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ORIGINAL ARTICLE

Development of olive cultivation at the site of Sikyon, Greece: evidence from the charred olive remains from the late Classical/early Hellenistic to the Roman period

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Abstract

Olea europaea (olive) is a typical fruit tree of the Mediterranean basin where it has been widely cultivated for millennia. In the Aegean, the growing of olives is known since the Neolithic period, and it has been suggested that their cultivation increased during the 1st millennium BCE. The olive and its by-products have played dynamic roles in the economies of the regions in which it was grown. The finding of charred olive stones at the site of Sikyon in the northeastern Peloponnese, Greece, reflects the role of olives in this region during the second half of the 1st millennium BCE until the beginning of the 1st millennium CE. The results of geometric morphometric analysis of some complete olive stones found in various archaeological contexts at Sikyon provide information on the state of olive cultivation and the richness of the various olive varieties grown there.

Keywords 1st millennia BCE and CE · Greece · Archaeological olive morphotypes · Geometric morphometric analysis

Introduction

The aim of this paper is to investigate the biodiversity of *Olea europaea* (olive) at the site of Sikyon from the Classical until the late Roman period. Although olive stones are a common find at archaeological sites in the Mediterranean region, complete ones are quite scarce and only few concentrations, where they have been preserved, have so far been found in Greece, as at Platania and Eretria (Margaritis 2006, 2013, 2015; Margaritis and Jones 2008; Margaritis and Pagnoux 2020; Margaritis et al. 2021). The evidence for the diversity of olive varieties in the Aegean region is limited and the datasets relevant to olive cultivation are fewer than those for another important fruit, *Vitis* (grapevine) (Pagnoux et al. 2015, 2021; Valamoti et al. 2020; Margaritis et al. 2021). The material from Sikyon therefore provides a significant opportunity for understanding the development of olive cultivation from ca. 500 BCE to ca. 500 CE in the northeastern Peloponnese and more generally in Greece by using geometric morphometric analysis.

Materials and methods

The site

The site of Sikyon is located in the northeastern part of the Peloponnese, southwest of the Gulf of Corinth (Korinthiakos Kolpos), in an area which is still well known for its soil

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fertility (Fig. 1). The archaeobotanical olive assemblages analysed in this paper derive from two different archaeological excavation areas, the plain and the plateau. The material was collected in two separate archaeological projects. The first, the Old Sikyon Project, is a five-year collaboration project on the plain between the plateau and the Gulf of Corinth, co-directed by Silke Müth-Frederiksen (National Museum of Copenhagen) and Konstantinos Kissas (Greek Ministry of Culture). The remains of the Classical city have been excavated private houses, parts of a cemetery, roads and structures related to workshops dating mainly to the Classical and early Hellenistic period. However, there are some remains which are dated earlier or later. The second, the Sikyon project studied sites on the plateau, the northwest and southeast parts of the *agora*, with large scale excavations of the area of the triangular plateau where the Hellenistic and Roman city of Sikyon was situated, directed by Yiannis Lolos (University of Thessaly). Northwest of the *agora* there was a small temple, part of a monumental structure, part of a *stoa* and a pi-shaped complex, as well as part of a central street of the city. Apart from the two latter areas, which are dated to the Roman period (146 BCE-330 CE), the rest are dated to the Hellenistic period (323-146 BCE). Additionally, two rooms (3rd century BCE), part of another Roman period *stoa* and a large Roman industrial complex were excavated in the southeast part of the *agora* (Lolos 2017, 2019).

The archaeobotanical material

The excavations of both the plain and the plateau of Sikyon provided 169 complete charred olive stones which are the subject of the present study (Table 1). Contexts excavated in five trenches on the plain (3A, 4B, 7C, 8A and 9B) provided 65 olive stones, dated mostly to the Classical period and from various contexts (Fig. 2). The nature of the contexts varies, so context 3.21 (context 21 from Field 3) was a domestic deposit originating from the interior of Room I excavated in Field 3 in Trench 3A and is dated to the Classical period. Two contexts (4.017 and 4.108), excavated in Trench 4A, represent the inner fill of a water channel. In the same Field, in Trench 4B, context 4.39 was a fill between two walls, 4.8 and 4.14, which does not seem to belong to the same building, but instead formed an outdoor space. Contexts 4.94, 4.98, 4.105, 4.106 and 4.109 from Trench 4B were correlated with a partially revealed structure (4.96) dated to the Classical period. One context (7.187) excavated in Trench 7C is associated with burial activities dated to the Hellenistic period. In Field 8, in Trench 8A, contexts 8.10, 8.34 and 8.39 are dated to the Roman period and are associated with a *pithos* (large storage jar) found in the southern part of the trench. Context 8.34 is associated with the discovery of the *pithos*; contexts 8.10 and 8.39 are its foundation layers. Finally, context 9.62 is a fill in Field 9 (Trench 9B), dated to the Classical period which is interpreted as a votive offering for religious purposes which was found in the southeastern area of the trench, and it is related to a cobbled floor (9.92).

The excavation on the plateau produced 104 olive stones (Fig. 3). Specifically, in the *agora* of Sikyon, contexts rich in olive stones are limited to those related to kilns and workshop areas, which cover a timespan from roughly 100 to 400/500 CE. The contexts that yielded olive stones are grouped into two categories according to their date. The contexts close to the kiln (1577), dated to the late 1st to early 2nd century CE, are mainly of ash. Context 1581 is an ashy

Fig. 1 Satellite image showing the location of Sikyon beside the Gulf of Corinth (image from ArcGIS)

Table 1 Archaeological contexts where the olive stones were excavated

Area	Context	Date	Type of context
Plain	3.21	C	Domestic deposit interior of Room I
Plain	4.39	C	Fill between structures 4.8–4.14
Plain	4.94	C	Deposit west of structure 4.96
Plain	4.98	C	Levelling fill
Plain	4.105	C	Levelling layer
Plain	4.106	C-EH	Levelling fill 4.98 = 4.106
Plain	4.107	C-EH	Fill of water channel with refuse material
Plain	4.108	C-EH	Fill of water channel with refuse material
Plain	4.109	C	Deposit above flattened bedrock and west of a structure (4.96)
Plain	9.62	C	Offering deposit
Plain	7.187	H	Burial
Plateau	1599	R	Fill of a pit
Plateau	566	LR	Fill
Plateau	1581	R	North of kiln 1577
Plateau	1585	R	Around kiln 1577
Plateau	1586	R	Around kiln 1577
Plateau	1587	R	Around kiln 1577
Plateau	1590	R	Interior of kiln 1577
Plateau	1595	R	Deposit related to workshop activities
Plain	8.1	R	Levelling fill for foundation of *pithos* (storage jar)
Plain	8.34	R	Discovery of *pithos*
Plain	8.39	R	Stabilizing layer of *pithos* foundation

layer located north of the smaller pottery kiln (1577), which is in the south part of the pottery workshop area. Contexts 1585–1587 are from the area around the kiln (1577), while context 1590 is from inside the same kiln. The following contexts, dated to the 5th/6th century CE contexts, are 566 which represents a fill or deposit excavated in a complex of rooms dug in the northern part of the workshop area and south of the Hellenistic *stoa*. Context 1595 is from a trench in the southern part of the pottery workshop area, while 599 is the fill of a pit in the area between contexts 1585–1587 and 1595.

Morphometric analyses

The analysis of the shape variation of the olive stones was based on the outlines of the two halves (valves) of the stones, following a method developed and improved in previous studies (Terral et al. 2004, 2021; Newton et al. 2006, 2014; Bourgeon et al. 2018). Each olive stone consists of two joined halves (valves), one (fertile) slightly larger than the other (sterile).

To record the outlines of the olive stones, they were photographed in two views, dorsal and lateral, the latter facing the joint between the two halves. Then the background of each image was removed and it was converted into a black silhouette on a white background. The silhouette (x, y) outlines were digitised and then analysed, using Momocs v. 1.3.2 for measuring the shapes of the stone outlines quantitatively (Bonhomme et al. 2014) in the R v. 4.0.5 statistical software environment (R Core Team 2021). We used the reference line method (Bookstein 1991; Terral et al. 2004) for the outlines analysis: two reference points (landmarks) were manually positioned at the base (B) and the apex (A) of each image, in both lateral and dorsal views (Fig. 4a). The outline was oriented along the x-axis using those two landmarks, with B (x=-0.5; y = 0) and A (x = 0.5; y = 0) (Fig. 4b.). This method both standardizes the outline size of the olive stones and also divides them into two open curves (half-outlines) for each half (valve) of the fruitstone (Fig. 4c), resulting in four half-outlines from each olive stone. Each half-outline was oriented in the same way and aligned along the axis defined by the base and the apex. Twenty equidistant points along the curvilinear abscissa of each half-outline were sampled, including the base and the apex. The (x, y) coordinates of these points were then adjusted using a third order orthogonal (or Legendre's) polynomial regression to examine the relationship between x and y (Terral et al. 2021). Each stone was thus described by 16 shape variables (four per half-outline) corresponding to the polynomial coefficients, and then treated as quantitative variables in multivariate analyses.

Statistical analyses

The two groups of samples, the Classical ones (from the plain) and the Hellenistic and Roman ones (mainly from the plateau), were compared to the shape differentiation model of modern olive stones defined by Bourgeon et al. (2018) combining two analyses, linear discriminant analysis (LDA) and a hierarchical cluster analysis using the unweighted pair group method with arithmetic mean (UPGMA). This was established from a modern reference collection of olive stones from 15 wild populations and 42 cultivars from several regions around the Mediterranean basin, within which morphotypes were identified. The archaeological olive stones could then be assigned to these morphotypes by using linear discriminant analysis (LDA), which had previously been trained on the reference collection, to analyse their shape variables. Olive stones assigned to a particular morphotype with a posterior probability ≥ 0.75 were retained.

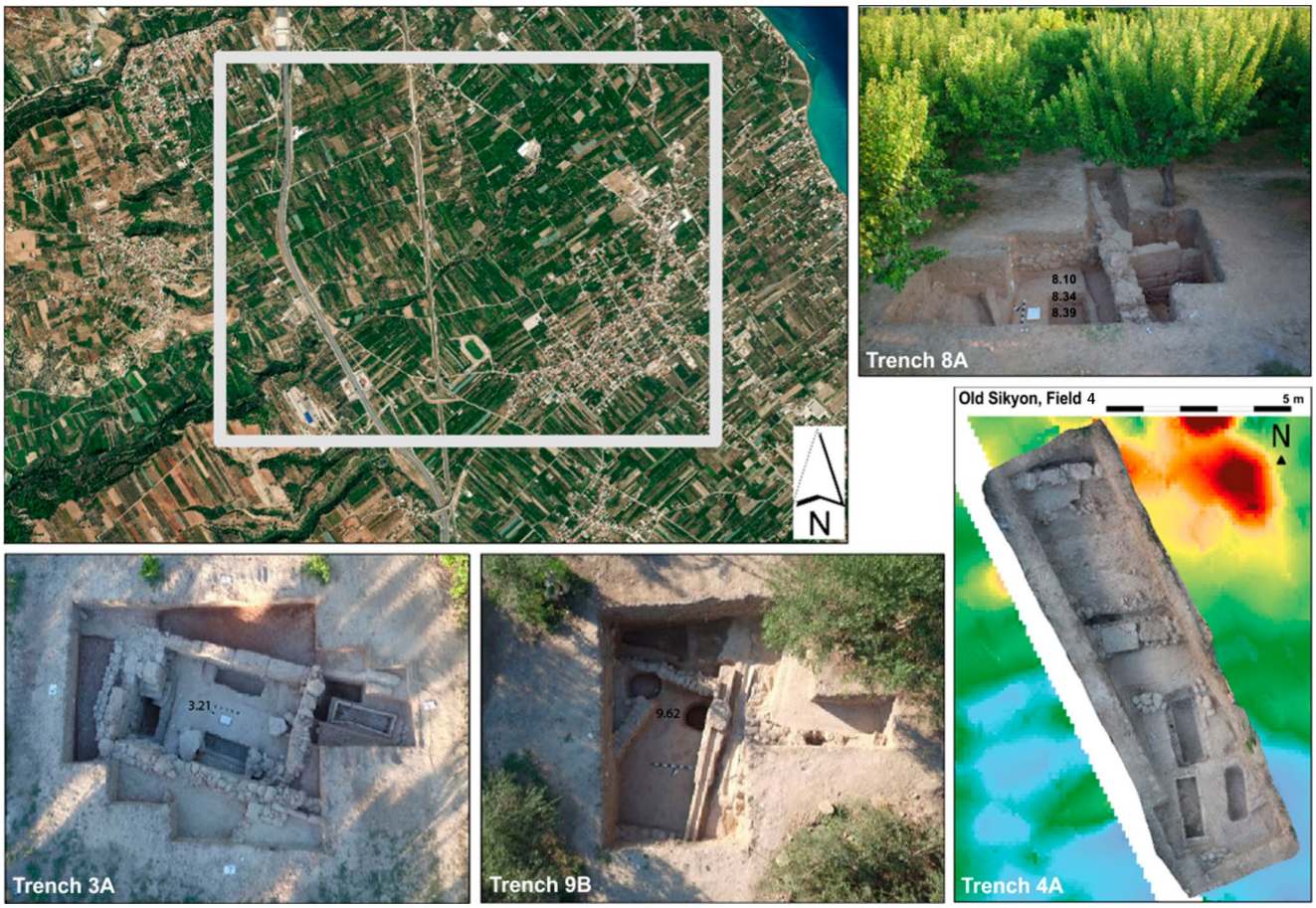

Fig. 2 Top left, satellite image of the plain; top right and below, trenches 8A, 3A, 9B and 4A from which complete olive stones were obtained. (Images from ArcGISPro; trench images are courtesy of the "Old Sikyon Project")

In addition, the morphotype definition by the LDA of olive stones with an intermediate shape between two morphotypes was also considered, on the condition that the "posterior probability" (P) of an olive stone to two morphotypes, MTa and MTb, having the highest and the second highest posterior probabilities, is: $P_{MTa}+P_{MTb} \geq 0.75$ and $P_{MTa}/2 \leq P_{MTb} \leq P_{MTa}$ so that P_{MTb} is not too low.

Results

Sixty-three archaeological olive stones were allocated by the LDA to modern morphotypes (Tables 2 and 3). In addition, 37 stones were close to intermediate forms. In particular, among the Classical olive stones, 17% (N = 11) were mainly allocated to MT5.3 which is considered to be a Greek morphotype, as it corresponds to a group of modern varieties from Greece (Bourgeon et al. 2018). Six olive stones, 9% of the same assemblage, were classified as MT2, which represents wild olive populations (Bourgeon et al. 2018). The Mediterranean morphotype MT5.2 which includes olives of various origins in the Mediterranean basin (Bourgeon et al. 2018) is represented by 8% (N = 5) of the olive stones from the plain. Four of the Classical olive stones (6%) from the plain were allocated to MT3, which corresponds to a group of olive varieties originating in the Levant which are used for extracting olive oil (Bourgeon et al. 2018). A small number of stones were classified as the intermediate types MT5.3-5.1 (5%, N = 3) and 5.3–5.2 (6%, N = 4).

The predominant morphotype in the Roman samples corresponds to MT5.3 (in 14%, N = 15). MT5.1 is also represented, with 5% (N = 5), mostly from the samples from the plateau but it is not represented among the Classical period stones from the plain. MT2 and MT3 are rare in Roman assemblages, but there were more in the Classical material. Among the intermediate forms, MT 5.3-MT5.2 is the most abundant (10%, N = 10), followed by MT5.3-5.1 (4%, N = 4). MT6, 7 and 10 are represented by only one olive stone in each assemblage, and no archaeological material was allocated to the other morphotypes.

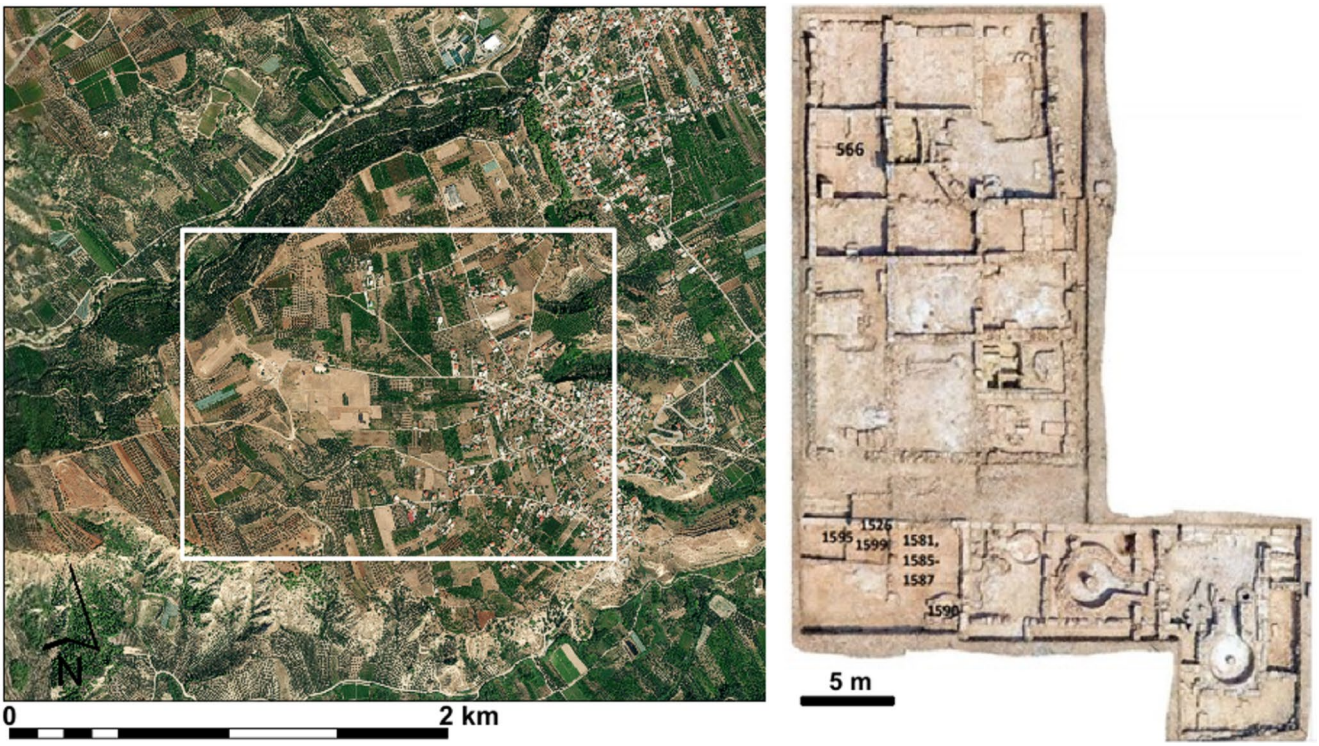

Fig. 3 Left, satellite image of the plateau; right, photo of the industrial complex where the kiln (1577) and the workshop area were. Photo from Lolos (2019, Plan 2, p 113)

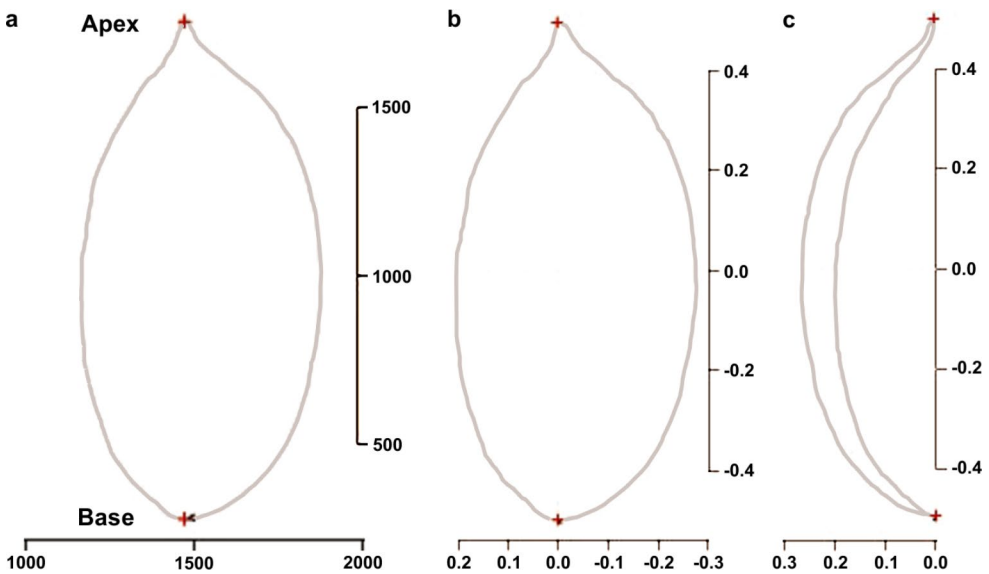

Fig. 4 The steps of morphometric data acquisition from the olive stones; **a** outline of the olive stone with smaller sterile half-stone on the left, division between the two halves in the middle and larger fertile half-stone on the right; red crosses, reference points (landmark) at apex and base; **b** size definition (standardization) of the outline on the x axis (A to B) between − 0.5 and 0.5; **c**, superimposition of the fertile and sterile half-stone (valve) outlines

Discussion

The olive stones came from various contexts and chronological phases at Sikyon. Those from the Classical period came from a partially excavated building with very rough walls of large blocks and mortar, which was probably erected in the 5th or first half of the 4th century BCE and presumably represents a grave monument or precinct, or else it belonged to a cult of deities; some stones are also from burials, water channels, offering deposits and fills. The Roman olive stones came from an industrial building complex in which kilns were located, and also from contexts associated with a *pithos*. Although the material under study is only from certain chronological phases and contexts, it does show the significant role of olives in the region throughout the Classical, early Hellenistic and Roman periods. Their presence in various contexts ranging from domestic to ritual and funerary, especially on the plain, indicates the importance of olives

Table 2 Amounts and percentages of the various olive stone morphotypes detected by the UPGMA cluster analysis (Bourgeon et al. 2018) from the two periods

Morphotype	Plain (Classical to early Hellenistic period)	Plateau (Roman period)	Total
MT1		1 (1%)	
MT2	6 (9%)	3 (3%)	
MT3	4 (6%)	1 (1%)	
MT4	2 (3%)	2 (2%)	
MT5.1		5 (5%)	
MT5.2	5 (8%)	4 (4%)	
MT5.3	11 (17%)	15 (14%)	
MT6	1 (2%)	1 (1%)	
MT7		1 (1%)	
MT10		1 (1%)	
Total classified as MT	29 (45%)	34 (33%)	63 (37%)
Total nr of individuals	65	104	169

Table 3 Main intermediate morphotypes of olive stones

Morphotype	Plain (Classical to early Hellenistic period)	Plateau (Roman period)	Total
MT5.3-MT5.2	4 (6%)	10 (10%)	
MT5.3-MT5.1	3 (5%)	4 (4%)	
MT5.3-MT4	2 (3%)	1 (1%)	
MT5.3-MT3		2 (2%)	
MT3-MT4	1 (2%)	1 (1%)	
MT5.1-MT2		2 (2%)	
MT5.1-MT3		2 (2%)	
Total classified as intermediate form	12 (18%)	25 (24%)	37 (22%)
Total nr of individuals	65	104	169

compared to other fruits such as grapes and figs in Sikyon (Tsirtsi 2022).

Our results suggest the local cultivation of several varieties of olive trees in the area of Sikyon.

Our reference collection is made up of 15 wild populations and 42 cultivars. Although it is small compared to the large number of named varieties (+2,000), the cultivars in our collection are representative not only of the diversity of olive varieties in the Mediterranean basin but also of the varied morphology of the stones, including small and large ones, with various shapes ranging from rounded to tapered, from symmetrical to asymmetrical. It should be noted that among the 2,000 named varieties, there are many synonymies or somatic variants (Besnard et al. 2001, 2011, 2018), so the number of distinct varieties may be fewer than that.

Moreover, our reference collection represents particularly well the diversity of olive varieties in Greece, whose origins (biological and chrono-cultural) are at the heart of this study. In the following text, we propose some interpretation of the results of the morphometric analyses. However,

Table 4 List of olive stone morphotypes and the corresponding olive varieties, wild populations (in italics) and cultivated varieties

Morphotype	Cultivar or wild population
MT1	Tanche (France), Teffahi (Syria)
MT2	*Jbel Zagwan (Tunisia), Desfina (Greece), Pylos (Greece), Slunfeh (Syria), Bucakkişle (Turkey), Moulay Bouazza (Morocco), Drasi (Greece)*, Arbequina (Spain)
MT3	*Viggianello (France)*, Istanbouli (Syria), *Aradena (Greece)*, Koroneiki (Greece), Psilolia (Greece), Picholine marocaine (Morocco), Lefkara (Cyprus), Athalassa (Cyprus)
MT4	Sourani (Syria), Bella di Spagna (Italy), Jlott (Syria), *Caldane (France)*, Picual (Spain)
MT5.1	Mesmouda (Morocco), Chemlali Chouamekh (Tunisia), Tlata Tagram (Morocco), Cypressino (Italy), Drobnica (Croatia), Besbessi (Tunisia), Tawil (Lebanon), Grappola (Italy), Cailletier (France)
MT5.2	Manzanilla (Spain), Grossane (France), Verdale de l'Hérault (France), *Ile Rousse (France)*, Zaity (Syria)
MT5.3	*Menzel Bourguiba (Tunisia)*, Mavrolia (Greece), Amphissa (Greece), Ecijano (Spain), Rkhami (Tunisia), Meski (Tunisia), *Cabo de San Antonio (Spain)*, Aglandau (France), Kalamata (Greece), Carolia (Greece), Lastovka (Croatia), Chondrolia (Greece), Megaritiko (Greece), Manaki (Greece)
MT6	Olivière (France)
MT7	Meslala (Morocco)
MT8	Aletrico (Cyprus)
MT9	Corniale (France), Abou Chawkeh (Lebanon)
MT10	Gaidouriola (Greece)

the conclusions reached show that an enlargement of the existing reference collection and also the study of new archaeological samples should form the objective of future research.

One morphotype, MT5.3, is the most abundant from both the Classical and Roman periods, and it is also represented in the intermediate forms of this morphotype as well as MT5.1 and MT5.2. These represent several cultivars from various regions, and in particular from Greece (Table 4). MT5.3 is present in Greece from the Bronze Age, and its cultivation is first known from the Roman period (Pagnoux 2016; Margaritis and Pagnoux 2020; Margaritis et al. 2021). It probably corresponds to olive types grown in the Aegean area since the beginning of olive cultivation in this region. On the basis of the limited morphometric studies from elsewhere, this morphotype is almost absent from Roman Las Delicias, Spain (Bourgeon et al. 2018) and absent from Neolithic Hishuley Carmel, Israel (Terral et al. 2021).

Although evidence is still scarce, MT5.3 seems to correspond to an olive type which was widely cultivated in the Aegean. Molecular analyses support the hypothesis of a secondary domestication centre for the olive which would have

involved both local wild olives and cultivated ones brought in from the supposed primary centre of domestication in the Levant (Besnard et al. 2013, 2018). Although analyses of further material would be needed to test this hypothesis, the Aegean could have been a secondary centre of olive domestication and diversification, since its cultivation there began as early as the Late Neolithic period (Valamoti et al. 2018; Langgut et al. 2019) or the Early Bronze Age (Bottema and Sarpaki 2003) according to pollen evidence, while charcoal remains suggest olive management from the Early Bronze Age onwards (Asouti 2003; Sarpaki and Asouti 2008; Ntinou 2013). Evidence of the use of the wild olives has not been found, but the presence of MT5.3 in most analysed assemblages from the Aegean is a first piece of evidence supporting the development of cultivated olive varieties in this area.

The presence of MT5.3 in Sikyon during both Classical and Roman periods may reflect some continuity in the use of olive varieties. The intermediate forms represented by MT5.3, which are numerous in assemblages from both periods, could indicate the use of other olive types arising from crosses between forms of MT5.3 and other olives, wild or cultivated, native or introduced.

At Sikyon, the olives grown during the Classical period are represented by several morphotypes, while fewer were identified in the Roman assemblages. The Classical samples included MT5.3 and also MT2, MT3 and MT5.2. MT2 consists of roundish olive stones, including those of most of the wild populations in our reference collection, as well as from one modern type/variety from Spain, Arbequina which looks similar to a wild olive. Although MT2 is clearly distinct from other morphotypes, the change from wild to domesticated in olives is represented by a continuous variation in stone shape, from the small, rounded stones of the oleaster (wild olive) to the elongated and pointed stones of the cultivars (Bourgeon et al. 2018). The presence of this morphotype at Sikyon is unlikely to reflect just the gathering of wild olives, but it may indicate the use of oleasters. Indeed, wild olives were used for grafting, as mentioned by Theophrastus (*De Causis plantarum* I, 6, 10; Amigues 2003) and described by Pliny (*Naturalis Historia* XVII, 129; André 1964). In addition, ethnographic studies have shown that in Morocco and in Turkey, these practices still exist (Zohary et al. 2012; Aumeeruddy-Thomas et al. 2014). Wild olives may also be useful as pollinators (Aumeeruddy-Thomas et al. 2014; Moukhli 2017). The small, rounded stones may result from hybridization between wild and domesticated olives, either accidentally or done intentionally to improve varieties through the growing of olives from their fruitstones. The intermediate stone types identified in the archaeological assemblages may also reflect cross-breeding and ongoing selection, or other olive varieties which are not included in our modern reference collection.

The MT2 olive stones may be from varieties close to the wild type and grown for specific uses, as for example medicinal use, as found by ethnographic research in Morocco (Aumeeruddy-Thomas et al. 2014). Written sources from antiquity refer to an olive type different enough from the cultivated one to have its own name, which was used specifically for the making of perfumed oil (Theophrastus *De odoribus* 15; Hort 1926; Brun 2000, 2003; Amigues 2003; Pagnoux 2016). Although there have been few studies of olive stones from Hellenistic and Roman contexts in the Aegean so far, MT2 was one of the dominant morphotypes in Hellenistic Platania and Roman Eretria in Greece (Pagnoux 2016; Margaritis and Pagnoux 2020; Margaritis et al. 2021) and in Roman southern Spain (Bourgeon et al. 2018), which may indicate the use of various types of olives for particular purposes.

Moreover, and to support this hypothesis, other morphotypes are present from the Classical contexts such as MT5.2 which represents olive varieties from various parts of the Mediterranean and MT3, which represents ones mainly used for oil. These morphotypes are rare in the few other Hellenistic contexts studied, except in one sample from Platania (Margaritis et al. 2021), dominated by MT5.2. They are also rare in Roman contexts in the Aegean as shown by this study and by the Roman olive stones from Eretria (Margaritis and Pagnoux 2020). However, at Roman Las Delicias, Spain, MT3 was more frequent, and this may reflect a preference there for olives with a high oil content for oil to export (Bourgeon et al. 2018). The scarcity of MT3 in Classical, Hellenistic and Roman material from the Aegean region is perhaps related to other preferences, choices and selection practices, which have led to the cultivation of other varieties there. However, the analyses of new assemblages from both the western Mediterranean and the Aegean regions may provide further information on olive diversity. All the ideas proposed here remain as hypotheses.

The most common morphotype in the Roman samples is MT5.3 (14%), to which we can add the intermediate type MT5.2-MT5.3 (10%). This shift towards one dominant morphotype may indicate a more specialized Roman olive growing which concentrated on fewer varieties in the region.

In addition, a new morphotype, MT5.1, was identified from Roman Sikyon. This represents varieties mostly from western Europe, but whose distant origins are considered to be eastern (Besnard et al. 2013). These cultivars perhaps result from selection and diversification in these regions since the 1st millennium BCE. MT5.1 was the most common morphotype identified from Roman Eretria, Euboea (Margaritis and Pagnoux 2020), as well as Roman Las Delicias,

and one can suggest that one or more varieties close to this morphotype developed during Roman times, under selection pressure from a search for better olives for producing oil, which was in great demand then. However, other morphotypes were also found from Roman Sikyon, showing that several olive varieties were grown then, even if fewer than during the Classical period. In addition, although part of the Roman olive growing was probably for oil to trade, we should consider that some of the yield may have been used for other purposes such as olives to eat, for perfumed oil, lighting, etc.

The growing of several olive varieties from the 5th century BCE to the first centuries CE at Sikyon was perhaps part of a strategy to limit the effects of pest attack or unfavourable climatic conditions and to favour cross-pollination, in order to ensure sufficient yields. The same pattern is observed at other sites dated from around 500-100 BCE from which olive stones have been analysed, and even during Roman times when specialized olive growing may have begun, many varieties were grown although there is a trend towards fewer through time, as at Roman Sikyon, the first site allowing the analysis of changes in assemblages of olive stones through time.

Conclusions

Regardless of the limitations of the evidence, our results from Sikyon show a great richness of cultivated olive varieties combined with the possibility that some which were good for producing oil or with other useful properties were grown there. The most common morphotype MT5.3 was present from around 500 BCE to 500 CE which suggests its enduring cultivation in the region. It was grown in Greece since the Bronze Age and its presence at Sikyon could reflect its extensive cultivation, suitable local conditions such as climate and soil quality, and availability of that particular type. The presence of various other morphotypes, found here for the first time, probably indicates that these varieties were also grown at this time, probably to ensure good yields to supply daily needs for olives to eat and for oil for cooking, cosmetics and medicines or even for lighting and fuel.

The overall results of this study and the conclusions that can be drawn from them reflect the current state of research, which may be challenged by future data and analyses. Future improvements to the morphometric method, and also to the development of the reference collection, as well as new archaeological data, will probably provide further evidence on the history of cultivated olives in the Mediterranean.

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