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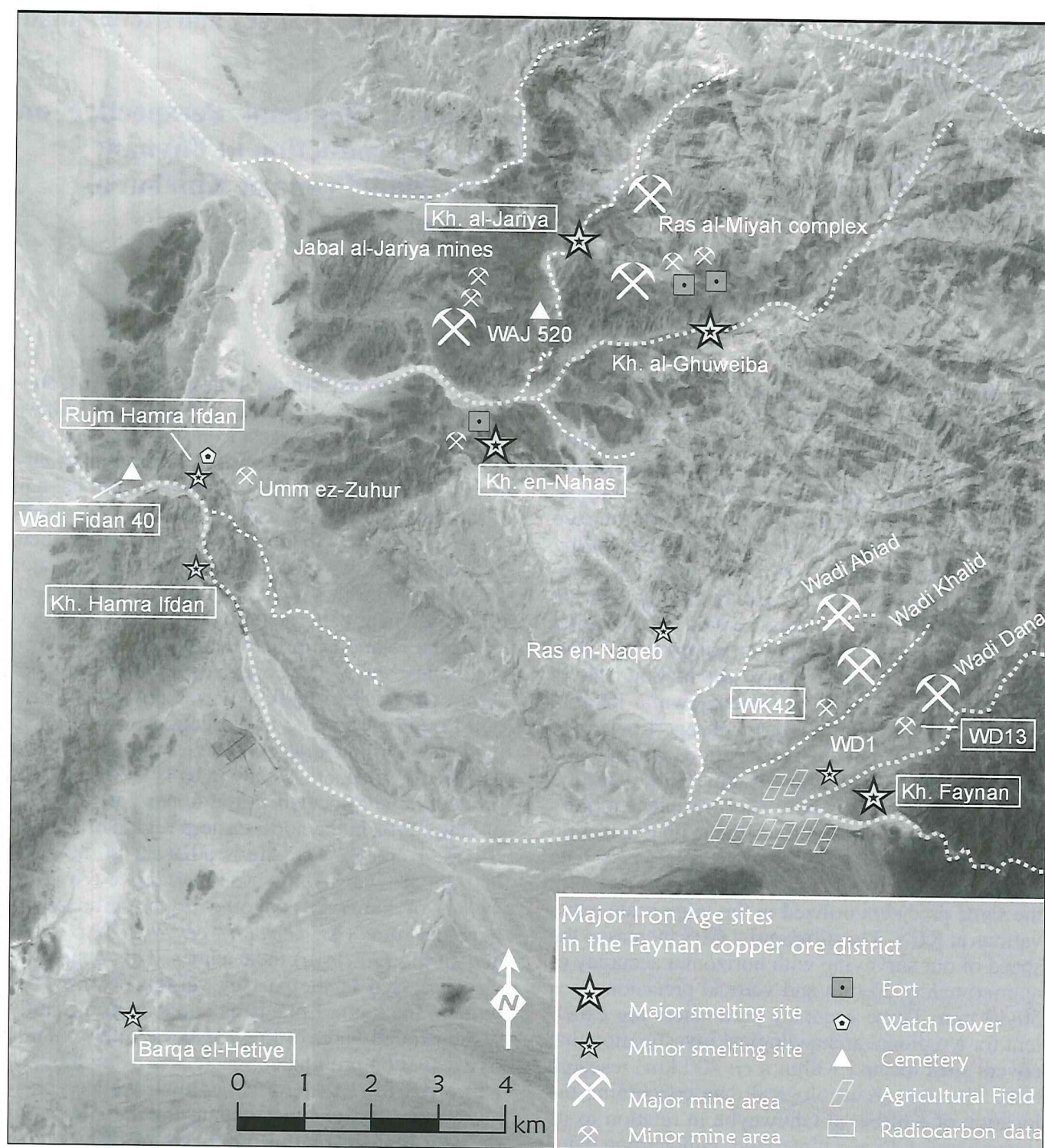
Challenges for a Regional Perspective on Iron Age Metal Production in Faynān: Results of the 2009 Prope at Khirbat al-Ghuwayba, Jordan

The theme “Changes and Challenges” for this year’s ICHAJ conference aimed at exploring how new tools and technologies can be used to study the archaeological record of Jordan. As part of the Edom Lowlands Regional Archaeology Project (ELRAP) that has focused on the role of Iron Age metal production in socio-cultural change during the late 2nd and early 1st millennia BC, we carried out a small-scale test excavation at Khirbat al-Ghuwayba using the latest version of our digital archaeology system in order to compare and contrast one of the smaller copper production centers in Faynān with the largest ones known at Khirbat an-Nuḥās (KEN) and Khirbat al-Jāriya (Levy *et al.* 2010). Over an eight day work period, thanks to the use of a Global Positioning System (GPS; real-time kinematic differential GPS) we were able to rapidly excavate a probe that explored the main occupation phases of the site, map the entire site (over 7 ha extent of rough terrain) and record these data with the same precision utilized in the large-scale excavations at KEN. The differential GPS increased the speed of our surveying with horizontal accuracy of approximately 20 mm and vertical precision to *ca* 30-40 mm. These accuracy parameters are excellent for a regional archaeological investigation that covers sites located within a *ca* 400 km² research area. The new archaeological data concerning the location of Khirbat al-Ghuwayba in relation to its immediate landscape hinterland, radiocarbon dates published here for the first time and the site’s relationship to the main centers of Iron Age copper production provide new insights into the regional historical and socio-economic processes of settlement in the Faynān copper ore district.

Regional archaeological surveys and excavations in Faynān carried out by UCSD’s ELRAP

team, the German Mining Museum and the Council for British Research in the Levant (CBRL) have shown that the three largest Iron Age copper smelting sites include (in order of size): Khirbat an-Nuḥās (Levy *et al.* 2008), the environs of Khirbat Faynān (Mattingly *et al.* 2007) and Khirbat al-Jāriya (Ben-Yosef *et al.* 2010). In terms of size and importance, Khirbat al-Ghuwayba (KAG) is the fourth major smelting center that must be factored into any Iron Age settlement pattern study of Faynān. To understand the relationship between KAG and the Iron Age landscape of the copper ore-rich lowlands of Edom (Levy *et al.* 2003), it was critical to carry out a rapid systematic investigation of this site in tandem with our large-scale excavations at KEN. The site of Khirbat al-Ghuwayba is a large copper production site located in the upper part of Wādī al-Ghuwayba in the north-eastern region of Faynān (FIGS. 1 and 2). The site is adjacent to the oasis of ‘Ayn al-Ghuwayba whose lush grove (Ar. *ghuweiba*) of tamarisk and other hydrophilic plants gave the ruins (Ar. *khirbah*), dry river (Ar. *wadi*) and spring (Ar. ‘*ayn*) their names. This major site was surveyed in the past by various scholars but without the kind of precision and diachronic study demonstrated here. In this paper we report results of excavation probing conducted by us in 2009, as part of UCSD’s ELRAP expedition. We also present a new stratigraphic scheme for the site based on new high resolution radiocarbon dates and a ceramic assemblage from the early Iron Age that challenges earlier assumptions about the nature of Iron Age copper production in Faynān.

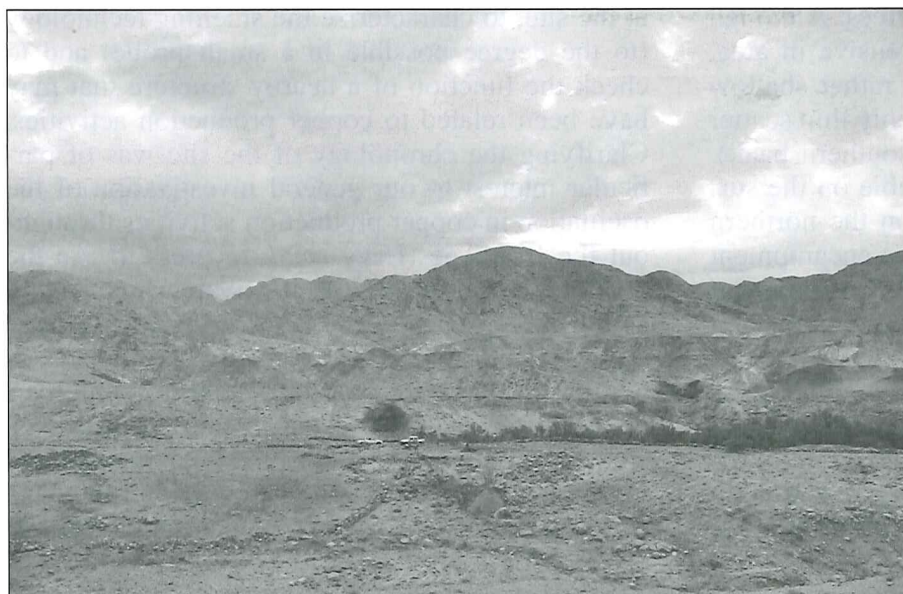
Khirbat al-Ghuwayba was first visited by Nelson Glueck in the 1930s (1935: 22-23, 164, Plate 162), surveyed in the 1980s as part of the Southern Ghawr and Northern Arabah Survey (SGNS)



1. Map of major Iron Age sites in Faynān (after Ben-Yosef *et al.* 2010). A growing dataset of radiocarbon measurements have become available recently (white squares around site names), including the new dates published here for KAG (see text).

(MacDonald 1992: 76, Site 161) and examined during the archaeometallurgical survey of the German Mining Museum (Deutsches Bergbau Museum, Bochum) (Hauptmann 2007: 132-133). It

was visited in 2006 as part of ELRAP's investigation of the Rās al-Miyah fortresses (Ben-Yosef *et al.* 2009) and in 2007 as part of ELRAP's FBRS project (Ben-Yosef *et al.* in press, Site 1). Glueck



2. Khirbat al-Ghuwayba: overview of the excavation area (Area E) during the 2009 excavation season.

(1935: 22-23) dated the smelting remains at the site mostly to the early Iron Age:

“On the surface of the site we found numerous sherds of rather coarse type belonging to EI I [Early Iron Age I] and to the first part of EI II. A few Nabataean sherds were also found. The considerable quantities of copper slag testify to intensive mining and smelting activities during the Early Iron Age. We did not actually find the copper bearing rock by *Kh. El-Gheweibeh*, but we did find large quantities of such rock a few kilometers away.”

It is interesting to compare Glueck's observation with the comments of the DBM's Gerd Weisgerber (2006:15): “[...] at Khirbat al Ghuwayba was another, seemingly unsuccessful, smelting site. Perhaps the yield in copper ore there did not meet expectations.” Indeed, the extensive scatter of slag on the surface is rather thin and less substantial than the nearby smelting sites of Khirbat an-Nuḥās and Khirbat al-Jāriya. The large slabs of tap slag, abundant on the surface of KEN, are completely absent and there are no substantial ‘mounds’ as at other Iron Age smelting sites in Faynān. However, as will be suggested below in light of the recent ^{14}C dates from KAG, the density differences of surface slag at the different Iron Age smelting centers in Faynān may be linked to both chronology and technological practice during the Iron Age sequence in Faynān (ca 1200-500 BC).

As part of the ELRAP 2009 field season we conducted a small sounding at Khirbat al-Ghuwayba in order to contextualize and date the copper production remains that dominate the site. The field work included a small team of UCSD students, local *bedouin* workers and a volunteer¹. As noted above, we applied the same excavation methodology and digital recording procedures as the main project (Levy and Smith 2007; Levy *et al.* 2010), situating the control points and site mapping with differential GPS and using a Total Station and GIS-based database for recording the excavations, with Microsoft Access forms for locus summary and ArcView for producing top plans and artifact spatial distribution maps (all material are available in ELRAP's digital database). The real-time kinematic GPS system enabled us to link the excavation and survey data from KAG on a daily basis with the general ELRAP GIS database.

Differential GPS is an enhancement of GPS that uses additional positioning data recorded by a stationary antenna (in our case located on the roof of our field laboratory at the village of Qurayqira) to correct the raw co-ordinates and increase accuracy.

The site extends over 7 hectares (70 *dunams*) on both sides of Wādī al-Ghuwayba, near the perennial spring of ‘Ayn al-Ghuwayba. Today, a family of the local al-Man’aja *bedouin* section of the Huwaytat tribal confederation has constructed a small farm-

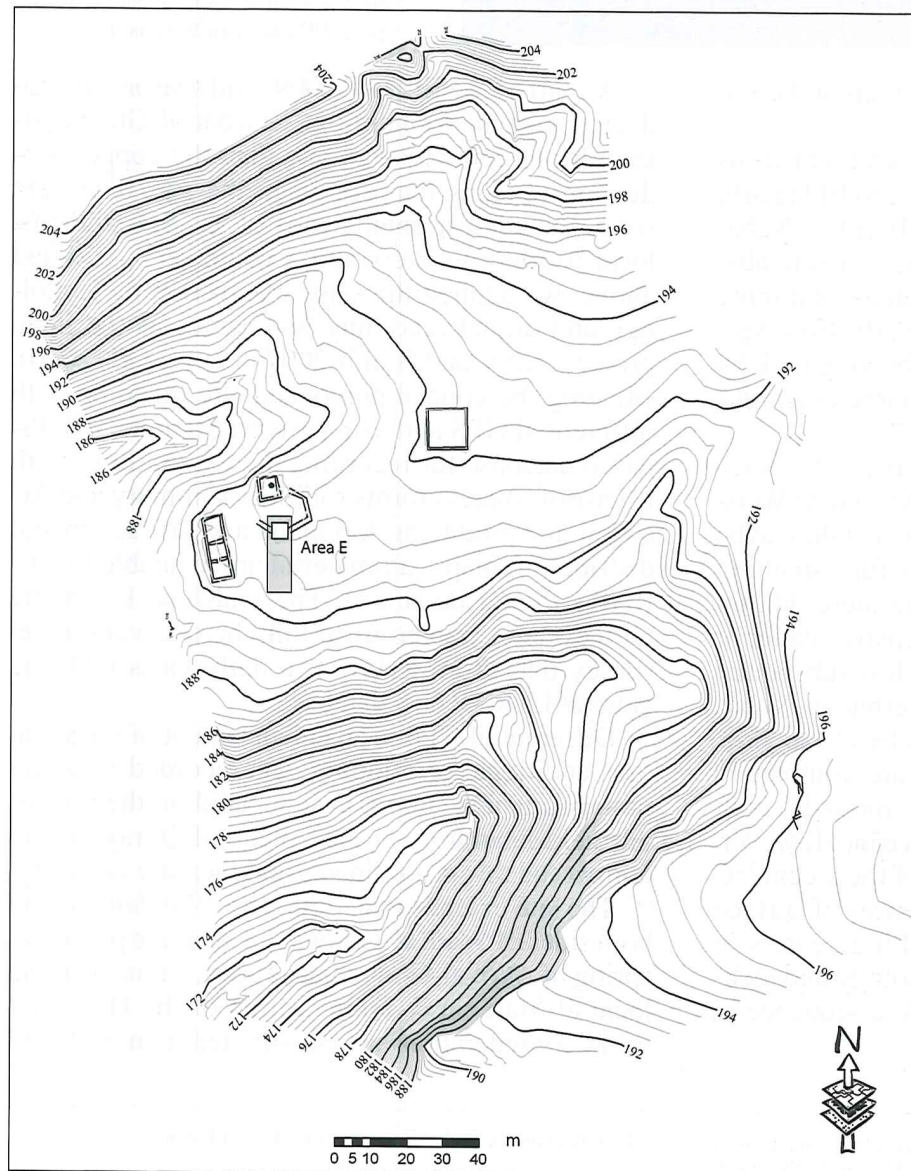
¹ The excavations were supervised by EB-Y with the assistance of Kathleen Bennallack under project directors TEL and MN. ZZ Y

FI serves as the ELRAP digital surveying advisor.

stead with pomegranate and olive trees. Although the archaeological site is quite extensive in area, the archaeological accumulation is rather shallow and in most places is composed of only thin scatter of broken slag (especially on the southern bank). Some substantial structures are visible on the surface, and a few are concentrated on the northern bank near a seasonally active *bedouin* encampment (during this season of excavation the encampment was vacant, although remains of the habitation and pens were visible; FIG. 2).

An area of relatively thick slag accumulation associated with some surface structures was selected for excavation on the northern bank of Wādī al-Ghuwayba ("Area E"; FIGS. 2 and 3). The main goals were to date the copper production activities

at the site, to characterize the smelting technology (to the degree possible in a small probe) and to check the function of a nearby structure that may have been related to copper production activities. Clarifying the chronology of the site was of particular interest to our general investigation of the oscillation in copper production activities throughout the Iron Age (Levy *et al.* in press a). As the nearby mining sites of Rās al-Miyah were dated by abundant ceramics to the late Iron Age (Iron Age IIB - C) (Ben-Yosef *et al.* 2009), we speculated that Khirbat al-Ghuwayba was the smelting counterpart of the mines and also dated to the late Iron Age (Ben-Yosef *et al.* 2009). Based on our surveys and those of other researchers in the vicinity of those mines, and in other nearby areas in the Faynān re-



3. Khirbat al-Ghuwayba on both sides of Wādī al-Ghuwayba. The site extends over 7 ha and consists mostly of a shallow scatter of slag fragments. Note the main architectural features and the location of the excavation probe ("Area E"): a small structure and half a 5 x 5 m square in metallurgical deposits were excavated. The most pronounced topographic low south of Area E on the map reflects the location of the wadi bed today.

gion that have been investigated to date, there are no good other 'candidates' for smelting sites associated with these mines.

Mapping Khirbat al-Ghuwayba

With the aid of ELRAP surveyor Fawwaz Ishakat of the Hashemite University, we produced a topographic map of the site with the main architectural features (FIG. 3) using the differential GPS system noted above. This general map helps to contextualize the excavated probe ("Area E") and demonstrates the extent of the site. The map has topographic contours of half a meter resolution, emphasizing the topography and the location of the main structures (mostly on the north bank of the wadi). The southern bank portion of Khirbat al-Ghuwayba is characterized by many small tumuli rather than rectangular or square architectural features. As clearly indicated on the map, most of the slag scatter is not associated with substantial structures and the southern bank is almost completely devoid of substantial architectural features (except small installations, not mapped). The spring of 'Ayn al-Ghuwayba is located between the two banks of the wadi, a small cemetery is located to the northwest of Area E (not shown on the map, but see FIG. 4) and the fortress of Rās al-Miyah West is visible from the site, located almost directly north of it.

KAG Area E: the Structure

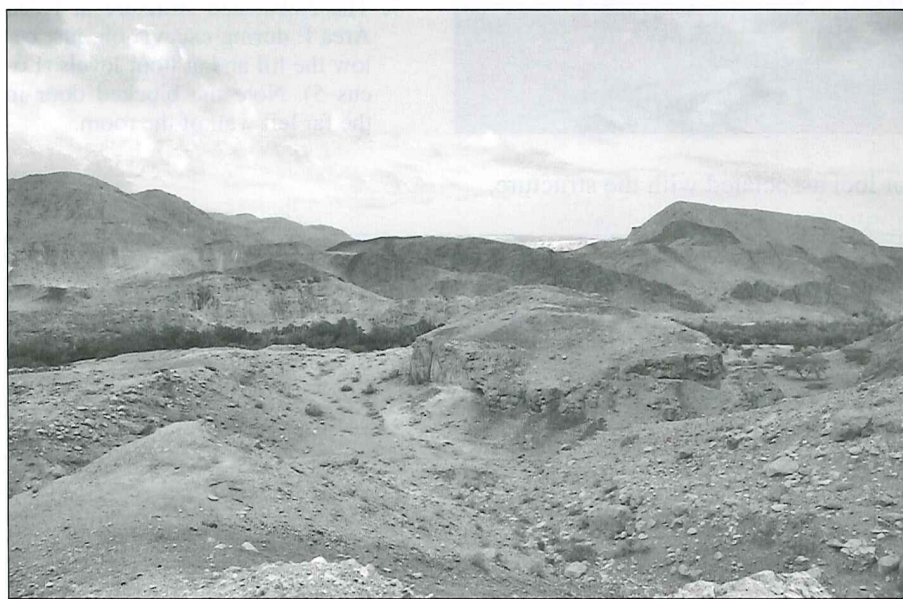
The excavation of the small square structure in Area E concluded with the exposure of a room dated to

the Roman-Nabataean period on the basis of the glass and pottery assemblages and small finds. The room contained several hearths and abundant carbon samples were collected from the floor levels. The structure was initially filled with collapse and windblown loess to the tops of the walls, a depth of less than 1 m (FIGS. 5, 6 and 7). The truncation of the walls may suggest that the stones had been removed for re-use in later structures. Beneath the fill we found several hearths and ash pockets with large accumulations of charcoal, in addition to a large quantity of glass fragments, pottery sherds and one playing die (TABLE 1).

Based on our extensive excavation of Iron Age structures at KEN and KAJ it was apparent that the building technique represented at Khirbat al-



5. The Nabataean structure at KAG Area E before excavation.



4. The location of a modern *bedouin* cemetery west of Khirbat al-Ghuwayba. The cemetery is at the base (left side) of the inselberg.

Ghuwayba Area E is quite different, reflecting both cultural and chronological differences. The con-



6. The Nabataean structure at KAG Area E during excavation (Locus 3: fill).

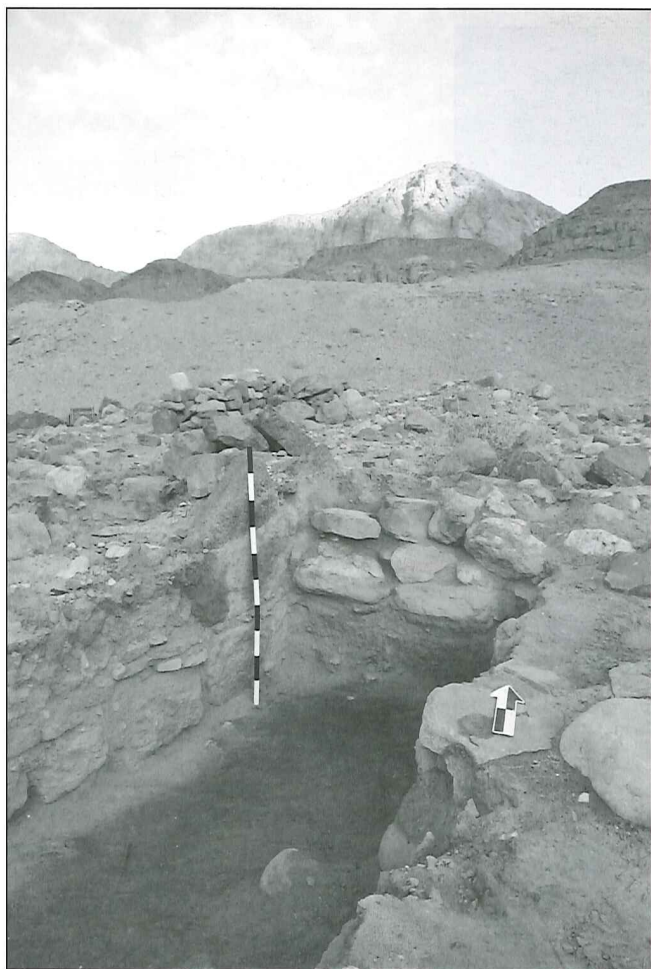
struction of the structure at Khirbat al-Ghuwayba is finer and more regular, consisting of courses of large stones of uniform thickness with courses of small stones between the larger courses. In addition, we observed two walls to the north of the building which abut the walls of the structure and curve outward and to the north, creating a rectangular courtyard with rounded corners (FIG. 3). Since these walls abut, but are not bonded with the walls of the structure, we conclude that they are from a separate (later) building phase. The fact that they are also higher than the foundation of the structure walls suggests that the courtyard is indeed from a later period (possibly Late Islamic?) (FIG. 8). The courtyard walls probably abut another structure located to the north (FIG. 3). On the basis of building techniques it seems that this structure and the elongated building to the west are also from the Nabataean period. There is a doorway in the north-



7. The Nabataean structure at KAG Area E during excavation, just below the fill and at floor levels (Locus 5). Note the blocked door in the far left wall of the room.

Table 1. KAG Area E: Harris Matrix for loci associated with the structure.

<i>Main building</i>				<i>Building walls</i>	<i>Probe below foundations</i>	<i>Courtyard(s) walls</i>
7	3	15	16		24	25, 26, 27
				18, 19, 20, 21, 22	28	
13	5				29	
	6	14				
	32 FL	33 FL	36, 37			
		35				



8. The courtyard wall abuts the eastern wall of the structure; its foundation is much higher, probably indicating that it was built in a later period (perhaps representing a secondary use of the stones of the Nabataean structure).

ern wall of the structure, facing the courtyard (and from which we did not remove the blockage). A third curvilinear wall was found to the south; its upper courses may have been accidentally removed during the excavations while removing the fill and collapse. This wall abuts the southern wall of the structure (although it ends abruptly to its south) and may have been part of a wall which delineated a southern courtyard.

Several hearths were found inside the structure associated with ash pockets (FIG. 9). Most ash pockets were located around the edges of the room, but some very thick deposits of ash, stones and large pieces of charcoal were found near its center. Adjacent to one of the hearths in the north-western corner of the room we found a single carved stone die for gaming (FIG. 10A-B). Some of the well defined hearths were recorded as separate intrusive



9. Example of one of several hearths found on the floor level of the Nabataean structure at KAG Area E (Locus 37).

loci (see TABLES 1 and 3). The floor of the building was not paved, but consisted simply of compact earth. However, the artifacts and installations such as the hearths made this level very distinct and well defined.

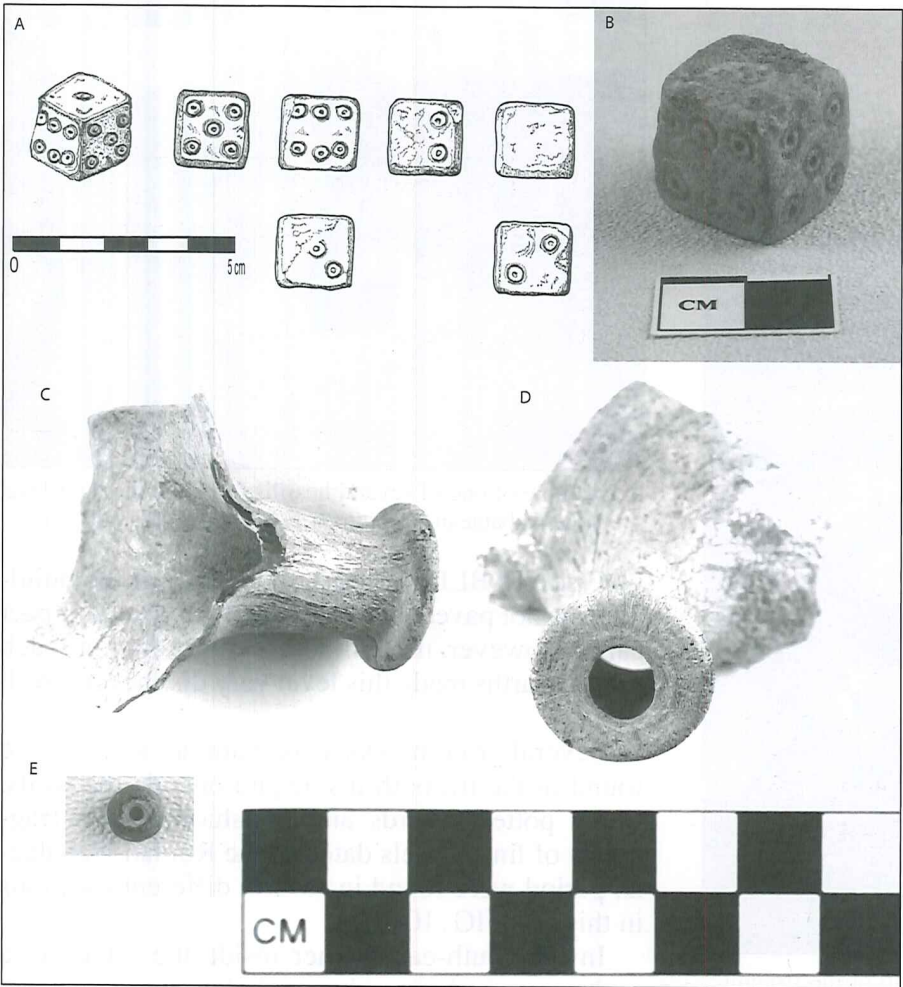
Several grinding slabs and hammer stones were found in the fill both inside and outside the walls. Many pottery sherds and translucent glass fragments of fine vessels dated to the Roman-Nabataean period were found in several different locations in this fill (FIG. 10C-D).

In the south-east corner inside the building, a probe was made to penetrate below the floor level to check the relation of the wall foundation and the floor, and to make sure there was only one floor level (Locus 35). Just below the floor level some copper production remains were exposed, and it was clear that the floor relates to one main occupation horizon with some minor accumulations in areas where hearths reflect intense use (FIGS. 7 and 11). The general character of the floor indicates quiet abandonment of the building, and not rushed or traumatic desertion.

In the south-western outside corner of the building another small probe was excavated to virgin soil (FIG. 12). There is a distinct metallurgical layer just beneath the wall foundation and collapse, however, in contrast to the situation in the excavated section in the slag scatter to the south, the accumulation here was very thin and made mostly of crushed slag, ash and charcoal.

KAG Area E: the Metallurgical Deposits

The relatively dense deposits of surface slag to the



10. Small finds from the Roman-Nabataean structure at KAG: (A) - (B) a gaming die found on the floor level near one of the many hearths (EDM E09F0202, Locus E09L032, Basket E09B0171), (C) - (D) a fragment of a glass bottle (EDM E09F0086, Locus E09L015, Basket E09B0074), (E) a small black bead (EDM E09F0095, Locus E09L007, Basket E09B0083).



11. KAG Area E: excavating the floor level of the Nabataean structure.

south of the Nabataean building complex provided an ideal location to make a second probe to investigate the history of copper production at Khirbat al-Ghuwayba. The area selected for probing was ten

meters to the south of the structure that appeared to indicate the top of a dense metallurgical slag (FIG. 13; TABLE 2). The center of the probe contained a stone feature that resembled an Iron Age grave of the type documented at other locations in Faynān (FIG. 13). The surface of this probe consisted of a layer of slag mixed with a few sherds of (probably

Table 2. KAG Area E, Harris Matrix for loci associated with the probe into the metallurgical deposits; shaded loci have radiocarbon dates (see text).

1 (slag scatter)			2 (stone feature)	
9	12	4	11	10
		8	17	
		23		
		30		
		31		
		34		

CHALLENGES FOR A REGIONAL PERSPECTIVE ON IRON AGE METAL PRODUCTION IN FAYNĀN

Table 3. Locus list of KAG 2009, Area E.

Locus	Square	Definition
1	metallurgical	Metallurgical layer / surface fragments
2	metallurgical	Stone feature
3	structure	Fill and wall collapse, surface finds from square structure
4	structure	metallurgical Ashy fill (accumulation of dust in a metallurgical context)
5	structure	Floor level (and a bit above), secondary?
6	structure	Hearth
7	metallurgical	Wall collapse / fill
8	metallurgical	Metallurgical layer / fill
9	metallurgical	Fill
10	metallurgical	Slag layer
11	metallurgical	Stone feature / installation / wall
12	structure	Wall / Installation
13	structure	Ash layer
14	structure	Ash pocket
15	structure	Fill / wall collapse
16	structure	Fill / Wall collapse
17	metallurgical	Stone feature (intrusive to locus 8)
18	structure	Wall (eastern wall of structure)
19	structure	Wall (southern wall of structure)
20	structure	Wall (western wall of main structure)
21	Structure	Wall (northwestern wall, by the doorway of main structure)
22	Structure	Wall (northeast wall of structure)
23	metallurgical	Metallurgical layer
24	Structure	Fill (a bit metallurgical layer)
25	Structure	Wall
26	Structure	Wall (part of courtyard wall, northwestern side of structure)
27	Structure	Wall (southern courtyard wall?)
28	Structure	Metallurgical" layer
29	Structure	Metallurgical layer (scant remains of the above locus) / fill / virgin soil
30	metallurgical	Fill
31	metallurgical	Fill / virgin soil
32	Structure	Floor
33	Structure	Floor
34	Metallurgical	Virgin soil
35	Structure	Fill (bottom of floor)
36	Structure	Hearth
37	Structure	Stone feature/ hearth?



12. Section of the south-western outside corner of the Nabataean structure at KAG Area E. The Iron Age metallurgical layer is represented here mostly by a thin layer of fine-crushed slag just above the bright virgin soil.



13. The 'slag mound' at KAG Area E before excavation. Note the stone feature near the black and white scale initially thought to be a grave (Locus 2).

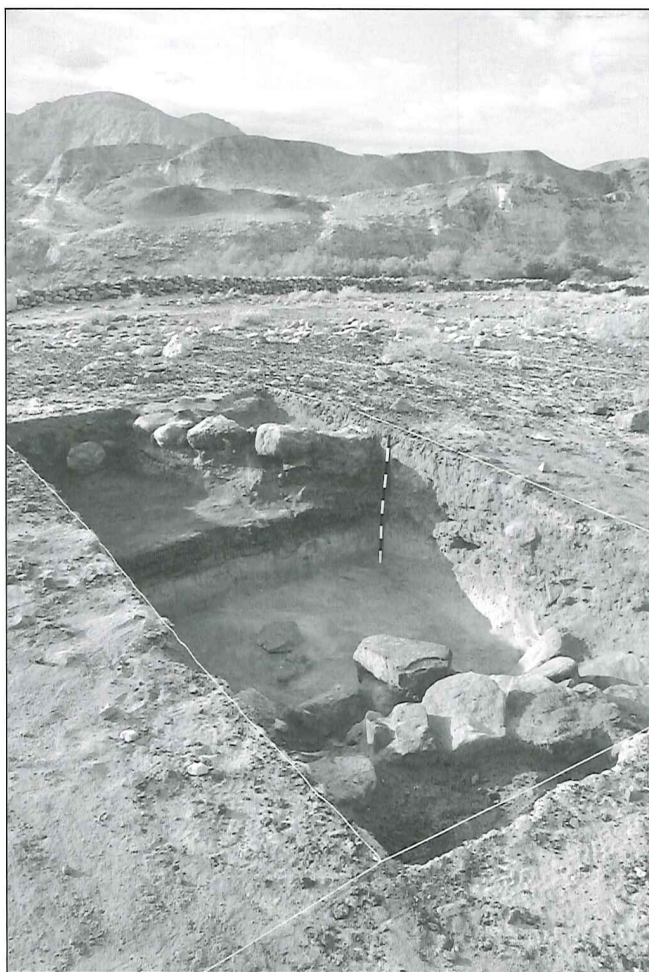
late) pottery, 'floating' on a layer of wind-blown aeolian dust. The surface slag fragments were black, matt and relatively small, containing no charcoal or copper prills. This was markedly different from the large tap slags ubiquitously found on the surface at Khirbat an-Nuhās dating to the 9th century BC (Levy *et al.* 2005; Ben-Yosef 2010). Beneath the slag on the surface was a thick layer of accumulated ashy dust relatively sparse in finds. No charcoal was found in this layer, however, several tuyère fragments, pottery and ground stones came to light. One copper object was found that may be a fragment from an earring. No bone fragments were recovered from beneath or near the 'grave',

and there was no cist beneath the surface feature; most likely this feature was either not a grave or, if it was, the remains have deteriorated to such an extent that no trace of them was left.

Below the fill, metallurgical remains became more prominent and the ashy dust less so. Additionally, patches of compact clay containing crushed slag were found here. Round stone features were also exposed in this layer (possibly circular, although we only uncovered the portions contained within the square). One of these was found in the north-eastern corner of the probe and the other in the south-western area (FIGS. 14 and 15). The north-eastern 'ring' was filled with crushed slag and metallurgical debris (tuyère fragments, some small



14. KAG Area E: metallurgical installations in the probe on the 'slag mound', looking south.



15. Overview of the southern probe at KAG Area E exposing the early Iron Age copper production layer at the site. The tamarisk trees in the background mark the present wadi channel.

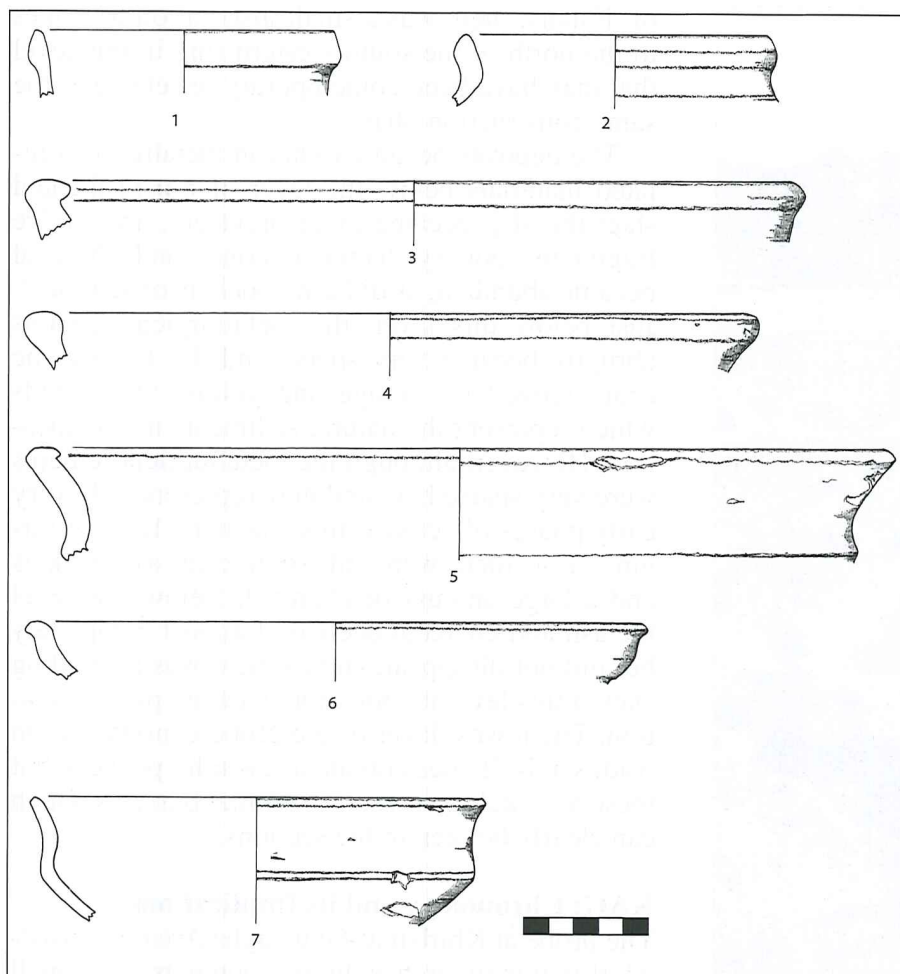
charcoal and a copper prill), however, it was not possible to excavate deeper than a few centimeters into this feature as only a small portion of its interior was exposed in the section. On initial exposure the stone ring appeared to be only one course, however, as the excavation deepened it appeared to have several layers of stones below it; they were not arranged in clear courses and extended beyond the original ring, so they may have been a sort of support, or possibly collapse. The south-western ring was excavated to a limited depth (~10 cm) to determine the surface sediments; it contained crushed slag, and it seems that this was the main sediment here and in the north-eastern feature. This 'ring' had one clear course of stones and may have more, but the outside remained almost entirely covered by a baulk which was our entrance and exit to the probe once it was too deep to climb in and out

of. Finally, there was a small installation of stones to the north of the south-western ring in this level that may have been contemporary or related to the same construction phase.

The deposits became richer in metallurgical related materials below the layer of mixed fill and slag; the slag became more prevalent, and tuyère fragments, pottery, hammer stones and charcoal became abundant, as did ashy pockets of sediment. Just below this layer, the metallurgical remains abruptly became very sparse and the fill became characterized by orange and yellow wadi sands which represent the natural sediments in this location. However, although the metallurgical remains were very sparse here and may represent only very early phases of activity, this was not a level of virgin soil as there were still some clear ash pockets and a large amount of charcoal. Below this level the ash and charcoal decreased almost completely but did not disappear, and as there was a grinding slab in this level it could not be called pre-occupation. The lowest layer of the probe contains virgin wadi sands; it does contain a few ashy pockets, but these are likely the result of animal burrows which can clearly be seen in the sections.

KAG: Chronology and its Implications

The probe at Khirbat al-Ghuwayba Area E consisted of two main archaeological contexts — a small structure and a shallow 'slag mound'. The excavated loci are summarized in Table 3, with indications of the areas as 'metallurgical' or 'structure'. A small Roman-Nabataean structure was excavated in the northern part of Area E that may have been related to a population whose subsistence activities focused on the nearby oasis of 'Ayn al-Ghuwayba. Alternatively, it may possibly represent a small military outpost in this region (perhaps indicated by the discovery of an arrow head and the gaming die found in the floor level of the structure). An adjacent structure (possibly a courtyard compound) may be of the same period or possibly later. Based on the very small probe carried out at Khirbat al-Ghuwayba, the site survey and digital mapping described here, it is not clear if there are any Iron Age structures at the site. Below the Nabataean structure, and stratigraphically older, are remains of metallurgical activities associated with copper production, very thin under the structure itself but more substantial to its south, where we exposed half a square that was excavated to virgin soil. The



16. Some representative ceramic types from metallurgical contexts at KAG Area E. The ceramic indicates early Iron Age copper production activities at the site, and shows similarity to the assemblage from KAJ: (1) EDM 0100, L.008, B.0087, R.457, (2) EDM 0100, L.008, B.0087, R.461, (3) EDM 0100, L.008, B.0087, R.458, (4) EDM 0662, L.008, B.0051, R.537, (5) EDM 0148, B.0130, R.474, (6) EDM 0181, L.030, B.0156, R.470, (7) EDM 0100, L.008, B.0087, R.463.

ceramics associated with the metallurgical context (FIG. 16) indicate early Iron Age occupation, and the assemblage has some similarities to the pottery from Khirbat al-Jāriya (Ben-Yosef 2010: 363). This also corroborates Macdonald's observations (Macdonald 1992, which dates the site to Iron Age I). Radiocarbon samples are currently being processed at the Oxford Radiocarbon Accelerator Unit (Research Laboratory for Archaeology); preliminary results that arrived shortly before the submission of the current work indeed indicate an early Iron Age date. Two charcoal samples from *Juniper* sp. were measured, one from Locus 30 (OxA-23159, 2919±29 BP, 1253-1016 Cal BCE 95.4% probability, 1192-1051 68.2% probability, OxCal2010, IntCal09, © C.B.Ramsey) and the other from Locus 23 (OxA-23159, 3288±28 BP, 1632-1497 Cal BCE 95.4% probability, 1608-1526 68.2% probability, OxCal2010, IntCal09, © C.B.Ramsey); three other samples from the excavations were also identified as *Juniper* sp.. It is probable that the preliminary

radiocarbon dates reported here are affected by 'old wood effect'. It should be noted that of the 101 radiocarbon determinations obtained from KEN's botanical samples (Levy *et al.* in press b), the majority are from the rapidly growing hydrophilic tamarisk — and none from juniper trees. In spite of these problems, when these dates are coupled with the ceramic data, there is no question that KAG played a key role in the earliest Iron Age copper production system in Faynān.

Finally, an early Iron Age date is also supported by similarities in the technological finds between KAG and Khirbat al-Jāriya. In general, copper production activities at KAG were lower in intensity than the peak presented at KEN in the 10th and 9th centuries BC. Utilization of the most advanced technology recorded at KEN, represented mostly by large, late 10th and 9th century BC tap slag, is not evident in KAG. Given the new dating of the smelting activities at KAG, the location of the mines that provided KAG with ore remains an

enigma. As noted above, the nearby mining complex at Rās al-Miyah has ample ceramic sherds that date to the late Iron Age (8th to 6th centuries BC), but lacks evidence of exploitation during the early Iron Age. Similarly enigmatic is the destination of the ore mined at Rās al-Miyah during the late Iron Age, as no complementary smelting site has been recorded in this area of Faynān.

Conclusions

Spread out over an area of some 7 hectares on both banks of the wadi that bears its name, the slag scatter of Khirbat al-Ghuwayba dominates the landscape of a remote location in the copper ore district of Faynān. Recent surveys and the UCSD ELRAP small scale excavation at Khirbat al-Ghuwayba demonstrate that this site played an important role in the earliest Iron Age occupation of the Faynān district. To date, no pre-Iron Age occupation has been recorded in the perennial spring environs of Wādī al-Ghuwayba where the ruins are located. The local *bedouin* refer to this section of the drainage as Wādī al-Ghuwayba Ruwānī (Ar. = “moist” / “luxuriant”) to distinguish it from another tributary to south called Wādī al-Ghuwayba ‘Aṭshāna (Ar. = “dry” / “thirsty”) and to emphasize its importance as a fresh water source. The site was the locus of periodic Nabataean settlement from the end of the 4th century BC until the annexation of the Nabataean kingdom by Rome in 106 AD (Schmid 2008). To date, there is no evidence of copper production at the site during this period (nor at any other copper production site in the Wādī al-Ghuwayba basin). Owing to the extensive Arabian trade network controlled by the Nabataeans at this time, virtually every easily accessible perennial water source in the southern Levantine desert zone was exploited and KAG is typical of this phenomenon. Thus, trans-regional trade, rather than copper production, was the catalyst for Nabataean occupation at KAG (see also Ben-Yosef *et al.* in press). As part of our general research to examine the Iron Age copper production landscape of Faynān, the preliminary research at KAG presents important information concerning the beginnings of the process of Iron Age industrialization in Faynān. Unlike the peak centuries of Iron Age copper production (10th-9th centuries BC), when the massive production site of Khirbat an-Nuḥās was the center of production on the margins of the ‘Arabah Valley, during the initial phases of Iron Age copper production, sites such

as KAG and Khirbat al-Jāriya were more scattered and located in ‘hidden valleys — far from the open reaches of the ‘Arabah plains. Khirbat Faynān and its extensive network of desert farm land may also have been an important early Iron Age center of settlement (Mattingly *et al.* 2007). However, more research and systematic excavations are needed there to identify these processes. The new chronological scheme for KAG presents a challenge for the interpretation of the nearby late Iron Age mines of Rās al-Miyah, and it is probably the case that the mining operation there was unsuccessful. Thanks to ELRAP’s digital archaeology system that evolves with each expedition season in the Faynān region, it is possible to carrying out rapid surveys and excavations that are accurately rooted in geo-databases which enable researchers to meet the challenges of archaeological research in Jordan in the 21st century.

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