An Early Bronze Age fertilized agricultural plot discovered near Tel Yarmouth, Ramat Bet Shemesh, Israel

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1. Introduction

Tel Yarmouth is located in the Judean Shaphelah (foothills) of Israel (Figs. 1–3), west of the modern town of Bet Shemesh, in a well-defined sub-region of Ramat Bet Shemesh that has been thoroughly explored in recent years (Dagan, 2010, 2011). The Early Bronze Age (EB) settlement of Tel Yarmouth was established on a natural hill that towers over the streambed of Nahal (the Hebrew term for ephemeral stream as Wadi in Arabic) Yarmouth, a location that benefited from steady water supply (until recently) and accessible land resources for agriculture and pasture (e.g., Bitan and Potchter, 2011). The settlement was excavated on a large scale by the French CNRS (de Miroschedji, 1988, 1999, 2006) and their excavations clearly showed that Yarmouth was a major fortified city in central Israel during the EBII–III (c. 3000–2500 BCE; Regev et al., 2012). The settlement reached its zenith towards the end of the EBIII, c. 2200–2700 BCE, a date based mainly on stratigraphy, pottery and synchronism with Egyptian Old Kingdom (e.g., Stager, 1992; Gophna and Paz, 2014; 2900–2500 BCE) as well as on recently published \textsuperscript{14}C dates (Regev et al., 2012), with the establishment of a large palace, planned and built according to the Egyptian cubit. The palace contained vast amounts of commodities that exceeded the needs of the city's inhabitants and were stored in large containers (mainly jars and pithoi) that were located in magazine rooms within the palace (de Miroschedji, 1999).

Notably, Tel Yarmouth was part of a flourishing urban system that prevailed in central Israel during the EBIII (mainly in the Judean Shephelah and in the southwestern coastal plain), in which urban sites like Horvat Shovav, Tel Zafit, Tel Halil, Tel Hesi, Tel Erani and Tel Sakani existed (Fig. 1), as well as many open air rural settlements like Horvat Ziqit, Bir Gamla and others (see Getzov et al., 2001: 26–28; Gophna and Paz, 2008, 2011).

As stated by de Miroschedji (2006), the fortified city of Tel Yarmouth, occupying no less than 15 ha, was the predominant political unit of at least the Bet Shemesh region, where smaller political units, perhaps small towns, existed at sites like Horvat Shovav and Tel Azeqah. The dwellers of Yarmouth resided within a well-planned city, defended by formidable fortifications (de Miroschedji, 1999).

The storage rooms located within the palace at Yarmouth contained hundreds of complete storage vessels, all testifying to the production and trade of agricultural products such as olive oil and wine. This said, the data accumulated from the city excavations were not sufficient to establish the exact source of these commodities. It is especially unclear which portion of the commodities stored in the magazines of Yarmouth originated in crops that were cultivated in the immediate surroundings of the site; above all, it was not known where the city's fields were located.

Although the location of agricultural plots adjacent to major EB towns has been suggested (e.g., Wilkinson, 1990), it was never proved empirically by any sort of fieldwork. The current paper provides this proof for the first time.

1.1. General environmental background

Tel Yarmouth is situated in the eastern part of the upper Judean Shephelah at an elevation of 410 m asl (above sea level; Figs. 1–3). The bedrock in the area is composed primarily of white Eocene chalk of the “Adulam formation” (Sneh, 2009), on which a calcrite crust, known locally as Nari (Wieder et al., 1994; Itkin et al., 2012), has developed. On the Tel, the bedrock is overlain by loess sediments.

The typical soils in the area are as follows (names listed according to Israeli and EU Commission taxonomies, respectively): On the hills, brown rendzina soil (Calcisol) is found in soil pockets on slopes with calcrite; pale rendzina soil (calcareous Leptosol) is found on the soft chalk. In the large valleys, there are dark brown soils (Kastanozem).
and/or grumusols (Vertisol) (Dan et al., 1972, 1976, 2007; Singer, 2007; Jones et al., 2005).

The climate of the area is semi-arid Mediterranean (Kaflé and Bruins, 2009), characterized by a hot, dry summer and a cool, rainy winter. The mean annual temperature is 20 °C, with mean January and August temperatures of 12 °C and 26 °C, respectively. The rainy season generally lasts from October to May, and the mean annual rainfall is ~500 mm (Israel Meteorological Service, 2011). The vegetation belongs to the xeric Mediterranean phytogeographic region, and has been subjected to intense human pressures and interventions for the past several thousand years. These pressures resulted in the formation of scrubland and dwarf shrubs dominated by Sarcopoterium spinosum (thorny burnet) (Lev-Yadun, 1997; Ackermann et al., 2013) and including other species such as Rhamnus (Palestine buckthorn), Quercus calliprinos (Palestine oak), and Ceratonia siliqua (carob) (e.g., Zohary, 1962).

1.2. Physical description of site 203a

Site 203a is located c. 150 m southwest of the gate area of the Tel

![Location map with main sites mentioned in the text.](image1)

![Air photo showing the study area.](image2)
Yarmouth fortifications (Fig. 2). The site is a natural rounded bowl-shaped depression, measuring c. 90 × 90 m, that is surrounded in the east, north and south by calcrete \((Nari)\) outcrops. The lowest point of the depression is c. 2 m below the base of the surrounding bedrock. GIS-based measurements outlined an open area measuring c. 0.4 ha. Fig. 2 shows that the depression in which site 203a is located is surrounded by thick vegetation, mainly trees such as olives and almonds, as well as large shrubs, all growing on the calcrete bedrock. In contrast, the depression is covered only by low grasses and dwarf shrub, and is visible in air imagery (Fig. 2) as a brownish patch.

The depression slopes gently westwards, and joins a narrow tributary of a dry stream channel that flows roughly north to south, an important factor in understanding the formation of site 203a. Calcrete rock outcrops act as an enhanced source of available runoff into the site \((\text{Ackermann et al., 2008})\), leading to high water availability in the depression.

1.3. Open air site 203a – discovery and excavations

Surveys conducted by the Israel Antiquities Authority (IAA) in the immediate vicinity of Tel Yarmouth revealed remnants of EB material culture, mainly in the form of pottery scatters and wall fragments (see e.g., Dagan, 2010: site 203). These finds were never excavated and thus were not fully understood.

In 2010, the IAA launched a detailed survey in the region that aimed at full documentation of ancient remains. In this survey, dozens of rock-cut installations were discovered on the calcrete surfaces south and southwest of the fortified city, mostly cup-marks, shallow basins and more elaborate features that include basins that were connected to deep cup-marks (Fig. 4). The latter were sometimes interpreted as ancient, simple olive-oil presses \((\text{Bodedah, see e.g., Dagan, 2010: 169, pl. 218.2})\).

No datable material, such as pottery or other finds, was retrieved during excavations of these installations (conducted by M. Haber on behalf of the IAA). This said, the plain morphology of the installations suggests an early date, and their proximity to Tel Yarmouth may at least suggest that they reflect agricultural activities carried out for the benefit of the fortified city.

Site 203a (Figs. 2, 6 and 7) was discovered during preparations prior to the excavations of these newly discovered rock-installations. Large amounts of EB Age pottery were found at the surface within the depression mentioned above. While the area was surrounded by exposed bedrock, the excavation within the depression reached bedrock at a depth of c. 2 m, exposing grayish sediment densely filled with occupation debris below the current surface brown soil.

To define the dimensions of the area of this gray debris, probe trenches were dug by a back-hoe across the depression down to bedrock. The trenches showed that most of the area, save for the westernmost edge that overlooks the sloping bedrock towards the streambed, was devoid of any architecture. However, the most prominent feature of the site is a continuous, thick layer of gray soil/sediment, provisionally interpreted as mound debris, buried below c. 0.5 m of brown soil. This accumulation is easily distinguishable from the overlying and underlyng dark brown soil by its gray color (Fig. 5). Trenching showed that it covers an area of c. 0.1 ha and exceeded 1 m in thickness.

To further understand this gray deposit, fifteen 5 × 5 m excavation squares were opened from east to west, leaving 0.5 m banquets between them (Fig. 6). The extent of the gray soil layer, as well as evidence from analyses carried out on the sediments, suggest an EBIII field that covered an area of c. 40 × 25 m. A representative section (in square J4, western side) was described in the field according to its structure, texture, color, pedological characteristics and unit boundaries. From this well-described section, samples were collected for additional laboratory analyses, as detailed below.

1.4. The stratigraphy in squares J4–J7

Squares J4 to J7 (Figs. 5 and 6) show the same stratigraphy and best represent the excavation area; these will be the focus of this article. The western profile in Square J4 is comprised of three main
The uneven surface of the bedrock was exposed in all of the excavated squares. The bedrock is overlain by a thin dark brown layer (Unit 3), the paleo-surface prior to human modifications. It is mostly comprised of natural clayey soil mixed with nari particles (Fig. 5). In Square J5, some pottery sherds hint at the possibility that area 203a was already occupied during the late 4th millennium BCE. Overlying this dark brown soil is an extensive, thick gray layer with a stony layer on top (Unit 2), common to all four squares, which is overlain by a thin brown soil mixed with small stones that contained both EB Age and Roman-Byzantine pottery (Unit 1). The thick gray accumulation is different in many aspects from the underlying and overlying brown and dark brown soils. It contained abundant pottery and other archaeological debris which could not have been deposited naturally. The focus of this paper is to show that this grayish layer must have been brought intentionally to the site from the city and the means by which the sediment has been modified.

1.5. The date of the plot in light of the ceramic assemblage

The main tool used to date archaeological contexts is archaeological finds, and pottery is one of the most abundant type of find. At site 203a, hundreds of diagnostic pottery sherds retrieved from Unit 2 securely date this context to the EBIII (c. 2900–2500 BCE, see Regev et al., 2012).

As discussed by de Miroshchedji (2000), three chronological-typological phases can be related to EBIII Yarmouth, the latest (designated EBIIIC) was directly related to the great Palace B (see e.g., de
Miroschedji, 2000, 2006). The ceramic shapes that characterize this last phase include, among other things, large amounts of wheel-finished bowls, squat narrow jars, large pithoi and flat shallow platters with plain rims (de Miroschedji, 2000: Figs. 18.8–18.10). A close examination of the pottery types found at site 203a clearly shows that this last phase of Yarmouth palace B1 is completely lacking. The types that can be assigned to EBIII Yarmouth cover the first two phases, EBIIA and EBIIIB, most notable large coarse platters, plain thickened rim holemouths and various jars and pithoi. Therefore, it can be assumed that site 203a was prepared and filled by the time the palace complex of Yarmouth was established. The question, of course, is for what purpose (see Discussion below).

As noted by Wilkinson, based on his thorough research of 3rd millennium BCE rural landscapes (1989: 41), people used to fertilize their fields with their own debris. If we follow this line, it is most plausible that the mound soil that filled the depression reflects the use of this area during the EBIII city at Yarmouth. We tested this premise by chemical analyses of the layers exposed at site 203a for fertilizing elements such as phosphorous, nitrogen and organic matter.

And yet, the possibility that EBIII soil from Tel Yarmouth could have been carried out and filled the depression during the Roman-Byzantine period (an unexcavated structure from this period exists at Tel Yarmouth) cannot be overlooked, and for that reason, an exact date for the gray material was needed in order to clarify the point.

1.6. Laboratory analyses

1.6.1. OSL dating

Four samples for optically stimulated luminescence (OSL) dating were collected from the western section of square J4 (Table 2; Fig. 5). To prevent exposure to sunlight, samples were drilled under a cover using a 1-inch hand-held auger and were placed immediately in light-tight bags. A complementary sample was collected for dose rate evaluations. Samples were prepared and quartz was extracted from the sediment following routine laboratory procedures (Davidovich et al., 2012). Equivalent doses (De) were measured on 2-mm aliquots from each sample using the conventional single aliquot regenerative dose (SAR) protocol (Murray and Wintle, 2000). Dose rates were calculated from the concentrations of the radioactive elements U, Th and K measured on the complementary sediment sample by inductively coupled plasma spectroscopy (ICP-MS and ICP-AES). Water contents were estimated at 10% and 15% for the upper and lower samples, respectively (Rosenzweig and Porat, 2015), and cosmic dose was estimated from burial depths.

The OSL data and ages are presented in Table 2. The ages range from 6790 ± 300 yr BP (years before present) to 5730 ± 210 yr BP for the upper part of the gray layer. The uppermost brown soil could not be dated with any precision due to large scatter in the De data, resulting from proximity to the surface and soil formation processes currently taking place. The OSL age of the gray layer, from 4120 to 3510 BCE, accords with the earliest EBIII city at Yarmouth. We tested this premise by chemical analyses of the layers exposed at site 203a for fertilizing elements such as phosphorous, nitrogen and organic matter.

However, these scanty remains represent a typical diet for Bronze
1.6.3. Palynological analysis

For the analyses of pollen and NPP (Non-Pollen Palynomorphs such as spores, fungi, algae, and micro-charcoals), five soil samples were collected from the exposed sedimentological section (Fig. 5): a single sample from Unit 1, three samples from Unit 2 and one additional sample from Unit 3. Palynomorphs extraction followed a physical-chemical preparation procedure: One Lycopodium spore tablet was added to each sample (batch number 1031, with an average 18,853 spores per tablet), in order to calculate palynomorphs concentrations (Stockmarr, 1971). Next, samples were immersed in HCl (10%) to remove the calcium carbonates, and then density separation was carried out using a ZnBr₂ solution (with a specific gravity of 1.95) in order to float the organic material, together with sieving (150 μm mesh screen). Acetolysis process was not performed because it can be destructive for some palynomorphs (Faegri and Iversen, 1989). Unstained residues were homogenized and mounted onto microscopic slides using glycerin. Palynomorphs were traced under a light microscope, with magnifications of 200 × and 400 ×.

The results of the palynological analyses showed that pollen was not preserved, probably due to oxidation. Other palynomorphs such as spores and fungi were not present as well. The most interesting observation of this analysis is the occurrence of micro-charcoals in a vast range of concentrations (Table 4). Their concentrations in each sample were calculated as follows: total of counted micro-charcoals times the number of Lycopodium spores added to the full sample (18,583). Then, the ratios between this value and the weight of the sample multiplied by the number of counted Lycopodium spores gave the value of micro-charcoal concentration. The highest concentration ratios were calculated for the upper sample of the gray fill sediment in Unit 2 (79 cm below surface): 25,457 micro-charcoals per gram/sediment. A gradient decline was documented within Unit 2 with 8415 and 6440 micro-charcoals per gram/sediment in depths of 92 cm and 135 cm (below surface, respectively). The brown local soil on top and below the gray fill exhibited dramatically low concentrations (100 in Unit 1 and 514 in Unit 3 micro-charcoals per gram/sediment).

The significantly higher micro-charcoal concentrations documented in the uppermost part of the gray fill (Unit II), which probably represents the layer of cultivation (the "garden surface") at the site 203a ancient field, may suggest the use of ash as a fertilizer. This may explain the gradual decrease in micro-charcoal concentrations throughout Unit II, and the extremely low concentrations characterizing Unit 1 and 3. In general, charcoal is very stable and remains in the soil for thousands of years, binding and retaining minerals and nutrients.

1.6.4. Chemical analyses

The plot in site 203a was also analyzed for the existence of fertilizers, mainly inorganic phosphorus and nitrogen, the most dominant fertilizers both in ancient times and today. Grain size distribution, carbonate contents and total organic matter were also measured. Four samples were collected from the site: from the uppermost layer of brown soil that sealed the EB Age plot, from the gray uppermost EB Age stony level, from the gray EB Age deposit that filled the depression, and from the underlying dark-brown peleosol (natural soil). A fifth sample was taken as a control from a dump within the walls of EB Age city, i.e., from an urban location that was visually similar to the gray layer in site 203a.

The results are presented in Table 5. The gray layers are highly enriched in phosphorus and have elevated values of NH₄ when compared to the upper and lower soils. Grain size analyses show that the underlying soil and the uppermost modern soil are more clayey, while the gray layers are clay loam, with ~33–35% silt. The sample from the Tel is also clay loam, with ~30% silt, a value that falls between the current surface (modern soil) and the gray layers (Table 5).

The similarity in color (light brownish gray 10YR 6/2) and grain size distribution between the urban debris and the gray unit in site 203a (Fig. 8), in addition to the abundant distinct ceramic assemblage at site 203a, augments our original supposition that the source of the gray layers is in mound debris that was carried from the city to fill the depression. The significantly higher phosphorus content in the gray layers compared with the city debris might suggest that the inhabitants of the city might have added organic material to the gray layer in order to fertilize it in a way that tripled its phosphorus contents.

2. Discussion

The excavated squares are located c. 150 m west of the city gate (Area E, Fig. 2). The defenses of Tel Yarmouth, which now tower to a height of c. 10 m, must have been substantially higher during the EBIII. These form a barrier that prevented archaeological material from within the city to be naturally transported westwards into the depression. Moreover, the rock surface that stretches between the fortified city to site 203a is devoid of any gray sediment, and the dozens of rock-cut installations that are strewn on that rock surfaces were filled with the brown soil (the current surface). It can thus be assumed that the depression was deliberately filled with mound soil transported from the city to the site. The volume of this fill can be roughly estimated using the dimensions of a surface area of 40 × 25 m and an average thickness of 1 m, giving a volume of 1000 m³, weighing at least 1000 tons.

The gray layer contains two main ceramic components that may

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**Table 3**

Plant remains from Yarmut agricultural plot.

<table>
<thead>
<tr>
<th>Unit/layer</th>
<th>Gray stony layer</th>
<th>Gray fill</th>
<th>Paleo-surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locus</td>
<td>101</td>
<td>119</td>
<td>135</td>
</tr>
<tr>
<td>Basket</td>
<td>1312</td>
<td>1314</td>
<td>1316</td>
</tr>
<tr>
<td>Triticum sp.</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Lolium sp.</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ficus carica cf.</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olea europaea</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Vitis vinifera</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trigonella sp.</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compositae</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phleum sp.</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scorpiurus murecatus</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thymelaes hirsuta</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Grand total</td>
<td>1</td>
<td>13</td>
<td>3</td>
</tr>
</tbody>
</table>

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**Table 4**

Laboratory ID, sedimentological description and micro-charcoals concentrations at Ramat Beit Shemesh buried field near Tel Yarmuth.

<table>
<thead>
<tr>
<th>Laboratory ID and depth below surface (cm)</th>
<th>Sedimentological unit and description</th>
<th>Micro-charcoals concentrations (per gram/sediment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBS 1 57 cm</td>
<td>Unit I: Current surface, brown soil</td>
<td>100</td>
</tr>
<tr>
<td>RBS 2 79 cm</td>
<td>Unit II: Uppermost layer of the gray fill sediments of the ancient field</td>
<td>25,457</td>
</tr>
<tr>
<td>RBS 3 92 cm</td>
<td>Unit II: gray fill sediments of the ancient field</td>
<td>8415</td>
</tr>
<tr>
<td>RBS 4 135 cm</td>
<td>Unit II: gray fill sediments of the ancient field</td>
<td>6440</td>
</tr>
<tr>
<td>RBS 5 163 cm</td>
<td>Unit III: paleo-surface, dark-brown soil</td>
<td>514</td>
</tr>
</tbody>
</table>
Table 5
Soil/sediments physical and chemical properties.

<table>
<thead>
<tr>
<th>Sample location</th>
<th>Unit/layer</th>
<th>Depth (cm)</th>
<th>Grain size contents (%)</th>
<th>Organic matter (%)</th>
<th>Calcium carbonate (%)</th>
<th>N-NH4 (mg/Kg)</th>
<th>N-NO3 (mg/Kg)</th>
<th>P-PO4 (mg/Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sand</td>
<td>Silt</td>
<td>Clay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Square J4</td>
<td>Unit 1: current surface</td>
<td>0–30</td>
<td>33.1</td>
<td>24.8</td>
<td>42.1</td>
<td>3.3</td>
<td>24</td>
<td>19.1</td>
</tr>
<tr>
<td></td>
<td>brown soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unit 2: gray stony layer</td>
<td>90–120</td>
<td>37.6</td>
<td>32.9</td>
<td>29.5</td>
<td>1.6</td>
<td>45</td>
<td>23.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120–150</td>
<td>41.8</td>
<td>35.4</td>
<td>22.7</td>
<td>1.7</td>
<td>42</td>
<td>22.7</td>
</tr>
<tr>
<td></td>
<td>Unit 3: paleo – surface</td>
<td>160</td>
<td>37.1</td>
<td>10.9</td>
<td>52</td>
<td>0.9</td>
<td>7.5</td>
<td>14.7</td>
</tr>
<tr>
<td>Tel Yarmuth</td>
<td>City debris</td>
<td>33.5</td>
<td>30.2</td>
<td>36.3</td>
<td></td>
<td>1.3</td>
<td>54</td>
<td>18.2</td>
</tr>
</tbody>
</table>

reflect two main stages of use, EBIII (the vast majority) and EBII (few sherds); most of the ceramics relate to an early stage that may be associated with the preparation of the field for agricultural use, i.e., when debris from the city was brought to fill the depression. The latter component is a light gray, stony layer, its thickness varies between 0.1 and 0.6 m of settlement debris mixed with small uneven stones. This thin stony layer may represent the top-soil during the stage in which the EBIII inhabitants of Tel Yarmouth started cultivating or occupied the field. It is suggested that this layer was gradually developed or placed right after the field-construction fill was placed in the depression prior to cultivation.

The relative date of the gray fill settlement debris was determined according to two parameters: stratigraphy and ceramic typology. Stratigraphically, the gray layer lies on the dark brown soil that, in places, is mixed with EBIB pottery, giving a post-4th millennium BCE date. On top, the gray fill was sealed by Unit 1. The absolute dating according to OSL was from 4120 to 3510 BCE. One possible explanation for the difference in ages between the pottery sherds and the OSL could be that the material was mixed.

2.1. The creation of an agricultural plot at site 203a during the Early Bronze Age

The location of the agricultural plot is a depression surrounded by calcareous rock outcrops which act as an enhanced source of available runoff into the plot (Ackermann et al., 2008), leading to high water availability. This might have been one of the reasons why the inhabitants of Tel Yarmouth chose this location for an agricultural plot. A vast amount of c. 1000 tons of mound soil/sediment was apparently carried from the fortified city of Tel Yarmouth and placed in the natural depression to fill it to a height slightly lower than today’s bedrock surface. The purpose of this enterprise can be understood, according to the presented results, in the framework of EB Age agriculture. As found from the pottery collected during the excavation, the date for its creation was the late phases of the EBIII. Through the site’s stratigraphy, we reconstructed the stages in which the agricultural plot was established.

The first step was to create a level surface above the uneven bedrock surface; this was achieved by spreading the available natural soil. Remnants of plaster were observed in square J5, and may have covered the entire area. While the plaster can be explained as an early (EBIB) occupation level that reflects a pre-city episode west of Yarmouth, it could also represent the leveling efforts aimed at cultivation. A similar leveled surface was detected at the Roman period garden at Jericho, as reported by Cunliffe (see in Miller and Gleason, 1994: Fig. 2.2). If this is the case at site 203a, then the construction level could be dated to EBIII. Similar gray layers were recently detected in other locations in the immediate vicinity of Tel Yarmouth. The EBII sherds found within and below EBII activity surfaces seem to reflect an early phase of agricultural activity on which the EBIII activity took place in order to enable larger fields.

The second step was to fill the depression with settlement debris that originated in the city. This debris contained large amounts of pottery sherds, charred remnants of food waste, animal dung, all which contained nitrogen, phosphorus and potassium that were essential fertilizers for crop yields (see also Miller and Gleason, 1994: 27). The high micro-charcoal concentration in the gray fill material suggests the use of ash as a fertilizer, a common practice in ancient times (e.g., Bruins and van der Plicht, 2005, 2007, 2017; van Asperen et al., 2014). The gray fill material enriched with fertilizers created optimal bedding for cultivation.

The last step was to create what was described by Cunliffe (see in Miller and Gleason, 1994) as a ‘garden surface contoured for irrigation’, the actual surface which was planted. This is clearly seen in squares J4–7 as the upper gray stony level, and is characterized by the highest micro-charcoal concentration.

Remnants of a stone wall dated to this period (W112, Figs. 6 and 7) may testify to the existence of a terracing system that was mostly dismantled in later periods. Later, a long terrace wall that covered the whole length of the area (W130, see Figs. 6 and 7) was created, among other things, by stones that were taken from the former EBIII wall.

The creation of the plot is understood as one event (rather than a continuous filling) that took place during the late EBIII, contemporaneously with the construction of the palace within the city of Yarmouth. It seems plausible that two goals were achieved at the same time in this way: the construction of the palace and the intensification of agricultural production through the creation of a plot that was composed of debris that was removed from the city during construction activities.

The data presented so far should be interpreted, in our view, as evidences for the creation of a plot that was intended to be cultivated. The material culture remains do not support a possibility that this area was used for animal husbandry. This is because no architectural remains that resemble animal pens was detected; moreover, the large amounts of micro-charcoal remains and the clear ‘garden surface’ that were retrieved at the site all suggest agricultural uses rather than animal husbandry.
2.3. The economy of Yarmouth during the EBIII

The immense effort in creating an area for raising crops raises several issues. First, one should address the fact that extensive human efforts and resources were employed to create the agricultural plot at site 203a. A close analysis of the excavated area clearly reveals the intensive work that enabled the inhabitants of Yarmouth (especially the rulers of the city palace) to prepare and use the site for their benefit. The recruitment of human labor for the preparation of the plot attests to a high level of political organization that corresponds well with the major city of Yarmouth.

Another question arises regarding the rather modest size of the depression into which the gray settlement debris was transported, estimated at 40 × 25 m or 0.1 ha. This agricultural plot is much too small to feed the inhabitants of a 15 h city, estimated to number c. 1500 people, who require c. 63 ha of cultivated land (based on calculations made by Bonfil and Hadas, 2011: 207–208). In this case, the immediate surroundings of Tel Yarmouth might not have been sufficient to yield the amounts of crops needed to support its population. The large amounts of storage vessels that were found at the palace rooms of the city may have contained commodities that plausibly originated (at least partially) outside Ramat Bet Shemesh. The open areas that surround the site, especially the areas that lie to the east and north that were probably irrigated by the Yarmouth stream (Fig. 1), can be estimated at c. 30 ha of agricultural land, also too small to meet the needs of the population. In this case, there is a high probability that the city of Tel Yarmouth was dependent on yields that were raised in villages outside Ramat Bet Shemesh that were still included within its ruled territory. While we cannot clearly establish the exact extent of this territory, it is sufficient to refer to Tel Yarmouth’s central role as a major urban center in southern Israel (de Miroshchidi, 2006).

2.4. Summary

An open air depression with an area of c. 0.1 ha and a depth of 1–1.5 m was discovered near Tel Yarmouth. The depression was artificially filled during the EBIII with mound debris that was brought from the occupation levels of the Tel. About 1000 tons of debris were transported from the Tel in order to create an agricultural plot. Chemical and microscopical analyses showed that the gray sediment in this field contains high levels of fertilizers. This can be considered as one of the earliest examples for open spaces that were prepared for agricultural use and that were thoroughly explored. There is a possibility that fertilized soil from this plot was taken to be spread in the fields around the city of Yarmouth in an effort to maximize agricultural production during the EB Age in this region.

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