

# FOOD PRODUCTION AT ARSLANTEPE (TURKEY): BOTANICAL EVIDENCES FROM KITCHENS OF THE LATE CHALCOLITHIC AND EARLY BRONZE AGE

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## ABSTRACT

This work focusses on plant remains from kitchens at the site of Arslantepe (Turkey) to address food processing and household economy throughout the Late Chalcolithic and Early Bronze Age. More than 100,000 seeds and fruits, mainly crop remains, have been considered. A similar family-based agriculture is postulated, with an increasing importance of barley as forage since the Bronze Age. Differences between common and elite contexts are reduced apart from the period of political centralization.

Key-words: Crop remains, Anatolia, Chalcolithic/Bronze Age, Food production

## INTRODUCTION

Arslantepe is located on the west bank of the Euphrates River in the alluvial Malatya plain (south-eastern Turkey). It was excavated since 1961 by the Italian archaeological expedition in Eastern Anatolia of the Sapienza University of Rome. Present-day climate is semiarid: rainfall occurs mainly during the spring (April–May), followed by the driest and hottest summer months (July–September). The mean annual precipitation is of 400 mm/year<sup>1</sup>. Nonetheless the plain is rich in groundwater, with the streaming out of many springs. This is tied to the winter precipitation on the surrounding Anti-Taurus Mountains, which amounts to 600/1000 mm/year and recharges the hydrogeological catchment of the Malatya area. The climatic and environmental conditions permit an intensive farming, at present, based on apricot cultivation. The vegetation is strongly influenced by the low summer humidity and the human activities, which limit forest areas<sup>2</sup>. The shrub steppe replaces the potential vegetation of the plain constituted by semi-open forest of deciduous broadleaved (mainly oaks and rosaceans) and conifer trees<sup>3</sup>.

The site covers an area of ca. 4.5 ha. The sequence of excavated settlements starts as early as the Chalcolithic and continues even beyond the Bronze Age. The interpolation of archaeological levels and 100 radiocarbon dates provides a high-resolution chronology<sup>4</sup>. Archaeological research has especially focussed on the contiguous levels from 4700 to 2000 BCE, i.e. from the Late Chalcolithic (henceforth LC) to the Early Bronze Age (henceforth EBA). During this time span, social, economic and climatic changes are testified<sup>5</sup>. The earliest levels (period VIII: LC 1–2, 4700–3900 BCE) were characterised by small dwellings with food processing and

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<sup>1</sup> Atalay 2006

<sup>2</sup> Atalay, Efe 2010

<sup>3</sup> Yildiz *et alii* 2004

<sup>4</sup> Vignola *et alii* submitted

<sup>5</sup> Frangipane 2011

storing rooms around courtyards<sup>6</sup>. When the site grew, a differentiation in the settlement layout developed (period VII: LC 3–4, 3900–3400 BCE): at the edge of the mound common houses were built, while elite residences and an imposing temple lied in the central area<sup>7</sup>. The rapid evolution of the Arslantepe elites converted the site in the centre of an early state and a huge palace was built (period VI A: LC 5, 3400–3100 BCE)<sup>8</sup>. The concurrent palaeoclimate instability seems to have influenced the evolution of the pristine state and its pressure on the economic productivity, exacerbating a social crisis<sup>9</sup>. After the destruction of the palace different communities occupied the site during the EBA, when the increase of local precipitation is testified by past climatic data<sup>10</sup>. Pastoral groups established short-lived settlement in period VI B1 (EBA Ia, 3100–3000 BCE), whereas an extensive farmers' village was brought to light in the subsequent levels (period VI B2: EBA Ib, 3000–2750 BCE)<sup>11</sup>. The latter particularly featured a renewed continuity with the earliest LC levels in terms of household economy<sup>12</sup>. After an evident cultural break, a restless village society interchanged with a rural community during period VI C (EBA II, 2750–2500 BCE)<sup>13</sup>. The layout of the last solidly founded village lasted into the following period VI D (EBA III, 2500–2000 BCE) until the end of the EBA<sup>14</sup>, in spite of a new and consistent palaeoclimatic fluctuations<sup>15</sup>.

Archaeobotanical research is carrying out at the site from the end of the 70ies<sup>16</sup> and more than 1,300 samples of seeds and fruits have now been collected from the investigated levels. Over 550 samples have been analysed, counting up to 200,000 remains, mainly cereal grains<sup>17</sup>. Generally, all the excavated settlements refer to a subsistence economy based on the agricultural production of both barley (*Hordeum vulgare* L.) and wheat species (*Triticum* sp.). Pulses are common, but they have been recovered at lower frequency<sup>18</sup>. In the LC 1-2 levels, hulled wheat (*Triticum dicoccon* Schrank, emmer and *T. monococcum* L., einkorn) is the predominant crop, while few specimens of legumes are preserved<sup>19</sup>. Barley grains prevail among the plant remains of the period VII assemblage. During the palatial phase the ubiquitous presence of multi-row barley, which is higher water demanding than the two-row species, suggests a centralised management of the agricultural system<sup>20</sup>. Opposite evidences have been postulated for the EBA levels: in VI B2 and VI C periods especially two-row barley is cultivated in the Malatya plain<sup>21</sup>. Legumes as chickpea (*Cicer arietinum*

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<sup>6</sup> Balossi Restelli 2012

<sup>7</sup> Frangipane 2016

<sup>8</sup> Frangipane 2018

<sup>9</sup> Vignola *et alii* 2018

<sup>10</sup> Masi *et alii* 2013a, b; Vignola *et alii* 2018

<sup>11</sup> Frangipane 2012

<sup>12</sup> Piccione *et alii* 2015

<sup>13</sup> Conti, Persiani 1993

<sup>14</sup> Frangipane 2012

<sup>15</sup> Vignola *et alii* 2018

<sup>16</sup> Follieri, Coccolini 1983

<sup>17</sup> Sadori, Masi 2012

<sup>18</sup> Sadori, Masi 2012

<sup>19</sup> Vignola *et alii* 2014

<sup>20</sup> Balossi Restelli *et alii* 2010

<sup>21</sup> Piccione *et alii* 2015; Sadori *et alii* 2006

L.) are abundant in the EBA II<sup>22</sup>. In the VI D settlement remains of naked wheat (*T. aestivum* L./*durum* Desf.) and fava bean/grass pea (*Vicia/Lathyrus* sp.) prevail. The cereal crops are usually free from chaff residues and the weed assemblage is rather limited<sup>23</sup>.

Crop remains come from different contexts inside the buildings, such as processing areas, domestic/public storages and ceremonial zones. Thus, it is quite rare they represent accumulations of waste activities or multiple burning events from secondary deposits. Rather, most of the Arslantepe seed/fruit samples provide the unique opportunity to study undisturbed archaeobotanical deposits representing single destruction events well-dated. Indeed the layers of collapsed mud-brick structures, often destroyed by fire, sealed the exceptionally rich plant assemblages on the floors and in the filling of the rooms.

Our paper focuses on the study of plant remains retrieved from the best-preserved rooms where crop processing and food preparation were clearly undertaken. This functional interpretation was made possible by the presence of fire installations and domestic tools. We refer to them as kitchens. In order to investigate changes in food production within the history of the site, we selected contexts from both the LC and EBA levels. The aim is to contribute to the knowledge of the socio-economic organization of the Arslantepe communities and to the definition of the household economy in terms of plant exploitation from a pivotal site of the Anatolian region.

## MATERIALS AND METHODS

A total of 79 seed/fruit samples have been analysed. They were collected on site by archaeologists according to an archaeobotanical protocol. Seeds and fruits are generally well preserved by charring, being found whole or coarsely fragmented. The plant materials are labelled according to the archaeological units. Accumulations of seeds and fruits, when visible, were recovered from filling layers/floors and their topographical position was carefully recorded. Plant remains found scattered were also collected and separated from the soil by dry sieving. All the soil samples were processed on site by using decreasing mesh sieves (5, 2, 1 and 0.5 mm). The Arslantepe plant remains cannot be water floated because of the dissolution of charred materials as in other arid environments<sup>24</sup>. Taxonomic identification of seeds and fruits was performed in the Laboratory of Palaeobotany and Palinology of the Sapienza University of Rome and was mainly carried out by naked eye. Stereomicroscopes at different magnifications (Zeiss stemi SV11, LEICA M205 C) were also used to recognised specific morphological features. Botanical nomenclature for crops and weed/wild taxa follows atlases and regional floras<sup>25</sup>. Seed determination is usually at the species level, but oat (*Avena* sp.), rye (*Secale* sp.) and weed/wild taxa have been purely identified at the genus level. All the remains, even fragmented, have been finally counted.

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<sup>22</sup> Sadori *et alii* 2006

<sup>23</sup> Sadori, Masi 2012

<sup>24</sup> Wright 2005

<sup>25</sup> Davis 1965-1985; Jacomet 2006; Neef *et alii* 2012; Renfrew 1973; Zohary, Hopf 2000

5 kitchen of the LC (periods VIII and VII) and EBA (periods VI B2 and VI C) levels have been considered in this study (Fig. 1). The archaeobotanical results of 3 of them were previously published in specific works<sup>26</sup>.

Kitchen A718 (period VIII) is part of a composite domestic unit, formed by an open courtyard, the study room and another one devoid of archaeological remains (Fig. 2)<sup>27</sup>. The kitchen was burnt by fire, preserved *in situ* installations and materials. A domed oven occupies the southern end of the room and against the eastern wall are a hearth and a parching oven, where fuel and food were originally kept in two distinct spaces. Between the ovens there is a mud platform for working. A lot of lithic tools were found lying at the free part of the room near the doorway. A coated hole on the floor has been interpreted as vessel holder or mortar.

Seeds and fruits are quite rare in room A849 from the mid-level of period VII. It was the kitchen in use within a residence of elites<sup>28</sup>: a service passageway separates it from other rooms on the north, where daily activities took place (Fig. 2). Indeed lithic tools and an andiron (i.e. the support for pots on hearths) were found. The eastern half of the kitchen is occupied by a domed oven and a working bench.

For the VI B2 period, a recent multidisciplinary study have been focussed on an illustrative dwelling of the rural village<sup>29</sup>. The household spaces are distributed between the main room A707 and other related structures, such as a storeroom and a stable (Fig. 2). Food preparation and craft activities were carried out in the room using hearths, benches, mortars, andirons and a lot of lithic tools (grinding stones, pestles, hammers)<sup>30</sup>. From the same level, we discuss the unpublished results of kitchen A1186, close to the VI B2 fortification wall<sup>31</sup>. The house layout is similar to the previous one: the only difference is the presence of a domed oven in the kitchen, where the lithic assemblage of grinding tools is usual (Fig. 2).

Also in VI C period the spatial patterning of room A607 (period VI C) features it as a multi-functional room where all the daily activities, in addition to food preparation, took place (Fig. 2). This one-room house is typical of the Malatya communities during the second half of EBA<sup>32</sup>. Among the domestic facilities (fire places, benches, mortars), the reconstruction of a wooden structure for drying is noteworthy<sup>33</sup>.

## RESULTS

Results of the seed/fruit analyses from the selected kitchens are shown in Tab. 1. The room A718 is the richest in materials and more than 86,500 specimens have been identified. Due to the amount of plant remains, a sub-sampling method was applied as reported elsewhere<sup>34</sup>. Cereals are the most abundant: the main crop is hulled wheat and especially emmer dominates followed by einkorn. Few hundreds of naked wheat grains have been counted. Barley, always hulled, is present in a very few amount, whereas oat and rye represent secondary cereal crops. Pulses were found in negligible

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<sup>26</sup> Piccione *et alii* 2015; Sadori *et alii* 2006; Vignola *et alii* 2014

<sup>27</sup> Balossi Restelli 2012

<sup>28</sup> Frangipane 2016

<sup>29</sup> Piccione *et alii* 2015

<sup>30</sup> Piccione, Lemorini 2012

<sup>31</sup> Frangipane 2012

<sup>32</sup> Conti, Persiani 1993

<sup>33</sup> Sadori *et alii* 2006

<sup>34</sup> Vignola *et alii* 2014

quantities. Among the very few specimens of weeds, *Aegilops* sp., *Bromus* sp. and *Galium* sp. have been identified. Between wild taxa, also the harvested fruits of hawthorn (*Crataegus* sp.) are represented.

Kitchen A849 preserved only few remains, as occurred for the whole period. Nevertheless, the proportions of cereal species (hulled wheat and barley) are similar to those of period VIII. The bad preservation of some *Triticum* sp. grains prevented the identification at the species level. Either chaff remains or weed seeds are not present in the room assemblage.

In the EBA kitchens (A707, A1186 and A607) proportions of wheat/barley remains are deeply changed. Barley is the most common crop species in the VI B2 village<sup>35</sup>. It's no coincidence that the A707 cereal assemblage is dominated by barley, following by emmer and einkorn; naked wheat is quite rare. Chaff remains are not many and only attributed to the wheat species. Although in very few quantities, also legumes and weeds are part of the plant assemblage. In kitchen A1186 almost all the grains are even attributed to barley.

This crop predominance continues in room A607. However, the naked (and free-threshing) wheat substantially increases being the main taxon among wheat species. A huge amount of chickpeas is exceptionally present, whereas seeds of lentil and pea are only sparsely recovered. Among weeds, only *Polygonum* sp. is poorly represented.

## DISCUSSION AND CONCLUSION

Firstly, we investigate differences in the taxonomic composition of the analysed assemblages in order to evaluate changes in crop production between the LC and EBA periods.

In the earliest levels, emmer and einkorn are the main staples. Their co-occurrence with only few other cereal grains, but in all samples, suggests that the harvest derives from a “maslin” (i.e. two or more cereals cultivated in the same field; Fig. 3)<sup>36</sup>. Results of the recent stable carbon isotope analysis on the Arslantepe wheat grains have revealed that this agricultural practice was developed in the Malatya area within all the LC and EBA settlements<sup>37</sup>. On the contrary it is very unlikely that barley crop was not part of the primary economy of period VIII. Indeed, other LC 2-3 archaeological sites of the Upper Euphrates and Tigris valleys preserved botanical assemblages with both wheat and barley remains<sup>38</sup>. In addition, it has been noted from stable isotope analysis that the production of the main crops was equally managed in the Malatya plain with mixed irrigation and fertilisation techniques<sup>39</sup>. For this reason the rareness of barley could suggest that this crop, not part of the houses daily food provisions, was stored elsewhere. Moreover we have to evaluate that, since wheat could be threshed more easily, it might have been preferred for human consumption, whereas barley for fodder of beer production (see interpretation of data from A707)<sup>40</sup>. At the mid-LC period the staple economy was evidently based on both wheat and barley crops again (Fig. 3). With regard to the previous contexts of common households, the cereal remains of the LC 3-4 elite residences evidence no social

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<sup>35</sup> Sadori, Masi 2012

<sup>36</sup> Jones, Halstead 1995

<sup>37</sup> Vignola *et alii* 2017

<sup>38</sup> Hald 2008; Miller 1996; Van Zeist, Bakker-Heeres 1975

<sup>39</sup> Vignola *et alii* 2017

<sup>40</sup> Ertuğ 2000; Milano 1987

differentiation for the accessibility of agricultural resources between different strata of the Arslantepe population. In this sense we could suppose that the development of social complexity at the site during these levels involved an accumulation of secondary (i.e. luxury) goods rather than the management of primary resources. The process advanced during the late-VII and VI A periods, when the early state organization possibly controlled the agricultural production and the redistribution of staples. Balossi Restelli and colleagues<sup>41</sup>, indeed, have suggested that the selection of multi-row barley, in a high-yield production, was only possible with a political centralization of even agricultural techniques. Also the agronomic conditions, revealed by the stable isotope approach, have been tied to a domestic crop management in the LC 1-4 levels and to the intensification of irrigation and manuring activities from the end of period VII<sup>42</sup>.

With the passage to the EBA, the high amounts of barley remains, which are preserved inside the houses, increase with respect to the other cereals (Fig. 3). Such an evidence may be tied to the different seasonality of barley and wheat harvesting: since the former is harvested earlier in the spring (end of April/beginning of May), we could suppose that the abrupt destruction of the study contexts occurred after the collection and the storing of barley grains and before those of the wheat ones. But the interpretation of cereal distribution from rooms A707 and A1186 of VI B2 period tends towards an opposite explanation. Indeed, the seed/fruit samples from A707 (and its storeroom A736<sup>43</sup>, Fig. 2) contain a mix of barley, emmer and einkorn. The same variability is shown by samples of A1186, but in lesser amounts (Fig. 3). Even if this co-occurrence is most likely derived from the mixing up of the staples fallen from above when the building was destroyed, it appears clear that all cereal crops were harvested at the time of the archaeological event. In addition, in the stable identified from the same building (A738<sup>44</sup>, Fig. 2) the plant sub-assembly consists only of barley found on the floor as possible residue of animal fodder. All these evidences therefore suggest that a change might have been occurred in the primary economy of EBA levels: thus the preference of processing and storing barley crops could be caused by an intensification of this cultivation for different demands, such as animal fodder or beer production. The VI B2 archaeozoological data effectively underline an increase in consumption of beef, whose forage cannot be found in pasturelands as for caprine livestock<sup>45</sup>. The consistent shift in the water imprint of barley grains recorded by using the stable carbon isotope analysis comply with the same suggestion: the relocation of barley fields in areas with lower water status than in the previous periods, pointed out by Vignola and colleagues<sup>46</sup>, could be derived by the increased extension of the fields and the inclusion of marginal lands.

The proportion of cereals within the plant assemblage of A607 points out the same interpretation (Fig. 3). In addition, the outstanding collection of thousands of chickpeas was useful for the reconstruction of the agronomic conditions through the stable nitrogen isotope analysis. The practice of intercropping cultivation (i.e. in the same field) of both cereals and legumes might have indeed reduced distance between plant and animal production in the socio-economic system of the EBA pastoral

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<sup>41</sup> Balossi Restelli *et alii* 2010

<sup>42</sup> Vignola *et alii* 2017

<sup>43</sup> Piccione *et alii* 2015

<sup>44</sup> Piccione *et alii* 2015

<sup>45</sup> Piccione *et alii* 2015

<sup>46</sup> Vignola *et alii* 2017

communities<sup>47</sup>: some legume species, as chickpea, are considered to be a good alternative to summer fallow using them as green manure or forage crop<sup>48</sup>. In such a way, farmers were able to produce forage on the same arable lands.

Secondly, we take into account the weed assemblages, whose ecological implications on the seasonality and growth conditions of cultivated plants can be beneficial. Unfortunately harvests from all the Arslantepe deposits appear to have been carefully cleaned before storing<sup>49</sup>. A low proportion of chaff remains and weed seeds among the analysed grains only suggests that the final hand sorting of the crop was not undertaken (Tab. 1)<sup>50</sup>. The reduced range of weed species does not allow discerning the environmental conditions in the fields from a diachronic perspective. Instead, ethnographic studies from rural communities of the Near East indicate that the separation of chaff and weeds from cereals by winnowing and coarse sieving took place directly in the fields or in open areas near the settlement. A fine sieving was carried out in the household spaces, picking out grass grains and small weed seeds before grinding and cooking crops<sup>51</sup>. Thus, the high proportion of chaff remains in rooms A718 and A707 suggests their use for the final processing of the crops (Tab. 1). Otherwise the storeroom of A707 yields the only evidences of wild plants and oat (*Avena* sp.), confirming that it was used to store the unprocessed crops (Tab. 1)<sup>52</sup>. The remains in A1186 and A607 are instead carefully cleaned and stored, ready to be used in the daily activities of food preparation (Tab.1).

The reconstruction of daily processing activities is essential to highlight changes in the household system between different communities as within common or stratified societies. We discuss archaeobotanical data together with the spatial patterning of lithic tools and other artefacts related to the food preparation.

In kitchen A718 the crops were stored in perishable containers, such as baskets or sacks, at the corners of the room. Therefore the floor had been left free for the daily meat preparation, carried out at the light of the entrance where mortars and pestles were kept on shelves. On the contrary the grinding activity probably took place outdoors since all grindstones were recovered in the courtyard (Fig. 2)<sup>53</sup>. As the analysed grains appear not to be milled prior to carbonization, as shown by the smooth fracture of broken specimens<sup>54</sup>, the preparation of meat was not involving people at the time of the destruction of the house. But the crop processing seems to have been currently underway in the southern side of the kitchen. In fact cereal grains were found on the plastered roof of the parching oven (Fig. 2), suggesting that the crop was drying to prevent microbiological deterioration or roasting (thanks to this operation, grains were also ground more easily). The big oven used for cooking was probably powered by animal fuel (dung cakes) since the highest concentration of chaff remains (spikelets, forks, rachises) comes from its chamber. All the other chaff

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<sup>47</sup> Vignola *et alii* 2017

<sup>48</sup> Duc *et alii* 2015

<sup>49</sup> Sadori, Masi 2012

<sup>50</sup> Hald, Charles 2008; Jones 1990

<sup>51</sup> Ertuğ 2000; Hillman 1984

<sup>52</sup> Piccione *et alii* 2015

<sup>53</sup> Vignola *et alii* 2014

<sup>54</sup> Willcox 2002

remains were found directly on the bench between the ovens (Fig. 2): straw or dung cakes might have originally been kept on it and used for ignition<sup>55</sup>.

In the investigated context of period VII these practices were carried out in different domestic spaces: the final spilling of cereal crops took place in another room in front of A849, where a fireplace and additional chaff remains were recovered (A580, Fig. 2). Also in the adjacent room A856 (Fig. 2) some cooking activities, for example boiling food, might have been occasionally carried out by using the hearth and the andiron here identified<sup>56</sup>. But we have not focussed on these rooms since the kitchen A849, which is separated from the rest by a narrow corridor, seems to have hosted the main food preparation practices, probably by several compounds of the elite residences. In fact, the big domed oven could be used for roasting meat or cooking bread in larger quantities.

As in kitchen A718, the south part of A707 closer to the entrance was empty, probably saving space and light for the daily activities (Fig. 2). On the contrary pots and tools were recovered in the opposite end, where staples, grinding slabs and a pestle were kept<sup>57</sup>. Cooking pots and bowls together with an andiron<sup>58</sup> were retrieved around to the fireplace, which may have been used for different purposes: heating and lighting the room, cooking and eating meals. Based on the distribution of cereal remains, barley was spread on the roof for sun-drying and also kept in containers (i.e. baskets or sacks) on raised shelves. On the contrary emmer had been probably cleaning on the floor, as a number of chaff remains has been identified. In this respect, it is known that hulled wheat is usually stored in unprocessed form to increase the grain conservation<sup>59</sup>. This room also exceptionally yielded remains of 'crumbs of bread' as in other houses of the VI B2 village, but no starch crystals have been found to confirm this hypothesis<sup>60</sup>.

In room A607, a clear correspondence between the distribution of crop remains and the position of vessels was already pointed out<sup>61</sup>. Pottery, cereals and legumes were concentrated near the two recognised fireplaces, while the rest of the room was left free once again for enabling the daily practices of food preparation (Fig. 2). In particular, the concentration of pulses coincides with two large *pithoi* placed beside the working bench found along the western wall. Barley grains are spread everywhere, but the main accumulation is near the other southern bench and a grinding stone, suggesting that the crop processing was underway.

In conclusion, the abundance of crops and related pots in the investigated kitchens indicates that quantities of staples were stored after the summer season and suggests a similar family based agriculture in both LC and EBA levels. As regards the household economy, this work has demonstrated that no differences between common and elite contexts are highlighted, suggesting that the elite groups of period VII based their status on secondary rather than primary economy. The spatial patterning of plant remains, in relation to fire installations, furniture and domestic tools, has shown a clear differentiation between working areas inside the rooms dedicated to food

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<sup>55</sup> Vignola *et alii* 2014

<sup>56</sup> Balossi Restelli 2015

<sup>57</sup> Piccione *et alii* 2015

<sup>58</sup> Balossi Restelli 2015

<sup>59</sup> Hillman 1984

<sup>60</sup> Piccione *et alii* 2015

<sup>61</sup> Sadori *et alii* 2006



processing and cooking. The crops were processed in domestic areas as the final cleaning of the harvest (chaff remains and weeds are very rare) and often stored separately. In this sense, evidences from kitchens of periods VIII and VI B2 indicates that barley was cultivated also to be used as forage. Since the proportion between cereal crops reflects their relative incidence, we postulate a stronger importance of barley since the EBA levels, within communities whose subsistence managed both agriculture and husbandry resources. A differentiated agricultural system through times was also testified by the stable isotope analyses.

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