Radiocarbon dating the Iron Age in the Levant: a Bayesian model for six ceramic phases and six transitions

Israel Finkelstein[1] & Eliezer Piasetzky[2]

The Bayesian model presented in this article is the first attempt to produce a chronological framework for the Iron Age in the Levant, using radiocarbon dating alone. The model derives from 339 determinations on 142 samples taken from 38 destruction contexts at 18 sites. The framework proposes six ceramic phases and six transitions which cover c. *400 years, between the late twelfth and mid-eighth centuries BC. It furnishes us with a new scientific backbone for the history of Iron Age Levant.*

Online supplement

The original article is published in Volume 84: 374–385
(http://antiquity.ac.uk/ant/084/ant0840374.htm)

Contents

[1] *The Jacob M. Alkow Department of Archaeology and Ancient Near Eastern Civilizations, Tel Aviv University, Tel Aviv 69978, Israel (Email: fink2@post.tau.ac.il)*

[2] *The Sackler School of Physics and Astronomy, Tel Aviv University, Tel Aviv 69978, Israel (Email: eip@tauphy.tau.ac.il)*

Received: 2 September 2009; Accepted: 23 November 2009; Revised: 8 December 2009

1. The data: all measurements used for the Bayesian model presented in the article

In the column titled 'Sample no.' references in single numbers (e.g. MG1) cite the average as calculated by Mazar and Bronk Ramsey (2008). Data added by us are marked in 100 series (e.g. MG102). Samples excluded from the model in order to achieve a 63% agreement between the data and the model are highlighted in grey.

Legend:

To laboratories:

Gr = Groningen; RW = Rehovot; R = Sample prepared in Rehovot and measured in Tucson; T = Tucson; H = Helsinki; NZ = New Zealand.

To counting method:

AMS = Accelerator Mass Spectrometry; LSC = Liquid Scintillation Counting; GPC = Gas Proportional Counting.

To sites:

MG = Megiddo; R = Rehov; L = Lachish; MQ = Tel Miqne/Ekron; D = Dor; SH = Shiloh; BS = Beth-shemesh; K = Tel Keisan; Y = Yokneam; HD = Tel Hadar; HM = Tell Hammah; QS = Tell Qasile; A = Aphek; HA = Atar Haroa; HZ = Hazor; RZ = Rosh Zayit; SF = Tell es-Safi/Gath; Z = Tel Zayit.

Data Table 1. The Late Bronze III.

Lab. and method	Lab. no.	Site and stratum	Type of sample	Average uncalib. date [BP]	Sample no.	Reference
R AMS	44993-5	Megiddo K-6 **Destruction**	Olive pits	2894±23	MG2	Sharon *et al*. 2007a
T AMS	4499a,aa			2893±27	MG1	
R AMS	4500.3-5			2918±22	MG4	
T AMS	4500a,aa			2968±30	MG3	
R AMS	5080			2965±30	MG102	Boaretto unpublished
	5081			2955±35	MG103	
	5082			2975±55	MG104	
	5083			3030±150	MG105	
	5084			2980±60	MG106	
Gr N	26118	Rehov D-6	Olive pits	2920±30	R120	Mazar *et al*. 2005
Gr A	18826			2950±50	R121	
Gr A	19034			2935±45	R122	
Gr N	26120			2880±30	R123	
RW LSC	2912	Lachish VI **Destruction**	Olive pits	2915±25	L104	Carmi & Ussishkin 2004
RW LSC	2755		Olive pits	2955±25	L105	
H GPC	1417		Seeds	2810±100	L106	

Data Table 2. The early Iron I.

Lab. and method	Lab. no.	Site and stratum	Type of sample	Average uncalib. date [BP]	Sample no.	Reference
R AMS	4286.3-5	Miqne VIIB	Seeds	2907±28	MQ103	Sharon *et al*. 2007a
R AMS	4528.3-5	Dor D2/13	Olive pits	2909±24	D103	Sharon *et al*. 2007a

Data Table 3. The middle Iron I.

Lab. and method	Lab. no.	Site and stratum	Type of sample	Average uncalib. date [BP]	Sample no.	Reference
R AMS	3927.3-5	Shiloh V **Destruction**	Seeds	2854±25	SH2	Sharon *et al*. 2007a
RW LSC	3492		Charred grain	2868±20	SH1	
R AMS	3928.3-5		Raisins	2897±23	SH3	
R AMS	3929.3-5		Seeds	2959±28	SH4	
R AMS	5078	Megiddo K-5	Olive pits	2885±40	MG101	Boaretto unpublished
R AMS	5934.3-5	Beth-shemesh 6	Olive pits	2855±35	BS104	Sharon *et al*. 2007a
R AMS	3935.3-5	Beth-shemesh 5		2786±33	BS105	
R AMS	3936.3-5			2835±32	BS106	
R AMS	4283.3-5	Miqne VIB[a]	Olive pits	2918±26	MQ101	
T AMS	4282a,aa		Seeds	2883±26	MQ1	
R AMS	4282.3-5			2872±27	MQ2	
R AMS	4284.3-4	Miqne VB	Seeds	2833±32	MQ 102	
R AMS	3809.4,5	Rehov D-4	Olive pits	2845±25	R1	Mazar *et al*. 2005
T AMS	3809a,aa			2913±45	R2	
Gr AMS	18825			2870±50	R124	
Gr N	261221			2890±30	R125	
R AMS	4522.3-5	Dor D2/12 **Destruction**	Olive pits	2857±25	D104	Sharon *et al*. 2007a
R AMS	4525.3-5		Olive pits	2847±22	D105	

[a]we include Miqne 4282 following Mazar and Bronk Ramsey (2008), though Sharon *et al*. (2007) put it as "VB (or IV?)".

Data Table 4. The late Iron I.

Lab. and method	Lab. no.	Site and stratum	Type of sample	Average uncalib. date [BP]	Sample no.	Reference
R AMS	3939.3-5	Megiddo K-4 **Destruction**	Olive pits	2804±24	MG9	Boaretto 2006
R AMS	3940.3-5			2765±25	MG10	
R AMS	3942.3-6			2845±25	MG11	
R AMS	3943.3-5			2855±25	MG12	
R AMS	3944.3-5			2957±31	MG5	
T AMS	18163a			2864±40	MG6	
T AMS	3945a,aa			2880±30	MG7	
T AMS	3946a,aa			2910±25	MG8	
R AMS	3796.3-5	Keisan 9a **Destruction**	Seeds	2855±29	K8	Sharon *et al*. 2007a
RW LSC	3777.1	Yokneam XVIIb **Destruction**	Olive pits	2866±25	Y1	Sharon *et al*. 2007a
R AMS	3777.3-5			2866±33	Y2	
R LSC	3778.1			2776±25	Y3	
R AMS	3778.3-5			2817±26	Y4	
T AMS	18150 a, aa			2818±29	Y5	
Gr AMS	A25534			2925±38	Y11	
Gr AMS	A25708			2897±38	Y12	
Gr AMS	A25767			2929±54	Y13	
R AMS	3795.3	Hadar IV **Destruction**	Grain	2791±52	HD1	Sharon *et al*. 2007a
R AMS	4291.3-5			2780±25	HD2A	
RW LSC	4291.3-5			2880±17	HD2B	
RW GPC	1490AC			2780±25	HD101	Kochavi and Yadin, pers. comm.
RW GPC	1417B					
RW GPC	1490B1					
RW GPC	0002/2					
RW GPC	1490C					
RW GPC	1490A					
RW GPC	000/3					
RW GPC	1491					
RW GPC	000/4					
RW	1418					

GPC						
RW GPC	000/1					
NZ AMS	4643					
R AMS	4417.3-5	Tell Hammah **Destruction**	Seeds	2790±23	HM2	Sharon *et al*. 2007a
R AMS	3805.3-5	Rehov D-3	Olive pits	2800±20	R3a	Mazar *et al*. 2005
Gr AMS	A19033			2835±45	R3b	
Gr GPC	N26119			2720±30	R3c	
Gr AMS	A16757			2820±50	R101	
R AMS R AMS	3806.3 3806.5			2754±24	R102	Sharon *et al*. 2007a
RW LSC	3120			2670±40	R103	Mazar *et al*. 2005
Gr AMS	A12889			2870±70	R105	
Gr AMS Gr AMS Gr AMS Gr AMS Gr AMS Gr AMS Gr AMS	A21044 A21056 A21183 A22302a A22302b A22329a A22329b			2827±18	R106	
R AMS	4532.3-5	Dor D2/10-9	Olive pits	2783±22	D2	Sharon *et al*. 2007a
R AMS Gr AMS Gr AMS Gr AMS	4531.3-5 A25543 A25772 A25712			2803±16	D1	
RW LSC	3108		Seeds	2735±40	D102	Sharon 2001
T AMS	18161 a, aa	Qasile X **Destruction**	Seeds	2818±26	QS1	Sharon *et al*. 2007a; Mazar & Bronk Ramsey 2008
R AMS	3932.3			2692±24	QS2	
R AMS	3932.4					
R AMS	3932.5					
R AMS	3932.6					
R AMS	3931.3-5			2911±26	QS3	
R AMS	3931.1			2853±25	QS4	
Gr GPC	27719			2895±25	QS5	
R AMS T AMS	3853. 1, 3, 4			2753±22	QS6	
T AMS	3930			2800±25	QS7	
T AMS	3933a,aa			2882±28	QS8	
Gr AMS	25535			2864±40	QS9	
Gr AMS	25710			2818±38	QS10	
Gr AMS	25768			2897±44	QS11	

Data Table 5. The early Iron IIA.

Lab. and method	Lab. no.	Site and stratum	Type of sample	Average uncalib. date [BP]	Sample no.	Reference
RW LSC	2960	Dor D2/8c	Olive pits	2710±20	D101	Gilboa & Sharon 2003
R AMS Gr AMS Gr AMS Gr AMS	4540.3-5 A25544 A25714 A25787			2757±18	D3	Sharon *et al*. 2007a
R AMS	4541.3-5			2764±22	D4	
R AMS	4542.3-5			2779±24	D5	
RW LSC	3159	Lachish V	Seeds	2775±55	L101	Carmi & Ussishkin 2004
Gr GPC	27366	Rehov VI	Seeds	2761±14 [a]	R107	Mazar *et al*. 2005
R AMS R AMS R AMS	4511.3 4511.4 4511.5	Aphek X-8	Seeds	2667±20	A1	Sharon *et al*. 2007
R AMS		Haroa[b]	Date pits, Barley, Grape	2721±13	HA101	Boaretto, Finkelstein & Shahack-Gross In Press

[a] Three 'fine charcoal' and one bone excluded.

[b] We thank the authors for allowing us to present the average for 15 determinations; the full data will appear elsewhere.

Data Table 6. The Late Iron IIA.

Lab. and method	Lab. no.	Site and stratum	Type of sample	Average uncalib. date [BP]	Sample no.	Reference
T AMS	18159a, aa	Rehov V **Destruction**	Olive pits	2685±25	R6	Mazar *et al*. 2005
R AMS	3808.3-5			2678±20	R7	
Gr AMS	24108,9, 11,12		Seeds	2766±23	R116	
Gr PGC	28368			2735±30	R117	
Gr AMS	21034, 47, 79		Olive pits	2786±22	R118	
Gr PGC	N27364		Grain	2764±11 [b]	R108	
Gr PGC	N26114 N26115			2788±14	R109	
T AMS T AMS T AMS T AMS T AMS T AMS T AMS T AMS	AA3043 1-U3- 11,12,13, 21,22,23, 31,32,33			2749±16	R110	
RW LSC RW LSC RW LSC RW LSC RW	3122A 3122A1 3122A2 3122B 3122B1 3122B2 3122BB 3122C[c] 3122D			2699±10	R111	
Gr PGC Gr PGC Gr PGC Gr PGC Gr PGC	N26116 N26117 N27363 N27385 N27386			2768±10	R112	
Gr PGC Gr PGC Gr PGC	N27361 N27362 N27412			2771±8	R113	
Gr AMS Gr AMS Gr AMS	A24455 A24456 A24497		Olive pits	2757±26	R114	
Gr AMS Gr AMS	A21152 A21154	Rehov IV **Destruction**	Grain	2758±16	R115	

Gr AMS Gr AMS Gr AMS Gr AMS Gr AMS	A21267 A22301a A22301b A22330a A22330b					
R AMS	3949.3-4	Megiddo H-5 = VA-IVB **Destruction**	Olive pits	2859±34	MG14	Boaretto 2006
T AMS	3949a, aa[d]			2783±32	MG13	
T AMS	3948a		Olive pits	2695±50	MG15	
R AMS	3784.3-6	Hazor IX **Destruction**	Olive pits	2632±27	HZ18	Sharon *et al*. 2007a
R AMS	3786.3-5			2585±80	HZ12	
TAMS	3786a,aa			2639±31	HZ11	
R AMS	3785.4-6			2689±27	HZ16	
T AMS	3785a,aa			2697±24	HZ15	
R AMS	3797.3-8 3797-1.1 -1.3	Rosh Zayit IIa **Destruction**	Seeds	2709±15	RZ7	Sharon *et al*. 2007a
RW LSC	3798.1			2745±30	RZ1	
R AMS	3798.3-5			2755±22	RZ2	
T AMS	3798a,aa			2689±28	RZ6	
RW LSC	3799.1			2745±30	RZ3	
R AMS	3799.3			2729±37	RZ4	
T AMS	3799a,aa			2692±31	RZ5	
RW LSC	4411.1a-b	Hammah Lower **destruction**	Seeds	2785±50	HM101[a]	Sharon *et al*. 2007a
R AMS	4412.3-5			2609±21	HM8	
R AMS	4413.3-5			2587±23	HM9	
R AMS	4414.3-5			2634±23	HM10	
R AMS	4415.3-5			2636±23	HM11	
R AMS	4418.3-5			2722±24	HM12	
R AMS	4419.3-4			2728±28	HM13	
R AMS	4420.3-5			2675±23	HM4	
R AMS	4423.3-4			2688±25	HM5	
R AMS	4424.3-5			2687±20	HM6	
R AMS	4425.3-5			2701±22	HM7	
R AMS	4422.3-5	Hammah Upper **destruction**	Seeds + sediment	2588±20	HM102	Sharon *et al*. 2007a
RW LSC	2961	Dor D2/8b	Olive pits	2710±40	D106	Gilboa & Sharon 2003
R AMS	4556.3-5			2750±23	D6	
RW LSC	2908	Lachish IV	Olive pits	2715±40	L102	Carmi & Ussishkin 2004
H GPC	1418		Pomeg.	2650±90	L103	

			seeds			
R AMS	4409.3-5	Safi IV **Destruction**	Seeds	2661±30	SF1	Sharon *et al*. 2007a
R AMS	4410.3-5			2704±28	SF2A	
Gr AMS Gr AMS Gr AMS	A25536 A25711 A25770			2736±24	SF2B	
Gr	1	Tel Zayit **Destruction**	Seeds	2750±20	Z101	Tappy *et al*. 2006
Gr AMS	2			2730±40	Z102	
R AMS	4275-1.3-1.5			2666±30	Z103	Sharon *et al*. 2007a
	4275-2.3		Olive pits	2616±40	Z104	Tappy *et al*. 2006

[a]Different from HM3 in Mazar and Bronk Ramsey (2008) due to the exclusion of an outlier
[b]A 'fine fraction' measurement excluded.
[c]Outlier, not calculated.
[d]For this measurement we took the latest result — Sharon *et al*. 2007a — which is somewhat different from Boaretto 2006.

Data Table 7. The Iron IIA/B transition (or Terminal Iron IIA).

Lab. and method	**Lab. no.**	**Site and stratum**	**Type of sample**	**Average uncalib. date [BP]**	**Sample no.**	**Reference**
R LSC	3937.1	Beth-shemesh 3 **Destruction**	Olive pits	2500±35	BS101	Sharon *et al*. 2007a
R AMS	3937.3-5			2475±20	BS102	
R AMS	3938.3-5			2453±32	BS103	

2. The model

Full Model 23.04.2009 step 4 /error correction in
Late Iron IIA /Lachish/
removed data:
SH4, BS105, MG5, HD2B, A1, R109, MG14
MG2, MG1, R103, R7, R113
R123, MG10, R3c, QS2, R118, R11
Y3

- Plot()
  - Sequence("Full model step 4 23.04.2009")
    - Boundary("START")
    - Phase("Late Bronze III")
      - Sequence()
        - Date("", BCE(1141))
        - Phase("Megiddo K-6")
          - Label("Olive pits")
          - R_Date("MG2", 2894,23)
            - Outlier()
            -
          - R_Date("MG1", 2893,27)
            - Outlier()
            -
          - R_Date("MG4", 2918,22)
          - R_Date("MG3", 2968,30)
          - R_Date("MG102", 2965,30)
          - R_Date("MG103", 2955,35)
          - R_Date("MG104", 2975,55)
          - R_Date("MG105", 3030,150)
          - R_Date("MG106", 2980,60)
          -
        - Boundary()
        -
      - Phase("Rehov D-6")
        - Label("No data")
        - R_Date("R120", 2920,30)
        - R_Date("R121", 2950,50)
        - R_Date("R122", 2935,45)
        - R_Date("R123", 2880,30)
          - Outlier()
          -
        -
      - Sequence()
        - Date("", BCE(1151))
        - Phase("Lachish VI")
          - Label("Olive pits")
          - R_Date("L104", 2915,25)
          - R_Date("L105", 2955,25)
          - Label("Seeds")
          - R_Date("L106", 2810,100)

- Boundary()
- Interval("i1 Late Bronze III")
- Boundary("Late Bronze III ends")
- Boundary("Early Iron I begins")
- Phase("Early Iron I")
  - Phase("Miqne VIIB")
    - Label("Seeds")
    - R_Date("MQ103", 2907,28)
  - Phase("Dor D2/13")
    - Label("Olive pits")
    - R_Date("D103", 2909,24)
  - Interval("i2 Early Iron I")
- Boundary("Early Iron I ends")
- Boundary("Middle Iron I begins")
- Phase("Middle Iron I")
  - Phase("Shiloh V")
    - Label("Seeds")
    - R_Date("SH2", 2854,25)
    - Label("Charred grain")
    - R_Date("SH1", 2868,20)
    - Label("Raisins")
    - R_Date("SH3", 2897,23)
    - Label("Seeds")
    - R_Date("SH4", 2959,28)
      - Outlier()
  - Phase("Megiddo K-5")
    - Label("Olive pits")
    - R_Date("MG101", 2885,40)
  - Sequence("Beth Shemesh")
    - Boundary()
    - Phase("Beth Shemesh 6")
      - Label("Olive pits")
      - R_Date("BS104", 2855,35)
    - Boundary()
    - Boundary()
    - Phase("Beth Shemesh 5")
      - Label("Olive pits")
      - R_Date("BS105", 2786,33)
        - Outlier()

- R_Date("BS106", 2835,32)
- Boundary()
- Sequence("Miqne")
  - Boundary()
  - Phase("Miqne VI B")
    - Label("Olive pits")
    - R_Date("MQ101", 2918,26)
    - Label("Seeds")
    - R_Date("MQ1", 2883,26)
    - R_Date("MQ2", 2872,27)
  - Boundary()
  - Boundary()
  - Phase("Miqne V B")
    - Label("Seeds")
    - R_Date("MQ102", 2833,32)
  - Boundary()
- Phase("Rehov D-4")
  - Label("Olive pits")
  - R_Date("R1", 2845,25)
  - R_Date("R2", 2913,45)
  - R_Date("R124", 2870,50)
  - R_Date("R125", 2890,30)
- Phase("Dor D2/12")
  - Label("Olive pits")
  - R_Date("D104", 2857,25)
  - R_Date("D105", 2847,22)
- Interval("i3 Middle Iron I")

Boundary("Middle Iron I ends")

Boundary("Late Iron I begins")

Phase("Late Iron I")

- Sequence("E/W Valleys")
  - Boundary()
  - Phase("Western Valley")
    - Phase("Megiddo K-4")
      - Label("Olive pits")
      - R_Date("MG9", 2804, 24)
      - R_Date("MG10", 2765, 25)
        - Outlier()
      - R_Date("MG11", 2845, 25)
      - R_Date("MG12", 2855, 25)
      - R_Date("MG5", 2957, 31)

- Outlier()
- R_Date("MG6", 2864, 40)
- R_Date("MG7", 2880, 30)
- R_Date("MG8", 2910, 25)
- Phase("Keisan 9a")
  - Label("Seeds")
  - R_Date("K8", 2855, 29)
- Phase("Yokneam VIIb")
  - Label("Olive pits")
  - R_Date("Y1", 2866, 25)
  - R_Date("Y2", 2866, 33)
  - R_Date("Y3", 2776, 25)
    - Outlier()
  - R_Date("Y4", 2817, 26)
  - R_Date("Y5", 2818, 29)
  - R_Date("Y11", 2925, 38)
  - R_Date("Y12", 2897, 38)
  - R_Date("Y13", 2929, 54)
- Boundary("West Valley ends")
- Boundary("East Valley begins")
- Phase("Eastern Valley (4)")
  - Phase("Hadar IV")
    - Label("Grain")
    - R_Date("HD1", 2791, 52)
    - R_Date("HD2A", 2780, 25)
    - R_Date("HD2B", 2880, 17)
      - Outlier()
    - R_Date("HD101", 2780, 25)
  - Phase("Tel Hammah")
    - Label("Semolina")
    - R_Date("HM2", 2790, 23)
  - Phase("Rehov D-3")
    - Label("Olive pits")
    - R_Date("R3a", 2800, 20)
    - R_Date("R3b", 2835, 45)
    - R_Date("R3c", 2720, 30)
      - Outlier()
    - R_Date("R101", 2820, 50)
    - R_Date("R102", 2754, 24)
    - R_Date("R103", 2670, 40)

- Outlier()
- R_Date("R105", 2870, 70)
- R_Date("R106", 2827, 18)
- Boundary("East Valley ends")
- Phase("Dor D2/10-9")
  - Label("Olive pits")
  - R_Date("D2", 2783, 22)
  - R_Date("D1", 2803, 16)
  - Label("Seeds")
  - R_Date("D102", 2735, 40)
- Phase("Qasile X")
  - Label("Seeds")
  - R_Date("QS1", 2818, 26)
  - R_Date("QS2", 2692, 24)
    - Outlier()
  - R_Date("QS3", 2911, 26)
  - R_Date("QS4", 2853, 25)
  - R_Date("QS5", 2895, 25)
  - R_Date("QS6", 2753, 22)
  - R_Date("QS7", 2800, 25)
  - R_Date("QS8", 2882, 28)
  - R_Date("QS9", 2864, 40)
  - R_Date("QS10", 2818, 38)
  - R_Date("QS11", 2897, 44)
- Interval("i4 Late Iron I")

Boundary("Late Iron I ends")

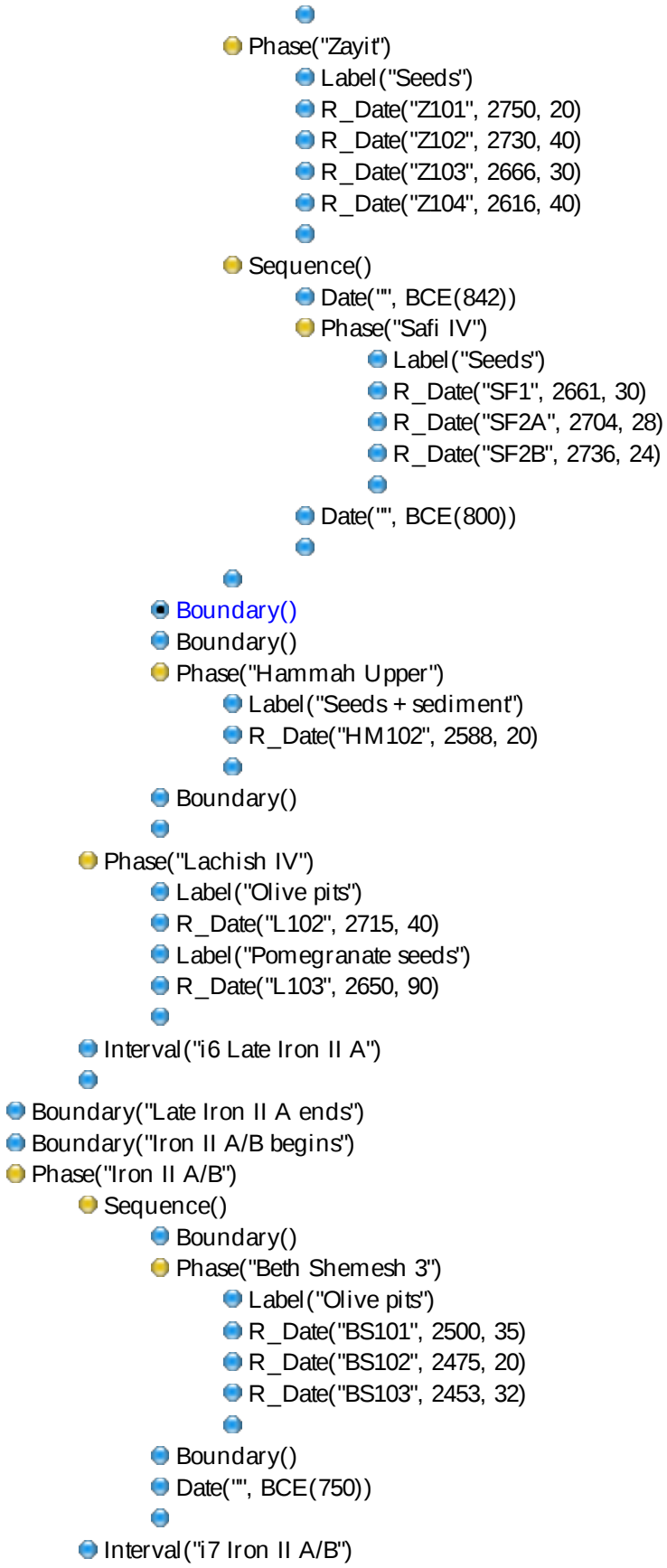
Boundary("Early Iron II A begins")

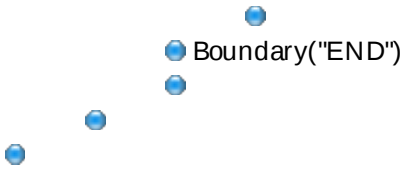
Phase("Early Iron II A")

- Phase("Dor D2/8")
  - Label("Olive pits")
  - R_Date("D101", 2710, 20)
  - R_Date("D3", 2757, 18)
  - R_Date("D4", 2764, 22)
  - R_Date("D5", 2779, 24)
- Phase("Lachish V")
  - R_Date("L101", 2775, 55)
- Phase("Rehov VI")
  - R_Date("R107", 2761, 14)
- Phase("Aphek X-8")

- Label("Seeds")
- R_Date("A1", 2667, 20)
  - Outlier()
  -
-
- Phase("Haroa")
  - Label("Date pits, Barley, Grape")
  - R_Date("HA101", 2721, 13)
  -
- Interval("i5 Early Iron II A")
-
- Boundary("Early Iron II A ends")
- Boundary("Late Iron II A begins")
- Phase("Late Iron II A")
  - Sequence()
    - Boundary()
    - Phase("Rehov V")
      - Label("Olive pits")
      - R_Date("R6", 2685, 25)
      - R_Date("R7", 2678, 20)
        - Outlier()
        -
      - Label("Seeds")
      - R_Date("R116", 2766, 23)
      - R_Date("R117", 2735, 30)
      - Label("Olive pits")
      - R_Date("R118", 2786, 22)
        - Outlier()
        -
      - Label("Grain")
      - R_Date("R108", 2764, 11)
      - R_Date("R109", 2788, 14)
        - Outlier()
        -
      - R_Date("R110", 2749, 16)
      - R_Date("R111", 2699, 10)
        - Outlier()
        -
      - R_Date("R112", 2768, 10)
      - R_Date("R113", 2771, 8)
        - Outlier()
        -
      - Label("Olive pits")
      - R_Date("R114", 2757, 26)
      -
    - Boundary()
    - Boundary()
    - Phase()
      - Phase("Rehov IV")
        - Label("Grain")

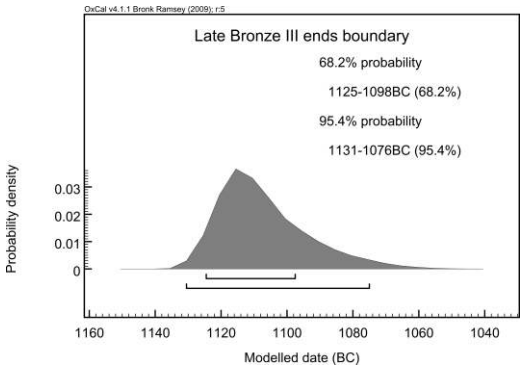
- R_Date("R115", 2758, 16)
- Phase("Dor D2/8b")
  - Label("Olive pits")
  - R_Date("D106", 2710, 40)
  - R_Date("D6", 2750, 23)
- Boundary()
- Boundary()
- Phase()
  - Phase("Megiddo H-5")
    - Label("Olive pits")
    - R_Date("MG14", 2859, 34)
      - Outlier()
    - R_Date("MG13", 2783, 32)
    - R_Date("MG15", 2695, 50)
  - Phase("Hazor IX")
    - Label("Olive pits")
    - R_Date("HZ18", 2632, 27)
    - R_Date("HZ12", 2585, 80)
    - R_Date("HZ11", 2639, 31)
    - R_Date("HZ16", 2689, 27)
    - R_Date("HZ15", 2697, 24)
  - Phase("Rosh Zayit IIa")
    - Label("Seeds")
    - R_Date("RZ7", 2709, 15)
    - R_Date("RZ1", 2745, 30)
    - R_Date("RZ2", 2755, 22)
    - R_Date("RZ6", 2689, 28)
    - R_Date("RZ3", 2745, 30)
    - R_Date("RZ4", 2729, 37)
    - R_Date("RZ5", 2692, 31)
  - Phase("Hammah Lower")
    - Label("Seeds")
    - R_Date("HM101", 2785, 50)
    - R_Date("HM8", 2609, 21)
    - R_Date("HM9", 2587, 23)
    - R_Date("HM10", 2634, 23)
    - R_Date("HM11", 2636, 23)
    - R_Date("HM12", 2622, 24)
    - R_Date("HM13", 2728, 28)
    - R_Date("HM4", 2675, 23)
    - R_Date("HM5", 2688, 25)
    - R_Date("HM6", 2687, 20)
    - R_Date("HM7", 2701, 22)

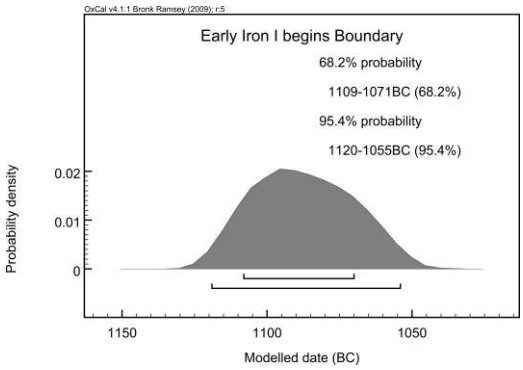

Phase("Zayit")
Label("Seeds")
R_Date("Z101", 2750, 20)
R_Date("Z102", 2730, 40)
R_Date("Z103", 2666, 30)
R_Date("Z104", 2616, 40)
Sequence()
Date("", BCE(842))
Phase("Safi IV")
Label("Seeds")
R_Date("SF1", 2661, 30)
R_Date("SF2A", 2704, 28)
R_Date("SF2B", 2736, 24)
Date("", BCE(800))
Boundary()
Boundary()
Phase("Hammah Upper")
Label("Seeds + sediment")
R_Date("HM102", 2588, 20)
Boundary()
Phase("Lachish IV")
Label("Olive pits")
R_Date("L102", 2715, 40)
Label("Pomegranate seeds")
R_Date("L103", 2650, 90)
Interval("i6 Late Iron II A")
Boundary("Late Iron II A ends")
Boundary("Iron II A/B begins")
Phase("Iron II A/B")
Sequence()
Boundary()
Phase("Beth Shemesh 3")
Label("Olive pits")
R_Date("BS101", 2500, 35)
R_Date("BS102", 2475, 20)
R_Date("BS103", 2453, 32)
Boundary()
Date("", BCE(750))
Interval("i7 Iron II A/B")

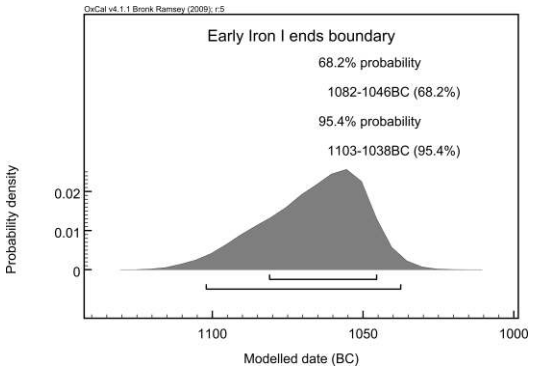

Boundary("END")

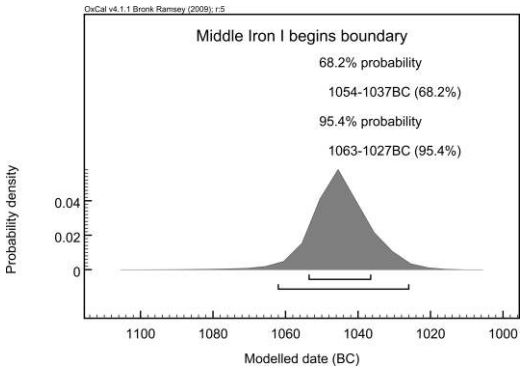
3. The results

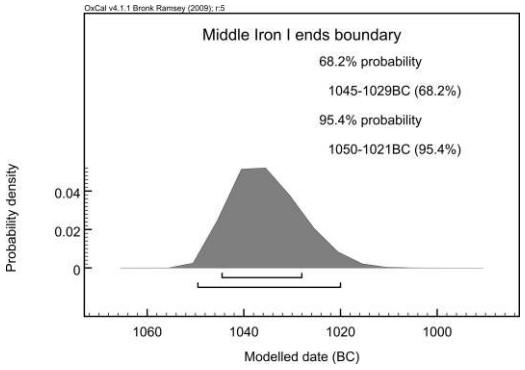
The full probability distribution, the 68% range, and the 95% range for each of the transitions discussed in the paper, are given below:

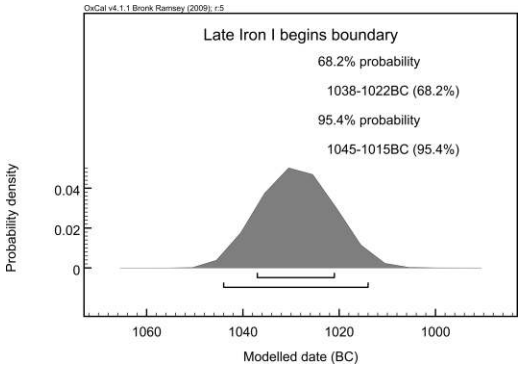


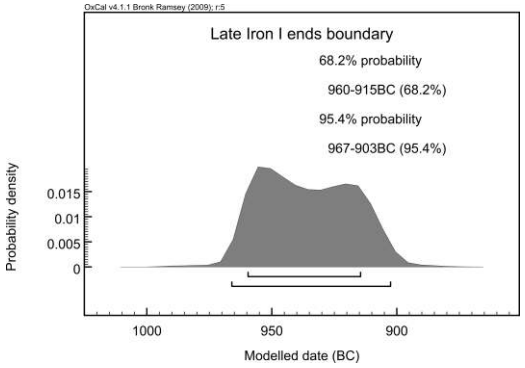


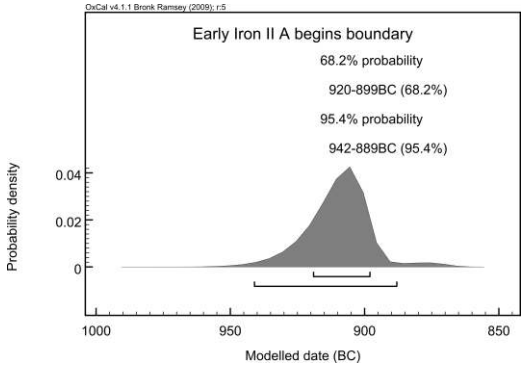


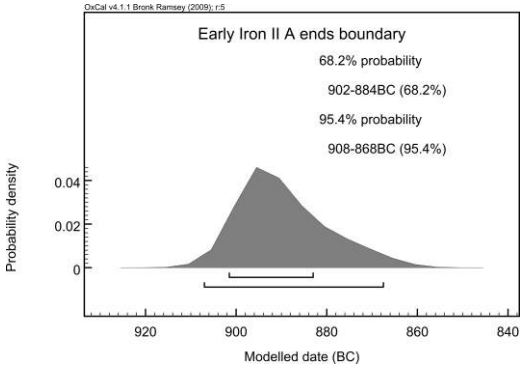


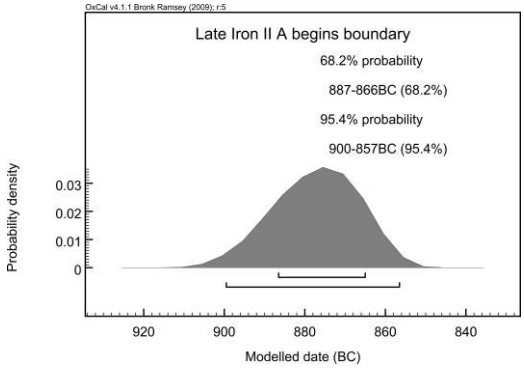


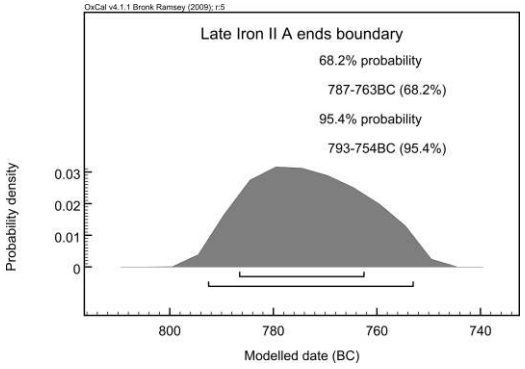


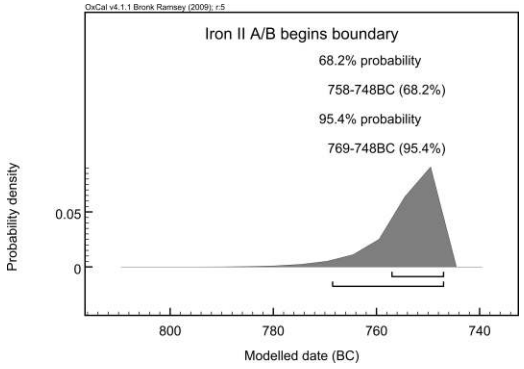

OxCal v4.1.1 Bronk Ramsey (2009); r:5
Late Iron I ends boundary
68.2% probability
960-915BC (68.2%)
95.4% probability
967-903BC (95.4%)
Probability density
0.015
0.01
0.005
0
1000
950
900
Modelled date (BC)


OxCal v4.1.1 Bronk Ramsey (2009); r:5
Early Iron II A begins boundary
68.2% probability
920-899BC (68.2%)
95.4% probability
942-889BC (95.4%)
Probability density
0.04
0.02
0
1000
950
900
850
Modelled date (BC)


OxCal v4.1.1 Bronk Ramsey (2009); r:5
Early Iron II A ends boundary
68.2% probability
902-884BC (68.2%)
95.4% probability
908-868BC (95.4%)
Probability density
0.04
0.02
0
920
900
880
860
840
Modelled date (BC)


OxCal v4.1.1 Bronk Ramsey (2009); r:5
Late Iron II A begins boundary
68.2% probability
887-866BC (68.2%)
95.4% probability
900-857BC (95.4%)
Probability density
0.03
0.02
0.01
0
920
900
880
860
840
Modelled date (BC)


OxCal v4.1.1 Bronk Ramsey (2009); r:5
Late Iron II A ends boundary
68.2% probability
787-763BC (68.2%)
95.4% probability
793-754BC (95.4%)
Probability density
0.03
0.02
0.01
0
800
780
760
740
Modelled date (BC)


OxCal v4.1.1 Bronk Ramsey (2009); r:5
Iron II A/B begins boundary
68.2% probability
758-748BC (68.2%)
95.4% probability
769-748BC (95.4%)
Probability density
0.05
0
800
780
760
740
Modelled date (BC)

4. The stratigraphic and ceramic sources for the radiocarbon dates

The Late Bronze III

This is the terminal phase of the Late Bronze (labeled by some scholars, e.g. Mazar 2005, as 'Iron Age IA'), that is, the last years of the system of Canaanite city-states under the domination of the Egyptian Twentieth Dynasty, before their collapse. For this phase we use data from three strata:

1A. Level K-6 of the renewed excavations at Megiddo in the Jezreel Valley, which equals the University of Chicago's Stratum VIIA (for the pottery see Arie in press). This layer produced well-dated Egyptian finds from the days of Ramesses III and Ramesses VI (the latter reigned between 1141–1133 BC; for Egyptian finds in this stratum see Singer 1988-9). It came to an end in a conflagration that was especially fierce in the area of the palace (Ussishkin 1995).

1B. Level VI at Lachish in the Shephelah (for the pottery see Yannai 2004). This layer came to an end in a major destruction, which was followed by an occupational gap of several centuries. A bronze plaque and a scarab carrying the name of Ramesses III and a scarab carrying the name of Ramesses IV (1151–1145 BC) found at Lachish originated from this layer (Ussishkin 2004).

1C. Stratum D-6 at Rehov in the Beth-shean Valley, described by Mazar *et al*. (2005: 202) as being *'parallel to the time of the Egyptian XXth Dynasty (most probably between the time of Ramesses III and Ramesses VI)'*.

The early Iron I

This earliest phase of the Iron I, which followed the collapse of the Late Bronze III Egypto-Canaanite system, is under-represented in our model. It is characterised by sites/strata such as Giloh in the highlands south of Jerusalem (Mazar 1981) and Stratum III at Izbet Sartah in the foothills overlooking the Yarkon basin (Finkelstein & Piasetzky 2006a). Along the Mediterranean coast it is represented by Stratum G10 at Tel Dor (Gilboa & Sharon 2003). These strata have not yielded radiocarbon determinations.

In this model we entered two samples for the early Iron I phase, neither admittedly ideal: Stratum D/2/13 at Tel Dor and Stratum VIIB at Tel Miqne/Ekron in Philistia. Dor D2/13 is labeled late Iron IA, but yielded a fragment of a Philistine bichrome vessel (Gilboa & Sharon 2003: 32), considered by us as Middle Iron I. Tel Miqne/Ekron VIIB belongs to a group of strata on the southern coastal plain (also layers at Ashdod and Ashkelon) which feature monochrome pottery — the earliest phase of Philistine ceramics (predating the Philistine bichrome), which is related to the Mycenaean IIIC: 1b pottery in the Aegean basin (e.g. Dothan & Zukerman 2004). The place of these strata in the stratigraphic sequence is debated. The traditional theory, which is based first and foremost on the interpretation of several Egyptian and biblical texts, places it in the Late Bronze III, in the days of Ramesses III (e.g. Stager 1995; Dothan & Zukerman 2004; Mazar 2007). Based on archaeological data — monochrome pottery has never been found in neighbouring Egyptian twentieth dynasty sites and twentieth dynasty Egyptian pottery has not been found in the monochrome strata — we argue for placing the monochrome strata in the early Iron I, after the collapse of the Egypto-Canaanite system (Ussishkin 1985; 2007; Finkelstein 1995).

Because of the problematic nature of these strata we also attempted to run a model without a slot for the early Iron I. The result placed the transition from the Late Bronze III to the Iron I (in this case the Middle Iron I) in 1060–1041 BC — far too low according to any historical or archaeological interpretation. Removing Tel Miqne/Ekron VIIB from the model or putting it in the Late Bronze III group does not change the results as long as Tel Dor D2/13 remains in the early Iron I slot. Moving Tel Dor D2/13 to the Middle Iron I and keeping Miqne VIIB as early Iron I does not change the results either. In other words, the model provides a reasonable result for the end of the Late Bronze III as long as at least one sample is kept in the early Iron I slot.

The middle Iron I

In this phase we have included layers that predate the final phase of the Iron I, according to two criteria: (1) Stratigraphically, they underlie the late Iron I strata; (2) Ceramically, their pottery predates the late Iron I assemblage in both the north (e.g. Megiddo K-4 — Arie 2006) and the south (Tel Qasile X — Mazar 1985).

3A. Shiloh V. This is the only site in the highlands that provided ^{14}C data for the Iron I. Shiloh V came to an end in a major destruction followed by a long occupational gap. Its

pottery assemblage (Bunimovitz & Finkelstein 1993) is typical of the Iron I in the highlands, but is later than early Iron I sites such as Giloh, and does not include items of the late Iron I strata in the neighbouring regions to the north and west (the Jezreel Valley and the Coastal Plain respectively; for the relative sequence of the Iron I pottery in the highlands see Finkelstein & Piasetzky 2006a).

3B. Level K-5 at Megiddo. This layer — which represents the first Iron I settlement at Megiddo (the University of Chicago's Stratum VIB) — is sandwiched stratigraphically between the destruction of the Late Bronze III city (Level K-6) and the late Iron I settlement (Level K-4; see Arie 2006; Gadot *et al*. 2006). It seems that Megiddo experienced a short occupational hiatus in the early Iron I, after the demise of the Late Bronze III city (Finkelstein 1996).

3C–D. Beth-shemesh Strata 6 & 5 and Tel Miqne/Ekron Strata VIB & VB in Philistia. These layers are characterised by Philistine bichrome pottery in its peak period (Dothan & Zukerman 2004; Bunimovitz & Lederman 2006 for Beth-shemesh; Gitin *et al*. 2006 for Tel Miqne). Those who place the Philistine monochrome in the Late Bronze III may argue that the bichrome strata should be labelled Early Iron I. This is not so for two reasons: (a) As mentioned above, in such a case the Bayesian model puts the Late Bronze/Iron I transition much too late and (b) the radiocarbon dates of the individual bichrome strata are all too late for such an assumption. They are followed by late Iron I strata which feature degenerated Philistine pottery.

3E. Stratum D-4 at Tel Rehov. This layer is characterised by 'Iron Age IB pottery'; it predates the terminal phase of the Iron I (Mazar *et al*. 2005).

3F. Stratum D2/12 at Tel Dor. This stratum is described by Gilboa and Sharon (2003: 14, 33) as Iron Ia/b, before the appearance of Phoenician bichrome pottery.

The late Iron I

This is a well-defined phase in the Iron Age sequence. Due to the many destruction layers, it features rich pottery assemblages (e.g. Mazar 1985; Arie 2006) and provided many samples for ^{14}C dating. The following layers were included in our model:

4A. Level K-4 at Megiddo (the University of Chicago's Stratum VIA), which features hundreds of pottery vessels (Arie 2006; Harrison 2004). The settlement was destroyed in a fierce fire, which left over a metre of destruction debris (e.g. Gadot *et al*. 2006).

4B. Stratum 9a at Tel Keisan on the Acco plain. The settlement was destroyed in a heavy conflagration (Humbert 1980: 20).

4C. Stratum XVII at Tel Yokneam in the Jezreel Valley. The division of Stratum XVII into two phases (b and a) is based on minor architectural alterations (Zarzecki-Peleg 2005: 17–18); it is reasonable to assume that the charred olive pits came from the destruction that sealed Stratum XVII (for the destruction see Zarzecki-Peleg 2005: 22–32).

4D. Stratum IV at Tel Hadar on the eastern shore of the Sea of Galilee, which was destroyed in a heavy conflagration (Kochavi 1998).

4E. Tel Hammah in the Beth-shean Valley. The late Iron I layer was destroyed by fire (Cahill 2006).

4F. Stratum D-3 at Tel Rehov in the Beth-shean Valley. Samples were taken from a series of pits (Mazar *et al*. 2005; see comments regarding the stratigraphy and method of selection of data for radiocarbon analysis in Finkelstein & Piasetzky 2006b). No destruction has been reported.

4G. Stratum D-2/10-9 at Tel Dor on the coast. Samples came from a building that was abandoned rather than destroyed (Gilboa & Sharon 2003: 33–4).

4H. Stratum X at Tel Qasile, in Tel Aviv. This 'classical' late Iron I layer in Philistia was destroyed in an intense fire. It features a rich assemblage of pottery (Mazar 1985b).

The early Iron IIA

Based on detailed stratigraphic and ceramic data, Herzog and Singer-Avitz have managed to distinguish between early and late Iron IIA ceramic phases in both the south and the north of

Israel (2004; 2006 respectively). Since there are no destruction layers in the early Iron IIA, the number of ^{14}C determinations is small relative to the large number of measurements from the destruction layers of the preceding and succeeding periods — the late Iron I (above) and the late Iron IIA (below). The following layers have been included in our model:

5A. Stratum VI at Tel Rehov—the earliest Iron IIA layer at the site (Mazar *et al.* 2005). We include only one sample; another sample which includes 'fine charcoal' and a bone was excluded.

5B. Stratum D2/8c at Tel Dor. This layer is equated with the early Iron IIA Stratum VB at Megiddo (Gilboa & Sharon 2003: 55).

5C. Stratum X-8 at Tel Aphek. Samples were taken from carbonised grain-seeds found in complete storage jars in a storage pit (for the stratum and its pottery see Gadot 2003).

5D. Level V at Lachish in the Shephelah. This is the 'classical' early Iron IIA layer in the Shephelah in particular and in the south in general (Zimhoni 1997; Mazar & Panitz-Cohen 2001: 274–5; Herzog & Singer-Avitz 2004).

5E. Atar Haroa. This is one in a system of sites in the Negev Highlands in southern Israel (Cohen 1970; Cohen & Cohen-Amin 2004; Shahack-Gross & Finkelstein 2008). Its affiliation with the early Iron IIA is acknowledged by all authorities (Herzog & Singer-Avitz 2004; Mazar 2005).

The late Iron IIA

This phase in the Iron Age sequence (Herzog & Singer Avitz 2004; 2006) is well-known stratigraphically and ceramically. The large number of samples for ^{14}C dating originated from many destruction layers in both the north and the south. The strata included in our model are:

6A. Strata V & IV at Tel Rehov. Both of these superimposed layers feature destruction layers (Mazar *et al*. 2005; for our treatment of the Tel Rehov determinations, including the affiliation of samples to Strata V or IV, see Finkelstein & Piasetzky 2006b).

6B. Tell el-Hammah in the Beth-shean Valley. The samples come from two superimposed destruction layers (Cahill 2006).

6C. Stratum IIA at Rosh Zayit on the coastal plain of the Galilee features the closing phase in the 'fort' uncovered at the site. It came to an end in a violent conflagration (Gal & Alexandre 2000: 21–2).

6D. Level H-5 at Megiddo. This is the latest of four Iron IIA layers in Area H. Level H-5 equals the end-phase of Stratum VA-IVB of the University of Chicago dig. Collapse of mudbricks indicates that it ended in destruction, though in this specific spot there was no evidence of a conflagration; other locations, excavated by the University of Chicago in the 1920s, did provide such evidence (see, e.g. pictures in Lamon & Shipton 1939: 6).

6E. Tel Hazor. Results of three samples were published — two assigned to Stratum Xa and one to Stratum IXa (Sharon *et al*. 2007a). The measurements from all three are consistent with each other, and their uncalibrated dates are relatively late in the Iron IIA sequence. The only destruction in the four phases of Hazor X-IX (Yadin 1972: 135–46; Ben-Tor & Ben-Ami 1998) is at the end of the sequence (Phase IXa — Yadin 1972: 143). Since the material seems to have originated from a conflagration layer, we propose to refer to all Hazor samples as representing the destruction of Stratum IX.

6F. Stratum D2/8b at Tel Dor. This layer is equated with Stratum VA-IVB at Megiddo (Gilboa & Sharon 2003: 55). It seems to have ended in destruction with no traces of fire, interpreted as the result of an earthquake (Sharon & Gilboa 1997: 22).

6G. Level IV at Lachish in the Shephelah — the 'classical' late Iron IIA layer in the south (Zimhoni 1997; Ussishkin 2004).

6H. Stratum IV at Tell es-Safi/Gath in the Shephelah. This layer provided the richest Late Iron IIA assemblage in the south (Shai & Maeir 2003). It came to an end in a fierce conflagration.

6I. Tel Zayit in the Shephelah. Samples came from the destruction of Local Level III (Tappy *et al*. 2006).

Iron IIA/B transition (or terminal Iron IIA)

A single stratum in the south represents this phase.

7A. Stratum 3 at Beth-shemesh in the Shephelah, which came to an end in a heavy conflagration. Typologically, the pottery of this stratum post-dates the late Iron IIA assemblage from the destruction layer of nearby Tell es-Safi/Gath; it already carries Iron IIA/B transition forms (Bunimovitz & Lederman 2006).

References

ARIE, E. 2006. The Iron Age I pottery: Levels K-5 and K-4 and an intra-site spatial analysis of the pottery from Stratum VIA, in I. Finkelstein, D. Ussishkin & B. Halpern (ed.) *Megiddo IV: the 1998–2002 seasons*: 191–298. Tel Aviv: Emery and Claire Yass Publications in Archaeology.

- In press. The Late Bronze III and Iron I pottery, in I. Finkelstein & D. Ussishkin (ed.) *Megiddo V: the 2004–2008 seasons*. Tel Aviv: Emery and Claire Yass Publications in Archaeology.

BEN-TOR, A. & D. BEN-AMI. 1998. Hazor and the archaeology of the tenth century BCE. *Israel Exploration Journal* 48: 1–37.

BOARETTO, E. 2006. Radiocarbon dates, in I. Finkelstein, D. Ussishkin & B. Halpern (ed.) *Megiddo IV: the 1998–2002 seasons*: 550–57. Tel Aviv: Emery and Claire Yass Publications in Archaeology.

BOARETTO, E., I. FINKELSTEIN & R. SHAHACK-GROSS. In press. Radiocarbon results from the Iron IIA site of Atar Haroa in the Negev Highlands and their archaeological and historical implications. *Radiocarbon* 52.

BUNIMOVITZ, S. & I. FINKELSTEIN. 1993. Pottery, in I. Finkelstein (ed.) *Shiloh: the archaeology of a Biblical site* (Tel Aviv University: Sonia and Marco Nadler Institute of Archaeology Monograph Series 10): 81–196. Tel Aviv: Emery and Claire Yass Publications in Archaeology.

BUNIMOVITZ, S. & Z. LEDERMAN. 2006. The early Israelite monarchy in the Sorek Valley: Tel Beth-Shemesh and Tel Batash (Timnah) in the tenth and ninth centuries BCE, in A.M. Maeir & P. de Miroschedji (ed.) "*I will speak the riddles of ancient times": archaeological and historical studies in honor of Amihai Mazar on the occasion of his sixtieth birthday*: 407–27. Winona Lake (IN): Eisenbrauns.

CAHILL, J.M. 2006. The excavations at Tell el-Hammah: a prelude to Amihai Mazar's Beth-Shean Valley regional project, in A.M. Maeir & P. de Miroschedji (ed.) "*I will speak the riddles of ancient times": archaeological and historical studies in honor of Amihai Mazar on the occasion of his sixtieth birthday*: 429–59. Winona Lake (IN): Eisenbrauns.

CARMI, I. & D. USSISHKIN. 2004. ^{14}C dates, in D. Ussishkin (ed.) *The renewed archaeological excavations at Lachish (1973–94), Volume V* (Tel Aviv University: Sonia and Marco Nadler Institute of Archaeology Monograph Series 22): 2508–513. Tel Aviv: Emery and Claire Yass Publications in Archaeology.

COHEN, R. 1970. Atar Haroa. *Atiqot* 6: 6–24 (Hebrew).

COHEN, R. & R. COHEN-AMIN. 2004. *Ancient settlement of the Negev Highlands, volume II: the Iron Age and the Persian periods* (IAA Reports 20). Jerusalem: Israel Antiquities Authority (Hebrew, English summary).

DOTHAN, T. & A. ZUKERMAN. 2004. A preliminary study of the Mycenaean IIIC:1 pottery assemblages from Tel Miqne-Ekron and Ashdod. *Bulletin of the American Schools of Oriental Research* 333: 1–54.

FINKELSTEIN, I. 1995. The date of the Philistine settlement in Canaan. *Tel Aviv* 22: 213–39.

- 1996. The stratigraphy and chronology of Megiddo and Beth-shan in the 12th-11th centuries BCE. *Tel Aviv* 23: 170–84.

FINKELSTEIN, I. & E. PIASETZKY. 2006a. The Iron I–IIA in the highlands and beyond: ^{14}C anchors, pottery phases and the Shoshenq I campaign. *Levant* 38: 45–61.

- 2006b ^{14}C and the Iron Age chronology debate: Rehov, Khirbet en-Nahas, Dan and Megiddo. *Radiocarbon* 48: 373–86.

GADOT, Y. 2003. Continuity and change: cultural processes in the Late Bronze and Early Iron Ages in Israel's central Coastal Plain. Unpublished PhD dissertation, Tel Aviv University. (Hebrew, English abstract).

GADOT, Y., M. MARTIN, N. BLOCKMAN & E. ARIE. 2006. Area K (Levels K-5 and K-4, the 1998–2002 seasons), in I. Finkelstein, D. Ussishkin & B. Halpern (ed.) *Megiddo IV: the 1998–2002 seasons*: 87–103. Tel Aviv: Emery and Claire Yass Publications in Archaeology.

GAL, Z. & Y. ALEXANDRE. 2000. *Horbat Rosh Zayit: an Iron Age storage fort and village* (*IAA Reports 8*). Jerusalem: Israel Antiquities Authority.

GILBOA, A. & I. SHARON. 2003. An archaeological contribution to the early Iron Age chronological debate: alternative chronologies for Phoenicia and their effects on the Levant, Cyprus and Greece. *Bulletin of the American Schools of Oriental Research* 332: 7-80.

GITIN, S., M. MEEHL & T. DOTHAN. 2006. Occupational history — stratigraphy and architecture, in M.W. Meehl, T. Dothan & S. Gitin *Tel Miqne-Ekron excavations 1995–1996: Field INE east slope Iron Age I (Early Philistine period) (Tel Miqne-Ekron Final Field Report Series 8)*: 27–67. Jerusalem: W.F. Albright Institute of Archaeological Research.

HARRISON, T.P. (ed.). 2004. *Megiddo Volume 3. Final report of the Stratum VI excavations*. Chicago (IL): University of Chicago press.

HERZOG, Z. & L. SINGER-AVITZ. 2004. Redefining the centre: the emergence of state in Judah. *Tel Aviv* 31: 209–44.

- 2006. Sub-dividing the Iron IIA in northern Israel: a suggested solution to the chronological debate. *Tel Aviv* 33: 163–95.

HUMBERT, J.-B. 1980. Les fouilles: objectifs, méthode, stratigraphie, in J. Briend & J.-B. Humbert (ed.) *Tell Keisan (1971-1976): une cité phénicienne en Galilée (Orbis Biblicus et Orientalis. Series Archaeologica 1)*: 13–29. Paris: J. Gabalda.

KOCHAVI, M. 1998. The eleventh century BCE tripartite pillar building at Tel Hadar, in S. Gitin, A. Mazar & E. Stern (ed.) *Mediterranean peoples in transition: thirteenth to early tenth*

centuries BCE: 468–78. Jerusalem: Israel Exploration Society.

LAMON, R.S. & G.M. SHIPTON. 1939. Megiddo I: seasons of 1925–34, Strata I–V (Oriental Institute Publications: University of Chicago 42). Chicago (IL): University of Chicago Press.

MAZAR, A. 1981. Giloh: an early Israelite settlement site near Jerusalem. *Israel Exploration Journal* 31: 1–36.

- 1985. *Excavations at Tell Qasile part two, the Philistine sanctuary: various finds, the pottery, conclusions, appendixes* (*Qedem Monographs of the Institute of Archaeology, the Hebrew University of Jerusalem* 20). Jerusalem: Institute of Archaeology.

- 2005. The debate over the chronology of the Iron Age in the southern Levant: its history, the current situation and a suggested resolution, in T.E. Levy & T. Higham (ed.) *The Bible and radiocarbon dating: archaeology, text and science*: 15–30. London: Equinox.

- 2007. Myc IIIC in the land of Israel: its distribution, date and significance, in M. Bietak & E. Czerny (ed.) *The synchronization of civilizations in the eastern Mediterranean in the second millennium BC* III: 571–82. Vienna: Österreichischen Akademie.

MAZAR, A. & C. BRONK RAMSEY. 2008. ^{14}C dates and the Iron Age chronology of Israel: a response. *Radiocarbon* 50: 159–80.

MAZAR, A. & N. PANITZ-COHEN. 2001. *Timnah (Tel Batash) II: the finds from the first millennium BCE, Text* (*Qedem Monographs of the Institute of Archaeology, the Hebrew University of Jerusalem* 42). Jerusalem: Institute of Archaeology.

MAZAR, A., H.J. BRUINS, N. PANITZ-COHEN & J. VAN DER PLICHT. 2005. Ladder of time at Tel Rehov: stratigraphy, archaeological context, pottery and radiocarbon dates, in T.E. Levy & T. Higham (ed.) *The Bible and radiocarbon dating: archaeology, text and science*: 193–255. London: Equinox.

SHAHACK-GROSS, R. & I. FINKELSTEIN. 2008. Subsistence practices in an arid environment: a geoarchaeological investigation in an Iron Age site, the Negev Highlands, Israel. *Journal of Archaeological Science* 35: 965–82.

SHAI, I. & A.M. MAEIR. 2003. Pre-*lmlk* jars: a new class of Iron Age IIA storage jars. *Tel Aviv* 30: 108-123.

SHARON, I. 2001. 'Transition dating' — a heuristic mathematical approach to the collation of radiocarbon dates from stratified sequences. *Radiocarbon* 43: 345–54.

SHARON, I. & A. GILBOA. 1997. Dor in the Iron I period: a port and trading emporium under cultural and economic changes, in E. Regev (ed.) *New studies on the Coastal Plain*: 12–34. Ramat Gan: Bar Ilan University (Hebrew).

SHARON, I., A. GILBOA, T.A.J. JULL & E. BOARETTO. 2007a. Report on the first stage of the Iron Age dating project in Israel: supporting a low chronology. *Radiocarbon* 49: 1–46.

SHARON, I., A. GILBOA & E. BOARETTO. 2007b. 14C and the early Iron Age of Israel — where are we really at? A commentary on the Tel Rehov radiometric dates, in M. Bietak & E. Czerny (ed.) *The synchronization of civilizations in the eastern Mediterranean in the second millennium BC* III: 149–55. Vienna: Österreichischen Akademie.

SINGER, I. 1988–9. The political status of Megiddo VIIA. *Tel Aviv* 15–16: 101–112.

TAPPY, R.E., P.K. MCCARTER, M.J. LUNDBERG & B. ZUCKERMAN. 2006. An abecedary of the mid-tenth century BCE from the Judaean Shephelah. *Bulletin of the American Schools of Oriental Research* 344: 5–46.

USSISHKIN, D. 1985. Levels VII and VI at Tel Lachish and the end of the Late Bronze Age in Canaan, in J.N. Tubb (ed.) *Palestine in the Bronze and Iron Ages, papers in honour of Olga Tufnell (University of London, Institute of Archaeology, Occasional Publications 11)*: 213–28. London: Institute of Archaeology.

- 1995. The destruction of Megiddo at the end of the Late Bronze Age and its historical significance. *Tel Aviv* 22: 240–67.

- 2004. A synopsis of the stratigraphical, chronological and historical issues, in D. Ussishkin (ed.) *The renewed archaeological excavations at Lachish (1973–94), Volume I* (Tel Aviv University: Sonia and Marco Nadler Institute of Archaeology Monograph Series 22): 50-119. Tel Aviv: Emery and Claire Yass Publications in Archaeology.

- 2007. Lachish and the date of the Philistine settlement in Canaan, in M. Bietak & E. Czerny (ed.) *The synchronization of civlizations in the eastern Mediterranean in the second millennium BC* III: 601–607. Vienna: Österreichischen Akademie.

YADIN, Y. 1972. *Hazor*: *the Schweich Lectures of the British Academy*. London: The British Academy.

YANNAI, E. 2004. The Late Bronze Age pottery from Area S, in D. Ussishkin (ed.) *The renewed archaeological excavations at Lachish (1973–94), Volume IIII* (Tel Aviv University: Sonia and Marco Nadler Institute of Archaeology Monograph Series 22): 1032–146. Tel Aviv: Emery and Claire Yass Publications in Archaeology.

- 2005. Stratigraphy and architecture, in A. Ben-Tor, A. Zarzecki-Peleg & S. Cohen-Anidjar *Yoqne'am II: the Iron Age and the Persian period: final report of the archaeological excavations (1977–1988* (Qedem Reports 6): 5–232. Jerusalem: The Institute of Archaeology, The Hebrew University of Jerusalem, in cooperation with Israel Exploration Society.

ZIMHONI, O. 1997. *Studies in the Iron Age pottery of Israel: typological, archaeological and chronological aspects* (Tel Aviv Occasional Publications 2). Tel Aviv: Institute of Archaeology.