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The Ceramic Building Material Industry along the Southern *Limes Arabicus*: The Nabataeans as Suppliers to the Roman Army

ZUSAMMENFASSUNG

In diesem Artikel wird die Ziegelversorgung des römischen Heeres entlang des südlichen *Limes Arabicus* untersucht. Da in dieser Region bislang keine Töpferöfen archäologisch erforscht worden sind und auch Ziegelstempel gänzlich fehlen, ist nur sehr wenig über die Organisation dieses Gewerbes bekannt. Hier wird die Möglichkeit erörtert, dass Nabatäer angeworben wurden, um das römische Heer mit Ziegeln zu versorgen. Obwohl nur spärliche Belege vorhanden sind, zeigen diese eindeutig, dass die Nabatäer vor und auch nach der Annexion durch die Römer 106 n. Chr. über eine funktionierende Ziegelproduktion verfügten und dass sie das römische Heer mit anderen Produkten und Dienstleistungen versorgten. Daher ist es wahrscheinlich, dass die Nabatäer die Kapazitäten dazu besaßen, das römische Heer entlang des südlichen *Limes Arabicus* tatsächlich mit Ziegeln zu versorgen.

Although ceramic building materials along the southern *Limes Arabicus* (central and southern Jordan) have received more attention in recent years, the material still remains poorly understood. Until now there has been no attempt to comment on its organization, particularly with regard to the production and supply of bricks and tiles for the numerous military installations located along this section of the frontier. As discussed below, this gap in our knowledge is in large part due to the absence of tile kiln sites and the lack of brick stamps in the region. Despite these deficiencies, it is still possible to use the available evidence to speculate about the supply and production of bricks and tiles along the southern *Limes Arabicus* (Fig. 1). In contrast to the typical model of tileries organized and operated by the Roman military, the evidence gathered here raises the possibility that the Roman army contracted the production of bricks and tiles out to local Nabataean workshops. Although this theory remains tentative, it fits the available evidence better than the alternative – that the Roman army produced its own bricks along the southern *Limes Arabicus*.

A major issue limiting our understanding of the organization of the military brick and tile industry in Roman Arabia is the paucity of excavated pottery kilns in the region, as well as the complete absence of kilns producing ceramic building material. At *Petra*, a major ceramic production centre, excavation of a number of kilns has recovered several examples of ceramic building materials[1]. These materials, however, are considered to post-date the operation of the kilns, when the site was used as a dump[2]. Aqaba was another major ceramic production centre, where excavation has uncovered two pottery kilns. These date, however, to the 7th century AD – well past the time period of concern for this paper[3]. At Oboda, in the Negev, a feature initially identified as a Nabataean pottery kiln has been reinterpreted as a bakery[4].

Given that elsewhere in the Roman Empire military-run kilns are sometimes located near Roman forts, one might reasonably expect to find tileries located next to military installations on the southern *Limes Arabicus*. As of yet, however, archaeology does not support this possibility. Excavators at Humayma, home to the region's earliest Roman fort, have concluded that it was an unlikely site of ceramic production[5]. Archaeologists working at the Roman legionary base at Lejjun, further north, found a few kiln wasters and ceramic slag, suggesting that some ceramic material had been made in or around the fort, but excavation was not able to locate a kiln to confirm this theory[6]. Only in one case has excavation found a kiln near a Roman military installation. Early excavation at the legionary fortress at Udhruh located a Nabataean pottery kiln next to the fort; however, this kiln was never fully published and is now believed lost[7]. Archaeologists are now left with the kiln near *Petra* as the only one in the region that dates to the Nabataean and Roman periods, and the fact that there is no definitive proof that this site produced tiles means that it cannot be used to help us understand this material.

Another difficulty in the study of bricks and tiles along the southern *Limes Arabicus* is the lack of brick stamps. The stamping of bricks and tiles was a common practice in many provinces of the Roman Empire. Scholars have suggested various reasons for stamping bricks, which include registering output, exempting the material from taxes, deterring theft, providing guarantees of quality and identifying the producers and owners of the bricks[8].

In the east, few military sites have yielded large corpora of brick stamps. Excavations at Jerusalem have uncovered numerous examples of stamped tiles of the *legio X Freten-*

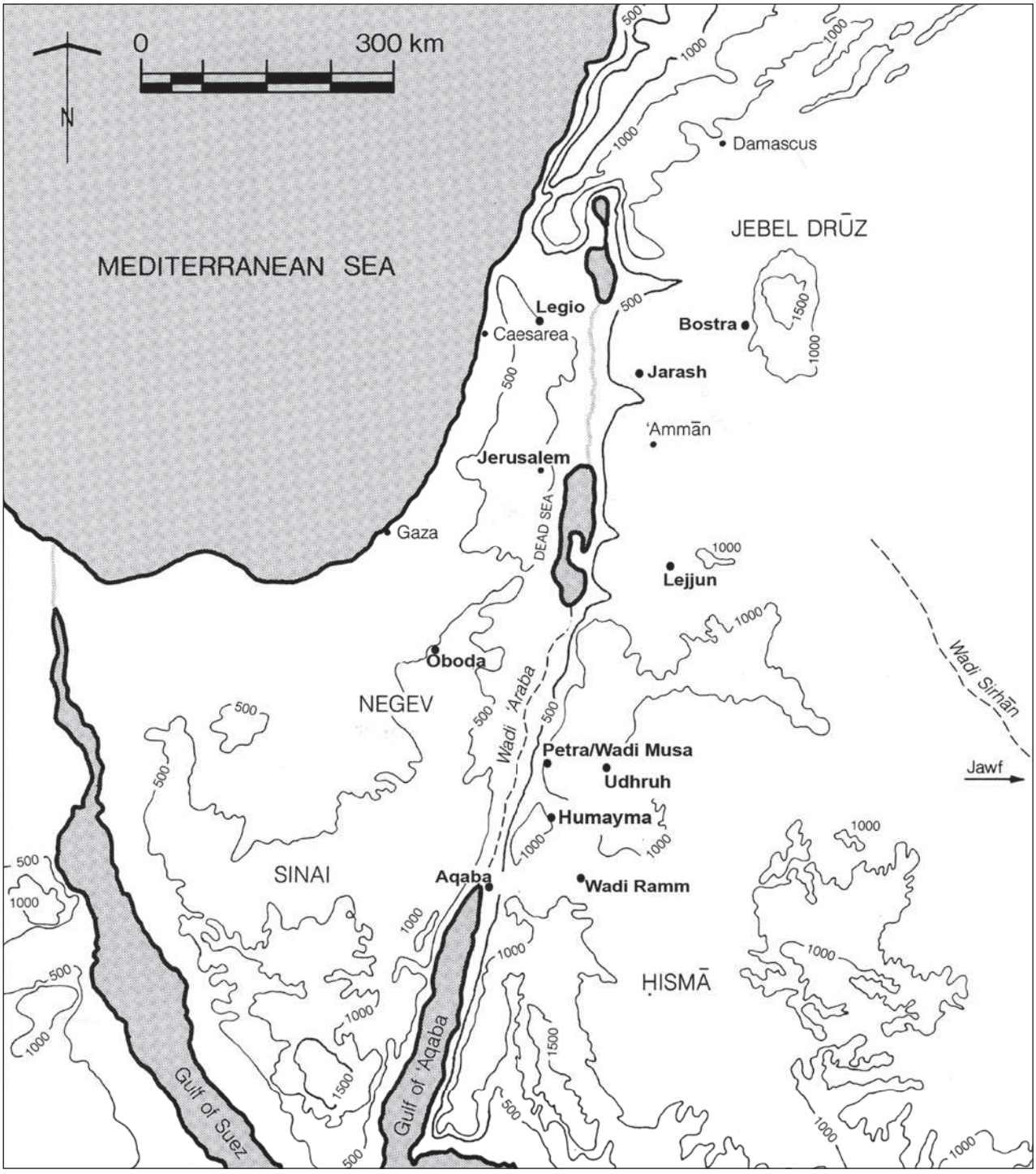

Fig. 1: Map of the region with the relevant sites highlighted in bold (map by the author, after Oleson 2010, fig. 2.1).

sis and the kiln in which they were produced[9]. Brick stamps of the *legio II Traiana* and *legio VI ferrata* are known from *Legio*, Israel,[10] and stamps of the *legio III Cyrenaica* have been found at *Bostra*.[11] Finally, *Zeugma* has produced a number of brick stamps from the *legio IIII Scythica*[12]. Outside these few sites, there is a surprising lack of brick stamps throughout the Roman East[13].

Along the southern *Limes Arabicus* brick stamps are completely lacking. At the Roman fort of Lejjun, excavators processed 56,574 tile fragments, all without stamps[14]. At the Roman fort in Humayma, excavators examined 8,297 tile fragments and again none of these had a stamp[15]. A similar absence of stamped tiles has been noted at *Petra*[16]. In some cases, excavated bricks and tiles show markings made by fingers or other tools during their production process, but it is not yet possible to use these markings to comment on the manufacturers[17].

The curious absence of brick stamps from this region has been explained so far as a result of the infrequent movement of bricks between military camps, an insufficient amount of field work in the region or poor excavation methods over the past centuries[18]. While it may be that there was not much movement of tiles, it cannot be said that there has not been enough meticulous excavation of military camps where stamped tiles are most likely to exist. Despite multiple years of excavation within the major

Fig. 2: Image of a Nabataean hypocaust system from Wadi Musa, near *Petra*, showing the use of small rectangular bricks in the *pilae* of the hypocaust (photo courtesy of K. 'Amr).

military forts at Lejjun and Humayma and careful examination of the bricks and tiles, not a single brick stamp has been found[19]. In the light of these careful examinations and the continued absence of brick stamps throughout the region, it seems likely that brick stamping simply did not occur along the southern *Limes Arabicus*.

Without a known tile production site or a single published brick stamp from the region, it is difficult to draw any firm conclusions about the organization of tile production for the Roman army along the southern *Limes Arabicus*. Until tile kilns are located and excavated or a detailed regional study is done on a large sample of bricks and tiles, the question of this industry's organization will remain unresolved. Nevertheless, there is evidence for a Nabataean tile industry before and after the Roman annexation, which raises the possibility that local Nabataean craftsmen supplied ceramic building material to the Roman military.

Although not much is known about this industry before the Roman annexation in AD 106, surviving evidence suggests that the Nabataeans had begun producing and using ceramic bricks and tiles a century before the Roman annexation. In *Petra*, for instance, tiled roofs covered portions of the Qasr el-Bint and the Temple of the Winged Lions, both of which date to the early 1st century AD[20]. In the elite residences at Zantur, in *Petra*, excavators uncovered a number of heated rooms with hypocaust systems that date to the early 2nd century AD[21]. Not only do these hypocausts contain a large number of ceramic bricks, but they also include reused roof tiles which definitively predate the Roman annexation[22]. Similarly, excavations at Wadi Ramm and Wadi Musa have recovered small rectangular bricks (equalling half the size of a Roman *bessalis*) from Nabataean hypocaust systems that date to the 1st century AD (Fig. 2)[23]. These finds not only show that the Nabataeans were producing bricks, but also that they were manufacturing bricks according to Roman modules of measurement and were using them in a Roman style hypocaust.

As noted above, no tile kilns have been identified; however, compositional analyses of bricks and tiles in the region have revealed that their production was focused around *Petra*. For example, energy dispersive X-ray fluorescence analysis of Byzantine roof tiles from Jabal Haroun near *Petra* has indicated that their production was in the local area[24]. An unpublished fabric study of ceramic building material from the military bathhouse at Humayma, determined that many of the bricks also came from *Petra*[25]. Although scientific analysis has yet to be carried out on the early Nabataean tiles from Zantur, *Petra*, they are also considered to have been manufactured locally[26]. Furthermore, it is evident that Nabataeans themselves were manufacturing ceramic building materials, as at least two tiles from *Petra* have Nabataean letters that had been pressed into the wet clay of tiles before firing[27]. In one instance, a tile from *Petra* contains the Nabataean characters *mīm* and *lām*, possibly representing the beginning of the word *malik*, i. e. "king" (Fig. 3)[28]. Finally, the absence of military stamps on the bricks lends strength to the hypothesis that they were produced by Nabataean contractors, who neither had the authority nor the motivation to mark them with official stamps.

Fig. 3: Image of tile from *Petra* showing the Nabataean characters *mīm* and *lām*, possibly representing the word *malik*, or "king" (photo courtesy of the Brown University Petra Archaeological Project).

Although the evidence is limited, that which does exist strongly suggests that the Nabataeans had established a brick and tile industry at *Petra* long before the Roman annexation and, in some cases, were even making and using the bricks in a Roman fashion. Fabric analysis of the material also reveals that bricks and tiles continued to be produced in *Petra* through the Roman and Byzantine periods. Examination of roof tiles in *Petra* has shown that there was no clear change in the material after the Roman annexation of AD 106[29]. Nabataean painted fine ware likewise shows a similar continuity of production over the same time, suggesting that the advent of Roman rule did not cause a major disruption in ceramic production[30]. It is entirely reasonable, therefore, that the Nabataean tile industry also survived the Roman annexation relatively intact or quickly recovered from any disruption.

If it was indeed the case that the Nabataean tile workshops survived the Roman annexation, it is not only possible but even probable that the Roman army took advantage of this already functioning industry. This local production of bricks would not be the only instance of the military contracting work out to local Nabataean workshops. The continued use of local production methods for the *tubuli* that are found in nearly all military bathhouses along the southern *Limes Arabicus* shows that these heating pipes are the product of Nabataean craftsmen who maintained their stylistic practices despite producing the material for the construction of Roman baths (Fig. 4)[31]. Further evidence of Nabataean involvement in supplying the Roman army comes from the early 2nd century fort at Humayma, where excavation within the fort's *praetorium* uncovered decorative floor mosaics. The excavators attributed these mosaics to a Nabataean workshop active in the *Petra* region, and nearly all the fine ware used in the fort during the 2nd and 3rd centuries likewise came from Nabataean workshops in *Petra*[32]. With the Nabataean workshops of *Petra* producing pottery and even other ceramic building materials for the Roman army, it is entirely possible that they also supplied the bricks and tiles. Further, as noted above, XRF analysis has confirmed that many of the bricks used in the garrison bathhouse at Humayma came from *Petra*, though the identity of their producers remains uncertain[33].

If the Roman army was willing to contract the production of brick out to Nabataean workshops in *Petra*, it is worth briefly considering why similar agreements did not exist elsewhere in the Roman East, such as at Jerusalem and *Zeugma*, where the Roman army undoubtedly produced its own ceramic building material. A possible explanation is the fact that both of these sites, along with *Bostra* and *Legio* which also have Roman brick stamps, were home to full legions. By comparison, there was no legionary base in the greater *Petra* area until the time of Diocletian. It is entirely possible that, without a full legion based nearby, the auxiliary forces and detachments in the region looked instead to local workshops for their brick and tile supply. When the legionary forts of Lejjun and Udhruh were constructed in ca. AD 300, it is possible that the Nabataean tile workshops continued their production and expanded their supply to these forts as well.

The availability of resources may have been another factor why the Roman army contracted out the production of brick along the southern *Limes Arabicus*, but not elsewhere. The manufacture of ceramic building materials requires a large amount of clay, water and fuel, resources that are scarcer in the deserts of southern Jordan than elsewhere in the Roman East. For instance, at the site of Humayma, where the Roman army constructed their first major military camp in the region, the lack of a clay source and the scarcity of fuel and water likely made it impossible to produce bricks locally[34]. *Petra*, on the other hand, had an abundance of good quality clay, perennial sources of water and an easily accessible fuel source from the neighbouring forests[35]. As a result of this distribution of natural resources, *Petra* was home to what can be considered a "nucleated brickyard complex", where adequate clay and other resources existed in one specific area[36]. It is likely that the Roman army had a presence in *Petra* immediately after the annexation of AD 106[37]. This force, however, was too small to operate an entire brickyard, and thus the Romans had to rely on the local workshops that were not only familiar with producing ceramic building material but were accustomed to producing bricks according to Roman measures for Nabataean hypocaust systems.

Although it was far more common for the Roman army to use bricks produced by militarily organized and operated tileries, the southern *Limes Arabicus* is not the only region where local contractors may have supplied brick to the Roman army. Further north, in the Decapolis region, Late Roman kilns in the hippodrome at Jarash may have supplied ceramic material to the Roman frontier stations in the region[38]. These kilns also produced tiles, though it is uncertain if they were for the Roman army[39]. In Roman Britain, scholars have suggested that a small ceramic kiln at Tarbock may have been a private industry that produced tiles for the nearby legion[40]. Similar arguments have also been posited for brick production along the Danube frontier[41]. On the other hand, some scholars have cate-

Fig. 4: Image of ceramic *tubulus* (box-flue) from the garrison bathhouse at Humayma (photo by the author with permission from M. B. Reeves).

gorically rejected the idea that civilian contractors produced bricks for the Roman army[42]. Nevertheless, there is increasing evidence in the form of brick stamps that a few legions in Roman Britain contracted the production of brick and other ceramic building material out to private workshops[43]. If this local supply to the army is indeed the case, the contracting of local Nabataean workshops for the production of ceramic building material was not that exceptional.

The argument presented here, that the Roman army contracted the production of bricks and tiles for the southern *Limes Arabicus* out to local Nabataean workshops, runs counter to the usual practice of the Roman army producing its own ceramic building material. Although not unique in the Roman Empire, this production of brick by private contractors aligns with the similar local supply of mosaics and other ceramic material to Roman forts. These contracts suggest a close and mutually beneficial relationship between Nabataean industry and the new Roman administration.

It is worth repeating one last time that the argument presented in this paper remains only a theory. Nevertheless, the evidence that does exist strongly suggests that Nabataean workshops supplied brick and tiles to the Roman army along the southern *Limes Arabicus*. Definitive proof, either supporting or negating this theory, will only come with the discovery and excavation of tile kiln sites in the region or the identification of hitherto elusive brick stamps – if they ever in fact existed. A comprehensive study of bricks and tiles that pre- and post-date the Roman annexation would allow a detailed study of the fabrication techniques and may thereby resolve this matter. Until that time, we are left with the evidence at hand.

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1 Zayadine 1982, 380–393; ʻAmr 1991; ʻAmr/al-Momani 1999, figs. 5.2, 12.29, 15.21–22.
2 ʻAmr/al-Momani 1999, 191.
3 Melkawi et al. 1994.
4 Negev 1974; Goren/Fabian 2008.
5 Oleson 2010, 327.
6 Parker 2006, 362.
7 Killick 1987, 173, fig. 3; Wenner 2015, 120.
8 Kurzmann 2006, 30–31.
9 Arubas/Goldfus 1995, 104, figs. 10–12; Arubas/Goldfus 2005, 15.
10 Tepper 2007, 66, figs. 8–9.
11 Brulet 1984.
12 Wagner 1977, 525–526, fig. 2; Kennedy 1998, 133–135.
13 Kurzmann 2006, 145–146.
14 Parker 2006, 361.
15 J. P. Oleson, pers. comm. March 2016.
16 Hamari 2012, 83.
17 Reeves/Harvey 2016, 472, fig. 11.
18 Kurzmann 2006, 146.
19 Parker 2006, 361; Reeves/Harvey in preparation.
20 Rababeh 2005, 196–197, 209–210; Hamari 2017, 94–95.
21 Kolb 2007, 168.
22 Hamari 2017, 93.
23 Reeves/Harvey 2016, 463, 470, fig. 13.
24 Holmqvist 2009, 93.
25 Dupuis 2015, 29.
26 Hamari 2017, 104.
27 Hammond/Johnson 1994, 336; Alcock et al. 2010, 159.
28 Alcock et al. 2010, 159, fig. 8.
29 Hamari 2012, 83.
30 Schmid 2003, 81.
31 This conclusion comes from my study of *tubuli* in Roman Arabia as part of my M.A. thesis (cf. Harvey 2013). Some of my conclusions are also published in Reeves/Harvey 2016 and Reeves/Harvey in preparation.
32 Oleson 2007, 452.
33 Dupuis 2015, 29.
34 Oleson 2010, 327.
35 Zayadine 1986, 185.
36 Peacock 1979, 7.
37 Parker 2015, 316–318.
38 Kehrberg 2007, 45–46.
39 Kehrberg 2009, 509, fig. 10b.
40 Swan/Philpott 2000, 57.
41 Jahn 1909, 115; Matteotti 1993.
42 Kurzmann 2005; Kurzmann 2006, 215–224.
43 Warry 2010, 145.

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