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Some Evidence for Glassworking at Silkstone, Barnsley, South Yorkshire

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Summary

The artefactual evidence from the excavation of a late 17th century glassworking site is examined. The site produced monochrome or colourless glass, naturally coloured glass and small amounts of splash-decorated glass. In addition, diagnostic production waste, e.g. moils, runs and crucibles, were recovered. The forms of the vessels suggests that production began in the 17th century and continued into the 18th century. The occurrence of splash decorated wares is among the earliest in England.

Keywords Glass Technology Post Medieval

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Introduction

This report outlines some evidence for glassworking found during the excavations at Silkstone, near Barnsley, South Yorkshire by The Centre for Archaeology in 2002. The material can be divided into four categories; vessel glass, window glass, working waste and crucibles. Although these categories are separated in this report, it is only by studying them collectively that a comprehensive understanding of the operation at Silkstone can be achieved.

It is also important to take into account that the Silkstone glass furnace was just one element in a much wider regional industry. The technology used, and the products made at the site, must all be viewed within a wider framework. As a consequence, any discussion of the industry at Silkstone must take into account other sites within South Yorkshire, an approach that is currently being undertaken (Willmott in prep).

Given that none of the glass or crucible fragments were found in direct association with any furnace structure or working areas, any conclusions much be treated with caution. However, what is clear is that there is significant evidence for glassmaking at Silkstone and it is possible to start to characterise this industry.

The Vessel Glass

Given the limited extent of the excavation a relatively large quantity of vessel glass was recovered. Whilst much of the glass consisted of tiny undiagnostic body fragments (summarised in Table 5), a number individual vessels could be identified. These have been assigned a separate **G** number and are catalogued by context in Appendix 1. The vessel glass can be broadly divided into three categories; colourless and monochrome glass, splash decorated or 'Nailsea' glass and natural green, brown or black glass.

Colourless and monochrome glass



Figure 1. Colourless and monochrome glass.

A large number of undiagnostic colourless chips, which are either working waste or undiagnostic vessel fragments, were recovered. However, far fewer fragments are large enough for more comprehensive identification (Figure 1). It is probable that most, if not, all the colourless fragments are in fact lead glasses, but this will remain uncertain until confirmed by analysis. The first, G1, is a small, footed base that retains the very lowest portion of a plain side. This base might come from a small tumbler, although given the angle of the body a jelly is more likely. It is very similar to at least one example found at Gawber (Ashurst 1970, 130 no 11). The second fragment, G12, is more problematic. It appears to be a small solid base, similar to those found on wine or cordial glasses. However, its diameter is very small and it is quite uneven, suggesting that it might be in fact a piece of working waste. If so, it would be one of the few direct pieces of evidence for clear or lead glass production. Other clear vessels were found. G4, appears to be the base from a bowl, and again a near identical parallel can be found at Gawber (Ashurst 1970, 130 no 14). G5 is harder to identify, although the nearest local parallel is a small tumbler from Bolsterstone (Ashurst 1987, 197 no 15). The final clear glass vessel is represented by four fragments of a foldedunder base-ring from a wine glass, G16. Unfortunately little more of its form can be identified, but it is comparable to similar bases from Bolsterstone (Ashurst 1987, 197 no 1) and Gawber (Ashurst 1970, 130 no 7).

Three other fragments of colourless, and probable lead, glass were found and all come from cylindrical rods (Figure 2). Two, **G21 & G24**, are small sections made in a clear glass with a distinct pink tint. The third, **G30**, contains in internal coloured twist consisting of opaque white, blue, yellow and purple threads. All three of these rods are too narrow to have been stems from wine or cordial glasses. However, it is likely that, particularly in the case of **G30**, they are the off-cuts from stem production. If this is the case, it would suggest that not only plain lead glasses were being made here, but also highly decorative colour-twist stems (see Summary and Recommendations).



Figure 2. Glass rods and amber vessel

A single fragment of bright blue glass was found, **G6**. This is the lower portion of a fine handle from a jug with a pronounced lower thumb rest (Figure 1). Although it is not possible to tell whether this is a product from the site, it might be no coincidence

that it is nearly identical to a blue glass handle made at Haughton Green, a site also associated with the Pilmay family (Hurst-Vose 1994, 37 no 6). Blue glass production at the site may be confirmed by the reference to "blew powder" in the 17th century probate of Abigail Pilmay, suggested by Ashurst (1992, 23) to be a cobalt compound for producing coloured glasses.

Another monochrome vessel is a single amber-coloured body fragment, **G17**, decorated with an optic-blown raised boss (Figure 2). Although of uncertain form, the closest parallel for this vessel is the Dutch *knobbelbeker*, a type produced throughout the 17th century (Henkes 1994,137-8). This form is occasionally found in England, such as several examples that form part of the late 17th to early 18th century assemblage from Tunsgate, Guildford (Fryer & Shelley 1997, 205). However, no examples made in an amber glass have thus far been found in England (Willmott 2002, 43), and this fragment remains ambiguous.

Splash-decorated glass

Eight tiny fragments from five different monochrome vessels were recovered that also received a secondary splash-decoration, making them resemble so-called Nailsea glass (Figure 3). This decoration was achieved by the rolling of the partially inflated paraison along a surface upon which coloured chips of glass had been scattered. The paraison picked these up on its surface and they were marvered flat and expanded as the vessel was further formed.



Figure 3. Splash-decorated or 'Nailsea' glass fragments

Only two vessels were of a form that could be identified. The first, **G14**, is the slightly in-turned rim from a green glass beaker with the remains of a faint opaque white splash on its surface. The second, **G29**, is similar, but the base colour is a deep, almost opaque, blue. The remaining fragments are undiagnostic body fragments, two with an amber ground, **G15 & G23**, and one with a colourless ground **G22**.

Although this decorative effect has its origins within Roman traditions of glassmaking, it is normally associated with production at the Nailsea works, near Bristol. However, Ashurst (1987, 199–201) has demonstrated that this attribution is erroneous. Not only was production at Nailsea restricted to window, and later bottle, glass; the works themselves were only founded in 1788. More importantly, excavations at Bolsterstone revealed fragments of vessel and waste glass decorated in the so-called Nailsea style what clearly have a *terminus ante quem* of 1756, and may date to several decades earlier (ibid.).

Unfortunately these tiny fragments from Silkstone show no definitive evidence of having been produced at the site, as none are obvious wasters or moils. However, given that splash-decorated glass of early 18th century date is extremely rare archaeologically (almost unrecognised outside of Bolsterstone) there is a case to be made for its production at Silkstone. Certainly the two beaker rims, **G14 & G29**, resemble the form, if not the exact decoration, of one of the Bolsterstone examples (Ashurst 1987, 201 no 4). Furthermore, small opaque white glass chips (Figure 4) which could have been used to produced the splashed decoration were found in two contexts [0014] and [0018]. It is perhaps no coincidence that these same two contexts also produced five out of the eight fragments of the splash-decorated vessel glass.



Figure 4. Opaque white glass lumps

Naturally coloured green, brown and black glass

The majority of vessel glass fragments found were in a naturally coloured green, brown or black glass (Figure 5). The term 'naturally coloured' is used here as the natural impurities within the network former or silica source affected the final colour outcome. This is not to say that some regulation did not take place to ensure consistency within the batch, but no decolourants or colouring agents were deliberately introduced. These naturally coloured vessels can be further divided into finewares, phials and bottles.



Figure 5. Natural green, brown and black glass

Interestingly the closest parallels for most of the finewares are not found at the other Yorkshire glasshouses of Bolsterstone and Gawber, but rather at the Haughton Green furnace in Denton (near Manchester). A fragment of pedestal beaker rim, **G34**, in a black glass is nearly identical to one from Haughton Green (Hurst-Vose 1994, 35 no 6), whilst fragments of similar type in green glass, **G43**, has several parallels there too (op cit 28, nos 55–6). Other finewares from Silkstone include the base of a dish, **G42**, and part of the neck from a wrythen-decorated flask, **G7**, both of which were again found at Haughton Green (Hurst-Vose 1994, 25 no 17; 36 no 16).

The provenance of these finewares is problematic. Certainly the dish base **G42** is completely unworn underneath, suggesting that it was never used. However, all these are forms consistent with a date in the first half of the 17th century. This leaves two possibilities. They could represent cullet brought from Haughton Green to Yorkshire with the move of the Pilmay family. More probably they suggest that the earliest phases of production at Silkstone mirrored what had been undertaken at Haughton Green, and already old-fashioned designs were produced, albeit for a short time.

The most common vessel form found at Silkstone is the phial. These vessels can be divided into two types (Willmott 2002, 89–90). The first is the globular phial, **G8**, **G18**, **G27**, **G 35 G38**-**G41**, a type that first occurred during the earlier 17th century, but continued to be popular until the beginning of the 18th century. The second type is the cylindrical phial, **G9**, **G13**, **G19**, **G25**, **G26**, **G33**. This has a more vertical side and sharply shaped shoulder than the globular phial. These first occur during the later 17th century, and become the predominant phial form during the 18th century.

As with the finewares, there are difficult questions of provenance associated with some of the phials. A number of the globular phials appear to never have been used. For instance, the bases G40 & G41 are completely unworn, the rims of G38 & G39 appear slightly rough and unfinished, whilst rim G18 is sufficiently distorted to be a possible waster. In most of these examples the quality of the metal is markedly poor and frequently full of large air bubbles. Consequently, it can be suggested that globular phials were a product of the earliest phases of production at Silkstone. As with the finewares, identical parallels with globular phials from Haughton Green, but not Bolsterstone or Gawber, can be made (Hurst-Vose 1994, 25 nos 3–4). It is also possible that the cylindrical phials which are identical to those known to have been produced at Bolsterstone (Ashurst 1987, 194 nos 1–13) and Gawber (Ashurst 1970, 118 nos 4–6 & 8–15), were also made at Silkstone.

The final fragments of vessel glass are all from wine bottles, in either an olive or a brown/green metal. A minimum number of seven can be identified, but this is probably a significant underestimate. At least two, **G20** & **G28**, are very early examples of either shaft & globe or proto onion form dating to the late 17th century. The remaining fragments, **G3**, **G10**, **G11**, **G31**, **G32**, are from later onion or bladder bottles, dating to the early 18th century.

Fragments of wine bottles are common finds on all post-medieval sites, and there is nothing distinctive about these fragments to suggest that they were made at Silkstone. However, it is likely that some might have been. It is clear that wine bottles were a staple product at the other local glasshouses of Bolsterstone (Ashurst 1987, 193) and Gawber (Ashurst 1970, 118), and three moils (**GM1**, **2** & **9**) from possible wine bottle production were also found at the site (see below). Furthermore, the probate inventory of Abigail Pilmay suggests that there were two furnaces in operation, and one was specifically for producing common bottle and window glass (Ashurst 1992, 23).

The Window Glass

A total of 30 fragments of window glass, weighing 101g, were recovered from the site (summarised in Table 1). This will be a slight underestimate of the real total, as many of the small undiagnostic chips and fragments of glass, (summarised in Table 5), are possibly from windows. However, given these factors the total is still small when compared to the vessel glass and working waste.

Tuble 1. Summary of the window glass				
Context	Number of fragments	Weight	Notes	
U/S	2	4g		
0007	3	8g		
0009	9	54g	1 with grozed edge	
0017	2	4g	1 cylinder edge	
0030	1	1g		
0034	6	16g	1 cylinder edge	
0035	2	4g		
0037	5	10g	1 cylinder edge	
		-		

Table 1. Summary of the window glass

It has been suggested that contemporary documentation indicates that during the late 17th century at least some window glass was produced at the site (Ashurst 1992, 23). All the fragments of window glass recovered from the excavation appear to have been made by the cylinder or muff glass method, where a long tube of glass was produced, which was subsequently opened out into a sheet. However, evidence for cylinder glass manufacture is always difficult to identify. Unlike crown production, where a central redundant 'bulls eye' was formed, the whole of the broad glass sheet was used for glazing. Three fragments from the edge of the cylinder were recovered, but these do not necessarily indicate production waste as they could have been used, or they may merely suggest that quarries were cut, but not produced, here.

Consequently, only unsatisfactory conclusions concerning window glass production can be arrived at. Documentary evidence suggests that it probably was happening at the site, and there is no reason why window and vessel glass would not have been made together. Nevertheless, there is no direct archaeological evidence to support this assumption.

The Working Waste

Most excavations at glass furnace sites produce groups of glassworking waste. However, this is notoriously hard to interpret, and often given little or no treatment in final reports. However, it is possible to gain some ideas as to the nature of the industry from the waste, which can be divided into several categories.

Moils

The most diagnostic and important form of glass waste is the moil. The moil comes from two different, but similar, elements of the vessel formation process. The first is when the moil is the section of glass that lies between the blowpipe and the paraison, or vessel, being formed. In this case it will normally be hollow, to allow air to pass from the pipe to the paraison. The second form of moil occurs when a pontil iron is attached to a vessel base, and the moil is the disc of glass connecting the two. In this case the moil will take the form of a solid pad or ring of glass, which often tapers along what would have been the length of the pontil. Interestingly it is this type of moil that Diderot illustrates being removed from a pontil iron with a hammer (Figure 6) perhaps explaining why those found archaeologically are rarely complete.



Figure 6. Removal of moils (from Diderot & L'Alembert's L'Encyclopédie)

Fragments from nine different moils were found at Silkstone (Figure 7). With one exception, all belong to the second category of moil, where pontil rather than blowing iron has been attached. The moils can be broadly divided into two types; smaller ones in a light blue/green glass and larger ones in a darker olive or brown glass.



Figure 7. Moils

All the small blue/green moils, **GM2–GM7**, are very similar being pad-like with some displaying where they spread up the length of the pontil iron for several millimetres. Although it is not possible to ascertain for certain what type of vessels these moils came from, they are likely to have been small and the metal closely resembles that of the phials also found at Silkstone. The fragments from larger olive or brown/green moils are easier to identify (**GM1**, **GM8–GM9**). This metal, as well as the diameter of the moil, suggests they came from the manufacture of wine bottles.

Heat distorted glass

A quantity of glass that had suffered significant heat distortion was recovered (summarised in Table 2). Heat distorted glass is not evidence for glassworking *per se*, as fragments that have clearly been in contact with fire may be found in ordinary contexts. However, at Silkstone there is a significant quantity from a relatively small area of excavation, so some might be related to the glassmaking process.

The heat distorted glass falls into two categories; fragments that were clearly semi- or fully-formed vessels prior to being distorted, and those that are amorphous lumps. Of the former category almost all were of a size and thickness that suggests they came from wine bottles. These could be rejected or accidentally lost products, collected cullet never added to the batch or simply ordinary vessel glass that came in close contact with the furnace. Likewise it hard to ascertain the precise nature of the heat distorted lumps. Whilst they may well relate to glassmaking, other processes might

also have formed them. Therefore, all that can usefully be said about the heat distorted glass is that there as was a significant source of heat in close proximity to the excavation area, and this could have been the glass furnace.

Tuble 2. Summary of the neur distorted glass			
Context	SFs	Colour	Weight
U/S	4087	Green	9g
0007	4017, 4018, 4020, 4023	Green	6g
0009	4026, 4034, 4035, 4038, 4042, 4043, 4061,	Green	72g
	4062, 4063, 4064		
0010	4067, 4079	Green	18g
0014	4070, 4071, 4072	Green	18g
0023	4088	Green	1g
0029	-	Blue	4g

Table 2. Summary of the heat distorted glass

Gall and slag

More diagnostic evidence for glassworking can be seen in the presence of gall and other glassworking slags (summarised in Table 3). Gall is the naturally occurring scum that forms on the surface of the batch in the crucible during the early stages of manufacture. During the first melt, most of the natural impurities and gasses rise up out of the glass to form a foamy residue, which was scraped off by the glassmaker.

Table 3. Summary of the gall and slag

Context	Colour	Weight
0014	Greenish	1,518g
0015	Greenish	36g
0017	Bluish	92g
0018	Bluish	16g
0027	Greenish	360g

The glass was usually heated several times to refine the batch and remove as many of these impurities as possible. Other glassy slags could be formed by dribbles of glass on the outside of the crucible and blobs of glass coming in direct contact with the heat of the furnace. Despite indicating that glassworking was taking place in the vicinity, the presence of gall can contribute little else to the understanding of the glassmaking process.

Runs, pulls and threads

Amongst the most recognisable type of glassworking waste are runs, pulls and threads (summarised in Table 4). Runs are pieces of glass that have been accidentally lost during the glassmaking process, having either been spilt from the crucible or dropped during blowing. As such they usually take the form of dribbles or splats, and often incorporate inclusions of grit and other impurities. Pulls and threads relate more directly to vessel formation. These are strands of glass of varying thickness and are the waste or off-cuts from the application of secondary elements onto vessels, such as trails or handles. Sometimes pulls take the appearance of solidified teardrops, and it is likely that these were formed by the glassmaker deliberately dripping glass from the end of a tool in order to gauge its viscosity and whether it was suitable for working.

One unusual, and thus far unexplained, element of glassworking waste was recovered from the sieving of context [0020]. These take the form of four tiny dumbbell-shaped fragments (Figure 8). These have clearly been formed during the glassmaking process, as they are not naturally occurring shapes. However, the precise way that this may have taken place is unclear.



Figure 8. Small 'dumbbell-shaped' waste fragments

Table 4. Summary of the runs, pulls and threads			
SFs	Colour	Weight	
4085, 4086	Dark green	16g	
4009	Light green	4g	
-	Light green	33g	
4023	Dark green	4g	
4089	Dark green	10g	
-	Light green	4g	
4123	Light green	4.5g	
-	Light green	0.5g	
4128, 4129	Light green	20g	
4121, 4122	Brown/green	10g	
+, 4135	Light & dark green	10g	
-	Black, light green	2g	
	Summary of the run SFs 4085, 4086 4009 - 4023 4023 4089 - 4123 - 4128, 4129 4121, 4122 +, 4135 -	Summary of the runs, pulls and threadsSFsColour4085, 4086Dark green4009Light green-Light green4023Dark green4089Dark green-Light green4123Light green-Light green4123Light green-Light green+, 4135Light & dark green-Black, light green	

As with other elements of vitreous waste, the presence of runs, pulls and threads indicates that glassworking was being undertaken in close proximity to the excavation. However, its precise nature from this evidence is less clear. However, one conclusion can be drawn. With the exception of only a few tiny clear glass threads found in the sieving (and too small to be measured in the table above), all the pulls, runs and threads were in green or black glasses.

Miscellaneous working waste and undiagnostic body fragments

The remaining glassworking waste is also relatively uninformative (summarised in Table 5). Almost all comes from sieving and takes the form of tiny undiagnostic chips, which might related to the manufacturing process or may be small unidentified body fragments. It is interesting to note, however, that these small chips occur in both green and clear (presumably lead?) glasses.

Two further forms of waste can also be identified. The first are some small chips of opaque white glass (Figure 4) from [0014] and [0018] that possibly related to the manufacture of splash-decorated vessels (discussed above). The others are a small quantity of different coloured lump glass from the early stages of manufacture.

Tuble 5. Summary of the other working waste and analognostic fragment			
Context	waste	Colour	weight
0014	Chips	Opaque white	2g
0014	Chips	Clear lead glass?	70g
0014	Chips	Green	728g
0015	Chips	Clear lead glass?	8g
0015	Chips	Green	54g
0018	Chips	Opaque white	5.4g
0020	Chips	Clear lead glass?	1g
0020	Chips	Green	200g
0020	Lump glass	Green	164g
0020	Lump glass	Bluish	258g
0027	Chips	Green	4g
0029	Chips	Green	18g

Table 5 Summary of the other working waste and undiagnostic fragments

The Crucibles

Over twelve kilograms of crucible sherds were recovered (summarised in Table 6), a relatively large number considering the size of the excavation. Although fragments were found in a variety of different contexts the majority came from just one [0020], a comparatively contained context dating to the end of the 17th century. It is interesting to note that most of the sherds of crucible are quite small. This is likely to be for one of two reasons. It was usual practice that once a crucible had ceased to be functional it was removed from the furnace and broken up so that any residual glass could be retrieved. The other explanation might be that the crucibles were deliberately broken up to be used as a hardcore or levelling material.

Table 6.	Summary	of crucibles
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Context	Parts	Weight
U/S	rim and body	1,884g
0009	body	576g
0015	body	12g
0017	body	174g
0018	base and body	474g
0020	rim, base and body	7,688g
0027	body	92g
0029	body	294g
0030	base and body	1,065g
0033	body	176g
0037	rim	36g
0042	body	186g
	Total	12,657g



Figure 9. Crucibles

All of the crucible sherds from which a form could be determined are of an 'open' type. It has been argued that from the later 17th century onwards, open crucibles could only be used to make a green glass, as fumes from the coal fuel would discolour any finer batch. Closed crucibles have been found at Bolsterstone (Ashurst 1987, 184), but this hypothesis can now be questioned. Despite excavations on an increasing number of sites, Bolsterstone is the only furnace with definitive evidence for the use of closed crucibles, although there is some suggestion that lids might have been used on a few crucibles at Haughton Green. For example, excavation of late 17th and early 18th century furnace at Vauxhall Bridgefoot, London, known to have produced a wide range of finewares as well and bottle glass, revealed in excess of a quarter of a tonne of crucible fragments (Tyler & Willmott in press). However, not one of these comes from a closed crucible and there is no evidence for the use of lids.

As would be expected, the majority of the crucible fragments are relatively undiagnostic body sherds, although some have been reconstructed to provided useful diameters. Several rims survive, but only a few sherds of base. This is a pattern consistent with other glassworking sites, as the base of the crucible usually fused to the siege benches in the furnace, so could only be removed by being smashed free. All of the crucible fragments come from vessels that had actually been used, their external surfaces are highly vitrified and many contain internal deposits. Interestingly, none of the crucible fragments suggest that the pots failed whilst in use in the furnace, as no sherds have solidified glass on the edges of any breaks, a feature that has been observed at a number of other furnace sites (e.g. Tyler & Willmott in press.)

Two types of crucible can be defined (Figure 9). The first, and the most common, is quite a small vessel that has a wall up to 25mm thick. Several rims from this type crucible were found (**C2–C4**), and these tend to be slightly in-turned. Although none of the rim fragments is sufficiently complete for a diameter to be measured, body fragments suggest that this would have been around 300–350mm. The second type of crucible is a larger vessel, with a more vertical rim and everted side (**C1**, **C5–C6**). The rims are also more flattened on their upper surface and have a diameter of around 450–500mm, whilst the crucible has a body thickness of between 40–45mm.

Although there is no apparent difference contextually between the two crucible types, it is possible that they relate to different phases of glass production. The first, smaller type of crucible is similar in size and shape to those found at earlier 17th century sites such as Haughton Green (Hurst-Vose 1994, 46) and Bickerstaff (Hurst-Vose 1995, 16–18). Likewise they appear to be of similar capacity to the many examples found at Little Birches, Staffordshire but with very different rim forms (Welch 1997, 16–18). By way of contrast the second, larger, type of crucible matches more closely those found at slightly at later sites. They are similar in form to examples found at Gawber (Ashurst 1970, 131), Bolsterstone (Ashurst 1987, 190) and Vauxhall (Tyler & Willmott in press) although the Silkstone examples have slightly narrower rim diameters and more everted sides.

Summary and Recommendations

Despite excavations at Silkstone in 2002, no structural evidence for a furnace was found. Nevertheless the glassworking evidence recovered enables a number of conclusions to be made. Furthermore, for the first time it is now possible to identify likely products, and suggest the types of glass made at the site.

The chronology of the industry and range of products

- The excavated material confirms the chronology identified through historical documents. Manufacture seems to start in the late 17th century and continues into the early 18th century.
- It is almost certain that green and black glass beakers, dishes and phials were made in the earliest phases of the works. Later products are possibly early 18th century wine bottles.
- Whilst there is only speculative evidence for lead glass manufacture, it might also be suggested that splash-decorated ware (or Nailsea glass) was made at the site. If this were the case, it would be the earliest evidence thus far found in England for this type of glass.
- There is no direct evidence for window glass manufacture, although given the limitations of the evidence this cannot be ruled out.
- There is nothing amongst the working waste that would conclusively suggest that manufacture continued beyond the first third of 18th century. The only exception is the single piece of rod, **G30**, possibly used in the production of a colour twist stem. However, if this were the case it would suggest manufacture continued until the1770s (Bickerton 1984, 16), although this is not supported historically.

Technology of manufacture

- Regrettably, no diagnostic evidence for a furnace or subsidiary features were found. Unlike other sites there was no evidence for gathering hole covers, raw materials or tools.
- A reasonably large number of crucible fragments were found given the small size of the excavation. It also suggests that the area of excavation was close to the original location of the furnace.
- Without exception all crucible fragments came from open varieties. This seems to agree with a growing body of excavated evidence, which suggests that despite contrary evidence from Bolsterstone, closed crucibles were not normally used in the 17th and 18th centuries.
- Two sizes of crucible were found. The first type is a smaller one with thin walls and a diameter of around 300mm, being similar in form and size to others found at Haughton Green and Bickerstaff. The second type has thicker walls and a larger diameter of over 400mm, typologically more consistent with those from Bolsterstone and Gawber.
- The glassworking waste (including moils, runs and pulls) suggests that green glass was the most predominant metal to be made at the site. There is far less working waste associated with clear glass, although this does not necessarily mean it was not produced at Silkstone.

Recommendations for further work and analysis

- All possible products have been individually catalogued. It is recommend that a representative sample (if not all) are analysed for comparison with the working waste and crucible glass already studied.
- Analysis should take place in two phases. The first should be to identify chemical profiles for the possible groups of products; for example lead glasses, green glasses and possible splash-decorated wares. The relative homogeneity of these groups should be assessed. The second phase should compare the analyses of various groups of vessels with the waste glass, and see if it is possible to confirm the suggested provenance of these products.
- If possible these results should be compared with data sets from other sites in South Yorkshire and beyond.
- The typological and analytical results, (where relevant), should receive full publication.
- The presence of an extremely important glass furnace in the very close proximity of the excavation has been demonstrated. Due consideration must seriously be given to the permanent preservation of the site either by record or *in situ*.

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Appendix 1 Catalogue of vessel glass

RD = rim diameter, BD = base diameter. NB. Identification of lead glass is based on visual appearance, not chemical analysis

Context [0007]

G1 <4013> 1 fragment of small applied pedestal base from a possible jelly glass. Clear lead glass with few air bubbles. Early 18^{th} century? BD 30mm. Figure 1.

G2 < 4022 > 1 fragment of lower side from a cylindrical phial. Green/clear glass with few air bubbles. Early 18^{th} century. Figure 1.

G3 <4014> <4016> 2 fragments of body from a wine bottle. Green glass with some air bubbles. Early 18^{th} century.

Context [0009]

G4 < 4030 > 1 fragment of applied low pedestal base, possibly from a bowl? Clear lead glass with some small air bubbles. Early 18^{th} century? BD 60mm. Figure 1.

G5 < 4033 > 1 fragment of low pedestal; base from a vessel of uncertain form. Clear lead glass with no air bubbles. Early 18th century? BD 50mm. Figure 1.

G6 <4056> 1 fragment of handle and lower thumb-rest from a jug. Blue glass with no air bubbles. Late 17^{th} -early 18^{th} century? Figure 1.

G7 <4055>1 fragment of neck from a flask? Decorated with wrythen ribbing. green glass with no Air bubbles. Early–mid 17^{th} century?

G8 <4027> <4029> 2 joining fragments of pushed-in base from a globular phial. Green glass with few air bubbles and no impurities. Late 17^{th} century. BD 58mm. Figure 5.

G9 <4037> 1 fragment of should from a cylindrical phial. Green/clear glass with no air bubbles or impurities. Early 18^{th} century. Figure 5.

G10 <4047>1 fragment of rim and neck from an onion or bladder wine bottle. Olive green glass with many fine air bubbles. 1700–1725. RD 24mm. Figure 5.

G11 <4032>1 fragment of neck from an onion or bladder wine bottle. Olive green glass with many fine air bubbles. 1700–1725. Figure 5.

Context [0010]

G12 <4065> 1 fragment of possible base from a stemmed vessel? Clear lead glass, distorted? Early 18th century? Figure 1.

G13 <4066> 1 fragment of shoulder from a cylindrical phial. Green/clear glass. Early 18th century.

Context [0014]

G14 2 fragments of inverted rim and body, possibly from a beaker? Green 'Nailsea' glass splashed with opaque white. 18th century? Figure 3.

G15 2 tiny fragments of body of unidentifiable form. Amber 'Nailsea' glass splashed with opaque white. 18th century? Figure 3.

G16 4 fragments of folded-under base from a goblet. Clear lead glass. Late 17th–early 18th century?

G17 1 fragment of side from a beaker? Amber glass with mould-blown raised boss. Late 17^{th} century? Figure 2.

G18 3 joining fragments of rim from a globular phial. Green glass, quite distorted. Late 17th–early 18th century. RD 25mm. Figure 5.

G19 3 joining fragments of everted rim and neck from a cylindrical phial. Green glass. Early 18th century. Figure 5.

G20 9 fragments of body from a shaft & globe or onion wine bottle. Green glass. Late 17^{th} -early 18^{th} century.

Context [0015]

G21 1 fragment of solid plain rod. Clear glass with a pink tint. 18th century? Figure 2.

Context [0017]

G22 1 tiny fragment of body of unidentifiable form. Clear 'Nailsea' glass splashed with opaque white. 18th century? Figure 3.

G23 2 tiny fragments of body of unidentifiable form. Amber 'Nailsea' glass splashed with opaque white. 18^{th} century? Figure 3.

G24 <4091>1 fragment of plain solid rod. Clear (pink tinted) lead glass with no air bubbles. Late 17^{th} -early 18^{th} century? Figure 2.

G25 <4105> 1 fragment of everted rim from a cylindrical phial. Blue/green glass with no air bubbles. Early 18^{th} century.

G26 <4077> 1 fragment of shoulder from a cylindrical phial. Blue/green with few air bubbles. Early 18^{th} century.

G27 <4101> 1 fragment of pushed-in base from a globular phial. Light green glass with few impurities. Late 17^{th} century?

G28 <4075> <4076> 2 fragments of base from a shaft & globe or early onion wine bottle. Green glass. 1650–1700.

Context [0018]

G29 <4078> 1 fragment of rim from an unknown vessel. Blue 'Nailsea' glass splashed with opaque white. 18^{th} century? Figure 3.

Context [0020]

G30 1tiny fragment of rod or stem with yellow, white and purple colour twist. 18th century. Figure 2.

Context [0027]

G31 <4125> 3 fragments of body from an onion or bladder wine bottle. Green glass. Late 17^{th} -early 18^{th} century.

Context [0028]

G32 <4106> 1 fragment of body from an onion wine bottle. Green glass. 1680–1725.

Context [0034]

G33 <4138> 1 fragment of shoulder from a cylindrical phial. Green glass, few impurities. Late 17^{th} -early 18^{th} century.

Context [0035]

G34 8 fragments of vertical rim, possibly from a beaker? Dark opaque black glass. Late 17th–early 18th century? RD 80mm. Figure 5.

Context [0037]

G35 <4110> 1 pushed-in base from a globular phial. Olive green glass, some air bubbles. Late 17^{th} century? BD 28mm. Figure 5.

G36 <4114> <4115> 2 fragments of body from a phial. Green glass. Late 17^{th} -early 18^{th} century.

G37 <4109> 1 fragment of string course from a bottle/phial. Light green glass. Late 17^{th} century.

Context [0039]

G38 <4145> <4161> 6 joining fragments of rim, neck and shoulder from a globular phial. Green glass, with many air bubbles and some impurities. Mid 17th century. RD 17mm. Figure 5.

G39 <4146> 2 joining fragments of rim, neck and shoulder from a globular phial. Green glass, with many air bubbles and some impurities. Mid 17^{th} century. RD 18mm. Figure 5.

G40 <4149> 10 joining fragments of pushed-in base and lower side from a globular phial. Green glass, with many air bubbles and some impurities. Mid 17^{th} century. BD 42mm. Figure 5.

G41 <4148> 12 fragments of pushed-in base from a globular phial. Green glass, with many air bubbles and some impurities. Mid 17^{th} century. BD 40mm. Figure 5.

G42 <4150> 15 frag of flat base, with distinct pontil mark, from either a jar or a dish. Green glass with few air bubbles or impurities. Mid 17^{th} century. BD 100mm. Figure 5.

G43 1 frag of slightly inverted rim, probably from a pedestal beaker. Green glass with no air bubbles or impurities. Mid 17th century. RD uncertain. Figure 5.

Appendix 2 Catalogue of moils

GM1 Context [0014] <4068>1 dark olive green moil, with elongated air bubbles and some impurities. Probably from a wine bottle. Late $17^{\text{th}}-18^{\text{th}}$ century. Figure 7.

GM2 Context [0014] <4069>

1 dark green brown moil, with few air bubbles and some impurities. Probably from a wine bottle. Late 17th–18th century?

GM3 Context [0030] <4130> 1 light green moil, some tiny air bubbles. Possibly from a phial? Mid to late 17th century? Figure 7.

GM4 Context [0030] <4131> 1 light green moil, some tiny air bubbles. Possibly from a phial? Mid to late 17th century? Figure 7.

GM5 Context [0030] <4132>

1 light green moil, some tiny air bubbles. Possibly from a phial? Mid to late 17th century? Figure 7.

GM6 Context [0030] <4133> 1 light green moil, some tiny air bubbles. Possibly from a phial? Mid to late 17th century? Figure 7.

GM7 Context [0034] <4137> 1 light green possible moil, some tiny air bubbles. Original vessel uncertain Mid to late 17th century? Figure 7.

GM8 Context [0037] <4111> 1 olive green moil, few tiny air bubbles. Probably from a wine bottle. Mid to late 17th century? Figure 7.

GM9 Context [0037] <4112> 1 possible olive green moil, few tiny air bubbles. Probably from a wine bottle. Mid to late 17th century? Figure 7.