

# EGYPTIAN IMPERIAL ECONOMY IN CANAAN: REACTION TO THE CLIMATE CRISIS AT THE END OF THE LATE BRONZE AGE

Israel Finkelstein, Dafna Langgut, Meirav Meiri and Lidar Sapir-Hen\*

**Abstract:** *In this article we discuss four datasets that provide evidence for the expansion of grain growing in Canaan in the second half of the 13<sup>th</sup> century and the 12<sup>th</sup> century BCE: the faunal and flint records from Megiddo, the pollen diagram for the Sea of Galilee and the ancient DNA study of Bronze and Iron Age cattle in the Levant. Efforts to expand dry farming in Canaan were probably related to the dry climate event in the later phases of the Late Bronze Age, which has recently been detected in several pollen records from the Eastern Mediterranean. We discuss textual evidence related to drought and famine that struck the Near East at that time. We then suggest that the Egyptian administration in Canaan initiated the extension of dry farming in order to stabilise the situation in the southern and eastern fringe areas of the Levant and supply grain to areas in the northern Near East which, according to textual data, were badly afflicted by the climate crisis.*

**Keywords:** *Late Bronze, Canaan, Egypt, grain, climate crisis, Megiddo, faunal assemblages, ancient DNA, cattle, zebu, flint tools, pollen*

## Introduction

Egypt ruled in Canaan for over three centuries, from the takeover by Thutmose III to its withdrawal from the region, probably during the reign of Ramesses VI. Pharaonic dominance in every aspect of Canaanite life is depicted in the Amarna correspondence of the 14<sup>th</sup> century BCE and Egyptian impact on the agricultural production can be gleaned from 12<sup>th</sup> century Hieratic inscriptions found in southern Canaan. Yet, the textual evidence does not shed light on macroeconomy: had the Egyptian administration implemented policies that influenced the entire Levant and beyond?

Archaeology has the potential to answer this question. In this article we discuss four datasets: the faunal and flint assemblages from the Late

Bronze Age layers at Megiddo in the Jezreel Valley, the pollen diagram for the Sea of Galilee, and ancient DNA results for Bronze and Iron Age cattle from different sites in Israel.<sup>1</sup> Together, they point to significant changes in the production of grain during the later phases of the Late Bronze Age, which we interpret as stemming from imperial decisions related to the dry climate crisis in the second half of the 13<sup>th</sup> and the 12<sup>th</sup> century BCE.

## New Data

### *Megiddo Fauna*

In order to detect economic changes in datasets such as faunal assemblages, researchers need to work with detailed information. What is required is evidence beyond general observations on the “Late Bronze Age”; we refer to assemblages from different phases of the period: before, during and after the rule of Egypt in the region. Most archaeological reports do not provide this kind of resolution. For sites which do present data according to phases there are additional requirements, first and foremost a good grip on stratigraphy, relative chronology (that is, ceramic typology) and absolute chronology (meaning radiocarbon dating). And in order to avoid bias that stems from fragmentary records, the assemblages need to be sufficiently extensive, ideally from more than one location at the given site.

Megiddo is an ideal site for such an investigation. It has a continuous, tight sequence of layers which cover the entire Late Bronze Age (Table 1), the ceramic record is intensive, enabling a reliable relative chronology (MARTIN 2013; in press), and the entire sequence is accompanied by a rigorous programme of radiocarbon dating, providing a secure absolute chronology (TOFFOLO *et al.* 2014; BOARETTO in press). The Late Bronze layers were

\* All authors: Tel Aviv University, Archaeology and Ancient Near Eastern Cultures Department. Langgut, Meiri and Sapir-Hen also: The Steinhardt Museum of Natural History.

<sup>1</sup> So far, Megiddo has not supplied archaeobotanical material which can shed light on the issue discussed here.

Table 1 Megiddo Late Bronze layers

Period	Approximate Date*	Area H	Area K
Late Bronze I	Second half of 16 <sup>th</sup> and 15 <sup>th</sup> century	H-15	K-10**
Late Bronze IIA	14 <sup>th</sup> and early 13 <sup>th</sup> century	H-14	K-9
Late Bronze IIB	Early 13 <sup>th</sup> –early 12 <sup>th</sup> century	H-13	K-8, K-7
Late Bronze III	Early to late 12 <sup>th</sup> century	H-12***	K-6

\* See e.g. TOFFOLO *et al.* 2014.

\*\* Starts in the Middle Bronze III

\*\*\* Continues into the early Iron I



Fig. 1 Aerial view of Megiddo, looking south, marking the two areas of excavation discussed in the article.

studied in a reasonably large exposure (twelve  $5 \times 5$  squares in Area K and eight in Area H – the two excavation areas which make up the backbone of the discussion below; Fig. 1) and supplied large assemblages of finds. The combination of all these factors makes the site a unique laboratory for the study of minute changes in material culture and economic practices.

Indeed, the analysis of animal remains from Megiddo offers a rare opportunity to examine changes in livestock exploitation through time. The above layers, dated to different phases of the Late Bronze Age (Table 1), yielded large assemblages of animal remains, which were studied in depth (SAPIR-HEN *in press*). Here, we focus on evidence for the exploitation of livestock animals

from the two stratigraphic trenches at the site. Area H, located in the north-western sector of the mound, close to the palace, features relatively elaborate buildings and prestigious finds, related to the ruling groups (LANGGUT *et al.* 2016; ARIE *in press*). Its animal economy is typical of a consuming society that does not manage herds, but rather receives its meat from outside sources. This is manifested in the presence of meat-rich parts of prime-age animals. Area K, located in the south-eastern sector of the site, is characterised by domestic buildings of lesser quality. Here, animal economy patterns are typical of a producing society, i.e. where animals are raised nearby and slaughtered on-site; all parts are present, and animals are kept to an older age. Area K's primary

Table 2 Frequencies of cattle in the livestock in the Late Bronze Age strata at Megiddo<sup>2</sup>

Level	% Cattle	Total NISP*	Level	% Cattle	Total NISP*
H-15	11	257	K-10	14.5	571
H-14	16	112	K-9	20	625
H-13	26	353	K-8/7	23	1717
H-12	28	531	K-6	28	309

\* Number of Identified Specimens

and secondary products were used locally and also distributed further (for details, see SAPIR-HEN in press).

Despite the above-mentioned differences between the inhabitants of the two areas – consumption and production groups (expressed in the age-profiles; more below) – in the Late Bronze I to the Late Bronze III they exhibit similar animal frequencies. The most pronounced site-wide change in the animal economy during the Late Bronze Age (beginning in the Late Bronze IIA) is the increase in cattle frequencies (Table 2; for details see SAPIR-HEN in press). Starting with ~12% cattle in the livestock (sheep, goats and cattle) in the Late Bronze I, a gradual increase is evident from the Late Bronze IIA with 18%, through the Late Bronze IIB with 24%, to the Late Bronze III with 28% cattle in the livestock (the numbers are the average for the two areas).

Another piece of important information is the age profile of the slaughtered animals. Not surprisingly, in Area H, the age profile remained quite similar, as the ruling groups continued to receive prime cuts. This is not the case in Area K: in the Late Bronze I, the young age of cattle (along with their low frequency) does not attest a tilt toward a use for agriculture. Yet, starting in the Late Bronze IIA cattle were kept to an older age (Table 3; for details, see SAPIR-HEN in press). In the Late Bronze IIA, together with their growing importance, no culling of cattle occurs before the age of two years. This trend continues in the later phases of the Late Bronze: the growing importance of cattle in the economy (in terms of relative frequency) is accompanied by keeping most animals later than the age of two years. The combination of these factors, occurring concurrently in the Late Bronze IIA and intensifying in the later phases of the Late Bronze, suggests that cattle were increasingly exploited for the plough (see e.g. GRIGSON 1995; SASSON 2005),

and hence demonstrates the gradual growing importance of dry farming around Megiddo.

Table 3 Survivorship of cattle to age 2 and 4 years in the different Late Bronze phases in Area K (based on fusion stages, following SILVER 1969)

Level/Age	K-10	K-9	K-8, K-7	K-6
2yr	41 (12)*	100 (8)	82 (43)	100 (11)
4yr	50 (4)	80 (5)	55 (20)	66 (18)

\* First number: % fused; in parenthesis: NISP

#### Other Faunal Assemblages

Comparing the Megiddo results to data from other sites in the region is difficult, as no site provides a full sequence of the Late Bronze Age, well-divided into sub-phases, with sufficiently good stratigraphic and chronological control and large enough datasets. Still, even the available fragmentary data seem to be of significance.

Two sites in the Jezreel Valley show high frequencies of cattle during the Late Bronze Age. The Tel Qashish assemblage (HORWITZ 2003) is too small to allow secure comparison, but a trend of increasing cattle frequencies was observed, from 33% of the livestock in the Late Bronze I to 68% in the Late Bronze II. At Tel Yoqne'am, HORWITZ *et al.* (2005) studied domestic dwellings from the Late Bronze I and II. The small sample (total of 190 NISP) produced similar high cattle frequencies in both periods – 20% of the livestock. Both assemblages were not examined for age profiles. Beyond the Jezreel Valley, at Tel Dor cattle make up 37% of the livestock in the Late Bronze Age and the animals were kept to an older age (BARTOSIEWICZ and LISK in press); no temporal trend within the period is available.

On the southern coastal plain and in the Shephelah, the picture is varied. It is also more difficult to decipher, as at most sites the data refer to only one phase of the period. Tell es-Safi of the Late Bronze IIB has a 13% cattle share in the livestock; no age data is given (LEV-TOV 2012). Tel Migne/Ekron of the Late Bronze II has 26% cat-

<sup>2</sup> The fact that Area K produced bigger samples is due to the larger area excavated and possibly different, status-based animal-economy practices (SAPIR HEN *et al.* 2016).



Table 4 Percentage of harvesting-related flint tools in the total tool assemblages in the Late Bronze Age layers at Megiddo (based on ELLIS 2013; ROSENBERG-YEFET in press).

Area H	H-15		H-14		H-13		H-12	
	N	%	N	%	N	%	N	%
	1	5	2	8	2	17	10	22
Area K	K-10		K-9		K-8, K-7		K-6	
	N	%	N	%	N	%	N	%
	9	11	20	22	5	8	14	20

tle, exploited to old age (LEV-TOV 2010). Tel Bethshemesh of the Late Bronze III has 18% cattle; based on the age-profile they were exploited for meat and work (TAMAR *et al.* 2013). Lachish has ~25% cattle in both the Late Bronze IIB and the Late Bronze III, with exploitation of both primary and secondary products (CROFT 2004).

HORWITZ and MILEVSKI (2001) reviewed data from the Middle Bronze III and Late Bronze I/II strata in different parts of the region, and noted an increase in cattle frequencies at several sites, without discussing age profiles. They interpreted this pattern as an indication of an increased intensity of agricultural production in the Late Bronze Age. They suggested that the need for agricultural surplus was “a direct result of economic demands excreted by the Egyptians” (*ibid.*, 300).

Finally, and most important, are three sites which were directly associated with the Egyptian administration in Canaan. We refer to Beth Shean (HORWITZ 2006), Kamid el-Loz, location of Kumidi (BÖKÖNYI 1990), and Tell Kazel, location of Sumur (CHAHOUH 2015). All three show high frequencies of cattle during the Late Bronze Age II, ranging between 25 and 50% of the livestock; age information is not available, and temporal trends within the Late Bronze Age could not be examined.

All in all, and with all due caution (because of the fragmentary nature of the evidence), it seems to us that faunal assemblages across Canaan show an emphasis on cattle exploitation for the plough during the Late Bronze Age, reflected in increasing cattle frequencies and animals that were kept to older age.

#### *Megiddo Flint Assemblage*

The detailed Megiddo stratigraphic-chronological record offers a glimpse into a development in the material culture of the site, which seems to be connected to an expansion of dry farming.<sup>3</sup> We refer to frequencies of flint tools bearing gloss,

which indicate harvesting activities, that is, sickle blades, geometric sickles and other glossed items. With all due caution (as a result of the relatively small assemblages in some of the relevant layers), increase in the percentage of these tools (in the total number of tools) can seemingly be observed in both Areas H and K (Table 4, based on ELLIS 2013 for Levels K-8, K-7 and K-6; ROSENBERG-YEFET in press for Area H and Levels K-10 and K-9). Since Megiddo is the only site which supplies data for a close examination per sub-phases of the Late Bronze Age, we cannot tell if this trend characterises other places and regions in Canaan.

#### *Sea of Galilee Pollen*

The pollen record from the Sea of Galilee is the result of a study which was carried out in unprecedented resolution, accompanied by rigorous radiocarbon dating (LANGGUT, FINKELSTEIN and LITT 2013). It reflects, *inter alia*, wind-transported pollen from areas west of the lake, including the Jezreel Valley. The pollen diagram reveals two significant peaks in the cerealia-type pollen (cereals) column, the first c. 1200 and the second c. 1100 BCE (LANGGUT *et al.* 2015, 222). Cerealia-type pollen, which is distinguished from that of other grasses by the size (at least 37µm large), thick wall and pronounced annulus around the pore, includes wild and cultivated cereals (e.g., VAN ZEIST, BARUCH and BOTTEMA 2009; LANGGUT *et al.* 2014). Whether these were indeed two different peaks with a short low phase between them, or one period of increase in grain growing, is impossible to say. This growth in cereal-pollen is especially noteworthy in view of the relatively low sedentary settlement activity in most of Canaan in the Late Bronze Age (e.g., GONEN 1984, 66; for the western Jezreel Valley, see FINKELSTEIN *et al.* 2006; for the Beth-shean Valley, see MAEIR 2010, 178 and maps on pp. 160, 166; for the Lower Galilee, see GAL 1992, 13, 56).

<sup>3</sup> In “expansion” we mean areas devoted to grain growing. Dry farming in the area of Megiddo evidently means wheat.

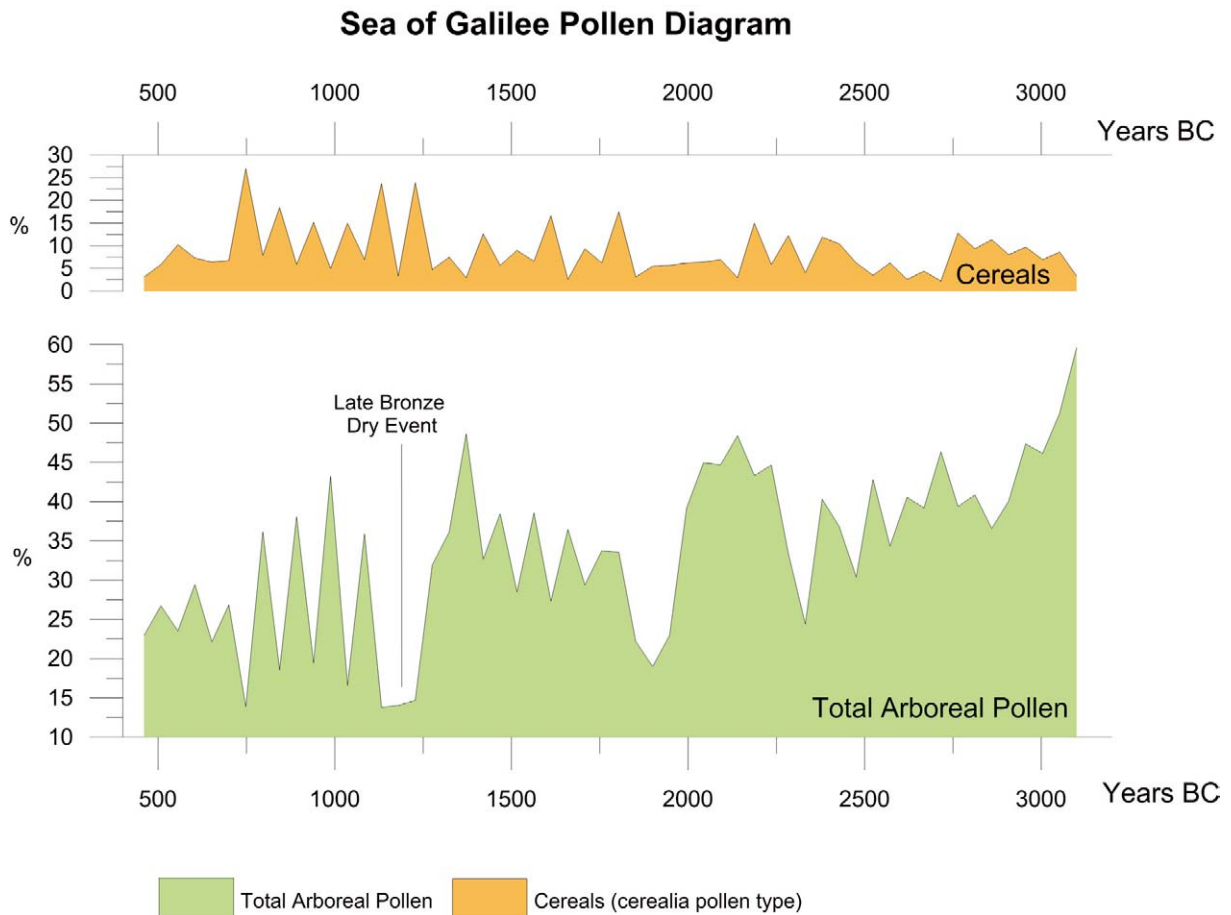


Fig. 2 The Bronze and Iron Ages palynological diagram of the Sea of Galilee, presenting the curve of the total Mediterranean arboreal pollen together with the curve of the cerealia (cereals) pollen type. Note the dry event at the end of the Late Bronze Age (bottom) and the contemporaneous growth in pollen of cereals (top).

### *Ancient DNA of Cattle*

A recent study of animal mobility in the Eastern Mediterranean in the Late Bronze and early Iron Ages (MEIRI *et al.* in press) yielded the first ancient DNA cattle sequences from the southern Levant. Ten taurine cattle from Megiddo and Azekah (the latter in the Shephelah of Judah), spanning from the Late Bronze IIA to the Iron Age IIB, yielded DNA. The results show an increase in the frequency of mitochondrial Haplogroup T1, a unique genetic signature which is dominant in Africa: from one of five samples dating to the Late Bronze II–III (Megiddo Level K-8) to all five samples dating to the Iron IIA–B (Levels H-5 and H-4 at Megiddo, Iron IIA and IIB respectively). Furthermore, we detected a specific Haplotype T1c at Megiddo (Area H, Levels H-5 and H-4 of the Iron IIA and Iron IIB respectively), which is dominant in Egypt today (BONFIGLIO *et al.* 2012; OLIVIERI *et al.* 2015). These data suggest that Egyptian taurine cattle were translocated to the southern Levant in

the Late Bronze Age or before. The period of Egypt's rule in Canaan in the Late Bronze is the most reasonable.

These taurine cattle data should be combined with another piece of genetic information that we have detected. One of the mitochondrial haplotype T1c samples from Megiddo carries a Y-chromosome which was identified as zebu (MEIRI *et al.* 2017). This sample, which comes from a late Iron IIA context (Level H-5, late Iron IIA), provides the earliest evidence for hybridisation between taurine cattle and zebu in the region. When was this done and why?

Regarding “when”, the scarce data at hand (a single sample) indicates that the taurine cattle-zebu hybridisation could have taken place any time before c. 840 BCE (the date of destruction of Level H-5). The most logical date would be in the Late Bronze Age, when Canaan was a province of the Egyptian Empire and was governed by Egyptian bureaucrats. Due to the small number of samples that yielded DNA, we could not determine if

the taurine-zebu crossbreeding occurred in the southern Levant, or whether crossbreeds were brought to Canaan from Egypt.

To answer “why”, there are clear benefits in crossbreeding taurine cattle with zebu. Zebu have a better heat tolerance (due to low metabolic rates, many large sweat glands and large skin surface) as well as a better resistance to insects, ticks and protozoa (EPSTEIN 1971). Indeed, zebu cattle and their crossbreeds are dominant in arid regions such as the Indian subcontinent and most of Africa. The zebu is, therefore, advantageous as a plough animal, especially in hot and arid zones, such as the eastern and southern fringe areas of Canaan. Therefore, the zebu evidence may point to a direct involvement of the Egyptian administration in Canaan in the expansion of grain production.

The four new datasets discussed here point in the same direction – expansion of grain growing in Canaan starting in the Late Bronze IIA and reaching a peak in the Late Bronze III. In absolute terms, this means from the 14<sup>th</sup> or early 13<sup>th</sup> century to the 12<sup>th</sup> century BCE.

### The textual information

The Amarna letters contain information about royal Egyptian estates in the Jezreel Valley (ALT 1924; NA'AMAN 1988). Especially noteworthy is EA 365, which refers to curvèe workers in the fields of a town named Shunama = the mound in the village of Sulam in the middle of the valley, 14 km to the east of Megiddo. Also noteworthy is EA 250, which speaks about the fields of the Pharaoh in the valley (for the texts see MORAN 1992, 303–304, 363). According to NA'AMAN (1988) the curvèe workers were brought from the vicinity as well as from places as far as the Egyptian centre of Jaffa on the coastal plain. Crown lands devoted to grain growing are also mentioned in relation to the Egyptian administration centre of Sumur on the coast (EA 60 – MORAN 1992, 131–132) and royal granaries in Jaffa are referred to in an Amarna tablet (EA 294; MORAN 1992, 336–337). NA'AMAN (1988) interpreted the reference in the annals of Thutmose III to “harvest which his majesty carried off from the Megiddo arable plots, 207,300 [+x] sacks of wheat...” as well as the text of Letter 2 from Ta'anach as evidence for the existence of Egyptian royal estates in the valley already a century before the Amarna period. The former text refers to a considerable amount of grain. There is simply no textual evidence for the later centuries

of the Late Bronze Age, but one can assume that the phenomenon of Pharaonic estates continued until the withdrawal of Egypt from Canaan, in the late 12<sup>th</sup> century BCE.

Hieratic inscriptions found in 20<sup>th</sup> Dynasty (Late Bronze III) sites in southern Israel (possibly also two or more 19<sup>th</sup> Dynasty ostraca from Tel Sera – Stefan Wimmer, personal communication), such as Lachish, Tel Sera and Tel Haror (summary in WIMMER 2008) support this notion. They provide a glimpse into the Egyptian economic management of Canaan, especially in reference to harvest taxes, mentioning large quantities of grain (GOLDWASSER 1984, 86; GOLDWASSER and WIMMER 1999; SWEENEY 2004). Their distribution – mainly in the southern part of the Shephelah and coastal plain – is noteworthy and will be discussed below.

### Discussion

The textual materials described above testify to the importance of grain growing in Canaan and to the involvement of the Egyptian administration in grain culture, in royal and temple estates and through taxation of the local city-states (GOLDWASSER 1984; NA'AMAN 1988). But they are spotty and do not provide the necessary temporal information, that is, they do not disclose changes in the Egyptian economic conduct over time. This aspect is now provided by the above-discussed datasets, which show an intensification of grain culture in the Jezreel Valley in particular and probably in Canaan in general, starting in the Late Bronze IIA and accelerating in the Late Bronze IIB and Late Bronze III. What could be the reason for this process?

It is doubtful if grain from Canaan was sent to Egypt, as the Nile Valley, the Delta and the Fayum depression constituted a grain growing powerhouse in antiquity (e.g. CASSON 1954; 1980). It is also unlikely that the intensification of grain growing as a decades-long policy was practiced in order to support Egyptian troops and administrators in Canaan. Both the textual and archaeological materials seem to indicate that on a daily basis (to differ from the few major military campaigns to the north), Canaan was dominated by a relatively small number of bureaucrats and troops (note requests in the Amarna letters to send 50 or 100 soldiers in order to pacify a local crisis).

It seems to us that the reason for the expansion of dry farming in Canaan is related to a major dry climate event that took place in the Eastern Medi-

terranean and Ancient Near East in the Late Bronze Age. This climate crisis has recently been detected in studies of pollen records in sediment cores from the Sea of Galilee and the Dead Sea (LANGGUT, FINKELSTEIN and LITT 2013; LANGGUT *et al.* 2014), the coast of Syria (KANIEWSKI *et al.* 2010; SORREL and MATHIS 2016), Cyprus (KANIEWSKI *et al.* 2013) and the Nile Delta (BERNHARDT, HORTON and STANLY 2012). The Sea of Galilee and Dead Sea studies provide a relatively accurate date of the dry period to c. 1250–1100 BCE – approximately in parallel to the period of growth in plough cattle and flint tools related to harvesting at Megiddo and the peak in cereal pollen at the Sea of Galilee.

Needless to say, in the “green” parts of the Levant, including the Jezreel Valley, the dry climate period is hardly supposed to bring about collapse. Ten or 20% reduction in precipitation from the current annual average of c. 550 mm at Megiddo could have been overcome by economic planning, especially when the country was under imperial rule. Life-threatening situations resulting from prolonged droughts could have developed in the southern and eastern fringe areas of the Levant as well as in Anatolia and the north. Regarding the Levant, we refer mainly to the ca. 200–300 mm annual precipitation line that characterises the system of urban centres from Amman in the south via Damascus, Hama and Homs, to Aleppo in the north. Deteriorating precipitation along this eastern frontier can bring about major economic trouble, accompanied by social unrest and demographic upheaval, with major political consequences of the kind seen in Syria in recent years (e.g. KELLEY *et al.* 2015). The same holds true for the southern fringe – the Gaza, Besor, southern Shephelah line. In the far north, a critical factor connected to dry events could be cold spells. Surveying the evidence for the period between 950 and 1070 CE, ELLENBLUM (2012) has shown how years of drought and cold spells in the northern steppe regions of the Near East can destroy yields and spread havoc by driving large groups of people from their homes to raid fertile areas in search of food.

There is no textual evidence for the situation in the southern and eastern fringe zones of the Levant for the dry event period c. 1250–1100 BCE. One can only assume that it was in the ultimate interest of the Egyptian administration to prevent chaos in these areas, for instance raids of “green” areas by displaced groups, which could have destabilised its grip on Canaan.

The northern areas of the Ancient Near East are better illuminated by textual materials, from Hatti, Ugarit and Emar in the north via Apehek in Canaan to Egypt in the south. The Amarna tablets provide a detailed account of life in Canaan in particular and the Ancient Near East in general, in a short period of several decades, c. 1360–1330/35 BCE. There is no mention in the correspondence for droughts and famine, or an urgent need for shipment of grain. This means that at that time the climate upheaval had not yet started. Indeed, a wet period during the middle of the 14<sup>th</sup> century BCE is testified in the Sea of Galilee pollen evidence (Fig. 2).

The first hint of trouble in the supply of grain in the north dates to the mid-13<sup>th</sup> century, when a Hittite queen writes to Ramesses II: “I have no grain in my lands” (KUB 21.38; SINGER 1999, 715). The Apehek letter, which can be dated quite precisely to c. 1230 BCE according to historically-known individuals mentioned in it (SINGER 1983), refers to an urgent need of grain in the north. To the issue discussed here, it is significant that the request for grain was addressed to an Egyptian official stationed in Canaan. In the late 13<sup>th</sup> century Pharaoh Merneptah reports in the Great Karnak Inscription that he “caused grain to be taken in ships, to keep alive the land of Hatti” (WAINWRIGHT 1960). The Ugarit letters describe the situation in the late 13<sup>th</sup> and early 12<sup>th</sup> century BCE. The king of Hatti writes to Ugarit (RS 20.212) about a vital grain shipment, which is “a matter of death or life” (SINGER 1999, 716). A letter from a prominent Hittite official speaks about “famine in the midst of my lands”. And a letter from the Urtenu archive says that the “gates of the house are sealed. Since there is famine in your house, we shall starve to death. A living soul of your country, you will no longer see” (RS 34.152; SINGER 2000, 24). Finally, let us mention that the price of grain in Egypt increased dramatically in the middle of the 20<sup>th</sup> Dynasty (ČERNÝ 1933), peaking in the second half of the 12<sup>th</sup> century (JANSSEN 1975, 551–552), perhaps because of transportation of grain to the north. Put together, the textual evidence covers the period from the middle of the 13<sup>th</sup> century to the second half of the 12<sup>th</sup> century BCE. This is contemporaneous to the dry event traced in the pollen record from the Sea of Galilee, as well as to the surge in dry farming in Canaan as detected in Megiddo faunal and flint records and by the Sea of Galilee cereals pollen curve.



Egypt must have been concerned with the events in Canaan and could have seen the situation in the north as both threatening and advantageous to its strategic economic and geo-political goals. The Nile Empire, which, thanks to the river-regime, was protected from danger of droughts and famine in the Near East, needed to act. We have no way of knowing whether grain growing expanded in the Nile Valley, the Delta and the Fayum depression. The new data presented above indicate that the Egyptian administration in Canaan – no doubt instructed by the imperial authorities – took steps to address the problem. Expanding dry farming in the “green” parts of Canaan could have provided an immediate solution to the problem on its southern and eastern fringes. We have no textual evidence for the eastern fringe. For the south, we have the texts of the hieratic inscriptions. Almost all of them come from sites located close to the southern fringe, in fact from the southernmost urban centres of the period (Lachish, Tel Sera, Tel Haror, Ashkelon). They may testify not simply to taxation and the storage of large quantities of grain, but to attempts to stabilise the situation in the area, which must have suffered sorely from the deteriorating climate conditions. It is noteworthy that archaeology testifies to the withdrawal of settlement activity from the Beer-sheba Valley in the Middle Bronze II–III to the area of the southern Shephelah in the Late Bronze Age (and back to the valley in the Iron I – HERZOG 1994). Further to the north-west, the southernmost settlement line in the Late Bronze Age can be found in the mounds along Nahal Besor, while in both the Middle Bronze II–III and the Iron I–IIA it stretches farther to the south (for the Middle Bronze Age, see FINKELSTEIN and LANGGUT 2014; for the early Iron Age, see GAZIT 2008).

In addition, Canaan was closer to areas in the north, which were in urgent need of help, than the heartland of Egypt. And it was well-equipped with ports, such as Jaffa and Acco, to facilitate the shipping of grain along the coast of the Mediterranean to Ugarit and beyond. From the perspective of Egypt, sending grain to the north could have

been profitable economically, and no less important, valuable strategically.

### Summary

The datasets presented here seem to testify to the expansion of dry farming in Canaan in the later phases of the Late Bronze Age. The detailed faunal assemblages from Megiddo show a significant increase of cattle in the livestock; the age-profiles apparently indicate growth in the quantity of cattle used mainly for the plough. The Megiddo flint tool evidence, although based on a limited number of items, seems to portray growth in cereal harvesting at that time. Expansion of cereal farming is also attested in the pollen record from the Sea of Galilee. Finally, ancient DNA study of cattle from Bronze and Iron Age sites in Israel testify to the importation of breeds from Egypt and to cross-breeding of taurine cattle with Egyptian zebu – the latter strong and well-adapted to dry, hot conditions – probably during the Late Bronze Age. These datasets seem to be related to evidence for a contemporary dry climate event detected in several pollen records from the Eastern Mediterranean. The increase of grain growing land could have been the result of an economic decision taken by the Egyptian imperial administration in Canaan in order to cope with the crisis: stabilise the situation along the southern and eastern desert fringe areas of Canaan and supply grain to the badly stricken lands of the northern Levant and beyond. All records discussed here, including the textual evidence for droughts and famine, assemble to the same period of time, c. 1250–1100 BCE.

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