

RADIOCARBON CHALLENGES ARCHAEO-HISTORICAL TIME FRAMEWORKS IN THE NEAR EAST: THE EARLY BRONZE AGE OF JERICHO IN RELATION TO EGYPT

Hendrik J Bruins¹ • Johannes van der Plicht²

ABSTRACT. Our stratified radiocarbon dates from EB Jericho (Trench III) on short-lived material are significantly older than conventional archaeo-historical time frameworks. The calibrated ¹⁴C date of Stage XV Phase li-lii (Early to Middle EB-I Kenyon) is 100–450 years older. Stage XVI Phase lxi-lxii (Early EB-II Kenyon) is 200–500 years older. Stage XVI Phase lxii-lxiii (destructive end EB-II) is 200–300 years older. Stage XVII Phase lxviii a – lxix a (Early EB-III) is 100–300 years older than conventional archaeo-historical time estimates. As the beginning of the Chalcolithic in the Near East has “become” a 1000 years older, from about 4000 in the 1960s to about 5000 BC in current perception based on ¹⁴C dating, it should not be surprising that the Early Bronze Age and related Egyptian Dynasties also yield ¹⁴C dates that are older by a few hundred years than current archaeo-historical time frameworks. Egyptian chronology should not be regarded as ultimately fixed. Egyptologists in the first half of the 20th century gave much older dates for the earlier Dynasties. The new ¹⁴C evidence is overwhelmingly in favor of an older Early Bronze Age and older dates for Dynasties 1–6.

INTRODUCTION

The Early Bronze Age in the southern Levant is associated with Egyptian archaeological and historical data through pottery and other artifacts in a complex process of archaeological age estimation. Though Egyptian chronology is used as the predominant time-basis for archaeology in the southern Levant, there is a range of chronological solutions to fit the textual Egyptian data and astronomical options (Ward 1992). Moreover, cultural classifications in archaeology are not necessarily time parallel. Finally, circular reasoning is not a rare characteristic in archaeo-historical time estimates, as noted for example by Savage (this volume) for seriation studies of Egyptian Predynastic ceramics.

Time is a physical dimension and ought to be measured first and foremost by independent physical methods, such as radiocarbon dating (Waterbolk 1987; Bruins and Mook 1989; Van der Plicht and Bruins, this volume). Chrono-stratigraphy should be the basis to study cultural developments in time and to make comparisons with other areas in spatial frameworks, whether another part of the same tell or another geographic region. Conventional chronologies for the Early Bronze Age in the southern Levant and Egypt are evaluated in the light of high-precision ¹⁴C dates from Early Bronze Jericho dated on short-lived organic materials. The samples are derived from the excavations conducted in the 1950s by the late Dame Kathleen Kenyon (Bruins and van der Plicht 1998). The results are discussed in relation to Egyptian chronology and other ¹⁴C dates from the southern Levant and Egypt.

MATERIALS AND METHODS

Our ¹⁴C dating results are based on short-lived organic samples from stratified layers in Trench III. Significant amounts of charred cereal grains constituted ideal material for high-precision ¹⁴C dating. Charred organic matter of Amaranthaceae and onions, though present in small quantities, provided important short-lived material for dating additional Early Bronze Age layers in Trench III with accelerator mass spectrometry (AMS). The paleobotany of the organic material had been investigated by Hopf (1983).

¹Ben-Gurion University of the Negev, Jacob Blaustein Institute for Desert Research, Social Studies Unit, Sede Boker Campus 84990, Israel. Email: hjbruins@bgumail.bgu.ac.il

²Center for Isotope Research, University of Groningen, Nijenborgh 4, 9747 AG Groningen, The Netherlands

The samples were analyzed for ^{14}C dating at the Centre for Isotope Research of the University of Groningen. All samples were treated by the acid/alkali/acid (AAA) method (Mook and Waterbolk 1985). The larger samples were dated conventionally (laboratory code GrN) in the 25 L gas counter and the small samples by AMS (laboratory code GrA). The stratigraphic context of the samples, their association with archaeo-historical time frameworks, and the ^{14}C dates are presented in Table 1.

The archaeological cultural periods (column 1) are indicated by the system of Kenyon (Kenyon and Holland 1983) as well as by the system used by others, such as Mazar (1990) and Ben-Tor (1992). Two conventional Egyptian chronologies were selected in our evaluation (column 1): the relatively “high” Cambridge Ancient History chronology by Hayes (1970) and the relatively “low” chronology as presented by Gutgesell (1984). The archaeo-historical age estimate is based on Kenyon (1957; 1981), Kenyon and Holland (1983), cultural association, and conventional relation with Egyptian dynasties using both the “high” and “low” chronologies (column 2).

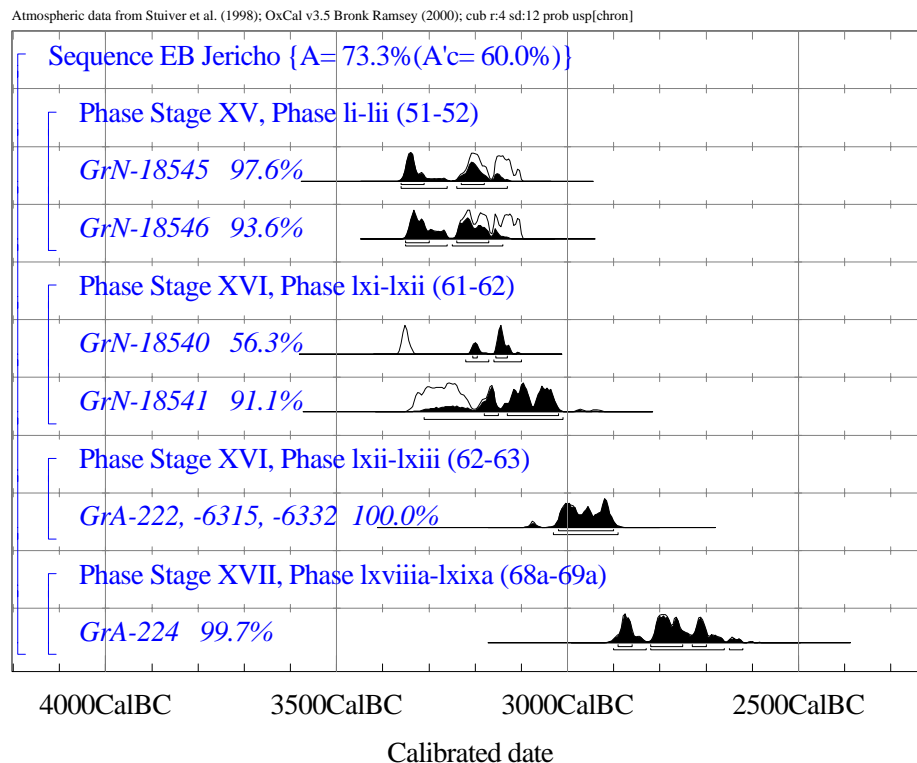


Figure 1 Sequence analysis without boundaries using OxCal v3.5 (Bronk Ramsey 2000). The solid black graphs show the statistically preferred calibrated age ranges, while the black lines over white together with the solid black show the entire calibrated range.

Calibration of the dates was carried out with the recommended INTCAL 98 calibration data set (Stuiver et al. 1998), using the OxCal program version 3.5 (Bronk Ramsey 2000). Besides regular calibration of the dates (column 4), the stratified series from Trench III enabled sequence analysis with the OxCal program (Figures 1 and 2). Sample GrN-18540 was the only date showing a poor agreement (56.3%) in the first sequence analysis (column 5; Figure 1). On the basis of its ^{14}C date we consider it likely that this sample may relate stratigraphically to Stage XV, Phase li-lii, as elabo-

Table 1 Sample stratigraphy, cultural associations, Egyptian chronology, ¹⁴C dates and calibrated results (1 σ confidence level), including sequence analyses

Position of sample in Trench III Stratigraphy and correlation with cultural classifications and with Egypt	Archaeo-historical age estimate (BC)	Lab nr ¹⁴ C date (BP)	Calibrated date 1σ (cal BC)	Sequence analysis 1σ (cal BC)	Sequence analysis without GrN-18540 1σ (cal BC)
Stage XV, Phase li–lii (51–52) Early-Middle EB-I (Kenyon) Early EB-II (others) Dynasty 1 3050–2890 or 2955–2780 BC	3000–2800	GrN-18545	3350–3320 (15.8%)	3360–3310 (37.5%)	3360–3320 (21.1%)
		4530 ± 19	3220–3180 (25.8%)	3230–3180 (30.0%)	3220–3170 (28.2%)
			3160–3120 (26.7%)	3160–3150 (0.7%)	3160–3120 (18.9%)
				Agreement 96.2%	Agreement 98.6%
Stage XV, Phase li–lii (51–52) Early-Middle EB-I (Kenyon) Early EB-II (others) Dynasty 1 3050–2890 or 2955–2780 BC	3000–2800	GrN-18546	3340–3310 (13.1%)	3350–3300 (33.7%)	3350–3300 (22.0%)
		4512 ± 15	3240–3170 (32.2%)	3240–3170 (34.5%)	3240–3170 (35.0%)
			3160–3100 (22.8%)	Agreement 93.9%	3160–3150 (3.1%)
					3140–3120 (8.0%)
					Agreement 97.9%
Stage XVI, Phase lxi–lxii (61–62) Early EB-II (Kenyon) Later EB-II (others) Dynasty 2 2890–2686 or 2780–2635 BC	2800–2700	GrN-18540	3370–3340 (44.0%)	3205–3195 (11.9%)	
		4560 ± 16	3210–3190 (10.1%)	3155–3125 (56.3%)	
			3160–3130 (14.2%)	Agreement 56.3%	
Stage XVI, Phase lxi–lxii (61–62) Early EB-II (Kenyon) Later EB-II (others) Dynasty 2 2890–2686 or 2780–2635 BC	2800–2700	GrN-18541	3330–3230 (41.6%)	3180–3150 (12.6%)	3180–3160 (5.3%)
		4465 ± 30	3180–3150 (5.9%)	3130–3020 (55.6%)	3130–3080 (32.2%)
			3120–3080 (10.2%)	Agreement 91.0%	3070–3020 (30.7%)
			3070–3030 (10.5%)		Agreement 90.1%

Table 1 Sample stratigraphy, cultural associations, Egyptian chronology, ¹⁴C dates and calibrated results (1 σ confidence level), including sequence analyses. (*Continued*)

Position of sample in Trench III Stratigraphy and correlation with cultural classifications and with Egypt	Archaeo-historical age estimate (BC)	Lab nr ¹⁴ C date (BP)	Calibrated date 1 σ (cal BC)	Sequence analysis 1 σ (cal BC)	Sequence analysis without GrN-18540 1 σ (cal BC)
Stage XVI, Phase Ixii–Ixiii (62–63) EB-II destructive end (Kenyon and others) End Dynasty 2 2686 or 2635 BC	about 2700	GrA-222,	3020–2900 (68.2%)	3020–2940 (47.5%)	3020–2900 (68.2%) Agreement 100.2%
		GrA-6315,		2930–2900 (20.7%)	
		GrA-6332 4350 \pm 27		Agreement 100.5%	
Stage XVII, Phase Ixviii–Ixixa (68–69a) Early EB-III (Kenyon and others) Early Dynasty 3 2686–2345 or 2635–2290 BC	about 2600	GrA-224	2890–2850 (16.9%)	2890–2850 (16.2%)	2890–2850 (17.7%)
		4210 \pm 40	2820–2750 (38.3%)	2820–2750 (39.6%)	2820–2750 (38.5%)
			2730–2700 (13.0%)	2730–2700 (12.4%)	2730–2690 (12.0%)
				Agreement 99.3%	Agreement 99.3%
			Overall agreement 73.3%	Overall agreement 93.8%	

Column 1: *Kenyon*, as based on Kenyon (1957, 1981) and Kenyon and Holland (1983); *others* including Mazar (1990) and Ben-Tor (1992); related Egyptian chronological data based on Hayes (1970) and Gutgesell (1984). Columns 4–6: calibrated data and sequence analyses calculated with INTCAL 98 data set (Stuiver et al. 1998) and OxCal v3.5 program (Bronk Ramsey 2000).

rated in more detail below. The second sequence analysis (column 6), without GrN-18540, showed a high overall agreement of 93.5% (Figure 2).

The wiggled plateau in the calibration curve between about 3350–2950 BC causes some dates to have a rather wide calibrated age range, despite the precise BP dates in ^{14}C years. Notwithstanding these constraints in ^{14}C dating for this time trajectory, the reality and quality of the dates (Van der Plicht and Bruins, this volume) remain genuine and highly consistent, being significantly older than historical-archaeological age assessments. If very detailed stratified series of ^{14}C dates would become available in the future, the above wiggles in the platform could lead to precise calibrated wiggle matching (Manning and Weninger 1992; Weninger 1995).

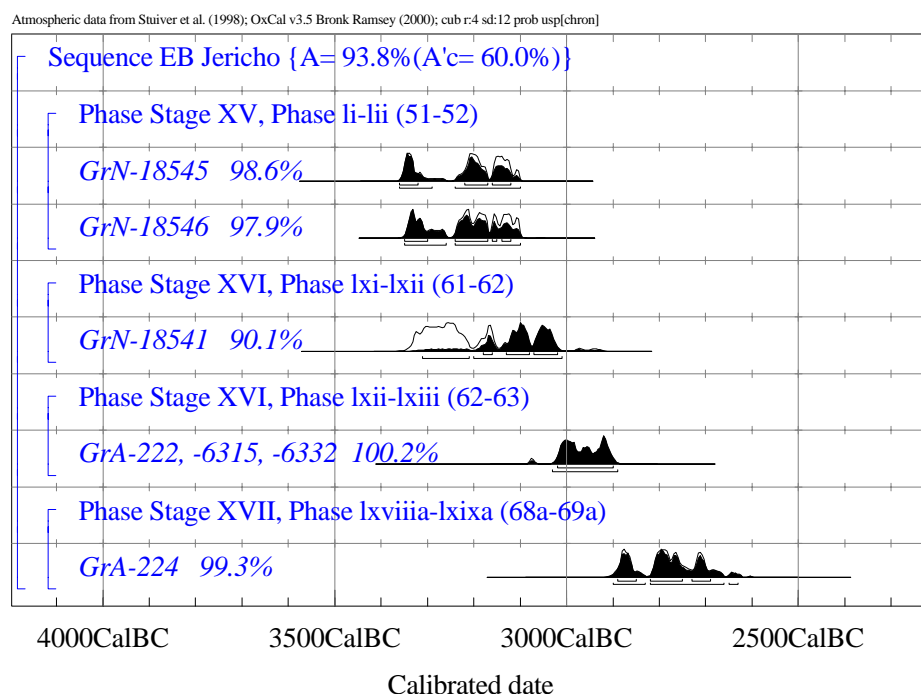


Figure 2 Sequence analysis without boundaries using OxCal v3.5 (Bronk Ramsey 2000). Idem as Figure 1, but the calculation was done without GrN-18540.

STAGE XV, Phases I (50) (SILO), li–lii (51–52) Destruction

Phase I (50) is characterized by a very complete rebuilding, though the plan remained essentially the same according to Kenyon (1981:198). She described that a brick-lined silo was inserted into wall NCN. “When the building was destroyed by fire, the silo contained a large quantity of grain” (Kenyon 1981:198). These are the grains that provided the two samples for ^{14}C dating. The cereal grains are contemporaneous with the destruction Phase li-lii (51–52), rather than with the preceding building phase I (50). “The buildings of Phase I were destroyed by a fierce fire... The floor further south against the eastern arm of NCV was also burnt, including the grain contents of the silo” (Kenyon 1981:199).

GrN-18545 (4530 ± 19 BP) was measured on charred seeds composed of unsorted cereal grains, particularly wheat (Hopf, personal communication 1990; sample Jp.N.5.112). GrN-18546 ($4512 \pm$

15 BP) was measured on a sub-sample of charred fragmented cereal seeds (Hopf, personal communication 1990; sample Jp.N.5.112). Both dates are similar and also have a very small standard deviation, measured by proportional gas counter. Hence the ^{14}C dates seem secure and of high quality (Table 1).

Calibrating our high-precision dates of Phase li-lii gives three distinct age ranges with various relative probabilities (Figure 1 and 2), due to the wiggles in the calibration curve at this time trajectory. GrN-18545 gives 3350–3320 (15.8%), 3220–3180 (25.8%) and 3160–3120 (26.7%) cal BC, while GrN-18546 3340–3310 (13.1%), 3240–3170 (32.2%) and 3160–3100 (22.8%) cal BC.

How do our two ^{14}C dates of Phase li-lii relate to archaeological age assessments? First, a statement by Kenyon and Holland (1983:xxxvi) referring to a previous ^{14}C date from this layer: “The charcoal sample (BM-549...) from the destruction of the Phase Tr.III. li room gives a calibrated date, c 2900 BC, which is the date for the end of the first Egyptian dynasty according to Hayes’s ‘high chronology’...”. This correlation by Kenyon and Holland with Egyptian chronology is based on an erroneous ^{14}C date. We found British Museum (BM) ^{14}C dates of EB Jericho, measured in the 1970s, about 200–300 BP years too young in comparison to our high-precision dates, as already presented in detail (Bruins and Van der Plicht 1998). Indeed the above date BM-549 (4204 ± 49 BP), used by Kenyon and Holland, is more than 300 years younger in ^{14}C years than our dates on short-lived material of the same destruction phase: GrN-18545 (4530 ± 19 BP) and GrN-18546 (4512 ± 15 BP). It was also found that systematic errors had occurred in BM dates measured during the period 1980–1984 (Bowman et al. 1990), which were on average 200–300 years too young. Therefore, the various assessments made by Kenyon and Holland (1983:xl, Chronology and Conclusions) in relation to the erroneous BM dates should not be taken at face value.

Concerning the basis of every archaeological excavation—the stratigraphy of the various layers and their content—Kenyon and Holland (1983:xxxv) note that the Proto-Urban/Early Bronze sequence in Trench III is much more complicated than in the other excavated areas of the tell. As a result, the assessment by the authors for assigning the various stages and phases to cultural periods seems somewhat uncertain. Stage XI is considered transitional between Proto-Urban and Early Bronze. But the number of Proto-Urban vessels remains high also in Stages XIII to XVI (Kenyon and Holland 1983:xlili, chart IV). Stage XV has 27 Phases, the highest number for a stage in Trench III. The authors consider Stage XV to be transitional between the end of Proto-Urban and the end of EB-I, which seems rather ambiguous, because it means that Stages XI, XII, XIII, XIV and XV are all somehow transitional between the above periods. This underscores the limitations of cultural remains to provide clear time separation and chronological estimation.

Kenyon and Holland (1983:xxxvi) state: “The vessels from Phase li-lii provide the best evidence for the dating and assessment of both the earlier and later pottery Stages in Trench III”. Important is the spouted jar (“teapot”), which is similar as found in the Jericho Proto-Urban tombs, the Tell el-Far’ah “énéolithique” Tomb 12, and another example from Ras el-‘Ain. Kenyon and Holland (1983:xxxvi) consider “that the Phase li–lii pottery assemblage comes late in the Jericho “Proto-Urban” period and probably should be assigned to the same horizon as Phase III (EBIC) at Ai (Callaway 1980: 273)”.

It seems, therefore, based on the attempted cultural classifications by Kenyon and Holland (1983), that Phase li–lii is situated in the early to middle part of Kenyon’s Early Bronze I. Kenyon (1957) stated in an earlier publication: “The full Early Bronze Age covers a period from approximately 2900 B.C. to approximately 2300.” Therefore, the archaeological age estimate for Phase li–lii based

on the various statements by Kenyon (1957) and Kenyon and Holland (1983) can be put at 2900 BC or younger.

Many other cultural classification schemes use EB-I for Kenyon's Proto-Urban period, and EB-II for Kenyon's EB-I. The beginning of the more conventional EB-II (Kenyon's EB-I) in the southern Levant is often linked with the beginning of the First Dynasty in Egypt (Gophna 1995), or with the reign of Djer considered the second or third pharaoh of the First Dynasty. The latter association is based on finds of Abydos ware—characteristic EB-II pottery from the Levant—in Egyptian Dynasty I tombs that date at the earliest to the reign of Djer (Mazar 1990; Ben-Tor 1992).

When was the beginning of the First Dynasty and when was the reign of pharaoh Djer? There are various opinions on these issues while there has been a tendency amongst scholars to lower the Egyptian chronology in the second half of the 20th century. For example, the *Cambridge Ancient History* (Hayes 1970) gives a range of 3100(3050)–2890 BC for the First Dynasty. Other scholars give younger dates: Otto (1966), as well as Drioton and Vandier (1962) put the beginning of the First Dynasty at 2850 BC, which is in fact 40 years later than the end of the First Dynasty according to Hayes! Gutgesell (1984) gives a range of 2955–2780 for the First Dynasty, while listing the reign of Djer from 2925–2880 BC.

The transition between EB-I and EB-II in traditional archaeo-historical frameworks is estimated at about 3050 BC by Mazar (1990:108–109) or about 2950 by Ben-Tor (1992:122). The time difference is directly related to the respective preference for a “higher” or “lower” Egyptian chronology. All this shows the uncertainties and differences in scholarly opinion concerning archaeo-historical time frameworks for the beginning of EB-II (Kenyon's EB-I). Our calibrated ¹⁴C dates of Jericho, Trench III, Phase li-lii are 200–450 years older than the estimated beginning at 2900 BC of Kenyon's Early Bronze Age (EB-II in other classifications), 150–450 years older than the EB-I/EB-II transition at 2950–2900 BC according to Ben-Tor (1992), and 50–300 years older than the estimate of this transition by Mazar (1990). Moreover, it should be realized that Phase lii-li may be situated later in Kenyon's Early Bronze Age, as indicated by Kenyon and Holland (1983:xlvii, chart x). Therefore, the age difference between archaeological age assessments and the ¹⁴C dates may even be larger.

STAGE XVI, Phases Ix (60) To Ixi–Ixii (61–62) Destruction

Kenyon (1981:202) noted that Stage XVI marked the beginning of new major building activity and period of occupation (Phase Ix). The contemporaneous levels south of wall NDO were designated as Phase Ixa, where also silo NDV is located. The above occupation levels were affected by major destruction (Phases Ixi–Ixii), which probably also involved the collapse of the town wall further south. The charred seeds used in the ¹⁴C determination are in all likelihood contemporaneous with the time of destruction, i.e. Phase Ixi-Ixii.

GrN-18540 (4560 ± 16 BP) was measured on a sample of charred wheat seeds (Hopf, personal communication 1990; sample Jp.N.5.61). The other date GrN-18541 (4465 ± 30 BP) was determined on a different sample of charred seeds of Emmer wheat (*Triticum dicoccum*) (Hopf 1983; personal communication 1990; sample Jp.N.5.61; SA-1030). The discrepancy between the dates is rather large. The charred Emmer seeds (GrN-18541) were derived from silo NDV. The source of the Emmer wheat sample used for GrN-18541 seems more secure than the non-specific wheat seeds used for GrN-18540, in terms of administrative detail and sample information. Kenyon and Holland (1983:xxxv) noted some problems in the original stratigraphic assignment in Trench III of certain terraces and walls that may be the cause of the above difference in ¹⁴C dates. They suggested that in the complicated stratigraphy some mistakes have been made between two destruction levels: Stage

XV, Phase li-lii, and Stage XVI, Phase lxi-lxii. GrN-18540 is rather close to the other two dates of Stage XV, Phase li-lii.

The younger date of GrN-18541 fits very well with the relative stratigraphy of all the samples and is probably to be preferred for Stage XVI, Phase lxa-li-lii. Indeed, sequence analysis with the OxCal 3.5 program (Bronk Ramsey 2000) gives poor agreement of 56.3% for GrN-18540 but good agreement of 91.0% for GrN-18541 (Table 1). The calibrated age is 3330–3230 (41.6%), 3180–3150 (5.9%), 3120–3080 (10.2%), 3070–3030 (10.5%). Following sequence analysis the calibrated result becomes more narrow and specific: 3180–3150 (12.6%), 3130–3020 (55.6%) with an agreement of 91.0%.

How does this dating result relate to archaeological age assessments of this phase? Kenyon and Holland (1983:xxxvii) state that the transition to EB-II in Trench III has taken place by Stage XVI. They notice many parallels between the juglets of this Stage and those found in Tomb D12. Moreover, they consider the small holemouth jar with vertically pierced lug handles of Phase lxi-lxiii similar as two examples from EB-II levels at Tell Far'ah. The correlation of pottery stages at the tell of Jericho (Kenyon and Holland 1983:xlvi, chart x) shows Stage XVI at the transition between EB-I and EB-II.

Kenyon's EB-II appears to be more or less coeval with the younger part of EB-II in other cultural classification schemes (Mazar 1990; Ben-Tor 1992), and with the Second Dynasty in Egypt. The age of the latter Dynasty is 2890–2686 BC in the Cambridge Ancient History (Hayes 1970), while Gutgesell (1984) gives 2780–2635 BC. The destruction Phase lxi-lxii may, therefore, be placed in the early to middle part of the Second Dynasty, around 2800 or 2700 BC in the above archaeo-historical time frameworks.

Our calibrated ^{14}C date of GrN-18541 is 330–530 years older than this age estimate according to conventional archaeo-historical time frameworks. Considering the calibrated date after sequence analysis (Table 1) the possible age difference becomes narrower, but is still 320–380 years older.

Stage XVI, Phase lxii–lxiii (62–63), Final Destruction of EB-II

Phase lxii is characterized by building alteration and site occupation. “The destruction at the end of Phase lxii was a severe one, which resulted in the collapse of all the structures in the southern half of the trench. It was accompanied by heavy burning, and fallen burnt timbers were especially noticeable in the area south of NDY” (Kenyon 1981:204). The charred short-lived organic matter from this destruction layer consisted mainly of Amaranthaceae (Hopf 1983; SA-739, Jp.N.5.53).

Four duplo's were made of the sample and were dated by AMS. Three of the four dates are very similar, while one is an outlier that was rejected (Bruins and Van der Plicht 1998). The three similar dates (GrA-222, 4360 ± 40 BP; GrA-6315, 4330 ± 50 BP; GrA-6332, 4360 ± 60 BP) were averaged, resulting in a date of 4350 ± 27 BP. The calibrated date is 3020–2900 (68.2%) cal BC (Table 1).

How does this rather precise calibrated ^{14}C date relate to archaeological age assessments. The destruction Phase lxii-lxiii probably marks the end of the EB-II period in Trench III, according to Kenyon and Holland (1983:xxxvii). The absence of Khirbet Kerak ware in Trench III means that no specific Phase may be designated as heralding the EB-III period. However, fully developed EB-III pottery forms occur in Stage XVII (Kenyon and Holland 1983). It seems that the end of Kenyon's EB-II coincides with the end of EB-II in other cultural classification systems, which is related to the end of the Second Dynasty. The Cambridge Ancient History (Hayes 1970) gives a date of 2686 BC, Gutgesell (1984) gives 2635 BC, and Otto (1966) gives 2650 BC for the end of the Second Dynasty,

i.e. the end of the Archaic Period and beginning of the Old Kingdom. In archaeological time frameworks the round number 2700 BC is often used as the transition from EB-II to EB-III (Mazar 1990; Ben-Tor 1992).

It is clear that our precise ^{14}C date based on three separate measurements is, after calibration, 200–320 years older than the archaeological age estimate for the transition of EB-II to EB-III, as related to the above scholarly opinions concerning the respective dates of the Egyptian Dynasties.

Stage XVII, Phases Lxviii A–lxix A (68a–69a)

Phase Lxviii was associated with significant occupation layers in Trench III. Kenyon (1981:207) writes about the related Phases Lxviii a–xix a of Stage XVII: “In the western room there was also a considerable depth of occupation levels, which sagged into the fill of the silo NEH-NEJ”. Charred onion bulbs, *Allium* spec. (Hopf 1983; SA-704, Jp.N. 5.30), were found in this layer and used for ^{14}C dating with AMS.

GrA-224 has a date of 4210 ± 40 BP. Another measurement of the same sample turned out to be much older (Bruins and van der Plicht 1998) and seems unrealistic within the chrono-stratigraphic sequence. There was not enough material to make a third measurement. Nevertheless, the date of GrA-224 fits very well in the sequence analysis with an agreement of 99.3% (Table 1). The calibrated date is 2890–2850 (16.9%), 2820–2750 (38.3%), 2730–2700 (13.0%).

The dated Phase Lxviii a–xix a of Stage XVII is listed in the early part of EB-III (Kenyon and Holland 1983:xlvii), while the later Phase Lxxvi (76) of Stage XIX marks the end of MB-III, followed by Kenyon’s Intermediate Early Bronze–Middle Bronze Period. The Early Bronze Age III is usually associated with Dynasties 3, 4, 5, and the beginning of Dynasty 6 (Mazar 1990), while other scholars also include part of Dynasty 6, the last Dynasty of the Egyptian Old Kingdom (Mazar 1990). Some archaeologists (Ben-Tor 1992) prefer to define a distinct cultural period EB-IV in parallel with the Sixth Dynasty. The time span covered by the Old Kingdom (Dynasties 3–6) is 2686–2181 BC, according to the Cambridge Ancient History (Hayes 1970), while Gutgesell (1984) gives 2635–2154 BC, and Otto (1966) lists 2650–2189 BC. The archaeological age estimate for EB-III by Mazar (1990) is 2700–2300 BC.

Anyhow, our dated Phase Lxviii a–lxix a of Stage XVII was placed by Kenyon and Holland (1983) in the early part of EB-III. Hence an archaeological age estimate around 2600 BC seems reasonable on the basis of the above correlations. The calibrated ^{14}C date of GrA-224 is significantly older, 100–290 years, than the above age assessment within the conventional archaeo-historical time framework.

DISCUSSION AND CONCLUSION

Our stratified high-quality ^{14}C dates from EB Jericho (Trench III) on short-lived material are all without exception significantly older than conventional archaeo-historical time frameworks. The calibrated ^{14}C date of Stage XV Phase li–lii (Early to Middle EB-I Kenyon, Early EB-II others) is 100–450 years older. Stage XVI Phase lxi–xii (Early EB-II Kenyon, Later EB-II others) is 200–500 years older. Stage XVI Phase lxii–lxiii (destructive end EB-II) is 200–300 years older. Stage XVII Phase Lxviii a–lxix a (Early EB-III) is 100–300 years older than conventional archaeo-historical time estimates (Figure 3).

The above ^{14}C results of EB Jericho are a challenge to the current archaeo-historical time framework in the southern Levant and Egypt. Albright (1960) noted that his framework (EB-I 3100–2900, EB-

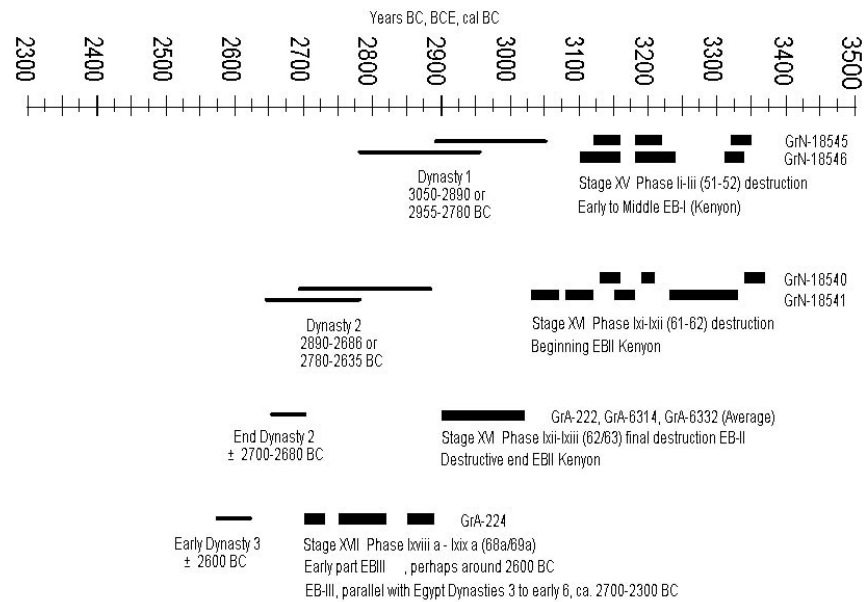


Figure 3 The significant and consistent difference between the ^{14}C dates and the archaeo-historical age assessment: all calibrated ^{14}C dates are much older

II 2900–2600, EB-III 2600–2300 BC) was based on a minimal Egyptian chronology. The assumption was that the lowest possible dates for the first 10 dynasties were likely to be more or less correct. Albright (1960) remarked that any shift of the Egyptian chronology to older dates must be accompanied by a similar shift of Early Bronze and Chalcolithic periods to older ages.

As a result of ^{14}C dating, the latter periods have indeed “become” much older. In the 1950s and early 1960s, when Albright (1960) wrote the above time assessments, it became quite fashionable to assign the Chalcolithic on archaeological estimates to about 4000–3100 BC and EB-I to about 3100–2900 BC. However, ^{14}C dating has changed this picture completely! The Chalcolithic is now understood to have begun almost a 1000 years earlier, close to 5000 BC! The transition between the Chalcolithic and EB-I has also been pushed back by many hundreds of years to somewhere in the early to mid-4th millennium (Gilead 1994; Joffe and Dessel 1995; Bourke et al., this volume; Burton and Levy, this volume).

Concerning EB-I, critical relationships with Egypt are being investigated by Savage (1998; this volume) in detailed ^{14}C analyses of Predynastic ceramics. Based on his initial results the Nagada II a/b to Nagada II b/c transition seems older than hitherto estimated (Savage, this volume). New ^{14}C dates from Early Bronze sites in the southern Levant (Braun, this volume) suggest that both the beginning and end of EB-I seem older than commonly estimated. Braun underlined the dilemma how to relate the ^{14}C chronology to currently accepted Egyptian chronology: “The logical outcome of an acceptance of these new dates puts such a strain on chronological correlations between the ^{14}C data and the archaeological record that the entire system would no longer be tenable if they were accepted” (Braun, this volume).

It must be realized that the traditional archaeo-historical framework based on Egyptian chronology is not immutable, because the diverse elements of Egyptian chronology are not yet ultimately “fixed”. There were various “older” opinions by egyptologists during the first quarter of the 20th century regarding the age of the First and Second Dynasties as listed by Emery (1961:28). A period of 3400–2980 BC was given by Breasted (1921), while Hall (1924) in an older version of the Cambridge Ancient History assigned an age of 3500–3190, and Weigall (1925) calculated yet another time slot of 3407–2888 BC for Dynasties 1 and 2. The opinions became “younger” during the middle of the 20th century, as Frankfort (1948) made an assessment of 3100–2700 and Hayes (1953) of 3200–2780 BC. Notice also that calculations about the total duration of Dynasties 1 and 2 ranges from 519 year (Weigall 1925) to 310 years (Hall 1924).

What about ^{14}C dates of Egyptian Dynastic material? Haas et al. (1987) published the calibrated results of 64 organic samples from Old Kingdom monuments. Most ^{14}C dates proved to be much older than current historical age assessments. Point estimates within the calibrated ranges suggested that the ^{14}C dates were on average 374 years older than the Egyptian chronology according to the Cambridge Ancient History (Hayes 1970). Subsequently, many more samples were collected and some 170 new dates were measured (Bonani et al., this volume). The previous 64 dates and the many new dates were calibrated in a somewhat different approach. However, many ^{14}C dates remain significantly older—up to a few hundred years—as compared to current egyptology age assessments. A different ^{14}C study of the remains of an unidentified female from the 3rd Dynasty Step Pyramid at Saqqara yielded a calibrated date of 3532–2878 cal BC (Strouhal et al. 1998). This result is again a few hundred years older than the age currently accepted by egyptologists for the 3rd Dynasty, about 2700–2600 BC.

In conclusion, the collective ^{14}C evidence of the Early Bronze Age from Jericho and other sites in the southern Levant as well as from Egypt for the Predynastic period and Dynasties 1–6 strongly challenges the current archaeo-historical time framework for these cultural and political periods. Most ^{14}C dates overwhelmingly show that these periods are significantly older than currently accepted.

ACKNOWLEDGMENTS

We are grateful to Dr Maria Hopf (Römisch-Germanisches Zentralmuseum, Forschungsinstitut für Vor- und Frühgeschichte, Mainz) for kindly making available paleobotanic material excavated in the 1950s under the direction of the late Dame Kathleen Kenyon. Thanks to Mr. HJ Streurman for the precise methodology in the conventional dating and to Mrs. Anita T Aerts-Bijma for carefully preparing the AMS samples (University of Groningen, Center for Isotope Research). We appreciate the comments by Dr Peter Stadler (Department of Prehistory, Museum of Natural History, Vienna).

REFERENCES

- Albright WF. 1960. *The Archaeology of Palestine*. Harmondsworth: Penguin Books.
- Ben-Tor A. 1992. The Early Bronze Age. In: Ben-Tor A, editor. *The Archaeology of Ancient Israel*. New Haven: Yale University Press. p81–125.
- Bonani G, Haas H, Hawass Z, Lehner M, Nakhla S, Nolan J, Wenke R, Wölfli W. 2001. Radiocarbon dates of Old and Middle Kingdom monuments in Egypt. *Radiocarbon*. This issue.
- Bourke S, Lawson EM, Lovell J, Hua Q, Zoppi U. 2001. The chronology of the Chalcolithic period in the southern Levant: New ^{14}C determinations from Teleilat Ghassul, Jordan. *Radiocarbon*. This issue.
- Bowman SGE, Ambers JC, Leese MN. 1990. Re-evaluation of British Museum radiocarbon dates issued between 1980 and 1984. *Radiocarbon* 32(1):59–79.
- Braun E. 2001. Proto and Early Dynastic Egypt and Early Bronze I-II of the southern Levant: some uneasy ^{14}C correlations. *Radiocarbon*. This issue.
- Breasted A. 1921. *A History of Egypt*.
- Bronk Ramsey C. 2000. OxCal Program version 3.5. Radiocarbon Accelerator Unit, University of Oxford.

- <http://www.rlaha.ox.ac.uk/oxcal>.
- Bruins HJ, Mook WG. 1989. The need for a calibrated radiocarbon chronology of Near Eastern archaeology. *Radiocarbon* 31(3):1019–29.
- Bruins HJ, van der Plicht J. 1998. Early Bronze Jericho: high-precision ¹⁴C dates of short-lived palaeobotanic remains. *Radiocarbon* 40(2):621–8.
- Burton M, Levy TE. 2001. The Chalcolithic radiocarbon record and its use in southern Levantine archaeology. *Radiocarbon*. This issue.
- Callaway JA. 1980. *The Early Bronze Age citadel and Lower City at 'Ai (et-Tell)*. Cambridge: American Schools of Oriental Research.
- Drioton E, Vandier J. 1962. *L'Égypte, Clio, Les Peuples de l'Orient Méditerranéen II*. Paris. Fourth edition.
- Emery WB. 1961. *Archaic Egypt*. Harmondsworth: Penguin Books.
- Frankfort H. 1948. *Kingship and the Gods*.
- Gilead I. 1994. The history of the Chalcolithic settlement in the Nahal Beer Sheva area: The radiocarbon aspect. *Bulletin American Societies of Oriental Research* 296: 1–13.
- Gophna R. 1995. Early Bronze Age Canaan: Some spatial and demographic observations. In: Levy TE, editor. *The archaeology of society in the Holy Land*. London: Leicester University Press. p269–80.
- Gutgesell M. 1984. Chronological overview. In: Eggebrecht A, editor. *Das Alte Ägypten*. München: Bertelsmann Verlag.
- Haas H, Devine J, Wenke R, Lehner M, Woelfli W, Bonani G. 1987. Radiocarbon chronology and the historical calendar in Egypt. In: Aurenche O, Evin J, Hours F, editors. *Chronologies in the Near East*. Oxford: BAR International Series 379: 585–606.
- Hall HR. 1924. Chronology of Egypt. *Cambridge Ancient History*. Volume 1. Cambridge.
- Hayes WC. 1953. *The scepter of Ancient Egypt*. New York.
- Hayes WC. 1970. Chronology: Egypt to the end of the twentieth century. In: Edwards IES, editor. *Cambridge Ancient History*. Volume 1. Third edition. Cambridge. p173–93.
- Hopf M. 1983. Jericho plant remains. In: Kenyon KM, Holland TA. *Excavations at Jericho, volume 5. The pottery phases of the tell and other finds*. Appendix B. London: The British School of Archaeology in Jerusalem: p576–621. Plates 25–31.
- Joffe AH, Dessel JP. 1995. Redefining chronology and terminology for the Chalcolithic of the southern Levant. *Current Anthropology* 36(3):507–18.
- Kenyon KM. 1957. *Digging up Jericho*. London: Ernest Benn.
- Kenyon KM, edited by Holland TA. 1981. *Excavations at Jericho, volume 3. The architecture and stratigraphy of the tell*. London: The British School of Archaeology in Jerusalem.
- Kenyon KM, Holland TA. 1983. *Excavations at Jericho, volume 5. The pottery phases of the tell and other finds*. London: The British School of Archaeology in Jerusalem.
- Manning SW, Weninger B. 1992. A light in the dark: archaeological wiggle matching and the absolute chronology of the close of the Aegean Late Bronze Age. *Antiquity* 66:636–63.
- Mazar A. 1990. *Archaeology of the land of the Bible*. New York: Doubleday.
- Mook WG, Waterbolk HT. 1985. *Radiocarbon dating*. Handbooks for archaeologists, No. 3. Strasbourg: European Science Foundation.
- Otto E. 1966. *Ägypten: Der Weg des Pharaonenreiches*. Stuttgart: Kohlhammer Verlag.
- Savage SH. 1998. AMS ¹⁴C dates from the Predynastic Egyptian cemetery, N7000, at Naga-ed-Dêr. *Journal of Archaeological Science* 25(3):235–49.
- Savage SH. 2001. Toward an AMS radiocarbon chronology of Predynastic Egyptian ceramics. *Radiocarbon*. This issue.
- Strouhal E, Gaballah MF, Bonani G, Woelfli W, Nemecková A, Saunders S. 1998. Re-investigation of the remains thought to be of King Djoser and those of an unidentified female from the Step Pyramid at Saqqara. In: Eyre CJ, editor. *Proceedings of the Seventh International Congress of Egyptologists*. Leuven: Uitgeverij Peeters. p.1103–7.
- Stuiver M et al. 1998. INTCAL98 radiocarbon age calibration 24,000–0 cal BP. *Radiocarbon* 40(3):1041–83.
- van der Plicht J, Bruins HJ. 2001. Radiocarbon dating in Near-Eastern contexts: confusion and quality control. *Radiocarbon*. This issue.
- Ward WA. 1992. The present status of Egyptian chronology. *Bulletin of the American Societies of Oriental Research* 288:53–66.
- Waterbolk HT. 1987. Working with radiocarbon dates in southwestern Asia. In: Aurenche O, Evin J, Hours F, editors. *Chronologies in the Near East*. Oxford: BAR International Series 379:39–59.
- Weigall A. 1925. *A History of the Pharaohs*. London.
- Weninger B. 1995. Stratified ¹⁴C dates and ceramic chronologies: case studies for the Early Bronze Age at Troy (Turkey) and Ezero (Bulgaria). *Radiocarbon* 37(2):443–56.