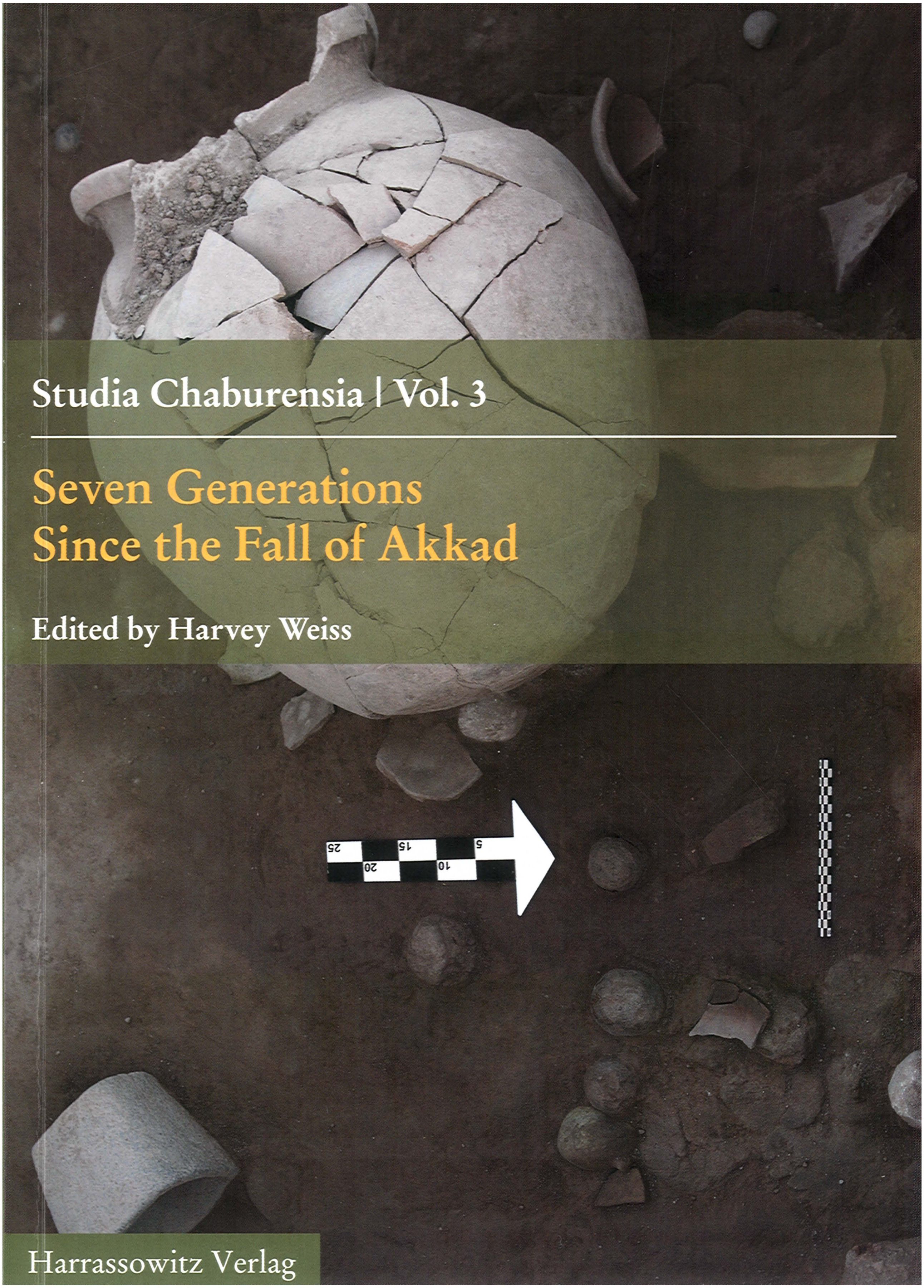

Studia Chaburensia | Vol. 3

Seven Generations Since the Fall of Akkad

Edited by Harvey Weiss

Harrassowitz Verlag

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Tell Leilan Akkadian Imperialization, Collapse and Short-Lived Reoccupation Defined by High-Resolution Radiocarbon Dating

The 2006 and 2008 excavations of the Leilan Acropolis Northwest focused upon the multi-phase building first discovered in 2002 in a 30 m long N-S test trench at the northern edge of the Acropolis (Figure 1). In 2002 the test trench was expanded to three ten by ten meter excavation units, grid squares 44S16, 44T16, and 44V16, where excavation exposed an irregular eroded, one-course pavement of unfired mudbrick (33 x 33 x 8 cms) in 44V16, and where adjacent 44S16 provided a four-room house and courtyard mostly enclosed within that excavation unit and built of the same size mudbrick. The northern end of the 44S16 four-room house terminated at the northern edge of the Acropolis mound with a wall of rectangular brick (37 x 16 x 8 cms) initially constructed for the earlier Leilan IIa palace. The floor of the house's central court, bounded by walls E, F, G, H, was covered with a 2-4 cms ash lens of carbonized grain that was radiocarbon sampled in both 2002 and 2006 (Figure 2 and 3). At the conclusion of the 2002 excavation it was assumed that the four-room house would subsequently prove to be part of a still larger structure or structures. That was not the case, however.

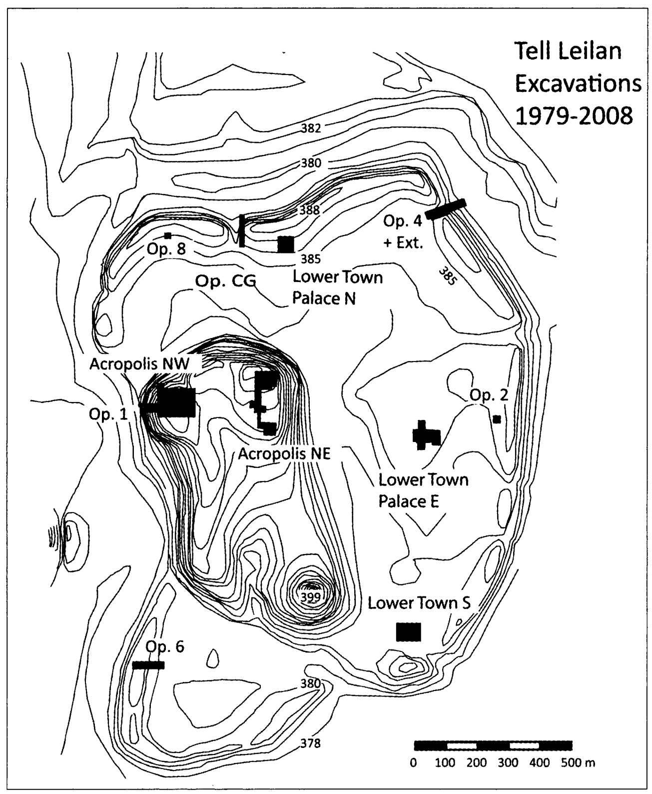

Figure 1: Tell Leilan 2008, Topographic Plan, and areas excavated.

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Figure 2: L02 44S16, stratum 9, Leilan IIc, 4-room house, central courtyard, carbonized grain ash, lot 33, on floor.

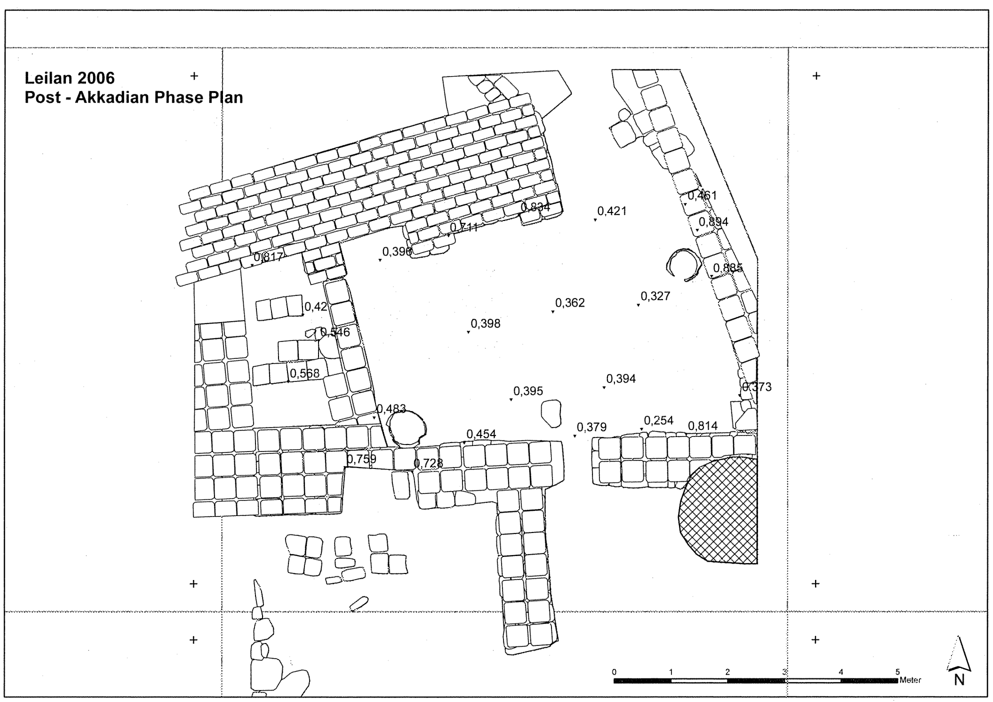

Figure 3: L02, L06 44S16, stratum 9, Leilan IIc, 4-room house, topographic plan.

In 2006, the same Acropolis NE area was extensively excavated with 10 ten-by-ten meter excavation units. Three major chronostratigraphic discoveries were made.

1. The Post-Akkadian Leilan IIc 4-room House. The 2006 re-excavation of the 44S16 4-room house proved it was a stratigraphically and spatially isolated structure, built in part upon earlier Leilan IIb wall stubs and using at its northern end walls initially constructed for the Leilan IIa palace (Figure 4). This building comprised the terminal occupation of the Tell Leilan Acropolis Northwest, and the only construction of this period presently known at Tell Leilan. The ceramic assemblage of the 44S16 4-room house is "post-Akkadian," i.e., Leilan period IIc, previously identified in the Leilan Region Surveys of 1995 and 1997 (Weiss et al 2002; Ristvet and Weiss 2005; Staubwasser and Weiss 2006) and well-known from Tell Taya period VII (Reade 1973). The quantified typological analysis of the 4-room, post-Akkadian, Leilan IIc ceramic assemblage (Quenet and Ristvet, this volume: 193) indicates similarity with the post-Akkadian, EJZ 4c, occupations retrieved at Brak TC Pisé Building (Emberling et al, this volume: 65) and Chagar Bazar Bâtiment 1 (McMahon and Quenet 2007), and with the Leilan Region Survey period IIc ceramic assemblages (Arrivabeni, this volume: 261).

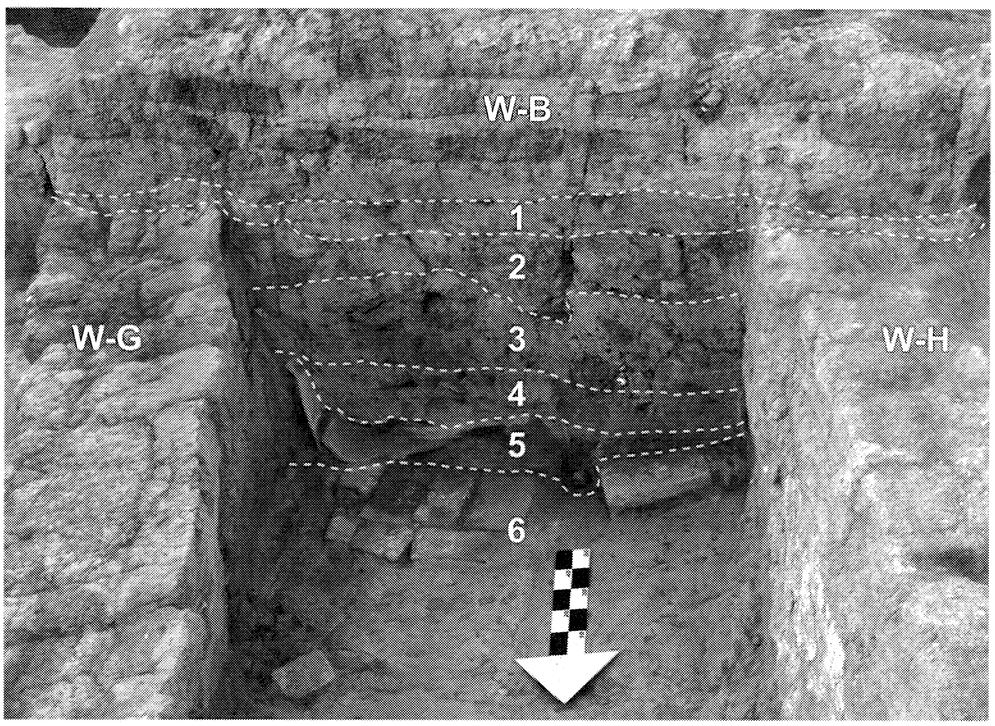

Figure 4: L06 44T16 room 16, south section.

1 = foundation and stratum 9 floor for wall B (5-courses), period IIc 4-room house.
2 = brick-filled leveling for foundation of Wall B
3 = brick collapse of Walls G and H (period IIa walls reused in period IIb) (lot 108)
4 = second Akkadian floor, stratum 10a, period IIb1(lot 109)
5 = artifact deposit on first Akkadian floor (lot 112)
6 = first Akkadian floor, stratum 11, period IIb2

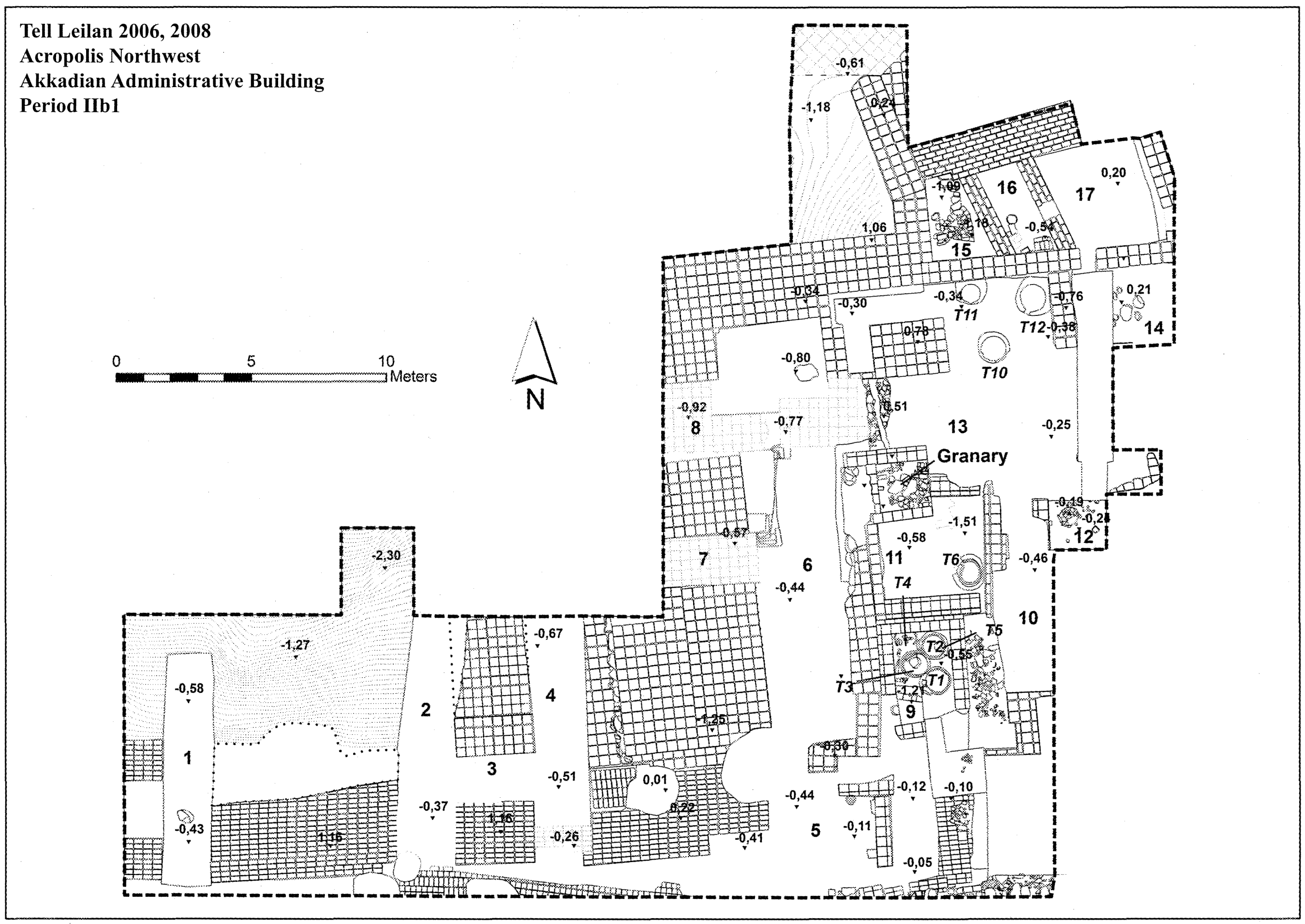

Figure 5: Tell Leilan, Acropolis Northwest, 2006, 2008, Akkadian Administrative Building, period IIb1, topographic plan.

2. <u>The Akkadian Administrative Building (AAB).</u> Under the Period IIc four-room house was a large, glacis-fortified, complex building of more than 17 connected rooms extending across and beyond the 2006 ten excavation units (Figure 5 and 6). To the north this building was bounded by the rectangular-brick (37 x 16 x 8 cms) period IIa palace wall at the northern limit of the ancient mound surface. To the south, this Akkadian Administrative Building was erected at the northern edge of the stone-paved, Akkadian street, excavated previously (deLillis Forest, Milano, Mori 2007).

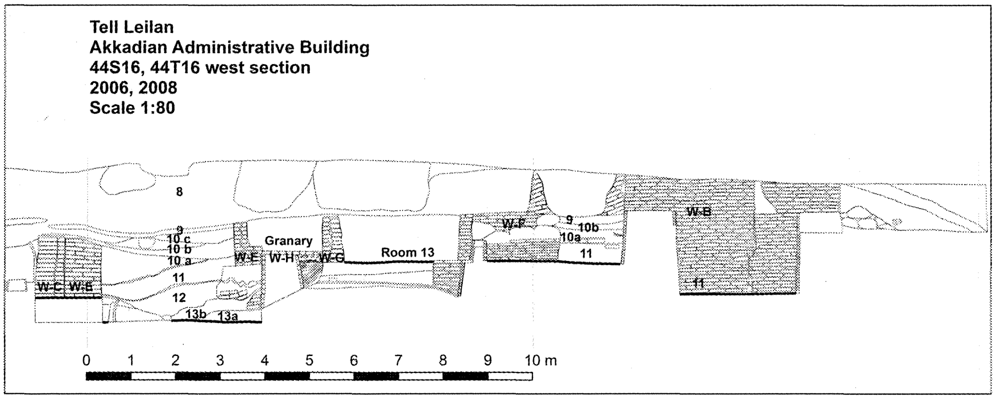

Figure 6: L06, L08 Akkadian Administrative Building, 44S16, 44T16 west section.
8 = brick collapse from period IIc walls
9 = post-Akkadian period IIc floor
10c, 10b = erosion surfaces from collapse of Wall E (North)
10a = floor, period IIb1
11 = floor, period IIb2
12 = brick collapse from period IIa walls
13a, b = period IIa "deep tannur room" floors

3. <u>AAB built upon and within period IIa Palace.</u> The Akkadian Administrative Building was constructed on top of the razed walls and against the still-standing remnant walls of a destroyed period IIa palace. This is documented by:
   a. period IIa-associated rectangular mudbrick (37 x 16 x 8 cms) paving immediately underlies the first Akkadian-related square bricks (33 x 33 x 7 cms) in the south Palace entryway extending from the Akkadian street (Figure 7).
   b. the earlier Period IIa rectangular brick/period II glacis wall was restored with mud pack and a mud plaster finish in rooms 1, 3, 4.
   c. some razed walls of period IIa were visible under AAB floors in rooms 3, 4, 13.
   d. some remnant period IIa walls were reused in AAB rooms 1, 3, 4, 12, 13 along with the IIa Palace north boundary wall.
   e. the period IIa Palace floor exposed in 44T16 stratum 13a, b, "the deep tannur room", with associated radiocarbon samples (Figure 8).

Figure 7: L06, AAB, Entryway from Akkadian Street, first period IIb bricks on period IIa brick pavement.

Figure 8: L06 44T16, stratum 13, period IIa floor, the "deep tannur room".

The Akkadian Administrative Building, periods IIb2-IIb1

The Akkadian Administrative Building's walls are associated in some rooms with two prepared floors, stratum 10a (period IIb1) and the earlier stratum 11 (period IIb2), while other rooms, such as room 13, had only one floor covered in part with a thin lens of caked mud (Figure 6). These floors were sampled extensively for radiocarbon dating. At its excavated western end, AAB rooms 1-4 were north-south galleys that provided defensive access to the rebuilt mudpack glacis which extended ca. 15 m below to plain level. The monumental brickwork of the period IIa palace was reused and rebuilt here, as in the wide southern façade walls that were preserved to two-meter heights.

The AAB western portion, between rooms 4 and 5-6, was delimited by the 6.6-meter wide period IIa wall that was rebuilt by the Akkadians. An Akkadian reconstruction feature, both here and at the Granary, was the placement of large basalt boulders against or within the façade of the rebuilt walls. The eastern side of this wall defined a north – south gallery, room 6, entered at room 5, with two east-west doorways, rooms 7 and 8, to the glacis that were sealed by the northernmost cross-wall. This gallery's features included floor discard of numerous ground stone grain processing tools, querns and rubbers, plastered work surfaces with *in situ* processing tools, and the unique Granary.

The Granary was a 3-meter x 3-meter mudbrick construction lined with a baked brick floor and interior walls. The extant upper course of baked bricks featured flues to facilitate air circulation and presumably cereal-drying. Lenses of cereal grain ash, from basal to terminal strata, filled the Granary's interior chamber (Figure 8) and were sampled for multiple radiocarbon dates.

The AAB middle corridor was the central tannur area presumably for grain cooking. Here were concentrated 12 large tannurs, each still filled with voluminous quantities of ash, sampled from basal to terminal strata for radiocarbon dating. Flotation of the ash on floors of rooms 9, 10, 11, and 13, and the combusted tannur fuel, produced large quantities of phytoliths distributed across this sector and extending to northernmost rooms 15, 16, and 17. Limited excavation of the glacis to the north of room 13 exposed an over-the-wall tannur refuse-dump 1.6 meters high, also sampled, basal to terminal strata, for radiocarbon dating.

The northern suite of AAB rooms was only accessible from the third, easternmost, and yet unexcavated sector of rooms, beginning at room 14. Room 15 had no doorway and with its two adjacent rooms was sealed at the north by the extant Period IIa enclosure wall. A 3.5 sq m partial exposure of room 12, part of the larger unexcavated eastern sector of AAB, revealed a terminal floor clearly linked stratigraphically and continuous with the stratum 10a floor in adjacent rooms 10, 13 and 14. Resting on this floor were a large grain storage vessel and a ground basalt 2-liter grain measure opposite 10 clay balls for tablet preparation, 5 clay balls flattened into uninscribed tablets, and a clay wetting pan with traces of evaporation rings (Figure 9).

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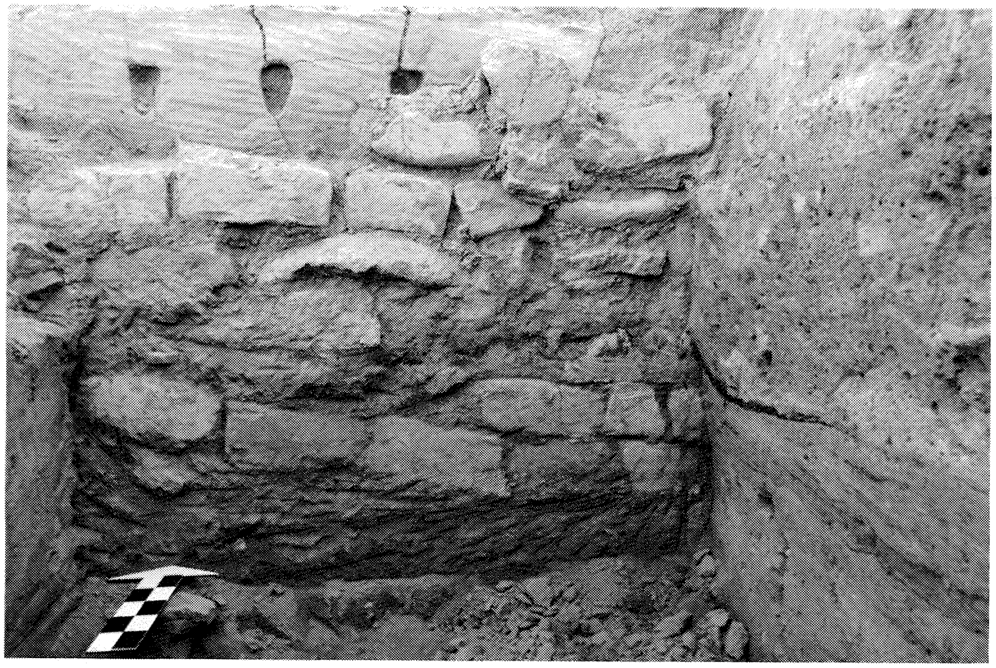

Figure 9: L06, Akkadian Administrative Building, The Granary, interior baked brick wall, flues, and cereal grain ash lenses.

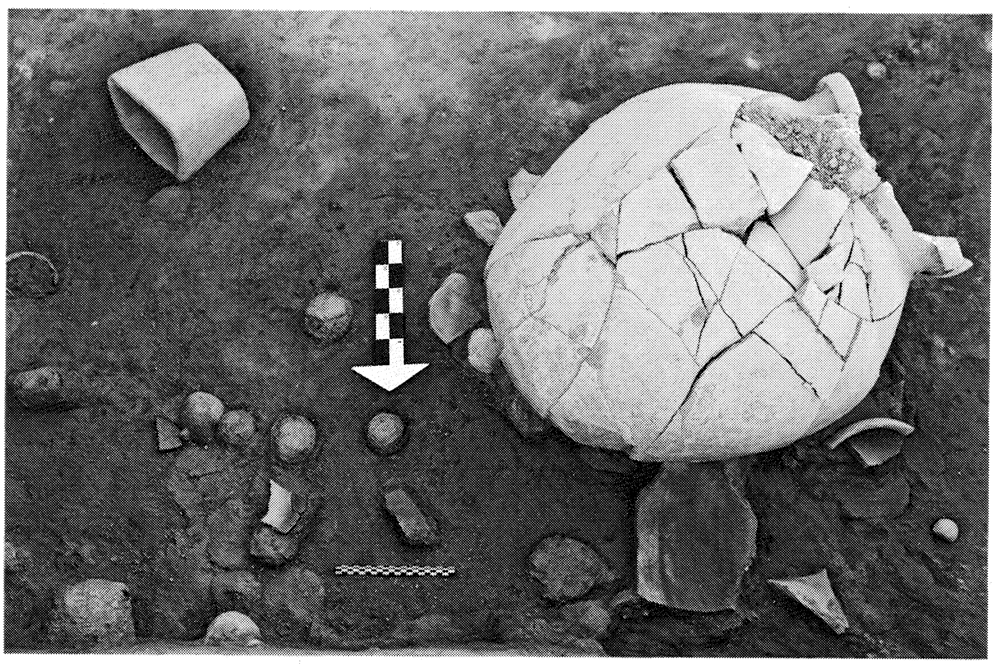

Figure 10: L06, Akkadian Administrative Building, room 12, period IIb1, stratum 10a floor, grain-storage jar, ground basalt 2-liter ration measure, 10 clay balls, 5 uninscribed clay tablets (see cover illustration).

The Date of the Akkadian Palace

The Akkadian structures on the southern side of the Akkadian Street comprise parts of a Leilan IIb/Akkadian period sequence of constructions. The earliest is Period IIb3, the Akkadian Scribal Room, that is contemporary with the last use of the period IIa Palace across the street, and may represent a pre-imperialization Akkadian presence at Tell Leilan (deLillis Forrest et al 2004). The following Period IIb2 Akkadian mudbrick residential rooms were built against The Unfinished Building and its worksite (deLillis Forrest et al 2004; deLillis Forrest, Milano, Mori 2007).

The Unfinished Building (TUB), stratigraphically spanning period IIb2-1, and larger than the retrieved 17.14 x 12.85 structure, was built of 2-meter thick basalt block walls, without foundation trenches and abandoned unfinished. At abandonment, chisel-dressed basalt blocks were arranged in a 6-meter diameter semi-circle adjacent to the west side of the construction. Basalt blocks extended, also, in a line from the worksite to the western edge of the Acropolis where a two block outcrop was visible enigmatically at the surface in 1978. Some of the TUB basalt blocks walls were covered with a thin mudpack onto which a layer of sherds was carefully set, and upon which four courses of mubrick were laid prior to the abandonment of the construction (Figure 11 and 12). This construction technique is known from Akkadian period Taya VIII, where it is succeeded by post-Akkadian Taya VII (Reade 1973). Limited exposures of this period at Mohammed Diyab recovered parts of two similar unfinished buildings, without mudbrick, in areas 6a-4 and 5a-12 (Nicolle 2006). The string-impressed, late imperial sealing of "Ḫaya-abum, šabra," (L93-66; Figure 13), likely from a southern manufacture seal (Boehmer 1965: Tafel XXII), rested on the unfinished floor as did a tablet fragment (L93-12, Weiss 1997).

In summary, the Akkadian Administrative Building is stratified below the period IIc post-Akkadian 4-room house, adjacent to the Akkadian street, and is linked stratigraphically with IIb2-IIb1 Akkadian building sequence on the south side of the street that included The Unfinished Building. A terminus ante quem for the dating of these last Akkadian occupations is provided by the succeeding stratum 8, comprising Akkadian brick collapse and disturbed mixes of occupational debris without floors. Flotation samples of these stratum 8 deposits, 44W17 lots 39 and 44, were retrieved and analyzed by Dr. Dominique deMoulins, and subsequently radiocarbon dated. Upon stratum 8 debris a subsequent early second millennium occupation was partially retrieved in 44W17 and 44W18, and flotation samples were similarly collected, analyzed, and radiocarbon dated. A prepared floor and two-brick wide walls comprised here one end of an early second millennium rectangular room or building. The ceramics on this stratum 7 floor and in a stratigraphically-linked pit (44W17 lots 7, 8, 11 and 44W18 lots 3, 6, 8) were of the well-known Khabur ware assemblages documented on the Leilan Acropolis Northeast and Lower Town and already cataloged (Frane 1996). However, a minor component of the ceramic assemblage comprised sherds not seen previously here, or elsewhere within Leilan Khabur ware assemblages, and seem parts of an Early Khabur ware assemblage (Figure 14). Strata 7 and 8 comprise a terminus ante quem for the stratum 9, Leilan IIc, post-Akkadian occupation.

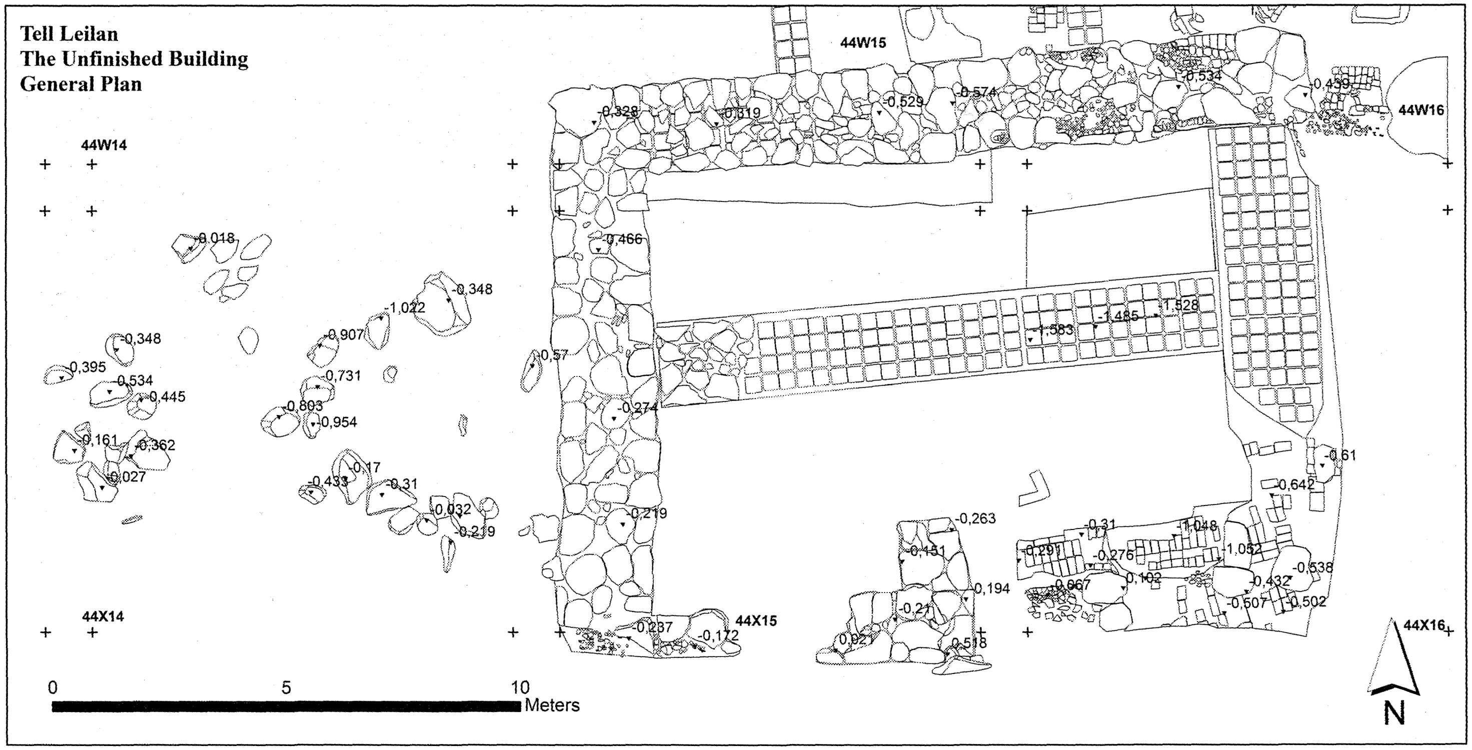

Figure 11: The Unfinished Building (1993, 1999, 2002, 2006) topographic plan.

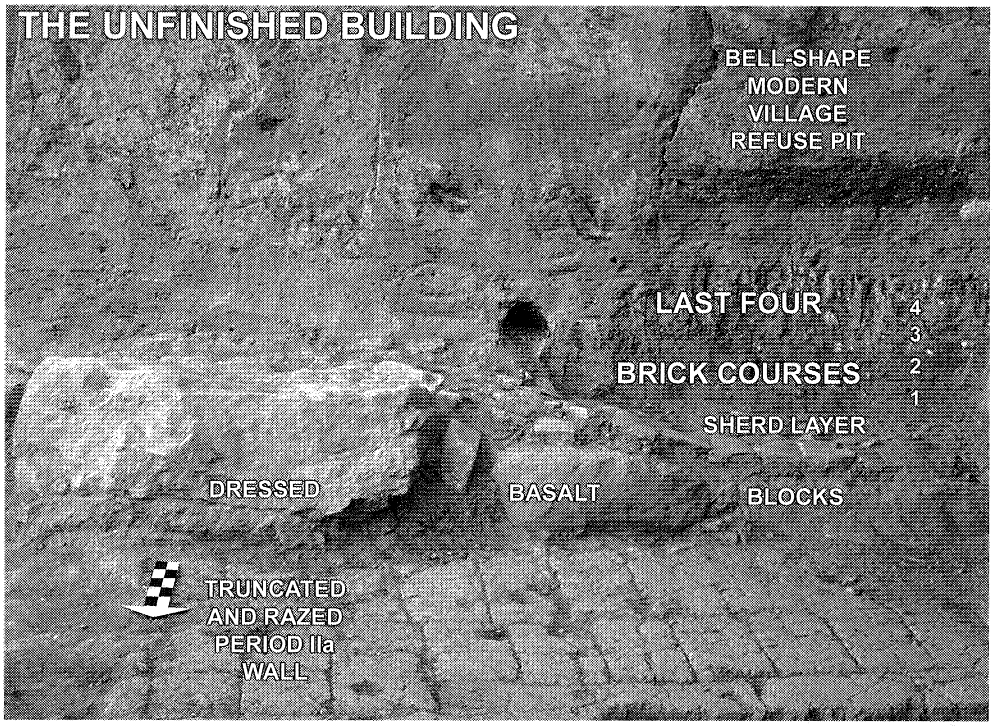

Figure 12: L99, The Unfinished Building, 44X16 south section: razed period IIa walls, incomplete line of dressed basalt blocks, mud pack, sherd layer, 4-courses of calcic horizon mud brick, modern village pit halted at TUB mud brick.

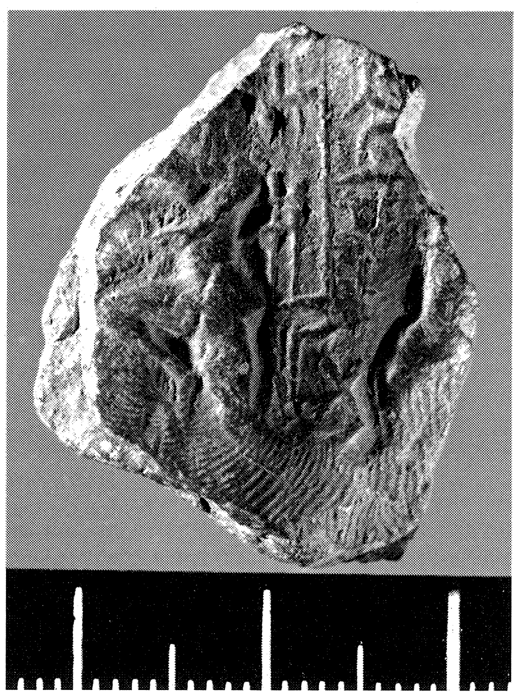

Figure 13: L93-66, 44W15, seal impression fragment, retrieved on working floor at corner of North and West basalt block walls. Obverse: partially frontal hero, with triangular upper body, raised knee pressing against back of animal. Inscription: "Ḫaya-abum, šabra." Reverse: string impressed.

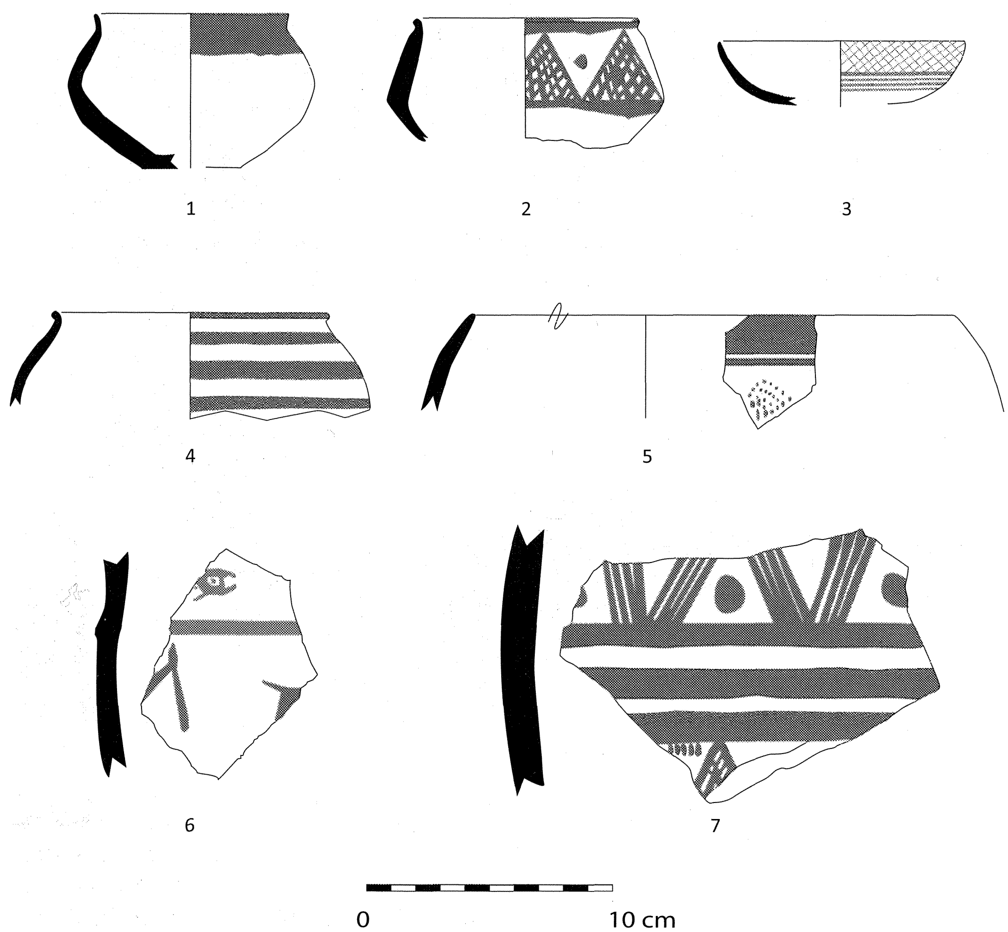

Figure 14: Early Khabur Ware sherds from the Acropolis Northwest, 44W17-18 stratum 7.

1) L99, 44W17, lot 11. Rim d=8cm, base d= 4cm, wheel made, interior and core 10YR8/3, buff, fine straw, grit, mica and lime temper. Exterior 10YR8/2, cream slip, and brown paint, 7.5YR3/2, on exterior. 2) L99, 44W18, lot 6. Rim d=9 cm, wheelmade, interior and core 10YR8/3 buff, fine straw and grit temper. Exterior 10YR8/2, cream slip, and brown paint, 7.5YR4/2, on exterior. 3) L99, 44W18, lot 3. Rim d=10cm, wheel made, interior and exterior, 7.5YR1/5, reddish brown, core 7.5YR6/4, grayish light brown, fine grit and mica temper, dark brown paint, 10YR3/1, on exterior. 4) L99, 44W17, lot 7. Rim d=11cm, wheel made, interior and core, 7.5YR7/4, orange/red, exterior 10YR8/3, buff slip, and red paint, 10R5/6, on exterior. 5) L99, 44W18, lot 8. Rim d=25cm, wheel made, interior, exterior and core, 10YR8/3, buff, very fine grit, occasional lime pop temper, brown paint, 7.5YR4/2, on exterior. 6) L99, 44W18, lot 3. Wheelmade, interior, exterior and core 10YR8/3, buff, fine straw temper, self slip on exterior, black paint, 5Y3/1, on exterior. 7) L99, 44W17, lot 8. Wheelmade, interior and exterior, 10YR8/2 buff, core, 7.5YR6/4, grayish light brown, medium straw and grit temper, self slip on exterior, brown paint, 7.5YR3/2, on exterior.

The stratigraphic dating for AAB period IIb2-1 is complemented by the relative dating of the building's contents, the ceramic assemblages (Quenet and Ristvet, this volume: 193) and the clay sealings within its rooms (McCarthy, this volume: 217), and the stratified sequence of Akkadian constructions, tablets and sealings on the southern side of the Akkadian street (deLillis-Forrest, Milano, Mori 2007). In addition, at the northern edge of the street, a burnt fragment of a late Akkadian incantation text (L06-300), identified by Prof. Piotr Steinkeller, was retrieved at the exterior face of the Akkadian Administrative Building's southern wall (Figure 15). But what is the date of the Leilan IIb2-1 buildings, the date of their abandonment, the date of the Leilan IIc rebuild, and the date of its abandonment? For the calendar dates we must turn to the Leilan radiocarbon project.

Figure 15: L06-300, burnt fragment of late Akkadian incantation text.

Radiocarbon (^{14}C) Dating

Ninety-three radiocarbon samples from the Leilan Acropolis Northwest excavations have been analyzed at the Center for Accelerator Mass Spectrometry/Lawrence Livermore National Laboratory (LLNL). These samples were retrieved within a directed radiocarbon sampling program comprised of hand-collection and some flotation-retrieval of short-lived grain from floors, special-use floor features, stratified construction and collapse caches, tannur floors and floor refuse, and granary strata. Collection was targeted at the beginning and end dates of floor-associated constructions, the construction and floor use periods, and termini post- and ante quem for building construction and occupation phases. Large seed samples were deliberately sought for division into two or three aliquots for multi-aliquot datings that can generate robust high-precision ($\leq$ 10-20 ^{14}C years) weighted average values (Ward and Wilson 1978). The samples were analyzed within a Bayesian analytical model integrating the archaeological sequence information with the radiocarbon dates using the OxCal software (Bronk Ramsey 1995; 2009) and the IntCal09 radiocarbon calibration dataset (Reimer et al. 2009). The end product from the LLNL data, summarized here, is comprised of six moments (a subsequent publication will present and explore these and other data in more detail and will consider issues of quality control and robustness).

Tell Leilan CAMS Modeled OxCal Dates (n=93).

Period	68.2% probability Cal BC	95.4% probability Cal BC
IIb3 Scribal Room	2433-2315	2454-2306
Early IIb2	2333-2280	2348-2270
End IIb1	2254-2220	2266-2211
IIc	2233-2206	2252-2202
End IIc	2233-2196	2253-2156
Start Early Khabur	1969-1919	1995-1896

Tell Leilan Context or Boundary	Model A[#]		Model B[#]	
	68.2% Probability Cal BC	95.4% Probability Cal BC	68.2% Probability Cal BC	95.4% Probability Cal BC
	Amodel 57.5, Aoverall 59.4		Amodel 71.3, Aoverall 70.6	
IIa Late	2531-2489	2577-2473 (88.8%)	2522-2490	2574-2475
IIb3 Scribal Room	2433-2315	2454-2306	2436-2319	2455-2309
Boundary End of IIb3 and pre-IIb2	2395-2299	2430-2289	2396-2301	2431-2290
IIb2a	2333-2280	2348-2270	2334-2281	2348-2271
Boundary End IIb2a	2308-2272	2339-2263	2310-2273	2340-2264
IIb2 Palace	2278-2261	2286-2251	2279-2264	2286-2254
Boundary End IIb2	2275-2255	2284-2239	2277-2259	2285-2242
IIb1 Palace	2264-2223*	2272-2219	2267-2226	2274-2220
IIb1 Terminal	2257-2233	2270-2215	NA	NA
Boundary End IIb1	2254-2220	2266-2211	2265-2221	2269-2216
IIc	2233-2206	2252-2202	2240-2206	2254-2204
Boundary End IIc	2233-2196	2253-2156	2239-2199	2257-2168
Start I Early = Early Khabur Ware	1969-1919	1995-1896	1967-1918	1990-1897
I Early	1949-1904	1971-1889	1947-1904	1964-1889

[#] All data (on short-lived samples) with additional 8 ^{14}C year (1‰) following Stuiver and Braziunas (1998)
* Weighted Average (narrowly) fails Chi-Square test df=16 T=28.446 > 5% 26.3

Model A includes as many data as possible (93) to get close to satisfactory OxCal agreement (60).
Model B excludes five additional data to achieve a satisfactory OxCal agreement.

Figure 16: Tell Leilan CAMS Modeled OxCal Dates Outcomes.

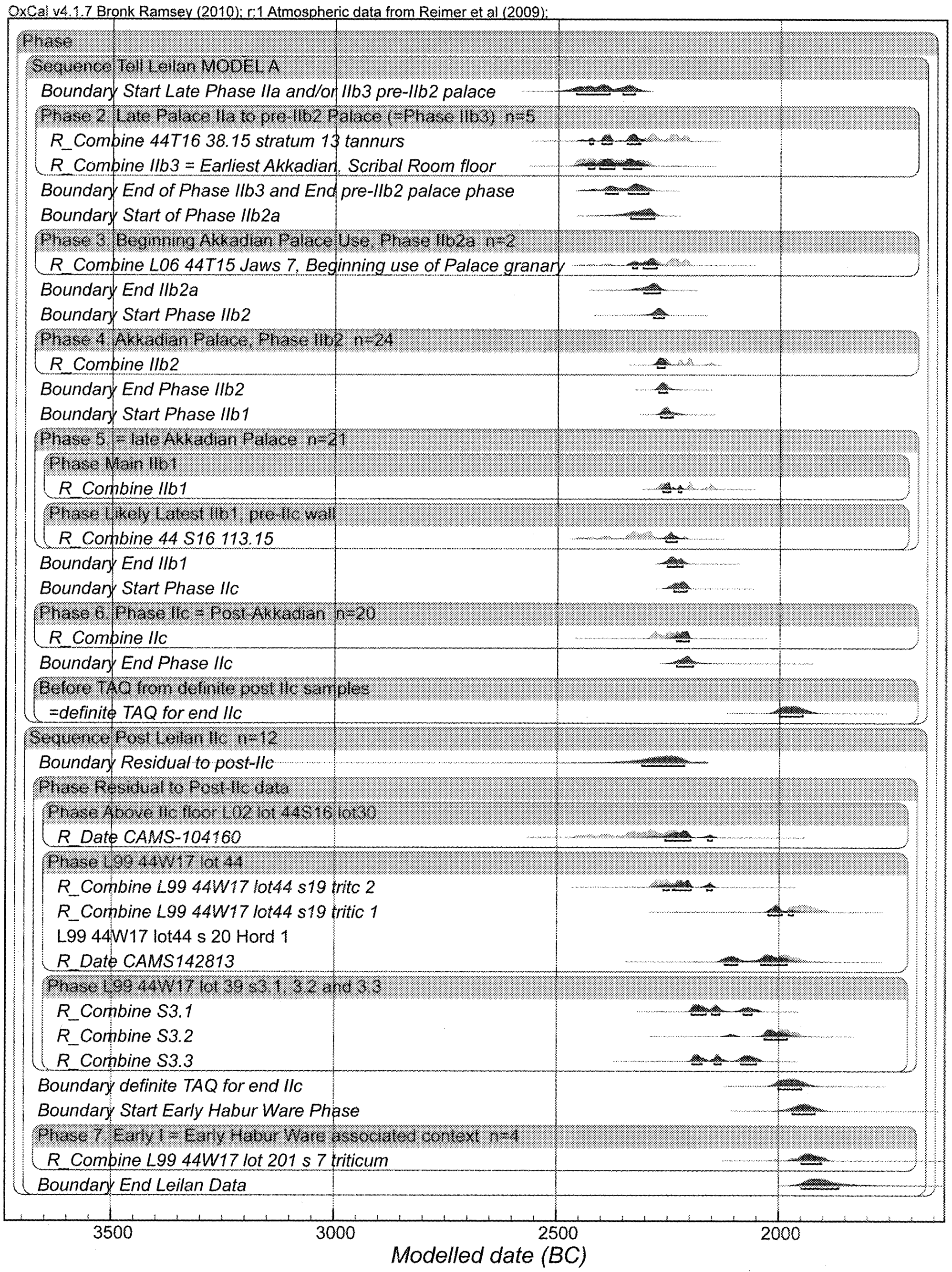

Figure 17: OxCal Model A, Sequence analysis for Tell Leilan Late Palace IIa to Early Khabur Ware.

The light grey distributions show the calibrated probability distributions in isolation (no model), and the solid distributions show the reduced probability distributions after applying the stratigraphically-based sequence analysis model (the lines under each distribution show the 68.2% probability ranges).

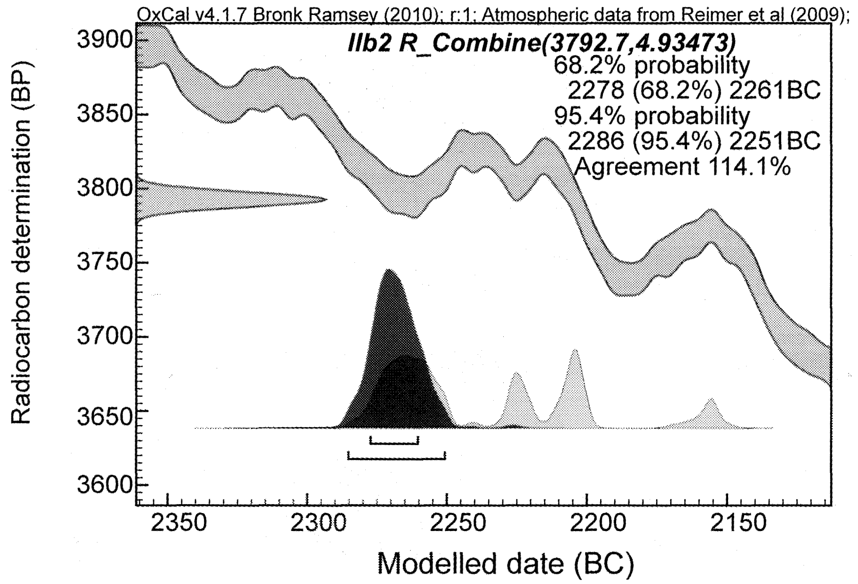

Figure 18: OxCal Model A, Tell Leilan period IIb2, outcome of sequence analysis.

The hollow distribution shows the calibrated probability distribution in isolation (no model), and the solid distribution shows the reduced probability after applying the sequence analysis (see Figure 17). The upper and lower lines under each distribution show the 68.2% and 95.4% calibrated ranges respectively. The OxCal agreement value compares the final (posterior) distribution against the non-modelled distribution. If the former is unaltered the index value is 100%. The value rises above 100% where the final distribution overlaps only with the very highest probability part of the prior distribution. In contrast, an agreement index below 60% indicates disagreement with the model (and insufficient overlap of the distributions) at about the 5% level of a chi-squared test.

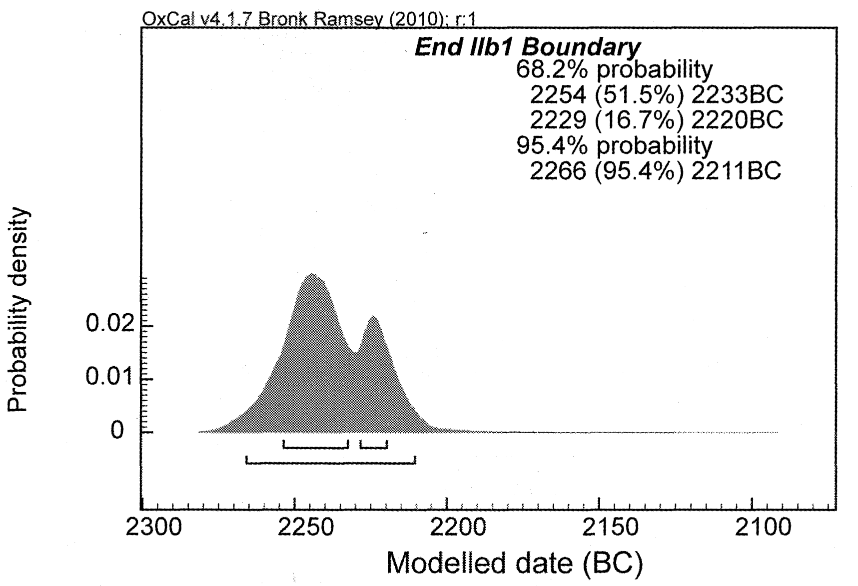

Figure 19: OxCal Model A, Tell Leilan end period IIb1 Boundary Detail (from Figure 17).

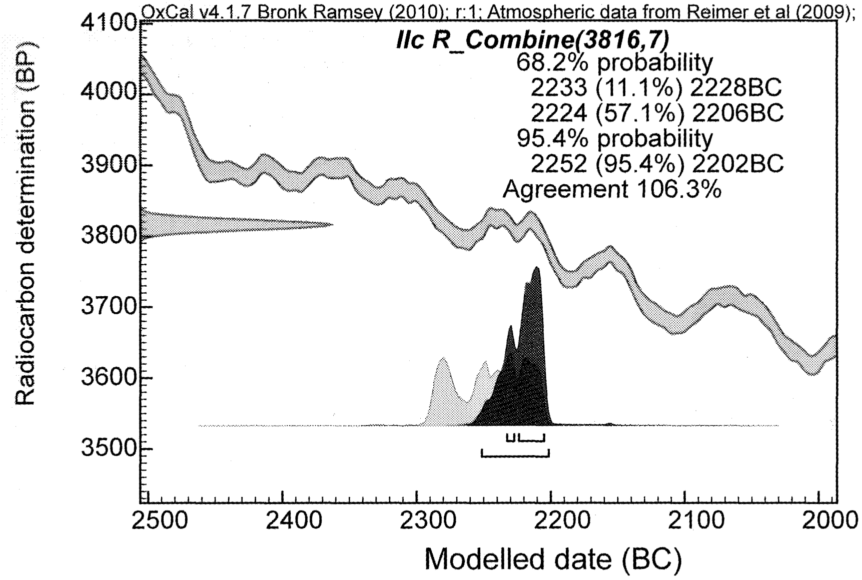

Figure 20: OxCal Model A, Tell Leilan period IIc. Otherwise see Figure 18 legend.

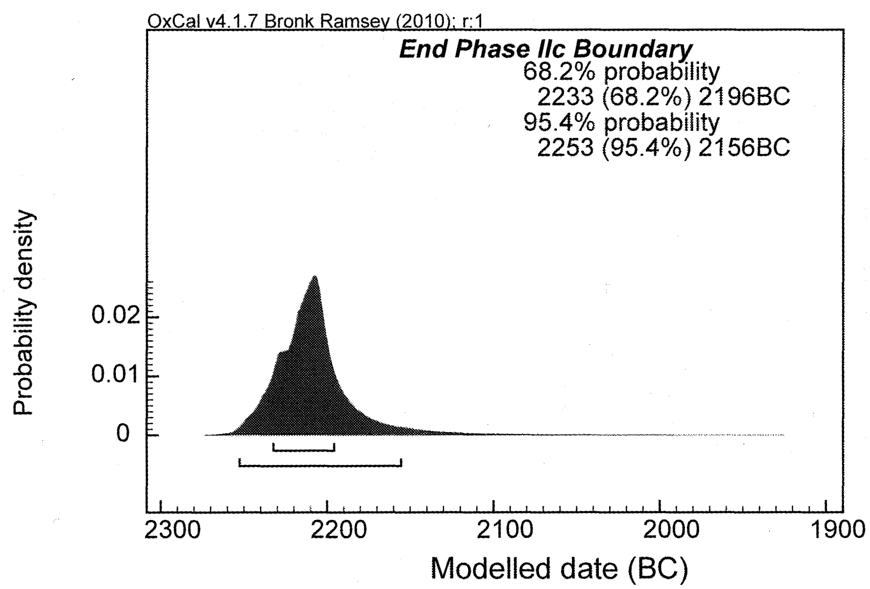

Figure 21: OxCal Model A, Tell Leilan End period IIc Boundary detail (from Figure 17).

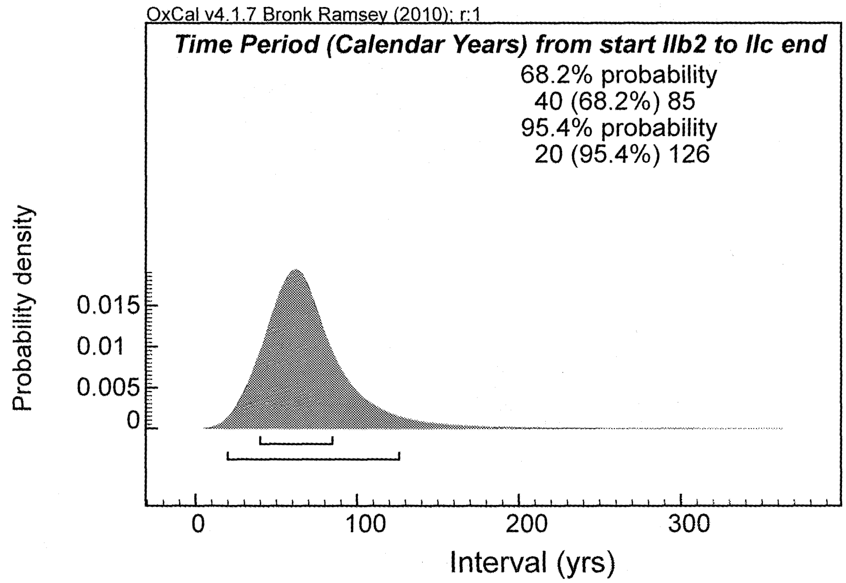

Figure 22: Calendar year interval from the start Phase IIb2 to the end Phase IIc Boundaries in Figure 17.

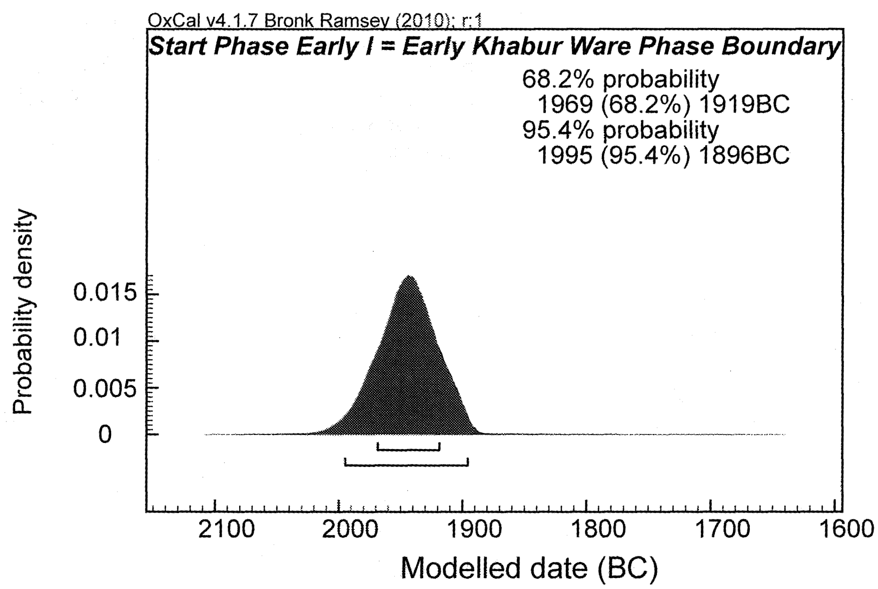

Figure 23: OxCal Model A, Tell Leilan Start Early Khabur Ware Period Boundary from Figure 17 shown in detail.

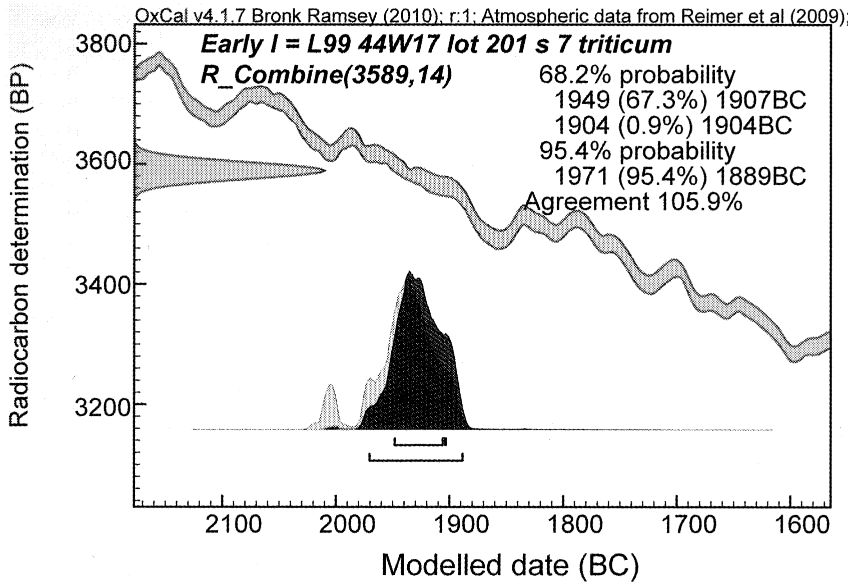

Figure 24: OxCal Model A, Tell Leilan Early Period I, L99 44W17 lot 201. Otherwise see Figure 18 caption.

CAMS ID	Sample ID and Locus	Material	Tell Leilan Phasing	δ13C*	14C age BP	SD	Model A	Model B
81861	L99 44W16 29#1 A	H. vulg.	IIc	-23	3810	25	A	B
81862	L99 44W16 29#1 B	H. vulg.	IIc	-23	3835	25	A	B
81863	L99 44W16 29 #2	H. vulg.	IIc	-23	3825	30	A	B
81864	L99 44W16 29 #3 A	H. vulg.	IIc	-23	3840	25	A	B
81865	L99 44W16 29 #3 B	H. vulg.	IIc	-23	3865	25	A	B
81866	L99 44W16 29 #4 A	H. vulg.	IIc	-23	3805	25	A	B
81867	L99 44W16 29 #4 B	H. vulg.	IIc	-23	3800	25	A	B
81868	L99 44W16 29 #5	H. vulg.	IIc	-23	3830	30	A	B
81869	Tell Leilan 44W13 15 #1	H. vulg.	IIa, Middle	-23	4075	25	A	B
81870	Tell Leilan 44W13 15 #2	H. vulg.	IIa, Middle	-23	4065	25	A	B
81871	Tell Leilan 44W13 15 #3	H. vulg.	IIa, Middle	-23	4070	25	A	B
81872	Tell Leilan 44W13 15 #4	H. vulg.	IIa, Middle	-23	4060	25	A	B
81873	Tell Leilan 44W 13 15 #5	H. vulg.	IIa, Middle	-23	4075	25	A	B
104154	L02 44S16 33 1 a	H. vulg.	IIc	-23	3815	30	A	B
104155	L02 44S16 33 1 b	H. vulg.	IIc	-23	3830	30	A	B
104156	L02 44S16 33 2 a	H. vulg.	IIc	-23	3805	30	A	B
104157	L02 44S16 33 2 b	H. vulg.	IIc	-23	3795	35	A	B
104158	L02 44S16 30 1 a	H. vulg.	post IIc or residual	-23	2810	30		
104159	L02 44S16 30 1 b	H. vulg.	post IIc or residual	-23	3990	30		
104160	L02 44S16 30 2	H. vulg.	post IIc or residual	-23	3875	30	A	B
104161	L02 44W16 415 1a	H. vulg.	IIb3 (pre-IIb2)	-23	3885	30	A	B
104162	L02 44W16 415 1b	H. vulg.	IIb3 (pre-IIb2)	-23	3880	25	A	B
130596	L06 44V15 200.3:5 Hvulg.1	H. vulg.	IIb2	-23.4	3770	25	A	B

CAMS ID	Sample ID and Locus	Material	Tell Leilan Phasing	δ13C*	14C age BP	SD	Model A	Model B
130597	L06 44V15 200.3:5 Hvulg.2	H. vulg.	IIb2	-23.4	3745	25	A	B
130598	L06 44V15 200.9 Hvulg.3	H. vulg.	IIb2	-23.4	3765	25	A	B
130599	L06 44V15 42.7 Hvulg.1	H. vulg.	IIb2	-22.7	3770	20	A	B
130600	L06 44V15 42.7 Hvulg.2	H. vulg.	IIb2	-22.7	3795	20	A	B
130601	L06 44V15 42.7 Hvulg.3	H. vulg.	IIb2	-22.7	3785	25	A	B
130602	L06 44V15 200.9 Hvulg.1	H. vulg.	IIb2	-23.7	3810	25	A	B
130603	L06 44V15 200.9 Hvulg.2	H. vulg.	IIb2	-23.7	3815	25	A	B
130604	L06 44V15 200.9 Hvulg.3	H. vulg.	IIb2	-23.7	3825	25	A	B
130605	L06 44T16 38.15 Hvulg.1	H. vulg.	IIa, Late to pre-IIb	-21.6	3815	25	A	B
130606	L06 44T16 38.15 Hvulg.2	H. vulg.	IIa, Late to pre-IIb	-21.6	3835	25	A	B
130607	L06 44T16 38.15 Hvulg.3	H. vulg.	IIa, Late to pre-IIb	-21.6	3855	25	A	B
130608	L06 44T15 21.30 H vulg.1	H. vulg.	IIb1	-21.6	3820	25	A	B
130609	L06 44T15 21.30 H vulg.2	H. vulg.	IIb1	-21.6	3830	20	A	B
130610	L06 44T15 21.30 H vulg.3	H. vulg.	IIb1	-21.6	3810	20	A	B
130611	L06 44T15 43.24 Aegilops.1	Aegilops	IIb2	-24.2	3820	25	A	B
130612	L06 44T15 43.24 Aegilops.2	Aegilops	IIb2	-24.2	3800	20	A	B
130613	L06 44T15 43.24 Aegilops.3	Aegilops	IIb2	-24.2	3815	20	A	B
130614	L06 44S16 108:16 Hvulg.1	H. vulg.	IIc	-23.2	3815	20	A	B
130615	L06 44S16 108:16 Hvulg.2	H. vulg.	IIc	-23.2	3800	20	A	B
130616	L06 44S16 108:16 Hvulg.3	H. vulg.	IIc	-23.2	3760	20	A	B
130617	L06 44S16 114:7 Trit spp.1	Trit. spp.	IIb2	-23.5	3840	20	A	B
130618	L06 44S16 114:7 Trit spp.2	Trit. spp.	IIb2	-23.5	3770	20	A	B
130619	L06 44S16 114:7 Trit spp.3	Trit. spp.	IIb2	-23.5	3790	20	A	B
130620	L06 44S16 209:10 Hvulg.1	H. vulg.	IIb2	-22.4	3760	20	A	B
130621	L06 44S16 209:10 Hvulg.2	H. vulg.	IIb2	-22.4	3800	25	A	B
130622	L06 44S16 209:10 Hvulg.3	H. vulg.	IIb2	-22.4	3825	25	A	B
130623	L06 44S16 206:16 Hvulg.1	H. vulg.	IIb1	-25.0	3825	25	A	B
130624	L06 44S16 206:16 Hvulg.2	H. vulg.	IIb1	-25.0	3790	25	A	B
130625	L06 44S16 206:16 Hvulg.3	H. vulg.	IIb1	-25.0	3775	25	A	B
130626	L06 44S16 210.4:13 Hvulg.1	H. vulg.	IIb1	-23.0	3795	30	A	B
130627	L06 44S16 210.4:13 Hvulg.2	H. vulg.	IIb1	-23.0	3835	25	A	B
130628	L06 44S16 210.4:13 Hvulg.3	H. vulg.	IIb1	-23.0	3805	30	A	B
130629	L06 44T16 100.19 Hvulg.1	H. vulg.	IIb2	-24.1	3835	25	A	B
130630	L06 44T16 100.19 Hvulg.2	H. vulg.	IIb2	-24.1	3850	25	A	B
130631	L06 44T15 Jaws 7 Hvulg.1	H. vulg.	IIb2a	-23.0	3820	25	A	B
130632	L06 44T15 Jaws 7 Hvulg.2	H. vulg.	IIb2a	-23.0	3850	25	A	B
130633	L06 44S16113.15 Aegilop sp	Aegilops	IIb1 Terminal	-24.1	3835	25	A	B
130634	L06 44S16 113.15 Hordeum sp	Hordeum sp.	IIb1 Terminal	-22.9	3885	25	A	
130635	L06 44S16 113.15 Trit	Trit. spp.	IIb1 Terminal	-21.7	3870	25	A	
130636	L06 44S16 113.15 Aeg glume	Aegilops	IIb1 Terminal	-25.5	3815	25	A	B
131476	L0644S16 108:16 H. vulg 4	H. vulg.	IIc	-23.187	3830	20	A	B
131477	L0644S16108:16 H. vulg 5	H. vulg.	IIc	-23.187	3815	20	A	B
131478	L0644S16114:7 Tritt spp. 4	Trit. spp.	IIb2	-23.538	3775	20	A	B
131479	L0644S16114:7 Trit spp. 5	Trit. spp.	IIb2	-23.538	3800	20	A	B
131480	L0644S16209:10 H. vulg 4	H. vulg.	IIb2	-22.378	3760	20	A	B
131481	L0644S16209:10 H. vulg 5	H. vulg.	IIb2	-22.378	3770	20	A	B
131482	L0644S16206:16 H. vulg 4	H. vulg.	IIb1	-24.991	3765	20	A	B

CAMS ID	Sample ID and Locus	Material	Tell Leilan Phasing	δ13C*	14C age BP	SD	Model A	Model B
131483	L0644S16206:16 H. vulg 5	H. vulg.	IIb1	-24.991	3745	20	A	B
134344	44S16 R3 105 1-2 Hord r1	Hordeum sp.	IIc	-23.2	3825	20	A	B
134345	44S16 R3 105 1-2 Hord r2	Hordeum sp.	IIc	-23.2	3830	20	A	B
134346	44S16 R3 105 1-2 Hord r3	Hordeum sp.	IIc	-23.2	3800	20	A	B
134347	44S15 13:89 mid dep Hord r1	Hordeum sp.	IIb1	-24.0	3785	25	A	B
134348	44S15 13:89 mid dep Hord r2	Hordeum sp.	IIb1	-24.0	3800	20	A	B
134349	44S15 13:89 mid dep Hord r3	Hordeum sp.	IIb1	-24.0	3820	20	A	B
134350	44S16 210 L1: 31 Hord r1	Hordeum sp.	IIb1	-23.9	3780	25	A	B
134351	44S16 210 L1: 31 Hord r2	Hordeum sp.	IIb1	-23.9	3740	20	A	B
134352	44S16 210 L1: 31 Hord r3	Hordeum sp.	IIb1	-23.9	3735	20	A	B
134353	L06 44T16 18:115 r1	H. vulg.	Not secure context	-23.4	3790	20		
134354	L06 44T16 18:115 r2	H. vulg.	Not secure context	-23.4	3845	20		
142773	L9944W17l39s3.1Hord 2	Hordeum sp.	post IIc or residual	-24.06	3770	25	A	B
142774	L9944W17lot39s3.2Hord1	Hordeum sp.	post IIc or residual	-23	3680	30	A	B
142775	L9944W17lot39s3.2Hord 2	Hordeum sp.	post IIc or residual	-22.83	3620	20	A	B
142776	L9944W17lot39s3.3Aeg1	Aegilops	post IIc or residual	-23	3700	20	A	
142811	L99 44W17 lot44 s19 tritic 1	Trit. spp.	post IIc or residual	-23	3605	25	A	B
142812	L99 44W17 lot44 s19tritic 2	Trit. spp.	post IIc or residual	-23.17	3810	20	A	B
142813	L99 44W17 lot44 s 20 Hord 1	Hordeum sp.	post IIc or residual	-23	3650	30	A	
142814	L99 44W17 lot 201 s 7 Hord	Hordeum sp.	Early Habur Ware Contexts	-23.49	3600	20	A	B
142815	L99 44W17 lot 201 s 7 triticum	Trit. spp.	Early Habur Ware Contexts	-23	3555	25	A	B
143995	L99 44W17 lot 201 s 7 Hord rep	Hordeum sp.	Early Habur Ware Contexts	-23	3615	30	A	B
143996	L99 44W17 lot 201 s 7 triti-cum rep	Trit. spp.	Early Habur Ware Contexts	-23	3590	30	A	B
143997	L9944W17lot39s3.3Hord1	Hordeum sp.	post IIc or residual	-23	3770	25	A	
143998	L99 44W17 lot44 s19tritic 2 rep	Trit. spp.	post IIc or residual	-23	3785	30	A	B
143999	L99 44W17 lot44 s19 tritic 1 rep	Trit. spp.	post IIc or residual	-23	3590	30	A	B
144000	L9944W17l39s3.1Hord1	Hordeum sp.	post IIc or residual	-23	3610	25		
144001	L99 44W17 39s3.1 trit	Trit. spp.	post IIc or residual	-24	3705	25	A	B
144002	L99 44W17lot39 s3.3.2 Aeg	Aegilops	post IIc or residual	-23	3940	25		
* Note where a δ^{13}C value is given with decimal place the values were measured for the sample; where no decimal is given then an assumed value of -23 ± 1 was employed.							n=93 (of 99)	n=88 (of 99)

Figure 25: List of Tell Leilan radiocarbon dates, Middle period IIa through Early period I.

Date of the Akkadian Collapse

The Akkadian razing and leveling of the Period IIa Palace walls was followed in early period IIb2, 2333-2238 BC (68.2%), by the construction and first use of the Akkadian Administrative Building. The building was used probably for ca. 70 years, and then abandoned, along with The Unfinished Building across the street, at the end of period IIb1, 2254-2220 BC (68.2%).

The stratigraphic and ceramic assemblage data suggest this Leilan end period IIb1 date is the date for the end of the Akkadian occupation of the Tell Leilan Acropolis and the Akkadian Lower Town (CG, Op 4, LTS, Op 7, Op 8), and the end date for the Akkadian ceramic assemblage sites in the 1650-square kilometer Leilan Region Survey (Ristvet, this volume: 241). Regional stratigraphy and ceramic assemblage typologies also suggest this date for the abandonment of Mohammed Diyab XIa, Tell Brak FS_3, Naram-Sin Palace and Akkadian Lower Town, the unexcavated Chagar Bazar Akkadian town, Arbid period VII houses, Barri level 36, Tell Mozan Palace 2 and Lower Town, and the Hamoukar period 3 settlement.

The epigraphic dating possibilities for the decadal Akkadian regnal spans still extend across more than 100 years (Sallaberger 2011) and are, therefore, not useful chronological categories for the date of the Akkadian collapse even if assignable to one monarch's reign. Additionally, the southern Mesopotamian cuneiform data for Naram-Sin and Šar-kali-šarri provide scant evidence for the Akkadian occupation of the Khabur Plains, none for its archaeologically well-documented abandonment, and meager data for the southern Akkadian collapse (Glassner 1986). At this time, therefore, the end of Leilan IIb1, 2254-2220 BC (68.2%), is a useful date for the Akkadian and indigenous population abandonment of the Khabur Plains, and for the Akkadian collapse.

<u>Post-Akkadian Settlement</u>. Small post-Akkadian populations reinhabited briefly Leilan IIc (Quenet and Ristvet, this volume: 193), Mohammed Diyab XIb-c (Nicolle 2006), the Leilan Region Survey (Arrivabeni, this volume: 261), Brak FS2-FS1 and the TC Pisé Building (Colantoni, this volume: 45; Emberling et al., this volume: 65), Chagar Bazar Batiment 1 (Tunça, McMahon, Baghdo, eds. 2007; McMahon, this volume: 25), and Mozan Houses 4 (Buccellati and Bucccellati 2000) in the period immediately after the Akkadian collapse. The ceramic assemblages of these occupations are similar, and comprise the EJZ 4c compilation (Rova 2011). None of these resembles the Mozan C7-5 / EJZ 5 ceramic assemblage that follows the Mozan Palace 2 abandonment, erosion, and houses 4 (Schmidt 2011).

The Leilan radiocarbon chronology, modeled and constrained by termini post- and antequem, defines the end of period IIc occupation at approximately 2233-2196 BC (68.2%). The radiocarbon dates from some flotation-retrieved samples now available from Brak (Emberling et al, this volume: 65) and Arbid (Kolinski, this volume: 109) suggest that the post-Akkadian remnants survived only a few decades there as well. Among the sites that have been excavation sampled and surveyed, only the reduced-size town at Mozan/Urkesh, as documented earlier epigraphically (Weiss et al 1993: 1009), and briefly the Barri stratum 35 kiln area (Orsi, this volume: 89), were occupied between 2200-1900 BC.

In this regard, and others, the post-collapse remnant situation on the Khabur Plains is similar to the abrupt megadrought – collapse – abandonment episodes documented for the Anasazi (Axelrod 2010), Teotihuacan (Lachniet et al 2012), Maya (Medina and Rohling

2012), Tiwanaku (Kolata et al 2000; Dillehay and Kolata 2004) and Angkor Wat (Buckley et al 2010). Regional abandonment and habitat-tracking are common features in each case, and, for the Maya Collapse we similarly observe the abrupt site abandonments evident at the unfinished Mayan temples, pyramids, and their adjacent stone piles at Aguateca, Ixtun, La Milpa, and Caracol (Houston and Imata 2009).

4.2 – 3.9 kaBP synchronism

North Atlantic cyclogenesis drives the humid westerlies across the Mediterranean trough and thereby delivers seasonal precipitation to west Asia. One of the several major abrupt Holocene anomalies within this process occurred at 4.2–3.9 ka BP as documented across the Mediterranean, from Spain to Albania, and across west Asia (Weiss, this volume: 1). Characteristics of the event's records include ca. 20-50% precipitation reductions, aeolian deflation quantifiable as dust spikes, deforestation, and colder temperatures (Weiss 2012). In west Asia, the anomaly is documented across Israel (Bar-Matthews 1999; Frumkin 2009), the Red Sea (Arz et al 2006; Edelman-Furstenberg, Almogi-Labin, Hemleben 2009), Turkey (e.g., Gökturk 2011; Kuzucuoğlu et al 2011; Lemcke and Sturm 1997), Iran (Djamali et al 2009; Leroy 2007), UAE (Parker et al 2006), and the Gulf of Oman (Cullen et al 2000), but is absent from the ITCZ-affected Yemen (Fleitmann 2007).

Synchronous disruption of the Indian Monsoon is documented across the Ethiopian and Somali highland lake sources (Lamb et al 2000; Stanley et al 2003; Bernhardt, Horton, Stanley 2012; Marshall et al 2012) for the Nile, adjacent east African lakes (Gasse 2000), and the Indian sub-continent (Berkelhammer et al 2012). At Mt. Kilimanjaro this "Middle Holocene Dust Event" is linked with Huascaran cores (Davis and Thompson 2010), and Lago Umayo aridification (Baker et al 2009) near Lake Titicaca. The aridification event was also experienced in central equatorial Africa (Marret, Maley, Scourse 2006), and as a major dust event at Lake Goa, Chad (Kröpelin et al 2008) whence it extended across the Mediterranean to Tuscany (Magri and Parra 2002) and across west Asia to Tibet (Gasse and van Campo 1994) and Mongolia (Wen et al 2010; Zhai et al 2011), synchronous with anomalous conditions across China (Schettler et al 2006; Liu and Feng 2012).

<u>Date of the 4.2 ka BP event.</u> After the Shaban Deep, Red Sea 15-year sampling intervals (Arz et al 2006), the highest resolution analysis for the 4.2-3.9 ka BP event is the 6-year speleothem sampling intervals at Mawmluh Cave, NE India (Berkelhammer et al 2012) and the 10-year sampling intervals at Mt. Logan, Yukon (Fisher 2011). The last are the Pacific extension of the North American 4.2 ka BP event proxy trail that extends from the Atlantic (Li, Yu, Kodama 2007) to the Pacific (Zhang and Hebda 2005; Menounos et al 2008). A multi-proxy stack (Figure 26) illustrates the variable dating qualities of several Mediterranean westerlies proxies alongside Mawmluh Cave and Mt. Logan, and characteristic low- to high-resolution datings. Linear interpolation, age-depth models, have been a characteristic of low-resolution datings, but the event's global distribution and significance has attracted such attention that higher resolution lake and speleothem core dating is now a research priority (Magny et al 2007; Magny et al 2011; Zanchetta et al 2012; Walker et al 2012).

The date of the Akkadian collapse on the Khabur Plains is illustrated with the vertical grey bar for the Leilan end IIb1 - end IIc, 2266-2156 BC (95.4%) at BP 1950 and radiometric datings of paleoclimate proxies illustrated with 2-standard deviations (Figure 26). The coinci-

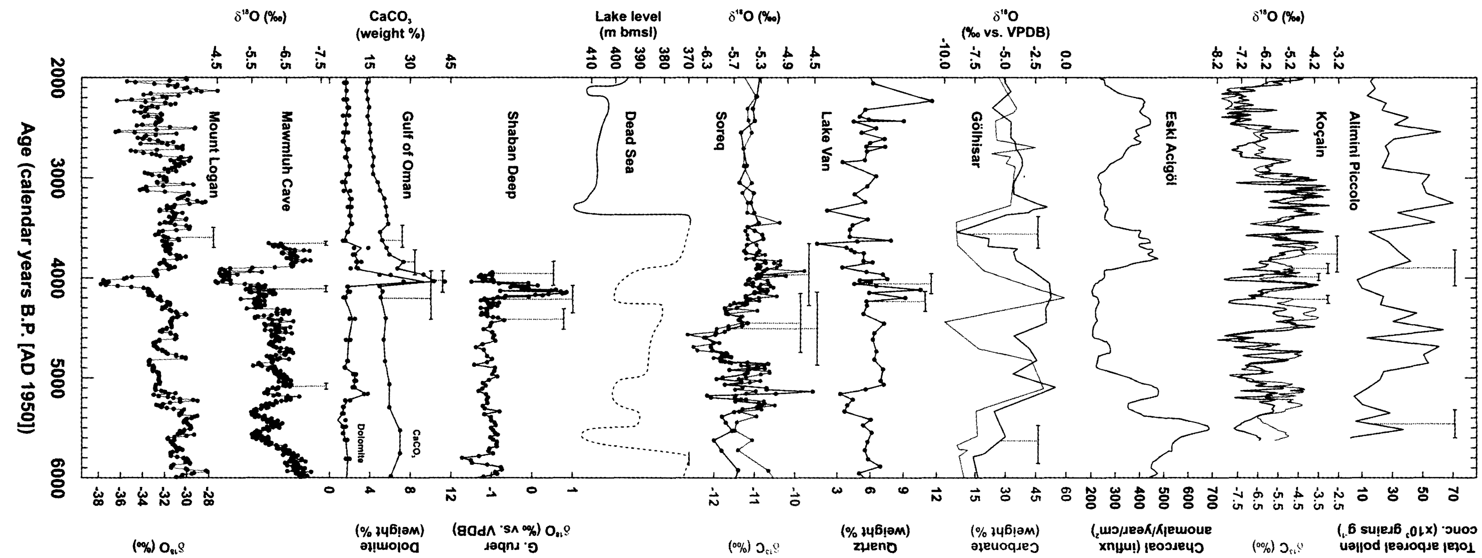

Figure 26: Multi-proxy stack, illustrating varieties of chronological resolution for 4.2 – 3.9 kaBP event, with two-standard deviations radiometric dating.

Vertical grey bar is Leilan end IIb1 – end IIc, 2266-2156 BC (95.4%) at BP 1950. Lago Alimini Piccolo, Apulia, Italy (DiRita and Magri 2009) lake core pollen indicates natural deforestation event constrained by radiocarbon dates on bulk sediment samples. Due to the influence of marine water on the younger sample, a mixed marine/atmospheric calibration was applied to that sample using a regional δR correction value of 118 ± 60 years. Koçain, Antalya, Turkey (Gokturk 2011), speleothem isotopes indicate precipitation decrease constrained within high-resolution U/Th dates. Eski Açigol (Roberts et al 2001; Turner et al 2008) oak decline and lake core charcoal spike, described as anthropogenic, has no radiocarbon constraints over period covered by this figure. Gölhisar lake core carbonate spike and δ ^{18}O plateau has two conventional (i.e. non-AMS) radiocarbon dates on bulk sediment samples two-thousand years apart (Roberts et al 2008: 2432). Lake Van, northeast Turkey (Lemcke and Sturm 1997) quartz spike, dated by varve counts linked to the modern sediment/water interface, is considered a proxy for aridification-generated dust. Two varves counts were made, and have mean deviations of ca. 2.6% illustrated by the error bars here. Soreq Cave, Israel (Bar-Matthews et al 1997) speleothem isotope values indicate gradual aridification with final δ ^{13}C spike. Samples are at ca. 20 year intervals, with interpolation from three U/Th dates. Dead Sea, Israel/Jordan (Migowski et al 2006) 45-meter lake-level drop is estimated for this period; the Mt. Sedom diapir *Tamarix* stem provides dense isotope sampling, with an estimated 50% precipitation drop, and radiocarbon dating for the interval (Frumkin 2009). Shaban Deep, Red Sea (Arz et al 2006), core has 15-year sampling intervals constrained by high-resolution radiocarbon dates on monospecific assemblages of *G. sacculifer*. A marine reservoir correction factor of 180-years was used during calibration (cf. Edelman-Furstenberg, Almogi-Labin, Hemleben 2009). A similar event is recorded by Gulf of Oman marine core aeolian dust proxies that are constrained by radiocarbon dates and Leilan Lower Town South-linked tephrochronostratigraphy (Cullen et al 2000). The radiocarbon dates were derived from monospecific *G. sacculifer* assemblages, and a 560-year marine reservoir correction factor was used during calibration. The Mawmluh Cave, India) speleothem (Berkelhammer et al 2012) has ca. 6 year sampling intervals constrained by high-resolution U/Th dates. Mt. Logan, Yukon, Canada glacial core (Fisher 2011), the Pacific expression of 4.2 kaBP event across ca. 10 year sampling intervals, is synchronous with eastern hemisphere records. Age control is provided by tephra cross-dating with the Greenland GRIP ice core record.

dence of the west Asian dry-farming collapse and the onset of the 4.2 – 3.9 kaBP event occurs at the tightly constrained Koçain Cave, Lake Van, Shaban Deep, Gulf of Oman, Mawmluh Cave and Mt. Logan records, and at the more than fifty Mediterranean and west Asian paleoclimate proxy sites not illustrated here. The abrupt 20-50% precipitation reduction across 250-300 years forced, very probably, the adaptive dry-farming Khabur Plains abandonment that is now documented archaeologically and dated with high-resolution.

Acknowledgments

Support for Tell Leilan research was provided by the National Endowment for the Humanities, National Science Foundation, Leon Levy Foundation, Raymond and Beverly Sackler Foundation, Malcolm and Carolyn Wiener Foundation, Barbara Clay Debevoise, Roger and Barbara Brown, and Yale University. The Directorate-General of Antiquities and Museums, Damascus, especially the late Adnan Bounni, Bassam Jamous, Michel al-Maqdissi, Salam al-Kuntar, Maryam Bshesh, Nada Qat, Mohammed Muslim, and Mohammed Fakhro, graciously offered the administrative and field support for Tell Leilan excavations and regional survey.

The Tell Leilan radiocarbon dating program was augmented with additional L99 44W17 paleobotanical samples provided by Dominique deMoulins (University College London), while Rafał Koliński (Poznan University) and Geoff Emberling (University of Michigan) swiftly accessed paleobotanical samples from their excavations for comparable radiocarbon dating. Dominik Fleitmann (University of Bern) and Miriam Bar-Matthews (Geological Survey of Israel) offered unpublished data from their speleothem researches at Koçain Cave and Soreq Cave. Piotr Steinkeller (Harvard University) identified the tablet fragment L06-300, and Marc van de Mieroop (Columbia University) read the inscription on sealing L93-66. Cristiano Putzolu and Stace Maples provided their essential total station and cartographic expertise at all hours. Anwar abd al-Ghafour, Giovanni Bertolani, Eric vanden Brink, Heidi Cullen, Francesca deLillis-Forrest, the late Ambassador William Eagleton, Charles Forrest, Ulla Kasten, Justin Kosslyn, Torben Larsen, Paul Lawrence, Richard Meadow, Mouhayeddin Osman, Ajita Patel, Elena Rova, Miranda Semple, and Wilma Wetterstrom have each made unique contributions to this research project. The late Azziz Zerovar, friend and mentor, and many friends at Qahtaniyeh, Tell Leilan, and Tell Barham, assisted this project in ways too numerous to mention.

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