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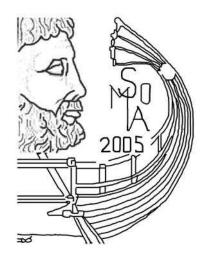
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Between the Sahara and the Mediterranean: a Study of the Middle Holocene Communities of the Sebkhet Halk el Menjel (Tunisia). The first three Campaigns 2002-2004.

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The main aim of the Hergla archaeological project is to study Tunisian Holocene coastal communities, their settlement dynamics and their palaeoeconomy. The coastal lagoon named Sebkhet Halk el Menjel was chosen for study due to its geographical location, between the pre-desert steppe of the Tunisian Sahel and the Mediterranean Sea. The project involves extensive surveys along the coasts, excavations of selected Neolithic sites, palaeoecological and geomorphological investigations to reconstruct past environments and human behaviours in the region during the early Holocene.

Introduction.

The Italo-Tunisian archaeological project began in 2002 with the aim to reconstruct the Holocene human occupation of the area around the Sebkhet Halk el Menjel, a lagoon along the central-eastern coast of Tunisia (Fig. 1). A series of Neolithic sites is known from the shores of the sebkha and from the Tyrrhenian littoral cordon that encloses it, as shown by map n° 9 for the Sousse region in the Atlas Préhistorique de la Tunisie (M'Timet et al. 1992). The Sebkhet Halk el Menjel lagoon is an ideal area for study, because it has in part escaped the devastating effects of recent human activities, which in other parts of Tunisia have resulted in substantial landscape changes often leading to the establishment of vast olive groves. The extensive surveys that have been undertaken in the initial three years of the project, along the edges of the sebkha, have found an Aterian site of the Middle-Upper Palaeolithic (Aumassip 2004: 161) and about fifty mid-Holocene sites, locally known as rammadiya,1 for their primarily ashy deposits (Camps 1987: 2685). These sites (otherwise known as amas coquilliers, or shell-middens) are characterised by shell-rich deposits, darkened by the action of fire and by the decomposition of organic materials.

The main objectives of the project are to study the communities living around the lagoon and to determine whether the transition from a Capsian Epipalaeolithic to a Neolithic subsistence economy occurred in this region. In this respect, stratigraphical excavations have been and will be undertaken at selected sites to understand settlement dynamics and seasonality of occupation of the lagoon ecosystem during the Holocene, as well as the specific function of each site and the palaeoconomy of the inhabitants of this north-African coastal environment.

This will all be linked to the study and reconstruction of the evolution of the ancient landscape, for which the GIS platform offers a powerful analytical tool for the interpretation of the data arising from the archaeological surveys.

Geomorphological evolution of the Sebkhet Halk el Menjel

The Sebkhet Halk el Menjel is one of the littoral sebkhas² of the Gulf of Hammamet on the eastern coast of central Tunisia. This area witnessed significant geomorphological changes during the Holocene, which have left behind sedimentary deposits resulting from continental hydro-aeolian processes, as well as from complex depositional exchanges between the sea and the land. The data collected show important morphological changes in the landscape within the context of a semi-dry environment. Sebkhet Halk el Menjel is a typical example of a lagoon of the middle and upper Holocene that later developed into a littoral sebkha, in historic and modern times, due to changing sea levels. During the Climatic Optimum (6000 to 5000 years BP) the sea level was higher than at present, allowing a connection between the sea and the land (fig. 3 - Imbrie et al. 1984). With the lowering of the sea level, during historic times, the

² The *sebkha* is a closed depression, filled temporarily by water that it

collects from ephemeral streams, therefore functioning as an internal

drainage system. The *sebkha* is an endorheic low-lying basin, affected by sporadic inundations, characterized by the presence of salt deposits

and the absence of vegetation. Sebkhas are subjected to strong aeolian

erosion causing deflation especially in the dry seasons, during which the

salt deposits crystallize and they always contain sodium chloride that

flocculates the clays and impoverishes their consistency. The deposits of

¹ from the Arabic ramad = ash

the *sebkhas* are generally fine (clays and silts), while the soils around them are often damp, allowing the formation of salt marshes in which plants resistant to high salinities manage to survive. This kind of area is called *chott* and it is characterised by the presence of halophytic

exchange between the sea and the land was progressively reduced, resulting in the formation of the *sebkha*.

The prehistoric sites that have been discovered range from about 5500 to 7000 years BP (according to the dated sequence at site SHM-1, discussed below) for the Neolithic and from about 45000 to 25000 BP for the Aterian (Aumassip 2004: 158). Different environments existed during these two phases depending on the position of the sea level (fig. 2, 3). During the older phase, from about 7000 to 25000 - 45000 years BP, the sea was far lower, as much as 120 metres below its present level and therefore saltwater was absent (as witnessed by the absence of Cerastoderma). In the more recent phase the sea level was roughly the same as, or a little higher than, at present. Excluding minor fluctuations, it is possible that the *sebkha* maintained the features of a lagoon with an uninterrupted connection to the sea. Because the area around Hergla has been tectonically stable from the Tyrrhenian to the present (about 125000 years), with an uplift of only about two metres, the effects of vertical crustal movements on relative sea levels are negligible (Paskoff and Sanlaville 1976; 1980).

Many of the prehistoric sites, discovered as a result of this research, are located on the ridges (*lunettes*³) of the *sebkha* (Boujelben 2002). The main geomorphological features arising from the evolution of the lagoonal environment are:

- The mid-lower Holocene *lunette* of the western and southern edge of the *sebkha* was probably produced by an occasional dry climatic event, characterised by an increase in aeolian activity from the north and north-east and by the contemporaneous disruption of the inflow of continental waters and of the sea.
- The mid to upper Holocene lagoon system is attested by the presence of marine and lagoonal shell deposits on the western edge of the present-day sebkha, linked to human occupation (VI-IV millennium B.C. cal.). The presence of such accumulations appears to be due to a significant communication between the land and the sea, favoured by a higher sea level than at present.
- The *lunette* of historic times is not very evident in the landscape and occupies the north and northwestern coast of the southern basin of the *sebkha*. Its formation suggests endorheism in historic times, with inputs from wind action from the south and south-east, as well as inflowing sediments from the *oued* al Manfas as-Sod (the main freshwater inflow to the lagoon) and from the sea.
- The post-Roman endorheic regime is represented by aeolian deposition and by nebkha formations, kept

in place by the tamarisks on the eastern margins of the northern basin of the *sebkha*. To the north of the *sebkha*, significant depositions blanket a pre-Roman cordon and sites of the Roman period (from the IV to the V century A.D.).

The present evolution of the *sebkha* is dominated by alluvial fill, with minor inputs of aeolian origin. The exceptional alluviation of 1969 produced a deltaic cone filling more than a third of the area of the *sebkha*.

The archaeological surveys

The archaeological surveys of 2002-2004 have been undertaken along the whole southern and eastern shores and in parts of the northern and western shores of the *sebkha*, as well as along the *oued* al Manfas as-Sod and the littoral coast to the north and south of the village of Hergla. The extensive surveys have been done in transects with by a varying number of fieldwalkers from 3 to 6, set at average distances between 10 and 30 metres, a spacing made necessary by the variable visibility of different terrains. Every site found has been positioned by GPS (in UTM coordinates) and catalogued, with a code and progressive numbering in individual spreadsheets in Microsoft Access 2000 and, as a layer, in GIS.

The environment behind the lagoon is mainly characterised by dunes devoid of vegetation, with a variable sedimentation dependent on various factors, such as the slope of the terrain, altitude and closeness to the water level, exposure to winds and other taphonomic agents, typical of these semi-arid environments. The rammadiya sites are usually visible on the surface, especially in areas that have not been subject to recent agricultural activities. They are easily recognisable by various characteristics that are common to most such sites in North-Africa: darkened deposits, stones darkened by marine molluscan shells (especially Cerastoderma, Murex and Glycimeris) in coastal sites, terrestrial gastropods of the genera Helix and Leucochroa in sites of the interior (Camps 1974: 168), ostrich egg fragments, lithic flakes and tools, and more rarely animal bones (fig. 5, 6).

A total of 53 pre- and proto-historic sites have been found, 13 of which are along the coast to the south of Hergla, 38 along the shore of the lagoon and 2 along the left shore of the *oued* (fig. 1).

Coastal sites. Twelve of the coastal sites can be attributed to the Neolithic. These sites are all along the littoral cliff of Tyrrhenian age, which is as high as about 10 metres above sea level and separates the open sea from the sebkha. These sites are very variable in size and state of conservation. Some sites, such as SHM-10, are subject to erosion by the wind, which is particularly damaging for the deposits on the cliff (fig. 5). The bestpreserved of these coastal settlements is SHM-5, that had already been the object of investigations by the researchers working on the Atlàs Préhistorique (M'Timet et al. 1992: 18) and that has been excavated during the 2003 season, in order to determine the presence of a stratified site to be investigated fully in future. Given the progressive deterioration of the coastal sites, due to

³ A *lunette* is a geomorphological half-moon-shaped feature of aeolian origin that develops on the margins of *sebkhas*, in the opposite direction to the prevailing winds. For example, if the winds come from a north-western direction, a *lunette* is formed on the south-eastern margins of a *sebkha*. During dry seasons, the clays of the *sebkhas* (rich in sodium chloride) flocculate and start deflating under the effect of the dominant winds, creating fine deposits (clays and silts), often rich in diffuse chalk or in crystals.

natural taphonomic agents and to anthropic development, part of the present project will be devoted to recording fully their presence.

Peri-lagoonal sites. The sites along the present-day shores of the *sebkha* are very heterogeneous in their size, state of preservation and surface materials, all of which depend not only on the specific function of the sites, but also on the length of occupation and on the effects of post-depositional processes. The best-preserved sites are usually those away from agricultural areas, and located at a sufficient distance and altitude to avoid the exposure to lagoonal overflows and to the floods of the *oued*, or to the occasional movements of its bed.

The proximity of a series of Neolithic settlements to the internal present-day shore of the lagoon (fig. 1) allows to hypothesise that during the mid-Holocene period the water level in the *sebkha* was lower, or only marginally higher, than at present, as confirmed by the geomorphological investigations. Thirty seven of the thirty eight sites around the *sebkha* are probably Neolithic, while SHM-31 has been assigned to the Aterian as well as to the Neolithic, on the basis of lithic industry recovered from surface collections.

The distribution of settlements obtained from the archaeological surveys, during these first three seasons, is largely a result of the geomorphological conformation of the region and of the formation processes of the *sebkha* (Boujelben 2002). The northern coast presents a series of *lunettes*, contemporary or prior to the mid-Holocene, that are still active and cut the lagoonal plain along a north-south axis. Neolithic sites (usually detectable by the presence of flint surface scatters), as well as sites of later periods are present on the top of these dunes.

The eastern and western shores of the lagoon have the highest number of sites which are the object of a distributional analysis on GIS platform. The latter shores have particularly large spreads of archaeological materials, especially in the strip of land between the mouth of the *oued* al Manfas as-Sod and the left side of the *oued* itself. In this part of the lagoon many surface scatters have diameters that extend for more than one hundred metres, often merging with other scatters. Investigations on such scatters, in addition to findings from current studies on stratified sites, will allow to determine for each site its specific function, period of deposition and relationship with other contemporary Neolithic settlements.

One of the most promising and well-preserved sites is SHM-15, situated on the summit of a hill, in the area in which the *oued* flows into the western part of the lagoon (M'Timet *et al.* 1992: 26) (fig. 1). The study of the surface materials collected systematically from two transects, crossing the site along its two main axes, is aimed at understanding the effects of post-depositional processes on the upper layers and at determining the full extension of the site itself. A detailed survey of the whole hill has been undertaken, in order to create a DEM (*Digital Elevation Model*) to be inserted in the territorial GIS. The results of these studies and surveys will allow to adopt the most suitable strategy in the excavation of the site. The initial examination of the archaeological

finds has confirmed that the site was occupied during the Neolithic given the presence of a flint arrowhead, a tool introduced in North Africa from the beginning of this period (Camps 1974: 267), and of an ostrich egg bead produced by means of a calibre, another tool introduced in the Neolithic (Camps-Fabrer 1960: 146).

The southern area of the lagoon and the right shore of the oued al Manfas as-sod are characterised by a series of low hills which are difficult to survey, as they have been used in recent times for cultivation. However over the whole area prehistoric materials have been found across the ploughed fields. Given the impossibility of stratigraphic excavations in these cultivated areas, few further data will be gathered from the surface materials, other than to highlight the evidence for the intensive Neolithic occupation. Closer to the present edge of the sebkha three sites have been detected, two of which are probably Neolithic. An area devoid of cultivations on the summit of a low hill, dominating the southern end of the lagoon (between the mouth of the *oued* and the *sebkha*), has been found to contain high densities of lithics and named site SHM-31. The lithic tools from this surface scatter can be assigned to the Aterian and to the Neolithic on typological grounds.

The excavations at site SHM-1

In order to understand the nature of the Holocene settlements discovered in the region and to establish the chronological sequence, the stratigraphic excavation of site SHM-1 has been undertaken (M'Timet et al. 1992: 22; Harbi-Riahi and Zoughlami 1971) as well as numerous sondages along the maritime littoral and the inner shores of the sebkha (fig. 4). SHM-1 (fig. 6) (UTM 32S 63140 3986054) is located along the western side of the sebkha on an aeolian clay dune (lunette), 4 metres above the present lagoonal level. The site has been investigated mainly by means of a 19 x 1 metre trench, oriented along a north-south axis starting from the eroding front at the edge of the lagoon, and through a 5 x 10 metre sondage area called 'Area 5' (fig. 4). This sondage has involved recording the position of all the archaeological finds and the evaluation of the total extent of the site. For this latter purpose a number of 1 x 2m sondages have also been done.

These excavations have revealed at least three occupation levels, which have been radiocarbon dated using Cerastoderma shells (in the ENEA laboratories of Bologna) to between the VI and IV millennia B.C. (fig. 9). All the layers are characterized by a grey-black clay matrix. The dark colour of the deposits and the constant presence of burnt stones suggest various combustion episodes at the site. Gabriel Camps has interpreted similar deposits and abundances of burnt stones at other rammadiya sites as the result of the combustion of grasses and shrubs, which were used to fuel fires, given the absence of trees caused by progressive deforestation in North Africa during the Holocene. The burnt stones, so abundant in these sites, would therefore have been used to contain the grasses and shrubs during the combustion and, following the fire, to heat liquids and foods, such as molluscs (Camps 1997: 2689).

The discovery of a series of post-holes and structures also offers potentially new interpretations regarding the activities and modes of settlement adopted at *rammadiya* sites. Two semi-circular rows of postholes, interpreted as structures for supporting tents (Fig. 8), constitute the first example of such features in North-African *rammadiya* sites. As a matter of fact, the finding of postholes and huts has been considered improbable at these kinds of sites, as they "..enterraient leurs morts, abandonnaient leurs outils, leurs rares objets de parure; ils y édifiaient de légères cabanes qui n'ont laissé aucune trace, le sol étant trop meuble pour garder d'une manière durable l'empreinte de piquets" (Camps 1997: 2685).

The study of the stratigraphic sequence appears to show phases of continuous occupation at the site, given the absence of sterile lenses between the main occupation layers. On the other hand, it has to be pointed out that the site has been subjected to significant sedimentary processes of deflation and compaction, which might have removed some layers; therefore the continuity of occupation will be explored through a more detailed investigation of the stratigraphy, as well as by attempting to determine the seasonality of exploitation of the faunal resources exploited at the site. The faunal remains include mainly shells of marine molluses (which are the object of detailed archaeomalacological investigations, discussed below) and skeletal remains of vertebrates, such as Bos primigenius, Gazella, other mammalian herbivores and carnivores, birds and fish. zooarchaeological study on the bones of the capro-ovines will ascertain whether they belong to the Barbary sheep (Ammotragus lervia), a wild species naturally present in North-Africa, or to the domestic sheep and/or goat, that would have been imported and would attest the adoption of pastoralism.4

The material culture confirms an intensive use of the territory and the full exploitation of its geo-environmental resources. The initial typological analyses on the bone and flint industries have revealed that the artefacts from the site can be safely attributed to the so-called Neolithic of Capsian Tradition (NTC). The use of ostrich egg shells, both as containers and as raw materials for beads, shows a strong connection with the Tunisian hinterland. On the other hand the exchanges with other Mediterranean regions is confirmed by the recovery of some impressed ceramic ware fragments (fig. 7), with decorative elements analogous to those common in the central Mediterranean. Moreover the find of some obsidian fragments, in a layer dated to the beginning of the IV millennium B.C., confirms the Mediterranean connections. Obsidian, a glass of volcanic origin, is naturally present only in a few sources across the Mediterranean, in the islands of Palmarola, Sardinia (at Monte Arci), Lipari, Pantelleria, Giali and Melos. The first chemical characterization studies on the obsidian from site SHM-1⁵ have shown that the source of origin of the raw material was the island of Pantelleria, located just 70 kilometres away from Cap Bon in north-eastern Tunisia (Camps 1964: 296). Obsidian fragments are not isolated finds in Tunisia, given that some fragments have been found in fifteen Neolithic sites and that two other fragments have been found during the surveys for the present project at site SHM-12. These discoveries clearly testify contacts with other Mediterranean communities. The preliminary study of the lithic assemblage from SHM-1 has produced data on the technology and

The preliminary study of the lithic assemblage from SHM-1 has produced data on the technology and typology of the lithic industry. Two raw materials were adopted: local limestone and allochthonous flint. The local beige siliceous limestone, with an irregular white cortex, occurs in two varieties, which can be found near the site as nodules and as pebbles. The finer-grained variety is easier to work and limits knapping errors. This calcareous rock was used to produce blades and bladelets and often nodules of this stone show signs of heat treatment to improve the properties of the raw material. The coarser variety is hard to work and fractures in conchoidal brakes, and therefore it cannot be used to produce standardised bladelets. The allochthonous flint has beige to brownish colourations and occurs as small nodules with a beige cortex and with clear signs of heating. Heat treatment appears to be connected to pressure debitage. Two distinct chaînes opératoires appear to have been used to produce blanks: direct percussion with a hard hammer for limestone flakes and blades, and percussion with a soft hammer or pressure for bladelets on flint and fine grained limestone. In the process of working the blanks into tools, some bladelets and flakes were made into arrowheads and backed bladelets, and into geometric microliths (scalene triangles). These tools make up about 5% of the lithic assemblage. The rest is dominated by notches and denticulates that represent 74% of the retouched lithics. From a techno-petrological viewpoint, 32% of the industry is on blades and bladelets; the raw material of these blanks is flint in 40% of cases, while the remaining part of the blanks is on limestone flakes (and extremely rarely on quartzite flakes).

The archaeomalacological investigations

The study of marine molluscs (archaeomalacology) of the area of the Sebkhet Halk el Menjel has currently only been concerned with the deposit of the SHM-1 site, as well as with a preliminary examination of the shells from some of the sites around the sebkha (SHM-12 and SHM-15). The two most common species in the three abovementioned sites are Cerastoderma glaucum and Trunculariopsis trunculus (previously known as Murex trunculus). The former is by far the most abundant, which is not surprising given that it is probably the most common bivalve in local lagoons. The latter is a rocky shore species, which also thrives in lagoons where vast quantities of bivalves rot, producing eutrophic conditions. As described above, extreme geomorphological changes occurred around the Sebkhet Halk el Menjel during the Holocene favouring Cerastoderma glaucum when sea

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 $^{^4}$ The zooarchaeological study has been undertaken by Dr. N. Aouadi, A. Curci and E. Maini, who have provided the preliminary results of their work.

⁵ The obsidian fragments recovered from sites SHM-1 and SHM-12 are being analysed by Prof. R. Tykot at the Laboratory for Archaeological

levels rose, but probably causing mass mortality either when sea levels were extremely low or when excessive inputs of freshwater occurred. Therefore it is not surprising that great quantities of molluscan shells have been naturally deposited around the edges of the *sebkha*. The shells contained in the archaeological deposit of SHM-1 are probably a mixture of naturally and anthropically-deposited remains. Considering that it is impossible to distinguish whether an unmodified shell has been consumed or not by humans simply from its appearance, the exact quantification of the dietary contribution of shellfish to the diet of the occupants of the site is difficult. The examination of Cerastoderma shells from SHM-1 has revealed that some of them have damages or in some cases holes on the dorsal side just below the umbo. The exact causes of such damages are currently unknown, although taphonomic studies have been undertaken to address this issue. Most of the molluscan species recovered at SHM-1 are typically found along the coastal lagoons of Tunisia, although it is worth mentioning that the Glycimeris shells from the deposit probably originate from the littoral cliff to the east of the sebkha where fossil assemblages of them are present. An interesting find is a broken shell of the genus Charonia, a species used in the Mediterranean since Neolithic times as a musical instrument and usually found in funerary contexts (Skeates 1991). The lateral hole on this specimen suggests that this shell might have been used as an instrument. The archaeomalacological studies also suggest that caution should be exercised in supposing that the sites at the edges of the sebkha are shell-middens. This definition is used for sites that are the result of the dumping of shells after mollusc consumption by humans, and although this might be the case for some of the surface sites found on the edges of the Sebkhet Halk el Menjel it is impossible to separate the naturallyaccumulated from the (possibly) anthropically-discarded shells. On the other hand the shells in the sites of SHM-12 and SHM-15 had almost certainly been discarded by humans. The sondage at SHM-12, a site on the littoral cliff to the east of the sebkha, has revealed a thick, discrete layer of shell refuse mainly of C. glaucum. Although the quantities of molluscan remains recovered at SHM-1 might seem vast, and supposing that many other shell middens were present around the lagoon, the inevitable conclusion is that it is improbable that this type of environment could support a prolonged exploitation through the year sufficient to allow a permanent occupation. Therefore one means of studying the possible mode of exploitation of these environments would be to survey regions (such as the area of the island of Kneiss, in southern Tunisia) where similar ecosystems have been exploited until recently by pastoralists who relied on fishing and foraging, collecting bivalves mainly during the cooler part of the year.

Conclusions

At the inception of the Holocene, the North-African human communities of the central Maghreb had acquired social and economic traits that allow them to be classified as part of the local development of Capsian societies, and to be considered within the wider context of postPleistocene adaptations of the central Mediterranean region. Zooarchaeological studies at numerous sites indicate the beginning of the domestication of some capro-ovine and bovine species (Roubet 1979). The ceramics, especially in the coastal sites, bear strong similarities with the cardial and impressed wares typical of the central Mediterranean Neolithic and in particular of Sicily. Contacts with other central Mediterranean communities are documented by finds of obsidian and impressed wares. Nonetheless a clearly Epipalaeolithic substrate is still present, not only for the typology of the lithic industry, but also for the total absence of agriculture.

The preliminary results of the first three years of research in the area around the Sebkhet Halk el Menjel appear to support the seasonal character of the human occupation of the coast during the Holocene, documenting varied subsistence activities such as hunting, the collection of molluses, fishing and, possibly, herding of caprines, ovines and bovines. Moreover it has been shown that the groups that populated the region of the lagoon were clearly in a contact zone between the pre-desertic steppe of the Tunisian Sahel and the wider Mediterranean context. The study of a lagoon, so close to the Sahel, and within a few hundred kilometres from the last outreaches of the Tell and in direct contact with the Mediterranean, will allow to gather useful data for reconstructions of past environments and settlement dynamics of the Tunisian coastal region during the Holocene. An important aim of the project is to study the relationships between the communities that settled along the sebkha and those on the main Mediterranean islands and in the Tunisian uplands. Given that the movements from the coastal region to the interior would have been favoured by a complex system of natural streams, that provide easily practicable routes from the coast to the interior (through the oued al Manfas as-Sod, the sebkha Kalbia and the streams that flow from the uplands of central Tunisia), one of the future objectives of the present research will be to survey these 'natural corridors' in the hope of finding and mapping sites along them.

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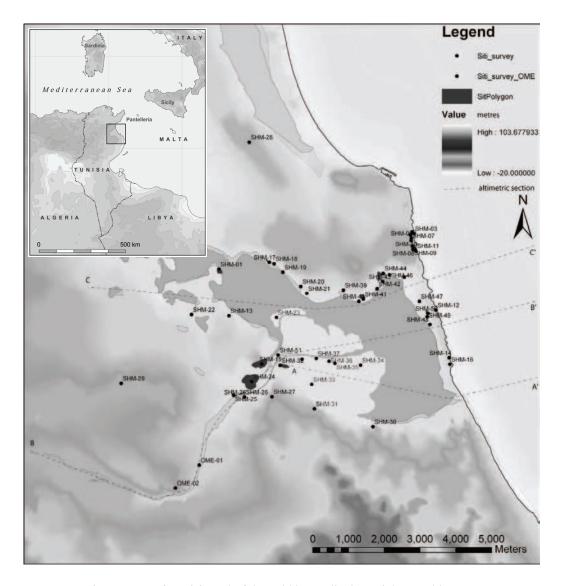


Fig. 1 Map of Tunisia and of the Sebkhet Halk el Menjel coastal lagoon. DEM of the area, and the prehistoric sites

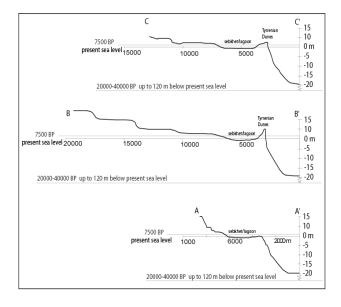


Fig. 2 Altimetric sections of the Sebkhet Halk el Menjel:

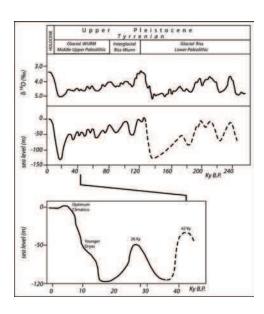


Fig. 3 - Isotopic curve and sea level curve - Imbrie *et al.* (1984) modif.

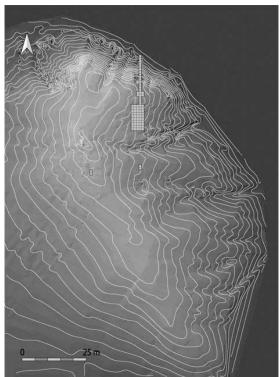


Fig. 4 SHM-1: Topographical plan of the site with the excavated areas



Fig. 5 Southern view of SHM-10, on the coastal cliff



Fig. 6 SHM-1: North-western view of the mound upon which the Neolithic site lies and view of the archaeological deposit exposed on the eroding front at the edge of the lagoon

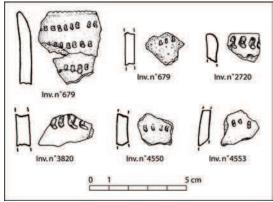


Fig. 7 Impressed pottery recovered in SHM-1 (drawing: Daniela Ursini)

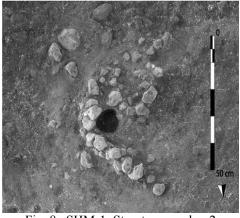


Fig. 8 SHM-1: Structure number 2

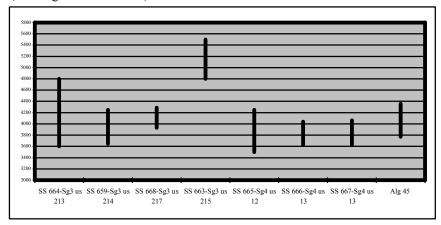


Fig. 9 Radiocarbon dates on Cerastoderma shells from SHM-1