

# An Intrasite Analysis of Agricultural Economy at Early Islamic Caesarea Maritima, Israel

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**Abstract** The archaeological site of Caesarea Maritima in modern-day Israel was an important coastal town in the Early Islamic period (c. 636–1100 CE). In this article, I analyze 15 samples of carbonized wood and non-wood macrobotanical remains recovered from two residential neighborhoods to investigate the production and consumption of agricultural plant products. The identified crop and wood taxa are typical for the Mediterranean coast. Wild seeds point to crop cultivation in the vicinity of the site. Plant remains were collected from discrete contexts and are interpreted with associated features and artifacts, revealing cereal processing debris across a series of rooms in a former warehouse. Such a socioeconomic shift in this building, from a storage area to a crop processing space, is detectable by combining this intrasite analysis with the diachronic research previously conducted at the site.

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## Introduction

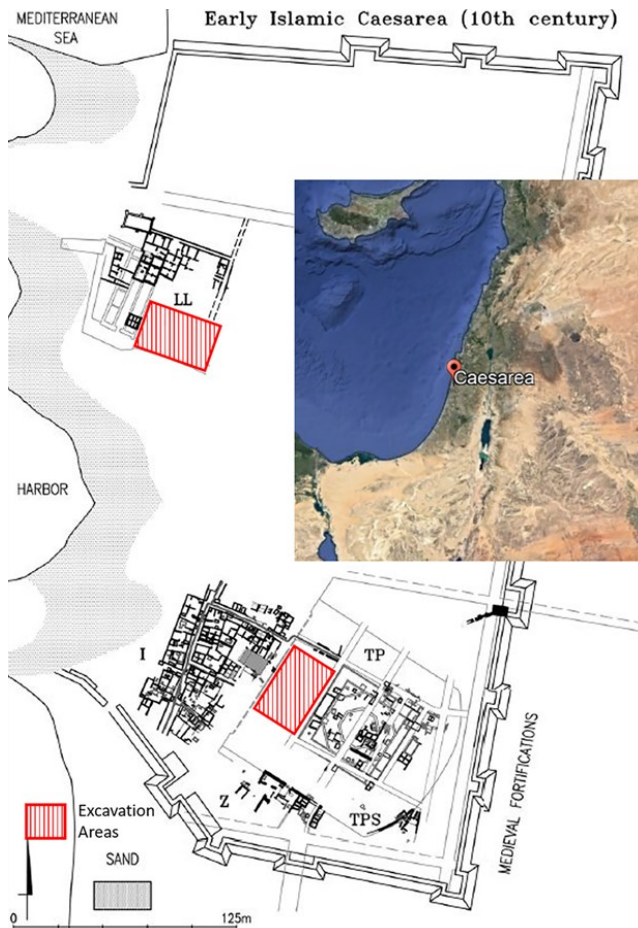
Archaeobotanical studies from the Early Islamic period (c. 636–1100 CE) in the Near East are relatively few (e.g., Ramsay and Holum 2015; van der Veen 2011) and generally discuss plant data at the scale of the site or excavation area, rather than by specific context. This approach characterizes the agricultural economy of a site by discussing broad patterns of presence and deposition of plant species and plant parts, providing data on what and how much is present. However, such an approach limits the identification of activity areas, such as discrete locations of food production, consumption, and waste discard (VanDerwarker et al. 2014 and references therein). In this article, I analyze carbonized wood and non-wood macrobotanical remains (seeds, fruits, and plant parts) in 15 samples collected from two Early Islamic neighborhoods at Caesarea Maritima, Israel. Through this intrasite analysis (studying samples individually based on their context of deposition), I

identify variation of plant remains across spatially discrete areas.

## Background

### Site

Caesarea Maritima is located on the northern Mediterranean coast of modern-day Israel, in the Sharon Plain (Figure 1). It enjoys a Mediterranean climate of cool, wet winters (average temperature 12–14° C) and warm, dry summers (average temperature 24–26° C), with precipitation averaging 500–600 mm annually (Danin and Orshan 1999:9, 12–13). The vegetation on the coast is typified by steppe and desert plants (Danin and Orshan 1999). Trees in these maquis and Mediterranean forest communities include *Quercus calliprinos* (Kermes/Palestine oak) and *Pistacea palaestina* (terebinth) (Liphschitz 2007). Caesarea Maritima was supplied with fresh water from nearby springs via Roman and Byzantine aqueducts, natural aquifers, cisterns, and wells (al-Muqaddasi 1886:55).



**Figure 1** Site map of Caesarea Maritima (courtesy of Combined Caesarea Expeditions; drawing by Anna Iamim) with inset of region (Google Earth). 2016 excavations in red.

The city was founded by Herod the Great in 22 BCE in honor of Caesar Augustus, and was built on an orthogonal plan flanked by agricultural lands (Gil 1992; Holum 2014; Ramsay and Holum 2015). Caesarea Maritima was the thriving capital city of the Byzantine province Palestina Prima and served as the main seaport of Palestine during this period (Avni 2014:41–42). In 640 CE, the city capitulated to a treaty with Muslim general Mu’awiya as the Islamic empire expanded (Gil 1992:59), and many wealthy inhabitants fled (Holum 2011; Ramsay and Holum 2015). Thereafter called Qaysariyya, the city was ruled under the Umayyad (661–750 CE), Abbasid (750–969 CE), and Fatimid (969–1101 CE) caliphates. Islamic Qaysariyya functioned as part of the coastal fort system along the Mediterranean to protect against the Byzantine Empire (Avni 2014), and is described as having “an impregnable fortress [around the city], and

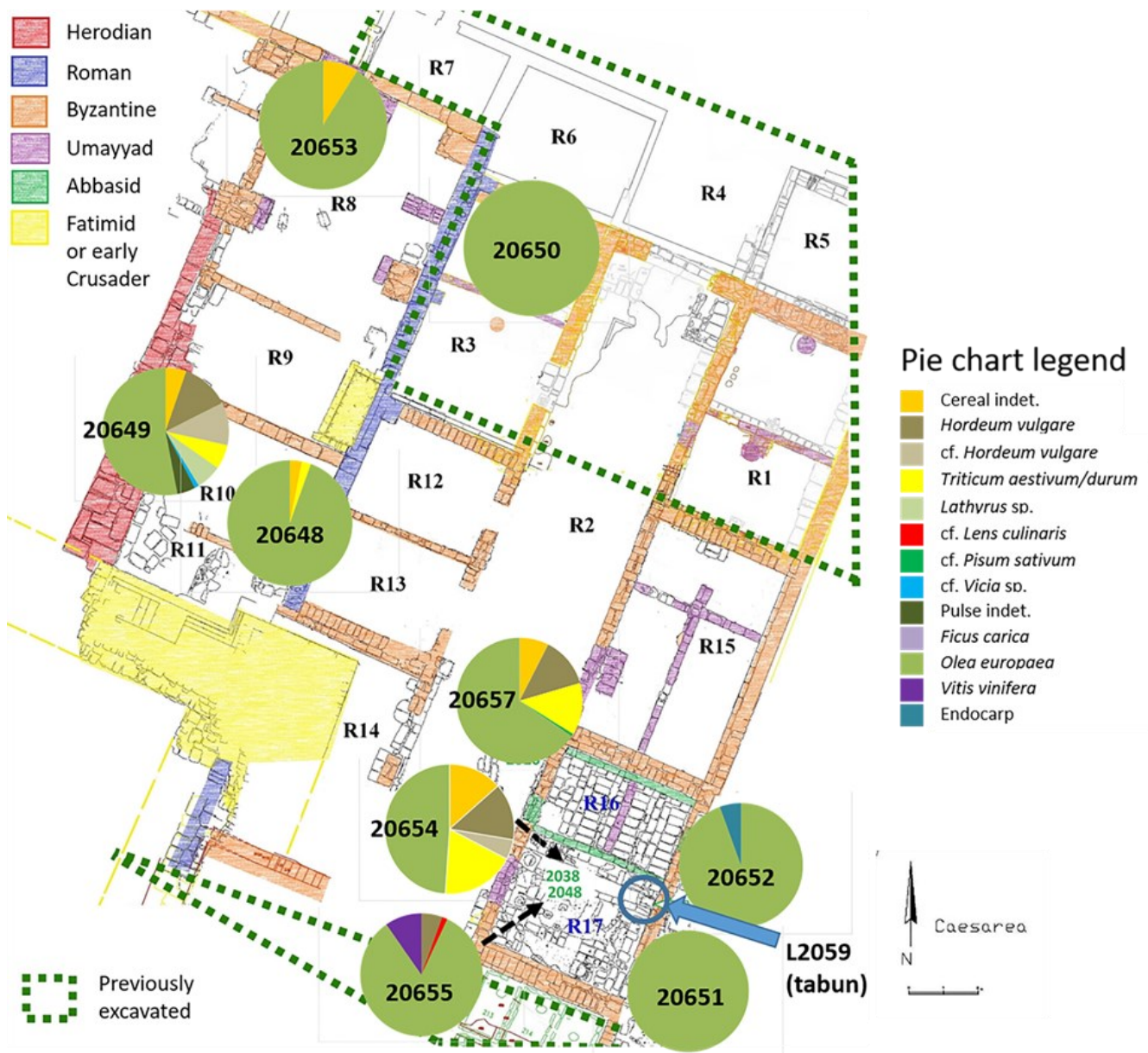
without lies the well-populated suburb which the fort protects” (al-Muqaddasi 1886:55). The role of capital was transferred from Caesarea Maritima to Lodd in 640 CE, and again transferred to Ramla in 717 CE (Avni 2014). Despite its shift in administrative importance, Caesarea Maritima remained an important and prosperous medium-sized town through the Early Islamic period (Avni 2014; Ramsay and Holum 2015).

#### *Excavation Areas*

Multiple excavations have identified Early Islamic occupation across the site (Patrich 2011; Ramsay and Holum 2015). In general, the Early Islamic town is characterized by dwellings intermixed with industrial installations, such as oil and wine presses, vats for cloth processing, and storage facilities for grain and other commodities (Ad et al. 2018; Ramsay and Holum 2015:658). The botanical remains discussed here were recovered from Area LL and the Temple Platform/Area C.

Area LL was a government warehouse quarter for imports and exports (*horrea*) north of the Inner Harbor during the first through early seventh centuries (the Roman and Byzantine periods) (Ramsay and Holum 2015:657–658). In 2016, the IAA excavated a mixed commercial-residential quarter with shops and storage facilities lining the streets dating to the Early Islamic period. These buildings maintain the orthogonal plan of the Byzantine-era warehouses (Figure 2) (Ad et al. 2018:3–4). Following the transition to Islamic control in the seventh century, rooms were subdivided, floors were raised, and openings between rooms were changed as this area was converted into a neighborhood with dwellings, tabun ovens, storage structures, drainage features, and various other installations (Ad et al. 2018:3). The possessions of its residents comprised an array of everyday utilitarian items such as amphorae, tableware, and cooking vessels. This neighborhood expanded into the silted-in harbor during the Abbasid and Fatimid periods (mid-eighth through twelfth centuries) (Ad et al. 2018).

The Temple Platform (TP) dominated the view of the city from the harbor and originally hosted a large Roman temple, which was replaced by an early Christian church c. 500 CE (Holum 2014:183–185, 193). The earthquake of 749 CE leveled the church, and during the Abbasid occupation the area became residential (Gil 1992:89–90; Ramsay and Holum 2015:657–658). In 2016, the IAA excavated Abbasid-era vaulted stone warehouses that abutted the



**Figure 2** Area LL with sample locations. Pie charts show percentage of economic seeds by weight in each sample (Sample 20656 is not displayed because it contained no economic seeds). Plan courtesy of Yoav Arbel and the IAA.

Herodian walls of the TP, and exposed a 1.5 m-high profile of alternating layers of burnt material, sandy fill containing ceramic fragments and gravel, and plaster and stone floors from the Abbasid and Fatimid periods.

*Plant Economy at Early Islamic Caesarea Maritima*

Agricultural production at Caesarea Maritima changed between the fifth and tenth centuries to fit the shifting availability of land and labor, and to meet the changing needs of the town. During the Byzantine

period, production centered on agricultural estates surrounding the city, but these were abandoned in the face of plagues and invasions during the sixth and early seventh century (Gil 1992:89). During the late seventh century, the beginning of the Early Islamic period, residents grew crops inside the town. In the southwest portion of the site, residents re-engineered the foundations of a Roman-Byzantine *horrea* into an irrigated, terraced garden (Patrich 2011). Previous botanical analysis demonstrate that residents of Caesarea Maritima continued to cultivate crops in the

fertile coastal plain and Shephelah to the east during the eighth through twelfth centuries (Ramsay and Holum 2015). However, during the tenth through early twelfth centuries (Abbasid to Fatimid periods) they also established a “plot-and-berm agroecosystem” on the coast to the south (Taxel et al. 2018). These were sunken plots of manured sand surrounded by raised berms that were watered by shallow groundwater (Taxel et al. 2018). This extensification of agricultural production transformed architectural ruins and previously barren coastal sands into fertile plots as people adjusted the scale and location of crop cultivation.

Archaeological and historical sources provide a glimpse of the type and quality of agricultural goods at Caesarea Maritima. Archaeological remains of many grain storage bins and warehouses attest to high-volume production of cereals and other crops (Patrich 2011; Ramsay and Holum 2015). Previous analysis of plant remains from Abbasid and Fatimid layers in other portions of Area LL and the TP revealed an economy based on local production and processing of wheat, barley, olive, grape, and fig (Ramsay and Holum 2015:663–666). Tenth-century geographer al-Muqaddasī praised its white bread and stated, “its lands are excellent, and its fruits delicious” (al-Muqaddasī 1886:55). Taken together, these lines of evidence point to the continuing agricultural production that provided Caesarea with a source of economic wealth and power, as well as sustenance, through the Early Islamic period.

Research on the use of wood along the coastal plain shows that locally available Kermes/Palestine oak, terebinth, and *Olea europaea* (olive) were commonly used (Liphshitz 2007). Studies from neighboring regions of the Eastern Desert of Egypt and the Negev Desert conclude that local woody taxa were used for fuel in domestic and industrial activities (Bouchaud et al. 2018; Jones et al. 2017; Ramsay et al. 2016), and that *Quercus* (oak), *Rhamnus* (buckthorn), and *Ulmus* (elm) as well as imported *Cedrus libani* (Cedar of Lebanon), *Cupressus sempervirens* (Mediterranean cypress), and *Pinus halepensis* (Aleppo pine) were used as timber for construction (Bouchaud et al. 2018; Liphshitz 2007; Ramsay et al. 2016).

## Methods

These 15 samples were collected during excavations conducted by the IAA and Israel Nature and Parks Authority in 2016, and date primarily to the Abbasid period in Area LL and the TP (Table 1). Bulk samples

were collected using a probabilistic strategy, targeting features already exposed by excavators such as tabuns and floors (d’Alpoim Guedes and Spengler 2014:80). I processed all samples on-site through wash-over (bucket) flotation (White and Shelton 2014:99–100). Window screen (1.5 mm mesh) was used to collect the heavy fraction, and lightweight organza (<0.1 mm mesh) for the light fraction. Heavy fractions were sorted on site, and botanical remains combined with the light fraction. Light fractions were dried and exported to the Boston University Environmental Archaeology Laboratory for analysis. I fractionated the samples into four size classes (>2 mm, >1 mm, >0.5 mm, <0.5 mm) using geological sieves. I identified botanical remains using modern comparative material, identification keys, and Early Islamic botanical reports from the Near East (Ramsay and Holum 2015; van der Veen 2011).

I weighed and counted recovered plant remains. Wood charcoal >2 mm was weighed, as were fragmented and whole economic seeds. Both economic and wild seeds were counted as whole when more than 50% of the original seed or endocarp (pit or stone) was intact. Cereals were counted when the embryo end of the seed was present, regardless of the completeness of the grain. Pulses were counted in halves. Complete plant parts, like spikelet forks and glume bases, were counted.

Plant remains were sorted using Leica stereomicroscopes with a magnification range of 6–60x. Wood charcoal was examined using a Leica DM2700 incident light microscope with 50x, 100x, 200x, and 500x magnification in tandem with Leica Application Suite imaging software. I identified a minimum of forty pieces of wood charcoal in each sample, except where impossible due to high fragmentation that obscured transverse sections.

Analytical metrics calculated here include relative abundance of weight and count of plant taxa, ubiquity of taxa, median weights and ratios of various plant parts to understand plant processing practices.

## Results

These 15 flotation samples comprise a total of 69.5 L of soil and come from four context types (Table 1). Ten samples (56.5 L total) come from floors, installations, and a tabun in Area LL. Five samples (13 L total) were taken from a series of plaster floors and fill with carbonized layers exposed in profile in the storage-vault-turned-residence in the TP. The carbonized carpological remains are relatively well-

**Table 1** Sample and context information (descriptions provided by Y. Arbel and P. Gendelman).

Excavation Area	Locus	Sample #	Sample Vol (L)	Context Type	Time Period	Description
LL	2019	20657	7	Floor	Abbasid	Tamped earth floor
LL	2020	20656	5	Floor	Abbasid	Plaster/tamped earth floor
LL	2032	20651	7	Floor	Byzantine/ Fatimid?	Disturbed stone-flag floor, related pottery
LL	2038	20654	3.5	Floor	Abbasid	Byzantine and Fatimid Plaster floor under debris
LL	2048	20655	1.5	Floor	Abbasid	Disturbed tamped earth floor from small yard that contained several installations
LL	2059	20652	8	Tabun	Abbasid	Floor, one of the phases in the in installations yard of Locus 2048
LL	2078	20648	5	Floor	Abbasid	Plaster/tamped earth floor over fill that covers Byzantine (?) mosaic, Abbasid pottery
LL	2078	20649	4.5	Floor	Abbasid	Collapse. Numerous large, cut stones. Pottery mixed Byzantine-Abbasid, probably Abbasid-period destruction of Byzantine-Early Islamic store room
LL	2097	20653	8	Installation	Abbasid	Floor, a store room in the main Byzantine complex
LL	2109	20650	7	Floor	Abbasid	Tamped earth floor
TP	292	3723	2	Fill	Fatimid	Construction fill for small courtyard paved with stone slabs
TP	293	3725	3	Fill	Abbasid/ Fatimid	Construction fill for floor paved with plaster floor
TP	294	3724	3	Fill	Abbasid/ Fatimid	Construction fill for floor paved with plaster floor
TP	294	3726	3	Fill	Abbasid/ Fatimid	Construction fill for floor paved with plaster floor
TP	294	3727	2	Fill	Abbasid/ Fatimid	Construction fill for floor paved with plaster floor

preserved though fragmented, and the economic seeds (those cultivated for consumption or use by humans) are not badly deformed and have major identifying features intact, and fragile chaff is preserved. All taxa are cultivars typical of or local to the region and correspond with previous archaeobotanical analysis of the site (Ramsay and Holum 2015; Table 2). A total of 2,138 pieces and 52.25 g of wood charcoal were recovered; however, it was highly fragmented and friable and thus only 36% of pieces ( $n = 778$ ) and 58% by weight ( $n = 30.35$  g) were identifiable. Wood charcoal taxa discussed below include only those identified to family or greater specificity.

#### Area LL

The ten samples from Area LL contain the vast majority of non-wood remains in this assemblage, thus providing the most information on plant

deposition in discrete contexts (Figure 2; Table 1). Five samples from floors contain sparse carpological and wood charcoal remains, and are not discussed here. These floors may have been subject to tramping or sweeping during their use and may also have been subject to further post-depositional disturbance that decreased plant preservation. Three floor samples rich with plant remains are associated with deposits of collapse (Table 1), which possibly increased plant preservation. These three floors have cereal chaff elements and the most economic seeds (cereals, pulses, fruits and nuts) by weight and count in the assemblage (see Supplementary Material).

Sample 20649 (Locus 2078), a floor in Room 10, contains whole grains of *Hordeum vulgare* (barley) and *Triticum aestivum/durum* (bread/hard wheat), and the most legume seeds in the assemblage, including *Lathyrus* sp. (grass pea) and cf. *Vicia* sp. (possible

**Table 2** Plant taxa summarized by area. Zeros indicate a fragment <0.001g; blanks indicate the absence of a taxon. Weight is in grams; counts in parentheses indicate uncarbonized seeds. Ubiquity calculated for carbonized remains only.

Taxon, plant part	Common name	LL		TP		Total		Ubiquity (n=15)
		Count	Weight	Count	Weight	Count	Weight	
<b>Cereals</b>								
<i>Triticum aestivum</i> /durum, grain	Bread/hard wheat	9	0.119			9	0.119	0.267
<i>Triticum aestivum</i> , rachis node	Bread wheat	1				1		0.067
<i>Triticum aestivum</i> , rachis segment	Bread wheat	5				5		0.067
<i>Triticum durum</i> , rachis segment	Hard wheat	2				2		0.067
<i>Hordeum vulgare</i> grain	Barley	20	0.134			20	0.134	0.267
<i>Hordeum vulgare</i> , glume base	Barley	1				1		0.067
<i>Hordeum vulgare</i> , spikelet fork	Barley	2				2		0.067
cf. <i>Hordeum vulgare</i> , grain	Possible barley	1	0.054			1	0.054	0.133
Cereal, grain		1	0.119			1	0.119	0.400
Cereal, rachis node		1				1		0.067
Cereal, culm node		1				1		0.067
cf. Cereal, awn fragment		9				9		0.133
cf. Cereal, rachis node		1				1		0.067
<b>Pulses</b>								
<i>Lathyrus</i> sp.	Grass pea	2.5	0.028			2.5	0.028	0.133
cf. <i>Lathyrus</i> sp.	Possible grass pea		0				0	0.067
cf. <i>Lens culinaris</i>	Possible lentil	0.5	0.002		0.001	0.5	0.003	0.133
cf. <i>Pisum</i> sp.	Possible pea		0.003				0.003	0.067
cf. <i>Vicia</i> sp.	Possible vetch	1	0.005				0.005	0.067
Pulse indeterminate		1	0.020				0.020	0.133
<b>Fruits and Nuts</b>								
<i>Ficus carica</i>	Fig	1	0			1		0.067
<i>Olea europaea</i>	Olive		1.827		0.230		4.127	0.867
cf. <i>Pinus</i> sp., nutshell	Possible pine				0		0	0.067
<i>Pinus</i> sp., scale fragment	Pine		0.050		0.050		0.100	0.133
<i>Vitis vinifera</i> , seed	Grape		0.007				0.007	0.133
cf. <i>Vitis vinifera</i> , pedicel	Possible grape pedicel	1				1		0.067
Endocarp indeterminate			0.007				0.007	0.067
<b>Wild Seeds</b>								
<i>Agrostemma</i> sp.		4				4		0.067
Asteraceae indeterminate		7 (43)				7		0.067
<i>Bromus</i> sp.		2				2		0.067
<i>Bupleurem subovatum</i>		1				1		0.067
Caryophyllaceae indeterminate		(99)						
cf. <i>Carex</i> sp.		1				1		0.067

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Taxon, plant part	Common name	LL		TP		Total		Ubiquity (n=15)
		Count	Weight	Count	Weight	Count	Weight	
<i>Chenopodium</i> sp.		1 (1)				1		0.067
cf. <i>Cynodon dactylon</i>		17				17		0.200
cf. <i>Echiochilon</i> sp.		1 (17)				1		0.067
cf. <i>Epilobium hirstum</i>		1				1		0.067
Fabaceae indeterminate		1				1		0.067
<i>Glaucium</i> sp.		(12)						
<i>Gypsophila</i> sp.		4 (187)				4		0.067
cf. <i>Lagurus ovatus</i>		1				1		0.067
<i>Lolium</i> cf. <i>persicum</i>		1				1		0.067
cf. <i>Lolium</i> sp.		1				1		0.067
<i>Malva</i> sp.		8 (1)				8		0.267
<i>Medicago</i> sp.		1 (3)				1		0.067
cf. <i>Melilotus</i> sp.		1				1		0.067
Papaveraceae		1				1		0.067
Poaceae indeterminate		9				9		0.267
<i>Rumex</i> sp.		1				1		0.067
<i>Suaeda</i> sp.		(4)						
Unknown		13		5		18		0.333
Unidentifiable		2				2		0.133
<b>Miscellaneous Plant Parts</b>								
Leaf fragment		4				4		0.067
cf. pod/capsule		2				2		0.067
<b>Wood charcoal</b>								
Gymnosperms	Softwoods/ conifers							
<i>Pinus</i> sp.	Pine	205	3.925	29	4.225	234	8.150	0.467
<i>Pinus pinea/halepensis</i>	Stone/Aleppo pine			15	7.065	15	7.065	0.067
cf. <i>Pinus</i> sp.	Possible pine	4	0.013	6	0.119	10	0.212	0.133
Gymnosperm indeterminate		181	2.880	56	3.547	237	6.427	0.600
Angiosperm dicots	Hardwoods							
<i>Quercus/Fagus</i> sp.	Oak/beechn	5	0.040			5	0.040	0.067
<i>Quercus calliprinos</i>	Kermes/ Palestine oak	99	6.127			99	6.127	0.267
cf. <i>Quercus calliprinos</i>	Possible Kermes/ Palestine oak	13	0.436			13	0.436	0.200
Fagaceae indeterminate		5	0.091			5	0.091	0.067
cf. <i>Olea</i> sp.	Possible olive	4	0.047			4	0.047	0.067
<i>Rhamnus</i> sp.	Buckthorn	2	0.265			2	0.265	0.067
cf. <i>Ulmus/Celtis</i> sp.	Possible elm/ hackberry	2	0.044			2	0.044	0.067
Diffuse porous		16	0.295			16	0.295	0.333
Semi-ring porous		1	0.005			1	0.005	0.067
Angiosperm indet.		36	1.023	4	0.214	40	1.023	0.533
Indeterminate wood		1038	13.904	322	7.992	1360	21.896	0.933

vetch). It also contains cereal chaff, including awn fragments and *Triticum durum* (hard wheat) rachis segments. The ratio of chaff:cereal grains is 0.86 by count; for every piece of chaff there is slightly less than one cereal grain recovered. In the 0.50 g of wood charcoal from this sample, only *Pinus* sp. (pine) can be identified (4%).

The second-floor sample, Sample 20654 (Locus 2038) in Room 17 alongside many undetermined installations, contains whole grains of barley and bread/hard wheat, as well as *Triticum aestivum* rachis segments and nodes, indeterminate cereal rachis nodes, and possible cereal awn fragments and rachis nodes. The ratio of chaff:cereal grains is 1.12; for each piece of chaff there is slightly more than one cereal grain. It is the only sample to contain *Vitis vinifera* (grape) pedicels, yet contains no grape seeds. Sample 20654 also contains 29 carbonized wild seeds, including plants that grow in disturbed areas and fields, such as *Cynodon dactylon* and *Mahua* sp. The wood charcoal from this sample is abundant, 6.96 g, and is dominated by angiosperms including Kermes/Palestine oak (44%) and buckthorn (4%).

The third-floor sample, Sample 20657 (Locus 2019) in Room 2, contains whole grains of barley, bread/hard wheat, and fragments of grass pea and *Pisum* sp. (pea), a barley glume base and two spikelet forks, and indeterminate cereal culm nodes and awn fragments. The ratio of chaff:cereal grains is 0.54; for every piece of chaff there are approximately two grains. This sample contains the largest number of carbonized wild seeds in count ( $n = 32$ ) and variety (12 taxa). The wood charcoal from this sample is abundant; the 6.97 g is mostly Kermes/Palestine oak (44%), with trace amounts of *Quercus/Fagus* sp. (oak/beech) (<1%) and possible pine (<1%).

The tabun (sample 20652, Locus 2059) in Room 17, alongside many industrial installations, is relatively devoid of carpological remains aside from small fragments of olive, indeterminate endocarp, one wild *Mahua* sp. seed, and two unknown wild seeds. The wood charcoal from the tabun is abundant, 6.98 g, yet only pine (23%) and potential olive (<1%) can be identified.

The cut-rock installation of unspecified function (sample 20653, Locus 2097) in a Byzantine-Early Islamic storeroom (Room 8) contains only small amounts of indeterminate cereal fragments, olive pit fragments, a single grape seed, and a potential *Lolium* sp. seed. It contains a small amount of highly

fragmented wood charcoal, 1.23 g, including potential Kermes/Palestine oak (4%) and indeterminate Fagaceae wood (7%).

#### *Temple Platform (TP)*

The TP samples contain scant carpological remains and are dominated by wood charcoal (Tables 1 and 2). Given their similarity of context and contents, I discuss all five samples together. They contain fragments of indeterminate cereal, cf. *Lens culinaris* (possible lentil), fragments of olive endocarp, fragments of pine nut shell and pine cone scale, and 11 mineralized seeds, showing no distinction or pattern through the Abbasid to Fatimid periods. They are dominated by gymnosperm wood charcoal, including pine (8%) and *Pinus pinea/halepensis* (stone/Aleppo pine) (13.5%). Their average density of wood charcoal is 1.54 g/L, three times the average of Area LL samples (0.51 g/L).

#### **Discussion**

Overall, the plant remains recovered from these domestic contexts are typical agricultural staples and local to the region. The non-wood remains are likely the residues of everyday food preparation (van der Veen 2007), and the economic taxa align with those identified by Ramsay and Holum (2015). The poorly preserved wood charcoal allows only broad observations to be made, but the taxa identified are typical for the region, and are likely the remains of fuel and possibly construction debris. The dearth of carpological remains in the TP samples preclude any interpretation of plant use in the area.

Remains of wheat and barley are intermingled, suggesting no spatial division in their processing location. Historical and ethnographic sources illustrate that wheat and barley are used in different ways (like paying different kinds of taxes) (Decker 2009:97–107 and references therein; Kraemer 1958), and are processed at separate times but in the same space. Thus, the by-products of these grains may have intermixed during repeated use and routine sweeping.

Importantly, the intrasite analysis of samples taken horizontally across Area LL enables the identification of specific activity areas. Room 17 contains installations, mortars, and plastered floors (Ad et al. 2018), as well as the tabun, suggesting a place of working plants into edible forms, such as grinding, pressing, or baking. While there is no strong botanical evidence of fruit processing, there is evidence for late-stage cereal processing.



The by-products of specific cereal processing steps have been identified through ethnographic and experimental archaeology (Hillman 1984). Glume bases and rachis pieces are associated with semi-cleaned grains stored in bulk, which are cleaned via hand sorting (Hillman 1984:10). The average ratio of chaff/cereal by count across all floors is 0.31; for approximately every 1 piece of chaff there are three grains recovered. More specifically, the highest ratios of chaff to cereals in this assemblage come from samples 20649, 20654, and 20657 (0.86, 1.11, and 0.54 respectively) suggesting that Rooms 10, 17 and 2 were sites of crop processing activities. Considering that complete cereal spikelets contain two to six grains per spikelet fork (a chaff/cereal ratio of 0.5 to 0.16), the ratios in these samples show that more chaff was deposited than could come from a typical ear of grain, indicating that after processing, chaff was discarded here while grains were taken elsewhere. Additionally, the presence of large seeds of agricultural weeds, such as a *Lolium* and *Medicago* (Table 3) support the interpretation of these rooms as crop processing areas (Stevens 2003).

There are no concentrations of grains or features that indicate storage areas in these Abbasid contexts, in contrast to the storage bins previously excavated in later Fatimid-era houses (Ramsay and Holum

2015:658). By tracing these differences in storage through time, a trajectory emerges of changes in Area LL's function. Originally Roman and Byzantine *horrea*, these buildings transitioned into mixed residential/work areas in the Abbasid period, and then into mixed residential/industrial/grain storage areas in the Fatimid period. This blending private with industrial/mercantile areas is common in Early Islamic settlements in the Levant (Avni 2014), and suggests a socioeconomic shift in the storage and distribution of grain.

Of the fruits and nuts recovered, olive is the most ubiquitous (93%). In addition to being a popular food, the large size and density of the olive endocarp make it more likely to preserve; both factors may explain its widespread distribution. However, all olive remains are fragmented, possibly because they are the remains of olive pressing that were used as fuel, then subject to post-depositional mixing (Rowan 2015). The few fruits and nuts in this assemblage likely do not represent the variety enjoyed by Early Islamic residents, especially when compared to the more robust findings of Ramsay and Holum (2015:662) who identified a suite that included pomegranate, date, and melon. The relative absence of fruits and nuts in this assemblage may be a result of different taphonomic pathways for these taxa—they were

**Table 3** Carbonized wild plant taxa and their preferred habitats (Feinbrun-Dothan 1978, 1986; Zohary 1966, 1987).

Species	Family	Preferred habitat
<i>Agrostemma</i> sp.	Caryophyllaceae	fields
Asteraceae indeterminate		
<i>Bromus</i> sp.	Poaceae	cultivated/fallow fields
<i>Bupleurem subovatum</i>	Apiaceae	open, dry areas
cf. <i>Carex</i> sp.	Cyperaceae	wet areas
<i>Chenopodium</i> sp.	Amaranthaceae	cultivated/fallow fields
cf. <i>Cynodon dactylon</i>	Poaceae	dry to wet areas
cf. <i>Echiochilon</i> sp.	Boraginaceae	sandy areas
cf. <i>Epilobium hirstum</i>	Onagraceae	wet areas
Fabaceae indeterminate		
<i>Gypsophila</i> sp.	Caryophyllaceae	shrub-steppe
cf. <i>Lagurus ovatus</i>	Poaceae	dry, sandy areas
<i>Lolium</i> cf. <i>persicum</i>	Poaceae	field weeds/fallow fields
cf. <i>Lolium</i> sp.	Poaceae	field weeds/fallow fields
<i>Malva</i> sp.	Malvaceae	field weeds/fallow fields
<i>Medicago</i> sp.	Fabaceae	field weeds/fallow fields
cf. <i>Melilotus</i> sp.	Fabaceae	dry to wet areas
Papaveraceae indeterminate		
Poaceae indeterminate		
<i>Rumex</i> sp.	Polygonaceae	wet areas

stored, consumed, and discarded in portions of the sites not represented here.

Pulses are scattered and fragmented, and are likely underrepresented due to processing such as soaking, boiling, or grinding that renders them too fragile to preserve through carbonization. However, the variety of lentil, possible pea, and vetches indicate a well-rounded diet.

The wild seeds come from a mix of habitats, including fields, wet and sandy areas (Table 3), corroborating with previous interpretations of local cultivation and potential irrigation at Caesarea Maritima (Ramsay and Holum 2015:668). The uncarbonized wild seeds in sample 20651 are likely contaminants from the current vegetation, given the poor preservation of Locus 232 (Figure 2).

The wood charcoal taxa are also typical for the region and period, and represent either natural vegetation (e.g., Kermes/Palestine oak, buckthorn) or cultivated species (e.g., possible olive). Area LL has a greater variety of taxa, but TP has a much higher wood charcoal density (g/L). This difference in variety parallels findings in the Eastern Desert of Egypt, where a greater variety of wood taxa in domestic contexts from Roman-era sites is interpreted to reflect the high diversity of wood used to construct buildings and everyday objects (Bouchaud et al. 2018). Specifically, pine is identified as a construction resource at these sites and at Shivta, a Byzantine agricultural village in the Negev Desert (Ramsay et al. 2016). The dominance of stone/Aleppo pine in the TP fill suggest the wood charcoal is derived from buildings. Generally, the abundance of conifer wood charcoal at sites in Israel increases through the Roman, Byzantine, and Early Islamic periods (Lipshitz 2007), and thus the preponderance of gymnosperm wood in this assemblage aligns with broader patterns of wood-use.

### Conclusion

This small assemblage provides evidence that the Early Islamic inhabitants of Caesarea Maritima continued a long tradition of local food cultivation focused on cereals, legumes, grapes, and olives, and probably used locally available pine for construction and other accessible wood as fuel. While the suite of economic plants has a long history of cultivation in the region, the locations in which they are cultivated, processed, and stored follow patterns of diversifica-

tion in the use of space, including locations and types of agricultural plots, that characterize the Early Islamic period in the Levant.

While this assemblage is both less rich and less abundant than that studied by Ramsay and Holum (2015), my intrasite analysis of individual samples in conjunction with associated features illuminates the relationship between plants and the places in which they were used and deposited, and brings to light the socioeconomic shift of Area LL from a place of centralized storage to a residential area with workshops and smaller-scale storage.

When these archaeobotanical data are considered alongside archaeological and contemporary historical evidence, a trajectory of agricultural plant production and processing at Caesarea Maritima can be hypothesized. We can speculate that people grew cereals in the plot-and-berm fields near the coast, or in the fields in the Shephelah, and then brought at least some of those cereals to these rooms in Area LL for processing. Residents could have then baked goods in the tabun to be sold in the markets mentioned by al-Muqaddasi. While it is not possible to identify the latter chain of events via the archaeobotanical record, the remains presented here do reveal the initial stages. By connecting all the various lines of evidence, it is possible to envision a more complete and dynamic picture of how people at Caesarea Maritima organized their agricultural economy, from cultivation to consumption.

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