

GLASS IN LATE ANTIQUITY IN THE NEAR EAST

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Abstract

This paper seeks to explore some of the possible connections between three late antique strands of glass technology and application in the Near East: windows, lighting, and finally, recycling. Glass has long been acknowledged to have influenced two major innovations in the use of internal space within the Roman world: firstly, during the Principate, when window-panes were first applied to bath-houses to maintain humidity and temperatures, whilst casting light into dark interiors, and secondly, in the 4th c. A.D., when oil-lights made of glass were finally adopted as an effective medium for ceiling-lighting.

Windows in Late Antiquity

When the archaeological evidence for the widespread application of glass panes in the early Empire is examined closely, ‘innovation’ becomes less apparent. Ward-Perkins used the unusual frames of the *Casa dell’Atrio a Mosaico* as an example of the ability of glass windows to highlight external views in architectural design, as well as change the way in which urban houses were designed so that window glass became common as a street-front device during the 1st c. A.D.¹ Other than in bathing-wings, however, there is as yet no overwhelming evidence that window-panes were widely used at Pompeii, Herculaneum, or at Ostia. Their earliest use in bath-houses seems to support this idea, as indicated by the comments of Seneca and Pliny the Younger; neither were they used to ‘open up’ street façades, nor were they normally used for external domestic windows. Examples of the sporadic use of glass by the Early Flavian period beyond bathrooms—as in the tiny window of the lunette in Room 5 of ‘House I.8.14’—are simply occasional exceptions.²

The fundamental problem in demonstrating this point is that much of it depends on an argument from silence, however. Since windowglass falls between ‘architectural fittings’ and glass typologies, it has been under-represented in modern archaeological publications. For example, a recent detailed discussion of the *Casa dell’Atrio a Mosaico*, describing construction technique, decoration and all available citations of artefacts, left out the remarkable set of rectangular glass panes supposedly set into a wooden frame down the eastern passage of the main courtyard, because they were not listed in Scatozza-Horlich’s masterful catalogue of Herculaneum glass—which dealt only with vessels.³

We can, nevertheless, dismiss the idea that the absence of window glass from thoroughly recorded sites could be due to ancient recycling, or the vagaries of artefact survival. As anyone who has broken a modern window knows, glass window shards are difficult to remove entirely. In Antiquity, when we know anything of window glass, it was fixed somehow into the window aperture. Boersma’s thorough survey of surviving architectural material at Ostia, including well-preserved walls, marble revetments, and stucco, did not mention one fragment either of a window pane, or of surviving plasterwork around window frames.⁴ This particular case is surely not one of omission, but of ‘real’ absence. One can be less certain of the lack of references to window glass from sites such as Zeugma on the Euphrates: this site was destroyed in the mid-3rd c. by the Parthians and so unlikely to have retained any architectural features in its collapsed and destroyed houses.⁵ Yet, the use of window-panes at the extremely well-studied site of late antique Ostia seems restricted to bath-houses. Most urban or rural Roman-period sites have suffered from processes of abandonment, re-building and subsequent ploughing, or levelling, which has resulted in a dispersion of artefacts. This also means that, where window-glass is recorded on these sites, it is difficult to determine exactly which rooms it came from.

¹ Ward-Perkins (1981) 187, 193.

² Berry (1997) 191.

³ De Kind (1998) 131–38.

⁴ Boersma *et al.* (1985).

⁵ Kennedy *et al.* (1998) 129–38.

Because villas, as well as military camps, tended to have bath buildings or bathing-wings, the simple ‘presence’ on these sites of window glass still cannot be taken to mean that glass windows were commonly used across the building complex.

The Evidence for Late Antiquity

In the Levant, there is surprisingly little published evidence for window panes in any Early Roman houses, regardless of whether domestic houses were built in stone or in a mixture of stone and mud-brick superstructure. The huge amount of debris from the city-dump southeast of Jerusalem, whose *terminus ante quem* is only nine years before the end of Pompeii and Herculaneum, and which must have included debris from the levelling of the city, has not yielded any identifiable window-panes.⁶ Material from Early Roman houses elsewhere is lacking—and again, there is no word of any from Masada, although the final report is still to come for the glass.

But, in the 4th c., a third type (and second form) of window pane was developed.⁷ The earliest technology created rectilinear panes by vertically cutting a blown, glass cylinder, which was then folded out flat into a rectilinear form; an alternative, pan-moulded technique, formerly thought to date to no earlier than the 3rd c., was probably also developed in the Early Roman period.⁸ In the Early Byzantine period, however, circular panes began to be produced in the eastern provinces. They were simply blown as a very shallow plate, sometimes with a folded edge to them for greater strength where they would be plastered into a wall.

Their appearance begs a few questions. Why produce circular panes in the first place, especially since they were more difficult to insert into a rectangular or square window than rectilinear panes? Why did they appear only in the 4th c. (or later, if Carol Meyer is correct),⁹ and why in a region that was probably *less* likely to be using window-panes than the western, or north-western provinces of the Roman empire?

Whether or not blowing a fl at dish was cheaper or quicker than a pan-moulded, or ‘muff’ blown, cylinder is not easily demonstrable. Those circular panes that I have catalogued seem, on average, probably lighter than the more uniformly thick rectangular panes, and their average size was probably the same (circular panes in the Levant tend to be diam. *ca.* 30 cm, compared with rectilinear panes from Sardis of 30–40 cm). The A.D. 301 *Price Edict* from Aphrodisias listed window glass at 8 *denarii* per pound, with ‘second quality’ window glass being two *denarii* per pound cheaper.¹⁰ Whether or not this list reflected a real set of prices used by glass-sellers, it is reasonable to assume that the comparative worth of the various types of glassware recorded within the *Price Edict* was fairly accurate. The same text gives us the prices of glass tableware as well. From this, it is clear that window glass was, depending on its ‘quality’, two-thirds to half the price per pound of ordinary glass tableware. As circular window-panes were made in exactly the same way as shallow bowls or dishes, it could be speculated that they would be closest in value to tableware in price and, therefore, that the circular panes were the more expensive quality mentioned in the *Edict*. Alternatively, however, heavier rectilinear panes might have been the more highly-priced category, if weight rather than production-time was the decisive factor.

⁶I am grateful to Dr Kay Prag for permission to publish the glass from Kenyon’s excavations in Jerusalem. For the city dumps, see also Reich and Shukron (2003) 12–16.

⁷Harden (1939) 91.

⁸Allen (2002) 102–11.

⁹Meyer (1989) 213–19.

¹⁰Barag (1987) 114.

The Levant was devastated by a series of major earthquakes in the 4th, 5th, 7th and 8th centuries, as well as two major invasions, by the Parthians and then the Arabs. In the cities of the Decapolis, we have a particularly good sequence of collapsed mud-brick superstructures which, although levelled for subsequent re-building, preserved at floor level a good assemblage of household artefacts and architectural material.

This can be studied along with re-deposited material from floor packing and rubbish dumps found elsewhere; this material provides some indication that Late Byzantine houses in Levantine towns seem to have had window panes more frequently than in earlier times. At Pella, this is supported by the presence of rectangular panes, in small amounts, from a house on Husn, which was built during the 5th or 6th centuries, without any bathing-rooms, and which was destroyed in the early to mid-7th c.; and also from a courtyard house, built originally in the Byzantine period, but destroyed in the mid-8th c. ('Pella North Building').¹¹ Circular panes are uncommon at Pella, only being used in some of the three churches there. Circular panes were, however, recorded from 4th–5th c. private houses on the 'Colonnaded Street' and from the élite 'House of Ganymede' at Samaria-Sebaste.¹²

That window-panes only became more widespread in Late Antiquity can, perhaps, be supported by the handful of published, excavated glass workshops from the region. The workshop from Jalame in the late 4th or early 5th centuries did not seem to produce window glass,¹³ but panes were produced at a workshop of a similar date in the forum at Samaria-Sebaste,¹⁴ and also one from Beth Shean from the Late Byzantine period (probably later 6th to early 7th centuries).¹⁵ Samaria-Sebaste produced mainly circular panes, but the later Beth Shean shop sold both round and rectangular ones. It overlaps in date with 'Shop E12' at Sardis in Asia Minor, which stocked large quantities of purely rectangular glass panes at the time of its destruction in A.D. 616.¹⁶

At Sardis, glass panes—which formed over 50% of the total mass of glassware on site¹⁷—were found within the area of the Bath-Complex and gymnasium/*palaestra*, as well as (mostly) within the street of colonnaded, two-storey Byzantine shops, which included 'Shop E12'. Such a disproportionate amount of window glass was explained by von Saldern in terms of the adjacent and grandiose synagogue, rather than the neighbouring bath-house, but it should be noted that the more recent publication of the synagogue is silent on the subject of glass windows in its detailed reconstruction of the synagogue's interior, its lighting and its fittings.¹⁸ The reconstruction of the upper façade of the line of shops which backed onto the synagogue and bath-house, however, had ample room for windows.

Further south, in the Levant, private urban houses seem to have used at most only small windows in Late Antiquity, whether freestanding or within an insula. The central courtyards in many urban Levantine houses probably normally supplied enough daylight. At Pella, for instance, there is scant evidence for large apertures in walls, and the survival of many walls to more than 1.5 m without any openings suggests that windows were indeed both high and small.

¹¹ I am grateful to Prof. J. B. Hennessy for permission to publish the glass from the University of Sydney's expedition to Pella, Jordan. For the dating of the Husn building, Watson (1993) 198–210.

¹² Crowfoot (1957) 419, 417.

¹³ Weinberg (1988).

¹⁴ Crowfoot (1957) 405.

¹⁵ Mazor and Bar-Nathan (1998) 27–28.

¹⁶ Hanfmann (1983) 164.

¹⁷ von Saldern (1980) 91.

¹⁸ Hanfmann (1983) 169.

At the northern end of the complex was an open *triclinium*, but it looked east, away from the ‘view’ enjoyed today by visitors, and to the outcrops above.²⁰ The use of circular panes—which, by their nature, could not be opened, as they were always set into plaster within a larger rectangular, or arched, aperture—perhaps also mitigated against the development in Late Antiquity of the hinged window. A window that could be opened went against the earliest use of glass panes in bath-houses, where they were used to keep in the humidity and help maintain stable internal temperatures, and this remained the case for late antique bath-houses, too, such as the 4th–5th c. *thermae* beneath the Early Islamic mosque at Jerash.²¹ But in private Levantine houses, cool breezes as well as ample light might have helped regulate internal temperatures. Allowing a view outside was, as has been said, not an issue here. Yet glass windows that could be opened did *not* develop in Late Antiquity, as far as the evidence shows, and circular, fixed panes continued in domestic use into the early 7th c. at Beth Shean, and rectilinear ones at Umayyad Pella.

So, if glass windows did not serve to open up an external view, or allow much of a breeze, then why did they spread in late antique domestic contexts? The use of glass panes in bath-houses kept in humidity—surely not something wished for in a Syro-Palestinian summer. What could have been the key to their gradual introduction into ordinary houses? I would suggest that this occurred for the same reason that private houses used glass oil-lamps in the 4th c.:²² the influence of church furnishings upon secular habits. The use of both circular and rectangular fixed panes in Levantine churches is almost too commonplace to discuss. The origin, in turn, of the ecclesiastical use of window-panes in basilicas from the 4th c. onwards probably leads back to that other major communal public building, the public bath-house, although it is possible that pre-Constantinian synagogues might have featured windows before basilical churches. For the purpose of this paper, however, it is the impact from the 4th c. onwards of ecclesiastical glass upon private homes that is at issue. Let us, therefore, briefly look at the most significant technological innovation of late antique architectural fittings: the hanging glass lamp.

Glass Lighting

The innovative melding of two previously extant technologies—oillighting and glass-blowing—to create the glass lamp had a major cultural impact upon late antique writers, starting with the famous *Catheme rinon V* of Prudentius in the late 4th c.:

With lights (*lychnoi*) sprinkled with rich oil or from dry rushes we feed them (fires), and we make rush-tapers (*scirpea*) too—smearing them with the flower-scented wax of the combs after the honey has been pressed from them.

However we feed it, the little flame grows: in a clay dish with oil and a linen wick or on pine knots dripping with pitch or on *hemp* that draws the warm wax up so that the flame can drink . . .²³

So with thy gifts, Father, do the atria shine with noble flames, and when the day is gone the emulous light simulates it.

The lamps hanging by swaying cords from all over the roof blaze brightly, and the flame fed by that in which it swims languidly shoots light through clear glass.

The place of our prayer is so brilliantly lit that one might think the stars of Heaven itself were burning there in the ceiling . . .

¹⁹ Kolb and Keller (2002) 279–93.

²⁰ Dussart (1997) 99.

²¹ I am grateful to Assoc. Professor A. Walmsley for permission to publish the glassware from the University of Copenhagen’s Islamic Jerash Project.

²² Cf. Keller and Lindblom (2001) 379–82 for the Petra house.

²³ *Seu ceram teretem stuppa calens bibit.*

The glass oil-lamp did not derive from pre-existing oil-lighting forms, but combined liturgical vessels and ritual lighting in a uniquely Christian format. To understand the roots of the glass oil-lamp, however, we must first digress on the subject of candles. In the Early Roman period, a *candela* meant both a simple rush-light, a reed that ‘stripped of its outer coat . . . serve as candles and funeral lights’,²⁴ and any cord covered with wax. As such, *candelae* in secular Roman texts can refer simply to reed torches, and their outdoor use reinforces this, as in Juvenal, *Satire* III, 85–86: ‘*breve lumen candelae, cuius dispenso et tempero filum*’. Such a meaning persists even in the Greek author Athenaeus (a later compendium of Book 15 mentions a servant who buys *kandela*).²⁵ This double meaning—for waxed cords and reed-lights—may have given rise to the early Latin word *candelabrum*, denoting a metal stand for holding reed torches or waxed splinters (*ligna*), as can be seen by a quick glance at any Etruscan versions of these. They have tiers of spikes pointing downwards that might not have been used for candles, since they would have undoubtedly melted the candles above them. By the time of the early empire, *candelabra* from Pompeii and Herculaneum were, in fact, simply stands for indoor oil-lamps.²⁶ Even spiked examples, which appear from the Early Byzantine period, can hold metal lamps with matching recesses on their bases, simply to make them more stable.

Although wax candles were, of course, known to the Romans, both archaeological and literary evidence confirms that oil lamps were *the* form of ancient domestic lighting, even for the poor, in the East or in the West. Moreover, certain evidence for domestic candlestick-holders before the 3rd c. is lacking. In the Roman period, the Jewish Sabbath *menorah* was a metal lamp-stand upon which oil-lamps sat; by the Late Roman period, synagogues could also hang the ‘perpetual light’, ‘usually made of glass’, above the *menorah*.²⁷

Without exact evidence for the domestic use of Roman candles, we have to rely on literary texts and scant images of candles to understand their functions. The primary use may have been in pagan religious rituals, especially if these had a funerary significance. A mural of the ‘Temple of Isis’ at Herculaneum probably shows a priest holding an upright wax candle, not simply a normal way to illuminate the nocturnal scene, but in the particular context of the goddess Isis, whose *lychnapsia* (festival of lights) allowed initiates to re-enact her search for Osiris, using—according to the 4th Calendar of Philocalus—candles, torches and lamps.²⁸ A 3rd c. A.D. reference to an eternally-lit ‘*lucerna super candelabrum*’ in a temple of Venus probably means an oil-lamp;²⁹ candles were not used within pagan temples for lighting, although, if the 3rd c. papyrus from the temple at Arsinoë is any indication, oil lamps were used.

Conceptually, both candles and torches seem to have been linked in both pagan and Christian Roman culture with funerals, and not with everyday life. Torches appear in tomb murals around the empire, presumably as both symbols and reflections of real practice for nocturnal funerary processions and visits to dark places: even Early Christian funerary images show torches, such as in the Christian meeting-house at Doura-Europus.³⁰ The earliest clear-cut depiction of candles dates from the 2nd–3rd centuries A.D., and also derives from a funerary context.

²⁴ ‘. . . detracto cortice candelae luminibus et funeribus serviunt’. Pliny *NH* 16.70.178 (Loeb edition 1960).

²⁵ Loeb edition (1971) 267.

²⁶ Lista (1986) 180, nn. 61–62, inv 78485, 78537.

²⁷ Sussman (1983) 232.

²⁸ Witt (1977) 92, n. 38–39.

²⁹ Lucius Ampelius *Liber Memorialis*: VIII. ‘. . . Bargylo est fanum Veneris super mare; ibi est lucerna super candelabrum posita lucens ad mare sub divo [caelo], quam neque ventus extinguit, nec pluvia aspargit.’ (Ed. E. Woelffl in 1873).

³⁰ Rostovtzeff *et al.* (1936).

A single mummy-case portrait from Hawara, now at Manchester Museum, shows a man holding in his left hand a lit candle, the lower part of which seems to be in a protective covering or cylindrical holder of indeterminate material.³¹ A 3rd c. pagan tomb at Abila, in northern Jordan, seems to show lit candles sitting on stemmed, low stands,³² as they do on the walls of the 4th c. tomb at Or ha-Ner.³³ A group of ceramic stands from late 3rd or early 4th c. tombs at Amman and at Rajib are said to be candle-holders, on the grounds that they have a 'drip-gutter'.³⁴

A now lost mural from a mid-2nd c A.D. tomb at Soussa, in North Africa, shows a man holding a glass candle-holder before a stall selling drink by the glass. I cannot make sense of it unless there was an intentional link between the chalice-like candle-holder and the glass goblets used by the stall-holder (who surely would have had his own lighting!).³⁵ Yet the goblets are clearly different in form from the candleholder. Two early 3rd c. Rhenish military graves actually contained glass candleholders in the form of two handle-less goblets attached end-to-end, one with an internal tube to hold the candle upright, rather like the wicktubes in later Levantine handled, glass beaker-lamps.³⁶ The vestibule mosaic from Piazza Armerina, which might be late 3rd c., shows a lit candle held in a silver or glass, handle-less goblet, just like the Rhenish examples.³⁷ The subject of the mosaic is a mystery, but it is located opposite a household shrine in the garden, recalling Juvenal's Satire 12.³⁸ A 4th c. Mithraic tomb at Gargaresh, North Africa, also shows servants holding lit and thick candles in footed, but handle-less, glass goblets,³⁹ and lit candles on stands appear in non-Christian contexts; from a 4th c. dining room mosaic in the 'Villa Fortunatus', near Fraga, Spain,⁴⁰ to the Egyptian-style frieze under the *opus sectile* mosaic from the 'Basilica of Junius Bassus', Rome.

And so we return to the late antique church. On the one hand, the Christian calendar is dominated by two events, one of which concerns death and renewal. I suspect that the use of candles as ritual items—not as lighting—developed from the widespread and varying ways in which a number of pagan cults also used candles. By A.D. 303, a reference to *cereofala* in a Numidian church and 'two wax-light bearers' (*ceroferarii*) who walk before the deacon, clearly indicate wax candles, not torches, which were always a form of outdoor lighting. By the A.D. 380s, the Aquitanian pilgrim, Egeria, twice refers to explicitly portable '*candelae et cerei*', which were both brought into the *Anastasis* at night in the Constantinian Church of the Holy Sepulchre, whilst *candelae* were also carried in mass baptismal processions.⁴¹

³¹ Doxiades (1995).

³² Smith and Mare (1997) 307–14.

³³ Tsafirir (1968) 174, fi g. 3.

³⁴ Bisheh (1972) 82–83, fi g. 3, pl. 3; Bisheh (1973) 66, pl. XL, 1.

³⁵ Reinach (1892) pl. XXIX and Yacoub (1988) 292, fi g. 12.

³⁶ Follmann-Schulz (1992) 95, n. 56.

³⁷ Wilson (1983) 90, fi g. 56.

³⁸ '... where my little images (of shining crumbling wax) are being decked with slender wreaths' (shrine to the Lares). Here all is bright; the gateway, in token of feast, has put up trailing branches and is worshipping with early lighted lamps (*lucernis*) ll. 85–92 (Ramsay translation (London 1918)).

³⁹ Romanelli (1970) 319, pl. 264.

⁴⁰ Tarradell (1969) pl. 173.

⁴¹ Ed. P. Geyer (1898): 58.

Candelae here clearly cannot be wax-tapers—these are *cerei* or *cereofala e*—and a clue as to their identity is also present in the same general description of the church: ‘*candelae* in glass hang everywhere and many wax candles are as much before the *Anastasis* as before the Cross and behind it’.⁴² Since the *cereofala* were also portable, it was not the container that differentiated them.

The conclusion must be that by the late 4th c., either ‘*candelae*’ were now oil-wicked, glass hanging-lamps, or they were still wax candles, but somehow distinguishable from those explicitly described as waxen. The former seems the more likely explanation.

It is possible that the Late Roman use of glass candle-holders in a pagan funerary and ritual context *may* have provided the impetus for the use of glass for oil-lamps. For practical reasons, having a lit wick leaning in a glass nozzle was not conducive to long-lasting lamps. Taking the candle-holder as a prototype, but using oil on water, with a floating but stable, clipped wick, glass goblets easily became lamps. As lamps, they appear in large numbers within Early Byzantine churches, such as at Anemurium.⁴³

Once provided with handles, glass goblets were used for oil-lamps, and their potential uses rapidly expanded. Christian congregations for the first time held indoor nocturnal vigils and nocturnal baptisms, needing good indoor lighting for communal liturgy. The Constantinian basilica, which appeared in the 4th c., needed sufficient lighting for a mass of people, unlike most Roman public buildings or temples. Glass bowls could be hung in metal rings, incised to be viewed from below. And whilst metal suspension-lamps were well-known in the Roman world, they were limited by lighting only upwards rather than radiating light downwards through glass chalices, bowls and tumblers. Glass-handled goblets could be hung from tripartite chains.

The well-documented iconography of the lamps on menorahs throughout the Roman period demonstrates well that synagogues took up glass lamps at roughly the same time as their appearance in Constantinian churches. From the 4th c., depictions of menorahs start to show tumbler-shaped glass oil-lamps rather than the standard ceramic or metal wick-lamp, although they never show goblet-shaped glass lamps.⁴⁴ The standing menorah over the niche on the synagogue wall at Dura Europos has tumbler-lamps on its arms which, if glass, are their earliest representation in art.⁴⁵ Hanging lamps with ring-handles could be depicted on 4th c. tombs in Rome (Via Latina, cubiculum E).⁴⁶ Whilst Christian candles from the 4th c. onwards continued to be hand-held (for example, the figure on the ceiling of the ‘Crypt of S Cecilia’ in the catacombs of St. Callistus), or placed on floor-stands (as with funerary mosaics of the pious in North Africa),⁴⁷ hanging gobletlamps filled with oil and water became part of the iconography of the illustration of churches for the next three centuries, on mosaics in the East, as well as in the West.

With the use of handles, suspension became the major innovation of the Byzantine period. No metal or ceramic lamps of the earlier period, suspended from their rods, could match the symbolic and real effect of translucent glass hanging lamps. This innovation cannot be underestimated—from churches and synagogues, this lighting spread to bathhouses⁴⁸ and, within decades, to private houses. That this development began in the Greek-speaking East is not provable, but it is possible: the lack of a Latin form of the label *polycandelon* for the hanger for these glass lamps might itself indicate that this was not a western innovation. Venantius Fortunatus (admittedly a reactionary Latinist) would describe it only as ‘*lychnus . . . cuius vitrea natat ignis in urna*’.⁴⁹ Glass lamps never developed their own label—they were simply *lychniai hyalai*, as a 5th c. Oxyrhynchus church ostrakon clearly shows.⁵⁰ But metal hanging holders for multiple glass lamps of the 4th c. needed a new term; and *polycandela* were definitely not multiple candle holders, but were very specifically filled with glass lamps.

⁴² *Candelae autem vitreae ingentes ubique plurimae pendent et cereofala plurima sunt tam ante Anastasim quam etiam ante Crucem, sed et post crucem* (edition 1898: 73, 5).

⁴³ Stern (1985) 35–63.

⁴⁴ Negev (1967) 193–210.

⁴⁵ Grabar (1967) pl. 68. ⁴⁶ Ferrua (1991) 98, fi gs. 77 and 158.

⁴⁷ Van Der Meer, Mohrmann, Hedlund and Rowley (1958) fi gs. 356, 458 and 575.

⁴⁸ Cohen (1997) 396–431.

⁴⁹ *Vita S Martini* 4.689.

Unlike window-panes, however, glass lamps quickly entered common domestic use, as 4th and 5th century houses from Petra to Sardis attest. They were commonplace by the time of the grand dining-room in the ‘House of Bronzes’ at Sardis, with its *polycandelon*.⁵¹ Moreover, in the Near Eastern provinces, the overall use of glassware—as vessels, lamps and architectural fittings—appears to have increased considerably in the Byzantine period. A number of Levantine churches have collections of broken glass which could be interpreted as having been collected for recycling. Yet again, it is possible to find an alternative explanation for these piles of glassware, without necessarily suggesting an increase in recycling in the Late Byzantine or Umayyad periods. At Pella, the smashed window and hanging lamps collected in locus 70 within the *parvis* of the ‘Civic Complex Church’ were interpreted as debris from the A.D. 717 earthquake, that had not been cleared by A.D. 749 when the last major earthquake hit.⁵² At Petra, the concentration was in a tower room on the far side of the forecourt.⁵³ Another pile was identified at Kharm al-Karak.⁵⁴ At Jerash, piles of glass were concentrated in a passageway between the ‘Fountain Court’ and S. Theodore’s.⁵⁵ But if these were piled for recycling, why was the recycling not achieved? At the monastery of Deir ‘Ain ‘Abata (S. Lot) in southern Jordan, vast piles of half-melted and collapsed glass lamps and window glass must have been deliberately swept, not washed, into a cistern adjacent to and beneath the pilgrimage church. It was scarcely a convenient place for future retrieval, and—as at Petra, at Pella, and at Jerash—the point is, that they were not retrieved at all. At Pella, for instance, we would have to ask why it would take 32 years for glass to be recycled (and then not re-used in the end). At Jalame, which certainly *was* a glass workshop in the late 4th or early 5th c., there is no record of piles of recycled glass, only of glass chunks (broken bits of ingots) and piles of wasters.⁵⁶ Chunks and wasters were also predominant at the glass works at Beth She’arim.⁵⁷ The clue to these piles of broken, ecclesiastical glass might be found in the *synthronon* of the ‘Civic Complex Church’ at Pella. There, the American team discovered that the rubble core of the secondary insertion of an odd *synthronon* into the central apse contained large amounts of smashed glass lamps, whose destruction must have belonged to an early phase of the church—after the 5th c., but well before the 8th c. This is an odd use of broken glass, but Smith’s and Day’s suggestion that it was, specially buried, and thus placed out of circulation by this unusual construction, seems plausible.⁵⁸ Could not the piles found elsewhere in churches have been similarly preserved *from* and not *for* recycling? If so—and this is just a hypothesis—then it might reflect the special significance of church glass fittings in the minds of the congregation and clergy in Late Antiquity. And could not this powerful effect of church fittings—such as the heavily symbolic ‘heaven’ of glass hanging lamps upon the imagination of Christian writers and church administrators—also have inspired emulation, beyond practical suitability or necessity? Perhaps glass windows slowly spread into everyday domestic use only through the strongly-visible example of churches, synagogues (and eventually, mosques), all of which had enclosed windows, either of glass or of thin gypsum. In other words, this could be one late antique technological innovation that filtered into general use because people were exposed to it in a religious setting: a fitting twist to the story of late antique glassware in the Levant.

⁵⁰ Montserrat (1995) 430–44.

⁵¹ Ellis (1997) 44, 48.

⁵² Smith and Day (1989) 70.

⁵³ O’Hea (2001) 370.

⁵⁴ Delougaz and Haines (1960) 49.

⁵⁵ Baur (1938) 521.

⁵⁶ Weinberg (1988) 28.

⁵⁷ Vitto (1996) 115–41.

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