

THE AGRICULTURAL LANDSCAPE OF TEL BURNA: ECOLOGY AND ECONOMY OF A BRONZE AGE/IRON AGE SETTLEMENT IN THE SOUTHERN LEVANT

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ABSTRACT

The Shephelah, known as the breadbasket of the southern Levant, is one of the more extensively investigated regions of the southern Levant in terms of archaeobotanical research. However, studies dealing with agriculture are scarce in comparison to the archaeobotanical data available. The analysis of the archaeobotanical assemblage in combination with the archaeological remains from Tel Burna will contribute to the investigation of the agriculture of the Shephelah. Several seasons of excavation revealed a cultic complex dating to the Late Bronze Age and an Iron Age II settlement with various agricultural installations such as silos and wine or olive presses. In this paper, we present the agricultural features in conjunction with the systematical archaeobotanical sampling, which enables us to reconstruct the types of crop plants cultivated at the site. Grass pea seeds dominate the assemblage collected from the Late Bronze Age complex, which may point to a connection to the Aegean. The Iron Age assemblage is distinguished by a significantly broad range of crop plants which were cultivated in vicinity of the tell. The archaeological Iron Age remains indicate that the processing of secondary products such as olive oil, wine, or textiles took place within the Iron Age settlement of Tel Burna. This first comprehensive overview describes the character of agricultural production in the Late Bronze Age to Iron Age environmental and geopolitical transformations.

Keywords: Agriculture, Shephelah, Southern Levant, Iron Age, Late Bronze Age, Landscape

INTRODUCTION

As David and Thomas state, "landscapes are topographies of the social and the cultural as much as they are physical contours" (2008: 35). In this sense, this paper aims to investigate the agricultural landscape of Tel Burna not only from the archaeobotanical perspective but also from the sociocultural point of view. The investigation of the archaeobotanical material in collaboration with the material culture demonstrates how the agricultural landscape of Tel Burna is not restricted to the conventional meaning of this concept. Archaeobotanical macro remains are more than the mere relics of ecological or economic significance (Fairbairn, 2008: 448); as the interpretation of

their presence in archaeological sites goes beyond their primary use as subsistence products (David & Thomas, 2008: 36).

The archaeology of agriculture in the southern Levant has been the topic of many research studies (e.g., Borowski, 1987; Dever, 2012; King & Stager, 2001; Zwickel, 2013). Notably, focus of these studies was limited to the archaeological finds and their contexts in combination with written sources. The actual object of research – the agricultural product – and its associated research field, namely Archaeobotany, have rarely been integrated into the general study of ancient agriculture in the southern Levant.¹

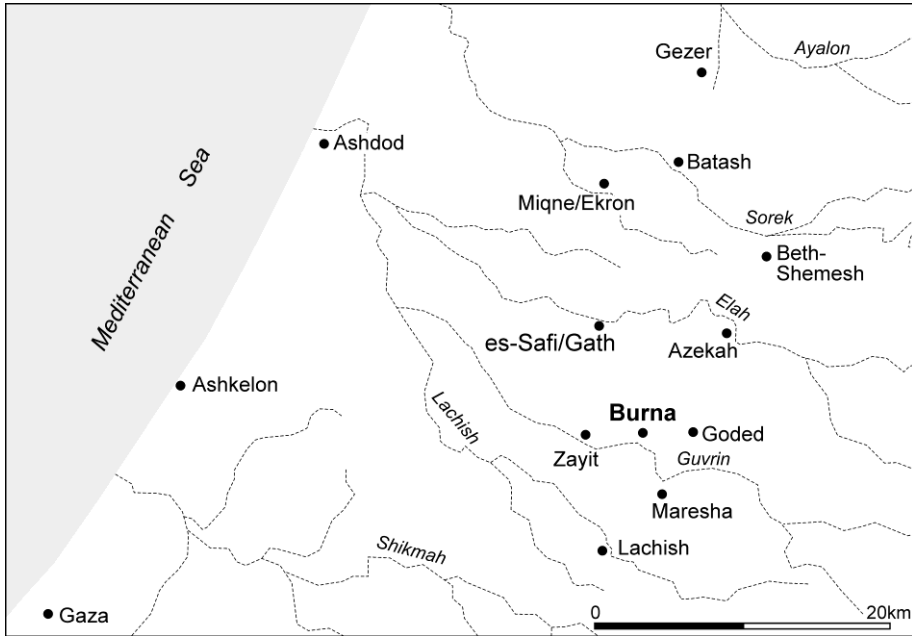
Although the Shephelah is one of the more extensively investigated regions of the southern Levant in terms of archaeobotanical research, studies dealing with the topic *agriculture*, however, are scarce in comparison to the archaeobotanical data available.² Exceptions can be seen in Salavert's (2008) research which takes a closer look at the cultivation of olive and olive oil processing at Tel Yarmuth during the Early Bronze Age. Kislev *et al.*, (2006) present the data found at Tel Batash, which mainly focuses on the Late Bronze Age period.

The systematic archaeobotanical sampling at Tel Burna offers a great opportunity to combine the archaeological remains directly with the archaeobotanical data. First insights into the Iron Age agriculture and trade system at Tel Burna have been discussed in Riehl and Shai (2015). The present paper, however, is the first presentation of the complete archaeobotanical data from Tel Burna to be found thus far. It significantly complements the archaeobotanical data for the Iron Age Shephelah regarding the investigation of agriculture in this region. Restricted to the settlement areas of the tell and its vicinity, it appears that the surrounding lands were cultivated for various crop plants. Separating the Late Bronze and Iron Age data will enable us to determine the changes, or developments, of the agricultural landscape of Tel Burna, pertaining to crop management and the selection of crops throughout the periods. The Late Bronze Age assemblage reveals regional and interregional contacts. In contrast, the Iron Age data indicates what kind of crops would have been cultivated near the site. For this, the natural preconditions of the physical landscape are decisive criteria for intense agricultural activities. The archaeological remains of agricultural installations such as wine/olive presses, and finds such as silos and loom weights, complement the evidence of residues from the surrounding agricultural landscape of the tell. We synthesize all the available evidence to-date for the harvesting, the processing and the storage of basic agricultural produce and for primary as well as secondary consumption.

¹ Clearly, there are exceptions, e.g., Faust & Weiss, 2005; Riehl & Shai, 2015; Weiss *et al.*, 2011.

² Tel Batash (Kislev *et al.*, 2006), Hirbet er-Rasm (Weiss, 2011), Tel Yarmuth (Salavert, 2008), Giv'at Shareit (Mahler-Slasky & Kislev, 2010), Lachish (Helbaek, 1958; Liphshitz, 2004; Liphshitz & Waisel, 1975), Tell eš-Šāfi /Gath (Mahler-Slasky & Kislev, 2012) and Tel Ḥalif (Lastrup & Seger, 1990).

GEOGRAPHICAL AND ENVIRONMENTAL SETTING OF TEL BURNA

Fig. 1: Location of Tel Burna**Geopolitical Setting**

Tel Burna is located in the southern Shephelah on the northern banks of the Nahal Guvrin at the elevation of 248 m a.s.l. Throughout the Bronze and Iron Ages the Shephelah was a densely occupied region (e.g. Hardin, 2014: 743). During the Late Bronze Age the political organization in the southern Levant, in general, and in the Shephelah region in particular, was comprised of city-states. Somewhere around the turn of the first millennium B.C.E., territorial states were established and the area of Tel Burna became designated as the border between Judah to the east and the Philistine cities to the west. Thus far, the material culture of the Iron Age inhabitants at Tel Burna indicates a political affiliation with the Kingdom of Judah (Shai *et al.*, 2012; Shai *et al.*, 2015; Shai, 2017). Based on this interpretation, we expected to find a heavy destruction layer dating to the end of the 8th century B.C.E. (Sennacherib's campaign to this region)³, however, as of yet, there is no indication for such a catastrophe at Tel Burna (Shai, 2017).

During the Iron Age, the site was situated between the two major cities of Tell eš-Šāfi/Gath and Lachish representing principle sites of Philistia and Judah respectively (Shai *et al.*, 2012: 152; Shai, 2017: 45; Fig. 1). Located on the border between these two biblical opponents, the Judahite city could monitor the road along Nahal Guvrin, with a clear view of the Coastal/Philistine Plain to the west. Tel Burna has been tentatively identified as the biblical city Libnah mentioned in various verses in the Hebrew Bible/Old Testament (see e.g., 2 Kgs 8:22; also Josh 15:42, 10:29; 21:13). However, the identification remains debated as there has yet to be a consensus on the actual location of this biblical city (Shai *et al.*, 2012: 143; Shai, 2017: 45-46).

³ Many studies have focused on this Assyrian campaign. On its results and effects in the southern Levant see e.g., Ussishkin, 1977; 2006; Finkelstein & Na'aman, 2004; Grabbe, 2003.

Environmental setting

The mean annual precipitation today in the southern Shephelah is between 400 and 500 mm distributed from October to May. The precipitation rate therefore provides an adequate water supply for rain-fed agriculture during winter and spring (Zohary, 1962: Map 3, Fig. 4). Moreover, the stream of Nahal Guvrin would provide sufficient water for manual irrigation if necessary (Riehl & Shai, 2015: 526).

The tell is situated within the Mediterranean plant geographical vegetation zone (Currid, 1984: 2). The paleo-vegetation of the eastern lower Shephelah was once dominated by Evergreen Oak-Terebinth forests (Currid, 1984: Fig. 1). However, due to extensive land use, the area is now dominated by degraded Mediterranean garigue and batha vegetation with small trees and shrubs such as *Ziziphus spina-christi*. In the river valleys, savanna-like vegetation with grasses such as *Hyparrhenia hirta* is common (Currid, 1984: 5-6; Riehl & Shai, 2015: 525; Zohary, 1962: 110-111, Map 5). The eastern and southern borders of the Mediterranean vegetation zone, which also fall into the region of Tel Burna, might be infiltrated by Irano-Turanian plant communities during drought periods (Olsvig-Whittaker *et al.*, 2015: 59). Today, most parts of the Shephelah are still used as agricultural and grazing lands. In fact, the tell itself is part of an extensive grazing range for cattle (Smejda *et al.*, 2017: 64, fig. 2d), whereas the southeastern plain below the tell along the nahal (a Hebrew equivalent for Arabic 'wadi') is agricultural land used for growing watermelons, cereals, sunflowers, and onions.

The southern Shephelah is mostly covered with brown and pale rendzinas, fertile soils suitable for the cultivation of different crops (Dan *et al.*, 1976; Smejda *et al.*, 2017: 45; Zohary, 1962: 11-12, Map 2). In her study of three nahals located south of Nahal Guvrin (Nahal Lachish, Nahal Adorayim, and Nahal Shiqma), Rosen (1986) identified several alluvial and erosional events. The two latest alluvial events, in the southern Shephelah, occurred during the Chalcolithic/Early Bronze Age period and during the Byzantine period. Although not included in Rosen's study, it should be assumed that such alluvial events, forming rich alluvial soils along the river beds, as well as the erosional events during drier time periods, likewise occurred in Nahal Guvrin.

According to studies of pollen remains, the Late Bronze Age IIB was struck by a short but intense drought period (Langgut *et al.*, 2013: 160-61; Langgut *et al.*, 2015: 229; Soto-Berelov *et al.*, 2015: 107). However, studies conducted in the area of the Dead Sea indicate that the Late Bronze Age dry period had already begun around 1500 B.C.E. (Migowski *et al.*, 2006: 426; Kagan *et al.*, 2015: 247). During the Iron Ages I and II, climate conditions tended to be slightly dry (Neumann *et al.*, 2007: 1488, 1491, Kagan *et al.*, 2015: 249; Migowski *et al.*, 2006: 426). Notably, pollen records from cores taken along the Jordan Rift Valley indicate drier conditions during the Iron Age II rather than in the Iron Age I (Langgut *et al.*, 2013: 157; Langgut *et al.*, 2015: 229-230).

According to paleo-rainfall calculated by the $\delta^{18}\text{O}$ -isotopes from a speleothem from Soreq Cave, about 20 km north of Tel Burna, precipitation dropped through the Iron Age I (3200 BP) and slightly increased until the end of the Iron Age II (2500 BP). The range of calculated rainfall, however, spanned from 430 to 510 mm per year (Bar-Matthews & Ayalon, 2004: Figure 12), still sufficient for rain-fed agriculture even during the drier periods. Rambeau (2010: 5230-33), however, observes that the data of the palaeo-climate proxies should be interpreted as local data. Problems of dating the proxies as well as various interpretation possibilities complicate a comprehensive paleo-climate study of supra-regional character.

Correspondence analyses of floral lists from various sites located in the Philistine Plain and the Shephelah show that the plant assemblages changed from mesic to xeric plants from the Late Bronze to the Iron Age. These results also indicate slightly drier conditions for the Iron Age than for the Late Bronze Age (Olsvig-Whittaker *et al.*, 2015: 64-65, Fig. 5). Direct evidence of the water supply is given by the stable carbon isotope analysis of 50 barley grains from Tel Burna

(Riehl & Shai, 2015: 527-528). The grains were taken from an accumulation layer, and a silo, dating to the Iron Age IIB and IIC. The analysis of the stable carbon isotope shows that the barley grains had a sufficient water supply during the grain filling period, corresponding with the Iron Age II increase in precipitation identified in the $\delta^{18}\text{O}$ from Soreq Cave (Riehl & Shai, 2015: 530; Bar-Matthews & Ayalon, 2004: Figure 12). While, it is not possible to directly link the $\delta^{13}\text{C}$ -values to precipitation values, the comparison to other ancient Near Eastern sites such as Qubur al-Walaydah, Tel Halaf, and Qatna indicates an ample water supply, either by natural precipitation or by artificial irrigation (Riehl & Shai, 2015: 528, Fig. 3). In summary, the Lower Shephelah was more than suitable for intense agriculture. Water supply, either by precipitation or irrigation, as well as soil conditions (Fig. 3), should have enabled the cultivation of various crop plants.

ARCHAEOLOGICAL RESEARCH

In 2009, the Tel Burna Archaeological Project initiated a high-resolution survey of the site and its immediate surroundings (Uziel & Shai, 2010). Subsequently, another survey method was applied, based on shovel test pits to further support the initial survey finds (Shai & Uziel, 2014). Excavations commenced in 2010 and have continued since (Shai & Uziel, 2014; Shai *et al.*, 2015; Shai, 2017). Thus far, the material culture exposed dates to the Late Bronze IIB, the Iron IIA, IIB, and IIC. In addition, pottery finds from unstratified layers, from the survey results (Uziel & Shai, 2010; Shai & Uziel, 2014), and from Area C indicate human activity in the Early and Middle Bronze Age, the Iron Age I, the Persian and the Byzantine periods. To date, five excavation areas have been opened throughout the tell enabling the investigation of significant features including the fortifications surrounding the summit (Areas A1 and B2), the Iron Age II occupation upon the summit (Area A2), a public Late Bronze Age building on a shelf west of the summit (Area B1) and agricultural installations on the north-eastern slopes (Area C; Shai *et al.*, 2012; Shai and Uziel 2014; Shai *et al.*, 2015; Fig. 2). Prospection investigating the long-term human impact on the chemical composition of topsoil at the site and its vicinity started in 2015, bringing complementary data to archaeological survey and excavation campaigns (Smejda *et al.*, 2017; Fig. 3).

Fig. 2: Site plan of Tel Burna with the locations of all Areas

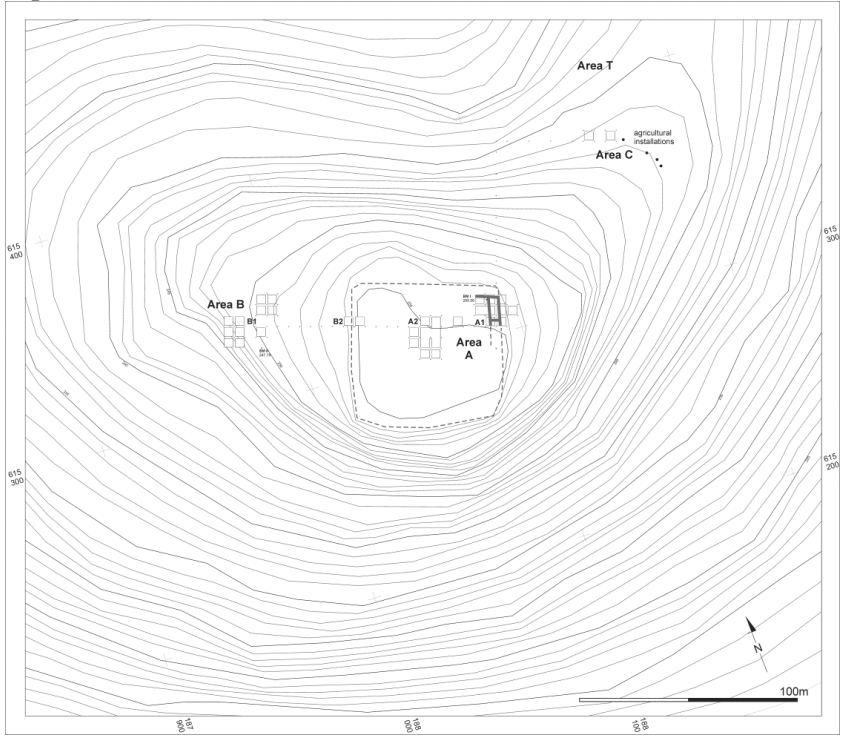
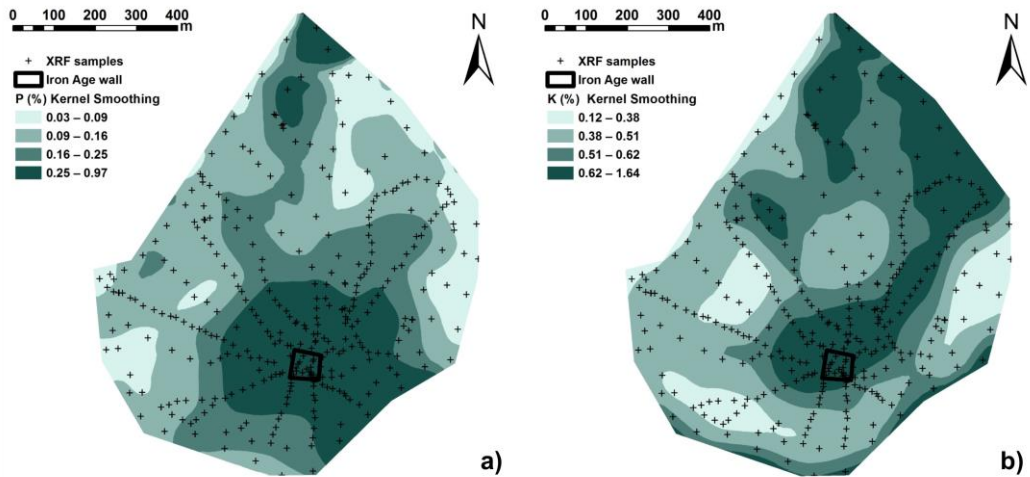


Fig. 3: Maps of selected nutrient concentrations in the contemporary topsoil around Tel Burna, resulting largely from ancient settlement activities and agricultural landscape management: a) Phosphorus, b) Potassium. Fertile soils were found in the close vicinity of the site that was fortified by a wall in the Iron Age (shown by the solid line enclosure). Interpolated values of our survey data (N=350) were divided into 4 classes by the quartile points. For details of the methodology used, see Smejda *et al.* 2017.



MATERIALS AND METHODS

Archaeobotanical sampling and flotation have been conducted continuously from 2011 to 2015, collecting a total of 127 samples from the Late Bronze and Iron Age layers. Due to restricted time and a small-scale flotation device we decided to follow judgmental sampling. Various contexts have been sampled including ash layers, silos, accumulation layers, ovens (i.e., *tabuns*), etc. to retrieve as much information as possible. The sediment volumes of the samples vary between 0.5 and 60 l, depending on the context, but most of the samples contained volumes of 30 l. The sediment samples were processed using a flotation device with water recycling. The light fraction was collected in a 0.2 mm sieve and dried in cotton cloths. These samples were sent to the Archaeobotanical Laboratory of the Institute of Archaeological Sciences, University of Tübingen for further examination. The heavy residue was collected from a 1 mm mesh and, after drying, the heavy residues were roughly sorted for remaining botanical macro remains, faunal remains (i.e. small mammals and fish bones), and artifacts.

The archaeobotanical macro remains were sorted and identified using a binocular microscope with 10x magnification. The seeds and the charcoals were set aside separately. Identification of the charred seeds was conducted using the Tübingen-Senckenberg modern seed reference collection and additional identification resources, such as Nesbitt (2008), Jacomet (2006), and Neef *et al.* (2011).

Each complete seed was counted as one. Two halves or four quarters of fragmented cereals were added up to one seed. Other fragmented macro remains were also added up to one seed but only when preserved at least in halves. As for the interpretation of the archaeobotanical material, proportion and percentage ubiquity of the identified seeds were calculated. As this paper aims to provide a holistic view of the agricultural landscape of Tel Burna the following section connects the archaeobotanical data directly to the archaeological remains for each area.⁴

RESULTS

The Late Bronze Age IIB **Area B1**

The architectural features found in Area B1 form a large structure (Building 29305), with several rooms and an inner courtyard (L33211) made of bedrock and crushed limestone. The bedrock fissures were filled with soil (Fig. 4; Shai *et al.*, 2015: 117; Sharp *et al.*, 2015: 61). The remains were only a few centimeters below surface level, and the Late Bronze Age sediment was only 20 to 120 cm thick before bedrock was reached (Shai *et al.*, 2015: 117; Sharp *et al.*, 2015: 61). The excavators maintain that the building was not of a domestic nature, due primarily to its impressive dimensions, of at least 20 x 23 m, and secondly to the technique by which it was constructed (Shai *et al.*, 2015: 117-120). The surface sediment (L29105) of the courtyard revealed many animal bones and various pottery remains. Two ovens/tabuns were revealed in the courtyard: one (L29104) on the northeastern edge of the courtyard, a second oven/tabun (L53403) in the center of it. Moreover, next to the latter oven/tabun a row of sunken pithoi (two of them imported from Cyprus; Shai *et al.*, 2015: 119) was discovered. The pottery included both locally produced vessels as well as Cypriot and Mycenaean imports in addition to numerous chalices, goblets, cup-and-saucer vessels, and a Cypriot triple-bowl votive vessel. Numerous figurines were found representing both local production (i.e., a Revadim-type figurine), imported Mycenaean and Cypriote zoomorphic figurines and an Egyptian influenced nude female plaque, as well as the nose fragments of two ceramic cultic masks (Sharp *et al.*, 2015: 63-69). The character of these finds

⁴ Area B2 will not be discussed as only one sample has been taken from this area thus far.

clearly implies that this building functioned as a center for cultic activities during the Late Bronze Age IIB (13th century B.C.E.; Shai *et al.*, 2015: 117).

Although a wide variety of contexts were sampled in this area (40 samples; Table 1), the archaeobotanical remains – with a total count of 541 macro remains – in general were scarce. The majority of seeds derive from two samples taken from a layer of smashed vessels *in situ*. This layer stretched along the western wall (W43105) of the building next to the courtyard. Amongst these vessel fragments about 370 charred seeds of grass pea (*Lathyrus sativus*; 68.4 %; Fig. 5; Table 1) were found, which were likely to have been stored inside the broken vessels. The preservation of the grass pea seeds was quite good, the majority were found as whole cotyledons, only single seeds were split into halves.

Fig. 4: Image of Area B1 with some features and finds marked



Table 1: List of taxa found at Tel Burna separated by the Areas B1, A1, A2, and C. Data is presented in percentage proportion (%) and percentage ubiquity (U). For the wild taxa only the most ubiquitous and numerous taxa are mentioned.

Area		Area B1		Area A1		Area A2		Area C
Period		Late Bronze Age IIB		Iron Age IIA-IIC		Iron Age IIA-IIC		Late Bronze and Iron Age
Number of samples		40		25		59		4
Volume in l		590		670		878.5		100
Total count of seeds		541		451		2284		20
Cultigens	Common Name	%	U	%	U	%	U	%
<i>Coriandrum sativum</i>	Coriander	0.0	0	0.0	0	0.0	2	0
<i>Lens culinaris</i>	Lentil	0.2	2.5	1.3	16	0.4	10	0
<i>Lathyrus sativus</i>	Grass Pea	68.4	5	0.0	0	0.1	3	0
<i>Lathyrus</i> sp.	Vetchling	0.0	0	0.0	0	0.1	3	0
<i>Lathyrus</i> sp./ <i>Vicia</i> sp.	Vetchling/Vetch	0.0	0	0.0	0	0.5	8	0
cf. <i>Pisum sativum</i>	Common Pea	0.0	0	0.0	0	0.2	8	0
<i>Vicia</i> cf. <i>faba</i>	Broad Bean	0.0	0	0.0	0	0.1	3	0
<i>Vicia ervilia</i>	Bitter Vetch	0.2	2.5	1.5	20	0.7	17	0
Legumes cultivated, indet.	Legumes	0.9	10	3.7	36	1.1	36	15
<i>Linum usitatissimum</i>	Flax	0.0	0	1.5	28	3.4	17	0
<i>Punica granatum</i>	Pomegranate	0.4	2.5	0.0	0	0.04	2	0
<i>Ficus carica</i>	Fig	3.1	25	2.2	36	18.3	58	0
<i>Olea europaea</i>	Olive	1.7	22.5	1.7	24	4.2	64	0
<i>Hordeum vulgare</i>	Barley	0.2	2.5	2.6	36	4.9	22	0
cf. <i>Hordeum vulgare</i>	Barley	0.2	2.5	0.2	4	0.1	3	10
<i>Hordeum vulgare</i> , rachis	Barley, chaff	0.2	2.5	0.6	4	0.1	5	0
<i>Hordeum vulgare</i> ssp. <i>distichon</i> , rachis	Two-Row Barley, chaff	0.4	2.5	0.0	0	0.0	0	0
<i>Triticum</i> sp.	Wheat	0.0	0	0.9	16	2.8	17	0
<i>Triticum dicoccum</i>	Emmer Wheat	0.0	0	0.4	8	0.6	8	0
<i>Triticum dicoccum/monococcum</i>	Glume Wheat	0.0	0	0.0	0	0.0	2	0
<i>Triticum dicoccum/monococcum</i> , spikelet	Glume Wheat, chaff	0.0	0	0.6	12	0.1	3	0
<i>Triticum dicoccum/monococcum</i> , glume base	Glume Wheat, chaff	0.0	0	0.0	0	0.2	3	0
<i>Triticum durum/aestivum</i>	Free Threshing Wheat	0.0	0	0.7	12	0.2	8	0

Cerealia	Cereals	2.8	17.5	9.1	68	11.5	46	20
Cerealia, culm	Cereals	0.2	2.5	0.0	0	0.0	2	0
Vitis vinifera	Grape	2.0	22.5	0.7	12	3.9	41	0
Vitis vinifera, undeveloped pip	Grape	0.0	0	0.0	0	0.3	10	0
Vitis vinifera, fruit	Grape	0.2	2.5	0.0	0	0.1	3	0
Most ubiquitous wild species								
Ornithogalum sp./Muscari sp.	Star of Bethlehem/Grape Hyacinth	0.0	0	0,0	0	2.0	12	0
Lithospermum cf. tenuiflorum, mineralized	Stoneseed	2.0	15	46.8	72	13.1	15	5
Vaccaria pyramidata	Cow Cockle	0.2	2.5	0.0	0	2.1	14	0
Chenopodium sp.	Goosefoot	0.4	5	0.0	0	0.4	10	0
Cuscuta sp.	Dodder	0.6	7.5	1.3	8	1.4	17	0
Medicago sp.	Snail Clover	0.2	2.5	0.6	8	3.5	19	0
Trifolium sp.	Trefoil	3.3	35	0.0	0	3.8	37	10
Malva sp.	Mallow	0.4	5	0.2	4	2.0	20	0
Lolium sp.	Darnel Grass	4.3	22.5	0.7	12	8.1	41	0
Phalaris sp.	Canary Grass	0.9	10	0.4	8	1.1	22	0
Poaceae	Wild Grasses	2.4	20	4.1	48	2.0	36	15
Anagallis sp.	Pimpernel	0.0	0	0.7	12	0	0	0
Thymelaea sp.	Thymelaea	0.0	0	0.4	8	0.3	12	10

Fig. 5: Image of *Lathyrus sativus* seeds from Area B1



The remaining archaeobotanical Late Bronze Age macro remains are scarce (Table 1). The preservation of the charred seeds is poor and they are mostly represented by wild species such as darnel grass (*Lolium* sp.; 4.3 %) and trefoil (*Trifolium* sp.; 3.3 %), which are indicators of segetal and pasture vegetation (Zohary, 1962: 215, 221-225). Crops are hardly represented with single finds of barley, unidentifiable cereals, fig, olive, grape, lentil, and bitter vetch.

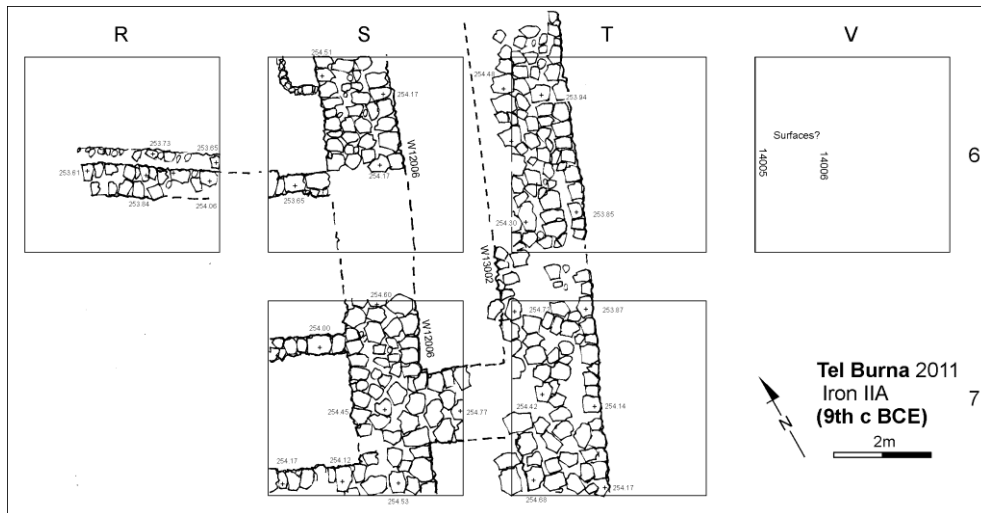
The Iron Age II

Throughout the Iron Age II, Tel Burna was part of the Kingdom of Judah (Shai, 2017). During this period, the settlement was not limited to the summit of the tell, but had apparently spread beyond the fortification walls and encompassed the southern, northern and eastern slopes as well. To date, excavations focused on the summit (Areas A1 and A2) and have exposed Iron Age occupation dating to the 9th through the 7th centuries B.C.E.⁵ Thus far, the main occupation stratum uncovered dates to the Iron Age IIB (8th century B.C.E.; Shai *et al.*, 2012; Shai, 2017).

Area A1

A square-shaped fortification wall enclosing an area of about 70 x 70 m surrounded the summit. This wall was of the casemate type with two parallel walls (W13002 and W12006) situated about 2 m apart and connected with perpendicular walls (W21206; Fig. 6; Shai *et al.*, 2012: 144).⁶

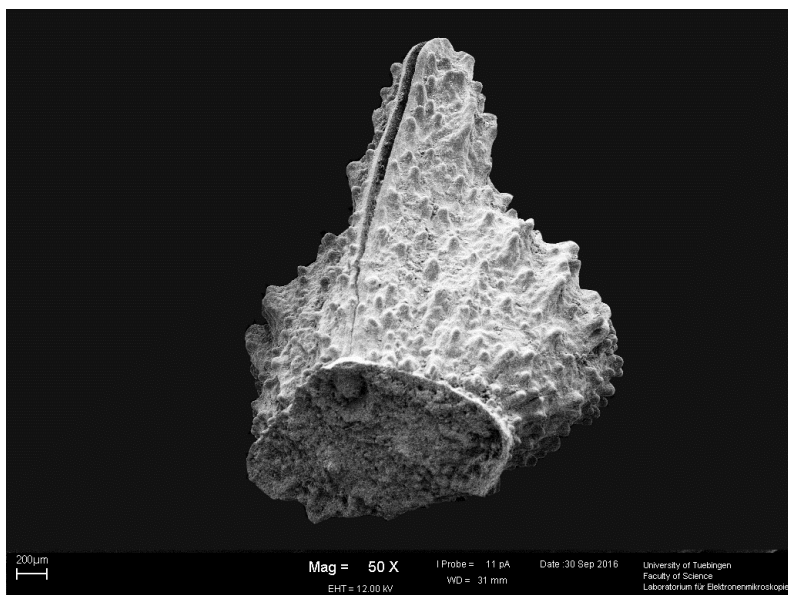
Fig. 6: Site plan of Area A1



numerous silos constructed during the Iron Age IIC, disturbing the architectural remains of the Iron Age IIB stratum in both Areas A1 and A2.

The 25 archaeobotanical samples from Area A1 (Table 1) were mostly collected from the excavation of four silos. In general, the successful recovery of seeds was very low with less than 60 seeds per sample. The assemblage is clearly dominated by wild species with close to 50 % of stoneseed (*Lithospermum* cf. *tenuiflorum* syn. *Buglossoides tenuiflora*; Fig. 7) which was also present in three-quarters of the samples (ubiquity of 72 %; Table 1). The stoneseed remains were mineralized. The fruits of *Lithospermum*-plants accumulate calcium carbonate, which derives from the sediments and soils in which they were preserved (Pustovoytov & Riehl, 2006: 508). The seeds have yet to be radiocarbon-dated (Pustovoytov & Riehl, 2006), thus, it remains unclear whether they were deposited in the Iron Age or are modern contaminants. In contrast, all other archaeobotanical remains from the Iron Age samples were preserved in carbonized state. In general, the preservation of seeds and fruits was poor, as most of the seeds were fragmented. In addition, most of the seed's outer coats were eroded so that a distinct identification of species level was not possible.

Fig. 7: SEM image of a mericarp from *Lithospermum* cf. *tenuiflorum* (from layer 42409, Area A2)



Some other wild taxa were found in lower quantities such as snail clover (*Medicago* sp.; 0.6 %), wild grasses (Poaceae; 4.1 %), darnel grass (*Lolium* sp.; 0.7 %), and pimpernel (*Anagallis* sp.; 0.7 %). Most of these grow in open vegetation, while some of them are field weeds (*Lolium* sp. and *Anagallis* sp.), whereas the stoneseed plants grow in stony places (Riehl, 2010: Table 4).

In contrast to the wild plant remains, the crops were found in low quantities (Table 1). They are mostly represented by various cereal grains of barley (2.8 %), different wheat species consisting of emmer wheat (*Triticum dicoccum*; 0.4 %) and free threshing wheat (0.7 %). Yet, most of the cereal grains (Cerealia; 9.1 % with a ubiquity of 68 %) could not be identified even to genus level, due to the poor preservation of the macro remains. Chaff remains of barley were low in number (0.6 %) compared to the grain finds. Lentil (*Lens culinaris*; 1.3 %) and bitter vetch (*Vicia ervilia*; 1.5 %)

were the only legumes found next to a higher amount of unidentifiable cultivated legumes (3.7 %). The macro remains from fruits are represented by olive (*Olea europaea*; 1.7 %), fig (*Ficus carica*; 2.2 %) and grape (*Vitis vinifera*; 0.7 %), the typical Mediterranean fruit species grown in the southern Levant. Finds of flax (*Linum usitatissimum*; 1.5 %; Fig. 8) were numerous compared to the general distribution of this plant in the southern Levant (Riehl & Shai, 2015: 528). The seeds of the dodder plant (*Cuscuta* sp.; 1.3 %; Fig. 9) indicate the cultivation of flax, as *Cuscuta epilinum*, the flax dodder, is a typical weed of cultivated flax plants (Feinbrun-Dothan, 1978: 47).

Fig. 8: SEM image of a seed of *Linum usitatissimum* (from ash layer 62213, Area A2)

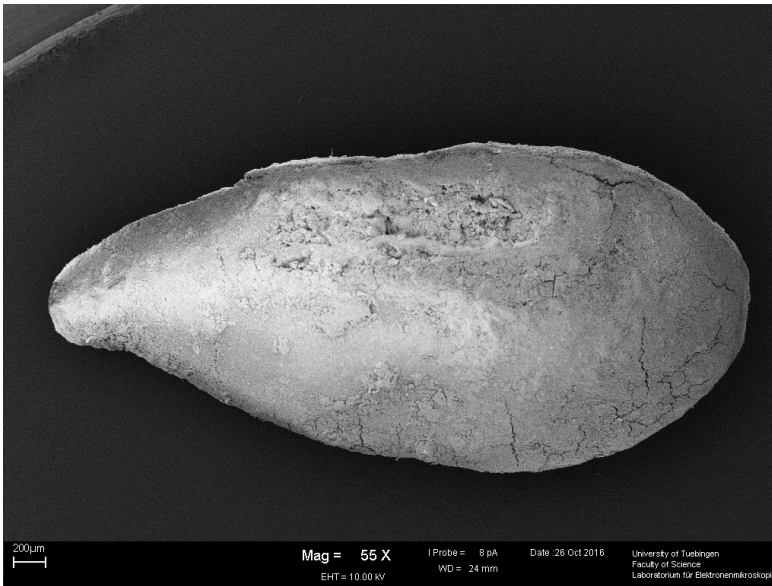
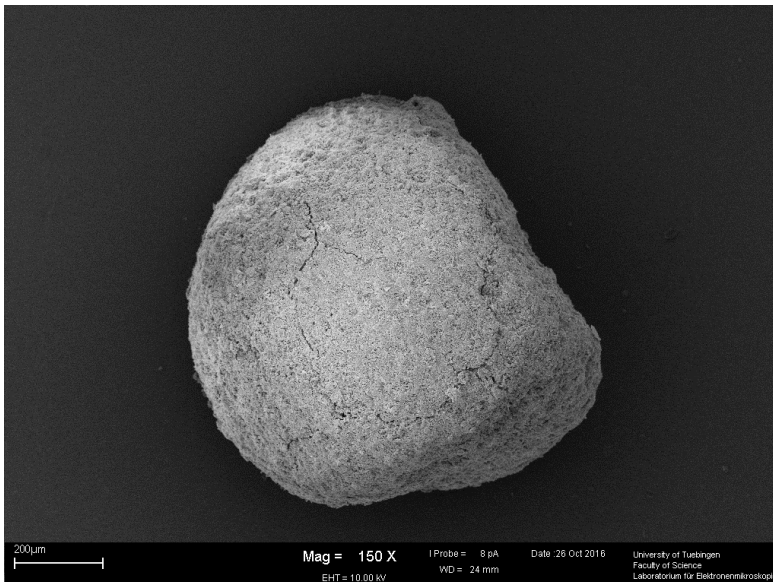


Fig. 9: SEM image of a seed of *Cuscuta* sp. (from silo 32105, Area A2)



The finds date the main occupation of this building complex to the Iron Age IIB (8th century B.C.E.). The interior of the building was covered with a beaten-earth floor. One room (R52006) contained vessels also found *in situ*. While it is tempting to correlate the end of the Iron Age IIB settlement (8th century B.C.E.) with Sennacherib's campaign, the lack of a clear destruction layer is surprising (Shai, 2017: 50). During the 7th century B.C.E. (Iron Age IIC), a new occupation phase is attested reusing some of the architectural remains of the Iron Age IIB occupation and three more round-shaped silos dug into the Iron Age IIB remains (Riehl & Shai, 2015: 526; Shai, 2017: 50-52).

Samples were collected from several contexts, including the fill of silos, ash layers, floor accumulation layers, debris layers, and pottery accumulations. The 59 samples (Table 1) revealed the highest number of macro remains from Tel Burna, which were mostly carbonized. However, most of the samples contained less than 50 seeds. Only three contexts provided the most macro remains from Area A2: an accumulation layer (L42409; Sq. L9) within a room of the building, another accumulation layer (L32208, Sq. K7; both dating to the Iron Age IIB), and a large silo (sediment layers 32103, 32105, 32106, 32107; Sq. J8) with a diameter of appr. 3.5 m dating to the Iron Age IIC.

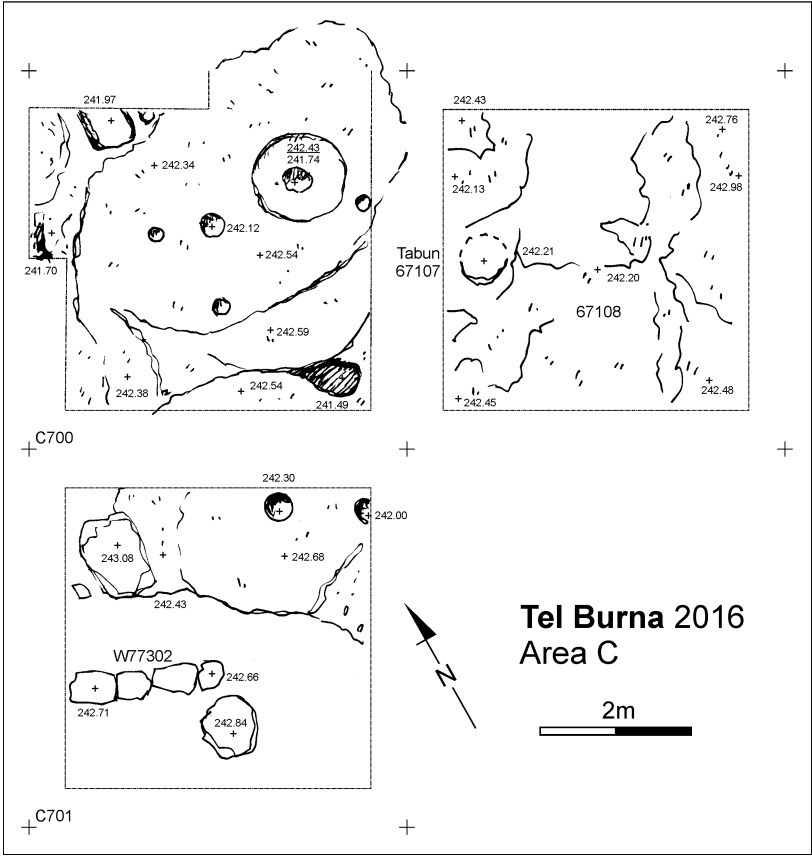
The proportion of cultigens and wild species is almost balanced with a slight prevalence for crop species. The variety of cultigens from this area is diverse. The legumes were mostly lentil (0.4 %), vetches/vetchlings (*Vicia* sp./*Lathyrus* sp. 0.5 %), bitter vetch (*Vicia ervilia*; 0.7 %), and unidentifiable legumes (1.1 %). The charred cereals were not very well preserved, and most of the remains (11.5 %) could not even be identified to genus level. However, some grains of barley (*Hordeum vulgare*; 5.0 %), wheat (*Triticum* sp.; 2.8 %), emmer wheat (*Triticum dicoccum*; 0.6 %), and free threshing wheat (*Triticum durum/aestivum*; 0.2 %) were found. Chaff remains from barley (0.1 %) and glume wheat (0.3 %) were scarce. Fruits are represented by grape remains (4.3 %), as well as olive (4.2 %), pomegranate (*Punica granatum*; 0.04 %), and many fig seeds (18.3 %). Moreover, olive and fig also show a vast distribution throughout Area A2 with a ubiquity of 64 % and 58 %. In comparison to Area A1, despite being higher in number, finds of linseeds (3.4 %) were quite numerous.

The wild species are dominated by stoneseed (13.1 %) and darnel grass (8.1 %). The mineralized mericarps of the stoneseed plants were mostly found associated with an accumulation of pottery sherds from a vessel embedded in one of the accumulation layers (L42409) mentioned above. The most ubiquitous wild species, next to stoneseed and darnel grass, are *Ornithogalum* sp./*Muscari* sp., *Cuscuta* sp., *Trifolium* sp., *Vaccaria pyramidata*, *Chenopodium* sp., *Anagallis* sp., *Malva* sp., *Thymelaea* sp., *Phalaris* sp., and wild grasses, all of which grow in open vegetation (Riehl 2010: Table 4). Among the above-mentioned wild taxa, there are typical field weeds like darnel grass, mallow, cow cockle, and pimperl (Zohary 1962: 221-225).

Area C

Area C was opened in 2015 on the eastern slopes of the tell (Fig. 11). It is located in an area which is densely covered with agricultural installations cut into the exposed bedrock. The installations appear to have functioned as wine or olive presses, but other uses are possible. Installations in this area vary greatly in size and shape, and it is likely that some may have had divergent functions during the various occupations of the site. In addition, more storage pits and basins are to be found along the eastern slope (Smejda *et al.*, 2017: 64). Basalt grinding stones and flint artifacts substantiate the area's agricultural activities. The pottery found in Area C, including within the installations themselves, dates from the Early and Middle Bronze Ages, in addition to the Late Bronze II and Iron Ages attested to in the other excavation areas.

Fig. 11: Site plan of Area C



As some of the installations are on surface level, the excavated sediment was only a few centimeters thick. The four samples taken from this area therefore contained in all only 20 seeds with single finds of barley (10 %), cereals (20 %) cultivated legumes (15 %) and some wild species which were also found in the other areas of the tell like stoneseed, trefoil, wild grasses and *Thymelaea* sp. (Table 1).

DISCUSSION

The *Lathyrus sativus* finds and their meaning

The absence of archaeological finds and installations connected directly to agricultural activities in Area B1 is noteworthy. The storage find of grass pea seeds might be connected to the cultic activities of the complex in which food preparation and feasting would have played a major role (Shai *et al.*, 2015: 116). The animal bones and drinking vessels from the courtyard support such activities, strengthening the interpretation of Building 29305 as cultic (Shai *et al.*, 2015: 129).

Compared to cereals or lentils, finds of grass pea in the southern Levant are relatively rare in the archaeobotanical record (Riehl & Kümmel, 2005). However, for the Late Bronze Age there are

two other sites in the vicinity of Tel Burna in which a relatively high amount of grass pea seeds have been found.

At Tel Miqne-Ekron, about 600 seeds of *Lathyrus sativus/cicera*⁸ were stored in a locally made bowl. The bowl was found within a destruction layer (Stratum VIIIA) of Building 150 (Field I) located on the summit of the tell dating to the Late Bronze Age IIB (Mahler-Slasky & Kislev, 2010: 2480-2481).

At Tel Batash, the grass pea seeds were also found in a layer of destruction debris (Stratum VIII) dating to the 15th century B.C.E. This layer was located in Room 494 of Building 475 (Area B), interpreted as a Canaanite patrician house (Mazar, 1997: 252). The seeds were found in the entrance area to this building (Mahler-Slasky & Kislev, 2010: 2480; Mazar, 1997: Fig. 15).

Unlike the finds from Tel Burna and Tel Miqne-Ekron, at Tel Batash only 60 seeds of *Lathyrus sativus/cicera* were found. However, the seeds also derive from only a single context similar to the contexts at Tel Burna and Tel Miqne-Ekron.

The grass pea in antiquity, as in modern times was preferably used as fodder, but it could also be used for human consumption. The growing conditions for *Lathyrus sativus* are less demanding than for other crops such as free threshing wheat or lentil (see Riehl, 2009: Table 1): the grass pea is more resistant to drought, it is quite resistant to pest infestation, and it can also grow in soils poor in nutrients. The seeds of the grass pea are extremely nutritious, however, they are toxic when consumed in high amounts (Mahler-Slasky & Kislev, 2010: 2478-2479). This might also be the reason why *Lathyrus sativus* did not reach the high number of finds within the archaeobotanical record of the southern Levant (see Riehl & Kümmel, 2005). Yet, cooking and soaking the seeds in water washes out the toxic amino acids, which cause lathyrism, a condition characterized by the loss of muscular control and paralysis of the lower limbs (Mahler-Slasky & Kislev, 2010: 2479). According to Mahler-Slasky & Kislev (2010: 2482) the cultivation of various *Lathyrus*-species including *Lathyrus sativus* have their origin in the Aegean and cultivation expanded to the southern Levant during the Middle Bronze Age.⁹

Tel Burna, Tel Batash, and Tel Miqne-Ekron in which comparatively high amounts of grass pea seeds have been found, are located in close proximity to one another. Like other important sites from the 13th century B.C.E., the Late Bronze Age pottery from Tel Burna includes many imports from Mycenae and Cyprus (Shai *et al.*, 2015: 117-119) indicating some sort of interconnections in the form of trade or otherwise with the Aegean. At both Tel Batash (Mahler-Slasky & Kislev, 2010: 2480; Steel, 2006: 152-153) and Tel Miqne-Ekron (Meehl *et al.*, 2006: 29) the remains of Mycenaean and Cypriot pottery and other prestige items were discovered, as well, indicating similar connections to the Aegean. Altogether, the evidence implies that either the grass pea finds were imported as merchandise from the Aegean or of some other affinity between these regions. It is also noteworthy that in all three sites, the grass pea seeds were discovered in elite or cultic contexts, which may be interpreted to reflect upon the consumption of the grass pea in the high-status social classes, or may imply their consumption as part of cultic activities in the Late Bronze Age and in this area.

⁸ "In archaeobotanical material it is not possible to distinguish between the seeds of [cultivated] *L.[athyrus] sativus* and those of the closely related [wild growing] *L.[athyrus] cicera*." (Mahler-Slasky & Kislev, 2010: 2478). However, in this paper we are convinced that we found cultivated grass pea seeds which that is why we identify them as *Lathyrus sativus*.

⁹ Ben-Shlomo *et al.* (2008: 235) mention that *Lathyrus sativus* was introduced to the southern Levant with the Philistines. However, the grass pea finds from Tel Batash (15th century B.C.E., Kislev *et al.*, 2006) clearly show that this plant is not a "new cultural element" (Ben Shlomo *et al.*, 2008: 235) introduced in the early Iron Age. Rather we can see increased finds of grass pea seeds from the Late Bronze Age IIB (13th century B.C.E.; see Riehl & Kümmel, 2005) in sites which are later connected to Philistine occupation.

Alternatively, the increased finds of grass pea seeds might also be the result of drier climatic conditions as *Lathyrus sativus* is more drought resistant than, for example, lentil. As mentioned above, the end of the Late Bronze Age was a period of drier conditions (Langgut *et al.*, 2013: 160-61; Langgut *et al.*, 2015: 229; Soto-Berelov *et al.*, 2015: 107). Yet, the Dead Sea levels indicate that the dry period had already started with the beginning of the Late Bronze Age (Migowski *et al.*, 2006: 426; Kagan *et al.*, 2015: 247). The calculated paleo-rainfall by Bar-Matthews and Ayalon (2004: Figure 12) in contrast show an increased precipitation around 3300 BP.

The other carbonized plant remains from the Late Bronze Age

The remaining charred macro remains found in Area B1 may be the remnants of crop storage or of food processing (see van der Veen, 2007: 979), as supported by the two pithoi and the two ovens/*tabuns*. The high proportion of wild species seeds and the bad preservation of the macro remains may be explained by the proximity of this layer to the modern surface. Hence, the macro remains from wild plants, although charred, might be the result of modern contaminants. Darnel grass, trefoil, and wild grasses show a relatively high proportion and ubiquity within the archaeobotanical material from Area B1 (excluding the grass pea finds). The local flora of the southern Levant consists of hundreds of pasture plants including many wild grass species, e.g. darnel grasses, as well as about 30 species of trefoil (Zohary, 1962: 215). As nowadays the tell is used as a grazing rangeland, and was likely used as such through the ages, it is possible that the macro remains mentioned above are residues of the pasture plants from the tell which entered the archaeological sediments after the abandonment of the site by soil bioturbation.

The Iron Age agriculture at Tel Burna

The archaeobotanical as well as the archaeological data allow us to gain comprehensive insights into the agricultural landscape of Tel Burna. The macro remains from Areas A1, A2, and C represent the wide range of crop species, which were cultivated around and processed at Tel Burna. The archaeological installations as well as archaeological finds were connected either to food storage (silos) or to crop processing of secondary products (like wine/olive presses, loom weights).

The natural preconditions such as water supply and soil conditions were favorable for extensive agriculture in the area surrounding Tel Burna. The stable carbon isotopes indicate good water supply of barley grains during the Iron Age IIB and IIC which is also confirmed by the cultivation of demanding crops, such as flax which annually needs at least 400 mm of water during the growing season (Ertuğ, 2000: 176; Riehl, 2008: S48). The cultivation of various field crops found at Tel Burna (barley, wheat, lentil, bitter vetch, and flax) is not only attested by the archaeobotanical macro remains but also by the fact that they were found in the storage contexts of silos. Moreover, finds of typical field weeds such as darnel grass, pimpernel, cow cockle, and mallow (Zohary, 1962: 221-225) were directly associated with the seeds of cultigens within the same contexts and samples. The weed plants were harvested and processed together with the crops. After crop processing like threshing, winnowing and sieving, the crop material was stored still containing some impurities of weed seeds. The final cleaning of the cereal grains then took place directly before consumption (Hillman, 1984; 1985). In addition, the cultivation of flax is affirmed by the finds of dodder seeds, a parasite to flax plants (Feinbrun-Dothan, 1978: 41) within the same samples and contexts.

The archaeobotanical finds of cultigens are most probably relics of the crops processed at Tel Burna that were cultivated during winter months (Borowski, 1987: 32-38; Charles, 1985: Table 1). There are remains of crops known to be demanding crops, whether for water supply, e.g. lentil and flax (Riehl, 2009: Table 1), or for soil nutrients, e.g. flax (Kislev *et al.*, 2011: 580). Other field

crops like emmer wheat, barley, and bitter vetch show a high tolerance to drier conditions and saline soils (Riehl, 2009: Table 1). According to Riehl and Shai (2015: 531), precipitation in the region of Tel Burna was sufficient for rain-fed agriculture. Yet, shifts in annual rainfall might have led to irrigation when needed. The majority of macro remains were found in the silo contexts in which the crops would have been stored (van der Veen, 2007: 979).

Olive, grape, and fig are typical fruit cultigens of the southern Levant. The fig seeds were more numerous in the archaeobotanical record than olive or grape. Yet, the seeds per distribution unit is much higher than for olive or grape so that the high number of fig seeds might not correspond to a more extant cultivation of this plant (Riehl & Shai, 2015: 531). Cultivation of olive trees and vineyards might have been possible, although both species need a higher amount of water supply (500-600 mm; Riehl, 2009: Table 1) than available by precipitation in the lower Shephelah. The regional distribution of ancient wine and olive presses, though, indicates that olive and grape cultivation extended into regions receiving less than 500 mm rainfall per year today (Riehl & Shai, 2015: 529-530). The archaeological remains of olive and/or wine presses on the eastern spur of the tell suggest that olive orchards and vineyards had been maintained in the vicinity. So far, the samples from Area C have not contained any remains of the basic products, which would have been processed for olive oil or wine.

The discovery of loom weights found *in situ*, provide evidence for the warp-weighted loom and hence weaving activity in the courtyard in Area A2.¹⁰ The abundance of linseeds at the site may be interpreted in this context as evidence of flax cultivation for the production of linen textiles. However, it is just as likely that the warp-weighted looms were used for weaving woolen textiles and the linseeds used for consumption, for the production of linseed oil, or as seeds for subsequent sowing (Kislev *et al.*, 2011: 582).

The agricultural activities during the Iron Age took place inside the fortified settlement and on the eastern slope of the tell directly outside the fortification. The archaeobotanical data alone cannot provide a full reconstruction of crop management at Iron Age Tel Burna. Yet, it is obvious from the archaeological remains that there was a shift in the settlement structure during the Iron Age IIC (7th century B.C.E.) when the silos appear on the site. In fact, the samples from the silos provide the highest and the most diverse macro remains from Tel Burna. However, as most of the Iron Age samples were poor in seed and fruit remains it is difficult to attest a difference between the Iron Age IIA/B and IIC assemblage. An extended need for large-scale crop storage might be one reason for the construction of the silos. This might be connected to sociocultural changes in the Shephelah, possibly intensified trade with the Coastal Plain or increased tribute imposed on Judah after the military campaign of Sennacherib (Faust & Weiss, 2005; Riehl & Shai, 2015: 531-532).

Some of the most ubiquitous wild species found in the Iron Age samples grow as weeds. Dodder, darnel grass, cow cockle, and pimpernel might have been gathered with the field crops and entered the settlement in this way. Other wild taxa might have entered the archaeological contexts after the abandonment of the settlement growing on the ruins of the tell. The seeds of *Lithospermum* cf. *tenuiflorum* from Area A2 might have been stored plant remains. However, stoneseed remains show a high distribution throughout all areas excavated at Tel Burna, which would suggest these macro remains to be modern contaminants. *Lithospermum tenuiflorum* grows in batha habitats and on fallow fields within the eastern Mediterranean and western Irano-Turanian

¹⁰ Loom weights were also found inside the casemate wall in Area A1. It is worth noting that flax (*pisteh*) appears twice in the Samson narrative (Judg 13-16; cf. also Josh 2:6 [Jericho]; Prov 31:13; Isa 19:9; Hos 2:5, 9)), which is set in the Judean Shephelah and Hill Country. In both cases, flax is referenced in association with the production of “new ropes” (Judg 15:14; 16:9), which failed to bind Samson. The occurrence of flax in this narrative is a textual indicator that flax was commonly grown, harvested, and developed into products during the Biblical era.

plantgeographical vegetation zone (Feinbrun-Dothan, 1978: 68). According to the *Flora of Israel Online* (Danin, 2003-2017) this plant rarely occurs in the Shephelah today, however this does not eliminate the possibility that it may be present at modern Tel Burna.

The archaeobotanical evidence, at least for the Iron Age II (Areas A1 and A2), demonstrates a thriving and diverse agricultural economy. The presence of numerous agricultural installations, the storage facilities, and the loom weights strengthen our understanding that Tel Burna was an active producer of agricultural primary and secondary products within the Shephelah, an area which has been established as the breadbasket of southern Canaan and, subsequently, the Kingdom of Judah (Riehl & Shai, 2015: 525).

CONCLUSION

The macro remains from the Late Bronze Age (Area B1) show that the significance of archaeobotanical remains goes beyond their apparent significance as mere ecological and economic products. The discovery of the stored grass pea seeds and of imported pottery from Tel Burna, similarly at both Tel Miqne-Ekron and Tel Batash, attests to a form of connection or affinity with the Aegean. The macro remains from the Iron Age (Area A1, A2, and C) are the relics of an agricultural economy. The complexities of the agricultural landscape at Tel Burna can be further understood when the agricultural remains, as attested by the archaeobotanical finds of cultigens and field weeds, are combined with the archaeological evidence associated with different agricultural activities. Environmental preconditions in the lower Shephelah were more than sufficient for extensive field farming, cultivation of orchards, and vinification. The Iron Age macro remains reveal a broad spectrum of Mediterranean crops, however, no specialization in a particular crop species can be identified. The archaeological Iron Age remains indicate that the processing of secondary products such as olive oil, wine, or textiles took place within the Iron Age settlement or directly outside the fortification wall on the eastern side of the tell (in the vicinity of Area C). Future archaeobotanical analyses at Tel Burna may help to differentiate between the other sub-periods of the Iron Age, against the obvious change in the agricultural landscape from the 8th to the 7th century B.C.E..

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