

Pottery and Glass Sherd-Tools from Roman and Byzantine Workshops at the Gerasa Hippodrome and other Sites: A Reappraisal

Research Background and Find Contexts

Before discussing the hippodrome sherd-tools I would like to recap some vital information about the Jarash hippodrome and its structural history, the excavation of which led to my discovery and classification of this group of artefacts.

There are many signatures one may assign to a site or town from chronological and cultural or civic developmental aspects, Classical-periods sites like Decapolis cities being mostly equated with their imposing architectural remains. In the case of Roman Gerasa and Jarash of the late Antiquity, this association has arisen from two centuries of exploration focusing on exposures of the monumental ruins and their anastyles. Some of the monuments have been explored, excavated and studied over many years and in great detail by teams of architects and archaeologists from independent institutes as well as the Department of Antiquities, the hippodrome project having been one example¹.

My identification of pottery and glass sherd-tools and assertion of their manufacture in these ancient urban settings were initially met with some incredulity. How could a Roman -

Byzantine city, a fully urbanised society, resort to such basic and in many eyes 'outdated' tools, reminiscent of prehistoric cultures and an altogether different life style? However, the consistent recovery of quantities and varieties of these tools from our excavations of the Roman circus, its workshops and simple dwellings substantiated the fact of their existence and indeed regular occurrence, the study of which I first published in 1992 (Kehrberg 1992)².

It suffices here to mention that I have worked for over 30 years at Jarash. I identified sherd-tools in a variety of assemblages at several sites in and around Jarash whose archaeological data I have been in charge of studying: the corpi now span find-contexts from Late Hellenistic to Islamic townships³. That is to say I retrieved these tools from a dispersed area of excavations, and not only a specific concentration like the workshops at the hippodrome. The latter concentration led me to advocate a specific association in a second brief publication updating my findings (Kehrberg 1995), in which a direct association of the tools with the workshops was demonstrated.

Views at FIG. 1 expose the hippodrome

1. The 1984 - 1996 *Jerash Hippodrome Project* was a DoA sponsored project and directed from its inception in 1984 by architect Dr Antoni A. Ostrasz until his death in October 1996 (e.g. Ostrasz 1989a, b). I would like to thank Dr Bill Finlayson for reading my paper at the *SHAJ* 12 conference.
2. Notwithstanding my early work experience with stone tools in Australia and in Jordan at Tulaylāt al-Ghassūl (excavations 1975

- 77), I submitted my article having shown the sherd-tools to palaeontologists working in Jordan at the time who confirmed my identification of these retouched sherds.

3. Only a select number of sherd-tools are shown here to demonstrate the points discussed in the article; they are not representative of the much larger corpi I worked on.



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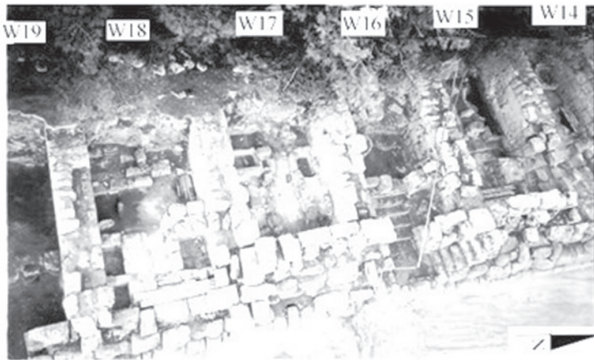
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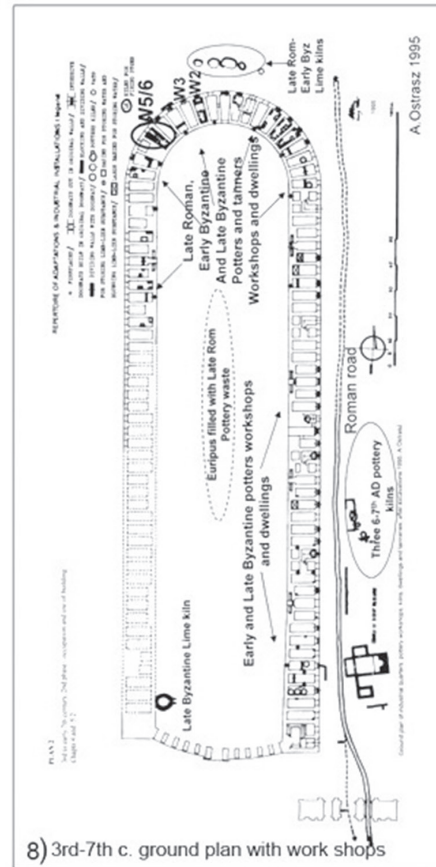
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7 Aerial view of hippodrome post-excavations 1984-1996 (Photo: APAAME: D. Kennedy & R. Bewley 1999)



8) 3rd-7th c. ground plan with work shops

1. Examples of Late Roman-Early Byzantine workshop installations: find contexts of sherd-tools (A.O. and I.K. excavations 1984-1996; photos 1-2: A-C. Goguel and I.K. 1996; 5: I.K. 2003).

building as it was left just after excavations had ceased in 1996 (Ostrasz 1989, 1990, 1991, 1993, 1994; Kehrberg and Ostrasz 1997; Kehrberg 2001, 2007, 2009a). The 1999 aerial view (FIG. 1.7) shows the whole extent of our excavations and Antoni Ostrasz' restorations of the south-eastern part of the circus building (east *carceres* and *cavea* with tower); he conserved the standing remains of the excavated east and west *cavea* walls, and *euripus* for their preservation, employing analogous authentic materials.

The ground plan (FIG. 1.8) illustrates the configuration of the circus building after chariot racing had ceased around the mid-third century and workshops had begun to be installed in the *cavea* chambers not long after in the same century. It shows at a glance how extensive the workshops were and how the circus building had indeed become the *sūq* of the potters and tanners, with dwellings for their families⁴. The bird's eye view and ground photos (FIG. 1.1-6) taken in 1996 detail examples of the workshop installations and dwellings inside chambers with which the sherd-tools were associated. FIG. 1.5 shows vats from a tannery caked with layers of once liquid lime used to soak the skins before their final treatment on the built platforms (FIG. 1.3). Glass and pottery sherd-tools used in the tanning process were found embedded in the lime layers and on the workshops floors.

The abridged stratigraphy of contexts and their assemblages at the hippodrome site in TABLE 1 (*infra*) reflects activities brought about by urban growth and decline from the Late Hellenistic to Late Islamic townships (*cf. e.g.* Kehrberg and Ostrasz 1997; Kehrberg 2009a). In particular, it is worth noting that *cavea* chambers W2 and W3 (FIG. 1.8) not only encapsulated this history, but also added to already substantive material

evidence attesting to the abandonment of the circus building by the early seventh century. Our excavations uncovered skeletal remains of over 200 human bodies inside both chambers: two mass burials of mid-seventh century plague victims (Ostrasz 1994; Kehrberg and Ostrasz 1997; Hendrix 1995). W2 and W3 would not have been chosen for these provisory mass graves had the hippodrome still been inhabited by the artisans and their families. The inevitable association with death and fear of the plague rendered the very idea of cohabitation alongside contemporary mass graves as impossible. The mass burials are in themselves conclusive evidence that the circus was already an abandoned building, thus serving as a suitably isolated place for improvised interments, away from the living in the walled city⁵. It was only after a period of 'desensitisation' and recovery of the township that pockets of occupancies reappeared at the hippodrome site, recycling what was left of some exposed workshops and adding on to some earlier structures along the periphery of the *cavea*, much of which had been destroyed by the 650 and 749 / 50AD earthquakes which buried the mass graves under dense layers of tumbled walls, vaults and seat stones of the *scalaria*.

The reason for stressing this particular part of the building's history is not because it is spectacularly gruesome. Instead it seemed expedient to reiterate the excavation history of the site – a history that, albeit documented, has recently been ignored. If one were to decide that the *cavea* workshops (FIG. 1), covered by Byzantine pottery dumps⁶ and the mid-seventh century mass burials, had been built later, then the manufacture and use of the sherd-tools found with the workshops and the waste they produced

4. There were other pottery workshops operating inside the walled city from the Late Roman to Byzantine periods, as well as in earlier periods. But they and their output were smaller, and none had the large clusters of workshops typical of the hippodrome *sūq*. The latter phenomenon only occurred at other sites after the hippodrome had been abandoned in the transition from the late Byzantine to early Islamic townships in the early seventh century. With regard to the families working and living at the hippodrome, see our forthcoming article on the graves of secondary

occupants and the mass burials at the site (Kehrberg and Ostrasz, in prep.).

5. Anecdotal evidence of another improvised mass grave in an abandoned structure outside the city walls may fit the same contemporary scenario (*pers. obs.*).

6. Workshop remains in most chambers were covered by thick layers of Early and Late Byzantine pottery waste, as in W2 and W3, on which the dead bodies had been laid.

Table 1. Gerasa - Jarash hippodrome excavations 1984-1996: abridged stratigraphic history of the circus occupancies relevant to the workshop installations and industrial and residual waste in the east and west *cavea* chambers and periphery.

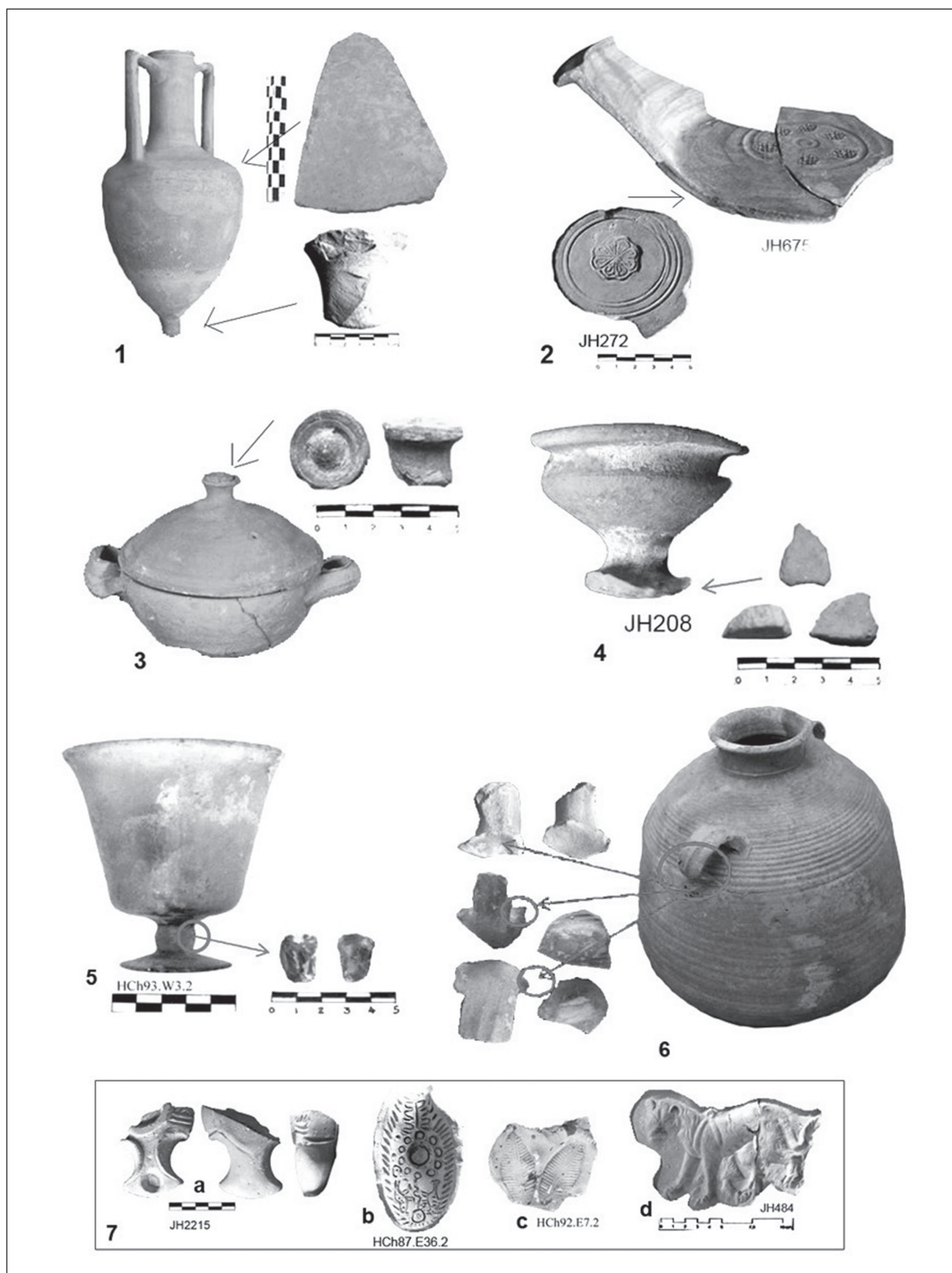
(1) Post-Umayyad → (2) Mamluk; (2) Ottoman.	(1) Evidence for transient occupancies; (2) some activity in arena: irrigation channel; cross wall; garden plots (?).
Massive earthquakes 749-750 and 13th century AD →	Major destructions / tumble of upper structural masonry of <i>scalaria</i> , <i>cavea</i> and <i>carceres</i> .
Umayyad →	Sporadic or opportune occupancies.
<i>Cavea</i> chambers W2 and W3 →	Mid-seventh century AD (coins and other artefacts) mass burials of over 200 plague victims.
Circus building abandoned early seventh century AD →	Allowing it to be used for mass graves (see above).
By sixth-seventh century AD: Late Byz. occupancies → (<i>cf.</i> Church of Bishop Marianus <i>ca.</i> 570 AD east of <i>cavea</i> and the deacon's dwelling inside <i>cavea</i> chambers)	<i>Cavea</i> chambers filled with late Byz. pottery and residual waste dumped on top of disused workshop installations; spill build-up continued along outer periphery and some industrial constructions alongside outer podium wall; kilns outside building.
North half of circus arena and <i>cavea</i> reclaimed for public games in fifth century	Workshops inside chambers closed and / or destroyed; potters moved to south end of hippodrome.
Later third-fifth century AD → secondary occupancies	Late Roman → Early Byz. pottery and tannery workshop installations and dwellings inside <i>cavea</i> chambers; layers of debris spill overflowing onto outer periphery, <i>cf. e.g.</i> W4 and W5 with steps cut into layers to reach doorway.
From second half of second to <i>ca.</i> mid-third century AD →	Circus used in its original capacity for chariot-racing.
First half of second century AD →	Construction of circus building for chariot-racing.

would also have to belong to that supposedly later hypothetical phasing of stratigraphy and occupancy. This critique of recent attempts to reverse established real sequences of events at the site does not exclude the fact that some exposed chambers and peripheral structures were reused in later periods and had features added to them. However, these subsequent and haphazard occupancies do not alter the fact that the original *cavea* workshops had already operated at the hippodrome for over 300 hundred years, accumulating debris covering disused installations and the periphery prior to the mass burials, all of which provide a solid chronological framework for the sherd-tools. The *in situ* relative stratigraphy of the hippodrome site underscores that the tools were being made in Roman Gerasa

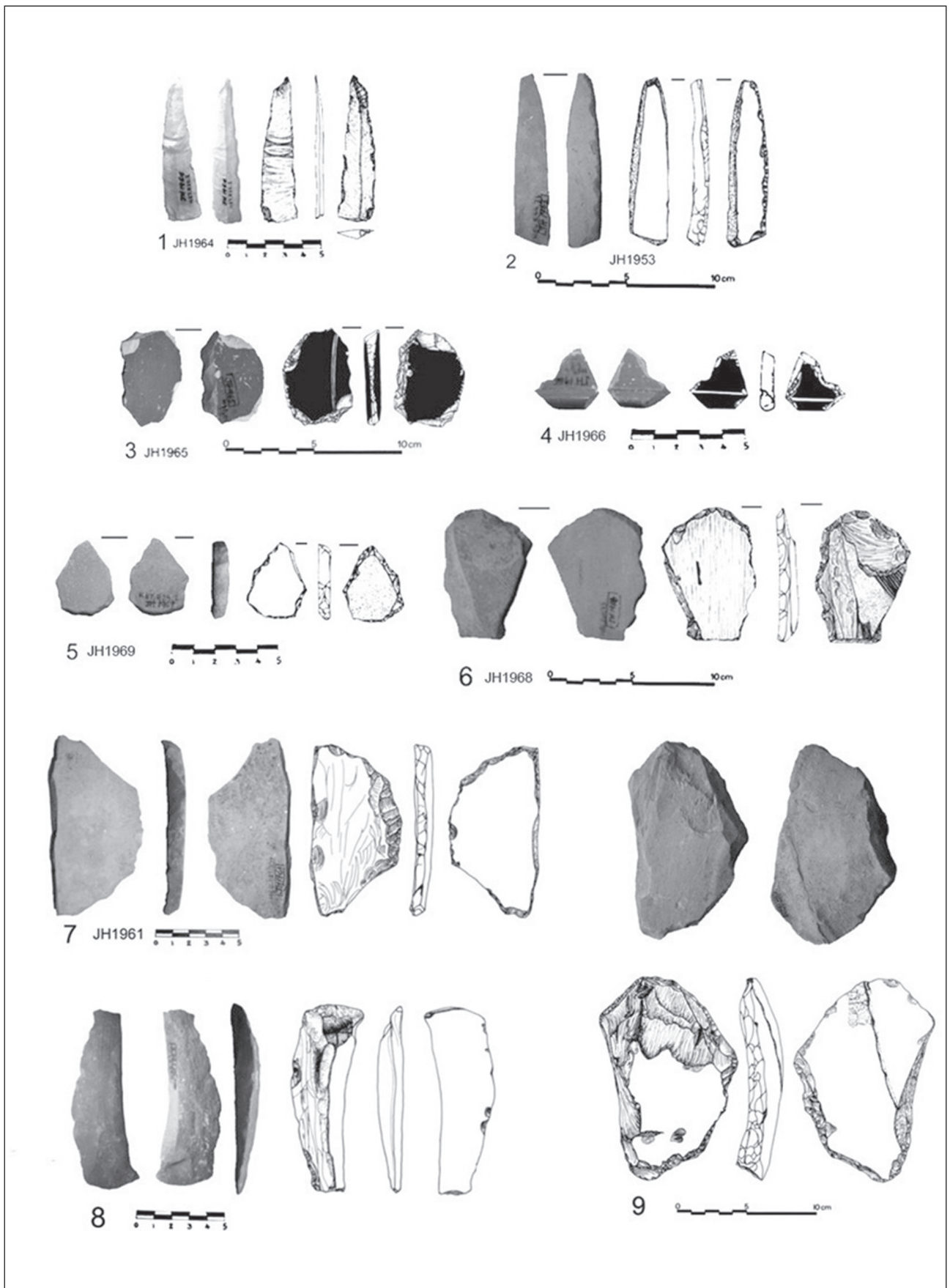
and Byzantine Jarash when trade of manufactured and agrarian goods grew and prospered (Kehrberg 2007, 2009a). The Umayyad and Abbasid townships of Jarash restored a period of relatively healthy proliferation before and after the 749 / 50 earthquake when other abandoned monuments inside the walled city were taken over by artisans, in the main potters. The hippodrome site had, however, a very modest share in the revival; occupancy was provisional and sporadic and the ruined building never regained its earlier place as the leading industrial quarter.

Sherd-Tools from the Gerasa-Jarash Hippodrome (FIGS. 2-7)

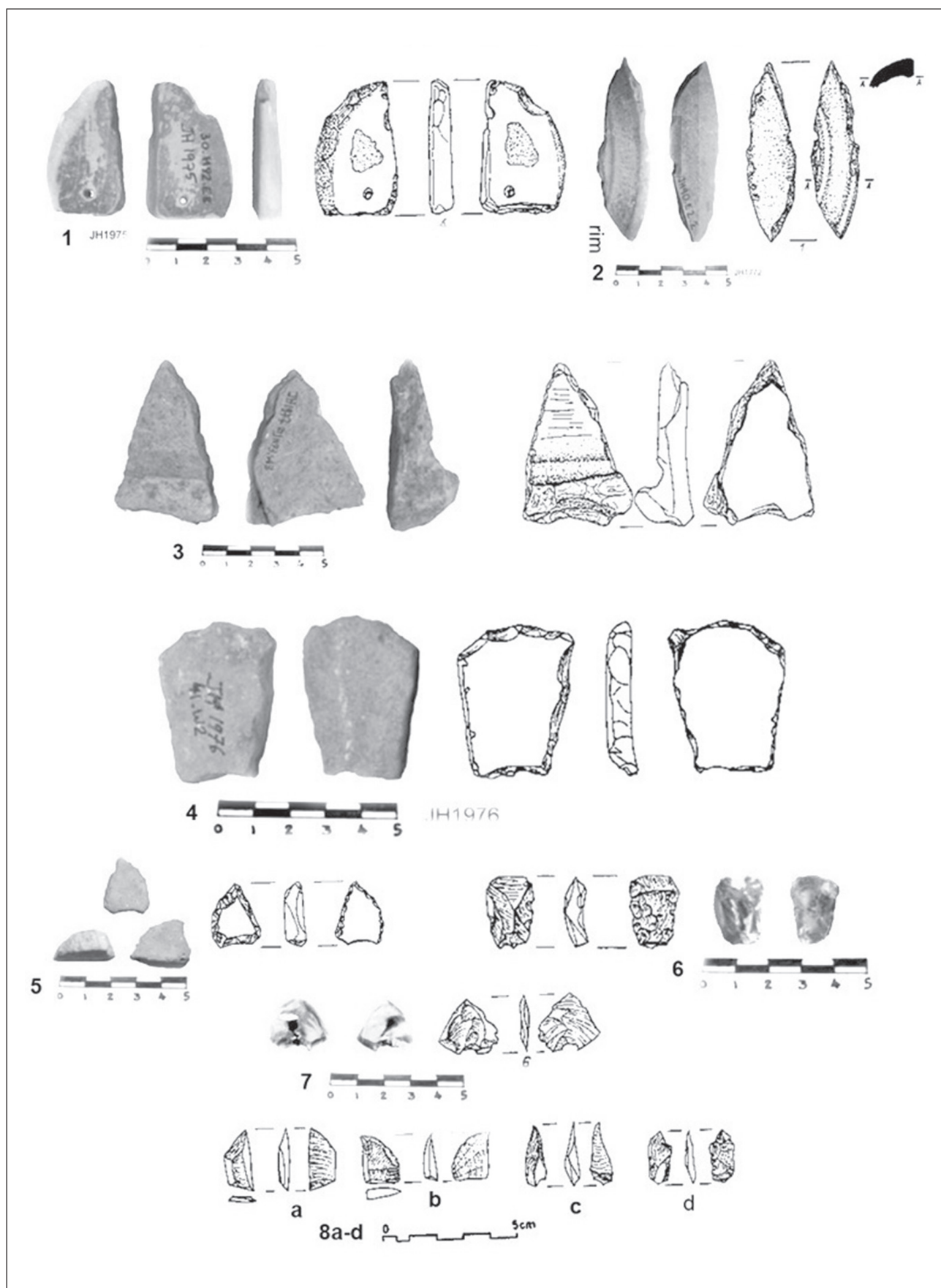
For those not familiar with Classical-period ceramics or glass, FIG. 2 introduces a range of



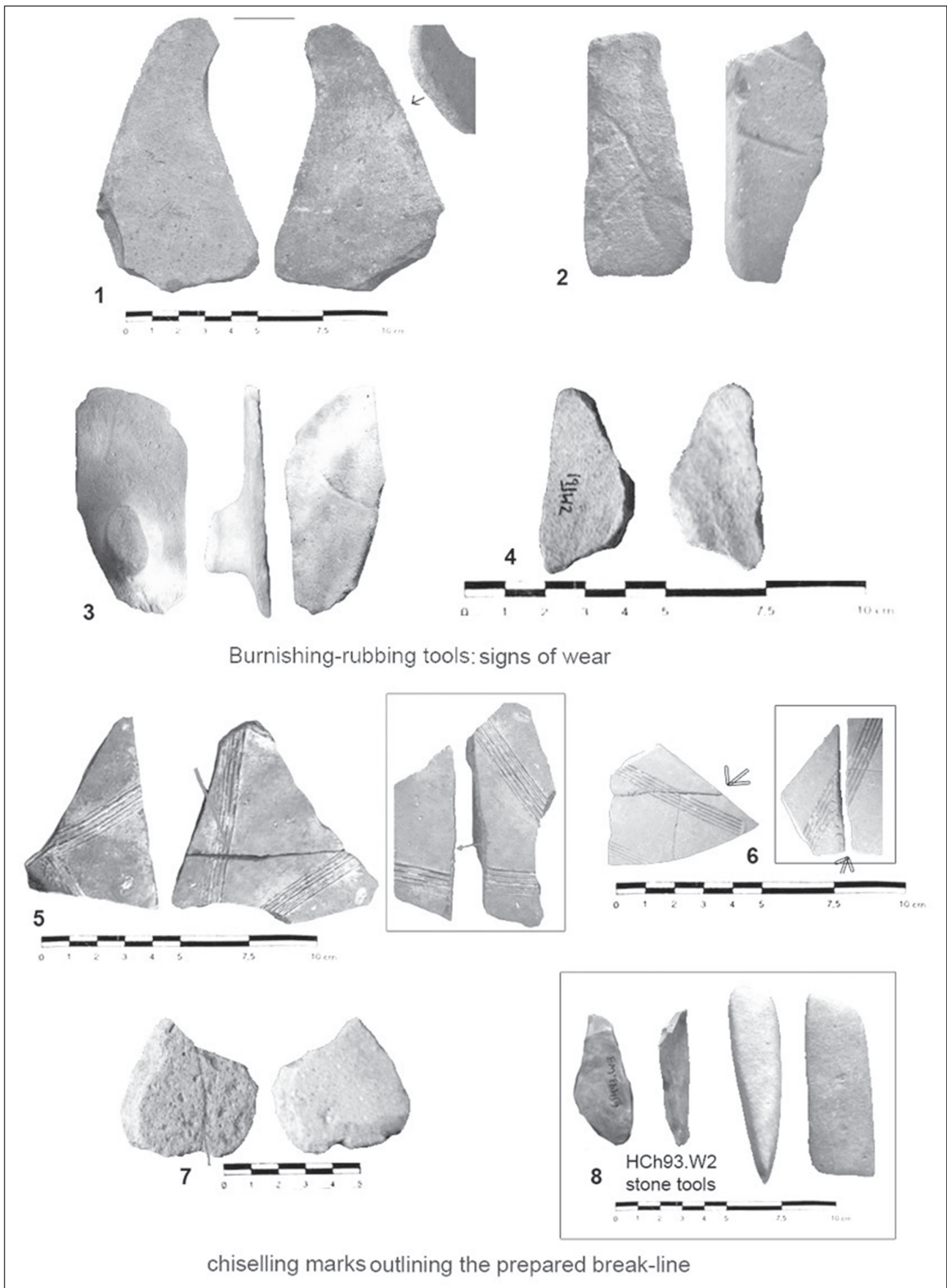
2, 2-5: Sherd-tools and vessels found in hippodrome workshops and pottery dumps; 1, 6: sherd-tools from the hippodrome dumps and vessels in the Jarash Museum; 7a-d: matrix, mould and stamped design examples from the hippodrome.



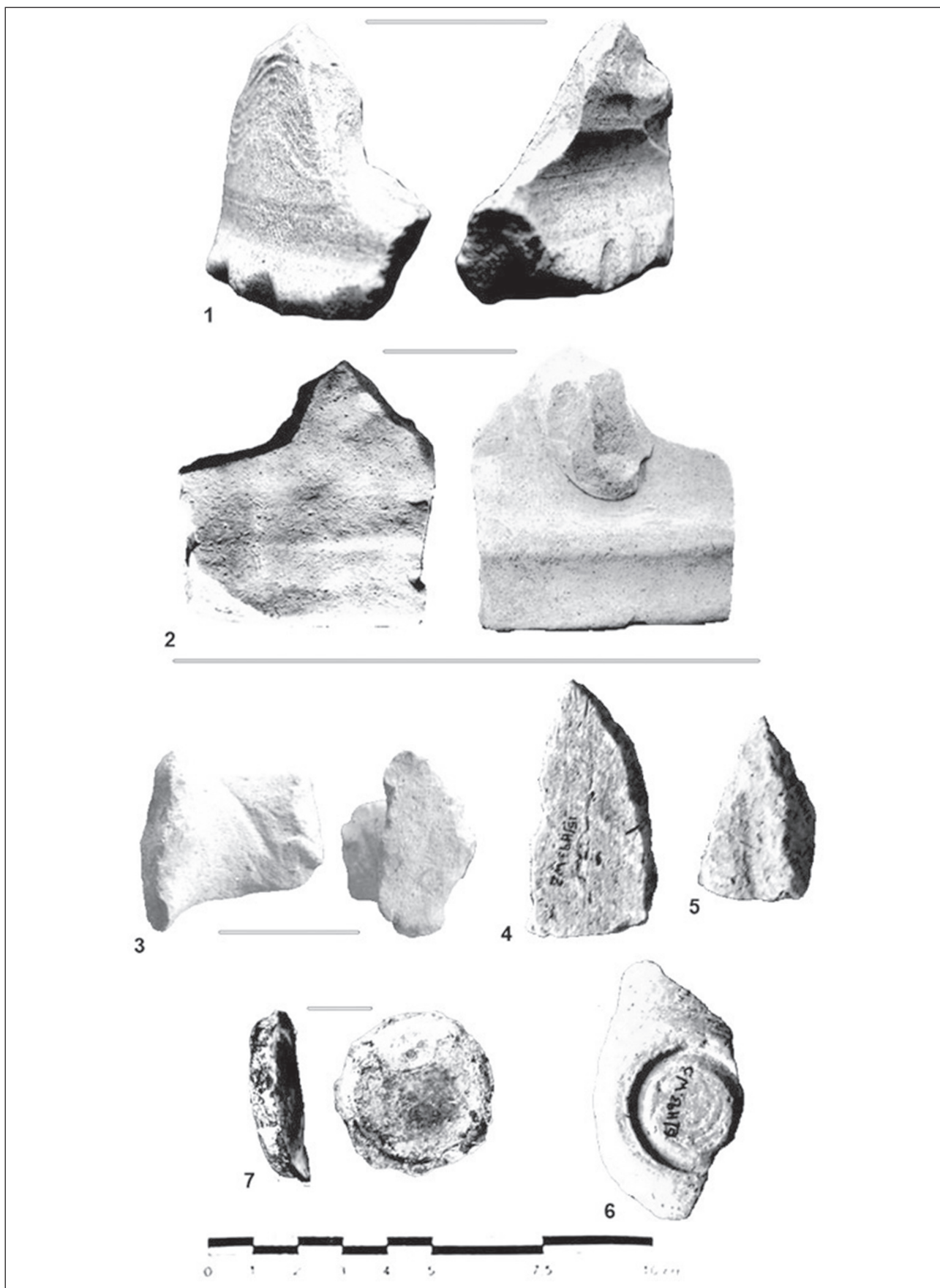
3. 1: Late Byzantine glass blade; 2-9: pottery sherd-tools from the hippodrome (cf. Kehrberg 1992).



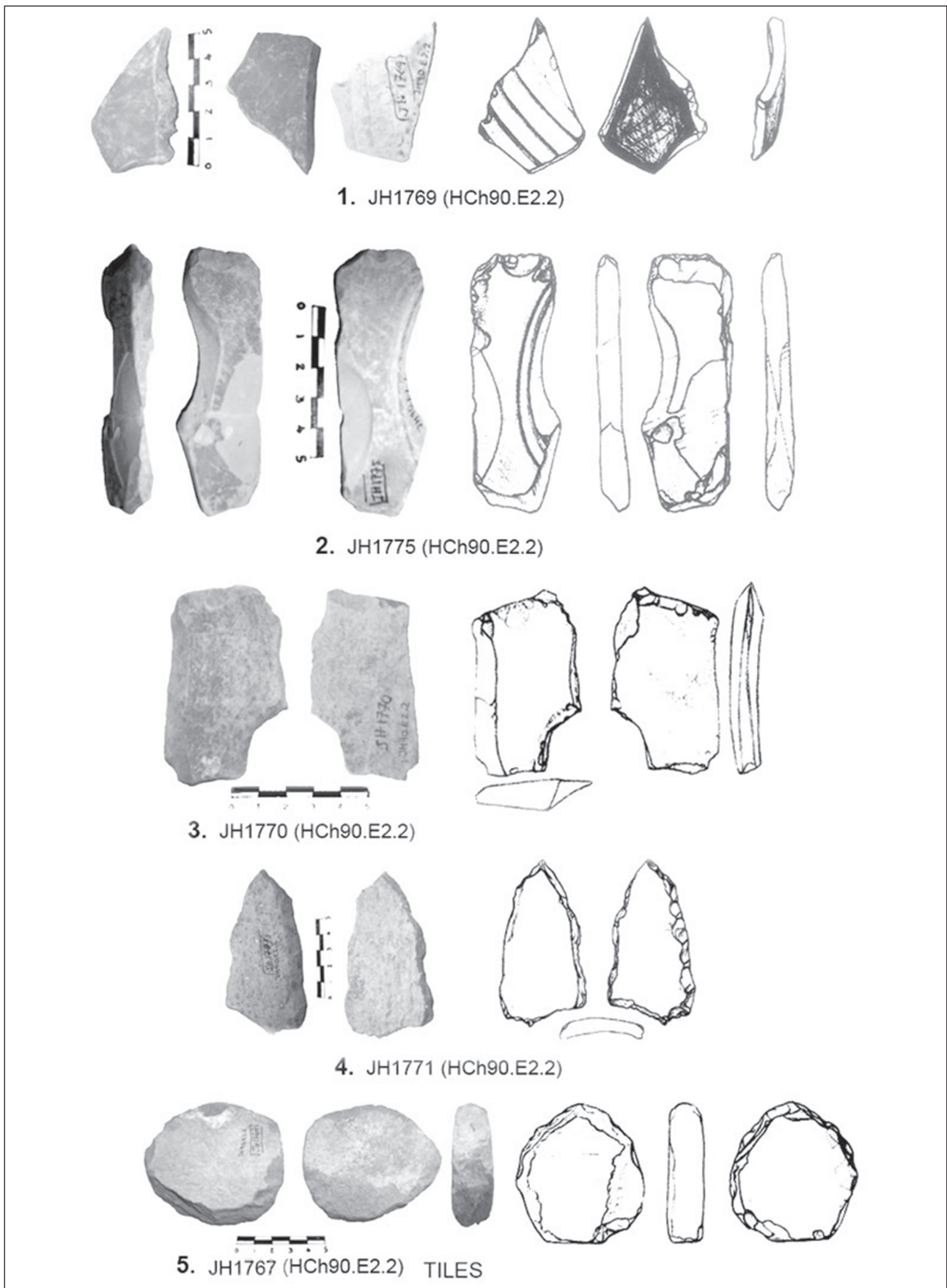
4. 1-5: Pottery sherd-tools; 7-8a-d: glass sherd-tools from the hippodrome (cf. Kehrberg 1995).



5. Pottery sherd-tools: some examples of tool making and use-wear.



6. Coarse ware (1; 2; 4; 5), common ware (3; 6) and glass (7) sherd-tools.



7. Scrapers and awls: 1-3: terra sigillata; 4-5: tiles.

vessels that supplied some of the main resources for sherd-tools. As already mentioned, most of the sherd-tools were found together with pottery discarded by workshops of the Late Roman to Byzantine periods. Dating these dumps, mostly contained within chambers (*supra*), was made possible by the wares and the stratigraphic sequence of deposits corroborated by coins and other finds. It was, however, the large quantity of pottery (wares and forms) making up the kiln wastes that provided statistically reliable date-ranges for the manufacture of the dumped ceramics. Other contexts for the sherd-tools were the original floor space of the workshops and the aforementioned lime deposits in the tanneries, which virtually sealed their ‘used-by’ date.

It soon emerged – again through quantitative analysis – that potters and tanners did not use sherds randomly but selected pottery wares and forms or glass for their specific qualities and for specific functions, *i.e.* to make specialised tools. This was particularly noticeable in dumps containing a limited range of sherd-tools, such as the many scores of handle sherd-tools (FIG. 2.6) in waste dumps with many ribbed jars. It was clear that the potters made and used the handle sherd-tools for ribbing, which was further evidenced by the worn points of the tools.

The diverse range of pottery and glass sherd-tools in FIGS. 3-7 are all associated with the hippodrome workshops and their discarded waste. Here, too, the choice of suitable pottery wares is easily discernible. For example, the terra sigillata sherd-tools (FIGS. 3.3-4; 4.1; 7.1-3) and local Late Roman wares (FIGS. 3.2, 5-7; 4.2, 4) made up awls and scrapers, while retouched glass sherds served as blades and burins (FIGS. 3.1; 4.6-8). They were picked for their specific fabric, which provided sharper points and edges for cutting, shaving or scraping surfaces. Other pottery wares, *e.g.* the coarser and softer fabrics, were selected for

burnishing or grinding, and as pounding tools. Thus, it was the function of the tool which dictated the type of ware and form of sherd chosen (FIGS. 2.1; 3.9). Some sherds display extensive retouch, while the burnishing tools have little secondary work beyond shaping their outline (FIGS. 2.1; 3.2; 4.1; 5.1-4). Some larger body sherd-tools were unfinished and preserved evidence of their manufacture. Other sherds retained traces of charcoal lines drawn across larger body sherds to outline the shape. As seen in FIG. 5 (nos. 5 and 6), finely chiselled break-lines are still preserved along the upper edge of the intended fracture: there are slight, regular indentations on the original surface away from the sharp fracture. In principle the technique is similar to that employed at quarries when preparing to split larger rocks into blocks. Another example of an ‘unfinished’ sherd-tool is the ‘heart-shaped’ body sherd (FIG. 5.7), on which the groove had been incised but that part had not yet been snapped off. It is clear from the shaped sherd that the opposite oblique outer edge had already been trimmed or retouched. These details provide important evidence for the systematic and efficient production of tools, rather than simply using sherds in their random fragmented state of incidental breakage or exploiting flaking caused by use or trampling⁷.

PLS 6 - 7 add to the wide range of retouched sherds, including the use of tiles (FIGS. 4.3; 6.4, 5; 7.4, 5). Two lithics in FIG 5.8 that were found with sherd-tools serve as a reminder that sherds were not used because stone was not available. Stone tools as shown here, newly made or recycled from early occupancies, were used and reused throughout historical Jarash, but not in large quantities⁸.

The hippodrome sherd-tools shown here provide a variety of examples attesting to their specialised employment, like the ‘handle-tool’ mentioned earlier (FIGS. 2.6, 7a-d; 6.3, *supra*).

7. This can also and does occur but is discernible and not the point I am raising in this paper.

8. On recycling of Neolithic and later stone tools at Jarash, see Kehrberg 1992. Stone tools made from retouched building

blocks and other stone fragments like marble will be discussed in the final publications of projects where I was ceramics and small finds specialist.

Having been found in workshops, it was this direct association with tanners and potters that firmly identified their function (Kehrberg 1995). Subsequent recoveries have borne out these earlier findings: potters employed a variety of tools purposely made:

1. To burnish slipped and slurried surfaces;
2. To shave or 'tidy' ridges along moulded joins like lamps, or for sharp carination and other renditions;
3. To incise or cut designs and for fenestrations and piercings;
4. To refresh or detail impressed designs (negatives) of lamps and other figurative moulds and stamps.

A Late Hellenistic-Early Roman pottery lamp matrix (clay model or 'positive' for making a lamp mould) and plaque figurine mould (FIG. 2.7a, d; Kehrberg 2011), one original Early Byzantine stamp sampling and a Late Byzantine lamp mould (Pl.2:7b,c) all share the soft broader incised designs⁹.

The glass sherd-tools reduced in frequency with the closure of the tanneries in the Early Byzantine period. The glass tools were used for cutting or trimming leather or hides, while pottery tools like scrapers were used after soaking to remove the pelt without damaging the skins and pottery rubbing tools were used to soften the skins. The end of the tanneries was almost certainly brought about by falling demand for leather in the market owing to closures or reductions of frontier stations and the withdrawal of armies who no longer bought leather in larger quantities (Kehrberg 2007).

Concluding this concise reappraisal of excavated tools, it is important to mention that sherd-tools and some stone tools (*supra*)

occurred regularly at other excavated sites where there was evidence of industrial activities like kiln waste¹⁰. They were found at the cathedral excavations (Kehrberg 1998) and at the upper Zeus temple complex excavations (Braun 1998; Kehrberg 2001a, 2007) in deposits associated with the building phase of the upper temple complex as well as later occupancies predating and succeeding the hippodrome workshops. It should be mentioned that sherd-tools were also associated with domestic and agricultural contexts, especially in late Antiquity and during the Late Islamic and Ottoman periods, evident in similar settings at other Decapolis cities. These findings recall my earliest visits to the Jordan valley in 1975 where I noticed farmers ploughing with hand-made wooden ploughs with flint heads (furrowers), an example of ancient technology surviving until modern times.

Jarash Hinterland Survey (JHS) 2005-2010¹¹ (FIGS. 8-9)

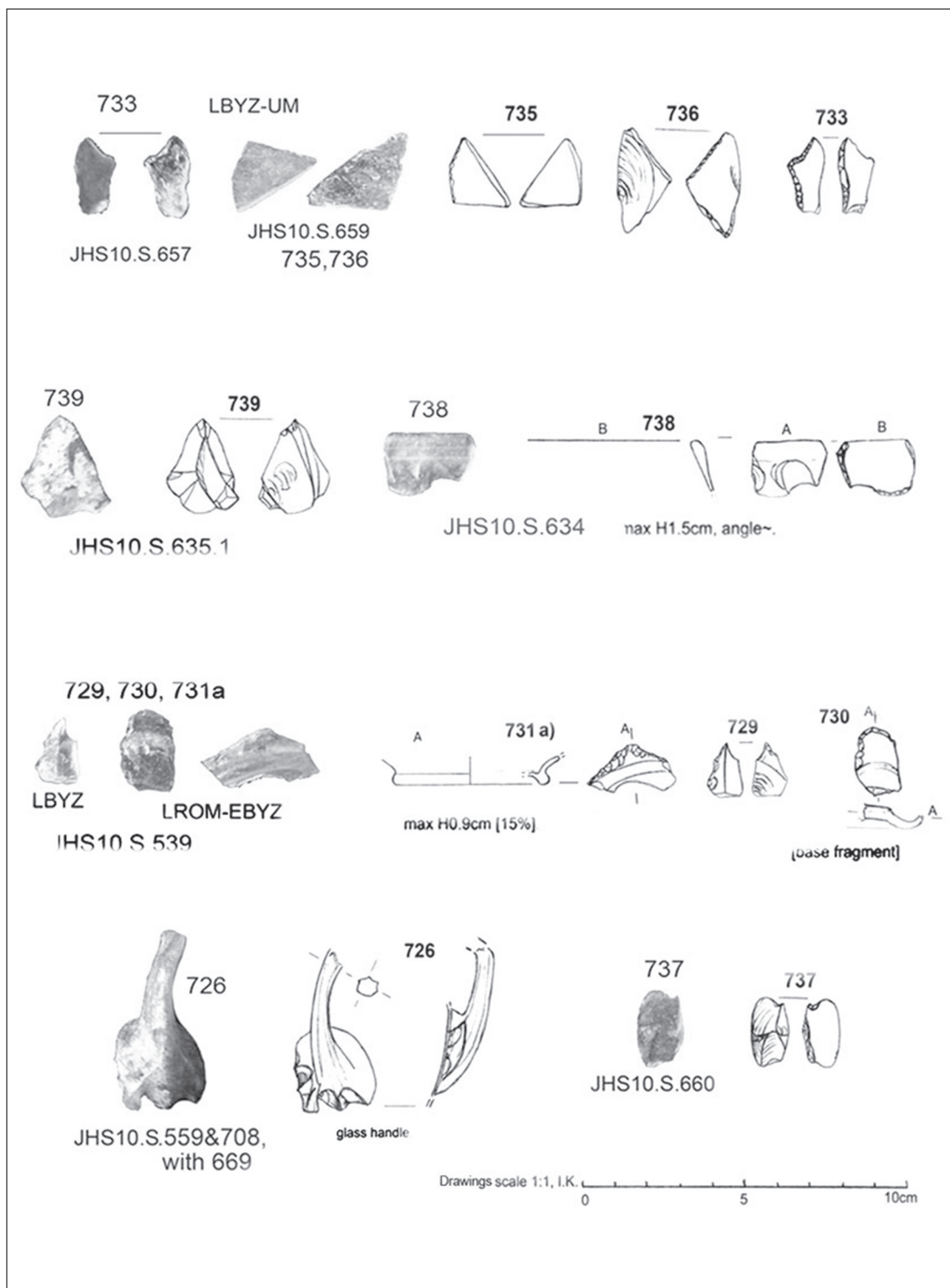
The sherd-tools in FIGS. 8 and 9 come from a different context, namely from survey or surface collections where correct readings of single artefacts are crucial in identifying and/or dating transects. Often lacking the *in situ* data that usually comes with excavated stratified contexts, the interpretation of a used and revisited location depends to an even greater extent on artefacts. Therefore, and as in the case of the JHS finds, the identification of pottery and glass sherd-tools are possibly even more important here than for excavated or 'sealed' contexts. The Jarash Hinterland Survey covered the areas surrounding the city walls and it is not surprising that the pottery and glass finds

9. We know from our excavations and foundation deposits that potters were active at the site before the hippodrome was built and littered it in the same manner as later workshops. The matrix and animal plaque belong to this pre-circus phase when the site was a necropolis and quarry (Kehrberg 2004).

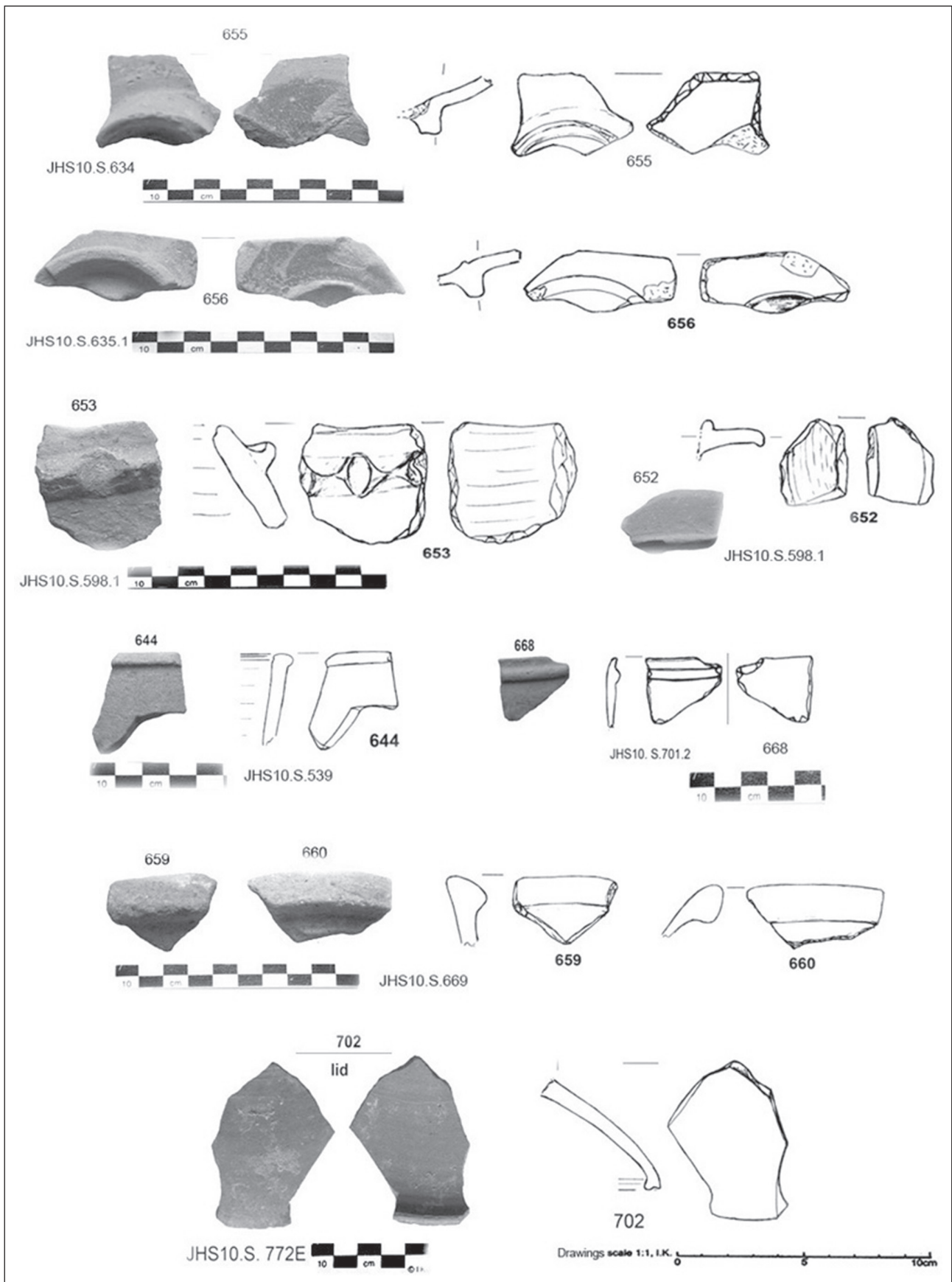
10. It is worth mentioning that archaeologists at Sagalassos identified pottery tools in Roman-period workshops (Murphy and Poblome 2012). These examples appear more 'stylish' whilst offering a typologically restricted range likely designated for particular applications. The important factor here is not that Jarash

pottery and glass sherd-tools are cruder, but that they are not an isolated case in the urban Roman Near East and most probably beyond.

11. www.academia.edu/582335/Jarash_Hinterland_Survey_2005_and_2008 and www.academia.edu/2482276/Jarash_Hinterland_Survey_2010_Season. Project directors: F. Baker (Firat Archaeological Services, UK) and D. Kennedy (University of Western Australia, Perth); archaeological finds analysis: I. Kehrberg. A full report on the 2005 - 2010 finds, including sherd-tools, will appear in the final JHS publication.



8. Glass-herd tools made from Late Roman-Early Byzantine, Byzantine and / or Umayyad glass sherds found along transects with pottery sherds.



9. Pottery sherd-tools made from Hellenistic, Roman, Byzantine, Islamic and prehistoric vessels found along transects with glass and other pottery fragments.

were very similar to those excavated inside the walled city. In fact, one deals with the same urban historical periods and contexts, including prehistoric occupancies. However, as with all surface finds, there remains the uncertainty of context associations. In this case, as in most proto-historical and historical areas (often marked by nearby ruins or urban outliers), one has to rely on quantitative sherd counts and statistical analysis to obtain an estimate of the main periods of occupancy represented along the transects.

The small selection of JHS sherd-tools are sufficient to illustrate the very similar range of types of pottery (wares) and glass tools already seen at the hippodrome. In addition, there are tools made on prehistoric sherds, but unless the transect collection is exclusively prehistoric one cannot establish when the latter tools were made. Their use could be contemporary with the ware itself or they were recycled at a later time, possibly indicated by other artifacts from the same cluster. Either interpretation is crucial for the identification of the surface site or transect. Nor can we say that a surface scatter necessarily reflects stratification in the ground (more on this in the conclusion). However, one is struck here again with the expediency shown in the choice of wares, tool types and their function, usually indicated by the worn sides of the tools. There have been some sites or transects whose finds of pottery wasters and slag clearly evidence industrial activities nearby, in this case the making of Early Islamic tiles and the common hand-made grey ware vessels. Sherd-tools found there can almost certainly be linked with the production of a kiln or kilns, but the assertion is based on reasonable assumption and is not ascertained by stratified context (Kehrberg forthcoming a).

The JHS survey serves as a reminder that ancient Jarash – a provincial but sophisticated urban centre – was actually (and until quite

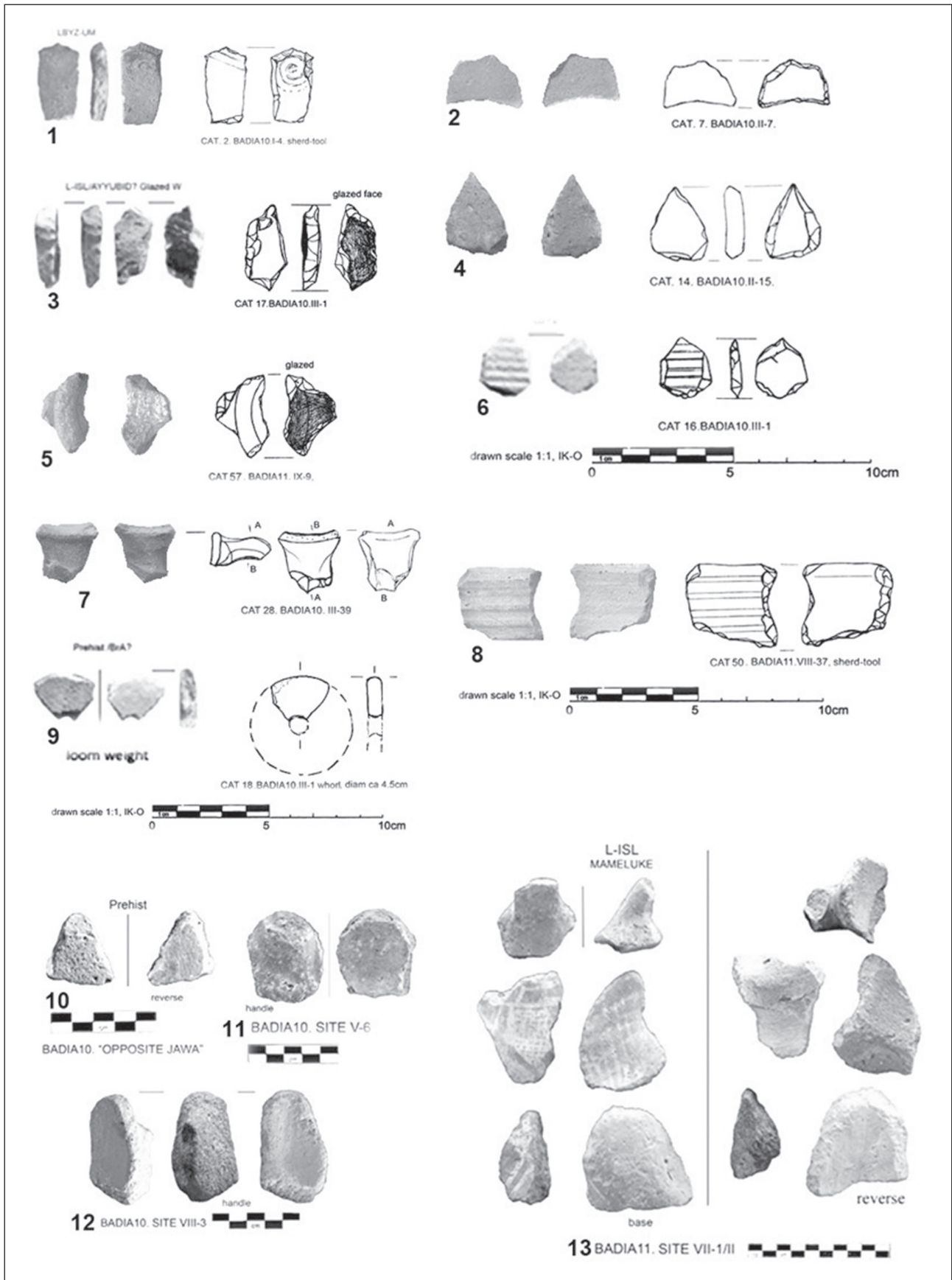
recently) a mixture of township and agrarian and transient pastoral occupancies. We can still witness the same pattern of ‘civic behaviour’ in ‘Ammān today where, in newer and rather affluent suburbs, impressive mansions may dictate the panorama, but looking closely one can see that vacant fields abutting these edifices are ploughed or used for herding, and occasionally occupied by bedouin tents, which in most cases accommodate the owners of the land. More recently, in pace with growing urbanisation, gypsies have pitched their tents next to building sites eking out an existence on the back of the building industry as well as grazing their small flocks.

Northern Badiya Survey 2010-2011¹² (FIGS. 10-11)

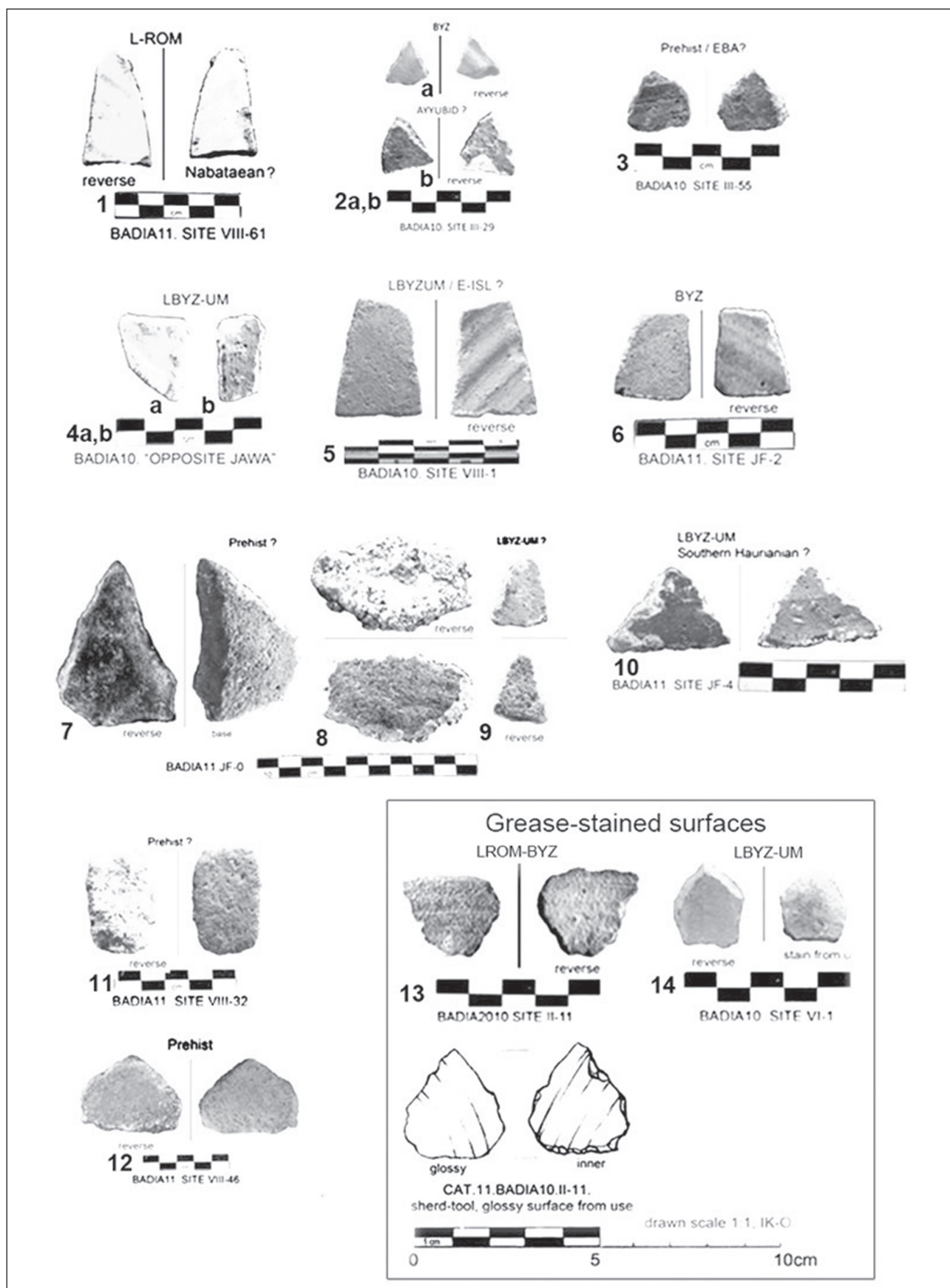
The Northern Badiya Survey of 2010-2011 presents an entirely different landscape setting in the northern desert of Jordan. When scanning the group of sherd-tools shown in PLS 10 and 11, one is immediately struck by the small size and limited range of ‘tool types’, as well as of wares and / or cultural periods represented. It has to be said that the pottery sherds were generally small and the sum total of the pottery surface collections was miniscule in comparison to the JHS survey, which is not surprising as one is looking at a totally different physical environment. While Jarash and its hinterland represent an area dominated by millennia of built and cultivated environments, the area covered by the northern desert survey is predominantly a natural habitat, or one that is at any rate not the urban or suburban outskirts of settlements so typical of Jarash hinterland occupancies. Apart from their small individual size, the relatively limited pottery corpus represents a haphazard assortment of wares and forms (Kehrberg forthcoming b). Coarse wares (e.g. FIGS. 10.10-13; 11.3, 7-8, 11) dominate, possibly partly due to their early and very late

12. www.dainst.org/en/project/badia-jordan?ft=all. Jawa's Hinterland: the Northern Badiya in the 5th to 3rd millennia BC (Jordan), DAI Project: director: B. Müller-Neuhof (DFG); pottery study:

I. Kehrberg; a complete account will appear with the project's publication.



10. Pottery sherd-tools made from Hellenistic, Roman, Byzantine, Islamic and prehistoric vessels found along transects with glass and other pottery fragments.



11. Pottery sherd-tools made from Hellenistic, Roman, Byzantine, Islamic and prehistoric vessels found along transects with glass and other pottery fragments; tools with residual fungoid growth and grease stains on surface.

periods of origin¹³ but also because they do not represent stationary urban or rural occupancies and the accompanying accumulations and productions usually associated with finer wares. Being entirely reliant on the random and small range of sherd scatters found at a ‘site’, the makers and users (most likely being one and the same) of the badiya sherd-tools had little to choose from for specialised tools. In view of the accumulation of predominantly lithic material on the ground, it is most probable that the range of employment and need for sherd-tools was limited, and possibly individual and spontaneous.

Although it is difficult to associate the badiya sherd-tools with a particular group of occupiers along a given transect, it is noteworthy that the tools again emerge consistently within a variety of occupancies at the sites. This signifies that sherd-tools are not exclusive to urban industrial activities such as kilns and tanneries, and for cultivation as evidenced at Jarash. At the upper Zeus temple complex, for instance, domestic or makeshift dwellings dating to later Antiquity and modern times were found which can also be linked with the making and use of sherd-tools, either in the kitchen or for some ‘cottage industries’. The latter includes the distinctive Late Islamic hand-made Mamluk pottery made by households, and not in the industrialised workshops known from the late Hellenistic to early Islamic periods. The badiya tools include some Mamluk-ware sherd-tools (FIG. 10.13), which clearly dates their earliest possible manufacture and secondary employment.

The final examples in FIG. 11 are of particular interest and appear rather unique. These sherd-tools have one feature in common: they all show a variety of fungal growth on used sides of the tools and two sherd-tools show grease stains on their surfaces from frequent handling (FIG. 11.13-14). It is interesting to note that none of the Jarash sherd-tools have this secondary feature, which is directly related to their use.

One reason is that the excavated tools have been buried deep underground with other pottery or in lime. Unlike the badiya tools, they had not been exposed to sunlight or rain, thereby inhibiting any subsequent organic growth on the accumulated residue adhering to the worked or used surfaces. The other question relates to the nature of employment for these particular tools and therefore the kind of residue left behind on the used surfaces: were the badiya sherd-tools used for food preparation or were they in frequent contact with other organic material, such as skins or woody plants? It is worth examining the fungoid growths; an analysis would not only identify that growth, but also the residue itself, which in turn (and most importantly) would identify the intended use of the sherd-tools. It also confirms, virtually by default, that the majority of the Jarash tools were used in industries such as ceramic production, leaving little or no organic residue on the tools. The lime in the tanning process would have killed any residue and thus fungal growth, and glass itself is not as prone to absorption or adhesion as tempered and porous clay.

Concluding Remarks

I would like to end by highlighting some aspects of this concise update on sherd-tools which, in my opinion, provide their most important contribution to archaeology.

As demonstrated, sherds-tools are often made from diagnostic pottery or glass sherds and/or specific wares or fabrics. If the secondary use of a sherd as a tool (the recycled state) is not recognized, these sherds (wares) may be and often are used to date or to support a date of a locus, level, transect, deposit or context. But it is the making of a sherd into a tool and its employment, i.e. its secondary function, which should date the ‘pottery artefact’ in that particular context or assemblage. The sherd-tool might be contemporary with its fabric, e.g. a Late Roman sherd (ware) could have been

13. These types of pottery may evidence early as well as late seasonal use or traversing of the landscape.

retouched by a Late Roman potter or tanner, or used in a household of the Late Roman period, but it could also have been made later, for instance by an Early Byzantine potter recycling a Late Roman sherd. The latter can be slightly problematic because Late Roman and Early Byzantine pottery types are very similar and often overlap within the space of a century, making it all the more important to be able to discern a recycled sherd. A similar problem of dating occurs with chronologically less defined (e.g. large storage jars) and hand-made wares. If not recognized as sherd-tools, either case may lead to the life-span of a pottery type being extended owing to the sherd (-tool)'s presence in a later context. Wider chronological gaps, e.g. between Roman and Late Byzantine (second and sixth century AD) or Late Roman and Umayyad (third and eighth century AD) pottery, do not affect analysis of a deposit, as most of these supposedly odd sherds (sherd-tools) will be regarded as anomalies and intrusive, leading to the deposit being interpreted as 'contaminated' (owing to rodent holes, erosion, baulk collapse, earthquake tumble etc.).

The problem escalates from being interesting to being acute when dealing with a group or cluster of sherd-tools within one context and when they are not recognized as tools, i.e. not being identified as intentionally 'intrusive' or recycled sherds. One or two sherds (sherd-tools) that do not match the typological-cum-chronological classification of an assemblage from a single deposit may be explained away as being intrusive as already mentioned. But the occurrence(s) of several sherds (sherd-tools) in one deposit and / or their repeated occurrence will probably be seen as part of, and therefore contemporary with, the deposit which indeed they are, but significantly only in their recycled state and not in their original ware-cum-type status. These pottery or glass sherd 'types' on which the tools were made may either be reclassified chronologically, according to the rest of the deposit, or the dating of the deposit

can be influenced by the ware or type of these unrecognized sherd-tools.

The use of sherd-tools from surveyed areas is either impossible or difficult to determine in chronological terms, apart from at the earliest possibly being contemporary with the ware. In addition, they may not all have been made in the location where the sherds were collected, but may instead have been brought to the find spot and left there, adding to the pre-existing sherd scatter. Nomads may keep worked sherds: although quickly manufactured and replaceable, pottery and / or glass sherds are not abundant in non-urban or rural / desert environments such as the badiya. Stone tools may be easily available in desert regions, but sherd-tools might have been the preferred object for some specific applications in the treatment of skins, weaving, making pottery by hand or food preparation.

Pottery sherd-tools have been used by households since prehistory and occur amongst utensils in industrial installations from early historical times onwards. The fact that they also occur in surveyed areas throughout Jordan (Kehrberg 2009b) undoubtedly links them with non-permanent, herding or semi-nomadic occupancies. The badiya survey also shows that their numbers increase with time. The predominantly later Islamic-period pottery scatters tend to have higher sherd-tool frequencies, which include worked contemporary pottery.

To conclude, for as long as the dating of a deposit or context relies on supporting evidence from single representatives of ceramic or glass chronological-cum-cultural types and this evidence is in turn used to date the same type(s) found elsewhere, one should pay greater attention to sherds which appear to be somewhat 'out-of-place' before reclassifying or revising their date, or that of the deposit, or defining them as intrusive or contaminants. The risk of shifting *in situ* historical boundaries by referring to misdated contexts or deposits are obvious.

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