ARCHÆO PLUS

Akten des 17. Österreichischen Archäologentages

am Fachbereich Altertumswissenschaften,
Klassische und Frühägäische Archäologie der Universität Salzburg
vom 26. bis 28. Februar 2018

Herausgegeben von

Lydia Berger – Lisa Huber – Felix Lang – Jörg Weilhartner

ARCHÆO Plus

Schriften zur Archäologie und Archäometrie
der Paris Lodron Universität Salzburg 11

Herausgeber der ArchaeoPlus-Reihe:

Jan Cemper-Kiesslich
Volker Höck
Felix Lang
Alexander Sokolicek
Stefan Traxler
Edith Tutsch-Bauer
Christian Uhlir
Michael Unterwurzacher
Wolfgang Wohlmayr (†)

Akten des 17. Österreichischen Archäologentages

am Fachbereich Altertumswissenschaften,

Klassische und Frühägäische Archäologie

der Universität Salzburg

vom 26. bis 28. Februar 2018

Herausgegeben von

Lydia Berger – Lisa Huber – Felix Lang – Jörg Weilhartner

Salzburg 2020

Mit freundlicher Unterstützung von

Stiftungs- und Förderungsgesellschaft
Fachbereich Altertumswissenschaften

Land Salzburg – Wissenschaft

Stadt Salzburg

TuBa Privatstiftung

Impressum

ArchaeoPlus. Schriften zur Archäologie und Archäometrie der Paris Lodron Universität Salzburg 11

Herausgegeben von
Lydia Berger, Lisa Huber, Felix Lang, Jörg Weilhartner

Salzburg 2020

ISBN 978-3-9504667-1-3

Im Eigenverlag: c/o Universität Salzburg, Fachbereich Altertumswissenschaften, Residenzplatz 1, 5020 Salzburg, Österreich.
Tel.: +43-(0)662-8044 4550, archaeometrie@sbg.ac.at, www.archaeoplus.sbg.ac.at

Für den Inhalt der Beiträge und die Einholung von Bildrechten sind die Autorinnen und Autoren verantwortlich.

Redaktion: Lydia Berger, Lisa Huber, Felix Lang, Jörg Weilhartner

Satz: Felix Lang

Layout: David Wilhelm

Umschlag Vorderseite: Salzburg, Festung Hohensalzburg vom Kapuzinerberg. Foto: S. Weilhartner.

Frontispiz: Salzburg, Residenzplatz mit Alter Residenz und Dom. Foto: M. Del-Negro.

Druck: Druck.at

Inhaltsverzeichnis

Im Gedenken an Wolfgang Wohlmayr
(14. 8. 1959–22. 11. 2018)

Evidence for a destruction of a LH IIA building at Aegina Kolonna and its macrobotanical remains

Lydia Berger – Angeliki Karathanou

Since the beginning of archaeological research at Aegina Kolonna, investigations have focused repeatedly on the area east of the Temple of Apollo (fig. 1). An almost complete excavation of the prehistoric Eastern Suburbs was finally achieved by H. Walter in the 1980s[1]. However, only a little information about this is known and merely a selection of the more eminent finds was stored. No detailed report nor documentation of these previous investigations has been published. Further, the uncovered architectural remains are progressively becoming endangered by erosion and vegetation. Therefore, a new plan is projected: not only for wall restoration, but also for the backfilling of the chambers to protect the foundation of the walls[2]. Prior to this backfilling, remaining parts in the Eastern Suburbs, not excavated previously, will be stratigraphically investigated in detail. These archaeological investigations, combined with various archaeometric studies, will help to clarify the less known stratigraphical sequence of the Late Bronze Age settlement in the East.

In this paper, a report on the recent excavation in chamber K10 in the Outer Suburb and first results of the study of its charred macrobotanical remains will be presented. Within the context of a partly burned LH IIA construction the material provides a rare opportunity to investigate the botanic evidence regarding agricultural practice and plant use processing in an Early Mycenaean settlement.

Excavation in chamber K10 in 2015 to 2017

The area of the Outer Suburb in the northeast of the prehistoric settlement is characterized by narrow chambers (approximately 1.8 × 1.5 to 4 m), attached to the eastern side of the fortification wall of the Inner Suburb (fig. 2: phases orange to green). The architecture of the Outer Suburb differs structurally from the older house-constructions in the Inner Suburb, which are formed in units of two to four rooms (fig. 2: phases blue to pink). The difference may be the result of a different function played by the chambers in the Outer Suburb, maybe as storerooms or work areas.

The new investigations focus on chamber K10 (figs. 3–4), where previous excavations stopped at about level 12.90 m asl. Chamber K10 is located east of the fortification wall of the Inner Suburb but is not attached to the latter and it is distinct from the narrow chambers seen in the north. It is surrounded by walls from different phases, which form the currently visible small chamber, which probably came into being in a rather late phase of the Late Bronze Age settlement[3]. At the beginning of the Late Helladic period (LH I, LH IIA) the small chamber did not exist: just the eastern wall M197[4] that belongs to the early construction (fig. 2: orange phase). The three walls to the south, west, and north, M217, M176 and M175[5], date to LH IIA or later phases.

[1] Overview of research history: Gauß 1999, 27–29; Sporn et al. 2017, 81–85 figs. 1–3. Excavation reports: Stais 1895, 235–253 figs. 1–3; Welter 1925, 317–321 figs. 3–5; Wolters 1925a, 47; Wolters 1925b, 4–9 with fig. 1; Welter 1926, 432; Welter – Wolters 1926; Welter 1938, 11 fig. 9. On the Eastern Suburbs: Walter 1983, 131–141; Walter 1993, 11 fig. 9; Wohlmayr 1989; Wohlmayr 2000, 127 f.; Wohlmayr 2007, 45; Sporn et al. 2017, 88–90. 92–96; Wohlmayr 2017, 136–139.

[2] Beginning with the project "Mapping Aegina Kolonna" (directed by K. Sporn) in 2011, an annual surveying and mapping of the damaged architectural structures in the Eastern Suburbs is carried out by the architect A. Tanner from Zurich University. Based on a comprehensive scientific investigation of all of the architectural remains, an architectural restoration started in 2015, see Sporn et al. 2017, 89 f.; Wohlmayr et al. 2018, 483 f.

[3] See green phases on the schematic plan fig. 2.

[4] For the numbers of the walls, see fig. 4.

[5] Cf. lower level of M217 at 12.22 m asl, of M176 at 12.23 m asl, and of M175 at 12.75 m asl.

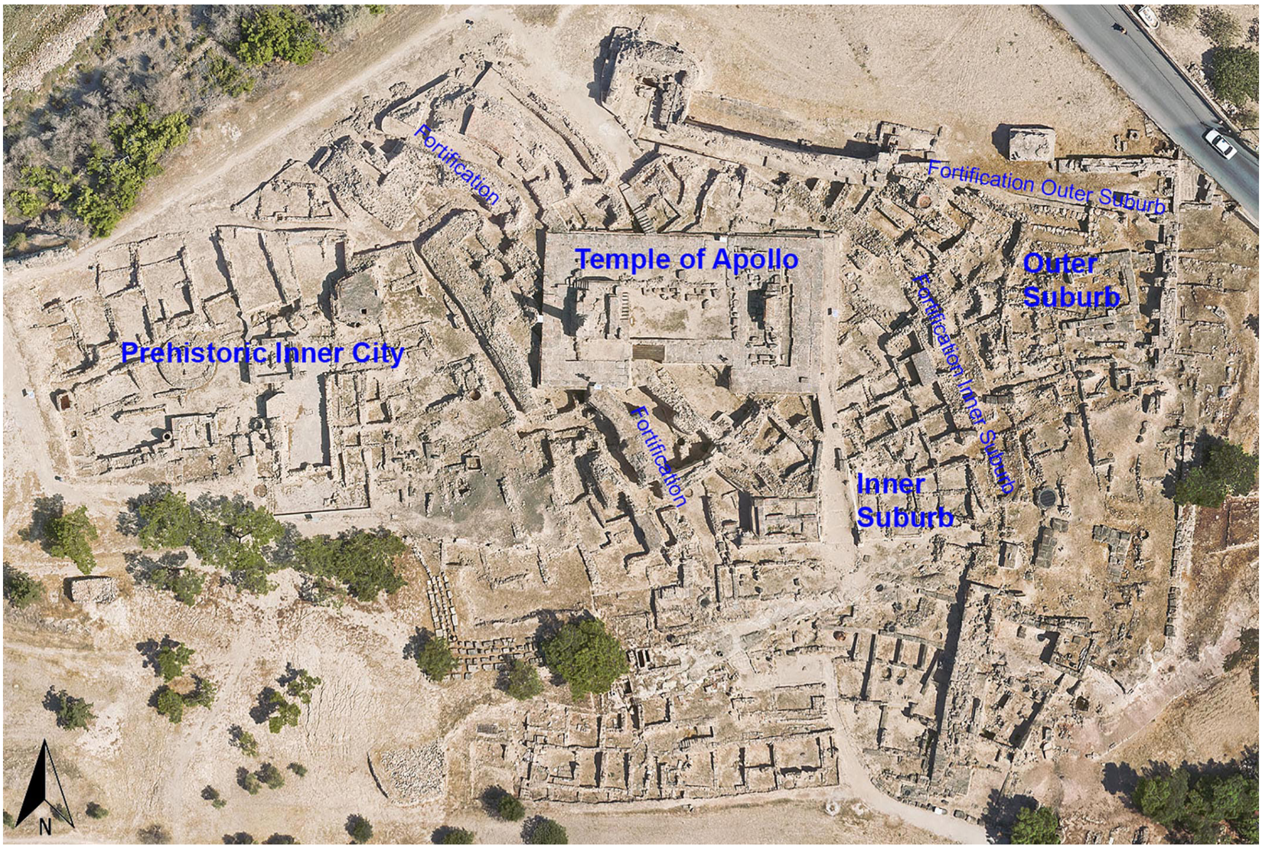

Fig. 1: Orthophoto of Aegina Kolonna 2012, central area (© FB Altertumswissenschaften/Klassische und Frühägäische Archäologie in cooperation with IFFB Geoinformatik-Z_GIS, Universität Salzburg).

In 2015, excavation in chamber K10 started in the eastern part[6]. Under the *uppermost deposit*, which covered especially the eastern area to a variable thickness, a *levelling layer* overlay a *destruction deposit* in the entire chamber K10. The reddish loamy soil of the levelling layer contained small and scattered pieces of marl, mud bricks, stones, small ceramic fragments of LH IIA/B date and very little charcoal. In large parts, the composition may derive from collapsed walls.

Underneath, the destruction deposit is built up of at least four main layers, which may reflect different temporal episodes of deposition and therefore a gradual process of formation of the destruction deposit. The destruction was accompanied by conflagration, indicated by a large amount of charcoal, charred timber and partly charred or burned bones and pottery fragments (fig. 5).

The west-section, running in north-south direction, in the centre of chamber K10 shows clearly destruction layers 1 to 3 (fig. 6; for the position of the section, see fig. 4). Generally, they are gently sloping down to the centre of K10, where a concentration of marl, lime and plaster fragments is evident.

Striking is *destruction layer 1* with its distinct layers of marl, ashes and greenish marly soil, with many (lying predominately horizontal) pen shells (Pinnidae)[7] and large pieces of charcoal. Immediately upon the marl layer, a large concentration of phytoliths of reeds was found[8]. The stratum may originate from a collapsed roof construction, which was made of timber and reeds, waterproofed with a thick layer of marl.

At the centre of chamber K10 in particular, in the lower parts of destruction layer 1 and in *destruction layer 2*, the loamy, partly sandy soil is mixed

[6] Wohlmayr 2017, 139 f.; Wohlmayr et al. 2018, 487–490.

[7] Pen shells could be used as food, as well as for the production of sea-silk yarn from their fine silk-like filaments (*byssus*), see Burke 2012.

[8] G. Tsartsidou analysed 18 samples, which she took from different layers in the central west-section of K10 (cf. west-section at fig. 6). The results of the study are summarized in her unpublished report of 2018.

Fig. 2: Schematic plan of the northeastern area of Aegina Kolonna with coloured marked architectural phases (K. Sporn and A. Tanner 2017, after Sporn et al. 2017, 95 fig. 15).

with a lot of large, partially upright pottery fragments, several obsidian (blades and flakes), pumice (also used as tools)[9], some loom weights and fragments of grinding stones, many bronze casting remnants, spills and slag[10], pieces of plaster and lime, sea urchins, molluscs, pen shells, a lot of bones and charcoal, stones and fragments of mud bricks (fig. 7). The ceramic fragments mostly come from unpainted coarse and medium-coarse cooking and storage vessels, but also from red solid-painted and pattern-painted vessels (matt painted and lustrous decorated) of the LH I and LH IIA periods (fig. 8). Numerous joining sherds from destruction layers 1 and 2 point to different phases of a gradual collapse and decay of the same construction[11].

The finds indicate that the structure existed within a domestic area with zones for specific activities. The selective samples taken for phytolith-analyses point at least to limited practices of agricultural procedures like threshing, winnowing, and grinding, as well as restricted storage, potentially on the top or in the upper floor of a building[12].

There are no linking elements, like joining sherds, between destruction layer 2 and the subjacent *destruction layer 3*, which came to light approximately at the level 12.20/30 m asl. It contained unconsolidated soil with randomly distributed fist-sized stones and several large, frequently horizontally lying, ceramic fragments from different

[9] One of the about fist-sized, naturally occurring pieces of pumice shows a flattened plane from grinding activities. For the use of pumice, especially for metalworking in the Minoan culture, see Evely 1993, 112.

[10] The area was obviously used as a dumping place for by-products of a nearby bronze foundry at a particular time. Cf. the ceramic fragment with a tiny bronze slag on the interior on fig. 8, 14.

[11] P. Karkanas analysed the micromorphology, microstratigraphy and microstructure of the central west-profile in K10. He took three blocks of sediments and studied thin sections of the blocks under a stereomicroscope. In his unpublished report of 2018, he points to similar results: the layer is "interpreted as fragments of calcareous construction material" and "the deposits are the results of gradual decay and accumulation after destruction of the original construction. There are several indications suggesting natural processes as the main agents responsible for the accumulation of the deposits in form of collapse, dry grain flow, debris flow, and rain-wash processes."

[12] After G. Tsartsidou (unpublished report), cf. note 8.

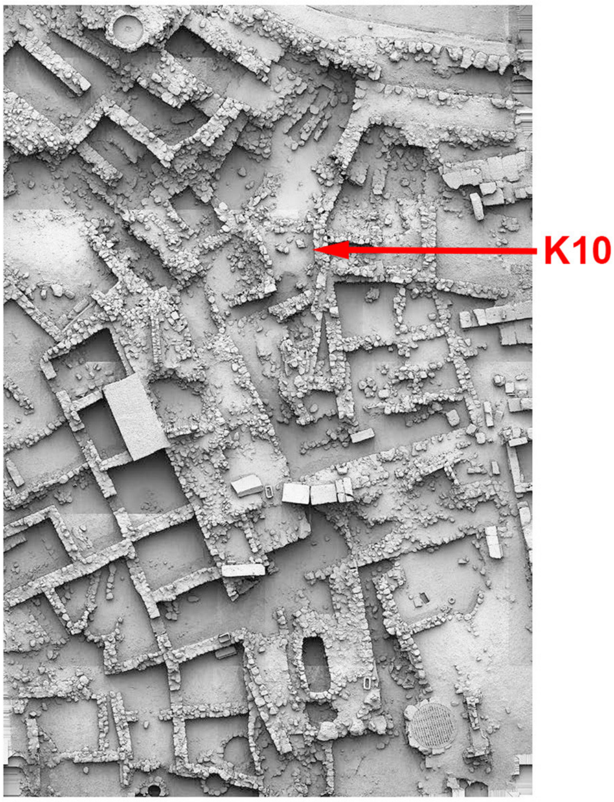

Fig. 3: Digital surface model of the Eastern Suburb of Aegina Kolonna 2012 (© FB Altertumswissenschaften/Klassische und Frühägäische Archäologie in cooperation with IFFB Geoinformatik-Z_GIS, Universität Salzburg).

vessels. Noticeable is the increased number of matt painted fragments in contrast to less lustrous decorated pottery. Underneath again, *destruction layer 4* is similar, but contains a huge amount of fist-sized stones, as well as large pieces of marl and lime (fig. 9). It is restricted to the northeastern, central and – to a degree – southwestern sections of chamber K10. Several specific finds in destruction layers 3 and 4 indicate the manufacturing of various products: ceramic fragments with purple-coloured pigments on the interior, as well as a small pit with crushed purple snail shells[13], grindstones, clay spools, as well as many fragments of obsidian.

In 2018, a multiphase tamped clay floor in the northern area and the remains of a stone structure to the south were investigated, lying under destruction layers 3 and 4. The stone structure may represent a retaining wall of a large podium or stairs leading to the higher area in the south. No specific installations for domestic or indeed craft activities, like a hearth, oven or a paved platform, have been located within K10.

Study of macrobotanical remains from the excavation in chamber K10 in 2015 to 2017

Methods

During the excavation in 2015–2017, a total of 118 soil samples were retrieved from chamber K10. Samples were collected in a systematic way from all excavated stratigraphical units, excluding those showing any profound disturbance[14]. Thus, the uppermost deposit and the four different destruction layers are represented by several different samples each, as also are individual burnt spots/ashy layers, possible floor or other surfaces, the interior of pots and a pit containing purple snail shells (mainly *Hexaplex trunculus*). The rather small average sample size (13.5 litres[15]) should not be considered problematic in terms of representativeness, as for the 70 samples where the relevant information was recorded, the majority (81.42 %) represented more than half of the excavated soil[16]. A total volume of 1595.6 litres was processed, sample by sample, in a simple flotation tank[17]. The floating light fraction bigger than 300 µm was collected in a pair of metal sieves, while heavy residues were retained in a mesh of 1 mm aperture.

The study of the macrobotanical remains from chamber K10 is still ongoing, but some preliminary results are available from the scanning of the light fraction of the samples (flots). Scanning is a step prior to sorting, adopted at the study of Kolonna mainly to facilitate prioritization of samples, as it provides a rough assessment of samples' contents and richness[18]. Coarse flots (> 1 mm) were inspect-

[13] See report in Wohlmayr 2017, 142 fig. 10; Wohlmayr et al. 2018, 489.

[14] One sample was collected from a possible pit in the northwest corner of K10 within the destruction layer 1 and another nine more from the same area but in lower depths corresponding to destruction layers 2 and 3. Stratigraphy and study of the finds (mostly pottery) from the "pit" proved that it actually represents some kind of disturbance, yet difficult to assess. Another sample from a 'fill' was also later proven to represent a disturbed deposit.

[15] Volumes ranged between 0.2 to 24 litres.

[16] Indeed, 80 % of those samples represented more than three-quarters of the total soil excavated.

[17] By 'simple', it is meant that neither froth nor chemicals were used to aid the floating of charred remains. In other words, water was the only agent used in our modified variant of the Ankara machine, constructed under the care of U. Thanheiser from the former Vienna Institute for Archaeological Science at the University of Vienna.

[18] This methodology is widely used among archaeobotanists to achieve rewarding numbers of sorted samples in the minimum time possible (cf. Valamoti 2004; Bogaard et al. 2013).

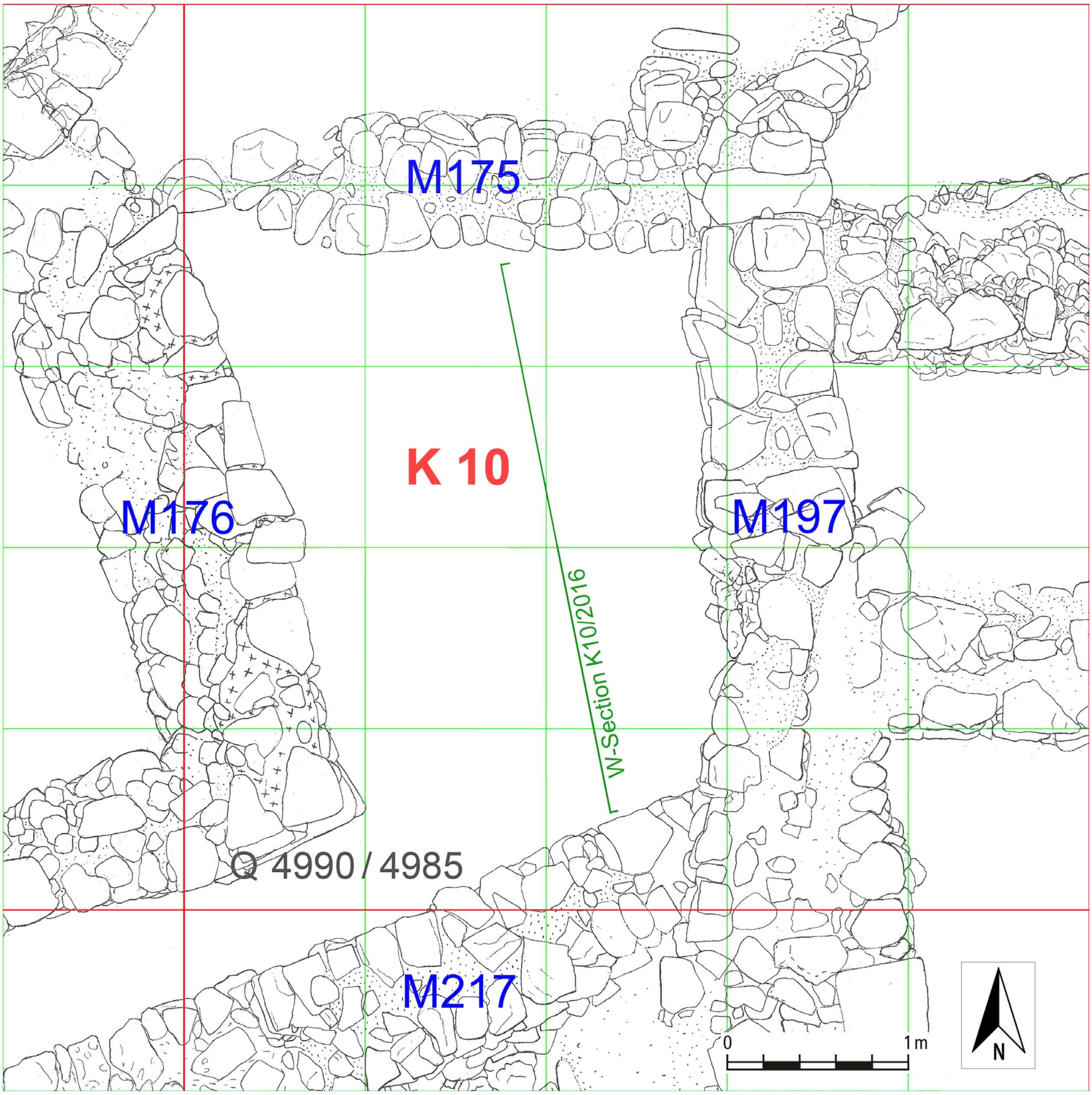

Fig. 4: Plan of chamber K10 with position of the west-section 2016 (© FB Altertumswissenschaften/Klassische und Frühägäische Archäologie, Universität Salzburg).

ed in their entirety using a stereoscope[19] and by naked eye for bigger remains. Fine flots were further divided with the additional use of a 500 µm aperture sieve before scanning. This fraction (> 500 µm) would be scanned at its entirety, if the sample quantity was equivalent to two teaspoonsful. If more than that, a spoonful of each sample would be examined after an adequate stirring/mixing of its contents, aiming thereby to achieve randomness of representation. One tea-spoonful of fine flots > 300 µm was examined in all cases. Based on observations of the scanned quantities, a rough estimation of the samples' contents was deduced. Sorting of useful samples has begun according to these scanning results. The 2018 excavation has added 24 more samples from the same area.

In the remaining sections, the plant species preliminary identified[20] up to now in the scanned samples will be summarily presented. Furthermore, some aspects of the samples' composition both in

[19] Achieved magnification ranging between X10 and X40.

[20] Identifications of cereals and pulses followed criteria summarized in Jacomet 2006 and in Valamoti – Kotzamani 2004/2005, while the open-access *Digital Seed Atlas* (<http://dzn.eldoc.ub.rug.nlhe> [18.01.2019]) was used for the wild species.

Fig. 5: Destruction layer 1 in the northeastern part of chamber K10 with charred timber, smashed pottery and charcoal in marl (photo: Grabung Aegina Kolonna 2015, FB Altertumswissenschaften/Klassische und Frühägäische Archäologie, Universität Salzburg).

terms of plant parts and species, and of their density/abundance, will be preliminarily discussed. This is undertaken not only to illustrate the uses of plants at Kolonna, but also to assist in the interpretation of chamber K10 through another line of evidence.

Overview of the plant assemblage

Four samples[21] produced only wood charcoal and no other kind of plant remains[22]. Excluding these four samples, all the rest contained also non-wood plant remains. In terms of the richness in the latter, samples can be classified as shown in the pie chart (fig. 10). *Substantial* and *rich* samples, containing more than 51 and 100 items respectively, comprise 50 % of the samples, while the other 50 % yielded *intermediate* and *poor* samples, containing less than 50 or even below 20 plant remains. All the different contexts sampled produced samples assigned to the four above-mentioned categories[23].

In the absence of absolute numbers in this preliminary stage of study, the precise density[24] of the samples from K10 cannot be calculated, but it is considered low even in the rich samples. Typically, the estimated density of the smallest (6 litre) rich sample (ca. 120 items) is provisionally calculated as only representing 20 items per litre of soil[25].

[21] Two of them from inside pots within destruction layer 1, one from the purple snail pit and another one from a levelling layer in the northwest part of the chamber.

[22] Regarding the tree species represented in the anthracological material and other relevant information, they cannot be further discussed here, being the object of a different study not yet under way.

[23] In other words, destruction layers have produced poor, medium, substantial and rich samples. The same is true for all other contexts, including the disturbed area in the northwest corner of chamber K10.

[24] Density of plant remains in the samples is a completely different parameter. For consistency reasons, it is usually calculated per litre of soil for each sample, and when combined with other features (i.e. sample composition and location) they can be revealing about the taphonomic processes that formed the archaeobotanical record (e.g. Van der Veen 2007).

[25] Truly dense assemblages feature a few thousands of items per litre of soil, e.g. the case of stored crops at Late Bronze Age Kynos and Ayios Vassileios, where severe conflagrations destroyed the excavated parts of the settlements *in situ* sealing stored caches of barley (Ayios Vassileios, Kynos) and broad beans (Kynos) in vessels and other installations (Karathanou accepted).

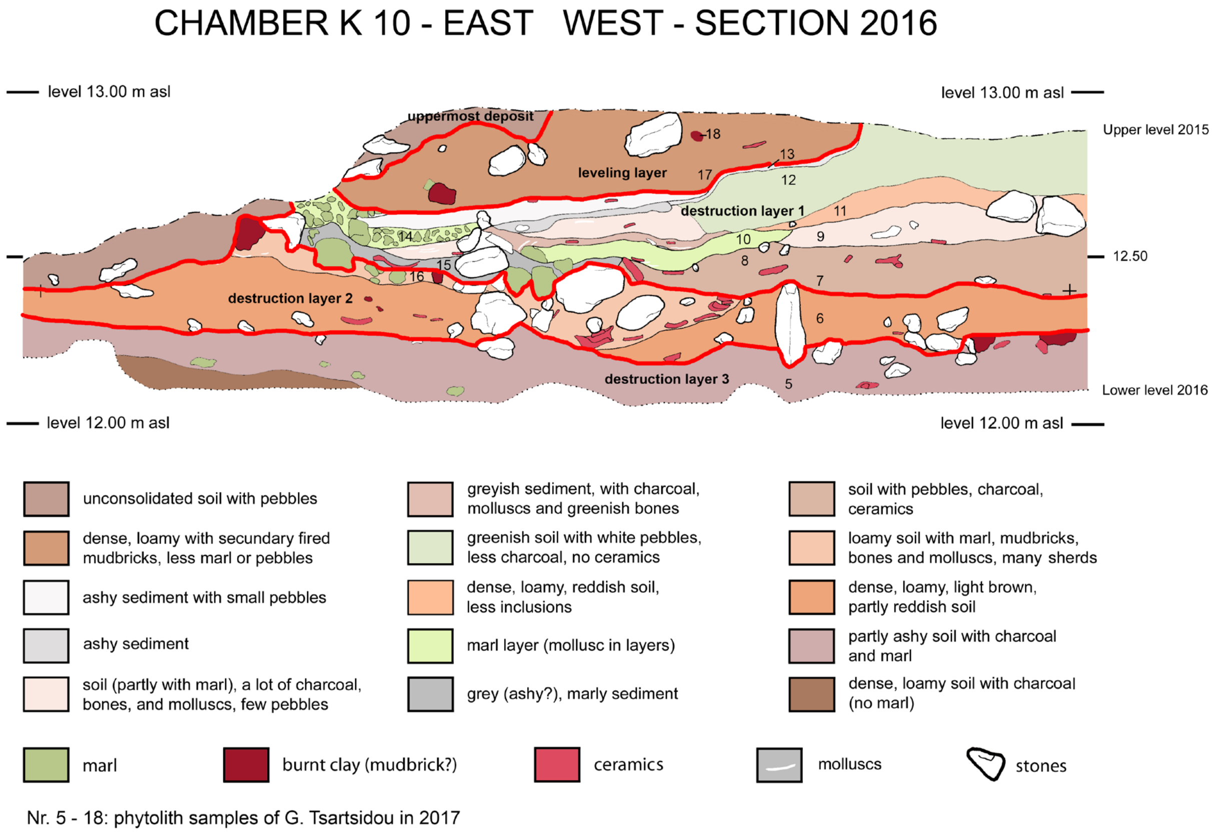

Fig. 6: West-section 2016 in the center of chamber K10, for the position see fig. 4 (© FB Altertumswissenschaften/Klassische und Frühägäische Archäologie, Universität Salzburg).

A minimum of 25 plant species, genera or families were attested: they comprise a variety of cereal, pulse, fruit/nut and other wild species. Among cereals, grains and chaff, namely glume bases and spikelet forks of einkorn (*Triticum monococcum*), emmer (*Triticum dicoccum*) and 'new type' (possibly *Triticum timopheevi*[26]) glume wheat were identified, as also were grains and rachises of the free-threshing bread/macaroni wheat (*Triticum aestivum/durum*) and barley (*Hordeum vulgare*). Careful inspection of barley remains allowed us to positively identify the presence of the hulled (*Hordeum vulgare* var. *vulgare*) and possibly of the naked (*Hordeum vulgare* var. *nudum*) variety too. Pulses were also attested, more precisely lentils (*Lens culinaris*), bitter vetch (*Vicia ervilia*), grass pea (*Lathyrus cicera/sativus*) and possibly pea (*Pisum sativum*). Olive stone fragments (*Olea europea*), grape pips (*Vitis vinifera*), fig (*Ficus carica*) seeds and fruit flesh parts were identified with certainty, while other nut stone or shell fragments still require closer examination. A variety of other wild species was also present, mostly representing the Graminae (e.g. *Lolium* sp., *Festuca* sp.), Boraginaceae (e.g. *Lithospermum* sp., *Echium* sp., *Alkanna* sp., *Heliotropium europaeum*), Fabaceae (e.g. *Trifolium/Melilotus* sp.), Amaranthaceae, and Caryophyllaceae families.

All the above are represented by generally low numbers of charred remains: the only exception, in all respects, being the fig. It is the only plant category ubiquitously attested in the samples so far, regardless of their composition, richness and density, and the most numerous with a total minimum of 2000 remains, of which the majority are preserved mineralized. These exhibit a whitish crystalline or semi-crystalline appearance because of the replacement of their organic features by calcium carbonate and phosphate[27].

In terms of plant composition, the rich and substantial samples are classified as such due to the dominant presence of fig seeds, though other plant species and parts are also present. The rest are characterized by a heterogeneous composition, comprising the different plant species and plant parts[28] in various low numbers and combinations.

[26] See Jones et al. 2000.

[27] Green 1979.

[28] Namely cereal grains and chaff, pulses, fruits/nuts, and other wild species.

Fig. 7: Destruction layer 2 in the southwestern part of chamber K10 with pottery, shells, charcoal, fragments of mudbricks, pieces of marl, plaster and lime, as well as stones (photo: Grabung Aegina Kolonna 2016, FB Altertumswissenschaften/ Klassische und Frühägäische Archäologie, Universität Salzburg).

Discussion

The relative importance and status of cereals and pulses as crops at the site are impossible to assess in this preliminary stage of study, and due to their limited presence. A greater importance should probably be attributed to wheat, judging by the most abundant wheat phytolith remains, as opposed to those of barley and dicot leaves[29], a fact demonstrating the necessity and significance of applying different techniques in the study of plant remains. It is worth noting that all cereals and pulses found in the Late Helladic chamber K10 are well known from other Mycenaean rural and palatial settlements[30], but also in the non-Mycenaean North[31] and the islands[32]. Most seem to have had a long history of use at the site, at least since the Early Bronze Age as previous research has shown[33], though new entries are also manifested in the studied assemblage, namely the 'new type' glume and the free-threshing wheat, as well as the grass pea. Husk phytoliths[34], recorded in large frequencies in many samples, imply that agricultural practices related to cereal seeds, such as threshing, winnowing and grinding, and possibly storage were performed most probably on site[35]. This is also inferred by the presence of charred cereal chaff in the samples from K10, suggesting that crop-processing activities such as parching, coarse and fine sieving[36] were indeed carried out in the settlement. During these procedures, grains would be freed from chaff, which subsequently became charred, being used for example as kindling, either on its own or as an ingredient of dung cakes, or even as a component of dung of animals fed with a chaff-based fodder[37].

The well-known triad, that of the vine, olive, and fig, was apparently favoured at Kolonna, as suggested by the finds there throughout the Bronze Age[38] and despite the scanty presence of the two former components in both studied assemblages. Fig, on the other hand, appears to be the most common of all species (including cereals and pulses) identified. Historically, it is renowned for its high nutritional value and beneficial effect in digestive function and bowel regularity[39]. Both qualities were presumably widely appreciated along with the fruit's ability to be easily converted into a long-term storable commodity, as suggested by the numerous caches of dried fruits recovered from Neolithic and Bronze Age sites all around the world, including the Aegean[40]. It is true that in chamber K10 no whole fig fruits were recovered, but A. Sarpaki[41] has suggested for the numerous mineralized fig seeds she has found in a LM IIIA house at Chania, that they may perhaps indicate remnants of dried figs. Though she clearly states that this possibility needs further research, the presence of few charred fragments identified as fig flesh parts in the assemblage from K10 may offer further evidence of such a possibility. Nonetheless, this state of preservation has also been linked to specific taphonomic environments featuring calcium carbonate and phosphate, such as cess pits, standing water or even naturally chemical-rich

29 After G. Tsartsidou (unpublished report), cf. note 8.
30 For example, Mycenae (Hillman 2011), Tiryns (Kroll 1982), Midea (Shay et al. 1998).
31 For example, at Assiros (Jones et al. 1986), Kastanas (Kroll 1983) and Ayios Mamas (Becker-Kroll 2008).
32 For example, at Akrotiri (Sarpaki – Asouti 2008), Chania (Sarpaki 2016) and elsewhere in Crete (Livarda – Kotzamani 2013).
33 Galik et al. 2013.
34 E.g. from the glumes covering the cereal grains.
35 After G. Tsartsidou (unpublished report), cf. note 8.
36 E.g. Hillman 1984, 1–41; Van der Veen 2007.
37 E.g. Anderson – Ertug-Yaras 1998.
38 Galik et al. 2013.
39 Bown 1995.
40 For an up-to-date synopsis regarding the finds from prehistoric Greece, see Valamoti 2009.
41 Sarpaki 2016.

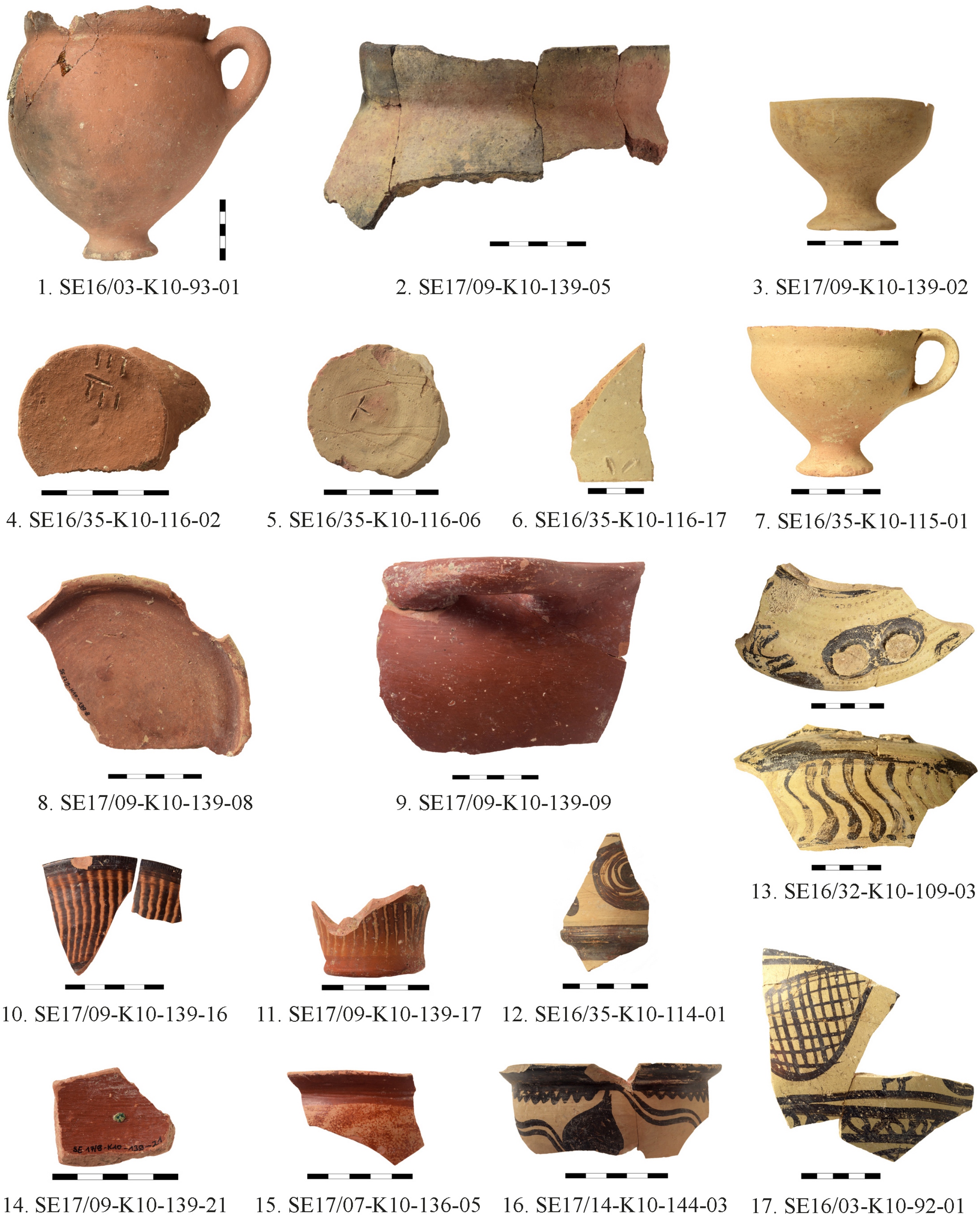

Fig. 8: Pottery from destruction layer 1 (2. 3. 8–11. 13–16) and 2 (1. 4–7. 12. 17): unpainted (1–7), solidly painted (8. 9. 14 with bronze slag), ripple pattern (10. 11), stipple pattern (15) and lustrous decorated (12. 13. 16. 17) (photo: Grabung Aegina Kolonna 2015, FB Altertumswissenschaften/Klassische und Frühägäische Archäologie, Universität Salzburg).

Fig. 9: Destruction layer 4 in the western part of chamber K10 with a lot of fist-sized stones, pottery, charcoal, marl, and lime (photo: Grabung Aegina Kolonna 2017, FB Altertumswissenschaften/Klassische und Frühägäische Archäologie, Universität Salzburg).

substrata[42]. Standing water does not seem an appropriate explanation for the dominant presence of figs generally[43] at Kolonna, according to the available stratigraphic evidence, but the other two possibilities need to be assessed, ideally in combination with micromorphological and geochemical data. Mineralized fig seeds could also indicate a potential use of space in the sampled areas within chamber K10 for the disposal of faecal materials. But such a scenario does not seem to be confirmed by the phytolith analysis, since no spheroulites at all were recorded in any of the eight sediment samples studied from K10 so far, thus indicating the absence of dung/ faecal material. Other taphonomic pathways should therefore be considered, for instance the alternative of a natural chemically rich substrata. The anthracological data will act as another excellent proxy in determining whether this strong presence is meaningful or misleading as regards the status of the fig tree at Aegina[44].

No contextual pattern seems to emerge from the available data, as regards sample composition, richness and density. This phenomenon should probably be related to the nature of the contexts themselves, representing as they do destruction layers, levelling and fills all apparently unrelated, within this area, to any kind of domestic activities associated with the use of fire, such as cereal processing and cooking. Such would account for the paucity of charred plant remains in the assemblage. Other factors, such as low preservation ability should most probably be excluded, considering that wheat glume bases, far more prone to complete destruction by fire compared to cereal grains and pulse seeds[45], are yet present within the remains. Rather, low density and heterogeneous samples are usually considered as indicators of secondary deposits containing, for example, discarded materials produced elsewhere (e.g. spent fuel, cooking accidents) or having been formed through various post- and/or depositional procedures and events (e.g. pit digging/levelling/filling and mixture during destruction). Such samples are also related to pre-depositional activities; thus certain cereal crop processing stages require the use of fire, while their by-products may purposefully be mixed with other materials, e.g. for fuel and/or fodder making. Based on the above, it is most probable that the plant remains recovered had got carbonized in any one of these circumstances, and were eventually accidentally entrapped in the deposits that filled the space in chamber K10. Of course, the ubiquitous presence of charcoal in the samples points to the fire that admittedly accompanied the destruction of chamber K10, causing indeed the carbonization of wooden objects and building materials, but not of other kinds of plant remains, such as *in situ* stored crops[46].

When the full archaeobotanical analysis of the Kolonna assemblage is completed, it will surely provide, in combination with detailed contextual analysis, valuable information regarding the exact formation processes of the archaeobotanical record, potentially revealing the various uses of plants at the site and the practices involving them. Furthermore, an exploration of husbandry regimes may be attempted, based on the wild flora recovered for the first time from Kolonna[47], thanks to the small aperture of the sieves used. For the time being, it can only be noted that many of the recovered wild seeds are considered arable/ruderal weeds, such as

[42] E.g. Jacomet – Kreuz 1999; Sarpaki 2016; Kotzamani – Livarda 2017.

[43] Mineralized figs were dominant throughout the Bronze Age layers according to the study of Galik et al. 2013.

[44] Considerable amounts of carbonized fig fruits have been found in Late Bronze Age storage contexts at Kakovatos (Eder 2012) and Ayia Triada (Follieri – Coccolini 1979).

[45] Boardman – Jones 1990.

[46] As before, note 23.

[47] As noted in Galik et al. 2013, "the samples were taken at the initial stages of the excavation in the late 1960s and 1970s, when sampling for archaeobotany was no common procedure, and they may have been sieved with a coarse mesh with a mesh size larger than 2 mm".

ryegrass (*Lolium* sp.), fescues (*Festuca* sp.), gromwell (*Lithospermum* sp.) and clover (*Trifolium/Melilotus* sp.), at least indirectly corroborating that subsistence here was indeed largely based on an agricultural economy.

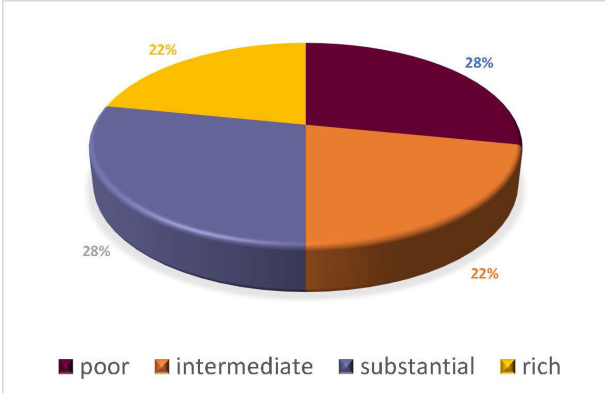

Fig. 10: Pie chart of the samples' abundancy in plant remains (A. Karathanou 2018).

Summary

In 2015–2017, the excavation of chamber K10 resulted in a detailed recovery of a destruction deposit from probably two LH IIA buildings (destruction layers 1 and 2 represent the younger and destruction layers 3 and 4 the older one). The layers and several accumulations indicate a gradual course of decay and a long-term process of formation of the destruction deposit in different temporal episodes. Within the layers, there is strong evidence of a collapsed roof construction, but the existence of a proved upper floor is still problematic. The original location and extent of the buildings are not evident. Just the preserved eastern wall was probably contemporaneous with the building. The finds from the destruction deposit indicate primarily a domestic area with zones for specific activities, but with no possible localisations now apparent. No internal installation, no hearth nor oven has been identified at present. The archaeological context excludes an interpretation of the original constructions as an explicit storage room or a specific workshop.

The results of this preliminary report of the archaeobotanical study enrich the stratigraphical observations and the interpretation of the finds. A first scanning of the macrobotanical remains recorded a wide variety of cereals and pulses, of which the most are common at the site at least since the Early Bonze Age and are well known from other Late Bronze Age settlements in the Aegean. The occurrence of cereal by-products implies that practices related to crop processing were performed on site, but cannot be localized within the area under study. Furthermore, vine, olive and most abundantly figs appear in chamber K10 at Kolonna. Due to the nature of the contexts, representing destruction layers, levelling and fills, the low density and heterogeneity of the samples seems understandable. It is most probable that the plant remains had been carbonized either during some cereal crop processing requiring fire or from being used as fuel, and were eventually accidentally entrapped in the deposits that filled the space in chamber K10.

A comprehensive study of the macrobotanical remains will provide more information regarding the exact formation processes, and the various uses of plants and agricultural practices at the site, as well as assist in the exploration of husbandry regimes in the Late Bronze Age.

Acknowledgments

We are grateful to the Ephorate of Antiquities of western Attica, Piraeus and Islands for their assistance and wish to extend our particular thanks for constant financial support to the University of Salzburg (Austria) and the Institute for Aegean Prehistory (INSTAP Philadelphia, USA).

Bibliography

Anderson – Ertug-Yaras 1998
S. Anderson – F. Ertug-Yaras, Fuel Fodder and Faeces: An Ethnographic and Botanical Study of Dung Fuel Use in Central Anatolia, Environmental Archaeology 1/1, 1998, 99–109.

Becker – Kroll 2008
C. Becker – H. Kroll, Das prähistorische Olynth. Ausgrabungen in der Toumba Agios Mamas 1994–1996. Ernährung und Rohstoffnutzung im Wandel, PAS 22 (Rahden/Westf. 2008).

Boardman – Jones 1990
S. Boardman – G. Jones, Experiments on the Effects of Charring on Cereal Plant Components, JASc 17/1, 1990, 1–11.

Bogaard et al. 2013
A. Bogaard – M. Charles – A. Livarda – M. Ergun – D. Filipovic – G. Jones, The Archaeobotany of Mid-Later Occupation Levels at Neolithic Çatalhöyük. Humans and Landscapes of Çatalhöyük: Reports from the 2000–2008 Seasons (Los Angeles 2013) 93–128.

Bown 1995
D. Bown, The Royal Horticultural Society Encyclopedia of Herbs & Their Uses (London 1995).

Burke 2012
B. Burke, Looking for Sea-Silk in the Bronze Age Aegean, in: M.-L. Nosch – R. Laffineur (eds.), Kosmos. Jewellery, Adornment and Textiles in the Aegean Bronze Age. Proceedings of the 13th International Aegean Conference, University of Copenhagen, Danish National Research Foundation's Centre for Textile Research, 21–26 April 2010, Aegaeum 33 (Leuven 2012) 171–177.

Eder 2012
B. Eder, Kakovatos. Jahresbericht 2011, AA 2012/1 Beiheft, 92–94.

Evely 1993
R. D. G. Evely, Minoan Crafts: Tools and Techniques. An Introduction 1 (Göteborg 1993).

Follieri – Coccolini 1979
M. Follieri – G. B. L. Coccolini, Travi carbonizzate del palazzo minoico de Festos (Creta), ASAtene 57, 1979, 173–185.

Galik et al. 2013
A. Galik – G. Forstenpointner – G. E. Weissengruber – U. Thanheiser – M. Lindblom – R. Smetana – W. Gauss, Bioarchaeological Investigations at Kolonna, Aegina (Early Helladic III to Late Helladic III), in: S. M. Valamoti – S. Voutsaki (eds.), Diet, Economy and Society in the Ancient Greek World: Towards a Better Integration of Archaeology and Science. Proceedings of the International Conference Held at the Netherlands Institute at Athens on 22–24 March 2010, Pharos Supplement I (Leuven 2013) 163–171.

Gauß 1999
W. Gauß, Aigina, DNP 13 (1999) 27–29.

Green 1979
F. J. Green, Phosphatic Mineralization of Seeds from Archaeological Sites, JASc 6/3, 1979, 279–284.

Hillman 1984
G. Hillman, Interpretation of Archaeological Plant Remains: The Application of Ethnographic Models from Turkey. Plants and Ancient Man (Rotterdam 1984).

Hillman 2011
G. Hillman, The Grain from the Granary, in: G. Hillman – E. B. French – S. Sherratt (eds.), Well Built Mycenae 16/17. The Post-Palatial Levels (Oxford 2011) 748–781.

Jacomet – Kreuz 1999
S. Jacomet – A. Kreuz, Archäobotanik: Aufgaben, Methoden und Ergebnisse vegetations- und agrargeschichtlicher Forschung (Stuttgart 1999).

Jacomet 2006
S. Jacomet, Identification of Cereal Remains from Archaeological Sites (Basel 2006).

Jones et al. 1986
G. Jones – K. A. Wardle – P. Halstead – D. Wardle, Crop Storage at Assiros, Scientific American 254/3, 1986, 96–103.

Jones et al. 2000
G. Jones – S. Valamoti – M. Charles, Early Crop Diversity: A 'New' Glume Wheat from Northern Greece, Vegetation History and Archaeobotany 9/3, 2000, 133–146.

Karathanou accepted
A. Karathanou, Intra-Settlement Use of Space in Late Bronze Age Mainland Greece: A Preliminary Archaeobotanical Exploration of Crop Storage and Refuse Disposal Strategies in the 2nd Millennium BC Aegean, Bulgarian e-Journal of Archaeology, forthcoming.

Kotzamani – Livarda 2017
G. Kotzamani – A. Livarda, Archaeobotanical Remains, in: R. A. K. Smith – M. K. Dabney – E. Pappi – S. Triantaphyllou – J. C. Wright (eds.), Ayia Sotira: A Mycenaean Chamber Tomb Cemetery in the Nemea Valley, Greece (Philadelphia 2017) 139–145.

Kroll 1982
H. Kroll, Kulturpflanzen von Tiryns, AA 1982, 467–485.

Kroll 1983
H. Kroll, Kastanas. Ausgrabungen in einem Siedlungshügel der Bronze- und Eisenzeit Makedoniens 1975–1979. Die Pflanzenfunde, PAS 2 (Berlin 1983).

Livarda – Kotzamani 2013
A. Livarda – G. Kotzamani, The Archaeobotany of Neolithic and Bronze Age Crete: Synthesis and Prospects, BSA 108, 2013, 1–29.

Sarpaki 2016
A. Sarpaki, The Archaeobotanical Remains from EM to LM IIIC at the Greek-Swedish Excavations, in: E. Hallager – B. P. Hallager (eds.), The Greek-Swedish Excavations at the Agia Aikaterini Square Kastelli, Khania 1970–1987, 2001, 2005 and 2008, 5, 1 (Stockholm 2016) 418–446.

Sarpaki – Asouti 2008
A. Sarpaki – E. Asouti, A Glimpse through a Kitchen Key-Hole at Late Bronze Age Akrotiri: The Organic Remains, in: N. Brodie (ed.), Horizon. A Colloquium on the Prehistory of the Cyclades, McDonalds Institute Monographs (Cambridge 2008) 370–376.

Shay et al. 1998
J. M. Shay – T. Shay – M. R. Kapinga, The Bronze Age Plant and Insect Remains and Modern Vegetation, in: G. Walberg (ed.), Excavations on the Acropolis of Midea. Results of the Greek-Swedish Excavations I/I: The Excavations on the Lower Terraces 1985–1991 (Stockholm 1998) 299–357.

Sporn et al. 2017
K. Sporn – L. Berger – A. Tanner, Mapping Aegina Kolonna, in: F. Lang – W. Wohlmayr (eds.), 50 Jahre Archäologie an der Paris Lodron-Universität Salzburg. Workshop Salzburg 14. Dezember 2016, ArchaeoPlus 9 (Salzburg 2017) 81–98.

Stais V. 1895
V. Stais, Προϊστορικοί συνοικισμοί εν Αττική και Αίγινα, AEphem 15, 1895, 193–264.

Valamoti 2004
S. M. Valamoti, Plants and People in Late Neolithic and Early Bronze Age Northern Greece: An Archaeobotanical Investigation, BARIntSer 1258 (Oxford 2004).

Valamoti 2009
S. M. Valamoti, Η αρχαιοβοτανική διερεύνηση της διατροφής στην προϊστορική Ελλάδα (Thessaloniki 2009).

Valamoti – Kotzamani 2004/2005
S. M. Valamoti – G. Kotzamani, Ιστορία του ανθρωπογενούς περιβάλλοντος. Κύκλος εργαστηριακών μαθημάτων αρχαιοβοτανικής. Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης, Φιλοσοφική Σχολή, Τμήμα Ιστορίας και Αρχαιολογίας (Thessaloniki 2004/2005).

Van der Veen 2007
M. Van der Veen, Formation Processes of Desiccated and Carbonized Plant Remains. The Identification of Routine Practice, JASc 34/6, 2007, 968–990.

Walter 1983
H. Walter, Die Leute im alten Ägina: 3000–1000 v. Chr. (Stuttgart 1983).

Walter 1993
H. Walter, Ägina. Die archäologische Geschichte einer griechischen Insel (München 1993).

Welter 1925
G. Welter, Archäologische Funde in den Jahren 1923/4. Aegina, AA 40, 1925, 317–321.

Welter 1926
G. Welter, Archäologische Funde des Jahres 1925. Inseln. Ägina, AA 41, 1926, 432–433.

Welter 1938
G. Welter, Aigina (Berlin 1938).

Welter – Wolters 1926
G. Welter – P. Wolters, Ausgrabungen des Deutschen Archäologischen Instituts in Griechenland. II. Aegina, Gnomon 2, 1926, 120–121.

Wohlmayr 1989
W. Wohlmayr, Ägina Kolonna. Die schachtgräberzeitliche Siedlung, in: R. Laffineur (ed.), Transition. Le monde égéen du Bronze moyen au Bronze récent. Actes de la deuxième Rencontre égéenne internationale de l'Université de Liège, 18–20 avril 1988, Aegaeum 3 (Liège 1989) 151–153.

Wohlmayr 2000
W. Wohlmayr, Schachtgräberzeitliche Keramik aus Ägina, in: F. Blakolmer (ed.), Österreichische Forschungen zur Ägäischen Bronzezeit. Akten der Tagung am Institut für Klassische Archäologie der Universität Wien, 2.–3. Mai 1998, Wiener Forschungen zur Archäologie 3 (Wien 2000) 127–136.

Wohlmayr 2007
W. Wohlmayr, Aegina MH III–LH I. Ceramic Phases of an Aegean Trade-Domain, in: F. Felten – W. Gauss – R. Smetana (eds.), Middle Helladic Pottery and Synchronisms. Proceedings of the International Workshop Held at Salzburg 31st of October – 2nd of November, 2004, Ägina Kolonna. Forschungen und Ergebnisse 1 (Vienna 2007) 45–55.

Wohlmayr 2017
W. Wohlmayr, Ägina-Kolonna – Ein Blick auf die Vorstädte, in: F. Lang – W. Wohlmayr (eds.), 50 Jahre Archäologie an der Paris Lodron-Universität Salzburg. Workshop Salzburg 14. Dezember 2016, ArchaeoPlus 9 (Salzburg 2017) 133–146.

Wohlmayr et al. 2018
W. Wohlmayr – A. Tanner – D. Frank, Ägina-Kolonna I – Neue Forschungen auf altem Terrain. Die frühmykenische Äußere Vorstadt und die Möglichkeiten ihrer Instandhaltung, in: G. Schörner – K. Meinecke (eds.), Akten des 16. Österreichischen Archäologentages am Institut für Klassische Archäologie der Universität Wien vom 25. bis 27. Februar 2016 (Wien 2018) 479–501.

Wolters 1925a
P. Wolters, Ausgrabungen am Aphroditetempel in Ägina 1924, Gnomon 1, 1925, 46–49.

Wolters 1925b
P. Wolters, Forschungen auf Ägina, AA 40, 1925, 1–12.