THE LATE THIRD MILLENNIUM IN THE ANCIENT NEAR EAST
THE LATE THIRD MILLENIUM IN THE ANCIENT NEAR EAST
CHRONOLOGY, C14, AND CLIMATE CHANGE

edited by

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Chronology, C14, and Climate Change

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Table of Contents

Preface ................................................................. vii
List of Abbreviations ................................................ ix
Seminar Participants ............................................... x

INTRODUCTION
1. The Late Third Millennium B.C. in the Ancient Near East and Eastern
Mediterranean: A Time of Collapse and Transformation ...................... 1
   Felix Höflmayer, Austrian Academy of Sciences

PART I: LEVANT
2. No Collapse: Transmutations of Early Bronze Age Urbanism in the
   Southern Levant .................................................. 31
   Raphael Greenberg, Tel Aviv University
3. Economic and Political Implications of Raising the Date for the Disappearance
   of Walled Towns in the Early Bronze Age Southern Levant ................. 59
   J. David Schloen, University of Chicago
4. The Transition from the Third to the Second Millennium B.C. in the
   Coastal Plain of Lebanon: Continuity or Break? ............................. 73
   Hermann Genz, American University of Beirut
5. Western Syria and the Third- to Second-Millennium B.C. Transition .......... 87
   Glenn M. Schwartz, Johns Hopkins University

PART II: MESOPOTAMIA
6. “Seventeen Kings Who Lived in Tents” .................................... 131
   Harvey Weiss, Yale University
7. Ḫabur Ware and Social Continuity: The Chronology of the Early to
   Middle Bronze Age Transition in the Syrian Jezireh ......................... 163
   Peter Pfälzner, University of Tübingen
   of the Cuneiform Evidence Concerning Climatic Change and the
   Early/Middle Bronze Age Transition .................................. 205
   Aron Dornauer, Albert Ludwig University of Freiburg
9. Regional Environments and Human Perception: The Two Most Important
   Variables in Adaptation to Climate Change ................................ 237
   Simone Riehl, Senckenberg Nature Research Society
10. Amorites, Climate Change, and the Negotiation of Identity at the End
    of the Third Millennium B.C. ........................................ 261
    Aaron A. Burke, University of California, Los Angeles

PART III: EGYPT
    The First Intermediate Period from an Epistemological Perspective .... 311
    Thomas Schneider, University of British Columbia
12. Absolutely Dating Climatic Evidence and the Decline of Old Kingdom Egypt. ......... 323  
   Michael W. Dee, University of Oxford

13. The Significance of Foreign Toponyms and Ethnonyms in Old Kingdom Text Sources .............................................................. 333  
   Roman Gundacker, Austrian Academy of Sciences

PART IV: EASTERN MEDITERRANEAN

   Bernhard Weninger, University of Cologne, and Donald Easton, London

15. Comments on Climate, Intra-regional Variations, Chronology, the 2200 B.C. Horizon of Change in the East Mediterranean Region, and Socio-political Change on Crete. ........................................................... 451  
   Sturt W. Manning, Cornell University

PART V: RESPONSE

16. Egypt and the Levant in the Early to Middle Bronze Age Transition ............... 493  
   Matthew J. Adams, W. F. Albright Institute of Archaeological Research
“The formula of the Naturalistic narrative is simple; it is one-way traffic: the description determines the action.” (Ibisch 1982, p. 102)

The 4.2–3.9 ka B.P. Abrupt Climate Change Event

Annual precipitation in the Mediterranean and west Asia is guided by the North Atlantic Oscillation (Kushnir and Stein 2010; Cullen et al. 2002) and delivered by the Mediterranean westerlies that pass through the Mediterranean trough to west Asia (Lionello, Malanotte-Rizzoli, and Boscolo 2013). Century-scale megadrought interruptions of the westerlies, at unexplained millennial periodicities — 8.2, 5.2, 4.2, 3.2 ka B.P. — reduced cultivable dry-farming areas in the eastern Mediterranean and west Asia and forced adaptive social responses among varied polities, economies, and agricultural regimes. During the 4.2–3.9 ka B.P. (ca. 2200–1900 B.C.) megadrought, which reduced precipitation in west Asia 30–50 percent, these adaptations — political collapse and regional desertion, habitat tracking, nomadization — are evident archaeologically and epigraphically (Weiss 2014; Weiss 2015). Many social-process details within these transitions, however, remain obscured by absent or low-resolution archaeological and epigraphic data, the targets for a new generation of researchers.

The frame of the 4.2 ka B.P. event’s North Atlantic chronology and magnitude is now available within the records of Icelandic lakes (Geirsdóttir et al. 2013) and the sequence of North Atlantic Oscillation anomalies (Olsen, Anderson, and Knudsen 2012). The high-resolution chronological boundaries of these records are reflected in the synchronous Mediterranean westerlies paleoclimate proxies that are distributed across seven regions:

Coastal Spain, France, and North Africa

Doñana National Park (Jiménez-Moreno et al. 2015), Sierra de Gador (Carrión et al. 2003), Cova da Arcola (Railsback et al. 2011), Borreguiles de la Virgen (Jiménez-Moreno and Anderson 2012), Lake Montcortès (Scussolini et al. 2011), Puerto de Mazzarón (Navarro-Hervás et al. 2014), Cueva de Asiul (Smith et al. 2016), Lake Estanya (Morellón et al. 2009), Ojo Guraena Karst Complex (Cruz et al. 2015), Lac Petit (Brisset et al. 2013), Lake Sidi Ali (Zielhofer 2017), Gueldaman Cave (Ruan et al. 2015).
Central Mediterranean Italian Lakes


Greece and Albania


Levant and Red Sea

Acre (Kaniewski et al. 2014), Tweini (Kaniewski et al. 2008), Dead Sea (Migowski et al. 2006), Zeelim, Dead Sea (Langgut et al. 2014), Sedom, Dead Sea (Frumkin 2009), Soreq Cave (Bar-Matthews and Ayalon 2011), Shaban Deep (Arz, Lamy, and Pätzold 2006), central Red Sea (Edelman-Furstenberg, Almogi-Labin, and Hemleben 2009), Lake Hula (Baruch and Bottema 1999), Lake Tiberias (Finkelstein and Langgut 2014), Jeita Cave (Cheng et al. 2015; Verheyden et al. 2008), Tell Sukas (Sorrel and Mathis 2016).

Anatolia

Konya lakes (Roberts et al. 1999; Leng et al. 1999; Reed, Roberts, and Leng 1999), Göl Hissar Gölü (Eastwood et al. 1999; Eastwood et al. 2007; Leng et al. 2010), Eski Açığöl (Roberts et al. 2001), Koçain Cave (Göktürk 2011), Abant Gölü (Bottema 1997), Yeniçağa Gölü (Bottema 1997), Söğütlu Marsh (Bottema 1997), Lake İznik (Ülgen et al. 2012), Yenişehir (Bottema, Woldring, and Kayan 2001), Arslan Tepe (Masi et al. 2013), Göbekli (Pustovoytov, Schmidt, and Taubald 2007), Lake Van (Lemcke and Sturm 1997; Wick, Lemcke, and Sturm 2003), Lake Tecer (Kuzucuoğlu et al. 2011), Nar Lake (Dean et al. 2015), Sofular (Göktürk et al. 2011; Fleitmann et al. 2009; Jones, Fleitmann, and Black 2016).

Persian Gulf

Gulf of Oman (Cullen et al. 2000), Awafi (Parker et al. 2006; Parker and Goudie 2008), Qunf Cave (Fleitmann et al. 2003).

Black Sea, Caspian Sea, Iranian Plateau

Lake Zeribar (Stevens, Wright, and Ito 2001), Lake Mirabad (Stevens et al. 2006; Schmidt et al. 2011), Lake Maharlu (Djamali et al. 2009), Black Sea (Cordova and Lehman 2005), Caspian Sea (Leroy et al. 2007; Leroy et al. 2014), Iranian plateau (Carolin et al. 2016).
Significant as well are the synchronous African and Indus proxy records that measure Nile flow and Indus precipitation, functions of the Indian summer monsoon as it passes across the Arabian Sea between the subcontinent and the Horn of Africa. The 4.2 ka B.P. event not only disrupted the Indian summer monsoon (Berkelhammer et al. 2012; Dixit, Hoddell, and Petrie 2014), northeast African precipitation (Marshall et al. 2011; Revel et al. 2014), and consequent Nile flow (Hassan and Tassie 2006), but also Saharan precipitation, as at Lakes Yoa (Kröpelin et al. 2008; Lamb et al. 2000) and Jikariya (Wang et al. 2008), where the aridification and dust event created the likely sources of African dust in Tuscany (Magri and Parra 2002). From Lakes Yoa and Jikariya, the westernmost proxy evidence for the event in central Africa is the Gulf of Guinea (Weldeab et al. 2005). In southern Africa the event is documented to the 30° latitude (Chase et al. 2010; Schefuss et al. 2011).

Some proxy data suffer from lengthy sampling intervals that preclude observation of century-scale events or source events — for example, Jeita Cave (Verheyden et al. 2008; Cheng et al. 2016) and Tell Sukas (Sorrel and Mathis 2016) with poor dating, confusion of wild and domesticated Olea, and misassignment of Olea, a component of dry-shrub steppe. So, too, some proxies are situated in regions where the Intertropical Convergence Zone or Black Sea orography may obscure signal clarity (Fleitmann et al. 2003; Jones, Fleitmann, and Black 2016), and some anomalies, such as Lake Bosumtwi, occur without obvious explanation but are surrounded by other robust proxies. The cumulative evidence now, however, revises prior uncertainties (Finné et al. 2011), including those from low-resolution Anatolian lake dating (e.g., Roberts et al. 2011), and indicates the event’s synchronicity across the Mediterranean (fig. 6.1) (Zanchetta et al. 2012; Zanchetta et al. 2016; Carozza et al. 2015).

The range of temporal resolution of the proxy excursions at 4.2–3.9 ka B.P. is provided by linear interpolation across uranium/thorium- (U/Th) or radiocarbon- (14C) dated points for measured quantities of stable isotopes, arboreal and other

Figure 6.1. Multi-proxy stack, Mediterranean westerlies, illustrating varied temporal resolution for 4.23.9 ka B.P. abrupt climate change event (Weiss et al. 2012; Walker et al. 2012). The Mount Logan, Yukon, glacial core and the Mawmluh Cave, India, speleothem are high-resolution examples of the global distribution of synchronous paleoclimate proxies that document the megadrought (Harvey Weiss and Mark Besonen)
pollen, diatoms, carbonates, lake levels, magnetic susceptibility, or other climate proxies. The Mediterranean westerlies multi-proxy stack (Weiss et al. 2012; Weiss 2015) illustrates the ranges of chronological resolution with two-standard deviations around 4.2–3.9 ka B.P. and, as well, the coincident 4.2 ka B.P. event high-resolution chronologies at Mawmluh Cave, India (Berkelhammer et al. 2012), and Mount Logan, Yukon (Fisher 2011), which illustrate global synchronicity already suggested (Walker et al. 2012) and increasingly well documented (Weiss 2015; Weiss 2016).

At Lac Petit, France, an abrupt detrital pulse triggered by more intense or more frequent rainfall in Alpine regions (Magny et al. 2013) marks a major shift in diatom assemblages framed around 4300–4100 B.C. by radiocarbon dates (Brisset et al. 2013). The Koçain Cave, Turkey, speleothem (Göktürk 2011) provides high-resolution U/Th dates that constrain abrupt decreases and increases of δ¹⁸O. The Eski Açıgöl, Turkey, lake core (Roberts et al. 2001) has no radiocarbon dates during a decline in lake-core charcoal interpreted as anthropogenic deforestation (Turner, Roberts, and Jones 2008), while the Göl Hissar, Turkey, lake core (Eastwood et al. 2007) carbonate spike and rise in δ¹⁸O are framed by radiocarbon dates 2,000 years apart. The Lake Van, Turkey, core (Lemcke and Sturm 1997) displays a quartz spike understood as a dust proxy dated by varve counts with slight errors (see Kuzucuoğlu et al. 2011). The dense sampling intervals for the Soreq Cave, Israel, speleothem δ¹⁸O and δ¹³C values are linked to U/Th dates (Bar-Matthews and Ayalon 2011), but with large standard deviations that provide a labile chronology. The Dead Sea (Migowski et al. 2006; Kagan et al. 2015) lake levels are estimated to have dropped 45 meters (see Frumkin 2009) during this period. At the Red Sea Shaban deep core (Arz, Lamy, and Pätzold 2006) fifteen-year diatom sampling intervals are constrained by high-resolution radiocarbon dates with a marine reservoir correction (see Edelman-Furstenberg, Almogi-Leben, and Hemleben 2009).

The Gulf of Oman marine core (Cullen et al. 2000) has dolomite and calcium carbonate (dust) spikes framed by radiocarbon dates and is tephra-linked to Tell Leilan chronostatigraphy (Weiss et al. 1993). The Mawmluh Cave, India, speleothem (Berkelhammer et al. 2012) provides six-year δ¹⁸O sampling intervals constrained with U/Th dates and links the Nile flow reductions (see Hassan and Tassie 2006), east African lake level reductions (see Gasse 2000), and the Indian summer monsoon deflection (see Dixit, Hodell, and Petrie 2014). The Mount Logan, Yukon, glacial core (Fisher 2011) is cross-dated with the NorthGRIP-core and exemplifies the event’s North American expression (e.g., annual resolution Great Basin tree rings; Salzer et al. 2014), second in magnitude to the 8.2 ka B.P. event. These dates correspond to other recent Mediterranean core dates, such as at Lake Shkodra (Zanchetta et al. 2012; Mazzini et al. 2015; Sadori et al. 2013; Sadori et al. 2014), Lake Accessa (Magny et al. 2009; Zanchetta et al. 2012), and Acre (Kaniewski et al. 2014), that is, about 4.2–3.9 ka B.P. (Zanchetta et al. 2016).

Akkadian Imperialization

The adaptive abandonment of dry-farming plains across west Asia and habitat tracking to sustainable riparian, plaudal, and karstic refugia were synchronous social responses at the 4.2 ka B.P. onset, alongside the likely, if problematic, nomadization of formerly sedentary populations (Alizadeh 2009). At this moment, the most intensively studied locus for the social effects of the 4.2–3.9 ka B.P. megadrought in west Asia is the Khabur plains of northeastern
Syria that were then under about 100 years of Akkadian imperialization, as determined from the Tell Leilan Acropolis radiocarbon-dated occupational sequence (Weiss et al. 2012).

Imperial Akkadian production and distribution in both southern and northern Mesopotamia were controlled by local palaces and the imperial šabra officials, acting as the bridges between imperial Akkad and its imperialized domains (Brumfield 2013). The documentation for the extraction of provincial surplus production, reprised often by modern epigraphers, included animals, oils, finished products, and grain, the latter usually measured in Akkadian imperial gur (Powell 1987–1990; Glassner 1986). In central Mesopotamia, these Akkadian extractions are documented at Ešnunna, Awal, Gasur, and Aššur (Brumfield 2013; Visicato 1999) (fig. 6.2).

To the limits of efficient transport, apparently, the extractive success was unconstrained. The extortion of land and estates from local southern rulers; the murder of thousands of insurgents (e.g., the Rimush incident); the conquest and rebuild of distant cities like Mari, Leilan/Shekhn̄a, Brak/Nagar, Nurrugum, and Ninua; crushing military defeat of “The Great Rebellion” and the deification of Naram-Sin suggest large Akkadian military forces and effective intimidation and terror.

The Akkadian extractions are certain, but their conveyance remains unclear. For example, how were imperial revenues collected and then delivered from Gasur/Yorgan Tepe to Akkad? Were the revenues collected at Aššur disposed there or removed to Akkad? Large grain shipments from NAGARKI, likely Tell Brak (Na-gārKI, Ebla; Na-ga-arkI, elsewhere; Gelb 1961, p. 191), were removed from the Khabur plains and collected at imperial Sippar (CT 1: 1b, 2,7; 1c, 12). By which waterborne route were these tons of cereal harvest dispatched to

Figure 6.2. Akkadian empire, ca. 2350–2200 B.C. Akkadian imperial control documented archaeologically and epigraphically across both dry-farming and irrigation agriculture Mesopotamia collapsed at ca. 2200 B.C. (Harvey Weiss and Stace Maples)
Sippar, and who controlled their measurement (Sommerfeld, Archi, and Weiss 2004)? Also on the Khabur plains, the 379 tons of river-transported emmer probably received at the 5-hectare small town at Chagar Bazar (Chagar Bazar A.391; CDLI P212515) were destined for which storehouses? The divide between state and private interests in such imperial extractions was likely porous, as in empires to this day.

Abandonment and Collapse

Abrupt termination of Akkadian imperial control and abrupt regional abandonment by the foreign and indigenous population have been exposed at the Khabur plains’ equidistant urban centers Brak, Leilan, and Mozan, and across the villages and towns of the surrounding countryside (figs. 6.3–6.4). Ritual closure of Akkadian public buildings sealed Tell Brak in dramatic fashion while the city’s Naram-Sin fortress walls and floors were left unfinished (Weiss 2012). The Akkadian Administrative Building at Tell Leilan was vacated during preparation of its terminal cuneiform records, while “The Unfinished Building” (TUB), across the Leilan Acropolis

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### Chronostratigraphy Late Third – Early Second Millennium BC Khabur Plains

<table>
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<th>BC</th>
<th>Leilan</th>
<th>Moh Diyab</th>
<th>Brak</th>
<th>Chagar Bazar</th>
<th>Arbid</th>
<th>Barri</th>
<th>Mozan</th>
<th>Hamoukar</th>
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<tbody>
<tr>
<td>1950</td>
<td>Early Khabur</td>
<td>IX pîse bldgs/ftdns</td>
<td>H H M N</td>
<td>Khabur houses</td>
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<td>Iic</td>
<td>O</td>
<td>34A</td>
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<td>1950</td>
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<td>houses 5</td>
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<td>2000</td>
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<td>2000</td>
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<td>2350</td>
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</table>

- **Abandonment and Collapse**

Figure 6.3. Chronostratigraphy late third–early second-millennium B.C. Khabur plains reveals a 250-year occupational hiatus, ca. 2200–1950 B.C., coincident with the ca. 4.2–3.9 ka B.P. megadrought (Weiss 2012)
Street, was deserted along a semicircle of basalt blocks that were being dressed for wall placement. Brick walls set upon mudpack sherds were left uncompleted, although sub-floor drains had been installed under unfinished working floors (Weiss et al. 2012). “Hayabum, šabra,” an early Amorite (Gelb 1980; Bauer 1926, p. 18), walked out on the TUB construction, but left his finger- and rope-impressed sealing on its floor (McCarthy 2012). Minor pieces of two similar and aborted Akkadian TUB constructions were observed at adjacent Tell Mohammed Diyab (Nicolle 2012), while at Tell Mozan the similar basalt block-base palace was abandoned, and upon its collapse and erosion surfaces irregular private houses were eventually constructed (Buccellati and Buccellati 2000). At Tell Taya, adjacent to Tell Afar, another high-yield cereal production center, the same curious Akkadian construction technique was deployed, perhaps for structures of similar function (Reade 1968).

Famously, the Lower Towns of Brak, Mozan, Leilan, the residences of the imperialized agricultural workers, were deserted alongside their central acropolises. At Tell Mozan/Urkesch, the “continuous occupation” of a post-Akkadian–Ur III-period wealthy city was, in fact, the 80-percent-abandoned Akkadian city, with a fraction of the former acropolis inhabited after desertion of the possibly 90-hectare lower town (Pfälzner 2012). Similarly, the purported high precipitation and dry-farming at Tell Mozan during this period (Riehl 2010)
Phase 4: Ḥabur

Phase 5: “… a single streaked layer represents all that is left of level V … chiefly black and grey, consisting respectively of carbonized sheep-dung and friable gypsous flooring … the whole deposit was clearly produced by a pastoralist population”

Phase 6: “Ur III”, “… did not last much more than half a century. The population either died in the destruction, though no skeletons were found, or deserted the site.”

Phase 7: “post-Akkadian”

Phase 8: Akkadian (ca. 2300–2200 B.C.)

(descriptions from Reade 1968)
have evaporated with notice of overlooked and unique Phalaris (canary grass) components of botanical samples that indicate stream-side cultivation only 8 kilometers from the Tur Abdin debouchement (Weiss 2012). Nawar, Urkesh’s remnant urban complement, the “large Hurrian city” importunately sought for decades at Tell Brak, was probably located similarly along the edge of the Tur Abdin, even perhaps at homonymous Gir Nawaz. By the time of the ca. 1950 B.C. resettlement, Mozan was a small village rest stop on the famous road west from Tell Leilan/Shubat Ennil.

Elsewhere on the Khabur plains, the same process was operative. Hamoukar, about 100 hectares at the eastern edge of the Khabur plains, was possibly occupied briefly in the post-Akkadian period, but was certainly abandoned before that period ended as the low-density site is capped by “early post-Akkadian pits” (Gibson 2001) that cannot extend beyond 2200 B.C. (fig. 6.3). Adjacent Tell al-Hawa, 66 hectares, was littered with Akkadian sila-bowls (Senior and Weiss 1992), but had no occupation thereafter until the Khabur ware resettlement (Wilkinson and Tucker 1995). Farther southeast, at Tell Afar, the Tell Taya acropolis excavation has illustrated the abandonment with its famously transparent stratigraphic section (Reade 1968) (fig. 6.5).

Region-wide, not only large cities but also their surrounding countrysides were deserted. In the Leilan Region Survey (1,650 sq. km; figs. 6.6a–d, 6.7), some 87 percent of dependent villages and towns were abandoned at the end of Leilan IIb1, 2254–2220 B.C. (68.2%), with the remainder disappearing completely less than 50 years later at the end of Leilan IIc, 2233–2196 B.C. (68.2%). That is, Bayesian-modeled short-lived radiocarbon dates provide a chronology that defines small village or household occupations for three to five decades after the major urban collapse (Emberling et al. 2012; Koliński 2012; Weiss et al. 2012). Significantly, these short-lived post-Akkadian remnants were five times more numerous (n=18, 0.01/km²) in the high-precipitation Leilan Region Survey (Arrivabeni 2012) than in the marginal-precipitation Brak survey area (Colantoni 2012) (table 6.1).

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<tbody>
<tr>
<td>Leilan</td>
<td>90</td>
<td>0.002 (-99%)</td>
<td>20 (-83%)</td>
<td>90</td>
</tr>
<tr>
<td>Mozan</td>
<td>120</td>
<td>20 (-83%)</td>
<td>&lt;20</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Brak</td>
<td>70</td>
<td>&lt;35 (-50%)</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Moh Diyab</td>
<td>50</td>
<td>14 (-72%)</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td>Chagar Bazar</td>
<td>10</td>
<td>1 (-90%)</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Hamoukar</td>
<td>100</td>
<td>0* (-100%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Arbid</td>
<td>4</td>
<td>3.2 (-20%)</td>
<td>0</td>
<td>1.75</td>
</tr>
<tr>
<td>Barri</td>
<td>&lt;6</td>
<td>0 (-100%)</td>
<td>0**</td>
<td>6</td>
</tr>
<tr>
<td>Leilan Region Survey</td>
<td>397</td>
<td>69 (-87%)</td>
<td>0</td>
<td>767</td>
</tr>
</tbody>
</table>

* Chronology uncertain; unlikely but possible partial occupation this period.
** Isolated stratum 35 kiln within this period.
Figure 6.6a. Leilan Region Survey, Leilan IIb settlement, ca. 2350–2250 B.C. (Ristvet 2012)

Figure 6.6b. Leilan Region Survey, Leilan IIc settlement, ca. 2250–2200 B.C. (Arrivabeni 2012)
Figure 6.6c. Leilan Region Survey, Leilan IId settlement, ca. 2200–1950 B.C. (Weiss 2012)

Figure 6.6d. Leilan Region Survey, Leilan I settlement, ca. 1950–1750 B.C. (Ristvet and Weiss 2013)
At Tell Leilan, the collapsed mudbrick walls of the pre-Akkadian palace and its rebuilt Akkadian Administrative Building were used as bases for the construction of a Leilan IIc period post-Akkadian four-room house and courtyard, the only post-Akkadian structure yet uncovered there (fig. 6.8; Weiss et al. 2012). The voluminous Tell Leilan radiocarbon-dating program defines as well the synchronous short-lived and ramshackle post-Akkadian-period structures at Tell Brak (Emberling 2012), the “communal” house at Chagar Bazar (Tunça, McMahon, and Baghdo 2007), and domestic structures at Tell Arbid (Koliński 2012).

The chronological definition of Leilan IIc is also useful, where comparable radiocarbon dating is available, for understanding the coincident inter-regional effects of the 4.2–3.9 ka B.P. event. The First Intermediate Period in Egypt began synchronously with Leilan IIc (Bronk Ramsey et al. 2010) and underscores the region-specific habitat-tracking variability and systemic similarities among and between societal megadrought responses (see Macklin et al. 2013; Weninger and Easton, this volume).
Megadrought and Leilan IId

Following the brief post-Akkadian interval, sedentary settlement within the Leilan Survey Region, and most of the Khabur plains, abandoned the region for about 250 years, the Leilan IId period, until the sudden return of pre-megadrought precipitation levels and Khabur-period resettlement at around 1950 B.C., earlier than a presumed Middle Chronology vanguard sedentarization led by Šamši-Adad (Weiss et al. 2012; Manning et al. 2016). The northern Mesopotamian post-megadrought soil landscape, perhaps altered analogously as that analyzed in post-megadrought south Alpine France (Brisset et al. 2013), may reveal some of the forces behind Khabur-period resettlement, possibly similar to the convenient social and climatic convergences at the termination of the Little Ice Age four thousand years later (Kaniewski, Van Campo, and Weiss 2012).

This same pattern of regional abandonment occurred across dry-farming western Syria (Weiss 2012; Weiss 2014), the Levant (Harrison 2012), Anatolia (Boyer, Roberts, and Baird 2006; Massa and Şahoğlu 2015), the Aegean (Weiss 2000; Weiberg and Finné 2013; Davis 2013), and in the western Mediterranean with the abandonment of the Late Neolithic and Bell Beaker settlements in the Languedoc and Rhône valleys (Carozza et al. 2015). However, low-resolution ceramic periodizations, survey intensity, and quantification still obscure some significant details and hinder comparative studies, as in western Syria (D’Andrea 2016). The extensive data for EB IV Ebla and its environs (Matthiae and Marchetti, eds. 2013) do not
yet permit discrimination of demographic changes during this period. Re-dating the end of the Early Bronze III period in the southern Levant, for example, has encouraged re-dating of the succeeding Early Bronze IV abandonments and collapse (Regev et al. 2012). Lowering the beginning of the southern Levant Early Bronze IV period, however, alters neither the radiocarbon-dated Early Bronze IV settlements here, some number of the around 2,000 central Negev Early Bronze IV pastoral sites (Haiman 1996; Adams 2000; Regev et al. 2012), nor the famous Hauran pastoralist settlements (Braemer, Échallier, and Taraqji 2004), nor the synchronous abandonments and collapses in western Syria (e.g., Rawda: Barge, Castel, and Brochier 2014; Brochier in press; Umm el-Marra: Schwartz et al. 2012) and across northern Mesopotamia (Weiss 2014). The limited and low-resolution chronology and simple quantification of Early Bronze III and Early Bronze IV settlement in small highland areas of Israel (Langgut et al. 2014; 2016) do not allow observation of abandonments, but emphasize the need for radiometric and relative chronology Early Bronze IV subdivisions (table 6.2) and, of course, quantified regional surveys (D’Andrea 2012; 2016).

<table>
<thead>
<tr>
<th>Date B.C.</th>
<th>Aegean</th>
<th>Egypt</th>
<th>Syria/Palestine</th>
<th>N. Mesopotamia</th>
<th>S. Mesopotamia</th>
<th>Indus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1800</td>
<td>Helladic II</td>
<td>Middle</td>
<td>Middle</td>
<td>Leilan I</td>
<td>Old Babylonian</td>
<td>Harappa 4</td>
</tr>
<tr>
<td>1900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>Helladic I</td>
<td>First</td>
<td>Early</td>
<td>“17 kings who lived in tents”</td>
<td>Isin-Larsa</td>
<td></td>
</tr>
<tr>
<td>2100</td>
<td>Early</td>
<td>Intermediate</td>
<td>Bronze IVx</td>
<td>Leilan IIId</td>
<td>Third Dynasty of Ur</td>
<td>Harappa 3C</td>
</tr>
<tr>
<td>2200</td>
<td></td>
<td>Period</td>
<td>Leilan IIc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2300</td>
<td>Late</td>
<td>Early</td>
<td>Leilan IIb</td>
<td>Akkadian</td>
<td>Harappa 3B</td>
<td></td>
</tr>
<tr>
<td>2400</td>
<td>Early</td>
<td>Old</td>
<td>Bronze IVa</td>
<td>Leilan IIa</td>
<td>Early Dynastic III</td>
<td></td>
</tr>
<tr>
<td>2500</td>
<td>Helladic II</td>
<td>Kingdom</td>
<td>Early</td>
<td>Bronze III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2600</td>
<td>Early</td>
<td>Leilan IIId</td>
<td>Early Dynastic II/III</td>
<td>Harappa 3A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Habitat Tracking

The regional populations that left the Khabur and adjacent dry-farming plains beginning at the end of Leilan IIb1 and during Leilan IIc (ca. 2250–2200 B.C.) were forced by their megadrought-altered landscapes to move abruptly to alternate sustainable habitats. The down-cut channels of the Euphrates and Tigris precluded innovative irrigation agriculture in northern Mesopotamia as, of course, did the topography and hydrography of the Levant. The habitat tracking (Coope 1979) that ensued was to sustainable riparian, paludal, and karstic refugia in adjacent regions. These refugia included the close-to-sea-level irrigation agriculture of Tigris-Euphrates regions of southern Mesopotamia, soon filled with hypertrophic Ur III cities; the central Euphrates valley dotted with irrigation agriculture cities at Mari, Tuttul and Terqa, the Madekh, Ghab, Amuq, and Radd swamps; the cities of the karst-fed Orontes River; the riverside towns of coastal Syria and Lebanon; and the karst-spring towns of the southern Levant (Weiss 2014). Similar movements to sustainable agricultural regions are observed synchronously in the megadrought-afflicted western Mediterranean (Carozza et al. 2015). Coincident abandonments likely occurred across desiccated dry-farming northern and northeastern Iraq, surrounded by the plateaus' megadrought proxies (e.g., Sea of Marmara: Felikci et al. 2016; Göbekli: Pustovoytov, Schmidt, and Taubald 2007; Lake Tecer: Kuzucuoğlu et al. 2011; Lake Van: Lemcke and Sturm 1997; Black Sea: Cordova and Lehman 2005; Caspian Sea: Leroy et al. 2014; Iranian plateau: Carolin et al. 2015).

The estimated scale of this region-wide population transfer awaits refinement with regional surveys of sufficient chronological resolution to observe decadal and century-scale alterations. An early conservative estimate assumed that approximately five times the population of the Khabur plains abandoned the plains from western Syria to northeastern Iraq during the interval between about 2200 and 1950 B.C. (Weiss et al. 1993). A trickle of persons per year could accommodate this figure, but larger groups likely left periodically at junctures that remain to be identified (see Burke, this volume).

Opportunistic Resettlement and Sedentarization

The Amorite intrusions, wars, and eventual presence in riverine central and southern Mesopotamia during the Ur III, Isin-Larsa, and early Old Babylonian periods (Edzard 1957; Garfinkle 2014) — that is, during the 4.2–3.9 ka B.P. megadrought — remain to be understood within this paleoclimate and demographic frame. In particular, the normative conceptualization of Ur III dynasty southern Mesopotamia awaits reconsideration. By the early nineteenth century B.C., two confederations of Hanaean pastoralist transhumant tribes, Yaminites and Simʾalites, already ranged between northern Mesopotamia, western Syria, and the central Euphrates (Rowton 1974; Heimpel 2003), where some controlled Mari, settling opportunistically the abandoned tracts within tribe-legitimized states and territories previously ignored and unidentified epigraphically, but now called Ida-Maras, Apum, and Subartu (Heimpel 2003; Ristvet 2008). This resettlement across dry-farming west Asia now seems a major archaeological research frontier.

The return of precipitation is evidenced by the abrupt 3.9 ka B.P. spikes within the paleoclimate proxies from Iceland to Iran, from the Mediterranean Sea to Mount Kilimanjaro, and from Lake Tilo to Mawmluh Cave. Geographic variability of drought stress was claimed for minor alterations of δ¹³C values of Middle Bronze Age (1900–1600 B.C.) barley grains from
Tell Mozan (Riehl et al. 2014), but the isotope analysis has been discredited (Maxwell, Silva, and Horwath 2014). Additionally, grain stable isotopes do not reflect climate but cultivation, including possible manuring (Styring et al. in press). Hence, robust transfer functions for the megadrought’s paleoclimate proxies, in addition to the 30–50-percent precipitation reductions already measured by Frumkin (2009), Bar-Matthews et al. (1997), and Kaniewski et al. (2012), remain a desideratum for observation and calculation of megadrought spatial variability across the Mediterranean and west Asia, and globally. Within current levels of resolution, however, the abrupt alterations of climate and settlement in the east Mediterranean/west Asia and the west Mediterranean at 4.2 and 3.9 ka B.P. are synchronous and extend to Central Asia, South Asia, East Asia, Australia, East Pacific, North America, South America, and the Antarctic as well (Weiss 2016).

A full appreciation and explanation of the societal forces released or propelled at about 3.9 ka B.P. awaits additional quantification of the return of pre-megadrought precipitation. In the Mesopotamian domains of the Mediterranean westerlies, this juncture is marked by the sedentarization of Amorite pastoralists and resettlement of previously desiccated and abandoned dry-farming territories. However, pre-Akkadian Amorite precursors of the nineteenth- and eighteenth-century B.C. Euphrates-Khabur pastoralist transhumants are not observed in the personal names of the Beydar archives (Talon 1996), while the mar.dú of the Ebla archives are not described as pastoralist transhumants (Archi 1985) and do not extend in time to the pre-Lim dynasty period at Mari (Butterlin 2007). Hence the megadrought “enforced sedentism” of Khabur pastoralist transhumants, along and down the Euphrates (Weiss et al. 1993), beginning at Leilan IIc and extending through Leilan IId, a potential correlate of “enclosed nomadism” (Rowton 1974; Klengel 1972), remains elusive but for records from the ethnographic present (de Boucheman 1934). This period, however, is likely that designated in the Assyrian King List as the reigns of the “seventeen kings who lived in tents” (Finkelstein 1966). Subsequent sedentarization, resettlement, and state formation across northern Mesopotamia and western Syria, idealized in Shamshi-Adad’s Amorite genealogy in the Assyrian King List, nevertheless remain enigmatically unexplained. Assyriological documentation assumes, however, that “there will always be some further more concrete description that the causing consists in” (Cartwright 1999, p. 120). Within central Asian Mongol history, a similar process of sedentary state formation at the return of pre-drought precipitation has been documented recently (Pederson et al. 2014). Here too, beyond the sudden availability of rain-fed domains, the forces for pastoralists’ opportunistic sedentarization and state formation await exploration.

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Abbreviations

CT Cuneiform Texts from Babylonian Tablets in the British Museum
CDLI Cuneiform Digital Library Initiative. cdli.ucla.edu

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