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IGHTHAM MOTE, IGHTHAM, KENT
PORTABLE XRF ANALYSIS OF THE WINDOW GLASS

TECHNOLOGY REPORT

Brice Girbal and David Dungworth

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SUMMARY

The analysis of historic window glass has been undertaken with the purpose of determining the age the glass. Previous research has established how changes in raw materials and window glass manufacturing technologies are manifested in the composition of the glass and that this can be used as the basis for a glass dating technique. This report contains the analysis of 1,939 panes of window glass from Ightham Mote, Kent. All of the analyses were carried out *in situ* and non-destructively using a portable X-Ray Fluorescence (pXRF) spectrometer. The report contains a discussion of the problems encountered in attempting to obtain reliable data on light elements with pXRF, especially the effect surface corrosion. These problems have prompted a greater reliance on heavy elements, such as rubidium and strontium, whose detection is less affected by surface corrosion. The pXRF data has been analysed to show that 10% of the analysed panes are made of forest glass, that is glass manufactured before the last third of the 16th century. These panes may represent original 14th-century glazing or the alterations and addition to the windows commissioned by Sir Richard Clements in the early 16th century. Chemical analysis indicates that 34% of the analysed panes are made from high-lime, low-alkali (HLLA) glass and so likely to have been manufactured towards the end of the 16th century or during the 17th century. Only 3% of the analysed panes were made using seaweed ash and so datable to the 18th century or first three decades of the 19th century. The remaining 53% of the analysed panes were made using synthetic soda and so datable to the years after c1835. The distribution of the forest and HLLA glass suggests that many of these panes have been re-set and that some may even have been moved from window to window, room to room and possibly building to building.

ACKNOWLEDGEMENTS

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DATE OF RESEARCH

2010–2011

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INTRODUCTION

The preservation of the fabric of historic buildings must include an appreciation of a wide range of architectural materials. While stone and brick components are prominent components of a historic building, some other materials are less highly regarded. The transparency of window glass can occasionally mean that it is less noticed; in extreme cases it may even be replaced with modern glass. This is regrettable as the surface texture and tint of much historic window glass lend character to buildings. An essential requirement for making a historic window glass conservation decision is a clear understanding of the age of surviving glass. If glass is original then it will usually have greater value. This report describes the application of scientific analysis to enhance historic window glass conservation decisions.

AIMS AND OBJECTIVES

English Heritage has undertaken significant research into historic window glass (Dungworth 2011). This research has been divided into two phases. In the first phase samples of historic window glass obtained from a wide range of architectural and archaeological contexts have been analysed using laboratory-based techniques (summarised below). This has established that a series of changes in glass composition have occurred over the past five centuries. The chronological changes in glass composition have been interpreted as the result of the rapid adoption of new technologies and raw materials as these have become available.

The second phase of this project has used a portable X-Ray Fluorescence (pXRF) spectrometer to investigate the chemical composition of historic windows, *in situ* and non-destructively. Several different buildings have been investigated (eg Dungworth and Girbal 2011) and Ightham Mote was selected because of the scale and complexity of the surviving glazing.

HISTORIC WINDOW GLASS: A SUMMARY OF CURRENT KNOWLEDGE

Almost all glass produced in Britain during the medieval period was made using sand and terrestrial plant ashes (primarily bracken) and has a distinctive potassium-rich composition (Dungworth and Clark 2004). The arrival of French glassmakers in the 16th century saw a change to a high-lime low-alkali (HLLA) glass. HLLA glass was probably made using sand and the ash of hardwoods (such as oak). This HLLA glass remained in use until the end of the 17th century when it was superseded by a glass made using sand and seaweed (kelp) ash (Dungworth *et al* 2009; Parkes 1823; Watson 1782). This kelp glass dominated the window glass industry until the early part of the 19th century when it was abandoned in favour of soda-lime-silica (SLS) glass made using synthetic soda (Cooper 1835; Ure 1844; Muspratt 1860).

Table 1. Average chemical composition of historic window glass at different times (Dungworth 2011)

Phase	1	2a	2b	3	4a	4b	5a	5b
Start		*c1567*	*c1600*	*c1700*	*c1835*	*c1870*	*c1930*	*c1960*
End	*c1567*	*c1600*	*c1700*	*c1835*	*c1870*	*c1930*	*c1960*	
Na_2O	2.5±0.3	1.4±0.7	2.4±1.4	7.9±0.7	12.7±0.9	12.9±2.1	13.9±0.5	13.3±0.4
MgO	7.3±0.7	3.4±0.5	3.0±0.7	5.3±0.3	0.2±0.1	0.2±0.2	2.8±0.2	3.8±0.1
Al_2O_3	1.6±0.5	2.8±1.0	3.0±1.3	2.6±0.6	0.6±0.1	1.2±0.3	0.9±0.6	1.3±0.2
SiO_2	55.8±2.5	60.4±1.8	60.9±2.0	66.5±1.4	70.8±1.2	71.9±0.4	72.2±0.7	72.2±0.5
SO_3	0.3±0.1	0.2±0.1	0.4±0.2	0.2±0.1	0.4±0.1	0.4±0.2	0.4±0.2	0.2±0.1
Cl	0.4±0.2	0.3±0.2	0.2±0.1	0.6±0.1	0.1±0.1	<0.1	<0.1	<0.1
P_2O_5	3.2±0.4	2.1±0.2	2.1±0.6	1.1±0.2	<0.2	<0.2	<0.2	<0.2
K_2O	11.4±1.5	5.6±1.6	5.1±1.9	4.2±0.2	0.1±0.1	0.5±0.2	0.1±0.1	0.6±0.1
CaO	15.3±1.6	21.5±1.9	21.1±1.7	10.4±1.0	14.0±0.8	12.9±1.6	9.7±0.8	8.3±0.6
MnO	1.26±0.30	0.94±0.37	0.24±0.20	<0.10	<0.10	<0.10	<0.10	<0.10
Fe_2O_3	0.65±0.13	1.01±0.20	1.31±0.29	0.71±0.14	0.22±0.06	0.21±0.06	0.13±0.03	0.12±0.01
As_2O_3	<0.20	<0.20	<0.20	<0.20	0.22±0.16	<0.20	<0.20	<0.20
SrO	0.07±0.01	0.09±0.02	0.07±0.01	0.45±0.10	0.03±0.01	0.02±0.01	0.01±0.01	0.01±0.01

Nicholas Leblanc invented a process for the manufacture of synthetic soda at the end of the 18th century. Common salt was heated with sulphuric acid to produce sodium sulphate (soda saltcake). The sodium sulphate was then heated with lime and charcoal or coal to produce sodium carbonate. Initially, glass could only be made with sodium carbonate, but glassmakers soon discovered that the sulphate could be used directly if it was combined with charcoal or coal. Glass made for the century or so following the 1830s was a simple soda-lime-silica (SLS) glass with low levels of impurities (Dungworth 2009). The plant ashes used before the introduction of Leblanc soda all naturally contained enough calcium (lime) to ensure that the glass manufactured was durable. Leblanc soda contained no calcium and from the 1830s lime was an essential ingredient in window glass recipes (batch).

The early decades of the 20th century saw the introduction of mechanisation in the window glass industry (Cable 2004; McGrath and Frost 1937). Ultimately, mechanisation allowed continuous production of huge quantities of flat glass; however, it was accompanied by problems of devitrification —small crystals would tend to form in the glass. This problem was overcome by replacing a proportion of the calcium in the batch with magnesium (Turner 1926) and virtually all window glass made in Britain since 1930 has contained 2–5wt% magnesia (Smrcek 2005). An examination of the magnesium content of flat glass produced since the introduction of mechanisation suggests that there are two groups: one with 2.5–3.0wt% MgO and one with 3.5–4.5wt% MgO. Contemporary technical literature does not provide an explanation for this; however, it is likely that the introduction of the float process (Pilkington 1969) saw the re-emergence of devitrification problems which were overcome by increasing the MgO:CaO ratio (from 0.3 to 0.4–0.5, Dungworth and Wilkes 2010).

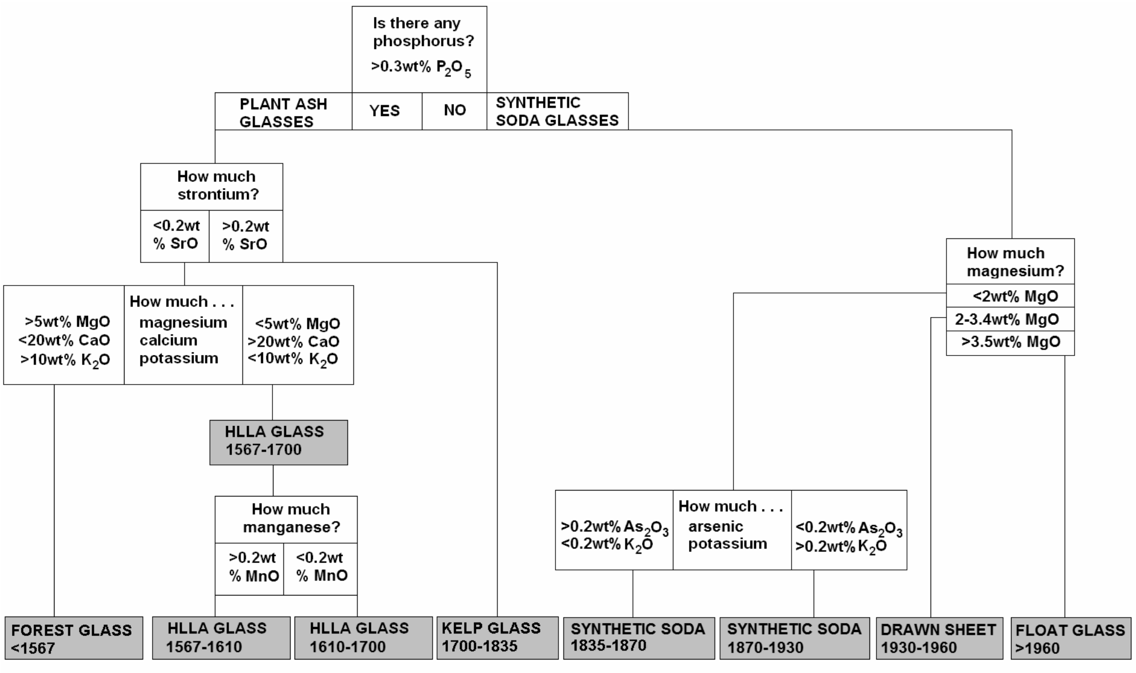

Figure 1. Model for assigning glass to chronologically significant compositional groups (Dungworth 2011)

The chemical analysis of over 800 samples of historic window glass suggests that such glass can be quickly assigned to a chronologically significant compositional group on the basis of a small range of oxides (especially MgO, P_2O_5, SrO, MnO and As_2O_3). A model for this process is given as Figure 1 and typical glass for each chronological phase is summarised in Table 1.The chemical analysis of window glass can provide important information about the date of manufacture and its installation. This information can provide a sound basis for informed conservation (Clark 2001) of historic window glass. Knowing the date of individual panes of glass in a building will allow the identification of original glazing and later repairs and replacements. This understanding is an essential prerequisite for appropriately valuing and managing the window glass in historic buildings (cf English Heritage 2005). The use of laboratory-based techniques can provide the necessary information; however, this is only possible where a window is broken or is undergoing renovation (cf Dungworth and Loaring 2009; Freestone *et al* 2010). As such this approach is of limited use for providing information about *in situ* glass. The solution proposed in this report is the use of a portable X-Ray Fluorescence (pXRF) spectrometer which will allow non-destructive *in situ* analysis.

IGHTHAM MOTE: ARCHITECTURAL BACKGROUND

Ightham Mote is a large, well-preserved moated site which is owned by the National Trust. The earliest surviving buildings, comprising an open hall, two solar ranges and a chapel (Figure 2), were thought to be constructed by Sir Thomas Cawne and dated to 'the middle years of Edward III's reign' (Starkey 1982). More recent research has shown that construction took place in the fourth decade of the 14th century (Pearson *et al* 1994, 74) and has indicated that there is no documentary evidence linking Cawne to Ightham Mote prior to the 1370s (Pearson 1994, 31).

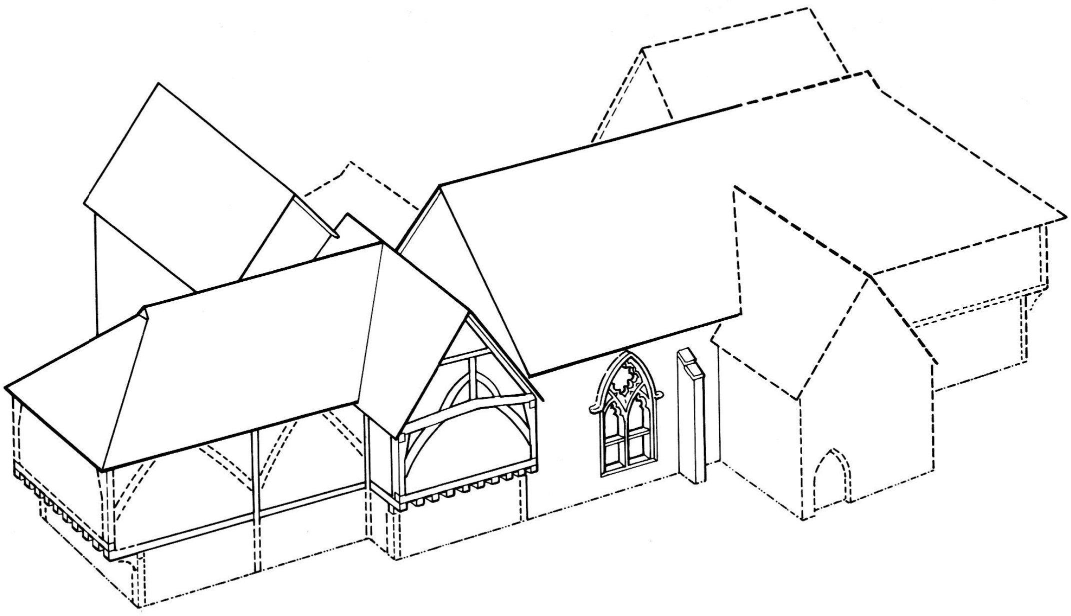

Figure 2. Reconstruction of the 14th-century buildings at Ightham Mote (Pearson et al *1994, Figure 22)*

The 14th-century buildings lie within what is now the eastern range — the western range being added in the late 15th century by Edward Haut, who probably also enclosed the courtyard (Pearson 1994, 128). Sir Richard Clement purchased Ightham Mote in 1521 and commenced a programme of repairs and alterations to support his aspirations for advancement at the royal court (Starkey 1982). The house was embellished with Tudor symbols (Figure 3), including the Tudor rose and the pomegranate of Granada (an explicit reference to Henry VIII's marriage to Catherine of Aragon, and allowing this glass to be dated to 1521–1529). Armorial glass in some first-floor windows of the gatehouse (W37 and W38, see Figure 4) appears to represent Clement's arms and commemorate both of his marriages (Anne Whittlebury in 1510 and Anne Barley c1530). The current setting of these windows suggests that the armorial badges have been retained but that the surrounding plain glass is later (late 18th century or early 19th century).

Figure 3. Ightham Mote window W02 (detail) containing Tudor badges

Figure 4. Ightham Mote window W37 containing Clement's armorial badges

The New Chapel was built by Clement and contains a richly decorated ceiling (Starkey 1982); however, the extant glass has an unusual provenance. Although it is thought that at least some of the glass is 16th century in date, much of it is of German origin (probably St Peter's, Cologne) from the Hampp hoard and only installed in the 19th century (Marsh 2009). The wide variety of glass tints in the plain glass panes of the windows in the New Chapel (as well as many other windows at Ightham Mote) suggests the collection of glass from several different sources (Figure 5). The glass in other windows (eg W01, W02, W57 and W58) includes several different sizes of pane and suggests that they have also been glazed using glass from multiple sources (see Figure 12, Panel 1).

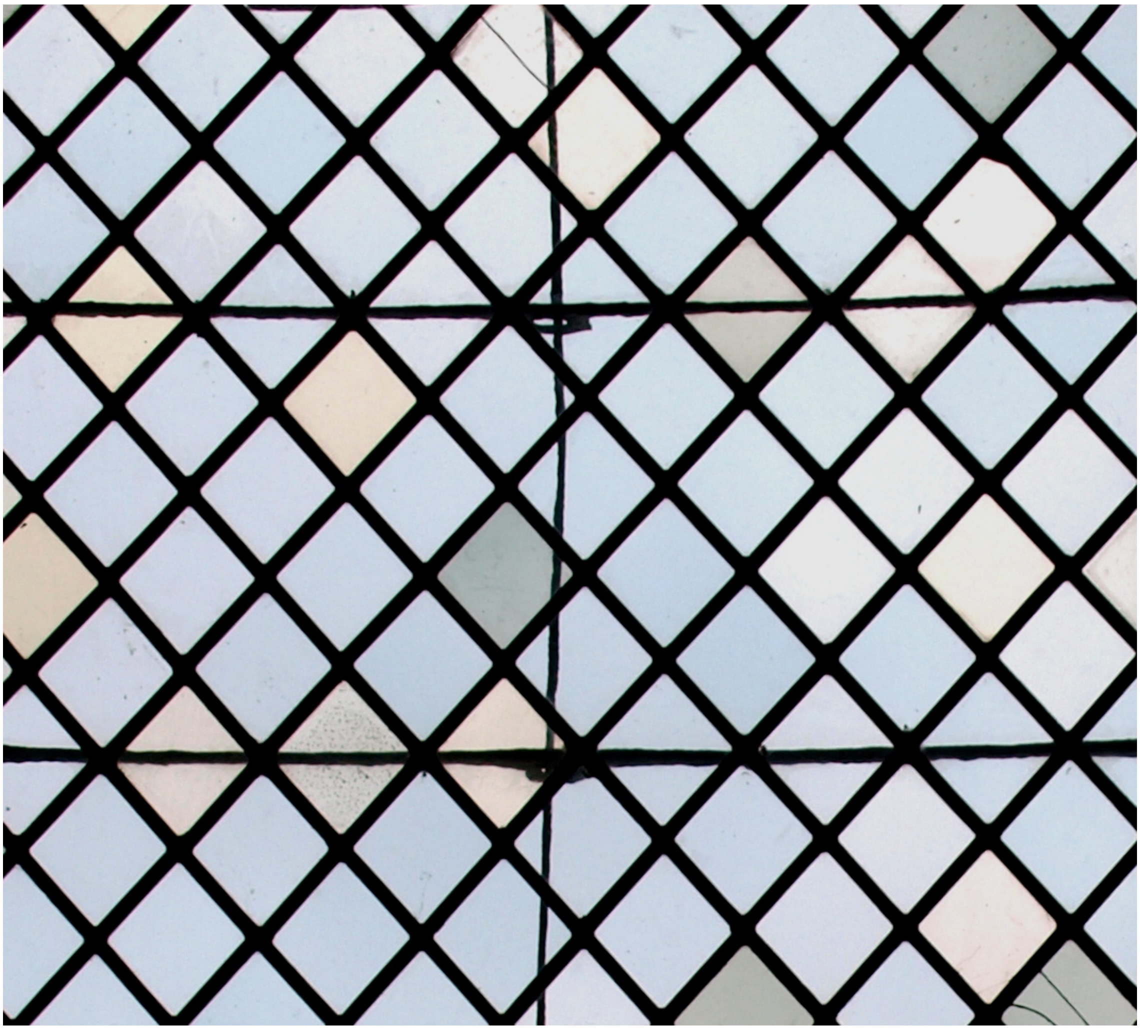

Figure 5. Ightham Mote window W45 (detail) showing a variety of glass tints

Ightham Mote was bought by the Selby family in 1591 and they retained ownership until the late 19th century. Sir William and Dame Dorothy Selby (1611–1641) developed the drawing room, rooms on the western range and the 'Jacobean' staircase.

According to Newman (1980, 345) most of the western and southern ranges were re-windowed c1800 with pointed windows and intersecting glazing-bars (Figure 6). In addition, the northern window of the drawing room (W40) contains 'an unexpected 18th-century Venetian window, superimposed on a large Jacobean window' (Newman 1980, 345). The painted glass roundel in this window (the Selby family symbol) is signed Eginton and dated 1810 — William Raphael Eginton was active from 1805 (Figure 7).

Figure 6 Ightham Mote window W07. Late 18th- or early 19th-century window

Figure 7. Ightham Mote window W40 with the painted roundel signed Eginton 1810

Sir Thomas Colyer-Fergusson purchased the house in 1889 and undertook an extensive repair programme. It is known that many parts of the house underwent significant restoration at this time (Starkey 1982) and it is possible that some windows were altered. Colyer-Fergusson owned the property until his death in 1951. His grandson sold the house itself to a local consortium which hoped to renovate and preserve it. This proved to be beyond their means and in 1953 it was sold to Charles Henry Robinson. On his death in 1985, he bequeathed the house to the National Trust, who started a major programme of renovation in 1989.

The architectural history of Ightham Mote suggests that the extant windows have a variety of origins. It is possible that a very small amount of glass may be medieval in date; it is likely that a significant proportion of the glazing is of 16th-century date, although some of this is of German origin and only installed in the 19th century. Some windows can be easily identified as 18th- or 19th-century replacements. Other contemporary windows are likely to have made extensive use of older glass.

METHODS

The pXRF instrument chosen to undertake the *in situ* non-destructive analysis of the historic window glass at Ightham Mote was a Niton XL3t (Cu/Zn Mining Mode) which allowed the simultaneous determination of the concentration of over 20 elements including almost all of those determined using the laboratory-based techniques. The only element which was routinely determined using laboratory-based techniques but which could not be determined with the Niton XL3t was sodium. The Niton X3Lt uses a helium flush to improve the detection of light elements (especially magnesium, aluminium, silicon and phosphorus) but it was still not possible to determine sodium.

The duration of each analysis was minimised to allow the collection of data from the largest possible number of panes (see Dungworth and Girbal 2011 for details). The analysis of a wide range of reference materials allowed the estimation of the likely analytical errors, precision and limits of detection (Table 2). For the light elements the accuracy and limits of detection are slightly inferior to the data that can be obtained using laboratory-based techniques and this is most marked for the lightest elements (especially magnesium). For heavier elements the accuracy and limits of detection are equal to or superior to those obtainable with laboratory-based techniques.

Table 2. Error and limit of detection (LoD) for the analysed oxides

Oxide	Error (1 sd)	Precision (1 sd)	LoD
MgO	0.3	0.3	2.0
Al_2O_3	0.7	0.1	0.5
SiO_2	1.1	0.8	NA
P_2O_5	0.1	0.1	1.0
SO_3	0.05	0.02	0.2
Cl	0.05	0.02	0.2
K_2O	0.3	0.05	0.1
CaO	0.8	0.5	0.05
MnO	0.02	0.01	0.001
Fe_2O_3	0.05	0.01	0.001
CuO	0.02	0.01	0.001
ZnO	0.01	0.01	0.001
As_2O_3	0.01	0.005	0.001
Rb_2O	0.001	0.0002	0.001
SrO	0.005	0.0002	0.001
ZrO_2	0.005	0.0002	0.001

Tests undertaken on a range of flat glass have shown that a range of factors can have an impact on the quality of the chemical data that can be obtained using pXRF (Dungworth and Girbal 2011; Dungworth *et al* 2011). Tests on identical glass of varying thickness have detected systematic errors where the glass thickness is less than 2mm (Dungworth and Girbal 2011, Figure 4). The analysis of glass which has an applied layer of UV-absorbing film shows that light elements (up to calcium) are attenuated by such films and the degree of attenuation is inversely proportional to atomic number (Dungworth and Girbal 2011,

Figure 5). The pXRF analysis of weathered glass (especially where results could be directly compared with laboratory-based analyses of the same glass) has shown that it can be very difficult to obtain reliable, quantitative results from such glass (Dungworth and Girbal 2011, Table 6; Dungworth *et al* 2011). The effect of surface corrosion on the apparent composition of window glass as determined by pXRF has recently been examined in relation to some of the window glass from Thornhill church (Dungworth *et al* 2011). The weathered surface of glass usually has a different chemical composition to that of the uncorroded glass — in particular, it often contains reduced levels of alkalis and some other elements. Low-energy X-rays (typically <3kV) characteristic of light elements (Mg–K) are easily absorbed and a corroded surface may completely absorb such X-rays (leading to a reduction in their apparent concentration, or even a failure to detect them completely). The degree to which the pXRF detection of light elements will be affected by surface corrosion will be in inverse relationship to the atomic number of the element in question. The phenomenon will also be most marked in those glasses which display the most severe surface corrosion.

The examination of the data obtained from the pXRF analysis of historic window glass at Ightham Mote quickly showed that corrosion and other factors had a significant impact on the apparent chemical composition. Some panes of glass could easily be assigned to a particular glass type within the model proposed by Dungworth (2011) but others had compositions which could not be reconciled with the model described above (cf Figure 1). Some pXRF analyses indicated potassium and calcium concentrations that were well within conventional limits for HLLA glass but no phosphorus was detected. The absence of phosphorus would, according to the proposed model (Dungworth 2011), lead to these panes of glass be assigned to a post-1830, synthetic soda SLS group.

There are additional problems with some of the Ightham Mote pXRF data, although these only became fully apparent months after the data was acquired. Data was collected over a period of five days (Monday to Friday). On Thursday the protective polyimide film in front of the detector was replaced twice. The purpose of the film is to prevent dust and other material accidentally entering the instrument and damaging delicate components (such as the detector window). In addition, the protective film serves to maintain the helium flush inside the instrument when this is employed. The film is very thin (to reduce the attenuation of low-energy X-rays) and so is easily damaged. A visual examination of the film shortly before midday on Thursday prompted the replacement of the film. This was repeated at the end of the working day on Thursday. If all of the SLS glass results are examined in the order in which they were collected (Figures 8 and 9) it is apparent there are two periods on Thursday (9am to 12 noon, and 4:30pm to 7:00pm) when the results are anomalous (reduced silicon and spurious phosphorus measurements). With hindsight, it can be suggested that the protective film was compromised between 4pm Wednesday and 9am Thursday leading to a degradation of the helium flush and consequent effects on

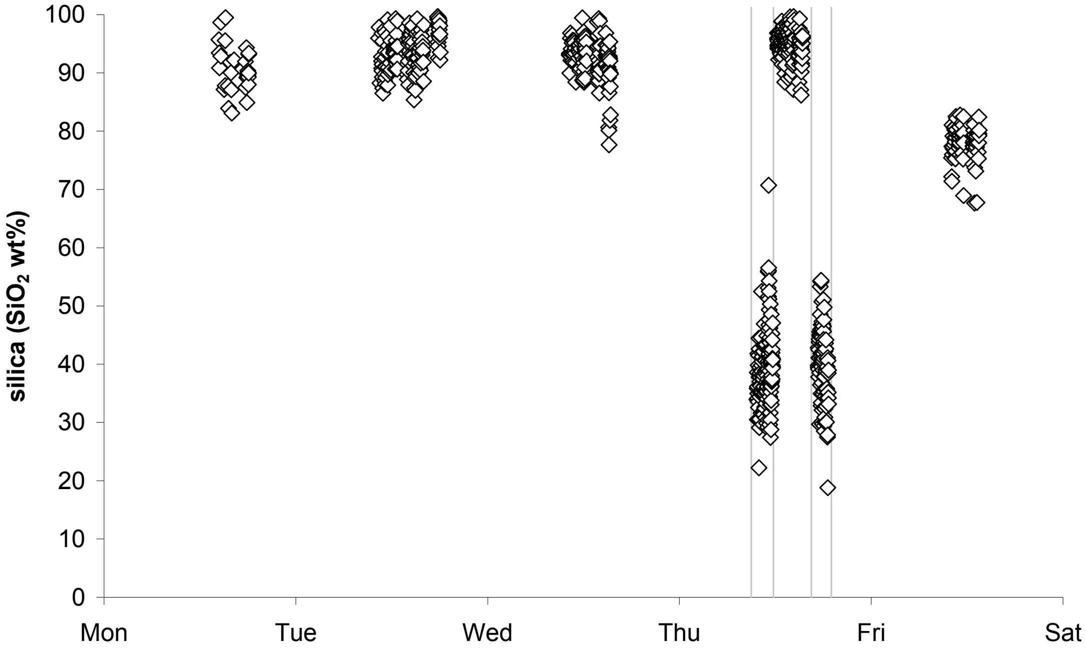

Figure 8. Apparent silicon concentration in all analysed SLS glass showing the effects of two episodes on Thursday when the protective film was compromised

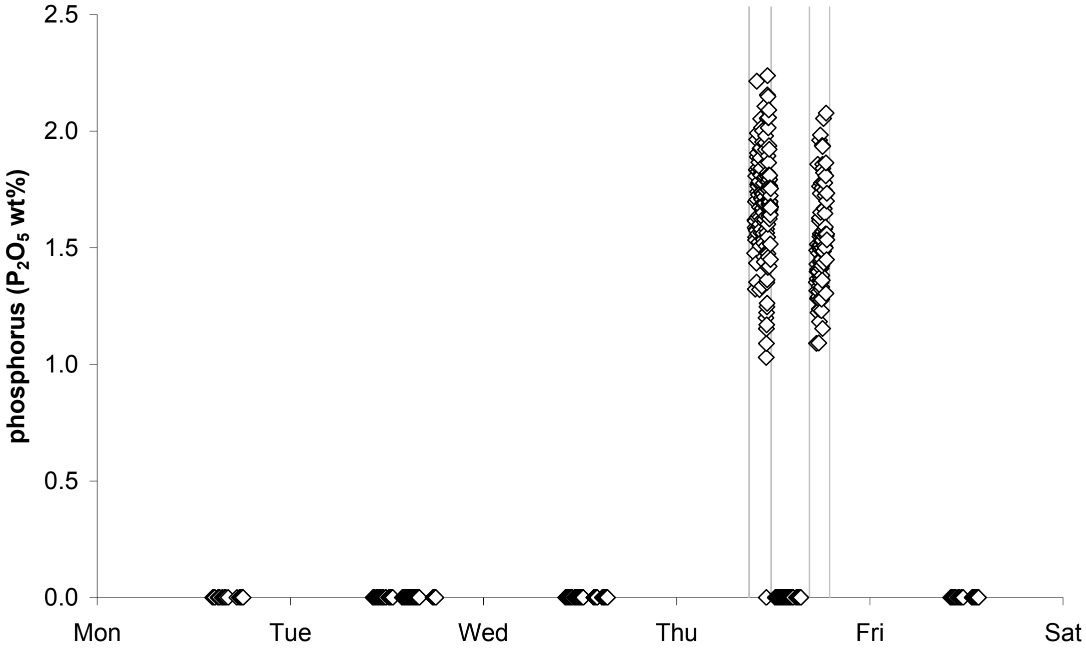

Figure 9. Apparent phosphorus concentration in all analysed SLS glass showing the effects of two episodes on Thursday when the protective film was compromised

the determination of many light elements. The reported silicon concentrations (Figure 8) are significantly lower than those on other days (and magnesium and aluminium were not detected in any of these samples). In addition the pXRF reports the detection of phosphorus in these samples even though this element should be absent from SLS glass made using synthetic soda (Figure 9). The replacement of the protective film at Thursday lunchtime ensured subsequent data were reliable, but that the problem recurred in the mid-afternoon.

While the Dungworth (2011) model can be easily applied to quantitative data obtained through laboratory-based analyses of prepared samples, it appears to be less reliable when pXRF is applied to weathered glass. The data available so far suggest that this unreliability is most marked for the older and most weather glass.

In order to overcome the limitations imposed by the effects of weathering (and other factors) on the pXRF *in situ* analysis of window glass, the chemical composition of different types of glass has been reconsidered. The pXRF data appears to be least likely to be altered by weathering (and other effects) for heavy elements (eg rubidium and strontium). In addition, the pXRF actually offers superior limits of detection, accuracy and precision for these heavy elements (compared to the laboratory-based instruments used during the first phase of this project). While data collection for these heavier elements was not systematically carried out for these heavier elements during the first phase of the project, sufficient data is available to suggest that the major glass types described in Figure 1 can also be identified using just the concentrations of rubidium and strontium (Figure 10).

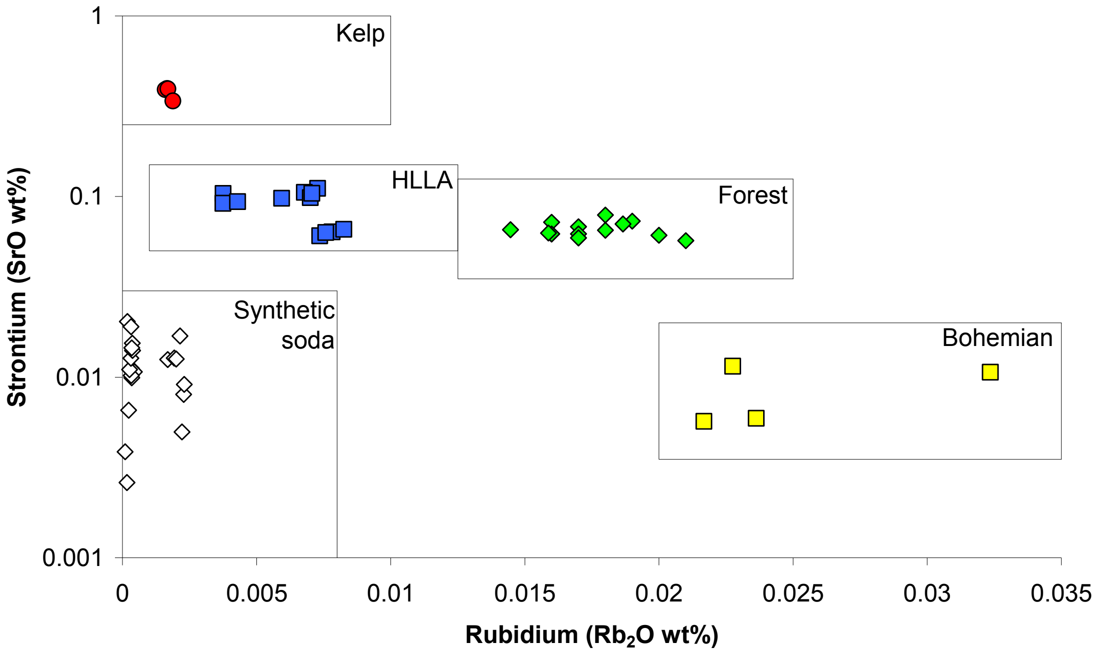

Figure 10. Rubidium and Strontium concentrations for some samples of historic glass (using data from Dungworth and Paynter 2010; Dungworth and Girbal 2011; unpublished ICPMS data)

RESULTS

A total of 1939 panes of glass from 32 windows were analysed using the pXRF; the data are reported in full in the appendices. The results are discussed below on a room by room (and occasionally window by window) basis. In some cases every available pane of glass was analysed (although panes smaller than the head of the instrument [~5cm] could never be analysed) but in most cases a selection of panes was made.

Great Hall

The Great Hall contains two windows (W01 and W02). W01 is in the Decorated style and probably originated as part of the original building; it does not, however, seem to be in its original location (Fowler and Kenwright 1988, 2). If this window has been moved then it is likely that at least a proportion of the glass will not be original. W02 is in the Perpendicular style and can be closely dated. The use of royal Tudor badges and badges commemorating the marriage of Henry VII and Catherine of Aragon indicate that the window was commissioned by Sir Richard Clement. As Clement only bought Ightham in 1521 and Henry approached the Pope for an annulment for his marriage to Catherine in 1529, the window must have originated in this period. Several glaziers have added their names and dates (James More 1793 and W Baker 1799) to panes in W02 and this has been interpreted by Starkey as representing the resetting of the glass. The variety of tints within this window, however, may indicate that at least a proportion of the extant glass represents later replacements (some possibly at the end of the 18th century).

W01

This window contains a total of 473 separate panes of glass in five panels. The glass comprises small diamond-shaped panes of varied surface finish and tint — although none appear to be deliberately coloured. A total of 67 panes from four panels were analysed (14%); due to limited access none of the panes from the top central panel were analysed (Table 3). Even for those panels which were accessible, some panes were too small (<5cm across) to allow analysis with the pXRF.

The panes can be divided into a series of groups based on their tint and chemical composition. The most abundant group is a pale blue-green high-lime low-alkali glass (33 panes). This glass type could be identified through its calcium content, however, the apparent composition of a few panes diverged from the model set out previously (Figure 1). Magnesium and phosphorus have been seen as important indicators of the use of plant ashes (Dungworth 2011) but the pXRF failed to detect these elements (Figure 11) in seven of the HLLA panes (ie a ‘failure’ rate of 21%). As discussed above, this ‘failure’ is likely to be due to the presence of corrosion on the surface of the glass. The trace elements rubidium and strontium provide a strong separation between the plant ash glasses (HLLA in this case) and the synthetic soda SLS glasses (Figure 12). Trace elements in the HLLA glass (eg manganese, arsenic, rubidium, strontium and zirconium) suggest the presence of two slightly different compositional groups. HLLA1 has a rather low manganese content and may have been manufactured in 17th century (Phase 2b in Table 1), while HLLA2 has a higher manganese content and may have been made in the late 16th century (Phase 2a in Table 1).

Table 3. W01 panes analysed

Panel	Ref	Total	Analysed	Rate (%)
Top central		57	0	0
Upper left	1	112	18	16
Upper right	2	110	19	17
Lower left	3	97	15	15
Lower right	4	97	15	15
All		473	67	14

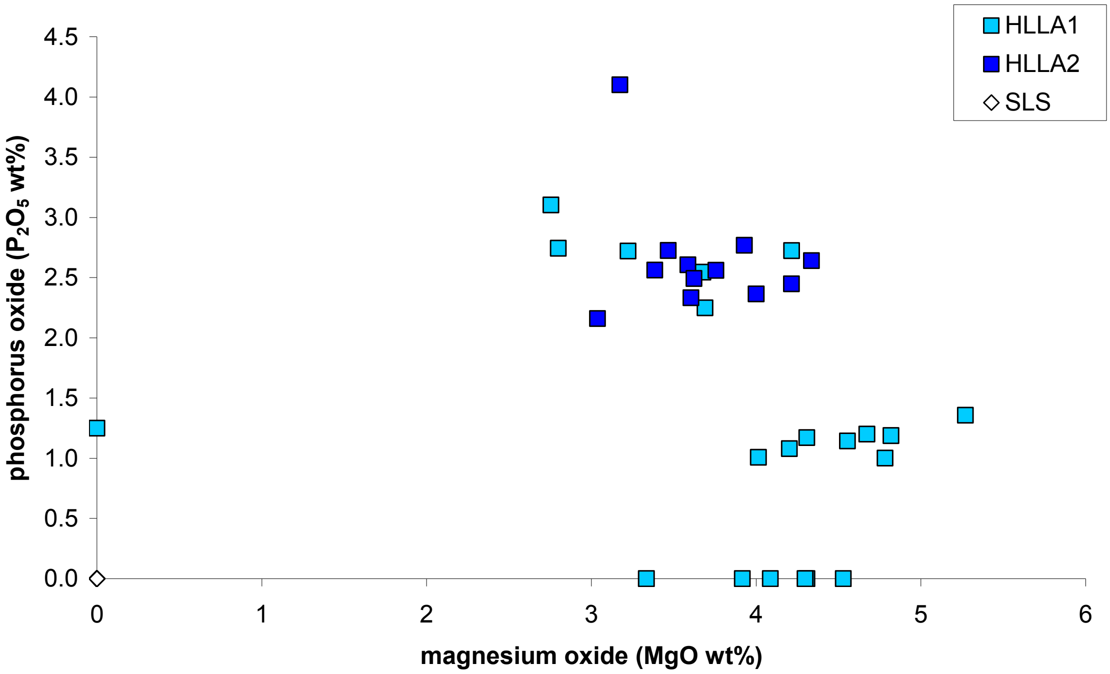

Figure 11. Magnesium and phosphorus content of the analysed panes from W01. The low levels of phosphorus detected in some of the HLLA glass (and its apparent absence from some samples) is likely to be due to the effects of surface corrosion.

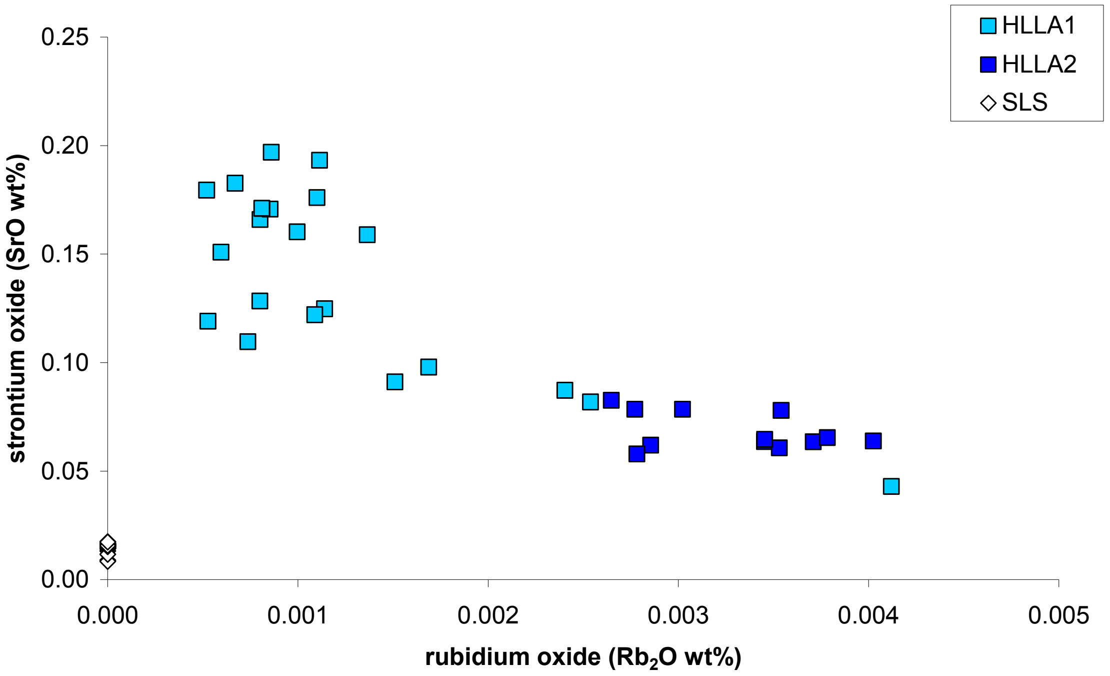

Figure 12. Rubidium and strontium content of the analysed panes from W01

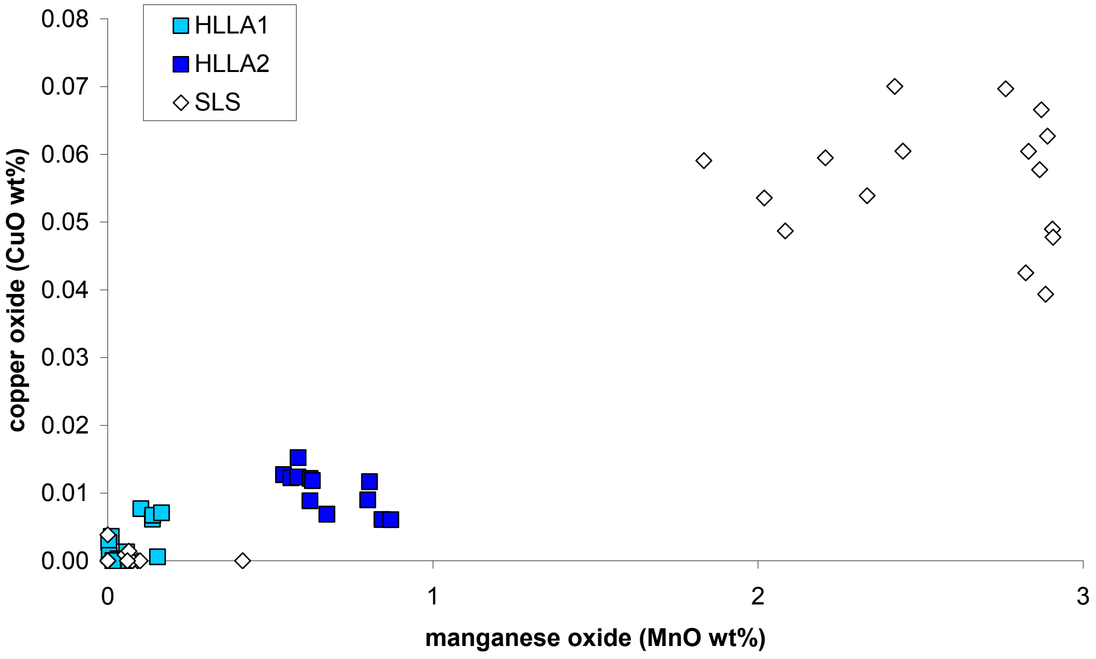

Figure 13. Manganese and copper content of the analysed panes from W01

All but one of the remaining analysed panes (8 pale green, 8 pale amber and 17 colourless) are made from soda-lime-silica (SLS) glass typical of the period from c1835 to c1930 (Phase 4 in Table 1). The colourless SLS has a low iron content and in most respects resembles ordinary plain glazing of the 19th century (cf Table 1). The amber and pale green SLS glass contain elevated levels of manganese, iron and copper (Figure 13, Table 4). It is likely that these elements were deliberately added to ordinary SLS glass in an attempt to achieve tints which would match those of the HLLA glass.

Table 4. Average composition of the main glass types from W01

Type	MgO	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Rb_2O	SrO	ZrO_2
HLLA1	3.9	1.3	2.5	22.3	0.05	1.17	<0.01	0.001	0.142	0.009
HLLA2	3.7	2.6	3.9	25.6	0.68	1.21	0.01	0.003	0.068	0.031
SLS (clls)	<2	<1	<0.1	14.3	0.07	0.20	<0.01	<0.001	0.014	0.005
SLS (amber)	<2	<1	0.1	12.6	2.87	0.62	0.05	<0.001	0.016	0.003
SLS (pl gr)	<2	<1	0.1	13.1	2.26	0.92	0.06	<0.001	0.014	0.005

W02

Window W02 comprises over 1600 panes of glass (Figure 14). Most of these are small diamond-shaped panes of varied surface finish and tint. Due to limitations of physical access and time a selection of panes were analysed but this included most of those panes that were readily accessible.

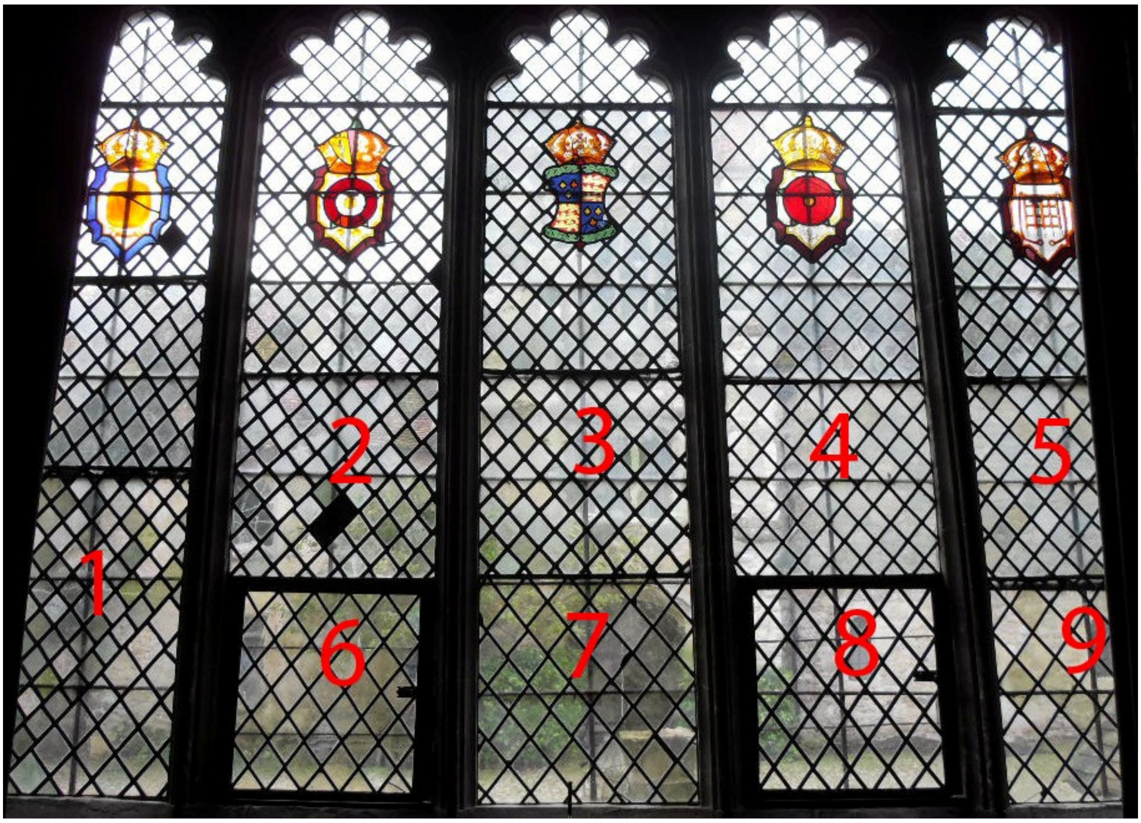

Figure 14. W02 showing the location of the analysed panels (note the different sizes of pane in Panel 1)

A total of 418 individual panes of glass from nine different panels were analysed (Figure 14, Table 5). For most of these panels all of the glass that could be analysed was analysed — the remaining panes being too small for pXRF analysis. The window contains a further 11 panels with approximately 920 panes which were not analysed. The upper parts of the window (including the decorated 16th-century glass) were not accessible. Overall, approximately 26% of the panes from this window were analysed.

Table 5. W02 panes analysed (does not include details of the unanalysed panels)

Panel	Total	Analysed	Rate (%)
1	125	96	77
2	86	54	63
3	90	60	67
4	95	47	49
5	90	60	67
6	48	30	63
7	60	31	52
8	49	9	18
9	55	31	56
All	698	418	60

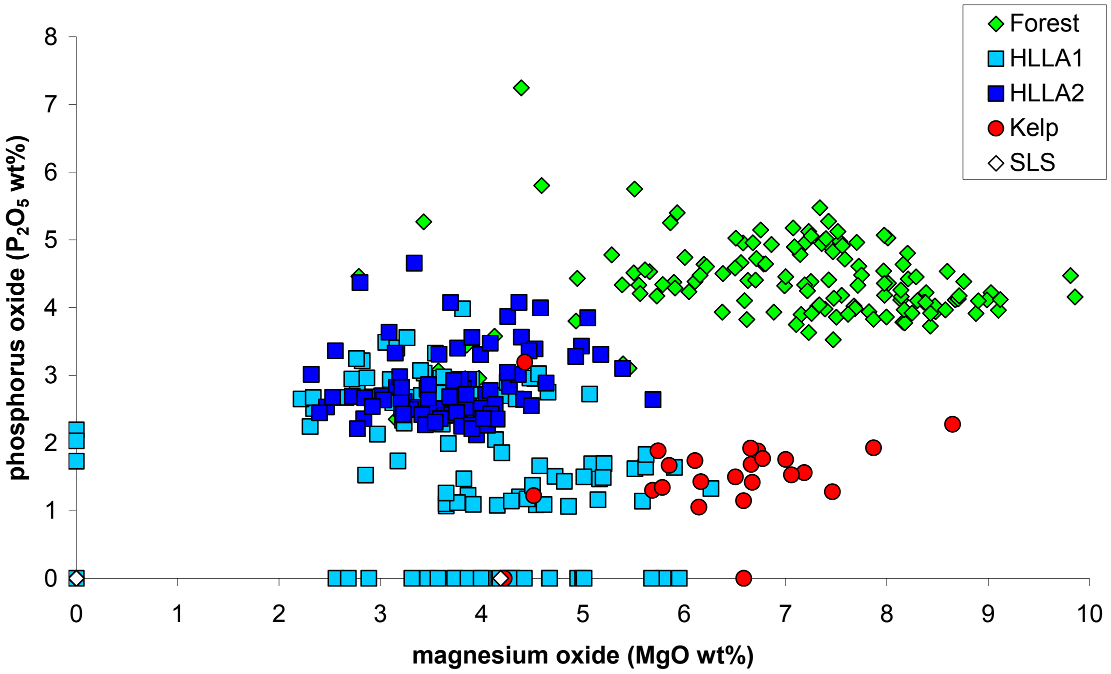

Figure 15. Magnesium and phosphorus content of the analysed panes from W02. The low levels of magnesium and phosphorus detected in some of the HLLA and kelp glass (as well as the apparent absence of these elements from some samples) is likely to be due to the effects of surface corrosion.

A careful consideration of the chemical compositions (including major and minor components, as well as trace elements) indicates that W02 contains 137 panes of forest glass, 204 panes of HLLA glass, 24 panes of kelp glass and 55 panes of SLS glass (Table 7). In many respects the apparent chemical compositions correspond to the model set out previously (Table 1; Figure 1). On average, the forest glass contains more magnesium, phosphorus and potassium than the HLLA glass, while the kelp glass contains more magnesium than the HLLA glass, but less phosphorus (Figure 15). Nevertheless, the pXRF failed to detect either magnesium or phosphorus in 29 panes of HLLA glass (all from HLLA1) and 2 of the kelp panes (failure rates of 7% and 2%). The heavy, trace elements, however, allowed the accurate identification of the principal glass types (Figure 16).

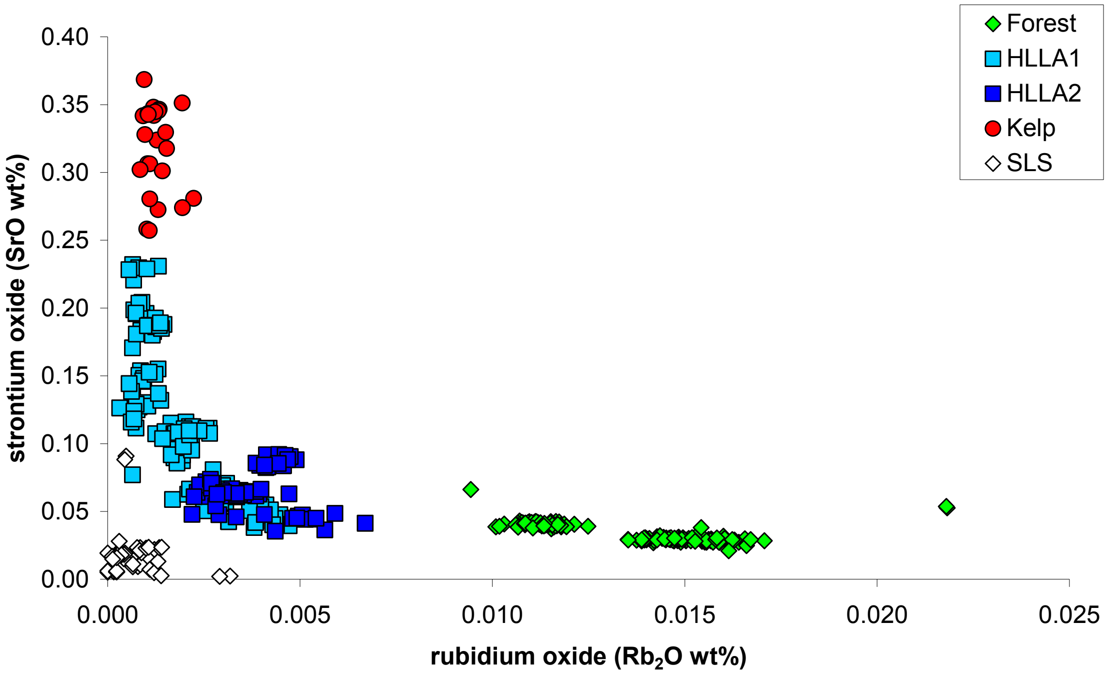

Figure 16. Rubidium and strontium content of the analysed panes from W02

The concentrations of a variety of minor and trace elements suggest the presence of several compositional sub-groups (Tables 6 and 7).

The forest glass can be divided into two sub-groups (as well as several outliers). Despite the differences in a few minor and trace elements (eg iron, copper, rubidium and strontium) these two glasses share almost identical overall compositions. It is likely that these two forest glasses were made using very slightly different raw materials. The significance of these differences is not immediately apparent. It is likely that these two glasses were made at different times or in different places, however, there is insufficient data available on medieval forest glass to allow a definitive statement. Nevertheless, the existence of two sub-groups and the limited variation within each suggests that these two sub-groups represent two different batches of glass manufacture. It is striking that this same division is apparent in forest glass from the New Chapel (see below).

The separation into HLLA1 and HLLA2 corresponds to that seen in W01 (higher manganese, copper, zinc, arsenic and zirconium in the latter sub-group) and the first sub-group (Phase 2a in Table 1) is probably earlier than the latter (Phase 2b in Table 1). The trace elements in both of these groups show some clustering which indicates at least the presence of several batches. These fine sub-groups may indicate glass obtained at different periods or from different sources, however, there are insufficient data on HLLA glass to allow any definitive statement. Some of these compositional clusters appear to be similar to some of those identified in other windows, such as those of the New Chapel (see below).

The presence of 24 panes of kelp glass was clearly identifiable through elevated strontium content (Table 7; Figure 16). Other aspects of the composition of this glass type, such as the low manganese content, are paralleled in kelp glass analysed previously.

The SLS glass present in W02 is identifiable through its low levels of strontium and rubidium (Figure 16). There are two analysed panes (W02.04.10 and W02.07.09) which in most respects appear to be SLS glass but which contain much higher levels of potassium (4–5wt% K_2O) than would be anticipated from previous work (cf Table 1). The potassium concentration is much lower than the 'Bohemian' glass identified at Walmer Castle (Dungworth and Girbal 2011). The low levels of rubidium and strontium suggest the glass was not made using a plant ash and so it has been grouped with the SLS glass (this glass type is designated HiK).

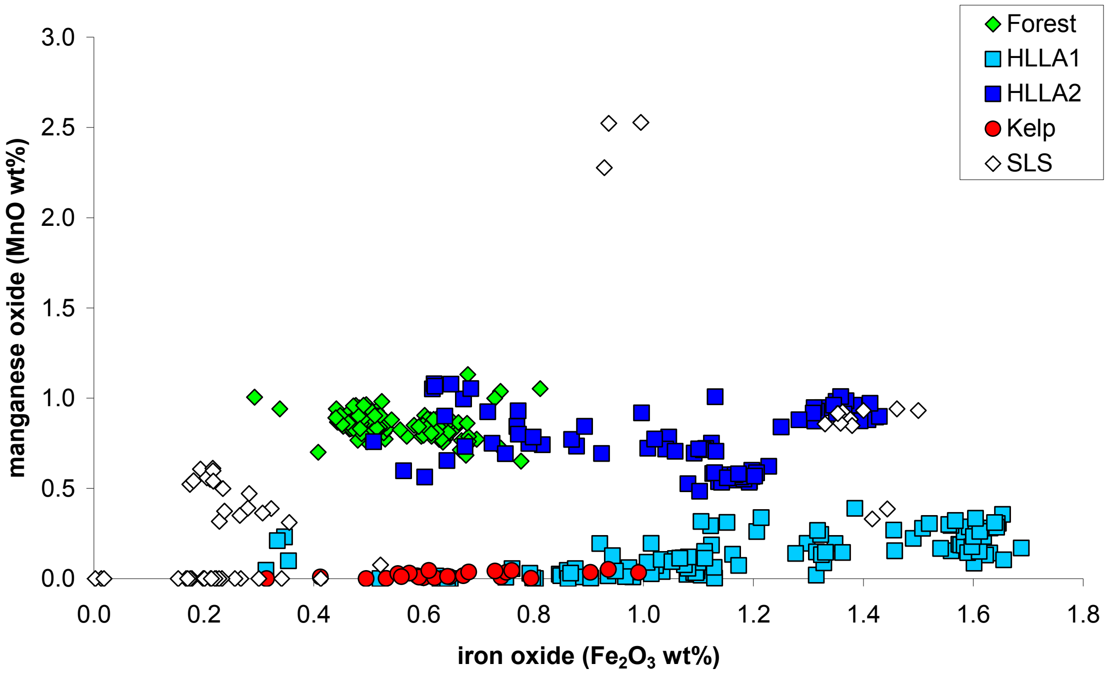

Figure 17. Iron and manganese content of the analysed panes from W02

Most of the SLS panes have iron and calcium contents that are typical of the 19th century (Phase 4 in Table 1), although some have much higher levels of iron (~1.4wt% Fe_2O_3). It is likely that the SLS glasses with elevated iron (Figure 17) were deliberately formulated to have a distinct colour in an attempt to match the colour of medieval window glass (cf Dungworth *et al* 2010). This SLS glass does not, however, match the deliberately coloured SLS glass in W01 — this suggests that the installation of deliberately coloured SLS glass as part of the restoration of these two windows occurred at different times (or that the work was carried out by two different workshops).

Table 6. Average composition of the main glass types from W02

Type	MgO	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Rb_2O	SrO	ZrO_2
Forest1	6.3	4.7	9.4	15.8	0.82	0.64	0.03	0.011	0.041	0.014
Forest2	7.7	4.2	9.5	14.9	0.87	0.49	0.01	0.015	0.029	0.012
HLLA1	3.8	1.8	3.6	21.4	0.14	1.18	<0.01	0.002	0.116	0.012
HLLA2	3.7	2.9	4.5	24.0	0.78	1.06	0.01	0.004	0.069	0.027
Kelp	6.2	1.5	3.6	11.0	0.02	0.64	<0.01	0.001	0.306	0.005
SLS (clls)	<2	<1	0.5	14.4	0.19	0.23	<0.01	0.001	0.011	0.005
SLS (amber)	<2	<1	0.1	12.7	2.44	0.95	0.06	<0.001	0.016	0.005
SLS (v pl gr)	<2	<1	0.7	17.1	0.90	1.39	<0.01	0.001	0.023	0.008

Table 7. Proportion of different glass types within different panels of W02

Panel	Forest	HLLA1	HLLA2	Kelp	SLS	All
1	11 (11%)	22 (23%)	42 (44%)	3 (3%)	18 (19%)	96
2	27 (50%)	6 (11%)	14 (26%)	0 (0%)	7 (13%)	54
3	40 (66%)	7 (12%)	7 (12%)	0 (0%)	6 (10%)	60
4	18 (38%)	15 (32%)	2 (4%)	10 (21%)	2 (4%)	47
5	41 (68%)	8 (13%)	9 (15%)	2 (3%)	0 (0%)	60
6	0 (0%)	16 (53%)	9 (30%)	4 (13%)	1 (3%)	30
7	0 (0%)	20 (64%)	0 (0%)	3 (10%)	8 (26%)	31
8	0 (0%)	0 (0%)	0 (0%)	0 (0%)	9 (100%)	9
9	0 (0%)	25 (81%)	0 (0%)	2 (6%)	4 (13%)	31
All	137 (33%)	119 (28%)	83 (20%)	24 (6%)	55 (13%)	418

In panel 1, all of the forest, kelp and HLLA2 glass is found in the top left section of the window (ie the region with the smaller panes). The bottom right portion with the larger panes is made from HLLA1 and SLS glass (Figure 18). The distribution of SLS glass (eg the placement of a coloured pane in-between two colourless panes) suggests that the coloured and colourless panes were carefully placed to blend as much as possible with the existing glass. It is likely that the coloured SLS glass was deliberately made in order to blend with existing older glass panes, however, these panes generally have a stronger colour than the HLLA and forest glasses they were supposed to match. The variety of glass types (as well as pane size) suggest that this window was assembled using glass from several different earlier windows. The presence of a high proportion of HLLA glass could indicate that the window has a 17th-century origin. The presence of SLS glass indicates repairs (and possibly a complete assembly) occurred in the 19th century.

Figure 18. W02 Panel 1 showing the spatial distribution of glass types (green = forest glass; pale blue = HLLA1; dark blue = HLLA2; red = kelp; white = SLS [c = colourless, a = amber, vpg = very pale green], grey = not analysed)

Panels 2–5 display some similarities, in particular they all contain a high proportion of forest glass (Figures 19–22). Two-thirds of the glass in panels 3 and 5 is forest glass and this glass would have been manufactured before the late 16th century. This glass is of the general type that would have been used to make the Clement window (1521–1529); however, there is no certainty that any of this glass is original to this window.

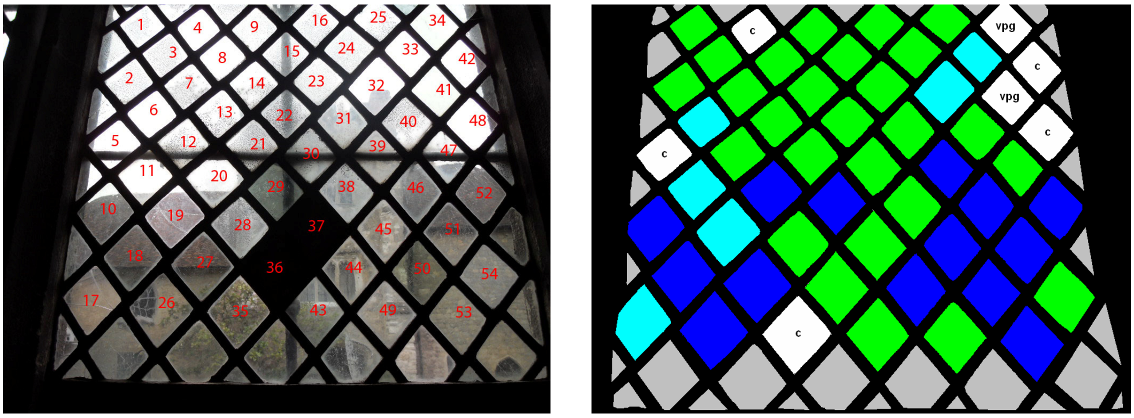

Figure 19 W02 Panel 2 showing the spatial distribution of glass types (see Figure 18 caption)

As mentioned above, the trace elements (especially rubidium) suggest the presence of two sub-groups of Forest glass but examples of both sub-groups are present in each of these panels. The window clearly underwent extensive repair and restoration at some later date and, while this made use of medieval glass, this may not have originally been in this window.

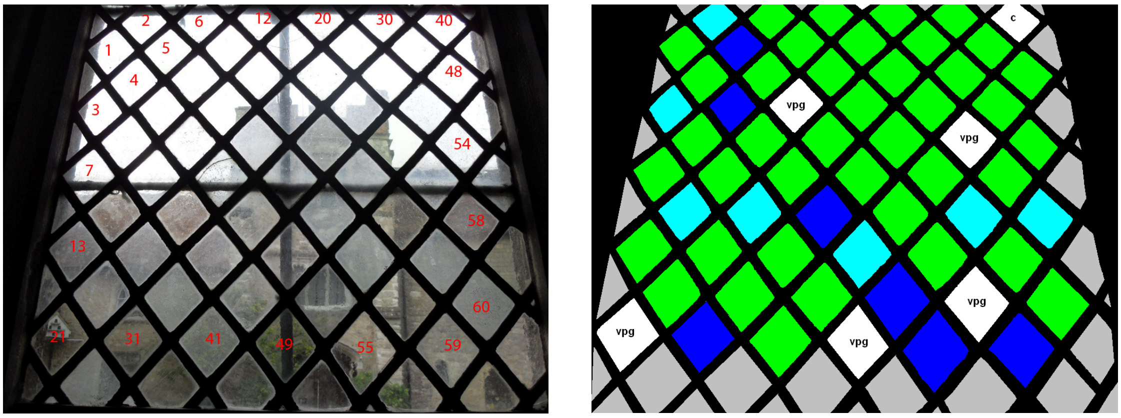

Figure 20 W02 Panel 3 showing the spatial distribution of glass types (see Figure 18 caption)

The presence of HLLA, kelp and SLS glass indicates that some repair occurred after the late 16th century. It is possible that repairs were carried out as an when required over the following centuries, however, there are some indications that the windows are largely the product of rather late repair and that much of the HLLA and kelp glass was anachronistic when it was installed.

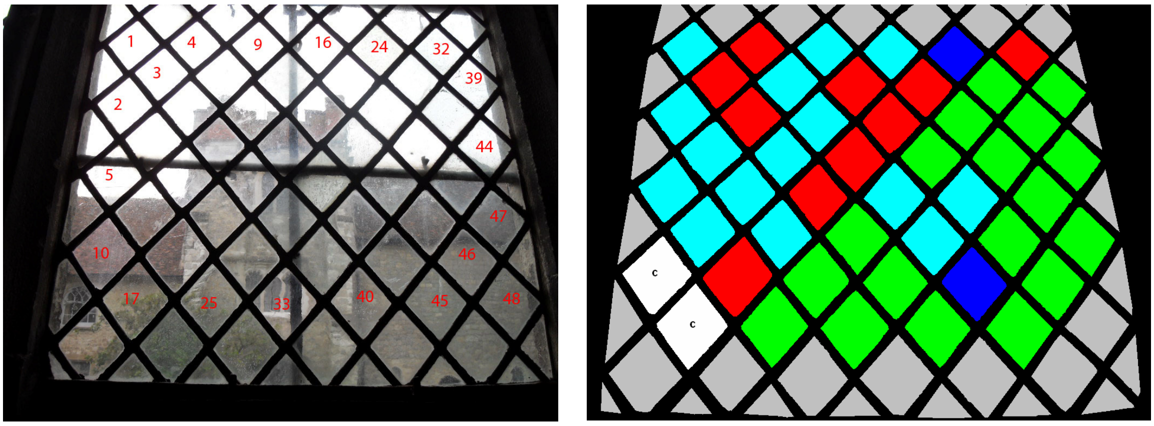

Figure 21 W02 Panel 4 showing the spatial distribution of glass types (see Figure 18 caption)

A significant proportion of the SLS glass in these panels was deliberately coloured (Figure 15), presumably to match the original glass, although, the deliberately coloured SLS glass is frequently more strongly coloured than the forest glass it was supposed to match. This clearly indicates that there was a period of repair and restoration in the 19th century. The spatial arrangement of the various panes (eg Figure 21) suggests that HLLA and kelp glass were installed together even though there was little or no contemporary production of these two types of glass.

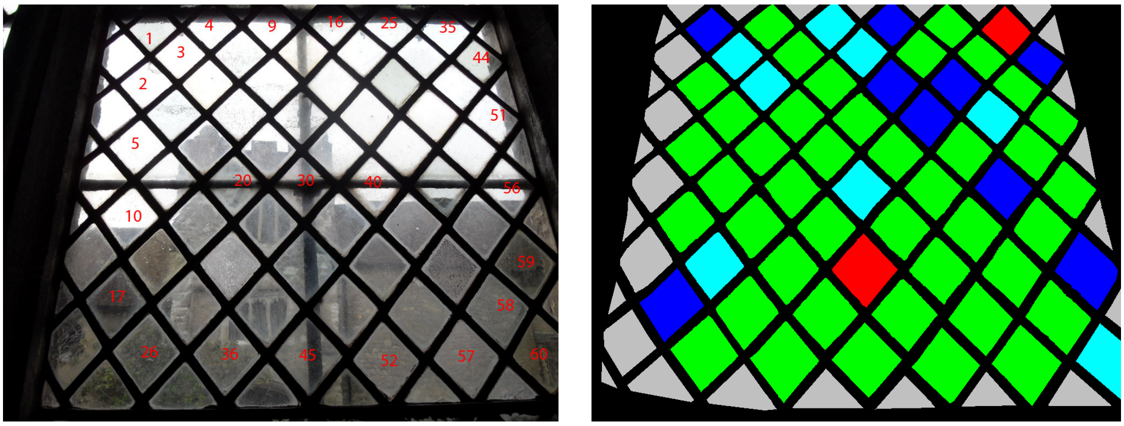

Figure 22 W02 Panel 5 showing the spatial distribution of glass types (see Figure 18 caption)

It is proposed that the windows underwent major repair/restoration in the 19th century and that the glaziers who undertook this work made use of window glass reclaimed from other windows (and these may not all have been at Ightham Mote). Most of the medieval forest glass belongs to one of two tight compositional groups which suggests that this glass derived from a restricted number of sources (and all may have originally been installed at Ightham).

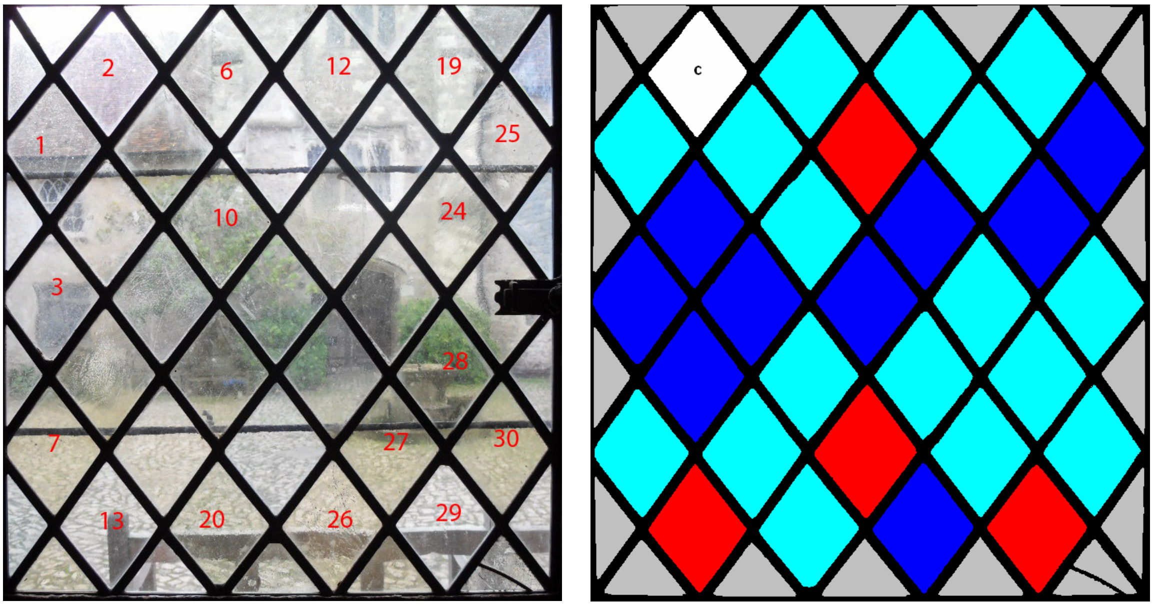

Figure 23 W02 Panel 6 showing the spatial distribution of glass types (see Figure 18 caption)

Panels 6–9 contain no samples of forest glass (Table 8, Figures 23–25): all of the glass was produced after the late 16th century and is not contemporary with the Clement window. Panel 6 contains HLLA (both sub-groups) and kelp glass (Figure 21) but has no glass that was produced after 1830 (although the panel may have been assembled at almost any date after the late 16th century).

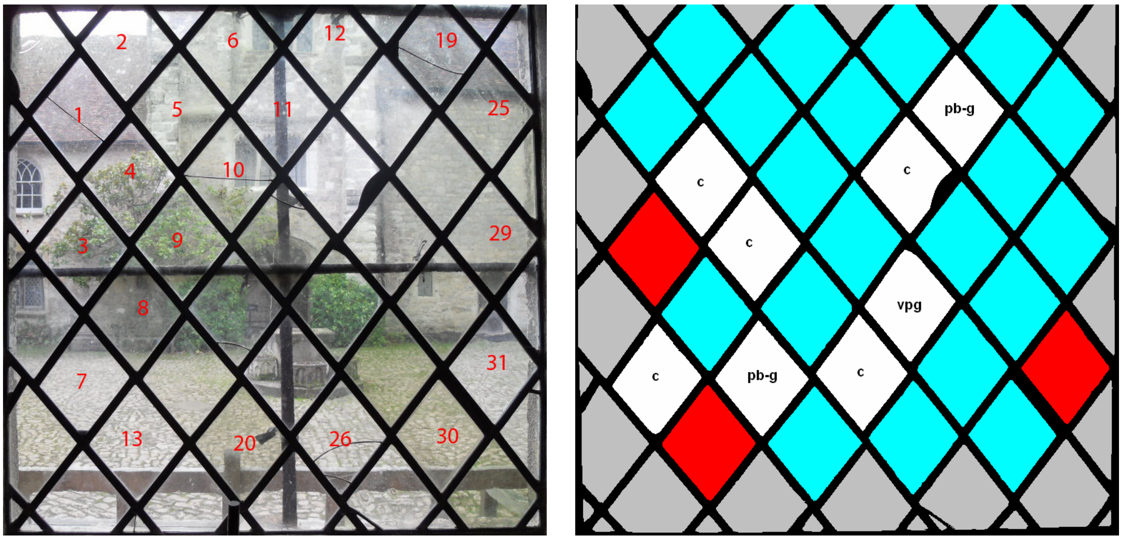

Figure 24 W02 Panel 7 showing the spatial distribution of glass types (see Figure 18 caption)

Panel 7 mostly contains HLLA1 glass (Figure 24) with a few panes of kelp glass and SLS glass (both colourless and deliberately coloured varieties). Panel 8 (not illustrated) contains only SLS glass and this all shares the same composition. The iron content of this glass suggests that it was produced in the 19th century (Phase 4 in Table 1). Panel 9 mostly contains HLLA1 glass (Figure 25) with two panes of kelp glass and four of SLS glass (colourless).

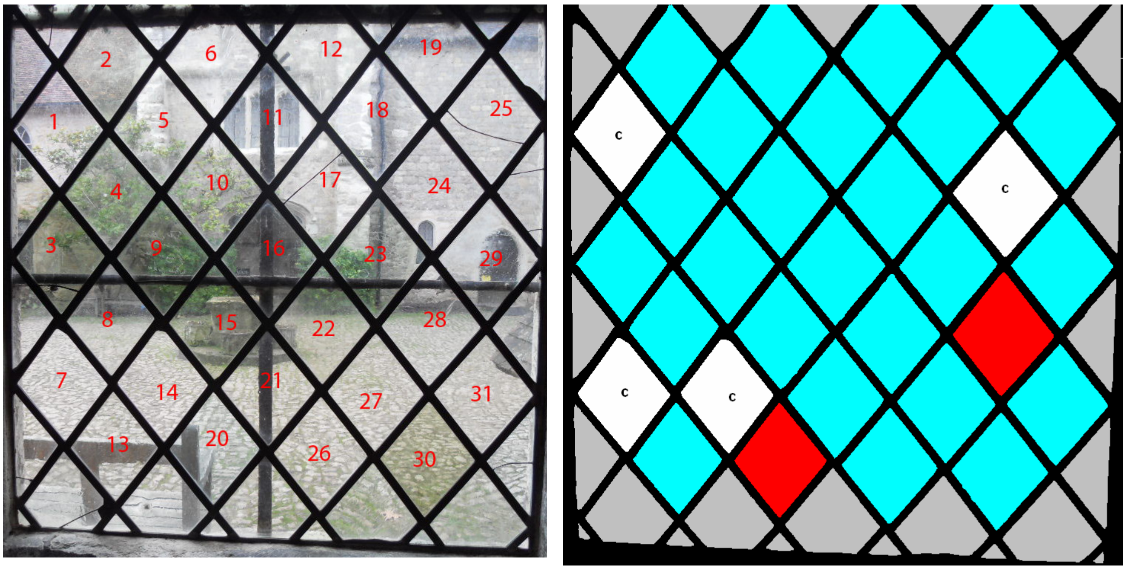

Figure 25 W02 Panel 9 showing the spatial distribution of glass types (see Figure 18 caption)

Outer Hall and Library

Five windows in the Outer Hall (W03) and Library (W04–W06) were analysed. Windows W03 and W07 are considered together as both are in the same style (probably early 19th-century) and face onto the courtyard. Windows W04–W06 are all in the same style (casement windows with small diamond-shaped panes) and face from the library over the moat.

W03 and W07

These windows both comprise a lower sash with eight rectangular panes and an upper sash with ten curved panes in a Gothic revival style (Figure 26). None of the panes has a strong tint. The relatively small number of panes in each window (18) allowed the analysis of all available panes in these windows.

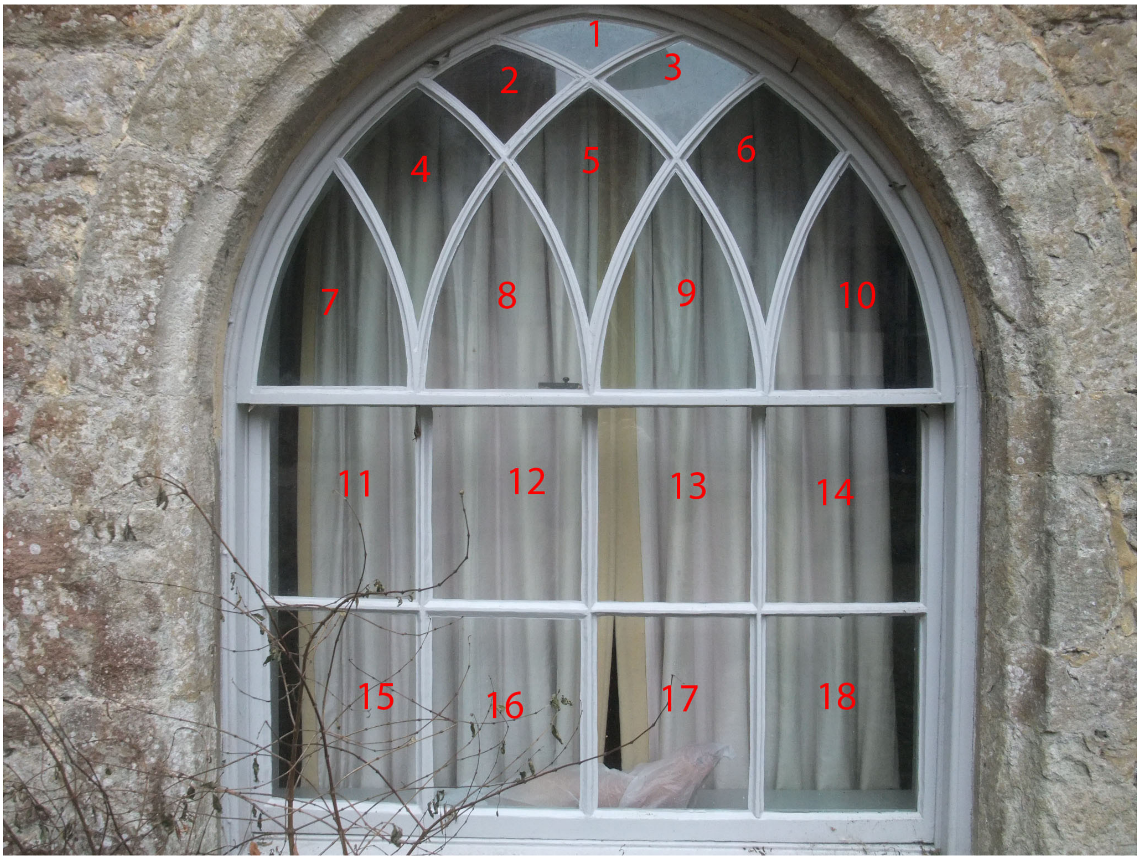

Figure 26. Window W07

Analysis shows that a few panes are kelp glass while all the others are SLS glass (Figures 27–28). The kelp glass displays little compositional variation and cannot be distinguished chemically from kelp glass in W02. The calcium and iron content of the SLS glass suggests

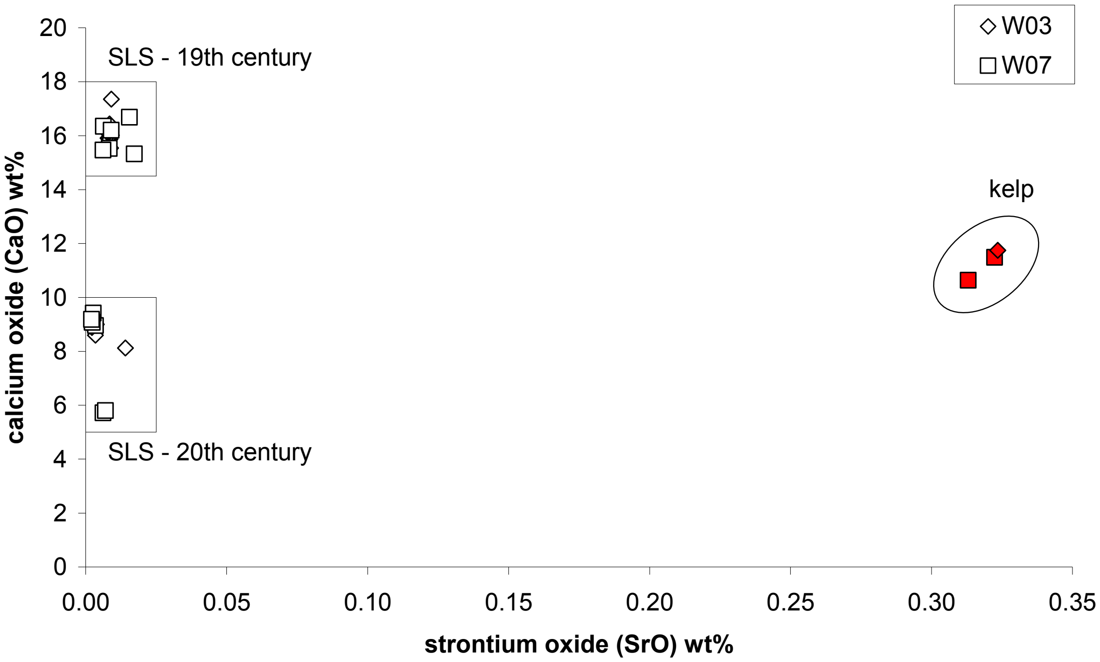

Figure 27. Calcium and strontium content of the analysed panes from W03 and W07

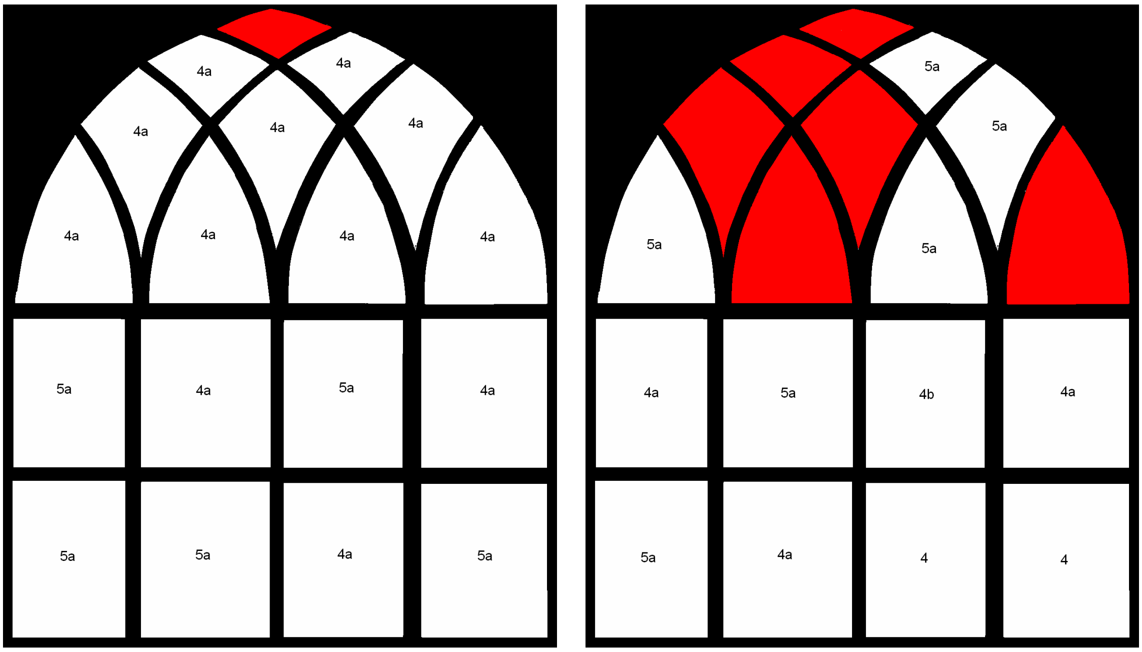

Figure 28. Spatial distribution of glass types in W03 (left) and W07 (right)
(red = kelp, white = SLS, numbers refer to period types in Table 1)

that some is likely to be 19th-century (Phase 4 in Table 1) but that most would have been manufactured in the 20th century (Phase 5). Some of the panes contain low levels of calcium and so are most likely to be of 20th-century manufacture (after the development of drawn or float production techniques), however, magnesium was not detected in any of these panes. The reasons for the failure to detect magnesium are uncertain, although surface weathering and/or adhering films of dirt may be responsible for the absorption of the low-energy X-rays characteristic of magnesium.

The presence of kelp glass indicates that the windows were probably first created between c1700 and c1835 (Phase 3 in Table 1). Given the style of the windows it is likely that they were made towards the end of this period. The surviving panes of original kelp glass are restricted to the upper sash; it is likely that the lower sash has been subject to the most movement and that this has led to breakages and replacements. The presence of SLS glass suggests that accidental breakage has led to replacement at various times since then (including two from W07 which were probably installed after c1960).

Windows W04–W06

Windows W04–W06 are all constructed in the same style (Figure 29). These are casement windows containing large numbers of small diamond-shaped panes with few if any differences in tint, thickness or surface texture. Given the number of panes and the limited time available for analysis a few panes from each panel in each window were selected for analysis (~18% of the available panes).

Figure 29. Window W06 showing the analysed panes

One pane of glass (from W06) is a kelp glass while all the others are SLS glass. A range of elements all suggest that both 19th-century (Phase 4 in Table 1) and 20th-century glass (Phase 5) is present. The samples with relatively high calcium (>10wt% CaO) are likely to have been manufactured in the 19th century (Phase 4) while those with <10wt% CaO were probably made after the mechanisation of the flat glass industry (Phase 5). The panes with the lowest calcium (<6wt% CaO) may have been made after the development of the float process (Phase 5b). The pXRF did not detect magnesium in any of the SLS glass although this should be present (2.5–4wt% MgO) in the Phase 5 glass. The failure to detect magnesium in these panes is almost certainly related to the problems noted with damage to the protective film over the pXRF and maintaining a helium flush. These windows were analysed between 9:40am and 11:40am on the Thursday morning (cf Figures 8 and 9).

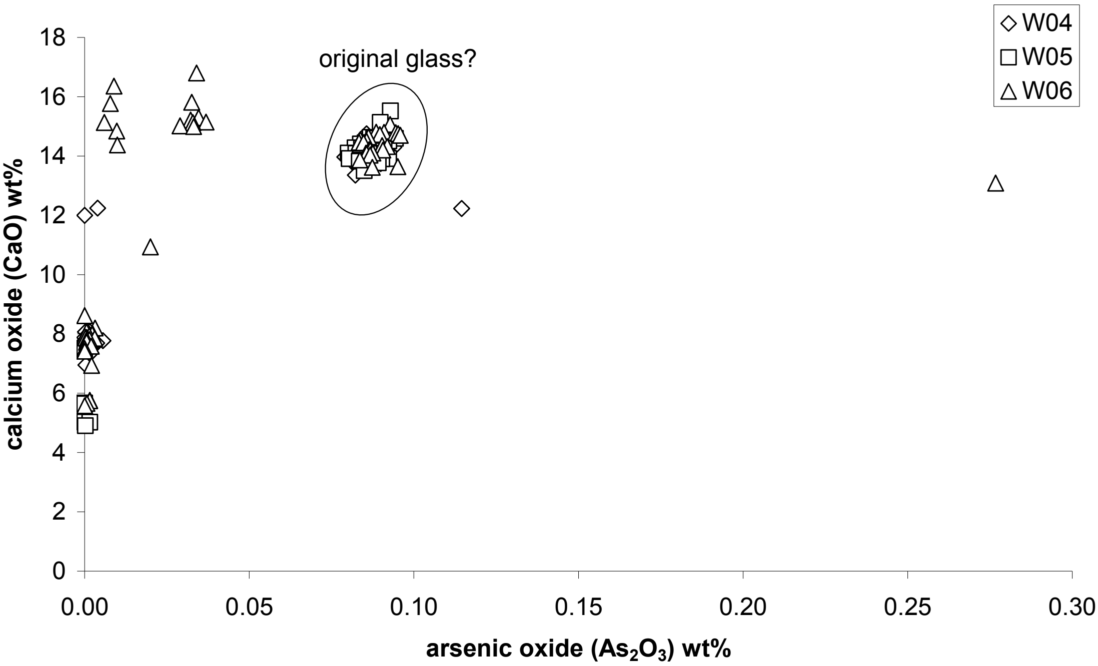

Figure 30. Arsenic and calcium content of the analysed panes from W04–W06

Among the 19th-century panes there is a tight compositional group (Figure 30, Table 8). The 82 panes of this glass were almost certainly made at the same time and place and installed at Ightham Mote at the same time. The absence of potassium from this glass, but the presence of arsenic, suggests manufacture between c1835 and c1870 (Phase 4a).

Table 8. Average composition of the principal (original?) SLS glass in W04–W06

Window	No	%	CaO	Fe_2O_3	As_2O_3	SrO	ZrO_2
W04	26	54	14.1±0.3	0.13±0.01	0.087±0.004	0.0081±0.0004	0.0129±0.0009
W05	30	83	14.2±0.4	0.13±0.01	0.087±0.004	0.0081±0.0004	0.0131±0.0009
W06	26	37	14.4±0.4	0.13±0.01	0.089±0.004	0.0082±0.0004	0.0133±0.0012

Squire's Room (W09–W13)

The five windows of the Squire's Room (W09–W13) are broadly similar to those of the outward facing windows of the Library (W04–W06). These windows are casement windows each with 70–200 diamond-shaped panes; most of which have no distinct colour or tint. A total of 184 panes were analysed — a 28% sample.

The chemical analysis indicates that most panes are SLS glass, although four from W10 are kelp glass and three others could not easily be categorised. These last three panes contain more strontium than is normal for SLS glass but much less rubidium than would be expected for a plant ash glass.

The SLS glass can be divided into three compositional groups which correspond to Phases 4, 5a and 5b (Figure 31, cf Table 1). Most of the Phase 4 SLS glass contains little or no arsenic (but does contain small proportions of potassium) and so is likely to have been manufactured in Phase 4b (c1870 to c1930).

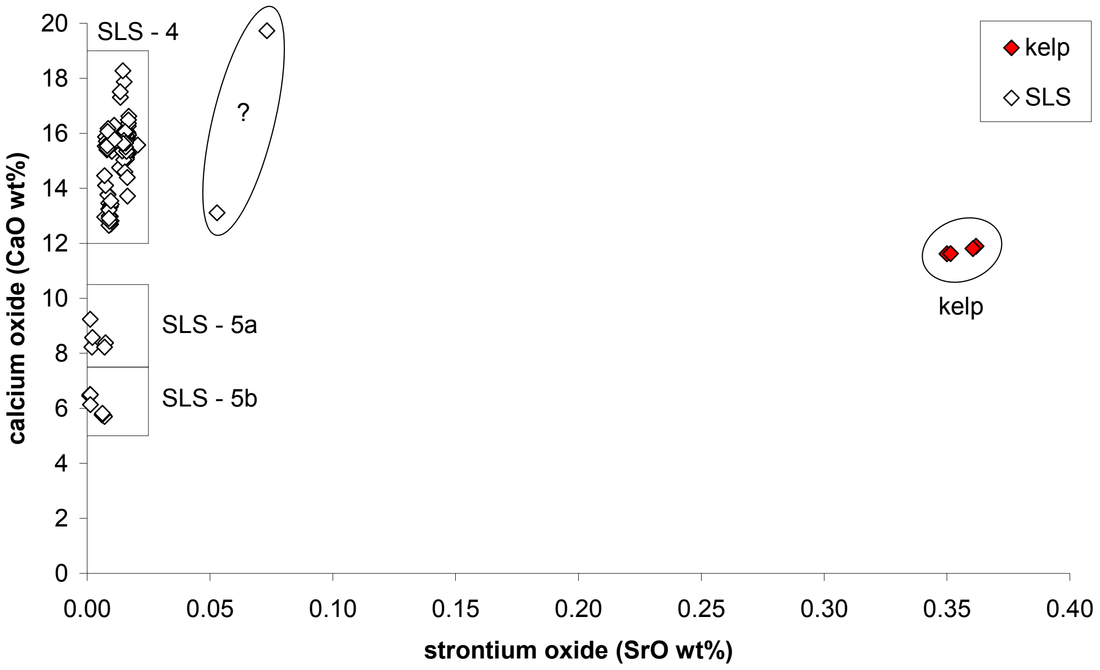

Figure 31. Strontium and calcium content of the analysed panes from W09–W13

Butler’s Pantry (W19)

The Butler’s Pantry includes a casement window with diamond-shaped panes similar to those of the Library and the Squire’s Room. The chemical analysis indicates that all these panes are SLS glass with the presence of four distinct compositional groups (Figure 32). Groups A–C contain relatively high levels of calcium and are likely to belong to Phase 4 (c1835–c1930). Magnesium was detected in group D (Table 9) helping to confirm that this glass belongs to Phase 5, and probably to Phase 5a (c1930–c1960).

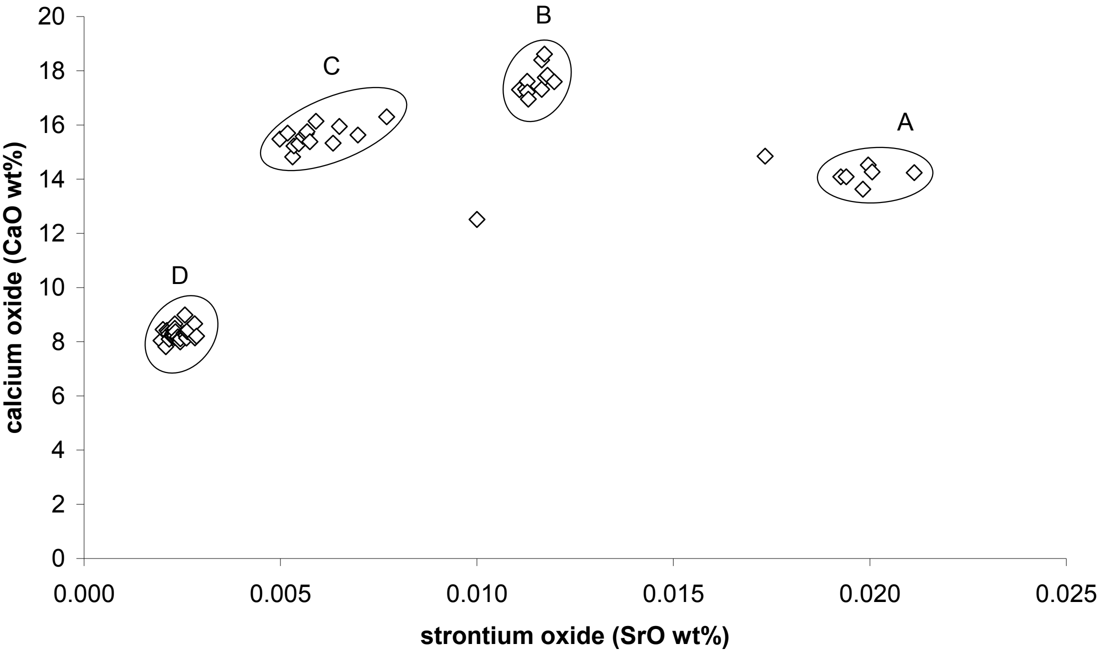

Figure 32. Strontium and calcium content of the analysed panes from W19

Table 9. Average composition of the principal SLS glass in W19

	No	MgO	K2O	CaO	MnO	Fe_2O_3	As_2O_3	SrO
A	6	<2	0.63±0.03	14.1±0.3	0.46±0.03	0.28±0.03	0.57±0.02	0.0199±0.0007
B	11	<2	0.19±0.01	17.6±0.5	0.26±0.02	0.27±0.02	0.27±0.02	0.0115±0.0003
C	14	<2	<0.05	15.6±0.4	<0.02	0.19±0.02	<0.01	0.0059±0.0008
D	34	3.5±0.4	<0.05	8.3±0.2	<0.02	0.07±0.01	<0.01	0.0024±0.0002

Billiard Room (W29 and W30)

The windows of this room comprise diamond-shaped panes similar to those of the Library. All of these windows have UV-absorbing films on the interior surfaces and so only the two windows facing the courtyard (W29 and W30) were accessible (and analysed from the outside). All but three of the analysed panes share identical chemical compositions and were clearly made and installed at the same time. This is a SLS glass with a relatively high calcium content indicating manufacture in Phase 4 (Table 10). The absence of potassium and the presence of arsenic suggests the glass belongs to Phase 4a (c1835–c1870). Almost all of the elements detected showed concentrations that are indistinguishable from those of the original glass employed in the Library. The concentrations of zirconium, however, are sufficiently different to be sure that the window glass employed in these two rooms was obtained from different sources (and probably at different times).

Table 10. Average composition of the principal SLS glass in W29 and W30 compared to that in W04–W06

Window	K_2O	CaO	MnO	Fe_2O_3	As_2O_3	SrO	ZrO_2
W29 & W30	<0.1	15.9±0.4	<0.02	0.14±0.01	0.088±0.004	0.0082±0.0004	0.0063±0.0005
W04–06	<0.1	14.2±0.4	<0.02	0.13±0.01	0.087±0.004	0.0081±0.0004	0.0131±0.0010

New Chapel (W41–W49)

While the ceiling of the New Chapel contains similar badges to Window W02 in the Great Hall, and so can be attributed to the 1520s, the windows obviously contain glass that was not original. The decorated glass (Virgin and Child, St George and St John the Baptist) is not of English manufacture and was probably obtained via Hampp who dealt extensively in stained glass removed from continental churches. The origins of the undecorated glass, which comprises small diamond-shaped panes with a variety of surface finishes and tints (Figure 5), are uncertain.

None of the decorated glass likely to have been obtained from St Peter's, Cologne, and installed at some point during the 19th century was analysed (W44 and W46). Due to limitations on time available for analysis a sample of the plain glass was analysed using pXRF (Table 11).

Table 11. Number of panes and number and proportion analysed from W41–W49

	Panes	Analysed	%
W41	266	50	19
W42	504	97	19
W43	495	64	13
W44	240	30	13
W45	480	64	13
W47	496	64	13
W48	512	47	9
W49	111	28	25
All	3104	444	14

The pXRF analysis showed several different types of glass were present (Figure 33), including forest, HLLA and SLS glass. As with the glass from W02, attempts to categorise the glass on the basis of light elements alone resulted in some misidentifications (Figure 34). The 34 panes of forest glass include one example where magnesium was not detected (a failure rate of 3%). Out of the 60 HLLA1 panes, magnesium was undetected in eight cases, and phosphorus in nine (a failure rate of 28%). The 135 panes of HLLA2 glass included 22 where magnesium was undetected (a failure rate of 16%). Among the 215 panes of SLS glass have been included 16 panes with levels of potassium (3–5wt% K_2O) that are much higher than is normal for SLS glass. This glass (HiK) is similar to that from W02 mentioned above — it is not 'Bohemian' and, except for the potassium content, the closest parallel is SLS glass of Phase 4 or 5. Most of the remaining SLS panes

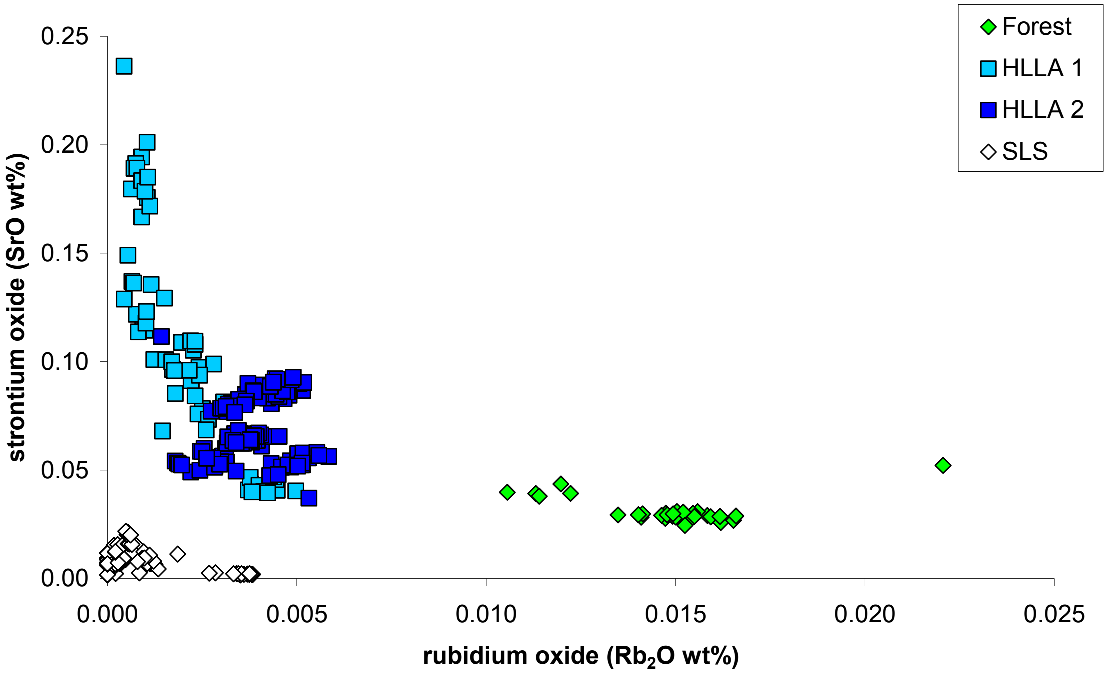

Figure 33. Rubidium and strontium content of New Chapel window glass (W41–W49)

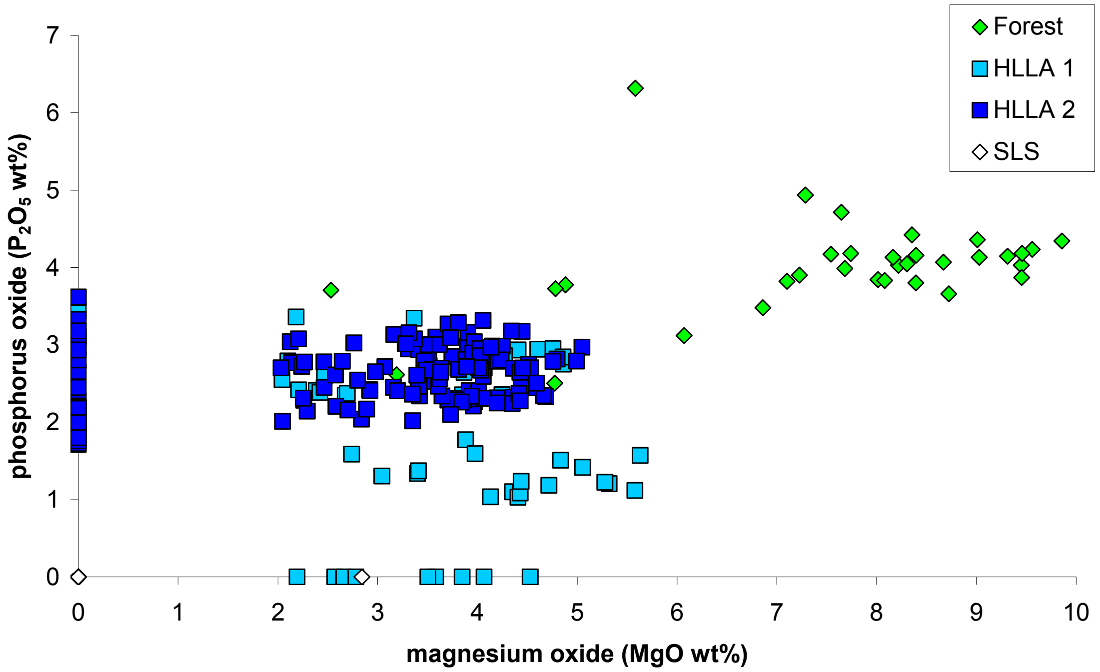

Figure 34. Magnesium and phosphorus content of New Chapel window glass (W41–W49). The low levels of magnesium and phosphorus detected in some of the HLLA and kelp glass (as well as the apparent absence of these elements from some samples) is likely to be due to the effects of surface corrosion.

have calcium concentrations which indicate that they belong to Phase 4 rather than Phase 5.

The forest glass appears to have two compositional groups similar to those seen in W02 (Figure 33, cf Figure 14). The HLLA glass has again been divided into HLLA1 (Phase 2a) and HLLA2 (Phase 2b). The concentrations of a range of minor and trace elements in the HLLA suggest the possibility of a number of compositional sub-groups, although there are no obvious correspondences with the possible compositional sub-groups present in the HLLA glass from W02.

Some of the SLS glass has iron concentrations similar to those seen in contemporary plain glazing, but some has higher concentrations of iron and some also contains manganese and/or copper (Figure 35). It is likely that these metals were deliberately added in order to provide the glass with a colour which would allow it to blend in with historic window glass. The tinted SLS glass includes a pale amber with relatively high concentrations of iron and manganese, a very pale blue-green with moderate iron and small amounts of copper, and a pale blue which contains very low levels of iron (~0.05wt% Fe_2O_3) but some copper (~0.2wt% CuO). None of the deliberately tinted SLS glass has a composition which matches exactly that seen in W02.

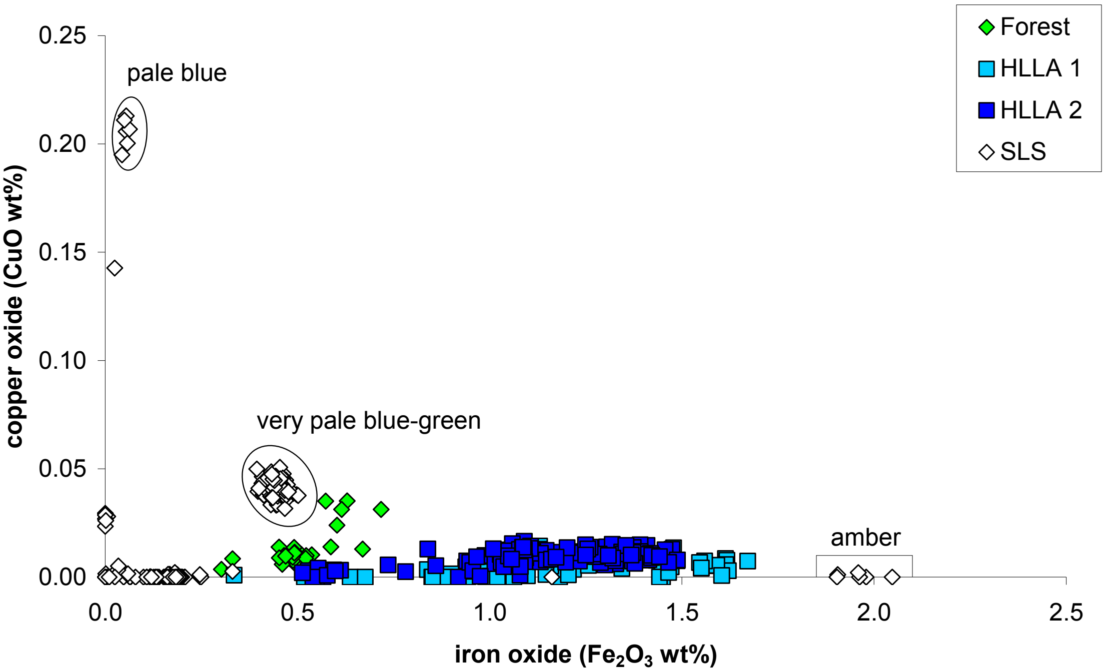

Figure 35. Iron and copper content of New Chapel window glass (W41–W49)

The presence of many different types of glass, especially deliberately tinted SLS glass suggests that these windows were assembled during the 19th century (Phase 4). The windows include some forest glass which could represent the original glass used in the New Chapel. The presence of two similar compositional sub-groups of forest glass in the

New Chapel and the Great Hall (W02) is noteworthy. It is likely that these two sub-groups represent two different glass production sites (or possibly just separate periods when this glass was produced). The mixture of medieval forest glass from two different production sites in two different rooms suggests that this glass does not simply represent a random collection of medieval glass. Nevertheless the exact circumstances responsible for the glass ending up in its current locations are likely to remain uncertain.

Table 12. Number (and proportion) of analysed panes of different glass types from the new Chapel (W41–W49)

	Forest	HLLA1	HLLA2	SLS	All
W41	1 (2%)	2 (4%)	31 (62%)	16 (32%)	50
W42	4 (4%)	15 (15%)	32 (33%)	46 (47%)	97
W43	6 (9%)	10 (16%)	21 (33%)	27 (42%)	64
W44	2 (7%)	1 (3%)	2 (7%)	25 (83%)	30
W45	9 (14%)	10 (16%)	17 (27%)	28 (43%)	64
W47	5 (8%)	13 (20%)	16 (25%)	30 (47%)	64
W48	3 (6%)	4 (9%)	2 (4%)	38 (81%)	47
W49	4 (14%)	5 (18%)	14(50%)	5 (18%)	28
All	34 (7%)	60 (14%)	135 (30%)	215 (49%)	444

Table 13. Average composition of the main glass types from the New Chapel (W41–W49)

	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
Forest1	9.0	15.7	0.79	0.63	0.03	0.03	0.03	0.011	0.040	0.014
Forest2	9.4	15.8	0.88	0.48	<0.01	0.03	0.02	0.015	0.029	0.012
HLLA1	3.5	21.8	0.11	1.19	<0.01	0.01	0.01	0.002	0.111	0.012
HLLA2	4.2	24.2	0.75	1.15	<0.01	0.03	0.10	0.004	0.069	0.026
SLS (colourless)	0.6	13.3	0.01	0.14	<0.01	<0.01	0.04	0.001	0.007	0.005
SLS (amber)	0.5	8.8	1.37	1.96	<0.01	<0.01	0.02	0.001	0.007	0.016
SLS (pale blue)	0.3	9.2	<0.01	0.05	0.20	<0.01	<0.01	0.001	0.021	0.075
SLS (pale bl-gr)	0.2	14.9	0.08	0.44	0.04	<0.01	0.06	<0.001	0.011	0.002

Chapel Corridor (W50)

This window comprises 174 diamond-shaped panes similar to those of the Library, of which 22 were analysed. The pXRF analysis indicates that all of the panes are SLS glass and that most have a high enough calcium content to suggest that they were manufactured in Phase 4 (c1835–c1930). Three panes contain relatively high proportions of potassium (HiK) for SLS glass (cf similar glass from the Great Hall and the New Chapel discussed above).

Oriel Corridor (W57)

This window comprises just over 1000 diamond-shaped panes in 20 panels, of which 176 have been analysed. The glass has a variety of tints and surface finishes. The pXRF analysis indicates the presence of several different types of glass (Figure 36). Most of these are HLLA (105 panes) and SLS glass (65 panes) but there are also five panes of forest glass and a single pane of kelp glass. The major elements again failed to provide an infallible means of identifying the glass type. The pXRF analysis of the 59 HLLA1 panes only detected phosphorus in 48 cases (a failure rate of 19%). Despite this magnesium was detected in a proportion of the SLS glass; and in these the magnesium was generally highest in those samples with the lowest calcium (ie in conformity with the model set out in Figure 1). The calcium and magnesium contents suggest that 30 SLS panes were produced in Phase 4, 30 in Phase 5a and five in Phase 5b. A proportion of the SLS glass contains elevated levels of iron and other colouring metals, compared to contemporary plain window glass; it is likely that these metals were deliberately added in order to achieve a tint which would allow these panes to blend in with the older glass in this window. This deliberately tinted glass mostly belongs to Phase 5a (c1930 to c1960) and includes two varieties: the first (and most abundant) contains slightly elevated iron (0.43±0.02wt% Fe_2O_3) and copper (0.010±0.003wt% CuO) while the second contains more iron (0.89±0.02wt% Fe_2O_3), no copper (<0.01wt% CuO) and significant quantities of manganese (1.00±0.02wt% MnO).

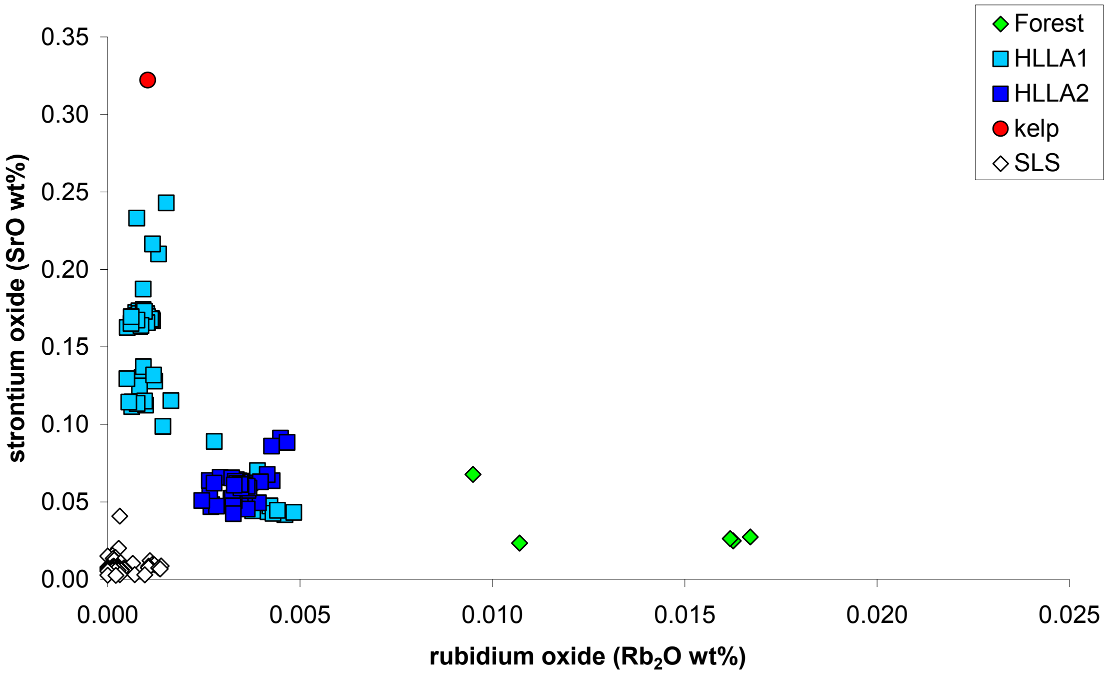

Figure 36. Rubidium and strontium content of Oriel corridor window glass (W57)

Table 14. Average composition of the major glass types from W57

	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
Forest	9.1	15.5	0.96	0.46	0.01	0.03	0.01	0.014	0.034	0.010
HLLA1	2.6	20.8	0.06	1.15	<0.01	0.01	<0.01	0.001	0.143	0.009
HLLA2	4.3	24.9	0.60	1.06	0.01	0.03	0.10	0.003	0.059	0.030
SLS	0.2	12.0	0.10	0.33	<0.01	<0.01	0.12	<0.001	0.008	0.005

South West Stairs (W31)

This window comprises 273 small diamond-shaped panes with little or no tint or surface texture (58 were analysed). The pXRF analysis (< 0.002wt% Rb_2O, <0.02wt% SrO and 0.16±0.04wt% Fe_2O_3) indicates that all of these panes are SLS glass of fairly recent manufacture (Phase 4 or 5). The light element data for these panes is, however, unreliable due to problems with the protective film and maintaining a helium flush. These windows were analysed between 5:30pm and 6:15pm (cf Figures 8 and 9).

Charles Henry Robinson Dressing Room (W35)

This window comprises 260 small diamond-shaped panes with little or no tint or surface texture (47 were analysed). The pXRF analysis (< 0.002wt% Rb_2O, <0.02wt% SrO and 0.13±0.04wt% Fe_2O_3) indicates that all of these panes are SLS glass of fairly recent manufacture (Phase 4 or 5). The light element data for these panes is, however, unreliable due to problems with the protective film and maintaining a helium flush. These windows were analysed between 5:00pm and 5:30pm (cf Figures 8 and 9). Most of the panes (41 out of 47) share identical composition with each other and with most of the glass from the outward-facing windows in the library (Table 15). It is likely that these windows (W04–W06 and W35) were installed at the same time (probably Phase 4a, c1835–c1870).

Table 15. Average composition of the principal SLS glass in W35 compared to that in W04–W06

Window	K_2O	CaO	MnO	Fe_2O_3	As_2O_3	SrO	ZrO_2
W35	<0.1	14.5±0.5	<0.02	0.14±0.01	0.089±0.005	0.0082±0.0004	0.0119±0.0008
W04–06	<0.1	14.2±0.4	<0.02	0.13±0.01	0.087±0.004	0.0081±0.0004	0.0131±0.0010

The Tower and Archaeology Room (W66–W70)

The Tower (including the room on the second floor used to display some archaeological materials) forms part of the western range likely to have been added in the 15th century. Glass from five windows was analysed: including three fairly small windows on the stairs (W66–W68) and two large windows in the Archaeology Room (W69 and W70). The windows are all composed of small diamond-shaped panes of varying tint and surface finish. Time limitations required that only a sample (230) of the 989 panes were analysed and these included a range of glass types (Figure 37, Table 15). As with other windows discussed above, the apparent concentration of some minor elements (such as magnesium and phosphorus) produced potentially misleading results which would have led to some panes being assigned to the incorrect compositional group (37% of the HLLA1 panes and 14% of the kelp panes).

Forest glass was detected in both of the Archaeology Room windows (W69 and W70) but was absent from the windows on the stairs (Table 16). All but one of the forest glass panes appear to belong to the higher rubidium sub-group (cf Figure 16). HLLA glass was found in all but one window and includes both the earlier sub-type (HLLA2) with the elevated manganese and the later sub-type (HLLA1).

Table 16. Numbers of different types of window panes analysed from the Tower and Archaeology Room (W66–W70)

	Total	Forest	HLLA1	HLLA2	kelp	SLS	Analysed
W66	43	0	0	9	0	6	15
W67	37	0	6	2	3	3	14
W68	21	0	2	0	1	9	12
W69	456	6	16	47	4	34	107
W70	432	6	3	33	6	34	82

Table 17. Average compositions of the glass types from W66–70

	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
Forest2	9.2	15.4	0.87	0.51	0.01	0.03	0.01	0.015	0.030	0.012
HLLA1	3.8	20.8	0.10	1.11	<0.01	0.01	<0.01	0.002	0.116	0.011
HLLA2	3.3	23.7	0.68	1.22	<0.01	0.03	0.14	0.003	0.066	0.024
kelp	3.6	11.0	0.01	0.60	<0.01	<0.01	<0.01	0.001	0.318	0.005
SLS	0.2	14.0	0.20	0.32	<0.01	<0.01	0.15	<0.001	0.011	0.004
SLS (HiK)	2.9	5.9	<0.01	0.02	0.08	0.03	0.16	<0.001	0.002	0.006

A substantial proportion (37%) of all the analysed panes are SLS glass which would have been manufactured after c1835. Most of this SLS glass contains relatively high levels of calcium and was probably made during Phase 4 (c1835–c1930). Almost all of the low-calcium glass contains levels of potassium that are much higher than would be expected for Phase 4 or 5 glass (SLS HiK in Table 17). The exact origins of this glass are uncertain, however, it is likely that the glass is of relatively recent manufacture (19th- or 20th-century).

The SLS (and SLS HiK) glass includes some with iron concentrations that are typical of plain window glass of the 19th and 20th centuries, however, some contains elevated levels of iron as well as manganese and/or copper (Figure 38). There is little doubt that these metals were deliberately added to the glass used for these panes in order to achieve particular colours or tints.

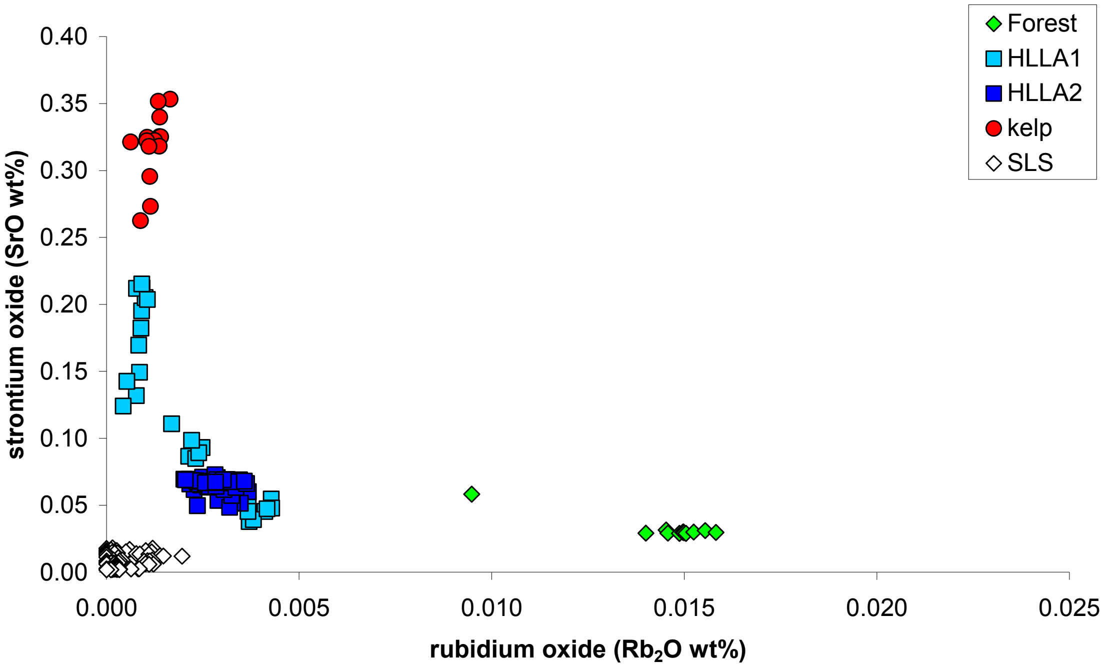

Figure 37. Rubidium and strontium content of the Tower and Archaeology Room window glass (W66–70)

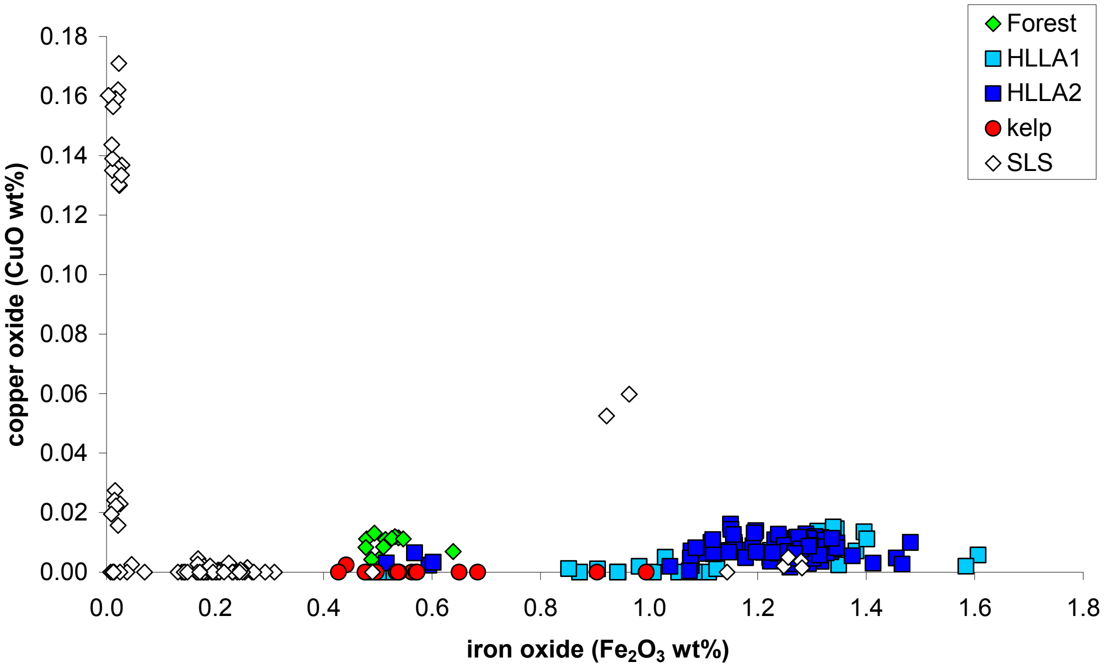

Figure 38. Iron and copper content of the Tower and Archaeology Room window glass (W66–70)

DISCUSSION

The analysis of 1939 panes of glass from Ightham Mote provides a wealth of information on the suitability of pXRF for characterising historic window glass. The following discussion looks in detail at the pros and cons of pXRF and the nature (chemical composition) of the extant historic window glass at Ightham Mote.

pXRF for in situ analysis of historic window glass: pros and cons

The main advantage offered by pXRF is the fact that it is not only a non-destructive technique but that the procedure can be used on *in situ* window glass and does no damage to the glass. No other analytical technique currently available can deliver non-destructive and damage-free chemical analysis for extant historic window glass. Where a window is undergoing conservation treatment it will often be possible to take samples and the analysis of such samples has the potential to provide detailed information on the nature of the glass. Nevertheless, there are many windows for which conservation treatment is not scheduled but which would benefit from a better understanding through chemical analysis.

The current state of pXRF detector technology allows the analysis of a window in as little as 30 seconds. This allows the acquisition of very large datasets that would not be feasible even if samples could be taken. While 1939 panes were analysed using pXRF at Ightham over a five-day period, the laboratory-based analysis of almost 800 glass samples for the first phase of the project took nearly five years to complete. A dataset as large as that acquired at Ightham Mote, however, requires considerably more than five days to fully analyse and interpret.

Table 18. Comparison of detection limits

Oxide	SEM/XRF (lab)	pXRF
Na_2O	0.1	NA
MgO	0.1	2.0
Al_2O_3	0.1	0.5
P_2O_5	0.2	1.0
K_2O	0.1	0.1
CaO	0.1	0.05
MnO	0.02	0.01
Fe_2O_3	0.02	0.01
CuO	0.02	0.01
ZnO	0.02	0.01
As_2O_3	0.02	0.01
Rb_2O	0.005	0.001
SrO	0.005	0.001
ZrO_2	0.005	0.001

Limits of detection achievable with pXRF for some heavy elements were substantially better than those achievable using the laboratory-based instruments employed in the first phase of this research project (Table 18). Even lower limits of detection would be possible with some laboratory-based techniques (eg ICPS), however, the sample would be destroyed during the course of analysis.

The precision for many heavy elements is better than those achievable using the laboratory-based instruments employed in the first phase of this research project (Table 19). This allows greater confidence in identifying batches (Freestone *et al* 2009).

Table 19. Comparison of precision

Oxide	SEM/XRF (lab)	pXRF
Na_2O	0.1	NA
MgO	0.1	0.3
Al_2O_3	0.1	0.1
P_2O_5	0.2	0.1
K_2O	0.1	0.05
CaO	0.1	0.5
MnO	0.01	0.01
Fe_2O_3	0.01	0.01
CuO	0.01	0.01
ZnO	0.01	0.01
As_2O_3	0.02	0.005
Rb_2O	0.005	0.0002
SrO	0.005	0.0002
ZrO_2	0.005	0.0002

The pXRF instrument used was provided with a helium flush in order to enable the determination of light elements (especially magnesium and phosphorus) which were deemed significant for the identification of glass types (cf Dungworth 2011). The practical maintenance of a good quality helium flush proved to be challenge in the 'field'. On two occasions (on the Thursday) the protective film on the nose of the instrument was compromised leading to a loss of helium flush and a degradation of data quality for light elements (Figures 8 and 9). The quality of the helium flush had no significant effect on the determination of heavy elements (calcium and heavier elements).

The pXRF analysis of some of the plant ash glasses (and a few SLS glasses) provided unreliable estimates of light element composition, even where there were no grounds for suspecting a problem with the helium flush. It is likely that the weathering on the surface of some glass and any films of dirt will have affected the pXRF analysis. It is well known that glass undergoes chemical alteration at its surface especially when exposed to moisture (Dungworth *et al* 2011). The exposed surface of glass will generally lose a proportion of alkalis (and some other elements). The severity of such chemical weathering depends on the nature of the local environment (humidity, temperature, etc) and the inherent stability of the glass. Where pXRF analysis is carried out on the weathered surface of glass it is anticipated that the result will be compromised to a certain degree. Depending on the analytical configuration (especially the voltage of the primary X-ray beam) the characteristic X-rays will be generated at a range of depths into the glass and this could include both the weathered surface and the underlying unaltered glass. The analytical result will in this case be a composite of both weathered and unweathered glass. The contribution made by the weathered and the unweathered glass will vary with the thickness of the weathered surface layer; in the most severe cases characteristic X-rays might only be detected from the weathered surface layer. The relative contribution to the analytical result made by the weathered surface and the underlying glass will also vary from element to element. Light elements only produce low-energy X-rays which are relatively easily absorbed, and so the characteristic X-rays for light elements that are detected, tend to come from close to the surface (Figure 39).

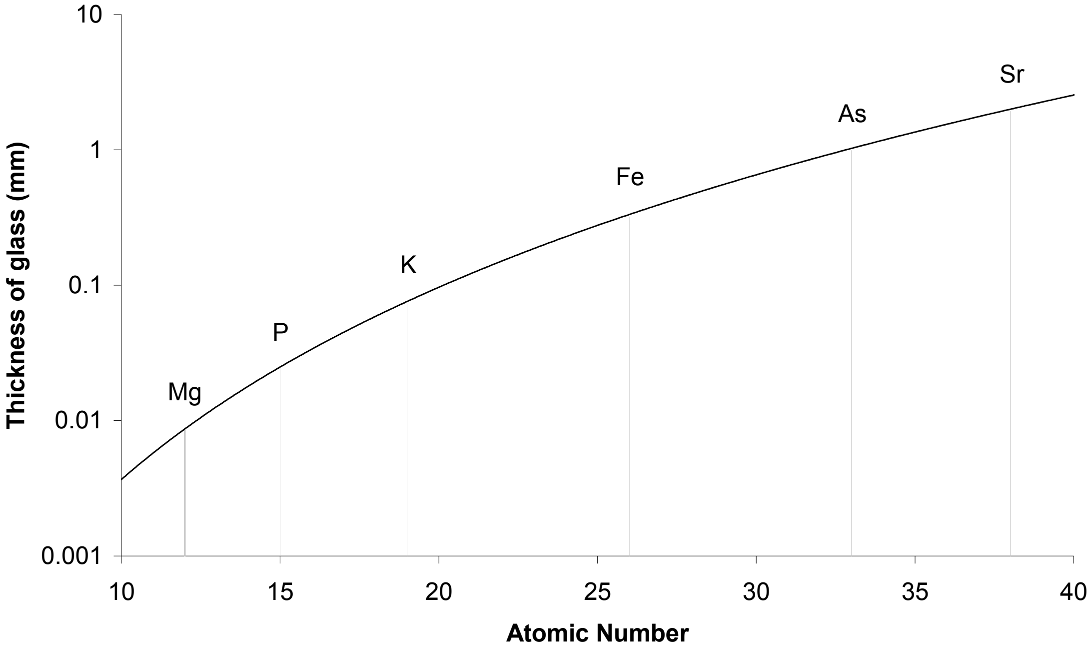

Figure 39. Relationship between atomic number and depth from which characteristic X-rays are detected (for K-series X-rays)

Surface layers make more of a contribution to the analytical result for light elements: for elements up to potassium it is largely the first 0.1mm of glass which provides the characteristic X-rays (Figure 39). The thickness of weathered surface layers vary depending on the local environment and the intrinsic stability of the glass. Recent SLS glass has a high intrinsic chemical stability and weathered surfaces are generally very thin (<0.001mm), except in the most severe environments. Earlier plant ash glasses tend to have low proportions of silica and so have low intrinsic stability leading to weathered surfaces up to 1mm in thickness (depending on their local environment). Thus, it is the older and less stable glasses that are most susceptible to weathering and so more likely to yield a pXRF result which does not accurately reflect the true composition of the glass.

The classification of some SLS glass was initially hampered by the presence of relatively high levels of iron and other metals. The plain window glass analysed during the first phase of this project (Dungworth 2011) showed plant ash glasses with relatively high iron concentrations (0.5–1.7wt% Fe_2O_3) while SLS glasses had much lower proportions (<0.4wt% Fe_2O_3). The suspicion that the Ightham Mote SLS glasses with elevated iron contents were deliberately made this way is confirmed by the elevated concentrations of other metals which provide glass with tint or colour (especially copper and manganese). The manufacture of such glasses is discussed further below.

The use of pXRF allows the analysis of large numbers of windows which would not otherwise be available for examination. The *in situ* analysis of windows at Walmer Castle identified a type of glass (Dungworth and Girbal 2011) not identified during the first phase of historic window glass research (Dungworth 2011). This was a potassium calcium silicate glass, the closest parallel for which could be found in glass manufactured in Bohemia. Further detailed characterisation of this glass type is continuing through the laboratory-based analysis of similar glass from Kenwood House, London. The use of Bohemian window glass at Walmer Castle and Kenwood House would appear to be an example of extremely wealthy clients obtaining prestigious and expensive glass from an obscure source. Such glass would not have been routinely used and so was not identified during the first phase of laboratory-based analysis (which was largely based on samples from fairly modest buildings and archaeological contexts). It is possible that the analysis of the Ightham Mote windows has identified another, ‘new’ type of glass (HiK). This has generally been grouped with the SLS glass but displays some unusual chemical characteristics, such as relatively high potassium. This glass is discussed in more detail below.

Glass types from Ightham Mote

The *in situ* pXRF analysis of window glass from Ightham Mote has allowed the identification a number of major compositional types. Most of these are well known from previous research. The different types were initially isolated using a variety of elements (Figures 40 and 41), especially those identified during the first phase of the project as most significant (phosphorus, magnesium, potassium, calcium and strontium). The problems encountered using pXRF to obtained light element concentration data led to increasing reliance on heavy elements such as rubidium (Figures 42 and 43).

The pXRF analysis has shown that,

10% are forest glass, manufactured before c1567,
34% are HLLA glass (c1567–c1700),
3% are kelp glass (c1700–c1835),
3% are HiK glass of likely late 18th- or early 19th-century manufacture, and
50% of the analysed panes are SLS glass, manufactured after c1835 (Figure 44).

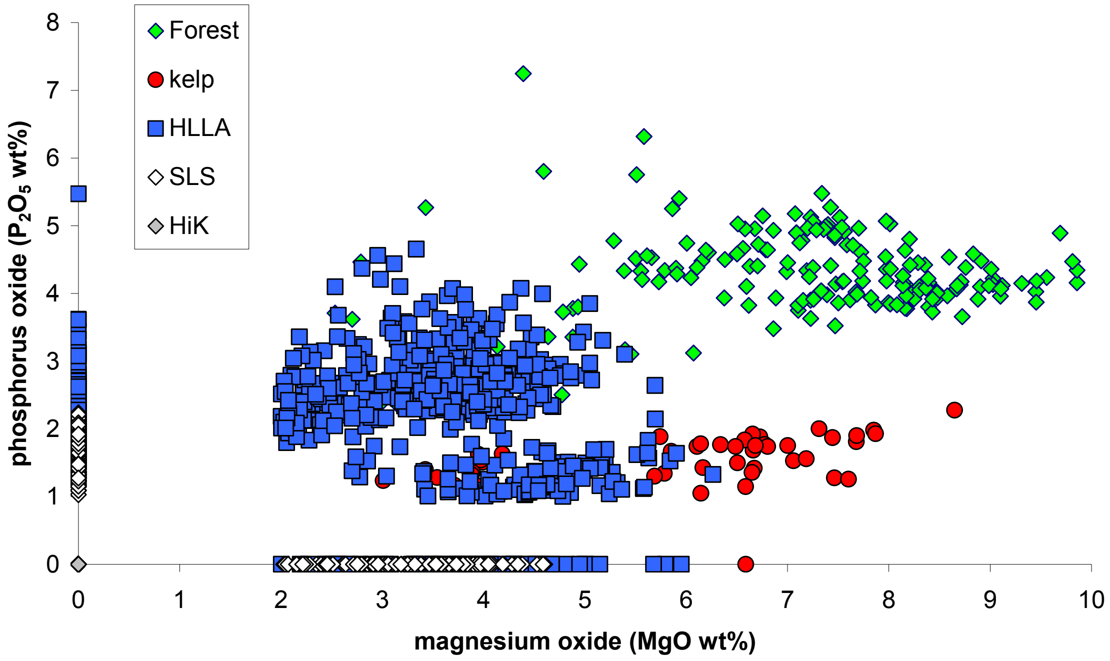

Figure 40. Magnesium and phosphorus content of all analysed Ightham Mote glass (includes HLLA samples where magnesium and/or phosphorus was not detected [due to corrosion] and SLS samples with spurious phosphorus results due to loss of helium flush, cf Figure 9)

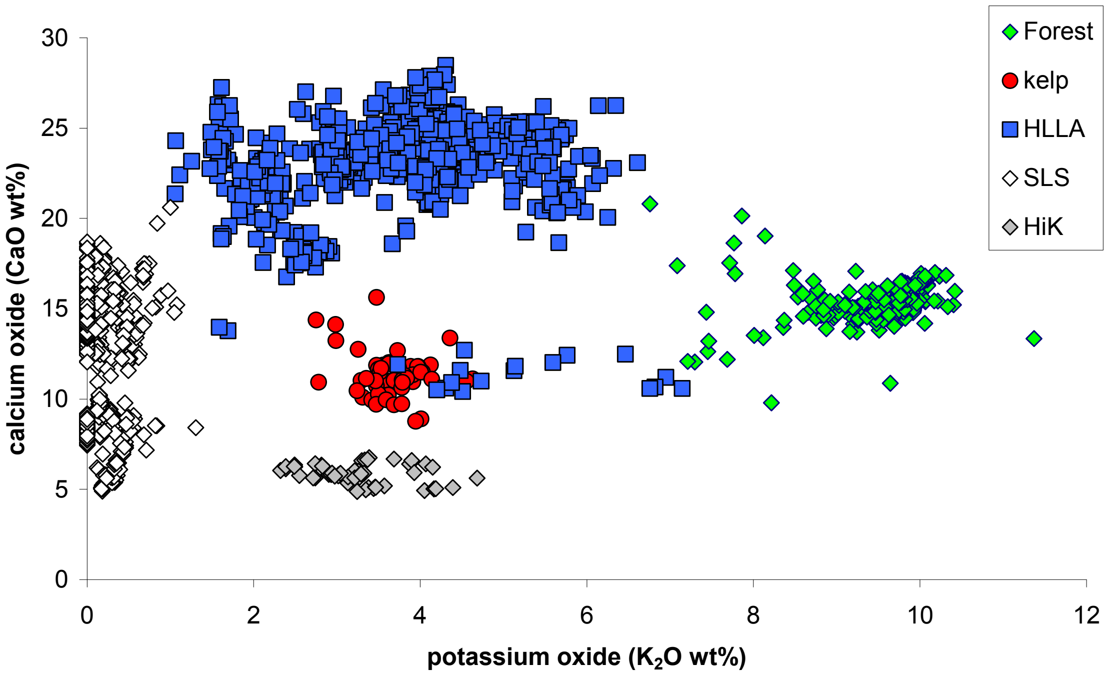

Figure 41. Potassium and calcium content of all analysed Ightham Mote glass

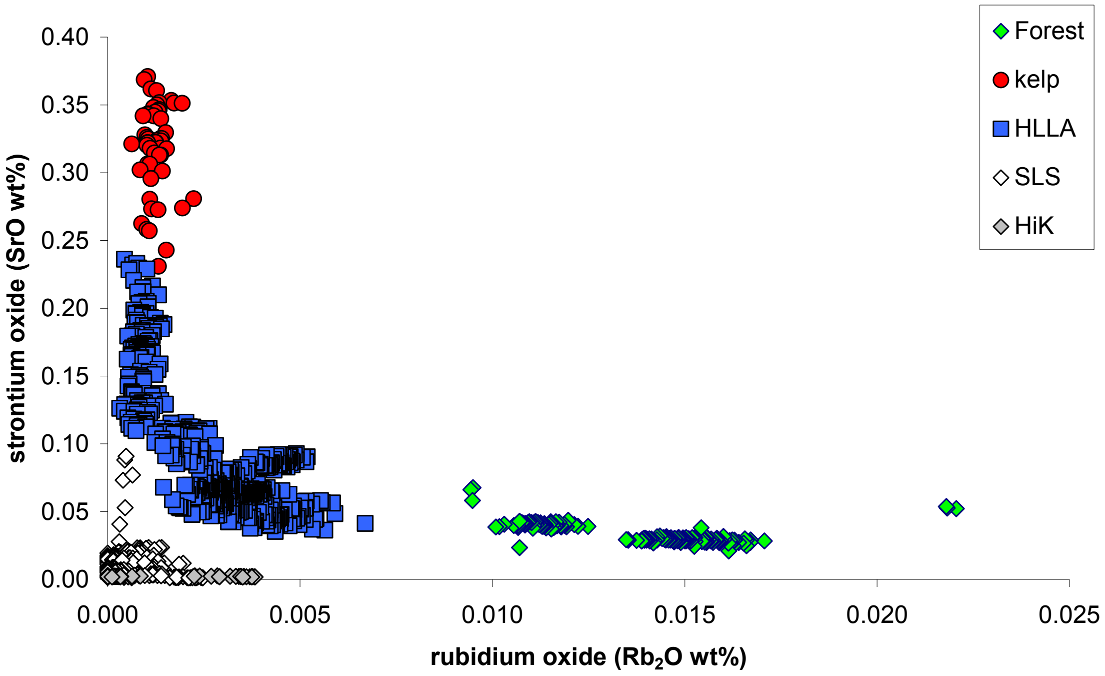

Figure 42. Rubidium and strontium content of all analysed Ightham Mote glass

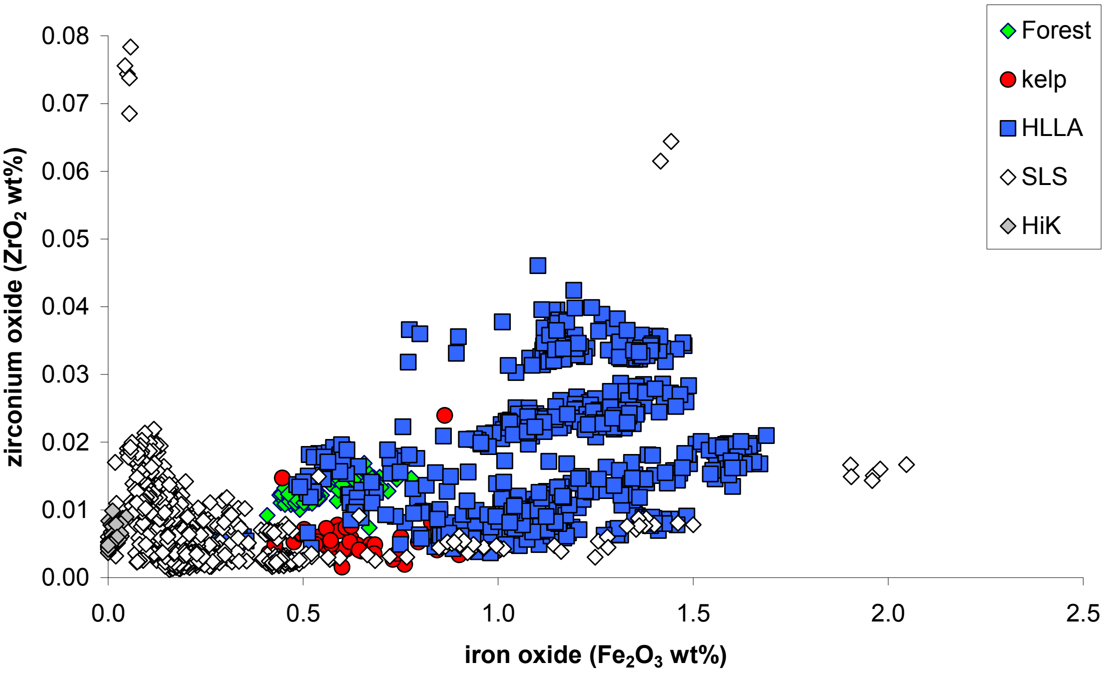

Figure 43. Iron and zirconium content of all analysed Ightham Mote glass

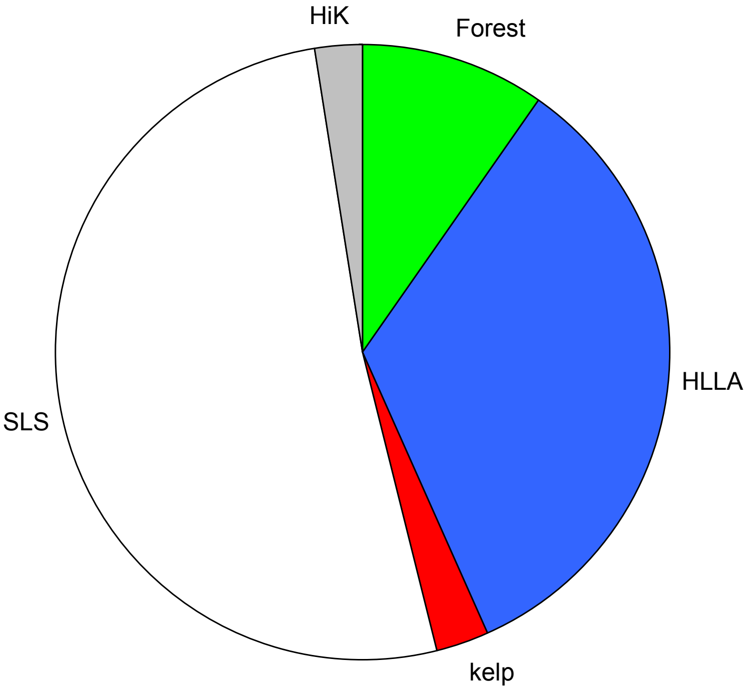

Figure 44. Proportions of different glass types at Ightham Mote

Forest Glass

A total of 188 panes have been identified as having been made from forest glass. In every case the concentrations of phosphorus and strontium indicated that glass had been made using the ash of a terrestrial plant. It is currently believed that the principle plant ash used was bracken or fern (Dungworth and Paynter 2010; Jackson *et al* 2005). In a minority of cases, however, the levels of calcium and/or potassium did not provide a reliable basis for distinguishing between forest glass and HLLA. The problem with these samples was clearly the presence and nature of weathered surfaces — the analysis of many of these samples showed the presence of high levels of sulphur that can be linked to corrosion of the glass (cf Dungworth *et al* 2011). Overall the forest glass shares the same overall composition as northern medieval forest glass (Table 20).

Table 20. Average major and minor element concentrations in all the Ightham Mote forest glass (and compared with some contemporary glass)

	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3
Ightham Mote	6.9	2.4	4.2	9.4	15.3	0.9	0.5
Blunden's Wood	6.8	1.0	3.0	11.0	13.7	1.1	0.7
Idehurst	8.1	1.3	3.7	11.1	16.7	1.0	0.6
Knightons	5.9	2.5	3.0	10.0	16.7	0.9	0.8
Little Birches	7.8	1.2	3.4	12.5	13.4	1.5	0.5

Some of the minor and trace elements present in the forest glass indicate the presence of two compositional sub-groups (Figure 45, Table 21). These are designated Forest1 and Forest2. The compositional differences are undoubtedly small, however, they are significant given the analytical precision of the pXRF.

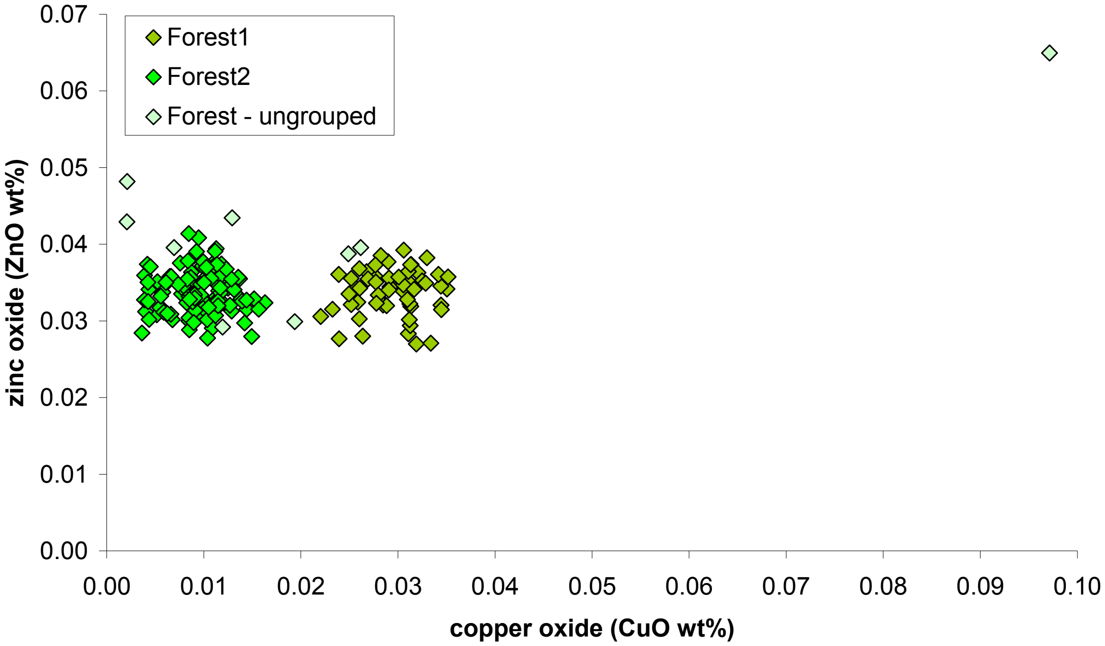

Figure 45. Copper and zinc content of the forest glass from Ightham Mote

The Forest1 glass is found in the Great Hall (80), the New Chapel (31) and the Tower (11), while Forest2 is mostly found in the Great Hall (52) and only five Forest1 panes were found in the New Chapel (and none in the Tower).

Table 21. Average minor and trace elements in the two compositional sub-groups of forest glass

	No.	Fe_2O_3	CuO	Rb_2O	SrO	ZrO_2
1	57	0.64±0.04	0.029±0.003	0.0113±0.0005	0.040±0.001	0.0142±0.0007
2	122	0.48±0.05	0.009±0.003	0.0151±0.0008	0.029±0.002	0.0119±0.0007

The significance of relatively distinct compositional sub-groups of glass (such as Forest1 and Forest2) has recently been explored by Freestone and colleagues (Freestone *et al* 2009). The nature of pre-industrial glass making is likely to have ensured that each batch of glass manufactured would, even if made to the same basic recipe, have a subtly different chemical composition. Such chemical variation could arise through a variety of factors, the most important of which are likely to be slight variations in the nature of the raw materials used, the proportions of these raw materials, and differences in melting temperature. The identification of such subtle compositional differences and the attribution of these differences to different batches of glass manufacture is a relatively straight-forward procedure if the analytical technique employed is capable of a high degree of precision. The identification of the significance of such batches is, however, somewhat more challenging. It is possible to imagine a single glasshouse which could produce two different batches on successive days and that these could then be identified through chemical analysis of the finished glass. Nevertheless, it is also possible to imagine that the batches were made at completely different glasshouses (perhaps separated by hundreds of kilometres) and at different times (perhaps even centuries apart). If the two Ightham Mote forest glass batches were the product of the first of these two scenarios, then it is likely that they were both ordered, manufactured, delivered and installed together. If, on the other hand, they represent the latter scenario then they probably result from two separate glazing episodes. Although both batches are found together in W02 in the Great Hall, it is likely that this window has undergone significant repair at later dates and could have used glass employed in earlier windows — the coexistence of both types in this window is not proof that they were originally supplied together.

The two batches share the same concentrations of major elements and are clearly made to the same basic recipe. The relatively high magnesium and low potassium content suggests that this glass was manufactured in England and not on mainland Europe (Dungworth and Paynter 2010). The differences in trace element concentrations (especially Rb, Sr and Zr) are sufficient to suggest that the two batches were probably not made at the same glasshouse. The difference in copper content is of uncertain significance; the proportion of copper in either batch is unlikely to have been deliberate or to have had an appreciable effect on the quality of the finished glass. It is unclear whether the copper originated as a trace element in a plant ash or derives from the use of cullet glass that could have included (stained) glass deliberately coloured with copper.

The forest glass would have been manufactured before c1567 and could have been installed at almost any earlier date. Some or all of the forest glass may have originally been installed into windows in the earliest 14th-century buildings; it could also represent repair, replacement and remodelling that took place when Sir Richard Clement owned Ightham Mote in the early 16th century. The forest glass would not have formed part of the original glazing of any windows installed by the Selby's or any later owners.

High-Lime Low-Alkali Glass

A total of 651 panes have been identified as having been made of HLLA glass. The identification of this glass type was frequently hampered by the failure to detect magnesium (107 panes) or phosphorus (61 panes). In some cases the apparent proportion of calcium was much lower than would be normal for this glass type. The identification of HLLA glass, therefore, relied heavily on the use of the trace elements rubidium and strontium: HLLA contains less rubidium than forest glass and less strontium than kelp glass, but significantly more of both of these elements than SLS glass (Figure 42). The HLLA glass panes can be divided into HLLA1 (low manganese) and HLLA2 (higher manganese). These two groups have tentatively been identified as of chronological significance (HLLA2 being made c1567–c1610 and HLLA1 c1610–c1700). The significance of this separations into two compositional sub-groups is strengthened by other minor differences, including iron and zirconium (Figure 46).

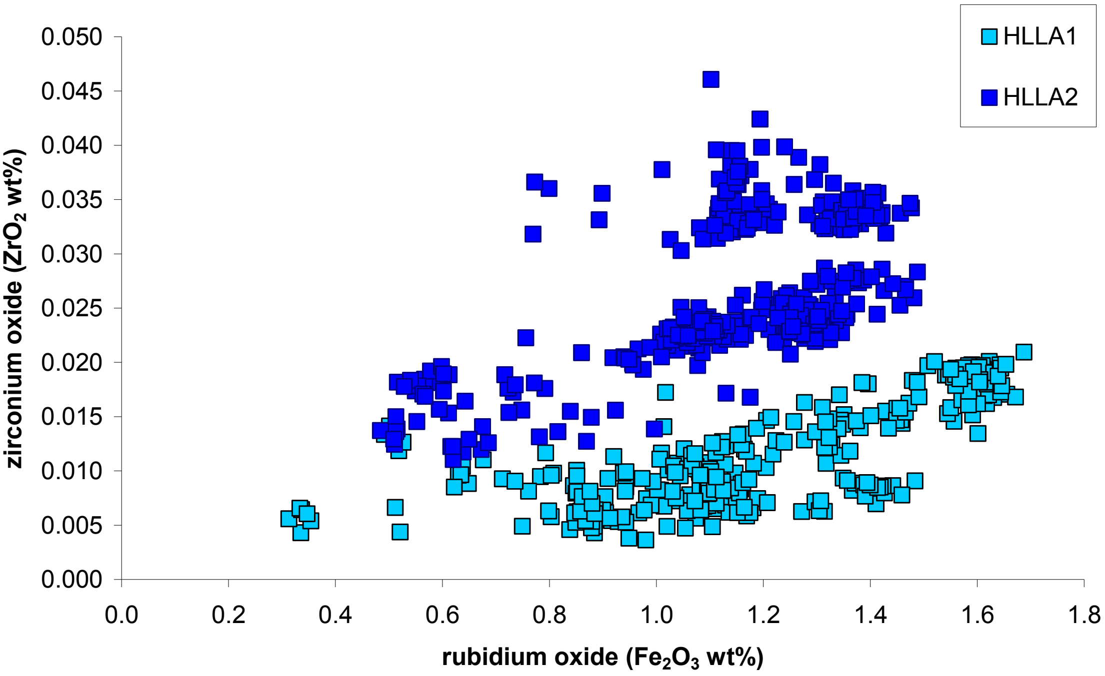

Figure 46. Iron and zirconium content of the HLLA glass from Ightham Mote

The distribution of HLLA1 and HLLA2 also suggests that the separation of these sub-groups is meaningful. Some of windows that contained HLLA glass only had HLLA1 (or only HLLA2, eg Figures 24 and 25) while, in some of those windows with both types, the spatial arrangement of the panes suggests that the two types of glass were made at different times and/or places (eg Figures 18 and 21). Nevertheless, both HLLA sub-groups can be found throughout many of the Ightham Mote windows. In some cases the present arrangement of HLLA panes is likely to be the result of restoration and repair programmes that could have taken place long after HLLA glass ceased to be made.

If it is assumed that all of the HLLA glass was originally installed at Ightham Mote, then it can be concluded that it would have been installed during the period when the site was owned by the Selby family. It is most unlikely that any of this glass was originally manufactured after c1700.

The concentrations of minor and trace elements in both HLLA sub-groups suggests the presence of several batches (and numerous outliers), however, the systematic identification of these groups was hampered by the limited range of elements which displayed differences in concentrations and the apparent high degree of overlap.

Kelp Glass

A total of 56 panes have been identified as having been made of kelp glass. The identification of this glass type was occasionally hampered by the failure to detect magnesium (1 pane) or phosphorus (5 panes). The kelp glass was, however, almost always identifiable by the relatively high strontium content. Kelp glass dominated the market for plain window glass throughout the 18th century (and the first three decades of the 19th century) and yet only 3% of the analysed panes at Ightham Mote are of this glass type. This suggests that very little work was undertaken to replace or repair any windows at Ightham Mote during this period. The notable exceptions to this are the Gothic revival windows which face onto the courtyard (W03 and W07).

SLS Glass

Over half of all of the analysed panes at Ightham Mote are made of SLS glass. In many instances, the identification of this glass type was straight forward: it rarely contained any detectable phosphorus and often contained very low levels of iron oxide. In some cases the initial identification was hampered by the detection of phosphorus and of rather high levels of iron. The presence of phosphorus would normally have indicated that the panes were made using a plant ash as the flux and have indicated manufacture prior to c1835. A consideration of the phosphorus content of these panes in relation to the date and time they were analysed, however, clearly showed that these anomalous results all took place during two short periods on the Thursday (Figure 9). The cause of the anomalous results has been attributed to issues with maintaining a protective film on the nose of the instrument and the inevitable loss of helium flush. The problems with the helium flush led to problems detecting and quantifying a range of light elements during these two periods on Thursday (Figure 8). Once this instrumental problem was diagnosed as the cause of the anomalous light element results it was possible to discount the light elements and focus on the data from heavier elements.

The heavy elements present in the SLS glass usually allowed the unambiguous identification of this glass type, however, some confusion was initially caused by the, at times, rather high iron content (Figure 47). These high-iron SLS panes also often contained elevated levels of other colouring elements such as manganese and copper (Figure 48). These panes have been interpreted as having been made using SLS glass (after c1835) but with the deliberate addition of a range of colouring metals in an effort to match the quality of older glass at Ightham Mote.

The SLS glass (including the deliberately tinted or coloured panes) can all be attributed to the period after c1835. The calcium content of the SLS glass (Figure 49) suggests the presence of a high-calcium group (768 panes) likely to have been manufactured c1835–c1930 (Phase 5a) and a low-calcium group (228 panes) likely to have been manufactured after c1930 (Phase 5b). Magnesium was (with one exception) not detected in any of the high-calcium SLS glass (cf Table 1). Magnesium was detected in some of the low-calcium

SLS glass, however, the failure to detect this element in some low-calcium SLS glass is likely to be due to problems with the helium flush and/or surface weathering of the glass.

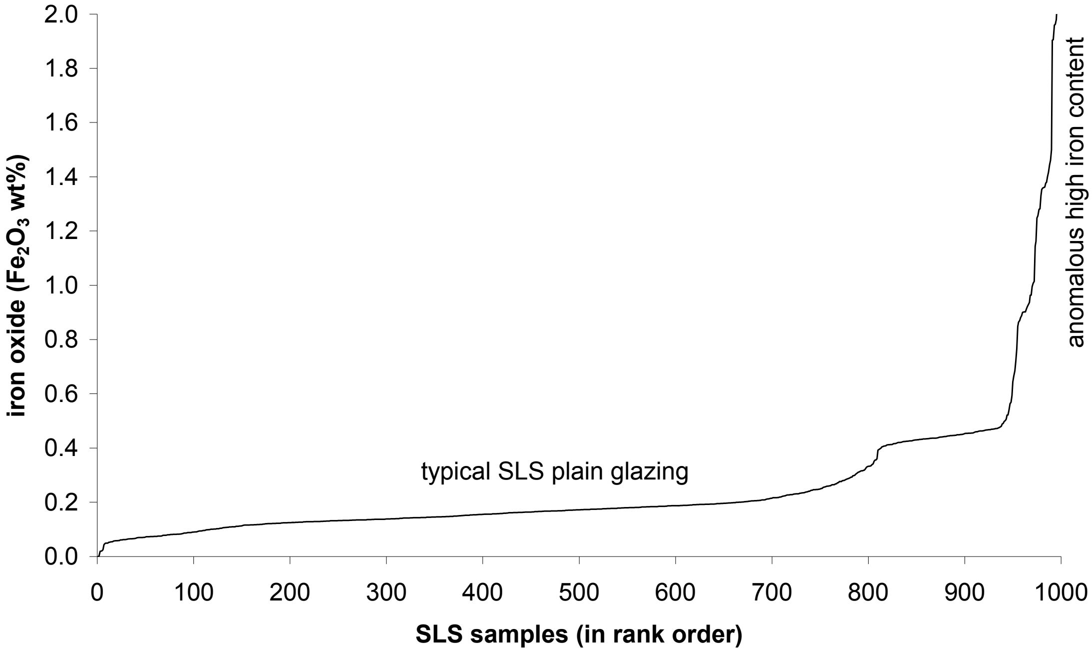

Figure 47. Iron content of SLS glass (in rank order)

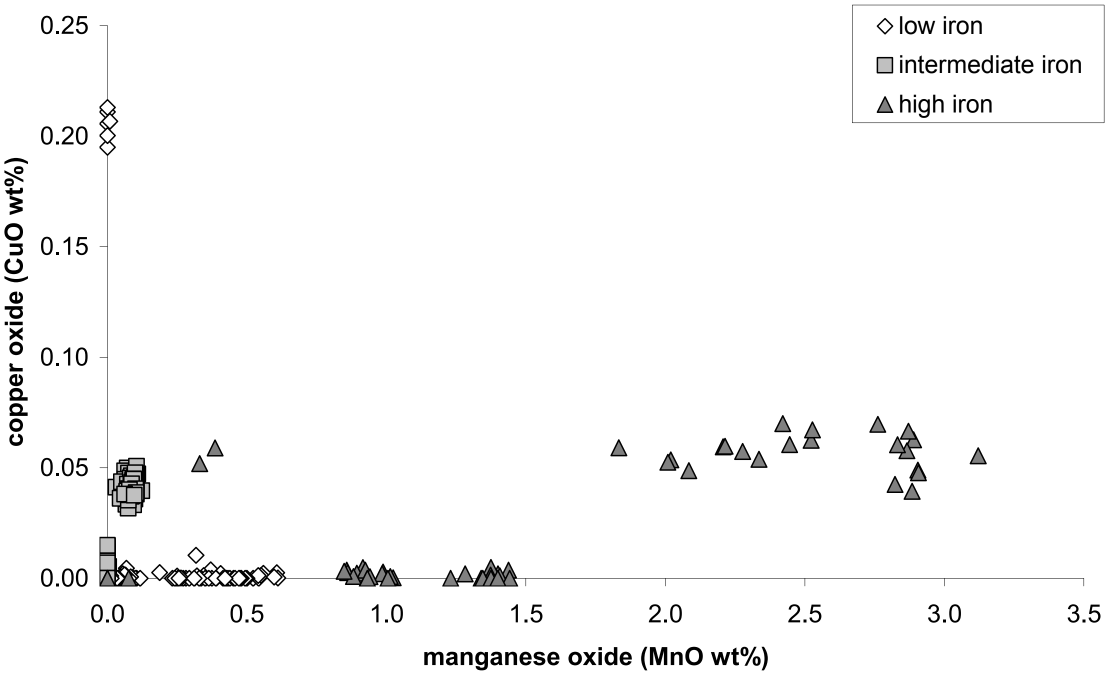

Figure 48. Manganese and copper content of SLS glass

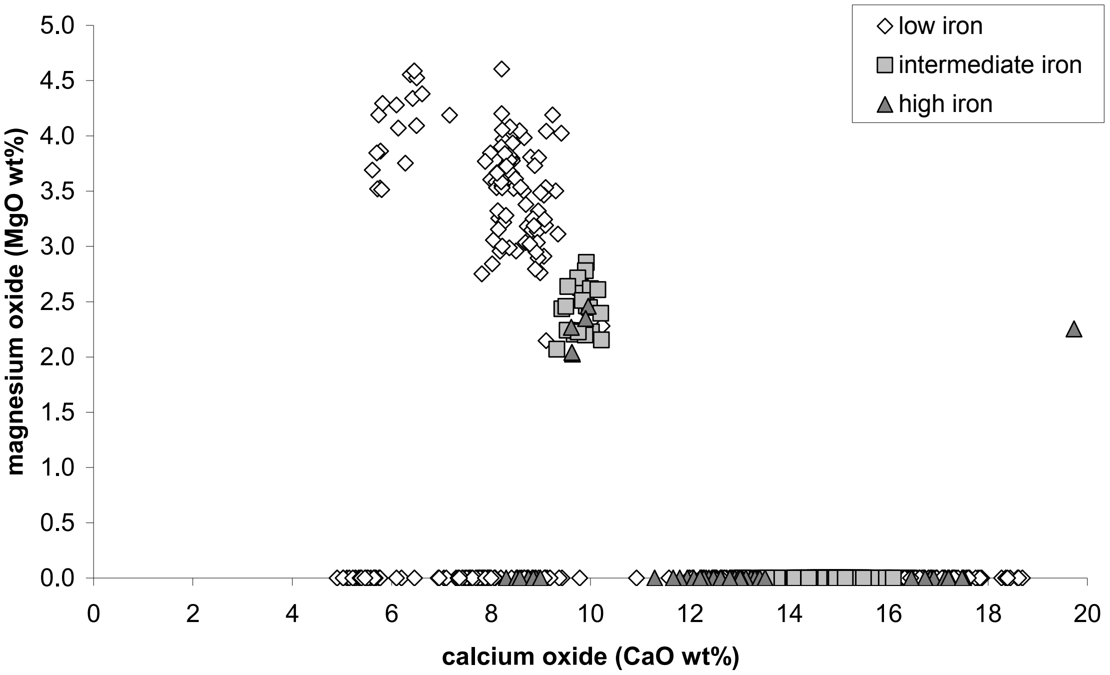

Figure 49. Magnesium and calcium content of SLS glass

SLS (HiK) Glass

A total of 51 panes have been identified as having been made of a glass not previously encountered (Table 22). The concentrations of most elements in this glass (eg rubidium and strontium) are similar to most SLS glass, however, the glass contains much more potassium (3.3wt% K_2O) than would be expected on the basis of all work to date on historic window glass (for the purposes of this report it is referred to as HiK). The pXRF analysis of windows at Walmer Castle (Dungworth and Girbal 2011) identified a potassium calcium silicate glass which had also escaped previous detection. The Walmer Castle glass contained very high levels of potassium (5–20wt% K_2O) that left little doubt that it was based on the recipe used for Bohemian crystal and known to have been employed in Germany and Bohemia for the manufacture of window glass in the early 19th century (Smrcek 2005). The Ightham Mote HiK glass has a chemical composition which is quite similar to the Walmer Castle Potash3 glass, however, there are sufficient minor differences (eg the Ightham Mote glass has less than a tenth of the rubidium content) to suggest that these are not identical glasses.

Table 22. Average composition of HiK glass

	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	As_2O_3	Rb_2O	SrO	ZrO_2
Ightham	<2	<0.5	<1	3.3	5.8	<0.01	0.01	0.05	0.09	0.002	0.002	0.006
Walmer	<2	0.9	<1	6.1	5.6	<0.01	0.15	<0.01	<0.01	0.022	0.006	0.006

There are a range of minor elements present in the Ightham Mote HiK glass (eg Figure 50) which suggest that this glass was on occasion produced with a deliberate colour or tint. Most of the HiK glass was found in the Tower (28 panes) and New Chapel (19 panes).

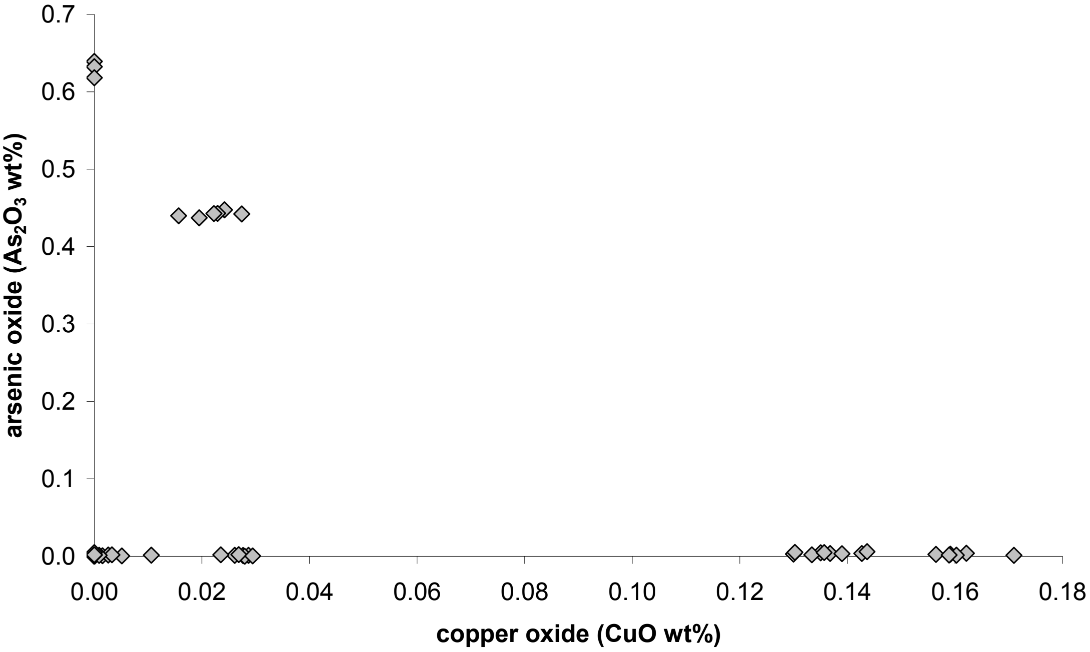

Figure 50. Copper and arsenic content of the HiK glass from Ightham Mote

The low iron, rubidium and strontium content of this glass is typical of SLS and flint glasses and it is unlikely to have been manufactured before the late 17th century. The parallels with Walmer Castle and Kenwood House suggest that the most likely period of manufacture is the late 18th century or early 19th century.

Reproducing colour/tint in historic window glass

The SLS glass from Ightham Mote includes panes with elevated levels of iron (Figure 47), even though plain SLS window glass of the 19th and 20th centuries normally contains rather low levels of iron (<0.4wt% Fe_2O_3). Iron is the most significant impurity in glassmaking materials that can give a colour or tint to the finished glass. The low levels of iron in plain SLS glazing is undoubtedly the result of the deliberate selection of low-iron sand that would yield a glass largely free from any tint. This contrasts with most earlier glass which contains higher levels of iron and therefore usually has a discernible colour.

The high-iron SLS glass from Ightham Mote falls into two groups, the first (132 panes) with 0.4–0.5wt% Fe_2O_3 and the second (54 panes) with 0.5–2.0wt% Fe_2O_3. Many of these panes also contain small but appreciable levels of manganese and copper (Figure 48). The presence of these elements is most likely to be the result of deliberate policy by the glassmakers to produce glass with a specific colour or tint. Varying levels of manganese, iron and copper could and would provide the glass with a variety of tints from pale blue to pale green. This deliberately tinted glass may have been made to a carefully laid out recipe, however, the concentration of colouring elements in the Ightham Mote glass are generally much lower than would be suggested by a consideration of most 19th-century recipes (eg Cable 2008). Bontemps, however, recommends the production of,

> *antique white glass*, which the English call *cathedral glass*. It will be understood that a glass manufacturer who makes large quantities of coloured glasses does not need to colour white glass by adding metal oxides, he needs only to add a small proportions of coloured cullet to larger proportions of his white window cullet to make *antique* glasses. For this purpose he will use mostly green and blue cullet, also amber coloured with iron and manganese, and ruby.
> (Cable 2008, 284)

CONCLUSIONS

The pXRF analysis of 1939 panes of window glass at Ightham Mote were undertaken to test the suitability of the methodology and to shed some light on the history of glazing at the site.

The pXRF was used with a helium flush to enable the detection of light elements that were diagnosed as significant in identifying different periods of manufacture (Dungworth 2011). The limitations of the physical conditions of surviving historic glass (in particular weathered surfaces) and the difficulties in maintaining a helium flush while completing such a large number of analyses have shown that the detection of light elements is never certain. In some cases the presence of light elements may be missed, or their concentrations may be misreported, due to problems with corrosion or the instrument itself. The inherent analytical problems do not, however, seem to have had any significant effect on the determination of heavier elements (iron, etc). The heavy elements which have proved most useful for the identification of basic glass types have been rubidium and strontium. Strontium was already identified as a key element for identifying kelp glass but it is now clear that, used in combination with rubidium, it can help identify all of the other major glass types.

The pXRF identified examples of every major type of window glass (forest, HLLA, kelp and SLS) at Ightham Mote. A tenth of the glass is forest glass which would have been produced before c1567 and could have formed part of the original 14th-century glazing or of the early 16th-century glazing under Sir Richard Clement. Most of this forest glass survives as occasional panes within windows that also include a greater proportion of much later glass. In some cases it is possible that the forest glass which is present in these windows has had a long history of use, possibly in more than one window, building or even site. It is clear that many of the older windows have undergone several periods of repair and restoration but that these are poorly documented. Untangling the original glass from later replacements and defining more than one period of repair based solely on the composition of the glass is far from straight forward, 'The absence of uniformity throughout gives a peculiar charm to the building' (Vallance 1933, 118).

A third of the analysed panes are made from HLLA glass that would have been manufactured between c1567 and c1700. In at least some cases, it is suspected that the current arrangement of the HLLA glass significantly post-dates its manufacture. It is possible that at least some of the HLLA glass was obsolete when it was introduced. It may have been reclaimed from different windows, buildings, or even sites but retained for use where *antique* glass was valued.

A very small proportion of the glazing can be dated to c1700–c1830 (the kelp glass, 3%). Just over half of the glass has a SLS composition that shows it was manufactured after c1835. Most of this SLS glass has a composition which indicates production prior to the mechanisation of the flat glass industry c1930. A proportion of the SLS glass appears to have been deliberately manufactured with a tint in order to match the older, surviving glass.

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APPENDIX 1. IGHTHAM MOTE FLOOR PLANS SHOWING THE LOCATIONS OF ALL ANALYSED WINDOWS

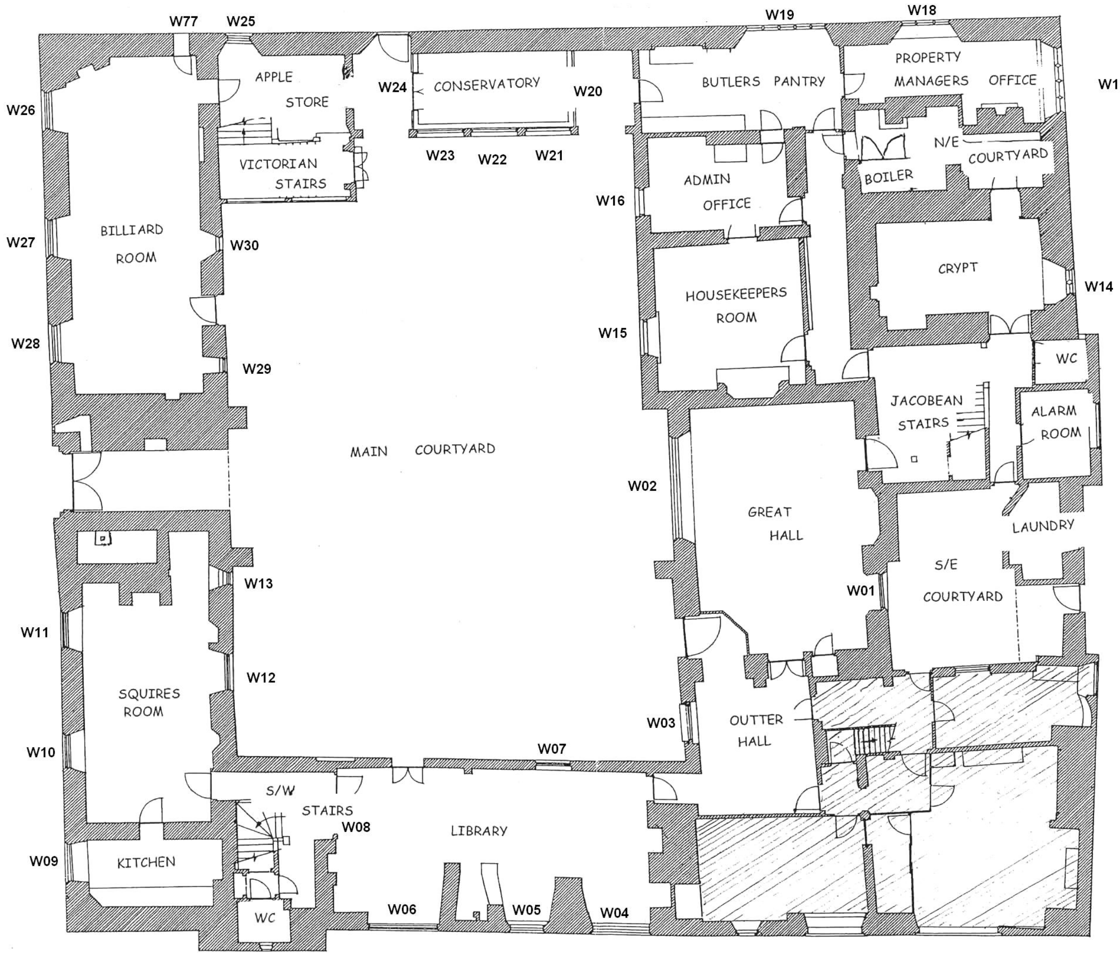

Figure 51. Plan of the ground floor, Ightham Mote (© National Trust)

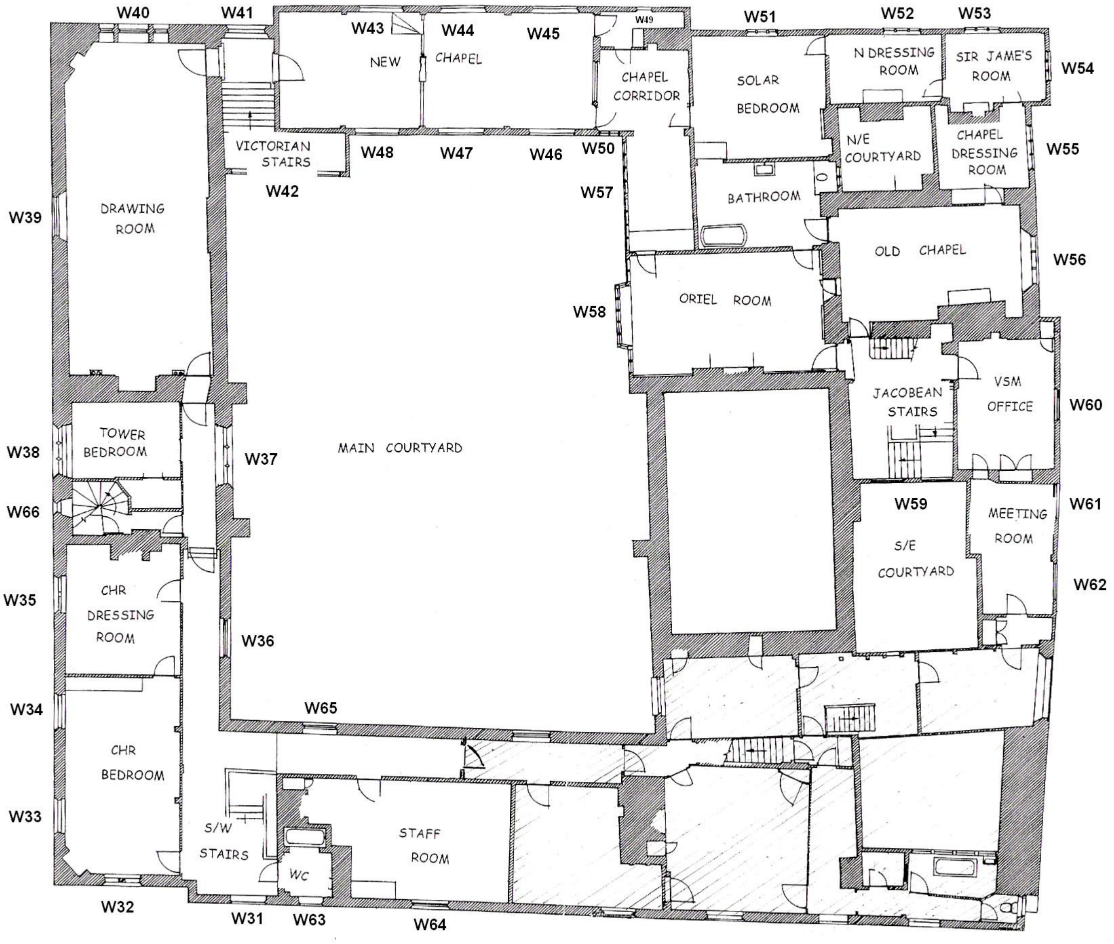

Figure 52. Plan of the first floor, Ightham Mote (© National Trust)

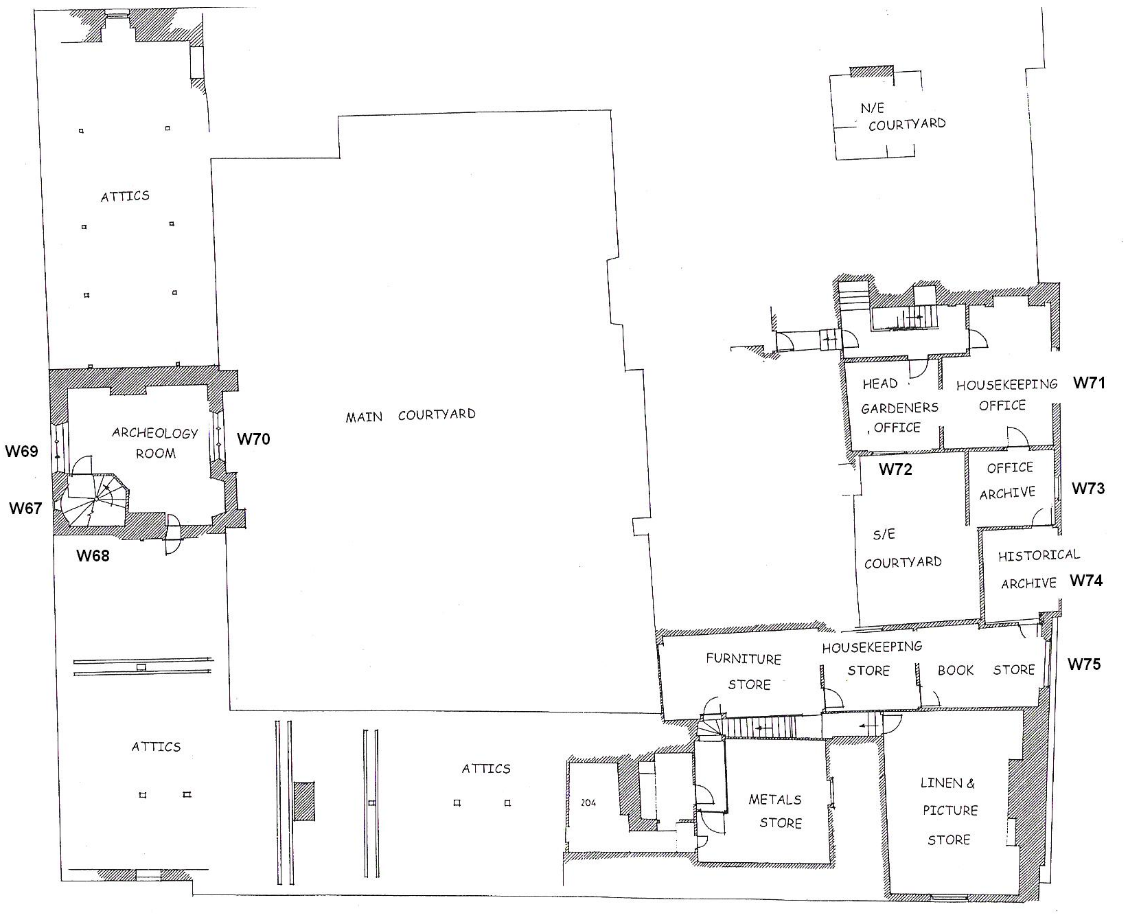

Figure 53. Plan of the second floor, Ightham Mote (© National Trust)

APPENDIX 2. pXRF RESULTS (W = WINDOW; P = PANE; nd = NOT DETECTED)

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w01.1	1	nd	0.6	92.7	nd	1.0	nd	nd	15.1	nd	0.204	0.004	nd	0.346	nd	0.015	0.004
w01.1	2	nd	0.6	92.0	nd	0.9	nd	nd	15.3	nd	0.190	nd	nd	0.342	nd	0.016	0.004
w01.1	3	nd	1.9	90.8	nd	0.6	nd	0.2	12.4	2.871	0.766	0.067	0.011	0.548	nd	0.017	0.003
w01.1	4	nd	nd	96.8	nd	0.6	nd	nd	13.6	0.092	0.174	nd	nd	0.222	nd	0.015	0.005
w01.1	5	4.2	4.6	87.0	1.1	1.7	0.5	2.5	18.4	0.029	1.426	nd	0.006	0.020	0.001	0.160	0.008
w01.1	6	nd	1.3	90.4	nd	0.9	nd	0.1	13.2	2.905	0.522	0.049	0.012	0.019	nd	0.017	0.003
w01.1	7	nd	1.5	91.5	nd	0.9	nd	0.1	13.3	2.907	0.569	0.048	0.011	0.021	nd	0.017	0.003
w01.1	8	nd	1.4	89.3	nd	0.9	nd	0.1	13.0	2.884	0.564	0.039	0.030	0.023	nd	0.016	0.003
w01.1	9	3.4	4.1	77.2	2.6	0.7	nd	4.1	26.8	0.629	1.182	0.012	0.021	0.109	0.003	0.065	0.033
w01.1	10	nd	1.2	89.3	nd	0.8	nd	0.1	12.8	2.823	0.507	0.043	0.029	0.019	nd	0.016	0.004
w01.1	11	nd	nd	95.5	nd	0.6	nd	nd	16.1	nd	0.132	nd	nd	0.087	nd	0.009	0.006
w01.1	12	3.2	3.6	69.8	4.1	9.7	0.6	3.3	23.2	0.844	1.321	0.006	0.026	0.177	0.004	0.078	0.028
w01.1	13	nd	0.6	87.4	nd	2.7	nd	nd	15.9	0.061	0.197	nd	nd	0.204	nd	0.015	0.006
w01.1	14	nd	1.8	86.5	nd	0.6	nd	0.1	11.8	2.866	0.684	0.058	0.014	0.539	nd	0.016	0.003
w01.1	15	3.5	4.6	81.0	2.7	1.2	nd	3.9	26.2	0.622	1.258	0.012	0.021	0.125	0.004	0.061	0.036
w01.1	16	3.6	4.3	77.7	2.5	0.9	nd	4.2	27.3	0.586	1.144	0.015	0.026	0.112	0.004	0.065	0.035
w01.1	17	4.6	3.2	87.7	1.1	0.8	0.4	2.4	22.6	0.029	1.112	nd	0.008	0.005	0.001	0.183	0.007
w01.1	18	4.3	2.7	85.0	nd	1.0	0.4	1.7	24.3	0.011	0.874	0.004	0.004	nd	0.001	0.119	0.007
w01.2	1	2.8	2.7	74.6	2.7	5.0	0.7	2.6	25.8	0.154	1.017	0.001	0.013	0.041	0.001	0.122	0.017
w01.2	2	nd	0.7	92.4	nd	0.6	nd	nd	12.4	0.077	0.230	nd	0.003	0.196	nd	0.013	0.005
w01.2	3	nd	1.5	88.6	nd	0.8	nd	0.1	13.5	1.833	1.007	0.059	0.019	0.018	nd	0.017	0.004
w01.2	4	3.6	4.2	77.5	2.6	0.7	nd	4.2	26.7	0.541	1.167	0.013	0.023	0.110	0.003	0.062	0.034
w01.2	5	4.3	5.1	88.4	nd	0.5	0.4	2.4	18.3	0.020	1.401	nd	0.004	0.005	0.001	0.159	0.008
w01.2	6	3.9	4.7	79.6	2.8	1.1	nd	4.3	27.4	0.622	1.296	0.009	0.029	0.102	0.004	0.064	0.037
w01.2	7	nd	nd	97.5	nd	0.6	nd	nd	13.6	0.062	0.193	nd	nd	0.215	nd	0.015	0.005
w01.2	8	nd	2.1	89.8	nd	0.8	nd	0.1	13.0	2.084	0.864	0.049	0.012	0.020	nd	0.016	0.005
w01.2	9	3.2	3.9	83.5	2.7	1.2	0.4	4.3	22.3	0.102	1.460	0.008	0.018	nd	0.003	0.082	0.014
w01.2	10	nd	2.4	91.1	nd	0.8	nd	0.1	13.1	2.019	0.881	0.054	0.011	0.020	nd	0.016	0.005
w01.2	11	3.8	4.5	79.6	2.6	0.6	nd	4.3	28.0	0.585	1.156	0.012	0.023	0.113	0.003	0.064	0.035
w01.2	12	4.7	2.9	85.8	1.2	1.1	0.5	2.0	23.3	0.018	0.879	nd	0.003	0.010	0.001	0.193	0.005

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w01.2	13	nd	0.7	96.9	nd	0.8	nd	nd	15.3	nd	0.205	nd	nd	0.037	nd	0.012	0.003
w01.2	14	4.2	3.8	77.0	2.4	0.9	nd	4.1	27.6	0.564	1.116	0.012	0.022	0.112	0.004	0.064	0.034
w01.2	15	nd	1.9	88.1	nd	0.7	nd	0.2	11.9	2.890	0.665	0.063	0.020	0.559	nd	0.016	0.003
w01.2	17	nd	0.5	92.7	nd	0.6	0.2	nd	13.5	0.065	0.193	0.001	0.001	0.209	nd	0.014	0.005
w01.2	18	nd	0.6	93.7	nd	0.7	nd	nd	13.4	0.099	0.187	nd	0.003	0.207	nd	0.015	0.004
w01.2	19	nd	0.6	91.0	nd	0.8	nd	nd	15.0	nd	0.203	nd	nd	0.386	nd	0.016	0.004
w01.2	20	nd	2.1	89.2	nd	0.6	nd	0.2	12.3	2.832	0.722	0.060	0.013	0.539	nd	0.016	0.003
w01.3	1	3.3	3.6	83.3	nd	0.8	0.4	1.8	22.7	0.005	0.851	0.001	0.042	0.007	0.001	0.128	0.010
w01.3	2	nd	0.6	99.1	nd	0.7	nd	nd	14.0	0.053	0.170	0.001	0.002	0.228	nd	0.015	0.004
w01.3	3	3.7	2.9	83.6	2.2	0.9	0.5	2.9	21.9	0.165	1.544	0.007	0.014	nd	0.002	0.098	0.015
w01.3	4	3.6	4.0	80.4	2.3	0.9	0.5	3.5	25.2	0.870	1.402	0.006	0.032	0.123	0.003	0.083	0.028
w01.3	5	nd	nd	96.3	nd	0.7	nd	nd	13.2	0.072	0.191	nd	nd	0.225	nd	0.014	0.004
w01.3	6	nd	2.2	87.9	nd	0.8	nd	0.2	12.8	2.762	1.014	0.070	0.027	0.015	nd	0.017	0.004
w01.3	7	4.3	5.7	81.4	2.6	0.3	0.5	4.2	20.5	0.675	0.723	0.007	0.027	0.041	0.003	0.058	0.018
w01.3	8	nd	4.3	85.6	1.2	3.6	0.4	1.6	22.9	0.054	1.010	nd	0.006	0.016	0.001	0.110	0.012
w01.3	9	nd	1.9	89.7	nd	0.9	nd	0.1	12.9	2.207	0.848	0.059	0.014	0.013	nd	0.015	0.004
w01.3	10	4.1	3.0	86.7	nd	1.1	0.5	2.0	22.0	0.045	0.880	nd	0.008	0.011	0.001	0.166	0.007
w01.3	11	4.8	3.3	84.6	1.2	1.5	0.3	2.3	23.2	0.003	1.272	0.003	0.009	nd	0.001	0.125	0.006
w01.3	12	nd	2.9	94.7	nd	1.0	0.2	0.4	15.0	nd	0.287	nd	nd	nd	0.001	0.008	0.005
w01.3	13	4.2	4.6	83.2	2.7	1.0	0.4	4.22	23.8	0.139	1.631	0.007	0.024	0.006	0.002	0.087	0.017
w01.3	14	3.7	2.6	78.1	2.5	8.1	0.6	1.8	21.1	0.026	0.886	nd	0.005	0.077	0.001	0.171	0.006
w01.3	14.3	nd	1.8	90.9	nd	1.0	nd	0.2	12.6	3.122	0.594	0.055	0.019	0.295	nd	0.016	0.003
w01.3	15	nd	0.6	93.5	nd	0.7	nd	nd	14.3	0.415	0.236	nd	0.002	0.261	nd	0.015	0.005
w01.4	1	nd	2.1	91.7	nd	0.8	nd	0.1	13.4	2.421	0.963	0.070	0.011	0.023	nd	0.016	0.004
w01.4	2	4.8	2.8	85.0	1.0	0.8	0.5	1.7	21.7	0.017	0.884	nd	0.008	0.009	0.001	0.179	0.004
w01.4	3	nd	nd	98.1	nd	0.6	nd	nd	13.9	0.071	0.206	nd	0.001	0.222	nd	0.014	0.005
w01.4	4	5.3	3.3	88.3	1.4	0.9	0.5	2.6	21.1	0.016	1.136	nd	0.004	nd	0.001	0.197	0.006
w01.4	5	nd	2.1	90.1	nd	0.8	nd	0.1	13.0	2.446	0.902	0.060	0.014	0.013	nd	0.016	0.005
w01.4	6	4.5	2.5	84.2	nd	1.1	0.4	1.6	24.7	0.032	0.858	nd	0.007	nd	0.001	0.151	0.006
w01.4	7	nd	nd	95.5	nd	0.6	nd	nd	13.4	0.075	0.186	nd	0.002	0.214	nd	0.014	0.005
w01.4	8	2.8	3.7	77.7	3.1	3.9	nd	5.1	23.3	0.138	1.375	0.006	0.024	0.015	0.004	0.043	0.015
w01.4	9	3.0	4.5	83.1	2.2	3.4	0.5	3.4	23.3	0.800	1.355	0.009	0.027	0.139	0.003	0.079	0.028

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w01.4	10	nd	1.9	90.5	nd	0.8	nd	0.1	13.1	2.335	0.902	0.054	0.014	0.021	nd	0.016	0.005
w01.4	11	4.5	1.8	91.6	nd	0.3	0.6	4.7	11.0	nd	0.712	nd	0.006	nd	0.002	0.091	0.009
w01.4	12	3.9	3.4	82.4	nd	0.4	0.4	2.1	21.3	0.058	1.357	0.001	0.007	nd	0.001	0.171	0.009
w01.4	13	4.0	3.4	85.4	1.0	0.4	0.4	2.1	21.8	0.024	1.297	nd	0.009	0.008	0.001	0.171	0.007
w01.4	14	4.0	4.1	81.2	2.4	nd	0.5	3.4	24.7	0.805	1.388	0.012	0.030	0.111	0.003	0.078	0.028
w01.4	15	4.3	3.8	85.5	1.2	1.6	0.5	2.0	21.5	0.029	1.411	nd	0.008	nd	0.001	0.176	0.007
w02.1	1	4.0	3.1	81.3	2.3	1.0	0.4	2.8	23.7	0.194	1.349	0.006	0.019	nd	0.002	0.115	0.014
w02.1	2	2.8	2.7	75.7	2.8	5.7	0.4	2.8	25.9	0.195	1.014	0.006	0.014	0.035	0.002	0.087	0.014
w02.1	3	4.0	4.3	78.5	2.4	0.5	nd	4.2	26.6	0.622	1.228	0.014	0.022	0.111	0.004	0.063	0.034
w02.1	4	4.0	4.2	78.9	2.5	0.6	nd	4.2	26.7	0.555	1.159	0.010	0.020	0.111	0.004	0.063	0.037
w02.1	5	4.0	4.4	80.8	2.4	1.1	nd	4.3	23.3	0.895	1.422	0.009	0.030	0.140	0.004	0.084	0.034
w02.1	6	3.9	4.2	80.1	2.2	1.1	nd	4.4	23.7	0.880	1.408	0.011	0.026	0.128	0.004	0.085	0.035
w02.1	7	nd	1.7	92.7	nd	0.8	nd	0.4	14.0	nd	0.168	nd	0.005	nd	0.001	0.009	0.005
w02.1	8	3.2	4.3	75.4	3.0	5.1	0.2	4.3	22.4	0.947	1.325	0.011	0.028	0.177	0.004	0.082	0.033
w02.1	9	5.8	3.0	89.5	nd	1.2	0.5	1.6	27.2	0.010	0.981	nd	0.005	nd	0.001	0.146	0.004
w02.1	10	3.4	2.9	79.1	2.5	1.3	nd	5.4	24.0	0.722	1.008	0.014	0.027	0.105	0.005	0.089	0.023
w02.1	11	2.5	3.5	72.6	2.7	3.9	nd	4.1	22.1	0.873	1.312	0.008	0.032	0.149	0.004	0.084	0.035
w02.1	12	6.9	1.7	68.1	3.9	2.4	0.4	9.6	14.4	0.915	0.473	0.008	0.032	0.016	0.015	0.028	0.011
w02.1	13	nd	1.6	93.7	nd	0.6	nd	0.4	14.1	nd	0.178	nd	0.002	nd	0.001	0.011	0.004
w02.1	14	nd	1.6	92.5	nd	0.5	nd	0.4	14.3	nd	0.153	nd	0.001	nd	0.001	0.009	0.005
w02.1	15	2.7	2.8	74.2	2.7	3.0	0.2	5.4	23.8	0.695	1.093	0.009	0.029	0.122	0.004	0.089	0.024
w02.1	16	2.8	3.9	76.4	2.4	2.6	nd	4.3	22.6	0.928	1.316	0.010	0.027	0.135	0.004	0.083	0.032
w02.1	17	7.0	2.0	72.0	4.3	1.1	0.9	9.5	14.2	0.867	0.449	0.004	0.035	0.045	0.016	0.029	0.012
w02.1	18	5.6	2.1	66.1	4.3	6.8	0.5	9.2	13.7	0.867	0.443	0.007	0.036	0.051	0.016	0.027	0.011
w02.1	19	2.4	3.5	71.9	2.4	1.4	nd	4.0	26.4	0.575	1.146	0.013	0.026	0.121	0.003	0.065	0.033
w02.1	20	3.7	1.7	91.4	nd	0.4	0.6	4.5	11.6	nd	0.630	nd	0.003	nd	0.002	0.091	0.010
w02.1	21	3.8	3.3	78.7	2.9	2.4	0.2	5.4	24.4	0.785	1.046	0.013	0.028	0.112	0.004	0.091	0.025
w02.1	22	4.1	4.5	79.8	2.4	1.6	nd	4.3	23.0	0.947	1.311	0.014	0.028	0.133	0.004	0.084	0.033
w02.1	23	7.4	2.4	72.1	5.0	0.6	0.4	9.8	16.4	0.834	0.593	0.025	0.032	0.008	0.011	0.042	0.014
w02.1	24	3.2	4.3	78.3	2.4	3.0	nd	4.4	23.1	0.915	1.351	0.010	0.027	0.144	0.004	0.086	0.032
w02.1	25	2.8	4.2	79.2	2.2	0.8	nd	4.4	23.8	0.899	1.429	0.020	0.026	0.122	0.004	0.084	0.032
w02.1	26	2.7	3.2	76.8	2.9	5.4	0.4	2.5	26.0	0.195	1.298	0.001	0.018	0.033	0.002	0.099	0.014

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.1	27	3.6	3.9	79.4	2.4	1.8	nd	4.4	23.8	0.982	1.350	0.006	0.028	0.143	0.005	0.088	0.033
w02.1	28	4.5	3.7	89.6	1.2	0.4	0.7	2.8	14.4	0.009	0.741	nd	0.007	nd	0.001	0.258	0.004
w02.1	29	5.5	3.2	77.3	4.5	2.2	0.4	9.0	15.4	0.835	0.618	0.031	0.035	0.018	0.011	0.042	0.015
w02.1	30	5.5	2.8	75.3	3.1	7.6	0.4	7.7	12.2	0.773	0.530	0.009	0.033	0.043	0.014	0.027	0.012
w02.1	31	3.9	4.2	81.9	2.3	0.9	nd	4.5	23.9	0.874	1.394	0.009	0.027	0.116	0.004	0.084	0.035
w02.1	32	2.6	4.0	75.2	3.4	5.6	0.3	3.9	24.2	0.541	1.193	0.013	0.028	0.120	0.003	0.061	0.034
w02.1	33	3.2	4.2	75.4	2.7	0.7	nd	4.2	27.4	0.566	1.198	0.018	0.021	0.109	0.003	0.064	0.034
w02.1	34	2.9	3.8	75.8	2.5	3.4	nd	4.3	22.3	0.936	1.365	0.015	0.029	0.154	0.005	0.084	0.033
w02.1	35	9.9	1.8	77.0	4.2	1.5	0.5	9.5	14.9	0.941	0.338	0.007	0.030	nd	0.016	0.027	0.007
w02.1	36	3.2	3.9	76.5	2.8	4.8	0.2	4.3	22.8	0.972	1.412	0.011	0.027	0.182	0.004	0.085	0.034
w02.1	37	3.5	4.2	78.6	2.3	0.7	nd	4.5	23.4	0.948	1.369	0.011	0.028	0.120	0.004	0.086	0.033
w02.1	38	3.9	3.5	83.4	1.2	0.9	0.4	2.7	19.2	0.017	0.851	nd	0.007	0.017	0.001	0.155	0.010
w02.1	39	7.0	2.6	90.1	1.8	0.5	0.6	3.3	12.7	nd	0.495	0.002	nd	0.006	0.001	0.324	0.006
w02.1	40	3.8	4.3	79.5	2.2	0.8	nd	4.4	24.5	0.960	1.383	0.008	0.026	0.128	0.004	0.087	0.035
w02.1	41	nd	0.8	94.7	nd	0.9	nd	0.1	15.6	0.607	0.194	0.003	nd	0.447	nd	0.018	0.006
w02.1	42	nd	1.0	94.4	nd	1.3	nd	0.1	15.1	0.551	0.211	0.001	nd	0.447	nd	0.017	0.007
w02.1	43	3.9	4.0	73.5	3.6	5.4	0.3	4.1	27.3	0.546	1.165	0.012	0.027	0.162	0.004	0.064	0.033
w02.1	44	2.8	3.6	65.5	4.4	10.1	0.4	3.9	25.4	0.582	1.126	0.012	0.022	0.164	0.003	0.063	0.033
w02.1	45	3.7	4.0	74.3	2.9	1.7	nd	4.0	26.2	0.537	1.136	0.009	0.018	0.112	0.004	0.062	0.035
w02.1	46	3.1	3.9	67.9	3.6	7.4	0.3	3.9	25.6	0.526	1.081	0.013	0.019	0.174	0.004	0.061	0.032
w02.1	47	3.8	4.3	77.5	2.5	0.7	nd	4.2	27.4	0.599	1.197	0.011	0.024	0.108	0.004	0.065	0.035
w02.1	48	3.5	3.9	74.0	2.9	2.1	nd	4.1	27.2	0.534	1.192	0.012	0.025	0.118	0.003	0.062	0.033
w02.1	49	8.2	2.2	71.4	4.8	5.0	0.4	9.8	14.5	0.890	0.463	0.009	0.041	0.034	0.016	0.027	0.011
w02.1	50	3.7	2.7	84.0	nd	0.8	0.4	2.1	22.3	0.025	0.847	nd	0.004	0.008	0.001	0.154	0.006
w02.1	51	2.5	3.6	71.8	2.5	4.0	nd	4.0	27.4	0.534	1.142	0.012	0.023	0.124	0.003	0.064	0.032
w02.1	52	3.7	3.6	73.6	2.4	0.6	nd	4.1	26.5	0.587	1.130	0.010	0.023	0.112	0.003	0.062	0.032
w02.1	53	nd	2.2	86.9	nd	0.9	nd	0.1	12.5	2.277	0.929	0.057	0.016	0.016	nd	0.017	0.004
w02.1	54	2.3	3.7	84.6	2.2	0.9	nd	5.7	24.5	0.093	1.102	nd	0.017	nd	0.005	0.039	0.010
w02.1	55	4.1	2.7	83.5	2.0	1.2	0.4	2.6	27.0	0.194	0.920	0.005	0.016	nd	0.001	0.107	0.011
w02.1	56	7.3	2.9	77.9	3.9	1.4	0.5	8.9	15.4	1.037	0.740	0.097	0.065	nd	0.011	0.043	0.017
w02.1	57	3.3	4.0	71.1	4.7	1.6	0.4	3.9	26.0	0.552	1.183	0.009	0.022	0.168	0.004	0.062	0.034
w02.1	58	2.8	3.5	71.8	2.7	4.7	0.2	4.0	25.0	0.586	1.206	0.011	0.022	0.115	0.003	0.061	0.035

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.1	59	nd	1.0	93.1	nd	1.4	nd	0.1	14.1	0.317	0.228	0.010	0.001	0.261	0.001	0.016	0.006
w02.1	60	nd	2.1	83.6	nd	4.0	nd	0.2	13.0	2.527	0.995	0.067	0.027	0.024	nd	0.016	0.005
w02.1	61	nd	1.3	93.9	nd	1.8	0.9	0.4	17.4	0.390	0.280	nd	0.002	0.268	nd	0.019	0.004
w02.1	62	4.1	4.2	79.2	2.3	1.3	nd	4.5	23.4	0.961	1.355	0.015	0.025	0.129	0.004	0.085	0.034
w02.1	63	3.0	4.2	76.4	2.6	3.5	nd	4.2	23.0	0.963	1.363	0.010	0.026	0.157	0.004	0.085	0.032
w02.1	64	nd	1.1	86.9	nd	2.0	0.8	0.3	16.0	0.350	0.265	nd	0.002	0.250	nd	0.019	0.003
w02.1	65	nd	2.3	84.5	nd	1.6	nd	0.2	12.5	2.523	0.937	0.062	0.012	0.020	nd	0.015	0.005
w02.1	66	nd	1.0	87.9	nd	1.0	nd	0.1	14.3	0.523	0.174	nd	nd	0.498	nd	0.015	0.006
w02.1	67	nd	4.1	101.0	nd	1.3	nd	0.4	15.2	nd	0.413	nd	nd	0.006	0.001	0.011	0.007
w02.1	68	8.0	2.6	74.5	5.0	0.5	0.4	10.2	16.8	0.880	0.612	0.029	0.038	0.017	0.012	0.039	0.015
w02.1	69	3.2	3.5	74.4	2.5	1.0	nd	4.2	26.5	0.564	1.177	0.012	0.027	0.115	0.003	0.063	0.033
w02.1	70	3.8	4.4	79.0	2.7	4.1	0.2	4.3	22.9	0.917	1.309	0.007	0.024	0.144	0.004	0.086	0.034
w02.1	71	3.7	4.5	80.8	2.7	3.2	nd	4.3	23.1	0.985	1.369	0.015	0.028	0.162	0.004	0.086	0.033
w02.1	72	3.6	3.2	80.1	2.4	1.1	nd	5.5	24.5	0.751	1.124	0.009	0.032	0.106	0.004	0.092	0.024
w02.1	73	3.8	2.9	76.8	2.6	2.2	0.2	5.3	23.8	0.718	1.040	0.017	0.028	0.111	0.005	0.090	0.023
w02.1	74	2.3	3.7	74.3	3.0	1.7	0.3	4.1	21.8	0.880	1.283	0.010	0.024	0.189	0.004	0.083	0.034
w02.1	75	4.2	4.4	80.4	2.4	1.4	nd	4.4	23.6	1.009	1.359	0.011	0.028	0.123	0.005	0.084	0.035
w02.1	76	7.1	2.6	72.3	5.2	0.8	0.5	9.9	16.4	0.905	0.602	0.033	0.038	0.018	0.011	0.042	0.015
w02.1	77	5.7	1.6	89.9	1.9	nd	0.6	3.3	11.0	nd	0.314	nd	nd	nd	0.001	0.342	0.003
w02.1	78	4.4	4.4	74.5	4.1	0.8	0.4	4.3	22.4	1.008	1.130	0.010	0.029	0.135	0.005	0.063	0.017
w02.1	79	nd	2.4	84.5	nd	1.2	nd	0.7	17.2	0.924	1.362	0.004	0.009	0.021	0.001	0.022	0.008
w02.1	80	nd	2.5	86.0	nd	1.3	nd	0.7	17.1	0.894	1.360	0.002	0.007	0.025	0.001	0.023	0.009
w02.1	81	nd	1.2	95.7	nd	1.6	0.2	0.1	15.5	0.559	0.206	0.002	nd	0.515	nd	0.016	0.006
w02.1	82	6.0	2.6	86.6	nd	1.4	0.5	1.6	25.5	0.023	0.872	nd	0.004	nd	0.001	0.137	0.006
w02.1	83	4.5	3.4	84.0	1.1	1.1	0.5	2.1	22.8	0.039	1.034	nd	0.008	0.013	0.001	0.127	0.011
w02.1	84	4.3	1.8	89.3	nd	0.5	0.6	4.4	10.9	0.010	0.635	nd	0.005	nd	0.002	0.089	0.010
w02.1	85	4.4	2.7	81.8	1.2	1.7	0.4	2.2	21.4	0.030	1.082	nd	0.010	0.012	0.001	0.183	0.008
w02.1	86	nd	2.0	93.5	nd	0.6	nd	0.6	12.5	nd	0.267	nd	0.003	nd	0.001	0.007	0.005
w02.1	87	4.9	3.0	83.4	nd	1.8	0.4	1.5	23.8	nd	0.803	nd	0.003	0.006	nd	0.126	0.006
w02.1	88	nd	1.2	90.9	nd	1.4	nd	0.1	14.8	0.542	0.181	nd	nd	0.498	nd	0.015	0.006
w02.1	89	5.7	3.1	85.5	nd	1.4	0.5	1.5	24.8	0.004	0.799	nd	0.003	0.010	0.001	0.128	0.006
w02.1	90	4.3	2.6	99.4	nd	0.7	0.6	3.5	15.6	0.001	0.863	nd	0.001	0.006	0.001	0.231	0.024

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.1	91	3.7	2.9	80.4	1.1	1.0	0.4	2.1	22.8	0.023	1.079	0.002	0.006	nd	0.001	0.130	0.010
w02.1	92	5.6	3.0	86.2	1.1	1.3	0.5	2.2	24.2	0.037	0.977	nd	0.005	0.009	0.001	0.196	0.006
w02.1	93	4.3	1.8	88.4	nd	0.6	0.6	4.5	10.4	nd	0.649	nd	0.006	nd	0.002	0.086	0.009
w02.1	94	4.2	2.6	84.5	nd	1.3	0.5	1.6	22.8	0.016	0.849	nd	0.003	0.005	0.001	0.150	0.005
w02.1	95	4.3	3.4	85.7	nd	0.9	0.5	2.1	23.2	0.033	1.091	0.001	0.008	nd	0.001	0.125	0.010
w02.1	96	3.6	3.0	80.6	1.1	1.9	0.5	2.0	22.7	0.034	1.101	0.001	0.011	0.005	0.001	0.128	0.011
w02.2	1	7.5	2.7	73.3	4.9	1.7	0.4	10.0	16.5	0.845	0.627	0.031	0.037	0.015	0.011	0.042	0.014
w02.2	2	4.0	3.0	80.1	3.0	8.3	0.4	7.5	13.2	0.713	0.666	0.030	0.036	0.129	0.010	0.041	0.014
w02.2	3	9.8	2.5	76.1	4.5	3.0	0.5	10.0	15.3	0.842	0.516	0.008	0.038	0.016	0.015	0.028	0.012
w02.2	4	nd	1.0	98.7	nd	1.1	nd	0.1	16.0	0.611	0.216	nd	nd	0.456	nd	0.018	0.007
w02.2	5	nd	1.4	92.9	nd	1.0	0.7	0.4	15.6	0.374	0.238	nd	nd	0.207	nd	0.018	0.003
w02.2	6	4.0	1.7	86.7	nd	0.5	0.6	4.2	10.5	0.014	0.622	nd	0.003	nd	0.002	0.092	0.009
w02.2	7	6.6	2.7	72.0	5.0	2.0	0.5	10.1	16.8	0.842	0.659	0.031	0.037	0.009	0.011	0.042	0.014
w02.2	8	8.2	2.4	74.6	3.8	1.1	0.4	9.6	15.7	0.849	0.494	0.015	0.033	nd	0.015	0.030	0.013
w02.2	9	7.1	2.8	74.3	4.9	0.4	0.4	10.0	16.4	0.885	0.607	0.025	0.036	nd	0.011	0.042	0.014
w02.2	10	3.3	2.9	80.0	2.5	0.9	nd	5.4	24.2	0.721	1.113	0.011	0.027	0.100	0.005	0.090	0.023
w02.2	11	2.9	3.5	80.5	1.5	2.1	0.6	2.3	24.7	0.139	1.277	0.004	0.011	0.011	0.001	0.132	0.013
w02.2	12	3.9	2.6	76.2	3.4	6.3	0.5	8.4	14.4	0.684	0.677	0.022	0.031	0.049	0.010	0.039	0.015
w02.2	13	4.1	2.6	82.4	3.6	1.8	0.5	9.0	15.2	0.853	0.631	0.028	0.033	0.039	0.011	0.043	0.014
w02.2	14	7.3	2.3	71.7	4.0	2.0	0.5	9.8	15.0	0.857	0.496	0.011	0.032	0.015	0.015	0.029	0.012
w02.2	15	7.4	2.8	73.9	4.9	0.5	0.4	10.1	16.6	0.828	0.651	0.028	0.035	nd	0.011	0.040	0.014
w02.2	16	7.5	2.8	75.1	5.0	0.5	0.4	10.3	16.9	0.864	0.645	0.031	0.035	nd	0.011	0.040	0.015
w02.2	17	3.0	3.4	82.8	2.1	1.4	nd	5.3	25.3	0.061	0.974	0.007	0.026	nd	0.004	0.043	0.009
w02.2	18	3.5	3.1	79.3	2.7	0.9	0.2	5.6	23.8	0.705	1.058	0.005	0.027	0.111	0.005	0.090	0.022
w02.2	19	3.5	1.5	90.2	nd	1.9	0.4	2.4	16.8	nd	0.521	nd	0.002	0.010	0.001	0.204	0.004
w02.2	20	4.5	3.4	81.4	2.5	1.1	nd	5.6	25.1	0.714	1.109	0.018	0.031	0.111	0.004	0.092	0.023
w02.2	21	3.8	3.5	87.8	3.0	6.9	0.3	7.2	12.1	0.651	0.777	0.028	0.037	0.053	0.011	0.042	0.015
w02.2	22	3.6	3.1	81.4	3.1	7.3	0.3	7.5	12.6	0.741	0.679	0.029	0.034	0.085	0.012	0.037	0.014
w02.2	23	8.0	2.6	75.4	5.1	0.6	0.4	10.1	16.6	0.863	0.622	0.026	0.037	nd	0.012	0.042	0.014
w02.2	24	7.5	2.7	75.1	4.8	0.7	0.4	10.1	16.5	0.851	0.646	0.029	0.036	nd	0.011	0.041	0.015
w02.2	25	4.9	2.7	74.5	4.4	2.8	0.4	8.9	14.6	0.803	0.617	0.029	0.035	0.064	0.012	0.038	0.014
w02.2	26	3.8	3.1	79.0	2.5	1.0	nd	5.6	24.5	0.718	1.100	0.011	0.027	0.103	0.005	0.091	0.023

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.2	27	3.6	3.1	79.9	2.5	1.0	nd	5.5	24.4	0.773	1.021	0.014	0.025	0.100	0.005	0.088	0.023
w02.2	28	4.9	3.1	81.0	3.8	5.1	0.4	8.0	13.5	0.724	0.740	0.028	0.039	0.050	0.012	0.043	0.015
w02.2	29	3.2	4.1	73.5	2.4	2.2	nd	4.0	27.2	0.575	1.167	0.015	0.022	0.110	0.003	0.064	0.032
w02.2	30	6.7	2.7	71.5	4.7	0.8	0.4	9.9	16.3	0.776	0.640	0.032	0.034	0.010	0.011	0.041	0.014
w02.2	31	7.4	2.6	73.3	4.9	0.4	0.4	10.0	16.6	0.771	0.635	0.031	0.033	nd	0.011	0.040	0.015
w02.2	32	4.2	2.0	94.9	1.1	0.5	0.6	1.6	14.0	0.007	0.749	nd	0.002	0.007	0.001	0.232	0.005
w02.2	33	5.1	3.3	86.8	1.2	0.9	0.4	2.4	21.9	0.028	1.097	nd	0.008	nd	0.001	0.184	0.007
w02.2	34	nd	2.6	87.2	nd	0.6	nd	0.7	17.2	0.882	1.376	0.001	0.009	0.011	0.001	0.023	0.008
w02.2	35	nd	3.6	103.2	nd	1.3	nd	0.4	17.1	nd	0.342	nd	0.001	0.018	0.001	0.011	0.005
w02.2	36	2.8	0.6	32.6	4.5	46.2	0.2	8.2	9.8	1.053	0.812	0.002	0.048	0.022	0.022	0.053	0.010
w02.2	37	3.4	0.8	26.9	5.3	51.8	nd	9.6	10.9	0.999	0.729	0.002	0.043	0.017	0.022	0.054	0.009
w02.2	38	7.7	2.9	75.8	5.0	0.6	0.4	10.2	17.0	0.864	0.633	0.028	0.032	0.010	0.011	0.040	0.015
w02.2	39	5.4	4.8	74.3	3.1	2.1	0.4	3.5	24.6	0.735	0.878	0.004	0.017	0.048	0.003	0.072	0.015
w02.2	40	3.2	3.1	94.3	2.3	4.3	0.3	7.3	12.1	0.773	0.696	0.028	0.032	0.038	0.011	0.042	0.015
w02.2	41	nd	2.8	87.8	nd	0.5	nd	0.7	16.7	0.849	1.380	0.003	0.010	0.014	0.001	0.023	0.009
w02.2	42	nd	1.1	95.5	nd	1.0	nd	0.1	15.3	0.597	0.217	0.001	0.001	0.427	nd	0.016	0.007
w02.2	43	7.1	2.9	73.7	4.8	3.1	0.4	9.6	16.3	0.821	0.652	0.026	0.028	0.035	0.011	0.042	0.014
w02.2	44	4.0	6.5	77.4	2.7	0.6	0.4	5.7	21.6	1.072	0.620	0.005	0.025	0.020	0.005	0.046	0.011
w02.2	45	3.9	6.7	78.8	2.9	0.9	0.4	5.8	21.7	1.051	0.616	0.005	0.017	0.022	0.005	0.044	0.012
w02.2	46	4.4	6.8	77.1	3.0	0.5	0.4	5.8	22.7	0.995	0.673	0.012	0.025	0.027	0.005	0.047	0.012
w02.2	47	7.7	2.0	74.9	4.0	0.7	0.4	9.9	15.2	0.912	0.477	0.009	0.032	0.006	0.016	0.029	0.012
w02.2	48	nd	1.3	99.5	nd	1.0	0.3	0.2	16.1	0.500	0.235	nd	nd	0.594	nd	0.020	0.007
w02.2	49	9.0	2.8	77.5	4.2	1.7	0.5	9.9	15.6	0.883	0.518	0.009	0.036	0.015	0.016	0.032	0.011
w02.2	50	5.7	7.9	76.4	2.6	0.6	nd	6.3	22.8	0.918	0.996	0.007	0.014	0.096	0.007	0.041	0.014
w02.2	51	3.6	6.9	77.6	3.3	2.5	0.4	5.6	21.3	1.077	0.650	0.005	0.020	0.036	0.005	0.045	0.013
w02.2	52	3.2	6.2	76.5	2.6	0.7	0.4	5.7	21.6	1.079	0.619	0.012	0.022	0.020	0.005	0.044	0.012
w02.2	53	3.8	6.6	78.2	3.4	0.7	0.6	4.7	22.4	0.654	0.643	0.018	0.029	nd	0.003	0.046	0.016
w02.2	54	6.4	2.3	68.5	3.9	5.8	0.5	8.9	14.7	0.807	0.527	0.011	0.033	0.047	0.014	0.029	0.012
w02.3	1	6.2	2.7	74.4	4.6	4.0	0.4	9.2	15.1	0.765	0.669	0.034	0.036	0.080	0.011	0.040	0.015
w02.3	2	2.8	3.4	80.5	3.2	0.8	0.4	4.8	24.2	0.292	1.123	0.008	0.028	0.007	0.004	0.043	0.012
w02.3	3	4.7	3.0	84.9	nd	2.1	0.4	1.6	23.3	0.015	0.936	nd	0.004	0.010	0.001	0.129	0.006
w02.3	4	7.4	2.9	73.1	5.0	2.5	0.5	9.4	16.0	0.820	0.625	0.031	0.034	0.038	0.012	0.039	0.014

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.3	5	4.4	6.7	74.5	2.6	1.2	0.2	6.1	21.9	0.742	0.816	0.007	0.017	0.028	0.006	0.036	0.014
w02.3	6	7.6	2.4	73.1	4.2	3.4	0.5	9.3	15.1	0.829	0.465	0.006	0.035	0.021	0.014	0.030	0.011
w02.3	7	7.1	2.9	73.4	4.9	3.4	0.5	9.4	16.0	0.756	0.635	0.029	0.032	0.056	0.012	0.040	0.013
w02.3	8	6.6	2.8	70.7	4.7	5.7	0.6	8.9	14.7	0.829	0.533	0.009	0.031	0.080	0.015	0.030	0.013
w02.3	9	4.6	7.1	77.0	2.9	2.8	0.4	6.0	20.4	0.771	0.869	0.006	0.021	0.044	0.006	0.049	0.013
w02.3	10	7.3	2.9	72.1	4.4	5.1	0.5	9.9	15.2	0.907	0.520	0.004	0.036	0.045	0.016	0.030	0.013
w02.3	11	7.2	2.2	71.2	4.3	4.7	0.5	9.8	15.2	0.919	0.512	0.006	0.035	0.042	0.016	0.030	0.013
w02.3	12	5.7	2.0	64.1	4.2	6.9	0.5	9.2	14.2	0.848	0.469	0.008	0.034	0.052	0.016	0.030	0.011
w02.3	13	7.4	2.4	73.7	4.0	3.5	0.5	9.0	14.6	0.851	0.488	0.006	0.033	0.071	0.015	0.029	0.011
w02.3	14	3.2	3.9	77.5	2.7	1.3	nd	5.8	25.0	0.223	1.491	0.009	0.026	nd	0.004	0.045	0.017
w02.3	15	8.1	2.6	73.5	4.1	3.7	0.4	9.4	15.6	0.965	0.495	0.010	0.035	0.018	0.014	0.030	0.012
w02.3	16	5.9	2.9	70.9	4.4	1.4	0.5	9.0	14.9	0.820	0.509	0.013	0.035	0.048	0.015	0.030	0.012
w02.3	17	nd	2.8	87.7	nd	0.5	nd	0.8	17.5	0.932	1.400	nd	0.008	0.022	0.001	0.023	0.008
w02.3	18	7.2	2.3	72.2	3.9	2.3	0.4	9.3	15.1	0.862	0.493	0.007	0.035	nd	0.014	0.030	0.012
w02.3	19	7.4	2.2	77.5	4.4	1.4	0.5	9.8	14.5	0.921	0.464	0.010	0.037	0.036	0.017	0.030	0.011
w02.3	20	7.7	2.5	71.5	4.6	6.8	0.5	9.7	14.8	0.900	0.478	0.009	0.031	0.047	0.015	0.030	0.012
w02.3	21	nd	2.4	83.9	nd	0.5	nd	0.7	16.8	0.857	1.330	0.004	0.009	0.013	0.001	0.021	0.008
w02.3	22	9.0	2.5	75.1	4.1	2.1	0.5	9.4	15.3	0.885	0.484	0.014	0.033	0.007	0.014	0.029	0.012
w02.3	23	6.1	2.9	70.5	4.4	4.6	0.6	8.8	14.5	0.900	0.495	0.012	0.034	0.075	0.014	0.030	0.012
w02.3	24	3.7	4.6	80.7	2.7	1.1	nd	5.9	23.4	0.278	1.508	0.012	0.025	0.006	0.004	0.048	0.020
w02.3	25	5.4	3.0	75.6	4.3	4.2	0.4	8.4	14.0	0.788	0.682	0.025	0.034	0.059	0.011	0.040	0.013
w02.3	26	6.6	2.5	74.5	4.1	4.2	0.5	9.5	13.8	0.838	0.522	0.006	0.034	0.035	0.016	0.027	0.011
w02.3	27	8.4	2.9	75.3	4.2	3.5	0.5	9.6	15.8	0.895	0.491	0.013	0.032	0.014	0.014	0.031	0.012
w02.3	28	5.5	2.8	70.3	5.8	2.0	0.5	9.5	15.7	0.866	0.622	0.032	0.036	0.062	0.012	0.042	0.015
w02.3	29	7.7	2.1	71.0	4.5	2.1	0.5	9.3	14.4	0.868	0.464	0.012	0.036	0.046	0.015	0.028	0.012
w02.3	30	7.0	2.4	72.6	4.5	1.2	0.5	9.3	15.3	0.917	0.502	0.010	0.037	0.029	0.014	0.029	0.011
w02.3	31	3.8	4.4	79.6	2.4	1.6	nd	4.4	23.5	0.960	1.346	0.010	0.028	0.131	0.004	0.085	0.034
w02.3	32	4.6	2.7	64.7	5.8	3.8	0.5	9.1	15.2	0.760	0.681	0.029	0.034	0.080	0.010	0.039	0.015
w02.3	33	6.6	3.0	70.8	4.4	4.1	0.6	8.7	14.8	0.842	0.523	0.016	0.032	0.047	0.015	0.029	0.011
w02.3	34	3.9	5.4	82.8	2.1	0.3	0.6	1.8	20.5	0.693	0.924	0.002	0.020	0.060	0.002	0.048	0.016
w02.3	35	7.2	2.8	74.6	5.1	1.0	0.4	10.1	16.3	0.849	0.599	0.028	0.036	0.015	0.012	0.040	0.015
w02.3	36	5.9	2.7	73.3	4.3	1.2	0.5	7.8	18.6	1.131	0.680	0.026	0.040	0.016	0.009	0.066	0.014

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.3	37	6.2	2.9	74.4	4.6	2.3	0.4	9.6	16.0	0.847	0.646	0.027	0.036	0.027	0.012	0.042	0.014
w02.3	38	8.2	2.7	71.7	4.4	4.6	0.5	9.5	14.8	0.804	0.501	0.010	0.030	0.036	0.015	0.030	0.012
w02.3	39	6.8	2.6	71.8	4.6	5.8	0.5	9.2	15.0	0.866	0.481	0.008	0.035	0.040	0.015	0.031	0.012
w02.3	40	nd	0.8	91.8	nd	1.4	nd	0.5	16.4	nd	0.256	nd	0.007	nd	nd	0.006	0.009
w02.3	41	6.6	2.5	72.1	3.8	5.8	0.4	9.1	15.3	0.899	0.502	0.010	0.032	0.038	0.014	0.030	0.012
w02.3	42	7.5	2.7	72.2	4.1	4.7	0.5	9.4	14.5	0.901	0.491	0.006	0.031	0.029	0.014	0.029	0.012
w02.3	43	6.3	3.1	85.7	1.3	0.6	0.8	1.1	21.4	0.045	0.862	nd	0.004	nd	0.001	0.221	0.008
w02.3	44	6.4	2.6	67.2	4.5	5.8	0.4	8.9	15.5	0.789	0.569	0.032	0.035	0.119	0.012	0.039	0.014
w02.3	45	5.9	2.6	70.5	5.3	3.0	0.4	9.1	15.2	0.810	0.645	0.034	0.031	0.057	0.012	0.039	0.014
w02.3	46	nd	2.9	90.0	nd	0.7	nd	0.7	17.5	0.861	1.359	0.003	0.009	0.026	0.001	0.023	0.009
w02.3	47	6.5	2.6	70.7	5.0	2.2	0.5	9.5	15.9	0.821	0.601	0.033	0.027	0.041	0.011	0.040	0.014
w02.3	48	8.2	2.4	71.4	4.6	6.0	0.6	9.6	14.9	0.758	0.497	0.009	0.035	0.043	0.015	0.028	0.012
w02.3	49	nd	2.4	87.1	nd	0.6	nd	0.7	16.9	0.916	1.354	0.005	0.009	0.020	0.001	0.023	0.007
w02.3	50	3.4	4.0	77.7	2.4	1.2	nd	4.1	27.0	0.559	1.153	0.014	0.024	0.106	0.004	0.064	0.036
w02.3	51	5.6	2.9	69.3	4.2	5.3	0.4	8.6	14.6	0.772	0.628	0.032	0.027	0.152	0.011	0.040	0.014
w02.3	52	2.8	4.0	78.3	3.2	1.2	nd	5.3	24.9	0.245	1.323	0.013	0.023	nd	0.004	0.040	0.015
w02.3	53	8.3	2.2	73.6	4.5	3.9	0.5	9.7	14.9	0.823	0.486	0.006	0.031	0.041	0.015	0.029	0.012
w02.3	54	4.4	2.6	64.2	7.2	1.8	0.7	10.1	14.2	0.789	0.596	0.019	0.030	0.089	0.015	0.038	0.015
w02.3	55	4.0	4.2	77.2	3.3	0.6	0.7	4.5	23.6	0.759	0.509	0.006	0.021	0.006	0.003	0.047	0.013
w02.3	56	nd	2.4	83.1	nd	0.5	nd	0.7	16.5	0.941	1.461	0.001	0.010	0.022	0.001	0.024	0.008
w02.3	57	5.4	2.0	66.0	3.2	7.2	0.5	8.1	13.4	0.767	0.480	0.009	0.033	0.099	0.014	0.029	0.011
w02.3	58	3.1	3.4	79.6	3.5	3.4	0.4	4.1	24.3	0.317	1.105	0.007	0.022	0.031	0.003	0.043	0.013
w02.3	59	4.3	4.9	74.1	3.9	1.7	0.7	4.1	25.2	0.563	0.602	nd	0.026	0.021	0.003	0.061	0.017
w02.3	60	6.0	2.9	69.4	4.2	7.5	0.5	8.6	15.8	0.772	0.632	0.026	0.034	0.168	0.012	0.041	0.013
w02.4	1	4.3	3.1	85.9	1.1	1.0	0.5	2.2	22.0	0.019	1.105	nd	0.012	nd	0.001	0.199	0.005
w02.4	2	3.6	3.2	80.7	2.3	1.5	0.4	2.8	25.3	0.186	1.124	0.006	0.013	nd	0.002	0.109	0.013
w02.4	3	8.6	3.2	94.3	2.3	0.6	0.7	4.4	13.4	0.015	0.588	nd	0.004	0.012	0.001	0.369	0.008
w02.4	4	7.9	3.0	96.2	1.9	0.5	0.6	3.7	12.7	0.005	0.600	nd	0.003	0.009	0.001	0.342	0.002
w02.4	5	4.2	2.7	80.5	1.9	3.1	0.5	2.2	22.5	0.072	1.022	nd	0.008	0.018	0.001	0.137	0.010
w02.4	6	4.6	2.7	86.1	1.1	0.9	0.4	2.3	20.4	0.011	0.967	nd	0.005	0.006	0.001	0.203	0.006
w02.4	7	6.6	2.5	90.9	nd	0.8	0.3	3.8	9.7	0.001	0.532	nd	0.004	0.011	0.001	0.257	0.005
w02.4	8	4.5	2.9	78.6	1.2	2.0	0.7	1.1	22.4	0.055	0.876	0.001	0.005	0.007	0.001	0.148	0.008

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.4	9	5.2	3.0	78.3	1.5	1.2	0.5	2.3	21.1	0.042	0.949	nd	0.008	nd	0.001	0.230	0.004
w02.4	10	nd	nd	91.1	nd	0.6	0.7	4.1	6.4	nd	0.013	nd	0.110	nd	0.003	0.002	0.007
w02.4	11	5.6	3.8	84.2	1.8	2.0	0.5	1.9	21.7	0.043	1.097	nd	0.008	0.016	0.001	0.229	0.009
w02.4	12	nd	3.3	89.5	nd	0.7	0.5	1.0	20.6	nd	0.643	nd	0.040	nd	0.001	0.077	0.009
w02.4	13	2.6	1.1	87.1	nd	0.6	0.7	5.1	11.8	0.046	0.313	nd	0.003	nd	0.002	0.050	0.006
w02.4	14	3.9	2.9	82.5	1.1	1.0	0.4	2.2	22.2	0.033	1.096	nd	0.009	0.005	0.001	0.196	0.008
w02.4	15	4.4	4.5	73.0	3.2	6.1	0.7	4.6	11.1	0.010	0.648	nd	0.002	0.034	0.002	0.351	0.009
w02.4	16	3.8	2.0	79.0	1.1	0.9	0.4	2.0	20.0	0.009	0.886	nd	0.005	0.009	0.001	0.171	0.005
w02.4	17	nd	1.2	92.2	nd	0.3	nd	1.3	8.4	nd	0.300	0.001	nd	0.213	0.001	0.005	0.003
w02.4	18	6.8	2.2	92.0	1.8	0.4	0.6	3.0	13.2	0.010	0.412	nd	0.003	0.019	0.001	0.328	0.004
w02.4	19	5.9	3.6	85.5	1.6	1.0	0.4	1.9	22.1	0.026	1.015	0.005	0.008	0.008	0.001	0.228	0.007
w02.4	20	6.7	2.5	91.6	1.7	0.5	0.6	3.6	11.9	0.028	0.553	0.002	0.002	0.011	0.001	0.348	0.005
w02.4	21	6.7	2.7	87.6	1.9	0.3	0.5	3.5	11.9	0.008	0.591	nd	0.003	0.008	0.001	0.347	0.007
w02.4	22	6.7	2.8	94.6	1.9	0.5	0.6	3.6	12.0	0.005	0.620	nd	0.004	0.012	0.001	0.346	0.005
w02.4	23	5.9	2.4	89.4	1.7	0.4	0.5	3.5	11.7	0.045	0.610	nd	nd	0.007	0.001	0.343	0.007
w02.4	24	3.2	3.0	81.4	2.8	0.7	nd	4.5	23.6	0.484	1.102	0.010	0.025	0.043	0.003	0.054	0.046
w02.4	25	7.5	2.9	74.7	5.1	0.5	0.4	10.0	16.9	0.885	0.624	0.027	0.035	nd	0.012	0.041	0.015
w02.4	26	8.7	2.8	75.9	4.1	1.3	0.5	9.8	15.3	0.897	0.475	0.011	0.037	nd	0.014	0.028	0.012
w02.4	27	5.7	2.3	68.0	4.5	1.4	0.4	10.1	16.3	0.789	0.614	0.034	0.032	nd	0.012	0.039	0.013
w02.4	28	2.3	3.3	80.5	2.5	0.9	0.7	2.9	25.6	0.261	1.206	0.003	0.022	nd	0.002	0.059	0.015
w02.4	29	7.6	2.8	73.5	4.9	0.5	0.4	10.0	16.6	0.859	0.617	0.031	0.028	0.008	0.012	0.040	0.015
w02.4	30	6.8	2.7	73.8	5.1	1.3	0.4	9.6	15.5	0.823	0.620	0.029	0.032	0.011	0.011	0.040	0.013
w02.4	31	6.5	2.5	71.2	4.6	0.9	0.4	9.8	16.3	0.794	0.600	0.031	0.032	0.013	0.012	0.040	0.015
w02.4	32	6.7	2.8	97.1	1.4	0.4	0.6	3.9	11.8	0.016	0.672	nd	0.003	0.013	0.001	0.345	0.005
w02.4	33	5.6	2.7	69.5	4.6	2.2	0.4	9.8	15.7	0.833	0.605	0.024	0.036	0.028	0.011	0.038	0.015
w02.4	34	8.4	2.2	74.6	3.7	0.9	0.5	9.8	14.8	0.838	0.475	0.004	0.033	0.007	0.015	0.030	0.012
w02.4	35	3.7	3.1	81.5	2.0	2.2	0.5	3.0	22.3	0.127	0.944	0.005	0.014	0.012	0.001	0.109	0.010
w02.4	36	4.4	4.4	85.9	nd	0.9	0.3	2.6	19.0	0.020	1.314	nd	0.006	0.009	0.001	0.187	0.006
w02.4	37	6.0	2.6	72.5	4.7	0.7	0.4	9.9	16.4	0.842	0.626	0.026	0.032	nd	0.012	0.040	0.014
w02.4	38	5.3	2.3	68.8	4.8	1.3	0.4	9.7	15.9	0.882	0.618	0.031	0.034	0.026	0.011	0.041	0.015
w02.4	39	6.9	3.2	71.9	4.9	4.4	0.5	9.3	14.4	0.815	0.500	0.009	0.034	0.021	0.015	0.029	0.013
w02.4	40	7.2	2.9	75.3	5.0	0.6	0.4	10.0	16.7	0.880	0.649	0.026	0.034	0.009	0.011	0.040	0.015

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.4	41	4.4	5.0	76.4	3.6	0.4	0.6	3.7	24.2	0.598	0.563	0.001	0.026	nd	0.002	0.064	0.017
w02.4	42	6.7	2.9	72.1	5.0	2.3	0.4	9.8	16.5	0.865	0.663	0.031	0.036	0.032	0.011	0.042	0.014
w02.4	43	7.3	2.8	73.4	5.5	0.9	0.4	9.7	16.2	0.849	0.582	0.034	0.035	0.039	0.011	0.042	0.015
w02.4	44	6.8	2.2	69.6	4.6	1.0	0.4	9.8	16.5	0.814	0.623	0.023	0.032	nd	0.011	0.041	0.013
w02.4	45	7.2	2.6	71.0	4.2	3.8	0.5	9.0	14.8	0.844	0.453	0.012	0.037	0.011	0.014	0.031	0.011
w02.4	46	5.9	3.7	73.3	5.4	2.2	0.5	9.5	15.7	0.861	0.679	0.031	0.039	0.040	0.011	0.041	0.014
w02.4	47	7.3	3.1	73.8	5.1	0.8	0.5	10.1	16.7	0.805	0.614	0.031	0.030	0.026	0.011	0.039	0.014
w02.5	1	3.0	3.8	76.5	2.7	2.8	nd	3.7	26.8	0.705	1.132	0.009	0.024	0.229	0.003	0.067	0.022
w02.5	2	8.6	2.1	73.4	4.5	5.0	0.5	9.8	14.5	0.869	0.491	0.010	0.036	0.053	0.016	0.028	0.012
w02.5	3	2.2	4.1	77.8	2.6	2.4	nd	5.3	25.4	0.088	1.328	0.010	0.024	0.011	0.004	0.045	0.013
w02.5	4	8.0	2.3	75.0	4.2	0.6	0.4	9.8	15.3	0.902	0.481	0.009	0.033	nd	0.014	0.030	0.013
w02.5	5	7.8	2.4	74.0	3.9	2.1	0.5	9.6	15.1	0.832	0.511	0.012	0.037	0.011	0.014	0.029	0.012
w02.5	6	6.7	2.4	71.5	4.4	0.7	0.4	9.8	15.8	0.825	0.557	0.033	0.035	0.024	0.011	0.038	0.015
w02.5	7	2.9	3.8	76.6	2.7	0.9	nd	4.9	25.3	0.390	1.385	0.008	0.024	nd	0.004	0.047	0.018
w02.5	8	7.9	2.3	74.9	3.8	1.7	0.5	9.8	14.8	0.864	0.532	0.012	0.034	0.007	0.016	0.027	0.012
w02.5	9	2.9	1.2	91.7	nd	0.3	0.7	5.8	12.4	0.231	0.347	0.001	0.010	nd	0.004	0.055	0.006
w02.5	10	8.5	2.3	73.6	4.0	2.0	0.4	9.9	15.5	0.946	0.483	0.004	0.037	0.015	0.015	0.031	0.011
w02.5	11	8.4	2.6	77.2	4.1	1.5	0.4	9.1	14.9	0.927	0.507	0.014	0.032	0.009	0.015	0.030	0.013
w02.5	12	8.5	2.5	75.3	3.9	3.1	0.5	9.9	14.8	0.911	0.445	0.009	0.033	0.028	0.016	0.027	0.013
w02.5	13	8.3	2.6	77.5	4.1	1.2	0.5	9.9	15.1	0.839	0.479	0.006	0.036	0.007	0.016	0.029	0.011
w02.5	14	9.1	2.2	76.0	4.0	3.3	0.4	10.2	15.4	0.941	0.441	0.004	0.031	0.029	0.016	0.029	0.012
w02.5	15	3.2	3.8	75.1	3.4	1.9	nd	5.7	24.6	0.338	1.214	0.007	0.030	nd	0.004	0.051	0.015
w02.5	16	4.4	6.1	76.0	3.0	1.3	0.5	4.8	22.8	0.901	0.639	0.048	0.019	0.028	0.004	0.048	0.012
w02.5	17	3.1	4.0	74.8	3.3	4.0	0.2	4.0	26.1	0.568	1.202	0.012	0.025	0.133	0.003	0.062	0.033
w02.5	18	3.3	4.4	78.8	3.6	0.7	0.4	4.5	25.0	0.305	1.520	0.008	0.025	nd	0.003	0.042	0.020
w02.5	19	8.0	2.6	73.9	4.5	1.3	0.5	9.4	15.4	0.869	0.503	0.011	0.033	0.050	0.015	0.031	0.012
w02.5	20	7.3	2.6	75.0	4.0	4.0	0.5	9.5	14.8	0.815	0.506	0.012	0.034	0.021	0.014	0.030	0.012
w02.5	21	8.9	2.8	76.3	3.9	2.1	0.5	9.8	15.5	0.878	0.480	0.016	0.032	0.014	0.014	0.030	0.011
w02.5	22	7.5	1.9	71.5	3.5	1.2	0.4	9.6	14.7	0.804	0.487	0.009	0.032	0.008	0.014	0.029	0.012
w02.5	23	4.3	6.5	78.0	2.8	0.3	0.3	5.8	21.8	1.066	0.621	0.002	0.023	0.019	0.005	0.045	0.012
w02.5	24	8.2	2.4	75.1	3.8	0.7	0.4	9.7	15.8	0.929	0.514	0.014	0.036	nd	0.015	0.031	0.012
w02.5	25	8.5	2.6	74.1	4.0	1.8	0.4	10.0	15.1	0.839	0.520	0.011	0.039	0.015	0.015	0.028	0.012

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.5	26	7.6	2.1	69.7	4.7	5.4	0.6	9.5	15.1	0.850	0.474	0.010	0.032	0.031	0.015	0.029	0.011
w02.5	27	8.9	2.8	75.7	4.1	1.7	0.5	9.7	15.7	0.859	0.487	0.008	0.035	nd	0.014	0.032	0.012
w02.5	28	7.1	1.9	72.3	3.7	8.0	0.6	8.9	13.9	1.006	0.292	0.005	0.031	0.038	0.017	0.025	0.006
w02.5	29	7.7	2.4	75.2	4.0	2.6	0.4	9.5	15.3	0.959	0.477	0.012	0.034	0.014	0.015	0.030	0.013
w02.5	30	3.3	1.0	90.9	nd	0.3	0.6	5.6	12.0	0.211	0.334	nd	0.007	0.013	0.004	0.053	0.007
w02.5	31	9.1	2.5	75.6	4.1	0.7	0.4	9.9	15.0	0.831	0.467	0.011	0.035	nd	0.015	0.027	0.012
w02.5	32	4.1	6.4	77.1	2.8	0.5	0.4	5.7	21.6	1.053	0.686	0.004	0.021	0.018	0.005	0.045	0.013
w02.5	33	3.8	3.8	75.4	2.8	0.3	0.2	4.1	23.4	0.840	1.251	0.006	0.030	0.111	0.004	0.066	0.021
w02.5	34	8.2	2.5	75.3	4.0	1.6	0.4	9.5	15.4	0.831	0.472	0.011	0.032	0.019	0.014	0.029	0.012
w02.5	35	5.8	1.7	85.5	1.3	nd	0.5	4.0	8.9	0.035	0.750	nd	0.001	nd	0.002	0.281	0.006
w02.5	36	8.0	2.3	73.8	4.4	3.5	0.6	9.9	15.5	0.863	0.462	0.008	0.033	0.034	0.016	0.028	0.012
w02.5	37	8.0	2.1	72.9	4.4	5.4	0.5	9.7	14.3	0.904	0.448	0.011	0.032	0.055	0.017	0.028	0.011
w02.5	38	6.2	1.7	86.0	1.4	nd	0.5	4.0	8.8	0.045	0.760	nd	0.002	0.023	0.002	0.274	0.002
w02.5	39	7.5	2.5	74.5	3.9	0.8	0.5	9.7	15.3	0.868	0.445	0.010	0.035	0.006	0.015	0.029	0.012
w02.5	40	8.2	2.1	75.8	3.9	1.4	0.5	10.3	15.1	0.891	0.490	0.004	0.034	nd	0.016	0.027	0.011
w02.5	41	8.6	2.6	76.6	4.0	0.7	0.5	9.9	15.6	0.927	0.505	0.011	0.032	nd	0.015	0.030	0.012
w02.5	42	3.5	3.5	81.4	3.3	1.1	0.3	5.0	24.9	0.311	1.152	0.011	0.020	nd	0.004	0.038	0.013
w02.5	43	8.8	2.4	76.5	4.4	2.4	0.5	9.9	15.6	0.902	0.517	0.011	0.036	0.015	0.015	0.030	0.013
w02.5	44	3.4	3.9	77.1	2.3	1.6	nd	4.4	23.3	0.912	1.365	0.010	0.025	0.122	0.004	0.084	0.034
w02.5	45	7.4	2.6	74.9	5.3	1.0	0.5	9.8	16.2	0.842	0.591	0.026	0.030	0.008	0.011	0.039	0.013
w02.5	46	8.1	2.4	73.3	4.2	3.0	0.5	9.7	14.8	0.902	0.481	0.004	0.037	0.016	0.015	0.029	0.012
w02.5	47	8.4	2.4	74.4	3.9	2.0	0.5	9.7	15.6	0.904	0.521	0.011	0.031	0.010	0.014	0.030	0.012
w02.5	48	8.0	2.4	77.2	3.9	3.3	0.5	9.7	14.7	0.982	0.524	0.005	0.032	0.024	0.016	0.028	0.012
w02.5	49	4.1	4.1	78.3	2.6	0.7	nd	4.2	27.7	0.580	1.173	0.014	0.023	0.110	0.003	0.063	0.034
w02.5	50	8.1	2.8	75.8	4.3	2.8	0.5	9.5	15.4	0.831	0.484	0.009	0.033	0.014	0.014	0.029	0.011
w02.5	51	5.8	1.7	65.6	4.3	4.8	0.5	9.5	15.2	0.834	0.515	0.008	0.033	0.038	0.016	0.029	0.013
w02.5	52	7.6	2.6	74.0	3.9	0.9	0.4	9.6	15.7	0.957	0.472	0.011	0.029	0.008	0.016	0.030	0.012
w02.5	53	8.7	2.1	74.5	4.1	2.3	0.5	9.6	14.9	0.880	0.542	0.008	0.033	0.024	0.016	0.029	0.012
w02.5	54	6.2	1.1	70.3	4.5	2.6	0.5	11.4	13.3	0.701	0.408	0.015	0.028	0.033	0.016	0.021	0.009
w02.5	55	8.4	2.6	76.9	4.1	1.4	0.4	9.7	15.7	0.855	0.451	0.009	0.030	0.007	0.015	0.031	0.011
w02.5	56	7.7	2.5	73.9	4.3	2.8	0.5	9.8	14.9	0.903	0.511	0.008	0.038	0.013	0.015	0.030	0.011
w02.5	57	7.2	2.4	75.4	3.6	5.8	0.5	9.7	15.0	0.960	0.491	0.011	0.038	0.030	0.017	0.029	0.011

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.5	58	8.7	2.0	74.9	4.2	4.4	0.4	9.2	13.7	0.891	0.440	0.010	0.028	0.029	0.015	0.028	0.012
w02.5	59	4.5	6.4	76.2	3.4	5.9	0.3	5.1	21.8	0.748	0.792	0.004	0.021	0.070	0.004	0.035	0.018
w02.5	60	2.9	4.5	74.1	3.0	2.9	nd	5.1	25.3	0.268	1.317	0.012	0.022	0.027	0.004	0.050	0.015
w02.6	1	nd	2.6	69.3	1.7	1.0	0.2	4.5	21.3	0.144	1.362	0.004	0.053	0.010	0.002	0.063	0.012
w02.6	2	nd	1.7	90.7	nd	1.2	nd	0.6	12.3	0.076	0.521	nd	nd	0.724	0.001	0.013	0.004
w02.6	3	3.7	3.7	70.3	4.1	2.3	0.6	4.6	23.3	0.749	0.724	0.002	0.028	0.018	0.003	0.065	0.015
w02.6	4	4.3	4.5	69.5	3.0	4.7	0.5	3.6	22.4	0.929	0.772	0.004	0.021	0.030	0.003	0.070	0.018
w02.6	5	3.6	4.5	76.3	2.5	1.1	0.2	5.8	20.6	0.154	1.560	0.008	0.047	nd	0.003	0.066	0.019
w02.6	6	3.2	3.9	72.7	2.3	0.9	nd	5.6	20.3	0.167	1.541	0.009	0.048	nd	0.003	0.066	0.019
w02.6	7	4.7	5.2	79.1	2.8	1.2	0.3	5.9	21.3	0.190	1.574	0.009	0.048	0.006	0.003	0.068	0.019
w02.6	8	4.9	5.6	72.8	3.3	2.8	0.5	4.4	23.3	0.843	0.893	0.003	0.026	0.021	0.002	0.069	0.033
w02.6	9	4.6	3.6	69.1	4.0	6.8	0.7	3.7	23.1	0.733	0.675	0.007	0.026	0.059	0.002	0.061	0.014
w02.6	10	3.8	4.7	73.6	4.0	6.0	0.4	5.6	20.7	0.141	1.630	0.012	0.045	0.042	0.003	0.067	0.018
w02.6	11	7.5	3.8	89.2	1.3	0.7	0.4	3.5	11.7	0.037	0.682	nd	0.013	0.016	0.001	0.306	0.004
w02.6	12	4.0	4.8	77.8	2.4	1.2	0.3	5.8	21.0	0.187	1.577	0.011	0.046	nd	0.003	0.068	0.019
w02.6	13	6.1	3.9	86.4	1.1	0.6	0.3	4.1	11.1	0.051	0.936	nd	0.008	0.021	0.002	0.318	0.007
w02.6	14	4.2	3.9	80.6	2.7	1.8	0.2	5.5	22.9	0.147	1.315	0.012	0.042	0.005	0.002	0.066	0.012
w02.6	15	2.7	4.1	70.4	2.7	2.4	0.3	5.5	20.4	0.185	1.584	0.010	0.049	0.023	0.003	0.067	0.020
w02.6	16	4.5	4.0	72.6	3.4	0.8	0.5	4.0	23.9	0.692	0.749	0.007	0.023	nd	0.003	0.067	0.016
w02.6	17	4.1	5.0	72.0	3.5	7.4	0.5	3.9	22.5	0.924	0.717	0.002	0.022	0.049	0.003	0.074	0.019
w02.6	18	3.7	4.2	81.9	2.6	1.3	nd	5.6	23.1	0.132	1.324	0.007	0.047	0.008	0.003	0.064	0.012
w02.6	19	3.5	4.6	76.9	2.7	1.5	0.3	5.7	20.3	0.131	1.623	0.011	0.049	nd	0.003	0.069	0.020
w02.6	20	3.9	4.6	81.9	2.4	1.3	0.3	5.6	21.7	0.146	1.331	0.010	0.048	0.009	0.002	0.066	0.023
w02.6	21	7.2	3.4	85.0	1.6	1.3	0.4	3.5	10.3	0.034	0.903	nd	0.007	0.033	0.001	0.306	0.006
w02.6	22	3.5	5.5	79.0	2.8	0.9	0.3	6.3	20.1	0.086	1.601	0.011	0.046	nd	0.003	0.056	0.013
w02.6	23	5.1	5.8	80.3	2.7	1.5	0.3	6.2	22.4	0.170	1.688	0.008	0.042	nd	0.003	0.071	0.021
w02.6	24	5.0	5.6	69.7	3.4	1.6	0.4	4.7	24.9	0.843	0.770	0.009	0.023	0.009	0.003	0.071	0.032
w02.6	25	5.0	5.5	72.9	3.8	2.3	0.4	4.1	24.9	0.800	0.773	nd	0.023	0.012	0.003	0.064	0.037
w02.6	26	5.2	5.7	74.0	3.3	1.3	0.4	4.2	23.4	0.785	0.799	0.004	0.024	nd	0.003	0.063	0.036
w02.6	27	4.5	5.2	78.7	2.9	2.7	0.3	5.6	20.8	0.143	1.590	0.013	0.045	0.013	0.003	0.069	0.020
w02.6	28	3.7	5.0	76.6	2.7	2.2	0.3	5.6	20.9	0.180	1.610	0.010	0.049	0.019	0.003	0.068	0.020
w02.6	29	4.2	3.7	84.5	nd	0.4	0.4	3.6	10.0	0.042	0.730	nd	0.004	0.012	0.001	0.273	0.003

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.6	30	nd	3.2	65.0	2.0	1.3	0.2	5.3	19.2	0.151	1.611	0.009	0.055	nd	0.003	0.067	0.019
w02.7	1	3.2	2.0	80.3	1.7	1.9	0.3	2.7	23.8	0.055	0.761	0.004	0.009	0.008	0.001	0.146	0.008
w02.7	2	4.5	4.0	77.0	3.0	0.7	0.5	4.4	22.3	0.307	1.646	0.007	0.027	nd	0.002	0.116	0.018
w02.7	3	6.1	1.8	90.1	1.7	0.3	0.6	3.6	12.0	0.031	0.574	nd	0.004	0.014	0.001	0.343	0.003
w02.7	4	nd	0.9	91.9	nd	0.9	nd	0.2	14.7	0.311	0.355	nd	0.009	0.708	nd	0.028	0.002
w02.7	5	3.9	3.9	74.3	2.8	0.7	0.5	4.1	20.8	0.234	1.619	0.007	0.022	nd	0.002	0.107	0.018
w02.7	6	3.3	3.5	73.8	2.7	0.7	0.5	4.2	20.9	0.259	1.584	0.004	0.024	nd	0.002	0.106	0.018
w02.7	7	nd	0.5	87.5	nd	1.2	nd	nd	15.6	nd	0.175	nd	nd	0.009	nd	0.006	0.002
w02.7	8	2.3	3.9	75.6	2.7	2.8	nd	5.2	25.4	0.151	1.111	0.007	0.025	0.016	0.004	0.042	0.012
w02.7	9	nd	nd	90.0	nd	0.6	0.8	4.7	5.6	nd	0.002	0.011	0.043	nd	0.003	0.002	0.005
w02.7	10	3.7	3.9	75.4	2.8	0.8	0.4	4.3	21.6	0.295	1.560	0.005	0.022	nd	0.002	0.107	0.018
w02.7	11	3.9	2.1	78.8	nd	1.1	0.3	2.1	22.2	nd	0.863	nd	0.002	0.007	0.001	0.124	0.006
w02.7	12	4.6	4.0	78.0	3.0	0.9	0.5	4.4	22.4	0.300	1.556	0.002	0.022	nd	0.003	0.111	0.019
w02.7	13	6.5	2.5	92.1	1.5	0.5	0.4	3.5	11.0	0.012	0.644	nd	0.003	0.010	0.001	0.302	0.004
w02.7	14	nd	1.3	89.5	nd	0.5	nd	0.2	8.7	0.386	1.444	0.059	0.006	nd	nd	0.091	0.064
w02.7	15	nd	3.9	77.3	2.2	0.8	nd	5.4	25.3	0.134	1.162	0.014	0.023	nd	0.004	0.040	0.013
w02.7	16	3.6	4.2	76.8	3.0	1.1	0.5	4.4	22.2	0.309	1.644	0.003	0.026	nd	0.002	0.109	0.019
w02.7	17	nd	1.4	94.3	nd	0.8	0.8	0.3	17.1	0.388	0.323	nd	nd	0.274	nd	0.018	0.003
w02.7	18	nd	1.2	86.7	nd	0.9	nd	0.2	8.3	0.331	1.416	0.052	0.006	nd	nd	0.088	0.062
w02.7	19	3.4	4.1	75.5	2.7	1.0	0.4	4.4	22.0	0.356	1.654	0.006	0.025	nd	0.002	0.112	0.020
w02.7	20	4.3	4.5	79.2	2.9	0.9	0.5	4.3	22.1	0.306	1.644	0.007	0.028	nd	0.002	0.112	0.017
w02.7	21	nd	0.7	89.2	nd	0.9	nd	nd	13.6	nd	0.199	nd	0.001	0.331	nd	0.006	0.014
w02.7	22	nd	2.4	84.9	nd	0.6	nd	0.7	17.5	0.932	1.500	nd	0.012	0.020	0.001	0.024	0.008
w02.7	23	3.1	3.4	71.0	2.6	0.7	0.5	4.1	20.8	0.280	1.631	0.004	0.023	nd	0.003	0.111	0.019
w02.7	24	3.5	3.6	76.1	2.8	1.0	0.4	4.1	20.9	0.286	1.593	0.004	0.020	nd	0.002	0.106	0.019
w02.7	25	3.8	4.2	76.9	2.8	0.8	0.4	4.1	21.4	0.280	1.619	0.006	0.026	nd	0.002	0.107	0.018
w02.7	26	4.7	3.1	83.1	nd	0.6	0.5	2.1	19.9	0.030	0.793	nd	0.005	nd	0.001	0.151	0.012
w02.7	27	3.4	3.9	74.0	3.0	1.6	0.5	4.1	21.3	0.282	1.605	0.004	0.022	0.011	0.003	0.107	0.018
w02.7	28	4.3	3.7	75.1	2.6	0.9	0.5	4.3	21.4	0.321	1.568	0.007	0.023	nd	0.002	0.109	0.018
w02.7	29	3.7	4.0	76.8	2.7	0.7	0.4	4.2	21.7	0.285	1.643	0.006	0.022	nd	0.002	0.111	0.020
w02.7	30	3.1	4.3	79.9	2.9	3.0	0.4	3.8	23.1	0.103	1.656	0.007	0.027	0.008	0.003	0.081	0.017
w02.7	31	5.7	2.2	88.6	1.3	0.4	0.4	3.2	10.5	0.011	0.559	nd	nd	0.009	0.001	0.280	0.007

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.8	1	nd	0.8	90.3	nd	0.7	nd	nd	15.4	nd	0.223	0.004	0.002	nd	nd	0.006	0.004
w02.8	2	nd	0.7	89.6	nd	0.7	nd	nd	15.1	nd	0.170	0.005	0.001	nd	nd	0.005	0.004
w02.8	3	nd	0.7	89.8	nd	0.8	nd	nd	15.3	nd	0.212	0.002	0.001	nd	nd	0.005	0.004
w02.8	4	nd	0.6	90.0	nd	0.8	nd	nd	15.4	nd	0.200	0.002	0.001	nd	nd	0.006	0.004
w02.8	5	nd	0.7	89.3	nd	0.8	nd	nd	15.2	nd	0.233	0.002	nd	nd	nd	0.005	0.004
w02.8	6	nd	0.7	88.0	nd	1.5	nd	nd	14.9	nd	0.227	0.003	0.001	nd	nd	0.005	0.004
w02.8	7	nd	0.7	90.0	nd	0.7	nd	nd	15.1	nd	0.201	0.002	0.001	nd	nd	0.006	0.004
w02.8	8	nd	0.7	93.2	nd	0.8	nd	nd	15.8	nd	0.220	0.006	0.002	nd	nd	0.005	0.004
w02.8	9	nd	0.8	93.4	nd	0.8	nd	nd	16.0	nd	0.214	0.003	0.003	nd	nd	0.006	0.004
w02.9	1	4.2	1.6	102.3	nd	0.9	nd	0.7	7.2	nd	0.018	nd	0.001	nd	0.001	0.003	0.017
w02.9	2	3.9	3.9	77.8	2.5	1.1	0.4	4.1	22.8	0.177	1.598	0.004	0.024	nd	0.002	0.095	0.017
w02.9	3	3.6	3.9	74.0	2.7	0.8	0.5	4.1	21.3	0.270	1.455	0.004	0.027	nd	0.002	0.108	0.016
w02.9	4	3.6	3.8	76.3	2.9	2.0	0.4	4.1	22.7	0.234	1.601	0.007	0.023	0.012	0.002	0.098	0.016
w02.9	5	5.2	2.6	88.2	1.5	0.9	0.4	2.7	17.3	0.091	1.007	0.003	0.009	nd	0.001	0.181	0.011
w02.9	6	4.5	2.4	84.4	1.4	0.9	0.4	2.7	18.0	0.115	1.072	nd	0.010	0.011	0.001	0.188	0.012
w02.9	7	nd	1.1	95.9	nd	0.7	0.8	0.3	17.0	0.363	0.307	nd	0.001	0.270	nd	0.019	0.004
w02.9	8	5.0	2.6	82.2	nd	1.2	0.4	1.6	23.6	0.031	0.868	nd	0.003	0.008	0.001	0.138	0.005
w02.9	9	3.9	4.2	77.2	2.9	1.0	0.4	4.3	21.7	0.262	1.612	0.005	0.026	0.008	0.002	0.106	0.019
w02.9	10	3.8	2.5	80.2	1.5	1.5	0.4	2.6	22.1	0.090	1.099	nd	0.011	0.009	0.001	0.153	0.010
w02.9	11	5.1	2.7	87.0	1.7	1.3	0.4	2.7	17.8	0.106	1.032	nd	0.009	0.008	0.001	0.180	0.010
w02.9	12	3.6	3.0	82.3	nd	1.0	0.4	1.6	25.9	0.057	1.081	0.003	0.009	nd	0.001	0.112	0.010
w02.9	13	4.9	3.4	88.7	1.1	0.7	0.3	2.5	19.2	0.003	1.129	nd	0.005	0.006	0.001	0.196	0.007
w02.9	14	nd	1.4	97.8	nd	1.4	nd	0.1	16.3	0.541	0.217	0.001	nd	0.497	nd	0.018	0.006
w02.9	15	3.6	4.2	77.9	3.0	0.7	0.5	4.3	22.1	0.333	1.604	0.003	0.027	nd	0.002	0.109	0.018
w02.9	16	3.7	2.9	81.6	1.3	1.6	0.4	1.6	26.2	0.063	1.129	nd	0.010	0.008	0.001	0.116	0.011
w02.9	17	4.7	2.8	90.3	1.5	1.0	0.4	2.9	18.4	0.111	1.058	nd	0.008	nd	0.001	0.193	0.010
w02.9	18	2.7	0.9	92.3	nd	nd	0.7	5.1	11.6	0.098	0.354	nd	0.006	nd	0.003	0.056	0.005
w02.9	19	4.8	2.4	87.0	1.4	1.0	0.4	2.8	18.1	0.077	1.074	0.003	0.007	0.006	0.001	0.186	0.010
w02.9	20	7.1	4.2	87.3	1.5	nd	0.6	4.6	11.0	0.034	0.991	nd	0.004	0.011	0.002	0.330	0.005
w02.9	21	5.2	3.0	89.6	1.7	1.3	0.4	2.8	18.5	0.095	1.052	0.003	0.006	0.009	0.001	0.185	0.012
w02.9	22	4.0	3.0	84.5	nd	1.3	0.4	1.6	26.3	0.073	1.173	0.001	0.010	0.010	0.001	0.118	0.009
w02.9	23	3.2	3.4	80.8	2.3	0.8	0.5	3.3	22.0	0.154	1.457	0.007	0.017	0.006	0.001	0.104	0.015

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w02.9	24	nd	2.8	88.2	nd	0.6	nd	0.7	14.2	0.471	0.283	nd	nd	0.565	0.001	0.019	0.008
w02.9	25	5.5	2.8	91.1	1.6	1.0	0.4	2.8	18.3	0.120	1.082	nd	0.010	0.007	0.001	0.187	0.010
w02.9	26	4.6	2.5	87.7	1.7	1.2	0.4	2.8	18.1	0.113	1.112	0.004	0.008	0.010	0.001	0.187	0.009
w02.9	27	5.6	3.0	90.0	1.6	1.3	0.4	2.9	18.2	0.114	1.066	0.002	0.015	0.013	0.001	0.187	0.010
w02.9	28	6.6	3.4	89.9	1.1	1.0	0.4	3.8	10.9	0.002	0.796	nd	0.002	0.015	0.001	0.301	0.005
w02.9	29	5.0	3.1	87.8	nd	0.8	0.5	2.1	21.2	0.003	0.904	nd	0.001	0.008	0.001	0.144	0.008
w02.9	30	3.4	4.1	78.5	3.1	1.3	0.5	4.2	21.6	0.310	1.639	0.005	0.025	0.010	0.002	0.110	0.019
w02.9	31	5.0	2.9	90.8	1.5	1.0	0.4	2.8	18.2	0.113	1.066	0.001	0.010	nd	0.001	0.189	0.011
w03	1	6.7	2.3	89.8	1.4	0.3	0.5	3.7	11.7	0.004	0.666	nd	0.002	0.014	0.001	0.323	0.004
w03	2	nd	nd	94.6	nd	0.7	nd	nd	16.0	nd	0.112	nd	0.001	0.090	nd	0.008	0.007
w03	3	nd	nd	93.4	nd	0.7	nd	nd	16.2	nd	0.137	nd	nd	0.089	nd	0.008	0.006
w03	4	nd	nd	93.6	nd	0.7	nd	nd	16.4	nd	0.146	0.001	0.002	0.090	nd	0.008	0.006
w03	5	nd	nd	94.1	nd	0.6	nd	nd	15.5	nd	0.168	nd	nd	0.080	nd	0.009	0.007
w03	6	nd	nd	93.8	nd	0.6	nd	nd	15.9	nd	0.135	nd	nd	0.091	nd	0.008	0.007
w03	7	nd	nd	93.6	nd	0.7	nd	nd	15.9	nd	0.133	nd	0.001	0.086	nd	0.008	0.006
w03	8	nd	nd	93.5	nd	0.6	nd	nd	15.9	nd	0.135	0.002	0.002	0.082	nd	0.009	0.006
w03	9	nd	nd	92.3	nd	0.6	nd	nd	15.5	nd	0.152	nd	0.001	0.090	nd	0.008	0.006
w03	10	nd	nd	94.4	nd	0.7	nd	nd	16.1	nd	0.141	nd	0.001	0.093	nd	0.008	0.006
w03	11	2.9	nd	93.6	nd	0.4	nd	nd	9.1	nd	0.069	nd	0.001	nd	nd	0.002	0.013
w03	12	nd	nd	94.5	nd	0.7	nd	nd	16.1	nd	0.144	nd	nd	0.086	nd	0.008	0.007
w03	13	3.5	0.7	90.7	nd	0.2	nd	0.1	9.0	nd	0.109	nd	nd	nd	0.001	0.004	0.010
w03	14	nd	nd	94.5	nd	0.7	nd	nd	16.0	nd	0.122	nd	nd	0.083	nd	0.009	0.007
w03	15	2.8	nd	93.9	nd	0.3	nd	nd	8.9	nd	0.090	nd	nd	nd	nd	0.002	0.008
w03	16	3.5	1.3	94.3	nd	0.2	nd	0.5	8.6	nd	0.097	0.004	nd	nd	0.001	0.003	0.005
w03	17	nd	nd	99.3	nd	0.7	nd	nd	17.4	nd	0.166	nd	nd	0.094	nd	0.009	0.007
w03	18	3.7	1.4	93.3	nd	nd	nd	0.3	8.1	nd	0.102	nd	nd	nd	nd	0.014	0.014
w04	1	nd	nd	33.9	1.5	0.4	nd	0.5	7.6	nd	0.130	nd	0.001	nd	0.001	0.004	0.009
w04	2	nd	nd	35.8	1.6	0.5	nd	nd	7.9	nd	0.063	0.001	0.001	nd	nd	0.002	0.014
w04	3	nd	nd	30.5	1.6	0.5	nd	nd	7.6	nd	0.081	nd	0.001	nd	nd	0.002	0.014
w04	4	nd	nd	38.6	1.3	0.4	nd	0.5	7.6	nd	0.143	nd	0.001	nd	0.001	0.004	0.010
w04	5	nd	nd	36.2	1.6	0.6	nd	nd	7.8	nd	0.078	nd	nd	nd	nd	0.002	0.017
w04	6	nd	nd	34.1	1.7	0.5	nd	0.4	7.7	nd	0.138	nd	nd	nd	0.001	0.004	0.010

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w04	7	nd	nd	41.8	1.5	0.4	nd	0.4	7.8	nd	0.135	nd	0.001	nd	0.001	0.004	0.009
w04	8	nd	nd	35.0	1.5	0.4	nd	0.4	7.6	nd	0.127	nd	nd	nd	0.001	0.004	0.009
w04	9	nd	nd	34.9	1.8	0.6	nd	nd	7.4	nd	0.081	nd	0.001	nd	nd	0.002	0.018
w04	10	nd	nd	39.8	1.6	0.4	nd	0.4	7.9	nd	0.152	nd	nd	nd	0.001	0.004	0.008
w04	11	nd	nd	33.6	1.8	0.6	nd	0.5	8.0	nd	0.138	nd	0.001	nd	0.001	0.004	0.010
w04	12	nd	nd	32.6	1.6	0.4	nd	0.4	7.4	nd	0.175	nd	nd	nd	0.001	0.004	0.010
w04	13	nd	nd	41.5	1.4	0.4	nd	0.5	8.0	nd	0.158	nd	0.001	nd	0.001	0.005	0.009
w04	14	nd	nd	44.5	1.4	0.5	nd	0.5	8.1	nd	0.132	nd	nd	nd	0.001	0.004	0.009
w04	15	nd	nd	30.6	2.0	0.9	nd	nd	7.8	nd	0.084	nd	0.002	0.006	nd	0.002	0.018
w04	16	nd	nd	22.2	2.2	1.1	nd	nd	7.6	nd	0.086	nd	0.001	nd	nd	0.003	0.019
w04	17	nd	nd	37.8	1.7	0.5	nd	0.5	8.1	nd	0.146	nd	0.001	nd	0.001	0.004	0.009
w04	18	nd	nd	42.6	1.6	0.7	nd	nd	14.5	nd	0.126	nd	0.001	0.088	nd	0.008	0.012
w04	19	nd	nd	29.1	1.9	0.6	nd	nd	13.4	nd	0.121	nd	nd	0.082	nd	0.008	0.013
w04	20	nd	nd	30.6	2.0	0.7	nd	nd	13.8	nd	0.122	nd	0.001	0.089	nd	0.008	0.015
w04	21	nd	nd	34.4	1.9	0.6	nd	nd	13.7	nd	0.128	nd	nd	0.090	nd	0.008	0.014
w04	22	nd	nd	39.5	1.8	0.6	nd	nd	14.2	nd	0.129	nd	0.003	0.085	nd	0.009	0.012
w04	23	nd	nd	37.0	1.7	0.6	nd	nd	14.0	nd	0.133	nd	nd	0.079	nd	0.008	0.013
w04	24	nd	nd	38.4	1.6	0.6	nd	nd	13.9	nd	0.139	nd	nd	0.086	nd	0.008	0.013
w04	25	nd	nd	36.4	1.8	0.7	nd	nd	14.0	nd	0.135	0.003	nd	0.088	nd	0.008	0.013
w04	26	nd	nd	37.8	1.8	0.8	nd	nd	14.0	nd	0.132	nd	0.001	0.084	nd	0.008	0.013
w04	27	nd	nd	36.2	1.8	0.7	nd	nd	14.3	nd	0.133	nd	nd	0.087	nd	0.009	0.013
w04	28	nd	nd	35.0	1.7	0.7	nd	nd	13.8	nd	0.128	0.001	0.003	0.081	nd	0.008	0.014
w04	29	nd	nd	35.3	1.8	0.7	nd	nd	13.7	nd	0.144	nd	0.001	0.083	nd	0.007	0.013
w04	30	nd	nd	44.6	1.6	0.7	nd	nd	14.3	nd	0.122	nd	0.001	0.088	nd	0.008	0.011
w04	31	nd	nd	31.6	1.9	0.7	nd	0.3	5.5	nd	0.149	nd	nd	nd	0.002	0.002	0.012
w04	32	nd	nd	38.9	1.5	0.6	nd	nd	13.9	nd	0.135	nd	nd	0.084	nd	0.008	0.013
w04	33	nd	nd	35.4	1.8	0.7	nd	nd	14.2	nd	0.122	nd	0.002	0.082	nd	0.008	0.014
w04	34	nd	nd	39.8	1.6	0.6	nd	nd	13.9	nd	0.137	nd	nd	0.084	nd	0.008	0.012
w04	35	nd	nd	42.0	1.6	0.7	nd	nd	14.0	nd	0.122	nd	0.001	0.085	nd	0.008	0.012
w04	36	nd	nd	52.5	1.3	0.7	nd	nd	14.7	nd	0.125	nd	nd	0.086	nd	0.009	0.011
w04	37	nd	nd	38.8	1.7	0.7	nd	nd	14.5	nd	0.122	nd	0.001	0.093	nd	0.008	0.012
w04	38	nd	nd	40.5	1.6	0.7	nd	0.5	12.2	nd	0.144	nd	nd	nd	0.001	0.007	0.010

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w04	39	nd	nd	41.3	1.6	0.5	nd	0.5	12.0	nd	0.161	nd	nd	nd	0.001	0.007	0.010
w04	40	nd	nd	35.2	1.9	0.7	nd	nd	14.2	nd	0.129	nd	nd	0.090	nd	0.008	0.014
w04	41	nd	nd	37.9	1.5	0.6	nd	nd	14.2	nd	0.126	nd	0.002	0.082	nd	0.009	0.013
w04	42	nd	nd	37.4	1.9	1.0	nd	0.4	12.2	nd	0.304	nd	0.003	0.115	0.001	0.007	0.012
w04	43	nd	nd	38.1	1.8	0.5	nd	0.2	7.0	nd	0.147	nd	nd	nd	nd	0.003	0.011
w04	44	nd	nd	31.8	1.9	0.6	nd	nd	14.0	nd	0.125	nd	0.001	0.091	nd	0.008	0.014
w04	45	nd	nd	29.7	2.1	0.7	nd	nd	14.2	nd	0.159	nd	nd	0.091	nd	0.008	0.014
w04	46	nd	nd	37.4	1.8	0.7	nd	nd	14.3	nd	0.121	nd	0.001	0.094	nd	0.008	0.013
w04	47	nd	nd	42.1	1.6	0.6	nd	nd	14.4	nd	0.123	nd	nd	0.091	nd	0.008	0.013
w04	48	nd	nd	31.6	1.8	0.6	nd	nd	13.9	nd	0.118	nd	nd	0.089	nd	0.009	0.013
w05	1	nd	nd	42.2	1.6	0.5	nd	nd	7.5	nd	0.074	nd	nd	nd	nd	0.002	0.013
w05	2	nd	nd	36.2	1.7	0.6	nd	0.2	5.0	nd	0.119	nd	nd	nd	nd	0.006	0.017
w05	3	nd	nd	31.3	2.0	0.7	nd	nd	13.5	nd	0.119	nd	0.002	0.085	nd	0.008	0.015
w05	4	nd	nd	43.2	1.7	0.7	nd	nd	15.5	nd	0.143	nd	nd	0.093	nd	0.009	0.013
w05	5	nd	nd	36.1	1.7	0.6	nd	nd	13.9	nd	0.146	nd	nd	0.080	nd	0.008	0.014
w05	6	nd	nd	38.0	1.7	0.7	nd	nd	14.1	nd	0.139	0.001	nd	0.082	nd	0.009	0.013
w05	7	nd	nd	46.9	1.3	0.7	nd	nd	14.6	nd	0.120	nd	0.001	0.088	nd	0.008	0.011
w05	8	nd	nd	43.1	1.6	0.7	nd	nd	14.3	nd	0.127	nd	0.002	0.084	nd	0.008	0.012
w05	9	nd	nd	35.0	1.7	0.7	nd	nd	13.9	nd	0.121	nd	nd	0.084	nd	0.008	0.013
w05	10	nd	nd	40.7	1.7	0.7	nd	nd	14.3	nd	0.148	nd	nd	0.088	nd	0.008	0.013
w05	11	nd	nd	32.7	2.0	0.6	nd	nd	14.4	nd	0.109	0.001	nd	0.084	nd	0.008	0.014
w05	12	nd	nd	32.4	2.0	0.7	nd	nd	14.0	nd	0.132	nd	nd	0.086	nd	0.008	0.015
w05	13	nd	nd	35.3	1.7	0.6	nd	nd	13.9	nd	0.140	nd	nd	0.090	nd	0.008	0.014
w05	14	nd	nd	40.8	1.7	0.7	nd	nd	14.3	nd	0.129	nd	nd	0.082	nd	0.008	0.013
w05	15	nd	nd	38.8	1.6	0.7	nd	nd	13.9	nd	0.143	nd	0.003	0.084	nd	0.008	0.013
w05	16	nd	nd	38.9	1.7	0.6	nd	nd	13.8	nd	0.140	nd	0.001	0.089	nd	0.008	0.013
w05	17	nd	nd	40.6	1.5	0.7	nd	nd	14.1	nd	0.136	nd	0.001	0.090	nd	0.007	0.012
w05	18	nd	nd	30.8	1.8	0.9	nd	nd	13.9	nd	0.136	nd	0.002	0.092	nd	0.008	0.012
w05	19	nd	nd	43.1	1.5	0.7	nd	nd	14.2	nd	0.135	0.002	0.001	0.086	nd	0.008	0.012
w05	20	nd	nd	33.3	1.7	0.6	nd	nd	13.8	nd	0.150	nd	nd	0.083	nd	0.008	0.013
w05	21	nd	nd	38.4	1.8	0.6	nd	nd	14.5	nd	0.132	nd	nd	0.085	nd	0.009	0.013
w05	22	nd	nd	39.1	1.5	0.6	nd	nd	14.0	nd	0.130	0.002	0.001	0.084	nd	0.008	0.012

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w05	23	nd	nd	43.4	1.4	0.7	nd	nd	14.1	nd	0.161	nd	0.001	0.080	nd	0.008	0.013
w05	24	nd	nd	36.9	1.6	0.8	nd	0.2	5.0	nd	0.111	nd	0.001	nd	nd	0.006	0.017
w05	25	nd	nd	29.9	1.7	0.6	nd	0.2	4.9	nd	0.119	nd	nd	nd	nd	0.006	0.017
w05	26	nd	nd	44.9	1.6	0.7	nd	nd	14.2	nd	0.132	nd	0.002	0.090	nd	0.008	0.013
w05	27	nd	nd	35.3	1.8	0.7	nd	nd	13.9	nd	0.134	nd	0.002	0.092	nd	0.008	0.014
w05	28	nd	nd	38.1	1.7	0.7	nd	nd	14.2	nd	0.132	nd	nd	0.088	nd	0.008	0.013
w05	29	nd	nd	34.0	2.1	0.7	nd	nd	14.6	nd	0.127	nd	0.002	0.094	nd	0.009	0.015
w05	30	nd	nd	36.5	1.8	0.6	nd	nd	14.5	nd	0.116	nd	nd	0.092	nd	0.009	0.013
w05	31	nd	nd	36.0	2.0	0.8	nd	nd	14.6	nd	0.149	nd	nd	0.087	nd	0.008	0.014
w05	32	nd	nd	36.1	1.7	0.7	nd	nd	14.3	nd	0.157	nd	nd	0.091	nd	0.009	0.013
w05	33	nd	nd	29.2	1.9	0.6	nd	0.3	5.7	nd	0.151	nd	0.002	nd	0.002	0.001	0.012
w05	34	nd	nd	37.4	2.0	0.7	nd	nd	15.1	nd	0.135	nd	nd	0.090	nd	0.008	0.014
w05	35	nd	nd	39.1	1.7	0.7	nd	nd	14.1	nd	0.129	nd	nd	0.086	nd	0.008	0.012
w05	36	nd	nd	30.5	1.9	0.7	nd	0.3	5.6	nd	0.155	nd	0.002	nd	0.002	0.001	0.013
w06	1	nd	nd	53.1	1.2	1.3	nd	nd	16.4	nd	0.112	nd	0.001	0.009	nd	0.007	0.021
w06	2	nd	nd	40.5	1.5	1.2	nd	nd	14.4	nd	0.101	nd	nd	0.010	nd	0.006	0.020
w06	3	nd	nd	55.9	1.0	1.3	nd	nd	15.8	nd	0.115	nd	nd	0.008	nd	0.006	0.019
w06	4	nd	nd	40.0	1.6	1.2	nd	nd	14.8	nd	0.118	nd	nd	0.010	nd	0.006	0.022
w06	5	nd	nd	56.1	1.1	1.3	nd	nd	15.1	nd	0.106	nd	nd	0.006	nd	0.006	0.019
w06	6	nd	nd	51.6	1.2	0.8	nd	0.2	5.3	nd	0.111	nd	nd	nd	nd	0.006	0.016
w06	7	nd	nd	70.7	nd	1.4	nd	nd	16.8	nd	0.128	0.003	nd	0.034	nd	0.007	0.019
w06	8	nd	nd	45.8	1.5	0.8	nd	0.2	5.1	nd	0.110	nd	nd	nd	nd	0.006	0.016
w06	9	nd	nd	56.6	1.2	1.3	nd	nd	15.8	nd	0.134	nd	nd	0.033	nd	0.007	0.019
w06	10	nd	nd	42.5	1.6	1.2	nd	nd	15.1	nd	0.110	0.001	nd	0.037	nd	0.006	0.021
w06	11	nd	nd	46.7	1.6	0.7	nd	0.2	5.3	nd	0.117	nd	nd	nd	nd	0.007	0.016
w06	12	nd	nd	41.8	1.5	0.6	nd	0.3	5.8	nd	0.137	nd	0.002	nd	0.002	0.001	0.011
w06	13	nd	nd	47.7	1.2	1.1	nd	nd	15.0	nd	0.110	nd	nd	0.033	nd	0.007	0.019
w06	14	nd	nd	51.2	1.4	1.3	nd	nd	15.0	nd	0.123	nd	nd	0.029	nd	0.006	0.020
w06	15	nd	nd	54.3	1.2	1.2	nd	nd	15.1	nd	0.098	nd	nd	0.033	nd	0.007	0.019
w06	16	nd	nd	49.3	1.3	1.1	nd	nd	15.2	nd	0.117	nd	nd	0.032	nd	0.006	0.019
w06	17	nd	nd	52.5	1.4	1.3	nd	nd	15.3	nd	0.106	nd	0.001	0.035	nd	0.006	0.020
w06	18	nd	nd	31.6	2.1	0.8	nd	nd	13.6	nd	0.135	nd	0.001	0.095	nd	0.008	0.014

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w06	19	nd	nd	28.6	2.2	0.7	nd	nd	13.9	nd	0.142	nd	0.001	0.084	nd	0.008	0.016
w06	20	nd	nd	36.7	1.8	0.7	nd	nd	14.1	nd	0.137	nd	nd	0.085	nd	0.008	0.013
w06	21	nd	nd	36.6	1.8	0.8	nd	nd	14.1	nd	0.129	nd	nd	0.088	nd	0.008	0.013
w06	22	nd	nd	29.6	1.8	0.6	nd	nd	13.6	nd	0.137	nd	0.001	0.087	nd	0.008	0.014
w06	23	nd	nd	38.9	1.8	0.7	nd	nd	14.5	nd	0.135	nd	nd	0.086	nd	0.008	0.012
w06	24	nd	nd	34.4	2.2	0.7	nd	nd	14.8	nd	0.144	nd	nd	0.095	nd	0.009	0.015
w06	25	nd	nd	41.0	1.8	0.7	nd	nd	14.8	nd	0.150	nd	nd	0.091	nd	0.009	0.013
w06	26	nd	nd	43.7	1.5	0.7	nd	nd	14.5	nd	0.133	nd	nd	0.085	nd	0.008	0.012
w06	27	nd	nd	44.6	1.4	0.6	nd	0.3	5.7	nd	0.143	nd	0.003	nd	0.002	0.001	0.011
w06	28	nd	nd	46.2	1.6	0.7	nd	nd	15.1	nd	0.136	nd	0.001	0.093	nd	0.009	0.013
w06	29	nd	nd	33.5	1.8	0.8	nd	0.4	6.9	nd	0.103	nd	nd	nd	0.001	0.007	0.011
w06	30	nd	nd	36.9	1.9	0.7	nd	nd	14.3	nd	0.143	nd	nd	0.092	nd	0.009	0.014
w06	31	nd	nd	42.5	1.5	0.4	nd	0.5	7.4	nd	0.101	0.002	nd	nd	0.001	0.007	0.009
w06	32	nd	nd	31.7	2.1	0.7	nd	nd	14.0	nd	0.134	nd	0.003	0.087	nd	0.008	0.015
w06	33	nd	nd	50.3	1.5	0.7	nd	nd	14.6	nd	0.129	nd	nd	0.086	nd	0.008	0.012
w06	34	nd	nd	33.0	2.0	0.7	nd	nd	14.1	nd	0.136	nd	nd	0.087	nd	0.008	0.013
w06	35	nd	nd	37.2	1.8	0.6	nd	0.3	5.7	nd	0.142	nd	0.001	nd	0.002	0.001	0.011
w06	36	nd	nd	30.5	2.1	0.7	nd	0.5	7.9	nd	0.137	nd	nd	nd	0.001	0.004	0.011
w06	37	nd	nd	27.4	2.1	0.6	nd	nd	7.5	nd	0.094	nd	nd	nd	nd	0.002	0.021
w06	38	nd	nd	36.0	1.7	0.6	nd	nd	8.0	nd	0.090	nd	nd	nd	nd	0.002	0.017
w06	39	nd	nd	35.2	1.9	0.6	nd	nd	7.9	nd	0.087	nd	0.001	nd	nd	0.002	0.020
w06	40	nd	nd	36.7	1.7	0.7	nd	nd	7.7	nd	0.074	0.001	0.001	nd	nd	0.002	0.015
w06	41	nd	nd	37.9	1.7	0.6	nd	nd	7.9	nd	0.082	nd	nd	nd	nd	0.002	0.016
w06	42	nd	nd	40.1	1.6	0.6	nd	nd	7.8	nd	0.080	nd	nd	nd	nd	0.002	0.016
w06	43	nd	nd	28.8	2.1	0.6	nd	nd	7.8	nd	0.071	nd	0.003	nd	nd	0.002	0.018
w06	44	nd	nd	37.7	1.8	0.7	nd	nd	7.8	nd	0.072	nd	nd	nd	nd	0.002	0.014
w06	45	nd	nd	36.4	1.8	0.6	nd	nd	7.9	nd	0.088	nd	nd	nd	nd	0.002	0.016
w06	46	nd	nd	33.1	1.9	0.6	nd	nd	8.0	nd	0.101	nd	0.001	nd	nd	0.002	0.016
w06	47	nd	nd	48.6	1.4	0.6	nd	nd	8.1	nd	0.090	nd	nd	nd	nd	0.002	0.013
w06	48	nd	nd	33.8	1.9	0.8	0.3	0.4	8.6	nd	0.021	nd	1.105	nd	nd	0.003	0.011
w06	49	nd	nd	36.2	1.7	0.5	nd	nd	7.6	nd	0.083	nd	0.001	nd	nd	0.002	0.015
w06	50	nd	nd	40.9	1.6	0.6	nd	nd	7.8	nd	0.082	nd	nd	nd	nd	0.002	0.015

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w06	51	nd	nd	41.4	1.7	0.5	nd	nd	8.2	nd	0.088	nd	0.001	nd	nd	0.002	0.015
w06	52	nd	nd	40.5	1.8	0.7	nd	nd	14.8	nd	0.137	nd	0.001	0.089	nd	0.008	0.014
w06	53	nd	nd	38.0	1.7	0.5	nd	0.3	5.4	nd	0.145	nd	nd	nd	0.002	0.002	0.010
w06	54	nd	nd	37.0	1.8	0.7	nd	nd	14.8	nd	0.116	nd	nd	0.094	nd	0.009	0.014
w06	55	nd	nd	39.8	1.8	0.7	nd	nd	14.3	nd	0.128	nd	nd	0.090	nd	0.008	0.013
w06	56	nd	nd	37.2	1.8	0.6	nd	nd	14.2	nd	0.104	nd	0.003	0.091	nd	0.008	0.013
w06	57	nd	nd	45.3	1.7	0.9	nd	nd	13.1	0.370	0.197	0.004	nd	0.277	nd	0.016	0.011
w06	58	nd	nd	42.0	1.6	0.7	nd	nd	14.7	nd	0.112	nd	0.002	0.096	nd	0.008	0.013
w06	59	nd	nd	40.4	1.7	0.6	nd	nd	14.4	nd	0.102	0.002	nd	0.085	nd	0.009	0.013
w06	60	nd	nd	39.8	1.8	0.9	nd	nd	14.1	nd	0.107	nd	0.003	0.086	nd	0.008	0.013
w06	61	nd	nd	37.5	1.7	0.6	nd	0.3	5.5	nd	0.164	nd	0.001	nd	0.002	0.002	0.010
w06	62	nd	nd	42.5	1.7	0.7	nd	nd	14.7	nd	0.129	nd	nd	0.090	nd	0.008	0.013
w06	63	nd	nd	39.7	1.7	0.6	nd	nd	8.1	nd	0.093	nd	0.001	nd	nd	0.002	0.017
w06	64	nd	nd	44.2	1.5	0.7	nd	nd	14.5	nd	0.127	nd	nd	0.084	nd	0.008	0.013
w06	65	nd	nd	39.5	1.6	0.4	nd	0.3	5.6	nd	0.116	nd	nd	nd	0.002	0.002	0.010
w06	66	nd	nd	41.0	1.7	0.6	nd	nd	14.2	nd	0.142	nd	nd	0.086	nd	0.008	0.012
w06	67	nd	nd	39.3	1.7	0.6	nd	nd	14.2	nd	0.124	nd	nd	0.087	nd	0.008	0.012
w06	68	nd	nd	40.9	2.8	0.6	0.5	2.8	10.9	0.002	0.447	0.004	0.002	0.020	0.001	0.371	0.015
w06	69	nd	nd	47.1	1.4	1.0	nd	0.2	5.2	nd	0.127	nd	nd	nd	nd	0.007	0.016
w06	70	nd	nd	40.8	1.8	0.8	nd	nd	14.5	nd	0.125	nd	0.001	0.083	nd	0.008	0.012
w07	1	6.3	2.7	94.0	1.8	nd	0.6	3.8	10.6	0.013	0.870	nd	0.004	0.005	0.001	0.313	0.005
w07	2	3.8	1.2	95.5	nd	0.3	nd	0.5	9.0	nd	0.081	nd	nd	nd	0.001	0.003	0.005
w07	3	6.8	2.7	95.8	1.7	nd	0.6	4.0	11.5	0.013	0.844	nd	0.005	0.006	0.001	0.322	0.004
w07	4	nd	0.6	92.4	nd	0.4	nd	nd	9.1	nd	0.243	nd	nd	nd	nd	0.002	0.003
w07	5	6.7	2.6	94.5	1.8	nd	0.6	3.8	11.0	0.025	0.864	nd	0.003	0.006	0.001	0.314	0.006
w07	6	6.5	2.8	94.3	1.7	nd	0.6	3.8	11.1	0.006	0.829	nd	0.004	0.014	0.001	0.313	0.008
w07	7	6.6	2.8	97.6	1.8	nd	0.6	4.0	11.8	nd	0.900	nd	0.006	0.009	0.001	0.326	0.003
w07	8	3.5	1.1	91.8	nd	0.8	nd	0.2	5.7	nd	0.105	nd	nd	nd	0.001	0.006	0.012
w07	9	6.1	2.8	96.1	1.8	nd	0.6	3.8	11.3	nd	0.910	nd	0.004	0.007	0.001	0.320	0.007
w07	10	3.5	1.3	91.5	nd	0.8	nd	0.2	5.8	nd	0.110	nd	nd	nd	nd	0.007	0.013
w07	11	nd	0.9	92.1	nd	1.2	nd	nd	16.3	nd	0.215	nd	nd	0.068	nd	0.006	0.003
w07	12	nd	0.8	96.6	nd	0.9	nd	0.1	16.7	nd	0.220	nd	nd	nd	nd	0.015	0.003

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w07	13	4.0	0.8	94.6	nd	nd	nd	0.2	9.4	nd	0.111	nd	0.001	nd	nd	0.003	0.016
w07	14	nd	0.8	92.2	nd	1.4	nd	0.1	16.2	nd	0.209	nd	nd	0.259	nd	0.009	0.001
w07	15	nd	0.7	94.5	nd	0.8	nd	0.1	15.5	nd	0.193	nd	0.001	0.043	nd	0.008	0.003
w07	16	nd	0.8	90.6	nd	0.8	nd	0.1	15.5	nd	0.237	nd	0.002	nd	nd	0.006	0.006
w07	17	nd	0.9	98.9	nd	0.9	nd	0.1	15.3	0.406	0.205	0.002	0.002	0.271	nd	0.017	0.006
w07	18	nd	nd	94.6	nd	0.3	nd	nd	9.2	nd	0.227	0.002	nd	nd	nd	0.002	0.003
w09	1	3.3	nd	96.9	nd	0.6	nd	nd	8.9	nd	0.087	nd	0.001	nd	nd	0.002	0.010
w09	2	3.0	nd	95.8	nd	0.9	nd	nd	8.5	nd	0.066	nd	nd	nd	nd	0.002	0.010
w09	3	2.9	1.7	94.7	nd	nd	nd	0.6	8.9	nd	0.137	nd	nd	nd	0.001	0.004	0.005
w09	4	3.0	nd	96.0	nd	0.4	nd	nd	8.9	nd	0.090	nd	nd	nd	nd	0.002	0.010
w09	5	3.2	nd	94.2	nd	0.5	nd	nd	9.0	nd	0.073	nd	nd	nd	nd	0.002	0.011
w09	6	3.2	nd	94.3	nd	0.5	nd	nd	9.1	nd	0.092	nd	nd	nd	nd	0.002	0.011
w09	7	3.1	nd	95.5	nd	nd	nd	0.1	9.3	nd	0.085	nd	0.001	nd	nd	0.003	0.007
w09	8	3.2	1.6	96.7	nd	nd	nd	0.6	9.1	nd	0.144	nd	nd	nd	0.001	0.004	0.004
w09	9	3.0	nd	94.9	nd	0.4	nd	nd	8.7	nd	0.081	nd	nd	nd	nd	0.002	0.010
w09	10	3.5	nd	94.8	nd	0.4	nd	nd	9.1	nd	0.096	nd	nd	nd	nd	0.002	0.011
w09	11	3.1	nd	92.3	nd	0.5	nd	nd	8.8	nd	0.086	nd	0.001	nd	nd	0.002	0.011
w09	12	3.2	nd	96.0	nd	0.6	nd	nd	8.8	nd	0.094	nd	nd	nd	nd	0.002	0.010
w09	13	3.4	nd	95.0	nd	0.5	nd	nd	8.7	nd	0.082	nd	nd	nd	nd	0.002	0.010
w09	14	2.9	nd	94.5	nd	0.4	nd	nd	8.9	nd	0.089	nd	nd	nd	nd	0.003	0.011
w09	15	3.2	nd	96.9	nd	0.5	nd	nd	8.7	nd	0.074	0.001	nd	nd	nd	0.002	0.011
w09	16	3.5	nd	96.6	nd	0.5	nd	nd	9.1	nd	0.099	nd	nd	nd	nd	0.002	0.012
w09	17	3.1	nd	94.1	nd	0.5	nd	nd	8.9	nd	0.088	nd	nd	nd	nd	0.002	0.010
w09	18	3.0	1.5	93.9	nd	nd	nd	0.6	8.8	nd	0.153	nd	nd	nd	0.001	0.004	0.005
w09	19	3.0	nd	94.1	nd	0.4	nd	nd	8.8	nd	0.089	nd	0.001	nd	nd	0.002	0.012
w09	20	3.7	nd	96.2	nd	0.5	nd	nd	8.9	nd	0.096	nd	0.001	nd	nd	0.002	0.010
w09	21	3.2	1.5	94.2	nd	0.2	nd	0.5	8.9	nd	0.148	nd	nd	nd	0.001	0.004	0.005
w09	22	3.7	1.2	93.5	nd	0.8	nd	0.2	5.6	nd	0.109	nd	nd	nd	nd	0.006	0.012
w09	23	4.3	2.2	94.2	nd	0.5	nd	0.3	6.4	nd	0.152	nd	nd	nd	0.002	0.001	0.005
w09	24	nd	0.8	95.2	nd	1.0	nd	0.3	16.0	0.427	0.174	nd	0.003	0.007	0.001	0.011	0.003
w09	25	3.8	1.2	93.9	nd	nd	nd	0.5	8.8	nd	0.078	nd	nd	nd	0.001	0.004	0.006
w09	26	nd	1.9	93.2	nd	0.9	nd	0.5	14.5	nd	0.335	nd	0.002	1.168	0.001	0.006	0.002

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w09	27	nd	nd	94.6	nd	0.9	0.5	0.5	9.8	nd	0.020	0.003	1.142	nd	nd	0.003	0.003
w09	28	4.0	nd	92.6	nd	0.2	nd	0.2	9.1	nd	0.080	nd	nd	nd	0.001	0.002	0.003
w09	29	3.9	1.4	94.8	nd	0.7	nd	0.2	5.8	nd	0.104	nd	nd	nd	nd	0.006	0.012
w09	30	nd	1.8	97.3	nd	0.4	nd	0.6	13.8	nd	0.132	nd	nd	nd	0.001	0.006	0.004
w09	31	4.4	2.2	95.1	nd	0.5	nd	0.4	6.6	nd	0.155	nd	0.002	nd	0.002	0.002	0.006
w10	1	nd	nd	92.4	nd	1.0	nd	nd	15.6	nd	0.174	nd	nd	nd	nd	0.016	0.002
w10	2	nd	0.8	94.8	nd	1.3	nd	nd	15.8	nd	0.170	nd	nd	nd	nd	0.016	0.003
w10	3	nd	0.7	93.7	nd	1.1	nd	nd	15.6	nd	0.173	nd	nd	0.006	nd	0.015	0.002
w10	4	nd	0.5	96.2	nd	1.1	nd	nd	15.7	nd	0.185	nd	nd	0.005	nd	0.016	0.001
w10	5	nd	0.8	97.2	nd	1.0	nd	nd	15.8	nd	0.161	nd	nd	0.005	nd	0.016	0.002
w10	6	nd	nd	95.8	nd	1.0	nd	nd	15.5	nd	0.180	nd	nd	nd	nd	0.016	0.003
w10	7	nd	0.5	91.2	nd	1.4	nd	nd	13.8	nd	0.231	nd	0.003	0.392	nd	0.006	0.010
w10	8	nd	0.8	96.5	nd	1.0	nd	nd	15.9	nd	0.154	nd	nd	nd	nd	0.016	0.002
w10	9	nd	1.9	96.2	nd	0.7	nd	0.6	13.5	nd	0.192	0.005	0.001	nd	0.001	0.006	0.005
w10	10	4.6	2.1	94.1	nd	0.6	nd	0.3	6.4	nd	0.135	nd	0.001	nd	0.002	0.001	0.006
w10	11	nd	3.1	97.7	nd	1.0	nd	0.3	15.0	nd	0.333	nd	nd	nd	0.001	0.006	0.006
w10	12	nd	2.1	98.1	nd	0.8	nd	0.6	13.6	nd	0.198	nd	0.001	nd	0.001	0.007	0.005
w10	13	nd	1.8	90.4	nd	0.7	nd	0.6	13.6	nd	0.174	nd	0.003	nd	0.001	0.007	0.005
w10	14	nd	0.9	99.9	nd	1.2	nd	nd	16.5	nd	0.168	nd	nd	nd	nd	0.016	0.003
w10	15	nd	0.7	97.9	nd	1.0	nd	nd	15.9	nd	0.166	nd	nd	0.005	nd	0.016	0.002
w10	16	nd	0.8	99.1	nd	1.0	nd	nd	15.8	nd	0.174	nd	nd	nd	nd	0.016	0.002
w10	17	nd	0.7	96.9	nd	1.0	nd	nd	15.7	nd	0.158	nd	nd	nd	nd	0.016	0.002
w10	18	4.3	2.0	92.6	nd	0.2	nd	0.4	6.1	nd	0.153	nd	0.001	nd	0.002	0.002	0.005
w10	19	nd	0.7	95.5	nd	1.1	nd	nd	15.4	nd	0.180	0.001	nd	nd	nd	0.016	0.002
w10	20	nd	0.8	99.3	nd	1.1	nd	nd	16.4	nd	0.164	nd	nd	nd	nd	0.017	0.002
w10	21	nd	2.0	96.2	nd	0.7	nd	0.6	13.9	nd	0.206	0.002	0.001	nd	0.001	0.006	0.005
w10	22	3.8	2.1	91.0	nd	0.5	nd	0.4	6.3	nd	0.155	nd	0.001	nd	0.002	0.002	0.005
w10	23	nd	0.9	99.5	nd	1.2	nd	nd	16.5	nd	0.188	nd	nd	nd	nd	0.017	0.002
w10	24	nd	2.8	96.0	nd	0.8	nd	0.3	14.5	nd	0.360	nd	0.001	nd	nd	0.006	0.005
w10	25	nd	0.6	95.0	nd	1.1	nd	nd	16.0	nd	0.187	nd	nd	0.006	nd	0.018	0.002
w10	26	7.7	3.4	95.7	1.8	nd	0.6	4.1	11.9	0.019	0.610	nd	0.001	0.006	0.001	0.362	0.004
w10	27	nd	0.5	95.3	nd	0.9	nd	nd	12.7	0.044	0.219	nd	nd	0.233	nd	0.013	0.006

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w10	28	nd	0.8	96.8	nd	1.1	nd	nd	14.9	nd	0.183	nd	nd	nd	nd	0.016	0.002
w10	29	nd	0.7	95.3	nd	0.7	nd	nd	14.0	0.043	0.228	nd	nd	0.221	nd	0.015	0.006
w10	30	nd	0.7	94.1	nd	1.2	nd	nd	14.9	nd	0.182	nd	nd	nd	nd	0.017	0.002
w10	31	nd	0.9	95.7	nd	1.2	nd	nd	15.3	nd	0.186	nd	nd	nd	nd	0.016	0.002
w10	32	nd	0.6	96.6	nd	0.9	nd	nd	13.3	0.025	0.188	nd	0.001	0.233	nd	0.014	0.005
w10	33	nd	0.7	94.4	nd	1.1	nd	0.1	14.7	nd	0.198	nd	nd	nd	nd	0.016	0.002
w10	34	nd	0.8	96.4	nd	0.9	nd	0.2	14.1	nd	0.178	nd	nd	0.065	nd	0.013	0.002
w10	35	nd	0.9	98.2	nd	1.1	nd	0.6	15.5	nd	0.264	nd	0.001	0.009	nd	0.007	0.002
w10	36	7.4	3.5	95.2	1.9	nd	0.6	4.0	11.6	0.001	0.639	nd	0.001	0.007	0.001	0.350	0.005
w10	37	nd	3.4	98.3	nd	1.5	nd	0.4	15.2	nd	0.247	nd	0.002	0.006	0.001	0.007	0.004
w10	38	nd	0.6	96.4	nd	1.0	nd	0.5	15.0	nd	0.260	nd	0.002	0.008	nd	0.007	0.002
w10	39	nd	0.7	94.8	nd	1.2	nd	nd	16.1	nd	0.188	nd	nd	nd	nd	0.016	0.003
w10	40	nd	0.7	97.3	nd	1.1	nd	0.6	15.3	nd	0.241	nd	0.002	0.005	nd	0.006	0.002
w10	41	nd	0.7	98.0	nd	1.3	nd	0.2	16.4	nd	0.174	nd	nd	nd	nd	0.007	0.002
w10	42	nd	nd	92.8	nd	1.2	nd	0.2	15.8	nd	0.161	nd	nd	nd	nd	0.006	0.003
w10	43	nd	0.7	97.0	nd	1.3	nd	0.1	15.7	nd	0.146	nd	0.002	nd	nd	0.006	0.002
w10	44	nd	0.7	95.2	nd	1.1	nd	nd	15.5	nd	0.152	nd	nd	nd	nd	0.016	0.002
w10	45	7.9	3.7	97.0	2.0	nd	0.6	4.0	11.6	nd	0.604	nd	nd	0.006	0.002	0.351	0.004
w10	46	7.7	3.4	95.7	1.9	0.4	0.6	4.0	11.8	nd	0.623	nd	nd	0.011	0.001	0.361	0.006
w10	47	nd	2.9	99.5	nd	1.3	nd	0.4	15.9	nd	0.286	nd	nd	0.006	0.001	0.007	0.004
w11	1	nd	0.6	95.5	nd	1.0	nd	nd	15.8	nd	0.172	nd	nd	nd	nd	0.016	0.002
w11	2	nd	0.9	98.8	nd	1.2	nd	nd	15.3	nd	0.187	nd	0.001	nd	nd	0.017	0.002
w11	3	nd	nd	96.3	nd	1.1	nd	nd	16.0	nd	0.180	nd	nd	nd	nd	0.017	0.002
w11	4	nd	0.8	98.9	nd	1.1	nd	nd	16.3	nd	0.167	nd	nd	nd	nd	0.017	0.002
w11	5	nd	0.5	91.5	nd	1.1	nd	nd	15.6	nd	0.182	nd	0.001	0.005	nd	0.016	0.002
w11	6	nd	0.8	96.9	nd	1.1	nd	nd	15.1	nd	0.150	nd	nd	nd	nd	0.016	0.002
w11	7	nd	0.7	94.0	nd	1.2	nd	nd	15.3	nd	0.182	nd	nd	nd	nd	0.016	0.001
w11	8	nd	0.7	95.0	nd	1.1	nd	0.1	16.0	nd	0.218	nd	nd	nd	nd	0.016	0.002
w11	9	nd	0.6	95.2	nd	1.1	nd	nd	15.9	nd	0.202	nd	nd	nd	nd	0.015	0.002
w11	10	nd	0.7	92.7	nd	1.0	nd	nd	15.3	nd	0.186	nd	nd	0.005	nd	0.016	0.002
w11	11	nd	0.8	97.6	nd	1.1	nd	nd	16.0	nd	0.198	nd	nd	0.006	nd	0.017	0.003
w11	12	nd	0.7	96.2	nd	1.2	nd	nd	16.6	nd	0.167	nd	nd	0.006	nd	0.017	0.002

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w11	13	nd	0.7	96.5	nd	1.1	nd	nd	16.0	nd	0.191	nd	nd	nd	nd	0.017	0.002
w11	14	nd	0.6	97.4	nd	1.2	nd	nd	16.4	nd	0.180	nd	nd	0.007	nd	0.017	0.002
w11	15	nd	1.9	98.1	nd	1.0	nd	0.5	13.8	nd	0.215	nd	nd	0.660	0.001	0.009	0.003
w11	16	nd	0.9	97.0	nd	1.1	nd	nd	15.7	nd	0.173	nd	nd	0.007	nd	0.016	0.002
w11	17	nd	0.7	95.9	nd	1.1	nd	nd	15.9	nd	0.178	nd	nd	nd	nd	0.017	0.002
w11	18	nd	0.7	98.0	nd	1.2	nd	0.1	16.5	nd	0.180	nd	nd	nd	nd	0.017	0.002
w11	19	nd	0.6	96.9	nd	1.0	nd	nd	15.7	nd	0.157	nd	nd	nd	nd	0.016	0.001
w11	20	nd	0.7	95.9	nd	1.1	nd	nd	15.5	nd	0.192	nd	nd	nd	nd	0.017	0.003
w11	21	nd	0.7	96.3	nd	1.0	nd	0.1	14.8	nd	0.148	nd	nd	0.067	nd	0.013	0.002
w11	22	nd	0.6	95.5	nd	1.1	nd	0.1	16.0	nd	0.175	nd	nd	nd	nd	0.016	0.003
w11	23	3.5	1.1	93.5	nd	nd	nd	nd	8.2	nd	0.074	nd	nd	nd	nd	0.002	0.013
w11	24	4.0	1.1	94.8	nd	nd	nd	nd	8.6	nd	0.081	nd	nd	nd	nd	0.002	0.012
w11	25	nd	nd	88.4	nd	1.1	nd	nd	15.1	nd	0.167	nd	0.001	0.007	nd	0.016	0.002
w11	26	nd	0.9	96.4	nd	1.2	nd	nd	15.6	nd	0.160	nd	nd	nd	nd	0.016	0.002
w11	27	nd	1.4	89.9	nd	0.3	nd	0.5	13.0	nd	0.151	nd	nd	nd	0.001	0.007	0.004
w11	28	nd	0.6	95.1	nd	1.1	nd	nd	15.5	nd	0.163	nd	nd	0.006	nd	0.016	0.001
w11	29	nd	0.6	91.3	nd	1.1	nd	0.1	15.3	nd	0.162	nd	nd	nd	nd	0.016	0.002
w11	30	nd	nd	94.0	nd	1.2	nd	0.1	15.7	nd	0.178	nd	nd	nd	nd	0.016	0.002
w11	31	nd	0.8	95.4	nd	1.2	nd	nd	15.5	nd	0.171	nd	nd	nd	nd	0.016	0.002
w11	32	nd	0.6	97.4	nd	1.0	nd	nd	15.5	nd	0.182	nd	nd	nd	nd	0.016	0.001
w11	33	nd	0.6	93.4	nd	1.0	nd	nd	15.3	nd	0.161	nd	nd	0.007	nd	0.015	0.002
w11	34	nd	0.7	94.3	nd	0.9	nd	nd	15.3	nd	0.164	nd	nd	nd	nd	0.016	0.002
w11	35	nd	0.7	96.7	nd	1.0	nd	nd	15.3	nd	0.166	nd	nd	0.005	nd	0.015	0.001
w11	36	nd	0.5	94.7	nd	1.0	nd	nd	15.3	nd	0.161	nd	0.001	0.005	nd	0.016	0.002
w11	37	nd	0.6	97.6	nd	0.9	nd	nd	15.9	nd	0.174	nd	nd	nd	nd	0.016	0.002
w11	38	nd	0.8	96.4	nd	1.0	nd	nd	15.3	nd	0.173	nd	nd	nd	nd	0.016	0.002
w11	39	nd	0.6	95.2	nd	0.9	nd	nd	15.7	nd	0.192	nd	nd	nd	nd	0.016	0.003
w11	40	nd	0.8	98.3	nd	1.0	nd	nd	15.8	nd	0.164	nd	nd	nd	nd	0.015	0.002
w11	41	nd	0.8	95.4	nd	1.0	nd	nd	15.7	nd	0.155	nd	nd	nd	nd	0.016	0.002
w11	42	4.2	0.6	94.1	nd	0.3	nd	0.2	9.2	nd	0.074	nd	nd	nd	0.001	0.001	0.002
w11	43	nd	0.6	95.6	nd	0.9	nd	nd	15.6	nd	0.169	nd	nd	nd	nd	0.016	0.002
w11	44	nd	0.7	96.8	nd	1.0	nd	nd	15.5	nd	0.185	nd	nd	nd	nd	0.016	0.002

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w11	45	nd	1.8	94.5	nd	0.6	nd	0.6	13.8	nd	0.256	0.002	0.003	nd	0.001	0.008	0.005
w11	46	nd	0.6	97.8	nd	1.2	nd	nd	16.0	nd	0.192	nd	nd	nd	nd	0.015	0.002
w11	47	nd	0.7	98.0	nd	1.2	nd	nd	16.1	nd	0.148	nd	nd	nd	nd	0.016	0.002
w11	48	nd	0.7	94.5	nd	1.0	nd	nd	15.2	nd	0.164	nd	nd	nd	nd	0.016	0.001
w12	1	nd	nd	95.6	nd	0.9	nd	0.2	15.0	nd	0.156	nd	0.003	0.111	nd	0.015	0.002
w12	2	nd	0.8	89.1	nd	0.7	nd	0.1	17.9	nd	0.231	nd	0.004	nd	nd	0.015	0.009
w12	3	nd	0.8	93.0	nd	0.7	nd	nd	17.3	nd	0.244	nd	0.002	nd	nd	0.014	0.008
w12	4	nd	1.1	96.9	nd	0.6	nd	0.2	16.3	nd	0.188	nd	0.003	nd	nd	0.011	0.004
w12	5	4.2	1.4	95.0	nd	0.8	nd	0.2	5.7	nd	0.121	nd	nd	nd	nd	0.007	0.012
w12	6	3.8	1.4	94.6	nd	0.8	nd	0.2	5.7	nd	0.132	nd	nd	nd	nd	0.007	0.012
w12	7	nd	nd	96.4	nd	1.1	nd	0.1	15.6	nd	0.147	nd	nd	nd	nd	0.021	0.002
w12	8	3.5	1.3	93.3	nd	0.8	nd	0.2	5.8	nd	0.095	nd	nd	nd	nd	0.006	0.012
w12	9	nd	1.6	98.9	nd	0.6	nd	0.5	14.1	nd	0.153	0.001	0.006	nd	0.001	0.007	0.005
w12	10	nd	0.9	95.2	nd	1.2	nd	nd	16.2	nd	0.212	nd	nd	0.048	nd	0.009	0.002
w12	11	4.3	1.4	96.5	nd	0.8	nd	0.2	5.8	nd	0.117	nd	nd	nd	nd	0.006	0.012
w12	12	nd	1.8	98.4	nd	0.5	nd	0.5	14.1	nd	0.165	nd	0.003	nd	0.001	0.008	0.005
w12	13	nd	0.9	95.2	nd	0.6	nd	0.2	15.3	nd	0.187	nd	0.002	nd	nd	0.010	0.005
w12	14	nd	1.0	97.5	nd	0.5	nd	0.2	15.6	nd	0.191	nd	0.002	nd	nd	0.010	0.005
w12	15	nd	1.0	98.1	nd	0.8	nd	0.2	15.5	nd	0.193	nd	0.001	nd	nd	0.013	0.005
w12	16	2.3	3.3	90.8	nd	0.3	0.5	0.8	19.7	nd	0.539	nd	0.029	nd	nd	0.073	0.015
w12	17	nd	1.1	95.9	nd	0.5	nd	0.3	15.9	nd	0.193	nd	0.001	nd	nd	0.010	0.005
w12	18	nd	0.9	94.1	nd	0.6	nd	0.2	15.4	nd	0.180	0.001	0.003	nd	nd	0.010	0.005
w12	19	nd	1.4	99.6	nd	0.5	nd	0.2	15.4	nd	0.133	nd	0.006	nd	nd	0.014	0.004
w12	20	nd	1.2	96.5	nd	0.2	0.5	0.5	13.1	nd	0.356	nd	nd	nd	nd	0.053	0.003
w12	21	nd	0.6	98.5	nd	0.9	nd	0.3	15.3	nd	0.187	nd	0.002	0.118	nd	0.016	0.002
w12	22	nd	nd	97.6	nd	0.9	nd	0.2	14.6	nd	0.189	nd	0.002	0.106	nd	0.015	0.002
w12	23	nd	0.6	99.1	nd	0.9	nd	0.2	15.5	nd	0.171	nd	0.001	0.121	nd	0.016	0.002
w12	24	4.1	1.7	94.8	nd	0.2	nd	0.6	8.4	nd	0.094	nd	nd	nd	0.001	0.008	0.006
w12	25	nd	0.9	98.4	nd	0.3	nd	0.2	15.7	nd	0.351	nd	0.002	nd	nd	0.015	0.010
w12	26	4.5	2.1	95.8	nd	0.5	nd	0.4	6.5	nd	0.153	nd	0.003	nd	0.002	0.001	0.006
w12	27	nd	1.0	95.4	nd	1.0	nd	nd	18.3	nd	0.176	nd	nd	0.347	nd	0.015	0.006
w12	28	4.1	1.8	94.5	nd	nd	nd	0.5	8.2	nd	0.101	nd	0.001	nd	0.001	0.007	0.006

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w12	29	nd	0.5	89.3	nd	0.6	nd	0.3	15.8	nd	0.315	0.001	0.003	nd	nd	0.008	0.007
w12	30	nd	0.6	94.9	nd	0.7	nd	0.3	15.7	nd	0.293	nd	0.003	nd	nd	0.008	0.007
w12	31	nd	0.8	95.3	nd	1.2	nd	0.1	15.5	nd	0.217	nd	nd	nd	nd	0.007	0.004
w12	32	4.6	2.0	94.8	nd	0.5	nd	0.4	6.5	nd	0.153	nd	0.004	nd	0.002	0.001	0.006
w12	33	nd	0.9	98.4	nd	0.2	nd	0.2	15.6	nd	0.334	nd	0.002	nd	nd	0.016	0.010
w12	34	4.1	2.1	93.5	nd	0.5	nd	0.4	6.5	nd	0.156	nd	0.002	nd	0.002	0.001	0.006
w12	35	4.1	1.9	90.2	nd	0.5	nd	0.3	6.1	nd	0.171	nd	0.001	nd	0.002	0.001	0.006
w12	36	nd	0.9	96.8	nd	0.3	nd	0.2	15.6	nd	0.311	nd	0.001	nd	nd	0.015	0.010
w12	37	nd	0.7	92.3	nd	0.6	nd	0.3	15.4	nd	0.280	nd	0.003	nd	nd	0.008	0.008
w12	38	nd	0.7	94.4	nd	0.7	nd	0.3	16.1	nd	0.333	nd	0.002	nd	nd	0.008	0.008
w13	1	nd	nd	91.3	nd	0.9	nd	nd	13.7	0.031	0.173	nd	nd	0.355	nd	0.016	0.002
w13	2	nd	1.7	95.0	nd	0.4	nd	0.5	13.0	nd	0.177	nd	0.005	nd	0.001	0.009	0.005
w13	3	nd	2.0	100.7	nd	0.4	nd	0.5	13.5	nd	0.176	nd	0.003	nd	0.001	0.009	0.005
w13	4	nd	1.5	94.7	nd	0.5	nd	0.5	12.7	nd	0.163	nd	0.003	nd	0.001	0.010	0.005
w13	5	nd	0.8	91.3	nd	1.0	nd	nd	17.5	nd	0.178	nd	nd	0.005	nd	0.013	0.003
w13	6	nd	nd	87.1	nd	1.3	nd	nd	14.5	nd	0.146	nd	nd	nd	nd	0.007	0.002
w13	7	nd	0.9	96.1	nd	1.1	nd	nd	15.4	nd	0.199	nd	0.001	0.161	nd	0.008	0.003
w13	8	nd	1.8	99.7	nd	0.4	nd	0.5	13.3	nd	0.177	nd	0.003	nd	0.001	0.009	0.005
w13	9	nd	2.1	101.6	nd	0.5	nd	0.6	13.4	nd	0.183	nd	0.002	nd	0.001	0.010	0.005
w13	10	nd	1.6	91.7	nd	0.2	nd	0.5	13.0	nd	0.146	nd	0.002	nd	0.001	0.009	0.005
w13	11	nd	1.6	93.9	nd	0.6	nd	0.5	12.7	nd	0.160	nd	0.004	nd	0.001	0.009	0.005
w13	12	nd	2.0	96.2	nd	0.6	nd	0.6	13.2	nd	0.172	nd	0.001	nd	0.001	0.009	0.005
w13	13	nd	0.9	96.0	nd	1.3	nd	nd	15.5	nd	0.183	nd	nd	0.155	nd	0.008	0.002
w13	14	nd	1.8	99.1	nd	0.6	nd	0.5	13.2	nd	0.162	nd	nd	nd	0.001	0.009	0.006
w13	15	nd	1.0	96.1	nd	1.2	nd	nd	14.4	0.432	0.229	nd	nd	0.282	nd	0.016	0.006
w13	16	nd	1.9	95.3	nd	0.5	nd	0.5	12.8	nd	0.163	nd	0.001	nd	0.001	0.010	0.005
w13	17	nd	1.8	96.0	nd	0.6	nd	0.5	12.8	nd	0.181	nd	0.001	nd	0.001	0.009	0.005
w13	18	nd	0.7	96.0	nd	1.4	nd	0.3	15.8	0.420	0.165	nd	0.001	0.009	nd	0.011	0.003
w13	19	nd	1.9	97.8	nd	0.5	nd	0.6	13.5	nd	0.185	nd	0.002	0.007	0.001	0.010	0.006
w13	20	nd	2.0	97.8	nd	0.6	nd	0.5	12.9	nd	0.167	nd	0.004	nd	0.001	0.009	0.006
w19	1	3.8	1.1	93.1	nd	0.3	nd	nd	8.4	nd	0.058	nd	0.001	nd	nd	0.002	0.018
w19	2	nd	0.8	91.9	nd	1.4	nd	0.2	17.6	0.264	0.290	nd	0.003	0.319	nd	0.011	0.003

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w19	3	nd	1.1	94.1	nd	1.4	nd	0.2	17.8	0.254	0.261	nd	0.002	0.319	nd	0.012	0.003
w19	4	3.8	1.2	93.1	nd	0.3	nd	nd	8.3	nd	0.073	nd	nd	nd	nd	0.003	0.018
w19	5	nd	1.0	94.4	nd	1.3	nd	0.2	17.6	0.281	0.239	nd	0.003	0.319	nd	0.012	0.002
w19	6	nd	0.9	95.0	nd	1.4	nd	0.2	18.4	0.293	0.288	nd	nd	0.192	0.001	0.012	0.003
w19	7	nd	1.2	95.0	nd	1.4	nd	0.2	18.6	0.245	0.251	nd	0.001	0.189	nd	0.012	0.003
w19	8	nd	0.6	93.1	nd	1.2	nd	nd	16.3	nd	0.178	nd	nd	nd	nd	0.008	0.002
w19	9	nd	1.0	93.8	nd	1.3	nd	0.2	17.0	0.250	0.258	0.001	0.001	0.315	nd	0.011	0.004
w19	10	nd	nd	90.9	nd	0.9	nd	nd	15.9	nd	0.185	nd	nd	nd	nd	0.007	0.002
w19	11	nd	1.1	93.2	nd	1.0	nd	0.2	17.3	0.233	0.279	nd	0.002	0.278	nd	0.011	0.003
w19	12	3.7	1.4	93.8	nd	0.2	nd	nd	8.2	nd	0.053	nd	nd	nd	nd	0.003	0.018
w19	13	nd	1.2	95.4	nd	1.3	nd	0.2	17.8	0.253	0.276	nd	0.002	0.185	nd	0.012	0.003
w19	14	3.7	1.3	89.5	nd	0.3	nd	nd	8.4	nd	0.070	nd	nd	nd	nd	0.002	0.019
w19	15	3.9	1.2	93.7	nd	0.2	nd	nd	8.2	nd	0.072	nd	nd	nd	nd	0.003	0.018
w19	16	3.8	1.3	93.3	nd	0.3	nd	nd	8.4	nd	0.075	nd	0.001	nd	nd	0.002	0.018
w19	17	3.8	1.2	93.0	nd	0.2	nd	nd	8.4	nd	0.054	nd	nd	nd	nd	0.002	0.018
w19	18	3.8	1.0	92.9	nd	0.2	nd	nd	8.3	nd	0.076	nd	nd	nd	nd	0.002	0.018
w19	19	3.7	1.2	92.3	nd	0.3	nd	nd	8.3	nd	0.083	0.002	nd	nd	nd	0.003	0.020
w19	20	nd	1.6	92.5	nd	0.8	nd	0.5	12.5	nd	0.114	nd	0.002	nd	0.001	0.010	0.005
w19	21	nd	0.9	96.0	nd	0.8	nd	nd	15.7	nd	0.184	0.003	0.003	nd	nd	0.006	0.004
w19	22	2.8	nd	96.9	nd	0.7	nd	nd	9.0	nd	0.075	nd	0.001	nd	nd	0.003	0.002
w19	23	nd	0.7	92.1	nd	0.7	nd	nd	15.4	nd	0.159	nd	0.002	nd	nd	0.006	0.003
w19	24	nd	0.9	93.3	nd	0.6	nd	0.2	15.6	nd	0.162	nd	0.006	nd	nd	0.007	0.005
w19	25	nd	0.9	92.4	nd	0.7	nd	nd	15.3	nd	0.194	0.004	0.003	nd	nd	0.005	0.004
w19	26	nd	0.8	95.3	nd	0.7	nd	nd	15.3	nd	0.222	0.004	0.001	nd	nd	0.006	0.003
w19	27	3.3	1.2	88.6	nd	0.3	nd	nd	8.1	nd	0.062	nd	0.001	nd	nd	0.003	0.018
w19	28	3.6	1.2	91.5	nd	0.3	nd	nd	8.2	nd	0.078	nd	nd	nd	nd	0.002	0.019
w19	29	3.8	1.2	92.8	nd	0.3	nd	nd	8.4	nd	0.075	nd	nd	nd	nd	0.003	0.018
w19	30	4.0	1.1	92.2	nd	0.3	nd	nd	8.2	nd	0.062	nd	nd	nd	nd	0.003	0.019
w19	31	4.0	1.4	95.3	nd	0.4	nd	nd	8.7	nd	0.066	nd	nd	nd	nd	0.003	0.018
w19	32	3.8	1.2	92.1	nd	0.3	nd	nd	8.4	nd	0.052	nd	0.001	nd	nd	0.002	0.018
w19	33	3.5	1.3	95.3	nd	0.2	nd	nd	8.7	nd	0.049	nd	nd	nd	nd	0.002	0.019
w19	34	3.5	1.1	91.2	nd	0.2	nd	nd	8.1	nd	0.064	nd	nd	nd	nd	0.002	0.018

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w19	35	3.9	1.3	93.8	nd	0.2	nd	nd	8.4	nd	0.073	nd	nd	nd	nd	0.003	0.018
w19	36	3.7	1.0	91.2	nd	0.3	nd	nd	8.1	nd	0.070	nd	nd	nd	nd	0.002	0.019
w19	37	3.6	1.2	92.6	nd	0.3	nd	nd	8.5	nd	0.073	nd	nd	nd	nd	0.002	0.019
w19	38	3.6	1.2	91.7	nd	0.2	nd	nd	8.0	nd	0.061	nd	nd	nd	nd	0.002	0.019
w19	39	3.3	1.2	91.9	nd	0.2	nd	nd	8.3	nd	0.068	nd	0.002	nd	nd	0.002	0.019
w19	40	3.3	1.3	90.1	nd	0.2	nd	nd	8.2	nd	0.049	nd	0.001	nd	nd	0.002	0.018
w19	41	3.1	1.1	87.5	nd	nd	nd	nd	8.0	nd	0.057	0.001	0.001	nd	nd	0.002	0.019
w19	42	2.8	1.0	84.8	nd	0.2	nd	nd	7.8	nd	0.058	nd	nd	nd	nd	0.002	0.019
w19	43	3.5	1.1	89.9	nd	0.2	nd	nd	8.5	nd	0.061	0.001	0.001	nd	nd	0.002	0.020
w19	44	3.0	1.2	90.7	nd	0.2	nd	nd	8.4	nd	0.067	nd	0.002	nd	nd	0.003	0.018
w19	45	3.0	1.0	88.9	nd	0.3	nd	nd	8.2	nd	0.075	nd	nd	nd	nd	0.002	0.018
w19	46	nd	0.7	92.7	nd	0.9	nd	nd	15.8	nd	0.199	0.001	0.001	nd	nd	0.006	0.004
w19	47	nd	0.8	92.5	nd	0.8	nd	nd	15.6	nd	0.194	0.004	0.001	nd	nd	0.006	0.003
w19	48	nd	0.5	88.4	nd	0.8	nd	nd	14.8	nd	0.202	nd	0.002	nd	nd	0.005	0.003
w19	49	nd	0.6	86.2	nd	0.8	nd	nd	15.2	nd	0.169	0.003	0.001	nd	nd	0.005	0.004
w19	50	nd	0.8	92.1	nd	0.9	nd	nd	15.5	nd	0.201	0.003	nd	nd	nd	0.005	0.003
w19	51	3.0	0.9	87.8	nd	0.3	nd	nd	8.2	nd	0.059	nd	0.001	nd	nd	0.002	0.018
w19	52	nd	0.6	91.9	nd	0.7	nd	nd	15.7	nd	0.197	nd	0.001	nd	nd	0.005	0.004
w19	53	nd	0.6	93.0	nd	0.8	nd	nd	16.1	nd	0.191	0.001	nd	nd	nd	0.006	0.004
w19	54	nd	0.8	94.8	nd	0.9	nd	nd	14.8	0.345	0.225	0.001	0.006	0.290	nd	0.017	0.006
w19	55	nd	1.0	92.8	nd	1.0	nd	0.2	17.3	0.272	0.276	nd	nd	0.278	nd	0.011	0.002
w19	56	3.5	1.1	90.8	nd	0.3	nd	nd	8.2	nd	0.066	nd	nd	nd	nd	0.002	0.019
w19	57	3.6	1.1	88.6	nd	nd	nd	nd	8.1	nd	0.063	nd	nd	nd	nd	0.002	0.017
w19	58	3.2	1.2	88.3	nd	nd	nd	nd	8.3	nd	0.058	nd	nd	nd	nd	0.002	0.019
w19	59	3.2	1.0	87.3	nd	0.3	nd	nd	8.1	nd	0.070	nd	nd	nd	nd	0.003	0.017
w19	60	nd	0.9	92.2	nd	1.0	nd	0.2	17.2	0.243	0.248	nd	0.004	0.286	nd	0.011	0.003
w19	61	nd	0.8	88.4	nd	1.2	nd	0.2	17.3	0.241	0.285	nd	0.004	0.328	nd	0.012	0.002
w19	62	nd	2.5	85.4	nd	0.6	nd	0.6	14.5	0.421	0.329	nd	0.001	0.536	0.001	0.020	0.007
w19	63	nd	2.5	85.4	nd	0.7	nd	0.6	14.1	0.452	0.272	nd	0.001	0.571	0.001	0.019	0.007
w19	64	nd	2.3	83.7	nd	0.7	nd	0.7	14.1	0.457	0.277	nd	nd	0.588	0.001	0.019	0.007
w19	65	nd	2.6	85.3	nd	0.7	nd	0.6	13.6	0.480	0.264	nd	nd	0.569	0.001	0.020	0.008
w19	66	nd	2.4	84.7	nd	0.6	nd	0.6	14.2	0.475	0.264	nd	nd	0.594	0.001	0.021	0.007

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w19	67	nd	2.6	85.6	nd	0.7	nd	0.6	14.3	0.494	0.259	nd	nd	0.590	0.001	0.020	0.008
w29	1	nd	nd	92.6	nd	0.6	nd	nd	16.2	nd	0.147	nd	0.001	0.095	nd	0.008	0.006
w29	2	nd	nd	93.5	nd	0.6	nd	nd	15.6	nd	0.145	nd	nd	0.085	nd	0.008	0.006
w29	3	nd	nd	84.6	nd	nd	0.6	3.9	5.9	nd	0.020	0.001	0.738	nd	0.003	0.002	0.008
w29	4	nd	nd	92.8	nd	0.6	nd	nd	16.0	nd	0.151	nd	nd	0.090	nd	0.009	0.006
w29	5	nd	nd	94.7	nd	0.7	nd	nd	15.9	nd	0.124	nd	nd	0.085	nd	0.008	0.006
w29	6	nd	nd	88.4	nd	0.6	nd	nd	15.0	nd	0.119	nd	nd	0.088	nd	0.008	0.007
w29	7	nd	nd	93.0	nd	0.6	nd	nd	16.3	nd	0.128	nd	0.001	0.087	nd	0.008	0.006
w29	8	nd	nd	97.6	nd	0.6	nd	nd	16.1	nd	0.149	0.002	nd	0.090	nd	0.008	0.007
w29	9	nd	nd	91.5	nd	0.6	nd	nd	16.0	nd	0.140	nd	0.003	0.093	nd	0.008	0.006
w29	10	nd	nd	96.0	nd	0.7	nd	nd	16.4	nd	0.153	nd	nd	0.092	nd	0.009	0.007
w29	11	nd	1.7	99.3	nd	0.5	nd	0.5	13.9	nd	0.167	0.001	nd	nd	0.001	0.010	0.005
w29	12	nd	nd	95.5	nd	nd	0.8	4.2	6.2	nd	0.033	nd	0.737	nd	0.003	0.002	0.008
w29	13	nd	nd	95.9	nd	0.6	nd	nd	16.1	nd	0.137	nd	nd	0.093	nd	0.008	0.007
w29	14	nd	nd	95.1	nd	0.7	nd	nd	15.7	nd	0.162	nd	nd	0.083	nd	0.008	0.006
w29	15	nd	nd	93.6	nd	0.7	nd	nd	15.8	nd	0.131	nd	nd	0.090	nd	0.008	0.006
w29	16	nd	nd	95.4	nd	0.7	nd	nd	15.8	nd	0.123	nd	0.002	0.088	nd	0.008	0.007
w29	17	nd	nd	93.6	nd	0.7	nd	nd	16.0	nd	0.135	nd	0.001	0.084	nd	0.009	0.006
w29	18	nd	nd	95.5	nd	0.7	nd	nd	16.3	nd	0.142	nd	0.002	0.090	nd	0.008	0.007
w29	19	nd	nd	94.6	nd	0.7	nd	nd	16.2	nd	0.129	nd	nd	0.095	nd	0.009	0.007
w30	1	nd	nd	87.1	nd	0.6	nd	nd	15.8	nd	0.124	nd	0.001	0.086	nd	0.008	0.006
w30	2	nd	nd	94.5	nd	0.6	nd	nd	16.2	nd	0.126	nd	0.001	0.088	nd	0.008	0.005
w30	3	nd	nd	94.5	nd	0.6	nd	nd	15.7	nd	0.141	nd	0.001	0.092	nd	0.008	0.006
w30	4	nd	nd	86.2	nd	0.6	nd	nd	15.0	nd	0.127	nd	nd	0.081	nd	0.008	0.006
w30	5	nd	nd	97.0	nd	0.8	nd	nd	15.9	nd	0.134	nd	0.001	0.089	nd	0.009	0.007
w30	6	nd	nd	90.2	nd	0.6	nd	nd	15.0	nd	0.123	nd	nd	0.084	nd	0.008	0.006
w30	7	nd	nd	94.0	nd	0.7	nd	nd	15.5	nd	0.148	nd	nd	0.086	nd	0.008	0.007
w30	8	nd	nd	91.6	nd	0.7	nd	nd	15.5	nd	0.135	nd	0.001	0.088	nd	0.008	0.006
w30	9	nd	nd	95.0	nd	0.7	nd	nd	16.0	nd	0.145	nd	0.001	0.085	nd	0.008	0.007
w30	10	nd	nd	91.2	nd	0.8	nd	nd	15.6	nd	0.141	nd	nd	0.087	nd	0.008	0.006
w30	11	nd	nd	96.4	nd	0.7	nd	nd	16.1	nd	0.140	nd	nd	0.087	nd	0.009	0.007
w30	12	nd	nd	92.5	nd	0.6	nd	nd	16.3	nd	0.131	nd	nd	0.081	nd	0.009	0.007

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w30	13	nd	0.5	93.6	nd	0.7	nd	nd	16.1	nd	0.118	nd	nd	0.087	nd	0.008	0.006
w30	14	nd	nd	95.1	nd	0.6	nd	nd	16.0	nd	0.144	nd	nd	0.088	nd	0.008	0.007
w30	15	nd	nd	96.0	nd	0.7	nd	nd	16.4	nd	0.139	nd	nd	0.089	nd	0.008	0.007
w30	16	nd	nd	96.3	nd	0.7	nd	nd	16.0	nd	0.146	nd	0.002	0.085	nd	0.008	0.007
w31	1	nd	nd	34.9	1.6	0.9	nd	nd	13.6	nd	0.196	nd	nd	nd	nd	0.015	0.010
w31	2	nd	nd	32.9	1.8	0.9	nd	nd	14.3	nd	0.157	nd	nd	nd	nd	0.017	0.009
w31	3	nd	nd	33.4	2.0	0.9	nd	nd	13.9	nd	0.177	nd	nd	0.007	nd	0.016	0.009
w31	4	nd	nd	40.0	1.6	1.0	nd	nd	14.0	nd	0.171	nd	nd	0.006	nd	0.016	0.009
w31	5	nd	nd	39.6	1.6	1.0	nd	nd	13.8	nd	0.191	nd	nd	nd	nd	0.016	0.008
w31	6	nd	nd	41.0	1.5	0.9	nd	nd	14.0	nd	0.157	nd	nd	nd	nd	0.015	0.008
w31	7	nd	nd	36.8	1.6	0.9	nd	nd	14.1	nd	0.167	0.001	nd	0.005	nd	0.017	0.009
w31	8	nd	nd	32.1	1.7	0.6	nd	0.3	5.4	nd	0.137	nd	0.002	nd	0.002	0.001	0.011
w31	9	nd	nd	30.2	2.0	0.7	nd	nd	13.8	nd	0.157	nd	nd	nd	nd	0.014	0.010
w31	10	nd	nd	40.7	1.4	0.5	nd	0.5	7.3	nd	0.102	nd	0.001	nd	0.001	0.003	0.010
w31	11	nd	nd	29.7	1.7	0.5	nd	0.4	7.0	nd	0.113	nd	nd	nd	0.001	0.003	0.012
w31	12	nd	nd	46.1	1.3	0.5	nd	0.3	5.7	nd	0.145	0.001	nd	nd	0.002	0.001	0.010
w31	13	nd	nd	46.9	1.3	0.8	nd	0.1	13.8	0.061	0.208	nd	0.005	0.164	nd	0.007	0.006
w31	14	nd	nd	39.0	1.4	0.4	nd	0.4	7.5	nd	0.082	nd	nd	nd	0.001	0.003	0.009
w31	15	nd	nd	41.8	1.5	1.0	nd	nd	14.5	nd	0.129	0.001	0.001	0.107	nd	0.011	0.007
w31	16	nd	nd	34.9	1.8	0.8	nd	nd	14.0	0.336	0.261	nd	0.014	0.015	nd	0.009	0.011
w31	17	nd	nd	40.6	1.2	0.5	nd	0.3	5.5	nd	0.137	0.001	0.001	nd	0.002	0.001	0.010
w31	18	nd	nd	42.3	1.5	0.9	nd	nd	14.1	nd	0.163	nd	nd	nd	nd	0.015	0.008
w31	19	nd	nd	46.5	1.3	0.5	nd	0.5	7.3	nd	0.130	nd	nd	nd	0.001	0.003	0.010
w31	20	nd	nd	45.7	1.4	1.0	nd	nd	14.3	nd	0.158	nd	nd	0.005	nd	0.017	0.008
w31	21	nd	nd	37.8	1.5	0.5	nd	0.3	5.5	nd	0.133	nd	0.001	nd	0.002	0.002	0.010
w31	22	nd	nd	35.7	1.8	1.0	nd	nd	13.5	nd	0.172	nd	0.002	nd	nd	0.016	0.010
w31	23	nd	nd	29.4	1.9	0.9	nd	nd	13.0	nd	0.177	nd	0.001	nd	nd	0.016	0.010
w31	24	nd	nd	37.9	1.6	0.9	nd	nd	13.7	nd	0.180	nd	0.001	0.006	nd	0.017	0.009
w31	25	nd	nd	28.5	1.9	0.9	nd	nd	12.9	nd	0.178	nd	nd	0.005	nd	0.017	0.010
w31	26	nd	nd	32.6	1.9	1.0	nd	nd	13.7	nd	0.204	nd	nd	0.005	nd	0.017	0.010
w31	27	nd	nd	42.5	1.6	1.1	nd	nd	13.9	nd	0.193	0.003	nd	0.007	nd	0.016	0.007
w31	28	nd	nd	37.8	1.8	0.7	nd	nd	12.1	0.029	0.181	nd	0.003	0.245	nd	0.014	0.012

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w31	29	nd	nd	32.3	1.6	0.9	nd	nd	12.9	nd	0.167	nd	0.001	0.007	nd	0.016	0.009
w31	30	nd	nd	30.9	1.8	0.9	nd	nd	13.5	nd	0.200	nd	nd	nd	nd	0.017	0.010
w31	31	nd	nd	42.2	1.5	0.5	nd	0.4	5.8	nd	0.147	nd	0.002	nd	0.002	0.001	0.010
w31	32	nd	nd	34.5	1.8	1.0	nd	nd	13.5	nd	0.188	nd	nd	nd	nd	0.017	0.009
w31	33	nd	nd	29.9	2.1	0.9	nd	nd	13.6	nd	0.164	nd	0.001	0.005	nd	0.017	0.010
w31	34	nd	nd	42.8	1.4	0.9	nd	nd	13.9	nd	0.184	nd	nd	nd	nd	0.016	0.008
w31	35	nd	nd	43.6	1.5	1.0	nd	nd	14.4	nd	0.179	nd	nd	nd	nd	0.016	0.009
w31	36	nd	nd	39.1	1.7	1.0	nd	nd	13.9	nd	0.168	0.002	nd	nd	nd	0.016	0.008
w31	37	nd	nd	42.6	1.5	0.5	nd	0.5	12.2	nd	0.131	nd	0.001	nd	0.001	0.007	0.011
w31	38	nd	nd	44.2	1.7	0.8	nd	0.4	13.1	0.013	0.316	nd	0.003	0.843	0.001	0.007	0.009
w31	39	nd	nd	38.8	1.5	0.5	nd	0.2	8.1	nd	0.074	nd	nd	nd	nd	0.002	0.008
w31	40	nd	nd	32.8	1.7	0.5	nd	0.5	11.6	nd	0.187	nd	0.001	nd	0.001	0.006	0.011
w31	41	nd	nd	34.1	1.6	0.5	nd	0.4	7.1	nd	0.128	nd	0.001	nd	0.001	0.003	0.011
w31	42	nd	nd	30.1	1.8	0.8	nd	nd	13.2	nd	0.146	nd	nd	nd	nd	0.016	0.009
w31	43	nd	nd	35.6	1.6	0.4	nd	0.3	5.6	nd	0.140	nd	nd	nd	0.002	0.001	0.010
w31	44	nd	nd	35.8	1.7	0.9	nd	nd	14.2	nd	0.171	nd	nd	0.006	nd	0.017	0.009
w31	45	nd	nd	41.0	1.6	0.8	nd	nd	14.4	nd	0.167	nd	nd	0.007	nd	0.016	0.008
w31	46	nd	nd	34.1	1.6	0.8	nd	nd	13.5	nd	0.170	nd	nd	nd	nd	0.015	0.008
w31	47	nd	nd	39.6	1.5	0.8	nd	nd	13.6	nd	0.160	nd	nd	nd	nd	0.016	0.009
w31	48	nd	nd	35.0	1.6	0.8	nd	nd	13.6	nd	0.162	nd	nd	0.005	nd	0.016	0.008
w31	49	nd	nd	27.5	1.8	0.5	nd	0.3	5.4	nd	0.160	nd	0.002	nd	0.002	0.001	0.011
w31	50	nd	nd	27.9	1.9	0.8	nd	nd	12.6	nd	0.168	nd	0.001	0.007	nd	0.015	0.009
w31	51	nd	nd	41.1	1.3	0.8	nd	nd	13.7	0.001	0.166	nd	nd	0.006	nd	0.016	0.008
w31	52	nd	nd	18.8	2.1	0.6	nd	0.4	6.5	nd	0.129	nd	nd	nd	0.001	0.003	0.013
w31	53	nd	nd	40.7	1.6	0.9	nd	nd	13.8	nd	0.157	nd	nd	nd	nd	0.015	0.008
w31	54	nd	nd	38.5	1.4	0.8	nd	nd	13.7	nd	0.176	nd	nd	0.006	nd	0.016	0.008
w31	55	nd	nd	35.2	1.7	0.9	nd	nd	13.5	nd	0.162	nd	nd	nd	nd	0.015	0.009
w31	56	nd	nd	34.2	1.6	0.8	nd	nd	13.4	nd	0.162	nd	nd	0.006	nd	0.015	0.008
w31	57	nd	nd	33.2	1.7	0.8	nd	nd	13.3	nd	0.142	nd	0.001	0.006	nd	0.015	0.009
w31	58	nd	nd	39.0	1.5	0.9	nd	nd	13.9	nd	0.158	nd	nd	nd	nd	0.016	0.008
w35	1	nd	nd	39.8	1.4	0.6	nd	nd	14.2	nd	0.154	nd	nd	0.086	nd	0.008	0.012
w35	2	nd	nd	42.8	1.1	0.7	nd	nd	14.2	nd	0.123	nd	nd	0.086	nd	0.007	0.011

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w35	3	nd	nd	39.5	1.3	0.7	nd	nd	14.5	nd	0.128	0.002	nd	0.092	nd	0.008	0.012
w35	4	nd	nd	39.1	1.5	0.7	nd	nd	14.1	nd	0.125	nd	nd	0.092	nd	0.008	0.012
w35	5	nd	nd	37.8	1.4	0.7	nd	nd	14.2	nd	0.122	nd	0.003	0.086	nd	0.008	0.013
w35	6	nd	nd	42.5	1.4	0.7	nd	nd	14.6	nd	0.144	0.001	0.002	0.085	nd	0.008	0.012
w35	7	nd	nd	41.1	1.4	0.6	nd	nd	14.2	nd	0.133	nd	nd	0.095	nd	0.008	0.012
w35	8	nd	nd	43.8	1.5	0.7	nd	nd	15.1	nd	0.142	nd	nd	0.094	nd	0.009	0.013
w35	9	nd	nd	44.3	1.3	0.7	nd	nd	14.6	nd	0.159	nd	0.002	0.086	nd	0.008	0.012
w35	10	nd	nd	41.0	1.4	0.7	nd	nd	14.3	nd	0.128	nd	nd	0.087	nd	0.007	0.012
w35	11	nd	nd	29.7	1.9	0.7	nd	nd	14.2	nd	0.152	nd	nd	0.092	nd	0.008	0.015
w35	12	nd	nd	45.6	1.4	0.8	nd	nd	14.4	nd	0.143	nd	nd	0.085	nd	0.009	0.012
w35	13	nd	nd	45.0	1.2	0.8	nd	nd	14.1	nd	0.136	nd	0.002	0.078	nd	0.008	0.011
w35	14	nd	nd	38.5	1.3	0.7	nd	nd	14.2	nd	0.143	nd	nd	0.097	nd	0.008	0.012
w35	15	nd	nd	44.8	1.3	0.7	nd	nd	14.3	nd	0.123	nd	nd	0.088	nd	0.008	0.011
w35	16	nd	nd	53.3	1.4	0.8	nd	0.4	13.5	nd	0.137	nd	0.004	nd	0.001	0.007	0.011
w35	17	nd	nd	48.5	1.3	0.8	nd	nd	14.9	nd	0.140	nd	0.001	0.088	nd	0.008	0.011
w35	18	nd	nd	36.4	1.5	0.7	nd	nd	13.4	nd	0.134	0.003	0.001	0.082	nd	0.008	0.012
w35	19	nd	nd	54.3	1.1	0.8	nd	nd	15.6	nd	0.146	nd	nd	0.095	nd	0.009	0.011
w35	20	nd	nd	46.0	1.3	0.9	nd	0.5	12.2	nd	0.204	nd	0.001	0.658	0.001	0.008	0.009
w35	21	nd	nd	41.8	1.3	0.7	nd	nd	14.2	nd	0.125	0.002	0.002	0.077	nd	0.008	0.011
w35	22	nd	nd	54.1	1.3	0.8	nd	nd	15.3	nd	0.131	nd	nd	0.085	nd	0.009	0.011
w35	23	nd	nd	44.8	1.2	0.8	nd	nd	14.2	nd	0.139	nd	nd	0.088	nd	0.008	0.011
w35	24	nd	nd	54.4	1.2	0.9	nd	nd	15.5	nd	0.144	nd	nd	0.094	nd	0.009	0.011
w35	25	nd	nd	46.8	1.2	0.8	nd	nd	14.7	nd	0.138	nd	0.003	0.091	nd	0.009	0.012
w35	26	nd	nd	39.5	1.5	0.7	nd	nd	14.2	nd	0.133	nd	nd	0.089	nd	0.008	0.012
w35	27	nd	nd	45.6	1.4	0.8	nd	nd	14.5	nd	0.144	nd	nd	0.090	nd	0.008	0.013
w35	28	nd	nd	41.5	1.5	0.7	nd	nd	14.4	nd	0.132	nd	nd	0.090	nd	0.008	0.012
w35	29	nd	nd	50.7	1.4	0.9	nd	nd	14.8	nd	0.144	0.001	nd	0.096	nd	0.008	0.011
w35	30	nd	nd	44.6	1.5	0.7	nd	nd	15.5	nd	0.116	nd	nd	0.095	nd	0.009	0.013
w35	31	nd	nd	47.3	1.4	0.8	nd	nd	15.0	nd	0.135	nd	nd	0.090	nd	0.008	0.012
w35	32	nd	nd	45.6	1.4	0.7	nd	nd	14.7	nd	0.125	nd	nd	0.086	nd	0.008	0.012
w35	33	nd	nd	43.2	1.5	0.7	nd	nd	14.6	nd	0.123	nd	nd	0.088	nd	0.008	0.012
w35	34	nd	nd	41.9	1.5	0.7	nd	nd	14.4	nd	0.139	nd	nd	0.090	nd	0.008	0.012

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w35	35	nd	nd	46.0	1.3	0.7	nd	nd	14.3	nd	0.124	nd	0.001	0.088	nd	0.008	0.011
w35	36	nd	nd	40.2	1.4	0.4	nd	0.4	7.7	nd	0.070	nd	nd	nd	0.001	0.004	0.011
w35	37	nd	nd	43.5	1.4	0.5	nd	0.1	6.2	nd	0.070	nd	nd	nd	nd	0.003	0.012
w35	38	nd	nd	42.3	1.3	0.8	nd	0.2	5.1	nd	0.102	nd	nd	nd	nd	0.007	0.016
w35	39	nd	nd	41.1	1.6	0.7	nd	nd	14.4	nd	0.118	nd	nd	0.087	nd	0.008	0.013
w35	40	nd	nd	41.8	1.5	0.7	nd	nd	14.4	nd	0.147	nd	nd	0.088	nd	0.008	0.012
w35	41	nd	nd	51.1	1.3	0.7	nd	nd	15.1	nd	0.130	nd	nd	0.089	nd	0.007	0.012
w35	42	nd	nd	44.3	1.4	0.7	nd	nd	14.5	nd	0.124	nd	nd	0.094	nd	0.008	0.011
w35	43	nd	nd	43.8	1.5	0.5	nd	0.1	6.1	nd	0.073	nd	0.001	nd	nd	0.002	0.012
w35	44	nd	nd	40.9	1.6	0.8	nd	0.2	5.3	nd	0.107	nd	nd	nd	nd	0.006	0.016
w35	45	nd	nd	47.6	1.4	0.8	nd	nd	14.8	nd	0.142	nd	0.001	0.095	nd	0.008	0.012
w35	46	nd	nd	35.3	1.5	0.7	nd	nd	14.2	nd	0.137	nd	0.004	0.087	nd	0.009	0.012
w35	47	nd	nd	49.8	1.2	0.7	nd	nd	15.0	nd	0.143	0.002	nd	0.094	nd	0.008	0.011
w41	1	4.7	4.8	84.9	2.3	0.6	nd	4.6	24.7	0.969	1.477	0.008	0.029	0.120	0.005	0.087	0.034
w41	2	nd	0.7	96.9	nd	1.2	nd	nd	16.6	nd	0.175	nd	nd	0.007	nd	0.007	0.002
w41	3	nd	nd	93.5	nd	1.3	nd	nd	15.6	nd	0.116	nd	nd	0.034	nd	0.006	0.015
w41	4	4.0	4.6	84.1	2.3	0.8	nd	4.5	24.1	0.973	1.392	0.008	0.028	0.138	0.004	0.087	0.034
w41	5	3.8	4.6	83.3	2.3	0.8	nd	4.5	23.7	0.904	1.376	0.011	0.028	0.118	0.005	0.084	0.034
w41	6	3.6	4.2	76.2	3.1	nd	0.6	3.8	22.5	0.550	0.567	nd	0.026	nd	0.003	0.053	0.018
w41	7	4.6	4.9	85.1	2.5	0.5	nd	4.5	24.4	0.931	1.415	0.008	0.029	0.123	0.004	0.086	0.036
w41	8	nd	0.6	95.8	nd	1.1	nd	nd	16.4	nd	0.189	nd	nd	0.010	nd	0.007	0.002
w41	9	4.6	5.0	85.8	2.4	0.7	nd	4.7	25.2	1.034	1.474	0.013	0.030	0.151	0.005	0.090	0.035
w41	10	4.7	4.7	84.7	2.3	0.9	nd	4.5	23.9	0.935	1.409	0.015	0.026	0.144	0.005	0.086	0.034
w41	11	2.8	3.8	76.5	2.0	0.7	nd	4.3	22.9	0.889	1.349	0.012	0.032	0.139	0.005	0.083	0.032
w41	12	3.9	4.7	81.6	3.0	3.2	nd	4.4	23.2	0.949	1.365	0.011	0.028	0.165	0.004	0.085	0.033
w41	13	nd	0.6	95.8	nd	1.1	nd	nd	16.6	nd	0.168	nd	nd	0.009	nd	0.007	0.002
w41	14	4.0	4.5	84.7	2.2	0.8	nd	4.4	23.6	0.961	1.406	0.011	0.031	0.135	0.004	0.085	0.033
w41	15	nd	0.5	97.6	nd	1.1	nd	nd	16.4	nd	0.187	0.001	nd	0.008	nd	0.008	0.002
w41	16	4.4	4.9	85.2	2.5	0.5	nd	4.7	24.8	0.966	1.391	0.015	0.028	0.126	0.004	0.089	0.034
w41	17	2.6	3.7	78.2	2.2	0.5	nd	4.3	23.0	0.866	1.304	0.014	0.027	0.116	0.004	0.081	0.033
w41	18	4.2	3.9	81.7	2.3	0.7	nd	4.3	23.4	0.951	1.328	0.006	0.026	0.138	0.004	0.084	0.035
w41	19	nd	0.6	92.4	nd	0.9	nd	nd	16.2	nd	0.177	nd	0.001	0.009	nd	0.007	0.002

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w41	20	2.2	3.4	75.0	3.4	1.3	nd	4.8	24.1	0.201	1.374	0.011	0.024	0.007	0.004	0.043	0.015
w41	21	nd	0.7	92.1	nd	1.0	nd	nd	16.0	nd	0.200	nd	nd	0.007	nd	0.006	0.002
w41	22	3.9	4.9	83.3	2.3	0.7	nd	4.5	23.7	0.919	1.457	0.013	0.026	0.127	0.005	0.087	0.034
w41	23	3.9	4.2	81.7	2.4	0.5	nd	4.5	24.5	0.971	1.421	0.009	0.027	0.130	0.005	0.090	0.034
w41	24	nd	0.5	92.4	nd	1.0	nd	nd	15.9	nd	0.174	nd	nd	0.008	nd	0.007	0.002
w41	25	4.4	4.9	83.9	2.3	0.7	nd	4.5	24.3	0.951	1.362	0.009	0.031	0.143	0.004	0.085	0.033
w41	26	nd	0.6	94.2	nd	1.0	nd	nd	16.1	nd	0.164	nd	nd	0.008	nd	0.007	0.002
w41	27	3.4	4.2	80.4	2.0	0.7	nd	4.2	23.9	0.890	1.367	0.009	0.030	0.135	0.004	0.088	0.036
w41	28	nd	0.6	95.7	nd	1.0	nd	nd	16.4	nd	0.178	nd	nd	0.008	nd	0.007	0.003
w41	29	nd	0.5	93.6	nd	1.1	nd	nd	15.7	nd	0.186	nd	nd	0.009	nd	0.007	0.002
w41	30	nd	0.7	95.7	nd	1.1	nd	nd	16.5	nd	0.176	nd	nd	0.011	nd	0.006	0.003
w41	31	nd	0.7	95.2	nd	1.1	nd	nd	16.2	nd	0.172	nd	0.001	0.009	nd	0.007	0.002
w41	32	2.3	2.1	71.3	2.3	1.2	nd	5.3	23.5	0.657	1.097	0.007	0.030	0.097	0.004	0.090	0.024
w41	33	nd	0.5	94.6	nd	1.0	nd	nd	16.1	nd	0.174	nd	0.001	0.009	nd	0.007	0.002
w41	34	4.0	4.6	83.2	2.4	0.6	nd	4.5	24.0	0.900	1.382	0.011	0.027	0.126	0.004	0.084	0.033
w41	35	3.4	4.6	83.9	2.3	0.6	nd	4.4	23.8	0.895	1.344	0.009	0.026	0.123	0.004	0.083	0.032
w41	36	4.1	4.7	83.5	2.3	0.8	nd	4.4	23.2	0.915	1.357	0.011	0.026	0.120	0.004	0.085	0.034
w41	37	4.3	4.6	84.1	2.2	0.7	nd	4.4	23.5	0.919	1.365	0.010	0.030	0.125	0.004	0.085	0.033
w41	38	4.5	2.5	85.8	nd	0.4	0.3	1.9	22.0	0.012	0.943	nd	0.005	nd	0.001	0.137	0.005
w41	39	3.6	4.2	82.7	2.5	0.9	nd	4.4	24.1	0.889	1.347	0.012	0.027	0.129	0.004	0.087	0.034
w41	40	nd	0.6	93.4	nd	0.9	nd	nd	15.9	nd	0.174	nd	nd	0.007	nd	0.006	0.002
w41	41	4.4	4.6	85.6	2.4	0.7	nd	4.6	24.5	0.989	1.372	0.007	0.031	0.153	0.005	0.086	0.035
w41	42	9.6	2.8	80.2	4.2	1.1	0.5	10.4	16.0	0.865	0.504	0.005	0.035	0.011	0.016	0.029	0.013
w41	43	3.7	4.6	82.4	2.3	1.0	nd	4.3	23.2	0.911	1.319	0.015	0.027	0.119	0.004	0.083	0.034
w41	44	3.9	4.3	80.6	2.3	0.4	nd	4.5	23.7	0.926	1.344	0.012	0.025	0.115	0.005	0.084	0.035
w41	45	nd	0.6	95.2	nd	1.1	nd	nd	16.2	nd	0.168	0.001	nd	0.008	nd	0.007	0.002
w41	46	4.2	4.4	82.1	2.2	0.8	nd	4.6	23.8	0.986	1.373	0.014	0.026	0.140	0.004	0.087	0.034
w41	47	3.9	4.1	82.6	2.3	0.8	nd	4.3	23.3	1.022	1.392	0.012	0.029	0.150	0.004	0.086	0.034
w41	48	4.4	4.6	82.2	2.3	0.4	nd	4.5	23.5	0.951	1.419	0.011	0.031	0.121	0.004	0.085	0.033
w41	49	3.6	4.4	81.2	2.3	0.6	nd	4.5	23.7	0.981	1.405	0.010	0.029	0.116	0.005	0.086	0.035
w41	50	3.8	3.9	78.9	2.3	0.5	nd	4.4	23.3	0.975	1.405	0.010	0.028	0.124	0.005	0.087	0.036
w42.1	1	nd	nd	74.7	nd	0.8	nd	nd	16.5	nd	0.205	nd	0.001	0.008	nd	0.007	0.002

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w42.1	2	nd	nd	74.8	nd	0.8	nd	nd	15.8	nd	0.183	nd	nd	0.006	nd	0.006	0.003
w42.1	3	nd	2.3	60.6	2.3	2.6	nd	3.9	25.8	0.598	1.132	0.007	0.021	0.124	0.004	0.063	0.036
w42.1	4	nd	1.9	65.3	1.7	0.6	nd	4.9	22.7	0.091	1.165	0.007	0.023	nd	0.004	0.041	0.012
w42.1	5	nd	2.2	60.6	2.0	1.6	nd	4.9	23.9	0.089	1.130	0.014	0.023	0.010	0.004	0.041	0.012
w42.1	6	nd	2.4	58.3	3.1	1.0	0.4	3.2	22.8	0.797	1.314	0.010	0.025	0.192	0.003	0.081	0.029
w42.1	7	nd	nd	77.9	nd	1.0	nd	nd	16.0	nd	0.157	nd	nd	0.010	nd	0.007	0.002
w42.1	8	nd	2.7	61.2	2.5	nd	0.5	3.8	22.7	0.641	0.529	0.003	0.020	0.006	0.003	0.056	0.018
w42.1	9	nd	2.3	52.9	2.7	1.4	0.5	3.6	23.9	0.537	0.594	0.003	0.023	0.014	0.002	0.059	0.016
w42.1	10	nd	nd	74.6	nd	1.0	nd	nd	15.9	nd	0.185	0.001	nd	0.006	nd	0.006	0.002
w42.1	11	nd	nd	79.3	nd	1.1	nd	nd	16.1	nd	0.108	nd	nd	nd	nd	0.006	0.016
w42.1	12	nd	2.2	54.4	1.7	0.4	nd	4.1	26.4	0.631	1.266	0.010	0.021	0.115	0.004	0.061	0.039
w42.1	13	2.1	2.9	63.2	2.8	nd	0.6	3.8	23.0	0.518	0.550	nd	0.024	nd	0.003	0.056	0.017
w42.1	14	nd	1.0	69.7	nd	0.3	nd	0.5	8.6	1.282	1.959	0.002	nd	0.020	0.001	0.007	0.014
w42.1	15	nd	2.4	65.1	1.8	nd	0.4	3.2	22.9	0.749	1.378	0.006	0.026	0.114	0.003	0.077	0.027
w42.1	16	nd	2.6	63.7	2.2	1.2	nd	5.4	22.2	0.212	1.479	0.013	0.024	0.020	0.004	0.047	0.018
w42.1	17	nd	2.5	66.5	1.9	0.8	0.5	3.3	24.0	0.857	1.422	0.010	0.027	0.114	0.003	0.080	0.029
w42.1	18	nd	0.7	77.0	nd	0.4	nd	nd	8.0	nd	0.140	nd	nd	nd	nd	0.002	0.004
w42.1	19	nd	nd	70.9	nd	0.9	nd	nd	14.6	nd	0.155	nd	nd	0.210	nd	0.015	0.003
w42.1	20	nd	nd	80.1	nd	1.2	nd	nd	16.7	nd	0.116	nd	nd	0.071	nd	0.006	0.014
w42.1	21	nd	nd	78.7	nd	0.8	nd	nd	16.6	nd	0.201	nd	nd	0.007	nd	0.007	0.002
w42.1	22	3.2	3.4	62.7	3.1	1.2	0.6	3.9	24.7	0.588	0.554	0.004	0.025	0.009	0.003	0.060	0.018
w42.1	23	nd	2.3	59.4	3.3	0.8	0.5	3.1	22.0	0.774	1.300	0.006	0.029	0.205	0.003	0.079	0.027
w42.1	24	nd	1.2	74.6	nd	0.2	nd	0.5	8.8	1.442	1.979	nd	nd	0.018	0.001	0.007	0.016
w42.1	25	nd	nd	83.4	nd	0.6	nd	nd	16.3	nd	0.164	0.001	nd	0.069	nd	0.010	0.003
w42.1	26	nd	nd	76.4	nd	1.1	nd	nd	16.0	nd	0.099	nd	nd	0.068	nd	0.007	0.014
w42.1	27	nd	2.5	67.2	1.9	0.3	0.3	3.6	24.7	0.854	1.488	0.008	0.027	0.133	0.003	0.082	0.028
w42.1	28	2.0	2.6	66.3	2.6	1.5	0.3	4.6	22.8	0.193	1.434	0.008	0.024	0.009	0.003	0.078	0.014
w42.1	29	nd	nd	79.4	nd	0.6	nd	nd	15.9	nd	0.152	nd	nd	0.069	nd	0.010	0.002
w42.2	1	nd	1.6	59.8	2.0	3.7	0.4	2.2	23.9	0.198	1.035	0.005	0.008	0.029	0.001	0.101	0.010
w42.2	2	nd	nd	73.0	nd	0.8	nd	nd	15.4	nd	0.182	nd	0.001	nd	nd	0.006	0.002
w42.2	3	nd	nd	75.5	nd	0.8	nd	nd	16.3	nd	0.207	nd	nd	0.008	nd	0.007	0.002
w42.2	4	nd	nd	73.3	nd	0.9	nd	0.4	15.2	nd	0.246	0.001	0.010	nd	nd	0.006	0.007

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w42.2	5	nd	nd	78.1	nd	nd	0.5	3.2	5.6	nd	0.025	0.143	0.016	nd	nd	0.002	0.006
w42.2	6	2.5	1.1	49.2	3.7	3.2	0.5	7.8	16.9	0.796	0.498	0.009	0.036	0.087	0.015	0.028	0.012
w42.2	7	2.1	2.8	65.2	2.8	3.9	nd	5.1	23.8	0.181	1.277	0.006	0.022	0.030	0.004	0.046	0.016
w42.2	8	2.3	2.6	66.2	2.1	0.4	nd	4.0	26.3	0.568	1.130	0.012	0.025	0.106	0.004	0.065	0.035
w42.2	9	nd	1.9	56.3	3.6	0.7	0.5	3.0	21.3	0.788	1.328	0.008	0.029	0.186	0.003	0.077	0.027
w42.2	10	nd	0.6	26.5	2.7	31.6	0.5	6.8	20.8	0.885	0.669	0.013	0.043	0.034	0.022	0.052	0.007
w42.2	11	nd	1.1	75.9	nd	0.3	nd	0.5	9.0	1.399	2.047	nd	nd	0.019	0.001	0.007	0.017
w42.2	12	nd	2.3	71.4	2.1	0.7	nd	5.6	24.0	0.097	1.318	0.010	0.023	nd	0.004	0.043	0.011
w42.2	13	nd	nd	79.1	nd	0.9	nd	nd	15.9	nd	0.174	nd	nd	0.005	nd	0.007	0.002
w42.2	14	nd	2.7	68.3	1.9	0.7	nd	4.9	24.2	0.058	0.994	0.002	0.018	nd	0.004	0.040	0.009
w42.2	15	nd	nd	78.1	nd	0.5	nd	nd	15.7	nd	0.136	nd	nd	0.084	nd	0.009	0.006
w42.2	16	nd	nd	76.7	nd	0.9	nd	nd	16.3	nd	0.170	nd	nd	nd	nd	0.006	0.002
w42.2	17	nd	nd	78.8	nd	0.9	nd	nd	16.4	nd	0.196	nd	nd	0.006	nd	0.007	0.002
w42.2	18	nd	2.8	69.2	2.1	0.5	0.3	3.6	24.2	0.802	1.466	0.007	0.028	0.123	0.004	0.082	0.027
w42.2	19	nd	1.1	75.9	nd	0.3	nd	0.5	8.9	1.375	1.962	nd	nd	0.022	0.001	0.007	0.015
w42.2	20	2.6	1.1	76.2	nd	0.3	0.5	4.3	10.6	nd	0.638	nd	0.003	nd	0.002	0.085	0.010
w42.2	21	nd	1.0	75.3	nd	0.2	nd	0.5	8.8	1.407	1.905	0.001	0.001	0.022	0.001	0.006	0.015
w42.2	22	nd	2.4	61.7	3.6	1.0	0.4	3.2	22.0	0.791	1.373	0.011	0.030	0.193	0.003	0.080	0.029
w42.2	23	nd	nd	78.3	nd	0.9	nd	nd	16.5	nd	0.181	0.002	nd	0.008	nd	0.006	0.002
w42.2	24	nd	1.5	63.4	3.4	1.2	0.5	2.1	17.6	0.005	0.838	0.003	0.005	0.106	0.001	0.194	0.005
w42.2	25	nd	2.7	67.8	2.2	0.4	nd	4.1	26.5	0.594	1.129	0.013	0.021	0.118	0.004	0.063	0.036
w42.2	26	nd	nd	76.8	nd	0.8	nd	nd	16.0	nd	0.184	nd	nd	nd	nd	0.006	0.003
w42.2	27	nd	nd	80.4	nd	0.9	nd	nd	16.3	nd	0.194	nd	nd	nd	nd	0.006	0.003
w42.2	28	2.2	2.6	65.5	2.4	0.9	0.3	4.6	23.3	0.180	1.449	0.007	0.025	nd	0.003	0.081	0.015
w42.3	1	nd	nd	78.0	nd	0.9	nd	nd	16.2	nd	0.195	nd	nd	nd	nd	0.007	0.002
w42.3	2	nd	2.5	61.8	2.8	5.1	0.4	3.4	23.2	0.815	1.348	0.011	0.026	0.165	0.004	0.080	0.027
w42.3	3	nd	nd	75.4	nd	0.8	nd	nd	15.5	nd	0.192	nd	nd	0.007	nd	0.007	0.002
w42.3	4	nd	2.7	62.2	2.2	2.3	nd	4.1	26.1	0.580	1.180	0.010	0.023	0.141	0.004	0.065	0.034
w42.3	5	nd	2.4	60.8	3.1	6.0	0.5	3.1	22.3	0.835	1.355	0.015	0.028	0.173	0.003	0.079	0.028
w42.3	6	2.8	1.4	78.7	nd	nd	nd	0.7	8.0	nd	0.157	nd	nd	nd	0.001	0.004	0.014
w42.3	7	nd	nd	78.6	nd	0.9	nd	nd	16.3	nd	0.195	nd	nd	0.007	nd	0.007	0.003
w42.3	8	nd	2.7	65.4	2.2	0.6	nd	4.0	26.8	0.587	1.172	0.011	0.023	0.110	0.004	0.064	0.033

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w42.3	9	nd	nd	75.7	nd	0.9	nd	nd	16.1	nd	0.165	nd	nd	nd	nd	0.007	0.002
w42.3	10	nd	0.9	69.7	nd	0.2	nd	0.5	8.5	1.345	1.903	nd	0.001	0.020	0.001	0.007	0.017
w42.3	11	3.1	3.0	65.3	2.7	0.3	0.3	4.3	22.5	1.009	1.176	0.009	0.027	0.111	0.004	0.065	0.017
w42.3	12	nd	0.5	80.1	nd	0.9	nd	nd	16.4	nd	0.172	nd	nd	nd	nd	0.007	0.002
w42.3	13	2.2	1.5	65.5	nd	1.1	0.3	2.3	21.9	0.105	0.938	0.005	0.010	nd	0.001	0.117	0.010
w42.3	14	2.3	3.9	62.0	2.3	4.9	0.2	5.7	18.7	0.782	0.839	0.013	0.019	0.033	0.005	0.037	0.015
w42.3	15	2.1	3.1	61.1	3.0	0.3	0.5	3.8	24.5	0.593	0.613	0.003	0.027	0.010	0.002	0.058	0.019
w42.3	16	4.9	1.9	66.5	3.8	0.4	0.4	8.5	16.3	0.727	0.603	0.024	0.028	0.008	0.012	0.044	0.015
w42.3	17	nd	nd	77.3	nd	0.9	nd	nd	16.9	nd	0.175	nd	nd	0.006	nd	0.006	0.002
w42.3	18	nd	2.6	57.2	3.0	7.4	0.6	2.9	25.0	0.808	1.288	0.007	0.025	0.177	0.003	0.078	0.027
w42.3	19	2.2	2.4	60.6	3.1	6.3	0.2	3.7	25.0	0.547	1.147	0.012	0.020	0.143	0.003	0.060	0.034
w42.3	20	nd	nd	76.5	nd	0.9	nd	nd	16.2	nd	0.184	nd	nd	0.005	nd	0.007	0.002
w42.4	1	nd	nd	79.5	nd	0.9	nd	nd	16.2	nd	0.198	nd	nd	0.007	nd	0.007	0.003
w42.4	2	2.2	3.2	66.5	2.7	nd	0.5	3.8	22.5	0.593	0.540	nd	0.018	nd	0.003	0.054	0.018
w42.4	3	nd	nd	76.7	nd	0.8	nd	nd	16.7	nd	0.162	nd	nd	0.007	nd	0.007	0.003
w42.4	4	2.0	3.3	65.6	2.7	nd	0.5	3.7	22.3	0.565	0.578	0.001	0.021	nd	0.003	0.054	0.019
w42.4	5	nd	2.6	62.6	2.9	5.3	0.2	3.7	25.8	0.594	1.221	0.009	0.023	0.149	0.004	0.064	0.033
w42.4	6	nd	nd	79.6	nd	0.9	nd	nd	16.4	nd	0.189	nd	nd	0.006	nd	0.007	0.002
w42.4	7	3.2	1.6	50.0	2.6	19.9	0.4	7.1	17.4	0.713	0.462	0.009	0.030	0.053	0.013	0.029	0.012
w42.4	8	nd	nd	75.7	nd	0.9	nd	nd	16.3	nd	0.199	nd	nd	nd	nd	0.006	0.002
w42.4	9	nd	2.4	71.3	2.1	0.5	nd	5.2	22.7	0.082	1.042	0.007	0.019	nd	0.004	0.039	0.011
w42.4	10	nd	2.3	65.6	2.0	1.3	0.3	2.6	23.6	0.746	0.781	0.003	0.016	0.056	0.001	0.112	0.013
w42.4	11	2.3	3.2	63.6	2.8	1.7	0.6	3.6	22.7	0.579	0.598	0.003	0.023	0.015	0.003	0.055	0.020
w42.4	12	nd	nd	74.2	nd	0.8	nd	nd	15.8	nd	0.187	nd	nd	0.006	nd	0.007	0.002
w42.4	13	2.7	1.6	74.9	nd	0.5	0.3	2.3	19.3	0.017	0.884	nd	0.003	0.010	0.001	0.191	0.005
w42.4	14	nd	0.6	74.8	nd	0.2	nd	nd	8.0	nd	0.126	nd	0.001	nd	nd	0.002	0.004
w42.4	15	nd	2.2	55.6	3.2	7.5	0.2	3.5	24.2	0.563	1.153	0.009	0.021	0.167	0.004	0.063	0.032
w42.4	16	nd	2.4	65.0	1.8	0.5	0.3	3.7	23.6	0.850	1.442	0.009	0.029	0.118	0.003	0.079	0.027
w42.4	17	nd	nd	75.3	nd	0.9	nd	nd	16.5	nd	0.193	nd	nd	nd	nd	0.007	0.003
w42.4	18	nd	nd	75.2	nd	0.9	nd	nd	16.0	nd	0.192	nd	nd	0.006	nd	0.007	0.002
w42.4	19	2.4	1.7	66.8	2.4	7.3	0.5	2.2	18.5	0.003	0.850	nd	0.003	0.053	0.001	0.189	0.008
w42.4	20	nd	nd	74.0	nd	0.9	nd	nd	15.8	nd	0.195	nd	0.002	nd	nd	0.007	0.002

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w43.1	1	3.2	2.8	76.8	2.5	0.8	nd	4.1	25.1	0.790	1.082	0.012	0.029	0.087	0.003	0.066	0.024
w43.1	2	4.8	2.0	68.5	2.5	3.0	0.4	7.7	17.5	0.751	0.479	0.009	0.035	0.074	0.015	0.029	0.011
w43.1	3	4.1	5.9	77.2	2.8	0.2	0.7	2.2	23.2	0.568	1.079	0.001	0.030	nd	0.002	0.049	0.021
w43.1	4	3.6	3.5	80.2	2.5	0.5	nd	4.8	24.2	0.587	1.230	0.008	0.018	0.118	0.005	0.052	0.025
w43.1	5	3.5	3.2	79.9	2.8	0.7	nd	4.3	25.9	0.787	1.052	0.013	0.028	0.074	0.004	0.067	0.024
w43.1	6	nd	0.7	98.8	nd	0.9	nd	0.1	17.2	nd	0.181	nd	nd	nd	nd	0.016	0.002
w43.1	7	3.7	5.1	79.8	2.1	0.2	0.7	1.5	24.0	0.536	0.956	0.003	0.028	0.006	0.002	0.054	0.020
w43.1	8	nd	1.0	92.7	nd	1.3	nd	0.3	16.7	nd	0.130	nd	0.001	0.407	0.001	0.010	0.003
w43.1	9	3.4	3.1	81.7	2.6	0.9	nd	4.9	24.3	0.597	1.161	0.008	0.021	0.118	0.005	0.051	0.026
w43.1	10	4.1	3.6	79.2	2.6	0.7	nd	5.3	24.6	0.639	1.243	0.012	0.026	0.113	0.005	0.052	0.026
w43.1	11	3.5	3.2	81.2	2.9	0.7	nd	4.3	25.7	0.746	1.113	0.012	0.028	0.073	0.005	0.065	0.023
w43.1	12	3.4	3.5	84.7	1.3	1.1	0.4	2.1	22.6	0.081	1.182	nd	0.012	nd	0.001	0.114	0.011
w43.1	13	4.0	3.8	81.3	2.8	0.7	nd	5.1	23.8	0.606	1.276	0.009	0.023	0.107	0.005	0.054	0.026
w43.1	14	4.0	3.2	81.4	2.7	0.8	nd	5.4	23.6	0.749	1.080	0.009	0.029	0.107	0.004	0.089	0.025
w43.1	15	3.3	3.0	79.0	3.0	0.8	nd	4.2	24.9	0.758	0.988	0.010	0.030	0.062	0.003	0.065	0.021
w43.1	16	nd	0.9	96.2	nd	1.4	nd	0.3	16.5	nd	0.117	nd	nd	0.384	nd	0.009	0.003
w43.1	17	7.5	2.6	70.9	4.2	3.4	0.5	9.4	14.9	0.871	0.587	0.014	0.033	0.020	0.014	0.028	0.011
w43.1	18	2.9	3.1	73.8	2.4	0.8	nd	4.8	23.9	0.616	1.227	0.011	0.025	0.109	0.004	0.053	0.025
w43.1	19	3.4	3.3	82.6	1.4	1.1	0.4	2.1	23.0	0.072	1.218	0.004	0.012	nd	0.001	0.122	0.012
w43.1	20	3.7	3.1	80.3	2.8	0.6	nd	4.3	25.4	0.776	1.026	0.010	0.027	0.064	0.004	0.064	0.023
w43.1	21	4.4	4.4	82.9	2.9	0.8	0.4	4.1	22.8	0.187	1.614	0.009	0.023	nd	0.002	0.096	0.017
w43.1	22	3.9	3.1	81.7	3.2	0.6	nd	4.4	25.6	0.734	1.014	0.006	0.030	0.057	0.004	0.064	0.022
w43.1	23	nd	nd	95.0	nd	nd	0.9	3.7	6.7	nd	0.001	0.002	0.030	nd	0.003	0.003	0.008
w43.1	24	nd	0.8	94.2	nd	0.8	nd	nd	14.1	0.321	0.246	0.001	0.002	0.250	nd	0.012	0.007
w43.1	25	3.9	3.4	76.8	2.8	1.8	nd	5.2	24.0	0.599	1.234	0.007	0.025	0.119	0.005	0.053	0.026
w43.1	26	3.3	2.7	78.8	2.9	0.6	nd	4.2	25.5	0.687	1.081	0.013	0.027	0.070	0.004	0.066	0.024
w43.1	27	3.5	4.4	83.3	2.6	0.9	0.3	3.9	22.9	0.161	1.617	0.008	0.023	nd	0.002	0.076	0.016
w43.1	28	3.9	2.1	82.7	1.8	0.6	0.7	2.8	23.9	0.179	0.910	nd	0.011	0.006	0.001	0.135	0.009
w43.1	29	3.9	4.2	80.0	2.6	1.2	0.4	4.1	21.9	0.191	1.472	0.005	0.023	0.007	0.002	0.091	0.016
w43.1	30	4.0	4.8	78.4	3.0	nd	0.7	2.1	22.9	0.613	0.939	0.004	0.027	nd	0.002	0.050	0.021
w43.1	31	3.0	2.8	78.2	2.6	0.8	nd	3.9	24.3	0.721	1.090	0.017	0.031	0.073	0.004	0.065	0.023
w43.1	32	3.8	1.6	85.5	nd	0.6	0.4	6.8	10.7	nd	0.519	nd	0.005	nd	0.002	0.084	0.012

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w43.1	33	3.4	3.2	79.3	2.9	0.7	nd	4.2	25.5	0.791	1.059	0.015	0.030	0.065	0.004	0.066	0.022
w43.1	34	nd	0.7	96.4	nd	0.9	nd	nd	13.4	nd	0.190	nd	0.010	0.408	nd	0.012	0.012
w43.1	35	4.9	4.7	85.0	2.8	0.9	0.4	4.0	22.8	0.179	1.614	0.006	0.026	0.005	0.002	0.097	0.018
w43.1	36	4.2	3.4	82.7	2.9	1.6	nd	5.6	24.5	0.785	1.089	0.010	0.029	0.106	0.004	0.092	0.024
w43.1	37	8.0	2.4	75.6	3.8	0.8	0.5	9.9	15.2	0.915	0.463	0.009	0.029	0.007	0.015	0.029	0.011
w43.1	38	8.4	1.4	74.5	4.4	0.8	0.5	8.7	15.6	0.942	0.302	0.004	0.028	0.039	0.016	0.026	0.007
w43.1	39	8.2	1.9	75.9	4.0	1.8	0.5	9.9	14.9	0.908	0.500	0.008	0.035	0.016	0.017	0.027	0.012
w43.1	40	2.7	2.8	80.2	1.6	3.3	0.5	1.7	25.5	0.052	1.002	nd	0.011	0.021	0.001	0.114	0.008
w43.1	41	3.4	2.7	77.1	2.5	0.9	nd	5.5	24.7	0.721	1.104	0.010	0.029	0.104	0.005	0.092	0.023
w43.1	42	4.4	2.9	85.7	1.1	0.7	0.4	2.2	21.2	0.036	1.096	0.001	0.006	0.006	0.001	0.176	0.008
w43.1	43	8.7	2.5	74.0	3.7	4.0	0.5	9.2	17.1	0.889	0.537	0.010	0.032	0.030	0.015	0.030	0.012
w43.2	1	nd	0.8	94.5	nd	0.8	nd	0.2	15.5	0.079	0.480	0.040	nd	0.062	nd	0.012	0.002
w43.2	2	nd	0.9	88.4	nd	0.9	nd	0.2	14.8	0.062	0.425	0.038	nd	0.063	nd	0.012	0.003
w43.2	3	nd	0.7	88.9	nd	0.8	nd	0.2	15.2	0.066	0.431	0.037	nd	0.073	nd	0.011	0.002
w43.2	4	nd	0.8	90.3	nd	0.8	nd	0.1	14.5	0.109	0.436	0.047	0.001	0.056	nd	0.009	0.002
w43.2	5	nd	0.7	90.9	nd	0.8	nd	0.2	14.4	0.084	0.470	0.042	0.002	0.057	nd	0.009	0.002
w43.2	6	nd	0.7	92.1	nd	0.8	nd	0.2	14.6	0.065	0.408	0.046	nd	0.058	nd	0.009	0.003
w43.2	7	nd	0.9	99.3	nd	1.2	nd	nd	18.4	nd	0.177	nd	nd	nd	nd	0.007	0.002
w43.2	8	nd	1.3	88.6	nd	0.3	nd	0.3	8.5	nd	0.065	nd	0.001	nd	0.001	0.014	0.010
w43.2	9	nd	0.8	89.8	nd	0.7	nd	0.2	14.8	0.069	0.427	0.037	0.001	0.062	nd	0.009	0.002
w43.2	10	nd	0.7	90.6	nd	0.8	nd	0.2	13.8	0.076	0.407	0.043	nd	0.047	nd	0.009	0.002
w43.2	11	nd	0.7	89.8	nd	0.8	nd	0.2	14.2	0.084	0.424	0.038	0.002	0.049	nd	0.009	0.002
w43.2	12	nd	nd	86.5	nd	1.0	nd	nd	16.8	nd	0.190	nd	nd	nd	nd	0.007	0.002
w43.2	13	nd	2.0	98.9	nd	0.3	nd	0.3	9.1	nd	0.065	nd	nd	nd	nd	0.016	0.011
w43.2	14	nd	0.8	91.4	nd	0.8	nd	0.2	14.9	0.031	0.427	0.041	nd	0.068	nd	0.012	0.002
w43.2	15	nd	nd	93.7	nd	0.9	nd	0.8	8.5	nd	0.025	nd	2.550	nd	0.001	0.003	0.006
w43.2	16	nd	0.9	93.3	nd	0.9	nd	0.2	15.5	0.074	0.426	0.039	0.001	0.067	nd	0.012	0.002
w43.2	17	nd	nd	94.0	nd	0.8	0.6	3.3	6.6	nd	0.010	nd	1.163	nd	0.003	0.002	0.008
w43.2	18	nd	0.9	90.8	nd	0.8	nd	0.2	15.1	0.090	0.469	0.045	nd	0.070	nd	0.013	0.002
w43.2	19	nd	1.8	96.8	nd	0.3	nd	0.3	9.0	0.012	0.061	0.001	nd	nd	0.001	0.015	0.011
w43.2	20	nd	1.6	94.6	nd	0.3	nd	0.3	8.7	0.004	0.064	nd	0.002	nd	0.001	0.012	0.010
w43.2	21	nd	1.1	90.6	nd	0.8	nd	0.2	14.8	0.085	0.432	0.037	0.001	0.064	nd	0.012	0.002

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w44	1	nd	nd	99.1	nd	1.4	0.5	3.5	5.1	nd	nd	0.029	0.019	nd	0.004	0.002	0.004
w44	2	nd	0.9	94.7	nd	0.7	nd	0.2	14.5	0.088	0.450	0.040	0.001	0.052	nd	0.009	0.002
w44	3	nd	0.9	92.6	nd	0.7	nd	0.2	14.5	0.094	0.445	0.033	nd	0.054	nd	0.009	0.003
w44	4	4.0	3.0	83.4	2.9	0.8	nd	4.1	25.7	0.752	1.105	0.011	0.027	0.077	0.004	0.066	0.024
w44	5	nd	1.0	94.0	nd	0.8	nd	0.2	14.5	0.080	0.429	0.041	0.001	0.053	nd	0.009	0.003
w44	6	3.6	3.4	82.5	2.6	0.4	nd	4.7	23.7	0.556	1.211	0.011	0.027	0.113	0.005	0.051	0.025
w44	7	4.8	2.3	76.4	3.7	9.6	0.4	7.4	14.8	0.704	0.718	0.031	0.029	0.062	0.011	0.039	0.013
w44	8	nd	1.1	94.8	nd	0.9	nd	0.2	15.9	0.051	0.455	0.044	nd	0.076	0.001	0.013	0.003
w44	9	nd	0.8	93.5	nd	0.8	nd	0.2	14.6	0.080	0.441	0.044	nd	0.053	nd	0.009	0.003
w44	10	4.0	3.2	89.0	1.6	1.0	0.3	2.8	23.5	0.093	1.040	0.006	0.011	nd	0.002	0.129	0.011
w44	11	7.6	2.4	73.7	4.7	0.7	0.4	9.9	16.1	0.839	0.573	0.035	0.034	0.010	0.012	0.039	0.014
w44	12	nd	nd	93.6	nd	nd	0.7	4.2	5.0	nd	0.004	nd	0.020	nd	0.004	0.002	0.004
w44	13	nd	1.7	94.8	nd	0.3	nd	0.3	8.8	0.010	0.048	nd	nd	nd	0.001	0.012	0.009
w44	14	nd	0.7	91.0	nd	0.9	nd	0.2	14.8	0.062	0.432	0.049	nd	0.058	nd	0.009	0.003
w44	15	nd	0.7	90.4	nd	0.9	nd	0.2	15.5	0.099	0.463	0.048	0.001	0.054	nd	0.010	0.003
w44	16	nd	0.6	90.7	nd	0.8	nd	0.2	14.6	0.091	0.464	0.042	nd	0.055	nd	0.009	0.003
w44	17	nd	1.6	93.2	nd	0.2	nd	0.3	8.7	nd	0.065	nd	nd	nd	0.001	0.016	0.011
w44	18	nd	0.7	94.1	nd	0.8	nd	0.2	14.6	0.075	0.440	0.036	nd	0.057	nd	0.009	0.003
w44	19	nd	0.9	92.9	nd	0.8	nd	0.2	14.5	0.069	0.397	0.040	nd	0.053	nd	0.009	0.003
w44	20	nd	nd	98.8	nd	1.4	0.6	3.4	5.1	nd	0.003	0.028	0.019	nd	0.004	0.002	0.004
w44	21	nd	2.2	95.1	nd	0.3	nd	0.3	8.9	0.012	0.079	nd	0.001	0.006	0.001	0.016	0.011
w44	22	nd	nd	102.5	nd	nd	0.7	4.1	4.9	nd	nd	nd	0.020	nd	0.003	0.002	0.005
w44	23	nd	0.9	92.9	nd	0.8	nd	0.2	14.3	0.083	0.411	0.041	nd	0.056	nd	0.009	0.002
w44	24	nd	2.7	95.8	nd	0.3	nd	0.3	8.7	0.002	0.059	0.002	nd	nd	0.001	0.016	0.011
w44	25	nd	nd	93.5	nd	1.3	0.5	3.2	4.9	nd	nd	0.023	0.021	nd	0.004	0.002	0.005
w44	26	nd	0.8	95.6	nd	0.9	nd	0.2	14.9	0.101	0.478	0.040	nd	0.059	nd	0.009	0.003
w44	27	nd	nd	98.7	nd	nd	0.8	4.2	5.0	nd	nd	nd	0.019	nd	0.004	0.002	0.005
w44	28	nd	1.0	99.5	nd	1.1	nd	0.2	16.1	0.103	0.456	0.047	nd	0.056	nd	0.011	0.003
w44	29	nd	0.8	88.7	nd	0.7	nd	0.2	14.6	0.082	0.435	0.043	0.001	0.046	nd	0.009	0.003
w44	30	nd	nd	100.3	nd	nd	0.8	4.4	5.1	nd	nd	nd	0.021	nd	0.003	0.002	0.005
w45.1	1	3.5	4.0	78.7	2.7	1.2	0.3	4.2	23.8	0.193	1.671	0.007	0.025	nd	0.003	0.099	0.017
w45.1	2	nd	0.9	93.1	nd	0.8	nd	0.2	15.0	0.104	0.454	0.051	0.001	0.052	nd	0.009	0.002

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w45.1	3	nd	0.7	93.3	nd	0.7	nd	0.2	15.0	0.077	0.453	0.041	0.002	0.058	nd	0.010	0.002
w45.1	4	5.6	2.4	81.8	1.6	0.9	0.4	2.2	22.6	0.007	0.916	nd	0.004	0.011	nd	0.236	0.005
w45.1	5	nd	0.8	93.0	nd	0.8	nd	0.2	14.7	0.085	0.434	0.046	nd	0.055	nd	0.009	0.003
w45.1	6	8.4	2.3	73.6	4.2	1.5	0.4	9.9	15.3	0.903	0.510	0.010	0.031	0.012	0.016	0.028	0.013
w45.1	7	3.5	3.1	74.7	3.0	0.8	nd	4.5	25.5	0.736	1.028	0.010	0.029	0.057	0.004	0.064	0.022
w45.1	8	3.2	5.2	82.1	2.4	nd	0.7	1.6	23.7	0.471	0.919	nd	0.026	nd	0.002	0.053	0.020
w45.1	9	7.3	2.8	73.4	4.9	0.7	0.4	9.9	16.3	0.871	0.630	0.035	0.036	0.024	0.011	0.040	0.014
w45.1	10	2.4	4.2	79.7	2.4	1.0	nd	5.6	24.4	0.117	1.374	0.009	0.020	nd	0.005	0.040	0.015
w45.1	11	nd	0.8	89.9	nd	0.7	nd	0.2	14.2	0.078	0.431	0.037	nd	0.054	nd	0.008	0.002
w45.1	12	9.0	2.5	77.5	4.1	1.1	0.5	10.0	16.0	0.961	0.468	0.009	0.035	0.012	0.015	0.029	0.012
w45.1	13	4.4	2.9	85.2	1.0	0.7	0.3	2.3	21.3	0.044	1.037	nd	0.008	nd	0.001	0.180	0.007
w45.1	14	2.9	3.1	77.7	2.4	1.5	nd	4.0	24.9	0.784	1.041	0.009	0.030	0.076	0.004	0.064	0.023
w45.1	15	4.5	3.8	79.9	2.7	0.7	nd	5.2	24.1	0.643	1.285	0.011	0.025	0.130	0.005	0.056	0.025
w45.1	16	4.1	2.6	85.0	1.0	0.4	0.5	2.0	21.4	0.024	0.900	0.001	0.006	0.009	0.001	0.167	0.006
w45.1	17	4.8	4.3	79.4	2.8	0.5	nd	5.7	24.6	0.694	1.321	0.009	0.019	0.128	0.005	0.058	0.025
w45.1	18	nd	0.6	95.9	nd	0.8	nd	0.2	15.3	0.092	0.449	0.044	0.002	0.052	nd	0.010	0.003
w45.1	19	8.2	2.4	77.0	4.1	2.2	0.5	10.1	15.4	0.867	0.502	0.008	0.041	0.015	0.015	0.031	0.012
w45.1	20	3.6	2.9	80.5	3.0	0.8	nd	4.3	24.9	0.724	1.095	0.014	0.028	0.070	0.003	0.062	0.023
w45.1	21	3.9	3.2	83.6	2.4	nd	0.5	3.3	22.3	0.158	1.450	nd	0.014	nd	0.002	0.101	0.016
w45.1	22	6.9	2.9	73.3	3.5	2.5	0.3	8.5	17.1	0.806	0.492	0.007	0.031	0.029	0.015	0.028	0.010
w45.1	23	4.1	3.8	77.9	2.9	0.7	nd	5.5	24.6	0.695	1.251	0.012	0.023	0.135	0.005	0.058	0.024
w45.1	24	9.3	2.5	77.9	4.1	0.8	0.4	10.4	15.2	0.988	0.483	0.012	0.036	nd	0.016	0.029	0.012
w45.1	25	4.2	3.0	81.4	3.0	0.6	nd	4.2	25.8	0.729	1.070	0.011	0.031	0.064	0.004	0.066	0.022
w45.1	26	7.1	2.2	73.3	3.8	1.1	0.4	10.1	15.4	0.953	0.522	0.010	0.035	0.010	0.016	0.031	0.013
w45.1	27	nd	nd	98.1	nd	nd	0.7	3.9	6.6	nd	0.032	0.003	0.001	nd	0.004	0.002	0.007
w45.1	28	4.2	3.8	82.4	2.8	1.0	nd	4.1	25.1	0.739	1.095	0.013	0.030	0.078	0.003	0.066	0.022
w45.1	29	4.0	3.0	85.0	3.0	0.7	0.4	6.0	23.5	0.712	0.941	0.007	0.024	0.120	0.003	0.052	0.020
w45.1	30	nd	nd	96.9	nd	nd	0.8	3.9	6.4	nd	0.034	0.005	0.003	nd	0.003	0.002	0.006
w45.1	31	5.0	4.2	82.5	3.0	0.6	nd	5.7	25.0	0.724	1.309	0.010	0.027	0.121	0.006	0.058	0.025
w45.1	32	5.0	4.0	80.2	2.8	0.6	nd	5.6	24.2	0.699	1.262	0.014	0.025	0.132	0.006	0.056	0.025
w45.1	33	9.5	2.4	76.9	4.0	0.7	0.4	9.9	15.3	0.855	0.516	0.006	0.034	0.009	0.015	0.029	0.011
w45.1	34	5.6	2.3	68.8	6.3	0.9	0.5	9.2	15.1	0.815	0.615	0.031	0.032	0.043	0.011	0.038	0.013

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w45.1	35	4.4	2.5	81.5	1.1	0.9	0.4	2.2	23.0	0.033	0.885	nd	0.004	nd	0.001	0.189	0.006
w45.1	36	4.2	4.0	83.1	2.4	1.1	0.4	3.0	26.8	0.198	1.257	0.005	0.016	0.013	0.002	0.096	0.015
w45.1	37	3.5	1.5	85.6	2.8	1.0	nd	4.8	24.1	0.677	0.860	0.005	0.019	0.085	0.003	0.051	0.021
w45.1	38	3.8	2.9	82.6	2.7	0.7	nd	4.0	25.5	0.747	1.086	0.010	0.029	0.071	0.003	0.067	0.024
w45.2	1	nd	1.0	96.8	nd	0.8	nd	0.2	15.1	0.067	0.446	0.041	0.001	0.060	nd	0.010	0.003
w45.2	2	4.2	3.5	83.3	2.8	0.8	nd	4.1	25.7	0.767	1.107	0.014	0.031	0.068	0.004	0.064	0.024
w45.2	3	4.0	3.7	85.4	2.9	1.8	nd	4.2	24.9	0.725	1.092	0.010	0.031	0.080	0.004	0.066	0.023
w45.2	4	nd	0.7	92.1	nd	0.8	nd	0.1	14.6	0.092	0.416	0.041	nd	0.050	nd	0.009	0.002
w45.2	5	4.8	3.7	89.1	1.5	0.4	0.4	2.6	18.3	0.030	1.442	nd	0.006	nd	0.001	0.172	0.009
w45.2	6	nd	0.8	92.8	nd	0.8	nd	0.2	15.5	0.062	0.498	0.038	nd	0.070	nd	0.012	0.003
w45.2	7	4.0	3.4	82.9	2.7	1.0	nd	5.7	24.9	0.706	1.125	0.011	0.028	0.091	0.004	0.092	0.022
w45.2	8	5.3	3.0	88.5	1.2	0.8	0.4	2.3	22.1	0.043	1.098	0.001	0.007	0.005	0.001	0.183	0.008
w45.2	9	nd	0.7	94.1	nd	0.8	nd	0.2	14.7	0.088	0.446	0.041	nd	0.059	nd	0.009	0.003
w45.2	10	nd	1.0	93.2	nd	1.0	nd	0.2	15.0	0.067	0.423	0.042	0.001	0.071	nd	0.012	0.003
w45.2	11	nd	0.9	93.4	nd	0.8	nd	0.2	15.1	0.093	0.468	0.045	0.002	0.068	nd	0.012	0.002
w45.2	12	nd	1.0	95.1	nd	1.0	nd	0.2	15.0	0.085	0.446	0.037	0.002	0.068	nd	0.012	0.002
w45.2	13	nd	1.1	96.5	nd	1.0	nd	0.2	15.6	0.103	0.489	0.039	0.002	0.069	nd	0.012	0.002
w45.2	14	nd	0.9	92.1	nd	0.8	nd	0.2	15.2	0.088	0.456	0.044	nd	0.075	nd	0.012	0.003
w45.2	15	nd	0.7	95.6	nd	0.8	nd	0.2	15.2	0.094	0.465	0.038	nd	0.058	nd	0.010	0.003
w45.2	16	nd	0.9	93.4	nd	0.8	nd	0.2	15.0	0.086	0.443	0.041	0.001	0.068	nd	0.012	0.002
w45.2	17	nd	0.9	91.7	nd	0.8	nd	0.2	14.6	0.104	0.411	0.038	nd	0.074	nd	0.012	0.003
w45.2	18	nd	1.0	93.2	nd	0.9	nd	0.2	15.3	0.093	0.472	0.040	nd	0.075	nd	0.012	0.002
w45.2	19	nd	0.9	93.7	nd	0.9	nd	0.2	15.0	0.069	0.468	0.036	nd	0.072	nd	0.012	0.002
w45.2	20	nd	1.9	95.5	nd	0.5	nd	0.5	13.9	nd	0.184	nd	0.003	nd	0.001	0.008	0.005
w45.2	21	nd	0.7	95.1	nd	0.9	nd	0.2	14.6	0.046	0.468	0.036	nd	0.045	nd	0.009	0.003
w45.2	22	nd	1.0	93.8	nd	0.9	nd	0.2	15.3	0.095	0.470	0.045	0.001	0.069	nd	0.013	0.002
w45.2	23	nd	0.9	93.4	nd	0.9	nd	0.2	15.0	0.097	0.462	0.046	nd	0.061	nd	0.012	0.002
w45.2	24	nd	1.0	94.3	nd	1.0	nd	0.2	15.3	0.059	0.430	0.039	0.002	0.063	nd	0.011	0.003
w45.2	25	nd	0.9	91.7	nd	0.8	nd	0.2	15.0	0.078	0.438	0.035	0.002	0.067	nd	0.011	0.002
w45.2	26	nd	0.7	88.4	nd	0.8	nd	0.2	14.9	0.101	0.441	0.044	nd	0.055	nd	0.010	0.003
w47.1	1	nd	0.9	92.3	nd	0.8	nd	0.2	15.2	0.058	0.442	0.040	nd	0.072	nd	0.012	0.003
w47.1	2	nd	0.9	90.2	nd	0.9	nd	0.2	14.8	0.089	0.464	0.039	0.001	0.068	nd	0.012	0.003

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w47.1	3	nd	0.9	91.7	nd	0.9	nd	0.2	14.8	0.098	0.436	0.036	0.002	0.070	nd	0.012	0.003
w47.1	4	nd	1.0	97.0	nd	0.9	nd	0.2	15.9	0.070	0.451	0.038	nd	0.069	nd	0.013	0.002
w47.1	5	nd	0.8	89.2	nd	1.2	nd	0.2	14.1	0.072	0.436	0.042	nd	0.068	nd	0.011	0.003
w47.1	6	nd	0.7	88.4	nd	1.1	nd	0.2	14.7	0.075	0.469	0.035	nd	0.066	nd	0.011	0.002
w47.1	7	nd	0.6	88.7	nd	0.7	nd	0.2	14.1	0.084	0.405	0.042	nd	0.052	nd	0.009	0.002
w47.1	8	nd	0.9	95.6	nd	0.7	nd	0.2	15.0	0.088	0.413	0.038	nd	0.055	nd	0.009	0.002
w47.1	9	nd	0.9	96.2	nd	0.9	nd	0.2	15.3	0.086	0.474	0.043	0.001	0.070	nd	0.012	0.002
w47.1	10	nd	0.9	91.0	nd	0.8	nd	0.2	14.2	0.082	0.420	0.044	nd	0.061	nd	0.009	0.002
w47.1	11	nd	1.1	93.5	nd	0.9	nd	0.2	15.0	0.105	0.443	0.047	0.002	0.064	nd	0.012	0.002
w47.1	12	nd	0.8	94.1	nd	0.9	nd	0.2	14.6	0.075	0.455	0.041	0.001	0.050	nd	0.009	0.003
w47.1	13	nd	nd	95.2	nd	1.4	0.5	3.4	5.0	nd	0.006	0.028	0.022	nd	0.004	0.002	0.005
w47.1	14	nd	1.0	93.5	nd	0.8	nd	0.2	14.1	0.061	0.430	0.043	0.001	0.054	nd	0.009	0.003
w47.1	15	nd	0.9	94.4	nd	0.9	nd	0.2	14.7	0.084	0.420	0.044	nd	0.051	nd	0.009	0.002
w47.1	16	nd	0.8	89.0	nd	0.7	nd	0.2	14.4	0.088	0.431	0.033	0.001	0.056	nd	0.008	0.002
w47.2	1	2.9	3.5	77.4	2.2	1.0	0.4	3.4	24.1	0.815	1.368	0.010	0.026	0.115	0.003	0.076	0.028
w47.2	2	4.6	4.8	81.8	2.9	0.9	0.5	4.3	22.0	0.330	1.551	0.004	0.024	0.007	0.002	0.109	0.019
w47.2	3	4.5	3.4	80.9	2.7	2.5	nd	5.7	24.4	0.692	1.062	0.011	0.030	0.117	0.004	0.090	0.024
w47.2	4	2.7	3.4	83.2	2.3	1.0	nd	4.8	24.6	0.120	1.159	0.005	0.021	nd	0.004	0.040	0.012
w47.2	5	4.8	4.0	84.7	2.8	0.5	nd	4.8	24.4	0.591	1.250	0.015	0.022	0.129	0.005	0.052	0.026
w47.2	6	3.7	3.2	81.4	3.3	0.4	nd	4.4	25.8	0.724	1.094	0.009	0.028	0.050	0.004	0.062	0.023
w47.2	7	3.6	1.1	92.0	nd	nd	0.8	3.7	11.9	0.025	0.335	0.001	0.004	0.342	0.001	0.068	0.004
w47.2	8	2.7	3.2	77.7	2.4	2.0	0.3	3.9	24.9	0.163	1.344	0.004	0.022	0.013	0.003	0.073	0.015
w47.2	9	4.6	3.5	82.6	2.5	0.6	nd	5.1	23.8	0.629	1.198	0.007	0.024	0.113	0.005	0.052	0.026
w47.2	10	4.8	4.5	81.1	3.0	0.8	0.5	4.3	21.6	0.284	1.584	0.005	0.023	nd	0.002	0.105	0.017
w47.2	11	4.4	4.2	81.1	2.7	1.3	nd	5.1	24.0	0.588	1.255	0.013	0.023	0.122	0.005	0.053	0.026
w47.2	12	9.9	2.5	77.4	4.3	1.9	0.5	9.6	15.6	0.894	0.452	0.014	0.033	0.011	0.015	0.030	0.013
w47.2	13	4.1	3.3	81.7	3.3	0.5	nd	4.4	25.8	0.709	1.030	0.007	0.028	0.054	0.003	0.063	0.023
w47.2	14	5.6	3.4	89.7	1.1	0.8	0.4	2.4	22.0	0.031	0.990	nd	0.004	nd	0.001	0.201	0.007
w47.2	15	3.8	3.2	81.4	3.3	0.6	nd	4.6	25.6	0.730	1.050	0.012	0.028	0.059	0.004	0.063	0.022
w47.2	16	9.0	2.7	76.7	4.4	2.2	0.5	9.9	15.3	0.871	0.488	0.008	0.034	0.017	0.015	0.030	0.012
w47.2	17	nd	0.9	94.8	nd	0.9	nd	0.2	14.4	0.123	0.421	0.040	0.002	0.062	nd	0.009	0.002
w47.2	18	nd	nd	97.0	nd	1.4	0.5	3.5	5.1	nd	nd	0.027	0.021	nd	0.004	0.002	0.004

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w47.2	19	3.5	2.8	79.7	2.7	0.9	nd	4.1	25.5	0.761	1.078	0.013	0.026	0.076	0.003	0.067	0.023
w47.2	20	4.4	3.4	83.2	3.2	0.5	nd	4.5	26.3	0.727	1.037	0.005	0.033	0.051	0.004	0.064	0.022
w47.2	21	nd	nd	98.6	nd	1.4	0.5	3.4	5.0	nd	nd	0.029	0.020	nd	0.004	0.002	0.005
w47.2	22	4.1	4.1	81.0	2.7	1.0	0.4	3.9	21.4	0.187	1.621	0.003	0.019	nd	0.002	0.094	0.017
w47.2	23	nd	2.0	93.9	nd	0.9	nd	0.4	13.7	0.187	0.331	0.003	0.003	0.233	0.001	0.008	0.004
w47.2	24	3.7	3.5	80.7	3.1	2.5	nd	4.0	24.8	0.776	1.109	0.011	0.027	0.084	0.004	0.065	0.023
w47.2	25	4.4	3.0	85.6	1.2	0.9	0.4	2.3	21.9	0.024	1.044	0.004	0.006	0.006	0.001	0.179	0.007
w47.2	26	3.9	3.4	83.4	2.7	0.7	nd	4.1	25.6	0.745	1.132	0.011	0.029	0.077	0.004	0.066	0.023
w47.2	27	nd	0.9	94.8	nd	0.9	nd	0.2	14.7	0.071	0.394	0.050	nd	0.052	nd	0.009	0.003
w47.2	28	nd	1.0	96.4	nd	0.8	nd	nd	14.6	0.439	0.249	nd	0.001	0.333	nd	0.012	0.005
w47.2	29	3.4	5.0	82.0	3.3	1.2	nd	5.3	25.3	0.243	1.488	0.008	0.026	0.020	0.004	0.047	0.018
w47.2	30	nd	1.0	96.0	nd	0.8	nd	0.2	15.4	0.070	0.461	0.039	nd	0.056	nd	0.010	0.003
w47.2	31	4.7	2.5	89.2	1.2	0.6	0.6	2.2	19.7	0.028	0.879	nd	0.005	0.006	0.001	0.185	0.005
w47.2	32	4.9	5.0	83.9	2.8	1.0	0.4	4.2	23.3	0.174	1.591	0.005	0.021	0.008	0.002	0.096	0.015
w47.2	33	4.4	4.2	80.4	2.6	0.7	nd	5.4	23.5	0.706	1.250	0.010	0.023	0.131	0.006	0.057	0.024
w47.2	34	nd	1.0	94.1	nd	0.8	nd	0.2	15.0	0.090	0.437	0.041	0.001	0.058	nd	0.009	0.003
w47.2	35	3.6	5.9	79.2	2.7	0.9	0.3	5.1	22.2	0.938	0.736	0.006	0.024	0.027	0.004	0.047	0.018
w47.2	36	nd	0.8	93.3	nd	0.9	nd	0.2	14.5	0.103	0.454	0.044	nd	0.051	nd	0.009	0.002
w47.2	37	4.1	3.2	83.8	3.0	0.8	nd	4.1	25.8	0.813	1.106	0.013	0.031	0.069	0.004	0.067	0.023
w47.2	38	8.7	2.5	76.0	4.1	1.3	0.4	10.0	15.5	0.870	0.491	0.014	0.035	0.005	0.015	0.028	0.012
w47.2	39	5.3	2.9	83.8	1.2	0.5	0.7	1.1	24.3	0.011	1.020	nd	0.007	nd	0.001	0.149	0.005
w47.2	40	nd	0.8	95.3	nd	0.8	nd	0.2	15.6	0.085	0.426	0.039	nd	0.063	nd	0.010	0.002
w47.2	41	5.1	2.9	85.8	1.4	1.3	0.6	1.3	23.2	0.014	1.063	nd	0.008	nd	0.001	0.136	0.008
w47.2	42	9.5	2.8	78.9	3.9	0.9	0.4	10.2	15.4	0.854	0.465	0.010	0.038	nd	0.015	0.029	0.012
w47.2	43	nd	0.8	92.4	nd	0.8	nd	0.2	14.8	0.067	0.447	0.033	nd	0.056	nd	0.009	0.003
w47.2	44	8.3	2.3	75.5	4.0	1.2	0.4	10.0	15.4	0.901	0.521	0.009	0.033	0.011	0.015	0.029	0.012
w47.2	45	4.3	2.3	83.2	3.2	1.2	0.3	6.1	23.3	0.815	0.948	0.007	0.027	0.118	0.003	0.053	0.020
w47.2	46	nd	0.9	93.5	nd	0.9	nd	0.2	14.5	0.086	0.445	0.046	0.001	0.054	nd	0.009	0.003
w47.2	47	nd	0.6	92.1	nd	0.8	nd	0.2	14.8	0.092	0.430	0.047	0.001	0.046	nd	0.009	0.003
w47.2	48	nd	nd	97.3	nd	1.5	0.5	3.6	5.2	nd	0.002	0.026	0.020	nd	0.004	0.002	0.005
w48.1	1	nd	0.9	94.8	nd	0.9	nd	0.2	15.3	0.053	0.452	0.040	nd	0.072	nd	0.012	0.003
w48.1	2	nd	1.0	93.0	nd	0.8	nd	0.2	14.9	0.055	0.446	0.041	nd	0.068	nd	0.012	0.002

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w48.1	3	nd	1.2	96.9	nd	1.0	nd	0.2	16.0	0.069	0.447	0.041	nd	0.070	nd	0.012	0.002
w48.1	4	nd	1.0	91.2	nd	1.0	nd	0.2	14.9	0.062	0.430	0.037	0.001	0.074	nd	0.011	0.002
w48.1	5	nd	1.0	93.0	nd	0.9	nd	0.2	15.6	0.089	0.458	0.038	nd	0.073	nd	0.013	0.002
w48.1	6	nd	1.1	91.5	nd	1.0	nd	0.2	14.9	0.072	0.460	0.043	nd	0.066	nd	0.012	0.003
w48.1	7	nd	1.0	92.6	nd	0.8	nd	0.2	14.7	0.095	0.413	0.044	nd	0.067	nd	0.012	0.002
w48.1	8	nd	1.1	92.8	nd	0.8	nd	0.2	15.5	0.094	0.460	0.038	0.001	0.068	nd	0.012	0.003
w48.1	9	nd	1.0	93.0	nd	0.8	nd	0.2	15.2	0.067	0.448	0.038	nd	0.067	nd	0.012	0.003
w48.1	10	nd	1.0	92.9	nd	0.8	nd	0.2	15.1	0.075	0.467	0.032	nd	0.073	nd	0.013	0.002
w48.1	11	nd	1.0	93.9	nd	0.8	nd	0.2	15.4	0.091	0.439	0.042	nd	0.069	nd	0.012	0.003
w48.1	12	nd	1.1	92.6	nd	nd	nd	0.3	9.1	nd	0.055	0.206	nd	0.006	0.001	0.021	0.069
w48.1	13	nd	1.0	92.8	nd	0.8	nd	0.2	15.2	0.087	0.448	0.037	0.001	0.068	nd	0.012	0.002
w48.1	14	nd	1.2	94.7	nd	nd	nd	0.3	9.4	nd	0.057	0.200	0.003	nd	0.001	0.020	0.078
w48.1	15	nd	1.0	92.5	nd	0.8	nd	0.2	15.5	0.076	0.466	0.041	0.003	0.067	nd	0.012	0.002
w48.1	16	nd	1.4	94.0	nd	nd	nd	0.3	9.2	nd	0.054	0.213	0.001	nd	0.001	0.021	0.074
w48.1	17	nd	1.2	92.4	nd	nd	nd	0.3	9.1	0.009	0.063	0.207	0.002	nd	0.001	0.021	0.080
w48.1	18	nd	0.9	93.6	nd	0.8	nd	0.2	14.9	0.065	0.463	0.038	0.001	0.068	nd	0.011	0.003
w48.1	19	nd	1.0	91.0	nd	0.8	nd	0.2	14.9	0.096	0.435	0.040	0.002	0.067	nd	0.012	0.002
w48.1	20	nd	0.9	90.7	nd	0.9	nd	0.2	15.2	0.082	0.450	0.039	nd	0.075	nd	0.011	0.003
w48.1	21	nd	1.2	94.3	nd	nd	nd	0.3	9.4	nd	0.049	0.211	0.001	nd	nd	0.022	0.074
w48.2	1	nd	1.4	92.6	nd	0.4	nd	0.5	13.6	nd	0.108	nd	0.003	nd	0.001	0.011	0.005
w48.2	2	nd	1.4	89.2	nd	0.4	nd	0.5	12.0	nd	0.133	nd	nd	nd	0.001	0.009	0.005
w48.2	3	nd	1.0	80.7	nd	0.4	nd	0.5	12.1	nd	0.120	nd	0.002	nd	0.001	0.009	0.004
w48.2	4	8.1	2.4	74.2	3.8	3.3	0.5	9.2	15.9	0.910	0.493	0.011	0.032	0.026	0.014	0.030	0.012
w48.2	5	4.2	3.7	76.1	3.0	1.3	0.4	4.2	21.5	0.267	1.604	0.001	0.019	0.010	0.002	0.110	0.020
w48.2	6	nd	0.8	80.1	nd	nd	nd	0.3	8.7	nd	0.043	0.195	0.001	nd	0.001	0.020	0.076
w48.2	7	nd	0.6	77.7	nd	0.6	nd	0.2	14.7	0.078	0.472	0.038	nd	0.065	nd	0.012	0.002
w48.2	8	3.9	4.0	77.4	2.8	0.7	0.5	4.3	21.3	0.315	1.560	0.007	0.026	nd	0.002	0.108	0.019
w48.2	9	nd	0.9	86.6	nd	0.8	nd	0.2	15.1	0.096	0.502	0.038	0.002	0.072	nd	0.012	0.003
w48.2	10	3.4	4.7	75.7	3.1	1.0	0.5	3.9	23.6	0.607	0.513	0.002	0.018	0.009	0.003	0.055	0.015
w48.2	11	nd	2.0	90.5	nd	0.5	0.3	0.3	12.3	1.339	1.162	nd	0.013	0.202	0.002	0.011	0.004
w48.2	12	nd	0.9	95.3	nd	0.9	nd	0.2	15.3	0.097	0.444	0.043	nd	0.066	0.001	0.012	0.002
w48.2	13	7.2	1.8	71.9	3.9	2.1	0.4	9.8	14.8	0.936	0.460	0.006	0.031	0.018	0.017	0.029	0.012

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w48.2	14	9.5	2.7	77.0	4.2	1.5	0.5	9.7	15.2	0.888	0.488	0.009	0.039	0.010	0.015	0.029	0.012
w48.2	15	nd	0.8	92.9	nd	0.8	nd	0.2	15.1	0.087	0.423	0.046	nd	0.069	nd	0.012	0.002
w48.2	16	4.3	4.5	80.3	2.9	0.7	0.5	4.2	22.0	0.285	1.546	0.007	0.024	0.006	0.002	0.109	0.019
w48.2	17	3.3	2.9	74.4	3.2	4.5	nd	3.8	24.0	0.742	1.049	0.010	0.031	0.123	0.004	0.062	0.022
w48.2	18	nd	0.9	92.5	nd	0.9	nd	0.2	15.0	0.105	0.467	0.040	nd	0.069	nd	0.011	0.003
w48.2	19	3.6	3.8	84.6	2.6	1.5	0.3	4.1	23.8	0.190	1.466	0.002	0.023	0.008	0.003	0.068	0.015
w48.2	20	nd	1.0	95.3	nd	0.8	nd	0.2	15.4	0.062	0.454	0.045	0.001	0.072	nd	0.012	0.002
w48.2	21	nd	0.9	92.1	nd	0.9	nd	0.2	15.1	0.082	0.455	0.045	0.001	0.071	nd	0.013	0.003
w48.2	22	nd	0.6	81.9	nd	0.8	nd	0.2	14.6	0.075	0.440	0.041	0.001	0.066	nd	0.012	0.002
w48.2	23	nd	0.9	90.0	nd	0.8	nd	0.2	14.9	0.069	0.476	0.039	0.001	0.067	nd	0.011	0.003
w48.2	24	nd	0.7	87.6	nd	0.8	nd	0.2	14.8	0.064	0.400	0.041	0.001	0.062	nd	0.011	0.003
w48.2	25	nd	nd	82.8	nd	0.7	nd	0.2	14.4	0.075	0.440	0.045	0.001	0.072	nd	0.011	0.002
w48.2	26	nd	1.0	89.8	nd	0.8	nd	0.2	14.8	0.071	0.433	0.037	0.001	0.066	nd	0.012	0.002
w49	1	2.0	3.6	69.8	2.0	nd	0.7	1.6	23.7	0.538	0.956	0.003	0.021	nd	0.002	0.053	0.020
w49	2	nd	0.6	89.5	nd	0.8	nd	0.2	15.1	0.098	0.436	0.045	nd	0.058	nd	0.009	0.002
w49	3	3.3	2.9	75.4	3.0	0.6	nd	4.3	25.1	0.785	1.010	0.013	0.028	0.060	0.004	0.065	0.020
w49	4	8.4	2.2	72.7	3.8	1.2	0.4	9.9	15.2	0.888	0.452	0.009	0.038	0.018	0.015	0.031	0.012
w49	5	2.5	2.2	72.6	2.4	1.5	nd	3.9	24.1	0.730	1.092	0.007	0.027	0.076	0.004	0.066	0.024
w49	6	3.5	2.9	77.2	2.7	2.0	nd	5.5	24.4	0.659	1.060	0.007	0.029	0.104	0.005	0.093	0.021
w49	7	7.7	2.2	73.1	4.0	1.1	0.4	9.9	15.7	0.903	0.492	0.011	0.036	nd	0.015	0.030	0.013
w49	8	2.8	3.0	78.4	2.5	1.1	nd	4.0	25.0	0.793	1.085	0.014	0.031	0.074	0.004	0.064	0.024
w49	9	nd	0.7	85.0	nd	0.7	nd	0.2	14.6	0.076	0.433	0.048	0.002	0.051	nd	0.009	0.003
w49	10	2.8	2.6	74.6	nd	1.3	0.3	2.2	22.0	0.022	1.147	0.001	0.011	0.005	0.001	0.118	0.008
w49	11	nd	0.9	87.3	nd	1.0	nd	0.2	14.6	0.082	0.436	0.037	nd	0.065	nd	0.012	0.003
w49	12	nd	0.9	90.8	nd	0.8	nd	nd	15.7	nd	0.247	nd	nd	0.171	nd	0.007	0.002
w49	13	2.5	2.7	78.5	2.8	1.5	nd	4.0	24.5	0.746	1.090	0.013	0.027	0.082	0.003	0.065	0.023
w49	14	2.8	2.0	73.0	3.0	1.8	0.3	6.6	23.1	0.668	0.966	0.009	0.027	0.118	0.003	0.049	0.021
w49	15	3.6	2.9	76.5	2.6	0.6	nd	3.9	26.8	0.743	1.148	0.008	0.030	0.070	0.003	0.068	0.025
w49	16	4.5	3.9	79.6	2.7	1.2	nd	5.1	23.8	0.641	1.202	0.014	0.027	0.107	0.005	0.052	0.027
w49	17	6.1	1.9	63.7	3.1	0.9	0.3	7.9	20.1	0.818	0.469	0.010	0.033	0.038	0.014	0.029	0.012
w49	18	3.3	2.7	74.1	2.4	0.5	nd	4.6	23.3	0.588	1.173	0.009	0.022	0.112	0.005	0.048	0.024
w49	19	2.7	3.8	72.5	2.2	0.2	0.7	1.5	22.8	0.477	0.976	nd	0.025	0.007	0.002	0.052	0.019

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w49	20	2.6	2.7	74.2	2.6	0.4	nd	4.1	24.4	0.719	1.080	0.005	0.031	0.066	0.003	0.064	0.023
w49	21	3.4	3.0	77.8	2.6	1.5	nd	4.1	25.1	0.760	1.087	0.014	0.028	0.070	0.004	0.064	0.024
w49	22	4.1	1.6	89.9	nd	0.6	0.6	4.5	12.7	nd	0.677	nd	0.003	nd	0.002	0.100	0.011
w49	23	2.6	2.3	73.3	2.8	0.7	nd	4.1	24.7	0.726	1.057	0.008	0.032	0.064	0.003	0.063	0.023
w49	24	2.5	3.2	73.3	2.6	0.9	0.4	3.9	22.0	0.194	1.550	0.004	0.020	nd	0.002	0.096	0.016
w49	25	nd	1.2	89.5	nd	1.2	0.3	0.4	15.9	0.328	0.316	nd	0.002	0.514	nd	0.020	0.003
w49	26	3.0	3.2	81.1	1.3	1.1	0.4	2.2	23.3	0.068	1.205	0.001	0.012	nd	0.001	0.123	0.010
w49	27	7.7	1.1	68.7	4.2	5.1	0.6	9.0	14.5	1.022	0.331	0.008	0.030	0.040	0.015	0.024	0.007
w49	28	3.5	2.1	78.5	nd	1.0	0.4	1.9	21.2	0.017	0.852	nd	0.003	nd	nd	0.129	0.006
w50	1	nd	0.6	99.6	nd	1.1	nd	nd	18.7	nd	0.184	nd	nd	nd	nd	0.007	0.003
w50	2	nd	0.7	99.2	nd	1.1	nd	nd	18.4	nd	0.212	nd	nd	nd	nd	0.008	0.002
w50	3	nd	0.8	98.2	nd	1.0	nd	nd	17.3	nd	0.184	nd	nd	0.009	nd	0.007	0.002
w50	4	nd	0.7	99.7	nd	1.2	nd	nd	18.6	nd	0.181	nd	nd	nd	nd	0.008	0.002
w50	5	nd	0.6	95.2	nd	1.0	nd	nd	17.2	nd	0.188	nd	nd	0.007	nd	0.006	0.002
w50	6	nd	0.6	94.6	nd	1.0	nd	nd	16.6	nd	0.193	nd	0.001	0.007	nd	0.007	0.002
w50	7	nd	nd	92.5	nd	0.9	nd	0.8	8.5	nd	nd	nd	2.427	nd	0.001	0.003	0.006
w50	8	nd	0.7	99.2	nd	1.0	nd	nd	17.6	nd	0.208	nd	nd	0.007	nd	0.007	0.002
w50	9	nd	0.6	96.7	nd	1.0	nd	nd	17.1	nd	0.180	nd	nd	0.006	nd	0.006	0.003
w50	10	nd	nd	96.4	nd	0.9	0.6	3.3	6.6	nd	0.007	nd	1.162	nd	0.002	0.003	0.008
w50	11	nd	0.9	99.4	nd	1.1	nd	nd	17.6	nd	0.183	nd	nd	0.007	nd	0.006	0.002
w50	12	nd	0.6	98.6	nd	1.0	nd	nd	17.5	nd	0.189	nd	nd	0.007	nd	0.007	0.002
w50	13	nd	0.7	98.1	nd	1.0	nd	nd	17.6	nd	0.224	nd	nd	0.009	nd	0.007	0.002
w50	14	nd	0.6	97.4	nd	1.0	nd	nd	17.3	nd	0.217	nd	nd	0.008	nd	0.007	0.002
w50	15	nd	0.7	99.0	nd	1.0	nd	nd	17.8	nd	0.172	nd	nd	0.009	nd	0.007	0.002
w50	16	nd	0.8	100.1	nd	1.2	nd	nd	18.6	nd	0.206	nd	nd	nd	nd	0.007	0.002
w50	17	nd	0.8	96.1	nd	0.9	nd	nd	16.9	nd	0.184	nd	nd	0.006	nd	0.007	0.002
w50	18	nd	0.7	96.6	nd	1.0	nd	nd	17.0	nd	0.192	nd	nd	0.008	nd	0.007	0.002
w50	19	nd	nd	98.1	nd	0.9	0.6	3.4	6.7	nd	0.010	nd	1.193	nd	0.002	0.002	0.008
w50	20	nd	0.7	92.2	nd	1.0	nd	nd	16.5	nd	0.178	nd	0.001	0.005	nd	0.006	0.002
w50	21	nd	nd	96.7	nd	0.9	0.6	3.4	6.8	nd	0.008	nd	1.181	nd	0.002	0.003	0.007
w50	22	nd	0.7	93.5	nd	1.0	nd	nd	16.2	nd	0.166	nd	nd	0.006	nd	0.006	0.002
w57.01	1	2.2	nd	89.7	nd	nd	nd	0.2	10.0	nd	0.435	0.011	0.007	0.117	nd	0.006	0.007

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w57.01	2	3.5	3.5	87.3	nd	0.3	0.4	1.7	19.6	0.007	0.808	nd	0.038	nd	0.001	0.115	0.010
w57.01	3	3.7	3.0	85.2	nd	0.8	0.4	1.9	21.2	0.018	1.158	nd	0.005	nd	0.001	0.166	0.008
w57.01	4	2.2	nd	88.9	nd	nd	nd	0.1	9.9	nd	0.449	0.010	0.005	0.116	nd	0.006	0.007
w57.01	5	4.7	3.9	87.2	1.4	0.4	0.4	2.5	17.5	0.029	1.367	nd	0.006	0.006	0.001	0.170	0.008
w57.01	6	3.1	3.8	88.9	nd	0.3	0.4	1.6	18.9	0.006	0.783	nd	0.021	nd	0.001	0.113	0.009
w57.01	7	4.8	3.4	87.2	nd	0.8	0.5	2.0	21.4	0.028	1.207	nd	0.004	0.007	0.001	0.169	0.007
w57.01	8	nd	0.6	91.5	nd	0.6	nd	0.3	16.0	nd	0.318	nd	0.003	nd	nd	0.008	0.007
w57.01	9	2.2	0.5	90.4	nd	nd	nd	0.2	10.0	nd	0.425	0.011	0.006	0.122	nd	0.005	0.007
w57.01	10	4.4	3.4	86.9	1.0	0.7	0.5	2.0	21.4	0.036	1.162	0.001	0.006	0.009	0.001	0.169	0.009
w57.01	11	4.6	3.7	86.8	1.1	0.8	0.5	2.0	21.3	0.032	1.152	nd	0.008	nd	0.001	0.171	0.006
w57.01	12	nd	0.8	95.2	nd	1.1	nd	0.3	16.3	0.024	0.246	nd	0.003	0.016	0.001	0.010	0.003
w57.01	13	2.9	nd	92.0	nd	nd	nd	0.1	9.9	nd	0.412	0.014	0.007	0.115	nd	0.006	0.007
w57.01	14	2.2	nd	88.0	nd	nd	nd	0.2	9.7	nd	0.420	0.011	0.006	0.114	nd	0.006	0.007
w57.01	15	nd	0.9	94.9	nd	1.4	nd	nd	15.6	nd	0.185	nd	nd	0.188	nd	0.007	0.003
w57.01	16	4.7	3.8	86.8	1.4	1.5	0.5	1.9	21.5	0.011	1.169	nd	0.006	0.009	0.001	0.169	0.006
w57.01	17	nd	nd	95.8	nd	0.9	nd	nd	14.8	nd	0.116	0.006	nd	0.050	nd	0.007	0.009
w57.01	18	4.1	3.6	86.1	1.5	0.4	0.4	2.5	17.6	0.041	1.424	0.001	0.008	0.006	0.001	0.167	0.009
w57.01	19	4.6	4.1	88.9	1.7	0.4	0.4	2.5	18.2	0.042	1.419	nd	0.009	0.016	0.001	0.170	0.009
w57.01	20	4.1	4.0	91.8	nd	0.3	0.4	1.6	19.0	nd	0.845	nd	0.022	nd	0.001	0.114	0.009
w57.01	21	nd	0.6	98.6	nd	1.1	nd	nd	15.0	0.104	0.156	nd	0.002	nd	nd	0.007	0.002
w57.01	22	nd	0.8	96.7	nd	1.0	nd	0.1	15.9	nd	0.182	nd	nd	0.047	nd	0.009	0.002
w57.01	23	3.8	3.8	91.8	nd	0.5	0.4	1.6	19.2	0.014	0.803	nd	0.035	nd	0.001	0.114	0.010
w57.01	24	4.9	4.2	87.7	1.5	0.4	0.4	2.5	17.4	0.038	1.388	0.002	0.009	0.010	0.001	0.166	0.009
w57.02	1	2.6	0.6	92.4	nd	nd	nd	0.2	10.0	nd	0.427	0.011	0.009	0.110	nd	0.006	0.007
w57.02	2	nd	2.0	99.3	nd	0.5	nd	0.5	14.1	nd	0.236	nd	0.001	nd	0.001	0.010	0.005
w57.02	3	2.8	0.5	92.7	nd	nd	nd	0.2	9.9	nd	0.413	0.008	0.005	0.110	nd	0.006	0.007
w57.02	4	4.5	3.4	89.5	1.1	0.9	0.5	2.1	22.3	0.023	1.189	0.003	0.004	0.005	0.001	0.174	0.007
w57.02	5	2.3	0.7	92.5	nd	nd	nd	0.2	10.2	nd	0.392	0.009	0.005	0.116	nd	0.006	0.007
w57.02	6	4.4	3.7	88.2	1.3	1.0	0.5	2.1	21.9	0.034	1.124	nd	0.005	nd	0.001	0.169	0.009
w57.02	7	4.5	3.4	82.2	1.7	5.1	0.5	1.8	20.1	0.020	1.089	0.002	0.005	0.044	0.001	0.162	0.007
w57.02	8	5.0	3.9	89.9	1.4	0.4	0.5	2.6	18.1	0.040	1.391	nd	0.009	nd	0.001	0.171	0.008
w57.02	9	nd	0.5	93.9	nd	0.7	nd	0.3	16.0	nd	0.340	nd	0.002	nd	nd	0.008	0.007

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w57.03	1	4.2	3.2	83.1	1.5	2.2	0.4	1.6	24.4	0.055	1.039	0.008	0.013	0.007	0.001	0.111	0.011
w57.03	2	3.1	3.0	82.9	3.7	3.6	nd	4.8	23.1	0.512	1.011	0.011	0.026	0.105	0.003	0.047	0.038
w57.03	3	5.0	3.2	85.2	1.3	1.4	0.3	2.4	23.9	0.119	1.045	0.001	0.006	nd	0.001	0.130	0.010
w57.03	4	2.8	3.9	78.6	2.9	2.1	nd	5.2	23.9	0.124	1.377	0.013	0.025	0.014	0.004	0.044	0.015
w57.03	5	2.6	3.4	85.2	2.4	0.6	nd	4.8	23.6	0.094	1.168	0.006	0.020	nd	0.004	0.043	0.012
w57.03	6	3.3	1.0	94.4	nd	0.3	0.7	6.5	12.5	0.200	0.337	0.003	0.009	nd	0.004	0.070	0.006
w57.03	7	7.6	2.6	94.3	1.3	1.5	0.3	3.7	9.7	0.002	0.503	nd	0.004	0.006	0.002	0.243	0.007
w57.03	8	4.6	4.0	86.1	1.6	2.0	0.4	1.7	26.2	0.035	1.112	0.005	0.008	0.014	0.001	0.112	0.011
w57.04	1	3.9	2.6	80.7	3.5	0.8	nd	5.2	24.7	0.682	1.147	0.013	0.033	0.129	0.003	0.049	0.037
w57.04	2	4.1	3.3	79.2	2.6	2.1	nd	5.6	24.9	0.733	1.107	0.013	0.025	0.119	0.004	0.091	0.022
w57.04	3	3.2	2.8	79.1	3.6	0.9	nd	5.1	24.8	0.684	1.157	0.013	0.035	0.121	0.004	0.049	0.038
w57.04	4	2.1	1.6	79.9	2.4	3.1	nd	3.6	23.2	0.445	0.756	0.010	0.018	0.081	0.002	0.051	0.022
w57.04	5	4.8	2.6	82.7	1.3	0.9	0.4	2.3	19.3	0.029	1.074	nd	0.006	0.008	0.001	0.187	0.006
w57.04	6	3.0	2.4	74.1	2.5	2.0	nd	5.2	23.5	0.678	1.032	0.009	0.025	0.103	0.004	0.086	0.023
w57.04	7	2.2	1.5	93.6	nd	nd	nd	0.2	9.8	nd	0.460	0.015	0.007	0.119	nd	0.006	0.007
w57.05	1	3.8	5.1	80.2	3.8	2.0	0.6	3.8	23.0	0.581	0.511	0.010	0.022	0.021	0.003	0.047	0.012
w57.05	2	2.7	nd	90.9	nd	nd	nd	0.2	9.7	nd	0.416	0.006	0.005	0.113	nd	0.005	0.007
w57.05	3	3.7	3.9	83.8	3.2	1.5	nd	5.1	24.1	0.287	1.187	0.002	0.027	0.024	0.005	0.042	0.014
w57.05	4	3.9	6.2	77.3	3.6	1.6	0.6	4.6	22.1	0.604	0.732	0.011	0.028	0.012	0.004	0.045	0.017
w57.05	5	3.6	4.9	79.8	3.5	1.7	0.6	3.8	23.7	0.588	0.516	0.009	0.023	0.018	0.003	0.050	0.014
w57.05	6	7.3	2.8	95.7	2.0	nd	0.6	3.5	11.5	nd	0.624	nd	0.001	0.007	0.001	0.322	0.008
w57.05	7	4.0	3.9	77.5	3.3	3.1	nd	5.6	22.4	0.804	1.426	0.013	0.042	0.103	0.004	0.064	0.027
w57.06	1	nd	0.9	95.7	nd	0.7	nd	0.3	16.1	nd	0.298	nd	0.002	nd	nd	0.008	0.008
w57.06	2	4.4	3.5	88.4	1.1	0.8	0.5	1.9	21.2	0.024	1.150	0.002	0.003	nd	0.001	0.168	0.008
w57.06	3	5.2	4.0	88.1	1.0	0.6	0.4	2.0	22.8	0.059	1.305	0.001	0.009	nd	0.001	0.168	0.006
w57.06	4	nd	nd	94.3	nd	1.3	nd	nd	15.3	nd	0.082	nd	nd	0.011	nd	0.006	0.011
w57.06	5	5.0	3.9	90.2	1.4	0.3	0.5	2.6	17.9	0.040	1.484	nd	0.006	nd	0.001	0.173	0.009
w57.06	6	nd	0.7	96.6	nd	0.5	nd	0.1	15.3	nd	0.168	nd	nd	nd	nd	0.011	0.009
w57.06	7	nd	nd	90.5	nd	0.4	nd	nd	8.7	nd	0.099	nd	nd	0.485	nd	0.003	0.004
w57.07	1	2.5	0.6	91.7	nd	nd	nd	0.1	9.9	nd	0.407	0.006	0.004	0.113	nd	0.006	0.007
w57.07	2	nd	1.1	97.4	nd	0.4	0.5	0.5	14.6	nd	0.317	nd	nd	0.013	nd	0.041	0.002
w57.07	3	3.8	3.6	88.3	1.0	1.0	0.5	2.0	21.3	0.028	1.158	0.001	0.005	nd	0.001	0.165	0.009

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w57.07	4	3.0	3.5	69.5	4.2	1.9	0.3	3.7	24.7	0.575	1.126	0.012	0.021	0.183	0.004	0.061	0.034
w57.07	5	nd	0.6	94.9	nd	1.2	nd	0.2	15.1	nd	0.147	nd	0.002	nd	nd	0.006	0.003
w57.07	6	4.6	3.6	86.5	1.2	0.8	0.4	1.9	21.1	0.046	1.109	0.003	0.001	nd	0.001	0.166	0.008
w57.07	7	3.7	3.6	75.1	2.7	2.0	nd	3.9	25.9	0.527	1.135	0.008	0.022	0.130	0.003	0.061	0.032
w57.07	8	nd	1.0	96.3	nd	0.8	nd	0.2	12.5	0.352	0.235	nd	0.004	0.819	nd	0.013	0.002
w57.07	9	nd	0.7	93.1	nd	0.9	nd	nd	17.1	nd	0.078	nd	nd	0.307	nd	0.015	0.003
w57.08	1	4.1	3.2	85.3	1.2	0.9	0.5	1.9	20.7	0.014	1.145	0.002	0.005	nd	0.001	0.164	0.008
w57.08	2	nd	0.6	95.3	nd	0.9	nd	nd	15.7	nd	0.156	nd	nd	nd	nd	0.008	0.002
w57.08	3	2.4	0.7	93.6	nd	nd	nd	0.2	10.2	nd	0.455	0.012	0.007	0.120	nd	0.006	0.008
w57.08	4	2.5	1.2	94.6	nd	nd	nd	0.2	9.8	nd	0.446	0.009	0.006	0.116	nd	0.006	0.007
w57.08	5	3.8	0.6	93.9	nd	0.6	nd	0.2	7.9	nd	0.118	nd	nd	nd	0.001	0.009	0.004
w57.08	6	4.7	3.5	88.3	1.1	1.2	0.4	2.0	21.2	0.014	1.181	0.001	0.002	0.010	0.001	0.173	0.007
w57.08	7	3.8	0.8	91.8	nd	0.7	nd	0.2	8.0	nd	0.098	nd	nd	nd	0.001	0.009	0.004
w57.08	8	2.2	nd	88.6	nd	nd	nd	0.1	9.7	nd	0.434	0.009	0.006	0.115	nd	0.006	0.006
w57.09	1	nd	2.1	98.3	nd	0.4	nd	0.5	13.3	nd	0.195	nd	0.003	nd	0.001	0.007	0.005
w57.09	2	2.5	nd	92.4	nd	nd	nd	0.2	10.0	1.014	0.902	0.001	0.003	nd	nd	0.008	0.005
w57.09	3	9.7	1.8	75.6	4.9	4.5	0.6	9.5	14.9	0.995	0.330	0.008	0.033	0.016	0.016	0.026	0.008
w57.09	4	7.1	2.9	75.7	4.7	1.0	0.4	8.1	19.0	1.217	0.700	0.025	0.039	nd	0.009	0.068	0.013
w57.09	5	2.1	4.4	82.5	2.1	0.6	nd	5.5	26.2	0.042	1.124	0.009	0.019	nd	0.004	0.044	0.009
w57.09	6	9.1	2.7	78.3	4.1	0.7	0.4	9.7	14.0	0.640	0.657	0.012	0.029	0.013	0.011	0.023	0.017
w57.09	7	8.8	1.8	74.2	4.6	0.7	0.5	8.8	14.6	0.996	0.297	0.013	0.031	0.025	0.016	0.025	0.007
w57.10	1	3.7	4.5	80.9	2.7	1.2	nd	4.1	27.3	0.569	1.212	0.007	0.020	0.105	0.003	0.063	0.034
w57.10	2	nd	2.0	95.3	nd	0.8	nd	0.5	14.0	0.012	0.298	0.001	nd	0.652	0.001	0.007	0.004
w57.10	3	3.9	4.1	80.6	2.6	0.9	nd	4.0	26.8	0.588	1.118	0.010	0.021	0.102	0.003	0.062	0.035
w57.10	4	4.6	1.3	96.5	nd	0.2	nd	0.2	8.2	nd	0.090	nd	nd	0.064	0.001	0.003	0.003
w57.10	5	3.4	4.5	81.5	2.7	0.8	nd	4.2	27.2	0.583	1.132	0.019	0.023	0.108	0.003	0.063	0.035
w57.10	6	5.4	3.2	84.7	1.1	0.7	0.3	1.7	23.0	0.025	1.148	nd	0.006	nd	0.001	0.137	0.010
w57.10	7	5.1	3.0	87.0	nd	1.2	0.4	1.7	23.2	0.010	0.929	0.003	0.004	nd	0.001	0.132	0.005
w57.11	1	5.7	3.0	87.2	2.1	1.0	0.5	3.7	18.6	0.094	1.072	nd	0.012	0.010	0.001	0.210	0.007
w57.11	2	2.5	2.8	78.5	4.1	0.9	0.6	2.9	22.2	0.593	1.357	0.010	0.026	0.135	0.003	0.066	0.024
w57.11	3	4.0	4.2	77.6	2.6	1.0	nd	4.1	27.1	0.541	1.193	0.008	0.025	0.107	0.003	0.063	0.033
w57.11	4	2.6	4.1	77.4	3.7	6.7	0.3	4.2	24.0	0.562	1.331	0.018	0.023	0.134	0.003	0.064	0.037

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w57.11	5	3.4	3.6	78.3	3.8	6.5	0.6	2.9	22.7	0.627	1.354	0.005	0.025	0.110	0.003	0.064	0.024
w57.11	6	3.1	3.1	76.0	4.4	1.6	0.3	5.3	22.2	0.690	1.021	0.009	0.029	0.169	0.005	0.088	0.022
w57.11	7	nd	2.0	71.4	5.5	1.6	0.3	4.4	22.2	0.579	0.898	0.011	0.030	0.184	0.003	0.052	0.036
w57.11	8	nd	2.0	95.1	nd	0.9	nd	0.5	13.5	nd	0.424	nd	0.001	0.613	0.001	0.009	0.003
w57.11	9	2.6	nd	93.2	nd	nd	nd	0.2	10.1	nd	0.473	0.007	0.008	0.117	nd	0.006	0.007
w57.11	10	4.6	3.8	88.3	1.2	0.9	0.3	2.0	21.1	0.029	1.155	0.002	0.003	nd	0.001	0.164	0.008
w57.11	11	3.6	4.4	69.8	4.0	9.3	0.3	3.7	25.3	0.560	1.115	0.016	0.019	0.173	0.004	0.060	0.034
w57.11	12	3.0	2.6	74.0	4.6	10.1	0.4	4.1	23.1	0.729	1.046	0.010	0.027	0.113	0.003	0.052	0.030
w57.12	1	4.4	1.8	93.7	nd	0.6	0.2	1.7	13.8	0.004	0.512	0.007	0.001	nd	0.001	0.216	0.007
w57.12	2	4.0	2.6	81.9	3.6	1.6	nd	5.1	25.1	0.682	1.140	0.012	0.035	0.135	0.004	0.051	0.040
w57.12	3	nd	2.0	96.6	nd	0.8	nd	0.5	14.4	nd	0.230	nd	0.002	nd	0.001	0.007	0.005
w57.12	4	3.4	3.4	84.3	3.3	2.1	nd	5.4	23.1	0.551	1.118	0.009	0.033	0.074	0.003	0.059	0.037
w57.12	5	2.3	3.4	74.4	3.1	1.1	nd	4.3	23.9	0.306	1.342	0.006	0.018	0.039	0.004	0.044	0.017
w57.12	6	3.7	2.6	81.6	3.6	1.0	nd	5.1	24.9	0.653	1.112	0.013	0.034	0.121	0.003	0.050	0.040
w57.12	7	4.1	3.0	82.8	3.7	0.9	nd	5.2	25.0	0.690	1.153	0.012	0.038	0.129	0.003	0.051	0.038
w57.12	8	3.5	0.5	95.5	nd	0.4	nd	0.2	9.3	0.085	0.002	nd	nd	nd	nd	0.003	0.004
w57.13	1	3.7	2.6	75.8	3.6	3.5	0.2	4.7	25.4	0.582	1.176	0.012	0.037	0.148	0.003	0.051	0.038
w57.13	2	2.2	0.6	92.9	nd	nd	nd	0.1	10.2	nd	0.463	0.008	0.007	0.113	nd	0.006	0.007
w57.13	3	2.7	2.5	80.9	3.3	1.2	0.2	5.3	23.0	0.624	1.139	0.011	0.027	0.055	0.004	0.057	0.038
w57.13	4	3.6	4.5	82.4	3.0	1.9	0.3	4.0	22.7	0.118	1.557	0.003	0.023	0.013	0.003	0.089	0.015
w57.13	5	4.1	3.2	76.8	3.6	3.5	0.2	5.5	23.9	0.569	1.197	0.010	0.032	0.097	0.004	0.059	0.036
w57.13	6	nd	0.8	97.3	nd	1.2	nd	nd	15.5	nd	0.164	nd	nd	0.124	nd	0.006	0.002
w57.13	7	3.6	4.7	77.5	3.6	1.4	0.6	3.9	24.5	0.660	0.513	0.013	0.025	0.013	0.003	0.047	0.014
w57.13	8	2.8	4.4	81.1	2.7	1.0	nd	6.1	26.2	0.159	1.351	0.010	0.026	nd	0.005	0.043	0.015
w57.13	9	8.9	1.3	73.7	4.5	4.5	0.6	9.2	14.7	0.938	0.326	0.014	0.030	0.019	0.017	0.027	0.007
w57.14	1	nd	0.8	97.8	nd	0.3	nd	0.2	15.6	nd	0.229	nd	0.004	nd	nd	0.012	0.005
w57.14	2	4.8	3.7	87.3	1.4	0.3	0.4	2.5	17.6	0.035	1.372	nd	0.008	0.012	0.001	0.168	0.009
w57.14	3	4.5	4.2	88.8	1.4	0.5	0.5	2.6	17.8	0.052	1.459	nd	0.006	nd	0.001	0.172	0.008
w57.14	4	nd	2.0	98.1	nd	0.3	nd	0.5	13.5	nd	0.156	nd	nd	nd	0.001	0.012	0.006
w57.14	5	4.7	4.3	90.5	1.4	0.4	0.5	2.6	17.6	0.048	1.394	nd	0.007	nd	0.001	0.163	0.009
w57.14	6	3.9	2.9	83.7	nd	0.7	0.5	1.9	21.0	0.012	1.125	0.001	0.005	0.008	0.001	0.165	0.007
w57.15	1	nd	0.6	94.7	nd	1.6	nd	nd	16.4	nd	0.157	nd	nd	nd	nd	0.006	0.003

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w57.15	2	3.9	3.3	86.6	1.1	0.7	0.4	2.0	21.3	0.038	1.164	nd	0.007	0.006	0.001	0.168	0.007
w57.15	3	4.0	3.8	86.5	1.3	1.3	0.4	2.0	21.3	0.013	1.124	0.002	0.006	0.011	0.001	0.167	0.007
w57.15	4	nd	0.6	93.0	nd	1.6	nd	nd	14.9	nd	0.156	nd	nd	nd	nd	0.006	0.003
w57.15	5	4.6	3.5	86.4	nd	0.9	0.4	2.0	21.6	0.031	1.139	0.002	0.006	0.006	0.001	0.169	0.008
w57.15	6	nd	0.7	91.2	nd	0.9	nd	0.3	15.4	nd	0.187	nd	0.007	nd	nd	0.005	0.006
w57.15	7	5.8	3.4	85.6	1.5	0.9	0.5	2.2	21.2	0.039	1.058	0.001	0.008	0.007	0.001	0.233	0.006
w57.16	1	3.5	6.8	81.5	3.9	0.8	0.6	4.4	25.0	0.453	0.612	0.108	0.025	0.052	0.003	0.042	0.015
w57.16	2	3.8	4.5	80.1	2.7	0.8	nd	4.3	28.5	0.585	1.152	0.012	0.024	0.119	0.004	0.068	0.033
w57.16	3	2.7	2.2	84.1	1.4	0.9	0.5	2.0	24.5	0.093	0.736	nd	0.011	nd	0.001	0.125	0.009
w57.16	4	3.6	4.2	79.2	2.6	0.8	nd	3.9	26.8	0.539	1.141	0.011	0.017	0.102	0.003	0.062	0.034
w57.16	5	3.1	4.4	76.7	3.4	2.1	0.6	3.7	22.8	0.638	0.552	0.002	0.023	0.019	0.003	0.055	0.015
w57.16	6	3.7	3.5	85.5	1.5	3.0	0.5	1.8	24.7	0.101	1.307	0.004	0.010	0.007	0.001	0.128	0.007
w57.16	7	3.9	4.3	78.6	2.6	0.5	nd	4.1	27.9	0.586	1.179	0.017	0.021	0.115	0.003	0.064	0.033
w57.16	8	4.5	2.8	80.8	1.2	3.8	0.4	1.6	22.4	0.031	0.914	nd	0.004	0.021	0.001	0.129	0.006
w57.16	9	2.1	nd	95.3	nd	0.3	nd	nd	9.1	nd	0.101	nd	nd	0.504	nd	0.002	0.004
w57.16	10	nd	nd	90.1	nd	0.7	nd	nd	13.3	0.067	0.125	nd	nd	0.429	nd	0.015	0.003
w57.16	11	3.4	4.2	78.1	2.4	1.5	nd	3.9	26.6	0.539	1.199	0.014	0.023	0.109	0.003	0.063	0.034
w57.17	1	4.0	4.1	76.4	2.9	2.0	nd	4.2	26.7	0.550	1.087	0.011	0.022	0.119	0.003	0.065	0.031
w57.17	2	2.1	nd	85.3	nd	nd	nd	0.1	9.3	0.004	0.433	0.005	0.006	0.108	nd	0.006	0.006
w57.17	3	2.6	0.6	92.4	nd	nd	nd	0.2	9.8	nd	0.404	0.009	0.008	0.120	nd	0.006	0.006
w57.17	4	2.2	0.5	87.4	nd	nd	nd	0.2	9.5	nd	0.436	0.015	0.006	0.107	nd	0.006	0.007
w57.17	5	4.0	4.3	83.3	2.4	0.4	nd	4.1	24.0	0.569	1.306	0.014	0.021	0.098	0.004	0.063	0.038
w57.17	6	4.6	4.6	80.6	2.8	0.6	nd	4.2	27.4	0.595	1.170	0.014	0.025	0.108	0.003	0.062	0.032
w57.17	7	4.0	3.9	76.2	3.0	1.7	0.4	3.5	23.7	0.218	1.571	0.007	0.023	0.014	0.002	0.115	0.017
w57.17	8	2.5	3.8	73.5	2.2	1.6	nd	4.0	27.8	0.530	1.026	0.009	0.019	0.137	0.003	0.062	0.031
w57.17	9	2.4	nd	89.1	nd	nd	nd	0.2	9.4	nd	0.416	0.008	0.008	0.109	nd	0.006	0.007
w57.18	1	4.0	4.7	79.6	3.2	3.7	nd	4.0	26.8	0.605	1.109	0.011	0.024	0.122	0.004	0.062	0.033
w57.18	2	2.3	nd	91.7	nd	nd	nd	0.2	9.9	1.005	0.912	nd	0.002	nd	nd	0.008	0.005
w57.18	3	2.0	0.5	87.0	nd	nd	nd	0.2	9.6	0.988	0.870	0.003	0.003	nd	nd	0.008	0.005
w57.18	4	2.5	4.0	80.6	2.4	2.2	nd	3.8	26.2	0.512	1.132	0.009	0.017	0.122	0.003	0.061	0.036
w57.18	5	2.3	0.6	89.7	nd	nd	nd	0.2	9.6	1.024	0.900	nd	0.003	nd	nd	0.008	0.006
w57.18	6	3.8	4.5	78.4	2.8	2.0	nd	4.1	26.6	0.585	1.173	0.009	0.022	0.116	0.003	0.063	0.035

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w57.18	7	2.0	0.6	89.3	nd	nd	nd	0.2	9.6	0.985	0.887	0.002	0.002	nd	nd	0.007	0.005
w57.19	1	5.2	3.8	88.8	1.4	0.4	0.5	2.6	18.1	0.044	1.414	nd	0.012	0.006	0.001	0.168	0.008
w57.19	2	nd	0.6	94.2	nd	0.8	nd	nd	15.4	nd	0.169	nd	0.002	nd	nd	0.020	0.006
w57.19	3	3.3	3.0	81.6	2.3	0.3	0.5	3.3	21.7	0.151	1.429	0.001	0.016	nd	0.001	0.099	0.015
w57.19	4	nd	1.1	96.8	nd	0.9	nd	0.2	12.5	0.312	0.227	nd	0.002	0.810	nd	0.014	0.002
w57.19	5	2.4	0.5	92.4	nd	nd	nd	0.1	10.0	nd	0.424	0.014	0.008	0.122	nd	0.006	0.006
w57.19	6	4.9	3.9	88.4	1.4	0.4	0.5	2.5	17.5	0.046	1.400	nd	0.008	0.008	0.001	0.166	0.009
w57.19	7	4.5	4.0	87.6	1.1	0.7	0.4	2.0	21.4	0.028	1.175	nd	0.007	nd	0.001	0.167	0.006
w57.20	1	nd	0.9	97.1	nd	0.7	nd	nd	14.4	0.256	0.313	nd	0.001	0.237	nd	0.015	0.005
w57.20	2	2.5	0.8	91.4	nd	nd	nd	0.1	9.5	nd	0.418	0.011	0.006	0.105	nd	0.006	0.007
w57.20	3	3.3	4.9	78.8	3.1	2.9	nd	4.9	25.7	0.268	1.323	0.006	0.021	0.013	0.004	0.047	0.013
w57.20	4	3.8	4.7	77.4	3.3	1.6	0.6	3.9	24.7	0.660	0.484	0.012	0.022	0.022	0.003	0.048	0.014
w57.20	5	2.6	0.5	89.9	nd	nd	nd	0.1	9.5	nd	0.419	0.011	0.007	0.113	nd	0.006	0.007
w57.20	6	3.7	4.9	78.2	2.8	1.9	nd	4.2	27.8	0.678	1.240	0.013	0.022	0.119	0.003	0.063	0.040
w57.20	7	4.2	1.4	94.2	nd	nd	nd	0.2	8.2	nd	0.082	nd	nd	0.065	0.001	0.003	0.003
w66	1	nd	1.2	75.4	nd	0.6	nd	0.1	12.6	2.213	0.963	0.060	0.012	0.014	nd	0.016	0.004
w66	2	nd	2.7	66.3	2.0	0.9	nd	3.7	26.8	0.673	1.192	0.009	0.027	0.222	0.003	0.065	0.024
w66	3	2.4	2.2	65.5	2.1	1.1	nd	3.5	26.4	0.728	1.146	0.007	0.027	0.223	0.003	0.064	0.023
w66	4	nd	2.2	62.2	1.7	0.5	nd	3.4	26.1	0.698	1.157	0.010	0.029	0.214	0.003	0.065	0.022
w66	5	nd	3.1	62.3	3.1	4.8	0.6	3.6	20.9	0.545	0.516	0.003	0.021	0.064	0.003	0.053	0.018
w66	6	2.1	2.2	65.8	1.9	0.6	nd	3.6	27.1	0.738	1.158	0.009	0.026	0.218	0.003	0.067	0.023
w66	7	nd	1.2	72.2	nd	0.4	0.2	0.2	11.7	1.400	1.248	0.002	0.015	0.236	0.001	0.012	0.003
w66	8	nd	nd	77.4	nd	0.9	nd	nd	14.9	nd	0.187	nd	nd	nd	nd	0.009	0.002
w66	9	2.3	2.3	65.7	1.8	0.8	nd	3.6	26.6	0.714	1.119	0.006	0.027	0.216	0.003	0.063	0.023
w66	10	nd	1.2	71.4	nd	0.6	nd	0.3	12.2	1.375	1.257	0.005	0.021	0.235	0.001	0.014	0.005
w66	11	nd	1.4	81.1	nd	0.6	nd	0.4	13.0	nd	0.490	nd	0.002	1.169	0.001	0.006	0.003
w66	12	nd	2.3	66.3	1.8	0.7	nd	3.5	26.3	0.656	1.167	0.007	0.021	0.225	0.003	0.067	0.022
w66	13	nd	3.2	67.6	2.7	0.6	0.5	3.9	22.7	0.530	0.594	0.002	0.022	0.010	0.003	0.054	0.018
w66	14	2.7	3.5	67.2	3.1	0.6	0.5	3.7	24.3	0.645	0.568	0.006	0.031	nd	0.003	0.067	0.017
w66	15	nd	1.4	76.0	nd	0.6	0.2	0.3	12.3	1.438	1.280	0.004	0.020	0.233	0.001	0.013	0.006
w67	1	2.4	1.8	69.9	nd	0.4	0.3	2.1	19.8	0.014	0.943	nd	0.006	0.007	0.001	0.195	0.009
w67	2	3.4	1.5	73.8	1.4	nd	0.5	3.9	11.0	0.004	0.533	nd	0.003	0.009	0.001	0.340	0.005

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w67	3	nd	2.1	62.4	2.3	0.8	nd	4.8	23.5	0.255	1.311	0.014	0.026	0.007	0.004	0.051	0.016
w67	4	2.4	2.5	63.3	3.2	7.3	0.4	3.2	23.7	0.156	1.381	0.007	0.013	0.049	0.002	0.111	0.014
w67	5	3.4	2.0	75.1	1.0	0.8	0.3	2.3	20.7	0.017	1.008	nd	0.003	0.015	0.001	0.205	0.008
w67	6	nd	nd	79.2	nd	0.9	nd	nd	15.3	nd	0.165	nd	nd	0.016	nd	0.007	0.003
w67	7	nd	1.0	77.0	nd	0.4	0.2	0.3	11.3	1.230	1.144	nd	0.014	0.196	0.001	0.012	0.005
w67	8	nd	1.3	77.3	nd	0.4	0.2	0.3	12.2	1.374	1.282	0.001	0.015	0.135	0.002	0.012	0.004
w67	9	nd	2.6	69.0	2.1	0.6	0.3	3.3	24.5	0.635	1.300	0.011	0.027	0.134	0.003	0.066	0.024
w67	10	nd	2.4	69.3	2.1	0.7	0.3	3.4	24.3	0.658	1.413	0.003	0.026	0.137	0.003	0.069	0.024
w67	11	4.1	2.6	77.3	nd	0.3	0.4	3.4	11.1	0.027	0.904	nd	0.002	0.009	0.001	0.296	0.006
w67	12	2.3	2.2	69.6	nd	0.7	0.4	1.9	21.9	0.019	1.350	0.002	0.007	0.009	0.001	0.170	0.009
w67	13	3.4	2.3	73.0	nd	1.1	0.3	2.0	21.9	0.004	0.982	0.002	0.004	nd	0.001	0.132	0.007
w67	14	4.2	1.7	77.7	1.6	nd	0.6	4.0	11.5	nd	0.563	nd	0.003	0.007	0.002	0.353	0.005
w68	1	3.3	1.7	71.0	nd	1.6	0.3	1.8	21.3	0.018	0.852	0.001	0.005	0.007	0.001	0.149	0.008
w68	2	nd	nd	80.6	nd	0.8	nd	nd	14.9	0.039	0.268	nd	0.001	0.224	nd	0.007	0.002
w68	3	nd	1.3	80.7	nd	0.5	nd	0.6	13.8	nd	0.191	0.002	0.001	nd	0.001	0.006	0.005
w68	4	2.7	1.5	69.0	1.9	5.1	0.5	2.0	18.9	0.014	0.872	nd	0.006	0.037	0.001	0.182	0.005
w68	5	nd	nd	77.6	nd	0.6	nd	0.1	16.9	nd	0.232	nd	0.005	nd	nd	0.004	0.002
w68	6	nd	nd	78.8	nd	0.9	nd	nd	15.1	nd	0.142	nd	nd	0.017	nd	0.007	0.003
w68	7	nd	0.5	80.2	nd	0.5	nd	nd	16.0	nd	0.138	nd	0.001	0.458	nd	0.014	0.005
w68	8	nd	nd	75.4	nd	0.7	nd	0.1	16.6	nd	0.233	nd	0.004	nd	nd	0.004	0.002
w68	9	nd	1.3	80.7	nd	0.4	nd	0.6	13.4	nd	0.196	nd	0.002	nd	0.001	0.006	0.006
w68	10	nd	nd	76.3	nd	0.2	nd	nd	8.2	nd	0.070	nd	0.007	0.341	nd	0.002	0.004
w68	11	nd	nd	78.6	nd	0.9	nd	nd	14.9	nd	0.174	nd	nd	0.016	nd	0.007	0.002
w68	12	4.5	1.6	76.5	nd	0.5	0.3	3.5	9.7	nd	0.570	nd	0.006	0.007	0.001	0.273	0.005
w69.1	1	nd	nd	78.2	nd	nd	0.6	2.5	6.3	nd	0.021	0.016	0.002	0.440	nd	0.002	0.006
w69.1	2	nd	nd	75.3	nd	nd	0.7	2.5	6.3	nd	0.017	0.022	nd	0.443	nd	0.002	0.005
w69.1	3	4.9	1.5	64.5	3.4	0.9	0.4	9.6	15.0	0.895	0.479	0.011	0.039	0.011	0.015	0.030	0.012
w69.1	4	3.8	1.8	64.1	3.0	1.5	0.4	9.3	15.2	0.889	0.538	0.012	0.034	0.020	0.015	0.031	0.012
w69.1	5	nd	2.4	68.2	2.1	4.1	0.4	3.0	22.1	0.667	1.289	0.006	0.025	0.164	0.003	0.067	0.023
w69.1	6	2.0	2.3	66.7	2.1	1.0	0.4	3.4	24.7	0.663	1.317	0.012	0.028	0.147	0.003	0.068	0.023
w69.1	7	nd	2.1	65.0	2.1	nd	0.4	2.9	24.3	0.661	1.039	0.002	0.031	0.143	0.002	0.065	0.021
w69.1	8	nd	nd	76.6	nd	0.9	nd	nd	15.1	nd	0.195	nd	0.001	nd	nd	0.009	0.002

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w69.1	9	nd	2.5	68.1	2.2	2.8	0.4	3.4	24.3	0.680	1.340	0.008	0.025	0.163	0.003	0.069	0.024
w69.1	10	nd	2.1	68.0	2.1	0.3	0.3	3.2	23.8	0.616	1.260	0.002	0.026	0.127	0.003	0.065	0.023
w69.1	11	2.0	2.7	70.0	2.2	0.4	0.3	3.6	25.0	0.675	1.237	0.010	0.028	0.138	0.003	0.069	0.025
w69.1	12	nd	2.4	68.3	2.1	0.9	0.3	3.2	23.4	0.709	1.300	0.009	0.029	0.141	0.003	0.067	0.024
w69.1	13	3.7	1.6	74.9	1.2	nd	0.5	3.7	11.0	0.022	0.684	nd	0.001	0.009	0.001	0.322	0.005
w69.1	14	2.0	2.8	67.6	2.5	2.1	0.4	3.6	24.8	0.694	1.270	0.004	0.033	0.146	0.003	0.066	0.024
w69.1	15	nd	2.1	64.0	2.0	1.5	0.3	3.3	23.5	0.636	1.289	0.013	0.027	0.133	0.003	0.064	0.024
w69.1	16	nd	nd	80.2	nd	1.1	0.6	2.8	6.3	nd	0.038	nd	0.170	nd	0.001	0.003	0.009
w69.1	17	nd	nd	78.9	nd	0.8	0.5	2.8	6.3	nd	0.011	nd	0.168	nd	0.001	0.002	0.010
w69.1	18	nd	2.5	69.8	2.2	1.0	nd	5.3	23.9	0.098	1.345	0.015	0.027	nd	0.004	0.045	0.011
w69.1	19	2.2	3.9	70.3	2.2	0.6	0.5	3.8	19.6	0.666	0.602	0.003	0.024	0.049	0.003	0.057	0.019
w69.1	20	2.2	2.3	63.2	1.9	0.8	nd	4.0	26.0	0.537	1.114	0.010	0.020	0.100	0.004	0.060	0.031
w69.1	21	2.7	1.4	59.3	3.6	1.0	0.4	8.8	14.9	1.091	0.639	0.007	0.040	0.075	0.009	0.058	0.010
w69.1	22	nd	nd	82.5	nd	0.3	nd	nd	12.7	0.117	0.196	nd	0.003	0.313	nd	0.015	0.005
w69.1	23	nd	nd	79.6	nd	0.5	nd	nd	12.9	0.055	0.180	0.002	0.002	0.236	nd	0.013	0.005
w69.1	24	nd	nd	80.1	nd	0.2	0.6	3.3	5.9	nd	0.023	0.130	0.014	0.005	nd	0.002	0.006
w69.1	25	nd	nd	80.3	nd	0.6	nd	nd	12.5	0.068	0.169	0.005	0.004	0.239	nd	0.013	0.005
w69.1	26	3.0	1.2	76.0	nd	0.4	0.5	7.1	10.6	nd	0.527	nd	0.002	nd	0.002	0.093	0.013
w69.1	27	nd	nd	82.2	nd	0.6	nd	nd	12.6	0.083	0.205	0.001	0.003	0.241	nd	0.013	0.005
w69.1	28	2.1	3.2	69.9	1.8	0.8	nd	5.3	22.6	0.189	1.239	0.011	0.024	nd	0.004	0.048	0.013
w69.1	29	2.1	2.4	69.6	2.2	0.9	0.3	3.3	23.6	0.661	1.245	0.008	0.028	0.133	0.003	0.066	0.025
w69.1	30	nd	2.5	67.8	2.0	2.2	0.3	3.0	22.7	0.668	1.317	0.004	0.029	0.158	0.003	0.067	0.023
w69.1	31	2.1	2.7	68.3	2.0	1.3	0.3	3.1	23.8	0.659	1.335	0.007	0.028	0.138	0.003	0.068	0.024
w69.1	32	2.2	2.5	64.0	1.9	1.6	0.3	3.0	24.3	0.684	1.258	0.003	0.029	0.157	0.003	0.065	0.025
w69.1	33	2.5	2.5	70.6	2.1	0.6	0.3	3.3	24.3	0.721	1.304	0.009	0.030	0.141	0.003	0.069	0.024
w69.1	34	nd	2.2	70.9	2.0	0.5	0.3	3.4	24.2	0.704	1.257	0.008	0.024	0.132	0.003	0.067	0.023
w69.1	35	2.2	3.4	66.4	2.0	0.8	nd	6.4	26.3	0.157	1.328	0.010	0.025	nd	0.004	0.055	0.014
w69.2	1	3.7	1.9	66.9	2.8	1.1	0.4	9.5	15.4	0.928	0.502	0.004	0.030	0.015	0.016	0.030	0.012
w69.2	2	nd	1.4	67.2	2.8	0.8	nd	5.0	23.7	0.640	1.197	0.014	0.034	0.133	0.003	0.052	0.040
w69.2	3	4.1	1.5	61.4	3.2	1.2	0.4	9.3	15.1	0.894	0.514	0.011	0.037	0.010	0.015	0.029	0.011
w69.2	4	nd	nd	77.1	nd	nd	0.6	2.4	6.1	nd	0.015	0.024	0.001	0.447	nd	0.002	0.006
w69.2	5	2.1	2.2	65.8	2.2	nd	0.4	2.9	24.6	0.610	1.095	0.006	0.031	0.147	0.002	0.069	0.022

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w69.2	6	2.1	2.7	68.0	2.2	1.3	0.3	3.5	23.9	0.664	1.289	0.011	0.028	0.138	0.003	0.066	0.025
w69.2	7	2.2	2.5	67.9	2.3	1.8	0.3	3.2	23.7	0.649	1.302	0.008	0.028	0.148	0.003	0.068	0.024
w69.2	8	nd	2.4	66.7	2.1	1.0	nd	4.8	24.1	0.126	1.224	0.007	0.022	nd	0.004	0.039	0.013
w69.2	9	nd	2.6	69.5	2.7	0.6	0.5	3.0	25.5	0.659	1.178	0.005	0.025	0.143	0.002	0.071	0.024
w69.2	10	nd	2.1	63.7	2.1	3.2	0.4	2.8	22.9	0.619	1.077	0.007	0.027	0.204	0.002	0.067	0.020
w69.2	11	nd	nd	79.4	nd	1.4	nd	0.1	16.1	nd	0.201	nd	0.001	0.008	nd	0.018	0.003
w69.2	12	2.4	2.4	69.1	1.9	0.5	0.33	3.3	24.1	0.679	1.309	0.008	0.028	0.128	0.003	0.066	0.023
w69.2	13	nd	nd	78.5	nd	0.8	0.6	2.7	6.4	nd	0.046	0.003	0.173	nd	0.001	0.002	0.009
w69.2	14	nd	nd	79.5	nd	1.2	nd	nd	16.7	nd	0.203	nd	0.002	0.007	nd	0.007	0.002
w69.2	15	nd	2.0	59.9	2.2	0.6	0.3	3.1	22.0	0.640	1.346	0.010	0.026	0.228	0.003	0.068	0.023
w69.2	16	nd	2.0	63.6	1.9	0.5	0.3	3.2	23.2	0.662	1.252	0.007	0.026	0.130	0.003	0.064	0.023
w69.2	17	nd	2.5	66.6	2.2	1.3	0.3	3.4	23.3	0.640	1.222	0.005	0.025	0.145	0.003	0.067	0.022
w69.2	18	nd	nd	77.7	nd	nd	0.6	2.4	6.3	nd	0.025	0.023	nd	0.443	nd	0.002	0.006
w69.2	19	nd	nd	80.7	nd	nd	0.9	2.7	5.6	nd	0.008	nd	0.012	nd	nd	0.002	0.005
w69.2	20	nd	2.4	65.8	2.4	1.7	0.4	3.0	25.5	0.687	1.076	0.005	0.027	0.169	0.003	0.070	0.024
w69.2	21	2.4	3.9	66.1	2.5	0.3	0.6	2.0	22.6	0.546	1.078	0.002	0.030	nd	0.002	0.050	0.022
w69.2	22	nd	2.6	68.1	2.2	1.3	nd	4.5	23.5	0.200	1.340	0.015	0.022	nd	0.003	0.052	0.014
w69.2	23	2.5	1.1	72.0	nd	0.5	0.5	6.8	10.6	nd	0.491	nd	0.002	nd	0.002	0.086	0.013
w69.2	24	nd	2.4	74.2	1.7	2.7	0.3	2.9	21.9	0.677	1.242	0.011	0.032	0.169	0.003	0.066	0.023
w69.2	25	3.0	1.0	72.7	nd	0.3	0.3	7.0	11.2	nd	0.501	nd	0.002	nd	0.002	0.085	0.014
w69.2	26	nd	nd	78.0	nd	0.4	nd	nd	12.9	0.075	0.169	nd	nd	0.201	nd	0.014	0.005
w69.2	27	nd	nd	78.8	nd	nd	0.7	2.5	6.2	nd	0.009	0.020	0.002	0.437	nd	0.002	0.006
w69.2	28	nd	0.7	76.0	nd	2.9	nd	0.8	15.1	0.016	0.250	nd	0.003	0.337	0.001	0.016	0.006
w69.2	29	2.4	2.8	69.1	2.1	0.9	0.4	4.1	22.5	0.123	1.607	0.006	0.024	nd	0.002	0.089	0.017
w69.2	30	2.0	1.8	71.5	nd	1.3	0.4	1.9	22.2	0.100	0.942	nd	0.007	0.010	0.001	0.143	0.008
w69.2	31	nd	nd	82.8	nd	nd	1.0	2.6	5.8	nd	0.014	nd	0.013	nd	nd	0.002	0.006
w69.2	32	3.5	1.1	76.2	1.3	0.3	0.4	3.3	10.1	0.013	0.497	nd	0.001	0.008	0.001	0.321	0.006
w69.2	33	4.0	1.4	80.3	1.5	0.2	0.5	3.5	10.7	0.012	0.540	nd	nd	0.007	0.001	0.322	0.006
w69.2	34	nd	2.1	61.9	2.1	0.8	0.4	3.8	19.3	0.244	1.584	0.002	0.022	nd	0.002	0.098	0.016
w69.2	35	nd	nd	79.3	nd	0.7	nd	nd	13.0	0.077	0.145	nd	0.001	0.418	nd	0.015	0.003
w69.3	1	3.4	1.6	66.0	2.9	1.3	0.4	9.2	14.7	0.875	0.531	0.012	0.032	0.011	0.015	0.030	0.012
w69.3	2	nd	1.3	53.2	2.0	0.6	nd	5.4	20.6	1.376	1.151	0.014	0.039	0.077	0.004	0.068	0.040

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w69.3	3	nd	nd	75.5	nd	nd	0.6	2.3	6.0	nd	0.016	0.027	nd	0.442	nd	0.002	0.005
w69.3	4	nd	1.6	66.8	2.8	0.5	nd	4.9	24.0	0.663	1.150	0.016	0.032	0.130	0.003	0.048	0.036
w69.3	5	nd	2.3	64.4	2.3	1.9	0.4	3.0	24.3	0.710	1.117	0.011	0.027	0.170	0.002	0.069	0.023
w69.3	6	nd	2.4	69.3	2.2	1.3	0.4	3.2	23.8	0.644	1.277	0.008	0.032	0.140	0.003	0.066	0.022
w69.3	7	nd	2.4	65.1	2.5	3.1	0.4	3.4	23.3	0.641	1.211	0.007	0.029	0.153	0.003	0.067	0.023
w69.3	8	nd	nd	76.2	nd	0.8	nd	nd	15.7	nd	0.168	0.003	0.001	0.038	nd	0.007	0.002
w69.3	9	nd	2.7	69.4	2.0	2.3	0.3	3.3	23.8	0.642	1.294	0.009	0.028	0.172	0.003	0.067	0.024
w69.3	10	nd	nd	79.0	nd	nd	0.8	2.9	5.8	nd	0.025	nd	0.014	0.632	nd	0.002	0.006
w69.3	11	nd	nd	81.5	nd	nd	0.6	3.3	6.0	nd	0.011	0.135	0.013	nd	nd	0.002	0.005
w69.3	12	nd	2.4	67.4	1.8	4.0	0.3	3.0	22.1	0.634	1.294	0.003	0.027	0.158	0.002	0.066	0.024
w69.3	13	nd	2.1	69.2	1.8	2.0	0.3	3.0	23.1	0.615	1.288	0.010	0.027	0.162	0.003	0.066	0.025
w69.3	14	nd	2.4	65.2	1.9	0.6	0.4	2.8	23.0	0.633	1.118	0.007	0.025	0.244	0.002	0.069	0.022
w69.3	15	nd	nd	78.3	nd	0.2	0.5	3.1	5.7	nd	0.028	0.137	0.013	nd	nd	0.002	0.006
w69.3	16	nd	2.0	64.0	2.2	1.0	0.4	3.0	24.7	0.692	1.074	nd	0.025	0.152	0.002	0.069	0.022
w69.3	17	nd	nd	79.5	nd	0.5	0.5	3.3	5.7	nd	0.011	0.139	0.010	nd	nd	0.002	0.006
w69.3	18	nd	2.5	69.2	2.2	2.4	0.3	3.2	23.1	0.650	1.279	0.007	0.029	0.158	0.003	0.067	0.023
w69.3	19	nd	nd	81.0	nd	0.3	0.6	3.3	5.9	nd	0.027	0.133	0.012	nd	nd	0.002	0.006
w69.3	20	2.8	2.1	71.9	1.3	2.8	0.3	2.3	20.3	0.035	1.054	nd	0.003	0.018	0.001	0.212	0.005
w69.3	21	nd	2.1	64.1	1.9	2.6	0.3	3.1	22.8	0.617	1.262	0.008	0.030	0.174	0.003	0.065	0.023
w69.3	22	nd	3.3	67.5	2.4	1.6	nd	4.9	24.3	0.305	1.396	0.014	0.024	0.014	0.004	0.045	0.018
w69.3	23	3.9	2.4	76.0	1.2	0.2	0.4	3.9	11.3	0.024	0.995	nd	0.005	0.012	0.001	0.325	0.004
w69.3	24	nd	nd	75.2	nd	nd	0.8	3.0	5.7	nd	0.012	nd	0.013	0.618	nd	0.002	0.006
w69.3	25	2.4	1.9	70.0	nd	0.7	0.3	2.2	19.9	nd	1.110	nd	0.003	0.006	0.001	0.212	0.007
w69.3	26	nd	nd	78.2	nd	0.7	nd	nd	14.9	nd	0.209	0.001	nd	0.353	nd	0.015	0.005
w69.3	27	nd	nd	79.7	nd	nd	0.8	3.0	5.7	nd	0.013	nd	0.016	0.639	nd	0.002	0.006
w69.3	28	3.4	2.1	72.0	1.1	1.0	0.3	2.4	20.7	0.055	1.083	nd	0.007	nd	0.001	0.215	0.006
w69.3	29	2.9	1.9	67.9	1.7	0.2	0.5	2.9	18.1	0.074	1.125	0.001	0.013	nd	0.001	0.204	0.008
w69.3	30	nd	nd	82.5	nd	0.3	0.5	3.3	5.8	nd	0.009	0.144	0.015	0.006	nd	0.002	0.006
w69.3	31	nd	2.5	68.9	2.1	0.7	0.3	3.4	24.2	0.672	1.306	0.012	0.025	0.144	0.003	0.066	0.023
w69.3	32	nd	nd	78.0	nd	0.4	0.5	3.2	5.6	nd	0.022	0.136	0.012	nd	nd	0.002	0.006
w69.3	33	2.2	2.5	68.8	2.1	0.3	0.3	3.4	23.8	0.708	1.224	0.004	0.028	0.124	0.003	0.067	0.022
w69.3	34	nd	2.4	68.5	2.2	2.5	0.4	3.3	23.7	0.666	1.334	0.009	0.022	0.168	0.003	0.068	0.026

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w69.3	35	2.0	2.1	65.9	2.0	0.4	0.3	3.3	23.5	0.692	1.327	0.006	0.024	0.131	0.002	0.068	0.023
w69.3	36	2.5	2.4	69.0	2.0	0.4	0.3	3.3	24.2	0.701	1.294	0.011	0.030	0.123	0.002	0.068	0.024
w69.3	37	nd	nd	68.9	nd	nd	0.4	3.1	5.4	nd	0.024	0.130	0.015	nd	nd	0.002	0.005
w70.1	1	nd	1.3	62.5	2.5	0.4	nd	5.0	24.0	0.635	1.155	0.013	0.032	0.121	0.003	0.051	0.038
w70.1	2	3.0	1.3	59.1	2.4	1.5	0.3	8.5	15.6	0.803	0.526	0.011	0.035	0.016	0.015	0.029	0.012
w70.1	3	nd	2.7	68.3	2.6	1.1	nd	5.1	21.5	1.152	1.194	0.013	0.033	0.083	0.004	0.066	0.042
w70.1	4	nd	nd	74.4	nd	nd	0.6	3.0	5.8	nd	0.023	0.171	0.012	nd	nd	0.003	0.006
w70.1	5	nd	nd	77.4	nd	nd	0.7	3.2	6.0	nd	0.012	0.156	0.012	nd	nd	0.002	0.005
w70.1	6	nd	2.3	63.1	2.6	3.8	0.4	3.1	22.9	0.683	1.297	0.009	0.023	0.163	0.002	0.066	0.022
w70.1	7	nd	nd	78.0	nd	0.3	nd	0.1	15.8	nd	0.143	nd	0.006	nd	nd	0.011	0.006
w70.1	8	nd	2.2	64.3	1.9	1.9	0.3	3.1	22.7	0.621	1.232	0.011	0.027	0.134	0.002	0.065	0.023
w70.1	9	nd	nd	79.3	nd	0.7	nd	0.1	14.9	nd	0.202	nd	0.001	0.110	nd	0.008	0.002
w70.1	10	nd	2.2	62.4	3.1	5.8	0.4	3.1	23.0	0.653	1.297	0.007	0.027	0.178	0.003	0.066	0.022
w70.1	11	nd	nd	77.3	nd	1.1	nd	nd	15.4	nd	0.181	nd	0.001	0.062	nd	0.018	0.002
w70.1	12	nd	2.2	66.3	1.9	0.4	0.3	3.3	23.5	0.672	1.238	0.006	0.028	0.130	0.003	0.065	0.023
w70.1	13	nd	2.1	65.8	2.1	1.3	0.3	3.2	23.4	0.670	1.280	0.004	0.031	0.148	0.003	0.064	0.023
w70.1	14	nd	0.9	78.3	nd	0.7	nd	0.4	13.9	nd	0.193	nd	nd	0.087	0.001	0.008	0.004
w70.1	15	nd	2.0	63.4	2.3	2.4	0.4	3.2	23.1	0.700	1.246	0.006	0.028	0.146	0.003	0.068	0.023
w70.1	16	2.2	2.5	68.0	2.4	2.2	0.3	3.3	23.5	0.775	1.255	0.007	0.023	0.135	0.003	0.067	0.023
w70.1	17	nd	nd	80.1	nd	0.8	nd	nd	15.3	nd	0.179	nd	nd	0.008	nd	0.007	0.002
w70.1	18	nd	nd	76.1	nd	0.6	nd	0.3	15.3	nd	0.208	nd	0.004	0.011	nd	0.014	0.007
w70.1	19	nd	2.3	69.2	2.2	0.7	0.3	3.3	24.2	0.762	1.302	0.005	0.025	0.144	0.003	0.069	0.024
w70.1	20	nd	nd	81.2	nd	0.8	nd	nd	16.1	nd	0.185	nd	nd	nd	nd	0.007	0.002
w70.1	21	nd	2.7	70.3	2.2	1.4	0.3	3.2	23.6	0.629	1.324	0.011	0.027	0.138	0.003	0.067	0.022
w70.1	22	nd	2.4	66.9	2.2	2.3	0.3	3.2	23.1	0.730	1.249	0.009	0.026	0.136	0.003	0.067	0.023
w70.1	23	nd	nd	79.2	nd	0.9	nd	0.1	12.5	nd	0.241	nd	0.003	0.007	nd	0.016	0.004
w70.1	24	nd	nd	79.0	nd	0.5	nd	nd	12.5	0.068	0.132	nd	nd	0.196	nd	0.011	0.004
w70.1	25	nd	2.3	67.7	2.0	nd	0.3	3.2	23.5	0.688	1.272	0.012	0.026	0.133	0.003	0.064	0.023
w70.1	26	nd	2.3	65.6	1.7	1.8	0.3	3.1	22.8	0.669	1.314	0.009	0.025	0.157	0.003	0.066	0.025
w70.1	27	nd	nd	79.3	nd	0.9	nd	0.1	12.6	nd	0.255	nd	0.007	0.006	nd	0.016	0.004
w70.1	28	nd	2.3	66.8	1.8	1.7	0.3	3.1	22.6	0.667	1.238	0.013	0.025	0.136	0.003	0.067	0.022
w70.1	29	nd	0.6	78.0	nd	0.6	nd	0.1	15.3	nd	0.292	nd	0.006	nd	nd	0.005	0.011

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w70.1	30	nd	nd	67.7	nd	0.2	0.5	2.7	5.6	nd	0.016	0.159	0.013	nd	nd	0.002	0.006
w70.1	31	nd	2.7	68.5	2.2	1.1	0.3	3.5	24.4	0.730	1.346	0.008	0.030	0.147	0.003	0.069	0.025
w70.1	32	nd	nd	73.7	nd	0.4	0.5	2.9	5.8	nd	0.021	0.162	0.013	nd	nd	0.002	0.005
w70.1	33	nd	1.4	54.8	1.8	1.4	0.3	3.6	22.6	0.606	1.197	0.007	0.031	0.125	0.003	0.061	0.025
w70.2	1	3.5	1.5	64.9	2.7	1.4	0.4	8.8	15.2	0.844	0.478	0.008	0.035	0.012	0.014	0.029	0.011
w70.2	2	3.3	1.5	65.2	2.5	1.5	0.3	8.7	16.5	0.873	0.494	0.013	0.034	0.020	0.015	0.029	0.012
w70.2	3	nd	nd	79.0	nd	nd	0.6	3.0	5.9	nd	0.018	0.159	0.014	nd	nd	0.002	0.006
w70.2	4	nd	nd	77.6	nd	0.8	nd	nd	15.5	nd	0.184	nd	nd	nd	nd	0.006	0.002
w70.2	5	nd	2.5	69.5	2.0	0.6	0.3	3.6	25.0	0.677	1.314	0.006	0.023	0.143	0.003	0.071	0.025
w70.2	6	nd	2.1	65.8	2.6	3.3	0.4	3.4	22.6	0.679	1.268	0.003	0.026	0.144	0.002	0.067	0.023
w70.2	7	nd	nd	73.1	nd	0.9	nd	nd	14.1	nd	0.177	nd	nd	nd	nd	0.006	0.002
w70.2	8	nd	2.2	67.5	2.1	0.8	0.3	3.3	23.6	0.729	1.273	0.005	0.034	0.137	0.003	0.067	0.023
w70.2	9	nd	nd	76.9	nd	0.8	nd	nd	16.0	nd	0.167	nd	nd	0.006	nd	0.007	0.002
w70.2	10	nd	2.2	64.2	2.1	1.5	0.3	3.3	23.2	0.675	1.278	0.010	0.029	0.144	0.003	0.066	0.023
w70.2	11	2.2	2.7	66.5	2.6	0.8	nd	5.6	23.8	0.321	1.401	0.011	0.023	nd	0.004	0.047	0.015
w70.2	12	4.0	1.1	78.6	1.5	nd	0.5	3.5	11.0	0.040	0.442	0.002	0.002	0.009	0.001	0.352	0.003
w70.2	13	nd	0.5	77.5	nd	0.8	nd	0.1	10.9	nd	0.149	nd	0.001	nd	nd	0.006	0.004
w70.2	14	3.9	1.6	80.1	1.2	nd	0.5	3.8	11.2	0.003	0.650	nd	0.003	0.011	0.001	0.325	0.004
w70.2	15	3.9	1.8	77.6	1.6	0.3	0.5	3.6	11.0	0.012	0.476	nd	0.001	0.012	0.001	0.325	0.005
w70.2	16	nd	0.8	78.2	nd	0.9	nd	1.1	15.2	0.031	0.245	nd	0.003	0.413	0.001	0.018	0.005
w70.2	17	nd	2.2	62.9	2.0	nd	0.3	2.9	23.8	0.652	1.086	0.008	0.024	0.144	0.002	0.066	0.021
w70.2	18	3.0	1.5	78.7	1.2	0.4	0.5	3.0	14.1	0.010	0.428	nd	0.001	nd	0.001	0.262	0.005
w70.2	19	nd	nd	77.2	nd	0.8	nd	nd	12.9	nd	0.225	0.003	0.005	0.484	nd	0.015	0.002
w70.2	20	nd	1.3	79.1	nd	0.5	nd	0.6	13.0	nd	0.207	nd	0.002	nd	0.001	0.008	0.005
w70.2	21	nd	1.3	66.0	1.6	0.7	nd	5.1	20.9	0.044	1.030	0.005	0.022	nd	0.004	0.038	0.008
w70.2	22	nd	2.3	68.7	2.3	3.5	0.5	2.7	21.4	0.627	1.466	0.003	0.022	0.124	0.003	0.063	0.027
w70.2	23	nd	0.6	77.9	nd	0.5	nd	nd	12.9	0.061	0.259	0.002	nd	0.214	nd	0.014	0.005
w70.2	24	nd	2.4	73.0	2.1	nd	0.4	2.9	23.1	0.634	1.482	0.010	0.022	0.080	0.003	0.066	0.026
w70.2	25	nd	0.6	67.8	nd	0.6	nd	nd	12.1	2.009	0.921	0.052	0.015	0.019	nd	0.016	0.004
w70.2	26	nd	2.4	68.6	1.9	1.0	0.4	2.9	22.5	0.561	1.456	0.005	0.018	0.082	0.002	0.062	0.025
w70.2	27	nd	1.3	79.6	nd	0.6	nd	0.5	13.0	nd	0.186	0.001	0.003	nd	0.001	0.009	0.005
w70.3	1	4.0	1.4	61.1	3.1	0.8	0.4	9.5	14.4	0.883	0.488	0.004	0.033	nd	0.015	0.029	0.011

W	P	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl	K_2O	CaO	MnO	Fe_2O_3	CuO	ZnO	As_2O_3	Rb_2O	SrO	ZrO_2
w70.3	2	nd	nd	76.4	nd	nd	0.7	2.9	5.9	nd	0.003	0.160	0.011	nd	nd	0.002	0.005
w70.3	3	4.6	1.8	65.2	3.4	1.1	0.4	10.0	15.8	0.869	0.547	0.011	0.037	0.014	0.016	0.031	0.012
w70.3	4	3.5	1.5	65.4	2.7	1.5	0.4	8.8	16.1	0.827	0.510	0.008	0.030	0.014	0.015	0.030	0.012
w70.3	5	nd	nd	79.7	nd	0.8	nd	0.1	12.5	nd	0.231	nd	0.008	0.007	nd	0.017	0.003
w70.3	6	2.3	2.5	67.4	2.5	2.7	0.4	3.5	23.8	0.590	1.276	0.012	0.032	0.158	0.003	0.066	0.024
w70.3	7	nd	nd	75.3	nd	0.7	nd	0.1	15.9	nd	0.309	nd	nd	nd	nd	0.008	0.009
w70.3	8	nd	2.2	69.6	1.8	2.0	0.3	3.2	23.6	0.712	1.268	0.006	0.024	0.155	0.003	0.067	0.023
w70.3	9	3.9	1.5	77.5	1.3	nd	0.4	3.6	10.2	0.015	0.572	nd	0.004	0.007	0.001	0.318	0.005
w70.3	10	2.2	2.4	71.0	2.1	0.7	0.4	3.5	23.8	0.706	1.227	0.007	0.033	0.119	0.003	0.062	0.024
w70.3	11	nd	0.7	78.0	nd	1.2	nd	1.0	16.0	0.019	0.172	nd	0.002	0.475	0.001	0.014	0.003
w70.3	12	nd	2.5	68.3	2.2	1.8	0.3	3.1	23.0	0.664	1.280	0.008	0.026	0.140	0.003	0.068	0.022
w70.3	13	3.9	1.4	76.0	1.4	nd	0.5	3.4	9.9	0.017	0.537	nd	0.002	0.022	0.001	0.318	0.005
w70.3	14	nd	0.7	82.4	nd	1.2	nd	0.9	15.7	0.047	0.247	0.001	0.003	0.329	0.001	0.017	0.006
w70.3	15	2.8	2.5	70.8	2.2	0.5	0.3	3.4	24.4	0.628	1.337	0.011	0.027	0.141	0.002	0.069	0.024
w70.3	16	nd	2.6	70.9	2.1	1.8	0.3	3.1	23.4	0.689	1.294	0.009	0.023	0.154	0.003	0.068	0.023
w70.3	17	nd	0.9	79.6	nd	1.0	nd	1.1	14.8	0.003	0.217	nd	nd	0.456	0.001	0.015	0.004
w70.3	18	2.3	2.6	69.7	2.1	0.8	0.3	3.4	24.6	0.677	1.374	0.005	0.029	0.139	0.003	0.068	0.025
w70.3	19	nd	3.0	69.9	2.3	0.7	0.4	3.1	25.0	0.720	1.147	0.007	0.030	0.154	0.003	0.073	0.024
w70.3	20	nd	1.0	79.2	nd	0.6	nd	0.4	13.7	nd	0.179	nd	0.003	0.098	0.001	0.009	0.004
w70.3	21	nd	0.7	80.2	nd	1.2	nd	0.8	15.0	0.035	0.272	nd	0.003	0.242	nd	0.015	0.008
w70.3	22	2.5	2.0	70.7	nd	2.4	0.3	1.6	24.0	0.017	0.905	0.001	0.006	0.015	nd	0.124	0.006

ENGLISH HERITAGE RESEARCH DEPARTMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for sustainable management, and to promote the widest access, appreciation and enjoyment of our heritage.

The Research Department provides English Heritage with this capacity in the fields of buildings history, archaeology, and landscape history. It brings together seven teams with complementary investigative and analytical skills to provide integrated research expertise across the range of the historic environment. These are:

- *Aerial Survey and Investigation*
- *Archaeological Projects (excavation)*
- *Archaeological Science*
- *Archaeological Survey and Investigation (landscape analysis)*
- *Architectural Investigation*
- *Imaging, Graphics and Survey (including measured and metric survey, and photography)*
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