Table 7: Blue glass XRF values

Na_2O	3.7	3.8	3.4
Al_2O_3	2.8	2.8	2.9
SiO_2	81.6	81.1	81.0
SO_3	0.7	0.6	0.7
K_2O	0.5	0.5	0.6
CaO	10.1	10.5	10.7
MnO	<0.1	<0.1	<0.1
Fe_2O_3	0.2	0.2	0.2
CoO	0.2	0.2	0.2
Ni_2O_3	0.1	0.1	0.1
CuO	<0.1	<0.1	<0.1
ZnO	<0.1	<0.1	<0.1
As_2O_3	0.2	0.2	0.2
SrO	<0.1	<0.1	<0.1

Clay ring fragment

EDS was carried out on a polished section of the clay ring fragment (NG83e (3)-69) to determine the chemistry of the clay as well as the adhering glass. The ceramic was found, as expected, to be high in silica and alumina. The glass was found to be higher in alumina where it had interacted with the ceramic (Table 8).

Table 8 :EDS values of clay ring fragment and adhering glass

	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	TiO_2	MnO	Fe_2O_3	As_2O_3	SrO	Total
Glass	10.3	0.1	4.1	69.7	0.3	11.9	0.1	0.1	0.5	0.1	0.4	97.4
Interaction	11.1	0.0	14.9	68.4	0.5	3.3	0.7	0.0	1.0	0.0	0.4	100.3
Ceramic	0.0	0.3	20.2	74.8	0.8	0.1	1.2	0.0	1.5	0.0	0.2	99.1

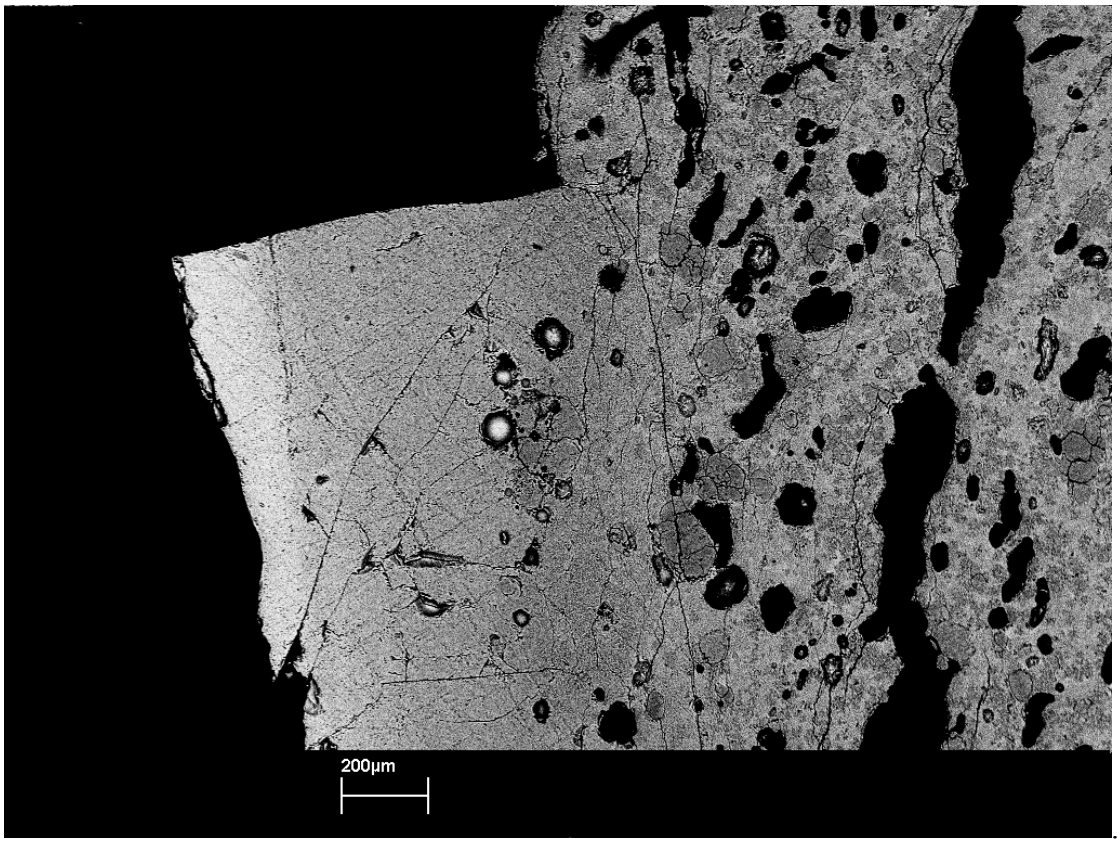

Figure 7: Backscatter electron image of a cross-section of the clay ring fragment. The black areas are voids.

Figure 7 shows the glass (paler on the left) adhering to the clay body (right, containing slightly darker grey quartz particles) with an interaction between the glass and the clay (areas with lower average atomic number look darker in backscatter electron images). The interaction causes a change in composition and therefore in backscatter contrast. The glass gets darker from left to right as lighter elements such as alumina are introduced into the glass from the ceramic by diffusion. It is likely that the composition of the glass is contaminated even at the edge by the clay-glass interaction due to the long time for which the gathering ring will have been subjected to high temperatures.

In light of these results, the possible drip adhering to a ceramic material found in when sieving sample [801] cone area (301) was re-examined. Under a binocular microscope the drip appears to be adhering to a mortar-like matrix that does not appear to have enough quartz grains to be of the same material that forms the clay ring. This was confirmed using XRF and dilute hydrochloric acid (the mortar fizzed). This drip was probably adhering to the furnace structure.

Conclusions

The analytical results show a tight clustering of compositions for the colourless glass. Because the samples were taken from two different cones and some taken from two different levels within the swing pit (on the west side of the New House Cone), it is likely that this lack of variation can be explained by the careful control of the raw materials used to produce the colourless glass. Though the majority of the glass

working debris may only be from one main phase of operation of the site, the stratigraphic relation ships of samples A10 and A14 does show that there was little variation over the period of use of the swing pit. Unfortunately at the current time we do not know how long a period these layers represent. However, these layers have to be after the introduction of cylinder glass to Nailsea (late 1830s) as finds were from a swing pit, essential for the manufacture of cylinder glass. We can also suggest that the recipe shown in Table 1 could have been the one used to produce the glass at Nailsea which has been analysed (although it dates to 30 years earlier than the last use of the site) as we find only low potash levels and traces of arsenic in the colourless glasses.

There is not a lot of coloured glass recovered from the material studied but it does suggest a bias towards brown bottle glass. This is unlikely to be colourless glass (of the type analysed) with the addition of a colorant but the colorant does introduce high levels of manganese, magnesium and iron. There is no coloured glass waste in the assemblage, suggesting that these pieces of bottle glass were not made at Nailsea. Further, a bottle base, brown in colour, was found that has BRI… imprinted in the glass. This clearly came from Bristol and is of a similar composition to the brown glass analysed, which may therefore also have been made in Bristol.

The compositions found for the colourless glass are that of the glass produced at Nailsea as we have primary glass waste. These may be isolated to one period of production, but are more like to have been from at least two. The glass is characteristic in that it contains a significant amount of arsenic, suggesting that it was, indeed produced using the materials suggested in the recipe (see Table 1).

There is no evidence in this assemblage for the manufacture of ‘Nailsea type’ glass at Nailsea.

It is also clear from the waste that coal was used as the source of fuel, as was suggested by the documentary evidence and siting of the glass works.

Further work

If there are identifiable pieces of cylinder glass and crown glass from secure contexts it may be possible to determine the composition of the glass and say for certain whether there was a compositional change over time.

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Appendix

Table 9: Samples from box 5 NG83.

Box 5 Bag	NG86	Sample	Weight (g)	Comments
5G	Ashy layer above brick floor area A above pit	2	270	Sieved and sorted (wet 270g)
5H	Soil and mortar from above brick floor area A	1	473	Fizz with HCl
5I	Ash or soot from hole 'drain' area C	3	286	Ash/coal ash
5P	A(10) area A sample of material from fill of pit	5	324	Stones/ash
5Q	A(10)	8	1662	Sieved and sorted (wet 500g)
5R	A(14)	9	1011	Sieved and sorted (wet 500g)
5T	Mortar from wall W9	4	430	Fizz with HCl

Table 10: Samples from NG86

Sample	Context	Plan No	Grid ref	Date		Level	Weight (g)	Comments
(SA04?) A	31	13	280(-)010	02/12/1986	DC		882	Nothing of interest
(SA03?) B	31	13	330(-)005	02/12/1986	DC		1168	Nothing of interest
SA11	45	19	290-010	22/01/1987	PB		299	Soil
SW Airway below context 18+26	27	4+8	004-008	18/10/1986	DMC		682	Compacted soil
SA23				29/05/1987	PB		153	Burnt coal
SA22				29/05/1987	PB		189	Coal/burnt coal
SA010	44	19	297-004	26/01/1987	PB		105	Soil
SW Airway bottom of fill cont. 18	26	4+8	004-008	18/06/1986	DMC		1172	Sieved and sorted (wet 500g)
SA06	31	13	330(-)005	08/12/1986	PB		652	Soil
	24	?		18/11/1986	PB		128	Soil
SA09	43	?	290-010	26/01/1987	PB		386	Soil
SA01	29	8	290-010	27/11/1986	PB	31-882	383	Sieved and sorted (wet 383g)
SA07	33	15	270-010	09/12/1986	PB		179	Soil
SA02	30	8	290-010	27/11/1986	PB		435	Sieved and sorted (wet 215g)
SA08	42	?	279-002	06/01/1987	PB		28	Soil/ash