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Klimonas

An Early Pre-Pottery Neolithic Village in Cyprus
Un village néolithique pré-céramique ancien à Chypre

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Chap. 23

Plant exploitation and vegetation cover

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Abstract. *The study of carbonised and mineralised seeds and fruits, charred wood fragments and plant impressions in building earth from all sectors excavated at Ayios Tychonas-Klimonas provide information on the use of plant resources by the inhabitants of the earliest known village on Cyprus, as well as on the vegetation cover that surrounded the site during the early Holocene. Two species of* Pistacia *(*P. terebinthus *and* P. atlantica*), deciduous oak, olive, buckthorn, hackberry, fig as well as several taxa from the Rosaceae-family (*Prunus, *Maloideae) were part of Mediterranean woodlands providing useful resources. Besides collecting wood and edible fruits from local trees, Klimonas villagers most likely cultivated cereals as shown by the recurrent use of barley and emmer wheat chaff as a temper in building earth and by the presence of a limited number of charred remains of these same taxa as well as einkorn. While wild barley is indigenous to Cyprus, wheat (emmer and einkorn) was most probably introduced to the island from the mainland Near East where contemporary populations appear to have practiced cultivation of wild progenitors. The presence of cereals at Klimonas constitutes the first evidence of cultivation on the island as well as an early example of Neolithic diffusion in the eastern Mediterranean.*

Exploitation des plantes et couverture végétale

Résumé. *Plusieurs types de vestiges botaniques ont été systématiquement collectés lors des fouilles de Klimonas de 2011 à 2016 : graines et fruits, charbons de bois et empreintes de végétaux dans la terre à bâtir. Ils correspondent aux plus anciens témoignages directs connus à ce jour de l'utilisation de plantes par les populations préhistoriques de Chypre. Dans un contexte où les reconstitutions des paléo-environnements végétaux sont rares, notamment à cause de l'absence d'études palynologiques, ils permettent également d'apporter des informations sur la nature et la composition des formations végétales présentes autour du premier village connu sur l'île.*

Dans tous les secteurs fouillés, des échantillons ont été prélevés manuellement ou extraits par la méthode de la flottation de sédiments en vue de la recherche de restes végétaux. Si ces prélèvements ont concerné prioritairement les niveaux du Néolithique pré-céramique, la période Sotira est également représentée dans le corpus archéobotanique. Malgré un effort d'échantillonnage considérable, avec la flottation de 6 025 litres de sédiments provenant de 168 contextes archéologiques, le nombre de restes carbonisés reste faible. Les médiocres conditions de préservation des restes végétaux peuvent être expliquées par la nature des sols et la forte bioturbation, phénomènes constatés également sur d'autres sites préhistoriques de l'île.

Les résultats de l'analyse anthracologique, associés à ceux de l'étude carpologique, apportent des éléments sur l'environnement du site lors de son occupation à au début du 9^{e} *millénaire av. n. è. Les charbons de bois et les fruits appartenant au genre* Pistacia *dominent les assemblages de restes végétaux carbonisés. La morphologie des endocarpes permet d'établir la présence de deux espèces : le pistachier térébinthe* (Pistacia terebinthus) *et le pistachier de l'Atlas* (P. atlantica)*. Les autres ligneux identifiés à partir des charbons de bois issus du Bâtiment communautaire et du Secteur B sont le chêne (*Quercus *sp.), le nerprun (*Rhamnus *sp.), l'olivier* (Olea europaea) *et plusieurs membres de la famille des Rosacées (*Prunus *sp., Maloideae). À ceux-là peuvent être ajoutés le micocoulier* (Celtis tournefortii) *et le figuier* (Ficus carica)*, identifiés à partir de leurs fruits. L'association de ces taxons suggère la présence autour du site de formations arborées, riches en ressources de bois et de fruits comestibles. La présence de bois de* Prunus *soulève des interrogations car tous les représentants de ce genre poussant actuellement sur l'île (abricotier, prunier, cerisier, amandier) sont considérés comme ayant été introduits plus tardivement pour y être cultivés. Si la présence d'une végétation forestière de type méditerranéen semble bien établie, les résultats de l'analyse archéobotanique n'indiquent pas l'existence de milieux humides proches ni l'exploitation d'espèces ripicoles.*

Dès la première campagne de fouilles à Klimonas, la présence de céréales a été constatée. De l'orge et du blé amidonnier ont été identifiés à partir d'empreintes laissées dans la terre utilisée pour construire le Bâtiment communautaire (St 10). De rares restes carbonisés de ces mêmes taxons ont également été collectés, tout comme un caryopse identifié comme étant du blé engrain. Leur statut en tant que plantes sauvages ou domestiquées ne peut pas être déterminé par l'analyse des restes disponibles, constitués surtout d'empreintes de paille et bale dans la terre crue. Cependant, il est vraisemblable que les blés aient été introduits à Chypre pour y être reproduits car les ancêtres sauvages de l'amidonnier (Triticum dicoccoides) *et de l'engrain (*T. monococcum *ssp.* aegilopoides*) ne font pas partie de la végétation spontanée de l'île. Sachons en revanche que l'orge sauvage* (Hordeum spontaneum) *est indigène à l'île et a pu être mise en culture à partir de populations locales.*

La présence du blé à Klimonas correspond à l'attestation la plus ancienne d'introduction de céréales à Chypre et à un exemple précoce de la diffusion des plantes et de pratiques agraires en Méditerranée orientale. Sur des sites proche-orientaux contemporains il n'y a, à cette période, pas encore d'indices de domestication bien que des populations dans plusieurs régions semblent déjà avoir expérimenté des pratiques agraires. Dans ce sens, les premiers agriculteurs-cueilleurs de Klimonas s'inscrivent dans la large koinè des populations du Néolithique pré-céramique de régions telles que le Levant ou l'Anatolie.

Parallèlement aux restes de céréales – peu nombreux mais hautement significatifs –, le site a produit une gamme réduite de taxons sauvages parmi lesquels figurent mauves, gaillets, graminées sauvages et plusieurs espèces fruitières mentionnées ci-dessus.

INTRODUCTION

Discoveries of early Neolithic settlements in Cyprus during the last decades have pushed the date for the first village communities on the island back to the early 9th millennium cal BC when the Cypro-PPNA sites of Klimonas and Asprokremnos were first established. This chapter presents the results of the archaeobotanical study undertaken at *Ayios Tychonas*-Klimonas and provides the earliest evidence at the time of writing of human-plant interactions on the island.

For the same period there is an increasing corpus of data from mainland southwest Asia where incipient cultivation is attested in different parts of the Near East (Willcox 2013, Arranz Otaegui *et al.* 2016). Since the earliest excavation conducted at Klimonas in 2011 it was established that the plant economy of the inhabitants included barley and emmer wheat (Vigne *et al.* 2012). Systematic sampling for plant remains from an area excavation of the PPNA village during the excavations reinforced this interpretation despite very poor preservation. As with other PPNA sites, questions such as whether crops were indigenous or allochthonous and their status as wild or domesticated plants are of particular interest.

Evidence for the vegetation on the island at the time of PPN settlements is attested through anthracological studies. Pollen-bearing sediments have not been located on the island to date and charcoal analyses up until now are limited to later periods (Asouti 2003, Thiébault 2003, 2011, 2021). Therefore, anthracological studies are crucial in order to reconstruct exploitation of woody species and by extrapolation the plant communities from which they originated. Evidence from seed and fruit remains also helps to establish the surrounding vegetation at the time of occupation.

While this chapter explores the above-mentioned issues through the analysis of charred plant macro-remains and impressions, the analysis of phytoliths conducted by Delhon *et al.* (chap. 22) sheds light on other aspects of the exploitation and use of plants at Klimonas.

1. MATERIAL AND METHODS

The plant remains from Klimonas can be divided into three categories.

1) Charred remains consisting of seeds/fruits and wood. Compared to many sites on the mainland, these remains from Klimonas are rare and poorly preserved. This is probably due to bioturbation all the more intense as the archaeological deposits were shallow. Indeed, modern rootlets were plentiful in most flotation samples.

2) Plant impressions in building earth left by cereal chaff used as a tempering material (see chap. 10). These proved to be particularly precious for the identification of cereals at Klimonas. Fragments of burnt building earth were broken manually in order to expose diagnostic plant elements such as spikelet bases. Casts were made of diagnostic impressions using vinyl polysiloxane and were then photographed.

3) Bio-mineralised seeds consisting of members of Boraginaceae and *Celtis* taxa make up 88% of the total number of seeds and fruits. Once mineralised, they become resistant to decay and are therefore overrepresented in archaeobotanical samples in comparison to charred remains. The presence of mineralised seeds and fruits is common on sites in the Near East and has raised questions of the age of these remains because whether modern or ancient they have the same aspect (Van Zeist and Bakker-Heeres 1982). The radiocarbon dating of mineralised *Lithospermum* remains from a Bronze Age site in Jordan has shown that at least in this case they were contemporary with the archaeological levels in which they were found (Pustovoytov *et al.* 2004). Even if this is the case it should be noted that many plants from the Boraginaceae family are myrmecochorous, that is their seeds are dispersed by ants attracted by the presence of lipid-rich seed appendages or elaiosomes (Quilichini and Debussche 2000, Lengyel *et al.* 2010). Ants make stockpiles of seeds that may sometimes account for high concentrations of Boraginaceae nutlets in archaeological contexts situated close to the surface, as is often the case in Klimonas.

Field season	Sector	N samples	Total vol. samples (L)	Min. vol. sample	Max vol. sample	Av. vol. sample
2011	St 10	17	288	4	34	16,9
2012	St 10	49	1040	4	64,5	21,2
2014	F	4	51	7	28	12,8
2015	F, B	7	353	7	219	50,4
2016	B	91	4293	1	344	47,2
	Total	**168**	**6025**	**1**	**344**	**35,9**

Tab. 23-1 – *Number of samples and volumes treated by flotation per year.* • *Nombre d'échantillons et volumes traités par flottation par année.*

Large scale sampling was carried out during fieldwork between 2011 and 2016. Part of the material was collected manually in the form of isolated finds of larger charcoal or seed/fruit remains, either during excavation or in the sieve used for large-scale water-sieving of sediments. However, most of the plant remains were obtained from the flotation of sediment samples collected from different structures (St) and stratigraphic units (S U). Sampling was concentrated on the PPNA levels but pottery Neolithic (Sotira) contexts were also occasionally sampled.

Both manual and machine flotation were carried out depending on sample size. In total 168 sediment samples corresponding to a total volume of 6025 litres of soil were processed. Sample volumes varied between 1 and 344 litres with an average volume of 35.9 litres (for more detail, see tab. 23-1). The flotation machine was installed near the excavation and water was recycled using an electric pump (chap. 2, fig. 2-9). The floated material was recovered in calibrated mesh tissue (300 µm) and laid out to dry. Inside the flotation tank a 1 mm calibrated mesh metal sieve allowed the recovery of small animal bones (see chap. 24 and 28) and other items included in the heavy fraction. After drying the light fraction was sorted and seed and fruit remains were preliminary identified in the field.

Samples that did not contain plant remains were discarded. Those containing identifiable remains for which the context is not securely dated or which may represent a mixture of material from several periods (notably in pits) are not included in this study.

The final analysis of plant remains was undertaken in the archaeobotanical laboratory of the research team *Archaeozoology, archaeobotany: Societies, practices and environments* (AASPE) in the Muséum national d'Histoire naturelle in Paris. Seed and fruit remains were studied using a binocular stereomicroscope (Nikon SMZ 1270), charcoal fragments were observed with an epi-illumination microscope (Olympus BX51M) allowing magnifications from 50x to 500x. Identifications were made by comparing the archaeological remains to modern specimens from Europe and the Near East held in the laboratory's reference collections. Morphological and anatomical descriptions in wood and seed atlases were also used (Fahn *et al.* 1986, Schweingruber 1990, Nesbitt 2006, Crivellaro and Schweingruber 2013).

Charcoal and seed/fruit remains were quantified as follows. Each identified charcoal fragment was counted as one. Entire or almost entire seeds/fruits were counted as one. Half seeds/fruits totals were divided by two. In the case of specific anatomical items such as grain apex, pedicel base or scutellum, the MNI (Minimum Number of Individuals) was calculated according to the maximum number of items thus 3 apex fragments + 2 pedicel base fragments = 3 individuals.

2. RESULTS OF THE CHARCOAL STUDY

2.1. GENERAL CONSIDERATIONS

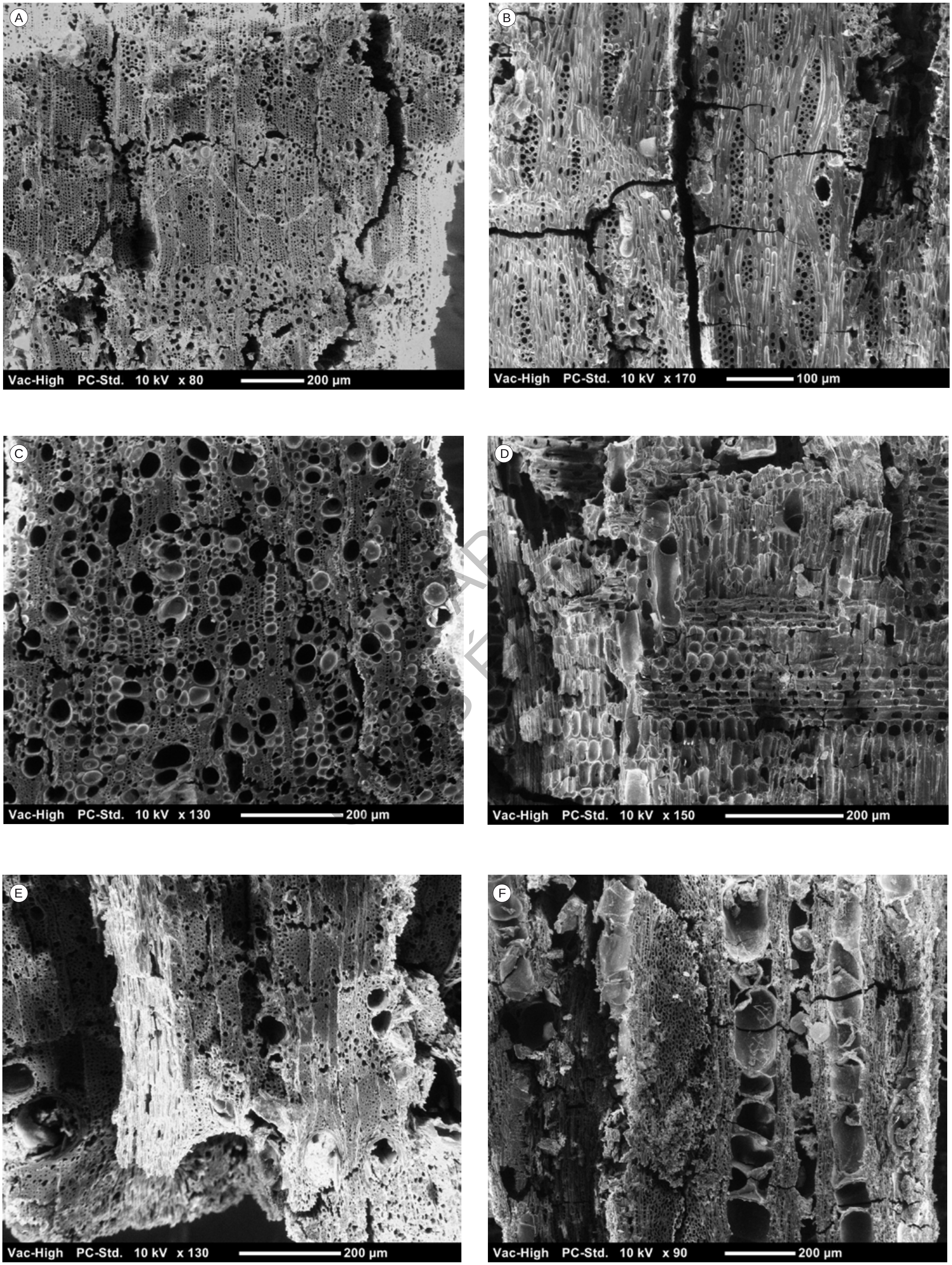
Due to the poor state of preservation, only a limited number of charcoal fragments were suitable for identification. Only fragments more than 2 mm in size were used when they were sufficiently well preserved to allow the observation of the anatomical structures of the wood. Charcoal fragments frequently had a vitreous aspect where cells appeared to have fused together to form a homogenous and shiny surface where anatomical features are difficult to observe. The "vitrification" of wood during charring is a recurrent phenomenon that has been the subject of studies and experimental work (Marguerie and Hunot 2006, Py and Ancel 2006, Braadbaart and Poole 2008, McParland *et al.* 2010). Several factors affecting the wood before, during or after charring such as the presence of resins or gums, its state (green, wet, dry, partially decomposed), combustion temperature, taphonomic condition, etc. may be responsible for this "vitrification" (Braadbaart and Poole 2008). Given this complexity, it is difficult to ascertain the causes of "vitrification" observed on charcoal remains from Klimonas. However, the presence of resin in the wood of members of the *Pistacia* genus may be a possible explanation.

Due to the reasons explained above, precise identifications of charcoal were often not possible at Klimonas. Of a total of 598 charcoal fragments examined, nine taxa were identified, with degrees of precision varying from the species level (*Olea europaea* L.) to simply angiosperms.

2.2. THE COMMUNAL BUILDING (ST 10)

The largest number of charcoal fragments were collected from the PPNA Communal building St 10 (tab. 23-2). Among 520 charcoals examined from 19 different contexts 74% could be identified to the genus or family level. Due to the limited number of fragments and similarities in composition between different building phases we have considered all samples from this sector together.

Wood from the Anacardiaceae (or cashew) family largely dominates the charcoal record from the Communal building. Even though *Pistacia* could only be identified with certainty from around half of the fragments, it is likely that all charcoal ascribed to the Anacardiaceae group belong to this genus (fig. 23-1, A-B). The only other taxon belonging to the cashew family in the Cypriot flora is *Rhus coriaria* L. (Tanner's sumac) whose structure in the transversal, tangential and radial anatomical planes is quite different. Moreover, the latter only grows in the hinterland at higher altitudes (600-1600 m). *Pistacia* is thus likely to represent almost 70% of the charred wood pieces from the Communal building. Other taxa are less frequent such as oak (*Quercus*), of which some fragments could be identified as belonging to deciduous oak (fig. 23-1, E-F). The rose family (Rosaceae) is recognised by the presence of *Prunus* (fig. 23-2, A-C, for a detailed description see appendix 23-1) and Maloideae-type wood. Buckthorn (*Rhamnus* sp.) and olive (*Olea europaea*) are tentatively identified from a limited number of fragments (fig. 23-1, C-D). A large portion (25.8%) of the charcoal fragments from the Communal building could not be identified further than to the large angiosperm group, that is broad-leaved trees and shrubs as opposed to conifers.


A
Vac-High PC-Std. 10 kV x 80 200 µm
B
Vac-High PC-Std. 10 kV x 170 100 µm
C
Vac-High PC-Std. 10 kV x 130 200 µm
D
Vac-High PC-Std. 10 kV x 150 200 µm
E
Vac-High PC-Std. 10 kV x 130 200 µm
F
Vac-High PC-Std. 10 kV x 90 200 µm

◂ **Fig. 23-1** – *Wood charcoal captions:* Pistacia *sp. (SU 10.8) in transversal (A) and longitudinal tangential (B) views;* Olea *sp. (St 6705) in transversal (C) and longitudinal radial (D) views; deciduous* Quercus *sp. (SU 10.13) in transversal (E) and longitudinal tangential (F) views. Photos captured with SEM Nikon JCM-5000 JEOL NeoScop, M. Rousou MNHN, U. Cyprus.* • *Clichés de charbons de bois :* Pistacia *sp. (SU 10.8), vues transversale (A) et longitudinale tangentielle (B) ;* Olea europaea *(St 6705), vues transversale (C) et longitudinale radiale (D) ;* Quercus *sp. à feuillage caduc (SU 10.13), vues transversale (E) et longitudinale tangentielle (F). Clichés pris à l'aide d'un MEB Nikon JCM-5000 JEOL NeoScop, M. Rousou MNHN, U. Cyprus.*

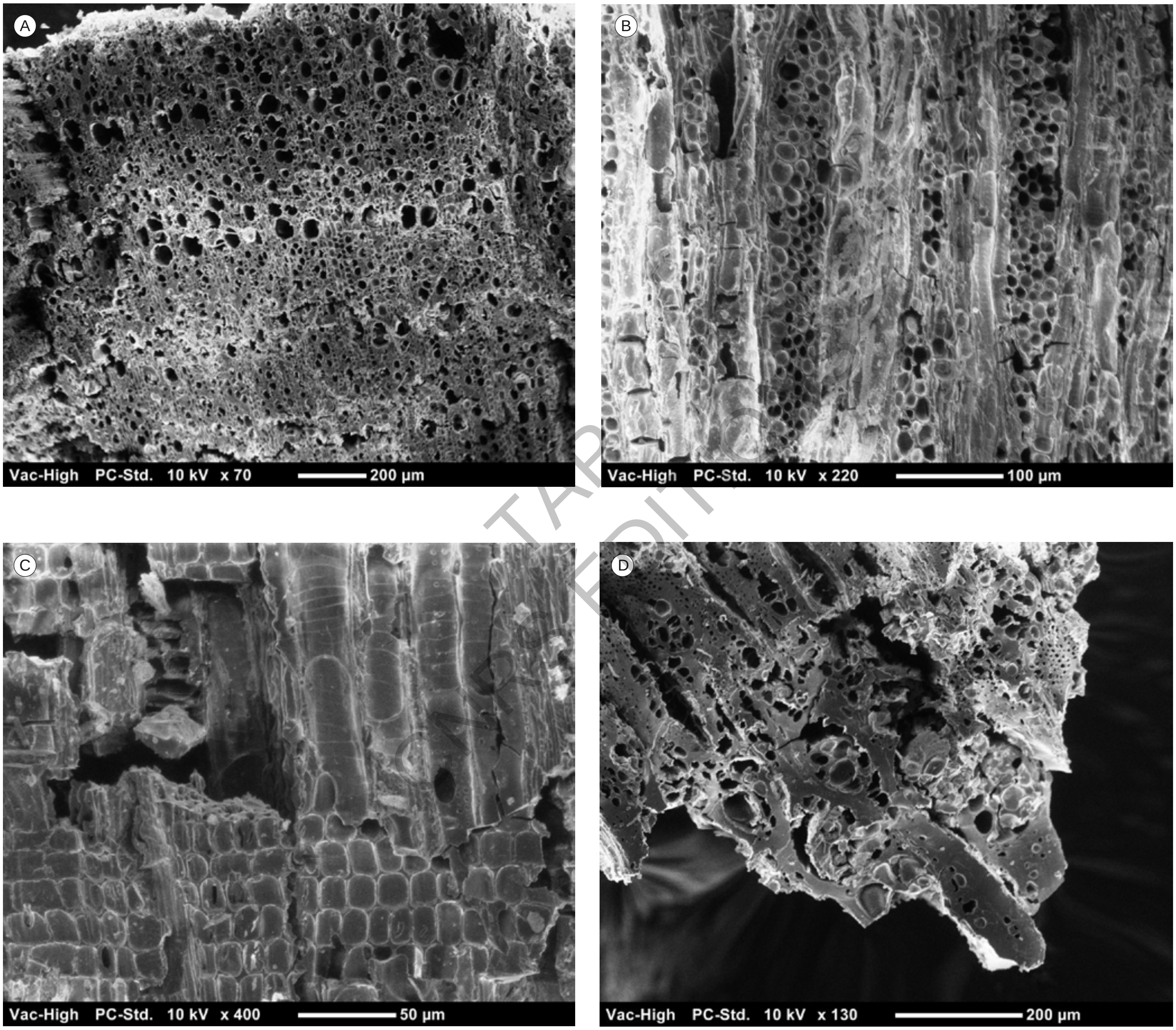


Fig. 23-2 – *Wood charcoal captions:* Prunus *sp. (172) in transversal (A), longitudinal tangential (B) and longitudinal radial (C) views; detail of vitrified* Pistacia *sp. (172) charcoal (D) in transversal view. Photos captured with SEM Nikon JCM-5000 JEOL NeoScop, M. Rousou MNHN, U. Cyprus.* • *Clichés de charbons de bois :* Prunus *sp. (172), vues transversale (A), longitudinale tangentielle (B) et longitudinale radiale (C) ; détail de charbon de* Pistacia *sp. (172) « vitrifié », vue transversale. Clichés pris à l'aide d'un MEB Nikon JCM-5000 JEOL NeoScop, M. Rousou MNHN, U. Cyprus.*

	Period	PPNA																			N	%
	Sector	St 10																				
	SU or structure (St)	10.10	10.38	10.44	St81	St140	10.3	10.13	10.6	10.8	10.28	10.31	10.32	10.37	St166	St172	178	St54	10.2	10.5		
	Building	1a	1a	1a	1	1	1b	1b	IM	IM	IM	IM	IM	IM	IM	IM	IM	2	2	2		
	Fl. Vol. (L)	22	57	45	/	17	159	64,5	247,5	29	64	/	13	20	23	35	/	18	69	39		
Pistacia genus	*Pistacia* sp.	2	34	8		2	44	27	76	13	8	2		18	10	5		3	2	1	255	49,0%
cf. *Pistacia* genus	cf. *Pistacia*		4	1			11	7	17	2	3		2	3	1	2	1				54	10,4%
Cashew family	Anacardiaceae		1				4														5	1,0%
cf. Cashew family	cf. Anacardiaceae	1	6				2	2	15	4	4		1	6	2	1					44	8,5%
Olive	cf. *Olea europaea*		1																		1	0,2%
cf. Buckthorn	cf. *Rhamnus*								1		2										3	0,6%
Almond/Plum	*Prunus* sp.															1					1	0,2%
cf. Almond/Plum	cf. *Prunus*						1														1	0,2%
cf. Apple subfamily	cf. Maloideae						1														1	0,2%
Deciduous oak	*Quercus* f. c.				3		2	1	5												11	2,1%
Oak	*Quercus* sp.				1		2	1													4	0,8%
cf. Oak	cf. *Quercus*									1						2					3	0,6%
Angiosperm	Angiospermae		15	8		10	14	7	37	12	4		3	15	2	5		2			134	25,8%
Undetermined	/						1		1					1							3	0,6%
	Total	**3**	**61**	**17**	**4**	**12**	**82**	**45**	**152**	**32**	**21**	**2**	**6**	**43**	**15**	**16**	**1**	**5**	**2**	**1**	**520**	**100,0%**

Tab. 23-2 – *Results of the charcoal analysis from Central Sector.* • *Résultats de l'analyse des charbons de bois du Secteur central.*

	Period	PPNA																N	%
	Sector	B																	
	Zone/TB	C	TB22	TB25	TB21	TB18	TB22	C	C	C	E	TB7-8	(b)	(b)	(b)	(a)	(a)		
	SU or Structure (St)	6038	6082	6087	6095	6106	6115	St6653	St6668	St6705	St6744	St6819	St6882	St6883	St6979	St7188	7242		
	Fl. vol. (L)	70	/	246	263	/	43	/	23	63	/	42	91	8	10	/			
Pistacia genus	*Pistacia* sp.	1	1		3						1				1			7	12,5%
cf. *Pistacia* genus	cf. *Pistacia*											1						1	1,8%
Cashew family	Anacardiaceae														1			1	1,8%
cf. Cashew family	cf. Anacardiaceae					1												1	1,8%
Olive	*Olea europaea*									11		1						12	21,4%
cf. Olive	cf. *Olea europaea*									4								4	7,1%
cf. Buckthorn	cf. *Rhamnus*				1													1	1,8%
Almond/Plum	*Prunus* sp.	1																1	1,8%
Deciduous oak	*Quercus* f. c.	1																1	1,8%
Oak	*Quercus* sp.						2											2	3,6%
Angiosperm	Angiospermae			1	1			1	5	1	2	2	1	2	4	1	3	24	42,9%
Undetermined	/			1														1	1,8%
	Total	**3**	**1**	**2**	**5**	**1**	**2**	**1**	**5**	**16**	**3**	**4**	**1**	**2**	**6**	**1**	**3**	**56**	**100%**

Tab. 23-3 – *Results of the charcoal analysis from Sector B.* • *Résultats de l'analyse des charbons de bois du Secteur B.*

	Period	Sotira					PPNA/Sotira?	Sotira/PPN?	?	?		
	Sector	St 10					B			?		
	Zone/TB						W	TB9-10	TB18	?		
	SU or Structure (St)	10.24	10.29	10.29	10.34	10.49	678.2	St6825	6089	St7744		
	Contexte						Comb final - B08	Gd creusement comblement B24 - Fos - B24	Comb prim - B28		N	%
Pictacia genus	*Pistacia* sp.		1		2	1	2				6	31,6%
cf. *Pictacia* genus	cf. *Pistacia*					2					2	10,5%
cf. Cashew family	cf. Anacardiaceae			1							1	5,3%
cf. Oak	cf. *Quercus*									1	1	5,3%
Oak	*Quercus* sp.					1					1	5,3%
Angiosperm	Angiospermae	1		1	1	1	2	1	1		8	42,1%
	Total	**1**	**1**	**2**	**3**	**5**	**4**	**1**	**1**	**1**	**19**	**100,0%**

Tab. 23-4 – *Results of the charcoal analysis Sotira period (Sectors St 10 and B).* • *Résultats de l'analyse des charbons de bois de la période Sotira (Secteurs St 10 et B).*

2.3. SECTOR B

Fifty-six charcoal fragments were available for study from Sector B where nearly 20 circular buildings were excavated (tab. 23-3). As was the case with the Communal building, many of the charcoal fragments (43.9%) could not be identified beyond the angiosperm group. The taxa are identical to those found in the Communal building (St 10) with the exception of Maloideae, a taxon that was not identified in Sector B. Wood from olive is present in somewhat higher proportions (21.4%) than the Anacardiaceae (*Pistacia* included), represented by 17.9% of the fragments identified.

A limited number of fragments (N = 20) were recovered from contexts dated to the Sotira period excavated in the Central and B Sectors (tab. 23-4). These were identified as: *Pistacia*/ Anacardiaceae (50%), oak (10%) and angiosperms (40%).

2.4. SECTOR F

Only two fragments from Sector F were identified and these only to angiosperm level. They will not be discussed further.

3. RESULTS OF THE STUDY OF SEED AND FRUIT REMAINS

3.1. GENERAL CONSIDERATIONS

As explained above, seed and fruit remains from Klimonas are generally scarce and in a poor state of preservation, with the exception of bio-mineralised remains dominated by Boraginaceae nutlets and hackberry (*Celtis*) endocarps. The density of remains, that is, the number of items per litre of sediment (N/litre) is in general very low. The higher values are due to concentrations of bio-mineralised remains which make up nearly 90% of the seed remains. The analysis of about 5200 seed/fruit remains from the Central, B and F Sectors and dated to the PPNA or Sotira periods has allowed the identification of 19 taxa. These have been identified to 7 species, 8 genera and 4 to the family level.

Tables 23-5 to 23-8 give the totals of the identifications by archaeological context, of charred and bio-mineralised remains, volume of sediment sampled and density of the finds. The paucity of the charred material is exemplified by the fact that only four cereal items were tentatively identified despite the 6025 litres of sediment that were sampled. However, evidence from impressions suggests cereals were readily available. As was the case with charcoal the charred seeds are dominated by *Pistacia* (76 identifications).

3.2. THE COMMUNAL BUILDING (ST 10)

Numerous samples of building earth examined from the Communal PPNA building in 2011 provided widespread evidence from impressions of emmer chaff that had been used as a tempering material. In one case where earth had been burnt prior to decomposition of plant matter a charred spikelet base was preserved (tab. 23-5, fig. 23-3, B). These finds were dominated by wild or domestic emmer wheat (*Triticum dicoccoides/dicoccon*). The presence of emmer in secure PPNA contexts is significant because wild emmer wheat is not thought to be indigenous. Thus, it must have been imported by early settlers, probably as a cultivated crop. However, it is not possible from the Klimonas remains to determine whether the emmer wheat present was morphologically domesticated or wild (see the discussion below).

Two other remains from the grass family found in the Communal building correspond to wild forms. One could be tentatively identified as wild barley (*Hordeum* cf. *spontaneum* K. Koch) (fig. 23-3, C), a common grass on Cyprus which can be found growing today in the area of Klimonas and elsewhere on the island.

Fig. 23-3 – *Captions of seeds/fruits:* Triticum *cf.* monococcum *(St 6668, B18) in dorsal, lateral and ventral views (A); spikelet fork* Triticum dicoccoides/dicoccon *(SU 10.3, B36) in ventral and dorsal views (B);* Hordeum *cf.* spontaneum *(172) section and ventral view (C); Poaceae (SU 6038) in dorsal, lateral and ventral views (D);* Galium *(St 6705, B10) (E);* Malva *(SU 10.37) (F);* Pistacia terebinthus *(Sector B) (G);* Celtis *cf.* tournefortii *(St 6668, B18) (H);* Ficus carica *(US 6047) (I). Photos M. Tengberg and M. Rousou, MNHN.*

• *Clichés de grains/fruits :* Triticum *cf.* monococcum *(St 6668, B18), vues dorsale, latérale et ventrale (A) ; base d'épillet* Triticum dicoccoides/dicoccum *(US 10.3, B36), vues ventrale et dorsale (B) ;* Hordeum *cf.* spontaneum *(172), section et vue ventrale (C) ; Poaceae (US 6038), vues dorsale, latérale et ventrale (D) ;* Galium *(St 6705, B10) (E) ;* Malva *(US 10.37) (F) ;* Pistacia terebinthus *(Secteur B) (G) ;* Celtis *cf.* tournefortii *(St 6668, B18) (H) ;* Ficus carica *(US 6047) (I). Clichés M. Tengberg et M. Rousou, MNHN.*

		Period	PPNA																			N	%
		Sector	St 10																				
		SU or structure (St)	10.10	10.38	10.44	10.3	10.3/10.13	10.13	2017	10.6	10.8	10.28	10.37	St. 47	St166	St172	10.2	10.5	St54	St153	St125		
		Building phase	1a	1a	1a	1b	1b	1b	1/2	2	2	2	2	2	2	2	3	3	3	3	Sect SE		
		Fl. vol. (L)	22	57	45	159	72	64,5	9	247,5	29	64	20	8	23	35	69	39	18	17	8		
		Density remains (N/L)	1,45	0,39	0,42	0,54	0,97	0,12	5,33	1,32	0,07	0,05	0,40	0,50	2,96	1,23	0,17	0,05	0,50	0,12	0,50		
C	Wheat, spikelet fork	*Triticum dicoccoides/dicoccon*				1																1	0,1%
C	Wild barley	*Hordeum* cf. *spontaneum*														1						1	0,1%
C	Grass family	Poaceae								1												1	0,1%
C	Pulses	Fabaceae								3												3	0,4%
C	Olive, endocarp frag.	*Olea europaea*						3		1												4	0,5%
C	Atlas pistachio	*Pistacia atlantica*			1							1										2	0,3%
C	Terebinth pistachio	*Pistacia terebinthus*						1									2					3	0,4%
C	*Pistacia* genus, seed	*Pistacia* sp.								1									4			5	0,7%
C	*Pistacia* genus, elongated type	*Pistacia* sp.																		1		1	0,1%
C	Undet. nutshell, frag.	/		1	15	1			1	2		1						1				22	2,9%
M	Borage family type 1	*Buglossoides/Echium*	31	16		81	60		46	301	1		1	4	68	42	9		1		3	664	86,3%
M	Borage family type 2	*Anchusa* sp.								1											1	2	0,3%
M	Borage family type 4	*Buglossoides* cf. *tenuiflora*								3												3	0,4%
M	Borage family undet.	Boraginaceae					1			2			1									4	0,5%
M	Bugle	*Ajuga* sp.								1												1	0,1%
C	Carnation family	Caryophyllaceae																1				1	0,1%
M	Carnation family	Caryophyllaceae																	3			3	0,4%
C	Mallow	*Malva* sp.		3	3	1	1	3		1			3							1		16	2,1%
M	Turnipweed	*Rapistrum rugosum*											1									1	0,1%
C	cf. Turnipweed	cf. *Rapistrum rugosum*		1			1															2	0,3%
C	Undetermined remains	/	1	1		2	7	1	1	3	1	1	2				1		1			22	2,9%
M	Undetermined remains	/								7												7	0,9%
		Total	**32**	**22**	**19**	**86**	**70**	**8**	**48**	**327**	**2**	**3**	**8**	**4**	**68**	**43**	**12**	**2**	**9**	**2**	**4**	**769**	**100%**

Tab. 23-5 – *Results of the analysis of seeds/fruits from Sector St 10.* • *Résultats de l'analyse des graines/fruits du Secteur St 10.*

Analysis of the endocarp morphology of *Pistacia* species native to the eastern Mediterranean and south-west Asia has provided reliable identification criteria for modern and archaeological representatives of a group that has long been problematic for archaeobotanists (Rousou *et al.* 2021). Applied to the charred *Pistacia* fruit stones from the Communal building St 10, two different species appeared to have been used: *Pistacia atlantica* Desf. and *P. terebinthus* L., the terebinth or turpentine tree (fig. 23-3,G). A third fruit species that also produces drupes is the olive (*Olea europaea*), which given the context was most probably its wild form, called oleaster.

Bio-mineralised nutlets belonging to the borage (Boraginaceae) family are by far the most well represented plant category from the Communal building as well as from other sectors of the site. They correspond to almost 87.5% of the seed and fruit remains from St 10 and can be ascribed to several morphotypes that are described in detail in appendix 23-2. *Buglossoides/Echium* (Type 1) is largely dominant and is attested in 74% of the samples. Two other taxa identified as *Anchusa* (Type 2) and *Buglossoides* cf. *tenuiflora* (Type 4) are present in much lower numbers (2 and 3 mericarps respectively). The Boraginaceae is a large family consisting of annuals, biannuals and perennials, frequently covered in sharp hairs. In many species the fruit divides when ripe into four nutlets or mericarps. In Cyprus representatives of this family grow in cultivated and fallow fields, on waste land and along roads but also as part of the natural vegetation, on sandy coastal flats and on various calcareous and igneous soils (Meikle 1985).

In addition, one seed was identified as *Ajuga* sp., three as *Rapistrum rugosum* (L.) All., sixteen as *Malva* sp. (fig. 23-3, F) and others identified only to the Caryophyllaceae family occur in the archaeobotanical samples from St 10. Of these, mallow (*Malva* sp.) is best represented. Seven *Malva* species occur in Cyprus: *M. aegyptia* L., *M. cretica* Cav., *M. multiflora* (Cav.) Soldano, Banfi and Galasso, *M. neglecta* Wallr., *M. nicaeensis* All., *M. parviflora* L., and *M. sylvestris* L. They grow from sea level to various altitudes and are frequently found on waste grounds and along roadsides and cultivated fields (Meikle 1977).

A limited number (N = 86) of seed/fruit remains from the Central Sector can be ascribed to the Sotira period (tab. 23-6). They correspond to mineralised Boraginaceae mericarps (84.9%), one barley grain (*Hordeum vulgare* L.), one fig achene (*Ficus carica* L.) and nine mallow seeds (*Malva* sp.).

3.3. SECTOR B

Sector B, where more than 20 domestic buildings were excavated in 2015 and 2016, produced the highest quantities of seed and fruit remains (tab. 23-7). A large quantity of soil (4293 litres) was floated and the remains extracted from more than 91 samples correspond to 84% of the total number of the Klimonas seed and fruit remains. The high number of plant remains is accompanied by an increase of mineralised nutlets from the Boraginaceae family that represent 89% of the identified remains (compared to 87.5% in St 10). Only three items of cereal remains were recovered including a relatively well-preserved grain found in the large combustion pit of the building B04, dated to the PPNA period (St 6688). This grain was directly dated by AMS to 9544 ± 26 BP (ECHo3451, [9125-8762] cal BC, 2 sigmas) demonstrating its contemporaneity with the archaeological level in which it was found. This grain strongly resembles that of single-grained einkorn (*Triticum monococcum*) by its lateral compression and convex ventral side (fig. 23-3, A). Despite this characteristic shape it is difficult to securely identify a single find to species level. Still, the presence of einkorn at Klimonas would not be surprising given that it has been found at other later Pre-Pottery Neolithic sites on the island (see discussion below). As in the case of emmer, it is not possible to determine whether the Klimonas einkorn is wild (ssp. *aegilopoides*) or domesticated (ssp. *monococcum*).

Caryopses from wild grasses are attested from several contexts in Sector B (fig. 23-3, D). Many of these were fragmentary or in a bad state of preservation and could not be identified more precisely than to the family level even though several morphotypes could be distinguished on the basis of the size and shape of the fruit and in some cases the morphology of the ventral furrow and the hilum.

Similar to St 10, the fruits from two *Pistacia* species (*P. atlantica* and *P. terebinthus*) are present together with charred endocarp fragments. While olive fruit stones are absent, *Olea* has been identified by the charcoal analysis. Two fruit species (not present in the Communal building) were identified from Sector B. One of these is fig (*Ficus carica* L.), represented by the charred remains of two fragmented figs (botanically a complex fruit called syconium) and one small drupelet (achene, fig. 23-3, I). In order to secure the dating of these first occurrences of figs on Cyprus, one of the two fruits was submitted to

		Period	Sotira						N	%
		Sector	B	St 10						
		SU or Structure (St)	St 142	10.23	10.24	10.29	10.34	10.49		
		Flot. vol. (L)	55	18	18	50	8,5	15		
C	Barley	*Hordeum vulgare*				1			1	1,2%
C	Fig, achene	*Ficus carica*	1						1	1,2%
M	Borage family Type 1	*Echium/Buglossoides*		3	53	11	3		70	81,4%
M	Borage family Type 2	*Anchusa*				1			1	1,2%
C	Borage family Type 4	*Buglossoides* cf.					2		2	2,3%
C	Mallow	*Malva* sp.						9	9	10,5%
C	Undetemined	/			1	1			2	2,3%
		Total	**1**	**3**	**54**	**14**	**5**	**9**	**86**	**100%**

Tab. 23-6 – *Results of the analysis of seeds/fruits Sotira period (Sectors St 10 and B).* • *Résultats de l'analyse des graines/fruits de la période Sotira (Secteurs St 10 et B).*

AMS dating and the date obtained 9471 ± 26 BP (ECHo3452, [9110-8636] cal BC, 2 sigmas) - corresponds to early 9th millennium occupation.

The other fruit species is hackberry (*Celtis*) whose fruits were preserved by bio-mineralisation. The endocarps from Klimonas are characterised by the presence of four ridges that converge towards the apex and a surface covered by a dense veined pattern (fig. 23-3, H). Two *Celtis* species are currently present in the Cypriot flora: oriental (*C. tournefortii* Lam.) and Mediterranean hackberry (*C. australis* L.), the latter being considered as introduced and naturalised on the island (Meikle 1985, p. 1461-62, Hadjikyriakou and Hadjisterkotis 2002,). When sufficiently well preserved the hackberry remains from Klimonas could be attributed to *C. tournefortii* Lam. according to the surface pattern of the endocarps, slightly different from that of *C. australis* (Simchoni and Kislev 2011). This identification is in accordance with the habitat of *C. tournefortii* that occurs on dry calcareous hillsides but today is attested in higher altitudes (600–925 m, Meikle 1985).

In addition to the Boraginaceae types 1 (predominant, 86% of the remains), 2 and 4 also identified in the Communal building St 10, two other types were distinguished in Sector B (appendix 23-2). Type 3 is close to the mericarps belonging to the *Anchusa* or *Nonea* genera, Type 5 is tentatively attributed to cf. *Arnebia* although no representatives of this genus are currently reported in the Flora of Cyprus (Meikle 1977, 1985).

A limited number of remains belonging to a few other taxa are attested in Sector B. Two of these are the same as in the Communal building St 10 (*Malva* sp. and *Rapistrum rugosum*), a third (bedstraw or *Galium* sp.) is found only in one foundation trench (St 6705) of the building B10 (fig. 23-3, E).

3.4. SECTOR F

Very few plant remains were preserved in building 800 and only three hand-picked fruit endocarps could be identified to hackberry (N = 2) and olive respectively (tab. 23-8).

4. RESULTS OF THE STUDY OF CEREAL CHAFF IMPRESSIONS

The analysis of plant impressions in building earth from the Communal building (St 10) provides an important complement to the study of mineralised and charred remains. The impressions were observed in fragments of building earth hardened by fire from various stratigraphic units in the first and the second buildings (figs. 23-4, 23-5, tab. 23-9). The construction technique used for building the walls of the Communal building was that of cob, that is the superposition of manually formed mud lumps or loaves (Mylona *et al.* 2017; see also chap. 10).

The use of cereal chaff to reinforce the building materials such as *pisé* and mudbrick to avoid shrinkage and cracking has been attested from the early Neolithic to the present day in the Near East and elsewhere. This practice leaves impressions after oxidation of organic material by burning and/or decomposition. The impressions identified at Klimonas were made from chaff that is the residue of the de-husking which separates the grain from the glumes, palea, lemma, and spikelet bases. The chaff residue is removed from the grain by winnowing. At Klimonas the chaff came predominantly from emmer wheat consisting of glumes, spikelet forks, awns and other fragments, probably lemmas and paleas. The analysis of phytoliths has also identified different parts of the grass plant each represented by specific morphotypes (see chap. 10).

Identification is much easier when silicone casts are made of the impressions which produce positive forms as opposed to the negative forms of the impressions. A selection of photographs of these casts is given in figs. 23-4 and 23-5 and explained in the captions. Identifications are given in table 23-9. Because of the nature of these finds it is not possible to quantify the results. The study of impressions of diagnostic spikelet forks allowed the identification of emmer wheat (*Triticum dicoccoides/dicoccon*) together with numerous non-identified impressions of chaff and various fragments. A few examples resembled barley (*Hordeum spontaneum/distichon*), but this could not be definitely confirmed.

		Period	PPNA											
		Sector	B											
		Zone/TB	C	C	C	C	C	C	C	C	C	C	C	C
		SU or Structure (St)	St690	6031	6033	6038	6039	6043	6046	6047	6072	St6600	St6614	St6634
		Fl. vol. (L)	19	135	/	70	345	/	/	/	137	49	114	23
		Density remains (N/L)	0,32	0,92	/	0,67	1,12	/	/	/	4,29	2,12	0,32	0,04
C	Einkorn	*Triticum monococcum*												
C	cf. Cereal caryopsis	cf. *Cerealia*					1							
C	Cereal chaff	*Cerealia*									1			
C	Grasses, type 1	Poaceae				2								
C	Grasses, type 2	"					1							
C	Grasses, type 4	"												
C	Grasses, indet.	"			1		1							
M	Tournefortii hackberry	*Celtis* cf. *tournefortii*				12	13				2			
M	Hackberry	*Celtis* sp.				25	60				24	15	1	1
M	cf. Hackberry	cf. *Celtis*				2								
C	Fig, fruit	*Ficus carica*							1	1				
M	Fig, achene	"												
C	Atlas pistachio	*Pistacia atlantica*												
C	cf. Atlas pistachio	*Pistacia* cf. *atlantica*					2							
C	Terebinth pistachio	*Pistacia terebinthus*					1							
C	cf. Terebinth pistachio	*Pistacia* cf. terebinthus												
C	*Pistacia* genus, elongated type	*Pistacia* sp.												
C	*Pistacia* genus, undet.	"					6							
C	*Pistacia* genus, seed	"						5						
C	Undet. nutshell, frag.	/					58	3			1	1		
M	Undet. nutshell, frag.	/					1							
M	Borage family type 1	*Echium/Buglossoides*	4	119		6	229				553	63	34	
M	Borage family type 2	*Anchusa* sp.												
M	Borage family type 3	*Anchusa/Nonea*					2				2			
M	Borage family type 4	*Buglossoides* cf. *tenuiflora*	2				1					10	1	
M	Borage family type 5	cf. *Arnebia*		3							3			
M	Borage family, undet.	"		1			1					12		
C	Bedstraw	*Galium* sp.												
C	Mallow	*Malva* sp												
M	Turnipweed	*Rapistrum rugosum*					7				1			
C	Undetermined remains	/		1			2				1	3		
M	Undetermined remains	/					2							
		Total	6	124	1	47	388	8	1	1	588	104	36	1

		Period	PPNA											
		Sector	B											
		Zone/TB	C	C	C	C	C	C	C	C	C	W	W	E
		SU or Structure (St)	St6637	St6638	St6643	St6648	St6668	St6705	St6716	St6758	St6759	6022	St6684	St6737
		Fl. vol. (L)	9	45	/	/	23	63	/	23	29	71	/	/
		Density remains (N/L)	0,11	0,24	/	/	6,65	1,14	/	2,87	0,45	0,25	/	/
C	Einkorn	*Triticum monococcum*					1							
C	cf. Cereal caryopsis	cf. *Cerealia*												
C	Cereal chaff	*Cerealia*												
C	Grasses, type 1	Poaceae												
C	Grasses, type 2	"												
C	Grasses, type 4	"								1				
C	Grasses, indet.	"												
M	Tournefortii hackberry	*Celtis* cf. *tournefortii*					2					1		
M	Hackberry	*Celtis* sp.				1	3					1		
M	cf. Hackberry	cf. *Celtis*						1						
C	Fig, fruit	*Ficus carica*												
M	Fig, achene	"												
C	Atlas pistachio	*Pistacia atlantica*												
C	cf. Atlas pistachio	*Pistacia* cf. *atlantica*												
C	Terebinth pistachio	*Pistacia terebinthus*												
C	cf. Terebinth pistachio	*Pistacia* cf. terebinthus												
C	*Pistacia* genus, elongated type	*Pistacia* sp.												
C	*Pistacia* genus, undet.	"							1			1		
C	*Pistacia* genus, seed	"												
C	Undet. nutshell, frag.	/			5									
M	Undet. nutshell, frag.	/												
M	Borage family type 1	*Echium/Buglossoides*		11			133	63		64	10	14	2	43
M	Borage family type 2	*Anchusa* sp.					2							
M	Borage family type 3	*Anchusa/Nonea*												
M	Borage family type 4	*Buglossoides* cf. *tenuiflora*	1				11	6			2	1		1
M	Borage family type 5	cf. *Arnebia*												
M	Borage family, undet.	"						1						
C	Bedstraw	*Galium* sp.						1						
C	Mallow	*Malva* sp								1				
M	Turnipweed	*Rapistrum rugosum*												
C	Undetermined remains	/												
M	Undetermined remains	/					1				1			
		Total	**1**	**11**	**5**	**1**	**153**	**72**	**1**	**66**	**13**	**18**	**2**	**44**

Tab. 23-7 (1) – *Results of the analysis of seeds/fruits from Sector B.* • *Résultats de l'analyse des graines/fruits du Secteur B.*

		Period	PPNA											
		Sector	B											
		Zone/TB	TB1/TB25	TB2	TB2	TB7	TB7-8	TB7-8	TB10	TB18	TB18	TB18	TB18	TB20
		SU or Structure (St)	6011	6012	St6831	6117	St6779	St6819	St6823	6099	6106	St6796	St6834	St6771
		Fl. vol. (L)	47	/	7	97	/	42	46	/	/	/	/	/
		Density remains (N/L)	0,11	/	9,29	3,73	/	12,31	0,59	/	/	/	/	/
C	Einkorn	*Triticum monococcum*												
C	cf. Cereal caryopsis	cf. *Cerealia*												
C	Cereal chaff	*Cerealia*												
C	Grasses, type 1	Poaceae												
C	Grasses, type 2	"												
C	Grasses, type 4	"												
C	Grasses, indet.	"	1			1			1					
M	Tournefortii hackberry	*Celtis* cf. *tournefortii*		15		1	3							
M	Hackberry	*Celtis* sp.		15			2	10		2				
M	cf. Hackberry	cf. *Celtis*											1	
C	Fig, fruit	*Ficus carica*												
M	Fig, achene	"												
C	Atlas pistachio	*Pistacia atlantica*												
C	cf. Atlas pistachio	*Pistacia* cf. *atlantica*												
C	Terebinth pistachio	*Pistacia terebinthus*	1											
C	cf. Terebinth pistachio	*Pistacia* cf. terebinthus												
C	*Pistacia* genus, elongated type	*Pistacia* sp.									4			
C	*Pistacia* genus, undet.	"												
C	*Pistacia* genus, seed	"												
C	Undet. nutshell, frag.	/	1							5		33		
M	Undet. nutshell, frag.	/												
M	Borage family type 1	*Echium/Buglossoides*	2		64	353		500	9					
M	Borage family type 2	*Anchusa* sp.				2			14					
M	Borage family type 3	*Anchusa/Nonea*						6						
M	Borage family type 4	*Buglossoides* cf. *tenuiflora*			1	1		1	1					1
M	Borage family type 5	cf. *Arnebia*				4								
M	Borage family, undet.	"												
C	Bedstraw	*Galium* sp.												
C	Mallow	*Malva* sp												
M	Turnipweed	*Rapistrum rugosum*												
C	Undetermined remains	/							2		1			
M	Undetermined remains	/												1
		Total	**5**	**30**	**65**	**362**	**5**	**517**	**27**	**7**	**5**	**33**	**1**	**2**

		Period	PPNA											
		Sector	B											
		Zone/TB	TB20	TB21	TB21	TB21	TB22	TB22	TB24-25	TB25	TB25	(a)	(b)	(b)
		SU or Structure (St)	St6837	6095	6097	St6826	6082	6115	6111	6087	St6852	St6846	St6882	St6883
		Fl. vol. (L)	/	263	/	138	/	43	34	246	20	/	91	8
		Density remains (N/L)	/	0,39	/	5,04	/	1,88	0,18	0,54	0,05	/	0,11	2,00
C	Einkorn	*Triticum monococcum*												
C	cf. Cereal caryopsis	cf. *Cerealia*												
C	Cereal chaff	*Cerealia*												
C	Grasses, type 1	Poaceae												
C	Grasses, type 2	"												
C	Grasses, type 4	"												
C	Grasses, indet.	"					2		2	4				
M	Tournefortii hackberry	*Celtis* cf. *tournefortii*			1					1				1
M	Hackberry	*Celtis* sp.		2						6				
M	cf. Hackberry	cf. *Celtis*		3										
C	Fig, fruit	*Ficus carica*												
M	Fig, achene	"												
C	Atlas pistachio	*Pistacia atlantica*								1			2	1
C	cf. Atlas pistachio	*Pistacia* cf. *atlantica*												
C	Terebinth pistachio	*Pistacia terebinthus*		1									1	
C	cf. Terebinth pistachio	*Pistacia* cf. terebinthus					6							
C	*Pistacia* genus, elongated type	*Pistacia* sp.												
C	*Pistacia* genus, undet.	"	9				4		1				1	14
C	*Pistacia* genus, seed	"					1							
C	Undet. nutshell, frag.	/		2			1		2	1			4	
M	Undet. nutshell, frag.	/								1				
M	Borage family type 1	*Echium/Buglossoides*		85		688	149	78		111	1	1	2	
M	Borage family type 2	*Anchusa* sp.		1		1								
M	Borage family type 3	*Anchusa/Nonea*												
M	Borage family type 4	*Buglossoides* cf. *tenuiflora*		8		4		1		1		4		
M	Borage family type 5	cf. *Arnebia*				3		2						
M	Borage family, undet.	"												
C	Bedstraw	*Galium* sp.												
C	Mallow	*Malva* sp												
M	Turnipweed	*Rapistrum rugosum*												
C	Undetermined remains	/		1					1	6				
M	Undetermined remains	/								1				
		Total	9	103	1	696	163	81	6	133	1	5	10	16

Tab. 23-7 (2) – *Results of the analysis of seeds/fruits from Sector B.* • *Résultats de l'analyse des graines/fruits du Secteur B.*

		Period	PPNA								
		Sector	B								
		Zone/TB	(b)	(b)	(b)	(b)	(c)	(c)	(c)	(c)	(c)
		SU or Structure (St)	St6884	St6976	St6979	St7243	St7125	St7126	St7127	St7135	St7137
		Fl. vol. (L)	/	22	10	24	7	5	20	36	23
		Density remains (N/L)	/	0,55	0,30	0,25	0,14	1,40	1,30	0,86	0,22
C	Einkorn	*Triticum monococcum*									
C	cf. Cereal caryopsis	cf. *Cerealia*									
C	Cereal chaff	*Cerealia*									
C	Grasses, type 1	Poaceae									
C	Grasses, type 2	"			1						
C	Grasses, type 4	"									
C	Grasses, indet.	"	4								
M	Tournefortii hackberry	*Celtis* cf. *tournefortii*								1	
M	Hackberry	*Celtis* sp.								1	
M	cf. Hackberry	cf. *Celtis*									
C	Fig, fruit	*Ficus carica*									
M	Fig, achene	"				1					
C	Atlas pistachio	*Pistacia atlantica*									
C	cf. Atlas pistachio	*Pistacia* cf. *atlantica*									
C	Terebinth pistachio	*Pistacia terebinthus*									
C	cf. Terebinth pistachio	*Pistacia* cf. terebinthus									
C	*Pistacia* genus, elongated type	*Pistacia* sp.									
C	*Pistacia* genus, undet.	"									
C	*Pistacia* genus, seed	"									
C	Undet. nutshell, frag.	/		4							
M	Undet. nutshell, frag.	/									
M	Borage family type 1	*Echium/Buglossoides*		7	2	2		7	22	24	5
M	Borage family type 2	*Anchusa* sp.									
M	Borage family type 3	*Anchusa/Nonea*									
M	Borage family type 4	*Buglossoides* cf. *tenuiflora*				3	1		3	1	
M	Borage family type 5	cf. *Arnebia*								1	
M	Borage family, undet.	"							1	1	
C	Bedstraw	*Galium* sp.									
C	Mallow	*Malva* sp									
M	Turnipweed	*Rapistrum rugosum*									
C	Undetermined remains	/		1							
M	Undetermined remains	/								2	
		Total	**4**	**12**	**3**	**6**	**1**	**7**	**26**	**31**	**5**

		Period	PPNA					
		Sector	B					
		Zone/TB	(d)	(d)	(d)	(d)	N	%
		SU or Structure (St)	6125	St6886	St7118	St7138		
		Fl. vol. (L)	59	/	3	7		
		Density remains (N/L)	1,10	/	0,67	44,14		
C	Einkorn	*Triticum monococcum*					1	0,02%
C	cf. Cereal caryopsis	cf. *Cerealia*					1	0,02%
C	Cereal chaff	*Cerealia*					1	0,02%
C	Grasses, type 1	Poaceae					2	0,04%
C	Grasses, type 2	"					2	0,04%
C	Grasses, type 4	"					1	0,02%
C	Grasses, indet.	"					17	0,38%
M	Tournefortii hackberry	*Celtis* cf. *tournefortii*		1			54	1,21%
M	Hackberry	*Celtis* sp.		5			174	3,91%
M	cf. Hackberry	cf. *Celtis*					7	0,16%
C	Fig, fruit	*Ficus carica*					2	0,04%
M	Fig, achene	"					1	0,02%
C	Atlas pistachio	*Pistacia atlantica*					4	0,09%
C	cf. Atlas pistachio	*Pistacia* cf. *atlantica*					2	0,04%
C	Terebinth pistachio	*Pistacia terebinthus*					4	0,09%
C	cf. Terebinth pistachio	*Pistacia* cf. terebinthus					6	0,13%
C	*Pistacia* genus, elongated type	*Pistacia* sp.			1		5	0,11%
C	*Pistacia* genus, undet.	"					37	0,83%
C	*Pistacia* genus, seed	"					6	0,13%
C	Undet. nutshell, frag.	/					121	2,72%
M	Undet. nutshell, frag.	/					2	0,04%
M	Borage family type 1	*Echium/Buglossoides*	64		1	309	3834	86,12%
M	Borage family type 2	*Anchusa* sp.					20	0,45%
M	Borage family type 3	*Anchusa/Nonea*					10	0,22%
M	Borage family type 4	*Buglossoides* cf. *tenuiflora*	1				68	1,53%
M	Borage family type 5	cf. *Arnebia*					16	0,36%
M	Borage family, undet.	"					17	0,38%
C	Bedstraw	*Galium* sp.					1	0,02%
C	Mallow	*Malva* sp.					1	0,02%
M	Turnipweed	*Rapistrum rugosum*					8	0,18%
C	Undetermined remains	/					19	0,43%
M	Undetermined remains	/					8	0,18%
		Total	**65**	**6**	**2**	**309**	**4452**	**100%**

Tab. 23-7 (3) – *Results of the analysis of seeds/fruits from Sector B.* • *Résultats de l'analyse des graines/fruits du Secteur B.*

			Period	PPNA			N
			Sector	F			
			SU	800.28	801.1	801.4	
			Volume (L)	/	/	12	
M	Hackberry	*Celtis* sp.			1	1	2
C	Olive, endocarp frag.	*Olea europaea*		1			1
C	Undet. nutshell, frag.	/		1			1
			Total	**2**	**1**	**1**	**4**

Tab. 23-8 – *Results of the analysis of seeds/fruits from Sector F.* • *Résultats de l'analyse des graines/fruits du Secteur F.*

SU	Building	Square	Layer	Description	Identification
10.38	1a	C35	3	Spikelet bases	*Triticum dicoccoides/dicoccon*
10.38	1a	D36	4		*Triticum dicoccoides/dicoccon*
10.3	1b		3	Spikelet bases	*Triticum dicoccoides/dicoccon*
10.3	1b	B36	4	Chaff; awns, glumes	*Triticum dicoccoides/dicoccon*
10.3	1b	D38		Carbonised spikelet bases + awns, glumes	*Triticum dicoccoides/dicoccon*
10.6	IM	C35		Carbonised spikelet bases + awns, glumes	*Triticum dicoccoides/dicoccon*
10.6	IM	C36		Chaff; awns, glumes	Cereals
166.1	IM			Chaff; spikelet bases	*Triticum dicoccoides/dicoccon*

Tab. 23-9 – *Identifications from plant impressions on earthen building materials.* • *Identifications des empreintes végétales sur terre à bâtir.*

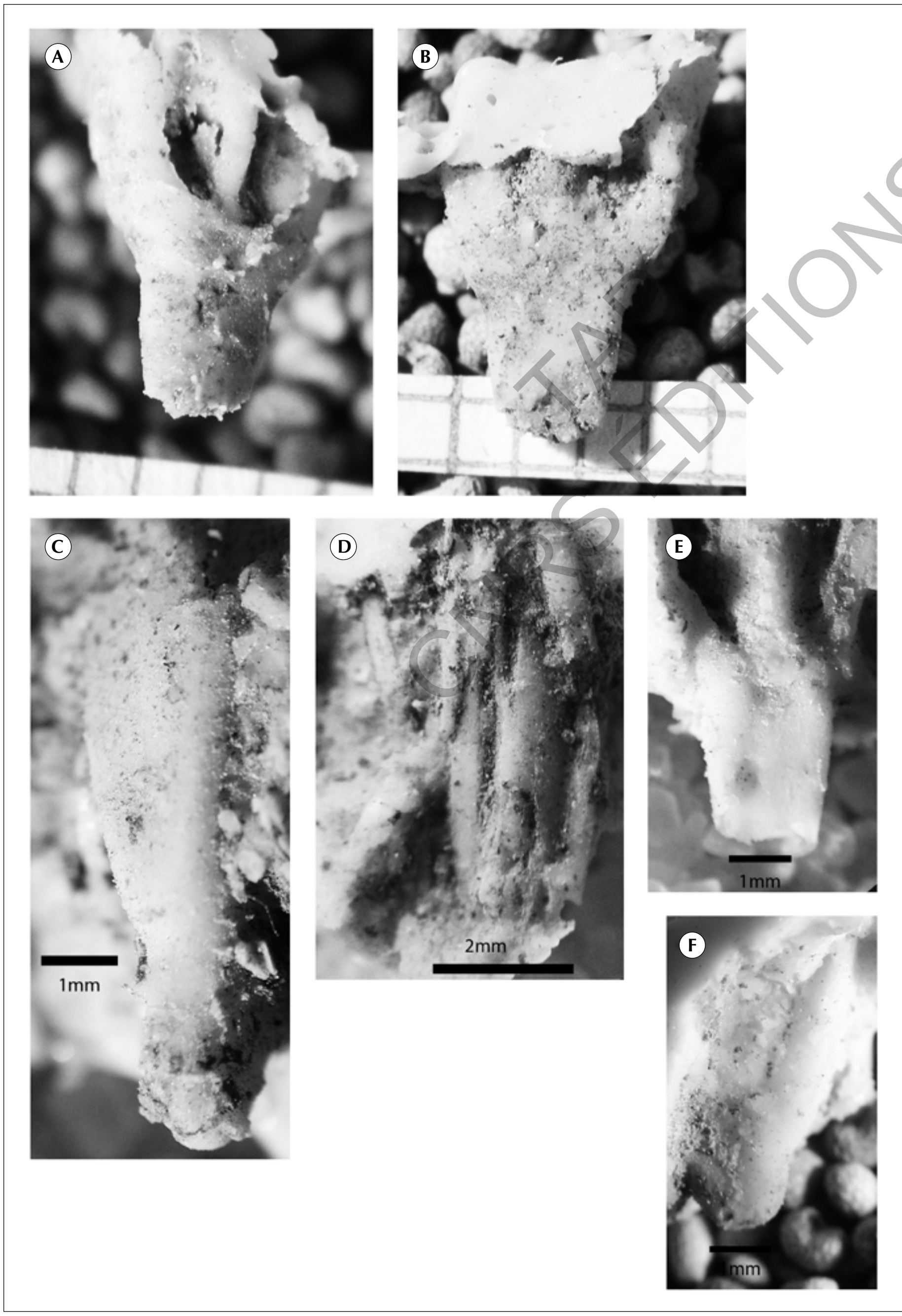


Fig. 23-4 – *Photos of moulds made from dental silicone which gives an accurate positive of the impressions. A (front view) and B (back view) are photos of a spikelet fork of emmer showing the widely separated glumes. C is a spikelet seen in lateral view with rounded keels on the glume. D shows broken fragments of awn and other chaff fragments. E and F are other examples of emmer spikelet forks. A, B and F come from SU 10.3, Décapage 3, PR 09. C, D and E come from St 10, SU 10.3, D/38, PR9. Photos G. Willcox, CNRS.* • *Photos de moulages réalisés avec de la silicone dentaire permettant d'obtenir une forme positive et précise des empreintes. A (face) et B (dos) sont des photos d'une base d'épillet d'amidonnier montrant les glumes largement écartées. C est une base d'épillet vue du côté présentant des glumes à crêtes arrondies. D correspond à des fragments d'une arête et d'autres fragments de bale. E et F présentent des exemples de bases d'épillets d'amidonnier. A et B proviennent de l'US 10.3, passe 2, PR 09. C, D et E proviennent de St 10, SU 10.3, D/38, PR9. Clichés G. Willcox, CNRS.*

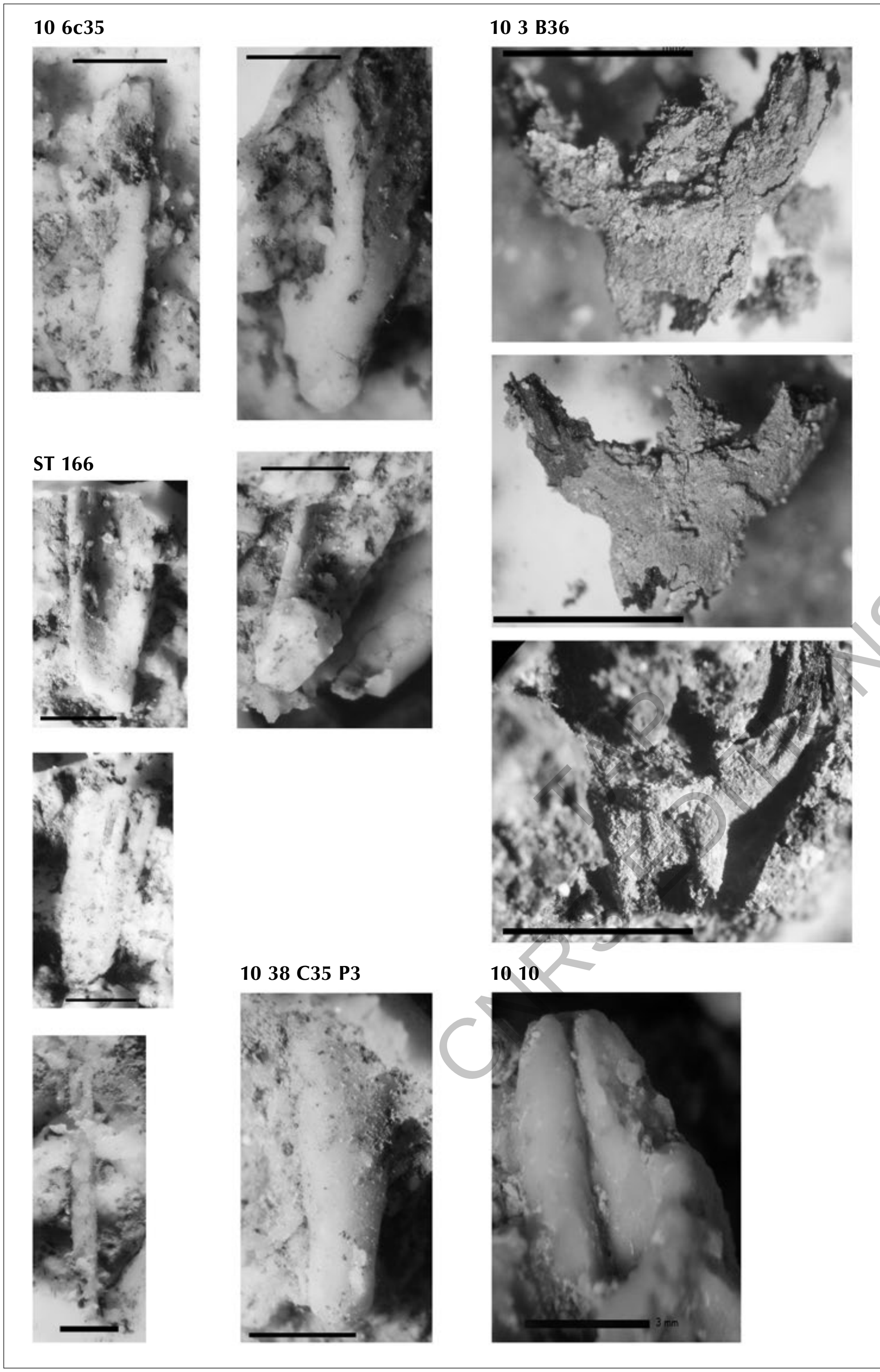


Fig. 23-5 – *Photos of moulds made from dental silicone which gives an accurate positive of the impressions. 10 6c35 Top left, top centre, middle centre emmer spikelet forks, the latter split showing inside of glume base, scale ≈ 2mm. SU 10 3 B. three top photos on the left, charred spikelet base preserved in its impression in the building earth. It must have been charred under reducing conditions, scale ≈ 5mm. St 166, upper glume fragment, middle unidentified fragment, lower cereal awn, scale 1mm. SU 10 38 C35 P3 lateral view of glume. SU 10 10 Mould of an emmer grain which had either been oxidized by burning or decomposition, scale ≈ 3mm. Photos G. Willcox, CNRS.*

• *Photos de moulages réalisés avec de la silicone dentaire permettant d'obtenir une forme positive et précise des empreintes. 10 6c35 en haut à gauche et au centre, au milieu bases d'épillets d'amidonnier, le dernier éclaté laisse voir l'intérieur de la base de glume, échelle ≈ 2 mm. US 10 3 B, trois photos en haut à gauche, base d'épillet carbonisée préservée à l'intérieur de son empreinte dans la terre à bâtir. Elle a dû être carbonisée en conditions réductrices, échelle ≈ 5 mm. St 166, fragment de glume supérieure, au milieu fragment non identifié, en bas arête de céréale, échelle 1 mm. US 10 38 C35 P3, vue latérale de glume. US 10 10, moulage d'un grain d'amidonnier disparu soit à cause de la combustion, soit par décomposition, échelle ≈ 3 mm. Clichés G. Willcox, CNRS.*

5. DISCUSSION

5.1. PRESENT AND PAST VEGETATION COVER AROUND KLIMONAS

The vegetation of Cyprus is typically Mediterranean and includes quite a high number of endemic species as well as plants from other phytogeographical regions (Zohary 1973a, p. 151). From sea level up to around 1200 m of altitude, the vegetation cover is dominated by evergreen shrub- and woodlands and forests with a succession of communities depending on rainfall and temperatures. In the coastal areas thermophilous associations of carob (*Ceratonia siliqua* L.) and lentisk (*Pistacia lentiscus* L.) are dominant (fig. 23-6, A). Inland they are progressively replaced by a more diversified communities where Palestine oak (*Quercus calliprinos* Webb.) and *Pistacia atlantica* Desf. are the dominant species, often associated with other typical Mediterranean trees and shrubs such as mock privet (*Phillyrea latifolia* L.), storax (*Styrax officinalis* L.), olive (*Olea europaea* L.), Greek strawberry tree (*Arbutus andrachne* L.), bay laurel (*Laurus nobilis* L.) and Mediterranean buckthorn (*Rhamnus alaternus* L.; fig. 6, B). Brutia pine (*Pinus brutia* Ten.) is frequent in the carob-lentisk and *Pistacia atlantica* communities where its range is above all due to its capacity to colonise where original woodlands have been cleared.

The surroundings of Klimonas belong to the coastal belt where *Ceratonia-Pistacia lentisci* associations are frequently dominant. Although scattered remnants of these communities still exist in the region (fig. 23-6, A), the immediate surroundings of the site are now characterised by *phrygana* formations (open dwarf scrub) where thorny shrubs such as spiny broom (*Calicotome villosa* (Poir.) Link) and spiny burnet (*Sarcopoterium spinosum* (L.) Spach) are associated with rockroses (*Cistus* spp.), aromatic herbs from the Lamiaceae-family and other low growing taxa. The *phrygana* generally replace the original woodlands as they become degraded by human activities (Arianoutsou-Faraggitaki and Diamantopoulos 1985). This is the case around Klimonas where humans have impacted the landscape since Prehistory. During the last decades agriculture, herding and tree cultivation have given way to the unbridled construction of villas, gardens and roads leading to a rapid destruction of the local fauna and flora.

The results of the study of seed/fruit remains and charcoal enable us to glimpse what the vegetation cover might have looked like around the PPNA village in the early 9th millennium BC. Most of the taxa found on the site are wild species and thus provide direct information about the local vegetation from which the Neolithic inhabitants of Klimonas collected resources for food, construction, and fuel.

Charred wood and fruit remains belonging to *Pistacia* are recurrent in the archaeobotanical samples from all periods. If the wood anatomy alone does not allow a determination to the species level, the analysis of endocarp morphologies has provided evidence for the presence of at least two different species: *Pistacia atlantica* and the terebinth tree, *P terebinthus. Pistacia atlantica* today is found from sea level to altitudes of about 1500 m, where it grows in abandoned fields, along field margins and on rocky slopes. Isolated trees as well as tree clusters can be seen in the regions of Akamas, Ktima (Paphos), Limassol and Kiti (Larnaka; Tsintides *et al.* 2002). *P. terebinthus* occupies the same altitudinal range as *P. atlantica* and is a frequent component of the Mediterranean vegetation. *P. lentiscus*, the third wild *Pistacia* species also present in Cyprus, has so far not been identified among the plant remains from Klimonas.

Oak is the second most frequent taxon identified for the PPNA period. When sufficiently well-preserved, *Quercus* fragments could be attributed on anatomical grounds to a deciduous type. The only indigenous deciduous oak in Cyprus is *Q. infectoria* ssp. *veneris* Olivier. This tree is found in mountain valleys on igneous rocks or sometimes on calcareous soils in lowland areas (0–1375 m, Meikle 1985). It is usually associated with *Calliprinos-Pistacia atlantica* communities and its present distribution in the lower Trodoos mountains and in the western part of the island is thought to represent the remnants of a wider distribution in the past (Christou 2001). Two evergreen oak species are also indigenous to the island: *Quercus coccifera* ssp. *calliprinos* (Webb) Holmboe and the endemic golden Cyprus oak *Q. alnifolia* Poech. The latter is common on the basaltic soils of the Troodos mountainsides where it grows in association with *Pinus brutia*.

Other representatives of the Mediterranean flora are present at Klimonas such as olive (*Olea europaea*), attested by both fruit and charcoal remains, and buckthorn (*Rhamnus* sp.). Two buckthorn species are part of the Cypriote flora: *Rhamnus alaternus* (0-1075 m) and *R. lycioides* (0-925 m). Both are characteristic of shrub- and woodlands and they can also be found in the lower stage of pine forests (Tsintides *et al.* 2002). *Rhamnus lycioides* moreover grows on rocky hillsides and in coastal shrublands (Meikle 1977).

The Rose family (Rosaceae) is represented by two types of wood identified as *Prunus* sp. and Maloideae respectively. Several cultivated *Prunus* species grow in Cyprus today: apricot (*P. armeniaca)*, peach (*P. persica*), cherry (*P. avium*), plum (*P. domestica*) and almond (*P. dulcis*) but they are all considered to have been introduced to the island as cultivars. They may also exist as escapes from cultivation (Meikle 1977). At present there is no known modern equivalent for the archaeological *Prunus* remains.

The specimens identified as belonging to the Maloideae (apple) subfamily probably correspond to species found growing today at lower altitudes, such as the Syrian pear (*Pyrus syriaca*, 25-1525 m) or one of the two species belonging to the genus of *Crataegus*, growing on rocky mountainsides at lower altitudes: Mediterranean medlar (*Crataegus azarolus*, 0-1075 m) or hawthorn (*Crataegus monogyna*, 300-1525 m). *Crataegus* x *sinaica*, a hybrid showing intermediate characteristics between the last two species is attested at higher altitudes (925-1650 m; Meikle 1977). The other two indigenous Maloideae trees – white beam (*Sorbus aria*) and round-leaved medlar (*Cotoneaster racemiflorus*) – only thrive in mountainous forests above 1000 m and their presence around Klimonas is unlikely (Meikle 1977, Tsintides *et al.* 2002).

Fig. 23-6 – *Present-day vegetation communities in Cyprus:* Ceratonia-Pistacia lentisci *open shrublands near Ayios Tychonas-Klimonas (A); open woodland with* Olea europaea, Pistacia terebinthus, Crataegus azarolus *and* Pinus brutia *near the village of Xyliatos, Nicosia (altitude 470 m a.s.l.). Photos M. Tengberg (A) and M. Rousou (B), MNHN.* • *Communautés végétales actuelles à Chypre : formations arbustives ouvertes avec* Ceratonia *et* Pistacia lentiscus *à proximité d'Ayios Tychonas-Klimonas (A), formation forestière ouverte avec* Olea europaea, Pistacia terebinthus, Crataegus azarolus *et* Pinus brutia *près du village de Xyliatos, Nicosie (B) (altitude 470 m au-dessus du niveau de la mer). Clichés M. Tengberg (A) et M. Rousou (B), MNHN.*

Oriental hackberry (*Celtis tournefortii* Lam.) has only been identified from its mineralised fruits. It is a drought-resistant shrub or tree (2-8 m high) that grows on dry calcareous hillsides. *Celtis australis* L. is a bigger tree (up to 20 m high) that was often planted near significant buildings in historical times (Meikle 1985). Another species that appears only in the seed/fruit remains is fig (*Ficus carica*), a Mediterranean species that would have grown in habitats with permanent water or where groundwater was readily available.

The general picture that appears from the results of the archaeobotanical study is that of a vegetation cover around the site that would have been more diversified and probably considerably denser during the early Holocene than it is today (see also convergent isotopic information in chap. 29). Even though the number of taxa identified is low due to taphonomic reasons, they point towards the existence of a Mediterranean woodland where *Pistacia* trees, oaks and olive trees would have grown together with other tree and shrub species.

The absence of lentisk and evergreen oaks may indicate that the thermo-Mediterranean flora of the type that we see in the region today was not yet well developed. Although absence is not necessarily evidence of absence, particularly when remains are scarce, it can be noted that other taxa characteristic of the carob-lentisk communities such as the carob tree and jujube (*Ziziphus lotus*) have not been noted in the Klimonas samples. The same holds true for Brutia pine, which in many areas is a sign of degraded woodlands.

The charcoal studies conducted on later PPN sites in Cyprus have provided similar results to those obtained at Klimonas. The charcoal records from Parekklisha-Shillourokambos and *Kissonerga*-Mylouthkia (8500-7000 cal BC) are characterised by the presence of Mediterranean taxa among which *Pistacia* spp., olive and deciduous oak are well represented (Asouti 2003, Thiébault 2011, 2021). The spectras obtained at Mylouthkia, where preservation conditions are better, are more diversified than at Klimonas or Shilloroukambos. They comprise the above-mentioned taxa as well as evergreen oak (*Quercus* sp.), strawberry tree (*Arbutus* sp.), honeysuckle (*Lonicera* sp.), carob (*Ceratonia* sp.), fig (*Ficus* sp.), *Prunus* sp. and a series of woody shrubs. The results are interpreted as reflecting the existence of a typical "Mediterranean woodland vegetation" (Asouti 2003).

Contrary to Klimonas, pine (*Pinus* sp.) is recorded at Shillourokambos and so are a few hygrophilous (water-loving) taxa such as ash tree (*Fraxinus* sp.) and chaste tree (*Vitex agnus-castus* L.) too (Thiébault 2011). At Klimonas, geomorphological data point to the significant activity of the Athiaki stream which flows 200 m just below Klimonas during the Pre-Pottery Neolithic (chap. 3). It could have provided the habitat for wild figs. The presence of freshwater crabs (chap. 24) and the abundance of water birds (chap. 26) in the archaeozoological record denotes moreover the presence of river or lake in the neighbourhood of the village. Still, there is no clear botanical evidence so far that reflects the environment of the riverside as at Shillourokambos or the Late Aceramic site of Khirokitia (Thiébault 2003, 2011, Parés 2015, Rousou in preparation).

5.2. WOOD COLLECTION AND USE

It is likely that most of the charcoal remains found in the archaeological layers at Klimonas represent the use of wood as fuel for heating, food preparation, etc. The most frequently attested taxon is *Pistacia*, present in various primary and secondary contexts such as floors, benches, probable hearths, foundation trenches, earthen building material, primary and secondary fills. Even though the *Pistacia* wood cannot be identified to the species level, the analysis of the charred endocarps suggests that it belongs to either *Pistacia atlantica* or *P. terebinthus.* The simultaneous presence of wood and whole fruits in several contexts might indicate that fruit-bearing branches were used as fuel. The same hypothesis has been developed at other later Pre-Pottery Neolithic sites in Cyprus such as Mylouthkia (Asouti 2003, Murray 2003) and Khirokitia (Parés 2015, 2017). *Pistacia* is also one of the main taxa identified in the anthracological assemblages of Shillourokambos and Khirokitia (Thiébault 2003, 2011, 2021, Rousou in preparation), as well as in various Epipalaeolithic and Neolithic sites in the Near East (Willcox 1991). Palynological studies in Anatolia and the Levant have demonstrated a peak of *Pistacia* pollen during the early Holocene (9000-6000 BP), indicating the expansion of forests in which *Pistacia* was a leading element (Rossignol-Strick 1995, Woldring and Bottema 2002). Thus, *Pistacia* wood was probably readily available in the surrounding vegetation and exploited for fuel in an opportunistic way.

Post holes found in the Communal building and in many buildings in Sectors B and F suggest a wooden roof supported by posts (chap. 12). Both deciduous oak and *Pistacia atlantica* provide good timber in the form of straight and relatively tall trunks. For example *Quercus infectoria* ssp*. veneris* can grow up to 10 m tall (Meikle 1985) while *P. terebinthus* tree has a rather shrubby growth less adapted for building purposes.

5.3. THE GATHERING OF WILD FRUITS

Besides wood for fuel and construction, the vegetation that grew around Klimonas in the early Holocene provided other useful plant resources. Several of the identified trees bear edible fruits such as the *Pistacia* species, olive, hackberry and fig, all identified among the fruit remains. Two other taxa – Maloideae type and *Prunus sp.* – identified from charcoal, may also correspond to fruit-bearing trees although examination of their cellular structure did not allow us to identify them more precisely.

Two charred syconia from fig (*Ficus carica*) were found in Sector B and one of them was dated directly by AMS to the early 9th millennium cal BC. Fig trees are characteristic of Mediterranean vegetation and it is likely that the sweet fruits, which can also be dried for later consumption, constituted an appreciated complement to the diet. Fig remains are relatively common on early Neolithic sites in the eastern Mediterranean (Zohary *et al.* 2012). Finds of whole figs as well as numerous drupelets identified at the PPNA site of Gilgal I in the Jordan valley led the archaeobotanists to suggest that figs were already vegetatively propagated (and thus by definition cultivated) more than 11,000 years ago (Kislev *et al.* 2006). This assumption, based principally on the presence of parthenocarpic fruits (e.g. fruits that develop despite the absence of fecundation of ovules) has later been disputed (Denham 2007) but the possibility of an early management of fruit trees such as figs is worth consideration.

Other traditional uses of *Pistacia atlantica* and *P. terebinthus* include the exploitation of gum, oil, the consumption of raw or grilled fruits, their use in pastries or as a coffee like drink used in eastern Turkey (Della *et al.* 2006).

The fruits of various species of hackberry, among them *Celtis tournefortii*, are consumed raw in Cyprus as well as in the Near East (Zohary 1973b, Della *et al.* 2006, Polat *et al.* 2015).

Interpreting the presence of mineralised fruits belonging to the Boraginaceae family in terms of human use is inconclusive as these may correspond to accumulations due to ants, as discussed above. Moreover, many species in this family are characterised by the presence of glandular hairs on the stems and leaves that can make them very difficult to collect (Taia 2006). Still, ethnobotanical studies conducted in the circum-Mediterranean region including Cyprus, record several species as sources for edible leaves and flowers. The aerial parts and leaves of *Anchusa azurea*, *A. strigosa* and *A. undulata* ssp. *hybrida* are consumed in various forms: boiled alone or with vegetables, fried, cooked, as pot herbs or in salad. The flowers of *Anchusa azurea* are edible as a snack, while a nectar is said to be extracted from the flowers of *Echium angustifolium* (Zohary 1973b, Della *et al.* 2006, Hadjichambis *et al.* 2008).

Rich in tannins (50-70% of gallotannins), the galls of *Quercus infectoria*, produced by the deposition of eggs by Hymenoptera wasps (Cynipidae; *Cynips* spp.) can be used in traditional medicine, for dyeing and leather tanning (Gennadios 1914, Fagan 1918, Cardon 2003, Elham *et al.* 2021).

Different parts of *Pistacia* spp. (leaves, galls, bark) have also been recorded as useful for leather tanning, while leaves contain yellow pigments (flavonols; Gennadios 1914, Bailey and Danin 1981, Cardon 2003, Papachristoforou 2015). In particular, the galls produced by Hemiptera (Aphididae; *Baizongia pistaciae*) are rich in gallotannins (50-60%), in flavonols and dihydroflavonols, and are thus very useful for leather tanning or dyeing. Gall tannins and ash can also serve as mordants (Cardon 2003).

Indications for the treatment of leather have also been documented by the use-wear analysis study of flint (chap. 15) and moreover of the macrotool, especially handstones used for skinning together with ochre (Robitaille 201; see also chap. 16). Pigments have been also appreciated by the inhabitants of Klimonas (chap. 21).

5.4. EXPLOITATION OF CEREALS

Despite unfavourable preservation conditions, several economically important cereal species are attested at Klimonas: barley, emmer and possibly einkorn. Barley is found in the form of impressions and a fragmentary caryopsis, emmer as impressions of spikelet bases in the earth building material of the bench of the second phase of the Communal building, close to the entrance (St 172) from which one charred spikelet was extracted. Einkorn is attested by the presence of a characteristic charred grain, found in the foundation trench of the building B18 (St 6668), in the Sector B, and directly dated by AMS. The nearly exclusive concentration of commensal mice bones and teeth in each of the packed earth floors of the three phases of the Communal building even suggest that cereal crops might have been preferentially stored in this place, like they were in some PPNA Communal buildings on the near mainland (see chap. 28).

Despite their paucity the cereal finds are highly significant as they are evidence for the earliest use of cereals in Cyprus. Their presence raises a fundamental question: were wheat and barley indigenous to the island or had these plants been introduced from the mainland as were wild boars, dogs and cats (Vigne *et al.* 2012)? This question also determines how we should consider the role of these plants in the local economy. If they were part of the natural vegetation in the surroundings of the small village they could have been gathered. If imported they would have been stored, and if introduced the intention would have been to cultivate them on the island. If cultivated, were these plants morphologically wild or already domesticated?

Wild barley (*Hordeum spontaneum* K. Koch) is common on the island today, growing along roads, on cultivated land and as part of the garrigue on dry hillsides (Meikle 1985, p. 1834-1835) This species could thus potentially have been gathered from local stands or taken into cultivation *in situ*. In contrast, neither emmer or einkorn have been reported growing on the island either at present or historically. Their absence in the indigenous flora, edaphic conditions that do not seem favourable to their spontaneous growth as well as the possibility that a denser vegetation covered the island in the early Holocene are the reasons suggested by botanists and archaeobotanists for explaining why wild stands of wheat were not available to the first colonisers of Cyprus. Viable seeds from einkorn and emmer were thus probably brought across the sea to be sown in arable soils around the new settlement. It is possible that barley was also imported as part of a crop assemblage cultivated in villages from which the first populations came but such a hypothesis remains speculative.

It should be recalled here that Klimonas also provided the earliest evidence at the time of writing, of the presence (thus of the recent introduction) of the commensal grey mouse (*Mus m. domesticus*) from the mainland (Cucchi *et al.* 2020) and that it was likely coming from Southeast Anatolia (chap. 28).

Based on the association of species, one could speculate on the geographical origin of the crop assemblage. The question was already raised previously concerning the origin of cereal species identified from late 9th millennium cal BC Shillourokambos and Mylouthkia where the crop assemblages are similar to that of Klimonas with the presence of barley, emmer and single-grained einkorn (Willcox 2001, 2003, 2021). However, at the time of writing the cereals identified at Klimonas do not allow us to suggest a specific region of origin as these are common on sites in different parts of the Fertile Crescent.

The scarcity of the plant remains makes it difficult to estimate the importance of crops at Klimonas in comparison to other activities such as hunting and foraging. However, there are several lines of evidence that indicate that cereals were an important part of the local subsistence economy. Impressions and phytoliths from most of the building earth samples examined indicate that chaff was readily available and widely used as a tempering material in the architecture at Klimonas (chap. 10 and 22), a widespread practice on Pre-Pottery and later Neolithic sites in the Near East. The *in situ* processing of crops further suggests that these were locally produced. Additional evidence for the harvesting and use of grasses are glossed flint sickle blades and querns (see chap. 14, 15 and 16).

The state of the cereal remains does not allow us to determine whether they correspond to morphologically wild or to domesticated plants. On mainland Near Eastern sites there is no evidence of plant domestication at PPNA sites contemporary with Klimonas, despite the strong possibility of the cultivation of wild cereals in several parts of the Near East (Willcox 2013). Whereas it seems unlikely that wheat existed in an already domesticated form in Cyprus in the early 9th millennium cal BC, the possibility that a local domestication process took place later cannot be ruled out. Indeed, in an insular environment where a cultivated population becomes isolated, with less or no input from wild stands, the selection pressure for domestic traits such as the non-shattering of the mature spike may have been higher than on the mainland. The first domesticated cereals known in Cyprus were sampled from a well dated to the mid-9th millennium cal BC at the site of Mylouthkia in the southwestern part of the island. Cultivated einkorn, emmer and barley were identified together with lentils (*Lens* sp.), flax (*Linum* sp.) as well as a series of wild taxa of which some may correspond to weeds (Murray 2003).

6. CONCLUSION

Despite unfavourable preservation conditions, similar to those found at other early sites on Cyprus (Willcox 2021), systematic sampling and the combined study of charcoal, seeds and plant impressions have produced results that can be interpreted in terms of plant palaeoecology and subsistence practices in the early Holocene.

The archaeobotanical assemblage of Klimonas points towards a woodland vegetation with wild olives, figs, terebinth and *Pistacia atlantica* trees, deciduous oak, Oriental hackberries, buckthorn and several species from the Rosaceae family. Such habitats, richer than those present around the site today, can be found more inland and at somewhat higher altitudes where rainfall is more abundant and disturbance by human activities less. This environment was rich in edible and other resources and also formed a favourable habitat for wild boar, the preferred game hunted at the site (chap. 24 and 29).

The presence of emmer wheat, possibly einkorn wheat and barley, in the form of impressions and a limited number of grain and spikelet remains, suggests that the inhabitants of Klimonas had introduced a selection of useful species from the mainland that they reproduced by cultivation around the village. The site has thus provided the first evidence for cultivation on Cyprus and the earliest example of the diffusion of Near Eastern cultivars to a Mediterranean island.

The results obtained by the archaeobotanical study at Klimonas show the importance of systematic sampling of plant remains and should encourage further studies of prehistoric sites on the island. They also highlight the importance of including different types of evidence, such as impressions and phytoliths, which contribute in a fundamental way to our understanding of past plant economies, in particular when charred macro-remains are rare.

Aknowledgements

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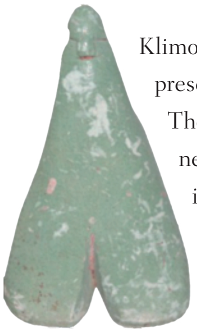
KLIMONAS-Ch23-A01, https://doi.org/10.34847/nkl.b1424j9j
Identification criteria for Prunus *sp. wood charcoal* • *Critères d'identification pour les charbons de bois de* Prunus *sp.*
Margareta TENGBERG (MNHN), George WILLCOX (CNRS), Maria ROUSOU (MNHN), Carolyne DOUCHÉ (MNHN), Andréa PARÉS (Muséum Toulon)

KLIMONAS-Ch23-A02, https://doi.org/10.34847/nkl.cdffo62g
Identification criteria for Boraginaceae mericarps • *Critères d'identification des méricarpes de Boraginaceae*
Margareta TENGBERG (MNHN), George WILLCOX (CNRS), Maria ROUSOU (MNHN), Carolyne DOUCHÉ (MNHN), Andréa PARÉS (Muséum Toulon)

Gallia Préhistoire

International Supplement, 1

avec la participation de *Paléorient*



Klimonas is the oldest Mediterranean island village. Occupied ca. 8 800 cal BC, it postpones by several centuries the Neolithic presence in Cyprus, at that time located more than 80 km offshore.

The village extended over more than 5,500 m², facing the sea, 2 km from the famous pre-pottery site of Shillourokambos and near rich flint outcrops. Excavations (2009-2016) revealed that it was composed of circular or oval earthen buildings 3-6 m in diameter, notched into the slope, modestly fitted out and organised around a semi-buried 10 m communal building.

The construction techniques, the abundance of either knapped or polished stone material, together with ornaments, symbolic objects, and plants and animal remains, as well as the 52 radiometric dates, point to the end of the Levantine Pre-Pottery Neolithic A (PPNA). The presence of a communal building, rebuilt numerous times over the course of several decades, also points to the same conclusion.

The villagers gathered seeds and fruits and cultivated wild starch and einkorn, recently imported from the continent.

They primarily hunted small endemic wild boar, the only large mammal species attested on the island at that time and, secondarily, birds. They did not eat fish or marine shellfish. Domestic dogs, mice and cats brought from the continent also lived in the village.

The remains of this cultivator-hunter community testify to the early extension of the Near Eastern Neolithic and to unsuspected seafaring skills, substantially improving our knowledge of the Neolithic transition in the Mediterranean.

Jean-Denis Vigne, emeritus director of research at the CNRS and project leader at the Muséum national d'histoire naturelle, co-directed the excavation with François Briois, assistant professor at the EHESS. The latter took over the direction of the "Neolithisation" mission in 2014, following Jean Guilaine, emeritus professor at the Collège de France and member of the French Institute.

Klimonas est le plus ancien village insulaire de Méditerranée. Occupé autour de 8 800 av. n.è., il recule de plusieurs siècles le début de la présence néolithique à Chypre, à cette époque déjà située à plus de 80 km du continent.

Le village s'étendait sur 5 500 m² au moins, face à la mer, à 2 km du célèbre site pré-céramique de Shillourokambos et au contact de riches sources de silex. Les fouilles (2009-2016) ont montré qu'il était composé d'édifices de terre crue (bauge) de 3 à 6 m de diamètre, circulaires ou ovalaires, encochés dans la pente, modestement aménagés, organisés autour d'un bâtiment communautaire semi-enterré de 10 m de diamètre.

Les techniques de construction, l'abondant mobilier de pierre taillée, le macro-outillage, les parures et objets symboliques, les restes de plantes et les ossements animaux, tout comme les 52 datations radiométriques renvoient à la fin du Néolithique pré-céramique A levantin (PPNA). La présence d'un bâtiment communautaire, plusieurs fois reconstruit en quelques décennies, le confirme.

Les villageois pratiquaient la cueillette et cultivaient l'amidonnier et l'engrain sauvages, récemment importés du continent. Ils chassaient un petit sanglier endémique, seule espèce de grand mammifère attestée sur l'île à cette époque, et, secondairement, des oiseaux. Poissons et coquillages marins n'étaient pas consommés. Des chiens domestiques, des souris et des chats de souche continentale vivaient dans le village.

Les vestiges de cette communauté d'agriculteurs-chasseurs témoignent de l'extension précoce du premier Néolithique du Proche-Orient et d'une maîtrise insoupçonnée de la navigation. Il enrichit de manière substantielle nos connaissances sur la transition néolithique en Méditerranée.

Jean-Denis Vigne, directeur de recherche émérite au CNRS et chargé de mission au Muséum national d'histoire naturelle a co-dirigé la fouille avec François Briois, maître de conférences à l'EHESS. Ce dernier a pris la direction de la mission « Néolithisation » en 2014, à la suite de Jean Guilaine, professeur émérite au Collège de France et membre de l'Institut.

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En couverture : © Photographie Jean-Denis Vigne.
Ci-dessus : *Anthropozoomorphic figurine in picrolite (height = 6.7 cm).* Figurine anthropozoomorphe en picrolite (hauteur = 6,7 cm).