RURAL SETTLEMENT AND ECONOMIC ACTIVITY

OLIVE OIL, WINE AND AMPHORAE PRODUCTION ON THE TARHUNA PLATEAU DURING THE ROMAN PERIOD

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Chapter 1

THE GEBEL TARHUNA

1.1 Introduction

The Tarhuna plateau region of Tripolitania offers a unique opportunity to study Roman rural settlement patterns and economic activity on a landscape that combined aspects of olive oil, wine and amphora production. The context and origins of many rural sites have not previously been recorded and my work confirms the suggestion that the Gebel Tarhuna was one of the best areas in Tripolitania for the production of olive oil during the Roman period (Goodchild 1976; Mattingly 1985; 1995; Oates 1953).

This study describes the results of the Tarhuna Archaeological Survey (TAS). In the last forty years, there have been several important archaeological surveys of suburban and rural landscapes in the Mediterranean world (e.g. for Libya the Unesco Libyan Valleys survey, Barker *et al.* 1996). However, the hinterland of the Tripolitanian coastal cities has rarely been the subject of regional survey. The TAS aims to gain a greater understanding of economic activity and settlement patterns in the Tarhuna plateau during the Roman period. Using an integrated approach based on archaeological materials, geographical data, landscape and surface survey, this work investigates the economic aspects of archaeological sites, and in particular, farm sites associated with presses and sites of amphora production. There is an urgent need for further recording and investigation of these sites as many have recently been disturbed by spoilage, looting, vandalism, rubbish dumping, encroachment of modern agriculture, land reclamation projects and urban sprawl, which in time will damage or erase their features.

The Roman presses of the Tarhuna plateau first came to scholarly attention through the work of Cowper (1897), who mistook them for prehistoric megaliths. Our knowledge of the archaeology of the Tarhuna plateau has increased since Cowper's day and has permitted new conclusions to be drawn through the analysis of material concerning settlement patterns and economic activity during the Roman period in this part of Tripolitania.

This study investigates the regional distribution, acquisition and production patterns of rural settlement during the Roman period on the Tarhuna plateau. Chapter 1 deals more generally with the geographical and historical background. Specific focus was then placed on the Wadis Turgut and Doga in the north-eastern sector of the Gebel Tarhuna as discussed in Chapter 2. In that chapter, I also describe the methodology that was employed in the TAS and the typology used for the identified sites. Chapter 3 deals with the settlement types found on the Tarhuna plateau and their organisation, construction, density and diversity. The pressing facilities for olive oil (and wine) are examined in Chapter 4, with particular attention paid to the quantitative analysis of press elements and their estimated annual production capacity. The importance of the amphora production sites on the Tarhuna plateau which have been newly recorded by the TAS, and the Tripolitanian amphora types and stamps are emphasised in Chapter 5. Chapter 6 concludes the study by summarising the most significant results, evaluating the project and addressing the future need for more archaeological research in this region.

1.2 Geography and climate of the study area

The Tarhuna plateau lies in north-western Libya, on the eastern part of the Gebel Nafusa which is called the Gebel Tarhuna-Msellata (Figure 1.1). It is bordered by the Gefara, or coastal plain, on the north, the predesert on the south, the Msellata plateau on the east, and the Gebel Gharian on the west (Figure 1.2). Although the northern boundary is formed by a narrow strip of the Gefara, topographically, the region is dominated by the mountain plateau which ranges in its elevation from

c.135 m asl at its north-eastern border to c.610 m asl in the Aurban village close to the Gebel Gharian.

The present-day aspect of the Tarhuna plateau territory reflects the course of geomorphological evolution in a period of tectonic activity within the Neogene-Quaternary Period. The neotectonic uplift of the northern periphery of the African continent in previous geological periods led to the final isolation of the littoral lowlands and elevated plains-plateaux, which represent the largest geomorphological elements of Tripolitania.

Scholars have argued that the continental uplift established in Tripolitania is earlier than that which occurred in Cyrenaica (Desio 1971; Hecht *et al.* 1963). A series of faults occurred in the process of uplifting on the steeper northern limbs, forming vast steps along the areas of the deepest and largest of these. In relief they represent the littoral plain and the steps of the Gebel Nafusa plateau (Desio 1971; El-Hennawy and Cheshiter 1975).

The Tarhuna plateau is crossed by several valleys (wadis) running to north or to south. The most famous one is the Wadi Taraglat-Caam which is considered the largest in the southern part of the plateau (Brehony 1960; Cowper 1897). The alluvial deposits of the Tarhuna region form part of the wider alluvial deposits of mixed genesis that display a considerable distribution in the Gebel Nafusa, from east of the Gharian meridian on the Gebel Tarhuna-Msellata to Lepcis Magna on the littoral plain. These deposits are composed of a stratum of loamy sands, loams and clays with interlayers of slightly rounded, coarse fragments of calcareous or silicon matter (Shishov 1980).

Most of the Gebel Tarhuna lies between the 300–200 mm isohyets; however, the annual distribution of precipitation is non-uniform, with some years featuring twice as much precipitation. According to data from the Tarhuna meteorological station the amount of precipitation for the period from 1925 to 1978 ranged from 55 mm (1925) to 506 mm (1974), with 28 % of the years being relatively hot and dry (less than 200 mm of precipitation) and 12 % of the years being slightly wetter (more than 400 mm of precipitation) (Jones 1971).

The territory under survey is situated in the Mediterranean climate zone, in the belt of subtropical, alternate atmospheric circulation. In summer, the climate is determined by the stable high pressure zone situated over the Mediterranean Sea, with descending tropical air currents. As they descend, the air masses become warm and dry. The air temperature reaches its maximum in this period while rainfall is at its minimum, with the period from May to August making up about 2 % of the yearly total. From autumn until spring, the climate conditions are determined by the cyclonic activity of the ascending air masses of the temperate zone. A number of cyclones moving over north and central Europe shift to the south together, becoming additionally saturated and strengthening over the Mediterranean Sea. The mean air temperature in winter is two or three times lower than it is in summer, and the precipitation from October to March accounts for 85–90 % of the annual amount (Table 1.1) (Shishov 1980).

1.3 The agricultural importance of the Tarhuna plateau

The region's economic resources, and in particular its agricultural constituents, played a substantial role in making it one of the most productive hinterlands in Tripolitania for the cultivation of olive trees and rural settlement. The density of archaeological remains of olive oil production sites can be seen as a reflection of the involvement of the elite, especially from Lepcis Magna, in exploiting this countryside as a prime source of revenue contributing to the power and wealth of the region (Manacorda 1976–1977; Mattingly 1988a; Reynolds 1995). The high level of monumental construction, the huge public buildings and the scale of use of luxury materials in the main coastal centres (Lepcis Magna, Oea and Sabratha) reflect their wealth and vast financial resources. According to Romanelli (1929), this wealth was developed mainly through the successful Roman agricultural expansion in Tripolitania and reached its climax before the third century AD. Similarly, Mattingly states that the extension of well-developed agricultural lands far into the Gebel Tarhuna-Msellata had a great impact on the wealth of many of the Lepcitanian aristocracy from the Augustan period onwards (Mattingly 1988c, 22–23; 1995, 141).The people of the Tarhuna plateau encountered by Barth and Cowper during their travels in the nineteenth century were practising pastoral transhumance integrated with multiple cropping on the wadi beds (Barth 1857; Cowper 1897), and this pattern continued in places well into the twentieth century. The archaeological evidence reveals that there was greater agricultural activity in the region during the classical period. The large amount of ancient farming remains still visible in the landscape in the last century encouraged the Italian colonial authority to re-establish many modern farms and to build a number of agricultural village centres (Hornby 1945). The present-day cultivation of the region is mainly concentrated in the northern sector of the plateau. The southern wadis of the plateau are still used as pasture lands, with cropping only during years of higher precipitation. Figure 1.3 illustrates the main arable lands in the northern areas of the Tarhuna plateau. Olives remain the most important crop, followed by almonds, grapes and figs.

A series of questions can be asked about the archaeology of the Tarhuna region. What processes lay behind the development of ancient agriculture on the Gebel Tarhuna, given that it has the character of a semi-arid plateau separating the coastal plain from the arid pre-desert

zone? What role did the Tarhuna plateau play in the economy of the main coastal centres, especially Lepcis Magna, during antiquity? Can it be demonstrated that the Tarhuna plateau succeeded in providing a large scale of olive oil production? To what extent do the archaeological data of the Tarhuna plateau make the region an appropriate case study for investigating larger research questions about the Roman economy? How can we best mobilise field survey results in the context of broader debates about rural settlement trends and the Roman economy? To what extent does the evidence tell us about economic growth, intensification of production, urban-rural relationships and networks, the wider agricultural economy (including the labour force) and the landscape? To what extent is it legitimate to consider an increasing level of specialisation as a proxy for economic growth, and to what extent is it legitimate to consider it as such in the Roman world?

With these problems in mind, a prime aim of this research is to determine the factors responsible for the permanent, sedentary agricultural settlement in this zone during the classical period. A range of archaeological and historical evidence will be used to build up a picture of ancient economic activity on the Tarhuna plateau. The evidence for two main economic activities, olive oil production and the manufacturing of amphorae, will be analysed with reference to this framework, in order to assess the organisation and level of these economic activities in relation to settlement patterns. The archaeological remains will be investigated to assess and place the Tarhuna plateau within the economic context and history of the region and to understand more clearly how the elite of the coastal cities were involved in investment in agricultural and rural estates.

Mattingly argued that the exploitation of the Gebel Tarhuna-Msellata coincided with the development of the coastal plain during the Roman period (Mattingly 1987b, 49). Initially, probably starting in the pre-Roman period (late Punic and early Numidian periods, second to first centuries BC), this agricultural development took place in areas where the rainfall was especially favourable. The minimum rainfall required for the cultivation of wheat and olives (200–400 mm) allows their safe cultivation in only limited areas of the Gebel by dry farming (Barker 1984). According to Mattingly, the Gebel Tarhuna-Msellata is more suitable for growing olive trees because the average rainfall usually received in the region is only of 300 mm per year (Mattingly 1985, 31).

The production of olive oil has long been recognised as the most likely mainstay of the agricultural economy of Tripolitania during the Roman period, though as we shall see, wine may have been more significant here than previously recognised (Brun 2004). Mattingly (1995) has emphasised that this situation was not unexpected or unnatural because the olive tree is considered a hardy tree and is able to adapt to marginal environments. The dry farming of olives was particularly suited to the hillsides of the Tarhuna plateau; indeed, the traces of olive farms and the existence of hundreds of presses attest to the widespread nature of olive cultivation in the region. Goodchild, for example, mentioned that the main area for the growing of olive trees in Tripolitania was the whole of the eastern Gebel from the Tarhuna and Msellata hill region to the sea, and from the Gebel escarpment to the Wadi Taraglat (Goodchild 1952a, 76). A very similar argument is presented by Mattingly, who observed that the Gebel Tarhuna includes the best-documented surviving traces of Roman olive farms in Tripolitania, even though the landscape and land-use had changed in the post-Roman period (Mattingly 1988c, 25). Oates (1954, 91) suggested that this change started from the fourth century AD, due to the marauding raids of pre-desert tribes such as the *Austuriani*, which caused a decline of the prosperous agricultural society of the first three centuries AD (Moderan 2003, 262 on Austuriani and p71 on defences).Some writers have claimed that the eastern Gebel lands were first opened up to intensive olive growing early in the first century AD (Grahame 1998). However, this claim was based on the fact that previous surveys had not been able to produce any proof that the farms discovered in the region had existed before the first century AD (Mattingly 1995, 140; Oates 1953, 110). However, the Roman-era agricultural boom did not start from nothing, and elements of the pre-Roman rural landscape are starting to be recognised (Munzi *et al.* 2004). Black glazed ware of Campana A production and Numidian coins found recently at some sites on the Tarhuna plateau are evidence of an early exploitation system and the proposed hypothesis is that the region witnessed a degree of settled life and agricultural practice from at least the second century BC. This new evidence supports Mattingly's conclusion that if Caesar's fine of three million pounds of olive oil (*Bellum Africum*, 97.3) was indeed imposed on Lepcis Magna, this level of production could only have been reached if the Gebel Tarhuna was already being intensively farmed by the mid-first century BC (Mattingly 1988c). It seems reasonable to suggest that sedentary agriculture was not only associated with the Tripolitanian coastal centres but also extended to the Tarhuna plateau during the pre-Roman period (Munzi *et al.* 2004, 21). A very different picture is presented by Grahame who has argued that the city fined by Caesar was Leptis Minor, not Lepcis Magna, and that the lands of the Gebel were dominated by fully pastoralist peoples until the first century AD (Grahame 1998, 107). An attempt will be made by this research to shed further light on this crucial issue of the nature and scale of pre-Roman agricultural development in the Gebel Tarhuna.

A basic problem with studying the ancient economy is that it is difficult to find any detailed information about it from the historical sources. There are few direct

references to farming and rural settlement beyond the coastal cities of Tripolitania or to the extent to which agricultural production in the hinterlands extended in scale beyond subsistence to surplus production in the classical period. A rare exception is presented by Apuleius in his *Apology*, in which he describes estates belonging to his wife (Aemilia Pudentilla) in the hinterland of Oea. The problem can only be more fully addressed by the examination of the ample archaeological evidence for rural settlement including villas, farms, and presses (Cowper 1897; Goodchild 1951; 1952a; Mattingly 1985; 1987b; 1988a; 1988b; 1988c; 1989a; 1995; Oates 1953; 1954).

Because the literary sources were mainly produced by and for a leisured elite, they say little about the economy (Morris *et al.* 2007). Archaeological evidence examined by field experts reveals that this perspective is misleading. Since the beginning of the second half of the twentieth century, archaeological data has expanded our knowledge about ancient economic behaviour, with Graeco-Roman economic historians becoming aware of new questions and using new methods to answer them (Finley 1973; Garnsey and Saller 1987; Jones 1974; Mattingly and Salmon 2001; Rostovtzeff 1953; 1957).

The last three decades have witnessed a great historical debate concerning the Graeco-Roman economy. Many historians have tried to find answers regarding the Roman economy and, in particular, whether it can be described in terms of the concepts of 'primitivism' or 'modernism', and whether the limitations of the Roman economy can be seen as a reflection of the influence of the consumer city. A consumer city was one with a lack of capital investment, limited technological innovation, a low level of growth, surplus production or industrial specialisation and little long-distance trade in non-luxury items. Proponents of this model believe that the Roman economy only grew to a limited extent, if at all (Finley 1985; Garnsey and Saller 1987). A different model for the Graeco-Roman economy was developed in intricate and painstaking detail by Finley and his school. This view is illustrated by Hopkins who stated that "the size of surplus produced in the Mediterranean basin during the last millennium BC and the first two centuries AD gradually increased ... The growth in the surplus produced and extracted was largely the result of two factors, political change and the spread of technical and social innovations" (Hopkins 1983, xiv). Archaeological data relating Graeco-Roman agricultural production and trade, especially of olive oil and wine, has revealed persuasive evidence of real growth, in contrast to the view of 'irrational' and limited economic growth (Amouretti 1986; Forbes and Foxhall 1978; Foxhall and Forbes 1982; Hitchner 2002; Mattingly 1988c). If growth can be shown to have occurred, underlying questions can be addressed. Accordingly, this study will highlight evidence which supports the view that there was economic growth, specialisation in olive oil production and surplus production for export on the Tarhuna plateau during the Roman period, particularly during the first to third centuries AD. In this case study, the use of new data on the production and export of olive oil and amphorae opens up new potential for debate about the social and infrastructural accelerators that were behind this growth in the Roman period. In the concluding chapter of this study, I shall review the impact of my data on wider debates about growth, scale, specialisation and standardisation in the Roman economy and the interrelationship between town and country.

1.4 The Tarhuna plateau and landscape archaeology

A prime attraction in studying Tarhuna's ancient landscape is that its prominent, well-preserved and extensive rural sites still stand out in the landscape, especially sites with presses. It is conventional to refer to these presses as 'oil presses', though as this work will show, some were evidently for wine production. Although these sites appear to have been abandoned for most of the last 1,500 years, a significant number remain standing and some of them still have presses of more than 3 m high. I can attest that this semi-arid area south of the cultivated coastal plain still presents a remarkable image with its substantial, well-built settlements, numerous farm buildings and presses. The process of rural exploitation, growth and decline occurred across more than five centuries, leaving distinct traces in the archaeological record (Cowper 1897; Oates 1953; 1954; Goodchild 1951; Mattingly 1985; 1987b; 1995). For instance, Cowper (1897) and Oates (1953) recorded more than 260 presses even though their works did not cover the whole of the Tarhuna region. There is undoubtedly enormous archaeological potential for renewed survey work here and as we shall see, this study adds a significant number of new rural sites which have not previously been recorded.

There are many archaeological remains in the Tarhuna region dispersed over most parts of the plateau (Chapters 2 and 3). An interesting point is that the Gebel Tarhuna was a boundary land between two important ancient coastal centres: Lepcis Magna and Oea (Di Vita-Evrard 1979; Mattingly 1987b). It is possible that this ancient reality may be reflected in settlement patterning. Like many other cities in the Roman world, Lepcis Magna was integral to its surrounding territory and hinterland (Munzi *et al.* 2004). Not all of the resources and items needed in the city could be obtained locally and from an early date Lepcis Magna imported various goods, through Mediterranean and sub-Saharan trade (Mattingly 1995, 158). Many of these goods were distributed not only at the urban centre but could also be found spread across the countryside.

In recent decades, a great interest in the economic archaeology of rural Roman North Africa has emerged thanks to a number of published survey and excavation projects in the countryside (Barker *et al.* 1996; De Vos 2000; De Vos 2013; Dietz *et al.* 1995; Fentress 2000; 2001; Fentress *et al.* 2009). Nonetheless, these rural sites have rarely been excavated, in contrast with the great number of excavations that have been concentrated in both large and small urban centres in Roman North Africa (Stone 1997 summarises some of these, so too Hobson 2015). The results of these surveys support the concept that the countryside and rural life played a significant role in the economy of Roman North Africa, since the majority of its inhabitants were living in the countryside during the Roman period, whether in villages, hamlets or isolated farms (Barker 1991). Most of the evidence from the field surveys indicates that there was intensive economic growth in the provinces of North Africa, particularly *Africa Proconsularis* (Hitchner 1993; Hobson 2015). As Mattingly has pointed out,

> [this] include[d]: growth in agricultural production and rural production, an increase in exports of primary products, raised levels of import substitution, large scale units of production (from farms to oileries, from workshop to manufactory pottery production), the emergence of a society that was patently involved in risk-taking, economic calculation, technological innovation, and other 'rational' economic behaviour (Mattingly 1997, 117).

This perspective supports the idea that North Africa's countryside played a substantial role in the economy of the Roman Empire as a prime resource for the food supply of the city of Rome. With regards to the importance of the countryside and rural economy, this research will suggest that the Gebel Tarhuna was one of the best rural areas in the province of Tripolitania during the Roman era because it included much of the best agricultural land. It is clear from the density of olive presses that the territory of the Gebel Tarhuna was an agricultural production area that had the capacity to produce millions of litres of oil in good years (Chapter 4) and was supplementary in important ways to the agricultural development of the coastal plain, especially the territory of Lepcis Magna (Mattingly 1985, 31; 1988c, 27; 1995, 140).

1.5 Background of the study

The archaeological sites of the Tarhuna region were first reported in the nineteenth century by Barth and Von Bary who visited them in 1849 and 1875 respectively (Barth 1857; Von Bary 1883). Both of these pioneers gave a summary description of some of the ancient sites on the plateau, which attracted the attention of other travellers and scholars in the late nineteenth and early twentieth centuries. During 1895 and 1896, Cowper visited the Tarhuna plateau and examined in considerable detail more than 80 ancient sites (Cowper 1897). Although he interpreted these sites as prehistoric monuments of religious character (*senams*), his work constitutes a significant pioneer survey. Once it was recognised that his *senams* were, in fact, olive oil presses, the enduring value of his work was that it revealed the importance of the Tarhuna region as a zone of intensive olive cultivation during the classical period. The Gebel Tarhuna was also partly surveyed by Goodchild (1951), who examined a number of ancient sites and undertook excavations in the Sanctuary of Ammon at Ras el-Haddagia and in the villa and pottery kilns at Ain Scersciara (*Cercar?*) (Goodchild 1951). At the same time (1949–1951), Oates carried out a more comprehensive archaeological survey in an area of some 300 km^2 around Gasr Ed-Dauun (*Subututtu*) in the eastern part of the Tarhuna Plateau. In three seasons of work, he revealed a distribution of more than 100 sites, which extended chronologically from the first century to the fifth century AD (Oates 1953, 1954). For the most part, the sites recorded by Oates consisted of varying sizes of farms with their associated presses, water control and supply works. The 130 separate press structures were interpreted as evidence of regional specialisation in oil production.

It is important to note here, in relation to the dating of sites, that in the middle of the twentieth century, pottery of the first century BC was poorly known. The archaeological notes gathered by Oates (1953, 89–104; 1954, 93–110) are, in general, very uneven, the descriptions of individual sites are too brief and they lack chronological details. Indeed, chronological indicators for sites are rarely provided, though it is clear from the descriptions of the archaeological features that most belonged to the Roman period. Since 1950, knowledge of pottery has improved greatly, and subsequent to the work of Hayes (1972; 1980) it is now much easier to recognise and date surface pottery assemblages, especially *sigillata* wares and Red Slip wares. For example, African Red Slip (ARS) ware was the most important type of Late Roman pottery distributed all over the empire. It was produced by various North African workshops over a period of some six centuries from the end of the first century AD until the seventh century AD (Hayes 1972, 13). In Tripolitania, it was accompanied by local variants in late antiquity known as Tripolitanian Red Slip (TRS) ware.

Archaeological evidence for olive presses from the Gebel Tarhuna suggests a remarkable level of oil production. Mattingly has estimated that the total potential oil production capacity in good years would have measured millions of litres; sites such as Henschir Sidi Hamdan (with nine presses) and Senam Semana (TUT54, with 17 presses) could have produced 100,000 and 200,000 litres respectively in peak production years (Mattingly

1988a; 1995, 143). The region unquestionably specialised in olive oil production, contributing significant exports to Mediterranean markets (Mattingly and Hitchner 1993, 454). There are, however, some factors that restrict our ability to make a successful comparison between the Roman period and modern Mediterranean oleoculture. These factors, according to Mattingly are: "regional diversity in olive cultivars, planting densities, soils and climate, cultivation techniques, harvesting and processing methods" (Mattingly 1994, 91). There is no doubt that differences in production techniques and climatic conditions played a significant role in the density of planting, the yield of individual trees and the potential production capacity of the olive presses (Mattingly 1996b). In contrast to the modern system of olive tree farming in the eastern Gebel, where extensive rows of trees facilitate mechanised cultivation (Taylor 1960), ancient olive trees were probably grown intensively in rows, in scattered groves or in association with other crops, and were worked by human power and animal traction.

As Figure 1.3 shows, some areas of the Tarhuna plateau are also favoured for viticulture and similar local trends would also have been possible for Roman farming. As we shall see, there is some evidence to suggest that wine production was a secondary, but significant component of the economic specialisation of the Roman period.

Chapter 1 TABLES

Table 1.1: *Mean monthly and annual precipitation recorded at the Tarhuna meteorological station for the period 1925–1978.*

Month	Mean precipitation (mm)
January	55.3
February	43.5
March	34.7
April	19.3
May	5.8
June	2.7
July	0.2
August	0.6
September	12.7
October	27.4
November	23.7
December	47.0
Annual	**272.9**

Chapter 1 FIGURES

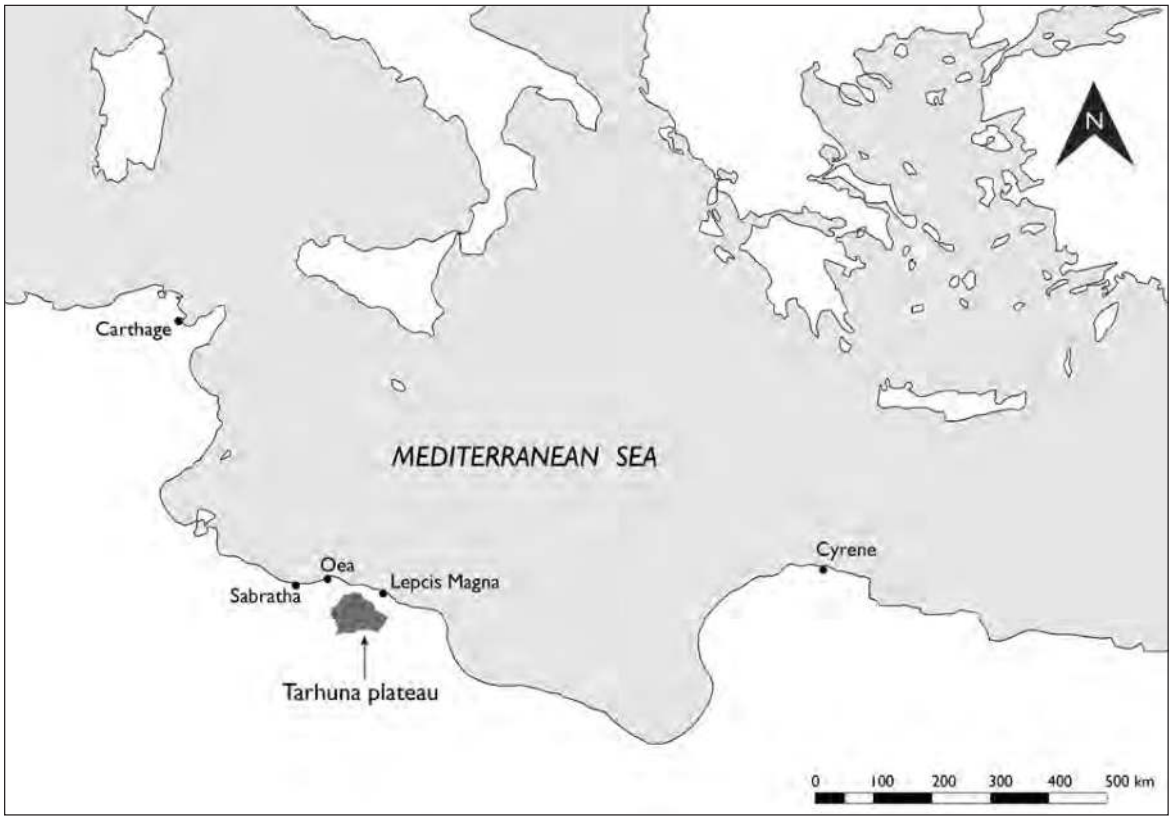

Figure 1.1: *Location of the Tarhuna plateau.*

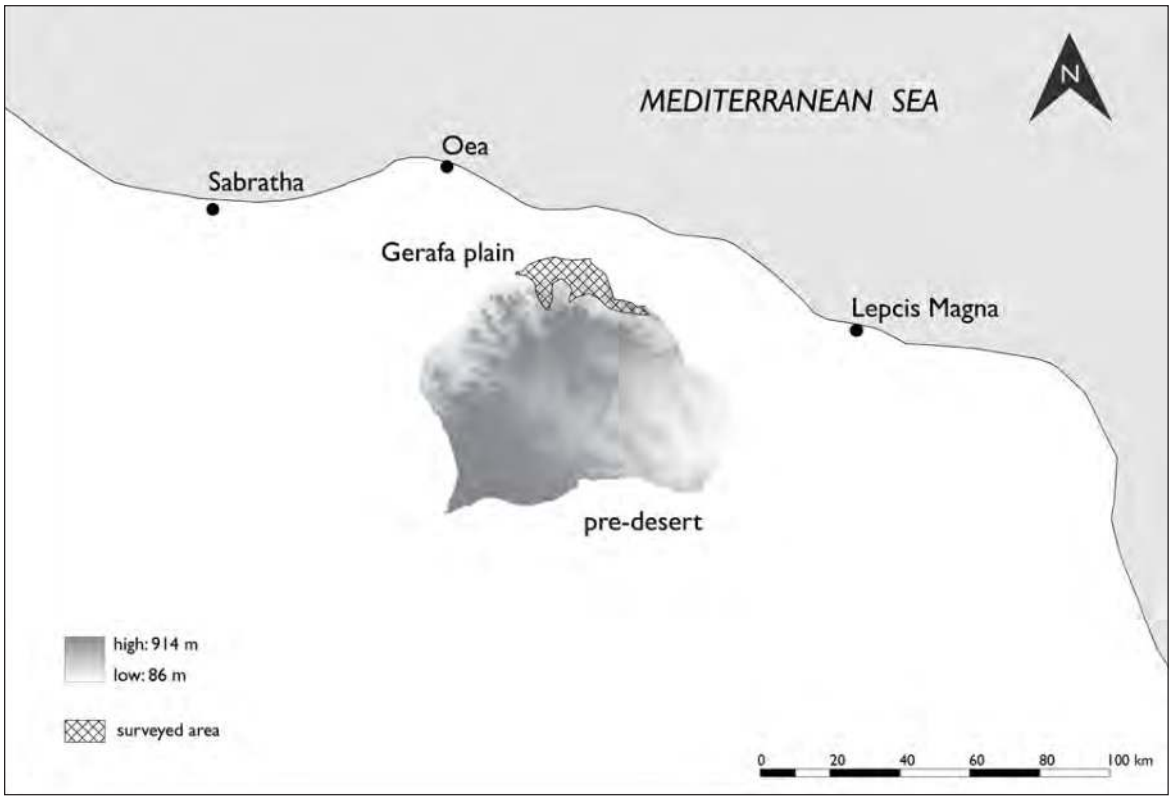

Figure 1.2: *The Tarhuna plateau.*

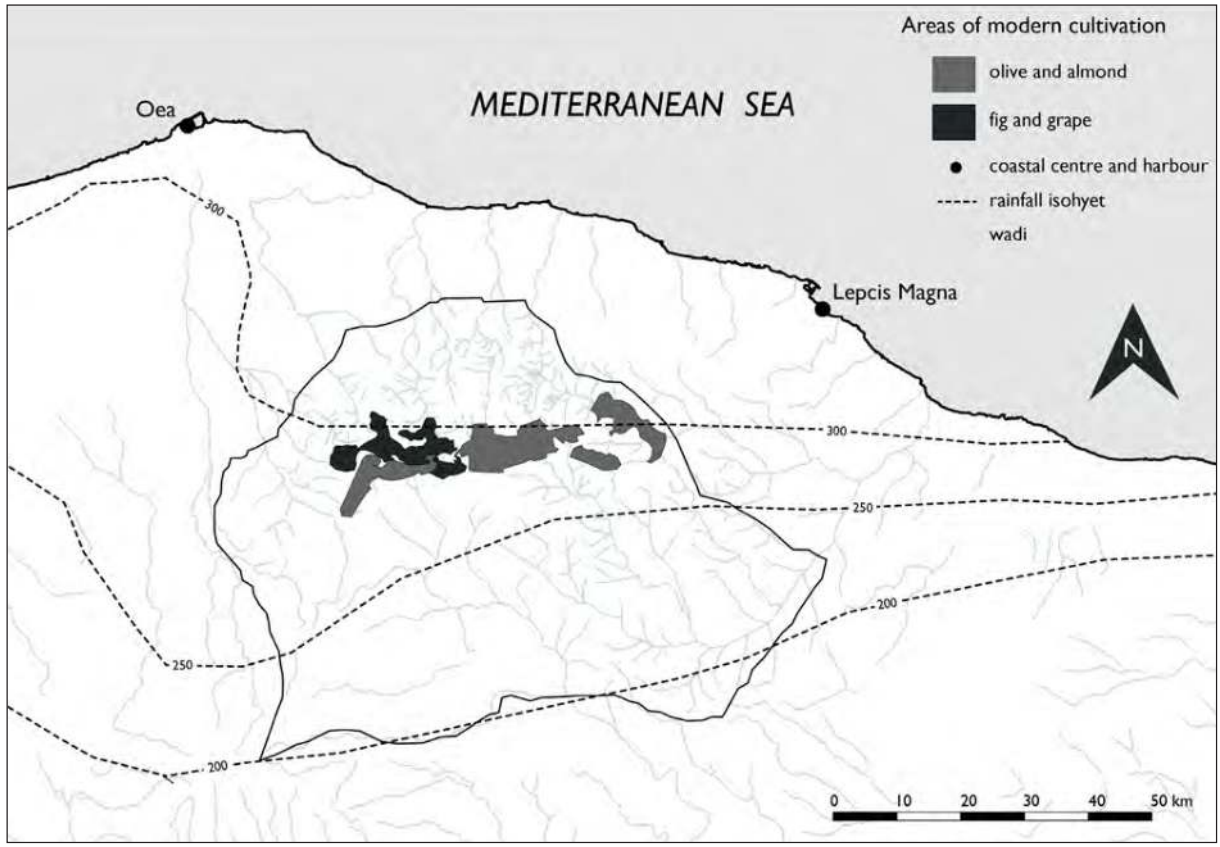

Figure 1.3: *Modern areas of cultivation on the Tarhuna plateau (After mapping of environmental resources project for agricultural use, National programme for development of vegetation cover, Tripoli 2007).*

Chapter 2

THE TARHUNA ARCHAEOLOGICAL SURVEY

2.1 Introduction

The Gebel Tarhuna and plateau is often referred to in general studies of Roman North Africa as a major olive-producing area (e.g.Goodchild 1952a; Hobson 2015). This is based on the evidence of numerous olive presses, oileries, farms and other olive oil-related facilities found in the hinterlands of the wealthy coastal cities, Lepcis Magna and Oea (e.g. Lloyd 1991; Mattingly 1985; Goodchild 1952a). Other archaeological surveys carried out in the Mediterranean world, particularly in North Africa, are of major importance for understanding the Tarhuna region's ancient landscape and for clarifying problems pertaining to the use of its land for agriculture and for its interpretation (Mattingly 1995; Mattingly and Hitchner 1995). Nevertheless, except for work carried out by Oates during the years 1949–1951 in the eastern part of the Gebel Tarhuna around Gasr Ed-Dauun (*Subututtu*) (Oates 1953; 1954), no systematic study of the rural settlement and economy of any part of this region has previously been undertaken.

The purpose of this chapter is to place the work of the Tarhuna Archaeological Survey, which I conducted in 2007, within a geographical and typological framework. Concentrating on specific areas of the Tarhuna region, this chapter presents the area of the Wadis Turgut and Doga and some of their tributaries as a key case study on ancient settlement patterns and site distribution within this landscape. In addition, this chapter will also give consideration to economic aspects of the archaeological remains.

2.2 Aims of the survey

The Tarhuna Archaeological Survey (TAS) aimed to investigate the organisation of rural agricultural settlement in the region of the Tarhuna plateau. The region's economy under the Roman Empire was evidently geared towards the production of olive oil for export (Mattingly 1985; 1987b; 1988a; 1988b; 1988c); however, the relationship between rural settlement and agricultural production remains unclear. Nevertheless, the range of settlement types recorded by previous works (Cowper 1897; Goodchild 1976; Oates 1953; 1954) clearly suggests the existence of sophisticated agricultural organisation in the countryside of the Tarhuna plateau. The TAS was therefore established in order to investigate the composition and organisation of this ancient rural settlement in the Gebel Tarhuna region of northwest Tripolitania and to gain an understanding of the agricultural economy of the area in the wider context of the Roman economy.

The nature of this organisation can be established through an understanding of the relationship between the various types of settlement. This is not easily achieved in the absence of documentary evidence or the opportunity for full-scale excavation at certain sites within each of the various settlement categories. In an attempt to deal with this gap in the evidence, the TAS carried out detailed recording of the landscape and standing remains in the survey areas. This survey has revealed the relative numbers, distributions and relationships between different types of sites, from farmsteads to small villages, which were integrated with elaborate terracing, cross wadi walls, and other irrigation features. In addition, the TAS undertook more detailed recording at a selection of these rural settlements, in order to improve our knowledge of the chronology of evolution and change in the landscape and settlement patterns during the classical period.

The TAS employed two types of survey method, extensive and intensive, in order to enhance the current understanding of ancient settlement in the Tarhuna region and to explain how rural settlement, and in particular olive farms, had developed during the classical period. This survey data is also supported by mapping of

the landscape in association with an investigation of the overall shape of rural settlement patterns in relation to economic and environmental factors. Many of the sites which were recorded during the late nineteenth and mid-twentieth centuries have not hitherto been accurately mapped. For this reason, a key goal of the TAS was to improve the overall mapping of the extensive spread of settlement on the landscape by using old and new fieldwork records and satellite imagery as a base, assembling archaeological materials for a first synthesis of the settlement history of the region. Google Earth provides increasingly high resolution satellite images on which larger sites (especially fortified ones) are clearly visible (Figure 2.1). However, there is no doubt, as the field survey results attest, that many smaller and less observable sites also exist and are, at present, only recognisable on the ground.

Another goal of the TAS was to investigate the density and distribution of surface artefacts and to shed light on their range and date, paying particular attention to the ceramic evidence. Useful comparisons can now be made between this region and the neighbouring pre-desert zone (Dore 1985; 1988; Mattingly 1996a; Barker *et al.* 1996) and other surveyed areas in North Africa such as the Kasserine region (Hitchner *et al.* 1990). Furthermore, the field survey results can be employed as a guide to finding archaeological answers for historical questions. For example, what is the evidence, if any, for pre-Roman (Punic or Numidian) farming activity on the Tarhuna plateau? What was the character and extent of the earliest inland Roman settlement in this zone? What was the nature and rate of economic activity in this region during the classical period?

2.3 Methodology

Since the 1960s, landscape perspectives and archaeological survey have developed together as the result of movement away from individual sites as analytical foci. Although landscape has served as a framework for constructing narratives that pursue chronological and historical rather than explicitly processual or post-processual methods (Banning 1996; Barker 1995; 2000), there remains a wide distinction between scientific and interpretive approaches to landscapes and survey. Although issues of landscape and archaeological survey span an enormous range of topics, some of the most pronounced distinctions between intensive and extensive methods concern conflicting opinions about sampling. Scientific conceptions of landscapes implicitly rely on the view that for any region and period, there is an archaeological landscape waiting to be retrieved and reconstructed, while interpretive methods depend on the contention that there can be many equally appropriate, archaeologist-specific encounters with landscapes. These views are reflected in disparate survey methods. Faced with limited time and resources, fieldworkers are often challenged with difficult choices between systematic and judgmental, opportunistic sampling. While scientific methods have sought increasingly sophisticated sampling methods appropriate for quantitative analyses, interpretive studies have deliberately eschewed systematic sampling (Tilley 1994).

The most powerful approaches utilise a combination of both systematic and opportunistic survey so that they can generate data appropriate for quantitative analyses, while also taking advantage of archaeologists' and locals' distinctive knowledge about areas where certain types of remains are likely to be found. Fieldwork in a given study area is concerned with the collection, management, and analysis of spatial information, which offers a variety of informative methods for investigating archaeological landscapes. It combines a range of closely related data-generating and analytical tools including satellite imagery, Global Positioning System (GPS), and Geographic Information System (GIS) technologies. The application of each of these technologies (often independently) have recently become common in archaeology (Barratt *et al.* 2000; Ebert 1984); together they offer an even more valuable research triad.

Intensive and extensive landscape approaches apply many of the same tools and information sources noted above, but in substantially different ways. Aerial photographs were being used for archaeology as early as the late 1800s (Ebert 1984), but since then have become far more than just pictures from above. Although aerial photography and satellite imagery were initially pursued as a means of identifying undiscovered archaeological sites, they have more recently become important tools for characterising environments and visualising landscapes. Satellite imagery has proved particularly useful in the Tarhuna plateau, where generally sparse cloud-cover provides unobstructed views of physical landscapes. The use of GIS is one of the primary methodological arenas where explicit conflicts between different conceptions of archaeological landscapes have centred (Gillings and Goodrick 1996; Kvamme 1997; Stoddart 1997). GIS was traditionally lauded as a tool that would allow social scientists more objective, quantitative and scientific means for spatial analyses (Openshaw 1991). However, GIS is inherently pre-disposed to the inclusion of data that are more readily available and more easily represented as maps. For archaeology, these data are often environmental (e.g. soil cover, elevation, aspect and slope) and GIS is therefore (to some degree) biased toward materialist analyses which consider associations between environmental conditions and ancient human behaviour (Gaffney and van Leusen 1995; Wheatley and Gillings 2002).

The TAS was conducted in the hinterlands of the Punico-Roman coastal centres of Lepcis Magna and Oea, mainly focusing on the areas which seem to have been located within the territory of the former, and was

designed to investigate the nature and extent of rural settlement and agricultural development on the semi-arid high plateau of the Gebel Tarhuna in the Roman period. The methods of any survey must take into account the survey's aims and questions with regard to the available data. It is especially important to provide some discussion of procedure here, since one of the goals of the study was to demonstrate the value of information obtained from surface survey carried out in a more systematic manner than had previously been performed on this plateau.

As discussed above, a fundamental objective of the TAS was to study how rural settlement and economic activity on the Gebel Tarhuna developed and changed over the extensive period from the later centuries BC until the fifth century AD. A second aim was to investigate the chief factors that may have lain behind these developments. The first significant matter requiring consideration is the choices made concerning the scale and nature of the area within which the survey was conducted. Briefly, the choices in this matter concerned the satisfactory definition of boundaries. The natural environment must have had some limiting and directional influence on site distribution and the development of rural settlement over this hinterland region. In most modern archaeological surveys, the typical approach to doing a survey is to select specific sample areas in order to employ effective methods of survey (Barker 1991). From the beginning, the TAS was designed to investigate only selected and restricted parts of the Tarhuna plateau, since the total area of the plateau (c. 3,500 km^2) far exceeded the available time and resources. As these limitations did not permit total coverage of the selected areas at a satisfactory level of intensity, several sub-areas which were representative of recognised topographical units were selected for more detailed study (Figure 2.2). It was clear from the outset that these areas had great archaeological potential, and they seem to have been the focus of important economic activities and water management during the whole Roman period, especially olive oil and amphora production.

2.3.1 Intensive survey method

Modern archaeological landscape survey, especially in the Mediterranean world, has benefited from a long history of applying well-developed methods for site discovery and investigation both to sites and to their surrounding areas (Bevan 2002; Gillings and Sbonias 1999; Pettegrew 2001). Nowadays archaeologists know that archaeological evidence takes many forms and its study requires the development of suitable field survey techniques. Even within the areas selected for intensive survey on the Tarhuna plateau there were a number of obstacles restricting observation of the entire ground surface. This is a phenomenon that affects most archaeological surveys (Mattingly 1989b). As has often been noted by archaeologists, there are two sets of variables that hinder field observations: geomorphological and vegetational (Velde 2001). Archaeologists have attempted to reduce this effect by repeated visits to the area under survey (Bintliff and Snoggrass 1988; Kamermans 1995). The TAS found that the most significant obstacles which affected the local archaeological record were modern building, paved roads, and land under cultivation.

In addition, fieldwork has often combined extensive regional survey coverage with intensive coverage of small selected areas (Keller and Rupp 1983). For the TAS, a few small areas were selected for intensive survey in order to recover the full site hierarchy and to elucidate the relationship between the largest and smallest sites. In order to test the density and diversity of settlements and their relationship to the natural environment and surrounding landscapes, the sampled areas were selected from different topographical locations on the Tarhuna plateau (Figure 2.2). Area 1 is located in the Wadi Hajaj (a small tributary of the Wadi Doga) on the north-eastern sector of the plateau; Area 2 covers the upper sector of the Wadi Guman close of the edge of the higher plateau; Area 3 is a southern area of the Gebel Tarhuna, in the Wadi Beni Mousa (one of the northern tributaries of the Wadi Taraglat).

In order to collect detailed information, an intensive survey method was applied in these three small areas of the Tarhuna plateau. I shall outline an evaluation of the research problems that have been addressed, field methods adopted and forms of analysis employed. The first intensive survey was made in the Wadi Hajaj (Area 1), where there is a small tributary flowing into the Wadi Doga (Figure 2.3). This area measured c. 82 ha and is known locally for the visible standing structure called Gasr Dehmesh (HAJ79), or as named by Cowper (1897, 237), Kasr Gharaedamish.

Area 2, located in the Wadi Guman, covered c. 125 ha (Figure 2.4, Appendix B). This valley forms one of largest tributaries of the Wadi Turgut. These two areas are located in the northern sector of the Tarhuna plateau, north of the Eastern Gebel road (built AD 15/16) that linked Lepcis Magna with the southwest limit of its territory, approximately 3 km west of *Mesphe* (Medina Doga, DOG75) on the Tarhuna plateau (Di Vita-Evrard 1979). The third intensively surveyed area was a small sector (10 ha) located in the Wadi Beni Mousa (Area 3), a small wadi that runs southwards and links with the Wadi Taraglat (Figure 2.5).

In each of the three areas mentioned above, the boundaries of the targeted survey were plotted in relation to natural features such as gullies, pathways, slopes and hills. Each survey area was divided into squares of 100 x 100 m, each east-west row of which was given a letter code and each north-south column a number. Thus HAJ A.1 designates square one of row A. Thus 'HAJ

A.1' designates square 1 of unit A in the Hajaj area. In order to gain familiarity with the selected areas and their materials, and to get a general impression of the boundaries of the intensive survey areas, in the first phase of work the field-walkers scouted out different parts of the landscape in each of the selected areas. In the second phase, the intensive investigation of the landscape was carried out using the basic method of transects. Survey units were systematically covered by a field team of five field-walkers who covered 2 m corridors spaced at regular intervals of 20 m, giving 10 % coverage of the landscape. The distance of 20 m was chosen as suitable for the Tarhuna region because very often there is a clear view over this distance. Ceramic sherds, kiln debris, and relevant artefacts were counted and a representative sample of diagnostics collected for specialist analysis. For pottery this typically included rims, bases, handles, and neck or shoulder sherds, as well as all painted or decorated sherds. Thus, it was possible to identify the principal elements of the ceramic typology (Arthur 1982; Dore and Keay 1989; Hayes 1972; Keay 1984). Ceramics collected included not only sherds of imported pottery and local amphorae but also coarse pottery sherds which contributed in a major way to the refinement of the dating of sites on the Tarhuna plateau (Dore 1984; 1988). In addition, records were made of the topographic features and land-use associated with the survey units. All of this information was entered into a database which was then linked to a GIS analysis of site location, artefact distribution and human economic activity across the landscape.

The initial survey was designed primarily as a tool for site discovery within the survey areas. The main objectives of the intensive methodology were to evaluate the density of material remains and advance preliminary hypotheses concerning the presence and absence of human economic activity, as well as to characterise, where possible, the chronology and functional characteristics of the material remains. It was not the purpose of this initial phase to investigate and analyse at a very fine resolution the structural remains of sites within the survey units, but rather to collect basic data over a broad area of the landscape. The methodology relied, in part, on relatively standard procedures for intensive survey in the Mediterranean world (Given 2004). Nevertheless, the traditional concept of the 'site' has become increasingly problematic in theoretical and methodological terms; archaeologists have generally retreated from terminology that makes transparent associations between artefact scatters and traditional functional classes of sites, giving rise to such concepts as the "place of special interest" (Caraher, Nakassis and Pettegrew 2006). In the course of TAS, when the survey team found an apparent archaeological site within an intensive survey unit, such as a pottery scatter around some mudbrick walls, or recognisable architectural features that were visible on the surface, they examined it as a separate entity using the method of laying out a specific collection area, either a square or circle, and counting and collecting the informative and unusual pieces; such places were often mapped and planned if there were any standing structures as a second phase of the work.

2.3.2 Extensive survey method

The extensive survey of the TAS focused on the discovery and investigation of 'sites'; however, particular attention was also paid to the broader picture of evidence relating to olive oil pressing and pottery production sites which were identified as more significant rural economic sites. The targeted region for extensive survey was divided into a number of areas: TUT (Wadi Turgut), GUM (Wadi Guman), DOG (Wadi Doga), TEL (Tella), DUN (Ed-Dauun) and TRG (Wadi Taraglat) (Figure 2.6). The most important factor in choosing an area for field survey was usually the ability to locate and map many sites in as short a period as possible. Although extensive survey has been widely adopted as a first step towards the establishment of a general overall picture of settlement patterns and site distribution of larger areas (Hope-Simpson 1983), the extensive survey of the valleys (wadis) in which the most important sites lay has usefully supplemented the areas of intensive survey on the Tarhuna plateau and has helped place the archaeological sites in their wider topographical context. The extensive survey was thus intended to provide a basic record of the archaeological and economic sites in the study area, with a special focus on the northern part of the Tarhuna region, where the first four areas mentioned above are located. Using the same approach, many previously known sites were revisited in order to locate them more accurately and to enhance the existing records, particularly for oil presses and amphora kilns. Thus, this method also involved driving down every passable road or track and looking at sections of road-cuts, wadi sides and hill slopes for visual remains.

To a degree, the basic strategy adopted in the TAS survey was an extensive rather than an intensive one. Priority was given to the broad, comprehensive coverage of the region in order to create a new baseline of knowledge of the overall settlement pattern along with more systematic efforts to record a sample more intensively and to recover data on site construction and function. It is important to recognise that the Tarhuna plateau is a semi-arid North African landscape where topographic and environmental factors play a significant role not only in archaeological visibility but also in past and present settlement dynamics and land-use.

2.3.3 The application of GIS

One of the research methods used in the TAS involved the application of GIS techniques in order to display the recorded sites and to execute spatial analyses.

Archaeologists have long used GIS as an active tool in archaeology, especially for inventory and mapping matters (Fisher 1999). In addition, GIS is a suitable tool for the investigation of the broader spatial structure of rural landscapes, the assessment of the effect of surface visibility on the recovery of archaeological remains, the examination of site definition and characterisation, and the analysis of the decisions behind site location (Bevan and Conolly 2004). The GIS analysis was initiated by the creation of a standard list of site data. Then, the site list was divided into two groups according to the site location on the Tarhuna plateau. The first records the north-eastern sector of the plateau (TUT, GUM, DOG and TEL). In this sector, a total of 135 sites were recorded by the TAS. The second group comprises a lesser number of sites (20) scattered on the south-eastern flank of the Tarhuna region. The increasing importance of GIS for any archaeological survey has been demonstrated in many survey projects in the Mediterranean during the last decade (Gillings 2000; Wheatley 1995). A GIS was used to analyse surface trends in site density patterning across the survey areas (Lock and Molyneaux 2006; Wheatley and Gillings 2002). This procedure involved comparing the site distribution and density of a particular area with the site densities present in its immediate vicinity, while also considering the effects of topographic factors. Integrating GIS with the archaeological data to create a spatial analysis of site distribution across the landscape can be expected to be influenced by environmental and topographic factors (Roy and Decker 1990). As we shall see, the use of the GIS in this study was useful for revisiting and reassessing specific locations for further investigation.

2.4 Case study: the Wadis Turgut and Doga

As mentioned above, this chapter formally presents the results of a research project which uses systematic survey and GIS applications to examine the spatial distribution of Roman period farming sites on the Tarhuna plateau and to investigate the main aspects of the rural economy and settlement patterns of Tripolitania. Since the second half of the twentieth century, archaeologists have been attempting to explain the distribution of Gebel Tarhuna farming sites. Goodchild examined several different categories of sites and noted the high density of settlement on the plateau (Goodchild 1976, 72–113). In a more detailed study of early and late Roman period settlement in the eastern Gebel Tarhuna, Oates (1953; 1954) presented the distribution of olive farm buildings in the Fergian area. More recently, it has been suggested that the Tarhuna plateau was one of the densest area of olive cultivation in the Tripolitanian landscape and actively produced a large surplus of oil, particularly in bumper years (Mattingly 1985; 1988a; 1988c; 1995).

The selection of the northern area of the Tarhuna plateau as my key case study was made because unlike the Fergian area, it had not previously been studied in detail. The best-known site is the mausoleum known as Gasr Doga (DOG72) (Figure 2.7) (Barth 1857; Haynes 1959). The small town of Medina Doga (*Mesphe*, DOG75) was one of the largest settlements in the region, located near the headwaters of the Wadi Doga. It was probably established at the beginning of the first century AD and served as a road station along the route that linked Lepcis Magna with the Gebel Tarhuna (Goodchild 1976, 75–79).

By focusing on the specific area of the Wadis Turgut and Doga, I shall attempt to explain the site distribution pattern using two different scales of analysis. The first will address the general distribution of Roman-period archaeological sites within the survey area; the second involves the detailed investigation of the location of individual sites. This two-scale approach will hopefully provide a clearer interpretation of the decisions made by the owners/occupiers of these sites regarding their exploitation of the Tarhuna plateau.

The Wadis Turgut and Doga are located in the north-eastern sector of the Tarhuna plateau and they run from south to north (see Figure 2.2). The remains of ancient settlement, mainly farming sites and sites associated with agricultural activities, are very often still visible on the landscape. These wadis are still, in all probability, the richest in terms of the high quality of preservation and the size of the ruins (*senams*) as described by Cowper more a century ago:

> Although it would appear that the series of senams are to be found almost everywhere within the limits of the country traversed ….Of these districts, the Tarhuna plateau has perhaps the most numerous remains, but those observed in the Wadis Doga and Terr'gurt have upon the whole the most remarkable features, and are perhaps the best preserved (Cowper 1897,133–134).

The greater part of this sector comprises a range of hills separated from the coastal plain on the north by a district of gently undulating, north- or northeast-falling slopes, reaching some 12 to 15 km in width (Cowper 1897). The Wadi Turgut runs through the extreme northeast part of the Gebel Tarhuna, beginning its natural course at the northern border of modern-day Gsea (a village 5 km east of Gasr Ed-Dauun (*Subututtu*)) and gaining in breadth from several main southern tributaries; it is the principal drainage system of the north-eastern sector of the Gebel Tarhuna. Its northern margin is sharply defined by the Gefara plain which reaches its highest elevation of 150 m at the foothills of the Gebel Tarhuna. This location marks the most north-easterly and eastern edges of the Tarhuna region and comprises the zone in closest proximity to Lepcis Magna (c. 40 km).

The TAS surveyed an area of approximately 115 km^2 in the Wadis Turgut and Doga (see Figure 2.6). The Wadi Turgut covers approximately 97 km^2, of which 66 km^2 or 68 % was extensively surveyed, locating 70 sites. The Wadi Doga covers about 73 km^2, of which 49 km^2 or 67 % was covered by extensive survey and 45 sites identified. The sites within both wadis vary in their topographic location; some were situated on hilltops, while others were located in low-lying areas, in particular, very close to the wadi courses.

The Wadi Doga is physically similar to the Wadi Turgut and can be considered as the best area of the Gebel Tarhuna for the preservation of significant archaeological remains. In addition, the Wadi Doga had a particular importance as it appears to have marked the ancient boundary between Lepcis Magna and Oea, which was demarcated c. AD 75 after a private dispute between the two cities erupted into open war in AD 69 (Tacitus, *Histories*, 4.50; Mattingly 1995, 71, 140–141).

The epigraphic evidence for this boundary line has been previously studied by Di Vita-Evrard, in the form of four inscriptions which have been found on the Tarhuna plateau during the last century: two milestones and two boundary inscriptions. Indeed, the discovery of these inscriptions gave her the opportunity to consider in concrete terms the extension of the territory of Lepcis Magna towards the west, where it bordered on that of Oea (Di Vita-Evrard 1979). The road built by the proconsul Aelius Lamia in AD 15/16 linked Lepcis Magna with the Gebel Tarhuna, and the milestone at Lepcis indicates its destination point as 44 (Roman) miles '*in Mediterrano*' (*IRT* 930; Di Vita-Evrard 1979, 89–91; Goodchild 1952b; Mattingly 1995). This end point seems to have coincided with the south-western boundary of the territory of Lepcis Magna (Di Vita-Evrard 1979, 89–91; Mattingly 1995, 140; 1996b).

In agreement with Di Vita-Evrard's geographical conclusions, the TAS has provided further proof of the route taken by the border between the territories of the Lepcitani and the Oeenses in the area of the Gebel Tarhuna. Three boundary stones are now known: the two reported by Di Vita-Evrard and a third discovered by the TAS (Figure 2.8). This boundary line evidently did not run in a perfectly straight line, but was probably affected by the topography of this rugged terrain. In fact, the boundary seems to have followed the natural features, such as valleys and ridges, that ran through the area between Medina Doga (*Mesphe*, DOG75) on the high plateau in the east and Ain Scersciara (*Cercar?*) to the west (Goodchild 1976, 76–79). From this point, the boundary appears to have turned to the northeast and ran along the watercourse of the Wadi Doga. The most southerly of the extant boundary inscriptions (Ras el-Halga) lies about 1 km north of the projected location of the 44 Roman mile mark from Lepcis Magna. The new inscription was found at Ras Abadla (DOG71), in the same area, c. 3.5 km northwest of Gasr Doga (DOG72). Although this new inscription is missing a number of lines, it is clearly based on the same text as the previously known Flavian boundary markers. Like those texts (from Ras el-Halga and Gasr Masaud), it related to an operation of boundary-marking between the adjoining territories of the *Lepcitani* and the *Oeenses* (Di Vita-Evrard 1979, 77–82).

Describing the above-mentioned inscriptions in geographical order from south to north, the first was discovered in the bed of small ravine (Wadi Scafell), below the hill of Ras el-Halga where the remains of small *gasr* stand (15 x 11 m, with walls built in *opus quadatrum*). The *gasr* is located beside a track 6 km west of Gasr Doga (DOG72) and about 3 km south of Gasr Bu Tuil (TEL93). The preserved lines have been read by Di Vita-Evrard as follows:

Ex [auctoritate] /
[I]mp(eratoris) . Ves[pasiani Cae] /
saris . Aug(usti) . p(atris) . p(atriae) . po[nt(ificis)
max(imi) trib(unicia)] /
potest(ate) . V . imp(eratoris) . XIII . c[o(n)s(ulis) V
desig(nati) VI] /
Q(uintus) . Iulius . Cordinus . [C(aius)? Rutilius
Galli] /
cus . leg(atus) . Aug(usti) . pro [pr(aetore) co(n)s(ul)
pont(ifex)] /
limitem . inter. Le[pcitanos et Oeen] / ses . derexit /
Lepcitan[i pub(lice)? Pos(uerunt)?]
(Di Vita-Evrard 1979, 78–79)

The second inscription was discovered at a place called Gasr Masaud on the right bank of the Wadi Msabha (in the central Wadi Doga) below a small hill. It has been read by Di Vita-Evrard as follows:

[Ex au]ctoritate /
[Imp(eratoris) Ve]spasiani . /
[Caes]aris . Aug(usti) . p(atris) p(atriae) /
[po]nt(ificis) . max(imi) . trib(unicia) pot(estate) /
[V im]p(eratoris) . XIII . con(n)s(ulis) V
design(nati) . VI /
[Q(uintus) Iulius] C[ord]inus Rutilius /
[Gallicus leg(atus) Aug(usti) pro pr(aetore)] co(n)
s(ul) pont(ifex) . /
[limitem inter Lep]citanos /
[et Oeenses derexit]
(Di Vita-Evrard 1979, 78–79).

As can be seen from the above inscriptions, the boundary operation was performed under the supervision of a well-known person, the consular legate Q. Iulius Cordinus Rutilius Gallicus, acting in accordance with special powers delegated to him by the Emperor Vespasian (*legatus Augusti pro praetor*), the *auctoritas* of which

guaranteed the juridical validity of the act (Di Vita-Evrard 1979, 82). Although the new inscription found in 2007 at Ras Abadla (DOG71) is missing most of its text, with only a few words in the first two lines preserved, it is clearly another example from the same series, reading:

Ex auct[oritate] I[mp(eratoris)]
Vespasian[i Caesaris]
.....

The diverse topographic settings and alluvial deposits in the Wadis Turgut and Doga offered a range of natural resources for exploitation. In comparison with the Tripolitanian pre-desert area, the wadis of the Gebel Tarhuna are shorter, but they receive much higher levels of winter rains before they join the Gefara plain. As fertile, well-watered valleys, they sustained a strong agricultural economy and contributed to the flourishing of the coastal centres during the classical era. In modern times, they still provide a good example of regional agricultural potential and practices because they contain arable land and have sufficient rainfall to allow dry farming, not only of olives but also the large-scale cultivation of almonds, figs, and other fruits, as well as grapes and cereals. Most of these agricultural products are nowadays used for domestic consumption and local markets.

2.5 The distribution of sites in the landscape

It should be clear from the aims outlined earlier that the main goal of the TAS was the collection of detailed information about the location of ancient economic activity and rural settlement patterns on this hinterland plateau. The study also considered existing data from earlier archaeological works, literary evidence and travellers' accounts. The TAS has identified a bimodal pattern at the regional scale, characterised by the existence of both small farm sites with one or two olive presses, and much larger sites with greater numbers of presses (from three to 17) and usually evidence for long periods of exploitation from late Punic or early imperial times to late antiquity (Cowper 1897; Goodchild 1976; Mattingly 1985; 1988b; 1988c; 1995; Oates 1953; 1954). The remains of rural settlement on the Tarhuna plateau comprise a rather wide variety of sites, including open farm buildings (oileries, large and small farms, and villas, with luxurious elements), baths, fortified farm structures, cisterns, wells, dams and terrace walls. The key question to be addressed here is whether the diversity and site distribution across the landscape were the result of natural or socio-economic processes that differentially affected the landscape. One possible way to assess this is to investigate whether the spatial distribution of settlements and their associated field systems followed natural divisions in the landscape such as wadis, plateaus, slopes and hills. If, for example, the local ancient economy primarily relied on agricultural production, it is reasonable to suppose that choice of site location was determined by the availability of suitable land and management of water for agriculture (Shaw 1984).

The main focus here will be on the spatial analysis of the Roman-period settlement data assembled by the TAS in the study area. The first section examines the distribution pattern of the different types of site. The second section analyses the location of a number of selected sites in order to understand the factors behind the location choice for different types of settlement and the apparent preference on the part of the owners for certain locations.

2.5.1 Site elevation

In order to investigate the distribution of settlement sites recorded in the surveyed area, I analysed their locations in terms of elevation and topography. The landscape of the Wadis Turgut and Doga is variable and local, natural features influenced the choice of particular positions for settlement. The sites recorded in this area show that there was a clear preference for certain favoured places in the landscape, including the wadi-side, break of slope and dominant positions on the plateau or hilltops overlooking the surrounding landscape, especially for fortified sites and watchtowers. Figure 2.9 clearly demonstrates that greater numbers of sites were located by the wadi-side or on adjoining slopes. This is most likely due to the fertile alluvial soil, access to the seasonal rainfall (via capture in cisterns and dams) and the use of wadi courses as routes to communicate, in different directions, with other areas.

Site elevation was considered an important variable since it might be indicative of patterned subsistence strategies within settlement systems. These patterns might, in turn, be associated with political and socio-economic changes during late antiquity. Elevations were initially examined for the Wadis Turgut and Doga, and then within specific tributary drainages where relief was sufficiently marked to allow for differences in site location to be detected. In general, these wadis and their tributaries are much more deeply carved in the north than in the south where the Tarhuna plateau reaches its highest elevation. Thus, one would expect more altitudinal differentiation in site location in the southern part of these wadi drainages. In fact, however, it is the middle of the Wadi Turgut that exhibits the most bimodal site distribution. The survey included elevations ranging from 135 m to 515 m asl. Elevations were grouped into four altitudinal bands (Table 2.1; Figure 2.10) and it is clear that the densest settlement is in the lower reaches of the wadis, closest to the most fertile land and the communication routes that run through the wadis.

The general distribution of site elevation in the Wadis Turgut and Doga indicates that 32 % of sites were located in a relatively narrow band between 250 and 299

m asl, 72 % of which came from the Wadi Turgut. On the other hand, sites located above 500 m asl are relatively rare in the survey area. Equally, there is only one site located below 150 m asl (Senam Semana (TUT54), 135 m asl), and this exception relates to a location below the extreme northern edge of the Gebel Tarhuna at the point where it meets the Gefara plain.

2.5.2 Distribution patterns of site types

The TAS has provisionally identified two main types of rural settlement on Gebel Tarhuna. The first type is sites which have an agricultural character and function with marked tendency towards specialisation in oleoculture and olive oil production. The farming sites include small villages, oileries, large and small farms and fortified farmhouses (*gsur*). The second type includes a range of non-agricultural sites which nevertheless often appear to have some kind of relationship with the agricultural activity, for example, dams, wells, cisterns, watchtowers, mausolea and amphora kilns.

Although the TAS has applied both intensive and extensive survey methods, the largest part of the surveyed area was covered by extensive survey. Sites were assigned to types according to the nature of the archaeological material observed on the surface of the surveyed area. Each site was defined by the extent of archaeological material and was assigned a single survey number by the TAS. Some sites comprised more than one type of feature. For example, the site of Sidi Eysawi (TUT53), a large farm-villa with three presses, was also associated with a pottery kiln, a bath-building, a cistern, an enclosure and a quarry.

The specific criteria for the descriptive terms currently used for the recorded archaeological sites of the Tarhuna plateau need to be clearly defined in order to avoid later confusion and misunderstanding. Previous studies of the rural settlements of the Gebel Tarhuna have succeeded in providing some interesting insights into the distribution and typology of farming sites in this hinterland region of Roman Tripolitania (Cowper 1897; Goodchild 1976; Mattingly 1987b; 1988a; 1988c; 1995; Oates 1953; 1954). However, the vast majority of the Gebel Tarhuna farming sites have been described as utilitarian sites, constructed in most cases for olive oil production, which is clearly seen in the press elements associated with them. As a result, most previous typological study has focused almost exclusively on olive oil production facilities and on press elements as the key characteristics of the sites.

Agriculture was the main basis of the Roman economy and contributed significantly to the development and maintenance of the Empire through a closely maintained relationship between urban centres and the rural communities in their hinterlands (Erdkamp 1999; Greene 1986). A major factor in the process of settlement and agricultural development of the Gebel Tarhuna area seems to have been the input of the expanding wealth of the coastal centres into this hinterland zone and the desire of the urban elite to invest in and profit from agricultural products (Mattingly 1995).

2.6 Site typology

The overall distribution of Roman-period settlement in the study area is heavily influenced by where detailed work has already been carried out. The Gebel Tarhuna is still far from totally surveyed. The research of Cowper, Oates and Goodchild was focused more on the eastern area of the Tarhuna plateau, and as a result, blank areas in the distribution cannot be assumed to be devoid of ancient sites. The apparent absence of recorded sites is more likely a result of the lack of fieldwork in these sectors. The next section will describe the principal types of site recognised and present representative examples.

2.6.1 Villages (small towns)

There are two previously known small towns (or large nucleated settlements) in the Gebel Tarhuna: Gasr Ed-Dauun (*Subututtu*) and Medina Doga (*Mesphe*, DOG75). According to Oates, Gasr Ed-Dauun (*Subututtu*) functioned as a market village for the surrounding regions such as Fergian, Gsea and Turgut. At the same time, it was the focus of their communications via a number of tracks in addition to the main Roman Gebel road that linked Lepcis Magna with the Tarhuna plateau (Oates 1953, 89–90). The traced remains indicate that the village structures seem to have been concentrated in a ribbon-like fashion, forming a straggling line of structures alongside the main road (Figure 2.11), though these remains have been largely demolished by fifteen centuries of erosion and almost continuous settlement around the wells here (Oates 1953, 90–91).

The second nucleated settlement is called Medina Doga (*Mesphe*, DOG75) and was located at the head of the Wadi Doga at an important meeting point of five tracks used during the Roman period (Figure 2.12). Some of these tracks can still be traced on satellite imagery; one comes from the east and crosses the town, probably leading towards Ain Scersciara (*Cercar?*). Another track seems to have led to the north through the Wadi Doga. Two other tracks traceable on the image run south and southwest, and perhaps were linked with Ain Wif (*Thenadassa*) and the pre-desert zone. At approximately 130 ha, Medina Doga was one of the largest sites in the Gebel Tarhuna (Goodchild 1976, 76). Although the village lies inconspicuously among the modern olive plantations, in 1949 Goodchild was able to identify the limits of the site and the different building types, which included a small mausoleum (A), a colonnaded building with limestone columns of 0.60 m diameter (C), two bath buildings (D) and (E), another colonnaded building (F), a large enclosure (G), a fortified farmhouse and necropolis (Figure

2.13) (Goodchild 1976, 78). He believed that Medina Doga, which he identified as the *Mesphe* of the Antonine Itinerary, had gradually developed from the early first century AD and might have functioned as the local administrative centre of the Tarhuna plateau during the Roman period (Goodchild 1976, 78–79).

Two new sites located in the Wadis Turgut and Doga can be added to the list of nucleated settlements, though these appear to have been agricultural villages (Section 3.2.4). Ain Astail village (TUT17–21) in the Wadi Turgut and Gasr Dehmesh village (HAJ78–82) in the Wadi Doga probably functioned as 'estate villages' and thus were different to the road stations (small towns) discussed above. Their location seems to be highly related to the availability of cultivable land and water resources.

Italian archaeologists working in a 20 km^2 area near the Villa Silin have also observed the phenomenon of small villages in the coastal hinterland of Lepcis Magna during the Roman period (Munzi *et al*. 2004). In considering the location of small agricultural villages in the Gebel Tarhuna, two factors seem to have primarily determined their location. On one hand, communication links no doubt contributed not only to their chosen position but also to their development through the classical period. On the other hand, these sites tended to coincide with the existence of major water resources, in particular, springs.

2.6.2 Oileries

Site definition within the TAS depends in part on the overall size of a settlement, in part on visible, functional features and thus, in part on the degree of site preservation. The term oilery is applied to the largest physical traces of sites linked to olive oil production and includes sites with five or more presses. Oileries were agricultural settlements comprising a complex of standing structures and usually using *opus africanum* construction. This is a method of constructing walls (already utilised by the Phoenicians) in which piers of ashlar blocks were set up at intervals and the gaps filled in with undressed stone, concrete or other material. It was adopted by the Romans and was used in their construction schemes, especially in North Africa (Adam 1999). In Tripolitania, in particular during the first two centuries AD, it was the characteristic construction method on rural sites and its use expanded even into the pre-desert area (Barker 2000; Mattingly and Dore 1996). Most of the oilery sites are characterised by the existence of a large courtyard which is surrounded by a number of press rooms marked by stone monoliths and other pressing facilities such as oil-settling tanks and millstones. Similar features occur at other sites in the study area, but where sites had less than five certain presses they have been classified separately as large or small (olive) farms.

The TAS has recorded 16 sites in the Wadis Turgut and Doga which could be identified as oileries (essentially factory farms); eleven sites are distributed along the Wadi Turgut, while the rest (five sites) are concentrated in the northern half of the Wadi Doga (Figure 2.14). The majority were located very close to the main course of the wadi and at lower altitudes on its side-slopes. Large-scale production sites commonly employed five or six presses, but larger numbers are known in a few instances; one site (TUT54, Senam Semana) included 17 presses in a single building (Cowper 1897, 279–282, Site 57). The distribution of these rural oil factories reflects a high degree of investment in the cultivation of olive trees and the production of oil. This demonstrates that there was large-scale exploitation of the oil-producing potential of the region for an export market, most likely on behalf of the local Libyphoenician elite based in the major coastal cities, who probably spent some part of the year in their hinterland properties (Mattingly 1987; 1995, 140; Oates 1953, 112). However, only eight of the oileries were associated with one or more indicators of luxury life (e.g. mosaic, wall painting, portico, bath-building), attesting the wealth of these settlements and their importance as upper-level economic sites in the rural settlement hierarchy during the early imperial period. These sites that combine the production capacity of oileries with luxury elements are termed 'oilery-villas'. The rest appear to have been purely functional facilities for the bulk production of olive oil, presumably within large estates.

2.6.3 Large farms

This term is used to describe farm sites containing three or four presses, comprising a courtyard surrounded by five or more rooms and stores showing signs of having served as centres of fairly substantial estates for the production of olive oil (Figure 2.15) (cf. Hitchner 1988). Their distribution is generally the same as that of the oileries, that is, close to the wadi or along its main tributaries. The majority of large farms are located in the Wadi Turgut (Figure 2.14). The distinction between oilery and large farm is a fine one, determined by our ability to positively identify the exact number of presses present. Some large farms may, in fact, originally have possessed five or more presses and would fall into the oilery class. Four out of 18 large farms have shown certain characteristics of luxury and are considered in this work as 'farm-villas'. Other sites could be described as utilitarian "villas" (cf. Percival 1976). Some scholars have demonstrated that the vast majority of the Gebel Tarhuna so-called villas are utilitarian ones and have not provided, at least on the surface, any evidence of luxurious materials (Mattingly 1995, 141), with the exception of the Ain Scersciara (*Cercar?*) (Goodchild 1951). The indicators of luxury (e.g. mosaic tesserae, portico elements, and bath-buildings) found at a number of sites during the TAS, however, demonstrate that the Ain Scersciara (*Cercar?*) villa was not unique in this respect (see Section 3.2.3). These

large farms, like the oileries, were probably central facilities within rural estates owned by the elite families of Lepcis Magna and Oea. The generally utilitarian character of many farms may support the view that the Lepcitanian and Oean elites had multiple rural estates, but only erected rural residential units for themselves at some locations. Excavation could yield additional evidence of luxury components at other large farms and oilery sites.

2.6.4 Small farms

Small farms are agricultural settlements comprising a courtyard or yard, with evidence of one or two presses. The architecture of these sites is similar to that of the large farms, but on a reduced scale. They were normally built in *opus africanum* construction. The spatial distribution of this type of settlement was evidently determined in relation to several types of landscape. In particular, a large number occupied the wadi-edge foothills or the margins of the alluvial soil of the wadis. Twenty-two small farms have been recorded by the TAS in the survey area of the Wadis Turgut and Doga, in addition to approximately 55 previously recorded by Cowper and Oates (Cowper 1897; Oates 1953). Figure 2.14 displays a remarkable density of these small farms in the eastern sector of the Gebel Tarhuna. On the other hand, it appears that the specific areas around the Wadis Turgut and Doga had a lower density of small farm sites. It could be suggested here that these areas were dominated to a greater extent by the presence of oileries and large farms rather than small farms. For example, 25 sites identified as oileries and large farms have been recorded in the Wadi Turgut, while only eleven small farms were recorded in the same wadi. However, six of these are concentrated in the middle sector of the wadi (Figure 2.16).

2.6.5 Fortified farmhouses

This term is applied to farm structures which were given a fortified appearance, usually by being surrounded by broad ditches or high walls enclosing the main building. The ditches were, in most cases, of square rectangular shape and they generally enclosed the most defensible position at the site location. Goodchild found that the greater majority of the ancient sites examined in his review of the Tarhuna plateau were encircled by a broad ditch and that they were easily identifiable on air photographs (Goodchild 1976, 88–89). In agreement with Goodchild's findings that these sites were widely distributed in the Tarhuna region, remote satellite survey conducted using Google Earth has shown that there is a dense distribution of fortified farmhouses in the districts which are covered by high resolution imagery (Figures 2.17–2.18).

Distribution of these fortified farms seems to be characterised by two facts: first, they are mostly located north of the east–west running Gebel road, and second, they are also more concentrated in the area southwest of the town of Tarhuna, close to the *Thenadassa* (Ain Wif) road station (Mattingly 1982), and in the north-eastern district of the Tarhuna plateau. According to the research conducted by Oates (1953; 1954) and Munzi *et al.* (2004) in the areas around Gasr Ed-Dauun (*Subututtu*) and the Villa Silin respectively, these constructions can be dated to the fourth and fifth centuries AD. These dates are also confirmed by the survey conducted recently in the territory of Lepcis Magna (Wadi Caam-Taraglat), which indicated that the phenomenon of fortification became more pronounced during the fourth and fifth centuries AD (Felici *et al.* 2006). In contrast with these areas, the changeover from open to fortified farms in the Tripolitanian pre-desert area to the south occurred more gradually, starting around the end of the second century AD and continuing into the fourth and fifth centuries AD and later (Barker 1984; Jones 1985; Barker *et al.* 1996).

Judging by the surface evidence alone, although all of the Gebel Tarhuna fortified farmhouses (*gsur*) seem to have been constructed in the later imperial period (fourth and fifth centuries AD), it has now become clear through the various surveys that the individual buildings consist of two types. Type 1 sites seem to have developed from earlier open settlements; they were set on the ends of spurs overlooking the surrounding area and very often constructed with reused masonry materials taken from the pre-existing open farms. The reuse of earlier materials has also been noted by Oates, especially in the upper reaches of the Wadi Turgut, e.g. Gasr Shaeir (Site 13). He described the site as originally comprising a large open farm (c. 70 x 40 m) with four presses, built in ashlar masonry. This was later replaced by a fortified farm superimposed over a large part of the original area (Figure 2.19) and built by reusing the original ashlar blocks. (Oates 1953, 105–107).

The TAS found 12 sites of *opus africanum* construction, ranking from small farm to oilery, in the Wadis Turgut and Doga which were certainly replaced by or partially incorporated into fortified farms (Figure 2.20). The second type shows a considerable decline in the techniques of fine stone-dressing and of mixing strong and durable concrete with rubble or roughly-squared small blocks (Mattingly 1996b).

Type 2 *gsur* were sited to take maximum benefit of natural topographic features, generally being constructed on hilltops and on the highest pieces of land, with their natural defences augmented with broad surrounding ditches (Figure 2.21). The question that arises here is why some *gsur* were built on these carefully selected positions. It could be suggested that they were built simply for defensive purposes, that is, in order to protect the dwellings and their estates. The epigraphic evidence, especially from the pre-desert zone, suggests that the most important goal of the *gsur*-builders was to protect their own families and estates (Mattingly 1995, 103). Furthermore, their location on the highest pieces

of land above the wadi bed could support the hypothesis that these fortified sites might have functioned as control points overlooking communication pathways along the wadi tracks. Mattingly has added to the defensive purpose an ideological interpretation: he suggests that these fortified structures could have functioned as an elite prestige indicator and as symbols of power and wealth within the society (Mattingly 1996a, 328–331).

The *gasr* is the most common archaeological remnant of the Tripolitanian hinterland (Gebel and pre-desert) from the late- and post-Roman periods. The Tripolitanian *gsur* are small fortifications, sometimes fitted with a ditch and often built at the expense of previous open constructions (Brogan 1976–1977). The typical fortified farm (*gasr*) was a tall, square or nearly square, structure with a single entrance leading into an internal courtyard, onto which faced two or three storeys of rooms. In the pre-desert area, they are usually found along the wadis at intervals of a kilometre or more, but a number of *gsur* may be grouped together at the convergence of two or three tributaries where cultivable land is available (Di Vita 1964; Goodchild 1950; Mattingly and Dore 1996). Many *gsur* in the pre-desert area have yielded evidence to indicate that the process of constructing and maintaining this type of settlement continued into the Islamic period (Barker *et al*. 1996). There has been much discussion of the question of whether these *gsur* were built by official Roman action or whether they were primarily of indigenous origin. Goodchild argued that the earliest *gsur* were built and designed by Roman architects for a military purpose, while the later *gsur* were constructed by local peoples (Goodchild 1976, 30). However, inscriptions found with the gsur demonstrate that most were the work of indigenous people (Elmayer 1983; 1984). Modern studies favour the view that these sites were the standard form of native farm, rather than a sign of paramilitary organisation of rural society. However, they may indicate that rural conditions were less secure at this date.

Turning to the distribution of fortified farmhouses in my case study area, Figure 2.18 and 2.22–2.23 show how these sites were distributed in relation to topographic features. During the TAS fieldwork, 28 Type 2 *gsur* were documented in the Wadis Turgut and Doga. Most of them were dated to the late Roman and Byzantine periods. They have been dated in a preliminary way on the basis of pottery sherds collected in the field. It is worth noting here, that many of these hilltop sites were previously unknown. Within the Wadis Turgut and Doga, a total of 17 Type 2 ditched hilltop sites were recorded, five of them also having evidence of early Islamic occupation.

In favour of a defensive interpretation of *gsur* one can see from the overall distribution of the Type 2 ditched hilltop sites that they too probably had a strong relationship with pre-existing open farms/estates which were located close by, often at the foot of the hill. It appears from the surface evidence that the Type 2 *gsur* were mostly created in the late Roman period. The TAS found that 63 % of hilltop *gsur* were established within 300 m of earlier open farm buildings (Figure 2.24), suggesting that they continued to protect the people and the cultivated land surrounding the *gsur*.

2.6.6 Dams, cisterns and wells

The vast majority of archaeological sites recorded during the TAS were associated with one or more types of water management works (e.g. dams, terrace walls, cisterns, wells). Cisterns were more common in the surveyed area and settlements rarely stood isolated from works for water control and supply, particularly in the case of farming sites such as oileries and farms. Groundwater wells are less common than cisterns fed by runoff rain, but they are found in a few places, such as in two tributaries of the Wadi Turgut (Wadis Guman and Astail), in the upper sector of the Wadi Doga (below Gasr Doga (DOG72)), in the Wadi Twafga (2 km south of al-Khadra church), and the well-known example in Gasr Ed-Dauun (*Subututtu*) village (Brehony 1960). These wells were usually associated with bath buildings or pottery kilns. The construction of cisterns, wells and spring catchments illustrates the needs of the ancient community to exploit rainfall and groundwater facilities for their benefit.

Cisterns and wells play an important role in a dry and thirsty land (Graham 1971; Wilson 2009). These water reservoirs are associated with the vast majority of the archaeological sites on the Tarhuna plateau, especially those characterised by agricultural or industrial activities. Roman-period cisterns lined with waterproof cement (*tebshemet*) are a remarkable feature of the Tarhuna landscape. No less than 85 out of 112 sites recorded in the Wadis Turgut and Doga had visible traces of cisterns and wells. They indicate that the process of water management and control was very significant in this environment. Undoubtedly many further examples are buried underneath the ruins and soil.

There are two main types of cisterns on the Tarhuna plateau: basins (*feskyah*) and deep rock-cut shaft cisterns (*majel* or *majen*). The rock-cut type is more abundant than the basin cisterns in the study area, and some of them have continued to serve nomads and farmers up until the last few decades. The same phenomenon of continued use of cisterns has been observed in the Tripolitanian pre-desert (Reddé 1985). For instance, Reddé mentioned that many ancient cisterns in the Wadi Tlal were relined with cement by the Italians or during recent agricultural works, which, unfortunately for archaeologists, does not always allow their initial use to be dated with certainty (Reddé 1985, 175).

Similar cisterns were recorded by the UNESCO Libyan Valleys Survey (ULVS) in the pre-desert zone

(Mattingly and Dore 1996, 134). In comparison with the pre-desert examples, the basin-type cisterns found during the TAS were generally smaller in size and of lesser capacity; the largest recorded single cistern, from Loud el-Meghara (TUT43), does not exceed 22 x 4 x 4.5 m (approximately 400 m3) (Figure 2.25). Furthermore, the cisterns on the Tarhuna plateau are always located close to the buildings, often on the slope just below the main structure, in contrast with the pre-desert area where they are usually located at the edge of the wadi floor in the vicinity of ancient settlements (Mattingly and Dore 1996, 134; Reddé 1985). Their location in the Tarhuna region could indicate that they were established to collect rainwater from the roofs of buildings rather than from surface run-off. The *majen* type is the most common in the study area, with around 70 cisterns of this type recorded, most between 4 and 5 m deep, with two or three radiating tunnels at the base of the shaft. These were filled by run-off water and very often occupied slopes in the vicinity of settlements.

Dams were commonly distributed along the wadi systems of Roman Tripolitania (Munzi *et al.* 2004; Vita-Finzi 1961), though only a small number of dams established on the Gebel Tarhuna have received the attention they deserve. For example, Oates (1953) mentioned that there were around 60 of these structures of varying size in the Udei el-Me and its tributaries alone, in the vicinity of Gasr Ed-Dauun (*Subututtu*). However, he described in detail only two barrages: one in the Udei el-Me and the second in the Wadi Turgut. The distribution of these water management works in this arid area indicates that they were very important and valuable hydraulic systems designed to improve soil fertility and agricultural production (Oates 1953, 87–89). The archaeological evidence shows that dams were built in the Gebel Tarhuna as an enhanced system of soil and water conservation.

Remains of dams are a more common feature in the Wadi Turgut and its tributaries (Figure 2.26) than in the Wadi Doga. For example, eleven dams have been recorded by the TAS in the Wadi Turgut, whereas only two have been observed in the Wadi Doga (Figure 2.27). It is possible that the Wadi Doga watercourses were criss-crossed by earthen dams which have been washed away by water pouring over them. It could be readily assumed that the rural farming of the hinterland of Lepcis Magna introduced a level of homogeneity into systems of land organisation and exploitation. The creation of various sizes of concrete and earthen dams across wadis was essential to the success of farming, not simply the big dams on the larger wadis such as the Wadi Taraglat-Caam. The dams were built on a local system of land-use (Vita-Finzi 1961, 15). It is also evident that many of the major and minor settlements on the Tarhuna plateau, as in the Tripolitanian pre-desert, were situated on or very near wadis in order to capture the run-off water and to exploit the fertile soil in the wadis above the dams (Barker *et al.* 1996, 159–190). Thus, by maximising the potential rainfall through run-off technology, the farmers achieved the highest degree of land exploitation and benefitted both from the water-catchment potential of the wadis and from the natural topography.

Stone and concrete dams were erected in different situations in the wadis. Where watercourses were narrow and steep (which is very common in the northern wadis of the Gebel Tarhuna such as Udei el-Me and Wadi Turgut), high, mortared stone dams were needed (Figure 2.28). Otherwise, wider earth and concrete dykes were constructed on the larger southern wadis such as Taraglat where the biggest expanses of cultivable area are found (Vita-Finzi 1961). The apparent discrepancy between the distribution of different types of dams may be explained partly by the spatial development of the rural settlements, the focus of their organisation and land-use. Furthermore, dams were built as a principal means of slowing down the floodwater and controlling its capacity for destruction, while retaining as much water as possible to feed the fertile soil created upstream from them (Oates 1953, 88).

As discussed earlier, the differences between the sizes and types of dams found in different areas of the Tarhuna plateau may have been influenced by the topography and how it was suitable for agricultural exploitation and settlement. The design of a dam was evidently adapted in relation to varying circumstances (Oates 1953). The distribution of dams in the Wadi Turgut for instance, shows that the dams there were mostly constructed in the tributaries rather than in the main wadi course (Figure 2.26). It seems that the object was to minimise the risks of flash floods, which may have occurred more commonly in the main valley, and their possible destruction of the dams. For example, the dam GUM84 was established in the Wadi Guman (one of largest tributaries of the Wadi Turgut), a short distance below a bath-house (GUM87 (Ain Guman)), see Figure 3.34). Its overall length is 50 m and its height is 3.5 m; the width at the base is 4 m, but it decreases to 3.2 m at the top. This dam seems never to have increased above its original height, which makes it different from a number of other dams located in the Udei el-Me and the Wadi Turgut examined by Oates (1953, 87–89). However, most of the examined dams show that they were constructed to control run-off water rather than for long-term water storage. It is evident that the erosive force of the water was always a considerable danger. Whether these dams were built under the supervision of the central authority or under the initiative of local communities, their location and distribution show that they must have been very valuable in protecting farmlands, increasing soil fertility and supplying water.

Settlements in such a semi-arid area were under continuing pressure to collect run-off water for domestic use or watering crops by devising means to capture

and divert water (Kennedy 1995). These varying systems of water-harvesting and run-off capture likely required considerable labour and effort to construct and maintain. The ULVS found substantial numbers of dry-stone walls built in most of the pre-desert wadis. The purpose of the vast majority of the walls was to catch, conduct and accumulate soil and floodwaters (Gilbertson and Hunt 1996). Twenty-five types of ancient walls and wall junctions have been classified by the ULVS investigators in the Tripolitanian pre-desert (Gilbertson *et al.* 1984). A number of the Wadi Taraglat's tributaries (e.g. Agoubia, Tahwalat and Beni Mousa) in the southern districts of the Tarhuna plateau seem to parallel the pre-desert valleys by using different types of wadi walls and floodwater farming systems. One of the most remarkable floodwater systems found by the TAS in the southern part of the Tarhuna plateau is located in the upper Wadi Beni Mousa tributary (Figure 2.29). Here, a concentration of Types 11, 12 and 19 of the wadi walls defined by Gilbertson and Hunt (1996) were recorded in the vicinity of an ancient settlement. Not only was the settlement of the Wadi Beni Mousa located along the wadi, but the vast majority of south Tarhuna remains are found on or near wadis. This phenomenon "demonstrates that the water catchment potential of the wadis was the primary factor affecting settlement location" (Mattingly and Flower 1996, 182). In contrast with the southern Tarhuna plateau wadis, a smaller number of wadi walls have been found in the Wadis Turgut and Doga. The Wadi Guman presents a good example of five cross-wadi walls (Type 11), two barrages (Type 12) and two rectangular, complete enclosures (Type 19), all constructed within a 1 km stretch. The absence of obvious chronological evidence (literary or epigraphic) means we cannot hope to provide a certain date for these walls. Nonetheless, these constructions could plausibly be dated to the fourth and fifth centuries AD in relation to the two nearby fortified farmhouses.

Chapter 2 TABLES

Table 2.1: *Distribution of sites by elevation asl.*

Elevation asl (m)	Wadi Turgut	Wadi Doga	Total number of sites	Percentage of sites	Average elevation (m)
135–249	23	13	36	32 %	212
250–299	26	10	36	32 %	272
300–399	13	7	20	18 %	347
400–515	6	14	20	18 %	442
Total	**68**	**44**	**112**		**297**

Chapter 2 FIGURES

Figure 2.1: *An example of a fortified site (DOG70) visible on satellite imagery via Google Earth.*

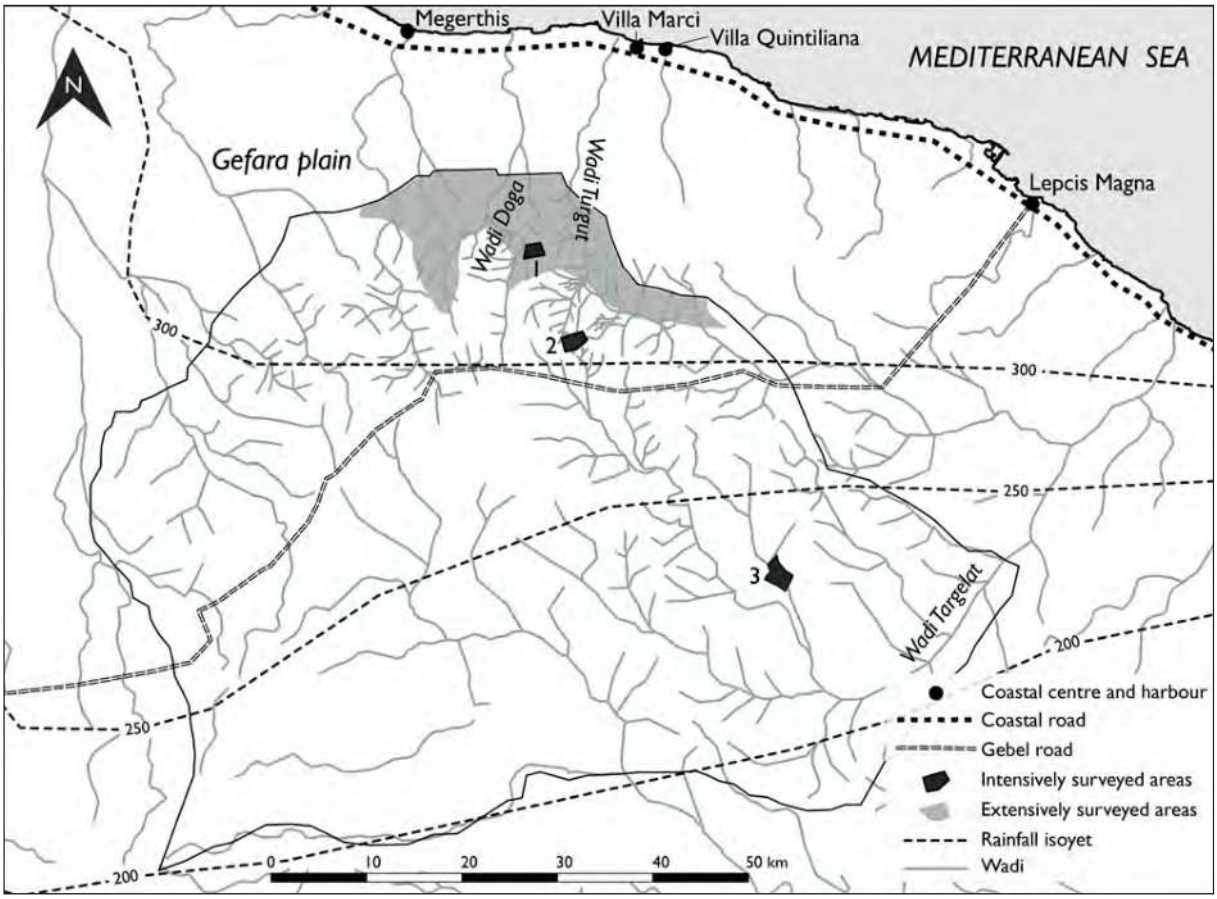

Figure 2.2: *The areas extensively and intensively surveyed by the TAS. Intensive Survey Area 1, Wadi Hajaj; Area 2, Wadi Guman; Area 3, Wadi Beni Mousa.*

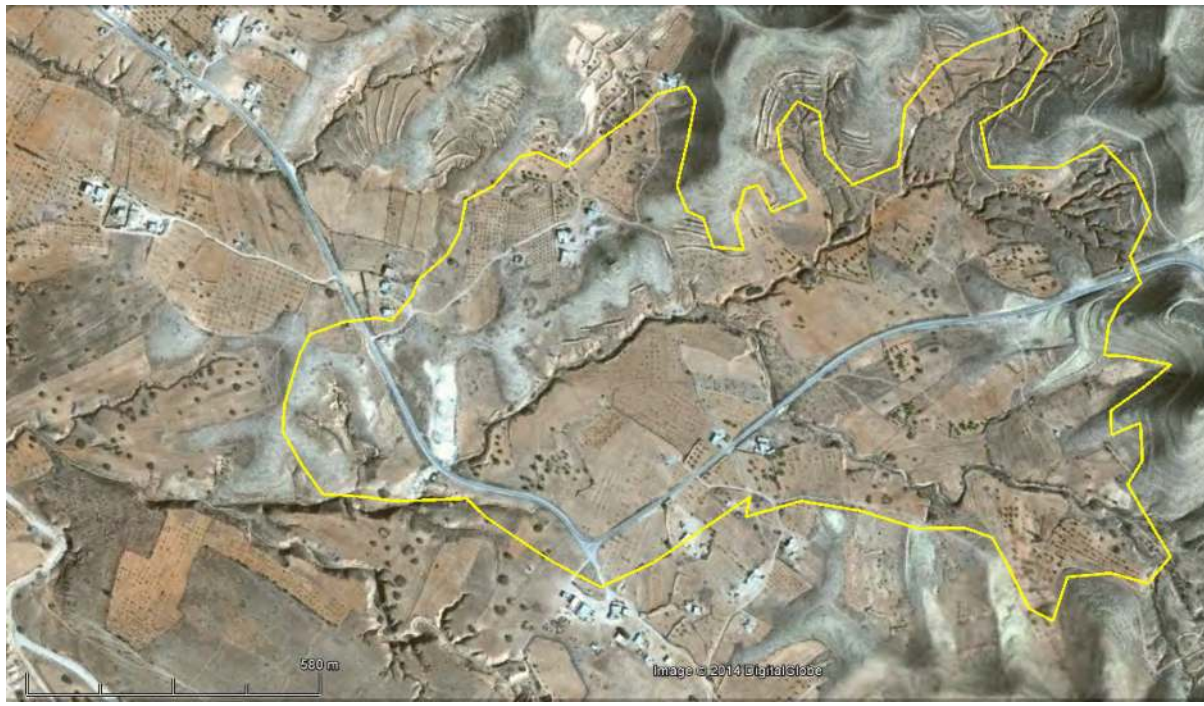

Figure 2.3: *Intensive Survey Area 1: Wadi Hajaj (Wadi Doga).*

Figure 2.4: *Intensive Survey Area 2: Wadi Guman.*

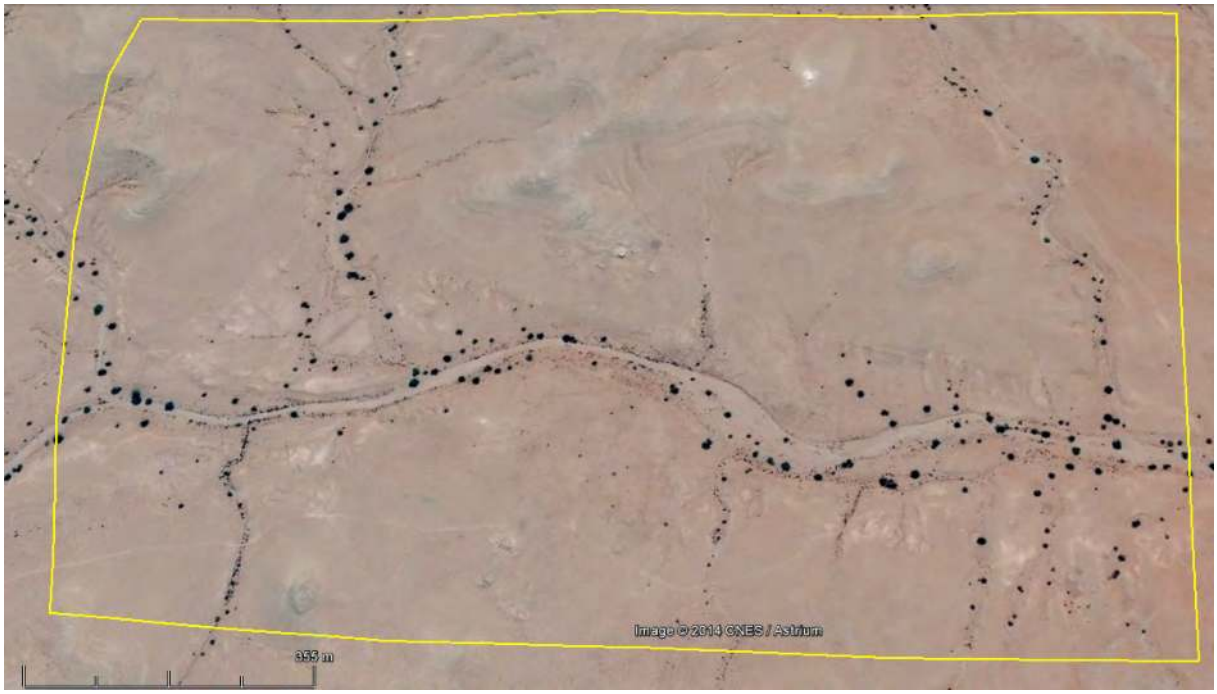

Figure 2.5: *Intensive Survey Area 3: Wadi Beni Mousa.*

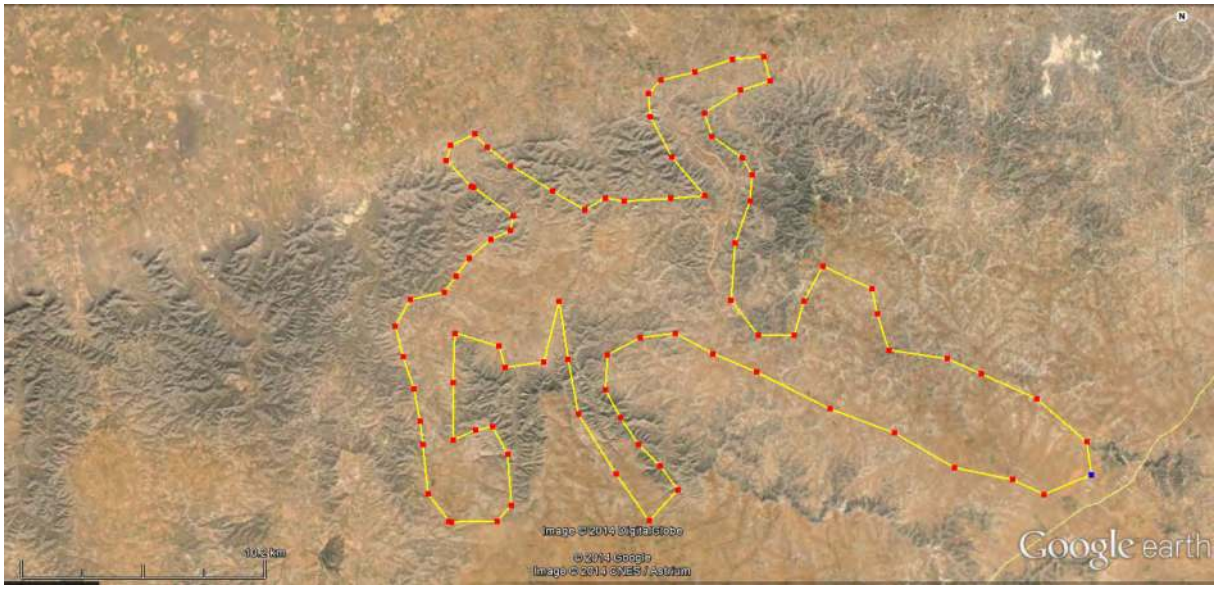

Figure 2.6: *The extensively surveyed area.*

Figure 2.7: *Gasr Doga mausoleum (DOG72) (photo D. Mattingly).*

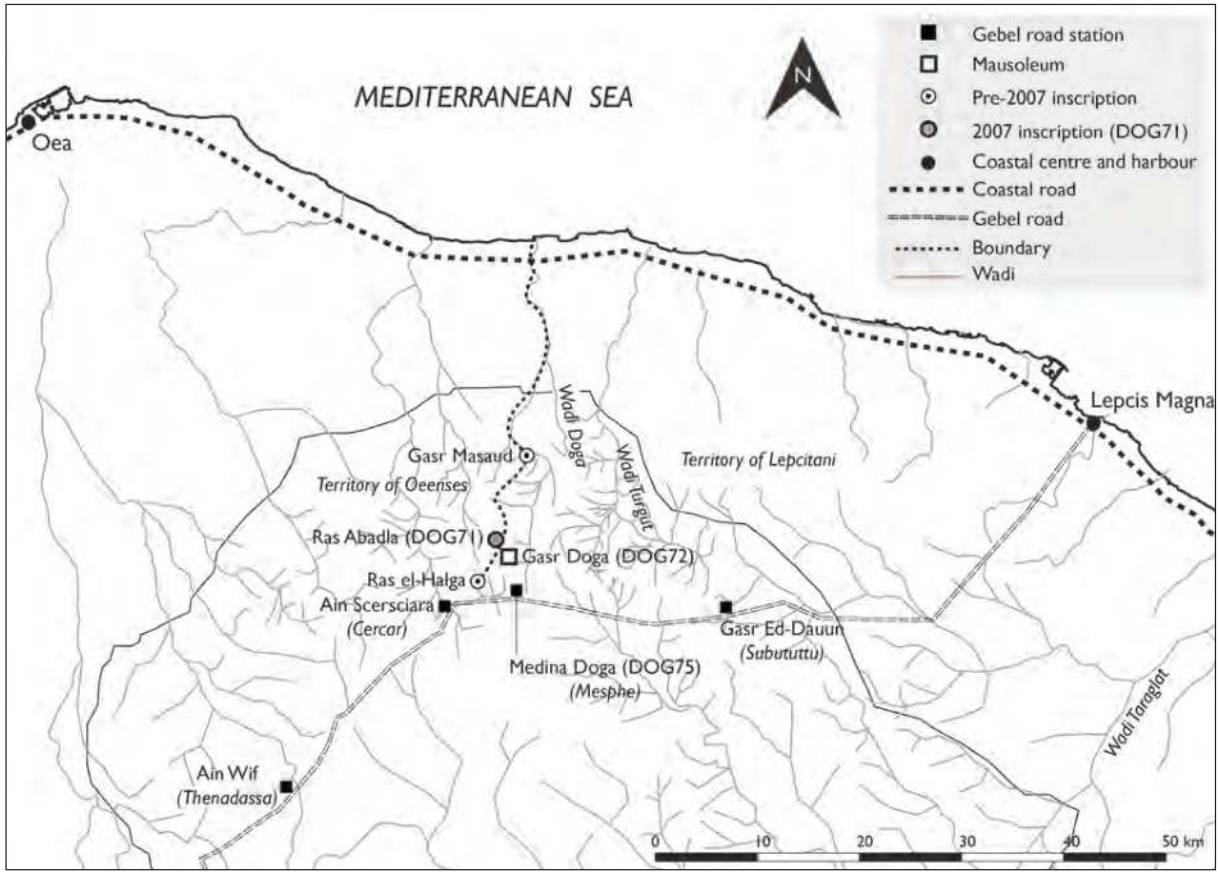

Figure 2.8: *The location of a new boundary inscription (DOG71) which fits within the line projected by Di Vita-Evrard.*

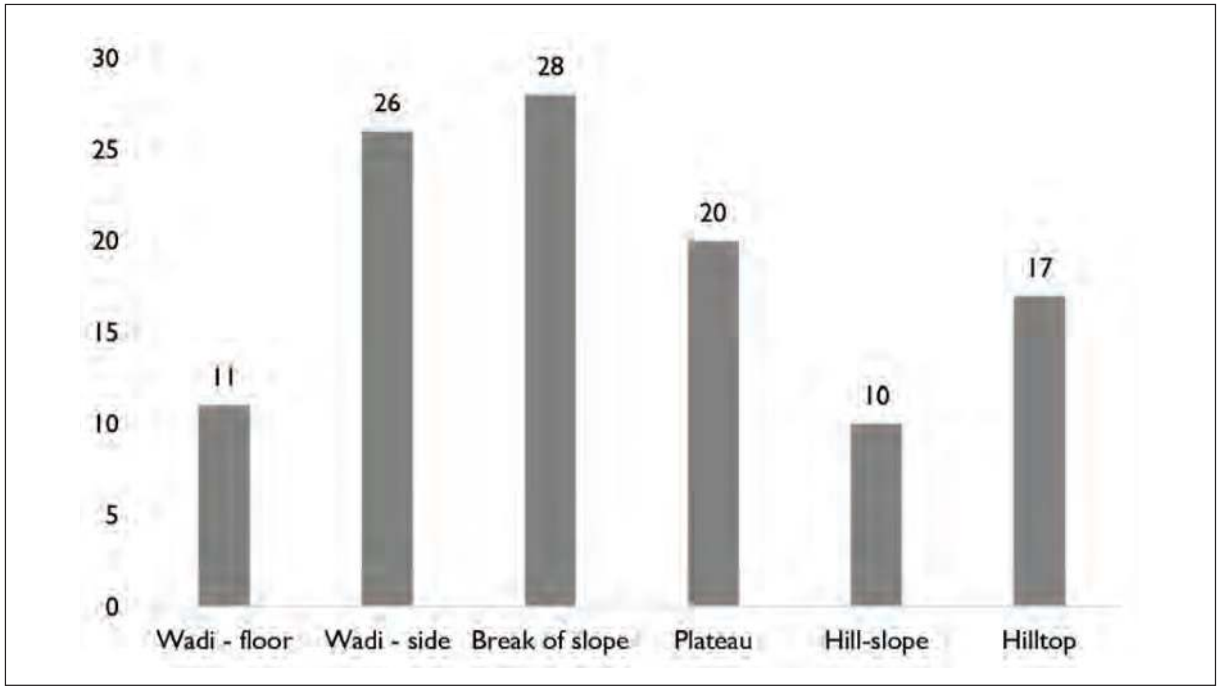

Figure 2.9: *Sites in the Wadis Turgut and Doga divided by topographic location.*

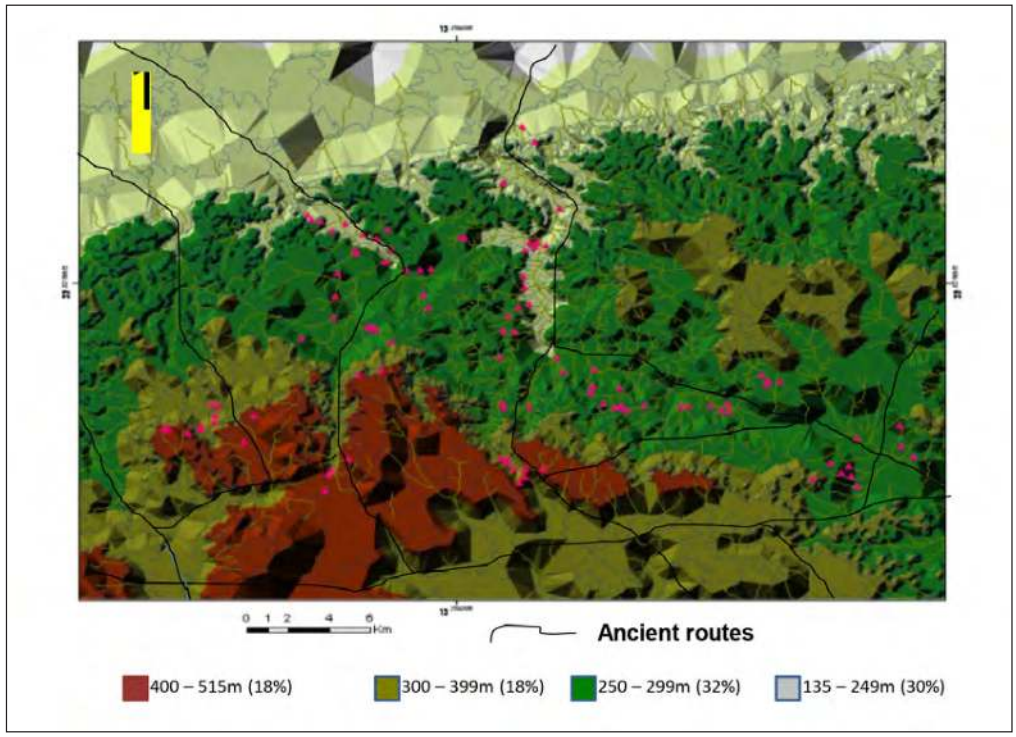

Figure 2.10: *Elevation and site locations in the north-eastern sector of the Gebel Tarhuna.*

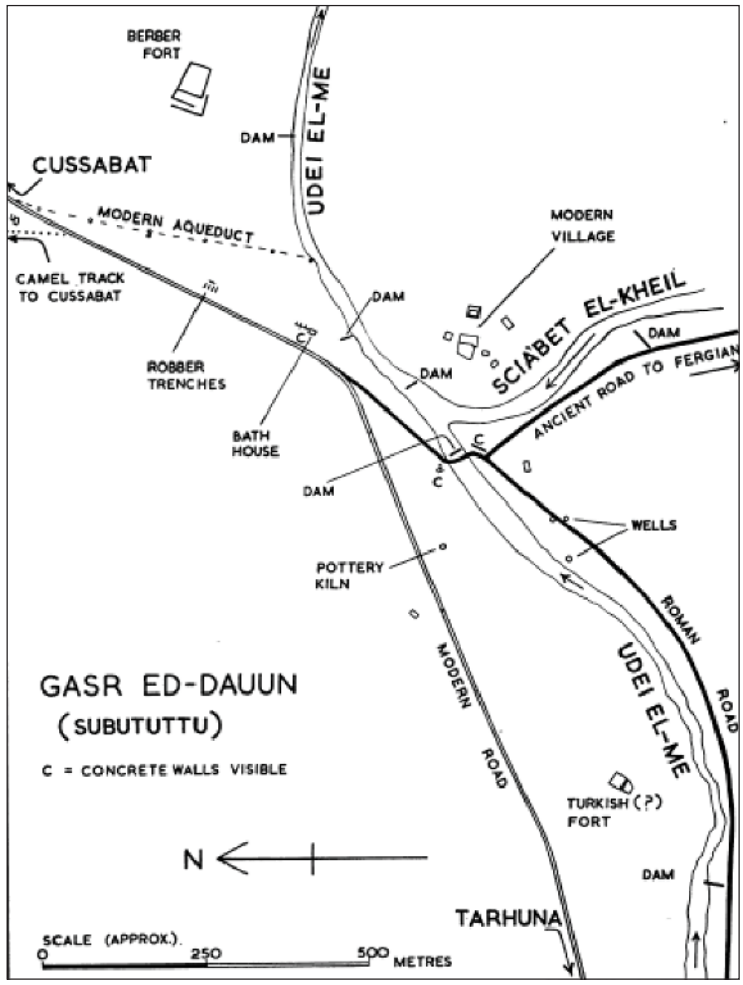

Figure 2.11: *Gasr Ed-Dauun (*Subututtu*) village (Oates 1953, 91, Fig. 4).*

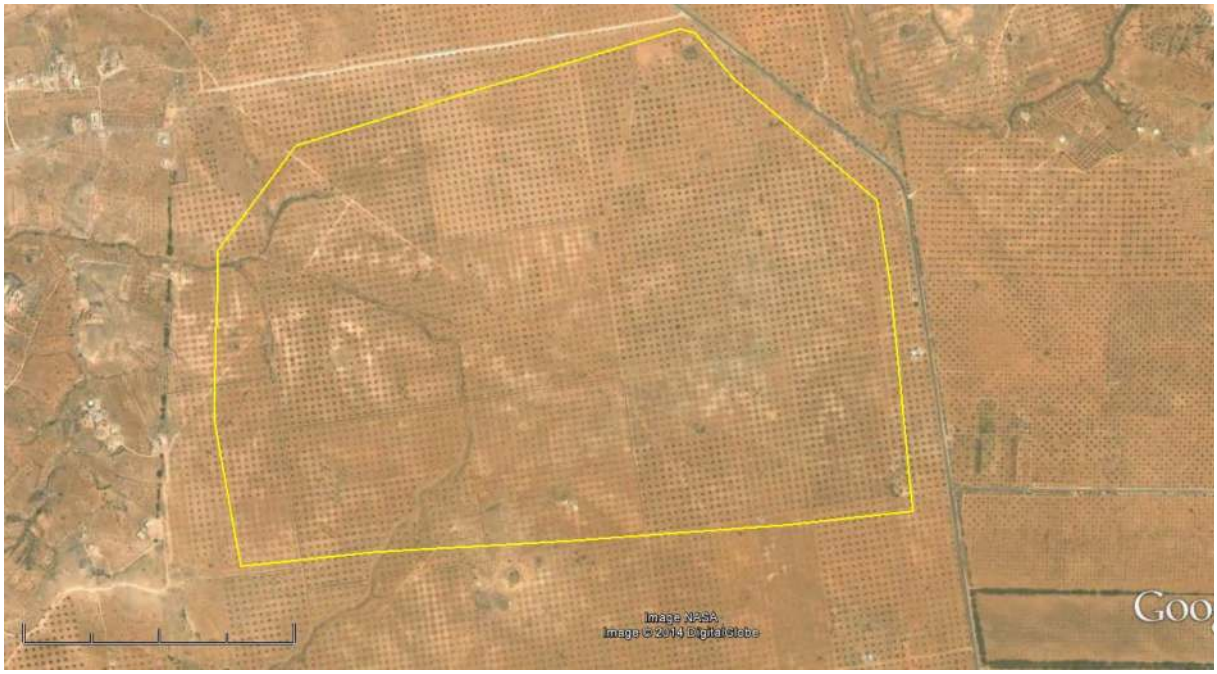

Figure 2.12: *Location of Medina Doga (*Mesphe*, DOG75) at the meeting point of five ancient tracks, with approximate limits of surface evidence.*

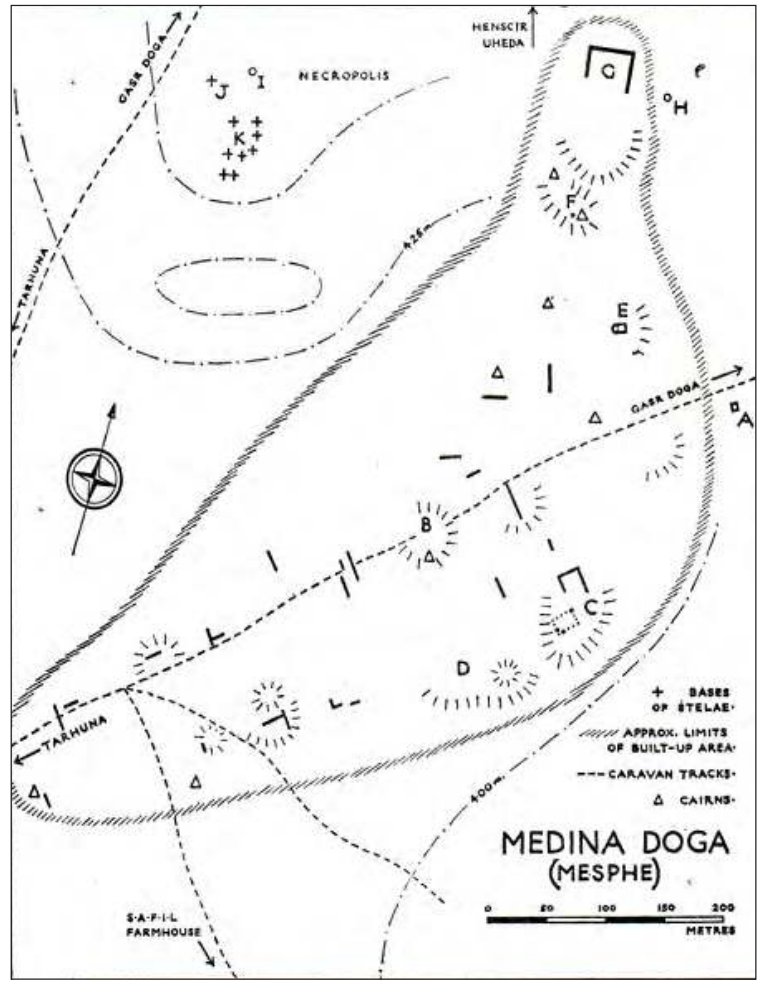

Figure 2.13: *Plan of Medina Doga (*Mesphe*, DOG75) (Goodchild 1976, 77).*

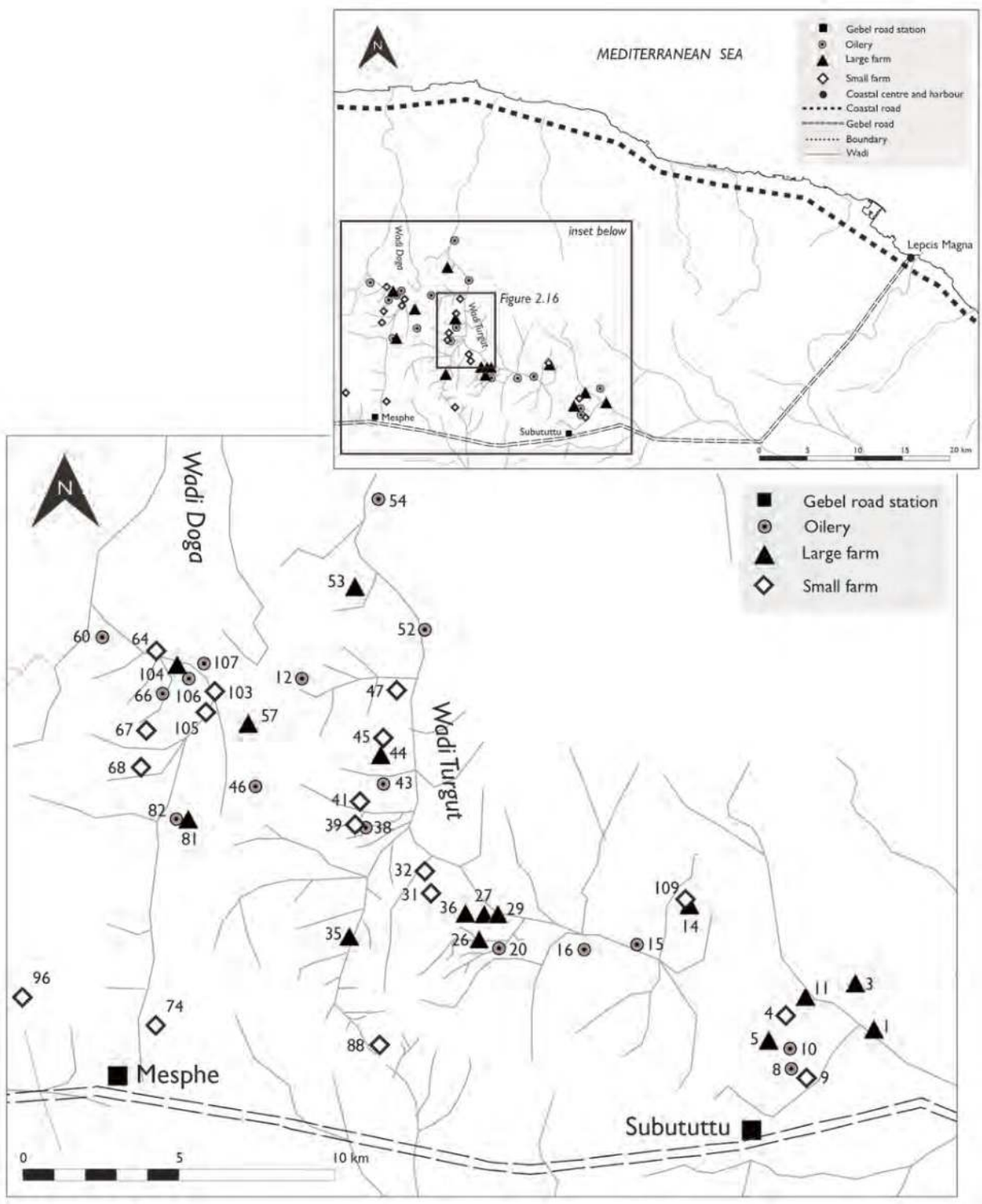

Figure 2.14: *Distribution of oileries, large farms, and small farms in the Wadis Turgut and Doga.*

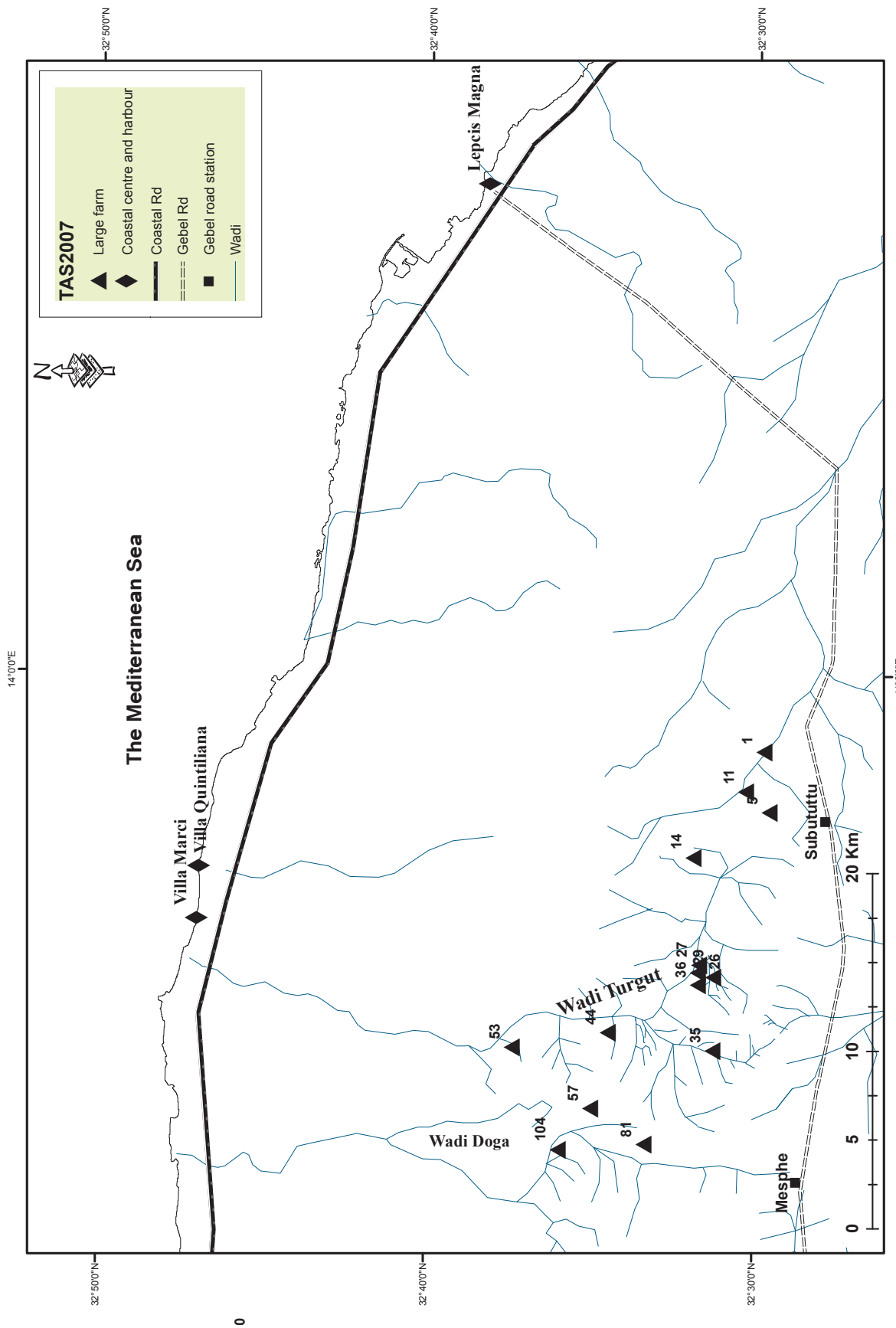

Figure 2.15: *An example of a large farm, Henschir Aziza (TUT5).*

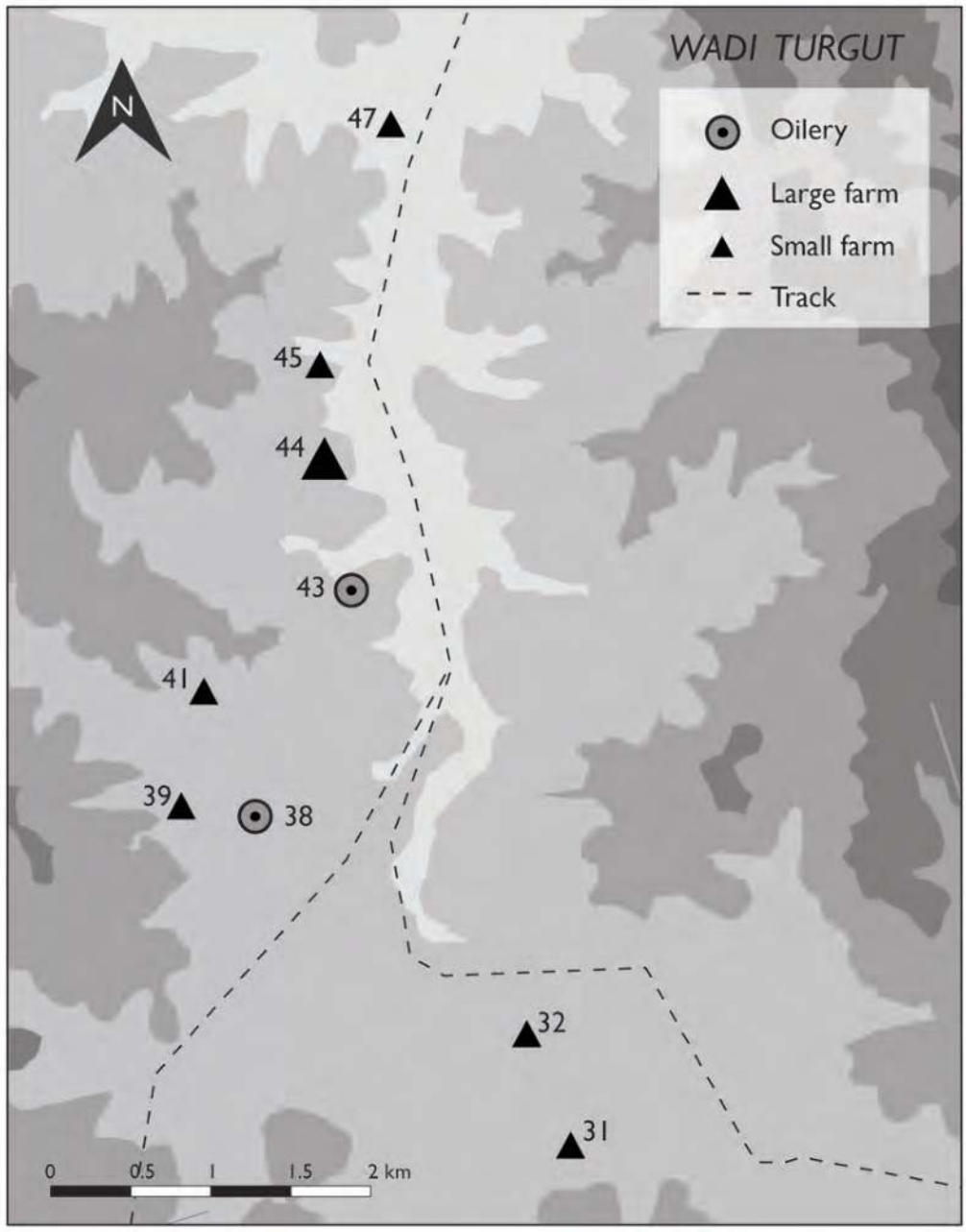

Figure 2.16: *Oileries and farms in the middle sector of the Wadi Turgut.*

Figure 2.17: *Examples of fortified farms in the Gebel Tarhuna visible on satellite imagery (Image © 2015 Digital Globe).*

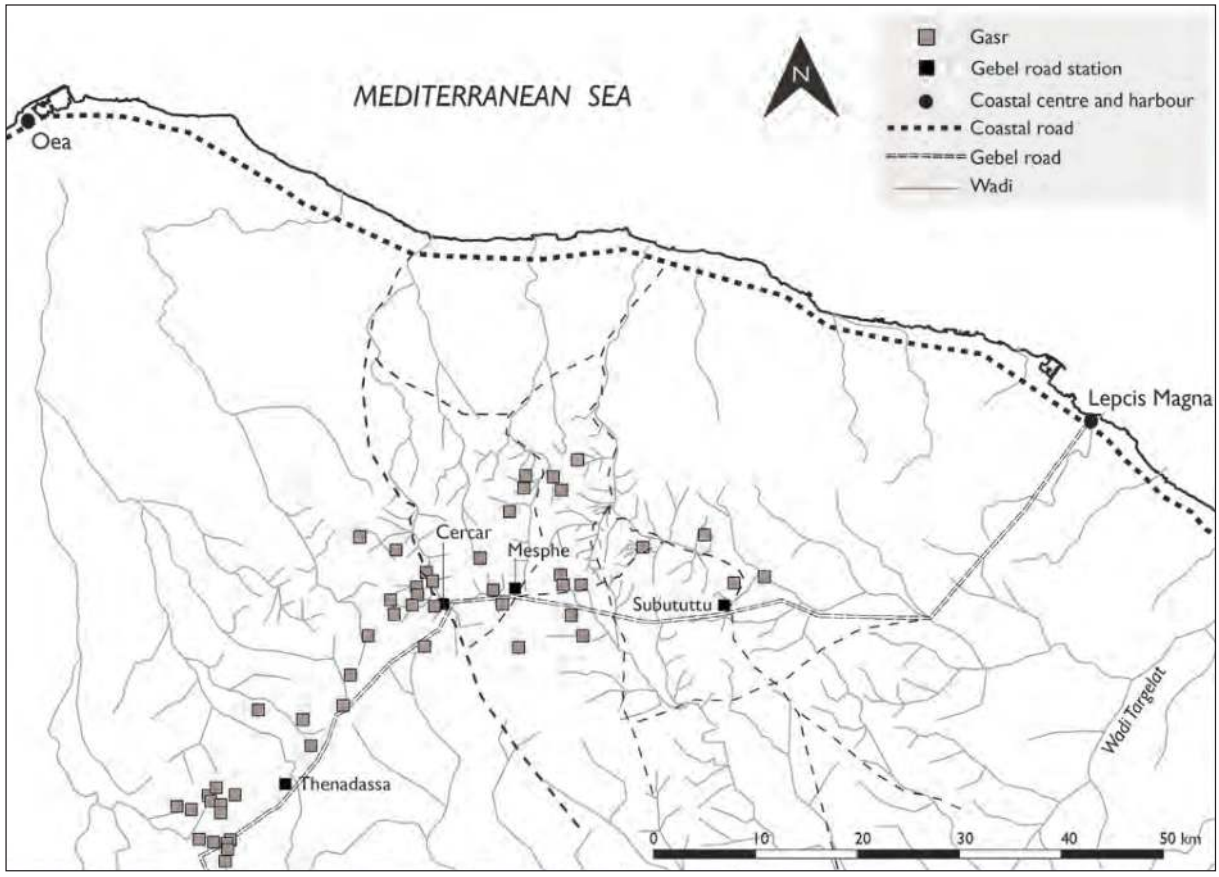

Figure 2.18: *Distribution of fortified farms recorded during the TAS and using satellite imagery (Google Earth).*

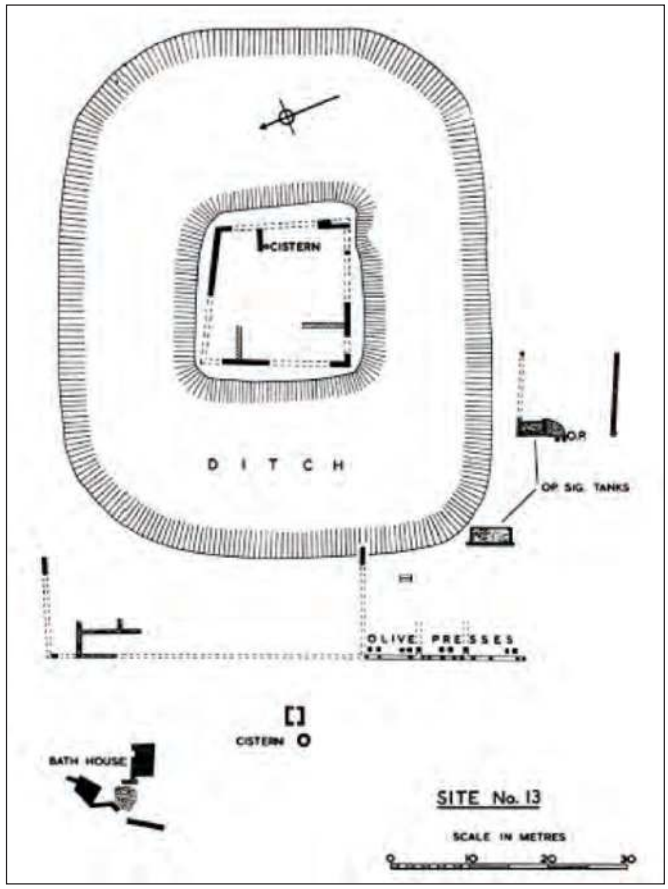

Figure 2.19 (left): *Gasr Shaeir (Site 13, from Oates 1953, 106, Fig. 10).*

Figure 2.20 (below): *Location of 12 open farms replaced by fortified ones in the late Roman period.*

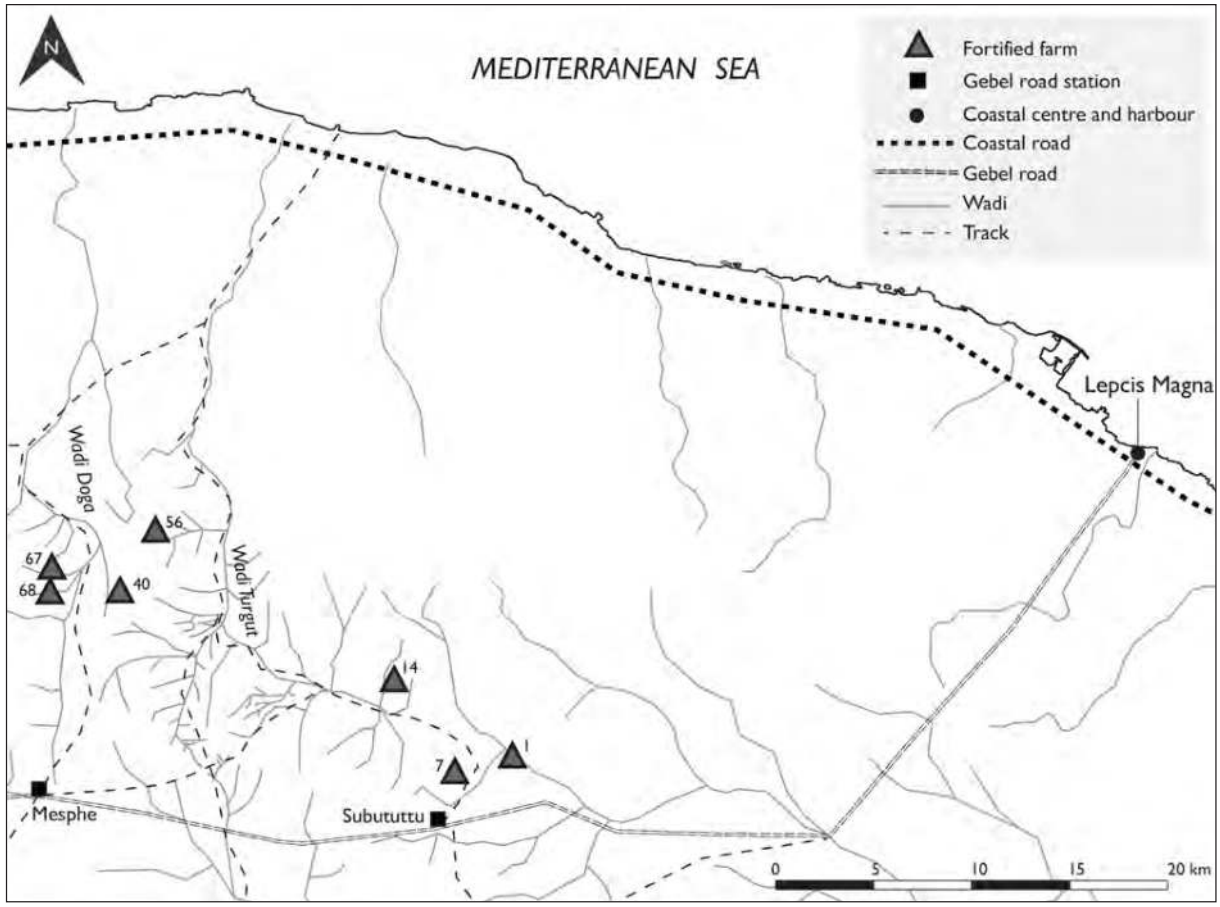

Figure 2.21: *An example of two Type 2 hilltop* gsur *(TUT17 (Ain Astail) and TUT28).*

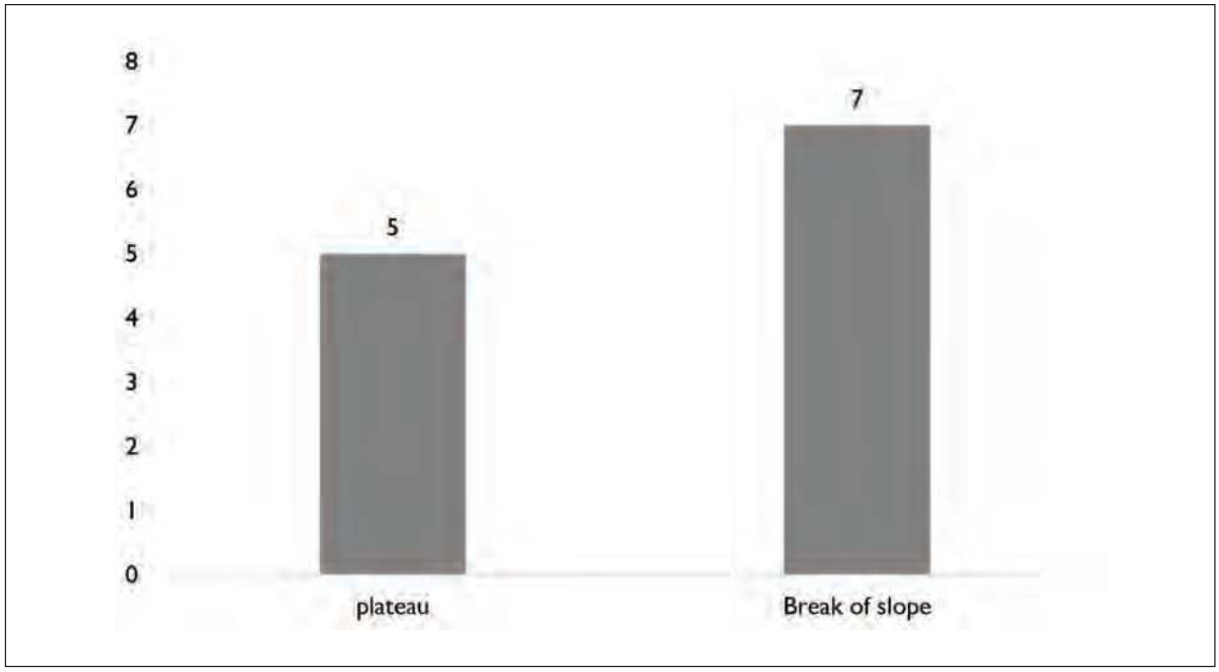

Figure 2.22: *Distribution of Type 1 fortified farmhouses by topographical location.*

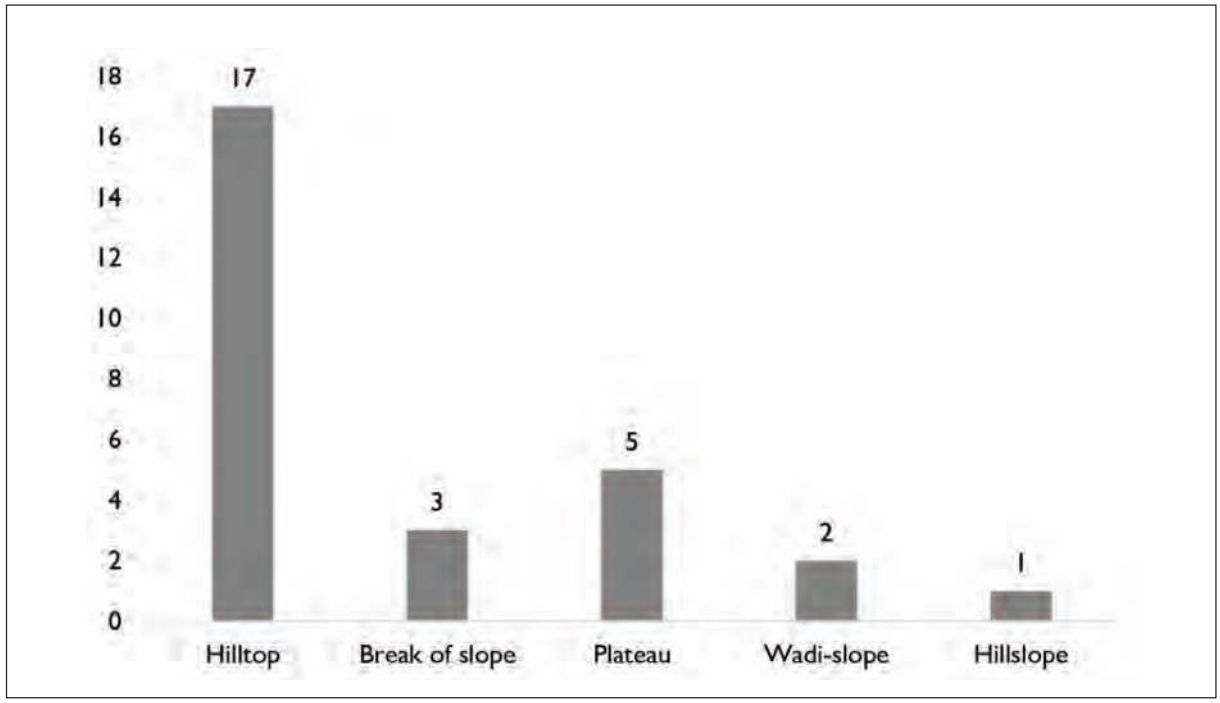

Figure 2.23: *Distribution of Type 2 fortified farmhouses by topographical location.*

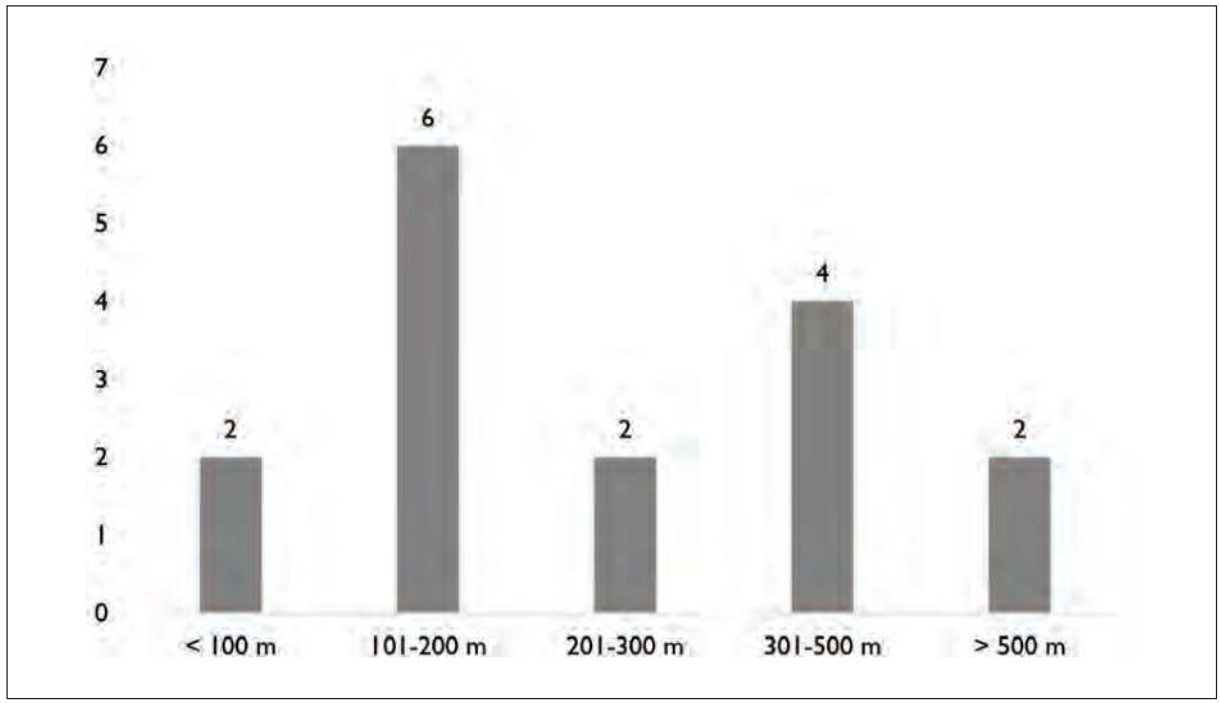

Figure 2.24: *The distance between Type 2 hilltop* gsur *and other farming sites.*

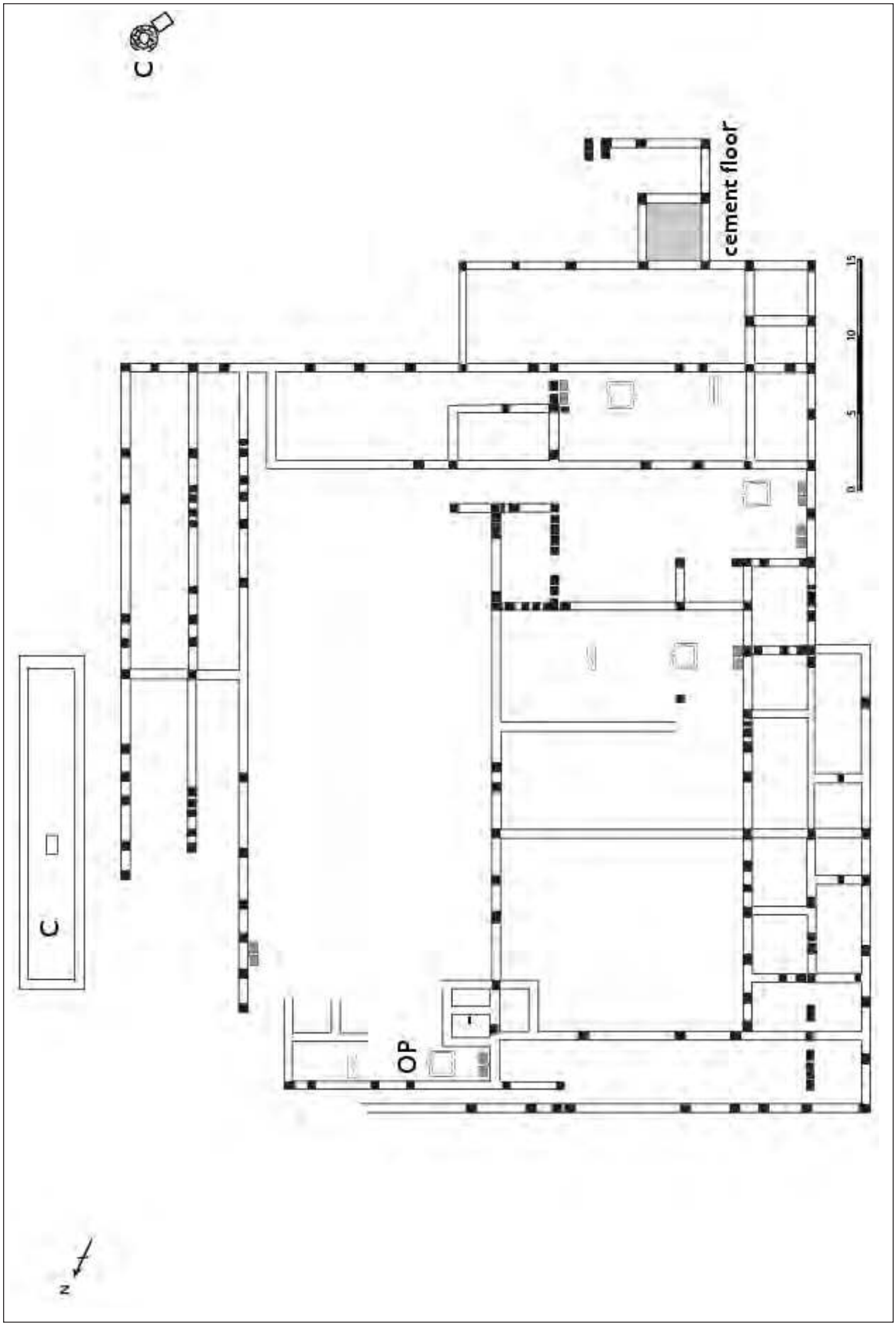

Figure 2.25: *The oilery of Loud el-Meghara (TUT43) illustrating how cisterns were associated with settlements.*

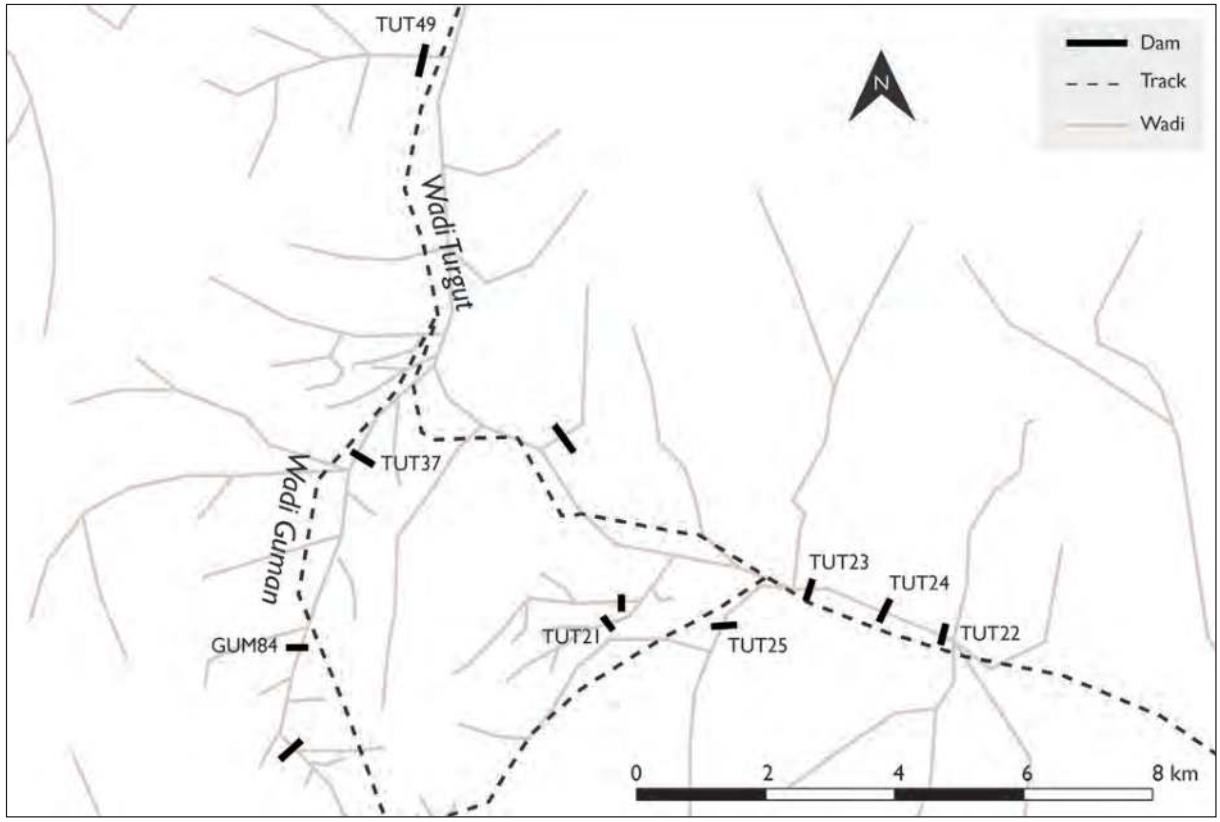

Figure 2.26: *Distribution of dams in the Wadi Turgut.*

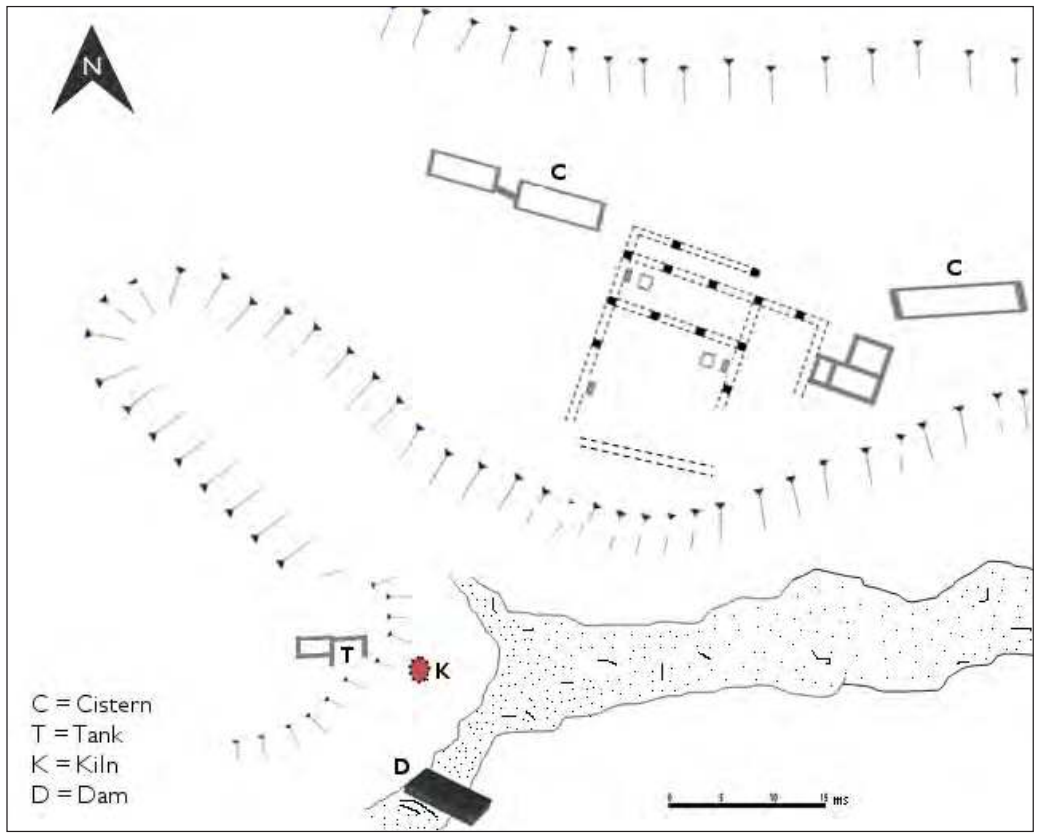

Figure 2.27: *DOG111 (Almseel), large farm associated with dam, cisterns, kiln and tanks.*

Figure 2.28: *A dam in the Wadi Turgut (TUT24).*

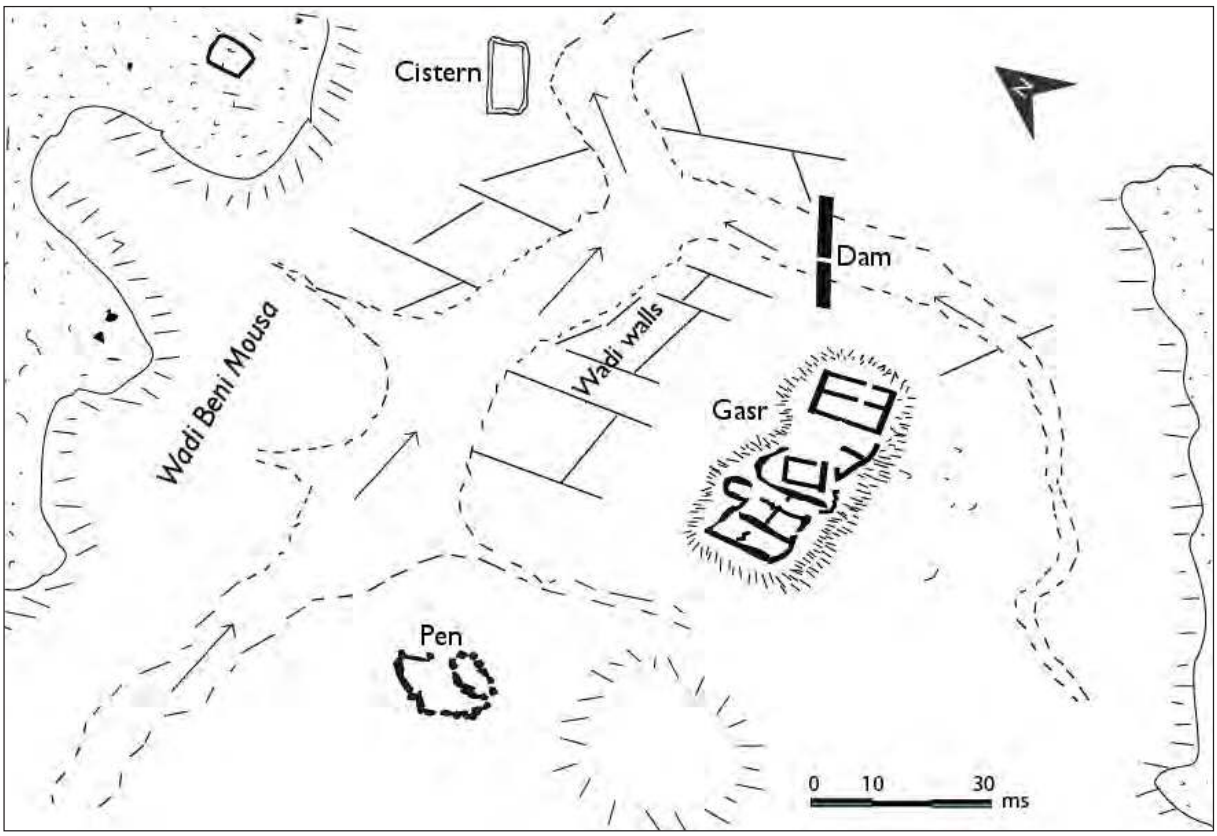

Figure 2.29: *Wadi wall systems in the Wadi Beni Mousa.*

Chapter 3

ANCIENT RURAL SETTLEMENT ON THE TARHUNA PLATEAU

3.1 Introduction

In this chapter the assessment of Roman-period settlement variation is based as far as possible on quantitative measurement in order to evaluate if there was a noticeable peak in site numbers during a specific period. A second issue concerns the settlement hierarchy (road-stations, agricultural villages, and farms). I shall discuss whether the shape of the settlement hierarchy was stable or whether it changed over time.

This first section is primarily devoted to the discussion of the inventory of rural archaeological sites within the chosen geographical and chronological framework. The different types of rural settlements are presented here for quantitative analysis based on an architectural approach. A number of descriptive terms, which were introduced in Chapter 2, are used to classify the rural settlements of the Gebel Tarhuna. Classification of these rural sites is based primarily on their size and functional characteristics. These criteria have been applied to the 112 rural sites recorded or re-recorded by the TAS in the Wadis Turgut and Doga. It needs stating that site definition, estimation of site size and number of presses recorded at each site depended on the visibility conditions and degree of preservation. Sites such as isolated dams were not included in size analyses.

There are few satisfactorily excavated Roman-period rural sites in the hinterland of the Tripolitanian coastal centres. There is a similar shortage of systematic archaeological surveys conducted in the Gebel Tarhuna. Nevertheless, this area has revealed a remarkable diversity of settlement types across space and time; there are varying sizes of open and fortified farm buildings, pottery kilns, baths, mausolea, watchtowers and water management works. Considering this diversity of site size and type, it is evident that the Roman-period settlement pattern of the Tarhuna plateau was a response to the high demand for settlement construction and land exploitation. The archaeological evidence shows that this demand reached its peak in the period between the first and third centuries AD, though with a large number of fortified farmhouses (*gsur*) also producing evidence for their continuous use until at least the sixth century AD (Brogan 1976–1977; Felici *et al.* 2006; Goodchild 1951; Mattingly 1983; 1995).

In the TAS area, there are several sites of various function that certainly continued into the late Roman period. However, it appears that sites of the early periods were more numerous and much more widely scattered across the landscape. The economic structure of the Tarhuna countryside can be investigated in several ways from the evidence of rural settlements. An important distinction concerns the scale of sites, that is, whether all buildings or production sites were of the same order of size, or whether one or more types were larger than the others.

In the Roman economy, agricultural investments became increasingly necessary and more profitable, in parallel with a more intensive exploitation of land and a growing demand for agricultural products by the Roman state and urban markets (Matijašić 1982). Conditions for growing olives in north-western Libya are most favourable in the hill lands of the Gebel Tarhuna-Msellata and the Gebel Gharian. Numerous remains of presses testify to a sophisticated process and large-scale capacity for the extraction of oil (Mattingly 1988a; 1995). There are almost no farms on the Tarhuna plateau without their own processing facilities for agricultural products; some of the larger sites were capable of almost industrial scale production. The significance of the rural potential, the distribution of agricultural resources and the organisation of agricultural production were prime considerations in the economy of pre-industrial societies (Alcock 1989). The rural settlement pattern is undoubtedly the most familiar aspect of the Roman period in the Gebel Tarhuna, although it has been subject to fewer

archaeological works in comparison with other areas in North Africa. Rome's economy was mainly based on agriculture, and the agricultural characteristics of the Gebel Tarhuna fit perfectly with this economic direction.

Farming sites dominated the settlement distribution pattern. The main aim of this chapter is to explain the relationship between this diffusion and the distribution of agricultural resources. Contrary to the idea that the expansion of rural settlement in the Gebel Tarhuna related to the agricultural possibilities in the most productive lands, it could be argued that the settlement pattern on the Tarhuna plateau was an off-shoot of what had taken place in the coastal area, drawing on capital investment from the *emporia*, i.e. the coastal cities. The increased demand for cultivable lands by the coastal cities was thus the main cause for the expansion into the Tarhuna region (Mattingly 1989a, 143–145; 1995, 140–141; Mattingly and Flower 1996, 167–168).

Moving beyond the outline of settlement types provided in Chapter 2, in this chapter I will provide more detailed answers to the following questions: what types of rural settlement existed in the Tarhuna region? How were these rural settlements influenced by environmental factors and the availability of natural resources? Was there a specific model of a typical farm? Does the archaeological evidence for rural farming sites reflect a certain type of ownership? What was the extent of the role played by the urban elite in the emergence and spread of rural sites? What is the archaeological evidence for this role? In dealing with the settlement pattern on the Tarhuna plateau I shall look at the distribution of different types of site across the landscape, and their relationship to each other, to the environment and to natural resources. The relationships between people and the environment have long been accepted in archaeology and geography as crucial to the understanding the development of ancient human settlement (Goudie 1981). For farming sites, for instance, their physical surroundings were necessarily related to the main economic activities undertaken at and around those sites. More insights can be provided into the economic dimension of settlements through site location analysis (Van Ossel and Quzoulias 2000). The impact of the physical surroundings on settlement location and land-use has been recognised in many archaeological surveys in the Mediterranean world (Barker 1995). In addition, the influence of the natural environment on human settlement has remained a dominant theme in many archaeological works, especially in regional analyses and landscape studies. The Gebel Tarhuna, however, is a reminder of the distinction which can be made between observations of landscape and the actual physical characteristics of the natural environment.

In order to gain insight into the parameters of the settlement patterns in the Gebel Tarhuna, the examination of farming sites will stand at the heart of this discussion, as they are generally assumed to represent a Tripolitanian economy based mainly on the production and export of olive oil (Mattingly 1988a; 1988b; 1988c). The archaeological evidence, however, highlights some differences between the coastal zone and the Tarhuna plateau, particularly the northeast sector, during the Roman period. The Gebel Tarhuna landscape was based, like the coastal region, on numerous farm buildings of varying sizes, from small farms to oileries and villas (see Section 3.2). However, the absence of reliable evidence for the emergence of villas before the end of the first century BC underscores the difference between the Tarhuna plateau and the coastal zone, where villas which appear to date from the second century BC have been recorded in the Wadis al-Tura, al-Fani, Giabrun and Caam (Cifani and Munzi 2002; Munzi *et al.* 2004).

A major problem regarding the documentation of the archaeological record of the pre-Roman period in Tripolitania and elsewhere is its recognisability. The identification of Punic- and Numidian-period remains in the archaeological record is still in its early stages. There is also a gap in terms of the classification and description of Punic pottery in Tripolitania, the consequence of which is, of course, difficulty in identification. Detailed studies have focused only on some types of Punic transport amphorae which have been found at a number of sites in Tripolitania, especially funerary ones (Bisi 1983; Di Vita-Evrard et al. 1997; Dore and Keay 1989). Seven sites which I identified in the territory of the Gebel Tarhuna have yielded second and first century BC pottery, as well as a possibly second century BC hoard of Numidian coins at Jbibina, representing the first evidence for the appearance of early settlement in the Tarhuna region (see Table 3.8). This evidence can be compared with data that have recently emerged from other areas in the hinterland of Lepcis Magna which indicate a slightly earlier intensification of rural settlement (Cifani and Munzi 2002).

The impact of the Roman economy on rural settlement organisation is very clear in the archaeological evidence of surface pottery. Without excavation, it is impossible to fully assess the scale and organisation of pre-Roman settlement. However, the epigraphic evidence unquestionably demonstrates that people of Libyco-Punic culture (*Libyphoenices*) were dominant in the area during the early years of the first century AD (Goodchild 1976; Mattingly 1995). The technological improvement of the Roman period brought new agricultural implements and resulted in a spread of different types of farms and architecture. The organisation of the regional rural economy reached a much more developed scale during the early imperial period (first and second centuries AD) with the establishment of numerous oileries and large farms. The construction of these farm buildings may have represented a cultural change in the countryside of the Gebel Tarhuna in that the builders

conformed to some degree of Roman lifestyle. On the other hand, the establishment of these sites may also have represented a change in economic goals, new farming techniques for achieving those objectives and a new organisation of the labour force. It is possible that all of these changes were a consequence of a basic change in land ownership related to new political and socio-economic circumstances in the urban centres. These changes affected rural settlement organisation and production, in addition to the relationship between property owners and the productive lands, with an increase in the number of large estates. Such changes are of great importance to the understanding of economic activity during the Roman period, but they are very difficult to recognise in the archaeological evidence. In addition, the issue of continuity and change in the ownership of lands can rarely be identified or proved in the absence of written documentation.

A good sample is necessary to identify patterns and deviations in the available rural settlement data. The TAS records thus provide a new baseline to discuss and evaluate rural settlement types and organisation. For example, site size is a major factor in identifying the function of the site. Evidence from the TAS and from previous fieldwork in Tripolitania informs this presentation of the settlement pattern and typology. It is known from previous surveys and excavations that there were larger, wealthier luxurious sites in the coastal area, in particular the maritime villas between Lepcis Magna and Oea (Di Vita 1995; Munzi and El-Nemsi 1998; Musso 1998; Munzi *et al.* 2004), while smaller and less wealthy sites were found in the hinterland. It has been stressed that only a hierarchical society with leisured elite could have established and occupied such luxury sites (Mattingly 1985; 1995). The archaeological evidence suggests that all rural sites, from both areas, were related to each other and that there was a hierarchical organisation of the settlement system related to the economic exploitation of the landscape. The Gebel Tarhuna, particularly the eastern area, is thought to have been the most densely settled zone in the Gebel, forming a deep hinterland for Lepcis Magna. This area was linked with the city by the Eastern Gebel road, the construction of which is dated to AD 15/16 under the authority of L. Aelius Lamia, proconsul of *Africa* (Goodchild 1976, 75).

3.2 Settlement types and organisation

3.2.1 Site size

For the majority of farm buildings on the Tarhuna plateau it is relatively easy to delineate their plans as a wealth of detail is visible on the surface, such as press elements (orthostats, press rooms, press beds, counterweights, mills and tanks), upright blocks of *opus africanum* construction, courtyards surrounded by a number of rooms and water catchment works. In addition, there is usually a varying density of scattered potsherds around the farm sites. In numerous cases, the TAS recorded middens on the slopes adjacent to farm buildings. The combination of the structural elements of the rural settlements and the pottery scatters permit a close estimate of the size of many sites. The degree of precision is much better than in conventional plough-zone surveys in north Mediterranean countries.

The characteristic features of settlement on the Tarhuna plateau were different forms of farm buildings (Cowper 1897; Goodchild 1951; Mattingly 1985; Oates 1953). With regional variations, these ranged in size from small farms to villages or small towns. These variations appear to have been replicated in most of the olive oil-producing regions of Roman North Africa. For example, a remarkably similar variety of site sizes and press distribution was found in the territories of *Cillium* (Kasserine), *Segermes* (Henschir Harat) and *Caesarea* (Cherchell) (Hitchner 1988; 1992–1993; Hitchner *et al.* 1990; Leveau 1984; Mattingly 1995; Ørsted 1992).

Measurements of site size performed on the ground by the TAS have been confirmed wherever possible on satellite imagery (Figure 3.1). The estimated sizes are, without doubt, still approximate in many cases, especially where subsequent demolition, cultivation or building over the site have been on a large scale or sustained across a long period. Nevertheless, the estimated size of rural sites is a broad indicator of the level of the productive and residential unit and of their continuity of use (Alcock 1989). The analysis of settlement size on the Tarhuna plateau provides important insights into site type and function. For example, an oilery comprises a large or very large farm building with large-scale press capacity, as defined by Mattingly (1985, 35–38; 1987b). In this survey, as noted above, the primary criterion for defining an oilery is the presence of a complex of farm buildings with at least five olive oil presses. Sites meeting this requirement vary considerably, covering between 0.5 and 2.8 ha in area. Some oileries were also equipped with signs of luxury facilities (porticoes, mosaics and bath suites) or other features reflecting a wealthy lifestyle.

Most rural sites in the Wadis Turgut and Doga range between 0.015 and 2.8 ha (excluding agricultural villages) and are marked by the presence of architectural material including buildings, walls, cisterns, kilns and dense spreads of pottery and tile fragments scattered on the surface. It should be noted here that enclosed or attached lands were not included in site measurements. The smallest sites have been divided into two groups: those less than 0.05 ha and those between 0.05 and 0.1 ha, accounting for 13 and 4 of the 98 sites of known size respectively (Figure 3.2). In most cases, these represent types of structures which are sometimes encountered as sub-elements of larger sites, e.g. pottery kilns, bath buildings, watchtowers and mausolea (with the exception of the mausoleum of Gasr Doga (DOG72)

which is of larger size). These site types were characterised by non-agricultural functions but still played a role in the settlement pattern and socio-economic life of rural society.

A third group comprises 41 sites measuring between 0.1 and 0.5 ha. Fortified farmhouses (*gsur*) make up an important proportion of these compact farms, with 18 belonging to this type. In most cases, these were Type 2 hilltop *gsur* rather than those established on top of earlier open farm sites (Type 1) (see Section 2.6.5). The second main type within this group were small farm buildings, accounting for 15 sites. Small farms are often located in areas with good agricultural and water-catchment potential, such as on gentle slopes and at the foot of hills, preferably facing east or west, close to the wadi courses. Five large farm sites (defined by the presence of three or four presses), one oilery, a mausoleum (Gasr Doga, DOG72), and a watchtower also fit within this size.

Sites that occupy an area between 0.5 and 1 ha account for 24 of the 98 sites of known size. The sites of this category all had a clear agricultural function and included seven small farms, six large farms, six *gsur* (mainly Type 2, i.e. established on earlier open farms) and five oileries. Thirteen sites occupy areas between 1 and 2 ha, divided between two types: seven oileries and six large farms. Except for the site of Senam Semana (TUT54), which was situated below 150 m asl, most of the oileries and large farms from this group fall close to between 275 and 300m asl, often situated in elevated positions looking out over pieces of arable land, on the top of small plateaus or on terraces above valleys. These sites tend to be highly visible in the landscape as an expression of economic and social status, as well as architectural pretension. Finally, three rural sites comprised particularly large scatters, 2.1–2.85 ha in size. These were oilery-villa or large farm-villa sites, two of which, Henschir Assalha (TUT15) and Sidi Eysawi (TUT53), were associated with pottery kilns. All of these sites were characterised by oil production facilities and represent the maximum size of rural settlements in the category below nucleated villages and small towns. All of the oilery and large farm sites in the surveyed wadis of the Gebel Tarhuna fell between 0.4 and 2.85 ha in size (Tables 3.1–3.2). Large farms were identified by evidence of three or four presses attached to a large building, often with storage rooms, and were associated with very dense scatters of amphorae, *dolia* and coarseware sherds and a lesser density of imported finewares. Sometimes pottery and tile kilns can be identified close to these productive sites. Oileries were similar, but with five or more presses. On the basis of the survey evidence, the majority of the oileries and large farms of the Gebel Tarhuna were undoubtedly productive units amassing large-scale surpluses of olive oil for export (Mattingly 1985, 31–38; 1987b, 56; 1988c, 25–27; 1989a, 144–145; Oates 1953, 87). Amphora kilns established within or adjacent to a number of farms also clearly attest to the density of specialised cultivation and oil production on these estates, indicating that the intensive agricultural economy was not only aimed at the production of a surplus destined for wider markets, but was capable of providing suitable containers for distribution (see Chapter 5).

3.2.2 Site types

Thanks to the high level of site preservation characterising most of the farming sites on the Tarhuna plateau, very important information can be obtained through studying the details of the buildings. In particular, a detailed typology of the plans of rural sites of the Roman period in this region can be attempted from the surface remains (see also Section 2.6). Agricultural villages, open and fortified farms and water management works formed a key part of agricultural intensification and specialisation in the Roman period, especially in the early imperial period (first and second centuries AD). The dense distribution of sites with indicators of agricultural specialisation (especially olive presses) has been taken as evidence for the intensification of agriculture in response to market demand (Mattingly 1987b; 1988a; 1988c; 1995).

The variability in size and the evidence concerning the scale of agricultural production associated with each site type help shed light on the organisation of these rural settlements. The description of settlement types is, in itself, a big order. However, as there is already a small amount of published data concerning the different kinds of sites in the Tarhuna region, I shall focus my initial discussion on sites not yet- or not well-reported. As the examination has focused on rural settlements, it is important to submit here the types of rural sites which I will discuss throughout this chapter and to clarify their terminology. The validity of the different groups of rural settlements which have been chosen and used in the quantitative analyses are reinforced by comparisons with a number of other recent rural settlement studies in Roman North Africa, in particular the UNESCO Libyan Valleys Survey and the Kasserine Archaeological Survey (Barker *et al.* 1996; Hitchner 1988; 1989; Hitchner *et al.* 1990).

3.2.3 Villas

Although many oilery and large farm sites give the impression that they functioned as rural agricultural production centres, there is a problematic issue concerning the use of the term 'villa' to describe these rural sites: while it remains a critical term, it is difficult to define accurately (Smith 1997). The problem is related to the definition and description of *villae* in the literary sources. The most important conclusion derived from the literary evidence is the absence of a particular meaning for the term (Marzano 2007). It is a Latin word which can mean a farm or a rural residence (Mulvin 2002). Varro

suggests that it can be a building in the countryside or in a suburban area and had an agricultural purpose, or a complex of buildings located in the heart of a working farm (*De re rustica*, 3.2.3–6, 6–12). The phenomenon of Italian luxury villas has strongly influenced the recent understanding of the term (Dyson 2003). Gandini clearly emphasises this terminological problem and proposes the following definition: "architecturally, it should be seen as the most complex rural settlement, bringing together a more or less comfortable residential part and a building part involved in agricultural activity which is clearly distinct from the first" (Gandini 1999, xx). It can be suggested that villas appeared more often in two main types of areas: one, regions characterised by a coincidence of favourable factors such as fertility, climate and good water supply, and two, locations close to transport routes, linking estates with cities for trade and exchange commodities. The villa is a representative sign reflecting a form of economic organisation centred on the rural estate. In economic terms, the Roman rural villa functioned as a centre of organisation performing management of the property and played a central role in co-ordinating its production to supply urban centres and market needs.

Recent archaeological surveys conducted in rural areas of North Africa have highlighted several types of agricultural sites, including villas. For instance, the Kasserine Survey identified five types of agricultural settlements in the Tunisian high steppe, ranking from *agrovilles* to small structures. Sites typified as villas occupied the second class in the settlement hierarchy after *agrovilles*. Hitchner has described the Kasserine's villas as large centres of agricultural exploitation comprising numerous buildings (Hitchner 1989). The focus on agricultural activities, in particular olive cultivation, at the rural settlements in the Kasserine region led Hitchner to conclude that the market potential of olive oil in the Roman period had encouraged the development of a hierarchical settlement system (Hitchner 1988; 1989; Hitchner *et al.* 1990). He also suggested that the villas functioned as centres of rural estates, which comprised a number of dependent residences and buildings (Hitchner *et al.* 1990; 1995). Villas of the Kasserine region were large centres of agricultural exploitation. Archaeologically, they comprised numerous constructions, including monumental ashlar buildings containing multiple presses, storage facilities and other rooms, such as at Henschir el Guellali and Henschir et Touil. Farms were distinguished from villas by the absence of monumental buildings and on the basis that they usually only contained one or two presses (Hitchner 1989, 392–394).

The archaeological survey conducted by an Italian-Libyan team around the Roman Villa Silin marked the first systematic topographic study of this hinterland strip near Lepcis Magna (Munzi *et al.* 2004, 11). The survey evidence from the Silin survey demonstrates substantial development in the countryside in the vicinity of Lepcis Magna, with a settlement hierarchy dominated by rural villas and farms. The early Roman period (first and second centuries AD) represented the peak period for rural villas and farms in the region around the Villa Silin (Munzi et al. 2004, 19–24).

The earliest appearance of rural villas and farms was in the second century BC, while the maximum expansion of villas and olive oil farms occurred between the first and second centuries AD (Table 3.3). Both villas and farms of the Silin area were marked by *opus africanum* construction and equipped with one or more oil presses, but the villas were additionally defined by the existence of decorative elements such as painted walls, mosaic floors and slabs of marble (Munzi *et al.* 2004, 26). Parallels with the typology of the Kasserine Survey are evident, although it is not possible to make more explicit comparisons owing to the extensive nature of the Silin project and the brevity of its single published report. Nevertheless, the high density of rural settlements in the early Roman period and the distinct hierarchy indicate their integration into a regional agricultural economy which was based mainly on the cultivation of olive oil and controlled by the Lepcitanian elite.

By way of contrast, De Vos, who directed an intensive topographical and archaeological reconnaissance in the vicinity of Dougga (ancient *Thugga*) in northern Tunisia between 1994 and 1999, avoids using the term 'villa' in her terminologies. She prefers to define rural sites as farms instead of villas because of the confusing multiple meanings of the term derived from literary sources. Villas could be rural or urban, suburban or seaside residences of *otium* or even a combination of these categories, ranging widely from overwhelmingly luxurious country homes to urban houses. Moreover, according to De Vos, the villa was transformed in the course of Roman history (e.g. the *villa* of Cato was different from that described by Varro, Cicero, Columella and Pliny), and varied according to geographical, climatic and cultural factors (De Vos 2000, 21).

Most of our previous knowledge of rural building types located in the Gebel Tarhuna depends on evidence derived from their archaeological remains. The greater majority of these rural structures can be described as utilitarian buildings (Mattingly 1985; 1995; Oates 1953; 1954; Percival 1976). However, fashions in interpreting the significance of settlement data have changed considerably in recent decades, with the emergence of refined chronological evidence and the identification of new categories of sites. There has also been an increase in our knowledge of the archaeology and settlement patterns of the Gebel Tarhuna since Cowper's day. Parallels for the types of sites represented on the Tarhuna plateau can be found in other recent rural surveys in Roman North Africa (Barker *et al.* 1996; Carlsen and Tvarnø 1989; De Vos 2007; Rebuffat 1988). Consequently, new

conclusions concerning settlement patterns and economic activity in this region can be drawn from analysis of the material.

A peculiarity of the Gebel Tarhuna rural sites is the evidence for luxurious amenities: 12 out of 34 oilery and large farm sites within the area of the Wadis Turgut and Doga have produced surface evidence for luxury elements such as columns, mosaics, wall-paintings and bath buildings. Although these features are well-represented in the maritime villas of Tripolitania such as the Villa Dar Buk Ammara, the Villa Silin, and Taggiura (Aurigemma 1926; Blázquez Martínez *et al.* 1990; Di Vita 1995), the Gebel Tarhuna 'villas' have previously been described as utilitarian, with luxury villas seen as something rare and exceptional in this hinterland (Percival 1976). Few of the olive farms planned by Oates in eastern Tarhuna give an impression of having had luxury remains. However, he did mention the existence of porticoes and bath-houses at Henschir Sidi Hamdan, noting that "on the south-east side a scatter of mosaic tesserae near the east corner may indicate the presence of a small bath-house just here; the tesserae are of the four common colours of black, white, brick-red, and yellowish-buff" (Oates 1953, 99).

Closer examination or excavation of other sites now provides additional examples. For instance, the site of Senam Halafi 1 (DUN129), south of Gasr Ed-Dauun (*Subututtu*) in the Fergian area (c. 3 km northwest of Henschir Sidi Hamdan), provides insight into how some of these sites were very carefully designed to meet both particular agricultural needs and to provide comfortable and status-enhancing residential accommodation for elite owners (Figure 3.3). The site occupies about 1 ha and is today still covered by a huge amount of ashlar stones, orthostats and columns drums. The columns seem to have formed a portico or colonnade which ran along the eastern side of the building where a column is still standing *in situ* (Figure 3.4). Many mosaic tesserae of different colours mixed with large and small pieces of mortar bedding are scattered on the northern side very close to a large cistern, surrounded by a dense spread of potsherds and fragments of tile indicating the location of a bath-suite. Although it can be hard to distinguish a building which was luxurious from surface survey alone, this type of evidence clearly indicates a greater level of wealth invested in accommodation on rural estates than the previous records in the Fergian area have indicated. There are important implications from this for our interpretation of the oilery-villas with regards to the elite class.

The key problem in our understanding of the villas of the Gebel Tarhuna is the general absence of excavations which provide detailed information about their main buildings and other facilities, as well as the true scale of production carried out in them. However, a point to stress here is that the villas of the Tarhuna plateau were rural buildings with clear signs of Roman influence. This influence appeared in their architectural design and in their exploitation of building materials. Features that indicate the presence of a *pars urbana* include mosaics, baths, hypocaust installations, porticoes and wall-paintings. Using these indicators, 12 oilery and large farm sites from the TAS survey can be typified as villas. This interpretation only emerged through the recording of the archaeological surface evidence. The expansion of systematic archaeological survey and excavations into other districts of the Gebel Tarhuna will certainly increase the number of sites in this category.

3.2.4 Agricultural villages

The substantial body of farming sites provides an excellent and datable record of rural agricultural production in the Roman imperial period. The quantity and density of these sites recorded in the Gebel Tarhuna reveal the fundamental role that olive oil production played in the Tripolitanian economy during the Roman period. Without doubt, the scale and number of presses found at many sites show that they were the centres of large estates with a high level of surplus production. Although the Gebel Tarhuna landscape was dominated in antiquity by different types and sizes of rural farm buildings, there were also a few settlements that can be classified as small agricultural villages. The TAS has identified three sites of this type: Ain Astail in the Wadi Turgut, Gasr Dehmesh in the Wadi Doga, and Halafi in the Fergian area (Figure 3.5).

These sites comprise different types of buildings which were linked together to establish a larger unitary settlement. In addition, they have some common characteristics. First, the archaeological evidence reveals that they were large production centres for both olive oil and amphorae. Second, since there were no towns in their vicinity, they were all located on or in very close to major transport routes in order to trade their products. Third, oilery buildings existed in all three villages. Fourth, in terms of architectural material, it is clear that similar building techniques were used within these agricultural villages.

Ain Astail (TUT17–21)

The small agricultural village of Ain Astail is located in the middle section of the Wadi Turgut and occupied an important position in the area. There were two significant factors in its location. First, the village was located at the meeting point of at least two important ancient tracks; one ran through the Wadi Turgut and linked the region around Gasr Ed-Dauun (*Subututtu*) in the south with the Gefara plain to the north, and the second united the higher plateau areas to the west and southwest, towards al-Khadra and Medina Doga (*Mesphe*, DOG75), with the Wadi Turgut via the Wadi Astail tributary. Second, without doubt, the village benefited from the natural spring of Ain Astail (200 m southwest) where the remains of a dam (TUT21) can still be seen in the tributary below the village (Figure 3.6).

The water from this spring was probably used extensively in the village, in particular for the bath building (TUT19) and pottery kilns (TUT18) constructed below the main farm building on the south and southeast slopes respectively. On the western flank of the village lay an oilery site with six presses (TUT20), overlooking the surrounding cultivated land. This was the largest structure in the village and some of the smaller buildings may have been satellites of this larger one, i.e. this may have been an estate centre village.

At the eastern extremity of the site a late Roman fortified farmhouse (TUT17) occupied the top of a small hill. This *gasr* was defended by a broad sub-rectangular ditch and is now in a ruined state, mostly reduced to its wall foundations with the exception of the north-eastern wall which still stands a few courses high. Within the structure itself, along the western wall, are the remains of a cistern that functioned as a small reservoir for the site. A notable feature is the quality of the *gasr* masonry, which employed smaller, semi-coursed blocks rather than the larger, carefully-coursed blocks that were used in *opus africanum* construction. Based on the surface ceramic evidence, this fortified hilltop site was certainly created in the late imperial period (Goodchild 1951; Oates 1954, 91–93).

Gasr Dehmesh (HAJ78–82)

In the Hajaj area, on the northern bank of a small tributary that runs northwest and flows into the main watercourse of the Wadi Doga, there are remains of another small agricultural village scattered over an area of c. 11 ha (Figures 3.7–3.8). Parts of the remains are well-preserved, such as the *gasr* which was established on top of a small hill on the east side of the village (HAJ79 = Cowper 1897, 237, Site 9, Kasr Gharaedamish). Other structures have suffered many disruptions: ploughing, reclamation of land and the building of new houses. For instance, it appears that there may have been a pottery kiln located at the bottom of the eastern slope next to the *gasr* but it is hard to make a clear identification from the surface evidence due to the site having been demolished by a bulldozer.

To the west of the *gasr* there is a group of buildings including a large farm-villa with four olive oil presses (HAJ81), a bath-house (HAJ80) and other enclosures. The bath-suite was probably revealed in trenches cut for the foundations of a new house. Further west and northwest, on an area of rocky relief, there are remains of an oilery with at least five presses (HAJ82). Although this side of the village has suffered a great deal of modern activity, which has damaged a large part of the surface material, the extension of subsidiary facilities can still be traced. It is worth pointing out that the village was watered by at least five rock-cut shaft-type cisterns (*majen*). The best-preserved example examined by the TAS team, measuring 1.2 x 1.5 x 4 m deep, had two subterranean storage tunnels dug facing each other on the east and west sides of the shaft (Figure 3.9). The eastern tunnel is the longest, measuring 16 x 3 x 2.5 m, in comparison with the western tunnel which was 11 x 3 x 2.5 m. In total, this *majen* had a capacity of c. 200 m^3, which is certainly less than many cisterns recorded in the pre-desert area (Reddé 1985; 1988); however, the village was able to keep over 1,000 m^3 in its five cisterns. This estimated figure could be increased if excavations uncover further buried cisterns.

Another noticeable feature is the remains of a small mausoleum (HAJ78) which was found c. 150 m away on the opposite side of the wadi. Unfortunately, all surface traces have been levelled by a bulldozer and looting operations. Nevertheless, the small subterranean funerary room is still visible, though completely robbed (Figure 3.10). It was dug in a hard clayey deposit and lined with fine ashlar blocks. Early Italian *sigillata* (Conspectus Form 4) and Eastern *sigillata* A (Form 43 = Hayes 1991a, Fig. 4, no. 30) sherds were collected at this site (Figure 3.11), indicating that the mausoleum probably belonged to the early first century AD (Fulford and Tomber 1994). As with Ain Astail, this appears to have been a village serving as an estate centre.

Halafi (DUN129 & DUN131)

Halafi is the only small agricultural village identified by the TAS in the southern Fergian area. It is located about 3 km southwest of Henschir Sidi Hamdan and sat at an important junction in the network of tracks, serving as a stopping point on the track from Gasr Ed-Dauun (*Subututtu*) in the north to the further interior zones such as the Wadi Taraglat-Caam (*Cinyps*) and the pre-desert (Figure 3.12). For transportation and communication, the Halafi village seems to have functioned as a collection point for olive oil in addition to being a centre for amphora production. During a reconnaissance survey in autumn 2007 I was fortunate to identify a large pottery production site with five or six kilns (Figure 3.13), unknown in the Fergian area with the exception of a kiln previously noted within the village at Gasr Ed-Dauun (*Subututtu*) (Mattingly 1995, 133; Oates 1953, 90). Although characterised by a high density of olive farming sites (Cowper 1897; Oates 1953; 1954; Mattingly 1985), there is no comparison between the Fergian area south of the Gebel road and the area from the Wadi Turgut northwards in terms of recorded amphora kilns.

Like Ain Astail and Gasr Dehmesh, there was a significant level of oil production here, with nine presses recorded (DUN129 & DUN131). The main difference at Halafi was the presence of an extraordinary central-aisled building (DUN131), measuring 50 x 30 m, close to the pottery kilns. This building was most likely related to the filling and storage of amphorae, suggesting that this village had a broader function in terms of handling oil surpluses from the Fergian region, rather than

simply being a self-contained estate centre. All of the sites mentioned so far can, to a greater or lesser extent, be identified both in their scales of production and in terms of their size, as small agricultural villages. These villages and the road stations or small towns discussed in Chapter 2 were located within the territory of Lepcis Magna, where they could have performed a significant function as local regional centres. They are considered the largest undefended settlements known in the Tarhuna plateau and considering their distance from the major coastal cities, they probably served as local regional markets and acted as gathering points for onward transportation of olive oil consignments from the many farms in their surrounding areas (Mattingly 1995, 133).

3.2.5 Oileries and large farms

Oileries occupy the second class in the settlement hierarchy of Roman-period rural sites on the Tarhuna plateau. As already noted in Chapter 2, the term 'oilery' is reserved for sites which were clearly substantial oil 'factories'. This classification is based on the number of identified presses at each site, with an oilery being defined as a farm containing five or more olive oil presses. The high degree of preservation of press elements at many sites makes the identification and counting of presses relatively easy. Many of them are still in much the same condition as they were when seen and described by Cowper during the 1890s (Figure 3.14). The majority of farming sites on the Tarhuna plateau employed the *opus africanum* technique in their construction.

There is no reason to consider the distribution of oileries in the Gebel Tarhuna as atypically dense in comparison to other regions of Tripolitania, and the limited survey of the Tarhuna region leaves the question of the total number there an open one.

The TAS recorded (or re-recorded) 16 oilery sites in the Wadis Turgut and Doga (Table 3.1). Although statistically the oileries constitute 29 % of the total number of open farming sites in these two wadis, their presses account for more than the half of the total number of presses in the same area (Table 3.4). Clearly the oilery farms were the largest olive oil production centres and were likely established within the largest agricultural estates in this area. It is worth noting that the Gebel Tarhuna certainly contained more oilery sites, in addition to those recorded in the area of the Wadis Turgut and Doga by the TAS. Although the Tarhuna plateau has not been completely surveyed and it is difficult to estimate the total number of oileries, previous works (especially those of Cowper and Oates) identified press complexes which may justifiably be described as oileries (Figure 3.15) (Cowper 1897, 254–290; Oates 1953, 89–110). The majority of oilery sites were concentrated in the eastern part of the Gebel Tarhuna, a point already apparent from Cowper's work. He recorded only one site containing five or more presses in the western section of the plateau during his travels to the Gebel Gharian (Cowper 1897, 276, Site 52, Senam el-Megagerah). This concentration may indicate that the most intensive exploitation of the Gebel Tarhuna lands was linked to the territory of Lepcis Magna rather than the territory of Oea, though it certainly extended into the western Gebel Tarhuna.

In terms of the number of presses at each site, it is necessary to take into account that many of the other farming sites, in particular sites identified as large farms, could also have been oileries. Because identification of type was based only on the visible surface evidence, there is a likelihood that further presses have either disappeared underneath rubble and soil, especially when sites are close to wadi-beds, or have been removed and reused in later constructions. It must, however, be remarked that in Cowper's day, most sites on the Tarhuna plateau were characterised by good visibility above the ground surface. This has changed somewhat as a result of subsequent development, starting in the Italian colonial period (Oates 1953, 85). As Oates pointed out, the highly developed Italian settlement of the Tarhuna plateau during the colonial period wiped out many ancient sites (Oates 1953, 110). For example, as Oates described:

> Farms comparable in size to Sidi Hamdan did exist nearer the road, but are usually too badly damaged for direct comparison of their layout. Henschir el-Mohammed in Wadi Gsea, of which Cowper published a description and a rudimentary plan, has been reduced by Italian quarrying to a barren hummock with two standing presses and a few battered blocks (Oates 1953, 101).

Sites demolished or quarried during the Italian colonial period were also witnessed by Goodchild during his investigation of the Sanctuary of Ammon at Ras el-Haddagia (al-Khadra) during 1947: "The inscription, rediscovered by Aurigemma and Beguinot in 1911, was transported to Tripoli Museum…and the site of the discovery was soon forgotten, so much so that in 1935 the contractors who built Breviglieri village-centre quarried much of their stone from the ancient walls" (Goodchild 1976, 79).

The oileries vary in their layout and size from one site to another; they are also differentiated by the numbers of presses identified, though the scale and layout of most presses suggest that they served the same purposes and employed the same facilities. They appear to have been built as central facilities on large estates from which their products were transported to the major urban centres for marketing and export. A principal characteristic in some of the oilery sites examined by the TAS in the Wadis Turgut and Doga was additional signs of luxury, suggesting elite occupation (at least periodically). A total of eight of the sixteen oileries identified in the Wadis

Turgut and Doga can thus be classified as oilery-villas (Table 3.5).

Oilery-villas are characterised by a number of luxurious elements (e.g. mosaics, bath-suites, porticoes and wall-paintings) which distinguish them from other, more utilitarian oileries. Although the countryside is considered primarily as a place of agricultural production, the principles of luxury in the Roman period were applied not only to coastal villas in the vicinity of Lepcis Magna (Fontana *et al.* 1996), but also expanded to the productive lands of the Gebel Tarhuna. This seems to have occurred in parallel with the extension of intensive olive oil production from the coastal plain into the Gebel. This development may have gathered pace with the construction of the road that linked Lepcis Magna with the Gebel Tarhuna in AD 15/16 (Mattingly 1995, 140).

These oilery-villas indicate that there was both large-scale investment in productive facilities and lavish spending on materials displaying the wealth and prestige of the urban elite outside their towns (Mattingly 1988c, 27; 1995, 141). The oilery-villas were largely associated with the main wadi valleys on the northern flank of the Gebel Tarhuna, on the shortest routes down to the coastal road and the major coastal cities. Mattingly argued that some of the coastal luxury villas were also located on estates and potentially related to an area of intense agricultural activity (Figure 3.16) (Mattingly 1995, 141). Indeed, the recent archaeological survey in the Silin area has confirmed Mattingly's argument: several oil pressing elements have been recorded in the vicinity of a number of luxury villas (Munzi *et al.* 2004). For instance, the excavation carried out in 1996–1997 by the Department of Antiquities of Lepcis Magna at ez-Zeita (Wadi Zennad, c. 3 km southwest of Lepcis Magna), and the co-operative Italian-Libyan work on the recording and planning of the settlement complex near the Wadi al-Fani (c. 3.5 km west of Lepcis Magna) indicate that these villas were also highly involved in oil production and in the region's successful olive oil economy (Ben Rabha and Masturzo 1997; El-Nemsi 1997). Although the oilery-villas of the Gebel Tarhuna were located further inland, their position close to the main wadis offered them favourable ways to communicate with the coastal villas and cities. Most of these oilery-villas looked out towards the Mediterranean coast and the most northerly oilery-villa (TUT54, Senam Semana) is only about 15 km from the sea.

From the early Roman period this part of the Tarhuna plateau had been intensively and efficiently developed. The Turgut and Doga valleys and their surrounding lands, located between mountains and hills, were probably the most fertile olive-cultivation areas in the whole of the Gebel. As a result, wealthy *Libyphoenices* had their estates in this region. As Mattingly wrote, "Much of the best agricultural land in the region [of Tripolitania] is in fact to be found in the foothills and on the plateaux of the Gebel" (Mattingly 1995, 140). Thus, this part of the Gebel Tarhuna became more agriculturally important once Lepcis Magna came to dominate the region. This is clearly stated by Mattingly:

> We know that by the Early Principate, Lepcis Magna and Oea had carved up the best olive growing lands of the Gebel Msellata and Tarhuna between them, with Lepcis certainly controlling the better share… It is clear that the higher quality of Lepcis' territory and its closer proximity to the coast will have given her considerable advantages in developing it (Mattingly 1988c, 23–24).

The location of most of the utilitarian oileries and oilery-villas in the zone can be assigned to the territory of Lepcis, offering further confirmation of this suggestion.

It is suggested here that the eastern and north-eastern zone of the Tarhuna plateau was inextricably linked to the properties of the Lepcitanians. It is also possible that some estates were developed and owned by local Libyan residents who were able to pursue independent relations with the urban centres. For example, 'NKSF (or TKSF) son of Shasidwasan (or Shasidwasat) son of Namrar (or Tamrar) of the sons of Masinkaw' built the Ammonium of Ras el-Haddagia (al-Khadra) in AD 16/17 at his own expense (Levi Della Vida 1951).

Nonetheless, scholars have taken the absence of large numbers of mausolea in the Gebel Tarhuna as an indicator that the majority of the most substantial estates were owned by wealthy urban citizens (Mattingly 1985; 1987a; 1995; Oates 1953). For instance, one can cite the case of Aemilia Pudentilla, the Oean woman who married Apuleius; she had large country estates and invested her fortune in land, houses, animals and slaves (Apuleius, *Apology*, 44.6, 71.6; Mattingly 1995, 143). Apuleius stated that many of the Oean elite possessed multiple estates during his time, distributed throughout Oea's territory and managed on their behalf by bailiffs or slaves. With regards to the wealth of Aemilia Pudentilla, Mattingly believes that she was not the only millionaire at Oea and that the aristocratic elite at Lepcis Magna were even wealthier (Mattingly 1995, 143). This point is supported by the higher density of oileries in the territory of Lepcis. The investment in these oileries and large farms, constructed in ashlar masonry with large-scale press facilities, is undoubtedly equivalent to conspicuous consumption of profit on site. However, the utilitarian character of the majority of the farming sites suggests that their owners did not reside on their estates.

3.2.6 Layout of the presses

During the early imperial period, the distribution of oilery sites reveals a dense cluster in the north-eastern part of the Tarhuna plateau, especially in the Wadi Turgut (Figure 3.16), the character of which suggests

a high potential output of olive oil. Despite the lack of epigraphic and literary records on land exploitation in the Gebel under Roman rule, the area seems to have been largely dominated by oileries and large farms (Mattingly 1996b). The organisation of the oileries and large farms reflects the nature of the economic exploitation of the region and the important role that they played in sustaining the development of the coastal cities and luxury coastal villas. Of particular note are the linear arrangements of the pressing facilities and the use of architectural elements such as finely-dressed masonry, square pillars, cylindrical columns and *opus signinum* floors, reflecting both a high level of investment on the part of the owners and the fact that this was targeted to achieve a large scale of production and income.

The vast majority of oileries investigated in the Gebel Tarhuna were similar to the large farms; both types were usually dominated by a monumental ashlar courtyard building with attached press facilities, associated cisterns and sometimes, pottery kilns. The range of potsherds at these sites included imported finewares (mainly Italian *sigillata* and ARS), local amphorae and local coarsewares. Sometimes the presses were located on one side of the building only, but in most cases they stood on two or more sides. Sites such as Sidi Buagela 2 (TUT12) and Senam Semana (TUT54) are examples of oileries with a linear arrangement of presses. At Sidi Buagela 2 (TUT12), there is a continuous arrangement of eight presses occupying the west side of the main oilery-villa building (Figure 3.17). This is quite similar to the arrangement at the oilery site of Henschir el-Begar 2 in Tunisia (Figure 3.18), which can be positively identified as the centre of a senatorial estate called *Saltus Beguensis* located to the north of Kasserine (*Cillium*) in the Tunisian high steppe (Sehili 2008). At Senam Semana (TUT54) a total of 17 olive presses form a nearly north–south running row, 73 m in length (Figure 3.19). The orthostats of some of the presses still stand up to 2.6 m high (below the lintels), indicating a potentially massive height for the beam operation (see Chapter 4). Opposite the line of presses were two rows of square columns (0.5 x 0.58 x 3 m high) separated by a long corridor, 3.2 m wide. Each row originally seems to have contained 17 columns, of which 12 in the western row and 14 in the eastern row are still visible at varying heights. A capital of trapezium shape appears to have been set on the top of each column to support the roof (Figure 3.20). Again, the total number of 17 presses and the other architectural elements employed in the site reveal the high level of investment required by the owner to build and maintain such a huge oilery-villa.

Although they served similar purposes and used the same building materials, the other utilitarian oileries and oilery-villas examined present a different distribution, the presses generally being arranged along two or more sides of the structure (e.g. Henschir es-Senam (TUT38), Figure 3.21). The majority of oileries of the Tarhuna plateau had rooms and storage areas of various sizes surrounding different sizes of courtyards. Their plans reflect traditional rural building styles influenced by a functional requirement, in order to provide higher productive potential. The same diversity of plan has been recognised in the large farms, for example the large farm-villa of Sidi Eysawi (TUT53, Figure 3.22). This site can be classified as a rural working villa with three olive oil presses (though it could potentially have had five or more presses originally and would thus have been an oilery-villa). It was similar to the coastal villas in its elements of architectural decoration and design. Here, both the luxurious aspects and the farming establishment were incorporated into the architectural layout, representing a continuation of the urban lifestyle in a rural place. The accommodation appears to have been in the eastern part of the building, comprising a number of rooms arranged behind a portico. Its roof was probably supported by eight large columns; some of their bases are still *in situ* (Figure 3.23).

3.2.7 Small farms

Small farms almost always began as open farms, though many of them became fortified during the late third and fourth centuries AD. They are differentiated from oileries and large farms by the fact that they had, at most, one or two presses, normally attached to courtyard buildings (Figure 3.24). In the absence of any epigraphic or literary records, a main problem is identifying what kind of relationship existed between these small farms and the oileries and large farms. Can they be seen as isolated and independent farms? Or were they in some form of dependent relationship with the other, larger farms? In terms of property, while the oileries and large farms belonged to the coastal urban elite such as Aemilia Pudentilla, the small farms could either have been attached to the larger farms and owned by the same large landowners, or they could have belonged to a group of less wealthy, independent farmers who looked to make their fortunes through exploitation of the land. These farmers were the sort of people described in Roman African inscriptions as *agricola bonus* or *diligens agricola* (Stone 1997). One of these was an initially landless reaper from Mactar, who after acquiring a piece of land and increasing his holdings, made a considerable fortune and obtained a high social position (*CIL* 8.11814).

A further step in understanding the relationship between the small farms and the oileries and large farms can be achieved by detailed analysis of their relative distribution within the surveyed region (see Figure 2.14). Some small farms, especially in the northern part, were most likely managed and operated by the nearby oileries or large farms. It can be argued that the oileries and large farms functioned as central estates which were probably owned by the elite families of the

coastal cities. It is possible that small farms in close proximity to the larger facilities formed component parts of a villa estate; equally some villa owners may have held several agricultural estates, on only one of which they built a villa residence.

Thus, in the middle of the Wadi Turgut, for example, it seems likely that the small farms TUT39 and TUT41 were operated by the owners of the oilery-villa of Henschir es-Senam (TUT38), because they are all located within a few hundred metres of each other (Figure 3.25). The location of many small farms in close proximity to larger ones raises the possibility that agricultural settlement of the Gebel Tarhuna was largely based around large estates which centred on oileries and large farms, but also involved smaller dependent farms, perhaps leased to tenants.

In the southern and south-western parts of the surveyed area, on the northeast side of the Tarhuna plateau, some of the small farms appear to have been more isolated and it is possible that these sites did not belong to an oilery or a large farm. Small farms have been noted in a number of locations without any evidence for an oilery or large farm nearby. This may be a case of independent farmers who cultivated small pieces of land and produced olive oil for their own consumption and the local market. The architecture and investment in presses at these sites suggests above-subsistence level production and engagement in the Roman market economy (and perhaps the emergence of a rural elite). However, this hypothesis is difficult to prove archaeologically, considering the lack of epigraphic or literary evidence. For instance, we lack any explicit references to the periodic rural markets (*nundinae*) which normally occurred in other parts of Roman Africa (Shaw 1981).

As in the case of oileries and large farms, most of the small farms of the Gebel Tarhuna were built in the *opus africanum* style and characterised during the early imperial period by the absence of formal defences that dominated the later Roman-period farming sites on the plateau: they mainly had concrete walls, sometimes faced with small coursed blocks, and supported at intervals of 2–3 m by dressed limestone orthostats (Oates 1953). An analysis of small farm plans (Figure 3.24) indicates that they generally had a small number of rooms (c. 8–12) and pressing facilities arranged around a small courtyard and that they were rarely associated with luxurious elements. Only one small farm is known to have had a bath-suite; at Henschir Aulad Ali (DOG105), this was established on the southern slope, 25 m below the farm building.The construction of this type of farming site has been attested in a vast geographical area extending from the coast to the pre-desert zone. In the Silin area, the majority of identified farms could be typified as small farms with one press, compared to only four farms equipped with two presses (Munzi *et al.* 2004, Sites 4, 19, 60, 61). A total of 15 rich farm-villas in the Silin area exhibited luxury markers, including wall-paintings, mosaic floors and slabs of marble (Munzi *et al.* 2004, 13, 26). Sites with olive presses have also been recorded in the Tripolitanian pre-desert where they are considered as "the most obvious archaeological feature attesting a specific agricultural activity" (Mattingly 1985, xx). These small farms occupied the top of the settlement hierarchy of the pre-desert area; principally, they began in the first and second centuries AD as undefended sites, often of *opus africanum* construction, before being increasingly replaced from the third century AD onwards by fortified farms (*gsur*) (Mattingly and Flower 1996, 168). The archaeological remains and pottery sherds, together with the wadi farming systems, demonstrate how agricultural production, especially of olive oil, developed economically in the early centuries AD, despite this being a marginal zone (Barker *et al.* 1996; Mattingly 1985; 1995). Their importance as upper-echelon sites in the rural settlement hierarchy is emphasised by their association with mausolea (Mattingly and Dore 1996). Mattingly believes that the pattern of pre-desert settlement was also based on estates holding large pieces of land, rather than a widespread network of small individual free-holdings (Mattingly and Flower 1996, 178). In view of the fact that the small farms of the pre-desert seen to have functioned as centres of independent estates, we could accept that at least some of the Gebel farms were also probably independently owned and not all controlled by bigger estates.

3.2.8 Associated mausolea and other tombs

There are few recorded mausolea in the Gebel Tarhuna in comparison with the number of known farming sites and considerably fewer farming sites actually associated with mausolea (Oates 1953). In comparison, further to the south in the pre-desert area, the region was dominated by elite farms which were very often associated with mausolea; more than 70 mausolea have been recorded in that area (Mattingly and Dore 1996). A total of only eight mausolea were recorded on the Tarhuna plateau (Figure 3.26), including three recorded by Oates in the early 1950s (Oates 1953, 104–105). With the notable exception of the massive mausoleum of Gasr Doga (DOG72), the other seven known mausolea of the Tarhuna plateau are of small or medium size and lesser architectural decoration. The largest of the three mausolea described by Oates in the Ed-Dauun-Gsea area measured 3.4 x 3.1 m, with a podium 1.5 m high. He considered them as an exceptional mode of burial (Oates 1953, 104–105).

One mausoleum examined by the TAS known as es-Sonama (TEL91, 4.5 km north of Ain Scersciara (*Cercar?*) and 7 km northwest of Gasr Doga (DOG72)) was located in the vicinity of a small farm (TEL95). At its foundation it measured 2.5 x 3 m, with two surviving courses of finely-dressed limestone blocks standing

c. 2 m high above a 0.75 m high podium. Judging from the collapsed architectural elements, it appears to have been carefully decorated, with angle pilasters surmounted by Corinthian capitals and a frieze at each corner (Figure 3.27).

The archaeological evidence shows that mausolea were not the only impressive burial type employed on the Tarhuna plateau; two hypogeal (subterranean) tombs have recently been discovered at Zwitina and Wadi es-Sri. The ceramic evidence found in these tombs reveals that they can be dated to the second century AD (Faraj *et al.* 1997).

Another eleven hypogeal tombs were discovered in the Gebel Tarhuna during the 1970s and 1980s (Appendix C). Their finds indicate the predominance of the cremation rite. Tombs of the eastern sector of the Tarhuna plateau seem to be earlier than those on the western plateau. Only one tomb of the five in the el-Zagadna and Sidi Asid areas has been dated to the first half of the first century AD; the others are dated to the fourth and fifth centuries AD. The tombs of eastern Tarhuna are dated to between the beginning of the first and the end of the third centuries AD.

3.3 Settlement construction and organisation

The large amounts of data collected by the TAS relating to the organisation of rural production and the Tripolitanian economy add important information to what can be gleaned from literary sources, such as the links between the urban and rural areas, specialist crafts production and the local settlement hierarchy. Previous studies of Roman Tripolitania have not addressed whether or not the high level of standardisation in the manufacture of pressing paraphernalia involved specialist craftsmen. The evidence from the Tarhuna plateau suggests that the construction of presses and other press and mill elements were created or overseen by trained specialists who possessed detailed knowledge of measurements and function (see Section 4.4). Based on the currently available evidence, it is difficult to determine whether these press and mill suppliers dwelled in the major cities and brought pre-fabricated elements to the countryside, or whether there were specialised outfits based permanently in rural areas or in small towns or villages on the main roads of the Gebel hinterland. The areas closest to Lepcis Magna and to the coastal maritime villas may have been supplied by urban-based units utilising the two main communication routes: the coastal road and the Gebel road (Goodchild 1976). However, further into the Gebel, it is likely that subsidiary workshops were established, perhaps based on some of the larger estates or in the small towns along the road, with specialist craftsmen who were able to fashion standardised stone press elements, timber beams, mills and their wood and metal fittings, pulleys and ropes, baskets, tanks and vats. The evidence for the quarrying of stone orthostats at some sites suggests that where possible, stone elements were produced on site to limit transport problems. It is likely that the workshops supplying the skilled personnel for this task and for the manufacture of other elements for the presses and mills were based close by.

The impressive level of olive oil production in Roman Tripolitania raises the question whether the development of the Libyphoenician-Roman urban centres engendered growth in the economy beyond their own consumption needs. The evident investment in specialised production, the scale of the oilery facilities, and the evidence for amphora production all support the view that production went far beyond regional market requirements. This appears to be a case of growth well beyond the expected demographic trend in the region. It is thus a clear example of genuine economic growth in this region of the Roman Empire, probably dated primarily to the early centuries AD. Economic growth on this scale has implications for the size and organisation of the labour force, both in agriculture and manufacturing, and must have entailed a substantial investment of capital (Hopkins 1995; Kehoe 2007). To what extent did the exploitation of the countryside reflect the wealth of the urban elite? It can be suggested that the surplus agricultural production, especially of olive oil, played a significant role in the wealth of the urban elite (Mattingly 1995). Through the early Roman imperial period, agriculture dominated the economy and characterised the imperial system. For the urban elite, land represented a resource providing not only income but also protection from unexpected risks, in addition to supporting their social and political position (Kehoe 1997). The main risk facing agriculture came from the irregularity of rainfall. However, both large landowners and small farmers were dependent for their livelihoods on agricultural production. Thus, they made efforts to conserve rainwater and land fertility by creating water management systems based on dams, wadi walls and cisterns. In addition, even though olives were the main crop, in order to reduce risk, they might have practised polyculture, that is, mixed plantations of olive trees, vines, vegetables and cereals which were harvested in different seasons (Kehoe 2007, 551). The engagement of the urban elite in rural production was most likely reflected in the employment of a large number of people from both urban and rural communities, and also affected investment in the development of new technologies that might have increased productivity. Settlement sites of the Roman period were widely distributed in the landscape. The archaeological evidence reveals that this landscape was mainly engaged in the production of olive oil. However, the raising of livestock was also of great importance to rural economies in antiquity and this issue needs consideration in relation to the TAS evidence. There were often close

associations between animal husbandry and more specialised cultivation in rural communities; exchange of produce or labour was commonly practised in rural societies between farmers engaged in agriculture and people who practised animal husbandry (Whittaker 1988). The natural environmental conditions of the Mediterranean lands played a central role in defining the relationship between traditional transhumance and the regional agricultural and arboricultural specialisation (Halstead 1987, 78). At this stage of investigation, it is difficult to judge whether the Gebel Tarhuna had the same traditional transhumance pattern observed in the northern Mediterranean of travelling between lowland grazing areas in the winter and highland pastures in the summer (Frayn 1984). However, the proximity of the pre-desert zone to the south of the Gebel is a factor that has supported the idea of seasonal transhumance within this region in the past (Mattingly 1995, 37–38).

Agricultural production and land use were integrally related to the traditional nucleated pattern of farming sites that clustered near the best arable lands for intensive farming (Keller and Rupp 1983). There are good reasons why sedentary farmers and pastoral groups have commonly enjoyed symbiotic relationships. Production at rural sites was considerably dependent on working animals, whether for ploughing or carrying equipment, workers and products, especially in the case of large estates involved in large-scale surplus production (Foxhall 1990). Furthermore, the use of animals for a wide range of key functions will have had wider implications for estate management, productivity and costs. Specialised estates would have needed extra labour and animals at certain times of the year and draught animals lost through death, injury or illness would have needed regular replacement. Manuring of orchards and fields could also be achieved through the seasonal grazing of flocks and herds that were located elsewhere for much of the year. Finally, agricultural products could be traded by the estates for meat and other animal products from the pastoralists, meeting subsistence needs on either side. All of these factors point to close and positive relations between sedentary farmers and pastoralists.

3.3.1 Farming sites

Most of the utilitarian farming sites on the Tarhuna plateau seem to combine, in an integrated structure, the functional requirements of both a working farm and a residence for workers. This type of farm building is well represented in recorded examples (Cowper 1897, 254–293; Goodchild 1976, 88–93; Mattingly 1985, 34–38; Oates 1953, 89–110), though the layout of different farms varies considerably according to altitude, topographic location and the scale of agriculture practised within them. At many sites, occupation and activity is likely to have varied considerably across the year, peaking in the olive season when the pressing operation was entirely employed. Luxurious elements at some sites suggest that these farms were occupied, at least periodically, by their owners who ran them as central estates. The capital outlaid on the pressing facilities of the farms supports the idea that the owners of these were, in general, wealthy citizens, and it seems reasonable to suppose that their prosperity was mainly derived from the products of these rural farms.

What were the architectural traditions behind the design of these types of farm buildings and how did this rural architecture correspond to the productive purposes of these farms? Firstly, there were characteristic features in the design of the oileries and large farms, and indeed, also in some of the small farms. The Tripolitanian examples share certain features encountered in the rural architecture of Roman Africa more broadly. The arrangement of the courtyard, pressing rooms, storage areas and the use of *opus africanum* or *opus quadratum* construction are paralleled in many of the rural farming sites in other parts of *Africa Proconsularis* (De Vos 2000; 2007; Hitchner 1988; 1989; Hitchner *et al.* 1990). As seen at the farms TUT11, TUT38 (Henschir es-Senam), TUT52 (Henschir Sidi Madi) and DOG60 (Senam Aref), *opus quadratum* generally appears to have been used in the outer walls (Figures 3.28–3.29) while *opus africanum* was primarily used at these same sites in the partitions of pressing rooms. At the oilery-villa of Henschir Sidi Madi (TUT52), which had seven olive oil presses, there is evidence of fine ashlar masonry, *opus signinum*, a bath-suite and an arched gateway.

A second feature of the farming sites of the Gebel Tarhuna is their use of local limestone, quarried from nearby scarp-foot and hill-slope locations. Some quarrying sites were examined by the TAS, where several examples of unfinished limestone blocks left on the ground of the quarry were identified. At a quarry on the eastern slope facing the main course of the Wadi Turgut, c.130 m above a small farm building (TUT45), two unfinished olive press uprights and the base of a column which had probably been left from the last quarrying activity were observed (Figure 3.30).

The large farm-villa of Sidi Eysawi (TUT53) was built of limestone blocks cut from the immediate locality; the quarry is visible as a stepped rock face with traces of wedge marks still visible. Another interesting feature at this site is a number of rectangular blocks marked with symbols which are most likely Neo-Punic letters, possibly engraved by the quarry workmen (Figure 3.31).

In the Wadi Guman, another quarry (GUM85) was identified on the edge of a hill, just 100 m southwest of a villa with a mosaic and bath (GUM87, Ain Guman). Two crushing stones have been found in this quarry; three crushing stones of the same type were also recorded at Henschir Boshaina (TUT16). The different kinds of architectural elements used at the olive farms such as orthostats, press beds, counterweights, columns,

capitals and bases, in addition to the well-cut holes, incisions and channels, give the impression that the quarry workers were skilled in cutting and dressing all of these types of stone masonry with perfect accuracy.

Based on the surface evidence, most of the farming sites described here seem to have been composed of two main parts: a working part and a storage part. These two elements were, of course, common to most farming sites in the Gebel Tarhuna, of whatever size, although their design varied considerably from one site to another. The two parts were sometimes combined into a single architectural building, especially in farms built on a larger scale, such as Senam Aref (DOG60), Sidi al-Akhder (DOG66) and TUT3 (Figure 3.32).

The vast majority of farming sites on the Tarhuna plateau are generally assumed to have been focused on the production of a single agricultural product: olive oil. However, in the absence of excavation and archaeobotanical analyses of the pressing deposits, we cannot reject the possibility that some of these presses might also have been employed as wine presses. This hypothesis is especially relevant at sites that have not produced evidence of olive mills or where there were large vats and presses. Wine-pressing elements are very similar to those used in olive pressing and they can be hard to differentiate without exceptional preservation on the surface or excavation.

Our understanding of the organisation and function of these farming sites is coloured by the quality of the ashlar building. These sites were evidently constructed to produce large surpluses of olive oil (and possibly also wine). Thus, the archaeological records show that pressing facilities occupied a large proportion of the total site areas. Although no site can be fully recorded without excavation, at a number of sites, the pressing facilities appear to have extended over about a third of the total surface area of the site.

3.3.2 Rural baths

It is commonly known that many Roman villas contained bathing facilities. Baths associated with villas have been considered as an indicator of luxurious living at these sites. The archaeological evidence for rural settlement of the Tarhuna plateau reveals that bath-houses were among the most important luxury characteristics of villa sites. A small number of baths had been recorded by previous work in the Gebel Tarhuna. Goodchild partly uncovered the *frigidarium* of a bath-building located at Medina Doga (*Mesphe*, DOG75, Figure 2.13 (E)) (Goodchild 1976, 78). A small bath-house was also identified by Oates alongside the Udei el-Me in the Gasr Ed-Dauun (*Subututtu*) village (Figure 2.11) (Oates 1953, 90). Both of these examples were associated with roadside settlements or small towns. In addition, Oates mentioned two other small bath-buildings with mosaics: one associated with the Henschir Sidi Hamdan oilery (Oates 1953, 99), and the other located at an oilery in the upper Wadi Turgut and overlaid by a fortified construction of the late Roman period (Oates 1953, 105–106, Site 13, Gasr Shaeir).

In addition to these examples, the other bath-buildings recorded on the Tarhuna plateau can be divided into two types. The first type were characterised by their association with farming sites, usually located close to the main farm building (e.g. TUT1, TUT19 (Ain Astail), TUT53 (Sidi Eysawi), TUT54 (Senam Semana), HAJ80 (Gasr Dehmesh), DOG105 (Henschir Aulad Ali) and DUN129 (Senam Halafi 1)). The second type were independent structures, very often sited at the location of perennial springs (in Arabic, *ain*, plural, *aioun*), as at Ain Wif (*Thenadassa*), Ain Doga (DOG73), Ain Guman (GUM87), Ain Hamzia (TEL101) and Ain Tarabout. There is also one isolated bath-house recorded near a well in the Wadi Garaah, which is known as Bir Twafga, c. 5 km southwest of Gasr Ed-Dauun (*Subututtu*). The baths located at springs appear to be larger and more complex, and it is safe to say that they benefited from the water provided by the springs, where there may also have been shrines or nymphaea. A total of 15 baths of both types have been recorded in the Gebel Tarhuna, of which nine were found in association with agricultural villages (such as Ain Astail and Gasr Dehmesh) or with other farming sites of varying sizes, while six were located at springs (Figure 3.33).

Some of these rural baths were still preserved well enough to draw their plans, e.g. at Bir Twafga, Ain Guman (GUM87) and Ain Astail (TUT19). At Bir Twafga, the site had completely disappeared, most likely in ancient times, under a thick layer of soil, until autumn 1996, when a great flood uncovered part of the site. The original burial of the bath had probably occurred due to its location at the confluence of the main course of the Wadi Garaah and one of its tributaries. The gully erosion in 1996 exposed a number of rooms, particularly along the eastern side where the internal walls still survive to more than 2 m in height (Figure 3.34). A preliminary observation of the eastern room revealed that the walls were painted in green, brown and yellow. At the east side there is also a hypocaust system which was used to heat a room that was probably the *tepidarium* or *caldarium*; this room opens onto another room placed in the centre of the bath-building and is crossed by an *opus signinum* channel. At least three further rooms were partially exposed underneath the alluvium in the northern side of the gully.

In the Wadi Guman, above the spring, there are the remains of a probable villa with a bath-suite (GUM87). The villa was carefully situated in the upper part of the wadi, close to a dam (GUM84) where a large area benefited from the fertile soil (Figure 3.35). From a landscape perspective, the site seems to have been placed within gardens which contained different kinds of fruit trees.

Some of these trees, such as date, olive, pomegranate and fig, are still planted in the wadi. The outer walls of the villa were built in the *opus africanum* style, as can still be seen along the eastern side of the building (Figure 3.36). The rooms of the bath appear to have extended onto the northern side, where at least two rooms were paved with mosaics and fragments of marble are still plastered on the wall. Another feature of the bath was pieces of a bronze pipe, c. 2.5 cm diameter, which were found on the surface and which likely provided the hot water to the *caldarium* on the east side (Figure 3.37). There was also a huge quantity of tile, including specialised bath tiles, scattered in and around the site.

The architectural elements of the two examples above indicate that they were of large size for rural baths (635 m^2 and 950 m^2 respectively). They show some signs of prestige, indicating the involvement of the urban or local elite who had the wealth and power to invest in such sites in the rural hinterland. The size and ornamentation of the bath-suites, which included mosaic pavements, marble slabs and painted walls, make them comparable to baths associated with villas in the coastal area. They provide evidence that the elite families of Tripolitania made a significant investment not only in pressing equipment, but also spent part of their profit on rural structures related to display and conspicuous consumption.

Some rural baths in the Gebel Tarhuna can be considered as indicators of wealth. The size and quality of the mosaic *tesserae* at Ain Guman (GUM87), Ain Doga (DOG73), Sidi Eysawi (TUT53) and Senam Halafi 1 (DUN129) are similar to those used in the Ain Scersciara (*Cercar?*) villa mosaic which I rediscovered in 1997 (its location having been lost since Goodchild's day). Goodchild suggested that the Ain Scersciara mosaic was of a type that could be dated to the second century AD (Goodchild 1976, 85). The ceramic evidence scattered on the surface of these sites indicates that they were established in the early imperial period. However, some late ARS and TRS sherds and fourth century AD coins were also collected in association with earlier material from Ain Guman (GUM87) and Bir Twafga. This later Roman-period evidence clearly indicates that there was some continuity of use of the baths and villas until late antiquity.

3.4 Settlement density and diversity

The term 'settlement' is applied, in most cases, to any site that has material culture remains in close association with architectural features spread over an observable space or including several distinct structures. Roman-period rural settlement on the Tarhuna plateau seems to have been based around the agricultural economy and this had significant consequences for the general relationship between the distribution of settlements and the landscape.

The density of rural in the Gebel Tarhuna seems to have depended on the ability to benefit from the cultivation of the available lands in order to derive income from the production of olive oil (and possibly also wine). Most of the varying types of settlement were concentrated along the wadis. Wadis and their adjacent hills and slopes were preferable places for settlement location; the best soils were in these valleys and their soils retained moisture better in dry years. Similar patterns are visible in many other hinterland areas of Roman North Africa (Barker *et al.* 1996; Barker and Gilbertson 2000; Carlsen and Tvarnø 1989; De Vos 2000; Felici *et al.* 2006; Hitchner 1988; Hitchner *et al.* 1990; Mattingly 1989b; Vita-Finzi 1961). As discussed in Chapter 2, the preferred areas for settlement were the main wadis, where the most fertile lands were concentrated and along which the main communication routes ran.

Approximately 115 km^2 were surveyed by the TAS in the Wadis Turgut and Doga (Figure 2.2) and 112 sites have been recorded. There is a great density of rural sites in the Wadis Turgut and Doga (Figure 3.38) which is entirely consistent with the agricultural development of the Roman period. However, there are other criteria for defining the characteristics of rural space. With regards to the rural settlement pattern, it is necessary to understand two principal factors: the geographical distribution of the settlements and the density of settlement sites. It is clear from the survey results that the settlement pattern was governed by these factors. As already noted, the areas close to the wadis were more favourable for settlement than other geographical features. Settlements needed to be close to cultivable land and, because of the limited and irregular rainfall, in locations where they could exploit water-catchment surfaces. As a consequence, most of the settlement sites in the survey area, in particular the oileries and large farms, were concentrated in or in the vicinity of the main wadi courses.

Although the survey area has only been extensively surveyed, it is possible to evaluate the state of the countryside and its exploitation levels in the Roman period. The data from the survey have provided the ability to produce maps that show settlement distribution and therefore to distinguish settlements that potentially served as the central foci of estates. In addition, it was also possible to judge whether the Tarhuna plateau was characterised by nucleated or dispersed settlement. The ceramic evidence collected from most of the sites also allowed me to add a chronological dimension to the settlement pattern on the Tarhuna plateau.

The distribution map of the Wadis Turgut and Doga (Figure 3.38) illustrates that the rural settlement pattern was a dispersed one. Although the evidence reveals that some settlements were nucleated around attractive locations such as the Msabha area in the Wadi Doga and around Henschir Assalha (TUT15) in the Wadi Turgut, and some settlements were concentrated on a broad

scale near the wadi courses, in general, the distribution pattern can be described as scattered. The important communication routes through the wadis appear to have attracted settlement, especially the large olive oil pressing centres and pottery production sites. Some rural settlements benefited from their location near the Roman Gebel road or other tracks and some eventually became small towns and agricultural villages.

Over 200 Roman-period sites are known from previous work in many parts of the Gebel Tarhuna. These studies also indicate that the most densely occupied areas of the plateau were the fertile soils of the wadis. This pattern is also paralleled in the sites recorded by the UNESCO Libyan Valleys Survey in the pre-desert zone to the south (Barker *et al.* 1996). As noted earlier, although the wadi-beds of the north-eastern plateau and their adjacent slopes were naturally the most favourable in terms of site location, settlements also occupied extensive areas around the upper northerly tributaries which led into the Wadi Taraglat (Cowper 1897; Oates 1953; 1954). The density of rural settlements in the Wadis Turgut and Doga was examined from the evidence of the field survey, in order to determine if there was a concentration of sites within specific areas in the Roman period. The middle of the Wadi Turgut appears to have had the highest density of settlement, where a total of 27 rural sites were noted in an area of about 30 km^2 (Figure 3.39). This sector of the Wadi Turgut seems to have been dominated by four oileries and five large farms during the early imperial period. In addition, three pottery kilns, four small farms and five dams were probably all constituent elements of large estates governed by the oileries and large farms. With the possible exception of the dams, all of these sites went into decline probably from the late third century AD and might have been abandoned or replaced by the six fortified farms (*gsur*).

Agriculture appears to have been specialised, based in particular on the cultivation of olive groves alongside the wadis, as indicated by the distribution of olive farms. These rural sites, especially the olive farms, reveal the significance of the wadis as a network that facilitated communication between the coastal area to the north and the interior of the region. In the Wadi Turgut, the western side of the valley was evidently more favourable than the eastern one, indicated by the fact that the majority of ancient sites were established in the west. This might have happened as a result of there being larger tributaries on the west side, such as the Wadis Astail, Guman, Tershan and Hwatem, which most likely formed principal communication routes to the south, north and west of the Gebel Tarhuna. The distance between the Roman-period rural sites distributed along these wadis ranges between c. 100 m and a few kilometres. For example, considerable new evidence has emerged from the TAS regarding the site of Henschir Assalha (TUT15) in the Wadi Turgut. This oilery-villa can now be seen in clear relation to other archaeological features located just to the west, where there are traces of four possible pottery kilns and three dams (TUT22–24) (Figure 3.40).

The evidence collected from the field survey shows clustering of rural settlements of varying types. These findings have led to an overall better understanding of the settlement patterns of the Gebel Tarhuna during the Roman period. A total of 109 rural sites (of the 112 known sites) in the Wadis Turgut and Doga have been classified and are presented in Figure 3.41. Sites characterised by an agricultural function, including *gsur* (and excluding the pottery kilns, dams, baths and mausolea) account for 78 % of the total, and 13 % produced signs of luxury. This high overall percentage was a unsurprising consequence of the fact that the agricultural economy, based mainly on olive oil production, was the driving factor behind the settlement of this area during the Roman period. Fortified farmhouses represent 27 % of the total number of sites and 34 % of the agricultural sites, suggesting continuity of some estates into late Roman and late antique times. There were a small number of mausolea recorded. Much closer to Lepcis Magna, the Silin area has shown a similar pattern, with only two mausolea recorded out of 63 sites (Munzi *et al.* 2004, 13, Sites 17, 49). Even in the central Wadi Taraglat (where I joined the Italian team that surveyed its left bank during two seasons in 1999 and 2000), out of around 50 ancient sites, there were no mausolea recorded (Felici *et al.* 2006). In sharp contrast, the Tripolitanian pre-desert, south of the Tarhuna plateau, presents a very different pattern and does not seem comparable; over 70 mausolea have been recorded by the UNESCO Libyan Valleys Survey in this marginal area (Barker *et al.* 1996, 145). This phenomenon seems to suggest a much stronger development of a rural elite in the pre-desert than was the case on the Tarhuna plateau, where large estates controlled by the urban elite were perhaps more the norm.

The TAS has collected archaeological evidence for varying types of rural sites, but the olive farm buildings with their oil presses were the main element of settlement. In the intensively surveyed area of the upper Wadi Guman, the surface evidence reveals a dense collection of various rural sites (Figure 3.42, Appendix B). Site density in this area appears to have evolved over the course of centuries. The archaeological evidence reveals that sedentary farmers had settled and exploited the area probably from the second century BC until the seventh century AD. A hoard of 373 coins of King Massinissa of Numidia (238–149 BC) discovered in the upper Wadi Guman in 1995 (Figure 3.43) can be compared with other evidence from the Wadi es-Sri. Although the wadi has not yet produced a farming site of large scale, especially as it is difficult to judge from the

surface evidence in this area because ancient building materials have largely been removed from the surface and reused in modern constructions, the wadi has produced the highest density of pottery production sites in the Gebel Tarhuna. These pottery kilns specialised in the production of Tripolitanian amphorae (see Chapter 5), and they were concentrated in an area which offered key resources for this economic activity: water, clay sources and communication routes. The first was provided by a spring, Ain Guman, while the second was provided by the many bands of clay. The third was provided by two major tracks which have been in use until modern times: the first runs northwest–southeast and is known by the name *attariq atrablsia* (the Tripoli road), and the second runs east–west and is known as *attariq msellatia* (the Msellata road).

Although it was already well-known that the archaeology of the Gebel Tarhuna was largely characterised by olive presses, the TAS has increased the total number of known rural settlements. Table 3.6 gives estimates for the numbers of sites previously known from the works of Cowper, Goodchild and Oates and the new total number after the TAS. Perhaps the most interesting figure in this table is the number of pottery kiln sites, which has increased remarkably from the three previously recorded sites at Gasr Ed-Dauun (*Subututtu*), Ain Scersciara (*Cercar?*) and Sidi Said (Arthur 1982; Goodchild 1976; Oates 1953) to 17, the TAS having identified 14 new sites (Chapter 5).

3.5 Evaluation of the settlement pattern over time

The state of the Gebel Tarhuna and its settlement in the Roman period can now be evaluated in the light of the available evidence. Although the available data do not cover the whole of the Tarhuna plateau, the settlement features and chronology can be discussed. The archaeological data were sufficient with regards to the east and northeast areas of the Gebel Tarhuna to produce a table presenting the chronological data (Table 3.7).

Intensive collection strategies and the study of surface materials can reveal the location of sites, even where surface remains have been entirely destroyed by subsequent construction or deep ploughing, as is the case in many places on the high Tarhuna plateau where the Italians established new farms in the colonial period. The peaks and troughs of landscape exploitation can be identified chronologically (Dunnell and Dancey 1983; Lewarch and O'Brien 1981). The collection and examination of imported and local products can reveal the extent to which settlements were involved in local, regional, provincial and empire-wide economic systems (Barker 1991, 6; Lloyd 1991, 238). This type of interaction is only very rarely perceptible in the literary texts (Barker *et al.* 1996). Many recent archaeological surveys have mapped the distribution of potsherds around the dense concentrations of building materials identified as settlement sites and interpreted the assemblages as evidence for the occupation period of these settlements (Bintliff and Snodgrass 1985).

It seems clear that the earliest stage of farming on the Tarhuna plateau, which was tentatively dated by previous studies to the early first century AD, can now be pushed back to the second and first centuries BC. The associated pottery sherds have allowed me to suggest approximate dates for the vast majority of the sites recorded or re-recorded by the TAS (Table 3.7). These data show the development of settlement trends and provide a preliminary chronological overview of the settlement patterns of the Tarhuna plateau.

Many of the best agricultural lands in Tripolitania were, in fact, located in the Gebel. The ancient exploitation of the Gebel lands was linked to the agricultural development of the coastal area (Mattingly 1995, 140). The Gebel Tarhuna-Msellata occupies the central and eastern limit of Lepcis' territory. The eastern boundary between Lepcis Magna and the town of *Thubactis* (Misurata?) is not definable in terms of epigraphic evidence, but it is likely that the Wadi Taraglat-Caam formed the extreme eastern boundary of Lepcis' territory in relation to the Gebel (Felici *et al.* 2006, 634). Mattingly argues that the territory of Lepcis Magna was very extensive, perhaps as much as 3,000–4,000 km^2 (Di Vita-Evrard 1979; Mattingly and Flower 1996, 167). He also believes that the expansion into the Gebel Tarhuna-Msellata reflected the view of the *Libyphoenices* that these lands formed one of their heartlands (Mattingly 1988c; 1995, 140; Mattingly and Flower 1996, 167–168). A measurement taken using Google Earth taking into account Felici's judgment that the Wadi Taraglat-Caam was its eastern limit, has confirmed Mattingly's estimation of the territory of Lepcis (c. 3,530 km^2) (Figure 3.44).

The new archeological evidence provided by the Silin and Wadi Taraglat-Caam surveys has shown that some rural settlements, in particular farms and villas, were established in those areas as early as the fourth or third centuries BC (Cifani and Munzi 2002). The evidence from the Silin area indicates that one site can be dated from the fourth to third centuries BC, 11 sites from the second century BC and 16 sites from the first century BC (Munzi *et al.* 2004, 22). This increase of rural settlements during the second and the first centuries BC in the areas close to Lepcis seems to have extended into the Tarhuna plateau. Materials collected by the TAS attest to the occupation of sites from the second century BC. A rural settlement located 12 km west of the town of Tarhuna in the Wadi es-Sri (SRI115) has produced the earliest ceramic evidence on the Tarhuna plateau. The collected materials include several sherds of Campana A black-glazed ware, associated with second century

BC Numidian coins, and a small number of fragments of Van der Werff (Type 1c) and Dressel 1 amphorae (Al-Hddad and Asmia forthcoming). Six rural sites were identified from the first century BC. Their dating evidence consisted mainly of late Punic amphorae, sherds of Campana A bowls and dishes and mid-first century BC Arretine ware and eastern *terra sigillata.*

This evidence demonstrates that the Gebel Tarhuna witnessed a degree of exploitation from the pre-Roman period (late Punic and early Numidian periods, second and first centuries BC) even though the previous works of Goodchild and Oates had not recorded any evidence dated to before the first century AD (Goodchild 1976; Oates 1953). It might be assumed that pre-Roman settlements and agricultural practices on the Tarhuna plateau were influenced by the policy of the Numidian kings. Strabo mentioned how Massinissa "turned nomads into farmers and welded them into a state" (*Geography*, 17.3.15). Polybius also described him as a great cultivator who encouraged his people to be farmers and settlers (*Histories*, 36.16.7–8). However, the archaeological record indicates that agriculture was practised, at least in some parts of North Africa, long before Massinissa's reign (Cherry 1998; MacKendrick 1980; Mattingly 1995; Whittaker 1980). It is difficult to judge the significance of the large number of Massinissan coins that have been found at some sites in the Gebel Tarhuna. It is recorded that Massinissa briefly held the area south and west of the *emporia* in 204 BC (Livy, *History of Rome*, 29.3.9; Mattingly 1995, 51). The economies of the *emporia* grew after the defeat of the Carthaginians at *Zama* by Scipio Africanus in 201 BC during the Second Punic War, because they were freed from the one talent daily tribute that they had to pay to Carthage (Di Vita 1982). The increase in the number of rural settlements established after the end of the Second Punic War, especially in the territory of Lepcis Magna, reflects the agricultural development, and in particular the production of olive oil, in the region.

Compared to the small number of pre-Roman settlements, the early imperial period witnessed a great development of rural sites in the Gebel Tarhuna. The TAS found that around 51 % of the total recorded sites (63 of 123) existed already by the first century AD. This increase was especially visible in the open farms (from small farms to oileries) and pottery kilns (Table 3.7; Figure 3.45). During the Roman period, the region experienced a new phase of development, especially from the first century AD onwards. Settlement intensified and agricultural settlements flourished. Mattingly suggests that the Gebel Tarhuna-Msellata was a desirable region due to market and investment demands (Mattingly 1985; 1987; 1989a; 1995). The expansion of settlement reached the marginal lands of the pre-desert area. This period was also characterised by a greatly increased density of settlement and evidence for highly intensive commercial farming. The flourishing settlement and maximum economic expansion appear to have continued into the late third century AD, but were probably not as strong as they had been previously following the Severan era. Surface ceramic materials of the first three centuries AD are considerably more abundant and more widely distributed throughout the region than those from earlier or later periods.

The first massive decrease in the number of open farms seems to have started in the fourth century AD, though this was also a period of emergence of the fortified sites (*gsur*) which dominated the landscape from this time forward. Overall settlement numbers thus remained relatively constant. The TAS found that about half of the open farming sites had been replaced by fortified ones beginning in the fourth century AD. Ceramic evidence collected from these *gsur* reveals that some of them, especially the Type 2 hilltop examples, continued in use until the early Islamic period.

Rural fortification does seem to have been a very widespread phenomenon in the late antique period. The settlement pattern of the Gebel Tarhuna appears to have been dominated by the *gasr* in much the same way as the pre-desert area where this kind of structure functioned as an agricultural installation. Mattingly suggests that from the fourth century AD *gsur* became increasingly important, replacing unfortified farms as the dominant form of settlement (Mattingly 1987b; 1989b; 1995). Survey evidence for the later Roman period from the Tarhuna plateau indicates increased construction of fortified farms, and that they expanded into areas which had not been settled very densely in earlier centuries. This implies increased use of highlands and hilltops that had not been chosen for settlement earlier, when the preference was for activity in the wadi-beds and foothills. This change in settlement patterns probably relates to an increased demand for defense and security. This trend was caused by an increase in the risk posed by raiders who probably came from the interior. Archaeological studies from the Tripolitanian pre-desert reveal that many fortified farms were built by landowners who were motivated by the incursions of local tribes to take measures for their security (Barker *et al.* 1996; Brogan 1976–1977; Felici *et al*. 2006; Mattingly 1995). Brogan, from her studies of some ancient sites in eastern Tripolitania, added that the careful siting of many later Roman buildings indicates that one of their main functions was to guard the communication routes and signal the approach of strangers (Brogan 1976–1977). Judging from the number of sites with pottery of the fifth to seventh centuries AD, the rise of the *gsur* was accompanied by a progressive decline in overall site numbers (Figure 3.45).

Goodchild argued that the fortified farmhouses (*gsur*) of the Gebel Tarhuna dominated the region; they formed the majority of the ancient farming sites and

occupied the upper rank of the settlement hierarchy in late antiquity (Goodchild 1976, 88–89). Some *gsur* were built to replace the earlier open farms within the boundaries of the previous estates, and their positions suggest that they were erected to guard the approaches to the main farms. Epigraphic evidence from a number of fortified farms shows that some of these *gsur* were private property built by landowners in selected positions on their lands to provide security and protect the boundaries of their farms. In the pre-desert as in the Gebel, a number of inscriptions confirm that the *gsur* were erected on behalf of the landowners. For instance, an inscription from a *gasr* near Bir Shemech records that a certain Flavius Dasama and his son Macrinus, the landowners, built the *gasr* to protect their own estate (*IRT* 889; Elmayer 1983). Another example from Sidi Ali ben Zaid in the Gebel Tarhuna mentions that a certain Marcus Caecilius Bumapal constructed a *centenarium* and a small altar, and that he lived in a state of grace (*IRT* 877; Elmayer 1983). An inscription from Sidi Sames (Sidi Assid, Tarhuna) indicates how perhaps some of these gsur were constructed on family estates to protect the inhabitants against an expected danger from the gentiles and *barbari* (*IRT* 871; Goodchild 1976, 112; Mattingly 1995, 195). I have based this discussion on surface evidence alone and this evaluation of chronology and settlement could be modified through further survey in other parts of the plateau and excavation.

Chapter 3 TABLES

Table 3.1: *Oilery sites in the Wadis Turgut and Doga.*

ID	Local name	Site type	Presses	Elevation	Size (m²)
TUT8		Oilery	5	290	8,500
TUT10		Oilery	5	295	6,500
TUT16	Henschir Boshaina	Oilery	5	375	15,000
TUT20	Ain Astail	Oilery	6	297	11,250
DOG66	Sidi al-Akhder	Oilery	6	230	8,000
HAJ82	Gasr Dehmesh	Oilery	5	280	11,200
DOG106	Sh'bet asc-Schood	Oilery	5	217	5,000
DOG107	Henschir ash-shuaud	Oilery	5	232	5,200
TUT12	Sidi Buagela 2	Oilery-villa	8	242	8,000
TUT15	Henschir Assalha	Oilery-villa	5	280	28,500
TUT38	Henschir es-Senam	Oilery-villa	6	227	11,300
TUT43	Loud al-Meghara	Oilery-villa	7	219	10,200
TUT46	Kerath	Oilery-villa	5	250	21,300
TUT52	Henschir Sidi Madi	Oilery-villa	7	150	9,150
TUT54	Senam Semana	Oilery-villa	17	135	12,500
DOG60	Senam Aref	Oilery-villa	6	184	10,200

Table 3.2: *Large farm sites in the Wadis Turgut and Doga.*

ID	Local name	Site type	Presses	Elevation	Size (m²)
TUT3		Large farm	3	300	14,120
TUT5	Henschir Aziza	Large farm	4	315	8,300
TUT7	Ben Hayb	Large farm	3	305	
TUT11		Large farm	3	266	4,000
TUT14	Bu-Kaala	Large farm	3	333	4,000
TUT26		Large farm	4	254	4,500
TUT27		Large farm	3	280	10,100
TUT29		Large farm	4	255	8,000
TUT35		Large farm	4	275	10,100
TUT36		Large farm	3	226	7,200
TUT44	Sidi Yekhlef	Large farm	3	211	9,000
DOG57	Henschir Hmoudat	Large farm	3	250	7,500
DOG111	Almseel	Large farm	3	170	10,200
TUT112		Large farm	4	280	12,400
TUT1		Large farm-villa	3	280	15,000
TUT53	Sidi Eysawi	Large farm-villa	3	180	21,000
HAJ81		Large farm-villa	4	215	4,500
DOG104		Large farm-villa	3	210	6,200

Table 3.3: *Rural villas and farms from the Silin survey divided by period (after Munzi* et al. *2004).*

Period	I	II	III	IV	Va	Vb	VIa	VIb	VII	VIII
Dates	1st–3rd BC	2nd BC	1st BC	1st AD	1st half 2nd AD	2nd half 2nd AD	1st half 3nd AD	2nd half 3nd AD	4th–5th AD	6th AD
Rural villas	0	4	6	15	15	15	10	8	7	2
Farms	0	5	7	24	26	26	19	14	12	2

Table 3.4: *Numbers of open farms and presses in the Wadis Turgut and Doga.*

Site type	Sites	%	Presses	%
Oilery	16	29 %	103	51 %
Large farm	18	32 %	60	29 %
Small farm	22	39 %	40	20 %
Total	**56**		**203**	

Table 3.5: *Oilery-villas recorded in the Wadis Turgut and Doga.*

ID	Local name	Presses	Location	Luxury elements
TUT12	Sidi Buagela 2	8	hill-slope	bath-suite
TUT15	Henschir Assalha	5	break of slope	bath-suite
TUT38	Henschir es-Senam	6	wadi-side	bath-suite, pieces of column.
TUT43	Loud el-Meghara	7	wadi-side	bath-suite, pieces of capital and columns
TUT46	Kerath	5	break of slope	bath-suite, 2 columns, capital, portico
TUT52	Henschir Sidi Madi	7	wadi-side	bath-suite, pieces of column, portico
TUT54	Senam Semana	17	wadi-side	bath-suite, portico, mosaic
DOG60	Senam Aref	6	wadi-side	bath-suite, capital, portico

Table 3.6: *Some of the estimated figures of the rural settlements before and after the TAS in the Tarhuna plateau.*

	Before TAS	After TAS
Sites	205	297
Presses	262	415
Pottery kiln sites	3	17

Table 3.7: *Synoptic table of the rural archaeological sites (excluding dams) recorded or re-recorded by the TAS.*

Site	Name	Type	Century								
			BC		AD						
			2	1	1	2	3	4	5	6	7
TUT1		Large farm-villa, *gasr*									
TUT2		Small farm, *gasr*									
TUT3		Large farm, *gasr*									
TUT4		Small farm									
TUT5	Henschir Aziza	Large farm, *gasr*									
TUT6		Hill-top *gasr*									
TUT7	Ben Hayb	Large farm, *gasr*									
TUT8		Oilery									
TUT9	Senam el-Gharabah	Small farm									
TUT10		Oilery									
TUT11		Large farm									
TUT12	Sidi Buagela 2	Oilery-villa									
TUT13		Hill-top *gasr*									
TUT14	Bu-Kaala	Large farm, *gasr*									
TUT15	Henschir Assalha	Oilery-villa, pottery kilns									
TUT16	Henschir Boshaina	Oilery, *gasr*									
TUT17	Ain Astail	Hill-top *gasr*									
TUT18	Ain Astail	Pottery kilns									
TUT19	Ain Astail	Bath									
TUT20	Ain Astail	Oilery									
TUT26		Large farm									
TUT27		Large farm									
TUT28		Hill-top *gasr*									
TUT29		Large farm									
TUT30		*Gasr*									
TUT31		Small farm									
TUT32		Small farm									
TUT33	Gasr al-Atresh	*Gasr*									
TUT34	Ras al-Assal	Hill-top *gasr*									
TUT35		Large farm									
TUT36		Large farm									
TUT37	Gsair al-Atshan	Hill-top *gasr*									
TUT38	Henschir es-Senam	Oilery-villa									
TUT39		Small farm									
TUT40	Kerath	Small farm, *gasr*									
TUT41		Small farm									
TUT42		Hill-top *gasr*									
TUT43	Loud el-Meghara	Oilery-villa									
TUT44	Sidi Yekhlef	Large farm									
TUT45		Small farm									
TUT46	Kerath	Oilery-villa, *gasr*									
TUT47	Arbaia	Small farm									
TUT48	Arbaia	Pottery kilns									

cont.

Site	Name	Type	Century								
			BC		AD						
			2	1	1	2	3	4	5	6	7
TUT50		*Gasr*									
TUT51		Hill-top *gasr*									
TUT52	Henschir Sidi Madi	Oilery-villa									
TUT53	Sidi Eysawi	Large farm-villa									
TUT54	Senam Semana	Oilery-villa									
TUT55		Hill-top *gasr*									
TUT56	Sidi Buagela 1	Large farm, *gasr*									
DOG57	Henschir Hmoudat	Large farm									
DOG58		*Gasr*									
DOG59		Hill-top *gasr*									
DOG60	Senam Aref	Oilery-villa									
DOG61		Quarry									
DOG62		Hill-top *gasr*									
DOG63		Hill-top *gasr*									
DOG64		Small farm									
DOG65		Hill-top *gasr*									
DOG66	Sidi al-Akhder	Oilery									
DOG67		Small farm, *gasr*									
DOG68		Small farm, *gasr*									
DOG69		*Gasr*									
DOG70		Hill-top *gasr*									
DOG71	Ras Abadla	Inscription									
DOG72	Gasr Doga	Mausoleum									
DOG73	Ain Doga	Bath									
DOG74		Small farm									
DOG75	Medina Doga, *Mesphe*	*Gasr*									
HAJ76	Gasr al-Ash	Hill-top *gasr*									
HAJ77	Gasr Abdalhadi	Watchtower									
HAJ78	Gasr Dehmesh	Mausoleum									
HAJ79	Gasr Dehmesh	*Gasr*									
HAJ80	Gasr Dehmesh	Bath									
HAJ81	Gasr Dehmesh	Large farm-villa									
HAJ82	Gasr Dehmesh	Oilery									
GUM83	Ras Deiseer	Hill-top *gasr*, quarry									
GUM85		Quarry									
GUM86	Scegafiat Asray	Pottery kiln									
GUM87	Ain Guman	Bath/villa									
GUM88	Gaytna	Small farm									
GUM89	Scegafiat Atriq	Pottery kilns									
GUM90	Scegafiat Ben Hemad	Pottery kilns									
TEL91	es-Sonama	Mausoleum									
TEL92		*Gasr*									
TEL93	Gasr Bu Tuil	Watchtower									
TEL94		*Gasr*									
TEL95		Small farm									

cont.

Site	Name	Type	Century								
			BC		AD						
			2	1	1	2	3	4	5	6	7
TEL96		Small farm									
TEL97		Small farm									
TEL98		*Gasr*									
TEL99		Small farm									
TEL100		Bath									
TEL101	Ain Hamzia	Bath									
TEL102	Hamzia	Pottery kilns									
DOG103	Sidi Masoud	Small farm									
DOG104		Large farm-villa									
DOG105	Henschir Aulad Ali	Small farm-villa									
DOG106	Sh'bet asc-Schood	Oilery									
DOG107	Henschir ash-Shuaud	Oilery									
TUT108	Henschir Armadia	Pottery kilns									
TUT109	Henschir ar-Rkkak	Small farm									
GUM110	Scegafiat Maamri	Pottery kilns									
DOG111	Wadi Almseel	Large farm, quarry, kiln									
TUT112		Large farm									
SRI113	Wadi es-Sri	Bath									
SRI114	Wadi es-Sri	Pottery kilns									
SRI115		Large farm, cemetery									
SRI116		Hill-top *gasr*									
TRG117		Small farm									
TRG118		Small farm									
TRG119		Small farm, quarry									
TRG120		*Gasr*									
TRG121		Small farm									
TRG122		*Gasr*									
TRG123		*Gasr*									
TRG124		*Gasr*									
DUN128		Oilery									
DUN129	Senam Halafi 1	Oilery-villa									
DUN130		Large farm									
DUN131	Halafi	Large farm, kilns									
SRI132	Wadi es-Sri	Small farm									
DUN133		Bath									
	Total	**123 sites**	**1**	**7**	**63**	**84**	**85**	**83**	**53**	**46**	**28**

Chapter 3 FIGURES

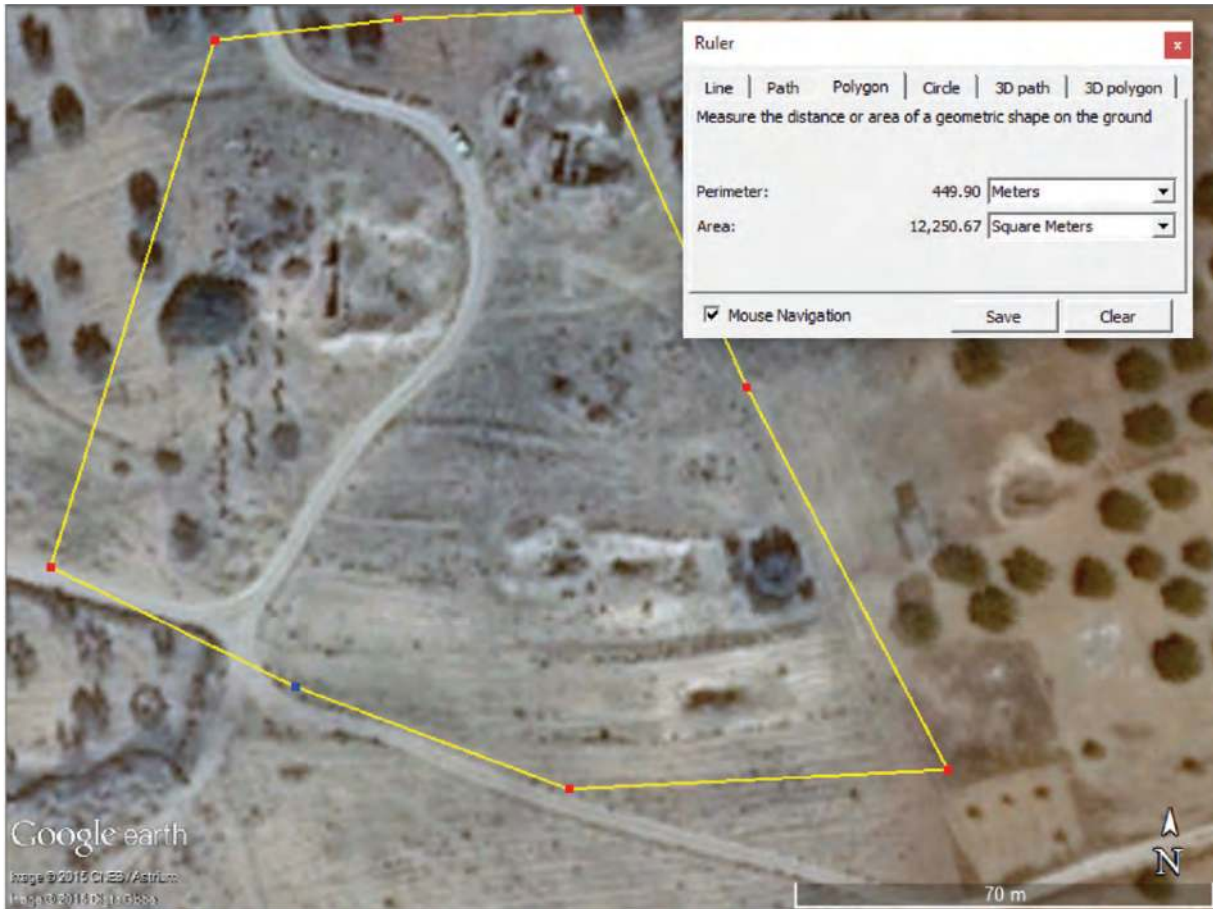

Figure 3.1: *Measuring site TUT54 (Senam Semana) on satellite imagery (Google Earth).*

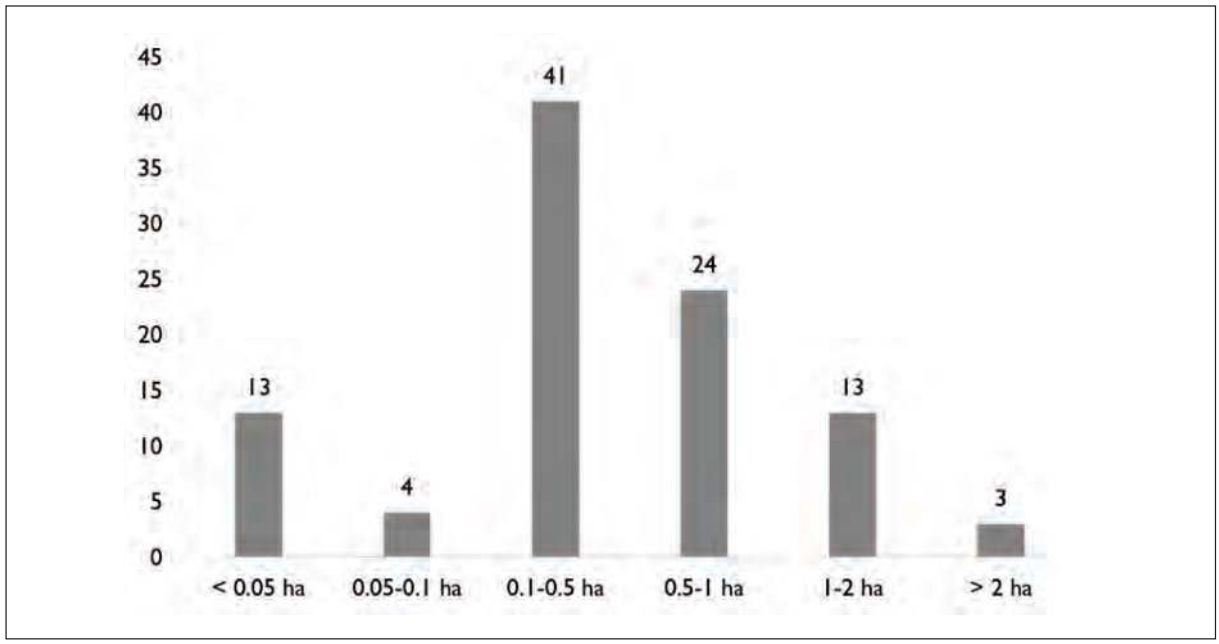

Figure 3.2: *Sites of known size located in the Wadis Turgut and Doga.*

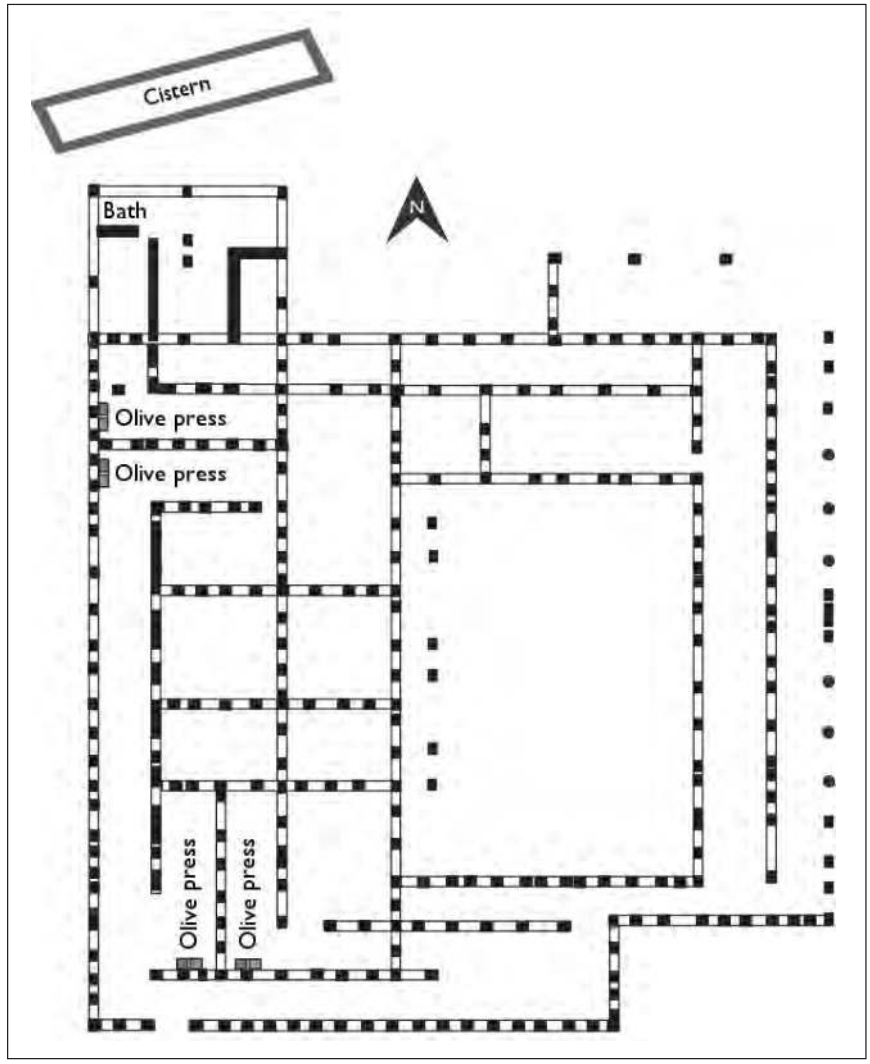

Figure 3.3: *Plan of Senam Halafi 1 (DUN129).*

Figure 3.4: *Senam Halafi 1 (DUN129), showing* in situ *columns (scale 1 m).*

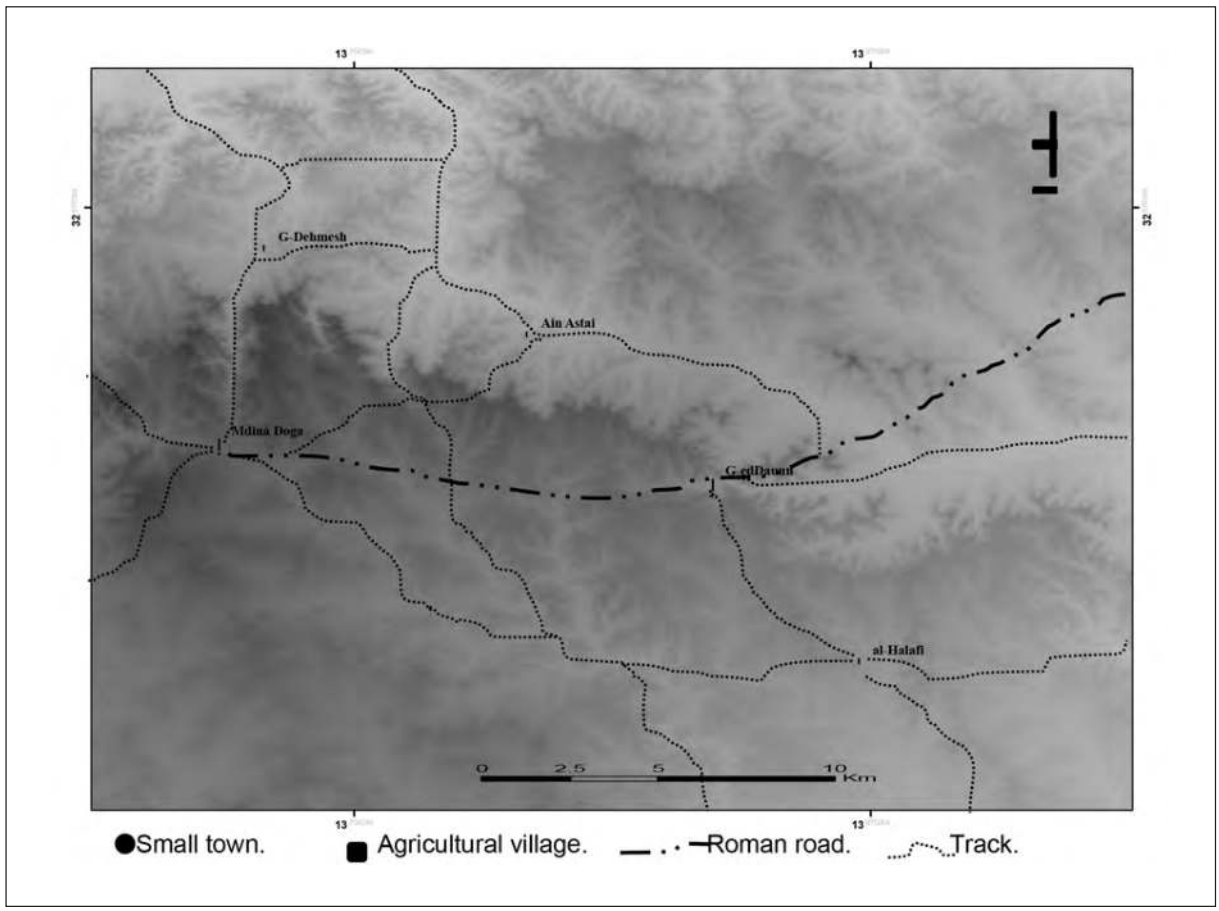

Figure 3.5: *Agricultural villages and small towns in the eastern part of the Tarhuna plateau (Image © 2015 Digital Globe).*

Figure 3.6: *Ain Astail agricultural village (TUT17–21).*

Figure 3.7: *Gasr Dehmesh village (HAJ78–82) (Image © 2015 Digital Globe).*

Figure 3.8: *Gasr Dehmesh (HAJ79) visible on the top of a small hill, with large farm-villa (HAJ81) in foreground.*

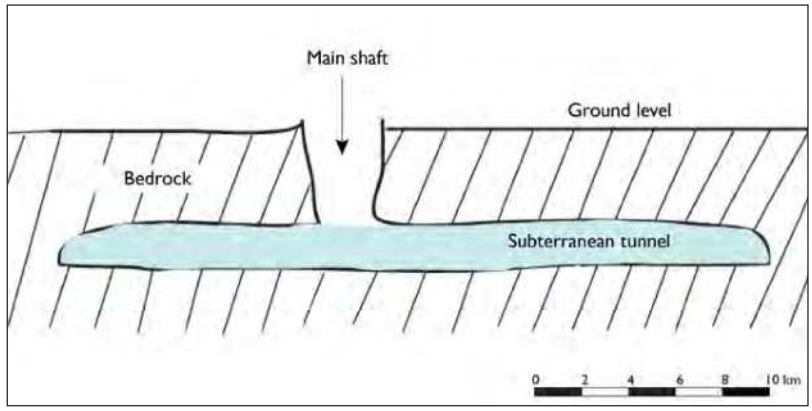

Figure 3.9: *A* majen *(cistern) in Gasr Dehmesh village.*

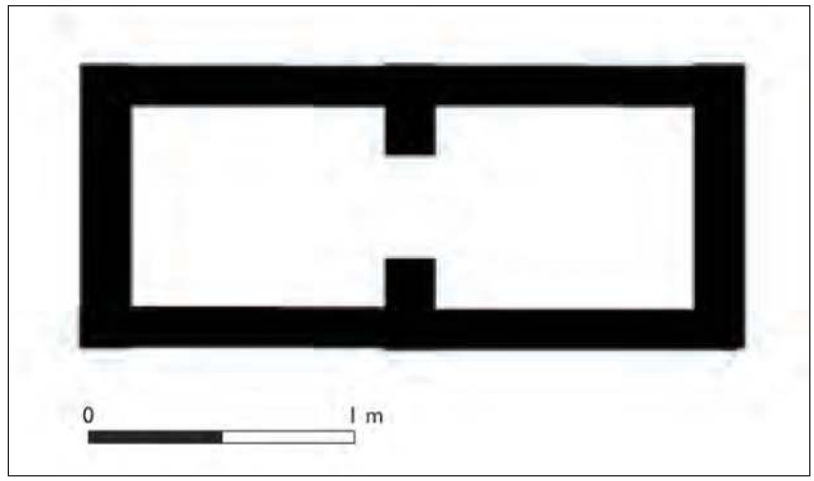

Figure 3.10: *Plan of subterranean funerary room at Gasr Dehmesh (HAJ78).*

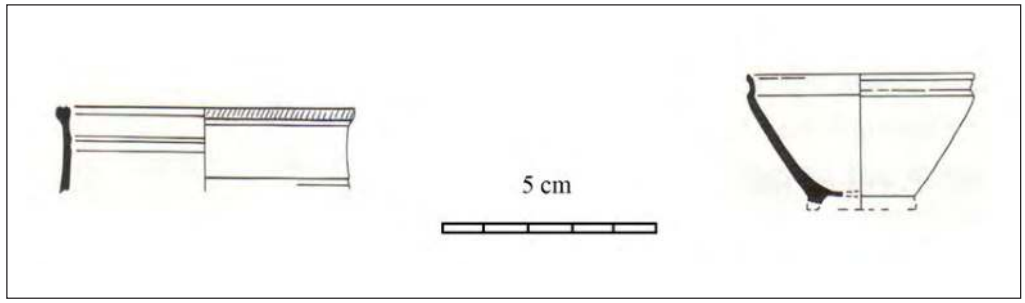

Figure 3.11: *Early first century AD fineware collected from a mausoleum (HAJ78) in the vicinity of Gasr Dehmesh village.*

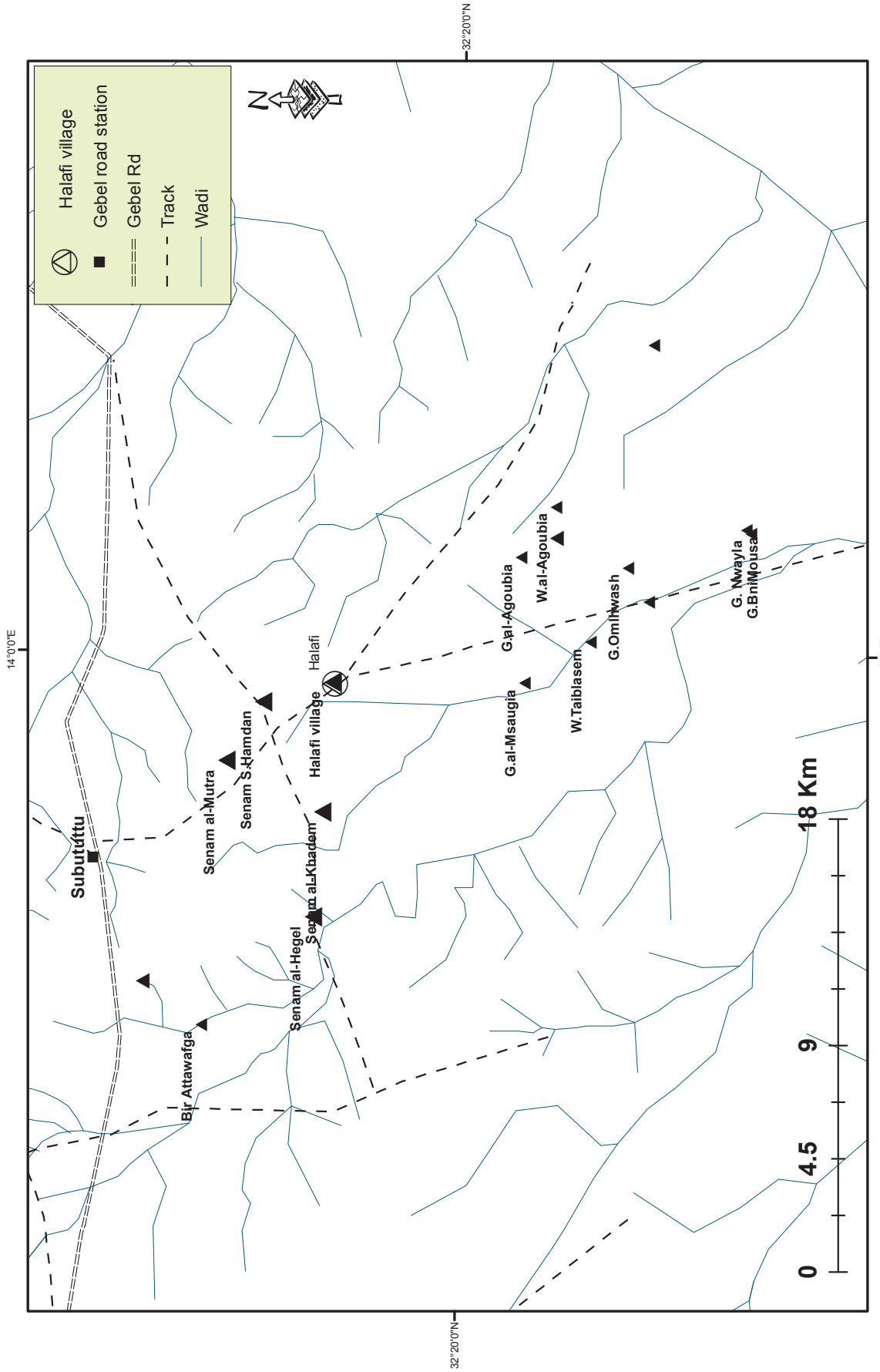

Figure 3.12: *Halafi village (DUN129 & DUN131).*

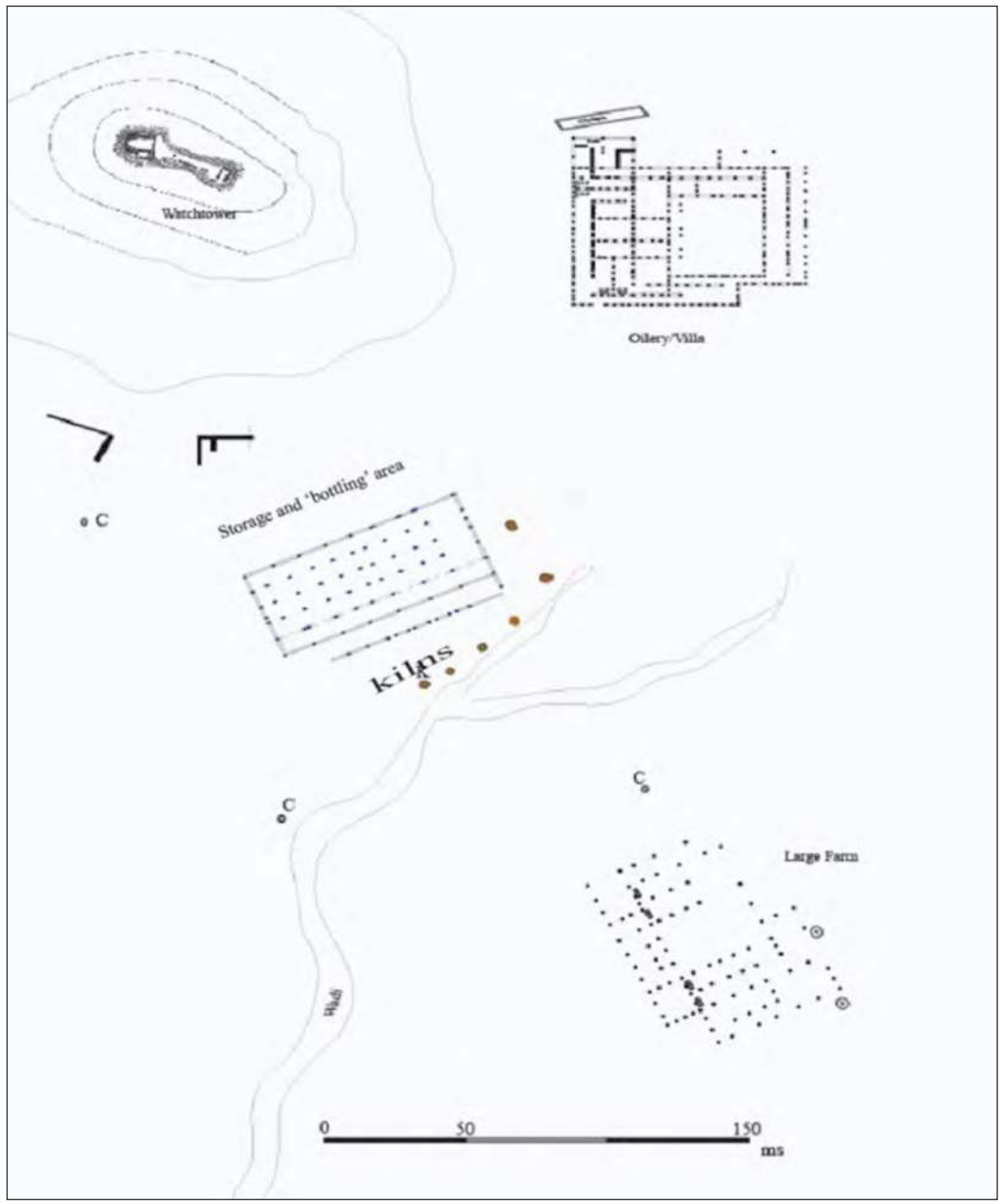

Figure 3.13: *Plan of Halafi village.*

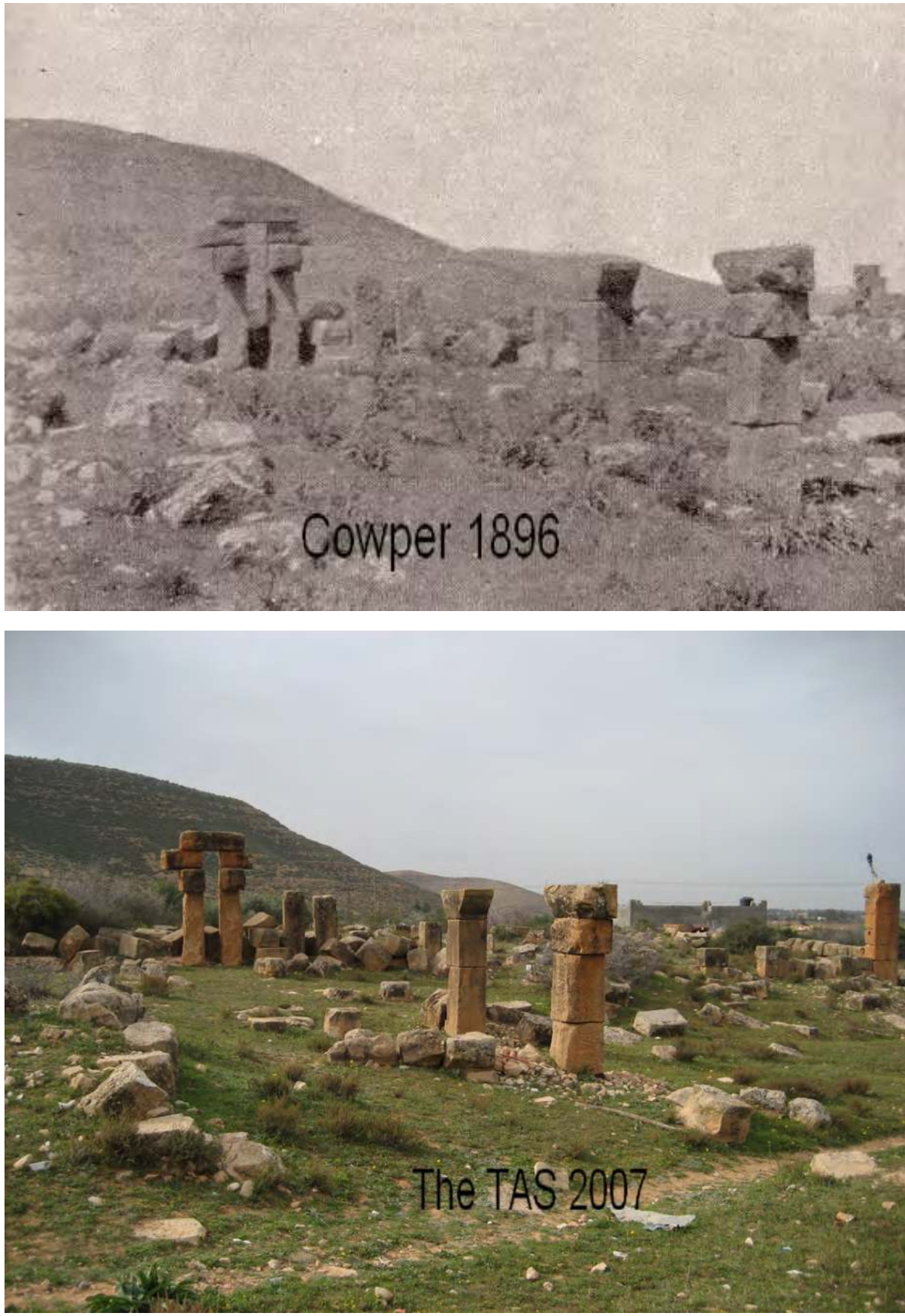

Figure 3.14: *Senam Aref (DOG60) in the 1890s (top) and in 2007 (bottom).*

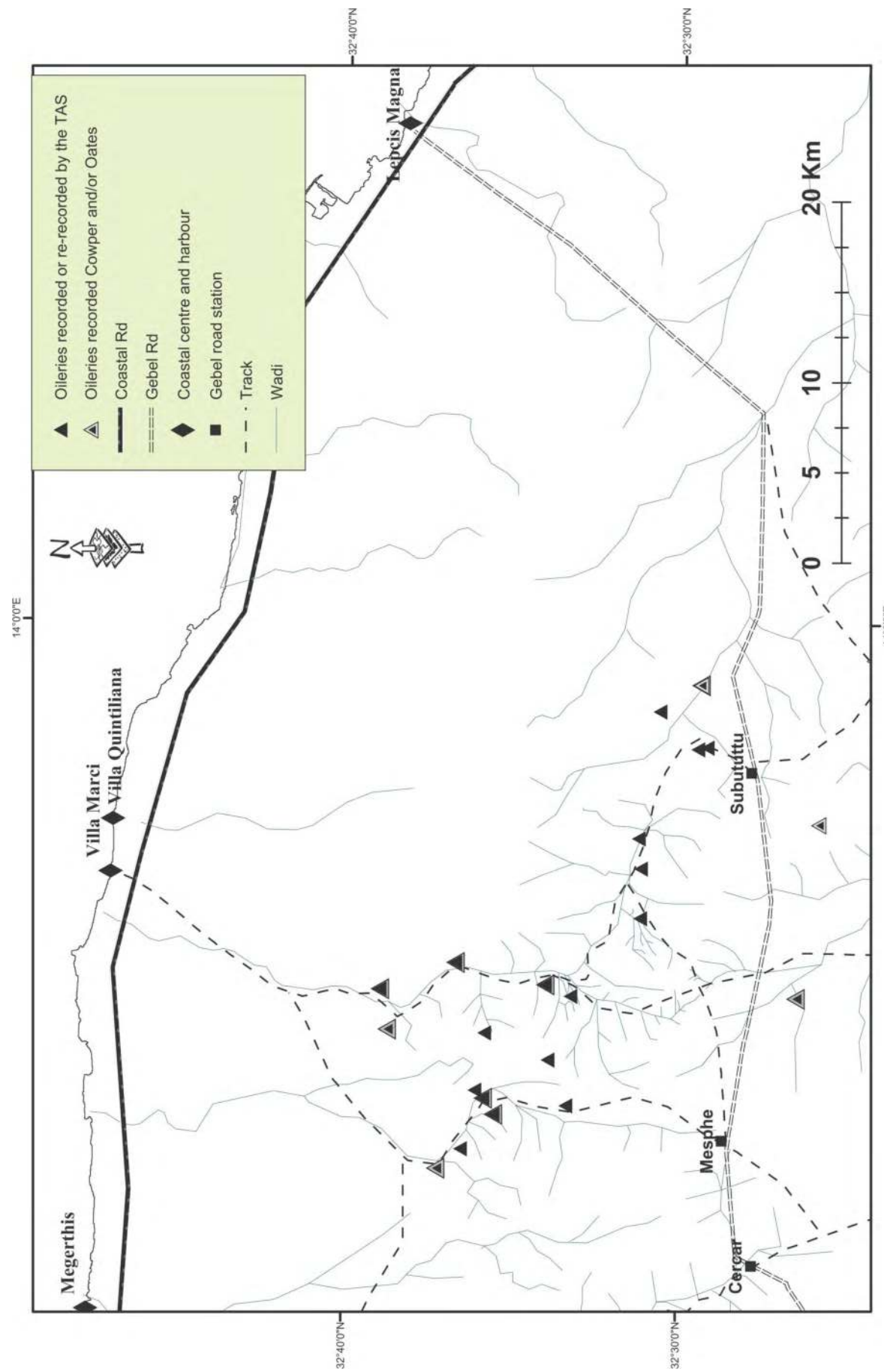

Figure 3.15: *Distribution of oilery sites identified by the TAS, Cowper and Oates in the Gebel Tarhuna.*

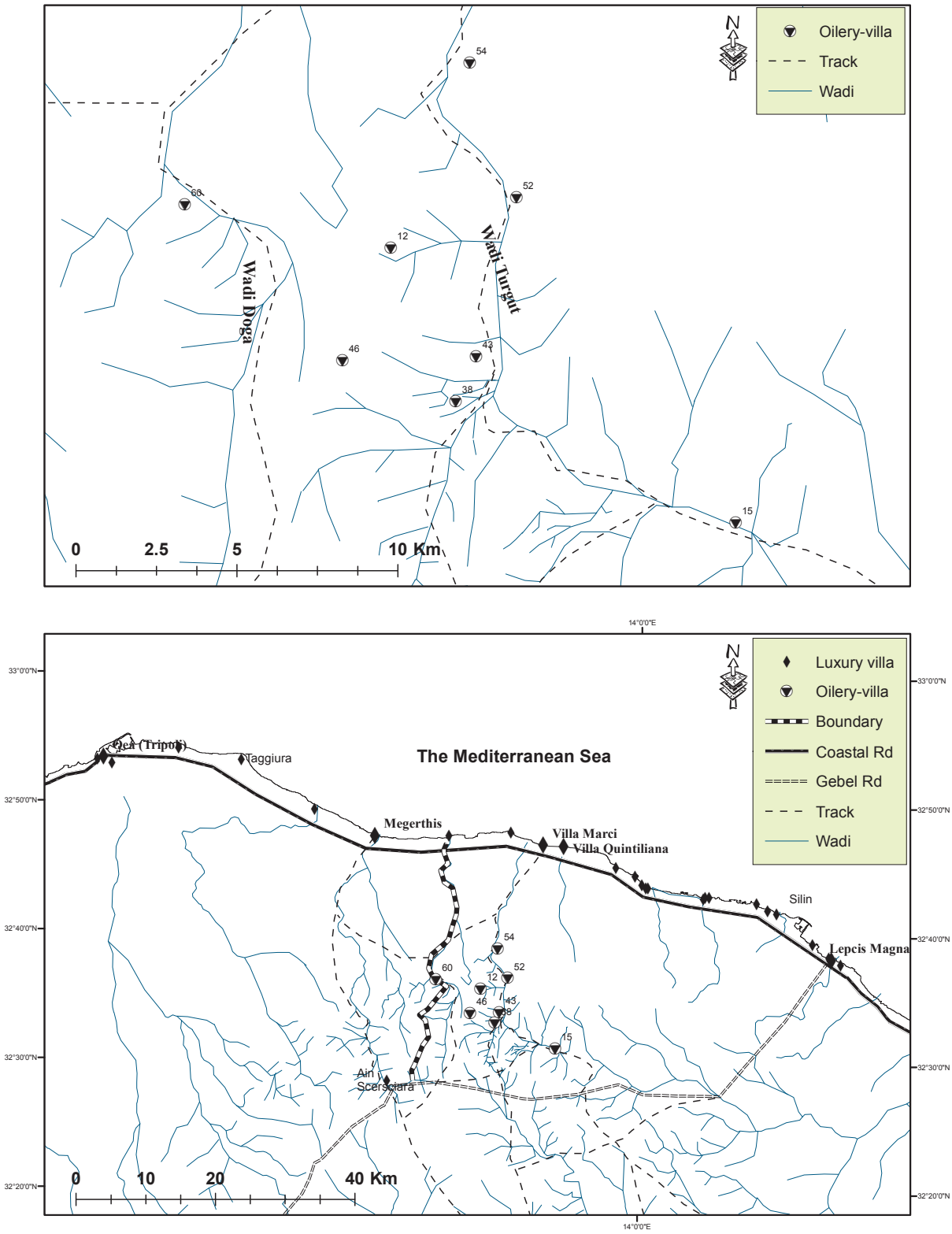

Figure 3.16: *Distribution of oilery-villas identified by the TAS in the Wadis Turgut (top) and Doga and coastal luxury villas in the area between Lepcis Magna and Oea (bottom) (after Mattingly 1995).*

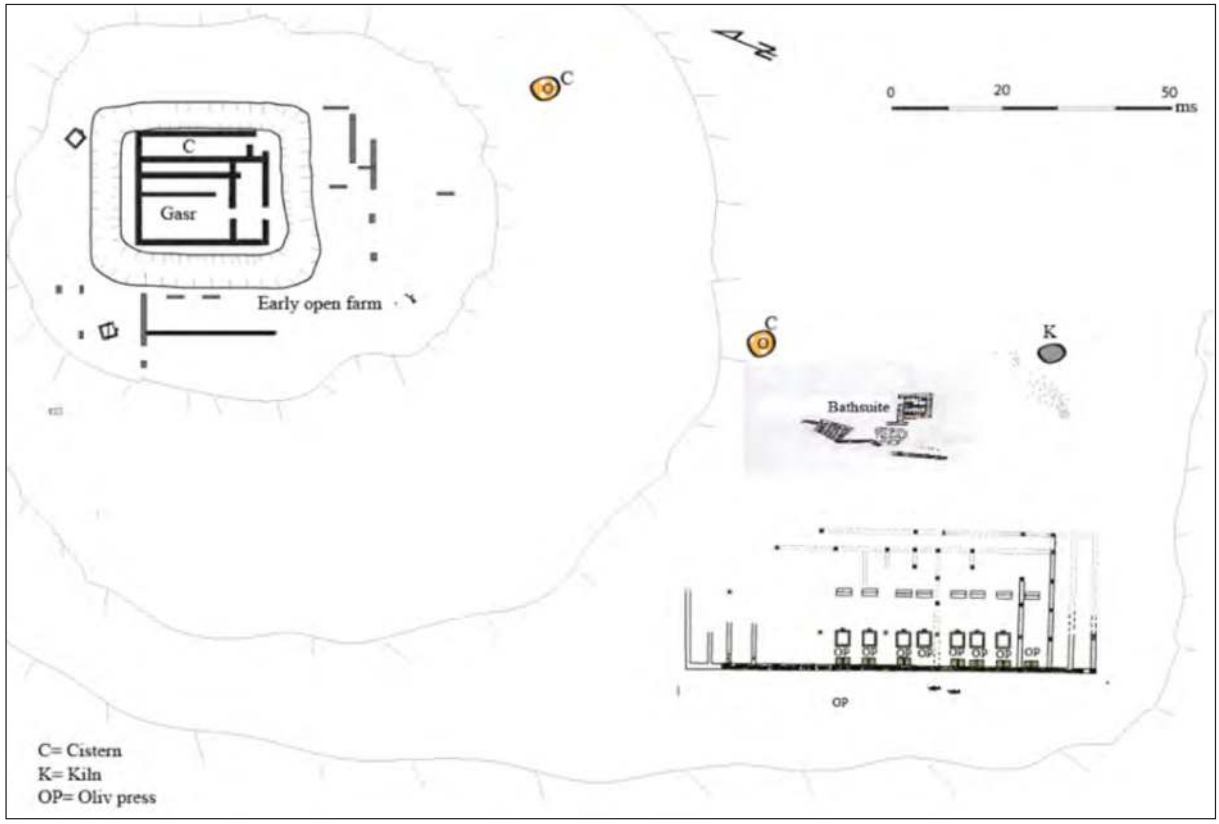

Figure 3.17: *Plan of Sidi Buagela 2 (TUT12).*

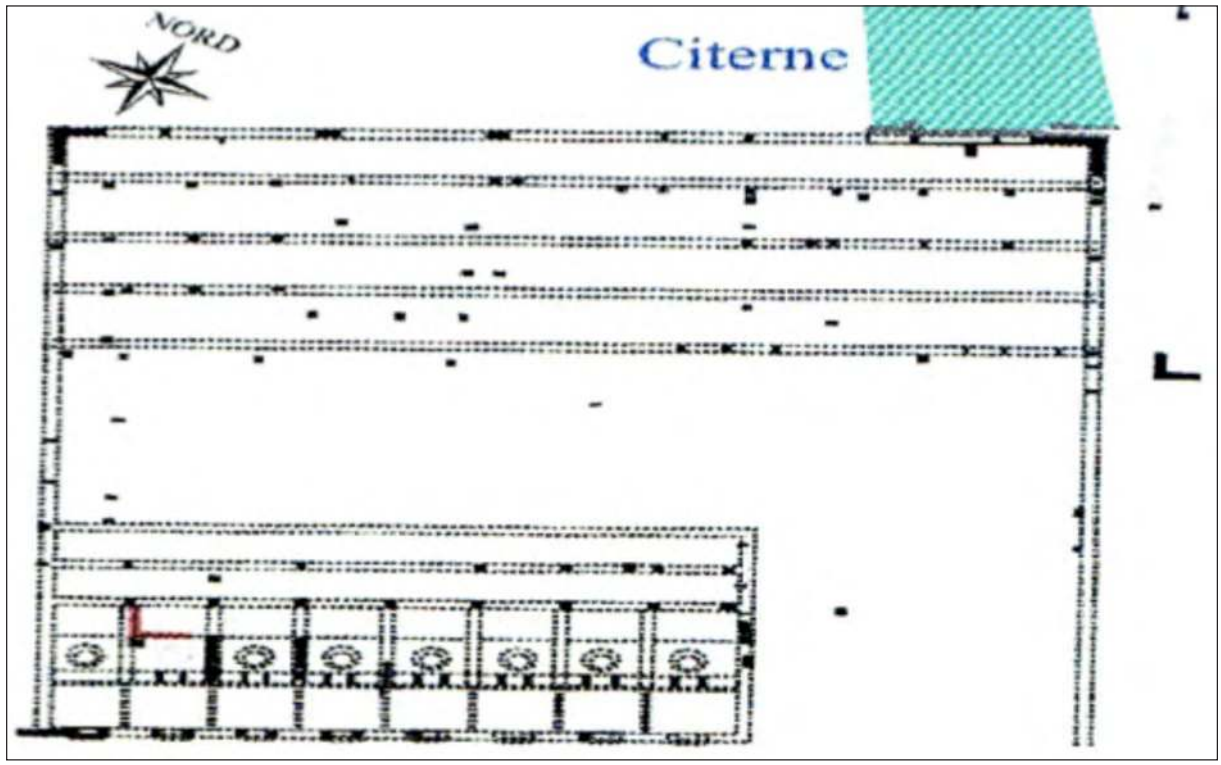

Figure 3.18: *Plan of Henschir el-Begar 2, Tunisia (after S. Sehili).*

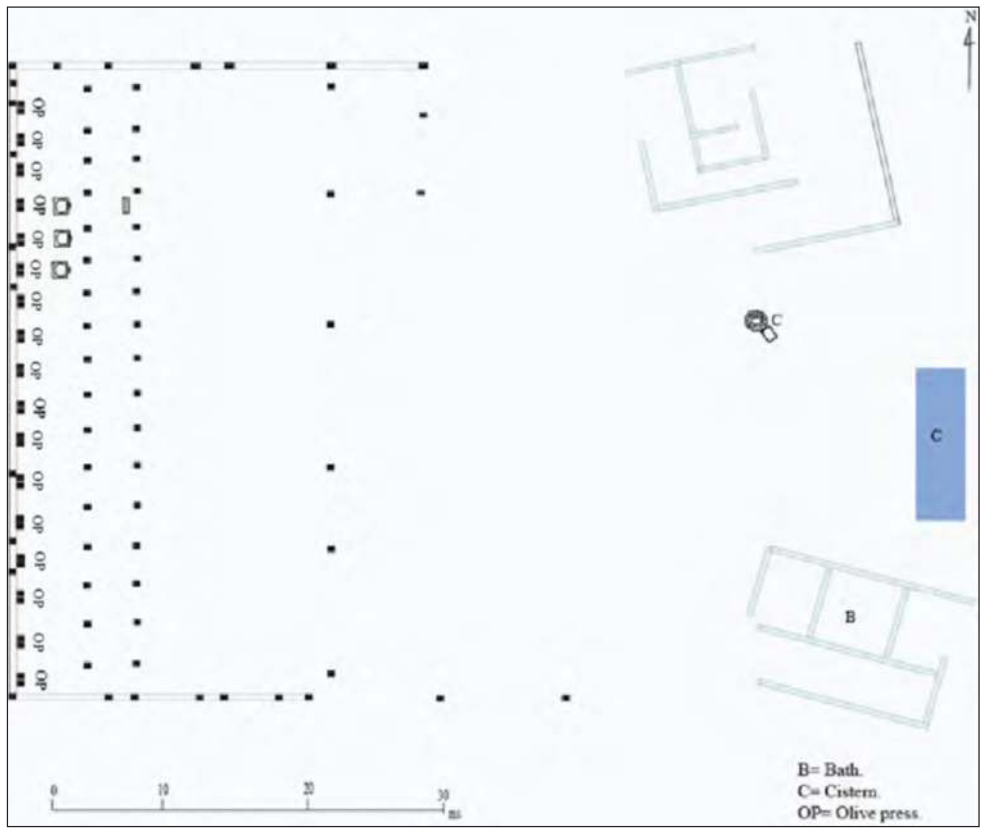

Figure 3.19: *Plan of Senam Semana (TUT54).*

Figure 3.20: *Orthostats and columns with trapezium capitals at Senam Semana (TUT54).*

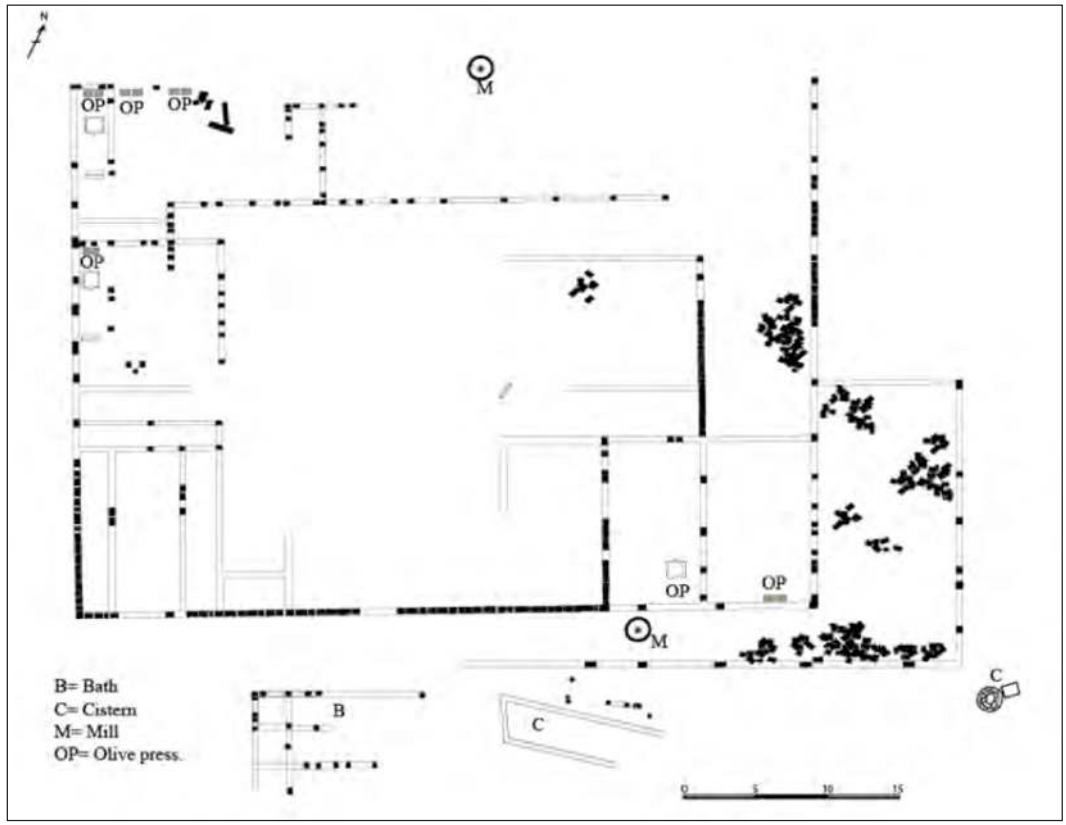

Figure 3.21: *Plan of the oilery-villa Henschir es-Senam (TUT38).*

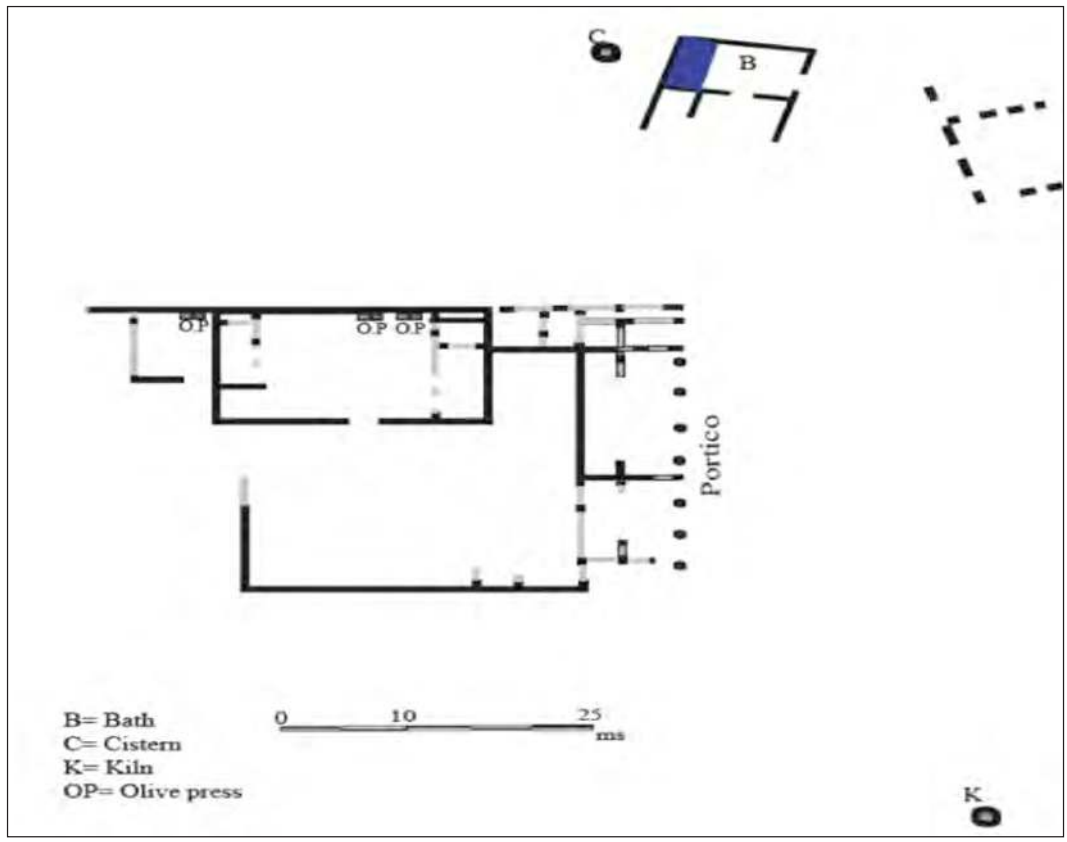

Figure 3.22: *Sidi Eysawi (TUT53), a large farm-villa with pottery kiln.*

Figure 3.23: *A column base at Sidi Eysawi (TUT53).*

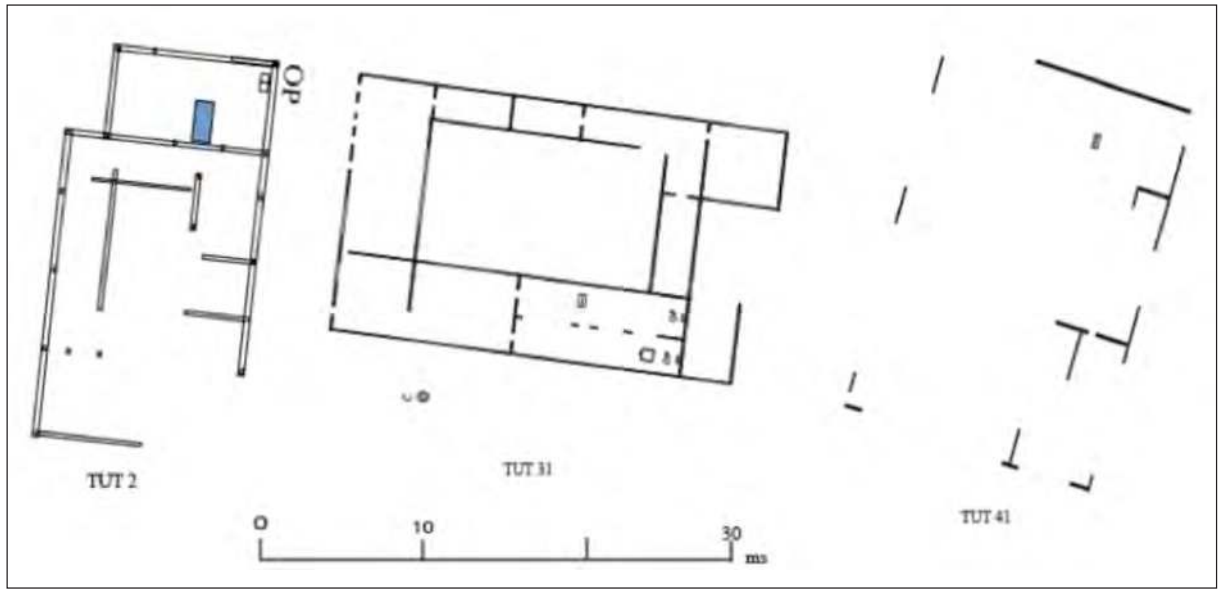

Figure 3.24: *Comparative plans of some small farms recorded by the TAS in the Wadi Turgut.*

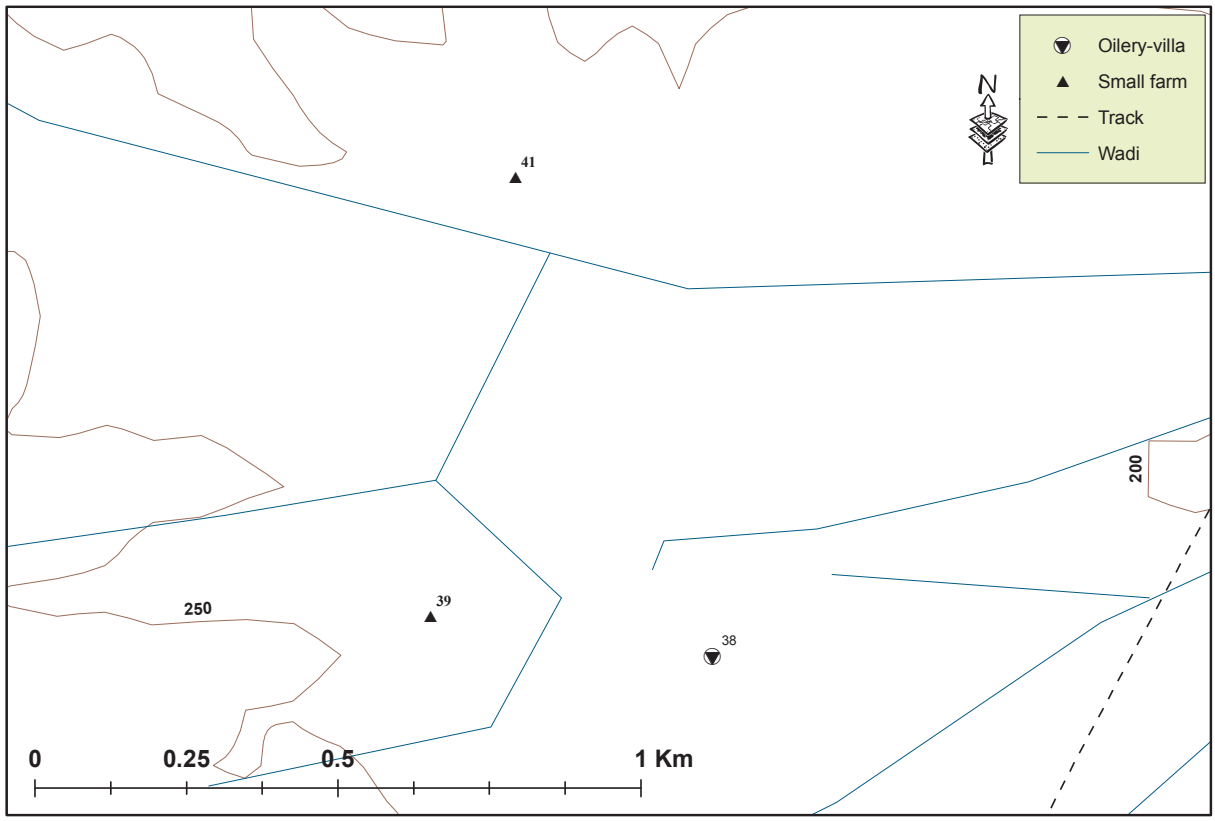

Figure 3.25: *Location of an oilery-villa (TUT38, Henschir es-Senam) with two small farms (TUT39, TUT41) nearby.*

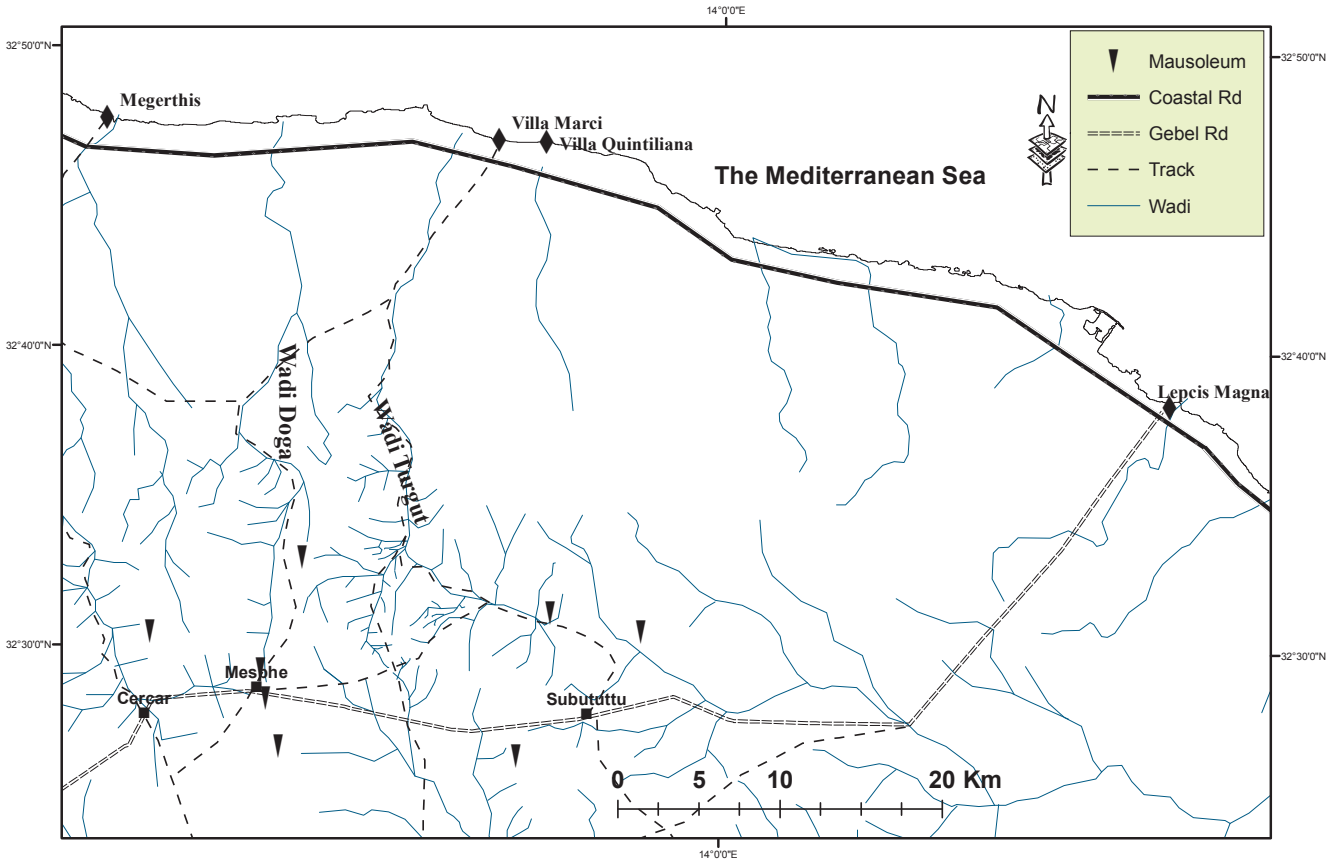

Figure 3.26: *Locations of eight mausolea recorded in the Gebel Tarhuna.*

Figure 3.27: *Corinthian corner-capitals from the es-Sonama mausoleum (TEL91).*

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Figure 3.29: Opus quadratum *at Senam Aref (DOG60).*

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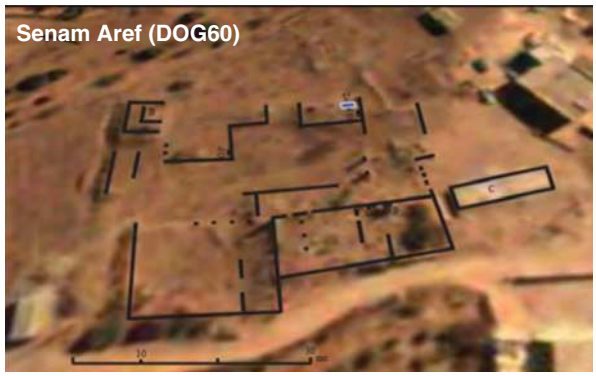
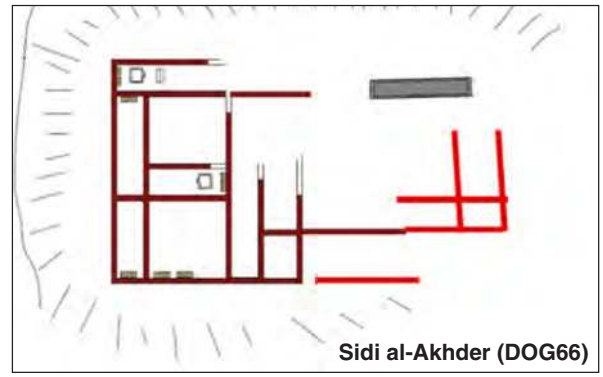
Figure 3.31: *Symbols (probably Neo-Punic letters) marking limestone blocks at the large farm-villa of Sidi Eysawi (TUT53).*





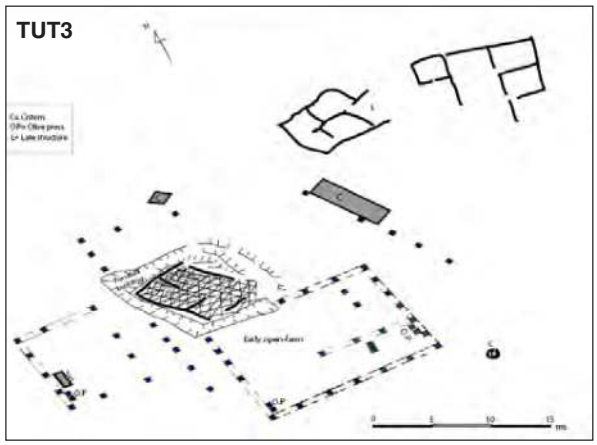


Figure 3.32: *Senam Aref (DOG60), Sidi al-Akhder (DOG66) and TUT3.*

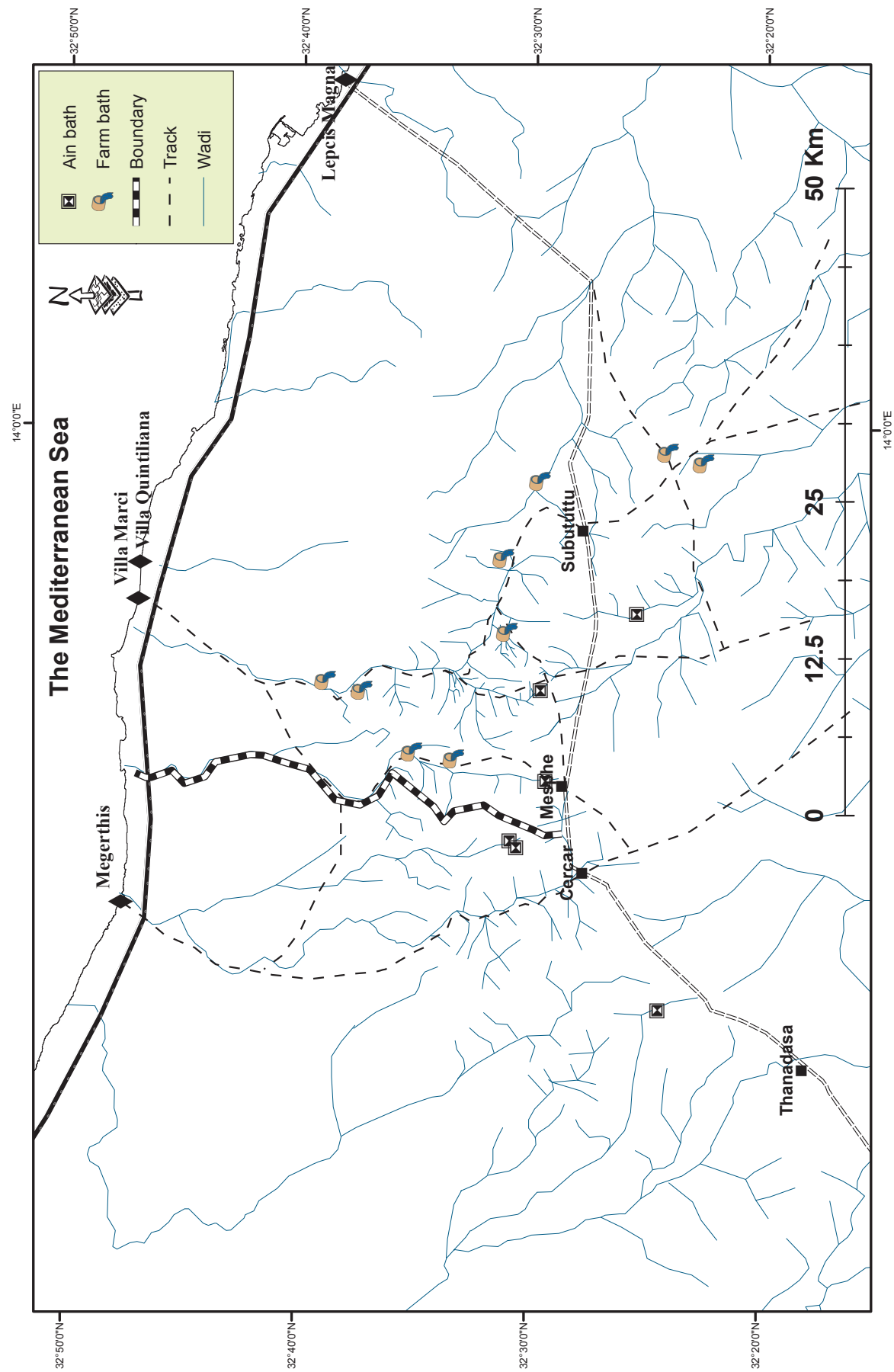


Figure 3.33: *Distribution of rural baths in the Gebel Tarhuna.*

Figure 3.34: *A bath-house at Bir Twafga.*

Figure 3.35: *Location of villa, bath (GUM87) and dam (GUM84) at Ain Guman.*

Figure 3.36: *A general view of Ain Guman villa and bath (GUM87) showing the eastern wall constructed in* opus africanum.

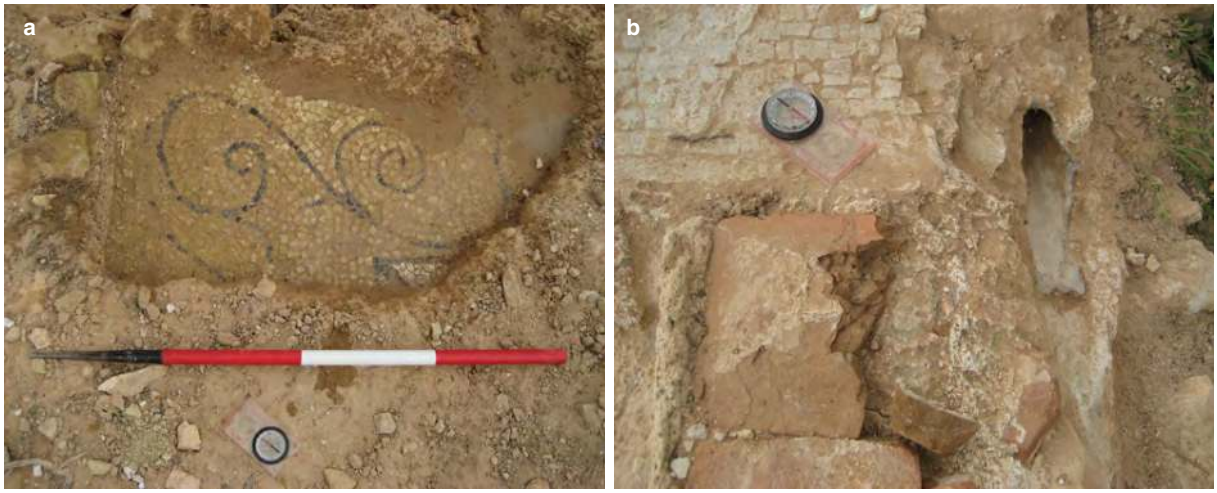


Figure 3.37: *(a) Mosaic and (b) tile and bronze pipe at the Ain Guman villa and bath (GUM87).*

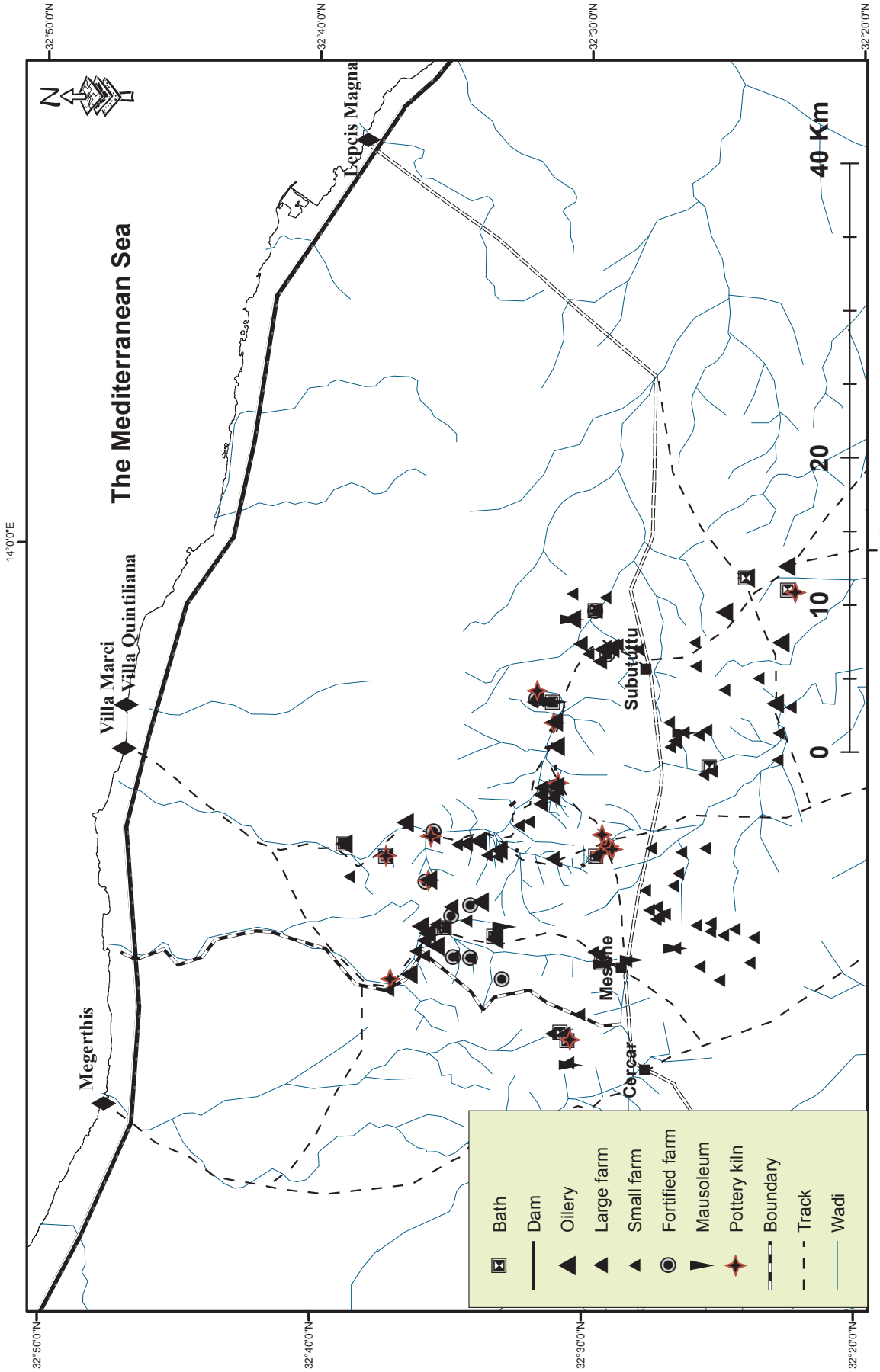


Figure 3.38: *Distribution of rural sites in the Wadis Turgut and Doga.*

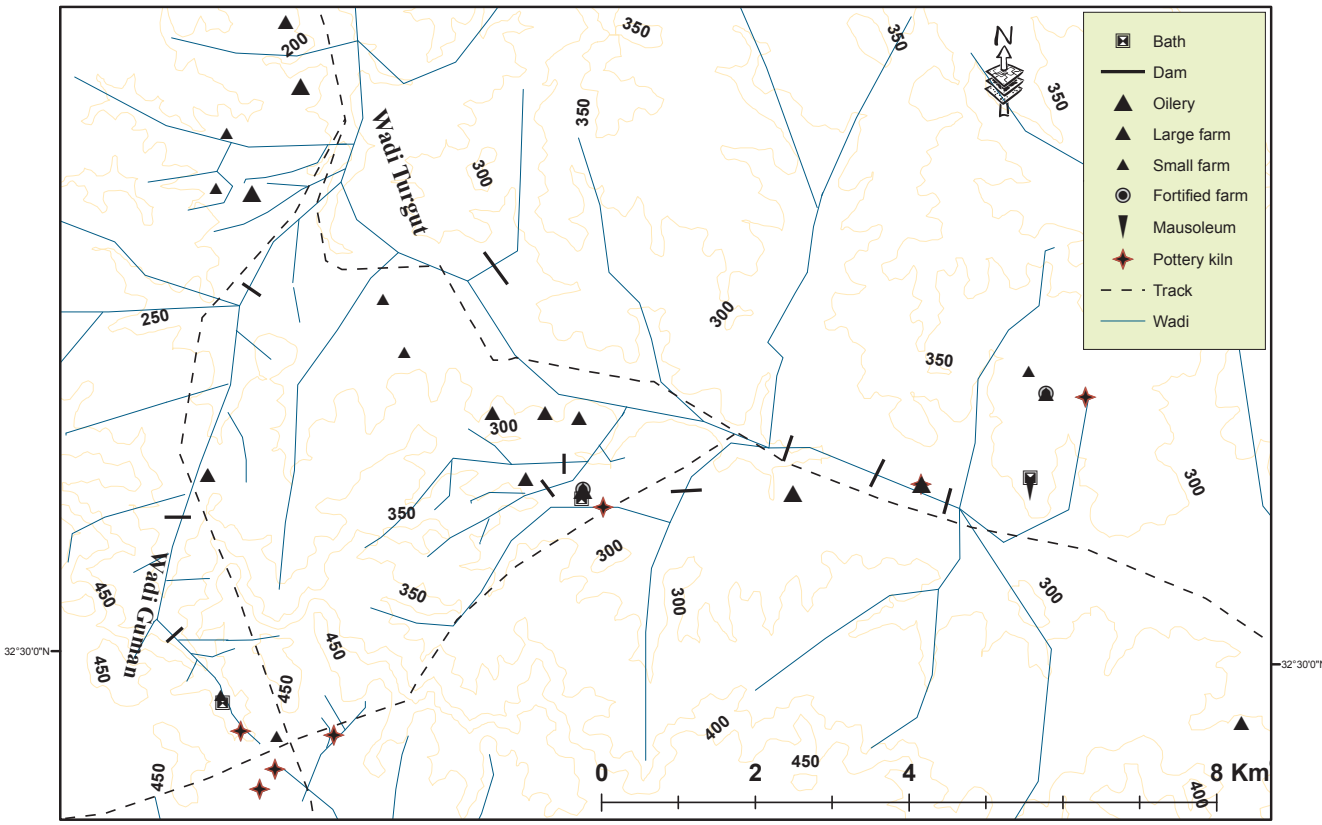


Figure 3.39: *Density of rural sites in the middle Wadi Turgut.*

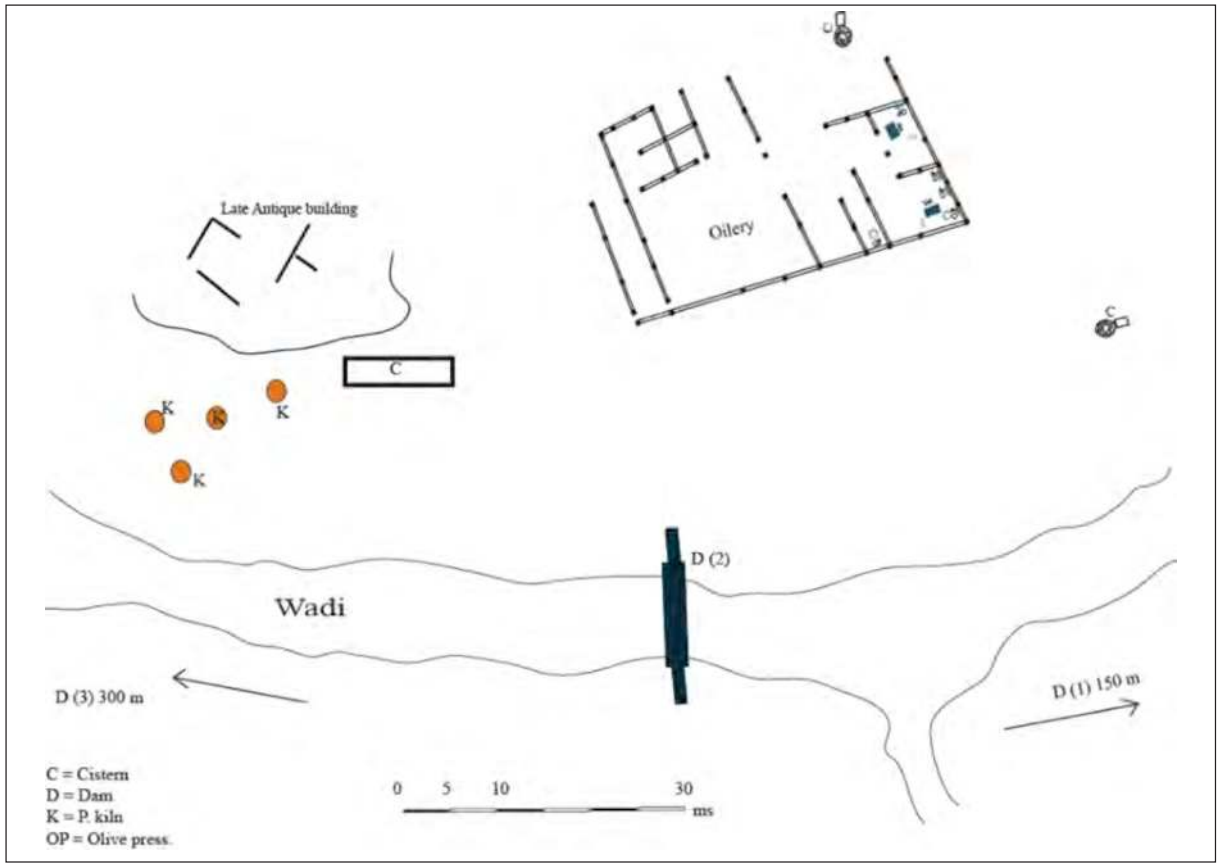


Figure 3.40: *Henschir Assalha oilery-villa (TUT15), kilns and dams (TUT22–24) in the Wadi Turgut.*

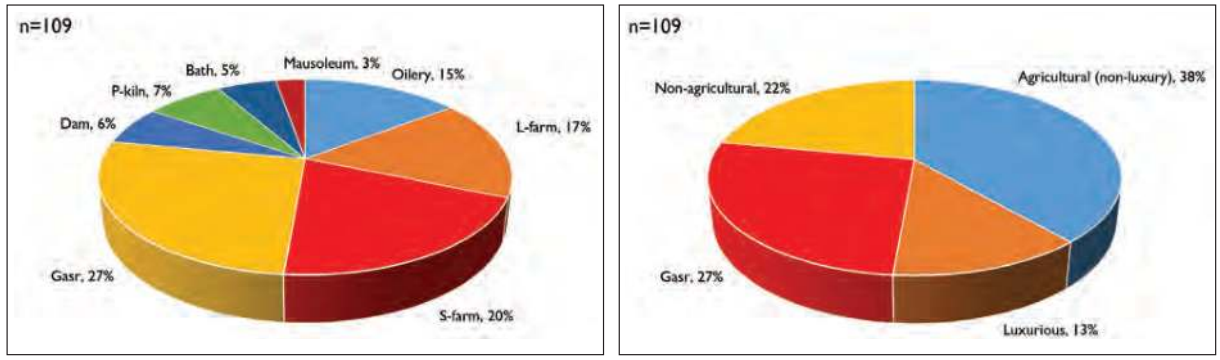


Figure 3.41: *Pie charts showing settlement diversity in the Wadis Turgut and Doga.*

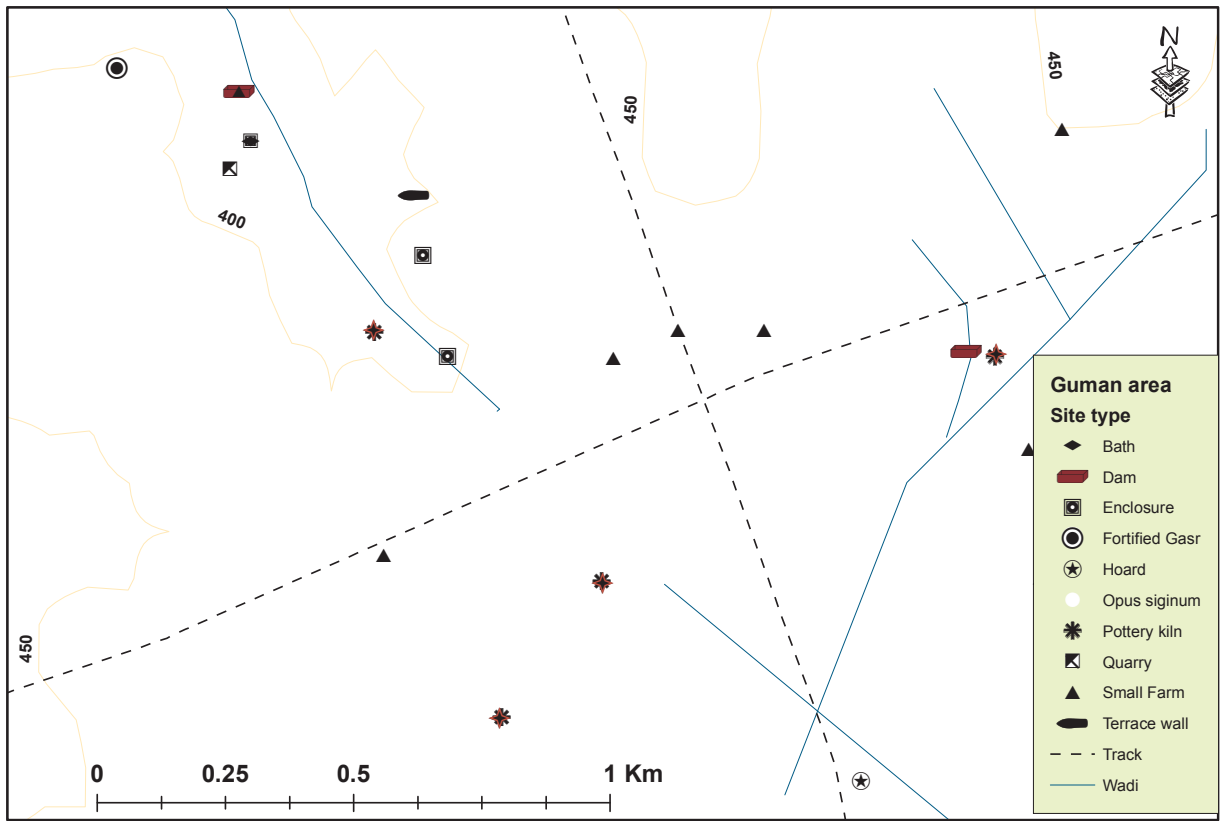


Figure 3.42: *Density of sites in the intensively surveyed area of the upper Wadi Guman.*

Figure 3.43: *An example from the hoard of Numidian coins found in the upper Wadi Guman.*

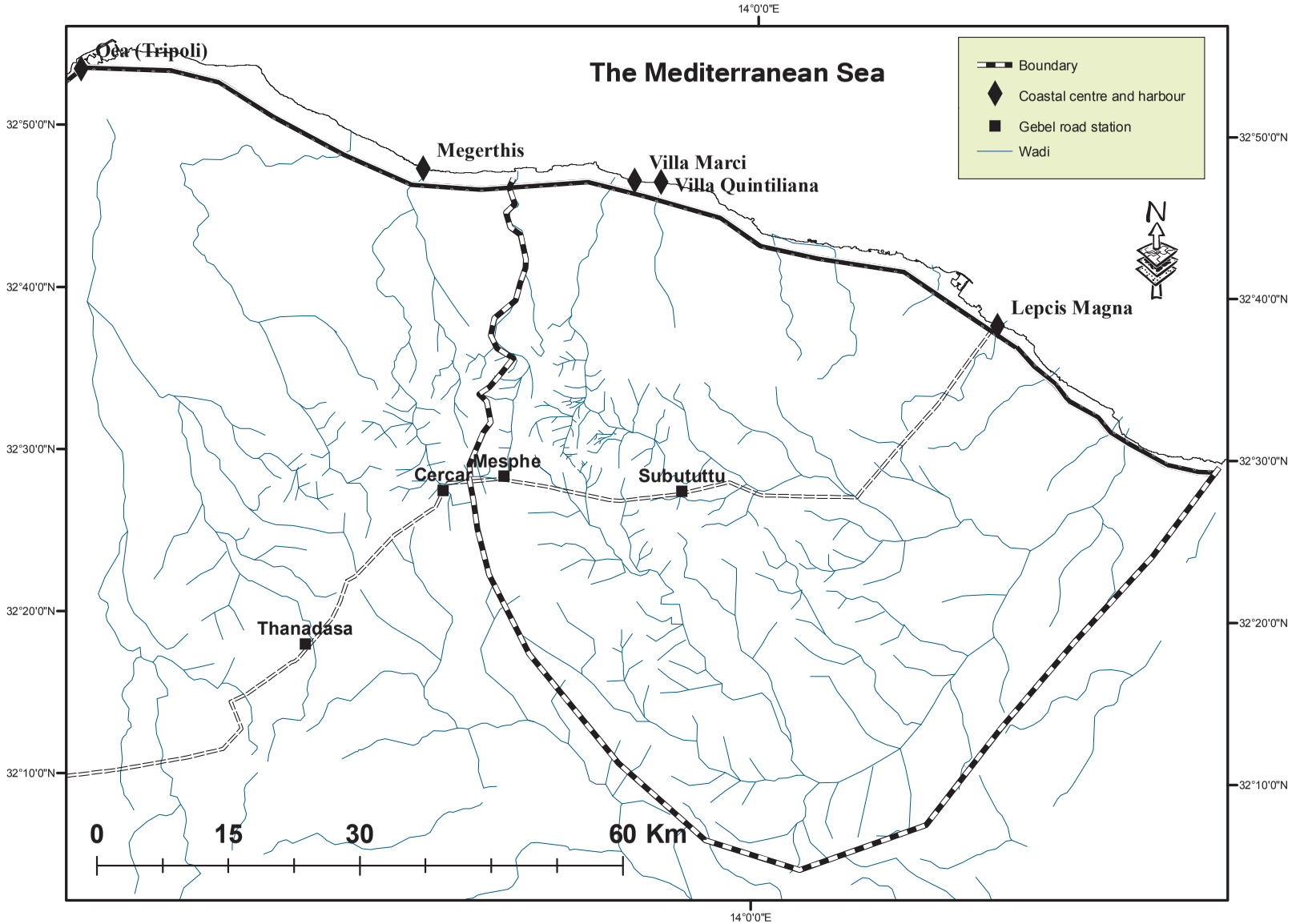


Figure 3.44: *The approximate limits of the territory of Lepcis Magna (c. 3,530 km²).*

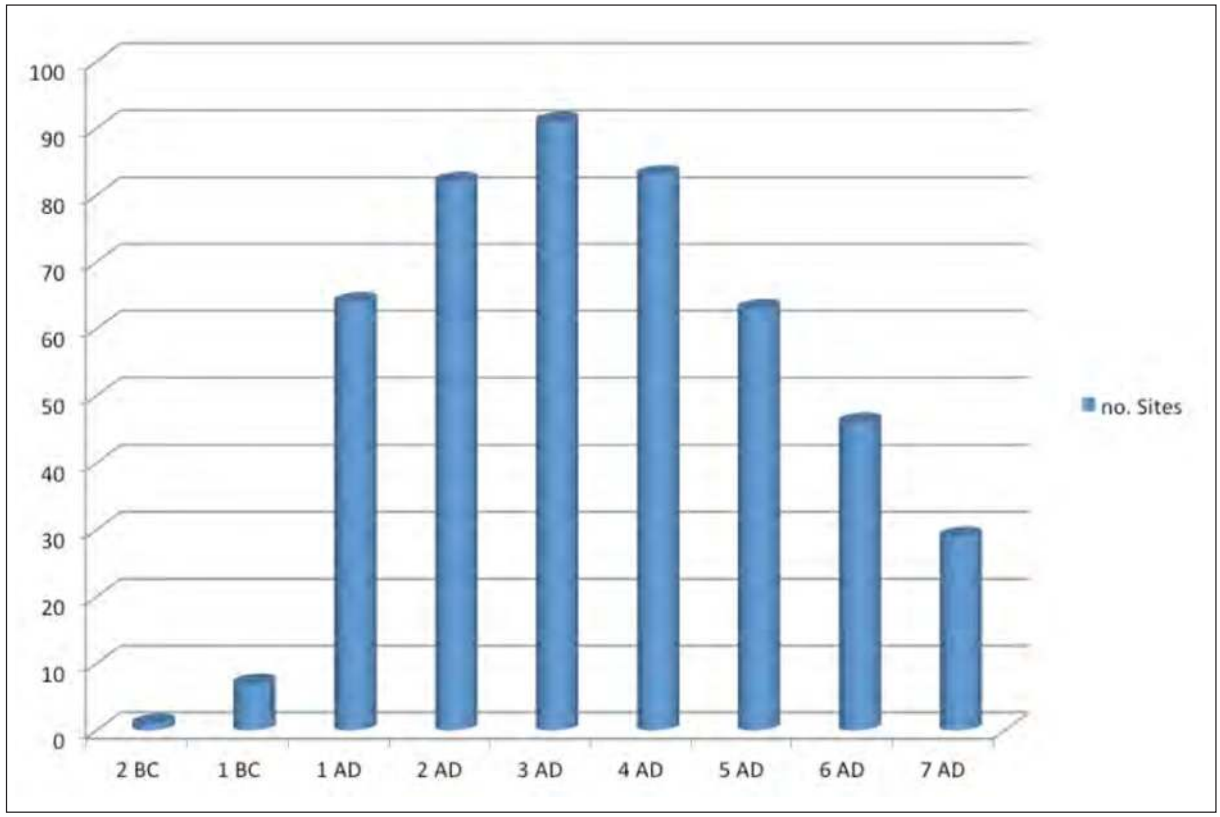


Figure 3.45: *Number of rural sites recorded or re-recorded by the TAS by century.*

Chapter 4

OLIVE OIL PRESSING FACILITIES AND THE PRESSING PROCESS

4.1 Introduction

The history of the Mediterranean world is linked to the cultivation of the olive. Geographically, the distribution of the olive tree corresponds to the Mediterranean climate zone where it has been densely cultivated since ancient times, particularly during the Roman period (Amouretti 1986; Brun 1986; Foxhall 2007; Mattingly 1996b). For many people in antiquity, the production of olive oil and wine for the markets marked the difference between the civilised provinces and the barbarian lands (Lanfranchi 2009). Under the Roman Empire, a number of regions and provinces such as Italy, *Baetica* and *Africa*, developed agriculturally and began to specialise in the production of wine and oil. Oil and wine were important commodities and in high demand not only in Rome, the capital, but also in other large cities such as Alexandria, Carthage, Antioch and in late antiquity, Constantinople (Brun 2003). Tripolitanian amphorae carrying Tripolitanian olive oil (and wine) have been inter-regionally and broadly recorded (Mattingly 1988a). In particular, Tripolitania III amphorae have been identified at many other centres, especially in the western Mediterranean (Carandini 1970; Marquez Villora 1999; Remesal Rodríguez 2004).

The olive tree is one of the three components of the Mediterranean triad (wheat, grapes and olives). It occupied a prime position in the life of Mediterranean peoples in their beliefs, religious rites and mythology, and was also an essential component in nutrition, lighting and body care (Mattingly 1988c; 1996b). In Roman times, the cultivation of the olive tree in North Africa was encouraged by the imperial power, enhancing lands which were once grazing lands or forests (Kehoe 1984). These incentives are reflected in the well-known agrarian tenancy law found at Henschir Mettich, the *lex Manciana*, which was a text specific to *Africa* relating to the management of the imperial estates that emerged there under the Flavians and more specifically under Vespasian. Clauses in the *lex Manciana* and the l*ex Hadriana* allowed tenants to acquire specific rights over the orchards and vineyards on lands they leased. While the lands remained the emperor's property, tenants effectively owned the things that they did to enhance the land and could transmit them to their heirs (Carcopino 1906; Kehoe 1988). It is likely that similar provision applied to imperial estates in Tripolitania, though no epigraphic proof survives.

The production of Ancient Tripolitanian olive oil has been studied increasingly since the 1980s. One of the main conclusions that has emerged from these efforts is that the agriculture practised in the Gebel Tarhuna was central to the development of the Tripolitanian coastal centres, especially Lepcis Magna. As Mattingly has put it:

> The existence of well-developed agricultural lands extending so far into the Gebel certainly helps to explain the wealth of many of the Lepcitanian aristocracy from the Augustan period. The primary cash crop of the Gebel farming was olive oil, as is made clear by the abundant evidence for olive presses, though no doubt a far wider range of produce was grown (Mattingly 1995, 141).

Rural settlements in Roman Tripolitania are predominantly seen from the point of view of agricultural production. More than 150 farming sites with presses have been identified in the Gebel Tarhuna and the number of presses per site varies between one and 17. The archaeological evidence has indicated that olive cultivation and olive oil production were the defining characteristics of the Gebel Tarhuna landscape. Furthermore, the numerous material remains of olive oil production during the Roman period support its identification as the most important economic resource in Roman Tripolitania, echoing Columella's description of the olive as 'first among all trees' (*De re rustica*, 5.8.1).

As we shall see in this chapter, there is some evidence to suggest that not all Tripolitanian presses were used for olive oil production; some were used to produce wine as well, though how many is difficult to evaluate accurately without excavation. While I follow the consensus view that most presses were used for oil, the possible extent of wine production will be discussed later in the chapter.

The production of olive oil has undergone several transmutations through constant innovations in techniques since ancient times. However, some basic methods have been preserved, especially in traditional societies that are still only partially engaged in the industrial revolution. The archaeological identification of ancient processing facilities specifically for olive oil, wine and other liquids is a fundamental and recurring issue. Significantly, technological development in the Roman period had comparatively little effect on the quantity and quality of wine or oil produced per volume of fruit, but had rather more impact on the volume of oil or wine which could be processed per press per hour. Well-preserved evidence, in particular the large presses of the Tripolitanian Gebel and some other parts of North Africa, has allowed scholars to estimate the productive potential of these presses and to speculate on the major investment of capital that would have been required for these large presses to produce a large scale of output. Citing the size and density of these presses, as well as the volume of associated ceramic production, Hitchner argues that the scale of olive oil production and export in the Roman empire suggests 'real economic growth' sufficient to justify the rejection of the Finley orthodoxy which sees the Roman economy as underdeveloped, and thus capable, at best, of only modest growth (Finley 1985; Hitchner 1993, 499–508).

Mattingly surveyed the production of olive oil and endeavoured to assess the scale of production of a number of well-preserved lever and windlass type olive presses in Roman Libya and Tunisia (Mattingly 1993; Hitchner and Mattingly 1991). His study provides the most detailed example of how quantitative research can be utilised effectively to interpret scales of regional production and how this information can be related to the agricultural economy. Mattingly combines textual, archaeological and ethnographic evidence in a detailed and convincingly argued estimate of the potential output of olive oil presses in North Africa. He suggests that "peak olive oil production in Tripolitania for one of the larger presses could have been 9,000–10,000 kg, in Tunisia for the Kasserine presses 5,000–10,000 kg and in the Libyan pre-desert for small presses 2,500–5,000" (Mattingly 1993, 490–491). Mattingly justifies the use of quantification because "... to talk simply of 'huge production' and 'large exports' will invite different readers to reach widely divergent quantitative conclusions" (1988c, 21).

Mattingly points to the numerous olive oil presses in the Tripolitanian Gebel and pre-desert and based on his calculations of their potential productivity suggests that olive oil was being produced for export. The profit from this export trade would have been a source of wealth for the elite and would have helped them maintain and enhance their political, social and economic status (Mattingly 1989a).

A major body of evidence is supplied by the remains of mills and presses. The archaeological evidence for olive presses in the Gebel Tarhuna suggests a remarkable level of oil production. For example, Mattingly has estimated that the total potential oil production capacity in good years will have measured in the millions of litres; sites such as Henschir Sidi Hamdan (with nine presses) and Senam Semana (TUT54, 17 presses) could have produced 100,000 and 200,000 litres respectively in peak production years (Mattingly 1995, 143). Including these massive oil production sites, around 415 olive presses have been identified on the Gebel Tarhuna, and there is other evidence to indicate that the area was cultivated as part of an extensive territory linked to the main coastal centres. Mattingly has argued that the region specialised overall in olive oil production, contributing significantly to exports to Mediterranean markets (Mattingly and Hitchner 1993, 454). There is no doubt that varying production techniques and climatic conditions across the Roman Empire played a significant role in the density of planting, the yield of individual trees and the potential production capacity of individual olive presses (Mattingly 1996b). In contrast to the modern system of olive farming in the Gebel Tarhuna, where extensive rows of trees facilitate mechanised cultivation (Taylor 1960, 91), ancient olive trees were probably grown intensively in rows, in scattered groves or in association with other crops, and were worked by human power and animal traction.

4.2 The Tarhuna plateau presses

All of the olive presses known from surveys in the Gebel Tarhuna are of the lever and windlass type. This situation is not unique to this region but rather conforms to the picture in most other surveyed areas of Roman Africa, in particular, in the area of the Kasserine survey (Hitchner *et al.* 1990; Hitchner and Mattingly 1991). Hitchner and Mattingly have presented a useful comparison between three North African zones with large numbers of well-preserved presses of Roman date: the Tripolitanian Gebel (the Tarhuna plateau), the Kasserine zone (central Tunisia) and the Tripolitanian pre-desert. They were dealing with the physical remains of a particular form of press, that is, the lever press (Figure 4.1). Referring to Figure 4.1, in the African lever press, the pressure on the olives is exerted by a long horizontally-placed timber beam or tree trunk (*prelum*) (A). One end (B) was fixed either between two upright orthostats (C), or supported by the wall or some other form

of vertical support (*stipites*). The woven baskets or mats (*fiscinae*) containing the already crushed olive pulp (D) were placed in a pile on the solid press bed (E), which was located under the beam. Pressure was exerted by lifting a counterweight stone (F) off the floor by means of a windlass (*sucula*) (G) mounted on its top and connected to the free end of the beam by ropes (see also Camps-Fabrer 1953 for a full description). The downward pressure on the baskets or mats in a press using a windlass is proportional to the weight of the various elements, the length of the beam and the height and size of the stack of baskets (Mattingly and Hitchner 1993, 439–440). In comparing the Gebel presses and the pre-desert presses of Tripolitania, Mattingly and Hitchner concluded that the pre-desert presses, though technologically the same, had a smaller processing capacity than their counterparts in the Gebel region (Mattingly and Hitchner 1993, 458).

A number of other studies have focused on the mechanical efficiency of the presses and their productive capacity (Sounni 1982). In general, scholars are in agreement with Mattingly's estimations concerning both the literary and archaeological evidence, including size of press elements, tanks and vats, storage jars, mills and press density (Mattingly 1993). These studies conclude that the ancient presses exerted lower pressures than modern ones. However, the difference in pressure primarily involves a longer cycle in the process of pressing rather than a reduction in the yield of oil extracted from the olives.

4.3 The production process

Mills, press orthostats, press beds and counterweights are all basic and fundamental elements of the processing operation and their existence is a clear indication of the presence of one or more presses at a site (Table 4.1).

4.3.1 Mills

Milling is the first step in the pressing process after harvesting the olives. The presence of mills is one way to distinguish between olive oil and wine presses. Columella mentioned four different types of ancient olive-crushing apparatus, but the two types of mill which are best known archaeologically are the *mola olearia* and the *trapetum* (Figure 4.2) (Columella, *De re rustica*, 7.52.6–7; Frankel 1993). Columella does not give any details about the measurements of the *mola olearia* type or any characteristics that define its production capacity or time of milling. The *mola olearia* is identified by its circular crushing basin, flat crushing surface and one or two wheel-shaped crushing stones (Drachmann 1932).

Ben Baaziz and Mattingly have indicated that the *mola olearia* was the predominant mill type in the olive production areas of *Africa Proconsularis* and Tripolitania (Figure 4.3), except in the Cap Bon region where the *trapetum* type was used (Ben Baaziz 1985; Mattingly 1996b).

The number of mills identified by the TAS in the Gebel Tarhuna (11) is far lower than the other press elements such as orthostats, bases of orthostats, press beds, counterweights and vats (Table 4.1). For comparison, there are more than 400 presses recorded in the Tarhuna region. However, this shortfall in the number of recorded mills is paralleled in other areas in the Roman world. For example, Hitchner found only seven mills, compared against more than 350 presses in the high steppe region of central Tunisia (Hitchner *et al.* 1990; Mattingly and Hitchner 1993, 443–444). In the Wadi el-Htab (the Tunisian Tell), Ben Baaziz identified nine mills and 97 olive presses (Ben Baaziz 1985), while in the *Caesarea* survey only three mills were identified from 55 sites (Leveau 1984, 427–439). In the territory of Dougga (*Thugga*), an area of 150 km^2, only four mills have been identified, compared to 196 counterweights (Lanfranchi 2009, 274). In ancient Greek contexts, olive mills are also few or absent from farming sites (Foxhall 1993). Because of their expense, mills are often not used for the domestic production of oil and other methods of crushing olives may be used. Mills are thus an indicator of surplus, market-oriented production. The absence of mill mortars and millstones from the majority of olive oil production sites can most likely be explained by the continuing phenomenon of preferential removal and reuse of millstones and mill mortars in the surveyed areas of North Africa (Mattingly 1993). The stone mill elements were expensive items and required considerable technical skill to manufacture. A further factor is the lack of excavation at rural sites: mills were usually located in the countryside and therefore, are rarely found in urban excavations.

Three broad types of the *mola olearia* were recorded during the Kasserine survey (Figure 4.4), with no evidence for the use of the *trapetum* type (Mattingly and Hitchner 1993, 444). These three types were described as follows:

> *Type 1:* Large shallow, generally flat-bottomed, stone basin with integral central pier (with square socket hole). The outer diameters vary in the four examples recorded from 1.19 to 1.58 m The working surface of the basin, between outer lip and central column varies between 0.30 and 0.42 m (bottom) and between 0.37 and 0.50 m (top), with a depth between 0.12 and 0.20 m.
>
> *Type 2:* Large shallow, flat-bottomed basin with central area cut away to leave a pierced ring of stone. The central pivot in this case was either a separate stone column anchored to the mill substructure or conceivably was made of wood and regularly replaced.

Type 3: Shallow, flat-bottomed basin, with broad central depression. This type is similar to Type 2, but the bottom is not pierced through. The central column for the pivot was presumably detachable and replaceable (Hitchner and Mattingly 1991, 45).

All of the mills recorded on the Tarhuna plateau by the TAS were also *mola olearia* type mills of Kasserine *Type 1*, with the addition of two further subtypes (Table 4.2; Figures 4.5–4.6):

Type 1a: Large shallow, generally flat-bottomed, stone basin with a depressed central pier. The recorded examples have both square and circular socket holes.

Type 1b: Shallow, flat-bottomed stone basin, with central pivot pier (the recorded mill at TUT16 (Henschir Boshaina) lacks a central pier, but it seems to have been broken off in later times). This type is differentiated by the provision of a rectangular or square drain with a surrounding incision, probably for fixing a filtration grill to prevent the crushed olives from flowing out.

The refining of the classification of the *mola olearia* type mills of the Gebel Tarhuna highlights important variations in the method used to mount the millstones. The thickness of the outer rims was, on average, 0.15 m; the external diameters varied between 1.32 and 2.1 m, and the external height ranged between 0.3 and 0.5 m. Some of the mills recorded on the Tarhuna plateau (TUT5 (Henschir Aziza), TUT16 (Henschir Boshaina), TUT20 (Ain Astail), TUT38 (Henschir es-Senam) and DUN130) are quite similar in their internal diameters to mills recorded in eastern Algeria, where Lanfranchi was able to measure 60 mills, the inner diameters of which varied between 1.0 and 1.53 m (Lanfranchi 2009, 273). Some of those from the Gebel Tarhuna are comparable with the largest known Roman mills as listed by Brun (1986, 77) and also cited by Lanfranchi (2009, 273) (Table 4.3). Four mills from the Tarhuna plateau (TUT4, SRI132 (Wadi es-Sri) and two at DUN128), and two mills identified by Ben Baaziz (2000) in the upper valley of the Wadi el-Htab (Tunisia) can be added to the mills mentioned by Brun, which were distributed throughout the Middle East and the North Africa. These mills are larger than six observed and studied by Hermassi at the sites of Slougia and Dakhlet Zmit in the Tunisian high steppe whose external diameters varied between 0.70 and 1.55 m (Hermassi 2004).

Millstones are rarer finds than mill mortars. The surface evidence found at three sites suggests that the olives were crushed in the mills by solid cylindrical stones with holes bored through the centre (Table 4.4; Figure 4.7). The millstone from TUT18 (Ain Astail) also had its central hole fitted within a square 0.05 m in depth. This was probably for an axle which was fitted around a freely-rotating horizontal bar. The millstone was rotated around another fixed element set in the pivot hole and probably connected to the ceiling or an overhead beam (Figure 4.8).

It is possible to calculate the volume and weight of olives it would be possible to process at any one time by subtracting the volume of the millstones from the total interior volume of the mill mortar (Table 4.5). It should be noted that the figures in Table 4.5 show the volume of unmilled olives, so the processing capacity would be higher by supplying more unmilled olives during the milling process.

4.3.2 Press orthostats (*arbores*)

As already mentioned, all Roman-period olive presses on the Tarhuna plateau were of the lever type, with the head of the lever anchored between a pair of limestone orthostats or uprights (*arbores*). These orthostats form the most obvious archaeological features of most pressing sites. Because these massive limestone uprights are still standing at many farming sites (Figure 4.9), their remains in the Gebel Tarhuna attracted the attention of early European travellers and scholars who initially mistook them for the remains of megalithic structures (Barth 1857; Cowper 1897). Nonetheless, the research of men like Cowper, for instance, on the *senams* of the Tarhuna plateau is extraordinarily valuable, especially since he described over 70 sites, with many photographs, measurements and sketches. However, Cowper misinterpreted them completely because he assumed that they were religious monuments of pre-Roman date (Cowper 1897, 131; Mattingly 1988a). Some of these sites are now destroyed or have completely disappeared.

The data derived from Cowper's records for the northern Tripolitanian presses "are unquestionably less reliable than those from the Kasserine survey" (Mattingly and Hitchner 1993, 454). The information on the Gebel Tarhuna presses presented here is mainly drawn from the TAS evidence. The TAS records and measurements improve on the data previously published by Mattingly (which were largely based on Cowper's records), now making the Tripolitanian evidence more reliable (see below for examples where Cowper's measurements have been corrected).

The size of the recorded ancient olive presses varied from one area to another. Mattingly stated that there were clear differences in size and scale between the elements of the olive presses recorded in the Tripolitanian Gebel, the Kasserine region and the Tripolitanian pre-desert (Mattingly 1993, 485). In terms of the size and scale of pressing facilities, the Gebel Tarhuna press orthostats have generally been considered to have been the largest in the three study areas (Mattingly 1988a, 188; Mattingly and Hitchner 1993,

456–457). The data recorded by the TAS allows these views to be re-evaluated. Exact measurements were a priority for the TAS survey work "since the size of the *arbores* and the manner in which they were bonded into the structure of the building can help elucidate the potential force generated by the press and this can help to distinguish in broad terms between presses of high and low capacity" (Mattingly 1988a, 187). Table 4.6 and Figure 4.10 illustrate the measurements of a total of 40 single press uprights examined by the TAS. It must be noted that, firstly, I selected only these 40 examples for analysis because they are the best-preserved uprights in the Gebel Tarhuna; the majority (37) were located in the Wadis Turgut and Doga, in addition to three from south of Gasr Ed-Dauun (*Subututtu*). Secondly, only a small number were chosen from the latter area because many of those presses have already been examined by Cowper, Oates and Mattingly (Cowper 1897; Mattingly 1985; Oates 1953; 1954). Thirdly, these measurements are only of the orthostats themselves, without the addition of the basal blocks and lintels that added extra height and weight. The height of the upright therefore refers to its length from its bottom end above the base to its higher edge under the lintel. Only two of the press uprights listed in Table 4.6 (TUT9 (Senam el-Gharabah) and TUT43 (Loud el-Meghara)) appeared in Mattingly's tables of Tripolitanian presses (Mattingly and Hitchner 1993, 458, Sites 44 and 59 respectively).

One particularly striking aspect of the Gebel Tarhuna press orthostats is that they were generally characterised by massive sizes and extraordinary weights (Table 4.6; Figure 4.11); 50 % were over 3 m in height to lintel alone, with individual orthostats generally weighing 2–3 metric tonnes apiece. Three exceptional press orthostats — TUT43 (Loud el-Meghara), DUN128 and DUN129 (Senam Halafi 1) — weighed 3.198, 3.348 and 3.084 tonnes respectively; the figures must then be doubled for each pair of orthostats. The *arbores* at DUN128 are also the tallest uprights recorded by the TAS, reaching 3.8 m in height and abutted by a wall built of ashlar blocks that rises to more than 5 m (Figure 4.12).

Because his measurements were based on information recorded by Cowper, Mattingly has commented that the measurements he presented must, in all cases, be seen as approximate. For this reason, in 2007 I re-measured the press uprights of site TUT9 (Senam el-Gharabah; Cowper 1897, Site 44) (Figure 4.13). As a result, their height can now be corrected from 3.3 m to 3.6 m, the measurement of the height of the top hole can be changed to 1.75 m from 1.65 m, and the base of the lower hole is at 1.1 m rather than 0.75 m above the base of the orthostat (Mattingly and Hitchner 1993, 458, Table 9).

The Tunisian high steppe and other areas of North Africa also have well-preserved *arbores*. The features of the Tarhuna plateau press orthostats can be compared with a number of examples from the *Thelepte* region of Tunisia (Table 4.7). The press orthostats at Mguismet were the highest (2.43 m) in the examined area, while those at Henschir Boudhaif were the lowest (1.7 m) (Hermassi 2004, 120). It is also clear that the size and weight of the Tarhuna plateau press orthostats were far greater than the *Thelepte* examples. In addition, out of 38 press orthostats examined during the Kasserine survey (close to *Thelepte*), there were only three that reached 2.5 m in height (Hitchner 1990, KS031.P13 (Ksar el-Guelal), KS031.P20 and KS031.P7).

The press orthostats recorded by the TAS have been classified into six types based on the number and arrangement of beam holes cut into them (Table 4.6; Figure 4.14). Only a single new type (Type T6) has been added to the typology of Tripolitanian press orthostats proposed by Mattingly:

> *Type T1:* Two pairs of lateral holes (normally pierced only in one of the two orthostats and recessed c. 0.15–0.20 m into the other), no angle cut slots….
>
> *Type T2:* Two pairs of lateral holes, one pair of angle cut slots (almost invariably located above the top pair of holes)….
>
> > *Type T2a:* Two pairs of lateral holes and two pairs of angle cuts….
> > *Type T2b:* Two pairs of lateral holes and three pairs of angle cuts….The angle cuts either coincide with the holes or are interspersed with them.
>
> *Type T3:* Three pairs of lateral holes and one pair of angle cut holes (normally positioned above the top pair of lateral holes)….
>
> > *Type T3a:* Three pairs of lateral holes and a single pair of angle cuts located between the top and middle pairs of lateral holes…. This is possibly a type T2 press which has been adapted by the insertion of a third pair of holes to increase its capacity.
> > *Type T3b:* Three pairs of lateral holes and two pairs of angle cuts. One pair of angle cuts is located above the top lateral holes, the other coincides in height with those holes. Once again, perhaps this is the result of the conversion of a type T2 press to enlarge processing capacity.
> > *Type T3c:* Three pairs of lateral holes and three pairs of angle cuts….
>
> *Type T4:* Four pairs of lateral holes….
>
> *Type T5:* No pairs of lateral holes, but four pairs of angle cuts… (Mattingly and Hitchner 1993, 460).

Type T6: No pairs of lateral holes cut into the inside faces, but three angle cuts in the right orthostat and three longer cuts along the width of the left orthostat. The uppermost of the long cuts extended only part way across the front of the left orthostat and does not provide an angle cut to match the right orthostat's top angle cut. A single example (TUT3) was recorded by the TAS with this arrangement (Figures 4.14–4.15).

4.3.3 Press beds (*arae*)

Press beds (*arae*) often consisted of monolithic slabs of limestone set in front of the orthostats (Figures 4.16–4.17) and were used in the middle stage between milling and refining to extract the oil. Once the paste was obtained after milling, the pulped olives were inserted into baskets (*fiscinae*) and placed on the *arae* for pressing (Brun 1986, 47; Mattingly 1988a, 187; Mattingly and Hitchner 1993, 451). Press beds are usually defined by a circular or square channel carved into their surface. This channel had the function of collecting the liquid from the pressed olives and directing its flow into the adjacent vats. Archaeological evidence from around the Mediterranean world indicates that press beds could be a monolithic slab or a pavement of *opus signinum*, but the latter has to be very strong in order to bear the large force exerted on it during the pressing operation (Vismara 2007).

Mattingly and Hitchner described three types of press beds found during the Kasserine survey: Type 1, a monolithic slab with a circular channel, Type 2, a circular channel cut across a series of slabs, and Type 3, an *opus signinum* floor. Without excavation, it has not been established whether beds of the last type had a circular channel incorporated into them or not (Hitchner and Mattingly 1991, 46; Mattingly and Hitchner 1993, 451). The archaeological evidence from the Tarhuna plateau has produced only one type of press bed, that is, a large monolithic slab, with two main variations: the first have a circular channel and the second have a square channel. Each of these types also had a number of sub-types .

A total of 45 press beds were examined by the TAS on the Tarhuna plateau; it is worth noting that some of these beds were incompletely preserved or exposed and thus difficult to classify. They are categorised as follows (Table 4.8; Figure 4.18):

Type 1: monolithic stone slab with a square channel cut on the bed surface.

Type 1a: monolithic stone slab with a square channel and one corner cut.

Type 1b: monolithic stone with a square channel and two corner cuts (only one press bed of this type has been recorded).

Type 1c: monolithic stone slab with a square channel and eroded meanders along the inner edge of the channel.

Type 2: monolithic stone slab with a circular channel cut on the bed surface.

Type 2a: monolithic stone slab with a circular channel and one corner cut.

Type 2b: monolithic stone slab with a circular channel and one angle cut.

Type 2c: monolithic stone slab with a circular channel and four angle cuts.

Type 2d: monolithic stone slab with a circular channel, but with eroded meanders alongside the inner edge of the channel.

It is worth noting that a few *opus signinum* floors were recorded by Oates (1953) and the TAS, but it is hard to judge without excavation if these floors were used for pressing. I do not believe that these *opus signinum* floors functioned as press beds because they were not located in front of surviving press orthostats; they were probably used as a waiting area for the baskets filled with pulped olives or as treading floors for wine production.

As Table 4.8 illustrates, the Gebel Tarhuna *arae* were characterised by large sizes and heavy weights; their total surface area often exceeded 4 m^2 and their total weights fell roughly between 4.6 and 5.7 tonnes. Square channels were slightly more common than circular channels: 26 press beds had a square channel and 19 a circular one. Nevertheless, the number of recorded examples of the two types of channels reveals that both were in common use during the Roman period in the Gebel Tarhuna. The internal diameter of the circular channel and that of the largest circle that could fit within a square or rectangular one reveal the maximum dimensions for the size of the flat *fiscinae*. With this in mind, the Tarhuna plateau press beds seem to have been intended for placing baskets of very large diameters (1 m or more) "and this has major implications for the quantity of olives which could be pressed at one time" (Mattingly 1988a, 187). Knowing the diameter of the *fiscinae* used is an important factor in the calculation of the productive capacity of the presses. There is no direct archaeological evidence for the actual size of *fiscinae*; they appear to have been made of organic materials, which modern parallels suggest might have been *halfa* grass or palm leaves. However, as Mattingly suggests, there was probably a close relationship between the internal diameter of the channel cut into the press bed surface and the size of baskets employed, and he emphasises the following point: "I do not believe that such large monolithic slabs would have been quarried and transported if baskets of much smaller diameter (say 0.60 m) were in use" (Mattingly 1993, 489). The *fiscinae* used to contain the pulped olives had to be carefully washed in order to remove the paste after pressing in order to reduce the danger of the residues giving an unpleasant taste to the oil obtained from the next pressing load (Cato, *De agricultura*, 67.2; Columella, *De re rustica*, 7.52.22; Pliny, *Natural History,* 15.22).

Thus, the diameter of the channel defined the maximum size of the flat baskets (*fiscinae*) used to contain the olive pulp (or possibly grapes). The liquid would begin to ooze out from the stacked baskets even before applying the pressure of the beam (*prelum*) and windlass. Some of the Tarhuna plateau press beds I examined had a ring of eroded notches (meanders) just inside the circular channel which were probably created by the acids in the olive oil over long periods of use (Brun 1986; 2004). These grooves probably formed due to the flow of olive oil on the exposed stone surface outside the stack of baskets. Measurements of press beds illustrate that the inner diameters of the eroded areas were not much smaller than the diameter of the channels, providing further support for Mattingly's view of the large size of the *fiscinae*. For instance, a press bed from site TUT27 (Figure 4.19) has a 0.07 m wide circular channel with an inner diameter of 1.48 m. There is a clear pattern of acidic erosion grooves on the inner side of the channel. Taking the inner edge of these grooves as the outer limit of the baskets, the maximum size of baskets used in this press appears to have been 1.25 m. Press beds with similar eroded meanders have been recorded at the site of Kef Lahmar (De Vos 2007, 50–51, Site 93), in the oil farm of the Oued R'mel in the region of Segermes, Tunisia and at a rural villa at Madaure, Algeria (Figure 4.20) (Brun 2004, 211, 219).

Turning again to the Gebel Tarhuna, other examples also provide suggestive evidence for the diameters of *fiscinae* (Figure 4.21). In particular, the examination of press beds with square channels from oilery-villas TUT15 (Henschir Assalha) and TUT38 (Henschir es-Senam) and one with a circular channel from large farm TUT14 (Bu-Kaala), indicates that while diameter may have varied from one press bed to another, the available evidence points to the general use of baskets with diameters larger than 1 m. This confirms Mattingly's suggestion that Tripolitanian presses had very large *fiscinae* compared to those used in more recent traditional presses (where *fiscinae* rarely exceed 0.6 m diameter) and supports this aspect of his calculations of the productive capacity of the Tarhuna presses (Mattingly 1993).

However, there are additional factors to be considered in relation to the Tripolitanian presses which were not considered by Mattingly, especially the possibility that not all presses employed baskets. According to the *Digesta* there were two ways to do pressing: a method which entailed the use of *regulae* and another method which did not (*Digesta*, 19.2). Pliny wrote that *regulae* represented the next step in technological innovation (*ut nuper inuentum*) after *fiscinae* (Pliny, *Natural History*, 15.5; Vismara 2007, 459). A *regula* was a kind of container made of wooden slats (*exilibus regulis*) which was built directly on the press bed and contained the load of pressed olives or grapes. Hero described two types of containers made from thin laths called *galeagra* (Hero, *Mechanica*, 3.16–17); possible reconstructions of these containers have been presented by Drachmann (Figure 4.22). An important factor to bear in mind is that this sort of container may have been better suited to wine rather than oil production.

It is possible that press beds with square or rectangular channels are indicative of the use of *regulae* rather than *fiscinae*; thus, square channels could indicate wine rather than oil production. Moreover, the available archaeological evidence from the Tarhuna plateau raises the possibility that some of these press beds might even have been used for pressing both olive oil and wine (as explained below). Unfortunately, no resolution of the wine/oil issue can be definitely reached without excavation at some of these rural farms; however, as a working hypothesis, it is suggested here that circular press bed channels generally indicate the pressing of olives in *fiscinae*, while square channels may indicate wine production using *regulae*. Baskets (*fiscinae*) were most likely used for pulped olives, while *regulae* probably functioned for pressing grapes. It is conceivable that some presses with square channels were used with both *regulae* and *fiscinae*.

There is also evidence of press beds with circular channels being converted for use with square *regulae*. These appear to belong to a hybrid type designed for use with either *fiscinae* or *regulae*. A number of press beds recorded by the TAS (TUT12 (Sidi Buagela 2), TUT27, TUT29, TUT38 (Henschir es-Senam), TUT44 (Sidi Yekhlef), and DOG60 (Senam Aref)) have traces of perpendicular angle cuts or semi-circular cut-outs adjacent to the external edge of the circular channel (Figures 4.23–4.24). Close examination of these corner cuts reveals traces of grooves at right angles extending beyond the circular channel, almost certainly employed to fix the wooden slats of the *regulae*. An example from TUT29 illustrates how the *regulae* could be fitted on top of this type of hybrid press bed (Figure 4.24). It is not clear whether the superimposed square and circular features reflect contemporaneous use of a press for both wine and oil production during the different pressing seasons of a single year or conversion of oil presses into wine presses at an unknown point. The possibility that a single press could be used for both wine and oil production is further suggested by the fact that some press beds had more than one channel, allowing liquid to be directed into different systems of tanks and vats. It is difficult to identify the full distribution of this sort of press bed in the Gebel Tarhuna because many of them have disappeared underneath soil and collapsed walls. However, this innovative pressing technology does not seem to have been widely used in the pressing operations of Tripolitania or at other pressing sites in North Africa. Previous archaeological surveys in the other parts of North Africa have not recorded any such modified press

beds, although a few eroded meanders on circular *arae* have been identified (Brun 2004; De Vos 2007). An excavation between 2007 and 2009 inside the Lebda Cement Factory (12 km southwest of Lepcis Magna) has uncovered a large rural villa, c. 9,400 m^2 in size. A press bed discovered during the 2007 season in the western part of the villa also appears to have been converted from a circular channel for the use of *fiscinae* to a square base for use with a *regula*. In this case, the press size was smaller in terms of beam length than those used on the Tarhuna plateau (Figure 4.25).

In this section I have tried to examine a number of aspects of the press beds recorded on the Tarhuna plateau and I have concluded that until systematic excavation in association with archaeobotanical analyses have been done, we can only make hypothetical conclusions about the commodity processed in individual Tripolitanian presses. Some press beds functioned with large circular baskets and seem to have related to olive oil, but wine cannot be excluded in all cases. Eroded channels and olive mills certainly support the identification of oil production at some sites. Square channels and the conversion or adaptation of some press beds to support square wooden structures (*regulae*) could possibly be related to wine production. Some press beds seem to have been used for both wine and oil production, but whether this was done contemporaneously or they were subsequently modified is not certain. In any case, the proportion of wine production in the region was certainly larger than has previously been recognised.

4.3.4 Counterweights

Counterweights are large rectangular blocks of stone which were employed to draw down the free end of the press beam by means of a windlass (Brun 1986, 96–113; Mattingly 1988a, 182; Mattingly and Hitchner 1993, 452). Their distance from the front of the orthostats indicates the minimum length of the pressing beam. Most of the Gebel Tarhuna counterweights were located at a distance of 8.5–9.5 m from the external edge of the orthostats, marking the anchored end of the beam (see Figure 4.16). Cowper named these 'Semana' type blocks because he first observed them at Gasr Semana (Site 4) in the Wadi Doga. Although he described them as being commonly found at sites on the Tarhuna plateau, he did not understand their function (Cowper 1897, 149–150).

The recorded counterweights in the Gebel Tarhuna are dominated by the Semana type (= Brun Type 11), which have a continuous groove in the upper surface linking two dovetail cut-outs into which the uprights of the windlass were set (Figure 4.26). The Semana type is characterised by a mortise and tenon joint formed by interlocking tenons and mortises that do not extend to the full height of the block (Mattingly and Hitchner 1993, 453). This type was widely used in Tripolitania, and has also been identified recently at a late Roman site at Hendek Kale in Turkey (Figure 4.27) (Bennett and Coockson 2009). It probably had its origins in the Aegean region, even though it is more commonly known in the western Roman world, particularly in southern France, North Africa and Spain (Frankel 1993, 77). Only one counterweight out of a total of 38 recorded by the TAS can be distinguished as Brun Type 30, which employed butterfly-shaped clamps in place of the longitudinal groove (Figure 4.28).

The vast majority of counterweights are still partially buried (Figure 4.29), making it impossible to measure their height without excavation. It was only possible to take complete measurements for one counterweight, from oilery HAJ82, part of the Gasr Dehmesh village, because it had been pulled out of the ground some time ago (Figure 4.30). Nonetheless, the surface traces of other counterweights suggest that they were of similar size (Table 4.9). In order to exert the maximum pressure and to match the weight of the other pressing elements, the counterweights of the Tarhuna plateau were cut from solid limestone with large dimensions and their approximate weights may have been as high as nearly eight tonnes.

By way of comparison, Mattingly showed that the elements of a pre-desert press at el-Amud were smaller in size, weight and potential production capacity than those of the Gebel Tarhuna;.for instance, the counterweight was smaller in size, perhaps two tonnes maximum (Mattingly 1995). In the Kasserine region few counterweights were visible in the lower press rooms (Mattingly and Hitchner 1993, 452); they mostly belonged to Brun Types 11, 30 and 32. The recorded examples from the Kasserine area were much smaller than those recorded on the Tarhuna plateau (Table 4.10).

As with the other elements, the size and weight of the counterweights of the Tarhuna plateau presses indicate that the pressing operations were highly organised and would have required considerable labour, technical skill and capital investment. These large-scale presses are among the largest known anywhere in the Roman Empire and must have been expensive to install and maintain. These massive pressing facilities also support Mattingly's point of view that there had been "a high level of local innovation and experimentation with the basic lever and windlass system" (Mattingly 1996b, 590).

4.3.5 Tanks and vats

Vats were usually set into the ground and have disappeared at many pressing sites underneath soil and collapsed walls. However, even without excavation, the TAS was able to identify a total of 13 vats which were partially or completely exposed (Table 4.11). The size of vats is another significant factor in determining the scale of production, but without excavation it is impossible to obtain a complete measurement of the vats, particularly their depth. Most of the recorded tanks were located

close to the press beds and often downslope (Figure 4.31). The recorded lengths and widths suggest that the Gebel Tarhuna vats had large capacities, which can be another indicator of high levels of productivity and may also relate to the issue of differentiating between oil and wine production, as wine tanks were generally larger than oil vats.

The oily liquid produced from pressing is an emulsion of oil and sludge which might also contain suspended solid fragments. This liquid corresponds to roughly 60 % of the weight of the processed olives, but it is still composed of two thirds water and olive residues and one third oil (Vismara 2007, 468). These components have to be separated by means of decantation in special basins or tanks. This separation process refines the oil from the other components and must be done quickly since the residues (lees) ferment quickly once in contact with the air. The virgin oil obtained from the first pressing of olives cannot be separated at a later stage from the less pure oil of the second pressing if allowed to accumulate in the same vat (Brun 2003, 156–158; Vismara 2007, 468).

In order to prevent leakage of liquid from the vats, they were coated with a thick layer of tebshemet (a mixed mortar of lime and crushed pottery), and the archaeological evidence reveals that this operation was often repeated two or more times. For the same reason, some vats on the Tarhuna plateau were cut from a monolithic block (Figure 4.32). The press vat discovered at the Lebda Cement Factory had a hollowed-out sediment trap set into the floor and a capacity of 2,000+ litres (Figure 4.33).

4.4 Standardisation

From the end of the third century BC, Roman Italy had access to a large supply of slave labour, which encouraged major property owners to begin the manufacturing of construction materials such as bricks and lime. A workforce trained in the production of construction materials could easily become very specialised and capable of producing standardised materials (Adam 1999, 259). Economic specialisation and standardisation became features of the more developed sector of the Roman economy. Similar processes occurred outside Italy, even where there was less abundant slave labour. A degree of standardisation at Roman North African rural production sites has already been identified by Mattingly and Hitchner in their investigation of the oileries of the Kasserine region. The layout of a number of oilery sites indicates that they had been arranged in a standard pattern, as though following a blueprint (Hitchner *et al.* 1990, 251–252).

This pioneering observation can now be taken a stage further with the TAS evidence. The measurements presented above of the press equipment of the Gebel Tarhuna demonstrate that many elements were produced as standardised components. This is clearly seen in the recorded mills, orthostats, press beds and counterweights. For example, Table 4.2 shows that the outer diameter of the recorded mills varies between 1.32 and 2.1 m; however, the majority (63 %) were between 1.32 and 1.5 m. The diameters of these mills are modest compared to those studied by Ben Baaziz in the upper valley of the Oued el-Htab, which vary between 1.85 and 1.95 m at sites such as Henschir el-Hammam and Henschir Gouzzah (Ben Baaziz 2000, 193, 198). However, what is striking about the Tarhuna material is the regional consistency in the size of the mills.

In order to further investigate the significance of the dimensions of the various press elements, I calculated preliminary standard deviations for the Tarhuna press elements and compared them with those from the Methana survey in Greece (Table 4.12) (Foxhall 1997). The data from the diameters of the mills, heights of the press orthostats and internal diameters of the press beds yielded mixed results; however, the Libyan material looks different than the Greek. The orthostat heights were varied and had a standard deviation of c. 0.4 m, which does not appear to be particularly significant; however, a glance at Figure 4.10 reveals that the vast majority of the orthostats fall between 2.8 and 3.2 m. If the outliers are excluded, the degree of variation from a mean of c. 3 m is fairly small. For greater statistical reliability it would be better to have a larger sample of press elements. However, the initial results are more encouraging for Type 2 circular press beds where there is a clear low standard deviation (0.045821 m, Table 4.12). Here the contrast with the Methana press beds, the dimensions of which were more varied, is particularly marked. One of the implications of the rather standardised internal diameters of the Type 2 Tarhuna press beds is that there was probably an associated industry producing baskets (*fiscinae*) of standard size for use specifically with these press beds. Overall, the press elements and related materials (mills, *fiscinae*, etc.) from the Tarhuna plateau show far clearer indications of standardisation of size than the press elements from Methana, Greece, where dimensions and standing variation shows greater randomness (Figure 4.34) (Foxhall 1997). This would seem to confirm that the production of presses, in addition to the overall layout of press buildings, was a specialised and standardised process in Tarhuna. If press elements were standardised, this also implies the existence of a specialised industry supplying these elements to the olive farmers.

4.5 Production capacity

A further objective of this work on the remains of presses on the Tarhuna plateau is to focus more attention on the potential productivity of this agricultural area. This work builds on Mattingly's previous studies of olive farming and oil pressing in Roman Africa, particularly

Roman Tripolitania (Mattingly 1985; 1987b; 1988a; 1988b; 1988c; 1993; 1994). Mattingly's data were mainly derived from the works of Cowper (1897) and Oates (1953), consisting of measurements of several different elements of the most well-preserved presses (Mattingly 1993, 483). These archaeological works, in addition to those of Goodchild (1951), remain central to any new attempt to discuss how the presses functioned in the Tripolitanian Gebel. The details of these early surveys allowed Mattingly to establish an overview of the production of olive oil, calculate press capacities and estimate the annual production in this region.

By using the TAS data, and especially the press dimensions taken in the field, in this section I shall first present a large sample of measured presses of the Gebel Tarhuna and secondly attempt to develop arguments based on the most certain data. Thirdly, on the basis of this data, I will re-examine the maximum and minimum processing capacities of the Roman-period olive presses in the Gebel Tarhuna and attempt to estimate the potential annual olive oil production for the region. These data will then be compared with similar data from the traditional olive oil presses which were used in the Msellata region (northeast of the Tarhuna plateau) during the late Ottoman period.

Evaluating the performance of an ancient press is not easy, as it was dependent on several factors which must be taken into account: the quality and degree of ripeness of the olives, the milling process, the type of machinery used, the amplitude of the press, the dimensions of the filled baskets, the force exerted by the timber beam, the time taken for each pressing load, the number of loads pressed and the duration of the harvest season (Mattingly 1993; 1996b; Vismara 2007, 445). It is worth remembering Mattingly's assessment of the problem, that "…despite the relative frequency with which olive presses are encountered in Mediterranean archaeology, there has been remarkably little curiosity as to their processing capacity. More attention has focussed on the efficiency of mechanical presses" (Mattingly 1993, 483).

The collected data confirms Mattingly's observation that "there are clear differences in size and scale between the elements of olive presses…from Africa at both inter- and intra- regional levels" (Mattingly 1993, 485). Scholars generally agree that the oil obtained from pressing makes up approximately 15–25 % of the total weight of olives being pressed. Some have argued that pressing facilities were designed on the basis of production in bumper harvest years, which normally alternated with poor harvest years (Brun 1993). Mattingly has discussed the production capacity of olive presses in several articles, offering maximum and minimum values, particularly for those well-known from surveys in the Kasserine region, the Tripolitanian Gebel and the Libyan pre-desert. He also addressed the issue of scale in a comparative way with an ethnographic study of traditional lever presses in southern Tunisia.

Mattingly has suggested two potential operational strategies. The first, which is also reflected in ethnographic comparisons, involved a long pressing process (up to 24 hours) for a large load, suggesting that this technique was employed for large properties which required a robust press. The second strategy involved many short pressings of small loads on behalf of small owners (Mattingly 1993, 494–496). The larger presses, however, have a greater aggregate extraction and capacity in both cases.

It seems to me that Mattingly's calculations for the Gebel Tarhuna olive presses, have, in most cases, tended to underestimate the production potential. According to him, this minimisation partly relates to the estimated heights of the beams, which were mainly reconstructed based on the measurements taken by Cowper.

Although Cowper took detailed measurements of the presses, he did not always specify whether he was measuring from centre to centre or edge to edge of the various elements, nor did he always list all of the relevant measurements in his published accounts. My reconstructions have been facilitated by personal observation and measurement of the presses and by using Cowper's excellent photographs to fill in measurements he omitted (Mattingly 1988a, 190).

4.5.1 Calculating production capacity

Using the archaeological evidence it is possible to calculate the size of a press load of crushed olives. While important press elements are often missing from the archaeological record in many regions of the Roman world because they were made of wood or other organic materials, the presses of North Africa (for example, in the areas of Kasserine, the Tripolitanian Gebel, and the pre-desert) are an exception in this respect. The North African presses reveal important evidence, in particular the fixing points of the beam head, i.e. where it was placed between the two orthostats and secured in special rectangular holes, usually between 0.15–0.20 m per side, at two or three different operating heights (Mattingly 1993; 1996b).

A previous reconstruction by Mattingly (1993) is based on examination of the orthostats found in the regions mentioned above. He assumed that the multiple pairs of holes indicate the various operational heights of the press beam. Mattingly was able to calculate the size of the crushed olive load for individual presses by taking the following factors into account:

1. The maximum operating height of the press beam, which corresponds with the highest pair of holes in the press uprights.
2. The minimum operating height of the press beam, which corresponds to the lowest pair of holes in the press uprights.

3. The diameter of the baskets holding the crushed olives during the pressing process.

Mattingly's measurements of maximum and minimum operating heights for several presses are shown in Table 4.13. The highest maximum operating height based on the bottom edge of the top hole was 2.10 m, which was observed in press orthostats at Kom es-las and the lowest was 1.30 m at Senam el-Jereh. The latter was the only example to fall below 1.50 m; the average maximum operating height was c. 1.67 m. The height of the base of the bottom hole relates to the lower operating height of the press beam and may also give an indication of the lowest possible stack volume.

As Table 4.14 shows, the maximum height of the base of a top hole from the presses recorded by the TAS was 2.35 m, which is 0.25 m higher than the maximum recorded by Mattingly. The average height was 1.73 m, also higher than Mattingly's group by 0.06 m. The minimum value of the base of the bottom hole recorded in both sets of data was 0.60 m, but the average height of the bottom set of holes was again higher for the TAS data.

As Table 4.13 illustrates, in Mattingly's sample the bottom hole was commonly at least 0.80 m above the base block, though four (40 %) did not exceed 0.65 m (Mattingly 1988a, 191). In the TAS sample, the vast majority were over 0.8 m (35 out of 40, 87.5 %) and 62.5 % were over 1 m. The distance between the holes was, in almost all of the TAS cases, in the range of 0.45–0.70 m, which is nearly the same as in Mattingly's sample (0.45–0.65 m). The combined figures from the two tables demonstrate that the large presses of the Gebel Tarhuna could accommodate a very substantial stack of *fiscinae* filled with olive pulp below their press beams. In some cases, such as at TUT3, DUN128, DUN129 (Senam Halafi 1) and DUN130, the maximum space available for stacking *fiscinae* could exceed 2 m. It is interesting to note here that the latter three, the largest presses in this respect, were all recorded at sites located near Senam el-Nejm in the south-eastern part of the Tarhuna plateau near Gasr Ed-Dauun (*Subututtu*) (Figure 4.35).

The baskets were not necessarily stacked right up to the height of the top hole. A space has to be allowed for the bulk of the beam and perhaps a stone or metal board which was set on the top of the baskets. The weight of the stack by itself would have been enough to start compression and some liquid would already have started to ooze out during loading, even from the upper baskets, before the pressing operation began. Mattingly states that:

> …if the stack height is 1.20 m and it is comprised of individual baskets of pulped olives each of which stand 0.04 m high prior to loading, the column would likely comprise more than 30 baskets. Compression of the lower part of the stack during loading of the press would allow perhaps a third more baskets to be accommodated (Mattingly 1993, 489).

For a stable pressing process, I agree with Mattingly's assertion that the maximum and minimum heights of stacked baskets for the large-scale presses were, on average 1.40 m and 0.70 m respectively.

The diameter of the *fiscinae* is another significant and necessary measurement to have in order to calculate the productive capacity of the presses, but as I have already mentioned there have been no discoveries of the baskets themselves to prove their actual size. As discussed above, the only way to estimate their diameter is by measuring the diameters of the circular channels in the stone press beds (see Table 4.8). In addition, there are a larger number of press beds with square channels which could also have framed stacks of large baskets (though square wooden structures or *regulae* may also have been used)

The diameter of the *fiscinae* used must be lesser than that of the circular channel cut into the press bed surface. The average inner diameter for the Gebel Tarhuna press beds with circular channels (Type 2) is c. 1.40 m. Mattingly has suggested this would indicate *fiscinae* with diameters of at least 0.8–1.0 m (Mattingly 1993, 490), though the TAS data suggest they could have been slightly bigger, perhaps in the range of 1.0–1.25 m. Based on these data and on other considerations relating to the volume and quantity of pulped olives it was possible to put in each basket (assuming that the pulp accounted for 50 % of the total volume of the stacked baskets), Mattingly has estimated that the large Tripolitanian presses of the Gebel Tarhuna could process a load equivalent to one tonne of pulped olives at a time, those of the pre-desert between 0.25 and 0.33 tonnes, and those in the Kasserine region somewhere in between. These African presses therefore had a production capacity of 250 to 1,000 kg of crushed olives per load, each of which required 24 hours, corresponding to 50 to 250 kg of oil output.

Building on the estimates above, Mattingly proposed that the annual production for the presses of the Tripolitanian Gebel (i.e. the Tarhuna plateau) may have reached 9–10 tonnes of oil each, the Kasserine region presses between 5 and 10 tonnes each, and the presses of the Tripolitanian pre-desert 2.5–5 tonnes each.

These figures are based on bumper years, when processing work could last for three months (Mattingly 1988c; 1993; 1996b). Based on these calculations and the large number of presses that existed in the territory of Lepcis Magna, Mattingly suggests that "in a peak production year ... Lepcis would have had the theoretical capacity of manufacturing 15 million litres of olive oil, though in years of dearth the level could have been a fraction of this" (Mattingly 1988c, 37).

My own calculations of the press capacities of the Gebel Tarhuna presses are built on these factors:

1. Maximum height of uncompressed stack = 1.60 m (perhaps 1.40 m when stacked).
2. Maximum diameter of *fiscinae* = 1.25 m.
3. Volume of stacked baskets = $\pi r^2 h$ = 3.142 x 0.625^2 x 1.60 = 1.964 m^3.
4. Volume of olive pulp = 50% of stack volume = 0.982 m^3
5. 1 m^3 of pulp = c. 1,000 kg of pulped olives(?) = c. 200 kg oil (perhaps = 3 loads milled olives?).

In the surveyed area of the Wadis Turgut and Doga (c. 115 km^2), the TAS recorded more than 200 large-scale presses. Taking into account a processing capacity of c. 1,000 kg of pulp every 24 hours during bumper production seasons, if all of these presses were in operation for oil production, they could potentially have had a total processing capacity of c. 200,000 kg every 24 hours, yielding c. 40,000 kg of oil per day. If we accept Mattingly's assumption of press loads ranging from 250–1,000 kg of olives, of which an average of 20 % was extracted as oil (Mattingly 1993, 492), the following hypothetical oil yields presented in Table 4.15 for presses of different sizes can be accepted.

The calculations above have built on Mattingly's suggestion that the maximum production capacity of the largest African presses was c. 10,000 kg of oil per season. However, my figures suggest that one of the largest presses used every day at full capacity for 60 days could have yielded 12,000 kg of oil. Mattingly's lower figure was based on several factors:

> First, the larger the press the greater the likelihood of reduced efficiency through friction, periods of enforced inactivity through mechanical failure (breakage of wooden parts/ropes) or through under-capacity loading. Second, the largest presses often occur in multiple banks of presses, where it is possible that there was some separation of the different stages of the process (one press being used only for the first pressing, another for second pressing etc.). Such practices could have reduced the aggregate output of the plant, though have facilitated the separate collection of the better quality oils (Mattingly 1993, 492).

Moreover, based on the new archaeological evidence relating to the press beds of the Gebel Tarhuna, I can suggest here that around 10 % may have been used for wine production, though some of them were probably used in the production of both wine and olive oil.

If the production of the territory of Lepcis Magna reached 10 million litres of oil in peak years (Mattingly 1988c, 38), this would correspond to the cultivation of 400,000 to 3 million trees (an adult tree can produce 20–100 kg of olives per year). This number of trees would have covered an area c. 400 km^2, which is around one tenth of the total extent of Lepcis' lands and therefore quite feasible. Considering the hypothetical yields over 60 days proposed above, the 200 TAS presses could have produced between 652,000 and 2.6 million litres in that time. An estimated 1,500 presses were distributed throughout the whole territory of Lepcis Magna during the Roman period, which could have resulted in a production potential of 7–15 million litres. The new data thus seem to fully support the original calculations made by Mattingly.

4.5.2 The production capacity of traditional lever presses in the Msellata region during the late Ottoman period

The Msellata region occupies an area of 10,050 km^2 in the north-eastern sector of the Tripolitanian Gebel. Approximately 7,350 km^2 (73 %) of this area is currently exploited as agricultural land (Alarabi 2006, 22). Along with the northern sector of the Tarhuna plateau, this region formed the core of the Lepcitanian cultivated hinterland during antiquity; however, unlike parts of Tarhuna, the region of Msellata has maintained its traditional farming practices until modern times. Olives are still considered the most important produce in the socio-economic life of Msellata's local people and they have paid a great deal of attention to olive oil production since ancient times. This region also has the oldest planted olive trees in the territory of Lepcis Magna; many people believe that they go back to the Punic and Roman periods (Abdassadq 2003).

Investigation of a traditional olive press owned by the Alarabi family in the Msellata region reveals a slightly different picture than that suggested by the ancient Gebel Tarhuna presses. The press elements here are smaller in size and the press therefore has a correspondingly lower production capacity. The press facilities are established inside underground rooms. The main central room is occupied by a semi-concave mill 2.5 m in diameter which utilises a cylindrical millstone of 1.0 x 0.9 m (Figure 4.36). At the left side of the room there is a 7 m length of thick tree trunk which forms the press beam. This press beam is anchored to a single fixed point in a shorter, vertically-placed tree trunk, c. 2 m in height, which is built into floor and ceiling.

The mill and press load capacity of the Alarabi family press is c. 30 *keala*. Each *keala* can hold about 14 kg olives and has a potential output of 3.5–4.5 litres of oil. Thus a single pressing load could yield 105–135 litres of oil from a 24 hour processing. The estimated annual production for 60 days, a medium-length season, can thus be estimated at 6,300–8,100 litres in good years; in some productive years the press would have worked for more than three months. However, it must be noted that the annual olive oil production generally fluctuates from one year to another and is principally affected by the average rainfall and the dry winds in summer (Abdassadq

2003, 36–37). As this press is smaller than the Roman presses, it encourages confidence in the higher estimate for annual production given above for the latter.

During the Ottoman period, Msellata's economy was strongly related to olives. It seems that there was specific encouragement to plant good sorts of olive, a policy not only followed by the local authority but also encouraged by the provincial government in Tripoli. For example, a letter relating to the administration of the province issued on 10 November 1880 ordered 1,000 transplanted olive trees to be planted on a number of specific farms (*waqef*), with a note mentioning the care that should be taken through the cutting process (JAG 1880, 447: 1).

The documentary evidence also reveals that the Ottoman taxation system imposed a tithe tax on agricultural production. However, the system also provided exemptions for quite a large number of landlords such as tribal chiefs, elites, administrators and religious men, as noted in M.T.T. 1888 (Figure 4.37).

Translation of document M.T.T. 1888:

> *As is known in all provinces the authority is announcing the collection of the tithe tax which is sold to an interested party. In the present case relating to the district of Msellata for the year of 1888, the announcement was issued by the local council via a public auction according to these conditions:*
>
> *The collection of the tithe amount must be in kind as it has been legally stated, that is, 1 part out of 10.*
>
> *An exemption from tax that has been given for decades by governmental decree [*dobyourldi*] to members of councils and tribal chiefs [*shayoukh*] for an amount of 88* aogtt *olive oil [c. 80 litres]. Those [of exempt status] who have got more than this amount will be charged for the addition.*
>
> *The value of the contracted tax amount must be paid in cash in Turkish piasters and sent to the provincial treasury in four regular instalments starting in December and ending in March.*
>
> *According to these conditions the auction has been convened on Msellata's olive tithe tax and knocked down to the merchant Livardo Csar for a price of four hundred and fourteen thousand and five hundred (414,500) piasters divided into four instalments of 103,625 each.*
>
> *Issued by the provincial government of Tripoli of the West.*

In another instance, document 64/M/Ch 1843 (Figure 4.38) contains a decree from an administrative official to the governor of Msellata in 1843 regarding an exemption that had been given to heirs of Abi Tabel for their 600 olive trees after they had paid 750 Turkish piasters.

Translation of document 64/M/Ch 1843:

> *To the honourable Mohammed, regarded as our son, the general director of Msellata. You know that the heirs of al-Sheikh Abi Tabel came to us and paid to the prosperous treasury seven hundred and fifty (750) Turkish piasters regarding their six hundred (600) planted trees in Msellata. So, our son, they are exempted from paying more and you have to respect that as indicated.*
>
> *Written on 7 Moharam [the first month of the Islamic calendar] 1259 [1843]. Issued by the provincial officer of Tripoli of the West, Mohammed Amin Basha.*

A calculation can be made here from another document concerning the annual production of olive oil in the Msellata region. The document (D/M/T/T 1863) related to a committee which was assigned the task of counting the productive olive trees liable to the tithe tax. Their result was a total of 711,592 olive trees. Excluding 5,525 as exempted trees, 656,342 trees were therefore charged for the tax (Figure 4.39).

Translation of document D/M/T/T 1863:

> *A* dobyourldi *issued by the provincial officer stating the count of Msellata olive trees by a provincial committee in association with local individuals who have good experience with Msellata's farms. As usual they do the job by counting the number of trees and this year they found a total of 71,159. By excluding the trees belonging to exempted individuals (5,525), the outstanding number was 65,634 olive trees.*
>
> *Written on 11 Rabeea the first 1285 [1863].*

Another document mentions the existence of 92 olive oil presses in Msellata working during the 1875 season (Alarabi 2006). These presses were probably able to produce an annual output of 580,000–750,000 litres given a 60 day pressing period.

Translation of documents D/M/T/T 1863 (Table 4.16) and D/M/T/T 1874 (Figure 4.40):

> *The calculation process of the Msellata olive forests in 1874 confirmed by the reporters and accountants. Indeed the amount of the tithe tax (*miry*) was twenty two thousand* gafeez *[1 gafeez = 7 litres of olive oil]. A dispatch has been submitted to Ahmed Bek (the Homes region Kaimmakam) who came to Msellata*

*this year accompanied by a clerk to verify the calculation results accompanied by some local council members. After their careful examination of the yield they found an increase of four thousand and one hundred [*gafeez*] over the previous year. So the* miry *of this year is twenty six thousand and three hundred* gafeez *of olive oil as it is shown above with each amount relating to each olive grove. Edited at Msellata Council 29/01/1875.*

Clearly it can be noted that the production capacities of the Msellata presses during the Ottoman period were much lower than those estimated for the Roman-period presses of the Tarhuna region; however, in general terms they support the estimates made above. With larger and far more presses and with more extensive olive orchards in Msellata and Tarhuna, the idea that Lepcis Magna could have produced millions of litres of olive oil appears feasible.

Chapter 4 TABLES

Table 4.1: *The number of different press elements recorded by the TAS at farming sites on the Tarhuna plateau.*

Sites	Press elements	Mills	Orthostats	Orthostat bases	Press beds	Counter-weights	Tanks and vats
64	370	11	95	98	48	38	15

Table 4.2: *The Gebel Tarhuna olive mills.*

Site	Name	Number of mills	Type	External diam. (m)	Internal diam. (m)	Internal depth (m)	Pivot Pier diam. (m)	Pivot Pier height (m)	Total capacity (m^3)*
TUT4		1	1a	1.80	1.50	0.30	0.20	0.18	0.524
TUT5	Henschir Aziza	1	1	1.35	1.05	–	0.27	0.10	–
TUT16	Henschir Boshaina	1	1b	1.32	1.00	0.38	–	–	0.298
TUT20	Ain Astail	1	1	1.45	1.30	–	0.22	0.15	-
TUT38	Henschir es-Senam	2	1b	1.45	1.25	0.40	0.35	0.40	0.452
DUN128		2	1	2.10	1.85	0.50	0.50	0.45	1.256
DUN130		2	1	1.50	1.20	0.40	0.40	0.18	0.430
SRI132	Wadi es-Sri	1	1	1.80	1.55	0.41	0.35	0.25	0.750

*Total capacity was calculated by subtracting the volume of the central pivot pier from the total internal volume of the mill.

Table 4.3: *The largest known Roman olive mills (after Brun 1986, 77).*

Mill location	Diameter (m)	Reference
Sbeitla (Tunisia)	1.50	Duval and Baratte 1973
Wadi Sebt (Algeria)	1.50	Leveau 1979
Kafr Nabo 1 (Syria)	1.60	Callot 1984
Taqle (Syria)	1.65	Callot 1984
El Arba (Algeria)	1.70	Leveau 1979
Khorazin (Palestine)	1.80	Yeivin 1966
Aghrem (Algeria)	1.90	Leveau 1979
Tirat Yehuda (Palestine)	1.90	Yeivin 1966
Khirbet Yajuz (Palestine)	2.00	Thomson 1979
El Kfeir (Syria)	2.05	Callot 1984
Kafr Nabo 2 (Syria)	2.10	Callot 1984
Amman (Jordan)	2.10	Zayadine 1977–1978

Table 4.4: *Dimensions of some millstones recorded by the TAS.*

Site	Name	Diameter (m)	Length (m)	Diameter of hole (m)
TUT16-1	Henschir Boshaina	0.55	-	0.15
TUT16-2	Henschir Boshaina	0.50	0.45	0.15
TUT16-3	Henschir Boshaina	0.50	-	0.15
TUT18	Ain Astail	0.45	0.47	0.15
GUM85	quarry	0.45	0.45	0.15

Table 4.5: *Estimated processing capacity for the mills recorded by the TAS taking into account the volume of the millstones.*

Site	Name	Total capacity (m^3)	Volume engaged millstone (m^3)	Processing capacity (m^3): one millstone	Approx. weight of unmilled olives (kg)	Processing capacity (m^3): 2 millstones	Approx. weight of unmilled olives (kg)
TUT4		0.524	0.029	0.495		0.466	
TUT38	Henschir es-Senam	0.452	0.029	0.423		0.394	
DUN128		1.256	0.029	1.227		1.198	
DUN130		0.430	0.029	0.401		0.372	
SRI132	Wadi es-Sri	0.750	0.029	0.721		0.692	

Table 4.6: *Dimensions and weights of 40 press orthostats from selected Tarhuna plateau sites.*

Site	Name	Height (m)	Width (m)	Thickness (m)	Weight* (tonnes)	Type
TUT1		2.30	0.45	0.50	1.382	T1
TUT3		3.10	0.50	0.50	2.069	T6
TUT5	Henschir Aziza	2.65	0.50	0.50	1.769	T1
TUT7	Ben Hayb	2.40	0.50	0.50	1.602	T3c
TUT8		2.85	0.45	0.55	1.883	T2a
TUT9	Senam el-Gharabah	3.60	0.50	0.50	2.403	T2a
TUT11		3.10	0.55	0.65	2.959	T5
TUT14	Bu-Kaala	3.40	0.50	0.50	2.269	T5
TUT15	Henschir Assalha	2.65	0.45	0.50	1.592	T2
TUT16	Henschir Boshaina	3.15	0.50	0.60	2.523	T3
TUT20	Ain Astail	3.30	0.50	0.60	2.643	T3
TUT26		3.00	0.50	0.55	2.203	T2
TUT27		2.90	0.55	0.55	2.342	T3
TUT29		2.45	0.50	0.50	1.635	T1
TUT35		2.85	0.50	0.55	2.093	T2
TUT36		2.20	0.45	0.50	1.322	T2a
TUT38	Henschir es-Senam	2.40	0.50	0.55	1.762	T2
TUT40	Kerath	2.90	0.50	0.50	1.936	T1
TUT42		3.10	0.55	0.60	2.731	T2
TUT43	Loud el-Meghara	3.35	0.55	0.65	3.198	T2
TUT44	Sidi Yekhlef	3.15	0.50	0.55	2.313	T1
TUT46	Kerath	2.20	0.50	0.50	1.468	T2
TUT52	Henschir Sidi Madi	2.55	0.50	0.55	1.872	T2
TUT53	Sidi Eysawi	2.30	0.50	0.50	1.535	T2
TUT54	Senam Semana	3.20	0.55	0.60	2.819	T1
TUT57	Henschir Hmoudat	3.00	0.50	0.50	2.002	T2a
DOG60	Senam Aref	2.95	0.50	0.50	1.969	T2a
DOG66	Sidi al-Akhder	3.05	0.55	0.60	2.687	T2
DOG67		2.90	0.50	0.50	1.936	T2a
DOG68		3.10	0.50	0.55	2.276	T1
HAJ82	Gasr Dehmesh	3.00	0.55	0.55	2.423	T2

cont.

Site	Name	Height (m)	Width (m)	Thickness (m)	Weight* (tonnes)	Type
TEL95		2.90	0.50	0.50	1.936	T2b
TEL96		2.80	0.50	0.50	1.869	T2
DOG104		2.90	0.50	0.50	1.936	T1
DOG106	Sh'bet asc-Schood	3.20	0.55	0.60	2.819	T2
DOG107	Henschir ash-Shuaud	3.00	0.50	0.55	2.202	T2a
TUT109	Henschir ar-Rkkak	2.40	0.50	0.50	1.602	T2
DUN128		3.80	0.55	0.60	3.348	T2a
DUN129	Senam Halafi 1	3.50	0.55	0.60	3.084	T2a
DUN130		3.35	0.55	0.55	2.706	T2
Average		**2.92**	**0.51**	**0.54**	**2.178**	
Minimum		**2.20**	**0.45**	**0.50**	**1.322**	
Maximum		**3.80**	**0.55**	**0.65**	**3.348**	

*Weight was calculated for all stone elements by multiplying the volume of each block (height x width x thickness) by the average approximate density of the local limestone, 2.67 tonnes/m^3 (Donahue *et al.* 1971; Shishov et al. 1980).

Table 4.7: *Dimensions and weights of some press orthostats recorded in the* Thelepte *region of Tunisia (after Hermassi 2004).*

Site name	Height (m)	Width (m)	Thickness (m)	Weight (tonnes)
Zâati	2.29	0.42	0.67	1.720
Touil	2.00	0.42	0.75	1.682
Oum Debban	2.30	0.45	0.80	2.211
Mguismet	2.43	0.50	0.80	2.595
Ksar Touil	2.25	0.38	0.75	1.712
Khimet Gharsallah	2.15	0.38	0.83	1.810
Herbouk	2.28	0.38	0.75	1.735
Guetib	2.36	0.47	0.73	2.162
Es Sdid	2.00	0.30	0.35	0.561
El Mlez	2.17	0.37	0.74	1.586
El Khmira	2.00	0.45	0.45	1.081
El Khima Darraouia	2.00	0.35	0.50	0.934
El Khangua	2.00	0.50	0.73	1.949
El Kamour	2.20	0.42	0.72	1.776
Dekhlet Zmit	2.30	0.45	0.75	2.072
Dalia	1.85	0.53	0.70	1.832
Betoum	1.93	0.33	0.78	1.326
Henschir Boudhiaf	1.70	0.50	0.45	1.021
Henschir Abacha	1.90	0.37	0.73	1.370
Average	**2.11**	**0.42**	**0.68**	**1.639**
Minimum	**1.70**	**0.30**	**0.35**	**0.561**
Maximum	**2.43**	**0.53**	**0.85**	**2.595**

Table 4.8: *The 45 press beds recorded by the TAS and selected for measurement and classification.*

Site	Name	Channel type	External dimensions (m)	Channel diameter/ dimensions (m)	approx. weight* (tonnes)	Corner cut(s)gm	Placement of corner cut(s)	Angle cuts	Added channel	Eroded meanders
TUT14	Bu-Kaala	2d	2.00 x 1.94	1.42	5.179					Y
TUT27		2c	1.95 x 1.92	1.48	4.998			4		Y
TUT29		2c	1.97 x 1.93	1.45	5.076			4		
TUT38	Henschir es-Senam	2c	2.00 x 1.95	1.45	5.206			4?	?	
TUT38	Henschir es-Senam	2	1.93 x ?	-	-					
TUT44	Sidi Yeklef	2c	1.98 x 1.95	1.40	5.154			4?		
TUT45		2?	-	-	-					
TUT46	Kerath	2	2.00 x 1.92	1.40	5.126				Y	
TUT54	Senam Semana	2	1.98 x 1.95	1.42	5.154					
TUT54	Senam Semana	2	1.95 x 1.95	1.44	5.076					
TUT54	Senam Semana	2	1.95 x 1.93	1.40	5.024					
TUT56	Sidi Buagela 1	2c	2.00 x 1.98	1.35	5.287			4	Y	
TUT56	Sidi Buagela 1	2c	2.05 x 1.97	1.37	5.391			4	Y	
HAJ81	Gasr Dehmesh	2a	2.00 x 2.00	1.38	5.340	1	Right back			
HAJ82	Gasr Dehmesh	2	1.98 x 1.75	1.33	4.626					
HAJ82	Gasr Dehmesh	2	2.02 x 1.98	1.44	5.339					
DOG106	Sh'bet asc-Schood	2	1.93 x 1.88	1.35	4.844					
DOG107	Henschir ash-Shuaud	2	1.97 x 1.85	1.33	4.865					
DUN128		2b	2.05 x 2.02	1.45	5.528			1		
TUT10		1	2.00 x 1.92	1.75 x 1.63	5.126					
TUT10		1	2.00 x 1.93	1.68 x 1.65	5.153					
TUT12	Sidi Buagela 2	1	2.03 x 1.98	1.55 x 1.50	5.366					
TUT12	Sidi Buagela 2	1	2.00 x 2.00	1.50 x 1.50	5.340					
TUT12	Sidi Buagela 2	1	2.02 x 1.98	1.52 x 1.48	5.339					
TUT12	Sidi Buagela 2	1	2.00 x 2.00	1.50 x 1.50	5.340					
TUT12	Sidi Buagela 2	1	1.98 x 1.95	1.45 x 1.42	5.154					
TUT12	Sidi Buagela 2	1	2.02 x 2.00	1.70 x 1.68	5.393					
TUT12	Sidi Buagela 2	1a	2.05 x 1.97	1.72 x 1.70	5.391	1	Left back			
TUT14	Bu-Kaala	1	1.95 x 1.93	1.62 x 1.60	5.024				Y	

TUT15	Henschir Assalha	1a	2.05 x 2.00	1.66 x 1.63	5.473	1	Right back		
TUT15	Henschir Assalha	1	2.00 x 1.97	1.68 x 1.65	5.260				
TUT15	Henschir Assalha	1	1.93 x 1.90	1.53 x 1.48	4.895				
TUT16	Henschir Boshaina	1	1.90 x ?	-	-	?	?	?	
TUT26		1a	1.97 x ?	-	-	1	Left back		
TUT29		1c	2.02 x ?	-	-	?	?	?	Y
TUT38	Henschir es-Senam	1	2.00 x 1.96	1.62 x 1.48	5.233				
TUT38	Henschir es-Senam	1b	1.98 x 1.96	1.65 x 1.50	5.181	2	Left + Right inner	Y	
TUT54	Senam Semana	1	1.93 x 1.90	1.53 x 1.48	4.895				
DOG66	Sidi al-Akhder	1a	2.03 x 2.00	1.45 x 1.45	5.420	1	Left back		
HAJ81	Gasr Dehmesh	1	2.07 x 2.02	1.60 x 1.57	5.582				
HAJ81	Gasr Dehmesh	1	1.98 x ?	-	-				
DOG106	Sh'bet asc-Schood	1c	2.05 x 2.00	1.63 x 1.58	5.473	1	Right back		Y
DOG107	Henschir ash-Shuaud	1a	2.00 x 1.97	1.62 x 1.58	5.260	1	Left back		
DUN128		1	1.95 x ?	-	-				
DUN130		1	2.10 x 2.00	1.55 x 1.50	5.607			Y	

*Weight was calculated as in Table 4.6; the majority of the Tarhuna plateau press beds are partly buried, so it was possible only to measure the thickness of a few examples, which were between 0.45 and 0.55 m. I have therefore used an average thickness of 0.50 m when calculating weight.

Table 4.9: *The visible surface size and approximate weight of selected counterweights recorded by the TAS.*

Site	Name	Length (m)	Width (m)	Height (m)	Weight* (tonnes)
TUT3		2.10	1.15	-	7.295
TUT5	Henschir Aziza	2.15	1.20	-	7.802
TUT14	Bu-Kaala	2.10	1.05	-	6.651
TUT15	Henschir Assalha	2.10	1.10	-	6.973
TUT16	Henschir Boshaina	1.85	1.10	-	6.129
TUT26		2.00	1.10	-	6.635
TUT27		2.10	1.10	-	6.973
TUT31		2.00	1.15	-	6.942
TUT35		2.10	1.05	-	6.651
TUT38	Henschir es-Senam	2.10	1.15	-	7.295
TUT43	Loud el-Meghara	1.95	0.95	-	5.568
TUT54	Senam Semana	2.00	0.95	-	5.714
DOG60	Senam Aref	2.10	1.20	-	7.618
DOG64		2.00	1.05	-	6.328
DOG66	Sidi al-Akhder	2.00	1.10	-	6.635
DOG68		2.05	1.00	-	6.157
HAJ81	Gasr Dehmesh	2.10	1.20	-	7.618
HAJ82	Gasr Dehmesh	2.10	1.25	1.15	7.295
GUM88	Gaytna	2.05	0.95	-	7.173
DOG104		1.95	0.90	-	5.269
DOG106	Sh'bet asc-Schood	2.10	1.00	-	6.328
DOG107	Henschir ash-Shuaud	2.10	0.95	-	6.000

*Weight was calculated as in Table 4.6 above (using the height measured at HAJ82 as an estimate for the rest which are still buried), minus the weight of the dovetail cutouts.

Table 4.10: *Dimensions of some of the Kasserine counterweights (after Mattingly and Hitchner 1993, 453).*

Site name	Dimensions (m)	Dovetails (m)	Weight (tonnes)
KS010	1.24 x 0.86 x 0.27+	0.22 x 0.16 x ?	[1.10]
KS013.p2	1.55 x 0.64 x 0.58	0.23/0.30 x 0.14/0.20 x 0.58	1.14
KS041	1.00 x 0.71 x 0.30	0.19 x 0.10 x 0.30+	[0.80]

Table 4.11: *Dimensions of some of the Kasserine counterweights (after Mattingly and Hitchner 1993, 453).*

Site	Name	Surface dimensions (m)
TUT3		1.80 x 1.15
TUT8		2.00 x 1.20
TUT14	Bu-Kaala	2.50 x 1.15
TUT15	Henschir Assalha	1.55 x 1.10
TUT16	Henschir Boshaina	1.75 x 1.15
TUT35		1.65 x 1.15
TUT41		1.50 x 0.50
TUT43	Loud el-Meghara	1.85 x 1.00
DOG60	Senam Aref	1.88 x 1.05
TEL97		1.55 x 1.00
TEL99		1.70 x 1.05
DOG107	Henschir ash-Shuaud	2.10 x 1.15
DUN128		2.80 x 1.00

Table 4.12: *The standard deviation of some press elements recorded in Methana (Greece) and Tarhuna (Libya). Methana data from Foxhall 1997.*

Methana				Tarhuna		
Site	**Trapetum D**	**Site**	**Press bed D**	**Mill D**	**Orthostat H**	**Press beds int.**
C20.2	0.69	MS123	0.55	1.5	2.2	1.33
C27.1	0.87	C29.1	0.55	1.5	2.2	1.33
MS19/20	0.9	D28.3	0.61	1.6	2.3	1.35
MS75	0.9	MS123	0.62	1.65	2.3	1.35
MS218	0.9	MS218	0.66	1.7	2.4	1.37
MS114	0.96	MS22	0.7	1.8	2.4	1.38
MS109	0.98	MS109	0.77	1.9	2.4	1.4
A9.1	0.99	C29.1	1.06	1.9	2.45	1.4
A21.2	1	MS70	1.1	2	2.55	1.4
MS101	1.13	MS122	1.12	2.05	2.65	1.42
MS22		MS210	1.22	2.1	2.65	1.42
MS70		MS123	1.45	2.1	2.8	1.44
C29.1		MS19/20		***St. deviation***	2.85	1.44
MS122		MS75		**0.223945**	2.85	1.45
MS123		MS101			2.9	1.45
MS123		C20.2			2.9	1.48
MS123		C27.1			2.9	***St. deviation***
MS210		MS114			2.9	**0.045821**
C29.1		A9.1			2.9	
D28.3		A21.2			2.95	
St. deviation	**0.113411738**		**0.305736815**		3	
					3	
					3	
					3	
					3.05	
					3.1	
					3.1	
					3.1	
					3.1	
					3.15	
					3.15	
					3.2	
					3.2	
					3.3	
					3.35	
					3.35	
					3.4	
					3.5	
					3.6	
					3.8	
					St. deviation	
					0.388942	

Table 4.13: *Mattingly's measurements of maximum and minimum operating heights of selected Tripolitanian presses as suggested by the positions of the holes for securing the beam end.*

Cowper (1897) site	Site name	Height of base of bottom hole (m)	Height of base of top hole (m)
11	Gasr Doga	1.05	1.65
20	Kom es-las	0.65	2.10
24	Kom Nasr	0.80	1.50
26	Senam el-Jereh	0.60	1.30
36	Senam Ferjana 1	0.60	1.80
41	Senam el-Nejm	0.60	2.00
44	El-Gharabah	0.90	1.65
45	Hr. El-Mohammed	1.10	1.65
49	Bu Mateereh	0.90	1.55
59	Senam Terr'gurt	0.90	1.55
Average		**0.81**	**1.67**

All figures are approximations based on his interpretation of Cowper's measurements and photographs or on his personal observation at some of the sites (after Mattingly 1988a, 191).

Table 4.14: *Operating heights of selected Gebel Tarhuna presses as recorded by the TAS.*

Site	Name	Height of base of bottom hole (m)	Height of base of middle hole (m)	Height of base of top hole (m)
TUT1		0.70	-	1.40
TUT3		0.95	1.75	2.20
TUT5	Henschir Aziza	0.90	-	1.50
TUT7	Ben Hayb	0.85	-	1.40
TUT8		1.00	-	1.45
TUT9	Senam el-Gharabah	1.00	-	1.55
TUT11		1.00	-	1.60
TUT14	Bu-Kaala	0.70	1.20	1.95
TUT15	Henschir Assalha	0.80	-	1.35
TUT16	Henschir Boshaina	0.70	1.15	1.80
TUT20	Ain Astail	0.75	1.30	1.85
TUT26		0.90	-	1.70
TUT27		1.00	-	1.55
TUT29		1.00	-	1.50
TUT35		0.95	-	1.70
TUT36		1.00	-	1.60
TUT38	Henschir es-Senam	1.00	-	1.65
TUT40	Kerath	0.60	1.20	1.70
TUT42		1.00	-	1.60
TUT43	Loud el-Meghara	1.40	-	1.85
TUT44	Sidi Yekhlef	1.10	-	1.75
TUT46	Kerath	1.30	-	1.80
TUT52	Henschir Sidi Madi	1.10	-	1.80
TUT53	Sidi Eysawi	1.00	-	1.75
TUT54	Senam Semana	1.15	-	1.65
DOG57	Henschir Hmoudat	0.80	-	1.55
DOG60	Senam Aref	1.00	-	1.70
DOG66	Sidi al-Akhder	0.80	1.30	1.75
DOG67		1.20	-	1.80
DOG68		0.85	1.35	1.80
HAJ82	Gasr Dehmesh	1.30	-	1.80
TEL95		0.80	1.30	1.85
TEL96		1.20	-	1.70
DOG104		1.25	-	1.80
DOG106	Sh'bet asc-Schood	1.50	-	1.95
DOG107	Henschir ash-Shuaud	1.35	-	1.80
TUT109	Henschir ar-Rkkak	1.20	-	1.75
DUN128		1.50	-	2.05
DUN129	Senam Halafi 1	1.50	-	2.20
DUN130		1.45	-	2.10
Average	**1.04**	**1.32**	**1.73**	
Minimum	**0.60**	**1.15**	**1.35**	
Maximum	**1.50**	**1.75**	**2.20**	

Table 4.15: *Hypothetical oil yields for the Wadis Turgut and Doga presses of small, medium and large capacity.*

		Yield*			
Presses	**Load size**	**Daily**	**30 days**	**60 days**	**90 days**
200	250 kg (small press)	10,000 kg 10,869 litres	300,000 kg 326,086 litres	600,000 kg 652,173 litres	900,000 kg 978,260 litres
200	600 kg (medium press)	24,000 kg 26,000 litres	720,000 kg 782,688 litres	1,440,000 kg 1,565,217 litres	2,160,000 kg 2,347,826 litres
200	1,000 kg (large press)	40,000 kg 43,478 litres	1,200,000 kg 1,304,347 litres	2,400,000 kg 2,608,695 litres	3,600,000 kg 3,913,843 litres

*1 kg olive oil = 0.92 litre.

Table 4.16: *Calculation of the olive oil produced from the Msellata olive forests in 1874 (after document D/M/T/T 1863).*

Name of olive grove	Oil output (*gafeez*)	Oil output (litres)
Garеam	300	2,100
Selama	725	5,075
Momen	725	5,075
Khalafoun	400	2,800
Karartha	455	3,185
Shaafeyeen	225	1,575
Shehaani	225	1,575
Ghawain	775	5,425
Galeil	1,900	13,300
Zawiat Samah	1,450	10,150
Bni Leath	925	6,475
Jadidd	750	5,250
Lawata	1,175	8,225
Wadna	2,850	19,950
Esh-Shaaba and Ghaba	2,000	14,000
Waarr	3,000	21,000
Khorma	1,600	11,200
Agnool	900	6,300
Aulad Sulaiman	850	5,950
Razagna	1,300	9,100
Messed Audan	725	5,075
Bni Yekhlef	200	1,400
Zafaran	1,200	8,400
Tellan	600	4,200
Amamra	225	1,575
Zerad	825	5,775
Total	**26,305**	**184,135**

Chapter 4 FIGURES

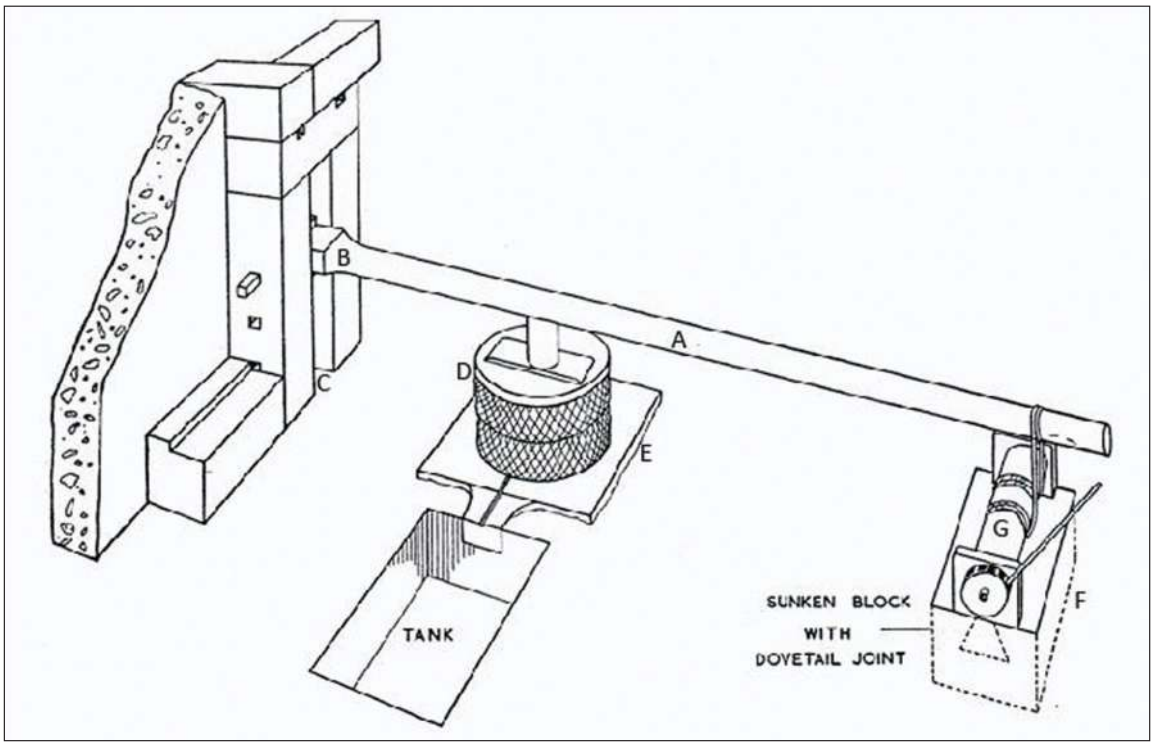


Figure 4.1: *Schematic drawing of a Tripolitanian lever press (Oates 1953).*

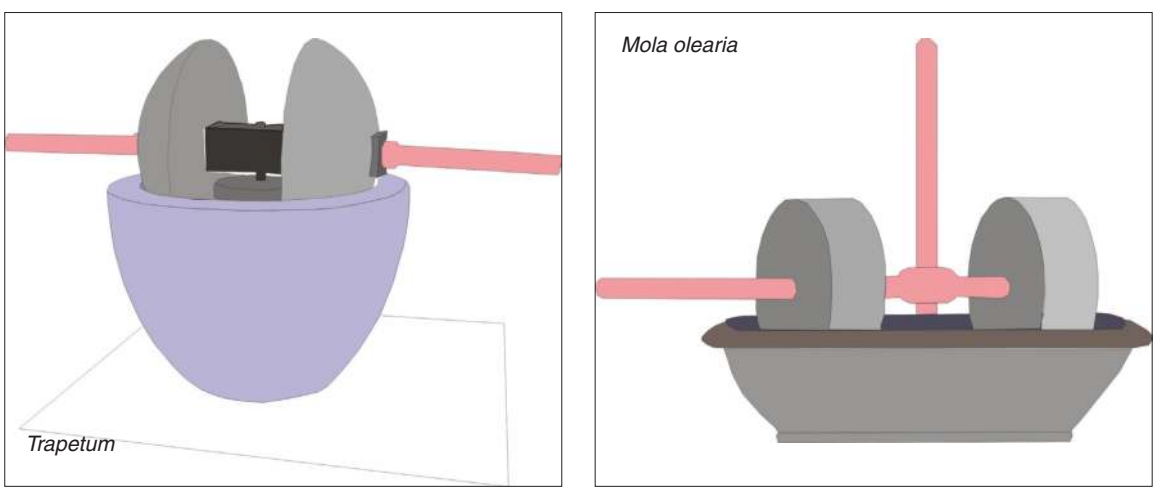


Figure 4.2: Trapetum *and* mola olearia *type mills (after Frankel 1993).*

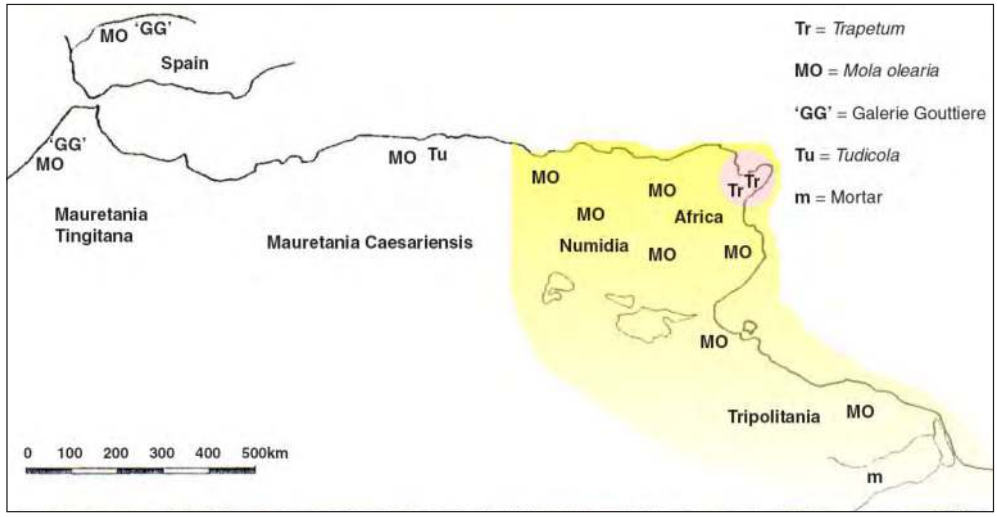


Figure 4.3: *Distribution of* trapetum *and* mola olearia *type mills in North Africa (after Mattingly 1996b).*

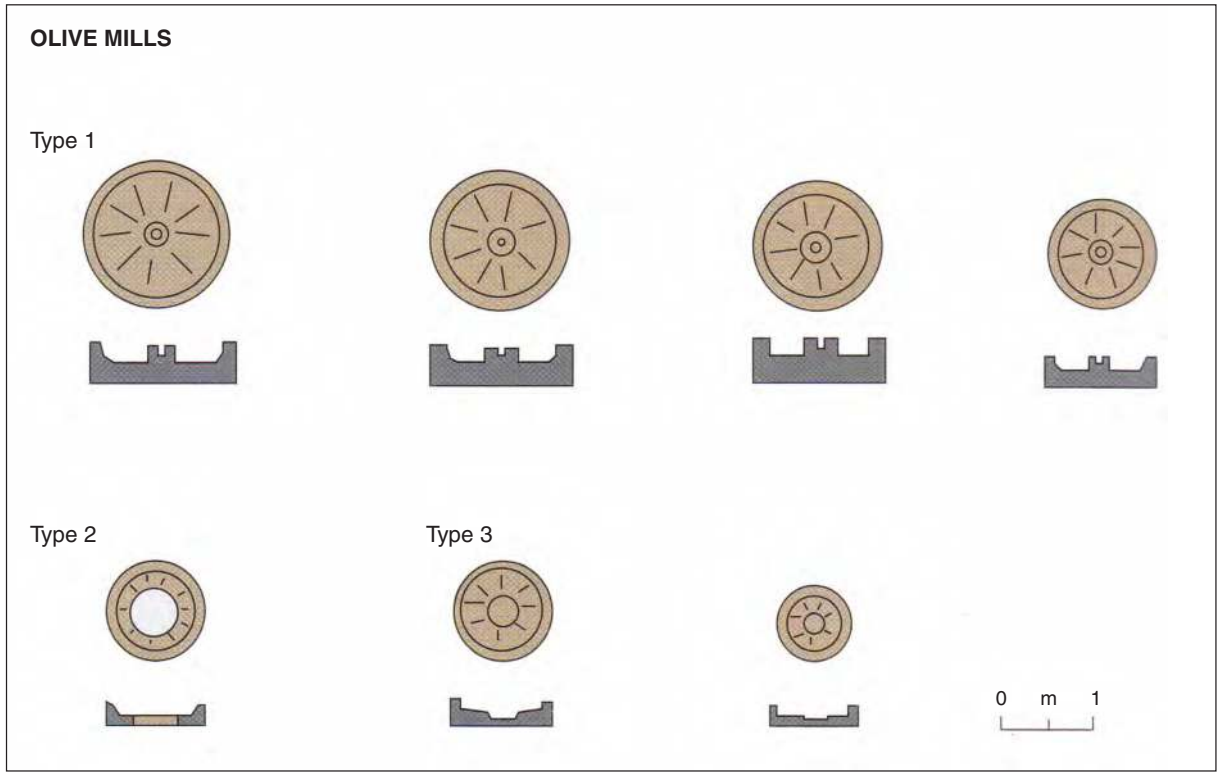


Figure 4.4: *The three types of* mola olearia *type mills recorded during the Kasserine survey (Hitchner and Mattingly 1991).*

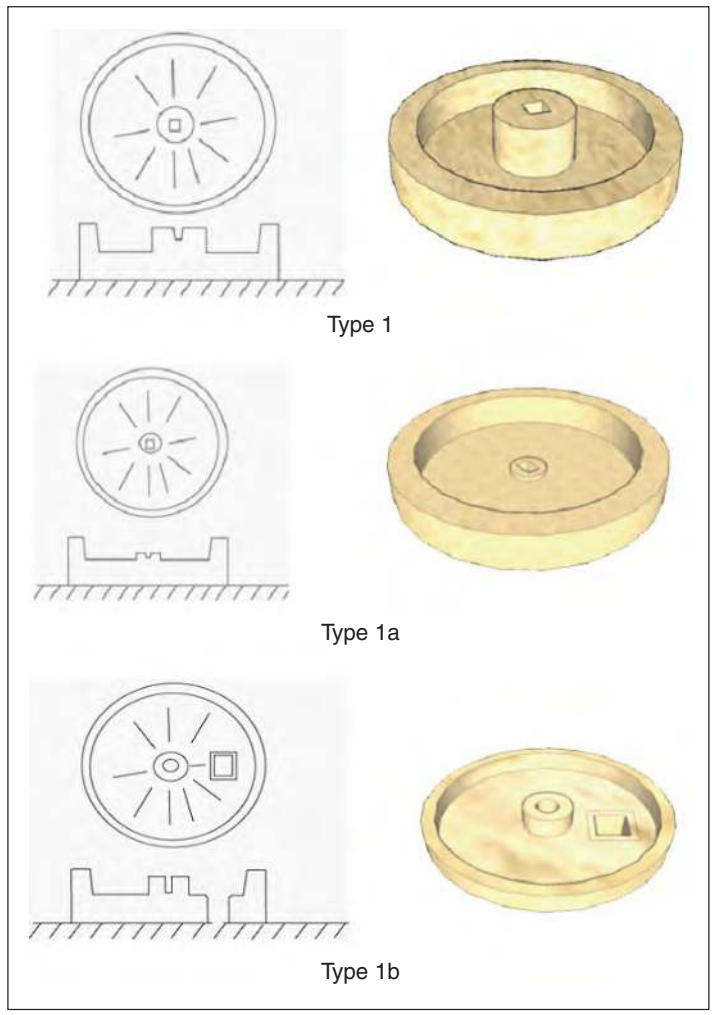


Figure 4.5: *Types of mill recorded by the TAS in the Gebel Tarhuna.*

Figure 4.6: *A Type 1a mill at TUT4 and a Type 1b mill at TUT38 (Henschir es-Senam).*

Figure 4.7: *Two types of millstones found in the Wadi Turgut.*

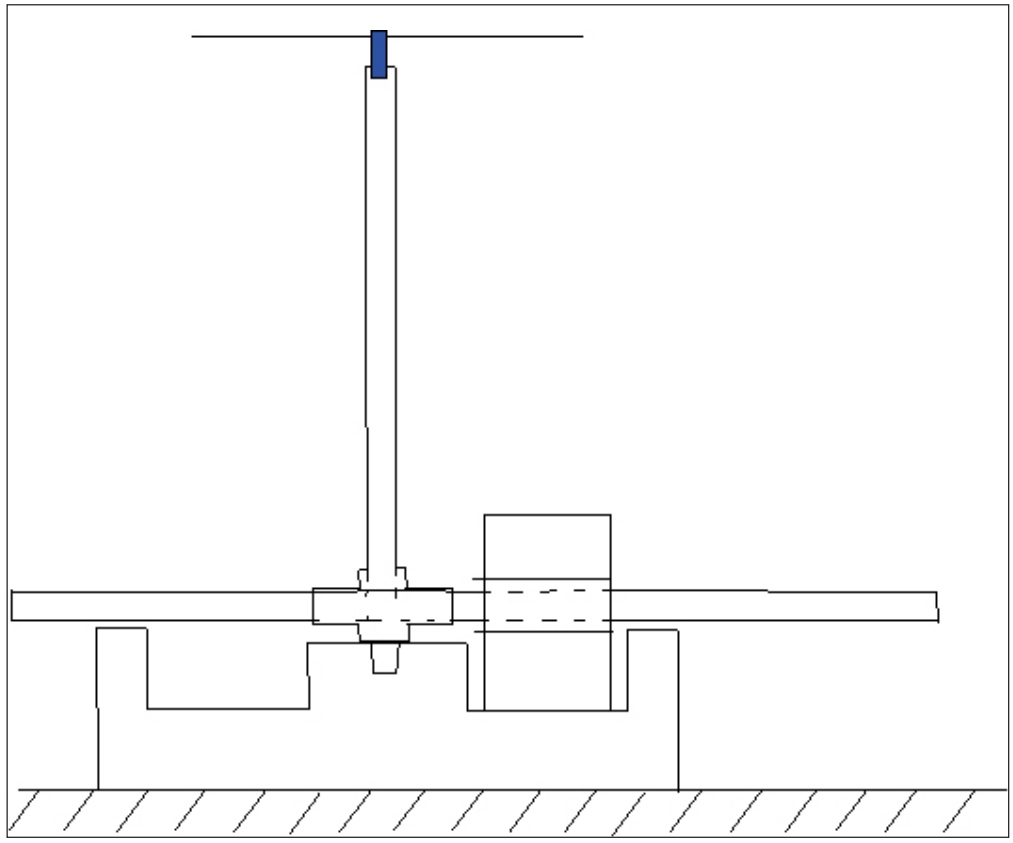


Figure 4.8: *A reconstruction elevation showing the possible milling process of the Gebel Tarhuna mills.*

Figure 4.9: *An olive press located at ancient oilery TUT43 (Loud el-Meghara) in the Wadi Turgut.*

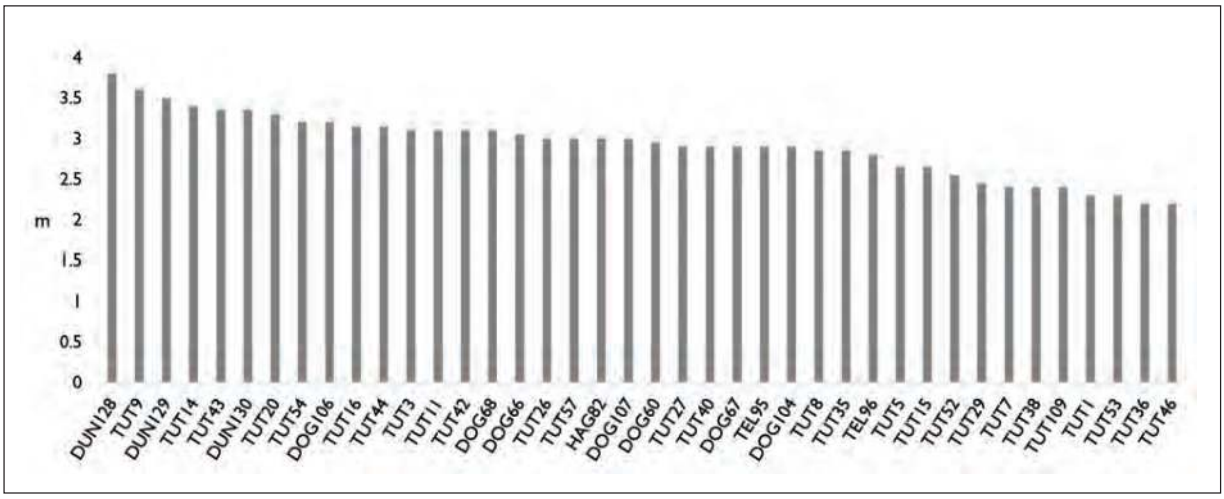


Figure 4.10: *Height (in m) of selected press orthostats from the Tarhuna plateau arranged in descending height order.*

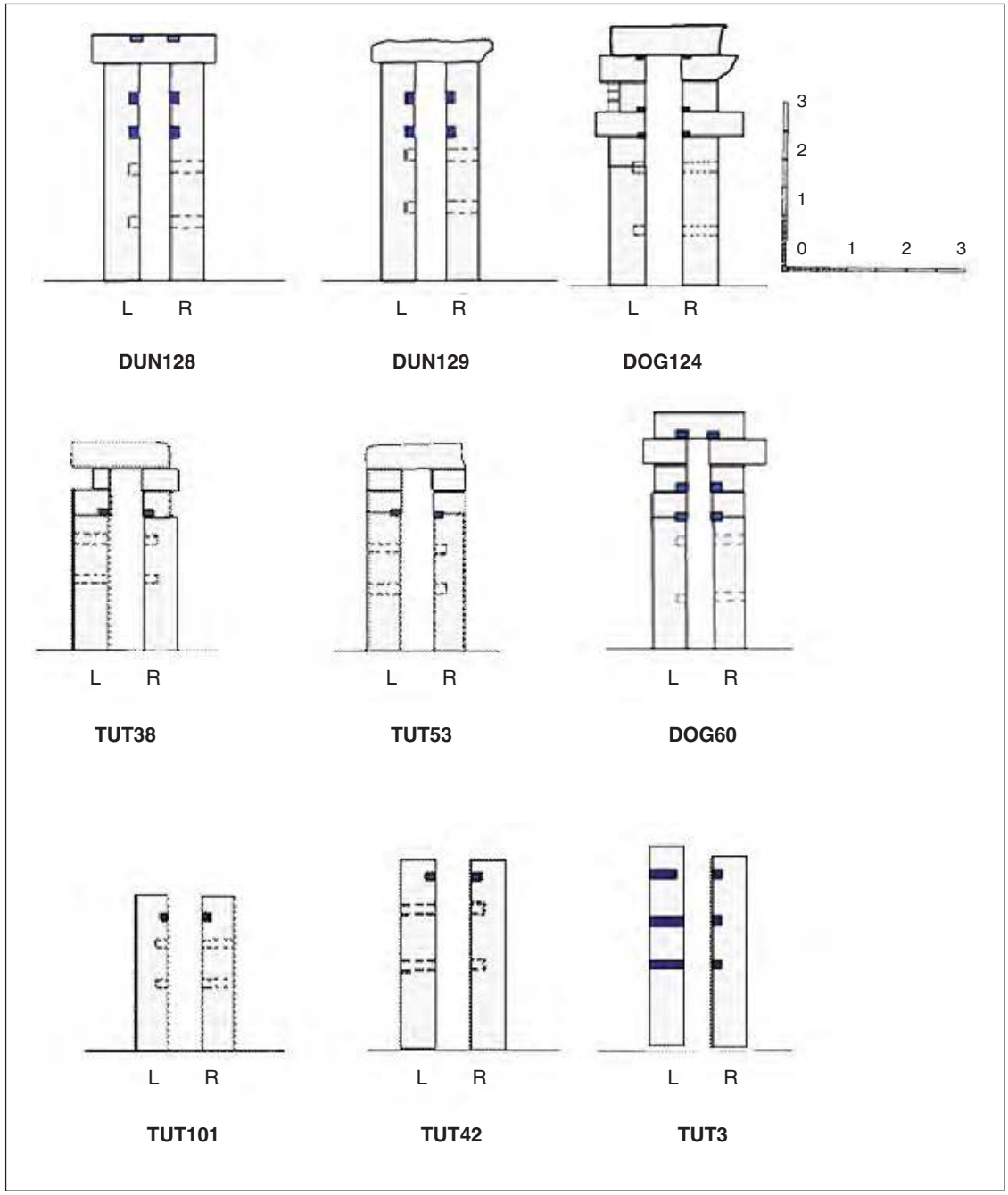


Figure 4.11: *A selection of press orthostats from the Tarhuna plateau.*

Figure 4.12: *The press orthostats at DUN128.*

Figure 4.13: *The press orthostats at TUT9 (Senam el-Gharabah).*

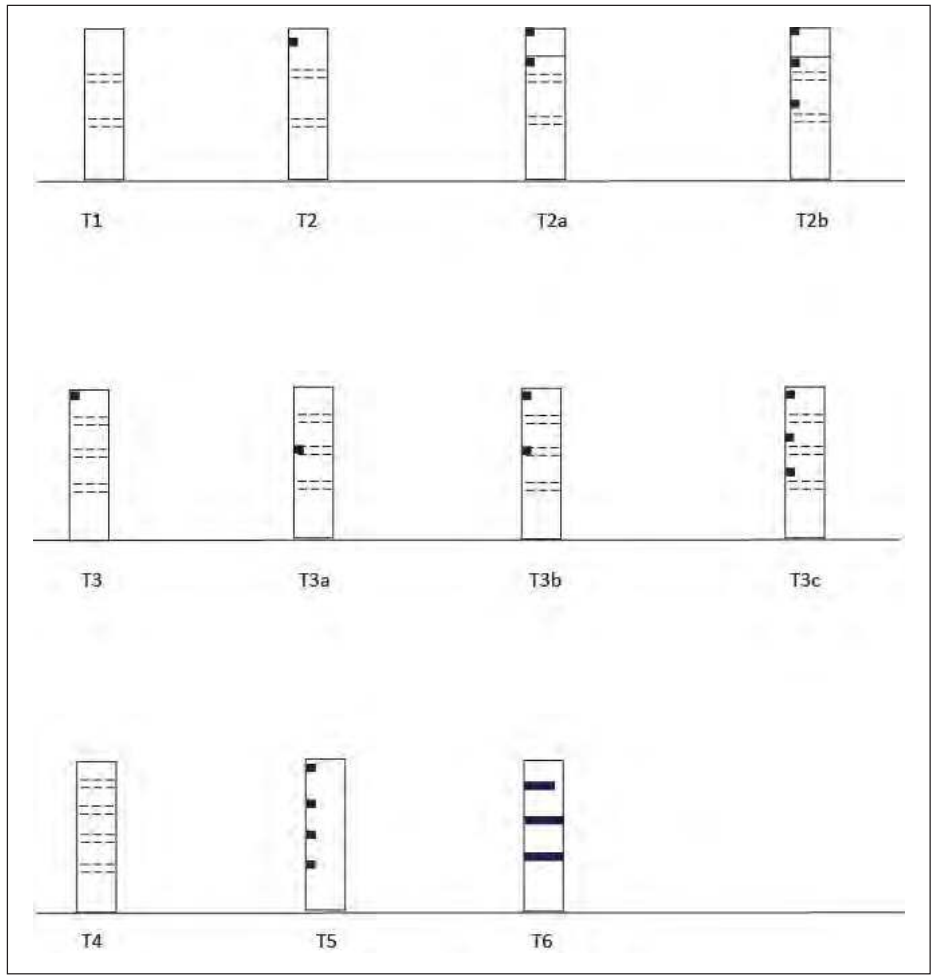


Figure 4.14: *An illustration of the press orthostat types.*

Figure 4.15: *Type T6 press orthostats at TUT3.*

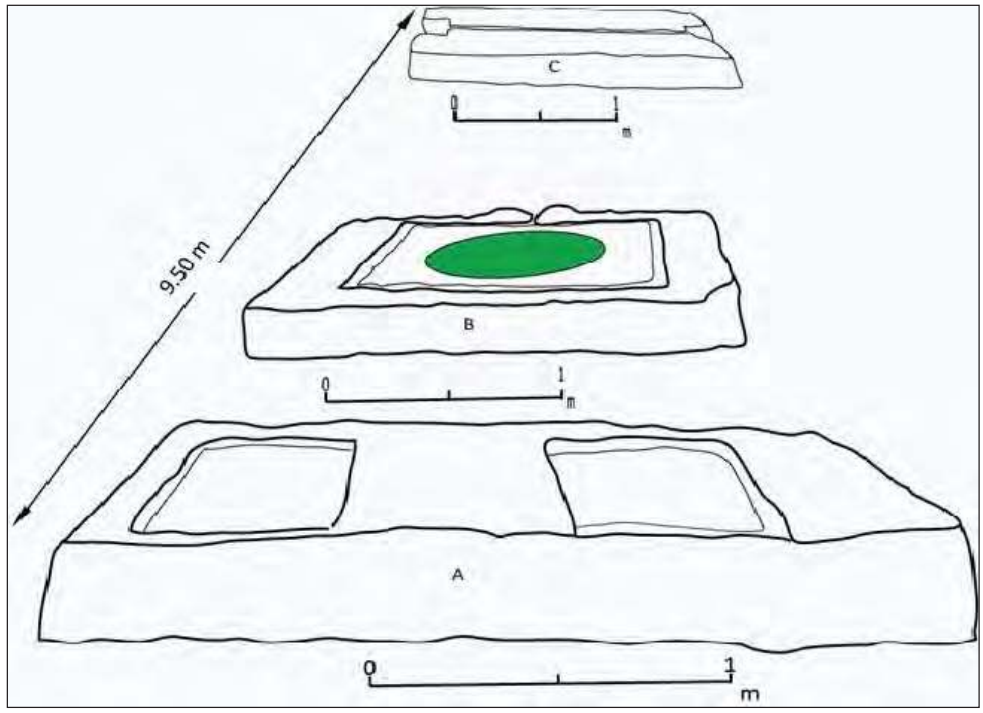


Figure 4.16: *Drawing of the main press elements at TUT12 (Sidi Buagela 2) as found* in situ*: base for the orthostats (A), press bed (B) and counterweight (C).*

Figure 4.17: *A line of seven* in situ *press beds at Sidi Buagela 2 (TUT12).*

Type 1

Type 1a

Type 1b

Type 1c

Type 2

Type 2a

Type 2b

Type 2c

Figure 4.18: *Types of Tarhuna press beds.*

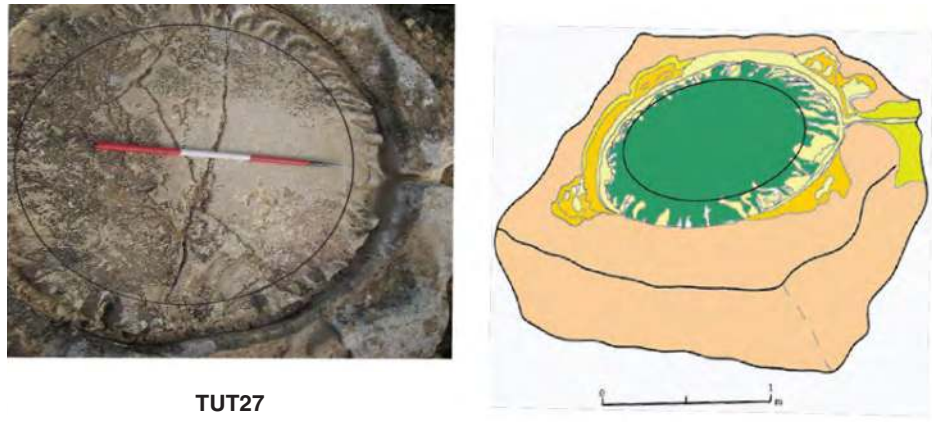


Figure 4.19: *A press bed with circular channel and internal meanders. The black circle indicates the hypothetical diameter of the stacked baskets.*

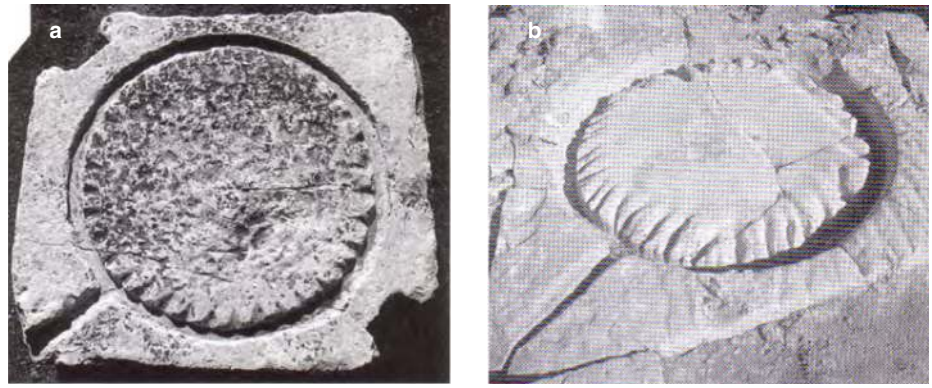
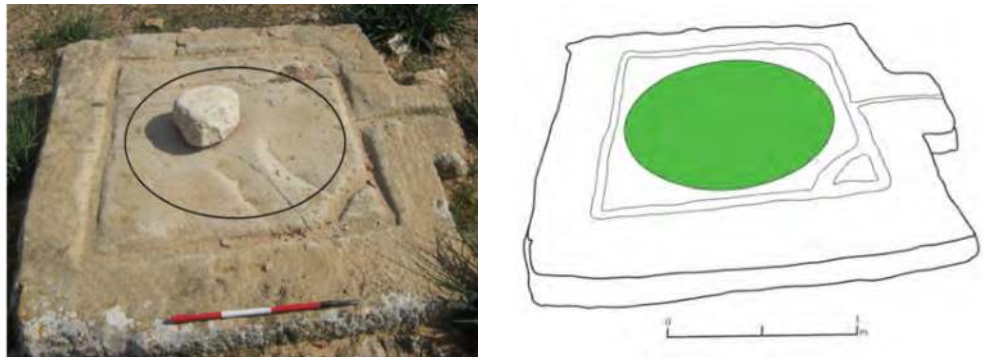


Figure 4.20: *Examples of press beds with eroded meanders recorded in Tunisia: a) Kef Lahmar (De Vos 2007), b) The Oued R'mel (Brun 2004).*



TUT15

TUT14 TUT38

Figure 4.21: *Some press beds recorded by the TAS in the Wadi Turgut with potential size of* fiscinae *marked.*

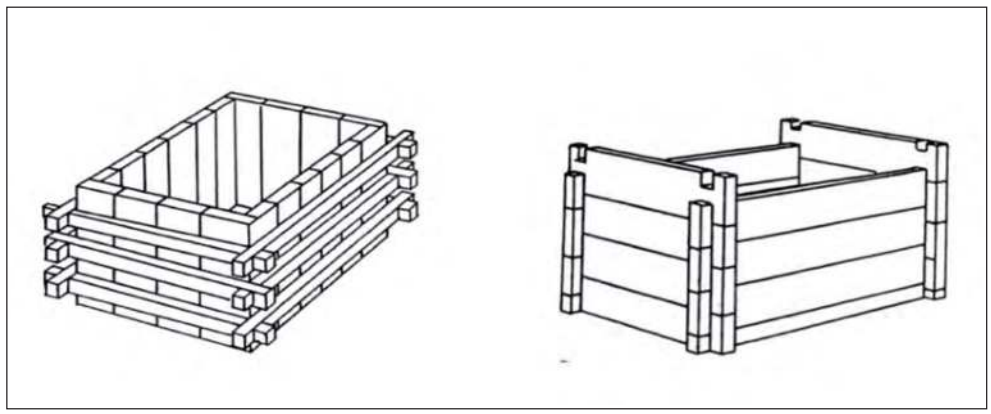


Figure 4.22: *Reconstructions of two types of* regulae *described by Hero (Drachmann 1932, 150).*

TUT127 TUT12

Figure 4.23: *Two press beds with circular channels with angle cuts.*

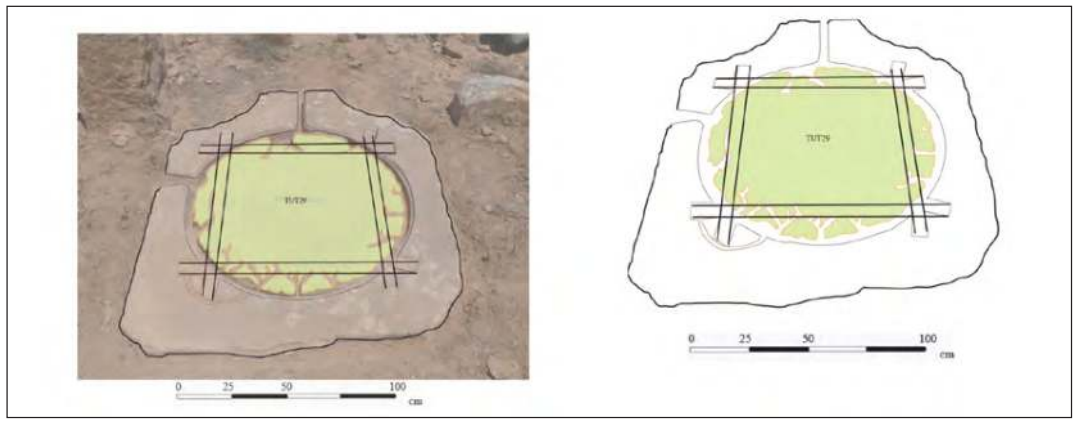


Figure 4.24: *An illustration of a press bed at TUT29 showing a reconstruction of how the wooden slats of a* regula *may have fit on top of it.*

Figure 4.25: *A press bed with angle cuts discovered in the Lebda Cement Factory.*

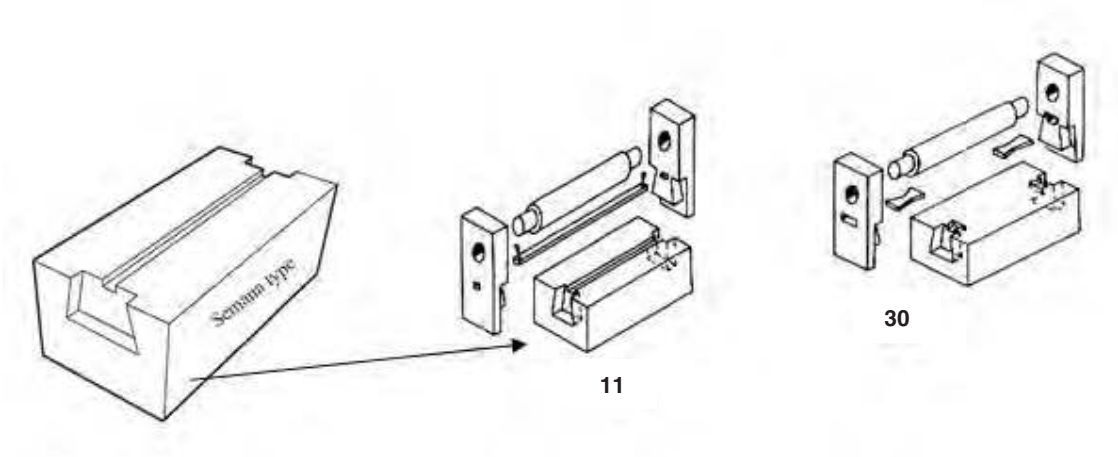


Figure 4.26: *A Semana type or Brun Type 11 counterweight (Brun 1987).*

Figure 4.27: *A Semana type counterweight found at Hendek Kale in Turkey.*

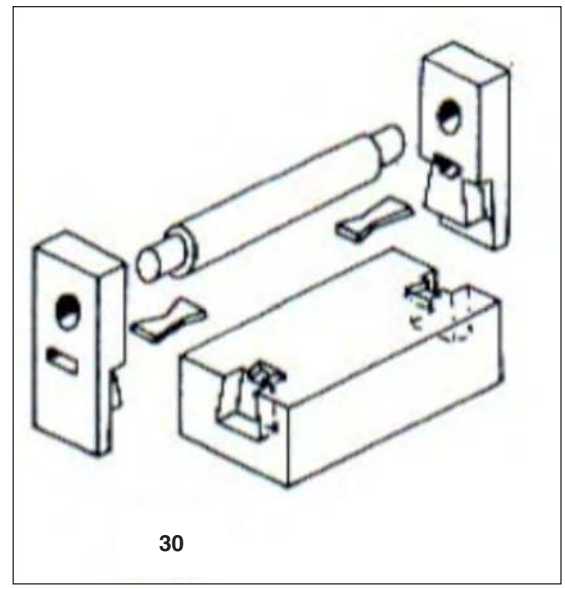


Figure 4.28: *A Brun Type 30 counterweight (Brun 1987).*

Figure 4.29: *An example of an* in situ *embedded counterweight from oilery-villa TUT43 (Loud el-Meghara).*

Figure 4.30: *A counterweight recorded at oilery HAJ82 (Gasr Dehmesh village).*

Figure 4.31 (above): *A press bed with adjacent vat at TUT14 (Bu-Kaala).*

Figure 4.32 (right): *A press vat cut from a piece of limestone and installed in front of a press bed at DUN128.*

Figure 4.33: *A press vat discovered in 2007 at the Lebda Cement Factory (photograph J. Dore).*

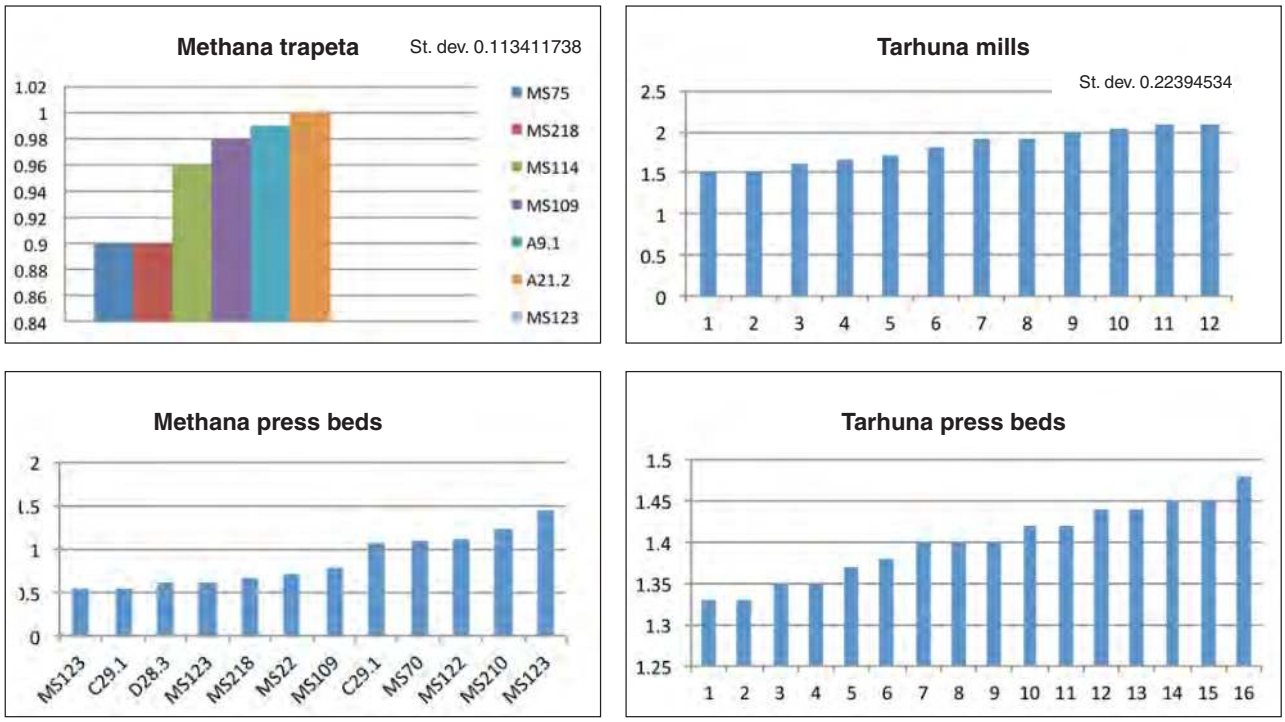


Figure 4.34: *A comparative standard deviation between some press elements of Methana (Greece) and Tarhuna (done by Lin Foxhall).*

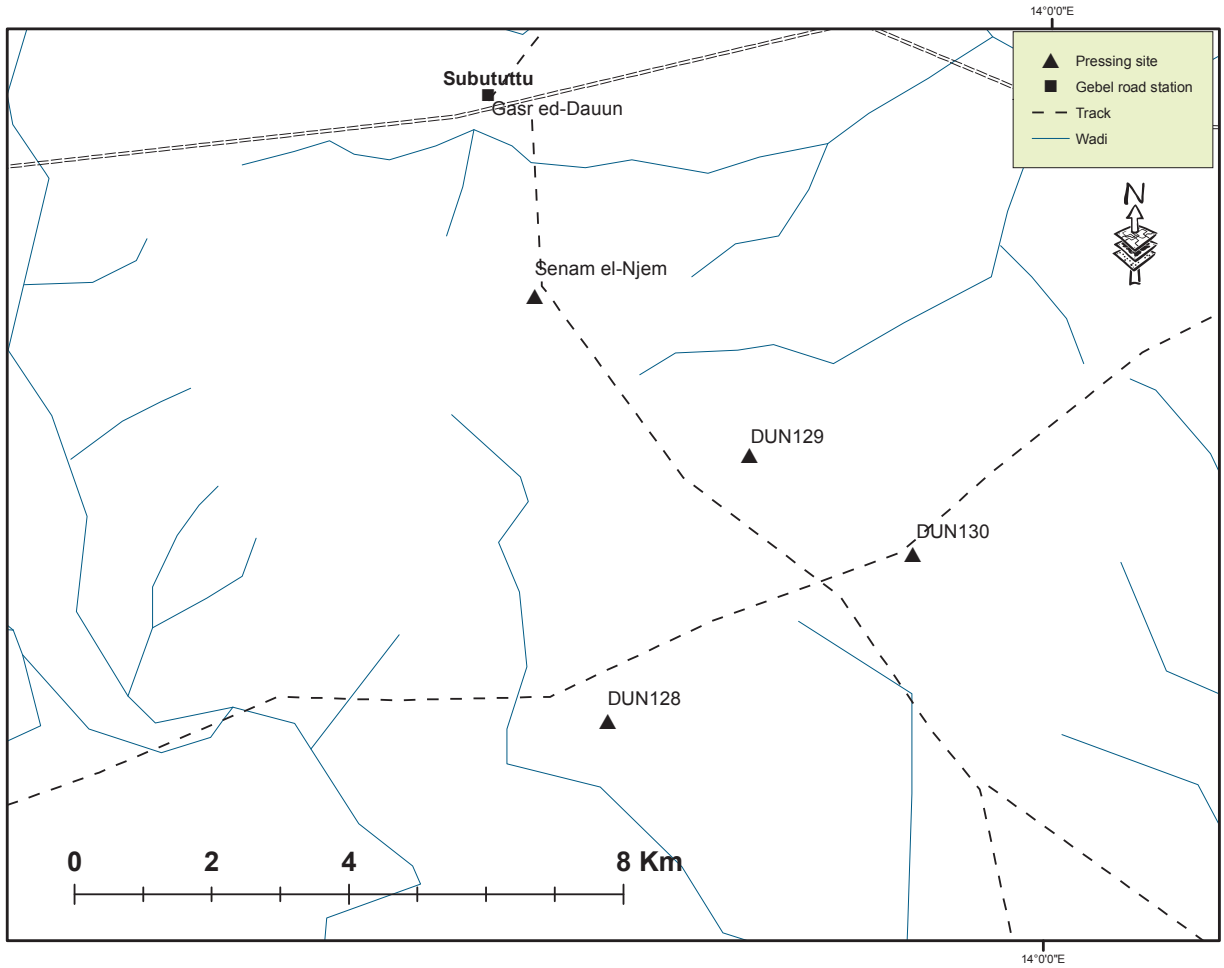


Figure 4.35: *Locations of sites with the highest orthostat holes, south of Gasr Ed-Dauun (*Subututtu*).*

Figure 4.36: *The mill and millstone of the Alarabi family olive oil press.*

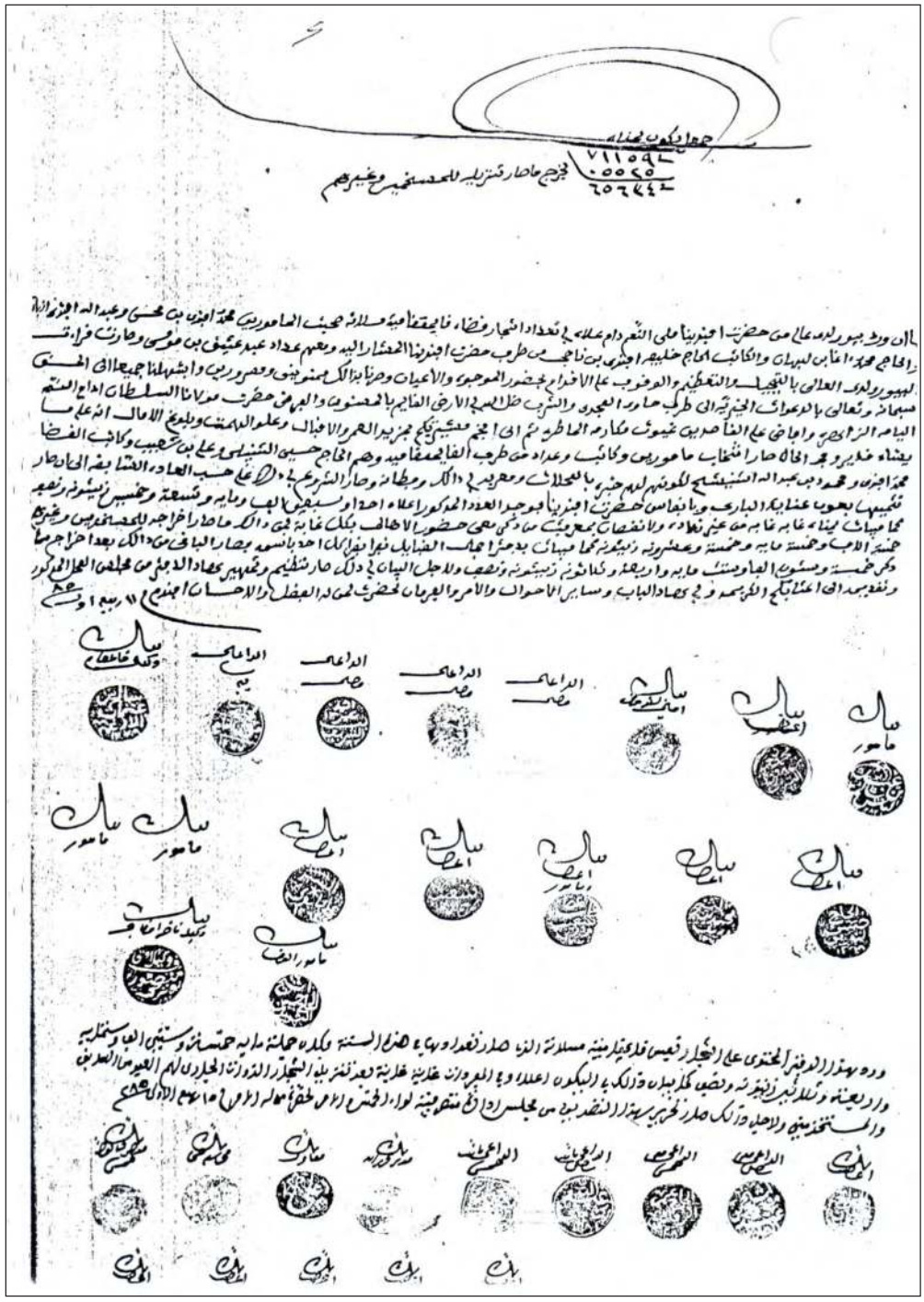


Figure 4.37: *The document M.T.T. 1888.*

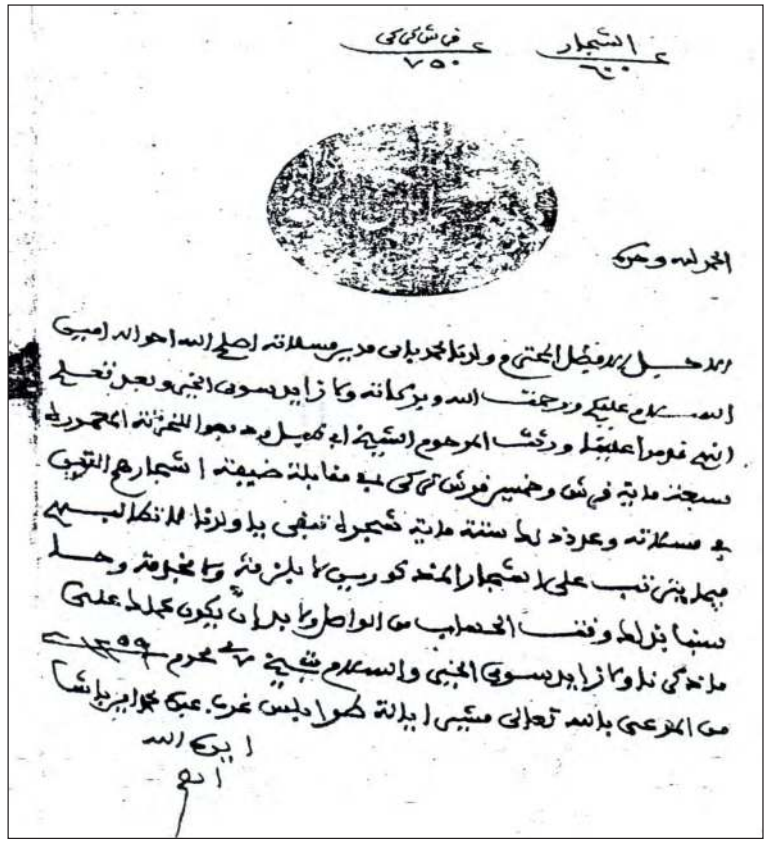


Figure 4.38: *The document 64/M/Ch 1843.*

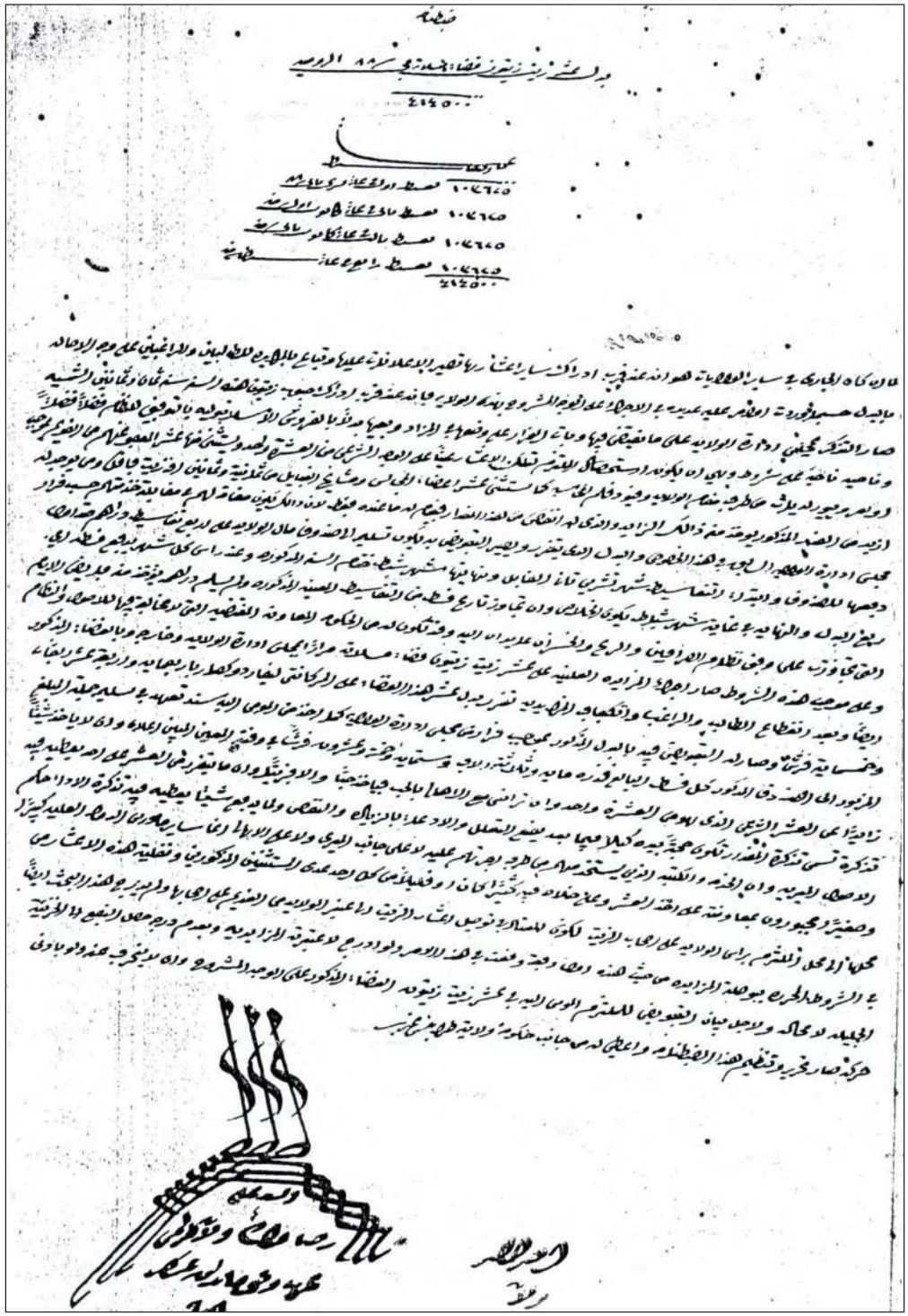


Figure 4.39: *The document D/M/T/T 1863.*

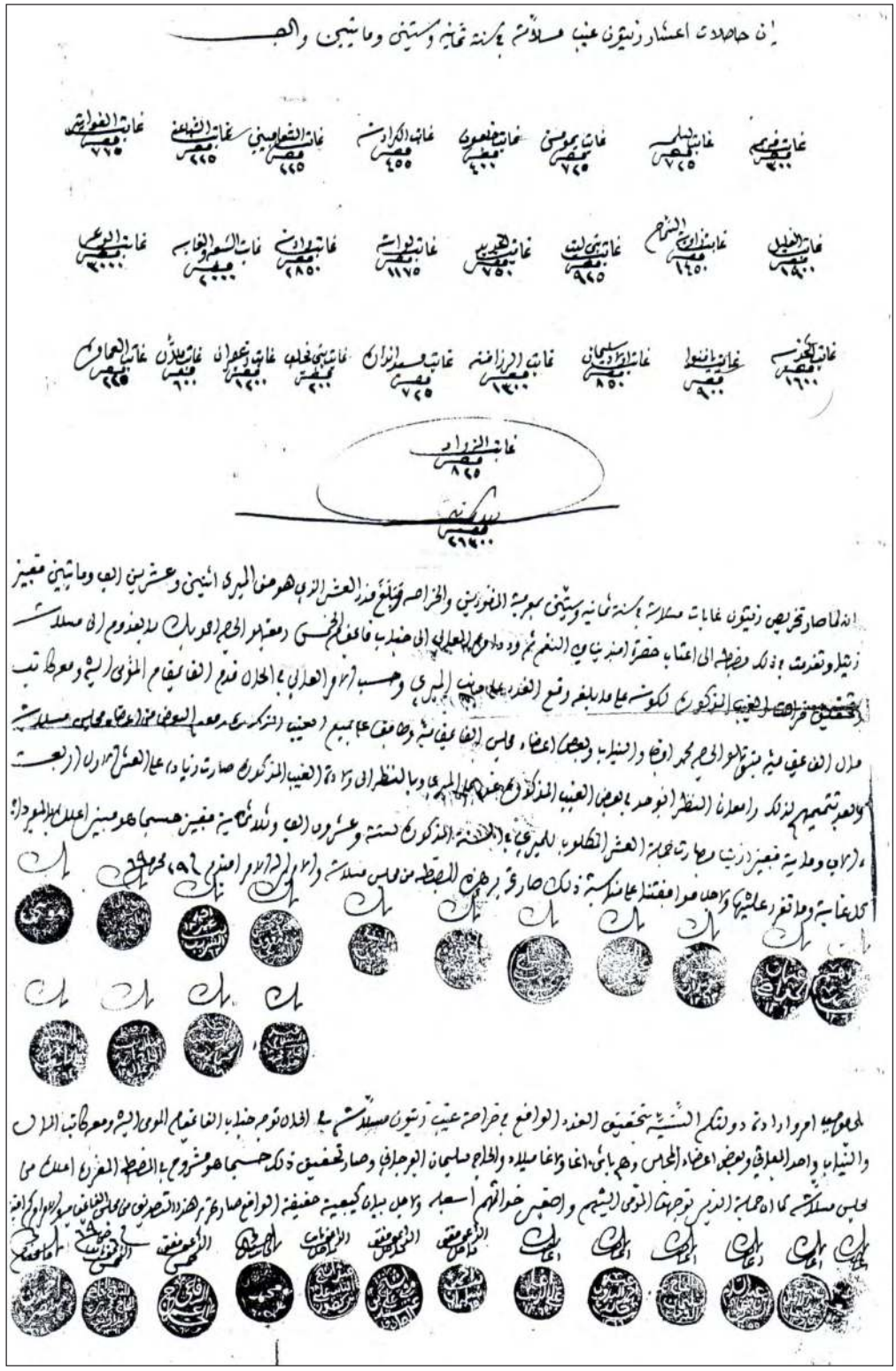


Figure 4.40: *The documents D/M/T/T 1863 and D/M/T/T 1874.*

Chapter 5

AMPHORA PRODUCTION SITES ON THE TARHUNA PLATEAU

5.1 Introduction

Previous evidence for amphora production in Tripolitania is relatively meagre and relates to two distinct areas: the Gebel Tarhuna, and the coastal zone in the immediate hinterland of the main cities and export harbours (Figure 5.1). Although the Gebel Tarhuna is characterised by a widespread distribution of different sizes of Roman-period farming sites which were mainly concerned with olive oil production, until recently only three pottery production sites were known in the region. Two of these were discovered between 1947 and 1948 by Goodchild. The first site had two kilns located c. 200 m north of a luxury villa at Ain Scersciara (*Cercar?*), and c. 100 m north of the waterfall at the spring head (Goodchild 1976, 96–97). The location of these kilns close to the villa and to the Roman-period road linking Medina Doga (DOG75, *Mesphe*) with Oea through the Wadi Reml, and the local availability of water and clay, suggest that this production site formed a workshop belonging to a wealthy estate (Arthur 1982; Goodchild 1951; Mattingly 1995).

The second kiln site identified by Goodchild was adjacent to the *gasr* of Sidi es-Sid which lies some 5 km west of Tazzoli village on the western part of the Tarhuna plateau. A collection of sherds from this ceramic production site was examined and illustrated by Arthur (1982). The illustrations reveal that these kilns were mainly producing amphorae of forms Tripolitania I and III, though the evidence indicates that coarsewares and tile were also produced. The third kiln site, found during Oates' survey around Gasr Ed-Dauun (*Subututtu*), is located a short distance westward of the eastern three dams constructed in the Udei el-Me and was recognised by its circular shape and burnt brick. Oates believed that this pottery kiln was of similar size to those at Ain Scersciara (*Cercar?*) (Oates 1953, 90).

As already mentioned, the Ain Scersciara (Cercar?) kiln site was characterised by a good water supply from the spring of Scersciara, while the other two were most likely dependent on water kept in cisterns and obtained from wells. Although the products of these Tripolitanian pottery kilns were mainly utilitarian, it was recognised early on that they would help investigations into the long-term occupation of sites in this hinterland, where the problem of establishing an absolute chronology is acute (Goodchild 1976, 99).

In addition to the pottery production sites on the Tarhuna plateau just described, a few other kiln sites have been identified in the Tripolitanian coastal area. The earliest identification of a pottery kiln was in 1925, found within modern Tripoli, though outside the walls of ancient Oea (Bartoccini 1928–1929, 93–95); however, since then, reported discoveries have been few. Goodchild also recorded a pottery kiln located on the north side of the main Tripoli–Khoms road (around kilometre 102) at the head of the Wadi Giabrun (Goodchild 1976, 96–97).

Some other kiln sites have been more recently discovered in Tripolitania such as the Hai al-Andalus (Tripoli) kilns (Shakshuki and Shebani 1998, 279) and the Sidi Andulasi (Taggiura) kilns (Preece, 2011). During the late 1990s, an archaeological survey conducted by a mission of the Università degli studi Roma Tre in the Wadi Caam-Taraglat identified four ceramic production sites (Felici and Pentiricci 2002, 1875–1900). Three sites specialised in the production of amphorae and coarsewares (Sites 47, 67, 106), while the fourth (Site 91) produced Tripolitanian Red Slip wares. In order to obtain good supplies of water and clay, all of these sites were situated beside the wadis and were also in the vicinity of several types of rural settlements. The surface evidence from Sites 47 and 91 revealed huge concentrations of potsherds and wasters, many of which were blackened, deformed and partly vitrified. The former site lies approximately 4 km from the coast on the west side of the Wadi Caam, with evidence for

ceramic production spread over a large area. Fragments of amphorae and coarsewares have been recorded in extremely high concentrations distributed over an area of approximately 6 ha (Felici and Pentiricci 2002, 1879–1880). These new pottery production sites lay in the immediate hinterland of Lepcis Magna and should be examined in relation to the other economic activities practised in its vicinity. Comparisons should be made to examine their production in relation to the large ceramic assemblages that have come out of excavations in the city.

5.2 The distribution of amphora kiln sites on the Tarhuna plateau

Based on the introduction above, it is clear that research into pottery production sites and their relationship with farming sites in the Gebel Tarhuna, and in particular olive oil production sites, is still in its infancy. There is almost nothing in the literary sources which deals with the economic activities of this region. Archaeologically speaking, the data for Roman-period economic activity are very imbalanced. There is a great deal of evidence for olive oil (and wine) production, extensively distributed and on an enormous scale; however, hitherto, the archaeological evidence for pottery production has been less impressive. My study, therefore, also set out to expand our knowledge of the amphora production sites on the Tarhuna plateau. During the course of the TAS I recorded many new sites and mapped their distribution in relation to farming sites and communication routes (Figures 5.1–5.2), thus furthering our understanding of Roman-period rural economic organisation. Although the results are still of a preliminary nature, the new data enable us to reinterpret our sources and advance our knowledge about this aspect of economic activity.

In light of the new evidence identified by the TAS, the study of olive oil production can now be complemented by an enlarged knowledge of Tripolitanian amphorae and their associated epigraphy.

The absence of secure data relating to non-agricultural rural economic activity resembles the situation in many other regions of Roman Africa. By producing several types of pottery on rural estates, villas and farms created additional labour needs inside and outside these rural properties. This diversity in rural economic activity provided estates and estate workers with employment and income, whether in goods or money. One possibility is that pottery production may have employed estate labour outside the harvest and pressing seasons, thus turning casual workers into full-time employees. This concept could be applied not only to the rural labour force but would also have had important consequences for other involved individuals, such as the owners of draught animals which were used to transport goods and the suppliers of other necessities to the rural community, whether from the countryside or urban centres.

As already mentioned, the TAS mainly concentrated on the Wadis Turgut and Doga in the north-eastern sector of the Tarhuna plateau (see Chapter 2). During this survey, 12 new pottery production sites were identified within these two valleys, plus two more: one recorded in Halafi village (DUN131), south of Gasr Ed-Dauun (*Subututtu*), and one in the Wadi es-Sri (SRI114), 12 km west of the town of Tarhuna (Table 5.1). Including the three kiln sites previously recorded by Goodchild and Oates at Ain Scersciara (*Cercar?*), Tazzoli and Gasr Ed-Dauun (*Subututtu*), there are now a total of 17 ceramic production sites known on the Tarhuna plateau. Most of the new sites came from the survey of the Wadi Turgut and one of its largest tributaries, the Wadi Guman, as was the case for the other categories rural settlement sites (Figure 5.2). Six sites with one or more kilns were identified in its main course (TUT12 (Sidi Buagela 2), TUT15 (Henschir Assalha), TUT18 (Ain Astail), TUT48 (Arbaia), TUT53 (Sidi Eysawi) and TUT108 (Henschir Armadia)) and four sites in the Wadi Guman (GUM86 (Scegafiat Asray), GUM89 (Scegafiat Atriq), GUM90 (Scegafiat Ben Hemad) and GUM110 (Scegafiat Maamri)). In contrast, only one pottery kiln has been recorded in the Wadi Doga (DOG111 (Almseel)). It should be added here that any future expansion of systematic archaeological survey, especially into the wadis located north and northwest of Ain Scersciara (*Cercar?*), would certainly increase the number of pottery production sites known in the Gebel Tarhuna.

These new ceramic production sites, especially those which produced the Tripolitanian amphorae, represent a considerable advance in knowledge over the previously known amphora kiln sites in the Tarhuna Gebel for a number of reasons. First, they have been systematically surveyed, revealing at least 53 amphora kilns and confirming Goodchild's statement that "further archaeological survey will undoubtedly bring to light additional kiln sites along the whole length of the Gebel" (Goodchild 1976, 98). Second, amphora sherds from these kilns have revealed more epigraphic information than the previously discovered kiln sites; only one amphora stamp was known from the Tazzoli pottery kilns, read by Arthur as *SPNS* (Arthur 1982, 64; Goodchild 1976, 98). The amphora kiln sites recorded by the TAS have produced 15 amphora stamps (Section 5.5). Third, these kilns were distributed within or near rural farming sites, particularly oileries and large farms, and were not isolated production sites.Attention has hitherto focussed on the extent of the relationship between these kiln sites and their surrounding landscape. It can be suggested that the establishment of the Tarhuna plateau pottery kilns in the landscape generally met the following conditions. First, they were often

attached to properties characterised by a high level of olive oil (or wine) production. This is indicated by a large number of presses, as was the case at TUT12 (Sidi Buagela 2), which was an oilery-villa with eight presses and was also located very close to TUT56 (Sidi Buagela 1), a farm with at least three further presses. At TUT15 (Henschir Assalha) the kilns were located about 100 m below an oilery-villa with five presses. The pottery workshops in Halafi village (DUN131) were situated midway between Halafi oilery-villa (DUN129) with five presses and Halafi large farm (DUN131), which had four presses (Figure 3.12).

Second, some pottery production sites appear to have been more influenced by the availability of water than other factors. This seems to have played a greater role with the location of the kiln sites at TUT18 (Ain Astail), TUT53 (Sidi Eysawi), GUM86 (Scegafiat Asray), GUM89 (Scegafiat Atriq), GUM90 (Scegafiat Ben Hemad), GUM110 (Scegafiat Maamri), TEL102 (Hamzia) and SRI114 (Wadi Sri). Their favourable situations are comparable to that of the Ain Scersciara (*Cercar?*) pottery kilns, which exploited the spring itself as well as the clay beds along the valley. By contrast, a lack of spring water at other kiln sites was offset by digging a number of different sizes of cisterns. For instance, at Sidi Buagela 2 (TUT12), the oilery-villa, bath-suite and two(?) kilns were supplied by water captured in two large shaft-cut cisterns. Third, in order to facilitate the movement of their products to the markets, all of the recorded pottery production sites in the Gebel Tarhuna were located close to the main Gebel road which was built in AD 15/16, or near secondary routes linking the plateau with the northern coastal area and the southern pre-desert zone (Figure 5.2).

The discovery of a large number of kiln sites in the Tarhuna region strongly suggests that pottery production was a rural economic activity located predominantly alongside the oil and wine production facilities, rather than close to the port cities. Many rural estates incorporated pottery workshops and functioned as centres of this type of production. For this reason, I would argue that the distribution of the pottery kilns in the countryside of the Tarhuna region provides further indications of the economic orientation of the Roman-period rural landscape, especially considering that amphora production sites enjoyed a strong relationship with olive farms and oil pressing sites. Moreover, it is the pottery evidence that defines the chronology of the occupation of these sites and buildings.

It is clear that there was a significant relationship between agricultural production, particularly of olive oil and wine, and sites of pottery production. This phenomenon in Tripolitania is comparable with most other areas of Roman Africa, especially *Africa Proconsularis* where the archaeological evidence very often reveals that this activity was part of the rural economy (Ben Mousa 2007, 225). In fact, there is also a complete absence of evidence of this type of economic activity within the city of Lepcis Magna, which appears to have depended on rural ceramic production centres, as well as imported wares, for its pottery needs.

Two amphora stamps support these proposals. In 1994 I collected a sherd of a Tripolitania II amphora rim from the kiln site GUM90 (Scegafiat Ben Hemad) bearing a stamp which can be read as *ARHC* (Figure 5.3). The same stamp was recorded on a sherd found during the excavation of a maritime villa in the Wadi er-Rsaf, in the western suburbs of Lepcis Magna. It appeared there on the same type of amphora as the example from GUM90 (Scegafiat Ben Hemad) and came from a context dated to the second half of the second century AD (Munzi and Pentiricci 1997, 272–276). Another example concerns amphorae produced at Henschir Assalha (TUT15), an estate production centre with an oilery-villa and four(?) kilns, where an amphora waster sherd was found with a distinctive stamp (Figure 5.4), examples of which have also been found at the third century AD Roman fort of *Gholaia* (Bu Njem) (Rebuffat 1976–1977) and at the Laurons II wreck near Marseille (Bonifay 2004, 105). This amphora, categorised by Bonifay as amphora Type 19 – Tripolitania I – (Bonifay 2004, 105), must have been produced at Henschir Assalha (TUT15) and offers a perfect example of regional and empire-wide exchange.

5.3 Types of amphorae produced by the Tarhuna plateau kilns

There are three main types of Tripolitanian amphorae: I, II and III (Figures 5.5–5.6). These amphorae are considered to belong to the imperial Roman African style, perhaps derived from Punic equivalents. The two main forms are known as Tripolitania I and III (Bonifay 2004, 105; Bonifay and Garnier 2007; Panella 1973, 560–562, 564–571). Classification of the Tripolitanian amphorae can inform us about their contents. Examples of both Tripolitania I and III amphorae have been found at Monte Testaccio, ranging in date from the Augustan period to the mid-third century AD; they almost certainly contained olive oil. On the other hand, there was also a regional distribution of the Tripolitanian amphorae, as attested at Bu Njem (*Gholaia*) (Rebuffat 1973a; 1973b; 1973c; 1975; 1977). These amphorae were certainly present at the fort, which was held by the Roman army in the mid-third century AD (Bonifay 2004, 20; Rebuffat 1973a; 1973b). All three types have also been found in Fazzan, in the Libyan desert (University of Leicester Trans-Sahara project, information from unpublished excavation report, and see also Mattingly *et al.* 2007, 2010, 2013)

Scholars believe that the distribution of African and Tripolitanian amphorae in many Mediterranean ports and centres reflects the expansion of the export of agricultural products (particularly olive oil and wine) and other commodities such as salted fish which were included in the commercial mobilisation of surplus production (Carandini 1970; 1983; Keay 1984; Mattingly 1988b; 1995; Reynolds 1995). In the peak period of production, especially during the Severan period, there is some evidence of state involvement in the supply of these products for both Roman civilian and military markets. In some cases this was achieved via the exploitation of the imperial properties (Kehoe 1988) and in others by indirectly encouraging certain policies, cultivation by private owners or transport by merchants, or also perhaps through imperial agents who directed trade as a part of the *annona* system (Reynolds 1995, 108–111). However, further detailed studies on the Tripolitanian amphorae need to be conducted in order to develop our knowledge and understanding of their morphology, production and chronology. (With acknowledgement to University of Southampton 2014 for much of the descriptive matter on the Tripolitanian amphora published here and below).

5.3.1 Tripolitania I amphorae

The Tripolitania I amphora was first described by Zevi (Zevi and Tchernia 1969) and following that Panella elaborated on its features (Panella 1973). It has a cylindrical body with a thickened, turned-over rim which has a concave outer face. Its neck is also cylindrical or very slightly tapered at an angle to the junction with the body (Bonifay 2004). Two short handles link the neck with the shoulder and the body ends in a solid or hollow cone-shaped point (Figure 5.7). Looking at the fabric, it is usually a red-orange with a hard and compact texture and limestone inclusions. The archaeological evidence along with the *tituli picti* reveal that this type mainly contained olive oil. However, there is sufficient variation in rim forms to suggest that some sub-types could have been used for other products such as wine (see also recent work by the Trans-Sahara Project on the Tripolitanian amphora at Fazzan, which were probably used for a variety of products, Leitch forthcoming).

5.3.2 Tripolitania II amphorae

The Tripolitania II is a cylindrical amphora topped by a short neck with a thickened everted rim with two overlying steps (see University of Southampton 2014 and Figure 5.8). The two ear-shaped handles are placed on the body below the shoulder. The base is tapered and hollow or filled with clay (Panella 1973, 564). Its form suggests it was derived from earlier Neo-Punic amphorae (Bonifay 2004, 88; Van der Werff 78, 184). At Ostia, Tripolitania II amphorae were recorded in levels dated to the first to mid-third centuries AD, with a peak occurring during the Antonine period (Bonifay 2004, 92). In Tripolitania, the form is attested from the first half of the first century AD until the late fourth century (Keay 1984, 43; Panella 1973, 563). Bonifay remarks that the morphological evolution of amphorae of this type during these centuries is still unclear (Bonifay 2004). He suggests that the first century AD form is clearly a transitional form of the Neo-Punic Van der Werff III type. Forms of third century date can be distinguished from the earlier examples by their more elongated necks, while the neck edge of forms of the fourth century were more atrophied (Bonifay 2004, 92). The fabric is generally either red with streaks of grey or brown in the core, with a grey surface and abundant limestone inclusions, or a red-orange mixture which is rather hard and compact with white angular granules. The contents carried by this type of amphora are unclear. While a complete profile was discovered *in situ* in a probable oil press room in the pre-desert (Barker *et al.* 1996, 279–280, Fig. 9.11), another fragment collected from the ancient port of Toulon has revealed pitch. An amphora found at Pupput also appears to have been coated with pitch (Bonifay 2004, 89, 92 and Table 4, 474–475). But it is important to note that Brun (2003) has argued that the press room in the pre-desert was for wine, and pitch is also an indicator for wine, so this may have been the main contents for Tripolitana II amphorae. Figure 5.8 shows some examples from the Tarhuna plateau kiln sites, which again show a certain amount of variation in the rim shape, especially those forms produced in the Wadi Guman. It is difficult to identify the reason behind this variation without complete examples, but unfortunately all of the surface finds were fragmentary.

5.3.3 Tripolitania III amphorae

Tripolitania III amphorae are characterised by a tall cylindrical body with an everted rim and are less massive than the Tripolitania I amphorae (see University of Southampton 2014 and Figure 5.9). The neck is very often short and connected with the shoulder in a continuous line (Bonifay 2004). The body ends with a curved base and conical foot usually filled with clay. In most examples there are two ear-shaped handles fixed below the rim. The Tripolitania III amphora succeeded the Tripolitania I in the second half of the second century AD and dominated the distribution process of Tripolitanian amphorae during the third century AD (Bonifay 2004, 105). The archaeological record demonstrates continuous production into the fourth century AD (Panella 2001, 211) when it was probably characterised by a hypertrophy of the upper edge, as seen in examples found at Ostia and Lepcis Magna (Figure 5.10) (Bonifay 2004, 105). Both Tripolitania I and III amphorae were often used to transport olive oil (Bonifay 2004, 470–475).

5.4 The construction of amphora kilns on the Tarhuna plateau

In terms of their construction, the Tarhuna plateau pottery kilns seem to parallel the ones excavated and examined by Goodchild at Ain Scersciara (*Cercar?*) (Figure 5.11a) and Tazzoli (Goodchild 1976). Regarding their furnaces, they can generally be divided into two types: Type 1, in which the furnace opens directly into the low-level compartment of the oven and Type 2, which is characterised by a dome supported on a central pillar, with its circular interior divided into two levels. An example of the second type was found outside the walls of ancient Tripoli and excavated by Bartoccini (1928–1929, 93–95) and was described by Goodchild in the following terms: "the lower level, elliptical, was close to the furnace, while the upper level, 'three-quarter-moon'-shaped, lay more distant from it" (Goodchild 1976, 96). In contrast, the design of the Hai al-Andalus pottery kilns (Figure 5.11b) appear to be more similar to the Ain Scersciara (*Cercar?*) and Tazzoli kilns (Shakshuki and Shebani 1998). Thus, the archaeological evidence suggests that the Tripolitanian pottery kilns were dominated by these two main types in terms of the level and position of the furnace.

The recorded diameters of the amphora kilns on the Tarhuna plateau reveal that most of them are among the largest known in Roman Tripolitania (Table 5.2). This mirrors other evidence relating to the size of farm buildings and pressing facilities. Capital investment in kilns, oileries, large farms, water management systems and baths in this region was not within the means of poor landowners and must be related to rich landlords.

It was not possible during the TAS to draw plans of all the pottery kilns identified in the Gebel Tarhuna. The principal reason for this was the poor preservation of many of the kilns; most of the kiln sites were recognised only as mounds of collapsed brick structures, ash and numerous wasters. Nevertheless, in a few cases it was possible to trace the remains of their walls and measure their dimensions. In the case of the destroyed kilns, an estimate of the number of kilns at each site was made by counting the mounds of kiln debris on the surface. The last kiln load was still *in situ* in at least one case, as revealed by a test excavation of one of the Arbaia (TUT48) pottery kilns during February 2007.

5.4.1 The excavation of a pottery kiln at Arbaia (TUT48)

The Arbaia pottery workshop contained at least five kilns located on a slope close to the wadi bed, at the meeting point of the Wadi Turgut, running from south to north, and the Wadi Hawatm Bo Salma, running west to east. The surrounding landscape was occupied by different types of rural settlements (Figure 5.12). The short distance between the kilns and the wadi bed was occupied by a huge amount of amphora and tile sherds and the remains of clay-built structures.

Kiln 1 was one of a series which were damaged by the cutting of a modern track through the area (Figure 5.13). However, this track, which had destroyed the eastern half of the kiln, revealed a cross-section view of it, which I recorded during a reconnaissance survey in October 2004 (Figure 5.14).

A trial excavation of Kiln 1 revealed a well-preserved, large, circular Type 1 pottery kiln (Figure 5.14). The walls of the kiln were built of small rectangular clay blocks which had been unevenly fired *in situ.* The walls enclosed two levels: the elevated upper floor, supported on a central circular pillar, was the oven, while the lower firing chamber was connected to a stoke-hole opening westwards, similar to one found at Ain Scersciara (*Cercar?*). The kiln diameter was 4.3 m, placing it among the largest pottery kilns yet known in Tripolitania, though it is still smaller than the Ain Scersciara kiln, which was over 6 m and probably fired hundreds of amphorae in each load (Figure 5.15). The latter was described by Goodchild as "one of the largest Roman circular kilns yet brought to light" (Goodchild 1976, 88). Arbaia Kiln 1 was full of waster sherds of Tripolitania II and III amphorae, possibly representing its final (unsuccessful) firing still *in situ*, rather than a rubbish disposal. The excavations produced an interesting collection, including four amphora stamps, rims and bases of amphorae and samples of the fuel used.

A huge number of complete, uncrushed olive stones were discovered mixed with the ash found inside the stoke-hole (Figure 5.16). Evidence for the use of uncrushed olives as fuel has also been found at an excavation at the site of Tria Platania in Pieria, southern Macedonia (Margaritis and Jones 2008). These could represent uncrushed olives that had been used as fuel or the residue of pressed olives. In addition, Brun (1986) found intact olive stones in two furnaces he excavated in France. The intact olive pits could represent the solid residue of the pulped olives after pressing, also known as pomace. The pomace contains residues of oil that make it an excellent solid fuel once dried. The fleshy pulp and small fragments of olive stone will generally be thoroughly consumed in the fire, but the intact stones are sometimes recognisable in carbonised form. However, Rowan (forthcoming) argues that uncrushed olives are not generally used as fuel, and if they were the residue from pressing, these would normally be crushed as they will have been milled, so it is unlikely that there would be that many uncrushed examples. Another hypothesis is that in peak production years, harvested olives probably waited for days or weeks to be crushed and pressed. Some olives in storage would start to rot and after drying could have been transferred to the pottery kilns. A careful archaeobotanical examination would cast more light on this issue.

5.5 The Tarhuna plateau amphora stamps

Detailed studies of amphorae are significant as these vessels are valuable evidence of economic activity which is not comparable to most other classes of pottery. They provide direct evidence for the transportation of a number of valued commodities that played important roles in the Roman economy and everyday life. Amphorae are among the most common ceramics encountered in Roman contexts, attesting to the scale of trade and transport between the provinces and Rome itself.

The three main types of Tripolitanian amphorae were all produced in the kilns of the Tarhuna plateau. The classification of these amphorae started more than forty years ago through the study of African ceramic containers from excavations at Ostia. Zevi and Tchernia were the first scholars to characterise the Tripolitanian amphorae (Zevi and Tchernia 1969, 193–195). In the early 1970s, Panella described their characteristics, specified sources, refined and defined the typology and tried to interpret their economic role (Panella 1973). She initiated investigations into the names which occurred on stamps, starting with an amphora stamp which reads *CAELEST* from a Tripolitania III amphora found at Lepcis Magna (Panella 1977, 135–149). Manacorda produced the first synthesis of Tripolitanian amphora stamps in his article published in *Dialoghi di Archeologia* (Manacorda 1976–1977). It should be noted that, in fact, Tripolitanian amphorae were rarely stamped; the stamped Tripolitanian amphorae probably did not exceed 1 % of the total number produced. The most prolific period for stamping seems to have been c. AD 200–230, though some evidence for earlier stamps has been recorded, including by the TAS on Tripolitania I and II amphorae.

All studies of amphora stamps build on the material from Dressel's work on the inscriptions and stamps on amphorae found at Rome and published in *CIL* 15. This work was expanded by Rodriguez Almeida, whose investigations focused on the amphora sherds at Monte Testaccio and has multiplied the numbers of known stamped amphorae, especially Dressel 20 amphorae from *Baetica* (Rodriguez Almeida 1975; 1984). Based on the detailed analyses of Tripolitanian amphora stamps done by Manacorda (1983) and Di Vita-Evrard (1985), Mattingly listed a total of 62 known Tripolitanian amphora stamps (Table 5.3). He suggested that they were largely from Tripolitania III amphorae and datable to the Severan period (Mattingly 1995, 153–155). Most of his evidence for the Tripolitania III amphorae came from Ostia and Rome, particularly Monte Testaccio (Mattingly 1988b). Recent Spanish work at Monte Testaccio has added five further examples (Table 5.4; Figure 5.17) to the list compiled by Mattingly and all of the known Tripolitanian stamps have been incorporated into the *Centro para el Estudio de la Interdependencia Provincial en la Antigüedad Clásica* (CEIPAC) online database (http://ceipac.gh.ub.es). The TAS recovered 34 stamped sherds and identified 15 different amphora stamps (Table 5.5; Figure 5.18), 12 of which were certainly or possibly previously unknown, bringing the total of known Tripolitanian amphora stamps to 79.

There are many difficulties with interpreting the abbreviated information on these stamps. In most cases they appear to relate to abbreviated names (*tria nomina*), though other formulations do occur (Bonifay 2004; Di Vita-Evrard 1985; Mattingly 1988b; 1995). One group of exceptional stamps seem to relate to imperial estates (Table 5.3, 1–4). Four stamps with the letters *IMPANT/AVG, F AVG* or IMPANT were collected by the TAS from the Arbaia (TUT48) pottery kilns (Table 5.5, 4). These evidently represent the titles of the Emperor Caracalla (Mattingly 1995, 154–155). These imperial stamps can help to locate some of the known imperial estates in the region. Di Vita-Evrard suggested that these stamps related to imperial estates located in the territory of Lepcis Magna (Di Vita-Evrard 1985, 149–150). Some stamps end with the letters *CV*, which stands for *clarissimus vir*, i.e. a senator, allowing us to relate them to the leading Lepcitanian families such as the Septimii, Fulvii, Plautii, Marcii, Ulpii, Vibii, Cornelii, Servilii, Pompeii, Cassii, Granii, Calpurnii and Verginii. These families are well-attested in many inscriptions from Lepcis Magna, allowing precise suggestions to be made in the identification of some of the individuals involved (Table 5.3) (Di Vita-Evrard 1985; *IRT*; Mattingly 1988b; 1995). For example, the letters of the stamp *LSACV*, of which two examples were found at Henschir Armadia (TUT108) by the TAS, are interpreted as either L. Septimius Aper or L. Silius Amicus Haterianus (*IRT* 542). Another amphora recorded at GUM110 (Scegafiat Maamri) and stamped with the initials *MVC* is probably related to either M. Ulpius Cerealis (*IRT* 388 and 440) or a member of the Vibii family, e.g. M. Vibius Annianus Geminus (*IRT* 578 and 608). This evidence is a clear indicator of the relationship between estate owners, the surplus production of olive oil (and wine) and the manufacturing of amphorae within the estates as containers.

It is also notable that some Tripolitanian amphora stamps identified at the fort of Bu Njem (*Gholaia*) have now been found associated with pottery kilns in the Gebel Tarhuna. For example, two stamps found at Bu Njem and published in the CEIPAC online database, nos. 18813 and 18808, were recorded by the TAS at Henschir Armadia (TUT108) and Halafi (DUN131) respectively (Figure 5.19) (Rebuffat 1997). Five examples of the former stamp (*LSACV*) have also been found at the *Hortis Torlonia* in (Rome) and two examples fromat Monte Testaccio (http://ceipac.gh.ub.es).

It is important to note here that some of the pottery kilns in the Gebel Tarhuna appear to have used more than one stamp with different initials. In particular, this

phenomenon has been identified at the Wadi Guman kiln sites (GUM89 (Scegafiat Atriq), GUM90 (Scegafiat Ben Hemad) and GUM110 (Scegafiat Maamri)). Since 1995 I have made repeated visits to these sites as they are all located very close to my home, and for example, a total of 14 stamped sherds have been identified among a sample of hundreds of rims and handles from GUM89 (Scegafiat Atriq) (Asmia and al-Haddad 1997, 218). Four different stamps are represented among these 14 sherds, of which ten were examples of the stamp bearing the letters *AIM*.

Remesal Rodríguez has studied in detail the amphora kilns located alongside the Guadalquivir River in *Baetica* (Spain) and has observed that the relationship between local landowners and the process of selling products of the land such as olive oil is hard to establish. This is also the case with trying to understand the organisation and exploitation of the Tripolitanian amphora kilns. Remesal Rodríguez created the following model to explain how the kilns were employed and by whom, dividing them into a number of different models:

a. Kilns located on private estates
   a-1) exploited by the owner of the estate for the packaging of his own oil alone;
   a-2) producing containers for the estate where it was located and for neighbouring properties;
   a-3) unconnected to its own estate and producing containers for others; either directly exploited by the owner, an actor, or leased to a *conductor*.
b. Kilns situated on public land
   b-1) leased to a *conductor*;
   b-2) managed by a *procurator* working for the public administration.

If we accept Remesal Rodríguez's model, the Tripolitanian amphora kiln sites presenting more than one stamp could have functioned as production sites supplying amphorae for several different estates or individuals (Models a-2 and a-3). In fact, the Wadi Guman area was particularly well-provided with the raw materials for ceramics, wells and springs, stone quarries for buildings and easy access to the most important communication routes (see Figure 3.41).

Nevertheless, the spatial relationship between many of the kilns and pressing facilities suggests that the majority of amphorae were manufactured on the estates which also produced their liquid contents (whether oil or wine) and used to transport those products designated for export markets. The detailed study of amphora stamps aids in the identification of production areas and the contributions that they made to the commercial movement of amphorae to different places. It is now possible to trace the contribution made by some specific production centres in the Gebel Tarhuna, as well as the period of greatest intensity of that contribution. However, some amphora stamps produced in the Gebel Tarhuna have not yet been recognised among the main amphora assemblages such as those from Ostia and Monte Testaccio. Further research on amphora stamp find-spots and further excavations may shed more light on this issue.

From the new evidence recorded by the TAS, it can be stated with reasonable certainty that the Tarhuna plateau was the chief producer of amphora-borne goods in Tripolitania during, at least, the first three centuries AD. Mattingly has already discussed the importance of Tripolitanian amphorae as a main piece of evidence in the identification of a high level of export of olive oil to Rome and its provinces (Mattingly 1988; 1995), both commenting on and adding to the evidence brought forward by Di Vita-Evrard, who was somewhat more cautious about certain aspects of this trade. They both emphasised that certain stamps, especially of the late second and early third centuries AD, referred to high-ranking landowners, members of the imperial family, senators or other leading families.

Stamps on Tripolitanian amphorae found at Monte Testaccio and other locations in the western Mediterranean indicate that the owners of estates were utilising these vessels not simply for their own consumption (i.e. as private commodities) but also to support export trade. Indeed, if they were intended for purely private consumption, why would they have put stamps on at all? The enormous extent of the olive oil and wine trade, particularly from Spain and North Africa, is attested by the very large number of amphorae, both stamped and unstamped, recorded at many sites throughout the Roman world (Bonifay 2004; Bonifay and Garnier 2007; Keay 1984; Panella 1973; 1977; 1982; Reynolds 1993; 1995; 1997).

Although the amphorae appear to have been made roughly and cheaply, they clearly contained valuable commodities (oil and wine), with the largest surpluses coming from the estates of the elite whose names the stamps represented. To judge by the stamps of the Tripolitanian amphorae found on Monte Testaccio, the peak period of export was characterised by the use of Tripolitania III amphorae and dated to the late second and the first half of the third century AD (though earlier Tripolitanian products may be hidden in the heart of Monte Testaccio). On the basis of the distribution of Tripolitanian amphora stamps recorded outside the province, it is clear that many of these amphorae were filled with Lepcitanian products and then transported from the Gebel Tarhuna.

From the Augustan period until the third century AD, the major part of the olive oil required by the Roman heartland was imported from Spain. Many

kiln sites have been identified along the Guadalquivir River in *Baetica*; these mainly produced Dressel 20 amphorae which were used to transport the olive oil to Rome. Competition from the North African provinces increased in the second century AD, and more dramatically under the Severans in the early third century AD. Olive oil from Tripolitania and *Africa Proconsularis* was carried to Rome and abroad in cylindrical amphorae. Whereas during the first two centuries AD Dressel 20 amphorae dominated the import of olive oil to Rome, from the end of the second and early third centuries AD, Tripolitanian amphorae, along with Tunisian Africana I and II amphorae, gained a solid foothold in the greater Mediterranean markets.During the Severan period, Tripolitania III amphorae became widely distributed throughout the Mediterranean and the form is represented in large numbers in Rome (University of Southampton 2014). Excavations conducted on Monte Testaccio from 1995 to 1997 revealed that sherds of Tripolitania III amphorae accounted for close to 30 % of the North African amphorae found, and, in fact, formed 100 % of the Tripolitanian amphorae collected in the three seasons of excavation. Meanwhile, Africana Type IB amphorae constituted 60 % of the total and the other 10 % comprised much lower percentages of other Tunisian forms, such as Africana IA, Africana II, Ostia LIX and Ostia XXIII (Aguilera Martín and Revilla Calvo 2004; Remesal Rodríguez 2004). Similar assemblages of Tripolitania III amphorae have been found at many excavated sites, especially in the western Mediterranean (Blázquez Martínez and Remesal Rodríguez 2001). A conclusion can be reached here that the amphora kilns of the Gebel Tarhuna produced all three Tripolitanian amphora types in workshops which were certainly related to the agricultural production estates that mainly produced olive oil (Types I and III) and also wine (Type II?). The amphora evidence thus corresponds with the evidence of the pressing facilities themselves, suggesting that while olive oil was the predominant product, wine also accounted for a sizeable minority of the agricultural production which occurred during the Roman period.

Chapter 5 TABLES

Table 5.1: *Amphora kilns recorded by the TAS on the Tarhuna plateau.*

ID	Location	Name	Kilns	Stamp	Within/near	Distance from the F-building
TUT12	Wadi Hwatem	Sidi Buagela 2	2?	Yes	Oilery-villa	50 m E
TUT15	Wadi Turgut	Henschir Assalha	4?	Yes	Oilery-villa	70 m W
TUT18	Wadi Turgut	Ain Astail	2	Yes	Oilery (TUT20)	250 m SE
TUT48	Wadi Turgut	Arbaia	5	Yes	Small farm (TUT47)	150 m N
TUT53	Wadi Turgut	Sidi Eysawi	1	No	Large farm-villa	50 m S
GUM86	Wadi Guman	Scegafiat Asray	1	No	Small farm (Upper Guman 16)	400 m NW
GUM89	Wadi Guman	Scegafiat Atriq	3?	Yes	Small farm (GUM88)	300 m SW
GUM90	Wadi Guman	Scegafiat Ben Hemad	3	Yes	Small farm (Upper Guman 9)	450 m SW
TEL102	Wadi Tarabut	Hamzia	2	No	Small farm	250 m S
TUT108	Wadi Turgut	Henschir Armadia	4?	Yes	Large farm (TUT14)	500 m E
GUM110	Wadi Guman	Scegafiat Maamri	2?	No	Small farm (Upper Guman 16)	300 m S
DOG111	Wadi Doga	Almseel	1	No	Large farm	50 m W
SRI114	Wadi es-Sri	Wadi es-Sri	18?	No	Large farm (SRI115)	200 m W
DUN131	Fergian	Halafi	5?	Yes	Large farm	300 m NW
Total			**53+**			

Table 5.2: *Diameters of some amphorae kilns recorded by the TAS in the Gebel Tarhuna.*

Site	Name	Kiln no.	Internal Diameter (m)
TUT48	Arbaia	1	4.30
		2	4.15
		3	4.85
		4	2.90
		5	5.25
TUT53	Sidi Eysawi	1	2.75
GUM86	Scegafiat Asray	1	2.80
GUM90	Scegafiat Ben Hemad	1	3.75
TEL102	Hamzia	1	3.35
		2	3.10
TUT108	Henschir Armadia	3	3.35
DOG111	Wadi Almseel	1	2.50
SRI114	Wadi es-Sri	16	3.80
		18	4.20
	Average		**3.65**
	Minimum		**2.50**
	Maximum		**5.25**

Table 5.3: *Mattingly's list of Tripolitania III amphora stamps and suggested identifications with individuals or families known from Lepcitanian epigraphy (after Mattingly 1988b, Table 1, originally compiled from Di Vita-Evrard 1985; Manacorda 1977, 1983).*

Stamp	Identification	Reference(s)
1. *AVGG*	Septimius Severus & Caracalla	
2. *AVGGG*	Septimius Severus, Caracalla & Geta	
3. *IMPANT/AVG*	Caracalla (or Elagabalus?)	
4. *[...]DAVG*	Severus Alexander	
5. *LAS*	L. Avillius[...] or L. Appius [...]?	
6. *S.A.BCV/+++*		
7. *SAB/ACMV*		
8. *CBSVR*		
9. *PBAV*		
10. *LBAI*		
11. *LCS[...]*		
12. *PCAGCV/STID*	Family of P.Cornelii	cf. IRT 263, 592
13. *PCAG[...]* (retro)	Family of P.Cornelii	cf. IRT 263, 592
14. *PCBSCV*	Kinsman of M. Cornelius Bassus Servianus	IRT 443
15. *PCRSSV* (retro)		
16. *PCSSCV/MARIA[...]*		
17. *OCHO*	Family of Calpurnii Honesti?	IRT 370–371
18. *QCL*	Q. Cassius Longinus?	IRT 601
19. *OCLCV*	Q. Cassius Longinus?	IRT 601
20. *QCV*	Q. Cornelius Valens?	IRT 594
21. *CPFCV*	C. Fulvius Plautianus (consul AD 193, praetorian prefect, father-in-law of Caracalla, executed AD 205)	PIR 2 F554
22. *CFPPP*	C. Fulvius Plautianus	
23. *CFPPPCV*	C. Fulvius Plautianus	
24. *CAELESTIN*	Q. Granius Caelestinus?	IRT 532
25. *LMPP++*		
26. *QMD* (retro)	Q. Marcius Dioga	IRT 401
27 *L.PCR*	Q. Pompeius Cerealis Felix or L. Pompeius Cerialis Salvianus	IRT 444 or IRT 602
28. *MPF*	Family of Pompeii	
29. *POMBAL*		
30. *L.APRI*	L. Septimius Aper (consul AD 207, executed AD 212)	IG 12.7.397.28
31. *L.S.A.CV*	L.Septimius Aper or L. Silius Amicus Haterianus	IRT 542
32. *L.S.PLH/BVR*	L. Silius Plautius Haterianus Blaesilianus (IRT 635)	
33. *L.S.PLH/MYC*	L. Silius Plautius Haterianus Blaesilianus	IRT 635
34. *[L?]SAHCV*	L. Silius Amicus Haterianus?	IRT 542
35. *CSM/BAICI (?)*	C. Servilius Marsus?	AE 1959, 271
36. *CSMCV*	C. Servilius Marsus?	AE 1959, 271
37. *LVTM*	L. Volusius [...] or L. Verginius Tiro Marcianus?	
38. *MVC*	M. Ulpius Cerialis or family of M. Vibii	IRT 388 or IRT 578
39. *MVM*	M. Ulpius [...] or family of M. Vibii?	
40. *[...]FCV*		
41. *ACVCF*		
42. *AC[...]*		
43. *ADYRMP*		

cont.

Stamp	Identification	Reference(s)
44. *ARAP*	Asinius Rogatianus APLL or Adelfius	IRT 539
45. *BINOMI[...]*		
46. *CEI*		
47. *CR*		
48. *CRCA*		
49. *FYN*		
50. *IVI[...]*		
51. *KATA**		
52. *MD[...]*		
53. *ONII (?)*		
54. *PC*		
55. *SA[...]*		
56. *SIAP*		
57. *THER*		
58. *VAR*		
59. *VIC*		
60. *QPGAT (?)*		
61. *[...]FC*		
62. *SNPS* (retro)		

Table 5.4: *The main Tripolitanian amphora stamps from Monte Testaccio (http://ceipac.gh.ub.es).*

CEIPAC no.	Mattingly (Table 5.2)	Stamp	Tripolitania amphora type	Position of stamp	Reference
1257	43	*ADYRMP & ADYRMF*	III	Neck	Callender 1965, no 29
1602		*QCCC*	III	Neck	Callender 1965, no 1428
1646–1647	18–19	*QCLCV*	III	Neck	Callender 1965, no 1436(b)
1731	47	*CR*	III	Handle	Callender 1965, no 449
2342	21	*CFPCV & CFRCV*	III	Handle	Callender 1965, no 319
2343	22–23	*CFPPPCV*	III	Neck	Callender 1965, no 319
3671–3673	28	*MPF*	III	?	Callender 1965, no 1158(a)
4073	32–33	*LSPLHBVR*	III	Neck	Callender 1965, no 941(b)
4379	38	*MVC*	III	Neck	Callender 1965, no 1188(a)
6361	4	*...DAVG*	III	Neck	Rodriguez Almeida 1981
6362	52	*MD...*	III	Neck	Rodriguez Almeida 1981
6363	3	*IMPANTAVG?*	III	Neck	Rodriguez Almeida 1981
6364	7	*SABCVACMV...?*	III	Handle	Rodriguez Almeida 1981
6366	45	*BINOM…*	III	Neck	Rodriguez Almeida 1981
6371	47	*CR*	III	Handle	Rodriguez Almeida 1981
6373	15–17	*PCSSCV MARIA…?*	III	Neck	Rodriguez Almeida 1981
6375	13	*PCAQ...?*	III	Neck	Rodriguez Almeida 1981
6376	11	*LCS*	III	Neck	Rodriguez Almeida 1981
6377	61	*...FC*	III	Neck	Rodriguez Almeida 1981
6378–6379	60	*OPGAT?*	III	Neck	Rodriguez Almeida 1981
6381–6382	31	*LSACV*	III	Neck	Rodriguez Almeida 1981
6383–6387	35–36	*CSM / BAICI*	III	Neck	Rodriguez Almeida 1981
6389	32	*LSPLHBVR*	III	Neck	Rodriguez Almeida 1981
6390	49	*FYN*	III	Handle	Rodriguez Almeida 1981
1646	18	*QCL*	III?	Neck	Callender 1965, no 1436(a)
15375		*MIVSCA?*	?	Handle	Blázquez Martínez and Remesal Rodríguez 2001
18484		*PSDL*	?	?	Blázquez Martínez and Remesal Rodríguez 2003
5899		*OPHNNAEAES*	I	Rim	Blázquez Martínez et al. 1994
18485		MVACGAL	I	Rim	Blázquez Martínez and Remesal Rodríguez 2003

Table 5.5: *List of amphora stamps identified at kiln sites by the TAS in the Gebel Tarhuna.*

No.	Site	Name	Stamp	Total found	Tripolitania amphora type	Position of stamp	Identification	Reference(s)	Mattingly (Table 5.2)	CEIPAC no. (Table 5.3)
1	TUT12	Sidi Buagela 2	*HIX*	1	?	Handle				
2	TUT15	Henschir Assalha	*PM?*	3	I & II	Neck	M. Pompei Gaetulici or M. Pompeius Geta?	IRT 649?		5899?
3	TUT18	Ain Astail	*Q.P.HANIV-LIANV…*	2	?	Handle				
4	TUT48	Arbaia	*IMPANT/AVG; IMPANT; F AUG*	4	II & III	2 handle, 2 neck	Caracalla (or Elagabalus?)		3	6363
5	GUM89	Scegafiat Atriq	*MAF*	1	?	Handle	Marcus Aemilius?	IRT 714	28?	3671–3673?
6	GUM89	Scegafiat Atriq	*AIM*	10	I	8 rim, 2 neck	Aemilia Iou[ina?on] ...?	IRT 363		
7	GUM89	Scegafiat Atriq	*AꟻNI*	2	I	Rim				
8	GUM89	Scegafiat Atriq	*MICA*	1	II	Neck				
9	GUM90	Scegafiat Ben Hemad	*ARHC*	2	II	Rim				
10	GUM90	Scegafiat Ben Hemad	*KAVL or KAVC*	2	I	Rim				
11	TEL102	Hamzia	*IS..*	1	II?	Rim				
12	TUT108	Henschir Armadia	*LSACV*	2	III	Neck	L. Septimius Aper or L. Silius Amicus Haterianus	IRT 542	31	6381–6382
13	GUM110	Scegafiat Maamri	*MVC*	1	I	Rim	M. Ulpius Cerialis or family of M. Vibii, e.g. M. Vibius Annianus Geminus	IRT 388 or IRT 578 and 608	38	
14	GUM110	Scegafiat Maamri	*IVM..*	1	II	Rim				
15	DUN131	Halafi	*BOYTO...*	1	I?	Rim				
Total				**34**						

Chapter 5 FIGURES

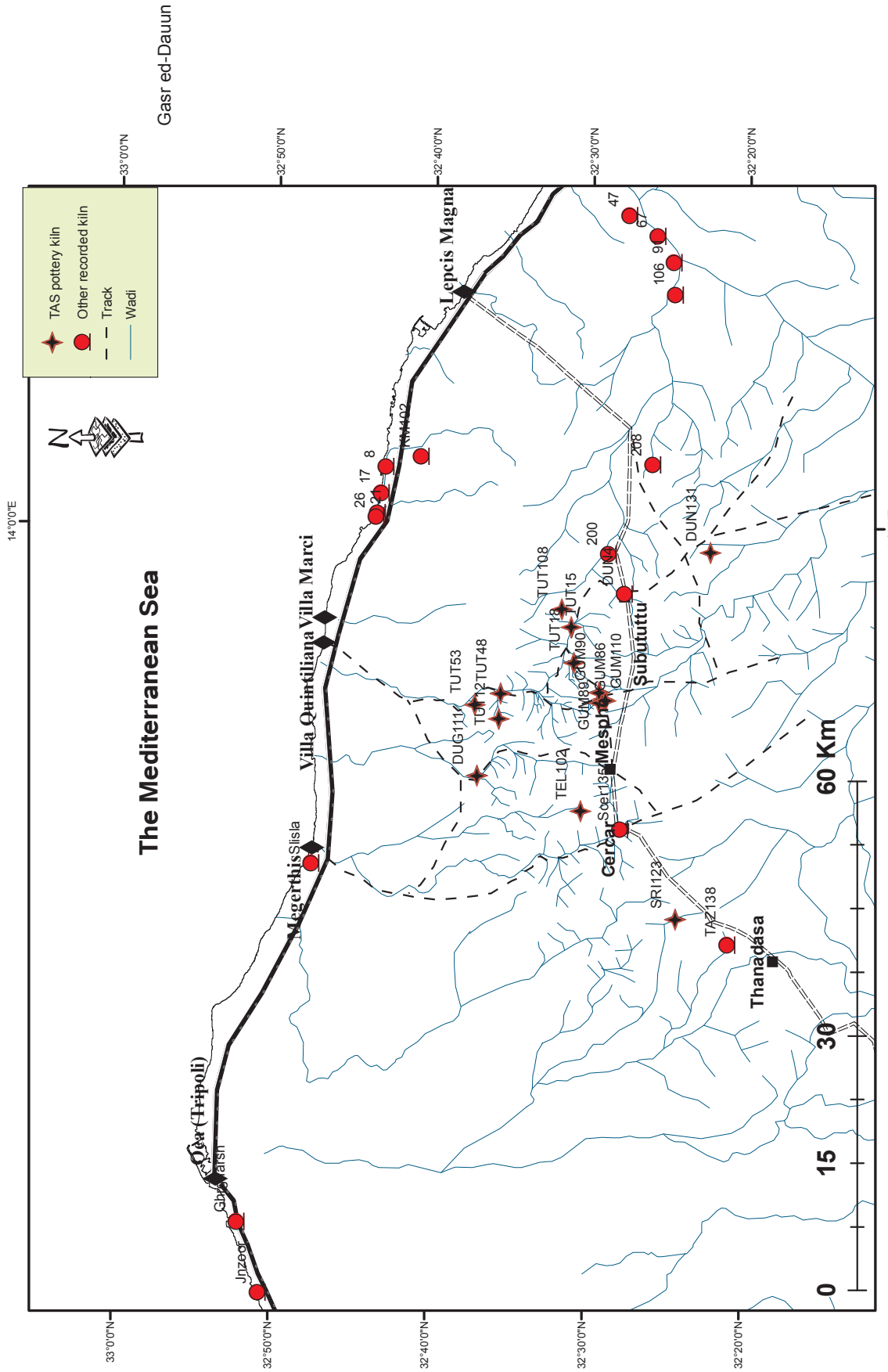


Figure 5.1: *Known pottery kilns in the territories of Lepcis Magna and Oea, before and after the TAS.*

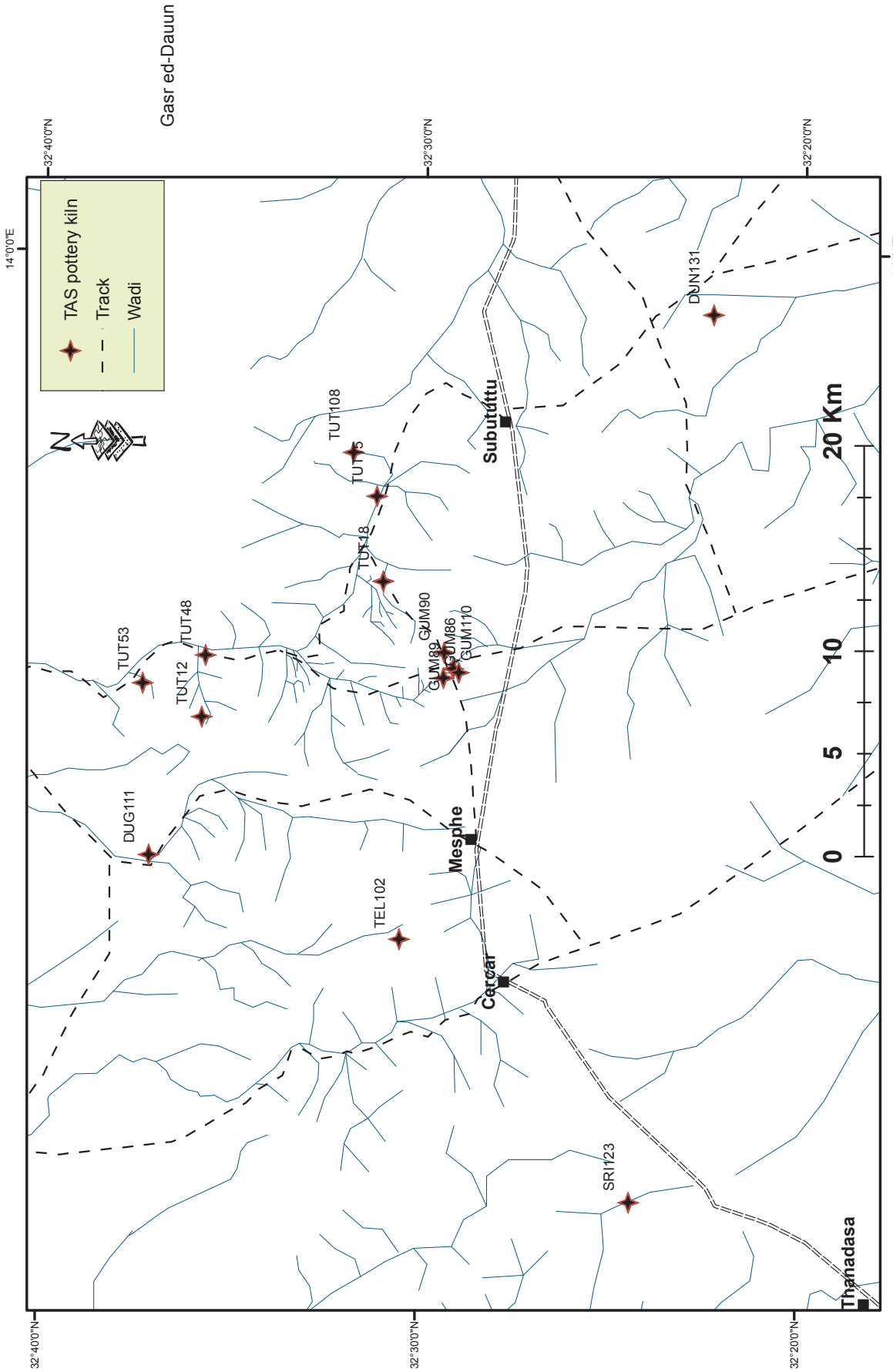


Figure 5.2: *The distribution of pottery production sites identified by the TAS on the Tarhuna plateau and their relationship to the Roman-period eastern Gebel road and other ancient tracks. .*

Figure 5.3: *An amphora stamp recorded in 1994 at GUM90 (Scegafiat Ben Hemad).*

Figure 5.4: *a) A stamp on a Tripolitania I amphora found by the TAS at Henscir Assalha (TUT15) and b) the same stamp on a Tripolitania I amphora found at the Laurons II wreck near Marseille (Bonifay 2004, 105).*

Figure 5.5: *Tripolitania I, II and III amphorae from (a) Lepcis Magna museum, (b) stores of the Department of Antiquities (Tripoli).*

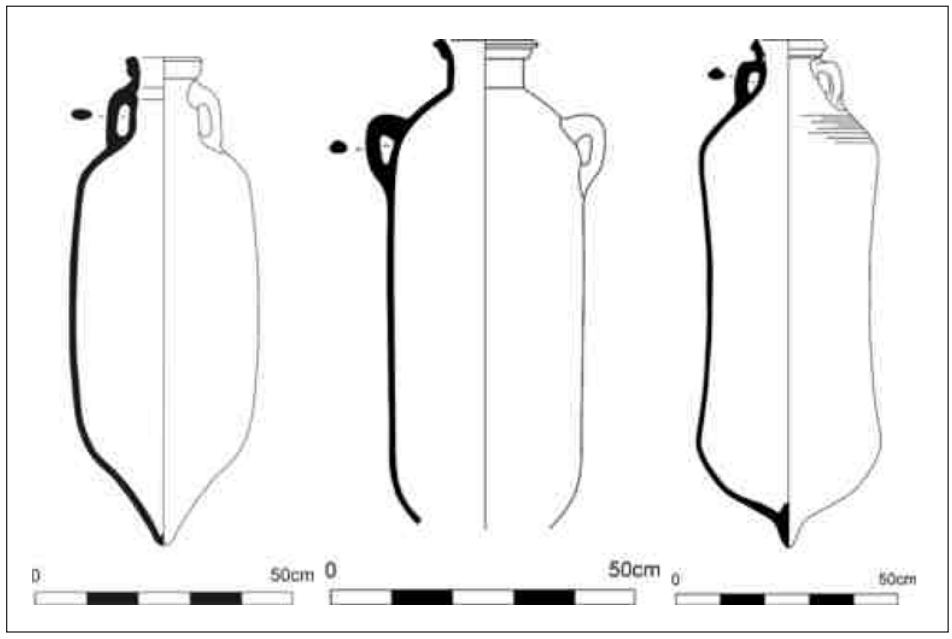


Figure 5.6: *Tripolitania I, II and III amphorae (University of Southampton 2014).*

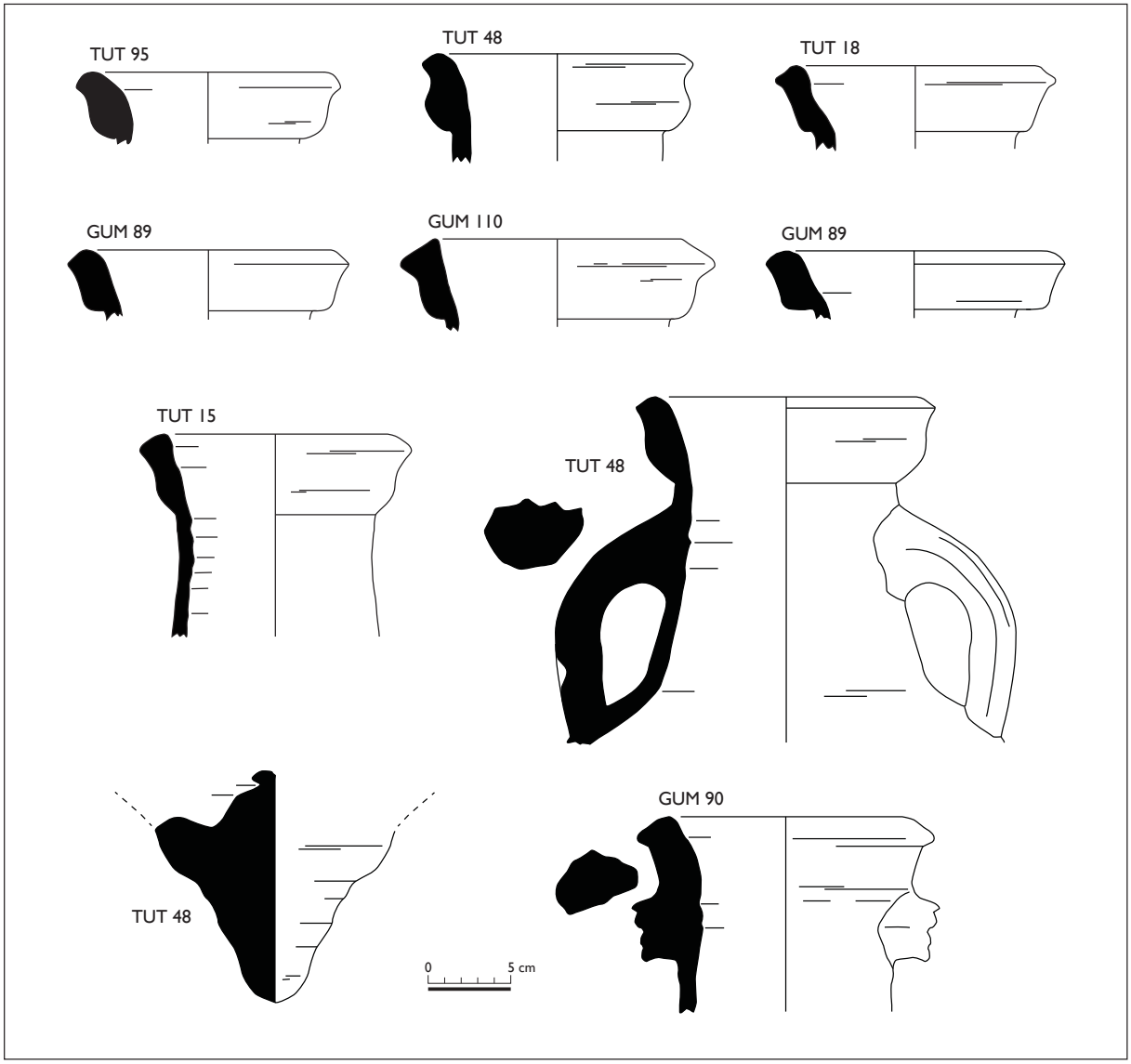


Figure 5.7: *Examples of Tripolitania I amphorae produced in kilns recorded by the TAS.*

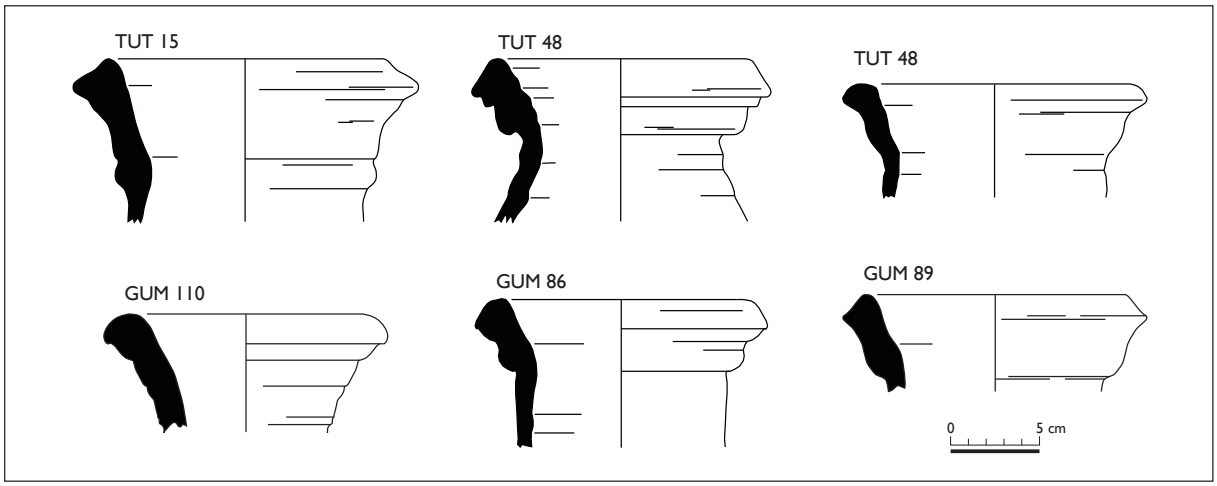


Figure 5.8: *Examples of Tripolitania II amphorae produced in kilns recorded by the TAS.*

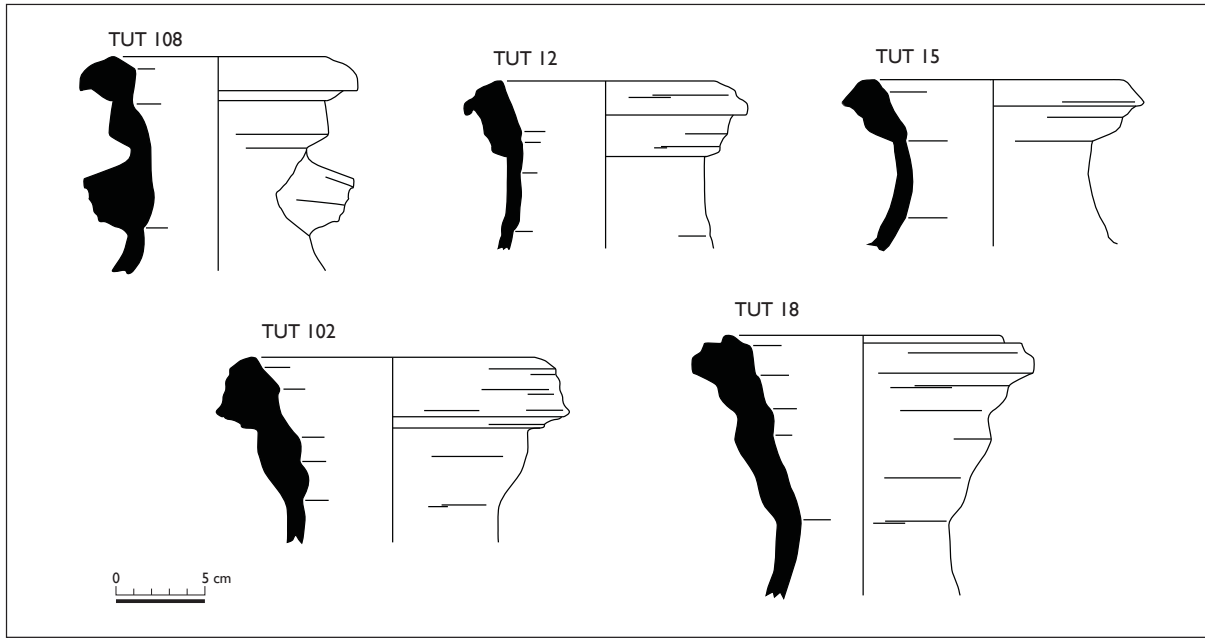


Figure 5.9: *Examples of Tripolitania III amphorae produced in kilns recorded by the TAS.*

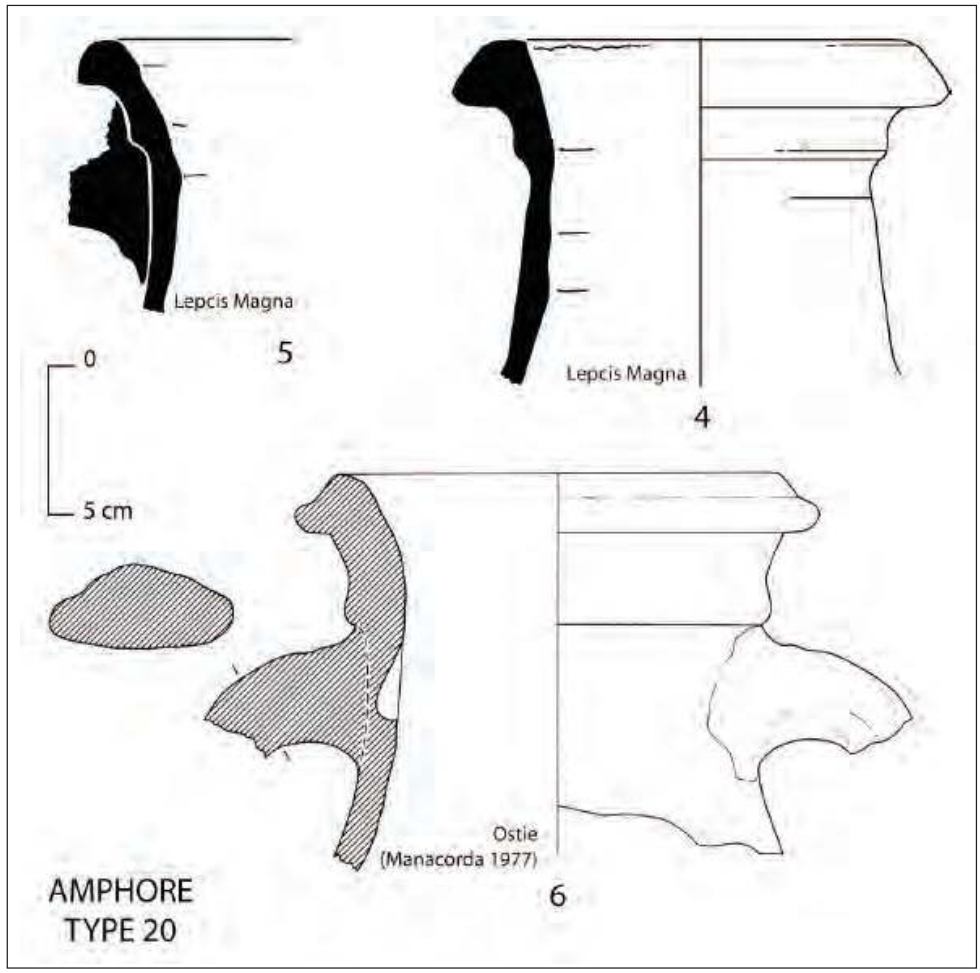


Figure 5.10: *Some examples of Tripolitania III amphorae from Ostia and Lepcis Magna dating to the fourth century AD (Bonifay 2004, 105).*

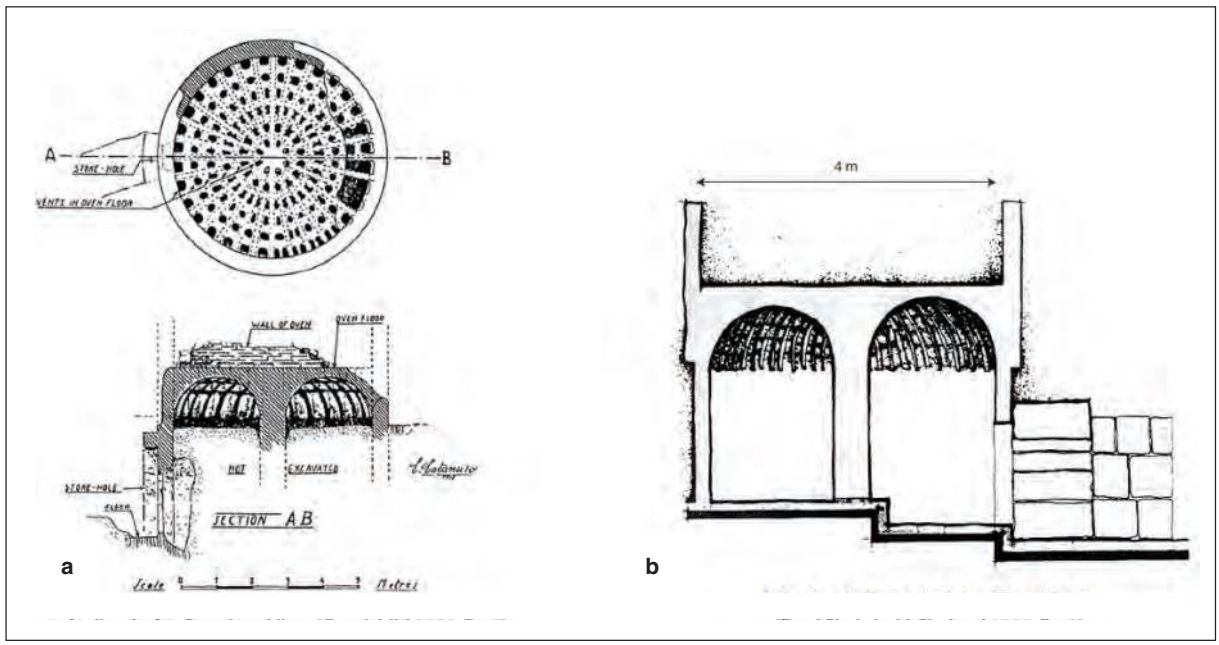


Figure 5.11: *(a) Sketch of the kilns at Ain Scersciara* (Cercar?) *(Goodchild 1976, 87, Fig. 35); (b) Sketch of the kilns at Hai al-Andalus (Bonifay 2004).*

Figure 5.12: *The location of the Arbaia pottery kilns (TUT48).*

Figure 5.13: *A line of three kilns cut by a modern track at Arbaia (TUT48).*

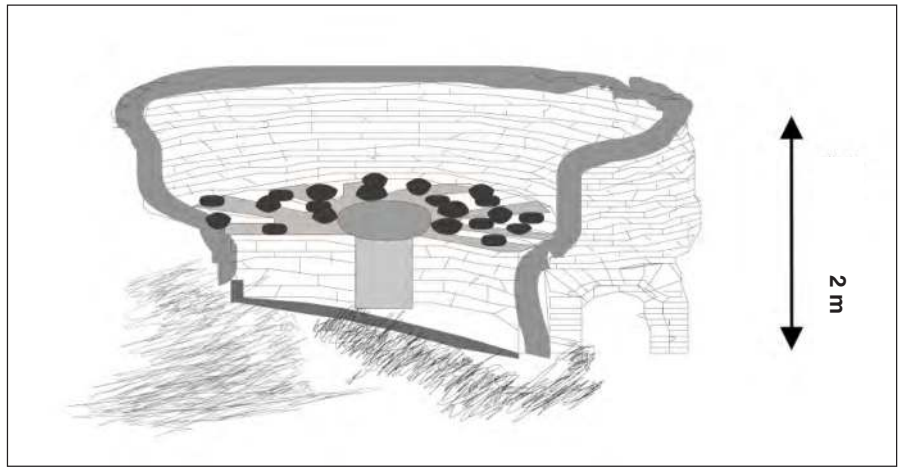
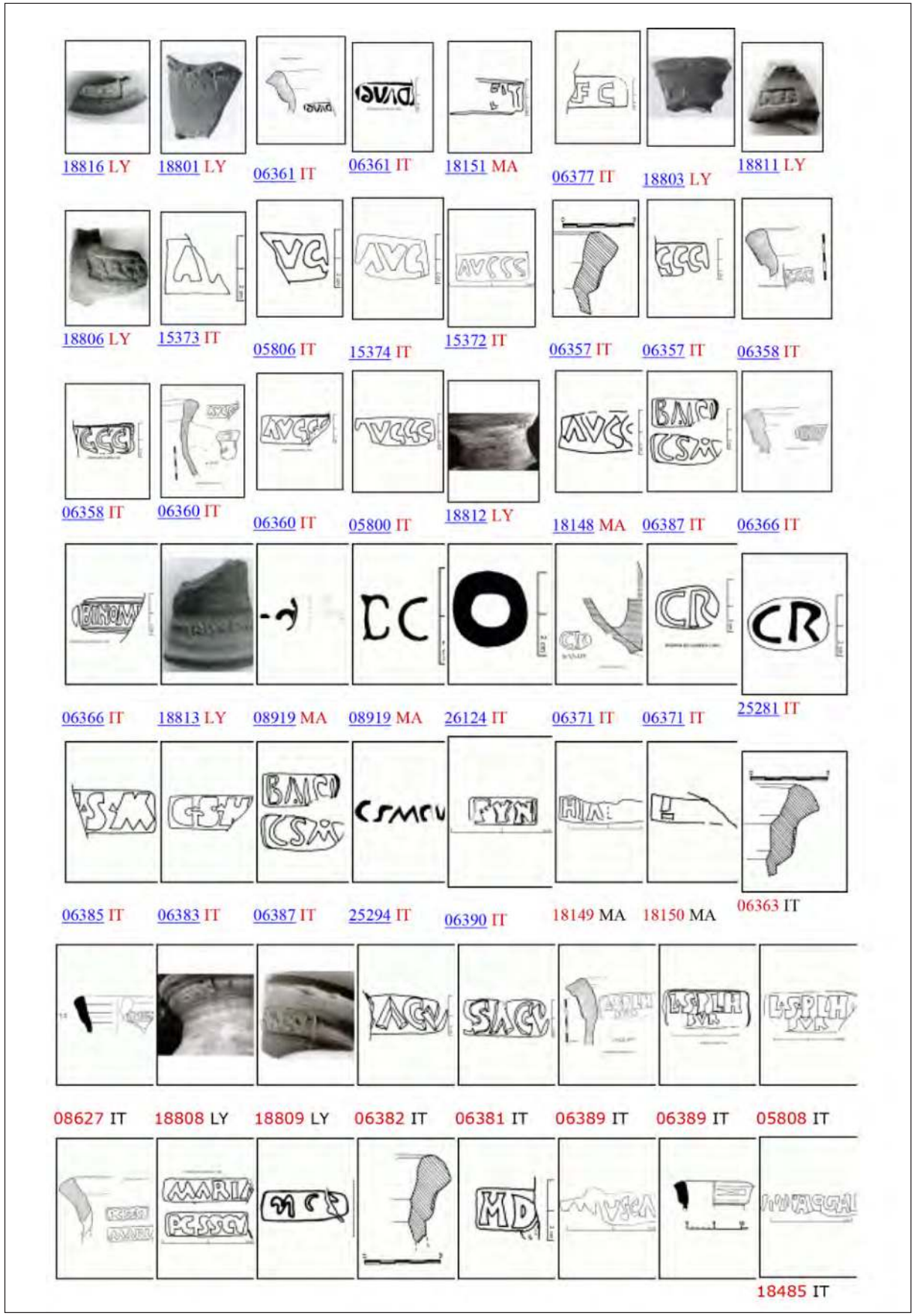


Figure 5.14: *Sketch view of Kiln 1 at Arbaia (TUT48).*

Figure 5.15: *The Ain Scersciara (*Cercar?*) pottery kiln.*

Figure 5.16: *Sample of complete, uncrushed olive stones found inside the stoke-hole of Arbaia Kiln 1 (TUT48).*


18816 LY
18801 LY
06361 IT
06361 IT
18151 MA
06377 IT
18803 LY
18811 LY
18806 LY
15373 IT
05806 IT
15374 IT
15372 IT
06357 IT
06357 IT
06358 IT
06358 IT
06360 IT
06360 IT
05800 IT
18812 LY
18148 MA
06387 IT
06366 IT
06366 IT
18813 LY
08919 MA
08919 MA
26124 IT
06371 IT
06371 IT
25281 IT
06385 IT
06383 IT
06387 IT
25294 IT
06390 IT
18149 MA
18150 MA
06363 IT
08627 IT
18808 LY
18809 LY
06382 IT
06381 IT
06389 IT
06389 IT
05808 IT
18485 IT

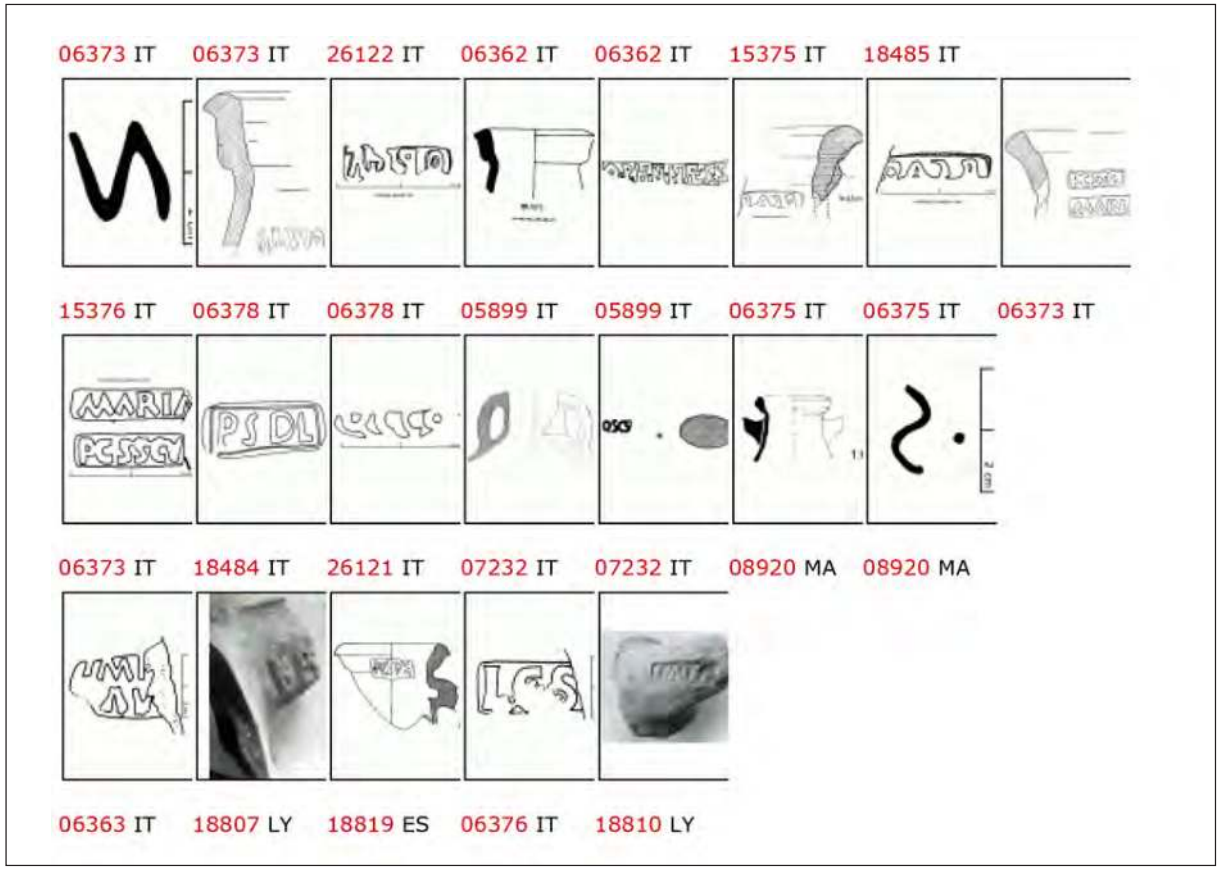


Figure 5.17 (opposite and above): *The Tripolitanian amphora stamps recorded at Monte Testaccio (Rome) and published in the CEIPAC database (http://ceipac.gh.ub.es).*


TUT15
GUM89
TUT48
TUT15
GUM89
GUM110
GUM90
GUM89
GUM110
TEL102
GUM89
TUT12
0
2 cm

TUT15

DUN131

TUT18

TUT108

TUT18

GUM90

Figure 5.18 (opposite and above): *Amphora stamps collected by the author in the last two decades from pottery production sites in the Gebel Tarhuna.*

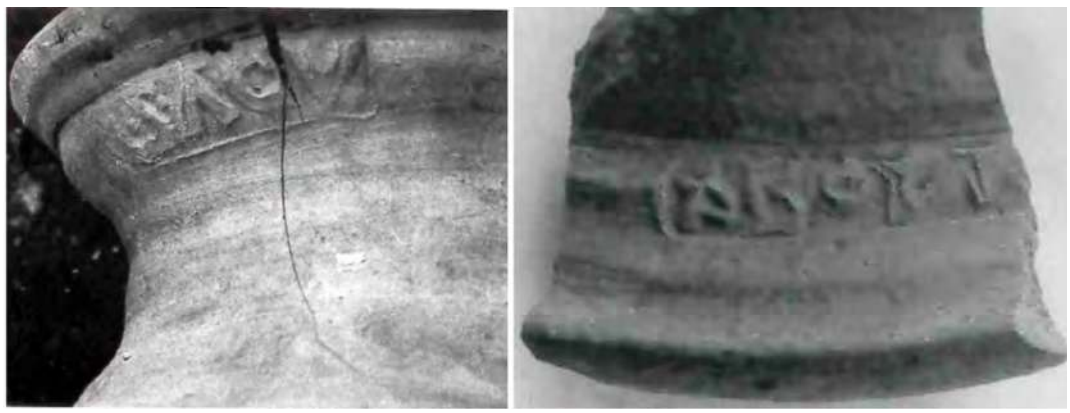


Figure 5.19: *Two Tripolitanian amphora stamps (CEIPAC nos. 18813 and 18808) found at Bu Njem.*

Chapter 6

CONCLUSION

6.1 Overview

Since the late nineteenth century when Cowper recorded many rural sites on the Tarhuna plateau, the significance of the region's rural landscape and its olive oil productivity has exerted an important influence over subsequent debate about the nature and scale of its economy in Roman times. As discussed in Chapter 2, archaeological fieldwork in the Gebel Tarhuna conducted since Cowper's pioneering study by Goodchild, Oates, Di Vita-Evrard and Mattingly, has added detail about the density of farming sites, their potential for surplus production and the role played by this region in the economy of the main coastal centres, especially Lepcis Magna. These works have highlighted the sophisticated agricultural organisation of the Tarhuna plateau's countryside. This area, along with the neighbouring Msellata district, acquired a reputation as an exceedingly good agricultural district within Tripolitania and this was the main reason that members of the Lepcitanian and Oean elite invested in agricultural estates and amphora production there. Other reasons such as its proximity to the coast and the communication routes crossing and linking the plateau with other areas encouraged investors to exploit the region. This recognition of the high economic potential of the Tarhuna landscape during the Roman period was an important starting point for this study.

In order to investigate the composition and organisation of ancient rural settlement in the Gebel Tarhuna and to gain a better understanding of the economic activity of the area in the wider context of the Roman economy, this study has focussed on a new source of data: the results of the Tarhuna Archaeological Survey (TAS), which mainly concentrated on the Wadis Turgut and Doga. This intensive study also built on my previous and more extensive research throughout the Tarhuna region.

Another goal of this research has been to make an assessment of the relationship between rural settlement and olive oil (and wine) production across a broad timeframe, from the pre-Roman to late Roman periods and to elucidate the pre-Roman (Neo-Punic and Numidian) origins of production, crossing periods in a way that earlier studies have not done. These data have shown that, as is common in imperial settings, Roman rule brought major changes not only to the coastal centres but also to their hinterlands. The following sections will review the important changes that I have identified and the improvements in knowledge that my study has made across several main categories: rural settlement patterns, olive oil production and pressing facilities, amphora production and the economic aspects of the recorded sites on the Tarhuna plateau.

6.2 Rural settlement patterns

The TAS aimed to achieve a higher level of recording for selected areas of the Gebel Tarhuna in order to examine different types of rural settlement and to attempt to improve our understanding of the chronology and the nature of change in the settlement of the ancient landscape. The TAS found that the landscape changed dramatically as early as the beginning of the first century AD when the Tarhuna plateau became more densely exploited than it had been in the pre-Roman period. The second and third centuries AD represent the peak settlement period when farming settlements (mainly pressing sites) came to characterise the rural landscape throughout the plateau. Overall mapping of the surveyed area demonstrated an extensive spread of settlement on the landscape, revealing that it was even more widespread than previously known (Chapter 2). The settlement pattern of the investigated areas was affected to some degree by the natural environment, which played a clear role in the distribution and

development of rural settlement over this hinterland region. The TAS has shown clearly that this area has great archaeological potential and has confirmed that the area was a focus of important economic activity and growth, particularly of olive oil pressing and amphora production, during the Roman period.

Wadis and hill-slopes provided suitable conditions for cultivation and were key features in the shaping of the rural landscape in the Roman period. The spectacular growth of the Tripolitanian coastal urban centres during the Roman period was matched by an increase in the agricultural surpluses that occurred in the rural landscape (Mattingly 1995, 140–144). The archaeological evidence reveals that rural production was likely dominated by a series of major rural estates that had links with the urban elite, as well as with small towns and agricultural villages. These rural estates acted as productive centres for elite investment, including the imperial family, senators and other local notables.

The TAS has demonstrated that the Gebel Tarhuna contains evidence for huge surpluses in the production of olive oil. This large-scale production was mainly directed towards the wider Roman markets. In order to achieve and sustain high production capacities, the estates required huge processing equipment and infrastructure such as roads, tracks, ports, containers, pressing schemes and facilities. Pressing sites, hydraulic features for capturing and storing water and amphora kilns dominate the archaeological evidence and give clear indications of the characteristics of the main economic activities practised in the Gebel Tarhuna during the Roman period. The archaeological evidence shows that many sites, particularly the oileries and large farms, were designed for a scale of production beyond local subsistence needs, with clear export potential. Investment in the rural facilities of the Tarhuna plateau appears to have been comparable to the economic transformation of the rural landscapes of some other areas of Roman North Africa, especially the Kasserine region (Hitchner 1988; 1989; 1992–1993; Hitchner *et al.* 1990).

As demonstrated in Chapter 1, the Tarhuna plateau did not provide a naturally conducive environment for agricultural development by the highest standards of the Mediterranean; it is a zone of poor rainfall, which is neither high nor regular enough for large-scale cereal cultivation. However, it is particularly suitable for olive cultivation and in some districts, probably also grapes. Investors in this rural landscape could achieve high rates of production only through extensive efforts to maximise their return on the land. Therefore, they built cisterns, wells and dams to ensure that the necessary amounts of water reached their land and conserved its fertility. They constructed different sizes of pressing sites (Chapters 2 and 3) and facilities which, as demonstrated in Chapter 4, could have produced millions of litres of olive oil in peak years.

The TAS has provided a starting point for the analysis in this study of the rural landscape and site distribution. The details collected regarding site locations in relation to topographic features have revealed two specific regional types of farming sites. The first group comprises small farm sites with one or two presses; the second group employed larger numbers of presses (from three to 17). For each type of production site (small farm, large farm and oilery) there were three further classification categories: open farm buildings, fortified farm structures and sites with both open and fortified buildings. In many cases these farm buildings and farm-villas were found in association with cisterns, wells, dams, amphora kilns, mausolea and baths (Chapter 3).

The natural and topographic divisions of the Tarhuna plateau landscape appear to have played a key role in the distribution of sites. Because of their primarily agricultural function, the vast majority of farming sites (in particular large farms and oileries) were located close to the most fertile alluvial soil available and were in locations where they could maximise rainfall capture and take advantage of the communication routes which ran along the main wadis and their tributaries. The TAS determined that 64 % of recorded sites in the Wadis Turgut and Doga were situated between 135 and 299 m asl and 36 % were located in the higher reaches of the landscape between 300 and 515 m asl.

It appears that the distribution pattern and choice of location for each site type were also affected by the altitude of the terrain. This observation is supported by the hierarchical organisation of sites and the variations between the size, elevation and wealth of the agricultural and non-agricultural sites. The TAS has increased the number of known sites that possessed evidence of luxury elements, i.e. those sites which are conventionally known as villas. Previous work has emphasised the utilitarian nature of the vast majority of Gebel Tarhuna farming sites (Oates 1953; Percival 1976), but in light of the new evidence a revision of this judgement is required. Clearly many of the larger estates possessed central facilities of some comfort; 12 out of 56 open farm sites (21 %) have evidence for luxury.

One of the most important results arising from the TAS survey concerning settlement continuity and change relates to the identification, for the first time, of pre-Roman (second to first centuries BC) evidence on the Tarhuna plateau. However, the pre-Roman settlement pattern cannot be fully evaluated through this limited surface evidence and without excavation. Future work will unquestionably be necessary to confirm and add detail to the evidence presented here. The physical remnants of farm buildings and the density of surface sherds of the principle Roman-period pottery types indicate that rural settlement and economic activity reached a much more developed scale during the early Roman

period. However, the Gebel Tarhuna appears to have faced changing conditions from the fourth century AD which were in line with similar circumstances attested elsewhere in the Tripolitanian hinterland regions (Felici *et al.* 2006; Günther 1994). The TAS has found that there was an increasing emphasis on fortified structures beginning in the late Roman period, as evidenced by the decline in open farming sites and their replacement with the fortified farms (*gsur*). This phenomenon is paralleled by evidence recorded in the Tripolitanian pre-desert by the UNESCO Libyan Valleys Survey (Barker *et al.* 1996; Mattingly 1995).

Measurements of the Gebel Tarhuna farming sites have revealed more information about site sizes and the TAS has prompted a re-evaluation of much of what was previously known about rural settlement size and complexity in Tripolitania. It is now possible to contrast the more utilitarian constructions with the development of surplus production centres. Examination of the larger settlements reveals an extraordinarily rich range of building materials coupled with complex construction technologies, although many sites were dominated by the *opus africanum* style.

As described in previous works (Cowper 1897; Goodchild 1951; Mattingly 1985; Oates 1953; 1954) and now more systematically by the TAS, the farming sites of the Tarhuna plateau reveal a great deal of variation in terms of form and size, ranging from small farms to agricultural villages. This variation in type and size is again comparable to other rural farming areas in Roman North Africa such as the regions around *Cillium* (Kasserine), *Segermes* (Henschir Harat) and *Caesarea* (Cherchell) (Hitchner 1988; 1990; 1992–1993; Leveau 1984; Ørsted 1992).

6.3 Olive oil production and pressing facilities

It is credible to describe olive oil production in the Gebel Tarhuna with the word 'industry' because of its scale of mass production. The olive oil industry of the Tarhuna plateau was undoubtedly on a very large scale. Moreover, as we have seen, the installation of pressing equipment and facilities required accompanying investment in land cultivation, farm buildings, water management systems and amphora production. Furthermore, it also necessitated a sizeable direct workforce of varying skills and negotiations with other indirect sources of labour to deal with the several stages of production, the manufacturing processes and transportation.

Agricultural production in the Gebel Tarhuna was central to the development of the Tripolitanian coastal centres, especially Lepcis Magna, during the Roman period. The TAS has confirmed Mattingly's conclusion that the intensification of production on well-developed agricultural lands on the Tarhuna plateau from the Augustan period onwards played a significant role in the increase of the wealth of many of the Lepcitanian aristocracy (Mattingly 1987; 1995). More than 200 presses have been recorded or re-recorded by the TAS in the Wadis Turgut and Doga. This archaeological evidence reveals that olive (and grape) cultivation and olive oil (and wine) production were major economic activities and the defining characteristic of the Tarhuna plateau.

The well-preserved pressing evidence has allowed me to evaluate the production potential of the region. There is mounting evidence that the elite landowners made major investments of capital into such large presses in order to produce a huge level of output. Furthermore, the size of the pressing elements indicates a large scale of production for export, which clearly shows that there was real economic growth during the Roman period (Hitchner 1993). The TAS has confirmed Mattingly's estimation that in good years, the total potential olive oil production capacity of the Gebel Tarhuna could have reached millions of litres (Mattingly 1988c).

Earlier works on the Tarhuna plateau by Cowper and Oates recorded large number of presses, mainly identified by the uprights that are still standing and visible in the landscape (Cowper 1897; Oates 1953). The TAS extended recording to the full planning of buildings and pressing elements at selected farm buildings and established detailed typologies for their interpretation. In this way, the TAS has transformed our knowledge and understanding of rural settlement and economic activity in the Gebel Tarhuna. The wealth of pressing elements recorded by the TAS has been carefully examined and has allowed me to establish a new classification for mills and millstones, orthostats, press floors and counterweights. All of these elements were typed and analysed through visual inspections, measurements and estimations of weight.

Examination of the press elements of the Tarhuna plateau has increased our admiration for the technical sophistication of the Tripolitanian presses and emphasised their extraordinary dimensions. The density of rural pressing sites in the Tarhuna region's landscape indicates how the production of olive oil (and wine) was in major demand and a key economic resource for many wealthy elites (Di Vita-Evrard 1979; Mattingly 1985; 1987; 1988a; 1991; 1995). By analysing the press beds recorded by the TAS, it can be concluded that there were two main types based on the channel shape (circular and square), but a number of sub-divisions have also been identified. A particularly interesting result that has come to light from this analysis is that some of these press beds appear to have been used not only for producing olive oil but also for wine, having been adapted for use with circular baskets and square wooden containers known as *regulae* (Chapter 4). The former appear to indicate

oil production and the latter, wine. However, further investigations and excavations at rural sites are needed to confirm this result.

The quantity of olive oil potentially produced from c. 200 presses has been estimated using the volume of the pulped olives, height of orthostat holes, diameter of *fiscinae* and milling capacity at up to 3.6 million kg of oil for a 90 day pressing season (Chapter 4). By contrast, a comparative study has revealed that the Ottoman-period pressing industry in the Msellata region, as evidenced by a number of manuscripts, was much smaller than its Roman predecessor in terms of the size of pressing facilities, production capacity and the density of pressing sites.

An initial evaluation of the evidence for wine production indicates that this activity can also be traced to some extent in the farming sites on the Tarhuna plateau. Wine appears to have been produced using the same techniques as oil. However, at this early stage of investigation it is difficult to evaluate the capacity of wine production, though on present evidence it does not seem to have been equal to olive oil production. For this reason, further fieldwork on farming sites and wine amphorae is necessary to develop this area of study.

6.4 Amphora production

It is already known that there was a strong relationship between olive oil and wine production and amphora kiln sites. Other main olive oil production areas in the Mediterranean, such as *Baetica* and *Africa Proconsularis*, have been shown to have been served by large numbers of amphora kilns (Bonifay 2004; Bonifay and Garnier 2007; Fentress 2001; Keay 1984; Manacorda 1976–1977; Panella 1973; Peacock and Williams 1986). Previous studies have considered Tripolitania as one of the major regions of olive oil export (Mattingly 1985; 1988b; 1988c). Recent studies at Monte Testaccio and of other amphora assemblages in the western Mediterranean have recorded high proportions of Tripolitanian amphorae (Aguilera Martín and Revilla Calvo 2004; Blázquez Martínez 1994; Remesal Rodríguez 2004). Nevertheless, Tripolitanian amphora studies are still in early stages. This study of amphora kiln sites on the Tarhuna plateau set out to improve our knowledge of amphora production in a hinterland area which was already famous for its remains of pressing facilities. Only three amphora kiln sites had previously been recorded on the plateau in the middle of the twentieth century (Arthur 1982; Goodchild 1976; Oates 1953). The TAS has identified 14 new amphora production sites. There is no doubt that future surveys will increase this number still further.

This study has not only increased our knowledge of Roman-period rural economic organisation but also revealed that there was a secure relationship between the production of olive oil and wine for export and amphora production (Mattingly 1988a; 1995). Epigraphic evidence in the form of multiple new amphora stamps collected by the TAS has shed more light not only on the location of amphora kiln sites but also on the involvement of many of the region's elite in this economic activity. The identification of a number of imperial and aristocratic estates in the Gebel Tarhuna is a major advance in our knowledge. The amphora stamps collected by the TAS have shown that elite families, especially from Lepcis Magna, were firmly engaged in the management and ownership of estates in this hinterland zone.

Amphorae produced in the Gebel Tarhuna clearly attest to both external and regional trade in olive oil (and wine). The TAS has added 12 new stamps to the previously established catalogues of Tripolitanian amphora stamps (Di Vita-Evrard 1979; Mattingly 1988b; 1995; http://ceipac.gh.ub.es) and has located the production sites for a number of previously attested stamps. Through the study of the amphora kiln sites and amphora stamps from the Gebel Tarhuna, I hope to have highlighted the need for the development and systematic revision of all related data and for the adoption of a methodology that integrates complementary data for this economic activity.

Further study of the distribution of these amphorae is essential. At present, results are inconclusive because they are highly conditional on the state of archaeological research. The expansion of survey in the Tripolitanian coastal and Gebel areas is needed if we are to develop ceramic studies more fully. Study of the Tripolitanian amphora finds (types, fabrics, stamps etc.) has made sure progress but can be misleading when the identification of production sites is so incomplete. In particular, a great contribution will be made to the study of the Tripolitania I, II and III amphorae types once proper excavations are carried out at kiln sites, which will perhaps allow greater discrimination to be made between oil and wine containers. However, such research will require a great deal of time and effort.

There is also a need to update the epigraphic data associated with the Tripolitanian amphorae. There is scope for further studies to investigate local and external distribution patterns and to explore stamp data to eliminate different elements of consumption. The link between amphora kilns and individual estates needs further consideration as the data are fragmented and scarce, but at a few sites, prosopographic data seem to indicate numerous producers, with some kilns serving multiple clients. The possibility of establishing clearer links between the amphorae, olive oil and wine production and the investment of the Tripolitanian elite in these economic activities should serve as a reminder that there is much more work to be done, particularly with regards to the social and economic organisation of Tripolitanian urban and rural communities.

6.5 The economic aspects of the archaeological sites

Most of the recorded archaeological remains illustrate aspects of ancient economic practices. The transformation of the region's economic processes in terms of agriculture, amphora production and trade and the impact of these activities on settlement patterns have been discussed. It is clear that a great deal of development of agricultural practices occurred during the early imperial era. A radical shift towards a market-oriented approach to agricultural production occurred, especially with regards to specialisation in olive oil in this hinterland zone. This was achieved through a remarkable level of capital investment in crops, pressing facilities and architecture at rural farms, dams and cisterns. This led to dramatic growth in the scale of production in relation to Roman export markets, and also improved the social and political situation of the regional elite class.

The area southwest of Lepcis Magna is an agriculturally rich region, the potential of which was clearly exploited in the Roman period. The archaeological material, whatever else it may indicate, makes it perfectly clear that at no point in the Roman period are we dealing with a peasant subsistence economy. As Mattingly has amply demonstrated, concepts like 'economic growth' and 'surplus economy' are quite relevant to the early Roman period of the region (Mattingly 1993). By the late second century AD, the agricultural economy of Tripolitania had been developed by its Libyphoenician aristocracy into a great source of wealth. This development allowed the Lepcitanian and Oean elite to exploit the best soil and most of the agricultural lands were divided into estates of varying sizes, marked by the foundations of different types and sizes of farm buildings and associated with a number of press elements and facilities. These farm buildings were an important new feature in the rural landscape during the Roman period and demonstrate the significance of the Tarhuna region's productive countryside. The capital-intensive nature of the oil-pressing facilities, combined with the lack of more luxurious elements at many of these sites, fits in with the idea that these were rural estates which were run for the main benefit of absentee landowners based in the coastal cities (Mattingly 1985; 1995; Oates 1953).

Urban elite landowners were looking to make the best use of the produce of their directly-managed estates and any rents collected in kind. There are various indicators that Tripolitanian oil production was directed well beyond local subsistence needs. The extraordinary growth and ornamentation of the Tripolitanian coastal cities demonstrates a healthy trade with other parts of the Roman world. The extraordinary scale of investment in olive farms is a strong clue as to what the key, locally-available trade commodity was (Mattingly 1988c). The benefits of Roman peace encouraged the efficient interregional and external distribution of regional goods. The widespread distribution of Tripolitanian amphorae shows the large scale of export of Tripolitanian olive oil (and perhaps wine, too) (Bonifay 2004; Peacock and Williams 1986). The Tripolitanian elite may have marketed their produce themselves or through their dependents (such as freedmen), and some certainly owned ships for this purpose (Morley 2007, 582).

The number of rural sites, presses and amphora kilns recorded by the TAS clearly indicates that the Tarhuna plateau was a major centre of agricultural production, particularly of olives. The Tarhuna plateau rural villas can be added to the figure of about 1,000 villas which have been systematically surveyed in other western Roman provinces such as Gaul, Germany, Spain and Britain (Leveau 2007, 652–653). A significant degree of economic growth in this hinterland could only have been achieved by improving agricultural efficiency or by expanding the amount of land under cultivation. As in other North African areas, the TAS has now demonstrated conclusively that production was increased, with the principal agent of expansion being a profound regional specialisation in oleoculture. It is clear that Roman rule contributed to the expansion of olive cultivation by providing new export markets that encouraged the introduction or spread of new and better methods of farming and water management.

It can be concluded here that the archaeological data collected from the Gebel Tarhuna makes it a remarkably interesting and appropriate area for the study of ancient economic activity and for the investigation of several economic concepts relating to larger debates of the Roman economy. The estate organisation of the Tripolitanian rural economy, the signs of economic growth, the clear evidence for olive oil specialisation and the standardisation of a wide range of components of rural production (from presses, to baskets and amphorae) can all be linked to the urban elite who led and oversaw these economic activities and increased the links between the city and the countryside. The importance of olive oil in the economy of Tripolitania was comparable to that in the other main olive oil exporting regions of the Mediterranean basin (Brun 2004; Mattingly 1988b). In Spain, particularly in the region of *Baetica*, the archaeological evidence indicates that "the known number of villas and presses are very impressive and the original total of presses could have been well in excess of 1,000" (Mattingly 1988b, 41). The evidence from Tunisia presents a very similar picture to that from Tripolitania, with increasing specialisation in oleoculture and massive capital investment into multiple press facilities (Mattingly and Hitchner 1993). However, with the exception of a few examples in Croatia (Brun 2004, 62, 70), there is a lack of evidence elsewhere in the Roman Empire for such massive oilery facilities. Olive presses were common features in many areas, such as Italy and Southern

Gaul (Brun 2004, 7–60), but these often occurred in relatively small units of one to two presses and to judge from the measured elements, the absolute scale of the presses themselves appears to have been much smaller than the North African examples (Brun 2004; Foxhall and Forbes 1978). For example, Foxhall's detailed study of olive cultivation in Greece considered a wide range of evidence, from literary and epigraphic material to archaeological excavations and surveys. She found that the majority of pressing facilities recorded in the Greek rural landscape could be dated to the Roman period, and regions such as Methana and the Southern Argolid were evidently substantial oil-producing areas during that time (Foxhall 2007, 202). However, the absolute numbers of presses and the sizes of press elements were consistently smaller than those recorded in Tripolitania, emphasising the unusual character of the latter's economic development.

The main contribution of this work to debates about the ancient economy thus concerns the growth and disposal of the surplus of Tripolitanian olive oil production in the Roman economy. The key to this debate is the level of agricultural surplus, for which the TAS has provided new direct evidence. It is clear that from the first century AD, Tripolitania was producing a sufficiently large and reliable olive oil surplus for export. The total wealth displayed in the coastal cities, especially Lepcis Magna, was clearly considerable; the evidence suggests significant increases in income alongside extensive building works, both public and private, and the expansion of both urban and rural activity. As already mentioned, future efforts are needed to move this debate forward. Urgent research priorities include the excavation of an oilery site and a major amphora kiln site and the improvement of our knowledge of the Tripolitanian amphora typological series. However, the work achieved to date remains an important contribution to the ongoing debate about the organisation and specialisation of agricultural production and the investment of the urban elite into the countryside in classical antiquity.

The archaeological data recovered and synthesised in this book have demonstrated that the estates of the Tarhuna plateau were involved in large-scale olive oil production during the Roman period, particularly during the first three centuries AD. Olive oil was the main Tripolitanian commodity involved in long-distance trade in the Roman world. It is considered to have been a relatively low-cost commodity (i.e. not a luxury item) and like other basic goods such as salted fish, grain and table pottery, its transport around the Roman world is best understood as trade rather than personal equipment or gift exchange (Wilson 2009; cf. Whittaker 1985; 1989). The archaeological evidence indicates that olive oil (and wine) production was managed by estates. Estates such as Sidi Buagela 2 (TUT12), Henschir Assalha (TUT15), Henschir es-Senam (TUT38), Loud el-Meghara (TUT43), Kerath (TUT46), Senam Semana (TUT54), Senam Aref (DOG60), Gasr Dehmesh village (HAJ78–82), Halafi village (DUN129 & DUN131) and Henschir Sidi Hamdan were large in size, perhaps controlling several hundred hectares. In addition to a *pars rustica*, they regularly included a *pars urbana*, an often luxuriously ornamented farmhouse that was periodically used by the landowner during his or her visits to the estate. This intensive cultivation and large-scale production most likely thrived through the careful management of land and labour, possibly including transhumant pastoral groups, seasonal harvesters and specialist press builders alongside the fixed labour of the estates. These estates seem to have been served by both slaves and tenants, as well as hired labour at the busiest times such as the harvest and pressing, though the evidence from the survey cannot yet confirm this conclusively.

The export trade of olive oil is also illustrated by the increasing archaeological evidence for kilns which made olive oil amphorae. The evidence that olive oil containers predominated over those for wine supports the view that olive oil production in the Gebel Tarhuna was organised on a massive scale during the Roman period and was more significant overall than wine production (Arthur 1982; Blázquez Martínez and Remesal Rodríguez 2001; Bonifay 2004; Peacock and Williams 1986). The large number of amphora kilns recorded by the TAS, along with the increased number of amphora stamps now known, support Mattingly's view that the hinterlands of Lepcis Magna and Oea were intensively exploited by the urban elite for the production of olive oil for export and that this made Tripolitania one of the key olive oil exporting areas in the Roman word (Mattingly 1988b). The major aristocratic landowners benefited from the commercial opportunities offered by the Roman Empire through their investment in specialised and large-scale cultivation of a cash crop for targeted export markets. This helped them to generate huge wealth and thereby support their social and political positions (Hitchner 1993; Kehoe 2007; Mattingly 1988c).

The wealth generated from agriculture by the urban elite also contributed to an expansion of production in non-agricultural spheres. Much of the income gained from rural estates was most likely spent in the cities and on the needs of urban life, and the urban elite who owned the rural estates invested in other non-agricultural trades such as the production of ceramic containers and shipping. This stimulus can clearly be traced in the manufacture of specialised pressing equipment and in the amphora industry that supported the agricultural production. Interestingly, these activities appear to have been largely associated with rural rather than urban landscapes. The scale of amphora production in the Gebel Tarhuna was obviously related to the scale of olive oil (and wine) production; it seems to have increased substantially in the rural areas where the olive oil was

produced. It is now certain from the TAS evidence that at least some of the urban-based landowners who engaged in olive oil production also produced their own amphorae as attested by the stamps. It is now possible to place the evidence for the organisation of the manufacturing of amphorae on the Tarhuna plateau within the broader context of the Roman economy (Peacock 1982).

The Tarhuna plateau's rural landscape contains extensive evidence for surplus production of agricultural produce. Tripolitania is similar to other areas in North Africa, in particular the regions around the Roman towns of *Cillium* (Kasserine), *Thelepte* (Thélepte), and *Sufetula* (Sbeitla) in south-central Tunisia (Hermassi 2004; Hitchner 1988; 1990; 1993; Sehili 2008). In examining the archaeological evidence for each of the Tarhuna settlement categories, I have tried to establish the nature of the agricultural economy. In the first place, the evidence suggests that the lands of the Gebel Tarhuna drew the attention of the coastal urban elite to the possibility of investing their capital in the exploitation of this interior territory. The large amount of capital invested into agricultural practices and pressing facilities is clear from the massive rural constructions, particularly at the oilery and large farm sites, with more than 200 presses having been recorded or re-recorded by the TAS in the Wadis Turgut and Doga. The general distribution of press elements in the Tarhuna countryside and their presence in considerable quantities at a large number of settlements suggests that the region witnessed a high level of agricultural exploitation and that it was one of the most important economic resources in Tripolitania during the Roman period. In the study area alone, there were at least 34 sites within the agriculturally productive area of the Wadis Turgut and Doga, from large farms with three to four presses to oileries with five or more presses, that could be described as villas, including the major sites at Senam Semana (TUT54, 17 presses), Sidi Buagela 2 (TUT12, eight presses), Henschir Sidi Madi (TUT52, seven presses) and Henschir es-Senam (TUT38, six presses). The majority of these farms featured an elaborate *pars rustica* which no doubt functioned as the central facility of an agricultural estate. The structures were utilitarian farm buildings that were used for practical purposes as rooms for pressing, the storage of crops and tools and the housing of labourers, servants and animals. Within these 34 farming sites, evidence of Roman-period luxurious settlement occurs at only 12, suggesting that only around a third of these estates had a *pars urbana*. This sub-group of luxury villas had both high productive potentials and elite residential facilities. Within the Roman world, such patterns of rural investment and the generation of wealth were comparatively rare, which enhances the importance of the present study.

The settlement and agricultural development of the Gebel Tarhuna seems to have achieved its peak during the second and the first half of the third centuries AD, a pattern that was reflected in the development of the countryside by the elite who sought to make their profit from these interior territories, extending and echoing the growing prosperity of the coastal zone (Mattingly 1987b). Though many of the major agricultural sites on the Tarhuna plateau appear to have been owned by the aristocratic elite of the coastal cities, these rural production centres were also economically linked with the towns. The rural districts supplied the towns, and the towns facilitated trade and exchange with external markets. Indeed, the growing exploitation of the countryside placed these rural settlements within the Roman imperial exchange network, where their long-term success was influenced by fluctuations in market demand, transport costs and peace.

APPENDIX

Appendix TABLES

Appendix A: *Sites recorded during the intensive survey in the upper Wadi Guman.*

Site number	Site type	Elevation
Upper Guman 1 (= GUM83)	*gasr*	407
Upper Guman 2 (=GUM84)	Dam	384
Upper Guman 3 (=GUM85)	Quarry	397
Upper Guman 4 (=GUM86)	Pottery kiln	404
Upper Guman 5 (=GUM87)	Bath	386
Upper Guman 6 (=GUM89)	Pottery kiln	413
Upper Guman 7 (=GUM90)	Pottery kiln	417
Upper Guman 8 (=GUM110)	Pottery kiln	420
Upper Guman 9	Small farm	450
Upper Guman 10	Small farm	449
Upper Guman 11	Small farm	460
Upper Guman 12 (=GUM88)	Small farm	423
Upper Guman 13	*Opus signinum*	416
Upper Guman 14	Enclosure	410
Upper Guman 15	*Opus signinum*	419
Upper Guman 16	Small farm	438
Upper Guman 17	Small farm	435
Upper Guman 18	Dam	429
Upper Guman 19	Enclosure	409
Upper Guman 20	Terrace wall	410
Upper Guman 21	Coin hoard	430

Appendix B: *The archaeological sites recorded by the TAS on the Tarhuna plateau.*

Site code	Local name(s)	Primary site type	Secondary site type	Topographic Location	Elevation	Number of presses	Number of kilns	Luxury element(s)	Other features	Period	Dating evidence
TUT1		Large farm-villa	*gasr*	Plateau	280	3		Traces of bath building on north side.	Cistern on southern slope.	1–5 AD	Eastern *sigillata* A, Ritt.8, Dr.27, *terra sigillata* and Trip. I amphora. ARS Hayes 94 and TRS Forms 2, 4C.
TUT2		Small farm	*gasr*	Plateau	295	1			Small dam in north western gulley	2–3, 6–7 AD	Coarseware 42,46, Keay 8b amphora. Building material.
TUT3		Large farm	*gasr*	Break of slope	300	3			2 cisterns and late building	1–6 AD	Curle 15 *terra sigillata*, CW49, Trip. I, III amphorae, ARS Hayes 94.
TUT4		Small farm		Wadi-side	280	2			Mill	2–4 AD	Trip. I, II, III amphorae.
TUT5	Henschir Aziza	Large farm	*gasr*	Break of slope	315	4			Mill, cistern	1–6 AD	Eastern *sigillata* A, Dr.2–4, Trip. II amphora, ARS Hayes 87b.
TUT6		*gasr*		Hilltop	374					4–7 AD	ARS Hayes 67, TRS.
TUT7	Ben Hayb	Large farm	*gasr*	Plateau	305	3			2 cisterns	1 BC–6 AD	Gaulish *terra sigillata*, Trip. I, III amphorae, TRS Forms 1, 10.
TUT8		Oilery		Plateau	290	5		Traces of bath elements, tile and large piece of column.		1–3 AD	Italian *terra sigillata*, Trip. I amphorae.
TUT9	Senam el-Gharabah	Small farm		Wadi-side	280	1				2–3 AD	Trip. I amphora.
TUT10		Oilery		Plateau	295	5			2 wells in the north and north-east sides.	1–4 AD	Dr.18, Trip. I, II, III amphorae, ARS Hayes 45a, 58.
TUT11		Large farm		Wadi-side	266	3				1 BC–3 AD	CW 35, 70, Arretine cub, Trip. I, II amphorae.
TUT12	Sidi Buagela 2	Oilery-villa		Hill-slope	242	8	2?	Traces of small bath (northeast side)	Stamped amphora handle, cisterns	1–3 AD	Eastern *sigillata* A, Italian *terra sigillata*, Dr.2–4 amphora, Trip. I, II, III amphorae.
TUT13		*gasr*		Hilltop	318					4–7 AD	ARS Hayes 67, 87c, TRS Forms 8B, 10.
TUT14	Bu-Kaala	Large farm	*gasr*	Plateau	333	3				1–3, 6–7 AD	Trip. I, II amphorae, ARS Hayes 71, TRS
TUT15	Henschir Assalha	Oilery-villa		Break of slope	280	5	4?	Traces of bath building	Amphora stamps	1 BC–3 AD	Campana A, Eastern *sigillata* A, Trip. I, II, III amphorae.

Site code	Local name(s)	Primary site type	Secondary site type	Topographic Location	Elevation	Number of presses	Number of kilns	Luxury element(s)	Other features	Period	Dating evidence
TUT16	Henschir Boshaina	Oilery	*gasr*	Break of slope	375	5			Mill, 3 millstones, 3 cisterns	1–3, 5–7 AD	Trip. I, II, III amphorae. ARS Hayes 87b.
TUT17	Ain Astail	*gasr*		Hilltop	290					6–7 AD	Late Roman coarseware, Hayes Type 2 Lamp. Building material.
TUT18	Ain Astail	Pottery kilns		Wadi-side	277		2		2 amphora stamps, cistern, millstone	1–3 AD	Trip. I, II, III amphorae.
TUT19	Ain Astail	Bath		Break of slope	293			Mosaic floors		2–5 AD	Trip. I, II, III amphorae Mosaics, ARS Stamped Floor, Style A.
TUT20	Ain Astail (Henschir Henash)	Oilery		Plateau	297	6			2 cisterns, mill	2–4 AD	Trip. I, II, III amphorae.
TUT21	Ain Astail	Dam		Wadi-floor	266						
TUT22		Dam		Wadi-floor	265						
TUT23		Dam		Wadi-floor	264						
TUT24		Dam		Wadi-floor	260						
TUT25		Dam		Wadi-floor	253						
TUT26		Large farm		Wadi-side	254	4				1 –4 AD	Italian *terra sigillata*, Trip. I, II, III amphorae.
TUT27		Large farm		Hill-slope	280	3			2 cisterns	1 BC–3 AD	Eastern *sigillata* A, Trip. II amphora. Numidian coin.
TUT28		*gasr*		Hilltop	290					4–7 AD	TRS Forms 1, 4C, 5. Building material.
TUT29		Large farm		Hill-slope	255	4			2 cisterns	1–4 AD	Trip. I, II, III amphorae. CW Type 133.
TUT30		*gasr*		Wadi-side	228					4–7 AD	Building material.
TUT31		Small farm		Plateau	272	2				2–5 AD	Trip. I, II, III amphorae, ARS Hayes 71
TUT32		Small farm		Hill-slope	222	2			Cistern	1–5 AD	Gaulish *terra sigillata*, Trip. I, II, III amphorae, TRS Form 3.
TUT33	Gasr al-Atresh	*gasr*		Wadi-side	268				Cistern	5–7 AD	ARS Hayes 74, TRS Forms 2, 5.
TUT34	Ras al-Assal	*gasr*		Hilltop	302					5–7 AD	Building material.
TUT35		Large farm		Wadi-side	275	4				1–4 AD	Trip. I, II, III amphorae, Eastern *sigillata* A, CW Types 43, 47.

cont.

Site code	Local name(s)	Primary site type	Secondary site type	Topographic Location	Elevation	Number of presses	Number of kilns	Luxury element(s)	Other features	Period	Dating evidence
TUT36		Large farm		Break of slope	226	3			3 cisterns	2–4 AD	Trip. II, III amphorae, ARS Hayes 197, CW Types 58,62.
TUT37	Gsair al-Atshan	*gasr*		Hilltop	241				Dam in the southern gulley	5–7 AD	ARS Hayes 87c Building material.
TUT38	Henschir es-Senam	Oilery-villa		Wadi-side	227	6		Traces of bath elements, tile and a large piece of column	2 mills, 2 cisterns	1–4 AD	Eastern *sigillata* A, Dr. 45, Italian *terra sigillata*, Trip. I, II, III amphorae
TUT39		Small farm		Break of slope	242	2				2–4 AD	Trip. I, II, III amphorae, CW Type 70.
TUT40	Kerath	Small farm	*gasr*	Break of slope	251	2			Cistern	2–6 AD	Trip. II, III amphorae. Building material.
TUT41		Small farm		Wadi-side	222	1				1–4 AD	Trip. I, II, III amphorae, CW Type 59.
TUT42		*gasr*		Hilltop	248	1				4–7 AD	TRS. Building material.
TUT43	Loud el-Meghara (Senam Terr'gurt)	Oilery-villa		Wadi-side	219	7		Traces of bath elements, tile, piece of columns and a piece of capital.		1–3 AD	Trip. I, II, III amphorae. Eastern *sigillata* A, ARS Hayes 193, 199.
TUT44	Sidi Yekhlef	Large farm		Break of slope	211	3			Cistern	1–4 AD	Trip. I, II, III amphorae, Italian *terra sigillata*.
TUT45		Small farm		Hill-slope	203	2				2–5 AD	Trip. II amphora, ARS Hayes 58.
TUT46	Kerath	Oilery-villa	*gasr*	Break of slope	250	5		2 columns and capital, portico, bath-suite		1 BC–3 AD	Campana A, Trip. I, II, III amphorae. CW Types 37, 241. Numidian coin
TUT47	Arbaia	Small farm		Wadi-side	168	2				1–4 AD	Trip. I, II, III amphorae..
TUT48	Arbaia	Pottery kilns		Wadi-side	150		5		4 amphora stamps	2–4 AD	Trip. I, II, III amphorae, Dressel 2–4.
TUT49	Arbaia	Dam		Wadi-floor	200						
TUT50		*gasr*		Plateau	200	1			2 cisterns	3–6 AD	Trip. III amphora, TRS Forms 1, 9.
TUT51		*gasr*		Hilltop	217					4–7 AD	Building material.
TUT52	Henschir Sidi Madi	Oilery-villa		Wadi-side	150	7		Arched gate and column-pieces, portico, bath-suite		1–4 AD	Trip. I,II,III amphorae, ARS Hayes 58, CW Types 254, 147, 324.

Site code	Local name(s)	Primary site type	Secondary site type	Topographic Location	Elevation	Number of presses	Number of kilns	Luxury element(s)	Other features	Period	Dating evidence
TUT53	Sidi Eysawi	Large farm-villa		Break of slope	180	3	1	Portico and bath with mosaic	Cistern	1–5 AD	Italian *terra sigillata*, Trip. I, II, III amphorae, ARS Hayes 71.
Mosaic.											
TUT54	Senam Semana	Oilery-villa		Wadi-side	135	17		Bath-building, portico, mosaic	Cisterns and hypogeal tombs.	1–4 AD	Eastern *sigillata* A, Dr. 45 Italian *terra sigillata*, Trip. I, II, III amphorae.
TUT55		*gasr*		Hilltop	219					4–7 AD	TRS. Building material.
TUT56	Sidi Buagela 1	*gasr*	Large farm	Plateau	240	3			2 cisterns	1–6 AD	Eastern sigillata A, Trip. I, II, III amphorae.
DOG57	Henschir Hmoudat	Large farm		Break of slope	250	3			Cistern	1–4 AD	Building material.
DOG58		*gasr*		Break of slope	250	1				4–6 AD	Building material.
DOG59		*gasr*		Hilltop	266					5–7 AD	TRS, ARS Hayes 87b.
DOG60	Senam Aref	Oilery-villa		Wadi-side	184	6		Traces of bath building on eastern side, portico, capital	Large cistern	1–4 AD	Curle 15 *terra sigillata*, Trip. I, II, III amphorae, CW Type 49.
DOG61		Quarry		Break of slope	225					1–5 AD	
DOG62		*gasr*		Hilltop	235					5–7 AD	Building material.
DOG63		*gasr*		Hilltop	243					5–7 AD	Building material.
DOG64		Small farm		Wadi-side	200	2				1–4 AD	Trip. I, II, III amphorae. CW Type 133.
DOG65		*gasr*		Hilltop	261					4–6 AD	Building material.
DOG66	Sidi al-Akhder	Oilery		Break of slope	230	6			Large cistern on eastern slope	1–3 AD	Trip. I, II, III amphorae.
DOG67		Small farm	*gasr*	Break of slope	275	2				2–6 AD	Trip. I, II, III amphorae, ARS Hayes 91c. ARS Stamped Floor, Style A(ii),
DOG68		Small farm	*gasr*	Break of slope	264	2				2–6 AD	Building material.
DOG69		gasr		Plateau	284					4–7 AD	Building material.
DOG70		*gasr*		Plateau	305	2				4–7 AD	ARS Hayes 105, TRS Form 3, 4C.
DOG71	Ras Abadla	Boundary inscription		Hill-slope	450					1 AD	

cont.

Site code	Local name(s)	Primary site type	Secondary site type	Topographic Location	Elevation	Number of presses	Number of kilns	Luxury element(s)	Other features	Period	Dating evidence
DOG72	Gasr Doga	Mausoleum		Wadi-side	420					1 AD	Neo-Punic inscription.
DOG73	Ain Doga	Bath		Wadi-floor	405			Many scattered mosaic tesserae		1–4 AD	Trip. I, III amphorae. Mosaic.
DOG74		Small farm		Plateau	474	2				1–4 AD	Trip. I, III amphorae. CW Type 70.
DOG75	Medina Doga, Mesphe	*gasr*		Plateau	445					4–6 AD	
HAJ76	Gasr al-Ash	*gasr*		Hilltop	457					5–7 AD	TRS Form 10 Building material.
HAJ77	Gasr Abdalhadi	*gasr* (watchtower)		Hilltop	477					4–7 AD	Building material.
HAJ78	Gasr Dehmesh	Mausoleum		Break of slope	325					1 BC–1 AD	Conspectus Form 4 Italian *terra sigillata*, Eastern *sigillata* A.
HAJ79	Gasr Dehmesh	*gasr*		Plateau	284					4–6 AD	ARS Hayes 71, 94.
HAJ80	Gasr Dehmesh	Bath		Break of slope	270				2 cisterns	2–4 AD	Trip. I, III amphorae.
HAJ81	Gasr Dehmesh	Large farm-villa		Break of slope	215	4			3 cisterns.	1–3 AD	Eastern *sigillata* A. Ritt. 12 Italian *terra sigillata*.
HAJ82	Gasr Dehmesh	Oilery		Plateau	280	5				1–3 AD	Trip. I, II, III amphorae. CW Type 184.
GUM83	Ras Deiseer	*gasr*	Quarry	Hilltop	407				2 unfinished columns and orthostat	4–7 AD	ARS Hayes 68, TRS Forms 2, 3.
GUM84		Dam		Wadi-floor	384						
GUM85		Quarry		Hill-slope	397				2 millstones	2–5 AD	
GUM86	Scegafiat Asray	Pottery kiln		Wadi-side	404		1			1–3 AD	Trip. I, III amphorae.
GUM87	Ain Guman	Bath/villa		Wadi-floor	386			Mosaic floors, tile and pipes	Spring and 5 wells	2–5 AD	ARS Hayes 62, Trip. I, II, III, amphorae. 5th century coins. Mosaic.
GUM88	Gaytna	Small farm (villa?)		Plateau	423	2		Traces of bath-building?	Large cave	1–4 AD	Eastern sigillata A, Gaulish *terra sigillata*, ARS Hayes 45a, 58.
GUM89	Scegafiat Atriq	Pottery kilns		Wadi-side	413		3?		Amphora stamps	1–4 AD	Trip. I, II, III amphorae.
GUM90	Scegafiat Ben Hemad	Pottery kilns		Plateau	417		3	.	Amphora stamps	1–4 AD	Trip. I, II, III amphorae.

Site code	Local name(s)	Primary site type	Secondary site type	Topographic Location	Elevation	Number of presses	Number of kilns	Luxury element(s)	Other features	Period	Dating evidence
TEL91	es-Sonama (Sonoma ar-Ragda)	Mausoleum		Break of slope	455					1–2 AD	Dr. 35 *terra sigillata*, CW Type 66.
TEL92		*gasr*		Break of slope	471					4–6 AD	ARS Hayes 94, 181, TRS Forms 2, 3.
TEL93	Gasr Bu Tuil	*gasr* (watchtower)		Hilltop	515					6–7 AD	TRS. Building material.
TEL94		*gasr*		Hill-slope	462					4–6 AD	ARS Hayes 181. Building material.
TEL95		Small farm		Break of slope	446	2			2 cisterns	2–4 AD	Trip. II, III amphorae
TEL96		Small farm		Plateau	468	2			Cistern	1–4 AD	Trip. I, II, III amphorae, ARS Hayes 45a.
TEL97		Small farm		Break of slope	378	1				2–4 AD	Building material.
TEL98		*gasr*		Break of slope	402				Cistern	4–7 AD	Building material.
TEL99		Small farm		Plateau	391	2				1–3 AD	Trip. II, III amphorae.
TEL100		Bath		Wadi-floor	357					2–5 AD	Building material.
TEL101	Ain Hamzia	Bath		Wadi-floor	353					3–6 AD	Walters 79 *terra sigillata*, ARS Hayes 53 Rim, TRS Forms 4–10.
TEL102	Hamzia	Pottery kilns		Wadi-side	365		2			1–3 AD	Trip. I, II amphorae.
DOG103	Sidi Masoud	Small farm		Wadi-side	224	2				2–4 AD	Trip. II, III amphorae.
DOG104		Large farm-villa		Wadi-side	210	3			2 cisterns.	1–4 AD	Dr. 35 *terra sigillata*, ARS Hayes 62, Trip. II, III amphorae.
DOG105	Henschir Aulad Ali	Small farm-villa		Break of slope	221	2		Traces of bath building and columns.	2 cisterns.	1–4 AD	Gaulish *terra sigillat*a, ARS Hayes 94, Trip. II, III amphorae.
DOG106	Sh'bet asc-Schood	Oilery		Break of slope	217	5				1–3 AD	Trip. I, II, III amphorae, CW Type 50.
DOG107	Henschir ash-Shuaud	Oilery		Wadi-side	232	5			3 cisterns	1–4 AD	Trip. I, II, III amphorae.
TUT108	Henschir Armadia	Pottery kilns		Wadi-side	320		4?		Amphora stamps	1–3 AD	Trip. I, II, III amphorae.
TUT109	Henschir ar-Rkkak	Small farm		Break of slope	353	2				2–5 AD	Trip. I, II, III amphorae, ARS Hayes 58, 60.

cont.

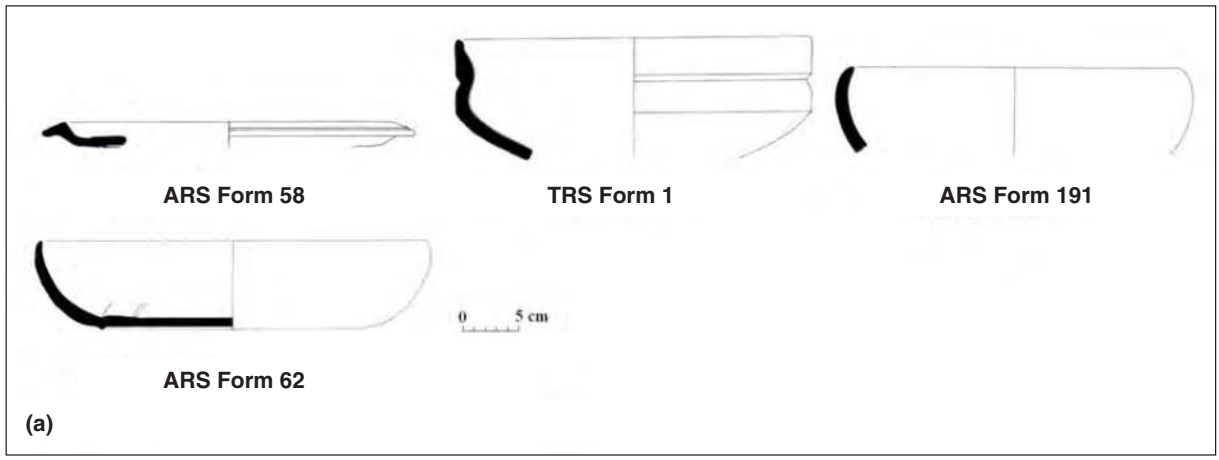
Site code	Local name(s)	Primary site type	Secondary site type	Topographic Location	Elevation	Number of presses	Number of kilns	Luxury element(s)	Other features	Period	Dating evidence
GUM110	Scegafiat Maamri	Pottery kilns		Wadi-side	420		2?			2–4 AD	Trip. I, II, III amphorae.
DOG111	Wadi Almseel	Large farm	Dam, kiln, quarry	Hill-slope	164	3	1			1–4 AD	Trip. I, II, III amphorae, CW Type 37.
TUT112		Large farm		Hill-slope	242	4		Bath	Cistern	2–4 AD	Trip. I, II, III amphorae.
SRI113	Wadi es-Sri	Bath		Wadi-side	335					4–6 AD	Mosaic. 4th–5th c. AD coins.
SRI114	Wadi es-Sri	Pottery kilns		Wadi-side	338		18			4–6 AD	Trip. II, III amphorae.
SRI115		Large farm	Cemetery	Plateau	342					2 BC–3 AD	Campana A finewares. Numidian coins.
SRI116		*gasr*		Hilltop	355					4–6 AD	Building material.
TRG117		Small farm								1–3 AD	
TRG118		Small farm								1–3 AD	
TRG119		Small farm	Quarry							1–3 AD	
TRG120		*gasr*								4–7 AD	
TRG121		Small farm								1–4 AD	
TRG122		*gasr*								4–7 AD	
TRG123		*gasr*								4–7 AD	
TRG124		*gasr*								4–7 AD	
DUN128		Oilery							2 mills	1–4 AD	
DUN129	Senam Halafi 1	Oilery-villa				5				1–3 AD	
DUN130		Large farm							2 mills	1–3 AD	
DUN131	Halafi	Large farm	kilns			4	5?			1–3 AD	
SRI132	Wadi es-Sri	Small farm							1 mill	1–4 AD	
DUN133		Bath								2–4 AD	

Appendix C: *The Hypogeal tombs discovered during 1970s and 1980s in the Gebel Tarhuna. All their finds transferred to stores of Lepcis Magna and have catalogued by Italian archaeologists.*

Tomb no.	Location	Date of discovery	Structural characteristics	Material	Type of pottery	Chronology	Bibliography
19	El-Zagadna	1982	Hypogeal	TRS(4); common ceramic(2); lamp(4).		4th–5th c. AD	Lepcis Magna inventory no. 7872–7880; *archivio Soprintendenza Leptis Magna.*
20	Gasr ed-Daun	1978	Hypogeal with two rooms and vaulted complied barrel	Urns, Type 1,1(8) with Neo-Punic inscriptions. Italian *sigillata*(22); Eastern *sigillata* A(1); ARS(1); common ceramic(13); amphorae(6); lamp(11).	Eastern *sigillata* A: *Atlante II* 35. ARS: Hayes 5a. Tripolitanian amphorae.	AD 50–150	Lepcis Magna inventory no. 5246–5347; archivio Soprintendenza Leptis Magna.
21	Gasr Doga	1980	Hypogeal shaft 2.60 x 1.60 m	Limestone urns(3); amphorae(3); ARS(6); TRS(2); common ceramic(4); lamp(4); terracotta(1).	ARS: Hayes 15, 25, 42; TRS: 2, 1	AD 200–300	Lepcis Magna inventory no. 6347–6420; *archivio Soprintendenza Leptis Magna.*
33	Sidi Asid	1974	Hypogeal	TRS; common ceramic.		4th–5th c. AD	Lepcis Magna inventory no. 1154–1165.
41	Gasr Doga	1977	Hypogeal	?	?	?	Lepcis Magna inventory no. 4943–4953.
44	Gasr Doga	1978	Hypogeal	?	?	?	Lepcis Magna inventory no. 6278–6289.
45	Gasr Doga	1978	Hypogeal	Eastern sigillata(1); lamp(3).	Eastern sigillata: Atlante II 12.	AD 1–50	Lepcis Magna inventory no. 6278–6289.
52	El-Zagadna	1984	Hypogeal with entrance of irregular shape.	TRS(7); glass(1); common ceramic(4); lamp(5).	?	5th c. AD	Lepcis Magna inventory no. 7884–7907.
55	Sidi Asid	1978	Hypogeal	Italian *sigillata*(1); Eastern *sigillata* A(1); amphorae(6).	Italian *sigillata*: form IX; Eastern *sigillata* A: *Atalnte II* 4; Tripolitania II amphora; Van Der Werf 3; *Benghazi* ER3	AD 1–50	Lepcis Magna inventory no. 3869–3932; *archivio Soprintendenza Leptis Magna.*
56	Sidi Asid	1973	Hypogeal	TRS(2); amphorae(2).	?	5th c. AD	Lepcis Magna inventory no. 3155–3160; *archivio Soprintendenza Leptis Magna.*
59	Sidi Mohammar Algnega	1989	Hypogeal	Four urns with Latin inscriptions; amphorae(2); lamp(1).	Tripolitania I amphora	AD 100–150	Lepcis Magna inventory no. 8123–8126; *archivio Soprintendenza Leptis Magna.*

Appendix FIGURES

Appendix D: *Samples of the TAS ceramic evidence.*



(b)

Figure 1: *(a) and (b) Campanian pottery.*

Figure 2: *(a) TRS Form 2; (b) TRS Form 10; (c) TRS Form 4c; (d) ARS Form 27; (e) ARS 185; (f) TRS lamp.*

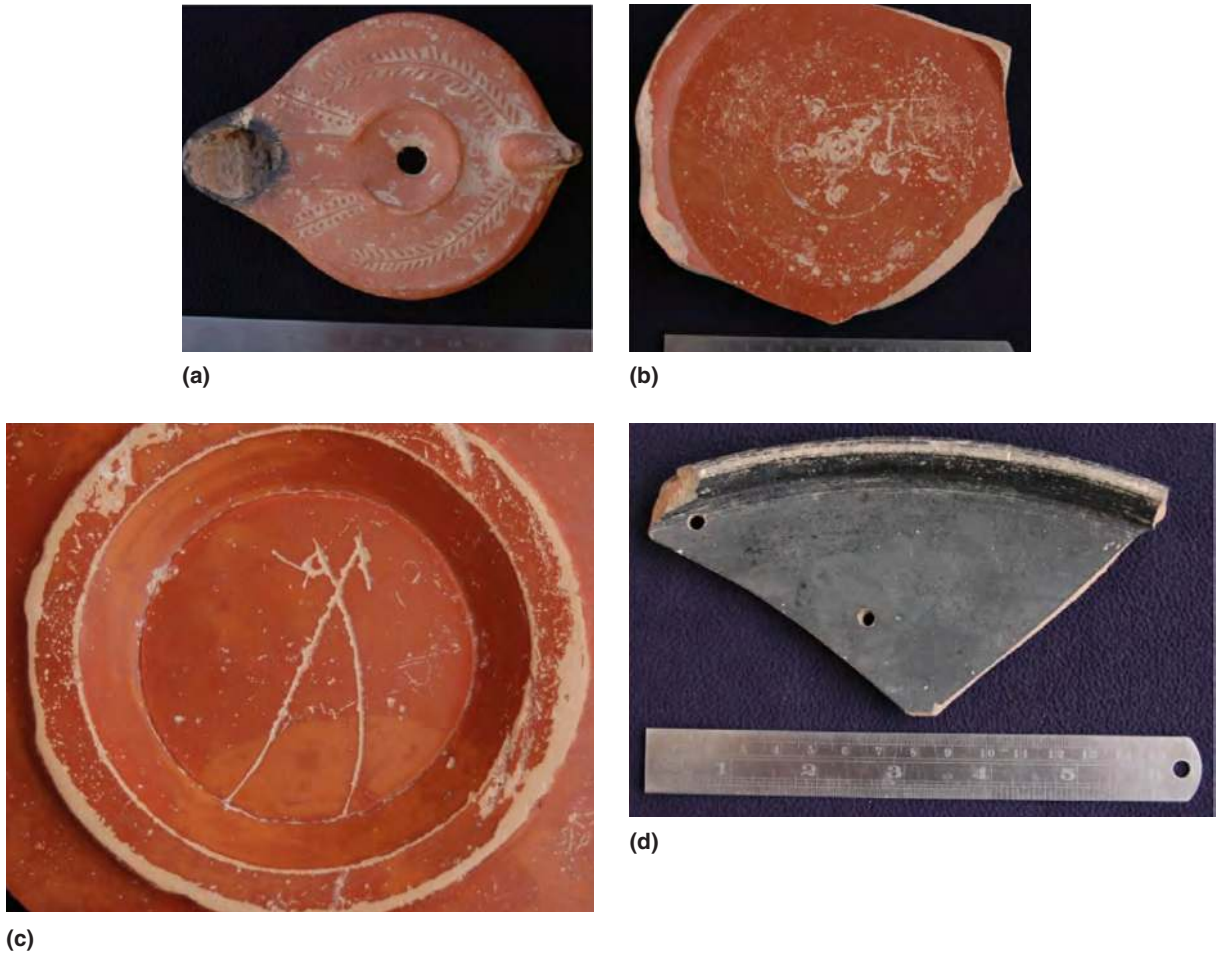


Figure 3: *(a) LR TRS lamp; (b) Eastern Sigillata A; (c) a New-Punic letter marks the eastern Sigillata dish; (d) Campana A sherd.*

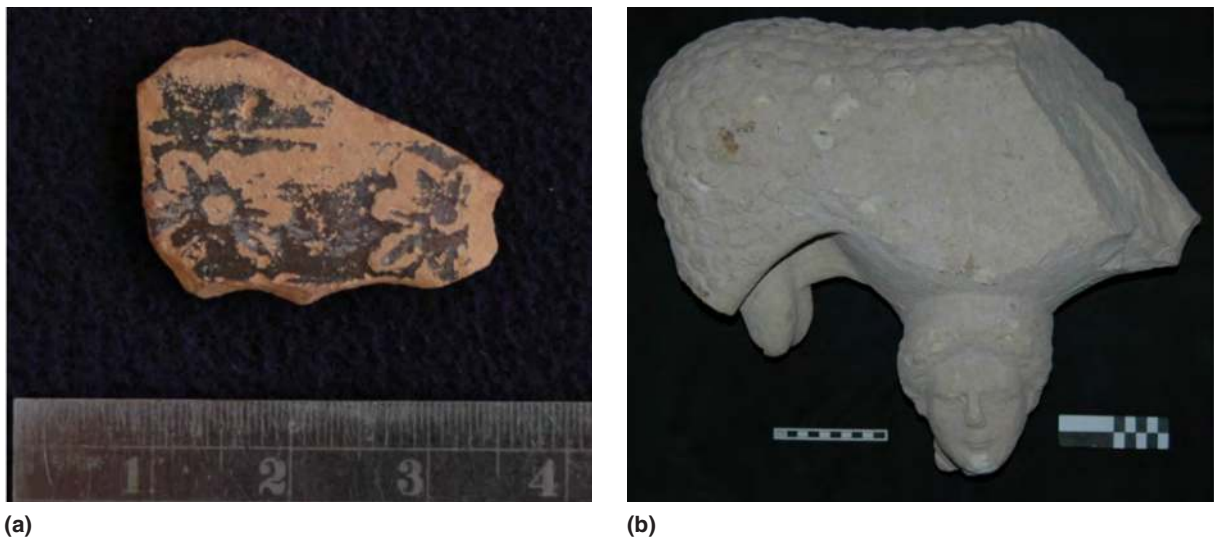


Figure 4: *(a) Campana A; (b) religious status found in a sanctuary site at the Wadi Sri within the same level of the Campana A potsherds and the Numidian coins.*

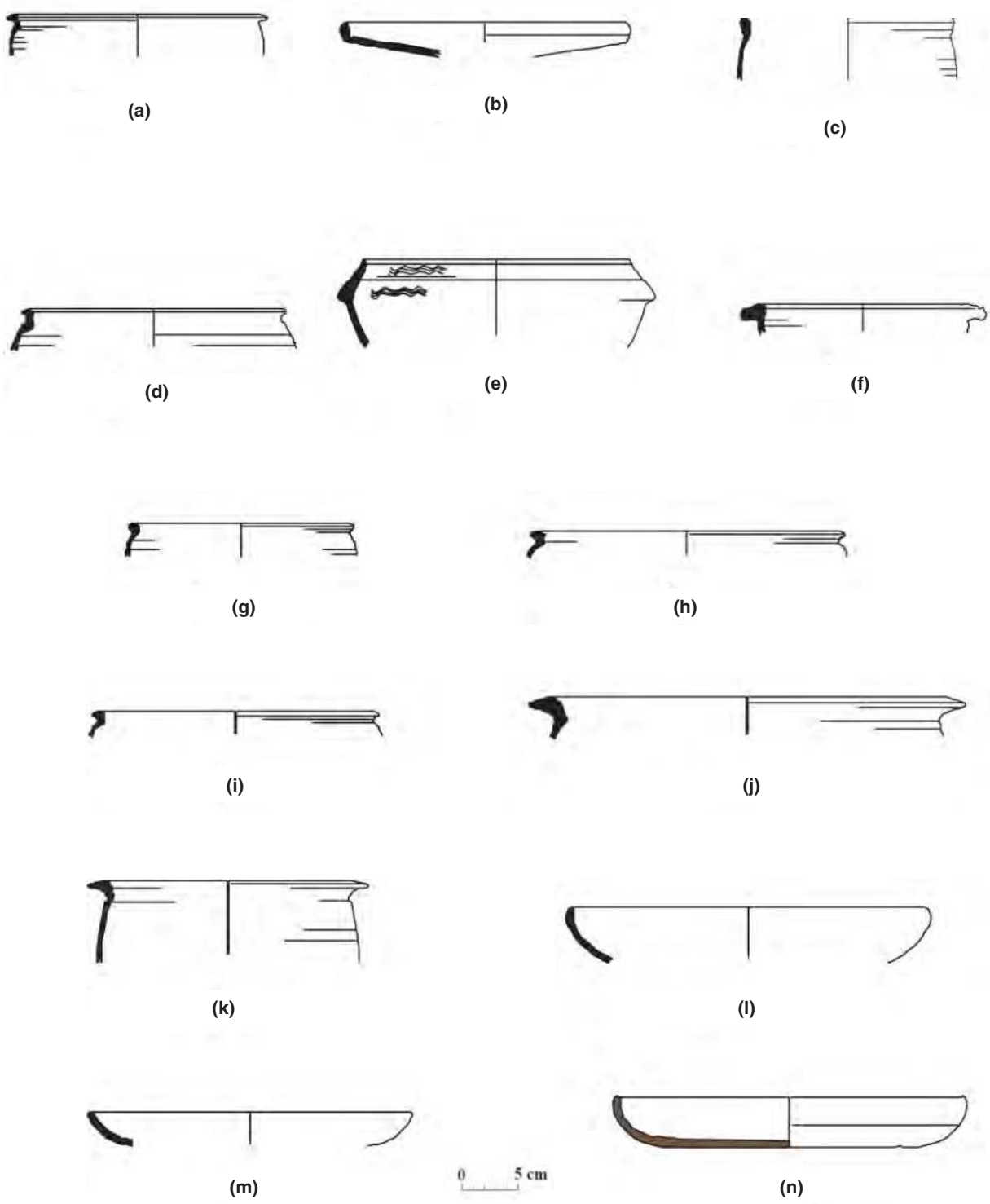


Figure 5: *(a) C ware Sabratha Type 37.481; (b) Campana A; (c) C ware Sabratha Type 63.662; (d) C ware Sabratha Type 50.538; (e) C ware Sabratha Type 324.2342; (f) C ware Sabratha Type 254.3205; (g) C ware Sabratha Type 70.2511; (h) C ware Sabratha Type 66.2499; (i) C ware Sabratha Type 262.3205; (j) C ware Sabratha Type 241.2153; (k) C ware Sabratha Type 37.487; (l) C ware Sabratha Type 147.2970; (m) C ware Sabratha Type 133.1601; (n) C ware Sabratha Type 147.2985 (Dore and Keay 1989).*

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