

## CHAPTER 25

# THE NORTHERN LEVANT DURING THE INTERMEDIATE BRONZE AGE

*Altered Trajectories*

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Societies adapted quickly to altered dry-farming cereal production at the onset and terminus of the 4.2–3.9 ka BP (4200–3900 years ago, or 2200–1900 BCE) abrupt climate change. Relatively high-resolution and independent archaeological and paleoclimate records document that the period of abrupt climate change began with: (1) regional abandonments; (2) habitat-tracking to riparian, paludal, and karst spring-fed refugia; and (3) nomadization (subsistence transfer from agriculture to pastoral nomadism). Adaptive social responses at the termination of the abrupt climate change included: (1) sedentarization; (2) political state formation; (3) increased and enhanced surplus agroproduction; and (4) politico-territorial expansion. This 300-year period provides, therefore, an alluring Holocene example of societal responses to abrupt climate change across the eastern Mediterranean and west Asian landscapes, and in particular across steep gradient ecotones of modern Syria and Lebanon. Most of these societal processes have previously been categorized archaeologically and historically as components of the unexplained ‘Intermediate Bronze Age’, ‘Early Bronze–Middle Bronze Transition’, ‘Akkadian collapse’, and ‘Amoritization’. The relatively highly resolved data currently available for the 4.2–3.9 ka BP abrupt climate change and the Intermediate Bronze Age of West Asia (2200–1900 BCE) have focused much paleoclimate and archaeological research on the period, even though century-scale Holocene climate changes different in their characteristics (abrupt, high-magnitude) also occurred at 8.2 (Weninger et al. 2009), 5.2 (Staubwasser and Weiss 2006), and 3.2 (Kaniewski et al. 2010) ka BP.

### THE PALEOCLIMATE RECORD: 4.2–3.9 KA BP ABRUPT CLIMATE CHANGE

Moisture-laden North Atlantic cyclonic westerlies seasonally break into the Mediterranean trough and provide the winter precipitation needed for dry farming along the northern

plains and mountain valleys of West Asia, as well as the spring melt that sustains Euphrates floodplain agriculture in Syria and Tigris–Euphrates irrigation agriculture in southern Iraq (Cullen et al. 2002; Lionello et al. 2006; Luterbacher et al. 2006). The annual variability in this seasonal precipitation during the modern instrumental period diverges from what is now known of the changes in the pre-instrumental period, which shows several century-scale disruptions with abrupt onsets and terminations. High-resolution paleoclimate proxy records, including lake, marine, speleothem, and glacial cores with annual resolution, document these century-scale excursions within the relative frequencies of stable isotopes, usually oxygen and carbon, as well as pollen and aeolian dust. The 4.2 ka BP–3.9 ka BP abrupt climate change is now well recorded globally and, within the limits of chronological resolution, synchronously (e.g. North America: Dean 1997; Zhang and Hebda 2005; Booth et al. 2005; Li, Yu, and Kodama 2007; Fisher et al. 2008; Menounos et al. 2008; South America: Thompson 2000; Baker et al. 2009; Licciardi et al. 2009; West Asia: Staubwasser and Weiss 2006; East Asia: Schettler et al. 2006; Wang et al. 2005; Liu et al. 2010). In the Mediterranean and western Asia, the 4.2 ka BP excursion was a sudden cooling and aridification, the product of a still unexplained weakening of North Atlantic cyclogenesis (Cullen et al. 2000; Cullen and deMenocal 2000; Weiss 2000; Bond et al. 2001) or deflection of the westerlies. Three hundred years later, westerlies-borne precipitation bounced abruptly back to its pre-aridification event levels.

## THE MULTI-PROXY STACK

The distribution of the proxy climate change variables is illustrated in Fig. 25.1, a multi-proxy stack from the Mediterranean westerlies region and, as well, the glacial core at Kilimanjaro (Thompson et al. 2002), indicating the larger-scale regions similarly affected. The Gulf of Oman marine core (Cullen et al. 2000) displays a carbonate and dolomite dust spike of 300 years and provides both the radiocarbon and tephrochronological linkage with 2200 BCE Tell Leilan (Weiss et al. 1993). The Lake Van core (Lemcke and Sturm 1997) quartz is background dust, understood as a function of aridification beginning at 2190 BCE. The dust does not represent suddenly intensified Mesopotamian agriculture, which would have caused a relatively minor disturbance; more intensive agricultural activity in southern Mesopotamia, such as during the Sassanian dynasty, did not generate similar dust spikes. In fact, similar dust spikes occur at Italian lake cores synchronously with precipitous *natural* deforestation (di Rita and Magri 2009; Magri and Parra 2002). Noticeably, however, some of the other Van proxies do not show this spike. The Gölhisar lake core in southwest Turkey (Eastwood et al. 1999) provides the same dust spike, and the parallel increases and decreases in  $\delta^{18}\text{O}$ , a proxy for precipitation decreases and increases in these realms (Leng et al. 2010; Fairchild et al. 2006). Dead Sea levels fell c.45m during this same period, then returned to a higher than previous level for the following 600 years, until the Late Bronze Age collapse (Migowski et al. 2006; Frumkin 2009; Kaniewski et al. 2010). The highest density of data points within a proxy record for this region, c.15-year intervals, is the Red Sea core at Shaban Deep (Arz, Lamy, and Pätzold 2006), where the  $\delta^{18}\text{O}$  spike is constrained to c.250 years. One attempt at a transfer of proxy values to precipitation values is from Soreq Cave, near Jerusalem, where the  $\delta^{18}\text{O}$  speleothem spike has been estimated to reflect a 30 per cent precipitation reduction (Bar-Matthews, Ayalon, and Kaufman 1997; Enzel

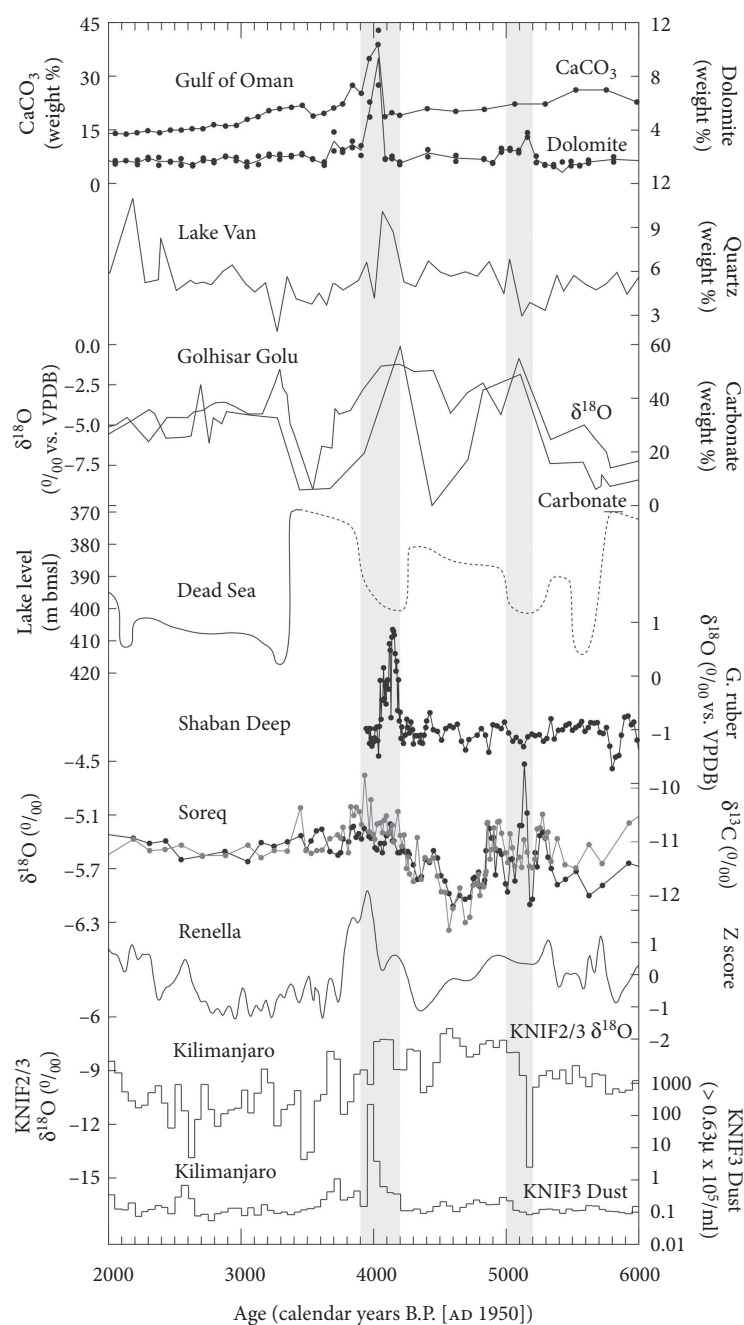


FIG. 25.1 Multi-proxy stack of Mediterranean westerlies and Kilimanjaro, displaying the 5.2 and 4.2 ka BP abrupt climate change events within marine, lake, speleothem, and glacial records (H. Weiss and M. Besonen; cf. Weiss et al. 2012: fig. 26)

et al. 2003; Jex et al. 2010). The synchronous Soreq  $\delta^{13}\text{C}$  spike, also reported at Gölhisar (Leng et al. 2010), probably reflects a sharp increase in drought-advantage C4 vegetation although the Th/U dates around this event at Soreq Cave have large standard deviations (Bar-Matthews and Ayalon 2004: 381). In Italy, the Renella flowstone's Z score (Drysdales et al. 2006) records a precipitous aridification event that also appears in several Italian lake records (e.g. Magny et al. 2007; Magri and Parra 2002). Lastly, the 'Middle Holocene Dust Event' record from the Kilimanjaro glacial cores (Thompson et al. 2002; Davis and Thompson 2006), with annual ice lamination dating, is slightly divergent chronologically, but numerous well-dated East African lake level reductions, the product of synchronous deflection of the Indian Ocean monsoon and Somali jet sources for the Nile, independently conform to the Kilimanjaro and Mediterranean westerlies record (Gasse 2000; Gasse and van Campo 1994). The East African lake level records explain the synchronous diminution of Nile flow coincident with the First Intermediate Period in Egypt (Stanley et al. 2003).

The 4.2 ka BP event noted in Anatolian lake pollen cores (Weiss 2000) has been amplified considerably, but at low chrono-resolution (e.g., Kuzucuoğlu et al. 2011). At Gölhisar, the  $\delta^{13}\text{C}$  spike (Leng et al. 2010; Eastwood et al. 2007) is synchronous with the carbonate and  $\delta^{18}\text{O}$  spikes (Fig. 25.1). At Eski Acigöl, mesic trees declined with falling lake levels (Roberts et al. 2001). Pollen, charcoals, benthic foraminifera, and geochemistry confirm these observations at Aegean and Levantine seas (Schmiedl et al. 2010; Kotthoff et al. 2008), Lake Van, Turkey (Wick, Lemcke, and Sturm 2003), Maharlu, central Iran (Djamali et al. 2009), Malatya (Masi et al. 2012), and the Caspian Sea (Leroy et al. 2007, 2013).

Recent research has focused on the components of the aridification event. Tuscan and Albanian lake core pollen and geochemistry suggest brief initial and terminal humid phases (Magny et al. 2009), and the mini-spikes of  $\delta^{18}\text{O}$  at Soreq Cave have been interpreted as short droughts between wetter stretches (Kuzucuoğlu 2007). The latter, however, are not congruent with higher-resolution samples, the Soreq  $\delta^{13}\text{C}$  record, nor the numerous Mediterranean and western hemisphere paleoarchives. Similarly, a time-transgressive quality (Roberts et al. 2001) is supported by neither the available chronological resolution nor the regional and global chronologies.

The uniquely resolved multi-proxy analysis of a 10cm diameter subfossil *Tamarix* stem from a Mount Sedom (Dead Sea) diapir included three radiocarbon dates with 60–80-year standard deviations, 109 carbon and nitrogen stable isotope measurements from rings dated by interpolation of the calibrated radiocarbon dates' peak probabilities, and transfer of the  $\delta^{13}\text{C}$  measurements to modern precipitation values. The *Tamarix* stem analyses document three or four successive multi-decadal droughts that reduced regional precipitation by 50 per cent between 2200 and 1900 BCE (Frumkin 2009).

## THE ARCHAEOLOGICAL RECORD: REGIONAL SOCIAL RESPONSES (2200–1900 BCE)

Across Syria and Lebanon are five regions distinguished by their precipitation and hydrological resources: dry-farming plains, semi-arid steppe, rivers, swamps, and karstic springs. These were the stage for the adaptive social responses to the abrupt climate changes: political collapse and regional abandonment, nomadization, and habitat-tracking (Coope 1979; Eldredge 1985: 10; Grosjean, Núñez, and Cartajena 2005), followed by resettlement, political consolidation, and state expansion.

## The Khabur Plains and the Akkadian Empire

The Akkadian extraction and deployment of cereal revenues from the rain-fed agricultural regions of Mesopotamia extended from Susa through Kirkuk/Nuzi, Erbil/Arbilu, Mosul/Nineveh to the Khabur Plains of northeast Syria dominated by Leilan/Shekhna, Mozan/Urkesh, and Brak/Nagar. At those cities the depth and extent of the Akkadian control is manifest in the monumental public buildings, Akkadian administrative texts, school texts (de Lillis-Forrest, Milano and Mori 2007), and standardized flat-based sila ration bowls (Senior and Weiss 1992). Impressive epigraphic representations also include the name-stamped foundation bricks at Brak's Naram-Sin fortress (Mallowan 1947: 66, pl. lxiv), the sealing of the daughter of Naram-Sin, wife of the ruler, at Mozan/Urkesh (Buccellati and Kelly-Buccellati 2002), and the seal impression of Haya-abum, the Akkadian *šabra*, at Tell Leilan (de Lillis-Forrest et al. 2004). As in other Akkadian imperialized domains, the target was cereal production revenues to augment the irrigation-agriculture imperial economy in southern Mesopotamia. One imperial Akkadian document, purchased in Baghdad by the British Museum shortly after Rassam's excavations at nearby Sippar, records receipt of 29 metric tonnes of barley, or 20,000 man-days of rations, from a city named Nagar (Sommerfeld, Archi, and Weiss 2004). These were probably the transported harvest of Akkadian-controlled lands in the high cereal-yield areas around Leilan and Mozan, where a cultivated hectare or two, at 1,200 kg/ha (Weiss 1986), produced c.400 man-days of barley rations for Akkadian workers. This combination of high yields and extensive cultivable land could have sustained multiples of the regional Akkadian-period population and imperialized cereal revenues, and did so only 300 years later (Fig. 25.2) (Ristvet and Weiss 2013).

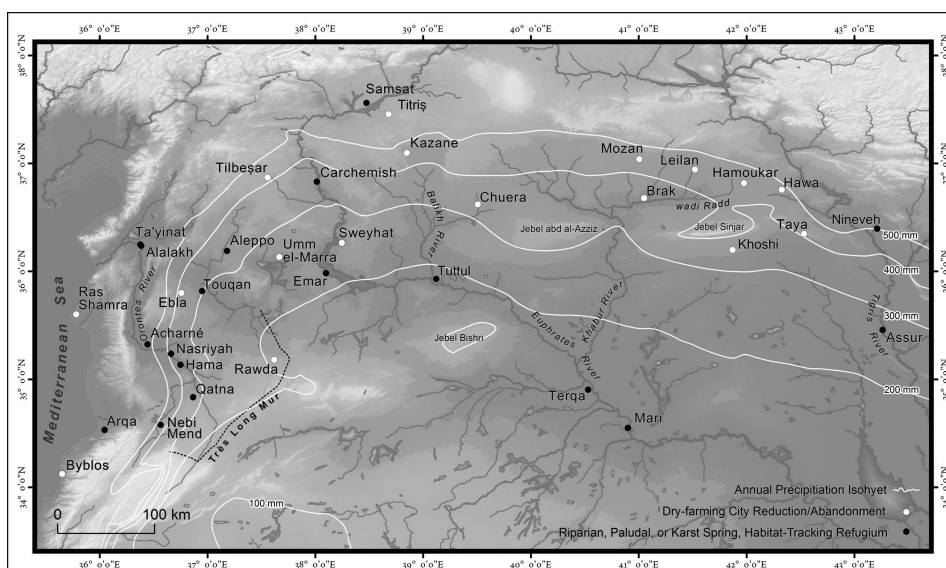


FIG. 25.2 Map of Intermediate Bronze Age sites in the northern Levant, 4.2–3.9 ka BP. Dry-farming settlement diminished while riparian, paludal, and karstic refugia settlement expanded. The Trés Long Mur was constructed and the Jebel Bishri became the pastoralists' regional cemetery (Weiss 2012: Fig. 5)

When precipitation dropped c.30–50% during the 4.2 ka BP abrupt climate change, the Khabur Plains' cultivable land areas narrowed (Staubwasser and Weiss 2006: figs 4 and 5) and regional cereal yields plummeted. Previously marginal production areas, such as the area around Brak, dropped below limits of cereal dry farming. The Akkadians departed suddenly, and with them so did the indigenous regional population. The Tell Leilan Region Survey, a 30km-wide north–south 1,650km<sup>2</sup> transect through the heart of the eastern Khabur Plains, documents an 87% reduction in settled area for the period immediately after the Leilan Akkadian Administrative Building abandonment (Fig. 25.2) (Ristvet and Weiss 2013; Weiss 2012).

The elimination of imperial revenues from the Khabur and the other imperialized dry-farming plains truncated imperialized grain flow to the Akkadian capital. Evocative epigrams for the subsequent Akkadian collapse in southern Mesopotamia include 'On its canal-bank tow-paths the grass grew long' (*The Curse of Akkade*: Black et al. 2004: 124), 'Who was king, who was not king' (Sumerian King List: Glassner 1993: 140), and, in northern Mesopotamia, 'seven generations since the Fall of Akkad' (Shamshi-Adad: Grayson 1987: 53; Glassner 1993: 22), and of Shamshi-Adad's predecessors, 'the seventeen [Amorite] kings who lived in tents' (Assyrian King List: Glassner 1993: 147). The contemporary epigraphic record for the Akkadian collapse (Glassner 1986) is now amplified and quantified through recent archaeological measurement of regional site abandonments, site-size reductions, and their rates of change on the Khabur Plains, as well as by the new paleoclimate records for abrupt climate change.

The Akkadians built several public structures at the north and south edges of the c.40ha Tell Brak/Nagar acropolis. At the southern edge, the massive Naram-Sin fortress was probably intended for regional grain harvest storage, but this building was probably still unfinished at the site's desertion: its walls were still under construction, a prepared floor was laid upon only one of four courtyards (Mallowan 1947), and re-excavation shows the walls' foundation trench, but no working/living exterior floor (Oates, Oates, and McDonald 2001: fig. 15). The unprovenienced sealing of Talpuš-atili of Nagar may date from shortly after the desertion, but the lack of evidence for a 'Hurrian period' rebuilding of the fortress suggests a fantasy as evanescent as its Ur III tablets and seal impressions (Sallaberger 2007: 432). Elsewhere on the acropolis, two elaborate Akkadian administrative buildings (FS and SS) and ceramic assemblages (McMahon 2012) were abandoned after ritual filling and sealing (Oates, Oates, and McDonald 2001). Synchronously, the Akkadian-period lower town at the southern edge of the acropolis was also evacuated (Ur, Karsgaard, and Oates 2011). Succeeding the Akkadian collapse and abandonments were a few short-lived houses of the ill-defined Period N in Area CH (Oates, Oates, and McDonald 2001). Similarly, the ramshackle, post-Akkadian *pisé* construction on top of the formal mud-brick Akkadian building in Area TC was abandoned at c.2200 BCE and never reoccupied (Emberling et al. 2012). The Brak occupational hiatus extended thereafter until the 19th-century Khabur Ware period's precipitation bounce-back, when some domestic construction appeared at the western (HH) and northwestern (HN) edges of the acropolis (McDonald and Jackson 2003).

Akkadian-controlled, 90ha Tell Leilan/Shekhna was similarly abandoned at c.2200 BCE. 'The Unfinished Building' on the southern side of the Leilan acropolis's Akkadian street was without a finished interior floor, with its walls built to only three or four mud-brick courses above dressed basalt block bases (like those used at the Mozan Akkadian palace), when the city was deserted (Ristvet and Weiss 2000; de Lillis-Forrest et al. 2004; Weiss et al. 2012).



Fragments of similar unfinished walls have been retrieved at nearby Mohammed Diyab (Nicolle 2012). At the glacis-protected Akkadian palace across the street, where grain harvests were collected and processed, clay balls for tablet manufacture and blank clay tablets were left on a palace room floor when the Akkadians walked away from the acropolis (Weiss et al. 2012). Lastly, the walled residential lower town of c.75ha was abandoned (Weiss 1990). On top of the abandoned Akkadian palace, a four-room house was built around a courtyard (Fig. 25.4; Leilan Period IIc), and is the only post-Akkadian construction yet detected within the site. Numerous radiocarbon dates from the Akkadian palace and its post-Akkadian house indicate that the remnant reoccupation here and at the other, infrequent, post-Akkadian Khabur Plains occupations survived 30–50 years after the Tell Leilan Akkadian palace abandonment (Weiss et al. 2012; Fig. 25.3).

At 120ha Tell Mozan/Urkes, close to the Tur Abdin Mountains, the Akkadian-period palace of large dressed basalt blocks and mud-brick construction (Buccellati and Kelly-Buccellati 2000) lacks high-resolution radiocarbon dates but was abandoned at the same time as the Akkadian collapse at Brak and Leilan. Here, the indigenous population also abandoned the lower town, and the city was reduced to a less than 20ha town at a remnant Tur Abdin stream refugium (Pfälzner, Wissing, and Hübner 2004; Weiss 2012). This was the period of Atal-shen and Tish-atal of 'Urkes and Nawar', the latter settlement possibly located 30km northeast at Gir Nawaz (Sallaberger 2007).

Recent studies based on excavation-retrieved archaeobotanical samples and an early paleoclimate model (Bryson 1997) conclude that Mozan environs did not experience an arid climate excursion during this period (e.g., Deckers et al. 2010). However, archaeobotanical records, whether at Mozan, Brak (Charles and Bogard 2001), or elsewhere, are not *paleoclimate* proxies; rather, they are the social products of a cultural filter. Meanwhile, the paleoclimate model used in the Mozan study had been rejected because the frequency and intensity of the Mediterranean westerlies was unknown (Bryson and Bryson 2000: 80–81).

Elsewhere across the Khabur Plains, the hastened search for and excavation of post-Akkadian settlement has so far produced three occupations, two certainly very small, and all abandoned quickly. At Tell Arbid, 45km south of Tell Mozan, the estimated 4ha Akkadian occupation, yet unexcavated, was reduced c.20%, and comprised a Main Building, its renovations, and abandonment. Radiocarbon dates indicate that this remnant settlement, like the other 'post-Akkadian' settlements, lasted only 30–50 years (Koliński 2012).

At 12ha Chagar Bazar, 22km south of Mozan, alongside the Wadi Khanzir and the 'old road' from Hasseke to Qamishli, post-Akkadian occupation comprised but 1ha at the c.5ha southern mound: the terminal 'Bâtiment 1', a four-room house, possibly two-storey and 'communal'. No radiocarbon dates are available, but the ceramic assemblage is similar to that of Leilan IIc. The earlier Akkadian occupation, as yet untested, may have extended across 10ha (Tunca, McMahon, and Baghdo 2007).

'Late third millennium' occupations, only preliminarily divided into Akkadian and post-Akkadian periods and without radiocarbon dates, have been surveyed and excavated at 100ha Hamoukar, still further east. After its Akkadian or post-Akkadian building abandonment, and a number of early post-Akkadian pits (Gibson 2001; Gibson et al. 2002; Ur 2002), Hamoukar was not reoccupied. Along the Jaghjagh River, at Tell Barri, the Akkadian settlement was abandoned, a kiln area briefly reoccupied about 75 years later, and then abandoned again until Khabur Ware times (Pecorella and Pierobon 2004: 21, 29; Orsi 2008, 2012). West of the Jaghjagh River, a Tell Beydar temple was still used during the early Akkadian period

but was abandoned subsequently (Van der Stede 2005). In general, Khabur Plain post-Akkadian sedentary settlement was reduced greatly, a short-lived step to almost three centuries of desertion similar to the synchronous settlement history of dry-farming Palestine (Gophna 1992). The Akkadian collapse on the Khabur Plains was, therefore, a two-phase regional process manifest within the synchronous public building and lower town abandonments at Leilan, Mozan, and Brak, accompanied by the widespread rural settlement abandonment that is visible in the Leilan Regional Survey (Arrivabeni 2012; Ristvet 2012; Weiss 2012; Weiss et al. 2012).

## The Euphrates River

Away and apart from the Akkadian imperialized realms, state polities and region-wide settlements were similarly affected by precipitation reduction and agricultural dislocation. Euphrates flow was probably diminished, but did not cease during this period. Hence habitat-tracking from dry-farming areas to Euphrates River settlements in Syria and southern Mesopotamia was one response of dry-farming sedentary agriculturalists and seasonal transhumant pastoralists as well (Weiss et al. 1993; de Boucheman 1934). Urban settlement flourished and expanded along the middle Euphrates during this *shakkanaku* period at Mari and its environs (Geyer and Monchambert 2003; Butterlin 2007: 242), as at Tuttul (Miglus, Strommenger, and Achwan 2007) and Emar, greater than 40ha (Faist and Finkbeiner 2002: 191). Settlement along the Balikh River was always limited, as Balikh spring flow from karstic 'Ain al-Arus was less than 6m<sup>3</sup> per second, within a channel that rarely exceeded 6m across (Wirth 1971). Here the small town at Hammam et-Turkman shows evidence of abandonment during this period (Curvers 1991; Wilkinson 1998). Just south of the Taurus, settlement system collapse and abandonment occurred within the rain-fed agriculture Karababa Basin at and around 43ha Titriş Höyük, which was then reduced to 3ha (Algaze et al. 1996). The same pattern is obtained with abandonments at 56ha Tilbeşar west of Carchemish within the Sajour River drainage (Kepinski 2007) and 100ha Kazane Höyük near Urfa (Creekmore 2010). Further south, along the Euphrates, however, settlement expanded greatly during this period in the Carchemish region, where a definitive study of that 40ha site is now in progress (Marchetti 2012). Tell es-Sweyhat, a 45ha settlement located, curiously, 4km east of the Euphrates, at the 200–300mm limit of dry farming, was occupied extensively to c.2150 BCE in Period 4, and then abandoned thereafter in Period 5, with Period 6 poorly preserved building levels extending only to the early transition to the Middle Bronze Age (Danti and Zettler 2007: 176). The Euphrates drainage region, therefore, indicates continued and thriving occupation during this period along the river, the target of habitat-tracking, and pronounced abandonment in the drainage's dry-farming zones. Similar habitat-tracking should have targeted the adjacent Anatolian plateau, within the Tur Abdin/Diyarbakr region of higher precipitation (Weiss and Courty 1993: 144), as has been suggested for the Upper Tigris/Batman region (Laneri et al. 2008).

## Dry-farming western Syria and the steppe

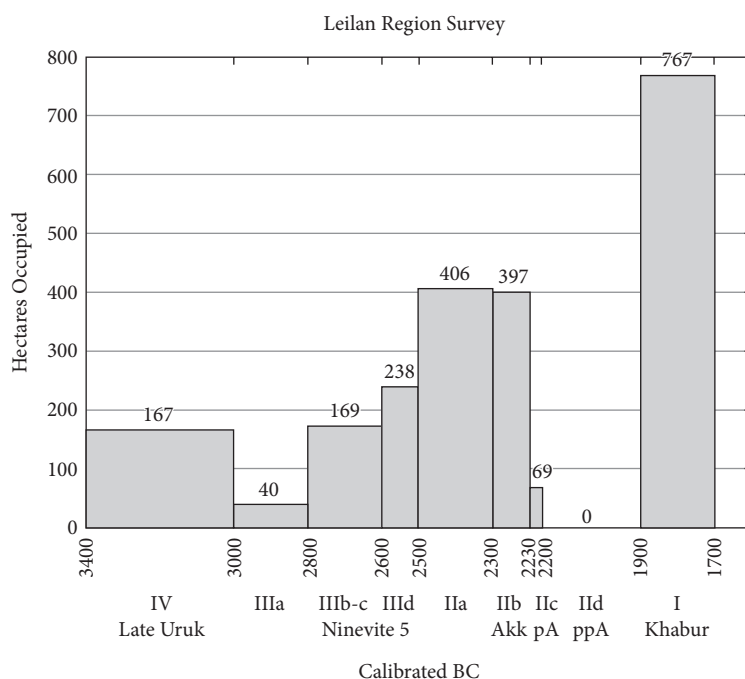
The wealth and power of Ebla on the Idlib Plain made it the famous target of the Mari coalition that destroyed its palace in c.2300 BC (Archi and Biga 2003). Following a short



occupational hiatus, the succeeding EB IVB city of this time period was reduced in size while ruled from the Archaic Palace with its unique water cisterns. The palace construction, however, remained unfinished, probably like the buildings at Leilan, Mohammed Diyab, and Brak, and the city was destroyed again in c.2000 BCE (Matthiae 1995a; 1995b; Fiorentino et al. 2008). Around this time, habitat-tracking to the Madekh Swamp, terminus of the Qoueiq River, resulted in the settlement at Tell Touqan (Baffi and Peyronel 2013).

Further east, at the limits of dry-farming cultivation prior to 2200 BC, the eastern Jabbul Plain, with the 20ha town at Umm el-Marra, was abandoned during the aridification period (Nichols 2004). To the south, Rawda, in the semi-arid marginal zone, was also abandoned after c.400 years of occupation. There the radial planned town (Castel and Peltenburg 2007), a major unexplained phenomenon from the Khabur Plains to the Orontes River, was the settlement outpost facing, or replaced by, the Très Long Mur during the aridification excursion.

The Très Long Mur (Fig. 25.3) was constructed of rough, calcareous, and basalt boulders along a 220km distance following precisely the precipitation isohyets of the western steppe (Geyer et al. 2010). This western analogue to the contemporary 'Repeller of the Amorites' wall in southern Mesopotamia delimited and protected urban agricultural territory from expanding Amorite, steppe nomad populations—described famously as the people 'who know not agriculture' in *The Curse of Akkade*. The extended pastoralist cemeteries of this



**FIG. 25.3** Leilan Region Survey histogram, preliminary analysis of settled areas showing sedentary population reductions during 5.2 and 4.2 ka BP abrupt climate change events. Minor 'post-Akkadian settlement' persisted for a few decades after initiation of the 4.2 ka BP abrupt climate change (Weiss 2012: Fig. 3)

period at the Jebel Bishri, probably mirroring tribal units in the spatial distribution of stone-lined and cairn-marked inhumations, is now under intensive survey and excavation (Ohnuma 2010).

The regional expansion of pastoralism is visible at the edge of the steppe, 'The Black Desert', at Khirbet al-Umbashi (Braemer, Échallier, and Taraqji 2004), some 70km southeast of Damascus, where settlement grew from 6ha to 60ha during this period and comprised c.250 large stone houses. Subsistence here was non-agricultural, exclusively dependent upon sheep/goat herding and dairy production, with no evidence for hierarchical organization. This settlement type extended across the Syro-Palestinian marginal steppe, but was mostly abandoned at c.3.9 ka BP with the sudden return of pre-abrupt climate change precipitation levels.

## Orontes River

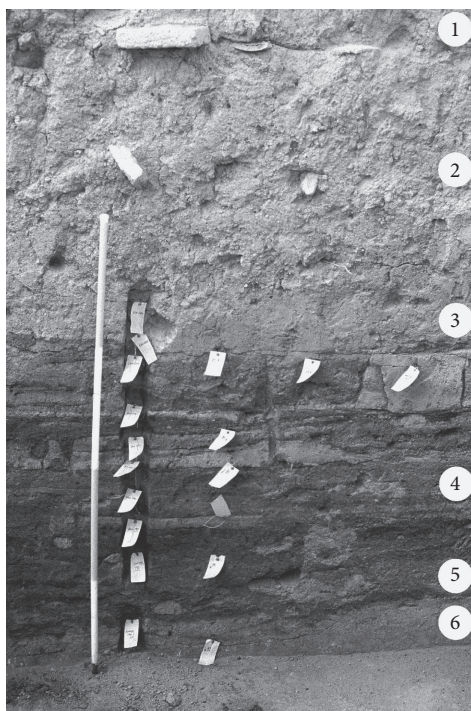
The Orontes River provides a unique environmental contrast with the Jabbul and Idlib Plains. The karstic 'Ain ez-Zarka, its source, drains a slow infiltration system with 10 billion m<sup>3</sup> of phreatic zone storage and a mean residence currently around 40 years (Bakalowicz, El Hakim, and El-Hajj 2008) that is extended downstream by other springs.

Hence, during this 300-year period of reduced precipitation, the Orontes River attracted and sustained large, habitat-tracking, sedentary agricultural populations (al-Maqdissi 2010). The karstic springs of the Jebel Ansariyeh, Lebanon/Anti-Lebanon, Orontes system include three at 100ha Mishrifé/Qatna that were dammed to create a >70ha lake during the city's late third-millennium growth (Fig. 25.5) (Cremaschi 2007; Morandi Bonacossi 2009). Survey and excavation along the Orontes River have also documented the sudden synchronous growth of square-walled, Qatna-like, 76ha Nasriyah, the smaller, but similarly square-walled, Tell She'irat (al-Maqdissi 2010), and the first occupations at 70ha Acharné (Fortin 2007), probably ancient Tunip, where 175 karst springs debouch into the paludal Ghab depression (Voûte 1961).

The 'Amuq Plain, at the terminus of Orontes River karst aquifer flow, provided the cultivable landscape for urban settlement at Ta'yinat and Atchana probably beginning at this period (Yener 2005: 173). On the western side of the Jebel Ansariyeh, along the fertile littoral, karstic springs provided for the villages of the Akkar Plain and the town at Tell Arqa, where settlement and paleobotanical remains indicating bountiful agriculture are robustly radiocarbon-dated to this period (Thalmann 2006). Coastal Syria and Lebanon lack karstic springs apart from Jeita Cave, along the Nahr el-Kalb Valley near Beirut (Verheyden et al. 2008). Hence population reductions and site abandonments were experienced at 23ha Ras Shamra/Ugarit between Levels III and II (Yon 1997: 16), at similarly sized Byblos (Saghieh 1983) down the coast, and at Sianu (al-Maqdissi 2006), while occupation continued in some areas of 12ha Tweini at the seaside conjunction of two rivers (Bretschneider and Van Lerberghe 2008).

## 3.9 KA BP

The abrupt return of pre-4.2 ka BP annual precipitation returned dry farming to the Khabur Plains on the east and to the fertile *terra rossa* plains of Aleppo and Idlib on the

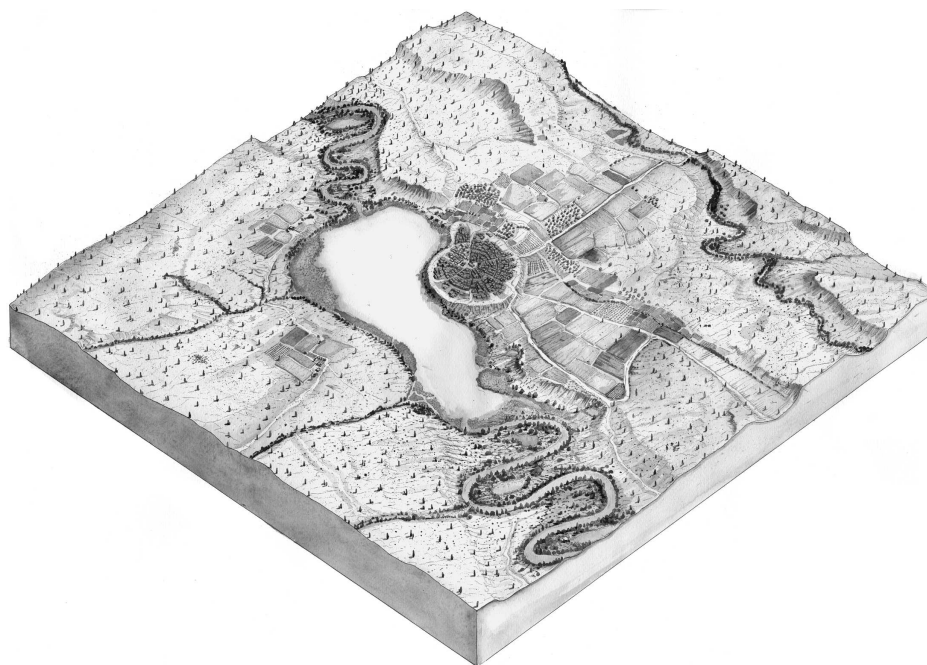


**FIG. 25.4** Stratigraphic profile of abandonment and reoccupation. Tell Leilan, 1989, Operation 8, one of the Lower Town soundings recording the abandonment at 2200 BCE (stratum 3, terminal Akkadian period) and the reoccupation at c.1900 BCE (stratum 1, Khabur Ware period). Excavation in 2006 and 2008 revealed a four-room post-Akkadian occupation of the Acropolis northwest Akkadian palace, the only post-Akkadian occupation recovered at the 90ha site (Weiss et al. 1993: Fig. 5)

west. The resettlement of formerly arid and abandoned territories was the second stage of Amoritization, the sedentarization of the Amorite pastoral nomads, dramatically recorded in their archaeologically retrieved settlements within the Leilan Region Survey (Fig. 25.3), well-recorded epigraphically, and thereafter famously engaged in military struggles for control of newly opened lands and agricultural wealth during the 19th and 18th centuries BCE, which initiate the succeeding Middle Bronze Age. While the physical return of dry-farming lands is now clear, the social forces behind this resettlement remain to be explored.

## CONCLUSIONS

Some archaeological perspectives on late third-millennium Syria and Lebanon view them as featureless isotropic planes, separate from the available and rich environmental and paleoclimatic data, and thereby provide a settlement and abandonment profile that is at once reductionist and stochastic (e.g. Marro and Kuzucuoğlu 2007; Schwartz 2007). The



**FIG. 25.5** A reconstruction of the settlement at Qatna where Mauro Cremaschi's cores and analyses identified dammed karst spring flow that produced a reservoir of more than 70ha for the settlement's expanding population at c.2200 BC (courtesy Daniele Morandi Bonacossi)

patterning of social responses to the late third-millennium abrupt climate excursion across hydrologically varied plains stands in marked contrast, however, to the apparent randomness within only two-dimensional views. Interpretations that champion the conscious self-determinism of these ancient societies evaporate alongside the illusory randomness. The non-imperialized settlements in dry-farming terrains collapsed unless situated, like Iktanu (Prag 2007), adjacent to karst springs. Likewise, the Akkadian Empire, barely a generation old, was expanding when it collapsed suddenly: (1) The 'Seventeen Kings against Naram-Sin' had been defeated (Westenholz 1997); (2) monumental imperial Akkadian architecture was in the course of construction at Leilan, Mohammed Diyab, and Brak; and (3) the marriage of Naram-Sin's daughter had successfully sealed the Akkadian alliance at Mozan.

The steppic, riparian, paludal, and karstic resources of Syria and Lebanon were the adaptively utilized theatre for the dramatic social and environmental interactions, and the altered trajectories at the 4.2–3.9 ka BP abrupt climate change. Societies responded to the abrupt climate change with political collapse, regional abandonment, nomadization, and habitat tracking to sustainable agricultural regions. These adaptations provided demographic and social resilience across the West Asian landscape at 2200 BCE, as did sedentarization and dry-farming resettlement at 1900 BCE, although the latter processes await explanation.

The accessibility of testable, reproducible, paleoclimate proxies extends, therefore, collapse research horizons beyond the concatenation of imagined events to the quantification of transfer functions and rates of climate change that are now well documented globally.

Similarly, quantification of the dynamics and variability within adaptive regional habitat tracking, nomadization, and sedentarization are new archaeological challenges for this and other prehistoric and early historic abrupt climate change research.

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