

BYZANTINE AND UmayyAD GLASS FROM JERASH: BATTLESHIP CURVES¹

by
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Glass and battleships — perhaps it would be useful to clarify at the outset what the paper does and does not cover. It is not a description of the Jerash glass corpus, which is too large to deal with here and which is described elsewhere (Meyer 1987). The corpus actually includes Roman through Mamluk and later periods, though the Byzantine and Umayyad glass constitutes by far the bulk of the material and the base for the present study. Rather, this paper is a presentation of a quantitative analysis of a glass corpus. As such it has to be based on a usable typology and on an adequate statistical sample. To this end a brief discussion of both the sample and the typology will be given.

Although this is not a theoretical paper it does ask a question, try to determine what data will answer it, call in those data, and try to evaluate how well they answer the question. The problem in hand, then, is: "Does the distribution of glass types (e.g., Stemmed Goblets) at Jerash, over time (i.e., from Byzantine through Umayyad periods) fit into the 'battleship curve' pattern anticipated for the life history of given types? If not, why not?" The paper may be considered an application of a model.

Battleship curves and other kinds of frequency distributions have not until very recently been commonly used in Near Eastern archaeology. First of all they require a good quantitative base. Given the sheer volume of artifacts produced by most Near Eastern sites, a quantitative reckoning was scarcely thinkable, much less feasible until computers became generally available (though this study required only a pocket calculator). Binford and Binford (1966) did use polygons in their study of Mousterian tools; the polygons,

however, do not represent tool types but "factors", clusters of tool types that had been factored out by multi-variate analysis. Hole and Flannery (1967) used "frequency polygons" to describe the life span of certain pottery or tool types at the Deh Luran sites, a use much closer to the one attempted here.

Battleship curves seem to be used mainly in American archaeology, and one of the earliest discussions of them *per se* is by Deetz and Dethlefsen (1965 and 1966). They analyze the carvings on New England gravestones and their distribution in time and space. They refer to the Doppler Effect and to Phillips, Ford, and Griffin's attempt to seriate Mississippi Valley pottery. From these few examples alone it is clear that battleship curves can be used in several ways. Here we are restricted to one site for lack of comparative material.

Having stated the question, a rather simple one, the evidence used in answering it may be presented: where the glass came from and what the corpus consists of.

It does not incorporate all the glass from Jerash but only that excavated by the American (ACOR) team between May 1982 and December 1983. These excavations included the lower *cavea* and *scaenae frons* of the North Theater, a Roman construction, the Byzantine Church of Bishop Isaiah, and some smaller soundings. Jerash, one of the Decapolis cities, covered about 210 acres (85 ha) at its height, plus some buildings and settlement outside the walls. The site is split by a tiny but permanent stream, and the archaeological zone today includes only the western half. Of the three theaters at Jerash, the small Festival Theater without the walls and the South Theater were cleared in the 1920s and 1930s. The North Theater was

1. The present paper is a revision of one delivered at the ASOR meetings in Chicago, Illinois in December 1984.

built about A.D. 165/6 as an odeon and enlarged to make a full-sized theater about A.D. 230. Little Roman glass was recovered from it, however; the theater was apparently kept too clean. After it went out of use as such, parts of it were reused in the Byzantine period, and some Early Byzantine (A.D. 325-491) and Late Byzantine (491-636) glass was recovered from construction inside the stage. The access passage to the west side of the theater yielded a little Roman and a great deal of Early Byzantine glass. A thick layer of tumbled blocks and nearly sterile silt, probably earthquake damage, filled in the lower part of the theater, but on top of that lay thick Late Byzantine/Umayyad (ca. A.D. 630-670) deposits. At this time the internal passages and *vomitoria* were reoccupied and a series of pottery kilns was built in and around the theater. A large amount of glass was recovered from these layers. The Church of Bishop Isaiah was built under Justinian the Great (mid 6th cent.) but continued in use until the middle of the 8th century, after the Islamic Conquest. Most of the glass from the church is actually Umayyad (A.D. 667-747 or later), dating from the final use of the church, not the time of its construction (contra Baur 1938:518). After the earthquake of 746/7, occupation and hence artifacts such as glass became much more sporadic.

Although it was not possible to screen more than a few loci, all glass recovered was saved, labelled, cleaned, tabulated, and selected pieces (about 300) were drawn. All the glass was given two dates, locus (findspot) date and stylistic date if any. The dating of the loci is based on pottery, lamps, coins, stratigraphy, and construction history of the buildings. For descriptive purposes most of the glass was grouped by locus date; in any case comparative material on which to base stylistic dates is, after the Roman period, quite sparse. Most of the Jerash Byzantine and Umayyad glass is light blue or blue-green with a silvery or creamy patination. The window glass, however, often has a black, flaky surface like paper ash, a phenomenon also noted at Sardis (Hanfmann

1959). Some clear green, yellowish, dark blue, and a few other colours or combinations were found but were not numerous. All of the glass discussed here is blown or mold-blown.

Relatively few complete forms were recovered. Four vessels — a lamp, a shallow bowl, and two goblets — were complete from rim to base and a few more forms were reconstructable on paper. None of the glass except some from the Church of Bishop Isaiah was in primary context. On the other hand, most of the glass probably was not deposited far from its point of use and breakage, i.e. most of it was probably tossed down from the dwellings above, either within the North Theater or uphill, or possibly even from repairs or reconstruction on the Church of Bishop Isaiah. Furthermore, the glass almost certainly represents domestic (or church) debris, not grave goods. Many, if not the majority, of the published, intact glass vessels of the 4th to 8th centuries from the Near East have no good provenience but were probably looted from tombs. In particular such collections include large numbers of perfume flasks and kohl jars, types poorly represented in this Jerash corpus. It is possible that most of the Byzantine and Umayyad glass without archaeological context published to date is not an accurate representation of the varieties of glass in use in daily life.

On the basis of the drawn pieces of Jerash glass, a typology of vessels, diagnostic fragments, and decorative techniques was established. Each type was identified by the shortest possible label, e.g., “Marvered”, “Looped-out Rim”, or “Tumbler Lamp”. A number and letter typology such as III A 3 was felt to be harder to associate with a given form such as “Looped-in Rim” and also too rigid. The minute a new shape is found the whole typology might well have to be changed.

Once a working typology was established the various diagnostic sherds could be tallied by period, e.g., how many Ground-Rim Vessels or how many Tumbler Lamps in which period. Then the percentages were calculated for a given

type within a certain period. Comparing the raw counts would be inaccurate because the number of diagnostic sherds for each of the periods varies considerably. The counts and percentages are shown on Tables 1 and 2. Table 1 lists identifiable forms (Hollow-Stem Lamps for instance), pieces almost certainly from identifiable forms (Goblet Stems), and very distinctive rims or bases (Looped Rim and Base). Table 2 lists rims, handles, bases, and decorated sherds that cannot be confidently identified as broken from a certain type of vessel.

Figs. 1 and 2 display the percentages for visual comparison. What we are looking for is a pattern. With a battleship curve we expect a few early pieces, predecessors, trial pieces; then we should see a rapid growth in popularity until the type becomes standard or characteristic of its period. Finally a given type should tail off into obsolescence, heirlooms, and redeposited fragments. The tail should be longer than the head, a skewed curve if graphed differently or a "battleship" if presented as it is here.

Note that the Late Byzantine/Umayyad bars are slashed rather than solid. This is because the changeover from Byzantine to Muslim rulers at Jerash was exceptionally difficult to detect from potsherds and the usual archaeological debris. It was therefore necessary to leave an overlap period, ca. A.D. 630-670, that includes the tag end of the Late Byzantine and the first part of the Umayyad period.

All of the major types are illustrated at the top of the figures. Forms that were too uncommon to be useful for statistical comparisons were lumped with "Other Vessels," "Other Rims," etc. This includes unguentaria and kohl jars, two of the forms best reported in the literature. Of the identifiable forms, shown on Fig. 1, we can see that the various beakers and Ground-Rim Vessels taper out about the time the Stemmed Goblets become popular. The Bulging Rims are similar to the Ground-Rim Vessels but it is not clear from the sherds, many of which have thick decomposition layers, whether the rims were

ground or fire-polished. The Stemmed Goblets seem to replace the earlier beakers and cups, and furthermore the Looped-Foot variety seems to be a little earlier than the Flat-Foot kind. The nearly ubiquitous goblets, then, might have potential as a chronological indicator. The delicate Bent, Looped-Rim Vessels and the distinctive dishes with both the rim and the base ring formed by folding the whole wall of the vessel out, down, and back up again at the base seem characteristic of the Byzantine period. A variety of more or less tall, thin bottles begin in the Late Byzantine period but become more frequent in the Late Byzantine/Umayyad and especially Umayyad times. Short-necked, wide-mouthed jars, however, do not become even moderately abundant until the Umayyad period.

The lamps are especially interesting. The first kind represented here is the Hollow-Stem Lamp that had to sit in a special holder. A little later the Tumbler Lamps that could sit on their own bases or be suspended by their three handles appear. Both of these are widespread types but the third one, Beaded-Stem Lamps, is so far known primarily at Jerash and mainly from the Umayyad period or later. A few similar lamps are reported from Mt. Nebo and Dibon; elsewhere they are rare. Thus all three kinds of lamps seem to have potential as chronological indicators at Jerash, and the Beaded-Stem Lamps could provide a clue as to a regional specialty.

There are more problems with Fig. 2 which shows parts of vessels. The Looped-Out Rims were originally tallied with Fig. 1 because they could be lamp rims but in the end they were placed on Fig. 2 because this is such a common means of finishing a rim. Judging from their erratic distribution curves the rims, as presently defined, are not good chronological indicators. This may however be a technical problem; there are relatively few ways to finish a rim on a blown vessel. The handles, except for the odd Bracket Handles, are not much more helpful, though most of the Blob Handles probably broke off Tumbler Lamps. Of the bases, only the thick Pad Bases and the

TABLE 1
 JERASH GLASS, COUNTS AND PERCENTAGES BY PERIOD

	EByz	LByz	LByz/Um	Um	Post-Um	Indet.
Beaker	4 4.9%	-	2 1.0%	-	-	-
Beaker Base	14 17.3	1 2.1	-	1 1.5	1 .6	-
Looped Base	11 13.6	-	5 2.6	-	3 1.9	-
Cylindrical Beaker w/ Flaring Rim	14 17.3	5 10.6	1 .5	1 1.5	-	-
Ground-Rim Vessel	13 16.0	5 10.6	2 1.0	-	1 .6	1
Bulging Rim	3 3.7	3 6.4	-	-	-	1
Stemmed Goblet, Looped Foot	-	8 17.0	59 30.4	5 7.5	31 19.1	-
Stemmed Goblet, Flat Foot	-	-	13 6.7	12 17.9	12 7.4	-
Goblet Stem	1? 1.2	4 8.5	11 5.7	5 7.5	27 16.7	-
Goblet Bowl	-	-	6 3.1	2 3.0	7 4.3	-
Bent, Looped-Rim Bowl	5 6.2	-	-	-	-	-
Dish w/ Looped, Rim and Base	3 3.7	-	-	-	-	-
Very Broad Base	2 2.5	1 2.1	-	-	-	-
Bottle w/ Flaring Mouth and Rolled- In Rim	-	3 6.4	8 4.1	11 16.4	6 3.7	-
Bottle Neck	2 2.5	1 2.1	16 8.2	1 1.5	7 4.3	1
Bottle Neck w/ Threads	-	3 6.4	7 3.6	1 1.5	4 2.5	-
Bottle w/ Straight Mouth	-	-	3 1.5	2 3.0	5 3.1	-
Bottle w/ Straight Mouth, Threads	-	2 4.3	8 4.1	3 4.5	5 3.1	-
Bottle Bottom	-	-	-	2 3.0	-	-
Rolled-In Rim (Bottle?)	1 1.2	-	18 9.3	1 1.5	19 11.7	-
Jars	-	-	1 .5	3 4.5	3 1.9	-
Other Vessels	4 4.9	6 12.8	8 4.1	1 1.5	2 1.2	-
Hollow-Stem Lamp	3? 3.7	1 2.1	11 5.7	1 1.5	10 6.2	1
Lamp w/ Solid, Beaded Stem	-	-	6 3.1	7 10.4	11 6.8	-
Tumbler Lamp	-	3 6.4	2 1.0	5 7.5	3 1.9	-
Looped-Out Rim and Handle	1? 1.2	1 2.1	7 3.6	3 4.5	5 3.1	-
TOTAL	81	47	194	67	162	

TABLE 2
JERASH GLASS, COUNTS AND PERCENTAGES BY PERIOD

	EByz	LByz	LByz/Um	Um	Post-Um	Indet.
Looped-In Rim	5 4.6%	3 2.0%	1 .4%	2 1.7%	-	-
Looped-Out Rim	14 12.8	25 17.0	27 10.3	20 16.7	18 7.9	-
Simple, Flaring Rim	2 1.8	4 2.7	5 1.9	4 3.3	4 1.8	-
Simple Rim	4 3.7	19 12.9	40 15.3	5 4.2	16 7.0	-
Thickened Rim	6 5.5	41 27.9	56 21.3	30 25.0	30 13.2	-
Thickened, Flaring Rim	3 2.8	-	3 1.1	-	4 1.8	-
Incurved Rim	2 1.8	-	1 .4	5 4.2	-	-
Other Rim	10 9.2	11 7.5	10 3.8	9 7.5	17 7.5	-
Bracket Handle	2 1.8	-	-	-	-	-
Blob Handle (all sizes)	-	9 6.1	19 7.3	10 8.3	35 15.4	-
Other Handle	2? 1.8	2 1.4	7 2.7	4 3.3	10 4.4	-
Waist	-	-	1 .4	-	3 1.3	1
Pad Base	18 16.5	-	-	-	2 .9	-
Ring Base	6 5.5	4 2.7	1 .4	1 .8	-	-
High, Looped Pedestal Base	3? 2.8	3 2.0	8 3.1	1 .8	4 1.8	2
Kick-Up Base	6 5.5	12 8.2	43 16.3	14 11.7	24 10.6	1
Other Base	18 16.5	6 4.1	17 6.5	7 5.8	13 5.7	1
Looped Ridge Decoration	3 2.8	2? 1.4	1? .4	-	-	-
Trailed Coil	2 1.8	-	3 1.1	-	2 .9	-
Ruffle	-	1? .7	7 2.7	3 2.5	8 3.5	-
Trailed Thread	-	2 1.4	8 3.1	-	8 3.5	-
Nipped	-	-	2 .8	-	3 1.3	-
Marvered	-	-	1? .4	1 .8	1 .4	-
Molded	-	-	1? .4	3 2.5	10 4.4	-
Prunt	-	2 1.4	-	-	-	-
Non-Vessel (except tesserae)	<u>3</u> 2.8	<u>1</u> .7	-	<u>1</u> .8	<u>15</u> 6.6	-
TOTAL	109	147	262	120	227	

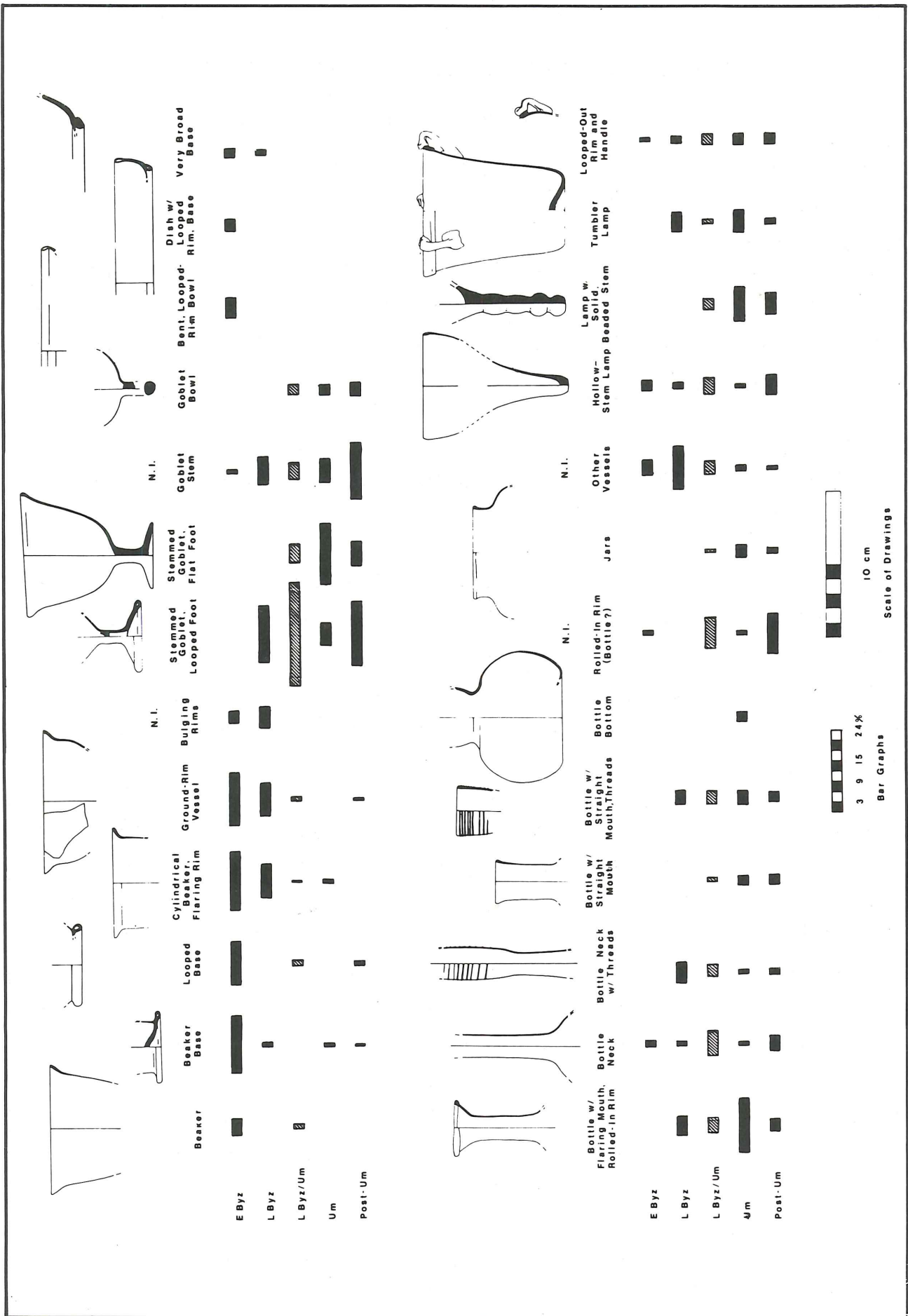


Fig. 1. Byzantine and Umayyad glass from Jerash, whole and identifiable forms.

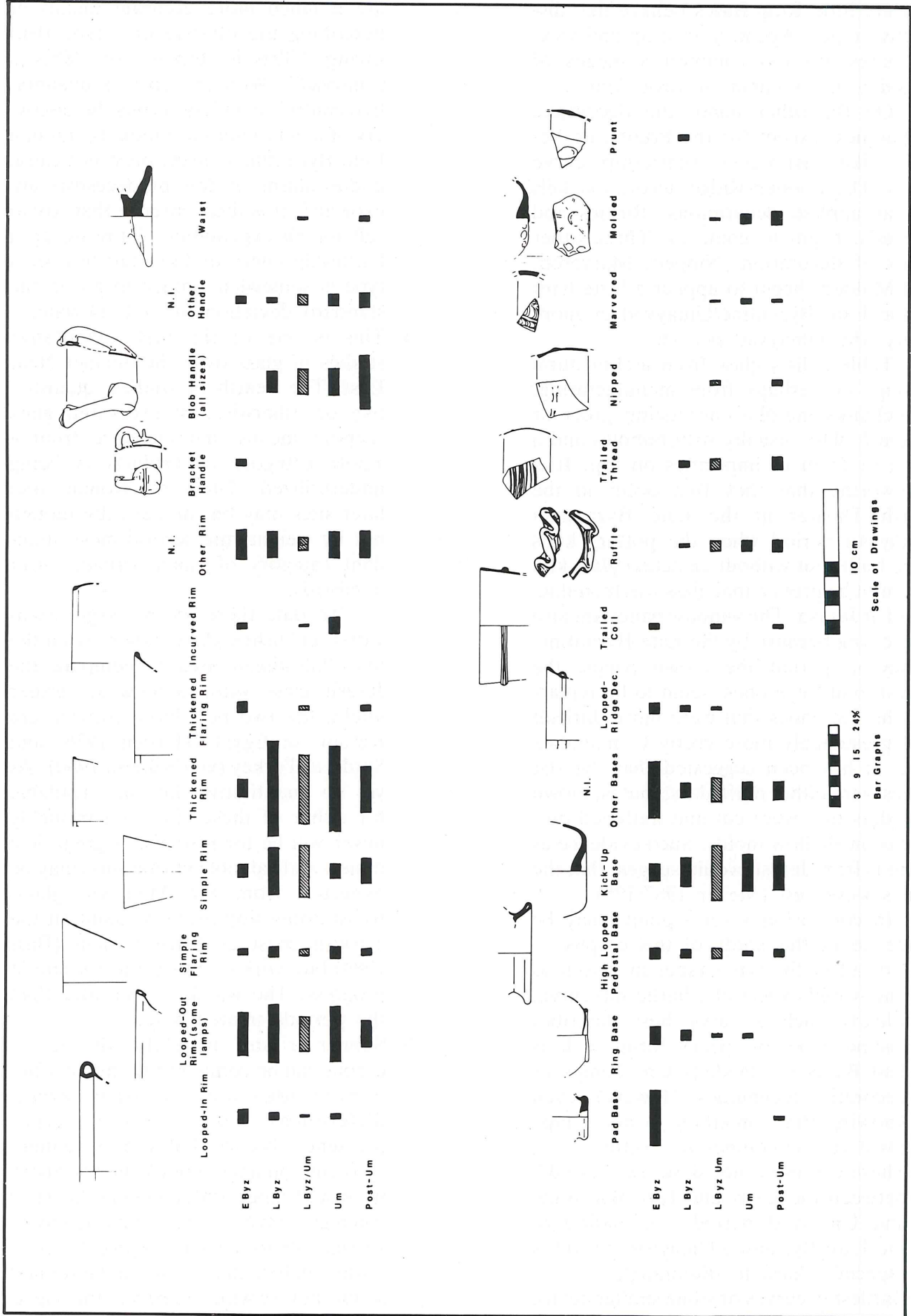


Fig. 2. Byzantine and Umayyad glass from Jerash, diagnostic sherds.

delicate little Ring Bases behave like distinctive types. Again, looped-up and kick-up bases are too common a means of finishing any number of vessel types.

On the other hand, the decorative techniques, except for the Prunts, do behave like distinctive, battleship curve types. The Looped-Ridge decoration tails out as applied decorations, Ruffles and Threads, begin to come in. Three other kinds of decoration, Nipped, Marvered, and Molded, begin to appear a little later in the Late Byzantine/Umayyad or more likely, the Umayyad period.

Table 3 lists glass from architectural settings or perhaps from manufacturing. The chunks and blobs are mainly green or greenish glass, usually with bubbles and a scum or forth of impurities on top. It is noteworthy that they first occur in the North Theater in the Late Byzantine/Umayyad period when the pottery kilns were built, but without an actual glass kiln it cannot be proven that glass was manufactured at Jerash. The window panes are also interesting because by the Late Byzantine/Umayyad period the crown panes, the round, bull's eye ones, seem to be replacing the flat panes that were more difficult and presumably more costly to manufacture. It has been suggested that the flat panes were either muff glass, that is, blown cylinders that were cut and flattened out, or cast in shallow molds. Such evidence as there is from Jerash would suggest that the panes were cast (Meyer 1987:195).

In conclusion several points may be made about this study of this corpus.

1. Not all of the types taper in or out as one would expect of a battleship curve. Clearly such a curve best describes distinct types or special forms such as Pad Bases or Beaded-Stem Lamps or decorative techniques. However, even knowing that something is not a type fossil can sometimes be useful.
2. These curves do not show any "break" between the Early and Late Byzantine and Umayyad periods. As indicated, the Late Byzantine/Umayyad period is especially hard to disentangle.
3. Battleship curves or some similar device

are a much more accurate means of describing the lifespan of a type than saying. "This is Roman" or "This is Umayyad". With any sort of quantitative control of a glass corpus the discovery of a very Umayyad-looking rim in a Late Byzantine context need not cause undue alarm. A few predecessors are expected; it is their absence that would call for an explanation. Drawing up a battleship curve or like statistics for a type is somewhat similar to giving the standard deviation for a C-14 date.

4. This is one of the first quantitative studies of glass from the ancient Near East. The dearth of studies, quantitative or otherwise, of excavated glass corpora means that evidence from a whole category of artifacts is being underutilized. Glass on Roman and later sites may be, numerically though not by weight, the second most abundant category of small artifacts after potsherds.

To date there are no large, excavated, published glass corpora from the Syro-Palestinian area to compare the Jerash glass with. Somewhat farther afield, the two best large corpora are Karanis in Egypt (Harden 1936) and Sardis in Turkey (von Saldern 1980). As yet no quantitative data are available for either of these sites and probably never will be for Karanis. A great deal of new and valuable information may be expected from the Medieval glass-transporting ship recently found off the Turkish coast at Serçe Limani (Bass 1984) but work on this project is still in progress. The wreck is also later than the periods treated here.

5. Sooner or later, hopefully, this Jerash corpus can be compared to the distributions at other sites. We would expect differences, not merely in types (presence/absence) but also in frequency (common/uncommon). Furthermore we would expect differences in the dates when given types were common in Syria versus Italy for instance. It may be quite a while before the dating can be refined so far, but we would expect a time lag as

Table 3: Jerash glass window panes, chunks, and tesserae

	<i>EByz</i>	<i>LByz</i>	<i>LByz/Um</i>	<i>Um</i>	<i>Post-Um</i>
Flat Panes	11 (+ 1 Roman?)	1(?)	1(?)	1(?)	4(?)
Crown Panes	2(?) (1 plate?, 1 v. thin)	8(?)	47	69	18
Unid. Panes ¹	273	2	14	41	12
Chunks and Blobs	—	—	19	79	97
Tesserae ²	3	8	96	11	40

¹Virtually all the EByz window glass, 281 pieces out of 286, came from JNT-A-XIV, the access corridor to the North Theatre, downslope from the Church of Bishop Isaiah. Of the "Unid. EByz" panes most are flat but could come from the flatter part of a crown pane or, more likely, from a flat pane. No window glass was recovered from Test Trenches A I and A II.

²No glass tesserae or chunks were recovered from JNT-A-XIV, and almost all the tesserae from the church were stone.

a style or type is carried from one province to another. Battleship curves, as most neatly expressed by Deetz and Dethlefsen, are one promising means of approaching the problem.

Clearly numerous problems remain. Nonetheless, it seems useful to present one analysis of one corpus as

thoroughly as its intrinsic limitations permit and to suggest some of the potential of such studies.

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