TECHNICAL COMMENT

Response to Comment on "^{14}C Dates from Tel Rehov: Iron-Age Chronology, Pharaohs, and Hebrew Kings"

Our investigation at Tel Rehov (*1*) aimed at obtaining reproducible high-quality ^{14}C dates that could serve as an independent chronological basis (*2*). Finkelstein and Piasetzky (*3*) charge that in the results of that study (*4*) we ignored previously published dates from Tel Rehov (*5*). We deliberately did not include these dates because of their consistent disparities. The basis for comparison is Locus 2425 of Tel Rehov, which yielded a large heap of charred cereal grains, previously dated by the Weizmann Institute (Rehovot) and University of Arizona ^{14}C laboratories (*5*). The average Rehovot date (excluding one outlier in order to pass the chi squared test) (*6*) was 2699 ± 7 years before the ^{14}C present (yr B.P.) (T=13.2, 5%=14.1). The average Arizona date for the same cereal grains (*5*) is 2749 ± 16 yr B.P. (T=7.1, 5%=15.5), a difference of 50 B.P. years. The average of two coherent Groningen dates of the same grains of locus 2425 is 2788 ± 14 yr B.P., about 90 B.P. years older than the Rehovot date. Moreover, other Groningen dates for the end of Stratum V are similar to those for Locus 2425, which amount, altogether, to 12 dates giving (*6*) an average of 2776 ± 5 yr B.P. (T=8.6, 5%=19.7).

As the radiocarbon dating method is pushed to the limit of resolution, which is required for Near Eastern archaeology of the Bronze and Iron Ages (*7*), comparatively small differences in dating results among individual ^{14}C labs, which have not previously been too much of an issue in prehistoric context, have become crucial for the periods cited above. The variability of results performed in a single laboratory, under as near identical conditions as possible, constitutes the repeatability (*8*). The variation in results under widely varying conditions in different laboratories constitutes the reproducibility. Thus, the quality of performance of an individual laboratory can be assessed and compared with that of other laboratories (*8, 9*).

The published dates of Tel Dor (*10*) and forthcoming dates of Megiddo (*11*) are said to support a Low Chronology (*12*) and contradict our results for Tel Rehov. More research concerning the reproducibility of ^{14}C dates among labs involved, as outlined above (*8*, *9*), may resolve this contradiction. Megiddo Stratum IVB-VA is very important in the chronological debate because its pottery and other artifacts are similar to those found at Tel Rehov Strata VI to IV.

Our 34 published dates of Tel Rehov from the University of Groningen Centre for Isotope Research (*4*)—based on two dating methods, accelerator mass spectrometry (AMS) and proportional gas counting (PGC) (two ^{14}C labs in the same institution)—comply with a high reproducibility standard. Moreover, all the samples were taken from well stratified contexts, usually from destruction debris inside rooms above floor surfaces. Only one sample came from a refuse layer (Phase D2, Locus 1802), which contained only Iron IIA pottery. The samples derived from pits (Phase D-3) came from well stratified contexts, containing a transitional Late Iron Age I/IIA ceramic assemblage. The dated seeds are in all cases derived from clusters found together in a reliable context. The reliability of the stratigraphic sequence at Tel Rehov is proven by the consistency of the entire Groningen radiocarbon series (*4*).

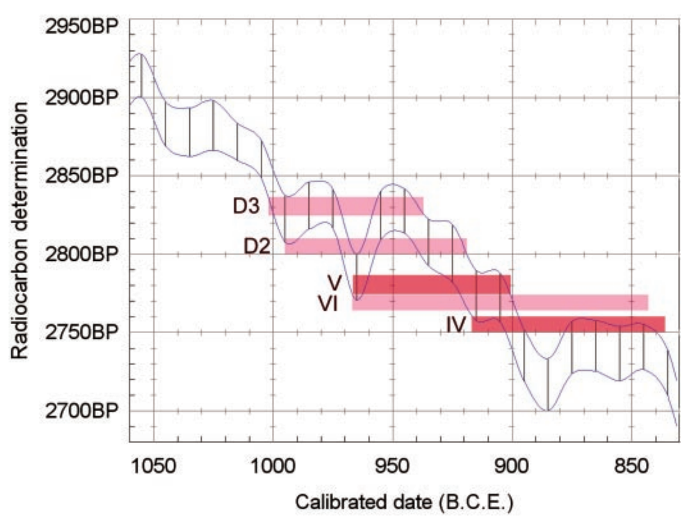

Fig. 1. The Tel Rehov Iron Age sequence for the 10th and 9th centuries B.C.E. The full, nondifferentiated, 1σ calibrated age ranges of Phases D3 and D2 and Strata VI, V, and IV are shown in relation to the calibration curve. The horizontal scale is in calendar years and the vertical scale is in conventional radiocarbon years. The respective 1σ ranges are centered around the BP midpoints for graphical clarity to prevent vertical overlap. D3 is transitional late Iron I to early Iron IIA. All other layers are Iron IIA. Stratum VI is older than V; V and IV are destruction layers, signifying the respective end of these cities.

Rehov is mentioned at Karnak (Egypt) as a place conquered by Pharaoh Shoshenq I. It is tempting to relate our destruction dates of Rehov Stratum V to this pharaoh, but the precise historical date of Shoshenq I within the second half of the 10th century B.C.E. remains a factor of uncertainty. However, our results (*4*) show that the ceramic assemblage of Iron IIA began in the first half of the 10th century B.C.E (Fig. 1). The life-span of the city of Rehov Stratum V must be older than our ^{14}C dates, which are based on charred seeds from its destructive end. The preceding city of Stratum VI was older still. Therefore, the suggestion by Finkelstein and Piasetzky (in their figure 1) to place Rehov Stratum VI and V tightly together in the last quarter of the 10th century B.C.E. is unrealistic.

The full 1σ ranges from Phase D3 to Stratum IV are shown in our figure. The association between Stratum VI and the wiggle of 970 to 960 B.C.E. (*4*) seems more plausible in view of the tell stratigraphy. Even Stratum IV has an age range beginning in the 10th century B.C.E. All these results support a Revised Traditional Chronology for the Iron Age IIA in the southern Levant, covering a time span of about 980 to 840 B.C.E. (*4*, *13*), in contrast to the Low Chronology of around 900 to 840 B.C.E. suggested by Finkelstein (*12*).

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References and Notes

1. A. Mazar, *Isr. Explor. J.* **49**, 1 (1999).
2. H. J. Bruins, W. G. Mook, *Radiocarbon* **31**, 1019 (1989).
3. I. Finkelstein, E. Piasetzky, *Science* **302**, 568; www.sciencemag.org/cgi/content/full/302/5645/568b
4. H. J. Bruins, J. van der Plicht, A. Mazar, *Science* **300**, 315 (2003).
5. A. Mazar, I. Carmi, *Radiocarbon* **43**, 1333 (2001).
6. C. Bronk Ramsey, OxCal Program v3.8, manual (Univ. of Oxford, Oxford, 2002).
7. J. van der Plicht, H. J. Bruins, *Radiocarbon* **43**, 1155 (2001).
8. E. M. Scott, D. D. Harkness, G. T. Cook, *Radiocarbon* **40**, 331 (1998).
9. E. Boaretto *et al.*, *Antiquity* **295**, 146 (2003).
10. A. Gilboa, I. Sharon, *Radiocarbon* **43**, 1343 (2001).
11. I. Finkelstein, E. Piasetzky, *Antiquity*, in press.
12. I. Finkelstein, *Levant* **28**, 177 (1996).
13. N. Coldstream, A. Mazar, *Isr. Explor. J.* **53**, 29 (2003).
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