High-precision radiocarbon dating and historical biblical archaeology in southern Jordan

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Recent excavations and high-precision radiocarbon dating from the largest Iron Age (IA, *ca.* 1200–500 BCE) copper production center in the southern Levant demonstrate major smelting activities in the region of biblical Edom (southern Jordan) during the 10th and 9th centuries BCE. Stratified radiocarbon samples and artifacts were recorded with precise digital surveying tools linked to a geographic information system developed to control on-site spatial analyses of archaeological finds and model data with innovative visualization tools. The new radiocarbon dates push back by 2 centuries the accepted IA chronology of Edom. Data from Khirbat en-Nahas, and the nearby site of Rujm Hamra Ifdan, demonstrate the centrality of industrial-scale metal production during those centuries traditionally linked closely to political events in Edom's 10th century BCE neighbor ancient Israel. Consequently, the rise of IA Edom is linked to the power vacuum created by the collapse of Late Bronze Age (LB, *ca.* 1300 BCE) civilizations and the disintegration of the LB Cypriot copper monopoly that dominated the eastern Mediterranean. The methodologies applied to the historical IA archaeology of the Levant have implications for other parts of the world where sacred and historical texts interface with the material record.

archaeometallurgy | social evolution | Iron Age | Levant | StarCAVE

In 1940, the American archaeologist Nelson Glueck summarized his extensive 1930s archaeological surveys in Transjordan in his book *The Other Side of the Jordan* (1), asserting that he had discovered King Solomon's mines in the Faynan district (the northern part of biblical Edom), ≈50 km south of the Dead Sea in what is now southern Jordan. The period between the First and Second World Wars has been called the "Golden Age" of biblical archaeology (2) when this subfield was characterized by an almost literal interpretation of the Old Testament (Hebrew Bible, HB) as historical fact. Archaeologists such as Glueck metaphorically carried the trowel in 1 hand and the Bible in the other, searching the archaeological landscape of the southern Levant for confirmation of the biblical narrative from the Patriarchs to the United Monarchy under David and Solomon to other personages, places, and events mentioned in the sacred text. Beginning in the 1980s, this paradigm came under severe attack, primarily by so-called biblical minimalist scholars who argued that as the HB was edited in its final form during the 5th century (c.) BC (3), any reference in the text to events earlier than *ca.* 500 BC were false (4). Accordingly, the events ascribed to the early Israelite and Judean kings from the 10th–9th c. BCE were viewed as concocted by elite 5th c. BCE editors of the HB who resided in postexilic times in Babylon and later in Jerusalem. Some of the casualities of the scholarly debate between the traditional biblical scholarship and biblical minimalists has been the historicity of David and Solomon–the latter of which is traditionally cross-dated by biblical text (1 Kings 11:40; 14:25; and 2 Chronicles 12:2–9) and the military topographic list of the Egyptian Pharaoh Sheshonq I (Shishak in the HB) found at the Temple of Amun in Thebes and dated to the early 10th c. BCE (5).

The power and prestige of Solomon as represented in the Bible has been most recently challenged on archaeological grounds by I. Finkelstein and N. Silberman in their book *David and Solomon* (6). When British archaeologists carried out the first controlled excavations in the highlands of Edom (southern Jordan) in the 1970s and 1980s (7), using relative ceramic dating methods, they assumed that the Iron Age (IA) in Edom did not start before the 7th c. BCE, confirming the minimalist position concerning the HB and archaeology. On the basis of the dating of the Edom highland excavations, Glueck's excavations at Tell el-Kheleifeh (which he identified with Solomon's Red Sea port of Ezion Geber in south Edom) and most IA sites in this region were reinterpreted as belonging to the 7th c. BCE and hence, in no way connected to the 10th c. and Solomon (8). Coinciding with the general "deconstruction" of Solomon as an historic figure, Glueck's identification of the Faynan mines as an important 10th c. BCE phenomenon were discarded and assumed to date to the 7th–8th c. BCE. The ^{14}C dates associated with smelting debris layers from Faynan reported here demonstrate intensive 10th–9th c. BCE industrial metallurgical activities conducted by complex societies.

The analytical approach advocated here argues for an historical biblical archaeology rooted in the application of science-based methods that enables subcentury dating and the control of the spatial context of data through digital recording tools. Advances in IA Levantine archaeology can serve as a model for other historical archaeologies around the world that engage ancient historical texts such as the Mahabharata and other ancient writings in India (9), the Sagas of Iceland (10), and Mayan glyphs (11).

Archaeological Context and Discussion. The work reported here represents the large-scale excavations at the IA copper production site of Khirbat en-Nahas (KEN) (12) and is a part of a deep-time study of the impact of mining and metallurgy over the past 8 millennia in Jordan's Faynan district. Faynan is part of an IA polity known from the HB as Edom, located in the Saharo-Arabian desert zone in southern Transjordan. By the 7th–6th c. BCE, Edom extended westward across the Wadi Arabah, from Transjordan into the Negev Desert. Edom is characterized by 2 major geomorphologic units, the highland plateau and the lowlands that border Wadi Arabah. Before our project, most IA excavations were carried out

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Fig. 1. Aerial photograph of KEN, Jordan, showing square Iron Age fortress (73 × 73 m), and massive black copper slag mounds on the site surface (photo courtesy UCSD Levantine Archaeology Laboratory).

on the highland plateau, largely ignoring the copper ore-rich Edom lowlands. Beginning in 2002, we carried out large-scale IA surveys and excavations in the lowlands. The largest site is KEN (≈10 hectares) with >100 buildings visible on the site surface, including one of the largest IA Levantine desert fortresses (Fig. 1). KEN was first systematically mapped by Glueck in the early 1930s (13) and identified as the center of Solomon's mining activities. It was initially sampled by the German Mining Museum (GMM) in the early 1990s (14). In 2002, we excavated the fortress gatehouse (Area A), a building devoted to copper slag processing (Area S), and ≈1.2 m of the upper part of a slag mound (Area M) by using stratigraphic methods. A suite of 37 radiocarbon samples from our 2002 excavations was processed by accelerator laboratories in Oxford and Groningen and yielded early IA dates for the occupation of the site, between the end of the 12th c. and the end of the 9th c. BCE (15, 16). These dates confirmed the radiocarbon dates published earlier by the GMM (17).

By pushing the absolute chronology of Edom back into 12th through 9th c. BCE, the stratified excavations in the lowlands of Edom provided an objective dating technique that linked this metal production center with the period of the early Israelite kings and their neighbors mentioned in the HB. The 10th c. BCE portion of this Levantine chronology is known as the IA IIa, a highly contentious period, but especially important for historical archaeology because it is partially dated on the synchronism between biblical texts related to Solomon's successor and son, Rehoboam (1 Kings 14:25–26 and 2 Chron. 12:2–10), and Egyptian texts of the Levantine military campaign by Pharaoh Sheshonq (Shishak) I, who reigned *ca.* 945–924 BCE (18). The campaign is mentioned in the HB and absolute dating evidence comes from Shishak's extensive triumphal topographical list related to his victories in Palestine at the temple of Amun at Karnak, Thebes (pls. 2–9) (19). The KEN excavations bring the early history of IA Edom into the realm of social interaction between 10th c. BCE (and earlier) ancient Israel and this region. Although the GMM published 9 radiocarbon dates from the Heidelberg lab and we published 10 dates from Oxford and 27 dates from the Groningen labs, this sample was not substantial enough for some scholars (total of 46 dates) (12, 16) to accept the implications of this new dating framework for Edom. The 2002 results were criticized by researchers who misunderstood the application of Bayesian statistics to help achieve subcentury dating accuracy (20) and had preconceived dating frameworks that would not allow for the construction of monumental fortresses and complex polities in Edom during the 10th and 9th c. BCE that might resonate with the biblical narratives for these centuries (21). To help resolve these controversies, deeply stratified excavations to virgin soil were needed to date the full occupation span of KEN and measure the tempo and scale of metal production during the IA. Here, we report on the complete stratigraphic sequence at KEN from 2006 dated with a suite of 22 high-precision radiocarbon measurements and artifact data.

Fig. 2. Industrial copper slag mound >6 m in depth excavated at KEN (Arabic, ''Ruins of Copper,'' Jordan). The Oxford dates published here indicate that the building and all layers above it date firmly to the mid-9th c. BC. The ≈3 m of slag deposits below the building date to the 10th c. BC. There is a built rectangular feature resting on virgin soil at the bottom of the section that may be an altar (photo T. E. Levy).

New Excavation Data and ^{14}C Dates. The second major excavation campaign at KEN took place in 2006. As part of the expedition, an ≈5 × 5-m excavation square was opened in the industrial slag mound from the surface to virgin soil, following the contours of the 2002 excavation, to a depth of ≈6.1 m (Fig. 2). This excavation revealed >35 superimposed layers of crushed slag, tapped earth and clay, and other materials related to copper smelting in this area. The excavation was extended to the north, exposing a 4-room (with possibly a fifth room extending into the bulk) building (≈7.25 × 8.50 m). As seen in Fig. 2, this building was constructed on top of >3 m of debris layers also representing industrial-scale copper production. The basal virgin sediment consists of sterile wadi sands. The first indications of human activity were found several centimeters above these sands – a well-built rectilinear installation ≈1 × 0.80 m, with 3 visible "horn-shape" rock features at each of its exposed corners. This represents the earliest phase of settlement activity at the site. Above this were >3 m of crushed slag and other copper industry debris layers also representing repeated episodes of smelting, furnace destruction, and related activities. To establish a foundation for the 4-room building, the top of the early industrial debris mound was truncated and leveled to form a surface for construction. Local dolomite and sandstone blocks were crudely trimmed and laid in place as walls by using dry-masonry techniques, preserved in the south to a height of > 2 m. During the occupation of this building, which had 2 main use phases, different types of massive industrial slag deposits accumulated in the open area behind the structure, to an additional height of ≈3 m (Fig. 2) that represent the final smelting activities in this part of the site. Thus, there are 4 major strata in the Area M slag mound and structure (from earliest): M4, virgin soil with initial occupation activities not connected to metal production; M3, a buildup of ≈3 m of copper production debris immediately under the Stratum M2 Area M building complex; M2, building interior is subdivided into M2b (the main building phase) and M2a (later phase of structural additions); and M1, accumulation of copper production debris outside of the building.

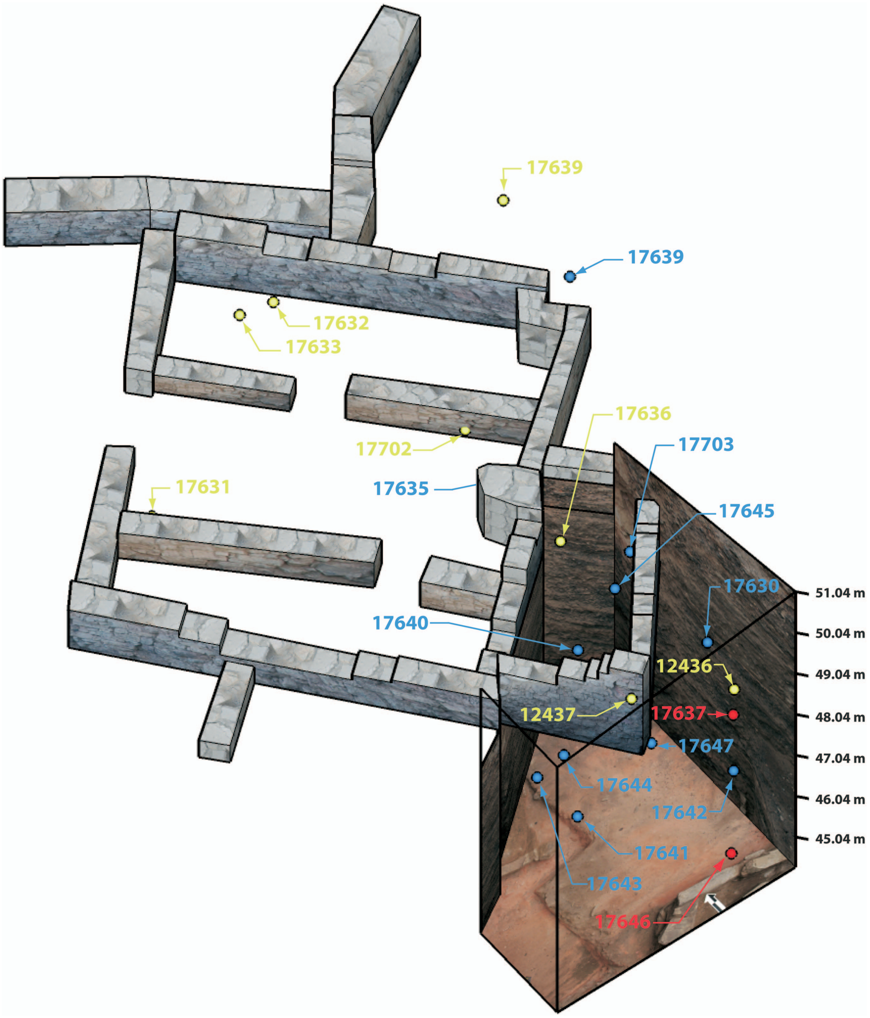

Fig. 3. 3-D visualization model of Area M 4-room building, excavation unit through slag mound and stratigraphic location of radiocarbon dates, KEN, Jordan. Numbers represent Oxford (OxA) laboratory numbers listed in Table 1. Blue spheres, 10th c. BCE; yellow, 9th c. BCE; red, outliers. Scale in meters above sea level shown on right side of model.

Archaeologically, the construction of the building in the Area M slag mound represents a major reorganization of metal production at the site in Stratum M2. The association of this structure with smelting activities indicates that it was tied to these behaviors during its entire use life. The earliest floor level associated with the building (Stratum M2b) contained 2 Egyptian artifacts that give a relative date for the initial occupation of the room. These include a scarab and an *aegis* (amulet with broad collar, often with a lion's head identifying the figure as Bastet or Sachmet) [supporting information (SI) Fig. S1]. Typologically, the scarab belongs to an early IA mass production series made of enstatite, a silicate mineral that is foreign to the southern Levant. Scarabs belonging to this series have been found at Megiddo Stratum VI, Dor 7a (Area G), Kinneret V, Tell es-Sai'diyeh (Tombs 65 and 118), and many other sites. These seals often appear in the IA IB (*ca.* 1140/30–1000/980 BCE) and peak at the beginning of the IA IIA (*ca.* 1000/980–840/830 BCE) (22). They originate from the Eastern Delta in Egypt, possibly from Tanis, where they may have been produced during the reign of the Pharaohs Siamun and Sheshonq I in the 10th c. BCE. The other Egyptian find, an *aegis* amulet made of faïence, is usually mold made. Parallels have been found at sites such as Tell el-Far'ah South (Tomb 201), Megiddo Stratum V, and, like the scarab found with it, are dated to the IA IB and IIA periods (23). Such amulets are primarily linked to the goddess Mut, the most important goddess during the early Third Intermediate period as part of the Theban triad Amun–Mut–Chonsu. Because there was a Mut temple at Pharaoh Siamun and Sheshonq I's capital at Tanis in the Eastern Delta, this amulet may also originate from Tanis. To help date the major phases of metal production and occupation at KEN, a rigorous program of high-precision radiocarbon dating was carried out in Area M. Great care was taken to select samples from the most representative archaeological contexts through the ≈6-m excavation unit. The location of the 22 samples selected for dating are portrayed in the 3-D visualization model presented in Fig. 3.

Controlling Space—Coupling Digitally Collected Field Data with 3-D Visualization Modeling. To achieve subcentury dating accuracy for ancient historical archaeology, as is the case for Levantine historical biblical archaeology, every effort should be made to move beyond nondigital survey technologies (i.e., builder's or dumpy levels, etc.) that rely on the skill of the surveyor to digital-based instruments that eliminate human error. To achieve this a completely digital-based on-site recording system with GIS as its nexus was developed (24). This enables all data to be recorded in 3-D [x–z (elevation) coordinates] and easily transferred to a variety of rapidly evolving 3-D computer modeling programs that help the researcher and public visualize archaeological data and models. Using the Area M data, we created a visualization application for the *StarCAVE*, an immersive virtual reality environment at University of California San Diego's Calit2 that allows a user to walk through a computer 3-D generated model (Fig. S2). Using *Google Sketchup*, we created a 3-D model of the ancient walls and the 5 × 5-m excavation unit in Area M, to which the 22 radiocarbon dating samples were plotted with blue spheres for the 10th c. BCE samples, yellow for the 9th

Table 1. Radiocarbon dates and calibrations from Area M, Khirbat en-Nahas, Jordan

								Calibrated dates (cal BC)			
								68.2%		95.4%	
OxA	Sample*	Stratum	Material	Species	Date	+/−	δ^{13}C, ‰	From	To	From	To
12436	KEN06 M L511 B8501 EDM80372	1	Charcoal	*Tamarix?*	2659	32		834	799	896	792
12437	KEN02 M L539 B9039	1	Charcoal	*Tamarix?*	2746	35		917	839	976	815
17630	M1 KEN06 M L535 B1025	1	Charcoal	*Retama raetam*	2764	25	−25.3	969	846	977	835
17631	M3 KEN06 M EDM91837 L	2	Charred seeds	*Phoenix dactylifera*	2676	26	−21.3	841	803	896	800
17632	M4 KEN06 M EDM91808 L	2	Charred seeds	*P. dactylifera*	2713	26	−23.8	896	828	908	811
17633	M5 KEN06 M EDM91641 L	2	Charred seeds	*P. dactylifera*	2734	25	−24.4	900	841	925	819
17634	M6 KEN06 M EDM90466 L	2	Charcoal	*Haloxylon persicum*	2783	25	−10.8	976	900	1005	846
17635	M6 KEN06 M EDM90466 L	2	Charcoal	*H. persicum*	2777	25	−11.1	976	860	1000	844
17636	M7 KEN06 M EDM90378 L	2	Charred seeds	*P. dactylifera*	2732	25	−24.5	899	840	922	819
17637	M8 KEN06 M EDM90395 L	1	Charcoal	*P. dactylifera*	2836	26	−22.7	1022	933	1110	913
17638	M9 KEN06 M EDM91773 L	2	Charred seeds	*P. dactylifera*	2814	25	−24.0	1001	928	1038	904
17639	M10 KEN06 M EDM91462	1	Charred seeds	*P. dactylifera*	2678	26	−23.8	841	804	896	801
17640	M11 KEN06 M EDM91098	3	Charcoal	*Tamarix* sp.	2770	25	−26.1	972	851	996	840
17641	M12 KEN06 M EDM90754	3	Charcoal	*Acacia* sp.	2767	25	−10.1	971	848	996	837
17642	M13 KEN06 M B10279	3	Charcoal	*Tamarix* sp.	2781	25	−9.8	976	898	1003	846
17643	M15 KEN06 M EDM91175	3	Charcoal	*Tamarix* sp.	2813	26	−25.5	1001	927	1041	903
17644	M16 KEN06 M EDM91211	3	Charcoal	*Tamarix* sp.	2824	25	−23.4	1008	932	1047	912
17645	M17 KEN06 M EDM90832	3	Charcoal	*Tamarix* sp.	2747	25	−24.8	913	843	972	827
17646	M18 KEN06 M B10285	3	Charcoal	*Tamarix* sp.	2871	26	−23.4	1112	1005	1129	936
17647	M19 KEN06 M EDM91192	3	Charcoal	*H. persicum*	2764	25	−11.4	969	846	977	835
17702	M2 KEN06 M EDM90181 L	2	Charcoal	*R. raetam*	2740	30	−23.6	906	841	972	816
17703	M14 KEN06 M EDM90527	3	Charred seeds	*P. dactylifera*	2792	30	−25.3	993	906	1013	845

Dates are calibrated using the IntCal04 data set (31) and the OxCal calibration program v4.0 (30). Only the outer limits of the ranges are shown. *, All samples from 2006 excavation except 12436 & 12437 from 2002.

c. BCE, and red for the outliers (Fig. 3). This 3-D model was then embedded in a satellite terrain image draped over a digital elevation model (DEM) extracted from *Google Earth*. The 3-D Area M IA architectural walls and adjacent excavation unit were textured with bitmaps from photographs. The Google Sketchup model was exported to the VRML file format, which can be read by Calit2's virtual reality COVISE software. It is now possible to walk or fly around a life-size representation of Area M in the StarCAVE, Calit2's latest virtual reality environment and one of the most advanced in the world (Fig. S2). The user interacts with the system with a 3-D mouse and wears polarized glasses to see a stereo image. As seen in Fig. 3, the yellow 10th c. BCE spheres cluster with and above the building; the 10th c. BCE blue samples, below the structure.

Charcoal Samples. The wood charcoal for radiocarbon dating fell into 2 major categories:

(1) Small diameter rods from shrubs, particularly of *Tamarix* sp. (tamarisk) but also including *Retama raetam*, *Haloxylon persicum*, and 1 example of *Acacia* sp. Their growth rings indicated they were cut when aged 5 years or less and, taking shrinkage on charring into account, <25 mm in diameter.

(2) Trunk fragments of *Phoenix dactylifera* (date).

There were also some seeds of *P. dactylifera* (dates; $n = 7$ samples). There was no change in the relative abundance and range of taxa throughout the stratigraphic sequence.

The majority, if not all of the charcoal, was probably related to copper smelting at KEN. The shrubs are rapidly growing taxa of saline soil in arid areas and presently around KEN, which readily regenerate after being cut back. They could have grown locally and given a substantial harvest of rods for charcoal manufacture. Date palms grown for their fruit can tolerate drought and some soil salinity. With time, they form suckering clumps and as part of their management, it is likely that old trunks would have been cut out, incidentally generating fuel. Similar results were given by an earlier GMM study of an IA slag mound at KEN (25). They point to sustainable charcoal production using local vegetation to supply the industry.

To obtain "short-life" carbon for the accelerator mass spectrometry (AMS) dating either the 2 outermost growth rings of a piece of shrub charcoal or a date seed were used for all but one of the determinations. The value of this approach was demonstrated by the results for Sample OxA-17637, where the only material available for dating was charcoal of *P. dactylifera*. The growth pattern of palms is such that it is not possible to differentiate between young and old wood. It gives a date that is too early in the statistical analysis.

^{14}C Dating and Bayesian Analysis. For this study, 20 new radiocarbon dates were made from the excavations that span the entire 6.1-m sequence (Table 1). Two radiocarbon dates were included from the initial 2002 probe in Area M (12). Because it was impossible to distinguish subphasing outside the Area M Stratum 2b–2a building, the Bayesian analysis presented here is undertaken according to the main strata designations (M1, M2, and M3).

The Bayesian method is widely used in the modeling of radiocarbon determinations derived from archaeological contexts. The attraction of the method is that it enables calibrated radiocarbon determinations to be included along with relative archaeological information to enable a proper chronometric assessment to be determined. This involves a sequence of strata or archaeological levels that is assumed to be temporally independent. The method is outlined in detail in various publications (26–29). Other workers (30) apply simple error-weighted mean methods in their analysis of the radiocarbon corpus of this site. The underlying assumption in using a technique such as this is that the dated samples ought to derive from the same organic object (e.g., a single charcoal shard) and therefore have the same true mean age. Averaging large numbers of determinations from different contexts and sites is inappropriate because it ignores the nonmonotonic nature of the variations in the atmospheric concentration of radiocarbon.

The Bayesian model (31, 32) for KEN is based on the archaeological observation that there are 2 main phases of activity repre-

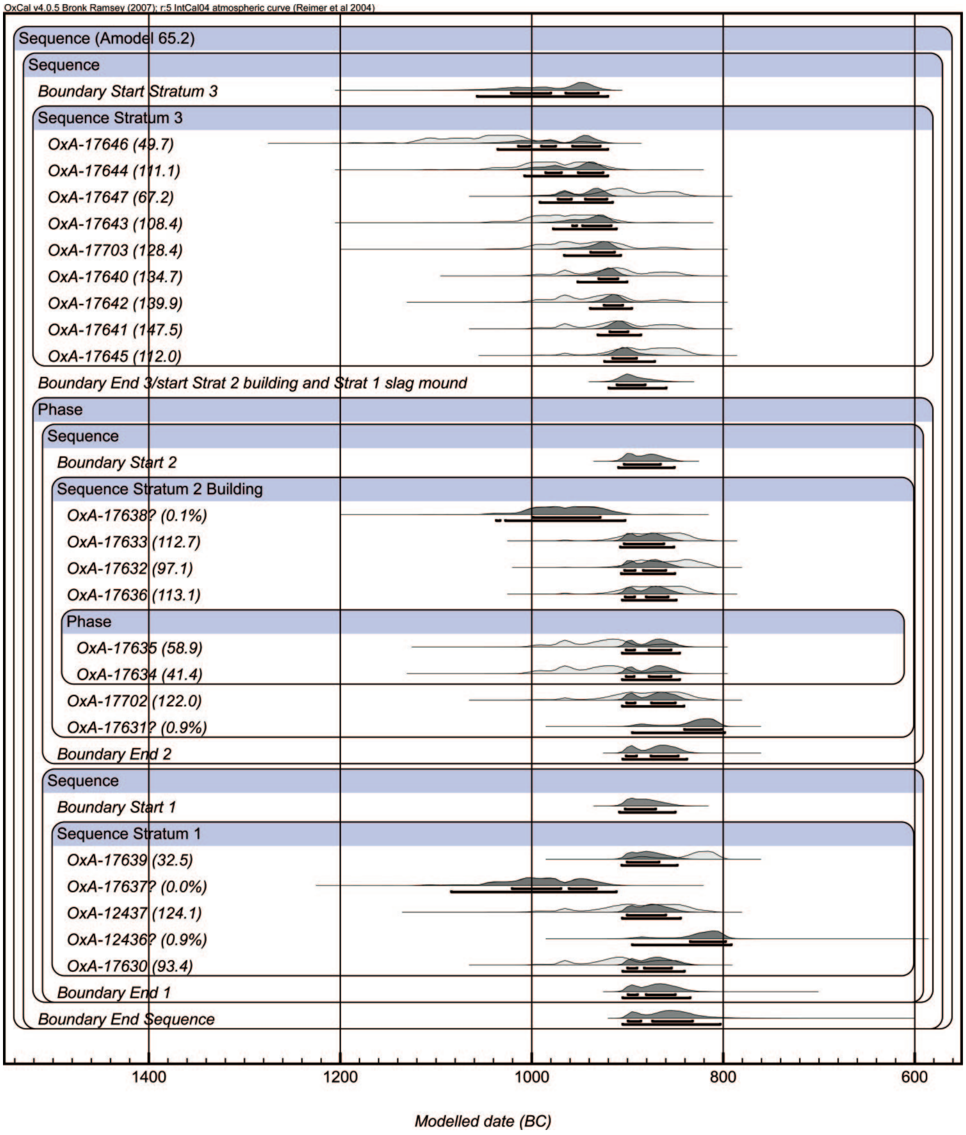

Fig. 4. Probability distributions for dates obtained using the Bayesian model derived by using the archaeological prior information shown in Fig. S3. The distributions shown in gray outlines represent the simple calibrated radiocarbon ages, whereas the dark black distributions represent the posterior probability distributions determined via the modeling. This figure was generated by using OxCal 4.0 (30).

sented. The first, represented by Stratum 3, consists of a series of radiocarbon dates deposited in a known order. The second phase is represented by Strata 1 and 2. We do not make any assumptions about the relative chronology of these 2 sequences in our model but assume that the material from them is all *later* than the material from Stratum 3 (Fig. 4). There are some clear outliers from this model that were questioned to achieve an acceptable agreement index (termed A_{model}). The dates that are questioned in the model are: OxA-17638, 17637 (both older than their context and assumed to be residual) and OxA-17631, OxA-12436 (both younger than their context and assumed to be intrusive). Sample OxA-17634 was dated twice (OxA-17625) as part of the Oxford laboratory's in-house program of assessing reproducibility. One sample in every 20 is dated twice to assess this, and in this particular case we decided to include both results to offer: (*a*) quality assurance to the work and (*b*) enhanced precision. The overall structure and details of the model is shown in Fig. 4 and schematically in Fig. S3.

The results of the Bayesian analysis show that metal production in Area M began after 1058–920 BC, with a highest probability of 950 BC (see start Stratum 3 boundary). This is effectively a *terminus post quem* for copper production in this area of the site. Stratum 3 itself spans between 5 and 135 years, with a highest probability associated with a brief period of only *ca*. 40 years. Stratum 2 begins after 910–850 BC, according to our modeling. The probability distribution associated with the end of occupation in this area of KEN is 906–800 BC, with a highest probability at 840 BC. The overall span of time represented in Area M ranges between 23 and 203 years (at 95% probability.).

New Stratigraphic Anchor for IA Ceramics in Edom–Rujm Hamra Ifdan (RHI). To supplement this chrono-social study of IA Edom, the small lowland site of RHI was sampled. Located ≈3 km SW of KEN, it was identified by Glueck during his survey in Edom as an IA watchtower situated on a small Pleistocene conglomerate outcrop (13). Two 5 × 5-m probes were excavated in 2004: Soundings A near the summit and B at the foot of the site near a large enclosure wall (Fig. S4). The results demonstrate that RHI is the first excavated site in Edom with stratified IA deposits that span most of the 10th–7th c. BCE IA sequence in Edom (Table S1). To date, there are no post-9th c. BCE deposits at KEN, so RHI is of particular importance. As seen in Table S1, ^{14}C dates from Sounding A fall within the 10th–9th c. BCE and those from B to the 7th c. BCE (Fig. S5). This site provides the first chronological link between IA Edom sites in both the lowlands and highlands. The ceramic data from this small site provide an important chronological framework for dating IA ceramics throughout Edom as demonstrated at KEN (33). The

Sounding A assemblage matches that of Area M at KEN (10th–9th c. BCE). They share parallel vessel types and fabrics typical of this period and from contemporary sites in the Negev. This includes high quantities of handmade wares and nonlocal "Midianite" or Qurayyah ware (thought to originate in the Hijaz region of northwest Arabia). Thus, the watchtower dates to the 10th–9th c. BCE. Sounding B is different and contains a late Iron Age ceramic corpus (bowls, kraters, and jugs) absent from KEN, but similar to the "Edomite" highland plateau and Negev Desert IA sites dated to the late 8th–6th c. BCE when Qurayyah ware disappears, indicating the lower enclosure dates to the 7th c. BCE. Importantly, radiometrically dated RHI provides a chronological anchor for situating IA ceramics from both the lowland and highland regions of Edom. Taken together, the ^{14}C and ceramic data from RHI and KEN (33), demonstrate that the late IA ceramic traditions of highland Edom originate in the lowlands and evolved locally from as early at the 10th c. BCE.

Conclusions

The application of high-precision radiocarbon dating, Bayesian analysis, and spatial modeling at IA sites in the southern Levant is an important tool for researchers interested in the relationship between ancient texts such as the HB and extrabiblical data including Egyptian, Assyrian, and other epigraphic sources with the archaeological record (15, 34). Given the unambiguous ^{14}C AMS dating evidence presented here for industrial-scale metal production at KEN during the 10th and 9th c. BCE in ancient Edom, the question of whether King Solomon's copper mines have been discovered in Faynan returns to scholarly discourse. The collapse of Late Bronze Age civilizations (35) in the eastern Mediterranean and the Cypriot monopoly on copper production left a power vacuum in the Levant that was filled by emerging IA complex societies such as Edom and Israel as early as the 10th c. BCE. The abrupt reorganization of metal production at the end of the 10th c. BCE and the discovery of Egyptian artifacts in the basal level of the 9th c. BCE building in Area M may be associated with the Pharaoh Sheshonq I's military campaign in the Negev and Arabah valley that occurred shortly after the death of Solomon (18). Most scholars agree that the aim of his campaign was to disrupt the economic success of local Levantine polities such as Philistia, Israel, Judah, and Edom rather than reestablish an Egyptian colony modeled on their previous Late Bronze Age system (18). The 10th c. BCE KEN fortress (15) and associated copper works may have been another target of Sheshonq's campaign (Fig. 2). For the IA archaeology of the southern Levant the new IA data from the Edom lowlands demonstrate the importance of local 10th and 9th c. BCE Levantine polities in the control of industrial-scale metal production. The dominance of local Edom IA ceramics at KEN during these centuries indicates the centrality of local societies in metal production at this time. The earlier model that assumed large-scale 7th c. BCE copper production in Faynan is no longer tenable. Thus, the rise of IA complex or state level societies in Edom was a cycling process of social evolution that began 3 centuries earlier than currently understood (36). These new data indicate the need to revisit the relationship between the early IA history of the southern Levant before the editing of the HB in the 6th c. BCE, the study of the archaeological record using science-based methodologies, and local models of social change such as those embedded in peer polity interaction studies. Finally, the application of high-precision radiocarbon dating, Bayesian analyses, and digital archaeology methods should be an integral part of all 21st c. research dealing with ancient historical archaeology problems around the world.

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