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Illustration on the cover: Vault ornament in stucco from Qaṣr al-‘Aẓm in Hama/ Syria (K. Bartl, A. Farzat, Qaṣr al-‘Aẓm. Ein osmanischer Gouverneurspalast in Hama. Baugeschichte und historischer Kontext, Damaszener Forschungen 15, 2012, 79, Abb. 105); drawing by Andrea Gubisch.

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Karin Bartl, Rouj Basin, Syria 2006
(photo: D. Rokitta-Krumnow)

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Contents

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A Late Roman Pastoralist Ironworking Site in the North-Eastern Black Desert, Jordan

Peter M. M. G. Akkermans – Merel L. Brüning

Introduction

In 2013, field survey conducted in Jordan revealed the remnants of a series of small stone-built installations to the east of Azraq, in the Jebel Qurma area. Looting of the site had occurred shortly before our identification, and the looting pits of different shapes and sizes made the contours of the site barely recognizable. To make matters worse, the material removed by this plunder was randomly thrown on what remained of the low stone walls (Fig. 1). The site was designated QUR-595 as part of our wider survey, and a closer inspection of the site and the looting debris yielded masses of charcoal and iron slag. This suggested that the place had once been used to work iron. Subsequent excavations in 2015 offered a more nuanced picture of the installations at QUR-595, together with their history of occupation and use.

Recently, Harmen Huigens has summarized the work and finds at QUR-595 in his 2018 PhD thesis on the archaeology of the Jebel Qurma region.[1] Here, we wish to expand and elaborate on Huigens' conclusions, and to emphasize the considerable importance of this site for our understanding of desert lifeways and conditions in the past. Despite its severely plundered condition, QUR-595 is highly relevant to us for three reasons: first, its evidence for ironworking in a pastoralist context in the late Roman period; second, its data regarding the local environment in this period; and third, its indications for a Mamluk-period burial associated with a so-called *balīya* sacrifice.

This paper is dedicated to Karin Bartl, who is a wonderful archaeologist and a very special friend. Karin's interests are very wide-ranging, from the Neolithic to the Islamic period, and across many different parts of the Middle East, and so we believe that the current theme of our contribution is perfectly appropriate.

QUR-595: the Site and its Location

In north-eastern Jordan the rough and rocky *ḥarra* begins about 30 km east of the small oasis town of Azraq. This *ḥarra* is characterized by basalt-capped table-mounds and plateaus that alternate with extensive gravel plains, mud flats of varying size, and low limestone ranges. The hyper-arid and difficult-to-cross uplands have an average annual precipitation of less than 50 mm and are known as Jebel Qurma. It is named after the prominent mound at the south-western edge of

[1] Huigens 2018.

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Fig. 1 The site of QUR-595 in the Jebel Qurma area, prior to excavation. The site was heavily looted in recent years (photo: Jebel Qurma Project Archive).

the *ḥarra* expanse, where Wadi Rajil debouches out of the basalt into the Hazimah plains (Fig. 2).

The site of QUR-595 is situated on small and low limestone hillock measuring about 45 m long, 20 m wide and 1–1.5 m high. It lies at the northern foot of the mound of Jebel Qurma and directly along one branch of Wadi Rajil. The 2013 survey and 2015 excavation at the site were carried out as part of the *Jebel Qurma Archaeological Landscape Project*, which seeks to address local settlement and quotidian activities from a multi-disciplinary and multi-period perspective, and investigates how these relate to the diverse landscapes and environment.[2] The project takes place under the auspices of the Faculty of Archaeology of Leiden University (The Netherlands), and in close collaboration with the Department of Antiquities of Jordan.

The excavation in 2015 made clear that the site had three (possibly four) roughly round or oval-shaped, stone-walled installations built against each other at the top of the limestone hillock. These structures are named A to D in this contribution for matters of convenience (Fig. 3). It seems that Structures A and B were constructed first as free-standing structures, with the smaller Structures C and D added afterwards. The buildings range in diameter from about 5.6 m (Structure A), to 5.9 m (Structure B), and 1.7/1.3 m (Structure C). Less clear is the outline of Structure D, although its stone concentrations suggest some irregular walling: this comprises an area about 2.3 by 1.3 m. Each structure was bounded by low (maximum 40 cm tall) and wide (between 40 and 80 cm) walls, which consisted merely of loosely piled heaps of basalt rocks, the outlines of which were often difficult

[2] Cf. Akkermans et al. 2014; Akkermans – Huigens 2018.

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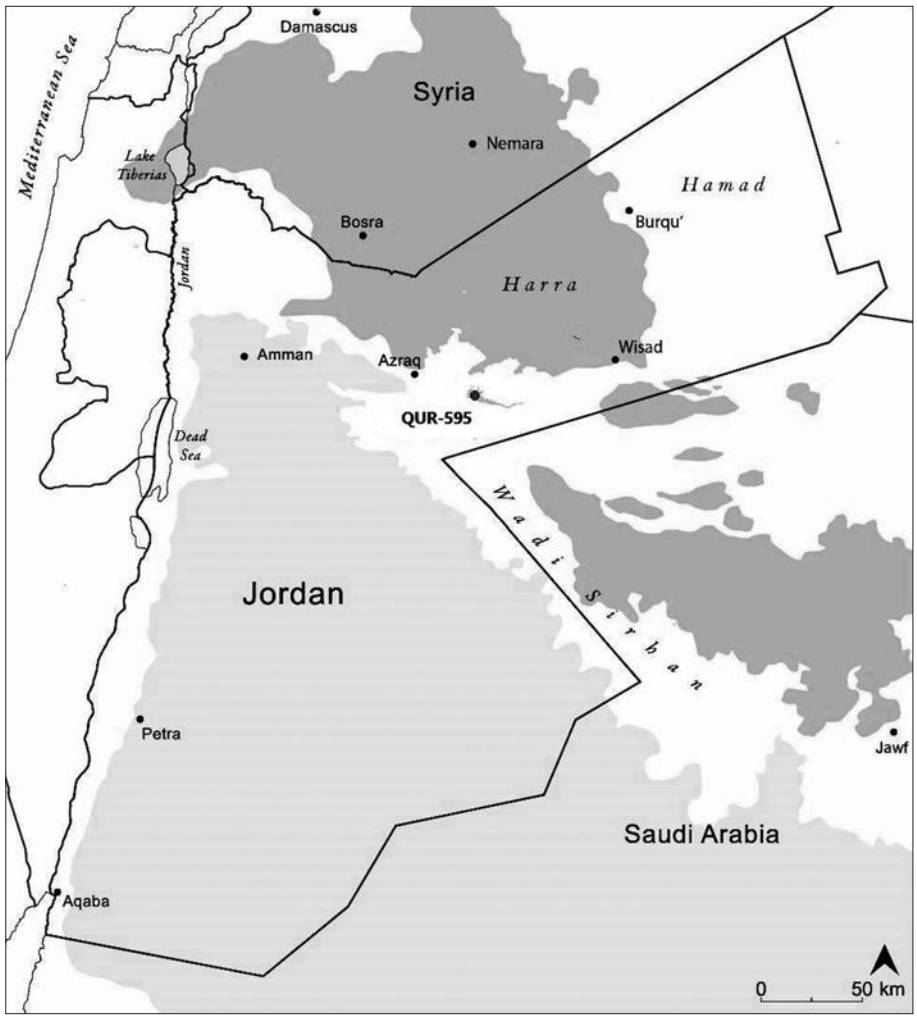

Fig. 2 Map of Jordan with the location of the site of QUR-595 (drawing: Jebel Qurma Project Archive).

to establish. In general, the amount of basalt stones uncovered in and around the structures is too limited to account for any substantially raised walls. The only undisputed remains of walling were found on the north side of Structure A, in the form of a relatively narrow wall made of basalt blocks carefully stacked up to three courses high (ca. 40 cm). However, it is highly likely that this wall is a (much) later addition to Structure A, not only because of its better state of preservation, but also because it seems to block the original entrance to the structure.

Structures A and B were originally accessible through openings in their northern walls, while the later Structures C and D had passages in the south-east (C) and south (D). None of the buildings preserved evidence for intentionally made floors or any form of roofing. Most likely the low structures were simply open to the elements or they had superstructures made of perishable materials (such as hides or brushes).

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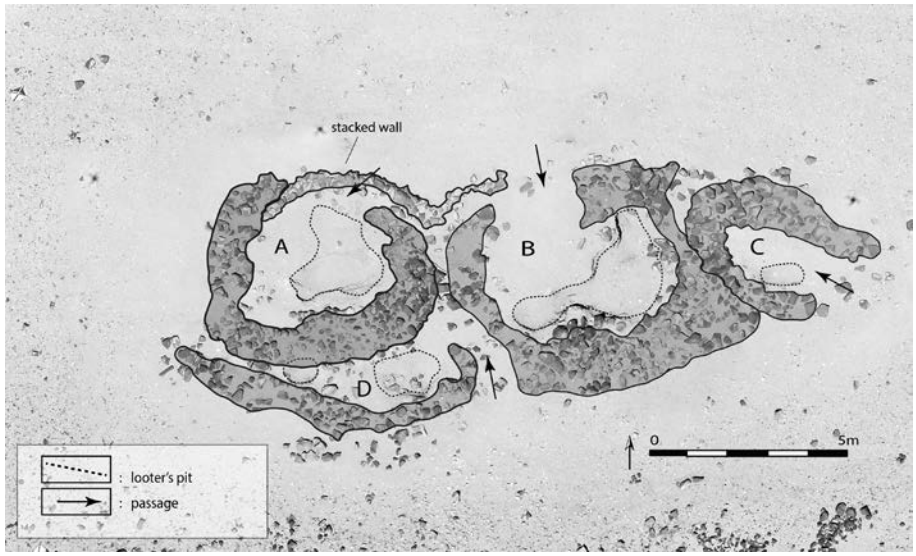

Fig. 3 Structures A to D and the location of the looting pits at QUR-595 (photo: Jebel Qurma Project Archive).

Ironworking

The looting debris in and around the structures at QUR-595 contained masses of ashes, charcoal, and iron slag, all indicative of local and small-scale ironworking (Table 1). From the small size, weight, and irregular appearance of the slags (see Fig. 4), it is clear they are smithing slags that derive from forging, which is the final step in the iron production process.[3] This step requires heating and hammering to work an iron bar or to rework an existing iron object into a new item. The heating of the iron in a fire or furnace produced smithing slags, as small pieces of the iron would drip off during this heating process. The sub-

Structure	Material	Weight (g)
A	Iron slag (fragments)	168
	Iron fragments	20
	Charcoal	64
	Charcoal conglomerate fragments	7
	Cinder	3
B	Iron slag (fragment)	7
	Iron fragments	9
	Unworked flint with slag	10
C	Iron slag (fragments)	5
	Charcoal	1
D	-	-

Tab. 1 Residues associated with the ironworking at QUR-595 (after Brusgaard 2015).

[3] Brusgaard 2015.

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Fig. 4 Iron slags from QUR-595 (photo: Jebel Qurma Project Archive).

sequent hammering and shaping would result in hammerscale, none of which, however, was found.

The many charcoal pieces found together with the slags likely come from the smithing hearth, as do the cinder and irregular iron fragments. Important in this respect are also the three small fragments of whitish stone that may have been a pipe or tube; one fragment had iron residue on both its interior and (to a much lesser extent) exterior surface. Found in Structure A, the fragments probably belong together and were part of a tuyère, which is a tube conducting air blown from the bellows into the hearth. Although tuyères in archaeological contexts usually are made of ceramics, they also can be made of other kinds of materials, including stone.

Unfortunately, the smithing hearth itself has not been identified, probably due to the destructive modern looting and/or the Mamluk burial sunk into the site (see below). Although from a different geographical context, excavated iron-production furnaces from pastoralist sites in Kenya dated to the first and second millennium AD were small and shallow; their traces easily could be obliterated through subsequent reuse or reworking of the production site.[4] We agree with Huigens[5] that the most likely location for the hearth at QUR-595 was within Structure A, given the abundance of both iron slags and charcoal in it, as well as the presence of the possible tuyère fragments, iron pieces, cinder, and conglomerates (the last type of evidence often forms in the charcoal bed of an ironworking hearth).

The many charcoal fragments probably resulted from the fuel used in the ironworking process. At present, six radiocarbon samples were analysed, all based on the retrieved charcoal. In addition, two radiocarbon dates were taken from human skeletal remains at the site (see Table 2). The six charcoal samples all gave highly similar, overlapping dates at the 95.4% (2δ) confidence level, between (rounded

[4] Iles – Lane 2015, 384–386.

[5] Huigens 2018, 118.

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off) 100–385 AD, falling broadly within the late Roman to early Byzantine era. However, we may suggest that a tighter date range between 210–320 AD is more likely, with regard to the overlap in dating, the available probability distributions at the 2δ level, and the contemporary use of the installations at the site.

Although the metal finds at QUR-595 are impressive by themselves, we believe they are the result of an incidental, *ad-hoc* use of the site for ironworking for small-scale, local needs. The quantity of slag, iron, and related material, is simply too low to account for an extensive, long-term production at the site. An incidental use of the installations also fits into the current reconstruction of desert lifeways in the late Roman to early Byzantine period.[6] The present archaeological record makes clear that people in the Jebel Qurma region in this period relied on mobility and pastoralism, characterized by temporary stops in places. Our surveys

Lab. No.	Material	Date BP	2δ date calAD
GrA-62243	Charcoal	1770 ± 30	138-345 AD (95.4%)
GrA-62240	Charcoal	1780 ± 30	137-335 AD (95.4%)
GrA-62244	Charcoal	1760 ± 30	171-383 AD (95.4%) 171-194 AD (2.3%) 211-383 AD (93.1%)
GrA-65947	Charcoal	1820 ± 30	98-320 AD (95.4%) 98-100 AD (1.0%) 124-257 AD (90.7%) 296-320 AD (3.7%)
GrA-65948	Charcoal	1755 ± 30	180-384 AD (95.4%) 180-185 AD (0.4%) 214-384 AD (95.0%)
GrA-65949	Charcoal	1760 ± 30	170-383 AD (95.4%) 170-194 AD (2.3%) 210-383 AD (93.1%)
GrA-67034	Human bone	645 ± 30	1281-1396 AD (95.4%) 1281-1328 AD (42.2%) 1341-1396 AD (53.2%)
GrA-67064	Human bone	590 ± 35	1297-1415 AD (95.4%)

Tab. 2 Radiocarbon dates from the site of QUR-595 (The age determinations were carried out at the Centre for Isotope Research at Groningen State University, The Netherlands, through Accelerator Mass Spectrometry [AMS].).

[6] See Huigens 2018 for a detailed account on pastoralists in the Jebel Qurma area.

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and excavations in the region have identified several dozen dwelling sites dated to the Roman and Byzantine period. The sites comprise stone-walled enclosures and simple open clearings in the basalt for camping. Often, they are located in relatively easily accessible and open areas in low-lying valley floors, gravel plains, or near mud flats. Potential water sources usually occur within a range of 0.5 km from the sites, although most of these sources may have had water only seasonally. The restricted site sizes at both the enclosures and the clearings suggest that the domestic installations were used by small groups, perhaps several dozen people at the most. Moreover, the shallow sediments in them and their limited artifact assemblages suggest that the sites were short-lived and probably occupied only on a seasonal basis. It seems reasonable to consider the groups as migratory pastoralists, who subsisted predominantly on raising camels, sheep, goats and horses. In addition to their places for camping, the local population left numerous burial cairns of different shapes and sizes across the *ḥarra* of Jebel Qurma.[7]

Unequivocally, the finds show that at the least some of those pastoralist people in the region were able to work metal to some degree. The main function of the smithing activity at QUR-595 may have been to manufacture or repair simple tools for quotidian use, although none of these were found at the site. If so, the occurrence of similar small and temporary metal workshops can be expected at many places throughout the basalt desert. Mobile pastoralists may have been trained in many different basic skills, including metalworking, in order to withstand the many difficulties associated with pastoralist life in the remote and uninviting Jebel Qurma region and beyond.

Pottery and Glass

Pottery occurred in (very) small quantities at the site, represented altogether by 49 sherds, only one of which was a rim sherd. The fragments comprise four different fabrics and hence represent at least four vessels. The fabrics consist of wheel-made, mineral-tempered products, and are all grey-black to buff and reddish-brown in surface colour, which are typical of the Roman to early Islamic

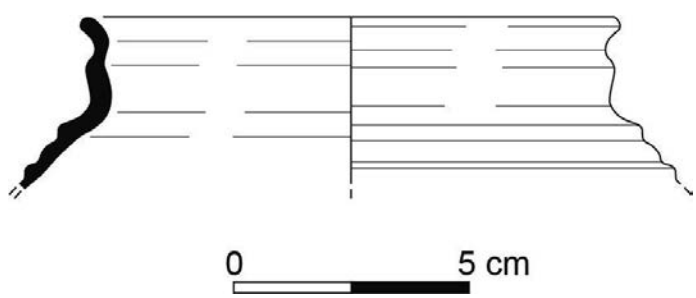

Fig. 5 Greyish-black cooking pot, found at QUR-595 (drawing: Jebel Qurma Project Archive).

[7] Cf. Akkermans – Huigens 2018; Akkermans – Brüning 2017; Akkermans in press; Huigens 2018.

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period.[8] The single diagnostic rim sherd (Fig. 5) belonged to a thin-walled, greyish-black cooking pot and is dated between the sixth to eighth century AD (the late Byzantine to early Islamic period). This date range is based on parallels found at Tell Jawa and Barsinia in north-western Jordan.[9]

None of the sherds were found in situ, but came from the looting debris in and around Structures A to D; all were consistently mixed with charcoal, iron slag, and human and animal bone fragments. In their attempts to find objects of interest, the looters dug at least five pits of different sizes and shapes in and around Structures A to D (some of which overlapped each other). In several locations, the plunderers seem to have excavated their own debris, further contributing to the highly mixed nature of the finds.

Although the site has been excavated nearly in its entirety, the number and size of sherds per fabric type is far too low to account for even one complete vessel. Originally there must have been many more pottery fragments at the site, but these sherds did not remain in place, for reasons unknown. Weathering and trampling undoubtedly contributed to the high level of ceramic fragmentation, which is so characteristic of the pottery found in the Jebel Qurma area.[10] Yet, these post-depositional forces do not fully account for the loss of ceramics. Perhaps the sherds do not reflect the domestic use of vessels at QUR-595 but ended up at the site as fragmentary waste from nearby camp sites.

The latter conclusion may perhaps also hold true for the small glass fragments. These comprise weathered, often iridescent rim-foot and body fragments that are between 2.5 and 4 mm thick. Altogether they represent at least three vessels of different kinds of opaque and transparent glass. The pieces were fragmented too greatly to reconstruct their shape, but they might have been goblets or other footed vessels. The fragile glass vessels may have been luxury items in the small, nomadic communities in this period.

Jewellery

Jewellery occurred in the looting debris at QUR-595 in the form of nine complete and fragmented beads, made of stone, faience, shell and bronze (Fig. 6 and Table 3). There were four complete or nearly complete beads (plus three small bead fragments) made of stone and in different shapes and sizes. There were also two beads made of black faience, one of which was distinctly in the form of a ring about 18 mm in diameter; perhaps this item served as a pendant. Two other beads consisted of small, perforated, marine shells. Finally, there was one (fragmented) cylindrical bead, made of sheet bronze.

These items may have been part of a single necklace, and they closely recall the finds in the many burial cairns in the Jebel Qurma region.[11] Actually there is proof for a (looted) burial at the site, in the shape of scattered and trampled, incomplete human skeletal remains. These were radiocarbon-dated to the Mamluk period (see below). It seems reasonable to assume that the jewellery originated

[8] Vijgen 2019.
[9] Cf. Huigens 2018; Vijgen 2019.
[10] Cf. Huigens 2018; Vijgen 2019.
[11] Akkermans – Brüning 2017.

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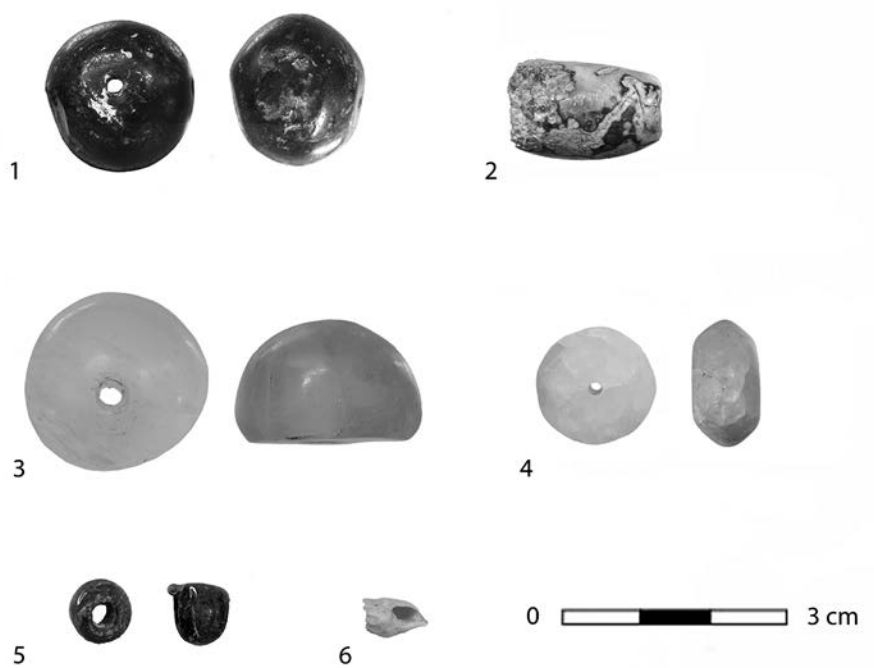

Fig. 6 Selection of beads from the looted burial at QUR-595. See Table 3 for details (photo: Jebel Qurma Project Archive).

from this plundered grave. The occurrence of personal belongings in Islamic tombs is not uncommon. For example, Tell Hisban in the Balqa' highlands near the Dead Sea had an Ottoman cemetery dating to the late 19th century. It contained an estimated 100 persons, many of whom were provided with jewellery and other burial goods of a personal nature.[12]

Mamluk Burial and Camel Remains

In addition to the ashes and slags, the looting debris at QUR-595 yielded the highly fragmented and poorly preserved skeletal remains of a single human individual, who apparently had been buried in one of the structures at the site. The skeletal elements included several small cranial parts, four incisor teeth, as well as fragments of a radius, a (right) mandible, a (right) carpal bone, a phalanx, and two ribs. The few bones seem to belong to a single adult person, but the high degree of fragmentation does not allow for further detail.

Two bone fragments were radiocarbon-dated and indicated that the adult person was interred somewhere in the 14th century AD, during the Mamluk period (cf. Table 2). Significantly, it seems that the deceased person bore a colourful necklace made of stone, faience, shell and bronze (see above). Our field surveys have yielded substantial evidence for Mamluk presence in the Jebel Qurma region, in the form of camp sites, so-called desert mosques and other places of religious significance, characterized by one or more inscriptions on stone. The

[12] Walker 2001.

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Identification number	Shape	Material	Size	Illustration
QUR-595-2	spherical	stone, black polished	20 mm in diameter	Fig. 6, no. 1
QUR-595-3	'spindle whorl', half-spherical with one flattened side	stone, pinkish translucent, probably quartzite	23 mm in diameter, 16 mm in height	Fig. 6, no. 3
QUR-595-4	round, biconical	stone, whitish, probably quartzite	20 mm in diameter, 8 mm in height	Fig. 6, no. 4
QUR-595-6	round, cylindrical	stone, greyish-white with reddish-orange veins	13 mm in diameter, 20 mm long	Fig. 6, no. 2
QUR-595-14	3 fragments of probably spherical beads	stone, greyish-white, probably quartzite	ca. 14 mm long and 7 cm wide	-
QUR-595-10	spherical	faience, black	8 mm in diameter	Fig. 6, no. 5
QUR-595-2013-1	ring (fragmentary)	faience, black	18 mm in diameter, 5 mm thick	-
QUR-595-9	natural shell but intentionally pierced longitudinally	shell, black, marine, species unidentified	8 mm in diameter, 12 mm long	-
QUR-595-11	natural shell (fragment)	shell, white, marine, species unidentified	5 mm in diameter, at least 9 mm long	Fig. 6, no. 6
QUR-595-2013-2	round, cylindrical	bronze	6 mm in diameter, 9 mm long	-

Tab. 3 Jewellery from the looted burial at QUR-595: shape, material, and size.

regular occurrence of *hijri* dates in the inscriptions confirm the date of these sites within the 14th century. Contemporary graves, however, are still rare: in addition to the burial at QUR-595, two other Mamluk-period graves have been located at present in the Jebel Qurma region. One comes from the site of QUR-829, in the form of an inhumation in a stone-lined pit; and another comes from the site of QUR-148, where a tower tomb of the late first millennium BC appears to have been re-used for burial in the Mamluk period. Contrary to the burial at QUR-595, these graves provided no evidence for the presence of (Mamluk-period) items that were worn on the body such as beads or clasps, nor for burial gifts.

Interestingly, together with the human remains at QUR-595, there were also a few skeletal parts of a single adult camel (*Camelus dromedarus*). These comprised seven phalanges and the fragments of teeth, a calcaneus, a talus, a humerus, a femur, a metatarsal/carpal, and several tarsal bones.[13] The phalanges show traces of exostosis (benign growths of bone extending outwards from the surface of the phalanges) on the lateral and medial side of the shaft. None of the

[13] Slim et al. 2014.

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bones had cut marks, indicating that they were not waste material or the result of slaughter for dietary purposes. Although the camel bones have not yet been radiocarbon-dated, it is highly tempting to associate them with the 14th-century human remains at the site. If so, they may represent a *balīya* sacrifice – the offering of an animal (usually a camel) for the deceased individual to use in the afterlife.[14] Several other burial cairns in the Jebel Qurma area, unfortunately all plundered and as yet undated, contained camel bones in the looting debris, and may perhaps represent similar *balīya* rituals.

Excavations in the Arabian Peninsula have made clear that the practice of *balīya* (or variants thereof) was common in pre-Islamic Arabia and persisted well into the early Islamic period, as late as the Abbasid times.[15] However, our current data from Jebel Qurma suggest the continuation of the *balīya* immolation in north-eastern Jordan into even much later periods, into the Mamluk era of the 14th century AD. While the *balīya* habit is formally prohibited by Islam,[16] it appears to have lingered for 800 years or so after the advent of the Muslim faith. However, it is important to note that we should not consider this persistence as a sign of local ignorance or any kind of deep conservatism because of the area's remoteness from Islamic centres. The Mamluk-period religious installations in the Jebel Qurma area and the many inscriptions in the form of prayers testify to the full adherence of the local population to the Islamic religion.

Because of the considerable damage done to the site by modern looting, virtually none of the human and animal skeletal remains were found in situ; hence, it remains difficult to precisely identify their place of burial. However, it can be safely assumed that the original burials did not take place in stone-built cairns that are several metres across, which are quite common in the Jebel Qurma area (and the *ḥarra* at large). The amount of basalt rocks in and around the installations at QUR-595 is simply too small to allow for any (substantial) mound of stone. We must therefore conclude that the burials were true inhumations, in the sense of burial pits dug into the ground. If we take into account their size, depth, and orientation, the looting pits, from which the skeletal remains must have come, suggest two places suited for burial: one in Structure A and another in Structure B (see Fig. 3). Although the contours of Structure A were cut by a looter's pit, it seems to comprise a roughly rectangular pit, about 2.5 m long, 1 m wide and 0.8 m deep. There was a small human cranial fragment still in it, presumably in situ in the soil at the very base of the pit. This pit, we believe, contained the human interment, the more so because of its roughly east-west orientation, in agreement with Islamic burial custom in the region. The looting pit in the neighbouring Structure B is much larger and much more irregular in shape and depth, and originally probably contained the camel burial. It extends in the shape of a crescent over a length of about 4 m along the southern and eastern interior façade of the structure. Its width ranges from 2.4 to 1.1 m and its depth varies from 0.95 to 0.4 m. The other, smaller looting pits in the installations at QUR-595 were most likely merely peepholes, made in the open spaces in search for valuable goods.

[14] King 2009.
[15] King 2009, 83.
[16] As a pagan rite of earlier *al-jahilīya*; see King 2009; Hayajneh 2006, 110.

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Wetter, Greener Environmental Conditions

Although the many charcoal fragments found in and around the installations at QUR-595 were all small (less than 3.5 cm across), they still allowed us to identify several species of trees and shrubs that were used assumedly as fuel in the local ironworking process.[17] The wood analysis revealed the presence of pine (probably *Pinus halepensis*, the common Aleppo pine) and hawthorn (most likely *Crategus aaronia*/*azarolus*), both of which are relics of a degraded forest-steppe vegetation with moderate water requirements. The presence of *Chenopodiaceae* was to be expected, as they are a family of woody shrubs typical of Saharo-Arabian desert flora, often highly salt-tolerant and with varying water demands.

Rather astounding, however, is the presence of several hydrophilous tree taxa with year-round water requirements, including fig (*Ficus carica*), plane (*Platanus orientalis*), and ash (probably the Syrian ash, *Fraxinus angustifolia* subsp. *Syriaca*). Both plane and ash are relatively large, deciduous trees, native to riverine settings and wetlands, although they may also occur in more ephemeral, drier environments once established. The common fig, one of the earliest cultivars in the Near East because of its edible fruits, occurs naturally in dense thickets in areas with consistent water supply. The species can tolerate seasonal droughts and a range of habitats, including marginal, rocky lands.

These three tree taxa, with their need for a regular water supply, are suggestive of wetter and greener local habitats. This contrasts greatly from the hyper-arid conditions (less than 50 mm of annual rainfall) in the Jebel Qurma region today. It may be telling that none of these tree species occurs in the area at present, not even in the nearby Azraq depression with its ponds and pools.[18] In addition to the ubiquitous *Chenopodiacea*, pollen and sediment sequences in a core from the Azraq area gave evidence for several tree species in the time frame from roughly 1450/1300 BC onwards, including pine (*Pinus halepesis*), poplar (*Populus* sp.), oak (*Quercus* sp.) and tamarisk (*Tamarix* sp.). Remarkably enough, there is no proof of either plane, ash, and fig.[19] It has been proposed that some of the tree pollen in the Azraq core, such as *Quercus* and *Pinus*, were non-local and carried from the western mountain ranges to the Azraq oasis by prevailing winds.[20] However, the new data from the Jebel Qurma area suggests that these species were in fact native to parts of Jordan's north-eastern *ḥarra* in antiquity. This conclusion is also in agreement with charred-wood finds in excavations elsewhere in the basalt expanse from much earlier periods, including deciduous oak (*Quercus ithaburensis*) at Wisad, dated to ca. 6600–5600 BC, and fig (*Ficus carica*) in Wadi al-Qattafi, dated to ca. 6490–6235 BC.[21] Pollen samples from Wadi al-Qattafi produced arboreal species like pine (*Pinus* sp.), oak (*Quercus* sp.), elm (*Ulmus* sp.) and hophornbeam (*Ostrya* sp.), but also wetland species like bulrush (*Typhus lattifolia*) and duckweed (*Lemna* sp.). This combi-

[17] Fantone 2014.
[18] Cf. Nelson 1973; Woolfenden – Ababneh 2011.
[19] Woolfenden – Ababneh 2011.
[20] Woolfenden – Ababneh 2011, 350.
[21] Rollefson et al. 2016; Rowan et al. 2015; 2017.

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nation of plant species implies marshy conditions in some places.[22] Rainfall in the north-eastern desert, it seems, was significantly higher in some periods than it is today. Woolfenden and Ababneh[23] suggested that there were episodic dryer and wetter conditions in the region, resulting in variations in the composition of the plant assemblages. However, these fluctuations did not imply significant changes in the prevalent Saharo-Arabian vegetation in the Azraq area during, at the least, the past 3100 years.

Huigens calls into question the local nature of wood species retrieved at QUR 595.[24] Instead, he suggests that they were brought to the Jebel Qurma area from the Azraq oasis or even beyond, because conditions may have been more favourable for tree growth given the presence of permanent water there. Even if there were trees locally, he proposes that the relatively large amount of fuel needed for the iron working was assumedly not met in the Jebel Qurma region. Here we take a different stance and propose that the wood used for fuel was, indeed, of local origin and collected near the site of QUR-595, for several reasons. First, there is no *a priori* reason to exclude the occurrence of trees in the basalt region in the past. While we should not expect dense forests, the find of several tree taxa at different sites and from different periods does strongly point to the presence of arboreal stands in places in, at least, some periods in antiquity. This interpretation is in agreement with the episodic dryer and wetter conditions in the area as reported by Woolfenden and Ababneh. Second, while the amount of fuel required for the smithing at QUR-595 may have been considerable, we suggest that it was an *ad-hoc* activity, rather than an activity carried out over a sustained period of time. Hence, the occasional need for large amounts of fuel could have been sufficient locally, even in the case of relatively thin, open tree distributions. Third, Fantone reports the presence of small wooden twigs among the charcoal finds, suggesting that entire trees or branches were used for fuel, instead of pre-prepared logs.[25] Most likely, the foliated trees were collected close to the site, rather than obtained through the laborious transport from further-away regions such as Azraq, which is situated about 30 km to the west of Jebel Qurma (i.e. roughly the distance made in a walking day by dromedary).

Phases of Occupation

Several phases of use can be distinguished at the site of QUR-595, despite the severe looting and the resulting substantial mixing of deposits. In its earliest phase, there were smithing facilities at the site, probably in Area A, used to forge iron bars into objects or to reshape existing iron. The iron slag, charcoal, cinder, tuyère fragments, and irregularly-shaped iron pieces bear witness to this phase.

A second phase is probably represented by the pottery finds, roughly dated to the Byzantine and/or early Islamic period. Apparently the small enclosures remained an attractive spot for episodic domestic activity. This might be related to the vicinity of water sources such as Wadi Rajil next to the site in the rainy season.

[22] Rowan et al. 2017.
[23] Woolfenden – Ababneh 2011, 350.
[24] Huigens 2018.
[25] Fantone 2014.

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Alternatively, there might be an association with nearby enclosures higher up the hill; people camping out there might have disposed of domestic waste down below.

A third phase comprised the re-use of the site for burial in the Mamluk period, possibly with a *balīya* sacrifice. The burial was dug into the metal-working deposits, dispersing some of this material in the vicinity of the grave.

Finally, looters tore the site apart in recent years, adding a stage of destruction to the remarkable life-cycle of this place. One may wonder what attracted looters to these enclosures in the first place, as large burial cairns are their usual target. A likely explanation is the use of metal detectors that would have reacted to the presence of the metal slag. Perhaps the looters hoped to find the Roman or Ottoman gold that is hidden somewhere in the basalt expanse according to widespread local legend.

Conclusions

In contrast to the relative abundance of research into the origins of ironworking in the Levant in the late second to early first millennium BC,[26] remarkably little has been reported on the industry in the Roman to early Islamic periods until now. The fourth century Roman legionary fortress at Lejjun gave evidence of small-scale ironworking in a military setting. This substantiated claims by the contemporary author Vegetius that some soldiers were skilled in crafts such as metalworking.[27] Useful information on various forms of ironworking also comes from Masada on the Dead Sea, likewise from a military context, albeit from the first century AD. Most of the retrieved weaponry was probably brought to Masada from elsewhere, although local production may have taken place as well.[28] Evidence for ironworking was also found at the urban site of Barsinia near Irbid in north-western Jordan, where excavations revealed a furnace-like structure and a smelting-refuse dump in a Roman-Byzantine layer. Substantial quantities of iron slag and two tuyère fragments were retrieved from the immediate surroundings of a furnace here.[29]

The evidence for metalworking at the site of QUR-595 is unique until now, with regard to its remote and marginal location, as well as its pastoralist setting in late Roman times. The activities took place in an area spatially separated from the living areas, although the latter probably were in the close vicinity. There is evidence for camp sites and stone-built enclosures for pastoralist use at a distance of a few dozen metres from QUR-595, some of which are indisputably of Roman to Byzantine date.[30] Unfortunately, we are still in the dark about nearly every aspect of this pastoralist iron manufacture, including the scale and organization of production, raw-material procurement, and furnace design and operation, let alone about its social and symbolic meanings. Above we suggested that iron production probably was an ad-hoc and small-scale activity at QUR-595, in response to immediate, local needs. We also believe that similar small-scale workshops may have

[26] See for example Veldhuijzen 2005; Veldhuijzen – Rehren 2007; Eliyahu-Behar et al. 2013.
[27] Koucky – Lapp 2006.
[28] Knox et al. 1983; Stiebel – Magness 2007.
[29] Bani-Hani et al. 2012.
[30] Cf. Huigens 2018.

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once existed at many places in the basalt badlands, as part of the pastoralist 'tool kit' and ability to cope independently with the many uncertainties in the isolated desert landscapes. Recently, Iles and Lane emphasized the importance of blacksmiths in East African pastoralist communities: although the smiths were often outsiders working in areas away from the main camps, they were highly respected as makers of indispensable tools and recognized as an essential part of the pastoralist lifeway.[31]

Until now, the earliest iron in the Jebel Qurma region predominantly occurs in the shape of small quantities of jewellery (beads and pins) in tombs dated between the mid-first millennium BC and the early first millennium AD.[32] Some burial cairns in this region also yielded iron weaponry, such as arrowheads and javelins. The local rock art, conventionally dated between the first century BC and the fourth century AD, also shows weaponry probably made of iron, including swords and spears.[33] We do not yet know where these objects were produced, but the finds from QUR-595 make it at least a possibility that some of them were locally made or reworked.

The charcoal found at QUR-595 suggests that the metalworking at the site took place in an environment that was more favourable than today: wetter, greener, and with tree growth in places. The benign conditions, we believe, considerably contributed to the abundance of pastoralist occupations of different size and layout in the Jebel Qurma region in the late Roman, Byzantine and early Islamic periods. At the same time, they also facilitated specialized activities dependent upon local resources, such as the fuel-intensive ironworking.

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[31] Iles – Lane 2015, 379.
[32] Akkermans – Brüning 2017.
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