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A submerged monolith in the Sicilian Channel (central Mediterranean Sea): Evidence for Mesolithic human activity

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A B S T R A C T

The ancient geography of the Mediterranean Basin was profoundly changed by the increase in sea level following the Last Glacial Maximum. This global event has led to the retreat of the coastlines, especially in lowland areas and shallow shelves, such as the Sicilian Channel. The NW sector of this shelf, known as Adventure Plateau, is studded by isolated shoals mostly composed of Late Miocene carbonate rocks and by some volcanic edifices. These shoals, until at least the Early Holocene, formed an archipelago of several islands separated by stretches of extremely shallow sea. One of these submerged features – the Pantelleria Vecchia Bank – located 60 km south of Sicily, has been extensively surveyed using geophysical and geological methods. It is composed of two main shoals, connected seaward by a rectilinear ridge which encloses an embayment. Here we present morphological evidence, underwater observations, and results of petrographic analysis of a man-made, 12 m long monolith resting on the sea-floor of the embayment at a water depth of 40 m. It is broken into two parts, and has three regular holes: one at its end which passes through from part to part, the others in two of its sides. The monolith is composed of calcirudites of Late Pleistocene age, as determined from radiocarbon measurements conducted on several shell fragments extracted from the rock samples. The same age and composition characterize the metre-size blocks forming the rectilinear ridge. The rest of the rocks composing the shoals are mostly Tortonian limestones–sandstones, as revealed by their fossil content. Extrapolating ages from the local sea level curve, we infer that seawater inundated the inner lands at 9350 ± 200 year B.P., the upper limit which can be reasonably taken for the site abandonment. This discovery provides evidence for a significant Mesolithic human activity in the Sicilian Channel region.

1. Introduction

An abundant number of archaeological and geological data acquired in several coastal areas of the Mediterranean Basin represent the evidence that it has undergone major changes in sea level during the glacial-interglacial cycles (e.g., Lambeck and Chappell, 2001; Lambeck and Purcell, 2005; Antonioli et al., 2009; Auriemma and Solinas, 2009). After the Last Glacial Maximum (LGM), around 19,000 year B.P., when the land area of Europe was ~40% larger than it is now, a relatively abrupt global rise in sea-level took place, estimated to be of 125 ± 5 m, as determined by correcting observed sea-level changes for glacio-hydro-isostatic contributions (e.g., Fleming et al., 1998; Mix et al., 2001; Siddall et al., 2003; Lambeck et al., 2004; Clark et al., 2009).

The Sicilian Channel is one of the shallow shelves of the central Mediterranean region where the consequences of changing sea-level were most dramatic and intense, as also occurred in part of the Aegean Sea, the northern Adriatic, and the Tunisia and Malta platforms. The Sicilian Channel is geologically part of the northern African continental shelf (Fig. 1) and lies mostly under shallow water, with the exception of three NW-trending, relatively deep troughs (the Pantelleria, Malta and Linosa grabens) produced since the Early Pliocene by rift-related processes (e.g., Reuther and Eisbacher, 1985; Boccaletti et al., 1987; Cello, 1987; Civile et al., 2010). This tectonic extension was also responsible of the formation of the two volcanic islands of Pantelleria and Linosa, and other submerged volcanic edifices lying along the eastern margin of the Adventure Plateau (Calanchi et al., 1989; Rotolo et al., 2006; Lodolo et al., 2012). It occupies the north-western sector of the Sicilian Channel, where available oil exploratory wells have shown that the sedimentary sequence ranges from Triassic to Plio-Quaternary, with various hiatuses associated with long periods of aerial exposition and/or erosion (Civile et al., 2014). The Adventure Plateau is the shallowest part of the entire Sicilian Channel, and is punctuated by several isolated banks, some of them rising up to less than 10 m below sea level (Colantoni et al., 1985). During the LGM, the Adventure Plateau was part of the former Sicily mainland, forming a peninsula (the Adventure Peninsula) bulging towards south into the Sicilian Channel, and

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separated from the North African coastline by less than 50 km. The gradual increase of the sea level caused the flooding of most of the peninsula, with the exception of some morphological highs that, until at least the Early Holocene, formed an archipelago of several islands separated by stretches of extremely shallow sea, as shown by the analysis of swath bathymetric mapping and high-resolution seismic profiles (Lodolo, 2012; Civile et al., 2015). Today, the Adventure Plateau is morphologically separated from Sicily by the Mazara del Vallo Channel (depth of about 120 m), and from Tunisia by the Pantelleria graben (depth of about 1300 m).

It is well known that the Mediterranean Sea is a unique basin from a historical and archaeological perspective, since it was an important means of communication among human communities living on its shores. These ancient civilizations have left numerous imprints along the former coasts, such as production and town structures, landing places, and ports. Some structures that are today submerged can provide fundamental information to support the reconstruction of the ancient coastlines (Auriemma and Solinas, 2009). Conversely, in shallow water areas distant from the coastline, the information on possible ancient permanent human settlements are scarce, and there are no traces to date found in the Mediterranean Basin mainly because the lack of detailed and extensive bathymetric mapping, and the presence of a variably thick sedimentary cover masking any submerged structure.

Here we present the results of high-resolution bathymetric surveys performed on the Pantelleria Vecchia Bank (PVB), a submerged shallow relief of the Adventure Plateau, located 40 km north of the volcanic island of Pantelleria, as well as underwater visual observations by divers, analyses of some rock samples collected in several locations of the bank, and radiocarbon dating. These data provide evidence for an unique and significant structure of anthropogenic origin.

2. Methods

Detailed sea-floor surveys were conducted in November 2012 using a hull-mounted multi-beam sonar system with the R/V *OGS-Explora*. Subsequently, in December 2012, a high-resolution survey was focused on a specific area of the PVB, which was mapped with a portable multi-beam sonar system. These surveys provided a context for direct sea-floor observation made by divers, who recorded high-definition video (for a total of approximately 8 h of registration) and photos, and collected several rock samples. In addition, radiocarbon measurements were made on small, intact shells extracted from 4 different rock samples, applying the Talma and Vogel (1993) calibration method. Because the obtained ages are close to the limit for ^{14}C dating, the measurements were performed in two different laboratories in USA (Lawrence Livermore National Laboratory, and Beta Analytic Inc., Miami) to verify the goodness of the data.

These activities, carried out in various phases from August 2013 to September 2014, were supported by the Italian *Arma dei Carabinieri*, who made available their boat and a group of divers. Francesco Spaggiari and Fabio Leonardi (*Global Underwater Explorers*) contributed with rock samplings and underwater videos. More details on acquisition parameters and processing of high-resolution bathymetric data can be found in the *Supplementary Material*.

3. Results

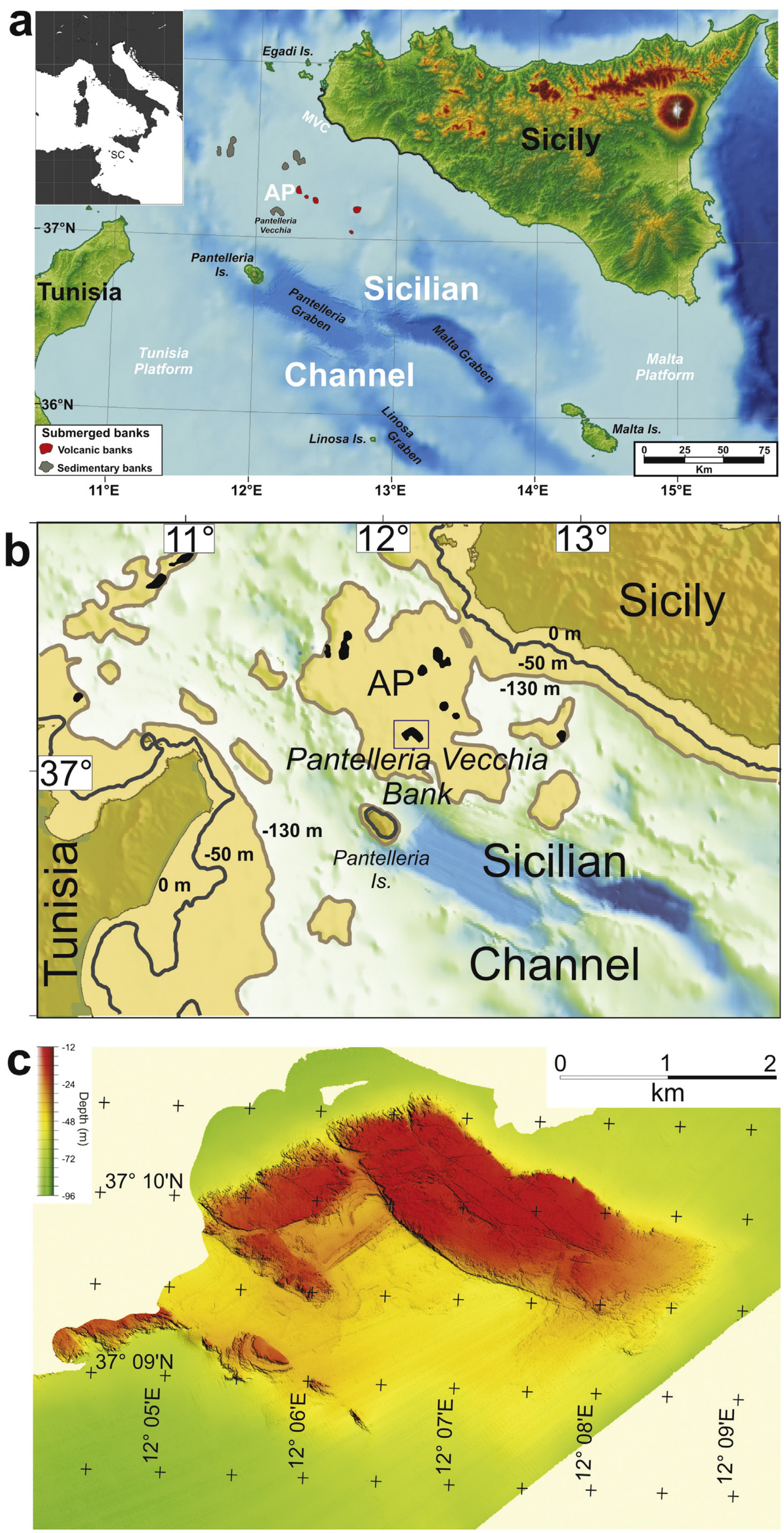
3.1. High-resolution bathymetric maps and underwater surveys

The bathymetric map (Fig. 1) reveals that the PVB is made up of two main shoals, intersected by fractures and steep valleys, and a number of smaller isolated bathymetric highs, covering a total area of 5.2 km^2, with little or no sedimentary cover. The present depth of the two main shoals varies from 16 to 24 m, while the surrounding areas are located at depths ranging from 46 to 60 m. Here, the unconsolidated sedimentary cover of the bedrock is composed of coarse organogenic sands with thickness ranging from a few decimetres to a few metres (Stanley et al., 1975; Colantoni et al., 1985). This bank is located in a sector of the Adventure Plateau dominated by NW-trending, high-angle normal faults related to the continental rifting phase that produced the Pantelleria graben (Civile et al., 2010). Compressional structures, generated by a Late Miocene compressional phase (Argnani et al., 1986; Lentini et al., 1996), have been also recognized in this sector.

The high-resolution map focussing on the area between the two shoals (Fig. 2) shows that the most evident morphological feature is an 820 m long, rectilinear ridge connecting the two shoals and enclosing an embayment. The base of this ridge lies at water depths ranging from 43.1 to 44.4 m while its summit lies between 35.1 and 36.8 m below sea level. The ridge is characterized by a flat top and a regular slope ranging from 16° to 20°. A parallel, but less continuous, segment of ridge is located 80 m inward of the main outer one and rises about 2 m above the surrounding sea-floor. Underwater surveys were made throughout the entire length of the outer ridge and part of the inner one, in order to obtain photographs and video images, and to collect rock samples. The slopes of the ridge are devoid of sedimentation due to a relatively strong and constant bottom current with velocity varying between 2 and 3 knots. The entire ridge is composed of rock blocks generally with a rectangular shape in plain view lying in close contact to each other. Such a geometric arrangement is particularly evident in the central part of the ridge. About 100 m seawards from the southern termination of the outer ridge, an elongated rectangular flat top ridge extends 82 m towards the open sea and rises ~2 m from the surrounding sea-floor. To the north of the rectilinear ridge, other important morphological elements seen on the map are at least three concentric, semi-circular ridges, and regularly spaced by 60 m. Between the two southern ridges the almost flat sea-floor lies at 36÷38 m below sea level. The water depth of the annular areas between the northern semi-circular ridges ranges from 32 to 34 m. At ~15 m from the base of the southern semi-circular ridge, an important morphological element, easily recognizable from the bathymetric maps (Fig. 3), is an elongated monolith laying on the sea-floor, isolated from the rest of the outcrops, and broken in half, as appears from inspections carried out by divers (Fig. 4). The good match between the two adjacent parts suggests that it was originally a single block. Its length is 12 m, with a recognizable squared section of about 2 m, particularly regular in its southern half. The longitudinal axis of the monolith is oriented N50°E. A rounded hole with a diameter of about 60 cm passes right through the monolith, at 50 cm from one end. Another hole of the same diameter, but not crossing the whole monolith, is present in one of its sides. It is about 40 cm deep and is located midway in the monolith, at a right angle with respect to the first hole. Another hole, but less regular, with a diameter of about 50 cm, is found along the other side of the monolith. Also this hole is located midway in the monolith.

3.2. Macroscopic and microscopic analyses on rock samples

Here we present analyses of rock samples recovered in some locations of the PVB (Fig. 5). Samples 1, 2, 3, 1A, 2A, 4A, 5A, 6A and 7A have been grouped together because these all correspond to a bioclastic calcirudite. Samples 1, 2, 3, 4A and 6A have been taken by divers at various water depths from the blocks composing the outer rectilinear ridge, and sample 7A was taken at the top of the inner ridge. Samples 1A, 2A and 5A have been taken by divers from the monolith described above. The macroscopic analysis shows that about 95% of the clasts consist of fragments of shells, red algae and corals, with rare, well rounded lithoclasts (generally between 0.5–4 mm in size), embedded in a thin layer of calcite. A photomicrograph of a thin section (transmitted light) shows that the coarse-grained, rounded bioclasts (red algae) are surrounded by an isopachous fringe of calcite, indicative of precipitation in marine phreatic zones where all pores are filled with water (typical feature of low-intertidal and sub-tidal cements). In this case, bridging


a
SC
Egadi Is.
MVC
Sicily
AP
Pantelleria Vecchia
37°N
Pantelleria Is.
Tunisia
Sicilian
Pantelleria Graben
Malta Graben
Tunisia Platform
Channel
Malta Platform
36°N
Linosa Graben
Linosa Is.
Malta Is.
Submerged banks
Volcanic banks
Sedimentary banks
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11°E
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37°
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Sicilian
Channel
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-48
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37° 10'N
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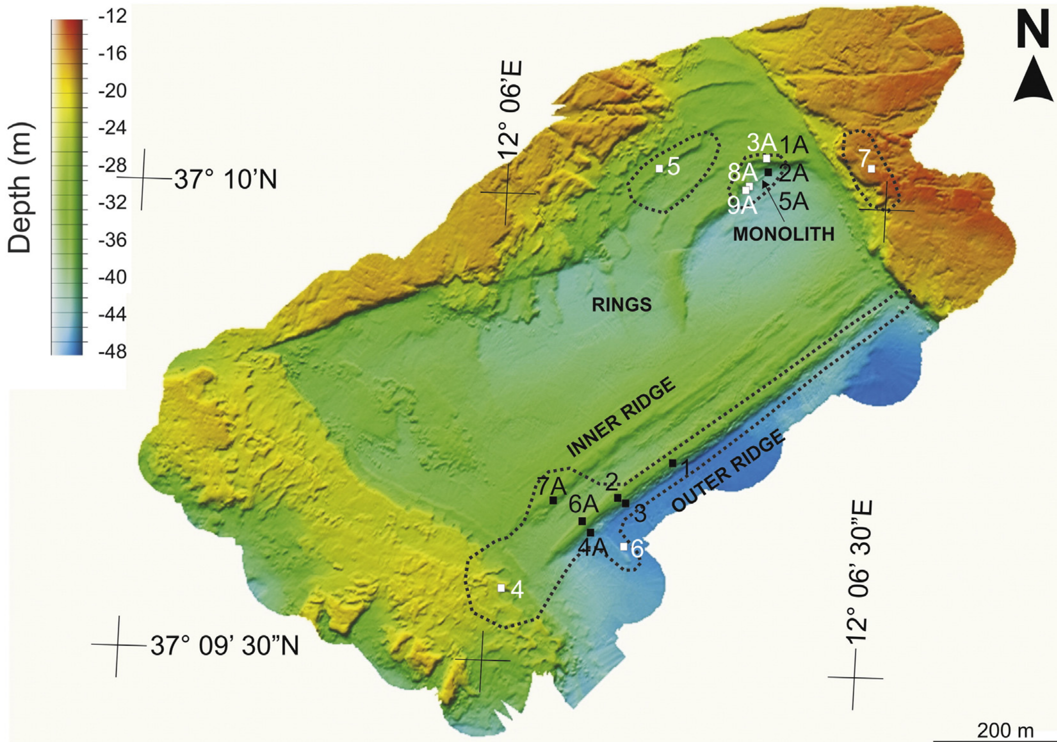

Fig. 2. High-resolution bathymetric map of part of the PVB. The 820 m long rectilinear ridge, as well as a parallel, but less continuous ridge, are seen on the map. To the north of these ridges, at least three semi-circular morphological ridges (concentric rings) are visible: the monolith is located within this area. Areas surrounded by black dashed segments are those where underwater surveys by divers were conducted. Numbers indicate the locations of rock samples collected in the PVB, some of them presented in Fig. 5. Black numbers refer to the Late Pleistocene calcirudites; white numbers refer to the Tortonian calcareous mudstones-sandstones.

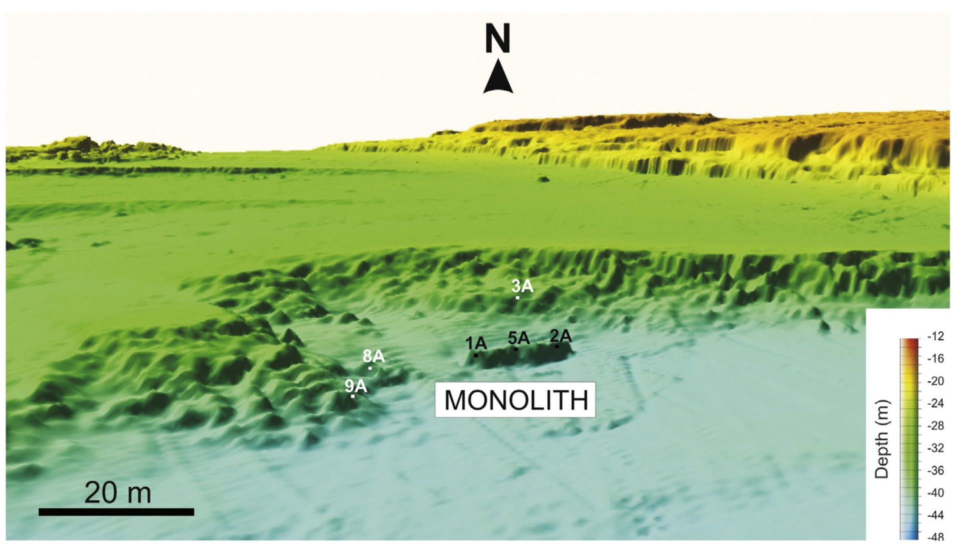

Fig. 3. 3-D perspective view of the high-resolution bathymetric map where the monolith has been discovered. No vertical exaggeration. Numbers indicate the locations of the corresponding rock samples.

cements (e.g., meniscus cement) crossing pores and connecting grains, indicative of vadose-zone precipitation (as occurs in high-intertidal, supra-tidal and shallow-subsurface meteoric environment), are absent (Flügel, 2009). The microscopic features of these rocks are not those of a typical beach-rock, and further analyses are in progress to recognize the depositional environment and the sedimentation processes.

Fig. 1. (a) Morpho-bathymetric map of the Sicilian Channel and surrounding regions. Bathymetric data are taken from the International Bathymetric Chart of the Mediterranean (http://www.ngdc.noaa.gov/mgg/ibcm/ibcm.html), and from the CIESM/IFREMER map of the Mediterranean sea-floor (http://www.ciesm.org/marine/morphomap.htm), integrated with data taken from Civile et al. (2010), whereas topographic elevations are taken from the Shuttle Radar Topography Mission (http://www2.jpl.nasa.gov/srtm). Box in the upper left corner locates the study area (SC: Sicilian Channel). AP: Adventure Plateau; MVC: Mazara del Vallo Channel; (b) Reconstruction of the Sicilian and Tunisian palaeo-shorelines at two different stages: (1) when sea level was ~120 m lower than the present-day (brown contour), corresponding to the Last Glacial Maximum, the Adventure Plateau was connected to Sicily, forming a broad peninsula; (2) when sea level was ~50 m lower than the present-day (dark grey contour), the formerly emerged islands (indicated in the map as small black areas) constituted a wide archipelago between Sicily and the Pantelleria Island (~10,500 year B.P.). (c) 3-D shaded-relief map of the Pantelleria Vecchia Bank obtained from high-resolution swath bathymetric soundings performed by the R/V *OGS-Explora*.

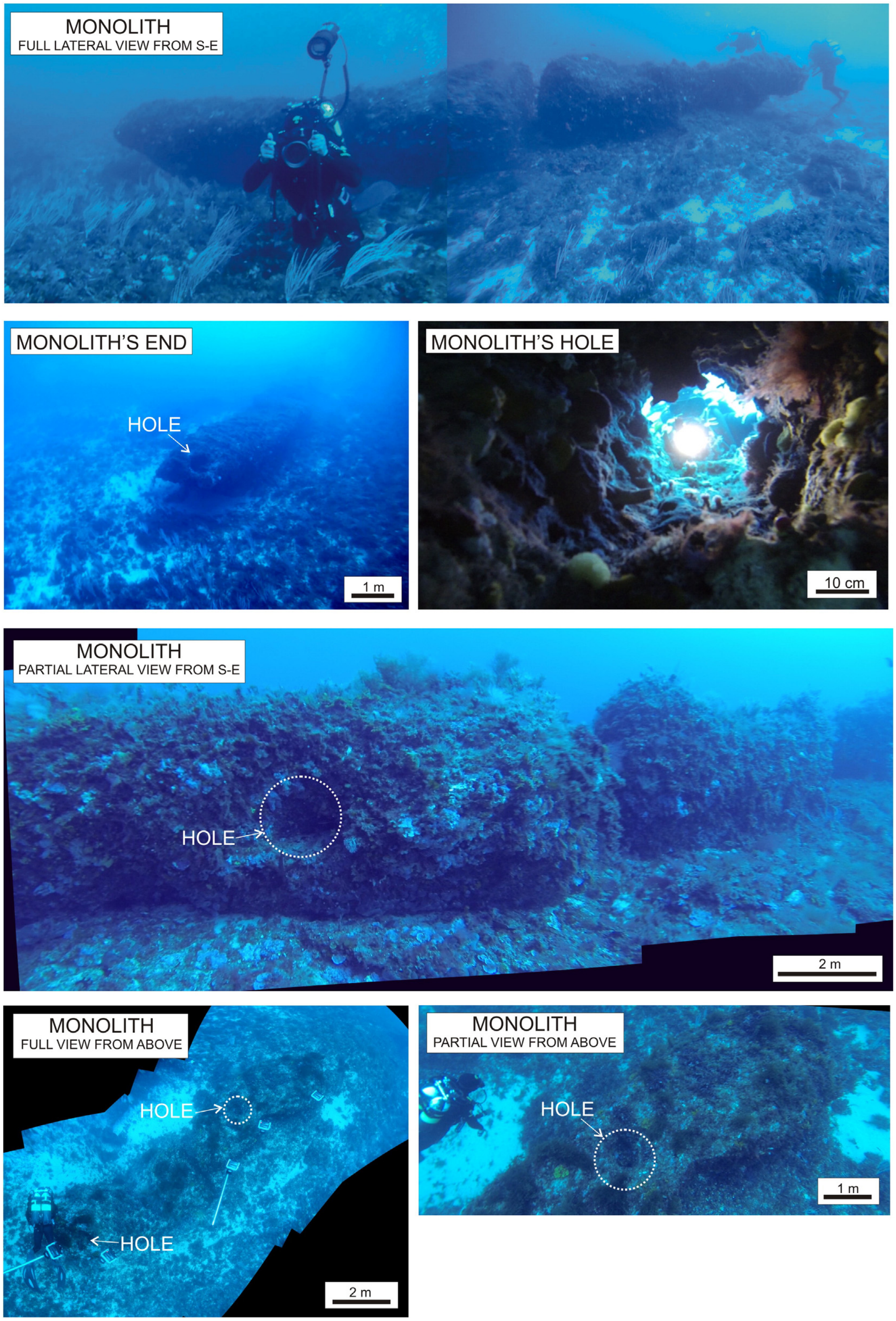

Fig. 4. Underwater composite photographs taken from divers, showing the discovered monolith and some details.

Samples 4 and 7 are mudstones taken at the top of the western shoal of the PVB at a 27 m water depth and at the top of the eastern shoal of the PVB at a 22 m water depth, respectively. These samples contain calcareous sponges, bryozoans and fragments of molluscs, planktonic and benthic foraminifera, indicating a patch-reef depositional environment. Rock samples 5, 3A, 8A, and 9A have been taken in the embayment area from the top of the semi-circular ridges. Sample 5 was taken at a water depth of 35 m; samples 3A, 8A and 9A were taken at water depth of 34 m. All of the rocks are bioclastic limestones containing cemented little clasts (size generally between 0.5 and 2 mm) and bioclasts, comprising some well-preserved benthic foraminifera. In addition, there are abundant fragments of gastropods, corals and molluscs. Sample 6 was taken by the divers at 42 m water depth from the elongated rectangular flat top ridge that extends 82 m perpendicular to the rectilinear outer ridge. It is a calcarenite containing a rich micro-fauna, with 11 genera of benthic foraminifera identified. In addition, ostracods and gastropods are also found, as well as rare bivalves, spines of echinoids and fish teeth.

In summary, samples 4, 5, 6, 7, 3A, 8A and 9A are lithologically similar, and represent calcarenites and bioclastic limestones and mudstones of Late Miocene (Tortonian) age, based on the occurrence of the benthic foraminifera *Borelis melo melo*, and generally deposited in a lower shore face environment. This chronostratigraphic attribution is compatible with coeval successions of the Sicilian Channel region studied by several authors (e.g., Van der Zwaan, 1982; Grasso and Pedley, 1988). The samples taken in correspondence of the rectilinear ridges (samples 1, 2, 3, 4A, 6A and 7A) and the monolith (samples 1A, 2A and 5A), represent calcirudites deposited in a shallow marine environment.

The results of these petrographic analyses, combined with the high-resolution morphological maps and the observations of divers, have allowed us to realize the geological map of the PVB (Fig. 6).

3.3. Radiocarbon dating results

Accelerator mass spectrometry (AMS) radiocarbon age determinations and their calibrated ages have been performed on 4 samples, and are presented in Table 1. Overall ages fall within the marine isotope stage MIS-3 (60 to 25 k year B.P.), a period characterized by several sea-level fluctuations (Siddall et al., 2008), and where the discrepancies among the sea-level values obtained from the isotope record of deep-sea cores, and those obtained from oceanic coral reefs, are more pronounced (e.g., Bailey et al., 2007).

4. Interpretation

From the data we have here presented and analysed, it can be inferred that the monolith discovered in the PVB is not a natural feature, but man-made. The elements that combine to formulate this interpretation can be listed as follows:

- the monolith has a rather regular shape;
- the monolith has three regular holes of similar diameter: one that crosses it completely on its top, and another two at two sides of the monolith; there are no reasonable known natural processes that may produce these elements;
- the monolith is made from stone other than those which constitute all the neighbouring outcrops, and is quite isolated with respect to them; and
- the lithology and age of the rock that makes up the monolith are similar to those that make up the blocks of the rectilinear ridge closing the embayment.

The presence of the monolith suggests extensive human activity in the PVB. It was cut and extracted as a single stone from the outer rectilinear ridge situated about 300 m to the south, and then transported and possibly erected. From the size of the monolith, we may presume that it weights about 15 t. The information so far available does not allow us however to formulate hypotheses about the specific function of this

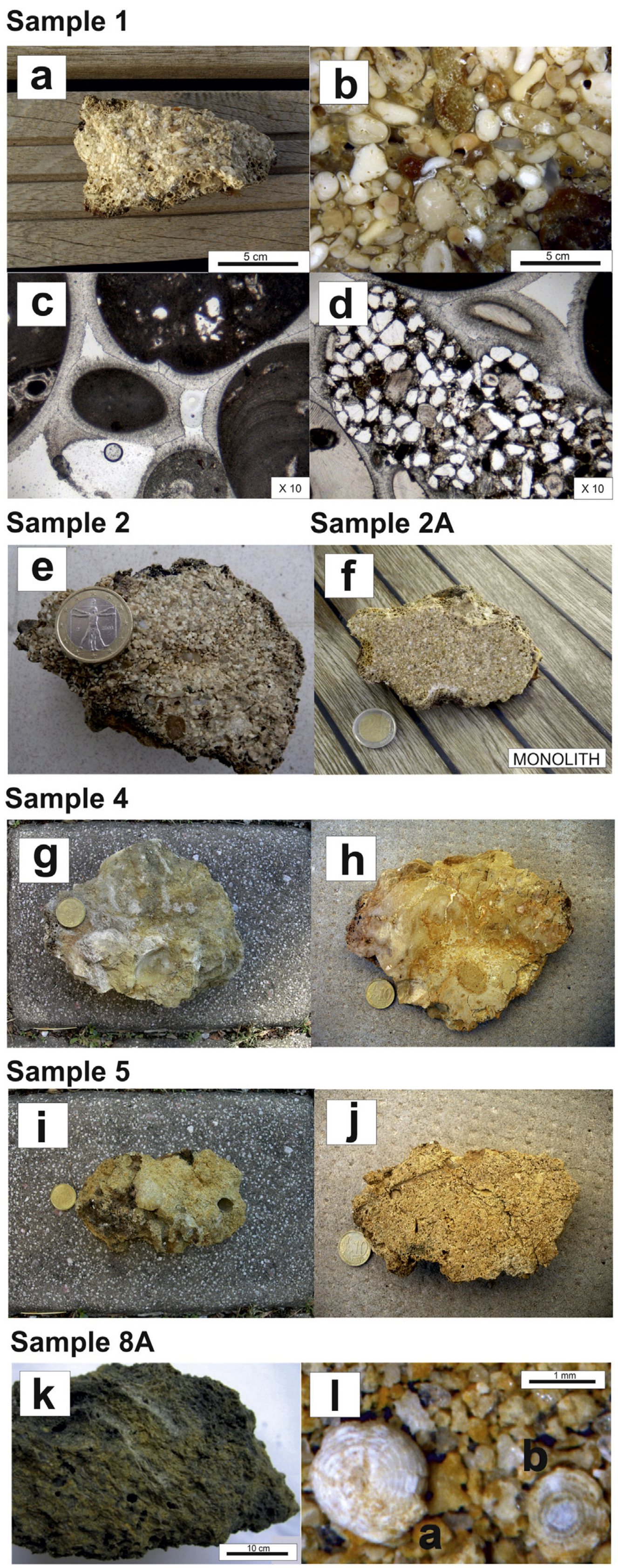

Fig. 5. Photographs of some of the rock samples collected. (a) Sample 1 (calcirudite) and its cut (b). (c) Photomicrograph of a thin section (transmitted light). Open parts of the void filled with resin appear white. See text for further details. (d) Photomicrograph (thin section) of a rounded quartz-arenite fragment wrapped by isopachous marine calcite cement. Within the clast are visible quartz crystals, echinoid spines, and planktonic foraminifera. (e) Sample 2 (calcirudite). (f) Sample 2A (calcirudite) taken from the monolith. (g) Sample 4 and its cut (h). (i) Sample 5 and its cut (j). (k) Sample 8A and disaggregated sediment (l), with two individuals of foraminifera *Borelis melo melo* (a and b). The genera of the benthic foraminifera identified in the samples has been determined following the taxonomic order of Loeblich and Tappan (1988).

monolith. It is however reasonable to assume that the PVB represented an important line of communication with the interior, because located midway between Sicily and Tunisia.

In the absence of finds of datable artefacts in the investigated area, we used the post-glacial curve of sea-level change for the Italian coasts to derive the latest date for the monolith and the term of human activities in the PVB. We are fully aware however, that a considerable debate has developed on the appropriate use and application of global curves for regional cases, and an abundant literature was produced in recent years on the spatial inhomogeneity in sea-level rise in different physiographic and tectonic context (e.g., Milne and Mitrovica, 2008).

The curve of change in sea level is the combined result of (a) eustasy, (b) glacial-hydro-isostasy, and (c) vertical tectonic motion. The first contribution to the sea-level change curve is global and time-dependent, while the latter two vary with location. Along the Italian coasts, the glacio-hydro-isostatic component has been predicted and compared with field data at several coastal sites (Lambeck and Purcell, 2005). The tectonic contribution is derived from the elevation of the Marine Isotope Substage (MIS) 5.5 shoreline-marker, aged at 124.5 k year (coinciding with the last interglacial), and its geochronology is based on orbital tuning of high-resolution deep-sea oxygen isotope stratigraphy (Shackleton et al., 2003). During this last interglacial period, the global sea level rose to a level higher than the modern sea level (Siddall et al., 2003). Along the Italian coasts, the average level attained by the sea during the MIS 5.5 is inferred to be of ~+7 m (Lambeck and Purcell, 2005). Markers attributed to the last interglacial are represented by notches, marine terraces, beach deposits, speleothem concretions and boreholes of molluscs living in the rocky cliffs. The MIS 5.5 was used as a benchmark to assess tectonic stability at individual coastal sites in Italy (Ferranti et al., 2006).

Analyses of geomorphological markers indicate that the western sector of Sicily and Egadi Islands is tectonically stable (the calculated vertical tectonic rate is ±0.04 mm/year), at least for the period of the Late Pleistocene and the Holocene (Ferranti et al., 2006; Antonioli et al., 2009), as also confirmed by independent measurements derived from semi-permanent GPS stations (Serpelloni et al., 2005). The lack of MIS 5.5 markers on the south-western shore of Sicily instead prevents a proper determination of the vertical movement rate in this sector. Because the Adventure Plateau, where the PVB is rooted, is part of the same geological province of the western Sicily, the contribution of the vertical motion which has to be introduced for deriving age uncertainties should be the same as that calculated for the western sector of Sicily (±0.04 mm/year).

Table 1
Radiocarbon dating results for the calcirudite samples.

Sample n°	Water depth	$\delta^{13}C$	Fraction modern	Error ±	$D^{14}C$	Error ±	^{14}C calibrated years B.P. (2SD)	Error ±
1A	38 m	0	0.0039	0.0006	−996.1	0.6	44,560	1270
2	36 m	0	0.0058	0.0006	−992.2	0.6	43,895	490
3	41 m	0	0.0100	0.0006	−990.0	0.6	36,960	500
6A	35 m	0	0.0054	0.0006	−994.6	0.6	41,970	920

The corresponding age, along with estimated errors, obtained by intercepting the post-glacial sea-level curve with the present-day water depths of the outer ridge summit (ranging from 35.1 to 36.8 m) is 9350 ± 200 year B.P. (Fig. 7). The choice of the depth of the top of the outer ridge is motivated because this morphological relief may have acted as a natural containment dam against the progressive flooding of the inner land. We would have obviously got an older age for the monolith by applying the present-day depth of the sea-floor on which it lies. The obtained age falls chronologically within the beginning of the Mesolithic period of the SE Europe and Middle East.

Age errors estimates for sites within the Italian Peninsula are given by the following function (spatially averaged data), which provides an

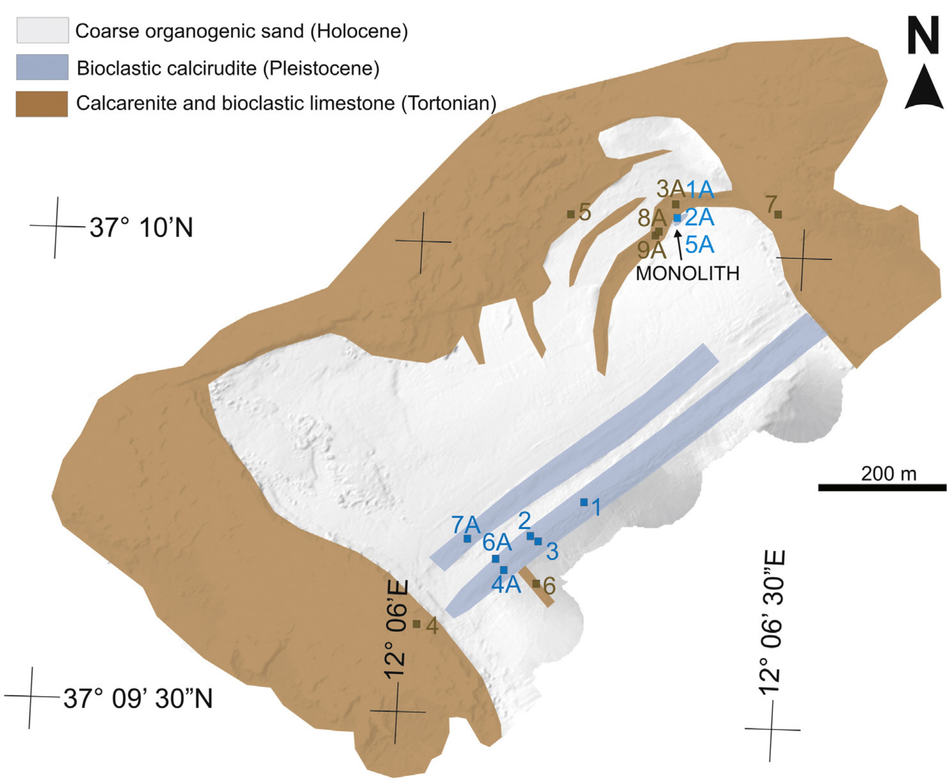

Fig. 6. Geological map of part of the PVB, produced on the basis of petrographic analyses of rock samples, divers inspections and detailed morphological mapping.

estimate of the total prediction uncertainty σ_{pred} for each locality and for each epoch (Lambeck et al., 2004):

$$\sigma_{pred} = 0.012\,T^2 + 0.24\,T - 0.13 \qquad (1 > T > 14\ \text{kyr})$$

This would be about ±3.5 m at ~10 k year.

When the sea level reached the upper threshold of the outer ridge, sea water would have flooded the inner areas of the PVB, probably forcing the abandonment of the site (Fig. 8).

5. Discussion

The obtained age for the PVB site places it within the beginning of the Mesolithic. Perhaps the most important archaeological discovery of the Mesolithic age is the monumental temple complex of Göbekli Tepe, situated in south-eastern Turkey. Carbon-dated to about 11,600 year B.P., this site is believed to have been a religious centre or sanctuary (Mann, 2011) serving a well-organized settlement (or series of settlements), as evidenced by its diverse range of megalithic art, as well as the large number of megaliths used in the construction of its shrines. Up until its excavation in the 1990s (Schmidt, 2000), archaeologists believed that only properly settled farming communities were capable of building a monumental complex like Göbekli Tepe. It contains the oldest art involving stone structures, including numerous reliefs of animals. Before the discovery of this monumental complex, the two Neolithic stone temples of Ġgantija in Gozo (Maltese Islands), unmatched by any other architectural construction in the Mediterranean region, represented the oldest man-made religious structures in the world (Trump, 2002). Regarding the underwater sites known to date, the PVB site is older than the Neolithic Atlit Yam site off the north coast of Israel, dated between 6900 and 6300 B.C. (Galili and Nir, 1993) and now lying between 8 and 12 m beneath the sea surface, and the city of Pavlopetri, situated 3 ÷ 4 m underwater off the coast of southern Peloponnese (Greece), until now considered the world oldest (about 5000 years old) submerged archaeological town.

Göbekli Tepe has revolutionised archaeological and anthropological understanding of the Middle East Mesolithic. It demonstrates that the construction of a monumental complex was within the capability of a hunter-gatherer society, although scientists do not yet understand exactly how its builders managed to mobilize and feed a force large enough to complete the project. It's worth noting, for instance, that during the first two phases of construction, over two hundred large pillars, each weighing up to 20 t, were erected and topped with huge limestone slabs. No other hunter-gatherer society has been able to match this feat.

The discovery of the submerged site in the Sicilian Channel may significantly expand our knowledge of the earliest civilizations in the Mediterranean basin and our views on technological innovation and development achieved by the Mesolithic inhabitants. The monolith found, made of a single, large block, required a cutting, extraction, transportation and installation, which undoubtedly reveals important technical skills and great engineering. The belief that our ancestors lacked the knowledge, skill and technology to exploit marine resources or make sea crossings, must be progressively abandoned. The recent findings of submerged archaeology have definitively removed the idea of "technological primitivism" often attributed to hunter-gatherers coastal settlers.

Finally, some considerations should be made regarding the provenience of these colonizers. Most likely the ancient inhabitants of the Adventure Peninsula came from Sicily, with which a direct terrestrial connection existed throughout the LGM, as indicated by morphological reconstructions of palaeo-shorelines. The provenance from North Africa would have been more difficult because of a nearly 50 km wide seaway between the Peninsula and the former Tunisian shore. The timing of the arrival of the first modern humans to Sicily remains however largely unknown (i.e., Tusa, 1999; Mussi, 2001). Specimens discovered in some

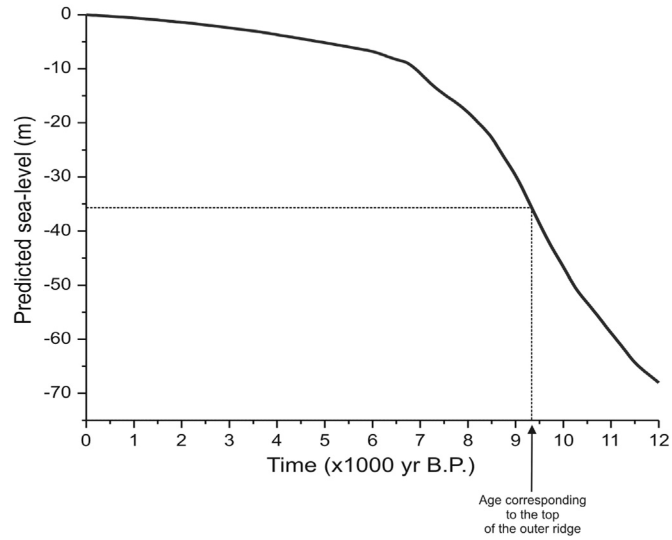

Fig. 7. Predicted sea-level change vs. time, calculated for the median latitude of the Adventure Plateau. Intercepted value along the x axis indicates the age corresponding to the water depth of the outer ridge summit.

Sicilian caves testify that the island was permanently colonized by Upper Palaeolithic hunter-gatherers (approximately 13,500 year B.P.; D'Amore et al., 2009). The migration from mainland Europe to Sicily took probably place between 27,000 and 17,000 year B.P., thanks to the emergence of a rocky continental bridge between the Sicilian coast and the Italian peninsula (Antonioli et al., 2014). These ancient inhabitants may have also colonized and settled the various islands of the archipelago, driven by a suitable climate and a favourable geographical position as a privileged route of communication. These islands thus have represented not barriers but gateways to human movement and contact.

The idea that early human ancestors once lived at the sea-floor of modern seas easily fascinates and attracts our imagination. What is more surprising, and until recently poorly recognized, is that an extensive archaeological record of early settlements still remains on the seafloor of our continental shelves. Almost everything that we do know about prehistoric cultures derives from settlements that are now on land, and that were tens to hundreds of kilometres distant from the coastline when they were occupied. The vast majority of marine geophysicist and archaeologists have now realized that to trace the origins of civilization in the Mediterranean region, it is necessary to focus research in the now submerged shelf areas.

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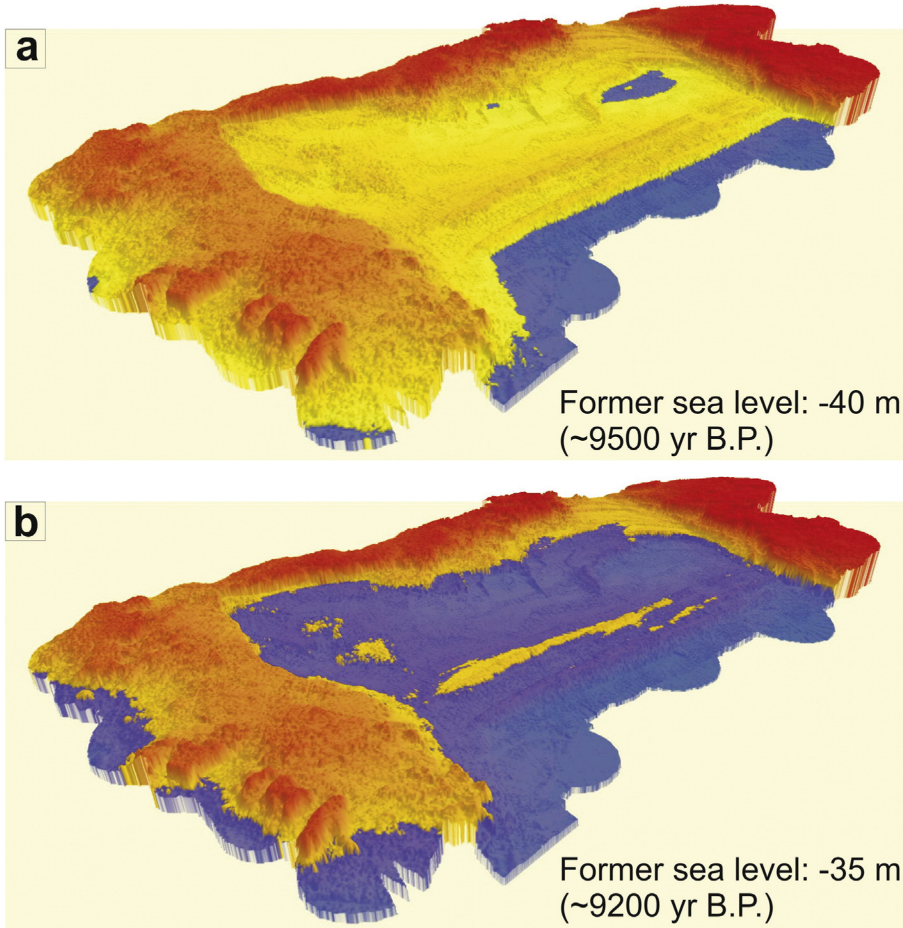

Fig. 8. Cartoon showing the progressive flooding of the PVB site when (a) sea level was −40 m (~9500 year B.P), and (b) when sea level was −35 m (~9200 year B.P.).

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