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ORIGINAL ARTICLE

The Territory of Ancient Tipasa, Algeria: Archaeological Survey, Material Culture, and Connectivity in Central Maghreb

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Abstract The territory of Tipasa, an iconic UNESCO landscape that comprises the ancient city of Mauretania and its Royal Mausoleum, has never been systematically investigated. The exception may be Gsell's archaeological atlas of Algeria, compiled more than a century ago (Gsell, 1911). Since 2021, the TIPASA Project, a Spanish-Algerian survey program, was organized to shed light on this ill-studied ancient city and its territory. The survey approaches the subject from both the "site" and "off-site" perspectives, using tools such as remote sensing, field survey, and material culture, as well as an education program for Algerian students. This research is essential to understanding the part played by Punic, Hellenistic, Mauretanian, and Roman agents in creating the territory. The research methods and conceptual framework emphasize the particularities of North African cities and the creation of African-led networks in Antiquity across the Mediterranean, particularly the connections with the Iberian Peninsula before and after the imposition of Roman administrative structures.

Résumé Le territoire de Tipasa, un paysage emblématique de l'UNESCO qui comprend la ville ancienne et le Mausolée royal de Maurétanie, n'a jamais fait l'objet d'une approche approfondie en dehors de l'Atlas archéologique de l'Algérie de Gsell (1911). Depuis 2021, le projet TIPASA, un projet d'enquête algéro-espagnol vise à faire la lumière sur ce territoire archéologique mal étudié, tant du point de vue du site que de son entourage. Le projet, qui est un ambitieux programme de formation pour les étudiants algériens, utilise différents outils de travail tels que la télédétection, l'enquête de terrain et l'analyse de la culture matérielle. Cette recherche est essentielle pour comprendre l'influence punique, hellénistique, mauritanienne et romaine dans la création du territoire, en soulignant les particularités des villes nord-africaines. Le projet cherche également à comprendre quels sont les liens établis depuis la rive nord de l'Afrique dans l'Antiquité avec la Méditerranée, et en particulier les connexions avec la péninsule ibérique, avant et après l'imposition de la politique administrative romaine.

Keywords Mauretania Caesariensis · Tipasa · Urban heritage · Algerian coast · Roman pottery · Field survey · Remote sensing

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Archaeology of Tipasa and the Algerian Coast

Algeria is one of the largest countries in the Mediterranean basin, and its archaeological heritage, both inland and alongside the coast, is considered one of Maghreb's great riches. Despite several archaeological research programs in the country, its urban heritage is largely unknown and unexplored (Blas des Roblès et al., 2019). The remains of classical Tipasa (nowadays Tipaza) are located in the eponymous wilayah/province at the foothill of Mount Chenoua, 905 m above sea level (Baradez, 1952; Lancel, 1990). One of the large Punico-Roman cities on the coast, Tipaza is 25 km from modern Cherchell (ancient Iol-Caesarea), the former capital of the Roman province, Mauretania Caesariensis (Fig. 1).

The origin of ancient Tipasa dates back to the Punic period. Evidence dating to the sixth century BC is only known thanks to a partially preserved necropolis around the modern harbor. The city gained major influence in the area under the Mauretanian Kingdom. After the incorporation into the Roman Empire during the reign of Claudius, the city became a *municipium.* At the beginning of the second century AD, it was promoted by emperor Hadrian (AE 1958, 128, and 129), bearing the title *Colonia Aelia Augusta Tipasensium*. From this period onwards, a strong city wall was built (AD 146/147, AE 1955, 130), and other public and private buildings such as the forum, theater, several temples, a *nymphaeum*, an outstanding *domus*, and an amphitheater were built cutting through earlier structures. The city reached its heyday in Late Antiquity (fourth to sixth century AD), as exemplified by the construction of several basilicas, including the remarkable temple devoted to local martyr, Saint Salsa.

The ruins of Tipasa have been identified since the eighteenth century (Shaw, 1743). Excavations at the ancient center began at the end of the nineteenth century (Gsell, 1894, 1926) and were undertaken more systematically between 1948 and 1961 by Baradez (1961). Regretfully, the reports do not

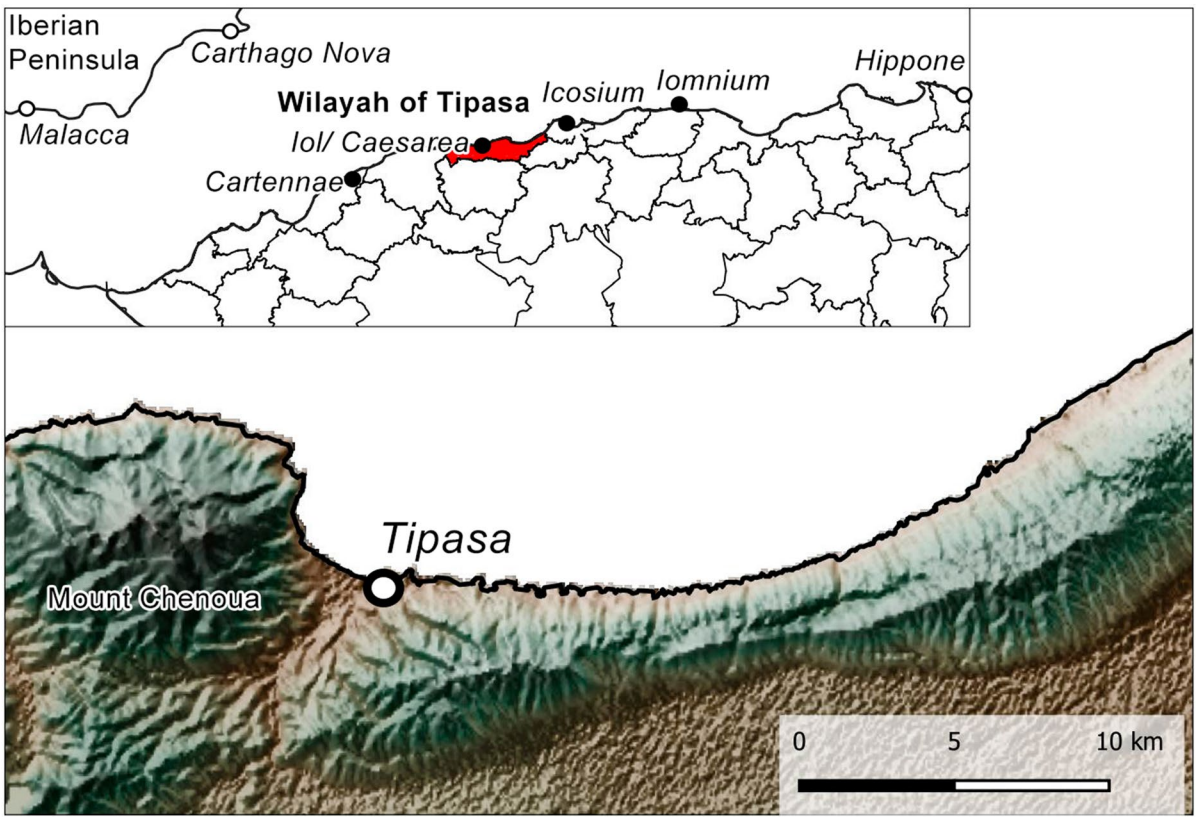

Fig. 1 Province (*Wilaya*) of Tipasa with major sites (above), and location of Tipasa city (below)

contain stratigraphic information that would allow one to trace the development of urbanism at *Tipasa* in detail. After the country's independence in 1962, excavations took place in peripheral areas of the city, chiefly the western necropolis (Bouchenaki, 1975). No excavations have been carried out in recent decades. Nevertheless, some archaeological areas have been re-studied, such as the funerary landscape of Saint Salsa's Basilica (Ardeleanu, 2018).

Regional syntheses have included valuable information about the monumentalization and urban developments of the Algerian coast (Hobson, 2019b). At a distance of 9 km from the ancient center lies the Royal Mauretanian Mausoleum, Kbor er Roumia, also known as Tombeau de la Chrétienne. The mausoleum consists of a large funerary enclosure that follows Hellenistic parallels. It has a cylindrical main body, topped with a stepped tumulus. The monument was supposedly built in the first century BC as the main grave of the Mauretanian kings that preceded Juba II (Gros, 1996, p. 415–420; Rakob, 1979, p. 138–142). The city and the Royal Mauretanian Mausoleum (Fig. 2) were designated as UNESCO world heritage sites in 1982 (Ferdi, 2004). However, despite this designation, the territory between the two sites has never been studied systematically. Gsell's (1911) archaeological atlas and very few excavations, such as the ones at the *villa* of Nador (Anselmino, 1989), are the only reference materials for the whole territory.

An Unknown Heritage at Risk

The TIPASA Project's main aim is to understand the long-term evolution of Tipasa's hinterland in Antiquity (sixth century BC through the seventh century AD) with a strong emphasis on the economic dynamics created during the Roman period. The research area comprises a territory of 25 km along the coast, between the ancient city of Tipasa and the Royal Mauretanian mausoleum (Fig. 1). Two factors influenced the selection of this area. Firstly, besides brief mentions in Pomponius Mela's *De Chorographia* (Mela.Chor.1.30.3 and 1.31.3) referring to main coastal cities as Iol and Icosium (Algiers) and the presence of the tomb belonging to the royal family, ancient literary sources are not much helpful for studying the city's hinterland. The work of Leveau (1984) in the territory of Iol-Caesarea shows the need to develop territorial studies to counter traditional bias in our understanding of Punic-Roman cities in the Maghreb.

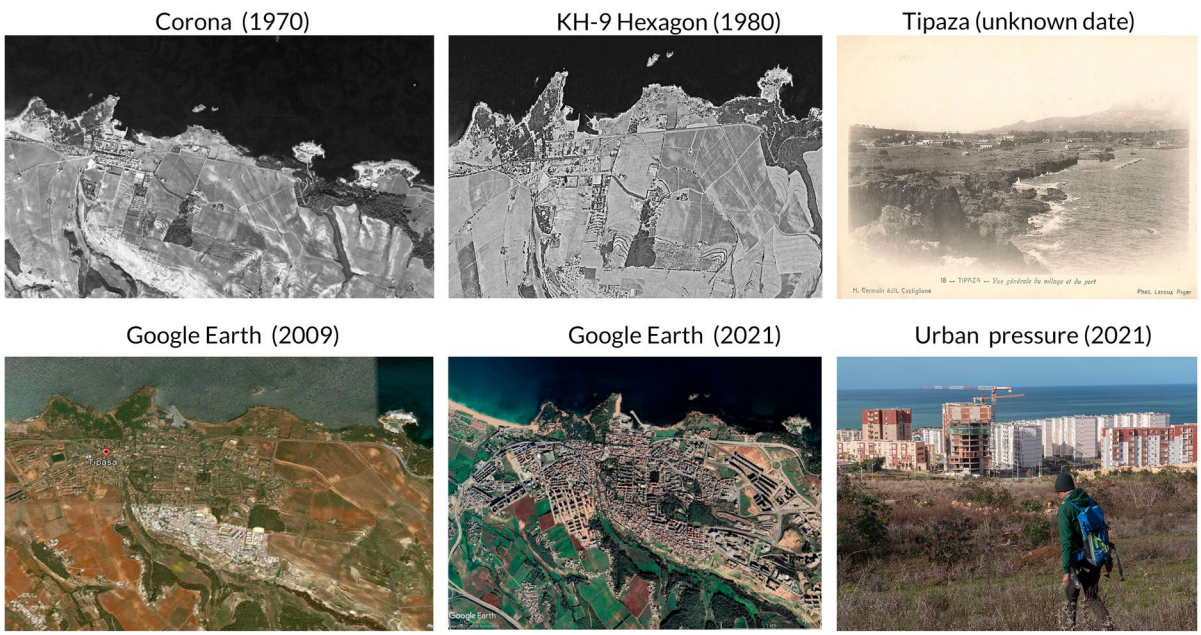

Fig. 2 Expansion of Tipaza's modern urban area in historical aerial photography

Hence, we designed an archaeological research project that would shed light on the suburban artisanal facilities or farm dwellings that provided the city (larger than 60 hectares) with the needed resources to sustain its population throughout a very long period, from the Punic to Byzantine times.

Secondly, Tipasa's territory and a vast number of archaeological remains suffer acute risks and threats, such as coastal erosion and urban encroachment (Aoudia Benali & Chennaoui, 2017; Aoudia Benali & Zebda, 2020; Hobson, 2019a; Nikolaus & Westley, 2021; Vousdoukas et al., 2022). For example, during the last decade, the old town of Tipaza has doubled its size, a rapid and uncontrolled growth compared to other modern towns on the seashore (Fig. 1).

The TIPASA Project, initiated in 2021 thanks to a collaboration between Algerian institutions and scholars and Spanish-based researchers, has three specific goals:

1. To explore and map the archaeology of the Algerian shoreline and create an archaeological catalog of Tipasa that will serve as a tool for efficient heritage management.
2. To understand the economic role of the province of Mauretania Caesariensis and the nature and intensity of Mediterranean trading networks, especially contacts with the Iberian peninsula. Both territories were closely connected in Antiquity, i.e., Pliny (N. H., 3.13) mentions direct routes between Iol/Caesarea and Carthago Nova. This research topic is currently attracting the interest of scholars (Bonifay & Tchernia, 2012; Hobson, in press; Quevedo et al., 2022).
3. To promote scientific cooperation between Spanish and Algerian scholars. One of the most important elements is to improve the academic and professional skills of students from Centre Universitaire Morsli Abdellah. During the 2021 campaign, they assisted in the fieldwork process, focusing on different aspects of survey techniques and all the phases of the study of archaeological materials, from documentation to publication.

Methods and Results

Although the archaeology of the ancient urban center is well protected by the UNESCO convention, the city's territory is at extreme risk of destruction from coastal erosion and urban encroachment. It is, therefore, necessary to implement a research strategy that records both site and off-site data from the Tipasa hinterland. Our approach to the territory of ancient Tipasa is informed by similar research projects in the Central and Eastern Mediterranean (Attema et al., 2020). Moreover, the vicinity of the Iberian coast and the Balearic Islands, in particular Ebusus (Ibiza), and the initial input by Italic and Gaulish productions should be taken into account. As described in the "Survey Data Analysis" section, we will emphasize material culture as a proxy for the macroeconomic understanding of the study area.

The methodology devised for the study of Tipasa's hinterland is threefold. Firstly, a remote sensing approach to the territory is based on well-known tools, such as Corona and Hexagon declassified satellite imagery from USA and multispectral analysis of acquired satellite imagery from 4-band Airbus imagery for a selected period. Secondly, a field survey carried out during the autumn of 2021 aimed to retrieve both off-site and on-site data and analyze the material culture that could potentially offer clues about the rhythms of the territory from the Hellenistic period to the Late Antiquity and beyond (Ottoman and French colonial periods). Eventually, the third step is the analysis of material culture that provides data for chronological modeling of economic contact with other production centers in North Africa (Africa Proconsularis and Mauretania Tingitana) and elsewhere.

Remote Sensing Approach

Remote sensing in North Africa, using aerial photography and satellite imagery, has a long history (see Baradez, 1949; Davis & Douglass, 2020, for a recent review). Recently, efforts have been directed towards the identification of threats derived from climatic change (Nikolaus & Westley, 2021; Vousdoukas et al., 2022), heritage preservation (Rayne et al., 2020), the training of local teams within the EAMENA initiative (Hobson, 2019a), and the examination of World War II archives for North Africa and the Levant (Scardozzi, 2015). The recent urban growth around ancient Tipasa is a great obstacle to a large-scale survey of the area. The location of Tipasa between Cherchell and Algiers fostered unprecedented urban pressure on the Algerian

coast. Therefore, we could only direct our attention to scattered open fields south of the city, the Oued Nador River valley, and the coastal terrace. Thus, aerial and satellite imagery from the mid-twentieth century provides the only means to plot the spatial distribution of the Hellenistic and Roman period countryside.

Two historic satellite imagers have provided insights into the radical transformation of coastal Algeria. In this regard, the 1970 Corona and 1980 KH-9 Hexagon declassified flights from USGS have helped map out shoreline movements (Nicolaus & Westley, 2021) and define areas of interest around Tipasa, such as possible ancient roads into the city both from the south and the east. Both USGS declassified Corona and Hexagon images offer a view of the modern territory of Tipaza before the unprecedented urban and rural growth after the independence from France in 1962. Archaeologically speaking, the information we could extract from these images is meager due to low resolution. However, more prominent elements, such as roads, are easily spotted and could be compared to other imageries, including modern Airbus satellites and the Google Earth time series.

Besides historical imagery, a 4-band PS Airbus satellite image (50 cm/pixel), taken on April 20, 2020, was used to explore large time series available on Google Earth. The 4-band spectral resolution allows the creation of vegetation indices (VI), chiefly NDVI and image enhancement (NIR-G-B) using image statistics, to spot possible archaeological features and geomorphology, and to cross-check the surrounding areas of already known sites (Fig. 3). The Airbus imagery demonstrates the importance of a remote-sensing analysis of Tipasa territory and also provides documentation that can be used for scientific and heritage management purposes. This methodology allowed us to document POIs (Points of Interest) south of Tipasa, an area that has traditionally attracted less scientific interest. A road approaching the ancient city from Algiers has been spotted (Fig. 3). Other possible archaeological features are small/rural sites, some of which have also been identified by field survey. Other potential sites were identified in the satellite imagery but were not ground-truthed because of the limited period of our field campaign.

Field Survey

Field survey is an essential method for understanding historical landscape development. Its contribution to our understanding of the long-term evolution of Mediterranean societies is well-attested (for a summary of methods and projects, see Attema et al., 2020). The potential of field survey for territorial analysis and heritage preservation has been explored in Maghrebian countries unevenly. Surveys mostly focus on the indigenous settlements and activities on the coast and desert (Mattingly, 2004; Stone, 2016), the Punic world, and the Roman influence in the countryside and the urban world. Such archaeological surveys in the Maghreb have concentrated in modern-day Tunisia (de Vos Raaijmakers & Attoui, 2013; Fentress & Docter, 2008, Fig. 5.3). Leveau's (1984) study of the territory of Cherchell is the only available reference for an urban territory in Algeria.

The extension of Roman control over North Africa also had an important impact on other Mediterranean provinces, starting in the first century AD (Knodell et al., 2022). The study of the territory of Tipasa aims to combine a century of archaeological research carried out in Algeria as a general spatial framework (Gsell, 1911) and in the territory of Cherchell (Leveau, 1984), and eventually, the research stemming from local studies in ancient farms (Anselmino et al., 1989) and in maritime facilities (Bensaidani et al., 2021; Khellaf et al., 2021). Our scope is not limited to reconstructing the surroundings of Tipasa but to documenting the history of landscape management from late prehistory to the twentieth-century colonial period (Fig. 4). The field survey aims to study the diverse, historical-laden, and unique landscapes described by UNESCO. These include the shoreline, the immediate surroundings of Tipasa, and the hinterland. The aim is to document a whole set of economic activities and dwelling models, from the sea-oriented manufacturers to farming facilities and production centers in the southern part of the city.

Sampling

One of the basic concepts of survey archaeology is sampling. In this sense, the landscape is understood as a sampling universe. As it is unfeasible to implement full coverage in practice, sampling techniques allow us to determine how much terrain should be

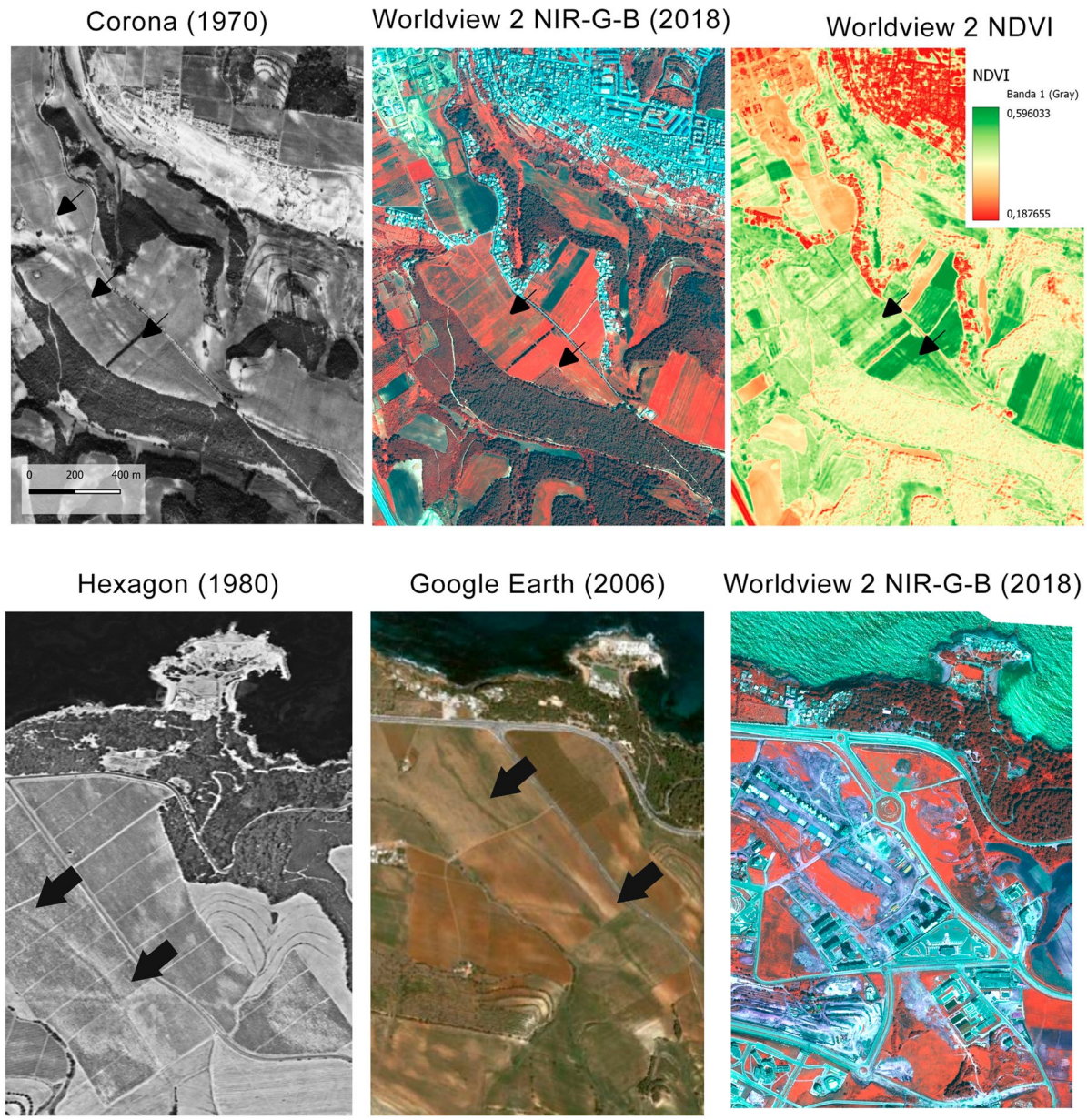

Fig. 3 Remote sensing, using different types of imagery (above: possible access to Tipasa from the south; below: traces of possible road junction to the east of Tipasa)

covered by a surveyor or the collection sample carried from the field to the laboratory to have representative results from a statistical point of view (Banning, 2021). For the survey, an 8-km long strip facing the coast was selected for an initial field survey campaign. Several issues affected the creation of a sampling strategy: closed farms, restricted military areas, and modern construction, among others. Furthermore, an initial non-systematic visit of research partners led our attention to particular areas of interest. On some occasions, sites were already detected by local scholars but not yet systematically surveyed (Bensaidani et al., 2021). One important aspect is the need to survey areas under great threat of destruction by coastal erosion. Several lime kilns, half destroyed, were spotted by Khellaf et al. (2021) in

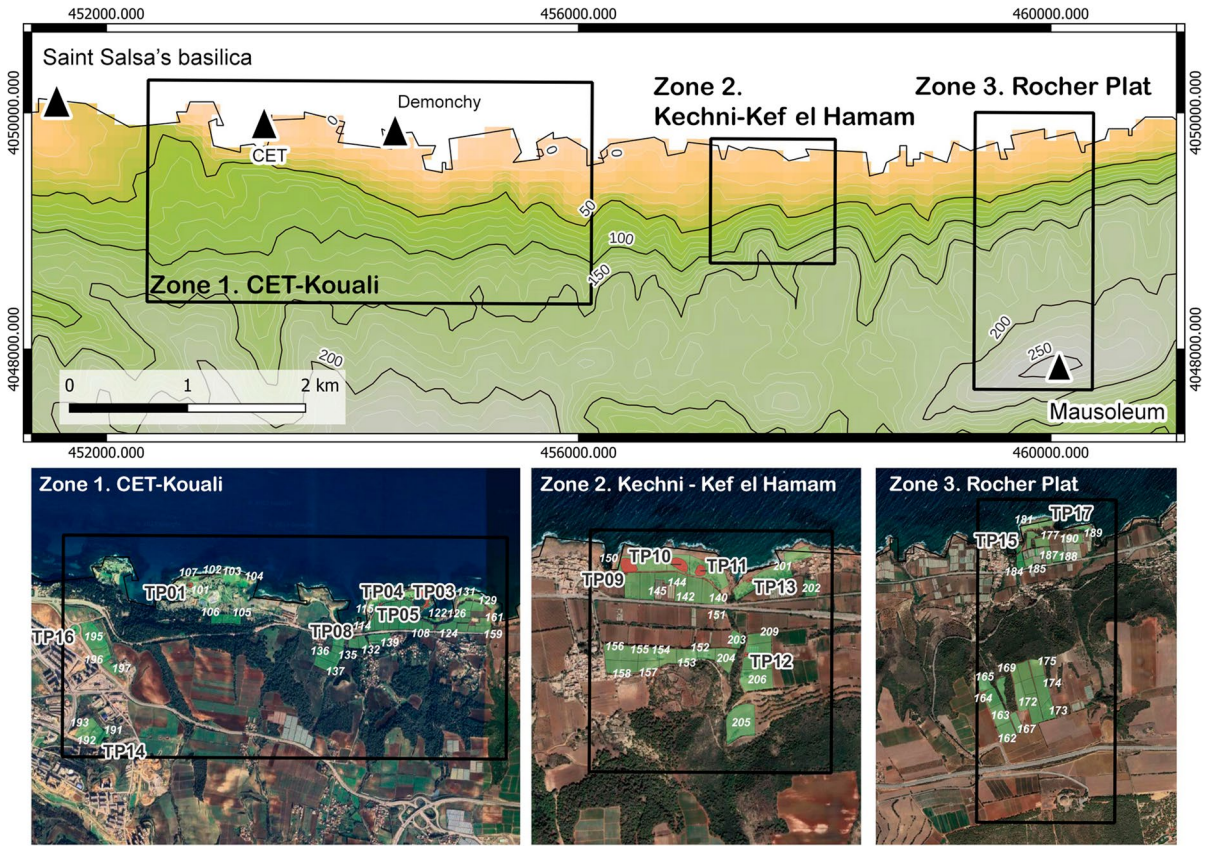

Fig. 4 Location of the survey zones east of modern Tipaza

preliminary visits to these sites, such as Rocher Plat (Berkane Belkacem) and Kef el Hamam (Khechni). Three zones were selected for the survey. Zone 1 is located at the easternmost fringe of modern Tipaza; it covers almost 4 km of the coastal area from Tipaza to Demonchy. Zone 2 is located around Kef el Hamam and its immediate inland territory. Zone 3 is situated around the bay known as Rocher Plat and Khechni and inland towards the Royal Mausoleum.

Survey Methodology

The survey methodology sought to use the materiality of sites to address questions of chronology, function, and settlement patterns. It also looked at the territory around sites to understand processes such as exploitation of the countryside and any other dwelling activities taking place beyond site's limits (García Sánchez et al., 2017; Waagen, 2014). The Tipasa survey adopted two basic concepts to develop a sampling strategy: the unit and the site. Units are limited blocks of space that share characteristics such as the parameters that affect visibility (vegetation, humidity, stoniness), land use, slope, or morphology. Surveyors are asked to survey these units with a separation of 10 m between them (20% coverage) and record information that define these blocks. In addition, they were asked to document any archaeological information, such as the presence of modern or off-site material or any other remark regarding archaeology, landscape, or any other modern issue that surveyors consider worth mentioning. If any archaeological material is spotted during the survey, students are asked to collect it. Once the unit is completely surveyed, a "diagnostic" sample is made by the pottery specialist.

The second concept used by the Tipasa survey is the site. A site is defined as a pottery scatter denser than five sherds per square meter. If such a density is found while surveying a unit, the surveyors are asked to replace the "unit" bag and collect pottery

Fig. 5 Sites and features: **a**. quarry in the CET Area and TP01 (Zone 1); **b**. wall in site TP5 at Demonchy (Zone 1); **c**. sarcophagus over rural installations in TP18 Tipaza (Zone 1); **d**. remains of *opus africanum* in site TP19, Kechni - Kef el Hamam (Zone 2); **e**. collapsing lime kiln near TP15 at Rocher Plat (Zone 3); **f**. surveying terraces under the Mauretanian Royal Mausoleum (Zone 3); **g**. repurposed Roman harbor at Farm Berard. Photos: J. Rodríguez Pandozi. Reproduced with permission

within a new "site" bag. Eventually, site bags or site collections are also recorded with the reference/label of the units where they were found. Thus, it would be possible to differentiate between off-site and site collections within the same unit. It is necessary to record the location of both units and sites. For this task, QField was installed on mobile phones to register the shape of units and sites during the survey, as well as to navigate to other landscape units of interest.

One striking difference between the TIPASA Project and some of the previous projects elsewhere is the material collection strategy. In this case, it was not possible to collect larger quantities of archaeological artifacts in an intensive survey fashion that will represent a proper 20% sampling of the landscape. This impossibility was caused by internal regulation and the lack of time within the survey campaign to fully process (cleaning, identification, drawing, and date) each fragment. Therefore, the project pottery specialist (AQ) collected the diagnostic samples in the field. A diagnostic collection comprises all sherds with any datable characteristic, shape, or fabric. Our collections strategy considered Attema et al.'s (2020, p. 14) critique, noting that the limitation of collections "to broad classes of likely diagnostics in the field may reduce chronological and functional resolution of the data recorded." The broad chronology of surface artifacts detected by the TIPASA survey team ranges from the Neolithic to the French colonial period. Thus, the chronological resolution is fully assured in this case. At the same time, the study also considers regional coarse ware, a category hitherto underestimated by researchers in the area. This ware makes it possible to qualify trade exchanges and their chronology. We focus on two categories. The first is Mauretanian Caesariensis Common Ware (MCComW). It is characterized by a yellowish-white paste and is abundantly documented from the first century BC to the Late Antiquity (Quevedo, 2019, p. 67–69). Secondly, the Late Mauretanian Caesariensis Cooking Ware (LMCCW) (Quevedo, 2019, p. 71–73). Its fabrics are dark red-brown with angular quartz, characteristic of the fourth and fifth centuries AD.

Despite the focus on the Punic and Roman phases, the field survey succeeded in documenting the long-term occupation of the area, whose materiality ranges from worked flint to the French colonial period (1830–1962). The sites are also indicative of a complex set of activities occurring around the city, i.e., sandstone quarries and lime kilns related to the development of the city of Tipasa during the Hellenistic period (Fig. 5). Moreover, large *villae* with remains of cisterns and thermal infrastructure were documented during the field survey (Demonchy TP05 and TP06). Fish salting pools are remarkably present in the shoreline and Late Roman sites. Some of these were even reoccupied in the Ottoman period (sixteenth to eighteenth century), i.e., the site of Demonchy. Other remarkable findings from the remote sensing and field survey are the southern road, and a possible Roman quay, a unique structure in the Western Mediterranean.

Survey Data Analysis

A key point of the survey project is to explore the formation of the territory around Tipasa. Another is to document the economic trends and connectivity in the Western Mediterranean with specific attention to the economic dynamics involving the exchange of Hispanic and Mauretanian pottery (mainly amphorae, cooking vessels, and oil lamps) at both shores of the Mediterranean (Quevedo et al., 2022). To this end, we focused on the survey-detected site contexts to model chronology and pottery imports (see "Discussion" section).

To analyze the chronological variations of pottery scatterings, we adopt a statistical approach that has been previously employed in other regions of central Mediterranean. This methodology has been used to model the chronology of Hellenistic sites (Pelgrom et al., 2014, 2016) as well as to study burial assemblages in Augusta Emerita, Lusitania province (Cáceres-Puerto & García Sánchez, 2020). The tables in this paper provide datasets related to comprehensive pottery assemblage information, including the assessment of chronology. These tables also refer to established protocols for comparing pottery assemblages from other research projects conducted in various parts of the Mediterranean basin (Cau et al., 2011). Importantly, it is not necessary to apply correction indices to assemblages collected from surface surveys (NMI). In the statistical analysis presented in the following section, each pottery fragment represents an individual unit.

Pelgrom (2014, 2016) determined the chronological variability of Hellenistic sites in Basilicata, Italy by studying a specific type of production known as Black Gloss. In contrast, other chronological modeling experiences, such as those in Augusta Emerita and Tipasa, consider multiple types of pottery that can be dated, with African Red Slip Ware (ARS) being one of the most prominent. The chronological modeling process begins with a detailed study of pottery assemblages and the assessment of chronology for all datable fragments, depending on the quality of the recovered materials. For instance, identifiable

forms can be dated more precisely, while sherds or fabrics associated with a general production type, like ARS D (Hayes, 1972), provide a broader timeframe. The classification of chronology has also facilitated the dating of architectural remains where pottery forms (such as rims) were embedded during construction, as observed in coastal sites with *opus signinum*.

The assigned chronology is subdivided into 50-year blocks with the R package developed by Crema (2012), whose approach is similar to Willet's (2014) comparison of chronological models. Still, it only employs a lineal distribution, also termed "weighted mean," since it assigns a probabilistic value to each 50-year block depending on the initially assigned chronology. Once the probabilistic value or weighted mean is assigned, it would be possible to create linear trends for each site (18 sites in the survey) and filter such lines by their origin of production. Production centers in Mauretania Caesariensis province were recorded according to six broad categories beyond local production). The geographical locations impacted economic trends of commerce and contact. These are (1) The Italic area, (2) Southern Gaul, (3) The Iberian Peninsula and Ebusus (Ibiza), (4) The Levant, (5) Tripolitania, and (6) Africa Proconsularis. The 2021 survey campaign has provided an initial yet relevant insight into landscape dynamics related to the city and other external processes, such as the incorporation into a market economy and the arrival of new products.

Field Survey Data

In total, 197 units were surveyed, and 20 sites were recorded with the abovementioned methodology. Table 1 provides insight into the zonal statistics to assess the representativity of our sample. Even though coverage is still low, the amount of collected information, especially the diagnostic sample, provides a clue to understanding these sites and the potential of such a historical landscape for future research.

A variety of land uses and geomorphology types were inspected during the fieldwork. Geomorphology, land use, and visibility are the main biases mediating between the field survey and the pottery collection (Ammerman, 1995; Casarotto et al., 2018; Terrenato & Ammerman, 1996). Very bad surface conditions could become a severe obstacle when surveying off-site or on-site. Experiments created in the last decades demonstrate that revisits are recommended in those places with poor visibility (Mlekuz & Taelman, 2013). Coastal plains and agricultural areas, and agricultural lands not in use are the most common land use types. Other land use types are forested areas, fruit trees, and olive groves. Some pasturelands and vineyards (for vinegar production) are also represented in the sample (see Table 2).

Another factor that affects sampling is ground visibility. We evaluated several factors that had an impact on the overall visibility of the surface. These factors include stoniness, humidity, and vegetation. Eventually, we used one to assess visibility from 1 (very poor) to 5 (excellent). Zones 1 and 2 show good visibility (categories 4–5) in more than 60% of the surveyed units. This percentage is lower in Zone 3, where only 70% qualify as excellent visibility (4–5). However, visibility category 3 reaches 50% of the units (Fig. 6).

Site Data Analysis

Pottery collections from the site and off-site contexts were studied using the chronological modeling technique described above. The selected types of graphs that go along with the assemblage analysis are useful for creating hypotheses to understand trends in the long-term occupation of the Algerian coast in the Hellenistic, Classical, and Late Antique periods. The following section will offer a detailed discussion of the pottery assemblages and the potential of its study to identify direct connections with other shores of the Mediterranean.

Table 1 Size of the survey sample by zone, with units and sites

Zone	Total area (ha)	Area surveyed (ha)	Area surveyed (%)	Units	Sites
Zone 1 (CET-Kouali)	705.85	42.27	5.99	50	10
Zone 2 (Kechni - Kef el Hamam)	111.02	19.70	17.75	28	7
Zone 3 (Rocher Plat)	235.06	21.60	9.19	28	3

Table 2 Distribution of land use types per geomorphological categories in each survey zone

Zone	Geomorphology	Agriculture	Agriculture not in use	Forest	Fruit trees	Olive groove	Other	Pasture	Vineyard	Total
1	Hill top		1	3						4
	Ridge top						2	2		4
	Plain	10	5	1			5			21
	Other						1			1
	Slope	3		1						4
	Ridge slope			2						2
	Undulating slope	2	4				1			7
	Terrace	1	1	2			3			7
2	Hill top	2								2
	Ridge top					1	4			5
	Valley top	1								1
	Plain	8								8
	Slope	5								5
	Undulating slope	6								6
	Terrace	1								1
3	Plain	10					1			11
	Other					1	1			2
	Slope	2				1				3
	Ridge slope						1			1
	Undulating slope	4	1		3				3	11
	Total	55	12	9	3	3	19	2	3	106

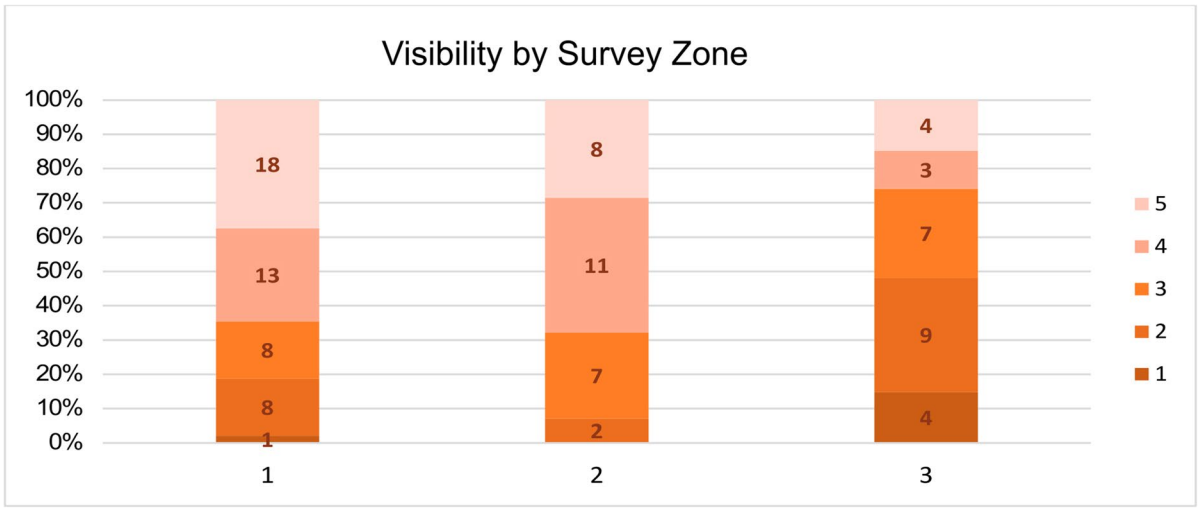

Fig. 6 Cumulative percentage of final visibility by Zone

One bias we face in the Tipasa survey is the representativeness of pottery collections. Due to administrative circumstances, we could not carry out intensive or total collections. Table 3 summarizes the samples we worked with to create chronological models for each site and off-site context. In total,

we worked with 661 datable artifacts. The following section presents an analysis of a selection of archaeological sites whose chronology covers the whole time spectrum under consideration. Moreover, these sites were selected only if the pottery assemblages were complex enough to offer representative data for material culture analysis and modeling.

The off-site chronological trend shows a peak in pottery frequency ca. AD 50 (Fig. 7). This date is directly related to the creation of the Roman province of Mauretania Caesariensis by Claudius (AD 40) and the promotion of Tipasa to a *municipium* in AD 46. The two first centuries AD are very well represented in the off-site record, with a remarkable decline in the third century AD and a slight but short, resurgence in the fourth century AD. The chronological modeling of site pottery displays similar trends: a peak starting around mid-first century, a decline in the third century, and a rebound from the fourth century onwards. Despite the similar overall trends, we also spot slight differences in the Late Hellenistic periods, perhaps related to activity in the countryside or coastal quarries. Regretfully, no single-phase Hellenistic or Punic site has been found in our survey area.

Table 3 Sample size used for chronological modeling. Frequency of artifacts (NMI) and weight by site

Zone	Site	Site name	Weight (gr)	Frequency (NMI)
1	TP01	CET	1383	27
	TP03-04	Demonchy	330	42
	TP05	Demonchy	547	8
	TP06	Demonchy	594	22
	TP08	Kouali	1125	40
	TP14	University	323	13
	TP16	Tipaza	1664	28
	Off-site		3068	112
2	TP09	Khechni	2405	113
	TP10	Khechni	703	14
	TP11	Khechni	254	19
	TP12	Aïn Maiza	136	10
	Off-site		1032	60
3	TP18	Rocher Plat	24	6
	Off-site		3015	101

In the following sections, we analyze the chronological trends derived from specific sites and site clusters and the material culture behind the model that also could shed light on the presence of specific imports from North Africa and elsewhere (Fig. 8). Regretfully, there is no stratigraphic data from urban phases. Only Baradez (1967) has referred to specific contexts that might demonstrate the existence of activity in different periods, i.e., Byzantine plates from the sixth century. Site descriptions are presented by survey zones, with special emphasis on Zones 1 and 2. The field survey in Zone 3 provided only off-site data because the sites are in cliffs and have been half-destroyed (TP15), thus not reachable by surveyors. Moreover, other sectors of this zone were not accessible due to the UNESCO-protected perimeter of the Royal Mauretanian Mausoleum. The interior of Zone 3 also provided information about the use of coastal terraces in prehistoric times. Figure 9 shows the location of all the sites mentioned

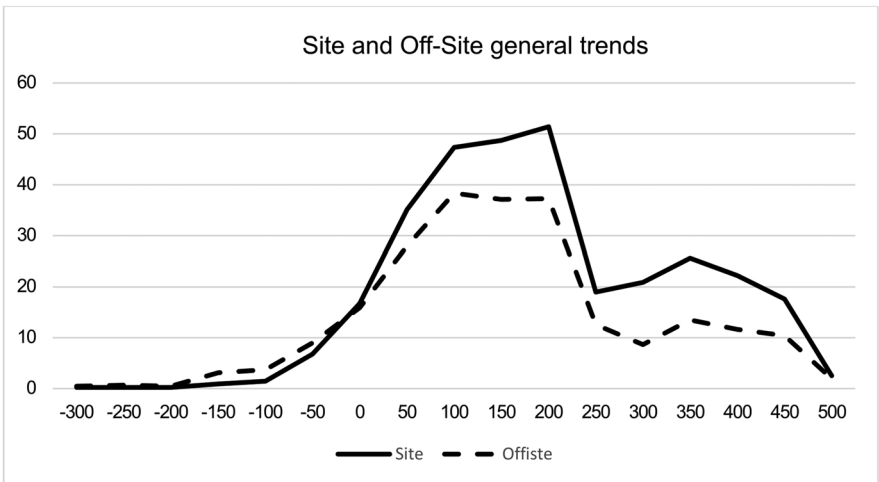

Fig. 7 Comparison of site (solid) and off-site (dashed) chronological curves

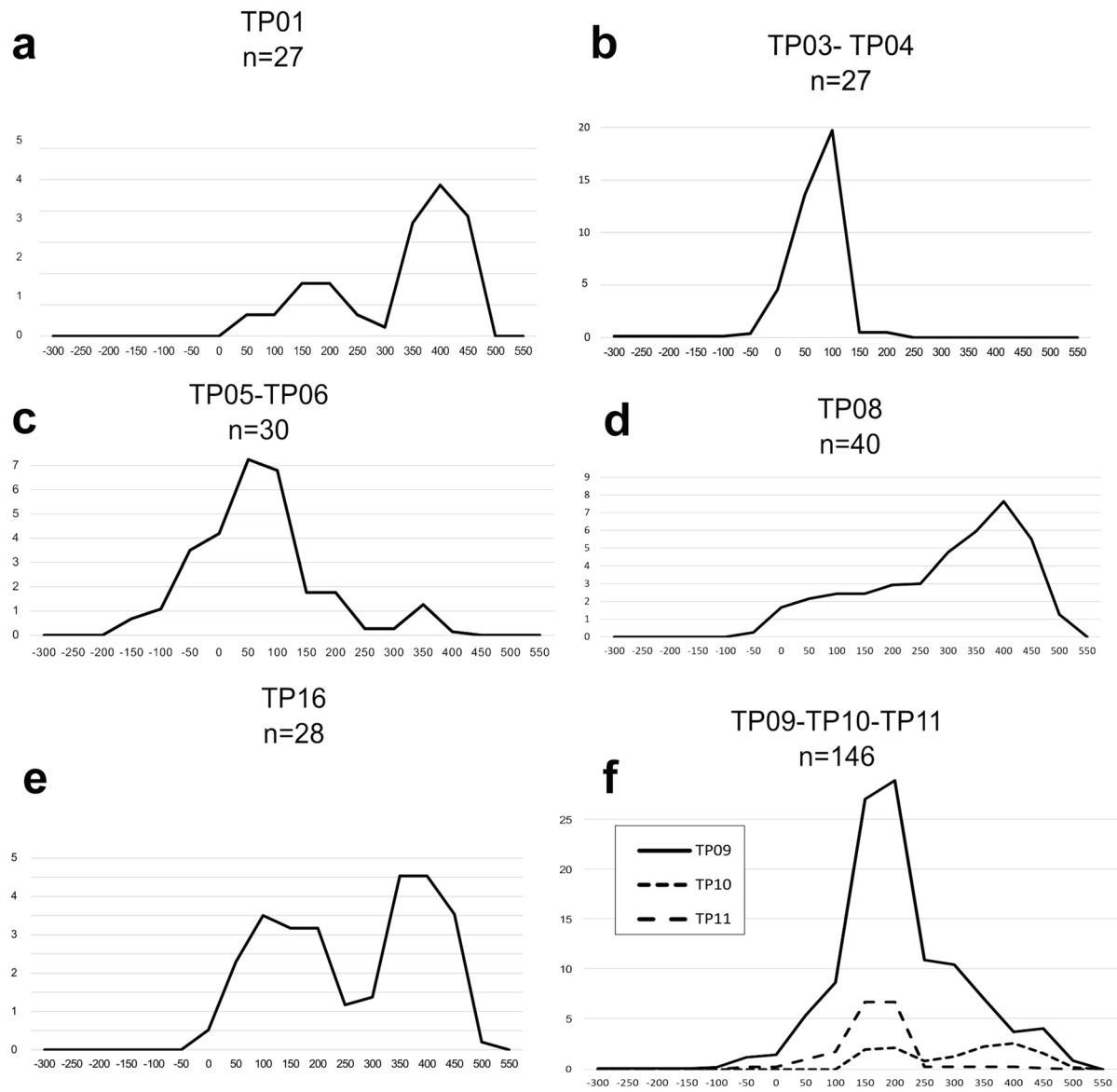

Fig. 8 Modelling of chronological trends for sites discussed in the text

in the text and some of the features recorded or visited during the survey. Some of these were already published for heritage management purposes and to widen the understanding of the settlement pattern in the coastal area of Tipasa (Khellaf et al., 2021).

TP01 (CET)

Site TP01 is located inside the CET area (Complexe Touristique C.E.T. village), a tourist complex created by the architect Fernand Pouillon in 1971 in the small bay of the Corne d'Or. Luckily, the modern construction respected the archaeological remains on top of a small artificial platform and the quarries on the peninsula's northern fringe. The site was documented by Gsell (1911, p. 11, no. 44), who identifies a mosaic, rooms of a bathhouse, and various funerary structures, including a marble sarcophagus with the legend of Pelops and Enomaus and the epitaph of an ancient 5-year duumvir. Previous

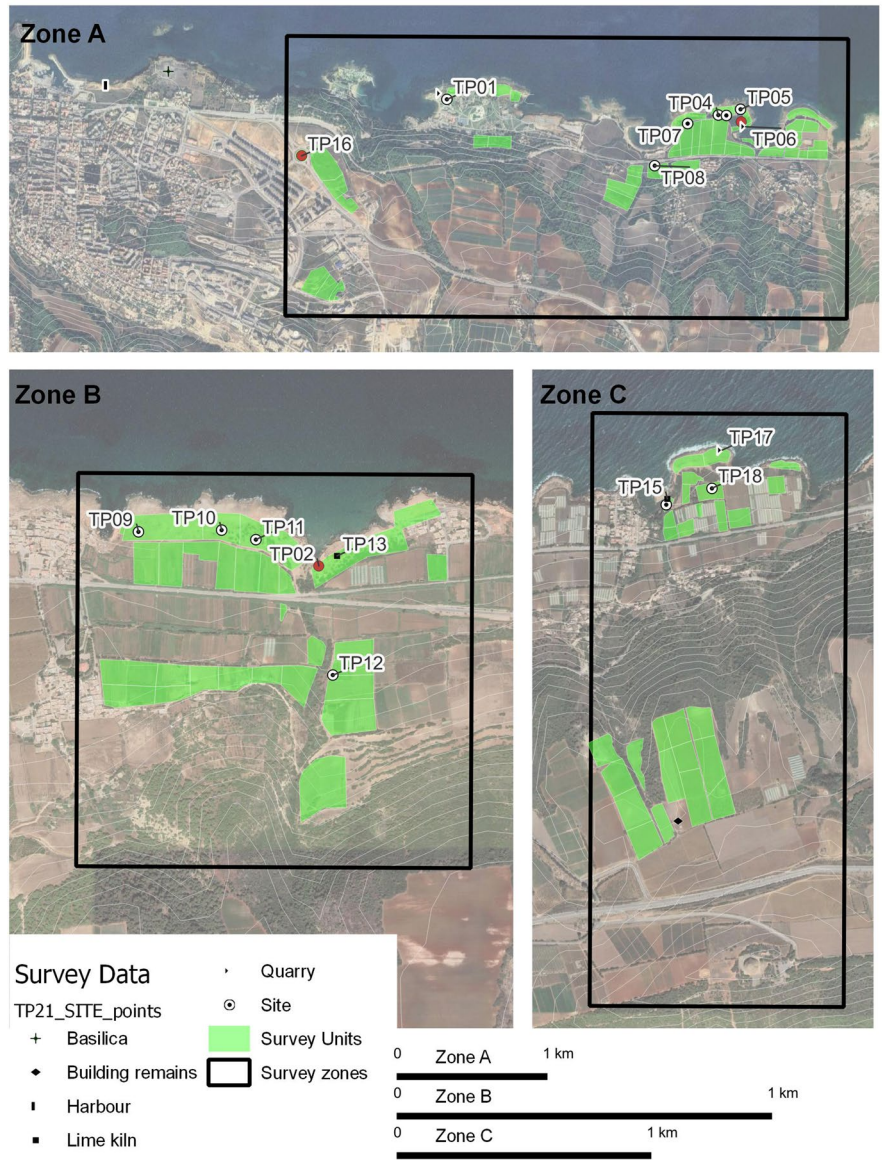

Fig. 9 Location of sites mentioned in the text for the 3 survey zones around Tipasa

work carried out by Algerian archaeologists confirmed the existence of an earlier phase dated to the first century AD and characterized by the presence of African cooking pots of the Ostia II, 312 and Hayes 197 types (Bensaidani et al., 2021). The chronological trend (Fig. 8a) clearly shows the origin of the site in the first decades of the era, followed by a decline in the third century, as we will note in other case studies, and eventually a remarkable transformation in Late Antiquity around the beginning of the fifth century.

Despite being a heavily built-up area, the survey documented a unit with scarce but interesting materials (U101S). Of the 27 fragments recovered, the bulk of the context (66.67%) corresponds to the Ottoman period, which shows the re-occupation of the bay in the modern period. Among the ancient pieces, coarse ware and building materials are the best represented, each bearing 11.11% of the total assemblage. Cooking ware is represented by 7.41%, and tableware by 3.70% of the assemblage. The only fragment of tableware is an ARS D mortar rim, type Hayes 91B (Fig. 10 (1)), dated

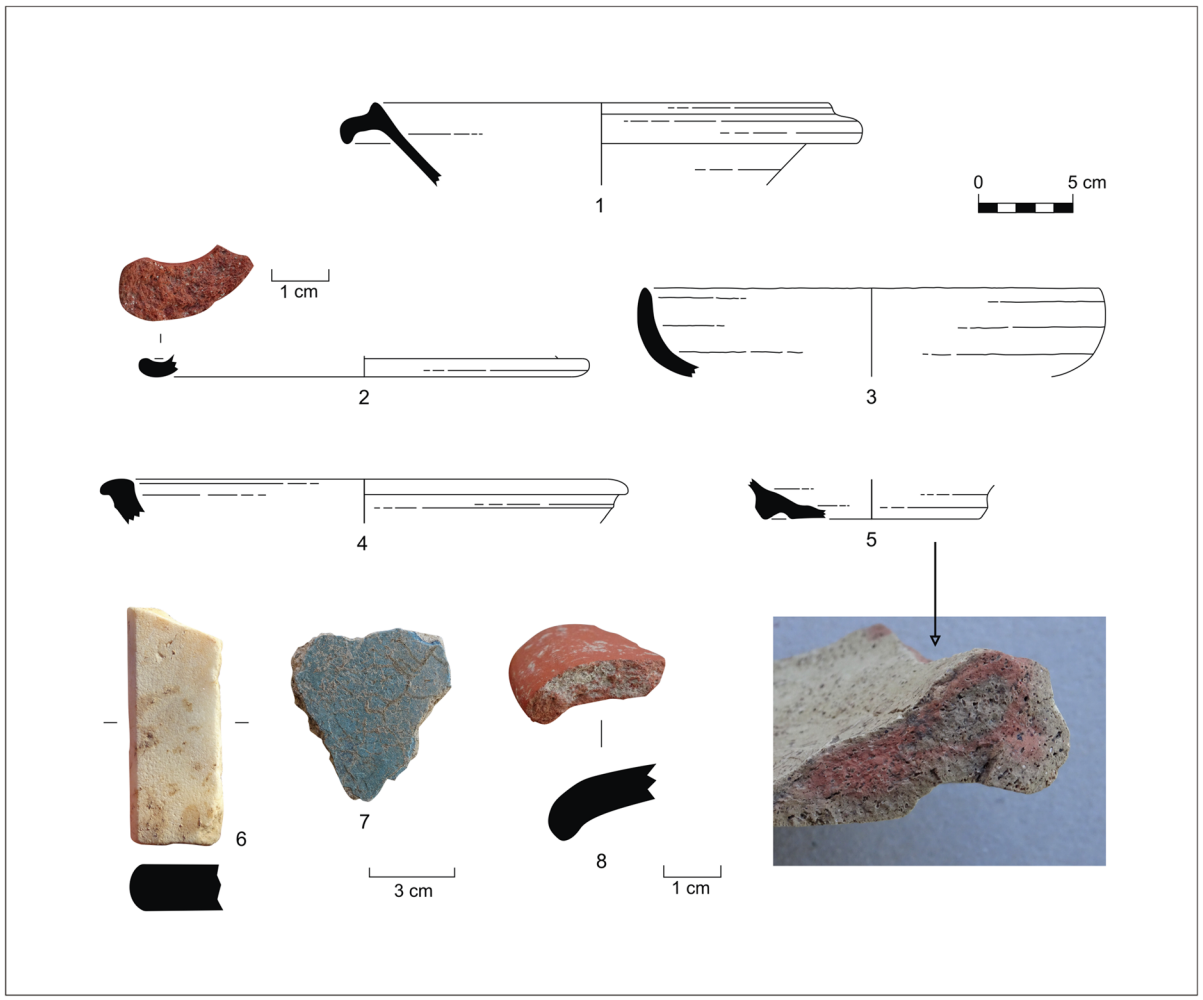

Fig. 10 Materials from site TP01 (CET) mentioned in the text

to the early fifth century AD. Cooking ware includes an LMCCW lid (Fig. 10 (2)) and a modeled casserole (Fig. 10 (3)) of undetermined origin. The category of coarse ware is composed entirely of regional production (MCComW), including a large basin for which an Ottoman provenance cannot be excluded (Fig. 10 (4)) and an undetermined base (Fig. 10 (5)). Regarding the building materials, there is a possible white marble molding (Fig. 10 (6)) and a fragment of mural painting in Egyptian blue (Fig. 10 (7)) as well as remains of white painting with incised decoration: a decorative technique identified to date only in south-eastern Hispania (Khellaf et al.,). Finally, a fragment of Hayes 91B (Fig. 10 (8)) was found as part of a mortar, suggesting transformations after the fifth century (Table 4).

TP03-04 (Demonchy)

Site TP03-04 is located near site TP05-06, in the Demonchy area, within a single unit (U117S). Regarding its functionality, we could tentatively assume a relationship with some built remains as salt basins and a nearby quarry. The site could have been a subsidiary of the above-mentioned larger center TP05-06 (Table 5).

The assemblage of 40 ceramic fragments from this site is dominated by imported tableware (72.5%), followed by African cooking ware (20%), amphorae (5%), and coarse regional pottery (2.5%). Among the tableware, we have a single fragment of Terra Sigillata Italica (TSI) partially preserving a central stamp in *planta pedis* […] E.A (Fig. 11 (1)) dated after 15

Table 4 TP01 (U101S)

Class	Ware	Form	Observations	TS	C	R	B	H	S	MNV	Fig
Fine wares	ARS D	Hayes 91B				1				1	10 (1)
S/total										1	
Cooking	LMCCW	Lid				1				1	10 (2)
Wares	Modelled	Casserole				1				1	10 (3)
S/total										2	
Plain	MCComW	Basin				2				2	10 (4)
Wares		Indeterminate					1			1	10 (5)
S/total										3	
Construction		Marble moulding	Imported (?) white marble						1	1	10 (6)
Material		Wall painting	Egyptian blue						1	1	10 (7)
		Mortar	With fragment of ARS D Hayes 91B						1	1	10 (8)
S/total										3	
Ottoman ware	Local and imported	Indeterminate	[Not studied here]			14	3	1		18	
S/total										18	
Total										27	

TS = total sherds; C = (near) complete shape; R = rim; B = base; H = handle; MNV = minimum number of vessels; Fig. = figure on which the material is illustrated

Table 5 TP03-04 (U133S)

Class	Ware	Form	Observations	TS	C	R	B	H	S	MNV	Fig
Fine wares	TSI	Indeterminate	*Planta pedis* stamp […] *E.A*				1			1	11 (1)
	TSG (La Graufesenque)	Dragendorff 18				1				1	11 (2)
		Ritterling 8B				2				2	
		Indeterminate					2		1	3	
	ARS A[1/2]	Hayes 3B				2				2	
		Hayes 7				1				1	11 (3)
		Hayes 8A				15			1	16	11 (4), 11 (5)
		Indeterminate							3	3	
S/total										29	
Cooking wares	African CA	Ostia II, 312				5				5	11 (6), 11 (7)
		Hayes 196				2				2	11 (8)
		Hayes 197				1				1	11 (9)
S/total										8	
Plain wares	MCComW	Basin				1				1	11 (10)
S/total										1	
Amphorae	Hispanic	PE 17 (?)	Ebusus (Ibiza)						1	1	11 (11)
		Dressel 2–4	Tarraconensis (El Maresme)			1				1	11 (12)
S/total										2	
Total										40	

TS = total sherds; C = (near) complete shape; R = rim; B = base; H = handle; MNV = minimum number of vessels; Fig. = figure on which the material is illustrated

AD (Oxé et al., 2000). There are also six fragments of Gaulish Terra Sigillata (TSG henceforth). Among these, we distinguish a Ritterling 8B (mid-first century AD) and Dragendorff 18 (Fig. 11 (2)), a form that continues from the Flavian period to the second century. ARS (22 fragments) constitute the majority of the assemblage, including Hayes 3B, Hayes 7 (Fig. 11 (3)), and Hayes 8A (Fig. 11 (4 and 5)). All these ARS are produced in A1/2 fabrics, providing a chronology between 70/80 AD and mid-second century AD. African Cooking ware is represented by five Ostia II 312 casseroles (Fig. 11 (6 and 7)), a form distributed from the early first century AD to the mid-second century AD (Aquilué, 1985). Other African cooking ware forms in the assemblage are Hayes 196 lid (Fig. 11 (8)) and other casseroles such as Hayes 197 (Fig. 11 (9)) in its older variants. As for the MCComW, only a large basin with an incised rim has been documented

Fig. 11 Pottery fragments from sites TP03-04 (Demonchy) mentioned in the text

(Fig. 11 (10)). Finally, the two amphorae identified are of Hispanic production. The first is a fluted wall corresponding to a wine amphora from Ibiza, similar to PE-17 (Fig. 11 (11)). This form is characteristic of the second century BC (Ramon Torres, 1991). The second form is a Dressel 2–4 Tarraconensis, that preserves both rim and handle (Fig. 11 (12)), a wine amphora from the Maresme region in Barcelona, dated between 30 AD and the second half of the first century AD (Berni, 2015).

This site represents a short period, dating to the Early Imperial period, starting around the Change of Era and mid-second century AD. The pottery assemblages consist primarily of imports from Gaul, Italy, and Hispania and the earlier forms of ARS. As abovementioned, these sites could represent the earliest phase of the Demonchy site (TP05-06) (Fig. 8b).

TP05-06 (Demonchy)

The site TP05-06, found in the Demonchy area, comprises four units (U118S, U120S, U121S, and U122S). It provides a total of 29 ceramic sherds for analysis. The most represented type in the assemblage is tableware (34.98%), followed by coarse ware of regional production (31.03%), amphorae (13.79%), African cooking ware (10.34%), and building materials (10.34%). The tableware includes a black gloss ware Lamboglia 1 (Fig. 12 (1)), dated to the mid-second century BC (Pedroni, 2001). TSG from La Graufesenque is also present, particularly Dragendorff types 15–18 and 27 (Fig. 12 (2 and 3)), dated between the Flavian period and the beginning of the second century AD (Genin, 2007). The arrival of ARS forms produced in A1/2 fabric is also recorded from the Flavian period, with types such as Hayes 6A and Hayes 8A (Bonifay, 2004). A fragment of Hayes 3C (Fig. 12 (4)) and another of Hayes 8B produced in A2 fabric could correspond to the mid-second and third century AD (Table 6).

The only unshaped fragment of thin-walled pottery is possible of Betic origin. All the cooking ware comes from the Carthage area and dates to between the first and third centuries AD. The Hayes 196 lid is the most represented form (Bonifay, 2004). Closed forms of MCComW (Fig. 12 (5)) and large jars or storage vessels (Fig. 12 (6)) are identified, as well as bowls (Fig. 12 (7)) and other indeterminate forms (Fig. 12 (8)). Alongside this repertoire is a coarse ware mortar in a fine paste of undetermined provenance (Fig. 12 (9)). Of the four amphorae documented, one is an eastern Mediterranean production of Dressel 2–4 for wine transportation, the others are Hispanic (Betic provenance). Two Dressel 9 amphorae from the Bay of Cadiz area (Fig. 12 (10 and 11); García Vargas & Bernal Casasola, 2008) and an undetermined amphora from Malaga (Fig. 12 (12)) have been identified (Mateo, 2015). Moreover, we collected materials related to building processes, a bronze nail (Fig. 12 (13)), and a fragment of *opus signinum*. About the construction of hydraulic mortars, we encounter a fragment of Hayes 50B dated to the second half of the fourth century AD inside the mortar of a salting-fish basin (Fig. 12 (14)).

The curve for TP05-06 (Fig. 8c) indicates an early origin in Hellenistic times with a peak in the Early Empire. The site appears to have quickly declined in the second century AD. Nevertheless, the site continues until the fourth century AD with signs of activity, such as the construction of fish-salting basins.

TP08 (Kouali)

Site TP08, located alongside Road R11, in the Kouali area, in unit U133S, yielded 40 pottery fragments. Tableware dominated the collection (32.50%), followed by coarse ware (25%), cooking ware (20%), amphorae (17.50%), and a small percentage of building materials (5%). With the exception of a fragment of Hayes 3C and a very late rim from Hayes 8B (Fig. 13 (1)), the tableware is mostly ARS D. Typical late fourth century and later forms stand out, such as a beveled rim similar to Hayes 64 (Fig. 13 (2)), Hayes 67B (Fig. 13 (3)), and Hayes 70 (Fig. 13 (4)). There are other types from the second half of the fifth century AD, such as Hayes 80B (Fig. 13 (5)), and late variant Hayes 91B (Fig. 13 (6)). The latest fragment is a Hayes 104A base (Fig. 13 (7)), dated not earlier than the end of the fifth or first half of the sixth century AD (Bonifay, 2004, p. 181–183). A final dark-toned fragment from the Nabeul region could be an ARS F (Fig. 13 (8)). The cooking ware, mostly African, comprises Hayes 196 lids and Hayes 197 casseroles. Alongside some early examples that could be residual (first through third century AD), late large-diameter forms are also documented (Fig. 13 (9)). Two fragments, a lid, and a pot rim, imitating the

Fig. 12 Materials from site TP05-06 (Demonchy) mentioned in the text

Tunisian Hayes 197 form, produced in LMCCW, are also present in the assemblage (Fig. 13 (10)). Coarse African ware includes a CATHMA A6-type jug handle (Fig. 13 (11)). This Nabeul form is typical of the fifth and first half of the sixth century AD, possibly used as a wine container (Bonifay, 2004: 290). The rest of the forms in this category belong to the MCComW, including a large jug (Fig. 13 (12)) similar to those documented in the village of Nador (Manacorda, 1989, p. 160, fig. 35.144). Regarding the amphorae, an oriental LRA 1 for wine with remains of *tituli picti* in red (Fig. 13 (13)), typical of Late Antiquity, stands out (Pieri, 2005). The rest are African. A rim of Tripolitana III is documented (Fig. 13 (14))—an oil container that might have survived until the fifth century AD (Bonifay, 2016). Four fragments correspond to African amphorae—one Keay 25.3 (for *salsamenta*?) of yellowish color (Fig. 13 (15)) and the rest in classical Nabeul pastes (Fig. 13 (16)). Finally, the building materials include the mortar remains with reused Late Mauretanian Caesariensis

Table 6 TP05-06 (U118S, U120S, U121S, U122S)

Class	Ware	Form	Observations	TS	C	R	B	H	S	MNV	Fig
Fine wares	Italian Black gloss ware	Lamboglia 1				1				1	12 (1)
	TSG (La Graufesenque)	Dragendorff 15–18				1				1	12 (2)
		Dragendorff 27				1				1	12 (3)
		Indeterminate							2	2	
	ARS A	Hayes 3C				1				1	12 (4)
		Hayes 6A				1				1	
		Hayes 8B				1				1	
		Indeterminate							1	1	
	Thin-walled pottery	Indeterminate	Baetican Mayet 38?				1			1	
S/total										10	
Cooking wares	African CA	Hayes 196				1				1	
		Indeterminate							2	2	
S/total										3	
Plain wares	MCComW	Closed form				1				1	12 (5)
		Jar	Storage vessel?			1				1	12 (6)
		Bowl				2	2			4	12 (7)
		Indeterminate					1		1	2	12 (8)
	Indeterminate	Mortar					1			1	12 (9)
S/total										9	
Amphorae	Eastern Mediterranean	Dressel 2–4						1		1	
	Hispanic	Dressel 9	Bay of Cádiz			2				2	12 (10), 12 (11)
		Indeterminate	Malacca (Málaga)					1		1	12 (12)
S/Total										4	
Construction material		Bronze nail		1						1	12 (13)
		Mortar	With fragment of ARS C Hayes 50B						2	2	12 (14)
S/total										3	
Total										29	

TS = total sherds; C = (near) complete shape; R = rim; B = base; H = handle; MNV = minimum number of vessels; Fig. = figure on which the material is illustrated

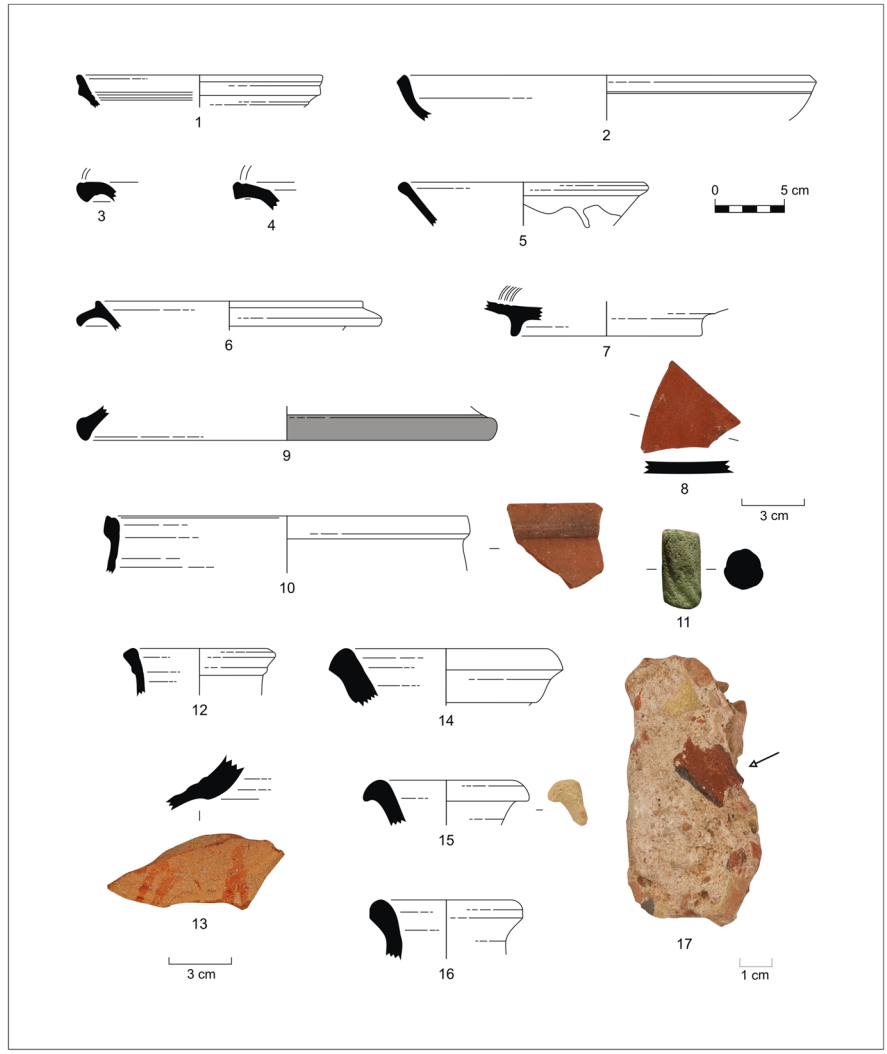

Fig. 13 Materials from site TP08 (Kouali) mentioned in the text

Cooking Ware, giving a *terminus post quem* of the mid-fourth century AD (Fig. 13.17) (Table 7).

Site TP08 represents an interesting trajectory (Fig. 8d) with a very early origin: first century AD. It saw activity for around 250 years, until a peak in the early fourth century and a decline at the beginning of the sixth century. It possibly represents an inland farm site that received the influence of fourth century AD imports.

TP16 (Tipaza)

Site TP16 is located in the interior of a roundabout on the easternmost edge of modern-day Tipaza. The site could be interpreted as a rural factory, repurposed in Late Antiquity as a Roman cemetery. The structures from both phases are visible on the surface, including evidence of pressing facilities such as anchor stones to sustain the *arbores* basins (Van Limbergen, 2011, p. 78) and at least six sarcophagi with lids.

The pottery scatter that defines the site is concentrated in a single unit (U194S). The pottery collection consists of 28 ceramic fragments. Cooking ware predominates in the assemblage (39.29%), followed by building materials (25%), coarse ware (17.86%), tableware (10.71%), and amphorae (7.14%). Tableware includes two characteristic sherds from the late second and early third century AD, Hayes 6C

Table 7 TP08 (U117S)

Class	Ware	Form	Observations	TS	C	R	B	H	S	MNV	Fig
Fine wares	ARS A	Hayes 3C				1				1	
		Hayes 8B	Produced in A/D?			1				1	13 (1)
	ARS D	Hayes 64				1				1	13 (2)
		Hayes 67B				1				1	13 (3)
		Hayes 70				1				1	13 (4)
		Hayes 80B				1			1	2	13 (5)
		Hayes 91A				1				1	
		Hayes 91B	Late variant			1				1	13 (6)
		Hayes 104 A					1			1	13 (7)
		Indeterminate				1			1	2	
	ARS F	Indeterminate	Nabeul?				1			1	13 (8)
S/total										13	
Cooking wares	African CA	Hayes 196	Ancient variant (70–150 AD)			3				3	
		Hayes 196	Late variant (250–400 AD)			1				1	13 (9)
		Hayes 197					1			1	
		Indeterminate							1		
	LMCCW	Casserole	Imitation Hayes 197			1				1	13 (10)
		Lid	Very deteriorated				1			1	
S/total										8	
Plain wares	African	CATHMA A6						1		1	13 (11)
		Jar type Nador 144				1				1	13 (12)
	MCComW	Jar				2				2	
		Bowl				1				1	
	Indeterminate	Lid				1				1	
		Dolium				1				1	
		Indeterminate				1	1	1		3	
S/total										10	
Amphorae	African	Keay 25.3	Nabeul? Yellowish fabric			1				1	13 (15)
		Nabeul indeterminate				1			2	3	13 (16)
	Tripolitanian	Tripolitana III				1				1	13 (14)
	Eastern Mediterranean	LRA 1	*Titulus pictus* in red unreadable						1	1	13 (13)
	Indeterminate	Indeterminate	Silver mica fabric						1	1	
S/total										7	

Table 7 (continued)

Class	Ware	Form	Observations	TS	C	R	B	H	S	MNV	Fig
Construction material		*Tegula*							1	1	
		Mortar	With fragment of LMCCW						1	1	13 (17)
S/total										2	
Total										40	

TS = total sherds; C = (near) complete shape; R = rim; B = base; H = handle; MNV = minimum number of vessels; Fig. = figure on which the material is illustrated

and Hayes 8B, and a slightly older Hayes 8A form. African cooking ware includes several ancient rims of Hayes 196 and Hayes 197 (first and second century AD). The forms in the later period are produced in LMCCW, attested by a local Hayes 23B (Fig. 14 (1)) and a fragment that belongs to a kettle (Fig. 14 (2)). The coarse ware category includes an undetermined (African?) wide-flanged mortar (Fig. 14 (3)). The rest are MCComW fragments, mostly large jars (Fig. 14 (4 and 5)). Amphorae have only two indeterminate fragments in Salakta and Nabeul fabrics, respectively. Finally, the building material is particularly significant at the site. Several *tegulae* (Fig. 14 (6)) and *imbrices* (Fig. 14 (7)) are documented, as well as *tegulae* or brick kiln failures (Fig. 14 (8)), indicating the production of architectural material in situ. Moreover, various ceramic fragments reused in the manufacture of mortars provide a *terminus post quem* for the late phase of the site. Of particular note are an early rim from Hayes 8B (Fig. 14 (9)) and another from the Hayes 61B3 dish with traces of lime (Fig. 14 (10)), a mid-fifth century AD variant (Bonifay, 2004, p. 171). A late Hayes 197 casserole rim and an LMCCW lid (Fig. 14 (11)), not earlier than the fourth century AD, were also reused for building purposes (Table 8).

The chronological curve (Fig. 8f) shows two important phases. The first phase started in the mid-first century and ran until the mid-third century AD when a drastic drop occurred. The site experienced transformations with the construction of a basin dated with an ARS fragment to the fourth century. It was repurposed as a cemetery at the beginning of the sixth century AD.

TP09-10–11

This site cluster is formed by three site scatters—TP09, TP10, and TP11. We proceed here with a combined analysis for the sake of clarity. However, chronological modeling has been performed individually, and the graph (Fig. 8e) illustrates the evolution of each site separately. The sites could be identified as small maritime *villae* or part of a larger settlement, with multiple structures distributed alongside a small peninsula. These sites are located on a rocky coastline west of the modern settlement of Khechni (U146S, U147S, U148S, U149S, U150S). The survey assemblage consists of 146 datable fragments belonging to two occupation phases, one

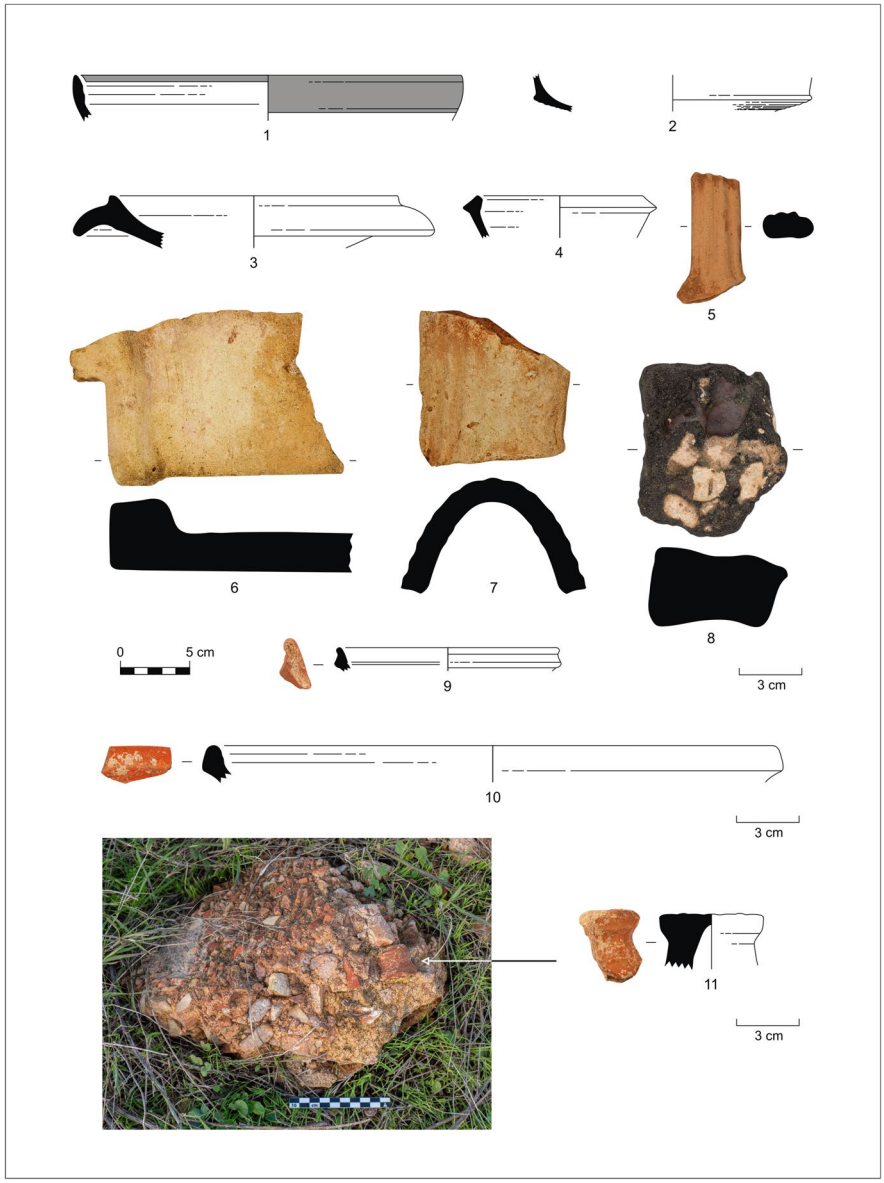

Fig.14 Materials from site TP16 (Tipasa) mentioned in the text

from the Early Imperial period (first through third century AD) and the other from the Late Antique period (fourth–sixth century AD) (Table 9).

The first phase (Early Imperial period) is defined by 90 pottery fragments, more than half of which belong to cooking ware (60%), followed by tableware (31.11%), coarse ware (4.44%), and amphorae (3.33%). There is also a flint flake, probably Neolithic. The tableware is entirely of African provenance. ARS forms produced in A1/2, such as Hayes 7B (Fig. 15 (1)) and Hayes 8A, are the oldest recognizable fragments. The majority of types date from the second half of the second century and early third century, such as Hayes 3C, Hayes 6C, Hayes 8B (Fig. 15 (2); 9 fragments), and Hayes 27 (Fig. 15 (3)). The cooking ware (all of the African production) is represented by classic types from this period such as Hayes 23B and Hayes 197 casseroles followed by Hayes 196 lids, some of which refer to older variants more typical of the first and second century AD (Fig. 15 (4)). There is also a kettle fragment—Uzita 48.1 (González Villaescusa et al., 2015) with calcareous concretions in the interior. Coarse ware is very scarce and consists of fragments of MCComW large jars. Finally, there

Table 8 TP16 (U194S)

Class	Ware	Form	Observations	TS	C	R	B	H	S	MNV	Fig
Fine wares	ARS A	Hayes 6C				1				1	
		Hayes 8A				1				1	
		Hayes 8B				1				1	
S/total										3	
Cooking wares	African CA	Hayes 196	Ancient variant (70–150 AD)			3				3	
		Hayes 197	Ancient variant (70–150 AD)			2				2	
		Hayes 23B	Ancient variant (150 AD)				1			1	
		Indeterminate	Ancient variants				3			3	
	LMCCW	Casserole	Imitation Late Hayes 23B			1				1	14 (1)
		Kettle	Imitation Uzita 48.1				1			1	14 (2)
S/total										11	
Plain wares	African ?	Mortar	Similar Fig. 17 (7)			1				1	14 (3)
	MCComW	Jar				1		1		2	14 (4), 14 (5)
		Indeterminate					2			2	
S/Total										5	
Amphorae	African	Salakta indeterminate							1	1	
		Nabeul indeterminate							1	1	
S/Total										2	
Construction material		*Tegula*				1				1	14 (6)
		Imbrice				1				1	14 (7)
		Brick	Local kiln failure			1				1	14 (8)
		Mortar	With rim of African Cooking Ware Hayes 197			1				1	
			With rim of ARS A Hayes 8B			1				1	14 (9)
			With rim of ARS D Hayes 61, B3 variant			1				1	14 (10)
			With fragment of LMCCW lid			1				1	14 (11)
S/total										7	
Total										28	

TS = total sherds; C = (near) complete shape; R = rim; B = base; H = handle; MNV = minimum number of vessels; Fig. = figure on which the material is illustrated

Table 9 TP09-10–11 (U146S to U150S)

Class	Ware	Form	Observations	TS	C	R	B	H	S	MNV	Fig
Lithic		Neolithic tool	[Not studied here]		1					1	
S/total										1	
Fine wares	ARS A	Hayes 3C				5				5	
		Hayes 6C				2				2	
		Hayes 7B				1				1	15 (1)
		Hayes 8A				2				2	
		Hayes 8B				9				9	15 (2)
		Hayes 8B Late variant	Produced in A/D? Suggested chronology 250–350 AD			11				11	15 (10), 15 (11), 15 (12), 15 (13)
		Indeterminate					3		1	4	
	ARS A/D	Hayes 27				2				2	15 (3)
		Indeterminate				1	2			3	
	ARS D	Hayes 58A				1				1	15 (14)
		Hayes 61A/B3				1				1	15 (15)
		Hayes 67A/B				1				1	15 (16)
		Hayes 91A				1				1	
		Indeterminate					1			1	
S/total										44	
Cooking wares	African AC	Hayes 195				4				4	16 (17)
		Hayes 196	Ancient variant (70–150 AD)			9				9	15 (4)
		Hayes 196	Late variant			10				10	16 (18), 16 (19)
		Hayes 197	Ancient variant (70–150 AD)			12	3		3	18	
		Hayes 197	Late variant			8				8	16 (20), 16 (21), 16 (22)
		Hayes 23B				5	2			7	
		Uzita 48.1					1			1	16 (23)
		Indeterminate					7			7	
	LMCCW	Lid	Imitation Late Hayes 196			1				1	16 (24)
		Casserole	Imitation Late Hayes 197			2				2	16 (25), 16 (26)
	Modelled	Indeterminate				1				1	
S/total										68	

Table 9 (continued)

Class	Ware	Form	Observations	TS	C	R	B	H	S	MNV	Fig
Plain wares	African?	Mortar	Similar Fig. 14 (3)			1				1	17 (27)
		Trifid-rimmed bowl				3				3	17 (28), 17 (29)
		Basin					1			1	17 (30)
	MCComW	Jar	Storage vessel?			3		1		4	
		Indeterminate						1	6	7	
S/total										16	
Amphorae	Hispanic	Indeterminate	*Ebusus* (Ibiza)						1	1	
	African	Africana II						1		1	
		Keay 25.3				1				1	17 (31)
		Keay 62Q				1				1	17 (32)
		Nabeul indeterminate	Stopper made from a reused fragment					1	1	2	17 (33)
		Inteterminate							2	2	
	Tripolitanian	Indeterminate						1		1	
	Mauretanian?	Tipasitanian Keay IA?	Possible local production			1				1	15 (5)
S/total										10	
Construction material		Mortar	With rim of ARS A Hayes 8B						1	1	15 (6)
			With rim of African Cooking Ware Hayes 23B						1	1	15 (7)
			With rim of African Cooking Ware Hayes 197						2	2	15 (8), 15 (9)
S/total										4	
Ottoman ware	Local and imported	Indeterminate	[not studied here]						3	3	
S/total										3	
Total										146	

TS = total sherds; C = (near) complete shape; R = rim; B = base; H = handle; MNV = minimum number of vessels; Fig. = figure on which the material is illustrated

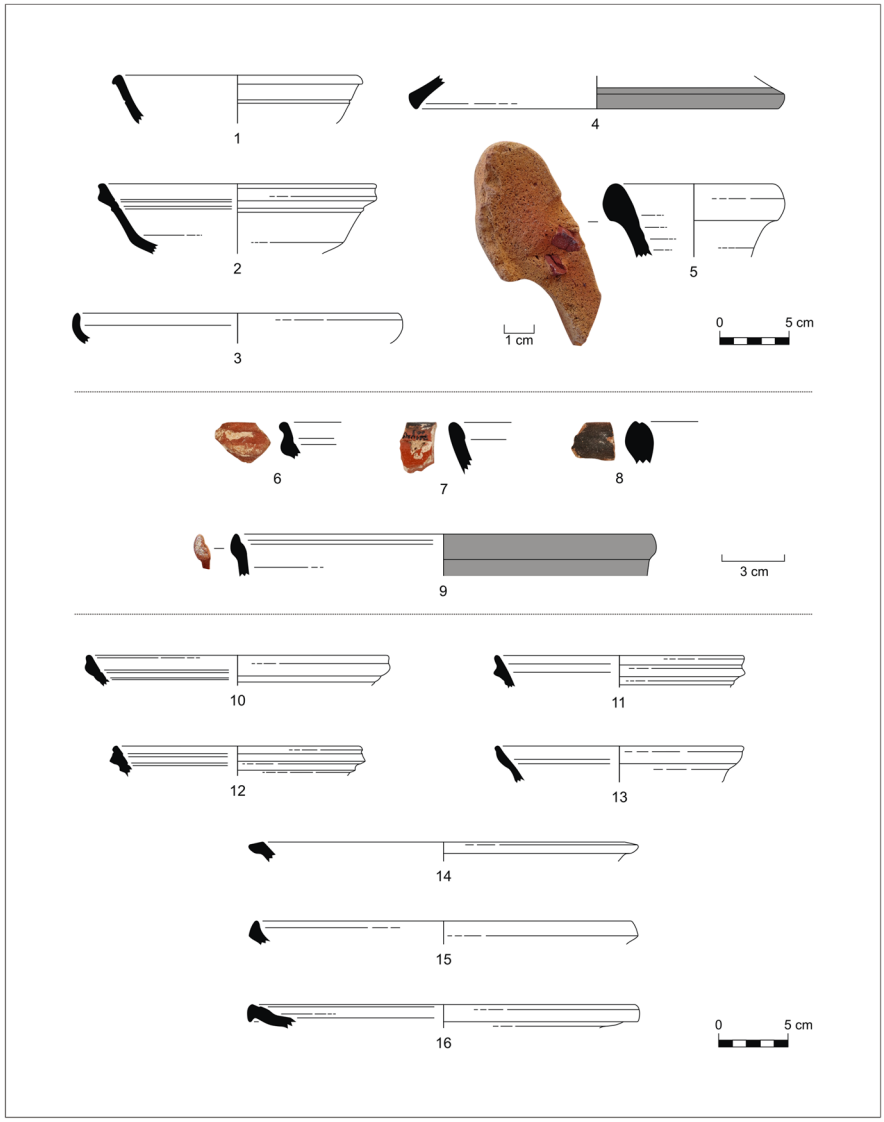

Fig. 15 Tableware, cooking ware and amphorae from TP09-10–11 (Khechni)

are three fragments of amphorae. Among these, we have a fragment of an Ebusitan amphora, possibly a wine container similar to PE-17, the oldest element in the assemblage. We also have an undefined rim with a quadrangular profile that resembles Keay IA amphorae (Fig. 15 (5)), the only known type produced in Algeria, in the ancient cities of Tubusuctu and Saldae (Laporte, 2010). However, its yellowish fabric (with large garnet inclusions) is reminiscent of the MCComW and might indicate production from Tipasa or within the region. The last fragment is a handle from an Africana II amphora, of which the type cannot be specified.

The second phase (Late Antique period) is represented by 56 pottery fragments. Tableware is the most represented category (26.79%), followed by cooking ware (25%), common ware (21.43%), building materials (14.29%), and amphorae (12.50%). In this phase, various diagnostic ceramic fragments were reused to create mortars. The use of pieces with traces of lime as construction material, such as the ARS bowl Hayes 8B (Fig. 15 (6)) or cooking pots Hayes 23B (Fig. 15 (7)) and Hayes 197 (Fig. 15 (8 and 9)), offer a *terminus post quem* no earlier than the end of the second and beginning of the third century. As for the analysis of the ceramic categories,

the tableware is composed of Late forms of African origin. Of the 17 fragments analyzed, 12 correspond to the Hayes 8B type. Their highly evolved profiles maintain classic aspects of the shape, such as internal incisions and external moldings, that become more angular (Fig. 15 (10, 11, and 12)). In some instances, the vessel rims are highly stylized (Fig. 15 (13)). The remaining fragments, such as Hayes 58A (Hayes, 1972, p. 92–96), are produced in ARS D and do not predate the fourth century (Fig. 15 (14)). In addition to these forms, there is a rim of Hayes 61A/B similar to variant B3 (Fig. 15 (15)), later than the second half of the fourth century, and more typical of the early fifth century AD (Bonifay, 2004, p. 167–168). From the same chronology, we also encounter a specimen of Hayes plate 67 (Fig. 15 (16)) that is worth noting since it is a transitional form between variants A and B, characteristic of the second half of the fourth and the first half of the fifth century AD (Bonifay, 2004, p. 171–173). Finally, a Hayes 91A mortar rim from the first half of the fifth century should be noted. Among the cooking ware fragments, which are mostly of African origin, there is an abundance of Hayes 195 (Fig. 16 (17)) and Hayes 196 in their variants from the third and fourth centuries, with an almond-shaped rim and a larger diameter than their predecessors (Fig. 16 (18 and 19)). Of the same chronology are the abundant Hayes 197 casseroles, either with S-profiles (Fig. 16 (20 and 21)) or less marked (Fig. 16 (22)) and a kettle with calcareous concretions in the interior similar to the Uzita 48.1 form (Fig. 16 (23)).

Alongside these types, we identify three fragments of LMCCW forms mostly produced in Carthage: a lid similar to Hayes 196 (Fig. 16 (24)) and two quadrangular rims imitating African Hayes 197

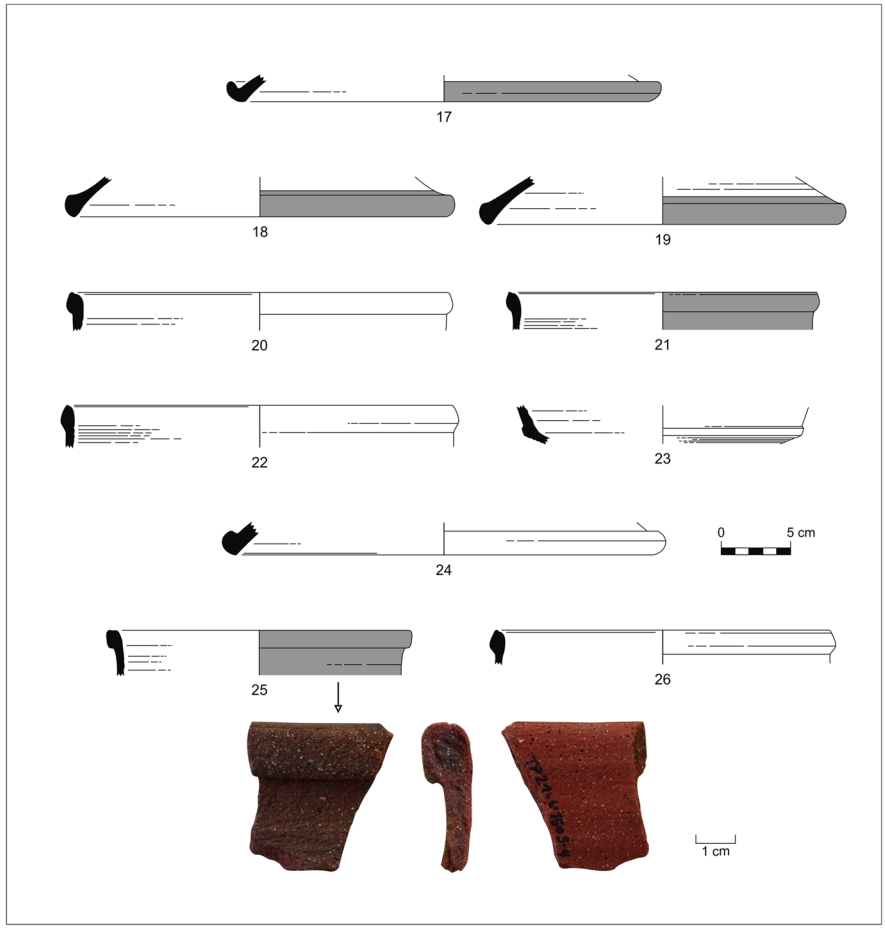

Fig. 16 African and Late Mauretanian Caesariensis Cooking Ware from TP09-10–11 (Khechni)

casseroles (Fig. 16 (25 and 26)). An undetermined sherd of modeled cooking pottery is also present in the assemblage. The coarse ware includes a possible African mortar produced in a beige fabric with abundant vacuoles (Fig. 17 (27)). Other cooking ware is composed of MCComW elements, such as large trifid-rimmed bowls (Fig. 17 (28 and 29)), a form that is also produced in African coarse ware (Bonifay, 2004, p. 245, Fig. 133). We also encountered umbilicated bottoms (Fig. 17 (30)) and fragments of large jars. The amphorae fragments are all of African origin. At least three fragments from Nabeul are documented, of which we identify an African IIIB /Keay 25.3 (Fig. 17 (31)), probably a salted fish container typical of the fourth century (Bonifay, 2016). The latest amphorae example is a Keay 62Q (Fig. 17 (32)), dated between the second half of the fifth century AD and the sixth century, which could also be from Nabeul due to its fabric. The assemblage is closed with a stopper made from the fragment of a reused African amphora (Fig. 17 (33)).

The site's chronological curve (Fig. 8e) shows a slow trajectory initiated in the first decades of the Common Era, followed by an increase in activity and pottery consumption after AD 50 and a peak at the beginning of the second century. Similar trends are observed for the three sites, despite the fact that the amount of ceramic evidence is large for site TP09. However, the site experienced a drop in pottery consumption from the third century onwards. TP11 disappears after AD 250. Only TP10, the smallest site in the area, continued until the fifth and sixth centuries but also suffered similar atrophy around AD 250–300.

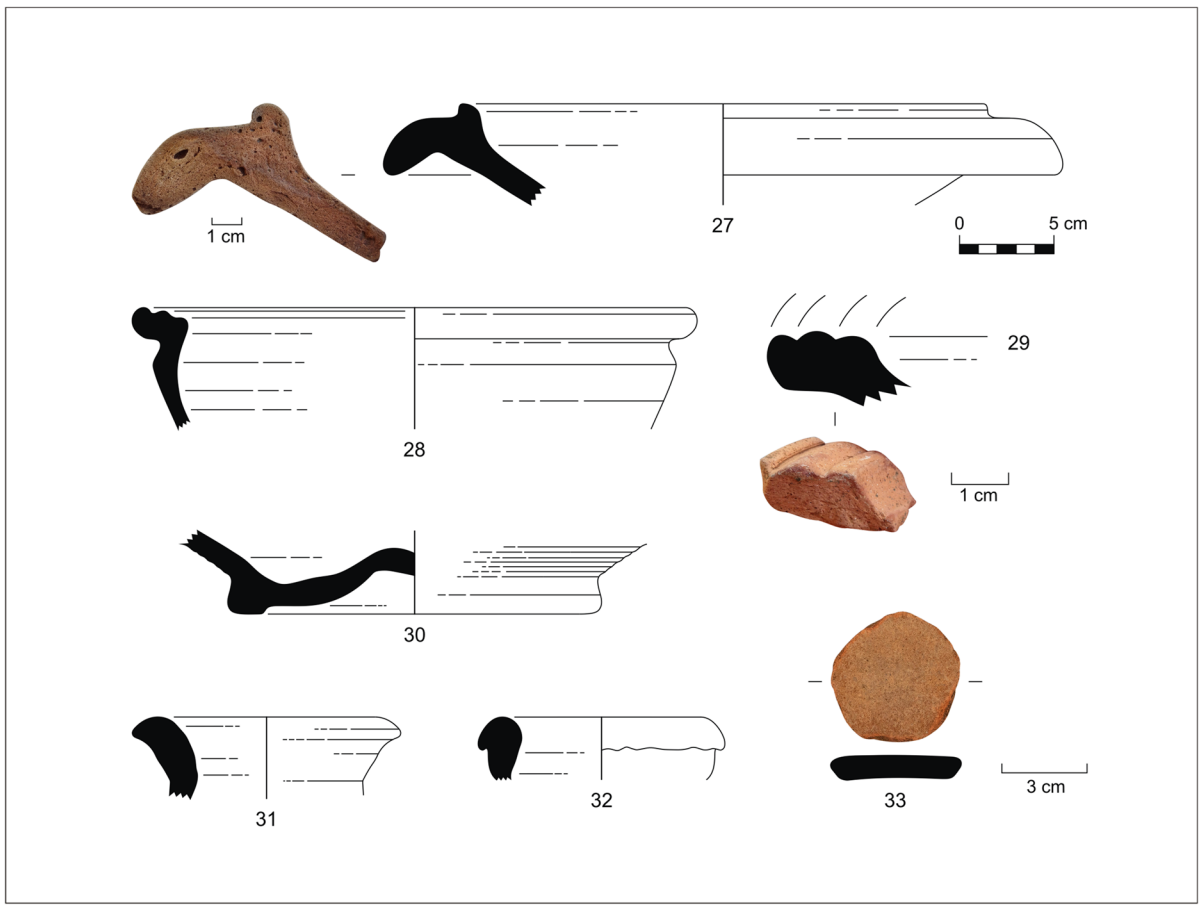

Fig. 17 Coarse ware and amphorae from TP09-10–11 (Khechni)

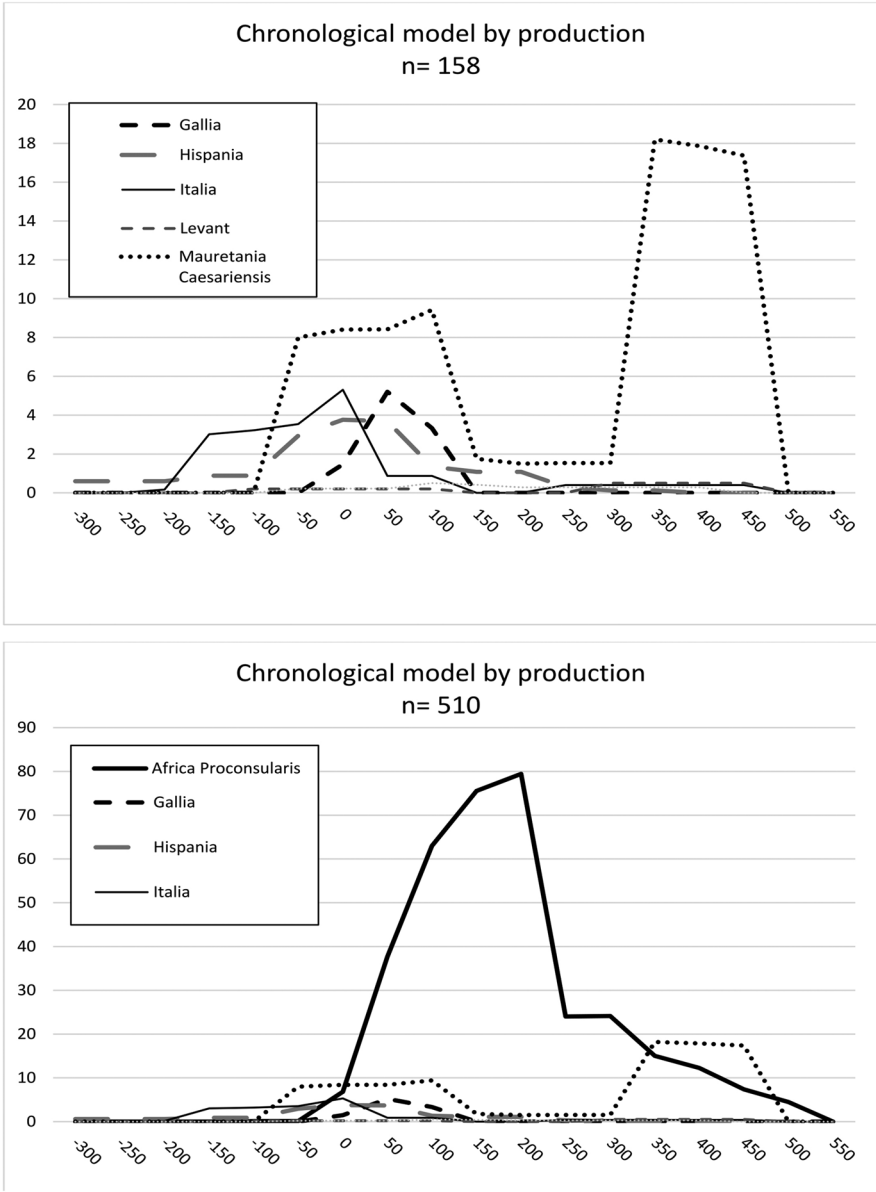

Fig. 18 Chronological model of exports in Tipasa (above: model without African Proconsularis [AP] production; below: model including AP production)

Discussion

The chronological modeling of the different sites, based on locally produced pottery, regional commerce within the North African coast, and imports from the northern shore of the Mediterranean, shows trends of contact similar to observed phenomena in the Western Mediterranean. The commercial trends in the Tipasa territory resemble the experience in the southeast Iberian Peninsula, where the opening to the Roman commercial routes could be traced to the Late Republic–Early Imperial period.

The prevalence of African Red Slip (ARS) ware from Africa Proconsularis is significant, and as a result, it is necessary to exclude this material from the graphs in order to better visualize the trends that occurred before the introduction of ARS ware. This is particularly interesting since we recognize the vivid momentum experienced by the Mauretanian territory

even when it was not yet incorporated as a province of the Roman Empire (40 AD).

In the first instance, the Italic and local Mauretanian productions dominate the consumption of the sites documented in our field survey (Fig. 18). Italic vessels evolved from Black Gloss to Italic sigillata. The Italic production overlap first with Hispanic production, chiefly amphorae, from Baetica to the Tarraconensis and *Ebusus*. Later on, the Gaulish production took over the pre-eminence in the imports from the other side of the Mediterranean. In contrast to the Hispanic imports, we only have evidence of TSG. However, we should consider that *sigillata* traveled together with wine amphora. In this sense, there is evidence of Gaulish 4 amphorae on the other side of Tipasa's bay, at the shores of Sidi Fredj (Algiers).

The trend of local productions in Mauretania Caesariensis is interesting, especially when viewed in relation to the Mediterranean imports and the African imports from Africa Proconsularis (AP). An example is an amphora similar to Keay IA, probably produced in Tipasa, the first of its kind. Other African products from Tripolitana are not representative ($n=3$). Mauretanian productions have an important presence in the assemblage until the mid-second century AD, perhaps representing a decline in favor of AP imports of consumption vessels. However, in the fourth century AD, there was a reboot in the production of Mauretanian storage vessels, which outnumbered the AP imports in the mid-fourth century. The AP imports have had a remarkable presence in the assemblage since the first century. Despite a reduction in the AP presence around the mid-third century, the consumption of this type persists, although slightly reducing until the sixth century.

One issue we should consider is the relationship between the trends detected in the Tipasa 2021 survey assemblages and the actual production trend of diverse workshops. This issue has been discussed by Di Giuseppe (2012) in the study of Black Gloss consumption in the Hellenistic Italian Peninsula. Our contribution here is preliminary because of the little evidence we have for regional pottery production. Nevertheless, the material culture study suggests a relationship between commerce and connectivity, especially from contexts of similar periods under current investigation in Águilas (Murcia), Cartagena (Murcia), and Ebusus (Ibiza), and how long-term economic variations affect political relations, and vice versa. There were also natural disasters that disrupted production and affected political affairs. We should consider events such as earthquakes as possible moments of tension that could disrupt long-term trends and provoke changes in subsistence and economic strategies (Ferdi & Harbi, 2014). Another relevant element to discuss is the political activity in the province in relation to similar processes on the Iberian coast that impacted transformations of communities in both the city and countryside (Hobson, in press).

Another point of relevance is the long-term evolution of the countryside from the Phoenician-Punic period to the Byzantine dominance in the sixth century. Despite the existence of Punic remains, albeit loosely dated, in the harbor of modern Tipaza, there is no evidence of Punic rural occupation. A possible hypothesis, already considered elsewhere to model the settlement pattern in coastal Morocco (Bernal Casasola et al., 2015, p. 505), is that the Punic settlement pattern was mostly urban, while the indigenous population occupied the inland territory with a mixed economy. This is the situation described for the territory around Tamuda, whose settlement pattern in protohistoric times is defined as "epidermal" (Bernal Casasola et al., 2015, p. 500). Further research on Phoenician-Punic settlement patterns in the central Mediterranean might reveal evidence of Punic occupation throughout the territory, extending beyond urban or coastal areas. Examples of Punic rural landscape are on the North African coast, such as the Djerba island (Fentress & Docter, 2008) and the main Mediterranean islands (Van Dommelen, 2006; Van Dommelen & Gómez-Bellard, 2008). The analysis of settlement patterns for the Punic period should be scrutinized further. It opens very relevant questions about the dialogue between Phoenician traders and settlers on the one hand and the indigenous communities on the other (López Pardo, 2015).

The new Hellenistic and Roman sites did not occupy Punic or indigenous settlements. The settlement logic seems to be completely new and variable in time, as we see for sites in Demonchy (TP05-06), which were occupied very early, as demonstrated by the presence of Black Gloss and wine amphorae from Ibiza, or other sites that

appear around the creation of Mauretania Caesariensis and follow very different trends; peak and disappearance, or continues through time until decadence in the sixth century.

The third century was a key moment for comparing global and regional dynamics in the Roman World (Hekster et al., 2007). Archaeological evidence shows that this was a period of rupture throughout the region. There was a general abandonment and a decline in trade with the rest of the Mediterranean, which was not resumed until the fourth century. This did not imply an interruption of life in the city, as shown by several funerary inscriptions from the second half of the third century (Ardeleanu, 2018). The creation of mortars for repurposing datable sherds makes it possible to provide a *terminus post quem* for the reawakening of activity at several sites (Peña, 2007). This new phase is characterized by the predominance of African imports, both tableware (ARS D) and amphorae. Among the latter, Nabeul productions are in the majority, including types such as Keay 25.3, probably intended for fish sauces and some Tripolitanian types for oil transport. A documented amphora of oriental wine could have been distributed from the Carthage area alongside other African products (Bonifay, 2013, p. 532–534).

Field survey has revealed the presence of salting factories on the coast, some of which (e.g., Demonchy) are accurately dated to post-third century AD. However, no local amphorae for fishing and salted fish or other products from the territory have been identified. Alongside amphorae and tableware, there is evidence of the arrival of African cooking wares. The percentage of cooking ware is higher than in the Early Imperial period, but the appearance of a specific type of production, the LMCCW, is noteworthy. Its repertoire largely imitates Zeugitan imports. At the same time, local coarse ware productions (MCComW), identified since the onset of the Common Era, show considerable presence and with new forms. The total absence of lighting material is surprising. As far as African tableware is concerned, the record of very late forms, such as Hayes 104, shows that the territory was occupied at least until the phase of the Byzantine conquest, after which no material was recorded until the Ottoman period.

The Late Antique phase (fourth through sixth century AD) is characterized by uneven trends in settlement patterns. On the one hand, some of the residential enclaves from the Early Imperial period remain. This is the case of TP01 (CET), where the remains of a bath have been found together with luxury architectural materials such as imported marble and blue mural painting. On the other hand, there are sites farther away from the coast that could indicate the exploitation of the agricultural resources of the *ager tipasitanus*. A good candidate for this is TP16, where the remains of kilns-ovens linked to the production of building materials and structures for oil production have been identified.

Conclusion

The field survey around the urban center of Tipasa has shed light on different archaeological topics and generated an unprecedented volume of information on an ill-studied area. This study has reinforced the archaeological significance of the area between the two UNESCO heritage monuments—the ancient city of Tipasa and the Royal Mauretanian Mausoleum. The surroundings of these monuments have an enormous potential to host new research programs that could contribute to our understanding of the long-term archaeological heritage of the region. Some of the topics that the TIPASA Project aims to tackle vary from methodological approaches and data analysis to the economic integration of North Africa and the debate about the third-century crisis, the role of cities in Late Antiquity, and the expansion of Christianity in North Africa and its expansion into the Iberian Peninsula.

Remote sensing tools are crucial in areas that have seen fast-paced development. Combined imagery from declassified satellite imagery, multispectral images, and other publicly available data (Google Earth, Sentinel, etc.) also impact the survey results over the whole area. The importance of ground-truthing for incorporating remotely detected sites into the regional archaeological catalog and collecting pottery assemblages to finetune site chronology and functionality is worth mentioning. We would like to emphasize two areas of research for future study. Firstly, fill the gaps in our data by accounting for the presence of Mauretanian communities and the Phoenician-Punic phase. This would set the stage for understanding the dialogues and relationships between the indigenous communities and the colonial powers and the impact on the area's long-term development. Secondly, attention should be given to the study of material culture and local production

activities as the basis for understanding the important trends in the history of contacts, interactions, and cultural exchanges along the North African coast, including the modern territories of Algeria and Tunisia. The contact between the northern and southern shores of the Mediterranean is already a well-known phenomenon. However, tracing North African dynamics may provide some clues about regional developments and local dynamics influenced by the particularities of indigenous communities (settlement patterns, etc.) and the needs of the new groups who settled in the region (Phoenician, Punic, Romans, and Byzantines). This article has shown that the study of pottery production promises to shed new light on trends previously unnoticed at the regional and local scales.

Finally, an archaeological landscape approach is invaluable to understanding the long-term history of the region across different periods, but this should include the modern era–the Ottoman and French colonial influence, which are barely mentioned in this article.

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Data Availability All data generated or analysed during this study are included in this published article.

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