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DEPENDING ON ^{14}C DATA: CHRONOLOGICAL FRAMEWORKS IN THE NEOLITHIC AND CHALCOLITHIC OF SOUTHEASTERN EUROPE

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ABSTRACT. With the introduction of the radiocarbon method in 1949 and the calibration curve constantly improving since 1965, but especially due to the development of the more accurate accelerator mass spectrometry (AMS) dating some 30 yr ago, the application of the ^{14}C method in prehistory revolutionized traditional chronological frameworks. Theories and models are adjusted to new ^{14}C sequences, and such sequences even lead to the creation of new theories and models. In our contribution, we refer to 2 major issues that are still heavily debated, although their first absolute dating occurred some decades ago: 1) the transition from the Mesolithic to the Early Neolithic in the eastern and western Aegean. Very high ^{14}C data for the beginning of the Neolithic in Greece around 7000 BC fueled debates around the Preceramic period in Thessaly (Argissa-Magoula, Sesklo) and the Early Neolithic in Macedonia (Nea Nikomedeia). A reinterpretation of these data shows that the Neolithic in Greece did not start prior to 6400/6300 BC; 2) the beginning and the end of the Chalcolithic period in SE Europe. Shifting from relative chronologies dating the Chalcolithic to the 3rd millennium BC to an absolute chronology assigning the Kodžadermen-Gumelniţa-Karanovo VI cultural complex to the 5th millennium BC, the exact beginning and the end of the period are still under research. New data from Varna (Bulgaria) and Pietrele (Romania) suggest that start and end of the SE European Chalcolithic have to be dated deeper into the 5th millennium BC.

INTRODUCTION

One of the results of the workshop “The Neolithic of Central Anatolia” held in Istanbul in 2001 (Gérard and Thissen 2002) was the compilation of a database including all available radiocarbon dates between 10,000 and 5500 BC in Turkey. Taking Anatolia as a starting point, the CANeW project (www.canew.org) expanded east- and westwards to include ^{14}C dates from Mesopotamia and southeastern Europe. By thoroughly scrutinizing not only the published dates, but also including new ones reported to CANeW by field directors of current excavations, we were able to question models and theories regarding the transition from hunter-gatherer groups to farming communities.

Prior to the development of the ^{14}C method, prehistorians were free to correlate materials and finds from different regions according to their knowledge and imagination. Of big help in producing creative comparisons was the fact that only few sites were excavated, which lay at big distances from each other. The most important tell used to be the Bronze Age mound of Troy. To its sequence many European sites were adjusted, including those belonging to the Neolithic Vinča or the Chalcolithic Baden cultures (Milojčić 1949; against the contemporaneity of Baden with Early Bronze Age Troy: Maran 1998).

Many archaeologists, especially those favoring the method of comparative stratigraphy like Vladimir Milojčić, severely dismissed the new dating method (Milojčić 1961). Milojčić’s criticism was inapt, because he rejected a helpful use of scientific dating methods in archaeology. The early dates, however, were indeed not acceptable because they needed calibration. Since Milojčić’s days, archaeologists became completely dependent on ^{14}C dates. But not all regions and periods are covered by trustworthy sequences of dates. For the Neolithic period in SE Europe, for instance, we have dates of different quality: sequences with many samples offering a reliable dating of the specific site (e.g. Achilleion in Thessaly) and sites with only few, often controversial, dates, which allow for subjective interpretations (e.g. Knossos on Crete) (Figure 1).

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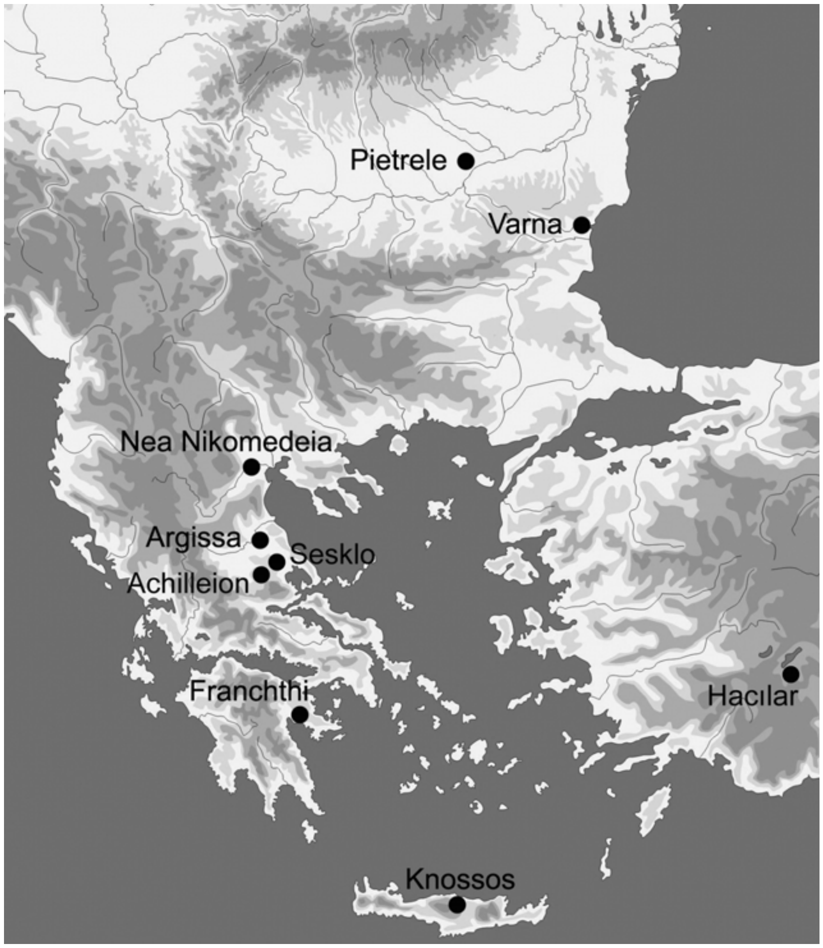

Figure 1 Map of the Aegean and the Balkans with sites mentioned in the text

THE DATA FROM THE AEGEAN

The "Preceramic Rush"

In the late 1950s to early 1960s, excavations were carried out both east and west of the Aegean Sea under the expectation of finding Preceramic layers—analogous to those described a decade earlier for the Near East. Between 1957 and 1960, this "Preceramic rush" was at its highest with James Mellaart excavating in Hacılar, John Evans in Knossos, Vladimir Milojčić in Argissa, and Dimitrios Theocharis in Sesklo and Achilleion. At the same time ^{14}C measurements were introduced into the prehistory of SE Europe (e.g. Vogel and Waterbolk 1963; Kohl and Quitta 1966; Quitta 1967; Quitta and Kohl 1969; Barker et al. 1969). Tacitly, the oldest dates, no matter from what context the sample derived, were claimed to be dating the site. Moreover, the Thessalian Preceramic sites had to be very early in order to stand the comparison to the Near Eastern Pre-Pottery Neolithic. The "Magic Marge" was situated at 7000 BC, a point in time that is still believed by many to represent the beginning of the Neolithic in the Aegean. Not only have the high dates to be questioned (Reingruber and Thissen 2005). but also has the Preceramic period, as postulated by Milojčić, to be rejected for Greece (Reingruber 2008).

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Mainland Greece (Thessaly, Macedonia, and the Argolid)

We do encounter a big discrepancy between reliable ^{14}C dates and single floating ones throughout Greece. The Neolithic had to start early in order to be comparable to the PPN in the Near East, as Milojčić and Theocharis wanted to show in the 1950s at sites like Argissa-Magoula and Sesklo. Considered uncritically, the sequences from Argissa-Magoula, Nea Nikomedeia, and Franchthi indeed seem to favor a very early beginning of farming in Europe.

The 8 samples from Argissa-Magoula (Figure 2) derive from different materials and were dated in 3 different laboratories. In 1958, Milojčić sent 12 charcoal samples from what he considered Preceramic contexts to the Heidelberg laboratory. They were processed by K Münnich at the very beginning of the activity of the laboratory and received entry numbers H-889 up to H-900 (B Kromer, personal communication, February 2004). Results are known from only 6 of these samples, 2 of which postdate 5000 cal BC, and are not included here.

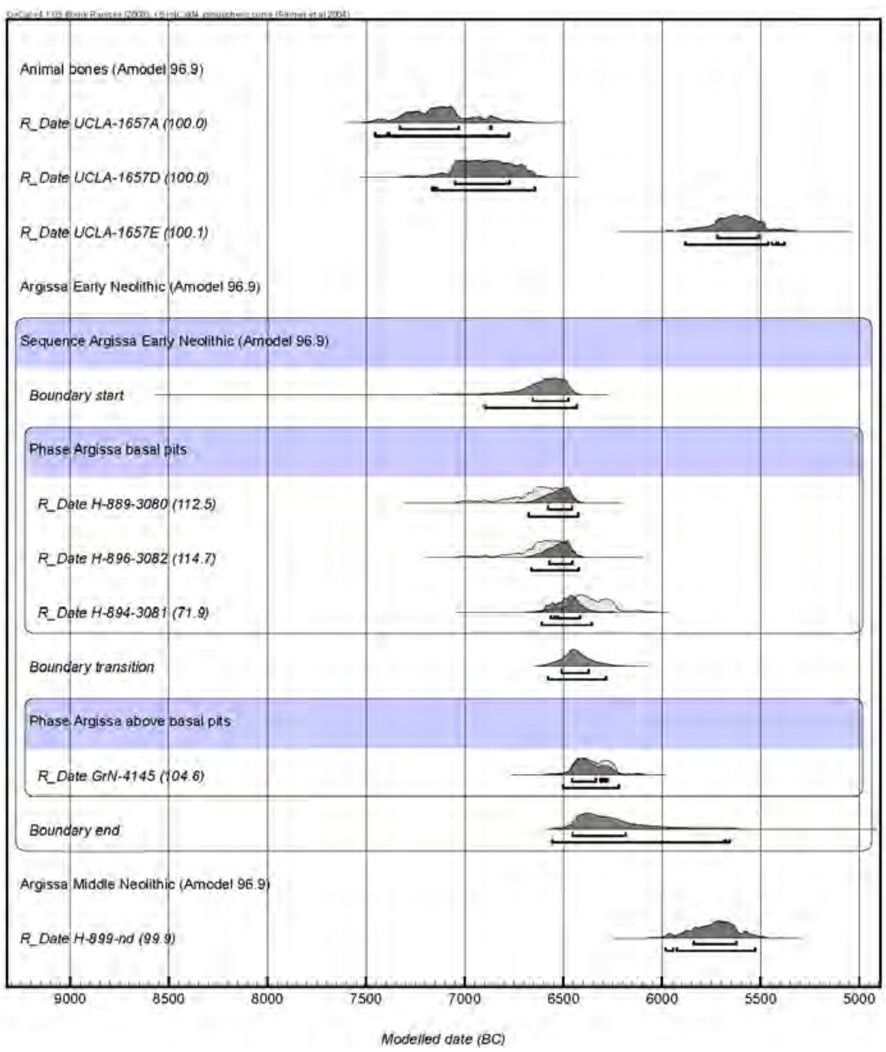

Figure 2 ^{14}C dates from Argissa-Magoula. Modeled dates in dark gray; original individually calibrated dates light gray.

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The 4 UCLA dates on animal bones should be treated with extreme caution: they were published in 1973 (see Berger and Protsch 1973; Protsch and Berger 1973; and discussion in Bloedow 1992/3: 51ff.), well before the introduction of the AMS dating technique in the late 1970s. Moreover, their exact provenance is not known. The date UCLA-1657B (5000 ± 1100 BP) is not included here either. The bone samples give too high or too low results in comparison to the charcoal samples, with which they are mutually exclusive. The latter form a consistent series and reflect also a change in stratigraphy. The sample H-889-3080 was taken from the rim of pit α—it can either belong to the pit itself, which was dug in from spit 27c, dating to EN II, or else it pertains to the bordering area in Δ 8/9, in which case it would belong to spit 31, dating to EN I. H-896 and H-894 are from the lowest level with "pits" from the "Preceramic," GrN-4145 from level 28b above the "pits" and H-899 from a beam sunk into pit α but belonging to a construction from a higher level. A tentative boundary model using this stratigraphical information results in a start boundary for the Argissa EN at 6660–6480 cal BC, a transition between 6580–6370, and an end boundary supplied by the single GrN date at 6450–6190 cal BC.[1] The Argissa charcoal samples, thus, would push the Early Neolithic at the site away from the 7000 marker towards the middle and second half of the 7th millennium cal BC.

The dates on charcoal also correspond to the sequence from Sesklo. Estimated boundaries for the beginning of Sesklo EN I and the transition to EN II/III yield 1-σ ranges between 6530–6430 and 6350–6190 cal BC, respectively (Figure 3).

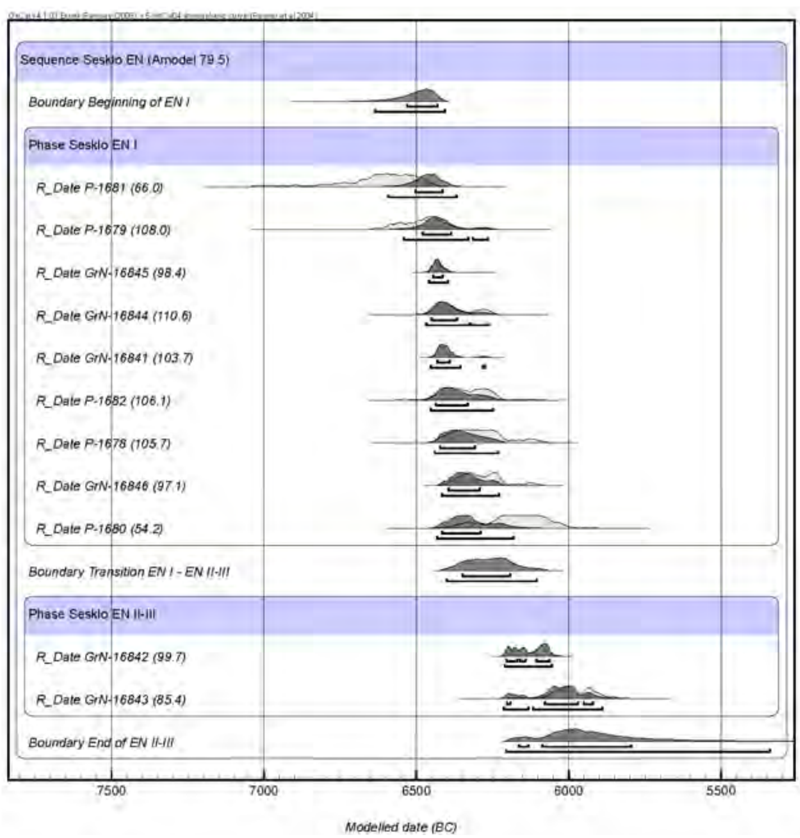

Figure 3 ^{14}C dates from Sesklo EN I–III

[1]All calculations are based on the IntCal04 calibration curve (Reimer et al. 2004), and carried out with OxCal v 4.1b3 (Bronk Ramsey 1995, 2001). In this article, ^{14}C measurements are standardly rounded by 10, ranges are quoted with 1-σ confidence intervals. For full references to the dates used, see the Appendix.

The Argissa and Sesklo results have to be balanced against the sequence from Achilleion, EN material culture of all 3 sites being considered as very similar (Wijnen 1981:66). Modeling the EN ^{14}C dates from Achilleion by constraining the 2 groups of events (Phase I and Phase II, respectively) between start, transition, and end boundaries results in a tight, circumscribed phasing in the last 3 centuries of the 7th millennium cal BC, where we have also combined the dates from individual phases, assuming them to stem from a cluster of events occurring within a short period (Figure 4, Table 1).[2]

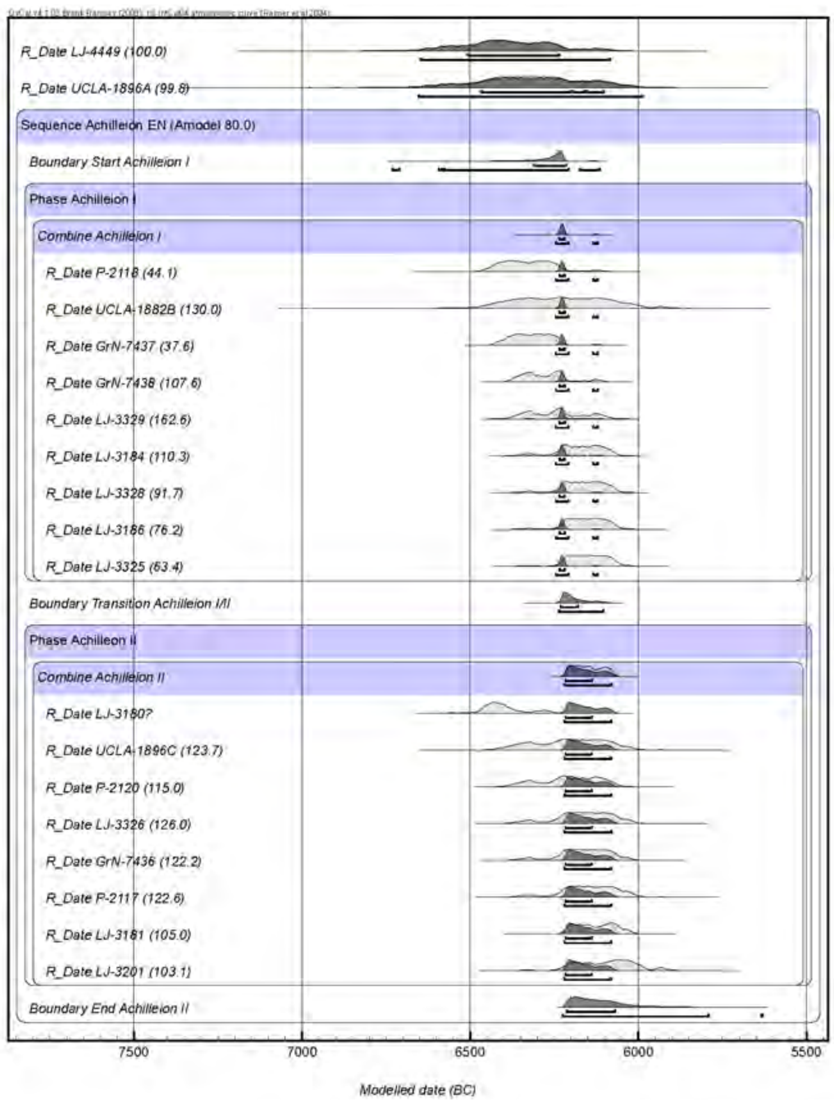

Figure 4 ^{14}C dates from Achilleion EN.

[2]In the figure and table, the dates LJ-4449 and UCLA-1896A are left out of the model since they stem from a small test pit away from the main excavation area. In contrast to the Achilleion publication, dates LJ-3328, -3186, and -3325 are reassigned from Phase II to Phase I on stratigraphical grounds (Thissen 2000:171).

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Table 1 Achilleion phase boundaries for the Early Neolithic occupation.

Boundary start phase I	6310–6220 cal BC
Transition Phase I/Phase II	6230–6180 cal BC
End Phase II	6210–6070 cal BC

The first dates from Nea Nikomedeia, acquired in the 1960s, would also suggest a very early beginning of farming starting at about 7000 BC. But the oldest of the Oxford dates—which were on bones and seeds and processed much more recently around 1990—are not earlier than 6400 BC when calibrated individually (Figure 5). Since several dates stem from the same sample and need an R_Combine calculation, we may combine the resulting 7 dates assuming they represent a single event or a short series of consecutive events (leaving out outlier OxA-1603 + OxA-4280). The resulting time span suggests that Nea Nikomedeia (or rather its end) "occurred" anywhere between 6230–6110 cal BC, being later than the beginnings of the EN in Thessaly.

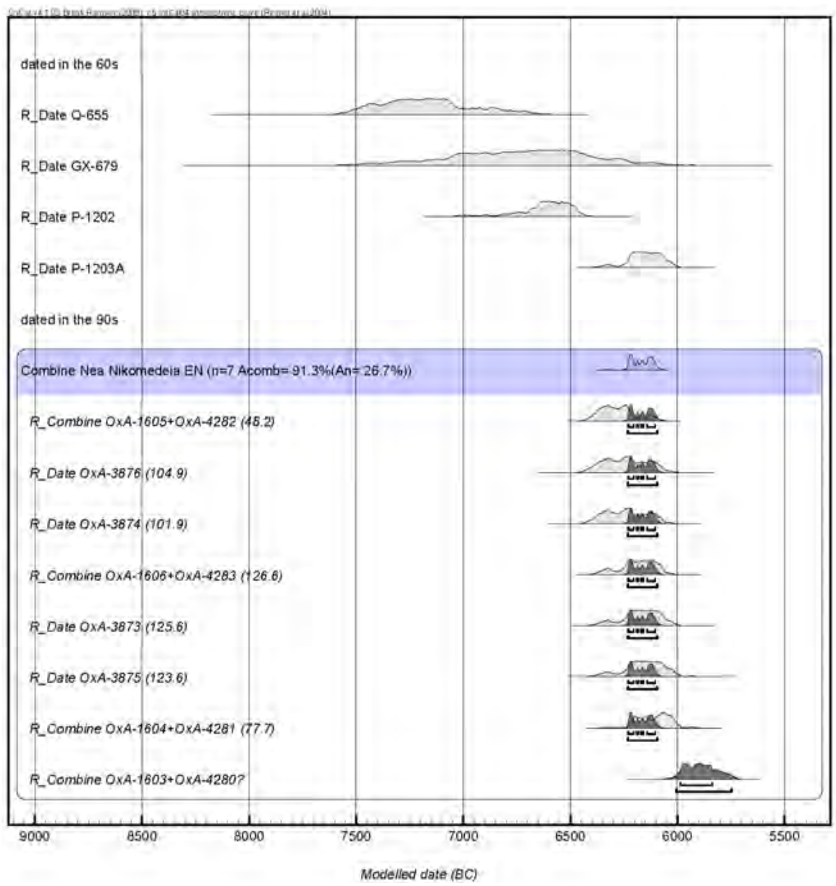

Figure 5 ^{14}C dates from Nea Nikomedeia

Not only has a Preceramic Neolithic in Thessaly as it was defined by Milojčić and Theocharis to be rejected, it also has to be questioned for the Argolid. Here, in Franchthi, a Preceramic phase had been constructed in the aftermath of the Preceramic rush in the late 1960s/early 1970s (Jacobsen and Farrand 1987; Perlès 1990; Hansen 1991; Vitelli 1993). For its validation, recourse was taken to the early ^{14}C dates at 7000 cal BC from Thessaly, since the transition to the Neolithic in the south was

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explained due to the influences from the north at the beginning of the 7th millennium. Moreover, the "Magic Marge" at 7000 BC also seemed to be conforming to Knossos (see below). When we have a closer look at the data from Franchthi, it becomes clear that the ones claimed for the Preceramic (Int 0/1) are identical to those from the Final Mesolithic (Phases IX–X), summing between 7040–6700 cal BC (Figure 6). The dates for the subsequent early pottery stage (Franchthi Ceramic Phase 1, FCP 1) are mutually exclusive of each other (Reingruber and Thissen 2005) and, therefore, only poorly fit into the applied boundary model. When treating date P-1525 as an outlier, it being from a questionable context in FF1 (Vitelli 1993:40, note 5), FCP 1 could have started anywhere between 6390 and 6030 cal BC. Subsequently, Franchthi FCP 2 may, on archaeological grounds (gradual transition in the pottery and lithics, similar patterns in faunal remains), be seen as following immediately upon FCP 1. If we ignore the FCP 2 date P-1399, which has a poor overall agreement, the transition from FCP 1 to FCP 2 and the end of FCP 2 are most likely to fall in the 58th/57th century and the 56th century cal BC, respectively (Table 2).

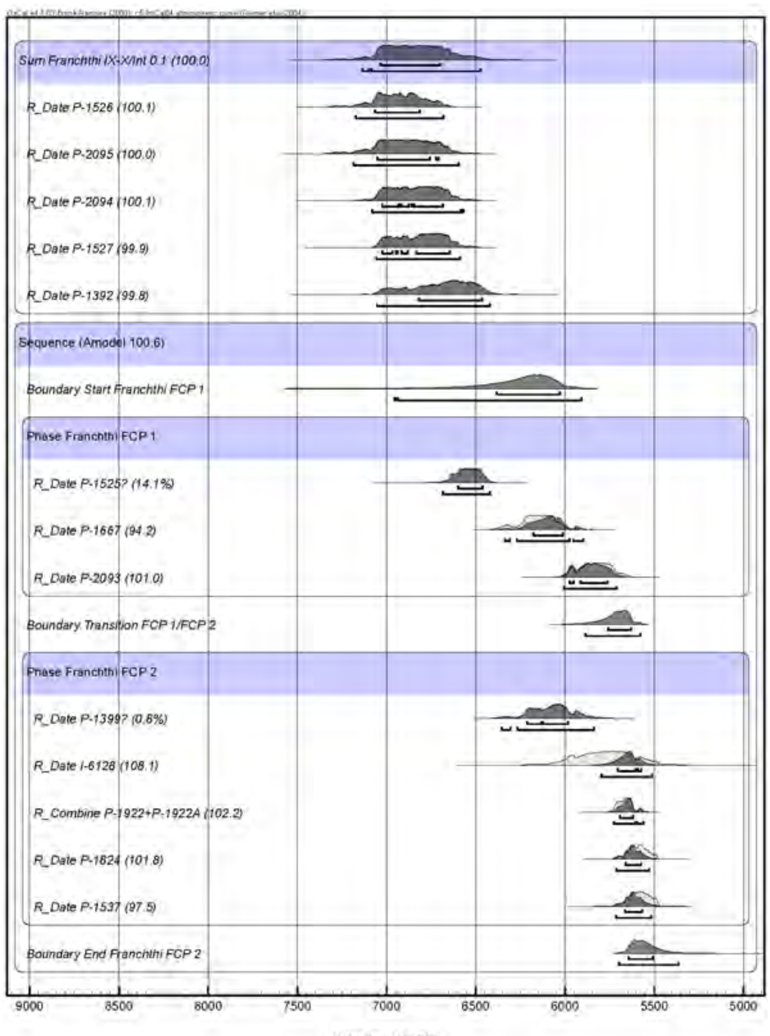

Figure 6 ^{14}C dates from Franchthi, Final Mesolithic/Aceramic, EN, and MN

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Table 2 Franchthi phase boundaries for the Early and Middle Neolithic occupation.

Boundary Start FCP 1	6390–6030 cal BC
Transition FCP 1/FCP 2	5760–5630 cal BC
Boundary End FCP 2	5640–5510 cal BC

In view of the inadequacies of the FCP 1 data, and given the consistent FCP 2 series and the short duration of the phase and the close similarity of the ceramics from FCP 1 and FCP 2, in our view the Neolithic in Franchthi should start at the end of the 7th millennium cal BC, or even in the early 6th millennium. The first pottery using deposits at Franchthi would thus rather be parallel to the beginning of the Middle Neolithic in Thessaly. Between the Mesolithic and Neolithic, there is a gap of at least 700 yr, which is supported by the lithostratigraphic sequence according to Farrand (1993:94).

Knossos on Crete

The only site on Crete for which a Preceramic habitation was claimed is Knossos. In trenches AC in the Central Courtyard of the Palace (Figures 7–8), a thin layer above sterile soil contained no pottery. It was interpreted as being the remains of a short-lived camp and labeled Knossos X. According to the excavator, people settling here knew already how to produce pottery but only started with its manufacture in the following phase IX (Evans 1964). In a second episode of excavations 10 yr later (1969–70), Evans made 17 small soundings around the Central Court and the Palace (test pits XY, Z, ZA–ZH, AA–GG) (Figure 7). In 2 of them—the tiny trenches X and ZE to the north and south of the Central Court—he found layers containing mud-brick architecture, but without pottery. For this reason, he reinterpreted Aceramic Knossos as the first settlement of a successful group of people occupying the site around 7000 BC (Evans 1971). Evans ignored the strong similarity existing between the mud-brick architecture found in the 2 small Aceramic soundings and the constructions from level IX in the central part found in the first seasons (Figure 8). And, although Evans observed that the floors in the new series of soundings were "frustratingly clean" (Evans 1971:102 and note 2)—without pottery but also with few other finds—the presence of 2 clay figurines not at all characteristic for the Aceramic period raises further doubts against his connecting these 2 soundings' basal deposits with Knossos X.

At first glance, the ^{14}C dates seem to support Evans' view that the first settlers appeared in Knossos at about 7000 BC (Evans 1994:5) (Figure 9). However, 2 of the 3 dates from Knossos X (BM-124 and BM-278) derive from the same piece of charcoal but were dated at different times using different methods (Evans 1994:20, Table II; Cherry 1990:160, Table 3). According to Winder (1991:40), the samples initially were considered as being too small, but nevertheless the datings were carried out. Winder dismisses these dates, since only new samples could resolve the doubts thrown on their high age. Since both dates stem from the same sample, a combination (R_Combine) is warranted and yields a date of 7964 ± 111 BP. The third date of the set, BM-436, was run on the more reliable sample deriving from grains. Although found in layer X and initially assigned to it (Warren et al. 1968:269, 272; Evans 1971:117), Evans later reassigned the date to Knossos IX instead (Evans 1994:5).

During a new sounding in 1997, Efstratiou was able to reach the lowest strata of the site in the courtyard of the Palace. The lowest unit 39 in an 8.50-m-deep test pit of 2.25 m^2 was assigned to the Aceramic period. Charred grains of *Quercus* evergreen belonging to the shallow deposit of ~15 cm were dated to the first half of the 7th millennium cal BC (OxA-9215). In Efstratiou's view, this result confirms Evans' high date of 7000 cal BC for the start of the Aceramic period, and it would also correlate well with the PPNB on Cyprus (Efstratiou et al. 2004:47 and Table 1.1). Aceramic levels are

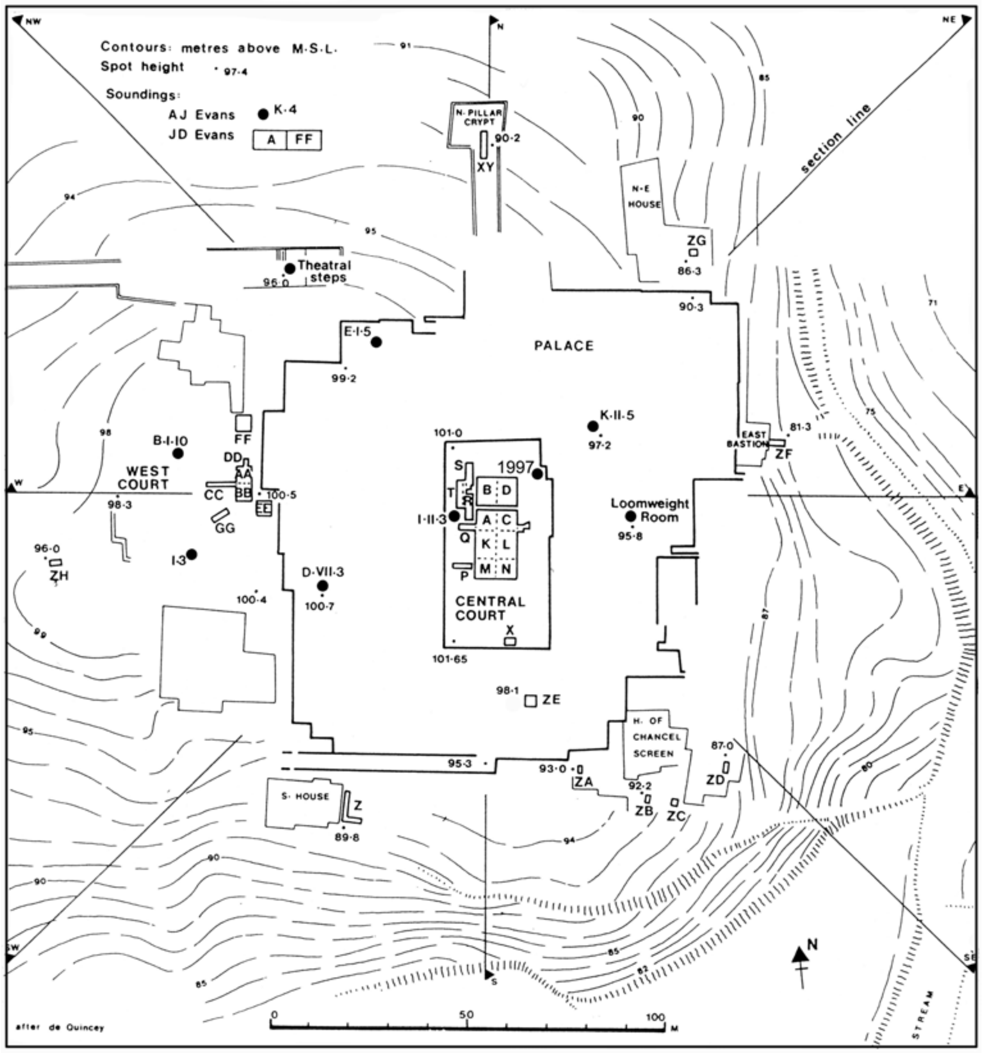

Figure 7 Knossos: plan of the Palace with the Central Court and trenches excavated by J D Evans and N Efstratiou (after Evans 1994: Figure 1).

followed without any stratigraphic gap by pottery-bearing layers (Efstratiou et al. 2004:45), but for the Early EN I (Evans layers IX–VII/Efstratiou unit 38), the new work did not yield further ^{14}C dates.

Discussion

The Knossos Aceramic ^{14}C evidence is ambiguous. Given their large errors, the British Museum (BM) ^{14}C samples are not very reliable, but it is significant that the new OxA date confirms the combined result from BM-124 and BM-278, suggesting the Knossos Aceramic to have occurred anywhere between 7040–6700 cal BC. Were we to combine the 3 results (BM-124 + 278, OxA-9215 and BM-436—where BM-436 has obviously poor agreement with the other 2 dates at 54.3%), a similar time span of 7020–6700 cal BC is reached (Figure 9). Alternatively, ignoring the combined

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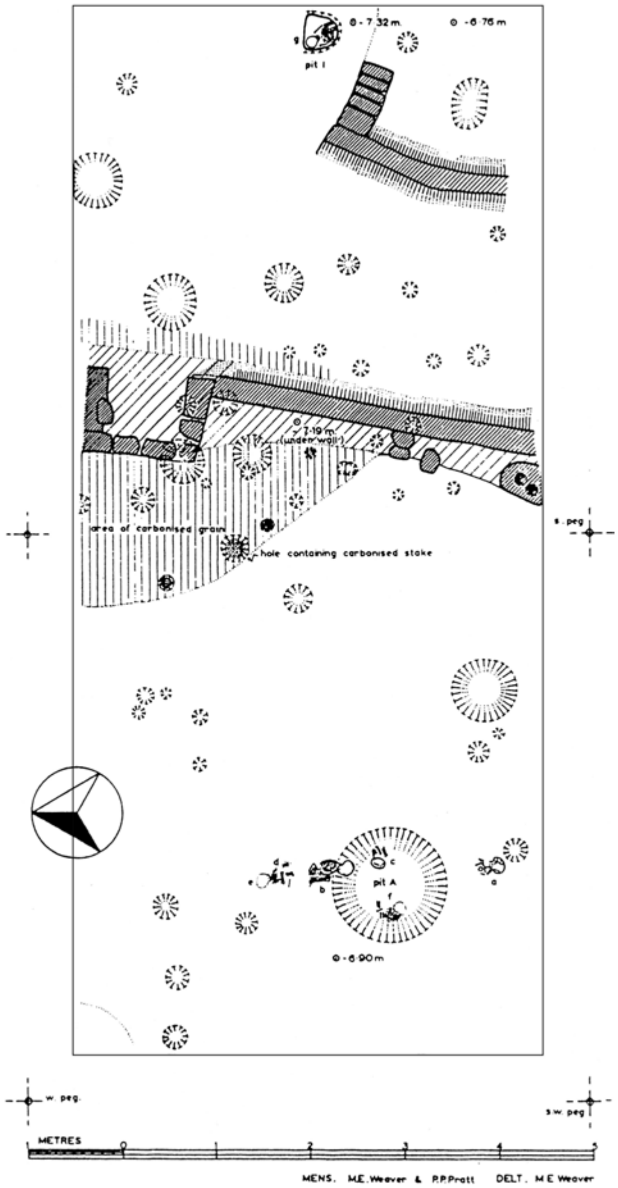

Figure 8 Knossos: trenches AC from the Central Court combining phases IX and X.

date stemming from old wood and the OxA date supplying only a *terminus post quem* the single reliable date of BM-436 having a median date of 6610 cal BC suggests a much later age for Knossos X. Neither exercise is convincing, i.e. neither a date in the first centuries of the 7th millennium cal BC nor the mid-millennium age can be taken as straightforwardly dating Knossos X.

After the short-lived camp of Knossos X, pottery-producing communities inhabited the site. Were we to treat the floating dates BM-272 (Knossos IX) and BM-126 (Knossos V) as outliers, Knossos EN I would date rather towards the middle and end of the 6th millennium cal BC (Figure 9). Such

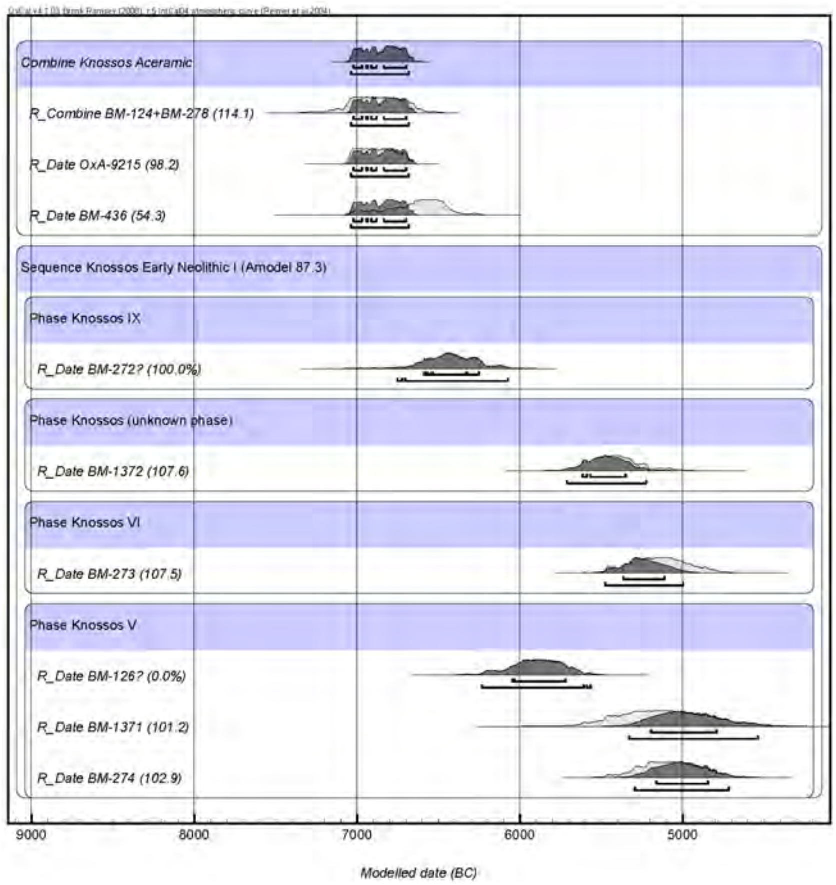

Figure 9 ^{14}C dates from Knossos X–V (after Evans 1964: Figure 7)

an estimate is not in conflict with the material culture of the surrounding areas, where ceramic shapes and ornaments from the Late Neolithic on the Greek islands Tigani and Ag. Gala, and from the Middle Chalcolithic in western Anatolia, bear strong resemblance to Knossos EN I. Evans, relying completely on the ^{14}C dates, explains this situation in the way that the same cultural expressions are hundreds of years older in Crete than elsewhere (Evans 1970:381–3), a viewpoint which is hardly tenable.

Conclusion

Contrary to the expectation of Milojčić and Theocharis in the 1950s and 1960s, on none of the sites could a Preceramic period be validated to a certain probability, as we have discussed elsewhere (Thissen 2000; Reingruber 2008). Contrary to the expectation of subsequent researchers, on none of the mainland sites could an Early Neolithic occupation prior to 6500 cal BC be proven satisfactorily. The “Magic Marge” of 7000 BC for a start of the sedentary way of life must be dismissed. On both sides of the Aegean, the Neolithic (Early Neolithic in Greece, Late Neolithic in Anatolia) must have started around or after 6500 BC and lasted until 6000 BC.

The absence of finds from the cave site of Franchthi at about 6500 BC is expressed not only in terms of charcoal samples, but almost no faunal and floral remains (Figure 10) and very few small finds were placed into this period. Thus, the 2-step model by Perlès with a primary neolithization zone in Thessaly and a secondary, contemporary one in the Argolid (Perlès 1990:115–6) needs modification: The neolithization of the Argolid did not occur around 7000 cal BC, but a millennium later at about 6000 cal BC, several hundred years after Thessaly.

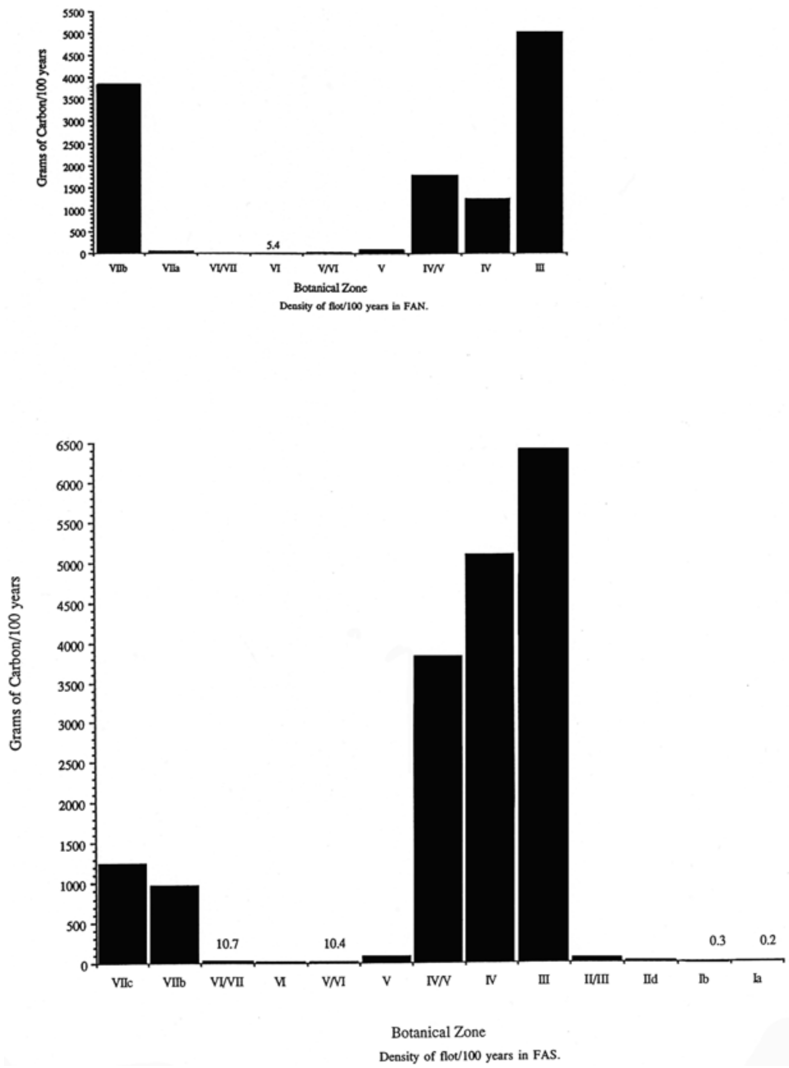

Figure 10 Floral remains from Franchthi Cave (note the lack of finds in the Preceramic–Early Neolithic botanical zones VI–VIIa) (after Hansen 1991: Figures 61–62).

THE CHALCOLITHIC IN THE EASTERN BALKANS

New sets of ^{14}C data from 2 Chalcolithic sites in the eastern Balkans have stirred the attention of archaeologists: the rich cemetery near Varna in northeast Bulgaria and the tell settlement of Pietrele in Romania, both belonging to the Chalcolithic period of the northeastern Balkans.

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Varna

A series of 28 dates from Varna constitute the first absolute evidence for the necropolis after 35 yr of its excavation (Chapman et al. 2006; Higham et al. 2007, 2008). Previously, for typological and stylistic reasons, the cemetery was dated to the third and last phase of the Varna culture during the second half of the 5th millennium BC (Ivanov 2000:9, 12). According to ^{14}C dates from Durankulak and Poveljanovo (Görsdorf and Bojadžiev 1996:147, 150), Varna I was placed into the 46th century cal BC and Varna II–III around 4450/4400–4250/4150 cal BC (Bojadžiev 2002:67).

Also, other tell sites from NE Bulgaria—including Goljamo Delčevo, Smjadovo, Ovčarovo, and Ruse—provided data belonging to the second half of the 5th millennium BC. Some dates, reaching back to 4700/4600 cal BC, were regarded as being too old (Görsdorf and Bojadžiev 1996:145, 147). Nevertheless, the new data from Varna would support a view according to which the Varna culture started earlier than previously thought, many of them fitting into the 46th century cal BC.

Problematic for the interpretation of the dates is the possibility of a marine reservoir effect from the Black Sea, which could make them appear up to 380 yr too old (Higham et al. 2007:643). In order to test the marine effect, also animal bones and antlers were analyzed, the samples deriving from artifacts belonging to the grave inventories (V Slavchev, personal communication, May 2008). For this reason, a control-dating could be performed in only 3 cases (burials 111, 117, and 143). Although the exact animal types were not indicated, it is well known that at least the antler-bearing species do not eat fish.

The results being similar, and also due to the ^{15}N concentrations, a reservoir effect on the human bones could be excluded (nitrogen isotopes were measured only for the human bones). Humans, although living close to the Black Sea, seem not to have eaten fish. Thus, the usage of the cemetery should indeed be placed at the very beginning of the Varna culture and not to its evolved phase.

Pietrele

The excavation at Pietrele near the Lower Danube has yielded 23 new ^{14}C dates, which span a period of 200 yr between 4450–4250 cal BC. They make it obvious that the Kodžadermen-Gumelniţa-Karanovo VI complex ended not at 4000/3900 cal BC (Görsdorf and Bojadžiev 1996; Lazarovici and Lazarovici 2007:81) as previously thought, but 250 yr earlier at 4250 cal BC (Hansen et al. 2008: Abb. 86). The burnt houses from the last habitation phase in both trenches B and F give similar data, although situated at different heights of the tell's uneven surface (Hansen et al. 2008: Abb. 3).

Since the appraisal of the data from trench B is still in progress, we will concentrate on the samples from trench F. Applying a boundary model on the Pietrele Area F dates, sequenced into 3 contiguous house-phases F3–F1, yields the following result, where it should be noted that 2 dates give a poor agreement within the model (Bln-5847 and Bln-5716 seemingly being too old and too young, respectively) (Table 3, Figure 11).

Table 3 Pietrele Area F house-phase boundaries.

Boundary Start F3	4370–4350 cal BC
Transition F3/F2	4360–4340 cal BC
Transition F2/F1	4350–4330 cal BC
Boundary End F1	4330–4270 cal BC

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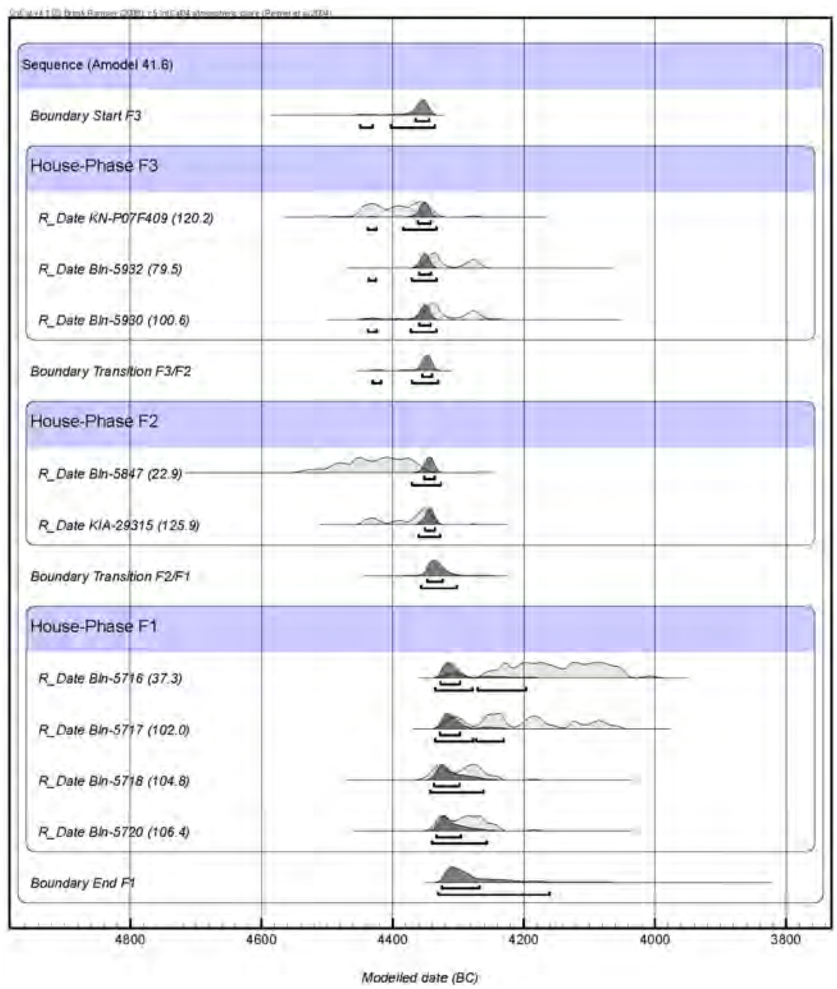

Figure 11 ^{14}C dates from Pietrele, Area F

Also, remeasurements done by Jochen Görsdorf in Berlin of old samples from Căscioarele in the Lower Danube region kept in the former Academy of the GDR and included in the collection of the Eurasia Department of the German Archaeological Institute, show that the dates from 1969 (Quitta and Kohl 1969:238–40) are too young and that the end of the Chalcolithic period in SE Europe should be updated to about 4300–4200 cal BC (J Görsdorf, personal communication, June 2007). This result would comply with the observation by Higham and others that the Varna dates “advance by 1 or 2 centuries the beginning of the late Copper Age in the Black Sea zone” (Higham et al. 2007: 652).

Discussion

Until recently, no ^{14}C data have been available for the Copper Age cemetery from Varna. On typological grounds, it was dated to the second half of the 5th millennium BC. The new dates suggest a higher age around the middle of the 5th millennium BC, if a reservoir effect on fish-eating humans is not feasible. As shown by the data set from Pietrele, the Chalcolithic ended not after 4000 BC, but at the latest at 4250 cal BC. The ongoing excavations will offer us a comprehensible sequence for the entire duration of the Kodžadermen-Gumelniţa-Karanovo VI complex, but both the Varna and the Pietrele dates suggest a general shift of 100–200 yr deeper into the 5th millennium cal BC, with Varna making the beginning of the SE European Chalcolithic earlier, Pietrele updating its end.

Whether the Varna cemetery dates to the very beginning of the period at 4700–4600 cal BC or rather spans a later part of it is crucial for the understanding of the social dimensions at this time. It will be interesting to see if indeed the old model according to which social differences became more pronounced during the Chalcolithic should be replaced with a new one according to which from the very beginning Chalcolithic leaders of different groups buried their dead in clusters in Varna, thus validating their influence and power. In this respect, the new AMS data, coming in from other southeast European sites of Late Neolithic and Chalcolithic times, are of high interest and have to be included into further discussions (Schier 1997; Biagi et al. 2005; Hofmann et al. 2007).

CONCLUSION

Thanks to ^{14}C dates, theories in archaeology cannot only be created, but also be adjusted and remodeled. Archaeology profits from a more precise phasing and a better chronology of a specific site or a certain culture, and influences and contacts can be elaborated on a supra-regional scale. A precise look at the data sets in combination with the analysis of material culture items reveals possible interactions between human groups. In some cases, previously widely accepted theories have to be rectified, like in the case of the neolithization of SE Europe. At the end of the 8th millennium cal BC, direct or indirect influences from groups of people from the Pre-Pottery Neolithic in the Near East can be ruled out for the Aegean. Also, a direct and long-lasting colonization of Crete around 7000 cal BC seems improbable, since the island, or at least Knossos X, was inhabited for only a short period during the first half of the 7th millennium cal BC. A Preceramic phase on the Greek mainland cannot be substantiated—to the contrary: only from ~6400 cal BC onwards sites in Thessaly with ceramics and domesticates appeared. In the Argolid, sites with a Neolithic inventory can even be dated some centuries later. Also, the sites discovered so far in the northern Aegean were founded only towards the end of the 7th millennium.

Some archaeologists immediately react to new ^{14}C dates with new models and new theories. Each date needs to be commented upon the moment it is published. Although most of the dates are precisely calculated, their mathematical value has to be placed into a system of archaeological values in order to gain historical and cultural importance as well. Dating procedures are only valid when scientific dating and archaeological context are separated in a first step from each other. Afterwards, context analyses and typological assessments will help to create a historical approach to prehistoric developments. Natural sciences have helped prehistory to free itself from a simple antiquarian approach, but archaeology should not give up its traditional methods like typological analyses, comparisons, and synchronizations between sites and regions. They, of course, need adjustments, but this can also be required for ^{14}C measurements.

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APPENDIX

^{14}C dates used in text, sites in alphabetic order (abbreviations: C = charcoal; A = antler; HB = human bone; AB = animal bone; CER = cereal; nd = no information available). Unless indicated otherwise, full references to the dates can be found online at http://www.canew.org/data.html.

Lab Nr	Date BP	cal BC (1 σ)	Material	Level	Provenance
Achilleion					
LJ-4449	7540 ± 140	6560–6230	C	Ia	Test pit east
UCLA-1896A	7460 ± 175	6470–6100	C	Ia	Test pit east
P-2118	7470 ± 80	6420–6250	C	Ia	B-2-26
UCLA-1882B	7360 ± 155	6380–6080	C	Ib	B-1-31
GrN-7437	7440 ± 55	6380–6250	C	Ib	A-2-27
GrN-7438	7390 ± 45	6370–6220	C	Ib	B-1-30
LJ-3329	7370 ± 50	6360–6110	C	Ib	B-1-26
LJ-3184	7320 ± 50	6230–6090	C	Ib	B-2-27
LJ-3328*	7310 ± 50	6230–6100	C	IIa	B-1-19
LJ-3186*	7300 ± 50	6220–6100	C	IIa	B-5-24
GrN-7436	7295 ± 70	6230–6080	C	IIa	A-1-21
LJ-3326	7290 ± 80	6230–6070	C	IIa	A-2-22
LJ-3325*	7290 ± 50	6220–6090	C	IIa	B-5-20, 21
P-2117	7270 ± 80	6220–6060	C	IIa	A-1-26
LJ-3180	7550 ± 60	6470–6370	C	IIb	D-2-22, beam
UCLA-1896C	7330 ± 100	6350–6070	C	IIb	D-2-18
P-2120	7340 ± 70	6330–6080	C	IIb	A-1-18, refuse pit
LJ-3181	7250 ± 50	6210–6060	C	IIb	D-2-22
LJ-3201	7210 ± 90	6210–6000	C	IIb	D-2-19, “carbonized lens”
Argissa					
UCLA-1657A	8130 ± 100	7330–6860	AB	EN I	Nd
UCLA-1657D	7990 ± 95	7060–6770	AB	EN I	Nd
H-896-3082	7740 ± 100	6660–6460	C	EN I	E 11, pit γ
H-894-3081	7520 ± 100	6460–6250	C	EN I	Γ 9, pit β
GrN-4145	7500 ± 90	6440–6250	C	EN I	Γ 8, 28b burnt post
UCLA-1657E	6700 ± 130	5720–5510	AB	EN I	spit 28b
H-889-3080	7760 ± 100	6690–6470	C	EN I or II	Δ 8/9, pit α ?
H-899-?	6820 ± 120	5840–5620	C	MN	Δ 8/9, pit α (post-hole in pit cutting 27c)
Franchthi					
P-1526	8020 ± 80	7070–6810	C	Late/Final Mesolithic (P. IX)	FF1:43A1
P-2095	7980 ± 110	7050–6700	C	Final Mesolithic (P. IX/ X)	FAS:146
P-2094	7930 ± 100	7030–6680	C	Interphase 0/1 (P. X)	FAS:143
P-1527	7900 ± 90	7030–6640	C	Interphase 0/1	FF1:44B5
P-1392	7790 ± 140	6830–6460	C	Interphase 0/1	A:63
P-1525	7700 ± 80	6600–6460	C	FCP 1	FF1:42B1

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Lab Nr	Date BP	cal BC (1 σ)	Material	Level	Provenance
P-1667	7280 ± 90	6240–6050	C	FCP 1	H[Ped]:37Y
P-2093	6940 ± 90	5970–5730	C	FCP 1	FAS:129
P-1399	7190 ± 110	6220–5980	C	FCP 2.2	A:56
P-1824	6670 ± 70	5650–5530	C	FCP 2.2	FAN:137
P-1537	6650 ± 80	5640–5510	C	FCP 2.3	G/G1:11
P-1922	6790 ± 90	5770–5610	C	FCP 2.3-2.4	FAN:129
P-1922A	6730 ± 70	5720–5570	C	FCP 2.3-2.4	FAN:129
P-1922 and P-1922A from same sample. R_Combine: 6753 ± 55 BP (5710–5620 cal BC)					
I-6128	6855 ± 190	5980–5610	C	FCP 2.5	FAN:120
Knossos (Barker et al. 1969:279–80; Burleigh and Matthews 1982:159)					
BM-124	8050 ± 180	7250–6650	C	X	Area AC, level 27
OxA-9215	7965 ± 60	7040–6770	*Quercus* evergreen charred grains		Unit 39
BM-278	7910 ± 140	7030–6640	C	X	Area AC, level 27
BM-124 and BM-278 from same sample. R_Combine: 7964 ± 111 BP (7050–6700 cal BC)					
BM-436	7740 ± 140	6770–6430	CER	X	Area AC, level 27, near the wood stake BM-278
BM-272	7570 ± 150	6590–6250	C	IX	Area AC, level 24
BM-1372	6482 ± 161	5620–5300	C	nd	W Court, Sounding AA/BB, level 279
BM-273	6210 ± 150	5330–4960	C	VI	Area AC, level 17
BM-126	7000 ± 180	6050–5710	C	V	Area A, level 16A
BM-1371	6201 ± 252	5470–4840	C	V	W Court, Sounding AA/BB, level 272
BM-274	6140 ± 150	5300–4850	C	V	Area A, level 15
Nea Nikomedeia					
Q-655	8180 ± 150	7460–7040	C	nd	LX1, D5/4
GX-679	7780 ± 270	7050–6420	C	nd	Nd
P-1202	7557 ± 91	6660–6470	C	nd	A4/3 feature A; ash pit or post hole
OxA-1605	7400 ± 90	6400–6110	CER	nd	H6/1a+H7/A
OxA-4282	7400 ± 90	6400–6110	CER (humic acid)	nd	H6/1a+H7/A
OxA-1605 and OxA-4282 from same sample. R_Combine: 7400 ± 64 BP (6380–6220 cal BC)					
OxA-3876	7370 ± 90	6370–6100	AB	nd	C 9/1, L644
OxA-3874	7370 ± 80	6370–6100	AB	nd	B 5/1, 664
OxA-1606	7400 ± 100	6400–6110	CER	nd	K6/1FG
OxA-4283	7260 ± 90	6230–6050	CER (humic acid)	nd	K6/1FG
OxA-1606 and OxA-4283 from same sample. R_Combine: 7324 ± 67 BP (6240–6080 cal BC)					
OxA-3873	7300 ± 80	6240–6070	AB	nd	D 8/2, 295/315cm
OxA-3875	7280 ± 90	6240–6050	AB	nd	F6/1 FC PD, 0470
P-1203A	7281 ± 74	6220–6070	C	nd	B4/1, feature A, ash pit
OxA-1604	7340 ± 90	6350–6070	CER	nd	C1 spit 3 A

^{14}C dates used in text, sites in alphabetic order (abbreviations: C = charcoal; A = antler; HB = human bone; AB = animal bone; CER = cereal; nd = no information available). Unless indicated otherwise, full references to the dates can be found online at http://www.canew.org/data.html. *(Continued)*

Lab Nr	Date BP	cal BC (1 σ)	Material	Level	Provenance
OxA-4281	7100 ± 90	6060–5880	CER (humic acid)	nd	C1 spit 3 A
OxA-1604 and OxA-4281 from same sample. R_Combine: 7223 ± 64 BP (6210–6020 cal BC)					
OxA-1603	7050 ± 80	6010–5840	CER	nd	C1 spit 2 A
OxA-4280	6920 ± 120	5980–5710	CER (humic acid)	nd	C1 spit 2 A
OxA-1603 and OxA-4280 from same sample. R_Combine: 7011 ± 67 BP (5990–5830 cal BC)					
Pietrele (Hansen et al. 2008: Abb. 86)					
KN-P07F409	5539 ± 43	4450–4340	C	House-phase 3	Area F
Bln-5932	5473 ± 32	4360–4260	C	House-phase 3	Area F
Bln-5930	5478 ± 36	4360–4260	C	House-phase 3	Area F
Bln-5847	5602 ± 47	4470–4360	C	House-phase 2	Area F
KIA-29315	5520 ± 30	4450–4330	AB	House-phase 2	Area F
Bln-5716	5328 ± 39	4240–4060	CER	House-phase 1	Area F
Bln-5717	5366 ± 34	4330–4070	CER	House-phase 1	Area F
Bln-5718	5443 ± 38	4350–4260	CER	House-phase 1	Area F
Bln-5720	5424 ± 33	4340–4260	C	House-phase 1	Area F
Sesklo					
P-1681	7755 ± 97	6680–6470	C	Pre-ceramic	Sesklo A, trench 2
P-1682	7483 ± 72	6430–6250	C	Pre-ceramic	Sesklo A, trench 2, square B, ▼4.32 m
P-1680	7300 ± 93	6250–6050	C	Pre-ceramic	Sesklo A, trench 2, square B, ▼4.10–4.20 m
P-1679	7611 ± 83	6570–6390	C	EN I	Sesklo A, trench 2, ▼3.88 m
GrN-16845	7560 ± 25	6460–6410	C	EN I	Sesklo C, trench 3, “levels” 16–17, ▼2.50 m
GrN-16844	7530 ± 60	6460–6270	C	EN I	Sesklo B, deep sounding B(I)E, ▼3.30 m, just above virgin soil
GrN-16841	7520 ± 30	6440–6380	C	EN I	Sesklo A, trench 2, floor, ▼3.55 m
P-1678	7427 ± 78	6390–6230	C	EN I	Sesklo A, trench 2
GrN-16846	7400 ± 50	6370–6220	C	EN I	Sesklo B, trench 2, ▼0.80 m
GrN-16842	7250 ± 25	6210–6060	C	EN II/III	Sesklo A, trench 2, “stratum 20,” fragments of roof beam ▼2.80 m
GrN-16843	7110 ± 70	6060–5910	C	EN III	Sesklo “B 1972”/area 2/▼1.60 m