



This is a repository copy of *A bottom-up view of food surplus: using stable carbon and nitrogen isotope analysis to investigate agricultural strategies and diet at Bronze Age Archontiko and Thessaloniki Toumba, northern Greece.*

White Rose Research Online URL for this paper:
<http://eprints.whiterose.ac.uk/114644/>

Version: Accepted Version

Article:

Nitsch, E., Andreou, S., Creuzieux, A. et al. (12 more authors) (2017) A bottom-up view of food surplus: using stable carbon and nitrogen isotope analysis to investigate agricultural strategies and diet at Bronze Age Archontiko and Thessaloniki Toumba, northern Greece. *World Archaeology*. ISSN 0043-8243

<https://doi.org/10.1080/00438243.2016.1271745>

Reuse

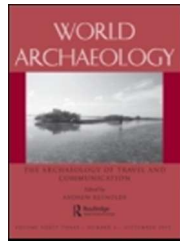
Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.



eprints@whiterose.ac.uk
<https://eprints.whiterose.ac.uk/>



A bottom-up view of food surplus: Using stable carbon and nitrogen isotope analysis to investigate agricultural strategies and food webs at Bronze Age Archontiko and Thessaloniki Tumba, northern Greece

Journal:	<i>World Archaeology</i>
Manuscript ID	RWAR-2016-0080.R1
Manuscript Type:	Original Papers
Keywords:	Agriculture, Herding, Bronze Age, Greece, Stable isotopes, Palaeodiet

SCHOLARONE™
Manuscripts

1
2
3 **A bottom-up view of food surplus: Using stable carbon and nitrogen isotope**
4 **analysis to investigate agricultural strategies and diet at Bronze Age Archontiko**
5 **and Thessaloniki Toumba, northern Greece**
6

7
8 *Abstract*

9 We use stable isotope analysis of crop, faunal and human remains to investigate
10 agricultural strategies and diet at EBA-LBA Archontiko and MBA-LBA Thessaloniki
11 Toumba. Crop production strategies varied between settlements, phases and species;
12 flexibility is also apparent within the crop stores of individual houses. Escalating
13 manuring intensity at LBA Thessaloniki Toumba coincides with large co-residential
14 'blocks' geared towards hoarding of agricultural surpluses, spectacularly preserved by
15 fire at nearby LBA Assiros Toumba. Faunal isotope values reflect a range of feeding
16 strategies, including probable herding of cattle on C₄-rich coastal salt marshes,
17 evident at Archontiko through to the LBA alongside bulk cockle harvesting.
18 Palaeodietary analysis of LBA humans at Thessaloniki Toumba indicates that C₃
19 crops represent the only plausible staples. Millet was a minor food but may have
20 played a particular role in the subadult diet. Meat probably featured in supra-
21 household food sharing and hospitality, associated with Mycenaean-style tableware in
22 the LBA.
23
24
25

26 *Keywords*

27 Agriculture, Herding, Bronze Age, Greece, Stable Isotopes, Palaeodiet
28
29
30

31 *Introduction*

32 Foods of differential perishability are associated with different types of storage, and
33 this variation has direct implications for the wider social significance of food
34 surpluses (Halstead 1993, 2007; Bogaard et al. 2009). Grains and seeds with a shelf-
35 life of months or years are amenable to relatively long-term storage, and hence
36 constitute prime candidates for 'normal surplus' acquisition as insurance against
37 future shortages (Halstead 1989). By contrast, meat is impractical to store over
38 extended periods without copious amounts of salt, or access to very cold or dry
39 conditions. Sharing of meat as a form of 'social storage' is therefore widely observed
40 in hunter-gatherer and agricultural contexts alike (e.g. Schneider 1957; Binford 1978;
41 Halstead 2007). These straightforward considerations offer a starting point for joint
42 investigation of the 'economic' and 'political' aspects of food surplus, often
43 dichotomised in theoretical contexts (Morehart and De Lucia 2015). While
44 archaeological discussion of surplus is often based on storage evidence (e.g.
45 Margomenou 2008; Bogaard et al. 2009), and/or preservation of particular
46 consumption events (e.g. Isaakidou et al. 2002; Pappa et al. 2004), other approaches
47 are needed to investigate the management strategies and general dietary practices that
48 form the broader context of such occasional 'snapshots' of storage and/or feasting
49 behaviours. Integrated stable isotope analysis of plants, fauna and humans not only
50 offers a means of reconstructing growing conditions, feeding ecologies and food
51 webs, but also a privileged insight into the production and consumption of differing
52 forms of foods and potential surpluses.
53
54
55

56 The aim of this paper is to interpret new stable isotope evidence for the ecology of
57 plants, animals and humans at the Bronze Age sites of Archontiko and Thessaloniki
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Toumba, located in the coastal lowlands to the west and east, respectively, of the Thermaic Gulf (Fig. 1), as evidence of agricultural strategy and diet. Both sites have yielded abundant bioarchaeological evidence in well defined contexts that raise questions concerning the politics of food acquisition, storage and consumption, including handling of food surplus (Andreou 2001, 2010; Papadopoulou 2010; Papadopoulou and Maniatis 2013, Papanthimou et al. 2013; Margomenou 2008; Valamoti et al. 2008a; Veropoulidou 2014). This evidence sheds light on foodways in small, often long-lived communities that preceded the formation of urban centres in Greek Macedonia in the first millennium BC (Andreou 2010). These sites thus form part of a distinctive trajectory of social change that contrasts with the rise and collapse of Bronze Age palatial centres in the southern Aegean (Halstead 1994; Andreou 2010).

The Early Bronze Age (EBA, 3300/3100-2300/2000 BC) of northern Greece featured the emergence of residential buildings ('households') with their own internal cooking and storage facilities, contrasting with earlier Neolithic arrangements in which the domestic unit was more fluidly defined (Halstead 2006b). Such households formed 'insulae' at final EBA Archontiko (c. 2130-2087 BC, Maniatis 2014), where a row of seven rectangular dwellings (c. 18-30 m² each) with shared walls had been destroyed by fire, preserving stored crops and cooking installations (Fig. 2) (Valamoti et al. 2008; Papadopoulou 2010; Papadopoulou et al. 2010; Papaefthymiou-Papanthimou 2010; Papaefthymiou-Papanthimou and Papadopoulou 2014). After a potential hiatus in occupation of c. 300 years, the Late Bronze Age occupation of Archontiko (c. 1516-1414 BC, Maniatis 2014) presents houses with stone-built foundations in what may have been a similar arrangement of closely spaced modular units in a row (Fig. 2) (Pilali-Papasteriou and Papaefthymiou-Papanthimou 2002).

The 'insulae' of Archontiko can be contrasted with more formalised housing 'blocks', built to accommodate large co-residential groups, at the long-lived tell settlements of Thessaloniki Toumba, Assiros Toumba and Agios Mamas, variously dating to the Middle Bronze Age (2000-1700/1600 BC) and Late Bronze Age (1700/1600-1050 BC) (Andreou et al. 1996; Andreou 2001, 2010, 2014; Wardle and Wardle 2007; Hänsel and Aslanis 2010). These blocks separated by streets extended over more than 200 m² at Thessaloniki Toumba and contained up to 15 rooms, including large dedicated storerooms as well as multi-purpose spaces (Fig. 3) (Margomenou 2008). At LBA Assiros Toumba there is direct archaeobotanical evidence for crop storage in quantities suggestive of supra-household provision, whether organised collectively or by a local leader, that underlines the potential of pooling or mobilisation at this social scale (Jones et al. 1986; Andreou 2001; Wardle and Wardle 2007; Margomenou 2008). The explicit architectural planning and formality of large residential 'blocks' arguably set the stage for the development of lasting inequalities and social hierarchy that emerged with the formation of larger, urban communities in the Iron Age (Andreou 2010; Bintliff 2012; cf. Flannery 2002). In the LBA, however, *inter-community* competition appears to have been more prominent, underscored by the construction of a casemate wall at LBA Thessaloniki Toumba and clay bank at Assiros Toumba, creating prominent, steep-sided mounds of highly visible 'ancestry' (Andreou 2001, 2010).

Thus, Archontiko (particularly in its EBA phase) and Thessaloniki Toumba (especially in the LBA) offer a subtle contrast in social morphology that has

1
2
3 implications for handling of food, including surpluses. While both communities
4 present architectural forms suggestive of cooperation between small-scale households,
5 the formality of the large residential 'blocks' at Thessaloniki Toumba including
6 provision for large-scale storage point to 'hoarding' at this social scale. Flannery
7 (2002) argued that large co-residential units emerge because they have greater labour
8 capacity than smaller households, enabling them to undertake more disparate tasks
9 (e.g. labour-intensive farming, herding, craft production). Moreover, the emergence of
10 such large co-residential groups often precedes that of long-term inequalities among
11 households (Bogucki 1999: 205-259; Flannery 2002). Evidence for overt social
12 inequalities is lacking amongst the large residential blocks at LBA Thessaloniki
13 Toumba (Andreou 2001, 2010; Margomenou 2008), however, suggesting that in real
14 terms the potential for unequal production was limited, and/or that competition
15 between *communities* overrode that among *households*.
16
17

18
19 Pioneering weed ecological analysis of the crop stores preserved at LBA Assiros has
20 suggested high soil fertility and mechanical disturbance, conditions maintained
21 through intensive 'horticultural' land management (Jones 1992). Such a production
22 system is labour-limited and yields modest surpluses relative to extensive, low-input
23 farming exploiting specialised plough animals and additional labour at harvest time
24 (Halstead 1995). Unspecialised plough animals can, however, modestly expand the
25 scale of intensive farming and ease labour limitations (Isaakidou 2006, 2011), a factor
26 that may have been crucial for large co-residential groups managing a range of
27 subsistence and craft activities. Faunal analysis at Toumba has identified bone
28 pathologies compatible with traction (Vasileiadou et al. 2010) from an MBA context
29 in Area 761 and from LBA contexts in Street X1 and Building A (Nikolaidou 2010;
30 Vasileiadou unpublished data).
31
32

33 Analysis of archaeobotanical assemblages from Archontiko, Thessaloniki Toumba,
34 Kastanas and Assiros Toumba reveals significant crop diversification, with the
35 addition of spelt in the EBA and of broomcorn millet in the LBA, as well as novel oil-
36 seed plants like *Lallemantia* (Kroll 1983; Jones et al. 1986; Jones and Valamoti 2005;
37 Valamoti et al. 2008; Valamoti 2016). A broader range of crops would not only
38 diversify cuisine but also enable more flexible strategies for ensuring household self-
39 sufficiency. Stable carbon isotope analysis of crops from LBA Assiros has also
40 demonstrated that wheat and barley were grown in distinct 'niches', with wheat
41 preferentially sown in better watered conditions than barley (Wallace et al. 2015).
42 Barley was not necessarily a neglected crop, however: analysis of crop deposits in
43 multiple EBA post-frame 'row houses' at Archontiko identified hulled barley grains
44 that had been coarsely ground to prepare a type of food such as 'groats',
45 demonstrating specific preparation likely intended for *human* consumption (Valamoti
46 2002; Valamoti et al. 2008b).
47
48

49
50 In terms of animal management and consumption, at EBA and LBA Archontiko
51 mortality data suggest that domestic cattle, pig and sheep/goat were exploited
52 primarily for meat, with particular emphasis on culling at maximum body size for
53 cattle in the EBA and for sheep and goat in the LBA (Creuzieux 2013). Spatial
54 analysis of faunal and shell remains among the EBA burned houses suggests similar
55 consumption between domestic units (Veropoulidou 2011; Creuzieux 2013). There is
56 little evidence (e.g. foetal bones, shed deciduous teeth) suggestive of stabling on the
57 tell itself, but micromorphological analysis of a sequence on the southern margin of
58
59
60

1
2
3 the tell at its base has revealed likely LBA animal pen deposits (Kyrillidou pers.
4 comm.). At MBA-LBA Thessaloniki Toumba mortality profiles suggest a meat-
5 oriented strategy, with particular emphasis in the final LBA on consumption of prime
6 large cattle carcasses (Vasileiadou et al. 2010). Given that the size of even small
7 ruminant carcasses would often exceed the needs of a small-scale household, the
8 implication is that consumption of livestock was oriented to supra-household
9 commensality, perhaps in association with Mycenaean style tableware that emerged
10 on LBA tell settlements such as Thessaloniki Toumba (Andreou 2003; Andreou and
11 Psaraki 2007). At Thessaloniki Toumba foetal bones suggest the presence of breeding
12 animals on the summit of the tell (Vasileiadou et al. 2010).
13
14

15 Both Archontiko and Thessaloniki Toumba are located in rolling landscapes near the
16 Thermaic Gulf, with access to well watered alluvial plains, but there are also contrasts
17 in setting and resource availability (Theodoropoulou 2007; Veropoulidou 2011,
18 2014). Archontiko was located c. 4-5 km from the sea in the Early Bronze Age (Pilali-
19 Papasteriou and Papaefthymiou-Papanthimou 2002; Ghilardi et al. 2008; Syrides et al.
20 2009). Its inhabitants specialised in bulk collection of cockles in an extensive coastal
21 brackish lagoon zone around the bay (Fig. 1), perhaps in conjunction with agricultural
22 activities (Veropoulidou 2014: 417). Coastal conditions c. 2 km from Thessaloniki
23 Toumba were fully marine, interrupted by estuaries; cockles were gathered for food
24 consumption, but on a much smaller scale compared to Archontiko. The
25 predominance of *Hexaplex trunculus*, processed for purple dye production, and a high
26 diversity of marine molluscs from MBA-LBA Toumba, reflect a general trend
27 towards selective harvesting of specific, valuable taxa in the later Bronze Age
28 (Veropoulidou 2011: 386-415).
29
30
31

32 *Methodological background – stable isotope analysis of plant remains*

33 Stable carbon and nitrogen isotope analysis of human and associated faunal remains is
34 now normative in archaeology, and has made a significant impact on understanding of
35 later prehistory in northern Greece (Triantaphyllou 2001, 2015). Here we build on
36 that work through large-scale sampling of faunal remains, to establish variation in
37 stable isotope values within and among taxa, and by integrating human and faunal
38 stable isotope measurements with those of preserved crops. Stable isotope analysis of
39 charred plant remains is relatively novel, with a single detailed case study for
40 prehistoric southern Greece, Neolithic Kouphovouno (Vaiglova et al. 2014a). Stable
41 isotope analysis of crop remains has the potential to provide new insights into
42 agricultural strategies and land use, and to refine palaeodietary reconstruction in
43 combination with faunal and human remains (Bogaard et al. 2013; Fraser et al. 2013;
44 Styring et al. 2015).
45
46

47 In order to be interpreted reliably, it is crucial to establish the effects of charring and
48 contamination on stable carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) isotope values in charred
49 plant remains. Recent work has shown that low-temperature charring preserves not
50 only the morphology of cereal grains and pulse seeds, enabling identification to
51 species (Charles et al. 2015), but also the original carbon and nitrogen isotope ratios
52 in complex molecules [melanoidins] that develop between starches and proteins
53 (Styring et al. 2013), albeit with a minor, well characterized offset of less than 0.6‰
54 for $\delta^{15}\text{N}$ values and 0.2‰ for $\delta^{13}\text{C}$ values (Fraser et al. 2013; Nitsch et al. 2015).
55 Moreover, Vaiglova et al. (2014b) have established a protocol for detecting carbonate,
56
57
58
59
60

1
2
3 nitrate and humic contamination from the burial environment and applying suitable
4 cleaning procedures.

5
6 $\delta^{13}\text{C}$ values for C_3 crops such as wheats, barleys and pulses are influenced by stomatal
7 conductance, a primary cause of which is water status (e.g. Araus et al. 1997; Wallace
8 et al. 2013). Stable carbon isotope ratios can be expressed either as absolute $\delta^{13}\text{C}$
9 ratios, or as a relative offset compared to the atmospheric value (carbon
10 discrimination, $\Delta^{13}\text{C}$) (Ferrio et al. 2005). Since atmospheric $\delta^{13}\text{C}$ values have
11 changed over time, most dramatically in the industrial era due to fossil fuels,
12 expressing results in $\Delta^{13}\text{C}$ allows results from different periods to be compared with
13 modern crops grown under known watering conditions.
14
15

16 Previous studies have shown that the $\Delta^{13}\text{C}$ values for grains of two-row barley are
17 consistently $\sim 1\text{‰}$ higher than grains of wheat grown under comparable conditions,
18 with evidence that six-row barley grain is a further 1‰ higher (Voltas et al. 1999;
19 Jiang et al. 2006; Anyia et al. 2007; Wallace et al. 2013). Lentils grown under the
20 same range of watering conditions show a broader range of $\Delta^{13}\text{C}$ values compared to
21 wheats, such that they appear 'drier' in unirrigated conditions but 'wetter' under
22 irrigation, suggesting that pulses are more sensitive to changes in water status
23 (Wallace et al. 2013).
24
25

26 C_4 plants, of which broomcorn millet is the only relevant crop here, follow a different
27 photosynthetic pathway adapting them to arid conditions (Sage and Monson 1999).
28 This 'leakier' form of photosynthesis means that stomatal conductance is not closely
29 linked with water status, unlike in C_3 species (e.g. Lightfoot et al. 2016).
30
31

32 Anthropogenic and natural sources of water cannot be directly distinguished using
33 crop stable carbon isotope values, but can be inferred when there are species-specific
34 differences (Wallace et al. 2013, 2015; Bogaard et al. 2013). While there is no
35 evidence for large-scale irrigation works in the study region, selective watering could
36 have been practiced on a localised scale, and specific crops could have been reserved
37 for relatively well watered soils. Such practices have recently been inferred at LBA
38 Assiros Toumba, where wheat and pulses appear better watered than barley (Wallace
39 et al. 2015).
40
41

42 Crop $\delta^{15}\text{N}$ values largely reflect the $\delta^{15}\text{N}$ value of the soil in which they are grown,
43 integrating the $\delta^{15}\text{N}$ value of nitrogen (N) inputs and the effect of N cycling processes
44 on N isotopic fractionation (e.g. Högberg 1997). Studies of modern crops have found
45 that manuring can increase cereal $\delta^{15}\text{N}$ values by as much as 10‰ across a range of
46 locations and soils, according to the intensity – amount and frequency – of manuring
47 (e.g. Fraser et al. 2011; Bogaard et al. 2016). The nitrogen in manure has a higher
48 $\delta^{15}\text{N}$ ratio than the surrounding soil: the ^{14}N quickly volatilizes in ammonia, leaving
49 heavier ^{15}N -rich nitrogen behind (e.g. Bol et al. 2005; Bogaard et al. 2007). Manuring
50 intensity (which could include middening and composting) is therefore likely to
51 override the effects of other variables, such as soil type and soil nitrogen content, on
52 crop $\delta^{15}\text{N}$ values in farming systems (cf. Peukert et al. 2012; Thornton et al. 2015). A
53 particularly strong case for manuring can be made where crop $\delta^{15}\text{N}$ values are
54 elevated above those inferred for unmanured vegetation (e.g. wild herbivore forage),
55 and where particular species appear to have been selected for relatively intensive
56 manuring (e.g. Vaiglova et al. 2014a; Styring et al. 2016; Styring et al. in press). Pulse
57
58
59
60

1
2
3 $\delta^{15}\text{N}$ ratios do not exhibit the same dramatic manuring effect as cereals since they fix
4 nitrogen directly from the atmosphere. However, in cases of extremely intensive
5 manuring pulse $\delta^{15}\text{N}$ has been observed to increase (Fraser et al. 2011; Treasure et al.
6 2015).
7

8 9 *The study sites*

10 Archontiko is a c. 12.8 ha tell settlement in central Macedonia, near the foothills of
11 the Paikon mountain, rising some 20 m above the alluvial plain that meets the
12 Thermaic Gulf (Fig. 1). The tell's size likely represents its maximum extent in the
13 Iron Age; its scale during the Bronze Age is unknown. Excavations by the
14 Department of Archaeology, Aristotle University of Thessaloniki, revealed two major
15 occupation phases, dated by a large series of radiocarbon dates and separated by a
16 possible hiatus of c. 300 years: an Early-Middle Bronze Age (2130-1877 BC) phase
17 represented by multiple wooden framed structures, and a Late Bronze Age phase
18 (1516-1414 BC) of stone-foundation structures, with possible mud-brick
19 superstructures.
20
21

22
23 The earliest horizon (4) of phase B, belonging to the final EBA (c. 2130-2087 BC,
24 Maniatis 2014), is the best preserved, containing the row of seven structures
25 destroyed by fire (Fig. 2a) described above. The numerous clay structures related to
26 food storage and preparation found in each building were often associated with
27 concentrations of charred crops (Papadopoulou 2010). Within the later phase, A,
28 belonging to the LBA (c. 1516-1414 BC, Maniatis 2014) at Archontiko, horizon 1
29 (Fig. 2b) is much more eroded than 4 but has yielded parts of rectangular houses with
30 stone foundations in a similar arrangement to the horizon 4 structures, i.e. closely
31 built and facing SE (Pilali-Papasteriou and Papaefthymiou-Papanthimou 2002).
32
33

34 Archaeobotanical analysis (Valamoti et al. 2008; Telioridou 2013; Petridou 2014) is
35 ongoing but indicates that the crop spectrum included species present in the northern
36 Aegean since the Neolithic – glume wheats (einkorn and emmer), free-threshing
37 wheat (bread/durum wheat), and hulled (likely 2- and 6-row) barley, the latter ground
38 prior to charring (Valamoti et al. 2008), lentil, bitter vetch, Celtic bean and grass pea
39 – plus spelt in the EBA and broomcorn millet in the LBA.
40
41

42 In addition to intensive archaeobotanical sampling, study of the mammalian fauna by
43 Creuzieux (2013), of the molluscan fauna by Veropoulidou (2011) and of the fish
44 assemblage by Theodoropoulou (2007) provides an unusually holistic picture of
45 subsistence practice, and of diverse resource use at the household level amongst the
46 final EBA burned structures at Archontiko. The small human assemblage from
47 Archontiko consists of seven intramural burials belonging to newborn babies and
48 individuals under 18 months placed underneath the house floors in a flexed position,
49 often associated with thermal constructions, while adult individuals were recognised
50 only as fragmented remains scattered in the settlement deposits (Triantaphyllou
51 2016).
52
53

54 Ongoing excavations at Thessaloniki Toumba (Fig. 1), located in the eastern part of
55 the modern city, by the Department of Archaeology, Aristotle University of
56 Thessaloniki, have revealed a series of stone-foundation buildings dating to the
57 Middle and Late Bronze Age (c. 2100-1050 BC) and continuing into the Iron Age
58
59
60

1
2
3 down to the 4th cent. BC. The site lies on hilly terrain on the edge of the coastal plain,
4 *c.* 2 km away from the modern coastline, which was probably not much closer during
5 the Bronze Age. The tell rises today *c.* 23 m over the top of the platform formed
6 around its base by Iron Age habitation. In the LBA it was surrounded by a system of
7 terracing and a casemate wall. Fourteen occupation phases have been defined
8 stratigraphically. They have been assigned to three chronological horizons with the
9 help of radiocarbon dates and links to the Aegean chronological sequence through the
10 presence of Aegean ceramic imports and local imitations in the deposits of the various
11 phases of Toumba (Psaraki and Andreou 2010; Andreou 2009; Jung et al 2009). Six
12 occupation phases have been assigned to the MBA (2100-1700/1600 BC), three to the
13 earlier LBA (*c.* 1700/1600-1390/1360 BC) and four to the later part of the LBA (*c.*
14 1390/1360-1050 BC). Phases 4 (with several sub-phases) and 3, spanning the end of
15 the 13th to the start of the 11th cent. BC, are the most extensively excavated and have
16 contributed most of the information relating to the LBA. The MBA and early LBA
17 occupation seems to have extended from the top to the base of the natural rise on
18 which the tell was originally established, and was not necessarily as compact as
19 subsequently. During the later part of the LBA (phases 5 to 2b) houses were confined
20 to the higher terraces around the summit of the tell, limited to an area of *c.* 0.408 ha,
21 of which *c.* 0.285 ha was probably built over (Andreou and Kotsakis 1996; Andreou
22 2001; Andreou and Psaraki 2007; Andreou and Efkleidou 2008; Andreou et al.
23 2010).

24
25
26
27 In the LBA the summit of the tell was divided into a series of domestic ‘blocks’ with
28 intervening streets; Building A, extending over *c.* 200 m², has been almost completely
29 excavated (Fig. 3). A series of small-scale burning events (cooking accidents,
30 processing residues discarded in domestic fires, etc.) preserved crop by-products and
31 occasionally grain concentrations in this complex. The plan of the MBA settlement is
32 less well known, but excavation of Building M, which was destroyed by fire,
33 uncovered what appear to be mixtures of crops and wild/weed species, perhaps
34 mixtures of spent fuel and cooking accidents (Andreou and Kotsakis 1996;
35 Kotsahristou 2009).

36
37
38 Archaeobotanical analysis of plant assemblages from Buildings M and A is ongoing
39 but has identified a range of crop species (einkorn, emmer, ‘new type’ glume wheat,
40 hulled (likely 2- and 6-row) barley, spelt, free-threshing wheat, lentil, bitter vetch,
41 Celtic bean, grass pea and, in the LBA, millet) similar to that at Archontiko.

42
43
44 In addition to intensive archaeobotanical sampling, study of the mammalian fauna by
45 Nikolaidou and Vasileiadou (Vasileiadou 2009; Nikolaidou 2010; Vasileiadou et al
46 2010), of the molluscan fauna by Veropoulidou (2011) and of the fish assemblage by
47 Theodoropoulou (2007) again provides an unusually rich understanding of
48 subsistence and craft activities, including purple dye production (Veropoulidou et al.
49 2008), at the household level. The human assemblage from LBA Toumba is
50 represented by seventeen intramural burials in either articulated or disarticulated
51 form. Both sexes were placed within and among the houses, underneath the floors and
52 in open areas of the settlement and such as streets and courtyards. Infants, children
53 and adolescents clearly predominate (newborn babies are totally lacking). Early
54 infants (1.5 and 2 yrs old) were placed in a flexed position on their left side, in
55 contrast to the extended position which is the rule for all age groups over 3 years old
56 (Andreou et al. 2010; Triantaphyllou 2016).

Materials and methods

Crop remains from Archontiko and Thessaloniki Toumba were subsampled from primary seed concentrations (e.g. storage contexts) for stable isotope analysis. For a given species within each context, 5-20 (normally 10) seeds/grains were homogenized per sample, in order to average the natural grain-to-grain variation and also to obtain enough nitrogen for analysis. Since carbonized remains were less abundant at Thessaloniki Toumba than at Archontiko, the number of seeds destroyed per sample was generally smaller, and occasionally seeds from closely related contexts were amalgamated. Fourier transform infrared spectroscopy analysis of a subset of samples ruled out any significant sources of contamination (Vaiglova et al. 2014b), except for trace amounts of carbonates, and so samples were pre-treated with a weak HCl solution. After treatment, samples were freeze-dried and then powdered by hand with an agate mortar and pestle. Samples were weighed out to 0.6-0.7 mg for carbon and 2-4mg for nitrogen, with carbon and nitrogen analysed separately.

Sampling of the Thessaloniki Toumba faunal assemblage was undertaken by Vasileiadou and Halstead, largely following a protocol designed by the latter. Good preservation normally enabled selection of sufficient numbers of domesticate specimens from single, where possible measurable, anatomical zones of the same body side (mainly distal humeri and proximal radii, whichever were most numerous in any given chronological/stratigraphic context; cf. Drucker et al. 2003, 377). For the less well represented wild species, stratigraphic information was used to reduce chances of sampling the same individuals twice.

At Archontiko, sampled by Gardeisen and Nitsch, it was not possible to achieve sufficient samples per taxon by targeting specific single (sided) body parts. Therefore, a range of body parts was selected, again using stratigraphic information to avoid sampling the same individual twice.

Sampling of human bone from Archontiko included two long bones from intramural burials belonging to neonates and one adult distal humerus provided from scattered bones. From LBA Thessaloniki Toumba, sampling of human remains was provided by fourteen intramural burials of the seventeen excavated to date. Individuals of both sexes and all age groups were selected in order to observe dietary variations within the population, while long bones, ribs and hand phalanges were preferred as opposed to flat and cranial bones.

For bone samples, collagen was extracted using a modification of the Longin (1971) method, following procedures described by Richards and Hedges (1999). While all measured samples are reported (Tables S6-8) only collagen values with C/N ratios between 2.9 and 3.6 were studied, following quality criteria described by DeNiro (1985). This excluded six of the Archontiko faunal samples but none of those from Thessaloniki Toumba; the resulting faunal isotope datasets (Archontiko, n = 173; Toumba, n = 145) represent some of the largest yet available from prehistoric Greece.

Isotopic measurements were made on a Sercon 20-22 EA-GSL isotope ratio mass spectrometer operating in continuous flow mode. Raw and drift-corrected isotope ratios were calculated against an internal alanine standard. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios normalized to the VPDB and AIR scales were calculated against two bracketing

reference materials: Caffeine-2* (U. Indiana) and an internal seal standard (for $\delta^{13}\text{C}$) or IAEA-N2 (for $\delta^{15}\text{N}$). Normalization and measurement uncertainty was calculated using the approximation method reported by Kragten (1994). This and all other statistical calculations were performed using the programming language R (3.2.4). The average measurement uncertainty for $\delta^{13}\text{C}$ values was 0.1‰ with a range from 0 to 0.5‰. The average measurement uncertainty for $\delta^{15}\text{N}$ values was 0.18‰, with a range from 0 to 0.6‰. Details of the analytical conditions are reported in Tables S1-2. The plant isotope results reported are corrected for the minor effect of charring on $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values (Nitsch et al. 2015), except where otherwise indicated.

For plants, absolute $\delta^{13}\text{C}$ values are converted to carbon discrimination values for the purposes of comparing them with values of modern crops grown under known watering conditions (e.g. Wallace et al. 2013) as follows (Farquhar et al., 1982, 1989):

$$\Delta^{13}\text{C} = \frac{\delta^{13}\text{C}_{\text{air}} - \delta^{13}\text{C}_{\text{plant}}}{1 + \delta^{13}\text{C}_{\text{plant}}/1000}$$

Values for $\delta^{13}\text{C}_{\text{air}}$ are obtained from reference tables provided by Ferrio et al. (2005), calculated based on the absolute (cal BC) date range of each individual sample.

Plant, faunal and human values from Thessaloniki Toumba were used to model different human dietary scenarios. The modelling parameters used are summarised in Table S3. The uncertainty of each trophic level offset (Table S3) was pooled with the calculated standard deviation from each of the measured food groups, creating a normally distributed estimate of human values for each dietary combination. A distribution of hypothetical human $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values was calculated for each dietary scenario using a resampling technique, drawing 10,000 normally distributed replicates from each calculated endpoint, weighting the mixture by the proportions from the relevant dietary scenario and correcting the proportions for differences in the ratio of digestible C and N.

Results

Crop results from Archontiko

Full results of the archaeobotanical analysis from Archontiko are reported in supplementary Table S4. The $\delta^{13}\text{C}$ values of cereals from EBA Archontiko range from -24.3 to -21.8‰, while $\delta^{15}\text{N}$ values range from 1.7 to 6.9‰; both ranges are similar to results reported elsewhere in the region (Wallace et al 2015; Vaiglova et al. 2014a) (Fig. 4). The five free-threshing wheat samples (all from House A – see Fig. 2 for architectural plan) produced similar values, with relatively low $\delta^{13}\text{C}$ (~ -23.5‰) and relatively low $\delta^{15}\text{N}$ (~2.0‰) values. Glume wheats (emmer, einkorn, spelt) had a wider range of $\delta^{13}\text{C}$ (~ -23.9 to -21.8‰) and $\delta^{15}\text{N}$ values (2.3-4.5‰). Six of the 11 barley samples produced relatively high $\delta^{15}\text{N}$ values (5.4-6.8‰). $\delta^{13}\text{C}$ values for barley range from ~ -24.2 to -22‰ but barley discriminates against atmospheric CO_2 differently than other cereals (Wallace et al. 2013) and so yields 1-2‰ lower than wheat grown under the same conditions. The barley was therefore probably growing in drier conditions than the free-threshing wheat. The range of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for House A is broad, implying multiple distinct sets of growing conditions, and is consistent with values from other contexts. The standard deviation for cereal $\delta^{13}\text{C}$ values is 0.7‰ and for cereal $\delta^{15}\text{N}$ values is 1.6‰, figures which are *c.* three times the

size of the typical standard deviation measured in replicates of 10 crushed grains from the same set of growing conditions (Nitsch et al. 2015). The single flax sample has the lowest $\delta^{13}\text{C}$ and highest $\delta^{15}\text{N}$ value measured from this phase: -24.3 and 7.2‰ .

Similar patterns are observed in the LBA samples from Archontiko (Fig. 4b). Barley has relatively low $\delta^{13}\text{C}$ ($-23.9 \pm 0.2\text{‰}$) and high $\delta^{15}\text{N}$ values ($4.0 \pm 1.2\text{‰}$), while other cereals (emmer, einkorn, spelt and free-threshing wheat) have higher $\delta^{13}\text{C}$ ($-23.1 \pm 0.5\text{‰}$) and lower $\delta^{15}\text{N}$ values ($2.5 \pm 0.9\text{‰}$). Pulses were recovered from LBA contexts and have low $\delta^{15}\text{N}$ values consistent with nitrogen fixers ($0.5 \pm 0.4\text{‰}$), while $\delta^{13}\text{C}$ values are more variable than in cereals ($-23.9 \pm 0.8\text{‰}$). The low and relatively uniform $\delta^{13}\text{C}$ values of the seven millet samples ($\sim -10.4\text{‰}$) is typical of C_4 plants, while their $\delta^{15}\text{N}$ values are high and relatively variable (ranging from 1.6 to 7.4‰).

Crop results from Thessaloniki Toumba

Fig. 5 shows the archaeobotanical isotope results from Thessaloniki Toumba, with full data reported in supplementary Table S5. All of the MBA crop remains derive from Building M (see Fig. 3 for architectural plan). Barley has relatively low $\delta^{13}\text{C}$ values ($-24.4 \pm 0.7\text{‰}$), as expected given its differential physiology in comparison with wheat, but also high $\delta^{15}\text{N}$ values ($6.1 \pm 1.3\text{‰}$) compared to other cereals (emmer and einkorn), which have higher $\delta^{13}\text{C}$ ($-23.9 \pm 0.5\text{‰}$) and lower $\delta^{15}\text{N}$ values ($4.7 \pm 0.49\text{‰}$). Pulses have more variable $\delta^{13}\text{C}$ ($-24 \pm 1.3\text{‰}$) and lower $\delta^{15}\text{N}$ values than cereals ($2.5 \pm 0.6\text{‰}$) but not as close to zero as expected for pulses obtaining all their nitrogen directly from nitrogen fixation. Among pulses, grass pea has the highest average $\delta^{13}\text{C}$ value (-22.3‰), lentils have intermediate $\delta^{13}\text{C}$ values (-23.8‰), and two of the four bitter vetch samples have very low $\delta^{13}\text{C}$ values ($< -25.0\text{‰}$).

All of the crop remains from the LBA phases at Toumba were associated with Building A. Barley again had relatively low $\delta^{13}\text{C}$ ($-24 \pm 0.5\text{‰}$) and high $\delta^{15}\text{N}$ values ($8.6 \pm 2.6\text{‰}$) compared to emmer and einkorn ($\delta^{13}\text{C}$: $-22.5 \pm 0.5\text{‰}$, $\delta^{15}\text{N}$: $5.5 \pm 1.5\text{‰}$). Millet's $\delta^{13}\text{C}$ value is about -10.7‰ , while its $\delta^{15}\text{N}$ value is relatively high ($8.9 \pm 1.9\text{‰}$).

Faunal results from Archontiko

Animal remains from the two EBA and one MBA occupation phases (4, 3, and 2) and the LBA horizon (1) show similar patterns (Fig. 6, Table S6). Non-domesticates (deer, hare, wild boar and aurochs) mostly have low $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios averaging $-21.0 \pm 1.1\text{‰}$ and $5.2 \pm 1.3\text{‰}$, respectively (Fig. 6). By comparison mean $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for ovicaprids and pigs were $-19.7 \pm 1.4\text{‰}$ and $6.4 \pm 1.3\text{‰}$, respectively. Among domesticates, cattle are notable for their wide range of $\delta^{13}\text{C}$ values compared to other fauna, ranging as high as -12‰ . Pigs generally have higher $\delta^{15}\text{N}$ values than sheep or goat, while not enough sheep and goats were identified to species level to allow comparison.

Faunal results from Thessaloniki Toumba

Similar inter-species differences in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values were observed at Thessaloniki Toumba (Fig. 7, Table S7). Deer generally have low $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios (averaging $-20.6 \pm 0.5\text{‰}$ and $5.0 \pm 1.0\text{‰}$, respectively), while the specimen identified as wild boar has isotopic ratios similar to domestic pigs. Among domesticates, pigs have relatively high $\delta^{15}\text{N}$ ratios ($7.6 \pm 1.0\text{‰}$). The separation of more specimens of sheep and goats at Thessaloniki Toumba allows us to observe that

1
2
3 sheep in general have higher $\delta^{15}\text{N}$ values than goats, with some overlap between the
4 higher goat and lower sheep values. While late LBA cattle have ratios comparable to
5 other domesticates, only $\delta^{15}\text{N}$ ratios of MBA-early LBA cattle are comparable to
6 other domesticates. Most of the earlier examples have higher $\delta^{13}\text{C}$ ratios, ranging
7 from -17‰ to -10‰.
8

9 10 Human results

11 For EBA Archontiko, three human samples were available, from one adult and two
12 neonates (Fig. 8 Table S8). The infant $\delta^{13}\text{C}$ values are higher (-19.0 and -19.3‰) than
13 the single adult value (-19.6‰), while the infant $\delta^{15}\text{N}$ values (8.7 and 10.7‰) are
14 ~0.6-2‰ higher than the adult value (8.1‰); the latter is consistent with the trophic
15 level effect due to the consumption of human breast milk, while the former may be a
16 younger individual (up to a few weeks old) in equilibrium with the mother's diet
17 (Nitsch et al., 2012). The adult human collagen has a $\delta^{15}\text{N}$ value 1.6-2.0‰ higher than
18 the average ovicaprid, pig and cattle ratios from EBA-MBA phases. The adult $\delta^{13}\text{C}$
19 value is similar to that of ovicaprids and pigs, but 2‰ lower than the mean cattle
20 value.
21

22
23 Human remains from Thessaloniki Toumba have mean $\delta^{13}\text{C}$ values of $-18.2 \pm 0.4\text{‰}$
24 and mean $\delta^{15}\text{N}$ values of $9.2 \pm 0.7\text{‰}$ (Fig. 9 Table S8). The human $\delta^{13}\text{C}$ values are all
25 lower than those for Archontiko. The five subadult humans from Thessaloniki
26 Toumba have $\delta^{13}\text{C}$ values 0.5‰ higher than the nine adults from Toumba ($t[12]=$
27 3.657 , $p = 0.003$) (see Fig. 9, inset), while there are no significant differences between
28 adult males and females. Adults have $\delta^{13}\text{C}$ values similar to cattle from late LBA
29 Thessaloniki Toumba, and ~1‰ higher than ovicaprids and pigs from the same
30 period. Adult human $\delta^{15}\text{N}$ ratios are 2.5-3‰ higher than ovicaprids, pigs and cattle.
31
32

33 34 *Discussion*

35 36 Crop husbandry

37 Fig. 10 compares crop $\Delta^{13}\text{C}$ values from all phases at Archontiko and Thessaloniki
38 Toumba with available data from Neolithic Kouphovouno, near Sparta (Vaiglova et
39 al. 2014a) and modern bands for poorly to well watered crops (Wallace et al. 2013).
40 Wheats, barley and pulses have $\Delta^{13}\text{C}$ values similar to reference values for moderately
41 to well watered crops. Wheat $\Delta^{13}\text{C}$ values from MBA Thessaloniki Toumba are
42 significantly higher than from other sites and phases (pairwise comparisons with
43 Tukey HSD post-hoc corrected p all < 0.003), suggesting particularly well watered
44 conditions. Barley $\Delta^{13}\text{C}$ values from EBA Archontiko are significantly lower than
45 barley from other sites and phases (pairwise comparisons with Tukey HSD post-hoc
46 corrected p all < 0.002001); wheat samples in the 'poorly watered' band also occur in
47 this phase. At EBA-LBA Archontiko, and MBA-LBA Thessaloniki Toumba, wheats
48 appear to be better watered than barley, assuming a difference of 1.5‰ in $\Delta^{13}\text{C}$ values
49 between wheat and barley grown in the same conditions. This pattern was also
50 recently noted at LBA Assiros Toumba (Wallace et al. 2015). If a difference of only
51 1.0‰ is assumed, however, the difference between wheat and barley is only
52 significant at EBA Archontiko. That the physiological offset between six-row barley
53 and wheat may have been smaller in prehistoric varieties than in modern ones is
54 suggested by recent results from late Neolithic Hornstaad-Hörnle IA, Germany, where
55 the $\Delta^{13}\text{C}$ values of six-row naked barley grain samples ($n = 59$) were found to be c .
56
57
58
59
60

1
2
3 1.1‰ higher than those of wheat grain samples (naked wheat and einkorn; n = 120)
4 grown in the same year (Styring et al. 2016, in press). All pairwise comparisons were
5 made with Tukey HSD post-hoc corrections, with $p < 0.002$ where significant.
6

7
8 Modern studies have shown that *well* watered pulses tend to have slightly higher
9 values than wheat grown under similar watering conditions (Wallace et al. 2013: Fig.
10 2). The fact that the pulses at MBA Thessaloniki Toumba and LBA Archontiko have
11 relatively high $\Delta^{13}\text{C}$ values compared with contemporary wheats therefore suggests
12 that they grew under similar conditions to the better watered end of the cereal
13 spectrum.
14

15 Fig. 11 shows crop $\delta^{15}\text{N}$ values from all phases at Archontiko and Thessaloniki
16 Toumba with published data from Neolithic Kouphovouno (Vaiglova et al. 2014a)
17 and estimated baseline values of local unmanured vegetation derived from wild
18 herbivore collagen values at each site. Despite similar baselines across the
19 assemblages, cereal $\delta^{15}\text{N}$ values and potential manuring levels varied considerably, as
20 observed also within individual house assemblages (above, Figs 4-5). Comparison of
21 Kouphovouno with Archontiko reveals a clear contrast in the relative values of barley
22 and free-threshing wheat, with *higher* values in barley than wheat in the latter
23 assemblage. Barley $\delta^{15}\text{N}$ values also tend to be elevated above those of hulled wheats
24 at MBA-LBA Thessaloniki Toumba. Thus, while barley was sometimes grown under
25 drier conditions than wheats, at least at EBA Archontiko (above, Fig. 10), it tended to
26 be a *more* intensively manured crop. (Similarly, at Neolithic Kouphovouno, the more
27 manured crop, free-threshing wheat, was of more variable water status than hulled
28 barley.) In some landscapes it is plausible that more water retentive/better watered
29 soils were not the most accessible for manuring; manure is heavy to transport and
30 tends to be applied most intensively near penning/stabling areas. It may also be the
31 case that barley was grown on drier (though still moderately to well watered) soils in
32 some contexts not because it was a low status crop but because it was better able to
33 tolerate drought due to an earlier harvest date/shorter photosynthetic period (Riehl et
34 al. 2009). Whatever the specific affordances of different crops and landscapes, it
35 appears that preferential manuring of barley was practised at both Bronze Age
36 northern sites, perhaps reflecting a particular importance of barley for human
37 consumption, as suggested by deposits of ground barley grains in multiple houses at
38 EBA Archontiko (Valamoti et al. 2008a). Equally, barley may have been manured to
39 ensure availability of 'early bite' pasture, a strategy practised in the region in the
40 recent past (Halstead 2006a). LBA millet at both sites has similar $\delta^{15}\text{N}$ values to
41 barley, perhaps because they were grown in rotation; millet could even be sown
42 immediately after the barley harvest if there was summer rain, a multi-cropping
43 strategy more feasible for barley than wheat due to the earlier harvest date of the latter
44 (Halstead 2014: 72). This interpretation assumes that barley and millet $\delta^{15}\text{N}$ values
45 can be compared directly; a priority for future work is to establish the effect of
46 charring and manuring on broomcorn millet $\delta^{15}\text{N}$ values (cf. Lightfoot et al. 2016).
47
48
49
50
51

52 Despite similar unmanured baselines, cereal $\delta^{15}\text{N}$ values are generally *higher* at
53 Thessaloniki Toumba than at Archontiko (Fig. 11). For cereals, pairwise comparison
54 of MBA and LBA Thessaloniki Toumba with EBA and LBA Archontiko, normalized
55 by subtracting the mean wild herbivore $\delta^{15}\text{N}$ value at each site and phase, showed
56 significantly higher $\delta^{15}\text{N}$ values ($p < 0.001$) at Thessaloniki Toumba. The implication
57 is that manuring tended to be more intensive at Toumba, with remarkably high cereal
58
59
60

1
2
3 values particularly in the LBA. Pulses at MBA Toumba map onto those expected
4 under intensive manuring, while those at Archontiko correspond with lower levels
5 (Fig. 12). The fact that pulses and cereals track each other at both sites is also
6 consistent with the inference from $\delta^{13}\text{C}$ values that cereals and pulses experienced
7 similar conditions, suggesting integrated production through mixed cropping or
8 rotation. Thus, while Archontiko and Toumba converge in a number of aspects of
9 crop husbandry – preferential manuring of barley, association (rotation?) of barley
10 and millet and plausibly integrated cereal and pulse production – differential
11 manuring rates suggest divergent long-term strategies for crop production, with more
12 intensive management at Toumba. Factors potentially contributing to this divergence
13 include availability of traction animals – evidenced at Thessaloniki Toumba
14 (Nikolaidou 2010, 113; Vasileiadou et al. 2010) but not confirmed at Archontiko
15 (Creuzieux 2013; Gardeisen, personal observations); community size – LBA Toumba
16 was crowded but very small (*c.* 0.408 ha with 70% of the area occupied by buildings),
17 minimising frictions of distance (e.g. transport costs of hauling manure) between
18 housing and arable fields (cf. Jones et al. 1999; Jones 2005; Isaakidou 2008), while
19 the size of BA Archontiko is unknown; and available labour within large co-
20 residential groups at Toumba, compared with smaller units at Archontiko.

21
22
23
24 Crop diversification in Bronze Age northern Greece included the addition of spelt
25 and, in the LBA, broomcorn millet. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values suggest that these crops
26 were grown or rotated with others: spelt with free-threshing wheat at Archontiko, and
27 millet with barley at both sites (Figs 10-11). Diversification thus not only spread
28 labour costs (e.g. short-season millet could be sown after barley) but also diversified
29 multiple crop ‘niches’.

31 32 Animal husbandry

33 Intensive sampling of the faunal assemblages, combined with protocols to avoid
34 multiple measurements of the same individual, opens up the opportunity to compare
35 animal feeding ecology and the effects of management in detail. Both assemblages
36 exhibit contrasts between wild and domestic herbivores: the former tend to have low
37 $\delta^{13}\text{C}$ values, potentially due to canopy effect (shade), although it should be noted that
38 these are generally higher than those reported in studies of modern deer populations
39 (e.g. Drucker et al. 2008), perhaps reflecting more open woodland and forays into
40 anthropogenic landscapes. The higher $\delta^{15}\text{N}$ values of sheep and pigs are compatible
41 with feeding on the more open and fertile anthropogenic agricultural landscapes,
42 suggesting greater integration of *sheep* with arable farming (cf. Halstead 2006a) and
43 perhaps also pigs with arable fields. Many goats at LBA Thessaloniki Toumba (the
44 species were seldom distinguished at Archontiko), however, tend to have lower
45 values, closer to those of deer, probably reflecting more browsing of rough pasture.
46 Pigs and especially dogs have higher values than domestic herbivores at Archontiko,
47 dogs overlapping with the few human values (Fig. 8). The increase in crop $\delta^{15}\text{N}$
48 values at LBA Thessaloniki Toumba is seen also in the domestic fauna (overall
49 difference = 0.5‰ $p = 0.003$). These patterns suggest a peak of intensive, integrated
50 management of crops and livestock at LBA Thessaloniki Toumba, including sheep
51 grazing of manured cereals, to control lodging and/or for access to early-bite pasture
52 (cf. Halstead 2006a).

53
54
55
56 Both assemblages include cattle with high $\delta^{13}\text{C}$ values indicative of significant C_4
57 plant consumption (Fig. 13, values $>-16\text{‰}$ suggesting $>35\%$ C_4 plants). At EBA
58
59
60

1
2
3 Archontiko this occurs *before* the introduction of broomcorn millet – a phenomenon
4 also observed at late Neolithic Makriyalos (Styring et al. 2015) – and includes two red
5 deer with high $\delta^{13}\text{C}$ values, suggesting that millet consumption/foddering does not
6 explain the pattern. A more plausible explanation is grazing in C_4 -rich coastal salt
7 marsh and associated habitats, available within a few km of both sites (Sage and
8 Monson 1999: 121). Cattle grazing of coastal marsh is common in the region today
9 (Halstead and Valamoti personal observations, cf. Valamoti 2004: 124). The
10 occurrence of C_4 cattle diets thus suggests grazing several kilometres from the
11 settlement, with associated ‘loss’ of manure. It is notable that this feeding strategy is
12 absent at late LBA Thessaloniki Toumba (Fig. 13), where the most intensive crop
13 manuring levels are observed. An absence of C_4 cattle is also observed at LBA
14 Assiros Toumba (Wardle et al. 2014: Table S1), where large-scale destruction
15 preserved crop stores with weeds indicative of intensive management (Jones 1992).
16 Cattle may have been kept locally both for traction/transport and to conserve manure.
17 A long-term tradition of coastal cattle grazing at EBA-LBA Archontiko coincides
18 with that of bulk cockle harvesting in this same landscape zone (Veropoulidou 2014).
19
20
21

22 Human diet

23 Making quantitative palaeodietary estimates of protein sources on the basis of only
24 $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values is complicated by several factors: a) the variety of dietary
25 components, b) the isotopic variability within each component, c) the uncertainty of
26 the assumptions that must be made about $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ discrimination factors
27 (O’Connell et al. 2012; Phillips 2012); and d) differences in the ratio of digestible C
28 and N in different sources (Phillips and Koch 2002; Hopkins et al., 2012). While it
29 would be unwise to make dietary estimates on the basis of such large variability and
30 uncertainties, here we explore the types of diets that are plausible and implausible by
31 comparing hypothetical $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for different dietary scenarios to the
32 actual $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values measured in humans. Since only one adult human value is
33 available from Archontiko, we focus on Thessaloniki Toumba. Eight different
34 isotopic food groups were created, based on the results reported here and (for fish) by
35 Vika and Theodoropoulou (2012) (Fig. 14). At Thessaloniki Toumba there were
36 significant differences in crops between MBA and LBA phases: no pulses were
37 recovered from the LBA phase, cereal $\delta^{15}\text{N}$ values were generally higher in the LBA
38 than the MBA, and cattle had significantly lower (more C_3) $\delta^{13}\text{C}$ ratios. Here we use
39 LBA data with the addition of MBA pulses, since the humans date to the LBA. The
40 single freshwater fish measurement from Thessaloniki Toumba was excluded, and
41 only marine/estuarine fish ($\delta^{13}\text{C} > -13\text{‰}$) were considered.
42
43
44

45 For Thessaloniki Toumba we report twelve different proportional combinations of the
46 eight food groups (Table S9) and compare their *estimated* human collagen $\delta^{13}\text{C}$ and
47 $\delta^{15}\text{N}$ ratios to the *actual* human collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values (Fig. 15). These
48 include three scenarios that achieve excellent overlap between hypothetical and actual
49 human isotope ratios (models A-C), five with good overlap (D-H) and four others (I-
50 L) with poor overlap representing implausible dietary combinations (Fig. 15).
51 Plausible diets include four based solely on crops (A-D), of which A (wheats) and B
52 (wheats and pulses) are particularly broad due to isotopic variability in these taxa.
53 Other diets considered contain small (E) and larger (F) amounts of livestock protein,
54 plus wild game and marine fish (G-H). Though no concentrations of pulses were
55 recovered from LBA Building A, some plausible scenarios are mathematically reliant
56 on a contribution of low $\delta^{15}\text{N}$ -value pulses. Similarly, a contribution of some high
57
58
59
60

1
2
3 $\delta^{13}\text{C}$ -value food source (marine fish or millet) is a small component of some plausible
4 scenarios. Implausible diets include those with 50% fish (model I), 50% cattle (model
5 J) and 30% millet (model K). Since Thessaloniki Toumba's human $\delta^{15}\text{N}$ ratios are
6 relatively low compared to the barley $\delta^{15}\text{N}$ values from Building A, 30% barley input
7 is also implausible (model K). Either barley was not a major human food crop, or the
8 very high barley $\delta^{15}\text{N}$ values from this structure were exceptional and not
9 representative of the average cereals consumed by the humans analysed.
10

11
12 This heuristic exercise suggests that C_3 crops (cereals and pulses) represent the only
13 plausible staple source for the majority of protein in the human diet at Thessaloniki
14 Toumba. Millet may have played a particular role in the subadult diet (above, Fig. 9)
15 but was a minor food overall. While mammals and fish probably made a contribution
16 to dietary protein, they were not the major source.
17

18 **Conclusions**

19 The stable isotope data from Archontiko and Thessaloniki Toumba offer a unique
20 means of linking agropastoral strategies to the human diet. While management
21 strategies *per se* have implications for how intensively these communities worked to
22 ensure their food supply, human palaeodietary reconstruction constrains assumptions
23 about the relative importance of different resources, and hence their wider economic
24 and political significance as (intermittently) surplus foods.
25
26

27 Human dietary reconstruction at LBA Thessaloniki Toumba suggests that crops were
28 the major source of protein; the single adult and dogs from Archontiko hint at a
29 similar situation. It is thus entirely plausible that the aim of producing a 'normal
30 surplus' of crops in good years was crucial for ensuring a mainstay of the diet. Crops
31 including any surpluses could be stored (e.g. in the large storage jars (*pithoi*) and
32 dedicated storage spaces of residential blocks such as Building A) for a year or more,
33 depending on storage conditions (Halstead 1990).
34
35

36 Management strategies for crops shed light on how households aimed to produce
37 'normal' surpluses of highly storable food to buffer against future harvest failure. The
38 results from both Archontiko and Toumba indicate varying levels of management
39 intensity in the form of manuring, with particular investment in barley, which may
40 have played a dual role as 'early-bite' pasture as well as human food (i.e. the milled
41 preparation in final EBA Archontiko houses). Variation amongst crop taxa, and
42 between crop stores within burned houses (at final EBA Archontiko), plausibly
43 reflects strategic decision-making by farmers juggling limited manure, differing crop
44 requirements/schedules and available labour. Both sites present evidence of relatively
45 intensive approaches to crop production, but they diverge in the absolute level of
46 manuring, which escalated at LBA Toumba in association with locally tended cattle
47 (including draught animals) and probable integration of sheep and pigs with arable
48 land. At Archontiko, by contrast, manuring levels were more moderate into the LBA,
49 together with a continuation of cattle herding in C_4 -rich environments, probably
50 coastal salt marsh.
51
52

53
54 While livestock and deer appear to have played a secondary role as a human dietary
55 protein source, their consumption plausibly lent itself to social storage through supra-
56 household sharing and displays of hospitality (cf. Halstead 2007). The production of
57 Mycenaean-style tableware at LBA Thessaloniki Toumba suggests particular
58
59
60

1
2
3 emphasis on formality and display on such occasions, underlining the political
4 importance of food and drink for maintaining alliances beyond the immediate
5 household. The concentration of clay structures relating to food preparation in each of
6 the 'row houses' at final EBA Archontiko, on the other hand, suggests a general
7 emphasis on modular cooking by each small-scale household.
8

9
10 Particularly intensive arable land management at LBA Thessaloniki Toumba involved
11 close integration of crop and livestock production, such that crops supplemented the
12 diet of especially sheep and pigs. In this way, crops were stored not only directly but
13 also 'indirectly' in livestock, linking normal surplus and 'social storage' surplus
14 production strategies. Intensive, integrated production of crops and livestock at LBA
15 Toumba, including stabling on the tell itself, served not only to ensure adequate stores
16 of crop staples (risk buffering) but also a political economy of solidarity in large
17 residential blocks and a wider community proud of its height and evident ancestry as
18 a tell community. Integration of livestock with arable management may have served
19 to underline household ownership of these animals and hence their ability to 'host'
20 supra-household consumption of the carcasses. Emphasis on the production of large
21 cattle carcasses in the late LBA (Vasileiadou et al. 2010) is consistent with this
22 inference.
23

24
25 The situation at Archontiko suggests a different, somewhat lower degree of
26 integration between crop and livestock husbandry, and hence a different inflection on
27 the relationship between 'normal surplus' strategies for crops and 'social storage' of
28 meat. Continued extensive grazing of cattle in C₄-rich habitats, probably coastal salt
29 marsh, indicates dedication of labour to herding beyond the immediate vicinity of the
30 settlement and the arable sector. The benefits of fattening cattle without provision of
31 fodder plausibly outweighed the losses of manure and capacity to transport it.
32 Intensive cockle harvesting through to the LBA (Veropoulidou 2014) was probably a
33 complementary strategy.
34

35
36 By combining reconstruction of agropastoral strategies with diet using stable isotope
37 analysis of associated plants, fauna and humans, we can thus achieve rare
38 archaeological insight into linkages between differing forms of storage (direct and
39 indirect) and aspects of food surplus (normal versus social storage). While theoretical
40 discussion of surplus often opposes 'economic' and 'political' accounts (e.g.
41 Morehart and De Lucia 2015), evidence of *actual* farming and dietary practices at
42 Archontiko and Toumba dissolves this dichotomy and suggests a variety of ways in
43 which different communities planned for and exploited food surpluses serving
44 complementary nutritional *and* political roles.
45
46

47 48 **Acknowledgements**

49 This paper is an outcome of many years' excavation and bioarchaeological
50 investigation at Archontiko and Toumba, combined with stable isotope analysis as
51 part of the European Research Council-funded AGRICURB project (grant no.
52 312785; PI Bogaard): AB conceived the study; EN carried out all stable isotope
53 laboratory work and data analysis; SA and AP directed excavations and advised on
54 archaeological contexts and chronology; AC, AG, PH, VI, EN, DK, DN, CP, AV, ST,
55 SV and AK conducted sampling and/or bioarchaeological analysis; SA, AB, PH, VI,
56 EN, ST and SV wrote the paper. Domna Isaakidou and Evi Papadopoulou kindly
57
58
59
60

provided architectural plans for Archontiko. We are very grateful to the Greek archaeological service for processing the sampling applications and for issuing the permits for analysis and export. Finally, we thank Petra Vaiglova for assistance with bone sampling at Archontiko, and Elizabeth Stroud, Amy Styring, Rena Veropoulidou and two anonymous reviewers for insightful criticism of the manuscript.

References

- Andreu, S. 2001. 'Exploring the patterns of power in the Bronze Age settlement of Northern Greece.' In *Urbanism in the Aegean Bronze Age*, edited by K. Branigan, 160-173. London: Sheffield Academic Press.
- Andreu, S. 2003. 'Η Μυκηναϊκή κεραμική και οι μακεδονικές κοινωνίες κατά την ύστερη εποχή του Χαλκού.' In *2ο Διεθνές Διεπιστημονικό Συμπόσιο. "Η περιφέρεια του Μυκηναϊκού κόσμου". 26-30 Σεπτεμβρίου, Λαμία 1999. Πρακτικά*, edited by A. Kyparissi-Apostolika and M. Papakonstantinou, 191-210. Athens: Ministry of Culture, 14th EPKA.
- Andreu, S. 2009. 'Stratified wheel made pottery deposits and absolute chronology of the LBA to the EIA transition at Thessaloniki Toumba.' In *LH III C Chronology and Synchronisms III. LH III C Late and the Transition to the Early Iron Age. International Workshop held at the Austrian Academy of Sciences at Vienna, February 23rd and 24th 2007*, edited by S. Deger-Jakotzy and A. Baehle, 15-40. Vienna: Verlag der Osterreichischen Akademie der Wissenschaften.
- Andreu, S. 2010. 'Northern Aegean.' In *The Oxford Handbook of the Bronze Age Aegean*, edited by E. H. Cline, 643-658. Oxford: Oxford University Press.
- Andreu, S. 2014. 'Εκατό χρόνια έρευνας στην Εποχή του Χαλκού της Μακεδονίας: τι άλλαξε;' In *International Conference Proceedings «1912-2012: A Century of Research in Prehistoric Macedonia»*, *Archaeological Museum of Thessaloniki, 22-24 November 2012*, edited by E. Stefani, N. Merousis and A. Dimoula, 141-152. Thessaloniki: Archaeological Museum of Thessaloniki.
- Andreu, S. and K. Kotsakis. 1996 (1997). 'Η προϊστορική τούμπα της Θεσσαλονίκης. Παλιά και νέα ερωτήματα.' *To Archaeologiko Ergo sti Makedonia kai Thraki* 10: 369-87.
- Andreu, S. and K. Psaraki. 2007. Tradition and innovation in the Bronze Age pottery of Thessaloniki Toumba. In *The Struma/Strymon River Valley in Prehistory. Proceedings of the international symposium "Strymon Prehistoricus", 27. 09-1. 10. 2004. Kjustendil-Blagoevgrad-Serres-Amphipolis*, edited by M. Stefanovich, H. Todorova and G. Ivanov, 397-420. Sofia: Gerda Henkel Stiftung.
- Andreu, S. and K. Efkleidou. 2008 (2011). 'Η πανεπιστημιακή ανασκαφή στη Τούμπα Θεσσαλονίκης, 2008.' *To Archaeologiko Ergo sti Makedonia kai Thraki* 22: 323-328.
- Andreu, S., M. Fotiadis and K. Kotsakis. 1996. Review of Aegean prehistory V: the Neolithic and Bronze Age of Northern Greece. *American Journal of Archaeology* 100: 537-597.
- Andreu, S., K. Efkleidou, and S. Triantafyllou. 2010 (2014). 'Η πανεπιστημιακή ανασκαφή στην Τούμπα Θεσσαλονίκης.' *To Archaeologiko Ergo sti Makedonia kai Thraki* 24: 359-64.

- 1
2
3 Anyia, A., J. Slaski, J. Nyachiro, D. Archambault and P. Juskiw. 2007. 'Relationship
4 of carbon isotope discrimination to water use efficiency and productivity of
5 barley under field and greenhouse conditions.' *Journal of Agronomy and Crop
6 Science* 193: 313-323.
- 7
8 Araus, J.L., A. Febrero, R. Buxo, M. D. Camalich, D. Martin, F. Molina, M.O.
9 Rodriguez-Ariza and I. Romagosa. 1997. 'Changes in carbon isotope
10 discrimination in grain cereals from different regions of the western
11 Mediterranean Basin during the past seven millennia. Palaeoenvironmental
12 evidence of a differential change in aridity during the late Holocene.' *Global
13 Change Biology* 3: 107-118.
- 14 Binford, L. R. 1978. *Nunamiut Ethnoarchaeology*. New York: Academic Press.
- 15 Bintliff, J. 2012. *The Complete Archaeology of Greece: From Hunter-Gatherers to
16 the 20th Century A.D.* Oxford: Wiley-Blackwell.
- 17 Bogaard, A., T. H. E. Heaton, P. Poulton and I. Merbach. 2007. 'The impact of
18 manuring on nitrogen isotope ratios in cereals: archaeological implications for
19 reconstruction of diet and crop management practices.' *Journal of
20 Archaeological Science* 34: 335-343.
- 21 Bogaard, A., M. Charles, K.C. Twiss, A. Fairbairn, N. Yalman, D. Filipovic, G.A.
22 Demirergi, F. Ertuğ, N. Russell and J. Henecke. 2009. 'Private pantries and
23 celebrated surplus: storing and sharing food at Neolithic Çatalhöyük.'
24 *Antiquity* 83: 649-668.
- 25 Bogaard, A., R. A. Fraser, T. H. E. Heaton, M. Wallace, P. Vaiglova, M. Charles, G.
26 Jones, R. P. Evershed, A. K. Styring, N. H. Andersen, R.-M. Arbogast, L.
27 Bartosiewicz, A. Gardeisen, M. Kanstrup, U. Maier, E. Marinova, L. Ninov,
28 M. Schäfer and E. Stephan. 2013. Crop manuring and intensive land
29 management by Europe's first farmers. *Proceedings of the National Academy
30 of Sciences* 110 (31): 12589-12594.
- 31 Bogaard, A., J. Hodgson, E. Nitsch, G. Jones, A. Styring, C. Diffey, J. Pouncett, C.
32 Herbig, M. Charles, F. Ertuğ, O. Tugay, D. Filipovic and R. Fraser. 2016.
33 'Combining functional weed ecology and crop stable isotope ratios to identify
34 cultivation intensity: a comparison of cereal production regimes in Haute
35 Provence, France and Asturias, Spain.' *Vegetation History and Archaeobotany*
36 25: 57-73.
- 37 Bogucki, P. 1999. *The Origins of Human Society*. Oxford: Blackwell.
- 38 Bol, R., J. Eriksen, P. Smith, M. H. Garnett, K. Coleman and B. T. Christensen. 2005. 'The
39 natural abundance of ¹³C, ¹⁵N, ³⁴S and ¹⁴C in archived (1923-2000) plant and soil
40 samples from the Askov long-term experiments on animal manure and mineral
41 fertilizer.' *Rapid Communications in Mass Spectrometry* 19: 3216-3226.
- 42 Charles, M., E. Forster, M. Wallace, and G. Jones. 2015. "Nor ever lightning char thy
43 grain": establishing archaeologically relevant charring conditions and their effect on
44 glume wheat grain morphology.' *Science and Technology of Archaeological Research*
45 1.
- 46 Creuzieux, A. 2013. *Économie animale au cours de l'âge du Bronze en Grèce
47 septentrionale*. PhD thesis, Université Paul Valéry – Montpellier III.
- 48 DeNiro, M. J., 1985. 'Postmortem preservation and alteration of *in vivo* bone collagen
49 isotope ratios in relation to palaeodietary reconstruction.' *Nature* 317: 806-
50 809.
- 51 Drucker, D., H. Bocherens, A. Bridault and D. Billiou. 2003. 'Carbon and nitrogen
52 isotopic composition of red deer (*Cervus elaphus*) collagen as a tool for
53 tracking palaeoenvironmental change during the Late-Glacial and Early
54
55
56
57
58
59
60

- Holocene in the northern Jura (France).’ *Palaeogeography, Palaeoclimatology, Palaeoecology* 195: 375-88.
- Drucker, D. G., A. Bridault, K. A. Hobson, E. Szuma and H. Bocherens. 2008. ‘Can carbon-13 in large herbivores reflect the canopy effect in temperate and boreal ecosystems? Evidence from modern and ancient ungulates.’ *Palaeogeography, Palaeoclimatology, Palaeoecology* 266: 69-82.
- Ferrio, J. P., J. L. Araus, R. Buxó, J. Voltas and J. Bort. 2005. ‘Water management practices and climate in ancient agriculture: inferences from the stable isotope composition of archaeobotanical remains.’ *Vegetation History and Archaeobotany* 14: 510–517.
- Flannery, K. V. 2002. ‘The origins of the village revisited: from nuclear to extended households.’ *American Antiquity* 67: 417-433.
- Fraser, R. A., A. Bogaard, T. Heaton, M. Charles, G. Jones, B. T. Christensen, P. Halstead, I. Merbach, P. R. Poulton, D. Sparkes and A. K. Styring. 2011. ‘Manuring and stable nitrogen isotope ratios in cereals and pulses: towards a new archaeobotanical approach to the inference of land use and dietary practices.’ *Journal of Archaeological Science* 38: 2790–2804.
- Fraser, R. A., Bogaard, A., Schäfer, M., Arbogast, R.-M. and Heaton, T. H. E. H. 2013. ‘Integrating botanical, faunal and human stable carbon and nitrogen isotope values to reconstruct land use and palaeodiet at LBK Vaihingen an der Enz, Baden-Württemberg.’ *World Archaeology* 45: 492-517.
- Ghilardi, M., E. Fouache, F. Queyrel, G. Syrides, K. Vouvalidis, S. Kunesch, M. Styllas and S. Stiros. 2008. ‘Human occupation and geomorphological evolution of the Thessaloniki Plain (Greece) since the mid Holocene.’ *Journal of Archaeological Science* 35: 111-125.
- Halstead, P. 1989. ‘The economy has a normal surplus: economic stability and social change among early farming communities of Thessaly, Greece.’ In *Bad Year Economics: Cultural Responses to Risk and Uncertainty*, edited by P. Halstead and J. O’Shea, 68-80. Cambridge: Cambridge University Press.
- Halstead, P. 1990. ‘Waste not, want not: traditional responses to crop failure in Greece.’ *Rural History* 1: 147-164.
- Halstead, P. 1993. ‘Banking on livestock: indirect storage in Greek agriculture.’ *Bulletin on Sumerian Agriculture* 7: 63-75.
- Halstead, P. 1994. ‘The North-South divide: regional paths to complexity in prehistoric Greece.’ In *Development and Decline in the Mediterranean Bronze Age*, edited by C. Mathers and S. Stoddart, 195-219. Sheffield: J.R. Collis Publications.
- Halstead, P. 1995. ‘Plough and power: the economic and social significance of cultivation with the ox-drawn ard in the Mediterranean.’ *Bulletin on Sumerian Agriculture* 8: 11-22.
- Halstead, P. 2006a. ‘Sheep in the garden: the integration of crop and livestock husbandry in early farming regimes of Greece and southern Europe.’ In *Animals in the Neolithic of Britain and Europe*, edited by D. Serjeantson and D. Field, 42-55. Oxford: Oxbow.
- Halstead, P. 2006b. *What's ours is mine? Village and household in early farming society in Greece*. Achtentwintigste Kroon-Voordracht. Amsterdam: Stichting Nederlands Museum voor Anthropologie en Praehistorie.
- Halstead, P. 2007. ‘Carcasses and commensality: Investigating the social context of meat consumption in Neolithic and Early Bronze Age Greece.’ In *Cooking up the Past: Food and Culinary Practices in the Neolithic and Bronze Age Aegean*, edited by C. Mee and J. Renard, 25-49. Oxford: Oxbow.
- Halstead, P. 2014. *Two Oxen Ahead: Pre-Mechanised Farming in the Mediterranean*.

- Oxford: Wiley-Blackwell.
- Hänsel, B. and I. Aslanis (eds). 2010. *Das prähistorische Olynth: Ausgrabungen in der Toumba Agios Mamas 1994-1996. Die Grabung und der Baubefund.* Prähistorische Archäologie in Südosteuropa. Rahden, Westfalia: Verlag Marie Leidorf.
- Högberg, P. 1997. 'Tansley Review No. 95. ¹⁵N natural abundance in soil-plant systems.' *New Phytologist* 137: 179–203
- Hopkins, J. B. III and J. M. Ferguson. 2012. Estimating the diets of animals using stable isotopes and a comprehensive Bayesian mixing model. *PLoS ONE* 7: e28478. doi:10.1371/journal.pone.0028478.
- Isaakidou, V. 2006. 'Ploughing with cows: Knossos and the Secondary Products Revolution.' In *Animals in Neolithic Britain and Europe*, edited by D. Serjeantson and D. Field, 95-112. Oxford: Oxbow.
- Isaakidou, V. 2008. 'The fauna and economy of Neolithic Knossos revisited.' In *Escaping the Labyrinth: the Cretan Neolithic in Context*, edited by V. Isaakidou and P. Tomkins, 90-114. Oxford: Oxbow.
- Isaakidou, V. 2011. 'Farming regimes in Neolithic Europe: gardening with cows and other models.' In *The Dynamics of Neolithisation in Europe: Studies in Honour of Andrew Sherratt*, edited by A. Hadjikoymis, E. Robinson and S. Viner-Daniels, 90-112. Oxford: Oxbow.
- Isaakidou, V., P. Halstead, J. Davis, and S. Stocker. 2002. 'Burnt animal sacrifice at the Mycenaean 'Palace of Nestor', Pylos.' *Antiquity* 76: 86-92.
- Jiang, Q., D. Roche and D. Hole. 2006. 'Carbon isotope discrimination of two-rowed and six-rowed barley genotypes under irrigated and non-irrigated field conditions.' *Canadian Journal of Plant Science* 86: 433-441.
- Jones, G. 1992. 'Weed phytosociology and crop husbandry: identifying a contrast between ancient and modern practice.' *Review of Palaeobotany and Palynology* 73: 133-143.
- Jones, G. 2005. 'Garden cultivation of staple crops and its implications for settlement location and permanence.' *World Archaeology* 37: 164-176.
- Jones, G., and S. M. Valamoti. 2005. '*Lallemantia*, an imported or introduced oil plant in Bronze Age northern Greece.' *Vegetation History and Archaeobotany* 14: 571-577.
- Jones, G., K. Wardle, P. Halstead and D. Wardle. 1986. 'Crop storage at Assiros.' *Scientific American* 254: 96-103.
- Jones, G., A. Bogaard, P. Halstead, M. Charles, and H. Smith. 1999. Identifying the intensity of crop husbandry practices on the basis of weed floras. *Annual of the British School at Athens* 94: 167-189.
- Jung, R., S. Andreou, and B. Weninger. 2009. 'Synchronisation of Kastanas and Thessaloniki Toumba at the end of the Bronze and the beginning of the Iron Age.' In *LH III C Chronology and Synchronisms III. LH III C Late and the Transition to the Early Iron Age. International Workshop held at the Austrian Academy of Sciences at Vienna, 23-24.2.2007*, edited by S. Deger-Jakotzy and A. Baehle, 183-202. Wien: Verlag der Osterreichischen Akademie der Wissenschaften
- Kotsahristou, D. 2009. *Οι αρχαιοβοτανικές έρευνες στην προϊστορική Μακεδονία: η συμβολή των δεδομένων της Τούμπας Θεσσαλονίκης.* MA thesis, Aristotle University of Thessaloniki.
- Kragten, J. 1994. 'Calculating standard deviations and confidence intervals with a universally applicable spreadsheet technique. *Analyst* 119: 2161-2166.
- Kroll, H. J., 1983. 'Die Pflanzenfunde.' In *Kastanas. Ausgrabungen in einem Siedlungshügel der Bronze und Eisenzeit Makedoniens 1975-1979*, edited by B. Hänsel. Berlin: Spiess.

- 1
2
3 Lightfoot, E., N. Przelomska, M. Craven, T. C. O'Connell, L. He, H. V. Hunt and M. K.
4 Jones. 2016. 'Intraspecific carbon and nitrogen isotopic variability in foxtail millet
5 (*Setaria italica*).' *Rapid Communications in Mass Spectrometry* 30: 1465-1487.
- 6 Longin, R. 1971. 'New method of collagen extraction for radiocarbon dating.' *Nature* 230
7 (5291): 241-242.
- 8 Maniatis, I. 2014. 'Χρονολόγηση με άνθρακα-14 των μεγάλων πολιτισμικών αλλαγών στην
9 προϊστορική Μακεδονία: πρόσφατες εξελίξεις.' In *Εκατό Χρόνια Έρευνας στην*
10 *Προϊστορική Μακεδονία (1912-2012), Πρακτικά Διεθνούς Συνεδρίου, Αρχαιολογικό*
11 *Μουσείο Θεσσαλονίκης, 22-24 Νοεμβρίου 2012*, edited by E. Stefani, N. Merousis and
12 A. Dimoula, 205-220. Thessaloniki: Εκδόσεις Ζήτη.
- 13 Margomenou, D. 2008. 'Food storage in prehistoric Northern Greece: interrogating
14 complexity at the margins of the 'Mycenaean World'.' *Journal of Mediterranean*
15 *Archaeology* 21: 191-212.
- 16 Morehart, C. and De Lucia, K. 2015. 'Surplus: The politics of production and the
17 strategies of everyday life – an introduction.' In *Surplus: The Politics of*
18 *Production and the Strategies of Everyday Life*, edited by C. Morehart and K.
19 De Lucia, 3-43. Boulder: University Press of Colorado.
- 20 Nikolaidou, D. 2010. *Ανάλυση και μελέτη ζωοαρχαιολογικού υλικού από την Τούμπα*
21 *Θεσσαλονίκης (τομή 761, κτήριο Ζ, δρόμος XI)*. MA thesis, Aristotle
22 University of Thessaloniki.
- 23 Nitsch, E., L. Humphrey, L. and R. Hedges. 2011. 'Using stable isotope analysis to
24 examine the effect of economic change on breastfeeding practices in
25 Spitalfields, London, UK.' *American Journal of Physical Anthropology* 146:
26 619-628.
- 27 Nitsch, E. K., M. Charles and A. Bogaard. 2015. 'Calculating a statistically robust
28 $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ offset for charred cereal and pulse seeds.' *Science and*
29 *Technology of Archaeological Research* 1.
- 30 O'Connell, T. C., C. J. Kneale, N. Tasevska, G. G. C. Kuhnle. 2012. 'The diet-body
31 offset in human nitrogen isotopic values: A controlled dietary study.' *Am. J.*
32 *Phys. Anthropol.* 149: 426-434.
- 33 Papadopoulou, E. 2010. *Οι ψηλοκατασκευές του προϊστο-*
34 *ορικού οικισμού στο Αρχοντικό Γιαννι-*
35 *τσών: συμβολή στη μελέτη της τεχνολογί-*
36 *ας της τροφής*. PhD Thesis, Aristotle University of Thessaloniki.
- 37 Papadopoulou, E., and I. Maniatis 2013. 'Reconstructing thermal food processing
38 techniques: the application of FTIR spectroscopy in the analysis of clay
39 thermal structures from EBA Archontiko.' In *Diet, Economy and Society in*
40 *the Ancient Greek World: Towards a Better Integration of Archaeology and*
41 *Science*, edited by S. Voutsaki and S.-M. Valamoti, 113-122. Leuven: Peeters.
- 42 Papadopoulou, E., A. Papanthimou and I. Maniatis 2010 (2007). 'Ζητήματα
43 οργάνωσης του χώρου στο τέλος της Πρώιμ
44 ης εποχής του Χαλκούς τα νέα δεδομένα απ
45 ό το Αρχοντικό Γιαννιτσών.' *To Archaeologiko Ergo*
46 *sti Makedonia kai Thraki* 21: 77-82.
- 47 Papaefthymiou-Papanthimou, A. 2010. 'Η ανασκαφική έρευνα στον προϊστορικό οικισμό
48 του Αρχοντικού Γιαννιτσών.' *ΕΓΝΑΤΙΑ* 14: 257-274.
- 49 Papaefthymiou-Papanthimou, A and E. Papadopoulou 2014. 'Αρχοντικό Γιαννιτσών, ένας
50 οικισμός της Πρώιμης Εποχής του Χαλκού στη Μακεδονία.' In *Εκατό Χρόνια*
51 *Έρευνας στην Προϊστορική Μακεδονία (1912-2012), Πρακτικά Διεθνούς Συνεδρίου,*
52
53
54
55
56
57
58
59
60

- 1
2
3 Αρχαιολογικό Μουσείο Θεσσαλονίκης, 22-24 Νοεμβρίου 2012, edited by E. Stefani,
4 N. Merousis and A. Dimoula, 271-280. Thessaloniki: Εκδόσεις Ζήτη.
- 5 Papanthimou, A., S.-M. Valamoti, E. Papadopoulou, E. Tsagaraki and E. Voulgari
6 2013. 'Food storage in the context of an Early Bronze Age household
7 economy.' In *Diet, Economy and Society in the Ancient Greek World:
8 Towards a Better Integration of Archaeology and Science*, edited by S.
9 Voutsaki and S.-M. Valamoti, 103-112. Leuven: Peeters.
- 10 Pappa, M., P. Halstead, K. Kotsakis and D. Urem-Kotsou. 2004. 'Evidence for large-
11 scale feasting at Late Neolithic Makriyalos, north Greece.' In *Food, Cuisine
12 and Society in Prehistoric Greece*, edited by P. Halstead and J. Barrett, 16-44.
13 Oxford: Oxbow Books.
- 14 Petridou, C. 2014. *Αρχοντικό Γιαννιτσών, Τομή Γ: Τα Αρχαιοβοτανικά Δεδομένα*. MA thesis,
15 Aristotle University of Thessaloniki.
- 16 Peukert, S., R. Bol, W. Roberts, C. J. A. Macleod, P. J. Murray, E. R. Dixon and R. E.
17 Brazier. 2012. 'Understanding spatial variability of soil properties: a key step
18 in establishing field- to farm-scale agro-ecosystem experiments:
19 Understanding spatial variability of soil properties.' *Rapid Communications in
20 Mass Spectrometry* 26: 2413-2421.
- 21 Phillips, D. L. 2012. Converting isotope values to diet composition: the use of mixing
22 models. *Journal of Mammalogy* 93: 342-352. doi:10.1644/11-MAMM-S-
23 158.1
- 24 Phillips, D. L. and P. L. Koch. 2002. 'Incorporating concentration dependence in
25 stable isotope mixing models.' *Oecologia* 130: 114-125.
- 26 Pilali-Papasteriou, A., and A. Papaefthymiou-Papanthimou. 2002. 'Die Ausgrabungen auf der
27 Toumba von Archontiko.' *Prähistorische Zeitschrift* 77: 137-147.
- 28 Psaraki, K. and S. Andreou. 2010. 'Regional processes and interregional interactions
29 in northern Greece.' In *La Grèce continentale au Bronze Moyen – Η η π ε
30 ι ρ ω τ ι κ ή Ε λ λ ά δ α σ τ η Μ έ σ η Ε π ο χ ή τ ο υ Χ α λ κ
31 ο ύ – The Greek Mainland in the Middle Bronze Age*, edited by A. Philippa-
32 Touchais et al., 995-1003. Bulletin de correspondance hellénique: Supplément
33 52. Athens: École française d'Athènes.
- 34 Richards, M. P. and R. E. M. Hedges. 1999. 'Stable isotope evidence for similarities in the
35 types of marine foods used by late Mesolithic humans at sites along the Atlantic coast
36 of Europe.' *Journal of Archaeological Science*. 26: 717-722.
- 37 Riehl, S. 2009. 'Archaeobotanical evidence for the interrelationship of agricultural
38 decision-making and climate change in the ancient Near East.' *Quaternary
39 International* 197: 93-114.
- 40 Sage, R. F. and R. K. Monson. 1999. *C₄ Plant Biology*. London: Academic Press.
- 41 Schneider, H. K., 1957. 'The subsistence role of cattle among the Pakot and in East
42 Africa.' *American Anthropologist* 59: 278-300.
- 43 Styring, A., H. Manning, R. Fraser, M. Wallace, G. Jones, M. Charles, T. H. E.
44 Heaton, A. Bogaard and R. P. Evershed. 2013. 'The effect of charring and
45 burial on the biochemical composition of cereal grains: investigating the
46 integrity of archaeological plant material.' *Journal of Archaeological Science*
47 40: 4767-4779.
- 48 Styring, A.K., R.A. Fraser, R.-M. Arbogast, P. Halstead, V. Isaakidou, J.A. Pearson, M.
49 Schäfer, S. Triantaphyllou, S.M. Valamoti, M. Wallace, A. Bogaard, and R.P.
50 Evershed. 2015. 'Refining human palaeodietary reconstruction using amino acid δ
51 ^{15}N values of plants, animals and humans.' *Journal of Archaeological Science* 53:
52
53
54
55
56
57
58
59
60

- 1
2
3 504-515.
- 4 Styring, A., U. Maier, E. Stephan, H. Schlichtherle and A. Bogaard. 2016.
5 'Cultivation of choice: new insights into farming practices at Neolithic
6 lakeshore sites.' *Antiquity* 90: 95-110.
- 7 Styring, A., M. Rösch, E. Stephan, H.-P. Stika, E. Fischer, M. Sillmann and A.
8 Bogaard. in press. 'Centralisation and long-term change in farming regimes:
9 comparing agricultural practice in Neolithic and Iron Age south-west
10 Germany.' *Proceedings of the Prehistoric Society*.
- 11 Syrides, G., K. S. Albanakis, A. Pilali-Papasteriou, A. Papaefhtymiou-Papanthimou, M.
12 Ghilardi, E. Fouache, T. Paraschou, and Psomiadis D. 2009. 'Holocene
13 palaeogeography of the Northern margins of Giannitsa Plain in relation to the
14 prehistoric site of Archontiko (Macedonia - Greece).' *Zeitschrift für Geomorphologie*
15 53: 71-82.
- 16 Telioridou, E. 2013. *Αρχαιοβοτανική έρευνα της φάσης 3 στο Αρχοντικό Γιαννιτσών: οι τομές*
17 *Ε και ΣΤ*. MA thesis, Aristotle University of Thessaloniki.
- 18 Theodoropoulou, T. 2007. *L'exploitation de ressources aquatiques en Égée*
19 *septentrionale aux périodes pré- et protohistoriques*. PhD thesis, Université de
20 Paris I.
- 21 Thornton, B., G. Martin, M. Procee, D. R. Miller, M. Coull, H. Yao, S. J. Chapman,
22 G. Hudson, A. J. Midwood. 2015. 'Distributions of carbon and nitrogen
23 isotopes in Scotland's topsoil: a national-scale study.' *European Journal of*
24 *Soil Science* 66: 1002–1011.
- 25 Treasure, E.R., M. J. Church and D. R. Gröcke. 2015. 'The influence of manuring on
26 stable isotopes ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) in Celtic bean (*Vicia faba* L.):
27 archaeobotanical and palaeodietary implications.' *Archaeological and*
28 *Anthropological Sciences*: 1–8.
- 29 Triantaphyllou, S. 2001. *A Bioarchaeological Approach to Prehistoric Cemetery Populations*
30 *from Central and Western Greek Macedonia*. BAR International Series 976. Oxford:
31 Archaeopress.
- 32 Triantaphyllou, S. 2015. 'Stable isotope analysis of skeletal assemblages from prehistoric
33 northern Greece.' In *Archaeodiet in the Greek World: Dietary Reconstruction from*
34 *Stable Isotope Analysis*, edited by A. Papathanasiou, M. P. Richards and S. C. Fox.
35 Hesperia Supplementary Volume 49, 57-75. Athens: The American School of
36 Classical Studies at Athens.
- 37 Triantaphyllou, S. 2016. 'Constructing identities by ageing the body in the prehistoric
38 Aegean: the view through the human remains.' In *An Archaeology of*
39 *Prehistoric Bodies and Embodied Identities in the Eastern Mediterranean*,
40 edited by M. Mina, S. Triantaphyllou and Y. Papadatos, 160-168. Oxford:
41 Oxbow Monographs.
- 42 Vaiglova, P., A. Bogaard, M. Collins, W. Cavanagh, C. Mee, J. Renard, A. Lamb, A.
43 Gardeisen and R. Fraser. 2014a. 'An integrated stable isotope study of plants
44 and animals from Kouphovouno, southern Greece: a new look at Neolithic
45 farming.' *Journal of Archaeological Science* 42: 201-215.
- 46 Vaiglova, P., C. Snoeck, E. Nitsch, A. Bogaard and J. A. Lee-Thorp. 2014b.
47 'Investigating the most appropriate laboratory pre-treatment method on
48 archaeological charred grain/seed remains for stable isotope analysis ($\delta^{13}\text{C}$ and
49 $\delta^{15}\text{N}$).' *Rapid Communications in Mass Spectrometry* 28: 2497–2510.
- 50 Valamoti, S.M. 2004. *Plants and People in Late Neolithic and Early Bronze Age Northern*
51 *Greece: An archaeobotanical investigation*. British Archaeological Reports
52 International Series 1258. Oxford: Archaeopress.
- 53
54
55
56
57
58
59
60

- 1
2
3 Valamoti, S.M. 2002. 'Food remains from Bronze Age-Archondiko and Mesimeriani
4 Toumba in northern Greece?' *Vegetation History and Archaeobotany* 11: 17-
5 22.
- 6 Valamoti, S.M. 2016. 'Millet, the late comer: on the tracks of *Panicum miliaceum* in
7 prehistoric Greece.' *Vegetation History and Archaeobotany* 8: 51-63.
- 8 Valamoti, S.M., Papanthimou, A. and Pilali, A. 2008a. 'Cooking ingredients from Bronze
9 Age Archontiko: The archaeobotanical evidence.' In *Proceedings of the Symposium*
10 *of the Hellenic Society for Archaeometry: National Hellenic Research Foundation,*
11 *Athens 28-31 May, 2003*, edited by Y. Facorellis, N. Zacharias and K. Polikreti, 187-
12 194. Oxbow: Archaeopress.
- 13 Valamoti, S.M., D. Samuel, D., M. Bayram and E. Marinova. 2008b. Prehistoric
14 cereal foods from Greece and Bulgaria: investigation of starch microstructure
15 in experimental and archaeological charred remains. *Vegetation History and*
16 *Archaeobotany* 17 Suppl 1: 265-276
- 17 Vasileiadou, A. 2009. *Ανάλυση και ερμηνεία του ζωοαρχαιολογικού υλικού από το κτήριο Α*
18 *της Τούμπας Θεσσαλονίκης της Ύστερης Εποχής του Χαλκού*. MA thesis, Aristotle
19 University of Thessaloniki.
- 20 Vasileiadou, A., D. Nikolaidou, S. Andreou and K. Kotsakis. 2010. 'Στρατηγικές διαχείρισης
21 και κατανάλωσης των ζώων στην Τούμπα Θεσσαλονίκης κατά τη μέση και ύστερη
22 εποχή του Χαλκού.' *To Arkhaiologiko Ergo sti Makedonia kai Thraki* 24: 365-374.
- 23 Veropoulidou, R., S. Andreou and K. Kotsakis. 2008. 'Small scale purple-dye
24 production in the Bronze Age of Northern Greece: the evidence from the
25 Thessaloniki Toumba.' In *Purpureae Vestes II: Vestidos, Textiles y Tintes.*
26 *Estudios sobre la produccion de bienes de consume en la Antiguedad*, edited
27 by C. Alfaro and L. Karali, 171-180. Valencia: Universitat de Valencia.
- 28 Veropoulidou, R. 2011. *Όστρεα από τους οικισμούς του Θερμαϊκού Κόλπου:*
29 *ανασυνθέτοντας την κατανάλωση των μαλακίων στη Νεολιθική και την Εποχή*
30 *Χαλκού*. PhD thesis, Aristotle University of Thessaloniki.
- 31 Veropoulidou, R. 2014. 'Molluscan exploitation in the Neolithic and Bronze Age
32 communities at the former Thermaic Gulf, North Aegean.' In *Physis:*
33 *L'environnement naturel et la relation home-milieu dans le monde Égéen*
34 *protohistorique*, edited by G. Touchais, R. Laffineur and F. Rougemont, 415-424.
35 Leuven - Liège: Peeters.
- 36 Vika, E. and T. Theodoropoulou. 2012. Re-investigating fish consumption in Greek
37 antiquity: Results from d13C and d15N analysis from fish bone collagen. *Journal of*
38 *Archaeological Science* 39: 1618-1627.
- 39 Voltas, J., I. Romagosa, A. Lafarga, A. Armesto, A. Sombrero, J. Araus. 1999.
40 'Genotype by environmental interaction for grain yield and carbon isotope
41 discrimination of barley in Mediterranean Spain.' *Australian Journal of*
42 *Agricultural Research* 50: 1263-1271.
- 43 Wallace, M., G. Jones, M. Charles, R. Fraser, P. Halstead, T. H. E. Heaton and A.
44 Bogaard. 2013. 'Stable carbon isotope analysis as a direct means of inferring
45 crop water status and water management practices.' *World Archaeology* 45:
46 388-409.
- 47 Wallace, M. P., G. Jones, M. Charles, R. Fraser, T. H. E. Heaton and A. Bogaard.
48 2015. Stable carbon isotope evidence for Neolithic and Bronze Age crop water
49 management in the eastern Mediterranean and Southwest Asia. *PLoS ONE*
50 10(6): e0127085. doi:10.1371/journal.pone.0127085.
- 51 Wardle, K.A. and Wardle, D. 2007. 'Assiros Toumba – A brief history of the
52 settlement.' In *The Struma/Strymon River Valley in Prehistory*, edited by H.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Todorova, M. Stefanovich and G. Ivanov, 451-479. Sofia: Museum of History-Kyustendil.
Wardle, K., Higham, T., Kromer, B. 2014. 'Dating the End of the Greek Bronze Age: A Robust Radiocarbon-Based Chronology from Assiros Toumba.' *PLoS ONE* 9(9): e106672. doi:10.1371/journal.pone.0106672.

For Peer Review Only

Figure captions

Figure 1. Map of central Macedonian lowlands showing the study sites (stars) and other key sites mentioned in the text. Dark grey shading with horizontal lines indicates the lagoon zone and coastline in the Early Bronze Age (after Ghilardi et al. 2008); light grey shading with horizontal lines shows the present-day plain and coastline.

Figure 2. Plans of Archontiko: a. final EBA horizon 4, LBA horizon 1 (both redrawn from a plan provided by D. Isaakidou and E. Papadopoulou (pers. comm.) by Alison Wilkins).

Figure 3. Plan of Thessaloniki Toumba showing the excavated part of the Late Bronze Age settlement. Early LBA architectural remains (with MBA directly underneath) on the western side of the mound (drawn by G. Vlahodimos and provided by the Thessaloniki Toumba excavation archive).

Figure 4. Crop $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for a. EBA and b. LBA contexts at Archontiko. Shaded samples are those found within House A (see Fig. 2a).

Figure 5. Crop $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for a. MBA and b. LBA contexts at Thessaloniki Toumba. Shaded samples are those found within Building M and Building A (see Fig. 3).

Figure 6. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of faunal collagen from EBA and LBA Archontiko.

Figure 7. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of faunal collagen from MBA, MBA-early LBA and late LBA Thessaloniki Toumba.

Figure 8. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of human and faunal bone collagen from Archontiko. The inset shows differences between the adult and subadults (neonates).

Figure 9. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of human and faunal bone collagen from Thessaloniki Toumba. The inset shows differences between males, females and subadults.

Figure 10. Beeswarm plot comparing $\Delta^{13}\text{C}$ from EBA and LBA Archontiko, MBA and LBA Thessaloniki Toumba and Neolithic Kouphovouno (Vaiglova et al. 2014). Dashed horizontal lines represent “well-watered”, “moderately-watered” and “poorly-watered” reference lines based on studies of modern crops in different agronomic conditions (Wallace et al. 2013). The reference lines for barley assume a mixture of two- and six-row varieties.

Figure 11. Beeswarm plot comparing $\delta^{15}\text{N}$ values from EBA and LBA Archontiko, MBA and LBA Thessaloniki Toumba and Neolithic Kouphovouno (Vaiglova et al. 2014). Shaded regions represent the 1 sd range of the estimated herbivore forage values, calculated from the mean \pm 1 sd range collagen $\delta^{15}\text{N}$ values of wild herbivores (deer and aurochs), subtracting 4‰ to approximate the trophic level effect for collagen. For Kouphovouno, single values based on one wild goat and one wild boar are shown as dashed lines.

1
2
3 Figure 12. Pulse $\Delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values from a. MBA Thessaloniki Toumba and b.
4 LBA Archontiko. The shaded region shows the 50% confidence region of modern
5 pulses grown under different conditions in Evvia, Greece (Fraser et al. 2011; Wallace
6 et al. 2013).
7

8
9 Figure 13. Distribution of $\delta^{13}\text{C}$ values for domesticated fauna from Archontiko and
10 Toumba, with cattle values highlighted.

11
12 Figure 14. 1sd $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ range of the seven selected food groups.
13

14
15 Figure 15. Examples of different dietary combinations (barplot inset) and their
16 estimated human collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values (shaded region) compared to the
17 actual human collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values from Thessaloniki Toumba. Models A-C
18 achieve excellent overlap between hypothetical and actual human isotope ratios,
19 models D-H have good overlap, while models I-L are examples of implausible dietary
20 combinations with poor overlap.
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

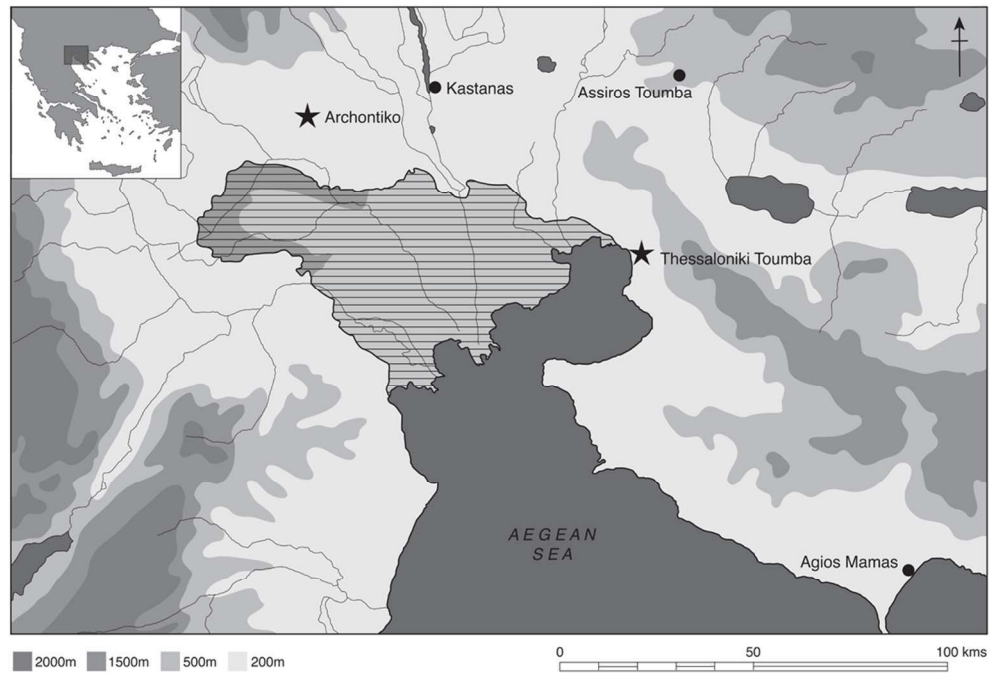


Figure 1. Map of central Macedonian lowlands showing the study sites (stars) and other key sites mentioned in the text. Dark grey shading with horizontal lines indicates the lagoon zone and coastline in the Early Bronze Age (after Ghilardi et al. 2008); light grey shading with horizontal lines shows the present-day plain and coastline.

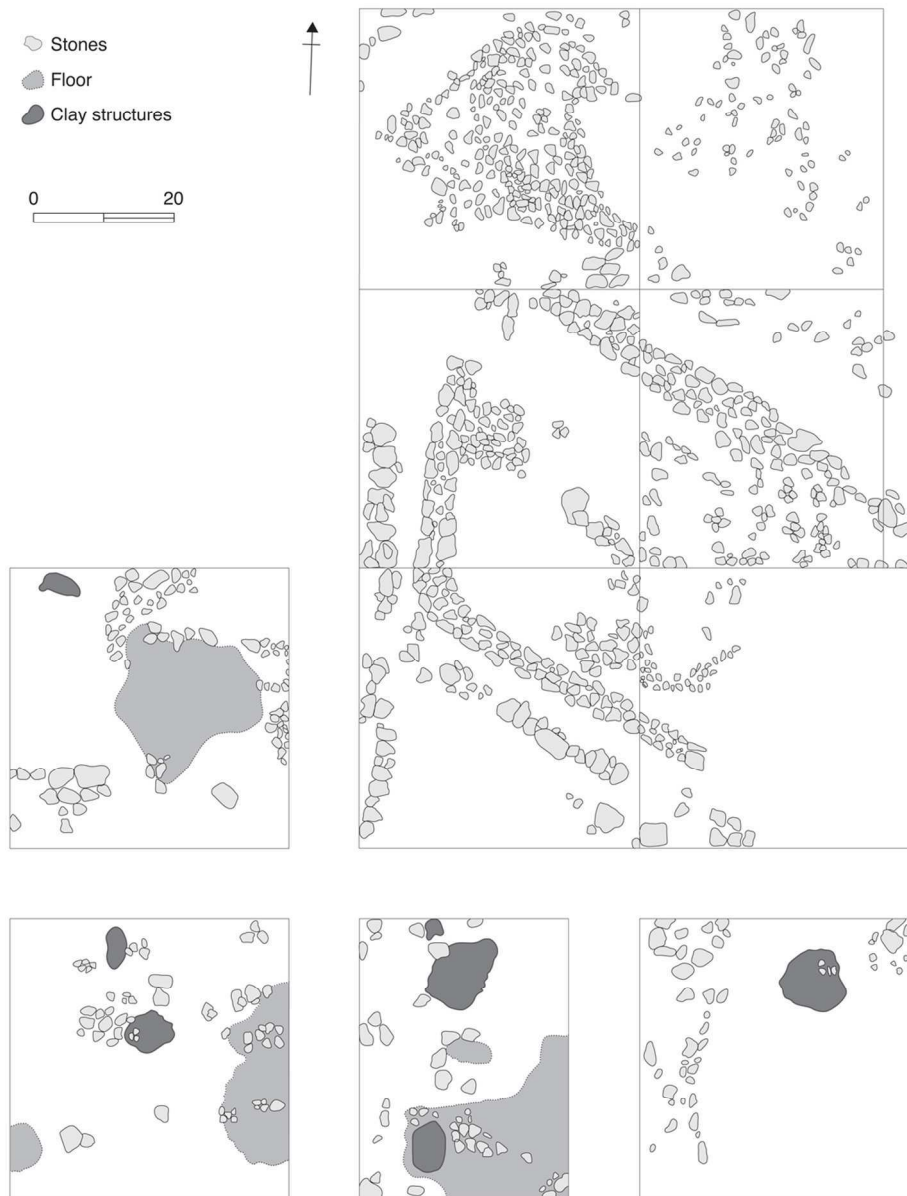
99x67mm (300 x 300 DPI)



Figure 2. Plans of Archontiko: a. final EBA horizon 4, LBA horizon 1 (both redrawn from a plan provided by D. Isaakidou and E. Papadopoulou (pers. comm.) by Alison Wilkins).

99x103mm (300 x 300 DPI)





46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Figure 2. Plans of Archontiko: a. final EBA horizon 4, LBA horizon 1 (both redrawn from a plan provided by D. Isaakidou and E. Papadopoulou (pers. comm.) by Alison Wilkins).

99x130mm (300 x 300 DPI)

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

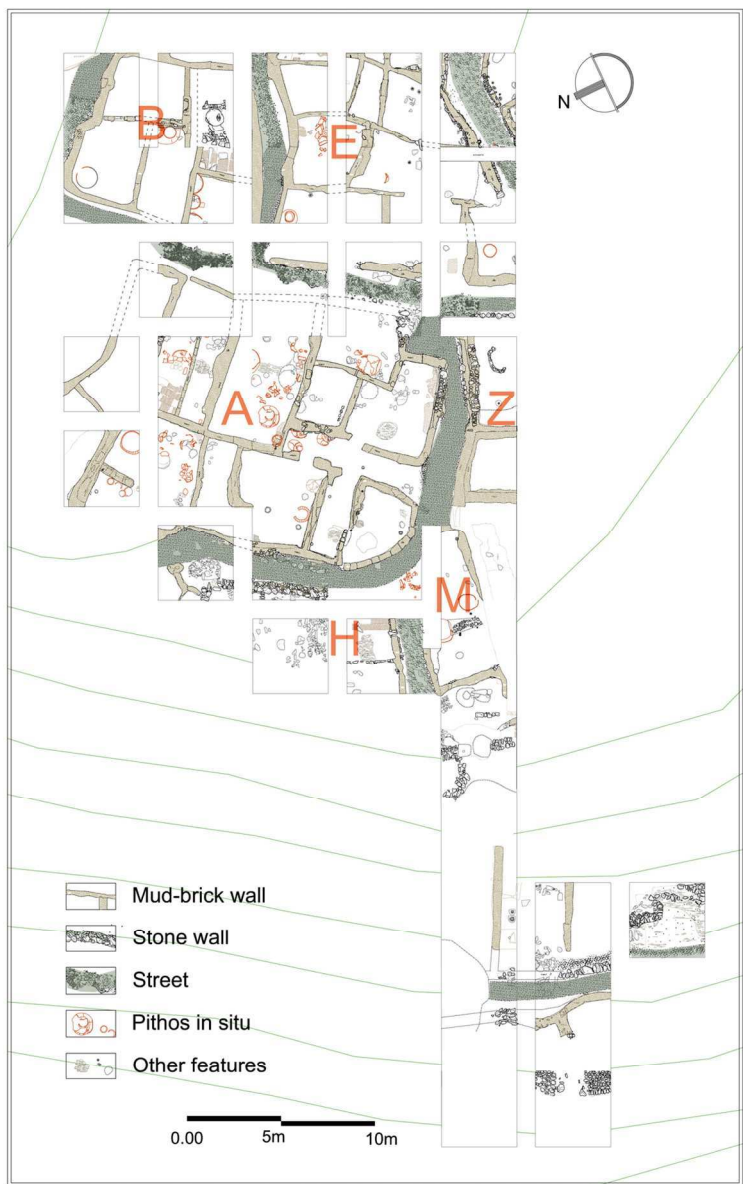


Figure 3. Plan of Thessaloniki Tomba showing the excavated part of the Late Bronze Age settlement. Early LBA architectural remains (with MBA directly underneath) on the western side of the mound (drawn by G. Vlahodimos and provided by the Thessaloniki Tomba excavation archive).

99x156mm (300 x 300 DPI)



Figure 3. Plan of Thessaloniki Tomba showing the excavated part of the Late Bronze Age settlement. Early LBA architectural remains (with MBA directly underneath) on the western side of the mound (drawn by G. Vlahodimos and provided by the Thessaloniki Tomba excavation archive).

99x156mm (300 x 300 DPI)

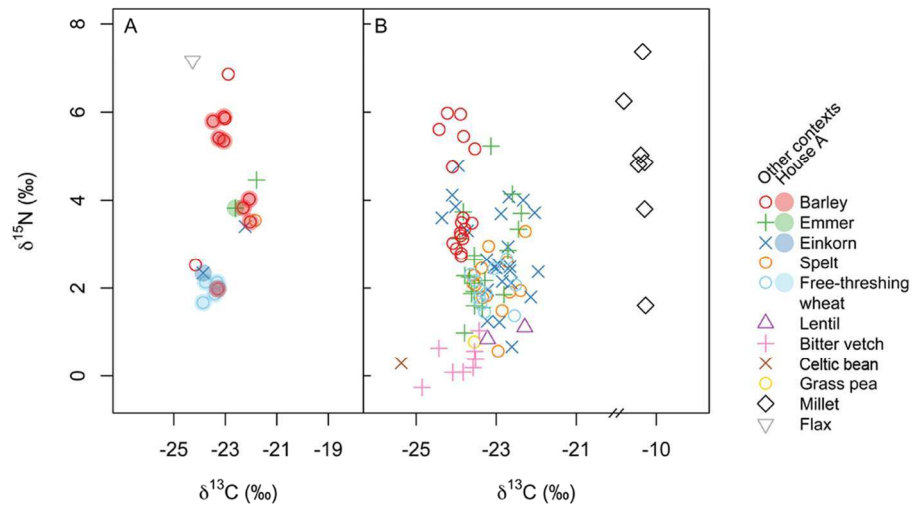


Figure 4. Crop $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for a. EBA and b. LBA contexts at Archontiko. Shaded samples are those found within House A (see Fig. 2a).

119x70mm (300 x 300 DPI)

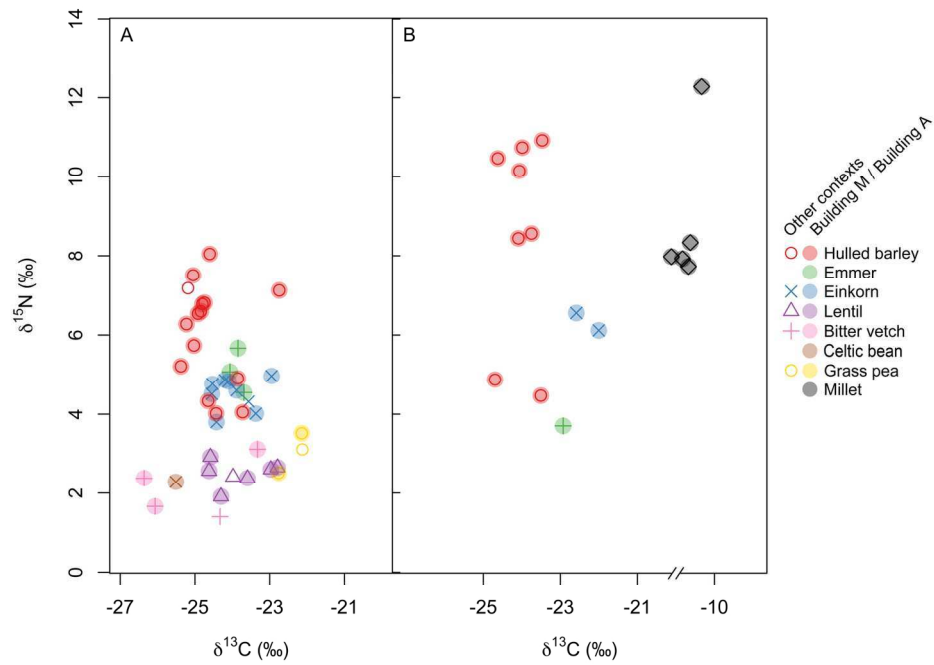


Figure 5. Crop $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for a. MBA and b. LBA contexts at Thessaloniki Toumba. Shaded samples are those found within Building M and Building A (see Fig. 3).

158x113mm (300 x 300 DPI)

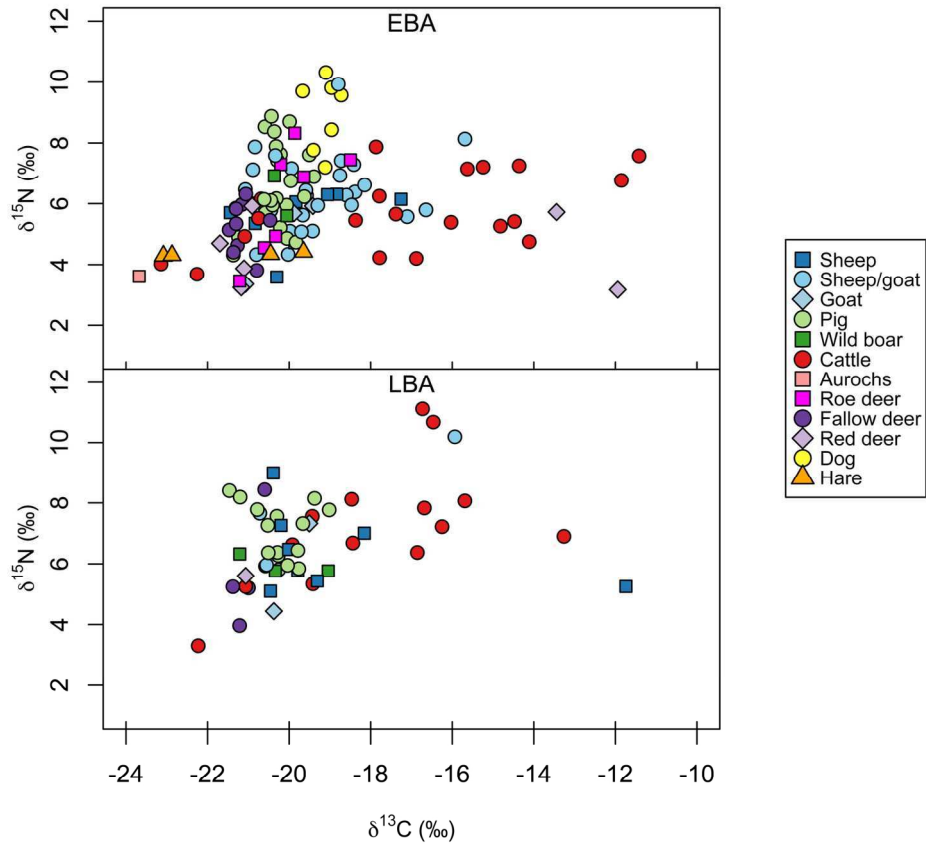


Figure 6. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of faunal collagen from EBA and LBA Archontiko.

154x138mm (300 x 300 DPI)

Only

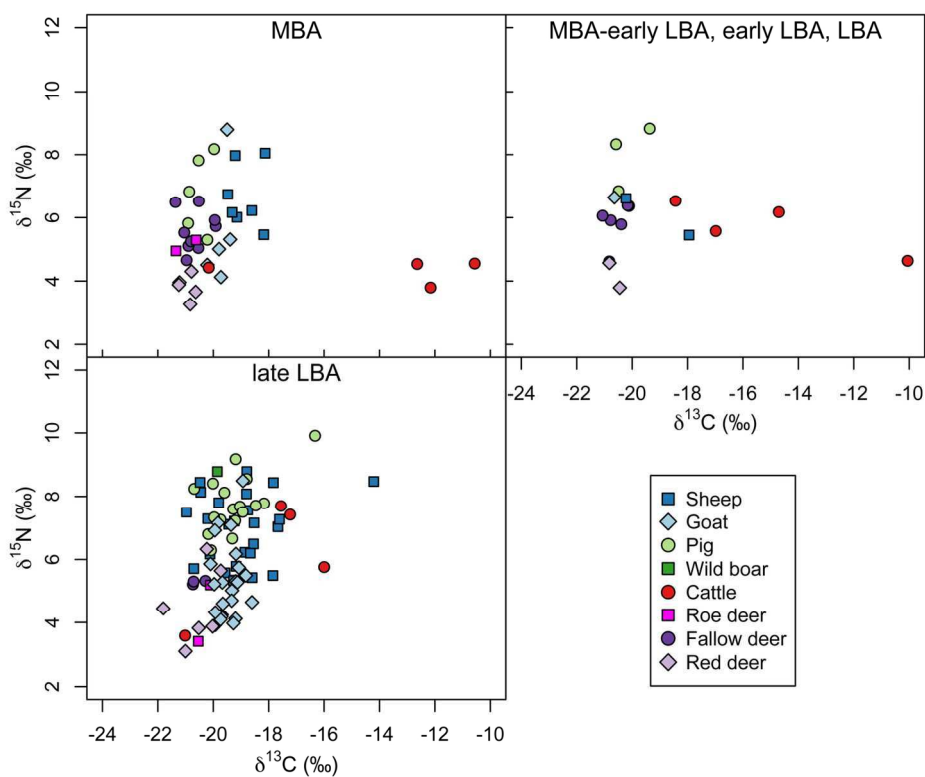


Figure 7. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of faunal collagen from MBA, MBA-early LBA and late LBA Thessaloniki Tombs.

148x122mm (300 x 300 DPI)

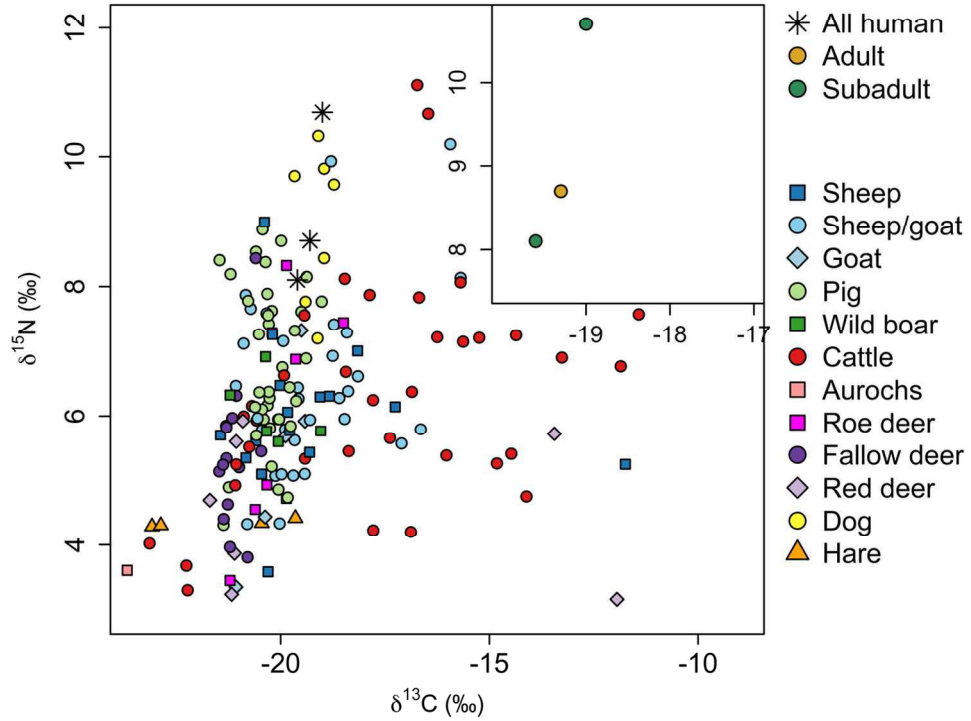


Figure 8. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of human and faunal bone collagen from Archontiko. The inset shows differences between the adult and subadults (neonates).

126x104mm (300 x 300 DPI)

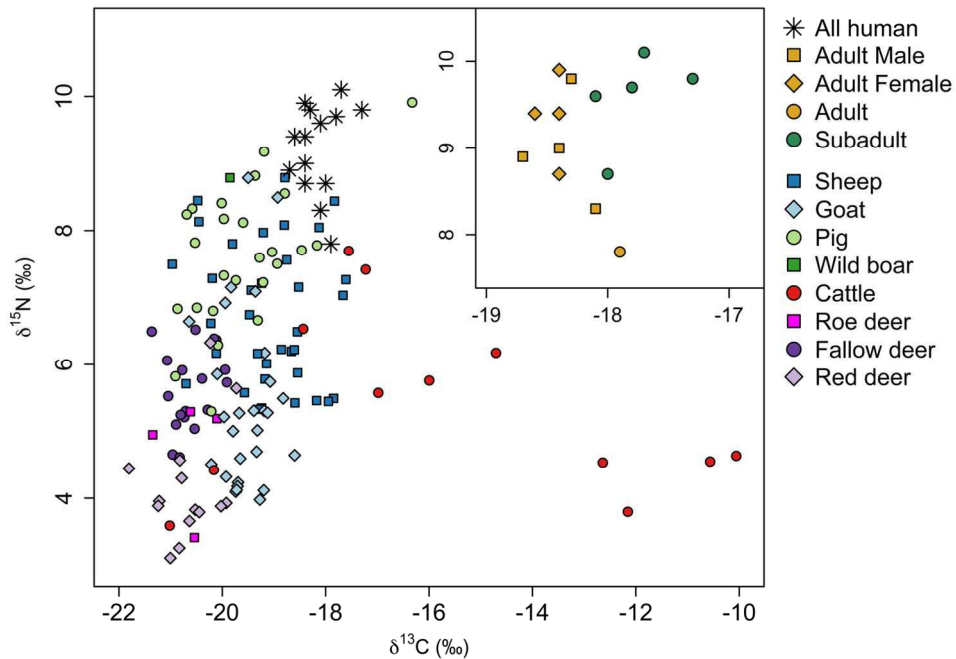


Figure 9. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of human and faunal bone collagen from Thessaloniki Toumba. The inset shows differences between males, females and subadults.

134x100mm (300 x 300 DPI)

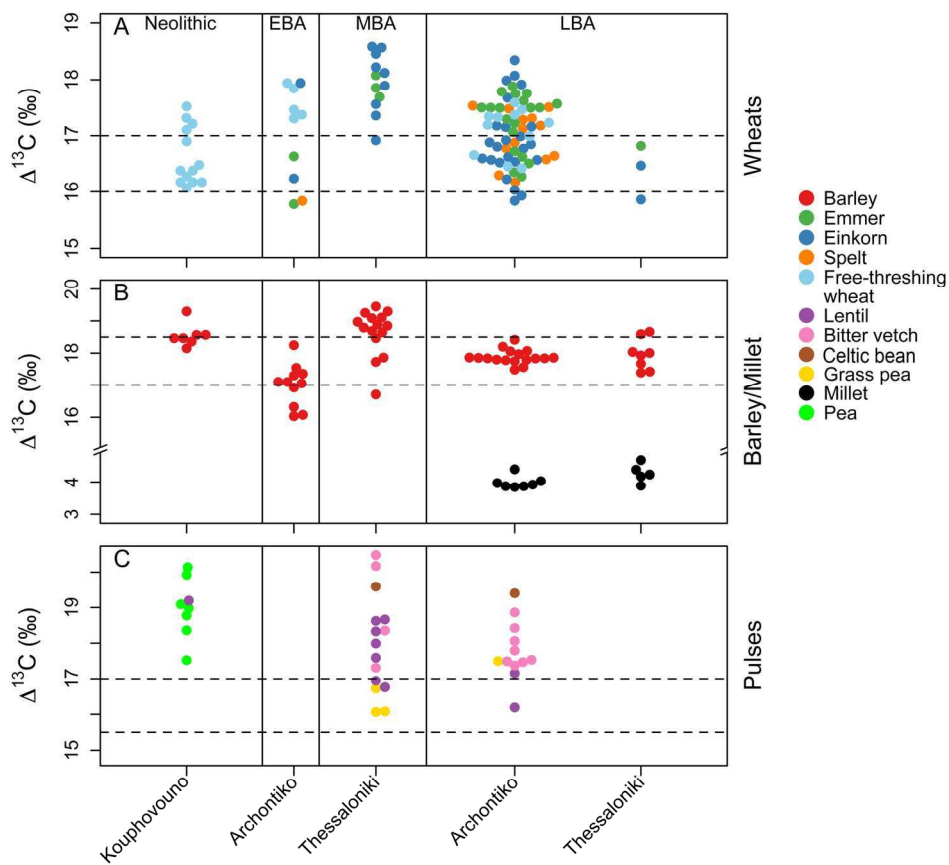


Figure 10. Beeswarm plot comparing $\Delta^{13}\text{C}$ from EBA and LBA Archontiko, MBA and LBA Thessaloniki Toumba and Neolithic Kouphovouno (Vaiglova et al. 2014). Dashed horizontal lines represent "well-watered", "moderately-watered" and "poorly-watered" reference lines based on studies of modern crops in different agronomic conditions (Wallace et al. 2013). The reference lines for barley assume a mixture of two- and six-row varieties.

158x140mm (300 x 300 DPI)

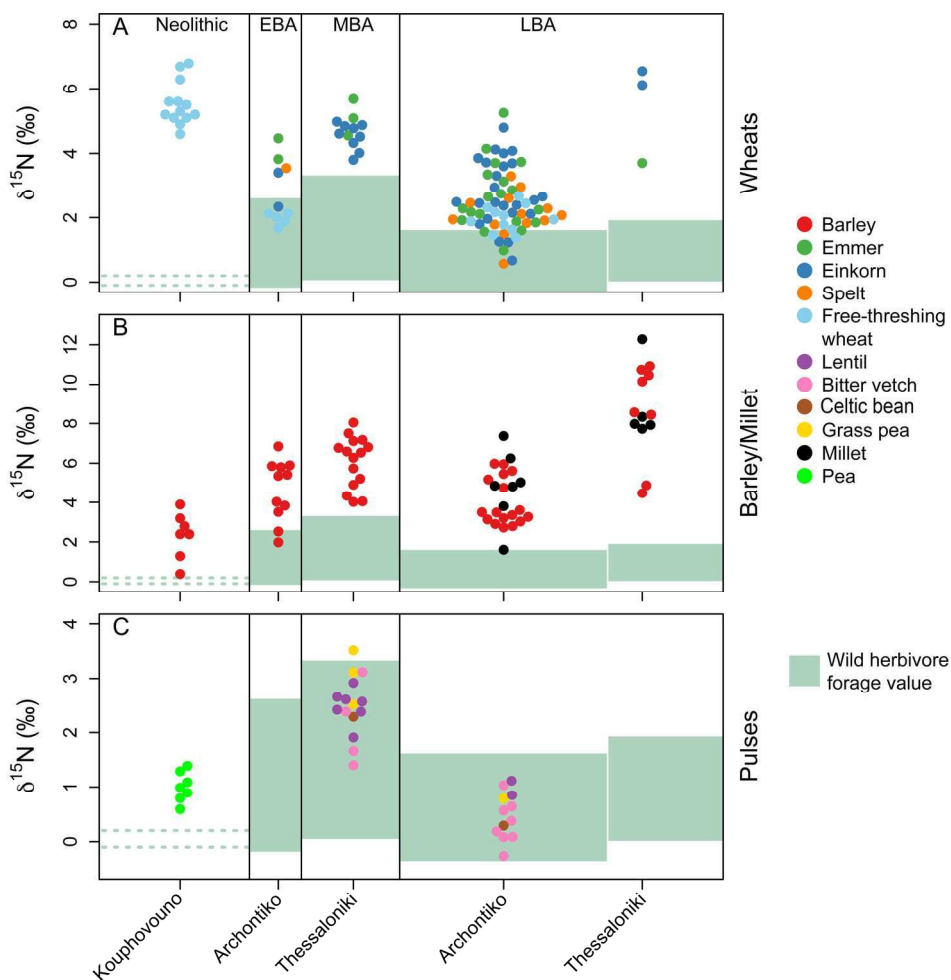


Figure 11. Beeswarm plot comparing $\delta^{15}\text{N}$ values from EBA and LBA Archontiko, MBA and LBA Thessaloniki Toumba and Neolithic Kouphovouno (Vaiglova et al. 2014). Shaded regions represent the 1 sd range of the estimated herbivore forage values, calculated from the mean \pm 1 sd range collagen $\delta^{15}\text{N}$ values of wild herbivores (deer and aurochs), subtracting 4‰ to approximate the trophic level effect for collagen. For Kouphovouno, single values based on one wild goat and one wild boar are shown as dashed lines.

177x177mm (300 x 300 DPI)



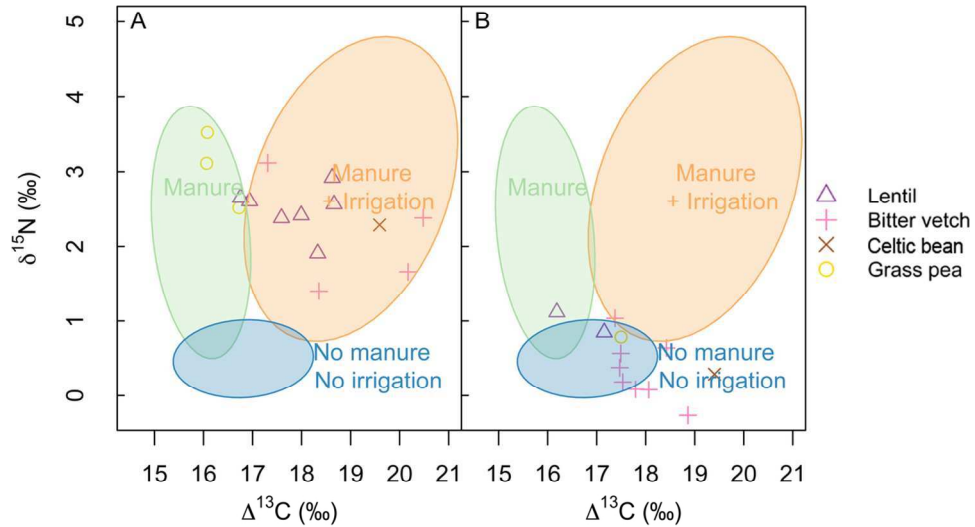


Figure 12. Pulse $\Delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values from a. MBA Thessaloniki Toumba and b. LBA Archontiko. The shaded region shows the 50% confidence region of modern pulses grown under different conditions in Evvia, Greece (Fraser et al. 2011; Wallace et al. 2013).

116x76mm (300 x 300 DPI)

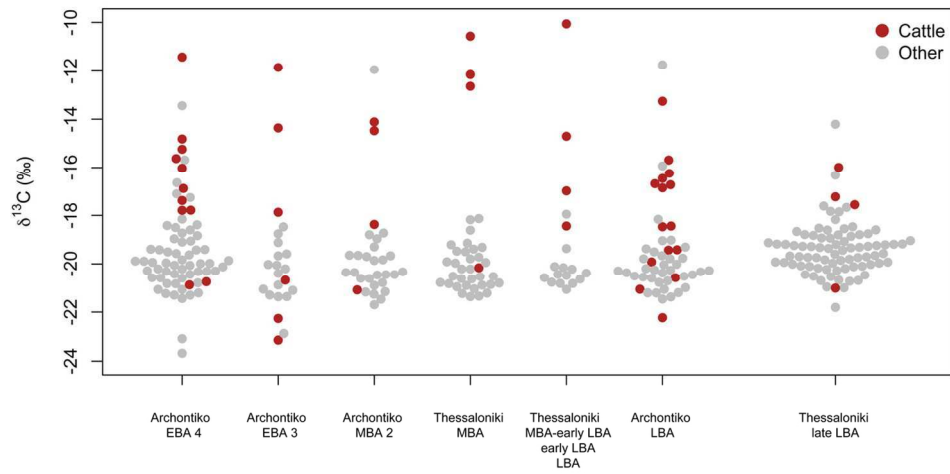


Figure 13. Distribution of $\delta^{13}\text{C}$ values for domesticated fauna from Archontiko and Toumba, with cattle values highlighted.

121x62mm (300 x 300 DPI)

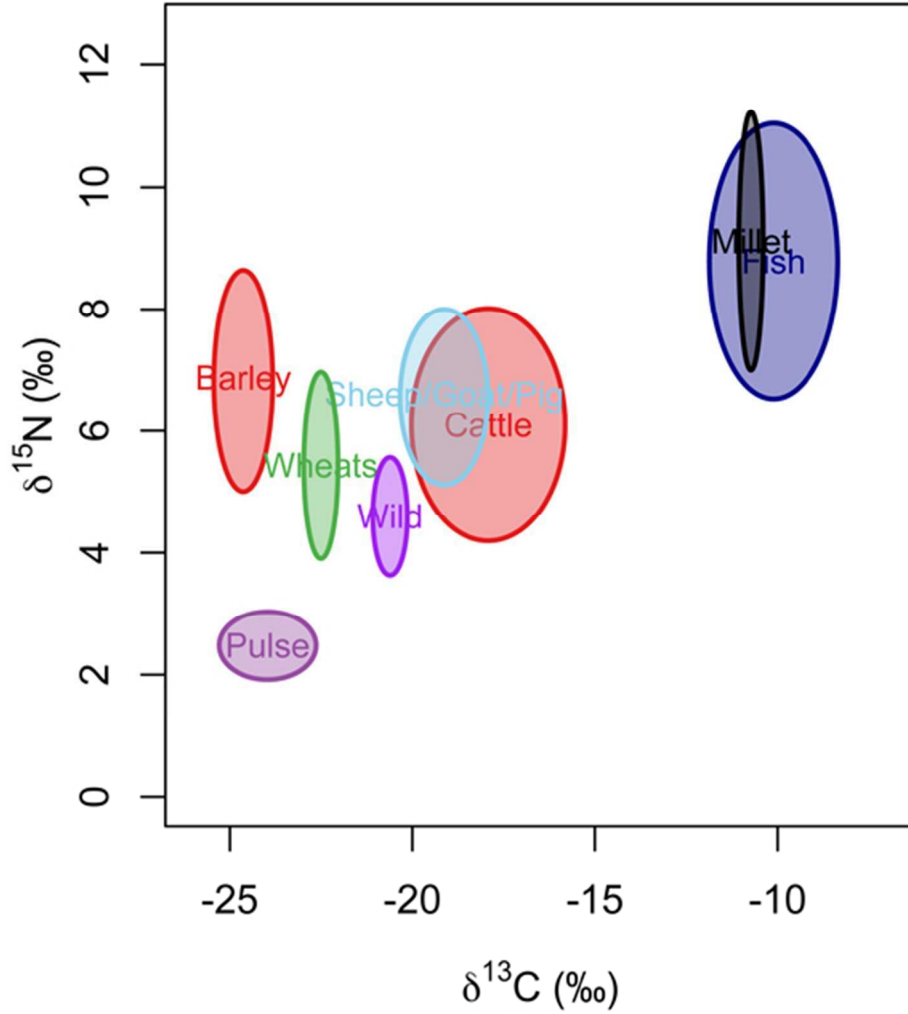


Figure 14. 1s $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ range of the seven selected food groups.

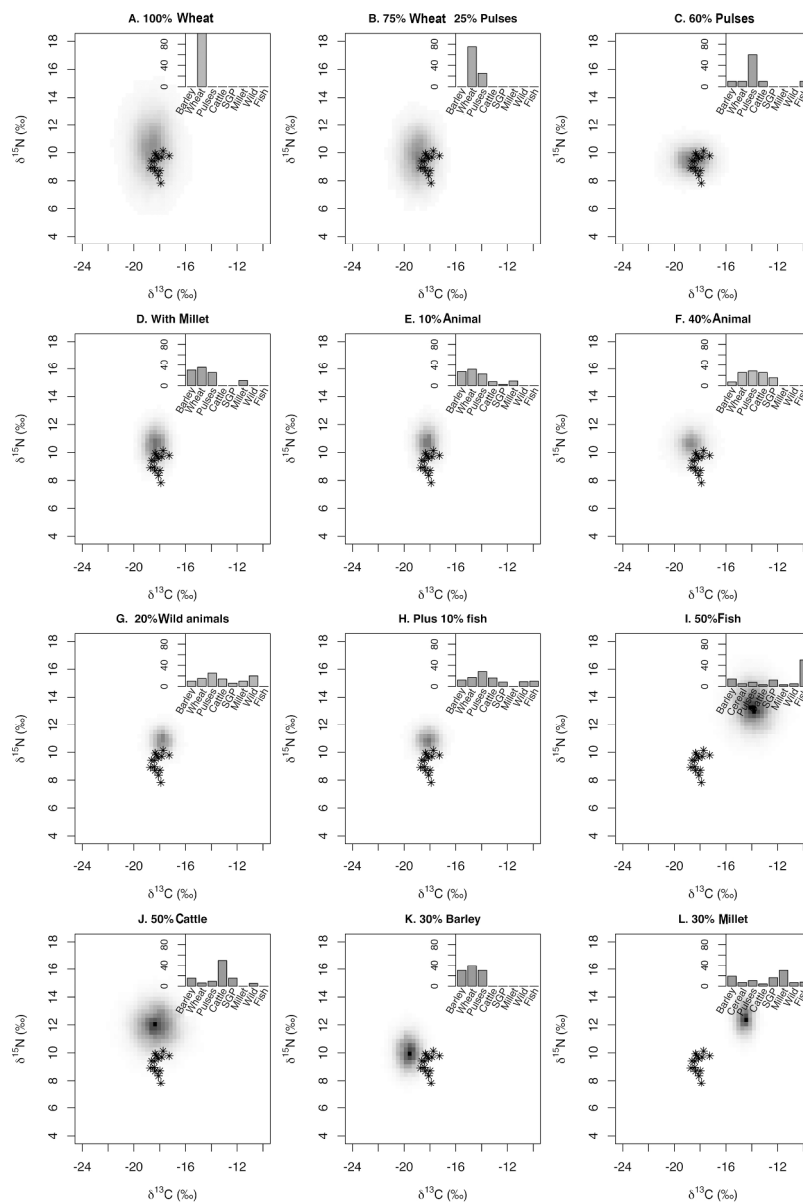


Figure 15. Examples of different dietary combinations (barplot inset) and their estimated human collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values (shaded region) compared to the actual human collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values from Thessaloniki Toumba. Models A-C achieve excellent overlap between hypothetical and actual human isotope ratios, models D-H have good overlap, while models I-L are examples of implausible dietary combinations with poor overlap.

199x290mm (300 x 300 DPI)

Supplementary Table S1. $\delta^{13}\text{C}$ values of standards in each carbon isotope run.

Runfile	Alanine	sd1	CAFF	CAFFsd	CAFF2	CAFF2sd	CH6	CH6sd	CH7	CH7sd	SEAL	SEALsd	USGS40	USGS40sd
130909	-26.91	0.03									-13.26	0.01	-26.03	0.03
140617	-26.90	0.08	-34.45	0.44							-13.28	0.30		
140918	-26.89	0.03	-34.63	0.06							-13.17	0.03		
140922	-26.91	0.03	-34.72	0.04							-13.19	0.02		
140924	-26.89	0.03	-34.67	0.02							-13.18	0.04		
140925	-26.88	0.08	-34.68	0.02							-13.18	0.01		
140926	-26.92	0.03					-10.42	0.03	-31.95	0.05				
140929	-26.89	0.06					-10.31	0.08	-31.91	0.01				
141002	-26.58	0.73	-34.60	0.12										
141120	-26.84	0.18					-10.40	0.20	-32.02	0.20				
150713	-26.90	0.05	-34.73	0.08							-13.22	0.04		
150714	-26.89	0.07	-34.70	0.03							-13.19	0.04		
150715	-27.00	0.33	-34.71	0.46							-13.44	0.46		
150722	-26.91	0.10			-27.42	0.12					-12.94	0.28		
150723	-26.76	0.40	-32.51	3.21							-13.27	0.41		
140610A	-26.91	0.05	-34.66	0.11							-13.16	0.07		
140610B	-26.90	0.04	-34.47	0.18							-13.07	0.02		
140611A	-26.88	0.04	-34.72	0.19							-13.03	0.26		
140611B	-26.87	0.06	-34.45	0.14							-12.98	0.14		
140929B	-26.91	0.03					-10.41	0.02	-31.90	0.03				
140930A	-26.83	0.07	-34.56	0.46										
140930B	-26.88	0.03					-10.45	0.03	-31.91	0.08				
140930C	-26.82	0.36	-34.64	0.23										
141001B	-26.83	0.11	-33.59	1.76										
150108B	-26.87	0.05					-10.21	0.15	-31.71	0.09				

150121C	-26.95	0.06	-34.75	0.03							-13.25	0.07		
150206B	-26.91	0.09					-10.18	0.06	-31.70	0.13				
150209A	-26.85	0.12	-34.62	0.18							-13.26	0.19		
150209B	-26.93	0.10	-34.69	0.09							-13.23	0.07		
150211A	-26.53	0.31	-34.15	0.69										
160210B	-27.08	0.05				-27.68	0.04					-12.36	0.04	

Supplementary Table S2. $\delta^{15}\text{N}$ values of standards in each nitrogen isotope run.

Runfile	Alanine	sd1	CAFF	CAFFsd	CAFF2	CAFF2sd	N2	N2sd	SEAL	SEALsd	SEAL2	SEAL2sd	USGS40	USGS40sd
130909	-1.53	0.06							17.49	0.08			-4.48	0.08
140617	-1.63	0.15	-2.74	0.44					17.02	0.43				
140918	-1.55	0.12	-2.88	0.02					17.18	0.04				
140922	-1.48	0.08	-2.87	0.11					17.07	0.07				
140924	-1.55	0.06	-2.86	0.05					17.07	0.04				
140925	-1.47	0.18	-2.94	0.11					17.02	0.02				
140926	-1.81	0.13												
140929	-1.84	0.12												
141002	-1.44	0.38	-2.41	0.06			21.03	0.27						
141120	-0.70	2.64												
150713	-1.60	0.07	-3.22	0.05					17.29	0.10				
150714	-1.68	0.14	-3.20	0.03					17.24	0.05				
150715	-1.81	0.43	-3.43	0.32					16.87	0.74				
150722	-1.57	0.09			0.92	0.12			17.59	0.33				
150723	-1.50	0.61	-1.84	1.59					17.14	0.71				
140610A	-1.68	0.13	-2.97	0.04					17.01	0.10				
140610B	-1.64	0.12	-2.65	0.23					17.23	0.09				
140611A	-1.57	0.09	-2.84	0.15					17.24	0.14				
140611B	-1.50	0.05	-2.61	0.14					17.51	0.33				
140929B	-1.83	0.11												
140930A	-1.63	0.19	-2.18	0.16			20.60	0.08						
140930B	-1.87	0.14												
140930C	-1.54	0.25	-2.82	0.21			20.53	0.17						
141001B	-1.73	0.35	-2.34	0.20			20.54	0.15						
150110B	-1.70	0.24	-3.24	0.18			20.22	0.24						

150121C	-1.60	0.12	-3.00	0.07					17.26	0.06				
150206B	-1.88	0.26												
150209A	-1.69	0.20	-2.66	0.28					16.89	0.21				
150209B	-1.59	0.15	-2.65	0.09					16.97	0.25				
150211A	-1.60	0.27	-2.87	0.18			20.69	0.31						
150211B	-1.78	0.20	-3.28	0.47			20.34	0.21						
160210B	-1.53	0.05				1.14	0.05					16.35	0.03	

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49

Supplementary Table S3. Modelling parameters based on those reported for large omnivores (bears, pigs, humans in wild and captive studies – e.g. Hopkins et al. 2012; O’Connell et al. 2012). Digestible C and N is from Phillips and Koch 2002, as is %C and %N for animals. %C and %N for cereals and pulses is from modern fresh measurements as reported by Fraser et al. (2013) and Nitsch et al. (2015).

Parameters	$\Delta^{13}\text{C}$	$\Delta^{13}\text{Csd}$	$\Delta^{15}\text{N}$	$\Delta^{15}\text{Nsd}$	%C	%N	DigestC	DigestN
Cereals	4	1	5	1	45	1.6	47	3.5
Pulses	4	1	5	1	40	4	42	8
Animals	1	1.5	6.5	1.5	20	12	51	12

Supplementary Table S4. Results of stable isotope analysis of archaeobotanical samples from Archontiko.

ID	SU	Flot no.	House	Date	Phase	Species	No. seeds	Runfile C	%C	d13C raw	d13C (VPDB)	d13C (-0.11‰)	d13C sd	Runfile N	% N	d15N raw	d15N (AIR)	d15N (-0.31‰)	d15N sd	CN
ARB001	27012	1026	G	EBA	4	Flax	20	140926	61.3	-24.0	-24.2	-24.3	0.1	140930A	5.1	8.0	7.5	7.2	0.2	14.1
ARB002	6020	648	A	EBA	4	Free-threshing wheat	10	140926	60.1	-23.0	-23.1	-23.3	0.0	140930A	3.9	2.9	2.3	2.0	0.2	18.0
ARB003	6017	631	A	EBA	4	Free-threshing wheat	10	140926	67.5	-23.2	-23.3	-23.4	0.0	140930A	3.4	2.8	2.2	1.9	0.2	23.2
ARB004	6020	647	A	EBA	4	Free-threshing wheat	10	140926	65.2	-23.1	-23.2	-23.3	0.0	140930A	3.5	3.1	2.4	2.1	0.2	22.0
ARB005	6031	685	A	EBA	4	Free-threshing wheat	10	140926	59.3	-23.5	-23.7	-23.8	0.1	140930A	3.3	3.1	2.4	2.1	0.2	20.9
ARB006	6031	684	A	EBA	4	Free-threshing wheat	10	140930B	59.4	-23.6	-23.8	-23.9	0.1	141002	3.2	2.5	2.0	1.7	0.4	21.8
ARB007	23102	1031	E	EBA	4	Barley	15	140926	59.8	-22.7	-22.8	-22.9	0.0	140930A	3.9	7.7	7.2	6.9	0.2	17.7
ARB008	30023	1256	ST	EBA	4	Emmer	15	140926	57.7	-21.6	-21.7	-21.8	0.0	140930A	2.8	5.4	4.8	4.5	0.2	23.8
ARB009	6020	649	A	EBA	4	Emmer	10	140926	67.7	-22.4	-22.5	-22.6	0.0	140930A	3.4	4.7	4.1	3.8	0.2	23.6
ARB010	30023	1256	ST	EBA	4	Einkorn	20	140926	61.9	-22.0	-22.1	-22.2	0.0	140930A	3.1	4.3	3.7	3.4	0.2	23.0
ARB011	6031	684	A	EBA	4	Einkorn	10	140926	58.5	-23.6	-23.8	-23.9	0.1	140930A	3.5	3.3	2.7	2.3	0.2	19.5
ARB012	24211	1813	A	EBA	4	Barley	10	140926	62.1	-23.2	-23.4	-23.5	0.1	140930A	3.4	6.7	6.1	5.8	0.2	21.1
ARB013		2101		EBA		Barley	10	140926	60.5	-22.8	-22.9	-23.0	0.0	140930A	4.6	6.7	6.2	5.9	0.2	15.3
ARB014	6017	631	A	EBA	4	Barley	10	140926	68.5	-23.0	-23.1	-23.3	0.0	140930A	4.5	6.3	5.7	5.4	0.2	17.8
ARB015	6020	649	A	EBA	4	Barley	10	140926	66.4	-23.1	-23.2	-23.3	0.0	140930A	3.8	2.9	2.3	2.0	0.2	20.6
ARB016	6019	645	A	EBA	4	Barley	10	140926	61.3	-22.8	-22.9	-23.1	0.0	140930A	3.7	6.8	6.2	5.9	0.2	19.6
ARB017	6016	627	A	EBA	4	Barley	10	140926	62.8	-22.1	-22.2	-22.3	0.0	140930A	3.6	4.7	4.1	3.8	0.2	20.4
ARB018	6019	641	A	EBA	4	Barley	20	140926	63.8	-22.8	-23.0	-23.1	0.0	140930A	3.6	6.2	5.7	5.4	0.2	20.8
ARB019	6016	625	A	EBA	4	Barley	10	140926	61.1	-21.8	-22.0	-22.1	0.0	140930A	3.6	4.9	4.3	4.0	0.2	19.8
ARB020	6020	650	A	EBA	4	Barley	10	140926	61.4	-21.8	-21.9	-22.0	0.0	140930A	3.5	4.4	3.8	3.5	0.2	20.3
ARB021	30023	1255	ST	EBA	4	Barley	10	140926	58.4	-23.9	-24.1	-24.2	0.1	140930A	1.9	3.5	2.8	2.5	0.2	35.1
ARB022	30023	1256	ST	EBA	4	Spelt	15	140926	62.3	-21.6	-21.7	-21.8	0.0	140930A	2.9	4.5	3.9	3.6	0.2	25.3
ARB023		2029		LBA	1	Spelt	10	140926	58.8	-22.2	-22.3	-22.4	0.0	140930A	3.3	2.9	2.3	1.9	0.2	20.8

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49

ARB024		2044		LBA	1	Spelt	10	140926	64.3	-22.6	-22.7	-22.9	0.0	140930A	3.2	2.4	1.8	1.5	0.2	23.4
ARB025		2001		LBA	1	Spelt		140926	57.3	-22.7	-22.8	-23.0	0.0	140930A	4.9	1.5	0.9	0.6	0.2	13.6
ARB026		2039		LBA	1	Spelt	10	140926	60.6	-23.1	-23.2	-23.3	0.0	140930A	2.8	2.7	2.1	1.8	0.2	25.6
ARB027		2035		LBA	1	Spelt	10	140926	55.3	-23.3	-23.4	-23.5	0.1	140930A	3.1	3.0	2.4	2.1	0.2	20.7
ARB028		2045		LBA	1	Spelt	10	140926	58.2	-22.5	-22.6	-22.7	0.0	140930A	2.9	3.5	2.9	2.6	0.2	23.9
ARB029		2042		LBA	1	Spelt	10	140926	57.0	-23.0	-23.1	-23.2	0.0	140930A	3.0	2.8	2.1	1.8	0.2	22.0
ARB030		2034		LBA	1	Spelt	10	140926	64.3	-23.3	-23.5	-23.6	0.1	140930A	3.0	3.1	2.4	2.1	0.2	25.1
ARB031		2048		LBA	1	Spelt	10	140926	56.8	-23.0	-23.1	-23.2	0.0	140930A	2.6	3.9	3.3	3.0	0.2	25.6
ARB032		2052		LBA	1	Spelt	10	140926	69.5	-23.1	-23.3	-23.4	0.0	140930A	3.0	3.4	2.8	2.5	0.2	27.4
ARB033		2030		LBA	1	Spelt	5	140926	63.9	-22.0	-22.2	-22.3	0.0	140930A	4.0	4.2	3.6	3.3	0.2	18.6
ARB034		2043		LBA	1	Spelt	10	140926	66.9	-23.3	-23.5	-23.6	0.1	140930A	2.7	3.2	2.6	2.3	0.2	29.5
ARB035		2024		LBA	1	Spelt	10	140929	58.0	-22.4	-22.6	-22.7	0.1	140930A	3.1	2.9	2.2	1.9	0.2	21.6
ARB036	5029	1601		LBA?	1	Einkorn	5	140929	65.3	-23.4	-23.6	-23.7	0.1	140930C	4.2	3.7	3.6	3.3	0.3	18.2
ARB037	6028	1717		LBA?	1	Einkorn	10	140929	71.3	-21.7	-21.9	-22.0	0.1	140930C	3.3	4.2	4.0	3.7	0.3	25.1
ARB038		2034		LBA	1	Einkorn	10	140929	57.8	-22.9	-23.1	-23.2	0.1	140930C	3.0	2.4	2.3	2.0	0.3	22.1
ARB039		2030		LBA	1	Einkorn	10	140929	57.0	-22.6	-22.8	-22.9	0.1	140930C	5.0	1.7	1.5	1.2	0.3	13.3
ARB040	6028	1714		LBA?	1	Einkorn	8	140929	60.1	-23.7	-23.9	-24.0	0.1	140930C	3.4	4.3	4.2	3.9	0.3	20.5
ARB041		2029		LBA	1	Einkorn	10	140929	57.4	-21.7	-21.8	-22.0	0.1	140930C	3.4	2.8	2.7	2.4	0.3	19.6
ARB042		2038		LBA	1	Einkorn	10	140929	58.7	-22.5	-22.7	-22.9	0.1	140930C	3.0	2.6	2.5	2.2	0.3	22.7
ARB043		2044		LBA	1	Einkorn	10	140929	61.6	-22.8	-23.0	-23.1	0.1	140930C	3.6	2.9	2.8	2.5	0.3	20.1
ARB044		2045		LBA	1	Einkorn	10	140929	61.1	-22.6	-22.8	-22.9	0.1	140930C	3.3	4.1	4.0	3.7	0.3	21.5
ARB045		2035		LBA	1	Einkorn	10	140929	60.6	-22.4	-22.6	-22.7	0.1	140930C	3.8	2.8	2.7	2.4	0.3	18.4
ARB046	6020	1702		LBA?	1	Einkorn	10	140929	62.2	-23.8	-24.0	-24.1	0.1	140930C	3.3	4.6	4.4	4.1	0.3	22.2
ARB047		2024		LBA	1	Einkorn	10	140929	61.7	-22.4	-22.6	-22.7	0.1	140930C	2.8	2.9	2.8	2.5	0.3	25.4
ARB048		2048		LBA	1	Einkorn	10	140929	61.2	-22.4	-22.6	-22.7	0.1	140930C	3.5	3.4	3.3	3.0	0.3	20.4
ARB049	6028	1719		LBA?	1	Einkorn	5	140929	55.1	-23.6	-23.8	-24.0	0.1	140930C	2.9	5.2	5.1	4.8	0.3	22.0
ARB050		2028		LBA	1	Einkorn	10	140929	58.2	-22.3	-22.5	-22.6	0.1	140930C	6.0	1.1	1.0	0.7	0.3	11.3
ARB051	6024	1709		LBA?	1	Einkorn	10	140929	62.4	-22.9	-23.1	-23.2	0.1	140930C	3.4	3.1	3.0	2.7	0.3	21.7
ARB052	6019	1700		LBA?	1	Einkorn	10	140929	62.1	-24.1	-24.3	-24.4	0.1	140930C	3.1	4.0	3.9	3.6	0.3	23.6
ARB053		2042		LBA	1	Einkorn	10	140929	60.6	-22.7	-22.8	-23.0	0.1	140930C	3.4	3.0	2.9	2.5	0.3	20.7
ARB054		2032		LBA	1	Einkorn	10	140929	59.7	-22.4	-22.6	-22.7	0.1	140930C	4.3	4.5	4.4	4.1	0.3	16.2
ARB055		2052		LBA	1	Einkorn	10	140929	61.4	-22.7	-22.9	-23.0	0.1	140930C	3.2	2.9	2.8	2.5	0.3	22.5
ARB056		2001		LBA	1	Einkorn	10	140929	61.3	-21.8	-22.0	-22.1	0.1	140930C	3.5	2.2	2.1	1.8	0.3	20.7
ARB057		2039		LBA	1	Einkorn	10	140929	64.0	-22.3	-22.5	-22.6	0.1	140930C	2.9	2.5	2.4	2.1	0.3	25.5

1																					
2																					
3																					
4																					
5																					
6																					
7	ARB058		2043		LBA	1	Einkorn	10	140929	63.0	-22.9	-23.1	-23.2	0.1	140930C	5.9	1.7	1.6	1.3	0.3	12.5
8	ARB059		2014		LBA	1	Einkorn	10	140929	62.1	-22.0	-22.2	-22.3	0.1	140930C	3.1	4.4	4.3	4.0	0.3	23.5
9	ARB060	6028	1719		LBA?	1	Emmer	7	140929	61.4	-22.8	-23.0	-23.1	0.1	140930C	3.4	5.7	5.6	5.2	0.3	21.1
10	ARB061		2052		LBA	1	Emmer	10	140929	60.6	-23.4	-23.6	-23.7	0.1	140930C	3.1	2.7	2.6	2.3	0.3	22.9
11	ARB062	6019	1700		LBA?	1	Emmer	10	140929	61.1	-23.5	-23.7	-23.8	0.1	140930C	3.1	4.2	4.1	3.7	0.3	23.1
12	ARB063	6028	1717		LBA?	1	Emmer	10	140929	60.5	-23.6	-23.8	-23.9	0.1	140930C	3.8	3.6	3.4	3.1	0.3	18.7
13	ARB064		2042		LBA	1	Emmer	10	140929	61.0	-23.2	-23.4	-23.5	0.1	140930C	2.8	2.0	1.9	1.6	0.3	25.6
14	ARB065		2044		LBA	1	Emmer	10	140929	63.2	-23.2	-23.4	-23.6	0.1	140930C	3.0	2.4	2.2	1.9	0.3	24.8
15	ARB066		2048		LBA	1	Emmer	10	140929	62.7	-23.5	-23.7	-23.8	0.1	140930C	2.9	2.7	2.6	2.3	0.3	25.3
16	ARB067		2045		LBA	1	Emmer	10	140929	61.4	-23.2	-23.4	-23.6	0.1	140930C	3.1	3.1	3.0	2.7	0.3	23.5
17	ARB068		2001		LBA	1	Emmer	10	140929	60.2	-22.5	-22.7	-22.8	0.1	140930C	4.2	2.3	2.2	1.9	0.3	16.7
18	ARB069		2030		LBA	1	Emmer	5	140929B	63.9	-22.3	-22.5	-22.6	0.0	140930C	3.1	4.6	4.5	4.1	0.3	23.9
19	ARB070		2038		LBA	1	Emmer	6	140929B	61.5	-23.1	-23.2	-23.4	0.0	141001B	2.7	2.4	1.9	1.6	0.4	26.2
20	ARB071		2034		LBA	1	Emmer	10	140929B	62.1	-23.3	-23.5	-23.6	0.0	141001B	1.8	2.7	2.2	1.9	0.4	39.6
21	ARB072		2024		LBA	1	Emmer	10	140929B	77.8	-22.5	-22.6	-22.7	0.0	141001B	1.1	3.7	3.2	2.9	0.4	84.0
22	ARB073		2043		LBA	1	Emmer	10	140929B	62.4	-23.0	-23.2	-23.3	0.0	141001B	3.0	3.0	2.5	2.2	0.4	24.3
23	ARB074		2035		LBA	1	Emmer	10	140929B	63.4	-23.3	-23.4	-23.6	0.0	141001B	1.4	2.9	2.4	2.1	0.4	51.8
24	ARB075	6020	1702		LBA?	1	Emmer	6	140929B	70.5	-23.3	-23.4	-23.6	0.0	141001B	2.7	3.5	3.1	2.8	0.4	30.9
25	ARB076		2029		LBA	1	Emmer	10	140929B	60.4	-22.1	-22.3	-22.4	0.0	141001B	3.2	4.5	4.0	3.7	0.4	22.0
26	ARB077		2014		LBA	1	Emmer	10	140929B	76.8	-22.2	-22.3	-22.4	0.0	141002	2.8	4.2	3.7	3.4	0.4	31.8
27	ARB078		2039		LBA	1	Emmer	10	140929B	60.5	-23.5	-23.7	-23.8	0.0	141001B	1.7	1.8	1.3	1.0	0.4	42.5
28	ARB079		2024		LBA	1	Barley	10	140929B	79.8	-23.5	-23.7	-23.8	0.0	141001B	3.2	6.2	5.8	5.5	0.4	28.8
29	ARB080	6028	1719		LBA?	1	Barley	10	140929B	73.5	-24.2	-24.3	-24.4	0.0	141001B	3.2	6.4	5.9	5.6	0.4	26.7
30	ARB081		2031		LBA	1	Barley	10	140929B	62.0	-23.6	-23.7	-23.8	0.0	141001B	3.4	3.9	3.5	3.1	0.4	21.4
31	ARB082		2034		LBA	1	Barley	10	140929B	62.2	-23.3	-23.5	-23.6	0.0	141001B	3.2	4.3	3.8	3.5	0.4	23.0
32	ARB083	6022	1706		LBA?	1	Barley	10	140929B	76.1	-23.7	-23.9	-24.0	0.0	141001B	2.7	3.7	3.2	2.9	0.4	32.5
33	ARB084		2042		LBA	1	Barley	10	140929B	61.9	-23.8	-24.0	-24.1	0.0	141001B	2.9	3.8	3.3	3.0	0.4	25.2
34	ARB085		2028		LBA	1	Barley	10	140929B	65.5	-23.8	-24.0	-24.1	0.0	141001B	3.4	5.5	5.1	4.8	0.4	22.4
35	ARB086		2045		LBA	1	Barley	10	140929B	60.5	-23.6	-23.8	-23.9	0.0	141001B	3.2	4.3	3.8	3.5	0.4	22.1
36	ARB087		2032		LBA	1	Barley	10	140929B	63.4	-23.9	-24.1	-24.2	0.0	141001B	3.2	6.7	6.3	6.0	0.4	23.0
37	ARB088		2048		LBA	1	Barley	10	140929B	70.8	-23.5	-23.7	-23.8	0.0	141001B	1.3	4.1	3.7	3.4	0.4	62.0
38	ARB089		2039		LBA	1	Barley	10	140929B	70.1	-23.6	-23.7	-23.8	0.0	141001B	2.9	4.4	3.9	3.6	0.4	28.0
39	ARB090		2043		LBA	1	Barley	10	140929B	62.4	-23.6	-23.8	-23.9	0.0	141001B	1.0	3.6	3.1	2.8	0.4	75.5
40	ARB091		2044		LBA	1	Barley	10	140930B	62.7	-23.6	-23.8	-23.9	0.1	141002	2.9	4.1	3.5	3.2	0.4	25.5
41																					
42																					
43																					
44																					
45																					
46																					
47																					
48																					
49																					

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49

ARB092		2035		LBA	1	Barley	10	140929B	60.0	-23.6	-23.8	-23.9	0.0	141001B	3.3	4.1	3.6	3.3	0.4	21.1
ARB093		2052		LBA	1	Barley	10	140929B	58.6	-23.6	-23.8	-23.9	0.0	141001B	2.8	3.5	3.0	2.7	0.4	24.5
ARB094		2029		LBA	1	Barley	10	140929B	58.6	-23.3	-23.4	-23.5	0.0	141001B	3.1	5.9	5.5	5.2	0.4	21.9
ARB095		2030		LBA	1	Barley	10	140929B	62.2	-23.6	-23.8	-23.9	0.0	141001B	3.3	6.7	6.3	6.0	0.4	22.3
ARB096	6019	1700		LBA?	1	Grass pea	5	140930B	60.9	-23.3	-23.4	-23.6	0.1	141002	5.8	1.6	1.1	0.8	0.4	12.2
ARB097	5029	1600		LBA?	1	Lentil	6	140929B	59.7	-23.0	-23.1	-23.2	0.0	141001B	7.0	1.7	1.2	0.9	0.4	9.9
ARB098		2030		LBA	1	Bitter vetch	10	140929B	61.6	-23.3	-23.4	-23.5	0.0	141001B	5.1	1.2	0.7	0.4	0.4	14.0
ARB099		2001		LBA	1	Bitter vetch	10	140929B	63.3	-24.6	-24.7	-24.9	0.0	141001B	3.1	0.6	0.1	-0.3	0.4	24.2
ARB100		2029		LBA	1	Bitter vetch	10	140929B	72.9	-23.2	-23.3	-23.4	0.0	141001B	5.1	1.9	1.4	1.0	0.4	16.7
ARB101	6019	1700		LBA?	1	Broad bean	5	140929B	63.2	-25.1	-25.3	-25.4	0.0	141001B	2.4	1.1	0.6	0.3	0.4	30.6
ARB102	6019	1700		LBA?	1	Lentil	10	140929B	61.2	-22.0	-22.2	-22.3	0.0	141001B	6.3	1.9	1.4	1.1	0.4	11.3
ARB103		2014		LBA	1	Bitter vetch	10	140930B	60.6	-23.3	-23.4	-23.5	0.1	141001B	6.2	1.4	0.9	0.6	0.4	11.5
ARB104		2045		LBA	1	Bitter vetch	10	140930B	59.3	-23.6	-23.7	-23.8	0.1	141001B	5.9	0.9	0.4	0.1	0.4	11.8
ARB105		2009		LBA	1	Bitter vetch	10	140930B	59.8	-23.3	-23.5	-23.6	0.1	141001B	6.4	1.0	0.5	0.2	0.4	10.9
ARB106		2043		LBA	1	Bitter vetch	5	140930B	60.9	-23.8	-24.0	-24.1	0.1	141001B	5.5	0.9	0.4	0.1	0.4	12.9
ARB107		2052		LBA	1	Bitter vetch	10	140930B	62.1	-24.2	-24.3	-24.4	0.1	141002	6.0	1.5	1.0	0.6	0.4	12.2
ARB108		2034		LBA	1	Free-threshing wheat	10	140930B	61.5	-23.0	-23.1	-23.3	0.1	141002	3.0	2.7	2.2	1.9	0.4	24.0
ARB109		2030		LBA	1	Free-threshing wheat	5	140930B	60.7	-22.5	-22.6	-22.7	0.1	141002	2.5	3.5	3.0	2.7	0.4	28.0
ARB110		2048		LBA	1	Free-threshing wheat	10	140930B	62.4	-23.4	-23.5	-23.6	0.1	141002	2.8	3.2	2.6	2.3	0.4	26.3
ARB111		2039		LBA	1	Free-threshing wheat	10	140930B	60.0	-23.1	-23.3	-23.4	0.1	141002	3.0	2.8	2.3	1.9	0.4	23.6
ARB112		2043		LBA	1	Free-threshing wheat	10	140930B	61.7	-23.2	-23.3	-23.4	0.1	141002	2.9	2.6	2.1	1.8	0.4	24.5
ARB113		2024		LBA	1	Free-threshing wheat	10	140930B	63.1	-22.3	-22.4	-22.5	0.1	141002	3.1	2.9	2.4	2.1	0.4	24.2
ARB114		2045		LBA	1	Free-threshing wheat	10	140930B	61.5	-23.0	-23.2	-23.3	0.1	141002	3.2	2.3	1.8	1.5	0.4	22.4
ARB115		2048		LBA	1	Free-threshing wheat	10	140930B	61.6	-23.1	-23.3	-23.4	0.1	141002	3.1	2.5	1.9	1.6	0.4	23.4

ARB116	2035	LBA	1	Free-threshing wheat	10	140930B	60.8	-23.3	-23.4	-23.5	0.1	141002	2.7	3.0	2.5	2.2	0.4	25.9
ARB117	2001	LBA	1	Free-threshing wheat		140930B	58.5	-22.3	-22.4	-22.6	0.1	141002	4.4	2.2	1.7	1.4	0.4	15.6
ARB118	2052	LBA	1	Free-threshing wheat	10	140930B	60.8	-22.8	-23.0	-23.1	0.1	141002	3.1	3.3	2.8	2.4	0.4	22.9
ARB119	2014	LBA	1	Millet	10	150108B	60.0	-10.5	-10.7	-10.8	0.2	150110B	3.4	6.3	6.6	6.3	0.3	20.6
ARB120	2024	LBA	1	Millet	10	140930B	55.2	-10.2	-10.2	-10.3	0.0	141002	4.8	4.7	4.1	3.8	0.4	13.3
ARB121	2032	LBA	1	Millet	10	140930B	60.4	-10.2	-10.2	-10.3	0.0	141002	3.2	5.7	5.2	4.9	0.4	22.4
ARB122	2022	LBA	1	Millet	10	140930B	58.8	-10.2	-10.2	-10.3	0.0	141002	3.4	2.5	1.9	1.6	0.4	20.2
ARB123	2029	LBA	1	Millet	10	140930B	61.0	-10.2	-10.2	-10.3	0.0	141002	3.2	8.3	7.7	7.4	0.4	22.1
ARB124	2030	LBA	1	Millet	10	140930B	61.7	-10.3	-10.3	-10.4	0.0	141002	2.6	5.9	5.3	5.0	0.4	27.9
ARB125	2028	LBA	1	Millet	10	140930B	61.8	-10.3	-10.3	-10.5	0.0	141002	3.0	5.7	5.1	4.8	0.4	24.3

Supplementary Table S5. Results of stable isotope analysis of archaeobotanical samples from Thessaloniki Toumba.

ID	SU	Flot no.	Building	Area	Date	Species	No. seeds	Runfile C	%C	d13C raw	d13C (VPDB)	d13C (-0.11‰)	d13C sd	Runfile N	%N	d15N raw	d15N (AIR)	d15N (-0.31‰)	d15N sd	CN
TOB001	32197	1432	Building M	internal space	MBA	Emmer	3	141120	57.9	-23.5	-23.6	-23.7	0.2	150211B	3.7	4.6	4.9	4.6	0.4	18.3
TOB004	32343	1889	Building M	internal space	MBA	Emmer	5	141120	60.3	-23.6	-23.7	-23.9	0.2	150211B	3.1	5.8	6.0	5.7	0.4	22.6
TOB006	32393	1971	Building M		MBA	Emmer	7	141120	61.9	-23.9	-24.0	-24.1	0.2	150211B	3.2	5.2	5.4	5.1	0.4	22.8
TOB007	32197	1432	Building M	internal space	MBA	Einkorn	6	141120	61.2	-24.0	-24.1	-24.2	0.2	150211B	3.5	5.0	5.2	4.9	0.4	20.5
TOB008	32231	1444	Building M	internal space	MBA	Einkorn	5	141120	59.6	-24.3	-24.4	-24.5	0.2	150211B	3.8	4.9	5.1	4.8	0.4	18.5
TOB009	32260	1511	Building M	internal space	MBA	Einkorn	5	141120	58.3	-23.7	-23.8	-23.9	0.2	150211B	3.7	4.7	4.9	4.6	0.4	18.4
TOB010	32261	1512	Building M		MBA	Einkorn	3	141120	57.6	-24.2	-24.3	-24.4	0.2	150211B	3.2	3.9	4.1	3.8	0.4	21.4
TOB011	32268	1515	Building M		MBA	Einkorn	6	141120	59.1	-23.9	-24.0	-24.1	0.2	150211B	3.8	4.9	5.1	4.8	0.4	18.3
TOB012	32288	1520	Building M	internal space	MBA	Einkorn	6	141120	58.0	-23.2	-23.3	-23.4	0.2	150211B	4.4	4.1	4.3	4.0	0.4	15.5
TOB013	33253	1601	area west of Building M		MBA	Einkorn	5	141120	57.9	-23.4	-23.5	-23.6	0.2	150211B	3.8	4.4	4.6	4.3	0.4	18.0
TOB015	32343	1889	Building M	internal space	MBA	Einkorn	5	141120	60.2	-24.3	-24.4	-24.6	0.2	150211B	3.7	4.6	4.8	4.5	0.4	19.2
TOB017	53289	1892	Building M	external space	MBA	Einkorn	5	141120	60.9	-22.8	-22.8	-23.0	0.2	150211B	4.3	5.1	5.3	5.0	0.4	16.4
TOB019	71135	380	Building A	A6	LBA	Einkorn	6	141120	54.6	-22.4	-22.5	-22.6	0.2	150211B	7.5	6.7	6.9	6.6	0.4	8.5
TOB020	71085	687	Building A	A6	LBA	Einkorn	7	141120	58.0	-21.8	-21.9	-22.0	0.2	150211B	7.2	6.2	6.4	6.1	0.4	9.4
TOB021	71101	689	Building A	A6	LBA	Emmer	5	141120	62.4	-22.7	-22.8	-22.9	0.2	150211B	4.0	3.8	4.0	3.7	0.4	18.1
TOB022	242083	756	Building A	A10	LBA	Millet	26	141120	58.2	-10.5	-10.5	-10.6	0.3	150211B	5.3	8.5	8.6	8.3	0.3	12.8
TOB025	242118	779	Building A	A10	LBA	Millet	13	141120	58.6	-10.7	-10.7	-10.8	0.3	150211B	4.2	8.1	8.2	7.9	0.3	16.2
TOB026	244102	416	Building A	A5	LBA	Millet	15	141120	58.0	-11.0	-11.0	-11.1	0.3	150211B	4.5	8.1	8.3	8.0	0.3	15.1
TOB035	74084	40	Building A	A6	LBA	Millet	20	141120	56.4	-10.2	-10.2	-10.3	0.3	150211B	7.9	12.5	12.6	12.3	0.3	8.3
TOB036	32383	1938	Building M		MBA	Grass pea	4	141120	55.9	-21.9	-22.0	-22.1	0.2	150211B	8.1	3.6	3.8	3.5	0.4	8.0
TOB037	33253	1601	area west of Building M		MBA	Grass pea	3	141120	54.5	-21.9	-22.0	-22.1	0.2	150211B	7.0	3.2	3.4	3.1	0.4	9.2
TOB038	32197	1432	Building M	internal space	MBA	Grass pea	3	141120	54.6	-22.6	-22.7	-22.8	0.2	150211B	6.0	2.6	2.8	2.5	0.4	10.6
TOB039	32351	1932	Building M	internal space	MBA	Broad bean	2	141120	60.0	-25.3	-25.4	-25.5	0.2	150211B	5.7	2.3	2.6	2.3	0.4	12.2
TOB043	32268	1515	Building M		MBA	Bitter vetch	5	141120	58.2	-23.1	-23.2	-23.3	0.2	150211B	6.7	3.2	3.4	3.1	0.4	10.2
TOB044	33253	1601	area west of Building M		MBA	Bitter vetch	3	141120	56.9	-24.1	-24.2	-24.3	0.2	150211B	5.1	1.4	1.7	1.4	0.4	13.1
TOB045	32191	1121	Building M	internal	MBA	Bitter	10	141120	58.2	-26.1	-26.3	-26.4	0.2	150211B	6.0	2.4	2.7	2.4	0.4	11.4

				space		vetch															
8	TOB047	32260	1511	Building M	internal space	MBA	Bitter vetch	6	141120	57.7	-25.9	-26.0	-26.1	0.2	150211B	5.3	1.7	2.0	1.7	0.4	12.7
9	TOB050	32268	1515	Building M		MBA	Lentil	5	141120	59.4	-24.4	-24.5	-24.6	0.2	150211B	6.5	2.6	2.9	2.6	0.4	10.7
10	TOB051	32343	1889	Building M	internal space	MBA	Lentil	5	141120	59.0	-23.4	-23.5	-23.6	0.2	150211B	6.7	2.4	2.7	2.4	0.4	10.3
11	TOB052	32189	1120	Building M	internal space	MBA	Lentil	5	141120	59.3	-24.4	-24.5	-24.6	0.2	150211B	6.2	3.0	3.2	2.9	0.4	11.2
12	TOB054	32393	1971	Building M		MBA	Lentil	5	141120	57.5	-24.1	-24.2	-24.3	0.2	150211B	5.7	1.9	2.2	1.9	0.4	11.9
13	TOB055	32197	1432	Building M	internal space	MBA	Lentil	6	141120	59.6	-22.8	-22.9	-23.0	0.2	150211B	5.8	2.7	2.9	2.6	0.4	12.1
14	TOB059	32288	1520	Building M	internal space	MBA	Lentil	10	141120	56.9	-22.6	-22.7	-22.8	0.2	150211B	6.0	2.7	3.0	2.7	0.4	11.1
15	TOB060	33253	1601	Building M area west of Building M		MBA	Lentil	6	141120	57.4	-23.8	-23.9	-24.0	0.2	150211A	6.6	2.8	2.7	2.4	0.3	10.1
16	TOB061	242118	779	Building A	A10	LBA	Hulled barley	4	150108B	60.6	-24.1	-24.5	-24.6	0.1	150211A	3.7	11.0	10.8	10.5	0.3	19.2
17	TOB062	244102	416	Building A	A5	LBA	Hulled barley	6	150206B	61.4	-23.6	-24.0	-24.1	0.1	150211A	3.7	9.0	8.8	8.4	0.3	19.4
18	TOB064	221119	1262	Building A	A3	LBA	Hulled barley		150206B	58.2	-23.6	-24.0	-24.1	0.1	150211A	4.2	10.7	10.5	10.2	0.3	16.2
19	TOB065	221131	1358	Building A	A3	LBA	Hulled barley	5	150206B	63.0	-23.0	-23.4	-23.5	0.1	150211A	2.9	4.9	4.8	4.5	0.3	25.1
20	TOB066	241146	1282	Building A	A11	LBA	Hulled barley		150206B	60.0	-24.2	-24.6	-24.7	0.1	150211A	3.0	5.3	5.2	4.9	0.3	23.5
21	TOB067	241144	1281	Building A	A11	LBA	Hulled barley	6	150206B	64.2	-23.3	-23.6	-23.8	0.1	150211A	3.3	9.1	8.9	8.6	0.3	22.8
22	TOB068	71196	521	Building A	A6	LBA	Hulled barley		150206B	61.5	-23.0	-23.4	-23.5	0.1	150211A	4.8	11.5	11.2	10.9	0.3	15.1
23	TOB069	71102	690	Building A	A6	LBA	Hulled barley		150206B	59.5	-23.5	-23.9	-24.0	0.1	150211A	4.6	11.3	11.1	10.7	0.3	15.2
24	TOB070	32114	429	Building M		MBA	Hulled barley	6	150206B	61.2	-23.9	-24.3	-24.4	0.1	150211A	4.1	4.5	4.3	4.0	0.3	17.2
25	TOB071	32288	1520	Building M	internal space	MBA	Hulled barley	9	150206B	59.8	-23.2	-23.6	-23.7	0.1	150211A	4.8	4.5	4.4	4.1	0.3	14.5
26	TOB072	32121	458	Building M	internal space	MBA	Hulled barley	5	150206B	58.2	-24.4	-24.8	-24.9	0.1	150211A	2.8	7.0	6.8	6.5	0.3	24.3
27	TOB073	32197	1432	Building M	internal space	MBA	Hulled barley	5	150206B	66.2	-23.4	-23.7	-23.9	0.1	150211A	3.0	5.4	5.2	4.9	0.3	25.4
28	TOB074	32231	1444	Building M	internal space	MBA	Hulled barley	8	150206B	61.9	-24.3	-24.7	-24.8	0.1	150211A	2.9	7.1	6.9	6.6	0.3	25.0
29	TOB075	32268	1515	Building M		MBA	Hulled barley	4	150206B	62.1	-24.3	-24.7	-24.8	0.1	150211A	2.8	7.3	7.1	6.8	0.3	25.7
30	TOB076	32393	1971	Building M		MBA	Hulled barley	10	150206B	63.6	-24.9	-25.3	-25.4	0.1	150211A	2.4	5.7	5.5	5.2	0.3	31.1

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49

TOB078	32331	1884	Building M	internal space	MBA	Hulled barley	5	150206B	61.9	-24.3	-24.6	-24.8	0.1	150211A	3.1	7.3	7.1	6.8	0.3	23.4
TOB079	32189	1120	Building M	internal space	MBA	Hulled barley	4	150206B	62.7	-22.3	-22.6	-22.8	0.1	150211A	2.9	7.6	7.4	7.1	0.3	25.0
TOB080	32261	1512	Building M		MBA	Hulled barley	5	150206B	58.6	-24.2	-24.5	-24.7	0.1	150211A	3.4	4.8	4.7	4.3	0.3	20.1
TOB081	32343	1889	Building M	internal space	MBA	Hulled barley	8	150206B	55.6	-24.7	-25.1	-25.2	0.1	150211A	2.8	6.8	6.6	6.3	0.3	23.0
TOB082	32191	1121	Building M	internal space	MBA	Hulled barley	6	150206B	60.4	-24.5	-24.9	-25.0	0.1	150211A	2.8	6.2	6.1	5.7	0.3	25.0
TOB083	33253	1601	area west of Building M		MBA	Hulled barley	5	150206B	63.7	-24.7	-25.1	-25.2	0.1	150211A	3.2	7.7	7.5	7.2	0.3	23.3
TOB084	32260	1511	Building M	internal space	MBA	Hulled barley	5	150206B	59.5	-24.6	-24.9	-25.1	0.1	150211A	3.0	8.0	7.8	7.5	0.3	23.5
TOB085	32345	1890	Building M	internal space	MBA	Hulled barley	8	150206B	62.1	-24.1	-24.5	-24.6	0.1	150211A	3.2	8.6	8.4	8.0	0.3	22.7
TOB100	244102	416	Building A	A5	LBA	Millet		150206B	58.2	-10.3	-10.6	-10.7	0.1	150211A	5.2	8.2	8.0	7.7	0.3	13.0

Supplementary Table S6. Results of stable isotope analysis of faunal bone collagen from Archontiko.

ID	SU	Area	Phase	Species	Element	Runfile	%C	d13C raw	d13C (VPDB)	d13C sd	%N	d15N raw	d15N (AIR)	d15N sd	CN	% collagen
ARC001	25039	O	4	Sheep/goat	metatarsal	140918	45.5	-18.2	-18.4	0.1	16.4	6.3	6.4	0.2	3.2	9.2
ARC002	19068	T	4	Sheep/goat	metatarsal	140918	43.6	-18.4	-18.6	0.1	15.8	6.2	6.3	0.2	3.2	10.0
ARC003	30030		4	Sheep/goat	metatarsal	140918	41.6	-20.2	-20.4	0.1	15.0	5.7	5.8	0.2	3.2	13.2
ARC004	3072	G	4	Sheep/goat	metatarsal	140918	41.9	-19.7	-19.9	0.1	14.9	5.8	5.8	0.2	3.3	9.8
ARC005	19087	T	4	Sheep/goat	metatarsal	140918	48.6	-20.6	-20.8	0.1	17.7	4.3	4.3	0.2	3.2	12.7
ARC006	19076	T	4	Sheep/goat	tibia	140918	45.4	-20.6	-20.8	0.1	16.5	7.8	7.9	0.2	3.2	12.3
ARC007	25037	O	4	Sheep/goat	tibia	140918	46.4	-19.9	-20.1	0.1	17.0	5.0	5.1	0.2	3.2	15.0
ARC008	25035	O	4	Sheep/goat	tibia	140918	45.3	-18.2	-18.4	0.1	16.3	7.2	7.3	0.2	3.2	12.9
ARC009	25035	O	4	Sheep/goat	tibia	140918	44.7	-19.7	-19.9	0.1	16.4	7.1	7.2	0.2	3.2	6.2
ARC010	6033	ST	4	Sheep/goat	tibia	140918	43.5	-16.5	-16.6	0.1	15.8	5.8	5.8	0.2	3.2	13.0
ARC011	19081	T	4	Sheep/goat	tibia	140918	44.8	-19.8	-20.0	0.1	16.3	5.1	5.1	0.2	3.2	7.9
ARC012	30019	M	4	Sheep/goat	tibia	140918	42.3	-15.5	-15.7	0.1	15.1	8.1	8.1	0.2	3.3	8.5
ARC013	19076	T	4	Sheep/goat	tibia	140918	44.8	-20.8	-21.1	0.1	16.2	6.4	6.5	0.2	3.2	14.4
ARC014	25029	O	4	Sheep/goat	tibia	140918	43.4	-16.9	-17.1	0.1	15.8	5.5	5.6	0.2	3.2	13.9
ARC015	19081	T	4	Sheep/goat	tibia	140918	45.1	-19.4	-19.6	0.1	16.4	6.2	6.3	0.2	3.2	11.7
ARC016	19085	T	4	Sheep/goat	tibia	140918	44.5	-18.5	-18.7	0.1	16.2	7.4	7.4	0.2	3.2	14.0
ARC017	6033	M2	4	Sheep/goat	mandible	140918	44.2	-17.9	-18.1	0.1	16.0	6.6	6.6	0.2	3.2	11.9
ARC018	3048	G	4	Sheep/goat	mandible	140918	44.4	-19.2	-19.4	0.1	16.1	5.1	5.1	0.2	3.2	12.4
ARC019	21055	F	3	Sheep/goat	mandible	140918	42.6	-19.8	-20.0	0.1	15.1	4.3	4.3	0.2	3.3	5.1
ARC020	19048	T	3	Sheep/goat	tibia	140918	42.9	-19.4	-19.7	0.1	15.2	5.6	5.6	0.2	3.3	3.7
ARC021	21028	F	3	Sheep/goat	tibia	150121C	41.2	-20.8	-20.9	0.1	14.9	7.0	7.1	0.2	3.2	14.5
ARC022	21031	F	3	Sheep/goat	tibia	140918	43.4	-18.6	-18.8	0.1	15.6	6.9	6.9	0.2	3.2	8.0
ARC023	21037	F	3	Sheep/goat	tibia	140918	43.7	-19.4	-19.6	0.1	16.0	6.4	6.4	0.2	3.2	11.9
ARC024	21028	F	3	Sheep/goat	tibia	140918	44.8	-18.3	-18.5	0.1	16.4	5.9	6.0	0.2	3.2	11.8
ARC025	25033	O	4	Sheep	metacarpal	140918	42.6	-20.6	-20.8	0.1	15.6	5.3	5.3	0.2	3.2	11.6
ARC026	23107	PSI	4	Sheep	metacarpal	140918	43.8	-21.2	-21.4	0.1	15.9	5.7	5.7	0.2	3.2	3.9
ARC027	25031	O	4	Sheep	metacarpal	140918	42.4	-17.1	-17.3	0.1	15.3	6.1	6.1	0.2	3.2	14.5
ARC028	6028	ST	4	Sheep	metacarpal	140918	42.6	-18.6	-18.8	0.1	15.4	6.3	6.3	0.2	3.2	12.2
ARC029	25037	O	4	Sheep	metacarpal	140918	42.9	-20.4	-20.6	0.1	15.7	5.6	5.6	0.2	3.2	14.0
ARC030	19083	T	4	Sheep	metacarpal	140918	42.5	-18.9	-19.1	0.1	15.5	6.2	6.3	0.2	3.2	8.0
ARC031	23107	PSI	4	Sheep	metacarpal	140918	44.9	-19.6	-19.8	0.1	16.4	6.0	6.1	0.2	3.2	10.0
ARC032	19085	T	4	Sheep	metacarpal	140925	42.4	-19.7	-19.9	0.1	15.3	4.6	4.7	0.2	3.2	10.2
ARC033	3027	T	4	Sheep	metacarpal	140918	44.6	-20.1	-20.3	0.1	16.2	3.5	3.6	0.2	3.2	14.7
ARC034	19074	T	4	Goat	metacarpal	140918	44.5	-19.7	-19.9	0.1	16.1	5.7	5.7	0.2	3.2	12.7
ARC035	25034	O	4	Goat	metacarpal	140922	43.2	-20.9	-21.1	0.1	15.7	3.3	3.4	0.2	3.2	4.7
ARC036	25031	O	4	Goat	metacarpal	140922	42.7	-19.2	-19.4	0.1	15.3	5.8	5.9	0.2	3.3	9.7

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49

ARC039	19076	T	4	Pig	humerus	140922	44.0	-19.9	-20.1	0.1	15.9	5.9	6.0	0.2	3.2	12.1
ARC041	6033	ST	4	Pig	humerus	140922	44.4	-20.4	-20.6	0.1	16.1	5.6	5.7	0.2	3.2	11.4
ARC042	3035	T	4	Pig	humerus	140922	44.4	-19.8	-20.0	0.1	16.0	8.6	8.7	0.2	3.2	11.7
ARC043	24113	X	4	Pig	humerus	140922	45.6	-20.1	-20.3	0.1	16.7	6.1	6.2	0.2	3.2	11.5
ARC044	19090	T	4	Pig	humerus	140922	46.8	-20.0	-20.2	0.1	17.0	7.5	7.6	0.2	3.2	9.0
ARC045	25036	O	4	Pig	humerus	140922	45.7	-19.2	-19.4	0.1	16.6	6.8	6.9	0.2	3.2	9.7
ARC046	30027	M	4	Pig	humerus	140922	46.9	-20.1	-20.3	0.1	16.9	7.3	7.4	0.2	3.2	12.9
ARC047	25039	O	4	Pig	humerus	140922	42.6	-20.4	-20.6	0.1	15.5	8.4	8.5	0.2	3.2	3.2
ARC048	19088	T	4	Pig	humerus	140922	43.2	-19.4	-19.6	0.1	15.6	6.1	6.2	0.2	3.2	7.4
ARC049	23100	PSI	4	Pig	maxilla	140922	44.8	-21.1	-21.2	0.1	16.3	4.8	4.9	0.2	3.2	12.0
ARC050	24105	X	4	Pig	maxilla	140922	43.8	-20.1	-20.3	0.1	15.6	7.8	7.9	0.2	3.3	8.0
ARC051	6019	IG	4	Pig	maxilla	140922	39.1	-21.1	-21.3	0.1	14.1	5.8	5.8	0.2	3.2	11.9
ARC052	6028	ST	4	Pig	maxilla	140922	43.2	-19.3	-19.5	0.1	15.5	7.5	7.6	0.2	3.3	9.2
ARC053	22012	X	4	Pig	maxilla	140922	41.9	-20.0	-20.2	0.1	15.2	5.1	5.2	0.2	3.2	10.5
ARC054	3011	M2	4	Pig	maxilla	140922	40.3	-20.2	-20.4	0.1	14.1	8.8	8.9	0.2	3.3	6.5
ARC055	6031	ST	4	Pig	maxilla	140922	42.6	-19.8	-20.0	0.1	15.4	6.7	6.8	0.2	3.2	11.6
ARC056	23019	PSI	3	Pig	radius	140922	41.4	-19.9	-20.1	0.1	14.9	4.8	4.9	0.2	3.2	13.0
ARC057	21058	F	3	Pig	radius	140922	21.2	-21.2	-21.4	0.1	7.3	4.2	4.3	0.2	3.4	3.4
ARC058	30015	M	3	Pig	radius	140922	44.2	-20.2	-20.4	0.1	16.1	5.9	6.0	0.2	3.2	12.4
ARC059	23102	PSI	4	Cattle	tibia	140922	44.9	-14.7	-14.8	0.1	16.5	5.2	5.3	0.2	3.2	12.8
ARC060	25035	O	4	Cattle	tibia	140922	44.3	-17.6	-17.8	0.1	16.2	4.2	4.2	0.2	3.2	8.1
ARC061	23106	PSI	4	Cattle	tibia	140922	43.7	-11.3	-11.4	0.1	16.0	7.5	7.6	0.2	3.2	12.2
ARC062	5034	E'	4	Cattle	tibia	140922	43.6	-20.6	-20.8	0.1	15.8	5.4	5.5	0.2	3.2	9.9
ARC063	6033	ST	4	Cattle	tibia	140922	44.1	-20.7	-20.9	0.1	16.0	5.9	6.0	0.2	3.2	10.7
ARC064	19090	T	4	Cattle	metatarsal	140922	44.5	-15.1	-15.2	0.1	16.4	7.1	7.2	0.2	3.2	10.3
ARC065	24105	X	4	Cattle	metatarsal	140922	46.3	-17.2	-17.4	0.1	16.8	5.6	5.7	0.2	3.2	10.4
ARC066	19068	T	4	Cattle	metatarsal	140922	43.7	-15.5	-15.6	0.1	16.1	7.0	7.2	0.2	3.2	10.1
ARC067	6027	ST	4	Cattle	metatarsal	140922	42.6	-16.7	-16.9	0.1	15.6	4.1	4.2	0.2	3.2	9.5
ARC068	4017	IA	4	Cattle	metatarsal	140922	44.7	-17.6	-17.8	0.1	16.3	6.2	6.2	0.2	3.2	9.3
ARC069	22011	MT G	4	Cattle	metatarsal	140922	41.4	-15.9	-16.0	0.1	15.0	5.3	5.4	0.2	3.2	13.0
ARC070	21035	F	3	Cattle	metatarsal	140922	45.0	-20.5	-20.7	0.1	16.1	6.1	6.2	0.2	3.3	11.9
ARC071	23019	PSI	3	Cattle	metatarsal	140922	43.6	-22.9	-23.1	0.1	15.8	4.0	4.0	0.2	3.2	13.6
ARC072	21050	F	3	Cattle	metatarsal	140924	43.5	-17.7	-17.9	0.1	15.8	7.8	7.9	0.2	3.2	14.4
ARC073	21035	F	3	Cattle	tibia	140924	39.0	-22.0	-22.3	0.1	14.1	3.6	3.7	0.1	3.2	5.0
ARC074	21034	F	3	Cattle	tibia	140924	43.4	-14.2	-14.4	0.1	15.8	7.2	7.2	0.2	3.2	4.3
ARC075	19054	T	3	Cattle	tibia	140924	42.4	-11.8	-11.8	0.1	15.3	6.7	6.8	0.2	3.2	8.3
ARC076	24104	X	4	Wild boar	humerus	140924	40.8	-19.9	-20.1	0.1	14.7	5.5	5.6	0.1	3.2	11.0
ARC077	19044	T	2	Fallow deer	tibia	140924	38.7	-20.3	-20.5	0.1	13.9	5.4	5.5	0.1	3.3	8.0
ARC078	21020	G	2	Fallow	tibia	140924	38.4	-20.9	-21.2	0.1	13.8	5.9	6.0	0.2	3.3	8.1

				deer													
ARC079	12006	IO	2	Fallow deer	tibia	140924	42.4	-21.3	-21.5	0.1	15.4	5.1	5.1	0.1	3.2	9.6	
ARC080	19041	T	2	Fallow deer	tibia	140924	43.5	-21.1	-21.3	0.1	15.9	4.6	4.6	0.1	3.2	9.6	
ARC081	21029	F	2	Fallow deer	tibia	140924	42.2	-20.6	-20.8	0.1	15.2	3.8	3.8	0.1	3.2	5.4	
ARC082	19084	T	4	Aurochs	metacarpal	140924	45.2	-23.4	-23.7	0.1	16.2	3.6	3.6	0.1	3.3	7.7	
ARC084	30013	M	3	Roe deer	tibia	140924	43.1	-20.0	-20.2	0.1	15.5	7.2	7.3	0.2	3.2	10.7	
ARC085	23100	F	4	Dog	ulna	140924	43.2	-19.2	-19.4	0.1	15.9	7.7	7.8	0.2	3.2	11.5	
ARC086	19075	T	4	Dog	ulna	140924	41.8	-18.8	-19.0	0.1	15.3	8.3	8.4	0.2	3.2	8.4	
ARC087	25039	O	4	Dog	ulna	140924	43.0	-18.9	-19.1	0.1	15.5	10.2	10.3	0.2	3.2	7.7	
ARC088	23021	PSI	3	Red deer	tibia	140924	40.0	-20.9	-21.1	0.1	14.4	3.8	3.9	0.1	3.2	3.3	
ARC089	21017	PSI	2	Red deer	tibia	140924	46.3	-21.5	-21.7	0.1	16.8	4.6	4.7	0.1	3.2	5.9	
ARC090	21017	PSI	2	Red deer	tibia	140924	42.0	-11.8	-11.9	0.1	15.2	3.1	3.2	0.1	3.2	7.2	
ARC091	25014	O	2	Red deer	tibia	140924	43.6	-20.7	-20.9	0.1	15.9	5.8	5.9	0.1	3.2	6.2	
ARC092	21020		2	Red deer	tibia	140924	43.5	-21.0	-21.2	0.1	15.5	3.2	3.2	0.1	3.3	2.7	
ARC093	6035	ST'	4	Red deer	tibia	140924	43.5	-13.3	-13.4	0.1	15.9	5.6	5.7	0.1	3.2	12.6	
ARC094	25036		4	Roe deer	ulna	140924	41.1	-18.3	-18.5	0.1	14.7	7.3	7.5	0.2	3.3	7.9	
ARC095	25036		4	Roe deer	radius	140924	42.8	-20.1	-20.3	0.1	15.5	4.9	4.9	0.1	3.2	8.1	
ARC096	19083	T	4	Roe deer	radius	140924	42.2	-21.0	-21.2	0.1	15.0	3.4	3.5	0.1	3.3	0.7	
ARC097	21035	F	3	Fallow deer	tibia	140924	43.2	-21.1	-21.4	0.1	15.6	4.3	4.4	0.1	3.2	9.9	
ARC098	21030	F	3	Fallow deer	tibia	140924	42.7	-20.9	-21.1	0.1	15.5	6.2	6.3	0.2	3.2	11.4	
ARC099	19059	I	3	Fallow deer	tibia	140924	41.7	-21.1	-21.3	0.1	15.2	5.3	5.3	0.1	3.2	7.9	
ARC100	16026	PY	4	Fallow deer	tibia	140924	43.7	-21.1	-21.3	0.1	16.1	5.7	5.8	0.1	3.2	9.6	
ARC101	12005	IO	2	Dog	ulna	140924	40.7	-18.5	-18.7	0.1	14.7	9.4	9.6	0.2	3.2	6.3	
ARC102	12005	IO	2	Dog	ulna	140924	45.4	-19.5	-19.7	0.1	16.5	9.6	9.7	0.2	3.2	0.0	
ARC103	21023	F	2	Dog	ulna	140924	40.5	-18.8	-19.0	0.1	14.6	9.7	9.8	0.2	3.2	4.5	
ARC104	3042	T	4	Hare	tibia	140924	41.7	-22.9	-23.1	0.1	15.1	4.2	4.3	0.1	3.2	11.9	
ARC105	19053	T	2	Pig	ulna	140924	37.2	-19.6	-19.8	0.1	13.3	4.7	4.7	0.1	3.3	12.0	
ARC106	19041	T	2	Pig	ulna	140925	41.4	-20.2	-20.4	0.1	14.8	8.2	8.4	0.3	3.3	9.3	
ARC107	21017	F	2	Pig	ulna	140925	40.8	-20.2	-20.4	0.1	14.7	6.0	6.1	0.2	3.3	9.9	
ARC108	25012	O	2	Pig	ulna	140925	40.9	-20.4	-20.6	0.1	14.7	6.0	6.1	0.2	3.3	6.3	
ARC109	12007	IO	2	Sheep/goat	tibia	140925	42.0	-19.5	-19.7	0.1	15.0	4.9	5.1	0.2	3.3	1.2	
ARC111	19026	T	2	Sheep/goat	tibia	140925	41.0	-20.1	-20.3	0.1	14.7	7.4	7.6	0.2	3.3	8.2	
ARC112	25010	O	2	Sheep/goat	tibia	140925	30.1	-19.1	-19.3	0.1	10.6	5.8	5.9	0.2	3.3	11.3	
ARC113	23018	F	2	Sheep/goat	tibia	140925	43.0	-18.6	-18.8	0.1	15.6	9.7	9.9	0.3	3.2	10.5	
ARC114	25016	O	2	Wild boar	ulna	140925	41.4	-20.2	-20.4	0.1	15.1	6.8	6.9	0.2	3.2	10.9	

ARC115	23007	PSI	2	Roe deer	mandible	140925	40.9	-20.4	-20.6	0.1	14.6	4.4	4.5	0.2	3.3	8.8
ARC116	25016	O	2	Roe deer	tibia	140925	42.7	-19.7	-19.9	0.1	15.4	8.2	8.3	0.3	3.2	7.0
ARC117	19034	T	2	Roe deer	tibia	140925	40.6	-19.4	-19.6	0.1	14.5	6.7	6.9	0.2	3.3	1.9
ARC118	30005	G	2	Cattle	metacarpal	140925	41.4	-14.0	-14.1	0.1	15.0	4.6	4.8	0.2	3.2	8.5
ARC119	25012	O	2	Cattle	metacarpal	140925	43.9	-18.2	-18.4	0.1	15.9	5.3	5.5	0.2	3.2	6.8
ARC120	21026	F	2	Cattle	metacarpal	140925	45.4	-14.3	-14.5	0.1	16.5	5.3	5.4	0.2	3.2	10.2
ARC121	19026	T	2	Cattle	metacarpal	140925	38.0	-20.9	-21.1	0.1	13.6	4.8	4.9	0.2	3.3	6.4
ARC122	21059	F	3	Dog	ulna	140925	42.2	-18.9	-19.1	0.1	15.5	7.0	7.2	0.2	3.2	12.8
ARC123	31003	M-IA	3	Hare	tibia	140925	43.8	-22.6	-22.9	0.1	15.8	4.2	4.3	0.2	3.2	9.9
ARC124	21029	F	2	Hare	tibia	140925	41.0	-19.5	-19.6	0.1	14.6	4.3	4.4	0.2	3.3	10.9
ARC125	21017	F	2	Hare	tibia	140925	42.8	-20.2	-20.4	0.1	15.5	4.2	4.3	0.2	3.2	8.0
ARC201	21007	PHI	1	Pig	femur	150713	36.1	-20.1	-20.3	0.1	13.0	6.1	6.3	0.2	3.2	13.2
ARC202	21007	PHI	1	Sheep	radius	150713	17.5	-11.7	-11.7	0.1	6.0	5.0	5.2	0.1	3.4	3.9
ARC203	21007	PHI	1	Pig	tibia	150713	37.7	-20.1	-20.3	0.1	13.7	6.2	6.4	0.2	3.2	11.9
ARC204	18004	S'	1	Wild boar	phalanx I	150713	35.5	-18.9	-19.0	0.1	12.6	5.6	5.8	0.2	3.3	8.5
ARC205	18004	S'	1	Fallow deer	humerus	150713	41.4	-20.8	-21.0	0.1	14.7	5.0	5.2	0.1	3.3	12.3
ARC206	18003	S'	1	Cattle	carpal	150713	35.2	-16.7	-16.9	0.1	12.7	6.2	6.4	0.2	3.2	10.5
ARC207	18003	S'	1	Pig	cranial	150713	32.0	-18.9	-19.0	0.1	11.2	7.6	7.8	0.2	3.3	4.3
ARC208	18007	S	1	Cattle	cranial	150713	23.2	-19.8	-19.9	0.1	8.2	6.5	6.6	0.2	3.3	4.3
ARC209	18007	S	1	Sheep	humerus	150713	42.6	-20.3	-20.5	0.1	15.2	4.9	5.1	0.1	3.3	8.4
ARC210	18008	S'	1	Cattle	phalanx I	150713	17.7	-20.4	-20.6	0.1	6.0	5.7	5.9	0.2	3.4	3.6
ARC211	18009	S	1	Cattle	phalanx II	150713	43.5	-22.1	-22.2	0.1	15.5	3.1	3.3	0.1	3.3	1.9
ARC212	18009	S	1	Cattle	rib	150713	32.8	-16.1	-16.2	0.1	11.8	7.0	7.2	0.2	3.2	8.4
ARC213	18009	S	1	Pig	calcaneus	150713	42.2	-20.1	-20.3	0.1	15.4	5.6	5.8	0.2	3.2	11.1
ARC214	18009	S	1	Sheep	humerus	150713	43.8	-19.6	-19.8	0.1	15.8	5.6	5.8	0.2	3.2	13.1
ARC215	19003	T	1	Cattle	tibia	150713	38.5	-15.6	-15.7	0.1	14.0	7.9	8.1	0.2	3.2	10.8
ARC216	19004	T	1	Cattle	phalanx I	150713	42.9	-19.3	-19.4	0.1	15.2	7.4	7.6	0.2	3.3	2.8
ARC217	19005	T	1	Cattle	talus	150713	41.6	-16.6	-16.7	0.1	15.1	11.0	11.1	0.2	3.2	8.7
ARC218	19005	T	1	Cattle	vertebra	150713	37.4	-19.3	-19.4	0.1	13.4	5.1	5.3	0.2	3.3	10.5
ARC219	3010	G	1	Cattle	humerus	150713	29.6	-18.3	-18.5	0.1	10.5	8.0	8.1	0.2	3.3	9.8
ARC220	3010	G	1	Cattle	carpal	150713	49.7	-16.4	-16.5	0.1	18.0	10.6	10.7	0.2	3.2	10.8
ARC221	3010	G	1	Pig	tibia	150713	38.0	-19.6	-19.8	0.1	13.5	5.7	5.8	0.2	3.3	12.8
ARC222	3010	G	1	Goat	pelvis	150713	32.5	-19.4	-19.5	0.1	11.6	7.2	7.3	0.2	3.3	6.2
ARC223	3010	G	1	Sheep/goat	mandible	150713	42.2	-15.8	-15.9	0.1	15.3	10.1	10.2	0.2	3.2	16.5
ARC224*	2022	B	1	Cattle	phalanx III	150713	1.1	-24.0	-24.2	0.1	0.2	6.6	6.7	0.2	8.7	1.8
ARC225*	2013	B	1	Aurochs	humerus	150713	1.8	-23.1	-23.3	0.1	0.2	4.2	4.4	0.1	10.2	0.9
ARC226*	2013	B	1	Cattle	tibia	150713	1.2	-23.4	-23.6	0.1	0.2	1.1	1.4	0.1	9.2	1.4
ARC228*	2002	B	1	Roe deer	tibia	150713	2.3	-23.0	-23.2	0.1	0.4	5.2	5.4	0.2	7.1	1.2
ARC229	2025	B	1	Cattle	talus	150713	24.4	-13.2	-13.3	0.1	8.6	6.7	6.9	0.2	3.3	4.6

ARC230	2017	B	1	Goat	phalanx I	150713	41.9	-20.2	-20.4	0.1	15.2	4.2	4.4	0.1	3.2	11.8
ARC231*	5015	E'	1	Sheep	phalanx II	150713	43.8	-20.7	-20.8	0.1	13.4	6.8	7.0	0.2	3.8	0.6
ARC232	3003	G'	1	Wild boar	talus	150713	34.6	-20.2	-20.3	0.1	12.1	5.6	5.8	0.2	3.3	4.7
ARC233	3003	G'	1	Fallow deer	tibia	150713	36.5	-20.4	-20.6	0.1	13.0	8.3	8.4	0.2	3.3	6.2
ARC234	3003	G'	1	Pig	metapodial	150713	31.3	-19.2	-19.4	0.1	10.7	8.0	8.2	0.2	3.4	4.8
ARC235	1002	A	1	Cattle	humerus	150714	41.0	-18.3	-18.4	0.1	15.0	6.5	6.7	0.2	3.2	17.0
ARC237	1002	A	1	Sheep	ulna	150714	41.2	-20.2	-20.4	0.1	14.9	8.8	9.0	0.2	3.2	5.4
ARC238	3004	G'	1	Cattle	calcaneus	150714	35.3	-20.9	-21.1	0.1	11.6	5.0	5.2	0.2	3.6	0.6
ARC239	3004	G'	1	Sheep	vertebra	150713	30.6	-19.9	-20.0	0.1	10.7	6.3	6.5	0.2	3.4	3.0
ARC240	1006	A'	1	Pig	maxilla	150714	36.1	-19.5	-19.7	0.1	13.0	7.1	7.3	0.2	3.2	8.2
ARC241	1006	A'	1	Fallow deer	phalanx II	150714	39.0	-21.0	-21.2	0.1	14.2	3.8	4.0	0.2	3.2	10.1
ARC242	1006	A'	1	Sheep/goat	tibia	150714	43.8	-20.5	-20.7	0.1	15.8	7.5	7.7	0.2	3.2	14.9
ARC243	3002	G'	1	Sheep	humerus	150714	40.1	-18.0	-18.2	0.1	14.4	6.8	7.0	0.2	3.3	8.9
ARC244	1007	A	1	Sheep	metatarsal	150714	43.8	-19.1	-19.3	0.1	14.5	5.2	5.4	0.2	3.5	0.5
ARC245	1003	A	1	Pig	talus	150714	36.2	-20.1	-20.3	0.1	12.6	7.4	7.6	0.2	3.4	1.4
ARC246	23119	PSI	1	Sheep/goat	metacarpal	150714	34.8	-20.4	-20.6	0.1	12.5	5.8	6.0	0.2	3.2	11.3
ARC247	23119	PSI	1	Pig	femur	150714	39.7	-21.3	-21.5	0.1	14.3	8.2	8.4	0.2	3.2	7.8
ARC248	13003	IH	1	Pig	humerus	150714	41.2	-19.6	-19.8	0.1	14.8	6.3	6.4	0.2	3.3	9.2
ARC249	21008	PHI	1	Pig	humerus	150714	38.8	-20.3	-20.5	0.1	13.9	6.2	6.4	0.2	3.3	8.2
ARC250*	21008	PHI	1	Cattle	talus	150714	7.6	-17.7	-17.9	0.1	2.4	6.6	6.8	0.2	3.8	0.8
ARC251	21008	PHI	1	Pig	maxilla	150714	42.6	-20.6	-20.8	0.1	15.5	7.6	7.8	0.2	3.2	9.5
ARC252	21009	PHI	1	Cattle	talus	150714	13.6	-16.5	-16.7	0.1	4.7	7.7	7.8	0.2	3.4	2.6
ARC253	21009	PHI	1	Red deer	calcaneus	150714	17.9	-20.9	-21.1	0.1	6.2	5.4	5.6	0.2	3.4	1.6
ARC254	21009	PHI	1	Fallow deer	humerus	150714	38.5	-21.2	-21.4	0.1	13.8	5.0	5.2	0.2	3.3	3.5
ARC255	21009	PHI	1	Wild boar	metacarpal	150714	43.3	-21.0	-21.2	0.1	15.5	6.1	6.3	0.2	3.3	6.4
ARC256	21009	PHI	1	Pig	scapula	150714	32.8	-21.0	-21.2	0.1	11.7	8.0	8.2	0.2	3.3	7.5
ARC257	21009	PHI	1	Sheep	metatarsal	150714	43.4	-20.0	-20.2	0.1	15.8	7.1	7.3	0.2	3.2	13.9
ARC258	21009	PHI	1	Pig	scapula	150714	43.4	-19.9	-20.0	0.1	15.7	5.8	6.0	0.2	3.2	10.0
ARC259	21009	PHI	1	Pig	scapula	150714	23.0	-20.3	-20.5	0.1	8.0	7.1	7.3	0.2	3.4	2.9

* Excluded due to poor collagen preservation

Supplementary Table S7. Results of stable isotope analysis of faunal bone collagen from Thessaloniki Toumba.

ID	SU	Building	Room	Date	Species	Element	Side	Runfile	%C	d13C raw	d13C (VPDB)	d13C sd	%N	$\delta^{15}\text{N}$ raw	$\delta^{15}\text{N}$ (AIR)	$\delta^{15}\text{N}$ sd	CN	% collagen
TOU001	264044	Building A	A17	late LBA	sheep	humerus	R	140611B	40.3	-20.0	-20.5	0.2	14.5	8.4	8.1	0.3	3.2	9.7
TOU003	242141	Building A	A7	late LBA	sheep	humerus	R	140611B	27.8	-20.3	-20.7	0.1	9.7	6.0	5.7	0.2	3.3	8.0
TOU004	241076	Building A	A11	late LBA	sheep	humerus	R	140617	40.3	-20.0	-20.2	0.3	14.4	7.2	7.3	0.4	3.3	3.8
TOU005	51097	Building A	A1	late LBA	sheep	humerus	R	140611B	42.2	-18.8	-19.2	0.2	15.1	7.5	7.2	0.2	3.3	12.4
TOU006	241110	Building A	A10	late LBA	sheep	humerus	R	140611B	33.2	-20.6	-21.0	0.1	11.8	7.7	7.5	0.2	3.3	15.6
TOU007	72080	Building Z	Z1	late LBA	sheep	humerus	R	140617	40.7	-19.0	-19.2	0.3	14.7	5.8	5.8	0.4	3.2	9.0
TOU008	71046	Building A	A8	late LBA	sheep	humerus	L	140617	40.3	-18.4	-18.5	0.3	14.5	6.4	6.5	0.4	3.2	19.2
TOU009	244106	Building A	A5	late LBA	sheep	humerus	L	140611B	33.8	-18.2	-18.6	0.2	12.1	5.7	5.4	0.2	3.3	9.7
TOU010	242153	Building A	A8	late LBA	sheep	humerus	L	140611B	36.3	-18.8	-19.2	0.2	13.0	5.6	5.3	0.2	3.3	11.9
TOU011	51087	Building A	A1	late LBA	sheep	humerus	L	140617	41.3	-18.7	-18.9	0.3	14.7	6.2	6.2	0.4	3.3	10.9
TOU012	243094	Building A	A3	late LBA	sheep	humerus	L	140611B	43.7	-17.5	-17.8	0.2	15.9	5.7	5.5	0.2	3.2	14.8
TOU013	74078	Building A	A6	late LBA	sheep	humerus	R	140611B	40.6	-18.3	-18.7	0.2	14.4	6.5	6.2	0.2	3.3	11.1
TOU014	221131	Building A	A3	late LBA	sheep	humerus	L	140611B	40.3	-17.5	-17.8	0.2	14.5	8.7	8.4	0.3	3.2	14.9
TOU016	74009	Building A	A6	late LBA	sheep	humerus	L	140617	43.1	-18.6	-18.8	0.3	15.5	7.5	7.6	0.4	3.2	11.3
TOU017	241081	Building A	A11	late LBA	sheep	humerus	L	140617	30.4	-19.6	-19.8	0.3	10.6	7.7	7.8	0.4	3.4	3.3
TOU018	233154	Building A	A13	late LBA	sheep	humerus	L	140611B	39.8	-18.1	-18.5	0.2	14.3	7.4	7.2	0.2	3.2	6.1
TOU019	244101	Building A	A5	late LBA	sheep	radius	R	140617	38.3	-19.9	-20.1	0.3	13.8	6.1	6.2	0.4	3.2	4.0
TOU020	233233	Building A	A5	late LBA	sheep	radius	R	140617	39.0	-19.4	-19.6	0.3	14.2	5.6	5.6	0.4	3.2	4.4
TOU021	241022-23	Building A	A11	late LBA	sheep	radius	L	140617	43.1	-19.1	-19.3	0.3	15.3	5.3	5.3	0.4	3.3	1.2
TOU023	241144	Building A	A11	late LBA	sheep	radius	R	140617	40.7	-19.3	-19.4	0.3	14.3	7.1	7.1	0.4	3.3	1.2
TOU024	221148	Building A	A3	late LBA	sheep	radius	L	140617	37.0	-18.6	-18.8	0.3	13.3	8.7	8.8	0.4	3.2	5.4
TOU025	233063	Building A	A5	late LBA	sheep	radius	R	140611B	39.8	-17.3	-17.7	0.2	14.2	7.3	7.0	0.2	3.3	5.2
TOU026	233139	Building A	A5	late LBA	pig	radius	R	140617	41.4	-19.1	-19.3	0.3	14.9	6.6	6.7	0.4	3.2	3.3
TOU027	242079	Building A	A10	late LBA	pig	radius	R	140617	44.5	-20.0	-20.2	0.3	15.6	6.7	6.8	0.4	3.3	1.7
TOU028	73109	Building Z	Z2	late LBA	pig	radius	R	140617	41.9	-19.9	-20.1	0.3	15.2	6.2	6.3	0.4	3.2	11.1
TOU029	74126	Building A	A1	late LBA	pig	radius	R	140610.1	40.0	-19.1	-19.3	0.1	14.2	7.4	7.6	0.2	3.3	4.1
TOU030	51068	Building A	A1	late LBA	pig	radius	R	140610.2	40.9	-18.7	-19.0	0.1	14.1	7.8	7.7	0.2	3.4	0.8
TOU032	243061	Building A	A3	late LBA	pig	radius	R	140610.1	39.2	-18.0	-18.2	0.1	13.6	7.6	7.8	0.2	3.4	1.5
TOU033	71028	Building A	A8	late LBA	pig	radius	L	140610.1	38.5	-18.7	-18.9	0.1	13.6	7.3	7.5	0.2	3.3	2.4
TOU034	242038	Building A	A10	late LBA	pig	radius	L	140610.1	36.2	-19.5	-19.7	0.1	12.8	7.1	7.3	0.2	3.3	7.0
TOU036	71193	Building A	A6	late LBA	pig	radius	R	140611A	39.7	-18.5	-18.8	0.2	14.0	8.5	8.6	0.2	3.3	1.4
TOU037	74120	Building A	A1	late LBA	pig	radius	L	140617	37.4	-19.8	-20.0	0.3	13.1	7.3	7.3	0.4	3.3	3.9
TOU038	51037	Building A	A1	late LBA	pig	radius	L	140617	35.7	-19.4	-19.6	0.3	12.7	8.0	8.1	0.4	3.3	8.8
TOU039	241064	Building A	A10	late LBA	pig	radius	L	140611A	42.7	-20.4	-20.7	0.2	15.4	8.2	8.2	0.2	3.2	11.8
TOU040	71059	Building A	A6	late LBA	pig	humerus	R	140611A	39.9	-19.7	-20.0	0.2	14.0	8.4	8.4	0.2	3.3	2.0

TOU041	71059	Building A	A6	late LBA	pig	humerus	L	140617	47.6	-18.3	-18.5	0.3	17.3	7.6	7.7	0.4	3.2	10.2
TOU042	241076	Building A	A11	late LBA	pig	humerus	L	140610.1	41.9	-19.0	-19.2	0.1	15.0	9.0	9.2	0.2	3.2	6.5
TOU043	241076	Building A	A11	late LBA	red deer	ulna	R	140610.1	26.2	-19.7	-19.9	0.1	9.0	3.8	3.9	0.2	3.4	5.3
TOU044	73031	Building Z	Z2	late LBA	red deer	humerus	L	140617	41.0	-19.8	-20.0	0.3	14.8	3.9	3.9	0.4	3.2	13.6
TOU045	233133	Building A	A5	late LBA	red deer	phalanx 2	-	140610.1	39.9	-20.8	-21.0	0.1	14.2	3.0	3.1	0.2	3.3	4.2
TOU046	243075	Building A	A3	late LBA	fallow deer	scapula	L	140610.2	40.3	-20.4	-20.7	0.1	14.6	5.3	5.2	0.2	3.2	5.9
TOU048	71088	Building A	A6	late LBA	roe deer	metatarsal	R	140610.1	40.4	-20.3	-20.5	0.1	14.3	3.3	3.4	0.2	3.3	7.4
TOU049	241023	Building A	A11	late LBA	red deer	humerus	R	140611A	40.3	-21.5	-21.8	0.2	14.3	4.5	4.4	0.2	3.3	6.4
TOU051	243057	Building A	A3	late LBA	fallow deer	humerus	L	140610.2	38.2	-20.4	-20.7	0.1	13.1	5.4	5.3	0.2	3.4	1.3
TOU052	264044/264048	Building A	A17	late LBA	red deer	humerus	R	140610.2	38.3	-19.4	-19.7	0.1	13.5	5.8	5.6	0.2	3.3	1.9
TOU056	241144	Building A	A11	late LBA	red deer	calcaneum	L	140610.1	33.7	-20.3	-20.5	0.1	11.8	3.7	3.8	0.2	3.3	2.6
TOU057	73077	Building Z	Z2	late LBA	boar	metacarpal	R	140610.2	40.8	-19.5	-19.9	0.1	14.8	8.9	8.8	0.2	3.2	12.0
TOU058	71100	Building A	A6	late LBA	fallow deer	humerus	R	140610.1	39.3	-20.1	-20.3	0.1	14.1	5.2	5.3	0.2	3.2	11.9
TOU059	51033	Building A	A1	late LBA	red deer	astragalus	L	140617	34.9	-20.0	-20.2	0.3	12.5	6.3	6.3	0.4	3.3	7.5
TOU060	244016	Building A	A4-A5	late LBA	roe deer	humerus	R	140610.1	40.3	-19.9	-20.1	0.1	14.3	5.0	5.2	0.2	3.3	5.7
TOU061	53215	Building M		LBA	sheep	radius	L	140611B	43.1	-17.6	-17.9	0.2	15.8	5.7	5.4	0.2	3.2	18.3
TOU062	52130	Building M		LBA	sheep	radius	L	140611A	40.5	-19.9	-20.2	0.2	14.7	6.6	6.6	0.2	3.2	13.1
TOU063	52117	Building M		late LBA	sheep	radius	L	140611A	43.5	-18.5	-18.8	0.2	15.9	8.1	8.1	0.2	3.2	5.4
TOU064	32369	Building M		MBA	sheep	humerus	L	140611B	40.4	-17.8	-18.2	0.2	14.7	5.7	5.5	0.2	3.2	13.0
TOU065	53057	Building M		late LBA	sheep	humerus	L	140611B	44.9	-20.1	-20.5	0.2	16.2	8.7	8.4	0.3	3.2	8.7
TOU066	53105	Building M		late LBA	sheep	humerus	R	140611A	41.7	-13.9	-14.2	0.3	15.1	8.5	8.5	0.2	3.2	6.4
TOU067	53085	Building M		late LBA	sheep	humerus	R	140611A	40.5	-17.3	-17.6	0.2	14.7	7.3	7.3	0.2	3.2	10.4
TOU068	761481			MBA	sheep	humerus	R	140611B	41.9	-18.2	-18.6	0.2	15.1	6.5	6.2	0.2	3.2	9.8
TOU069	761371			MBA	sheep	humerus	L	140611A	42.1	-17.8	-18.1	0.2	15.2	8.0	8.0	0.2	3.2	13.4
TOU070	761312			MBA	sheep	humerus	L	140611B	43.3	-18.8	-19.2	0.2	15.7	8.2	8.0	0.3	3.2	11.5
TOU071	761194				sheep	humerus	R	140611B	41.9	-18.2	-18.5	0.2	15.0	6.1	5.9	0.2	3.3	11.3
TOU072	761450			MBA	sheep	humerus	R	140611B	39.8	-18.8	-19.1	0.2	14.4	6.3	6.0	0.2	3.2	13.9
TOU073	761388			MBA	sheep	humerus	R	140611A	44.1	-19.2	-19.5	0.2	15.9	6.7	6.7	0.2	3.2	13.8
TOU074	761198			MBA	sheep	humerus	R	140611A	43.8	-19.0	-19.3	0.2	15.8	6.2	6.2	0.2	3.2	11.2
TOU075	761322			MBA	pig	humerus	R	140611A	41.2	-20.6	-20.9	0.2	14.7	5.8	5.8	0.2	3.3	10.4
TOU076	53114	Building M		late LBA	pig	humerus	L	140611B	40.0	-16.0	-16.3	0.2	14.4	10.1	9.9	0.3	3.2	4.1
TOU077	32191	Building M		MBA	pig	humerus	L	140611B	41.2	-19.6	-20.0	0.2	14.7	8.4	8.2	0.3	3.3	2.3
TOU078	761150			early LBA	pig	humerus	L	140611B	39.7	-20.1	-20.5	0.2	14.3	7.1	6.8	0.2	3.2	12.1
TOU079	761414			MBA	pig	radius	L	140611A	20.7	-19.9	-20.2	0.2	6.9	5.3	5.3	0.2	3.5	2.1
TOU080	761175			MBA	pig	radius	L	140611B	43.6	-20.5	-20.9	0.1	15.4	7.1	6.8	0.2	3.3	1.9
TOU081	52130	Building M		LBA	pig	radius	R	140611A	37.6	-19.1	-19.4	0.2	13.4	8.8	8.8	0.2	3.3	3.5
TOU082	53243	Building M		early LBA	pig	radius	R	140611A	39.7	-20.3	-20.6	0.2	14.3	8.3	8.3	0.2	3.2	5.7

TOU083	52107	Building M		late LBA	pig	radius	R	140611B	37.6	-18.8	-19.2	0.2	12.9	7.5	7.2	0.2	3.4	1.2
TOU084	53303	Building M		MBA	pig	radius	L	140611B	42.5	-20.1	-20.5	0.1	15.2	8.1	7.8	0.3	3.3	13.1
TOU085	761355			MBA	goat	radius	L	140617	40.2	-19.2	-19.4	0.3	14.6	5.3	5.3	0.4	3.2	15.4
TOU086	761312			MBA	goat	radius	L	140617	43.7	-19.6	-19.8	0.3	15.9	5.0	5.0	0.4	3.2	12.9
TOU087	761306			MBA	goat	radius	L	140610.1	36.9	-19.3	-19.5	0.1	13.0	8.6	8.8	0.2	3.3	3.2
TOU088	761108			MBA	goat	humerus	L	140610.1	42.1	-19.5	-19.7	0.1	15.0	4.0	4.1	0.2	3.3	7.1
TOU089	761200			MBA	goat	humerus	R	140610.1	41.8	-20.0	-20.2	0.1	14.9	4.4	4.5	0.2	3.3	12.2
TOU090	761155			early LBA	goat	humerus	R	140611A	41.8	-20.4	-20.6	0.2	15.0	6.6	6.6	0.2	3.2	9.5
TOU091	244025	Building A	A5	late LBA	cow	humerus	L	140610.1	38.2	-17.4	-17.6	0.1	13.5	7.5	7.7	0.2	3.3	6.9
TOU092	244063	Building A	A4	late LBA	cow	humerus	L	140617	32.4	-20.8	-21.0	0.3	11.5	3.6	3.6	0.4	3.3	11.3
TOU093	244069	Building A	A5	late LBA	cow	humerus	R	140617	41.8	-15.9	-16.0	0.3	15.1	5.7	5.8	0.4	3.2	17.4
TOU094	244137	Building A	A11	late LBA	cow	humerus	R	140610.1	41.5	-17.0	-17.2	0.1	14.8	7.2	7.4	0.2	3.3	14.9
TOU095	53337	Building M		MBA-early LBA	cow	radius	L	140610.2	28.1	-18.1	-18.4	0.1	9.9	6.6	6.5	0.2	3.3	14.1
TOU096	761356			MBA	cow	radius	R	140610.1	29.7	-12.0	-12.2	0.1	10.3	3.7	3.8	0.2	3.4	12.7
TOU097	761388			MBA	cow	humerus	L	140617	27.8	-10.6	-10.6	0.4	9.8	4.6	4.6	0.4	3.3	8.1
TOU098	761096			early LBA	cow	humerus	L	140617	46.7	-14.6	-14.7	0.3	17.0	6.1	6.2	0.4	3.2	15.5
TOU100	32341	Building M		MBA	cow	humerus	R	140610.1	40.9	-19.9	-20.2	0.1	14.7	4.3	4.4	0.2	3.2	8.0
TOU101	761334			MBA	cow	humerus	L	140611A	39.9	-12.4	-12.6	0.3	14.5	4.6	4.5	0.2	3.2	16.4
TOU102	761073			early LBA	cow	humerus	L	140610.1	38.9	-16.8	-17.0	0.1	13.8	5.4	5.6	0.2	3.3	18.8
TOU103	32260	Building M		MBA-early LBA	cow	humerus	L	140617	41.9	-10.1	-10.1	0.4	15.1	4.6	4.6	0.4	3.2	14.4
TOU104	72101	Building Z	Z1	late LBA	goat	humerus	L	140610.1	42.9	-18.9	-19.1	0.1	15.4	5.6	5.7	0.2	3.2	11.7
TOU105	241052	Building A	A11	late LBA	goat	humerus	R	140610.1	37.3	-19.1	-19.3	0.1	13.3	4.9	5.0	0.2	3.3	7.7
TOU106	221107	Building A	A3	late LBA	goat	humerus	L	140610.1	38.7	-19.0	-19.2	0.1	13.6	4.0	4.1	0.2	3.3	8.2
TOU107	221067	Building A	A3	late LBA	goat	humerus	L	140617	46.1	-19.0	-19.2	0.3	16.7	6.1	6.2	0.4	3.2	13.8
TOU108	233133	Building A	A5	late LBA	goat	humerus	R	140617	40.2	-19.2	-19.3	0.3	14.5	4.7	4.7	0.4	3.2	13.8
TOU109	243093	Building A	A3	late LBA	goat	humerus	L	140610.1	40.1	-18.4	-18.6	0.1	14.3	4.5	4.6	0.2	3.3	14.2
TOU110	243083	Building A	A10	late LBA	goat	humerus	R	140610.1	36.1	-19.0	-19.2	0.1	12.8	5.2	5.3	0.2	3.3	11.6
TOU111	244069	Building A	A5	late LBA	goat	humerus	R	140611B	35.2	-19.3	-19.7	0.2	12.5	4.5	4.2	0.2	3.3	11.3
TOU112	221136	Building A	A3	late LBA	goat	humerus	R	140617	32.5	-19.1	-19.3	0.3	11.7	4.0	4.0	0.4	3.3	18.0
TOU113	94113	Building A	A8	late LBA	goat	humerus	R	140610.1	41.3	-19.5	-19.7	0.1	14.8	4.0	4.2	0.2	3.3	14.2
TOU114	221123	Building A	A2	late LBA	goat	humerus	R	140610.1	31.8	-19.5	-19.7	0.1	11.1	4.0	4.1	0.2	3.4	7.4
TOU115	241081	Building A	A11	late LBA	goat	humerus	R	140610.1	32.8	-19.5	-19.7	0.1	11.5	5.1	5.3	0.2	3.3	12.9
TOU116	233158	Building A	A13	late LBA	goat	humerus	L	140610.1	32.4	-19.4	-19.7	0.1	11.3	4.4	4.6	0.2	3.3	7.6
TOU117	241076	Building A	A11	late LBA	goat	humerus	L	140617	38.8	-18.9	-19.1	0.3	13.6	5.3	5.3	0.4	3.3	3.0
TOU118	94108	Building A	A8	late LBA	goat	humerus	L	140610.2	40.8	-19.5	-19.8	0.1	14.4	7.2	7.2	0.2	3.3	13.8
TOU119	73018	Building Z	Z2	late LBA	goat	radius	R	140610.1	42.4	-19.9	-20.1	0.1	15.2	5.7	5.9	0.2	3.3	13.5
TOU120	244021	Building A	A4-A5	late LBA	goat	radius	L	140610.1	31.2	-19.2	-19.4	0.1	10.9	6.9	7.1	0.2	3.4	14.6
TOU122	244129	Building A	A3	late LBA	goat	radius	L	140610.1	33.0	-19.7	-19.9	0.1	11.7	4.2	4.3	0.2	3.3	13.7
TOU123	241027	Building A	A11	late LBA	goat	radius	L	140617	31.6	-18.7	-18.8	0.3	10.6	5.5	5.5	0.4	3.5	0.8

TOU124	51100	Building A	A1	late LBA	goat	radius	R	140610.1	40.9	-18.7	-18.9	0.1	14.7	8.3	8.5	0.2	3.2	7.4
TOU125	233162	Building A	A5	late LBA	goat	radius	R	140617	32.2	-19.8	-20.0	0.3	11.4	5.2	5.2	0.4	3.3	16.0
TOU126	233226	Building A	A5	late LBA	goat	radius	R	140611A	39.4	-19.7	-19.9	0.2	14.2	6.9	6.9	0.2	3.2	9.8
TOU127	761127			early LBA	fallow deer	metacarpal	-	140611B	45.7	-20.4	-20.8	0.1	16.7	6.2	5.9	0.2	3.2	11.0
TOU128	761139			MBA	fallow deer	phalanx 1	-	140611A	44.0	-21.1	-21.4	0.2	16.0	6.5	6.5	0.2	3.2	6.9
TOU129	761058			early LBA	fallow deer	metatarsal	R	140611A	27.2	-19.8	-20.1	0.2	9.4	6.4	6.4	0.2	3.4	2.8
TOU130	53352	Building M		MBA-early LBA	fallow deer	radius	R	140611A	39.6	-20.5	-20.8	0.2	14.2	4.6	4.6	0.2	3.3	11.1
TOU131	32319	Building M		MBA	fallow deer	metacarpal	L	140611B	39.9	-20.6	-21.0	0.1	14.3	5.8	5.5	0.2	3.2	5.1
TOU132	53303	Building M		MBA	fallow deer	scapula	R	140611A	42.7	-20.2	-20.5	0.2	15.2	6.5	6.5	0.2	3.3	2.5
TOU133	32200	Building M		MBA	fallow deer	metatarsal	-	140611A	42.0	-19.6	-19.9	0.2	15.2	5.7	5.7	0.2	3.2	12.5
TOU134	32193	Building M		MBA	fallow deer	humerus	L	140611A	41.4	-19.7	-19.9	0.2	14.9	5.9	5.9	0.2	3.2	6.8
TOU135	761120			early LBA	fallow deer	phalanx	-	140611A	43.3	-20.8	-21.1	0.2	15.8	6.1	6.1	0.2	3.2	13.3
TOU136	761096			early LBA	fallow deer	astragalus	L	140611A	43.8	-19.9	-20.2	0.2	15.9	6.4	6.4	0.2	3.2	8.8
TOU137	52135	Building M		early LBA	fallow deer	metatarsal	L	140611B	31.9	-20.0	-20.4	0.2	11.2	6.0	5.8	0.2	3.3	4.3
TOU138	32369	Building M		MBA	fallow deer	radius	R	140611A	44.5	-20.2	-20.5	0.2	16.3	5.1	5.0	0.2	3.2	13.3
TOU139	761284			MBA	fallow deer	radius	L	140611A	36.6	-20.6	-20.9	0.2	13.0	5.1	5.1	0.2	3.3	12.0
TOU140	761454			MBA	fallow deer	radius	L	140611A	39.0	-20.7	-21.0	0.2	14.1	4.7	4.7	0.2	3.2	12.2
TOU141	761204			MBA	fallow deer	phalanx 1	-	140611A	36.2	-20.5	-20.8	0.2	12.9	5.3	5.2	0.2	3.3	13.3
TOU142	53329	Building M		MBA	roe deer	metatarsal	-	140611A	38.7	-21.1	-21.3	0.2	13.8	5.0	5.0	0.2	3.3	11.6
TOU143	761414			MBA	roe deer	humerus	R	140611A	40.2	-20.3	-20.6	0.2	14.5	5.3	5.3	0.2	3.2	12.2
TOU144	761458			MBA	red deer	radius	R	140611B	42.9	-20.8	-21.2	0.1	15.7	4.2	4.0	0.2	3.2	13.6
TOU145	53301	Building M		MBA-early LBA	red deer	metacarpal	-	140611B	40.4	-20.4	-20.8	0.1	14.6	4.8	4.6	0.2	3.2	12.7
TOU146	761483			MBA	red deer	humerus	R	140611B	41.9	-20.8	-21.2	0.1	15.2	4.1	3.9	0.2	3.2	10.8
TOU147	761321			MBA	red deer	humerus	L	140611A	34.4	-20.3	-20.6	0.2	12.3	3.7	3.7	0.2	3.3	5.4
TOU148	32193	Building M		MBA	red deer	metatarsal	-	140611B	38.2	-20.4	-20.8	0.1	13.7	4.6	4.3	0.2	3.3	12.3
TOU149	761355			MBA	red deer	radius	L	140611B	36.9	-20.4	-20.8	0.1	13.2	3.5	3.3	0.2	3.3	15.8
TOU150	53343	Building M		MBA-early LBA	red deer	metacarpal	L	140611A	43.3	-20.2	-20.4	0.2	15.9	3.8	3.8	0.2	3.2	12.4

Supplementary Table S8. Results of stable isotope analysis of human bone collagen from Archontiko and Thessaloniki Toumba.

ID	Site	Context	SU	Age	Sex	Phase	Element	Runfile	%C	d13C raw	d13C (VPDB)	d13C sd	%N	d15N raw	d15N (AIR)	d15N sd	CN	% collagen
ARX01	ARX	Undetermined	6025	Neonate		EBA	Long bone	150209A	19.8	-19.1	-19.3	0.2	6.7	8.6	8.7	0.3	3.5	14.4
ARX02	ARX	Undetermined	16007, 16013	Neonate		EBA	Long bone	150209A	36.6	-18.8	-19.0	0.2	13.1	10.5	10.7	0.3	3.3	5.5
ARX03	ARX	Undetermined	30014	Adult		EBA	L humerus - dist 1/3	150209A	33.6	-19.4	-19.6	0.2	11.9	7.9	8.1	0.3	3.3	13.7
TOS001	TOS	X3-Burial 1	262133, 262134	8	?	4A	L femur - distal 1/3	130909	41.4	-17.6	-17.8	0.1	14.9	9.6	9.7	0.1	3.2	6.2
TOS002	TOS	X3-Burial 2	262133, 261134	Adult	?	4A	L fibula - prox 1/3	130909	26.9	-17.7	-17.9	0.1	9.3	7.8	7.8	0.1	3.4	7.6
TOS003	TOS	B2-B3-Burial A	261253	3	?	4A	R femur - distal 1/3	130909	41.9	-17.1	-17.3	0.1	15.3	9.7	9.8	0.1	3.2	7.6
TOS004	TOS	B2-B3-Burial	261259	Adult	Female	4A	R femur - distal 1/3	130909	38.8	-18.2	-18.4	0.1	14.0	9.3	9.4	0.1	3.2	14.4
TOS005	TOS	7-Burial 6	273160, 273178	7	?	3	L femur - prox 1/3	130909	44.2	-17.9	-18.1	0.1	16.1	9.5	9.6	0.1	3.2	11.7
TOS006	TOS	7-Burial 7	273237	2	?	3	L femur - distal 1/3	130909	41.0	-17.5	-17.7	0.1	14.8	10.1	10.1	0.1	3.2	13.3
TOS007	TOS	7-Burial 8	273259, 273262	9	?	3	5 L ribs	130909	28.5	-17.8	-18.0	0.1	10.1	8.7	8.7	0.1	3.3	13.5
TOS008	TOS	7-Burial 9	273264	40-50	Male	3	4 R ribs	130909	42.0	-18.2	-18.4	0.1	15.2	8.9	9.0	0.1	3.2	11.9
TOS009	TOS	A5-disturbed burial	233138, 233139, 233140	40-50	Male	3B-4A	Femoral fragment	130909	18.9	-17.9	-18.1	0.1	6.3	8.3	8.3	0.1	3.5	12.0
TOS010	TOS	A6-disturbed burial	74101, 74104	18-20	Female	4B-4G	L femur - prox 1/3	130909	40.1	-18.4	-18.6	0.1	13.8	9.4	9.4	0.1	3.4	5.4
TOS011	TOS	A7-disturbed burial	242144	Adult	Male?	4	3 Hand phalanges	130909	44.8	-18.5	-18.7	0.1	16.2	8.9	8.9	0.1	3.2	5.5
TOS012	TOS	A13	233080	16-18	Female	3	3 Hand phalanges	130909	40.8	-18.1	-18.4	0.1	14.7	9.9	9.9	0.1	3.2	6.8
TOS013	TOS	A8	94127	Adult	Female?	study not complete	L humerus - proximal 1/3	130909	31.5	-18.2	-18.4	0.1	11.1	8.6	8.7	0.1	3.3	9.4
TOS014	TOS	X Street_3	73058	Adult	Male?	4C-4D?	R femur - proximal 1/3	130909	44.5	-18.1	-18.3	0.1	16.3	9.8	9.8	0.1	3.2	15.2

Supplementary Table S9. Twelve dietary scenarios for LBA Thessaloniki Toumba. Each row is a different model, with the columns listing the different percentages contributed from each of the seven dietary groups.

Model Name	Barley	Wheats	Pulses	Cattle	Ovicaprids +pig	Millet	Wild Fauna	Marine fish
A. 100% wheats	0	100	0	0	0	0	0	0
B. 75% wheats 25% pulses	0	75	25	0	0	0	0	0
C. 60% pulses	10	10	60	10	0	0	0	10
D. With millet	30	35	25	0	0	10	0	0
E. 10% animal	27	31.5	22.5	7.5	2.5	9	0	0
F. 40% animal	7	25	28	25	15	0	0	0
G. 20% wild animals	10	15	25	14	6	10	20	0
H. Plus 10% fish	12	17	28	16	8	0	9	10
I. 50% fish	14.1	5.1	7.8	3	12	3	5	50
J. 50% cattle	15	6	9	50	15	0	5	0
K. 30% barley	30	40	30	0	0	0	0	0
L. 30% millet	18.8	6.8	10.4	4.0	6.0	30	6.7	7.4