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Waterscapes Through Time

The Menga Well as a Unique Hydraulic Resource in its Geographic and Historical Context

Keywords: megalithism, landscape, hydrology, ecology, economics, water resources, beliefs

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Abstract

The discovery of the Menga dolmen water well in 2005 raised a number of scientific challenges. The obvious connection of this great megalithic monument with water demands an entirely new approach to its geographical and historical context. To achieve this, a complete analysis of the geochemical characteristics of the well's water is undertaken and the hydrological context of the surrounding region is examined. The results of this study are discussed within the context of the complex economic, social and cultural history of water resources in Lands of Antequera, which are reviewed on the basis of archaeological, historical and geographic data. Altogether, this approach reveals a completely new dimension of this great megalithic monument, in which ecology, water resources, economy, architecture and beliefs are interwoven into one of the most complex and persistent monumental landscapes of European Prehistory.

1. Menga: A Dolmen in a Waterscape

Located in southern Spain, Malaga province (*fig. 1*), Menga is one of the most remarkable megalithic constructions in the world. Listed in the UNESCO World Heritage List since July 2016 as part of the Antequera Megalithic Site,[1] Menga is unique because of its architecture (both in terms of scale and building technique) (Carrión Méndez et al. 2009; 2010; Lozano Rodríguez et al. 2014), because of its landscape dimension (visual relationship with La Peña de los Enamorados mountain and association with the Late Neolithic occupation of the surrounding region) (García Sanjuán/Wheatley 2009; 2010; García Sanjuán et al. 2015;

1 The site includes three megalithic monuments (Menga and Viera dolmens and El Romeral tholos) as well as two natural-cultural monuments (La Peña de los Enamorados and El Torcal karstic formation).

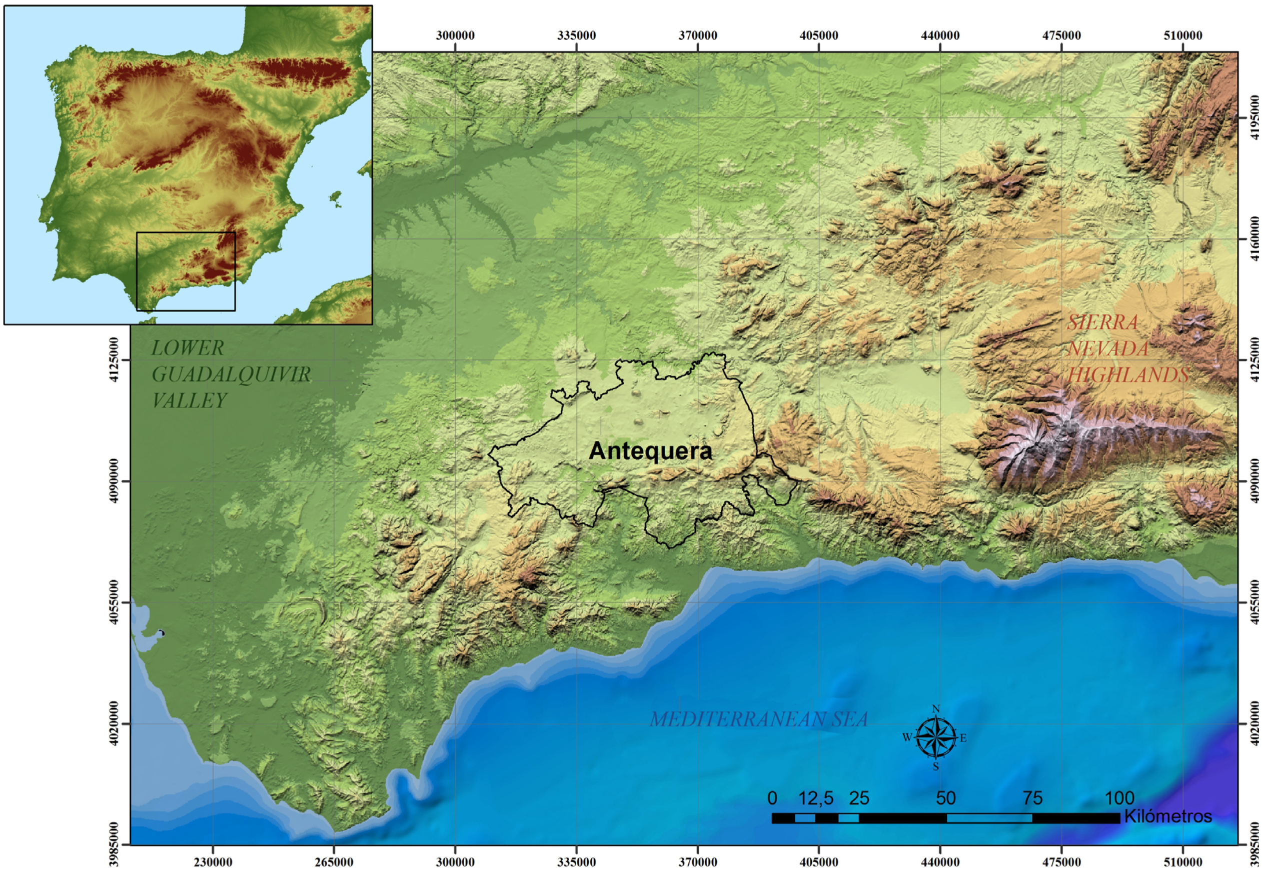

Fig. 1. Location map of Antequera in southern Iberia (Design: María del Carmen Moreno Escobar and Leonardo García Sanjuán).

Bradley/García Sanjuán 2017; Rogerio-Candelera et al. 2018), and also because of its remarkable biography as a monument, which spans the last six thousand years and reflects the constant cultural changes experienced by a region that represents a true 'cross-roads' in southern Iberia (García Sanjuán/Lozano Rodríguez 2016; García Sanjuán et al. 2018a).

Part of Menga's grandiosity lies in its architectural genius, based on the creation of an internal space made with an overwhelming mass of stone. Built with 25 uprights (twelve on each side, and one backstone), and five huge capstones, with a total length of 24.9m, a maximum width of 5.7m in the back of the chamber, and a height that rises from 2.65m at the entrance of the chamber to 3.45m at the rear, Menga is by far the largest megalith in Iberia, only matched by Anta Grande do Zambujeiro in Portugal. The combined weight of its stones rises to nearly 900t. The three pillars, which appear aligned at the centre of the chamber, are a highly unusual architectural device intended to support the massive capstones. The mound that covers the megalithic space, 50m across and built with a very stout fabric of alternating layers of stone and clay, provides further stability to the enormous construction. The very fact that Menga has stood on its feet for the past six millennia in a highly seismic region bears witness to the quality of its architectural design and the mastery of its builders.

No less remarkable is the relationship of this magnificent monument with the landscape surrounding it. Firstly, Menga's axial orientation towards the northeast (north of the summer solstice sunrise) is quite anomalous in terms of the standard pattern found of Iberian megalithic monuments. Recent research has shown that Menga's axial orientation towards La Peña de los Enamorados can be explained because of the importance of Late Neolithic activity on the northern sector of this mountain, where the schematic rock art shelter of Matacabras and the site of Piedras Blancas are located (for more detailed descriptions

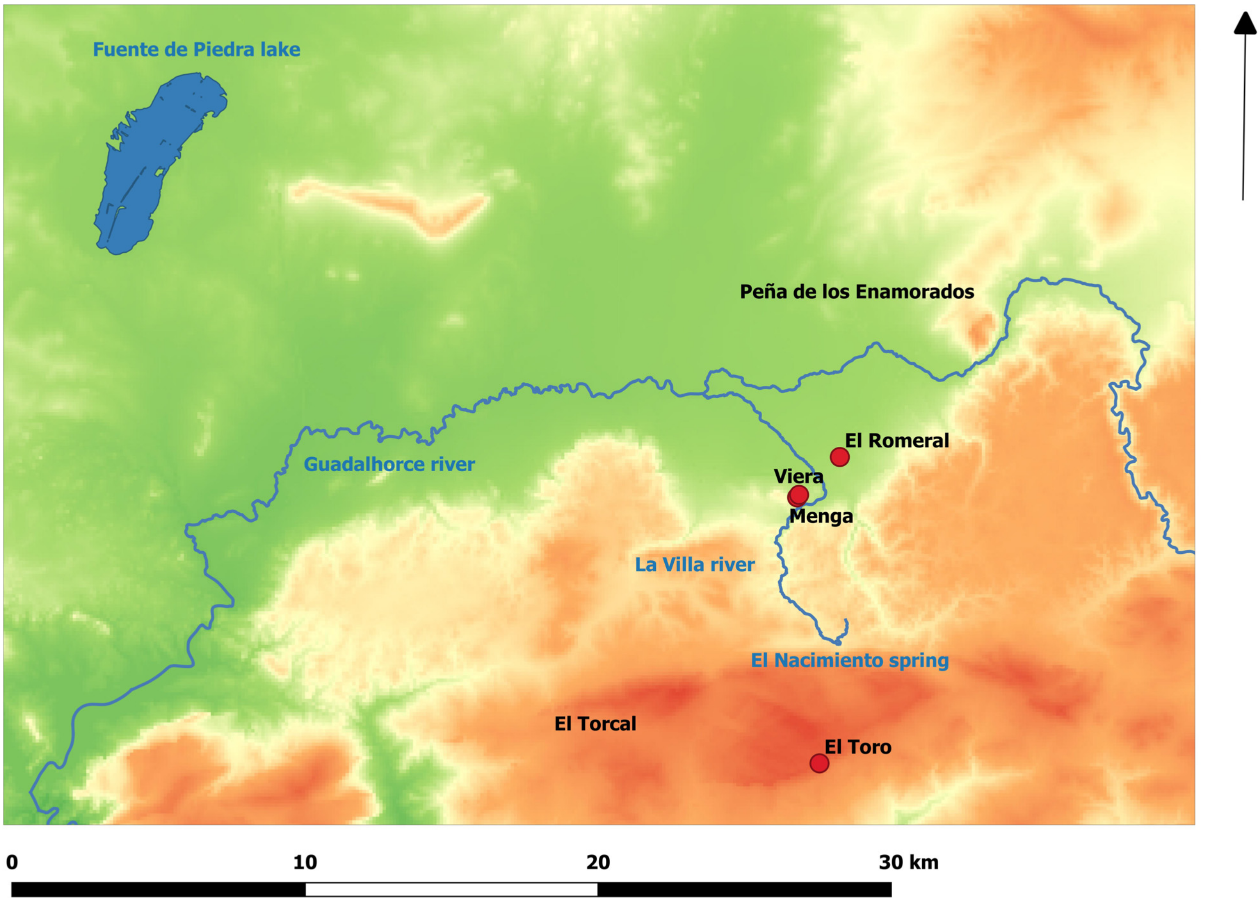

Fig. 2. Location map of the main hydrological and topographical features mentioned in the text (Design: Raquel Montero Artús).

see García Sanjuán/Wheatley 2009; 2010; García Sanjuán et al. 2015; Rogerio-Candelera et al. 2018). Therefore, although sunlight does play a role in Menga's design (see Lozano Rodríguez et al. 2014), its orientation was also intended as a tribute to a pre-existing ancestral place. Secondly, Menga was built on a very special location, sitting as it is on a small elevation of the Betica sierras that leans over the fertile plain of the Guadalhorce river, with commanding views of the two exceptional natural formations so present in the region: El Torcal karst to the south and the La Peña de los Enamorados limestone massif to the east, both characterised by conspicuous natural forms and silhouettes (*fig. 2*). Furthermore, Menga is located exactly where the La Villa river runs onto the alluvial plain of the Guadalhorce river, of which it is a tributary. It is important to note that the La Villa river springs from the base of El Torcal's northern face, literally bursting off the karstic formation from within an underground cavity known locally as El Nacimiento ('the Birth'), where a subterranean lake is often formed. This spring is, in fact, a natural outlet of El Torcal's aquifer, a gigantic mass of water that lays underneath the karstic formation and which, through the La Villa river, provides a steady supply of fresh water throughout the year[2] (*fig. 3, 4*). Upon reaching the plain, the La Villa river surrounds and envelops the hill where Menga (and later, Viera) was built, running a short distance across the plain just before it joins the Guadalhorce on its path westwards and then southwards towards the Mediterranean. With an Arabic name that roughly translates as 'river of the wheat' (Fernández 1842, 240), the Guadalhorce river cuts across one of the most fertile lands of Andalusia.[3]

2 Historically, this spring has supplied the bulk of Antequera's fresh water for human consumption and in fact, it does so even today despite the population being much larger – with basically no prior chemical treatment.

3 Rafael Mitjana y Ardison, the first scholar to study the Antequera monuments, already noted Menga's advantageous topographic location, next to 'two sources of wealth, El Nacimiento and its lowlands', which have turned the city

Fig. 3. La Villa river running a few metres down El Nacimiento spring (Photograph: Leonardo García Sanjuán).

Fig. 4. El Nacimiento spring cavity and underground pond (Photograph: Leonardo García Sanjuán).

Some 15km to the west is the endorheic Fuente de Piedra lake, remarkable because of its salty waters.

In summary, Menga was built where the perennial fresh water descending from underneath El Torcal meets that of the Guadalhorce river, which runs from La Peña de los Enamorados, on the exact location where views of the two conspicuous natural formations are possible, and facing the ancestral (perhaps very 'archaic') rock art sanctuary of La Peña's northern cliff. The fact that the city of Antequera itself is basically in the same location as Menga (ancient and medieval Antequera were located on a slightly higher hill about a mile west of Menga) is hardly random. The city is, quite literally, a 'gift' of El Torcal's aquifer, whose high-quality water flows all year-round from El Torcal onto the plain. By occupying the lowest elevations of the Baetic system, just where La Villa runs onto the Guadalhorce plain, the Late Neolithic settlers of the region secured a steady supply of fresh water, access to first-rate agricultural land and a great diversity of abiotic resources (including, among others, high-quality flint as well as, crucially, salt), as well as, of course, a privileged geo-strategic position at the cross-roads of Andalusia's main natural routes.

The UNESCO declaration establishes that Antequera represents one of the oldest and most original monumentalised landscapes by integrating stone architecture and natural formations. Basically, this landscape dates back to the late 5th mill. BCE (Late Neolithic) but has deep roots in the Early Neolithic (late 6th and early 5th mill. BCE) through the occupation of El Toro, a cave located in El Torcal karstic massif. However, the cultural significance of the Antequera megalithic landscape goes well beyond the Neolithic period. In fact, it is impossible to understand its full significance without looking at the wider picture of the Late Prehistory and History of the surrounding region. Nowhere becomes this more obvious than when considering Menga's water well, a feature that, while part of the megalithic monument, highlights the relationship between this monument and the local waterscapes, a relationship that, as has been discussed above, is, already from a purely locational point of view, quite strong.

2. The Water Well

2.1. Morphology and Infill

Once inside Menga, the visitor may be surprised not by the colossal stones around and above him/her, or by the beautiful human-like silhouette of La Peña de los Enamorados cutting the eastward skyline just across the entrance to the monument,

and its region into a successful agricultural and manufacturing economy (Mitjana y Ardison 1847, 13). He also described how the Guadalhorce river ran through the 'vega', watering multiple crops ('wheat, barley, corn and all sorts of seeds that could be turned into flour, olives, good fruit and legumes in general') (Mitjana y Ardison 1847, 13). In his view, this wealth had propitiated a steady and substantial human occupation in the region, dating back to 'the highest Antiquity, two thousand years before Christ' (Mitjana y Ardison 1847, 13).

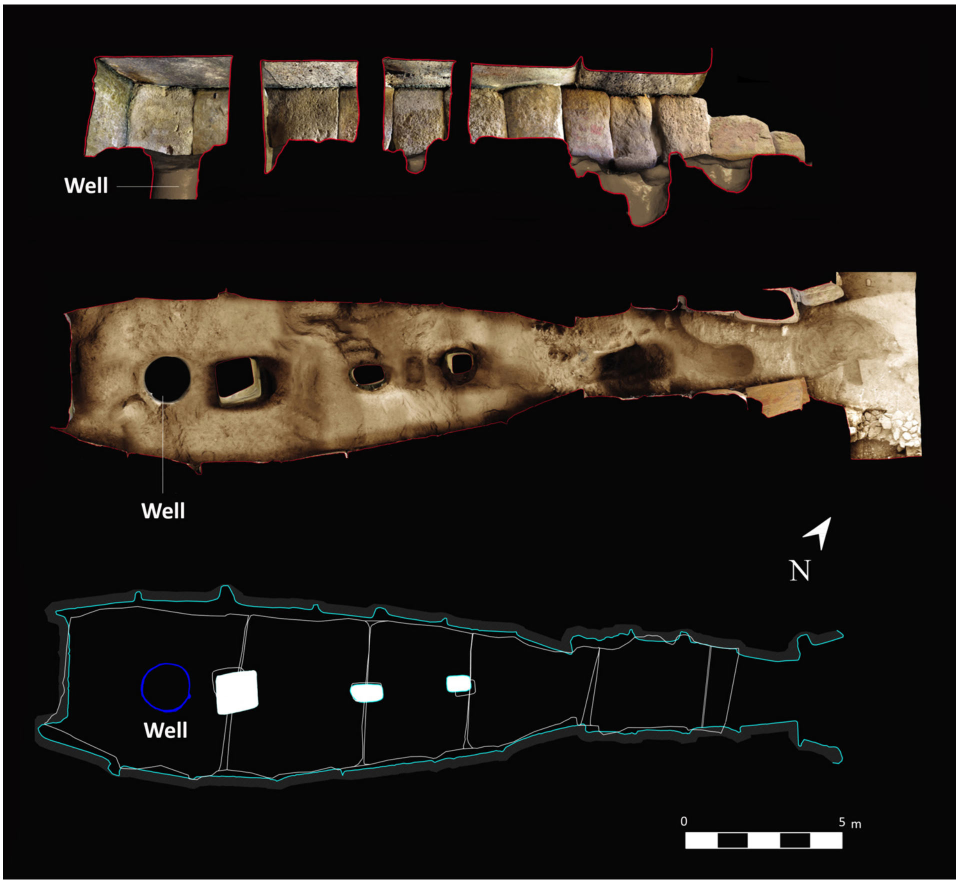

Fig. 5. Plan of Menga showing the location of the water well at the back of the chamber (García Sanjuán et al. 2016).

but by the remarkable water well located at the back of the great megalithic chamber. The water well, so to speak, steals the show – an otherwise excellent show.

The Menga well was discovered in the spring of 2005 (García Sanjuán/Mora Molina 2018). Although it has already been described in Spanish (García Sanjuán et al. 2016; 2018b), given its centrality for the argumentation presented in this paper, it will be summarily described here in order to facilitate its knowledge by a more international readership.

The well is located at the rear of Menga's chamber, almost perfectly centred with regards the backstone (2.3m away) and the two orthostats on the sides (2m away) (*fig. 5, 6*). It is circular in plan, presenting a diameter of 1.7m to 1.6m on its mouth and 1.1m at the bottom, with a depth of 19.4m, and it reaches the local water table at approximately 17m (*fig. 7, 8*). It was cut into the calcarenite geological substrate and shows a fairly regular finish throughout. No lining of any kind (wood, brick) was used to coat or cover its walls. It presents 77 putlog holes from its upper rim down

Fig. 6. View of Menga's water well without the protection set up to guarantee visitor safety (García Sanjuán et al. 2016).

Fig. 7. David García González descends into the Menga well to continue the excavation of its infill, late in 2005 (García Sanjuán et al. 2016).

Fig. 8. Start of the water table inside Menga's well as it was discovered at -17.55m late in 2005 (García Sanjuán et al. 2016).

to 17m of depth, of which 67 are on the northeast side, forming two roughly parallel columns separated by 40cm, whereas the remaining ten appear on its south-western side, forming a single column at between -10.4m and -17m (García Sanjuán et al. 2016, 206). Numerous marks on its sides bear witness to the careful quarrying work undertaken to make it.

Although its discovery in 2005 was a major surprise, subsequent research soon revealed that the well had already been known in the 19th cent. Probably, the first mention of it is to be found in Rafael Mitjana y Ardison's memoir, which he wrote to account for the excavations he carried out in Menga in the second half of the 1840s. In his report, he mentioned that his excavations inside the monument reached a depth of between 5.4m and 7m, a search that he regarded as mostly 'fruitless' as it yielded no vestiges of 'cadavers' or 'urns' (Mitjana y Ardison 1847). Although he never used the word 'well' (*pozo* in Spanish) in his brief report, it does not seem possible that he reached such depth unless he ran into the well and partly emptied it. The absence of an explicit description of the well in his report may be explained simply by the misplaced expectation he may have had about the discoveries awaiting him and which, by his own admission, were frustrated.[4] The hypothesis that Mitjana y Ardison found the well is backed by the fact that, barely three years after the publication of his booklet, in 1850, Louisa Tenison, a British traveller touring southern Spain, mentioned it explicitly as part of her account of her visit to the great dolmen (Tenison 1853).

The only other two explicit references to the well come from two short journalistic pieces published some years later by Trinidad de Rojas y Rojas (1861, 295; 1874, 58; 1879, 25). However, it is important to note that in the book Antigüedades Prehistóricas de Andalucía ('Prehistoric Antiquities of Andalusia'), published in 1868 by Manuel de Góngora y Martínez, a pioneer of Andalusian prehistory, Menga was described in full, but without any reference to the well. Perhaps, even more revealing is the fact that the sketch of Menga's plan made by hand by Manuel Gómez-Moreno González also in 1868 (Moya Morales 2004, 20) does not portray the well (*fig. 9*). Therefore, it seems likely that by the late 1860s, the well had been fully backfilled, and the reference made by Trinidad de Rojas y Rojas in 1874 and 1879 was

4 It is hard to know what preconceived ideas Mitjana y Ardison may have had about the nature of Menga, which he referred to as a 'druidic temple', at a time when so little was known about megalithic monuments or indeed about the Prehistory of Europe.

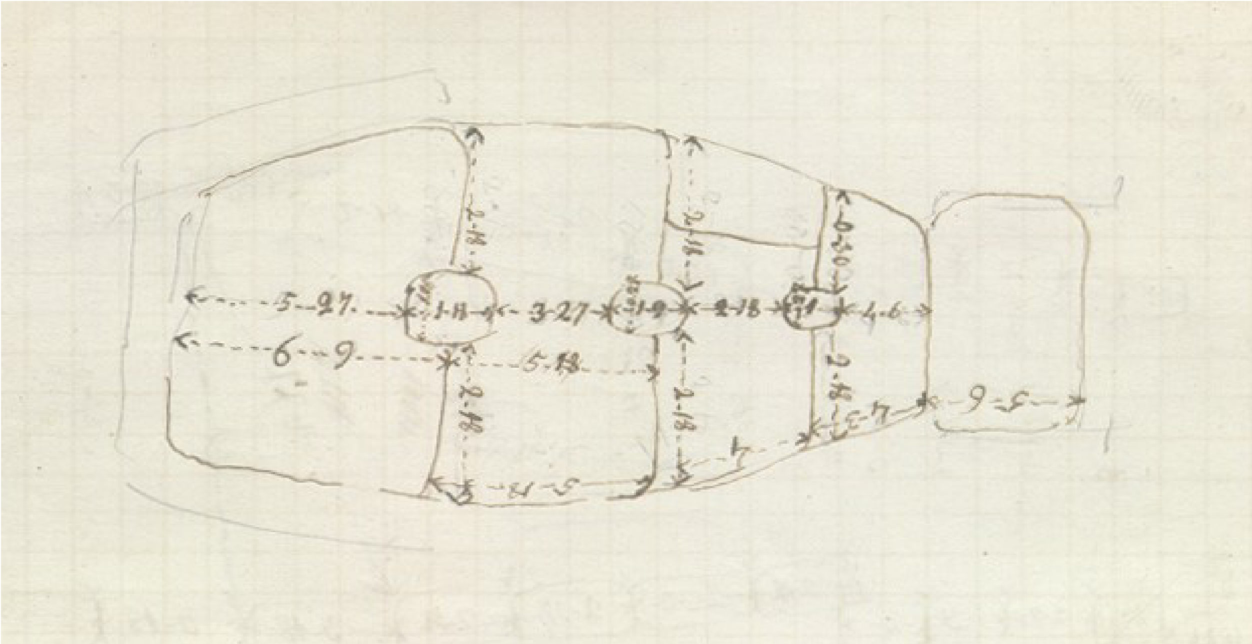

Fig. 9. Hand-made sketch plan by M. Gómez-Moreno González in 1868, showing the internal dimensions of the dolmen and the uprights (Moya Morales 2004, 20).

based on earlier reports, in his own recollections or in deductions based on Mitjana y Ardison's report. Whatever the case, between 1879 and 2005, no published description of the dolmen would ever mention the well again, which means that, at some point between 1850 and 1868, it was backfilled and its existence forgotten (García Sanjuán et al. 2018b, 339).

In light of this, it seems probable that the first six meters of infill excavated in 2005–2006 were the backfill used to refill the well after Mitjana y Ardison's excavations, whereas the infill found between -6m and -19.4m would correspond to an earlier episode of backfilling. And this is exactly what the radiocarbon-based chronometric model obtained on the basis of the animal bones found as part of the infill (cow, horse, donkey, dog, cat and hare), some of them in primary (articulated) position, suggests. This Bayesian model sets the formation of the 'original' infill in the first half of the 18th cent. CE, in a relatively short time span, probably not longer than 35 years (68% probability)

Event	Chronology	Evidence
The well is carved	?	None
The well is backfilled	Early 1700s	Radiocarbon-based chronometric model
Mitjana y Ardison excavates first 6m to 9m of the infill	Late 1840s	Deduction based on his own description
Louisa Tenison sees the well	1850	Her own description
The section of the well emptied by Mitjana y Ardison is backfilled	1850–1868	Deduction based on contemporary references
The well is no longer visible	1868	Hand-made sketch of Menga's plan made by Manuel Gómez-Moreno González
The well is discovered again by Verónica Navarrete Pendón	2005	Her own description

Tab. 1. Time-line of the Menga water well in the last three hundred years.

(García Sanjuán et al. 2016). Table 1 summarises the main known events in the timeline of the well in the last 300 years.

The infill between -6m and -19,4m presented a large amount of sandstone blocks not unlike those used to build the dolmen's sturdy mound, as well as wheel-thrown typologically-modern pottery, iron objects (nails, buttons, horseshoes), fragments of large tiles like those found forming ancient graves around Menga and Viera, and hammerstones similar to those found in other parts of the dolmen itself or at Piedras Blancas I, in the northern sector of La Peña de los Enamorados. Therefore, it seems clear that, as could be expected, whoever backfilled the well in the early decades of the 18th cent., worked in an essentially opportunistic manner, making use of the filling materials available at hand, and probably dismantling part of the mound in the process. This is hardly surprising. Considering that the well has a volume of 35.36m^3 (35360 litres), filling it must have involved the carrying and dumping of more than 51 tonnes of material, roughly equivalent to the load of six regular dump-trucks (García Sanjuán et al. 2016, 220). Why would have anyone gone any farther to find the necessary filling material when there was plenty of it just outside the megalithic 'cave'?

Of course, the discovery of the water well inside Menga raises a number of major scientific questions. The character and chronology of its infill seem to have been established fairly securely, but when was the well cut and for how long was it in use? And above all: what relationship was it intended to have with the megalithic monument? Although Menga was conceived and built in the Late Neolithic (probably between the 38th and 36th cent. BC), the currently available evidence suggests it was in use essentially uninterruptedly since its construction all the way to the 18th cent. CE, in what is possibly one of the most remarkable 'megalithic biographies' known to date. Did the water well play a major role in this biography? Was it made before the construction of the dolmen? Or was it open at the same time the dolmen was built? Or sometime after? And if so, how long after? These questions are fairly difficult to answer in the present state of our knowledge. However, any attempt to answer them must take into account the role of water resources in the Antequera region. In this context, and given the absence of direct dating evidence, the study of the hydrological background to the well (i.e. the water history of the surrounding region) becomes a highly necessary task.

2.2. Hydrology

Ever since human societies became sedentary, inhabiting more or less permanently the same pieces of land, water supply became a major concern. Since the Neolithic, access to water has often been achieved through wells. Thus, natural settings and climatic conditions played a major part in the decision of when and where to settle and where to open wells. In this sense, what are the hydrogeological characteristics of the Antequera region?

First of all, it is important to note that Antequera is located in the Mediterranean hydrological and climatic domain, where surface water availability is subject to intense annual fluctuations (including summer dryness) and cyclic long-term fluctuations with periods of reduced precipitations or even drought. In addition, from a geological viewpoint Antequera presents rather special hydrogeological features. On the one hand, the El Torcal limestone massif was sculpted by erosion into one of the most spectacular Iberian karstic landscapes. The lithology, the presence in wide areas of virtually horizontal layers, the intense breakage, the high precipitations and the gelifraction have all favoured remarkable karstification processes whereby soluble rocks (limestones, dolomites) have been dissolved by water. Over time, this process produced numerous rocky formations on the surface and underground cavities, while at the same time, a large aquifer was formed underneath (López-Geta et al. 2010).

The geologically oldest materials in Antequera are the Triassic ones, of between 230 and 195 million years of age. The prevailing lithology of this period includes clays and gypsum clays of various colours (red, grey, green) often integrating isolated layers of gypsum, limestone, sandstone and ophites. It is also common to find high contents of halite (common salt) and sylvite (potassium chloride). These formations with gypsum and salty

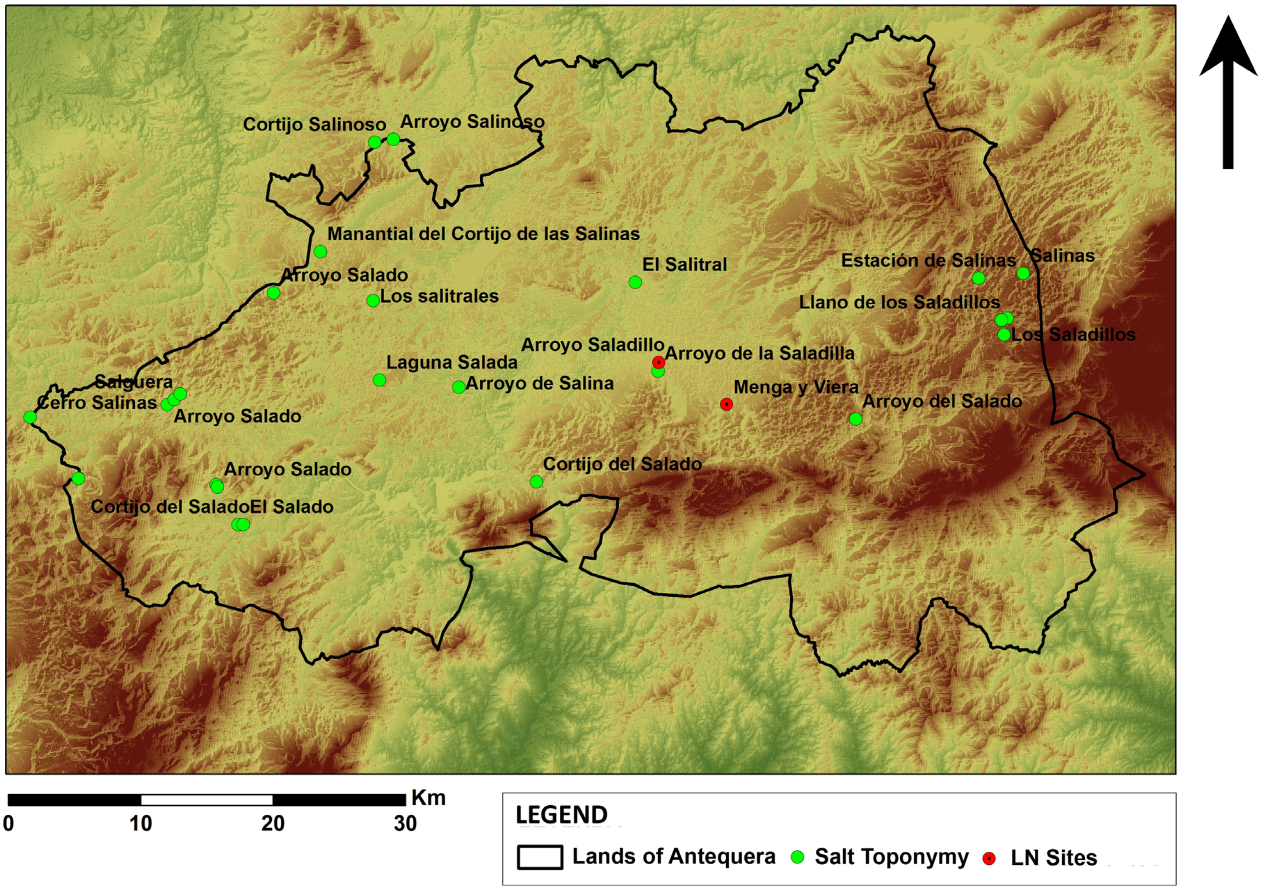

Fig. 10. Plan of Antequera showing brackish-water related toponymy (García Sanjuán et al. 2016).

materials are also susceptible to karstification, although they are less frequent than the carbonated ones of the Baetic mountain range (Durán Valsero et al. 1998). In some sectors, the Trías extends over major extensions such as Gobantes, Antequera, Salinas and Fuente Camacho (Pulido Bosch 1998) where water springs linked to gypsum are numerous and where some lakes also do appear. The springing waters present high calcium sulphate and sodium chloride content, that is to say, they are chemically 'poor' and not interesting in terms of human consumption (Durán Valsero et al. 1998). However, springs of salty water often form true salt lakes ('salmueras' in Spanish) as is the case of Fuente Camacho (Loja, Granada), 35km East of Antequera. In general, the whole of the Lands of Antequera region is dotted with brackish water places, as illustrated by toponymy itself (*fig. 10*). A conspicuous example of this is the Fuente de Piedra lake, located barely 20km northwest of Antequera and one of the most outstanding cases of endorheism known in Andalusia (Linares Girela/Rendón Martos 1998). Resulting from the dissolution and karstification of the salty gypsum materials of the Trías, with salty water with concentrations in calcium sulphate and sodium

Fig. 11. Pink flamingos at the Fuente de Piedra salty lake (García Sanjuán et al. 2016).

Fig. 12. Sampling of Menga's well's water in May 2017 (Photograph: Javier Pérez González).

Fig. 13. Sampling of El Nacimiento's water in May 2017 (Photograph: Leonardo García Sanjuán).

chloride, this seasonal lake is, with 13km^2, one of the largest of its kind in Iberia[5] (*fig. 11*).

Lastly, the Antequera depression post-orogenic materials are composed by sedimentary materials of the Miocene and Quaternary periods. This area was 'depressed' after the collision between the internal and external zones in the Alpine folding of the Middle Miocene, and where later filled with marine sediments during the Tortonian (Carrión Méndez et al. 2006a; 2006b).

From a geological viewpoint, Menga sits on sedimentary materials of Upper Tortonian age, corresponding to a delta facies with abundant gravels, sands (with little or no cementation) and lutites wrapped in a clayish matrix. Although these rocks present small-sized pores, resulting in the area being a poor aquifer, they are interdigitating with marine beach facies constituted by calcarenites, which themselves present optimum pore sizes to host good quality free aquifers (Carrión Méndez et al. 2006a; 2006b). Piezometric data obtained some 200m east of Menga, at an altitude of 474m above sea level, shows the water table at three metres of depth. Further to the north, the water table is cut by the topography, which might suggest that in the past there may have been been a spring nearby (Carrión Méndez et al. 2006a; 2006b).

The chemical study of the water from the Menga well undertaken by us (Montero Artús 2018) is important in order to establish its properties and to contextualise it within the local hydrological background and the locally available water resources (Durán Valsero 2007). In May 2017 water samples were obtained and in situ measurements were made both in the well and El Nacimiento spring (*fig. 12, 13*). A portable impermeable multiparametric (IP67), HI9819x series HANNA Instruments recorder with a 20m probe, coupled with a measuring tape was used. The sample was analysed at the laboratories of the Sevilla-based 'Grupo Soil' following standardised methods. Table 2 shows the results for the Menga well water compared with standard values for water intended for human consumption according to Spanish law (Royal Decree 140/2003, by which health criteria for the quality of water intended for human consumption are established).[6]

The results obtained suggest that all these physical-chemical parameters comply with the

5 It also is the only place in the Iberian Peninsula where pink flamingos (Phoenicopterus ruber roseus) breed regularly. The lagoon and its surroundings are part of the Network of Natural Protected Areas of Andalusia (Natural Reserve). It has also been declared a wetland of international importance (Ramsar Convention, 1983) and Special Protection Area for Birds (SPA) (Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, OJ L 20, 26.01.2010, 7–25, <http://data.europa.eu/eli/dir/2009/147/oj>).

6 From the Council Directive 98/83/EC (3rd November 1998) on the quality of water intended for human consumption (OJ L 330, 5.12.1998, 32, <https://eur-lex.europa.eu/eli/dir/1998/83/oj>). However, it is important to note that our analysis of the water from the Menga well is not intended to establish whether or not it is suitable for human consumption today, as that would involve a microbiological characterisation in order to establish health risks, as well as an assessment of other chemical parameters, including pesticides and numerous synthetic substances.

Parameters	Units	Well sample	EU Regulatory limits
Antimony	µg/l	<0.25	5
Arsenic	µg/l	1.67	10
Boron	mg/l	0.226	1
Cadmium	µg/l	<0.05	5
Chromium	µg/l	1.17	50
Copper	mg/l	<0.10	2
Fluoride	mg/l	1.33	1.5
Lead	µg/l	<0.5	10
Mercury	µg/l	<0.10	1
Nickel	µg/l	0.84	20
Nitrate	mg/l	229.6	50
Selenium	µg/l	1.52	10
Aluminium	µg/l	11.6	200
Ammonium	mg/l	<5.2	0.5
Chloride	mg/l	92.2	250
Conductivity	µS/cm	1798	2500
Iron	µg/l	18.4	200
Manganese	µg/l	0.77	50
pH		7.73	6.5–9.5
Sodium	mg/l	89.4	200
Sulphate	mg/l	496	250
Turbidity	NTU	12.12	1–5
Barium	µg/l	34	-
Bicarbonate	mg/l	143.3	-
Carbonate	mg/l	<10	-
COD	mg O2/l	<10	-
Calcium	mg/l	240.48	-
Magnesium	mg/l	9.72	-
Hardness	mg CaCO3/l	640.56	-
Phosphate	mg/l	<1.5	-
Potassium	mg/l	62	-
Silica	mg/l	46	-
Strontium	mg/l	1852	-
Suspended Solids	mg/l	30	-
Total Solids	mg/l	1520	-
Zinc	mg/l	<0.1	-

Tab. 2. Results of the chemical analysis of the Menga well water compared with standard values for water intended for human consumption according to Spanish law

current standards for water intended for human consumption, with only two exceptions: nitrates and sulphates. The presence of high levels of nitrates in the water is usually caused by anthropogenic factors largely connected with the use of fertilisers for agriculture. The Antequera plain is in fact recognised legally as 'vulnerable to pollution by nitrates' by the Andalusian regional government (Decree 36, February 5th 2008, by which zones vulnerable to pollution from nitrates used in agriculture are designated and measures against it are established) (Gonzalez 2008, 5). In turn, the presence of high levels of sulphates (twice the maximum levels set by legislation) is not only caused by anthropogenic factors, but also by the very nature of the geological substrate, given the presence of gypsum in the 'Trías de Antequera'. A recent study based on the analysis of both radioactive and stable sulphate isotopes in the region has established that its natural contribution to the underground water from evaporitic substrate oscillates between 70 and 85% of dissolved sulphate (Urresti Estala 2016).

The quality of the water from Menga's well must be compared with the three main aquifers of the surrounding region: Llanos de Antequera-Vega de Archidona (060.032), El Torcal (060.032) and Fuente de Piedra (060.034).[7] From a chemical viewpoint, this comparison is important in order to establish whether Menga's water is different or similar from other locally available resources, fundamentally in terms of their hydrogeological characteristics.[8]

In general, the chemistry of Menga's water matches well that of the Llanos de Antequera-Vega de Archidona aquifer, with higher mineralisation than El Torcal aquifer water, which has outstanding quality. The water from the Llanos de Antequera-Vega de Archidona aquifer also presents high levels of sulphates resulting from the underlying geological substrate, the gypsum-rich Trías de Antequera (*fig. 14*). In this sense, Menga's water is within the expected values. The water of the Fuente de Piedra aquifer has naturally-occurring calcium-sodium sulphate-chloride facies (chloride values are in excess of 1,000mg/l), although there is also anthropogenic salinisation caused by the return of irrigation waters which are by themselves quite salty and form *salmueras* (salt ponds) after evaporating.

The La Villa river, originating in the El Torcal aquifer, shows increased concentrations after passing near Antequera, which may be due to its flowing over the Trías before joining the Guadalhorce but also to the potential effects of diffuse and sporadic pollution caused by intensive farming across the Antequera plain. By comparison with Menga's well, the La Villa river water shows considerably lower levels in almost all parameters, which is linked with high contents of dissolved salts in the groundwater, except with magnesium, which shows similar values. Again, it is worth noting the high levels of nitrate (229.6mg/l), generally explained by the use of fertilisers in agriculture. The highest average values of parameters such as calcium, chloride, water hardness, sulphate and magnesium are found in the Guadalhorce river, and its surrounding plain, probably due to the influence of the underlying gypsum-rich substrate.

In order to understand the locational and functional background of the Menga well, it is important to consider the topography linked to the subterranean waters, that is to say, the depths at which they can be found throughout

7 Coding assigned to each of the three bodies of water identified in the immediate vicinity of Antequera as established in the Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ L 327, 22.12.2000, <https://eur-lex.europa.eu/eli/dir/2000/60/oj>) (last access 19.05.2021).

8 For each parameter basic and reference levels are used following the definition of the EFD (European Framework Directive). Reference levels represent the concentration of a substance within a mass of underground water with no or minimal anthropogenic alterations (32_R, 33_R and 34_R). These levels are generally established following the methodology in Report D18 ('Final Proposal for a methodology to set up groundwater threshold values in Europe') of the BRIDGE project (Background cRiteria for the iDentification of Groundwater thrEsholds). The temporal series is different for each parameter and each mass, although the first and last year recorded are 1977 and 2004 respectively. The basic values of each water mass (32_B, 33_B and 34_B) are average values recorded at least within the reference years (2012, 2013) on the basis of control programs applied in accordance with article 8 of Directive 2000/60/CE.

the Antequera region. To this end, the data on piezometric levels stored in the Spanish 'Red de Seguimiento del Estado e Información Hidrológica' ('Nation-Wide Monitoring and Hydrological Information Network'),[9] have been used. Piezometric data show a flow of underground water running from east to west, from La Peña de los Enamorados to the Guadalhorce dam. In the Antequera plain, underground water drains in the same direction as the Guadalhorce river. In this system, underground water can be found at depths ranging from a few centimetres to up to 25m. Low values are usually located on the northern edge, at between 5m and 13m, whereas near to Antequera depths range from 22m to 25m. When our sampling was carried out (May 2017) the water of the Menga well was at 15.06m from the dolmen's floor.

The variation of piezometric levels is closely connected with the porosity of the geological substrate. In the Antequera plain, the Quaternary alluvial deposits, with thicknesses ranging from 15m to 18m, are in hydrogeological continuity with Miocene calcarenites when the latter are arranged laterally or in-depth, as it occurs between the Guadalhorce river and the city of Antequera. In this sense, it is remarkable that inside Menga's well, the water table is reached at a depth of between 15m and 20m, when in nearby locations, it appears at between 5m and 10m, or even less.

In summary, the analysis of the water from Menga's well against its hydrogeological background reveals a number of important conclusions. Firstly, this water is within the range of what modern regulations impose for human consumption. Only nitrate and sulphate values are outside that range. While the former reflect the use of nitrogen-based fertilisers in modern agriculture (possibly less than the last 100 years), the latter occur naturally as a result of Triassic gypsum. However, to this date, no evidence has been found concerning possible negative effects of sulphates on human health. As a result, and subject to biological parameters (highly variable over time), we must conclude that the Menga

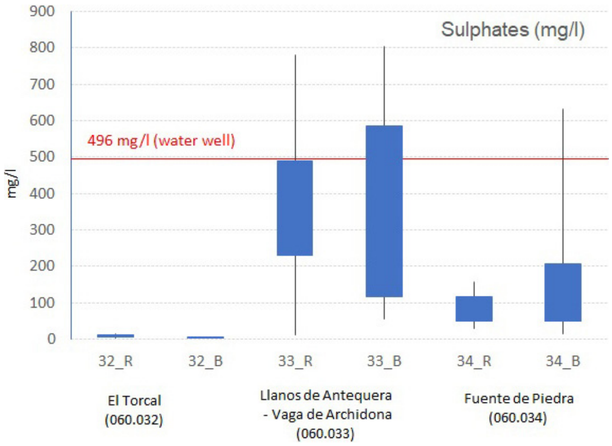

Fig. 14. Sulphate concentration in the well water vs. underground water in the surroundings of Antequera.

well water may have been used for the consumption of humans and animals. Secondly, we must note the similarity between the water of Menga's well and that of the Antequera plain. Given that, objectively, there is a multitude of points in Antequera's *vega* where water of the same quality and characteristics can be found, and that often this water is a lot closer to the surface, it seems clear that the action of making Menga's well where it was made did not respond to a simple cost-benefit economic rationale. Thirdly, La Villa's river water, streaming from El Nacimiento spring, presents a low-minerals quality that far surpasses that of the Antequera plain (and Menga's well). The massive aquifer underneath El Torcal provides a constant supply of high-quality water throughout the year, which would pretty much make it a strategic economic resource in any Mediterranean region, let alone in Antequera, where, in addition, much of the locally available water is brackish and unsuitable for human consumption.

Altogether, Antequera's hydrological configuration reveals a great diversity of water resources, some of which are located in the immediate vicinity of Menga in accordance with the exceptional diversity of the geological substrate in that location. Since early times, this fact may have played a key role, causing local communities to choose this particular location as especially suitable for stable occupation. As we will show in the next section, water resources have indeed played a crucial role in the history of the Antequera region.

9 <http://sig.mapama.es/redes-seguimiento/> (last access 19.05.2021).

3. A Past of Waterscapes

There is substantial evidence of the great social, and cultural significance water resources have had throughout the late Prehistory and History of Antequera. This significance derives from their use for human consumption and farming purposes (including irrigation and salt production), but also from their pervasiveness in the ideological sphere, especially in terms of their healing or medicinal qualities (real or imagined), as well as their sacredness.

The earliest known evidence of a likely 'cult of water' in Lands of Antequera is the Huelva-type bronze sword found near the town of Almargen, barely 400m from where a remarkable warrior stela was found in the 1980s (Díaz-Guardamino et al. 2020). The Huelva-type swords, usually interpreted as specifically Iberian in their style, although occasional examples have been found in Britain and France, are dated to the Willburton/Satin-Brieuc/Hío Late Bronze Age phase (ca. 1130 to 1050 BCE) (Rovira Llorens 2007; Brandherm 2007). This find is a classic occurrence of the 'water cult' found throughout western Europe in the Late Bronze Age, often materialised in the hoarding of objects (and special metal artefacts) in water places such as river crossings, fords, lakes, swamps, etc. (Levy 1982; Bradley 1990; etc.).

Almargen itself is a place of outstanding hydrological significance, as it is located at the watershed of the Mediterranean and Atlantic domains, acting as a true 'hinge' between the two main climatic and hydrological zones of Iberia. Its strategic location as a pass between the Mediterranean-bound Guadalhorce river (and Lands of Antequera) on the one hand, and the Guadalquivir river valley, of Atlantic configuration, on the other, also lends Almargen a strong cultural significance. It is worth noting that Antequera and the lower Guadalquivir valley (and particularly at Valencina) represent two of the most accomplished and spectacular cycles of monumentalisation in Late Neolithic and Copper Age Iberia. It is quite possible that Almargen played a significant role in connecting these two regions at that time (Díaz-Guardamino et al. 2020). In fact, barely 200m from where the warrior stela and the Huelva-type sword were found, a third unusual archaeological find underlines the potential significance of the place in the 4th and 3rd mill. BCE: the so-called Almargen idol. This anthropomorphic sculpture, 48cm high and 22.2kg in weight, made in marble, is one of the most remarkable pieces of plastic art made in Iberian late Prehistory and displays a complex, hybrid nature in terms of fertility and reproduction (for a full description, see García Pérez et al. 2020). It is important to note that while the sword represents a water deposit in itself, both the idol and the stela were found at the nearby edge of what used to be a wide meadow dotted by fresh water wells. In fact, the very name Almargen derives from Arabic *al-marj* ('swamp, meadow or pasture') (Vernet 1960), although Asín (1940, 67) uses a slightly different spelling (Almarjen), and translates the name as *maryain* ('the two meadows'). The two etymologies, however, suggest the importance of Almargen in terms of water resources, both at a local (pastures which, as the wells in the area show, must have been frequently flooded), and supra-local scale (liminal place, in terms of Atlantic/Mediterranean watershed).

Another significant case of 'water cult' can be found south of Antequera, near the town of Valle de Abdalajís (Martín Ruiz 2009, 182). Evidence uncovered at the Cerro Tozaire hill, just outside the town and near the Las Piedras brook, suggests the existence of a Late Iron Age sanctuary devoted to fertility and healing deities in connection with the local water and certain medicinal plants. Although the exact location of the sanctuary is not known, several votive figurines made of bronze and numerous coins suggest this cult place was in use until the Late Roman Empire (Martín Ruiz 2006, 148–154). Various anthropomorphic votive figurines portraying female personages have been interpreted as offerings to some of the many water springs located at the limestone massif of Sierra de Abdalajís. The use of these waters for healing purposes is further underlined by various altar stones with Latin inscriptions (Martín Ruiz 2006, 151 f.; Peréx Agorreta/Miró i Alaix 2017). In one of them, M. Cornelio Optatus recounts his healing experience, while another was dedicated by L. Postumio Castrensis to Asclepius and Apollo, gods linked with the healing power of the waters, and a third inscription by Lucio Postumio Satulio was dedicated to a divine spring. In both Pre-Roman and

Roman religions, the healing power of water was seen within the context of the beneficial action of a deity so that springs were sanctified (Martín Ruiz 2006, 155). At Valle de Abdalajís, water cult is so deeply rooted in the local culture that it is alive even today through folklore. In the summer solstice (Saint John's Night) celebrations are held around the theme of water, and not fire as it normally happens in the rest of Spain.

The sacralisation of water in the region extends well into modern times. Today, the patron saint of Antequera is the Holy Christ of Health and Waters (Santísimo Cristo de la Salud y de las Aguas), whose seat is the church of St. John the Baptist, located in one of the oldest neighbourhoods of the city, next to the La Villa river. The popular devotion to this Christ finds its roots in the draughts suffered by the region in the 17th century AD. According to the local tradition, in the last Sunday of April 1668 its image was paraded to the Vera-Cruz hill, which led to copious rains. The 'miracle' caused the sacred image to receive the name it is known for today (León Vegas 2006, 453).

Apart from these cases of 'water cult', salt seems to have played a major part in the pervasive influence of water resources quite early on. It is quite possible that the production of salt played a part in the cultural flourishing experienced by Lands of Antequera in the Late Neolithic. Some 35km to the East of Antequera, at Fuente Camacho, there is a spring of brackish water leading to high concentrations of sodium chloride that have been traditionally exploited by local communities (Terán Manrique/Morgado Rodríguez 2011). Eleven sites of Late Prehistoric chronology are found within a 2.5km radius around the spring, some showing activity dated to the 4th and 3rd mill. BCE and continued throughout late Prehistory (Terán Manrique/Morgado Rodríguez 2011).

Salt exploitation, particularly at the Fuente de Piedra lake, also played a major economic role in Antiquity, contributing to the thriving of the region within the Roman empire (Gozalbes Cravioto/Muñoz Hidalgo 1986). Roman Antikaria,[10] one of the most prosperous towns in the Baetica province, developed in the same location as earlier settlements dating back to the Neolithic, Copper Age, Bronze Age and Iron Age. This is also, of course, the almost exact same location chosen by the local Late Neolithic communities to build Menga and Viera: at the foot of the Baetica cordillera, on a gentle elevation commanding a good view of (and easy access to) the Guadalhorce alluvial soil and, above all, near La Villa river, which granted a year-round supply of high-quality fresh water. Defence does not seem to have been a major concern in Antiquity, as there is much higher ground (representing more easily defensible locations), less than a kilometre to the south, deeper into the cordillera. Therefore, the location of Roman Antequera is best explained by the same kind of rationality that explains the location of the Late Neolithic dolmens: a secure supply of fresh water and access to good arable land.

Medieval Antequera would also develop within the same location, although occupying slightly higher ground for defensive purposes. Throughout the Late Middle Ages, the region experienced frequent conflict as the Castilian kingdom of Seville, and the Nasri kingdom of Granada fought against each other (Cobos Rodríguez 2016, 52 f.). After the Castilian conquest of the city in 1410, and especially at the start of the 16th cent., the city expanded considerably, and arrangements had to be made to grant water supply for a larger urban population (Escalante Jiménez 2008). To this end, water from other nearby springs, such as La Magdalena or Las Arquillas, was channelled into the city by means of a series of galleries, aqueducts and wells, in order to complement the water supplied by La Villa river. This is basically the water supply system that was in place in the city until the mid-20th cent. A history of Antequera published early in the 19th cent. (Fernández 1842) underlines the importance of the Fuente de Piedra lake salt exploitation throughout the Middle Ages.

10 Antequera's modern Spanish name, derived from Antikaria ('Antiquarian' or 'City of Antiquities'), is quite revealing in terms of the awareness that, already in Antiquity, existed concerning its very old origins. Archaeological evidence conclusively shows that in Antiquity there was full awareness of all three megalithic monuments, all of which were used as burial ground and, possibly, cult places (Aranda Jiménez et al. 2015; García Sanjuán/Lozano Rodríguez 2016; García Sanjuán et al. 2018a).

The *ordenanzas* (regulations) issued by the city council in 1531 provide a full picture of the importance of the La Villa river for human consumption. Essentially, these regulations protected the river from potential pollution from the cattle being moved from the Guadalhorce plain to the higher grounds of El Nacimiento springs for fresh pastures. The *ordenanzas* established at which points animals were allowed to drink water, expressly excluding fountains used for human consumption. The opening of wells expanded considerably at this time, although the search for water was reportedly difficult and laborious, as wells often had to be dug quite deeply,[11] and the discovery of good quality water was never guaranteed (Cobos Rodríguez 2016, 621). Documents dating from the second half of the 16th cent., also reflect frequent conflicts among the city's inhabitants due to water access (Cobos Rodríguez 2016, 1164).

Water-carrying pots (such as *alcarrazas*) and coins found inside Menga and in its atrium suggest an inordinate amount of activity at (or inside) the megalithic monument throughout the 16th and 17th cent. CE (García Sanjuán et al. 2018a). In light of the evidence proving the need for an expanded supply of fresh water, the existence of disputes over access to water wells and competing interests for water use (herders, farmers, neighbours) at that time, it is, of course, quite tempting to assume that the water well inside the megalithic monument was being used at that time, and perhaps its water even sold.

In fact, there is strong evidence showing that water was a highly valued and widely commercialised commodity in Antequera in that period. In his book 'Las Antigüedades de las Ciudades de España' ('Antiquities of the Cities of Spain'), published in 1575, in which a survey of the resources and wealth of the kingdom was made, Cordoba-born Ambrosio de Morales, historian and chronicler in the court of Phillip II, claimed that 'the most noble of all fountains in Spain seems to be that of Antequera, given its great strength against the terrible disease of the [kidney] stone, which breeds inside our bodies' (Morales 1575). Although the water was generally referred to as coming from Antequera, he is clear that it sprung not at the city of Antequera itself, but at the village of Fuente de Piedra, located some 20km further west. According to De Morales, the famed Antequera underground waters were delivered throughout Spain at distances over 100 leagues (between 500km and 600km) and were even exported to the Spanish overseas colonies in America and to Naples, at the time part of Spain. The exportation business in place included a quality control system that granted the authenticity of the provenance of the water. Different certification systems were used depending on how far it was meant to travel. For water jars intended to travel short distances, garlands of freshly cut *saxifragia* grass (*Saxifraga granulata*) were used as this plant was believed to grow only in the vicinity of the spring. For water to be shipped overseas, a notary certified the person, day, month and year in which the water had been collected and then the water jars were sealed and stamped by a priest. De Morales claimed that, on account of the high demand for water, in the preceding 30 years, Antequera had filled with priests and notaries. He goes on to explain his own experience after going to the spring and drinking its waters: '[…] the goodness of the water and its benefits are, to my judgement, ever greater than is published.' He highlighted the quality of the water from the spring as opposed to others springing nearby and which were of far lower quality.

Between 1524 and 1526, Andrea Navagiero, ambassador of the Venetian Republic in the court of emperor Charles V reported, while travelling through Spain that '[…] two leagues before arriving to Antequera, on the right and outside the road, there is a fairly large and wonderful salt marsh [located] at a concave site which, by virtue of the form of the ground, fills with brackish water that, without any industry or engineering, freezes [sic], thus supplying large quantities of salt' (García Mercadal 1952, 853, cited in Gozalbes Cravioto/Gozalbes Busto 1996, 203). Given that the traveller claims to be moving from the west, it is possible that the salt marsh he saw was at the Fuente de Piedra lake, although he did not provide further details.

About eighty years later, in 1603, Agustín de Rojas Villandrando, published his book 'El

11 As mentioned above, in the *vega* (Guadalhorce plain) the water table is often between 25m and 30m deep.

Viaje Entretenido' ('The Fancy Voyage'), in which he provided another account of the wealth of water resources available in the Antequera region. Firstly, he mentioned a fountain from a rock ('una fuente de una peña'), located at a distance of one league from Antequera, and which he acknowledged as nothing less than the best water of Spain. According to him, the water streaming from that spring was used by more than twenty water-mills and was used to irrigate several olive-tree grooves and 'more than a hundred' orchards (Rojas Villandrando 1603). He is obviously referring to El Nacimiento and the La Villa river, where milling was a very important activity still well into the 20th cent. Fully in line with the account published by De Morales some 30 years earlier, De Rojas also described a major spring, four leagues, away from Antequera, whose water was sold in many places, because it was good against the kidney-stone disease. The national and international fame of the Fuente de Piedra/Antequera waters, it seems, still lived on in the early 17th cent. CE.

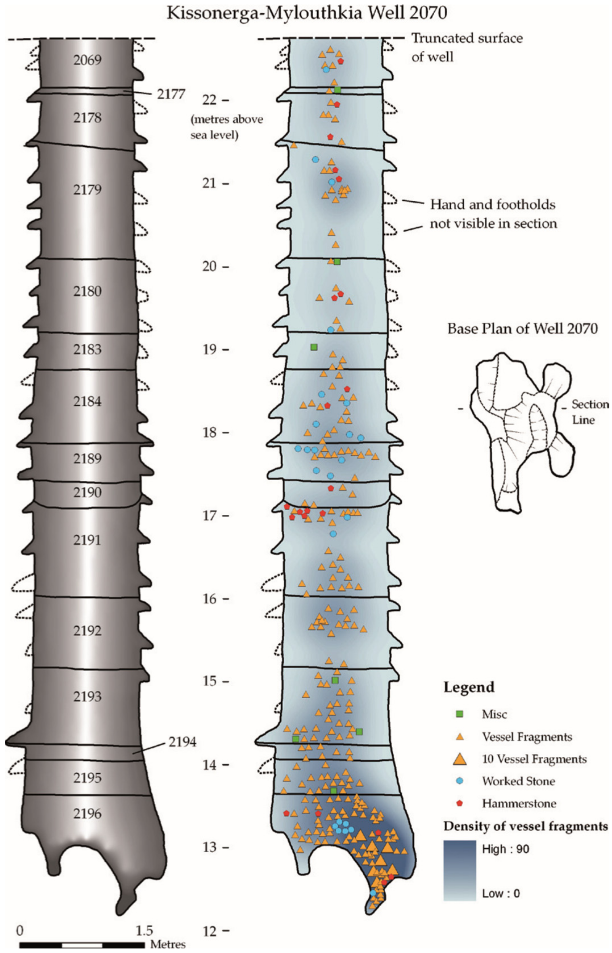

Fig. 15. Well #2070 at Kissonerga-Mylouthkia (Cyprus) (Peltenburg 2012, 74).

4. Discussion

The review made above reveals the important role water resources have played in the economic and social life of Lands of Antequera since the Neolithic. The year-round supply of good quality fresh water provided by the La Villa river was in itself of great importance in the social development of the region in the Late Neolithic period. Within a Mediterranean setting, such permanent and reliable access to fresh water must have been seen as nothing short of a special 'gift' of nature, especially in a region where there was (and is) a remarkable abundance of brackish waters. Therefore, it cannot be entirely surprising that Menga, the largest megalithic monument built in Neolithic Iberia, was erected exactly where the La Villa river met the fertile Guadalhorce plain, and the city of Antequera also started right there. Salt exploitation at Fuente Camacho and, perhaps, Fuente de Piedra lake would have provided local communities of the 4th mill. BCE with a strategic resource that, together with other factors already mentioned above, probably contributed to the accumulation of the wealth, technical know-how and social capital that led to the construction of such a magnificent monument. The basic pattern of human interaction with water resources in the region was already laid out in the Late Neolithic. In later periods, water would hold massive economic and social significance, whether in the form of economic practice (irrigation, salt production, water exportation) or as cult places (the Almargen water deposit in the Late Bronze Age, the Cerro Tozaire sanctuary in the Iron Age and Antiquity, the Fuente de Piedra healing water of the 16th and 17th cent. CE). Seen in this light, the presence of a unique hydraulic feature in Menga acquires a significance more in line with the geography and the social and cultural history of the region.

Like the history of Antequera itself, the biography of Menga cannot be understood without reference to the complex social and cultural connection of the whole region with water resources.

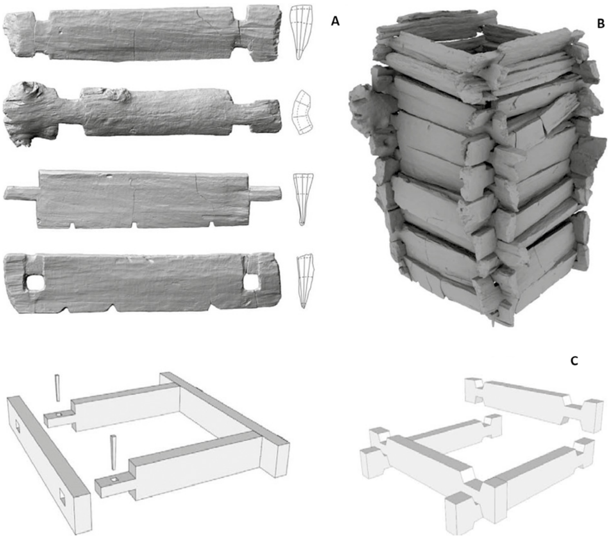

Fig. 16. 3D model of well A at Altscherbitz (Germany) (Tegel et al. 2012, 4).

Fig. 17. Early Neolithic flint mining shaft at Casa Montero (Vicálvaro, Madrid) (Photograph: Proyecto Casa Montero).

Fig. 18. Copper Age shaft at Cerro de la Cabeza sector in the Valencina mega-site (Sevilla) (Fernández Gómez/Oliva Alonso 1980).

Naturally, this observation brings to the fore the problem of when the Menga well was constructed: was it made during the Late Neolithic, as part of the grandiose megalithic project? Or was it opened later? If later, was it made during Late Prehistory – in the Copper Age, Bronze Age or Iron Age – or was it made more recently – in Antiquity, the Middle Ages, or even in the modern period? And was the well the reason why Menga's biography was so long? The currently available data are not conclusive: essentially, no direct evidence exists to tell when the well was made. There is, however, a substantial amount of indirect evidence that is worth discussing.

Firstly, there is solid evidence that Neolithic societies across the Old World had the know-how necessary to detect underground water, dig hydraulic wells (sometimes to great depths) and obtain a steady supply of fresh water. Several examples of this have been discovered during the last 30 years. They include the water wells found in Cyprus (Peltenburg et al. 2003; Thomas 2003; Peltenburg 2012; Koutrafouri 2008; 2013), cylindrical structures with diameters between 0.90m and 1.20m and depths up to 13m, dating to the Pre-Pottery Neolithic B, in the 9th mill. BCE – which makes them the oldest water wells known in the world (*fig. 15*). Other hydraulic wells dating to the Neolithic period are known in Israel (Galili et al. 1993; Garfinkel et al. 2006; Weinberger et al. 2008; Mithen 2010) and in Germany, where *Linearbandkeramik* communities of the 6th mill. BCE built remarkable wells lined with timber planks (Tegel et al. 2012) (*fig. 16*). Of course, specific hydrological situations and water management were a key issue for the development of social complexity in the Near and Middle East, as postulated by the classic 'hydraulic hypothesis' of the rise of the state (Wittfogel 1957; Butzer 1976). In Mediterranean and arid regions, water resources have often played a key role in the development of technical innovations and economic change (Müller-Neuhof 2014). In Iberia, there is also widespread evidence of the ability of Neolithic societies to dig complex underground structures. Such is the case of the shafts used for the mining of flint at Casa Montero (Vicálvaro, Madrid) (Consuegra Rodríguez et al. 2004) (*fig. 17*) or variscite at Can Tintorer (Gavá, Barcelona) (Blasco et al. 2000, 78), dated to the late 6th and early 5th mill. BCE respectively. Deep shafts of unknown function have been found at sites dated to the 4th and 3rd mill. BCE in southern Iberia, like for example El Jadramil (Cádiz) (Lazarich González et al. 2003) or Valencina (Seville) (Fernández Gómez/Oliva Alonso 1980; Fernández Gómez 2012) (*fig. 18*). Although the El Jadramil and Valencina shafts were almost certainly not used for mining, there is no clear evidence to understand what they were used for, water supply being one possibility. Regardless of the specificities, it is beyond any doubt that when Menga was built, there was widespread knowledge among Old World societies about how to locate underground water and how to dig deep wells to extract it. The Neolithic communities of Antequera had the necessary technical expertise and sufficient economic motivation to open a well like Menga's.

Secondly, throughout the Mediterranean, as indeed across the Old World, there is a widespread tradition of sacred water wells, often integrated in temples and cult places. In the Iberian region of La Mancha, the so-called Motillas Culture of the Early Bronze Age (ca. 2200 to 1550 BCE) was characterised by a remarkable phenomenon of well-digging and water management that has been linked with the more arid conditions brought about by the 4.2 ky BP climatic event (Mejías Moreno et al. 2015; López Sáez et al. 2014). In Sardinia, the Bronze Age 'Nuragic Culture' was characterised by a similar pattern of well-digging, water control, and monumentalisation of water wells. Often monumentalised by means of large-scale megalithic architecture, some Nuragic 'sacred wells', experienced extremely long biographies, which in some cases extend to this day (Melis 2003; 2008; Moraveratti 2003; Rassu 2016; Spanedda 2006; Zucca 1988) (*fig. 19*). The use of water in connection with sacred places is well attested world-wide throughout the last 10,000 years. In this sense, the Menga water well fits easily within a more general pattern of cult places and cult buildings linked to water.

Thirdly, it is worth considering the spatial and morphological characteristics of Menga's well. There are four main aspects to take into account:

(i) From a purely spatial perspective, and within the context of the local hydrology described above, the location of Menga's well does not make sense if the purpose of those who made it was only practical – for example, to obtain drinking water for people and/or animals. To achieve that, it would have been far easier to open the well 200m further to the east, where the same underground water can be reached at between 2m and 3m of depth. The topographic and hydrogeological location of Menga's well suggests that those who undertook the serious job of cutting through 20m of calcarenite rock (not the hardest of rocks, but rock all the same) all the way down to the water table, did so because they wanted the well to be right there, and not anywhere else. This suggests the well was not made for a purely practical purpose but invested of some kind of significance, and was made where it was made precisely because of the dolmen.

(ii) From a micro-spatial point of view, the well is located right behind Menga's pillar 3, and perfectly centred with regards to the uprights on both sides and the backstone behind it (*fig. 5*). This suggests that those who made it wanted it to be in a prominent place of the monument (at the back of the chamber, the deepest recess inside the 'underground' space) and in harmony with the architecture surrounding it.

(iii) Last but not least, the morphology of the well presents characteristics that set it clearly apart from all other Neolithic or Chalcolithic wells or shafts known in Iberia. Compared with the coarsely finished shafts at Casa Montero, Can

Fig. 19. Bronze Age monumentalised sacred water well at Santa Vittoria (Sardinia). General perspective (Photograph: Leonardo García Sanjuán).

Tintorer, El Jadramil or Valencina, Menga's well presents carefully carved sides, a smooth finish, and almost perfect circularity, all of which are elements that please the eye and convey a sense of geometric perfection. Unlike other more 'practical' wells known in Iberian prehistory, Menga's well produces a pleasant aesthetic and artistic effect – in line with what one would expect had it been conceived as one with the dolmen itself. However, there is also evidence to suggest that the making of the well may not have been part of the megalithic project or was not built by the same people who built the dolmen. For instance, in a picture taken during the 2005 excavations inside Menga (Mora Molina et al. 2018, 42, fig. 22), the upper part of the well appears to have cut the socket of pillar 3, which is very important for the stability of the monument, as it supports capstones 4 and 5 (Mora Molina 2019, 1070). If the well had cut pillar 3's socket, that would obviously mean that the well was made some time after the dolmen. Unfortunately, there is no drawing of that particular section, and no specific description of the possible stratigraphic connection between those two elements was made. Therefore, only a future study will help determine the stratigraphic connection between those two elements. At the same time, it is important to note that in principle, the idea of a water well inside a dolmen mostly built on calcarenite rock is not very conducive to its long-term preservation: the sandstones and breccias used to make to uprights and capstones are three times less efficient when soaked in humidity (García Sanjuán et al. 2018b, 333 f.).

Fourthly, it is important to pay some attention to the data concerning the backfilling of the well in the first half of the 18th cent. CE. The available chronometric model shows that the infill was formed in a period lasting not much longer than 35 years (68% probability) (García Sanjuán et al. 2016). It is not entirely unreasonable to think that the well was filled in a gradual manner (deliberate, but gradual). The materials and animals used in the backfilling could have entered the well gradually over a period of three or four decades. However, it is also possible that the filling of the well was an action planned and executed within a shorter period of time. The presence in the infill of fully articulated skeletons of various animals suggests that they were dumped into the well in a deliberate manner, as it is highly unlikely that so many different animals would have fallen accidentally into the well within a relatively short period of time. Indeed, why so many animals? It is worth noting that a well-established way to corrupt sources of drinking water is to dump dead animals into them. The fact that the infill includes the same mixture of materials of heterogeneous chronology (prehistoric, ancient, modern) found in the sediments of the atrium and surroundings of the dolmen points into the same direction. If the hypothesis of the backfilling having been executed in a quick and planned manner is correct, the transportation and dumping of all the material involved must have implied a significant effort, demanding some funding and a minimum amount of technical and human coordination. What could explain the serious amount of work involved in backfilling the 35.36m^3 (35360l) of volume of the well, roughly equivalent to 51t of material? (García Sanjuán et al. 2016, 220). A possible explanation for this would be the desire to achieve an ideological and/or 'moral' destruction of the well (and perhaps the dolmen itself). In this sense, it is perhaps worth remembering that in his 1587 manuscript 'Discursos Históricos de Antequera', Agustín de Tejada Páez, prebendary at the Granada cathedral had described Menga as a 'nocturnal temple where the gentiles came at night to perform their sacrifices.' The same idea echoed across various other manuscripts written locally in the 16th and 17th cent., at a time when the Spanish Catholic church was very much at war with any form of heresy or religious dissension. Inevitably, this lends credibility to the hypothesis that by the second half of the 17th cent. Menga may have been seen as a place of 'pagan' connotations (or, worse, worship), and therefore entirely unacceptable, especially if the use of the well and the consumption of its water was propitiating a significant frequentation of the place (García Sanjuán et al. 2016, 221). Along this line of reasoning, it is important to note that between the 16th and 17th cent., a period of religious wars in Europe, church authorities (Catholic or Protestant) imposed stricter limitations on the frequentation or use of ‘folk’ sanctuaries of ‘pagan’ origin. A well-known case is the destruction by fire and hammering of some of the menhirs at the Neolithic site of Avery (United Kingdom) in the early 18th cent. (Pollard/Reynolds 2002). Sometimes, church authorities made efforts to ‘Christianise’ prehistoric monuments, as is the case with some of the dolmens in the Alentejo region of Portugal, like São Dinis or São Brisos, which in the 17th cent. were physically transformed (but not destroyed) to resemble something more akin to a Christian chapel. Thus, the filling of Menga’s well, including the dumping of several animals to make sure the water was rendered unusable, may well have been a case of religious condemnation of a place that Catholic authorities felt uneasy about (García Sanjuán et al. 2016, 221).

Whatever the specific reasons or circumstances, the filling of the well seems to have effectively killed off the frequentation of the dolmen. When a hundred years later, Mitjana y Ardison wrote his memoir, he would claim that ‘This temple, called by the plebs Cueva de Mengal, was entirely forgotten and blocked by the accumulation of earth that filled it up almost completely’ (Mitjana y Ardison 1847, 5). Is it possible that the filling of the well in the 18th cent. was accompanied by a filling of the whole megalithic chamber? That, of course, would have entailed a much bigger investment of labour, rendering even more plausible the hypothesis of a deliberate and planned filling of the well, executed within a short period of time. However, it is unlikely that we will ever know, as Mitjana y Ardison devoted several years to empty and excavate the ‘druidic temple’, and all traces of the infill he removed are now gone.

To recapitulate, as far as our present knowledge goes it is not possible to rule out any date for the cutting of Menga’s well. It may have been carved before the construction of the dolmen, which likely took place between 3800 and 3600 BCE (García Sanjuán/Lozano Rodríguez 2016, 5; García Sanjuán et al. 2018c, 315 f.). There is solid evidence of activity at Menga’s hill prior to the construction of the dolmen, particularly evidenced by the materials used to fill the dolmen’s mound. But the specific nature of that activity remains unknown. It is also possible that the well was made as part of the megalithic project: its position inside the dolmen and its formal characteristics clearly invite to take this possibility into account (García Sanjuán et al. 2018b, 346). On the other hand, it is not possible to rule out that the well was made some time after the construction of the dolmen, at any time before the early 18th cent. CE. Recent studies show the presence in Menga of various elements of material culture linked with water management, including a Roman ceramic *tubulus* (pipe) as well as several jars which in the Late Middle Ages and Modern History were used to carry, sell and consume drinking water, as is particularly the case with *alcarrazas*, which were widely used by *aguadores* (water sellers) in the streets of Spanish cities during the 16th and 17th cent. CE (García Sanjuán et al. 2018b, 396). The very presence of coins dated to the 16th and 17th cent. in Menga, at a time when Antequera’s water was famed both nationally and internationally because of its alleged healing properties, hints at the possibility of the dolmen being a focus of activity because of the well.

5. Conclusion

The evidence presented in this paper suggests that Menga cannot be understood without reference to the hydrology of the surrounding region and the complex patterns of use and ideological appropriation of water deployed by local populations throughout time. Menga is an exceptional megalithic monument that presents an equally exceptional relationship with water. The location of the dolmen within the local geography invites to consider the possibility that the original ‘idea’ of the monument was already associated with water. This would not be entirely surprising for two reasons:

(i) While the region is subject to a Mediterranean water regime, which entails annual fluctuations of surface water and multi-year cycles of dryness, and is dotted with brackish water that make fresh water a scarce and difficult-to-find resource, Menga is spatially connected to a permanent source of high-quality fresh water, El Nacimiento-La Villa, which has provided the basis for the very existence and development of Antequera as a city.

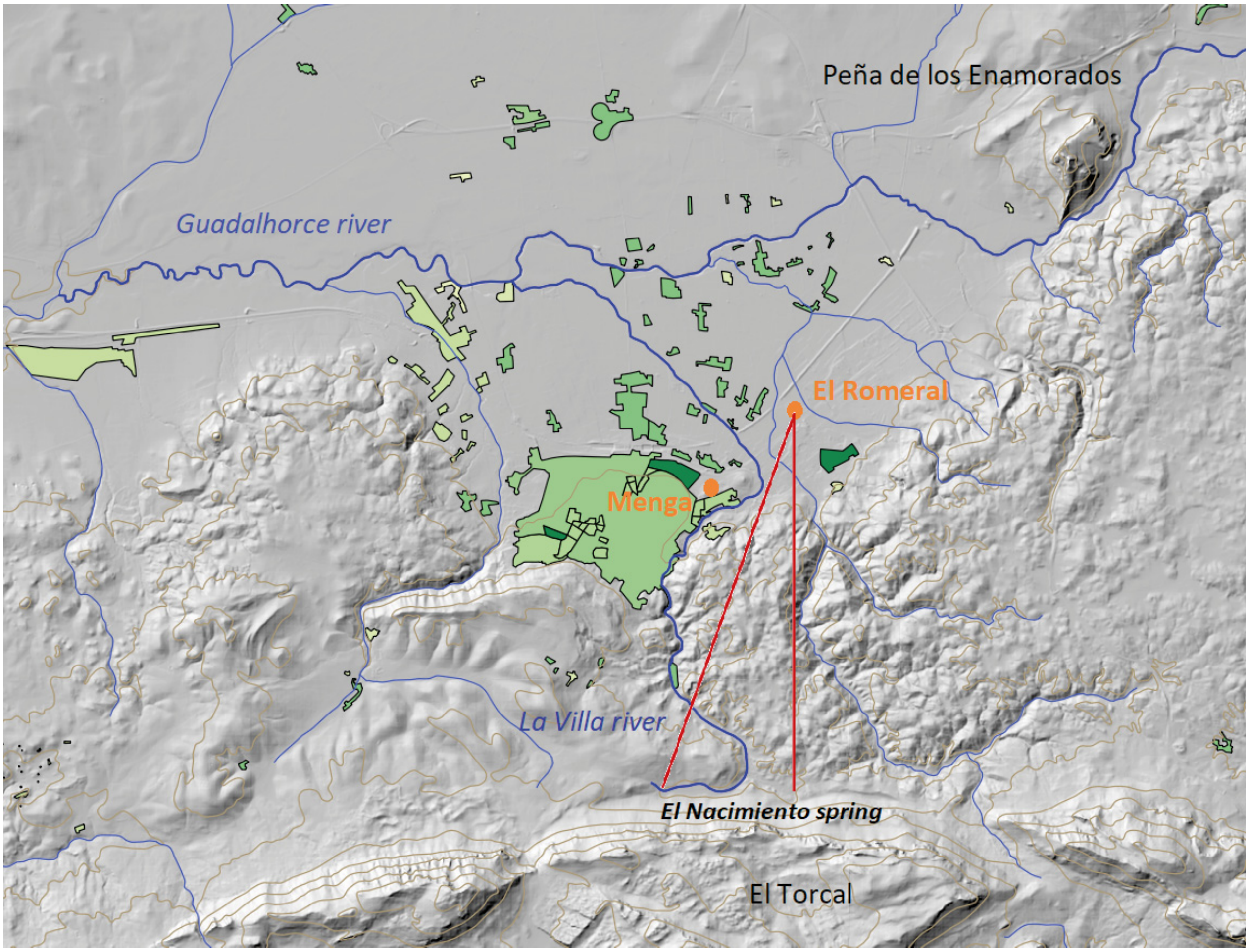

Fig. 20. Map showing the orientation of El Romeral with regards to El Nacimiento and El Torcal (Design: Raquel Montero Artús).

(ii) Both its spatial location and morphology open up the possibility that the well was meant to be integrated within ideas of sacredness embedded with the megalithic monument, regardless of whether it was made in the Neolithic, Antiquity or a later historical period.

(iii) Across the Mediterranean, water cult and especially healing waters, present impressive continuities that sometimes extend from the late Prehistory to modern times, and which often cut through modern religions, such as Christianity (Eliade 1974, 234), as is the case with the Sardinia sacred water-well sanctuaries.

Within the present state of our knowledge, two hypotheses regarding the making of Menga's well can be contemplated. Firstly, it is possible to consider that the well was part of the earliest megalithic project at Menga. This project would have been exceptional in terms of the extraordinary combination and intrinsic execution of both features. The transmission of humidity from the well onto the uprights and capstones, which is detrimental to the stability of the construction, seems to speak against that hypothesis. Secondly, it is possible to think of both features as constructed at different times. In this case, the possibility that the well was carved inside the megalithic chamber long after the construction of the dolmen would be equally remarkable. The location of the well with regards to the local piezometric levels and its morphology strongly suggests that regardless of which hypothesis we choose as more likely, the well was not made for purely practical reasons, as neither of those variables fit in a cost-benefit rationality.

Beyond the problem of the well's age, it is worth noting that our review of the waterscapes of the lands of Antequera suggests the special significance of water over time. The well intimately connects Menga with water just like the whole of the Antequera region is closely connected with water throughout its past. Whether since the inception of Menga or since a later date, there is every reason to think that the well was a key element in its remarkable journey through time. It is even possible that Menga is not the only monument presenting a close relationship with water. In this respect, the UNESCO declaration emphasises the exceptionality in the conception of Antequera's megalithic landscape, which emanates from a profound relationship between 'built' and 'natural' places (or between architecture and nature), including some 'anomalous' orientations. In that sense, just like Menga is oriented towards an anthropomorphic mountain (La Peña de los Enamorados), El Romeral is oriented towards the southwest, facing El Torcal roughly at the point where El Nacimiento spring is located (*fig. 20*). If the intention of those who built El Romeral was to pay tribute to the most important water resource in the region, they would have 'closed' in a remarkably harmonious way the relationship between water and monumentality. Therefore, a question for future research could well sound like this: did the builders of El Romeral celebrate the material and symbolic importance of the limestone massif that had been inhabited by the ancestors in time immemorial and whose water sprung relentlessly to provide life to the communities of the region?

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