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# Breaking the Bond: Investigating The Neolithic Expansion in Asia Minor in the Seventh Millennium BC

**Bleda S. Düring**

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**Abstract** In the early seventh millennium BC an expansion of the Neolithic economy and sedentism took place in Asia Minor. This occurred nearly two millennia after the emergence of Neolithic societies in southern central Anatolia, which raises the question of how this expansion occurred, and why it came about at this particular moment. This paper considers various elements that might have played a role in this expansion episode, such as climate change, demography, and agricultural and social changes.

**Keywords** Prehistory · Near East · Neolithic expansion · Asia Minor

## Introduction

The processes of domestication of plants and animals and the accompanying sedentarisation of human groups, conveniently captured in the phrase 'Neolithic Revolution', are at the root of complex societies worldwide. While we have good examples of sedentary hunter-gatherer-fisher communities from the end of the Palaeolithic onwards in various parts of the Near East (Özkaya and San 2007; Maher 2010), farming was of key significance for the further spread and consolidation of sedentary communities. Given the significance of this development, it is not surprising that the emergence of agriculture, and in particular the initial domestication of plants and animals, has been the subject of a massive amount of research (Hillman 1996; Tchernov 1998; Vigne et al. 1999; Colledge 2001; Nesbitt 2002, 2004; Colledge et al. 2004; Colledge and Conolly 2007; Fuller et al. 2012). Some scholars have argued that cognitive changes in the way humans perceived their world and society were as important as the emergence of farming in this transition (Hodder 1990; Cauvin 1997; Watkins 2009).

B. S. Düring (✉)
Faculty of Archaeology, Leiden University, Reuvensplaats 4, 2300 RA Leiden, The Netherlands
e-mail: b.during@arch.leidenuniv.nl

Undoubtedly the best investigated region where the Neolithic transition took place is the Near East, where this process occurred earliest and from where agriculture spread to a much larger region than in other parts of the world (Harris 2002a). The focus on this transition into sedentary farming communities—and, in particular, on the initial domestication of cereals and mammals—has, however, condensed the Neolithic transition to a threshold event occurring within a relatively brief time period, namely the Early Neolithic, during which it is generally thought that the Neolithic package effectively took shape; the subsequent spread of the Neolithic has often been regarded as a relatively self-evident process (for example: Harris 2002b; Bellwood 2005; Peters et al. 2005). It is probably because of this threshold view of the Neolithic, in which the main developments are held to occur in the ninth and eighth millennia BC (all dates in this paper are calibrated BC), that the later Neolithic has been relatively poorly investigated and has been regarded as a period in which there was little change to the way of life that had developed earlier in the Neolithic (Bogaard 2005; Özdoğan 2008).

By contrast, this paper focuses on developments in the later Neolithic, in particular the seventh millennium BC, in Asia Minor, that is, Turkey west of the East Anatolian Massif. Drawing on recent evidence from central and western Anatolia, it is argued in this paper that the spread of sedentary farming societies was far from self-evident. Instead, Neolithic societies were confined to a relatively small region, which can be characterised as a steppe environment, in central Anatolia for at least 1,500 years, before a further expansion towards western Anatolia occurred in the early to mid seventh millennium BC. This expansion of the Neolithic into more temperate regions was of great significance for the cultural history of Eurasia. However, the expansion of sedentary farming in Asia Minor in the early seventh millennium BC has not been much investigated, and is explicitly discussed in only one short paper (Schoop 2005a).

In this paper I would like to explore in more detail this episode in the prehistory of Asia Minor. A large amount of evidence relating to this expansion has been obtained in recent decades. The most important questions to address are why this development occurred in the early seventh millennium BC, and what factors contributed to it. But before I introduce this expansion episode, it is necessary to briefly discuss the early Neolithic in Asia Minor.

## The Neolithisation of Central Anatolia

In many respects our understanding of the earliest Neolithic has become more complex over the last 20 years. In the traditional view, which dominated Near Eastern Prehistory until recently and continues to have many proponents, a very specific set of circumstances in the southern Levant, in which sedentary hunter-gatherer Natufian groups started on the road to agriculture when faced with climatic adversity during the Younger Dryas, led to the Neolithic Revolution (Henry 1989; Bar-Yosef and Belfer-Cohen 2002; Colledge et al. 2004; Simmons 2007). In recent decades, the view that the Neolithic transition occurred over a much wider area, covering much of the Fertile Crescent but with the Taurus foot hills playing a prominent role, consisted of multiple domestication events, and lasted several millennia, has become mainstream (Smith 2001; Nesbitt 2002; Kozlowski and Aurenche 2005; Wilcox 2005; Vigne 2008; Zeder 2009; Fuller et al. 2012).

While the latter model seems the more plausible on the basis of current data, adherents of both models agree that farming first emerged in the hilly flanks of the Fertile Crescent.

This view of the Fertile Crescent as the cradle of agriculture is based on: first, the reconstructed distribution of wild progenitors of plant and animal species later domesticated (Zohary and Hopf 1993; Hillman 1996); and second, the evidence for the earliest domesticated crops and animals in that region (Nesbitt 2002; Colledge et al. 2004; Vigne 2008; Zeder 2009; Fuller et al. 2012). Although it is plausible that the tending and cultivation of crops and animals started very early in the Holocene in the Fertile Crescent, the earliest firm evidence for domestication of crops and animals dates to about 8500 BC (Nesbitt 2002; Wilcox 2005; Vigne 2008; Zeder 2009).

Around the same period an expansion of the Neolithic can be documented towards central Anatolia (Baird 2007a; Esin and Harmankaya 2007; Özbaşaran 2011a; Baird 2012). On Cyprus, the earlier idea of a colonisation by farmers in the mid ninth millennium BC (Swiny 2001; Guilaine and Le Brun 2003; Peltenburg and Wasse 2004) has been criticised, with new data suggesting that Mesolithic groups with Levantine 'Neolithic' chipped stone industries were already present from the start of the ninth millennium BC, and that farming was introduced later on the island (McCartney et al. 2010). Interestingly, while the Aceramic Neolithic lithic industries of Cyprus seem to bear clear resemblances to those of the Fertile Crescent (Peltenburg et al. 2001; McCartney et al. 2010, p. 141), the Neolithic assemblages of central Anatolia differ in almost every aspect from those of the Fertile Crescent (Özbaşaran 2000; Özdoğan 2002; Düring 2006, 2011; Özbaşaran 2011a; Baird 2012).

The earliest Neolithic societies in central Anatolia (Fig. 1), are best documented at the sites of Aşıklı Höyük (Esin and Harmankaya 2007; Özbaşaran 2011a), and Boncuklu Höyük (Baird 2006a, 2007b, 2012). At the extensively investigated site of Aşıklı Höyük a chipped stone industry occurs that is distinct from that in the Fertile Crescent, and has a microlithic component that can probably be linked with earlier hunter-gatherer groups in the area (Abbes et al. 1999; Düring 2011, pp. 51–52; Baird 2012). Further, we find buildings which were accessed from the roof and clustered into neighbourhoods, and sub-floor burials, which include only a selection of the deceased (Esin et al. 1991; Esin and Harmankaya 2007; Özbaşaran 2011a). These elements contrast markedly with contemporary settlements and burials in the northern Fertile Crescent, where buildings were free standing, and sub-floor burials were uncommon (Guerrero et al. 2009), but are typical for Neolithic settlements in central Anatolia, including later sites such as Canhasan 1 and 3, Çatalhöyük, and Erbaba (Özbaşaran 2000; Düring 2006).

Notwithstanding the distinctiveness of this earliest Neolithic, it is clear that people from central Anatolia and the Fertile Crescent, although separated by the substantial mountain chain of the Taurus, were in contact from the Epipalaeolithic onwards, as demonstrated most clearly by the occurrence of Cappadocian obsidian in the Levant (Cauvin and Chataigner 1998; Chataigner 1998; Düring 2011).

Further, it is plausible that domestic crops were transferred from the Fertile Crescent to central Anatolia (Asouti and Fairbairn 2002; Colledge et al. 2004). The earliest crop assemblages of central Anatolia show strong similarities, in particular, with those found in the Syrian Upper Euphrates, suggesting that crops might have arrived from that direction (Colledge et al. 2004). Intriguingly, however, central Anatolia has a high number of weed taxa in its early crop assemblages, and this has been interpreted as possible evidence for the presence of wild cereals in central Anatolia, which might have been cultivated alongside domestic crops (Colledge et al. 2004, p. 46; Özbaşaran 2011b; Fuller et al. 2012). Epipalaeolithic strata in central Anatolia at the site of Pınarbaşı B (Baird 2007a, p. 291, 2012) do not seem to contain any cereals, but it is not clear whether this reflects local conditions or an absence of these plants altogether. At

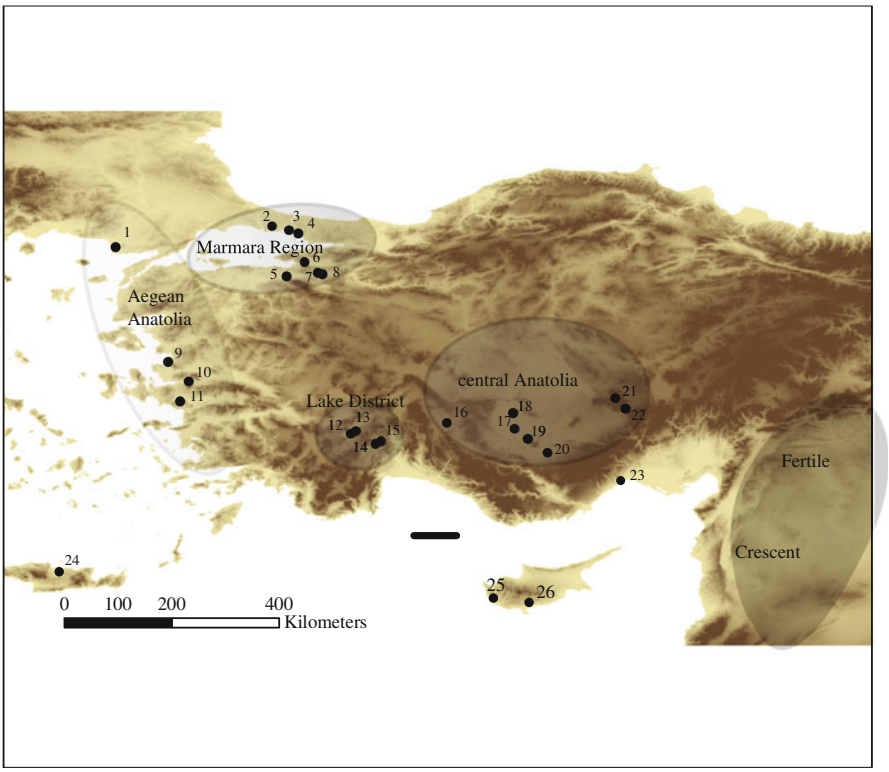


**Fig. 1** Map of Anatolia with the sites discussed in text. *1* Hoca Çeşme, *2* Yarımburgaz and Yenikapı, *3* Fikirtepe, *4* Pendik, *5* Aktopraklık, *6* Ilıpınar, *7* Menteşe, *8* Barcın Höyük, *9* Ege Gübre, *10* Ulucak, *11* Dedecik-Heybelitepe, *12* Hacılar, *13* Kuruçay, *14* Bademağacı, *15* Höyücek, *16* Erbaba, *17* Çatalhöyük East and West, *18* Boncuklu Höyük, *19* Pınarbaşı, *20* Canhasan, *21* Aşıklı Höyük, *22* Kaletepe, *23* Mersin-Yumuktepe, *24* Knossos, *25* Mylouthkia, *26* Shillourakambos

present, however, the most plausible reading of the evidence is that cereal crops were indeed imported into central Anatolia from the Fertile Crescent (Baird 2012, p. 440; Fuller et al. 2012).

In contrast with the crops, there is no evidence at present that domestic animals were introduced from the Fertile Crescent to central Anatolia during the Early Neolithic. At Aşıklı Höyük, the best known Aceramic Neolithic site in central Anatolia, no domestic animals were present, although it has been argued on the basis of cull patterns that sheep and goat were herded (Buitenhuis 1997; Vigne et al. 1999; Martin et al. 2002; Özbaşaran 2011b). Later, in the seventh millennium at Ceramic Neolithic Çatalhöyük, domestic sheep and goat are documented, but there is no evidence for domestic cattle at this site until around 6500 BC, that is from level V onwards (Russell and Martin 2005; Russell et al. 2005; Arbuckle 2013). However, sheep, goat, and cattle were domesticated by the eighth millennium BC in the Fertile Crescent (Peters et al. 1999; Helmer et al. 2005; Vigne 2008; Zeder 2009; Arbuckle 2013). Thus, regardless of how one interprets the differential evidence for domestic animals in the Fertile Crescent and central Anatolia, it is clear that the two regions did not develop synchronously with regard to animal domestication, and that domestic cattle, in any case, appear in central Anatolia more than a millennium after they had been domesticated in the Fertile Crescent.

## The Neolithisation of Western Asia Minor and the Aegean

While farming and sedentism were taken up in south-central Anatolia from about 8500 BC, it was not until 7000 BC that Neolithic societies appeared elsewhere in Asia Minor, and it was only at around 6500 BC that this expansion gained the momentum to colonise comprehensively the landscapes of western Anatolia and the Aegean.

The earliest evidence for Neolithic sites in Asia Minor, to the west and north of south-central Anatolia, dates to around 7000 BC. An even earlier date at around 8000 BC has been suggested for Aceramic Hacılar (Mellaart 1970), but this is based on a single radiocarbon date taken from a small sounding, has no parallels, and is rejected by most researchers working on Anatolian prehistory (Duru 1989; Thissen 2002; Schoop 2005b, pp. 178–179). Occupation at the site of Bademağacı, located in the Lake District like Hacılar, seems to have begun around 6800 BC (Duru 2004, 2008). Unfortunately, the 'Early Neolithic I' exposure at this site was very small, and consequently we know very little about the early seventh millennium in this region. Further, only a single radiocarbon date is available for this phase of occupation preceding 6500 BC, and more evidence would be useful.

The best evidence for Neolithic settlement in western Anatolia in the first half of the seventh millennium BC derives from the site of Ulucak, where seven radiocarbon dates of the earliest Level VI suggest a date of c. 6700 BC (Çilingiroğlu et al. 2012, pp. 141–142, 153). Interestingly, this Level VI occupation at Ulucak appears to be Aceramic and has elaborate red painted floors. The latter are also known from early seventh millennium BC strata in the Lake District, at sites such as Bademağacı and Aceramic Hacılar (Duru 2008).

For the Marmara region, Özdoğan and Gatsov (1998) have argued for the existence of an Aceramic Neolithic phase, to be dated from about 7000 BC onwards. The evidence upon which they base this consists of two survey sites, Çalca and Musluçesme. In addition, Efe has likewise dated various sites in the Eskişehir region, such as Keçiçayırı and Asarkaya to the Aceramic Neolithic (Efe 2005; Efe and Türteki 2007), and Aydıngün (2009) has argued that at Küçükçekmece in the Istanbul area, she found an Aceramic Neolithic site. No absolute dates are available, however, for any of these sites, and consequently their assignment of these sites to the Aceramic Neolithic is tentative and needs to be confirmed through excavations. Many of the chipped stone finds published from these sites would not be out of place at the later Ceramic Neolithic sites of Ilıpınar and Menteşe, even if some artefact classes, such as bullet cores and blades converted into perforators, are absent. It is conceivable that we are dealing with special purpose sites dating to the later Ceramic Neolithic or Early Chalcolithic.

In contrast to this rather scant evidence for Neolithic settlements west and north of central Anatolia in the first half of the seventh millennium, the evidence for Neolithic settlements from about 6500 BC in the Pisidian Lake District (Schoop 2005b; Duru 2008; Brami and Heyd 2011); Aegean Turkey (Çilingiroğlu et al. 2004; Çilingiroğlu and Çilingiroğlu 2007; Herling et al. 2008; Brami and Heyd 2011); and the Marmara Region (Özdoğan 1999; Özdoğan 2007; Brami and Heyd 2011) is overwhelming (Fig. 2). Thus, while it is possible that more early seventh millennium BC sites will surface in the coming years in western Asia Minor, it seems likely that the true turning point in the expansion of the Neolithic beyond central Anatolia occurred around 6500 BC.

Moving beyond Anatolia, new investigations at Knossos have reconfirmed earlier radiocarbon dates taken from the oldest layers of the site, which suggest that its occupation started around 7000 BC, for which there are now a number of radiocarbon dates (Evans 1964; Efstratiou et al. 2004). Although the excavated area is small, there is solid evidence

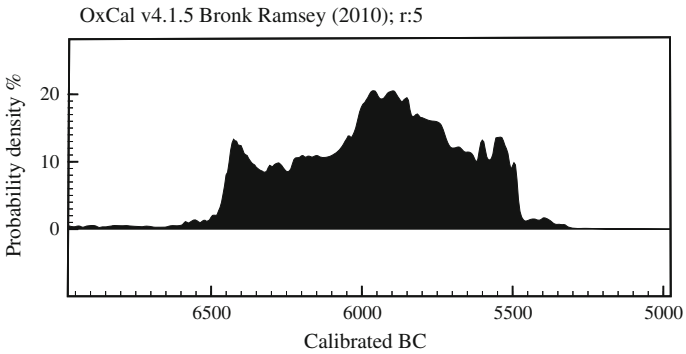


**Fig. 2** Cumulative radiocarbon *plot* for the Lake District, Agean Anatolia, and the Marmara Region. Produced in OxCal with the help of Quentin Bourgeois (n = 168, data obtained from Context database at context-database.uni-koeln.de augmented with data from Özdoğan and Başgelen (2007), and Çilingiroğlu et al. 2012)

for a Neolithic settlement, with domestic sheep, pig, and cattle, as well as domestic cereals and pulses. It has been postulated that the Knossos Neolithic might have arrived via the Mediterranean coastal regions rather than from the Anatolian mainland (Runnels and van Andel 1988; Perlès 2001, 2005; Broodbank 2006, pp. 214–215). The origins of the Knossos Neolithic are beyond the scope of this paper, and would be difficult to address with the present dataset. What is significant in light of the Neolithic expansion, however, is that Knossos remains a singular early site in the Aegean, and that the remaining dates for the earliest Neolithic sites start at around 6500 BC, synchronous with those of Asia Minor (Perlès 2001; Reingruber 2005; Thissen 2005; Brami and Heyd 2011, p. 174)—a circumstance that could suggest that the two developments were not entirely unrelated.

Summarising the above, our current evidence then suggests that after the start of the central Anatolian Neolithic, at around 8500 BC, it took about 1,500 years, until 7000 BC, for the Neolithic to spread further, and another half millennium, until 6500 BC, for this development to occur on a comprehensive scale. Moreover, this spread around 6500 BC probably occurred relatively rapidly, possibly in less than a century (Thissen 2005, p. 37, fig. 5; Brami and Heyd 2011). This relatively fast expansion is all the more remarkable in light of the long period in which the Neolithic remained largely confined to central Anatolia.

## Modelling the Spread of the Neolithic

The manner in which archaeologists have conceptualised the spread of the Neolithic in the Near East is heavily influenced by the ideas put forward by Gordon Childe in the early twentieth century (Childe 1928, 1936). For Childe, the Neolithic Revolution was a relatively rapid transformation of the economy, the advantages of which were self-evident, making the spread of the Neolithic more or less a fait accompli (Zeder 2009, p. 13). A similar understanding of the Neolithic transition is at the basis of the famous ‘wave of advance’ model put forward by Ammerman and Cavalli-Sforza (1971), in which they argued that the spread of the Neolithic was a stochastic process, resulting from small scale migrations, and that the Neolithic spread at a pace of about 1 km per year.

This model was subsequently criticised in the context of European archaeology, where it was realised early on that the Neolithic spread was not gradual and constant, but consisted of a series of expansion episodes separated by long periods of gestation and stable boundaries with non-farming societies (Zvelebil 1986; Fiedel and Anthony 2003). In light of this halted expansion of sedentary farming life, the particular circumstances surrounding the transition to farming in a specific region and the role that Mesolithic groups might have played in this process became the focus of interest (Whittle 1996; Zvelebil 1998).

In Near Eastern archaeology, by contrast, the mechanisms operating behind the spread of the Neolithic and the respective contribution of colonising farmers on the one hand and local hunter-gatherer groups on the other, have been less intensively investigated (Sherratt 2004). The overarching tendency has been to characterise almost the entire Near East as a Neolithic core region—in which the primary transition to a sedentary way of life, based in part on a farming economy, took place—albeit one with a variety of local manifestations and distinct cultural traditions (Özdoğan 2008; Zeder 2009).

Further, in recent years new variants of the wave of advance model have been put forward, in which demographic growth following the Neolithic transition, coupled with colonising farmers, is seen as the main mechanism behind the spread of Neolithic societies: the 'farming/language dispersal hypothesis', which postulates that the distribution of the main language families in the world can be correlated with the spread of farming (Bellwood 2005); and the 'Neolithic Demographic Transition', which postulates that the shift to the Neolithic resulted in rapid population growth until a new equilibrium was reached (Bocquet-Appel 2008).

The idea of the 'Neolithic package' forms an integral part of the wave of advance model: in the region of origin a consolidated complex of crops, domestic animals, technologies and material culture supposedly took shape, the spread of which by migrants can then be documented archaeologically. For the Prehistory of Anatolia and the Aegean various authors have now argued for a series of Neolithic packages that spread with migration waves at particular moments and to specific regions (Çilingiroğlu 2005, 2010; Brami and Heyd 2011; Özdoğan 2011), and this appears to be the consensus view among scholars working on explaining the Neolithic expansion in the region (but see Reingruber 2011).

The wave of advance model and its more recent variants are problematic for Asia Minor, however. As in Europe, the spread of the Neolithic—defined here as sedentary village life relying on agriculture for a substantial part of its subsistence—was not gradual but episodic, with rapid expansion separated by long periods of gestation. This suggests that a model of population growth and random migration is probably not accurate. Instead, it becomes necessary to investigate why the Neolithic did not spread for hundreds or even thousands of years, and was then suddenly taken up across large regions in a rather brief span of time.

As an alternative to the wave of advance model, Zvelebil (1986), Zvelebil and Lillie (2000) developed an availability model for the adoption of farming, in which three stages are distinguished: first, a stage in which agriculture as a technology becomes available; second, a stage in which agriculture becomes a substitute for other types of food procurement; and, third, a phase of consolidation, in which agriculture becomes the main subsistence technology. This model should be applied in the analysis of specific agricultural frontiers, which may be dynamic or relatively static. In general, where one is dealing with a moving or dynamic frontier, explanations of agricultural frontiers tend to focus on the farmers as the main actors in the expansion of agriculture, whereas in static frontier situations the role of hunter-gatherer groups is accorded more prominence. The classic case

in European prehistory is that of southern Scandinavia, where a stable boundary between more or less sedentary hunter-gatherers and farmers existed for many centuries, and where the transition to farming is explained as an economic shift by hunter-gatherer groups that was triggered by social or ecological change (Price 2000). The availability model is undoubtedly much better suited to analysing the agricultural expansion in Asia Minor around 6500 BC than the wave of advance model, even if some of its parameters remain difficult to define in this particular context, as discussed below.

## Evaluating the Neolithic Expansion in Asia Minor Around 6500 BC

How can we explain the fact that for 1,500 years the Neolithic did not expand beyond central Anatolia? And why was there a sudden expansion of the Neolithic around 6500 BC? Obviously, the answer to these questions could be complex and we need to consider factors such as ecology, agriculture, climate, demography, and culture. In the following sections I would like to evaluate these various factors consecutively. This discussion is to be regarded as a first inventory of issues bearing on this research problem, which will undoubtedly be revisited many times in the future as research progresses.

### Ecology and Agriculture

Asia Minor is characterised by marked ecological variation (Hütteroth 1982; Alex 1985; van Zeist and Bottema 1991). Relevant to the topic addressed here are the following ecological regions: central Anatolia; Mediterranean Anatolia; and the Marmara Region (Table 1). Central Anatolia is the driest region of Asia Minor. Around Tüz Gölü, the great salt lake located in the middle of central Anatolia, annual precipitation is 300–400 mm, while in the outer rim of Central Anatolia it is 400–500 mm. Central Anatolia is commonly classified as a 'steppe', a region where tree cover would have been limited even without human interference, but with enough rain to allow dry farming. In the western part of Asia Minor and along the southern littoral the climate is Mediterranean. Although precipitation is high in some parts, exceeding 1,000 mm per year, rainfall is almost absent during the summer, and winters are mild. The climate of the Marmara region is more temperate than that of the Mediterranean. Precipitation is about 800 mm per year, and occurs in all seasons, although summers are relatively dry, and winters are somewhat colder, with about 12 frost-days per year.

The ecological differences within Asia Minor are of course relevant to a discussion of the expansion of agriculture around 6500 BC, given that ecological conditions directly

**Table 1** Temperatures, precipitation figures, and frost days for central Anatolia, Mediterranean Anatolia, and the Marmara Region

| Region | Annual precipitation | | Average temperatures | | Frost days |
|---|---|---|---|---|---|
| | Amount (mm) | Summer rain | Summer (July) ( °C) | Winter (January) ( °C) | |
| Central Anatolia | 300–500 | No | 22 | −1 | 20 |
| Mediterranean Anatolia | 1,000–600 | No | 27–33 | 11 | 1–3 |
| Marmara region | 800 | Yes | 22 | 6 | 12 |

affect the productivity and feasibility of agriculture. It is possible that in the early Neolithic central Anatolia had a slightly more temperate climate (Rossignol-Strick 1997), but on the whole conditions probably did not differ much from those that currently prevail (van Zeist and Bottema 1991; Woldring and Bottema 2002). Given the ecological differences in Asia Minor, it is clear that one element that could have played an important role in the Neolithic expansion is transformations in agriculture. Such transformations might have included: first, changes in existing domestic crops and animals; second, the addition of new crops and animals to the agricultural package; and, third, the emergence of new farming technologies.

The fact that central Anatolia has a steppe environment might in part explain why the Neolithic sequence in this region starts relatively early and why expansion beyond central Anatolia did not occur for two millennia. The central Anatolian steppe in many respects resembles that of the Fertile Crescent. The latter includes or straddles the natural habitat of all the major plant and animal species domesticated in the earliest Neolithic (Zohary and Hopf 1993; Hillman 1996; Schoop 2005a, b). Here it is significant that the earliest crop assemblages of central Anatolia show strong similarities in particular with those found in the Syrian Upper Euphrates (Colledge et al. 2004). These crops would have been well adapted to the local environment, and were probably less productive in other climates. It has been argued that sites such as Çatalhöyük and Boncuklu, which were located in marshy areas, show evidence for wetland-adapted farming (Baird 2012, p. 440), but botanical and phytolith data suggest that cereals at least were farmed in dryer parts of the landscape (Fairbairn et al. 2005; Roberts and Rosen 2009), which would have been similar in ecology to the Fertile Crescent.

One of the characteristic of early Neolithic sites in central Anatolia is that the gathering of wild food resources and the hunting of animals remained significant to the subsistence economy (Esin and Harmankaya 2007, p. 266), although cultivated crops formed its mainstay (Asouti and Fairbairn 2002; Fairbairn et al. 2005, p. 183). The idea that in this early Neolithic horizon plants could be cultivated and animals could be tended with relatively little effort, as sometimes argued for the early Neolithic in the Fertile Crescent (Harris 1998; Smith 2001), probably does not apply for central Anatolia.

Undoubtedly the best documented agricultural system of the central Anatolian Neolithic is that of Çatalhöyük. This site was located in a marshy landscape that was regularly flooded, and was once interpreted as an example of flood plain agriculture (Sherratt 1980; van Andel and Runnels 1995). By contrast, in recent years it has been argued that the back-swamp soil surrounding Çatalhöyük in the Neolithic was ill suited to farming, and that the people at Çatalhöyük were mainly using sandy ridges located 12 km away from the site for the cultivation of cereals (Fairbairn et al. 2005, p. 183; Rosen 2005, pp. 210–211; Roberts and Rosen 2009). On the other hand, tubers and pulses, documented in considerable quantities at Çatalhöyük, might have been grown closer to the site (Fairbairn et al. 2005, pp. 173–174). While many questions about the nature of agriculture at Çatalhöyük remain, it seems clear that we are not dealing with a labour-extensive type of agriculture.

Returning to the issue of the Neolithic expansion in Asia Minor at 6500 BC, is there any evidence for changes in existing domestic crops and animals or for the addition of new domesticates in the seventh millennium BC which would have facilitated the expansion of farming to western Asia Minor?

First, in terms of new plant domesticates, there are crops such as naked barley and free-threshing wheat (*Triticum durum/aestivum*) that first appear in the seventh millennium BC (Kislev 1999; Colledge et al. 2005, p. 143). The addition of bread wheat, in particular, is of significance as it is better adapted to climates with a continental winter and humid

summers than the cereals previously cultivated (Zohary and Hopf 1993), a characteristic which would potentially have facilitated the adoption of farming in, for example, the Marmara region and in Europe. Nonetheless, it seems that in many European settlements there was a preference for glume wheats over naked barley and free-threshing wheat, possibly because they are easier to store and preserve (Colledge et al. 2005, pp. 149–150; Marinova 2007).

Second, in the seventh millennium BC we can document the appearance of various domestic animals in Asia Minor, many of which had been domesticated millennia before in the Fertile Crescent. In the early Çatalhöyük sequence, from about 7000 to 6500 BC, the only domestic animals are sheep, goat, and dog (Russell and Martin 2005; Arbuckle 2013). However, domestic cattle are in evidence at a range of sites in the Lake District, Aegean Anatolia, and the Marmara region from about 6500 BC (Boessneck and von den Driesch 1979; De Cupere et al. 2008; Gourichon and Helmer 2008; Çakırlar 2012a; Arbuckle 2013). Likewise, domestic pig was absent at Çatalhöyük, but appears in the Lake District and Marmara Region from about 6500 BC (Russell and Martin 2005; Buitenhuis 2008; De Cupere et al. 2008; Arbuckle 2013). Both domestic cattle and pig had been domesticated by the eighth millennium BC in the Fertile Crescent, and might have been either imported from that region in the mid seventh millennium BC, or domesticated locally (Peters et al. 1999; Helmer et al. 2005; Vigne 2008; Arbuckle 2013). Recent DNA research has not yet provided clear answers to such questions (Zeder 2009, p. 37; Çakırlar 2012b). Whatever the case, it has been argued that both cattle and pig are better adapted to temperate climates than are sheep and goat (Buitenhuis 1995). Nonetheless, in both the Lake District and the Marmara region, sheep and goat, rather than cattle and pig, seem to numerically dominate the earliest domestic assemblages (Buitenhuis 2008; De Cupere et al. 2008).

What about changes in farming technologies? In general, it has been argued that early farming was quite varied, and that an integrated set of crops and animals interlinked by means of optimal farming strategies first emerged in the seventh millennium BC (Kislev 1999; Perrot 2001; Bogaard 2005; Zeder 2009, p.40). Two models of farming strategies emerging in the seventh millennium BC have been put forward. One idea is that an integrated agro-pastoral economy took shape, providing a more productive and robust subsistence base than had previously pertained (Harris 2002b; Peters et al. 2005). In this mode of farming, cattle, sheep and goat fed on post-harvest cereal stubble, or in bad years on the failed crops. A complementary view has been put forward by Bogaard (2004, 2005), who has argued that increasingly managed and artificial growing conditions made the cultivation of a standard range of crops (cereals, pulses, flax) possible. Further, she argues that this took the form of 'intensive mixed farming', in which small garden plots were cultivated intensively, with a range of crops grown, and with manure from small animal flocks used to replenish soil nutrients.

Such changes in agricultural practices in the seventh millennium BC remain tentatively understood and require further study, but they do point to one mechanism which could help us to understand why the Neolithic expanded out of central Anatolia at approximately 6500 BC. It might be that these integrated farming technologies made farming an attractive option outside central Anatolia. However, there is almost no evidence at present for Neolithic Asia Minor to confirm the integrated intensive farming hypothesis.

Somewhat better understood are changes in animal husbandry practices occurring around this time. Whereas the 'secondary products revolution', in which animals started to be exploited for dairy, wool, and traction, was long postulated to have taken place in the fourth millennium BC in the Near East (Sherratt 1983; Greenfield 2005), in recent years it has been argued that some of these 'secondary products' were in use much earlier than was

previously thought. At present there is good evidence for the use of animal dung, primarily as a fuel, in the early Neolithic (Miller 1998: Fairbairn et al. 2005), and perhaps for animal traction in the late seventh millennium, although this is based on very limited evidence (Gourichon and Helmer 2008; Vigne 2008).

The most exciting new evidence, however, concerns the consumption of dairy products. Residue analysis on ceramics has demonstrated that dairy products were being consumed in the Balkans by the early sixth millennium BC (Craig et al. 2005), and in the Near East from the seventh millennium BC onwards (Evershed et al. 2008). Some of the earliest and best evidence for dairy consumption is found in the Marmara region (Evershed et al. 2008; Thissen et al. 2010). This corresponds well with possible evidence for cattle dairy consumption in Menteşe, where it has been argued that cull patterns point in this direction (Gourichon and Helmer 2008), and similar evidence for ovicaprid dairy consumption in the Late Neolithic levels at Bademağacı, and cattle dairy consumption from the Early Chalcolithic at the same site (De Cupere et al. 2008, p. 385). Similar evidence has now been obtained from the site of Ulucak, where dairy from cattle seems to have become important from about 6000 BC (Çakırlar 2012a). Finally, I should mention an early sixth millennium BC image from Köşk Höyük, on a relief-decorated pot, which has been interpreted as a cow being milked (Öztan 2007, p. 29 and fig. 16), an interpretation that has not found broad acceptance. However, this interpretation gains credibility from the fact that other agricultural activities, such as grain harvesting, are also depicted on relief-decorated pots at Köşk Höyük.

Some scholars (Harris 2002a; Vigne and Helmer 2007; Vigne 2008) have even argued that dairy consumption was important from the Middle PPNB onwards in the Fertile Crescent, c. 8000–7500 BC, and was closely linked with the emergence of animal management in the Near East. In residue analysis of pots, however, the earliest milk residues date from about 6500 BC (Evershed et al. 2008), although this might simply reflect sampling procedures and the scarcity of pottery prior to that date.

Nevertheless, it is clear that in Asia Minor dairy consumption appears as a new agricultural technology around 6500 BC. The introduction of dairy consumption was very significant for prehistoric subsistence: even in traditional farming, keeping cattle for dairy yields four times as much food as keeping cattle for meat (Legge 2005, p. 12). Further, unlike meat, dairy products such as hard cheeses do not need to be consumed immediately. Thus the consumption of dairy creates the potential to optimize production and storage of animal proteins and can act as a buffer against food shortages, as well as supporting feasting and hospitality.

Summarising this section on ecology and agriculture, it is possible to argue that a series of changes took place in agriculture that might have facilitated the expansion of farming beyond the central Anatolian steppe. However, the picture is far from straightforward. While 'new' domestic crops and animals surface in Asia Minor around 6500 BC, many of which are better adapted to temperate climates and forested environments, these are not necessarily the crops and animals dominating the assemblages.

More importantly, many of these crops and animals, and some of the ways in which they are exploited, such as for dairy consumption, do not have documented antecedents in central Anatolia at, for instance, Çatalhöyük, a site which has been intensively investigated. Thus the idea that farming was consolidated into a coherent and integrated package in the central Anatolian steppe, which then enabled the subsequent expansion towards the Lake District, the Aegean, and the Marmara region (Harris 2002a, b; Peters et al. 2005), does not seem to apply. Instead, these farming staples and technologies were either imported from the Fertile Crescent or developed locally. Whatever the origin of the crops,

animals, and technologies concerned, the important point is that the shift to farming in western Asia Minor was not a matter of simply introducing a package already in place in a neighbouring region.

Elsewhere, I have labelled the agricultural changes occurring in the seventh millennium BC, which allowed the expansion beyond the central Anatolian steppe, the 'Second Neolithic Revolution' (Düring 2011, pp. 122–125). This phrase was coined to emphasise the magnitude and speed of changes in agricultural practices in the seventh millennium BC. Future research will show whether the sudden and profound change in agriculture is real or simply what the data at present suggest. In any case, it is time to start the investigation of how agriculture was transformed in the Later Neolithic and to deconstruct the idea that farming was a consolidated practice from the Early Neolithic onwards.

## Demography and Climate Change

One element that has recently been connected with the Neolithic expansion around 6500 BC is the climatic fluctuation known as the '8.2 ka event'. This 'event', caused by the release of a massive amount of cold water from Lake Agassiz in Canada into the Atlantic after the ice dams behind which it was trapped burst, can be traced in climatic data from many parts of the globe. It has sometimes been argued that between 6400 and 6100 BC, there were lasting droughts in many parts of the world, possibly including parts of the Near East, with effects on Neolithic societies (Weiss and Bradley 2001; Wagner et al. 2002; Akkermans 2004; Budja 2007). It has been suggested that a combination of demographic pressure in the steppe regions of the Near East and climate change induced farmers to move out of the steppe into the more temperate regions of Asia Minor, Greece, and the Balkans in the seventh millennium BC (Bar-Yosef 2001; Budja 2007; Clare et al. 2008). In some cases, this has been linked with the so-called 'PPNB collapse' in the Levant. However, it has become clear in recent years that there was no sharp decline in population numbers at the end of the PPNB in that region (Banning 2004; Kuijt 2008).

The reconstruction in which a combination of demographic pressure in the steppe regions of the Near East and the 8.2 ka event induced farmers to migrate elsewhere, can be problematised in various ways. I will now briefly discuss the issue of demography, and then evaluate climate reconstructions, focussing on the evidence from Asia Minor.

Reconstructing demographics with archaeological data is very problematic (Cohen 2008, p. 483). Most archaeologists would argue that the best kind of evidence we have for this purpose is survey data, in which the number and size of sites per period is reconstructed and taken as a proxy for Prehistoric population densities (Kuijt 1999; Henry 2002). In the context of Asia Minor this requirement is especially difficult to meet, because the country has for the most part been surveyed extensively only, and consequently little is known about aggregate site numbers and areas (Düring 2008).

The most reliable evidence in this regard in central Anatolia is the Konya Plain Survey (Baird 2002, 2006b), which documents an increase both in the number of sites and in the aggregate site area from the seventh millennium into the sixth millennium. While one could interpret this data as reflecting increased population pressure, there is no evidence for a departure of a large part of the population around 6500 BC (Asouti 2009; Baird 2012, pp. 435–436). DNA studies, although difficult to evaluate, also seem to suggest that migrations from central Anatolia and the Fertile Crescent into Europe in the Neolithic were relatively limited (Richards et al. 2000; Haak et al. 2005).

Further, while the 8.2 ka event may have contributed to the Neolithic expansion in the seventh millennium, this statement requires qualification. First, without appropriate

agricultural technologies, the expansion of farming into other ecological zones simply would not have been feasible. It has already been argued that such novel technologies might have been an important component in the expansion of agriculture towards western Asia Minor.

Second, it is important to reconstruct the precise climatic effects and the timing of climatic changes. The effects of the 8.2 ka event across the globe appear to have been quite varied (Alley and Agustsdottir 2005; Morrill and Jacobsen 2005), and so far this event, like the earlier Younger Dryas, has yet to be demonstrated in the pollen cores that have been taken across Asia Minor (Bottema 2002; van Andel 2005). In many parts of Asia Minor the effects may have been minimal or non existent. No 8.2 ka event has been recognised in pollen sequences from, for example, Beyşehir, Eski Acıgöl, and Gölhısar Gölü, where one would expect this event to show up. Some of these sequences were published after the discovery of the 8.2 ka event, but this climatic change is not discussed (van Zeist and Bottema 1991; Eastwood et al. 1999; Woldring and Bottema 2002). This does not, of course, mean that there were no effects of the 8.2 ka event, but simply that we should be careful when reconstructing dramatic ecological changes.

Third, given that the 8.2 ka event is dated between about 6400 and 6100 BC, it is difficult to argue that it was at the root of the Neolithic expansion (Thissen 2010, p. 278). At 6400 BC, the expansion of the Neolithic to western Asia Minor, the Aegean, and the Marmara region, had effectively been completed. Thus the 8.2 ka event is too late to account for this expansion of the Neolithic (Berger and Guilaine 2009).

Perhaps the most reliable regional study to inform us about climate changes in the seventh millennium BC is based on deep sea cores taken in the southern Aegean (Clare et al. 2008). It is argued that the 8.2 ka event was embedded in a longer cold period, between about 6600 and 6000 BC (Rohling and Pälike 2005), during which the southern Aegean Sea was 2°–3° colder in winter. Effects were probably more pronounced on land, with the regular occurrence of severely cold and dry winter in the north of the Aegean and in the Marmara region (Clare et al. 2008, pp. 67–70). Again, this reconstruction cannot be easily linked with data from pollen sequences. For example, one would expect the 6600–6000 BC cold period to show up in the pollen sequence of Yenişehir, located in the Marmara region of Asia Minor. However, in that pollen sequence, no vegetation changes can be observed at 6600–6000 BC (Bottema et al. 2001). The conclusion must be that either pollen sequences are not suited to the detection of such climate changes, or the consequences of the cold event postulated between 6600 and 6000 BC were milder than reconstructed.

If we accept the cold period 6600–6000 BC as real, this change in temperatures would have had dramatic effects, especially in the northern Aegean and in the Marmara region. It is not clear whether there would have been detrimental effects in the steppe of southern central Anatolia, where, moreover, the results of the Konya Plain Survey suggest that on the whole population levels rise through the late seventh millennium and in the subsequent early sixth millennium BC (Baird 2002, 2006b, 2012, pp. 435–436). Instead, it is plausible that the 6600–6000 cold period might have had a significant impact on hunter-gatherer-fisher groups in the Aegean and the Marmara region, and this might have been one element that triggered the adoption of farming in these regions.

To summarise, the evidence for a scenario in which demographic pressure in the Near Eastern steppe regions, combined with climate change, induced farmers to leave the steppe for the more temperate regions of Asia Minor, Greece, and the Balkans in the seventh millennium BC, is not particularly compelling. There is no evidence that a large part of the population moved out of the Levant or central Anatolia in this period, and it is plausible

that the climate of central Anatolia, in particular, was little affected by climatic changes. Finally, the conventional dates for the 8.2 ka event are too late to explain the expansion of farming. Instead, if climate change is accepted as a factor, the strongest evidence for a—relatively mild—change in climate is in the Aegean and the Marmara region around 6600–6000 BC, possibly affecting local groups. However, given that no significant changes are visible in pollen sequences, the actual impact of climatic changes remains to be established.

## Culture

For the expansion of the Neolithic across Asia Minor at 6500 BC, two opposing scenarios can be put forward. One is that in central Anatolia the balance was upset for one reason or another, triggering an exodus of farmers to adjacent regions. The alternative model would be that predominantly local groups in Asia Minor took up farming around 6500 BC.

To some degree we can test which of these two models best fits our archaeological evidence. If the first scenario holds, we would expect changes in central Anatolia prior to 6500 BC, followed by the emergence of Neolithic societies in the west, where one would expect similarities with the assemblages from central Anatolia, at least in the earliest phases of occupation. If the second scenario holds, we would expect continuities between Neolithic assemblages and preceding Mesolithic assemblages, and the emergence of a series of distinct Neolithic horizons.

In central Anatolia, there is definitely a case for changes occurring around 6500 BC. At Çatalhöyük—the best documented sequence in central Anatolia—changes can be demonstrated in social organisation during this period. In particular, we can document: first, the break up of neighbourhood communities that had dominated the settlements of the early Neolithic in the region; and second, the end of building continuity, and the values attached to that continuity, as expressed most clearly in the clustering of burials in high status buildings (Düring 2006, 2007). These developments can be seen in the context of a general trend in which large, aggregate communities gave way to more dispersed, smaller groups living in more modest settlements, with households more prominent after 6500 BC (Düring and Marciniak 2005; Marciniak and Czerniak 2007). Such developments, in which small groups operated more independently, could have facilitated the expansion of the Neolithic into adjacent regions.

Turning to the Neolithic evidence from western Asia Minor, we can ask the following questions. First, how do the earliest Neolithic assemblages of the Lake District, Aegean Anatolia, and the Marmara region relate to those of the central Anatolian Neolithic? Second, to what degree are the earliest Neolithic assemblages in these western regions comparable with each other? Third, are there any elements in the Neolithic assemblages that can be linked with earlier local Mesolithic assemblages?

The clearest evidence for the transition to the Neolithic around 6500 BC is available for the Marmara region. In this region, not only has the Neolithic been documented at a range of excavated sites, but we also have evidence for the preceding Mesolithic (Özdoğan 2007), from the 'Ağaçlı' group. Ağaçlı sites are located near the sea or at lake shores, and it is plausible that marine resources were important in their economy. The chipped stone industries of Ağaçlı sites include backed bladelets, conical cores, and circular end-scrapers, and they have been compared with contemporary assemblages found along the Black Sea in Bulgaria and Romania (Gatsov and Özdoğan 1994).

Sites that are similar in many respects to the earlier Ağaçlı sites have been found in the Marmara region's Neolithic Fikirtepe horizon, which has been documented in the Istanbul

region and extends in Asia towards Eskişehir. A number of coastal sites, such as the eponymous Fikirtepe, Pendik, Yarımburgaz, and the recently excavated Yenikapı, have lithic assemblages that closely resemble those of the Ağaçlı group (Gatsov and Özdoğan 1994; Özdoğan 2007), as well as pottery in the Fikirtepe tradition. The economy of these coastal Fikirtepe sites—which consisted of groups of round sunken hut features—included a substantial component of seafood (molluscs and fish), and domestic animals (cattle, sheep, goat and pig), while hunting was relatively insignificant (Boessneck and von den Driesch 1979).

Contemporaneous with these coastal Fikirtepe sites, there were inland sites at Ilıpınar, Menteşe, Aktopraklık, and Barcın Höyük (Özdoğan 2007; Roodenberg and Alpaslan-Roodenberg 2007; Karul 2011; Karul and Avcı 2011), at which Fikirtepe ceramics and chipped stone artefacts of the same tradition were found in settlements which consisted of large rectangular houses and relied for their subsistence primarily on the cultivation of crops and the keeping of livestock (Buitenhuis 2008; Cappers 2008; Gourichon and Helmer 2008).

The situation in the Marmara region is an interesting hybrid. On the one hand, there is a range of distinctly local characteristics. These include the lithic industries, which descend from the Mesolithic Ağaçlı tradition. Likewise, the ceramics are distinctively local from the start, and cannot be linked convincingly with ceramic traditions from central Anatolia. The round sunken huts of the coastal Fikirtepe sites are probably also Mesolithic in ancestry, but because no Ağaçlı sites have so far been excavated we cannot be certain about this. The inland settlements consist of free-standing rectangular buildings, which are constructed with loam slabs or wattle and daub, and have gabled roofs (Coockson 2008). Both the organisation of settlement space and the construction methodology of buildings in these earliest Neolithic inland sites in the Marmara region differ from what people were doing in central Anatolia in the seventh millennium BC. On the other hand, we see that in both coastal and inland Fikirtepe sites domestic resources play a very important role and that, with the exception of seafood in the coastal sites, hunting wild animals and collecting wild foods seems to have been marginal to the subsistence economy. Thus, in the Fikirtepe sites we can document the take-up of food production technologies by groups who used and developed distinctly local technologies and styles for their chipped stone tools, ceramics, and buildings.

In Aegean Anatolia and the Lake District the Mesolithic horizons are less well documented than in the Marmara region. Nonetheless, it is fairly certain that these areas were occupied in that time period. Not very far from the Lake District a series of Epipalaeolithic and Mesolithic sequences have been investigated in cave sites in the Antalya region, at sites such as Öküzini, Beldibi, Belbaşı and Karain (Yalçınkaya et al. 2002; Kartal 2003). In Aegean Anatolia similar sequences are so far lacking, but given that Mesolithic sites are documented on the Aegean islands, as on Youra and Kythnos (Sampson 2005), it is plausible that the discovery of similar sites in western Asia Minor is simply a matter of time. Reingruber (2011, pp. 295–296) has argued that the Epipalaeolithic/Mesolithic assemblages of Öküzini and Franchti are part of the same tradition, implying that more sites of the same period remain to be found in the west of Turkey. It also possible that some of the Latmos rock paintings in western Asia Minor are Epipalaeolithic/Mesolithic (Peschlow-Bindokat 1996), given that there are also rock paintings from the same period in the Antalya region, but there is no evidence to demonstrate this.

In both Aegean Anatolia and the Lake District, a microlithic component that could indicate continuity with earlier Mesolithic traditions seems absent from the earliest Neolithic strata, although many conical micro-cores have been found (Balkan-Atlı 2005; Herling et al. 2008). Thus it is not possible to argue for Mesolithic–Neolithic continuities

in chipped stone industries in these two regions. It has been recently suggested that in Aegean Anatolia there may be a settlement differentiation comparable to that in the Marmara region, with coastal sites focussing on marine resources and inland sites relying primarily on agriculture (Herling et al. 2008, p. 56), but this needs to be further substantiated. Even if this distinction is valid, it is not necessary to link the coastal sites with an earlier Mesolithic presence.

However, what is remarkable in the earliest Neolithic occupation levels in both Aegean Anatolia and the Lake District is that in both regions very distinctive assemblages are found from the start, which on the whole bear little or no resemblance to the Neolithic of central Anatolia in the seventh millennium BC. For example, in the Lake District, where the earliest Neolithic horizon is one with monochrome ceramics and has been excavated in Hacılar, Kuruçay, Höyücek, and Bademağaci (Schoop 2002; Düring 2011, pp. 160–174), the settlements are distinct from those known from central Anatolia. Buildings consist of a large rectangular room, in some cases with an additional room on one side, with a door in the centre of the long wall and an oven on the wall opposite, and in most cases a hearth aligned along the same axis (Umurtak 2000). These buildings are constructed in rows that included a handful of structures all facing the same side, and the settlements consist of several such clusters grouped around open spaces. The ceramics associated with these buildings have features that are absent in the seventh millennium in central Anatolia, such as tubular lugs, S-profiled bowls, and globular jars, and it has been argued that we are dealing with traditions that are distinct from those in central Anatolia (Duru 1999; Last 2005).

In Aegean Anatolia the ceramics in the earliest Neolithic strata, such as at Ulucak Level V, are predominantly red burnished S-shaped vessels, some with tubular lugs, and some decorated with impressions. These ceramics can be clearly distinguished from those in the Lake District and the Marmara region (Çilingiroğlu and Çilingiroğlu 2007; Sağlamtimur 2007; Herling et al. 2008).

The buildings found in the Neolithic of Aegean Anatolia are diverse. At Ulucak Level V rectangular structures of about 6 by 6 m constructed of wattle and daub have been found. If the settlement in this period resembles that in subsequent phases, these buildings were arranged along narrow streets (Çilingiroğlu and Çilingiroğlu 2007). By contrast, at nearby Ege Gübre stone foundations of similar sized buildings were found, arranged around a central court. Some of these had a rectangular side room, but there were also numerous smaller, round structures associated with these buildings, which probably served non-domestic purposes (Sağlamtimur 2007).

Summarising the discussion above, the following conclusions can be drawn. First, only in the Marmara region can a cultural continuity be documented from a Mesolithic horizon into the Neolithic. The lack of similar evidence in the Lake District and Aegean Anatolia could mean one of two things: that the Neolithic in these areas was genuinely novel, or that the absence of evidence for Mesolithic–Neolithic continuity is simply a consequence of a lack of research. Second, the earliest Neolithic cultures in western Asia Minor are remarkably diverse. Buildings, settlements, and ceramics are all distinct from one region to another, and from those in seventh millennium BC central Anatolia.

## Discussion and Conclusions

How can we understand the Neolithic expansion in Asia Minor around 6500 BC in light of the evidence discussed in this paper? First, it is clear that the central Anatolian Neolithic is

a classic example of a static boundary (Dennell 1985), as farming remained confined to this steppe region for about 1,500 years. Second, the Mesolithic of Asia Minor remains very poorly investigated and is known mainly from survey evidence. These circumstances make it impossible to discuss the characteristics of the boundary between farmers and hunter-gatherers and the degree of interaction between these groups in Asia Minor, elements that are central to studies of Neolithisation in Europe (Zvelebil 1986; Zvelebil and Lillie 2000). Third, the suddenness of the Neolithic expansion around 6500 BC across much of Asia Minor is remarkable.

In terms of farming, various innovations can be documented in Asia Minor in the seventh millennium BC, including: the addition of crops and animals better adapted to temperate climates and forested regions (although these crops and animals do not dominate the archaeological assemblages in the west); the possible integration of crops and animals in garden agriculture; and the addition of dairy products to the agricultural economy. Intriguingly, many of these elements that surface in western Asia Minor, such as domestic cattle and pig, lack good antecedents in the Neolithic of central Anatolia, and must have been either obtained from the Fertile Crescent or domesticated locally. Further, the Marmara region appears to have been a centre for early dairy consumption, undoubtedly a very significant development for prehistoric subsistence economies.

The demography of seventh millennium BC central Anatolia can only be approached with proxy data from the Konya Plain Survey. The evidence obtained does not suggest a scenario in which a large part of the population left the region in a situation of stress, but instead shows continued population growth into the sixth millennium BC. The idea that people were forced out of the steppe by a deteriorating climate during the 8.2 ka event is thus problematic. Further, it remains to be established that the 8.2 ka event had an impact on climate and people in central Anatolia, and the climatic oscillation is in any case too late to explain the expansion of farming around 6500 BC. A better match is provided by a recently proposed (Rohling and Pälike 2005; Clare et al. 2008) cold period dated around 6600–6000 BC, which would have primarily impacted people in the Aegean and Marmara region, where winters might have been substantially colder during these centuries. Thus, if climate played a role in this expansion of farming, the effects would have been felt mainly in western Asia Minor, where local groups might have faced difficult times.

There are social transformations in central Anatolia in the mid seventh millennium, in which large agglomerate communities broke up into smaller segments in which households became more autonomous, and this might have stimulated enterprising individuals to migrate elsewhere. A survey of the earliest Neolithic occupation levels in the Lake District, Aegean Anatolia, and the Marmara region, makes it clear that all these regions have assemblages and settlements that differ completely from those in the seventh millennium BC in central Anatolia, and from each other. Further, in the Marmara region, a clear cultural continuity could be established between an earlier Mesolithic horizon and the subsequent Neolithic assemblages.

Innovations in agriculture and possible effects of climatic changes very likely played a role in the Neolithic expansion in Asia Minor around 6500 BC. If this were not the case it would be difficult to explain why the process occurred simultaneously in the Lake District, Aegean Anatolia, and the Marmara region. However, it is clear that we need to understand the Neolithic expansion in social terms as well. What type of model could best explain this expansion episode? Here I would like to consider first the possibility of colonisation from central Anatolia.

Migrations occur in many varieties. Anthony (1990, 1997), has distinguished several types of migration relevant to prehistory. First, local migration occurs where people move

over a distance small enough to maintain (part of) their existing social network. This would resemble the wave of advance model discussed earlier, and is inadequate for explaining the expansion of farming in Asia Minor, because the farming frontier did not move gradually and farmers concentrated in specific regions of western Asia Minor. Second, in 'leap-frog migrations' people move selectively to regions that are attractive, while avoiding other regions with less potential. The best documented example of this is the targeted migration of LBK farmers in Europe to loess soils, producing a very homogeneous assemblage across a large part of Europe (Bogucki 2000). This model is clearly difficult to apply to western Asia Minor, with its diverse Neolithic assemblages. Third, in 'chain migrations' a small number of pioneers move to a new region and these pioneers are later followed by kinsmen. The first colonists often culturally dominate the societies that emerge. Culture in these newly colonised regions may transform rapidly in a kind of 'founder's effect', given that the initial colonising group is small.

In theory, the chain migration model could work for the expansion of farming to western Asia Minor, in which early settlements, such as those at Ulucak and Bademağacı, might have facilitated the rapid expansion of farming in the mid seventh millennium BC. If this were the case, however, one would expect some affinities with central Anatolian assemblages, at least in the earliest Neolithic occupation levels, and one would not expect cultural continuities with preceding Mesolithic horizons. More data from the early levels of Ulucak and Bademağacı would be essential to investigate the chain migration scenario.

The case for hunter-gatherer groups taking up farming in the Marmara region, Aegean Anatolia, and the Lake District can be supported in various ways. The cultural diversity of Neolithic horizons in western Asia Minor could point to a development in which local groups played an important role in the articulation of distinctive Neolithic horizons in their respective regions. This would also explain the strong continuities between Mesolithic and Neolithic cultural traditions documented in the Marmara Region.

On the other hand, the degree to which Neolithic people in the Marmara Region almost completely rely on agriculture for their subsistence is remarkable. Further, they must have been familiar with farming technologies practised hundreds of kilometres away in southern central Anatolia, to the degree that they were able to obtain domesticates and technologies not common in southern central Anatolia as soon as they decided to take up farming. This does suggest that in western Asia Minor we are dealing with more than a process of an available farming technology that quickly became a substitute for hunter-gathering and was then consolidated. Instead, the conversion to farming was simultaneously the development of new agricultural assemblages and a new 'culture' in a more general sense, consisting of distinctive settlement forms, material culture and burial traditions. The mid seventh millennium BC must then be considered an extremely creative episode in the prehistory of Asia Minor.

Given the complexity of what happened in Asia Minor around 6500 BC, and the intimate knowledge of farming that it required, it is likely that at least some of the actors in this process were migrant farmers. Indeed, it is possible to explain the Neolithic expansion of 6500 BC in Asia Minor as a combination of small-scale chain migration from central Anatolia, possibly documented at Ulucak and Bademağacı, and local hunter-gatherer groups opting into farming, in which the migrants would have contributed farming expertise, and the hunter-gatherers knowledge of the local environment and its resources. Such a dual ancestry of Neolithic societies in western Asia Minor could explain the continuities with the earlier Mesolithic in the Marmara region; the cultural distinctiveness that characterises the Lake District, Aegean Anatolia, and the Marmara region in the Neolithic; and the innovative agriculture witnessed in these Neolithic societies.

In conclusion, I have argued that the Neolithic expansion in Asia Minor that occurred around 6500 BC was a creative episode, involving the adoption of new farming technologies by groups that consisted of both migrant farmers and local hunter-gatherers. It is clear then that the idea that Anatolia was simply a bridge transmitting the Neolithic from the Fertile Crescent to Europe should be discarded. Finally, I have only scratched the surface here of the processes occurring in the seventh millennium BC in Asia Minor, which deserve much more detailed investigation.

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