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^{14}C AND THE IRON AGE CHRONOLOGY DEBATE: REHOV, KHIRBET EN-NAHAS, DAN, AND MEGIDDO

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ABSTRACT. A recently published volume, *The Bible and Radiocarbon Dating: Archaeology, Text and Science* (Levy and Higham 2005), provides data related to the debate over the chronology of the Iron Age strata in the Levant (for a review, see Carmi 2006). The present article comments on several chapters in the volume. The article highlights methodological problems, such as insecure stratigraphic provenance of ^{14}C samples, and demonstrates how unjustified selection of data can bias the result. The article offers a new interpretation to some of the results and shows that the full set of measurements from Tel Rehov supports the Low Chronology system.

TEL REHOV: ANOTHER SUPPORT FOR THE LOW CHRONOLOGY

Mazar and his colleagues have presented Tel Rehov as the key site for resolving the Iron Age chronology debate and have interpreted the radiocarbon measurements of samples from the Iron I and Iron IIA strata at the site as supporting a "Modified Conventional Chronology" (Mazar et al. 2005; see also Bruins et al. 2003, 2005a). We have already challenged some of the methods and assumptions behind the interpretation of the Tel Rehov ^{14}C readings and have shown that the Tel Rehov data can be interpreted in a different way, which complies with the Low Chronology (Finkelstein and Piasetzky 2003a,b; Finkelstein 2004). Mazar and his team have now published the most detailed article on the Tel Rehov stratigraphy, pottery, and ^{14}C results (Mazar et al. 2005). They reveal new information that calls for a reevaluation of the data. In fact, they make Tel Rehov another anchor for the Low Chronology system.

Methodology

Our criteria for accepting or rejecting measurements and the procedures we use to interpret the data are simple and consistent for all readings, from all strata and laboratories:

- As in all our previous works (e.g. Finkelstein and Piasetzky 2003c, 2006), only short-lived samples are included;
- All available readings from loci safely assigned stratigraphically are incorporated;
- Results of all laboratories are included (see below);
- The uncalibrated dates corresponding to a given stratum were checked for consistency by fitting to a constant. Two readings (~3% of the total), which are different by more than 5 standard deviations from the average of the other measurements in their group, were excluded as outliers.
- The result of the fit specified above was used as the combined uncalibrated date for the stratum. In cases that $\chi_\nu > 1$ for the fit, we increased the error by the square root of the χ_ν.
- The calibrated dates were obtained using the 2004 calibration by means of the 1999 OxCal v 3.3 computer program of Bronk Ramsey (1995).[1]
- Regarding calibrated dates, in order to work on safer grounds and to avoid having to choose between close probabilities (e.g. 40% and 27%), we take the full 1-σ range for each stratum; for

[1]Mazar et al. (2005) used the IntCal98 calibration curve (Stuiver et al. 1998). The differences from the IntCal04 calibration curve (Reimer et al. 2004) are minimal and quite meaningless—a few years in each case.

example, in a situation of 905–890 BCE (18%) and 880–840 BCE (49%), we opt for a date in the full range, 905–840 BCE.

Our method differs from that deployed by Mazar et al. (2005) in the following points:

- In the cases of strata D-3, VI, and V, Mazar et al. (2005) included in their calculation several long-term samples, which may introduce the old-wood (or old-bone[2]) effect;
- In several cases, Mazar et al. excluded "outliers" that are within the allowed statistical deviations (e.g. less than 2 σ in Pit 4830 of Stratum D-3);
- In the case of Stratum V, they excluded the 1990s results of the Rehovot laboratory as too low; they also excluded the Arizona measurements;
- In most cases, they opted for the highest probability date, but in the case of Stratum V preferred a low probability result.

Results

Table 1 presents all available short-lived readings from Tel Rehov, from all 3 laboratories, from loci safely assigned stratigraphically (that is, excluding those loci described in Mazar et al. [2005] as, e.g. "IV or V?", "V?"[3]). Accelerator mass spectrometry (AMS) normally provides repeated readings of the same material, intended to reduce systematic errors; the data in the table represent the average results as determined by the laboratories.

Strata D-6 and D-4

We accept Mazar et al.'s (2005:199) choice of data, though we have serious reservations regarding the origin of the samples—raised from surfaces and pits rather than from destruction layers (Finkelstein and Piasetzky 2003b). For Stratum D-6, the uncalibrated result is 2912 ± 18 BP and the 1-σ full range is 1130–1050 BCE. For Stratum D-4b, the uncalibrated result is 2895 ± 19 BP; since the χ_ν = 2.7, we increased the error according to the procedure described above from 19 to 32. The 1-σ full range is 1130–1010 BCE. For Stratum D-4a, the uncalibrated result is 2878 ± 15 BP, corresponding to a full 1-σ range of 1115–1010 BCE.

Stratum D-3

Stratum D-3 dates to the late Iron I (roughly contemporary to the "classic" layer of this horizon, Stratum VIA at Megiddo) and is therefore essential for the Tel Rehov sequence. Samples from 5 loci—all of them pits—were sent to the laboratory. In the case of Pit 4830, Mazar et al. (2005:211) preferred to calculate 5 of the 7 results, arguing that "the two young dates are outliers, not in the classical sense as they are within the 2-σ overlap range, but in comparative terms." There is no reason to exclude these data, as they are consistent with the rest of the measurements. Pit 1858 was excluded by Mazar et al. as standing "in contrast to the other dates" (Mazar et al. 2005:212) from this stratum. We do not exclude data on the basis of results, unless they are outliers as specified above. Note that Stratum D-3 consists of "more than 30 small and shallow pits … the activity represented by these pits might have lasted quite some time. The function of these pits remains obscure; it seems that they were used for storage or refuse" (Mazar et al. 2005:208). In a situation like this, all results, including those in the 2-σ range, must be included.

[2]Even in the case of destruction debris resting on a floor, bones may originate from bricks and therefore taken (when the bricks were made) from an earlier deposit at the site.

[3]Also Locus 4218 from Stratum B-5; for the uncertainty in synchronizing this stratum with the better established stratigraphy of Area C, see Mazar et al. (2005:246). Note that even if included, these readings would not change the result.

Table 1 All available short-lived readings from Tel Rehov.

Str.	Locus	Lab nr[a]	Uncalibrated result (BP)	Comments	Source[b]
D-6	1876	RT-3119	2685 ± 40	Outlier, agreed by both Mazar et al. and us	A
	2836	GrN-26118	2920 ± 30		A
	2836	GrA-18826	2950 ± 50		A
	2874	GrA-19034	2935 ± 45		A
	2874	GrN-26120	2880 ± 30		A
D-4b	1845	GrA-21046	2905 ± 35		A
	1845	GrA-21057	2945 ± 35		A
	1845	GrA-21184	2920 ± 50		A
	1845	RT-3121	2800 ± 40		A
D-4a	1836	GrN-26121	2890 ± 30		A
	1836	GrA-18825	2870 ± 50		A
	1836	RTT-3809	2830 ± 35		B
	1836	—	2860 ± 35		B
	1836	T18150A	2890 ± 35		B
	1836	—	2950 ± 45		B
D-3	1858	RT-3120	2670 ± 40		A
	2862	RTT-3805	2775 ± 35		B, A
	2862	—	2810 ± 35		B, A
	2862	—	2815 ± 35		B, A
	2862	GrA-19033	2835 ± 45		A
	2862	GrN-26119	2720 ± 30		A
	4815	GrA-16757	2820 ± 50		A
	4816	GrA-12889	2870 ± 70	1 charcoal reading excluded	A
	4830	GrA-21044	2845 ± 35		A
	4830	GrA-21056	2825 ± 35		A
	4830	GrA-21183	2820 ± 50		A
	4830	GrA-22302a	2730 ± 50		A
	4830	GrA-22302b	2820 ± 40		A
	4830	GrA-22329a	2810 ± 50		A
	4830	GrA-22329b	2760 ± 40		A
VI	4426	GrN-27366	2761 ± 14	3 "fine charcoal" and 1 bone excluded	A
V	2444	GrN-27364	2764 ± 11	A "fine fraction" reading excluded	A
	2425	GrN-26114	2775 ± 20		A
	2425	GrN-26115	2800 ± 20		A
	2425	AA-30431-U3-11	2830 ± 55		C
	2425	AA-30431-U3-12	2745 ± 50		C
	2425	AA-30431-U3-13	2730 ± 45		C
	2425	AA-30431-U3-21	2815 ± 50		C
	2425	AA-30431-U3-22	2770 ± 50		C
	2425	AA-30431-U3-23	2710 ± 45		C
	2425	AA-30431-U3-31	2685 ± 45		C
	2425	AA-30431-U3-32	2760 ± 60		C
	2425	AA-30431-U3-33	2740 ± 50		C
	2425	RT-3122-A	2700 ± 20		C

Table 1 All available short-lived readings from Tel Rehov. *(Continued)*

Str.	Locus	Lab nr[a]	Uncalibrated result (BP)	Comments	Source[b]
	2425	RT-3122-A1	2655 ± 25		C
	2425	RT-3122-A2	2655 ± 25		C
	2425	RT-3122-B	2720 ± 20		C
	2425	RT-3122-B1	2700 ± 25		C
	2425	RT-3122-B2	2650 ± 30		C
	2425	RT-3122-BB	2725 ± 15		C
	2425	RT-3122-C	2860 ± 20	Outlier not calculated. Agreed by both Mazar et al. and us.	C
	2425	RT-3122-D	2710 ± 20		C
	2441	GrN-26116	2810 ± 20		A
	2441	GrN-26117	2775 ± 25		A
	2441	GrN-27363	2745 ± 15		A
	2441	GrN-27385	2771 ± 15		A
	2441	GrN-27386	2761 ± 15		A
	2422	GrN-27361	2764 ± 11		A
	2422	GrN-27362	2777 ± 13		A
	2422	GrN-27412	2785 ± 28		A
	6449	GrA-24455	2775 ± 45		A
	6449	GrA-24456	2750 ± 45		A
	6449	GrA-24497	2745 ± 45		A
IV	5498	GrA-21152	2770 ± 50		A
	5498	GrA-21154	2730 ± 50		A
	5498	GrA-21267	2760 ± 35		A
	5498	GrA-22301a	2710 ± 45		A
	5498	GrA-22301b	2775 ± 40		A
	5498	GrA-22330a	2760 ± 50		A
	5498	GrA-22330b	2785 ± 40		A

[a]GrN = Groningen PGC; GrA = Groningen AMS; RT = Rehovot LSC; RTT = Rehovot/Arizona AMS; AA = Arizona AMS; T = Arizona AMS.
[b]A: Mazar et al. 2005:198–201; B: Boaretto et al. 2005:14; C: Mazar et al. 2005:232.

Calculating 5 of 7 readings from 1 locus, Mazar et al. (2005:211) reached a 1-σ calibrated date of 1001–971 (39.9%) and 958–937 BCE (28.3%). They opted for the older date because the younger overlaps with their interpretation of the results for Stratum VI of the early Iron IIA—the next in the Tel Rehov sequence. But as we shall see later, Stratum VI produced more than one possibility and a choice for the less probable older date was taken arbitrarily.

Calculating the short-lived results of all 5 loci, we reach an uncalibrated date of 2789 ± 15 BP, which translates into 1-σ calibrated dates of 975–955 BCE (24%) and 945–905 BCE (44%). Therefore, the full 1-σ range is 975–905 BCE. These results call for the following comments:

1. Since we are dealing with pits, some of which may have been used for refuse (in a case like this, old material, including a few olive stones, could have been swept into the pits—Ilan [1999]), the results above should be taken as the oldest possible dates. Incidentally, Pit 4830—the anchor in Mazar et al.'s calculation—was cut by a later pit, possibly also dating to Stratum D-3 (Mazar et al. 2005:208)!

2. Elsewhere, we calculated the results for the Megiddo VIA horizon (Megiddo VIA and Tel Hadar) as 1005–925 BCE (Finkelstein and Piasetzky 2006). Close results were obtained for 13 samples from the contemporary Stratum XVII at Yokneam (Boaretto et al. 2005:7). Stratum D-3 at Tel Rehov provides a slightly later date, in the second half of the 10th century BCE. It should probably be interpreted as the latest late-Iron I stratum known to date in the north of Israel.

Stratum VI

Stratum VI (Area C) represents the earliest Iron IIA activity at Tel Rehov. The ^{14}C results come from 1 locus (4426). Mazar et al.'s (2005:221) highest probability 1-σ result for all samples from this locus is 927–897 (52.2%), but they opted for the older 1-σ date of 969–960—only 12.4% probability. They did so because, in their view, taking the highest probability would result in too short a period of time for strata VI and V combined. Whether Stratum VI represents an independent settlement or an early phase of Stratum V remains to be decided when the full results, including detailed plans and sections, are published. Mazar et al.'s cautious description of Building A, which yielded the samples for the ^{14}C measurement (Mazar et al. 2005:218), demonstrates the problem. In any event, Area C consists of brick-built domestic houses, in which one can expect changes in layout, including rising of floors, even in a relatively short period of time. Note, for instance, that the transition from Stratum V to Stratum IV in Area C is characterized by continuity (Mazar et al. 2005: 253). On this background, any reference to length of life of a given stratum is meaningless.

It is also noteworthy that 4 of the 5 readings for Stratum VI come from "fine charcoal" and a bone. These measurements introduce the possibility of old-wood (and old-bone, see footnote 2) effect. Calculating the single short-lived cereal grains sample, one reaches an uncalibrated result of 2761 ± 14 BP, that is, a 1-σ date of 925–890 BCE (49%) or 870–850 (19.2%; indeed, not very different from Mazar et al.'s [2005] highest probability date of 927–897 BCE for of all 5 samples together). The full-range result is 925–850 BCE.[4]

Stratum V

Mazar et al. (2005:229–34) opted for certain loci and for the Groningen laboratory results, for calculating the average date for Stratum V, and reached a date of 924–897 BCE (58.8%). We see no rationale in this selection of data.

Locus 6449, from a different building in Area C, which provides a 1-σ calibrated date of 879–837 BCE (41.7%), should also be included. In addition, we see no reason to exclude the Arizona and Rehovot dates for Locus 2425. Mazar (2004; Mazar et al. 2005:232) argued that the Rehovot 1990s results are too low; but in the same way, one can argue that the Groningen results are too high (contra Mazar's claim, see Sharon et al. [2005] comparing old and new Dor dates measured at Rehovot); and why exclude the Arizona results, which fall between the 2 other laboratories? The only safe way to avoid bias is to include all samples and increase the error if necessary according to the rules specified above.

Mazar et al. (2005:225) suggested 3 alternative interpretations for the stratigraphic affiliation of loci 2425 and 2444 and calculated the date of Stratum V with the Groningen (but not Rehovot and Arizona) samples from these loci (their alternatives 1–2). Calculating all 31 available readings for Stra-

[4]In a previous publication, taking into consideration all readings from this locus, we pointed out to 2 possible calibrated dates (Finkelstein and Piasetzky 2003a), while the Tel Rehov team opted for one (the earlier) possibility only (Bruins et al. 2003). The current analysis eliminates the early-dates alternative.

tum V results in an uncalibrated date of 2743 ± 9 BP, which translates to a 1-σ date of 905–890 (18.6%) and 880–840 BCE (49.6%). Therefore, the full 1-σ range is 905–840 BCE.[5]

Stratum IV

We accept all 7 measurements calculated by the Tel Rehov team (Mazar et al. 2005:244). They reached a 1-σ date of 877–840 (40%, according to Stuiver et al. 1998). We reached an uncalibrated date of 2758 ± 16 BP, which translates to 925–890 (40.9%) and 875–845 BCE (27.3%, according to Reimer et al. 2004). The full 1-σ range for this stratum would be 925–845 BCE. This is the only case in which the 1998 and 2004 calibration curves provide somewhat different results, in the sense that the 1998 calibration prefers the late range while the 2004 calibration prefers the earlier one.

Conclusions

Table 2 summarizes the 2 sets of results for Tel Rehov (for the individual measurements, uncalibrated and calibrated, see Table 1). Figure 1 presents the interpretations on the calibration curve, taking into consideration the sequential aspect of the stratigraphy (for the Tel Rehov team's interpretation, see Mazar et al. 2005:251).

Table 2 Two systems of dating for Tel Rehov.

Stratum	Mazar et al. (2005) 1-σ highest probability (Stuiver et al. 1998)	Finkelstein and Piasetzky (this paper) Full 1-σ range (Reimer et al. 2004)
D-6	1159–1108	1130–1050
D-4b	1208–1050	1130–1010
D-4a	1053–1005	1115–1010
D-3	1001–971	975–905
VI	927–897 (they preferred the date 969–960, 12.4%)	925–850
V	924–897	905–840
IV	877–840	925–845

The following conclusions can be drawn:

1. According to Mazar et al. (2005), the transition from the Iron I to the Iron II (strata D-3 to VI) is fixed at about 970 BCE; according to us, it should be placed between 925 and 905 BCE.
2. For Mazar et al. (2005), the Iron IIA has a range of approximately 970–840 BCE; according to us, it covers the period 925–845 BCE.
3. According to Mazar et al.'s (2005) interpretation, Tel Rehov provides earlier dates than other Iron I and Iron IIA strata in the north of Israel. Our method makes it comply with the measurements from these strata (see e.g. Boaretto et al. 2005). There is no need, then, for a "Modified Conventional Chronology" (Mazar 2005).[6]

[5]Opting for alternative 3 (i.e. moving loci 2425 and 2444 to Stratum IV), the results would be: 925–895 BCE for Stratum V (quite similar to Mazar et al. 2005) and 905–840 BCE for Stratum IV.

[6]Bruins et al. (2005a) employed Bayesian statistics for the interpretation of the Tel Rehov results. Their system is based on a set of rules that come from the archaeological and historical interpretation of the excavator. In other words, Mazar's ideas on the stratigraphy of Rehov and the chronology of the Iron Age (e.g. regarding the transition from Stratum D-3 to VI and from VI to V) make the basis for the whole endeavor. It is not surprising, then, that "the result confirms the conclusions drawn by Bruins, van der Plicht and Mazar … in which the Bayesian statistics were not employed" (Mazar 2005). Needless to say, this is a circular argument.

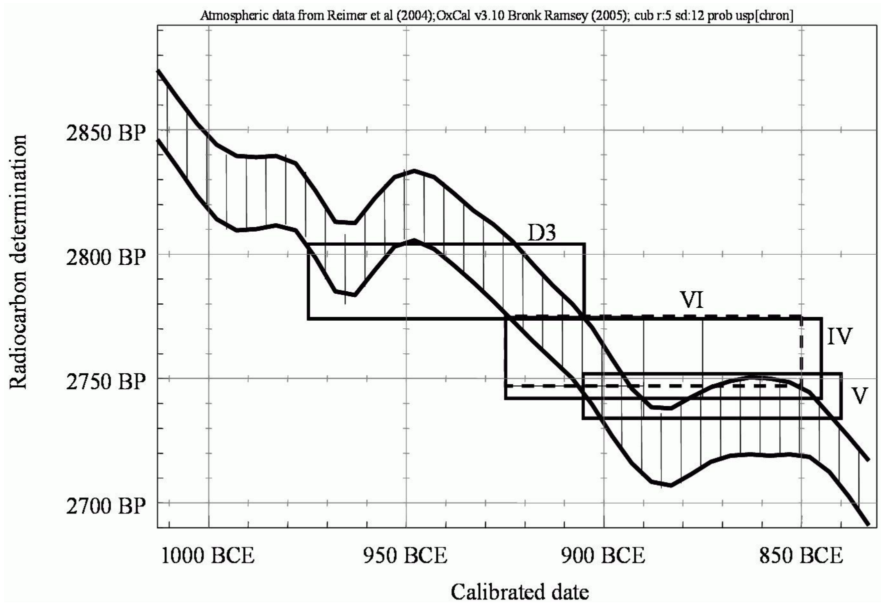

Figure 1 The full 1-σ range for Tel Rehov strata D-3 to IV (Table 2) superimposed on the IntCal04 calibration curve (Reimer et al. 2004).

THE KHIRBET EN-NAHAS FORT

^{14}C results from the copper production site of Khirbet en-Nahas indicate that activity there commenced in the 12th century and lasted until the late 9th century BCE (Levy et al. 2004, 2005). These results are of utmost importance for the reconstruction of the history of the south in the Iron I and the Iron IIA (Finkelstein 2005; Fantalkin and Finkelstein 2006). The problem with Kh. en-Nahas is Levy et al.'s (2004) dating of the large square fort to the 10th century BCE.

One of us has already raised questions on this matter (Finkelstein 2005). Levy et al. (2004:870; 2005:135) supply decisive evidence in support of the dating of the fort to the late Iron II, rather than to the 10th century BCE (late Iron I). We refer to the ^{14}C dates of charcoal taken from under the fort (Stratum A4a, see below) and from the foundation layer of the fort (Stratum A3; Table 3).

Table 3 ^{14}C results from Khirbet en-Nahas.

Stratum	Lab nr[a]	Location according to Levy et al. (2004, 2005)	Calibrated 1-σ date (BCE)
A3	GrA-25318	The gate	1210–1045
A3	GrA-25354	The gate	1185–1180, 1125–945
A3	GrA-25321	The gate	835–793
A3	GrA-25322	The gate	895–875, 835–800
A3	OxA-12366	The gate	1000–985
A4a	OxA-12365	Under the foundations of the gate	1010–920
A4a	GrA-25320	Under the foundations of the gate	895–825

[a]Gr = Groningen AMS; Ox = Oxford AMS.

One of the samples retrieved from a layer under the gate (which was built, according to Levy et al. [2004], in the 10th century BCE) dates to the 9th century. Two of the 5 samples associated, according to Levy et al. (2004), with the construction of the gate also date to the 9th century BCE. It is also noteworthy that these samples gave a large range of dates.

The samples from the "industrial utilization (Strata A2A–B) that post-dated the defensive stage" (Levy et al. 2004:871–2) were found in fact inside the structure of the gate. They too provided dates, which ranged between the 12th and 9th centuries BCE. Six of the 8 samples date to the 9th century.

There is only one way to explain these peculiar results: with the possible exception of the 2 items from Stratum A4 (under the fort), all the samples (from strata A3 and A2) come from a fill or a podium that was made of industrial waste (for other clues, including the fact that no floor was found in the gate, see Finkelstein [2005]; a comparable podium can be seen in the similar fort of En Hazeva: David Ussishkin, personal communication). Since the latest pieces of charcoal in the fill date to the 9th century BCE (one dates to the late 9th century), the fort must have been constructed no earlier than ~800 BCE. Judging from its layout and the comparisons mentioned below, it is reasonable to suggest that it was built by the Assyrians in the late 8th century BCE; the fort was probably connected to the renewal of copper production in the Arabah at that time (Knauf and Lenzen 1987).

Against these data, Levy et al. (2004, 2005) insist on dating the fort to the 10th century, and then take an additional step. Observing that the closest parallel to the Kh. en-Nahas gate and fortress complex is the fort unearthed by Glueck at Tell el-Kheleifeh on the northern tip of the Gulf of Aqaba, they faced a problem: though Glueck dated the construction of the site to the 10th century BCE, later work by Pratico (1993) proved that the earliest pottery there dates to ~700 BCE. Surprisingly, Levy et al. suggest that "in light of the corpus of ^{14}C dates from KEN [Kh. en-Nahas], the dating of Tell el-Kheleifeh needs to be reassessed." In other words, they suggest changing the date of a well-known assemblage according to the finds in a building with no floors, apparently with no homogeneous pottery, dated according to ^{14}C measurements of charcoal in a fill below its foundations.

TEL DAN

Bruins et al. (2005b) present ^{14}C dates from Tel Dan and do not hesitate to declare that their dates "clearly support a High Chronology." Yet, Tel Dan cannot contribute to the chronology debate, because its stratigraphy is not well established. David Ilan, who is publishing the Iron I strata from Tel Dan, described the situation in the following passage:

> There was much continuity in use of architecture from stratum to stratum in these levels. Old walls were reused and built up and new ones added in places, with a tendency to subdivide existing spaces. The progression of strata is defined by these supplements and by the raising of floors … In places, elevations seem not to mesh and, in Area B-east, the area's grid orientation was changed, creating difficulties in matching up architectural remains. Also, the data gleaned in earlier seasons were often not integrated properly into that attained in subsequent seasons … Thus developed discrepancies that have sometimes proven impossible to rectify. I have been forced in places to rely on ceramic assemblages to correlate contexts that are not otherwise endorsed by elevations or other stratigraphic criteria. It is also plain that many features, especially mudbrick ones, have gone unidentified. The pits that characterize Stratum VI, and are also present in Strata V and IVB, create a stratigraphic headache of another kind in the context of dense architecture—one that often has no good cure. For these reasons stratigraphic resolution is not always sharp as might be expected (Ilan 1999:27–8).

In addition, Ilan showed that material from living surfaces was swept into silos in preparation of new construction (1999:114). In a situation like this, samples for ^{14}C dating should not have been collected in the first place.

Ilan (above) was open in saying that sometimes stratigraphic affiliation was decided not according to the stratigraphy, but according to the pottery. But if the stratigraphy is not reliable, how can one be sure that the pottery assemblages are clean? Indeed, the authors candidly say (or hint) that in many instances the stratigraphic affiliation was decided, or even changed, according to the ^{14}C results:

> A sample of mixed charred seeds … gave a very low date that does not fit the other results for Stratum V… The stratigraphic archaeological context was re-evaluated as a result. Re-examination of field photographs allowed us to identify a pit originating in Stratum II or III at precisely the location of the charred seeds. The original stratigraphic attribution was erroneous (Bruins et al. 2005b:333).

And again:

> The youngest radiocarbon date in our Iron Age series from Tel Dan came from charcoal of olive wood … derived from destruction debris above a floor, associated originally with Stratum IVB. The radiocarbon date in this case also suggests that at least part of the destruction debris is much younger, perhaps from Stratum II... (Bruins et al. 2005b:333).

Ignoring younger results and fixing the stratigraphy according to ^{14}C results (Table 4 reveals that the same was done in 5 more instances) is wrong, especially in the case of long-lived samples (16 of the 19 items from Dan), which introduce the old-wood effect. In such a case, the youngest results are probably the most important, or at least cannot be brushed aside as irrelevant.

Finally, the Dan samples do not come from secure locations. It is enough to read the description column in Table 19.1 (Bruins et al. 2005b:325–7) to realize how fragile the whole stratigraphic system is. Table 4 presents the full list, with our interpretation.

To sum up, from the 19 loci, only 1 may be safe enough to be assigned stratigraphically; 7 were affiliated according to the ^{14}C results. According to the Megiddo standards (Boaretto 2006), not a single locus in this list—not even the "good" one—would have qualified as stratigraphically reliable for ^{14}C measurement. Under these conditions, Tel Dan cannot contribute to the Iron Age chronology debate.

THE NEGEV HIGHLANDS

Bruins and van der Plicht's report (2005) on ^{14}C results from the Negev Highlands also does not contribute to the Iron Age chronology debate. First, the authors do not address the archaeological problems related to the sites; for instance, the "middle fort" at Tell el-Qudeirat being no more than broad foundations for the late-Iron II casemate fort (Ussishkin 1995). Second, as the authors admit, the readings for the Iron IIA settlements may be biased by the old-wood effect.

Yet, Bruins and van der Plicht's Negev Highlands results (2005) may be useful in a different way—to establish the early days of activity in the Iron IIA Negev Highlands sites. Though the assemblages from these sites clearly date to the Early Iron IIA (Herzog and Singer-Avitz 2004), a late-Iron I date for the commencement of activity seems to be hinted at in their pottery assemblages (Fantalkin and Finkelstein 2006). This idea seems to be supported by ^{14}C measurements of charcoal from Kadesh-barnea and the site of Nahal Elah, which provided 1-σ highest probability dates in the 11th and early 10th century BCE, respectively (Bruins and van der Plicht 2005:352); these dates are too early for the Iron IIA even according to Mazar's (2005) "Modified Conventional Chronology." At both sites, there is no earlier layer, a fact which diminishes the danger of the old-wood effect.

Table 4 Stratigraphic affiliation of the Tel Dan samples.

Locus	Stratum	Bruins et al.'s (2005b) description	Comments
3171	III?	"This surface appears as Stratum IVB, but the section shows a disturbance."	The stratigraphic affiliation was decided according to the ^{14}C results (see Bruins et al. 2005b:333).
4718	III or II	Pit.	Pits may include older material, especially at Dan, where there is evidence for sweeping of old debris into pits (Ilan 1999:114). Indeed, the stratigraphic affiliation of this locus was decided according to the ^{14}C results (see Bruins et al. 2005b:333).
570a	IVA	Pit.	See above.
6453	IVA	"The final stratigraphy has not been worked out … the pottery is clearly Stratum IVA … the Stratum IVA people were accessing Stratum V or Stratum VI remains to recycle them, which may be the source of the charcoal."	Against these warnings, the charcoal was tested as belonging to Stratum IVA!
7114	IVB	"This charcoal date is indeed younger than most charcoal dates of Stratum V."	This is why the sample was assigned to Stratum IVB.
3024	V	"As there was quite a bit of LB material, it was initially thought to be a layer of LB age with intrusions from Iron I pits … The ^{14}C date indicates that it is a Stratum V surface."	In this case too, the stratigraphy was decided according to the ^{14}C results.
1204	V	"Horizon in between two pits"	Hardly a safe location.
3127a	V	"Sealed pit. The original pit … was originally made in Phase Y7 (Stratum VI) but at least some of the contents are later – from Stratum V or IVB."	Decision to ascribe this locus to Stratum V was probably taken according to the ^{14}C results.
593	V	"destruction layer above stone pavement"	The size of stone pavement is limited. Note that "the irregular nature of the gaps seen in most pavements shows evidence of post-deposition disturbance … Much of this can probably be blamed on subsidence into the non-compacted debris previously dumped into the old grain-pits…This may also explain the fact that a number of floors in the central area slope in odd directions and are slightly lower in places than the foundation courses of surrounding walls" (Ilan 1999:45; Locus 593 is specifically referred to as such a case, see Ilan 1999: Figure 20).
593	V	"destruction layer above stone pavement"	See above.
1203	V	"Initially associated with MB-IIA. However, the ^{14}C date suggests Iron I."	The association with Stratum V was decided according to the ^{14}C results.
675	V	"destruction layer on stone pavement"	Possibly the only good locus in the list.
7147	V	"Amongst collapsed mudbrick and plaster from destruction"	Bricks may include older material.
593	V	"In destruction layer above stone pavement, next to W4330"	Wall 4330 does not have a pavement next to it (see plan in Ilan 1999). For this locus, see above.
593	V	"destruction layer above stone pavement"	For Locus 593, see above.

Table 4 Stratigraphic affiliation of the Tel Dan samples. *(Continued)*

Locus	Stratum	Bruins et al.'s (2005b) description	Comments
660	V	"in destruction layer above stone pavement"	The pavement covers only a small part of the room.
7208	V	"Youngest Iron I; in destruction layer on lime plaster floor"	Originally retrieved from a Stratum IVB locus and assigned to Stratum V according to the ^{14}C result?
7168	VI	"Destruction debris associated with ash pits and metallurgy installations"	Difficult to establish here between strata VIIA and VI; both strata drawn in one plan.

MEGIDDO

In an appendix to his opening chapter, Mazar (2005:26–7) refers to ^{14}C data from Megiddo that were published by Boaretto et al. (2005) as ostensibly supporting his "Modified Conventional Chronology" (a term coined in order to accept half of the premises of the Low Chronology). Mazar cites 2 samples from Level K-4 (University of Chicago's Stratum VIA of the late Iron I) and 2 samples from Level H-5 (probably equivalent to Stratum VA-IVB of the late Iron IIA). Yet, Megiddo produced many more ^{14}C readings (Boaretto 2006): 7 short-lived samples from Level K-4 were checked in the course of the Iron Age Transition Dating Project supported by the Israel Science Foundation (Grant No. 778/00), and 12 charcoal samples from the same level were checked in the Rehovot laboratory after the season of 1998. The results for both are very close. The short-lived samples from Level K-4 produced an average date of 1015–920 BCE (Finkelstein and Piasetzky 2006). The 2 short-lived samples from Level H-5 provided 1-σ dates of 900–805 and 1005–925 BCE.

Adding data from other sites in the region puts the end of the Megiddo VIA horizon at 1005–925 BCE (Finkelstein and Piasetzky 2006). The data for Stratum D-3 at Tel Rehov may indicate another, slightly later phase of the late Iron I in the north of Israel. Stratigraphically, Stratum VA-IVB closes the Iron IIA sequence at Megiddo, and is therefore contemporary to Rehov IV, Hazor IX, and Rosh Zayit IIa. These strata all provided dates in the 9th century BCE (Mazar et al. 2005:243–4, 254; Boaretto et al. 2005).

The uncalibrated dates obtained in the measurements shown in Table 5, except for the second sample from Megiddo, provide a well-defined result with a small uncertainty of <10 yr (2720 ± 8 BP). The second Megiddo measurement is 4-σ away from this determination and therefore may be treated as an outlier.

Table 5 ^{14}C dates for late Iron IIA strata in the north.

Site	Dates	Source
Hazor IX	895–805/825–790	Boaretto et al. 2005
Rosh Zayit IIa	895–835/910–840	Boaretto et al. 2005
Rehov IV	877–840	Mazar et al. 2005
Dor 8b in Area D2	890–820	Gilboa and Sharon 2003
Megiddo H-5 (a phase of VA–IVB)	900–805 1005–925	Boaretto, forthcoming
Aphek X-8	832–800	Gadot, personal communication

Mazar (2005:21) still thinks it is possible to date the construction of Stratum VA-IVB at Megiddo to the mid-10th century. In view of the ^{14}C data from Tel Rehov (above), the only way to do this is to associate them with an early phase of the Iron IIA. But even according to Mazar, Rehov V dates to the late 10th century (924–897 BCE, above). In any event, at Megiddo the settlement that represents the Early Iron IIA is Stratum VB, while Stratum VA-IVB with its palaces closes the Iron IIA sequence. In other words, there can be no doubt that Megiddo VA-IVB is the contemporary of Rehov IV, which dates (also according to Mazar) to the first half of the 9th century. At both sites, the next stratum belongs to the Iron IIB.

Support for this dating comes from Franklin (2005), who has argued that the masons' marks that characterize Palace 1723 at Megiddo and the palace at Samaria (but no other building unearthed in Israel) prove that the two were constructed at the same time, probably by the same group of masons. In this case (and on the background of what has been said above about the Megiddo VA-IVB–Rehov IV match), it is clear that the Megiddo palace was built in the first half of the 9th century (contra Mazar's assumption that "both kings—Solomon and Ahab—used Phoenician masons," Mazar et al. 2005:21–2).

Several other issues raised by Mazar need to be addressed, first and foremost among them is the linkage between the Sheshonq I list and Arad. Mazar (2005:19–20) and many others (e.g. Zimhoni 1985; Finkelstein 1996:180–1; Herzog and Singer-Avitz 2004) argued that the only settlement at Arad that may be identified with the one mentioned in the Sheshonq I Karnak list is that of Stratum XII of the early Iron IIA. This implies that the appearance of the Iron IIA pottery repertoire must have occurred in the mid-10th century (Herzog and Singer-Avitz 2004).[7] Yet, Herzog (2002:17) has already noted the possibility that Arad XII survived the campaign, and hence the pottery associated with it represents later decades. Fantalkin and Finkelstein (2006) have recently suggested that the wave of settlement in the Beer-sheba Valley and the Negev Highlands—the only system that fits the Karnak list—started in the late Iron I and continued well into the 9th century. If this is the case, there is no need to put the Iron I/Iron IIA transition in the south of Israel as early as the mid-10th century—earlier than what we now know about the north of the country (above).

[7] In the volume discussed here, Shortland (2005) tried to fix the dates of Sheshonq I, ostensibly without using the biblical reference of I Kings 14:25–26. How much his study is biblically related, one can learn from his references to Sheshonq I as having claimed "to have campaigned in Judah and Israel" and as "the attacker of Jerusalem" (Shortland 2005:44). Yet, nowhere in the relief is there a reference to Israel and Judah, and while names of certain cities can be associated with the territories of the Northern Kingdom (first and foremost Megiddo, Taanach, and Rehov), not a single town in Judah—in the highlands or the Shephelah—is mentioned; needless to say, this includes Jerusalem. In several junctions in the count-back from his departure datum—the sacking of Thebes by Ashurbanipal in 664 BCE—Shortland needs to close gaps and introduce learned assumptions. In view of his mistakes above, one wonders if these assumptions were not influenced by a wish to harmonize the result of the investigation with the biblical reference.

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