

DOCUMENT RELEASE AND CHANGE FORM		1a. Doc No: RPP-RPT-59268 Rev. 00																																												
Prepared For the U.S. Department of Energy, Assistant Secretary for Environmental Management By Washington River Protection Solutions, LLC., PO Box 850, Richland, WA 99352 Contractor For U.S. Department of Energy, Office of River Protection, under Contract DE-AC27-08RV14800		JRR 4/11/16 per e-mail with E. Brown 1b. Project Number: ☒ N/A																																												
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2. Document Title ILAW Glass Testing for Disposal at IDF: Phase 1 Testing																																														
3. Design Verification Required ☐ Yes ☒ No JRR 4/11/16 per e-mail with E. Brown																																														
4. USQ Number ☒ N/A	5. PrHA Number ☒ N/A Rev.																																													
6. USQ Screening: a. Does the change introduce any new failure modes to the equipment? ☐ Yes ☒ No JRR 4/11/16 per e-mail with E. Brown Basis is required for Yes: _____ b. Does the change increase the probability of existing failure modes? ☐ Yes ☒ No Basis is required for Yes: _____ c. For Safety Significant equipment, does the change require a modification to Chapter 4 of the DSA and/or FRED? ☐ Yes ☐ No ☒ N/A Basis is required for Yes: _____																																														
7. Description of Change and Justification (Use Continuation pages as needed) This is a report done by Vitreous State Laboratory - Energy Solutions on LAW glass testing performed in 2011. JRR 4/11/16 per e-mail with E. Brown																																														
8. Approvals <table border="1" style="width: 100%; border-collapse: collapse; font-size: 0.8em;"> <thead> <tr> <th style="width: 30%;">Title</th> <th style="width: 30%;">Name</th> <th style="width: 30%;">Signature</th> <th style="width: 10%;">Date</th> </tr> </thead> <tbody> <tr> <td>Checker</td> <td>KELLY, STEVE E</td> <td>KELLY, STEVE E</td> <td>03/22/2016</td> </tr> <tr> <td>Document Control Approval</td> <td>RAYMER, JULIA R</td> <td>RAYMER, JULIA R</td> <td>04/11/2016</td> </tr> <tr> <td>Originator</td> <td>BROWN, ELVIE E</td> <td>BROWN, ELVIE E</td> <td>04/06/2016</td> </tr> <tr> <td>Other Approver</td> <td>CAVANAHA, PAUL A</td> <td>CAVANAHA, PAUL A</td> <td>04/11/2016</td> </tr> <tr> <td>Quality Assurance</td> <td>FRANK, ROBERT E</td> <td>FRANK, ROBERT E</td> <td>03/22/2016</td> </tr> <tr> <td>Responsible Engineer</td> <td>BROWN, ELVIE E</td> <td>BROWN, ELVIE E</td> <td>04/06/2016</td> </tr> <tr> <td>Responsible Manager</td> <td>SWANBERG, DAVID J</td> <td>SWANBERG, DAVID J</td> <td>03/30/2016</td> </tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>			Title	Name	Signature	Date	Checker	KELLY, STEVE E	KELLY, STEVE E	03/22/2016	Document Control Approval	RAYMER, JULIA R	RAYMER, JULIA R	04/11/2016	Originator	BROWN, ELVIE E	BROWN, ELVIE E	04/06/2016	Other Approver	CAVANAHA, PAUL A	CAVANAHA, PAUL A	04/11/2016	Quality Assurance	FRANK, ROBERT E	FRANK, ROBERT E	03/22/2016	Responsible Engineer	BROWN, ELVIE E	BROWN, ELVIE E	04/06/2016	Responsible Manager	SWANBERG, DAVID J	SWANBERG, DAVID J	03/30/2016												
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9. Clearance Review: Restriction Type: <table style="width: 100%; font-size: 0.8em;"> <tr> <td style="width: 50%; vertical-align: top;"> ☒ Public ☐ Undefined ☐ Unclassified Controlled Nuclear Information (UCNI) ☐ Export Control Information (ECI) ☐ Official Use Only Exemption 2-Circumvention of Statute (OUO-2) </td> <td style="width: 50%; vertical-align: top;"> ☐ Official Use Only Exemption 3-Statutory Exemption (OUO-3) ☐ Official Use Only Exemption 4-Commercial/Proprietary (OUO-4) ☐ Official Use Only Exemption 5-Privileged Information (OUO-5) ☐ Official Use Only Exemption 6-Personal Privacy (OUO-6) ☐ Official Use Only Exemption 7-Law Enforcement (OUO-7) </td> </tr> </table>			☒ Public ☐ Undefined ☐ Unclassified Controlled Nuclear Information (UCNI) ☐ Export Control Information (ECI) ☐ Official Use Only Exemption 2-Circumvention of Statute (OUO-2)	☐ Official Use Only Exemption 3-Statutory Exemption (OUO-3) ☐ Official Use Only Exemption 4-Commercial/Proprietary (OUO-4) ☐ Official Use Only Exemption 5-Privileged Information (OUO-5) ☐ Official Use Only Exemption 6-Personal Privacy (OUO-6) ☐ Official Use Only Exemption 7-Law Enforcement (OUO-7)																																										
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CONTINUATION SHEET****Document No:** RPP-RPT-59268 **Rev.** 00

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RPP-RPT-59268, Rev. 00

ILAW Glass Testing for Disposal at IDF: Phase 1 Testing

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U.S. Department of Energy Contract DE-AC27-08RV14800

EDT/ECN: **DRCF** JRR 4/11/16

UC:

Cost Center: 2PG00

Charge 200213

Code:

B&R Code:

Total Pages: ~~498~~ 502 JRR 4/11/16

Key Words: Hanford, WTP, low activity waste, ORP, LAW glass formulation, testing, Integrated Disposal Facility (IDF), performance assessment, SPFT, VHT, PCT

Abstract: This document reports the results of the testing of phase 1 ORP LAW (low activity waste) glasses, also identified as enhanced LAW glasses. Testing involved are SPFT (Single Pass Flow Through), VHT (Vapor Hydration Test) and PCT (Product Consistency Test), along with the analytical tests (XRD and SEM-EDS). This report contains the data of the high waste loading ORP LAW glasses that will be used for the performance assessment of the IDF (Integrated Disposal Facility).

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APPROVED

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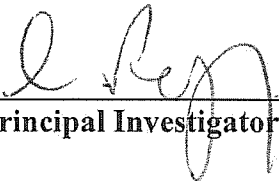
VSL-11R2270-1**Final Report****ILAW Glass Testing for Disposal at IDF:
Phase 1 Testing***prepared by***Adonia Papathanassiu, Isabelle S. Muller, Marek Brandys, Konstantin Gilbo,
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Washington, DC 20064***for***EnergySolutions Federal EPC, Inc.
Columbia, MD 21046***and***Washington River Protection Solutions, LLC
Richland, WA****April 11, 2011*****Rev. 0, 6/6/11***

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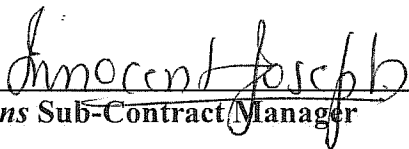
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Completeness of Testing:

This report describes the results of work and testing specified by WRPS. The work and any associated testing followed established quality assurance requirements. The descriptions provided in this test report are an accurate account of both the conduct of the work and the data collected. Results required by the test program are reported. Also reported are any unusual or anomalous occurrences that are different from the starting hypotheses. The test results and this report have been reviewed and verified.

I. L. Pegg: 
VSL Program Director/Principal Investigator

Date: 6/6/11

I. Joseph: 
EnergySolutions Sub-Contract Manager

Date: 6/6/11

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List of Abbreviations

ANL-LRM	Argonne National Laboratory – Low-Activity Waste Reference Material
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BNI	Bechtel National, Inc.
CCC	Canister Centerline Cooling
CUA	The Catholic University of America
CV	Check Valve
DCP-AES	Direct Current Plasma Atomic Emission Spectroscopy
DF	Degassing Filter
DOE	Department of Energy
DWPF	Defense Waste Processing Facility
EDS	Energy Dispersive X-Ray Spectroscopy
ES	Energy <i>Solutions</i>
FEP	Fluorinated Ethylene Propylene Co-polymer
HDPE	High-density Polyethylene
HLW	High Level Waste
ICP	Inductively Coupled Plasma
IDF	Integrated Disposal Facility
ILAW	Immobilized Low Activity Waste
IHLW	Immobilized High Level Waste
LAW	Low Activity Waste
LFRG	Low-Level Waste Disposal Facility Federal Review Group
NDR	Normalized Boron Dissolution Rate
NIST	National Institute of Standards and Technology
ORP	Office of River Protection
PA	Performance Assessment
PCT	Product Consistency Test
PEEK	Polyether ether ketone
PFA	Perfluoroalkoxy Polymer
PNNL	Pacific Northwest National Laboratory
PP	Polypropylene
PUF	Pressurized Unsaturated Flow
QA	Quality Assurance
QARD	Quality Assurance Requirements and Description
RCRA	Resource Conservation and Recovery Act
S/V	Ratio of Surface Area to Solution Volume
SEM	Scanning Electron Microscopy
SPFT	Single-Pass Flow-Through Test
SRL-EA	Savannah River Laboratory-Environmental Assessment Glass
STORM	Subsurface Transport over Reactive Multiphases

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TEC	Thermal Equilibration Coil
TFCOUP	Tank Farm Contractor Operation and Utilization Plan
TST	Transition State Theory
TTL	Transistor-Transistor Logic
US	United States
VHT	Vapor Hydration Test
VSL	Vitreous State Laboratory
WRPS	Washington River Protection <i>Solutions</i> , LLC
WTP	Hanford Tank Waste Treatment and Immobilization Plant
XRD	X-Ray Diffraction
XRF	X-Ray Fluorescence Spectroscopy

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SECTION 1.0 INTRODUCTION

1.1 Background

About 50 million gallons of high-level mixed waste is currently stored in underground tanks at The United States Department of Energy's (DOE's) Hanford site in the State of Washington. The Hanford Tank Waste Treatment and Immobilization Plant (WTP) will provide DOE's Office of River Protection (ORP) with a means of treating this waste by vitrification for subsequent disposal. The tank waste will be separated into low- and high-activity waste fractions, which will then be vitrified respectively into Immobilized Low Activity Waste (ILAW) and Immobilized High Level Waste (IHLW) products. The ILAW product will be disposed in an engineered facility – the Integrated Disposal Facility (IDF) – on the Hanford site, while the IHLW product will be directed to the national deep geological disposal facility for high-level nuclear waste. The ILAW and IHLW products must meet a variety of requirements with respect to protection of the environment before they can be accepted for disposal. The objective of the work described in this report is to perform testing, data collection, and analyses for the ILAW glass product for subsequent use in the performance assessment (PA) of the IDF to assess any potential environmental risk associated with long term storage.

The Record of Decision for the Hanford Site Solid Waste Environmental Impact Statement established the IDF to be located in the 200 East Area as the waste disposal facility for ILAW, secondary waste associated with ILAW production, other Hanford waste not going to the Environmental Restoration Disposal Facility, and low-level and mixed low-level waste from other parts of the DOE complex. In accordance with the DOE order on radioactive waste management (DOE Order 435.1), the IDF performance assessment is intended to analyze the long-term impacts on human health and the environment of the disposition of waste placed into the facility. Evaluation of the impact of disposed waste requires the ability to predict the long-term release of key radionuclides from the engineered system. In the case of IDF, the engineered system includes a number of components including the proposed Resource Conservation and Recovery Act (RCRA) cap, back fill material, ILAW glass, leachate collection system, etc.

Since 1998, the IDF PA (formerly the ILAW PA) has been supported by a PA maintenance plan focused on collecting the critical data needed to predict long-term performance: site geology, recharge, hydrology, geochemistry and waste form release. The purpose of the PA maintenance plan is to allow PA revisions to reflect new scientific information that reduce the technical uncertainty associated with critical aspects of the PA. Although many of the components contained in the engineered system and addressed in previous IDF PAs are important in minimizing radionuclide release, arguably the most important, protective, and uncertain aspect of the engineered system is the long-term performance of the ILAW glass. The ILAW glass serves as a primary barrier that

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minimizes radionuclide release. Therefore, developing robust, scientifically defensible predictions of long-term glass performance for the IDF PA is critical. The technical approach that is currently used to predict long-term release from ILAW glass for the IDF PA has gained acceptance from the Low-Level Waste Disposal Facility Federal Review Group (LFRG) and the international community evaluating the long-term corrosion of waste glass. It has also been peer reviewed and approved by a panel of independent experts during development of the 1998 IDF PA.

In previous IDF PAs, three or four prototypic glasses that spanned the range of glass compositions expected to be produced by the WTP were selected based upon specific processing constraints and composition projections that were current at the time. However, subsequent work has expanded the range of glass compositions that may be produced at the WTP and this type of composition range expansion is likely to continue through the life of the project. Thus, while the basic technical approach is both well developed and well substantiated, there was a need to expand the range of glasses tested in order to span the composition range expected to be disposed in the IDF, and to develop an understanding of the dependence of the underlying model parameters and reaction network on the ILAW glass composition. Washington River Protection *Solutions*, LLC (WRPS) is addressing this need and contracted with Energy*Solutions* (ES) and the Vitreous State Laboratory of The Catholic University of America (VSL-CUA) and with Pacific Northwest National Laboratory (PNNL) to provide the required scientific, technical, and engineering support. This final report presents the work performed in response to the corresponding WRPS scope of work [1].

The technical approach used to predict long-term release from ILAW glass for the IDF PA has been developed, refined, and updated over the past decade or so. The approach and the supporting test data for ILAW glasses has been extensively documented [2 - 8]. The underlying premise of the IDF PA is that the source term for radionuclide release is controlled by the long-term weathering of the glass matrix. This engineering-based approach has been used in previous PAs to provide the defense-in-depth required to defend the above premise and demonstrate through computer simulations that the proposed glass waste form will meet the regulatory requirements put forth by the LFRG. The focus of this engineering-based approach is estimating the model parameters and chemical reaction network needed to provide a robust simulation of glass weathering and the corresponding release of radionuclides over the period of performance (~10,000 years). The present work provides a means to estimate, through multiple measurements, the model parameters used to populate a chemical affinity-based kinetic rate law that is based upon Transition State Theory (TST) [9]. The model parameters k_0 , η , E_a , K_g , and r_{IEX} are used to populate the chemical affinity-based kinetic rate law:

$$r = k_0 10^{\eta \cdot pH_T} \exp(-E_a / RT) [1 - (Q / K_g)]^\sigma + r_{IEX} \quad (1.1)$$

where the reaction rate r and each of the model parameters are described below.

The boron glass dissolution rate ($\text{g m}^{-2} \text{d}^{-1}$) can be described from this equation as a function of the forward rate constant k_0 ($\text{g m}^{-2} \text{d}^{-1}$), the pH power law coefficient η , the apparent activation energy E_a (kJ/mol) and the pseudo-equilibrium constant K_g for the rate controlling phase (or phases),

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all of which can be deduced from experimental measurements by varying the effect of: (1) pH, (2) temperature, (3) saturation state of the system, and (4) the activities of rate-enhancing or -inhibiting species on glass dissolution. Equation (1.1) is based on the kinetic rate equation developed by Åagaard and Helgeson [10] and applied to glass by Grambow [11]. The additional effect of Na ion exchange reaction, which had been emphasized previously by Feng and Pegg [12 - 14], is included as r_{IEX} . This parameter can be estimated by comparing the boron and sodium dissolution rates; measurement of its temperature dependence also permits estimation of the activation energy of the Na ion exchange reaction E_x .

In previous work [2 -8], the model parameters have been obtained from the analysis of data produced using a variety of experimental techniques, including the single-pass flow through test (SPFT), long-term high surface area to solution volume (S/V) product consistency test (PCT-B), vapor hydration test (VHT), and pressurized unsaturated flow test (PUF). This suite of tests evaluates different aspects of the glass-water reaction over the course of the five¹ stages or regimes of glass weathering [15]: Stage I – early interdiffusion; Stage II – the initial forward rate regime; Stage III – the decreasing rate regime, Stage IV – the residual rate regime; and Stage V – alteration rate renewal regime. These five stages are described below. In Stage I, ion exchange between glass network-modifying cations and protons from the leaching solution takes place beginning at the earliest times. The term of ‘reactive diffusion’ has also been used to describe the combined effects of water diffusion into the glass, alkali ion exchange, and the resulting reorganization of the glass network leading to concomitant release of boron. The initial forward rate consists of both ion-exchange and hydrolysis reactions. In dilute to near-saturated solutions, the TST-based model (without the ion-exchange term) successfully accounts for silicate dissolution in terms of temperature, pH, and reactive surface area because hydrolysis is the controlling reaction (Stage II). However, as the glass-water reaction proceeds and the concentration of glass components (particularly silicic acid) increases in solution, the rate of dissolution decreases (Stage III). For ILAW glasses tested under alkaline conditions, it has been observed that ion exchange becomes the dominant process controlling glass weathering under these near-saturated conditions. The data collected from SPFT experiments conducted as a function of pH, temperature, and silicic acid concentration have been used to evaluate Stage II and III and to obtain the model parameters k_0 , η , E_a and K_g .

As the glass continues to dissolve, the aqueous concentration of dissolved components approaches saturation with respect to the formation of a hydrated surface layer. The hydrated surface layer forms when relatively insoluble glass components (e.g., Al, Fe, and Si) accumulate in the bulk solution and condense at the glass-water interface. The dissolution then continues at a relatively constant residual rate (Stage IV) consistent with a process controlled by diffusion through the hydrated surface layer. During Stage IV, the key alteration phase is often a clay mineral, such as smectite. The precipitation kinetics associated with these phases can be complex, but in general the rate of secondary phase growth increases in response to an increase in the degree of supersaturation

¹ Although many of the US authors of work supporting the ILAW PA [2-8] consider only four stages by combining Stage I and Stage II, the description of nuclear waste glass leaching in five stages is now part of accepted international record on the present state of knowledge on alteration of nuclear waste glasses.

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[16, 17]. The data collected from SPFT experiments conducted as a function of temperature and silicic acid concentration can be used to evaluate the residual rate (Stage IV) and obtain the ion exchange rate of sodium (by subtracting boron dissolution rate from the sodium dissolution rate).

Finally, depending on the type of alteration phases that form, the glass-water reaction can increase from the residual rate and return to an elevated rate (Stage V). This type of behavior has been observed in accelerated testing of US HLW glasses [18, 19, 21, 23, 25, 26], Belgian HLW glasses [20], as well as Hanford LAW glasses [22 - 24].

The data collected from VHT, PCT-B, and PUF experiments, along with geochemical modeling (using EQ3/6), and solid-phase characterization, have been used to identify the key alteration phases formed as the glass weathers. The results from these tests provide the additional confirmatory information needed to identify and constrain the appropriate chemical reaction network required for model simulations. Thermodynamic data, namely chemical reactions and corresponding equilibrium constants, are obtained from the EQ3/6 or PHREEQC geochemical codes and are added to the reactive transport code (Subsurface Transport Over Reactive Multiphases (STORM) [27]).

Previous ILAW glass PA modeling has been based on test results for individual representative LAW glasses. However, as the number and range of LAW glasses that the WTP is expected to produce increases, a need to develop approaches that are more broadly applicable was identified. Thus, a primary objective of the present work was to identify and test LAW glasses that might reasonably be expected to bound the performance of those produced at the WTP. A further objective was to collate and present data from the numerous LAW glasses that have been developed and subjected to long-term testing at VSL. Longer-term objectives of this program would include the development of sub-models that describe the dependence of the parameters in the glass dissolution rate equation on the glass composition over the range of interest, development of the capability to predict secondary phase formation from the glass composition, and verification or modification of the glass model currently employed in the ILAW PA.

1.2 Test Overview

The major activities that have been completed in the present work are listed below and described in the following sections of this report.

- Selected ten bounding LAW glass compositions for testing.
- Prepared large batches of the ten selected LAW glasses for testing at VSL and PNNL.
- Selected 137 LAW glass tests from VSL's suite of ongoing long-term PCT-B tests; some of these tests have been in progress for up to 3400 days.
- Performed sampling and analysis from selected long-term tests, including secondary phase characterization by scanning electron microscopy/energy dispersive x-ray spectroscopy (SEM/EDS) and x-ray diffraction (XRD).
- Submitted long-term LAW PCT data to WRPS. A comprehensive set of PCT data was

submitted in June, 2010 followed by an update in September, 2010.

- Extended long-term PCT tests on LAW glasses.
- Performed PCT-B on ten selected glasses at S/V values of 2,000 and 20,000 m⁻¹, and temperatures of 40, 90 and 120°C. Sampling at 7, 28 and 56 days has been completed and the results are presented.
- Performed full-suite of SPFT experiments as a function of pH and temperature on the selected bounding glass (48 tests) and as a function of silicic acid concentration and temperature on specific glasses.
- Estimated rate law parameters for tested ILAW glasses.
- Reviewed literature on glass corrosion data and long-term modeling.

Section 2.0 provides an overview of over 350 LAW glass formulations that were developed and tested at VSL in support of the WTP and used for the present study. These include statistically and actively designed formulations prepared and tested at VSL over the past twelve years.

Section 3.0 follows with a description of the process used in selecting ten LAW glasses intended to bound the performance of the broad range of LAW glasses that the WTP is expected to produce. In particular, these “IDF” glass compositions include extremes in sodium, potassium, and sulfate contents. Section 3.0 also describes the preparation and analytical and microscopic characterization of the batches of glasses prepared prior to leach testing at VSL and shipment to PNNL.

Section 4.0 includes the results of long-term leach tests selected from a large inventory of tests conducted at VSL since 1994 on Hanford LAW glasses. This inventory includes PCT-B tests on LAW glasses that provide valuable long-term test data for the present study. Data from 253 relevant LAW glass compositions were selected from this suite of ongoing long-term PCT-B tests, with test durations extending from greater than 750 days up to 3982 days. The data set, which was transmitted to WRPS during the course of this work, is also included in Appendix A. Numerous leach tests were terminated in order to sample and characterize the reacted glasses by SEM and XRF to investigate the hydrated gel layer and alteration phases developed in the leaching process. The compiled XRD and SEM data are included in Appendix B.

Section 5.0 provides the results of PCT-B leach testing that was performed on the ten new glasses that were selected over a range of test conditions intended to probe the later stages of glass corrosion. The test conditions included variations of the ratio of the glass surface area to solution volume (S/V) (2000 m⁻¹ and 20,000 m⁻¹) and temperature (40°C, 90°C and 120°C). The tests have been sampled at 7, 28, 56, 120, and 180 days and are ongoing at the time of writing. Results of VHT on the same glasses (200°C, 24-day) complement the data set with evaluation of the depth of hydration and SEM evaluation of the hydrated layers in the case of two of the selected glasses, ORPLA20 (IDF4) and ORPLE12 (IDF7).

Section 6.0 presents the results obtained from leaching under dilute solution conditions using the SPFT. Three of the ten IDF glasses were selected for SPFT testing: the highest sodium glass

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(IDF1-B2 at 25 wt% Na₂O), the highest combined sodium and potassium glass (IDF2-G9 at 21 wt% Na₂O and 5.75 wt% K₂O), and the highest sulfate glass, which is also the highest in lithium (IDF3-F7 at 12 wt% Na₂O, 4.35 wt% Li₂O, and 1.93 wt% target SO₃ target). The resulting experiments performed as a function of pH, temperature, and silicic acid concentration provide estimates of the rate law parameters.

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SECTION 2.0 OVERVIEW OF WTP LAW GLASS FORMULATIONS

The database of LAW glasses developed at VSL for the WTP provided the basis for the selection of the glasses used for the present work. The database includes LAW glass compositions and associated glass characterization data collected in support of the WTP project since 1998 that satisfy the applicable QA requirements, as well as data for higher waste loading LAW glass compositions that have been developed at VSL for ORP. Some of the data are from statistically designed² composition matrices that were intended to cover the particular LAW glass composition regions of interest. Other data are from actively designed glass formulations that relied on glass science rather than statistical methods to develop glass compositions with desired properties. Property data for glass samples from melter tests are also included in the database. The glass compositions used for melter tests were selected from actively designed glass formulations that meet all WTP processing and product quality requirements. Melt viscosity, melt electrical conductivity, glass crystallization, and K-3 glass contact refractory corrosion are properties that are important to glass processing in a Joule Heated Ceramic Melter (JHCM). Elemental releases in the PCT and glass alteration rate in the VHT, both of which are specified with associated limits in the WTP contract, were used to screen for product quality.

Sections 2.1 to 2.8 provide the identifications and target compositions of LAW glasses in the VSL property-composition database used in the selection process. Each section describes a series or group of glasses for which data on some or all of the properties were collected. The property data that were collected from each set of glasses are identified in each section. Section 2.9 gives a comparison of the compositions of the glasses used in the current selection process with the PA glasses from the PNNL report on the sensitivity of the rate law model to the model parameters [28].

2.1 Phase 1 Test Matrix Glasses

The Phase 1 Test Matrix consists of a set of 56 glass formulations specified by a statistically-designed test matrix [29] that was prepared and characterized to support Phase 1 of ILAW property-composition modeling for the WTP contract. The focus of the ILAW Phase 1 Test Matrix was the first 11 LAW streams planned for the WTP at the time of the test matrix design: AP-101, AZ-101, AZ-102, AN-102, AN-103, AN-104, AN-105, AN-107, AW-101, AP-101 combined with SY-104 and SY-101 combined with AP-104. The waste composition information considered in the development of the ILAW Phase 1 Test Matrix included Tank Farm Contractor Operation and

² “Statistically designed” refers to a set of glass compositions designed using statistical experimental design methods to cover a composition space. “Actively designed” refers to glasses developed to meet certain specified requirements such as a glass composition to immobilize a LAW tank waste stream that has to meet all product quality and processing requirements. In this approach, information from characterization of one set of glasses is used to guide formulation of future glass compositions, with little or no intent to cover a composition space.

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Utilization Plan (TFCOUP) Rev. 3A [30], TFCOUP Rev. 2 [31], the WTP Test Specification for LAW melter testing [32], which also contained LAW actual waste characterization data, and prior VSL assessments of LAW waste composition [33, 34].

These glasses were selected to augment 21 Existing Matrix glasses (see Section 2.2). Additional details of the test matrix development are discussed in a previous technical report [29]. Details of glass property measurements have been presented in an earlier report [35]. PCT, VHT, viscosity, and electrical conductivity data were collected on all 56 of the ILAW Phase 1 Test Matrix glasses.

2.2 Existing Matrix Glasses

A set of 21 Existing glasses representative of the range of working compositions at that time (early 2002) was chosen as the starting point for the ILAW Phase 1 Test Matrix development. Even though the Existing Matrix consists of only 21 target glass compositions, 23 glass melts were prepared because the initial crucible melts of two of the glasses did not yield sufficient glass sample to perform all of the property measurements. Hence, additional melts were prepared with the same target compositions. Details of the preparation and characterization of these samples have also been reported earlier [33, 36-38].

The relevance of these glass compositions with respect to the composition ranges for LAW glass testing is discussed in a previous report [39]. Of the 23 glasses in this subset, 22 have PCT data, 21 have VHT data, 21 have viscosity and electrical conductivity data, and 12 have K-3 refractory corrosion data.

2.3 Phase 1a Augmentation Test Matrix Glasses

In view of the large lack-of-fit in models for VHT alteration rates using Phase 1 data, 20 glass compositions, selected from a statistically-designed composition matrix, were formulated and tested with the primary objective of augmenting the LAW VHT data set available for modeling [40]. This augmentation matrix was designed with the objective of selecting 20 glass compositions for testing that have VHT alteration rates near the contractual limit of 50 g/m²/day [41]. In order to augment the capability of the VHT model, it was considered more important to obtain measurable VHT responses³ near or above the contractual limit than to select glasses that are likely to meet the contractual requirement. The VHT alteration rate of 50 g/m²/day corresponds to an alteration depth of 453 μm for a 24-day test and an average glass density of 2.65 g/cc. The objective, therefore, was to select glass compositions that would show VHT alteration depths preferably in the range of about 200 to 800 μm, with the measurable upper limit being determined by the thickness of the VHT

³ If the VHT alteration rate is too high, the test coupon is completely altered over the test duration and, therefore, the test yields only a "greater than" result, which is not amenable to property-composition modeling. Of the 56 Phase 1 Test Matrix glasses, 5 could not be used in modeling for that reason.

coupon. Given the lack of models that could reliably predict VHT responses in the high-alkali region of the LAW correlation, a two-step approach was used to select the 20 glasses for testing. Thirty glass compositions were generated using statistical experimental design software, from which 20 were selected manually through comparison with the few preexisting glass compositions with VHT responses in the desired range.

Twenty glasses were selected for testing from the 30 design compositions through additional screening aimed at decreasing the likelihood that the VHT alteration depths of the selected compositions would exceed the coupon thickness. PCT and VHT data were collected on all 20 samples, whereas viscosity and electrical conductivity data were collected on only nine glasses selected to augment the corresponding property-composition databases. K-3 refractory corrosion data were collected on all 20 glasses.

2.4 LAW Correlation and High Cr₂O₃ Correlation Glasses

A set of 21 LAW correlation glasses were formulated using a set of empirical relationships that define waste loadings and the concentrations of glass former additives for LAW wastes as a function of the molar ratio of sulfate to sodium (SO₄/Na). These relationships together define the LAW Correlation [42]. The LAW Correlation is based on LAW glass compositions developed at VSL and tested at various scales including the one-third-scale LAW Pilot Melter. The LAW Correlation algorithm uses a two-step process to calculate glass compositions for a given waste stream composition. First, waste loading (expressed as the alkali content of the waste $ALK = Na_2O \text{ (wt\%)} + 0.66 K_2O \text{ (wt\%)}$) is calculated as the highest of three waste loading limiting constituents, leading to three types of formulations as follows:

Sodium limited formulations:

$$Na_2O \text{ (wt\%)} \leq 21 \text{ (wt\%)} \quad (2.1)$$

Potassium limited formulations (for $ALK = Na_2O \text{ (wt\%)} + 0.66 K_2O \text{ (wt\%)}$):

$$Na_2O \text{ (wt\%)} + 0.66 K_2O \text{ (wt\%)} \leq 21.5 \text{ (wt\%)} \quad (2.2)$$

Sulfate limited formulations:

$$Na_2O \text{ (wt\%)} + 42.5 SO_3 \text{ (wt\%)} \leq 35.875 \text{ (wt\%)} \quad (2.3)$$

Equation (2.3) can be rearranged and used as an equality to relate the Na₂O concentration to the SO₄/Na ratio for a given waste as:

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$$\text{Na}_2\text{O (wt\%)} = \frac{35.875}{1 + \frac{80.06}{30.99} * 42.5 * \frac{\text{SO}_4}{\text{Na}}} \quad (2.4)$$

(the molecular weights of SO_3 and Na_2O are 80.06 g/gmol and 61.98 g/gmol, respectively; one mole of SO_3 contributes one mole of SO_4 and one mole of Na_2O contributes two moles of Na).

Amongst the glass former additives, the concentrations of the following three components also vary with the waste loading (expressed as ALK):

$$\text{Li}_2\text{O (wt\%)} = 4.3 * \left(1 - \frac{(\text{ALK} - 5.4)^2}{12.75^2} \right)^{0.7} \quad (2.5)$$

$$\text{CaO (wt\%)} = 1.5 + 5.5 [1 + \exp((\text{ALK} - 17) / 2)]^{-1} \quad (2.6)$$

$$\text{MgO (wt\%)} = 1.48 + 1.49 [1 + \exp(\text{ALK} - 9)]^{-1} \quad (2.7)$$

Several of the added components (Al_2O_3 , B_2O_3 , Fe_2O_3 , TiO_2 , ZnO , ZrO_2 , and “Others”) are kept at fixed concentrations and the SiO_2 concentration is calculated such that the glass composition in wt% sums to 100. “Others” is a component that captures the concentrations of all of the minor components in the glass.

Additionally, four correlation glasses with increased Cr_2O_3 concentrations (from 0.35 to 1.4 wt% based on predicted maximum Cr_2O_3 concentrations in LAW waste streams) were prepared, subjected to container centerline cooling (CCC) heat treatment (Figure 2.1), and characterized. Of the 21 glasses in these two subsets, 18 have PCT data, 19 have VHT data, 15 have viscosity and electrical conductivity data, and 15 have K-3 refractory corrosion data.

2.5 High Cr_2O_3 and P_2O_5 LAW Glasses

A set of seven glasses with higher concentrations of Cr_2O_3 and P_2O_5 (in the range of 0.3 to 0.6 wt% Cr_2O_3 and 1.3 to 2.4 wt% P_2O_5) [43] were tested to determine the acceptable ranges for these components in LAW glasses formulated based on the LAW Correlation algorithm. Of the seven glasses in this subset, 7 have PCT data, 7 have VHT data, 5 have viscosity and electrical conductivity data, but none have K-3 refractory corrosion data.

2.6 Remaining Actively Designed WTP LAW Glasses

This group consists of LAW glasses tested at VSL from 1998 to 2006 during Part B1 and subsequent contract phases. All of these glasses were “actively” rather than “statistically” designed.

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Of the 135 glasses in this set, 39 were tested during Part B1 [33] to support the development of glass formulations for LAW Envelope A, LAW Envelope B, and LAW Envelope C, for which the primary source of tank waste compositional data was the Best Basis Inventory [44]. A glass sample prepared at VSL with the same composition as that of a PNNL composition used as the central glass composition of the initial Hanford Immobilized LAW Product Acceptance study [45] is also part of this set of glasses.

Subsequent changes to the tank waste compositions were addressed in later glass formulation testing of each LAW Envelope. Of these, 51 glasses were subjected to the PCT with lesser numbers selected for VHT, viscosity, electrical conductivity, and K-3 refractory corrosion measurements. Details of the preparation and testing of these glasses are reported elsewhere [46].

For convenience in glass formulation development for the Hanford LAW tank wastes, the waste compositions were divided into seven LAW Sub-Envelopes, namely A1, A2, A3, B1, B2, C1, and C2. Glass formulations were developed and selected for melter testing of each of the LAW Sub-Envelope compositions, the results of which have been reported previously [38]. Thirty-five glasses from this group are included in the database for selection of bounding LAW glasses, of which eight are crucible melts with the nominal composition of each of the selected glass formulations. Four of the crucible glasses were prepared to study the effect of $\pm 15\%$ variation in the blending of waste and glass former additives on their properties, and nine crucible melts were prepared and characterized to determine the effect of $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ composition changeovers⁴ on glass properties as the composition of the melt pool transitions from the glass composition for one tank waste to another [38]. Fourteen of the glass samples are from melter tests conducted at three different scales [47-60]. Glass samples subjected to CCC heat treatment were also included in the database.

Simulant crucible glasses based on composition analysis of actual waste samples at PNNL and SRTC were also prepared and characterized at VSL. Eight such samples were prepared at VSL from slurry feeds made by mixing waste simulants with glass former oxides. The crucible melts were prepared and subjected to CCC heat treatment before characterization. Property data from these glass samples [36, 37, 61-64] are included in the database.

Of the 135 glasses in this subset, 132 have PCT data, 58 have VHT data, 75 have viscosity and electrical conductivity data, and 70 have K-3 refractory corrosion data.

2.7 WTP Glasses for VHT Model Augmentation

LAW glass property-composition models developed for the WTP [65] using the glass data described above showed large prediction errors for the VHT model. The errors were attributed to inherent variability in the VHT alteration measurement for glasses and lack of data in the higher

⁴ "Changeover" refers to the change in the melt pool composition as the melter feed source transitions from one tank waste composition to another.

alkali range of compositions that typically show higher VHT alteration rates. Accordingly, multiple VHT measurements (about 45) were performed on 10 different glass compositions [66]. These included replicates to determine the variability in the measurement method and new high-alkali glass compositions developed to augment the existing composition matrix.

Of the 10 glasses in this subset, none have PCT data, 10 have VHT data, all in replicate totaling 21 new VHT data, none have viscosity or electrical conductivity data, and none have K-3 refractory corrosion data.

2.8 ORP Glasses

The glass formulations described above were developed to support the WTP baseline using the waste composition basis current at that time. The WTP baseline formulations were developed to comply with the requirements of the Bechtel National, Inc (BNI) contract with ORP [41]. As a result of the considerable testing completed with the WTP baseline formulations, there is high confidence that they can be used to process LAW at Hanford. However, due to time constraints in the BNI schedule, little effort was devoted to optimization of the glass formulation with respect to waste loading. Therefore, while this extensive set of formulations provides a solid underpinning of the WTP baseline, there is also potential for improvement of waste loadings. Exploiting this potential has been the subject of the work performed at VSL for ORP.

LAW testing for ORP at VSL was aimed at optimizing the glass formulations and processing parameters in order to minimize the volume of glass produced and to shorten the plant operating schedule. An important objective was to determine the likely limits of LAW loading across the full range of expected LAW compositions. Since the major waste loading limiting constituents in Hanford LAW are sodium and sulfur, glass formulation development and testing were focused on maximizing the incorporation of these components in the glass. An overview of the Na_2O and SO_3 loadings for the WTP and ORP glasses is given in Figure 2.2. The labels in the figure refer to various ORP glasses that were used in melter tests. As is evident from Figure 2.2, ORP glasses represent considerable increases in waste loadings over the WTP baseline and therefore considerable potential for reductions in cost and schedule. Results from the work for ORP [67-71] have already shown the potential for a 58% increase in average Na_2O loading in Hanford LAW glasses from the WTP baseline of approximately 13 wt% to about 20.6 wt%.

Compared to the baseline WTP LAW glasses, the ORP LAW glasses have higher waste loadings (higher sodium and sulfur concentrations). In order to achieve higher sodium (or alkali) loading, changes were made to glass former additives, including higher ZrO_2 concentration and/or the introduction of new component, SnO_2 . Higher sulfur loadings were achieved by increasing the concentrations of glass former additives such as CaO and Li_2O and introducing a new additive, V_2O_5 .

Data for the 139 ORP glasses include 129 viscosity measurements, 124 electrical

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conductivity measurements, 95 K-3 refractory corrosion tests, 112 PCT and 163 VHT (including replicates). Since ORP glasses were designed with higher waste loadings (higher alkali contents), and since higher alkali contents increase PCT releases and VHT alteration rates, they feature prominently in the selection of bounding glasses in the present work.

2.9 Comparison of the VSL LAW Glass Database and PA Glasses

The minimum, maximum, and mean concentrations of major components in the VSL LAW glass database used in the selection of bounding glasses, and the PA glasses from the sensitivity report [28] are given in Table 2.1. Distributions of the VSL LAW glass database and the PA glasses in composition space are given in Figures 2.3 and 2.4, respectively. Some of the differences include maximum Na_2O concentration in the VSL LAW glass database of 26.0 wt% compared to 23.0 wt% for the PA glasses, and higher maximum ZrO_2 , CaO , and Li_2O concentrations in the VSL LAW glass database. SnO_2 and V_2O_5 are present only in the VSL LAW glass database. As stated earlier, most of these differences can be attributed to the design of the ORP LAW glasses with the objective of maximizing waste loading.

SECTION 3.0

SELECTION, PREPARATION, DISTRIBUTION AND TESTING OF NEW GLASSES

Previous ILAW glass PA modeling has been based on test results for individual representative LAW glasses. However, as the number and range of LAW glasses that the WTP is expected to produce increases, there is a need to develop approaches that are more broadly applicable. Several such approaches are possible, including the use of LAW glasses that are expected to bound the performance of those produced at the WTP, and the development of sub-models that describe the dependence of the parameters in the rate equation on the glass composition over the range of interest. The latter approach would also require the ability to predict secondary phase formation from the glass composition, which is particularly challenging. The longer-term objective of the present effort is to develop such an approach that is applicable to the prediction of the performance of the envelope of glasses that the WTP is projected to produce.

The selection of appropriate ILAW glass compositions for Phase 1 testing was an important component of this work. As described in the Test Plan for this work [72], that selection must take into consideration a number of factors including:

- Projections of LAW compositions to be processed in the WTP LAW vitrification facility
- Projections of the corresponding glass compositions that will be produced based on the expected glass former addition and process control strategy and LAW glass formulation correlation [42]
- The present WTP baseline LAW operating envelope and baseline glass compositions
- The impact of potential enhanced operating strategies, including the use of LAW formulations with higher waste loadings, on the baseline operating envelope and glass compositions
- The range of LAW glass compositions for which data have been collected previously to support the ILAW PA
- The sensitivity of the model parameters and predictions to the likely range of LAW glass compositions [28].

In addition, although glasses of the same composition are expected to exhibit the same leaching behavior, it is desirable to test LAW glasses produced in melter tests as well as in crucible tests in order to demonstrate that this is so. Accordingly, it is desirable to include LAW glasses produced in previous melter runs performed on scale melters at VSL (DM10, DM100, and DM1200)

and archived at VSL in the selection process to the extent possible based on availability and appropriateness of their compositions.

Compositions of the PA glasses from the sensitivity report from PNNL [28] are given in Table 3.1. A comparison of the compositions of the PA glasses to the compositions of the glasses in the VSL LAW glass database is given in Section 2.9. One of the objectives of the selection process was to ensure that the selected glasses would augment the PA glasses and have compositions that are different from those of the PA glasses.

3.1 LAW Glass Property-Composition Data Review and Screening

The first step in the selection of bounding glasses was a review of the property-composition relationships for the glasses in the VSL LAW glass database. In the next step, the glasses were screened for compliance with properties relevant to processing, including melt viscosity and electrical conductivity. In the following step the glasses were screened with respect to PCT release. In the final step, glasses were screened with respect to K-3 refractory corrosion and VHT alteration rate. The WTP processing [73] and product quality [41] requirements for the LAW glasses are given in Table 3.2. For WTP baseline glasses, K-3 refractory neck corrosion of 0.035 inches was used as the acceptance criterion, whereas a neck corrosion of 0.04 inches was used for the higher waste loading ORP glasses. For the current selection process, K-3 refractory neck corrosion of 0.04 inches was used as the acceptance criterion.

Previous analysis [65] has shown that crystallization is rarely an issue with LAW glasses. Therefore, crystallization data for these glasses were not used as a screening criterion. Crystallization characteristics of the *selected* glasses were, however, reviewed to make sure that they meet the WTP requirement. Measured melt viscosity values for 421 LAW glasses from the VSL LAW glass database, along with the WTP limits [73] are given in Figure 3.1. As is evident from the figure, almost all of the glasses meet the viscosity requirement. Measured electrical conductivity values for 413 LAW glasses from the VSL LAW glass database, along with the WTP limits [73] are given in Figure 3.2. Again, almost all of the glasses meet the electrical conductivity requirement. The PCT sodium and boron releases of the LAW glasses in the database, along with the WTP contract limits [41] are illustrated in Figure 3.3. The left side of the figure shows data for all of the glasses including the SRL-EA glass [74] used as a standard. The three other data points with PCT releases significantly higher than the WTP limit at the left side of the figure belong to statistically designed matrix glasses and are not compositions that will be used for LAW processing at the WTP. The right side of the figure shows that almost all of the LAW glasses meet the PCT release requirements. Based on this review, viscosity, electrical conductivity and PCT release were not used as screening criteria, except to make sure that the selected glasses meet the WTP contract requirements for these properties. The critical properties that remained for screening the glasses were K-3 refractory corrosion and VHT alteration rate. The selection process first eliminated glasses that did not meet the K-3 refractory corrosion criterion. From the remaining glasses, bounding glass compositions were selected that are at the high end of (or above) VHT alteration rate requirements

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so that the expected LAW glass composition range is adequately covered.

Previous analysis of VHT alteration rate [65] data showed a strong correlation between VHT alteration rate and alkali content of the glass. A similar correlation is expected for the K-3 corrosion data. Figure 3.4 shows K-3 corrosion as a function of Na_2O concentration (top) and as a function of alkali concentration (bottom). The K-3 neck corrosion label on the y-axis refers to corrosion of the K-3 coupon at the glass-air interface after a 6-day test at 1208°C with air bubbling. In the bottom graph, alkali concentration is given as $\text{Na}_2\text{O} + 0.6 \text{ K}_2\text{O} + 2 \text{ Li}_2\text{O}$ to approximate the molar concentration effects of the components. From the bottom part of the figure, it is evident that K-3 corrosion increases rapidly above $\sim 21 \text{ wt}\%$ alkali. Plots of VHT alteration rates as a function of alkali content are given in Figure 3.5 for the VSL LAW glasses, and seven of the PA glasses (top) and nine of the PA glasses (bottom). Two of the PA glasses have VHT alteration rates well above the WTP contract limit. Again, from the plots it can be seen that VHT alteration rates increase rapidly at alkali concentrations above about $21 \text{ wt}\%$. Based on these observations, it was decided to select a number of the bounding glass compositions at the high alkali end of the glass composition range using VHT alteration rate and K-3 refractory corrosion as the primary screening criteria. The remaining bounding glasses were selected to provide adequate coverage of the composition space expected for the Hanford LAW glasses.

3.2 Selection of Bounding Glasses

Review of VHT alteration rate and K-3 refractory corrosion data indicated that bounding glass compositions are best selected at the high alkali end of the LAW glass composition range. Alkali concentrations in the WTP LAW glasses result from three sources: (1) Na_2O from the Hanford LAW, (2) K_2O from the Hanford LAW, and (3) Li_2O added as a glass former. Since Na_2O is the major alkali component in Hanford LAW, four bounding glass compositions were selected at the high-sodium end of the composition range. For this, VHT alteration and K-3 corrosion data for these glasses were analyzed in three concentration ranges: (1) $25.0 \text{ wt}\%$ Na_2O , (2) 23.5 to $24.5 \text{ wt}\%$ Na_2O , and (3) 23.0 to $23.5 \text{ wt}\%$ Na_2O . VHT alteration rates and K-3 refractory corrosion of glasses with $25.0 \text{ wt}\%$ Na_2O are given in Figure 3.6. The K-3 refractory neck corrosion limit of 0.04 inches and the VHT alteration rate limit of $50 \text{ g/m}^2/\text{day}$ are also shown on the plot. The glasses that are available for the selection are also indicated on the plot. Even though most of the LAW glasses meet the viscosity criteria, three of these glasses (ORPLA5, ORPLA6 and ORPLA7) have viscosity values outside of the acceptable WTP upper limit of 150 poise at 1100°C . Another glass (LAWA195) shows about $3 \text{ vol}\%$ crystals. Of the remaining glasses, ORPLB2 has K-3 refractory corrosion close to the limit of 0.04 inches and VHT alteration rate slightly more than double the WTP limit. Due to its high Na_2O concentration, properties relevant to processing that are close to but within limits, PCT releases within the WTP limits, and only VHT above the WTP limit, ORPLB2 was selected as the bounding glass composition for the full suite of Single Pass Flow Through (SPFT) testing and PCT-B testing.

VHT alteration rates and K-3 refractory corrosion of glasses in the 23.5 to $24.5 \text{ wt}\%$ Na_2O

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range are given in Figure 3.7. The horizontal lines show the VHT alteration rate limit of 50 g/m²/day, as well as the upper and lower variability limits based on replicate measurements. In this plot, three glasses meet both the K-3 corrosion and VHT alteration rate requirements, if the variability in the VHT measurements is included. Of the three, one (ORPLA13) does not meet the viscosity requirement. Therefore, the remaining two (ORPLA15 and ORPLA20) were selected for PCT-B testing. Both ORPLA20 and ORPLA15 have been used in melter tests at the VSL; results of their PCT testing are also available for comparison. VHT alteration rates and K-3 refractory corrosion of glasses in the 23.0 to 23.5 wt% Na₂O range are given in Figure 3.8. Of the three glasses that meet both the K-3 corrosion and VHT alteration criteria, LAWA187 has the highest VHT alteration rate. In addition, even though within the WTP limits, LAWA187 shows high PCT releases as compared to most other LAW glasses. This glass was, therefore, selected for PCT-B testing. LAWA187 has been used in melter tests at the VSL and archive samples of the melter glass are available for testing.

VHT alteration rates and K-3 refractory corrosion of high-alkali (>21 wt%) glasses with >3 wt% K₂O are given in Figure 3.9. From the plot, five glasses are available for selection. Of these, ORPLG9, with the highest K-3 corrosion and VHT alteration rate within acceptable limits, was selected for partial SPFT testing and PCT-B testing. ORPLG9 has been used in melter tests at the VSL and archive samples of the melter glass are available for testing. Another glass, LAWA125, was selected for PCT-B testing. ORPLG8 was not selected for testing because it is similar in composition to ORPLG9.

Once the high alkali glasses were identified, the remaining glasses for testing were selected to cover the expected composition space for Hanford LAW. The Hanford LAW glass composition range can be illustrated in terms of the Na₂O and SO₃ concentrations, as shown in Figure 3.10. In the first part of the selection process, six glasses from the high-alkali end of the composition region were selected as described above. Another three glasses were selected from the medium and low-alkali part of the composition range, which is also the medium and high-sulfur part of the composition range. Figure 3.10 shows two curves: (1) the inner curve based on the lower waste loading WTP baseline compositions, and (2) the outer curve based on the higher waste loading ORP glasses. A number of the PA glasses are from the WTP baseline glass composition region. Therefore, for the current selections, glasses from the higher waste loading ORP set were selected. For the highest SO₃ and lowest Na₂O concentrations, ORP glass ORPLF7 was selected for partial SPFT testing and PCT-B testing. Another glass, ORPLE12, was selected at the highest SO₃, but higher Na₂O than ORPLF7 (16 wt% versus 12 wt%), for PCT-B testing. A third glass, ORPLD6, was selected for PCT-B testing at the medium SO₃ and Na₂O concentrations from the higher waste loading ORP glasses. All of the selected glasses are shown in Figure 3.10. ORPLD6, ORPLE12 and ORPLF7 have been used in melter tests at the VSL and archive samples of the melter glasses are available for testing.

As the alkali content in LAW glasses is increased, both the VHT alteration rate and the K-3 corrosion increase. One of the glass former additives used to improve both properties is ZrO₂. Recent tests for WRPS [75] to improve technetium retention in LAW glasses showed that ZrO₂ is beneficial for this application also. One of the glasses formulated for this application, LE4H-Zr6,

contains 9.50 wt% ZrO_2 . For the above mentioned reasons, it is likely that higher ZrO_2 glasses will be formulated for WTP to improve both waste loading and technetium retention. Accordingly, this glass was selected for PCT-B testing because none of the other glasses has such high ZrO_2 concentration. Since this was a newly formulated glass, property measurements had not been completed on this glass composition at the time of selection.

3.3 Compositions of Selected Bounding Glasses and Comparison to PA Glasses

A total of 10 glasses were selected as bounding glasses for SPFT or PCT-B testing. The list of glasses and tests conducted on these samples in the present work are given below.

Full SPFT testing - ORPLB2

Partial SPFT testing - ORPLG9, ORPLF7

PCT-B - ORPLB2, ORPLA15, ORPLG9, ORPLF7, ORPLA20, LAWA125, LAWA187, ORPLD6, ORPLE12, LE4H-Zr6

The compositions of the selected bounding LAW glasses are given in Table 3.3. The composition ranges of the selected bounding LAW glasses and the PA glasses are compared in Table 3.4 and Figure 3.11. Both show that the selected LAW bounding glasses cover a larger composition range than PA glasses and include more glasses in the important higher alkali region.

Compared to the PA glasses, the selected glasses have higher alkali (Na_2O and K_2O) concentrations. Glasses with higher alkali concentrations tend to have higher leach rates. Other major differences are higher concentrations of ZrO_2 and the presence of SnO_2 in some of the selected glasses. Both of these components are added to reduce VHT alteration rate as the alkali content in the glass is increased. The selected LAW bounding glasses contain higher concentrations of CaO , and V_2O_5 is present as a glass former additive. Both of these differences are due to the design of the ORP glasses to incorporate higher concentrations of sulfur. A review of the compositions of the PA glasses and the selected LAW bounding glasses in Table 3.4 shows that the compositions of the two sets are different, with the PA glasses mostly in the composition range of the lower waste loading WTP baseline glasses and the selected LAW bounding glasses in the composition range of the higher waste loading ORP glasses. Thus, as intended, the selected LAW bounding glasses appropriately augment the PA glass set such that the composition range is expanded to include higher waste loading glasses that are likely to be used in LAW processing at the WTP. The selected LAW bounding glasses also include glass compositions that have been used in melter tests, which provide the flexibility to use melter glass samples in future testing.

In all, twenty-three 500 g glass batches of the selected glasses were prepared at VSL so that sufficient material was available for all of the planned testing at both VSL and PNNL. The glasses

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were analyzed by both XRF and DCP to confirm their composition prior to acceptance for testing. The glasses were distributed for SPFT and PCT-B testing at PNNL and VSL.

3.4 Glass Preparation

The LAW glasses selected for testing were prepared from reagent grade or higher purity chemicals according to VSL standard operating procedures. Every batch (see full target composition of the ten glasses in Table 3.5) also included a rhenium spike targeted at 0.1 wt% Re_2O_7 , if all of it were retained in the glass. Since rhenium volatilizes from the glass during melting, excess Re_2O_7 was added to compensate, assuming 53.5% retention. This resulted in the addition of 0.93 g instead of 0.50 g of Re_2O_7 to each batch targeting 500 g of glass.

The glasses were prepared in crucible melts by melting the appropriate combination of well-mixed chemicals at 1200°C for 75 minutes in a platinum-gold crucible. Mixing of the melt was accomplished with a platinum stirrer beginning 15 minutes after the start of melting and continuing for the next 60 minutes, until the end of melting. The molten glass was poured onto a graphite plate to cool and the resulting glass was then distributed for analyses. Each crucible melt produced about 500 g of glass. Three 500 g batches each were prepared to obtain sufficient samples for shipping to PNNL as well as full testing at VSL for glasses IDF1-B2, IDF2-G9, and IDF3-F7. Two 500 g batches were prepared for each of the other seven formulations. The glasses were broken into pieces < 1cm in size and samples were collected for analysis by x-ray fluorescence (XRF) and direct current plasma- atomic emission spectroscopy (DCP-AES). Multiple batches of the same glass formulation were mixed together, remelted at 1200 °C, and heat treated according to the canister centerline cooling (CCC) profile given in Figure 2.1 [76] before leach testing.

3.5 Glass Compositional Analysis

The primary method used for glass composition analysis was XRF on powdered glass samples. An ARL 9400 wavelength dispersive x-ray fluorescence spectrometer was used for this purpose. The XRF was calibrated over a range of glass compositions using standard reference materials traceable to the National Institute of Standards and Technology (NIST), as well as waste glasses such as the Argonne National Laboratory – Low-Activity Waste Reference Material (ANL-LRM) [77] and the Defense Waste Processing Facility (DWPF) – Environmental Assessment Glass (SRL-EA) [74]. Since boron and lithium are not determined by this procedure, the glass samples were subjected to acid digestion followed by solution analysis, as described below.

Glass samples for analysis by DCP-AES are first subjected to microwave-assisted total acid dissolution in Teflon vessels according to VSL standard operating procedures. Twenty milliliters of a 1:5 mixture of concentrated $\text{HF}:\text{HNO}_3$ is diluted to 50 ml and used for the dissolution. This procedure is similar to the ASTM Test Method C1412-99, which also employs a mixture of concentrated HF and HNO_3 in microwave digestion of pulverized glass samples; supplemental use

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of HCl/H₃BO₃ is not included in the VSL procedure since boron is normally one of the analytes. The solutions resulting from the acid digestion are analyzed by DCP-AES.

XRF and DCP-AES analyzed compositions of the glasses are given in Tables 3.6 and 3.7, respectively. Any sample that showed relative deviation from the target composition of greater than 10% for any of the major oxides (those present at > 1 wt% target) was rejected, and a fresh batch was prepared. Once deemed acceptable, 700 to 1000 g of glass chunks from multiple batches of each composition were combined in a 1000 ml platinum-gold crucible for CCC heat treatment. Samples after CCC heat treatment also were analyzed for composition by XRF and all were found to be on target (see Table 3.6).

3.6 Evaluation of Secondary Phases

Five of the ten glass samples subjected to CCC heat treatment were clear, but the others appeared opalescent or clearly contained crystals. All ten samples were evaluated by SEM while XRD was used to further identify the crystalline phase observed. Results of the evaluation are given in Table 3.8. IDF2G9, IDF3F7, IDF5A20, IDF8A125 and IDF10ZR6, which appeared optically clear, showed very few or no crystals. A crystal content of 3 to 4 vol% was found in IDF1B2, IDF4A15 and IDF7E12. The two remaining glass samples, IDF6D6 and IDF9A187, contained as much as 19.5 and 22 vol% crystals, respectively. A sodium sulfate aluminosilicate phase identified as sulfate sodalite or nosean (Na₈AlSi₆O₂₄SO₄) was the crystalline phase responsible for the opalescent appearance of all of these glasses. Small amounts of zincochromite also were detected in these samples. Overall, glasses with the highest sodium and aluminum concentrations along with high sulfate content were the most prone to crystallization after CCC heat treatment. Such crystals were not detected in earlier isothermal heat treatments of the same formulations.

SECTION 4.0

DATA FROM ONGOING VSL LAW PCT-B TESTS

VSL maintains a large inventory of ongoing glass leach tests, the oldest of which was initiated in 1978. Hanford LAW glasses were added to this inventory starting in 1994. This inventory includes PCT-B tests on LAW glasses that provide valuable long-term test data for the present study. In the present work, relevant LAW glass tests were selected from this suite of ongoing long-term PCT-B tests. The basis for selection included the relevance of the glass compositions for Hanford LAW as well as the accumulated test durations. In the present work, the selected long-term tests were subjected to sampling and analysis in order to bring the last data point for each test up to the present time. In addition, samples of reacted glass were recovered from selected test vessels for analysis of the secondary phases that have developed. The long-term data set for the selected glasses was compiled and previously submitted to WRPS; the compiled glass compositions and leach data are included in Appendix A.

4.1 PCT-B Data Set

A large data set of results from long term PCT-B testing performed at VSL on WTP LAW glasses was compiled and submitted to WRPS. The data set includes glass compositions, leachate compositions and pH at each sampling interval, sampling times, test conditions (leachant, temperature, S/V, test protocol, etc.), and associated secondary phase information. Data for a total of 253 glass compositions are included in the data set. These glasses span a composition range that is more extensive than those used in previous performance assessment glass testing work. The glass compositions include two new glass former additives that are used in some of the high waste loading Hanford LAW glasses, SnO_2 and V_2O_5 .

The data set includes the results from triplicate leachate analyses for Al, B, Ca, Fe, K, Li, Mg, Na, Si, Ti, Zn, and Zr. The sampling protocol consisted of removal of an aliquot of 4 ml leach solution (or 4% of the total volume) at 7, 28, 56, 120, 181, 269, 365 and 547 days, and yearly after that. The solution that is removed for analysis is replaced with 4 ml of deionized water. Tests on some of these LAW glass samples were initiated in 1999 and are still ongoing. Variations in temperature (40°C and 90°C), S/V (2000 m^{-1} and 20,000 m^{-1}), and the effect of leaching vessel (stainless steel and Teflon) are also represented in this dataset.

Figure 4.1 shows the measured normalized leachate concentration curve for a representative glass (A1-AN105-R2), which illustrates the five stages of leaching:

- A transition from Stage I to Stage II takes place when the initial rise in concentration is no longer linear and the rate falls below its initial value

- The transition from Stage II to Stage III is associated with a large decrease in rate
- Stage IV is typified by a nearly flat portion of the curve where the rate is characteristic of the low residual rate value
- Stage V is characterized by a resumption in leaching when the rate rises from the residual rate value towards the initial rate.

4.2 Secondary Phase Analysis

Samples of altered glass were collected from the selected ongoing PCT-B tests and analyzed. For each glass, the PCT-B is typically performed in triplicate, in three sealed stainless steel vessels (304L). In cases where the selected glass has shown a resumption of alteration (Stage V), one vessel from the triplicate set was typically sacrificed for sampling. For glasses that are observed to be in the residual rate regime (Stage IV), and which have not yet reached Stage V, a small amount of the altered glass was removed from one of the triplicate set of vessels (which is then so identified).

Samples representative of broad families of long-term PCT responses were selected among those subjected to the longest leach periods (117 glasses tested for longer than 750 days and up to 3982 days of PCT-B leaching). From this population, JMP[®] 7.0.1 Partition Platform⁵ was used to sub-divide the glasses available for long-term sampling and guide the selection process. JMP's partition platform enables the user to systematically analyze large data sets to discover unsuspected or unknown relationships. In this partition analysis, the normalized boron leaching (in g/m²) versus glass composition (in molar fraction) behavior was used to develop constraints to classify the glasses into subsets or clusters. The set of seven constraints that were selected to partition the glasses into seven clusters are presented in Table 4.1. As shown in Table 4.1, at least two and up to six glasses were selected from each cluster for subsequent sampling. Table 4.1 also shows all of the selected glasses, their respective leaching stage at the time of sampling, and the total number of glasses in each cluster. The selected altered glass samples were collected and then rinsed and dried prior to preparation for analysis by XRD and SEM.

For XRD analysis, powders of dried altered glass samples were used. Measurements were typically made in the 2 θ range of 5 to 80° at a step width of 0.02° and count time of 5 seconds at each step. The XRD patterns were analyzed using a pattern-matching software with an associated XRD pattern database. In previous analyses of altered glass samples from this inventory that have been subjected to long-term leaching, typical phases identified included nontronite, saponite, smectites (a group of phyllosilicate mineral species), phillipsite, zeolites, analcime, etc. SEM was used to characterize the microstructure developed at the interface between the glass and the leachant and EDS was used to analyze the glassy and crystalline phase compositions. SEM-EDS also permits analysis of composition variations through the altered layer and into the remaining glass.

The data set from this work was initially submitted to WRPS in June 2010 and updated in

⁵ www.jmp.com

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September 2010; the compiled XRD and SEM data are included in Appendix B. Summary observations regarding the secondary phases observed in these samples are as follows:

- Analcime is present in large amounts on the surface of glasses exhibiting high or medium alteration
- Zeolites, such as phillipsite, are present in samples taken at Stage V of alteration
- Phyllosilicates of the smectite group (stevensite, swinefordite) are detected in most samples and are generally associated with glasses that show low alteration.

Clearly, the very extensive set of data extending over wide composition ranges and over very long leaching durations deserve considerably more detailed analysis than that presented here. However, the objective of the present work was to collate the data and collect associated secondary phase information for a representative subset of the glasses tested in order to make the information available for future analyses to support the IDF PA.

SECTION 5.0

PCT-B AND VHT TESTING OF SELECTED GLASSES

The ten new LAW glasses for testing in the present work were selected with the goal of intentionally challenging the WTP contract leachability limits (PCT-A and VHT); as described in Section 3.0, some of the glasses such as IDF1-B2 performed poorly in VHT but still pass the PCT-A limit. Some formulations include higher sodium or sulfate content than present WTP baseline glasses, new additives (SnO_2 and V_2O_5), and extended ranges of constituents (such as higher ZrO_2). In the present work, long-term PCT-B tests were performed on the ten newly selected glasses. In these tests, the ratio of the glass surface area to the leachant volume (S/V) and the test temperature were varied from the nominal PCT values (2000 m^{-1} and 90°C). A higher S/V value ($20,000 \text{ m}^{-1}$) and a range of temperatures were used in order to investigate the effects of leaching behavior and the secondary phases that are formed. Temperature effects were investigated by performing selected tests at lower and higher temperatures (40°C and 120°C). Not all combinations of temperature and S/V were tested: temperatures of 40°C and 90°C were investigated at S/V of 2000 m^{-1} while the higher S/V of $20,000 \text{ m}^{-1}$ was used in combination with the higher temperatures (90°C and 120°C) in order to optimize the possibility of reaching the more advanced stages of corrosion and facilitate secondary phase formation and identification. Once initiated, these tests were continued with periodic sampling and analysis throughout the program to obtain a set of long-term test data on the selected glass compositions.

As discussed in Section 3.0, the target compositions of the ten selected glasses are presented in Table 3.5. It should be noted that the glass names were appended with “CCC” for the samples that were subjected to canister centerline heat treatment; the PCT-B testing was performed on the CCC-treated samples. The results from the PCT-B tests are tabulated in Appendix C.

5.1 Product Consistency Test (PCT)

The product consistency test (PCT; ASTM C 1285) is used to evaluate the relative chemical durability of glasses by measuring the concentrations of the chemical species released from 100-200 mesh crushed glass ($75\text{-}149 \mu\text{m}$) to the test solution (de-ionized water in this case). PCT-A tests (90°C , 2000 m^{-1} , 7-day) had been performed previously on all of the selected LAW glasses, in accordance with the current WTP contract requirement. Thus, in the present work, higher S/V values ($20,000 \text{ m}^{-1}$) and different temperatures (40 and 120°C) were investigated over extended leaching times. All tests were conducted in triplicate, in 304L stainless steel vessels, and in parallel with a standard glass included in each test set. The internal standard was the ANL-LRM reference glass [77], which has undergone round-robin testing. The leachates were sampled at predetermined times, with samplings at 7, 28, 56, 120, and 180 days; not all tests reached the later sampling points during the present work but many of the tests are ongoing. Note that the 4 ml sampling volume (out of

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100 ml) with replacement by deionized water constitutes a small deviation from purely static leaching conditions. However, as the data will show, the very low but non-zero flow rate does not preclude closely approaching saturation conditions and extensive secondary phase formation within the duration of these tests. The tests performed at the highest temperature and S/V values (120°C , $20,000\text{ m}^{-1}$) were discontinued at the 119-day sampling point for characterization of the reacted glass. In each sampling, one milliliter of sampled leachate is mixed with 20 ml of 1M HNO_3 and the resulting solution is analyzed by DCP-AES; another 3 ml of sampled leachate is used for pH measurement.

The PCT results of the ten newly prepared and canister centerline cooled glasses compare well with the results of 7-day PCT tests on quenched glasses performed earlier. The results are compared in Figure 5.1. It is notable that the results for all glasses are below the PCT limit of 2 g/m^2 , with all except IDF9-A187 being less than about half of that limit. In general, there is not a large difference between the quenched or canister cooled glasses, with a general trend of slightly lower leaching from the canister cooled glass. The exception is in the case of IDF9-A187, which showed significantly lower leaching after canister cooling. In this glass, CCC heat treatment induced extensive ($\sim 22\text{ vol}\%$) crystallization of sodalite, which is a likely source of this difference; however, IDF6-D6, which crystallized in similar manner and to a comparable extent, did not exhibit such a difference.

To support the following discussions on PCT-B results, the glass compositions are provided in Table 5.1 expressed in mol% and compared to that of LAWA44, the Envelope-A baseline glass, and the ANL-LRM glass. From this table it is evident that IDF9-A187, which shows the highest leaching on PCT-A, is not the glass with the highest alkali content; it is, however, the glass that is highest in aluminum and boron and lowest in silicon, and the glass that is most susceptible to nosean crystallization. Nosean crystals ($\text{Na}_8\text{AlSi}_6\text{O}_{24}\text{SO}_4$) formed upon CCC treatment will alter the composition of the remaining glass that is subjected to leaching thereby changing the PCT response. It has also been speculated [78] that the presence of crystals may create grain boundaries that can selectively undergo accelerated leaching.

It is noted that in view of the relatively poor leaching behavior of the LAWA187 formulation (here tested as IDF9-A187), and particularly its VHT high alteration rate, the glass was reformulated to address these issues as well as the crystallization on CCC treatment. Thus, LAWA187 (for tank AN-105) was revised to formulation ORPLA20, which is also one of the ten selected glasses tested in the present work, as IDF5-A20.

5.1.1 Extended PCT-B: Effect of Time

The new PCT tests that were initiated in the present work were sampled at 7, 28, 56, 120, 180 days and are continuing, with the exception of the tests at 120°C , which were stopped at 119 days for sampling for secondary phase analysis (see Section 5.1.3). Under the standard conditions (90°C , 2000 m^{-1}), the normalized PCT release was observed to increase with time, as exemplified by

the curve depicted in Figure 5.2 for glass IDF1-B2, for at least 180 days. This glass, as was the case for every one of the ten new samples tested, exhibits the first four stages of leaching behavior described in Section 4.1. Boron and sodium are both leached at higher rate than silicon. No resumption of alteration (Stage V) is evident over the time period covered so far but tests are continuing. An overview of the observed PCT leaching behavior over time for all ten glasses is presented in Figure 5.3 for B and Na. Characteristic of leaching over time is the rate drop in Stage (III) on the approach to saturation and/or as a passivating gel layer develops at the glass/water interface.

For five of the glasses (IDF1-B2, IDF3-F7, IDF4-A15, IDF7-E12 and IDF8-A125) and the ANL-LRM reference glass, normalized boron and sodium release are approximately linear when plotted as a function of the square root of time from 7 to 56 days, with slopes increasing in the order: $IDF3-F7 \approx IDF7-E12 > IDF4-A15 > IDF1-B2 > IDF8-A125 > ANL-LRM$. However, the correlation is much less convincing for the other five glasses because their concentration vs. time curves “flatten out” much more quickly (Figure 5.3). Many authors have interpreted a square root of time dependence as an indication of diffusion control (such as transport through a protective layer) being rate limiting rather than the approach to saturation but such apparent correlations are insufficient to separate these alternative explanations for the rate decrease and more extensive tests are required. However, it is likely that both mechanisms can be important in the overall glass leaching process and it is noteworthy that the effects of diffusion barriers (e.g., resulting from the growth of alteration layers on the glass surface) are not included in the prototypical rate law (Equation (1.1)).

The normalized leaching rates of boron and sodium are more than twice that of silicon for most glasses, with the exceptions of IDF3-F7 and IDF7-E12. In these two glasses, boron remains closer to silicon and is significantly lower than sodium and lithium (present only in these two glasses). Furthermore, although sodium and lithium are approximately congruent in IDF3-F7, they differ significantly in IDF7-E12 (Figure 5.5). This behavior is notable since boron is generally used to provide a measure of the reaction rate of the glass matrix and is therefore the preferred component used in modeling (see further discussion in Section 6); it is therefore the component used to define glass reaction rate in the prototypical rate law in Equation (1.1). In terms of Equation (1.1), such behavior would imply a very large ion exchange rate for these glasses, which seems unlikely. More generally, such observations highlight potentially important effects that may be missing from Equation (1.1).

Solution pH values range from 10.88 for IDF10-Zr6 to 11.66 for IDF9-G2 (Figure 5.6) and increase moderately over time; at the 7-day sampling, the leach concentrations show that the glass reactions have already reached Stage II, and possibly Stage III in some cases; the early $H^+ \leftrightarrow$ alkalis inter-diffusion causes the early rise in pH. There is a good correlation between pH and sodium concentration in the leachate (plus lithium for IDF3-F7 and IDF7-E12) shown in Figure 5.7. For IDF10-Zr6, the pH is generally lower than expected on the basis of the released sodium. There is also a weak linear trend ($R^2 = 0.63$) of 7-day pH variation with the total molar fraction of alkalis in the glass. Significant deviations from that trend are IDF9-A187 at pH 11.65, higher than expected based on alkali content, and the high zirconia glass IDF10-Zr6, which deviates from the trend with a

much lower pH than expected based on the total alkali content of the glass.

5.1.2 Extended PCT-B: Effect of S/V

PCT leach testing at ten times higher S/V ($20,000 \text{ m}^{-1}$ versus $2,000 \text{ m}^{-1}$) significantly increases the resulting pH at the same sampling time (Figure 5.8). At the same temperature of 90°C , pH increases by approximately one full unit. For the five glasses highest in alkalis (IDF1-B2, IDF2-G9, IDF4-A14, IDF5-A20, and IDF9-A187), the pH difference is a little less (about 0.8). Conversely, the pH increases more (by 1.1 to 1.2 units over time) with glass IDF8-A125. Furthermore, as shown in Figure 5.9, glass IDF8-A125 differs from the other nine glasses in the much greater magnitude of the effect of increased S/V on the concentrations of leached constituents. Leachate concentrations increased by a factor of about 11 to 17 over the 56 days of testing for this glass. Next, is IDF7-E12, for which normalized leachate concentrations rise by a factor of about 10, while for all other glasses, the increase is by about a factor of 4 to 5 at the higher S/V. Glass IDF8-A125 is one of two high potassium glasses, the other one being IDF2-G9. IDF8-A125 does not contain any SnO_2 and is the only glass with less than 3 wt% ZrO_2 . Group IV elements are believed to improve the cohesiveness of the hydrated glass when used within limits [79]; more than 3 wt% ZrO_2 (or 1.2 mol% Zr) appears necessary to maintain lower leaching with high alkali glasses such as the formulations tested here. Along with low alumina (5.6 mol% Al in this case), this glass offers few charge compensation sites for alkalis, and likely produces a gel of little cohesiveness and protection. Figure 5.7 shows that IDF10-Zr6, which contains 9.5 wt% ZrO_2 , deviates from the pH vs. sodium trend. Recent studies of simplified glasses ranging from 1 to 8 mol% zirconium, suggest that increasing Zr beyond 4 mol% considerably slows the glass dissolution kinetics in the early stage of corrosion but ultimately leads to a greater degree of corrosion [79-82].

5.1.3 Extended PCT-B: Effect of Temperature

In addition to the standard temperature of 90°C , PCT tests were conducted at 40°C and at 120°C . The low temperature was combined with a low S/V, which is likely to produce a lesser extent of reaction, while the high temperature was combined with high S/V to maximize the extent of reaction.

The test results for all of the glasses are plotted in Figure 5.10. Note that the 120°C data are shown on a log scale extending to 1000 g/L normalized, which corresponds to fully reacted glass. The high temperature/high S/V combination (120°C , $20,000 \text{ m}^{-1}$) resulted in greatly increased leaching which drove the reactions to Stage V for four of the LAW glasses (IDF3-F7, IDF6-D6, IDF7-E12 and IDF9-A187) and for the ANL-LRM reference glass (as early as 28 days in this case – see Figure 5.10, top). By the time the leaching analyses were available, it was apparent that the resumption of alteration had taken place but the tests were continued for all glasses until 119 days, at which point all tests were terminated and the glass was sampled for characterization (Section 5.1.5). For the glasses at Stage V, most of the leaching solution was also consumed in the hydration process and only hydrated glass material was sampled. It is notable that all four of these glasses contain 6.5

to 10 wt% calcium. Calcium normalized release in these cases rises above 0.1 g/L, while boron, sodium, and silicon increase and aluminum decreases. This may be indicative of the formation of secondary phases, which are identified and discussed in Section 5.1.5. The other six glasses were found to show less than 10% reacted glass, if estimated on the basis of normalized boron release. Most of these glasses show a significant residual rate of alteration (4×10^{-3} to 6×10^{-3} g/m²·d) with the exception of IDF10-Zr6, for which the alteration rate remains much lower (less than 1×10^{-3} g/m²·d).

At the lower temperature of 40°C (and standard S/V of 2000 m⁻¹), the extent of leaching was correspondingly much lower, as can be seen in the lower part of Figure 5.10. (Note that the 40°C data are plotted on a linear scale). At 40°C and 2000m⁻¹ S/V, the normalized boron release remains well below 4 g/L. Leaching from glass IDF9-A187 is more than double that from all other glasses from the earliest time, with a higher residual rate (1×10^{-3} g/m²·d) between 120 and 180 days. A similar behavior is observed with IDF8-A125 after 120 days. As shown in Figure 5.11, the order of the ten LAW glasses based on normalized boron leaching after 180 days at 40°C is:

IDF9-A187>>

IDF8-A125>IDF6-D6>IDF3-F7>IDF10-Zr6>IDF7-E12>IDF5-A20>IDF1-B2> IDF4-A15

The temperature dependence of the glass dissolution rate can be expressed as an Arrhenius function, yielding from its slope the apparent activation energy of the controlling reaction. Such plots are shown in Figure 5.12, where the breaks are due to the difference in S/V which offsets the two points at 120°C and 90°C (S/V = 20,000 m⁻¹ on the left) from the two points at 90 °C and 40°C (S/V = 2,000 m⁻¹ on the right). The slopes for the two portions are generally quite close. This break is also evident in the plot of the pH values versus temperature shown in Figure 5.13. The slopes of these plots suggest apparent activation energies of about 30 kJ/mol, which is about half of the values that are determined for specific aspects of the assumed rate law (Equation (1.1) from SPFT tests, as discussed in Section 6.3. However, it should be noted that in tests such as the PCT, many components of the overall glass alteration reaction are proceeding in parallel and therefore the slopes of such Arrhenius plots provide only an apparent activation energy for the composite process.

As shown in Figure 5.14, the logarithm of the normalized sodium release rate for all of the ten LAW glasses and the ANL-LRM reference glass is observed to vary approximately linearly with the leachate pH ($R^2 = 0.86$ at S/V = 2000 m⁻¹). The data for different temperatures fall on the same curve whereas those for different S/V values fall on separate curves, with the curve for the higher S/V data displaced to higher pH values.

5.1.4 Congruence of Sodium and Boron

The ratio of the normalized boron concentration to the normalized sodium concentration provides a measure of the extent to which these species are released congruently (ratio ~ 1) as compared to a predominance of interdiffusion (B/Na < 1) or retention of sodium in the hydrated gel layer (B/Na > 1), for example as charge compensation for the four-coordinated aluminum that may

be part of the protective gel layer, or as a result of its inclusion in secondary phases that may precipitate as leaching progresses. A summary of this B/Na ratio for the first 56 days of leaching for all glasses is shown in Figure 5.15.

The B/Na ratios from tests performed at 40°C generally remain at low (below 1) due to the slower reaction progress. Glass IDF9-A187, which has been clearly identified as a more reactive glass under all conditions, is a notable exception. The results for test conducted at 90°C and 120°C can be summarized in terms of three different types of behavior:

1. Glasses showing B/Na ~ 1 at 90°C and for which B/Na <1 at 120°C:

IDF1-B2
IDF2-G9
IDF4-A15
IDF5-A20

These are all glasses with greater than 38 mol% alkali content but low in alkaline-earth.

2. Glasses for which B/Na exceeds 1 at both temperatures:

IDF8-A125
IDF9-A187
IDF10-Zr6
ANL-LRM

These are all glasses slightly lower in alkali but also higher in elements that require charge compensation in the glass structure (Al, B, Zr), thus releasing slightly higher boron than sodium.

3. Glasses for which B/Na remains low (~0.5) until the reaction reaches Stage V:

IDF3-F7
IDF6-D6
IDF7-E12

These are all glasses that were designed for high sulfate tank wastes. This led to decreased waste loading, which was limited by the SO_4^{2+} content in the waste. The formulations therefore include greater calcium content (7 to 8.5 mole%) and in some cases, addition of lithium (IDF3-F7 and IDF7-E12), since both Ca and Li were found to improve sulfate incorporation in the glass. All three formulations also include vanadium, but vanadium is also included in some of the formulations found in the above two groups and therefore does not appear to play a major role in determining congruence. Figure 5.16 shows the B/Na ratio for 28 and 56 days leaching plotted

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against the sulfate content measured in the glasses; it should be noted, however, that higher sulfur content drives potentially much more significant changes in the glass compositions so the effect of sulfur content is likely rather indirect.

5.1.5 Phase Identification by X-Ray Diffraction

Results of XRD analyses of the glass samples recovered after termination of the 120°C, 20,000 m⁻¹ S/V test are provided in Appendix D. Three types of behavior that differentiate the ten LAW glasses and the ANL-LRM glass can be deduced from these analyses:

1. Glasses that remained amorphous and for which no XRD pattern could be detected above the characteristic broad peak of the glass:

IDF2-G9
IDF5-A20
IDF10-Zr6

This group also includes glasses that remained mostly amorphous but for which a few small diffraction peaks are observed that correspond to the pre-existing ~3 vol% crystallization of lazurite (nosean):

IDF1-B2
IDF4-A15

2. Glasses that remained predominantly amorphous but for which some diffraction peaks are observed; these diffraction peaks indicate a zeolite such as analcime $\text{NaAlSi}_2\text{O}_6 \cdot (\text{H}_2\text{O})$:

IDF8-A125, which is mostly amorphous with a few peaks due to analcime.
IDF6-D6, in which the pre-existing pattern of nosean (20 vol%) remains, but with additional peaks due to zeolite.
IDF9-A187, in which the pre-existing pattern of (22 vol%) nosean remains, but with additional peaks due to a zeolite, gmelinite $(\text{Ca}, \text{Na}_2)\text{Al}_2\text{Si}_4\text{O}_{12} \cdot 6(\text{H}_2\text{O})$.

3. Glasses formulated for high sulfate content, in which both a zeolite and hydrated sodium sulfate phases are evident.

IDF3-F7, which shows analcime and bloedite $\text{Na}_2\text{Mg}(\text{SO}_4)_2 \cdot 4(\text{H}_2\text{O})$.
IDF7-E12, in which the pre-existing pattern of nosean (3 vol%) remains, but with additional peaks due to zeolite and hydrated sodium calcium sulfate $\text{Na}_4\text{Ca}(\text{SO}_4)_3$.

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Glass ANL-LRM could be associated with the third group, although it generally reacted much more than any of the LAW glasses; in the XRF sample after 119 days at 120°C, very little glass remains. The diffraction pattern is broad and shows evidence of hydrated sodium and calcium aluminosilicates of the zeolite group such as chabazite $(\text{Ca}_{0.5}, \text{Na}, \text{K})_4(\text{Al}_4\text{Si}_8\text{O}_{24}) \cdot 12\text{H}_2\text{O}$ and philipsite $(\text{Na}, \text{K}, \text{Ca})_{1-2}(\text{Si}, \text{Al})_8\text{O}_{16} \cdot 6(\text{H}_2\text{O})$.

5.1.6 Extended PCT-B: Discussion

The results from these PCT tests over extended periods of time, multiple temperatures, and multiple S/V ratios showed that all phases of alteration were evident for many of the glasses tested, even over the limited test duration. The results also show that although the LAW glasses selected for this evaluation are glass compositions that have higher waste loadings than those developed for the WTP baseline, they follow generally similar leaching behavior. Based on the compositions of the five glasses (IDF1-B2, IDF2-G9, IDF4-A15, IDF5-A20 and IDF10-Zr6) that perform generally better than the others, it is evident that an increase in total alkali content alone is not necessarily detrimental to long-term PCT leaching. Furthermore, glass IDF1-B2, which has the highest alkali content of all ten glasses and which fails the WTP VHT requirement by a significant margin (see Section 5.2), was actually one of the better performing glasses over the range of PCT-B conditions investigated. Glass IDF1-B2 showed robustness with respect to moving from Stage IV to Stage V despite increases in test temperature and S/V, both of which promote more interactive leaching conditions that drive the system towards secondary phase formation.

Nosean crystallization, which was observed in samples heat treated according to centerline canister cooling, may also cause enhanced leaching but since the occurrence of this crystal can be easily reduced through reformulation, this should not be a significant concern for more typical WTP glasses. However, inclusion of such glasses in the present work adds to the bounding nature of the selected formulations.

Use of calcium as an additive has been found to be beneficial in the case of the French HLW glass R7T7. However, the primary reason for its inclusion in the WTP LAW glasses is to improve sulfate incorporation. The present results provide some indications that high calcium contents may promote earlier transition to Stage V behavior, which would be worth further investigation. The present tests were all conducted in de-ionized water whereas the realistic situation in the IDF will likely also include calcium (and other constituents) as a reactant coming from the leaching solution. Leach tests similar to those presented in this report but using simulated repository pore water would be enlightening. Prior testing in support of the ILAW PA has focused on leaching in deionized water with spikes of specific presumed rate-controlling species such as silicon and, in some case, aluminum.

Sulfate phases such as $\text{Na}_2\text{Mg}(\text{SO}_4)_2 \cdot 4(\text{H}_2\text{O})$ and $\text{Na}_4\text{Ca}(\text{SO}_4)_3$ were identified at the surface of highly reacted glasses (PCT at 120°C and S/V of 20,000 m^{-1}). The role of sulfate in glass leaching

is one that has not been extensively considered, especially since it is of low solubility in the glass and is rarely included at much greater than 0.5 wt% SO₃. Glasses IDF3-F7, IDF7-E12 and IDF6-D6 have been designed to increase the sulfate glass content to above 1 wt% through associated changes in the balance of the glass composition. The significant departures from congruency of boron and sodium (and lithium) observed for these glasses, and the slower release of boron, are noteworthy and deserve further attention.

5.2 Vapor Hydration Test (VHT)

All of the glass compositions selected for PCT-B tests had already been subjected to the VHT. The results of the VHT tests are given in Figure 5.17. A summary of the test method and conditions is provided below

The vapor hydration tests are run in Parr series 4700 screw-cap pressure vessels made of 304L stainless steel and having either 22 or 45 ml capacity in accordance with VSL procedures. Glass coupons are prepared about 5 to 10 mm square, about 2 mm thick, and with one cut and one fractured surface. A hole, approximately 1.6 mm in diameter, is drilled near one corner of the coupon to allow it to be suspended from a hanger made of 24 gauge stainless steel wire. Dimensional measurements are made to permit calculation of the area, and the coupon is weighed before and after the VHT on a balance having a resolution of 100 µg. The coupon is suspended vertically from the hanger in the pressure vessel and enough deionized water is added to the vessel to saturate the volume at the test temperature of 200°C, and to allow for a non-dripping layer covering the coupon. The pressure vessels are flushed with argon, sealed, weighed, and placed in an oven held at 200°C. The temperature is monitored continuously with an independent thermocouple. At the completion of the test, the pressure vessels are removed and immediately partially immersed in an ice/water bath to condense the water vapor near the bottom of the vessel. Once cool, the vessels are weighed and opened, and then the coupons are removed and weighed. If the difference in the mass of the sealed pressure vessel before and after the test indicates a water loss in excess of 50% of the original amount, the test results are discarded. Otherwise, the coupons are examined using low-power optical microscopy and an XRD pattern is taken directly off the surface of the coupon. Next, the coupons are sectioned and the pieces mounted separately to allow SEM examination both of the cross section of the leached coupon and the leached surface itself. The thickness of the altered layer is measured and used to determine the alteration rate under VHT conditions. For consistency with all existing data, the nominal test duration is 24 days.

Two of the VHT coupons were extensively studied in an effort to relate the above description of long-term reactivity at 120°C and high S/V to the results of the VHT. Images resulting from SEM analyses on the VHT coupons of glass ORPLA20 and ORPLE12 are presented in Figures 5.18 and 5.19, respectively. Layer thicknesses presented in the bar graph are measurements made from SEM cross sections such as these. Further examination of the leach layers using EDS line scans (Figures 5.20 through 5.24) yields information about the profile of the components across the alteration layer. These results show that the alkalis (sodium is shown) are depleted in the alteration layer while

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aluminum, silicon, and zirconium are enriched. A sodium aluminosilicate matching the analcime mineral composition ($\text{NaAlSi}_2\text{O}_6 \cdot (\text{H}_2\text{O})$) was identified on the surface of ORPLE12 by EDS. Multiple other aluminosilicates were present but could not be unambiguously identified.

As noted above and shown in Figure 5.17, the VHT results for glass ORPLB2 (IDF1-B2) exceed the WTP contract limit. This glass was deliberately included in the present study to provide such a bounding case. However, the results from the PCT-B tests over a range of test conditions suggest that, by that measure, this is actually one of the more durable glasses. Accordingly, it may be prudent to reconsider the role of the VHT in the criteria for acceptance of LAW compositions for production at the WTP or at least the present contract limit. It is quite possible that the present limit may exclude higher waste loading glasses that would meet the IDF PA, which is not an economically desirable situation.

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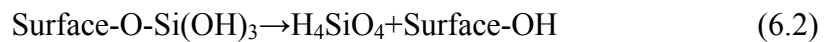
SECTION 6.0 SINGLE PASS FLOW THROUGH TESTS AND KINETIC LAW

6.1 Background

The kinetics of glass dissolution under dilute conditions have traditionally been modeled using the transition state theory (TST) as applied by Aagard and Helgeson [10] for the dissolution of minerals and modified by Grambow [11] for the dissolution of glasses. Briefly, glass corrosion is considered to proceed through a number of reversible and irreversible reactions with rates calculated according to the following equation:

$$r_j = k_j \Pi a_i^{v_{i,j}} (1 - \exp(-A_j / \sigma_j RT)) \quad (6.1)$$

where r_j is the rate of the reaction j , k_j is the rate constant, a_i are the activities of reactants i and $v_{i,j}$ are their stoichiometric factors in the reaction j , A_j is the affinity of the reaction j , σ_j is the stoichiometric reaction coefficient, which describes the ratio of the rate of the reaction j to the overall glass corrosion, R is the gas constant, and T is the absolute temperature. The rate of glass dissolution is expected to be the rate of the slowest irreversible reaction that takes place on the surface of the glass ($\sigma=1$), which, according to TST, is the irreversible decomposition of a critical activated complex. Because, SiO_2 is the dominant glass constituent, it is generally accepted that formation of orthosilicic acid is the primary driving force behind silicate glass corrosion:



Reaction (6.2) suggests that hydrolysis of the first three bonds of the silica tetrahedron is rapid and not-limiting, and independent of the X atom in the Si-O-X bond [86]. As a result, the rate at which glass dissolution rate proceeds can be described by the following equation:

$$r = k_0 10^{\eta \cdot \text{pH}_T} \exp(-E_a / RT) [1 - (Q / K_g)] \quad (6.3)$$

where η is the power law coefficient, E_a is the activation energy, Q is the ion activity product, K_g is the pseudo-equilibrium constant of the irreversible reaction, and pH_T refers to the pH at the temperature T . Under dilute conditions, $Q \ll K_g$ and Eq. (6.3) can be written as:

$$r = k_0 10^{\eta \cdot \text{pH}_T} \exp(-E_a / RT) \quad (6.4)$$

Eqs. (6.3) and (6.4) suggest that, provided enough data are collected, the parameters k_0 , η , E_a , and K_g can be estimated by performing linear and nonlinear regression analyses on the glass dissolution rates obtained experimentally at steady state by varying pH and temperature and under dilute and

near-saturation conditions [2, 3]. The single-pass flow-through (SPFT) test method [83] is well-suited to such measurements and was used for that purpose in the present work. Details of the test set-up that was employed are provided below.

6.2 Experimental Methods

6.2.1 Description of the SPFT Setup

In an SPFT experiment, a solution flows at constant temperature and rate through a reaction cell (leaching reactor) containing the sample. The system is open-ended, hence operating in a “single-pass” mode. The reactor employs diffusive mixing facilitated by a very long residence time (of the order of tens of hours) of the mobile phase in the reactor. In the SPFT test, the dissolution kinetics of a glass specimen of a specific composition are quantified over a range of pH_{RT} values⁶ (typically 7 to 12), temperatures (typically 23 to 90°C), and solution compositions (typically Si doped at various concentrations). Dissolution rate parameters are obtained following establishment of steady-state conditions between the glass and the aqueous solution. At steady-state conditions, the pH and concentrations of elements in the contacting solution are invariant with respect to time and the chemical affinity of the system remains constant (pseudo-equilibrium conditions).

The SPFT apparatus used for the present work follows recommendations outlined in a corresponding ASTM standard practice [83] and is functionally equivalent to one previously employed for ILAW PA testing at PNNL [4-6, 8]. Figure 6.1 shows a single specimen test train marked by an index “i” along the diagram. In the present work, there were several such trains running simultaneously at the same constant temperature for the duration of the given test set (see the test matrix below). The system utilizes bi-directional syringe pumps capable of driving six syringes at a time thereby reducing the number of pumps per set temperature run to three: two six-position pumps for the test samples and one two-position pump for blanks. The only wetted materials throughout the system are plastics. These include high-density polyethylene (HDPE), polypropylene (PP), polyetheretherketone (PEEK), perfluoroalkoxy polymer (PFA), and fluorinated ethylene propylene co-polymer (FEP). These materials are known not to leach out any components that are relevant to the glass leaching process⁷. However, since all leaching solutions have elevated pH values and all tests have long durations, protection from ingress of atmospheric carbon dioxide is an issue, as all plastics are somewhat permeable to carbon dioxide. To address this, all reservoirs and enclosures are continuously purged with CO₂-free air (<1 ppm CO₂ from a dedicated Balston model 75-52NA “zero” gas generator). A short length of interconnecting PEEK tubing (less than 1 m of 1.59 mm OD x 0.51 mm ID) is exposed to ambient atmosphere – an insignificant exposure

⁶ pH_{RT} values are the pH values at room temperature.

⁷ SPFT testing at 70°C, which utilized 12 positions for test samples and 2 positions for blanks, confirmed that system materials did not leach any components that were relevant to glass leaching. As a result, the blank positions were eliminated in subsequent tests and the positions were used for leaching of glasses selected for partial SPFT testing, namely IDF2-G9 and IDF3-F7.

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considering the carbon dioxide permeability constant for PEEK of $6.1 \cdot 10^{-9} \text{ cm}^3_{(\text{STP})} \cdot \text{cm}/\text{cm}^2 \cdot \text{s} \cdot \text{atm}$ at 25°C [84], which is an order of magnitude lower than the one for commonly used FEP and PFA materials [85] ($7.0 \cdot 10^{-8}$ and $9.4 \cdot 10^{-8}$, respectively)⁸.

Referring to Figure 6.1, the solution is contained in a continuously purged reservoir R from which it is drawn into a syringe P and then discharged through a 3-way solenoid switching valve V. The aspiration and discharge cycle are triggered by TTL signals from a computer controlled syringe pump. The aspiration step is very fast (3 ml/min) in comparison to discharge rate required for testing. The fastest projected test flow rate requires replenishment of the 50 ml syringe contents every 15 hours at most, introducing less than 0.5% error in the test time line. Upon entering the constant temperature oven the leaching solution passes through a degassing filter (DF) followed by a 50-cm long thermal equilibration coil (TEC) and low cracking pressure check valve (CV) before reaching the reaction vessel (LC). Analytical samples are collected downstream in a series of 25 ml vials served by a programmable gantry positioner. Samples at volumes determined by the analytical requirements (5-20 ml) are collected continuously throughout the test but only those specified by the test matrix are analyzed. This manner of sample collection has the advantage of enabling examination of adjacent samples if more data are needed.

6.2.2 Test Matrix

The test matrix shown in Table 6.2a-d is modeled after results presented by PNNL for LAWC22 glass [8] and modified according to footnote 2. Each segment of the table (a-d) pertains to a specific test temperature (col. 1) at which all 12 specimen trains (col. 2) and 2 blanks (col. 7) were run (14 trains per temperature). Other columns list overall test duration (col. 3), intended analytical sampling interval (col. 4), time needed to acquire a 10 ml sample (col. 5), total intended number of samples to be analyzed per specimen (col. 6), total minimum volume of leaching solution needed (col. 8), initial elemental silicon concentration in the leaching solution (col. 9), leachant flow rate (col. 10), leaching solution pH (col. 11), and mass of the glass specimen (col. 12). Within a given run (temperature), all analytical samples (S) and blanks (B) were indexed according to train number (index $1 < i < 12$) and order of collection (index $1 < j < N$) and analyzed by ICP for silicon, boron, sodium, and aluminum.

In all, 62 experiments were conducted: 48 with IDF1-B2, on which the complete four matrices presented in Table 6.2a-d were run (Appendix E, Table E1); and 7 with each of IDF2-G9 (Appendix E, Table E2) and IDF3-F7 (Appendix E, Table E3), on which three temperatures (23, 40, and 90°C) were tested at $\text{pH}_{\text{RT}} 9$ and four influent Si concentrations (1, 40, 80 and 100 ppm) were run at 90°C at $\text{pH}_{\text{RT}} 9$.

⁸ Accordingly, $9.1 \cdot 10^{-9}$ mol of CO_2 will diffuse through a 1 m long, 0.5 mm wall PEEK tubing in 24 hours at room temperature, assuming ambient CO_2 concentration of 387 ppm.

6.2.3 Buffer Solutions

Glass leaching experiments at a pH_{RT} range from 7 to 10 were performed in 0.05 M tris(hydroxymethyl)aminomethane (Tris) solutions buffered to the target pH using concentrated HNO_3 or 1 M LiOH as described by Pierce et al.[7]. Glass leaching experiments at pH_{RT} 11 and 12 were performed in 0.001 M LiOH and 0.01 M LiOH, respectively. The pH_T values of the buffer solutions, heated to the test temperature, were measured using a temperature-compensated pH meter before addition of the glass and initiation of the tests. Determination of pH_T was necessary for the calculation of dissolution rates using Eq. (3). Table 6.2 shows the pH values obtained at various temperatures.

Leaching solutions containing varying amounts of Si were formulated by dissolving analytical grade silicic acid powder ($SiO_2 \cdot H_2O$) in 0.05 M Tris held at 90°C for 7 days. Due to the low solubility of amorphous silica in aqueous solutions, stock solutions containing at least 140 ppm [Si] were prepared, heated at 90°C for a period of time, filtered to remove any un-dissolved silicic acid that could potentially clog the lines of the apparatus, and analyzed by ICP or DCP in order to determine the final concentration of Si. When necessary, stock solutions were diluted to the target [Si] and buffered to pH_{RT} 9 as previously described.

6.2.4 Data Analysis

The data analysis follows the guidelines outlined in the ASTM Standard C 1662-07, which specifies that, if a glass specimen of a known surface area is contacted by a solution that flows continuously at a known flow rate and at a constant temperature, the concentration of the i -th soluble glass component in the effluent solution exiting the reactor vessel can be used to calculate the amount of glass that has been dissolved. The dissolution rate of the glass is then calculated as:

$$(rate) = \frac{[C_i - C_i^o] \cdot \left(\frac{F}{S^o} \right)}{f_i} \quad (6.5)$$

where: C_i - is the steady-state concentration of component i measured in the effluent solution

C_i^o - is the background concentration of component i in the influent solution as measured in a blank test

F - is the solution flow rate

S^o - is the initial surface area of the glass sample that is exposed to solution, and

f_i - is the mass fraction of component i in the glass.

In Eq. (6.5), the surface area (S^o) is calculated as the product of the specific surface area and the initial sample mass (m_o) used in the test. The specific surface area is approximated based on the mesh size of the fraction used in the test and the density of the glass. The particles of glass are presumed to be spherical with diameter (d) equal to the arithmetic average of the openings of the

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sieves used to prepare the material. The specific surface area (S_p) of a glass having a density ρ is:

$$S_p = \frac{6}{\rho \cdot d} \quad (6.6)$$

thus,

$$S^o = S_p \cdot m_o \quad (6.7)$$

During glass dissolution, the mass and surface area of the glass sample are expected to change over time as material is dissolved. The surface area S_j at time j during a SPFT test is calculated from the following expression [87]:

$$S_j = \frac{3}{\rho r_o} m_o^{1/3} m_j^{2/3} \quad (6.8)$$

where r_o is the radius of the glass particle and m_j is the sample mass at time j . The parameter m_j is estimated by the equation:

$$m_i = m_o - \frac{1}{f_i} \left[\sum_{n=1}^{j-1} F_n C_{n,i} \Delta t_n + F_j C_{j,i} \frac{\Delta t_j}{2} \right], j \geq 1 \quad (6.9)$$

where i is an element representative of glass dissolution such as B. Here it should be noted that Eq. (6.8) inherently assumes uniform dissolution during SPFT testing and the absence of any surface alterations such as cracking.

The volumetric flow rate (F) is calculated by dividing the mass of solution that is collected by the time for its collection and its density (which can be assumed to be 1 g/cm³ in most cases in view of the dilute solutions involved).

To determine the steady-state concentration (C_i), the measured concentration of the i -th component is plotted versus time in order to visually identify the data to be used. Data that precede the attainment of steady-state conditions (i.e., essential constant concentration) are excluded before calculating the mean and standard deviation of the subsequent data points. The relative standard deviation (the standard deviation divided by the mean) of the calculated steady state concentration must be less than 0.15 for the test results to be valid [83]. Soluble components monitored in this fashion include silicon, aluminum, sodium, and boron. Because boron is a glass network former that does not participate in the formation of alteration phases, parameters of Eq. (6.3) are estimated using normalized boron dissolution rates (NDR) [11]. However, differences in rates calculated using different elements may provide added insight into the dissolution mechanism. For example, the rate of sodium ion exchange (r_x) at steady state is typically calculated by subtracting the boron from the sodium dissolution rate. This value has been used to provide an estimate of the contribution of ion exchange to the overall leaching of sodium from the glass [7].

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To determine the dependence of glass dissolution rate on pH (the parameter η in Eq. (6.3)), the log NDR is plotted as a function of pH_T at a specific temperature and linear regression of the data is performed for $\text{pH}_T > 7.0$. Because the parameter η is assumed to be independent of temperature, the power law coefficient for a particular glass is considered to be the average value obtained at various temperatures. Once the parameter η is calculated, the activation energy E_a and rate constant k_0 of the glass are determined by performing a nonlinear regression on all data obtained under dilute conditions (non Si-doped influent) using Eq. (6.3) [7]. This is based on the observation that both parameters are independent of pH.

K_g is estimated from the NDR values obtained at steady state when the glass is leached in the presence of increasing concentrations of Si and at specific pH and T. To determine the parameter K_g at a given T, NDR values are plotted as a function of the activity of orthosilicic acid ($a[\text{H}_4\text{SiO}_4]$) dissolved in the glass leachates at steady state (Eq. (6.3)) and a linear regression on the data is performed. Values of $a[\text{H}_4\text{SiO}_4]$ are determined from the corresponding solution chemistry using PHREEQC (version 2.17.00). From Eq. (1.1), K_g is given by the value of $a[\text{H}_4\text{SiO}_4]$ at $\text{NDR}=0$ [7]. To determine the K_g value at the presumed repository temperature of 15°C , the natural logarithm of known K_g values are plotted against the reciprocal of the absolute temperature and a linear regression is performed on the data [7].

Finally, the parameters E_x , the activation energy of the Na ion exchange reaction, and r_x (15°C), the rate of the Na ion exchange reaction at 15°C , are calculated after plotting the natural logarithm of r_x at steady state as a function of the reciprocal of the absolute temperature (Eq. (6.3)) and performing a linear regression on the data.

6.3 Results

The selected LAW glass IDF1-B2 was subjected to the full suite of SPFT tests as a function of pH_{RT} (7, 8, 9, 10, 11 and 12), temperature (23, 40, 70, and 90°C), and silicic acid concentration (from 1 to 140 ppm [Si]). The complete SPFT test matrix is shown in Table 6.1a-d. Two additional LAW glasses, IDF2-G9 and IDF3-F7, were subjected to more limited SPFT testing, which included dissolution at pH_{RT} 9 at temperatures of 23, 40, and 90°C . In addition, IDF2-G9 and IDF3-F7 were leached in the presence of various concentrations of silicic acid at 90°C and at pH_{RT} 9.

The elemental concentrations of B, Al, Na, and Si (in ppm) found in the effluent solutions of the three glasses leached under various experimental conditions are listed in Appendix E (Tables E1-3) along with the corresponding leaching conditions (influent [Si] in ppm, temperature T in $^\circ\text{C}$, solution pH at 23°C , flow rates in $\text{m}^3 \text{d}^{-1}$, sample mass m in g, surface area S in m^2 , and time of leaching in d). The calculated normalized dissolution rates (in $\text{g m}^{-2} \text{d}^{-1}$) for each element of interest are also listed.

6.3.1 Dynamic Leaching of LAW Glasses Far from Silicon Saturation

Congruency of leaching

As expected, dissolution of the LAW glass IDF1-B2 led to the rapid release of Na and, to a lesser extent, B into solution. For Tris-based leaching buffers, the concentrations of both elements decreased over time and became invariant after about 3 to 6 reactor volumes⁹. Effluent concentrations of Si and Al increased gradually and reached a steady state without a decrease and at the same time as Na and B. Pierce et al. [8] have attributed the rapid increase and subsequent decrease in glass dissolution to the faster leaching of surface irregularities and fine particles remaining in ground glasses after washing. Although this may be a contributing factor, the lack of a similar decrease in the dissolution of Si and Al suggests that phenomena such as ion exchange and differential elemental diffusion may play a significant role. Figures 6.2 and 6.3 show the normalized dissolution rates NR_i , where i is B, Al, Na, or Si, as a function of time and in leaching solutions of varying pH at 90°C and 23°C, respectively. It is apparent from these figures that Na leaches incongruently with B (with the exception of glass leaching performed at 90°C and pH_{RT} 7) and with Al and Si (at all times).

The accelerated release of Na is attributed to the diffusion of hydronium (H_3O^+) ions into the glass and the substitution of Na^+ bonded to non-bridging oxygens (NBO) with H^+ . The ion exchange rate of Na is clearly dependent on the concentration of available H_3O^+ and diminishes with increasing pH. For example, at 90°C and at pH_{RT} 7, the dissolution rate of Na is ~45-fold higher than the dissolution rate of Si (1.4113 ± 0.0078 vs. 0.0314 ± 0.0023 g m⁻² d⁻¹), while it is only 2-fold higher at pH_{RT} 9 (0.3159 ± 0.0270 vs. 0.1512 ± 0.0060 g m⁻² d⁻¹). It is apparent that, while the Si dissolution rate increases with pH from pH_{RT} 7 to pH_{RT} 9 due to increased network depolymerization, the Na dissolution rate decreases due to a decrease in ion exchange. The ion exchange rate of Na increases dramatically in LiOH-containing buffers (experiments 5 and 6 in Table E1) despite the increased pH likely due to the exchange of Na^+ with Li^+ (see also Section 6.3.3). It is worth noting that lithium buffers have been employed in all previous ILAW PA testing but the potential impact is not included in Eq. (1.1).

Although B is not subject to ion exchange, it exhibits congruent dissolution with Al and Si only on occasion. This congruency appears to depend on the experimental pH and temperature (see Figures 6.2 and 6.3), with lower temperatures and increased Tris buffer pH promoting congruency. At 90°C and pH_{RT} 7, dissolution of B resembles that of Na (Figure 6.8a). A rapid release of B without the concomitant depolymerization of the silica network is often observed in nuclear waste glasses undergoing corrosion in water under static conditions [15]. Under those conditions, Na and B diffusion results in the formation of an alkali-depleted and silica-rich surface layer (gel). Geneste et al. [88] have suggested that, when diffusing hydronium ions undergo ion exchange with Na ions bonded to boron tetrahedra through a charge compensating mechanism, neighboring B-O bonds become the target of a nucleophilic attack by the molecular water released during the ion exchange because substituting protons are unable to balance the charge of BO_4^- . B can diffuse out of the

⁹ This is a cumulative value.

hydrated glass as mobile H_3BO_3 [89]. This mechanism may also be at play under dynamic conditions, which would explain the increased boron release at low pH (increased $[\text{H}_3\text{O}^+]$) or at increased temperatures, when the tendency for hydronium ion diffusion is higher. It is worth noting that the potential effects of boron release by such mechanisms are not included in Eq. (1.1).

The above described hypothesis essentially suggests that water diffusion is the rate limiting mechanism for boron dissolution, at least under certain conditions, an idea that is controversial [89]. Under static conditions, the rate of water diffusion/ion exchange is estimated to be inversely proportional to the square root of time and, although initially higher than the rate of network dissolution, it eventually becomes equal to the rate of glass depolymerization due to the creation of the surface gel layer that acts as a diffusion barrier. Under dilute conditions, this gel layer is expected to dissolve at the same rate as that at which it is formed [90], an assumption that, in clear disagreement with the present experimental evidence, suggests the congruent dissolution of B and Si. Furthermore, Kim et al. [91] studied the dynamic and static leaching of waste glass formulations with compositions based on the French R7T7 glass and reported that diffusion was the major mechanism of Na and B leaching, while Si and Ca leached through a dissolution mechanism. B dissolution is of particular importance because it does not precipitate nor recombine with glass constituents in the gel layer, and its dissolution is considered to be an indicator of the overall glass dissolution. If, under certain experimental conditions, B release is controlled by water diffusion and not glass depolymerization, then, in those instances, equating B dissolution with glass dissolution will lead to overestimation of glass corrosion.

In the absence of a more reliable alternative, and consistent with previous ILAW PA testing [4 - 7], the present study uses the normalized dissolution rate of boron (NDR) for the estimation of the kinetic law parameters. However, NDR values obtained at $\text{pH}_T \leq 7$, where water diffusion/ion exchange mechanisms are prominent, were not included in the calculation of the kinetic law parameters. Furthermore, plotting of NDR values obtained for IDF1-B2 as a function of $1/\sqrt{t}$, where t is the dissolution time, reveals that the rapid release of B observed at the initial stages of glass leaching is inversely proportional to the square root of time, as predicted by Ferrand [90]. Figure 6.4 shows several examples where IDF1-B2 NDR values are plotted as a function of $1/\sqrt{t}$.

Estimation of parameters η , E_a , and k_0 for LAW glass IDF1-B2

The power-law coefficient η and activation energy E_a were calculated as described in Section 6.2.4. Table 6.3 shows estimates of η for IDF1-B2 calculated from the normalized B leaching at various temperatures along with the corresponding correlation coefficients. It is evident that η is essentially independent of temperature and the various estimates listed in the Table 6.3 can be averaged to an apparent η value of 0.49 ± 0.05 for IDF1-B2. This is within the experimental error of the reported η estimate for the prototypical glass LAWA44 ($\eta = 0.49 \pm 0.09$) and in good agreement with η values reported for other LAW glasses [8].

A non-linear regression performed on all data obtained for glass IDF1-B2 at $\text{pH}_T > 7$ gave an apparent E_a value of $64 \pm 4 \text{ kJ mol}^{-1}$ and a kinetic rate constant of $k_0 = 4.5 \times 10^4 \text{ g m}^{-2} \text{ d}^{-1}$. The

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corresponding values previously reported for LAWA44 are $E_a=60\pm7$ kJ mol⁻¹ and $k_0=3.4 \times 10^4$ g m⁻² d⁻¹ [8]. Historically, E_a values for nuclear waste glass formulations are within the range of values reported for SiO₂ matrices such as quartz (66-83 kJ mol⁻¹) and amorphous silica (74.5 kJ mol⁻¹), which is thought to be indicative of the breakage of a Si-O bond being the rate-limiting step in the depolymerization of the glass network [92].

The kinetic law parameters obtained here for IDF1-B2 can be used to calculate the glass dissolution rates expected for all test conditions and the results can be compared with the experimental values, as shown in Figure 6.5, where the solid lines are the calculated values. There is reasonably good agreement with the data with a correlation coefficient of $R^2=0.98$.

Comparison of IDF1-B2 dissolution with IDF2-G9 and IDF3-F7: Effect of composition

The three LAW glasses subjected to SPFT testing differed compositionally mainly in their Na, Al, and Ca contents, as evident by the molecular formulas shown below:



Comparison of the glass dissolution rates exhibited by these glasses at 23, 40, and 90°C at pH_{RT} 9 suggests that composition variations have a limited effect on glass leaching under dilute conditions. The measured rates shown in Table 6.4 show that glasses IDF1-B2 and IDF2-G9 dissolved at similar rates, within experimental error, at all temperatures. IDF3-F7 exhibits slightly (~2-3-fold) elevated leaching at 23 and 40°C but not at 90°C. The dissolution rates of these glasses were also similar to the values previously reported by Pierce et al. [8] for other LAW glasses, specifically LAWA44, LAWB45, and LAWC22. Not surprisingly, IDF2-G9 and IDF3-F7 have calculated E_a values that are similar to the one estimated for IDF1-B2 (Figures 6.6 and 6.7). Here, it should be noted that, due to the absence of experimental data for leaching of IDF2-G9 and IDF3-F7 at pH_{RT} values other than 9, activation energies E_a for these glasses were estimated by plotting $\ln \text{NDR}$ (g m⁻² d⁻¹) values at pH_{RT} 9 as a function of $1/T$ (K⁻¹) and performing a linear regression on the data (see Eq. (6.4)).

The apparent weak dependence of glass dissolution under dilute conditions on glass composition has been noted previously by Pierce et al. [8] and attributed to the existence of an identical polymerization state among the LAW glasses. As utilized by Grambow [11], TST suggests that the rate of glass dissolution is determined by the rate of rupture of surface Si-O bonds. Glass formulations with similar numbers of silica tetrahedra present on their surface are expected to exhibit comparable dissolution rates, irrespective of their specific composition.

6.3.2 Dynamic Leaching Near Silicon Saturation.

Congruency of leaching: Estimation of K_g

As in the case of dissolution under dilute conditions, IDF1-B2 leaching near silicon saturation was characterized by the incongruent release of Na (see also Section 6.3.3). With the exception of experiments performed at 90°C, B release resembled that of Al. At 90°C, B dissolution was congruent with Na leaching, an observation that suggests a diffusion mechanism as the dominant means of B release at pH_T of 7.8. Si dissolution was variable and depended on the individual experimental conditions. Occasionally, a dramatic increase in Si leaching was seen over time in the presence of influent Si, an unexpected phenomenon that was independent of the experimental temperature (Figures 6.8 and 6.9). Figures 6.8 and 6.9 show the NR_i values for IDF1-B2 as a function of time and increasing influent $[\text{Si}]$ at 90° and 23°C, respectively. In certain conditions, Si leaching even exceeded that of Na (Figures 6.8b and 6.9e). A similar trend was observed for leaching of IDF3-F7 glass leached with Si-spiked influent at 90°C (Figure 6.10).

Glass leaching in the presence of significant concentrations of Si in the leachant is thought to be most relevant to service conditions, in which, after coming in contact with groundwater, nuclear waste glass formulations are expected to leach in increasing amounts of silica supplied initially by the groundwater and, later on, via glass dissolution. It is generally agreed that the presence of silica in the leachant limits glass dissolution. However, depending on the model used to explain glass corrosion, this decrease in glass leaching has been attributed to silanol condensation reactions (taking place on the glass surface and leading to the formation of an amorphous gel that progressively restricts the water diffusion into the pristine glass) [93], or to the decrease in the chemical affinity of the rate-limiting reaction (6.2) with increasing concentrations of dissolved H_4SiO_4 [11, 86]. According to Eq. (6.3), the reaction rate of the irreversible reaction driving glass corrosion should approach zero as the ion activity product Q approaches the pseudo-equilibrium constant K_g . Although mechanisms such as ion exchange and water diffusion ensure that glass corrosion never becomes zero, several studies have confirmed a linear dependence between LAW glass dissolution and the activity of H_4SiO_4 [3,4,8].

Analysis of experimental data presented here suggests that, for solutions that remain undersaturated with respect to amorphous silica and at temperatures other than 90°C, the Grambow model correctly predicts a linear dependence of the corrosion of IDF1-B2 on $a[\text{H}_4\text{SiO}_4]$ (Figure 6.11). In Figure 6.11, $a[\text{H}_4\text{SiO}_4]$ values were obtained from the solution chemistry data using the geochemical code PHREEQC, which also provided the solution saturation indices (SI) for a variety of potential secondary phases including chalcedony, quartz, gibbsite, albite, and kaolinite, in addition to amorphous silica. Based on the idea that glass corrosion results in the formation of an amorphous Si-rich layer that controls dissolution, Grambow [11] and Berger et al. [94] have suggested that the affinity term in Eq. (6.3) is equal to that of a simple SiO_2 polymorph such as chalcedony, quartz or amorphous silica. In the present experiments, effluent solutions became quickly supersaturated with respect to chalcedony and quartz, even though the IDF1-B2 dissolution rate continued to decrease with increasing $a[\text{H}_4\text{SiO}_4]$. IDF1-B2 leaching became invariant with time when effluent solutions became saturated with respect to amorphous silica (see open squares in Figure 6.11). Subsequently,

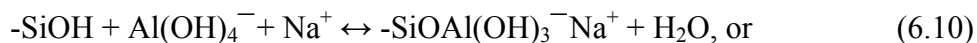
to obtain the K_g values associated with IDF1-B2 corrosion, linear regression was performed on data points associated only with solutions under-saturated in amorphous silica.

At 90°C (Fig. 6.11d), the corrosion rate of IDF1-B2, as indicated by the normalized B dissolution, failed to decrease with increasing $a[\text{H}_4\text{SiO}_4]$. In fact, introduction of 40 ppm Si into the leachant led to a dramatic increase in the B dissolution rate: the steady state NDR was $0.5240 \pm 0.0365 \text{ g m}^{-2} \text{ d}^{-1}$ at 40 ppm Si compared to $0.1803 \pm 0.0087 \text{ g m}^{-2} \text{ d}^{-1}$ at 0 ppm Si, or $0.1914 \text{ g m}^{-2} \text{ d}^{-1}$ at 1 ppm Si. Further increase in influent Si led to a minor decrease in NDR. NDR values did not diminish even when solutions became saturated with respect to amorphous silica. The lack of a linear dependence between IDF1-B2 dissolution at 90°C and $a[\text{H}_4\text{SiO}_4]$ meant that it was not possible to estimate a K_g value for the glass at that temperature.

The possible role of Al

One of the unusual characteristics of IDF1-B2 leaching in various influent [Si] at 90°C and $\text{pH}_{\text{RT}} 9$ is the nearly congruent release of B and Na (Figure 6.8). In contrast, when IDF1-B2 is leached at the same temperature and pH but in the absence of any influent Si, B dissolution resembles that of Si and Al (Figure 6.2c). This suggests that SiO_2 , externally added to the leaching environment of IDF1-B2, alters the mechanism of B release from glass depolymerization to diffusion and brings into question the use of normalized B dissolution rate in the estimation of K_g (90°C). If Al is used in place of B to model glass corrosion, then a linear dependence is revealed between NR_{Al} and $a[\text{H}_4\text{SiO}_4]$ (Figure 6.12). A linear regression performed on the data of Figure 6.12 yields a K_g (90°C) value of $5.28 \times 10^{-3} \text{ mol L}^{-1}$, which is close to the solubility limit of amorphous silica at 90°C (see Section 6.3.3).

The assumption that, under certain conditions, Al dissolution describes glass corrosion is not without caveats. Although alteration phases are not expected to form and, thus, to play a role in the decrease of the aluminum dissolution rate with increasing influent [Si], formation and adsorption of $\text{Al}(\text{OH})_4^-$ to silanol sites, present on the dissolving glass surface, may explain such a decrease. A variety of studies have shown that quartz dissolution decreases in the presence of $\text{Al}(\text{OH})_4^-$ likely due to condensation reactions with silanol groups [95,96]:



Geochemical modeling of the solution chemistry shows that the majority of the dissolved Al in our experiments exists in the form of $\text{Al}(\text{OH})_4^-$. However, concentrations of $\text{Al}(\text{OH})_4^-$ in the various tests were far less than the activities of H_4SiO_4 and likely played a very limited role in controlling IDF1-B2 dissolution. In two different studies, Abraitis et al. [92] and McGrail et al. [4], who also observed a similar trend of increasing or invariant boron-based glass dissolution rate with increasing influent [Si], suggested that dissolution of certain nuclear waste glass formulations was influenced by dissolved Al and Si species. Abraitis et al. [92] used a mixed Al-Si activity product term, in which the activities of Al and Si were raised to powers that were equal to their respective

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molar fractions in the glass, and successfully modeled the kinetics of the specific glass dissolution at 40°C. In a similar manner, McGrail et al. [4] was able to model dissolution of glass LAWABP1 at 40°C but not at 90°C (R^2 values were 0.92 and 0.62, respectively). The investigators then concluded that corrosion of LAWABP1 was driven by the simpler activity product term $a[\text{H}_4\text{SiO}_4] \times a[\text{Al}(\text{OH})_4^-]$. They considered the term to be representative of the formation of an activated complex with a molecular structure similar to that of a simple aluminosilicate mineral such as kaolinite. However, the linear regression that the investigators performed on their experimental data showed a rather poor correlation between glass dissolution rates and $a[\text{H}_4\text{SiO}_4] \times a[\text{Al}(\text{OH})_4^-]$. The R^2 values were 0.62 and 0.75 at 40°C and 90°C, respectively. The experimental rates obtained in the present work for the dissolution of IDF1-B2 at 90°C did not correlate well with either $a[\text{H}_4\text{SiO}_4] \times a[\text{Al}(\text{OH})_4^-]$ or $a[\text{H}_4\text{SiO}_4]^{0.464} \times a[\text{Al}(\text{OH})_4^-]^{0.137}$, a term that takes into consideration the Al and Si molar fractions in the IDF1-B2 glass.

Another explanation for the irregular behavior of IDF1-B2 dissolution at 90°C may be found in the chemistry of silica. McGrail et al. [4] reported that the effects of Al and Si on glass dissolution are anti-correlated and that Si caused a decrease in the activity of $\text{Al}(\text{OH})_4^-$. In a recent study, Rajmohan et al. [97] concluded that Al, and to a small extent Zr, reduce Si activity at saturation. They observed that silica activity was the highest for Al-free glasses, where it recondensed as pure silica below pH 9. It is thus conceivable that the $a[\text{H}_4\text{SiO}_4]$ values used in Figure 6.11d are greater than the ones operating on the glass surface especially if one considers that the increased release of B, Na, and Si from the surface of the IDF1-B2 at 90°C likely leaves behind a hydrated layer that is rich in Al. This layer also contains insoluble glass constituents such as Zr [97] and possibly Na atoms, which are retained on the glass surface to balance the Al charge (see Reactions 6.10 and 6.11) [94]. Gin et al. have suggested that a hydrated gel layer needs to be saturated in Si before it becomes protective and that an unsaturated gel functions as a Si pump [98]. This may explain why Si dissolution increases with time in certain instances upon addition of exogenous silica into the glass leaching environment.

A final consideration is that $a[\text{H}_4\text{SiO}_4]$ values calculated from the ICP [Si] may ignore potentially significant effects due to the formation of silica polymers. At saturation, monosilicic acid is known to polymerize by condensation to form dimers and higher molecular weight species of silicic acid with the minimum number of uncondensed SiOH groups [99]. Such polymerization will reduce the number of silanol groups available for condensation on the surface of the glass and may act as a silicon pump. Since polymerization increases with temperature, it may be a factor only at 90°C. This may explain why dissolution of IDF1-B2 (here) and LAWABP1 [4] shows a linear dependence on influent [Si] at 40°C but not at 90°C. However, it does not explain why other LAW glasses including LAWA44, LAWB45, and LAWC22 do not exhibit a similar behavior at 90°C [7].

Dissolution of IDF2-G9 and IDF3-F7 near saturation at 90°C and $\text{pH}_{\text{RT}} 9$

Dissolution of IDF2-G9 (4 experiments at 90°C and at $\text{pH}_{\text{RT}} 9$) failed to show a linear dependence on $a[\text{H}_4\text{SiO}_4]$ (Figure 6.13) and therefore a K_g value could not be estimated. Introduction of exogenous Si into the leachant glass dramatically increased B dissolution from

$0.2112 \pm 0.0055 \text{ g m}^{-2} \text{ d}^{-1}$ in the absence of influent Si to $0.4842 \pm 0.0462 \text{ g m}^{-2} \text{ d}^{-1}$ in the presence of 1 ppm [Si]. In contrast, IDF3-F7 dissolved as anticipated by Grambow [11] (Figure 6.14). A linear regression, performed on the experimental data in Figure 6.14 yielded a K_g value of 5.95×10^{-3} and a coefficient of correlation R^2 value of 0.97.

The disparity in the leaching behavior of glasses IDF2-G9 and IDF3-F7 is intriguing but may be explained by the difference in compositions. Interestingly, Si dissolution of IDF3-F7 appears to increase over time in the presence of influent Si (Figure 6.10), an observation that suggests the formation of an Al-rich and Si-deficient gel on the surface of the glass. The gel layer of IDF3-F7 is expected to be different in composition from the gel layer of IDF1-B2 because Ca is known to be preferentially retained over Na in such layers in order to balance the charge of Al and Zr [97]. The presence of Ca^{2+} may result in the creation of a dense layer that is able to inhibit boron diffusion and/or dissolution from the glass.

Estimation of IDF1-B2 K_g at 15°C and Comparison with other LAW glasses

To estimate the value of K_g for glass IDF1-B2 at the presumed repository temperature of 15°C, $\ln K_g$ values previously obtained at 23, 40, and 70°C were plotted as a function of $1/T$ (K^{-1}) and a linear regression was performed on the data (Figure 6.15). The K_g value at 15°C was estimated to be 1.70×10^{-3} , which is close to the solubility constant of amorphous silica at the same temperature (Table 6.5). Figure 6.15 confirms the notion that, since glass dissolution results in the formation of an amorphous Si-rich surface, which controls the rate of glass corrosion, the chemical affinity term in Eq. (6.1) can be assumed to be equal to the chemical affinity of amorphous silica [11,94].

The values of the kinetic rate law parameters determined in the present work are summarized in Table 6.6. Values of the kinetic rate law parameters have been measured and reported previously for several other LAW glasses. Pierce et al. [7] reported values for three glasses formulated at VSL for the WTP (LAWA44, LAWB45, and LAWC22), which are reproduced in Table 6.7. These glasses are of particular interest since they are baseline glasses for WTP LAW Envelopes A, B, and C, respectively. The glasses therefore provide a natural comparison for the results from the present work for the bounding glass IDF1-B2.

Comparison of the results for IDF1-B2 in Table 6.6 with those for LAWA44, LAWB45, and LAWC22 [7] in Table 6.7 shows generally good agreement between the respective rate law parameters. However, the values for K_g are a notable exception, particularly in view of the closeness of the reported K_g values for glasses LAWA44, LAWB45, and LAWC22. The K_g value for IDF1-B2 is about a factor of three greater than the values reported for glasses LAWA44, LAWB45, and LAWC22 [7]. A review of the raw data [7] used to determine the K_g values for LAWA44, LAWB45, and LAWC22 suggests that the $a[\text{H}_4\text{SiO}_4]$ values were determined incorrectly. It appears that the molarity of H_4SiO_4 was calculated by dividing the ICP-determined concentration of Si by the molecular weight of H_4SiO_4 (96 g/mol) instead of the atomic weight of Si (28 g/mol); that molarity was then used to calculate the fraction of un-dissociated H_4SiO_4 (typically around 90% [7]). This

leads to an underestimate of $a[\text{H}_4\text{SiO}_4]$ by an approximate factor of $96/28 \sim 3.4$.¹⁰ Clearly, this will have a direct impact on the resulting value of K_g , which is simply the extrapolated value of $a[\text{H}_4\text{SiO}_4]$ at which the dissolution rate goes to zero. If the reported K_g values for LAWA44, LAWB45, and LAWC22 are multiplied by this factor, respective values of 1.87×10^{-3} , 1.80×10^{-3} , and 1.80×10^{-3} are obtained, in remarkably close agreement with the value of 1.70×10^{-3} determined for IDF1-B2 in the present work.

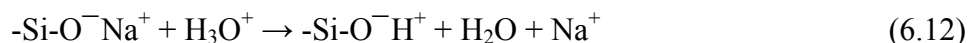
The fact that the rate law parameters determined for the bounding glass are close to those for the more typical WTP glasses is of practical significance since it suggests that higher waste loading glasses such as IDF1-B2 may still meet the requirements of the IDF PA. Establishing the viability of such high waste loading glasses in this regard is important in realizing their potential benefits in terms of reductions in life cycle costs and mission duration. It is also noteworthy in this context that IDF1-B2 exceeds the present WTP contract limit on the VHT test.

Unfortunately, the error in the calculation of previously reported values of K_g appears to have been propagated into a number of other reports [e.g., 6, 7, 28, 100, 117, 118] as well as into results for tests on other glasses (e.g., BKV1 [117] and BKV6 [118]). Conversely, the values of K_g reported in reference [5] appear to have been calculated correctly. More recently, the erroneous values are reproduced in references [28] and [100] from 2010. This includes the recent study on the sensitivity of the glass dissolution rate calculated from the kinetic rate law with respect to variations in the model parameters [28], where it is concluded that “...the pseudo-equilibrium constant (K_g) is one of the most important kinetic rate-law parameters...”. That document reproduces the (incorrect) K_g values for LAWA44, LAWB45, and LAWC22 (Table 2.3 in [28]) that are presented in reference [7], and, in particular, the value of $K_g = 5.45 \times 10^{-4}$ at 15°C , but later (Table 3.6 in [28]) uses the value of $K_g = 5 \times 10^{-3}$ at 99°C for LAWA44, which is substantially different from the value of 1.59×10^{-3} that is obtained from the values reported in Table 4 of reference [7].

In summary, once corrected, the previously reported K_g values for the typical WTP glasses LAWA44, LAWB45, and LAWC22 are in good agreement with that determined for glass IDF1-B2 in the present work. Clearly, however, the impact of this error on the IDF PA will need to be assessed.

6.3.3 Ion Exchange

As previously discussed (Section 6.3.1), glass dissolution results in an initial rapid release of Na due to the diffusion of hydronium ions into the glass and exchange of network modifying Na^+ with H^+ [88]:



¹⁰ This simplified estimate will be modified slightly as a result of a small change in the results of the H_4SiO_4 speciation calculation.

This process takes place in parallel with glass network hydrolysis, is dominant at low pH due to the increased $[H_3O^+]$, and becomes diminished over time under static conditions due to the formation of a hydrated gel layer, which acts as a barrier to the diffusion of hydronium ions into the glass. In actual service conditions, ion exchange is expected to play a role primarily upon contact of the nuclear waste glass formulations with groundwater. Release of Na^+ from the glass will not only yield a protective surface layer but will also raise the pH of the solution in contact with the glass, thus, diminishing the concentration of available H_3O^+ . Feng and Pegg [8] have argued that close to saturation, when the reaction affinity and therefore the glass dissolution rate become very small, ion exchange reactions will continue and thereby cause a slow upward drift in pH that will tend to increase the reaction affinity as a result of the increased ionization of the rate controlling silicic acid. As a result, the continuing ion exchange process maintains a small but non-zero glass dissolution rate, a phenomenon often referred to as the “residual rate,” which is of obvious importance to the release over the long term.

Following the convention set by McGrail et al. [4] and Pierce et al. [7], the ion exchange rates (r_x) of IDF1-B2 were calculated by subtracting B dissolution rates from the Na dissolution rates and expressing the result in $mol\ m^{-2}\ s^{-1}$. This approach was based on the idea that Na is released from the glass through a combination of ion exchange and glass dissolution with the latter being represented here by B release. Figure 6.16 shows steady state r_x values as a function of pH_T at 70 and 90°C and highlights the dramatic increase observed when the leaching buffer contains Li (two highest pH values). Figure 6.17 shows the natural logarithm of r_x for IDF1-B2 as a function of $1/T$. Because ion exchange is not affected by the saturation state of leaching environment [101], Figure 6.17 includes r_x values calculated for dissolution of IDF1-B2 from all experiments performed at a specific T and pH_{RT} 9. With the exception of IDF1-B2 dissolution at 90°C, the spread of data at a given temperature is indeed very small. At 90°C and influent $[Si] > 1$ ppm, steady state B dissolution rates exceed those of Na and therefore r_x values are not calculated. A linear regression performed on all data points shown in Figure 6.17 gave an r_x value of $3.4 \times 10^{-10}\ mol\ m^{-2}\ s^{-1}$ at the repository temperature of 15°C and an E_x value of $58 \pm 3\ kJ\ mol^{-1}$. The r_x (15°C) of IDF1-B2 was approximately 6-fold greater than the one estimated by Pierce et al. [7] for LAWA44. This likely reflects the higher alkali content present in IDF1-B2: IDF1-B2 contains 25 wt% Na_2O while LAWA44 contains 20 wt% Na_2O .

Here, an obvious caveat in the estimation of parameters r_x (15°C) and E_x should be noted. The calculation of these parameters assumes that B dissolution is representative of glass dissolution. As previously discussed, depending on the specific experimental conditions, B can be released from the glass through a water diffusion-based mechanism without concomitant silica network dissolution. This explains why, in certain experiments, steady-state B dissolution rates exceed those of Na and suggests that r_x values obtained in this way may be underestimated.

Table 6.6 summarizes all of the kinetic parameters obtained for IDF1-B2.

6.3.4 Re Dissolution

Despite recent reports that Re and Tc can exhibit diverse behavior in borosilicate glasses [102,103], Re is often used as a non-radioactive analogue of ^{99}Tc because, in general, the two elements have similar chemistry and no better surrogate for technetium is known. IDF1-B2 contains $\sim 0.14\%$ Re_2O_7 . Due to its low content, Re concentrations were determined by ICP only in effluent solutions obtained from IDF1-B2 dissolution in highly corrosive conditions, specifically at 70°C (Figure 6.18a) and 90°C (Figure 6.18b) and at $\text{pH}_{\text{RT}} 12$. Raw data are shown in Appendix E, Table E4. Figure 6.18 suggests that Re was released congruently with Al and Si and not with Na or B. This is not surprising since Re dissolution is not believed to be influenced by an ion exchange/water diffusion mechanism. However, since Re is expected to be released via glass dissolution, incongruent dissolution of Re and B further highlights possible problems associated with the use of B as a glass corrosion tracer.

Furthermore, the fate of Re was investigated during dissolution of IDF1-B2 in the presence of 1 and 40 ppm influent [Si] at 90°C and $\text{pH}_{\text{RT}} 9$. Under these conditions, Na and B are released congruently (Figure 6.8a-b), while there is a dramatic increase in B dissolution rate from 1 ppm to 40 ppm influent [Si] (see Section 6.3.2). At steady state, Re dissolution rate was similar to Al rate and decreased with increasing influent [Si] (see experiments 31 and 32 in Table E4 in Appendix E; also solid circles in Figure 6.8a-b). Because of the unusual nature of IDF1-B2 leaching at 90°C we have previously hypothesized the formation of a surface layer, which is rich in Al and other insoluble glass constituents such as Zr, deficient in Si and B, and which retains some Na for charge balancing purposes (Section 6.3.2). The congruency in the release of Re and Al suggests that Re also can be retained within the surface layer.

6.3.5 Investigation of Surface Layer Using IR Spectroscopy

Glasses IDF1-B2, IDF2-G9, and IDF3-F7 were analyzed by infra red (IR) spectroscopy before and after reaction. The IR spectrum of untreated LAWA44 was also analyzed. IR spectra were deconvoluted and peaks were identified based on Table 6.8, which shows stretching, bending, and other vibrations for groups anticipated to be present on the surface of a boroaluminosilicate glass before and after hydrothermal treatment [90,104-106].

Deconvoluted spectra of untreated glasses are shown in Figures 6.19 – 6.22. Deconvoluted spectra of treated glasses are shown in Figures 6.23 – 6.26.

A comparison of Figures 6.19 – 6.22 suggests the following:

- The peak centered at $\sim 1030\text{-}1050\text{ cm}^{-1}$, which corresponds to the asymmetric stretching of Si-O-Si bonds within the silica network, is broader in IDF3-F7 than in the other glasses. Since a broad peak indicates a high degree of structural disorder, this suggests that IDF3-F7 is more amorphous than the rest of the glasses.

- IDF3-F7 is the only glass that has a peak at $\sim 1080\text{--}1090\text{ cm}^{-1}$ and another at $\sim 1150\text{ cm}^{-1}$. Although not exclusively assigned, these peaks are characteristic of the presence of IV-coordinated B-O bonds (see Table 6.8). All glasses exhibit a 700 cm^{-1} peak, which can be assigned to the bending vibration of III-coordinated B-O bonds. The peak is presented as a doublet in IDF1-B2 and IDF3-F7, possibly due to the presence of ring and non-ring BO_3 groups. Taken collectively, the data suggest that IDF3-F7 has B in III- and IV-coordination, while the other glasses have only III-coordinated B. IDF1-B2 and IDF3-F7 possibly have two different types of trigonal BO_3 groups. Interestingly, IDF3-F7 has a lower Na_2O content than the rest of the glasses (12 wt% vs. 20–25 wt%); additionally, it contains $\sim 10\text{ wt}\%$ CaO . Na_2O is known to modify the coordination number of B from III to IV and it does so after all the AlO_4 groups present in the glass have been charge-compensated. Since IDF1-B2, LAW44, and IDF2-G9 have excess amounts of Na_2O , the lack of evidence for the presence of IV-coordinated B in these glasses is somewhat surprising. It is possible that all Ca present in IDF3-F7 is used for the charge compensation of AlO_4 leaving Na free to charge-compensate BO_4 and to shift the B coordination number from III to IV. It should be noted, however, that IDF3-F7 also contains a significant amount of lithium.
- All glasses contain molecular water on their surface, which is likely H-bonded to silanol groups. H-bonded silanol groups exhibit a characteristic peak at $\sim 3740\text{ cm}^{-1}$, while H-bonded molecular water appears at $\sim 3450\text{ cm}^{-1}$ and $\sim 1610\text{--}1620\text{ cm}^{-1}$. Both peaks are present in all glasses. The --OH peak present at $3400\text{--}3800\text{ cm}^{-1}$ is sharper in LAW44 than in the other glasses possibly indicating a lesser degree of H-bonding among molecular water and silanol groups.

A comparison of Figures 6.19, 6.23, and 6.24 suggests the following:

- Hydrothermal treatment of IDF1-B2 shifts the molecular water peak from $\sim 1620\text{ cm}^{-1}$ to a higher wavelength ($\sim 1645\text{ cm}^{-1}$). Such a shift indicates molecular water that is bonded within a porous glass layer. The peak at 1645 cm^{-1} is far more prominent after hydrothermal treatment of the glass at 90°C than at 40°C despite the increased duration of the treatment at 40°C .
- Hydration of the glass increases with temperature, as evidenced by the increase in peak area of the --OH band present at $3400\text{--}3800\text{ cm}^{-1}$.
- The doublet at $\sim 700\text{ cm}^{-1}$ becomes a singlet and, in the case of IDF1-B2 treated at 90°C , shifts to higher wavelength. These changes may be associated with leaching of B from the surface of the glass.
- The sharpening of the $\sim 1030\text{ cm}^{-1}$ band in Figure 6.23 suggests a higher degree of network order on the surface of the treated glass at 40°C than on the surface of the untreated glass.

Interestingly, the band broadens again after treatment at 90°C, possibly due to the formation of an amorphous gel-like hydrated surface layer.

Similarly to IDF1-B2, treatment of IDF2-G9 at 90°C and in the presence of 40 ppm Si led to an increase in the glass hydration evidenced by the increase in the peak area of the 1645 and 3400-3800 cm^{-1} bands (compare Figures 6.20 and 6.25). Interestingly, the peaks centered at 960 cm^{-1} and 920 cm^{-1} appear to have been consumed and shifted to a higher wavelength after treatment, thus leading to the sharpening of the $\sim 1030 \text{ cm}^{-1}$ peak. Peaks at $\sim 960 \text{ cm}^{-1}$ can be assigned either to the asymmetric vibration of IV-coordinated B-O or to the asymmetric stretching of Si-O, where O is a non-bridging O (NBO). The peak at $\sim 700 \text{ cm}^{-1}$ assigned to III-coordinated B-O appears to have been consumed and shifted to a higher wavelength.

Treatment of IDF3-F7 at 90°C and in the presence of 40 ppm Si led to the hydration of the glass, a stark sharpening of the $\sim 1030 \text{ cm}^{-1}$ band due to the consumption of the 1090, 960, and 912 cm^{-1} peaks, and the transformation of the $\sim 700 \text{ cm}^{-1}$ band from a doublet to a singlet centered at 720 cm^{-1} (compare Figures 6.21 and 6.26). Furthermore, three additional peaks appear at 2780-2935 cm^{-1} possibly indicating the formation of Al-OH groups.

Analysis of the IDF1-B2, IDF2-G9, and IDF3-F7 spectra after treatment of the glasses at 90°C and in the presence of Si provides evidence for the structural alteration of the glass during treatment and the formation of a hydrated layer with a relatively ordered silica network due to the leaching of alkali and boron. However, the results did not reveal the origin of some of the unusual leaching behavior of IDF1-B2 and IDF2-G9 under these conditions.

6.4 Discussion

Over the past 30 years, a significant effort has been made towards the development of a mathematical model that accurately predicts nuclear waste glass durability [78,89]. Two primary approaches have emerged. The first approach considers the irreversible destruction of an activated complex on the surface of the glass as the driving force behind glass corrosion and utilizes the TST to mathematically predict matrix dissolution. This approach, pioneered by Grambow in 1985 [11], has been used widely to study glass leaching under dilute conditions in dynamic tests. It is less robust under conditions of near saturation, where it erroneously predicts a dissolution rate of zero. The second approach pays attention to ion exchange and water diffusion mechanisms and emphasizes the formation of a hydrated surface layer as the key player in glass corrosion. In this approach, glass dissolution rates decrease near saturation due to the presence of the surface layer, which behaves as a physical barrier in limiting water diffusion, and not solely due to a decrease in chemical affinity. Extensive studies using nuclear waste glasses of different compositions have shown that both approaches have their limitations.

Experimental evidence obtained in the present study suggests that the kinetic rate law model previously used for the ILAW PA exhibits variable degrees of success depending on the specific

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experimental conditions. For example, the model worked well in IDF1-B2 tests performed far from saturation. Under near saturation conditions, however, there was a correlation between experimentally obtained and calculated IDF1-B2 dissolution rates only at low temperatures, presumably because a leaching environment with $\text{pH}_{\text{RT}} 9$ is inherently more alkaline at low temperature, thus, limiting water diffusion/ion exchange phenomena. The possible dependence of the kinetic law on the leaching environment of a glass was previously noted by Oelkers and Gislason [107,108], who observed that the dissolution rate of basaltic glass was contingent on the activity ratio $a_{\text{H}^+}^3 / a_{\text{Al}^{3+}}$. This reflected the idea that liberation of silica tetrahedra from the basaltic glass surface and destruction of the glass network required the removal of neighboring Al atoms through an ion exchange mechanism with three aqueous H^+ ions. Basaltic glass dissolution is known to increase rapidly with decreasing pH under acidic conditions. Similarly, Conradt et al. [109] have suggested the incorporation into the kinetic law of a complex solubility product that changes with dissolved matter.

The idea that the kinetic law depends on the leaching environment means that essential aspects of the reaction mechanism are missing from that rate law. Of particular interest in the present work is the increase in IDF1-B2 dissolution rate observed with increasing influent [Si] under certain conditions, which suggests that the kinetic models may underestimate glass dissolution in near saturation conditions. This has been experimentally shown by Gin et al. [86], who studied dynamic SON68 glass dissolution in increasing concentrations of dissolved silica at 90°C and pH 8. The investigators observed that experimental dissolution rates decreased with increasing $a[\text{H}_4\text{SiO}_4]$ slower than predicted by the kinetic law and became invariant (but not zero) at influent [Si] ≥ 90 ppm. Furthermore, the increase in glass dissolution with increasing concentrations of dissolved silica challenges the assumption that, under service conditions, nuclear waste glass will dissolve slower in groundwater than predicted from tests performed in pure water due to the presence of dissolved silica in the former [93].

Before a definite conclusion can be drawn regarding the unusual corrosion behavior of IDF1-B2 at 90°C, two additional possibilities need to be examined. The first is the formation of cracks on the surface of the glass that accelerate glass leaching. Greaves [110] has shown that ion exchange occurs along channels, which exist within the glassy network and are formed by NBOs. Since IDF1-B2 experiences an increase in ion exchange at 90°C, it is conceivable that heterogeneous leaching results not only in chemical but also in physical alteration of the glass surface. Alternatively, IDF1-B2 glass could be phase-separated, with different phases preferentially dissolved at different temperatures. However, etching tests on IDF1-B2 glass coupons followed by SEM observation indicate no such phase separation.

Phase separation is usually associated with excess of a specific oxide. Alkali borosilicate glasses tend to separate into a sodium borate phase ($\text{BO}_4^- \text{Na}^+$) and a silica-rich phase when excess B is present [111]. Addition of Al into a borosilicate glass shifts the coordination number of B from IV to III, resulting in the formation of $\text{AlO}_4^- \text{Na}^+$ and BO_3 units. Trigonal BO_3 units can exist in ring and non-ring forms. The ratio of $\text{B}_{\text{ring}}^{\text{III}} / \text{B}_{\text{non-ring}}^{\text{III}}$ increases with increasing B/Al ratios [112]. The former tend to aggregate, while the latter are randomly mixed throughout the glass matrix. The

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presence of B^{III} favors the formation of NBOs and is expected to increase Na ion exchange. B^{IV} can be formed in the presence of Al only when excess Na is available for charge compensation. The presence of Al in a borosilicate glass alters not only ion exchange/water diffusion phenomena but also the nature of the gel layer that is formed. Although less favorable than hydrolysis of Si-O-Si, hydrolysis of Si-O-Al leads to the formation of Si-OH-Al groups and the possibility of increasing H^+ diffusion via neighboring Si-O-Al bridges [104]. The retention of charge compensating cations in the bulk is stronger in aluminosilicate glasses than in borosilicate glasses, a phenomenon that is expected to alter the rate of cation diffusion as well the composition of the surface gel layer [88, 95, 113].

While IDF1-B2 is not a B-rich or Al-rich glass, it does contain an excess of Na_2O . Due to the excess of Na, B present in IDF1-B2 is expected to exist mainly as BO_4^- and to form reedmergnerite ($BSi_4O_{10}^-$) units with Si, an expectation that is somewhat disputed by the IR spectrum of the glass. Excess Na is also expected to increase the number of NBOs. However the degree of silica polymerization within the glass should not be dramatically different than the degree of silica polymerization seen in a glass such as LAWA44, which does not exhibit an unusual behavior at $90^\circ C$ [2]. Furthermore, LAWA44 has an alumina content that is similar to IDF2-G9. This argues against the possibility of an Al effect as the cause behind the irregular behavior of IDF1-B2 and IDF2-G9.

Although IDF1-B2 exhibits an abnormal corrosion only at $90^\circ C$, a temperature far from that of the disposal site, the behavior warrants further investigation in order to identify areas (compositional, structural, and otherwise), where glass dissolution kinetics deviate significantly from the previously assumed kinetic law.

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SECTION 7.0 SUMMARY AND CONCLUSIONS

This report provides the results of work performed to collect information on the corrosion behavior of a wide range of LAW glasses to support the IDF PA. The work included collation and reporting of data from long-term tests on LAW glasses that are ongoing at VSL and the selection and testing of several glasses intended to augment glasses that have been previously tested in support of the IDF PA. The new glasses include compositions that are bounding with respect to performance on the WTP leach test specifications and glasses that are higher in waste loading than the baseline WTP glasses.

A large data set of results from long term PCT-B testing performed at VSL on WTP LAW glasses was compiled and is included in this report. The data set includes glass compositions, leachate compositions and pH at each sampling interval, sampling times, test conditions (leachant, temperature, S/V, test protocol, etc.), and associated secondary phase information. Data for a total of 253 glass compositions are included in the data set, which extends up to 3982 days of PCT-B leaching. These glasses span a composition range that is more extensive than those used in previous performance assessment glass testing work. Selected tests were sampled and analyzed to characterize the secondary phases, which included zeolites such as analcime and phillipsite and phyllosilicates of the smectite group, stevensite and swinefordite. Glasses in the later stages of the reaction progress (Stage IV and Stage V) were included in this analysis.

The range of glass compositions that may be produced at the WTP is expanding toward higher sodium and sulfate content, and this type of composition range expansion is likely to continue through the life of the project. To encompass the composition range expected to be disposed in the IDF, a total of 10 glasses were selected as bounding glasses for this composition expansion. The selection was based on an analysis of the compositions and properties of the large number of LAW glasses that have been developed for the WTP at VSL. Multiple batches of these ten selected glasses were prepared for testing at VSL. Samples of each of these glasses were also shipped to PNNL to support complementary testing. All ten of these glasses were subjected to PCT-B testing at VSL at three temperatures (40°C, 90°C and 120°C) and two S/V ratios (2,000 m⁻¹ and 20,000 m⁻¹). The results show that although the LAW glasses selected for this evaluation are glass compositions that have higher waste loadings than those developed for the WTP baseline, they follow generally similar leaching behavior. It is also evident that an increase in total alkali content alone is not necessarily detrimental to long-term PCT leaching. Furthermore, glass IDF1-B2, which has the highest alkali content of all ten glasses and which fails the WTP VHT requirement by a significant margin, was actually one of the better performing glasses over the range of PCT-B conditions investigated. Glass IDF1-B2 showed robustness with respect to moving from Stage IV to Stage V despite increases in test temperature and S/V, both of which promote more interactive leaching conditions that drive the system towards secondary phase formation. This glass was deliberately included in the present study

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to provide such a bounding case. However, the results from the PCT-B tests over a range of test conditions suggest that, by that measure, this is actually one of the more durable glasses. Accordingly, it may be prudent to reconsider the role of the VHT in the criteria for acceptance of LAW compositions for production at the WTP or at least the present contract limit. It is quite possible that the present limit may exclude viable higher waste loading glasses that would meet the IDF PA, which is not an economically desirable situation.

Three of the ten selected glasses were also subjected to SPFT testing. A full-suite of SPFT experiments as a function of pH, temperature and silicic acid concentration was performed on the selected bounding glass (48 tests). More limited SPFT tests as a function of silicic acid concentration and temperature were performed on two other glasses. The selected bounding glass was IDF1-B2, which has a high Na₂O concentration (25 wt%), and properties that challenge but are with the WTP limits with the exception of its VHT response, which significantly exceeds the WTP limit. The results of the SPFT tests were analyzed to determine the parameters in the ILAW glass dissolution model. However, a number of significant deviations from that model are identified and discussed. For example, results from the present study suggest that the kinetic rate law model previously used for the ILAW PA exhibits variable degrees of success depending on the specific experimental conditions. For example, the model worked well for IDF1-B2 tests performed far from saturation. Under near saturation conditions, however, there was a correlation between experimentally obtained and calculated dissolution rates for glass IDF1-B2 only at low temperatures. The results also suggest that there may be important limitations on the use of boron release rate as a reliable indicator of the overall glass reaction rate.

The rate law parameters determined from the SPFT tests are in good agreement with those determined for other LAW glasses, such as LAWA44, LAWB45, and LAWC22, which are baseline WTP formulations that have generally lower waste loadings and, therefore, lower alkali contents. It should be noted, however, that there appears to be an error in the previously reported values of the pseudo-equilibrium constant K_g for these glasses, which has been propagated over the course of several years. The error makes the reported K_g values low by a factor of about 3.4. Once corrected, the K_g values are in good agreement with that determined for glass IDF1-B2 in the present work. Clearly, however, the impact of this error on the IDF PA will need to be assessed.

The fact that the rate law parameters determined for the bounding glass are close to those for the more typical WTP glasses is of practical significance since it suggests that higher waste loading glasses such as IDF1-B2 may still meet the requirements of the IDF PA. Establishing the viability of such high waste loading glasses in this regard is important in realizing their potential benefits in terms of reductions in life cycle costs and mission duration. It is also noteworthy in this context that IDF1-B2 exceeds the present WTP contract limit on the VHT test.

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SECTION 8.0 QUALITY ASSURANCE

This work was conducted under a quality assurance program compliant with the applicable criteria of 10 CFR 830.120; the American Society of Mechanical Engineers (ASME) NQA-1, 2004; and DOE Order 414.1 C, Quality Assurance. These QA requirements are implemented through a Quality Assurance Project Plan for WTP work [115] that is conducted at VSL. Test and procedure requirements by which the testing activities are planned and controlled are also defined in this plan. The program is supported by VSL standard operating procedures that were used for this work [116]. This is LAW work and is therefore not subject to the requirements of DOE/RW-0333P, Office of Civilian Waste Management Quality Assurance Requirements and Description (QARD), Revision 20.

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**Table 2.1. Comparison of Composition Ranges for
VSL LAW Glass Database and PA Glasses.**

-	VSL LAW Glass Database			PA Glasses from Sensitivity Report		
Oxide	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Al ₂ O ₃	7.60	3.50	13.66	7.98	4.00	12.00
B ₂ O ₃	9.66	6.00	14.03	8.43	4.19	14.14
CaO	5.13	0.00	12.81	2.43	0.00	6.63
Fe ₂ O ₃	3.29	0.00	9.98	4.81	0.00	12.55
K ₂ O	1.29	0.00	5.88	1.22	0.00	3.10
Li ₂ O	1.26	0.00	5.82	1.13	0.00	4.62
MgO	1.68	0.00	10.00	1.31	0.00	2.97
Na ₂ O	17.45	2.46	26.00	17.46	6.50	23.00
SiO ₂	42.52	30.19	52.15	47.29	38.25	55.91
SnO ₂	0.47	0	5.00	None		
TiO ₂	0.87	0	3.01	1.06	0.00	3.06
V ₂ O ₅	0.37	0	3.00	None		
ZnO	3.25	0	5.82	1.88	0.00	4.27
ZrO ₂	3.76	0	11.25	2.85	0.00	6.82

- Empty data field

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Table 3.1. Compositions of PA Glasses.

Glass ID	HLP51-LAWBP1	HLP56-LAWA44	LAWB45	LAWC22	HLP53-LAWA23	HLP48-LAWA33	HLP-10	HLP-31	LD6-5412	LRM-1	BKV1	BKV6	SRL-202	SON68
Al ₂ O ₃	10.00	6.20	6.13	6.08	9.70	11.97	7.15	4.00	12.00	10.00	8.69	10.02	4.77	5.00
B ₂ O ₃	9.25	8.90	12.34	10.06	4.32	8.85	8.00	12.00	5.00	8.00	5.99	4.19	6.99	14.14
CaO	0.00	1.99	6.63	5.12	4.46	0.00	0.01	0.01	4.00	0.50	2.71	3.36	1.11	4.07
Fe ₂ O ₃	2.50	6.98	5.26	5.43	7.43	5.77	5.63	3.36	0.00	1.00	3.69	4.75	12.55	3.03
K ₂ O	2.20	0.50	0.26	0.10	2.31	3.10	0.42	0.47	1.46	1.50	1.65	1.14	2.01	0.00
Li ₂ O	0.00	0.00	4.62	2.51	2.08	0.00	0.00	0.00	0.00	0.10	0.00	0.00	4.53	1.99
MgO	1.00	1.99	2.97	1.51	2.08	1.99	1.53	0.92	0.00	0.10	1.23	1.54	1.51	0.00
Na ₂ O	20.00	20.00	6.50	14.40	20.00	20.00	20.45	23.00	20.00	20.00	22.19	19.83	7.91	10.22
SiO ₂	41.89	44.55	47.86	46.67	40.52	38.25	50.16	52.00	55.91	54.37	45.20	47.23	51.53	45.85
SnO ₂	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TiO ₂	2.49	1.99	0.00	1.14	0.00	2.49	3.06	1.83	0.00	0.10	0.63	0.88	0.24	0.00
V ₂ O ₅	NA ^b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ZnO	2.60	2.96	3.15	3.07	3.34	4.27	1.53	0.92	0.00	0.00		0.03	0.09	2.53
ZrO ₂	5.25	2.99	3.15	3.03	3.05	2.49	1.53	0.92	0.00	1.00	6.82	5.79	1.19	2.75
Others*	2.82	0.95	1.13	0.88	0.71	0.82	0.53	0.57	1.62	3.33	1.20	1.24	5.57 ^s	10.42
Sum	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Others include minor amounts of Ag₂O, BaO, CdO, Ce₂O₃, Cl, Cr₂O₃, Cs₂O, F, I, La₂O₃, MnO, MoO₃, Nd₂O₃, NiO, P₂O₅, PbO₂, Pr₂O₃, Re₂O₇, SO₃, SeO₂, SnO₂, SrO, TeO₂, and Y₂O₃. Not all elements are present in every glass

NA – Not included

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Table 3.2. Summary of WTP LAW Glass Requirements [41, 73].

Test	Requirement [41, 73]
Density of glass	< 3.7 g/cc
Crystalline Phase	Phase identification
Liquidus	< 950°C
Centerline Canister Cooling	Phase identification
PCT B (g/m ²)	< 2.0 g/m ²
PCT Na (g/m ²)	< 2.0 g/m ²
PCT Si (g/m ²)	< 2.0 g/m ²
VHT at 200°C (g/m ² /day)	< 50 g/m ² /day
Viscosity (poise) at 1100°C	10 to 150 P
Conductivity (S/cm) at 1100°C	0.2 to 0.7 S/cm
T _G (°C)	Report for modeling

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Table 3.3. Compositions of Selected VSL LAW Bounding Glasses.

GLASS	ORPLB2	ORPLA15	ORPLA20	ORPLG9	LAWA125	LAWA187	ORPLD6	ORPLE12	ORPLF7	LE4H-Zr6
Al ₂ O ₃	10.00	9.46	6.70	6.74	5.64	10.65	10.12	7.58	8.60	4.95
B ₂ O ₃	7.30	8.65	8.80	8.49	9.55	12.79	9.87	9.82	9.50	11.77
CaO	1.10	3.34	3.34	2.69	1.94	6.48	7.91	10.02	9.72	2.43
Fe ₂ O ₃	1.10	0.93	0.30	0.28	5.39	0.91	0.30	0.24	0.30	6.70
K ₂ O	0.12	0.54	0.54	5.75	4.21	0.51	0.17	0.55	0.50	0.54
Li ₂ O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.49	4.35	0.00
MgO	1.10	0.93	0.93	0.95	1.44	0.91	0.99	1.04	0.98	1.45
Na ₂ O	25.00	24.00	24.00	21.00	20.00	23.00	22.00	16.00	12.00	21.27
SiO ₂	39.98	39.50	42.51	40.75	42.91	34.86	37.33	41.27	42.14	38.99
SnO ₂	1.08	2.75	2.76	2.83	0.00	1.00	0.00	0.00	0.00	0.00
TiO ₂	0.00	0.00	0.00	0.00	1.94	0.00	0.00	0.01	0.00	0.00
V ₂ O ₅	2.00	0.00	0.00	0.00	0.00	0.98	1.97	1.74	2.50	0.00
ZnO	3.65	2.45	2.76	3.39	2.88	3.00	2.97	3.21	2.91	1.50
ZrO ₂	5.44	5.95	6.00	5.66	2.91	3.00	3.99	3.53	3.88	9.50
Others	2.13	1.51	1.37	1.48	1.19	1.92	2.38	2.50	2.62	0.90
Sum	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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Table 3.4. Composition Ranges of Selected VSL LAW Bounding Glasses and PA Glasses.

GLASS	Proposed VSL LAW Glass Selections			PA Glasses from Sensitivity Report		
	Mean	Min	Max	Mean	Min	Max
Al ₂ O ₃	8.04	4.95	10.65	7.98	4.00	12.00
B ₂ O ₃	9.65	8.49	12.79	8.43	4.19	14.14
CaO	4.90	1.94	10.02	2.43	0.00	6.63
Fe ₂ O ₃	1.64	0.24	6.70	4.81	0.00	12.55
K ₂ O	1.34	0.17	5.75	1.22	0.00	3.10
Li ₂ O	0.68	0.00	4.35	1.13	0.00	4.62
MgO	1.07	0.91	1.45	1.31	0.00	2.97
Na ₂ O	20.83	12.00	25.00	17.46	6.50	23.00
SiO ₂	40.02	34.86	42.91	47.29	38.25	55.91
SnO ₂	1.04	0.00	2.83	None		
TiO ₂	0.19	0.00	1.94	1.06	0.00	3.06
V ₂ O ₅	0.92	0.00	2.50	None		
ZnO	2.87	1.50	3.65	1.88	0.00	4.27
ZrO ₂	4.98	2.91	9.50	2.85	0.00	6.82

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Table 3.5. Target Compositions of the Ten New IDF Glasses (wt%).

GLASS	IDF1-B2	IDF2-G9	IDF3-F7	IDF4-A15	IDF5-A20	IDF6-D6	IDF7-E12	IDF8-A125	IDF9-A187	IDF10-Zr6
Al ₂ O ₃	10.00	6.76	8.65	9.45	6.65	10.09	7.58	5.64	10.57	4.95
B ₂ O ₃	7.30	8.51	9.53	8.60	8.74	9.85	9.82	9.55	12.77	11.77
CaO	1.10	2.70	9.77	3.32	3.32	7.89	10.02	1.94	6.47	2.43
Cr ₂ O ₃	0.52	0.59	0.56	0.49	0.50	0.50	0.50	0.02	0.52	0.08
Cs ₂ O	0.15	-	-	0.14	-	-	0.15	0.18	-	-
Fe ₂ O ₃	1.10	0.20	0.23	0.92	0.19	0.28	0.24	5.39	0.90	6.70
K ₂ O	0.12	5.76	0.50	0.54	0.53	0.17	0.55	4.21	0.51	0.54
Li ₂ O	-	-	4.37	-	-	-	2.49	-	-	-
MgO	1.10	0.96	0.98	0.92	0.92	1.00	1.04	1.44	0.90	1.45
MnO ₂	0.06	-		-	-	-	-	-	-	-
Na ₂ O	25.00	21.00	12.00	24.00	24.00	22.00	16.00	20.00	23.00	21.27
NiO	0.04	0.01	-	-	-	0.04	-	-	-	0.01
PbO	-	0.01	-	-	-	0.01	-	-	-	0.01
SiO ₂	39.88	40.82	42.38	39.17	42.24	37.14	41.19	42.81	34.70	38.89
SnO ₂	1.08	2.84	-	2.73	2.74	-	-	-	1.00	-
TiO ₂	-	-	-	-	-	-	-	1.94	-	-
V ₂ O ₅	2.00	-	2.50	-	-	1.96	1.74	-	0.97	-
ZnO	3.65	3.40	2.92	2.43	2.74	2.96	3.21	2.88	2.99	1.50
ZrO ₂	5.44	5.68	3.92	5.91	5.96	3.98	3.53	2.91	2.99	9.50
Cl	0.11	0.23	0.01	0.68	0.67	0.35	0.02	0.22	0.64	0.20
F	0.49	0.09	0.08	0.00	0.00	0.18	0.20	0.32	-	0.08
P ₂ O ₅	0.23	0.14	0.04	-	-	0.30	0.12	0.08	-	0.12
SO ₃	0.52	0.20	1.50	0.60	0.70	1.20	1.50	0.37	0.95	0.41
Re ₂ O ₇	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
SUM	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

- Empty data field

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Table 3.6. XRF Analyses (wt%) of the Ten IDF Glasses (multiple batches and CCC samples).

Glass Oxides	IDF1-B2 Target	IDF1-B2-1	IDF1-B2-2	IDF1-B2-3	IDF1B2-CCC	IDF1B2 CCC1	IDF2-G9 Target	IDF2-G9-4	IDF2-G9-5	IDF2-G9-6	IDF2G9 CCC1	IDF2G9 CCC2
Al ₂ O ₃	10.00	9.44	9.51	9.61	9.64	9.56	6.76	6.37	6.26	6.45	6.35	6.45
B ₂ O ₃	7.30	NA	NA	NA	NA	NA	8.51	NA	NA	NA	NA	NA
CaO	1.10	1.24	1.22	1.19	1.13	1.19	2.70	2.86	2.90	2.80	2.89	2.77
Cr ₂ O ₃	0.52	0.69	0.68	0.68	0.63	0.68	0.59	0.74	0.77	0.72	0.76	0.71
Cs ₂ O	0.15	0.204	0.154	0.139	0.138	0.153	-	-	-	-	-	-
Fe ₂ O ₃	1.10	1.18	1.15	1.16	1.07	1.16	0.20	0.23	0.24	0.22	0.25	0.22
K ₂ O	0.12	0.129	0.121	0.121	0.117	0.128	5.76	5.72	5.60	5.37	5.61	5.38
MgO	1.10	1.16	1.17	1.17	1.19	1.14	0.96	0.94	0.86	0.93	0.93	0.96
MnO ₂	0.06	0.054	0.054	0.056	0.049	0.052	-	-	-	-	-	-
Na ₂ O	25.00	24.74	25.13	25.44	26.14	24.94	21.00	21.21	21.37	21.50	20.63	21.65
NiO	0.04	0.044	0.049	0.046	0.043	0.044	0.01	0.01	0.00	0.00	0.00	0.01
PbO	-	-	-	-	-	-	0.01	0.01	0.01	0.00	0.01	0.00
SiO ₂	39.88	39.88	40.35	40.12	40.2	40.42	40.82	40.93	40.29	41.07	40.64	40.84
SnO ₂	1.08	1.25	1.05	0.994	1.06	1.08	2.84	2.62	2.88	2.72	3.02	2.95
TiO ₂	-	0.02	0.01	0.02	0.01	0.02	-	0.00	0.01	0.01	0.00	0.00
V ₂ O ₅	2.00	2.05	1.98	2.00	1.86	1.98	-	0.01	0.00	0.00	0.00	0.00
ZnO	3.65	3.78	3.63	3.63	3.42	3.71	3.40	3.44	3.53	3.35	3.57	3.29
ZrO ₂	5.44	5.63	5.25	5.17	4.88	5.28	5.68	5.49	5.77	5.41	5.86	5.35
Cl	0.11	0.11	0.10	0.09	0.09	0.10	0.23	0.22	0.22	0.20	0.20	0.18
F	0.49	NA	NA	NA	NA	NA	0.09	NA	NA	NA	NA	NA
P ₂ O ₅	0.23	0.268	0.258	0.251	0.251	0.249	0.14	0.15	0.15	0.16	0.16	0.156
SO ₃	0.52	0.473	0.508	0.485	0.484	0.477	0.20	0.17	0.18	0.19	0.18	0.18
Re ₂ O ₇	0.10	0.148	0.13	0.13	0.115	0.127	0.10	0.09	0.11	0.09	0.10	0.08
SUM	100.0	99.8	99.8	99.8	99.8	99.8	100.0	99.7	99.6	99.7	98.5	98.5

- Empty data field
NA – Not analyzed

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Table 3.6. XRF Analyses (wt%) of the Ten IDF Glasses (multiple batches and CCC samples) (cont'd).

Glass Oxides	IDF3-F7 Target	IDF3-F7-4	IDF3-F7-5	IDF3-F7-7	IDF3F7 CCC1	IDF3F7 CCC2	IDF4-A15 Target	IDF4-A15-3	IDF4-A15-4	IDF4A15 CCC
Al ₂ O ₃	8.65	8.13	8.11	8.03	8.13	8.02	9.45	8.85	8.99	8.94
B ₂ O ₃	9.53	NA	NA		NA	NA	8.60	NA	NA	NA
CaO	9.77	10.23	10.35	10.47	10.36	10.91	3.32	3.65	3.52	3.56
Cr ₂ O ₃	0.56	0.73	0.72	0.73	0.72	0.77	0.49	0.62	0.60	0.61
Cs ₂ O	-	-	-	-	-	-	0.14	0.13	0.12	0.12
Fe ₂ O ₃	0.23	0.25	0.25	0.27	0.26	0.27	0.92	0.99	0.96	1.01
K ₂ O	0.50	0.44	0.45	0.50	0.46	0.47	0.54	0.51	0.51	0.51
Li ₂ O	4.37	NA	NA	NA	NA	NA	-	-	-	-
MgO	0.98	0.95	0.95	0.97	0.97	0.93	0.92	0.86	0.90	0.87
Na ₂ O	12.00	11.98	12.59	12.31	12.00	11.71	24.00	23.98	24.43	23.68
SiO ₂	42.38	42.75	41.79	41.83	42.37	41.39	39.17	38.97	38.97	39.36
SnO ₂	-	0.01	0.00	0.00	0.01	0.01	2.73	2.78	2.66	2.77
V ₂ O ₅	2.50	2.45	2.52	2.57	2.53	2.64	-	-	-	
ZnO	2.92	2.96	3.03	3.11	3.08	3.25	2.43	2.49	2.42	2.50
ZrO ₂	3.92	3.88	3.97	4.11	4.01	4.40	5.91	5.92	5.69	5.82
Cl	0.01	0.00	0.01		0.01	0.01	0.68	0.67	0.65	0.60
F	0.08	NA	NA	NA	NA	NA	0.00	-	-	-
P ₂ O ₅	0.04	0.05	0.05	0.05	0.05	0.05	-	0.00	0.01	0.02
SO ₃	1.50	1.11	1.11	0.94	0.95	1.04	0.60	0.52	0.50	0.57
Re ₂ O ₇	0.10	0.09	0.09	0.11	0.07	0.08	0.10	0.15	0.14	0.13
SUM	100.0	99.9	99.9	99.9	99.9	99.9	100.0	99.7	99.7	99.7

- Empty data field
NA – Not analyzed

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Table 3.6. XRF Analyses (wt%) of the Ten IDF Glasses (multiple batches and CCC samples) (cont'd).

Glass Oxides	IDF5-A20 Target	IDF5-A20-3	IDF5-A20-4	IDF5A20 CCC	IDF6-D6 Target	IDF6-D6-3	IDF6-D6-4	IDF6D6 CCC	IDF7-E12 Target	IDF7-E12-1	IDF7-E12-2	IDF7E12 CCC
Al ₂ O ₃	6.65	6.35	6.18	6.30	10.09	9.54	9.56	9.98	7.58	7.19	7.24	7.31
B ₂ O ₃	8.74	NA	NA	NA	9.85	NA	NA	NA	9.82	NA	NA	NA
CaO	3.32	3.50	3.72	3.54	7.89	8.60	8.85	8.37	10.02	10.18	10.40	10.16
Cr ₂ O ₃	0.50	0.60	0.67	0.65	0.50	0.64	0.67	0.63	0.50	0.65	0.64	0.63
Cs ₂ O	-	-	-	-	-	-	-	-	0.15	0.16	0.17	0.17
Fe ₂ O ₃	0.19	0.22	0.23	0.23	0.28	0.32	0.33	0.32	0.24	0.27	0.27	0.26
K ₂ O	0.53	0.51	0.52	0.50	0.17	0.16	0.18	0.16	0.55	0.51	0.52	0.13
Li ₂ O	-	-	-	-	-	-	-	-	2.49	NA	NA	NA
MgO	0.92	0.98	0.98	0.98	1.00	0.95	1.00	0.95	1.04	0.99	1.00	1.14
MnO ₂	-	-	-	-	-	-	-	-	-	-	-	0.05
Na ₂ O	24.00	24.17	23.71	23.85	22.00	21.96	21.02	21.75	16.00	16.86	16.23	24.94
NiO	-	-	-	-	0.04	0.05	0.04	0.04	-	-	-	-
PbO	-	-	-	-	0.01	0.01	0.02	0.01	-	-	-	-
SiO ₂	42.24	42.28	41.00	41.83	37.14	37.05	36.97	37.34	41.19	41.20	41.40	40.42
SnO ₂	2.74	2.59	3.03	2.86	-	0.00	0.00	0.00	-	0.01	0.01	1.08
V ₂ O ₅	-	-	-	-	1.96	1.99	2.06	1.92	1.74	1.67	1.70	1.98
ZnO	2.74	2.67	2.73	2.85	2.96	3.03	3.20	2.92	3.21	3.12	3.21	3.71
ZrO ₂	5.96	5.63	6.55	5.99	3.98	4.00	4.35	3.83	3.53	3.30	3.39	5.28
Cl	0.67	0.68	0.65	0.58	0.35	0.33	0.34	0.29	0.02	0.02	0.01	0.10
F	0.00	NA	NA	NA	0.18	NA	NA	NA	0.20	NA	NA	NA
P ₂ O ₅	0.00	0.00	0.01	0.00	0.30	0.31	0.31	0.32	0.12	0.14	0.13	0.25
SO ₃	0.70	0.60	0.16	0.64	1.20	0.97	1.01	1.10	1.50	1.27	1.21	0.48
Re ₂ O ₇	0.10	0.16	0.14	0.12	0.10	0.11	0.13	0.10	0.10	0.06	0.05	0.13
SUM	100.0	99.7	98.9	99.7	100.0	99.9	99.9	99.9	100.0	99.9	99.9	105.6

- Empty data field

NA – Not analyzed

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Table 3.6. XRF Analyses (wt%) of the Ten IDF Glasses (multiple batches and CCC samples) (cont'd).

Glass Oxides	IDF8-A125 Target	IDF8-A125-1	IDF8-A125-2	IDF8A125 CCC	IDF9-A187 Target	IDF9-A187-1	IDF9-A187-2	IDF9A187 CCC	IDF10-Zr6 Target	IDF10-Zr6-1	IDF10-Zr6-2	IDFZr6 CCC
Al ₂ O ₃	5.64	5.33	5.43	5.35	10.57	10.05	9.94	10.69	4.95	4.74	4.76	4.56
B ₂ O ₃	9.55	NA	NA	NA	12.77	NA	NA	NA	11.77	NA	NA	NA
CaO	1.94	2.04	2.05	2.02	6.47	6.85	6.98	6.74	2.43	2.62	2.59	2.72
Cr ₂ O ₃	0.02	0.03	0.03	0.03	0.52	0.64	0.67	0.77	0.08	0.10	0.10	0.10
Cs ₂ O	0.18	0.23	0.19	0.20	-	-	-	-	-	-	-	-
Fe ₂ O ₃	5.39	5.34	5.43	5.39	0.90	0.94	0.97	0.98	6.70	6.89	6.81	7.41
K ₂ O	4.21	3.89	3.90	3.83	0.51	0.49	0.50	0.48	0.54	0.54	0.52	0.55
MgO	1.44	1.35	1.40	1.38	0.90	0.91	0.90	0.84	1.45	1.44	1.44	1.40
Na ₂ O	20.00	20.76	20.30	20.76	23.00	22.99	22.67	23.06	21.27	20.91	21.38	21.06
SiO ₂	42.81	42.83	43.04	42.83	34.70	34.90	34.90	33.70	38.89	39.35	39.08	37.63
SnO ₂	-	0.00	0.01	0.01	1.00	1.02	1.02	1.08	-	0.00	0.00	0.00
TiO ₂	1.94	2.06	2.10	2.08	-	0.01	0.00	0.01	-	0.02	0.02	0.02
V ₂ O ₅	-	-	-	-	0.97	0.95	0.98	0.97	-	-	-	-
ZnO	2.88	2.86	2.89	2.89	2.99	2.94	3.05	3.06	1.50	1.51	1.49	1.64
ZrO ₂	2.91	2.79	2.77	2.81	2.99	2.86	2.94	3.08	9.50	8.98	8.89	10.07
Cl	0.22	0.20	0.22	0.17	0.64	0.58	0.60	0.52	0.20	0.20	0.19	0.16
F	0.32	NA	NA	NA	-	NA	NA	NA	0.08	NA	NA	NA
P ₂ O ₅	0.08	0.09	0.09	0.09	-	0.01		0.01	0.12	0.15	0.15	0.13
SO ₃	0.37	0.40	0.40	0.39	0.95	0.82	0.85	0.98	0.41	0.35	0.35	0.32
Re ₂ O ₇	0.10	0.12	0.12	0.09	0.10	0.12	0.13	0.12	0.10	0.15	0.15	0.13
SUM	100.0	99.9	99.9	99.9	100.0	99.9	99.9	99.8	100.0	99.7	99.7	99.7

- Empty data field

NA – Not analyzed

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Table 3.7. DCP Analyses (wt%) of the Ten IDF Glasses.

Glass Oxides	IDF1-B2-1	IDF1-B2-2	IDF1-B2-3	IDF2-G9-4	IDF2-G9-5	IDF2-G9-6	IDF3-F7-4	IDF3-F7-5	IDF3-F7-7	IDF4-A15-3	IDF4-A15-4	IDF5-A20-3	IDF5-A20-4
Al ₂ O ₃	9.96	9.61	8.91	6.49	6.24	6.42	7.93	7.93	8.22	9.20	9.19	5.98	5.85
B ₂ O ₃	7.61	7.62	7.25	8.49	8.16	8.17	9.21	9.18	9.62	8.63	8.57	8.54	8.38
CaO	1.28	1.31	1.24	2.81	2.81	2.84	8.85	8.83	8.96	3.21	3.19	3.08	3.00
Cr ₂ O ₃	0.56	0.57	0.53	0.58	0.58	0.60	0.51	0.50	0.50	0.45	0.46	0.50	0.52
Fe ₂ O ₃	1.14	1.13	1.14	0.23	0.23	0.23	0.25	0.25	0.27	0.94	0.95	0.23	0.23
K ₂ O	0.14	0.13	0.13	5.35	4.97	5.00	0.48	0.49	0.54	0.51	0.52	0.57	0.58
Li ₂ O	0.03	0.03	0.03	0.03	0.03	0.02	4.20	4.30	4.32	0.03	0.03	0.03	0.03
MgO	1.12	1.11	1.14	1.00	1.00	1.02	1.05	1.05	1.06	0.92	0.93	0.98	1.00
MnO ₂	0.06	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na ₂ O	22.57	22.80	22.69	19.69	19.59	19.05	11.13	11.32	11.22	22.19	22.25	21.66	22.21
NiO	0.06	0.07	0.06	0.02	0.01	0.01	0.02	0.02	0.03	0.01	0.00	0.00	0.01
P ₂ O ₅	0.43	0.42	0.25	0.13	0.16	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SiO ₂	39.56	39.80	40.67	41.56	42.15	40.80	42.06	42.28	43.45	39.71	39.75	41.66	42.31
SnO ₂	1.24	1.26	1.32	3.14	3.20	3.18	0.15	0.14	0.14	2.95	2.89	3.08	3.13
TiO ₂	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
V ₂ O ₅	2.03	2.04	1.99	0.01	0.01	0.01	2.55	2.48	2.47	0.02	0.01	0.01	0.01
ZnO	3.79	3.81	3.53	3.28	3.31	3.34	2.77	2.76	2.81	2.44	2.42	2.64	2.68
ZrO ₂	5.70	5.72	5.52	5.81	5.73	5.69	3.86	3.64	3.99	6.01	6.00	5.82	5.72
Sum	97.3	97.5	96.5	98.6	98.2	96.4	95.0	95.2	97.6	97.2	97.2	94.8	95.7

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Table 3.7. DCP Analyses (wt%) of the Ten IDF Glasses. (cont'd).

Glass Oxides	IDF6-D6-3	IDF6-D6-4	IDF7-E12-1	IDF7-E12-2	IDF8-A125-1	IDF8-A125-2	IDF9-A187-1	IDF9-A187-2	IDF10-Zr6-1	IDF10-Zr6-2
Al ₂ O ₃	9.92	9.90	7.14	7.12	5.46	5.44	10.26	10.59	4.86	4.82
B ₂ O ₃	9.93	9.95	9.48	9.36	9.33	9.55	12.80	13.05	11.90	11.80
CaO	7.83	7.77	9.13	9.28	2.14	2.07	6.30	6.45	2.57	2.53
Cr ₂ O ₃	0.48	0.47	0.48	0.48	0.03	0.02	0.50	0.50	0.08	0.08
Fe ₂ O ₃	0.31	0.30	0.26	0.26	5.34	5.35	0.96	0.93	6.63	6.62
K ₂ O	0.18	0.18	0.55	0.54	3.59	3.57	0.52	0.52	0.54	0.53
Li ₂ O	0.05	0.05	2.72	2.75	0.04	0.03	0.04	0.04	0.03	0.03
MgO	1.04	1.05	1.08	1.07	1.46	1.46	0.92	0.92	1.48	1.41
MnO ₂	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na ₂ O	20.37	20.26	14.89	14.62	18.65	18.75	21.00	21.35	19.96	19.86
NiO	0.07	0.06	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.01
P ₂ O ₅	0.33	0.11	0.00	0.07	0.03	0.00	0.00	0.00	0.00	0.00
SiO ₂	37.68	36.85	41.10	40.73	43.29	43.11	34.50	34.89	39.45	39.79
SnO ₂	0.18	0.14	0.19	0.20	0.02	0.01	1.26	1.25	0.09	0.08
TiO ₂	0.02	0.02	0.02	0.02	2.13	2.13	0.02	0.01	0.03	0.03
V ₂ O ₅	2.02	2.06	1.87	1.86	0.02	0.01	1.09	1.07	0.02	0.01
ZnO	2.95	2.91	3.24	3.24	2.97	2.90	2.98	3.05	1.51	1.47
ZrO ₂	4.14	4.11	3.46	3.40	3.05	3.06	3.03	3.11	9.86	9.81
Sum	97.5	96.2	95.6	95.0	97.6	97.5	96.2	97.7	99.0	98.9

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Table 3.8. Summary of Microscopic and XRD Evaluation of the Thirteen Centerline Canister Cooled IDF Glass Samples.

Glass ID	Description	Crystal (vol.%)	Std. Dev	SO ₃ (wt%)
IDF1-B2CCC	Lime green slightly opalescent glass containing sodalite and small amount of zincochromite detected by SEM	4	1	0.48
IDF1B2CCC1		2.8	5.3	0.48
IDF2G9CCC1	Clear dark emerald green glass	0.1	-	0.18
IDF2G9CCC2		0	-	0.18
IDF3F7CCC1	Light Brown slightly opalescent glass with small amount of crystals identified as chromite by SEM and XRD	0.2	0.2	0.95
IDF3F7CCC2		0.3	0.1	1.04
IDF4A15CCC	Dark green slightly opalescent glass	3.6	6	0.57
IDF5A20CCC	Light emerald green slightly opalescent glass containing sodalite	0.4	0.1	0.64
IDF6D6CCC	Lime green slightly opalescent glass containing sodalite and small amount of zincochromite detected by SEM – nosean and sodalite were identified by XRD	19.5	1.4	1.10
IDF7E12CCC	Mixture of clear emerald glass and lime green opalescent glass containing sodalite and small amount of zincochromite detected by SEM	2.8	5.6	0.48
IDF8A125CCC	Clear brown glass	0	-	0.39
IDF9A187CCC	Lime green opalescent glass containing sodalite on SEM evaluation	22	5.6	0.98
IDFZr6CCC	Clear dark brown glass	0	-	0.32

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Table 4.1. Summary of PCT-B Glasses Selected for Secondary Phase Sampling.

Glass Name	Stage III or Stage IV alteration regime	Group Criteria (Molar Fractions)	Number of Glasses Selected	Total Number of Glasses in the Group
LAWB31	IV	$\text{Na}_2\text{O} < 0.204$ & $\text{B}_2\text{O}_3 \geq 0.097$ & $\text{MgO} < 0.044$	6	18
LAWB32	IV			
LAWB60	IV			
LAWC23	IV			
LAWC27	IV			
A88Si-15	Transition*	$\text{Na}_2\text{O} < 0.204$ & $\text{B}_2\text{O}_3 \geq 0.097$ & $\text{MgO} \geq 0.044$	2	14
LAWB35	IV			
LAWB81	Transition	$\text{Na}_2\text{O} < 0.204$ & $\text{B}_2\text{O}_3 < 0.097$ & $\text{ZnO} \geq 0.024$ & $\text{CaO} \geq 0.094$	2	5
LAWB73	IV			
LAWC32	Transition	$\text{Na}_2\text{O} < 0.204$ & $\text{B}_2\text{O}_3 < 0.097$ & $\text{ZnO} \geq 0.024$ & $\text{CaO} < 0.094$	5	34
LAWB89	V			
LAWB90	Transition			
LAWA126	V			
LAWC31	V			
PNLA126CC	V	$\text{Na}_2\text{O} < 0.204$ & $\text{B}_2\text{O}_3 < 0.097$ & $\text{ZnO} < 0.024$	3	18
A1C1-2	V			
A2-AP101	V			
C100GCC	V			
A88AP101R1	V	$\text{Na}_2\text{O} \geq 0.204$ & $\text{Al}_2\text{O}_3 \geq 0.04$	3	18
LAWA44R10	V			
LAWA88R1	V			
A1-AN105R2	V	$\text{Na}_2\text{O} \geq 0.204$ & $\text{Al}_2\text{O}_3 < 0.04$	3	10
A1C1-1	V			
LAWA53	V			

* Data suggest onset of transition from Stage IV to Stage V

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Table 5.1. Composition Overview in Mole% of the Ten Selected Glasses, LAWA44, and ANL-LRM.

Mol%	IDF1-B2	IDF2-G9	IDF3-F7	IDF4-A15	IDF5-A20	IDF6-D6	IDF7-E12	IDF8-A125	IDF9-A187	IDF10-4HZr	LAWA44	ANL-LRM
Al	9.7	6.5	8.0	9.1	6.4	9.6	7.1	5.6	9.8	5.0	6.0	9.6
B	10.3	12.0	12.9	12.1	12.3	13.8	13.5	13.8	17.4	17.3	12.6	11.2
Ca	1.0	2.4	8.2	2.9	2.9	6.8	8.5	1.7	5.5	2.2	1.8	0.4
Fe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0
K	0.1	6.0	0.5	0.6	0.6	0.2	0.6	4.5	0.5	0.6	0.6	1.6
Li	0.0	0.0	13.8	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.3
Mg	1.3	1.2	1.2	1.1	1.1	1.2	1.2	1.8	1.1	1.8	2.4	0.1
Na	39.7	33.4	18.4	37.8	37.6	34.5	24.7	32.5	35.1	35.1	31.8	31.5
Si	32.7	33.3	33.2	31.8	34.3	30.1	32.8	35.9	27.3	33.1	36.6	44.7
Zn	2.2	2.0	1.7	1.4	1.6	1.7	1.8	1.7	1.7	0.9	1.8	0.0
Zr	2.2	2.3	1.5	2.3	2.4	1.6	1.4	1.2	1.1	3.9	1.2	0.4
Sn	0.4	0.9	0.0	0.9	0.9	0.0	0.0	0.0	0.3	0.0	0.7	0.0
Ti	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.1
V	0.5	0.0	0.7	0.0	0.0	0.5	0.5	0.0	0.3	0.0	0.0	0.0
Sum	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Al+B	20.0	18.5	20.9	21.1	18.7	23.4	20.6	19.4	27.2	22.3	18.6	20.8
K+Li+Na	39.8	39.4	32.7	38.4	38.2	34.7	33.2	37.0	35.6	35.7	32.4	33.4
Ca+Mg	2.30	3.53	9.37	4.01	4.02	8.05	9.78	3.54	6.51	4.06	4.20	0.56
Si+Sn+Zr	35.2	36.5	34.7	35.1	37.5	31.6	34.1	37.1	28.8	37.1	38.4	45.1
others	2.7	2.0	2.3	1.4	1.6	2.2	2.3	3.0	1.9	0.9	6.4	0.1
<i>K+Li+Na/Si</i>	<i>1.2</i>	<i>1.2</i>	<i>1.0</i>	<i>1.2</i>	<i>1.1</i>	<i>1.2</i>	<i>1.0</i>	<i>1.0</i>	<i>1.3</i>	<i>1.1</i>	<i>0.9</i>	<i>0.7</i>

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Table 6.1a. Baseline Matrix for SPFT Testing at 23°C.

Temp [°C]	Train # “i”	Duration [d]	Dt _{samp} [d]	Dt(10ml) [h]	# Samples “N”	# Blanks	V _{efl} [L]	[Si] _{efl} [ppm]	F [μl/m]	pH	m _g [g]
1	2	3	4	5	6	7	8	9	10	11	12
23	1	40	5.0	23.8	8		0.40	0	7.0	7	1.00
	2	40	5.0	23.8	8		0.40	0	7.0	8	1.00
	3	40	5.0	23.8	8	8	0.40	0	7.0	9	1.00
	4	40	5.0	23.8	8		0.40	0	7.0	10	0.50
	5	40	5.0	23.8	8		0.40	0	7.0	11	0.50
	6	40	5.0	23.8	8		0.40	0	7.0	12	0.50
	7	90	9.0	23.8	10		0.91	1.0	7.0	9	4.00
	8	90	9.0	23.8	10		0.91	15	7.0	9	4.00
	9	90	9.0	23.8	10	10	0.91	30	7.0	9	4.00
	10	90	9.0	23.8	10		0.91	45	7.0	9	4.00
	11	90	9.0	23.8	10		0.91	52.5	7.0	9	4.00
	12	90	9.0	23.8	10		0.91	60	7.0	9	4.00

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Table 6.1b. Baseline Matrix for SPFT Testing at 40°C.

Temp [°C]	Train # “i”	Duration [d]	Dt _{samp} [d]	Dt(10ml) [h]	# Samples “N”	# Blanks	V _{eff} [l]	[Si] _{eff} [ppm]	F [μl/m]	pH	m _g [g]
1	2	3	4	5	6	7	8	9	10	11	12
40	1	10	0.83	5.95	12		0.40	0	28.0	7	1.00
	2	10	0.83	5.95	12		0.40	0	28.0	8	1.00
	3	10	0.83	5.95	12		0.40	0	28.0	9	0.50
	4	10	0.83	5.95	12	12	0.40	0	28.0	10	0.50
	5	10	0.83	5.95	12		0.40	0	28.0	11	0.50
	6	10	0.83	5.95	12		0.40	0	28.0	12	0.50
	7	30	3.3	23.8	9		0.30	1.0	7.0	9	0.50
	8	30	3.3	23.8	9		0.30	15	7.0	9	0.50
	9	30	3.3	23.8	9		0.30	30	7.0	9	1.00
	10	30	3.3	23.8	9	9	0.30	45	7.0	9	1.00
	11	30	3.3	23.8	9		0.30	60	7.0	9	2.00
	12	30	3.3	23.8	9		0.30	75	7.0	9	2.00

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Table 6.1c. Baseline Matrix for SPFT Testing at 70°C.

Temp [°C]	Train # “i”	Duration [d]	Dt _{samp} [d]	Dt(10ml) [h]	# Samples “N”	# Blanks	V _{eff} [l]	[Si] _{eff} [ppm]	F [μl/m]	pH	m _g [g]
1	2	3	4	5	6	7	8	9	10	11	12
70	1	10	1.3	4.76	8		0.50	0	35	7	1.00
	2	10	1.3	4.76	8		0.50	0	35	8	1.00
	3	10	1.3	4.76	8		0.50	0	35	9	1.00
	4	10	1.3	4.76	8		0.50	0	35	10	0.50
	5	10	1.3	4.76	8	8	0.50	0	35	11	0.50
	6	10	1.3	4.76	8		0.50	0	35	12	0.50
	7	10	1.3	3.70	8		0.65	1.0	45	9	0.50
	8	10	1.3	3.70	8		0.65	30	45	9	0.50
	9	10	1.3	3.70	8		0.65	60	45	9	1.00
	10	10	1.3	3.70	8		0.65	90	45	9	1.00
	11	10	1.3	3.70	8	8	0.65	120	45	9	2.00
	12	10	1.3	3.70	8		0.65	140	45	9	2.00

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Table 6.1d. Baseline Matrix for SPFT Testing at 90°C.

Temp [°C]	Train # “i”	Duration [d]	Dt _{samp} [d]	Dt(10ml) [h]	# Samples “N”	# Blanks	V ^o _{efl} [L]	[Si] _{efl} [ppm]	F [μl/m]	pH	m _g [g]
1	2	3	4	5	6	7	8	9	10	11	12
90	1	10	1.1	4.76	9		0.50	0	35	7	0.75
	2	10	1.1	4.76	9		0.50	0	35	8	0.75
	3	10	1.1	4.76	9		0.50	0	35	9	0.50
	4	10	1.1	4.76	9		0.50	0	35	10	0.50
	5	10	1.1	4.76	9		0.50	0	35	11	0.50
	6	10	1.1	4.76	9	9	0.50	0	35	12	0.50
	7	10	1.1	3.33	9		0.72	1.0	50	9	0.50
	8	10	1.1	3.33	9		0.72	40	50	9	0.50
	9	10	1.1	3.33	9		0.72	80	50	9	1.00
	10	10	1.1	3.33	9		0.72	100	50	9	1.00
	11	10	1.1	3.33	9		0.72	120	50	9	2.00
	12	10	1.1	3.33	9	9	0.72	140	50	9	2.00

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Table 6.2. Measured in Situ pH of Leaching Solutions.

pH (23°C)	pH (~40°C)	pH (~70°C)	pH (~90°C)
7.0	6.6	6.1	5.8
8.3	8.0	7.4	7.1
9.0	8.7	8.2	7.8
10.0	9.6	9.1	8.7
11.0	10.5	9.9	9.6
12.0	11.6	11.0	10.7

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Table 6.3. Estimate of the Power-Law Coefficient as a Function of temperature as Calculated from the Normalized B Leaching at Steady State.

Temperature (°C)	η	R^2
23	0.5154	0.95
40	0.4092	1.00
70	0.5262	0.97
90	0.4899	0.94

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Table 6.4. Comparison of the Dissolution Rates of IDF1-B2, IDF2-G9, and IDF3-F7 at Various Temperature and at pH (23°C) 9.

T (°C)	NDR (g m ⁻² d ⁻¹)		
	IDF1-B2	IDF2-G9	IDF3-F7
23	0.0014±0.0001	0.0012±0.0000	0.0032±0.0001
40	0.0112±0.0002	0.0128±0.0011	0.0207±0.0021
90	0.1803±0.0087	0.2112±0.0055	0.2090±0.0120

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Table 6.5. Comparison of the K_g Values Calculated for IDF1-B2 Dissolution with the Dissociation Constant of Amorphous SiO_2 (K_{SiLam}) Estimated as Described by Gunnarsson and Arnorsson (2000).

Temperature (°C)	Calculated K_g	K_{SiLam}
15	1.70×10^{-3}	1.57×10^{-3}
23	$(2.02 \pm 0.63) \times 10^{-3}$	1.85×10^{-3}
40	$(2.18 \pm 0.49) \times 10^{-3}$	2.56×10^{-3}
70	$(3.51 \pm 0.65) \times 10^{-3}$	4.18×10^{-3}
90	$(5.28 \pm 0.65) \times 10^{-3} *$	5.52×10^{-3}

* Based on the normalized dissolution of Al

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**Table 6.6. Summary of the Kinetic Rate Law Parameters Obtained for
IDF1-B2, IDF2-G9, and IDF3-F7.**

Kinetic Rate Law Parameter	IDF1-B2	IDF2-G9	IDF3-F7
η	0.49±0.05	ND	ND
E_a , kJ mol ⁻¹	64±4	66	53
k_o , g m ⁻² d ⁻¹	4.5x10 ⁴	ND	ND
K_g (T)	1.70x10 ⁻³ (15°C)	ND	5.95x10 ⁻³ (90°C)
r_x , mol m ⁻² s ⁻¹ (T)	3.4x10 ⁻¹⁰ (15°C)	ND	ND
E_x , kJ mol ⁻¹	58±3	ND	ND

NC: Not Determined

Table 6.7. Summary of the Kinetic Rate Law Parameters Obtained for LAWA44, LAWB45, and LAWC22 in Previous Work [7].

Kinetic Rate Law Parameter	LAWA44	LAWB45	LAWC22
η	0.49±0.08	0.34±0.03	0.42±0.02
E_a , kJ mol ⁻¹	60±7	53±6	64±4
k_o , g m ⁻² d ⁻¹	1.3x10 ⁴	1.6x10 ⁴	1.0x10 ⁵
$K_g(T)$	5.45x10 ⁻⁴ (15°C)	5.24x10 ⁻⁴ (15°C)	5.25x10 ⁻⁴ (15°C)
r_x , mol m ⁻² s ⁻¹ (T)	5.3x10 ⁻¹¹	0	1.2x10 ⁻¹⁰
E_x , kJ mol ⁻¹	65±6	ND	45±4

ND: Not Determined

Table 6.8. Vibrational Frequencies of Groups Commonly Found on the Surface of Boroaluminosilicate Glasses.

Group	Peak (cm ⁻¹)	Description
B-(OSi ₃)	1310	B-O stretching vibration
B-O	~939 Wide frequency	symmetric vibration, BO ₃ coordination
B-O	700	bending vibration, BO ₃ coordination
B-O	1400 faint	asymmetric vibration, BO ₃ coordination
B-O	~960, 920 (zeolites)	asymmetric vibration, BO ₄ coordination
B-O	~1090	BO ₄ coordination
B-O, Si-O	1080	superposition of asymmetric stretching vibration of Si-O-Si and BO ₄
B-OH	1150	stretching, BO ₃ coordination bending, BO ₄ coordination
Al-O-Si	1100	asymmetric stretching
Al-O-Si	524	bending
Al-O-Al	464	
Al-OH	1160	bending
Al-OH	3098	stretching
Al-O	785-795	AlO ₄ coordination
Si-O-Si	455	bending vibration, SiO ₄ tetrahedra
O-Si-O	760	stretching
Si-O-Si	1020	asymmetric stretching
Si-OH	1030, 1130	bending
Si-OH	3280, 3490	stretching
Si-OH	1240, 1400	bending, involves –OH that are H-bonded
Si-OH	2060, 3160	stretching, involves –OH that are H-bonded
Al-OH	1600	bending
Al-OH	2860, 3280	stretching
Al-OH	810	rocking
-OH	1260, 1170	bending, involves –OH groups that are H-bonded, one is Si-OH and the other one is Al-OH
-OH	3300, 3420	stretching, involves –OH groups that are H-bonded, one is Si-OH and the other one is Al-OH
-OH	3200	molecular water, which vibrates freely and/or is H-bonded to a silanol group
-OH	3425	molecular water directly connected to the network.
-OH	3570	Silanol groups
-OH	872 w/ shoulder at 895	Si-OH bending
Si-O	944	Si-O stretching in silanols, which are hydrogen bonded to O of neighboring silanol groups or water (at high molecular water content)

Table 6.8. Vibrational Frequencies of Groups Commonly Found on the Surface of Boroaluminosilicate Glasses (cont.).

Si-O	964	asymmetric stretching of O_3SiOH ; Si-O stretching of non-bridging oxygens
H_2O	1611	bending of free water and water, which is H-bonded to the proton of silanol groups
H_2O	1640	molecular water in porous layer
-OH	2820	stretching of silanol groups H-bonded to NBOs
H_2O	3225	first overtone of the 1611 cm^{-1} bending mode
H_2O	3450	asymmetric stretching of water bound to silica network or symmetric stretching of free/H-bonded molecular water inside the glass.
-OH	3510	OH stretching of silanols which are H-bonded to the O of neighboring silanols
-OH	3673	stretching vibration for silanol groups formed inside the glass during high temperature hydrations
-OH	3749	freely vibrating silanol groups on the surface of highly porous silica glasses and silica gels
-OH	3846-3850	Combination torsion and OH stretching vibration of silanol groups (possibly)

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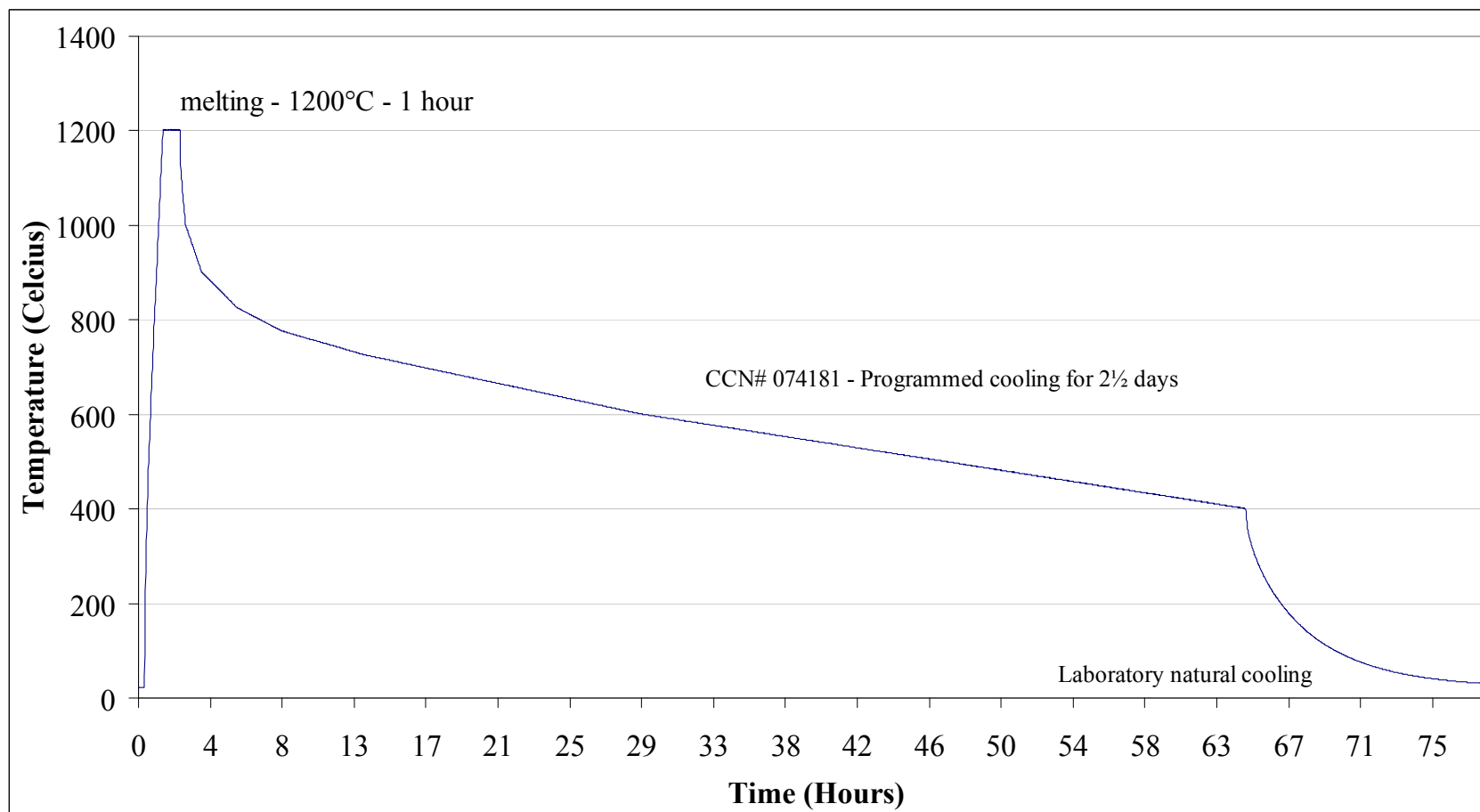


Figure 2.1. Measured CCC heat treatment profile for sample IDF1B2-CCC.

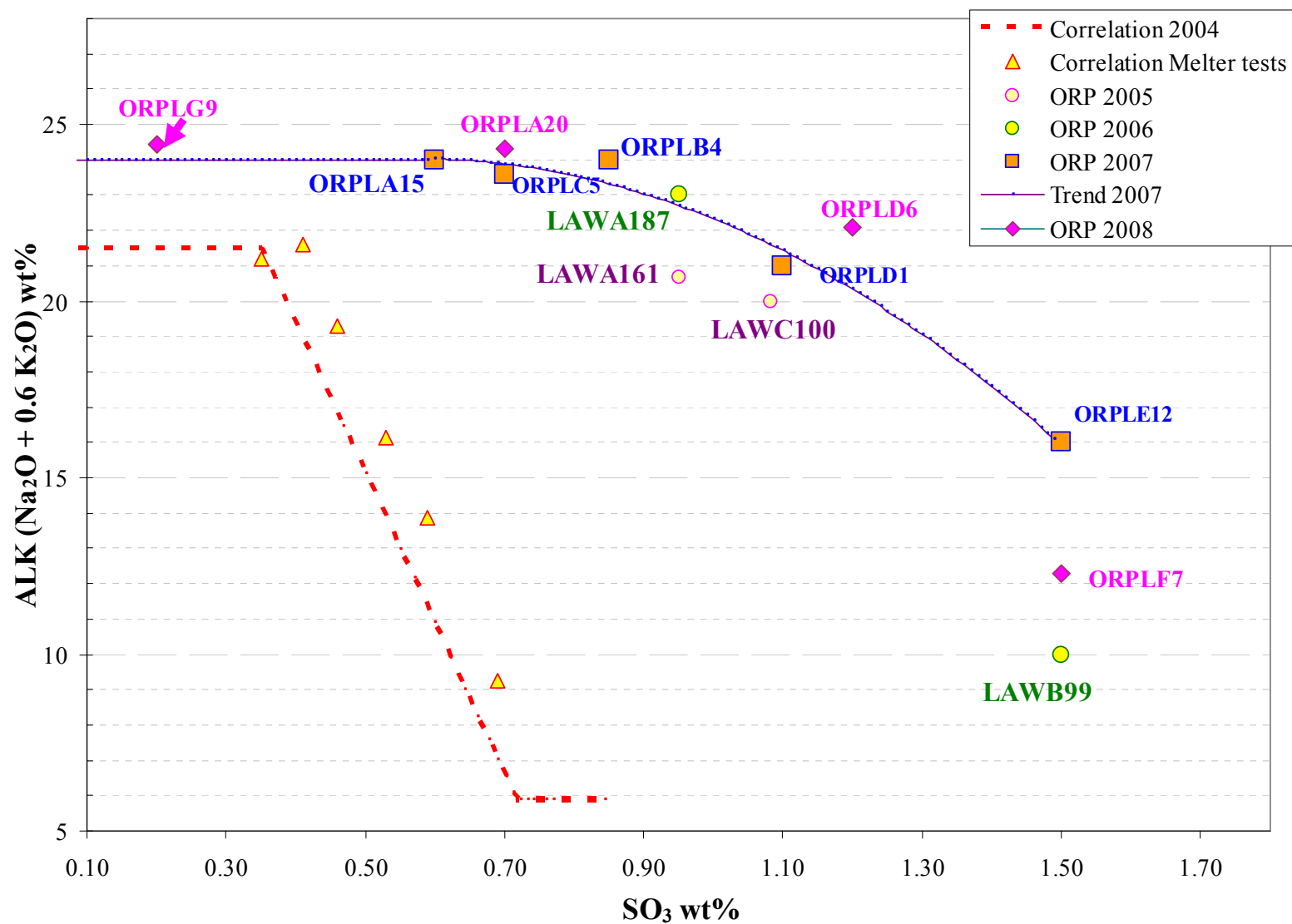


Figure 2.2. Overview of Na_2O and SO_3 loadings for WTP and ORP glasses.

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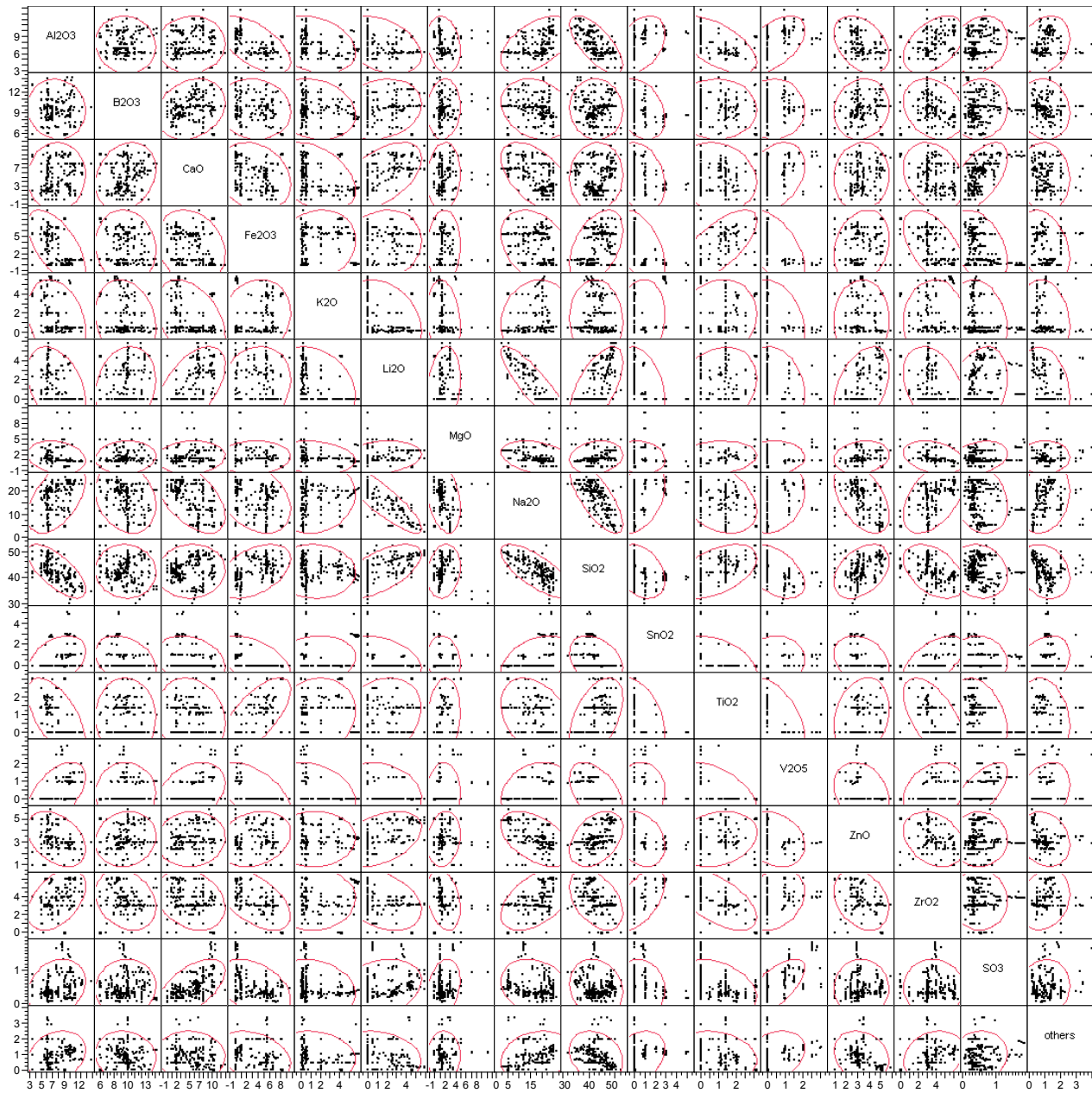


Figure 2.3. Distribution of 352 glasses from VSL LAW glass database in composition space.

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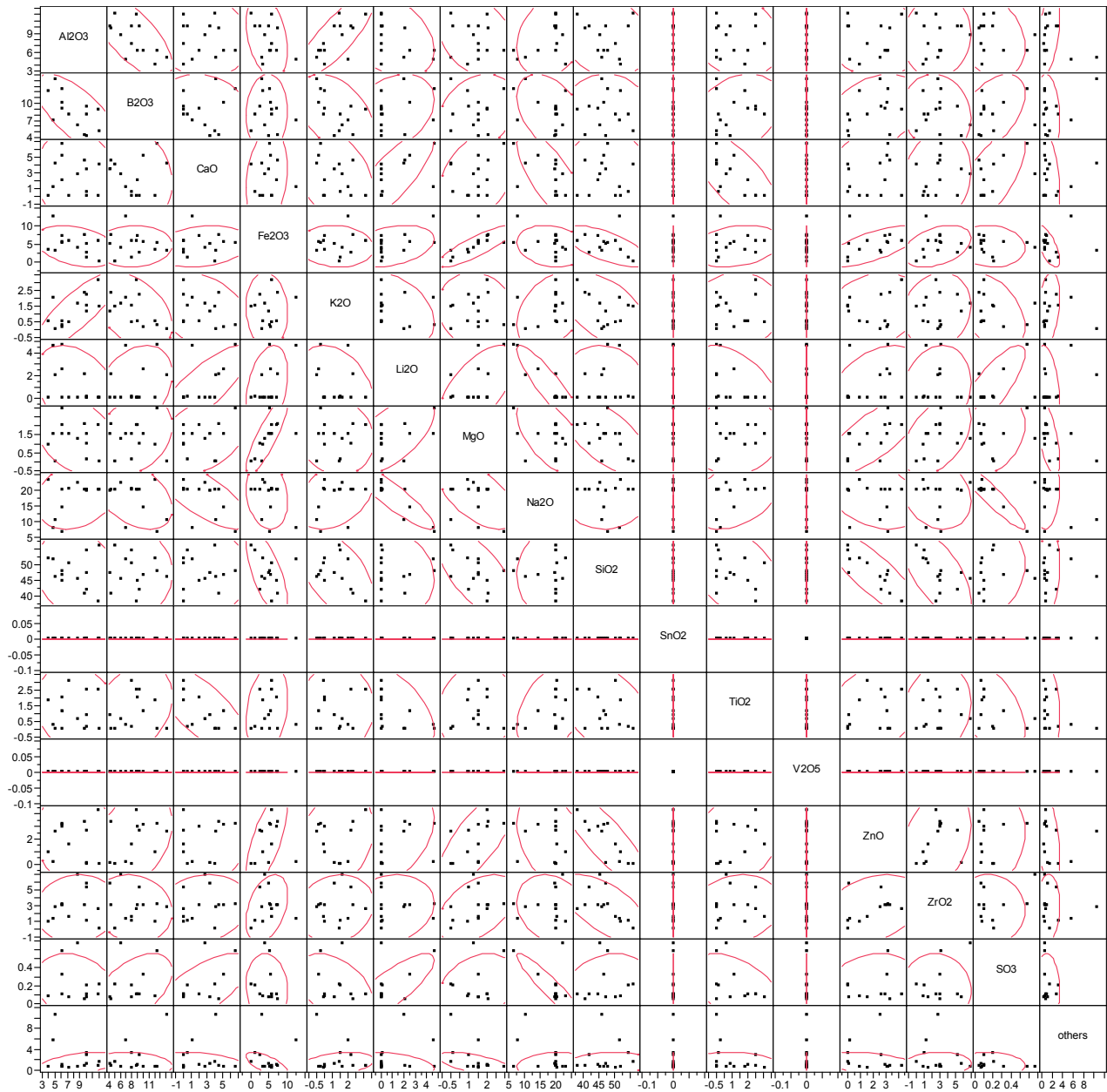


Figure 2.4. Distribution of 14 PA glasses in composition space.

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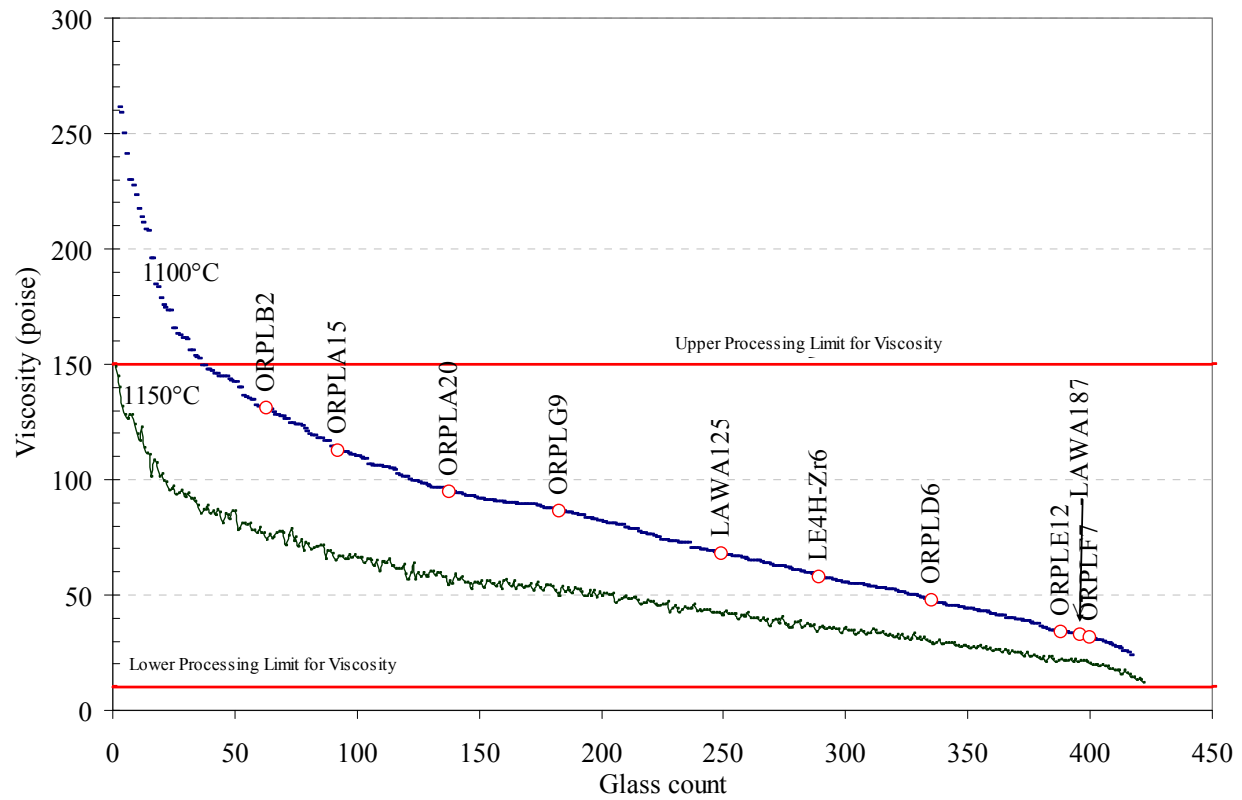


Figure 3.1. Viscosity values for 421 glasses from the VSL LAW glass database.

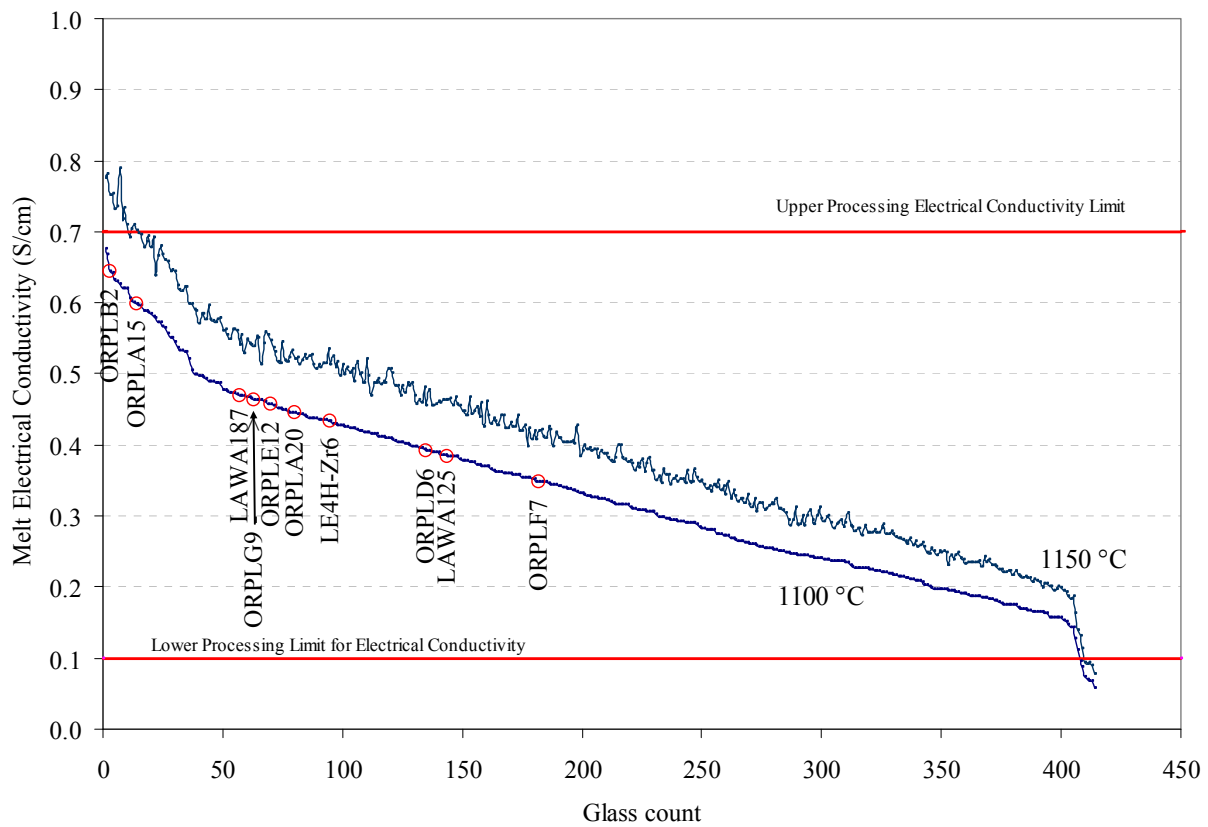


Figure 3.2. Electrical conductivity values for 413 glasses from the VSL LAW glass database

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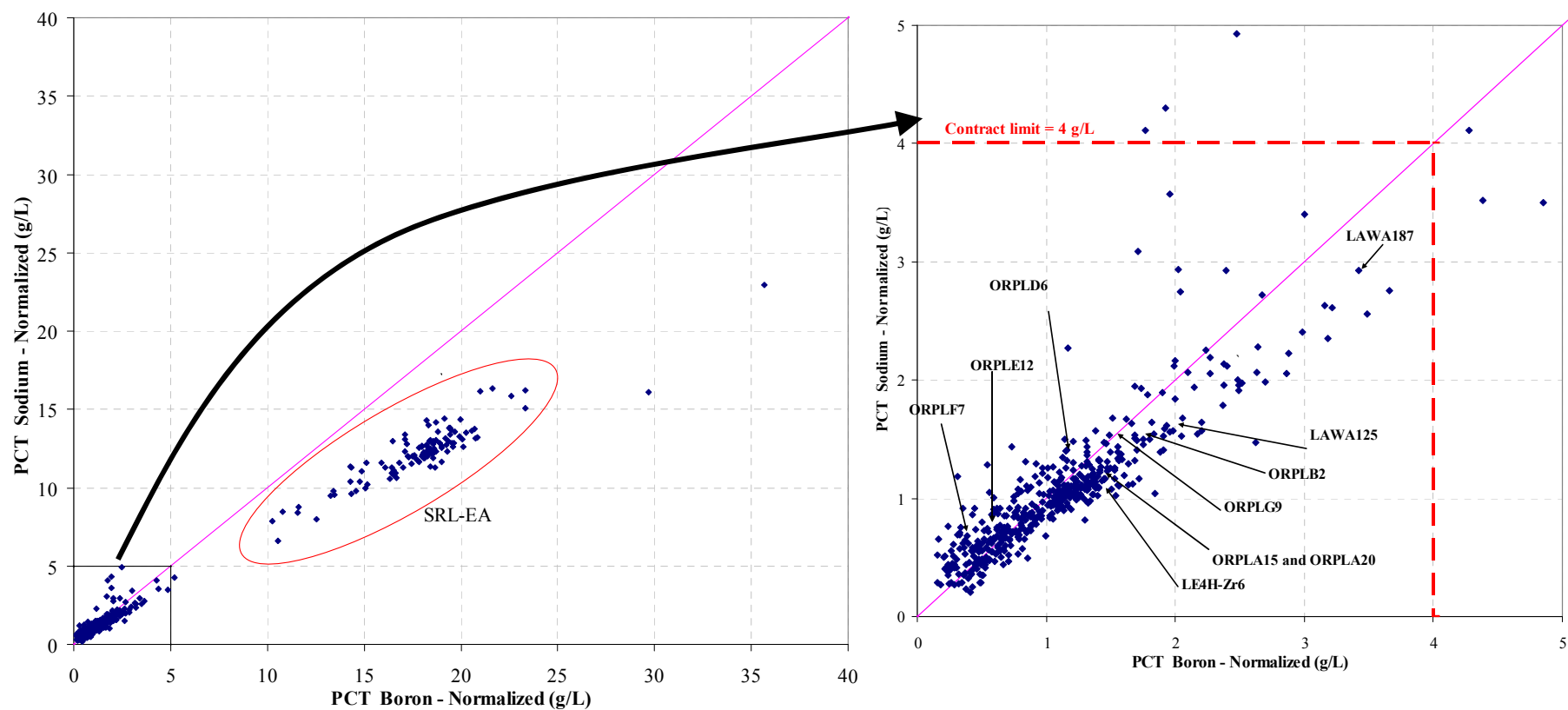


Figure 3.3. PCT releases for 368 glasses from the VSL LAW glass database

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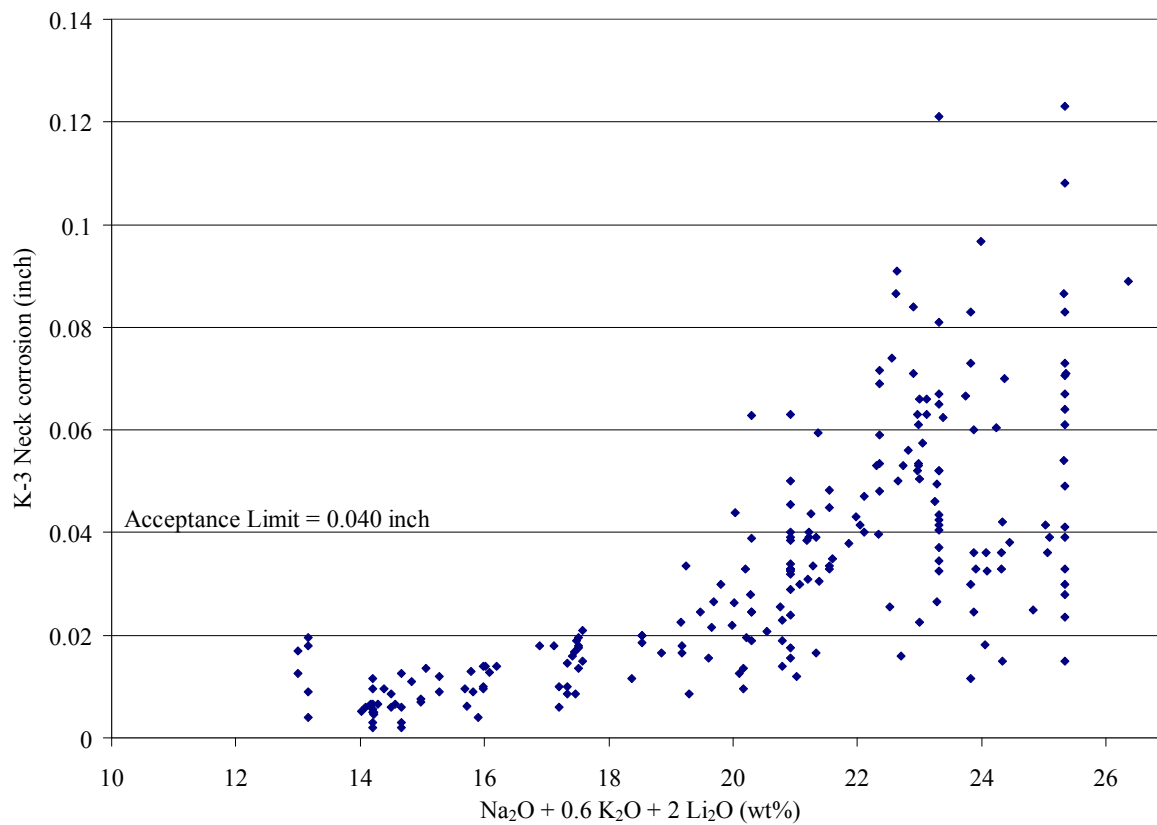
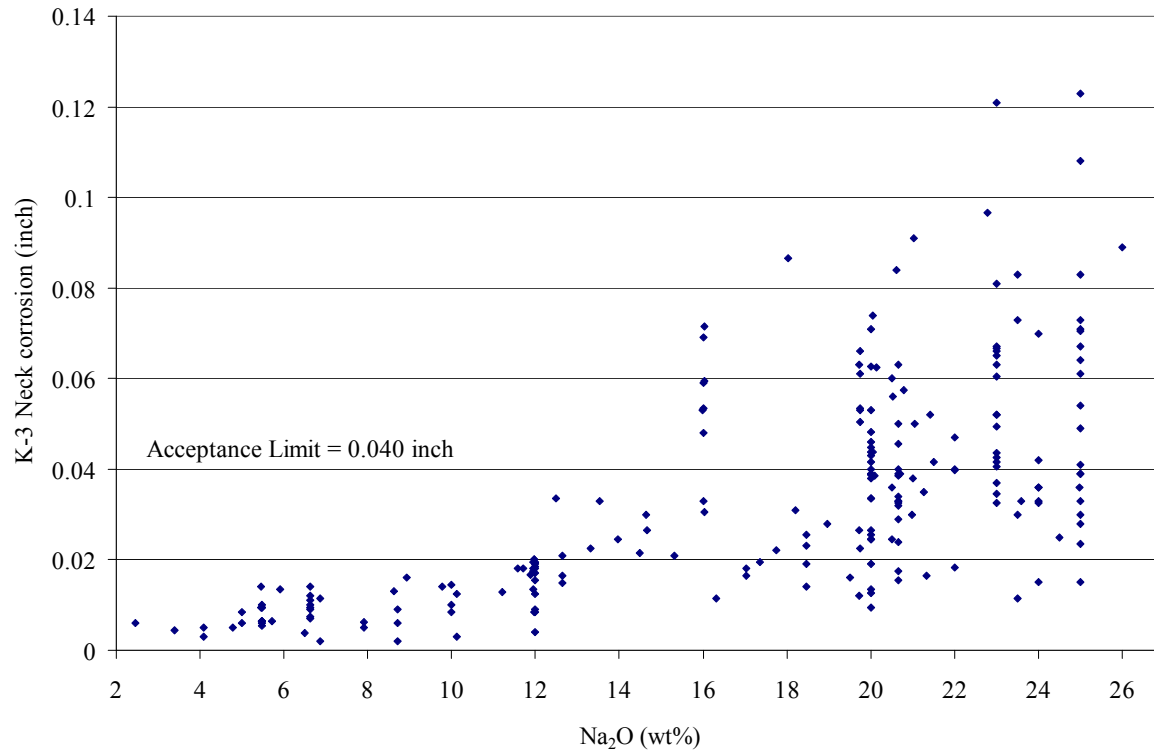


Figure 3.4. K-3 refractory corrosion data for 221 glasses from the VSL LAW glass database

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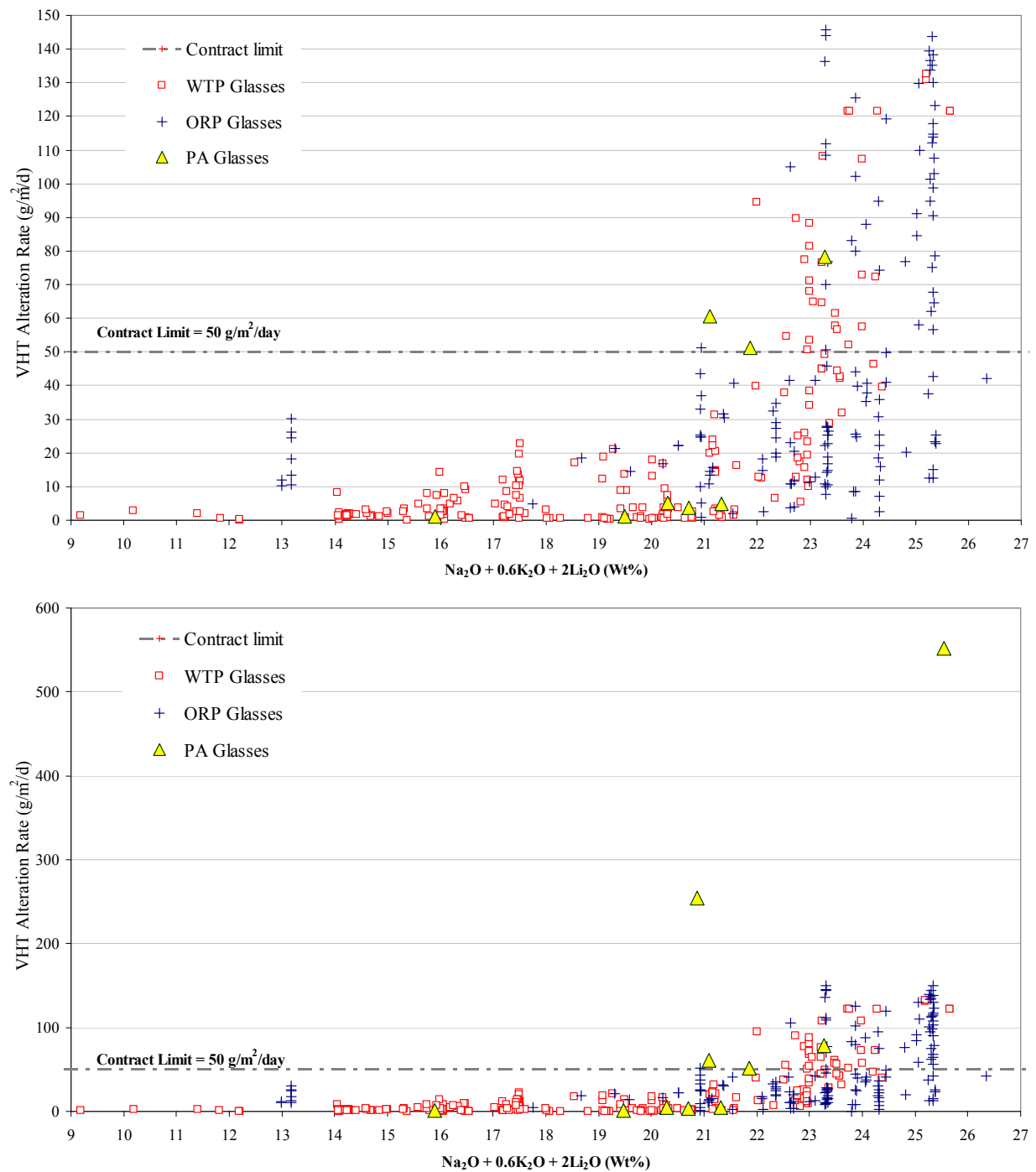


Figure 3.5. VHT alteration rates for 350 glasses from the VSL LAW glass database, and PA glasses (7 top and 9 bottom)

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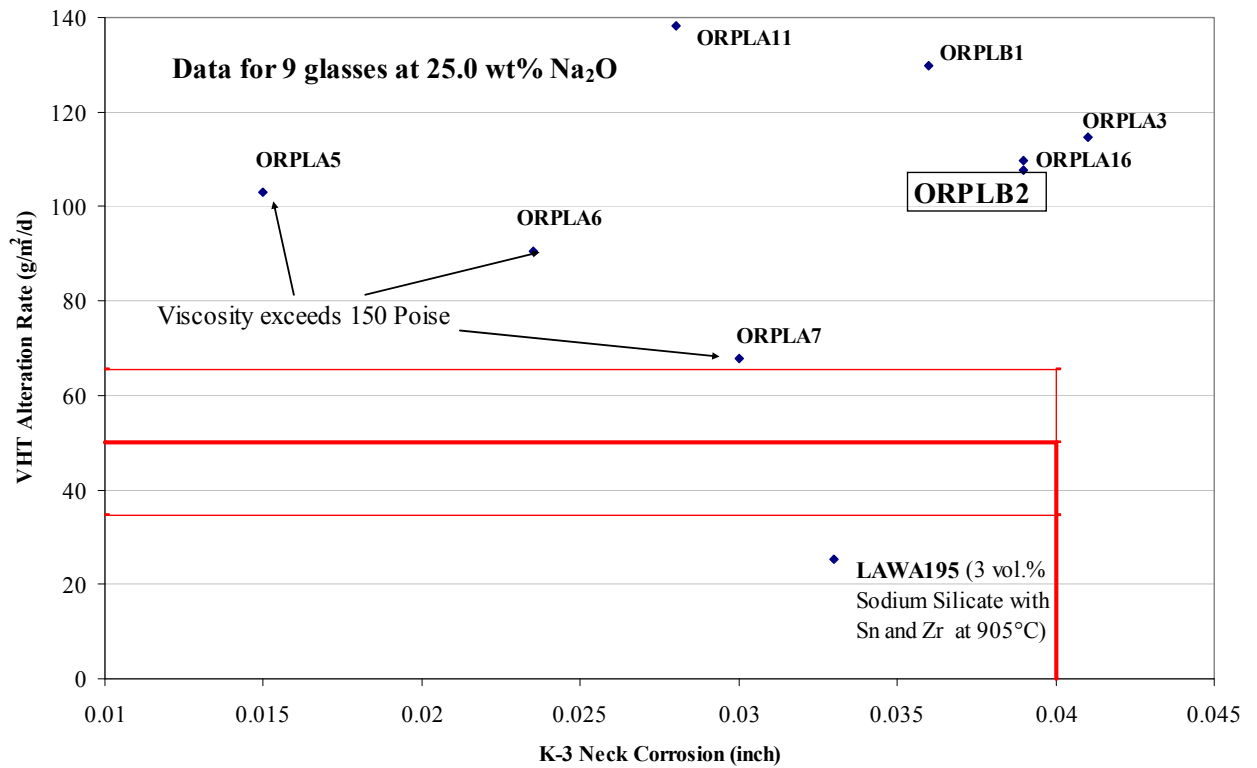


Figure 3.6. VHT alteration rate and K-3 corrosion for glasses with 25.0 wt% Na₂O.

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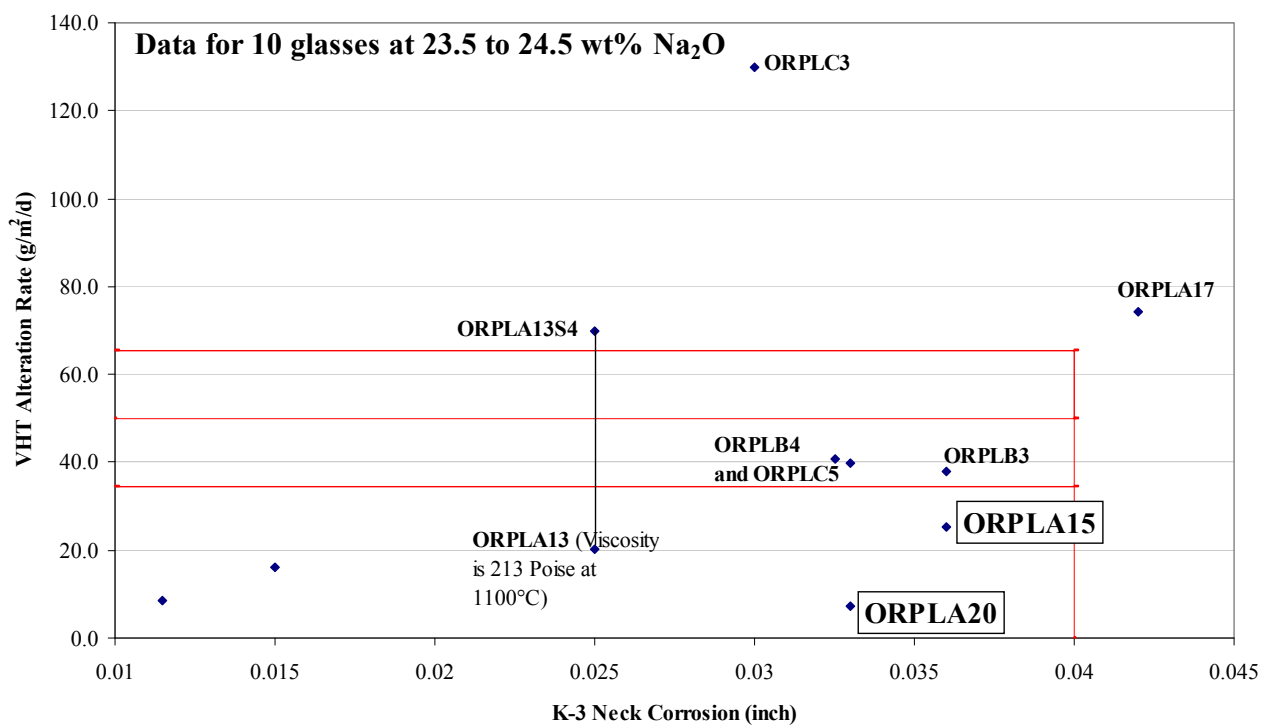


Figure 3.7. VHT alteration rate and K-3 corrosion for glasses with 23.5 to 24.5 wt% Na₂O.

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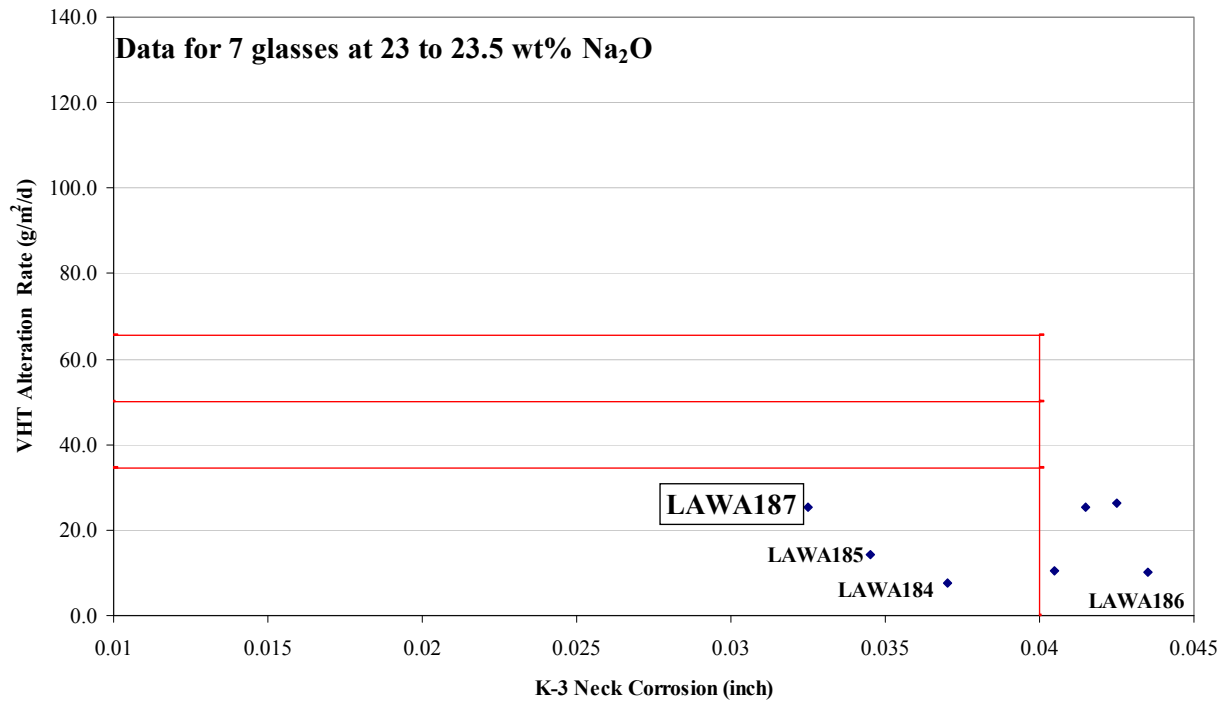


Figure 3.8. VHT alteration rate and K-3 corrosion for glasses with 23.0 to 23.5 wt% Na₂O.

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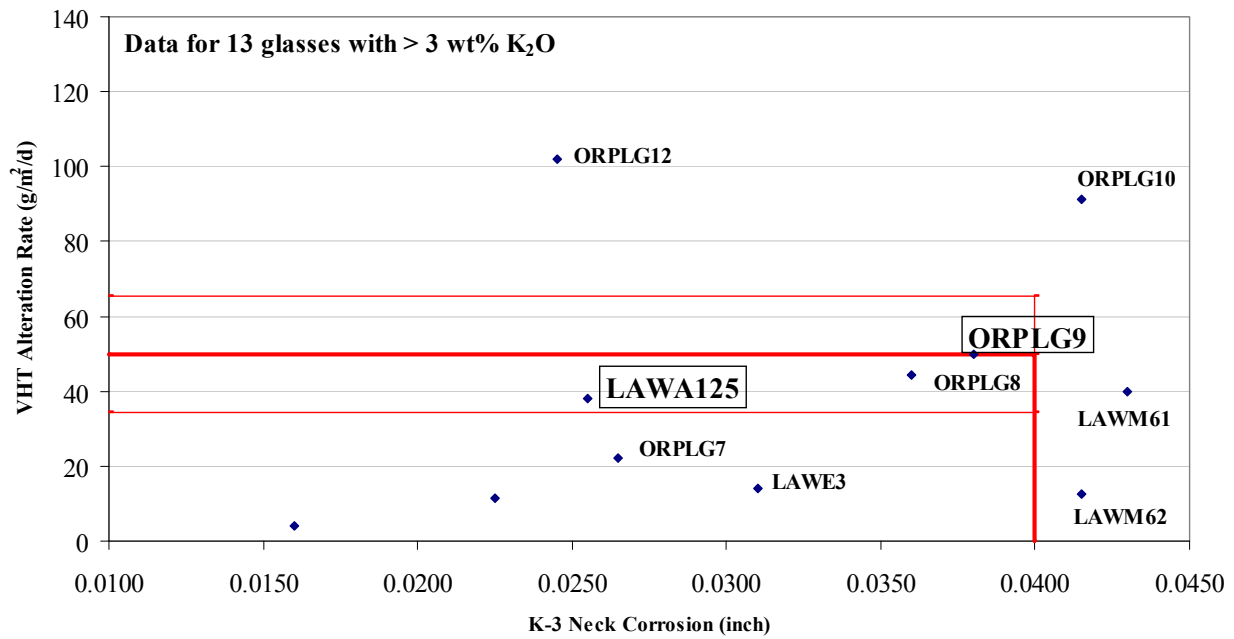


Figure 3.9. VHT alteration rate and K-3 corrosion for glasses with > 3.0 wt% K₂O.

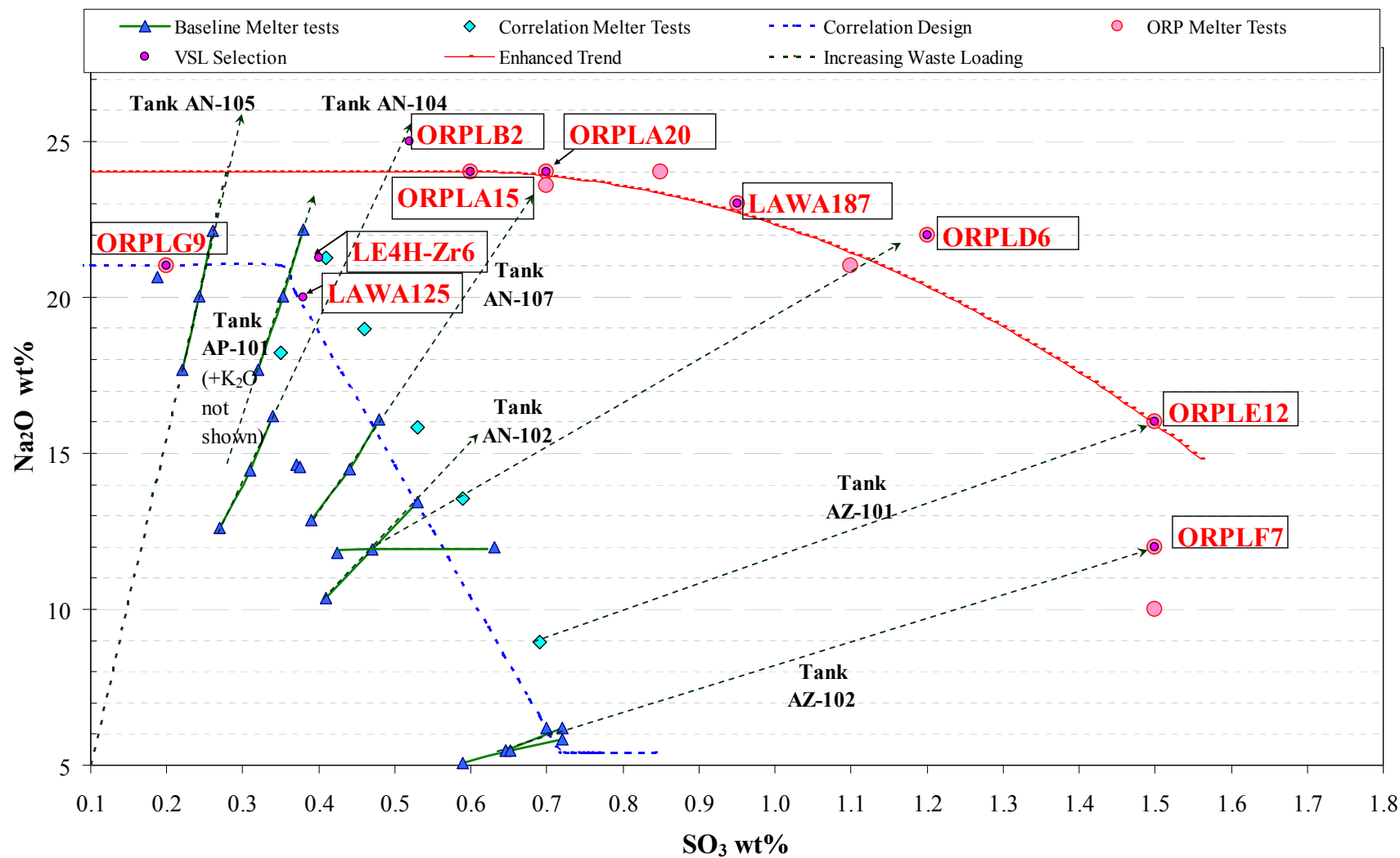


Figure 3.10. Composition range of Hanford LAW glasses in terms of Na_2O and SO_3 concentrations and selected glasses.

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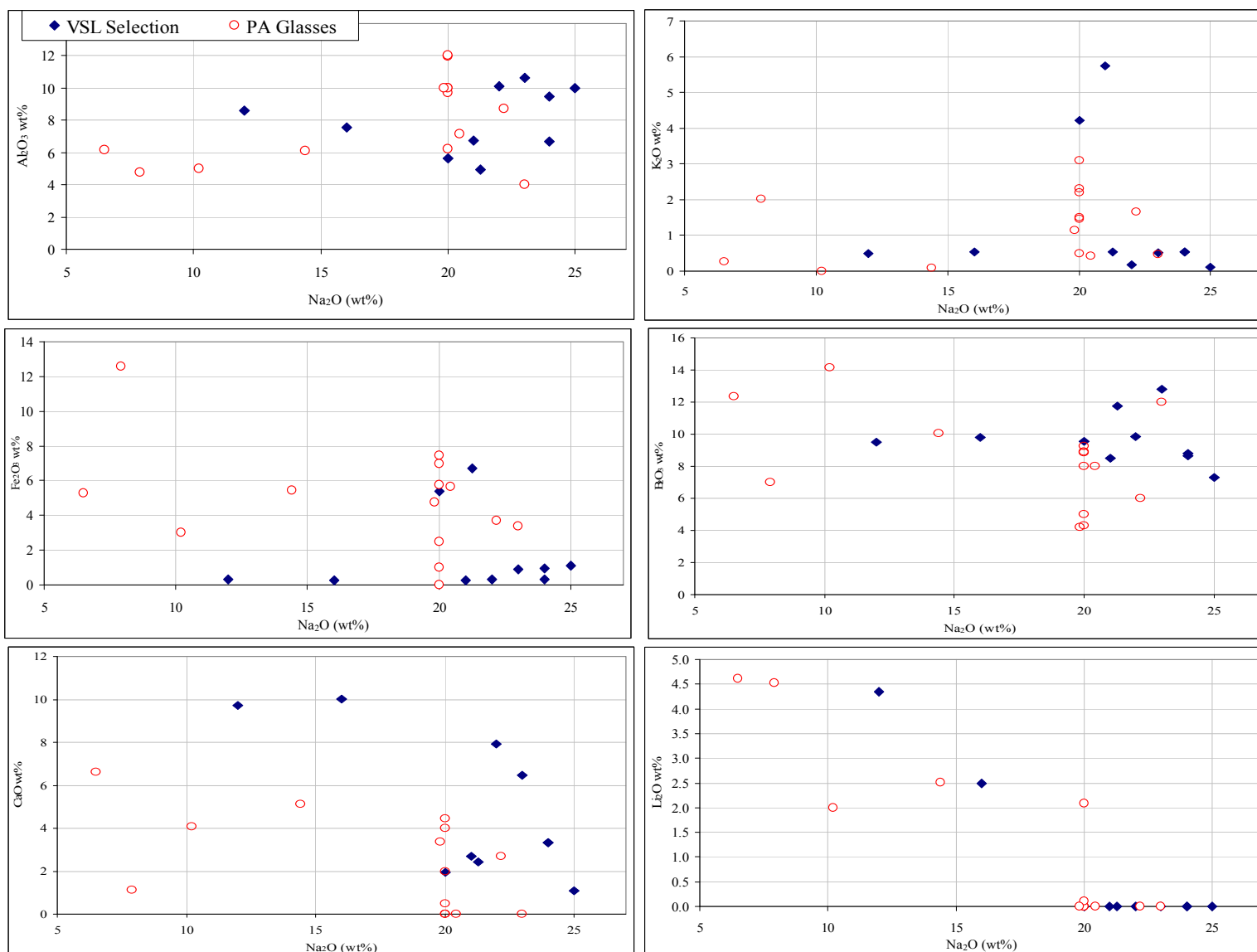


Figure 3.11. Illustration of composition ranges of PA glasses and selected VSL LAW glasses.

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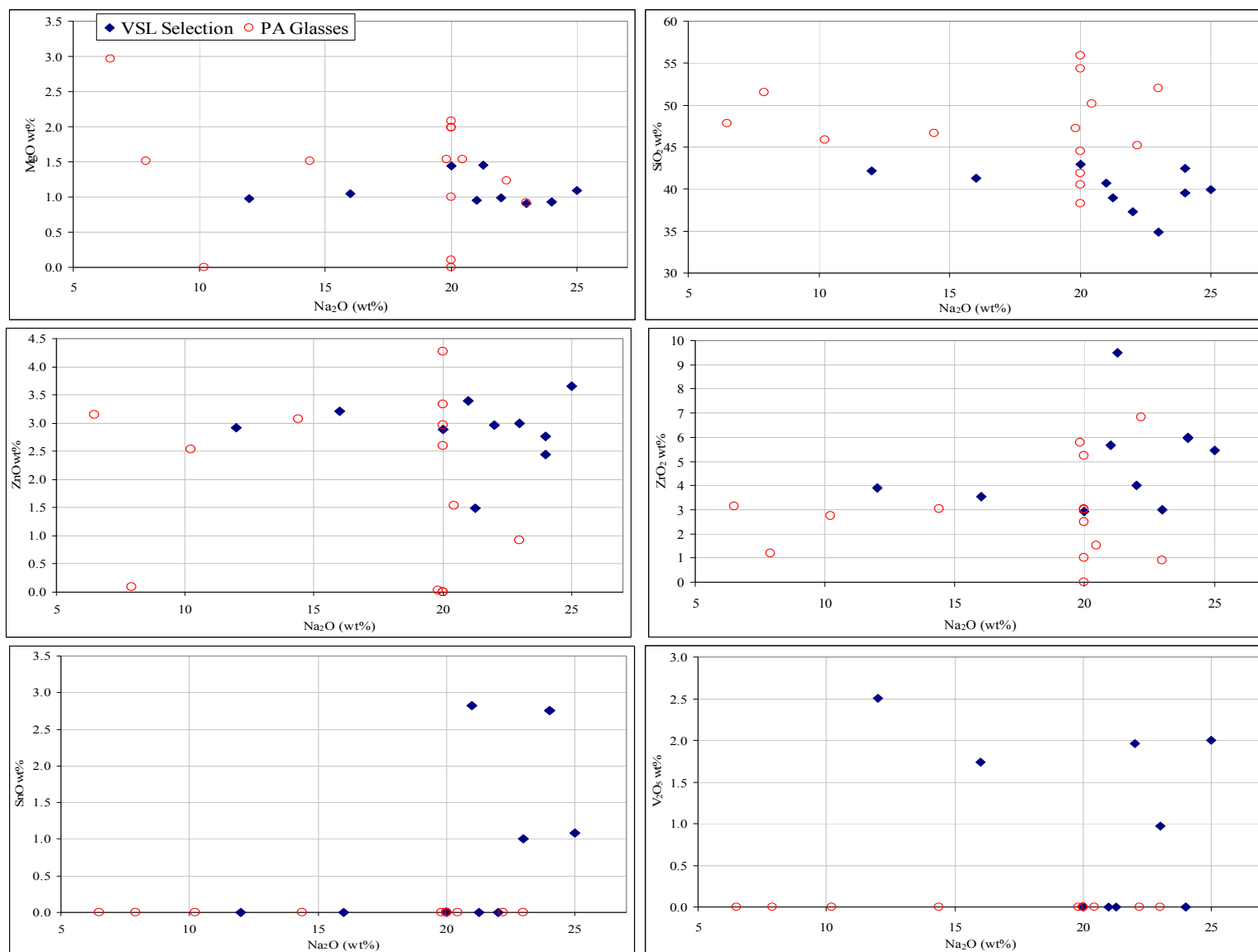


Figure 3.11. Illustration of composition ranges of PA glasses and selected VSL LAW glasses (cont'd).

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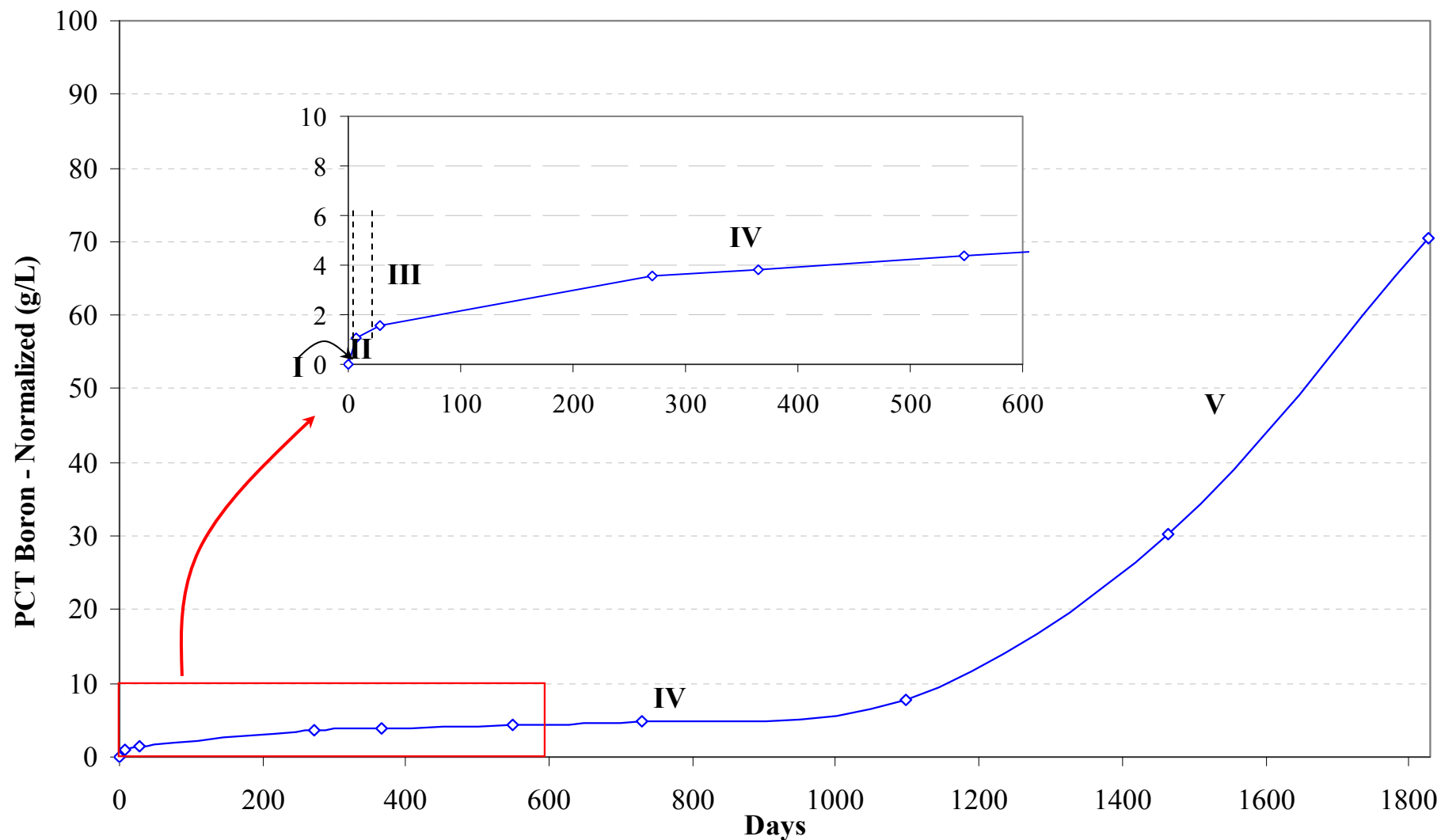


Figure 4.1. Boron normalized leach data for sample A1-AN105R2 (formulation LAWA44) showing the sequence in the five alteration stages: I – initial diffusion, II – initial rate, III – rate drop, IV – residual rate, V – resumption of alteration.

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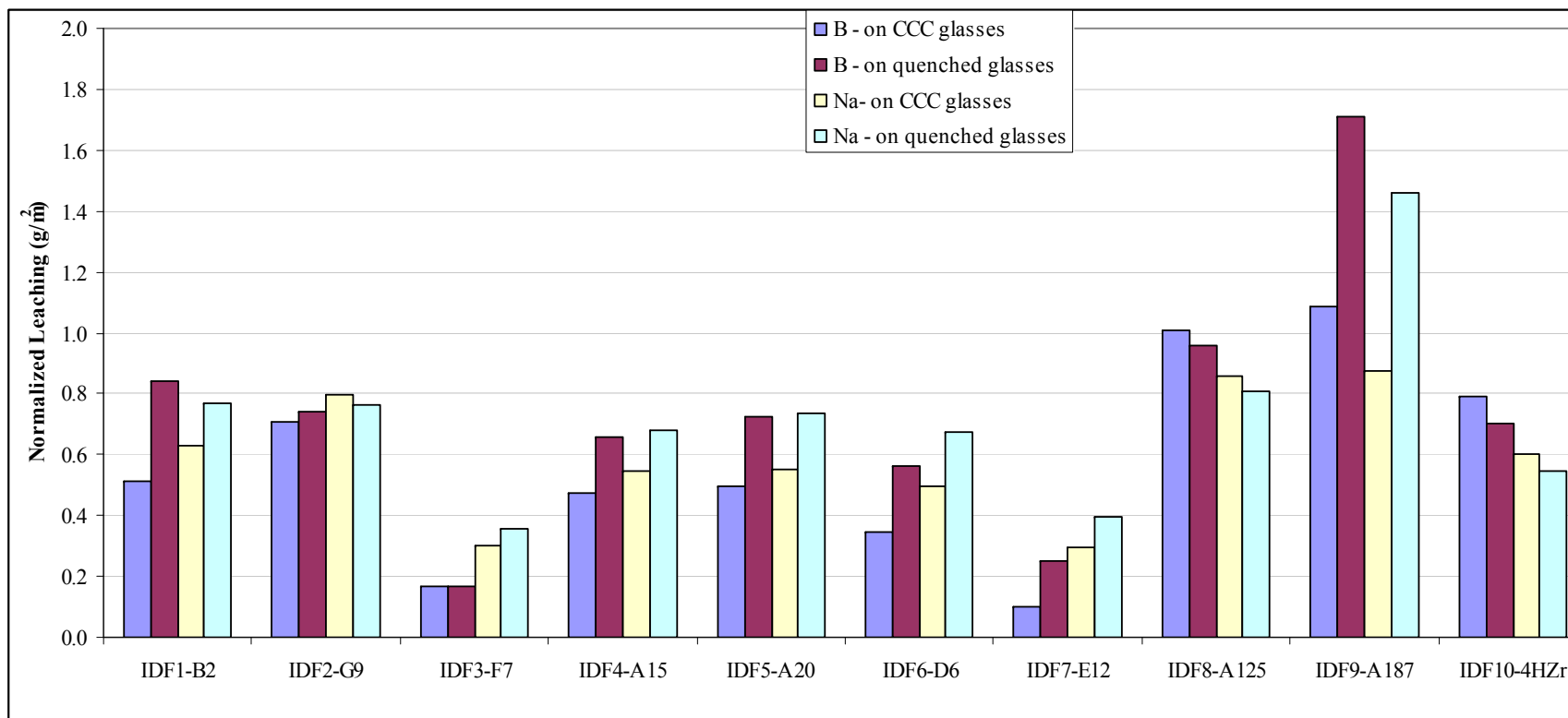


**Figure 5.1. 7-day PCT results for samples of the ten IDF glasses after CCC and from previous tests on quenched samples
(Note that the scale matches the WTP contract limit of 2 g/m² at 7-day).**

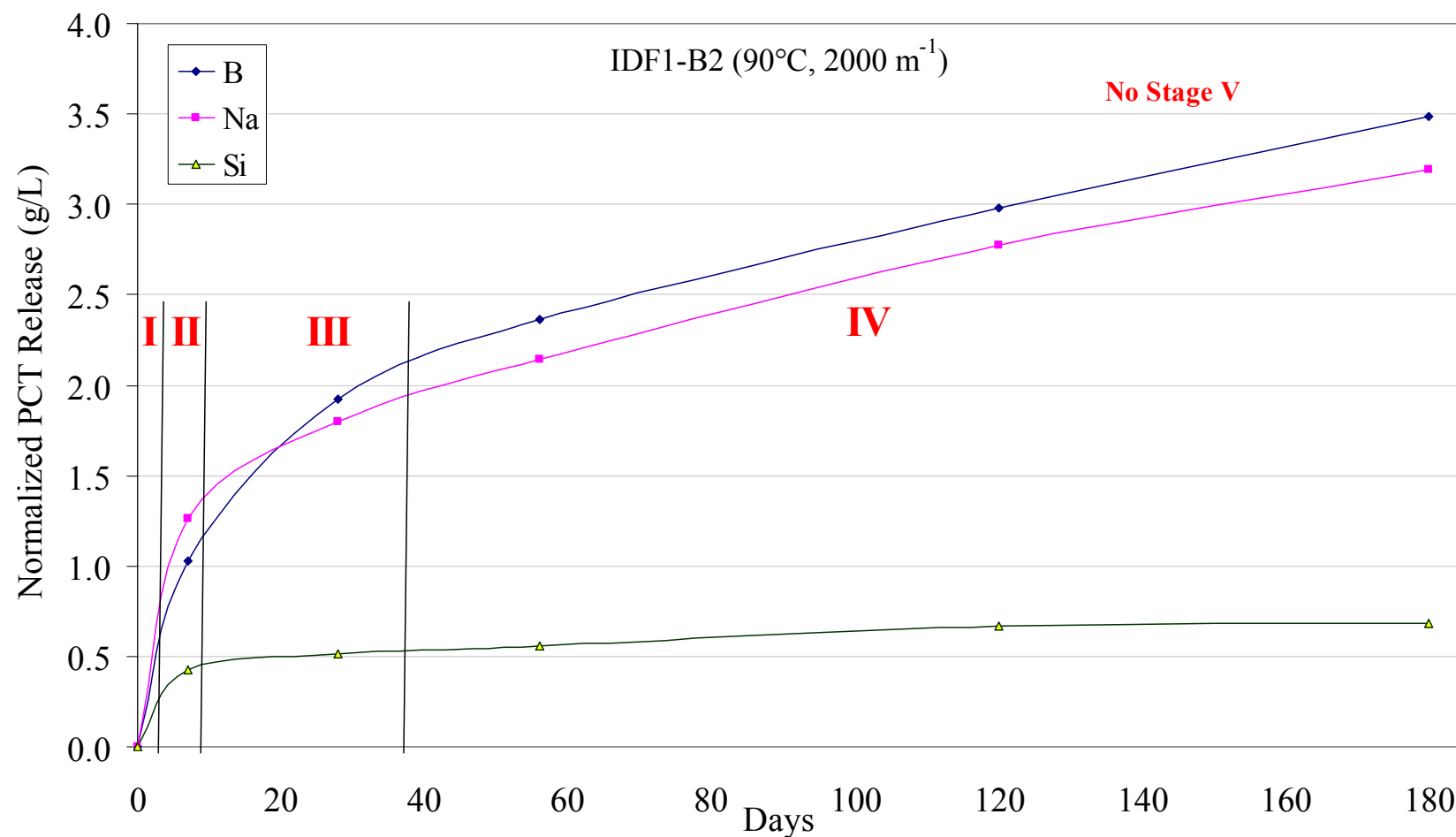


Figure 5.2. Normalized PCT Release of B, Na and Si for IDF1-B2 after 180 days.

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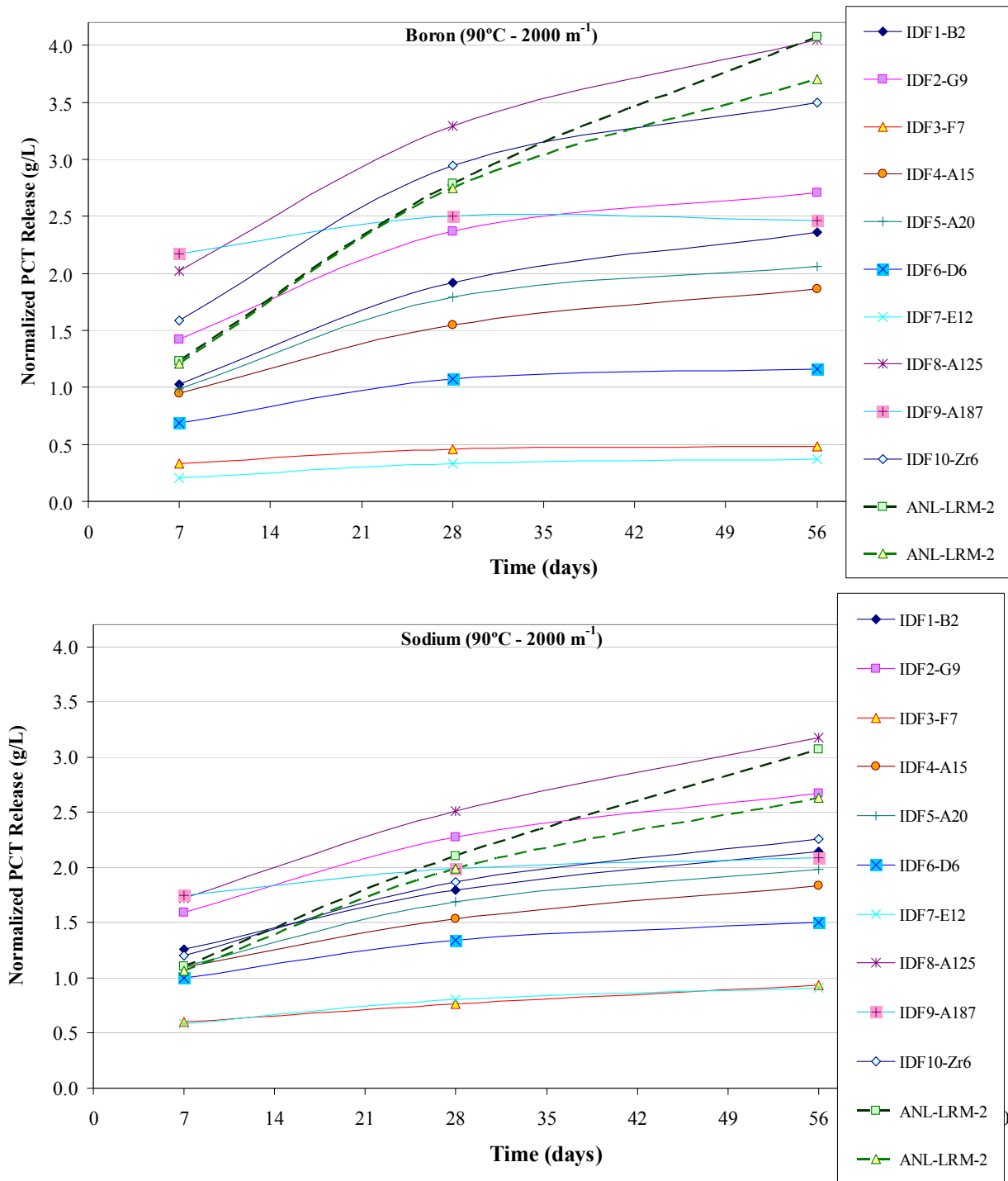


Figure 5.3. PCT Release for boron and sodium for the 10 selected glasses (90°C , 2000 m^{-1}). (note that the scale matches the WTP contract limit of 4 g/L at 7-day).

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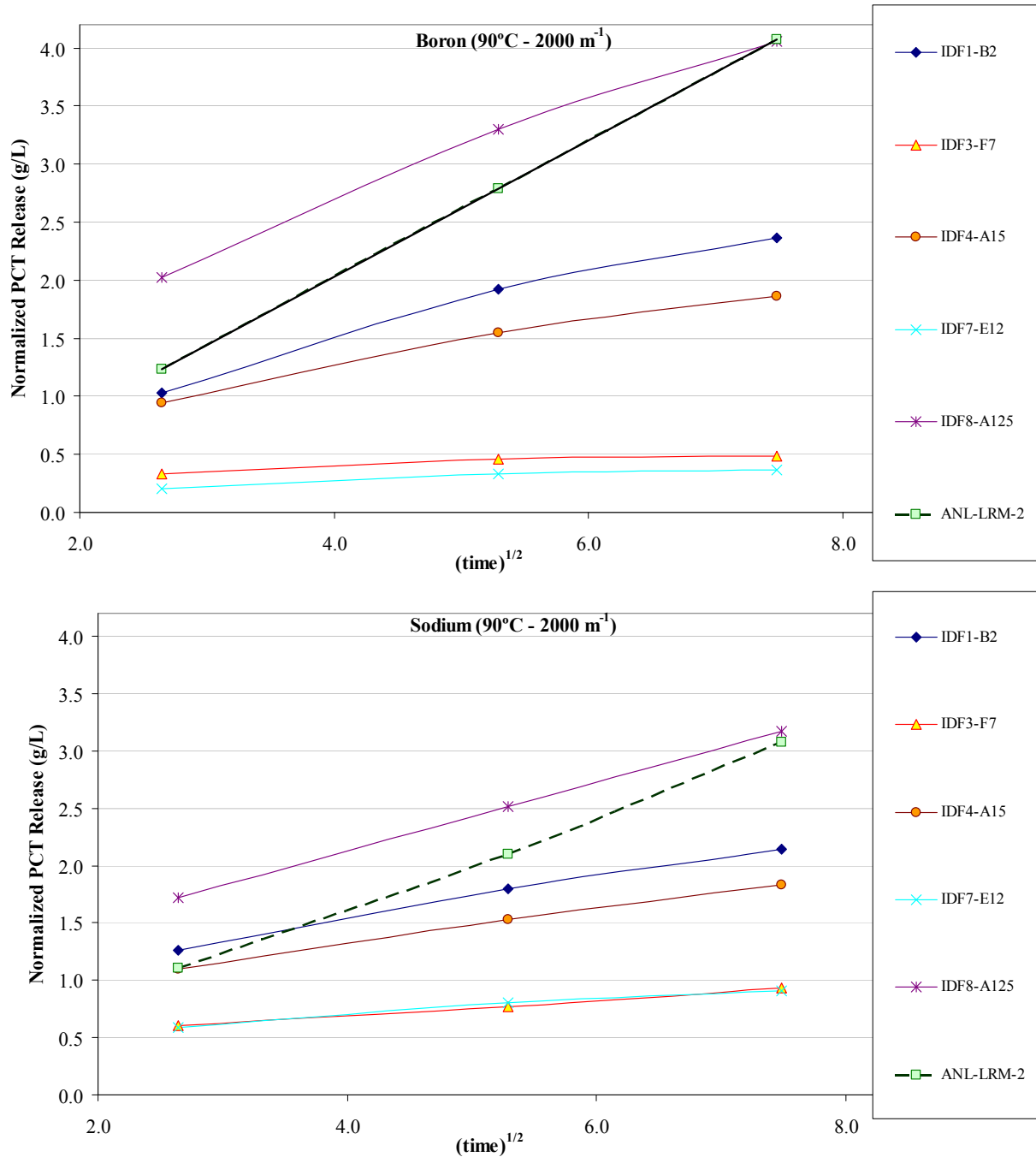


Figure 5.4. PCT Release for boron and sodium measured on IDF1-B2, IDF3-F7, IDF4-A15, IDF5-A20 and reference glass ANL-LRM, as a function of square root of time.

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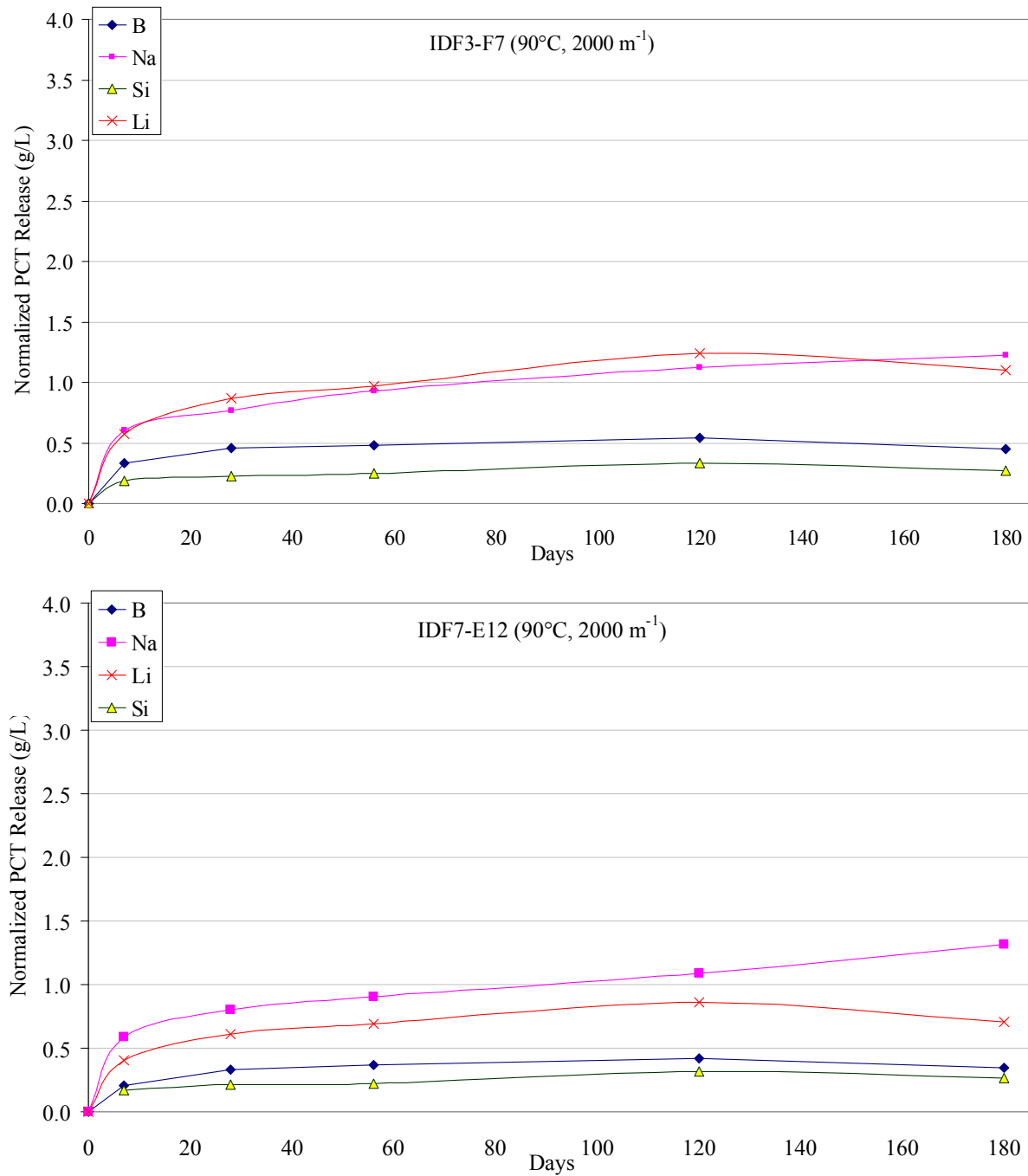


Figure 5.5. PCT Release for boron, sodium, lithium and silicon measured on IDF3-F7 and IDF7-E12.

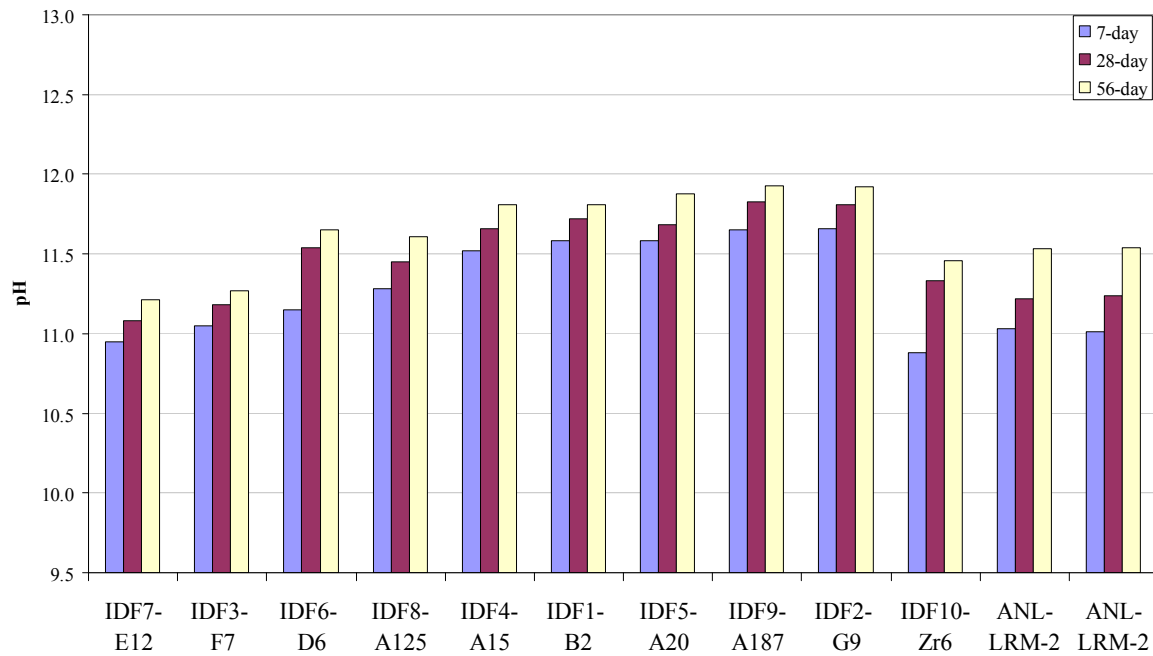


Figure 5.6. Leachate pH in 7-day PCT (90°C, 2000 m-1) test of the 10 IDF glasses tested and ANL-LRM Reference.

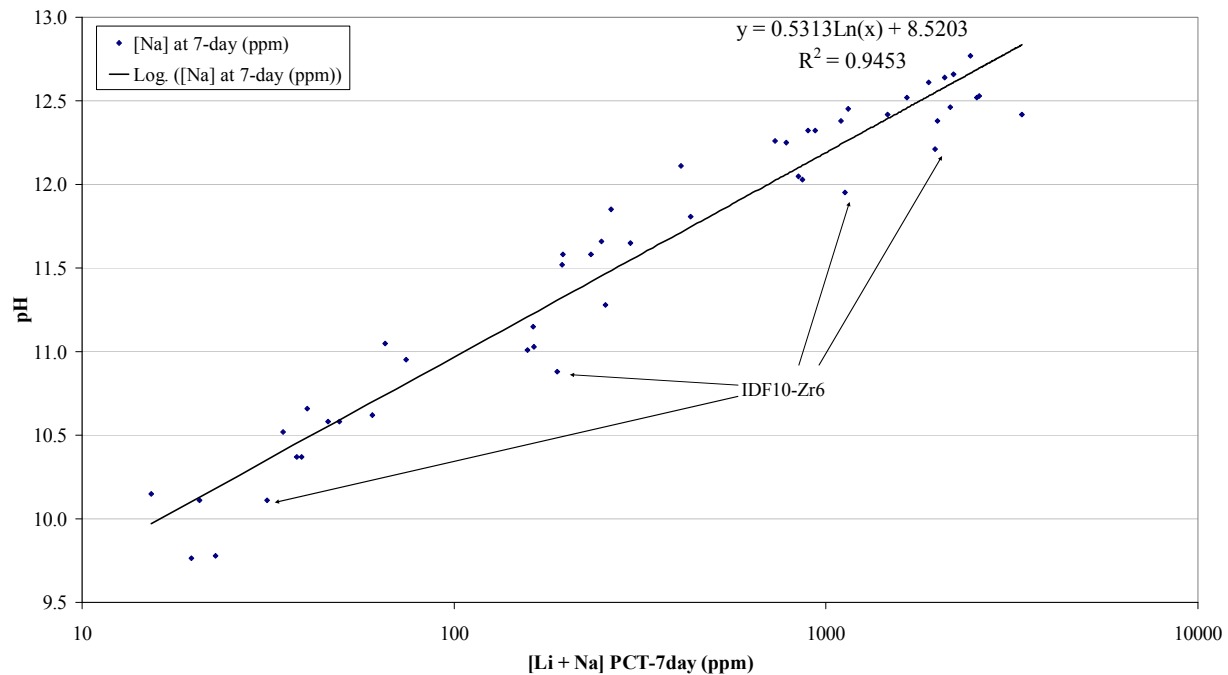


Figure 5.7. pH in 7-day PCT as a function of the leachate sodium and lithium concentration.

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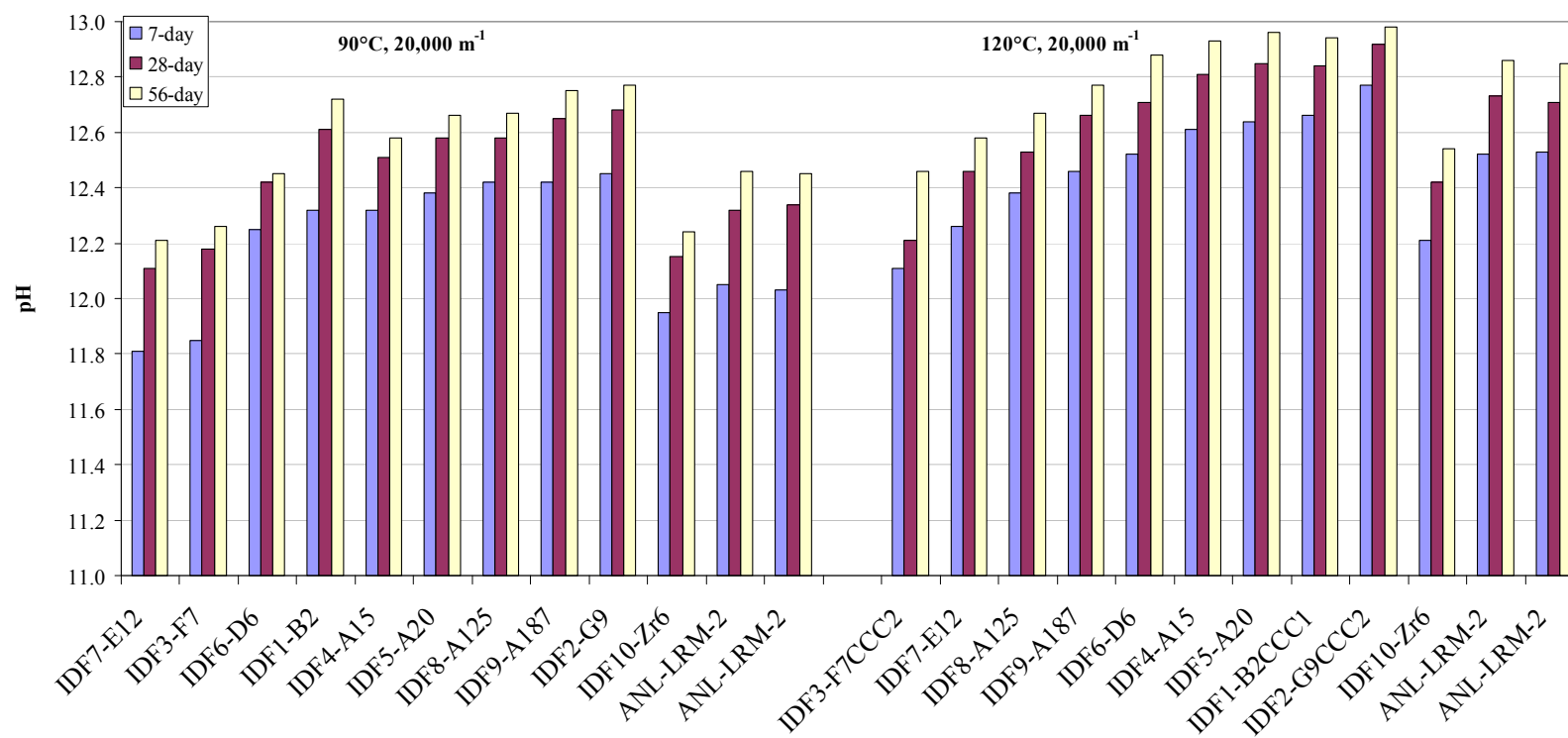


Figure 5.8. pH measured in higher S/V PCT tests.

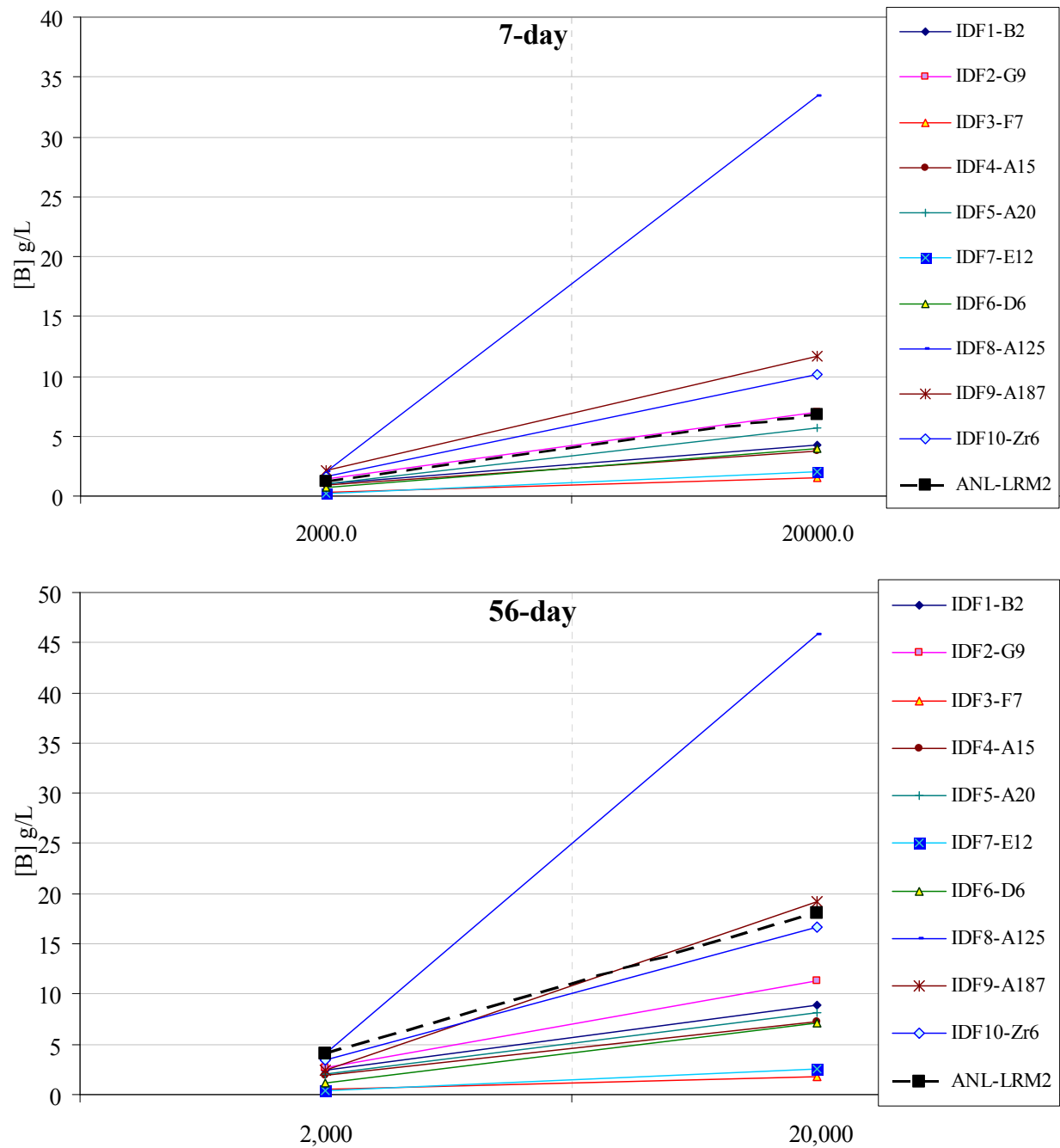


Figure 5.9. Effect of S/V in PCT leaching of the ten selected glasses

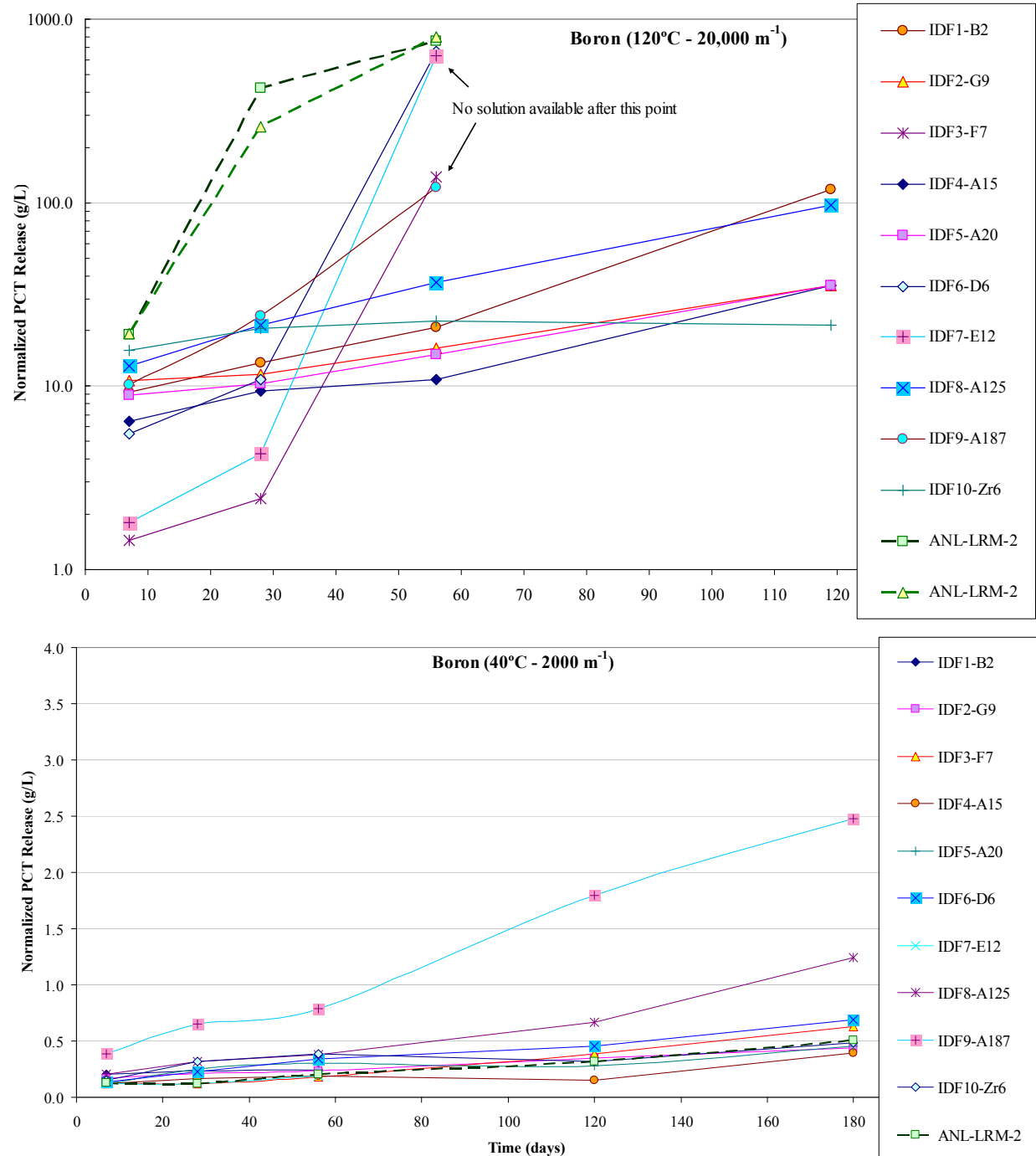


Figure 5.10. Effect of temperature (120°C – top and 40°C – bottom) in PCT leaching for the ten selected glasses and the ANL-LRM reference glass.

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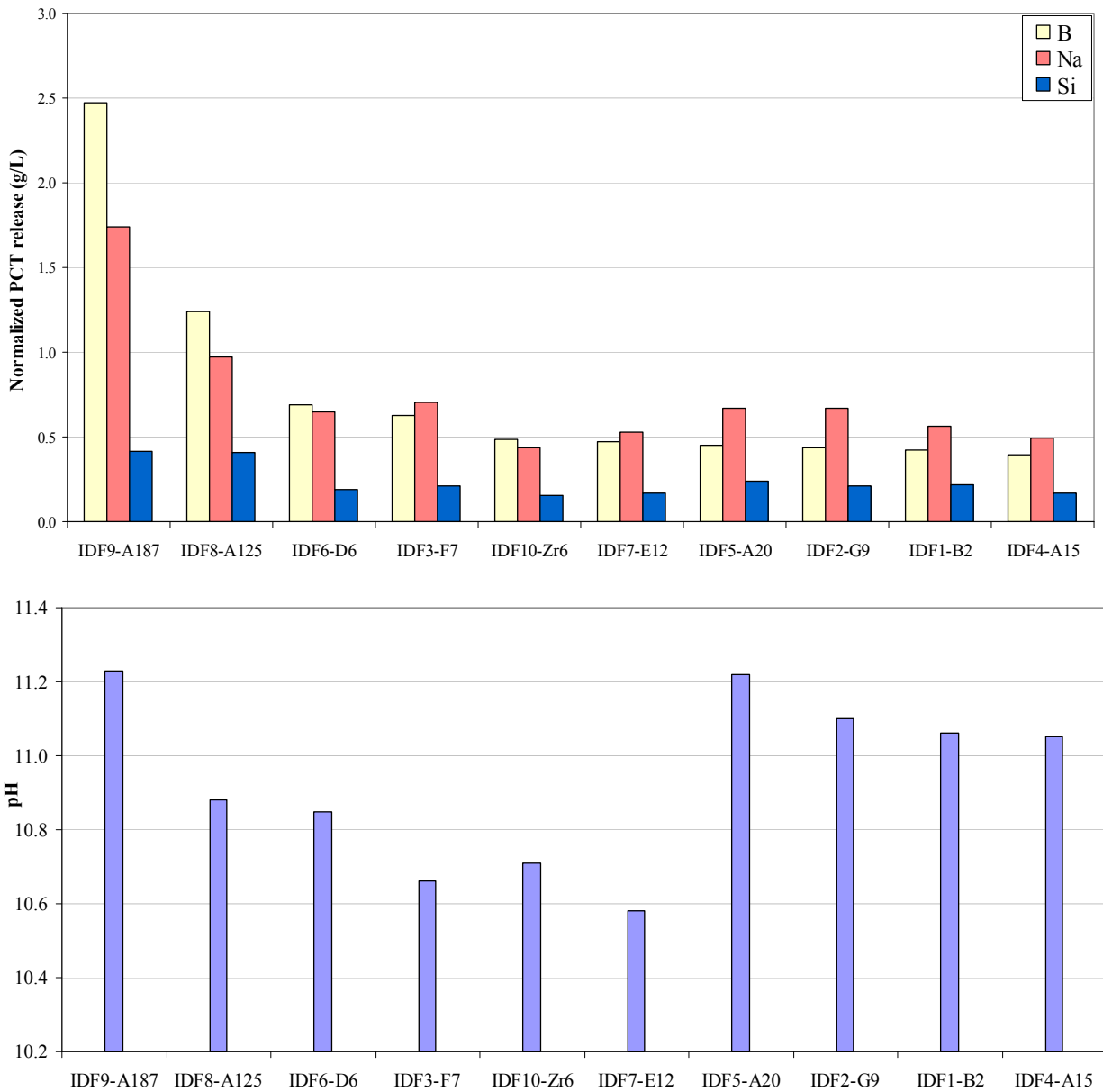


Figure 5.11. Concentrations (top) and pH (bottom) in 40°C PCT leaching for the ten selected glasses.

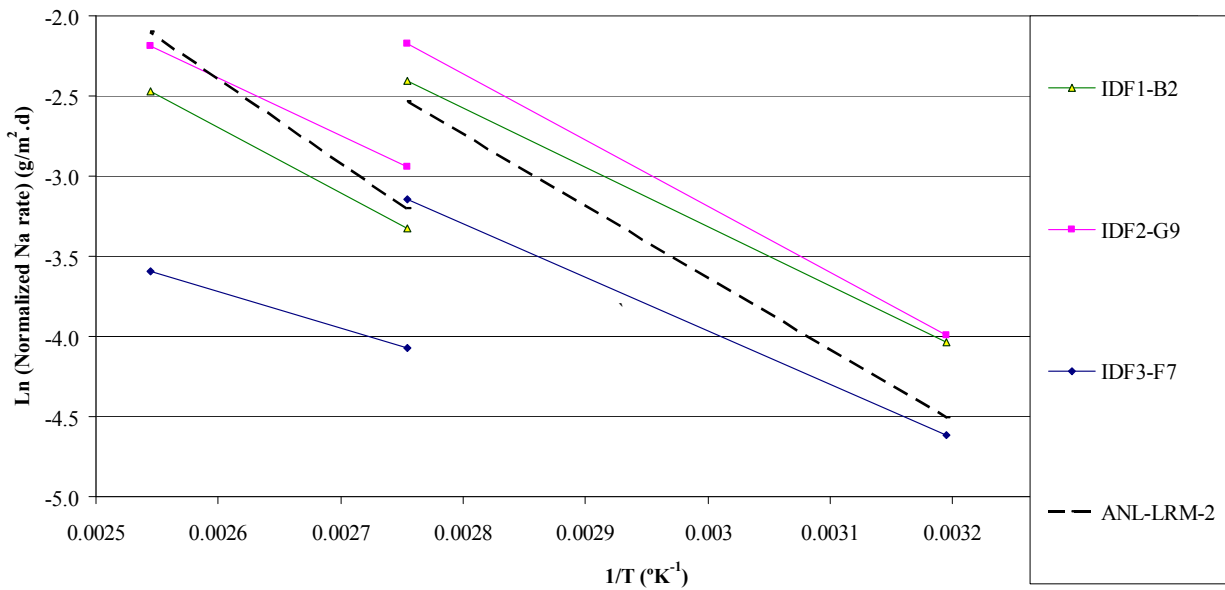


Figure 5.12. Variation of sodium normalized leach rate as a function of inverse temperature in IDF1-B2, IDF2-G9, IDF3-F7.

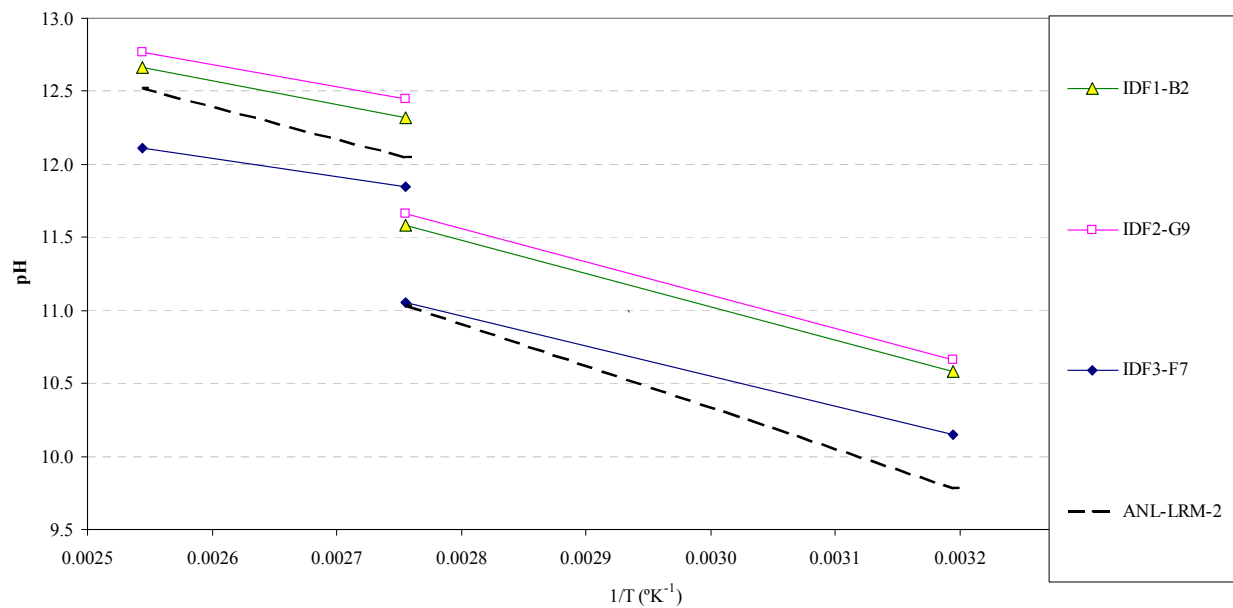


Figure 5.13. Variation of pH as a function of inverse temperature in IDF1-B2, IDF2-G9, IDF3-F7.

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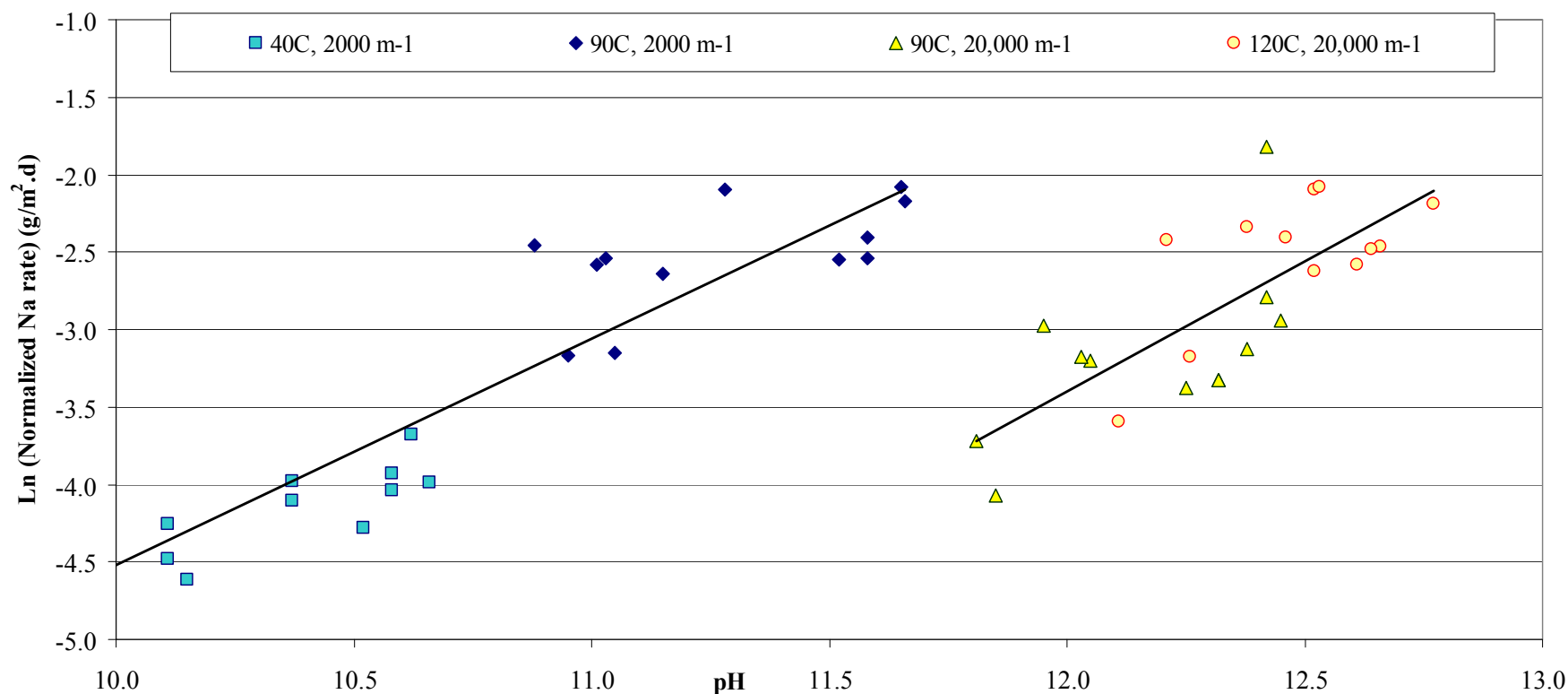


Figure 5.14. Correlation between pH and Ln(normalized Na rate) for the three temperatures and the two S/V values tested. (The slopes of the power law trend lines are 0.63 and 0.73 at respective S/V values of 2,000 and 20,000 m⁻¹)

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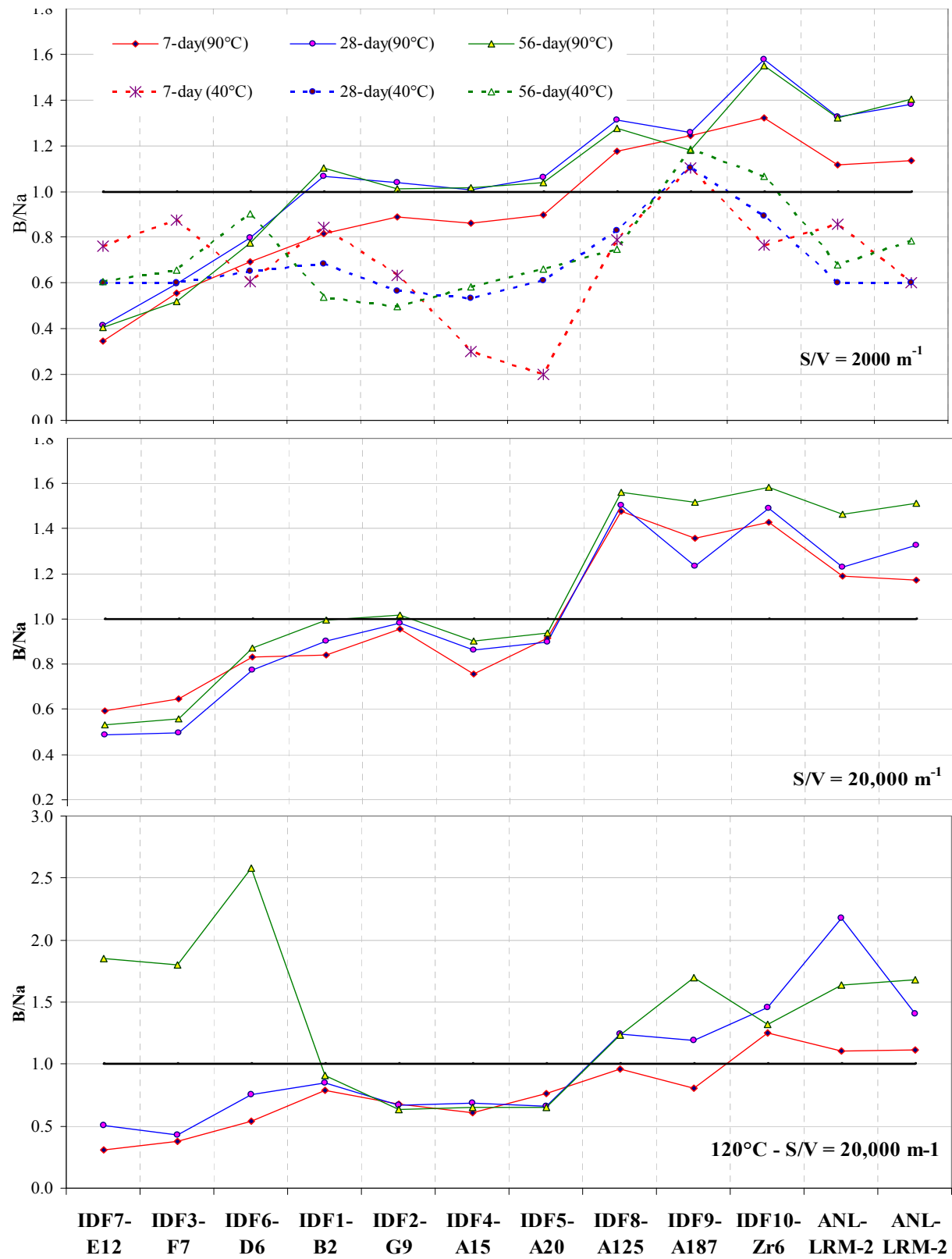


Figure 5.15. Test of congruency (ratio of boron to sodium) for the 10 selected glasses.

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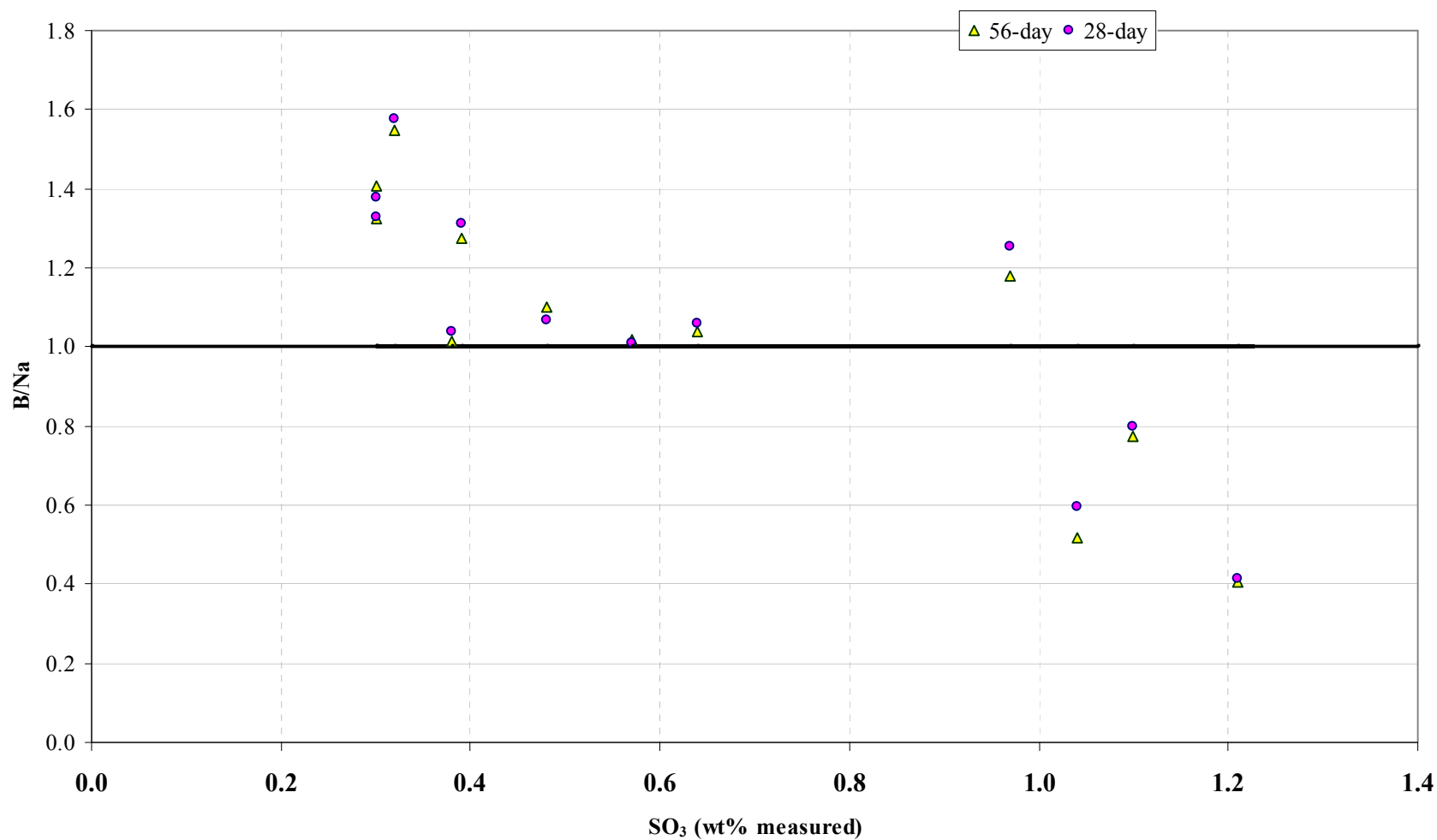


Figure 5.16. Boron and sodium congruency at 28 and 56 days in PCT-B (90°C, 2,000 m⁻¹) as a function of sulfate content measured in the glass.

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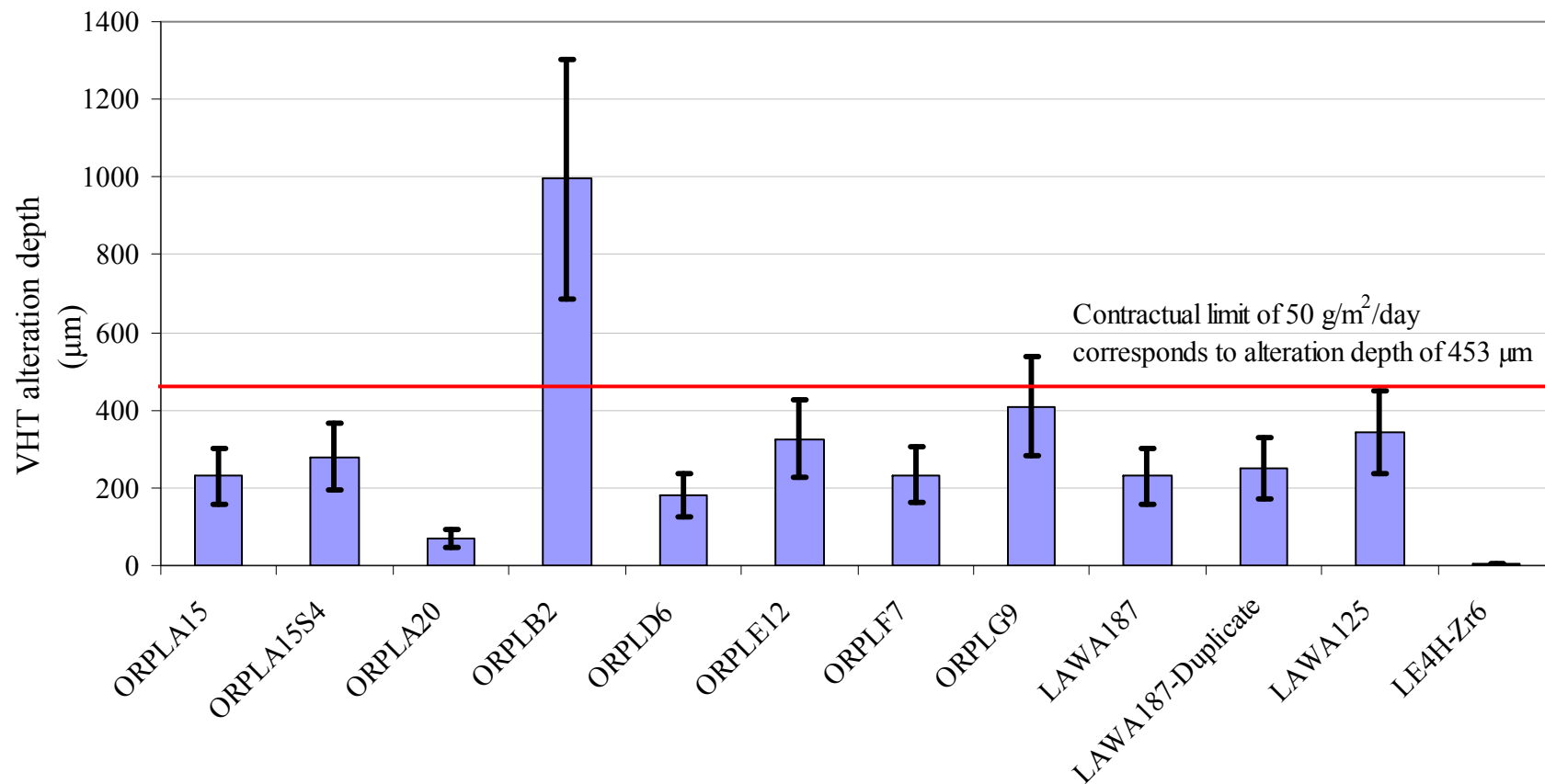


Figure 5.17. Summary of VHT results for the selected glasses.

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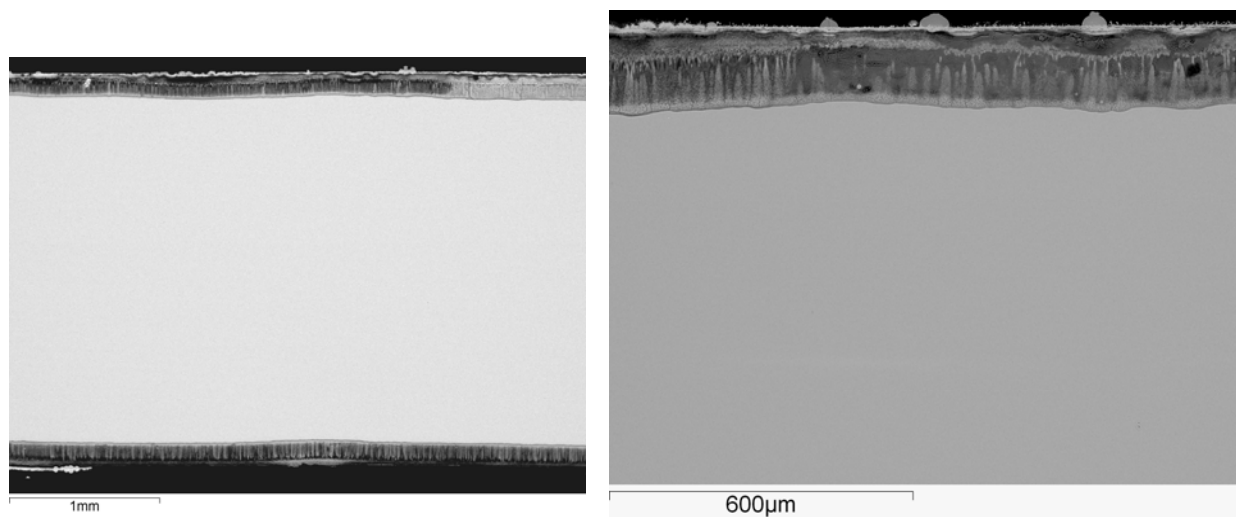


Figure 5.18. SEM image of cross section of crucible glass ORPLA20 after VHT (24-day).

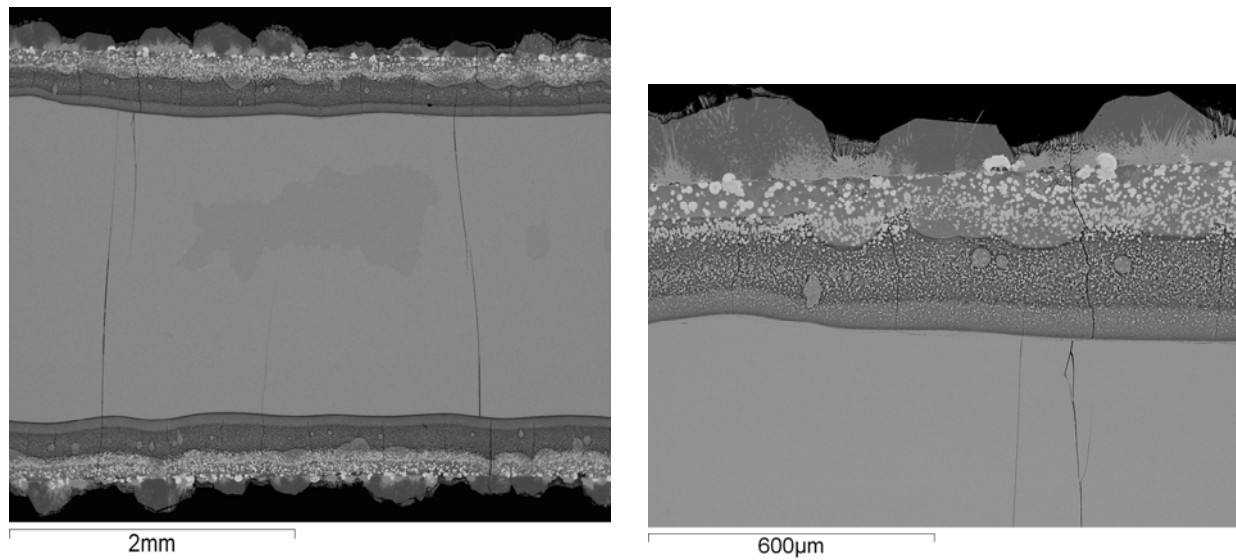


Figure 5.19. SEM image of cross section of crucible glass ORPLE12 after VHT (24-day).

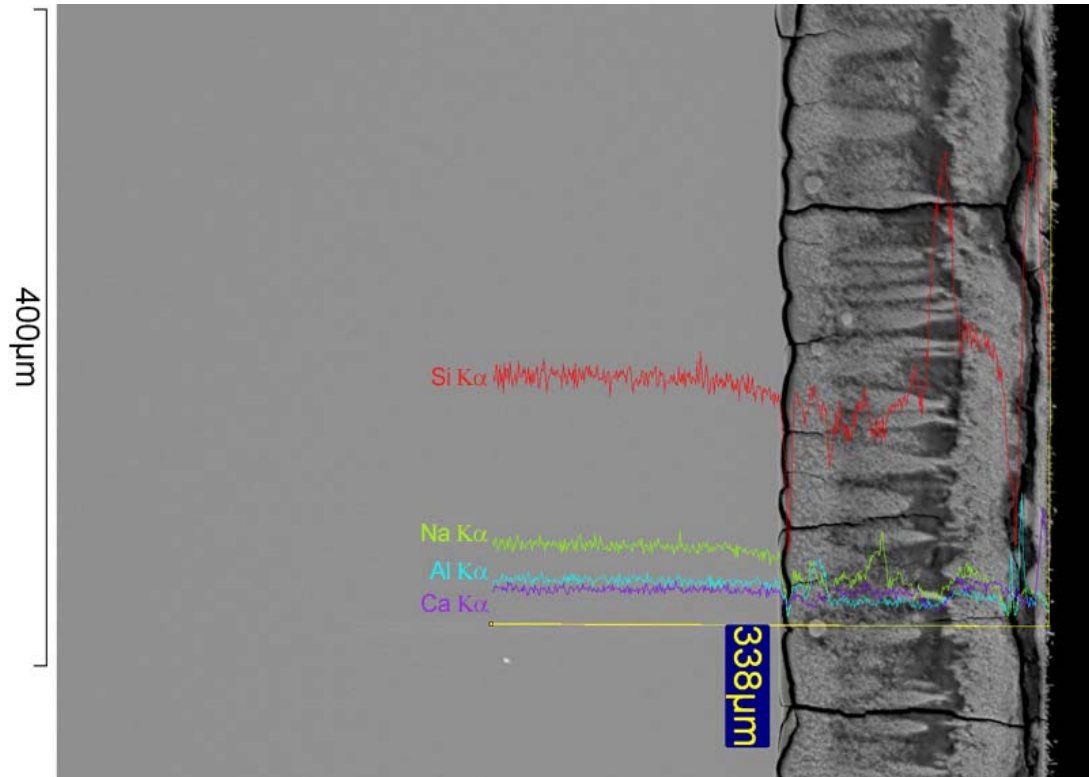


Figure 5.20. SEM image of cross section of crucible glass ORPLA20 after VHT with EDS line scan.

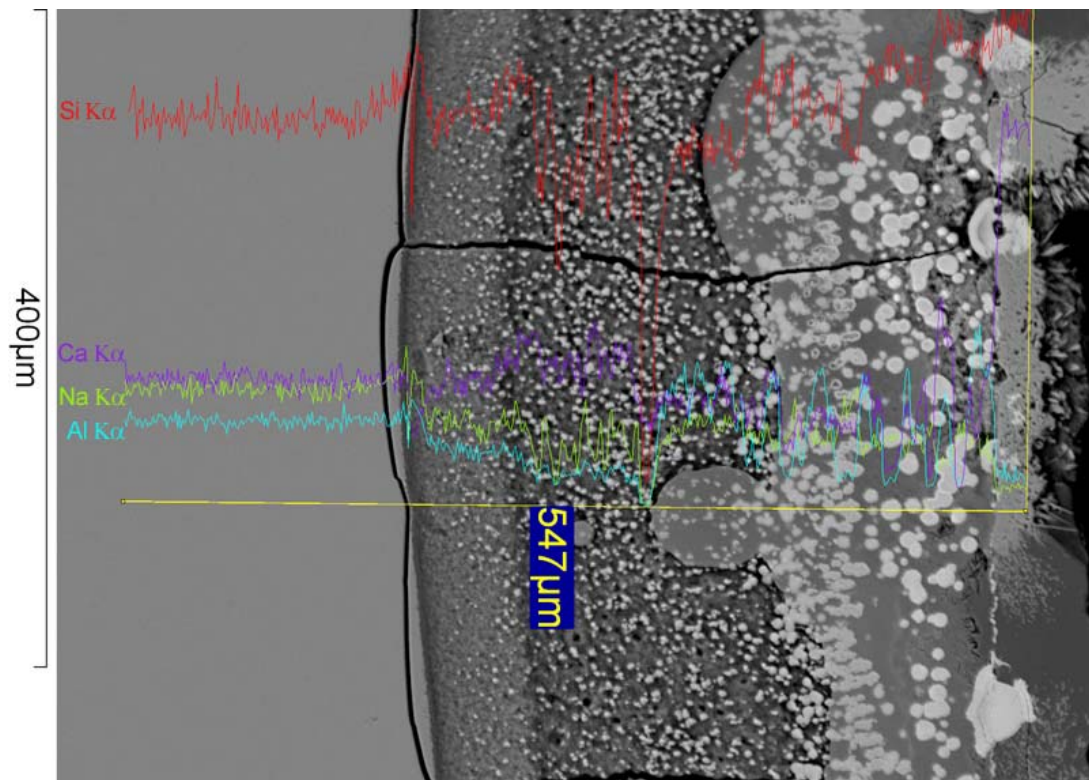


Figure 5.21. SEM image of cross section of crucible glass ORPLE12 after VHT with EDS line scan.

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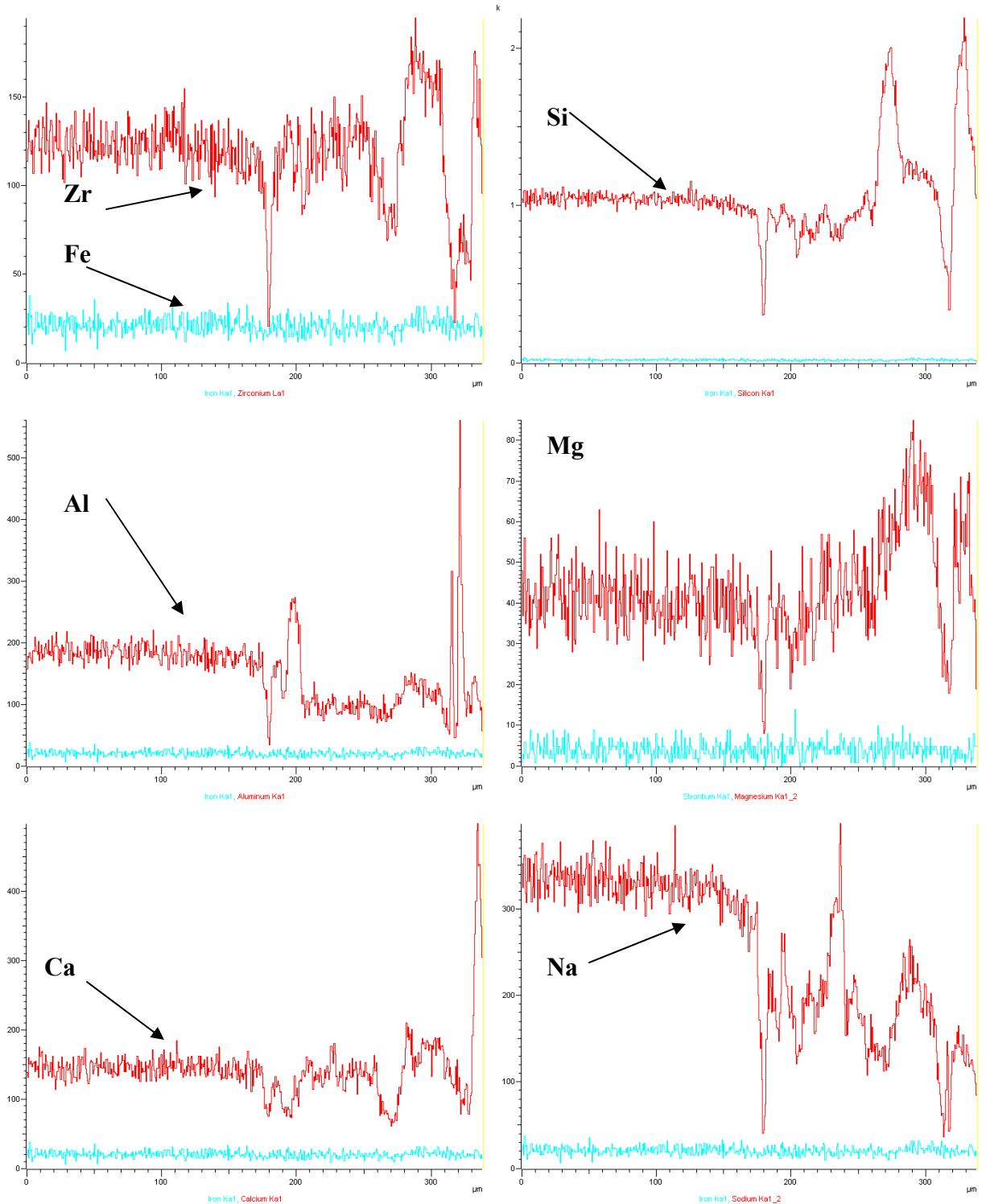


Figure 5.22. EDS line scan across the leached layer in ORPLA20.

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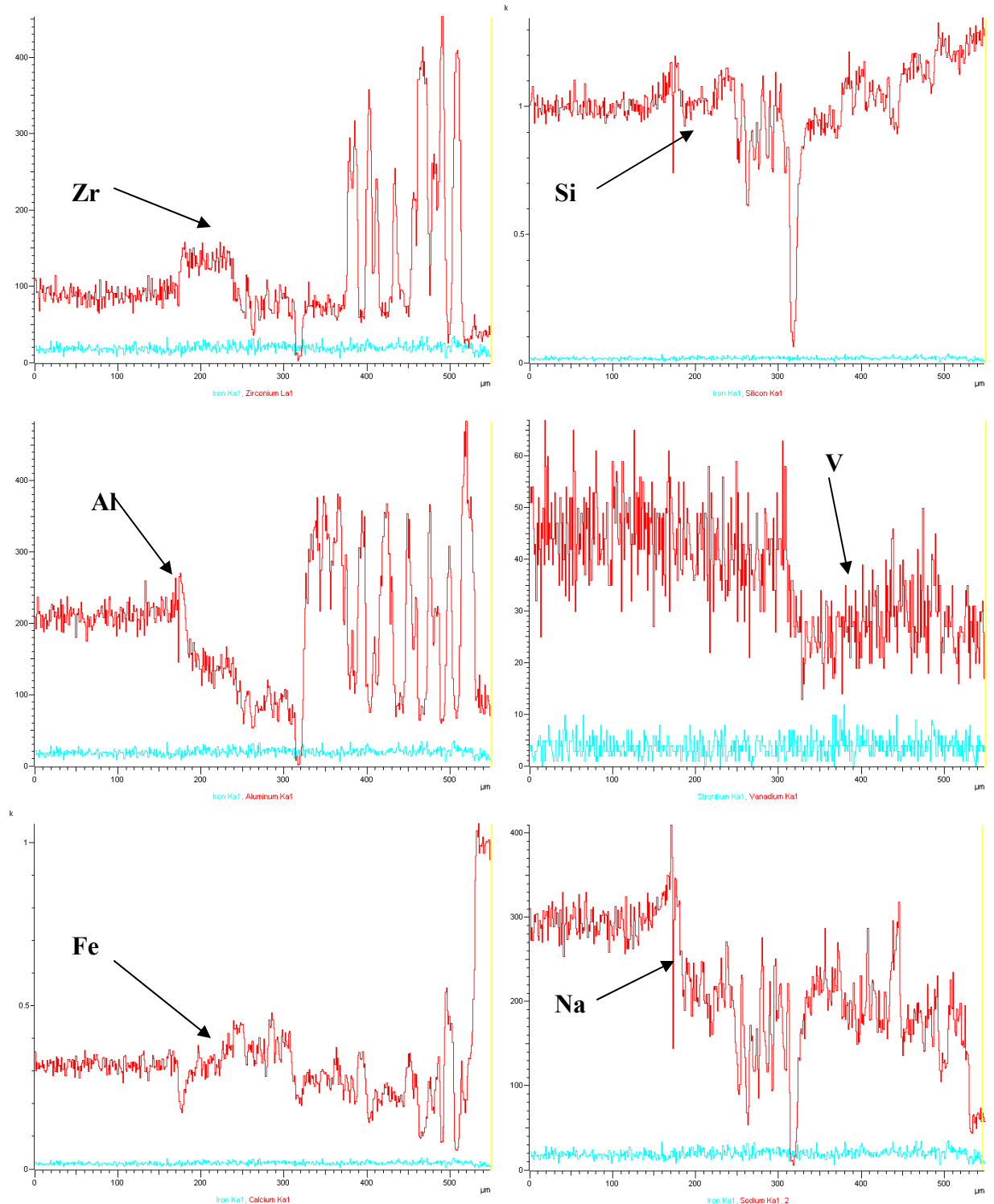


Figure 5.23. EDS line scan across the leached layer in ORPLE12.

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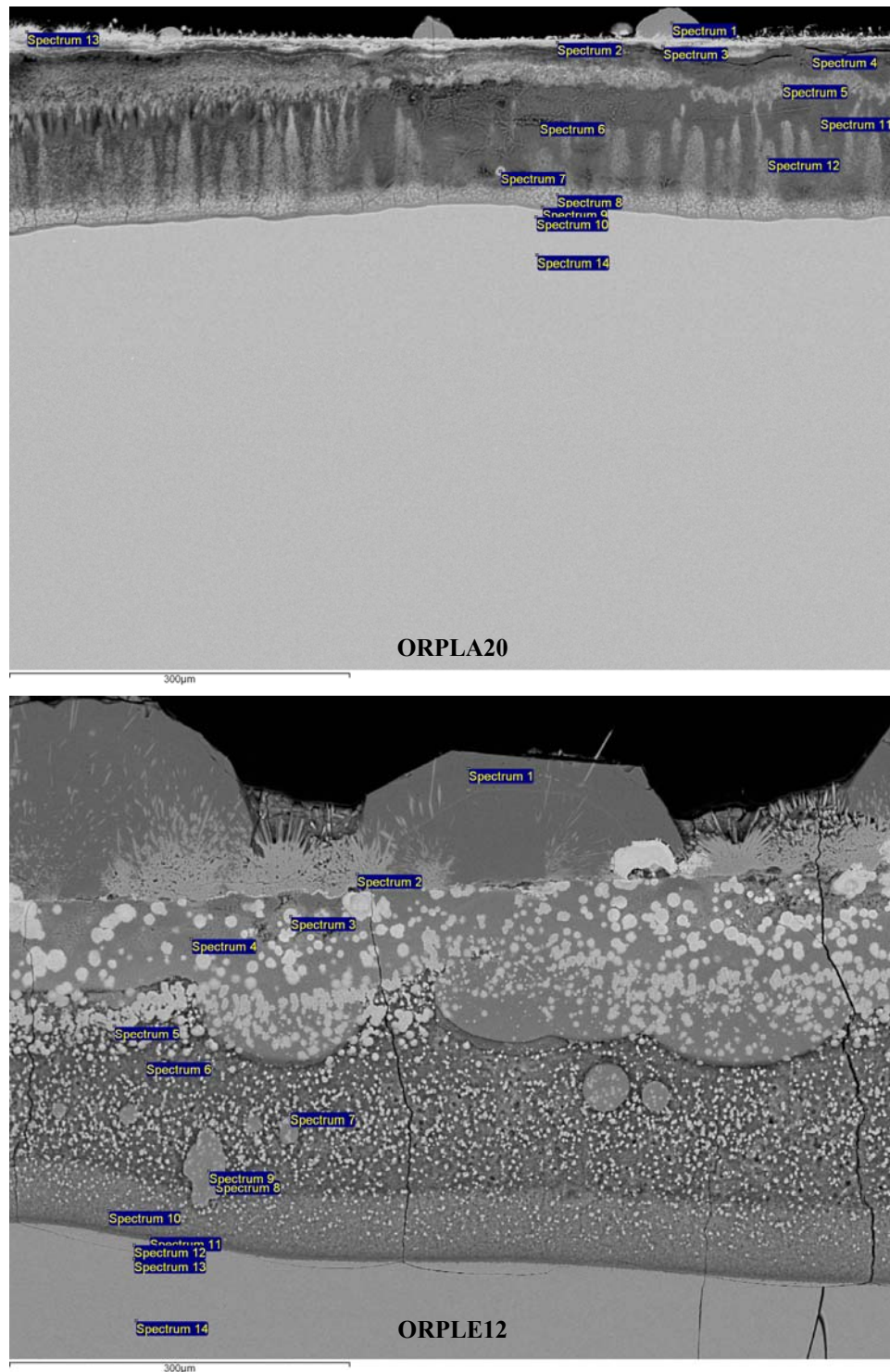


Figure 5.24. SEM image of cross section of crucible glasses ORPLA20 (top) and ORPLE12 (bottom) showing the locations where EDS spectra were collected of individual phases and hydrated gel layers to determine compositions.

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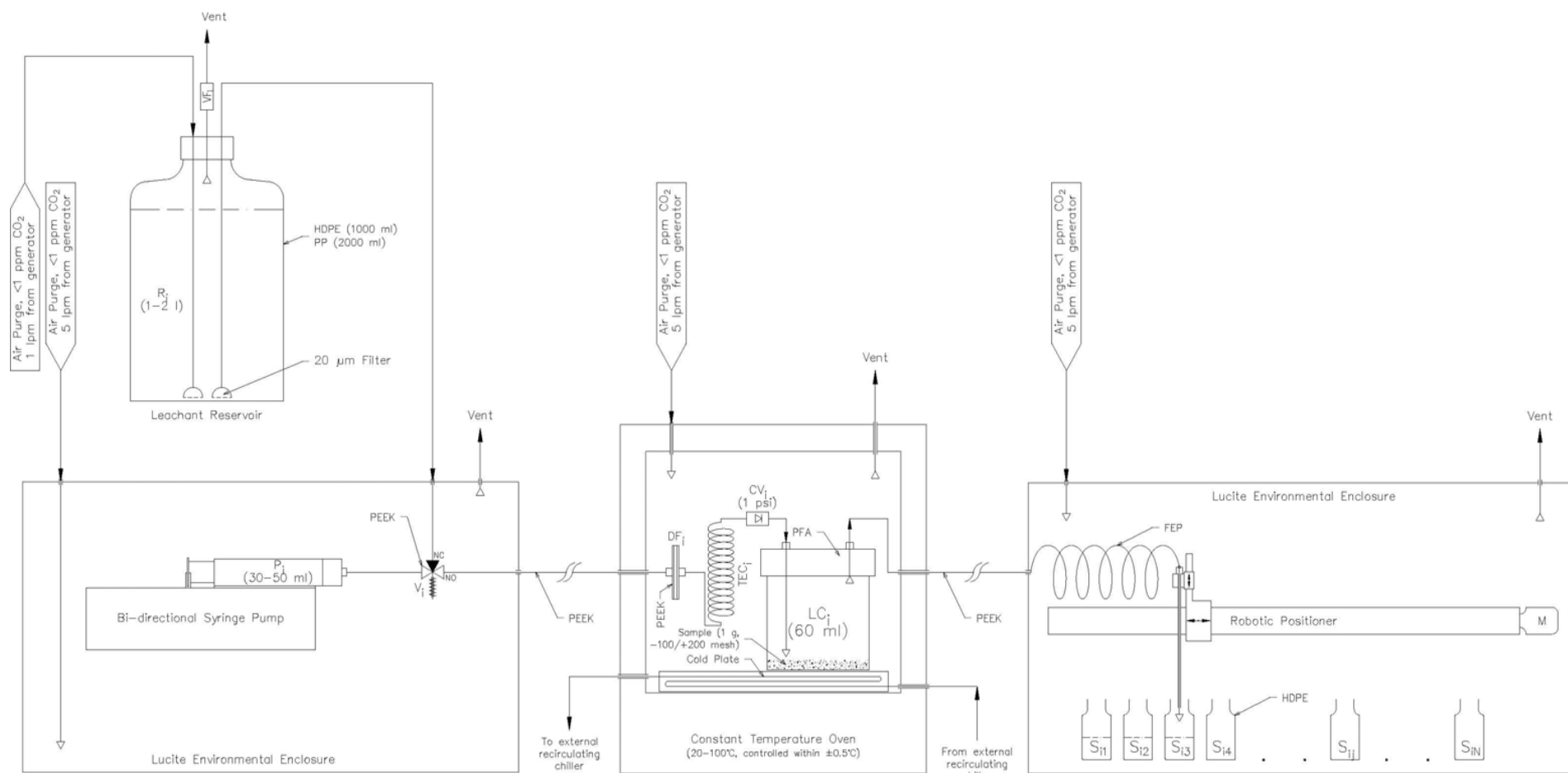


Figure 6.1. Schematic diagram showing the i -th train of the SPFT test Setup. See text for detailed description.

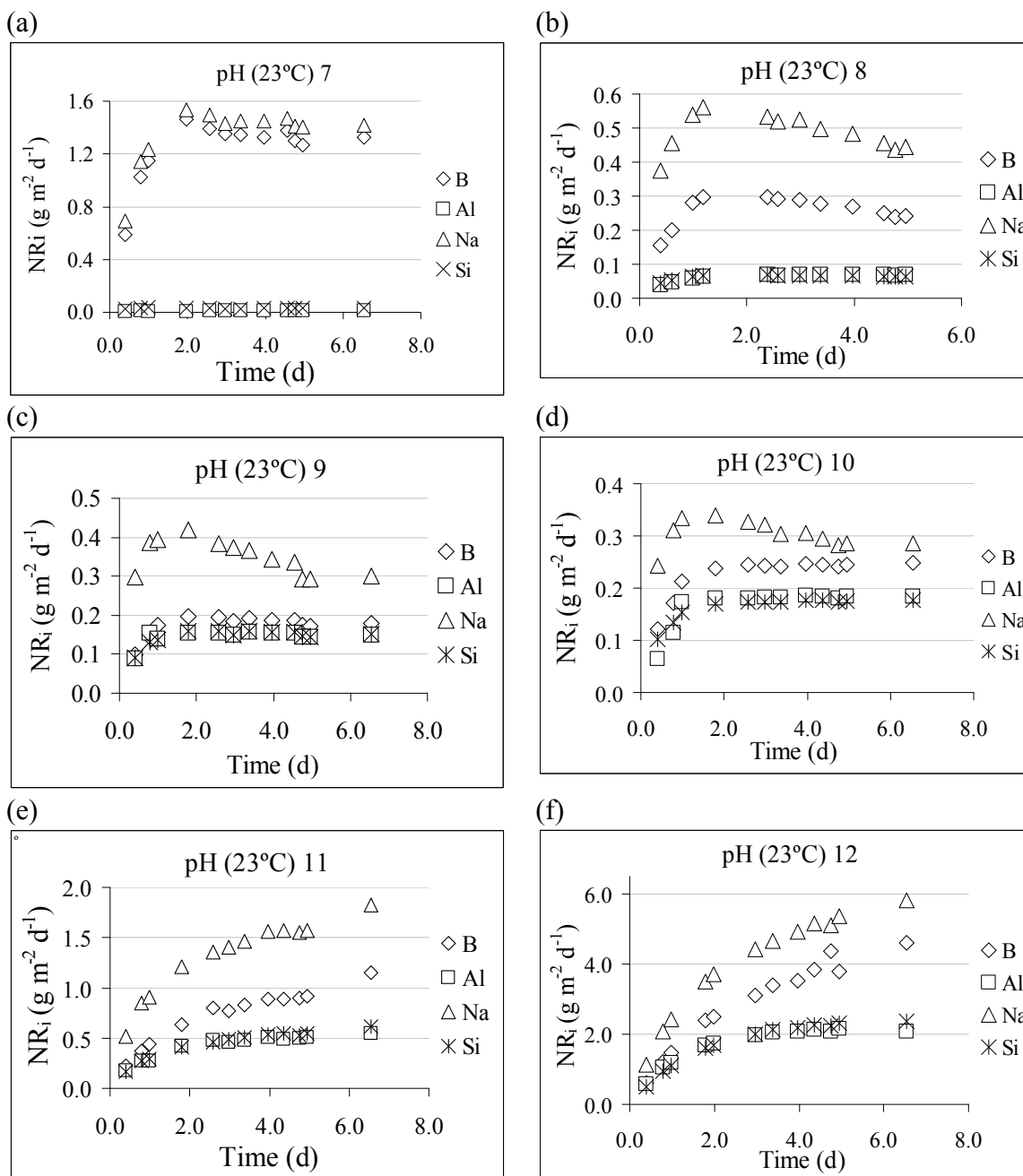


Figure 6.2. Dissolution of IDF1-B2 at 90°C and in leaching solutions of varying pH.

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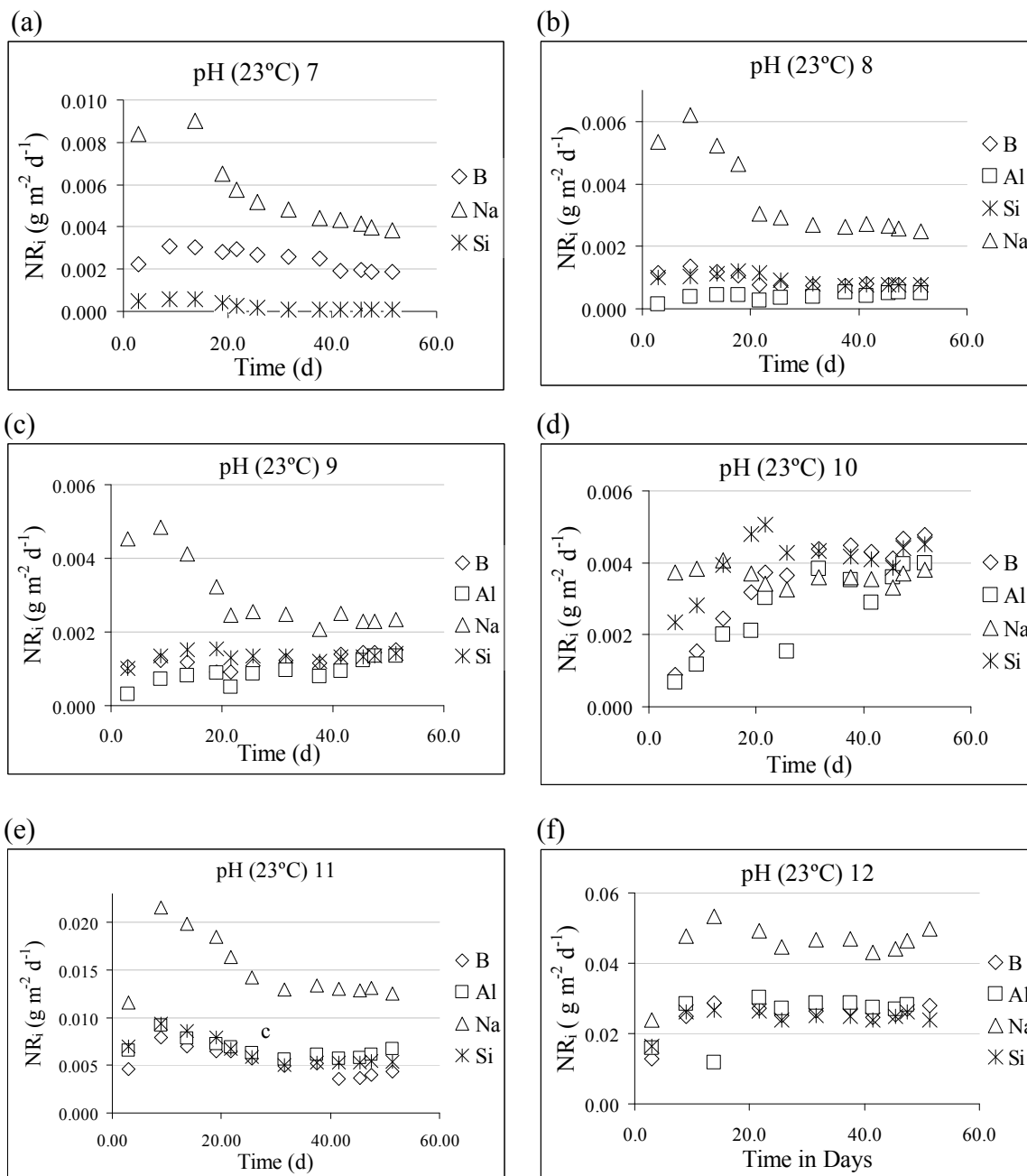


Figure 6.3. Dissolution of IDF1-B2 at 23°C and in leaching solutions of varying pH.

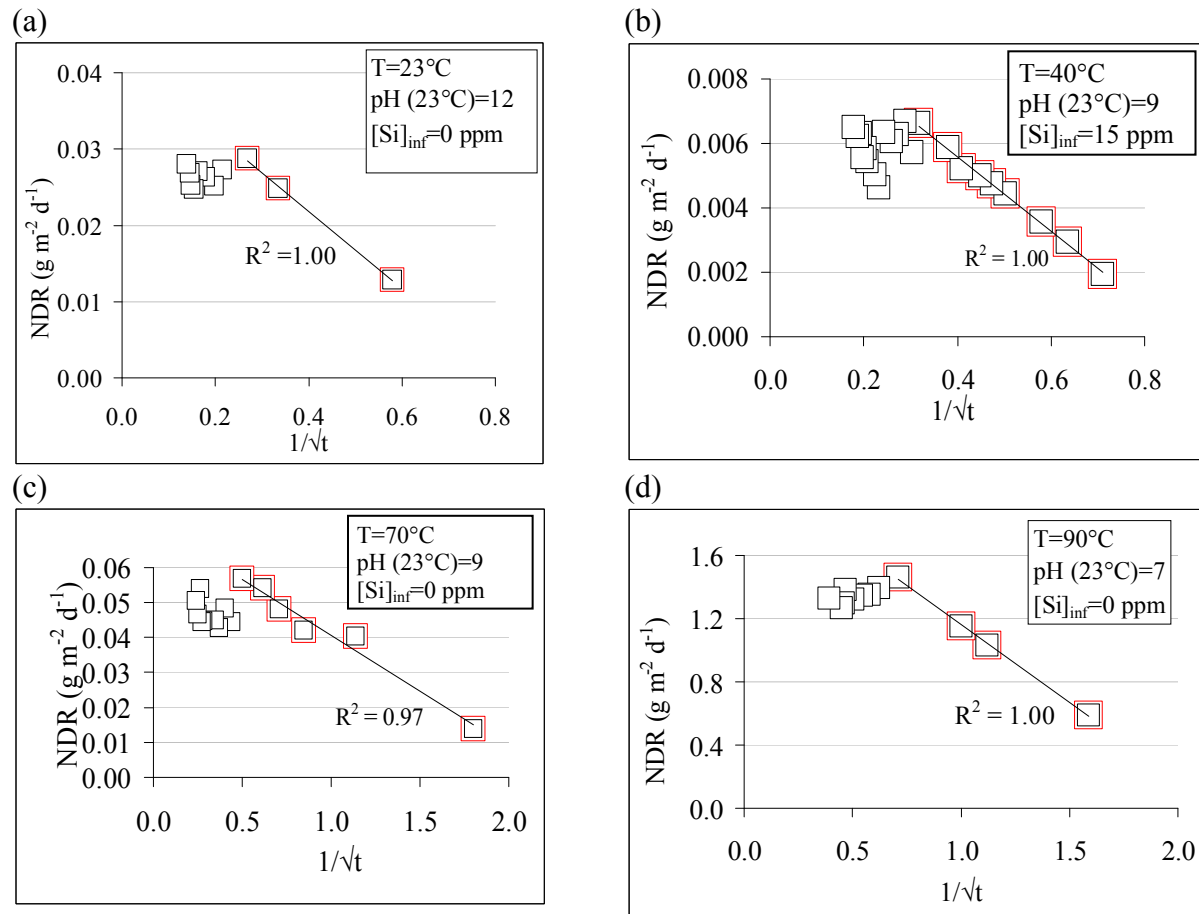


Figure 6.4. Examples of plots of IDF1-B2 NDR (g m⁻² d⁻¹) values as a function of inverse square root of time in days. Linear regression was performed only on the data outlined in red.

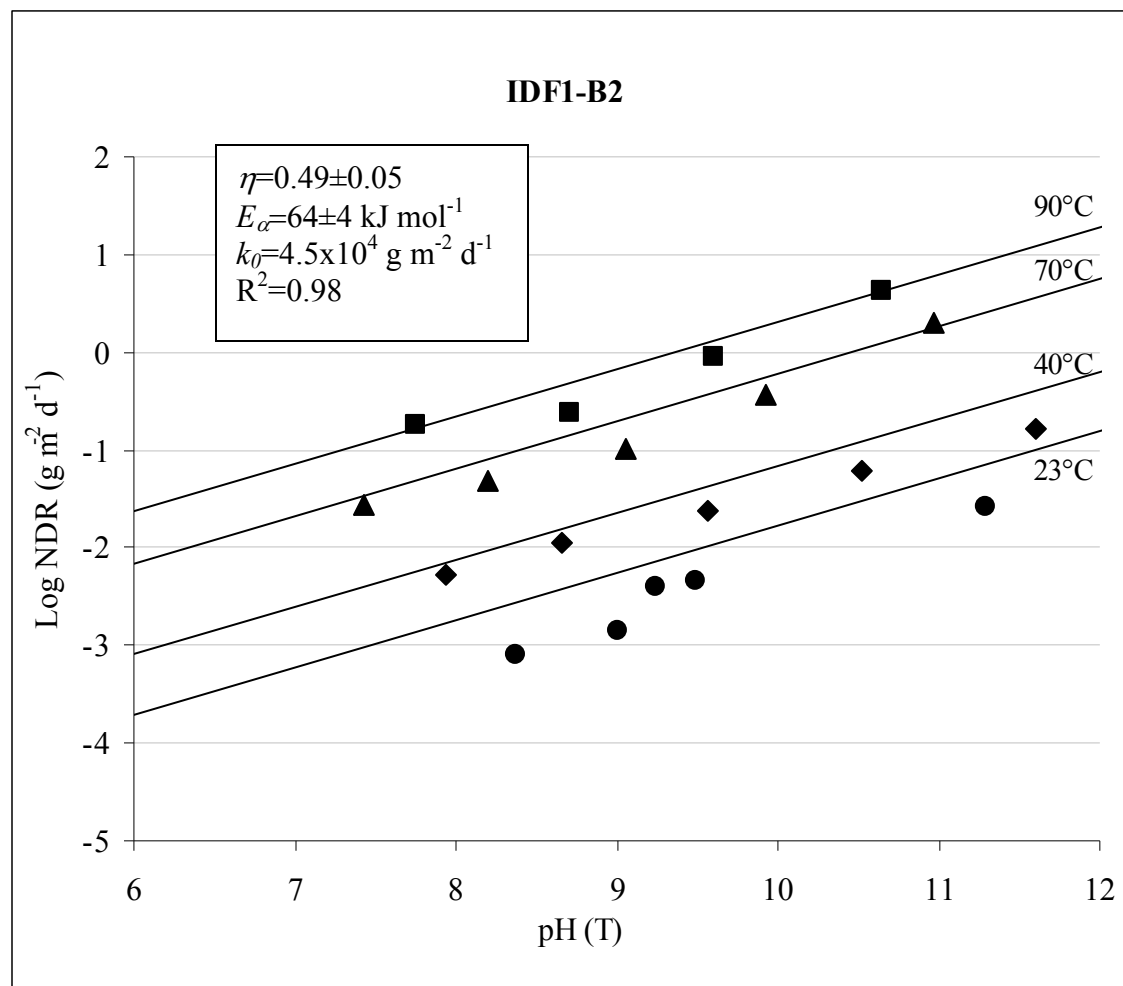


Figure 6.5. Log NDR of IDF1-B2 as a function of in situ pH and temperature.

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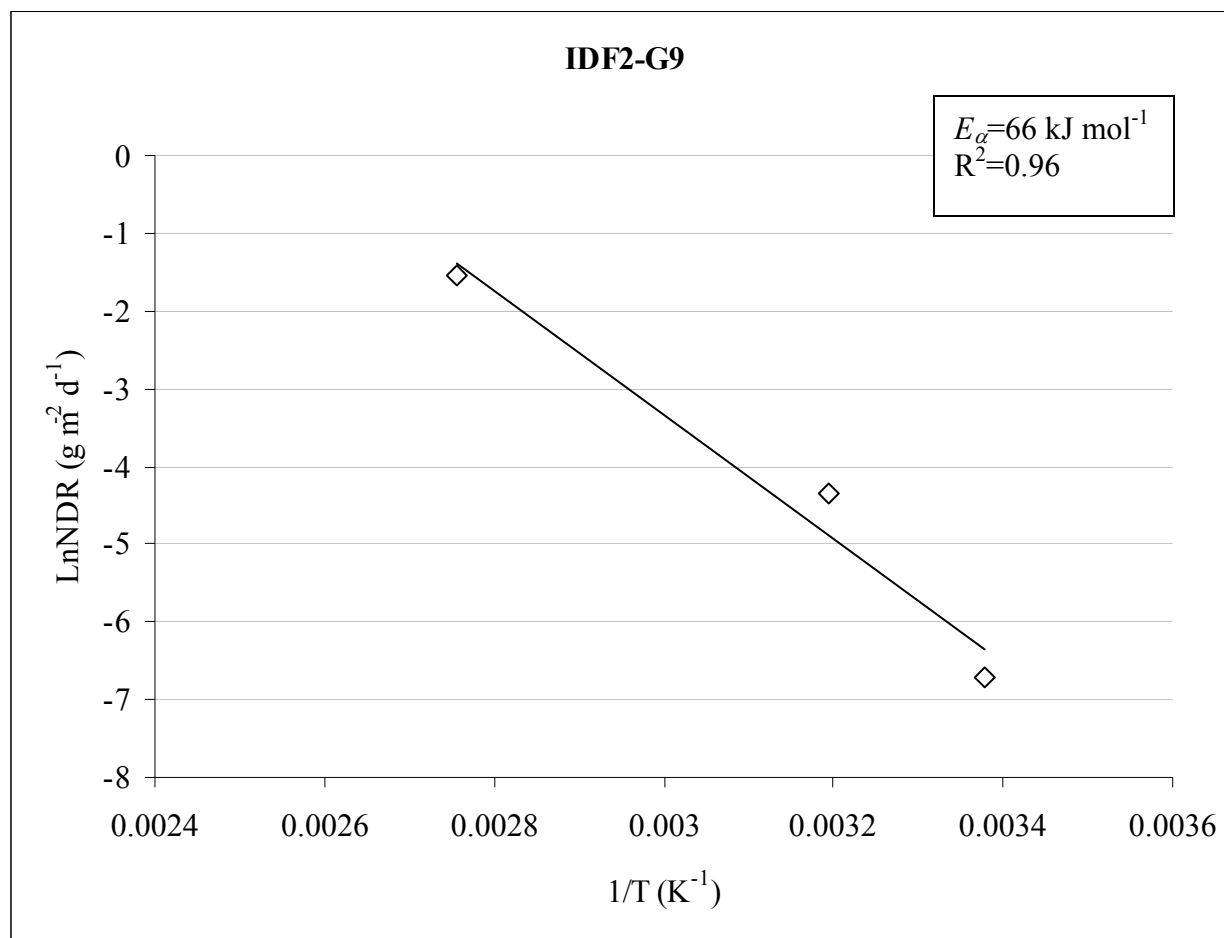


Figure 6.6/. Ln NDR of IDF2-G9 as a function of 1/T.

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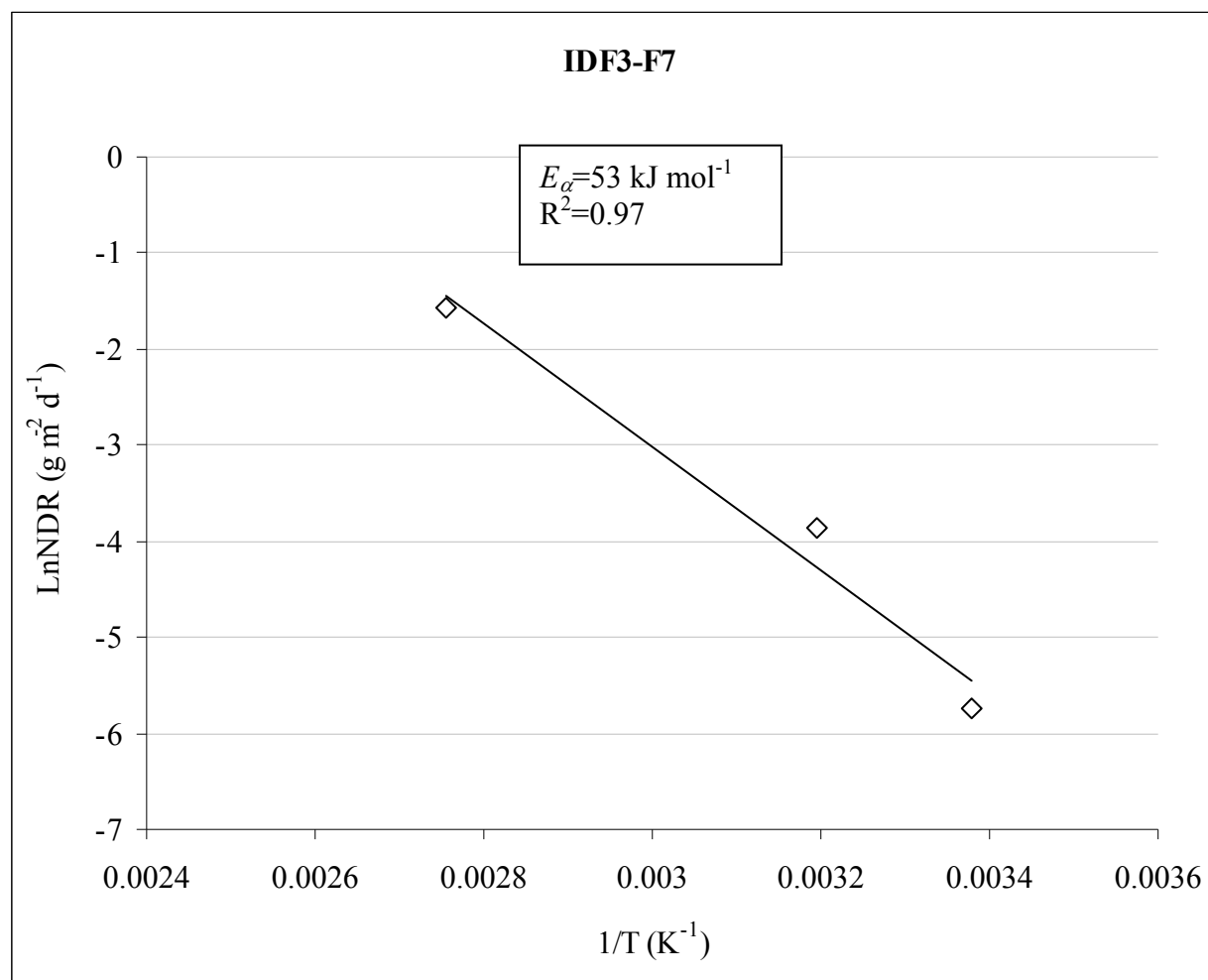


Figure 6.7. Ln NDR of IDF2-F7 as a function of 1/T.

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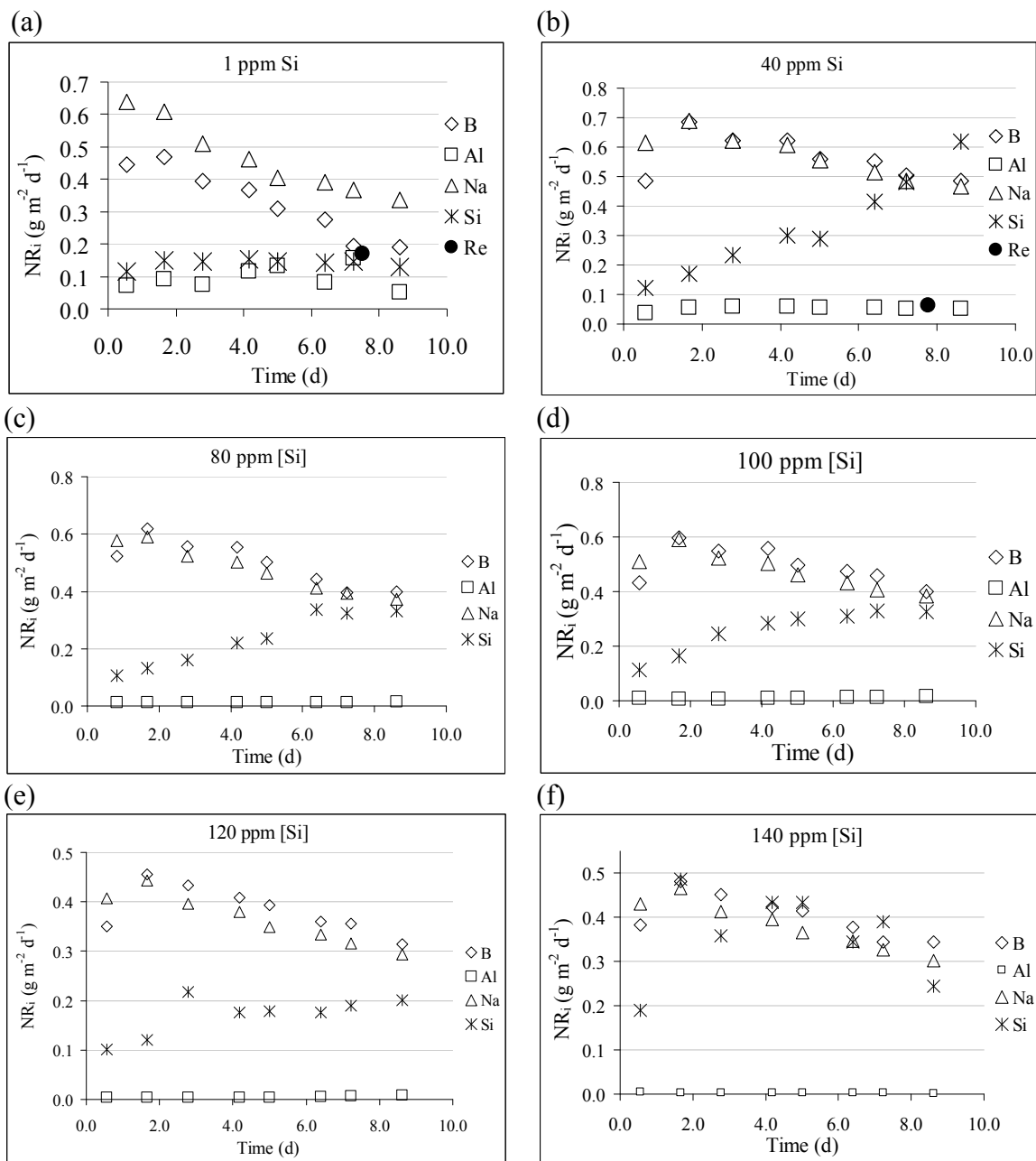


Figure 6.8. Dissolution of IDF1-B2 in the presence of various influent [Si] at 90°C and pH (23°C) 9 as a function of time.

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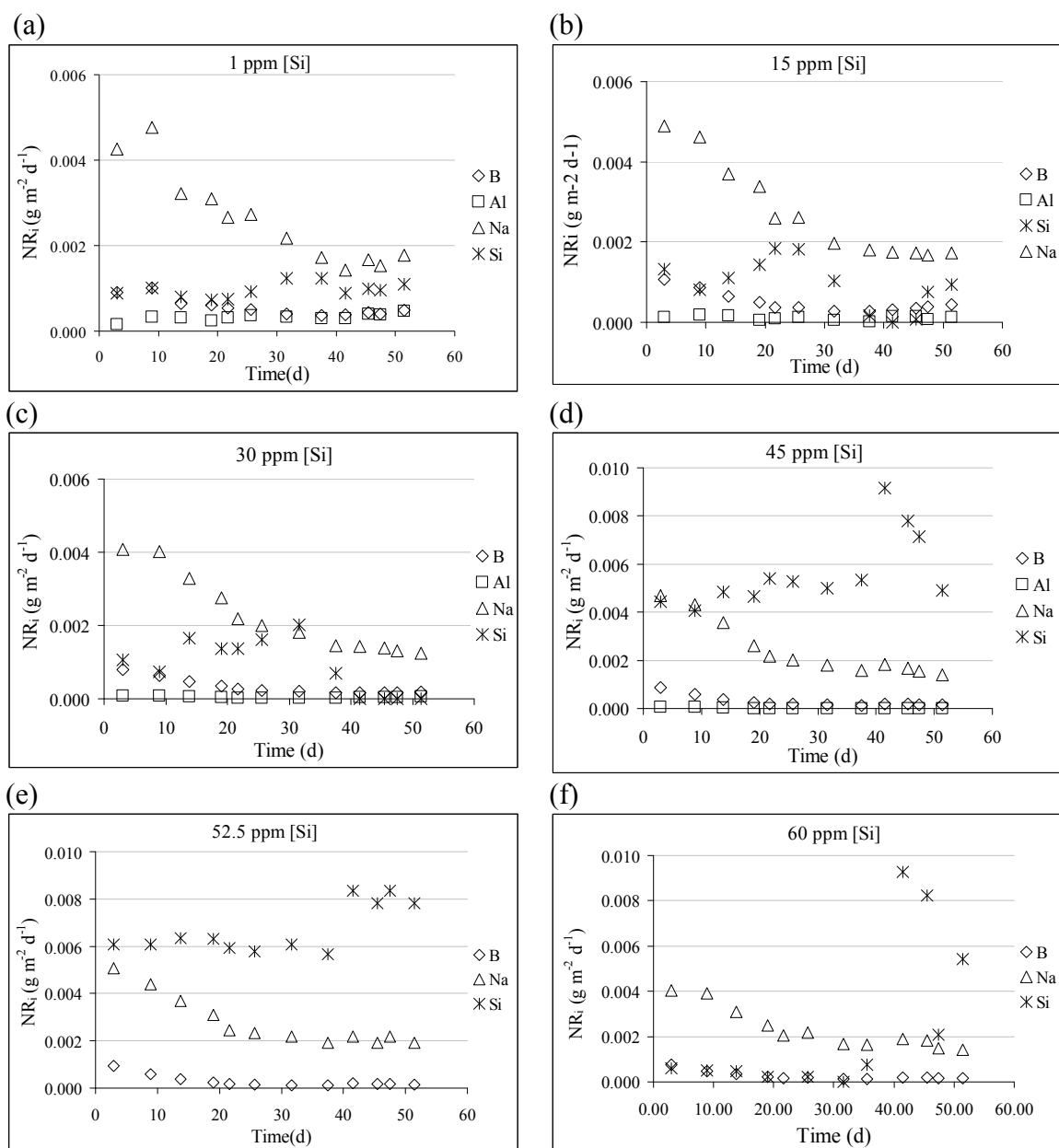


Figure 6.9. Dissolution of IDF1-B2 in the presence of various influent [Si] at 23°C and pH (23°C) 9 as a function of time.

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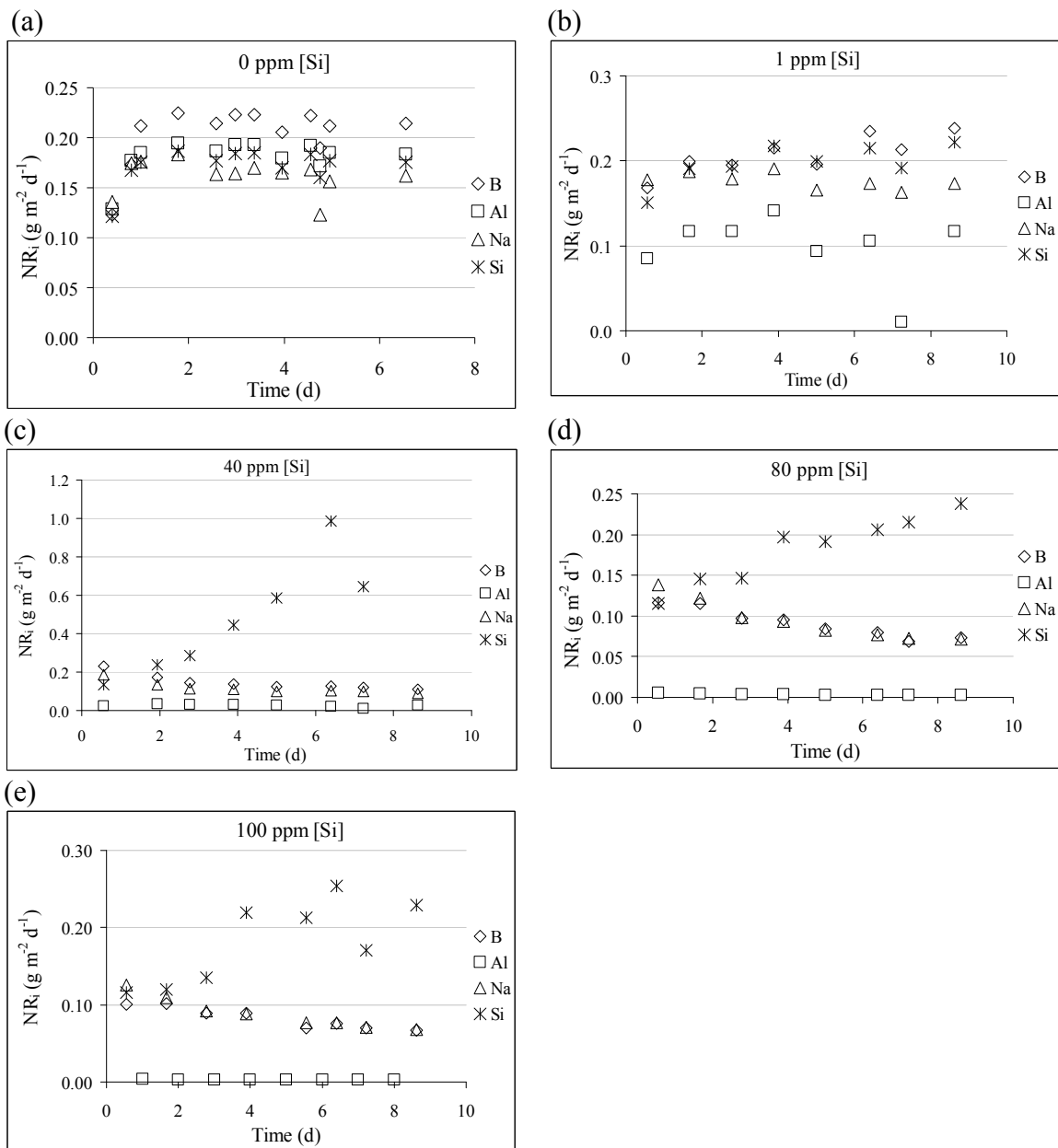


Figure 6.10. Dissolution of IDF3-F7 in the presence of various influent [Si] at 90°C and pH (23°C) 9 as a function of time.

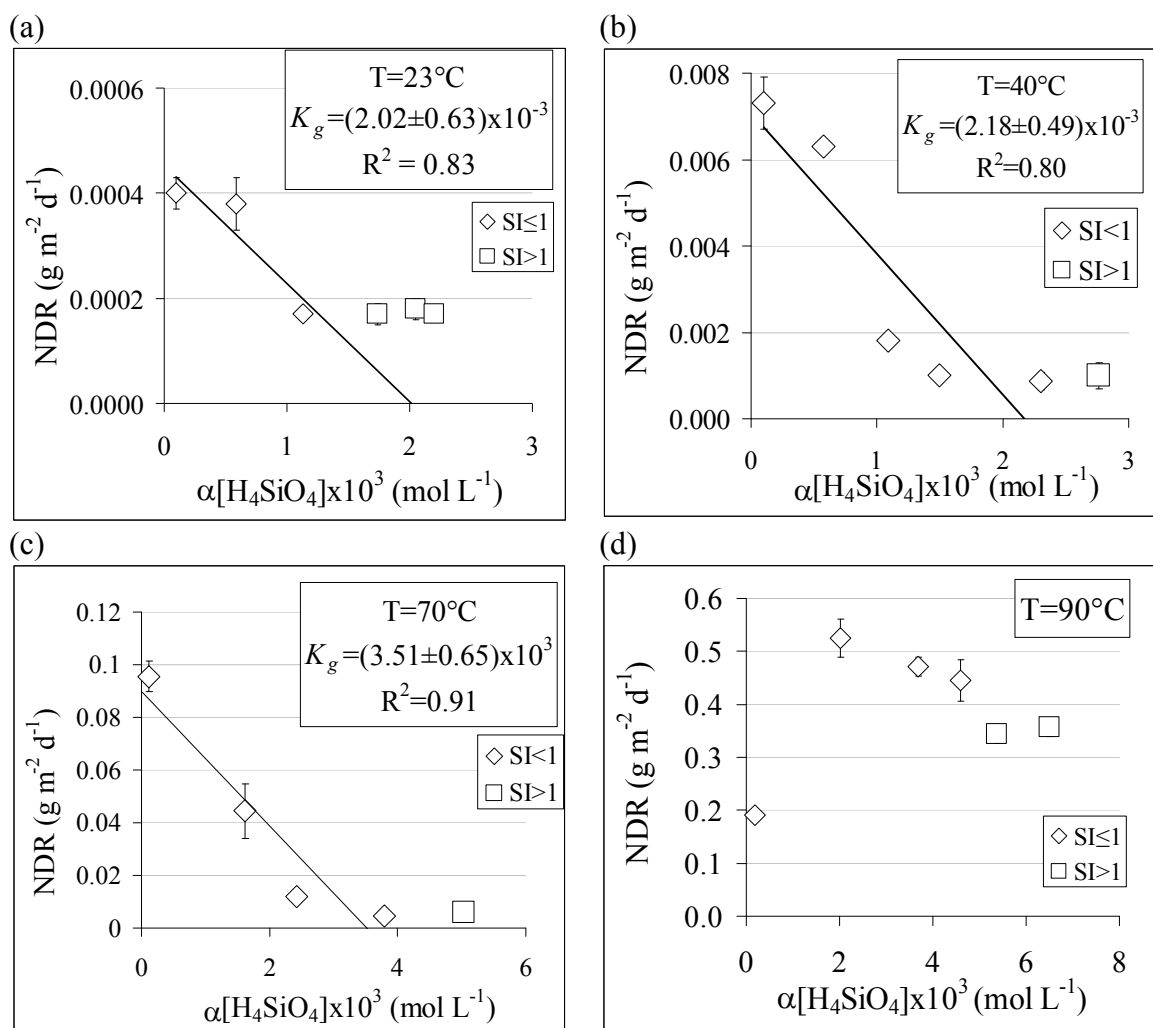


Figure 6.11. NDR as a function of the activity of H_4SiO_4 present in the effluent solutions of IDF1-B2 leached at various temperatures and pH (23°C) 9. SI: saturation index of amorphous silica obtained by PHREEQC.

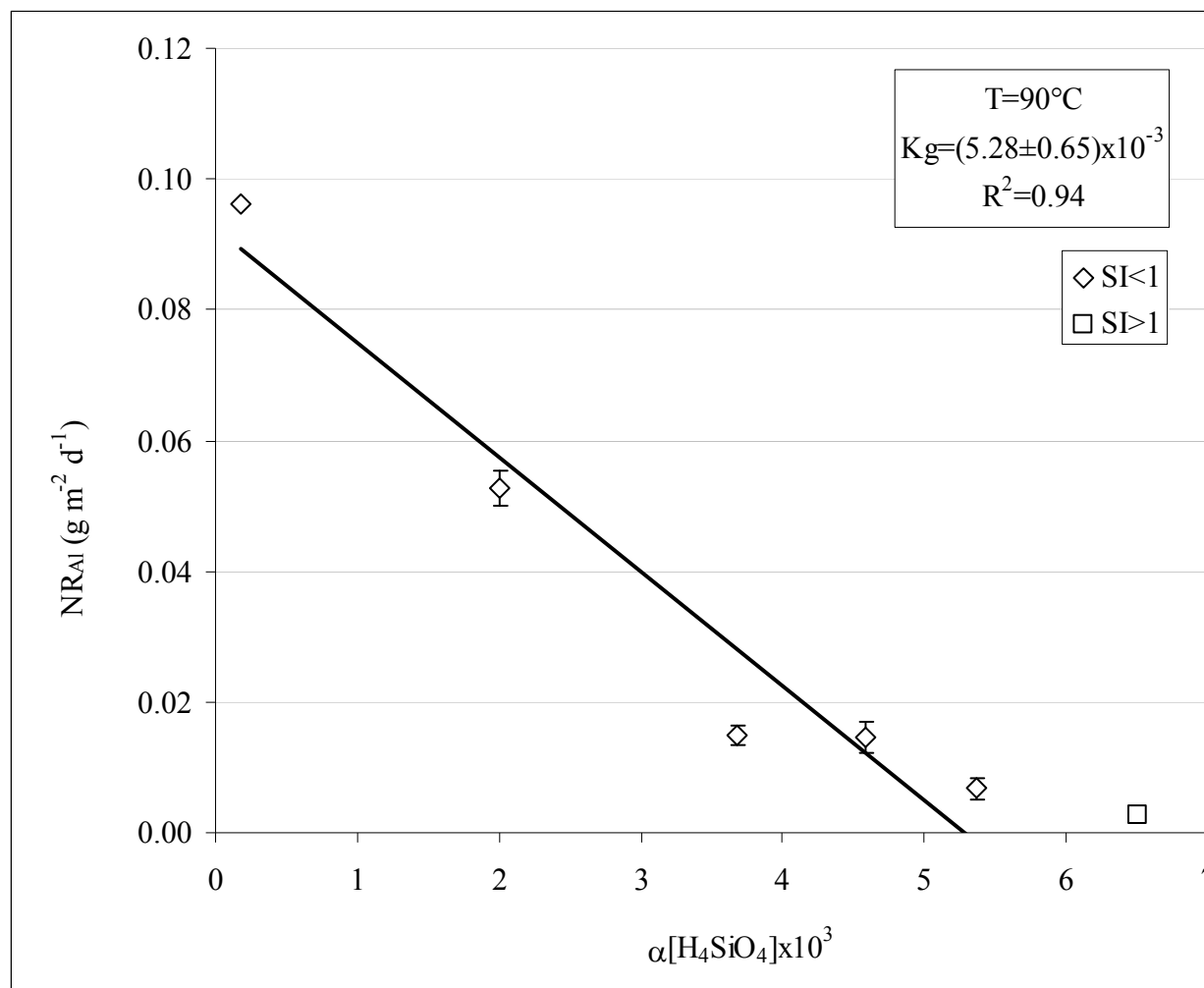


Figure 6.12. NR_{AI} as a function of the activity of H_4SiO_4 present in the effluent solutions of IDF1-B2 leached at 90°C and pH (23°C) 9.

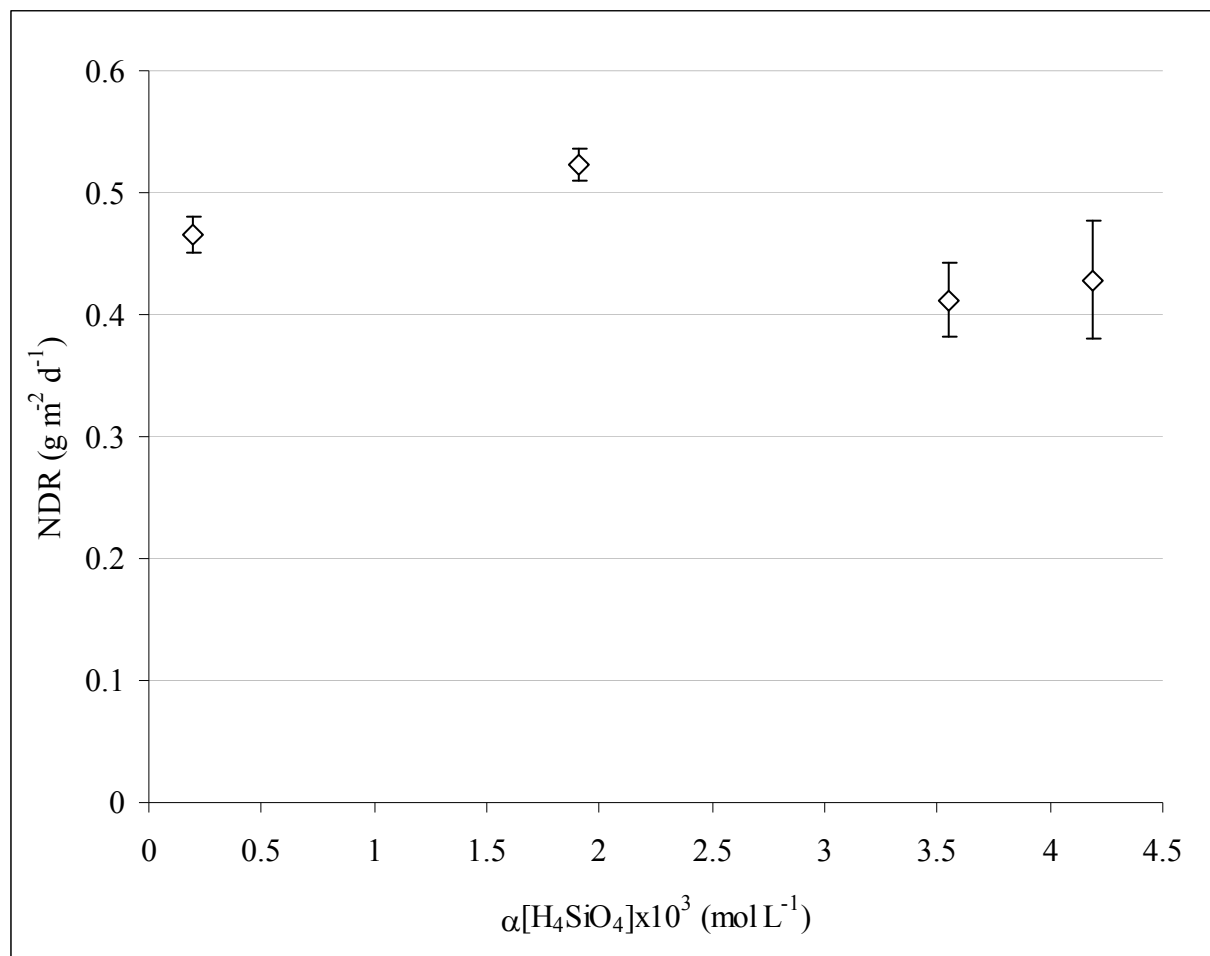


Figure 6.13. NDR as a function of the activity of H_4SiO_4 present in the effluent solutions of IDF2-G9 leached at 90°C and pH (23°C) 9.

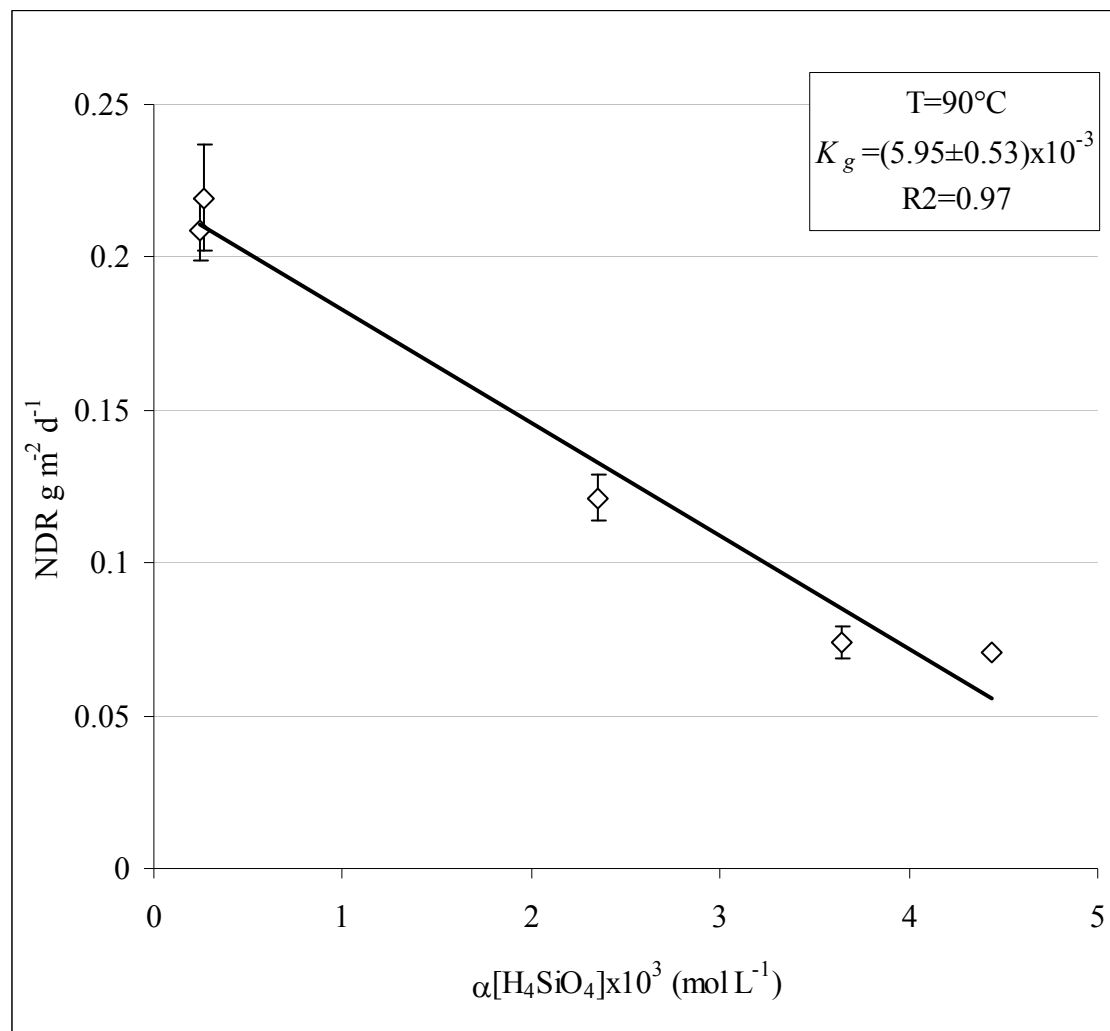


Figure 6.14. NDR as a function of the activity of H_4SiO_4 present in the effluent solutions of IDF3-F7 leached at 90°C and pH (23°C) 9.

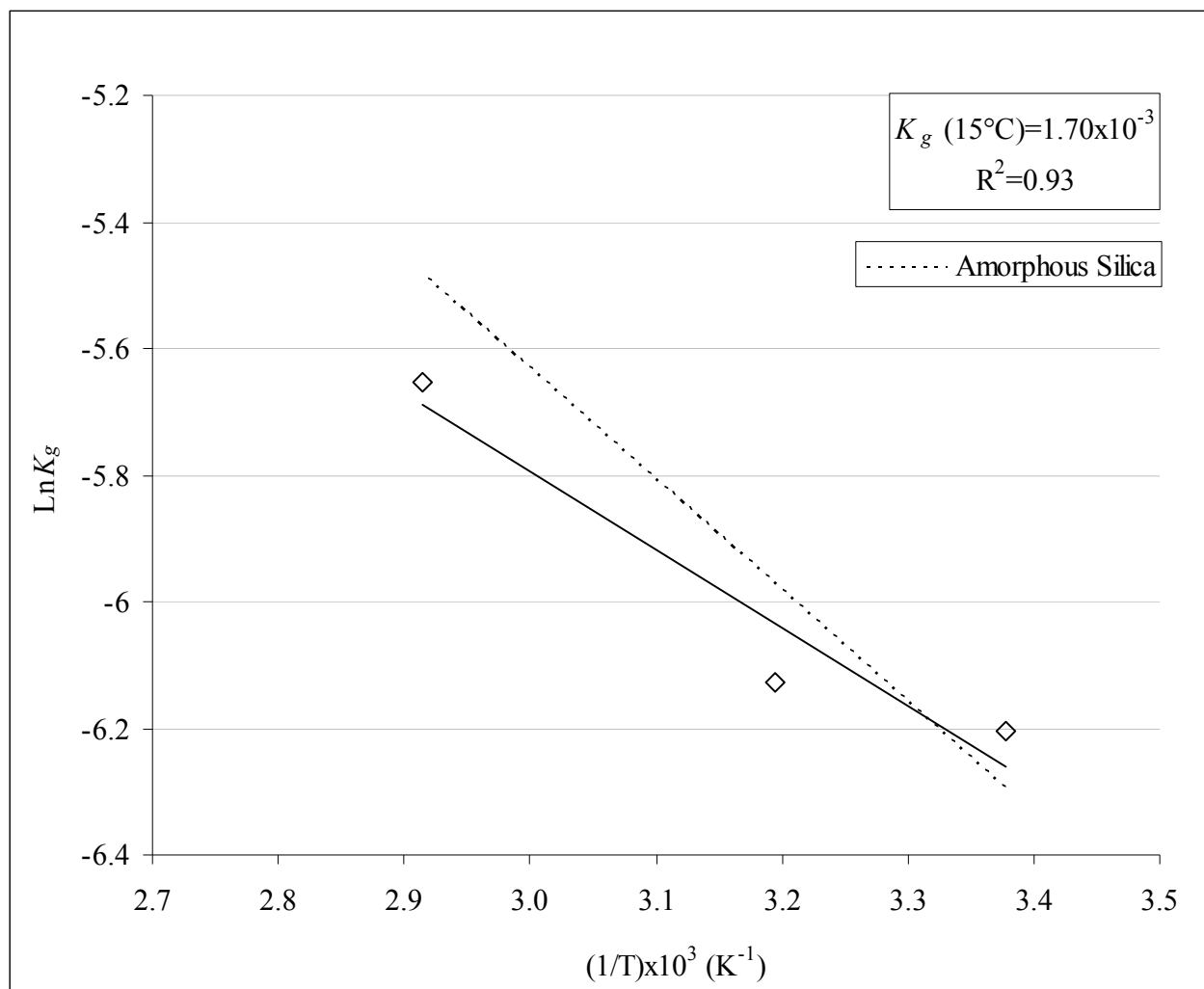


Figure 6.15. Ln K_g of IDF1-B2 as a function of $1/T \text{ (K}^{-1}\text{)}$

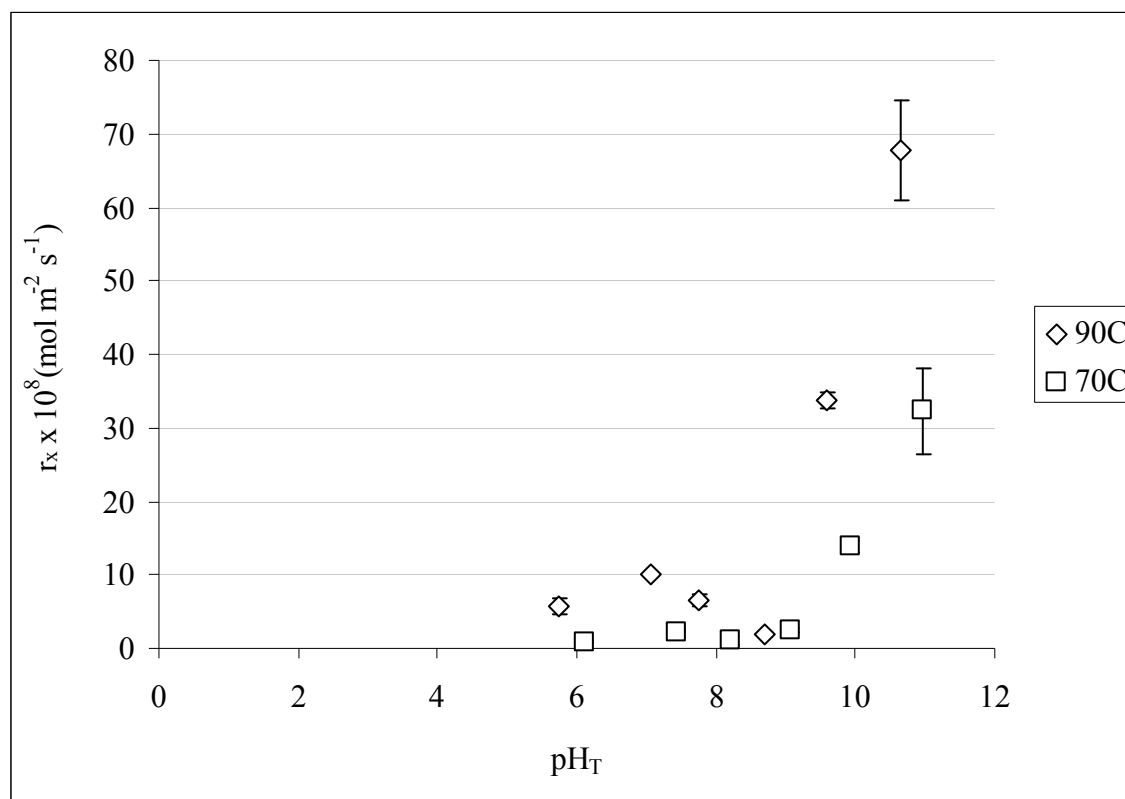


Figure 6.16. Na IEX rates as a function of pH_T at 70 and 90°C.

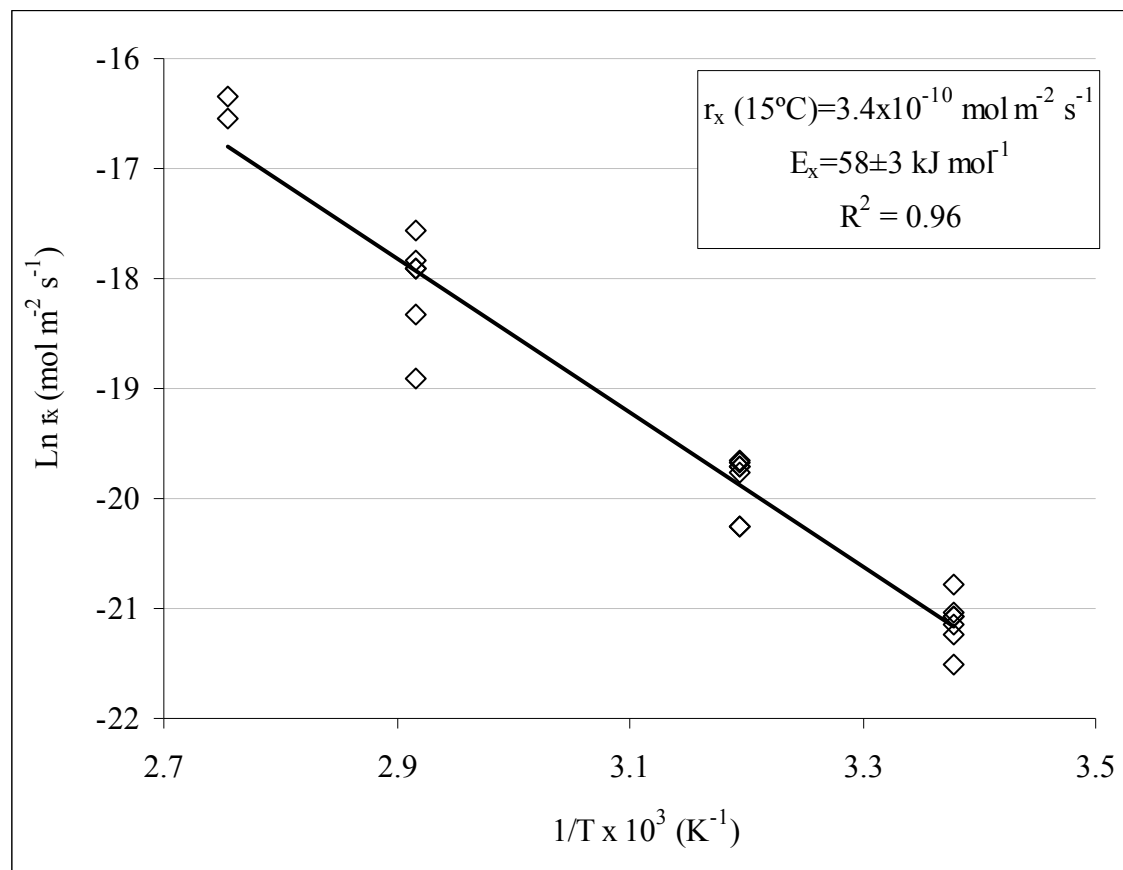
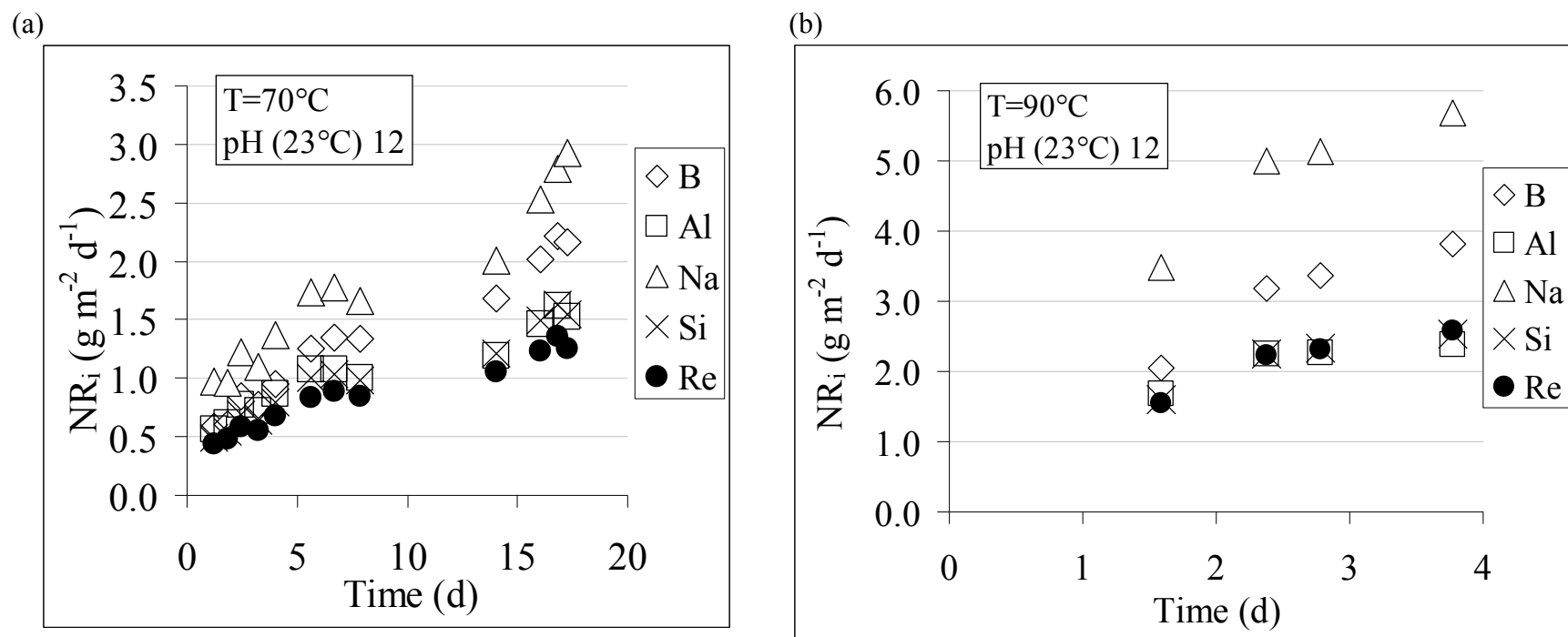


Figure 6.17. $\ln r_{\text{IEX}}$ of IDF1-B2 as a function of $1/T$ (K^{-1}).



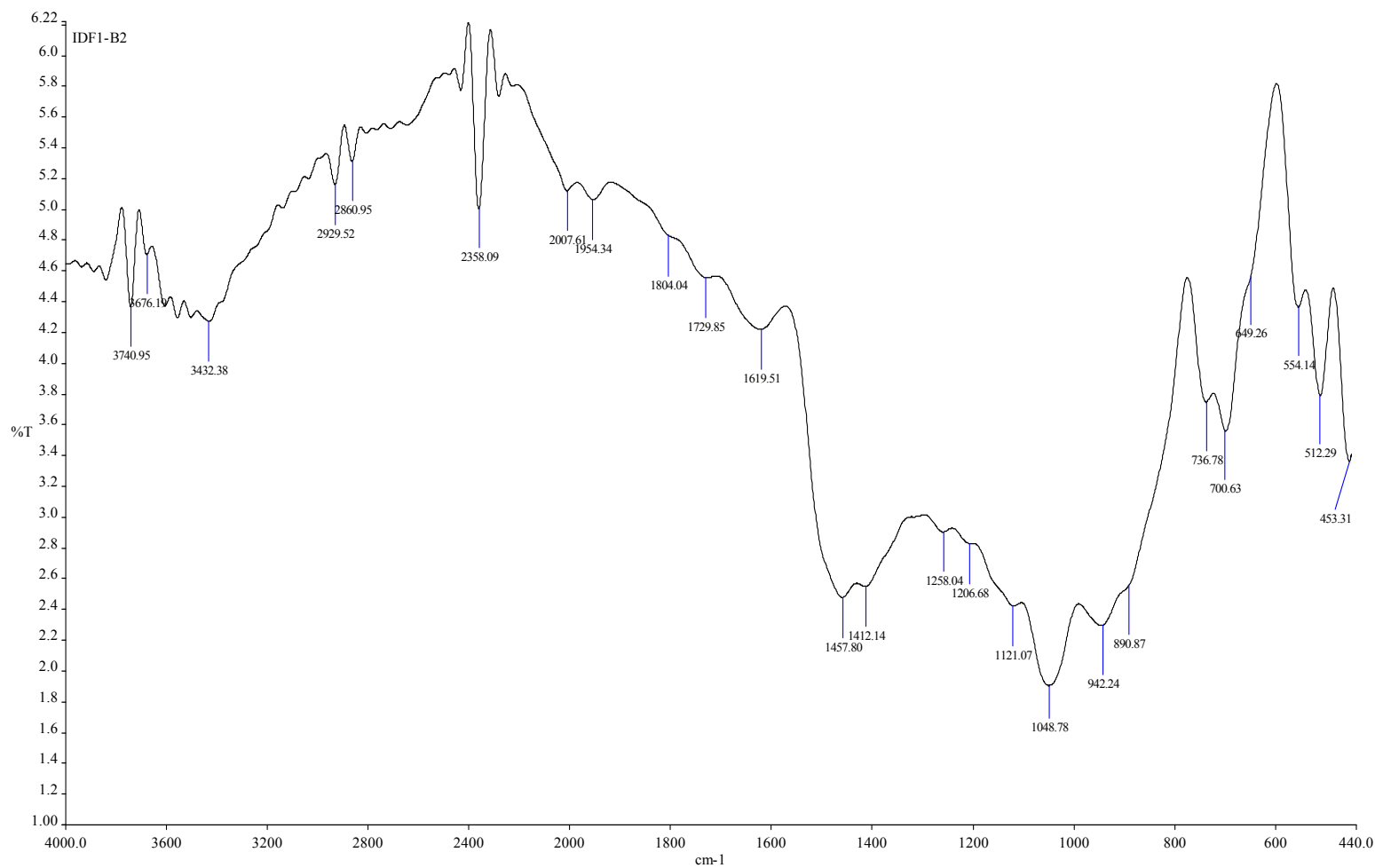


Figure 6.19. IR spectrum of untreated IDF1-B2.

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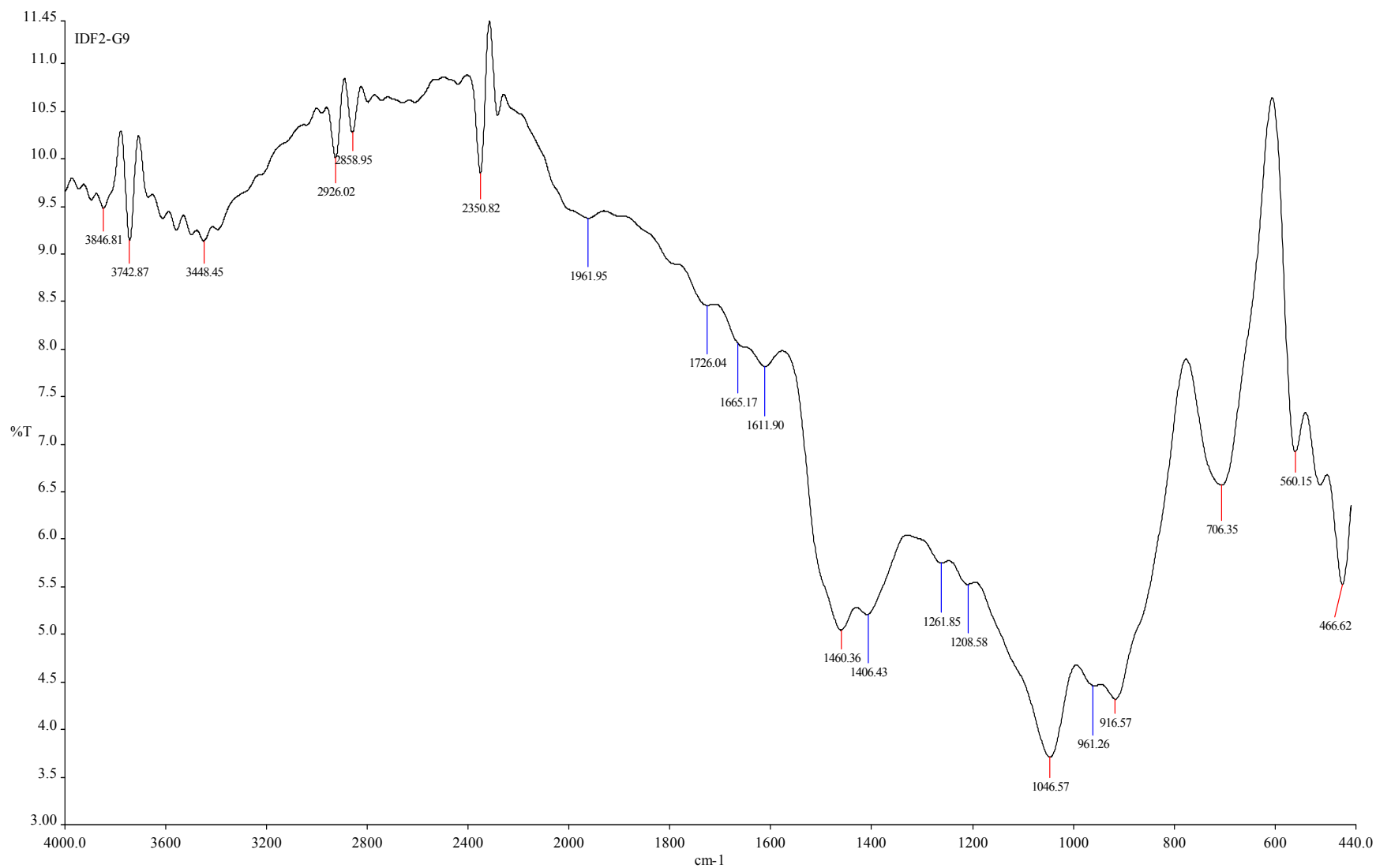


Figure 6.20. IR spectrum of untreated IDF2-G9.

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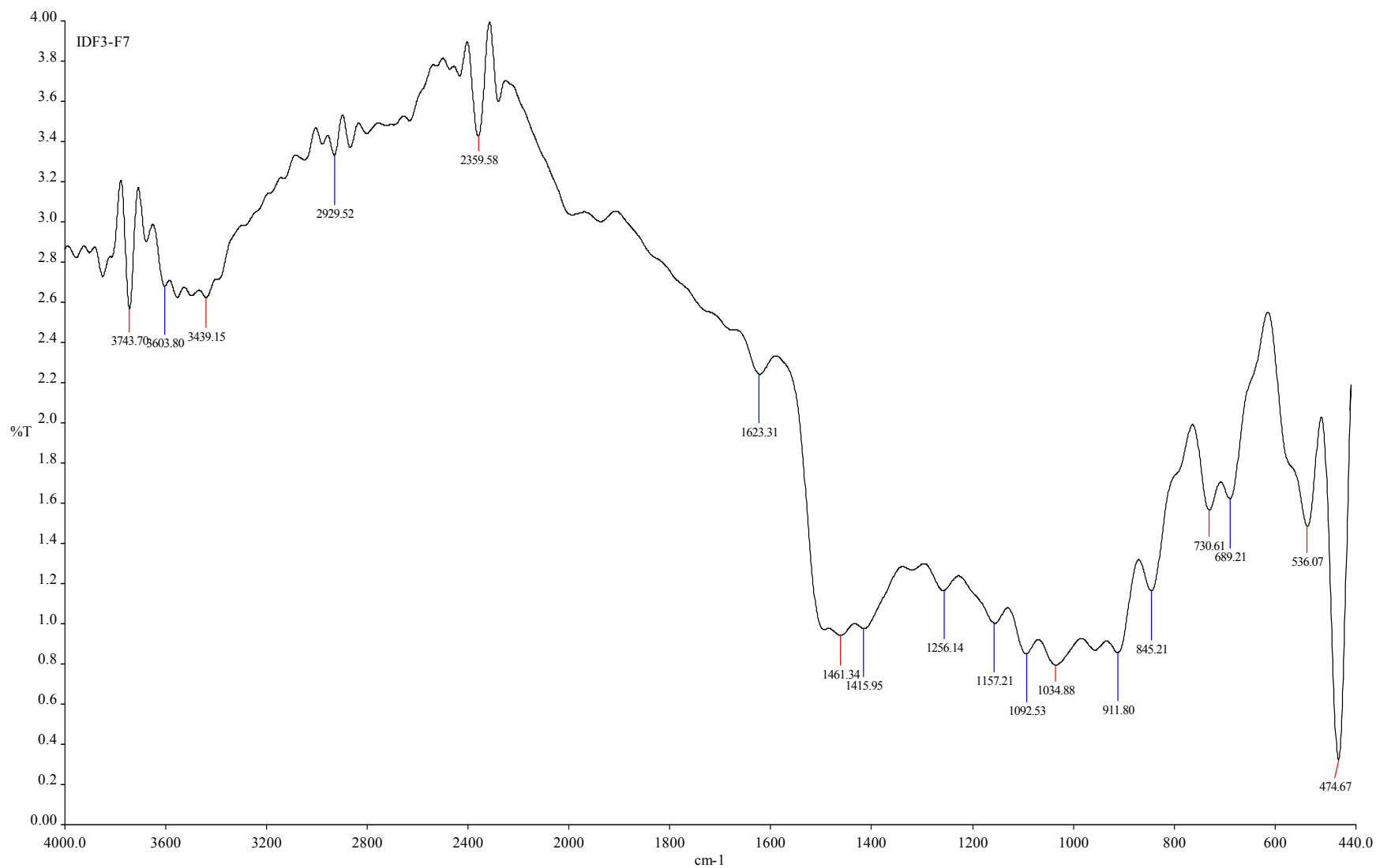


Figure 6.21. IR spectrum of untreated IDF3-F7.

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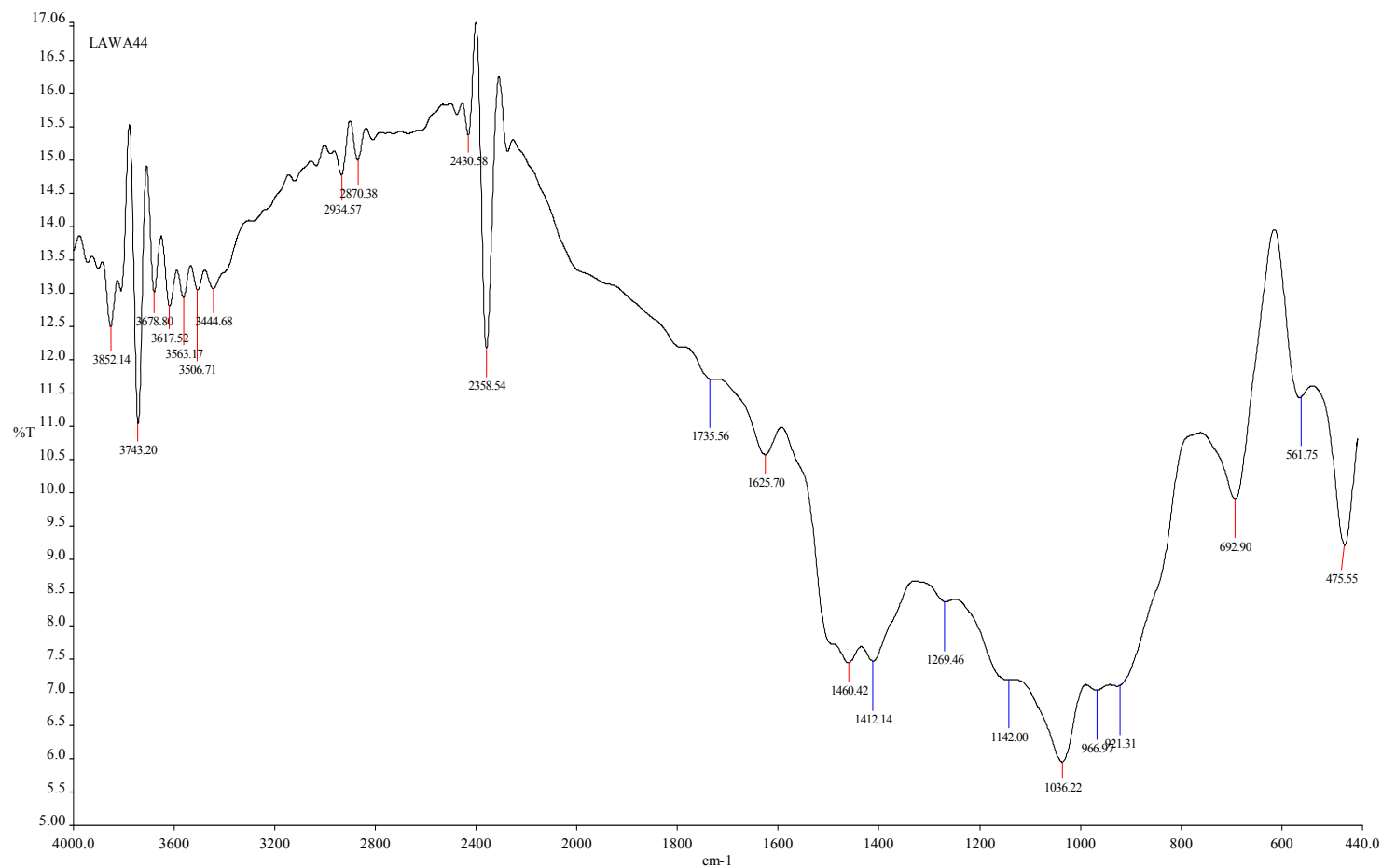


Figure 6.22. IR spectrum of untreated LAWA44.

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Figure 6.23. IR spectrum of IDF1-B2 after treatment in 45 ppm Si at 40°C for 31 days.

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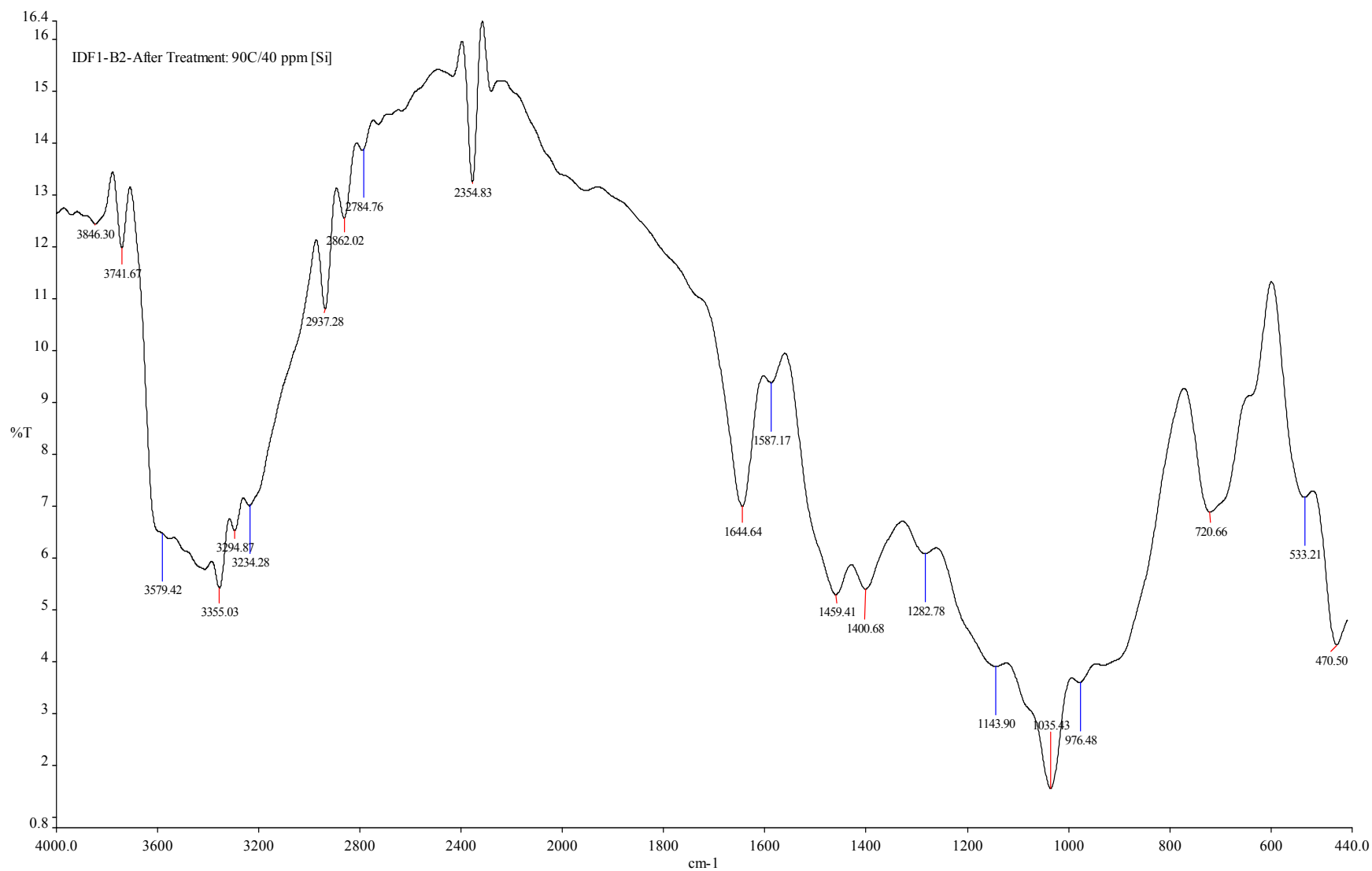


Figure 6.24. IR spectrum of IDF1-B2 after treatment in 40 ppm Si at 90°C for ~9 days.

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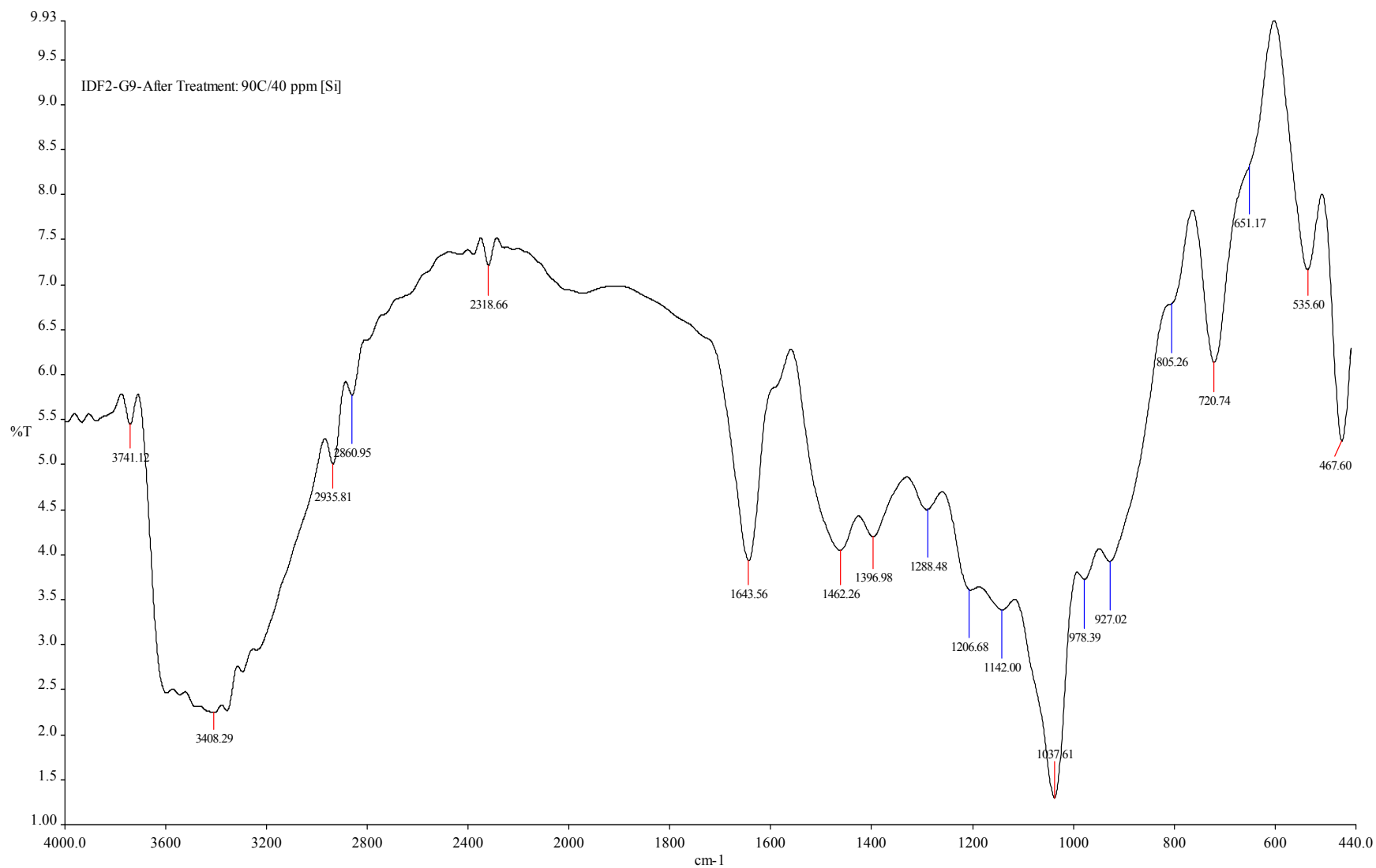


Figure 6.25. IR spectrum of IDF2-G9 after treatment in 40 ppm Si at 90°C for ~9 days.

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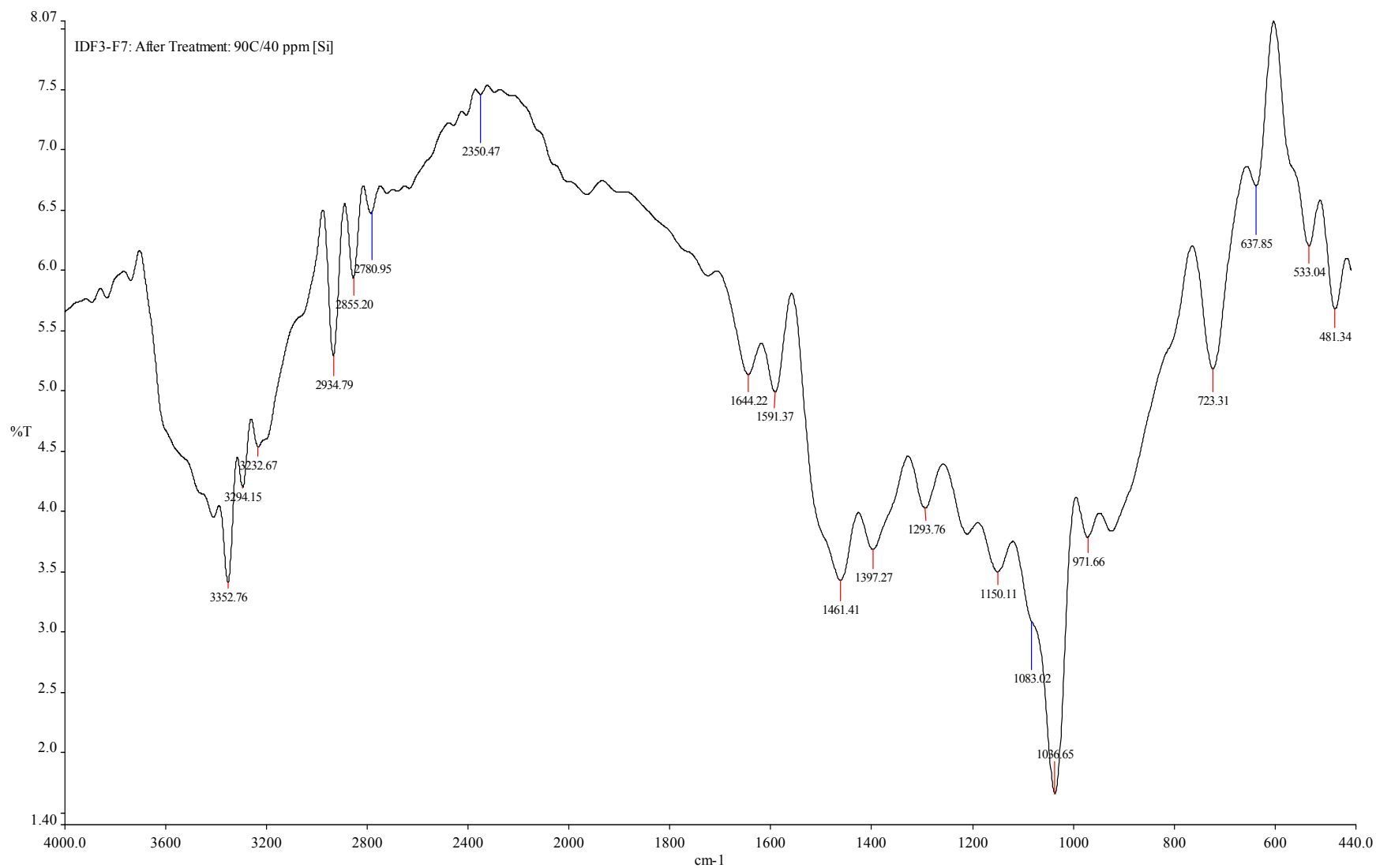


Figure 6.26. IR spectrum of IDF3-F7 after treatment in 40 ppm Si at 90°C for ~9 days.

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APPENDIX A

LAW Glass Compositions and PCT-B Data from The VSL Long-Term Test Inventory

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APPENDIX A1

LAW Glass Compositions

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Glass ID \ Weight %	Al ₂ O ₃	B ₂ O ₃	CaO	Fe ₂ O ₃	K ₂ O	Li ₂ O	MgO	Na ₂ O	SO ₃ target	SO ₃ XRF Measured or Interpolated	SiO ₂	TiO ₂	ZnO	ZrO ₂	Others	SUM
12S-G-85C	6.080	10.050	5.090	5.560	0.080	2.500	1.510	14.430	0.38	0.38	46.430	1.140	3.060	3.010	0.680	100.000
12U-G-86A	6.161	8.952	1.980	6.941	0.440	0.000	1.980	19.964	0.24	0.23	44.329	1.980	2.951	2.971	1.120	100.000
A100CC	6.064	10.007	5.064	5.414	0.260	2.502	1.491	14.470	0.44	0.36	46.613	1.141	3.072	3.032	0.510	100.000
A100G115A	6.063	10.005	5.063	5.413	0.260	2.501	1.491	14.467	0.44	0.38	46.603	1.141	3.072	3.032	0.510	100.000
A1-AN105R2	6.101	8.841	1.960	6.871	0.440	0.000	1.960	20.662	0.19	0.18	43.824	1.960	2.920	2.940	1.340	100.000
A1C1-1	6.088	9.126	2.742	6.501	0.347	0.623	1.850	19.167	0.24	0.21	44.480	1.759	2.951	2.956	1.200	100.000
A1C1-2	6.073	9.415	3.521	6.135	0.255	1.247	1.735	17.673	0.28	0.23	45.142	1.554	2.984	2.974	1.062	100.000
A1C1-3	6.057	9.701	4.299	5.766	0.161	1.871	1.619	16.170	0.33	0.29	45.787	1.348	3.017	2.991	0.924	100.000
A2-API01	5.622	9.824	1.991	5.532	3.812	0.000	1.481	18.467	0.40	0.35	44.008	1.991	2.941	2.961	1.020	100.000
A2B1-1	5.758	9.883	3.184	5.477	2.904	1.071	1.852	15.230	0.46	0.35	45.179	1.842	3.414	3.014	0.841	100.000
A2B1-2	5.895	9.919	4.374	5.405	2.002	2.152	2.232	11.981	0.52	0.42	46.292	1.692	3.894	3.063	0.681	100.000
A2B1-3	6.037	9.971	5.576	5.346	1.091	3.224	2.603	8.730	0.59	0.47	47.432	1.542	4.365	3.113	0.501	100.000
A3-AN104	6.051	9.921	5.031	5.371	0.330	2.480	1.480	14.641	0.37	0.35	46.095	1.130	3.040	3.000	1.080	100.000
A3C2-1	6.064	9.796	5.613	4.923	0.270	2.672	1.481	13.978	0.43	0.38	46.408	1.121	3.282	3.002	1.011	100.000
A3C2-2	6.066	9.680	6.196	4.485	0.210	2.863	1.481	13.323	0.50	0.40	46.707	1.111	3.514	3.003	0.961	100.000
A3C2-3	6.064	9.547	6.775	4.043	0.150	3.062	1.491	12.649	0.57	0.49	46.983	1.091	3.753	3.002	0.901	100.000
A88API01R1	6.102	9.834	1.999	5.552	2.136	0.000	1.480	20.011	0.28	0.23	44.153	1.999	2.961	2.998	0.546	100.000
A88Si+15	6.141	9.481	1.930	5.351	2.370	0.000	1.430	22.182	0.31	0.29	42.554	1.930	2.850	2.890	0.600	100.000
A88Si-15	6.055	10.218	2.072	5.765	1.882	0.000	1.541	17.674	0.25	0.19	45.867	2.072	3.072	3.112	0.480	100.000
B1-AZ101	6.180	10.026	6.771	5.278	0.180	4.307	2.985	5.479	0.65	0.49	48.578	1.392	4.848	3.165	0.321	100.000
C100-G-136B	6.127	10.092	6.408	6.478	0.150	2.733	1.512	11.874	0.63	0.40	46.726	1.121	3.014	3.024	0.340	100.000
C100GCC	6.127	10.092	6.408	6.478	0.150	2.733	1.512	11.874	0.53	0.40	46.726	1.121	3.014	3.024	0.340	100.000
C1-AN107	6.066	10.031	5.098	5.421	0.069	2.506	1.510	14.465	0.38	0.29	46.636	1.147	3.062	3.020	0.679	100.000
C22AN107	6.106	10.079	5.115	5.585	0.090	2.512	1.511	14.433	0.31	0.27	46.612	1.141	3.063	3.023	0.460	100.000
C22Si+15	6.043	9.837	4.994	5.358	0.095	2.459	1.484	16.197	0.34	0.31	45.581	1.121	3.001	2.960	0.561	100.000
C22Si-15	6.160	10.291	5.218	5.555	0.076	2.572	1.551	12.812	0.27	0.23	47.680	1.175	3.139	3.096	0.446	100.000
C2-AN102C35	6.075	9.428	7.356	3.603	0.090	3.253	1.491	11.980	0.63	0.54	47.278	1.081	3.993	3.002	0.831	100.000
GTSD-1126	6.183	10.041	6.784	5.301	0.120	4.309	2.976	5.492	0.65	0.45	48.843	1.393	4.860	3.177	0.070	100.000
GTSD-1437	6.091	9.463	7.386	3.613	0.090	3.271	1.495	12.032	0.63	0.29	47.467	1.084	4.004	3.011	0.702	100.000
LA126CCC	5.652	9.854	2.001	5.562	3.882	0.000	1.481	18.467	0.35	0.29	44.238	2.001	2.961	3.001	0.610	100.000
LA137SRCCC	6.051	9.911	5.031	5.361	0.620	2.480	1.480	14.641	0.28	0.27	46.065	1.130	3.040	3.000	0.920	100.000
LA44CCCR2	6.173	8.874	1.981	6.963	0.260	0.000	1.971	20.010	0.25	0.21	44.472	1.971	2.911	2.991	1.211	100.000
LA44PNCC	6.173	8.874	1.981	6.963	0.260	0.000	1.971	20.010	0.25	0.21	44.472	1.971	2.911	2.991	1.211	100.000
LAWA102R1	6.040	9.968	5.044	5.383	0.259	2.492	1.485	14.503	2.50	0.67	46.350	1.136	3.050	3.010	0.609	100.000
LAWA102R2	6.057	10.011	5.066	5.406	0.260	2.503	1.502	14.496	0.44	0.33	46.631	1.141	3.063	3.023	0.511	100.000
LAWA104	6.614	8.591	1.924	6.735	0.551	0.000	1.924	22.001	0.10	0.10	42.989	1.924	2.861	2.886	0.899	100.000
LAWA105	7.027	8.281	1.854	6.490	0.602	0.000	1.854	24.006	0.11	0.09	41.430	1.854	2.757	2.782	0.972	100.000
LAWA112B14	6.095	9.861	7.643	0.000	1.888	0.000	1.479	19.982	0.17	0.16	44.220	1.998	2.967	3.007	0.699	100.000
LAWA112B15	6.154	9.801	7.603	0.000	2.408	0.000	1.479	19.982	0.11	0.11	43.980	1.988	2.947	2.987	0.559	100.000
LAWA125	5.637	9.545	1.939	5.387	4.208	0.000	1.439	19.990	0.38	0.31	42.888	1.939	2.879	2.909	0.930	100.000
LAWA126	5.637	9.815	1.989	5.537	3.878	0.000	1.479	18.451	0.35	0.31	44.098	1.999	2.959	2.989	0.860	100.000
LAWA127R1	5.651	10.205	2.068	5.758	3.430	0.000	1.536	16.312	0.31	0.18	45.828	2.073	3.071	3.110	0.779	100.000

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LAWA127R2	5.658	10.217	2.069	5.768	3.429	0.000	1.540	16.305	0.31	0.21	45.886	2.079	3.079	3.119	0.640	100.000
LAWA128	6.027	7.066	2.079	5.787	3.878	0.000	1.179	18.451	0.35	0.30	46.067	2.089	3.088	3.128	0.860	100.000
LAWA129	7.466	8.515	3.528	0.000	3.878	0.000	1.179	18.449	0.35	0.31	47.511	2.089	3.088	3.128	0.859	100.000
LAWA130	6.025	8.943	2.078	2.858	3.877	0.000	1.179	18.445	0.35	0.33	46.053	2.088	4.137	3.127	0.859	100.000
LAWA133	6.204	8.901	5.485	3.487	0.430	0.000	1.998	19.980	0.22	0.20	44.535	1.998	2.967	2.997	0.819	100.000
LAWA134	5.647	9.964	2.019	5.627	3.728	0.000	1.499	17.729	0.33	0.28	44.753	2.029	2.998	3.038	0.690	100.000
LAWA135	5.655	10.092	2.048	5.695	3.577	0.000	1.519	17.016	0.32	0.27	45.304	2.048	3.038	3.078	0.659	100.000
LAWA136	5.655	10.092	3.048	5.695	3.577	0.000	1.519	17.016	0.32	0.27	44.304	2.048	3.038	3.078	0.659	100.000
LAWA170	6.056	9.664	1.980	5.513	3.055	0.000	1.473	19.905	0.21	0.21	43.841	1.984	2.936	2.976	0.406	100.000
LAWA41	6.203	7.501	2.000	6.983	3.101	0.000	1.995	20.002	0.10	0.10*	43.414	1.995	2.993	2.995	0.719	99.900
LAWA42	6.204	9.034	2.404	8.411	3.101	0.001	2.402	20.004	0.10	0.10	38.007	2.403	3.605	3.607	0.715	100.000
LAWA43-1	12.002	7.391	1.967	6.881	3.101	0.001	1.965	20.004	0.10	0.10	38.007	1.966	2.949	2.951	0.715	100.000
LAWA44	6.202	8.903	1.991	6.982	0.500	0.000	1.991	20.006	0.10	0.10	44.563	1.991	2.971	2.991	0.810	100.000
LAWA44R10	6.202	8.903	1.991	6.982	0.500	0.000	1.991	20.006	0.10	0.09	44.563	1.991	2.971	2.991	0.820	100.000
LAWA45	6.201	11.901	0.000	6.980	0.501	0.000	1.477	20.000	0.10	0.10	44.552	1.994	2.477	2.992	0.825	100.000
LAWA49	6.203	8.904	0.000	9.982	0.501	0.000	1.478	20.005	0.10	0.07	44.565	1.995	2.478	2.992	0.827	100.000
LAWA50	6.201	8.902	0.000	11.981	0.501	0.000	1.477	20.000	0.10	0.10	42.550	1.994	2.477	2.992	0.825	100.000
LAWA51	6.203	11.976	0.000	6.998	0.451	0.000	1.484	18.003	0.09	0.07	46.579	1.996	2.488	2.998	0.754	100.000
LAWA52	6.179	6.191	7.882	7.505	0.501	0.000	1.477	19.999	0.10	0.10	42.247	1.108	2.994	2.992	0.827	100.000
LAWA53	6.145	6.165	7.840	7.467	0.494	0.000	1.473	19.898	1.48	0.62	42.036	1.100	2.977	2.977	0.807	100.000
LAWA56	6.151	12.050	1.970	7.474	0.495	0.000	1.475	19.918	1.48	0.52	42.079	1.101	2.980	2.980	0.808	100.000
LAWA60	8.528	11.228	4.321	0.000	0.501	0.000	1.994	19.999	0.10	0.10	44.551	1.994	2.965	2.992	0.827	100.000
LAWA65	6.155	6.167	3.289	7.476	0.499	0.000	6.034	19.924	1.48	0.48	42.087	1.104	2.983	2.980	0.821	100.000
LAWA76	6.132	10.916	7.822	7.448	0.497	4.985	1.466	10.098	1.48	0.86	41.919	1.100	2.971	2.969	0.818	100.000
LAWA81	6.201	8.902	3.989	6.980	0.501	0.000	1.994	20.000	0.10	0.10	44.552	0.000	2.965	2.992	0.825	100.000
LAWA82	6.201	8.902	0.000	6.980	0.501	0.000	1.994	20.000	0.10	0.10	44.552	3.989	2.965	2.992	0.825	100.000
LAWA83	6.201	8.902	1.994	4.986	0.501	0.000	1.994	20.000	0.10	0.10	44.552	1.994	2.965	2.992	2.820	100.000
LAWA84	6.201	8.902	1.994	2.992	0.501	0.000	1.994	20.000	0.10	0.10	44.552	1.994	2.965	2.992	4.814	100.000
LAWA87	4.481	8.874	1.992	6.971	2.583	0.000	1.992	20.005	0.21	0.19	44.467	1.992	2.958	2.988	0.508	100.000
LAWA88	6.082	9.700	1.992	5.533	2.583	0.000	1.475	20.005	0.21	0.19	44.002	1.992	2.951	2.988	0.508	100.000
LAWA88R1	6.082	9.700	1.991	5.532	2.581	0.000	1.475	20.006	0.21	0.19	44.004	1.991	2.951	2.987	0.510	100.000
LAWA89	6.082	9.700	0.000	5.533	2.583	0.000	1.475	20.005	0.21	0.19	44.002	3.983	2.951	2.988	0.508	100.000
LAWA90	6.082	9.700	3.983	5.533	2.583	0.000	1.475	20.005	0.21	0.19	44.002	0.000	2.951	2.988	0.508	100.000
LAWA93	6.179	11.095	7.882	7.505	0.501	5.067	1.477	10.027	0.10	0.10	42.247	1.108	2.994	2.992	0.827	100.000
LAWA96	6.201	7.904	3.989	2.992	0.501	0.000	1.994	20.000	0.10	0.10	43.555	1.994	2.965	2.992	4.814	100.000
LAWB30	8.604	10.039	7.235	8.276	0.323	4.070	3.075	7.902	0.20	0.18	42.730	0.000	4.115	3.120	0.330	100.000
LAWB31	6.183	12.141	4.047	7.195	0.320	2.968	2.248	7.932	1.03	0.63	47.101	0.000	3.103	3.103	3.032	100.000
LAWB32	6.180	15.146	4.045	4.180	0.320	2.966	2.247	7.928	1.03	0.68	47.077	0.000	3.101	3.101	3.030	100.000
LAWB33	6.175	12.125	4.042	5.164	0.320	2.964	2.245	7.921	1.03	0.76	47.039	0.000	3.099	3.099	5.048	100.000
LAWB34	6.178	12.131	6.065	5.167	0.320	2.965	2.246	7.925	1.03	0.71	47.063	0.000	3.100	3.100	3.029	100.000
LAWB35	6.178	12.132	4.044	5.167	0.320	2.966	4.269	7.926	1.03	0.70	47.067	0.000	3.100	3.100	3.029	100.000
LAWB37	6.166	12.108	4.709	5.157	0.319	2.960	2.915	7.910	1.03	0.90	46.973	0.000	3.094	3.094	3.696	100.000

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LAWB38	6.156	12.088	4.746	5.149	0.319	3.806	2.239	7.897	1.03	1.06	46.897	0.000	3.089	3.089	3.466	100.000
LAWB40	6.137	12.052	4.687	5.133	0.318	6.294	2.901	7.873	1.03	1.36	46.755	0.000	3.080	3.080	0.331	100.000
LAWB41	6.145	12.067	6.481	5.140	0.318	4.514	2.905	7.884	1.02	1.23	46.816	0.000	3.084	3.084	0.332	100.000
LAWB60	6.143	12.366	11.905	0.000	0.261	4.630	2.976	6.514	0.85	0.64	47.961	0.000	3.157	3.157	0.291	100.000
LAWB61	6.205	9.966	6.708	5.310	0.261	5.823	2.977	5.501	1.28	0.71	48.624	1.398	3.168	3.168	0.181	100.000
LAWB62	6.194	9.948	11.996	0.000	0.261	5.812	2.971	5.491	1.28	0.89	48.536	1.395	3.162	3.162	0.181	100.000
LAWB63	6.579	9.953	9.351	0.000	0.261	5.052	2.973	5.494	1.28	0.84	48.942	1.396	5.815	3.164	0.181	100.000
LAWB64	6.207	9.969	6.710	3.300	0.262	5.825	2.978	5.503	1.28	0.68	48.639	1.398	5.181	3.169	0.181	100.000
LAWB65	6.188	9.939	6.690	5.295	0.261	4.303	2.969	5.476	1.28	0.89	48.492	1.394	4.664	3.159	0.281	100.000
LAWB66	6.203	9.963	8.214	5.308	0.261	4.313	2.976	5.489	1.28	0.65	48.609	1.397	3.167	3.167	0.282	100.000
LAWB67	6.189	9.940	5.186	5.296	0.261	4.303	2.969	5.487	1.28	0.97	48.497	1.394	3.160	3.160	3.190	100.000
LAWB68	6.192	8.440	8.199	5.299	0.261	4.305	2.970	5.479	1.28	0.83	48.521	1.395	4.666	3.161	0.281	100.000
LAWB69	6.151	12.332	10.462	0.000	0.230	4.611	2.971	6.621	0.78	0.65	47.960	0.000	4.571	3.151	0.290	100.000
LAWB70	6.159	12.347	6.629	3.255	0.230	4.616	2.974	6.629	0.78	0.54	48.018	0.000	5.157	3.154	0.290	100.000
LAWB71	6.162	10.802	6.633	3.257	0.230	4.619	2.976	6.633	0.78	0.48	48.047	1.553	5.160	3.156	0.291	100.000
LAWB72	6.154	12.339	7.125	3.252	0.230	4.113	2.972	6.625	0.78	0.61	47.984	0.000	5.154	3.152	0.290	100.000
LAWB73	6.193	9.947	9.345	1.907	0.261	5.049	2.971	5.490	1.28	0.90	48.531	1.395	4.667	3.162	0.181	100.000
LAWB74	6.218	10.108	8.728	1.915	0.262	5.331	2.983	5.513	1.28	0.77	48.728	1.401	4.686	3.175	0.181	100.000
LAWB75	6.187	11.792	8.684	1.905	0.261	5.304	1.504	5.485	1.28	1.00	48.482	1.394	4.663	3.159	0.180	100.000
LAWB76	6.186	11.790	8.682	1.905	0.261	5.805	1.504	5.484	1.28	1.02	49.365	0.000	4.662	3.158	0.180	100.000
LAWB77	6.160	12.350	6.631	2.204	0.230	4.117	2.975	6.631	0.78	0.52	48.027	1.552	5.158	3.155	0.290	100.000
LAWB78	6.161	12.351	7.132	3.256	0.230	3.055	2.975	9.797	0.78	0.51	47.080	0.000	4.007	3.155	0.290	100.000
LAWB79	6.156	12.342	7.127	3.253	0.230	3.514	2.973	8.629	0.78	0.58	47.748	0.000	4.004	3.153	0.290	100.000
LAWB80	6.156	12.341	7.126	3.253	1.992	3.513	2.973	6.626	0.78	0.58	47.993	0.000	4.004	3.153	0.290	100.000
LAWB81	6.155	12.340	7.126	3.253	0.230	4.263	2.972	6.625	0.78	0.60	47.989	0.000	5.004	3.153	0.290	100.000
LAWB82	6.162	10.100	7.134	9.519	0.230	4.269	1.483	6.633	0.78	0.48	45.532	0.000	5.010	3.156	0.291	100.000
LAWB83	6.183	10.035	6.783	5.293	0.190	4.312	2.971	5.473	0.65	0.49	48.624	1.391	4.842	3.162	0.250	100.000
LAWB84	6.187	10.041	6.687	5.296	0.190	4.405	2.973	5.476	0.65	0.44	48.654	1.392	4.845	3.163	0.250	100.000
LAWB85	6.184	11.527	5.283	5.293	0.190	4.313	2.972	5.473	0.65	0.49	48.629	1.391	4.843	3.162	0.250	100.000
LAWB86	6.188	12.426	5.737	5.297	0.190	4.356	2.974	5.477	0.65	0.43	48.664	0.000	4.846	3.164	0.250	100.000
LAWB87	6.495	13.020	6.114	5.032	0.200	4.701	1.413	5.012	0.81	0.57	49.214	0.000	4.891	3.197	0.140	100.000
LAWB88	6.488	13.006	7.990	2.203	0.200	4.696	1.412	5.006	0.81	0.68	50.101	0.000	4.886	3.194	0.140	100.000
LAWB89	6.186	10.040	6.787	5.295	0.190	5.005	2.973	4.084	0.65	0.44	49.350	1.391	4.845	3.163	0.250	100.000
LAWB90	6.192	10.050	6.794	5.301	0.190	3.617	2.976	6.884	0.65	0.34	47.996	1.393	4.850	3.166	0.251	100.000
LAWB91	6.191	10.047	6.792	5.299	0.190	2.925	2.975	8.735	0.65	0.37	46.820	1.392	4.848	3.165	0.250	100.000
LAWB92	6.187	10.041	6.787	5.296	0.190	2.222	2.973	10.121	0.65	0.43	46.101	1.392	4.845	3.163	0.250	100.000
LAWB93	6.186	10.039	6.786	5.295	0.190	4.664	2.973	4.784	0.65	0.45	48.984	1.391	4.844	3.163	0.250	100.000
LAWB94	6.186	10.031	6.780	5.295	0.194	5.359	2.972	3.385	0.65	0.50	49.662	1.393	4.839	3.158	0.247	100.000
LAWB95	6.189	10.035	6.783	5.297	0.194	5.761	2.973	2.457	0.65	0.46	50.211	1.394	4.841	3.159	0.247	100.000
LAWB96	6.171	10.027	6.772	5.289	0.120	4.297	2.975	5.479	0.65	0.48	48.743	1.392	4.858	3.175	0.220	100.000
LAWC12	11.989	9.142	1.596	5.716	0.141	0.000	1.387	20.026	0.20	0.18	39.384	3.416	4.274	2.458	0.292	100.000
LAWC15	6.221	8.929	2.006	7.007	0.142	0.000	2.009	19.963	0.13	0.23	44.713	2.001	2.990	3.005	0.786	100.000

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Final Report, VSL-11R2270-1, Rev. 0

Glass ID \ Weight %	Al ₂ O ₃	B ₂ O ₃	CaO	Fe ₂ O ₃	K ₂ O	Li ₂ O	MgO	Na ₂ O	SO ₃ target	SO ₃ XRF Measured or Interpolated	SiO ₂	TiO ₂	ZnO	ZrO ₂	Others	SUM
LAWC21	6.139	10.104	6.419	6.489	0.150	2.744	1.512	11.897	0.42	0.29	46.766	1.122	3.024	3.024	0.320	100.000
LAWC21rev2	6.125	10.058	6.415	6.435	0.140	2.732	1.501	11.970	0.48	0.29	46.778	1.121	3.022	3.022	0.390	100.000
LAWC22	6.076	10.056	5.110	5.426	0.083	2.506	1.514	14.408	0.32	0.29	46.642	1.144	3.071	3.028	0.646	100.000
LAWC23	6.118	10.076	6.401	6.470	2.881	0.000	1.507	11.856	0.44	0.35	46.763	1.122	3.014	3.017	0.426	100.000
LAWC24	5.955	9.808	6.231	6.297	5.558	0.000	1.467	11.541	0.42	0.34	45.429	1.090	2.934	2.937	0.414	100.000
LAWC25	5.784	9.526	6.052	6.116	8.079	0.000	1.425	11.209	0.41	0.53	44.122	1.058	2.850	2.852	0.398	100.000
LAWC26	6.121	13.263	6.411	0.010	0.140	2.731	1.500	11.962	0.48	0.35	49.960	1.120	3.021	3.021	0.390	100.000
LAWC27	6.117	12.183	8.544	0.009	0.136	2.733	1.500	11.953	0.48	0.41	48.868	1.121	3.018	3.018	0.391	100.000
LAWC28	6.117	10.045	12.814	0.010	0.140	2.729	1.499	11.954	0.48	0.43	46.717	1.119	3.018	3.018	0.390	100.000
LAWC29	6.551	10.049	9.617	0.009	0.136	2.734	1.501	11.958	0.48	0.37	47.181	1.121	5.365	3.019	0.390	100.000
LAWC30	6.122	10.053	6.412	4.101	0.140	2.731	1.500	11.964	0.48	0.34	46.754	1.120	5.352	3.021	0.390	100.000
LAWC31	6.119	10.048	7.409	4.429	0.140	2.729	1.500	11.958	0.48	0.39	46.731	1.120	4.019	3.019	0.390	100.000
LAWC32	6.490	10.047	9.038	2.424	0.136	2.734	1.501	11.956	0.48	0.38	46.744	1.121	4.019	3.019	0.391	100.000
LAWC33	6.146	10.100	6.947	4.444	0.140	2.753	1.512	12.012	0.48	0.37	46.977	1.131	4.044	3.033	0.390	100.000
LAWCrP1R	6.101	10.002	2.761	5.501	0.125	0.000	1.480	19.347	0.39	0.37	44.401	1.400	3.501	3.001	2.010	100.000
LAWCrP2R	6.099	9.998	2.105	5.499	0.275	0.000	1.480	20.996	0.34	0.36	43.065	1.400	3.499	2.999	2.225	100.000
LAWCrP3R	6.101	10.001	2.761	5.500	0.125	0.000	1.480	19.345	0.39	0.38	43.458	1.400	3.500	3.000	2.948	100.000
LAWCrP4R	6.098	9.997	2.104	5.498	0.275	0.000	1.480	20.994	0.34	0.37	42.014	1.400	3.499	2.999	3.272	100.000
LAWCrP5	6.108	10.013	5.813	5.507	0.087	2.642	1.488	14.395	0.51	0.38	43.505	1.402	3.504	3.004	2.151	100.000
LAWCrP6	6.104	10.007	6.945	5.504	0.087	4.173	2.552	8.006	0.65	0.58	44.770	1.401	3.502	3.002	3.367	100.000
LAWCrP7	6.104	10.007	6.985	5.504	0.087	4.303	2.932	5.404	0.73	0.66	46.741	1.401	3.502	3.002	3.367	100.000
LAWE10H	6.086	9.976	6.978	5.498	0.541	4.271	2.948	5.735	0.80	0.54	49.054	1.394	3.489	2.998	0.491	100.000
LAWE10HCr3CCC	6.081	9.968	6.973	5.494	0.541	4.268	2.945	5.730	0.80	0.62	48.742	1.393	3.486	2.995	0.763	100.000
LAWE11	6.106	10.010	2.322	5.506	4.755	0.000	1.481	17.377	0.35	0.25	43.784	1.401	3.504	3.003	0.501	100.000
LAWE12	6.952	8.753	1.971	4.361	5.412	0.000	1.440	19.746	0.35	0.32	41.853	1.370	3.411	3.921	0.490	100.000
LAWE13	6.952	9.753	1.971	5.362	5.412	0.000	0.440	19.746	0.35	0.32	41.853	0.370	3.411	3.921	0.490	100.000
LAWE14	4.942	9.754	1.471	5.366	5.412	0.000	0.440	19.748	0.35	0.31	43.363	1.371	3.411	3.922	0.490	100.000
LAWE15	5.942	8.754	1.471	5.366	5.412	0.000	0.940	19.748	0.35	0.31	42.863	1.371	3.411	3.922	0.490	100.000
LAWE16	5.934	8.241	1.468	5.358	5.404	0.000	0.939	19.719	0.35	0.46	42.798	1.369	3.406	4.415	0.489	100.000
LAWE2H	5.951	9.751	1.970	5.365	3.790	0.000	1.440	20.782	0.32	0.31	42.440	1.370	3.410	2.930	0.490	100.000
LAWE3	6.102	10.003	2.021	5.502	4.992	0.000	1.480	18.215	0.35	0.32	42.963	1.400	3.501	3.001	0.500	100.000
LAWE3Cr2CCC	6.103	10.005	2.021	5.503	4.992	0.000	1.481	18.219	0.35	0.30	41.651	1.401	3.502	3.002	1.821	100.000
LAWE3H	5.942	9.743	1.971	5.366	5.412	0.000	1.440	19.746	0.37	0.34	41.859	1.360	3.411	2.921	0.490	100.000
LAWE4H	5.974	9.796	2.461	5.383	0.540	0.000	1.451	21.283	0.41	0.35	44.527	1.371	3.432	2.942	0.490	100.000
LAWE5H	5.997	9.821	3.614	5.410	0.541	0.491	1.452	18.991	0.46	0.35	45.096	1.372	3.434	2.943	0.491	100.000
LAWE7H	6.027	9.882	6.318	5.441	0.541	3.174	1.492	13.546	0.59	0.47	44.810	1.382	3.464	2.964	0.491	100.000
LAWE9H	6.066	9.946	6.878	5.468	0.541	4.091	2.366	8.953	0.69	0.43	46.919	1.394	3.479	2.978	0.491	100.000
LAWE9HCr1CCC	6.059	9.934	6.870	5.462	0.541	4.086	2.363	8.943	0.69	0.55	46.339	1.392	3.475	2.974	1.013	100.000
LAWE9HCr2CCC	6.060	9.937	6.872	5.463	0.541	4.087	2.364	8.945	0.69	0.52	46.503	1.392	3.476	2.975	0.863	100.000
LAWM1	9.044	6.029	10.048	8.039	4.019	4.522	0.000	5.024	1.00	0.52	44.666	3.015	5.024	0.000	0.050	100.000
LAWM10	9.005	13.007	10.006	0.000	0.000	4.503	0.000	13.074	0.29	0.23	40.170	3.002	1.001	4.002	2.001	100.000

* boldface denote interpolated SO₃ - all other measured

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LAWM11	3.504	13.013	9.413	5.317	4.004	4.505	0.000	11.491	1.00	0.90	46.804	0.000	1.001	0.000	0.050	100.000
LAWM12	3.501	13.005	0.000	2.310	4.002	4.502	1.971	14.259	0.27	0.23	42.215	3.001	5.002	4.002	2.001	100.000
LAWM13	3.501	6.001	10.002	8.002	3.785	0.000	0.000	22.005	0.52	0.50	40.009	3.001	2.164	0.000	1.030	100.000
LAWM14	3.500	6.000	2.045	0.000	0.000	0.881	5.000	21.999	0.52	0.53	51.997	3.000	5.000	0.000	0.050	100.000
LAWM15	8.999	9.356	0.000	6.283	0.000	0.000	3.724	21.998	0.16	0.17	43.471	3.000	1.000	0.000	2.000	100.000
LAWM16	8.006	12.008	8.006	6.505	0.100	3.002	1.001	10.007	0.40	0.33	42.480	2.502	5.004	1.001	0.050	100.000
LAWM17	5.002	12.004	2.215	6.502	2.001	0.500	3.501	17.006	0.24	0.20	42.015	0.500	5.002	3.501	0.050	100.000
LAWM18	8.005	12.007	8.005	6.504	0.100	3.002	1.001	10.006	0.40	0.34	42.025	2.502	2.001	2.501	2.001	100.000
LAWM19	7.997	11.996	7.997	1.999	1.999	0.500	1.000	13.170	0.33	0.36	41.986	0.500	4.998	3.499	1.999	100.000
LAWM2	3.512	6.020	10.033	8.027	0.000	4.515	5.017	5.017	1.00	0.67	47.157	3.010	5.017	0.000	2.007	100.000
LAWM20	5.001	7.002	8.002	2.001	2.001	2.265	3.501	17.004	0.24	0.21	42.011	0.500	5.001	3.501	2.001	100.000
LAWM21	5.005	10.901	8.008	6.507	2.002	3.003	1.001	10.010	0.56	0.46	42.042	2.503	5.005	3.504	0.050	100.000
LAWM22	7.990	6.992	1.998	6.492	1.998	0.499	3.496	16.979	0.33	0.45	41.949	0.670	4.994	3.496	1.998	100.000
LAWM23	5.011	7.015	8.018	2.004	2.004	3.007	1.002	10.022	0.56	0.34	48.547	2.506	5.011	3.508	2.004	100.000
LAWM24	8.000	12.001	2.000	6.500	2.000	0.641	1.000	17.001	0.24	0.23	47.076	0.500	2.000	1.000	0.050	100.000
LAWM25R1	8.011	12.017	2.003	3.684	2.003	3.004	3.505	10.014	0.40	0.26	49.991	0.501	2.003	1.001	2.003	100.000
LAWM26	8.006	12.008	4.970	2.001	0.100	3.002	1.001	10.007	0.56	0.49	49.909	0.500	5.004	1.001	2.001	100.000
LAWM27	8.006	7.005	8.006	6.505	2.001	0.500	3.502	13.381	0.32	0.25	42.030	2.502	3.309	1.001	2.001	100.000
LAWM28	5.010	12.024	8.016	6.513	0.703	0.690	1.002	10.020	0.56	0.36	50.101	2.505	2.004	1.002	0.050	100.000
LAWM29	7.565	7.006	2.002	6.506	2.002	3.003	3.503	10.009	0.40	0.31	46.892	2.502	5.005	3.503	0.192	100.000
LAWM3	9.033	6.022	10.036	8.029	0.000	4.487	5.018	11.521	1.00	0.64	40.145	0.000	1.004	4.015	0.050	100.000
LAWM30	8.003	12.004	2.001	6.502	0.100	2.023	1.000	17.006	0.24	0.20	42.015	0.592	5.002	3.501	0.050	100.000
LAWM31	5.002	7.003	8.003	6.502	0.100	3.001	1.000	16.758	0.34	0.30	42.327	2.501	2.001	3.501	2.001	100.000
LAWM32	5.146	7.002	2.001	2.001	2.001	3.001	3.501	16.514	0.35	0.32	50.013	0.500	5.001	1.000	2.001	100.000
LAWM33R1	5.002	12.005	8.003	6.503	1.722	0.899	1.000	17.007	0.33	0.29	42.017	2.501	2.001	1.000	0.050	100.000
LAWM34	5.001	8.356	8.002	6.295	2.001	3.001	1.000	17.005	0.33	0.30	42.012	1.474	2.001	3.501	0.050	100.000
LAWM35	5.003	12.007	6.182	4.413	0.100	0.500	3.502	17.010	0.24	0.18	42.023	2.501	2.001	2.576	2.001	100.000
LAWM36	7.002	11.004	7.002	5.002	0.300	2.501	1.501	12.004	0.40	0.37	45.016	2.001	3.501	2.001	0.795	100.000
LAWM37	6.751	11.009	7.006	5.004	0.300	2.502	2.502	12.010	0.40	0.32	45.038	1.001	3.503	3.003	0.050	100.000
LAWM38	6.998	7.998	6.998	2.999	0.154	2.499	1.500	13.997	0.35	0.37	47.988	1.000	3.499	2.000	2.000	100.000
LAWM39	7.007	9.063	5.005	3.003	0.100	2.502	2.502	14.013	0.35	0.25	48.046	1.001	3.503	2.002	2.002	100.000
LAWM4	3.516	13.058	10.044	5.560	4.018	4.520	0.000	5.022	1.00	0.56	41.599	3.013	5.022	4.018	0.050	100.000
LAWM40	6.003	11.006	5.003	5.003	0.100	1.001	1.501	14.008	0.37	0.31	48.027	1.001	3.502	3.002	0.535	100.000
LAWM41	7.002	8.002	7.002	5.001	0.300	1.000	2.501	14.004	0.37	0.34	45.012	1.000	4.601	2.235	2.001	100.000
LAWM42	6.004	8.005	5.003	4.037	0.100	2.502	1.501	14.009	0.37	0.30	48.032	2.001	3.502	3.002	2.001	100.000
LAWM43	7.002	8.678	5.002	5.002	0.300	2.501	2.501	12.004	0.42	0.39	45.016	2.001	4.602	3.001	2.001	100.000
LAWM44	6.325	10.039	7.008	5.006	0.100	1.001	1.502	12.014	0.40	0.29	48.055	2.002	4.605	2.002	0.050	100.000
LAWM45	7.003	8.003	5.784	5.002	0.300	1.423	1.501	14.005	0.35	0.31	48.017	2.001	4.602	2.001	0.050	100.000
LAWM46	6.012	11.023	6.523	5.010	0.100	1.002	2.505	12.025	0.40	0.20	48.034	1.002	3.507	3.006	0.050	100.000
LAWM47	6.200	8.003	7.003	5.002	0.100	1.000	2.501	14.005	0.35	0.31	48.017	1.307	3.501	3.001	0.050	100.000
LAWM48	6.234	11.016	5.277	5.007	0.100	1.001	1.502	12.017	0.40	0.26	48.070	2.003	3.505	2.003	2.003	100.000
LAWM49	7.001	10.906	5.001	3.000	0.100	1.000	1.500	14.002	0.37	0.35	47.538	1.000	4.601	2.000	2.000	100.000

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LAWM5	9.041	6.027	5.794	8.036	4.018	4.520	0.000	5.023	1.00	0.55	48.903	3.014	1.005	4.018	0.050	100.000
LAWM50	6.530	9.700	6.109	4.111	0.204	1.668	2.032	13.095	0.38	0.29	46.982	1.528	4.104	2.533	1.115	100.000
LAWM51	6.528	9.697	6.107	4.110	0.204	1.667	2.031	13.091	0.38	0.32	46.968	1.528	4.102	2.533	1.115	100.000
LAWM52	6.088	9.711	1.994	5.538	2.586	0.000	1.477	20.027	0.21	0.18	44.051	1.994	2.954	2.991	0.409	100.000
LAWM53	9.031	6.021	10.034	8.027	4.014	4.515	0.000	5.017	1.00	0.66	44.603	3.010	5.017	0.000	0.050	100.000
LAWM54R1	3.505	6.008	10.014	8.011	4.006	2.391	0.000	5.007	0.40	0.26	49.782	0.000	5.007	4.006	2.003	100.000
LAWM55	3.501	13.004	0.000	2.310	4.001	4.501	1.971	14.257	0.27	0.24	42.211	3.001	5.001	4.001	2.001	100.000
LAWM56	4.990	11.975	6.166	4.402	0.100	0.499	3.493	16.965	0.24	0.44	41.914	2.495	1.996	2.570	1.996	100.000
LAWM57	6.997	11.000	3.000	4.659	3.801	0.000	1.440	20.620	0.35	0.32	39.274	1.370	3.026	4.001	0.490	100.000
LAWM58	7.002	9.294	1.028	6.500	3.800	0.000	1.440	20.536	0.35	0.32	41.654	1.370	2.563	4.001	0.490	100.000
LAWM59	6.847	9.009	2.965	6.492	2.004	0.000	1.441	20.008	0.35	0.31	44.558	1.371	2.506	2.001	0.490	100.000
LAWM6	9.002	10.612	10.002	8.002	4.001	0.000	5.001	8.999	0.34	0.32	40.009	3.001	1.000	0.000	0.050	100.000
LAWM60	5.003	11.006	1.714	4.503	2.004	0.000	1.441	20.015	0.35	0.30	45.351	1.371	2.804	3.998	0.491	100.000
LAWM61	5.002	11.001	1.001	4.502	3.293	0.000	1.440	20.004	0.35	0.33	45.060	1.370	4.501	2.005	0.490	100.000
LAWM62	5.004	9.004	1.002	6.500	3.380	0.000	1.440	20.006	0.35	0.32	44.341	1.370	3.842	3.300	0.490	100.000
LAWM63	7.001	9.402	1.044	4.695	2.059	0.000	1.440	22.998	0.35	0.34	42.601	1.370	4.500	2.058	0.490	100.000
LAWM64	6.991	10.989	3.002	6.503	2.001	0.000	1.441	20.051	0.35	0.30	38.379	1.371	4.490	3.993	0.491	100.000
LAWM65	5.001	9.001	2.964	4.503	2.001	0.000	1.440	22.791	0.35	0.34	43.599	1.370	2.501	3.997	0.490	100.000
LAWM66	7.587	10.637	1.003	6.315	0.479	0.000	1.440	22.996	0.35	0.32	38.362	1.370	4.500	4.498	0.490	100.000
LAWM67	8.002	10.601	1.545	4.603	5.402	0.000	1.440	20.134	0.35	0.32	38.370	1.370	2.720	5.001	0.490	100.000
LAWM68	5.003	9.002	2.999	6.500	4.803	0.000	1.440	20.009	0.35	0.33	40.815	1.370	3.562	3.677	0.490	100.000
LAWM69	7.976	10.990	2.997	6.370	1.829	0.000	1.440	20.095	0.35	0.34	39.601	1.370	4.499	2.002	0.490	100.000
LAWM7	5.441	6.966	10.028	8.023	0.000	2.585	5.014	5.014	1.00	0.72	52.147	3.008	1.003	0.000	0.050	100.000
LAWM70	5.002	9.397	1.047	6.498	4.550	0.000	1.440	20.011	0.35	0.33	45.357	1.370	2.501	2.006	0.490	100.000
LAWM71	5.006	9.001	1.003	4.501	5.401	0.000	1.440	20.004	0.35	0.34	44.943	1.370	4.498	2.002	0.490	100.000
LAWM72	8.002	11.002	2.937	6.449	4.177	0.000	1.440	20.042	0.35	0.32	39.173	1.370	2.501	2.095	0.490	100.000
LAWM73	8.002	9.006	2.996	4.878	1.221	0.000	1.440	23.002	0.35	0.32	40.391	1.370	4.494	2.388	0.490	100.000
LAWM74	7.589	9.009	1.001	4.504	0.000	0.000	1.441	21.329	0.35	0.29	45.377	1.371	2.598	5.002	0.491	100.000
LAWM75	8.003	9.157	2.996	6.497	1.082	0.000	1.441	20.691	0.35	0.31	38.461	1.371	4.500	5.001	0.490	100.000
LAWM76	6.403	9.926	1.923	5.424	2.599	0.000	1.441	21.409	0.35	0.31	41.881	1.371	3.423	3.401	0.490	100.000
LAWM8	9.027	13.039	6.448	0.000	0.000	2.087	5.015	5.015	1.00	0.70	44.626	3.009	5.015	4.012	2.006	100.000
LAWM9	3.506	6.010	10.016	8.013	4.006	2.392	0.000	5.008	0.40	0.24	49.792	0.000	5.008	4.006	2.003	100.000
LB83CCC-1	6.214	10.047	6.795	5.294	0.180	4.313	2.992	5.374	0.55	0.49	48.714	1.401	4.853	3.172	0.160	100.000
LB83PNCC	6.214	10.047	6.795	5.294	0.180	4.313	2.992	5.374	0.55	0.49	48.714	1.401	4.853	3.172	0.160	100.000
LB88CCC	6.505	12.980	7.976	2.202	0.200	4.694	1.411	5.004	0.81	0.73	50.080	0.000	4.884	3.193	0.140	100.000
PLTC35CCC	6.091	9.463	7.386	3.613	0.090	3.271	1.495	12.032	0.63	0.29	47.467	1.084	4.004	3.011	0.702	100.000
PNLA126CC	5.652	9.854	2.001	5.562	3.882	0.000	1.481	18.467	0.35	0.29	44.238	2.001	2.961	3.001	0.610	100.000
TFA-BASE	6.999	9.999	0.010	5.499	0.410	0.000	1.500	19.998	0.07	0.08	49.065	3.000	1.500	1.500	0.440	100.000
WVB-G-124B	6.039	9.969	5.049	5.399	0.260	2.490	1.490	14.419	0.44	0.44	46.455	1.140	3.060	3.020	0.770	100.000
WVF-G-21B	6.079	9.799	1.990	5.539	2.130	0.000	1.480	20.008	0.35	0.33	43.996	1.990	2.950	2.990	0.720	100.000
WVH-G-57B	6.102	10.023	7.392	4.421	0.140	2.731	1.500	11.934	0.47	0.43	46.644	1.120	4.011	3.011	0.540	100.000
WVJ-G-109D	6.174	10.022	6.775	5.282	0.190	4.310	2.977	5.472	0.65	0.43	48.577	1.393	4.841	3.157	0.401	100.000

* boldface denote interpolated SO₃ - all other measured

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Glass ID \ Weight %	Al ₂ O ₃	B ₂ O ₃	CaO	Fe ₂ O ₃	K ₂ O	Li ₂ O	MgO	Na ₂ O	SO ₃ target	SO ₃ XRF Measured or Interpolated	SiO ₂	TiO ₂	ZnO	ZrO ₂	Others	SUM
WVM-G-142C	5.618	9.825	1.993	5.538	3.816	0.000	1.472	18.468	0.40	0.25	44.006	1.983	2.944	2.964	1.122	100.000
WVR-G-127A	6.049	9.908	5.019	5.359	0.330	2.480	1.480	14.627	0.38	0.38	46.031	1.130	3.039	2.999	1.170	100.000

* boldface denote interpolated SO₃ - all other measured

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APPENDIX A2

Long-Term PCT-B Data

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
I2S-G-85C	2/23/2005	2000	90	Steel	3/2/2005	7	3.6	21.13	0.32	0	2.21	7.39	0	71.15	68.34	0	0	0	0.677	0.665	0.315	10.66
I2U-G-86A	2/23/2005	2000	90	Steel	3/2/2005	7	7.37	22.43	0.14	0	2.57	0	0.31	113.84	75.1	0	0	0	0.807	0.769	0.362	10.87
A1-AN105R2	10/16/2002	2000	90	Steel	10/23/2002	7	8.04	29.15	0.2	2.16	2.07	0	0.72	153.6	81.5	0	1.37	0	1.062	1.002	0.398	10.88
A1-AN105R2	10/16/2002	2000	90	Steel	11/13/2002	28	9.47	42.5	0.29	2.74	2.33	0	0.94	196.4	95.16	0	2.25	0.83	1.548	1.281	0.465	10.96
A1-AN105R2	10/16/2002	2000	90	Steel	12/11/2002	56	11.53	58.55	0.44	3.03	3.95	0	1.14	244.96	117.83	0.64	2.79	1.29	2.133	1.598	0.575	11.05
A1-AN105R2	10/16/2002	2000	90	Steel	2/13/2003	120	10.97	73.88	0.61	1.48	3.77	0	0.95	338.28	133.09	0.54	1.97	0.99	2.691	2.207	0.65	11.14
A1-AN105R2	10/16/2002	2000	90	Steel	4/14/2003	180	11.33	83.93	0.37	3.09	4.18	0	1.27	360.12	135.57	0.78	2.34	1.31	3.057	2.349	0.662	11.24
A1-AN105R2	10/16/2002	2000	90	Steel	7/14/2003	271	10.61	97.99	0.38	1.35	5.24	0	0.47	397.48	145.28	0.83	1.1	0.83	3.57	2.593	0.709	11.34
A1-AN105R2	10/16/2002	2000	90	Steel	10/16/2003	365	12.48	104.52	0.4	1.27	5.4	0	0.44	451.79	154.06	0.46	1.28	0.47	3.808	2.947	0.752	11.45
A1-AN105R2	10/16/2002	2000	90	Steel	4/16/2004	548	12.53	119.78	0.31	0	5.88	0	0.51	515.55	206.78	0	0.77	0.44	4.363	3.363	1.009	11.55
A1-AN105R2	10/16/2002	2000	90	Steel	10/15/2004	730	11.66	133.36	0.23	1.68	7.04	0	0.99	560.32	193.11	0	1.41	0.6	4.858	3.655	0.943	11.64
A1-AN105R2	10/16/2002	2000	90	Steel	10/17/2005	1097	5.24	209.85	0.26	0	9.51	0	0	840.25	274.55	0	0	0	7.645	5.481	1.34	11.76
A1-AN105R2	10/16/2002	2000	90	Steel	10/20/2006	1465	1.35	828.36	0.27	0	36.83	0	0	2598.63	625.82	0	0	0	30.176	16.952	3.055	11.82
A1-AN105R2	10/16/2002	2000	90	Steel	10/18/2007	1828	0.82	1936.93	2.9	0	105.17	4.49	0.39	5372.23	1075.7	0	0	0	70.56	35.046	5.252	11.86
A100CC	6/14/2000	2000	90	Steel	6/21/2000	7	4.69	22.14	0.82	0	0	6.95	0	70.02	67.77	0	0	0	0.713	0.652	0.311	10.41
A100CC	6/14/2000	2000	90	Steel	7/12/2000	28	7.46	26.2	0.59	0	0	9.83	0	104.4	81.57	0	0.7	0	0.843	0.972	0.374	10.55
A100CC	6/14/2000	2000	90	Steel	8/9/2000	56	7.86	29.37	0.52	0	0	9.66	0	104.71	82.5	0	0	0	0.945	0.975	0.379	10.67
A100CC	6/14/2000	2000	90	Steel	10/12/2000	120	8.74	32.3	0.15	0	0	10.77	0.45	113.33	94.21	0	0.63	0	1.04	1.056	0.432	10.85
A100CC	6/14/2000	2000	90	Steel	12/11/2000	180	8.74	33.37	0.56	0	0	11.26	0	145.3	95.14	0	0.79	0	1.074	1.353	0.437	10.93
A100CC	6/14/2000	2000	90	Steel	3/12/2001	271	8.53	38.43	0.68	0	0	12.82	0	148.13	112.7	0	0.58	0	1.237	1.38	0.517	10.97
A100CC	6/14/2000	2000	90	Steel	6/14/2001	365	12.95	56.94	0.45	0	2.98	18.83	0	217.53	158.17	0	0.54	0	1.833	2.026	0.726	10.98
A100CC	6/14/2000	2000	90	Steel	12/13/2001	547	11.25	54.52	0.53	0	2.81	18.07	0	237.47	153.8	0	0.77	0	1.755	2.212	0.706	11.05
A100CC	6/14/2000	2000	90	Steel	6/13/2002	729	11.77	63.73	0.56	0	3.19	20.94	0	264.66	173.54	0	0.75	0	2.051	2.465	0.797	11.18
A100CC	6/14/2000	2000	90	Steel	6/4/2003	1085	7.85	61.58	0.74	0	2.76	19.59	0	271.81	158.36	0	0	0	1.982	2.532	0.727	11.24
A100CC	6/14/2000	2000	90	Steel	6/16/2004	1463	3.8	76.4	0.71	0	3.42	23.85	0	278.42	190.52	0	0	0	2.459	2.593	0.874	11.36
A100CC	6/14/2000	2000	90	Steel	6/21/2006	2198	1.15	854.18	3.5	0	29.75	134.17	0	2116.1	416.52	0	0	0	27.49	19.711	1.912	11.54
A100CC	6/14/2000	2000	90	Steel	9/11/2007	2645	6.81	1951.5	5.96	0	85.55	292.45	0	3912.3	547.34	0	0	0	62.806	36.443	2.512	11.56
A100G115A	5/16/2000	2000	90	Steel	5/23/2000	7	3.77	30.03	0.33	0	0	9.76	0	96.27	74.41	0	0.47	0	0.967	0.897	0.342	10.16
A100G115A	5/16/2000	2000	90	Steel	6/13/2000	28	3.96	48.56	0.52	0	1.96	14.89	0.25	149.2	105.3	0	0.59	0	1.563	1.39	0.483	10.24
A100G115A	5/16/2000	2000	90	Steel	7/11/2000	56	3.1	52.91	0.25	0	0	15.28	0	165.8	109.93	0	0	0	1.703	1.545	0.505	10.34
A100G115A	5/16/2000	2000	90	Steel	9/13/2000	120	3.58	58.48	0.67	0	2.07	17.81	0	188.73	121.4	0	0	0	1.882	1.758	0.557	10.53
A100G115A	5/16/2000	2000	90	Steel	11/13/2000	181	3.69	61.56	0.55	0	2.66	19.1	0	200.23	129.3	0	0	0	1.982	1.866	0.594	10.85
A100G115A	5/16/2000	2000	90	Steel	2/12/2001	272	3.68	72.53	0.87	0	2.94	22.44	0	232.17	145.97	0	0	0	2.335	2.163	0.67	10.92
A100G115A	5/16/2000	2000	90	Steel	5/16/2001	365	5.36	104.56	0.58	0	4.11	31.7	0	325.28	201.57	0	0	0	3.366	3.031	0.925	10.97
A100G115A	5/16/2000	2000	90	Steel	11/14/2001	547	4.11	130.88	0.5	0	4.92	38.25	0	390.42	201.8	0	0	0	4.213	3.637	0.926	11.05
A100G115A	5/16/2000	2000	90	Steel	5/16/2002	730	3	399.96	1.96	0	11.9	102.19	0	988.78	342.93	0	0	0	12.875	9.212	1.574	11.22
A100G115A	5/16/2000	2000	90	Steel	5/14/2003	1093	2.3	3304.4	5.78	0	132.2	510.51	0	6427	837.17	0	0	0	106.368	59.879	3.843	11.34
A100G115A	5/16/2000	2000	90	Steel	5/14/2004	1459	1.72	2788.57	4.44	0	119.14	357.96	0.23	5229.1	626.01	0	0	0	89.764	48.719	2.874	11.45
A100G115A	5/16/2000	2000	90	Steel	5/18/2005	1828	1.31	2721.67	4.25	0	118.24	379.3	0	6397.9	607.81	0	0	0	87.61	59.608	2.79	11.52
A100G115A	5/16/2000	2000	90	Steel	5/19/2006	2194	0	2763.3	4.32	0	121.9	373.13	0	5509.37	555.55	0	0	0	88.951	51.33	2.55	11.54
A1C1-1	8/20/2002	2000	90	Steel	8/27/2002	7	8.85	24.89	0.28	1.42	0	1.94	0.52	119.57	80.57	0	1.04	0	0.878	0.841	0.388	10.82
A1C1-1	8/20/2002	2000	90	Steel	9/17/2002	28	8.89	31.93	0.59	1.47	0	1.67	0.55	155.63	103.2	0	1.32	0	1.127	1.094	0.496	10.96
A1C1-1	8/20/2002	2000	90	Steel	10/15/2002	56	8.3	39.16	0.3	1.96	0	1.72	1.05	173.53	98.77	0	1.43	0.57	1.382	1.22	0.475	11.05
A1C1-1	8/20/2002	2000	90	Steel	5/14/2003	267	9.1	63.05	0.31	0	2.83	1.98	0	347.23	123.37	0	0.94	0.49	2.225	2.442	0.593	11.36
A1C1-1	8/20/2002	2000	90	Steel	8/20/2003	365	8.67	71.62	0.15	0	3.28	2.12	0	302.47	131.7	0	0.63	0.54	2.528	2.127	0.633	11.45
A1C1-1	8/20/2002	2000	90	Steel	2/20/2004	549	9.86	79.71	0.24	2.11	3.24	2.52	0.77	342.15	137.61	0.43	1.88	0.63	2.813	2.406	0.662	11.53
A1C1-1	8/20/2002	2000	90	Steel	8/22/2005	1098	6.16	599.04	0.4	0	17.05	8.31	0	1664.33	324.8	0	1.1	0	21.14	11.704	1.562	11.64
A1C1-1	8/20/2002	2000	90	Steel	8/7/2006	1448	2.68	941.52	0.7	0	29.78	13.64	0	2793.43	542.66	0	0	0	33.227	19.644	2.61	11.74
A1C1-1	8/20/2002	2000	90	Steel	10/4/2007	1871	3.45	1924.07	1.68	0	82.04	24.76	0.34	5610.93	887.27	0	0	0	67.901	39.457	4.268	11.76
A1C1-2	8/20/2002	2000	90	Steel	8/27/2002	7	7.27	24.22	0.31	0	0	4.17	0.34	113.77	78.19	0	0.91	0	0.828	0.868	0.371	10.71
A1C1-2	8/20/2002	2000	90	Steel	9/17/2002	28	6.8	29.42	0.43	0	0	3.89	0.39	124.33	96.03	0	1.03	0	1.006	0.948	0.455	10.87
A1C1-2	8/20/2002	2000	90	Steel	10/15/2002	56	6.48	30.27	0.18	1.62	0	3.81	0.72	132.47	89.66	0	1.18	0	1.035	1.01	0.425	10.94
A1C1-2	8/20/2002	2000	90	Steel	5/14/2003	267	6.88	47.55	0.21	0	2.52	4.8	0	252.7	115.88	0	0.64	0	1.627	1.927	0.549	11.25
A1C1-2	8/20/2002	2000	90	Steel	8/20/2003	365	5.88	56.59	0	0	2.73	5.39	0	233.26	124.3	0	0.49	0	1.936	1.779	0.589	11.34
A1C1-2	8/20/2002	2000	90	Steel	2/20/2004	549	7.4	66.72	0.19	1.52	2.51	6.37	0.46	287.41	133.16	0	1.3	0	2.282	2.192	0.631	11.44
A1C1-2	8/20/2002	2																				

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
A2-AP101	10/8/2002	2000	90	Steel	4/9/2003	183	9	119.78	0.28	1.37	43.44	0	0.71	394.06	119.48	0	1.92	0.92	3.927	2.876	0.581	11.43
A2-AP101	10/8/2002	2000	90	Steel	7/7/2003	272	10.67	146.85	0.32	1.26	52.6	0	0.38	451.4	140.96	0.49	0.83	0.87	4.814	3.295	0.685	11.53
A2-AP101	10/8/2002	2000	90	Steel	10/8/2003	365	10.25	147.12	0.19	0	54.81	0	0.27	457.42	135.41	0	0.49	0.74	4.823	3.339	0.658	11.65
A2-AP101	10/8/2002	2000	90	Steel	4/7/2004	547	10.78	158.44	0.2	1.36	60.9	0	0.76	564.56	147.04	0	1.61	0	5.194	4.121	0.715	11.75
A2-AP101	10/8/2002	2000	90	Steel	10/8/2004	731	9.58	168.37	0.13	0	61.04	0	0.22	549.96	136	0	0	0	5.52	4.014	0.661	11.85
A2-AP101	10/8/2002	2000	90	Steel	10/6/2005	1094	10.53	172.45	0.18	0	63.55	0	0	581.08	153.43	0	0.53	0	5.653	4.241	0.746	11.92
A2-AP101	10/8/2002	2000	90	Steel	10/19/2006	1472	7.39	194.3	0.57	0	68.11	1.3	0	620.05	165.8	0	0	0	6.37	4.526	0.806	11.96
A2-AP101	10/8/2002	2000	90	Steel	10/16/2007	1834	5.21	225.59	1.38	0	82.82	1.86	0	734.8	209.99	0	0	0	7.396	5.363	1.021	12.05
A2B1-1	10/8/2002	2000	90	Steel	10/15/2002	7	4.28	21.89	0.4	0	8.16	2.82	0.35	73.11	68.79	0	0.84	0	0.713	0.647	0.326	10.75
A2B1-1	10/8/2002	2000	90	Steel	11/5/2002	28	5.01	30.22	0.15	0	11.53	3.65	0.4	103.2	76.08	0	0.88	0	0.985	0.913	0.36	10.92
A2B1-1	10/8/2002	2000	90	Steel	12/3/2002	56	4.99	39.18	0	0	14.02	4.17	0.31	124.75	83.23	0	1.14	0	1.277	1.104	0.394	10.97
A2B1-1	10/8/2002	2000	90	Steel	2/5/2003	120	5.5	47.53	0.38	0	16.37	4.9	0	151.67	90.33	0	0.74	0.58	1.549	1.342	0.428	11.05
A2B1-1	10/8/2002	2000	90	Steel	4/9/2003	183	4.77	52	0.12	0	17.25	4.95	0.35	170.59	89.03	0	1.05	0	1.695	1.51	0.422	11.14
A2B1-1	10/8/2002	2000	90	Steel	7/7/2003	272	6.15	61.45	0.23	0	20.88	6.22	0	194.81	107.01	0	0	0	2.003	1.724	0.507	11.24
A2B1-1	10/8/2002	2000	90	Steel	10/8/2003	365	5.92	71.05	0.17	0	21.44	6.46	0	204.87	106.25	0	0	0	2.315	1.813	0.503	11.34
A2B1-1	10/8/2002	2000	90	Steel	4/7/2004	547	5.62	80.05	0.23	0	25.71	7.68	0.29	256.38	118.83	0	0.94	0	2.609	2.269	0.563	11.45
A2B1-1	10/8/2002	2000	90	Steel	10/8/2004	731	5.34	86.8	0.29	0	25.27	8.2	0.25	261.26	112.2	0	0	0.43	2.829	2.312	0.531	11.54
A2B1-1	10/8/2002	2000	90	Steel	10/6/2005	1094	6.18	90.77	0.13	0	26.7	8.53	0	294.43	127.42	0	0	0	2.958	2.606	0.603	11.64
A2B1-1	10/8/2002	2000	90	Steel	10/19/2006	1472	4.3	102.42	0.13	0	28.88	9.01	0	294.8	131.24	0	0	0	3.338	2.609	0.622	11.67
A2B1-1	10/8/2002	2000	90	Steel	10/16/2007	1834	4.35	111.07	0.24	0	31.73	10.02	0	352.42	143.97	0	0	0	3.62	3.119	0.682	11.74
A2B1-2	10/8/2002	2000	90	Steel	10/15/2002	7	2.48	20.97	0.6	0	6	6.2	0	53.54	65.87	0	0	0	0.681	0.602	0.304	10.54
A2B1-2	10/8/2002	2000	90	Steel	11/5/2002	28	2.82	25.41	0.29	0	7.95	7.84	0.3	72.38	72.79	0	0	0	0.825	0.814	0.336	10.75
A2B1-2	10/8/2002	2000	90	Steel	12/3/2002	56	2.7	30.69	0.26	0	9.45	9.19	0	90.5	79.6	0	0.6	0	0.996	1.018	0.368	10.85
A2B1-2	10/8/2002	2000	90	Steel	2/5/2003	120	2.89	30.07	0.47	0	9.92	8.93	0	88.67	82.2	0	0	0	0.976	0.998	0.38	10.93
A2B1-2	10/8/2002	2000	90	Steel	4/9/2003	183	2.41	34.32	0.19	0	11.07	9.88	0	98.35	83.51	0	0	0	1.114	1.106	0.386	11.03
A2B1-2	10/8/2002	2000	90	Steel	7/7/2003	272	3.82	41.71	0.36	0	13.55	13.18	0	122.2	108.81	0	0	0	1.354	1.375	0.503	11.16
A2B1-2	10/8/2002	2000	90	Steel	10/8/2003	365	3.13	47.66	0.23	0	12.75	13.11	0	128.68	102.11	0	0	0	1.547	1.448	0.472	11.24
A2B1-2	10/8/2002	2000	90	Steel	4/7/2004	547	2.85	63.45	0.41	0	17.94	19.3	0	184.42	126.3	0	0	0	2.06	2.075	0.584	11.34
A2B1-2	10/8/2002	2000	90	Steel	10/8/2004	731	2.43	75.39	0.33	0	18	22.35	0	211.03	121.73	0	0	0	2.448	2.374	0.563	11.45
A2B1-2	10/8/2002	2000	90	Steel	10/6/2005	1094	5.46	983.39	2.58	0	193.46	152.24	0	1761.77	274.95	0	0	0	31.93	19.821	1.271	11.53
A2B1-2	10/8/2002	2000	90	Steel	10/19/2006	1472	0	2260.17	5.48	0	407.67	239.36	0	3778.57	321.97	0	0	0	73.386	42.51	1.488	11.57
A2B1-2	10/8/2002	2000	90	Steel	10/16/2007	1834	1.11	3027.5	11.91	0	639.89	331.26	0	5441.77	408.32	0	0	0	98.301	61.222	1.887	11.65
A2B1-3	10/8/2002	2000	90	Steel	10/15/2002	7	1.37	25.69	0.99	0	3.64	10.84	0	42.45	66.61	0	0	0	0.83	0.655	0.3	10.35
A2B1-3	10/8/2002	2000	90	Steel	11/5/2002	28	1.49	39.79	0.61	0	5.93	18.31	0	70.26	86.25	0	0	0	1.285	1.085	0.389	10.53
A2B1-3	10/8/2002	2000	90	Steel	12/3/2002	56	1.04	47.35	0.73	0	7.23	22.97	0	91.15	96.08	0	0	0	1.529	1.407	0.433	10.64
A2B1-3	10/8/2002	2000	90	Steel	2/5/2003	120	1.54	51.57	1.11	0	8.48	23.57	0	94.53	107.67	0	0	0	1.666	1.46	0.486	10.74
A2B1-3	10/8/2002	2000	90	Steel	4/9/2003	183	1.05	53.2	0.73	0	9.1	23.55	0	92.52	102.92	0	0	0	1.718	1.429	0.464	10.84
A2B1-3	10/8/2002	2000	90	Steel	7/7/2003	272	1.98	70.18	1.4	0	11.4	32.36	0	119.41	144.19	0	0	0	2.267	1.844	0.65	10.94
A2B1-3	10/8/2002	2000	90	Steel	10/8/2003	365	1.59	73.39	1.24	0	10.8	32.03	0	121.58	138.39	0	0	0	2.37	1.877	0.624	11.05
A2B1-3	10/8/2002	2000	90	Steel	4/7/2004	547	1.42	74.25	1.76	0	13.33	36.8	0	140.51	146.84	0	0	0	2.398	2.17	0.662	11.14
A2B1-3	10/8/2002	2000	90	Steel	10/8/2004	731	1.11	79.63	1.77	0	11.49	39.74	0	141.02	144.83	0	0	0	2.572	2.177	0.653	11.24
A2B1-3	10/8/2002	2000	90	Steel	10/6/2005	1094	1.53	81.34	2.11	0	12.29	41.7	0	153.3	163.43	0	0	0	2.627	2.367	0.737	11.35
A2B1-3	10/8/2002	2000	90	Steel	10/19/2006	1472	0.7	153.05	1.29	0	27.66	54.41	0	257.18	193.85	0	0	0	4.943	3.971	0.874	11.46
A2B1-3	10/8/2002	2000	90	Steel	10/16/2007	1834	1.61	754.02	2.82	0	133.31	87.94	0	1339.7	229.7	0	0	0	24.355	20.685	1.036	11.55
A3-AN104	2/4/2003	2000	90	Steel	2/11/2003	7	3.02	33.32	0.52	0	0	11.25	0	115.1	84.5	0	0	0	1.082	1.06	0.392	10.84
A3C2-1	2/4/2003	2000	90	Steel	2/11/2003	7	2.79	33.46	0.66	0	0	12.57	0	110.6	85.04	0	0	0	1.1	1.066	0.392	10.84
A3C2-2	2/4/2003	2000	90	Steel	2/11/2003	7	2.47	32.84	0.81	0	0	13.98	0	109.27	83.64	0	0	0	1.093	1.105	0.383	10.88
A3C2-3	2/4/2003	2000	90	Steel	2/11/2003	7	2.23	24.46	1	0	0	11.98	0	80.38	70.98	0	0	0	0.825	0.857	0.323	10.83
A88AP101R1	10/10/2001	2000	90	Steel	10/17/2001	7	9.52	41.9	0.17	1.4	10.77	0	0.62	173.5	84.97	0	1.27	0	1.372	1.169	0.412	10.64
A88AP101R1	10/10/2001	2000	90	Steel	11/7/2001	28	10.64	77.41	0	1.81	17.72	0	0.79	282.37	104.37	0.46	1.82	1.02	2.535	1.902	0.506	10.93
A88AP101R1	10/10/2001	2000	90	Steel	12/5/2001	56	10.59	91.81	0.18	2.04	20.33	0	0.84	333.97	116.87	0.64	1.72	1.4	3.007	2.25	0.566	10.98
A88AP101R1	10/10/2001	2000	90	Steel	2/7/2002	120	11.42	111.03	0.21	2.1	24.04	0	0.82	398.4	125.13	0.67	1.96	1.32	3.636	2.684	0.606	11.03
A88AP101R1	10/10/2001	2000	90	Steel	4/8/2002	180	12.12	117.27	0.38	2.32	28.29	0	0.85	389.3	132.6	0.54	1.84	1.1	3.841	2.622	0.643	11.28
A88AP101R1	10/10/2001	2000	90	Steel	7/8/2002	271	11.21	124.43	0.3	1.7	27.45	0	0.73	418.83	130.77	0	1.58	0.83	4.075	2.821	0.634	11.33
A88AP101R1	10/10/2001	2000	90	Steel	10/10/2002	365	16.9	164.65	0.26	2.36	37.93	0	0.99	634.49	173.32	0.48	2.49	1.16	5.392	4.274	0.84	11.45
A88AP101R1	10/10/2001	2000	90	Steel	4/10/2003	547	14.76	169.86	0.27	1.52	36.54	0	0.52	572.41	172.9</							

The Catholic University of America
Vitreous State Laboratory

ILAW Glass Testing for Disposal at IDF
Final Report, VSL-11R2270-1, Rev. 0

Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
A88Si+15	10/10/2001	2000	90	Steel	10/13/2006	1829	1.01	3094.23	0.43	1.19	812.01	0	0	10798	2045.13	0	1.69	0	105.109	65.613	10.282	12.75
A88Si-15	10/10/2001	2000	90	Steel	10/17/2001	7	6.25	20.58	0.21	0	5.04	0	0.4	85.62	65.56	0	0.82	0	0.649	0.653	0.306	10.27
A88Si-15	10/10/2001	2000	90	Steel	11/7/2001	28	6.75	48.01	0	1.23	8.49	0	0.54	157.1	79.75	0	1.51	0.72	1.513	1.198	0.372	10.36
A88Si-15	10/10/2001	2000	90	Steel	12/5/2001	56	6.51	62.37	0.14	1.48	10.65	0	0.59	192.17	86.44	0.59	1.65	1.18	1.966	1.466	0.403	10.45
A88Si-15	10/10/2001	2000	90	Steel	2/7/2002	120	6.74	80.28	0.14	1.44	13.08	0	0.71	238.93	93.52	0.57	1.88	1.16	2.53	1.822	0.436	10.54
A88Si-15	10/10/2001	2000	90	Steel	4/8/2002	180	6.43	90.47	0.27	1.12	15.53	0	0.64	250.73	100.3	0.54	1.57	1.13	2.851	1.912	0.468	10.85
A88Si-15	10/10/2001	2000	90	Steel	7/8/2002	271	6.91	98.61	0.28	1.39	15.68	0	0.74	268.97	102.77	0.6	1.74	1.1	3.108	2.051	0.479	10.95
A88Si-15	10/10/2001	2000	90	Steel	10/10/2002	365	9.61	129.31	0.32	2.41	20.39	0	1.36	396.5	131.98	0.78	3.24	1.51	4.076	3.024	0.616	11.05
A88Si-15	10/10/2001	2000	90	Steel	4/10/2003	547	9.15	141.07	0.61	2.09	21.55	0	1.06	384.21	132.1	0.76	2.61	1.49	4.446	2.93	0.616	11.15
A88Si-15	10/10/2001	2000	90	Steel	10/9/2003	729	7.98	136.91	0.24	0	21	0	0	380.99	118.82	0.58	0	0.88	4.315	2.906	0.554	11.25
A88Si-15	10/10/2001	2000	90	Steel	10/7/2004	1093	9.42	149.42	0.17	0	23.75	0	0.58	459.39	134.06	0.71	1.34	0.57	4.709	3.503	0.625	11.34
A88Si-15	10/10/2001	2000	90	Steel	10/13/2006	1829	5.13	198.8	0	0	32.62	0	0	660.91	174.23	0	0	0.81	6.266	5.04	0.813	11.55
A88Si-15	10/10/2001	2000	90	Steel	9/26/2007	2177	4.03	200.41	0.31	0	29.15	0	0	546.83	175.25	0	0	0.94	6.317	4.17	0.817	11.55
B1-AZ101	10/8/2002	2000	90	Steel	10/15/2002	7	0.95	24.3	1.74	0	0	13.12	0	21.52	58.04	0	0	0	0.781	0.529	0.256	10.35
B1-AZ101	10/8/2002	2000	90	Steel	11/5/2002	28	1.02	46.62	1.26	0	0	28.6	0	48.29	86.72	0	0	0	1.498	1.188	0.382	10.55
B1-AZ101	10/8/2002	2000	90	Steel	7/7/2003	272	1.82	287.01	4.5	0	5.65	115.95	0	246.44	158.59	0	0	0	9.219	6.063	0.698	10.94
B1-AZ101	10/8/2002	2000	90	Steel	10/8/2003	365	1.47	437.19	6.99	0	8.53	175.05	0	425.84	143.14	0	0	0	14.044	10.476	0.63	11.04
B1-AZ101	10/8/2002	2000	90	Steel	4/7/2004	547	0.76	691.61	16.01	0	14.52	216.13	0	634.44	141.3	0	0	0	22.216	15.608	0.622	11.14
B1-AZ101	10/8/2002	2000	90	Steel	10/8/2004	731	0	765.93	12.9	0	14.05	237.84	0	671.47	130.93	0	0	0	24.603	16.519	0.577	11.25
B1-AZ101	10/8/2002	2000	90	Steel	10/6/2005	1094	4.8	847.76	22.17	0	21.37	252.56	0	826.44	147.79	0	0	0	27.232	20.332	0.651	11.34
B1-AZ101	10/8/2002	2000	90	Steel	10/19/2006	1472	0	851.85	17.03	0	23.17	286.13	0	849.88	143.27	0	0	0	27.363	20.909	0.631	11.42
B1-AZ101	10/8/2002	2000	90	Steel	10/16/2007	1834	0.77	521.17	13.42	0	14.97	187.13	0	530.08	159.96	0	0	0	16.741	13.041	0.705	11.46
C1-AN107	8/20/2002	2000	90	Steel	8/27/2002	7	4.56	32.01	0.55	0	0	12.63	0.27	113.77	89.64	0	0.82	0	1.028	1.06	0.411	10.74
C1-AN107	8/20/2002	2000	90	Steel	9/17/2002	28	3.45	46.93	0.91	0	0	16.17	0	156.43	119.87	0	0.78	0	1.507	1.458	0.55	10.87
C1-AN107	8/20/2002	2000	90	Steel	10/15/2002	56	3.37	47.65	0.34	0	0	15.73	0	165.6	115.87	0	0	0	1.53	1.543	0.532	10.97
C1-AN107	8/20/2002	2000	90	Steel	5/14/2003	267	3.84	73.85	0.56	0	2.69	22.43	0	288.88	167.16	0	0	0	2.371	2.692	0.767	11.28
C1-AN107	8/20/2002	2000	90	Steel	8/20/2003	365	3.17	74.21	0.41	0	0	22.99	0	249.45	166.35	0	0	0	2.383	2.324	0.763	11.36
C1-AN107	8/20/2002	2000	90	Steel	2/20/2004	549	3.58	78.22	0.48	0	0	24.22	0	294.4	174.26	0	0	0	2.511	2.743	0.799	11.45
C1-AN107	8/20/2002	2000	90	Steel	8/22/2005	1098	1.57	1549.8	3.03	0	13.44	252.52	0	3174.2	504.32	0	0	0	49.76	29.577	2.314	11.65
C1-AN107	8/20/2002	2000	90	Steel	8/7/2006	1448	0	2853.3	4.83	0	30.02	372.25	0.89	6187.63	687.94	0	0	0	91.613	57.657	3.156	11.77
C100-G-136B	7/6/2000	2000	90	Steel	7/13/2000	7	2.31	23.01	0.12	0	0	8.42	0	61.38	58.3	0	0	0	0.734	0.697	0.267	10.11
C100-G-136B	7/6/2000	2000	90	Steel	8/8/2000	33	2.97	43	0.98	0	0	15.82	0	108.33	97.26	0	0	0	1.372	1.23	0.445	10.24
C100-G-136B	7/6/2000	2000	90	Steel	8/31/2000	56	3.28	48.6	1.03	0	0	17.24	0	132.6	106.27	0	0	0	1.551	1.505	0.487	10.37
C100-G-136B	7/6/2000	2000	90	Steel	11/2/2000	119	2.71	56.88	0.66	0	0	21.48	0	157.2	119.17	0	0	0	1.815	1.784	0.546	10.47
C100-G-136B	7/6/2000	2000	90	Steel	1/2/2001	180	2.99	60.41	1.07	0	0	23.64	0	180.13	129.37	0	0	0	1.928	2.045	0.592	10.52
C100-G-136B	7/6/2000	2000	90	Steel	4/2/2001	270	3.12	68.8	1.26	0	2.24	27.66	0	205.37	149.27	0	0	0	2.196	2.331	0.683	10.65
C100-G-136B	7/6/2000	2000	90	Steel	7/5/2001	364	2.82	71.8	1.03	0	1.8	28.12	0	219.53	152.97	0	0	0	2.291	2.492	0.7	10.74
C100-G-136B	7/6/2000	2000	90	Steel	1/3/2002	546	2.01	106.17	1.91	0	2.34	39.23	0	317.17	205.82	0	0	0	3.388	3.6	0.942	10.87
C100-G-136B	7/6/2000	2000	90	Steel	7/8/2002	732	1.25	121.51	2.36	0	2.57	45.65	0	321.94	254.99	0	0	0	3.878	3.654	1.168	10.97
C100-G-136B	7/6/2000	2000	90	Steel	7/9/2003	1098	1.13	488.3	3.38	0	9.26	104.84	0	1107.03	287.24	0	0	0	15.583	12.566	1.315	11.15
C100-G-136B	7/6/2000	2000	90	Steel	7/6/2004	1461	0	2094.2	8.37	0	45.7	374.97	0	3620	382.01	0	0	0	66.83	41.092	1.749	11.26
C100-G-136B	7/6/2000	2000	90	Steel	7/8/2005	1828	0	2463.7	11.98	0	62.82	488.59	0	4797.33	345.99	0	0	0	78.622	54.456	1.584	11.32
C100-G-136B	7/6/2000	2000	90	Steel	7/10/2006	2195	0	2623.63	14.2	0	76.65	457.73	0	4504.7	405.19	0	0	0	83.725	51.134	1.855	11.43
C100GCC	7/6/2000	2000	90	Steel	7/13/2000	7	3.15	14.51	0	0	0	5.83	0	42.65	46.28	0	0	0	0.463	0.484	0.212	10.06
C100GCC	7/6/2000	2000	90	Steel	8/8/2000	33	5.78	24.07	0.77	0	0	9.4	0	70.15	72.54	0	0	0	0.768	0.796	0.332	10.15
C100GCC	7/6/2000	2000	90	Steel	8/31/2000	56	6.51	22.12	0.99	0	0	9.72	0	73.03	76.73	0	0	0	0.706	0.829	0.351	10.26
C100GCC	7/6/2000	2000	90	Steel	11/2/2000	119	7.1	28.36	0.45	0	0	12.24	0	93.35	87.55	0	0	0	0.905	1.06	0.401	10.35
C100GCC	7/6/2000	2000	90	Steel	1/2/2001	180	7.94	28.28	0.73	0	0	13.58	0	102.87	93.03	0	0	0	0.902	1.168	0.426	10.41
C100GCC	7/6/2000	2000	90	Steel	4/2/2001	270	8.63	30.13	0.99	0	0	15.13	0	112.8	103	0	0	0	0.962	1.28	0.472	10.55
C100GCC	7/6/2000	2000	90	Steel	7/5/2001	364	8.22	30	0.54	0	0	14.94	0	120.17	99.59	0	0	0	0.957	1.364	0.456	10.66
C100GCC	7/6/2000	2000	90	Steel	1/3/2002	546	9.6	40.65	0.72	0	0	18.81	0	155.97	137.31	0	0	0	1.297	1.77	0.629	10.77
C100GCC	7/6/2000	2000	90	Steel	7/8/2002	732	7.88	40.32	0.92	0	1.88	22.09	0	163.55	149.39	0	0	0	1.287	1.857	0.684	10.83
C100GCC	7/6/2000	2000	90	Steel	7/9/2003	1098	2.69	39.25	0.95	0	0	24.03	0	198.63	164.29	0	0	0	1.253	2.255	0.752	10.97
C100GCC	7/6/2000	2000	90	Steel	7/6/2004	1461	1.51	74.46	1.47	0	2.59	30.42	0	225.69	184.53	0	0	0	2.376	2.562	0.845	11.05
C100GCC	7/6/2000	2000	90	Steel	7/8/2005	1828	0	201.62	2.87	0	4.24	61.88	0	545.17	258.81	0	0	0	6.434	6.188	1.185	11.15
C100GCC	7/6/2000	2000	90	Steel	7/10/2006	2195	0	789.86	4.24	0	13.79	177.83	0	1670.97	380.64	0	0	0	25.206	18.968		

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
C22Si+15	7/18/2001	2000	90	Steel	8/15/2001	28	4.21	70.51	0.2	0	0	20.63	0	266.93	151.9	0	0.57	0	2.309	2.221	0.713	10.94
C22Si+15	7/18/2001	2000	90	Steel	9/12/2001	56	4.1	82.36	0.3	0	0	23.79	0	304.8	176.57	0	0	0	2.696	2.537	0.829	11.27
C22Si+15	7/18/2001	2000	90	Steel	11/15/2001	120	3.12	102	0.63	0	0	28.08	0	345.27	204.7	0	0	0	3.34	2.873	0.961	11.32
C22Si+15	7/18/2001	2000	90	Steel	1/14/2002	180	4.34	103.43	0.84	0	0	26.69	0	343.87	208.6	0	0	0	3.386	2.862	0.979	11.47
C22Si+15	7/18/2001	2000	90	Steel	4/15/2002	271	3.34	108.37	0.79	0	1.98	26.48	0	366.9	233.33	0	0	0	3.548	3.053	1.095	11.75
C22Si+15	7/18/2001	2000	90	Steel	7/18/2002	365	4.58	189.62	1.01	0	2.22	47.56	0	569.61	349.27	0	0	0	6.208	4.74	1.639	11.85
C22Si+15	7/18/2001	2000	90	Steel	1/16/2003	547	8.72	2540.3	3.55	0	39.23	411.51	0	5664.17	997.94	0	0	0.67	83.17	47.138	4.684	11.94
C22Si+15	7/18/2001	2000	90	Steel	7/17/2003	729	9.48	3104.67	3.32	1.13	47.53	460.67	0.33	6047.07	1066.43	0	0	0.47	101.648	50.324	5.006	12.06
C22Si+15	7/18/2001	2000	90	Steel	7/15/2004	1093	1.22	2711.8	2.15	0	45.1	405.72	0	6659.57	832.26	0	0	0	88.785	55.421	3.906	12.17
C22Si+15	7/18/2001	2000	90	Steel	7/11/2006	1819	0.92	2706.9	2.48	0	41.1	370.47	0	5903	817.37	0	0	0	88.625	49.125	3.837	12.34
C22Si-15	7/18/2001	2000	90	Steel	7/25/2001	7	3.24	28.27	0.3	0	0	10.2	0	83.41	75.62	0	0	0	0.885	0.878	0.339	10.54
C22Si-15	7/18/2001	2000	90	Steel	8/15/2001	28	3.24	44.93	0	0	0	15.75	0	127.47	104.6	0	0	0	1.406	1.341	0.469	10.86
C22Si-15	7/18/2001	2000	90	Steel	9/12/2001	56	3.22	52.64	0.19	0	0	18.68	0	147.27	116.3	0	0	0	1.647	1.549	0.522	11.12
C22Si-15	7/18/2001	2000	90	Steel	11/15/2001	120	3.13	64.92	0.46	0	0	20.92	0	165.93	131.8	0	0	0	2.032	1.746	0.591	11.22
C22Si-15	7/18/2001	2000	90	Steel	1/14/2002	180	2.99	84.86	0.93	0	0	26.49	0	200.9	161.23	0	0	0	2.656	2.114	0.723	11.37
C22Si-15	7/18/2001	2000	90	Steel	4/15/2002	271	2.09	90.29	0.94	0	0	27.33	0	209.1	163.9	0	0	0	2.826	2.2	0.735	11.53
C22Si-15	7/18/2001	2000	90	Steel	7/18/2002	365	3.16	93.86	0.8	0	0	31.78	0	269.09	179.76	0	0	0	2.937	2.831	0.807	11.64
C22Si-15	7/18/2001	2000	90	Steel	1/16/2003	547	3.61	102.45	0.79	0	0	34.66	0	278.84	194.01	0	0	0	3.206	2.934	0.871	11.74
C22Si-15	7/18/2001	2000	90	Steel	7/17/2003	729	3.77	92.21	0.82	0	1.93	33.32	0	287.34	200.12	0	0	0	2.886	3.023	0.898	11.87
C22Si-15	7/18/2001	2000	90	Steel	7/15/2004	1093	1.37	131.94	0.97	0	0	38.87	0	347.66	214.97	0	0	0	4.129	3.658	0.965	11.96
C22Si-15	7/18/2001	2000	90	Steel	7/11/2006	1819	0	2032.43	5.69	0	17.25	332.63	0	3308.77	514.68	0	0	0	63.607	34.81	2.309	12.15
C22Si-15	7/18/2001	2000	90	Steel	9/18/2007	2253	1.92	2809.67	12.94	0	29.14	396.5	0	4858.97	461.54	0	0	0.63	87.932	51.119	2.071	12.25
GTSD-1126	3/2/2005	2000	90	Steel	3/9/2005	7	0.68	17.92	1.55	0	0	12.15	0	22.49	53.44	0	0	0	0.575	0.552	0.234	10.18
GTSD-1437	5/4/2005	2000	90	Steel	5/11/2005	7	2.02	20.71	0.65	0	0	9.72	0	65.32	65.34	0	0	0	0.705	0.732	0.295	10.71
LA126CCC	1/13/2004	2000	90	Steel	1/20/2004	7	6.38	28.93	0	0	14.99	0	0	116.93	67.41	0	0.46	0	0.946	0.853	0.326	10.86
LA137SRCCC	3/16/2004	2000	90	Steel	3/23/2004	7	3.3	33.31	0.25	0	3.74	10.86	0	104.88	89.68	0	0.49	0	1.082	0.966	0.417	10.85
LA44CCCR2	5/11/2004	2000	90	Steel	5/18/2004	7	7.29	18.19	0.1	0	0	0	0.4	107.31	79.34	0	0.6	0	0.66	0.723	0.382	11.02
LA44PNCC	5/11/2003	2000	90	Steel	5/8/2003	7	6.55	18.36	0	0	0	0	0.25	99.8	69.67	0	0.57	0	0.666	0.672	0.335	10.81
LAWA102R1	9/5/2001	2000	90	Steel	9/12/2001	7	3.29	26.74	0.46	0	0	8.04	0	78.61	78.43	0	0	0	0.864	0.731	0.362	9.92
LAWA102R1	9/5/2001	2000	90	Steel	10/3/2001	28	4.26	41.94	0.3	0	0	12.97	0	126.33	102.73	0	0	0	1.355	1.174	0.474	10.04
LAWA102R1	9/5/2001	2000	90	Steel	10/31/2001	56	3.86	46.87	0.28	0	0	14.95	0	147.5	113.83	0	0	0	1.514	1.371	0.525	10.17
LAWA102R1	9/5/2001	2000	90	Steel	1/3/2002	120	3.18	53.76	0.56	0	0	16.68	0	161.07	121.63	0	0	0	1.737	1.497	0.561	10.35
LAWA102R1	9/5/2001	2000	90	Steel	3/4/2002	180	3.48	55	0.57	0	1.81	17.39	0	178.73	126.07	0	0	0	1.777	1.661	0.582	10.65
LAWA102R1	9/5/2001	2000	90	Steel	6/3/2002	271	3.26	58.29	0.65	0	1.76	19.16	0	182.43	129.3	0	0	0	1.883	1.695	0.597	10.85
LAWA102R1	9/5/2001	2000	90	Steel	9/4/2002	364	4.3	72.74	0.9	1.37	2.55	22.7	0.37	240.48	174.24	0	1.09	0	2.35	2.235	0.804	10.94
LAWA102R1	9/5/2001	2000	90	Steel	3/6/2003	547	4.06	88.01	0.61	0	3.38	28.46	0	262.55	183.43	0	0	0	2.844	2.44	0.847	11.15
LAWA102R1	9/5/2001	2000	90	Steel	9/8/2003	733	2.5	90.84	0.71	0	3.46	27	0	263.94	191.19	0	0	0	2.935	2.453	0.883	11.24
LAWA102R1	9/5/2001	2000	90	Steel	9/2/2004	1093	3.31	86.05	0.5	0	2.78	26.9	0	287.51	188.36	0	0	0	2.78	2.672	0.869	11.35
LAWA102R1	9/5/2001	2000	90	Steel	9/24/2007	2210	0	2343.63	7.36	0	62.18	347.69	0	4329.8	531.25	0	0	0	75.723	40.24	2.452	11.57
LAWA102R2	3/2/2005	2000	90	Steel	3/9/2005	7	3.8	23.56	0.24	0	0	8.91	0	94.62	73.07	0	0	0	0.758	0.88	0.335	10.82
LAWA104	7/6/2000	2000	90	Steel	7/13/2000	7	9.87	30.99	0	1.42	2.27	0	0.54	171.5	84.59	0	2.43	0	1.162	1.051	0.421	11.23
LAWA104	7/6/2000	2000	90	Steel	8/8/2000	33	14.12	68.25	0.49	2.75	4.12	0	0.93	321.6	133.13	0.59	3.23	0.95	2.559	1.97	0.663	11.33
LAWA104	7/6/2000	2000	90	Steel	8/31/2000	56	15.96	78.13	0.58	3.13	4.99	0	1.06	425.83	142.9	0.56	4.75	1.01	2.929	2.609	0.711	11.45
LAWA104	7/6/2000	2000	90	Steel	11/2/2000	119	16.97	99.93	0.16	2.59	7.13	0	0.96	512.27	159.67	0	1.55	0.77	3.746	3.138	0.795	11.54
LAWA104	7/6/2000	2000	90	Steel	1/2/2001	180	16.8	106.53	0.27	2.06	6.24	0	0.62	622.63	164	0	1.43	0.63	3.994	3.814	0.816	11.65
LAWA104	7/6/2000	2000	90	Steel	4/2/2001	270	19.56	142.23	0.45	1.71	7.29	0	0.35	650.57	187.7	0.69	0.77	0	5.332	3.986	0.934	11.86
LAWA104	7/6/2000	2000	90	Steel	7/5/2001	364	15.85	127.57	0	0	6.9	0	0	706.1	183.8	0	0	0	4.783	4.326	0.915	12.06
LAWA104	7/6/2000	2000	90	Steel	1/3/2002	546	8.97	382.22	0.25	0	22.47	0	0	1617.77	416.92	0	0	0	14.329	9.911	2.075	12.12
LAWA104	7/6/2000	2000	90	Steel	7/8/2002	732	2.29	1431	0.58	0	99.45	0	0	4752.27	1075.77	0	0.65	0	53.647	29.114	5.354	12.23
LAWA104	7/6/2000	2000	90	Steel	7/9/2003	1098	1.73	2719.87	0.74	1.55	206.64	0	0	8828.9	1669.77	0	1.89	0	101.966	54.089	8.31	12.36
LAWA104	7/6/2000	2000	90	Steel	7/6/2004	1461	1.13	2619.43	1.29	0	205.86	0	0	8587.77	1723	0	1.57	0	98.201	52.612	8.575	12.45
LAWA104	7/6/2000	2000	90	Steel	7/8/2005	1828	0.83	2374.37	0.87	0	203.31	0	0	8841.73	1594.4	0	1.15	0	89.014	54.168	7.935	12.52
LAWA104	7/6/2000	2000	90	Steel	7/10/2006	2195	1.24	2500.43	0.45	1.44	200.78	0	0	8153.8	1903.47	0	1.22	0	93.74	49.954	9.473	12.64
LAWA105	7/6/2000	2000	90	Steel	7/13/2000	7	14.24	49.27	0	2.71	3.81	0	1.02	282.33	108.43	0	3.99	0.48	1.916	1.585	0.56	11.35
LAWA105	7/6/2000	2000	90	Steel	8/8/2000	33	17.85	96.94	0.5	3.79	6.52	1.33	1.41	507.8	172.73	0.56	4.94	0.79	3.77	2.851	0.892	11.54
LAWA105	7/6/2000	2000	90	Steel	8/31/2000	56	20.95	109.43	0.53	3.58	8.58	0	1.29	634.57	182.5	0.49	4.82	0.74	4.256	3.563	0.942	11.73
LAWA105	7/6/2000																					

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWA112B14	2/27/2002	2000	90	Steel	8/26/2002	180	8.83	65.8	1.12	0	27.98	0	0	544.03	177.93	0	0	0	2.149	3.67	0.861	11.84
LAWA112B14	2/27/2002	2000	90	Steel	11/25/2002	271	6.81	128.76	0.37	0	48.34	0	0	691.76	298.41	0	0	0	4.205	4.666	1.444	11.94
LAWA112B14	2/27/2002	2000	90	Steel	2/26/2003	364	2.47	326.39	1.32	0	79.25	0	0	1264.57	455.94	0	0	0	10.66	8.53	2.206	12.05
LAWA112B14	2/27/2002	2000	90	Steel	8/25/2003	544	2.48	3345.4	1.18	0	754.85	0	0	9531.5	1644.7	0	1.04	0	109.26	64.295	7.958	12.15
LAWA112B14	2/27/2002	2000	90	Steel	2/25/2004	728	1.1	3074.53	0.53	0	623.48	0	0	8231.7	1460.1	0	0.66	0	100.413	55.527	7.064	12.24
LAWA112B14	2/27/2002	2000	90	Steel	2/22/2005	1091	4.83	2840.1	0.98	0	585.44	0	0	7825.87	1355.27	0.47	0.76	0.65	92.757	52.79	6.557	12.35
LAWA112B14	2/27/2002	2000	90	Steel	2/15/2006	1449	0	3169.9	1.24	1.4	724.89	0	0.35	8638.63	1656.73	0.44	0.77	0.68	103.528	58.272	8.016	12.43
LAWA112B14	2/27/2002	2000	90	Steel	2/27/2007	1826	0.85	2896.17	1.11	1.39	645.46	0	0.26	8142.6	1630.5	0.53	0.77	0.67	94.588	54.926	7.889	12.47
LAWA112B15	2/27/2002	2000	90	Steel	3/6/2002	7	4.26	23.71	1.6	0	14.06	0	0	154.8	72.46	0	0	0	0.779	1.044	0.352	11.15
LAWA112B15	2/27/2002	2000	90	Steel	3/27/2002	28	6.13	35.86	1.28	0	19.63	0	0	238.77	102.47	0	0	0	1.178	1.611	0.498	11.34
LAWA112B15	2/27/2002	2000	90	Steel	4/24/2002	56	7.03	42.65	1.27	0	23.74	0	0	306.53	122	0	0	0	1.401	2.068	0.593	11.65
LAWA112B15	2/27/2002	2000	90	Steel	6/27/2002	120	9.36	55.03	1.35	0	31.59	0	0	434.27	153.9	0	0	0	1.808	2.929	0.749	11.75
LAWA112B15	2/27/2002	2000	90	Steel	8/26/2002	180	9	58.53	1.32	0	32.99	0	0	492.93	160.27	0	0	0	1.923	3.325	0.78	11.85
LAWA112B15	2/27/2002	2000	90	Steel	11/25/2002	271	11.28	78.7	0.32	0	46.12	0	0	564.28	213.28	0	0	0	2.586	3.806	1.038	11.96
LAWA112B15	2/27/2002	2000	90	Steel	2/26/2003	364	2.66	145.75	1.23	0	60.88	0	0	675.37	284.3	0	0	0	4.789	4.556	1.383	12.06
LAWA112B15	2/27/2002	2000	90	Steel	8/25/2003	544	2.68	2497.9	1.28	0	615.05	0	0	6880.1	1356.87	0	1.01	0	82.08	46.41	6.601	12.15
LAWA112B15	2/27/2002	2000	90	Steel	2/25/2004	728	1.87	3172.07	0.29	0	638	1.49	0	8493.77	1445.53	0	0.96	0	104.233	57.295	7.032	12.25
LAWA112B15	2/27/2002	2000	90	Steel	2/22/2005	1091	4.61	2936.3	1.3	1.74	629.39	0	0	7876.43	1424.2	0.65	0.88	1.07	96.485	53.131	6.928	12.34
LAWA112B15	2/27/2002	2000	90	Steel	2/15/2006	1449	0	3137.27	1.72	1.44	783.02	0	0.34	9075.73	1599.87	0	1.07	0.58	103.089	61.221	7.783	12.45
LAWA112B15	2/27/2002	2000	90	Steel	2/27/2007	1826	0.87	2902.53	0.91	1.53	779.48	0	0.26	8437.97	1522.47	0.61	1.1	0.81	95.376	56.919	7.406	12.52
LAWA125	1/24/2002	2000	90	Steel	1/31/2002	7	7.28	57.18	0	2	27.63	0	0.91	239.93	88.74	0	1.82	0	1.929	1.618	0.443	11.21
LAWA125	1/24/2002	2000	90	Steel	2/21/2002	28	8.81	101.8	0.13	2.3	47.12	0	1.09	385.97	116.23	0	2.45	0	3.435	2.603	0.58	11.43
LAWA125	1/24/2002	2000	90	Steel	3/21/2002	56	11.47	135.27	0.24	2.37	62.58	0	1.16	516.6	145.97	0	2.63	0.47	4.564	3.483	0.728	11.64
LAWA125	1/24/2002	2000	90	Steel	5/24/2002	120	11.9	157.6	0	1.76	75.52	0	0.78	566.47	155.33	0	1.67	0	5.318	3.82	0.775	11.74
LAWA125	1/24/2002	2000	90	Steel	7/23/2002	180	12.44	169.13	0	0	78.34	0	0.44	619.23	164.47	0	0.97	0	5.707	4.175	0.82	11.92
LAWA125	1/24/2002	2000	90	Steel	10/23/2002	272	15.56	224.5	0.65	0	106.34	0	0.28	826.73	208.5	0	0.71	0	7.575	5.575	1.04	11.96
LAWA125	1/24/2002	2000	90	Steel	1/28/2003	369	14.61	221.66	0.82	0	108.54	0	0	854.6	210.57	0	0	0	7.479	5.762	1.05	12.07
LAWA125	1/24/2002	2000	90	Steel	7/22/2003	544	10.25	277.63	0	0	124.93	0	0	1012.37	261.08	0	0	0	9.367	6.826	1.302	12.17
LAWA125	1/24/2002	2000	90	Steel	1/23/2004	729	3.41	492.26	0.28	0	229.87	0	0	1645.83	463.69	0	0	0	16.609	11.098	2.313	12.24
LAWA125	1/24/2002	2000	90	Steel	1/27/2005	1099	0.7	1000.74	0	0	399.85	0	0	3352.73	884.75	0	0	0	33.766	22.607	4.414	12.34
LAWA125	1/24/2002	2000	90	Steel	1/25/2006	1462	0	1485.53	0.15	1.22	576.8	0	0	4810.17	1159.43	0	0	0	50.123	32.434	5.784	12.43
LAWA125	1/24/2002	2000	90	Steel	2/5/2007	1838	1.06	2329.77	0.49	1.33	839.84	0	0	7206.77	1790.03	0	2.35	0	78.608	48.594	8.93	12.47
LAWA126	1/24/2002	2000	90	Steel	1/31/2002	7	6.07	36.47	0	1.24	18.33	0	0.6	143.5	68.28	0	1.36	0	1.197	1.048	0.331	10.74
LAWA126	1/24/2002	2000	90	Steel	2/21/2002	28	6.94	75.28	0.22	1.87	32.41	0	1.15	255.33	93.56	0	2.1	0.83	2.47	1.865	0.454	10.94
LAWA126	1/24/2002	2000	90	Steel	3/21/2002	56	8.73	97.07	0.3	2.06	40.47	0	1.07	321.07	107.47	0.54	2.36	0.94	3.185	2.346	0.521	11.24
LAWA126	1/24/2002	2000	90	Steel	5/24/2002	120	9.23	119.6	0.15	2.3	52.62	0	1.05	381.77	122.13	0.67	2.41	1.07	3.924	2.789	0.593	11.35
LAWA126	1/24/2002	2000	90	Steel	7/23/2002	180	9.1	124.43	0	2.08	52.13	0	1.07	395.97	123.53	0.55	2.21	1.05	4.083	2.893	0.599	11.64
LAWA126	1/24/2002	2000	90	Steel	10/23/2002	272	12.24	167.79	0.28	2.91	72.87	0	1.34	546.68	160.74	0.74	3.23	1	5.506	3.994	0.78	11.74
LAWA126	1/24/2002	2000	90	Steel	1/28/2003	369	11.74	175.27	0.28	1.44	76.27	0	0.72	579.41	165.86	0	2.4	0.75	5.751	4.233	0.805	11.84
LAWA126	1/24/2002	2000	90	Steel	7/22/2003	544	10.39	172.24	0.1	0	71.08	0	0	539.84	148.3	0	0	0	5.652	3.944	0.72	11.94
LAWA126	1/24/2002	2000	90	Steel	1/23/2004	729	6.17	181.65	0.17	0	74	0	0	573.77	165.94	0	0	0	5.96	4.192	0.805	12.05
LAWA126	1/24/2002	2000	90	Steel	1/27/2005	1099	3.11	318.51	0	0	128.27	0	0	998	276.88	0	0	0	10.451	7.291	1.343	12.14
LAWA126	1/24/2002	2000	90	Steel	1/25/2006	1462	0	704.93	0	0	281.09	0	0	2231.3	521.44	0	0	0	23.131	16.3	2.53	12.24
LAWA126	1/24/2002	2000	90	Steel	2/5/2007	1838	0.7	1171.03	0.32	0	411.04	0	0	3414.57	894.76	0	0.63	0	38.425	24.945	4.341	12.34
LAWA127R1	1/24/2002	2000	90	Steel	1/31/2002	7	4.96	21.13	0	0	8.86	0	0.29	82.72	58.43	0	1.04	0	0.667	0.684	0.273	10.46
LAWA127R1	1/24/2002	2000	90	Steel	2/21/2002	28	4.86	45.16	0.25	1.18	14.3	0	0.68	140.2	72.8	0	1.55	0.56	1.425	1.158	0.34	10.58
LAWA127R1	1/24/2002	2000	90	Steel	3/21/2002	56	5.6	64.86	0.21	1.27	18.69	0	0.81	204.27	84.64	0.5	1.82	0.8	2.047	1.688	0.395	10.77
LAWA127R1	1/24/2002	2000	90	Steel	5/24/2002	120	5.84	88.49	0.12	1.55	25.54	0	0.9	242.83	98.64	0.65	1.91	1.05	2.793	2.007	0.461	10.87
LAWA127R1	1/24/2002	2000	90	Steel	7/23/2002	180	5.61	97.7	0.16	1.16	26.31	0	0.81	243.73	102.4	0.65	1.58	1.11	3.083	2.014	0.478	11.25
LAWA127R1	1/24/2002	2000	90	Steel	10/23/2002	272	7.25	130.77	0.6	1.53	35.64	0	0.98	368.28	124.38	0.79	2.4	1.24	4.127	3.043	0.581	11.37
LAWA127R1	1/24/2002	2000	90	Steel	1/28/2003	369	6.11	128.86	0.23	1.16	33.85	0	0.58	358.22	119.18	0.53	1.43	0.96	4.067	2.96	0.556	11.45
LAWA127R1	1/24/2002	2000	90	Steel	7/22/2003	544	7.29	140.19	0.2	0	36.16	0	0	367.97	115.84	0.52	0	0.82	4.424	3.041	0.541	11.57
LAWA127R1	1/24/2002	2000	90	Steel	1/23/2004	729	5.59	139.83	0.3	1.27	35.37	0	0.64	372.47	113.86	0.63	1.37	0.78	4.413	3.078	0.532	11.66
LAWA127R1	1/24/2002	2000	90	Steel	1/27/2005	1099	5.16	163.5	0.15	0	43.21	0	0.4	457	121.45	0	1.46	0.45	5.16	3.776	0.567	11.75
LAWA127R1	1/24/2002	2000	90	Steel	1/25/2006	1462	4.16	171.77	0	0	43.75	0	0	495.61	133.27	0	1.77	0	5.4			

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWA128	1/24/2002	2000	90	Steel	1/28/2003	369	17.91	53.68	0.57	4.81	45.94	0	1.15	390.3	180.66	0.68	4.47	1.2	2.447	2.851	0.839	11.93
LAWA128	1/24/2002	2000	90	Steel	7/22/2003	544	16.65	54.07	0.23	2.22	44.35	0	0.39	377.12	161.26	0.52	1.57	1.06	2.464	2.755	0.749	12.05
LAWA128	1/24/2002	2000	90	Steel	1/23/2004	729	15.05	55.77	0.21	2.12	45.61	0	0.54	388.31	161.2	0	2.17	0	2.542	2.837	0.749	12.16
LAWA128	1/24/2002	2000	90	Steel	1/27/2005	1099	7.66	93.42	0	1.26	62.49	0	0	543.75	207.67	0	0.68	0	4.258	3.972	0.964	12.26
LAWA128	1/24/2002	2000	90	Steel	1/25/2006	1462	1.06	441.01	0	0	244.52	0	0	1811.87	693.29	0	0.47	0	20.099	13.236	3.22	12.32
LAWA128	1/24/2002	2000	90	Steel	2/5/2007	1838	0.99	1124.7	0.24	1.2	450.19	0	0	4013.83	1571.23	0	1.32	0	51.259	29.322	7.297	12.46
LAWA129	1/24/2002	2000	90	Steel	1/31/2002	7	7.06	14.3	0	0	12.19	0	0	101.73	62.28	0	0	0	0.541	0.743	0.28	10.85
LAWA129	1/24/2002	2000	90	Steel	2/21/2002	28	7.62	23.41	0.17	0	17.89	0	0	148.57	78.62	0	0	0	0.885	1.085	0.354	11.06
LAWA129	1/24/2002	2000	90	Steel	3/21/2002	56	9.16	32.47	0.19	0	22	0	0	197.9	91.3	0	0	0	1.228	1.446	0.411	11.25
LAWA129	1/24/2002	2000	90	Steel	5/24/2002	120	10.19	43.94	0	0	28.98	0	0	232.27	107.6	0	0	0	1.662	1.697	0.485	11.34
LAWA129	1/24/2002	2000	90	Steel	7/23/2002	180	10.79	50.79	0	0	31	0	0	258.53	114.57	0	0	0	1.921	1.889	0.516	11.53
LAWA129	1/24/2002	2000	90	Steel	10/23/2002	272	14.28	64.65	0.95	0	40.7	0	0.25	343.05	138.17	0	0.62	0	2.445	2.506	0.622	11.65
LAWA129	1/24/2002	2000	90	Steel	1/28/2003	369	14.06	70.45	0.08	0	43.36	0	0	367.56	145.86	0	0.44	0	2.665	2.685	0.657	11.75
LAWA129	1/24/2002	2000	90	Steel	7/22/2003	544	13.4	72.73	0.12	0	43.09	0	0	359.32	135.6	0	0	0	2.751	2.625	0.611	11.87
LAWA129	1/24/2002	2000	90	Steel	1/23/2004	729	7.72	79.79	0.15	0	44.53	0	0	377.39	147.32	0	0	0	3.018	2.757	0.663	11.95
LAWA129	1/24/2002	2000	90	Steel	1/27/2005	1099	0	769.08	0.57	0	317.53	0	0	2434.53	814.7	0	0	0	29.089	17.787	3.669	12.04
LAWA129	1/24/2002	2000	90	Steel	1/25/2006	1462	0	2125.77	1.05	1.2	824.15	0	0	6612.33	1849.13	0	0	0	80.404	48.31	8.327	12.14
LAWA129	1/24/2002	2000	90	Steel	2/5/2007	1838	0.93	2766.03	1.32	1.7	860.88	0	0	8093.73	2444.27	0.53	2.18	0.67	104.621	59.133	11.007	12.25
LAWA130	2/27/2002	2000	90	Steel	3/6/2002	7	6.11	25.59	0	0	14.81	0	0.73	126.53	76.74	0	1.8	0	0.922	0.925	0.357	10.65
LAWA130	2/27/2002	2000	90	Steel	3/27/2002	28	7.87	50.11	0	0	22.55	0	0.52	217.1	98.09	0.54	2.69	0.87	1.805	1.586	0.456	10.84
LAWA130	2/27/2002	2000	90	Steel	4/24/2002	56	8.75	64.01	0.3	0	28.13	0	0.7	286.9	109.47	0.63	2.77	1.15	2.305	2.097	0.509	11.04
LAWA130	2/27/2002	2000	90	Steel	6/27/2002	120	11.4	92.65	0.7	1.15	40.79	0	0.91	419	142.37	0.89	3.58	1.41	3.337	3.062	0.661	11.14
LAWA130	2/27/2002	2000	90	Steel	8/26/2002	180	10.53	94.21	0.55	1.7	38.76	0	0.96	469.83	137.3	0.79	3.67	1.53	3.393	3.433	0.638	11.35
LAWA130	2/27/2002	2000	90	Steel	11/25/2002	271	13.82	120.41	0	1.84	53.94	0	1.12	474.77	169.78	0.72	4.41	1.24	4.336	3.469	0.789	11.45
LAWA130	2/27/2002	2000	90	Steel	2/26/2003	364	13.39	127.24	0.33	0	55.35	0	0.71	506.83	171.08	0.67	3.34	1.08	4.582	3.704	0.795	11.56
LAWA130	2/27/2002	2000	90	Steel	8/25/2003	544	12.51	141.61	0	0	55.96	0	0	592.36	170.89	0.45	0	0.81	5.1	4.329	0.794	11.64
LAWA130	2/27/2002	2000	90	Steel	2/25/2004	728	9.93	132.62	0	0	57.64	0	0.31	573.09	166.12	0	1.2	0	4.776	4.188	0.772	11.74
LAWA130	2/27/2002	2000	90	Steel	2/22/2005	1091	2.97	252.42	0.24	0	112.73	0	0	946.64	358.04	0	0	0	9.09	6.918	1.663	11.85
LAWA130	2/27/2002	2000	90	Steel	2/15/2006	1449	0	911.13	0.22	0	316.69	0	0	2939.57	869.44	0	0	0	32.813	21.481	4.039	11.94
LAWA130	2/27/2002	2000	90	Steel	2/27/2007	1826	0	1033.9	0.54	0	378.62	0	0	3220.03	1078.77	0	0.59	0	37.234	23.531	5.012	12.03
LAWA133	9/11/2002	2000	90	Steel	9/18/2002	7	6.39	29.89	0.4	0	3.39	0	0	168.33	92.72	0	0	0	1.081	1.136	0.445	11.14
LAWA133	9/11/2002	2000	90	Steel	10/9/2002	28	6.07	45.59	0.49	0	3.2	0	0	230.77	126.07	0	0	0	1.65	1.557	0.606	11.22
LAWA133	9/11/2002	2000	90	Steel	11/6/2002	56	6.41	52.51	0	0	3.62	0	0	333.1	133.73	0	0	0	1.9	2.247	0.642	11.34
LAWA133	9/11/2002	2000	90	Steel	6/9/2003	271	5.26	100.47	0.56	0	7.8	0	0	566.67	211.53	0	0	0	3.635	3.823	1.016	11.64
LAWA133	9/11/2002	2000	90	Steel	9/11/2003	365	11.12	774.51	1.42	0	39.58	0	1.04	2529.23	588.18	0	0	0	28.024	17.063	2.826	11.74
LAWA133	9/11/2002	2000	90	Steel	3/11/2004	547	0.74	1222.93	0.94	0	71.75	0	0	3832.07	857.27	0	0.51	0	44.248	25.852	4.118	11.84
LAWA133	9/11/2002	2000	90	Steel	9/14/2005	1099	5.4	1701.2	1.43	0	131.77	0	0	5418.83	1266.47	0	0	0	61.553	36.557	6.084	12.05
LAWA134	9/11/2002	2000	90	Steel	9/18/2002	7	6.65	28.39	0	0	13.12	0	0	102.5	63.06	0	0.81	0	0.918	0.779	0.301	10.52
LAWA134	9/11/2002	2000	90	Steel	10/9/2002	28	7.33	62.56	0.26	1.24	23.41	0	0.58	175.33	92.28	0	1.29	0.82	2.022	1.333	0.441	10.66
LAWA134	9/11/2002	2000	90	Steel	11/6/2002	56	7.66	74.71	0	1.39	26.78	0	0.98	266.73	91.35	0	1.56	1.06	2.415	2.028	0.437	10.97
LAWA134	9/11/2002	2000	90	Steel	6/9/2003	271	7.54	114.06	0.33	0	39.81	0	0	393.5	113.81	0.6	0	0.75	3.687	2.992	0.544	11.24
LAWA134	9/11/2002	2000	90	Steel	9/11/2003	365	9.56	119.85	0.26	0	39.81	0	0	368.98	113	0.52	0	0.93	3.874	2.805	0.54	11.35
LAWA134	9/11/2002	2000	90	Steel	3/11/2004	547	8.38	122.44	0.21	1.3	43.58	0	0.64	412.89	116.93	0.46	1.67	1.26	3.958	3.139	0.559	11.43
LAWA134	9/11/2002	2000	90	Steel	9/14/2005	1099	8.6	144.45	0.32	0	48.4	0	0	448.54	132.69	0	0.46	0.63	4.669	3.41	0.634	11.64
LAWA134	9/11/2002	2000	90	Steel	10/9/2007	1854	4.24	203.39	0.17	0	61.35	0	0	620.24	171.95	0	0	0	6.574	4.715	0.822	11.76
LAWA135	9/11/2002	2000	90	Steel	9/18/2002	7	6.92	27.2	0	0	12.17	0	0	93.78	62.68	0	0.77	0	0.868	0.743	0.296	10.43
LAWA135	9/11/2002	2000	90	Steel	10/9/2002	28	6.48	57.54	0.2	1.39	19.63	0	0.59	157.63	86.07	0	1.2	0.78	1.836	1.249	0.406	10.57
LAWA135	9/11/2002	2000	90	Steel	11/6/2002	56	6.69	70.24	0	1.4	22.91	0	0.87	236.1	85.58	0.49	1.5	1.03	2.242	1.87	0.404	10.67
LAWA135	9/11/2002	2000	90	Steel	6/9/2003	271	6.38	108.79	0.39	0	34.47	0	0	357.01	107.75	0	0	0.91	3.472	2.828	0.509	10.94
LAWA135	9/11/2002	2000	90	Steel	9/11/2003	365	8.21	117.79	0.23	0	36.22	0	0	324.65	109.28	0.58	0	0.77	3.759	2.572	0.516	11.04
LAWA135	9/11/2002	2000	90	Steel	3/11/2004	547	6.49	113.69	0.12	1.14	37.6	0	0.62	371.15	109.67	0.46	1.58	1.25	3.628	2.94	0.518	11.15
LAWA135	9/11/2002	2000	90	Steel	9/14/2005	1099	6.82	146.21	0.38	0	44.87	0	0	428.77	137.61	0.51	0	0.68	4.666	3.396	0.65	11.35
LAWA135	9/11/2002	2000	90	Steel	10/9/2007	1854	2.42	188.77	0.11	0	52.65	0	0	491.72	167.76	0	0	0.49	6.024	3.895	0.792	11.37
LAWA136	9/11/2002	2000	90	Steel	9/18/2002	7	5.34	23.49	0.15	0	12.3	0	0	89.12	61.06	0	0.53	0	0.75	0.706	0.295	10.56
LAWA136	9/11/2002	2000	90	Steel	10/9/2002	28	6.38	46.05	0.29	0	20.2	0	0.31	137.8	85.09	0	0.73	0	1.47	1.092	0.411	10.67
LAWA136	9/11/2002	2000	90	Steel	11/6/2002	56	6.29	54.61	0	0	21.4	0	0.56	203.07	81.74	0	0.91	0</				

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWA41	3/24/1999	2000	90	Steel	3/23/2001	730	15.86	93.3	0.66	0	51.6	0	0	562.33	200.77	0	0	0	4.006	3.789	0.989	12.12
LAWA41	3/24/1999	2000	90	Steel	11/14/2002	1331	2.38	1423.53	0.69	0	460.92	0	0	5120	1467.5	0	1.13	0	61.123	34.503	7.232	12.25
LAWA41	4/20/1999	2000	90	Teflon	4/27/1999	7	11.17	24.53	0.71	1.34	16.75	0	0.47	172.27	89.89	0	0.93	0	1.053	1.161	0.443	11.06
LAWA41	4/20/1999	2000	90	Teflon	5/17/1999	27	11.5	36.08	0.43	1.36	22	0	0.63	228.03	97.99	0	1.15	0.71	1.549	1.537	0.483	11.02
LAWA41	4/20/1999	2000	90	Teflon	6/15/1999	56	11.45	42.32	0.25	1.58	22.46	0	0.63	270.77	104.83	0	0.96	0.83	1.817	1.825	0.517	11.06
LAWA41	4/20/1999	2000	90	Teflon	8/18/1999	120	8.99	54.32	0	1.62	30.55	0	0.77	359.4	98.95	0	1.79	0.76	2.332	2.422	0.488	11.11
LAWA41	4/20/1999	2000	90	Teflon	10/18/1999	181	5.78	60.11	0.22	0	29.58	0	0.66	335.63	86.43	0	3.33	0.59	2.581	2.262	0.426	10.43
LAWA41	4/20/1999	2000	90	Teflon	1/4/2000	259	4.94	80.68	0.34	1.28	41.73	0	0.84	451.37	88.64	0	3.14	0.65	3.464	3.042	0.437	10.14
LAWA42	3/24/1999	2000	90	Steel	3/31/1999	7	9.72	43.65	0.42	0	22.49	0	0.38	206.4	77.24	0	0.99	0	1.556	1.391	0.435	11.27
LAWA42	3/24/1999	2000	90	Steel	4/6/1999	13	11.49	63.78	0.68	1.6	26.82	0	0.45	264.23	101.77	0	1.26	0.46	2.274	1.78	0.573	11.42
LAWA42	3/24/1999	2000	90	Steel	5/19/1999	56	13.07	76.46	0.55	1.69	37.45	0	0.51	315.2	108.5	0	1.53	0.55	2.726	2.124	0.611	11.57
LAWA42	3/24/1999	2000	90	Steel	7/22/1999	120	15.45	91.18	0.42	1.78	43.97	0	0.45	424.36	120.12	0	1.37	0	3.25	2.859	0.676	11.72
LAWA42	3/24/1999	2000	90	Steel	9/20/1999	180	14.61	99.76	0.65	1.39	50.06	0	0.36	494.33	131.13	0	0.78	0	3.556	3.331	0.738	11.82
LAWA42	3/24/1999	2000	90	Steel	12/20/1999	271	15.04	107.1	0.57	0	49.7	0	0.39	487.67	136.2	0	0.82	0	3.818	3.286	0.767	11.87
LAWA42	3/24/1999	2000	90	Steel	3/23/2000	365	15.46	119.07	0.19	0	54.38	0	0	537.1	150.03	0	0	0	4.245	3.619	0.845	11.93
LAWA42	3/24/1999	2000	90	Steel	9/21/2000	547	14.55	124.33	0.3	0	62.02	0	0	546.9	158.67	0	0	0	4.432	3.685	0.893	11.98
LAWA42	3/24/1999	2000	90	Steel	3/23/2001	730	9.52	307.47	0.53	0	119.43	0	0	1093.8	279.53	0	0	0	10.961	7.37	1.574	12.15
LAWA42	3/24/1999	2000	90	Steel	11/14/2002	1331	4.24	2433.93	0.96	0	657.01	0	0	6907.7	1117.33	0	1.64	0	86.765	46.545	6.29	12.26
LAWA42	4/20/1999	2000	90	Teflon	4/27/1999	7	9.55	42.2	0.23	0	22.06	0	0.38	205.27	78.95	0	0.86	0	1.504	1.383	0.444	11.31
LAWA42	4/20/1999	2000	90	Teflon	5/17/1999	27	10.43	64.37	0.21	0	30.78	0	0.56	279.87	90.01	0	1.13	0.5	2.295	1.886	0.507	11.25
LAWA42	4/20/1999	2000	90	Teflon	6/15/1999	56	10.81	74.09	0.17	1.17	33.07	0	0.51	339.3	96.64	0	0.75	0.57	2.641	2.286	0.544	11.28
LAWA42	4/20/1999	2000	90	Teflon	8/18/1999	120	8.73	88.13	0	0	41.78	0	0.5	423.27	89.52	0	0.83	0.48	3.142	2.852	0.504	11.28
LAWA42	4/20/1999	2000	90	Teflon	10/18/1999	181	6.23	95.17	0.12	0	40.29	0	0.45	390.33	78.79	0	2.36	0	3.393	2.63	0.444	10.65
LAWA42	4/20/1999	2000	90	Teflon	1/4/2000	259	4.16	115.47	0.18	0	51.6	0	0.37	496.83	70.28	0	1.55	0	4.116	3.348	0.396	10.35
LAWA43-1	3/24/1999	2000	90	Steel	3/31/1999	7	22.22	17.59	0.37	0	12.98	0	0.25	127.8	57.66	0	0.77	0	0.767	0.861	0.325	11.21
LAWA43-1	3/24/1999	2000	90	Steel	4/6/1999	13	25.36	26.6	0.56	1.89	14.15	0	0.31	168.2	78.02	0	1.16	0.77	1.159	1.133	0.439	11.27
LAWA43-1	3/24/1999	2000	90	Steel	5/19/1999	56	29.76	35	0.74	2.44	21.1	0	0.53	207.57	83.42	0.57	1.71	1.01	1.525	1.399	0.47	11.43
LAWA43-1	3/24/1999	2000	90	Steel	7/22/1999	120	32.28	44.77	0.5	2.83	25.03	0	0.73	287.09	90.44	0.7	2.22	1.02	1.951	1.934	0.509	11.51
LAWA43-1	3/24/1999	2000	90	Steel	9/20/1999	180	32.73	52.84	1.14	2.94	30.89	0	0.77	339.5	98.33	0.7	2.04	1.03	2.303	2.288	0.554	11.64
LAWA43-1	3/24/1999	2000	90	Steel	12/20/1999	271	35.2	59.83	0.4	3.07	30.44	0	1.01	361.7	106.4	0.57	3.01	0.95	2.607	2.437	0.599	11.76
LAWA43-1	3/24/1999	2000	90	Steel	3/23/2000	365	38.06	68.96	0.44	3.18	35.53	0	1	393.87	116.33	0.67	3.09	1.14	3.005	2.654	0.655	11.84
LAWA43-1	3/24/1999	2000	90	Steel	9/21/2000	547	36.38	77.78	0.56	1.9	41.77	0	0.45	417.9	121.1	0	1.26	0.77	3.389	2.816	0.682	11.92
LAWA43-1	3/24/1999	2000	90	Steel	3/23/2001	730	30.56	91.57	0.66	1.57	41.42	0	0.3	500.7	130	0	0.87	0	3.99	3.374	0.732	12.12
LAWA43-1	3/24/1999	2000	90	Steel	11/14/2002	1331	10.3	2907.1	1.7	1.26	1226.2	0	0	8554.17	717.31	0	2.93	0	126.683	57.639	4.038	12.24
LAWA43-1	4/20/1999	2000	90	Teflon	4/27/1999	7	23.18	18.14	0.4	0	12.52	0	0.26	132.47	59.47	0	0	0	0.79	0.893	0.335	11.11
LAWA43-1	4/20/1999	2000	90	Teflon	5/17/1999	27	24.84	26.68	0.41	1.24	16.85	0	0.41	177.57	65.16	0	1.26	0.59	1.163	1.196	0.367	11.04
LAWA43-1	4/20/1999	2000	90	Teflon	6/15/1999	56	25.09	33.44	0.28	1.5	17.95	0	0.51	214.37	70.62	0.45	1.09	0.83	1.457	1.444	0.398	11.06
LAWA43-1	4/20/1999	2000	90	Teflon	8/18/1999	120	22.13	45.92	0	1.47	24.88	0	0.77	295.43	64.88	0.5	1.79	0.83	2.001	1.991	0.365	11.12
LAWA43-1	4/20/1999	2000	90	Teflon	10/18/1999	181	16.78	52.62	0.16	1.31	23.8	0	0.97	184.53	55.25	0	3.57	0.77	2.293	1.243	0.311	10.43
LAWA43-1	4/20/1999	2000	90	Teflon	1/4/2000	259	10.28	65.01	0.2	1.59	25.99	0	1.18	338.93	43.3	0.5	4.5	0.81	2.833	2.284	0.244	10.13
LAWA44	4/29/1999	2000	90	Steel	5/6/1999	7	10.51	20.51	0.36	1.1	0	0	0.49	106.07	68.11	0	0	0	0.742	0.715	0.327	10.27
LAWA44	4/29/1999	2000	90	Steel	5/27/1999	28	11.86	36.2	0.39	1.53	0	0	0.61	162.17	83.46	0	1.35	0.65	1.31	1.093	0.401	10.33
LAWA44	4/29/1999	2000	90	Steel	6/24/1999	56	12.12	45.62	0.67	2.02	3.09	0	0.79	223.97	92.22	0.54	0.98	0.86	1.65	1.509	0.443	10.43
LAWA44	4/29/1999	2000	90	Steel	8/27/1999	120	13.86	59.32	0.46	2.29	3.3	0	0.82	261.37	106.43	0.68	0.84	0.97	2.146	1.761	0.511	10.66
LAWA44	4/29/1999	2000	90	Steel	10/26/1999	180	12.6	67.95	0.38	2.75	4.31	0	1.22	304.47	115.37	0.94	2.33	1.42	2.458	2.051	0.554	10.84
LAWA44	4/29/1999	2000	90	Steel	1/24/2000	270	13.21	78.74	0.4	2.52	4.18	0	1.14	313.77	127.67	0.74	2.73	1.05	2.848	2.114	0.613	11.15
LAWA44	4/29/1999	2000	90	Steel	5/4/2000	371	13.01	86.12	0.26	2.62	4.2	0	1.17	335.1	134.5	0.78	2.81	1.16	3.115	2.258	0.646	11.27
LAWA44	4/29/1999	2000	90	Steel	10/27/2000	547	11.58	90.23	0.13	2.18	6.5	0	0.85	464.83	135.43	0.64	1.76	1.13	3.264	3.132	0.65	11.32
LAWA44	4/29/1999	2000	90	Steel	4/25/2001	727	12.04	101.07	0.47	2.31	5.74	0	0.92	429.3	153.37	0.44	2.53	0.79	3.656	2.892	0.736	11.43
LAWA44	4/29/1999	2000	90	Steel	11/15/2002	1296	6.81	174.92	0.17	1.36	8.57	0	0.34	679.49	254.97	0	1.05	0.62	6.328	4.578	1.224	11.55
LAWA44	5/12/1999	2000	90	Teflon	5/19/1999	7	8.36	20.79	0.31	0	0	0	0.32	100.63	64.48	0	0	0	0.752	0.678	0.31	10.43
LAWA44	5/12/1999	2000	90	Teflon	6/9/1999	28	8.76	35.18	0.29	1.15	2.35	0	0.52	165.6	78.36	0	0.59	0.51	1.273	1.116	0.376	10.41
LAWA44	5/12/1999	2000	90	Teflon	7/7/1999	56	7.54	44.73	0.39	1.38	2.86	0	0.61	219.63	77.29	0	0.98	0.81	1.618	1.48	0.371	10.38
LAWA44	5/12/1999	2000	90	Teflon	9/9/1999	120	4.62	60.35	0.17	0	2.48	0	0.37	273.1	74.5	0	0.84	0.75	2.183	1.84	0.358	10.37
LAWA44	5/12/1999	2000	90	Teflon	11/8/1999	180	3.01	73.09	0.38	0	2.81	0	0.34	283.27	73.65	0	1.33	0.78	2.644	1.9		

The Catholic University of America
Vitreous State Laboratory

ILAW Glass Testing for Disposal at IDF
Final Report, VSL-11R2270-1, Rev. 0

Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWA45	4/29/1999	2000	90	Steel	8/27/1999	120	6.74	226.53	0.24	2.69	5.59	0	1.16	521.97	93.94	0.9	1.67	1.55	6.13	3.518	0.451	10.47
LAWA45	4/29/1999	2000	90	Steel	10/26/1999	180	6.09	268.67	0.2	2.75	6.75	0	1.37	640.5	104.47	1.03	2.34	1.52	7.271	4.317	0.502	10.58
LAWA45	4/29/1999	2000	90	Steel	1/24/2000	270	5.83	303.37	0.16	2.82	7.71	0	1.27	702.97	111	1.23	2.61	2.15	8.21	4.738	0.533	10.72
LAWA45	4/29/1999	2000	90	Steel	5/4/2000	371	5.96	345.4	0	1.58	8.6	0	0.72	723.37	117.97	0.7	1.45	1.2	9.347	4.875	0.567	10.87
LAWA45	4/29/1999	2000	90	Steel	10/27/2000	547	5.08	366.73	0	0	11.26	0	0	954.43	115.53	0	0	0.9	9.925	6.432	0.555	10.94
LAWA45	4/29/1999	2000	90	Steel	4/25/2001	727	5.29	421.83	0.22	0	11.28	0	0	914.3	131.57	0	0	0	11.416	6.162	0.632	11.06
LAWA45	4/29/1999	2000	90	Steel	11/15/2002	1296	7.38	576.51	0.1	0	16.29	0	0	1302.57	191.19	0	0	0	15.602	8.779	0.918	11.17
LAWA45	5/12/1999	2000	90	Teflon	5/19/1999	7	7.71	59.53	0.18	1.54	0	0	0.56	154.9	61.69	0	0.91	0.57	1.611	1.044	0.296	10.33
LAWA45	5/12/1999	2000	90	Teflon	6/9/1999	28	6.61	128.73	0	2.64	3.39	0	1.33	324.97	76.76	0.69	2.18	1.18	3.484	2.19	0.369	10.27
LAWA45	5/12/1999	2000	90	Teflon	7/7/1999	56	5	163.87	0.25	2.62	4.44	0	1.32	444.57	74.36	0.78	2.58	1.43	4.435	2.996	0.357	10.27
LAWA45	5/12/1999	2000	90	Teflon	9/9/1999	120	2.72	227.87	0.19	1.3	4.91	0	0.63	561.7	75.19	0.71	1.38	1.2	6.167	3.786	0.361	10.26
LAWA45	5/12/1999	2000	90	Teflon	11/8/1999	180	1.85	267.9	0.31	1.13	4.58	0	0.46	578.07	74.3	0.55	2.12	1.03	7.25	3.896	0.357	10.06
LAWA45	5/12/1999	2000	90	Teflon	1/7/2000	240	0	325.5	0	0	3.74	0	0.41	867.07	68.09	0	1.11	0	8.809	5.844	0.327	9.82
LAWA49	5/26/1999	2000	90	Steel	6/2/1999	7	9.63	17.18	0.17	2.09	0	0	0.49	86.71	63.38	0	1.04	0	0.621	0.584	0.304	10.51
LAWA49	5/26/1999	2000	90	Steel	6/23/1999	28	10.61	33.82	0	4.11	1.79	0	0.92	144.7	79.41	0.6	2.31	1.05	1.223	0.975	0.381	10.60
LAWA49	5/26/1999	2000	90	Steel	7/21/1999	56	11.47	48.75	0.23	5.59	2.13	0	1.23	192.17	90.37	0.96	3.02	1.52	1.763	1.295	0.434	10.82
LAWA49	5/26/1999	2000	90	Steel	9/23/1999	120	11.92	65.13	0.2	7.01	2.44	0	1.5	247.5	103.83	1.41	4.01	2.22	2.356	1.668	0.498	11.11
LAWA49	5/26/1999	2000	90	Steel	11/22/1999	180	12.39	75.49	0.29	8.3	3.15	0	1.8	276.27	117.63	1.6	4.84	2.55	2.73	1.861	0.565	11.22
LAWA49	5/26/1999	2000	90	Steel	2/21/2000	271	13.8	92.09	0	9.86	3.61	0	2.38	314.33	126.87	1.99	5.92	2.94	3.331	2.118	0.609	11.32
LAWA49	5/26/1999	2000	90	Steel	5/25/2000	365	13.58	104.4	0	10.05	4.12	0	2.19	348.8	135.9	1.93	6.17	3.08	3.776	2.35	0.652	11.42
LAWA49	5/26/1999	2000	90	Steel	11/21/2000	545	12.55	108.47	0.34	9.14	4.82	0	2	414.23	134.03	1.86	5.9	2.55	3.923	2.791	0.643	11.53
LAWA49	5/26/1999	2000	90	Steel	5/24/2001	729	19.98	170.34	0.12	12.68	7.7	0	2.76	542.34	202.92	2.87	7.43	4.37	6.161	3.654	0.974	11.64
LAWA49	5/26/1999	2000	90	Steel	11/18/2002	1272	15.82	183.28	0.28	10.05	8.15	0	2.51	617.19	197.59	2.26	7.38	3.32	6.629	4.158	0.949	11.77
LAWA50	5/26/1999	2000	90	Steel	6/2/1999	7	10.93	17.28	0.28	1.89	0	0	0.44	88.98	61	0	0.86	0	0.625	0.6	0.307	10.62
LAWA50	5/26/1999	2000	90	Steel	6/23/1999	28	11.87	34.46	0.18	4.16	1.82	0	0.83	149.03	75.85	0.47	1.89	0.82	1.247	1.004	0.381	10.71
LAWA50	5/26/1999	2000	90	Steel	7/21/1999	56	12.51	48.93	0.2	5.99	2.18	0	1.12	193.17	86.47	0.86	2.41	1.31	1.77	1.302	0.435	10.92
LAWA50	5/26/1999	2000	90	Steel	9/23/1999	120	13.51	66.9	0.36	8.06	2.71	0	1.38	255.07	101.07	1.37	3.5	2.02	2.42	1.719	0.508	11.21
LAWA50	5/26/1999	2000	90	Steel	11/22/1999	180	13.76	78.7	0.14	10.47	3.56	0	1.73	283.2	115.57	1.77	4.6	2.52	2.847	1.909	0.581	11.34
LAWA50	5/26/1999	2000	90	Steel	2/21/2000	271	14.98	92.03	0	12.47	3.65	0	2.21	318.7	121.7	2.12	5.47	2.95	3.33	2.148	0.612	11.45
LAWA50	5/26/1999	2000	90	Steel	5/25/2000	365	14.85	104.73	0	13.1	4.59	0	2.11	360.33	133.47	2.2	5.91	3.2	3.789	2.428	0.671	11.52
LAWA50	5/26/1999	2000	90	Steel	11/21/2000	545	14.83	116.47	0.2	12.75	5.39	0	2.02	424.6	138.77	2.3	5.82	2.75	4.214	2.862	0.698	11.65
LAWA50	5/26/1999	2000	90	Steel	5/24/2001	729	21.94	183.08	0.13	17.31	8.16	0	2.61	592.18	207.6	3.3	7.24	4.69	6.624	3.991	1.044	11.75
LAWA50	5/26/1999	2000	90	Steel	11/18/2002	1272	18.98	201.37	0.31	13.13	8.45	0	2.06	666.89	205.33	2.6	6.69	3.77	7.286	4.495	1.032	11.85
LAWA51	5/26/1999	2000	90	Steel	6/2/1999	7	8.37	26.24	0.1	1.57	0	0	0.41	69.32	52.5	0	0.83	0	0.706	0.519	0.241	10.03
LAWA51	5/26/1999	2000	90	Steel	6/23/1999	28	7.53	75.34	0	2.91	0	0	1.22	169.13	63.67	0.63	2.66	1.1	2.026	1.266	0.292	10.12
LAWA51	5/26/1999	2000	90	Steel	7/21/1999	56	6.62	115.63	0.22	3.46	2.32	0	1.79	254.27	71.23	0.92	3.44	1.5	3.11	1.904	0.327	10.22
LAWA51	5/26/1999	2000	90	Steel	9/23/1999	120	4.8	158.53	0.3	2.59	2.96	0	1.21	333.5	76.6	1	2.43	1.9	4.263	2.497	0.352	10.26
LAWA51	5/26/1999	2000	90	Steel	11/22/1999	180	4.54	190.57	0.96	2.87	3.8	0	1.57	375.37	88.16	1.08	3.32	1.98	5.125	2.81	0.405	11.22
LAWA51	5/26/1999	2000	90	Steel	2/21/2000	271	4.58	237.33	0.15	2.89	3.9	0	1.33	456.33	93.47	1.31	2.41	2.42	6.382	3.417	0.429	11.34
LAWA51	5/26/1999	2000	90	Steel	5/25/2000	365	3.55	273.73	0	2.44	5.21	0	1.15	528.2	97.47	1.25	2.62	2.4	7.361	3.955	0.448	11.43
LAWA51	5/26/1999	2000	90	Steel	11/21/2000	545	3.43	303.53	1.78	2.78	6.36	0	1.6	642.47	102.53	1.26	3.39	2.02	8.163	4.81	0.471	11.52
LAWA51	5/26/1999	2000	90	Steel	5/24/2001	729	5.23	510.19	0.53	3.53	11.22	0	1.8	943.76	152.31	1.79	3.37	2.98	13.72	7.066	0.7	11.65
LAWA51	5/26/1999	2000	90	Steel	11/18/2002	1272	3.29	516.27	0.2	1.67	9.99	0	0.46	977.76	135.51	1.17	1.39	1.83	13.884	7.321	0.622	11.75
LAWA52	6/22/1999	2000	90	Steel	6/29/1999	7	5.56	16.36	1.19	0	3.15	0	0	163.6	67.82	0	0	0	0.851	1.103	0.343	10.82
LAWA52	6/22/1999	2000	90	Steel	7/20/1999	28	7.63	28.94	0.47	0	4.54	0	0	271.1	109.63	0	0	0	1.506	1.827	0.555	11.33
LAWA52	6/22/1999	2000	90	Steel	8/17/1999	56	8.01	37.7	0.95	0	6	0	0	333.87	125.4	0	0	0	1.961	2.25	0.635	11.77
LAWA52	6/22/1999	2000	90	Steel	10/20/1999	120	8.96	42.61	0.5	0	6.3	0	0	378.2	147.8	0	0	0	2.217	2.549	0.749	11.85
LAWA52	6/22/1999	2000	90	Steel	12/19/1999	180	9.92	48.86	0.51	0	6.55	0	0	443.9	168.13	0	0	0	2.542	2.992	0.851	11.96
LAWA52	6/22/1999	2000	90	Steel	3/17/2000	269	9.01	51.73	0.47	0	7.32	0	0	496.17	171.17	0	0	0	2.691	3.344	0.867	12.04
LAWA52	6/22/1999	2000	90	Steel	6/21/2000	365	2.22	651.33	0	0	82.97	0	0	3131.4	590.7	0	0	0	33.885	21.105	2.991	12.17
LAWA52	6/22/1999	2000	90	Steel	12/19/2000	546	0	880.1	1.08	0	121.5	0	0	3922.5	726	0	0.62	0	45.786	26.436	3.677	12.36
LAWA52	6/22/1999	2000	90	Steel	6/21/2001	730	2.56	1299.77	1.05	1.86	195.89	0	0	6269.8	1019.47	0	1.56	0	67.619	42.257	5.163	12.56
LAWA52	6/22/1999	2000	90	Steel	6/22/2004	1827	2.95	1995.47	0.68	1.53	315.67	0	0	7525.27	1026.33	0	1.49	0	103.813	50.718	5.198	12.92
LAWA52	6/22/1999	2000	90	Steel	6/20/2005	2190	2.37	1686.53	0.62	1.56	239.31	0	0	6808.13	922.63	0	1.36	0	87.74	45.885	4.672	12.92
LAWA52	6/22/1999	2000	90	Steel	6/23/2006	2558	2.27	1735.87	0.93	1.58	243.2	0	0	6859.77	972.95	0	1.11	0	90.307	46.233	4.927	12.96
LAWA53																						

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWA56	7/25/2002	2000	90	Steel	10/3/2007	1896	5.88	376.46	0.41	0	17.02	0	0	980.33	182.81	0	0	0	10.062	6.634	0.929	11.75
LAWA60	6/22/1999	2000	90	Steel	6/29/1999	7	8.88	20.11	0.63	0	0	0	0	92.5	47.72	0	0	0	0.577	0.623	0.229	10.21
LAWA60	6/22/1999	2000	90	Steel	7/20/1999	28	10.54	42.44	0.25	0	2.48	0	0	172.73	57.61	0	0	0	1.217	1.164	0.277	10.52
LAWA60	6/22/1999	2000	90	Steel	8/17/1999	56	10.86	60	0.94	0	3.43	0	0	216.37	71.8	0	0	0	1.721	1.458	0.345	10.82
LAWA60	6/22/1999	2000	90	Steel	10/20/1999	120	10.73	72.6	0.35	0	3.32	0	0.25	239.47	79.71	0	0	0	2.082	1.614	0.383	11.12
LAWA60	6/22/1999	2000	90	Steel	12/19/1999	180	11.28	83.33	0.5	0	3.57	0	0	274.27	89.94	0	0	0	2.39	1.848	0.432	11.23
LAWA60	6/22/1999	2000	90	Steel	3/17/2000	269	11.54	88.43	0.23	0	4.44	0	0.37	302.03	92.37	0	0	0	2.536	2.036	0.444	11.35
LAWA60	6/22/1999	2000	90	Steel	6/21/2000	365	11.14	94.55	0	0	4.82	0	0	323.8	93.64	0	0	0	2.712	2.182	0.45	11.45
LAWA60	6/22/1999	2000	90	Steel	12/19/2000	546	7.65	113.1	0.62	0	6.45	0	0	364.53	121.53	0	0	0	3.244	2.457	0.584	11.55
LAWA60	6/22/1999	2000	90	Steel	6/21/2001	730	2.71	177.15	1.51	0	12.08	0	0	584.94	242.39	0	0	0	5.081	3.942	1.164	11.65
LAWA60	6/22/1999	2000	90	Steel	6/22/2004	1827	0.85	3637.07	3.03	0	191.28	0	0	8128.3	1095	0	0	0	104.322	54.782	5.259	12.07
LAWA60	6/22/1999	2000	90	Steel	6/20/2005	2190	0	3086.57	3.18	0	193.7	0	0	7350.37	968.78	0	0	0	88.532	49.539	4.652	12.02
LAWA60	6/22/1999	2000	90	Steel	6/23/2006	2558	0	3244.47	3.05	0	181.41	0	0	7540.23	980.25	0	0	0	93.061	50.819	4.707	12.14
LAWA65	7/25/2002	2000	90	Steel	8/1/2002	7	10.21	27.02	0.27	0	3.22	0	0	194.73	93.65	0	0	0	1.411	1.317	0.476	11.42
LAWA65	7/25/2002	2000	90	Steel	8/22/2002	28	14.67	42.58	0.11	0	4.41	0	0.44	275.3	125.13	0	0	0	2.224	1.862	0.636	11.54
LAWA65	7/25/2002	2000	90	Steel	9/19/2002	56	13.44	54.64	0.21	0	5.3	0	0.37	363.43	150.8	0	0	0	2.853	2.459	0.767	11.65
LAWA65	7/25/2002	2000	90	Steel	4/14/2003	263	7.97	451.16	0.53	0	40.15	0	0	2232.6	550.65	0	0	0	23.56	15.104	2.799	11.93
LAWA65	7/25/2002	2000	90	Steel	7/22/2003	362	6.36	823.11	0.42	0	75.41	0	0	3367.53	871.23	0	0	0	42.984	22.782	4.429	12.04
LAWA65	7/25/2002	2000	90	Steel	1/28/2004	552	8.15	1026.1	0.49	0	97.45	0	0	3879.37	873.42	0	0	0	53.584	26.245	4.44	12.14
LAWA65	7/25/2002	2000	90	Steel	7/12/2006	1448	1.48	1341.67	1.37	0	171.94	0	0	5162.53	1046.4	0	0	0	70.064	34.926	5.319	12.45
LAWA76	3/16/2000	2000	90	Steel	3/23/2000	7	3.06	47.77	0.78	0	3.7	32.96	0	98.61	76.23	0	0	0	1.409	1.316	0.389	10.82
LAWA76	3/16/2000	2000	90	Steel	4/13/2000	28	2.93	161.63	2.25	0	11.23	98.91	0	319.77	169.67	0	0	0	4.769	4.268	0.866	11.14
LAWA76	3/16/2000	2000	90	Steel	5/11/2000	56	2.79	223.03	2.66	0	14.39	115.53	0	390.97	200.83	0	0	0	6.58	5.219	1.025	11.26
LAWA76	3/16/2000	2000	90	Steel	7/13/2000	119	2.76	327.3	3.21	0	20.96	170.83	0	541.93	239.13	0	0	0	9.657	7.234	1.22	11.35
LAWA76	3/16/2000	2000	90	Steel	9/12/2000	180	3.44	583.63	1.95	0	36.68	285.2	0	878	277.23	0	0	0	17.219	11.72	1.415	11.53
LAWA76	3/16/2000	2000	90	Steel	12/11/2000	270	3.99	1871	5.2	0	127.93	687.8	0	2958.1	289.77	0	0	0	55.201	39.486	1.479	11.84
LAWA76	3/16/2000	2000	90	Steel	3/15/2001	364	4.72	2670.57	10.01	0	191.03	987.07	0	3593.13	269.87	0	0	0	78.792	47.963	1.377	11.97
LAWA81	9/14/1999	2000	90	Steel	9/21/1999	7	7.17	21.54	0.54	0	0	0	0	124.3	61.73	0	0	0	0.779	0.838	0.296	10.88
LAWA81	9/14/1999	2000	90	Steel	10/12/1999	28	9.68	30.15	0	0	3.83	0	0	161.63	76.29	0	0	0	1.091	1.089	0.366	10.91
LAWA81	9/14/1999	2000	90	Steel	11/9/1999	56	9.85	42.88	0.47	0	2.99	0	0.28	234.2	92.5	0	0	0	1.551	1.578	0.444	10.98
LAWA81	9/14/1999	2000	90	Steel	1/12/2000	120	10.11	52.85	0.21	0	3.87	0	0.46	264.5	105.7	0	0.84	0	1.912	1.783	0.508	11.25
LAWA81	9/14/1999	2000	90	Steel	3/13/2000	181	11.25	64.76	0.28	0	4.99	0	0.43	316.8	119.73	0	0.99	0	2.343	2.135	0.575	11.34
LAWA81	9/14/1999	2000	90	Steel	6/9/2000	269	10.69	77.67	0.4	1.43	4.79	0	0.48	356.5	131.87	0	1.09	0	2.81	2.403	0.633	11.45
LAWA81	9/14/1999	2000	90	Steel	9/13/2000	365	11.14	86.66	0.17	0	5.42	0	0.41	400.53	146.47	0	0	0	3.135	2.699	0.703	11.56
LAWA81	9/14/1999	2000	90	Steel	3/14/2001	547	11.82	103.5	0.59	0	5.65	0	0	465.77	168.3	0	0.66	0	3.745	3.139	0.808	11.74
LAWA81	9/14/1999	2000	90	Steel	9/13/2001	730	12.45	137.56	0.28	0	8.7	0	0	647.34	217.45	0	0.47	0	4.977	4.363	1.044	11.92
LAWA81	9/14/1999	2000	90	Steel	9/19/2002	1101	0	1022.6	1.51	0	78.79	0	0	3478.83	782.69	0	0.47	0	36.998	23.446	3.759	12.05
LAWA81	9/14/1999	2000	90	Steel	9/25/2003	1472	0.81	1753.77	1.29	0	118.35	0	0	5041.03	1263.77	0	0	0	63.452	33.975	6.069	12.15
LAWA81	9/14/1999	2000	90	Steel	9/22/2005	2200	4.85	1787.9	1.55	0	150.98	0	0.58	5366	1154.43	0	0	0	64.686	36.165	5.544	12.22
LAWA81	9/14/1999	2000	90	Steel	9/19/2006	2562	1.07	2178.87	1.05	0	154.53	0	0	6543.77	1499.83	0	0	0	78.832	44.102	7.203	12.27
LAWA82	9/14/1999	2000	90	Steel	9/21/1999	7	9.1	18.83	0.21	1.18	0	0	0.6	99.37	69.19	0	0.87	0.47	0.681	0.67	0.332	10.51
LAWA82	9/14/1999	2000	90	Steel	10/12/1999	28	10.18	33.74	0	2.03	2.91	0	1.1	143.1	81.95	0.97	1.89	1.03	1.221	0.964	0.394	10.65
LAWA82	9/14/1999	2000	90	Steel	11/9/1999	56	10.72	51.44	0.39	2.9	3.16	0	1.39	225.93	100.18	1.09	2.38	1.07	1.861	1.523	0.481	10.76
LAWA82	9/14/1999	2000	90	Steel	1/12/2000	120	10.82	70.8	0	2.91	3.07	0	1.7	259.73	112.5	1.2	3.63	1.34	2.562	1.75	0.54	10.97
LAWA82	9/14/1999	2000	90	Steel	3/13/2000	181	12.15	87.69	0	2.72	4.3	0	1.72	326.17	125.93	0.81	3.52	0.85	3.173	2.198	0.605	11.05
LAWA82	9/14/1999	2000	90	Steel	6/9/2000	269	11.28	95.91	0.17	3.38	3.45	0	1.68	347.07	130.47	0.93	3.87	1.07	3.47	2.339	0.627	11.14
LAWA82	9/14/1999	2000	90	Steel	9/13/2000	365	11.13	104.67	0	2.06	3.72	0	1.8	374.23	136.87	0.79	2.65	0.95	3.787	2.522	0.657	11.25
LAWA82	9/14/1999	2000	90	Steel	3/14/2001	547	11.31	115.33	0.31	2.61	3.66	0	1.14	404.47	147	0.65	2.63	0.86	4.173	2.726	0.706	11.36
LAWA82	9/14/1999	2000	90	Steel	9/13/2001	730	14.64	152.45	0.23	2.46	10.16	0	1.12	550.6	191.15	0.72	2.92	0.97	5.516	3.711	0.918	11.62
LAWA82	9/14/1999	2000	90	Steel	9/19/2002	1101	13.23	152.5	0.3	1.18	6.22	0	0.63	590.91	182.07	0.65	1.64	0	5.517	3.983	0.874	11.75
LAWA82	9/14/1999	2000	90	Steel	9/25/2003	1472	6.54	156.35	0	0	4.94	0	0	541.53	224.09	0	0	0.47	5.657	3.65	1.076	11.87
LAWA82	9/14/1999	2000	90	Steel	9/22/2005	2200	3.77	242.53	0.28	0	10.53	0	0	790.87	307.84	0	0	0	8.775	5.33	1.478	12.07
LAWA82	9/14/1999	2000	90	Steel	9/19/2006	2562	1.04	413.46	0	0	13.32	0	0	1143.63	491.6	0	0	0	14.959	7.708	2.361	12.15
LAWA82	9/14/1999	2000	90	Steel	8/9/2007	2886	0.68	648.74	0.09	0	27.7	0	0	1827	621.6	0	0	0	23.471	12.313	2.985	12.17
LAWA82	9/14/1999	2000	90	Steel	1/14/2008	3044	0	819.18	0.09	0	34.47	0	0	2375.87	750.39	0	0	0	29.638	16.012	3.604	12.22
LAWA82	9/14/1999	2000	90	Steel	1/9/2009	3405	0	1721.03	0.24	0	72.04	0	0	4535.53	1356.4	0	0	0	62.267	30.568	6.514	12.24
LAWA83	9/14/1999	2000	90	Steel	9/21/1999	7	6.6															

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWA83	9/14/1999	2000	90	Steel	1/14/2008	3044	0.7	1290.7	0.2	0	60.18	0	0	3864.23	948.02	0	0	0	46.698	26.043	4.553	12.12
LAWA83	9/14/1999	2000	90	Steel	1/9/2009	3405	0	2095	0.22	0	99.86	0	0	5398.17	1346.5	0	0	0	75.797	36.382	6.466	12.14
LAWA84	9/14/1999	2000	90	Steel	9/21/1999	7	6.96	16.33	0.43	0	0	0	0.41	99.2	66.25	0	0.71	0	0.591	0.669	0.318	10.41
LAWA84	9/14/1999	2000	90	Steel	10/12/1999	28	8.91	19.27	0.17	0	0	0	0.55	118.17	76.36	0	1	0	0.697	0.796	0.367	10.52
LAWA84	9/14/1999	2000	90	Steel	11/9/1999	56	9.65	23.42	0.58	0	0	0	0.65	159.97	91.51	0	0	0.71	0.847	1.078	0.439	10.72
LAWA84	9/14/1999	2000	90	Steel	1/12/2000	120	10.26	29.44	0.3	0	2.23	0	0.87	175.73	100.94	0.47	1.42	1.01	1.065	1.184	0.485	10.95
LAWA84	9/14/1999	2000	90	Steel	3/13/2000	181	11.03	40.01	0.27	0	2.89	0	0.92	225.3	109.87	0	1.48	0	1.448	1.518	0.528	11.06
LAWA84	9/14/1999	2000	90	Steel	6/9/2000	269	10.19	52.45	0.27	1.2	2.51	0	0.93	243.13	115.57	0.6	1.62	0.98	1.898	1.639	0.555	11.13
LAWA84	9/14/1999	2000	90	Steel	9/13/2000	365	9.84	60.11	0	0	2.87	0	0.99	272.07	121.6	0.56	0.94	0	2.175	1.834	0.584	11.27
LAWA84	9/14/1999	2000	90	Steel	3/14/2001	547	9.94	74.59	0.64	1.25	3.09	0	0.85	311.3	138.3	0.68	1.51	0.54	2.699	2.098	0.664	11.37
LAWA84	9/14/1999	2000	90	Steel	9/13/2001	730	11.61	105.16	0.21	0	4.68	0	0.67	437.09	180.68	0.97	1.22	0	3.805	2.946	0.868	11.64
LAWA84	9/14/1999	2000	90	Steel	9/19/2002	1101	9.26	102.89	0.69	1.13	4.59	0	0.98	422.18	172.07	0.73	1.78	0	3.723	2.845	0.826	11.76
LAWA84	9/14/1999	2000	90	Steel	9/25/2003	1472	4.05	125.89	0.14	0	5.04	0	0	478.55	209.86	0	0	0	4.555	3.225	1.008	11.85
LAWA84	9/14/1999	2000	90	Steel	9/22/2005	2200	2.76	235.38	0.27	0	12.06	0	0.25	877.61	342.34	0	0	0	8.516	5.915	1.644	11.97
LAWA84	9/14/1999	2000	90	Steel	9/19/2006	2562	0	357.03	0	0	14.21	0	0	1156.6	474.91	0	0	0	12.917	7.795	2.281	11.97
LAWA84	9/14/1999	2000	90	Steel	8/9/2007	2886	0	605.29	0.11	0	25.7	0	0	1791.63	559	0	0	0	21.899	12.075	2.684	12.05
LAWA84	9/14/1999	2000	90	Steel	1/14/2008	3044	0	777.81	0.17	0	34.93	0	0	2420.67	625.43	0	0	0	28.141	16.314	3.003	12.16
LAWA84	9/14/1999	2000	90	Steel	1/9/2009	3405	0	1584.03	0.28	0	70.95	0	0	4408.63	1016.37	0	0	0	57.31	29.712	4.881	12.22
LAWA87	10/13/1999	2000	90	Steel	10/20/1999	7	4.01	32.85	0.15	1.91	14.42	0	0.82	163.67	102.07	0	1.45	0	1.192	1.103	0.491	10.97
LAWA87	10/13/1999	2000	90	Steel	11/10/1999	28	4.53	55.36	0.46	2.88	21.64	0	0.95	298.8	142	0	1.22	0	2.009	2.013	0.683	11.23
LAWA87	10/13/1999	2000	90	Steel	12/8/1999	56	5.18	65.8	0.69	3.62	24.03	0	1.11	317.6	155.7	0	2.42	0.48	2.388	2.14	0.749	11.37
LAWA87	10/13/1999	2000	90	Steel	2/10/2000	120	5.03	76.77	0.47	3.33	28.73	0	1.05	337.79	166.28	0	2.69	0.48	2.786	2.276	0.8	11.53
LAWA87	10/13/1999	2000	90	Steel	4/10/2000	180	5.53	86.97	0.51	3.85	29.84	0	1.13	424.17	177.83	0	2.65	0	3.156	2.858	0.856	11.65
LAWA87	10/13/1999	2000	90	Steel	7/10/2000	271	6.25	98.9	0	2.91	35.01	0	1.06	411.3	208.4	0	2.1	0	3.589	2.771	1.003	11.77
LAWA87	10/13/1999	2000	90	Steel	10/12/2000	365	5.8	96.89	0.25	3.04	33.14	0	1.06	446.9	197.67	0	2.36	0	3.516	3.011	0.951	11.83
LAWA87	10/13/1999	2000	90	Steel	4/10/2001	545	5.73	90.3	0.24	0	37.89	0	0.36	550.8	202.87	0	0.99	0	3.277	3.711	0.976	11.94
LAWA87	10/13/1999	2000	90	Steel	10/12/2001	730	7.18	137.41	0.15	1.65	49.13	0	0.33	619.58	281.89	0	0.51	0	4.987	4.175	1.356	11.97
LAWA87	10/13/1999	2000	90	Steel	10/10/2002	1093	5.1	237.67	0.27	0	87.44	0	0	975.65	406.37	0	0	0	8.626	6.574	1.955	12.06
LAWA87	10/13/1999	2000	90	Steel	10/7/2003	1455	1.27	716.62	0.2	0	224.95	0	0	2520.63	922.32	0	0	0	26.008	16.983	4.438	12.14
LAWA87	10/13/1999	2000	90	Steel	10/18/2004	1832	3.24	1059.43	0.21	0	321.57	0	0	3429.43	1252.9	0	0	0	38.449	23.107	6.028	12.25
LAWA87	10/13/1999	2000	90	Steel	10/19/2005	2198	0	1504.8	0.32	0	440.8	0	0	5383.63	1589.17	0	0.84	0	54.612	36.274	7.646	12.23
LAWA87	10/13/1999	2000	90	Steel	10/12/2006	2556	1.83	1546.93	0.27	0	454.2	0	0	5244.9	1715.7	0	0.78	0	56.141	35.339	8.255	12.34
LAWA88	10/13/1999	2000	90	Steel	10/20/1999	7	8.16	26.11	0.14	1.14	10.49	0	0.47	126.5	70.24	0	1.21	0	0.867	0.852	0.342	10.91
LAWA88	10/13/1999	2000	90	Steel	11/10/1999	28	10.51	56.37	0.66	2.27	17.3	0	0.77	265.7	99.52	0.5	1.19	1.01	1.872	1.79	0.484	11.18
LAWA88	10/13/1999	2000	90	Steel	12/8/1999	56	11.4	70.29	0.88	2.41	20.15	0	0.91	297.07	109.3	0.57	2.33	1.17	2.334	2.002	0.531	11.31
LAWA88	10/13/1999	2000	90	Steel	2/10/2000	120	11.37	85.1	0.55	2.18	25.25	0	0.9	315.81	122.57	0.57	2.66	1.12	2.825	2.128	0.596	11.51
LAWA88	10/13/1999	2000	90	Steel	4/10/2000	180	11.94	97.44	0.52	2.5	26.56	0	0.99	397.7	124.57	0.62	2.74	1.07	3.235	2.68	0.606	11.61
LAWA88	10/13/1999	2000	90	Steel	7/10/2000	271	13.32	111.1	0	1.65	29.88	0	0.78	399.2	144.27	0	1.86	0	3.689	2.69	0.701	11.72
LAWA88	10/13/1999	2000	90	Steel	10/12/2000	365	12.47	110.93	0.42	1.96	29.9	0	0.93	439.7	138.13	0	2.35	0.82	3.683	2.963	0.672	11.84
LAWA88	10/13/1999	2000	90	Steel	4/10/2001	545	13.09	112.47	0.42	1.5	33.07	0	0.63	526.23	146.67	0	1.86	0.78	3.734	3.546	0.713	11.93
LAWA88	10/13/1999	2000	90	Steel	10/12/2001	730	17.15	164.57	0.12	1.84	46.41	0	0.56	614.98	197.2	0.57	1.36	0	5.464	4.144	0.959	11.95
LAWA88	10/13/1999	2000	90	Steel	10/10/2002	1093	15.55	174.59	0.24	0	48.52	0	0.26	696.36	205.61	0	0.85	0	5.797	4.692	1	12.04
LAWA88	10/13/1999	2000	90	Steel	10/7/2003	1455	7.57	211	0.23	0	54.98	0	0	827.25	267.12	0	0	0	7.005	5.574	1.299	12.15
LAWA88	10/13/1999	2000	90	Steel	10/18/2004	1832	3.11	405.27	0	0	118.48	0	0	1349.3	549.8	0	0	0	13.455	9.091	2.673	12.25
LAWA88	10/13/1999	2000	90	Steel	10/19/2005	2198	0.73	824.09	0.34	0	198.85	0	0	2967.23	875.63	0	0	0	27.361	19.992	4.258	12.24
LAWA88	10/13/1999	2000	90	Steel	10/12/2006	2556	1.29	1126.47	0.36	0	268.78	0	0	3679.03	1144.67	0	0.49	0	37.4	24.788	5.566	12.35
LAWA88	10/13/1999	2000	90	Steel	1/22/2008	3023	0.95	2174.6	0.51	0	601.13	0	0	5815.7	1519.37	0	0	0	72.199	39.185	7.388	12.44
LAWA88	10/13/1999	2000	90	Steel	1/22/2009	3389	0.92	2774.77	0.67	0	681.3	0	0	7109.93	2023.57	0	0	0	92.125	47.905	9.839	12.46
LAWA88R1	9/5/2001	2000	90	Steel	9/12/2001	7	9.33	49.18	0	1.44	17.02	0	0.61	192.17	93.01	0	1.27	0.46	1.633	1.295	0.452	10.92
LAWA88R1	9/5/2001	2000	90	Steel	10/3/2001	28	14	96.86	0.13	2.26	27.9	0	1.05	353.53	114.47	0	2.02	1.16	3.216	2.382	0.557	11.15
LAWA88R1	9/5/2001	2000	90	Steel	10/31/2001	56	13.96	112.3	0.26	2.31	31.89	0	0.91	421.27	136.57	0.58	2.01	1.16	3.729	2.838	0.664	11.33
LAWA88R1	9/5/2001	2000	90	Steel	1/3/2002	120	14.65	128.67	0.41	2.31	34.53	0	0.99	496.27	149.27	0.56	1.98	1.08	4.272	3.344	0.726	11.52
LAWA88R1	9/5/2001	2000	90	Steel	3/4/2002	180	15.31	134.63	0.31	2.18	38.48	0	0.88	546.63	151.03	0.59	1.96	1.02	4.47	3.683	0.734	11.85
LAWA88R1	9/5/2001	2000	90	Steel	6/3/2002	271	14.69	138.93	0.28	1.75	37.3	0	0.72	539.87	151.87	0.45	1.62	0.84	4.613	3.637	0.738	11.98
LAWA88R1	9/5/2001	2000	90	Steel	9/4/2002	364	18.57	177.76	0.4	2.78	48.75	0	1.05	684.29	193.42	0.5	2.38	0.89	5.902	4.61	0.94	12.15
LAWA88R1	9/5/2001	2000																				

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWA89	10/13/1999	2000	90	Steel	10/18/2004	1832	3.63	271.77	0	0	60.87	0	0	879.9	325.22	0	0	0	9.023	9.929	1.581	12.15
LAWA89	10/13/1999	2000	90	Steel	10/19/2005	2198	0.95	393.16	0.13	0	87.83	0	0	1313.9	440.23	0	0	0	13.053	8.853	2.141	12.14
LAWA89	10/13/1999	2000	90	Steel	10/12/2006	2556	1.04	564.21	0	0	153.71	0	0	1907.07	659.62	0	0	0	18.732	12.849	3.207	12.26
LAWA89	10/13/1999	2000	90	Steel	1/22/2008	3023	0	959.84	0.11	0	227.6	0	0	2660.5	1023.9	0	0	0	31.868	17.926	4.978	12.45
LAWA89	10/13/1999	2000	90	Steel	1/22/2009	3389	0	1223.07	0.12	0	238.04	0	0	3358.4	1272.03	0	0	0	40.607	22.628	6.185	12.47
LAWA90	10/13/1999	2000	90	Steel	10/20/1999	7	6.42	29.35	0.26	1.3	12.93	0	0.45	144.53	73.74	0	1.1	0	0.974	0.974	0.359	10.98
LAWA90	10/13/1999	2000	90	Steel	11/10/1999	28	8.39	47.47	0.6	1.79	18.85	0	0.58	243.63	97.52	0	0	0	1.576	1.642	0.474	11.18
LAWA90	10/13/1999	2000	90	Steel	12/8/1999	56	9.2	57.08	0.74	1.99	20.54	0	0.68	266.27	108.93	0	1.67	0	1.895	1.794	0.53	11.31
LAWA90	10/13/1999	2000	90	Steel	2/10/2000	120	8.77	65.96	0.59	2.05	24.64	0	0.69	285.09	120.19	0	2.08	0	2.19	1.921	0.584	11.51
LAWA90	10/13/1999	2000	90	Steel	4/10/2000	180	9.53	79.54	0.53	2.33	28.56	0	0.74	379.83	128.77	0	2.18	0	2.641	2.559	0.626	11.62
LAWA90	10/13/1999	2000	90	Steel	7/10/2000	271	10.46	95.98	0.19	1.22	30.54	0	0.62	407.63	149.3	0	1.26	0	3.187	2.747	0.726	11.71
LAWA90	10/13/1999	2000	90	Steel	10/12/2000	365	10.35	100.05	0.2	1.91	32.81	0	0.85	423.43	148.67	0	2	0	3.322	2.853	0.723	11.84
LAWA90	10/13/1999	2000	90	Steel	4/10/2001	545	10.48	114.87	0.39	1.19	36.7	0	0.38	519.9	164.1	0	1.06	0	3.814	3.503	0.798	11.95
LAWA90	10/13/1999	2000	90	Steel	10/12/2001	730	12.09	157.67	0.19	0	52.72	0	0	642.76	212.07	0	0	0	5.235	4.331	1.031	11.96
LAWA90	10/13/1999	2000	90	Steel	10/10/2002	1093	3.55	622.88	0.65	0	189.12	0	0	2022.97	668.19	0	0	0	20.68	13.63	3.249	12.06
LAWA90	10/13/1999	2000	90	Steel	10/7/2003	1455	0	1317.5	0.77	0	342.17	0	0	4098.9	1130.77	0	0	0	43.742	27.617	5.498	12.15
LAWA90	10/13/1999	2000	90	Steel	10/18/2004	1832	3.93	1925.8	0.94	0	456.25	0	0	5543.9	1403.07	0	0	0	63.939	37.353	6.822	12.26
LAWA90	10/13/1999	2000	90	Steel	10/19/2005	2198	0	2215.63	1.56	0	514.78	0	0	6930.1	1478.97	0	0.93	0	73.561	46.693	7.191	12.24
LAWA90	10/13/1999	2000	90	Steel	10/12/2006	2556	1.74	2403.4	0.76	1.29	550.8	0	0	6836.07	1704.23	0	0.78	0	79.795	46.06	8.286	12.34
LAWA93	3/16/2000	2000	90	Steel	3/23/2000	7	3.29	36.25	0.85	0	3.22	26.92	0	0	79.66	67.04	0	0	1.052	1.071	0.34	10.86
LAWA93	3/16/2000	2000	90	Steel	4/13/2000	28	3.45	121.37	2.08	0	9.46	79.15	0	0	247.47	154.27	0	0	3.523	3.327	0.781	11.15
LAWA93	3/16/2000	2000	90	Steel	5/11/2000	56	2.95	166.07	2.29	0	11.39	103.63	0	0	302.93	181.23	0	0	4.82	4.072	0.918	11.27
LAWA93	3/16/2000	2000	90	Steel	7/13/2000	119	3.35	254.13	2.83	0	18.7	150.4	0	0	459.33	237.47	0	0	7.377	6.174	1.203	11.36
LAWA93	3/16/2000	2000	90	Steel	9/12/2000	180	4.53	430.6	1.39	0	28.48	219.6	0	0	702.13	271.3	0	0	12.499	9.438	1.374	11.58
LAWA93	3/16/2000	2000	90	Steel	12/11/2000	270	5.31	1754.87	3.85	0	104.89	644.03	0	0	2690.3	328.77	0	0	50.938	36.163	1.665	11.95
LAWA93	3/16/2000	2000	90	Steel	3/15/2001	364	5.54	2735.13	6.11	0	169.9	998.3	0	0	3653.93	319.77	0	0	79.392	49.117	1.619	12.13
LAWA96	11/16/1999	2000	90	Steel	11/23/1999	7	6.35	15.14	0.35	0	0	0	0	111.4	70.07	0	0	0	0.751	0.344	10.63	
LAWA96	11/16/1999	2000	90	Steel	12/14/1999	28	8.64	19.56	0.94	0	2.43	0	0	166.1	88.46	0	0	0	0.797	1.119	0.435	10.84
LAWA96	11/16/1999	2000	90	Steel	1/11/2000	56	9.86	19.99	0.19	0	1.76	0	0	169.32	99.31	0	0.54	0	0.814	1.141	0.488	10.92
LAWA96	11/16/1999	2000	90	Steel	3/15/2000	120	11.3	23.76	0.22	0	2.62	0	0.26	221.8	115.67	0	0.49	0	0.968	1.495	0.568	10.96
LAWA96	11/16/1999	2000	90	Steel	5/15/2000	181	11.51	26.96	0.15	0	2.8	0	0.23	217.57	123.87	0	0.5	0	1.098	1.466	0.608	11.12
LAWA96	11/16/1999	2000	90	Steel	8/11/2000	269	12.72	32.32	0	0	3.32	0	0	250.6	143.73	0	0	0	1.317	1.689	0.706	11.22
LAWA96	11/16/1999	2000	90	Steel	11/15/2000	365	11.58	31.08	0.22	0	2.91	0	0	254.47	132	0	0	0	1.266	1.715	0.648	11.33
LAWA96	11/16/1999	2000	90	Steel	5/16/2001	547	16.23	49.5	0.1	0	4.84	0	0.23	396.1	197.34	0	0	0	2.017	2.627	0.969	11.42
LAWA96	11/16/1999	2000	90	Steel	11/15/2001	730	12.44	49.3	0.48	0	4.23	0	0.29	390.14	186.87	0	0	0	2.009	2.629	0.918	11.52
LAWA96	11/16/1999	2000	90	Steel	11/7/2002	1087	10.79	604.63	0.29	0	30.31	0	0.25	1964.33	630.92	0	0.55	0	24.635	13.239	3.099	11.66
LAWA96	11/16/1999	2000	90	Steel	11/10/2003	1455	5.94	1009.03	0.17	0	56.77	0	0	3073.3	876.68	0	0.61	0	41.112	20.713	4.306	11.75
LAWA96	11/16/1999	2000	90	Steel	11/15/2005	2191	0	1675.57	0.12	0	94.74	0	0	6270.2	1400.47	0	0.57	0	68.27	42.259	6.879	11.87
LAWA96	11/16/1999	2000	90	Steel	11/10/2006	2551	4.4	2096.63	0	0	124.37	0	0	6906.5	1827.73	0	0.75	0	85.426	46.547	8.978	11.94
LAWB30	6/22/1999	2000	90	Steel	6/29/1999	7	3.37	15.09	2.65	0	0	9.91	0	0	27.9	35.13	0	0	0.484	0.476	0.176	10.11
LAWB30	6/22/1999	2000	90	Steel	7/20/1999	28	4.04	21.33	1.84	0	0	15.08	0	0	41.01	42.93	0	0	0.684	0.7	0.215	10.18
LAWB30	6/22/1999	2000	90	Steel	8/17/1999	56	3.98	28.99	2.62	0	1.96	19.93	0	0	54.86	53.93	0	0	0.93	0.936	0.27	10.32
LAWB30	6/22/1999	2000	90	Steel	10/20/1999	120	3.85	35.31	2.11	0	0	23.34	0	0	65.13	62.2	0	0	1.133	1.111	0.311	10.55
LAWB30	6/22/1999	2000	90	Steel	12/19/1999	180	3.81	44.46	2.46	0	2.34	29.27	0	0	81.2	72.96	0	0	1.426	1.385	0.365	11.02
LAWB30	6/22/1999	2000	90	Steel	3/17/2000	269	3.76	66.12	2.11	0	4	44.7	0	0	125.07	87.22	0	0	2.121	2.133	0.437	11.14
LAWB30	6/22/1999	2000	90	Steel	6/21/2000	365	3.64	111.33	2.67	0	6.59	64.59	0	0	189.27	105.4	0	0	3.571	3.229	0.528	11.27
LAWB30	6/22/1999	2000	90	Steel	12/19/2000	546	3.43	280.07	4.01	0	12.76	117.43	0	0	431.93	127.57	0	0	8.985	7.368	0.639	11.55
LAWB30	6/22/1999	2000	90	Steel	6/21/2001	730	6.67	798.15	7.28	0	36.08	299.04	0	0	1055.27	190.96	0	0	25.605	18.001	0.956	11.77
LAWB30	6/22/1999	2000	90	Steel	6/22/2004	1827	3.23	3164.5	36.29	0	120.97	846.07	0	0	3258.6	95.83	0	0	101.518	55.586	0.48	12.04
LAWB30	6/22/1999	2000	90	Steel	6/20/2005	2190	1.83	2493.73	28.85	0	92.37	687.36	0	0	3033.03	74.24	0	0	79.999	51.738	0.372	12.03
LAWB30	6/22/1999	2000	90	Steel	6/23/2006	2558	2.54	2766.83	35.29	0	122.93	694.86	0	0	3041.27	104.77	0	0	88.761	51.878	0.525	12.16
LAWB31	9/29/1999	2000	90	Steel	10/6/1999	7	1.45	15.65	0.35	0	0	7.01	0	0	12.32	44.22	0	0	0.415	0.209	0.201	9.41
LAWB31	9/29/1999	2000	90	Steel	10/27/1999	28	3.16	21.49	0.21	0	0	10.66	0	0	22.85	55.71	0	0	0.57	0.388	0.253	9.51
LAWB31	9/29/1999	2000	90	Steel	12/24/1999	86	3.27	24.62	0.37	0	0	11.83	0	0	22.9	67.82	0	0	0.653	0.389	0.308	9.63
LAWB31	9/29/1999	2000	90	Steel	1/27/2000	120	3.21	28.53	0.29	0	0	14.3	0	0	24.86	65.23	0	0	0.757	0.422	0.296	9.73
LAWB31	9/29/1999	2000	90	Steel	3/27/2000	180	3.46	31.79	0.54	0	0	16.48	0	0	26.38	72.19	0	0	0.843	0.448	0.328	9.82
LAWB31	9/29/1999	2000	90	Steel																		

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWB32	9/29/1999	2000	90	Steel	3/27/2000	180	1.73	100.7	0.4	0	0	30.43	0	76.83	84.78	0	0	0.45	2.141	1.306	0.385	9.85
LAWB32	9/29/1999	2000	90	Steel	6/26/2000	271	1.42	116.17	0	0	0	35.32	0	85.3	75.29	0	0	0	2.47	1.45	0.342	9.98
LAWB32	9/29/1999	2000	90	Steel	9/29/2000	366	1.54	147.5	0.7	0	0	41.76	0	102.67	87.06	0	0	0	3.136	1.746	0.396	10.12
LAWB32	9/29/1999	2000	90	Steel	3/28/2001	546	1.38	180.9	0.66	0	0	49.8	0	113.17	89.54	0	0	0	3.847	1.924	0.407	10.22
LAWB32	9/29/1999	2000	90	Steel	9/28/2001	730	2.12	255.46	0.46	0	2.9	75.26	0	167.96	117.66	0	0	0	5.432	2.856	0.535	10.34
LAWB32	9/29/1999	2000	90	Steel	9/24/2002	1091	1.48	298.89	0.56	0	3.06	82.84	0	191.09	112.79	0	0	0	6.356	3.249	0.513	10.45
LAWB32	9/29/1999	2000	90	Steel	9/26/2003	1458	1.56	325.74	0.86	0	3.2	92.18	0	207.91	113.61	0	0	0	6.927	3.535	0.516	10.55
LAWB32	9/29/1999	2000	90	Steel	9/23/2005	2186	1.75	304.81	1.26	0	2.34	83.4	0	187.63	100.25	0	0	0	6.481	3.19	0.456	10.64
LAWB32	9/29/1999	2000	90	Steel	9/20/2006	2548	2.53	328.62	1.51	0	3.16	85.44	0	194.06	116.33	0	0	0	6.988	3.3	0.529	10.75
LAWB32	9/29/1999	2000	90	Steel	1/15/2008	3030	1.3	392.5	1.77	0	3.18	106.69	0	225.39	131.9	0	0	0	8.346	3.832	0.599	10.84
LAWB32	9/29/1999	2000	90	Steel	1/12/2009	3393	1.37	389.28	2.31	0	3.32	110.8	0	230.24	133.05	0	0	0	8.278	3.915	0.605	10.86
LAWB33	5/18/2000	2000	90	Steel	5/25/2000	7	2.58	14.29	0.43	0	0	6.33	0	13.65	43.22	0	0	0	0.38	0.232	0.197	9.18
LAWB33	5/18/2000	2000	90	Steel	6/15/2000	28	2.61	19.01	0.21	0	0	8.51	0	15.3	51.26	0	0	0	0.505	0.26	0.233	9.26
LAWB33	5/18/2000	2000	90	Steel	7/13/2000	56	3.03	21.71	0	0	0	11.04	0	17.67	60.96	0	0	0	0.577	0.301	0.277	9.37
LAWB33	5/18/2000	2000	90	Steel	9/14/2000	119	3.44	27.26	0.18	0	0	13.92	0	20.35	66.02	0	0	0	0.724	0.346	0.3	9.53
LAWB33	5/18/2000	2000	90	Steel	11/14/2000	180	3.25	28.73	0.59	0	0	14.82	0	19.88	66.27	0	0	0	0.763	0.338	0.301	9.74
LAWB33	5/18/2000	2000	90	Steel	2/13/2001	271	3.26	30.32	0.21	0	0	16.85	0	21.66	69.03	0	0	0	0.805	0.369	0.314	9.82
LAWB33	5/18/2000	2000	90	Steel	5/18/2001	365	4.72	46.33	0.15	0	0	25.95	0	33.39	94.35	0	0	0	1.231	0.568	0.429	9.93
LAWB33	5/18/2000	2000	90	Steel	11/15/2001	546	3.74	45.86	0.16	0	0	24.32	0	30.59	80.18	0	0	0	1.218	0.521	0.365	10.05
LAWB33	5/18/2000	2000	90	Steel	5/17/2002	729	4.05	51.61	0.33	0	0	27.06	0	33.99	87.02	0	0	0	1.371	0.578	0.396	10.12
LAWB33	5/18/2000	2000	90	Steel	5/19/2003	1096	3.74	67.29	0.23	0	0	33.48	0	41.36	100.96	0	0	0	1.787	0.704	0.459	10.25
LAWB33	5/18/2000	2000	90	Steel	5/17/2004	1460	2.69	61.64	0.18	0	0	27.78	0	34.33	84.44	0	0	0	1.637	0.584	0.384	10.38
LAWB33	5/18/2000	2000	90	Steel	5/19/2005	1827	3.02	71.64	0.34	0	0	32.51	0	42.13	94.52	0	0	0	1.903	0.717	0.43	10.43
LAWB33	5/18/2000	2000	90	Steel	5/22/2006	2195	2.61	74.35	0.52	0	0	34.43	0	44.91	93.29	0	0	0	1.975	0.764	0.424	10.52
LAWB33	5/18/2000	2000	90	Steel	9/5/2007	2666	2.46	78.67	4.71	0	0	33.54	1.02	60.2	90.9	0	0	0	2.09	1.024	0.413	10.56
LAWB34	9/29/1999	2000	90	Steel	10/6/1999	7	0.86	16.22	0.36	0	0	6.72	0	14.69	43.77	0	0	0	0.431	0.25	0.199	9.51
LAWB34	9/29/1999	2000	90	Steel	10/27/1999	28	2.43	21.49	0.29	0	0	9.86	0	25.67	53.03	0	0	0	0.571	0.437	0.241	9.58
LAWB34	9/29/1999	2000	90	Steel	12/24/1999	86	2.3	24.27	0.77	0	0	10.08	0	24.3	61.29	0	0	0	0.644	0.413	0.279	9.72
LAWB34	9/29/1999	2000	90	Steel	1/27/2000	120	2.53	27.55	0.48	0	0	12.67	0	28.04	61.76	0	0	0	0.731	0.477	0.281	9.85
LAWB34	9/29/1999	2000	90	Steel	3/27/2000	180	2.9	30.87	0.99	0	0	14.91	0	31.48	69.8	0	0	0	0.82	0.535	0.317	9.93
LAWB34	9/29/1999	2000	90	Steel	6/26/2000	271	2.52	30.95	0	0	0	15.44	0	29.88	62.93	0	0	0	0.822	0.508	0.286	10.03
LAWB34	9/29/1999	2000	90	Steel	9/29/2000	366	2.59	34.89	1.06	0	0	16.75	0	31.87	71.57	0	0	0	0.926	0.542	0.325	10.17
LAWB34	9/29/1999	2000	90	Steel	3/28/2001	546	2.64	40.32	1.16	0	0	18.14	0	33.92	77.05	0	0	0	1.07	0.577	0.35	10.32
LAWB34	9/29/1999	2000	90	Steel	9/28/2001	730	3.94	50.16	1.05	0	0	24.78	0	47.05	104.61	0	0	0	1.332	0.8	0.476	10.45
LAWB34	9/29/1999	2000	90	Steel	9/24/2002	1091	3.17	55.71	1.54	0	1.72	26.45	0	48.05	103.63	0	0	0	1.479	0.817	0.471	10.56
LAWB34	9/29/1999	2000	90	Steel	9/26/2003	1458	3.08	55.41	1.4	0	1.85	28.15	0	49.82	102.3	0	0	0	1.471	0.847	0.465	10.64
LAWB34	9/29/1999	2000	90	Steel	9/23/2005	2186	2.29	58.29	1.69	0	0	25.79	0	46.91	96.29	0	0	0	1.548	0.798	0.438	10.75
LAWB34	9/29/1999	2000	90	Steel	9/20/2006	2548	3.2	70.44	1.34	0	0	28.19	0	52.42	110.23	0	0	0	1.87	0.892	0.501	10.85
LAWB34	9/29/1999	2000	90	Steel	1/15/2008	3030	2.82	84.19	2.07	0	0	33.39	0	64.14	122.52	0	0	0	2.235	1.091	0.557	10.94
LAWB34	9/29/1999	2000	90	Steel	1/12/2009	3393	2.72	95.51	2.12	0	1.9	39.3	0	72.87	131.63	0	0	0	2.536	1.239	0.598	10.96
LAWB35	9/29/1999	2000	90	Steel	10/6/1999	7	0	37.43	0.25	0	0	12.71	0	40.06	62.19	0	0	0	0.994	0.681	0.283	9.56
LAWB35	9/29/1999	2000	90	Steel	10/27/1999	28	1.5	57.71	0.18	0	0	20.55	0	64.91	80.15	0	0	0	1.532	1.104	0.364	9.64
LAWB35	9/29/1999	2000	90	Steel	12/24/1999	86	1.41	60.57	0.37	0	0	20.18	0	60.34	89.05	0	0	0	1.608	1.026	0.405	9.84
LAWB35	9/29/1999	2000	90	Steel	1/27/2000	120	1.66	62.74	0.32	0	0	22.31	0	62.47	87.66	0	0	0	1.665	1.062	0.398	9.94
LAWB35	9/29/1999	2000	90	Steel	3/27/2000	180	1.76	69.21	0.44	0	0	25.94	0	68.04	94.14	0	0	0	1.837	1.157	0.428	9.97
LAWB35	9/29/1999	2000	90	Steel	6/26/2000	271	1.52	63.22	0	0	0	24.79	0	60.29	79.08	0	0	0	1.678	1.025	0.359	10.07
LAWB35	9/29/1999	2000	90	Steel	9/29/2000	366	1.6	69.31	0	0	0	26.39	0	62.6	88.55	0	0	0	1.84	1.065	0.403	10.22
LAWB35	9/29/1999	2000	90	Steel	3/28/2001	546	1.66	80.12	0.71	0	0	29	0	69.37	103.6	0	0	0	2.127	1.18	0.471	10.37
LAWB35	9/29/1999	2000	90	Steel	9/28/2001	730	2.16	98.74	0.12	0	1.93	37.2	0	87.43	124.66	0	0	0	2.621	1.487	0.567	10.48
LAWB35	9/29/1999	2000	90	Steel	9/24/2002	1091	2.06	122.44	0.18	0	2.1	46.48	0	101.08	137.68	0	0	0	3.25	1.719	0.626	10.57
LAWB35	9/29/1999	2000	90	Steel	9/26/2003	1458	2.15	113.43	0.1	0	2.13	44.15	0	96.46	130.55	0	0	0	3.011	1.64	0.593	10.67
LAWB35	9/29/1999	2000	90	Steel	9/23/2005	2186	1.46	119.6	0.2	0	1.85	41.58	0	95.27	137.35	0	0	0	3.175	1.62	0.624	10.76
LAWB35	9/29/1999	2000	90	Steel	9/20/2006	2548	2.88	133.03	1.09	0	2.34	44.61	0	103.29	162.81	0	0	0	3.531	1.757	0.74	10.83
LAWB35	9/29/1999	2000	90	Steel	1/15/2008	3030	2.49	154.22	1.77	0	2.02	53.2	1.45	117.99	172.51	0	0	0.82	4.094	2.007	0.784	10.94
LAWB35	9/29/1999	2000	90	Steel	1/12/2009	3393	1.33	156.9	0.88	0	1.99	55.23	0	115.86	160.26	0	0	0	4.165	1.97	0.728	10.97
LAWB37	11/16/1999	2000	90	Steel	11/23/1999	7	2.02	19.16	0.57	0	0	7.46	0	20.79	47.44	0	0	0	0.51	0.354	0.216	9.43
LAWB37	11/16/1999	2000	90	Steel	12/14/1999	28	2.26	23.69	0.66	0	0	9.87	0	23.05	54.33	0	0	0	0.63	0.393	0.247	9.66
LAWB37	11/16/1999	2000	90	Steel	1/1/2000	56	2.31	23.91	0.21	0	0	10.97	0	22.5	54.6							

The Catholic University of America
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ILAW Glass Testing for Disposal at IDF
Final Report, VSL-11R2270-1, Rev. 0

Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWB37	11/16/1999	2000	90	Steel	1/23/2009	3356	1.91	155.43	0.34	0	4.98	45.74	0	252.48	197.75	0	0	0	4.134	4.302	0.901	10.85
LAWB38	11/16/1999	2000	90	Steel	11/23/1999	7	2.48	18.72	0.44	0	0	9.59	0	20.73	49.79	0	0	0	0.499	0.354	0.227	9.56
LAWB38	11/16/1999	2000	90	Steel	12/14/1999	28	2.58	23.48	0.84	0	0	12.1	0	22.7	55.85	0	0	0	0.626	0.387	0.255	9.74
LAWB38	11/16/1999	2000	90	Steel	1/1/2000	56	2.72	23.65	0.21	0	0	13.11	0	22	55.87	0	0	0	0.63	0.375	0.255	9.85
LAWB38	11/16/1999	2000	90	Steel	3/15/2000	120	3.05	29.5	0.3	0	0	17.95	0	26.96	66.3	0	0	0	0.786	0.46	0.302	9.94
LAWB38	11/16/1999	2000	90	Steel	5/15/2000	181	2.59	31.16	0	0	0	16.78	0	24.53	69.93	0	0	0	0.83	0.419	0.319	9.97
LAWB38	11/16/1999	2000	90	Steel	8/11/2000	269	3.05	38.57	0	0	0	21.02	0	29.48	80.87	0	0	0	1.028	0.503	0.369	10.12
LAWB38	11/16/1999	2000	90	Steel	11/15/2000	365	2.71	38	0.39	0	0	21.76	0	29.23	74.92	0	0	0	1.012	0.499	0.342	10.22
LAWB38	11/16/1999	2000	90	Steel	5/16/2001	547	4.23	60.23	0.22	0	0	34.42	0	46.63	109.19	0	0	0	1.605	0.796	0.498	10.34
LAWB38	11/16/1999	2000	90	Steel	11/15/2001	730	3.15	63.62	0.14	0	0	35.91	0	47.59	102.51	0	0	0	1.695	0.812	0.468	10.43
LAWB38	11/16/1999	2000	90	Steel	11/7/2002	1087	4.43	87.34	0.3	0	0	48.57	0	67.29	144.14	0	0	0	2.327	1.148	0.658	10.55
LAWB38	11/16/1999	2000	90	Steel	11/10/2003	1455	2.51	81.36	0.15	0	0	45.54	0	62.26	117.93	0	0	0	2.168	1.063	0.538	10.65
LAWB38	11/16/1999	2000	90	Steel	11/15/2005	2191	2.23	85.92	0.26	0	0	49.94	0	66.7	113.21	0	0	0	2.289	1.138	0.516	10.76
LAWB38	11/16/1999	2000	90	Steel	11/10/2006	2551	2.99	98.87	0.18	0	0	48.29	0	69.36	133.33	0	0	0	2.634	1.184	0.608	10.84
LAWB38	11/16/1999	2000	90	Steel	8/16/2007	2830	2.45	107.25	9.46	0	3.45	50.91	2.22	98.69	129.08	0	0	0	2.857	1.684	0.589	10.87
LAWB38	11/16/1999	2000	90	Steel	1/23/2008	2990	2.41	103.4	0.34	0	0	51.79	0	72.55	142.75	0	0	0	2.755	1.238	0.651	10.94
LAWB38	11/16/1999	2000	90	Steel	1/23/2009	3356	1.93	111.45	0.1	0	0	54.19	0	75.53	146.69	0	0	0	2.969	1.289	0.669	10.96
LAWB40	5/3/2000	2000	90	Steel	5/10/2000	7	1.66	119.23	0.52	0	3.36	80.96	0	137.63	142.13	0	0	0	3.186	2.356	0.65	10.41
LAWB40	5/3/2000	2000	90	Steel	5/3/12000	28	0.98	461.87	2.17	0	10.74	231.9	0	456.6	266.6	0	0	0	12.343	7.817	1.22	10.52
LAWB40	5/3/2000	2000	90	Steel	6/28/2000	56	0.81	1155.6	4.36	0	31.47	505.67	0	1139.7	264.23	0	0	0	30.882	19.511	1.209	10.64
LAWB40	5/3/2000	2000	90	Steel	8/3/12000	120	1.34	1969.07	18.03	0	73.6	696.03	0	2134.4	243.07	0	0	0	52.621	36.541	1.112	10.82
LAWB40	5/3/2000	2000	90	Steel	10/30/2000	180	1.59	2519.7	24.63	0	98.17	872.8	0	2570.6	251.03	0	0	0	67.335	44.008	1.149	10.97
LAWB40	5/3/2000	2000	90	Steel	1/25/2001	267	0.98	2585.03	26.01	0	107.83	939.83	0	2852.37	233.27	0	0	0	69.081	48.832	1.067	10.96
LAWB40	5/3/2000	2000	90	Steel	5/3/2001	365	1.41	2782.5	25.3	0	110.07	960.2	0	2941.03	247.93	0	0	0	74.358	50.35	1.135	11.04
LAWB40	5/3/2000	2000	90	Steel	11/1/2001	547	0.65	3508	36.93	0	144.9	1259.23	0	3615.67	253.71	0	0	0	93.746	61.9	1.161	11.12
LAWB40	5/3/2000	2000	90	Steel	5/2/2002	729	1.42	3627.4	43.89	0	173.87	1327.77	0	3784.3	256.87	0	0	0	96.937	64.787	1.175	11.37
LAWB40	5/3/2000	2000	90	Steel	5/1/2003	1104	2.08	3679.57	45.32	0	178.54	1279.03	0	3689.3	256.19	0	0	0	98.331	63.16	1.172	11.45
LAWB40	5/3/2000	2000	90	Steel	5/4/2004	1462	0.84	2831.1	32.59	0	114.27	967.04	0	2984.5	165.82	0	0	0	75.657	51.094	0.759	11.54
LAWB40	5/3/2000	2000	90	Steel	5/3/2005	1826	2.79	2810.23	30.65	0	117.67	943.55	0	2967.67	183.48	0	0	0	75.099	50.806	0.84	11.61
LAWB40	5/3/2000	2000	90	Steel	5/18/2006	2206	0.75	3012.53	33.5	0	135.01	877.93	0	3100.07	186.55	0	0	0	80.506	53.073	0.854	11.74
LAWB41	5/3/2000	2000	90	Steel	5/10/2000	7	0.91	63.73	1.33	0	2.41	31.4	0	82.37	83.63	0	0	0	1.701	1.408	0.382	10.17
LAWB41	5/3/2000	2000	90	Steel	5/3/12000	28	0.79	165	2.92	0	5.28	77.95	0	197.1	141.87	0	0	0	4.404	3.37	0.648	10.27
LAWB41	5/3/2000	2000	90	Steel	6/28/2000	56	0	256.2	3.54	0	8.05	111.5	0	307.47	163.8	0	0	0	6.838	5.257	0.749	10.34
LAWB41	5/3/2000	2000	90	Steel	8/3/12000	120	0	459.5	6.14	0	12.66	178.03	0	507.57	177.23	0	0	0	12.263	8.678	0.81	10.54
LAWB41	5/3/2000	2000	90	Steel	10/30/2000	180	0	791.17	11.53	0	26.44	296.37	0	880.33	189.27	0	0	0	21.115	15.051	0.865	10.75
LAWB41	5/3/2000	2000	90	Steel	1/25/2001	267	0	1288.1	22.11	0	43.35	395.2	0	1551.47	147.23	0	0	0	34.377	26.526	0.673	10.85
LAWB41	5/3/2000	2000	90	Steel	5/3/2001	365	0.7	1661.2	32.05	0	61.95	464.53	0	1882	151.13	0	0	0	44.335	32.177	0.691	10.96
LAWB41	5/3/2000	2000	90	Steel	11/1/2001	547	0	2331.47	57.75	0	104.92	687.88	0	2742.9	158.74	0	0	0	62.223	46.896	0.725	11.04
LAWB41	5/3/2000	2000	90	Steel	5/2/2002	729	0	2760.57	76.1	0	142.9	756.19	0	3215.47	196.34	0	0	0	73.675	54.976	0.897	11.24
LAWB41	5/3/2000	2000	90	Steel	5/12/2003	1104	1.04	3243.4	81.85	0	161.15	881.47	0	3563.87	202.46	0	0	0	86.561	60.933	0.925	11.34
LAWB41	5/3/2000	2000	90	Steel	5/4/2004	1462	0	2561.9	67.07	0	126.5	707.53	0.23	3182.2	193.78	0	0	0	68.373	54.407	0.886	11.45
LAWB41	5/3/2000	2000	90	Steel	5/3/2005	1826	2.17	2576.13	59.25	0	115.37	628.21	0	3113.43	143.07	0	0	0	68.753	53.231	0.654	11.55
LAWB41	5/3/2000	2000	90	Steel	5/18/2006	2206	0	2773.1	73.89	0	175.37	675.2	0	3332.13	172.6	0	0	0	74.01	56.97	0.789	11.56
LAWB60	3/13/2002	2000	90	Steel	3/20/2002	7	0.84	16.95	11.44	0	0	10.81	0	21.83	42.83	0	0	0	0.441	0.452	0.191	10.36
LAWB60	3/13/2002	2000	90	Steel	4/10/2002	28	1.23	19.77	13.5	0	0	14.34	0	26.49	48.92	0	0	0	0.515	0.548	0.218	10.57
LAWB60	3/13/2002	2000	90	Steel	5/8/2002	56	1.25	21.43	12.82	0	0	14.98	0	28.25	52.51	0	0	0	0.558	0.585	0.234	10.65
LAWB60	3/13/2002	2000	90	Steel	7/11/2002	120	1.41	23.66	15.18	0	0	20.06	0	36.16	61.83	0	0	0	0.616	0.748	0.276	10.77
LAWB60	3/13/2002	2000	90	Steel	9/9/2002	180	1.6	23.16	16.23	0	0	20.44	0	36.53	63.18	0	0	0	0.603	0.756	0.282	10.84
LAWB60	3/13/2002	2000	90	Steel	12/9/2002	271	1.8	33.51	16.34	0	1.9	27.88	0	51.75	84.77	0	0	0	0.873	1.071	0.378	10.92
LAWB60	3/13/2002	2000	90	Steel	9/11/2003	547	2.58	32.85	9.4	0	0	25.96	0	48.15	78.1	0	0	0	0.856	0.996	0.348	11.23
LAWB60	3/13/2002	2000	90	Steel	3/15/2004	733	1.56	38.93	7.63	0	2.36	29.44	0	53.38	82.36	0	0	0	1.014	1.105	0.367	11.34
LAWB60	3/13/2002	2000	90	Steel	3/11/2005	1094	1.47	55.37	7.09	0	2.45	42.46	0	78.86	110.65	0	0	0	1.442	1.632	0.494	11.42
LAWB60	3/13/2002	2000	90	Steel	3/9/2006	1457	1.09	70.33	6.8	0	2.88	47.26	0	92.28	120.9	0	0	0	1.832	1.91	0.539	11.52
LAWB60	3/13/2002	2000	90	Steel	3/7/2007	1820	1.18	97.27	6.82	0	3.51	65.8	0.3	131.5	153.47	0	0	0	2.533	2.721	0.685	11.57
LAWB61	2/5/2002	2000	90	Steel	2/12/2002	7	1.51	24.13	0	0	0	20.98	0	27.36	63.49	0	0	0	0.78	0.67	0.279	10.45
LAWB61	2/5/2002	2000	90	Steel	3/5/2002	28	1.1	67.47	0.88	0	2.38	53.07	0	72.9	114.93	0	0	0	2.18	1.786	0.506	10.64
LAWB61	2/5/2002	2000	90	Steel	4/2/2002	56	1.07	126.2	1.44	0	3.86	95.62	0	138.57	165.63</							

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWB62	2/5/2002	2000	90	Steel	8/5/2002	181	1.92	33.96	9.53	0	0	29.76	0	32.72	71.64	0	0	0	1.099	0.803	0.316	11.16
LAWB62	2/5/2002	2000	90	Steel	11/1/2002	269	3	45.9	8.33	0	2.34	45.54	0	51.38	101.7	0	0	0	1.486	1.261	0.448	11.25
LAWB62	2/5/2002	2000	90	Steel	2/5/2003	365	2.88	41.79	6.14	0	1.71	47.17	0	52.41	101.15	0	0	0	1.353	1.287	0.446	11.15
LAWB62	2/5/2002	2000	90	Steel	8/4/2003	545	5.08	48.85	4.16	0	3.28	65.19	0	74.49	126.01	0	0	0	1.581	1.829	0.555	11.23
LAWB62	2/5/2002	2000	90	Steel	2/4/2004	729	1.97	300.56	2.73	0	11.75	121.27	0	349.55	242.18	0	0	0	9.73	8.58	1.068	11.34
LAWB62	2/5/2002	2000	90	Steel	2/3/2005	1094	1.35	3007.27	10.83	0	79.75	1214.87	0	2417.8	158.32	0	0	0	97.37	59.35	0.698	11.45
LAWB62	2/5/2002	2000	90	Steel	2/6/2006	1462	1.05	3303.13	12.01	0	71.02	1288.9	0	2547.37	157.1	0	0	0	106.936	62.53	0.693	11.53
LAWB62	2/5/2002	2000	90	Steel	2/9/2007	1830	1.32	2797.53	11.78	0	68.86	1158.57	0	2498.27	172.77	0	0	0	90.567	61.325	0.762	11.62
LAWB63	2/5/2002	2000	90	Steel	2/12/2002	7	1.21	11.15	4.28	0	0	9.87	0	14.12	37.7	0	0	0	0.361	0.346	0.165	10.35
LAWB63	2/5/2002	2000	90	Steel	3/5/2002	28	1.23	16.55	5.97	0	0	15.52	0	20.35	50.04	0	0	0	0.536	0.499	0.219	10.55
LAWB63	2/5/2002	2000	90	Steel	4/2/2002	56	1.63	18.64	6.61	0	0	19.44	0	23.59	58.34	0	0	0	0.603	0.579	0.255	10.76
LAWB63	2/5/2002	2000	90	Steel	6/5/2002	120	1.71	25.47	7.26	0	1.86	23.63	0	28.67	73.32	0	0	0	0.824	0.703	0.321	10.96
LAWB63	2/5/2002	2000	90	Steel	8/5/2002	181	1.97	27.04	6.98	0	1.8	28.43	0	32.51	79.36	0	0	0	0.875	0.798	0.347	11.17
LAWB63	2/5/2002	2000	90	Steel	11/1/2002	269	2.48	39.15	7.95	0	3.11	36.11	0	41.89	97.24	0	0	0	1.267	1.028	0.425	11.24
LAWB63	2/5/2002	2000	90	Steel	2/5/2003	365	2.35	39.47	7.43	0	2.1	40.31	0	44.81	107.13	0	0	0	1.277	1.099	0.468	11.64
LAWB63	2/5/2002	2000	90	Steel	8/4/2003	545	3.69	33.52	6.35	0	3.02	41.56	0	47.16	104.79	0	0	0	1.085	1.157	0.458	11.76
LAWB63	2/5/2002	2000	90	Steel	2/4/2004	729	2	37.81	5.3	0	3.29	43.01	0	46.76	112.98	0	0	0	1.223	1.147	0.494	11.84
LAWB63	2/5/2002	2000	90	Steel	2/3/2005	1094	2.1	46.7	4.42	0	2.9	56.81	0	60.57	125.91	0	0	0	1.511	1.486	0.55	11.95
LAWB63	2/5/2002	2000	90	Steel	2/6/2006	1462	1.8	72.65	3.8	0	4.4	75.29	0	91.55	166.49	0	0	0	2.351	2.246	0.728	12.03
LAWB63	2/5/2002	2000	90	Steel	2/9/2007	1830	1.23	1133	14.62	0	41.95	479.14	0	1129.97	194.13	0	0	0	36.661	27.723	0.849	12.15
LAWB64	2/5/2002	2000	90	Steel	2/12/2002	7	0.97	17.25	0	0	0	15.41	0	19.89	47.79	0	0	0	0.557	0.487	0.21	10.27
LAWB64	2/5/2002	2000	90	Steel	3/5/2002	28	1.15	52.42	0.94	0	2.02	43.17	0	57.99	104.67	0	0	0	1.693	1.42	0.46	10.45
LAWB64	2/5/2002	2000	90	Steel	4/2/2002	56	1.25	87.74	1.28	0	2.84	72.92	0	102.63	146.3	0	0	0	2.834	2.514	0.644	10.55
LAWB64	2/5/2002	2000	90	Steel	6/5/2002	120	1.26	320.73	3.65	0	8.83	187.07	0	314.8	246.57	0	0	0	10.361	7.711	1.085	10.77
LAWB64	2/5/2002	2000	90	Steel	8/5/2002	181	1.98	1060.47	9.15	0	37.28	479.03	0	968.3	240.8	0	0	0	34.259	23.719	1.059	10.94
LAWB64	2/5/2002	2000	90	Steel	11/1/2002	269	2.92	3076.5	22.11	0	130.46	1319.93	0	2897.03	242.76	0	0	0.59	99.388	70.963	1.068	11.15
LAWB64	2/5/2002	2000	90	Steel	2/5/2003	365	1.64	3262.23	23.18	0	135.77	1275.47	0	3182.13	205.22	0	0	0	105.388	77.947	0.903	11.14
LAWB64	2/5/2002	2000	90	Steel	8/4/2003	545	12.6	2970	23.14	0	116.9	1016.97	0	3066.63	138.71	0	0	0	95.947	75.117	0.61	11.24
LAWB64	2/5/2002	2000	90	Steel	2/4/2004	729	1.02	2527.3	22.25	0	109.11	890.35	0	2368.23	140.37	0	0	0	81.646	58.01	0.617	11.34
LAWB64	2/5/2002	2000	90	Steel	2/3/2005	1094	0.75	2668.33	23.02	0	94.93	967.18	0	2307	118.6	0	0	0	86.202	56.51	0.522	11.45
LAWB64	2/5/2002	2000	90	Steel	2/6/2006	1462	0	2743.37	23.77	0	104.69	973.54	0	2434.87	150.57	0	0	0	88.626	59.642	0.662	11.54
LAWB64	2/5/2002	2000	90	Steel	2/9/2007	1830	0.73	2341.1	21.01	0	84.37	853.6	0	2106.77	148.61	0	0	0	75.631	51.606	0.654	11.65
LAWB65	2/5/2002	2000	90	Steel	2/12/2002	7	0.94	17.14	0	0	0	11.6	0	19.39	46.73	0	0	0	0.555	0.477	0.206	10.24
LAWB65	2/5/2002	2000	90	Steel	3/5/2002	28	0.82	44.92	1.09	0	0	27.42	0	47.63	80.07	0	0	0	1.456	1.172	0.353	10.45
LAWB65	2/5/2002	2000	90	Steel	4/2/2002	56	0.75	71.11	1.27	0	2.08	43.53	0	78.41	102.27	0	0	0	2.304	1.93	0.451	10.57
LAWB65	2/5/2002	2000	90	Steel	6/5/2002	120	0.96	145.4	3.12	0	4	76.69	0	145.93	139.6	0	0	0	4.711	3.592	0.616	10.76
LAWB65	2/5/2002	2000	90	Steel	8/5/2002	181	0.97	227.9	3.99	0	5.94	101.37	0	204.47	159.83	0	0	0	7.385	5.033	0.705	10.94
LAWB65	2/5/2002	2000	90	Steel	11/1/2002	269	1.05	649.04	8.87	0	16.28	283.52	0	624.72	186.8	0	0	0	21.031	15.377	0.824	11.15
LAWB65	2/5/2002	2000	90	Steel	2/5/2003	365	0.72	1073.8	15.24	0	28.31	374.01	0	971.26	170.45	0	0	0	34.795	23.907	0.752	11.43
LAWB65	2/5/2002	2000	90	Steel	8/4/2003	545	10.91	1725.83	37.19	0	60.98	496.64	0	1484.03	130.21	0	0	0	55.923	36.529	0.574	11.54
LAWB65	2/5/2002	2000	90	Steel	2/4/2004	729	0.69	1934.7	45.73	0	75.98	576.23	0	1845.83	136.29	0	0	0	62.691	45.434	0.601	11.65
LAWB65	2/5/2002	2000	90	Steel	2/3/2005	1094	0	2173.87	49.1	0	83.9	622.69	0	1975.97	121.87	0	0	0	70.441	48.637	0.538	11.74
LAWB65	2/5/2002	2000	90	Steel	2/6/2006	1462	0	2377.73	50.22	0	96.08	613.96	0	2100.87	133.67	0	0	0	77.047	51.712	0.59	11.84
LAWB65	2/5/2002	2000	90	Steel	2/9/2007	1830	0	2070.4	52.97	0	85.81	582.75	0	2040.93	144.06	0	0	0	67.088	50.236	0.636	11.94
LAWB66	2/19/2002	2000	90	Steel	2/26/2002	7	0.81	18.11	2.47	0	0	13.35	0	22.2	48.55	0	0	0	0.585	0.545	0.214	10.17
LAWB66	2/19/2002	2000	90	Steel	3/19/2002	28	1.02	39.6	2.41	0	0	26.52	0	46.52	77.53	0	0	0	1.28	1.142	0.341	10.35
LAWB66	2/19/2002	2000	90	Steel	4/16/2002	56	1.08	53.23	2.28	0	1.83	35.19	0	61.41	93.43	0	0	0	1.721	1.508	0.411	10.45
LAWB66	2/19/2002	2000	90	Steel	6/19/2002	120	1.44	65.12	2.86	0	3.02	44.7	0	75.84	111.43	0	0	0	2.105	1.862	0.49	10.57
LAWB66	2/19/2002	2000	90	Steel	8/19/2002	181	1.04	71.65	3.09	0	2.68	46.51	0	76.48	116.8	0	0	0	2.316	1.878	0.514	10.67
LAWB66	2/19/2002	2000	90	Steel	11/15/2002	269	1.08	87.26	3.87	0	4.41	60.5	0	100.01	149.66	0	0	0	2.821	2.456	0.659	10.76
LAWB66	2/19/2002	2000	90	Steel	2/19/2003	365	1.08	94.14	3.86	0	5.39	63.69	0	100.3	153.46	0	0	0	3.043	2.463	0.675	10.84
LAWB66	2/19/2002	2000	90	Steel	8/20/2003	547	1.06	98.66	1.81	0	5.09	68.64	0	102.63	158.1	0	0	0	3.189	2.52	0.696	10.94
LAWB66	2/19/2002	2000	90	Steel	2/24/2004	735	0.92	101.6	2.07	0	5.63	71.57	0	105.3	175.06	0	0	0	3.284	2.586	0.771	11.04
LAWB66	2/19/2002	2000	90	Steel	2/16/2005	1093	1.17	103.07	3.77	0	5.39	73.24	0	105.29	165.97	0	0	0	3.332	2.585	0.731	11.14
LAWB66	2/19/2002	2000	90	Steel	2/14/2006	1456	0.84	154.2	3.63	0	6.04	94.32	0	164.75	183.87	0	0	0	4.985	4.045	0.809	11.22
LAWB66	2/19/2002	2000	90	Steel	2/20/2007	1827	0.97	764.28	13.46	0	25.03	325.24	0	799.27	184.76	0	0	0	24.706	19.626	0.813	11.34
LAWB67	2/19/2002	2000	90	Steel	2/26/2002	7	1.94	14.97	0.11	0	0	11.76	0	11.51	50.91	0						

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWB68	2/19/2002	2000	90	Steel	4/16/2002	56	1.14	37.33	2.02	0	1.99	29.14	0	49.98	84.8	0	0	0	1.425	1.229	0.374	10.65
LAWB68	2/19/2002	2000	90	Steel	6/19/2002	120	1.64	59.82	2.82	0	3.3	48.42	0	82.52	121.13	0	0	0	2.283	2.03	0.534	10.76
LAWB68	2/19/2002	2000	90	Steel	8/19/2002	181	1.23	66.69	2.88	0	3.53	53.31	0	90.4	129.1	0	0	0	2.545	2.224	0.569	10.87
LAWB68	2/19/2002	2000	90	Steel	11/15/2002	269	1.37	88.09	3.34	0	4.95	68.47	0	121.86	164.47	0	0	0	3.362	2.998	0.725	10.95
LAWB68	2/19/2002	2000	90	Steel	2/19/2003	365	0.95	91.31	3	0	6.42	71.19	0	127.44	154.6	0	0	0	3.484	3.135	0.682	11.04
LAWB68	2/19/2002	2000	90	Steel	8/20/2003	547	1.22	144.68	1.4	0	8.29	103.55	0	182.92	201.9	0	0	0	5.521	4.5	0.89	11.16
LAWB68	2/19/2002	2000	90	Steel	2/24/2004	735	1.15	292.19	1.93	0	12.88	149.06	0	332.11	206.63	0	0	0	11.15	8.17	0.911	11.24
LAWB68	2/19/2002	2000	90	Steel	2/16/2005	1093	2.12	1615.77	21.84	0	71.04	552.06	0	1862.53	159.19	0	0	0	61.658	45.817	0.702	11.35
LAWB68	2/19/2002	2000	90	Steel	2/14/2006	1456	0.95	2061.5	36.74	0	98.08	616.74	0	2399.1	146.31	0.45	0	0	78.667	59.017	0.645	11.43
LAWB68	2/19/2002	2000	90	Steel	2/20/2007	1827	1.06	1926.07	42.57	0	99.97	679.89	0	2208.7	156.02	0	0	0	73.499	54.333	0.688	11.55
LAWB69	3/13/2002	2000	90	Steel	3/20/2002	7	0.77	18.82	8.96	0	0	11.65	0	23.44	44.25	0	0	0	0.491	0.477	0.197	10.36
LAWB69	3/13/2002	2000	90	Steel	4/10/2002	28	1.32	22.9	10.24	0	0	16.1	0	29.38	50.94	0	0	0	0.598	0.598	0.227	10.56
LAWB69	3/13/2002	2000	90	Steel	5/8/2002	56	1.24	25.63	10.16	0	0	17.58	0	33.01	56.52	0	0	0	0.669	0.672	0.252	10.64
LAWB69	3/13/2002	2000	90	Steel	7/11/2002	120	1.47	27.37	12.64	0	0	24.22	0	43.48	70.31	0	0	0	0.715	0.885	0.314	10.76
LAWB69	3/13/2002	2000	90	Steel	9/9/2002	180	1.53	27.89	12.45	0	0	23.89	0	41.89	68.6	0	0	0	0.728	0.853	0.306	10.85
LAWB69	3/13/2002	2000	90	Steel	12/9/2002	271	1.74	40.25	14.93	0	2.14	32.08	0	58.27	94.39	0	0	0	1.051	1.186	0.421	10.94
LAWB69	3/13/2002	2000	90	Steel	9/11/2003	547	2.57	35.31	8.52	0	1.84	27.84	0	49.03	79.6	0	0	0	0.922	0.998	0.355	11.26
LAWB69	3/13/2002	2000	90	Steel	3/15/2004	733	1.63	43.66	7.69	0	2.78	31.6	0	55.24	90	0	0	0	1.14	1.125	0.401	11.35
LAWB69	3/13/2002	2000	90	Steel	3/11/2005	1094	1.39	59.24	6.21	0	3.05	45.8	0	81.97	117	0	0	0	1.547	1.669	0.522	11.41
LAWB69	3/13/2002	2000	90	Steel	3/9/2006	1457	1.11	73.59	6.11	0	3.06	50.6	0	93.12	132.06	0	0	0	1.922	1.896	0.589	11.52
LAWB69	3/13/2002	2000	90	Steel	3/7/2007	1820	1.3	94.97	5.91	0	3.38	65.18	0.7	125.67	167.25	0	0	0	2.48	2.558	0.746	11.62
LAWB70	3/13/2002	2000	90	Steel	3/20/2002	7	0.74	42.81	1.65	0	0	21.95	0	46	69.01	0	0	0	1.117	0.935	0.307	10.32
LAWB70	3/13/2002	2000	90	Steel	4/10/2002	28	1.19	110.87	2.21	0	2.26	57.02	0	116.4	115	0	0	0	2.892	2.367	0.512	10.55
LAWB70	3/13/2002	2000	90	Steel	5/8/2002	56	0.99	180.8	2.93	0	3.52	87.42	0	178.6	149.63	0	0	0	4.716	3.631	0.667	10.65
LAWB70	3/13/2002	2000	90	Steel	7/11/2002	120	0	361.4	6.14	0	6.85	166.33	0	414.1	194.63	0	0	0	9.427	8.42	0.867	10.76
LAWB70	3/13/2002	2000	90	Steel	9/9/2002	180	0	559.97	9.28	0	10.45	223.77	0	544.5	173.4	0	0	0	14.606	11.071	0.773	10.87
LAWB70	3/13/2002	2000	90	Steel	12/9/2002	271	0.85	1254.3	24.57	0	32.13	414.5	0	1165.27	238.89	0	0	0	32.716	23.693	1.064	10.95
LAWB70	3/13/2002	2000	90	Steel	9/11/2003	547	9.26	1942	51.73	0	62.88	619.03	0.51	1773.3	174.09	0	0	0	50.654	36.055	0.776	11.26
LAWB70	3/13/2002	2000	90	Steel	3/15/2004	733	0.67	2143	52.93	0	71.85	647.71	0.27	2137.57	167.94	0	0	0	55.897	43.462	0.748	11.33
LAWB70	3/13/2002	2000	90	Steel	3/11/2005	1094	0	2583.17	58.26	0	80.74	716.15	0	2647.23	136.33	0	0	0	67.378	53.824	0.607	11.38
LAWB70	3/13/2002	2000	90	Steel	3/9/2006	1457	0	3017	62.33	0	100.23	857.98	0	3479.63	146.97	0	0	0	78.694	70.749	0.655	11.43
LAWB70	3/13/2002	2000	90	Steel	3/7/2007	1820	0.76	2902.67	72.61	0	96.38	845.32	0.88	3547.13	169.72	0	0	0	75.711	72.121	0.756	11.52
LAWB71	3/13/2002	2000	90	Steel	3/20/2002	7	0.93	21.5	1.29	0	0	13.35	0	27.19	52.44	0	0	0	0.641	0.552	0.234	10.28
LAWB71	3/13/2002	2000	90	Steel	4/10/2002	28	1.36	57.66	1.17	0	0	33.63	0	69.81	93.76	0	0	0	1.719	1.419	0.418	10.51
LAWB71	3/13/2002	2000	90	Steel	5/8/2002	56	1.18	92.42	1.44	0	2.32	50.41	0	106.23	127.83	0	0	0	2.756	2.159	0.569	10.64
LAWB71	3/13/2002	2000	90	Steel	7/11/2002	120	0.82	159.87	2.57	0	3.47	90.14	0	209.13	174.97	0	0	0	4.767	4.25	0.779	10.77
LAWB71	3/13/2002	2000	90	Steel	9/9/2002	180	0	283.5	3.35	0	5.8	140.57	0	322.27	178.5	0	0	0	8.453	6.549	0.795	10.84
LAWB71	3/13/2002	2000	90	Steel	12/9/2002	271	1.19	979.85	9.76	0	24.1	347.41	0	971.23	269.75	0	0	0	29.215	19.735	1.201	10.94
LAWB71	3/13/2002	2000	90	Steel	9/11/2003	547	10.23	2226.37	38.38	0	84.23	705.15	0.49	2345.87	169.49	0.43	0	0	66.381	47.668	0.755	11.26
LAWB71	3/13/2002	2000	90	Steel	3/15/2004	733	1.12	2478.83	41.64	0	95.72	735.18	0.27	2730.6	164.64	0	0	0	73.908	55.486	0.733	11.34
LAWB71	3/13/2002	2000	90	Steel	3/11/2005	1094	0	2641.8	41.19	0	90.07	770.52	0	3033.87	135.17	0	0	0	78.767	61.648	0.602	11.42
LAWB71	3/13/2002	2000	90	Steel	3/9/2006	1457	0	2704.13	44.11	0	102.57	824.82	0	3516.63	146.18	0	0	0	80.626	71.458	0.651	11.53
LAWB71	3/13/2002	2000	90	Steel	3/7/2007	1820	0.99	2738.3	47.67	0	89.27	747.65	0.81	3334.47	161.98	0	0	0	81.645	67.756	0.721	11.57
LAWB72	3/13/2002	2000	90	Steel	3/20/2002	7	0	33.65	2.71	0	0	15.88	0	37.78	58.14	0	0	0	0.878	0.769	0.259	10.24
LAWB72	3/13/2002	2000	90	Steel	4/10/2002	28	0.92	76.16	2.74	0	0	35.12	0	83.36	90.23	0	0	0	1.988	1.696	0.402	10.42
LAWB72	3/13/2002	2000	90	Steel	5/8/2002	56	0.87	95.8	2.99	0	2.41	42.44	0	100.97	106.63	0	0	0	2.501	2.054	0.475	10.54
LAWB72	3/13/2002	2000	90	Steel	7/11/2002	120	0	116.2	4.08	0	2.79	54.48	0	123.13	125.77	0	0	0	3.033	2.505	0.561	10.68
LAWB72	3/13/2002	2000	90	Steel	9/9/2002	180	0.78	110.87	4.18	0	2.58	53.2	0	127.43	118.03	0	0	0	2.894	2.593	0.526	10.76
LAWB72	3/13/2002	2000	90	Steel	12/9/2002	271	0.74	157.77	5.94	0	4.73	72.9	0	163.47	167.93	0	0	0	4.118	3.326	0.749	10.84
LAWB72	3/13/2002	2000	90	Steel	9/11/2003	547	1.92	153.84	5.26	0	4.25	67.54	0	158.38	151.36	0	0	0	4.015	3.222	0.675	11.05
LAWB72	3/13/2002	2000	90	Steel	3/15/2004	733	0	155.05	6.58	0	4.91	67.32	0	158.6	164.09	0	0	0	4.047	3.227	0.732	11.14
LAWB72	3/13/2002	2000	90	Steel	3/11/2005	1094	0	168.4	7.25	0	4.87	84.18	0	186.62	192.64	0	0	0	4.396	3.797	0.859	11.26
LAWB72	3/13/2002	2000	90	Steel	3/9/2006	1457	0	193.95	5.93	0	5.31	89.8	0	244.32	201.49	0	0	0	5.062	4.971	0.898	11.37
LAWB72	3/13/2002	2000	90	Steel	3/7/2007	1820	0	272.49	6.68	0	5.92	111.84	0.68	268.02	234.66	0	0	0	7.112	5.453	1.046	11.45
LAWB73	4/17/2002	2000	90	Steel	4/24/2002	7	0.9	12.74	5.89	0	0	10.76	0	15.47	39.51	0	0	0	0.412	0.38	0.174	10.25
LAWB73	4/17/2002	2000	90	Steel	5/15/2002	28	1.16	19.14	5.43	0	0	16.38	0	24.2	53.02	0	0	0	0.62	0.594	0.234	10.43
LAWB73	4/17/2002	2000	90	Steel	6/12/2002	56	1.07	22.91	5.11	0	0	20.39										

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWB74	4/17/2002	2000	90	Steel	4/10/2006	1454	1.1	81.23	4.52	0	4.19	80.76	0	102.09	182.92	0	0	0	2.588	2.496	0.803	11.34
LAWB74	4/17/2002	2000	90	Steel	4/24/2007	1833	0.92	136.9	4.15	0	5.49	101.58	0	146.96	217.5	0	0	0	4.362	3.593	0.955	11.41
LAWB75	4/17/2002	2000	90	Steel	4/24/2002	7	1.1	12.57	3.97	0	0	9.7	0	11.73	36.1	0	0	0	0.343	0.288	0.159	10.16
LAWB75	4/17/2002	2000	90	Steel	5/15/2002	28	1.16	20.4	3.4	0	0	16.17	0	19.7	51.43	0	0	0	0.557	0.484	0.227	10.34
LAWB75	4/17/2002	2000	90	Steel	6/12/2002	56	1.18	25.29	3.09	0	0	20.9	0	23.72	60.4	0	0	0	0.691	0.583	0.267	10.52
LAWB75	4/17/2002	2000	90	Steel	8/15/2002	120	1.2	32.71	3.6	0	0	25.78	0	27.33	75.57	0	0	0	0.893	0.672	0.333	10.66
LAWB75	4/17/2002	2000	90	Steel	10/16/2002	182	1.42	35.5	3.67	0	0	28.38	0	29.08	79.99	0	0	0	0.97	0.715	0.353	10.76
LAWB75	4/17/2002	2000	90	Steel	10/16/2003	547	1.71	46.25	3.39	0	2.09	42.15	0	40.31	103.95	0	0	0	1.263	0.991	0.459	11.07
LAWB75	4/17/2002	2000	90	Steel	4/18/2005	1097	2.4	45.47	3.59	0	2.23	50.65	0	44.36	113.88	0	0	0	1.242	1.09	0.503	11.25
LAWB75	4/17/2002	2000	90	Steel	4/10/2006	1454	1.76	58.46	4.3	0	3.06	67.82	0	59.82	149.68	0	0	0	1.597	1.47	0.661	11.35
LAWB75	4/17/2002	2000	90	Steel	4/24/2007	1833	1.49	63.14	4.26	0	3.22	63.39	0	54.68	151.92	0	0	0	1.724	1.344	0.67	11.44
LAWB76	4/17/2002	2000	90	Steel	4/24/2002	7	1	15.37	5.27	0	0	12.57	0	14.64	42.69	0	0	0	0.42	0.36	0.185	10.24
LAWB76	4/17/2002	2000	90	Steel	5/15/2002	28	1.08	22.21	4.81	0	0	19.08	0	22.41	56.97	0	0	0	0.607	0.551	0.247	10.43
LAWB76	4/17/2002	2000	90	Steel	6/12/2002	56	1.16	24.8	4.44	0	0	21.59	0	24.11	63.4	0	0	0	0.677	0.593	0.275	10.58
LAWB76	4/17/2002	2000	90	Steel	8/15/2002	120	1.14	30.75	5.31	0	0	24.88	0	26.48	76.05	0	0	0	0.84	0.651	0.33	10.67
LAWB76	4/17/2002	2000	90	Steel	10/16/2002	182	1.2	30.79	5.26	0	0	27.4	0	27.59	78.04	0	0	0	0.841	0.678	0.338	10.77
LAWB76	4/17/2002	2000	90	Steel	10/16/2003	547	1.56	38.73	5.64	0	2.11	38.66	0	37.19	100.81	0	0	0	1.058	0.914	0.437	11.06
LAWB76	4/17/2002	2000	90	Steel	4/18/2005	1097	2.03	42.56	6.27	0	1.98	44.47	0.33	39.57	112.98	0	0	0	1.163	0.973	0.49	11.27
LAWB76	4/17/2002	2000	90	Steel	4/10/2006	1454	1.6	41.86	6.12	0	2.64	53.43	0	47.32	129.34	0	0	0	1.143	1.163	0.561	11.37
LAWB76	4/17/2002	2000	90	Steel	4/24/2007	1833	1.43	45.49	6.24	0	2.24	52.89	0	44.32	131.86	0	0	0	1.243	1.089	0.571	11.46
LAWB77	4/17/2002	2000	90	Steel	4/24/2002	7	0.89	27.73	1.79	0	0	13.68	0	29.53	52.03	0	0	0	0.723	0.6	0.232	10.04
LAWB77	4/17/2002	2000	90	Steel	5/15/2002	28	0.78	87.78	1.36	0	1.81	40.27	0	93.38	97.25	0	0	0	2.289	1.898	0.433	10.24
LAWB77	4/17/2002	2000	90	Steel	6/12/2002	56	0	120.37	1.64	0	2.23	52	0	126.5	116.43	0	0	0	3.139	2.572	0.519	10.37
LAWB77	4/17/2002	2000	90	Steel	8/15/2002	120	0	149.87	2.87	0	3.28	64	0	136.2	140.8	0	0	0	3.908	2.769	0.627	10.47
LAWB77	4/17/2002	2000	90	Steel	10/16/2002	182	0	151.93	3.09	0	2.79	65.52	0	139.17	143.27	0	0	0	3.962	2.829	0.638	10.55
LAWB77	4/17/2002	2000	90	Steel	10/16/2003	547	0	208.55	4.04	0	4.59	91.45	0	212.44	161.66	0	0	0	5.439	4.319	0.72	10.84
LAWB77	4/17/2002	2000	90	Steel	4/18/2005	1097	2.21	603.99	11.04	0	12.29	197.37	0	560.43	154.4	0	0	0	15.751	11.392	0.688	11.07
LAWB77	4/17/2002	2000	90	Steel	4/10/2006	1454	0	1043.43	21.54	0	24.54	313.38	0	1079.03	163.76	0	0	0	27.211	21.935	0.73	11.14
LAWB77	4/17/2002	2000	90	Steel	4/24/2007	1833	0	1061.63	23.06	0	26.01	304.31	0	1109	197.41	0	0	0	27.685	22.544	0.879	11.24
LAWB78	5/7/2002	2000	90	Steel	5/14/2002	7	0.88	46.94	2.25	0	0	16.24	0	80.68	70.59	0	0	0	1.224	1.11	0.321	10.58
LAWB78	5/7/2002	2000	90	Steel	6/4/2002	28	0.79	82.23	2.54	0	2.08	28.71	0	133.87	100.8	0	0	0	2.144	1.842	0.458	10.74
LAWB78	5/7/2002	2000	90	Steel	7/2/2002	56	0	87.37	2.91	0	0	30.02	0	130.97	97.18	0	0	0	2.278	1.802	0.442	10.84
LAWB78	5/7/2002	2000	90	Steel	9/4/2002	120	0.97	95.8	3.43	0	2.44	31.79	0	161.07	120.93	0	0	0	2.498	2.216	0.55	10.93
LAWB78	5/7/2002	2000	90	Steel	5/7/2003	365	0	104.62	4.24	0	3.42	37.3	0	191.18	129.42	0	0	0	2.728	2.263	0.588	11.14
LAWB78	5/7/2002	2000	90	Steel	11/5/2003	547	0.75	101.72	3.91	0	3.01	34.35	0	180.42	138.72	0	0	0	2.652	2.482	0.63	11.26
LAWB78	5/7/2002	2000	90	Steel	5/6/2005	1095	1.39	114.06	4.56	0	3.19	40.28	0	180.77	141.24	0	0	0	2.974	2.487	0.642	11.43
LAWB78	5/7/2002	2000	90	Steel	5/23/2006	1477	0.73	132.96	4.65	0	3.99	48.51	0	225.08	152.47	0	0	0	3.467	3.097	0.693	11.54
LAWB78	5/7/2002	2000	90	Steel	5/23/2007	1842	0	171.98	7.77	0	6.32	68.35	0	327.2	215.4	0	0	0	4.484	4.502	0.979	11.54
LAWB79	5/7/2002	2000	90	Steel	5/14/2002	7	0.7	41.78	2.39	0	0	16.58	0	62.59	67.28	0	0	0	1.09	0.978	0.301	10.35
LAWB79	5/7/2002	2000	90	Steel	6/4/2002	28	0.83	75.37	2.3	0	2.09	30.9	0	108.8	98.16	0	0	0	1.967	1.7	0.44	10.56
LAWB79	5/7/2002	2000	90	Steel	7/2/2002	56	0	77.37	2.86	0	0	31.42	0	102.83	98.84	0	0	0	2.019	1.606	0.443	10.66
LAWB79	5/7/2002	2000	90	Steel	9/4/2002	120	0.84	84.58	3.4	0	2.23	34.03	0	125.47	111.33	0	0	0	2.207	1.96	0.499	10.77
LAWB79	5/7/2002	2000	90	Steel	5/7/2003	365	0	106.84	4.37	0	3.84	45.84	0	171.5	135.25	0	0	0	2.788	2.679	0.606	11.05
LAWB79	5/7/2002	2000	90	Steel	11/5/2003	547	0	106.22	4.38	0	3.33	42.43	0	154.21	144.03	0	0	0	2.772	2.409	0.645	11.15
LAWB79	5/7/2002	2000	90	Steel	5/6/2005	1095	1.37	116.01	5.77	0	3.6	47.66	0	158.61	150.65	0	0	0	3.027	2.478	0.675	11.34
LAWB79	5/7/2002	2000	90	Steel	5/23/2006	1477	0.73	126.04	6.69	0	4.65	55.54	0	189.25	169.44	0	0	0	3.289	2.956	0.759	11.42
LAWB79	5/7/2002	2000	90	Steel	5/23/2007	1842	0	122.64	7.69	0	5.61	60.52	0	214.54	183.49	0	0	0	3.2	3.351	0.822	11.45
LAWB80	5/7/2002	2000	90	Steel	5/14/2002	7	0	33.76	3.16	0	9.45	13.33	0	35.79	56.41	0	0	0	0.881	0.728	0.251	10.25
LAWB80	5/7/2002	2000	90	Steel	6/4/2002	28	0	56.28	3	0	14.33	23.4	0	60.81	76.67	0	0	0	1.469	1.237	0.342	10.43
LAWB80	5/7/2002	2000	90	Steel	7/2/2002	56	0	57.75	3.46	0	13.44	23.45	0	60.58	77.37	0	0	0	1.507	1.232	0.345	10.57
LAWB80	5/7/2002	2000	90	Steel	9/4/2002	120	0	62.66	4.26	0	14.22	24.76	0	63.36	81.59	0	0	0	1.635	1.289	0.364	10.65
LAWB80	5/7/2002	2000	90	Steel	5/7/2003	365	0	71.01	4.57	0	18.78	29.28	0	75.34	95.15	0	0	0	1.853	1.533	0.424	10.94
LAWB80	5/7/2002	2000	90	Steel	11/5/2003	547	0	73.45	5.1	0	19.02	29.71	0	74.98	109.47	0	0	0	1.917	1.525	0.488	11.05
LAWB80	5/7/2002	2000	90	Steel	5/6/2005	1095	1.2	79.43	6.17	0	20.51	33.48	0	80.59	112.31	0	0	0	2.073	1.639	0.501	11.25
LAWB80	5/7/2002	2000	90	Steel	5/23/2006	1477	0.69	80.91	5.92	0	23.28	35.75	0	86.39	114.97	0	0	0	2.111	1.757	0.513	11.34
LAWB80	5/7/2002	2000	90	Steel	5/23/2007	1842	0	80.39	7.7	0	24.54	41.72	0	99.97	136.34	0	0	0	2.098	2.034	0.608	11.36
LAWB81	5/7/2002	2000	90	Steel	5/14/2002	7	0.76	34.46	2.77	0	0	16.7	0	38.59	59.15	0	0	0	0.899	0.785	0.264	10.24
LAWB81	5/7/2002	2000	90	Steel	6/4/2002	28	0.76	73.19	2.56	0	1.81	36.										

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWB82	5/7/2002	2000	90	Steel	11/5/2003	547	1.72	428.68	6.89	0	11.4	190.17	0	548.39	193.93	0	0	0	13.669	11.143	0.911	11.07
LAWB82	5/7/2002	2000	90	Steel	5/6/2005	1095	4.42	1296.2	18.41	0	33.05	470.01	0	1391.3	144.01	0	0	0	41.331	28.271	0.677	11.24
LAWB82	5/7/2002	2000	90	Steel	5/23/2006	1477	1.99	2065.77	31.61	0	60.58	644.14	0	1991.43	150.8	0	0	0.75	65.87	40.466	0.709	11.34
LAWB82	5/7/2002	2000	90	Steel	5/23/2007	1842	1.02	2209.33	41.49	0	66.04	715.48	0	2795.03	146.63	0	0	0	70.447	56.795	0.689	11.36
LAWB83	5/29/2002	2000	90	Steel	6/5/2002	7	1.06	19.06	1.66	0	0	13.03	0	21.38	52.35	0	0	0	0.612	0.527	0.23	10.16
LAWB83	5/29/2002	2000	90	Steel	6/26/2002	28	0.93	44.99	0.98	0	0	27.93	0	48.61	84.45	0	0	0	1.444	1.197	0.372	10.33
LAWB83	5/29/2002	2000	90	Steel	7/24/2002	56	2.11	70.56	1.26	0	0	40.85	0	74.59	103.37	0	0	0	2.265	1.837	0.455	10.53
LAWB83	5/29/2002	2000	90	Steel	9/26/2002	120	0.7	136.1	2.5	0	2.4	72.52	0	151.27	133.53	0	0	0	4.368	3.726	0.588	10.67
LAWB83	5/29/2002	2000	90	Steel	11/25/2002	180	0	290.16	3.54	0	6.01	121.34	0	266.84	171.99	0	0	0	9.312	6.572	0.757	10.75
LAWB83	5/29/2002	2000	90	Steel	2/24/2003	271	0	484.63	7.27	0	8.63	198.36	0	477.16	172.52	0	0	0	15.554	11.752	0.759	10.84
LAWB83	5/29/2002	2000	90	Steel	5/27/2003	363	0.71	690.16	9.12	0	14.16	266.87	0	605.87	161.41	0	0	0	22.15	14.922	0.71	10.93
LAWB83	5/29/2002	2000	90	Steel	11/24/2003	544	1.17	1278.57	24.25	0	27.6	397.05	0	1047.13	138.59	0	0	0	41.034	25.79	0.61	11.07
LAWB83	5/29/2002	2000	90	Steel	5/27/2004	729	0	1604.4	32.21	0	33.67	484.87	0	1517.97	111.76	0	0	0	51.491	37.386	0.492	11.15
LAWB83	5/29/2002	2000	90	Steel	5/23/2006	1455	0	1893.27	51.62	0	43.95	543.51	0	1998.2	109.47	0	0	0	60.762	49.214	0.482	11.26
LAWB83	5/29/2002	2000	90	Steel	5/24/2007	1821	0	1959.33	47.28	0	50.4	539.06	0	1876.7	110.87	0	0	0	62.882	46.221	0.488	11.32
LAWB84	5/29/2002	2000	90	Steel	6/5/2002	7	1.1	21.02	1.53	0	0	14.16	0	22.72	55.73	0	0	0	0.674	0.559	0.245	10.16
LAWB84	5/29/2002	2000	90	Steel	6/26/2002	28	0.87	48.99	0.92	0	0	30.91	0	52.92	88.87	0	0	0	1.571	1.303	0.391	10.34
LAWB84	5/29/2002	2000	90	Steel	7/24/2002	56	2.27	78.49	1.67	0	0	45.13	0	81.25	108.33	0	0	0	2.518	2	0.476	10.57
LAWB84	5/29/2002	2000	90	Steel	9/26/2002	120	0.65	155.13	2.66	0	2.64	83.42	0	166.13	140.7	0	0	0	4.976	4.089	0.619	10.66
LAWB84	5/29/2002	2000	90	Steel	11/25/2002	180	0	343.54	4.04	0	6.81	144.6	0	297.51	172.48	0	0	0	11.019	7.323	0.758	10.76
LAWB84	5/29/2002	2000	90	Steel	2/24/2003	271	0.71	655.48	9.31	0	11.27	257.23	0	633.07	186.85	0	0	0	21.024	15.583	0.822	10.85
LAWB84	5/29/2002	2000	90	Steel	5/27/2003	363	0	860.37	10.85	0	15.36	290.61	0	712.75	147.55	0	0	0	27.596	17.544	0.649	10.96
LAWB84	5/29/2002	2000	90	Steel	11/24/2003	544	1.19	1491	28.46	0	31.76	432.14	0	1162.67	136.29	0	0	0	47.823	28.618	0.599	11.06
LAWB84	5/29/2002	2000	90	Steel	5/27/2004	729	0	1810.67	34.8	0	38.96	543.62	0	1698.17	116.35	0	0	0	58.076	41.799	0.512	11.18
LAWB84	5/29/2002	2000	90	Steel	5/23/2006	1455	0	1872.8	54.6	0	43.23	560.72	0	2038.8	110.88	0	0	0	60.069	50.184	0.488	11.32
LAWB84	5/29/2002	2000	90	Steel	5/24/2007	1821	0	1990.8	47.27	0	51.74	533.91	0	1991.73	109.81	0	0	0	63.854	49.025	0.483	11.35
LAWB85	5/29/2002	2000	90	Steel	6/5/2002	7	1.28	23.29	0.69	0	0	12.37	0	20.3	55.69	0	0	0	0.651	0.5	0.245	10.11
LAWB85	5/29/2002	2000	90	Steel	6/26/2002	28	0.86	61.62	0.34	0	0	30.84	0	53.38	88.47	0	0	0	1.722	1.315	0.389	10.27
LAWB85	5/29/2002	2000	90	Steel	7/24/2002	56	2.5	163.3	1.38	0	1.92	72.1	0	127.77	114.33	0	0	0	4.563	3.147	0.503	10.42
LAWB85	5/29/2002	2000	90	Steel	9/26/2002	120	0	386.07	3.58	0	3.99	150.27	0	291.7	129.67	0	0	0	10.787	7.184	0.57	10.57
LAWB85	5/29/2002	2000	90	Steel	11/25/2002	180	0	631.7	5.31	0	7.91	208.68	0	410.94	147.63	0	0	0	17.65	10.12	0.65	10.65
LAWB85	5/29/2002	2000	90	Steel	2/24/2003	271	0	830.9	9.16	0	9.64	287.17	0	650.11	133.53	0	0	0	23.215	16.01	0.587	10.76
LAWB85	5/29/2002	2000	90	Steel	5/27/2003	363	0	1094.17	11.26	0	14.05	342.06	0	721.3	121.98	0	0	0	30.571	17.763	0.537	10.85
LAWB85	5/29/2002	2000	90	Steel	11/24/2003	544	1.08	1892.2	30.6	0	27.51	476.9	0	1337.43	115.74	0	0	0	52.868	32.936	0.509	10.95
LAWB85	5/29/2002	2000	90	Steel	5/27/2004	729	0	2051.4	39.39	0	34.04	567.81	0	1656.7	99.25	0	0	0	57.316	40.799	0.437	11.14
LAWB85	5/29/2002	2000	90	Steel	5/23/2006	1455	0	2337.87	60.52	0	38.86	596.68	0	2085.17	98.37	0	0	0	65.32	51.351	0.433	11.27
LAWB85	5/29/2002	2000	90	Steel	5/24/2007	1821	0	2694.83	53.27	0	43.64	544.21	0	1914.97	92.2	0	0	0	75.293	47.159	0.406	11.37
LAWB86	5/29/2002	2000	90	Steel	6/5/2002	7	0.83	48.31	1.07	0	0	23.17	0	41	75.22	0	0	0	1.252	1.009	0.331	10.14
LAWB86	5/29/2002	2000	90	Steel	6/26/2002	28	0	161.57	1.55	0	2.16	70.31	0	128.87	114.87	0	0	0	4.188	3.171	0.505	10.26
LAWB86	5/29/2002	2000	90	Steel	7/24/2002	56	3.36	265.4	3.26	0	3.02	102.33	0	203.13	121	0	0	0	6.879	4.999	0.532	10.43
LAWB86	5/29/2002	2000	90	Steel	9/26/2002	120	0	492.47	7.86	0	5.25	172.03	0	347.37	136.53	0	0	0	12.764	8.549	0.6	10.56
LAWB86	5/29/2002	2000	90	Steel	11/25/2002	180	0	820.94	10.95	0	10.88	259.65	0	508.25	150.47	0	0	0	21.277	12.508	0.662	10.65
LAWB86	5/29/2002	2000	90	Steel	2/24/2003	271	0	1153.97	22.5	0	14.07	361.73	0	892.67	142.13	0	0	0	29.908	21.968	0.625	10.75
LAWB86	5/29/2002	2000	90	Steel	5/27/2003	363	0	1262.57	22.68	0	17.96	367.98	0	823.38	121.84	0	0	0	32.723	20.263	0.536	10.85
LAWB86	5/29/2002	2000	90	Steel	11/24/2003	544	1.2	1792.27	44.42	0	26.78	467	0	1298.57	119.54	0	0	0	46.452	31.957	0.526	10.97
LAWB86	5/29/2002	2000	90	Steel	5/27/2004	729	0	1884.03	52.58	0	30.49	538.91	0	1424.3	106.7	0	0	0	48.83	35.051	0.469	11.14
LAWB86	5/29/2002	2000	90	Steel	5/23/2006	1455	0	2008.3	64.89	0	31.07	549.5	0	1730.1	105.12	0	0	0	52.051	42.577	0.462	11.35
LAWB86	5/29/2002	2000	90	Steel	5/24/2007	1821	0	2257.57	61.9	0	36.46	536.34	0	1735.17	96.57	0	0	0	58.511	42.701	0.425	11.37
LAWB87	6/25/2002	2000	90	Steel	7/2/2002	7	1.56	21.4	0.98	0	0	13.44	0	15.47	50.52	0	0	0	0.529	0.416	0.22	10.03
LAWB87	6/25/2002	2000	90	Steel	7/23/2002	28	1.42	40.03	0.78	0	0	22.78	0	24.81	71.71	0	0	0	0.99	0.667	0.312	10.22
LAWB87	6/25/2002	2000	90	Steel	8/20/2002	56	1.17	42.86	0.86	0	0	25.33	0	25.53	72.25	0	0	0	1.06	0.687	0.314	10.34
LAWB87	6/25/2002	2000	90	Steel	10/23/2002	120	1.31	48.14	1.08	0	0	28.74	0	27.82	81.67	0	0	0	1.191	0.748	0.355	10.46
LAWB87	6/25/2002	2000	90	Steel	12/15/2003	538	1.23	66.68	1.24	0	0	38.86	0	31.94	101.8	0	0	0	1.649	0.859	0.443	10.85
LAWB87	6/25/2002	2000	90	Steel	6/22/2006	1458	0.73	71.9	1.74	0	0	42.89	0	30.87	112.57	0	0	0	1.778	0.83	0.489	11.15
LAWB87	6/25/2002	2000	90	Steel	10/22/2007	1925	1.04	97.35	2.48	0	1.88	58.03	0	42.15	147.52	0	0	0	2.408	1.134	0.641	11.23
LAWB88	6/25/2002	2000	90	Steel	7/2/2002	7	1.17	15.86	3.72	0	0	10.67	0	11.9	43.3	0	0	0	0.393	0.32	0.185	10.04
LAWB88	6/25/2002	2000	90	Steel	7/23/2002	28	1.1	20.81	3.5	0	0											

The Catholic University of America
Vitrous State Laboratory

ILAW Glass Testing for Disposal at IDF
Final Report, VSL-11R2270-1, Rev. 0

Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWB89	9/18/2002	2000	90	Steel	10/11/2007	1849	0	1027.23	28.27	0	27.18	412.41	0	784.36	148.75	0	0	0	32.951	25.887	0.645	11.26
LAWB90	9/18/2002	2000	90	Steel	9/25/2002	7	1.33	19.41	2.1	0	0	10.57	0	27.78	57.26	0	0	0	0.622	0.544	0.255	10.28
LAWB90	9/18/2002	2000	90	Steel	10/16/2002	28	1.04	39.39	1.15	0	0	20.61	0	55.95	81.51	0	0	0	1.262	1.096	0.363	10.37
LAWB90	9/18/2002	2000	90	Steel	11/13/2002	56	1.08	50.11	1.34	0	0	25.34	0	68.1	88.52	0	0	0.63	1.606	1.333	0.395	10.45
LAWB90	9/18/2002	2000	90	Steel	6/16/2003	271	0.79	88.08	2.48	0	2.62	45.71	0	122.41	136.12	0	0	0	2.823	2.397	0.607	10.76
LAWB90	9/18/2002	2000	90	Steel	9/17/2003	364	0.86	86.49	2.2	0	2.53	45.61	0	126.67	135.36	0	0	0	2.772	2.48	0.603	10.86
LAWB90	9/18/2002	2000	90	Steel	3/17/2004	546	0.64	87.56	2.19	0	2.58	48.01	0	121.75	134.52	0	0	0	2.806	2.384	0.6	10.97
LAWB90	9/18/2002	2000	90	Steel	9/17/2004	730	0	91.06	2.73	0	2.15	55.53	0	128.75	158.46	0	0	0	2.918	2.521	0.706	11.05
LAWB90	9/18/2002	2000	90	Steel	9/19/2005	1097	1.15	108.94	3.54	0	2.82	56.42	0	143.86	165.08	0	0	0	3.491	2.817	0.736	11.15
LAWB90	9/18/2002	2000	90	Steel	10/11/2007	1849	0	163.29	4.67	0	4.09	86.58	0	198.91	192.32	0	0	0	5.233	3.895	0.857	11.35
LAWB91	9/18/2002	2000	90	Steel	9/25/2002	7	1.37	24.65	1.77	0	0	10.2	0	44.92	62.79	0	0	0	0.79	0.693	0.287	10.34
LAWB91	9/18/2002	2000	90	Steel	10/16/2002	28	1.11	55.22	1.08	0	0	21.39	0	97.66	92.68	0	0	0	1.77	1.507	0.424	10.45
LAWB91	9/18/2002	2000	90	Steel	11/13/2002	56	0.95	74.9	1.36	0	0	28.56	0	135.5	101.73	0	0	0	2.401	2.091	0.465	10.56
LAWB91	9/18/2002	2000	90	Steel	6/16/2003	271	0.82	248.83	3.75	0	5.3	81.74	0	467.27	181.16	0	0	0	7.976	7.21	0.828	10.84
LAWB91	9/18/2002	2000	90	Steel	9/17/2003	364	0.71	317.28	3.9	0	6.76	97.36	0	542.91	180.03	0	0	0	10.17	8.378	0.823	10.95
LAWB91	9/18/2002	2000	90	Steel	3/17/2004	546	0	486.33	6.21	0	10.38	123.56	0	790.66	193.84	0	0	0	15.589	12.201	0.886	11.06
LAWB91	9/18/2002	2000	90	Steel	9/17/2004	730	1.27	886.52	10.03	0	17.32	186.84	0	1243.23	198.44	0	0	0	28.417	19.184	0.907	11.12
LAWB91	9/18/2002	2000	90	Steel	9/19/2005	1097	4.15	1313.27	20.97	0	31.59	275.87	0	1799.33	168.53	0	0	0	42.097	27.766	0.77	11.25
LAWB92	9/18/2002	2000	90	Steel	9/25/2002	7	1.35	28.43	1.74	0	0	8.41	0	59.63	64.66	0	0	0	0.912	0.794	0.3	10.38
LAWB92	9/18/2002	2000	90	Steel	10/16/2002	28	1.14	63.98	1.09	0	1.71	17.96	0	128.17	96.52	0	0	0	2.052	1.707	0.448	10.48
LAWB92	9/18/2002	2000	90	Steel	11/13/2002	56	0.93	78.4	1.47	0	0	21.95	0	167.8	101.97	0	0	0	2.515	2.235	0.473	10.56
LAWB92	9/18/2002	2000	90	Steel	6/16/2003	271	0.89	148.35	2.38	0	3.48	38.15	0	318.6	150.2	0	0	0	4.758	4.243	0.697	10.85
LAWB92	9/18/2002	2000	90	Steel	9/17/2003	364	0.91	182.68	2.76	0	4.57	47.63	0	386.18	176.22	0	0	0	5.859	5.143	0.818	10.95
LAWB92	9/18/2002	2000	90	Steel	3/17/2004	546	0	197.55	3.43	0	4.74	51.51	0	376.35	185.78	0	0	0	6.336	5.012	0.862	11.07
LAWB92	9/18/2002	2000	90	Steel	9/17/2004	730	0.79	239.41	4.04	0	5.18	65.08	0	459.57	206.48	0	0	0	7.679	6.12	0.958	11.15
LAWB92	9/18/2002	2000	90	Steel	9/19/2005	1097	2.65	704.15	9.45	0	16.28	129.87	0	1085.37	176.95	0	0	0	22.585	14.454	0.821	11.26
LAWB92	9/18/2002	2000	90	Steel	10/11/2007	1849	0.69	740.57	12.43	0	17.53	143.89	0	1240.33	256.47	0	0	0	23.753	16.518	1.19	11.36
LAWB93	10/16/2002	2000	90	Steel	10/23/2002	7	1.39	26.69	2.09	0	0	12.85	0	17.55	52	0	0	0	0.856	0.494	0.227	10.27
LAWB93	10/16/2002	2000	90	Steel	11/13/2002	28	1.03	38.32	1.29	0	0	22.83	0	30.5	72.12	0	0	0	1.229	0.859	0.315	10.37
LAWB93	10/16/2002	2000	90	Steel	12/11/2002	56	0.97	51.76	1.48	0	0	30.38	0	44.14	91.28	0	0	0	1.661	1.244	0.399	10.45
LAWB93	10/16/2002	2000	90	Steel	2/13/2003	120	0	64.32	1.67	0	0	38.31	0	54.76	99.06	0	0	0	2.063	1.543	0.433	10.55
LAWB93	10/16/2002	2000	90	Steel	4/14/2003	180	0	71.61	1.67	0	1.77	40.59	0	55.18	109.79	0	0	0	2.297	1.555	0.48	10.64
LAWB93	10/16/2002	2000	90	Steel	7/14/2003	271	1.09	84.52	2.26	0	2.62	48	0	66.21	137.44	0	0	0	2.711	1.865	0.6	10.77
LAWB93	10/16/2002	2000	90	Steel	10/16/2003	365	1.06	89.78	2.73	0	2.48	56.77	0	78.55	154.19	0	0	0	2.88	2.213	0.673	10.85
LAWB93	10/16/2002	2000	90	Steel	4/16/2004	548	0	101.92	3.48	0	2.87	68.92	0	95.08	170.4	0	0	0	3.27	2.679	0.744	10.95
LAWB93	10/16/2002	2000	90	Steel	10/15/2004	730	0	107.25	3.37	0	3.05	71.96	0	92.37	152.16	0	0	0	3.441	2.602	0.665	11.04
LAWB93	10/16/2002	2000	90	Steel	10/17/2005	1097	1.22	99.7	3.34	0	2.64	69.23	0	87.59	160.75	0	0	0	3.198	2.468	0.702	11.14
LAWB93	10/16/2002	2000	90	Steel	10/20/2006	1465	0	126.25	3.04	0	10.17	75.56	0	165.09	207.38	0	0	0	4.05	4.651	0.906	11.25
LAWB93	10/16/2002	2000	90	Steel	10/18/2007	1828	0	165.28	4.81	0	13.25	98.45	0	194.5	264.14	0	0	0	5.302	5.48	1.154	11.27
LAWB94	10/16/2002	2000	90	Steel	10/23/2002	7	1.14	22.12	2.06	0	0	14.59	0	11.75	52.87	0	0	0	0.71	0.468	0.228	10.76
LAWB94	10/16/2002	2000	90	Steel	11/13/2002	28	0.94	34.67	1.37	0	0	26.27	0	20.89	75.73	0	0	0	1.113	0.832	0.326	10.95
LAWB94	10/16/2002	2000	90	Steel	12/11/2002	56	0.96	50.8	1.62	0	1.86	38.33	0	32.9	102.18	0	0	0	1.631	1.31	0.44	10.97
LAWB94	10/16/2002	2000	90	Steel	2/13/2003	120	0	61.51	2.14	0	0	47.75	0	38.73	114.61	0	0	0	1.975	1.542	0.494	11.04
LAWB94	10/16/2002	2000	90	Steel	4/14/2003	180	0.97	63.97	1.76	0	1.81	47.47	0	37.55	119.81	0	0	0	2.054	1.495	0.516	11.14
LAWB94	10/16/2002	2000	90	Steel	7/14/2003	271	0.81	71.7	1.98	0	2.35	47.48	0	37.56	127.58	0	0	0	2.302	1.496	0.55	11.25
LAWB94	10/16/2002	2000	90	Steel	10/16/2003	365	0.98	80.36	2.36	0	2.55	59.26	0	47.4	149.97	0	0	0	2.58	1.887	0.646	11.35
LAWB94	10/16/2002	2000	90	Steel	4/16/2004	548	0	81.39	2.8	0	2.69	65.61	0	50.4	154.92	0	0	0	2.613	2.007	0.667	11.45
LAWB94	10/16/2002	2000	90	Steel	10/15/2004	730	0	118.14	3.54	0	2.91	90.54	0	72.24	174.93	0	0	0	3.793	2.877	0.754	11.55
LAWB94	10/16/2002	2000	90	Steel	10/17/2005	1097	1.31	121.58	3.62	0	3.07	92.08	0	72.49	188.1	0	0	0	3.904	2.887	0.81	11.64
LAWB94	10/16/2002	2000	90	Steel	10/20/2006	1465	0	136.98	4.36	0	3.2	105.31	0	84.76	220.14	0	0	0	4.398	3.375	0.948	11.67
LAWB94	10/16/2002	2000	90	Steel	10/18/2007	1828	0	344.64	5.98	0	6.26	189.6	0	196.54	217.74	0	0	0	11.065	7.826	0.938	11.74
LAWB95	10/16/2002	2000	90	Steel	10/23/2002	7	1.24	20.85	2.02	0	0	15.12	0	8.02	51.49	0	0	0	0.669	0.44	0.219	10.26
LAWB95	10/16/2002	2000	90	Steel	11/13/2002	28	0.9	40.78	1.16	0	0	33.26	0	17.72	82.9	0	0	0	1.309	0.972	0.353	10.36
LAWB95	10/16/2002	2000	90	Steel	12/11/2002	56	0.84	72.69	2.12	0	2.15	55.72	0	34.26	114.48	0	0	0	2.333	1.879	0.488	10.45
LAWB95	10/16/2002	2000	90	Steel	2/13/2003	120	0	207.63	3.13	0	3.45	132.29	0	102.13	162.64	0	0	0	6.664	5.603	0.693	10.54
LAWB95	10/16/2002	2000	90	Steel	4/14/2003	180	0.79	413.95	4.34	0	6.19	222.48	0	177.38	148.15	0	0	0	13.285	9.73	0.631	10.64
LAWB95	10/16/2002	2000	90	Steel	7/14/2003	271	2.49	1069.57	16.25	0	19.54	474.66	0	438.01	134.3	0	0	0	34.327</			

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWC12	3/24/1999	2000	90	Steel	9/21/2000	547	20.62	117.1	0.53	1.25	0	0	0.46	434.2	130.8	0	2.49	0	4.126	2.923	0.711	11.54
LAWC12	3/24/1999	2000	90	Steel	3/23/2001	730	14.55	135.73	0.51	0	1.92	0	0	505.93	158.07	0	0.91	0	4.782	3.405	0.859	11.64
LAWC12	3/24/1999	2000	90	Steel	11/14/2002	1331	2.1	3087.2	1.25	0	78.89	0	0	7230.87	998.61	0	1.08	0	108.764	48.669	5.425	11.75
LAWC15	5/3/2000	2000	90	Steel	5/10/2000	7	7.68	18.29	0	0	0	0	0.32	99.49	67.59	0	0.59	0	0.66	0.672	0.323	10.45
LAWC15	5/3/2000	2000	90	Steel	5/3/2000	28	8.77	31.09	0.28	1.67	0	0	0.56	146.27	86.53	0	1.13	0.67	1.121	0.988	0.414	10.55
LAWC15	5/3/2000	2000	90	Steel	6/28/2000	56	9.74	41.67	0	1.63	0	0	0.52	198.6	101.47	0	1.11	0.94	1.503	1.341	0.486	10.64
LAWC15	5/3/2000	2000	90	Steel	8/31/2000	120	8.83	47.93	0.39	2.13	0	0	0.72	209.67	100.28	0.74	3.3	0.9	1.729	1.416	0.48	10.77
LAWC15	5/3/2000	2000	90	Steel	10/30/2000	180	10.35	52.75	0.65	1.91	0	0	0.76	229.07	115.67	0	1.2	1.39	1.903	1.547	0.553	10.94
LAWC15	5/3/2000	2000	90	Steel	1/25/2001	267	9.14	57.66	0.56	2.09	0	0	0.78	263.67	109.43	0.66	1.91	0	2.08	1.78	0.524	10.98
LAWC15	5/3/2000	2000	90	Steel	5/3/2001	365	10.52	66.55	0.45	2.4	0	0	0.93	289.3	124.63	0.62	1.95	1.21	2.4	1.953	0.596	11.07
LAWC15	5/3/2000	2000	90	Steel	11/1/2001	547	12.16	84.96	0.63	2.37	0	0	1.1	364.64	155.16	0.68	2.84	1.03	3.064	2.462	0.742	11.12
LAWC15	5/3/2000	2000	90	Steel	5/2/2002	729	12.67	93.48	0.46	2.49	2.2	0	0.94	376.74	169.19	0.71	2.13	1.36	3.372	2.544	0.81	11.37
LAWC15	5/3/2000	2000	90	Steel	5/12/2003	1104	4.57	156.61	0.24	0	2.4	0	0	560.7	224.12	0.6	0	0.75	5.649	3.786	1.072	11.45
LAWC15	5/3/2000	2000	90	Steel	5/4/2004	1462	1.23	521.48	0.33	0	7.82	0	0	1655.97	409.6	0	0	0	18.809	11.181	1.96	11.56
LAWC15	5/3/2000	2000	90	Steel	5/3/2005	1826	2	1370.73	0.43	0	19.71	0	0	3812.2	800.91	0	0	0	49.441	25.74	3.832	11.65
LAWC15	5/3/2000	2000	90	Steel	5/18/2006	2206	0	2203.97	0.67	0	35.2	0	0	6018.03	955.73	0	0	0	79.495	40.634	4.573	11.74
LAWC21	3/2/2005	2000	90	Steel	3/9/2005	7	2.51	20.47	0.44	0	0	8.82	0	62.94	56.73	0	0	0	0.652	0.713	0.26	10.64
LAWC21rev2	2/27/2002	2000	90	Steel	3/6/2002	7	2.15	21.63	0.52	0	0	9.03	0	63.84	60.18	0	0	0	0.693	0.719	0.275	10.27
LAWC21rev2	2/27/2002	2000	90	Steel	3/27/2002	28	2.39	40.52	0.5	0	15.41	0	0	107.67	92.71	0	0	0	1.297	1.212	0.424	10.44
LAWC21rev2	2/27/2002	2000	90	Steel	4/24/2002	56	2.36	50.23	1.25	0	20.63	0	0	146.37	110.93	0	0	0	1.608	1.648	0.507	10.65
LAWC21rev2	2/27/2002	2000	90	Steel	6/27/2002	120	2.55	68.48	1.21	0	26.05	0	0	204.07	139.03	0	0	0	2.193	2.298	0.636	10.77
LAWC21rev2	2/27/2002	2000	90	Steel	8/26/2002	180	2.43	70.23	1.2	0	26.16	0	0	225.77	142.13	0	0	0	2.249	2.542	0.65	10.87
LAWC21rev2	2/27/2002	2000	90	Steel	11/25/2002	271	2.68	95.91	1.02	0	1.83	37.73	0	260.17	190.13	0	0	0	3.071	2.93	0.87	10.95
LAWC21rev2	2/27/2002	2000	90	Steel	2/26/2003	364	2.63	93.44	1.13	0	0	35.49	0	250.64	183.49	0	0	0	2.992	2.822	0.839	11.05
LAWC21rev2	2/27/2002	2000	90	Steel	8/25/2003	544	1.85	100.3	1.15	0	2.68	41.72	0	302.03	198.53	0	0	0	3.212	3.401	0.908	11.15
LAWC21rev2	2/27/2002	2000	90	Steel	2/25/2004	728	1.35	107.11	1.49	0	3.11	42.43	0	311.13	211.01	0	0	0	3.43	3.504	0.965	11.25
LAWC21rev2	2/27/2002	2000	90	Steel	2/22/2005	1091	1.44	142.58	2.13	0	2.52	51.61	0	353.28	251.19	0	0	0	4.565	3.978	1.149	11.34
LAWC21rev2	2/27/2002	2000	90	Steel	2/15/2006	1449	0.76	241.5	2.95	0	3.68	74.54	0	582.08	371.19	0	0	0	7.733	6.555	1.698	11.46
LAWC21rev2	2/27/2002	2000	90	Steel	2/27/2007	1826	1.07	1303.17	5.35	0	26.14	276.73	0	2397.53	423.94	0	0	0	41.728	26.998	1.939	11.54
LAWC22	5/18/2000	2000	90	Steel	5/25/2000	7	2.93	32.32	0.57	0	0	10.29	0	100.17	78.92	0	0.57	0	1.035	0.937	0.362	10.53
LAWC22	5/18/2000	2000	90	Steel	6/15/2000	28	2.84	56.14	0.53	0	0	16.84	0	167.4	116.87	0	0.55	0	1.798	1.566	0.536	10.62
LAWC22	5/18/2000	2000	90	Steel	7/13/2000	56	2.99	65.07	0.32	0	0	20.44	0	178.93	136.53	0	0	0	2.084	1.674	0.626	10.77
LAWC22	5/18/2000	2000	90	Steel	9/14/2000	119	3.1	72.89	0.68	0	0	21.65	0	223.5	144.27	0	0	0	2.334	2.091	0.662	10.93
LAWC22	5/18/2000	2000	90	Steel	11/14/2000	180	2.8	82.25	0.69	0	0	24.21	0	250.47	159.13	0	0	0	2.634	2.343	0.73	11.22
LAWC22	5/18/2000	2000	90	Steel	2/13/2001	271	2.54	98.61	1.1	0	0	29.4	0	311.07	191.2	0	0	0	3.158	2.91	0.877	11.33
LAWC22	5/18/2000	2000	90	Steel	5/18/2001	365	3.3	139.65	0.9	0	1.88	40.76	0	432.79	243.9	0	0	0	4.473	4.049	1.119	11.45
LAWC22	5/18/2000	2000	90	Steel	11/15/2001	546	2.95	155.69	1.28	0	0	45.36	0	440.83	257.82	0	0	0	4.986	4.124	1.183	11.52
LAWC22	5/18/2000	2000	90	Steel	5/17/2002	729	1.34	246.7	1.79	0	2.28	65.82	0	630.72	298.46	0	0	0	7.901	5.9	1.369	11.65
LAWC22	5/18/2000	2000	90	Steel	5/19/2003	1096	0.96	2803.93	6.42	0	31.83	416.83	0	5898.1	678.1	0	0	0	89.802	55.176	3.11	11.72
LAWC22	5/18/2000	2000	90	Steel	5/17/2004	1460	0	2592.6	4.92	0	32.01	387.83	0	5214.5	724.79	0	0	0	83.034	48.781	3.325	11.84
LAWC22	5/18/2000	2000	90	Steel	5/19/2005	1827	1.29	2547.7	5.19	0	31.22	368.53	0	5059.67	600.44	0	0	0	81.596	47.332	2.754	11.95
LAWC22	5/18/2000	2000	90	Steel	5/22/2006	2195	0	2438.57	3.92	0	25.85	341.61	0	4898.03	523.74	0	0	0	78.101	45.82	2.402	12.05
LAWC23	5/16/2000	2000	90	Steel	5/23/2000	7	1.76	14.98	0.7	0	8.13	0	0	48.19	41.75	0	0	0	0.479	0.548	0.191	9.74
LAWC23	5/16/2000	2000	90	Steel	6/13/2000	28	2.04	27.27	1	0	12.85	0	0	78.22	61.83	0	0	0	0.872	0.889	0.283	9.83
LAWC23	5/16/2000	2000	90	Steel	7/11/2000	56	1.8	28.69	1.01	0	12.7	0	0	87.32	61.44	0	0	0	0.917	0.993	0.281	9.97
LAWC23	5/16/2000	2000	90	Steel	9/13/2000	120	1.83	31.67	1.09	0	14.68	0	0	99.34	67.24	0	0	0	1.012	1.129	0.308	10.12
LAWC23	5/16/2000	2000	90	Steel	11/13/2000	181	1.84	32.25	1.22	0	16.48	0	0	103.1	72.68	0	0	0	1.031	1.172	0.333	10.35
LAWC23	5/16/2000	2000	90	Steel	2/12/2001	272	1.98	36.59	1.49	0	18.66	0	0	113.5	80.22	0	0	0	1.169	1.29	0.367	10.43
LAWC23	5/16/2000	2000	90	Steel	5/16/2001	365	2.46	49.3	1.15	0	25.07	0	0	162.2	107.02	0	0	0	1.576	1.844	0.49	10.55
LAWC23	5/16/2000	2000	90	Steel	11/14/2001	547	2.41	45.49	0.9	0	21.28	0	0	177.84	93.98	0	0	0	1.454	2.022	0.43	10.63
LAWC23	5/16/2000	2000	90	Steel	5/16/2002	730	2.41	41.93	1.04	0	21.95	0	0	184.03	96.21	0	0	0	1.34	2.092	0.44	10.87
LAWC23	5/16/2000	2000	90	Steel	5/14/2003	1093	2.34	51.3	1.22	0	25.99	0	0	181.65	113.82	0	0	0	1.64	2.065	0.521	10.93
LAWC23	5/16/2000	2000	90	Steel	5/14/2004	1459	1.31	47.35	1.15	0	24.82	0	0	180.08	111.1	0	0	0	1.513	2.047	0.508	11.12
LAWC23	5/16/2000	2000	90	Steel	5/18/2005	1828	1.2	65	1.47	0	29.2	0	0	213.16	128.99	0	0	0	2.078	2.423	0.59	11.21
LAWC23	5/16/2000	2000	90	Steel	5/19/2006	2194	0	79.22	1.64	0	34.71	0	0	249.48	137.64	0	0	0	2.532	2.836	0.63	11.25
LAWC23	5/16/2000	2000	90	Steel	8/21/2007	2653	0.76	107.16	8.82	0	43.74	0	1.81	353.76	166.79	0	0	0	3.425	4.022	0.763	11.26
LAWC24	5/16/2000	2000	90	Steel	5/23/2000	7	2.95	13.45	0.63	0	16.36	0	0	48.22	38.94	0	0	0	0.44			

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWC25	5/16/2000	2000	90	Steel	5/23/2000	7	4.26	18.93	0.4	0	32.99	0	0	64.06	45.12	0	0	0	0.64	0.77	0.219	9.76
LAWC25	5/16/2000	2000	90	Steel	6/13/2000	28	4.28	32.9	0.52	0	51.19	0	0	101.97	63.21	0	0	0	1.112	1.226	0.307	9.86
LAWC25	5/16/2000	2000	90	Steel	7/11/2000	56	3.75	38.94	0.37	0	59.22	0	0	126.4	66.6	0	0	0	1.317	1.52	0.323	10.04
LAWC25	5/16/2000	2000	90	Steel	9/13/2000	120	4.05	47.82	0.59	0	69.56	0	0	144.83	76.72	0	0	0	1.617	1.742	0.372	10.22
LAWC25	5/16/2000	2000	90	Steel	11/13/2000	181	3.99	52.82	0.53	0	83.86	0	0	170.13	85.47	0	0	0	1.786	2.046	0.414	10.45
LAWC25	5/16/2000	2000	90	Steel	2/12/2001	272	4.15	60	0.69	0	93.29	0	0	184.97	93.52	0	0	0	2.029	2.224	0.453	10.54
LAWC25	5/16/2000	2000	90	Steel	5/16/2001	365	5.29	81.87	0.48	0	132.69	0	0	261.06	121.07	0	0	0	2.768	3.139	0.587	10.65
LAWC25	5/16/2000	2000	90	Steel	11/14/2001	547	5.88	94.99	0.43	0	145.42	0	0	354.21	133.2	0	0	0	3.212	4.26	0.646	10.74
LAWC25	5/16/2000	2000	90	Steel	5/16/2002	730	5.47	101.61	0.55	0	151.55	0	0	318.1	142.4	0	0	0	3.435	3.825	0.691	10.94
LAWC25	5/16/2000	2000	90	Steel	5/14/2003	1093	5.18	113.58	0.45	0	171.57	0	0	354.21	157.24	0	0	0	3.84	4.26	0.762	11.03
LAWC25	5/16/2000	2000	90	Steel	5/14/2004	1459	2.85	96.88	0.23	0	146.48	0	0	330.74	132.77	0	0	0	3.275	3.977	0.644	11.17
LAWC25	5/16/2000	2000	90	Steel	5/18/2005	1828	1.45	306.8	0.85	0	362.69	0	0	817.28	258.76	0	0	0	10.373	9.828	1.255	11.23
LAWC25	5/16/2000	2000	90	Steel	5/19/2006	2194	0	904.08	1.69	0	846.44	0	0	2002.7	418.87	0	0	0	30.566	24.083	2.031	11.32
LAWC25	5/16/2000	2000	90	Steel	8/21/2007	2653	1.07	1106.93	16.73	0	1024.3	0	3.1	2276.2	464.05	0	0	0	37.425	27.372	2.25	11.37
LAWC26	2/7/2002	2000	90	Steel	2/14/2002	7	0.85	28.16	0	0	0	8.66	0	58.95	60.07	0	0	0	0.684	0.664	0.257	10.17
LAWC26	2/7/2002	2000	90	Steel	3/7/2002	28	1.14	41.55	1.16	0	0	13.07	0	87.61	79.2	0	0	0	1.009	0.987	0.339	10.36
LAWC26	2/7/2002	2000	90	Steel	4/4/2002	56	1.49	46.43	1.17	0	0	13.93	0	93.75	85.46	0	0	0	1.127	1.056	0.366	10.46
LAWC26	2/7/2002	2000	90	Steel	6/7/2002	120	1.89	52.41	1.05	0	0	17.68	0	113.63	92.27	0	0	0	1.273	1.28	0.395	10.56
LAWC26	2/7/2002	2000	90	Steel	8/5/2002	179	1.75	59.37	1.25	0	0	15.59	0	123.8	101.43	0	0	0	1.442	1.395	0.434	10.66
LAWC26	2/7/2002	2000	90	Steel	11/4/2002	270	2.83	80.34	2.31	0	0	25.4	0	169.75	135.59	0	0	0	1.951	1.913	0.581	10.75
LAWC26	2/7/2002	2000	90	Steel	2/10/2003	368	2.48	84.21	1.69	0	0	24.7	0	169.23	135.29	0	0	0	2.045	1.907	0.579	10.84
LAWC26	2/7/2002	2000	90	Steel	8/18/2003	557	3.56	79.9	1.24	0	0	24.37	0	175.98	123.65	0	0	0	1.94	1.983	0.53	10.95
LAWC26	2/7/2002	2000	90	Steel	2/5/2004	728	2.18	89.06	1.32	0	1.98	26.73	0	171.09	137.39	0	0	0	2.163	1.928	0.588	11.07
LAWC26	2/7/2002	2000	90	Steel	2/9/2005	1098	2.5	96.29	1.29	0	0	29.3	0	186.77	145.49	0	0	0	2.338	2.104	0.623	11.12
LAWC26	2/7/2002	2000	90	Steel	2/7/2006	1461	0.85	123.94	1.71	0	2.36	36.95	0	256.18	175.4	0	0	0	3.01	2.887	0.751	11.25
LAWC26	2/7/2002	2000	90	Steel	2/13/2007	1832	0.88	184.39	2.79	0	2.58	57.77	0	337.56	259.53	0	0	0	4.478	3.804	1.111	11.35
LAWC27	2/7/2002	2000	90	Steel	2/14/2002	7	1.18	14.27	2.5	0	0	5.48	0	39.02	41.86	0	0	0	0.377	0.44	0.183	10.35
LAWC27	2/7/2002	2000	90	Steel	3/7/2002	28	1.38	21.25	3.28	0	0	8.49	0	60.51	56.11	0	0	0	0.562	0.682	0.246	10.53
LAWC27	2/7/2002	2000	90	Steel	4/4/2002	56	1.92	25.9	3.14	0	0	10.11	0	71.94	65.65	0	0	0	0.685	0.811	0.287	10.75
LAWC27	2/7/2002	2000	90	Steel	6/7/2002	120	2.29	29.99	2.99	0	0	13.5	0	94.77	76.3	0	0	0	0.793	1.069	0.334	10.86
LAWC27	2/7/2002	2000	90	Steel	8/5/2002	179	2.34	31.35	2.62	0	0	13.14	0	83.42	75.99	0	0	0	0.829	0.941	0.333	10.98
LAWC27	2/7/2002	2000	90	Steel	11/4/2002	270	3.66	41.86	3.76	0	1.71	20.19	0	143.47	115.22	0	0	0	1.107	1.618	0.504	11.05
LAWC27	2/7/2002	2000	90	Steel	2/10/2003	368	3.4	45.87	3.55	0	0	19.44	0	143.59	116.32	0	0	0	1.213	1.619	0.509	11.14
LAWC27	2/7/2002	2000	90	Steel	8/18/2003	557	4.06	39.78	3.19	0	0	19.06	0	141.53	108.86	0	0	0	1.052	1.596	0.477	11.24
LAWC27	2/7/2002	2000	90	Steel	2/5/2004	728	3.27	43.23	3.27	0	2.71	19.84	0	139.29	117.22	0	0	0	1.143	1.571	0.513	11.37
LAWC27	2/7/2002	2000	90	Steel	2/9/2005	1098	3.13	44.04	2.97	0	0	21.03	0	149.58	124.53	0	0	0	1.164	1.687	0.545	11.45
LAWC27	2/7/2002	2000	90	Steel	2/7/2006	1461	1.35	56	2.95	0	2.32	24.71	0	189.55	150.67	0	0	0	1.148	2.138	0.66	11.54
LAWC27	2/7/2002	2000	90	Steel	2/13/2007	1832	1.36	96.37	3.48	0	2.59	39.06	0	264.59	235.17	0	0	0	2.548	2.984	1.03	11.64
LAWC28	2/7/2002	2000	90	Steel	2/14/2002	7	1.65	8.92	7.63	0	0	5.44	0	38.91	35.72	0	0	0	0.286	0.439	0.164	10.74
LAWC28	2/7/2002	2000	90	Steel	3/7/2002	28	2.04	11.76	9.76	0	0	7.81	0	57.4	45.08	0	0	0	0.377	0.647	0.206	11.25
LAWC28	2/7/2002	2000	90	Steel	4/4/2002	56	2.54	12.74	9.86	0	0	8.81	0	65.51	49.46	0	0	0	0.408	0.739	0.227	11.28
LAWC28	2/7/2002	2000	90	Steel	6/7/2002	120	3.02	14.13	10.11	0	0	12.01	0	90.61	56.57	0	0	0	0.453	1.022	0.259	11.35
LAWC28	2/7/2002	2000	90	Steel	8/5/2002	179	3.36	16.41	7.13	0	0	11.73	0	85.76	56.75	0	0	0	0.53	0.967	0.26	11.45
LAWC28	2/7/2002	2000	90	Steel	11/4/2002	270	4.9	18.4	8.62	0	2.2	18.14	0	139.77	84.45	0	0	0	0.59	1.576	0.387	11.54
LAWC28	2/7/2002	2000	90	Steel	2/10/2003	368	4.84	29.12	5.61	0	0	19.31	0	152.96	95.76	0	0	0	0.934	1.725	0.439	11.65
LAWC28	2/7/2002	2000	90	Steel	8/18/2003	557	5.95	29.39	3.95	0	1.91	21.95	0	178.06	103.7	0	0	0	0.942	2.008	0.475	11.78
LAWC28	2/7/2002	2000	90	Steel	2/5/2004	728	5.9	36.11	3.08	0	2.05	25.38	0	188.18	119.85	0	0	0	1.158	2.122	0.549	11.84
LAWC28	2/7/2002	2000	90	Steel	2/9/2005	1098	5.3	54.1	2.18	0	2.16	32.33	0	232.35	152.26	0	0	0	1.735	2.62	0.697	11.95
LAWC28	2/7/2002	2000	90	Steel	2/7/2006	1461	2.54	132.8	1.71	0	4.59	59.38	0	445.49	252.32	0	0	0	4.258	5.023	1.156	12.04
LAWC28	2/7/2002	2000	90	Steel	2/13/2007	1832	2.66	2522.73	6.59	0	37.53	585.41	0.47	4171.53	512.18	0	0	0	80.884	47.037	2.346	12.14
LAWC29	2/7/2002	2000	90	Steel	2/14/2002	7	1.8	9.46	3.82	0	0	5.1	0	36.73	36.23	0	0	0	0.303	0.414	0.164	10.36
LAWC29	2/7/2002	2000	90	Steel	3/7/2002	28	2.21	13.53	5.23	0	0	8.11	0	58.9	49.91	0	0	0	0.434	0.664	0.226	10.57
LAWC29	2/7/2002	2000	90	Steel	4/4/2002	56	2.57	16.08	5.33	0	0	9.13	0	66.9	56.74	0	0	0	0.515	0.754	0.257	10.77
LAWC29	2/7/2002	2000	90	Steel	6/7/2002	120	3.37	19.13	5.58	0	0	13.11	0	94.46	68.31	0	0	0	0.613	1.065	0.31	10.85
LAWC29	2/7/2002	2000	90	Steel	8/5/2002	179	2.91	20.85	5.67	0	0	11.78	0	96.92	74.26	0	0	0	0.668	1.092	0.337	10.94
LAWC29	2/7/2002	2000	90	Steel	11/4/2002	270	4.72	27.98	7.22	0	0	18.42	0	136.63	100.55	0	0	0	0.897	1.54	0.456	11.06
LAWC29	2/7/2002	2000	90	Steel	2/10/2003	368	4.47	27.88	6.13	0	0	17.6	0	138.59	100.39	0	0	0	0.894	1.562	0.455	11.14
LAWC29	2/7/2002	2000	90	Steel	8/18/2003	557	5.79	26.89	5.05	0	0	16.83	0	145.64	93.79	0	0	0	0.862			

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWC30	2/7/2002	2000	90	Steel	2/5/2004	728	1.2	110.81	2.6	0	3.32	47.86	0	340.14	240.2	0	0	0	3.55	3.832	1.099	11.65
LAWC30	2/7/2002	2000	90	Steel	2/9/2005	1098	1.58	161.35	3.37	0	3.63	60.99	0	398.33	308.15	0	0	0	5.169	4.488	1.41	11.74
LAWC30	2/7/2002	2000	90	Steel	2/7/2006	1461	0.78	199.3	2.1	0	3.74	66.78	0	466.48	302.74	0	0	0	6.385	5.256	1.385	11.84
LAWC30	2/7/2002	2000	90	Steel	2/13/2007	1832	2.11	958.28	4.84	0	13.15	215.23	0	1811.87	454.02	0	0	0	30.7	20.414	2.078	11.87
LAWC31	2/19/2002	2000	90	Steel	2/26/2002	7	1.83	17.14	1.19	0	0	7.96	0	55.57	52.25	0	0	0	0.549	0.626	0.239	10.43
LAWC31	2/19/2002	2000	90	Steel	3/19/2002	28	1.85	29.68	0.96	0	0	12.86	0	91.99	77.19	0	0	0	0.951	1.037	0.353	10.63
LAWC31	2/19/2002	2000	90	Steel	4/16/2002	56	2.16	36.03	1	0	0	15.84	0	112.37	89.6	0	0	0	1.155	1.267	0.41	10.74
LAWC31	2/19/2002	2000	90	Steel	6/19/2002	120	3.24	51.46	1.5	0	0	22.7	0	153.03	122.1	0	0	0	1.649	1.725	0.559	10.95
LAWC31	2/19/2002	2000	90	Steel	8/19/2002	181	3.42	55.36	1.54	0	0	25.84	0	186.8	132.8	0	0	0	1.774	2.106	0.608	11.06
LAWC31	2/19/2002	2000	90	Steel	11/15/2002	269	3.55	73.58	1.78	0	2.56	33.67	0	243.09	168.14	0	0	0	2.358	2.74	0.77	11.18
LAWC31	2/19/2002	2000	90	Steel	2/19/2003	365	3.37	72.39	1.69	0	2.6	33.43	0	249.16	168.71	0	0	0	2.32	2.809	0.772	11.24
LAWC31	2/19/2002	2000	90	Steel	8/20/2003	547	2.71	80.94	0	0	2.75	35.98	0	256.85	177.85	0	0	0	2.594	2.895	0.814	11.37
LAWC31	2/19/2002	2000	90	Steel	2/24/2004	735	1.77	100.53	0	0	3.37	41.22	0	305.28	205.62	0	0	0	3.222	3.441	0.941	11.43
LAWC31	2/19/2002	2000	90	Steel	2/16/2005	1093	1.51	185.52	2.06	0	3.87	69.92	0	518.12	270.98	0	0	0	5.946	5.84	1.241	11.55
LAWC31	2/19/2002	2000	90	Steel	2/14/2006	1456	1.08	932.64	3.87	0	14.53	180.42	0	1667.43	358.35	0	0	0	29.893	18.796	1.641	11.65
LAWC31	2/19/2002	2000	90	Steel	2/20/2007	1827	1.24	1870.23	10.49	1.29	38.43	365.37	0	3404.77	417.74	0	0	0	59.945	38.379	1.913	11.67
LAWC32	2/19/2002	2000	90	Steel	2/26/2002	7	2.14	13.05	3.66	0	0	6.73	0	49.04	45.34	0	0	0	0.418	0.553	0.208	10.57
LAWC32	2/19/2002	2000	90	Steel	3/19/2002	28	2.16	16.88	3.44	0	0	8.78	0	65.54	53.48	0	0	0	0.541	0.739	0.245	10.74
LAWC32	2/19/2002	2000	90	Steel	4/16/2002	56	2.54	19.04	3.23	0	0	10.46	0	77.63	59.46	0	0	0	0.61	0.875	0.272	10.86
LAWC32	2/19/2002	2000	90	Steel	6/19/2002	120	4.05	26	3.68	0	0	14.75	0	103.2	80.27	0	0	0	0.833	1.163	0.367	10.98
LAWC32	2/19/2002	2000	90	Steel	8/19/2002	181	3.57	26.96	3.46	0	0	16.7	0	134.5	87.94	0	0	0	0.864	1.516	0.403	11.11
LAWC32	2/19/2002	2000	90	Steel	11/15/2002	269	4.94	39.2	3.7	0	2.42	23.19	0	179.85	114.68	0	0	0	1.257	2.028	0.525	11.25
LAWC32	2/19/2002	2000	90	Steel	2/19/2003	365	4.32	35.12	3.14	0	2.09	21.27	0	173.92	106.58	0	0	0	1.126	1.961	0.488	11.36
LAWC32	2/19/2002	2000	90	Steel	8/20/2003	547	5.28	42.76	0.83	0	2.58	26.52	0	201.46	129.99	0	0	0	1.371	2.271	0.595	11.44
LAWC32	2/19/2002	2000	90	Steel	2/24/2004	735	5.15	43.08	0.64	0	2.93	26.16	0	202.62	134.03	0	0	0	1.381	2.284	0.613	11.55
LAWC32	2/19/2002	2000	90	Steel	2/16/2005	1093	5.27	43.91	2.07	0	2.35	30.89	0	248.5	156.03	0	0	0	1.407	2.801	0.714	11.65
LAWC32	2/19/2002	2000	90	Steel	2/14/2006	1456	3.55	85.24	1.82	0	2.31	41.88	0	321.76	212.64	0	0	0	2.732	3.627	0.973	11.76
LAWC32	2/19/2002	2000	90	Steel	2/20/2007	1827	1.79	255.28	1.74	0	5.27	90.55	0	695.18	355.21	0	0	0	8.183	7.837	1.626	11.77
LAWC33	7/25/2002	2000	90	Steel	8/1/2002	7	2.49	22.03	1.01	0	0	9.86	0	67.86	66.05	0	0	0	0.702	0.761	0.301	10.53
LAWC33	7/25/2002	2000	90	Steel	8/22/2002	28	3.03	35.16	0.82	0	0	15.67	0	102.73	89.61	0	0	0	1.121	1.153	0.408	10.64
LAWC33	7/25/2002	2000	90	Steel	9/19/2002	56	2.61	44.12	1.44	0	0	19.17	0	127.23	108.53	0	0	0	1.407	1.428	0.494	10.74
LAWC33	7/25/2002	2000	90	Steel	4/14/2003	263	2.56	62.32	1.57	0	2.02	24.96	0	183.47	142.68	0	0	0	1.987	2.059	0.65	11.04
LAWC33	7/25/2002	2000	90	Steel	7/22/2003	362	3.95	67.32	1.72	0	2.12	29.48	0	203.1	170.29	0	0	0	2.147	2.279	0.776	11.15
LAWC33	7/25/2002	2000	90	Steel	1/28/2004	552	2.64	58.36	1.58	0	1.81	24.97	0	180.61	146.33	0	0	0	1.861	2.027	0.666	11.24
LAWC33	7/25/2002	2000	90	Steel	7/12/2006	1448	0	152.99	3.77	0	3.26	55.17	0	373.97	282.33	0	0	0	4.878	4.196	1.286	11.55
LAWC33	7/25/2002	2000	90	Steel	10/3/2007	1896	2.72	312	3.17	0	6.03	109.14	0	697.92	280.4	0	0	0	9.949	7.831	1.277	11.62
LAWCp1R	7/6/2006	2000	90	Steel	7/13/2006	7	8.29	17.55	0	0	0	0	0	94.13	61.09	0	0	0	0.565	0.656	0.294	10.58
LAWCp2R	7/6/2006	2000	90	Steel	7/13/2006	7	8.31	34.28	0	0	0	0	0	163.38	75.84	0	0.44	0	1.104	1.049	0.377	10.75
LAWCp3R	7/6/2006	2000	90	Steel	7/13/2006	7	7.49	23.31	0	0	0	0	0	121.59	73.34	0	0	0	0.751	0.847	0.361	10.43
LAWCp4R	7/6/2006	2000	90	Steel	7/13/2006	7	9.42	27.14	0	0	0	0	0	136.18	76.89	0	0	0	0.874	0.874	0.392	10.84
LAWCp5	9/14/2005	2000	90	Steel	9/21/2005	7	3.96	45.53	0.1	0	1.69	15.63	0	156.56	102.55	0	0	0	1.464	1.466	0.504	11.08
LAWCp6	1/1/2006	2000	90	Steel	1/18/2006	7	2.87	20.81	0.11	0	0	13.61	0	34.18	58.18	0	0	0	0.67	0.575	0.278	10.34
LAWCp7	1/1/2006	2000	90	Steel	1/18/2006	7	2.18	15.03	0.22	0	0	11.42	0	14.22	49.94	0	0	0	0.484	0.355	0.229	10.01
LAWE10H	1/14/2005	2000	90	Steel	1/21/2005	7	1.05	14.08	1.79	0	1.89	9.99	0	18.38	47.87	0	0	0	0.455	0.432	0.209	10.25
LAWE10HCr3CCC	5/4/2006	2000	90	Steel	5/11/2006	7	3.17	8.21	0.55	0	0	7.08	0	12.14	32.85	0	0	0	0.265	0.286	0.144	9.97
LAWE11	5/19/2005	2000	90	Steel	5/26/2005	7	6.92	34.03	0	0	20.55	0	0.26	116.77	64.5	0	0	0	1.095	0.906	0.315	10.88
LAWE12	11/3/2005	2000	90	Steel	11/10/2005	7	12.16	65.27	0.1	0	56.58	0	0	310.37	92.75	0	0.69	0	2.402	2.119	0.474	11.74
LAWE13	11/3/2005	2000	90	Steel	11/10/2005	7	12.77	76.16	0	0	51.64	0	0	289.56	77.66	0	0.48	0	2.515	1.977	0.397	11.62
LAWE14	2/23/2006	2000	90	Steel	3/2/2006	7	8.61	90.46	0.52	0	63.62	0	0	352.45	99.31	0	0	0	2.987	2.406	0.49	11.58
LAWE15	2/8/2006	2000	90	Steel	2/15/2006	7	12.49	61.81	0	2.62	52.36	0	0.96	300.55	90.1	0	0	0	2.274	2.051	0.45	11.61
LAWE16	4/25/2006	2000	90	Steel	5/2/2006	7	10.79	42.48	0.1	0	41.69	0	0	238.76	83.97	0	0	0	1.66	1.632	0.42	11.61
LAWE2H	1/11/2005	2000	90	Steel	1/18/2005	7	11.46	75.57	0.25	2.71	33.71	0	0.77	301.11	97.86	0	0	0	2.496	1.953	0.493	11.62
LAWE3	5/19/2005	2000	90	Steel	5/26/2005	7	7.92	59.18	0	0	33.66	0	0.34	191.01	73.49	0	0.65	0	1.905	1.413	0.366	11.24
LAWE3Cr2CCC	5/4/2006	2000	90	Steel	5/11/2006	7	8.63	36.3	0	0	27.13	0	0	148.62	67.92	0	0	0	1.168	1.1	0.349	10.96
LAWE3H	1/1/2005	2000	90	Steel	1/18/2005	7	11.78	87.08	0.16	1.91	56.51	0	0.52	326.06	99.9	0	0	0	2.879	2.226	0.511	11.66
LAWE4H	1/12/2005	2000	90	Steel	1/19/2005	7	8.78	38.34	0.11	0	2.95	0	0.26	189.7	87.92	0	0	0	1.261	1.201	0.422	11.24
LAWE5H	1/12/2005	2000	90	Steel	1/19/2005	7	5.5	23.95	0.13	0	2.36	0	0	129.84	78.42	0	0	0	0.785	0.922	0.372	11.06
LAWE7H	1/14/2005	2000	90	Steel	1/21/2005	7	3.07	32.72	0.43	0												

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWM18	3/26/2003	2000	90	Steel	4/2/2003	7	4.23	16.12	0.81	0	0	7.99	0	37.77	37.39	0	0	0	0.432	0.509	0.19	10.53
LAWM19	2/26/2003	2000	90	Steel	3/5/2003	7	2.64	18.8	2.14	0	6.54	1.4	0	54.12	36.13	0	0	0	0.505	0.554	0.184	10.48
LAWM2	3/19/2003	2000	90	Steel	3/26/2003	7	0	12.57	5.14	0	0	18.04	0	31.74	67.17	0	0	0	0.672	0.853	0.305	11.03
LAWM20	3/4/2003	2000	90	Steel	3/11/2003	7	3.1	58.05	0.76	0	32.92	26.67	0	343.57	147.5	0	0	0	2.67	2.723	0.751	11.91
LAWM21	3/18/2003	2000	90	Steel	3/25/2003	7	1.49	30.16	0.67	0	11.16	13.19	0	70.94	61.49	0	0	0	0.891	0.955	0.313	10.97
LAWM22	3/19/2003	2000	90	Steel	3/26/2003	7	8.6	8.53	0	0	6.66	0	0	78.57	56.35	0	0.5	0	0.393	0.624	0.287	11.04
LAWM23	3/11/2003	2000	90	Steel	3/18/2003	7	1.58	6.06	1.36	0	5.09	6.62	0	37.94	45.74	0	0	0	0.278	0.51	0.202	10.84
LAWM24	2/12/2003	2000	90	Steel	2/19/2003	7	8.64	39.26	0	1.19	6.49	2.2	0.27	103.83	62.85	0	0.52	0	1.054	0.823	0.286	10.57
LAWM25R1	4/2/2003	2000	90	Steel	4/9/2003	7	5.9	30.37	0	0	6.36	9.27	0.39	42.73	61.98	0	0	0	0.814	0.575	0.265	10.03
LAWM26	2/26/2003	2000	90	Steel	3/5/2003	7	3.51	15.77	0.98	0	0	7.4	0	26.37	48.99	0	0	0	0.423	0.355	0.21	10.18
LAWM27	1/30/2003	2000	90	Steel	2/6/2003	7	3.79	15	1.98	0	9.38	1.76	0	84.37	49.24	0	0	0	0.69	0.85	0.251	11.06
LAWM28	3/26/2003	2000	90	Steel	4/2/2003	7	1.18	13.77	2.7	0	2.09	2.01	0	39.23	49.44	0	0	0	0.369	0.528	0.211	9.97
LAWM29	2/12/2003	2000	90	Steel	2/19/2003	7	5.47	10.96	0	0	4.73	7.51	0.29	36.31	60.93	0	0	0	0.504	0.489	0.278	10.55
LAWM3	3/18/2003	2000	90	Steel	3/25/2003	7	7.13	14.86	2.89	0	0	23.55	0	98.87	47.31	0	0	0	0.795	1.157	0.252	11.68
LAWM30	3/26/2003	2000	90	Steel	4/2/2003	7	10.22	43.96	0	0	0	7.94	0	128.96	60.51	0	0	0.85	1.179	1.022	0.308	10.86
LAWM31	3/12/2003	2000	90	Steel	3/19/2003	7	3.64	49.43	0.18	0	0	27.63	0	272.21	146.44	0	0	0	2.273	2.189	0.74	11.85
LAWM32	3/12/2003	2000	90	Steel	3/19/2003	7	3.63	43.46	0.45	2.01	18.02	22.89	2	225.04	202.32	0	4.15	0.52	1.999	1.837	0.866	11.43
LAWM33R1	1/30/2003	2000	90	Steel	2/6/2003	7	2.34	159.5	0.52	0	32.73	16.06	0	518.73	179.5	0	0	0	4.279	4.111	0.914	11.66
LAWM34	3/12/2003	2000	90	Steel	3/19/2003	7	4.35	135.47	0.56	0	51.61	60.55	0	538.02	234.38	0	0	0	5.221	4.265	1.194	12.14
LAWM35	1/15/2003	2000	90	Steel	1/22/2003	7	2.2	392.5	0.56	0	3.81	18.15	0	836	168.9	0	0	0	10.528	6.625	0.86	11.35
LAWM36	3/12/2003	2000	90	Steel	3/19/2003	7	3.23	16.7	1.11	0	0	7.25	0	54.06	49.52	0	0	0	0.489	0.607	0.235	10.64
LAWM37	1/22/2003	2000	90	Steel	1/29/2003	7	2.12	40.06	1.51	0	0	11.19	0	88.05	66.13	0	0	0	1.172	0.988	0.314	10.93
LAWM38	3/25/2003	2000	90	Steel	4/1/2003	7	3.47	9.5	1.44	0	2.43	6.47	0	71.16	58.99	0	0	0	0.383	0.685	0.263	11.24
LAWM39	1/15/2003	2000	90	Steel	1/22/2003	7	3.27	13.87	1.14	0	1.78	5.56	0	48.09	47.67	0	0	0	0.493	0.463	0.212	10.75
LAWM4	1/30/2003	2000	90	Steel	2/6/2003	7	1.44	18.59	1.18	0	14.33	13.34	0	22.32	36.68	0	0	0	0.459	0.599	0.189	10.67
LAWM40	3/26/2003	2000	90	Steel	4/2/2003	7	2.5	26.25	0.22	0	0	2.95	0	75.38	65.45	0	0	0	0.768	0.725	0.292	10.37
LAWM41	3/19/2003	2000	90	Steel	3/26/2003	7	2.43	8.95	1.05	0	1.9	2.33	0	60.85	49.26	0	0	0	0.36	0.586	0.234	10.74
LAWM42	1/22/2003	2000	90	Steel	1/29/2003	7	2.97	13.23	0.45	0	0	6.41	0	60.31	60.31	0	0	0	0.532	0.58	0.269	10.78
LAWM43	3/26/2003	2000	90	Steel	4/2/2003	7	3.48	17.55	0.24	0	0	7.31	0	57.47	57.7	0	0	0	0.651	0.645	0.274	10.65
LAWM44	2/26/2003	2000	90	Steel	3/5/2003	7	2.1	15.5	2.09	0	0	2.68	0	50.46	52.35	0	0	0	0.497	0.566	0.233	10.33
LAWM45	1/22/2003	2000	90	Steel	1/29/2003	7	3.54	10.6	0.81	0	0	3.22	0	60.82	51.51	0	0	0	0.427	0.585	0.23	10.88
LAWM46	1/15/2003	2000	90	Steel	1/22/2003	7	1.06	16.35	2.01	0	0	2.64	0	41.6	40.86	0	0	0	0.478	0.466	0.182	10.17
LAWM47	3/18/2003	2000	90	Steel	3/25/2003	7	1.92	12.96	0.88	0	0	2.57	0	75.99	60.47	0	0	0	0.522	0.731	0.269	10.86
LAWM48	3/11/2003	2000	90	Steel	3/18/2003	7	1.89	16.01	0.43	0	0	2.42	0	50.77	51.75	0	0	0	0.468	0.569	0.23	10.23
LAWM49	3/25/2003	2000	90	Steel	4/1/2003	7	2.66	18.16	0.45	0	0	2.03	0	52.35	47.81	0	0	0	0.536	0.504	0.215	10.51
LAWM5	11/4/2003	2000	90	Steel	11/11/2003	7	4.98	4.59	0.26	0	4.04	7.36	0	10.4	36.38	0	0	0	0.245	0.279	0.159	10.53
LAWM50	3/25/2003	2000	90	Steel	4/1/2003	7	2.1	19.49	0.59	0	0	4.35	0	61.17	55.67	0	0	0	0.647	0.63	0.254	10.53
LAWM51	1/30/2003	2000	90	Steel	2/6/2003	7	1.95	20.84	0.72	0	0	5.29	0	69.67	57.32	0	0	0	0.692	0.717	0.261	10.54
LAWM52	2/26/2003	2000	90	Steel	3/5/2003	7	8.17	43.56	0.27	1.26	13.33	0	0.32	172.46	84.73	0	0.6	0.66	1.445	1.161	0.412	11.37
LAWM53	1/15/2003	2000	90	Steel	1/22/2003	7	3.59	3.34	4.64	0	5.51	6.11	0	9.95	23.67	0	0	0	0.179	0.267	0.114	10.74
LAWM54R1	4/2/2003	2000	90	Steel	4/9/2003	7	0.73	6.94	2.64	0	7.79	4.17	0	13.64	32.05	0	0	0	0.372	0.367	0.138	10.35
LAWM55	2/12/2003	2000	90	Steel	2/19/2003	7	1.22	1439.63	0.18	0	475.97	406.3	0	2425.57	441.83	0	0	0	35.655	22.932	2.239	12.05
LAWM56	2/26/2003	2000	90	Steel	3/5/2003	7	1.27	543.15	0.91	0	5.07	20	0	1233.03	209.52	0	0	0.44	14.607	9.796	1.069	11.38
LAWM57	1/11/2006	2000	90	Steel	1/18/2006	7	12.22	89.86	0	0	42.04	0	0.22	315.53	77.19	0	0.68	0	2.631	2.063	0.421	11.65
LAWM58	1/11/2006	2000	90	Steel	1/18/2006	7	12.94	63.64	0	1.28	30.33	0	0.36	250.31	77.06	0	0.84	0.63	2.205	1.643	0.396	11.61
LAWM59	1/12/2006	2000	90	Steel	1/19/2006	7	8.87	21.54	0	0	8.41	0	0	133.41	71.36	0	0	0	0.77	0.899	0.343	11.17
LAWM6	3/25/2003	2000	90	Steel	4/1/2003	7	2.59	18.04	6.23	0	19.14	0	0	47.66	36.07	0	0	0	0.547	0.714	0.193	10.55
LAWM60	1/12/2006	2000	90	Steel	1/19/2006	7	1.96	80.87	0	0	15.61	0	0	265.53	105.99	0	0	0	2.367	1.788	0.5	11.15
LAWM61	1/12/2006	2000	90	Steel	1/19/2006	7	1.92	125.01	0	0	44.09	0	0	409.31	163.24	0	0	0	3.66	2.758	0.775	11.28
LAWM62	1/12/2006	2000	90	Steel	1/19/2006	7	6.12	41.95	0	0	19.73	0	0	185.85	83.63	0	0.56	0	1.501	1.252	0.404	11.26
LAWM63	1/12/2006	2000	90	Steel	1/19/2006	7	15.2	72.72	0.19	2.44	18.33	0	1.14	326.67	108.52	0.59	2.86	1.07	2.491	1.915	0.545	11.61
LAWM64	1/12/2006	2000	90	Steel	1/19/2006	7	8.96	66.74	0	0	15.04	0	0.24	231.84	69.64	0	0.76	0	1.956	1.558	0.388	11.37
LAWM65	2/7/2006	2000	90	Steel	2/14/2006	7	3.12	73.73	0	0	24.48	0	0	384.93	167.72	0	0	0	2.638	2.276	0.823	11.67
LAWM66	2/7/2006	2000	90	Steel	2/14/2006	7	13.27	72.76	0	0	3.55	0	0	267.52	71.33	0	0	0	2.203	1.568	0.398	11.45
LAWM67	2/7/2006	2000	90	Steel	2/14/2006	7	13.15	88.73	0	0	56.33	0	0	296.17	62.95	0	0	0	2.696	1.983	0.351	11.61
LAWM68	2/7/2006	2000	90	Steel	2/14/2006	7	2.96	135.75	0	1.73	101.93	0	0.36	519.2	182.85	0	0	0	4.857	3.498	0.958	11.82
LAWM69	2/7/2006	2000	90	Steel	2/14/2006	7	11.57	54.23	0	0	11.79	0	0	198.21	70.75	0	0	0	1.589	1.33	0.382	11.17
LAWM7	3/19/2003	2000	90	Steel	3/26/2003	7	0	5.39	8.36	0	0	4.91	0	15.97	52.08	0	0	0	0.249	0.429	0.214	10.13
LAWM70	2/8/2006	2																				

The Catholic University of America
Vitreous State Laboratory

ILAW Glass Testing for Disposal at IDF
Final Report, VSL-11R2270-1, Rev. 0

Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
PLTC35CCC	5/1/2004	2000	90	Steel	5/18/2004	7	2.1	14.86	0.7	0	0	7.76	0	54.98	63.92	0	0	0	0.506	0.616	0.288	10.73
PNLA126CC	11/19/2002	2000	90	Steel	11/26/2002	7	5.93	27.4	0	0	14.27	0	0.97	107.5	64.91	0	1.39	0	0.896	0.785	0.314	10.56
PNLA126CC	11/19/2002	2000	90	Steel	12/17/2002	28	7.7	63.09	0	0	26.66	0	0.84	207.43	85.7	0	2.11	0.55	2.062	1.514	0.414	10.65
PNLA126CC	11/19/2002	2000	90	Steel	1/14/2003	56	8.16	82.52	0.21	2.46	32.69	0	1.02	264.29	99.25	0.55	2.27	0.97	2.697	1.929	0.48	10.74
PNLA126CC	11/19/2002	2000	90	Steel	3/19/2003	120	8.65	103.97	0	0	41.75	0	0	318.74	109.23	0	2.06	0.72	3.398	2.326	0.528	10.84
PNLA126CC	11/19/2002	2000	90	Steel	5/19/2003	181	8.16	112.81	0.13	0	42.29	0	0.36	330.48	110.97	0	0.7	0.75	3.687	2.412	0.537	10.92
PNLA126CC	11/19/2002	2000	90	Steel	8/15/2003	269	9.72	131.55	0.25	2.14	50.23	0	1.05	382.38	110.3	0	2.35	0.8	4.3	2.791	0.533	11.05
PNLA126CC	11/19/2002	2000	90	Steel	11/19/2003	365	9.55	139.12	0.18	0	51.71	0	0.34	412.77	126.69	0	0.64	0.64	4.547	3.013	0.613	11.17
PNLA126CC	11/19/2002	2000	90	Steel	11/18/2004	730	10.86	169.48	0.19	0	67.21	0	0	523.48	141.1	0	1.06	0	5.539	3.821	0.682	11.34
PNLA126CC	11/19/2002	2000	90	Steel	11/16/2005	1093	4.66	209.19	0.1	0	79.62	0	0	643.23	195.94	0	0	0	6.837	4.695	0.948	11.45
PNLA126CC	11/19/2002	2000	90	Steel	11/14/2006	1456	1.82	430.67	0.18	0	162.62	0	0	1230.27	394.25	0	0	0	14.076	8.979	1.907	11.55
PNLA126CC	11/19/2002	2000	90	Steel	10/23/2007	1799	1.68	909.11	0.69	0	323.3	0	0	2368.07	639.63	0	0	0	29.713	17.284	3.093	11.65
TFA-BASE	4/29/1999	2000	90	Steel	5/6/1999	7	11.75	24.39	0.17	4.83	0	0	1.27	96.56	73.52	2.04	1.56	1.1	0.786	0.651	0.321	10.21
TFA-BASE	4/29/1999	2000	90	Steel	5/27/1999	28	12.96	56.17	0.22	5.92	0	0	2.09	178.67	92.13	2.58	3.01	1.48	1.809	1.204	0.402	10.28
TFA-BASE	4/29/1999	2000	90	Steel	6/24/1999	56	13.04	75.77	0.29	6.21	2.14	0	2.59	254.17	102.5	2.61	3.48	1.4	2.441	1.713	0.447	10.72
TFA-BASE	4/29/1999	2000	90	Steel	8/27/1999	120	13.56	97.82	0.23	5.79	2.66	0	2.58	297.77	108.47	2.39	3.15	1.08	3.151	2.007	0.473	10.82
TFA-BASE	4/29/1999	2000	90	Steel	10/26/1999	180	12.07	112.17	0.2	5.92	2.93	0	3.05	362.43	119.17	2.39	3.67	1.34	3.613	2.443	0.52	11.03
TFA-BASE	4/29/1999	2000	90	Steel	1/24/2000	270	10.38	121.8	0.11	5.76	2.63	0	3.03	417.47	119.3	2.5	4.58	1.68	3.923	2.814	0.52	11.24
TFA-BASE	4/29/1999	2000	90	Steel	5/4/2000	371	12.58	157.7	0	5.91	3.78	0	3.34	414.87	143.63	2.5	4.13	1.43	5.079	2.796	0.626	11.41
TFA-BASE	4/29/1999	2000	90	Steel	10/27/2000	547	10.66	149.53	0.19	4.83	0	0	2.85	585.43	129.9	1.75	2.85	0.76	4.816	3.946	0.566	11.54
TFA-BASE	4/29/1999	2000	90	Steel	4/25/2001	727	10.83	185.63	0.38	3.67	6.16	0	1.94	533	157.27	1.38	2.59	0.75	5.979	3.592	0.686	11.65
TFA-BASE	4/29/1999	2000	90	Steel	11/15/2002	1296	11.4	264.71	0.26	3.15	6.98	0	1.7	757	233.42	1.19	2.17	0.79	8.526	5.102	1.018	11.77
TFA-BASE	5/12/1999	2000	90	Teflon	5/19/1999	7	12.5	24.79	0.22	5.33	0	0	1.15	93.7	68.57	2.41	1.98	1.43	0.798	0.632	0.299	10.35
TFA-BASE	5/12/1999	2000	90	Teflon	6/9/1999	28	12.3	56.52	0.12	6.23	0	0	2.32	186.27	82.18	2.76	2.84	1.47	1.82	1.255	0.358	10.27
TFA-BASE	5/12/1999	2000	90	Teflon	7/7/1999	56	11.42	76.46	0.25	6.07	2.01	0	2.68	266.1	82.93	2.66	3.66	1.5	2.463	1.794	0.362	10.27
TFA-BASE	5/12/1999	2000	90	Teflon	9/9/1999	120	7.29	108.37	0.58	4.78	2.29	0	2.45	337.27	79.34	2.12	3.69	1.22	3.491	2.273	0.346	10.62
TFA-BASE	5/12/1999	2000	90	Teflon	11/8/1999	180	5.64	129.87	0.21	3.91	0	0	2.26	370.67	78.47	1.71	3.98	1.12	4.183	2.498	0.342	10.43
TFA-BASE	5/12/1999	2000	90	Teflon	1/7/2000	240	4.18	161.93	0	2.91	2.68	0	2.44	576.57	72.9	1.59	4.51	1.17	5.216	3.886	0.318	10.24
WVB-G-124B	3/4/2003	2000	90	Steel	3/11/2003	7	3.23	24.96	0.19	0	3.23	9.62	0.24	88.79	72.99	0	0.49	0	0.806	0.83	0.336	10.85
WVF-G-21B	11/19/2002	2000	90	Steel	11/26/2002	7	6.86	25.39	0	0	7.45	0	0.82	108.8	66.35	0	1.24	0	0.834	0.733	0.323	10.67
WVF-G-21B	11/19/2002	2000	90	Steel	12/17/2002	28	8.03	50.6	0.1	1.57	12.42	0	0.7	209.99	86.68	0	1.85	1.01	1.663	1.415	0.422	10.76
WVF-G-21B	11/19/2002	2000	90	Steel	1/14/2003	56	9.77	79.26	0.26	1.95	17.41	0	0.97	266.32	105.05	0.72	2.03	1.16	2.605	1.794	0.511	10.84
WVF-G-21B	11/19/2002	2000	90	Steel	3/19/2003	120	10.22	94.95	0	1.26	21.39	0	0	285.98	114.54	0.59	2.04	1.06	3.121	1.927	0.557	10.94
WVF-G-21B	11/19/2002	2000	90	Steel	5/19/2003	181	9.98	102.01	0.13	0	21.41	0	0.38	300.13	114.35	0.64	0.68	0.87	3.353	2.022	0.556	11.14
WVF-G-21B	11/19/2002	2000	90	Steel	8/15/2003	269	12.15	121.06	0.35	1.67	25.59	0	0.97	416.45	121.23	0.54	2.22	0.89	3.979	2.806	0.59	11.24
WVF-G-21B	11/19/2002	2000	90	Steel	11/19/2003	365	11.83	123	0.28	0	26.09	0	0.44	457.22	128.6	0	0.69	1.21	4.043	3.08	0.625	11.36
WVF-G-21B	11/19/2002	2000	90	Steel	11/18/2004	730	13.03	149.04	0.22	0	31.45	0	0.49	519.02	147.71	0	0.89	0.53	4.898	3.497	0.718	11.55
WVF-G-21B	11/19/2002	2000	90	Steel	11/16/2005	1093	5.33	226.17	0.25	0	52.11	0	0	832.55	237.32	0	0	0	7.433	5.609	1.154	11.65
WVF-G-21B	11/19/2002	2000	90	Steel	11/14/2006	1456	4.28	511.53	0.17	0	106.28	0	0	1698.73	464.08	0	0.58	0	16.812	11.444	2.257	11.74
WVF-G-21B	11/19/2002	2000	90	Steel	10/23/2007	1799	1.87	1276.63	0.38	0	234.35	0	0	3441.5	773.16	0	0.47	0	41.959	23.185	3.76	11.82
WVH-G-57B	12/11/2002	2000	90	Steel	12/18/2002	7	1.78	14.97	1.01	0	0	6.51	0	43.01	44.52	0	0	0	0.481	0.486	0.204	10.35
WVH-G-57B	12/11/2002	2000	90	Steel	1/8/2003	28	1.86	30.03	0.99	0	0	11.54	0	78.05	77.37	0	0	0	0.965	0.882	0.355	10.43
WVH-G-57B	12/11/2002	2000	90	Steel	2/5/2003	56	2.1	37.55	1.17	0	0	14.39	0	100.21	88.19	0	0	0	1.207	1.132	0.405	10.54
WVH-G-57B	12/11/2002	2000	90	Steel	4/10/2003	120	1.94	41.28	1.01	0	0	17.29	0	114.02	101.28	0	0	0	1.326	1.288	0.465	10.64
WVH-G-57B	12/11/2002	2000	90	Steel	6/9/2003	180	1.21	45	1.01	0	1.99	18	0	119.89	103.94	0	0	0	1.446	1.354	0.477	10.75
WVH-G-57B	12/11/2002	2000	90	Steel	9/8/2003	271	2.36	53.52	1.4	0	1.84	21.02	0	139.93	120.56	0	0	0	1.72	1.58	0.553	10.85
WVH-G-57B	12/11/2002	2000	90	Steel	12/8/2003	362	2.32	53.37	1.64	0	2.28	23.37	0	145.86	128.11	0	0	0	1.715	1.647	0.588	10.95
WVH-G-57B	12/11/2002	2000	90	Steel	6/9/2004	546	2.23	56.03	1.58	0	0	24.12	0	166.56	128.33	0	0	0	1.8	1.881	0.589	11.15
WVH-G-57B	12/11/2002	2000	90	Steel	12/9/2004	729	2.32	62.81	1.9	0	2.44	26.79	0	172.53	148.71	0	0	0	2.018	1.949	0.682	11.26
WVH-G-57B	12/11/2002	2000	90	Steel	12/7/2005	1092	1.02	144.56	2.07	0	3.55	58.78	0	346.64	215.13	0	0	0	4.645	3.915	0.987	11.34
WVH-G-57B	12/11/2002	2000	90	Steel	11/15/2006	1435	1.52	325.84	3.85	0	6.2	108.28	0	705.15	327.64	0	0	0	10.47	7.965	1.503	11.45
WVH-G-57B	12/11/2002	2000	90	Steel	10/24/2007	1778	0.74	1150.63	5.6	0	20.42	235.65	0	2179.67	433.06	0	0	0	36.972	24.619	1.986	11.55
WVJ-G-109D	12/11/2002	2000	90	Steel	12/18/2002	7	1.44	15.35	1.2	0	0	10.15	0	17.72	44.33	0	0	0	0.493	0.436	0.195	10.27
WVJ-G-109D	12/11/2002	2000	90	Steel	1/8/2003	28	1.09	31.11	1.13	0	0	17.84	0	33.23	70.14	0	0	0	1	0.819	0.309	10.34
WVJ-G-109D	12/11/2002	2000	90	Steel	2/5/2003	56	1.38	43.49	1.37	0	2.02	23.65	0	44.28	83.39	0	0	0	1.398	1.091	0.36	

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWA41	3/30/1999	20000	90	Steel	9/27/1999	181	9.45	250.5	0.38	0	144.37	0	0	1493.93	486.13	0	0	0	10.756	10.067	2.396	12.48
LAWA41	3/30/1999	20000	90	Steel	12/21/1999	266	2.24	972.3	0.5	0	374.63	0	0	1926.03	1404.7	0	1.03	0	41.748	12.979	6.923	12.76
LAWA41	3/30/1999	20000	90	Steel	3/29/2000	365	3.32	2448.03	0.41	1.37	696.63	0	0	8204.5	1975.07	0	2.26	0	105.113	55.289	9.733	12.82
LAWA41	3/30/1999	20000	90	Steel	9/27/2000	547	16.27	12784.3	3.91	11.32	3073.13	1.47	0	32360.9	6105.57	1.78	27.83	1.91	548.93	218.077	30.089	12.96
LAWA41	3/30/1999	20000	90	Steel	3/29/2001	730	20.52	17344.1	4.93	14.93	3658.07	2.82	0	45184.47	7506.3	3.13	45	3.97	744.717	304.493	36.992	13.06
LAWA41	3/30/1999	20000	90	Steel	11/14/2002	1325	30.3	21064.33	6.96	28.64	4079.77	3.57	1.14	56689.67	10456.33	9.48	58.82	0	904.456	382.026	51.531	13.15
LAWA41	4/21/1999	20000	90	Teflon	4/28/1999	7	15.65	89.04	0.39	2.92	58.98	0	0.96	649.77	162.83	0	1.7	0	3.823	4.379	0.802	11.71
LAWA41	4/21/1999	20000	90	Teflon	5/19/1999	28	19.34	138.43	0.27	0	85.15	0	0.23	899.63	210.17	0	0	0	5.944	6.063	1.036	12.12
LAWA41	4/21/1999	20000	90	Teflon	6/16/1999	56	18.39	157.37	0	0	88.78	0	0	1021.83	249.23	0	0	0	6.757	6.886	1.228	12.23
LAWA41	4/21/1999	20000	90	Teflon	8/19/1999	120	14.02	196.87	0	0	100.9	0	0	1443.87	280.43	0	0.74	0	8.453	9.73	1.382	12.41
LAWA41	4/21/1999	20000	90	Teflon	10/18/1999	180	15.34	204.6	0.25	0	128.33	0	0	1326.17	250.7	0	0.73	0	8.785	8.937	1.235	12.14
LAWA41	4/21/1999	20000	90	Teflon	1/18/2000	272	2.15	774.37	0.58	0	365.1	0	0	3281.93	820.17	0	0.51	0	33.25	22.117	4.042	12.24
LAWA42	3/30/1999	20000	90	Steel	4/6/1999	7	7.12	651.53	0.39	0	276.03	0	0	2218.3	402	0	0.52	0	23.226	14.947	2.263	12.32
LAWA42	3/30/1999	20000	90	Steel	4/27/1999	28	8.06	1062.53	0.5	0	395	0	0	3798.13	558.3	0	0.62	0	37.877	25.592	3.143	12.55
LAWA42	3/30/1999	20000	90	Steel	5/25/1999	56	8.51	1058.37	1.12	0	399.73	0	0	3378.43	590.07	0	0.65	0	37.729	22.764	3.322	12.62
LAWA42	3/30/1999	20000	90	Steel	7/28/1999	120	5.22	2898.27	1.22	1.46	936.7	0	0	8865.6	889.8	0	2.83	0	103.318	59.738	5.009	12.71
LAWA42	3/30/1999	20000	90	Steel	9/27/1999	181	7.86	7331.7	2.06	2.88	1869.27	0	0	19110.33	1439.83	0	9.94	0	261.361	128.768	8.105	13.04
LAWA42	3/30/1999	20000	90	Steel	12/21/1999	266	12.44	10442.97	2.49	3.73	2719.9	2.08	0	24173.2	1943.5	0.73	17.19	0	372.272	162.882	10.94	13.24
LAWA42	3/30/1999	20000	90	Steel	3/29/2000	365	15.22	15607.13	3.72	4.97	3527.47	3.54	0.27	36074.13	2496.97	1.37	23.31	0.86	556.365	243.072	14.056	13.33
LAWA42	3/30/1999	20000	90	Steel	9/27/2000	547	17.71	20851.13	7.03	7.38	4259.27	2.15	0	40008.57	3340.57	1.33	37.43	1.13	743.304	269.583	18.805	13.42
LAWA42	3/30/1999	20000	90	Steel	3/29/2001	730	16.31	19310.27	7.47	7.43	4413.3	3.55	0	45056.53	3561.5	1.6	36.54	1.78	688.375	303.597	20.048	13.55
LAWA42	3/30/1999	20000	90	Steel	11/14/2002	1325	12.59	20947.33	4.85	4.14	4203.47	2.44	0.4	48448.67	3613.8	1.1	33.52	0	746.733	326.453	20.343	13.66
LAWA42	4/21/1999	20000	90	Teflon	4/28/1999	7	6.87	582.07	0.33	0	243	0	0	2247.17	341.87	0	0	0	20.75	15.142	1.924	12.24
LAWA42	4/21/1999	20000	90	Teflon	5/19/1999	28	8.72	1175.4	0.94	0	451.03	0	0	3752.13	579.37	0	0.68	0	41.901	25.282	3.261	12.52
LAWA42	4/21/1999	20000	90	Teflon	6/16/1999	56	7.73	1113.8	0.17	0	410.6	0	0	3657.47	586.2	0	0	0	39.705	24.645	3.3	12.57
LAWA42	4/21/1999	20000	90	Teflon	8/19/1999	120	4.48	1318.23	0	0	442.83	0	0	5902.8	593.13	0	0	0	46.992	39.774	3.339	12.72
LAWA42	4/21/1999	20000	90	Teflon	10/18/1999	180	15.62	2158.77	0.82	0	680.33	0	0	6251.1	670.03	0	3.04	0	76.956	42.121	3.772	12.65
LAWA42	4/21/1999	20000	90	Teflon	1/18/2000	272	7.61	4866.83	1.49	2.18	1445.33	1.11	0	11719.1	1060.07	0	4.39	0	173.493	78.965	5.967	12.85
LAWA43-1	3/30/1999	20000	90	Steel	4/6/1999	7	54.19	72.16	0.5	2.82	42.64	0	1.3	482.73	99.71	0	3.26	0.65	3.145	3.253	0.561	11.83
LAWA43-1	3/30/1999	20000	90	Steel	4/27/1999	28	64.84	109.83	0.44	2.46	57.21	0	1.16	788.47	127.9	0	2.73	0	4.786	5.313	0.72	12.15
LAWA43-1	3/30/1999	20000	90	Steel	5/25/1999	56	61.88	140.57	0.51	0	69.25	0	0.25	835.83	153.07	0	0.63	0	6.126	5.632	0.862	12.22
LAWA43-1	3/30/1999	20000	90	Steel	7/28/1999	120	62.81	176.57	0.36	0	85.03	0	0	1127.37	184.1	0	0	0	7.694	7.596	1.036	12.31
LAWA43-1	3/30/1999	20000	90	Steel	9/27/1999	181	48.03	321.27	0.64	0	131.4	0	0	1542.2	251.7	0	0.58	0	14	10.392	1.417	12.45
LAWA43-1	3/30/1999	20000	90	Steel	12/21/1999	266	33.71	31487.77	6.59	9.91	10223.1	4.54	0	51960.73	2801.33	2.92	115.33	1.59	1372.144	350.118	15.769	12.65
LAWA43-1	3/30/1999	20000	90	Steel	3/29/2000	365	28.31	30551.03	5.5	7.16	8599.8	5.33	0.34	76318.23	2664.57	2.5	86.09	1.59	1331.324	514.242	14.999	12.77
LAWA43-1	3/30/1999	20000	90	Steel	9/27/2000	547	24.37	22120.7	6.3	6.61	8064.67	2.27	0	44777.93	2638.8	1.15	68.02	1.01	963.955	301.72	14.854	13.15
LAWA43-1	3/30/1999	20000	90	Steel	3/29/2001	730	19.2	16664.53	6.38	6.21	6837.27	2.96	0	41002.63	2653	1.16	48.64	1.67	726.191	276.281	14.934	13.25
LAWA43-1	3/30/1999	20000	90	Steel	11/14/2002	1325	26.07	21033.33	6.08	6	8046	2.8	0.82	51067	2855.63	1.31	50.51	0	916.57	344.096	16.075	13.35
LAWA43-1	4/21/1999	20000	90	Teflon	4/28/1999	7	53.62	66.18	0.53	1.75	45.08	0	0.44	517.33	86.27	0	0.81	0	2.884	3.486	0.486	11.72
LAWA43-1	4/21/1999	20000	90	Teflon	5/19/1999	28	64.92	118.6	0.3	1.16	69.43	0	0.59	760.63	120.2	0	1.38	0	5.168	5.125	0.677	12.11
LAWA43-1	4/21/1999	20000	90	Teflon	6/16/1999	56	63.12	136.97	0	0	70.71	0	0	828.97	128.27	0	0	0	5.969	5.586	0.722	12.17
LAWA43-1	4/21/1999	20000	90	Teflon	8/19/1999	120	58.12	168.37	0	0	87.76	0	0	1113.43	135.97	0	0	0	7.337	7.502	0.765	12.41
LAWA43-1	4/21/1999	20000	90	Teflon	10/18/1999	180	52.18	199.77	0.25	0	98.65	0	0	1098.63	125.4	0	1.04	0	8.705	7.403	0.706	12.12
LAWA43-1	4/21/1999	20000	90	Teflon	1/18/2000	272	44.32	247.2	0	0	135.83	0	0	1346	131.07	0	0	0	10.772	9.07	0.738	12.35
LAWA44	5/4/1999	20000	90	Steel	5/11/1999	7	21.88	97.87	0.59	7.81	5.68	0	4.92	505.27	139.57	0.91	7.28	0.84	3.541	3.404	0.67	11.42
LAWA44	5/4/1999	20000	90	Steel	6/1/1999	28	24.93	144.67	1.03	8.26	8.03	0	6.02	654.37	166.33	1.06	8.93	0.86	5.234	4.409	0.799	11.91
LAWA44	5/4/1999	20000	90	Steel	6/29/1999	56	22.34	162.9	0.77	5.16	7.25	0	4.06	793.33	187.7	0.74	5.58	0.63	5.893	5.345	0.901	11.97
LAWA44	5/4/1999	20000	90	Steel	9/1/1999	120	15.85	207.4	0.28	0	9.39	0	0.39	1003.3	231.3	0	0.47	0	7.503	6.76	1.11	12.12
LAWA44	5/4/1999	20000	90	Steel	11/1/1999	181	17.08	232.13	0	0	10.24	0	0	975.53	282.3	0	0	0	8.397	6.573	1.355	12.22
LAWA44	5/4/1999	20000	90	Steel	1/28/2000	269	4.13	349.97	0.37	0	16.93	0	0	1352.03	476.47	0	0	0	12.66	9.109	2.288	12.35
LAWA44	5/4/1999	20000	90	Steel	5/9/2000	371	0.96	1901.33	1.55	0	70.15	0	0	5312.33	1232.17	0	0.59	0	68.782	35.791	5.916	12.43
LAWA44	5/4/1999	20000	90	Steel	11/1/2000	547	1.83	3808.57	3.02	1.41	166.33	0	0	9435.17	1425.33	0	1.19	0	137.778	63.569	6.843	12.52
LAWA44	5/4/1999	20000	90	Steel	5/3/2001	730	2.68	8903.03	3.57	1.87	416.5	1.68	0	20393.8	2019.93	0	2.18	1.01	322.074	137.402	9.698	12.65
LAWA44	5/4/1999	20000	90	Steel	11/15/2002	1291	7.99	15439	6.88	3.07	909.21	2.95	0	37605.67	3023.37	0.43	4.8					

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Ti (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	Norm. B Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]	pH
LAWA45	5/13/1999	20000	90	Teflon	5/20/1999	7	5.49	338.57	0.49	6.46	8.77	0	5.13	802.77	116.43	0.96	6.14	1.13	9.163	5.41	0.559	10.75
LAWA45	5/13/1999	20000	90	Teflon	6/10/1999	28	2.09	610.23	0	1.79	14.31	0	1.55	1358.13	170.4	0	1.31	0	16.514	9.153	0.818	10.94
LAWA45	5/13/1999	20000	90	Teflon	7/8/1999	56	0.9	715.53	0.24	0	19.35	0	0	1551.73	196.63	0	0	0	19.364	10.458	0.944	10.92
LAWA45	5/13/1999	20000	90	Teflon	9/10/1999	120	0.65	0	0.39	0	25.17	0	0	2090.63	229.73	0	0	0	0	14.09	1.103	10.92
LAWA45	5/13/1999	20000	90	Teflon	11/8/1999	179	0	873.67	0.37	0	23.73	0	0	2378.6	212.13	0	0	0	23.644	16.031	1.019	10.58
LAWA45	5/13/1999	20000	90	Teflon	1/7/2000	239	0	1280.33	0.52	0	28.45	0	0	3036.07	196.93	0	0	0	34.649	20.462	0.946	10.46
LAWA49	5/27/1999	20000	90	Steel	6/3/1999	7	16.56	93.17	0.5	13.32	3.83	0	4.83	417.87	136.1	1.65	9.13	2.06	3.37	2.815	0.653	11.57
LAWA49	5/27/1999	20000	90	Steel	6/24/1999	28	18.55	141.63	0.44	17.04	5.79	0	6.58	597.07	173.6	2.21	13.06	2.56	5.123	4.023	0.833	11.70
LAWA49	5/27/1999	20000	90	Steel	7/22/1999	56	18.74	174.77	0.4	14.92	7.48	0	6.31	705.8	198	2.02	12.08	2.8	6.321	4.755	0.951	11.76
LAWA49	5/27/1999	20000	90	Steel	9/24/1999	120	13.52	202.4	0.5	1.47	9.12	0	0.61	797.73	199.57	0	1.27	0.55	7.321	5.375	0.958	11.91
LAWA49	5/27/1999	20000	90	Steel	11/23/1999	180	12.53	267.17	0.17	1.88	10.31	0	0.81	1018.37	281.53	0	0	0.54	9.663	6.861	1.352	12.02
LAWA49	5/27/1999	20000	90	Steel	2/22/2000	271	10.46	328.63	0	0	13.01	0	0	1177.67	338.6	0	0	0	11.886	7.935	1.626	12.13
LAWA49	5/27/1999	20000	90	Steel	5/26/2000	365	0.99	626.3	0	0	25.21	0	0	2038.3	656.23	0	0	0	22.653	13.733	3.15	12.22
LAWA49	5/27/1999	20000	90	Steel	11/22/2000	545	1.6	6433.17	1.54	1.82	208.63	0	0	15622.93	2123.67	0	1.8	0	232.686	105.262	10.195	12.35
LAWA49	5/27/1999	20000	90	Steel	5/24/2001	728	3.26	12366	0.93	3.18	368.55	0	0.59	27620	2760.17	0.78	3.82	0.91	447.275	186.095	13.251	12.45
LAWA49	5/27/1999	20000	90	Steel	11/18/2002	1271	3.86	18492.67	0.95	2.93	786.51	1.89	0.48	40349.33	2846.93	0.98	6.02	1.16	668.875	271.861	13.668	12.56
LAWA50	5/27/1999	20000	90	Steel	6/3/1999	7	21.37	92.62	0.2	13.53	4	0	4.96	409.4	115.97	1.36	9.09	1.77	3.351	2.759	0.583	11.60
LAWA50	5/27/1999	20000	90	Steel	6/24/1999	28	24.41	140.43	0.33	18.61	5.74	0	6.99	585.07	149.5	1.91	13.81	2.13	5.081	3.943	0.752	11.76
LAWA50	5/27/1999	20000	90	Steel	7/22/1999	56	24.46	180.63	0.35	17.44	7.85	0	7.07	725.47	176.1	1.8	13.21	2.36	6.535	4.889	0.885	11.78
LAWA50	5/27/1999	20000	90	Steel	9/24/1999	120	15.86	250	0.2	0	10.02	0	0.33	921.47	234.27	0	0.6	0	9.045	6.21	1.178	11.96
LAWA50	5/27/1999	20000	90	Steel	11/23/1999	180	16.4	266.03	0.16	1.85	10.77	0	0.9	958.9	248.07	0	0.62	0	9.625	6.463	1.247	12.14
LAWA50	5/27/1999	20000	90	Steel	2/22/2000	271	13.24	344.37	0	0	13.15	0	0.34	1127.57	332.73	0	0	0	12.459	7.599	1.673	12.26
LAWA50	5/27/1999	20000	90	Steel	5/26/2000	365	5.17	409.03	0	0	14.98	0	0	1383.23	417.8	0	0	0	14.799	9.322	2.101	12.35
LAWA50	5/27/1999	20000	90	Steel	11/22/2000	545	1.76	6241.23	0.83	1.77	190.47	0	0	15413.8	1481.23	0	1.28	0	225.808	103.883	7.448	12.47
LAWA50	5/27/1999	20000	90	Steel	5/24/2001	728	3.45	17705.33	1.04	3.09	749.1	1.38	0.67	39349.67	2732.67	0.78	4.47	1.01	640.581	265.202	13.74	12.54
LAWA50	5/27/1999	20000	90	Steel	11/18/2002	1271	4.73	27515.33	1.13	3.47	959.44	2.75	0.58	52797.33	2957.4	1.42	5.99	1.77	995.507	355.834	14.87	12.65
LAWA51	5/27/1999	20000	90	Steel	6/3/1999	7	8.58	210	0.23	7.64	3.71	0	7.17	462	81.71	1.4	10.51	1.66	5.647	3.459	0.375	10.22
LAWA51	5/27/1999	20000	90	Steel	6/24/1999	28	7.85	415.63	0.47	10.61	6.7	0	10.88	826.37	112.53	2.31	16.7	2.41	11.177	6.187	0.517	10.33
LAWA51	5/27/1999	20000	90	Steel	7/22/1999	56	5.37	545.47	0.69	8.01	9.09	0	8.68	1095.4	126.2	1.78	12.35	2.21	14.669	8.201	0.58	10.38
LAWA51	5/27/1999	20000	90	Steel	9/24/1999	120	1.02	731.93	0.45	0	11.75	0	0.99	1347.97	136.73	0	1.27	0	19.683	10.092	0.628	10.42
LAWA51	5/27/1999	20000	90	Steel	11/23/1999	180	0	863.93	1.73	0	21.72	0	0	1706	160.43	0	0	0	23.233	12.773	0.737	12.05
LAWA51	5/27/1999	20000	90	Steel	2/22/2000	271	0.99	1031.33	0	0	16.4	0	0	1626.83	160.53	0	0	0	27.735	12.18	0.737	12.15
LAWA51	5/27/1999	20000	90	Steel	5/26/2000	365	0	1140.07	0	0	16.56	0	0	1906.67	159.27	0	0	0	30.659	14.275	0.732	12.25
LAWA51	5/27/1999	20000	90	Steel	11/22/2000	545	0.7	1273.23	0.64	0	23.14	0	0	2340.9	174.8	0	0	0	34.24	17.526	0.803	12.37
LAWA51	5/27/1999	20000	90	Steel	5/24/2001	728	1.47	1741.9	0.3	0	35.42	0	0.26	3233.1	316.65	0	2.26	0	46.843	24.206	1.454	12.46
LAWA51	5/27/1999	20000	90	Steel	11/18/2002	1271	1.13	2167.57	0.23	0	37	0	0	3541.7	406.58	0	0	0	58.29	26.517	1.868	12.54
TFA-BASE	5/4/1999	20000	90	Steel	5/11/1999	7	16.05	140.7	0.27	8.72	3.54	0	6.68	475.67	143.07	2.98	5.93	1.4	4.532	3.206	0.624	11.31
TFA-BASE	5/4/1999	20000	90	Steel	6/1/1999	28	13.97	244.97	0.34	9.33	5.99	0	8.93	729.23	191.17	2.88	7.9	1.34	7.89	4.915	0.834	11.53
TFA-BASE	5/4/1999	20000	90	Steel	6/29/1999	56	9.53	294.03	0.4	4.28	5.93	0	4.35	937.2	209.03	1.38	3.72	0.56	9.471	6.317	0.911	11.58
TFA-BASE	5/4/1999	20000	90	Steel	9/1/1999	120	6.39	359.43	0.3	0	6.49	0	0.68	1161.27	239.87	0	0	0	11.577	7.827	1.046	11.63
TFA-BASE	5/4/1999	20000	90	Steel	11/1/1999	181	8.46	413.77	0	0	7.16	0	0	1166.87	274.67	0	0	0	13.327	7.865	1.198	11.83
TFA-BASE	5/4/1999	20000	90	Steel	1/28/2000	269	7.39	517	0.61	0	13.73	0	0	1473.23	339.37	0	0	0	16.652	9.93	1.48	11.93
TFA-BASE	5/4/1999	20000	90	Steel	5/9/2000	371	4.68	618.77	0.31	0	16.01	0	0	1562.9	487.13	0	0	0	19.93	10.534	2.124	12.13
TFA-BASE	5/4/1999	20000	90	Steel	11/1/2000	547	0	1052.67	1.24	0	28.72	0	0	3469.53	1051.9	0	0	0	33.906	23.385	4.587	12.22
TFA-BASE	5/4/1999	20000	90	Steel	5/3/2001	730	0.83	2808.37	0.3	0	71.77	0	0	6718.77	1835.13	0	0.97	0	90.456	45.285	8.002	12.34
TFA-BASE	5/4/1999	20000	90	Steel	11/15/2002	1291	5.97	12417.67	0.81	3.1	463.27	1.54	0	27598	3735.5	1.25	3.89	0	399.965	186.014	16.289	12.46
TFA-BASE	5/13/1999	20000	90	Teflon	5/20/1999	7	25.01	140.23	0.3	6.32	3.74	0	3.47	480	102.9	2.43	3.63	1.42	4.517	3.235	0.449	11.43
TFA-BASE	5/13/1999	20000	90	Teflon	6/10/1999	28	18.64	265.47	0.19	5.61	5.65	0	4.27	814.4	144.87	1.9	4.08	1.09	8.551	5.489	0.632	11.62
TFA-BASE	5/13/1999	20000	90	Teflon	7/8/1999	56	14.01	321.13	0.21	2.45	7.7	0	1.91	957.47	147.33	0.79	1.82	0	10.343	6.453	0.642	11.62
TFA-BASE	5/13/1999	20000	90	Teflon	9/10/1999	120	9.85	430.43	0.4	0	9.57	0	0	1274.03	170.43	0	0	0	13.864	8.587	0.743	11.65
TFA-BASE	5/13/1999	20000	90	Teflon	11/8/1999	179	5.69	493.87	0	0	9.75	0	0	1336.73	151.7	0	0	0	15.907	9.01	0.661	11.55
TFA-BASE	5/13/1999	20000	90	Teflon	1/7/2000	239	4	606.97	0.14	0	10.78	0	0	1395.9	146.5	0	0	0	19.55	9.409	0.639	11.45

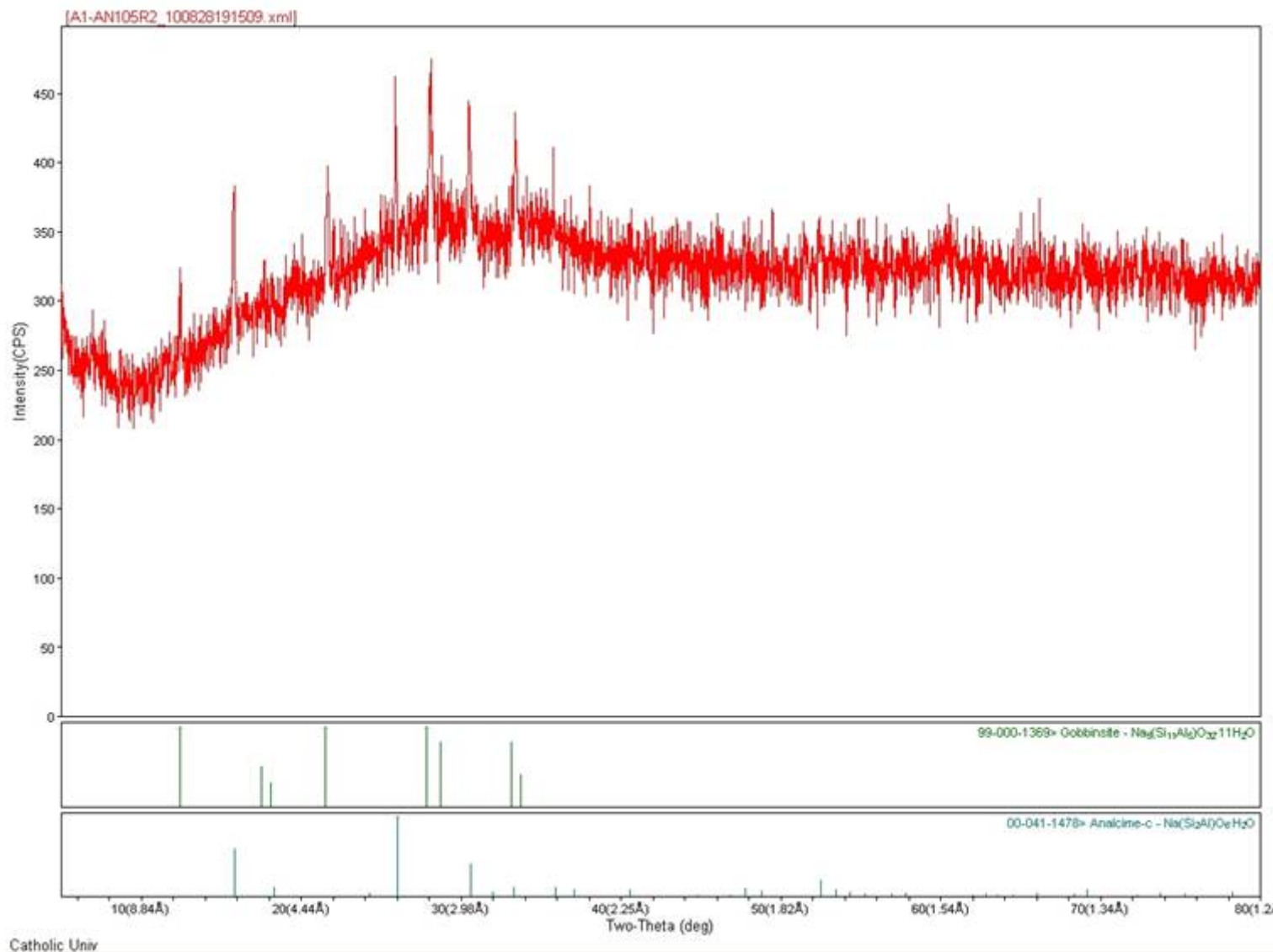
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APPENDIX B

Results from XRD and SEM-EDS Analysis of Reacted LAW Glasses from Long-Term PCT-B Tests

**XRD powder patterns (raw data and best match) and SEM/EDS analysis of glass A1-AN105R2,
collected from 90°C PCT-B vessel after 2869 days.**



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A1-AN105R2.

Spectrum processing :
Peak possibly omitted : 6.410 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

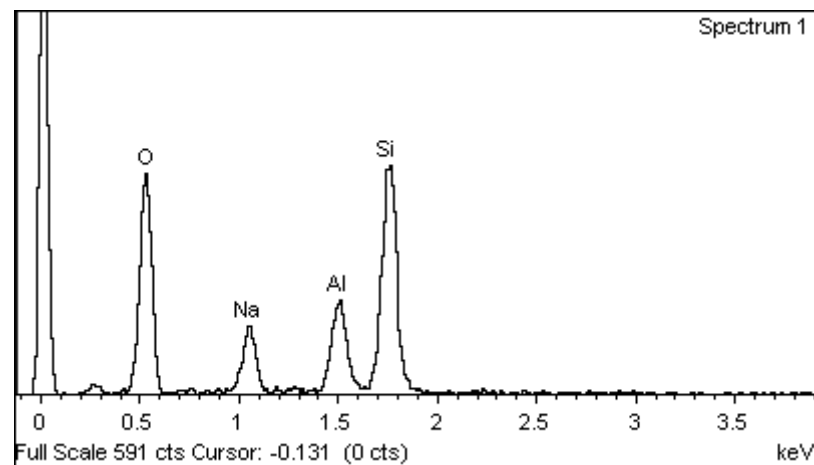
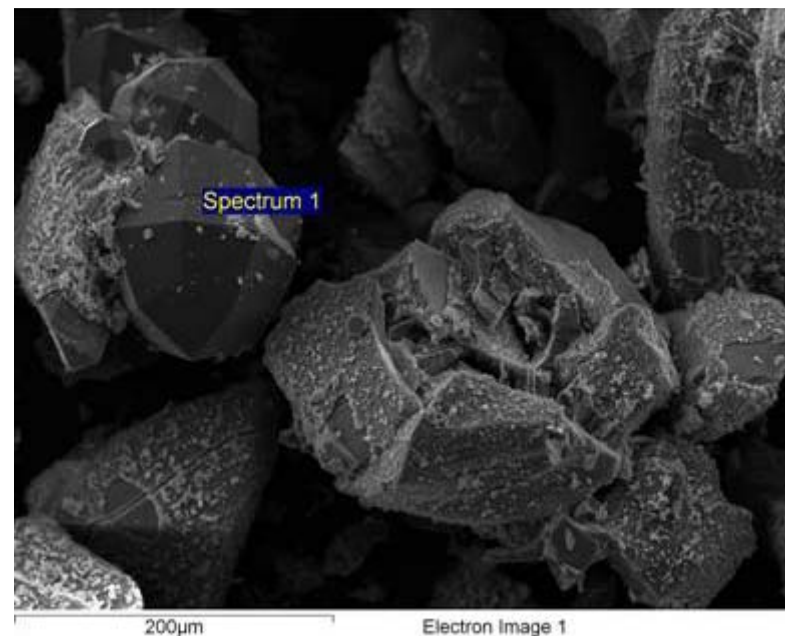
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	9.28	8.15	12.51	Na ₂ O
Al K	10.33	7.72	19.51	Al ₂ O ₃
Si K	31.78	22.83	67.98	SiO ₂
O	48.62	61.31		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A1-AN105R2.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

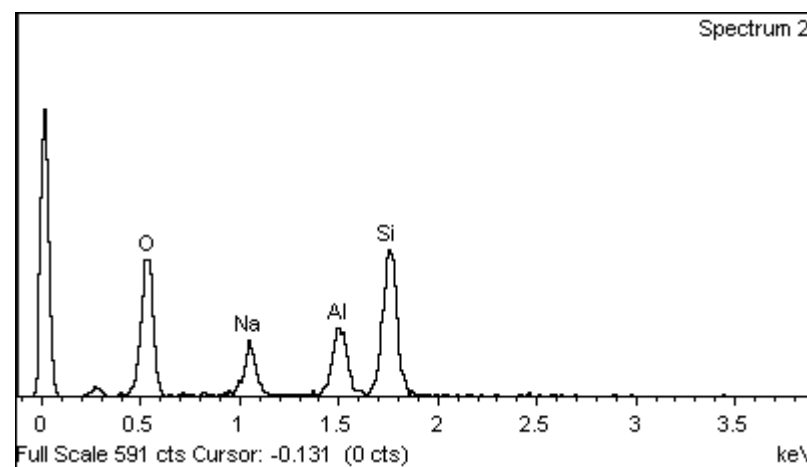
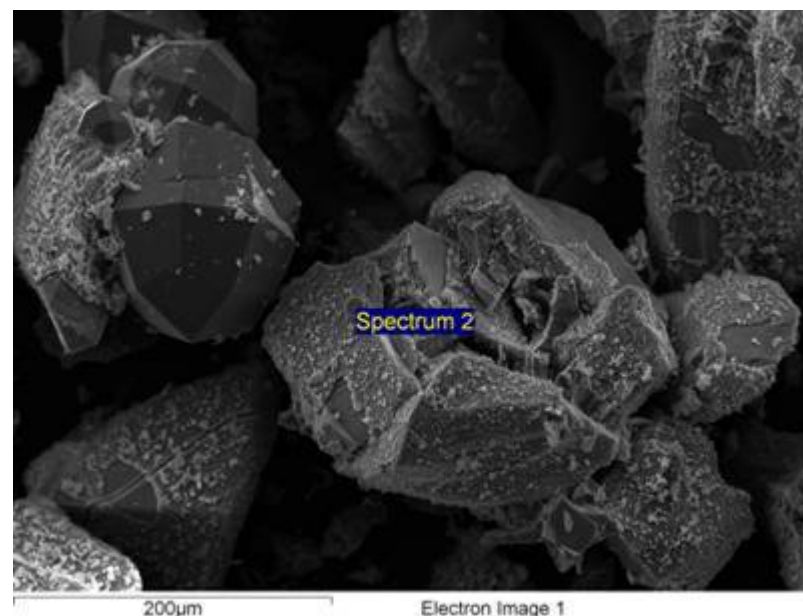
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	9.96	8.75	13.43	Na ₂ O
Al K	11.77	8.81	22.25	Al ₂ O ₃
Si K	30.07	21.62	64.33	SiO ₂
O	48.20	60.82		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A1-AN105R2.

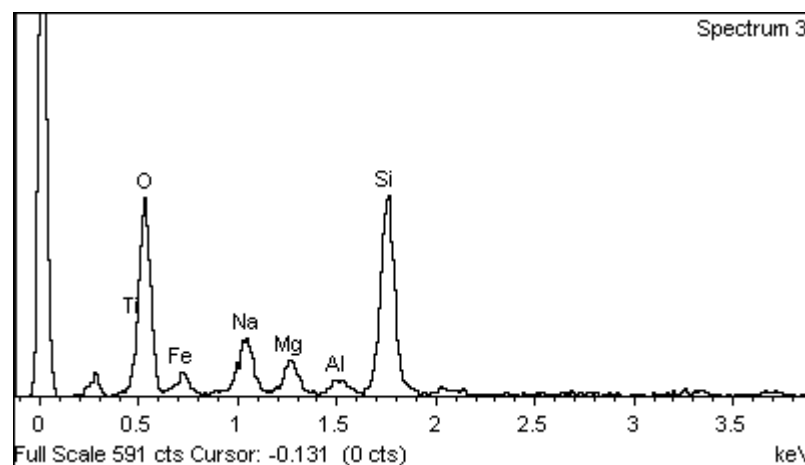
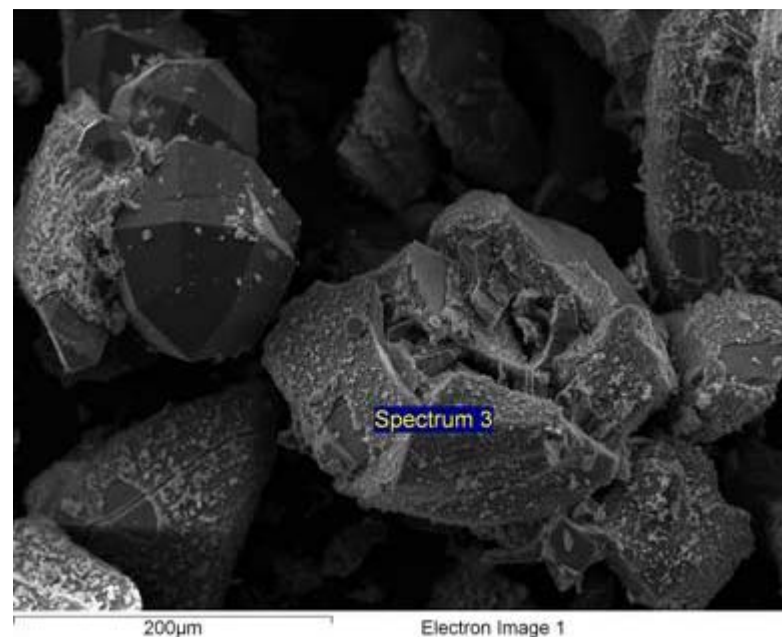
Spectrum processing :
Peak possibly omitted : 3.685 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.66	7.48	10.33	Na ₂ O
Mg K	4.18	3.86	6.94	MgO
Al K	1.43	1.19	2.70	Al ₂ O ₃
Si K	23.78	18.99	50.87	SiO ₂
Ti K	2.67	1.25	4.45	TiO ₂
Fe K	17.29	6.95	24.72	Fe ₂ O ₃
O	42.99	60.28		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A1-AN105R2.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

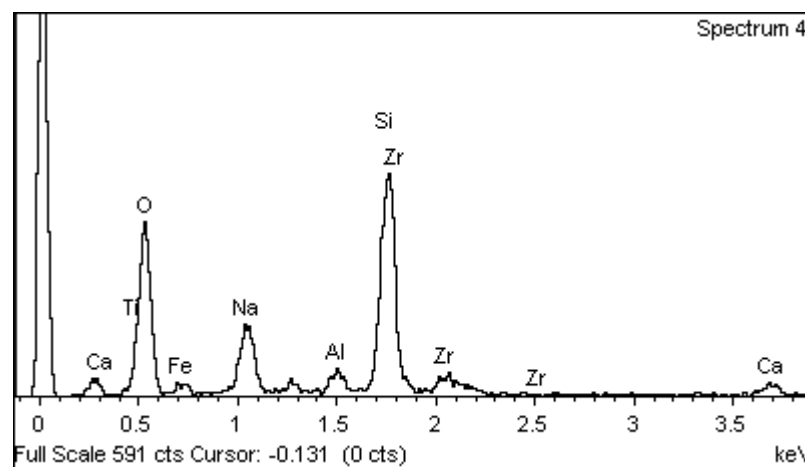
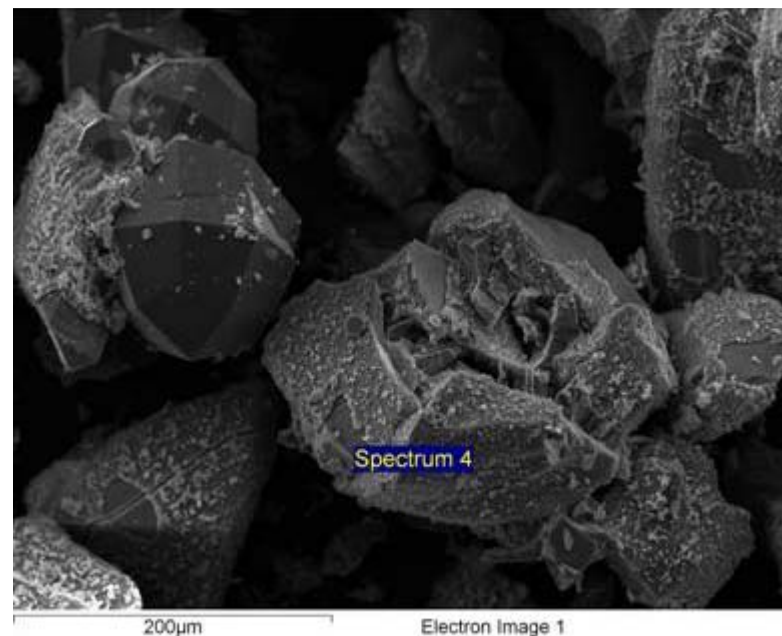
Ca Wollastonite 1-Jun-1999 12:00 AM

Ti Ti 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	10.01	9.60	13.49	Na ₂ O
Al K	2.41	1.97	4.56	Al ₂ O ₃
Si K	27.84	21.87	59.56	SiO ₂
Ca K	2.54	1.40	3.55	CaO
Ti K	2.21	1.02	3.69	TiO ₂
Fe K	4.78	1.89	6.84	Fe ₂ O ₃
Zr L	6.15	1.49	8.31	ZrO ₂
O	44.05	60.75		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A1-AN105R2.

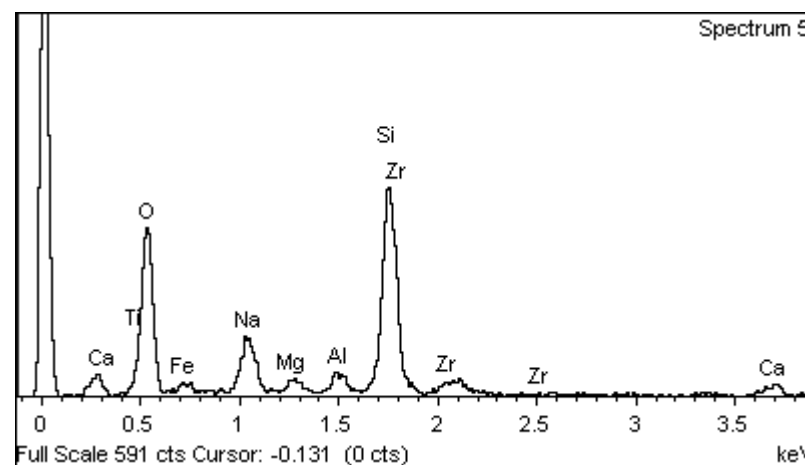
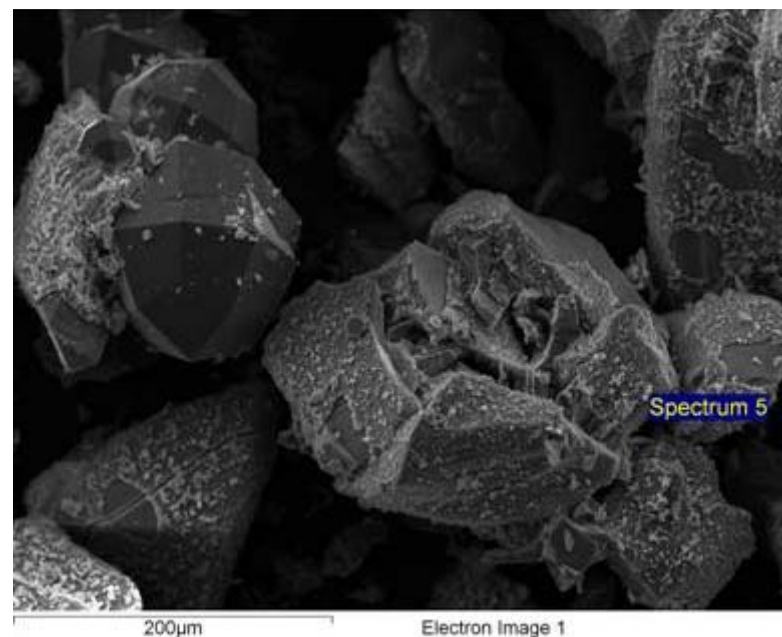
Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
 Mg MgO 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM
 Ca Wollastonite 1-Jun-1999 12:00 AM
 Ti Ti 1-Jun-1999 12:00 AM
 Fe Fe 1-Jun-1999 12:00 AM
 Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.27	7.97	11.15	Na ₂ O
Mg K	1.58	1.44	2.62	MgO
Al K	2.54	2.09	4.80	Al ₂ O ₃
Si K	26.77	21.12	57.26	SiO ₂
Ca K	2.49	1.37	3.48	CaO
Ti K	1.97	0.91	3.28	TiO ₂
Fe K	7.71	3.06	11.03	Fe ₂ O ₃
Zr L	4.72	1.15	6.38	ZrO ₂
O	43.95	60.88		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A1-AN105R2.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

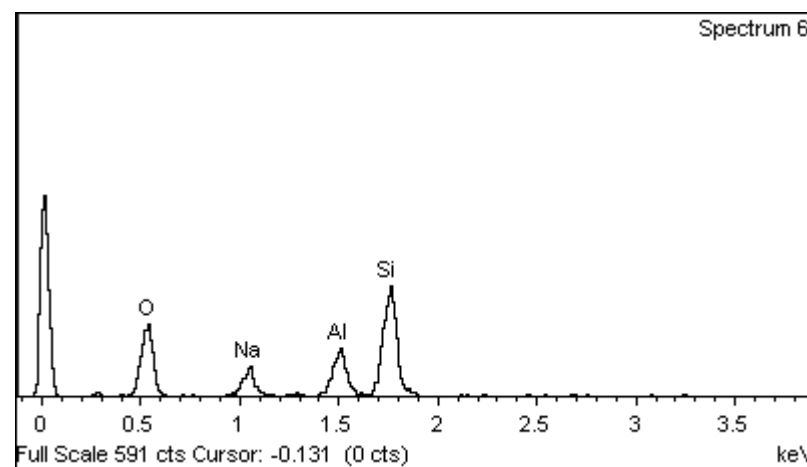
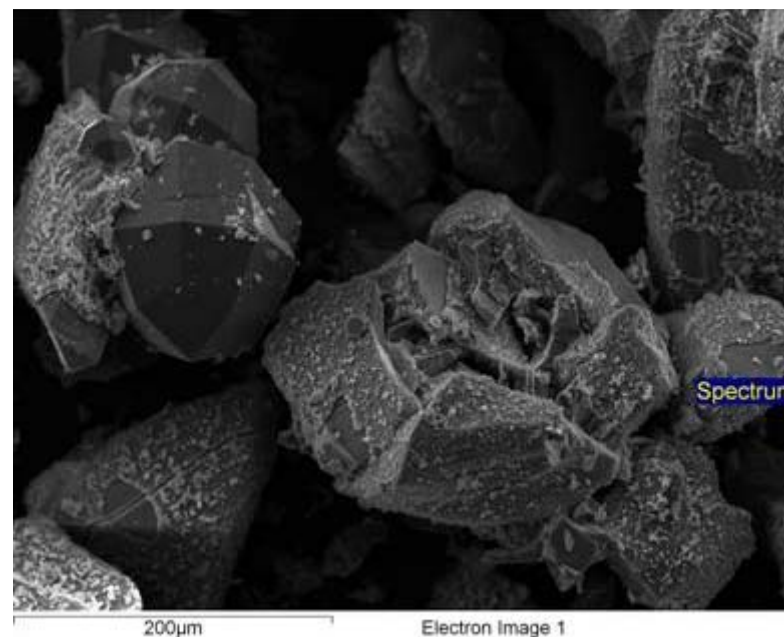
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.72	6.77	10.40	Na ₂ O
Al K	11.03	8.24	20.83	Al ₂ O ₃
Si K	32.14	23.08	68.76	SiO ₂
O	49.11	61.91		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A1-AN105R2.

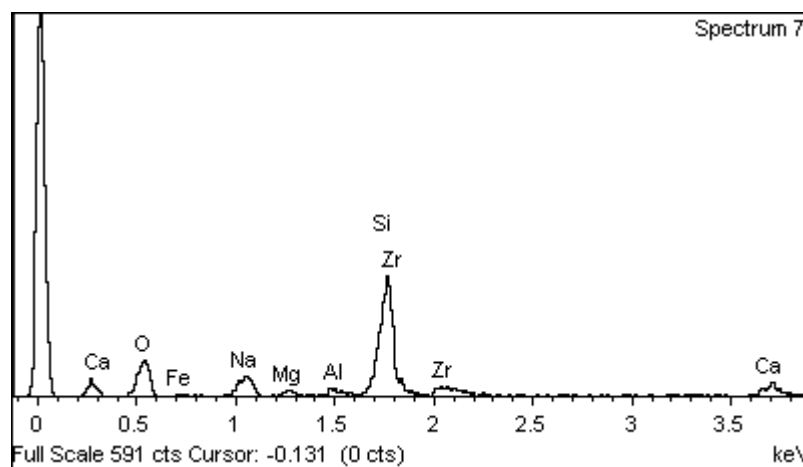
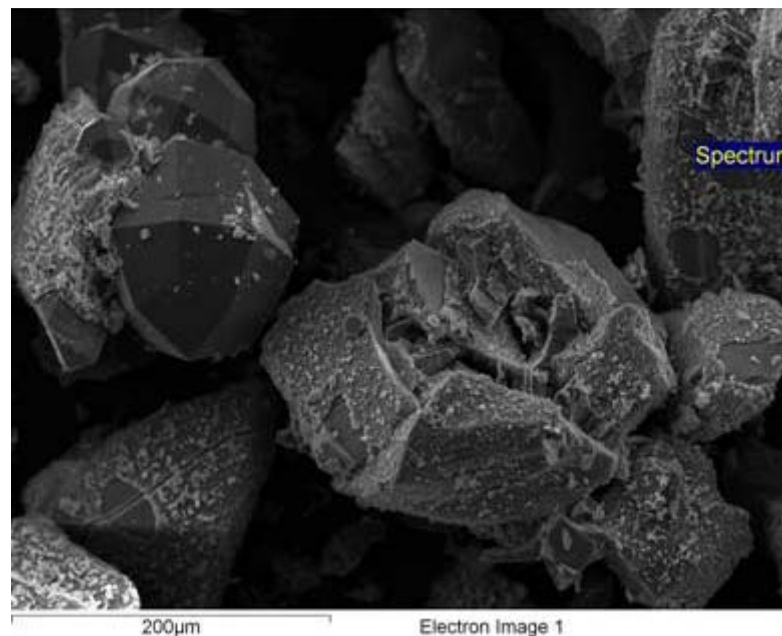
Spectrum processing :
Peak possibly omitted : 4.510 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 2

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.95	5.97	8.02	Na ₂ O
Mg K	1.45	1.38	2.41	MgO
Al K	1.19	1.02	2.26	Al ₂ O ₃
Si K	25.56	20.99	54.69	SiO ₂
Ca K	5.10	2.94	7.14	CaO
Fe K	11.21	4.63	16.03	Fe ₂ O ₃
Zr L	7.00	1.77	9.46	ZrO ₂
O	42.52	61.30		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A1-AN105R2.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

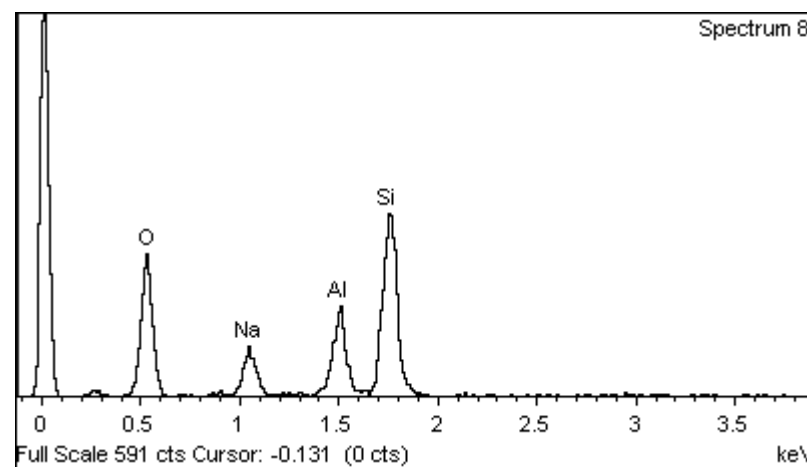
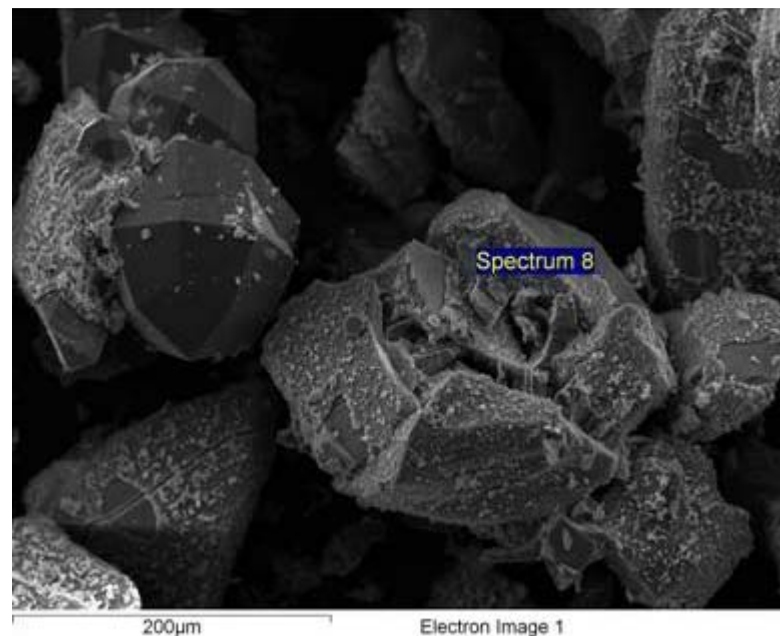
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

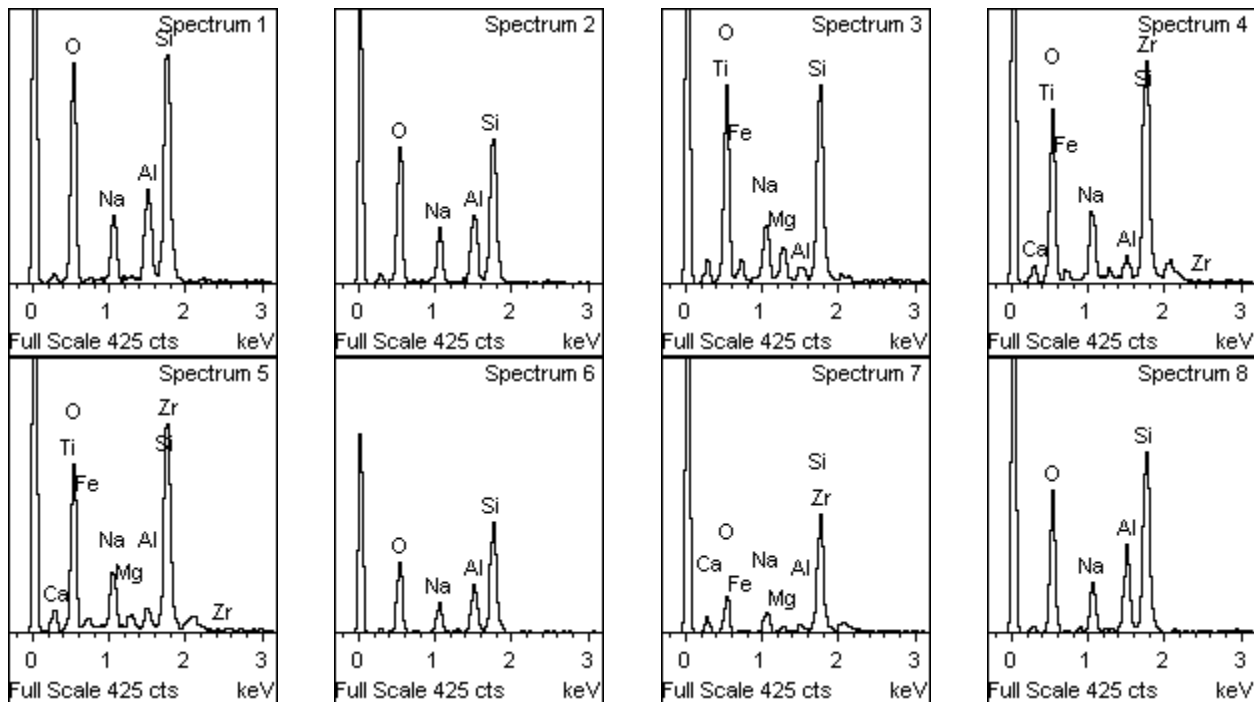
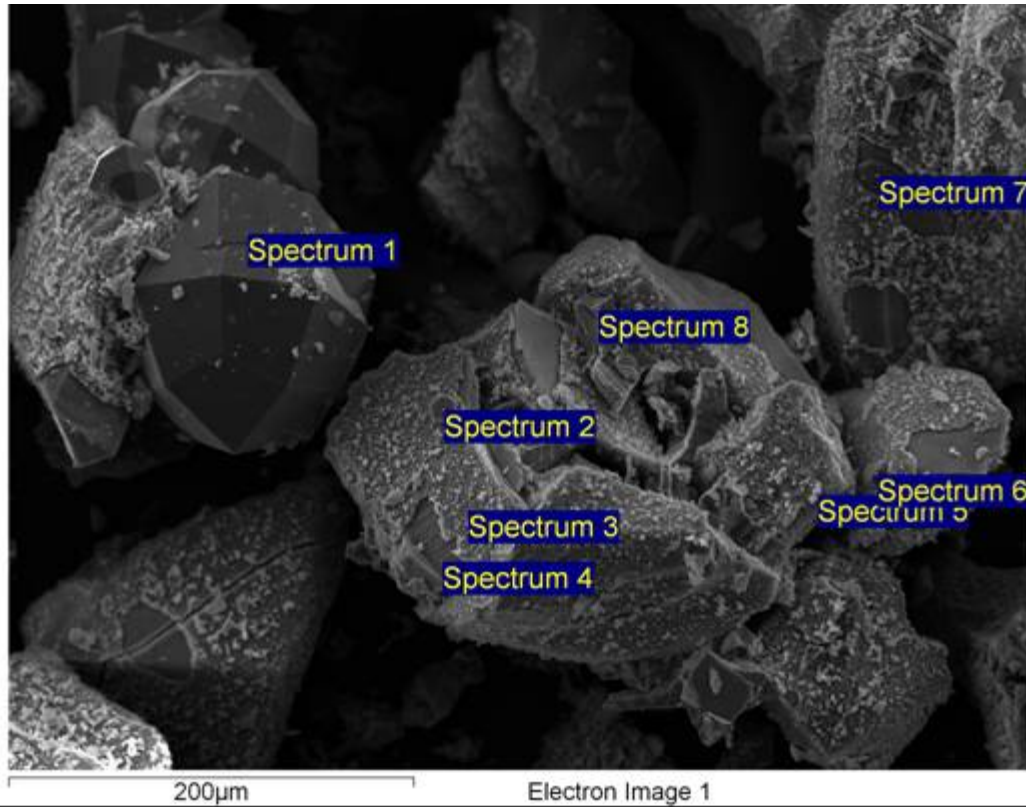
Element	Weight%	Atomic%	Compd%	Formula
Na K	8.19	7.18	11.04	Na ₂ O
Al K	11.37	8.50	21.48	Al ₂ O ₃
Si K	31.55	22.66	67.49	SiO ₂
O	48.90	61.66		
Totals	100.00			



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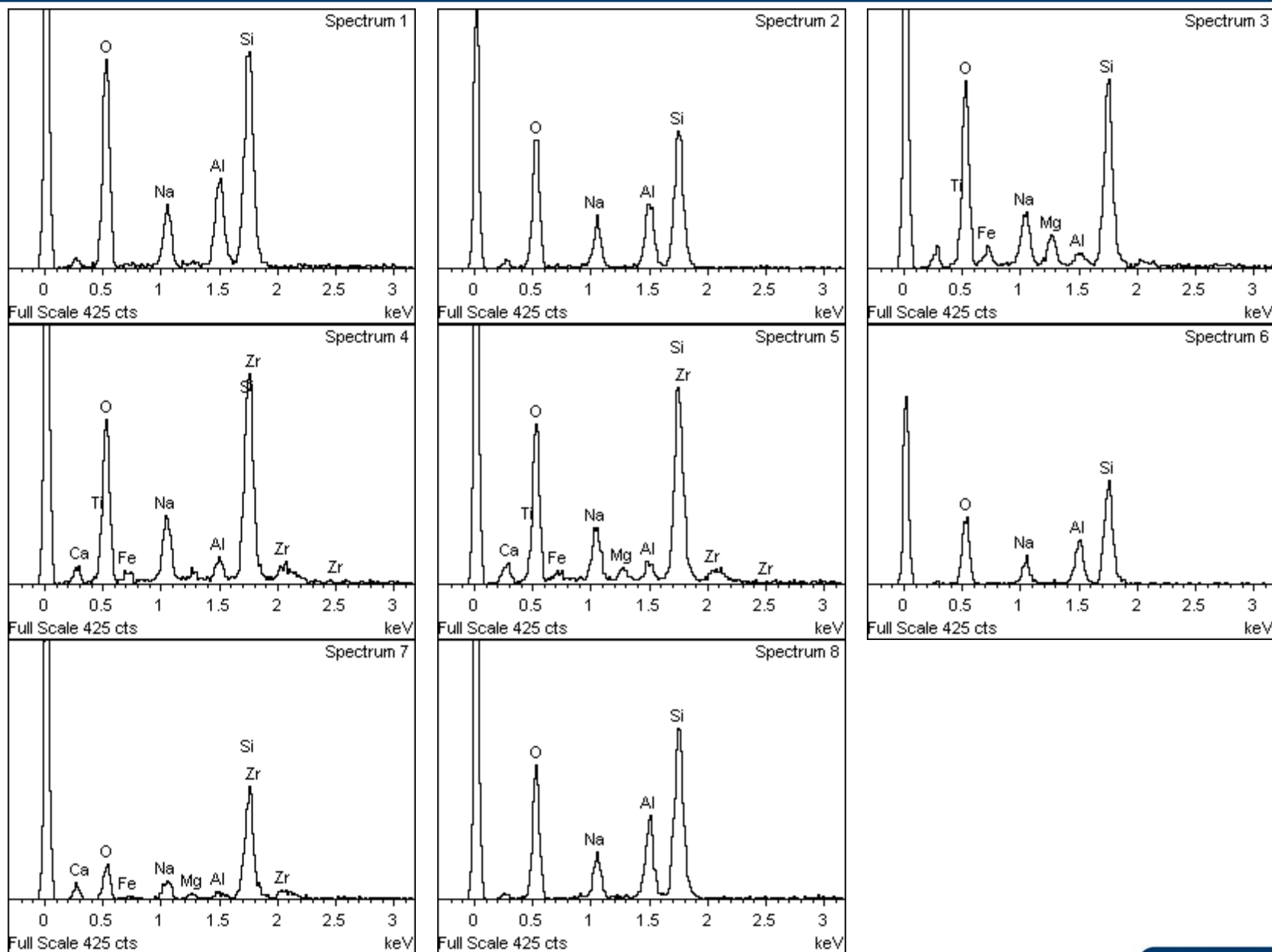


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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A1-AN105R2.

Project: PCT SURFACE CORROSION 4
Owner: cavinm
Site: Site of Interest 1

Sample: A1-AN105R2
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Ca	Ti	Fe	Zr	O	Total
Spectrum 1	Yes	9.28		10.33	31.78					48.62	100.00
Spectrum 2	Yes	9.96		11.77	30.07					48.20	100.00
Spectrum 3	Yes	7.66	4.18	1.43	23.78		2.67	17.29		42.99	100.00
Spectrum 4	Yes	10.01		2.41	27.84	2.54	2.21	4.78	6.15	44.05	100.00
Spectrum 5	Yes	8.27	1.58	2.54	26.77	2.49	1.97	7.71	4.72	43.95	100.00
Spectrum 6	Yes	7.72		11.03	32.14					49.11	100.00
Spectrum 7	Yes	5.95	1.45	1.19	25.56	5.10		11.21	7.00	42.52	100.00
Spectrum 8	Yes	8.19		11.37	31.55					48.90	100.00
Max.		10.01	4.18	11.77	32.14	5.10	2.67	17.29	7.00	49.11	
Min.		5.95	1.45	1.19	23.78	2.49	1.97	4.78	4.72	42.52	

All results in weight%

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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A1-AN105R2.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

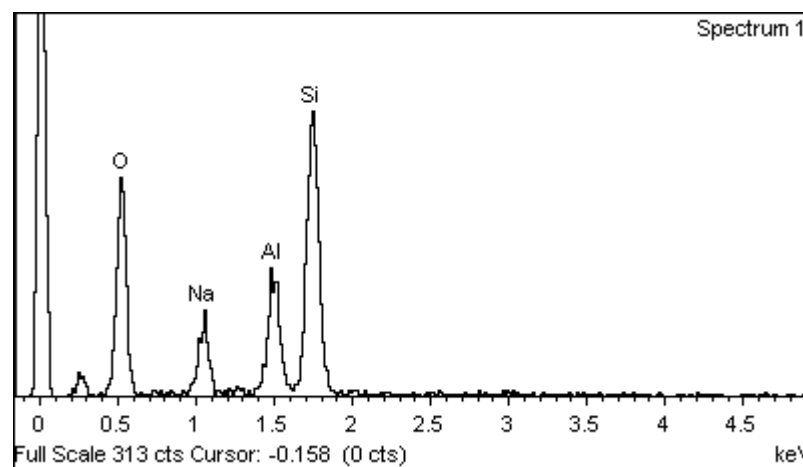
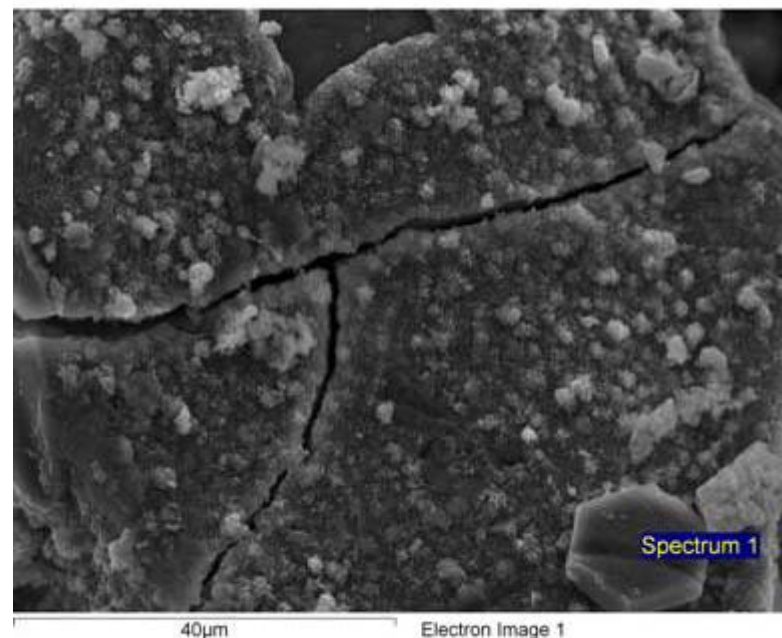
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.47	7.43	11.42	Na ₂ O
Al K	10.76	8.04	20.33	Al ₂ O ₃
Si K	31.90	22.91	68.25	SiO ₂
O	48.86	61.61		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A1-AN105R2.

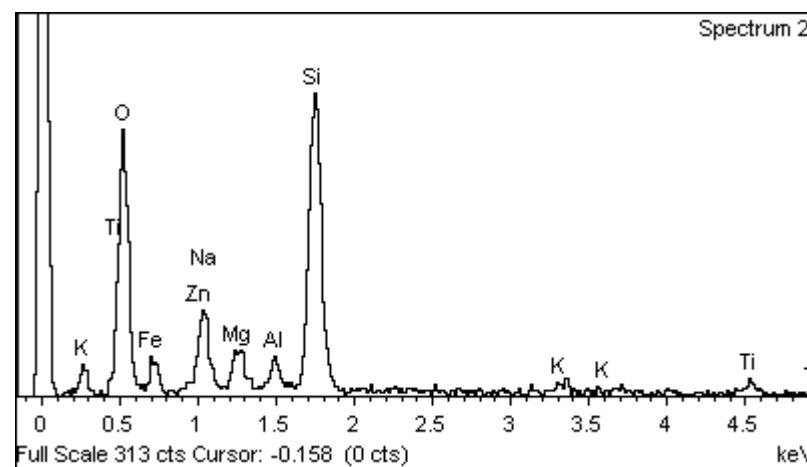
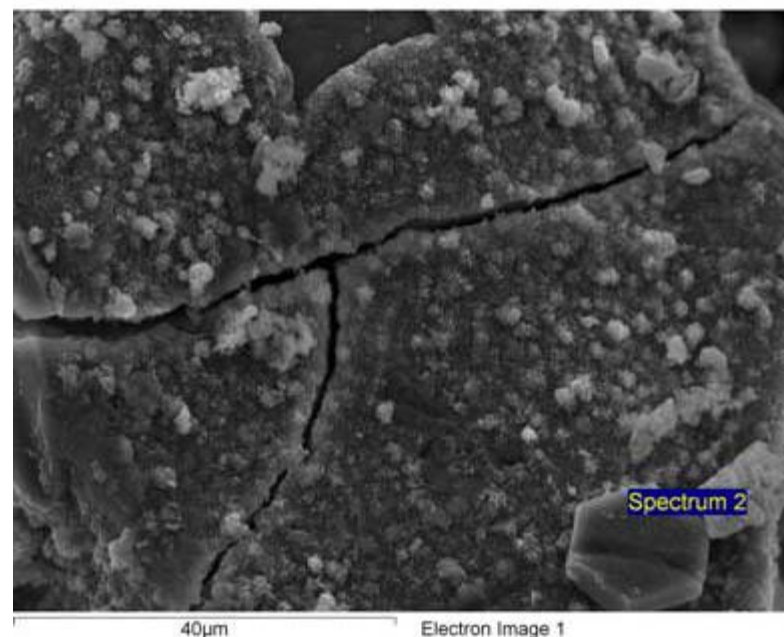
Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
 Mg MgO 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM
 K MAD-10 Feldspar 1-Jun-1999 12:00 AM
 Ti Ti 1-Jun-1999 12:00 AM
 Fe Fe 1-Jun-1999 12:00 AM
 Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.46	4.61	6.01	Na ₂ O
Mg K	3.02	2.95	5.01	MgO
Al K	1.84	1.62	3.47	Al ₂ O ₃
Si K	21.69	18.34	46.40	SiO ₂
K K	1.36	0.83	1.64	K ₂ O
Ti K	2.13	1.06	3.55	TiO ₂
Fe K	17.15	7.29	24.52	Fe ₂ O ₃
Zn L	7.55	2.74	9.40	ZnO
O	40.80	60.57		
Totals	100.00			



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Final Report, VSL-11R2270-1, Rev. 0*

PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A1-AN105R2.

Spectrum processing :

Peaks possibly omitted : 4.530, 8.615 keV

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

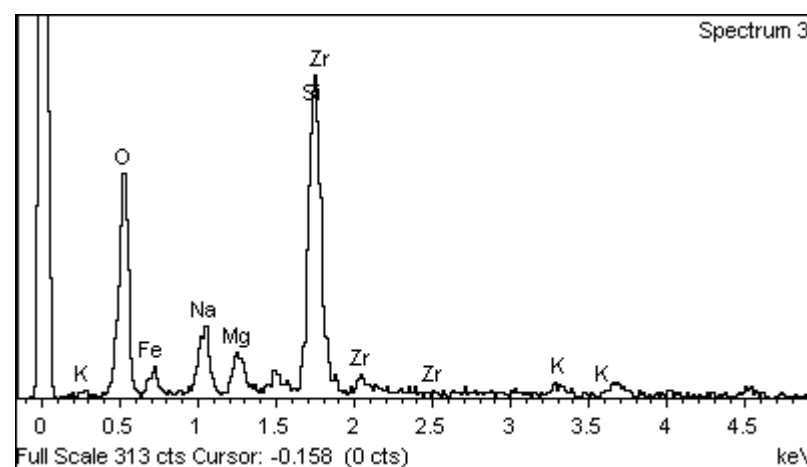
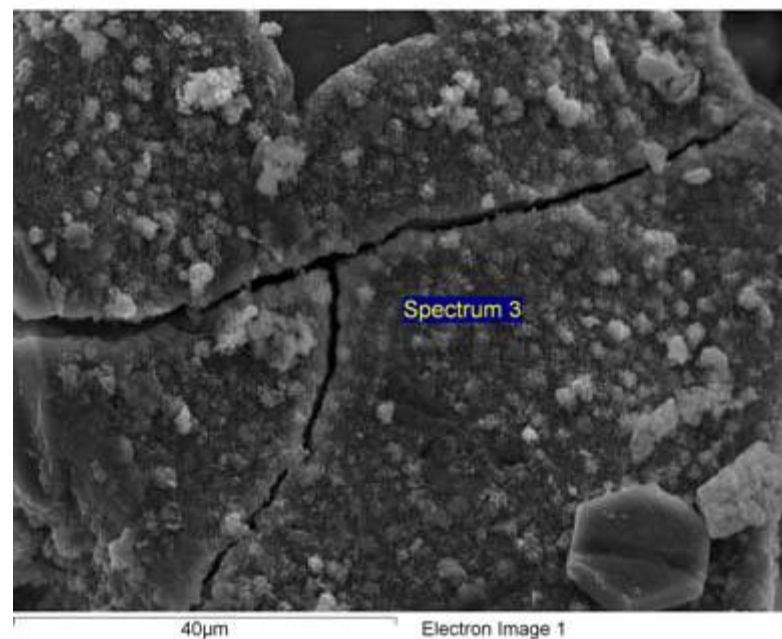
Si SiO2 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.90	6.84	9.30	Na2O
Mg K	3.46	3.24	5.73	MgO
Si K	25.82	20.95	55.24	SiO2
K K	1.16	0.67	1.40	K2O
Fe K	16.22	6.62	23.19	Fe2O3
Zr L	3.81	0.95	5.14	ZrO2
O	42.64	60.73		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A1-AN105R2.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 2

Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

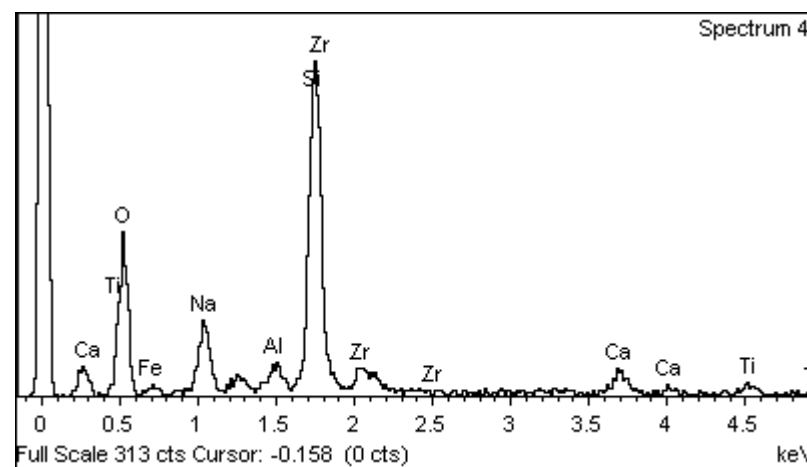
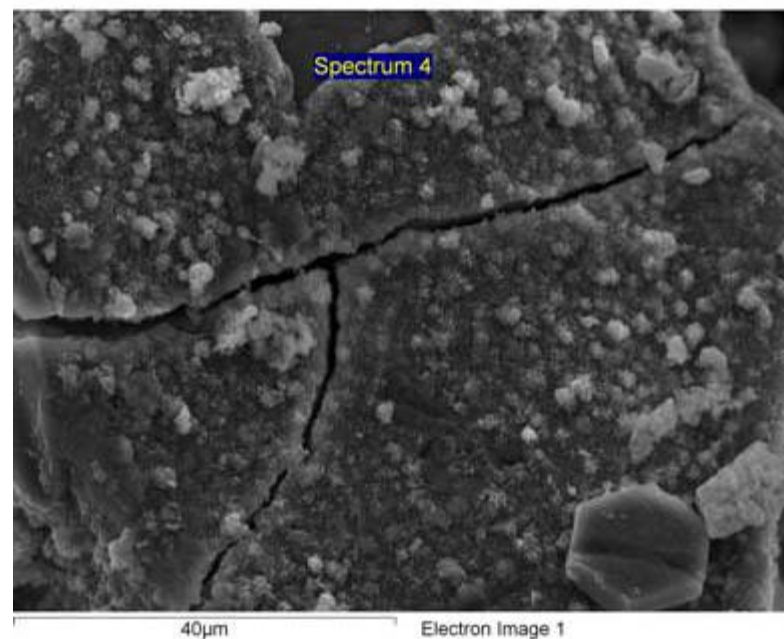
Ca Wollastonite 1-Jun-1999 12:00 AM

Ti Ti 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.80	6.69	9.17	Na ₂ O
Al K	1.73	1.45	3.27	Al ₂ O ₃
Si K	27.40	22.07	58.61	SiO ₂
Ca K	3.36	1.90	4.70	CaO
Ti K	2.50	1.18	4.17	TiO ₂
Fe K	7.71	3.12	11.02	Fe ₂ O ₃
Zr L	6.70	1.66	9.05	ZrO ₂
O	43.80	61.92		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A1-AN105R2.

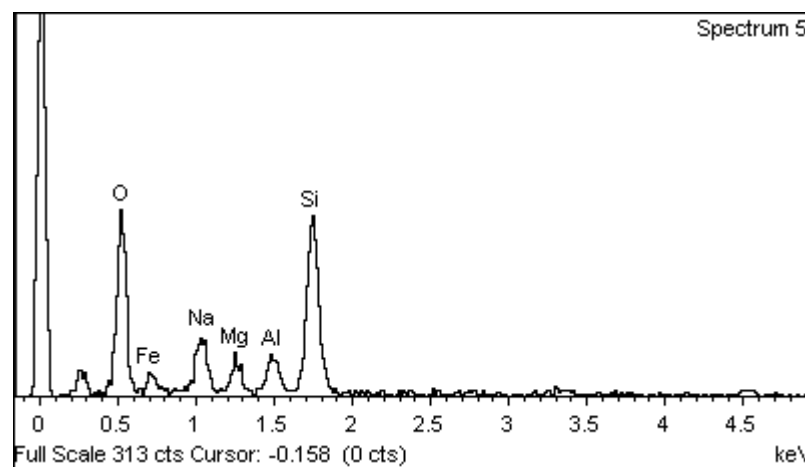
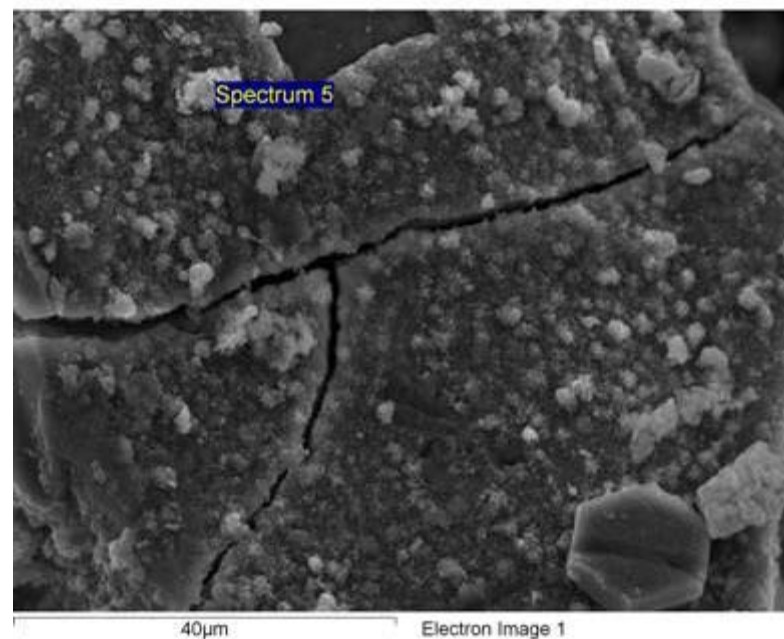
Spectrum processing :
 Peak possibly omitted : 4.521 keV

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
 Mg MgO 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM
 Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.15	7.80	10.99	Na ₂ O
Mg K	4.55	4.11	7.54	MgO
Al K	4.60	3.74	8.68	Al ₂ O ₃
Si K	23.53	18.42	50.34	SiO ₂
Fe K	15.70	6.18	22.45	Fe ₂ O ₃
O	43.47	59.74		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A1-AN105R2.

Spectrum processing :
Peak possibly omitted : 3.340 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

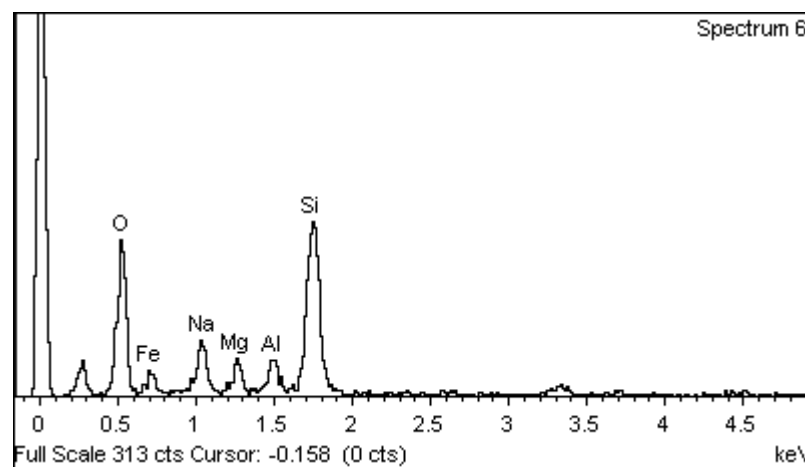
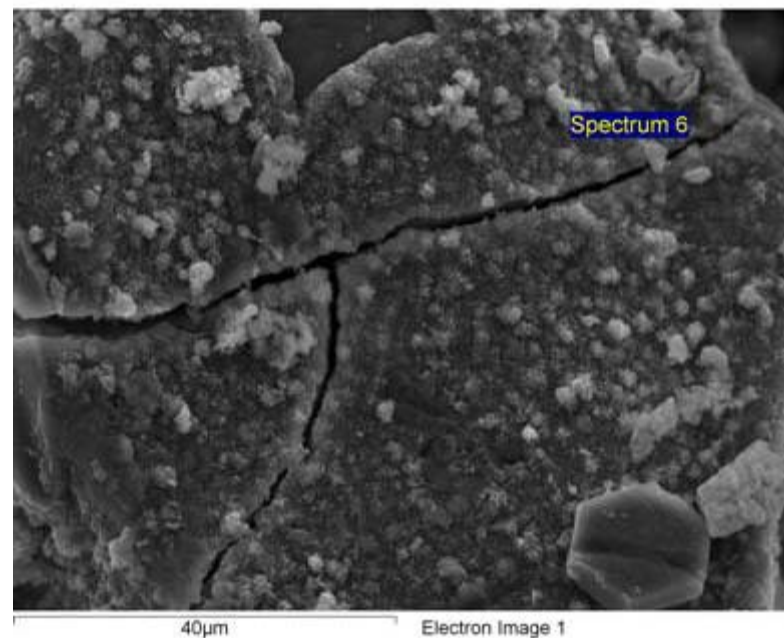
Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

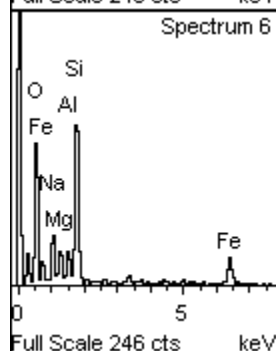
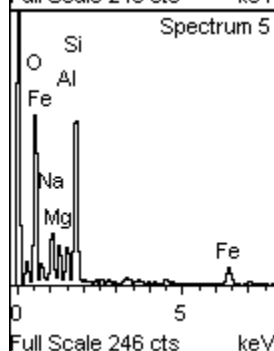
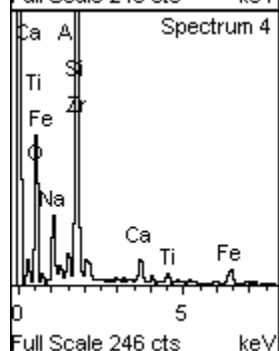
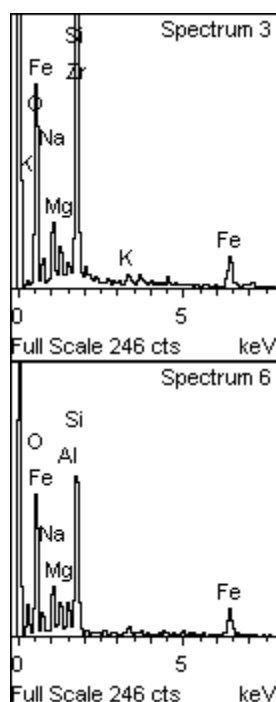
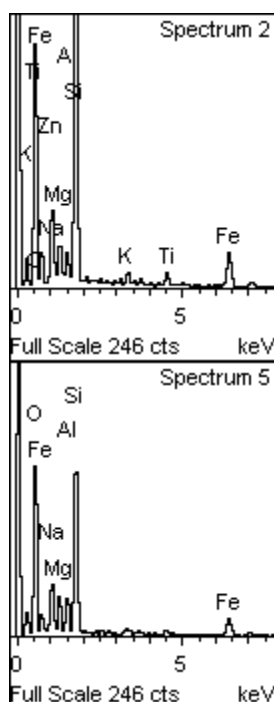
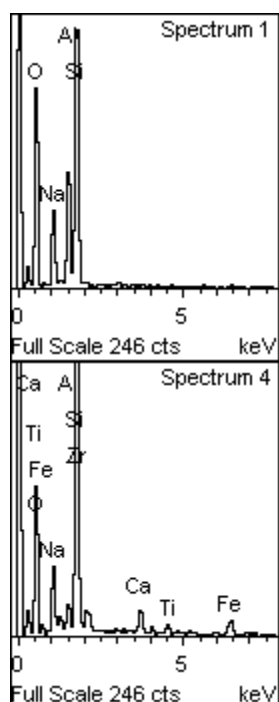
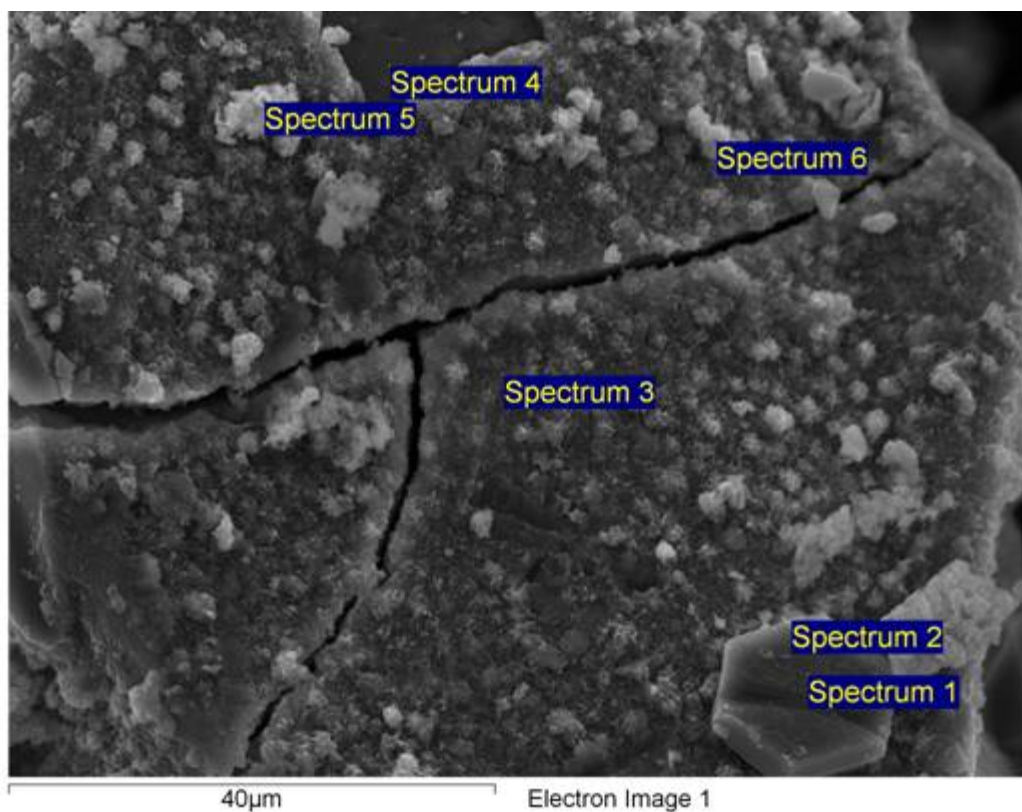
Element	Weight%	Atomic%	Compd%	Formula
Na K	7.58	7.36	10.22	Na ₂ O
Mg K	4.12	3.78	6.83	MgO
Al K	4.17	3.45	7.88	Al ₂ O ₃
Si K	22.83	18.14	48.84	SiO ₂
Fe K	18.35	7.34	26.24	Fe ₂ O ₃
O	42.95	59.93		
Totals	100.00			



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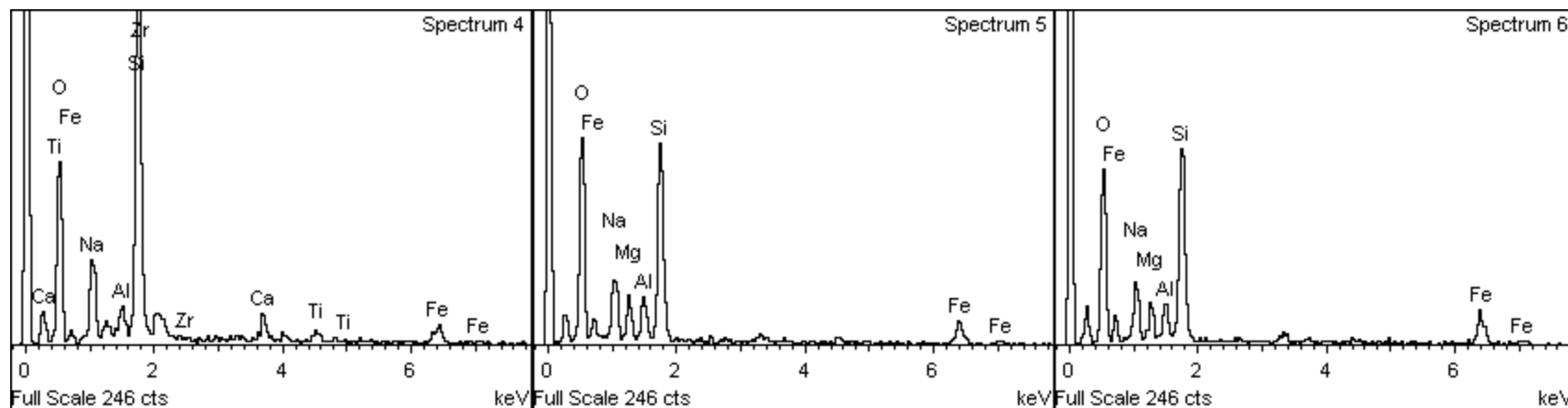
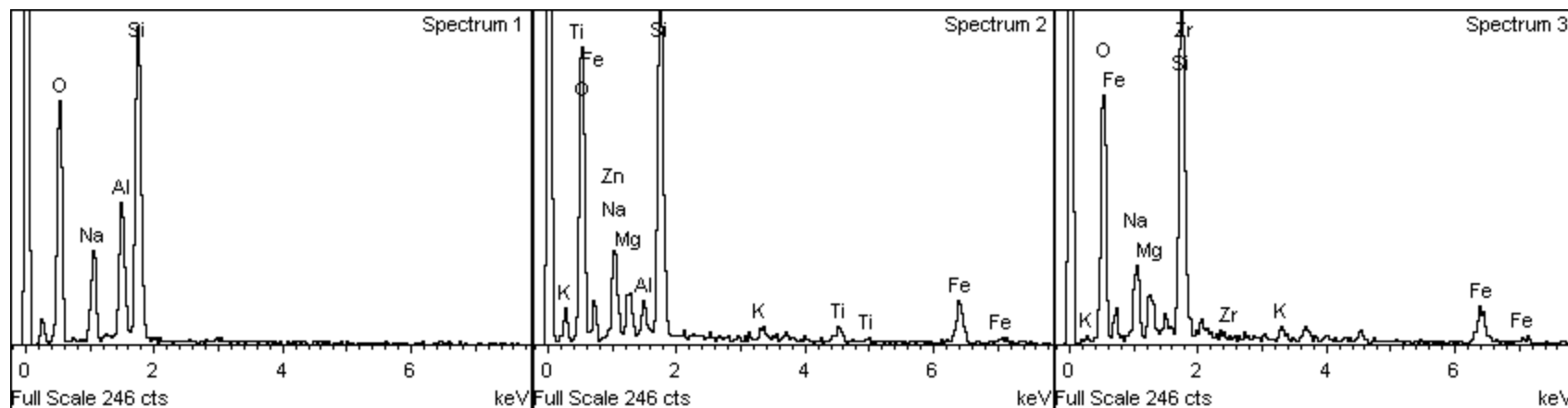
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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A1-AN105R2.



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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A1-AN105R2.



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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A1-AN105R2.

Project: PCT SURFACE CORROSION 4
Owner: cavinm
Site: Site of Interest 2

Sample: A1-AN105R2
Type: Default
ID:

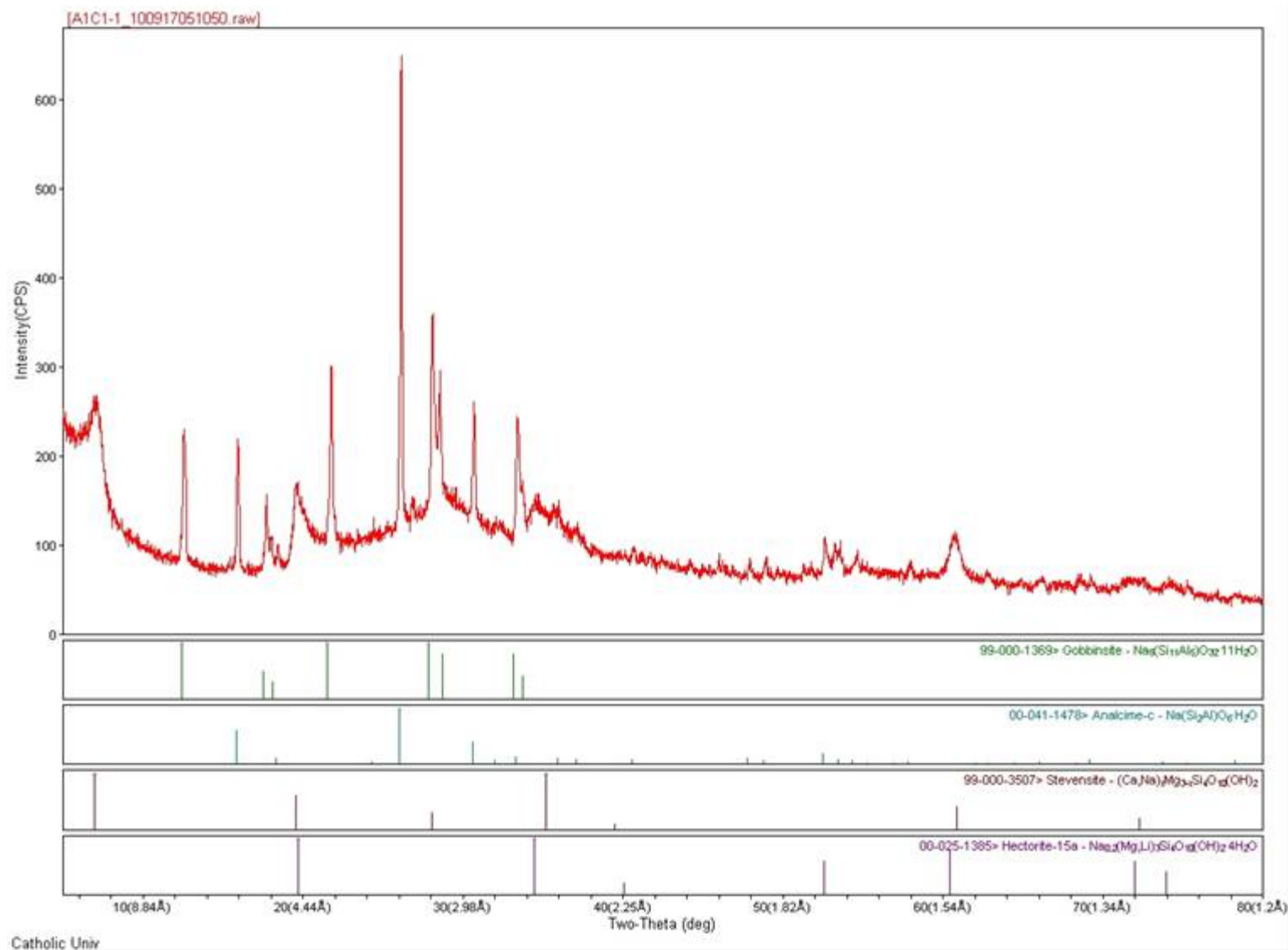
Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ca	Ti	Fe	Zn	Zr	O	Total
Spectrum 1	Yes	8.47		10.76	31.90							48.86	100.00
Spectrum 2	Yes	4.46	3.02	1.84	21.69	1.36		2.13	17.15	7.55		40.80	100.00
Spectrum 3	Yes	6.90	3.46		25.82	1.16			16.22		3.81	42.64	100.00
Spectrum 4	Yes	6.80		1.73	27.40		3.36	2.50	7.71		6.70	43.80	100.00
Spectrum 5	Yes	8.15	4.55	4.60	23.53				15.70			43.47	100.00
Spectrum 6	Yes	7.58	4.12	4.17	22.83				18.35			42.95	100.00
Max.		8.47	4.55	10.76	31.90	1.36	3.36	2.50	18.35	7.55	6.70	48.86	
Min.		4.46	3.02	1.73	21.69	1.16	3.36	2.13	7.71	7.55	3.81	40.80	

All results in weight%



**XRD powder patterns (raw data and best match) and SEM/EDS analysis of glass A1C1-1,
collected from 90°C PCT-B vessel after 2926 days.**



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PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-1.

Spectrum processing :
Peak possibly omitted : 2.345 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

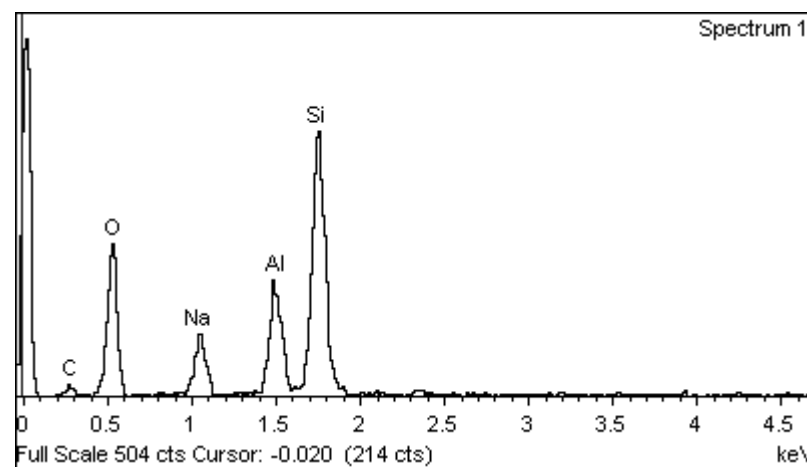
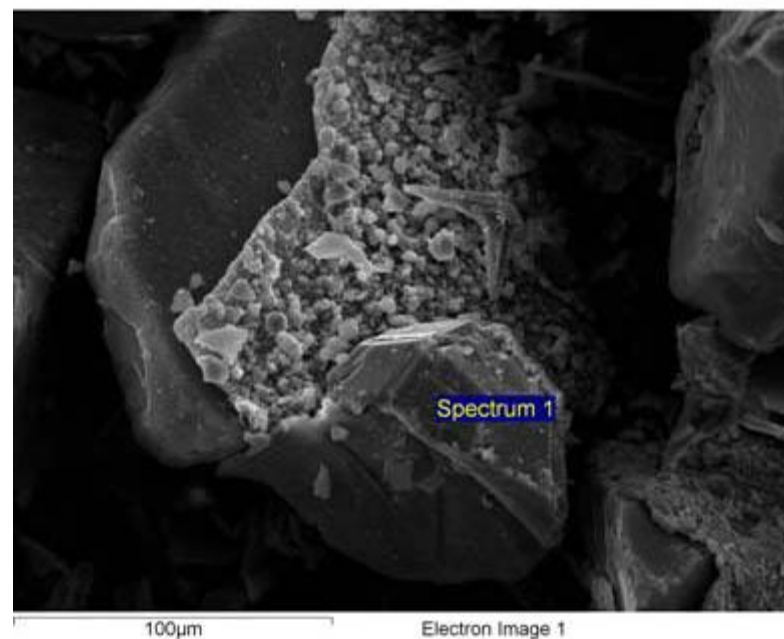
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.90	7.81	12.00	Na ₂ O
Al K	10.91	8.16	20.61	Al ₂ O ₃
Si K	31.50	22.63	67.39	SiO ₂
O	48.69	61.40		
Totals	100.00			



PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-1.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

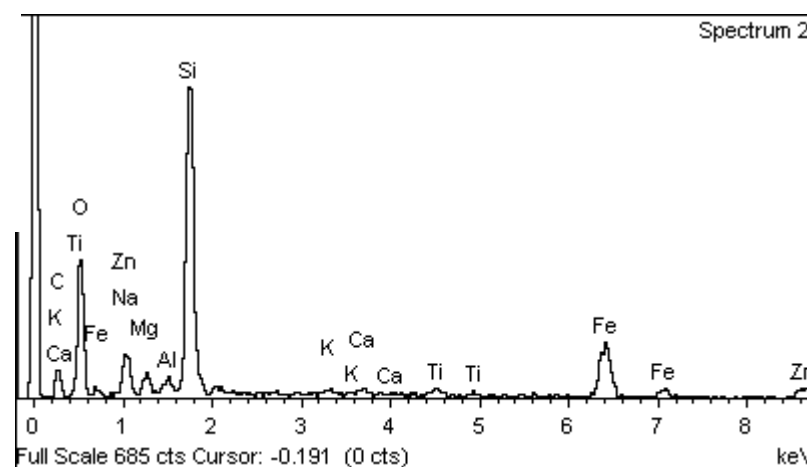
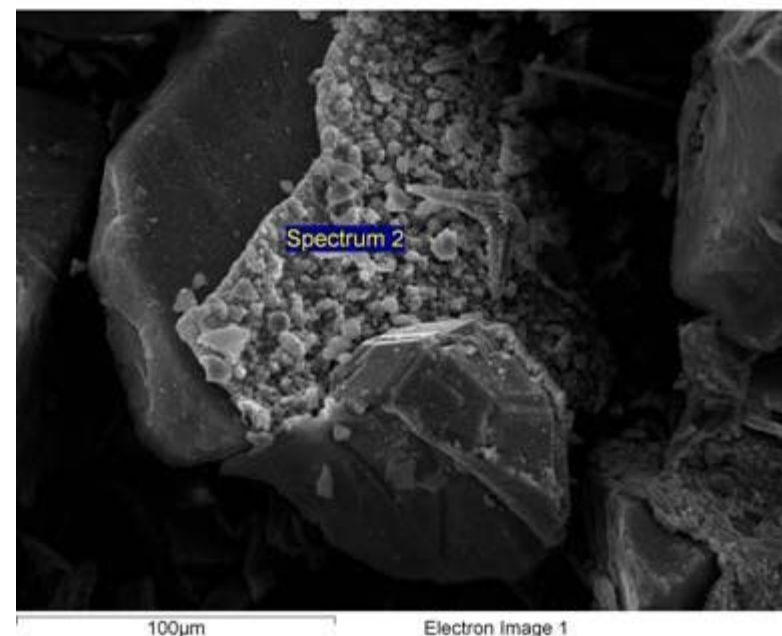
Ca Wollastonite 1-Jun-1999 12:00 AM

Ti Ti 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.67	4.76	6.29	Na ₂ O
Mg K	2.21	2.14	3.67	MgO
Al K	1.05	0.92	1.99	Al ₂ O ₃
Si K	24.40	20.36	52.19	SiO ₂
K K	0.63	0.38	0.76	K ₂ O
Ca K	0.67	0.39	0.93	CaO
Ti K	1.14	0.56	1.90	TiO ₂
Fe K	15.95	6.70	22.81	Fe ₂ O ₃
Zn K	7.60	2.72	9.46	ZnO
O	41.68	61.08		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-1.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

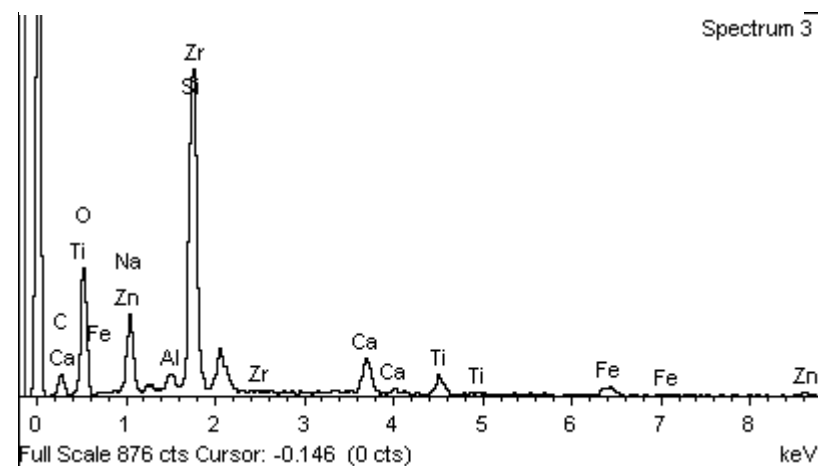
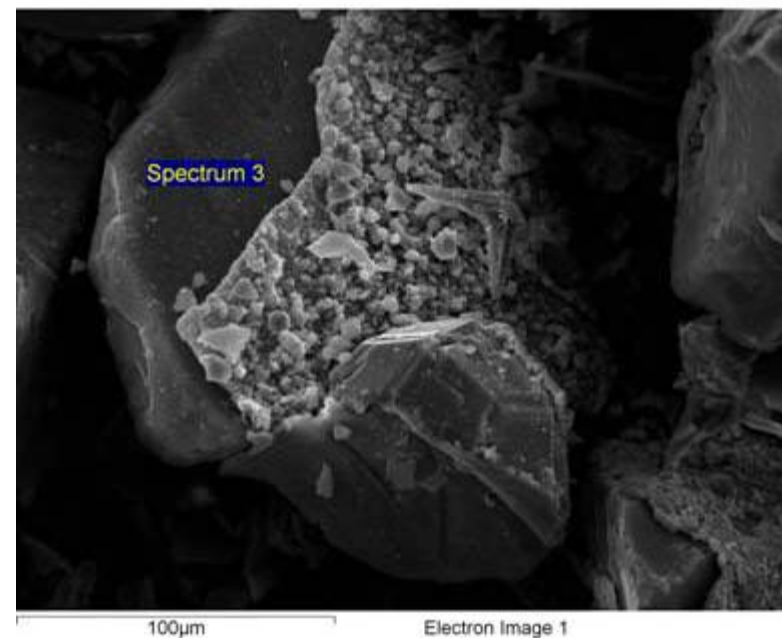
Ti Ti 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Zn Zn 1-Jun-1999 12:00 AM

Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.80	8.85	11.86	Na ₂ O
Al K	1.18	1.01	2.23	Al ₂ O ₃
Si K	25.37	20.88	54.27	SiO ₂
Ca K	4.39	2.53	6.14	CaO
Ti K	2.97	1.43	4.96	TiO ₂
Fe K	2.66	1.10	3.80	Fe ₂ O ₃
Zn K	2.81	0.99	3.49	ZnO
Zr L	9.80	2.48	13.24	ZrO ₂
O	42.02	60.72		
Totals	100.00			



PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

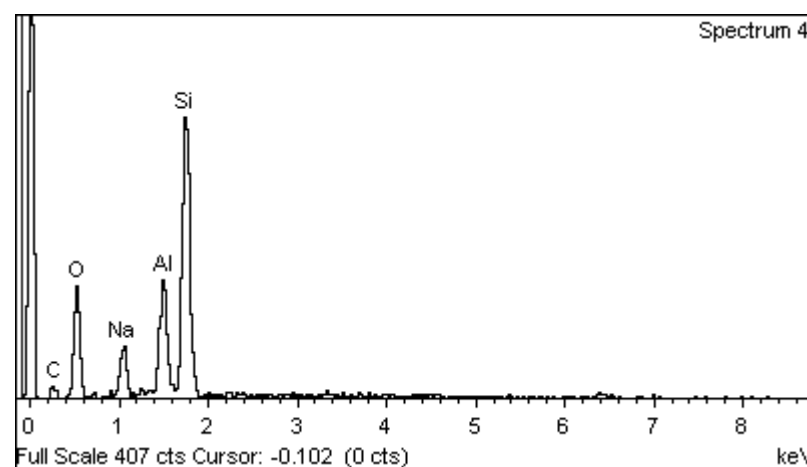
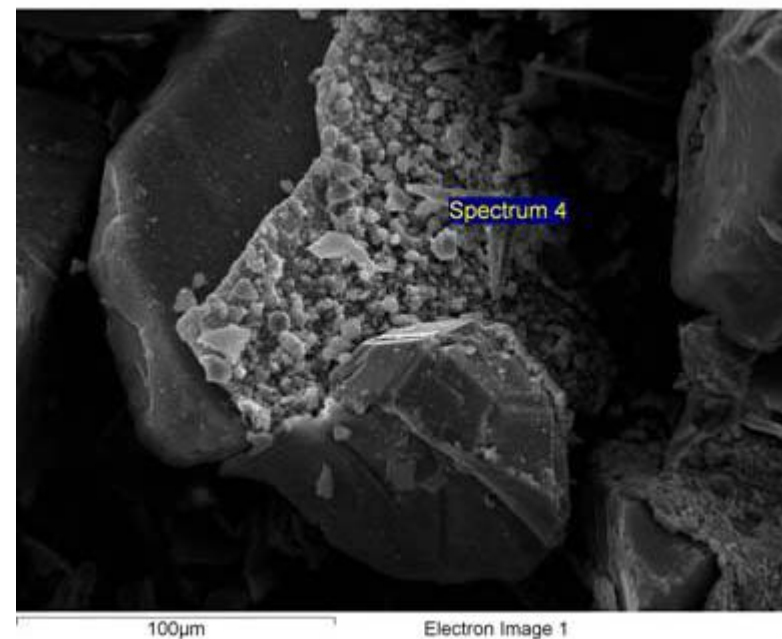
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.73	6.78	10.42	Na ₂ O
Al K	10.92	8.16	20.63	Al ₂ O ₃
Si K	32.23	23.14	68.95	SiO ₂
O	49.12	61.92		
Totals	100.00			



PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-1.

Spectrum processing :
Peak possibly omitted : 8.630 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

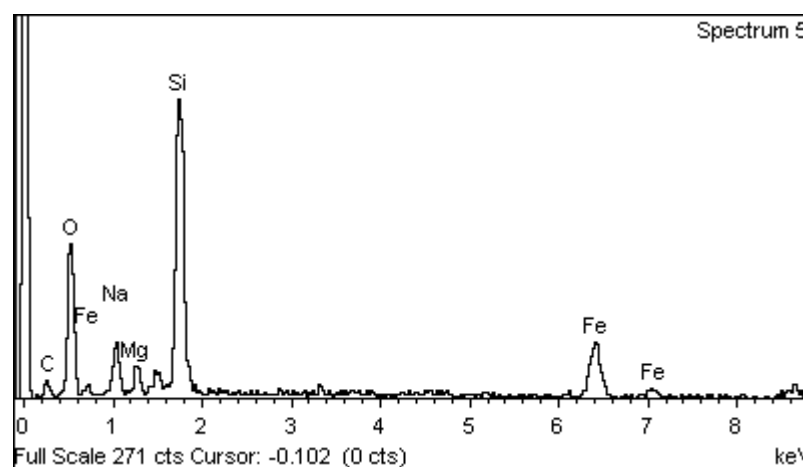
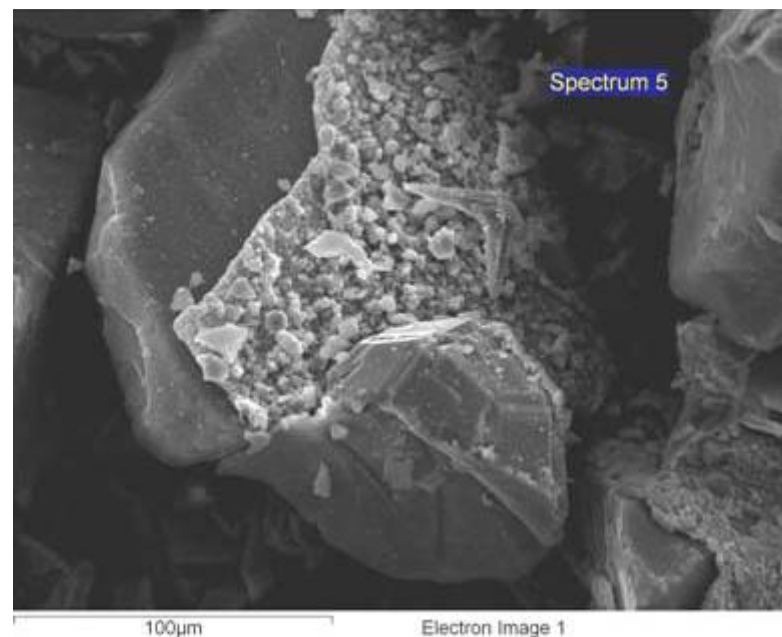
Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

Si SiO2 1-Jun-1999 12:00 AM

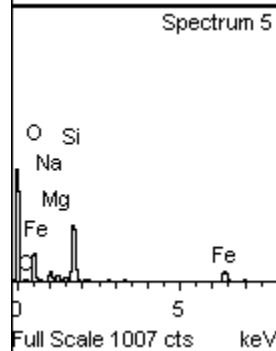
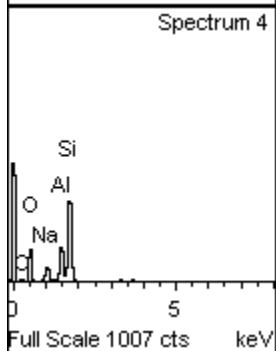
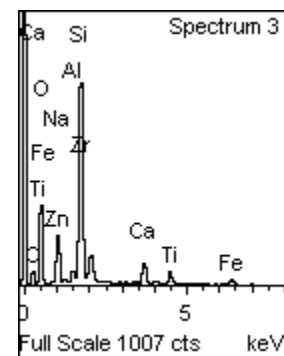
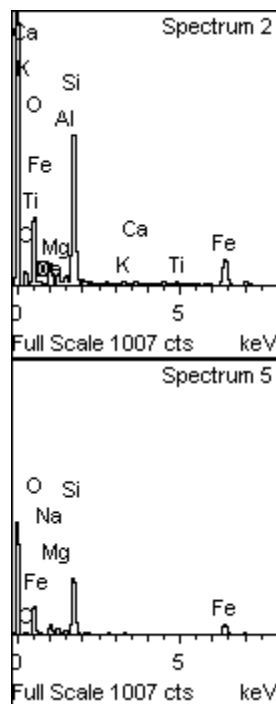
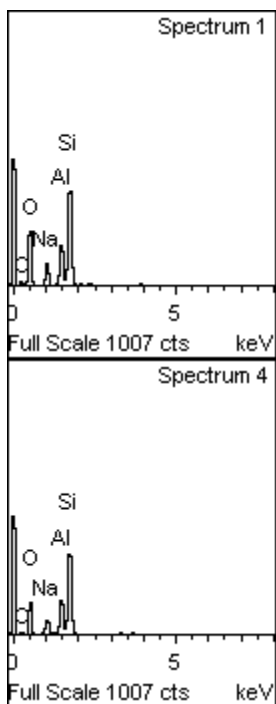
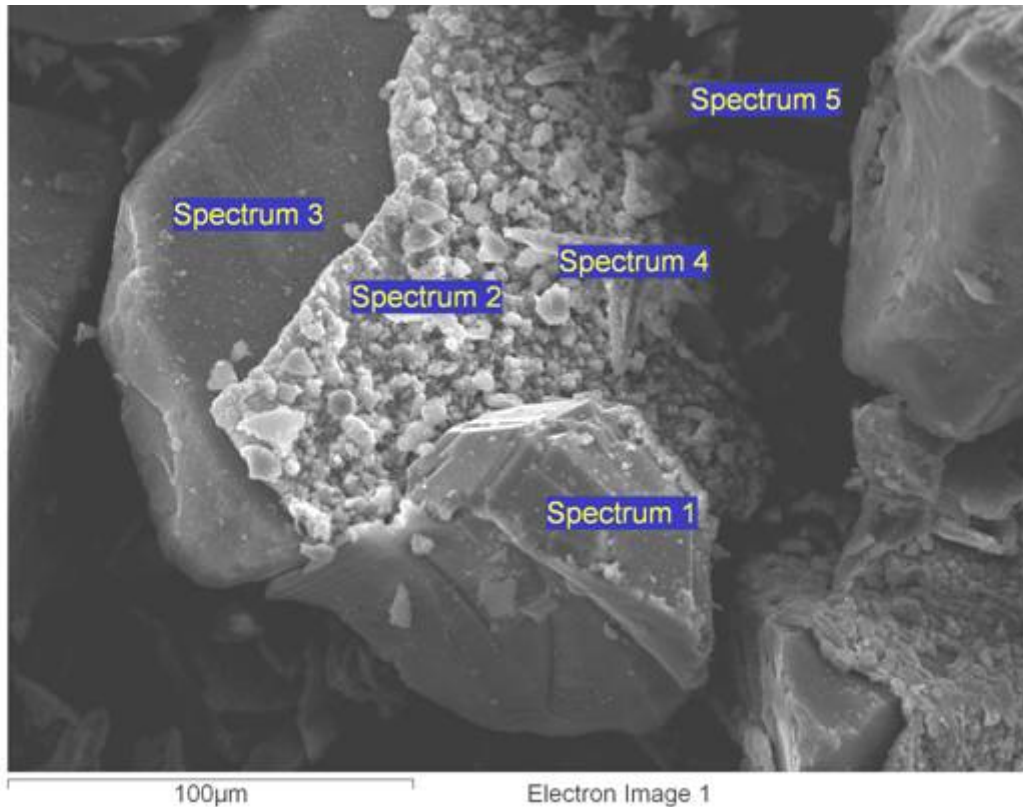
Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.23	6.06	8.40	Na2O
Mg K	3.42	3.15	5.68	MgO
Si K	27.49	21.88	58.81	SiO2
Fe K	18.97	7.59	27.12	Fe2O3
O	43.89	61.32		
Totals	100.00			



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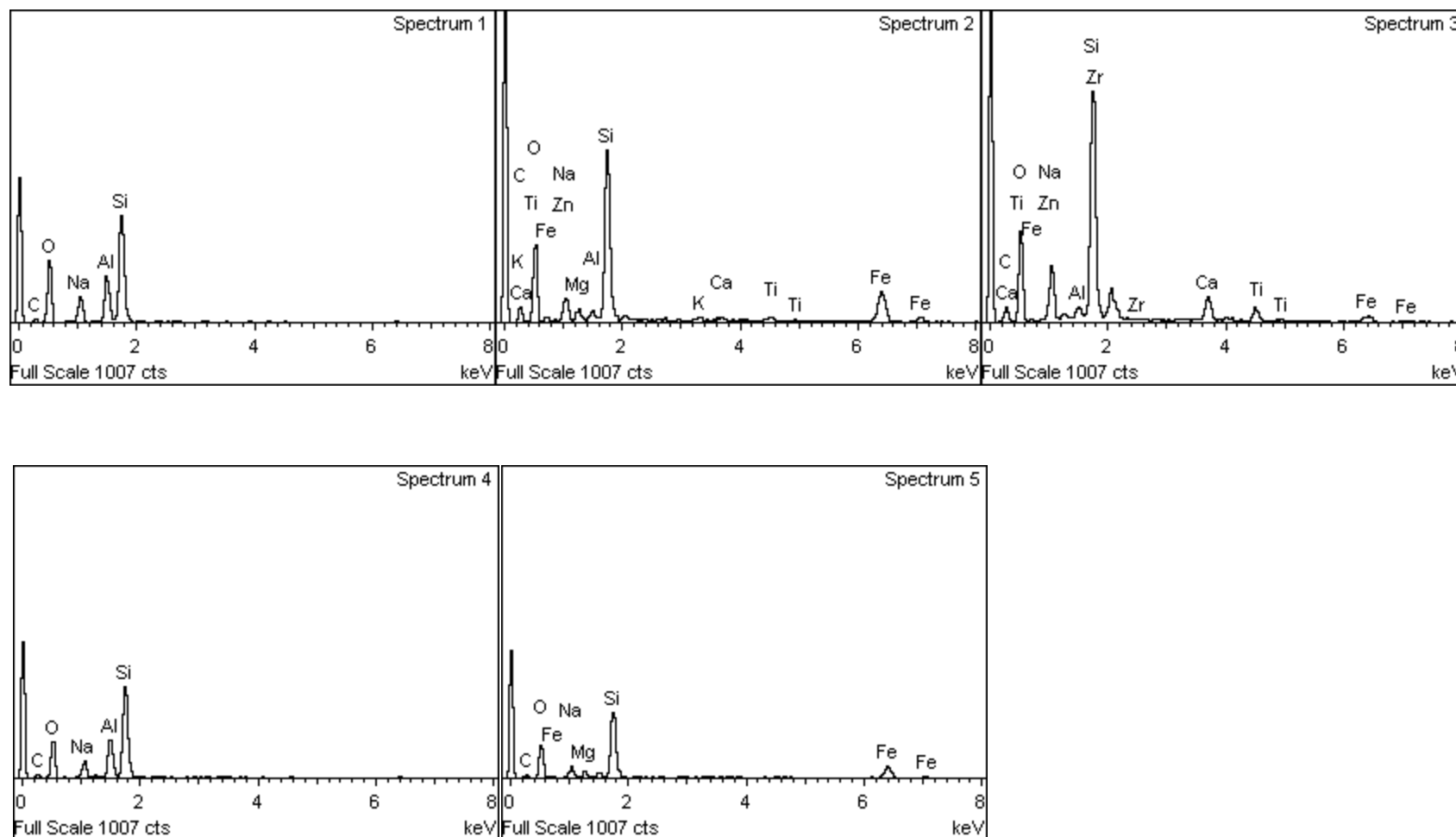
PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-1.



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PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-1.



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PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-1.

Project: PCT SURFACE CORROSION 3
Owner: cavinm
Site: Site of Interest 1

Sample: A1C1-1
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ca	Ti	Fe	Zn	Zr	O	Total
Spectrum 1	Yes	5.50	2.25	4.20	20.16			1.31	15.77	10.49		40.32	100.00
Spectrum 2	Yes	11.27		13.02	28.14							47.57	100.00
Spectrum 3	Yes	9.45		3.20	22.51		4.80	2.57	4.24	2.87	9.19	41.16	100.00
Spectrum 4	Yes	9.29	2.32	5.81	21.51	0.77		1.24	11.16	6.18		41.72	100.00
Spectrum 5	Yes	10.57		12.53	29.01							47.88	100.00
Max.		11.27	2.32	13.02	29.01	0.77	4.80	2.57	15.77	10.49	9.19	47.88	
Min.		5.50	2.25	3.20	20.16	0.77	4.80	1.24	4.24	2.87	9.19	40.32	

All results in weight%

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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-1.

Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

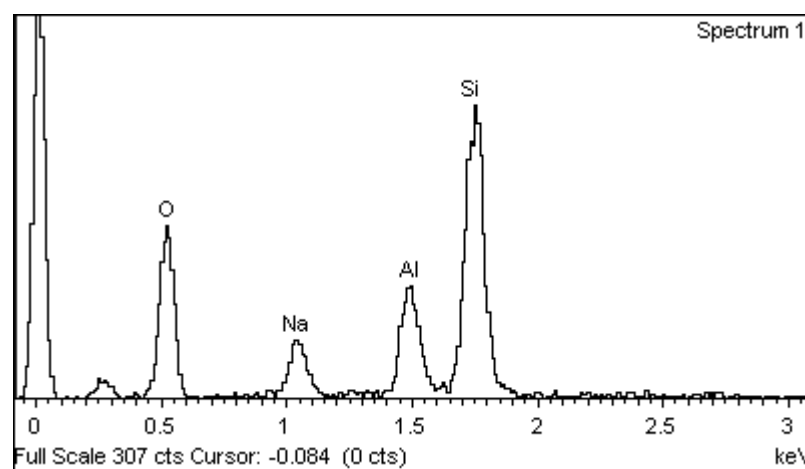
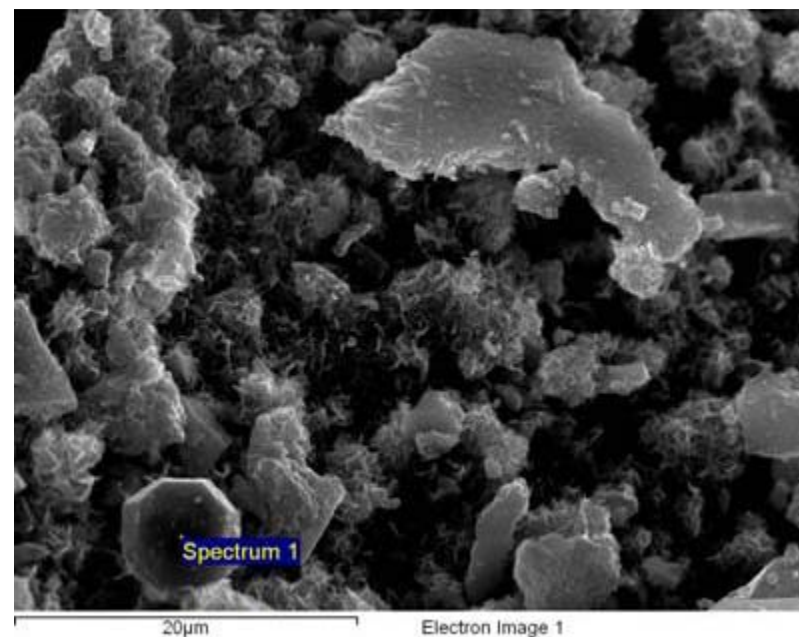
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.98	7.00	10.76	Na ₂ O
Al K	10.39	7.77	19.63	Al ₂ O ₃
Si K	32.54	23.36	69.61	SiO ₂
O	49.09	61.87		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-1.

Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

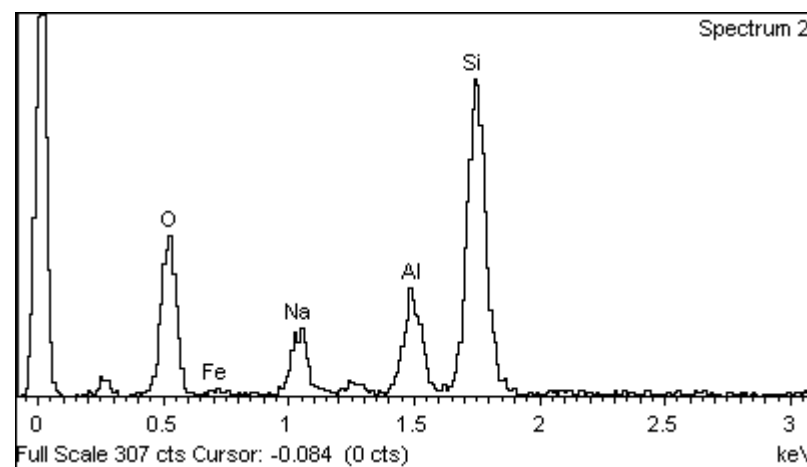
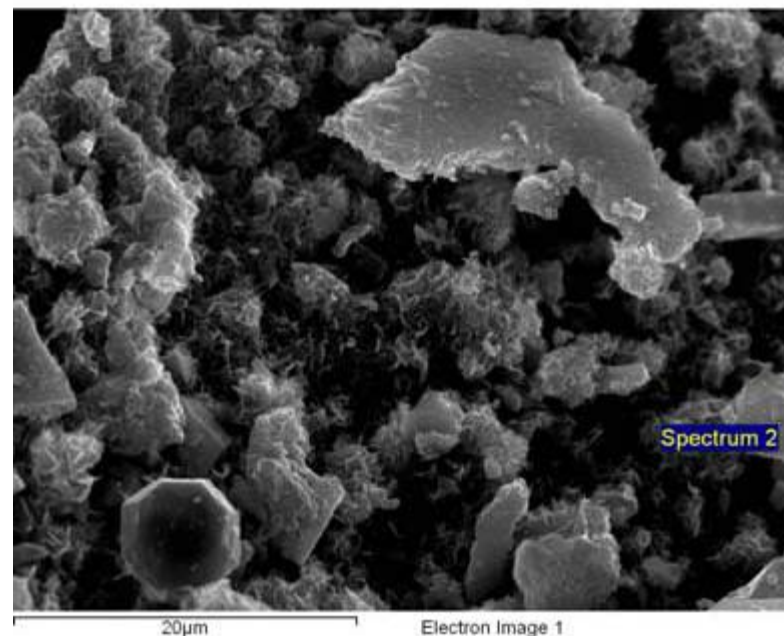
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.42	7.58	11.35	Na ₂ O
Al K	8.39	6.44	15.84	Al ₂ O ₃
Si K	30.70	22.64	65.68	SiO ₂
Fe K	4.99	1.85	7.13	Fe ₂ O ₃
O	47.51	61.49		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-1.

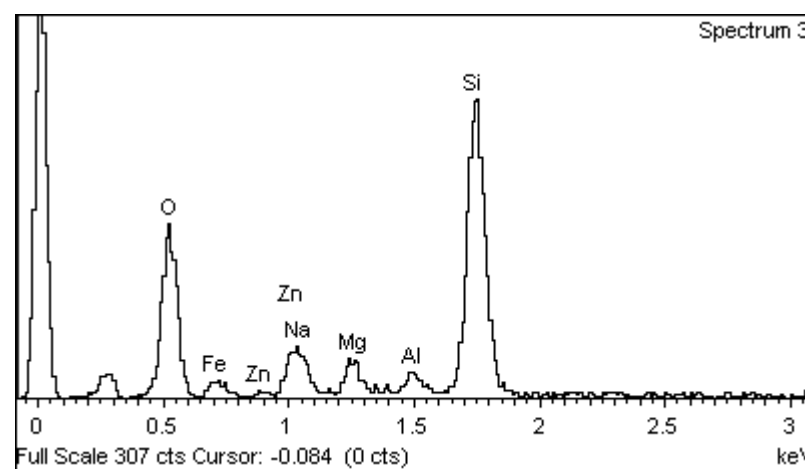
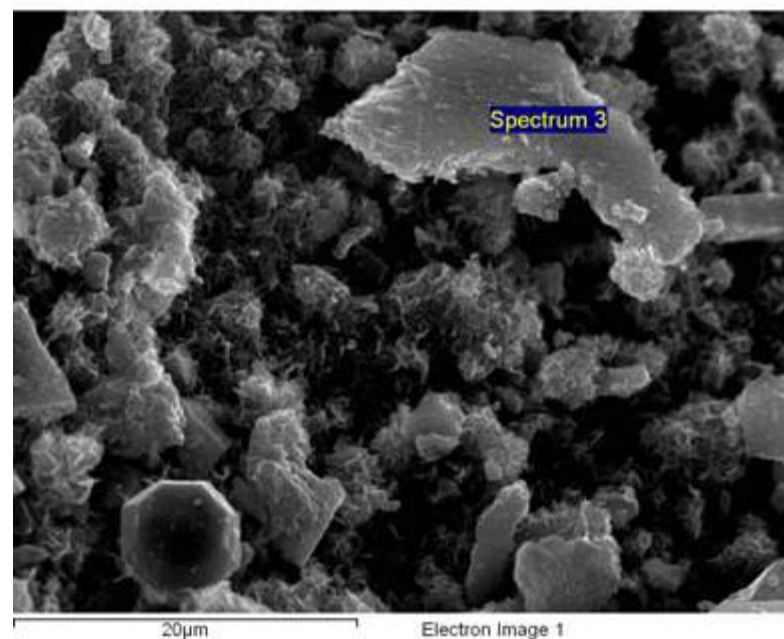
Spectrum processing :
 Peak possibly omitted : 4.505 keV

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
 Mg MgO 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM
 Fe Fe 1-Jun-1999 12:00 AM
 Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	3.71	3.63	5.00	Na ₂ O
Mg K	3.98	3.69	6.61	MgO
Al K	1.57	1.31	2.97	Al ₂ O ₃
Si K	27.95	22.39	59.80	SiO ₂
Fe K	11.92	4.80	17.04	Fe ₂ O ₃
Zn K	6.90	2.37	8.59	ZnO
O	43.97	61.81		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-1.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

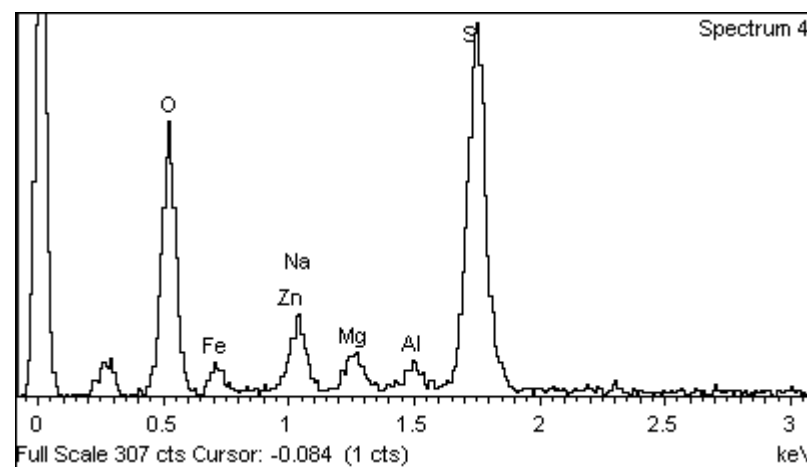
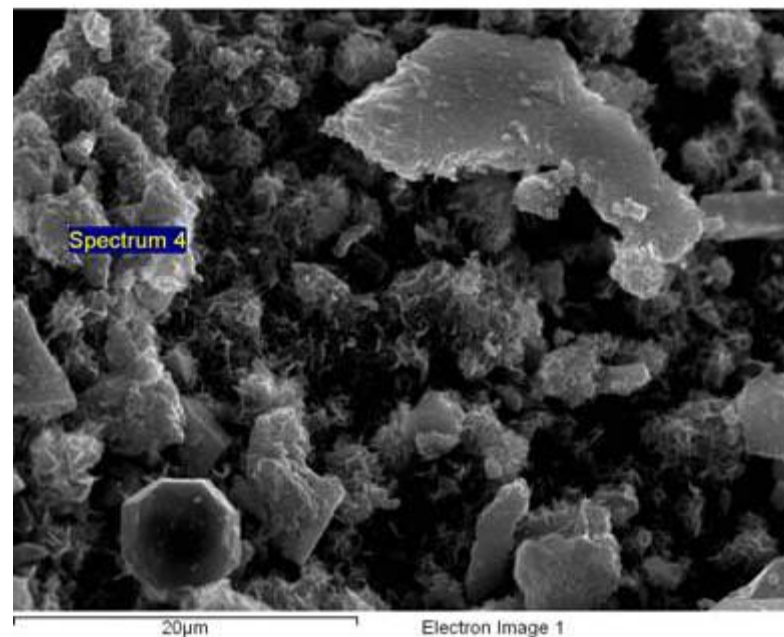
Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.14	6.03	8.28	Na ₂ O
Mg K	3.47	3.22	5.76	MgO
Al K	1.73	1.45	3.27	Al ₂ O ₃
Si K	26.19	21.05	56.03	SiO ₂
Fe K	13.62	5.51	19.48	Fe ₂ O ₃
Zn K	5.78	2.00	7.19	ZnO
O	43.07	60.75		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-1.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

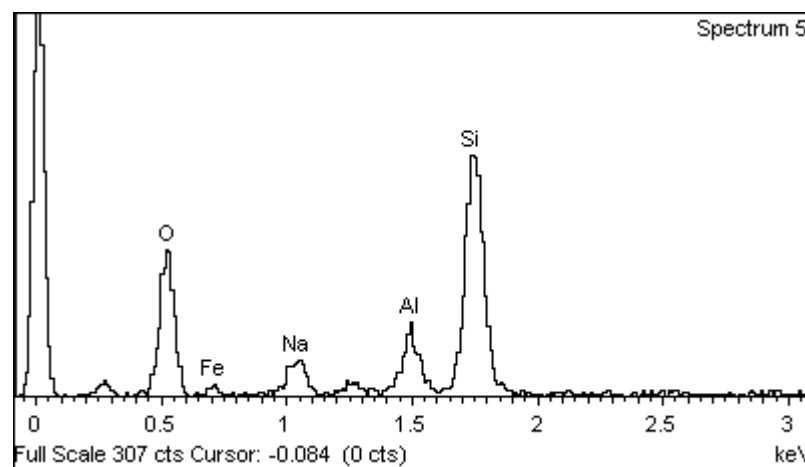
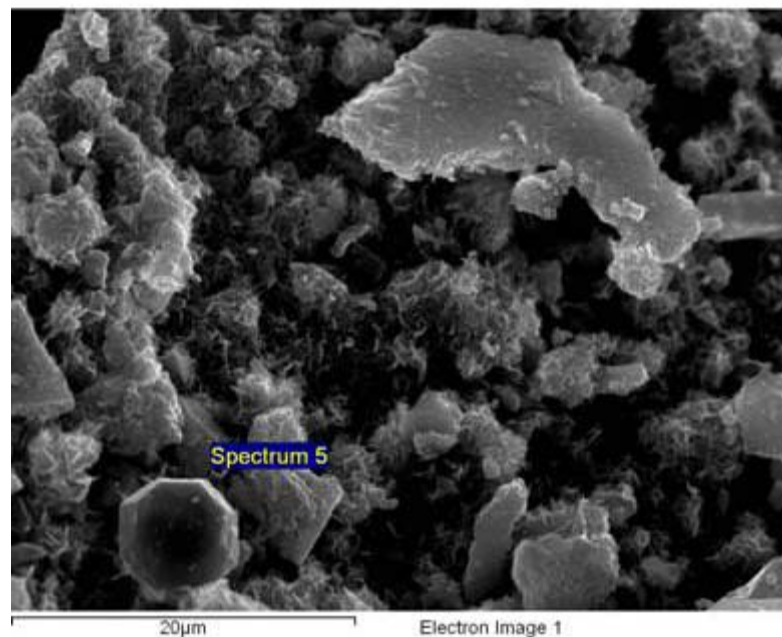
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.51	5.95	8.77	Na ₂ O
Al K	6.55	5.10	12.37	Al ₂ O ₃
Si K	31.60	23.64	67.60	SiO ₂
Fe K	7.88	2.96	11.26	Fe ₂ O ₃
O	47.47	62.35		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-1.

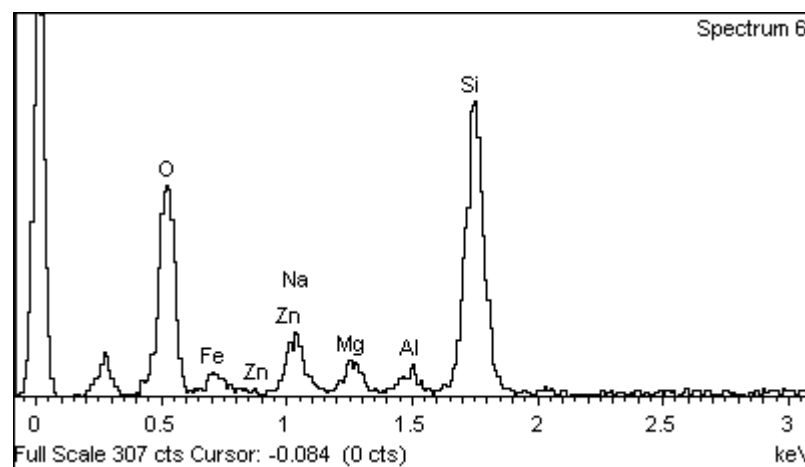
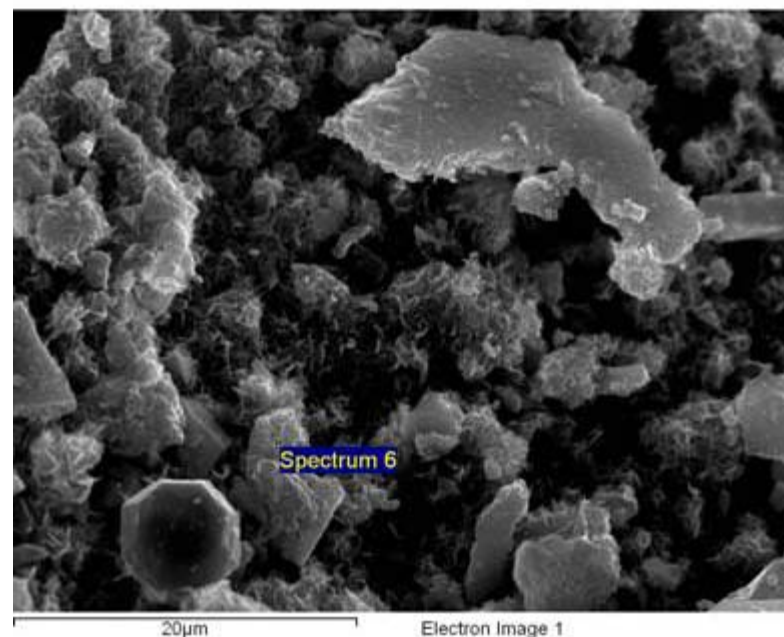
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.27	4.21	5.75	Na ₂ O
Mg K	3.63	3.39	6.02	MgO
Al K	1.97	1.65	3.71	Al ₂ O ₃
Si K	26.50	21.42	56.69	SiO ₂
Fe K	13.67	5.56	19.54	Fe ₂ O ₃
Zn K	6.65	2.31	8.28	ZnO
O	43.32	61.46		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-1.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

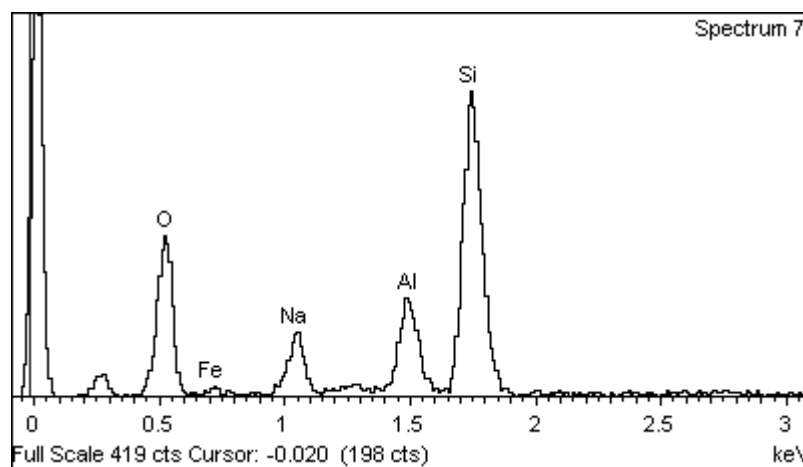
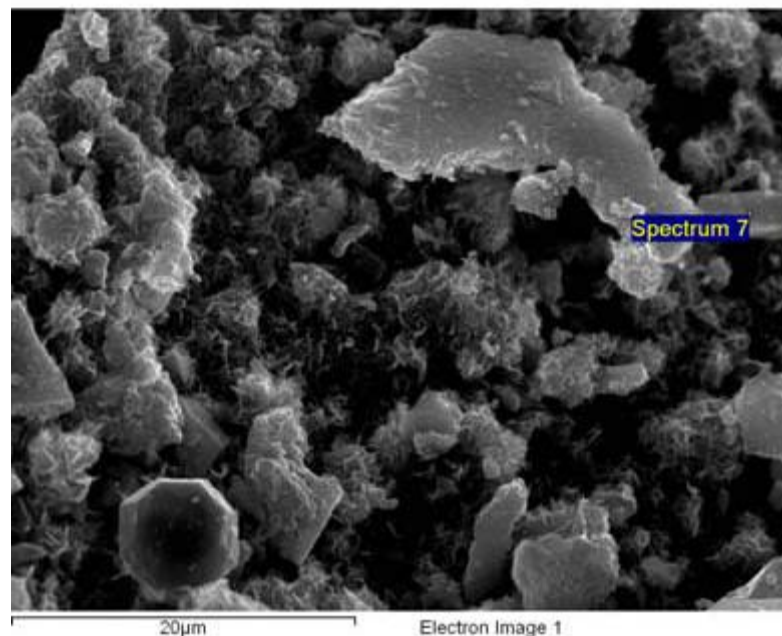
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

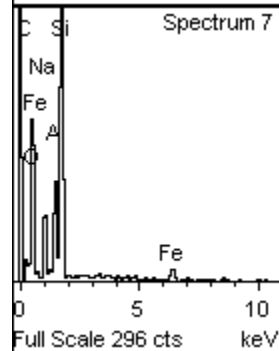
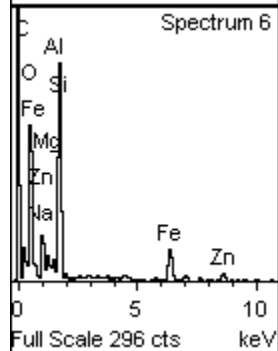
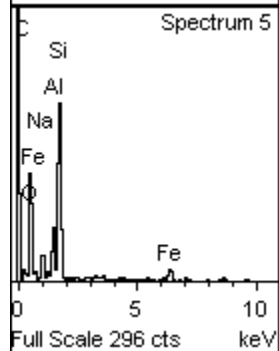
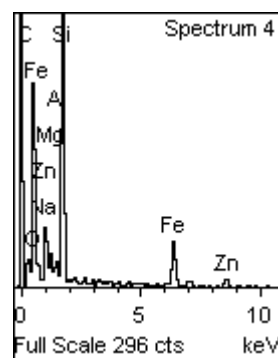
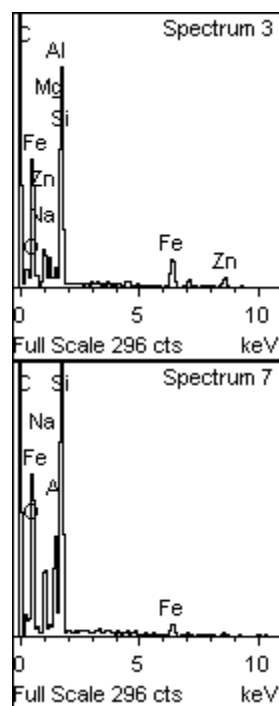
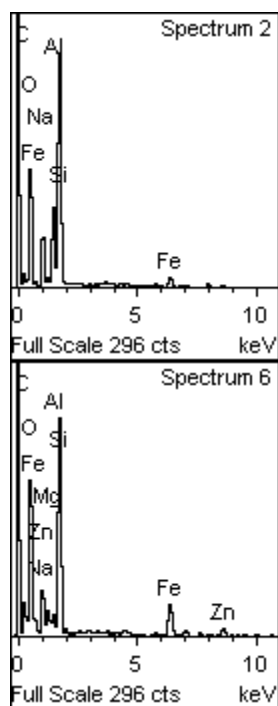
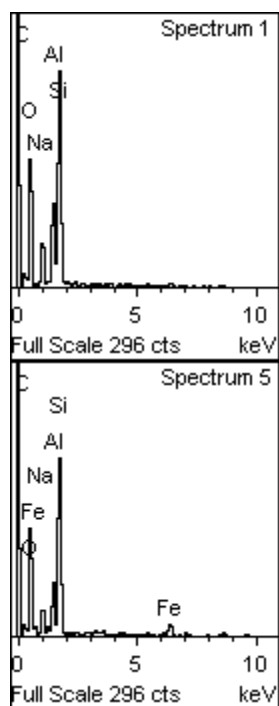
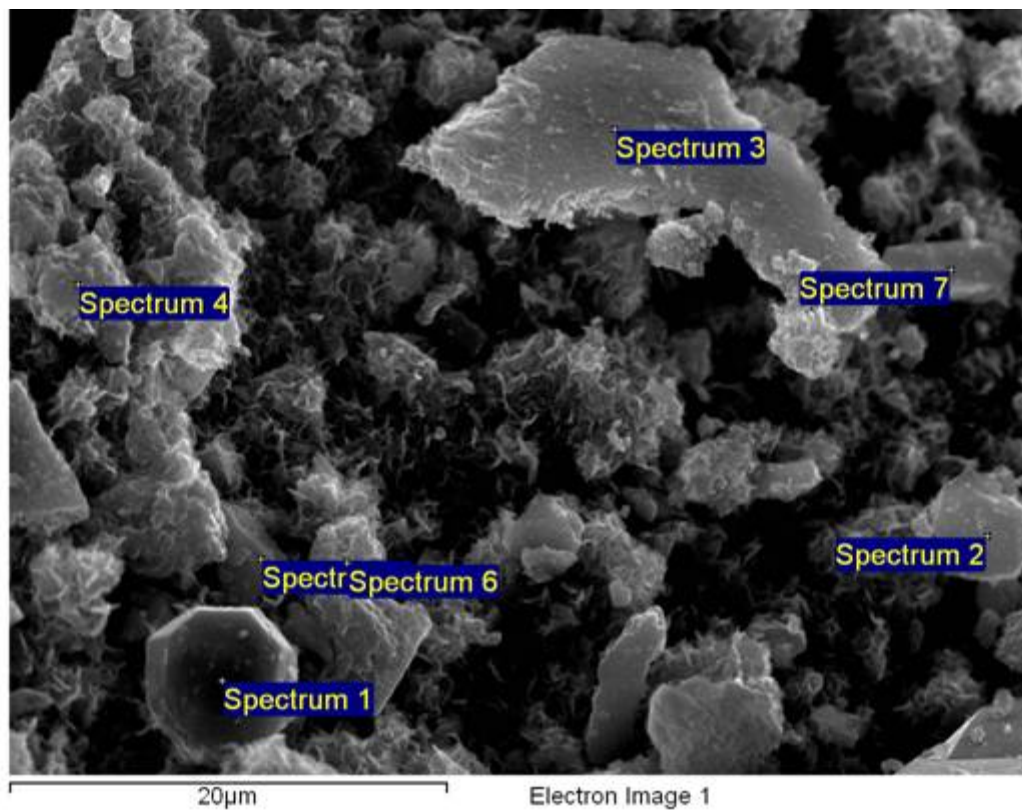
Si SiO₂ 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

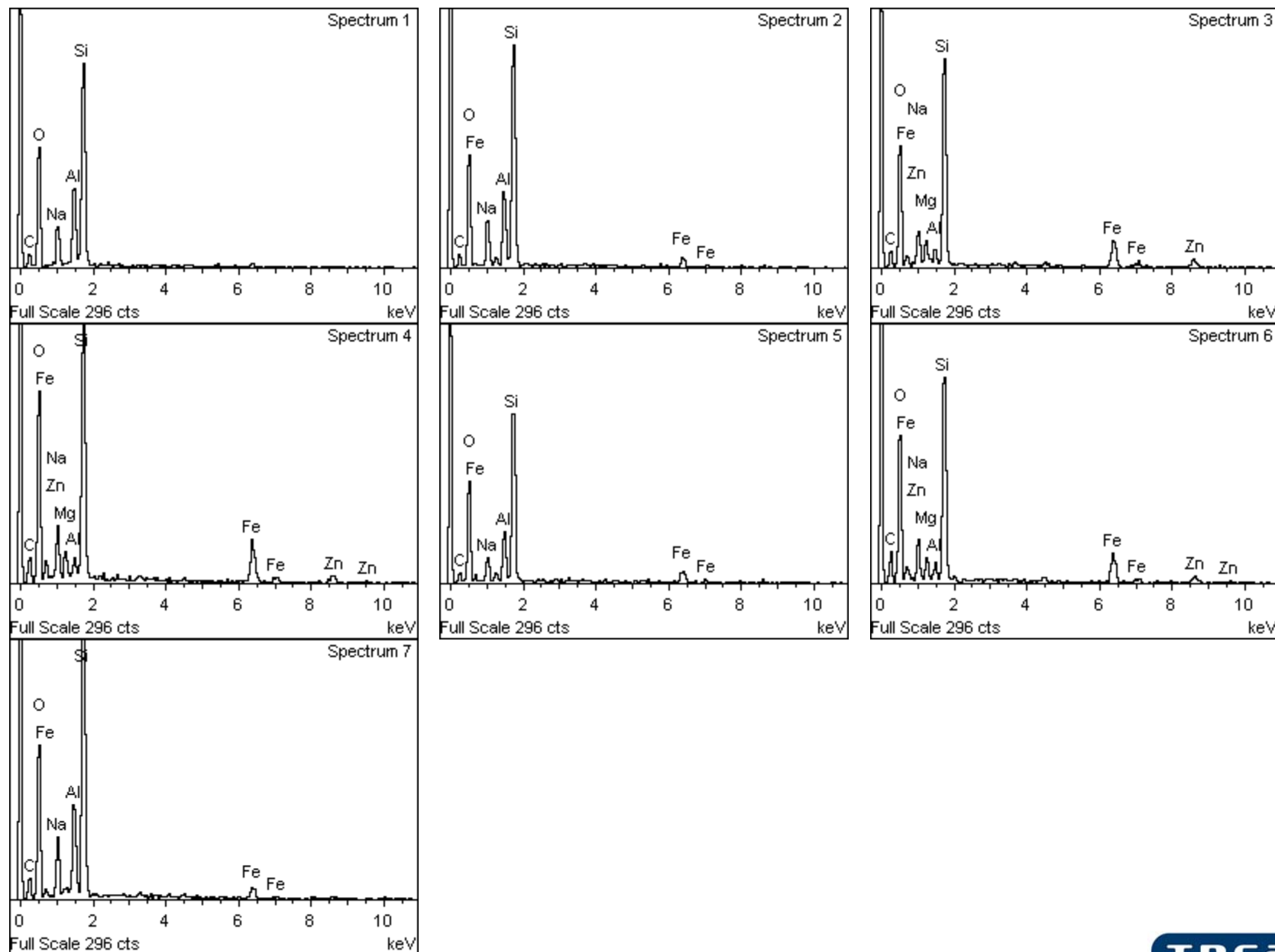
Element	Weight%	Atomic%	Compd%	Formula
Na K	8.48	7.61	11.43	Na ₂ O
Al K	8.49	6.49	16.04	Al ₂ O ₃
Si K	31.11	22.84	66.56	SiO ₂
Fe K	4.18	1.54	5.97	Fe ₂ O ₃
O	47.74	61.53		
Totals	100.00			



PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-1.



PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-1.



PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-1.

Project: PCT SURFACE CORROSION 3
Owner: cavinm
Site: Site of Interest 2

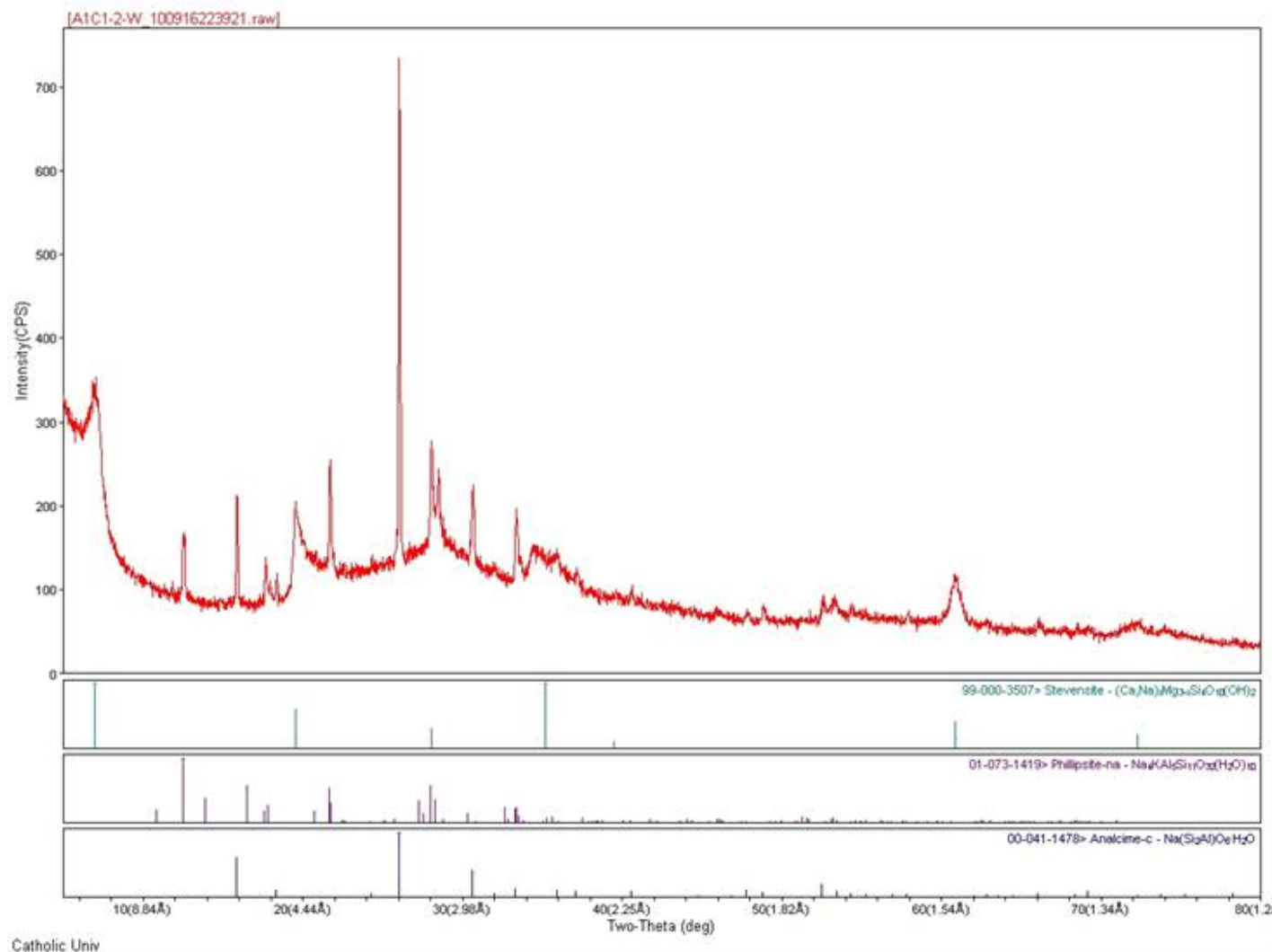
Sample: A1C1-1
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Fe	Zn	O	Total
Spectrum 1	Yes	7.98		10.39	32.54			49.09	100.00
Spectrum 2	Yes	8.42		8.39	30.70	4.99		47.51	100.00
Spectrum 3	Yes	3.71	3.98	1.57	27.95	11.92	6.90	43.97	100.00
Spectrum 4	Yes	6.14	3.47	1.73	26.19	13.62	5.78	43.07	100.00
Spectrum 5	Yes	6.51		6.55	31.60	7.88		47.47	100.00
Spectrum 6	Yes	4.27	3.63	1.97	26.50	13.67	6.65	43.32	100.00
Spectrum 7	Yes	8.48		8.49	31.11	4.18		47.74	100.00
Max.		8.48	3.98	10.39	32.54	13.67	6.90	49.09	
Min.		3.71	3.47	1.57	26.19	4.18	5.78	43.07	

All results in weight%

XRD powder patterns (raw data and best match) and SEM/EDS analysis of glass A1C1-2, collected from 90°C PCT-B vessel after 2926 days



PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-2.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

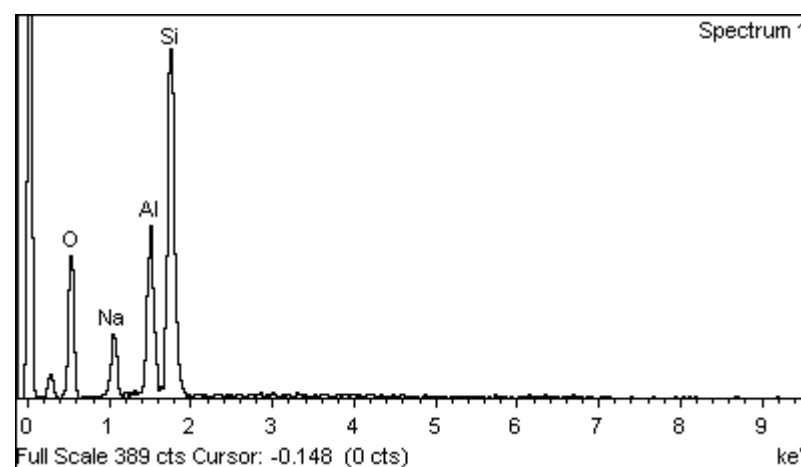
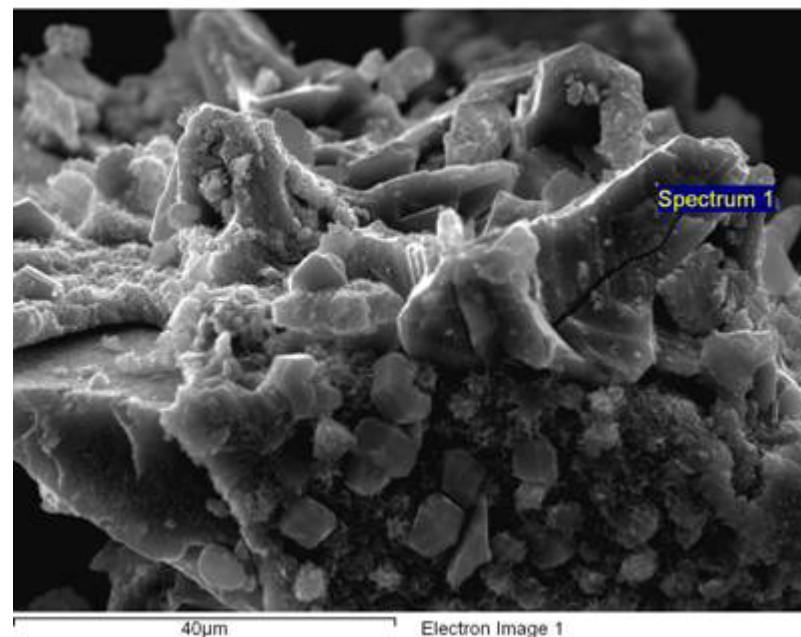
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.13	6.26	9.61	Na ₂ O
Al K	11.85	8.85	22.38	Al ₂ O ₃
Si K	31.79	22.83	68.01	SiO ₂
O	49.23	62.06		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-2.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

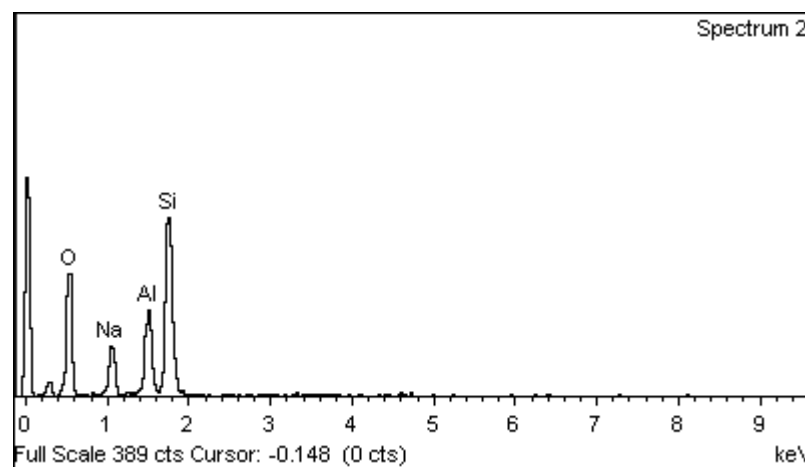
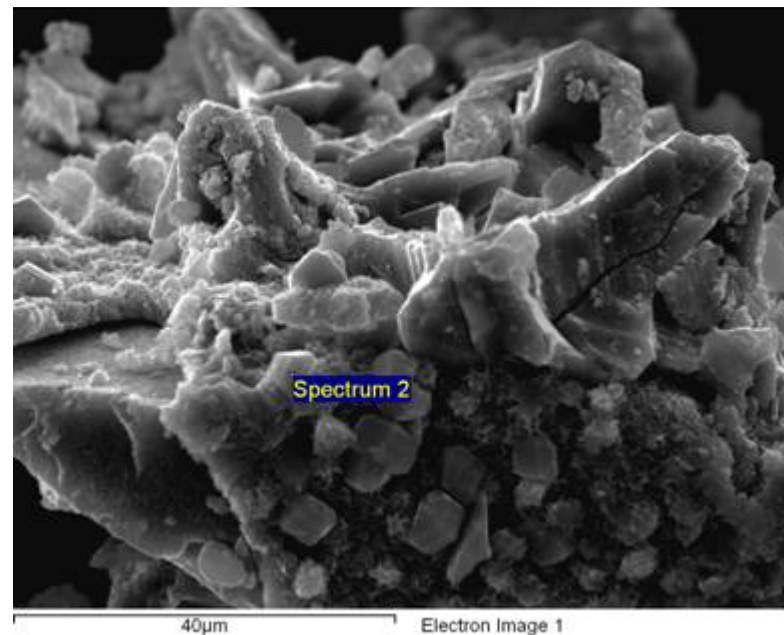
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	10.25	9.01	13.82	Na ₂ O
Al K	11.54	8.63	21.80	Al ₂ O ₃
Si K	30.09	21.64	64.38	SiO ₂
O	48.12	60.73		
Totals	100.00			



Inca

PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-2.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

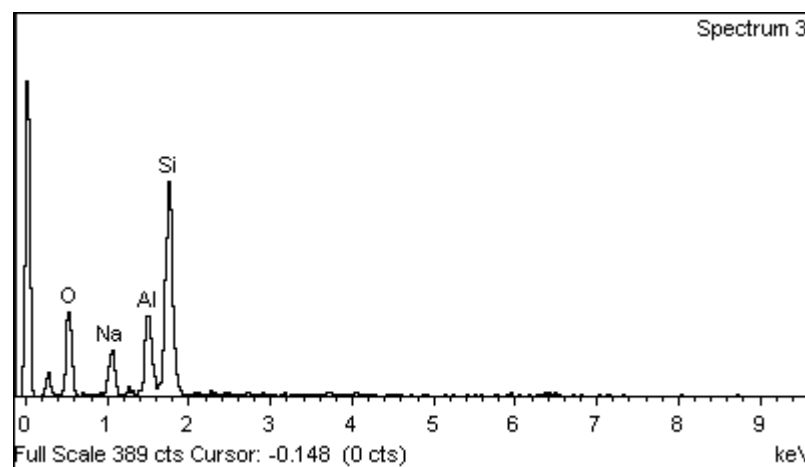
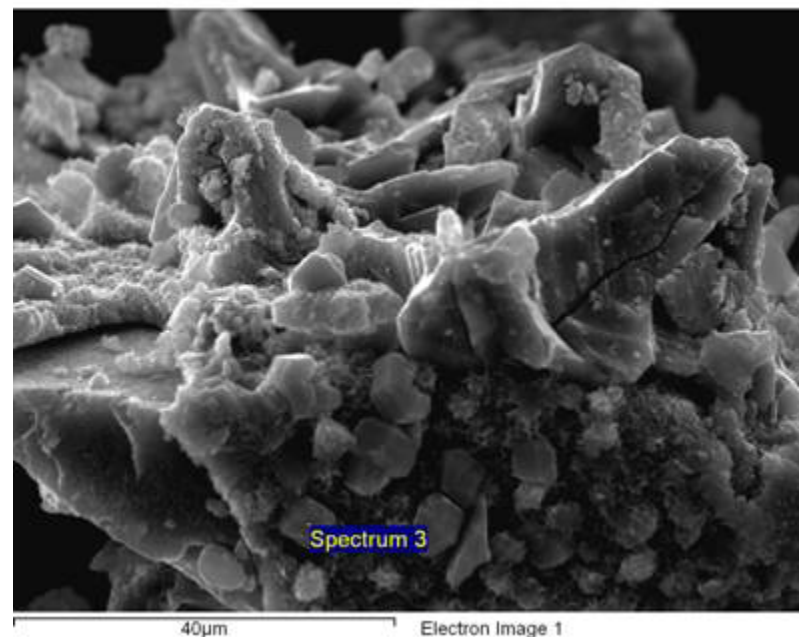
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	9.02	7.92	12.16	Na ₂ O
Al K	11.08	8.29	20.94	Al ₂ O ₃
Si K	31.27	22.47	66.90	SiO ₂
O	48.62	61.33		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-2.

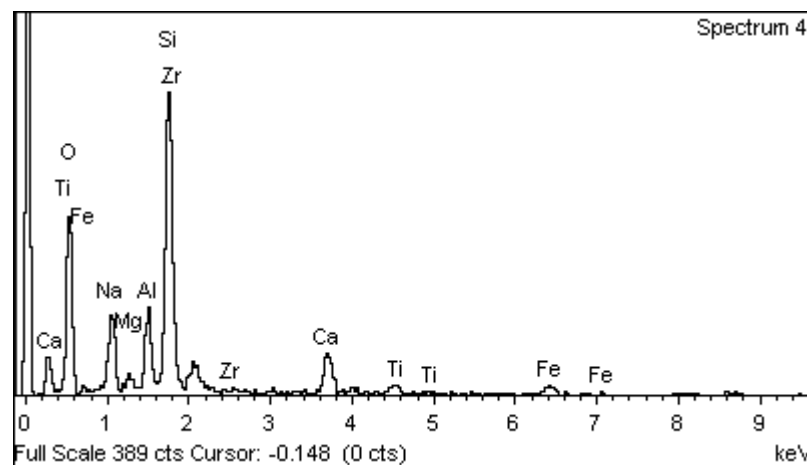
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.85	8.54	11.93	Na ₂ O
Mg K	1.23	1.12	2.04	MgO
Al K	6.26	5.15	11.82	Al ₂ O ₃
Si K	23.56	18.62	50.40	SiO ₂
Ca K	5.17	2.86	7.24	CaO
Ti K	1.77	0.82	2.95	TiO ₂
Fe K	3.08	1.22	4.40	Fe ₂ O ₃
Zr L	6.83	1.66	9.22	ZrO ₂
O	43.26	60.01		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-2.

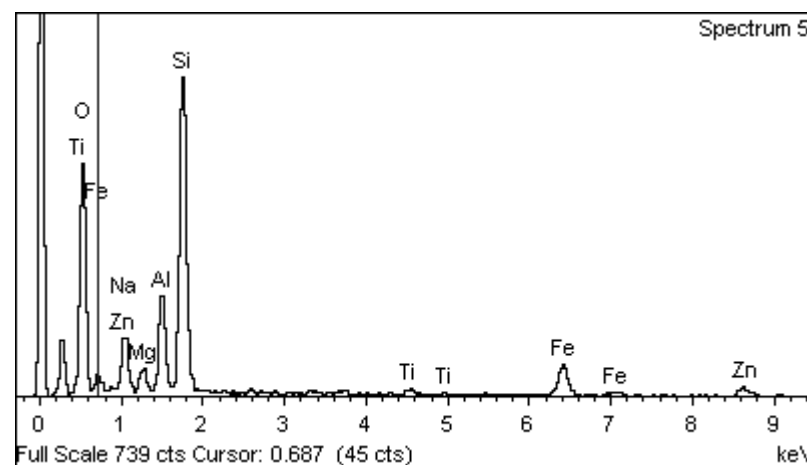
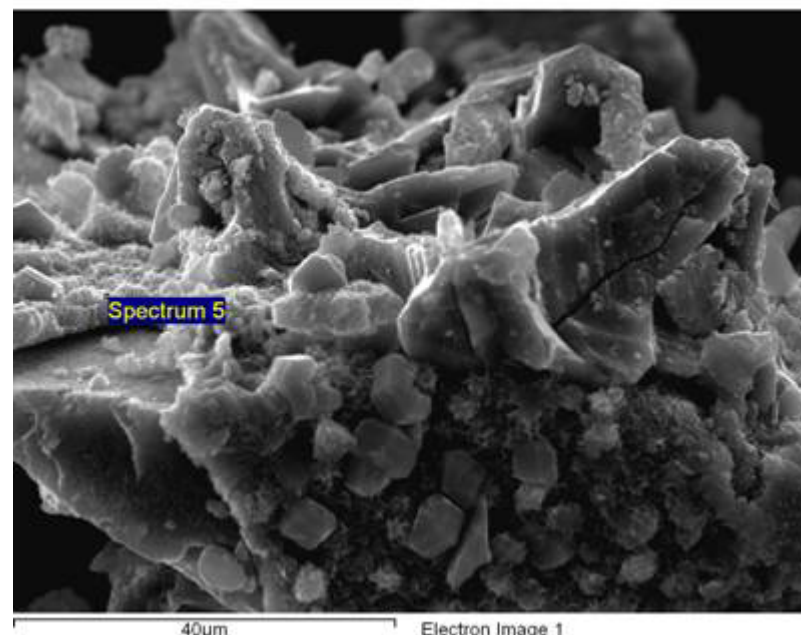
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.85	4.64	6.54	Na ₂ O
Mg K	2.30	2.08	3.81	MgO
Al K	7.44	6.06	14.05	Al ₂ O ₃
Si K	25.69	20.10	54.96	SiO ₂
Ti K	0.86	0.40	1.44	TiO ₂
Fe K	8.89	3.50	12.71	Fe ₂ O ₃
Zn K	5.21	1.75	6.49	ZnO
O	44.76	61.48		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-2.

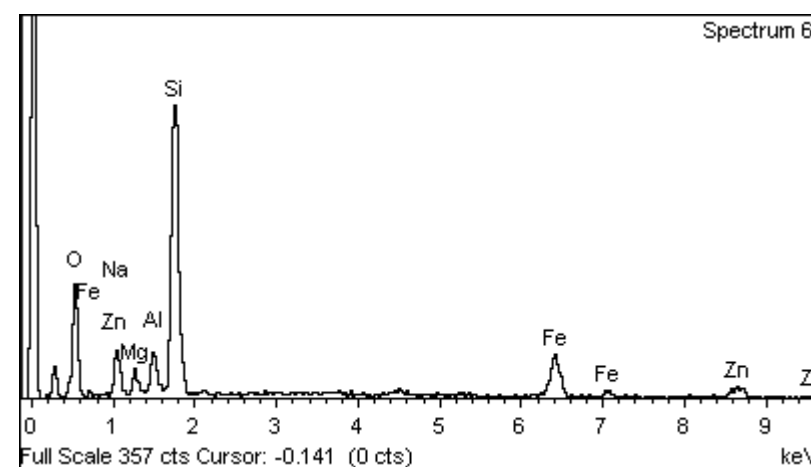
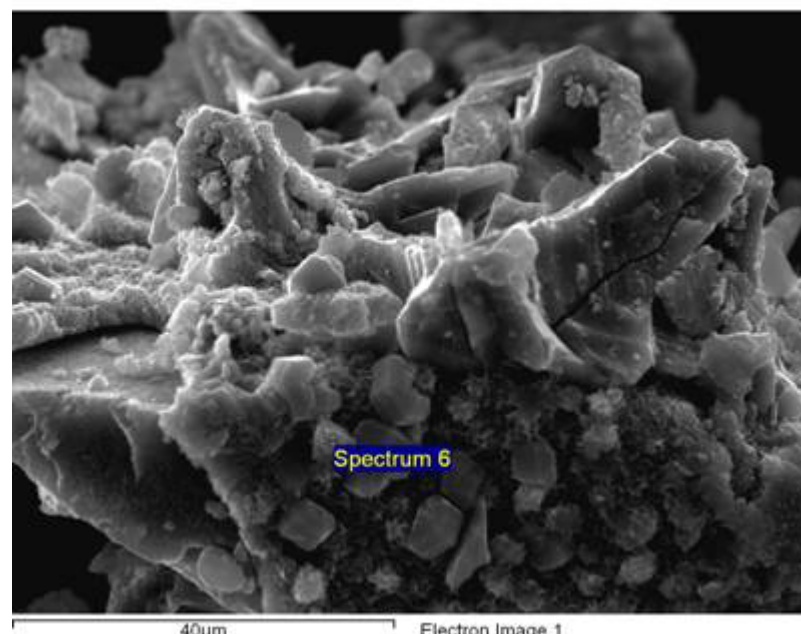
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

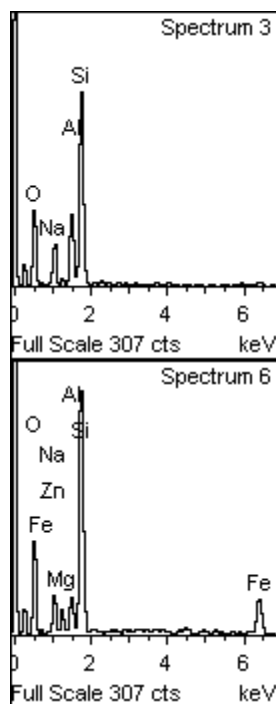
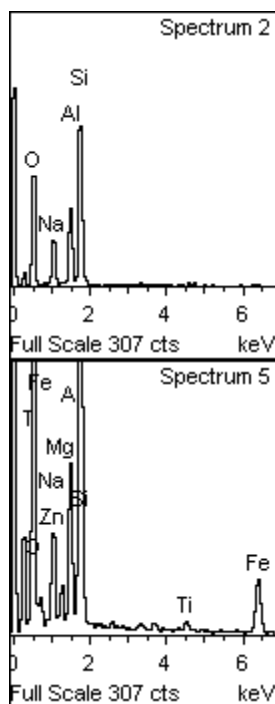
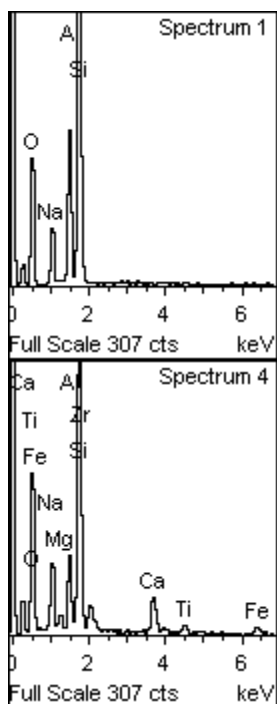
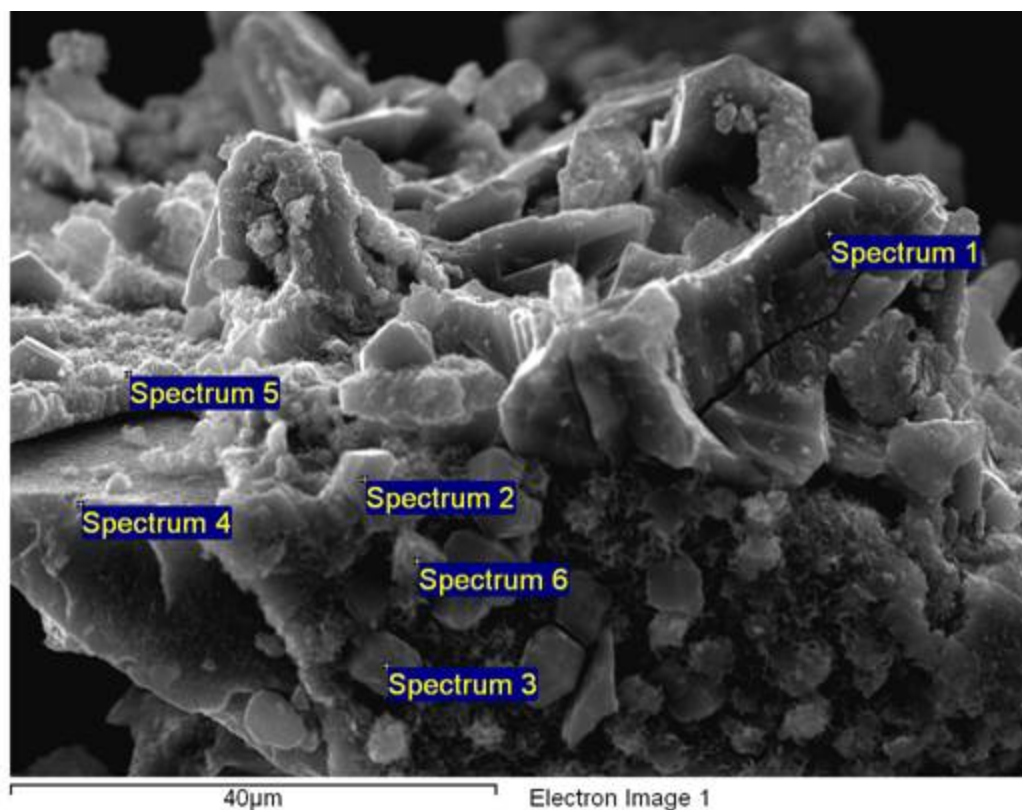
Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.86	4.79	6.55	Na ₂ O
Mg K	2.22	2.07	3.69	MgO
Al K	3.19	2.68	6.03	Al ₂ O ₃
Si K	26.35	21.27	56.38	SiO ₂
Fe K	13.35	5.42	19.08	Fe ₂ O ₃
Zn K	6.64	2.30	8.27	ZnO
O	43.38	61.46		
Totals	100.00			



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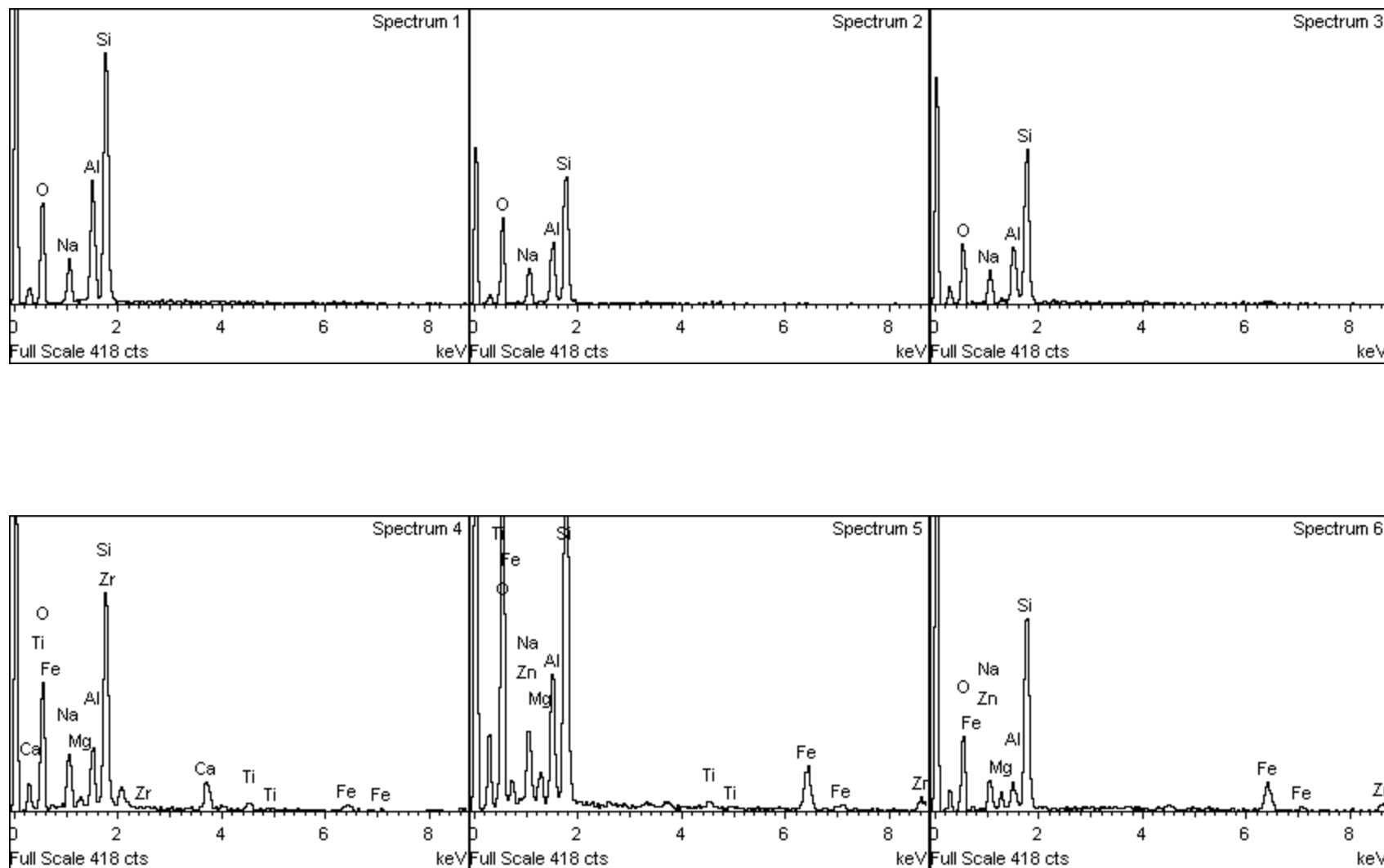
PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-2.



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PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-2.



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PCT SURFACE CORROSION. FILE 3. ROI 1. GLASS NAME A1C1-2.

Project: PCT SURFACE CORROSION 3
Owner: cavinm
Site: Site of Interest 1

Sample: A1C1-2
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Ca	Ti	Fe	Zn	Zr	O	Total
Spectrum 1	Yes	7.13		11.85	31.79						49.23	100.00
Spectrum 2	Yes	10.25		11.54	30.09						48.12	100.00
Spectrum 3	Yes	9.02		11.08	31.27						48.62	100.00
Spectrum 4	Yes	8.85	1.23	6.26	23.56	5.17	1.77	3.08		6.83	43.26	100.00
Spectrum 5	Yes	4.85	2.30	7.44	25.69		0.86	8.89	5.21		44.76	100.00
Spectrum 6	Yes	4.86	2.22	3.19	26.35			13.35	6.64		43.38	100.00
Max.		10.25	2.30	11.85	31.79	5.17	1.77	13.35	6.64	6.83	49.23	
Min.		4.85	1.23	3.19	23.56	5.17	0.86	3.08	5.21	6.83	43.26	

All results in weight%

PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-2.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

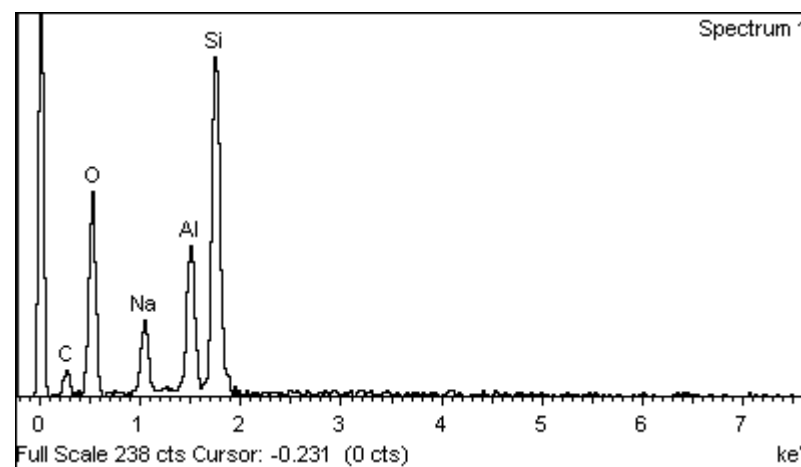
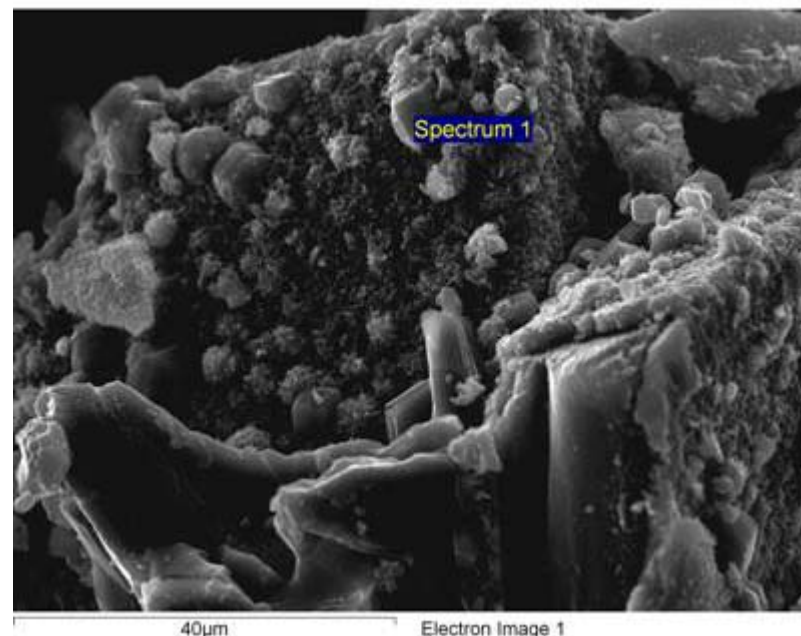
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.20	7.19	11.05	Na ₂ O
Al K	11.41	8.53	21.55	Al ₂ O ₃
Si K	31.51	22.63	67.40	SiO ₂
O	48.89	61.65		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-2.

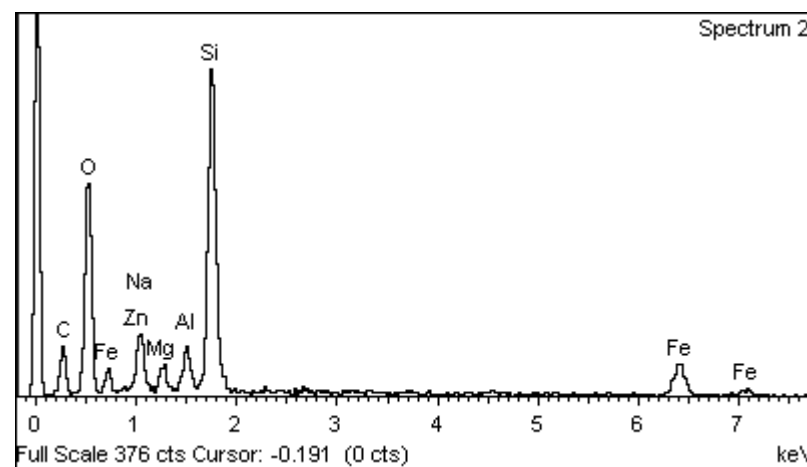
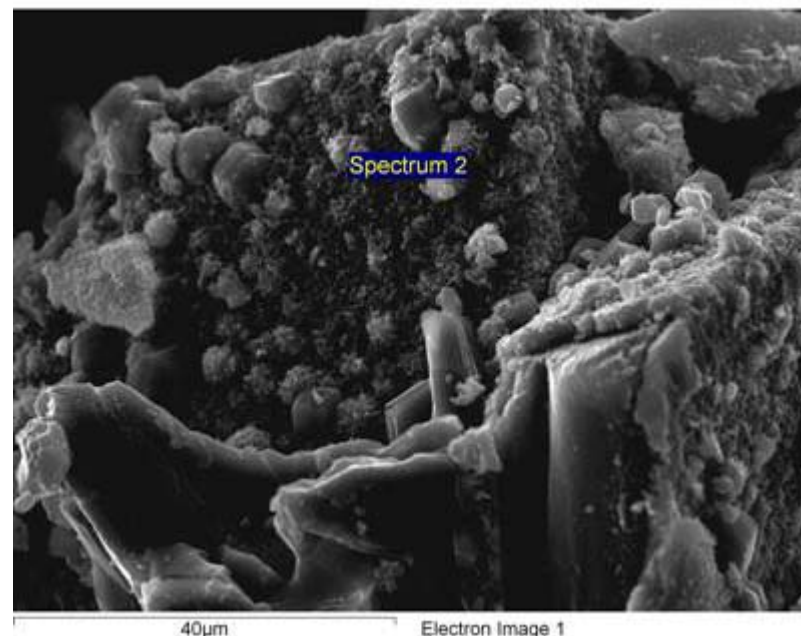
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.31	4.16	5.81	Na ₂ O
Mg K	3.03	2.76	5.02	MgO
Al K	3.63	2.99	6.85	Al ₂ O ₃
Si K	27.82	22.00	59.52	SiO ₂
Fe K	10.80	4.29	15.44	Fe ₂ O ₃
Zn K	5.92	2.01	7.37	ZnO
O	44.50	61.78		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-2.

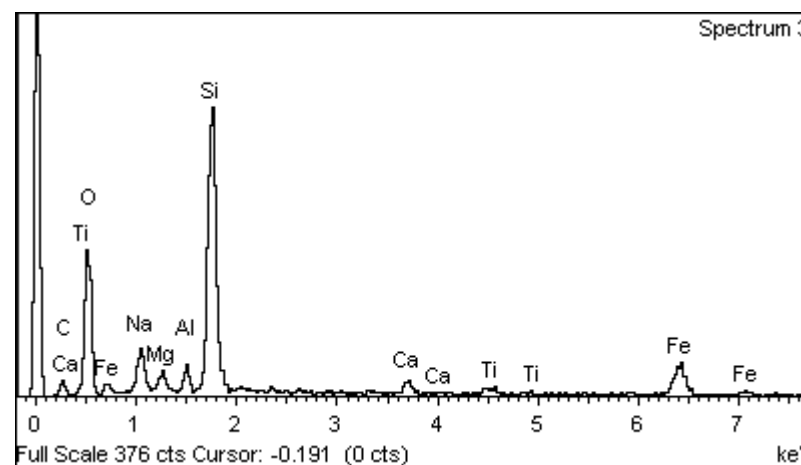
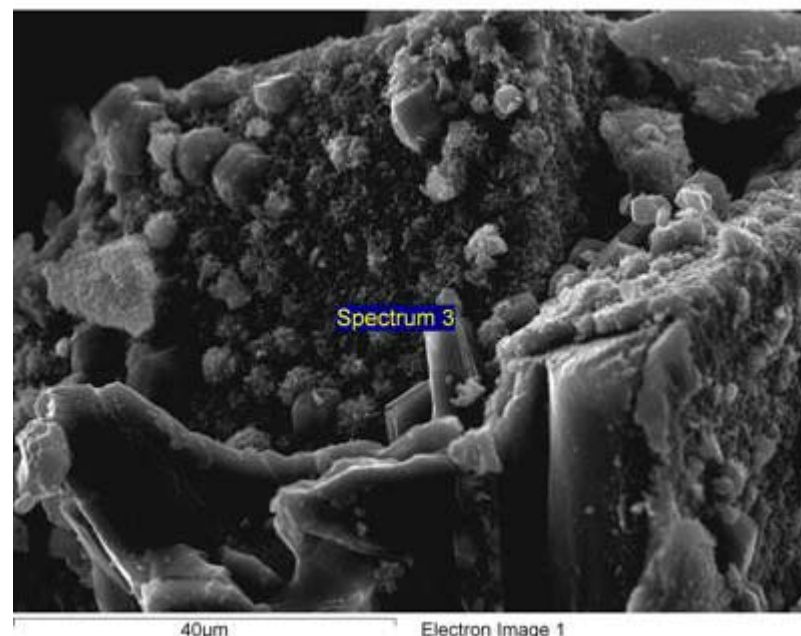
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.42	6.10	8.65	Na ₂ O
Mg K	2.00	1.80	3.32	MgO
Al K	2.31	1.87	4.36	Al ₂ O ₃
Si K	28.46	22.14	60.89	SiO ₂
Ca K	1.92	1.04	2.68	CaO
Ti K	1.43	0.65	2.38	TiO ₂
Fe K	12.39	4.85	17.71	Fe ₂ O ₃
O	45.07	61.55		
Totals	100.00			



PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-2.

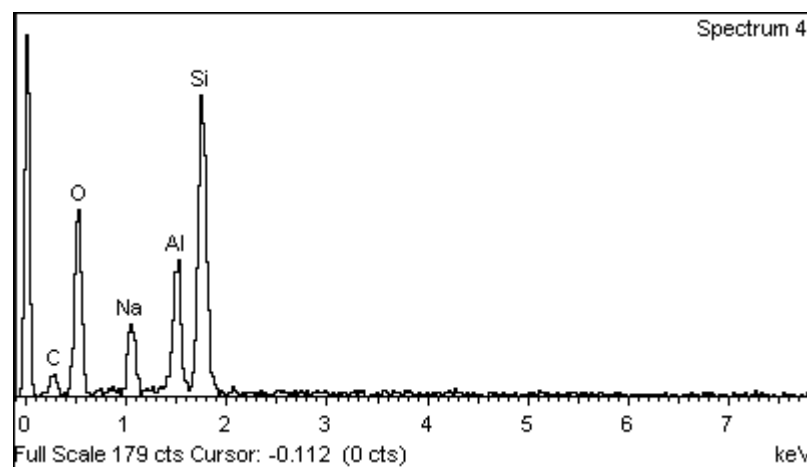
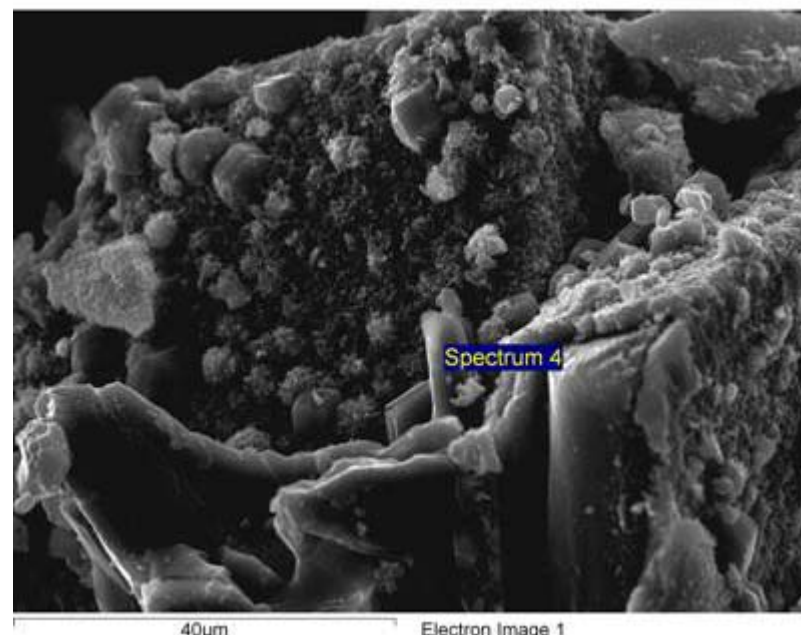
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	9.59	8.42	12.92	Na ₂ O
Al K	11.41	8.54	21.56	Al ₂ O ₃
Si K	30.62	22.01	65.51	SiO ₂
O	48.38	61.04		
Totals	100.00			



PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-2.

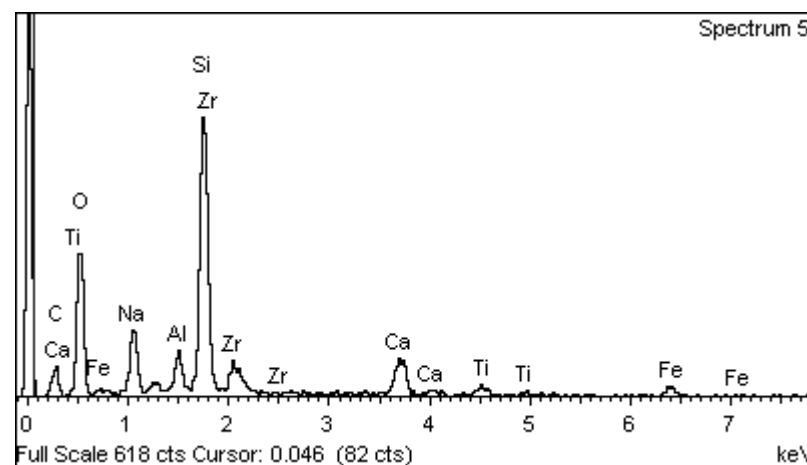
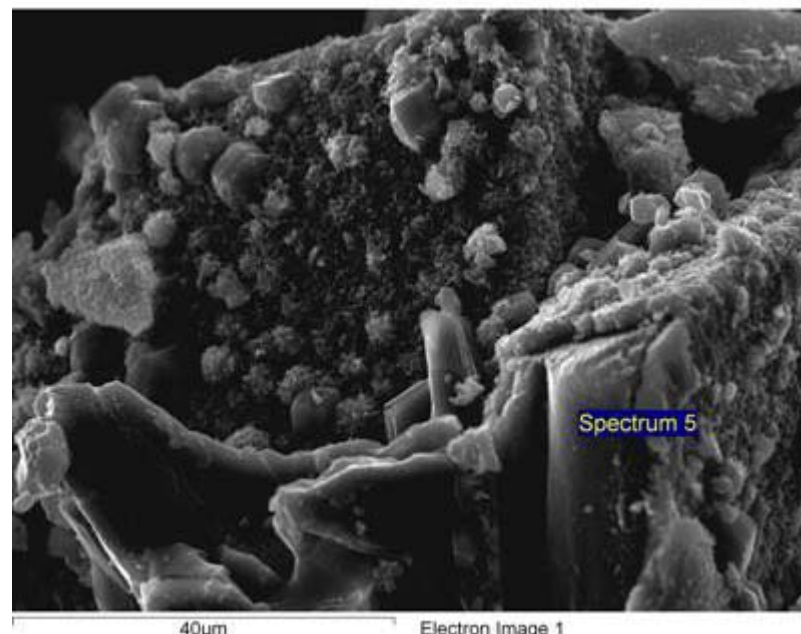
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	9.44	9.21	12.73	Na ₂ O
Al K	3.44	2.86	6.51	Al ₂ O ₃
Si K	25.49	20.35	54.53	SiO ₂
Ca K	5.49	3.07	7.69	CaO
Ti K	1.85	0.87	3.09	TiO ₂
Fe K	3.51	1.41	5.02	Fe ₂ O ₃
Zr L	7.72	1.90	10.43	ZrO ₂
O	43.04	60.33		
Totals	100.00			

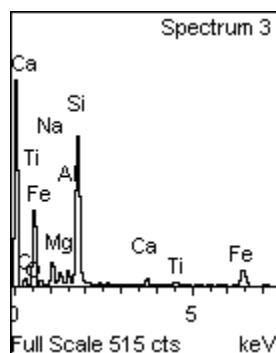
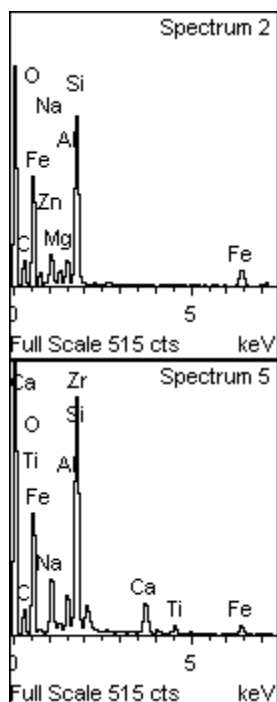
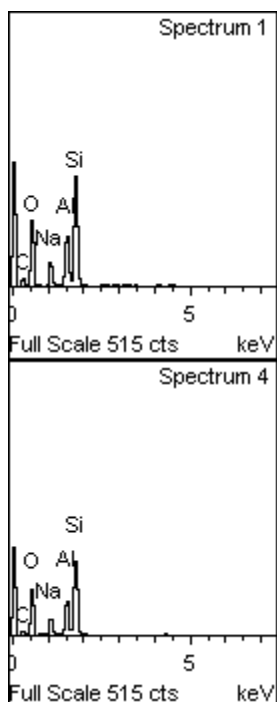
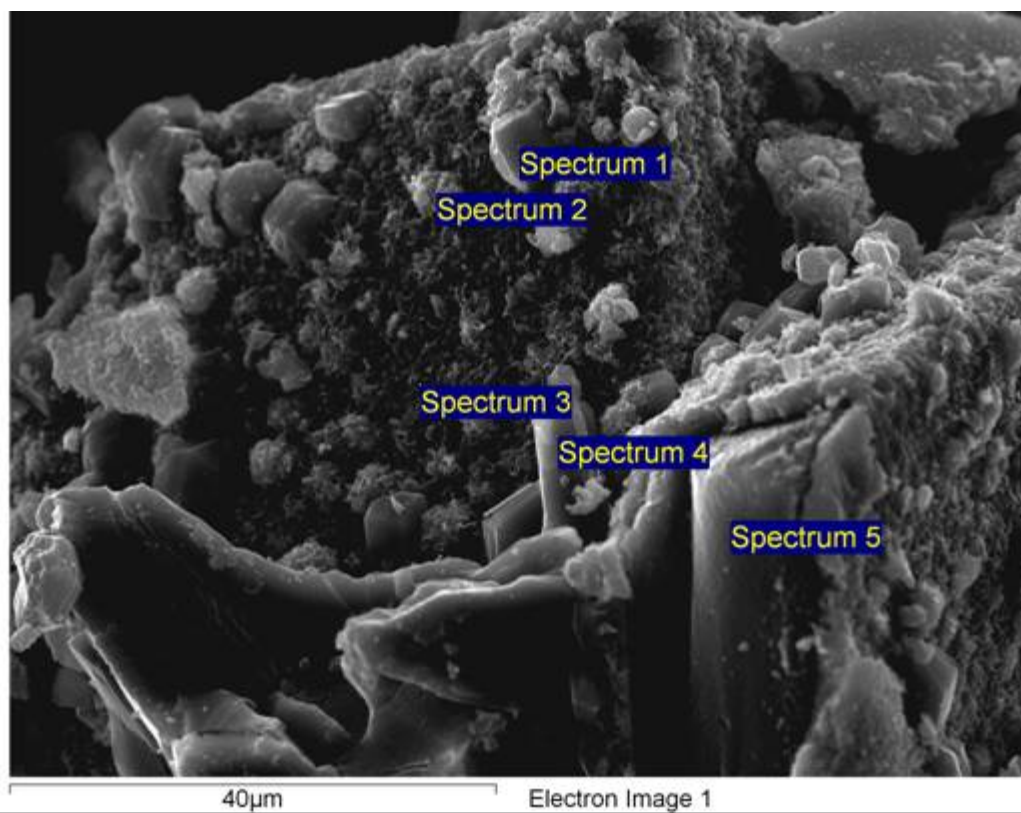


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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-2.

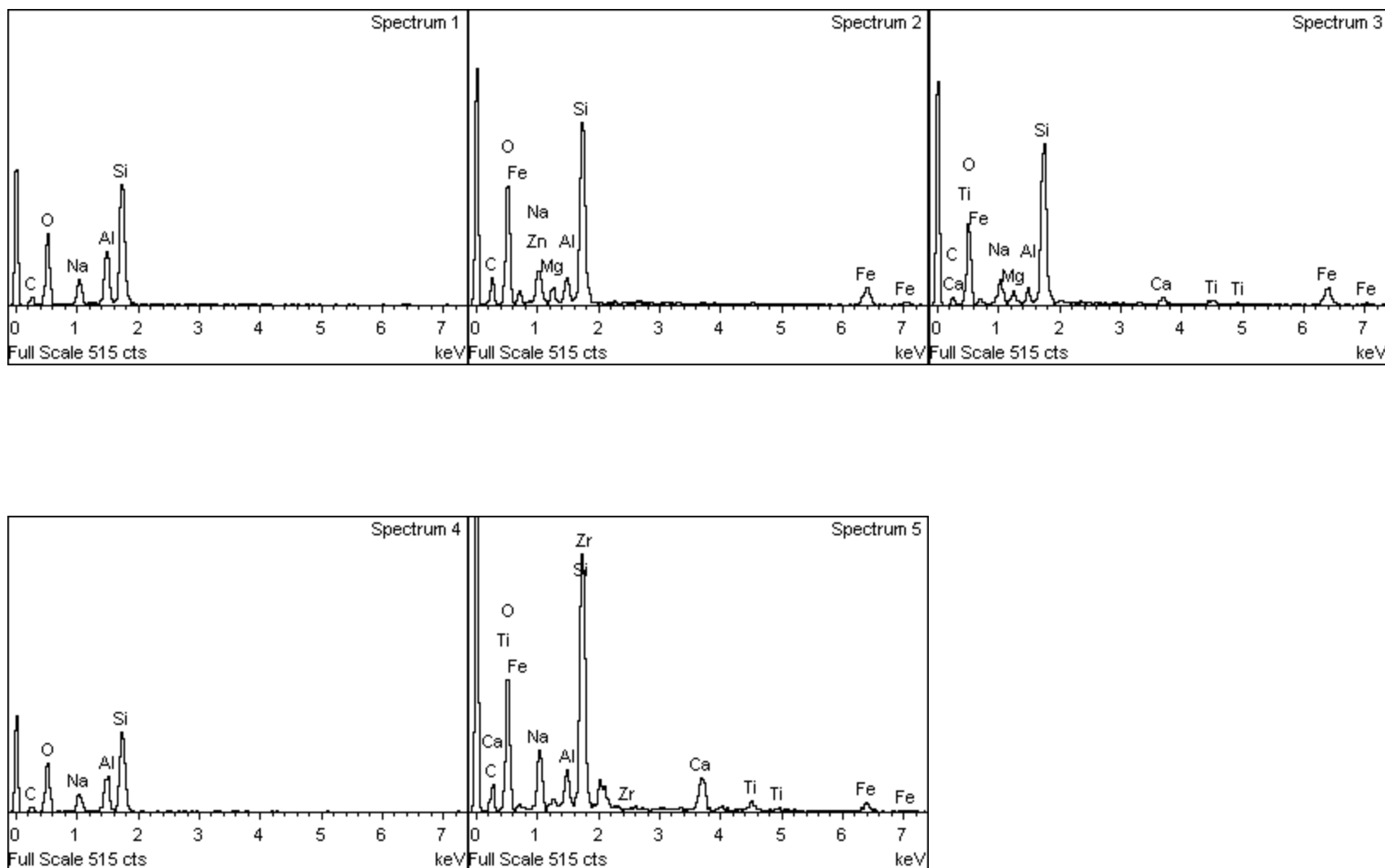


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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-2.



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PCT SURFACE CORROSION. FILE 3. ROI 2. GLASS NAME A1C1-2.

Project: PCT SURFACE CORROSION 3
 Owner: cavinm
 Site: Site of Interest 2

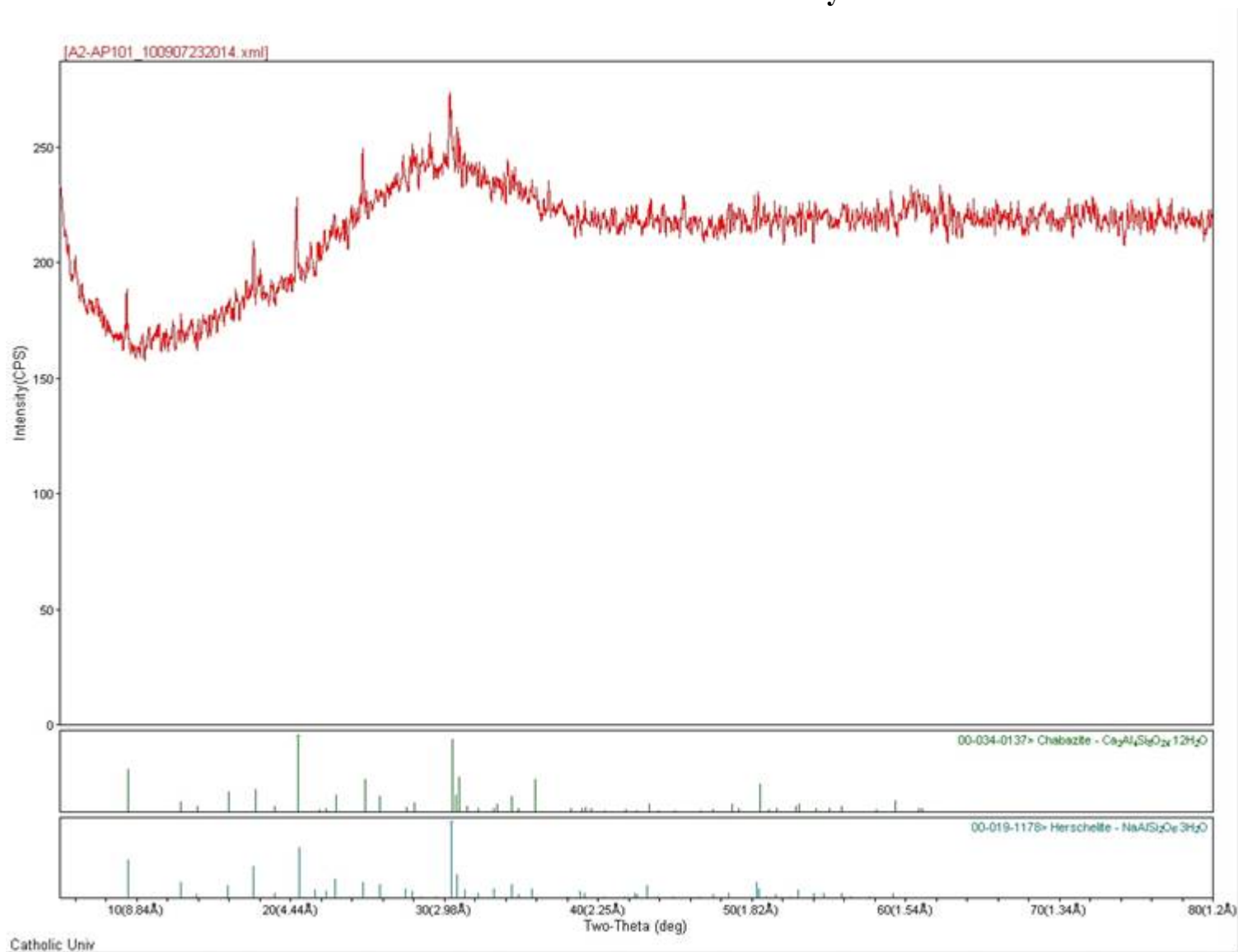
Sample: A1C1-2
 Type: Default
 ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Ca	Ti	Fe	Zn	Zr	O	Total
Spectrum 1	Yes	8.20		11.41	31.51						48.89	100.00
Spectrum 2	Yes	4.31	3.03	3.63	27.82			10.80	5.92		44.50	100.00
Spectrum 3	Yes	6.42	2.00	2.31	28.46	1.92	1.43	12.39			45.07	100.00
Spectrum 4	Yes	9.59		11.41	30.62						48.38	100.00
Spectrum 5	Yes	9.44		3.44	25.49	5.49	1.85	3.51		7.72	43.04	100.00
Max.		9.59	3.03	11.41	31.51	5.49	1.85	12.39	5.92	7.72	48.89	
Min.		4.31	2.00	2.31	25.49	1.92	1.43	3.51	5.92	7.72	43.04	

All results in weight%

XRD powder patterns (raw data and best match) and SEM/EDS analysis of glass A2-AP101, collected from 90 °C PCT-B vessel after 2877 days.



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A2-AP101.

Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

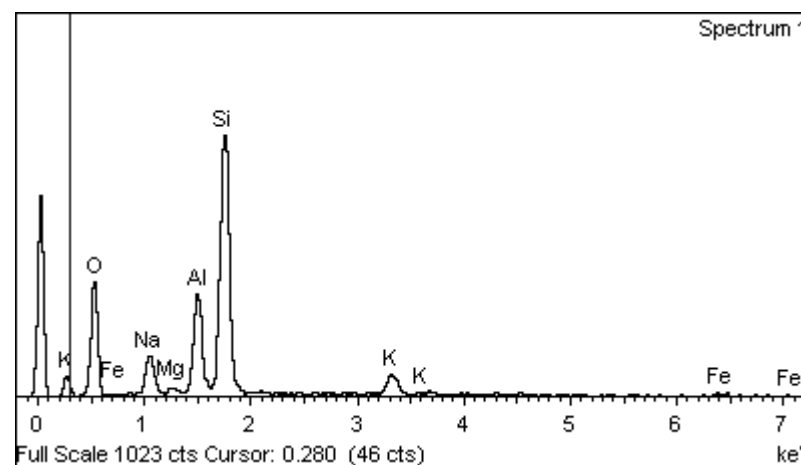
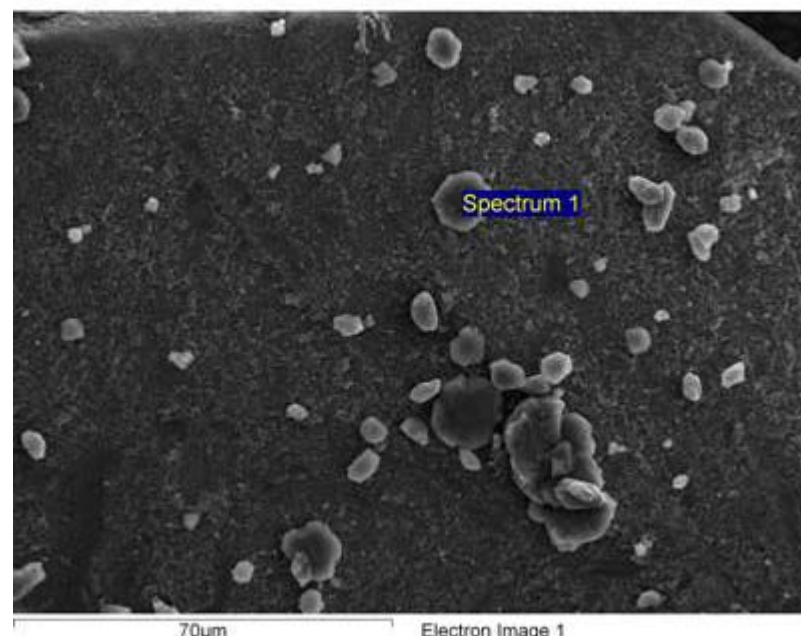
Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.99	4.50	6.73	Na ₂ O
Mg K	0.62	0.53	1.02	MgO
Al K	9.44	7.26	17.84	Al ₂ O ₃
Si K	31.03	22.92	66.38	SiO ₂
K K	4.04	2.15	4.87	K ₂ O
Fe K	2.21	0.82	3.16	Fe ₂ O ₃
O	47.67	61.82		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A2-AP101.

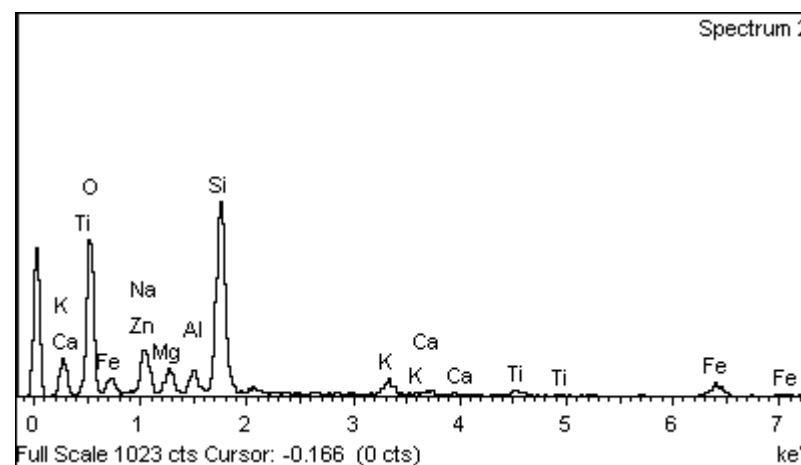
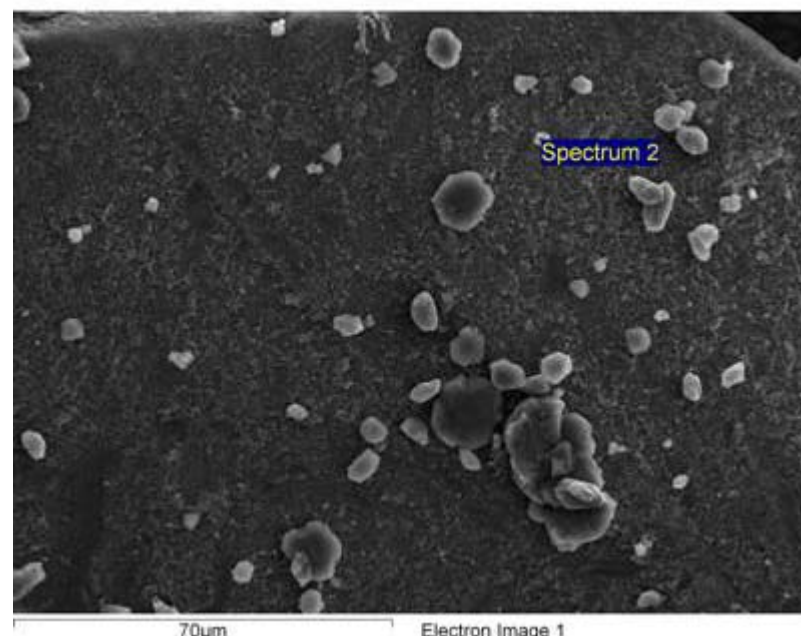
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.53	5.45	7.45	Na ₂ O
Mg K	3.38	3.14	5.60	MgO
Al K	2.54	2.13	4.80	Al ₂ O ₃
Si K	24.81	20.01	53.08	SiO ₂
K K	2.98	1.73	3.59	K ₂ O
Ca K	1.12	0.63	1.57	CaO
Ti K	1.72	0.82	2.88	TiO ₂
Fe K	10.02	4.06	14.33	Fe ₂ O ₃
Zn L	5.39	1.87	6.71	ZnO
O	42.51	60.17		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A2-AP101.

Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

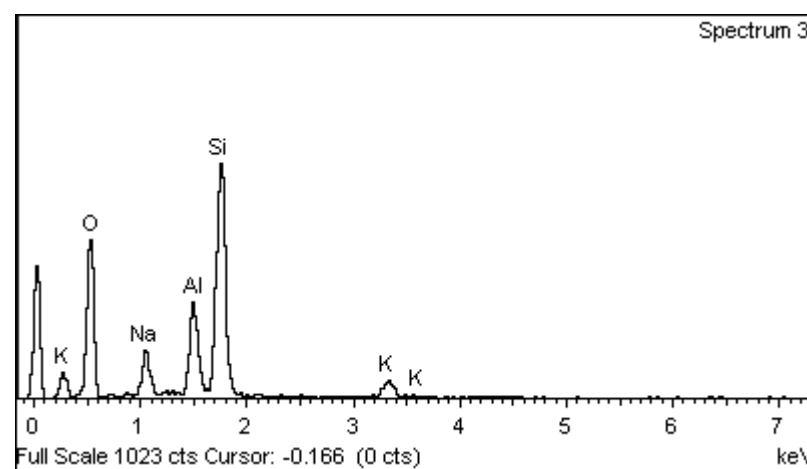
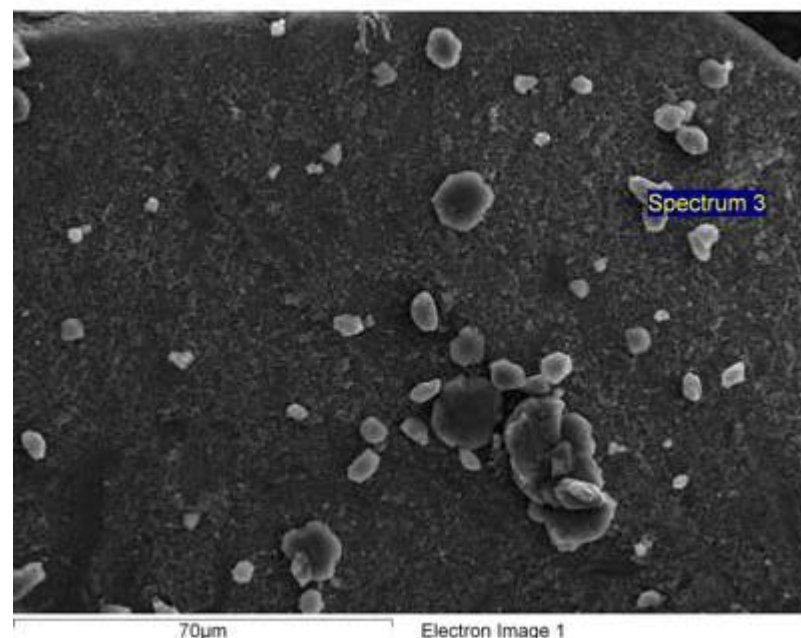
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.22	5.55	8.38	Na ₂ O
Al K	10.05	7.64	18.98	Al ₂ O ₃
Si K	31.67	23.13	67.76	SiO ₂
K K	4.05	2.13	4.88	K ₂ O
O	48.01	61.56		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A2-AP101.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

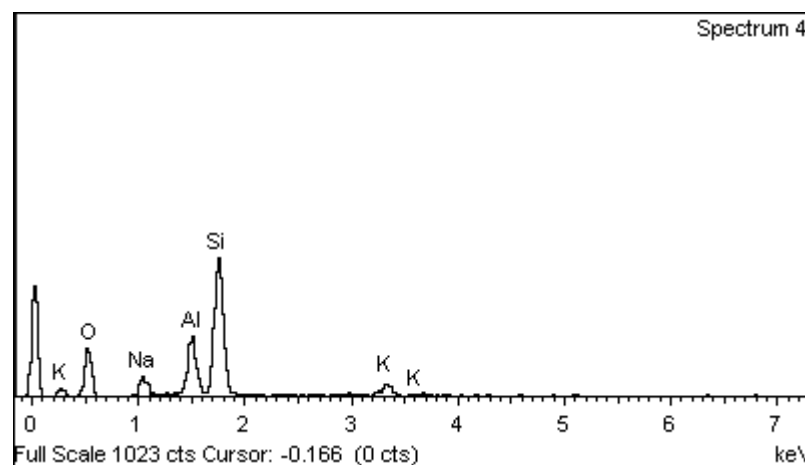
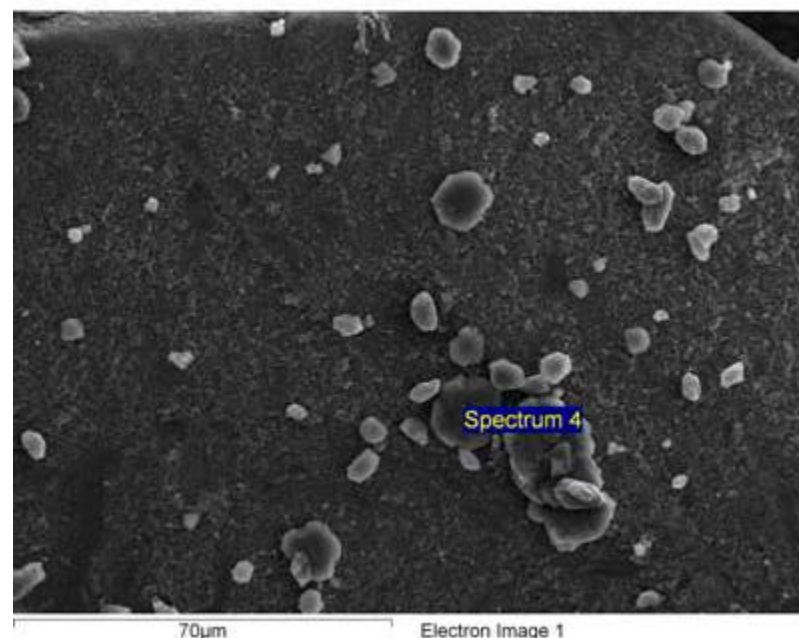
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.65	4.16	6.27	Na ₂ O
Al K	10.76	8.20	20.33	Al ₂ O ₃
Si K	31.64	23.17	67.68	SiO ₂
K K	4.75	2.50	5.72	K ₂ O
O	48.20	61.97		
Totals	100.00			



PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A2-AP101.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

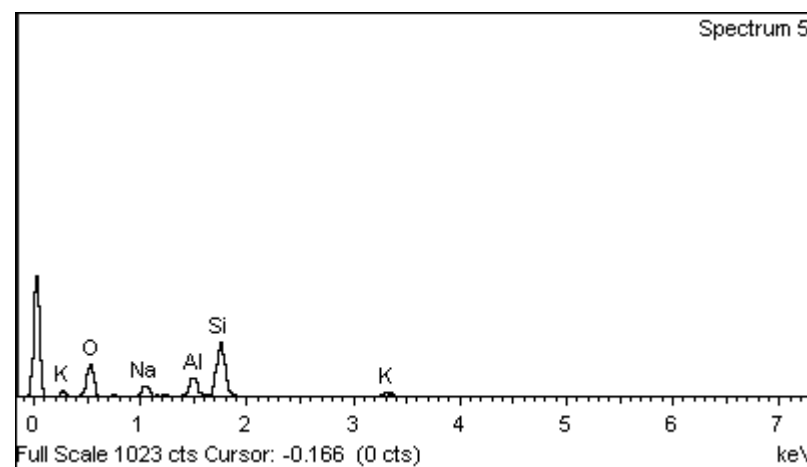
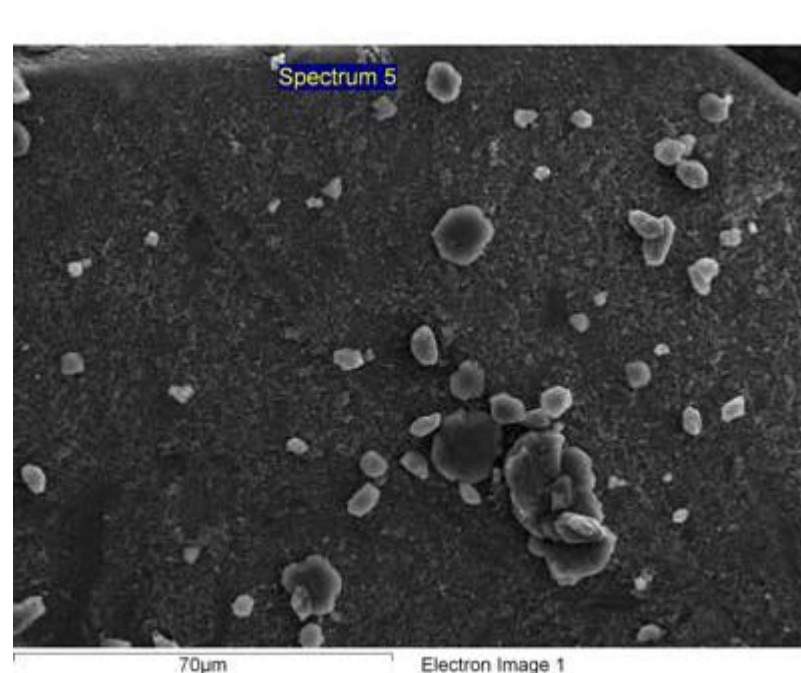
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.23	6.47	9.75	Na ₂ O
Al K	9.22	7.03	17.41	Al ₂ O ₃
Si K	31.37	22.99	67.12	SiO ₂
K K	4.75	2.50	5.72	K ₂ O
O	47.43	61.01		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A2-AP101.

Spectrum processing :

Peak possibly omitted : 2.045 keV

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

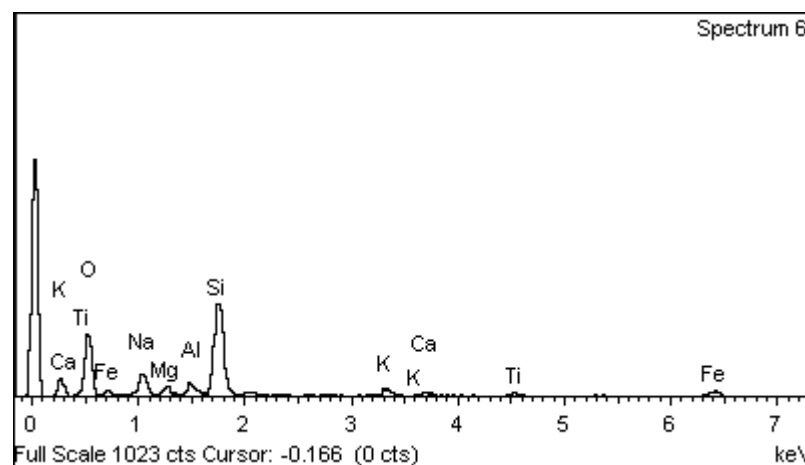
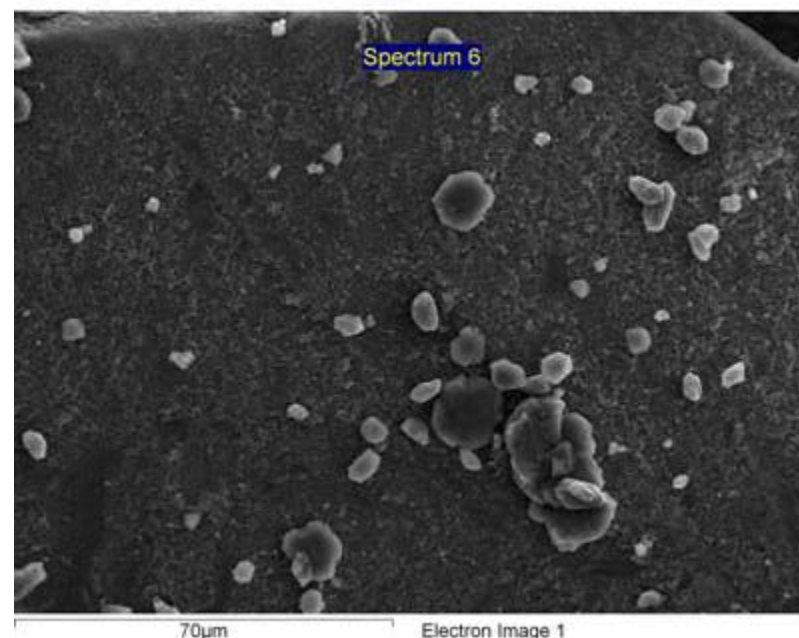
K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

Ti Ti 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.41	7.07	9.98	Na ₂ O
Mg K	2.07	1.86	3.43	MgO
Al K	2.67	2.17	5.04	Al ₂ O ₃
Si K	26.79	20.93	57.32	SiO ₂
K K	3.33	1.87	4.02	K ₂ O
Ca K	1.58	0.86	2.21	CaO
Ti K	2.48	1.14	4.14	TiO ₂
Fe K	9.70	3.81	13.87	Fe ₂ O ₃
O	43.97	60.29		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A2-AP101.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

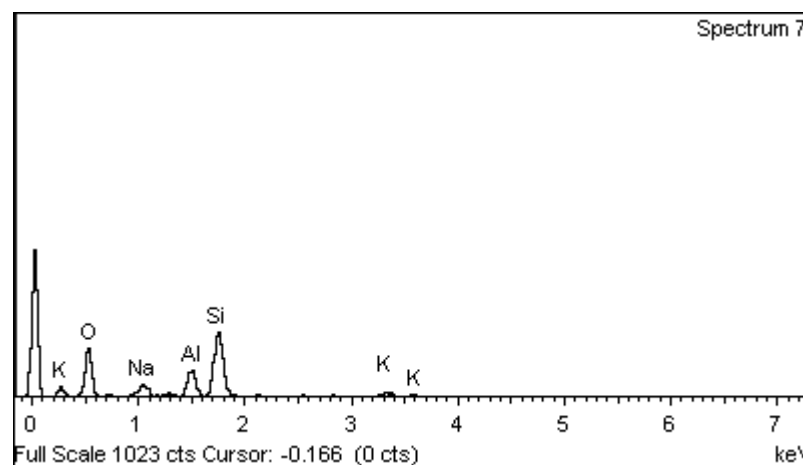
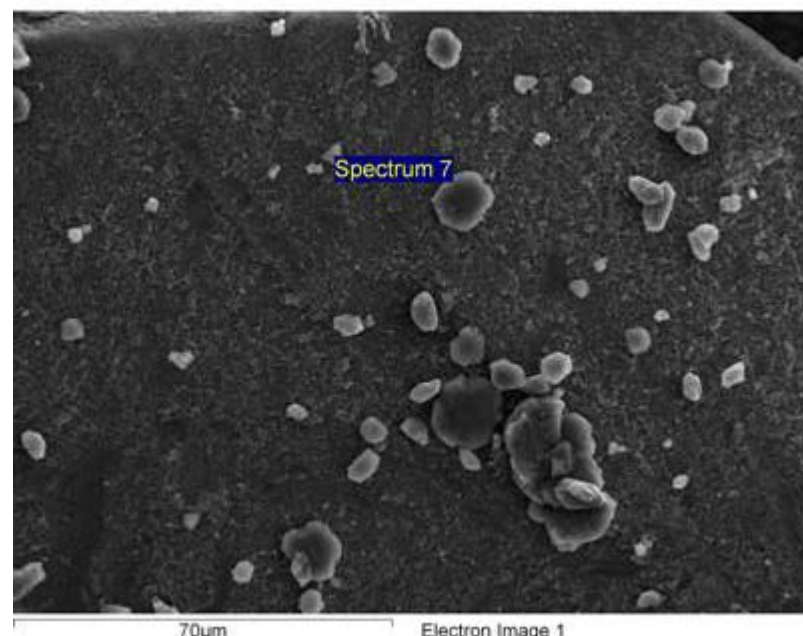
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.11	5.45	8.23	Na ₂ O
Al K	10.81	8.22	20.42	Al ₂ O ₃
Si K	30.99	22.65	66.30	SiO ₂
K K	4.19	2.20	5.04	K ₂ O
O	47.90	61.47		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A2-AP101.

Spectrum processing :
Peak possibly omitted : 2.061 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

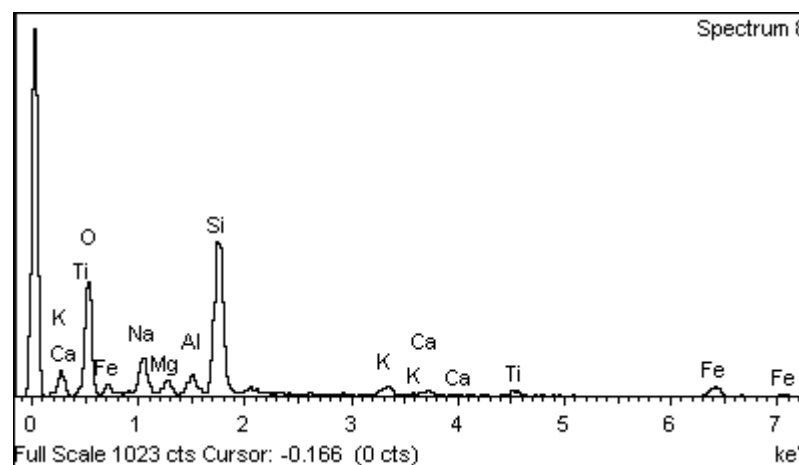
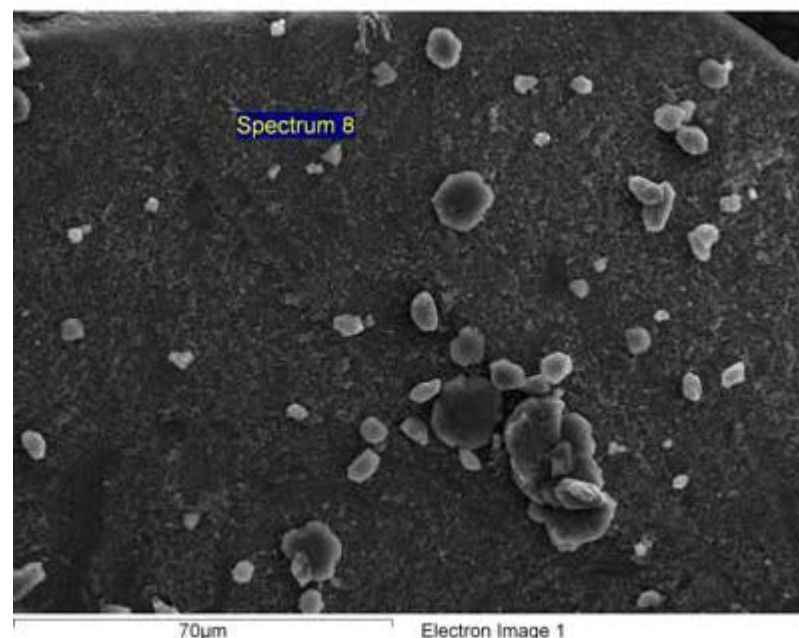
K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

Ti Ti 1-Jun-1999 12:00 AM

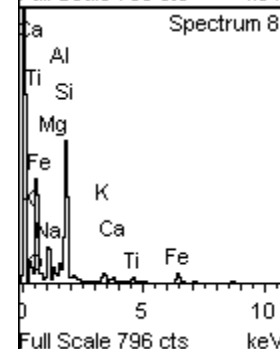
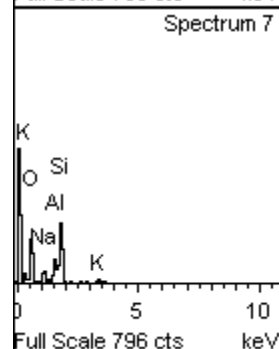
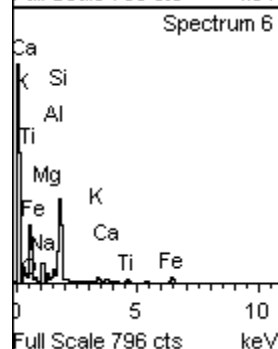
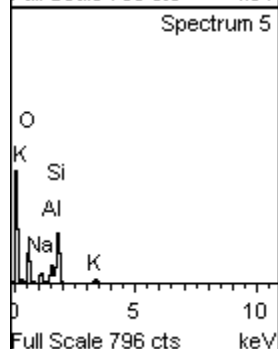
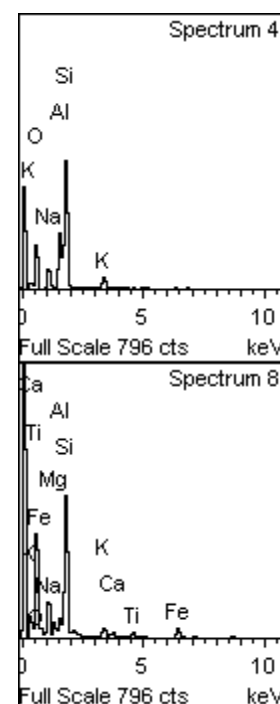
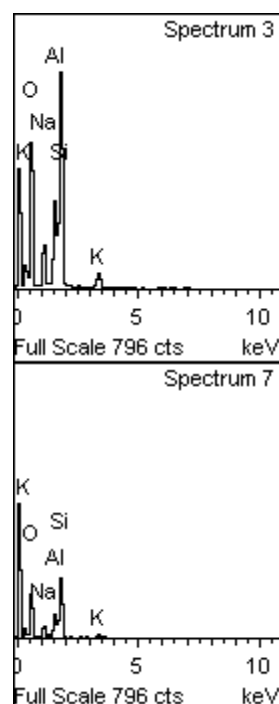
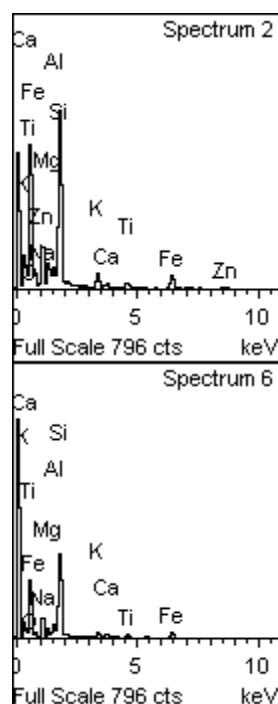
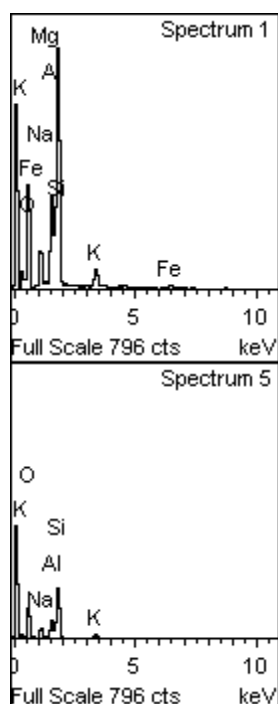
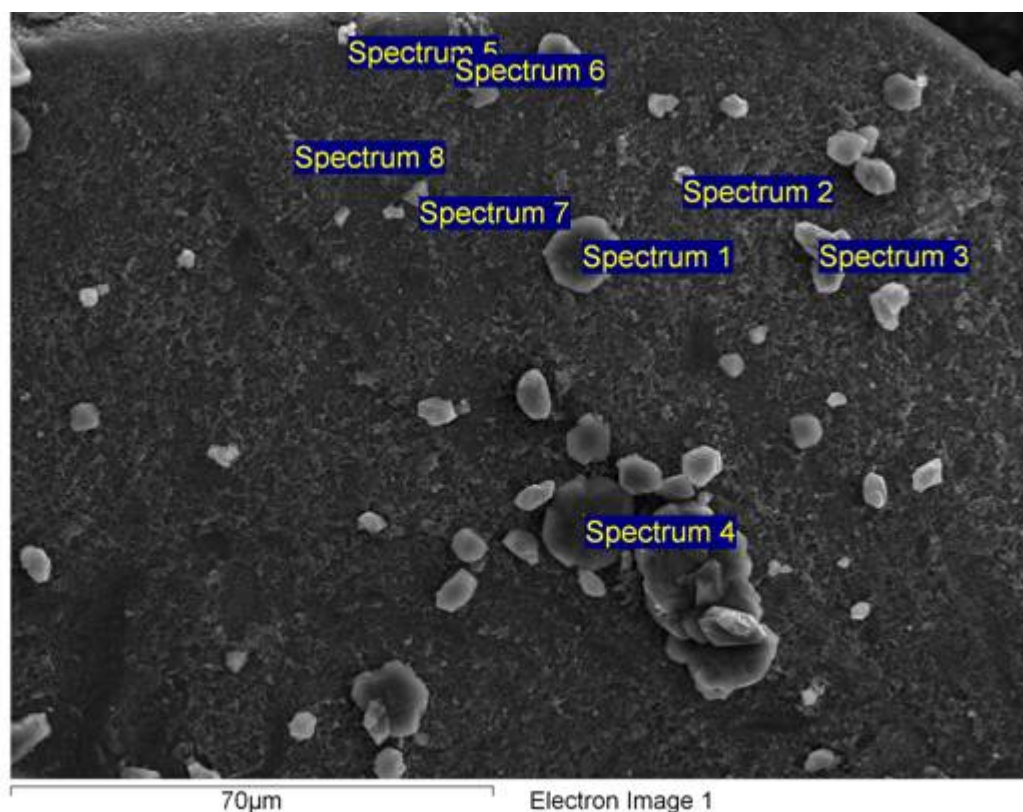
Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.05	6.75	9.50	Na ₂ O
Mg K	2.45	2.22	4.06	MgO
Al K	2.44	1.99	4.62	Al ₂ O ₃
Si K	26.58	20.81	56.86	SiO ₂
K K	2.53	1.43	3.05	K ₂ O
Ca K	1.53	0.84	2.14	CaO
Ti K	2.65	1.22	4.43	TiO ₂
Fe K	10.73	4.23	15.34	Fe ₂ O ₃
O	44.03	60.53		
Totals	100.00			

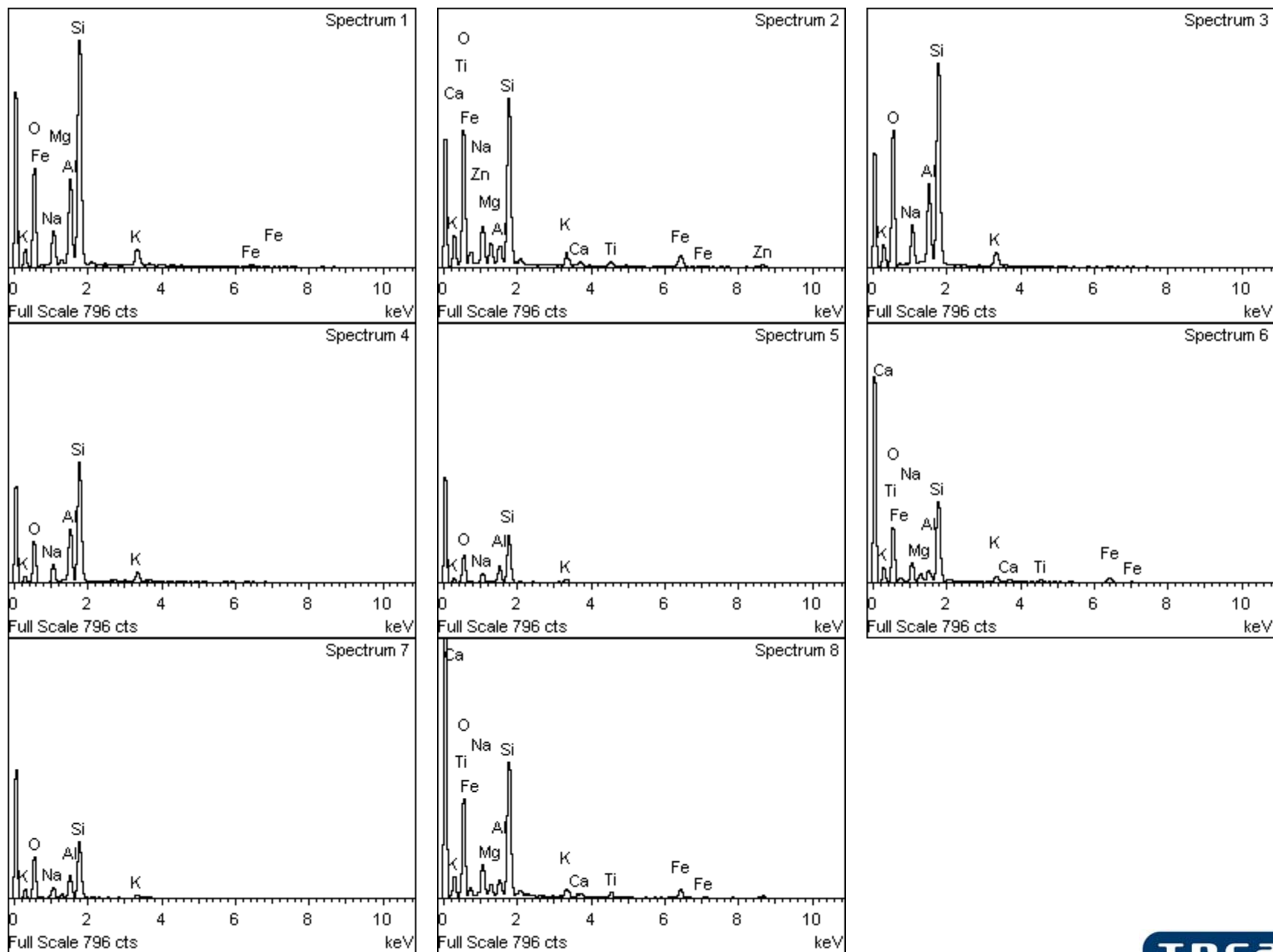


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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A2-AP101.



PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A2-AP101.



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME A2-AP101.

Project: PCT SURFACE CORROSION 4
 Owner: cavinm
 Site: Site of Interest 1

Sample: A2-AP101
 Type: Default
 ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ca	Ti	Fe	Zn	O	Total
Spectrum 1	Yes	4.99	0.62	9.44	31.03	4.04			2.21		47.67	100.00
Spectrum 2	Yes	5.53	3.38	2.54	24.81	2.98	1.12	1.72	10.02	5.39	42.51	100.00
Spectrum 3	Yes	6.22		10.05	31.67	4.05					48.01	100.00
Spectrum 4	Yes	4.65		10.76	31.64	4.75					48.20	100.00
Spectrum 5	Yes	7.23		9.22	31.37	4.75					47.43	100.00
Spectrum 6	Yes	7.41	2.07	2.67	26.79	3.33	1.58	2.48	9.70		43.97	100.00
Spectrum 7	Yes	6.11		10.81	30.99	4.19					47.90	100.00
Spectrum 8	Yes	7.05	2.45	2.44	26.58	2.53	1.53	2.65	10.73		44.03	100.00
Max.		7.41	3.38	10.81	31.67	4.75	1.58	2.65	10.73	5.39	48.20	
Min.		4.65	0.62	2.44	24.81	2.53	1.12	1.72	2.21	5.39	42.51	

All results in weight%

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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A2-AP101.

Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

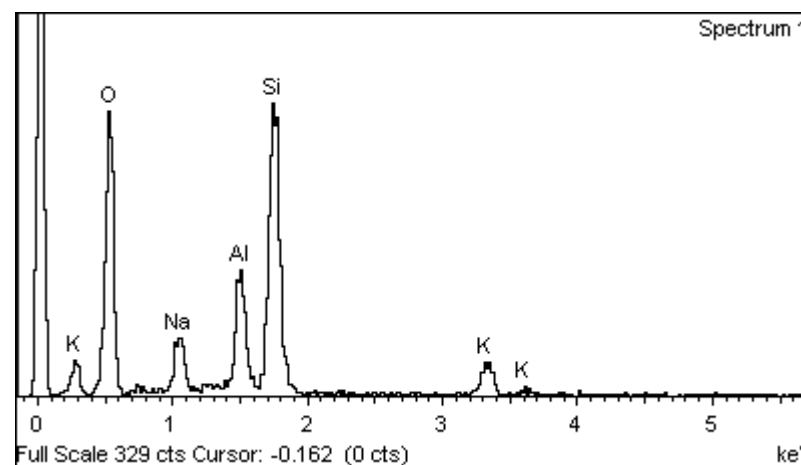
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.21	5.60	8.37	Na ₂ O
Al K	10.40	7.99	19.66	Al ₂ O ₃
Si K	30.14	22.23	64.48	SiO ₂
K K	6.22	3.29	7.49	K ₂ O
O	47.03	60.89		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A2-AP101.

Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

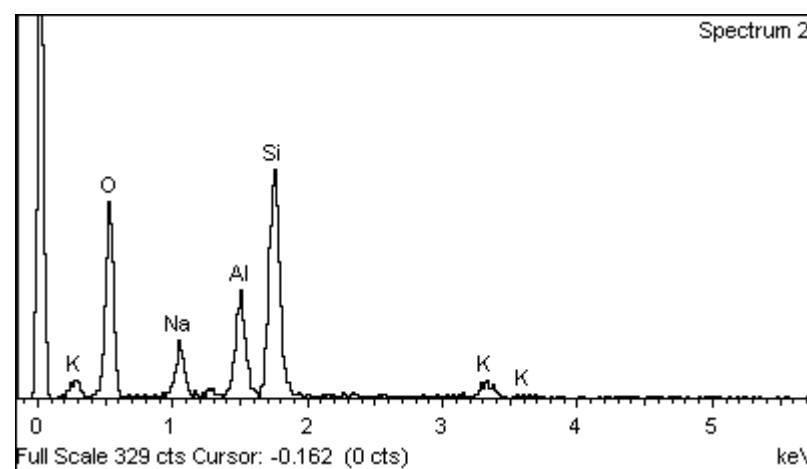
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.28	6.49	9.81	Na ₂ O
Al K	10.90	8.28	20.59	Al ₂ O ₃
Si K	30.40	22.19	65.03	SiO ₂
K K	3.80	1.99	4.58	K ₂ O
O	47.63	61.05		
Totals	100.00			



PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A2-AP101.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

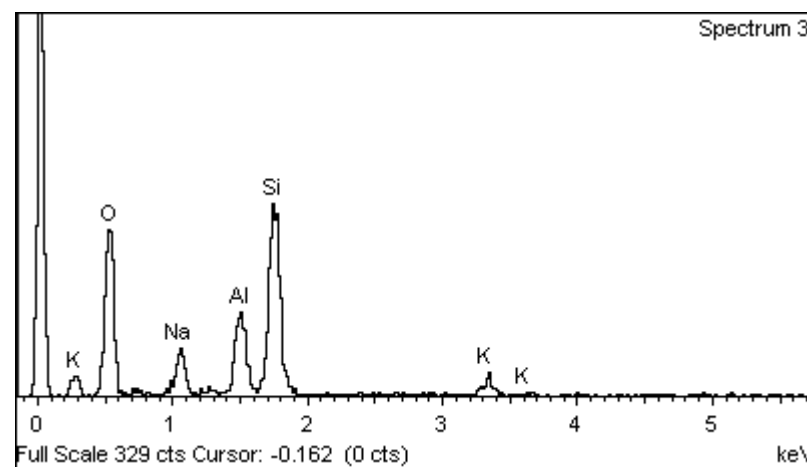
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.10	6.34	9.58	Na ₂ O
Al K	10.59	8.06	20.00	Al ₂ O ₃
Si K	30.58	22.36	65.43	SiO ₂
K K	4.15	2.18	5.00	K ₂ O
O	47.58	61.06		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A2-AP101.

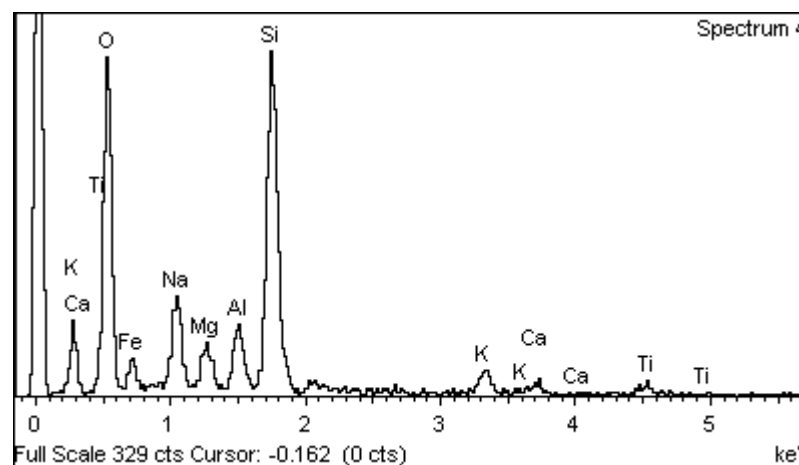
Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

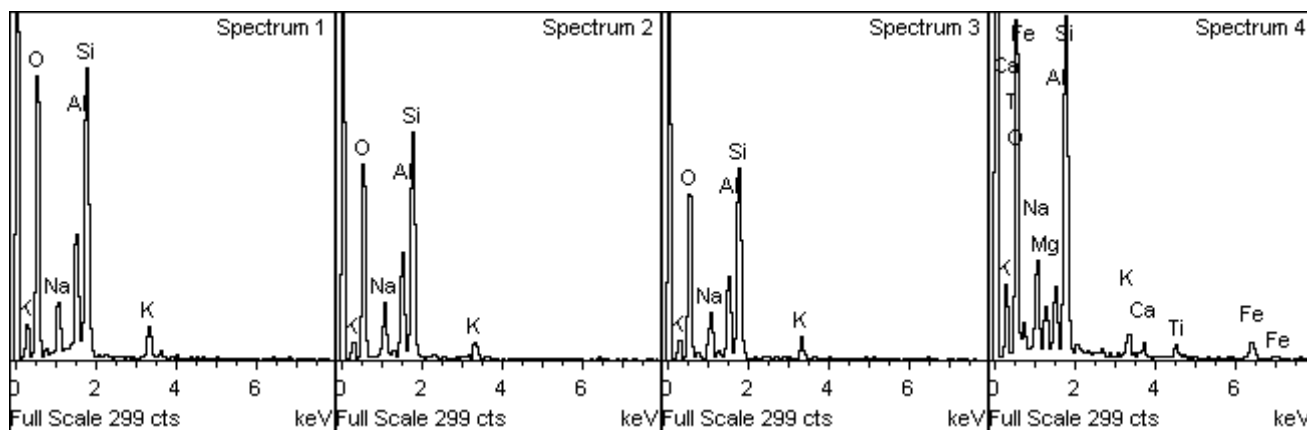
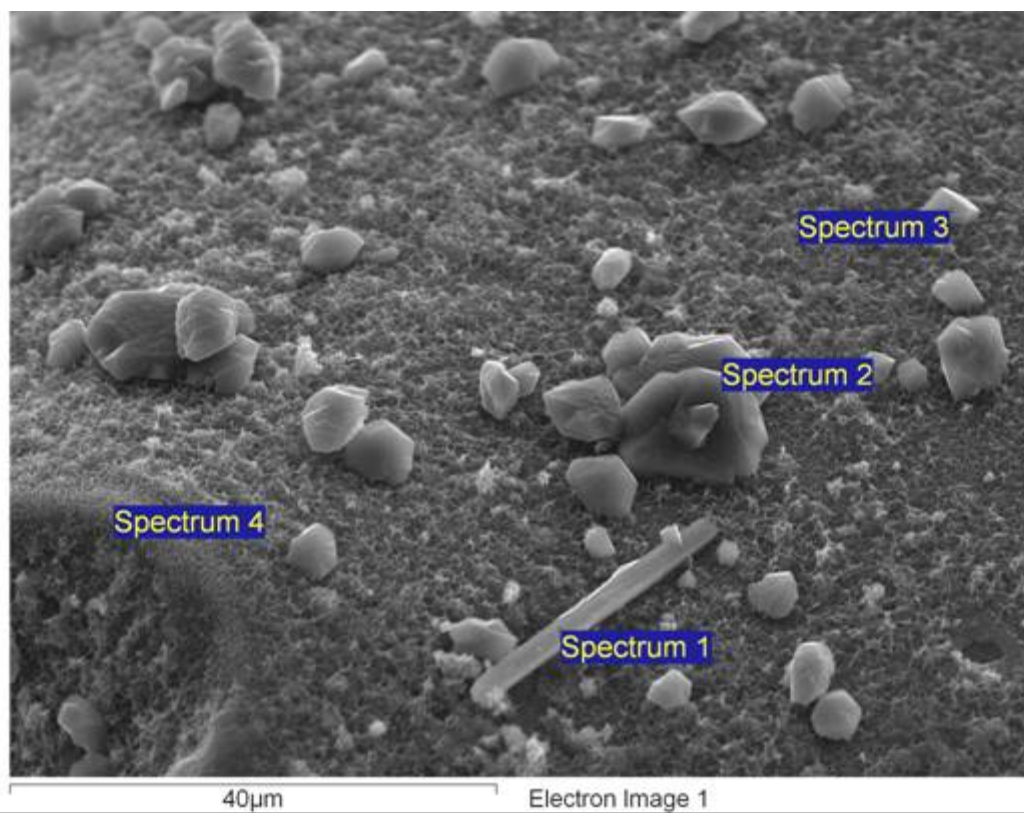
Standard :

Na Albite 1-Jun-1999 12:00 AM
 Mg MgO 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM
 K MAD-10 Feldspar 1-Jun-1999 12:00 AM
 Ca Wollastonite 1-Jun-1999 12:00 AM
 Ti Ti 1-Jun-1999 12:00 AM
 Fe Fe 1-Jun-1999 12:00 AM

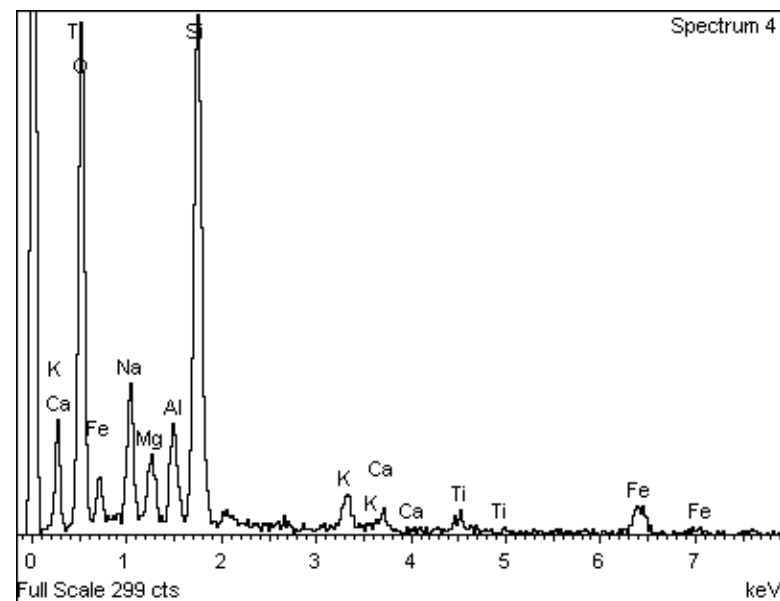
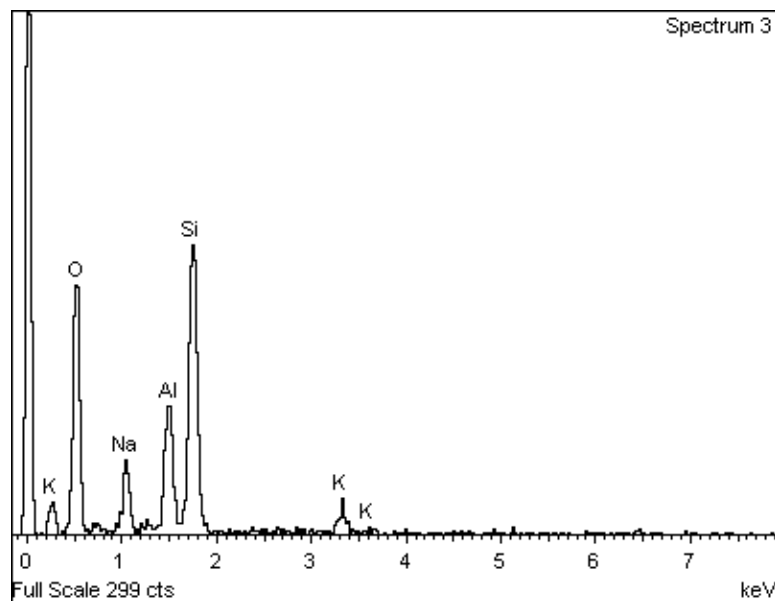
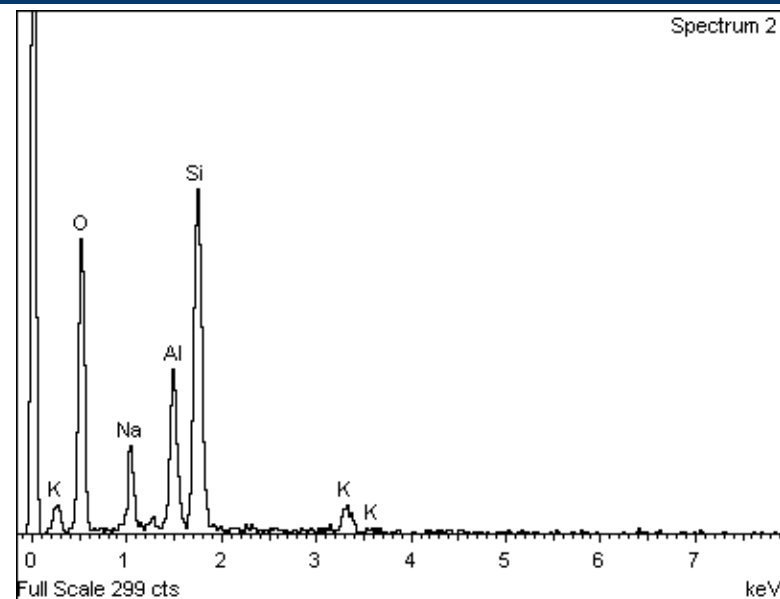
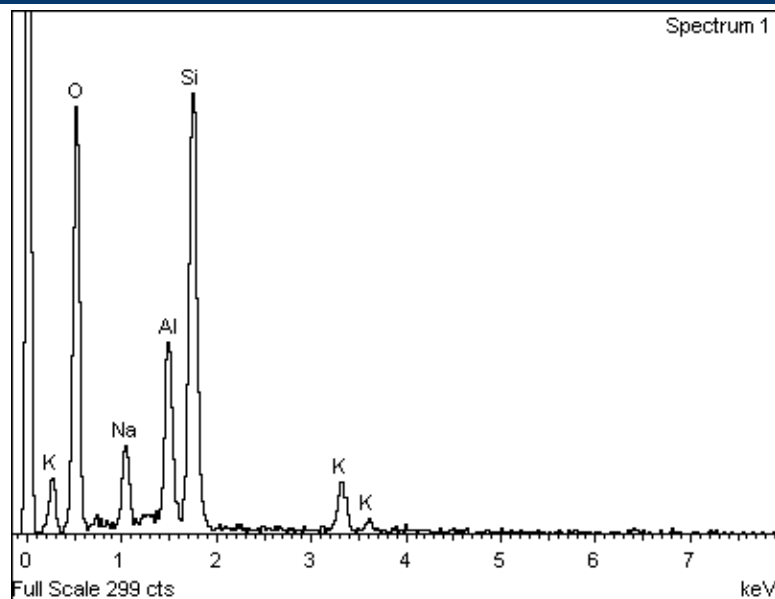
Element	Weight%	Atomic%	Compd%	Formula
Na K	7.59	7.20	10.23	Na ₂ O
Mg K	3.08	2.77	5.11	MgO
Al K	4.51	3.65	8.53	Al ₂ O ₃
Si K	25.12	19.52	53.73	SiO ₂
K K	3.11	1.74	3.75	K ₂ O
Ca K	1.44	0.79	2.02	CaO
Ti K	1.89	0.86	3.16	TiO ₂
Fe K	9.43	3.68	13.48	Fe ₂ O ₃
O	43.83	59.79		
Totals	100.00			



PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A2-AP101.



PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A2-AP101.



Comment: XRD Herschelite 99-000-1529; Stipnomelane – 00-045-1357

PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME A2-AP101.

Project: PCT SURFACE CORROSION 4
Owner: cavinm
Site: Site of Interest 2

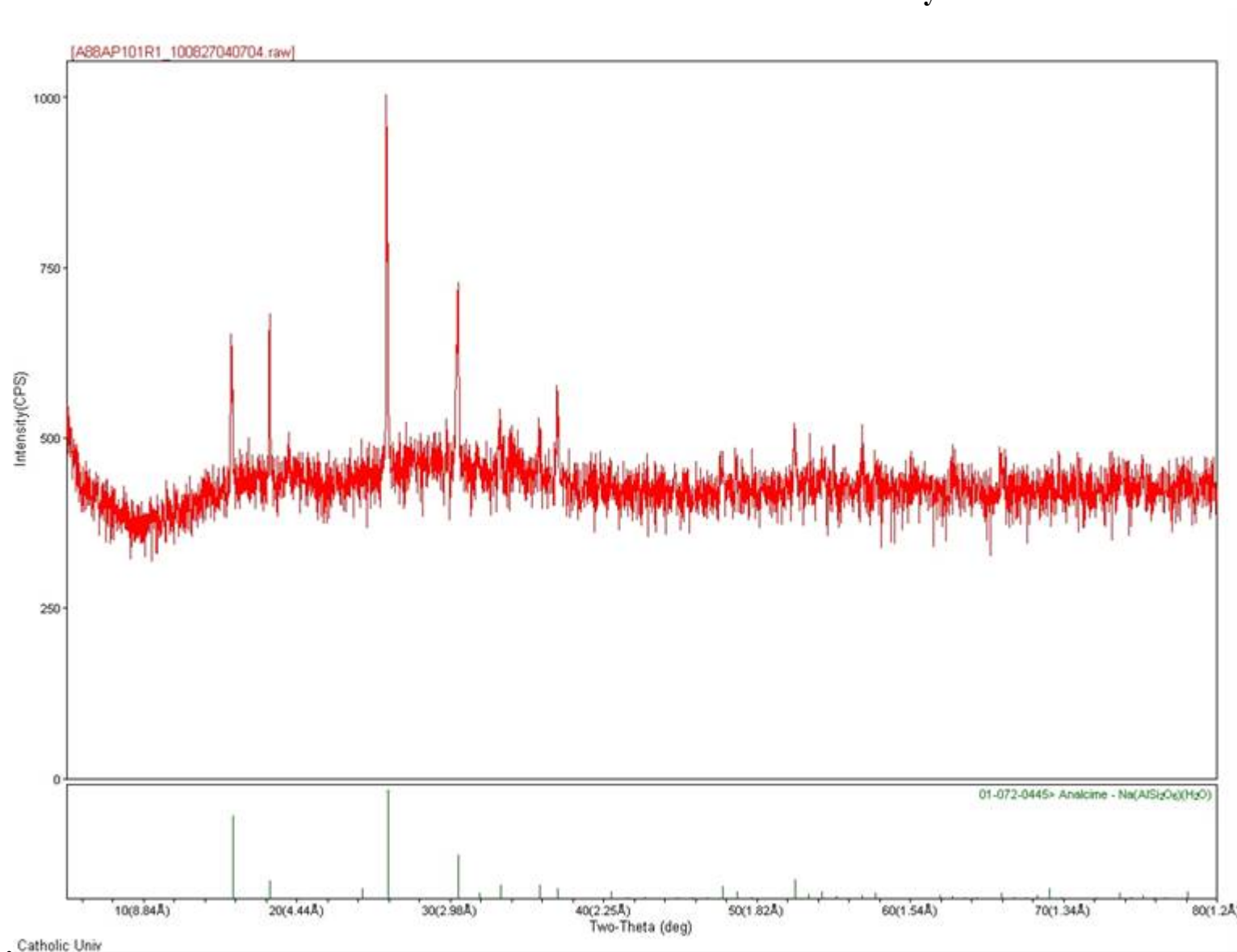
Sample: A2-AP101
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ca	Ti	Fe	O	Total
Spectrum 1	Yes	6.21		10.40	30.14	6.22				47.03	100.00
Spectrum 2	Yes	7.28		10.90	30.40	3.80				47.63	100.00
Spectrum 3	Yes	7.10		10.59	30.58	4.15				47.58	100.00
Spectrum 4	Yes	7.59	3.08	4.51	25.12	3.11	1.44	1.89	9.43	43.83	100.00
Max.		7.59	3.08	10.90	30.58	6.22	1.44	1.89	9.43	47.63	
Min.		6.21	3.08	4.51	25.12	3.11	1.44	1.89	9.43	43.83	

All results in weight%

**XRD powder patterns (raw data and best match) and SEM/EDS analysis of glass A88AP101R1,
collected from 90°C PCT-B vessel after 3275 days**



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME A88AP101R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

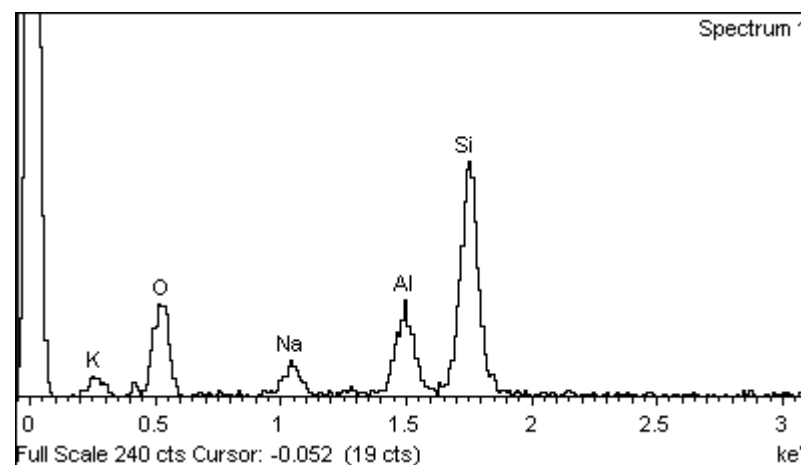
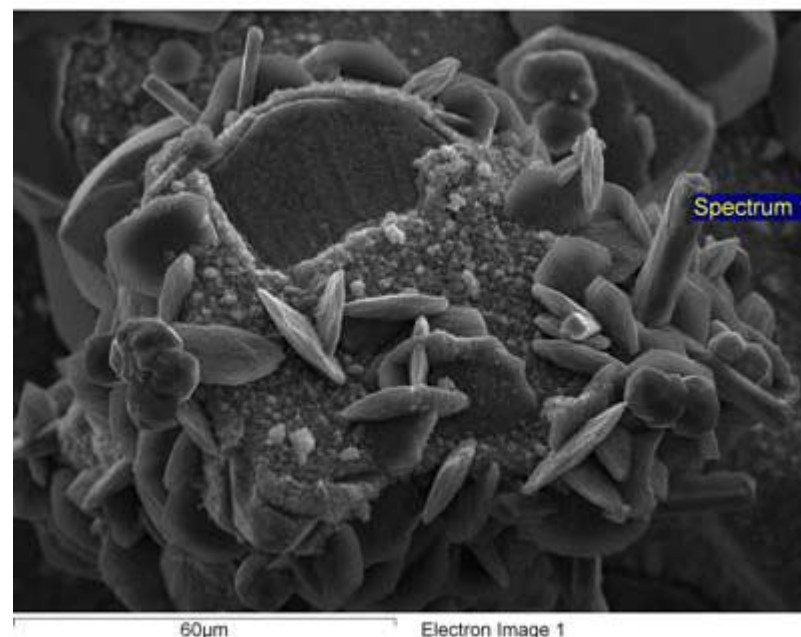
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.50	4.04	6.06	Na ₂ O
Al K	9.32	7.14	17.62	Al ₂ O ₃
Si K	32.39	23.83	69.30	SiO ₂
K K	5.83	3.08	7.02	K ₂ O
O	47.96	61.92		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME A88AP101R1.

Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

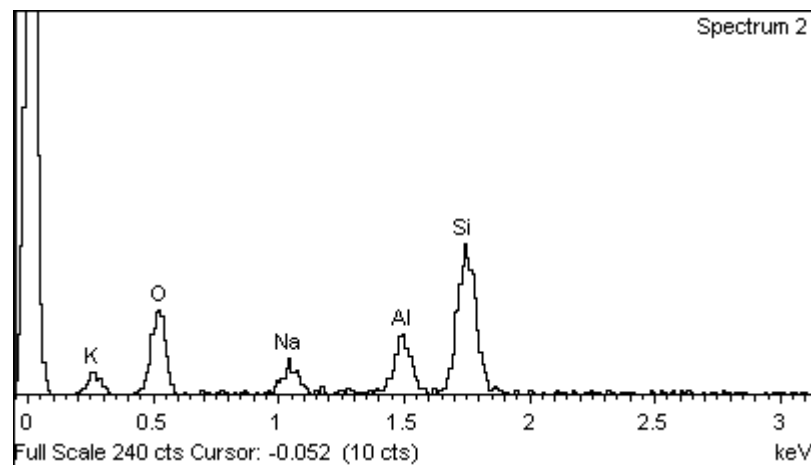
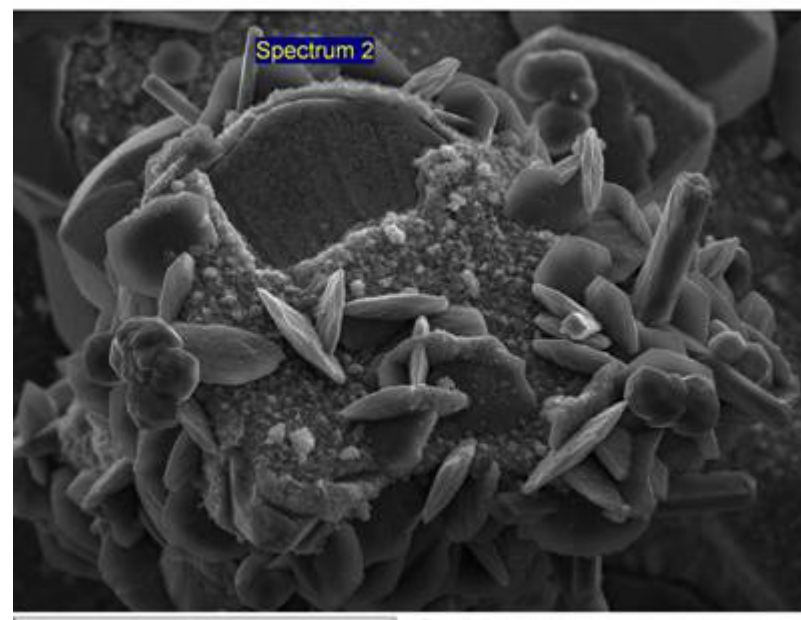
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.86	5.29	7.90	Na ₂ O
Al K	9.61	7.39	18.15	Al ₂ O ₃
Si K	30.84	22.78	65.98	SiO ₂
K K	6.61	3.51	7.96	K ₂ O
O	47.08	61.04		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME A88AP101R1.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

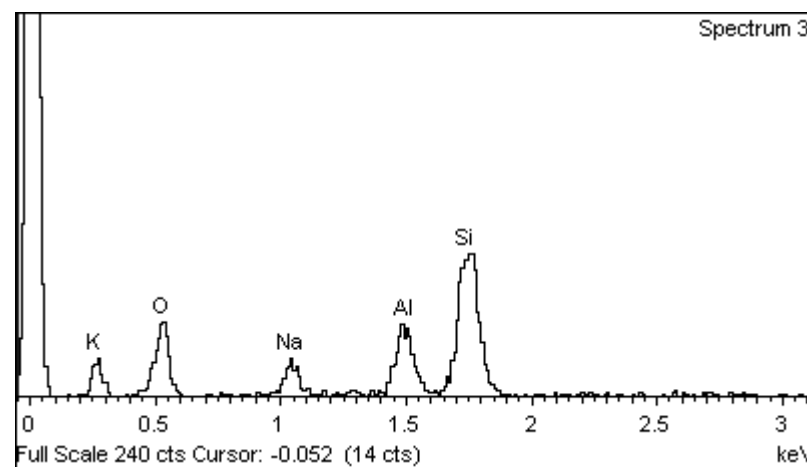
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.96	6.23	9.39	Na ₂ O
Al K	11.32	8.63	21.39	Al ₂ O ₃
Si K	29.80	21.83	63.75	SiO ₂
K K	4.54	2.39	5.46	K ₂ O
O	47.37	60.92		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME A88AP101R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

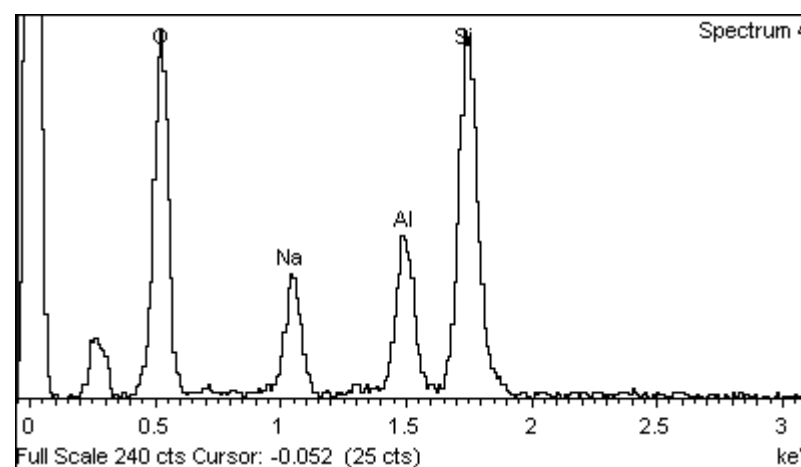
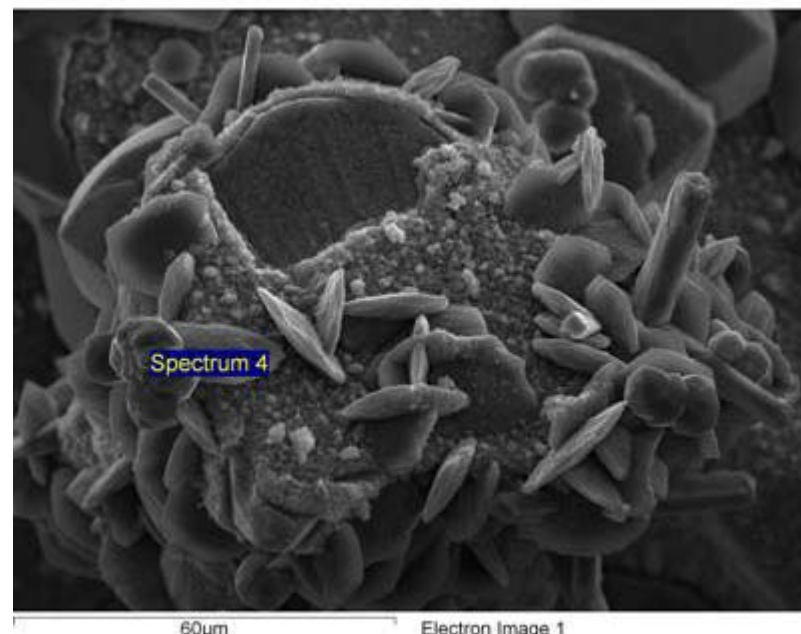
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	10.00	8.78	13.48	Na ₂ O
Al K	11.18	8.37	21.13	Al ₂ O ₃
Si K	30.57	21.97	65.39	SiO ₂
O	48.25	60.88		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME A88AP101R1.

Spectrum processing :
 Peak possibly omitted : 6.425 keV

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

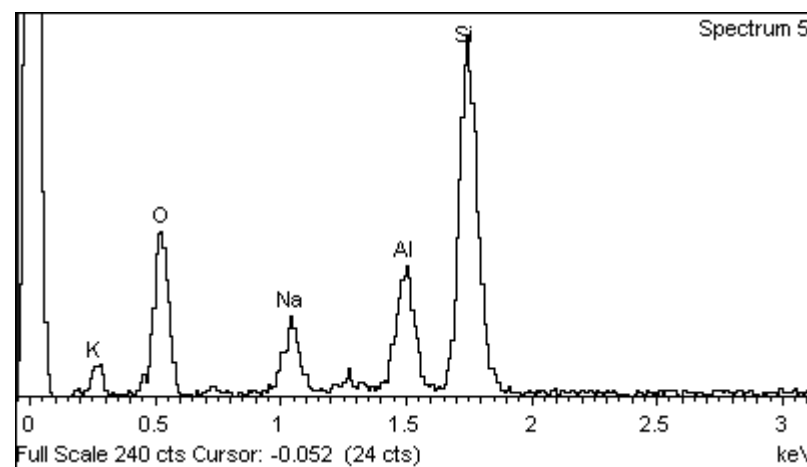
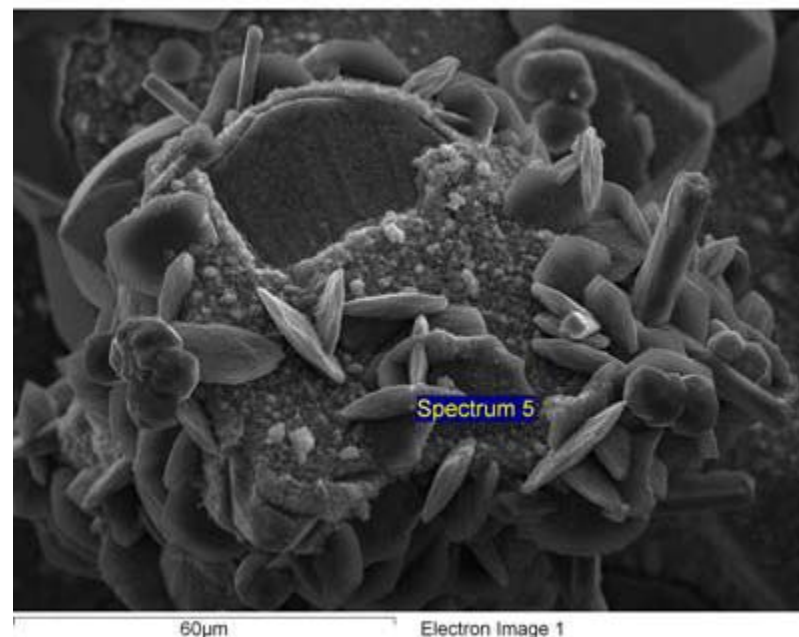
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.35	5.68	8.56	Na ₂ O
Al K	9.29	7.08	17.55	Al ₂ O ₃
Si K	32.00	23.42	68.47	SiO ₂
K K	4.50	2.36	5.42	K ₂ O
O	47.86	61.47		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME A88AP101R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

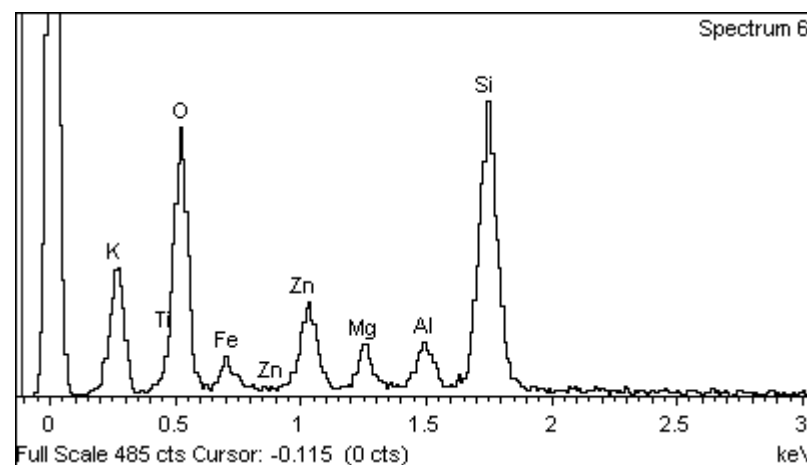
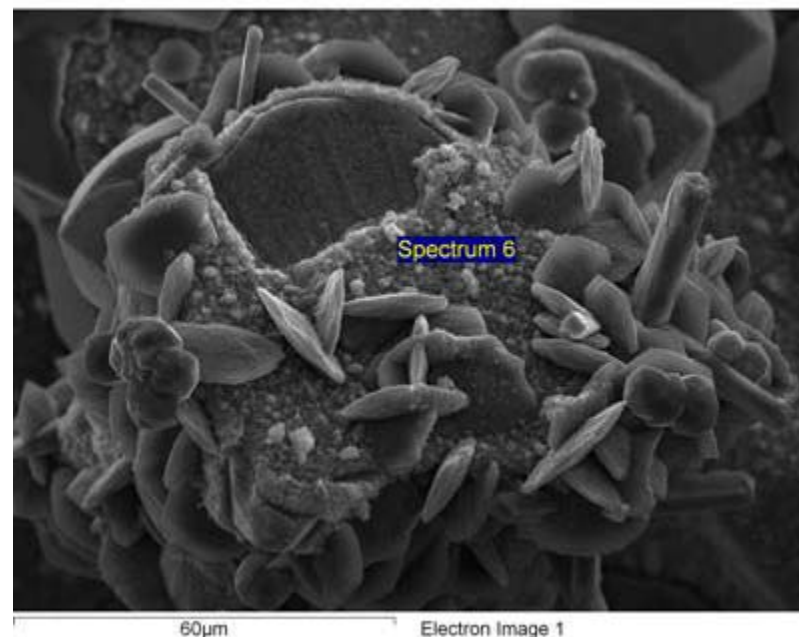
K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Ti Ti 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Mg K	3.53	3.54	5.85	MgO
Al K	3.07	2.78	5.81	Al ₂ O ₃
Si K	20.43	17.77	43.70	SiO ₂
K K	2.69	1.68	3.24	K ₂ O
Ti K	4.20	2.14	7.00	TiO ₂
Fe K	12.83	5.61	18.35	Fe ₂ O ₃
Zn L	12.91	4.82	16.06	ZnO
O	40.35	61.64		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME A88AP101R1.

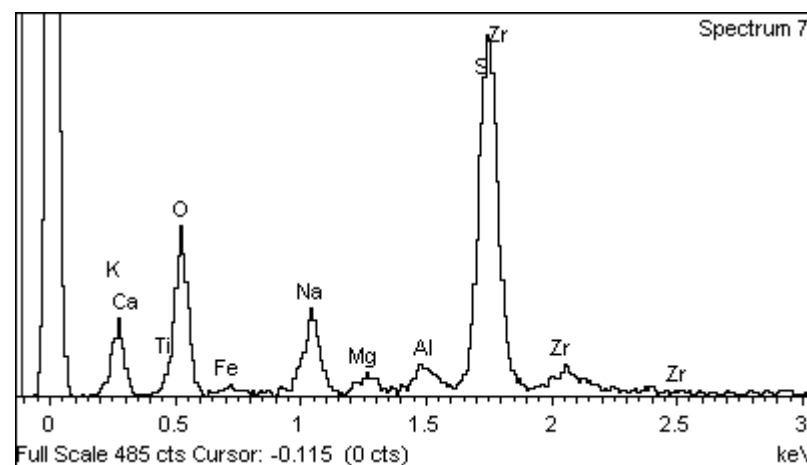
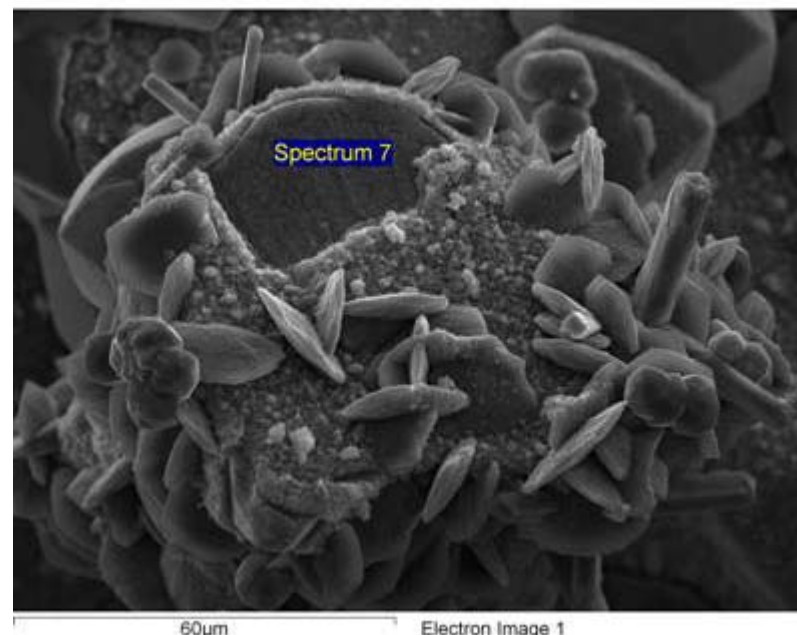
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

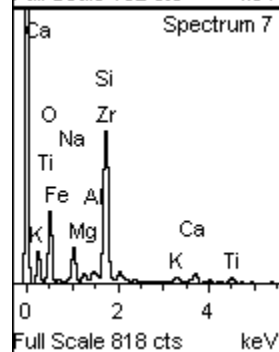
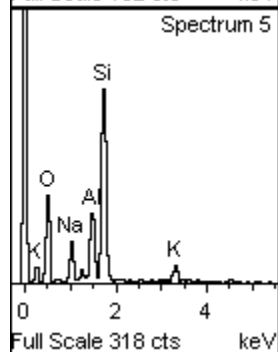
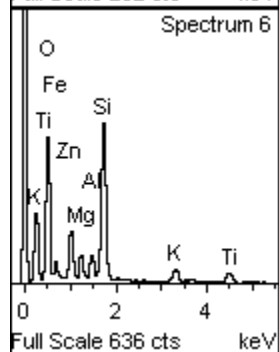
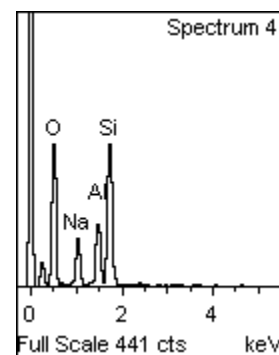
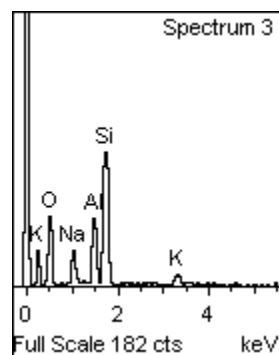
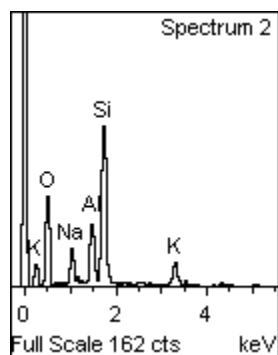
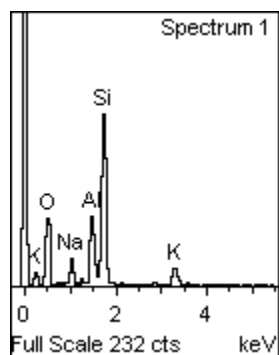
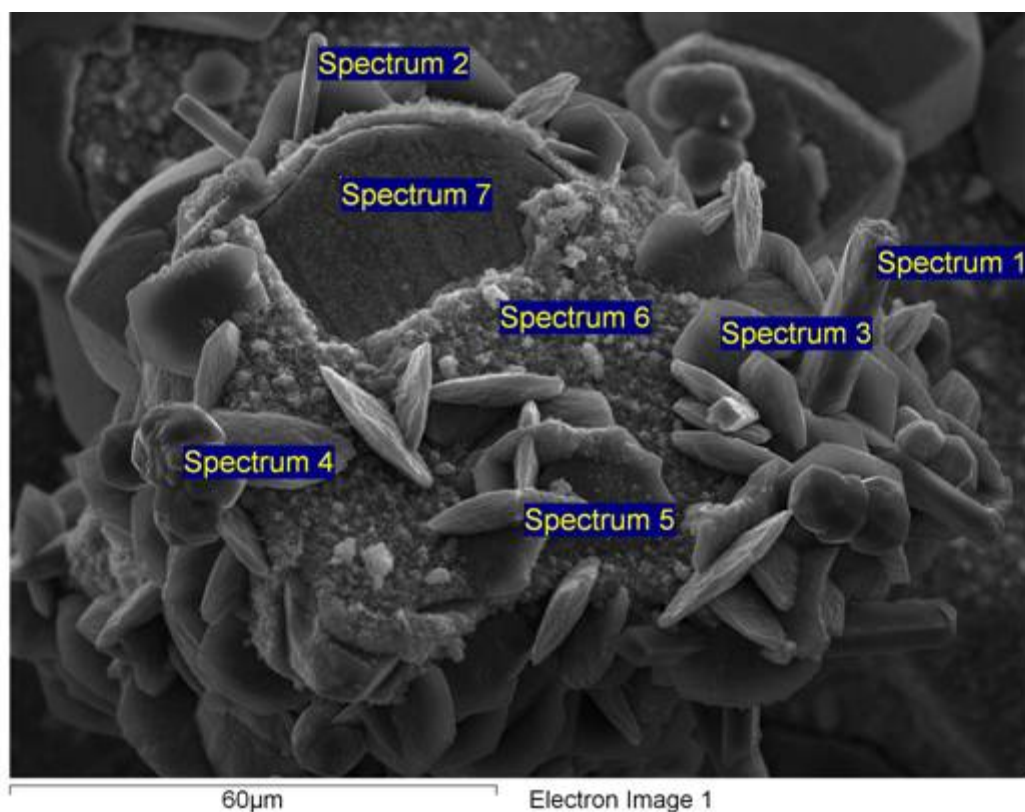
Element	Weight%	Atomic%	Compd%	Formula
Na K	7.01	6.79	9.45	Na ₂ O
Mg K	1.27	1.17	2.11	MgO
Al K	1.58	1.30	2.98	Al ₂ O ₃
Si K	27.74	21.99	59.35	SiO ₂
K K	1.63	0.93	1.97	K ₂ O
Ca K	3.16	1.75	4.41	CaO
Ti K	2.57	1.19	4.28	TiO ₂
Fe K	6.29	2.51	9.00	Fe ₂ O ₃
Zr L	4.77	1.16	6.45	ZrO ₂
O	43.97	61.20		
Totals	100.00			



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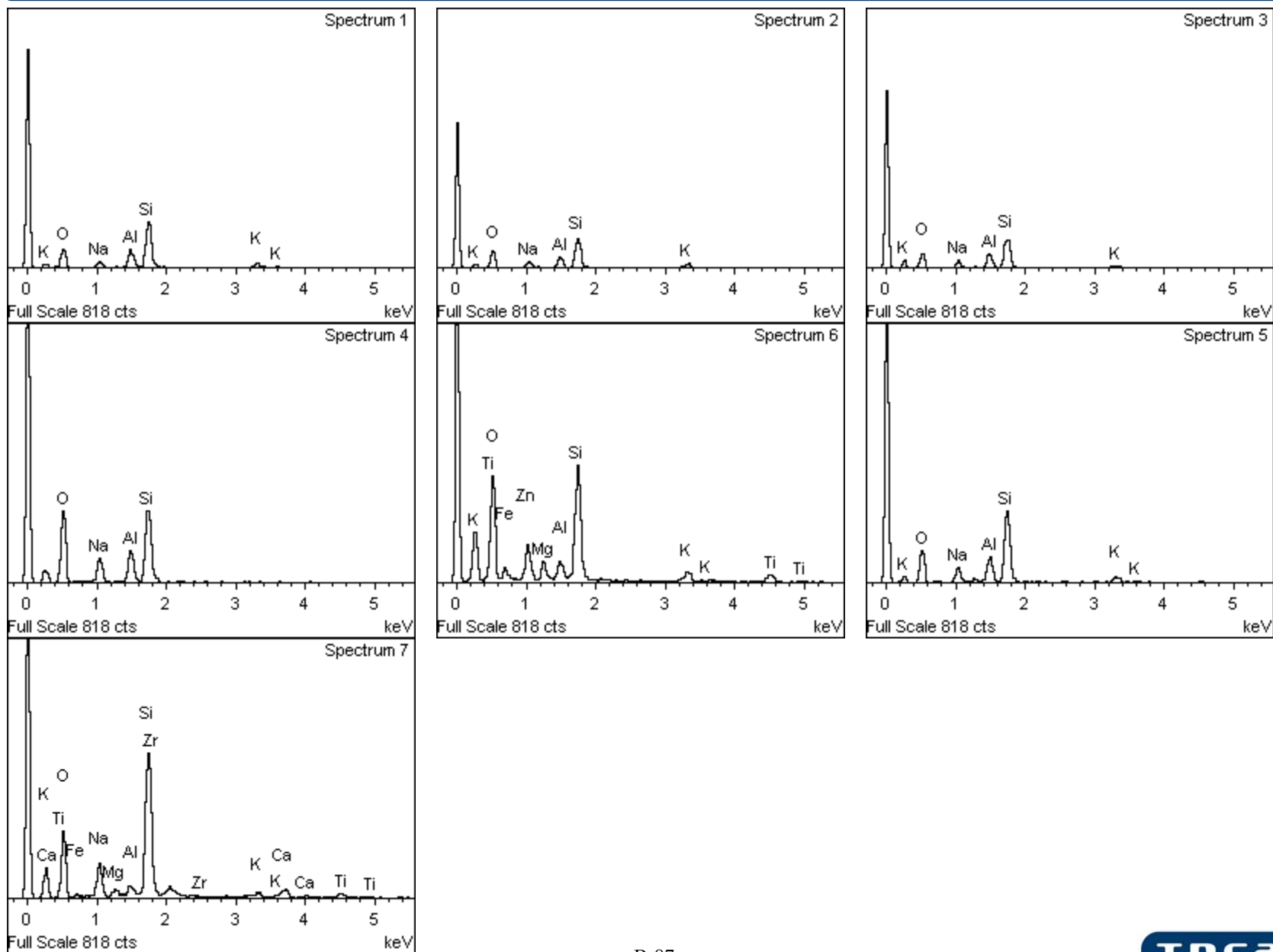
PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME A88AP101R1.



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME A88AP101R1.



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME A88AP101R1.

Project: PCT SURFACE CORROSION 1
Owner: cavinm
Site: Site of Interest 1

Sample: A88 AP101 R1
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ca	Ti	Fe	Zn	Zr	O	Total
Spectrum 1	Yes	4.50		9.32	32.39	5.83						47.96	100.00
Spectrum 2	Yes	5.86		9.61	30.84	6.61						47.08	100.00
Spectrum 3	Yes	6.96		11.32	29.80	4.54						47.37	100.00
Spectrum 4	Yes	10.00		11.18	30.57							48.25	100.00
Spectrum 5	Yes	6.35		9.29	32.00	4.50						47.86	100.00
Spectrum 6	Yes		3.53	3.07	20.43	2.69		4.20	12.83	12.91		40.35	100.00
Spectrum 7	Yes	7.01	1.27	1.58	27.74	1.63	3.16	2.57	6.29		4.77	43.97	100.00
Max.		10.00	3.53	11.32	32.39	6.61	3.16	4.20	12.83	12.91	4.77	48.25	
Min.		4.50	1.27	1.58	20.43	1.63	3.16	2.57	6.29	12.91	4.77	40.35	

All results in weight%

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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME A88AP101R1.

Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

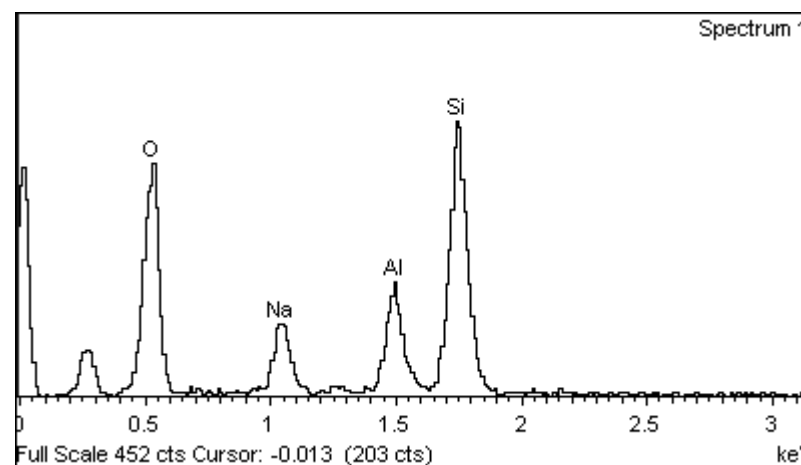
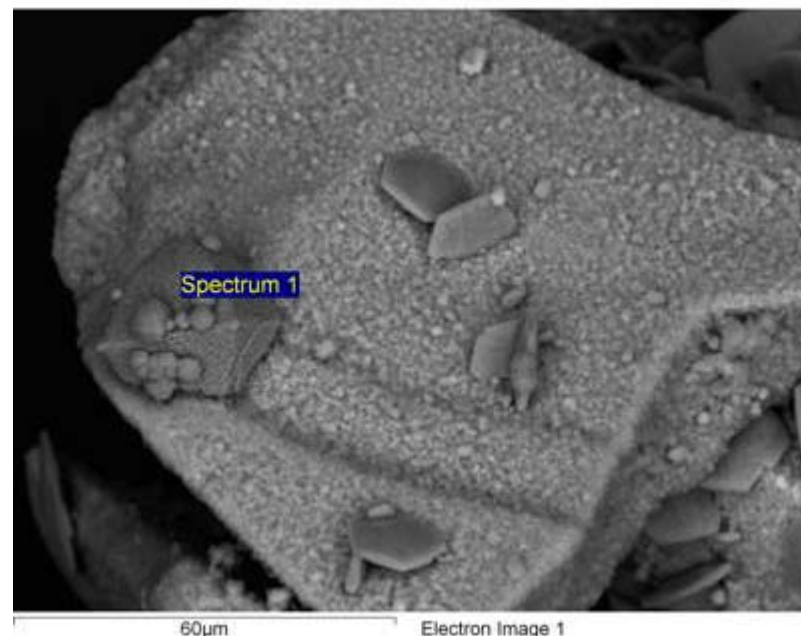
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	9.11	7.99	12.28	Na ₂ O
Al K	10.00	7.48	18.89	Al ₂ O ₃
Si K	32.18	23.11	68.83	SiO ₂
O	48.72	61.43		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME A88AP101R1.

Spectrum processing :
Peak possibly omitted : 3.305 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

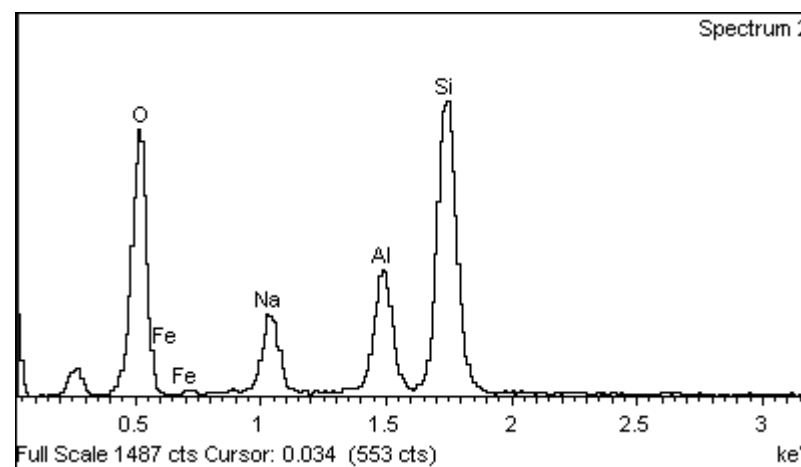
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.64	7.68	11.65	Na ₂ O
Al K	10.24	7.75	19.34	Al ₂ O ₃
Si K	30.65	22.30	65.58	SiO ₂
Fe K	2.40	0.88	3.43	Fe ₂ O ₃
O	48.07	61.39		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME A88AP101R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

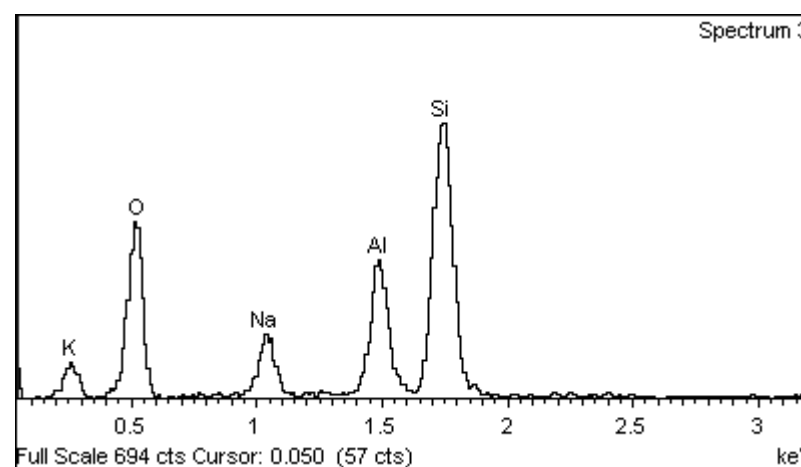
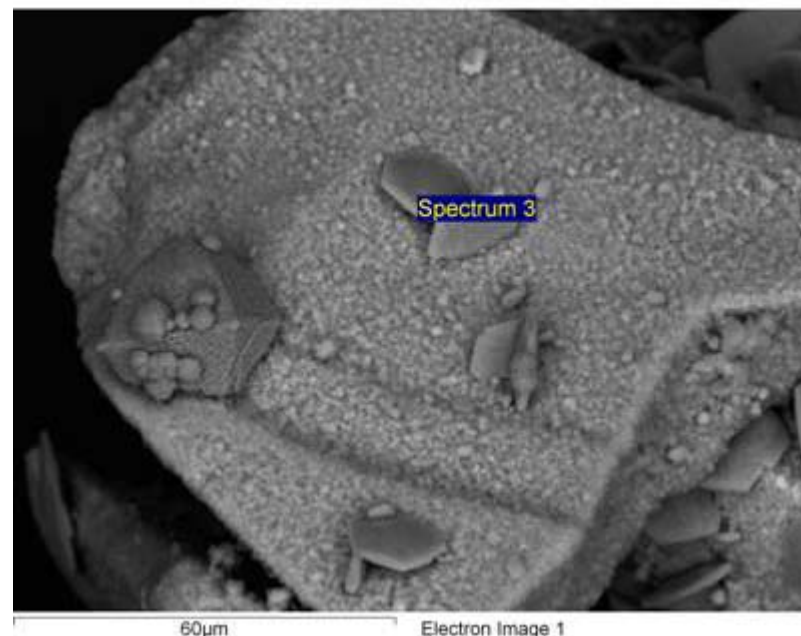
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.87	6.10	9.27	Na ₂ O
Al K	11.69	8.84	22.08	Al ₂ O ₃
Si K	30.56	22.20	65.37	SiO ₂
K K	2.73	1.42	3.29	K ₂ O
O	48.16	61.43		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME A88AP101R1.

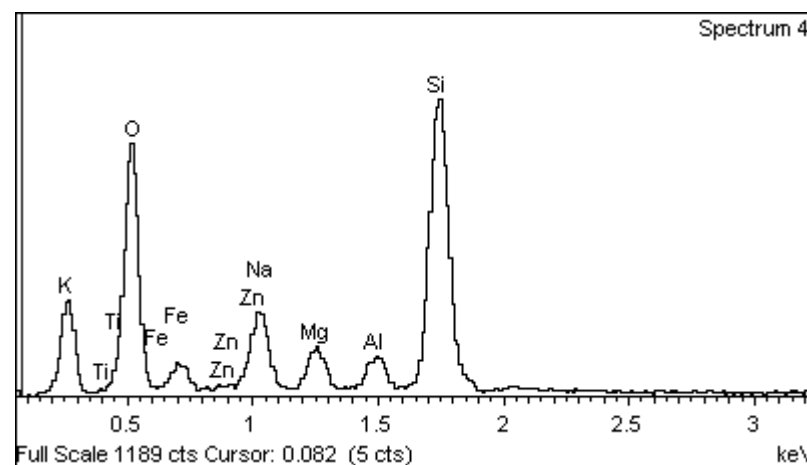
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.41	4.51	5.95	Na ₂ O
Mg K	3.50	3.39	5.81	MgO
Al K	2.28	1.98	4.30	Al ₂ O ₃
Si K	21.98	18.39	47.02	SiO ₂
K K	3.64	2.19	4.38	K ₂ O
Ti K	2.39	1.17	3.99	TiO ₂
Fe K	13.34	5.62	19.08	Fe ₂ O ₃
Zn L	7.62	2.74	9.48	ZnO
O	40.84	60.01		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME A88AP101R1.

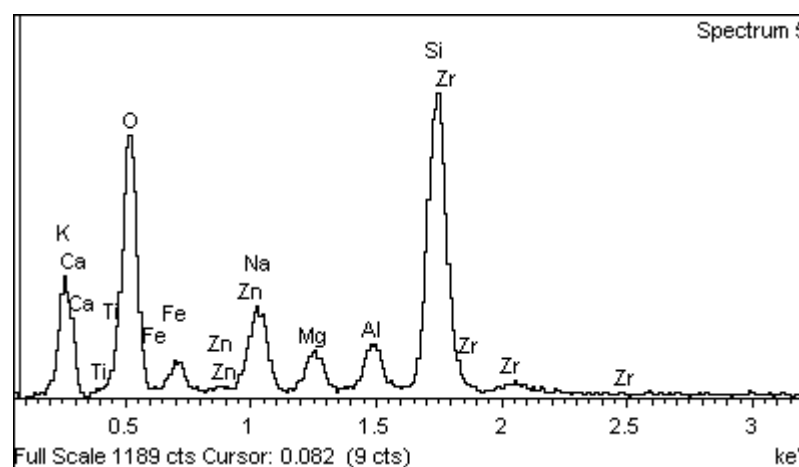
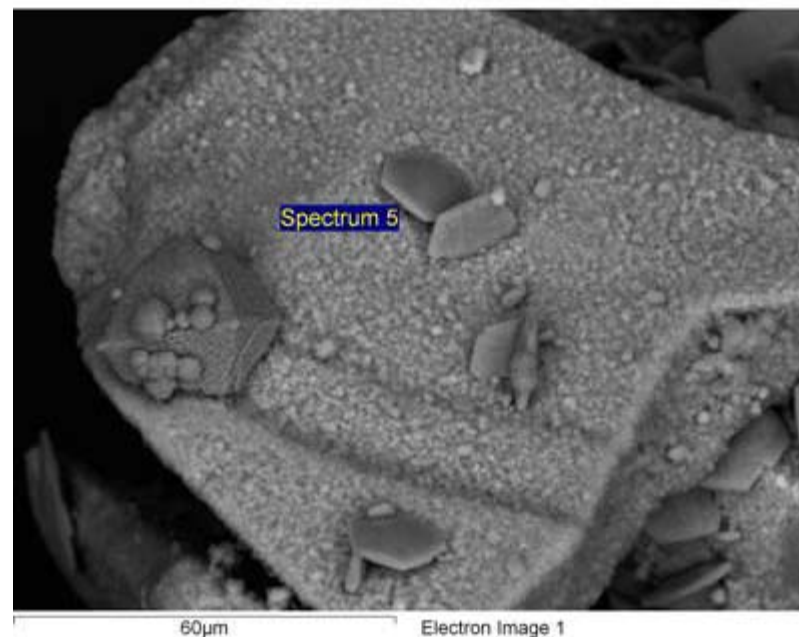
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zn Zn 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

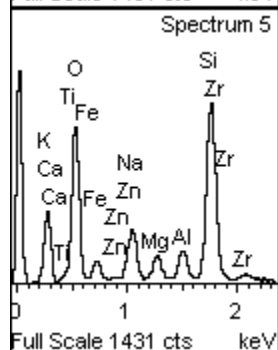
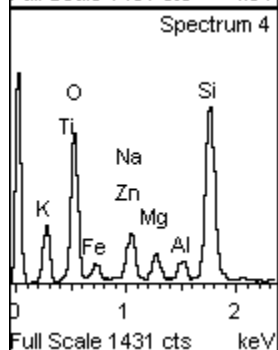
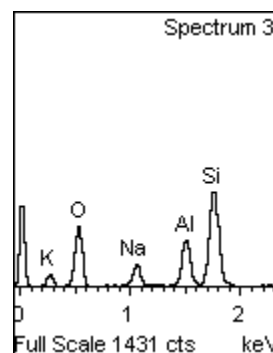
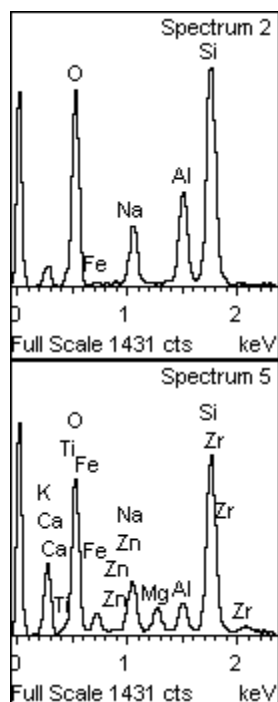
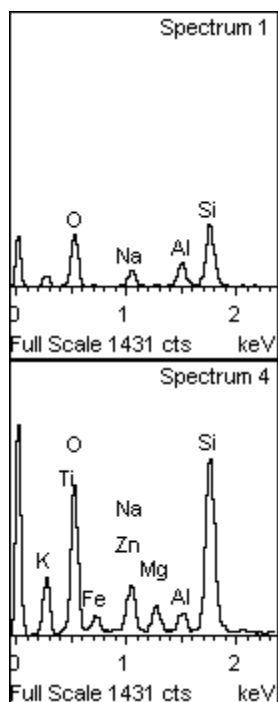
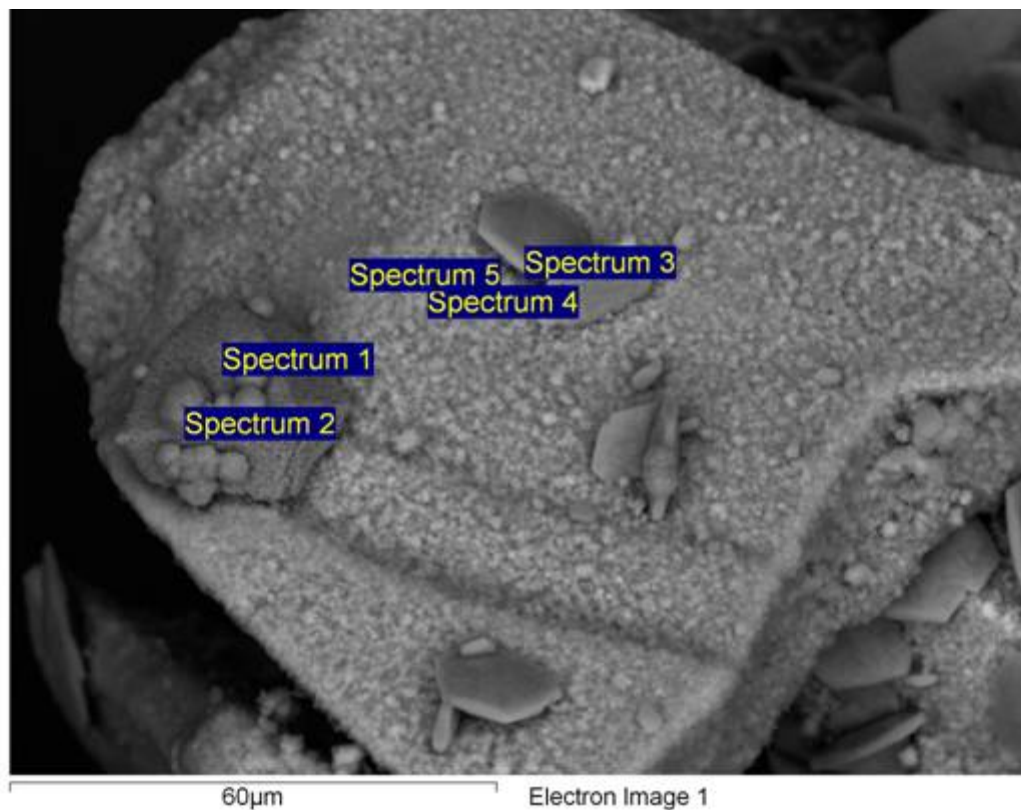
Element	Weight%	Atomic%	Compd%	Formula
Na K	5.15	5.26	6.94	Na ₂ O
Mg K	3.09	2.98	5.13	MgO
Al K	3.08	2.68	5.82	Al ₂ O ₃
Si K	21.50	17.96	46.00	SiO ₂
K K	2.95	1.77	3.56	K ₂ O
Ca K	0.69	0.41	0.97	CaO
Ti K	2.98	1.46	4.97	TiO ₂
Fe K	10.70	4.50	15.30	Fe ₂ O ₃
Zn L	6.88	2.47	8.56	ZnO
Zr L	2.04	0.52	2.75	ZrO ₂
O	40.93	60.00		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME A88AP101R1.

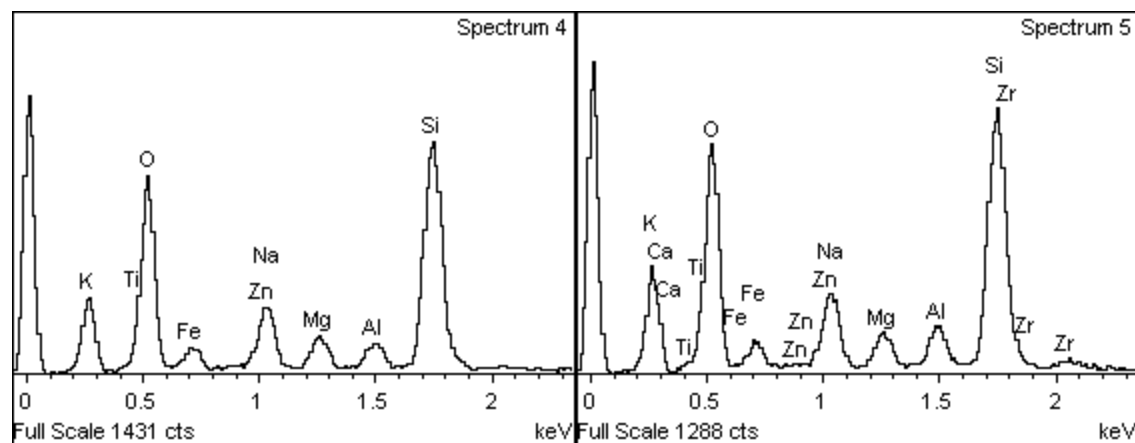
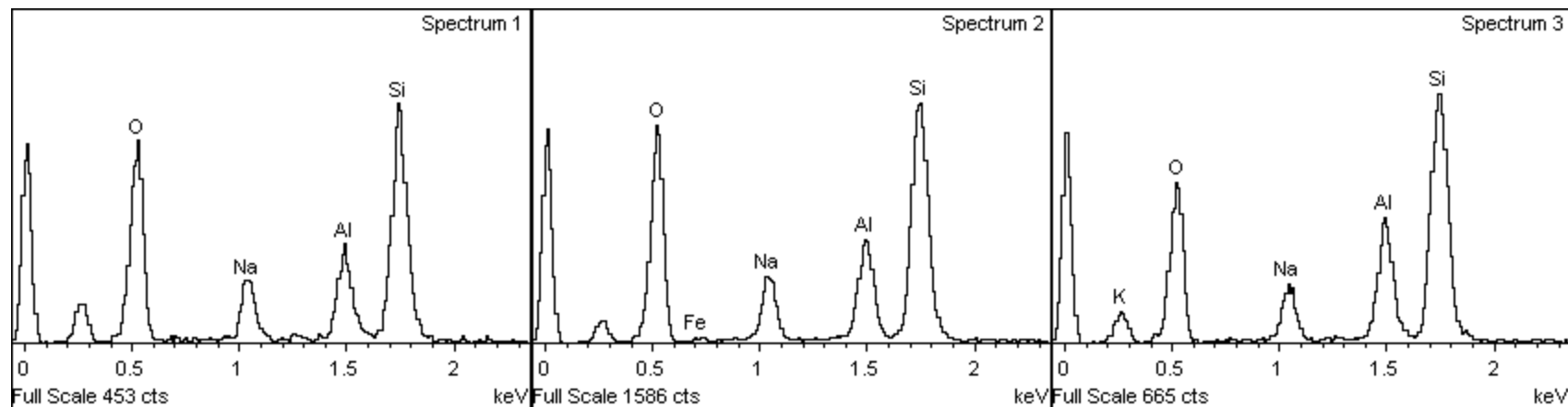


Inca

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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME A88AP101R1.



PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME A88AP101R1.

Project: PCT SURFACE CORROSION 1
Owner: cavinm
Site: Site of Interest 2

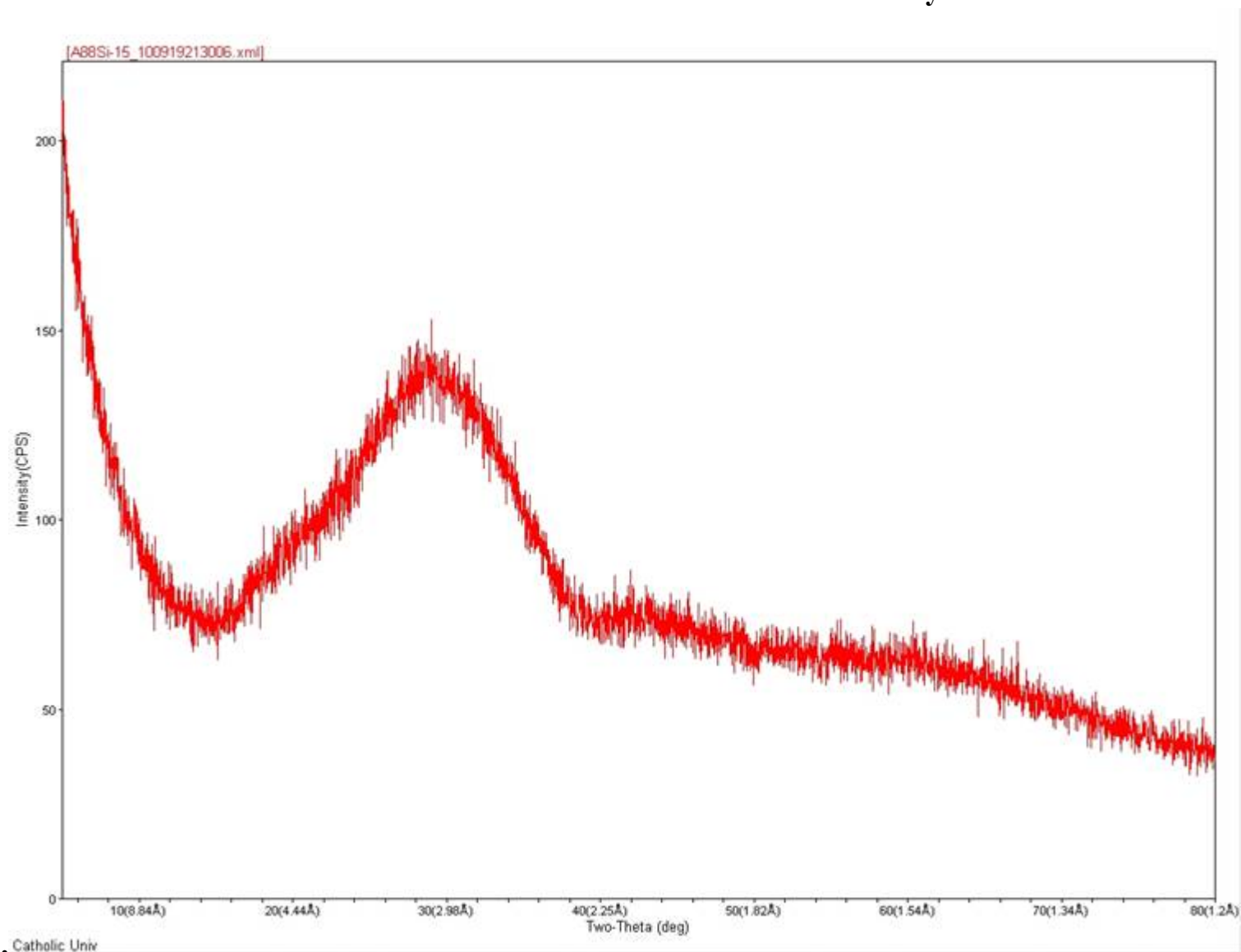
Sample: A88 AP101 R1
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ca	Ti	Fe	Zn	Zr	O	Total
Spectrum 1	Yes	9.11		10.00	32.18							48.72	100.00
Spectrum 2	Yes	8.64		10.24	30.65				2.40			48.07	100.00
Spectrum 3	Yes	6.87		11.69	30.56	2.73						48.16	100.00
Spectrum 4	Yes	4.41	3.50	2.28	21.98	3.64		2.39	13.34	7.62		40.84	100.00
Spectrum 5	Yes	5.15	3.09	3.08	21.50	2.95	0.69	2.98	10.70	6.88	2.04	40.93	100.00
Max.		9.11	3.50	11.69	32.18	3.64	0.69	2.98	13.34	7.62	2.04	48.72	
Min.		4.41	3.09	2.28	21.50	2.73	0.69	2.39	2.40	6.88	2.04	40.84	

All results in weight%

**XRD powder patterns (raw data) and SEM/EDS analysis of glass A88Si-15,
collected from 90°C PCT-B vessel after 3240 days**



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PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME A88Si-15.

Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

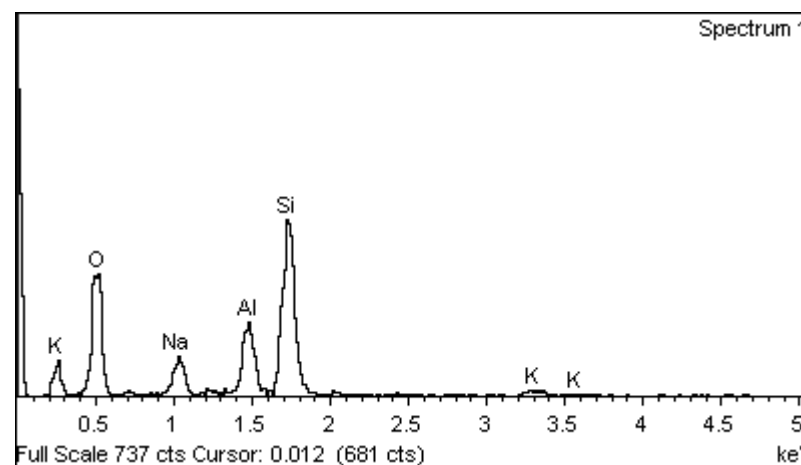
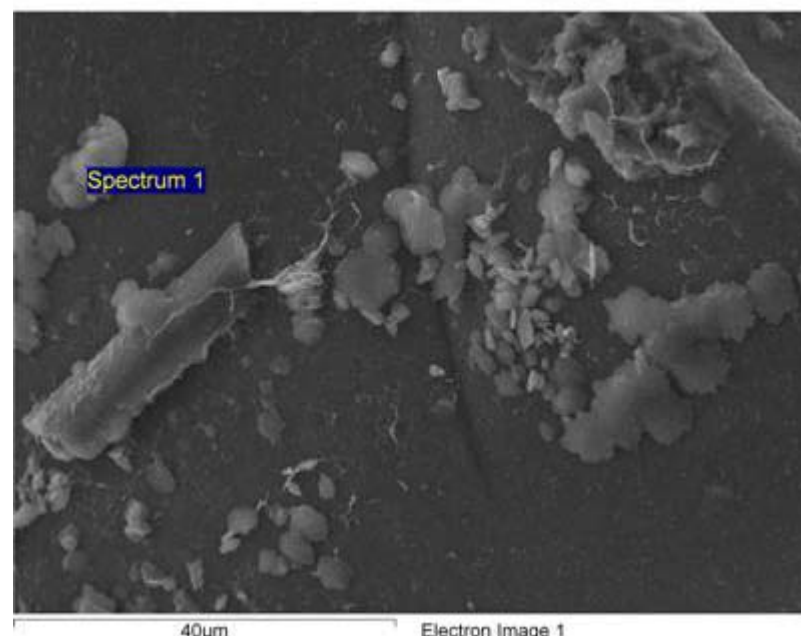
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.35	6.50	9.91	Na ₂ O
Al K	10.69	8.05	20.19	Al ₂ O ₃
Si K	31.63	22.89	67.67	SiO ₂
K K	1.85	0.96	2.22	K ₂ O
O	48.48	61.59		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME A88Si-15.

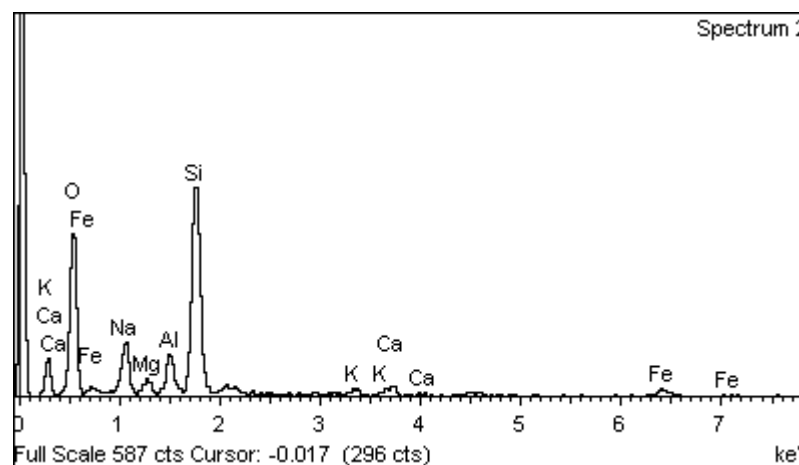
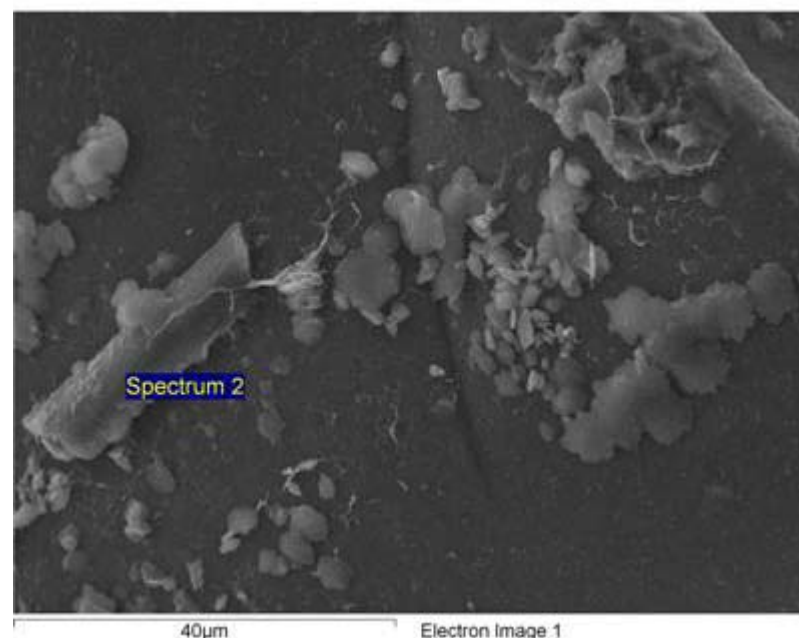
Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
 Mg MgO 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM
 K MAD-10 Feldspar 1-Jun-1999 12:00 AM
 Ca Wollastonite 1-Jun-1999 12:00 AM
 Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.86	7.23	10.59	Na ₂ O
Mg K	1.89	1.65	3.14	MgO
Al K	4.63	3.63	8.76	Al ₂ O ₃
Si K	29.79	22.44	63.73	SiO ₂
K K	1.66	0.90	2.00	K ₂ O
Ca K	2.47	1.30	3.46	CaO
Fe K	5.82	2.21	8.33	Fe ₂ O ₃
O	45.87	60.65		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME A88Si-15.

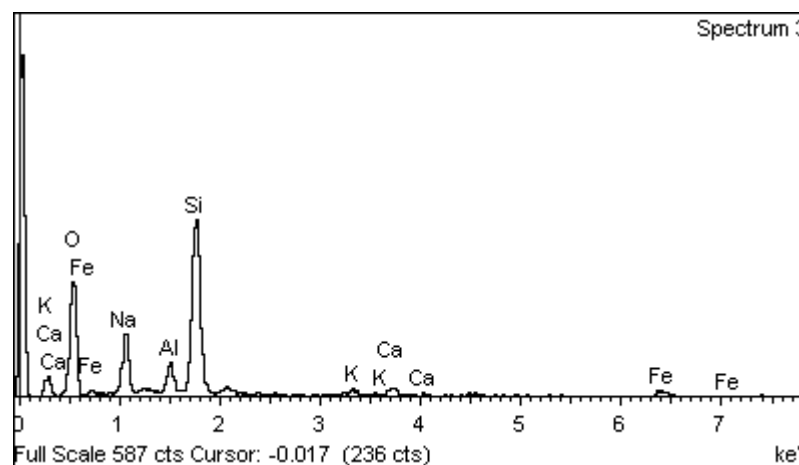
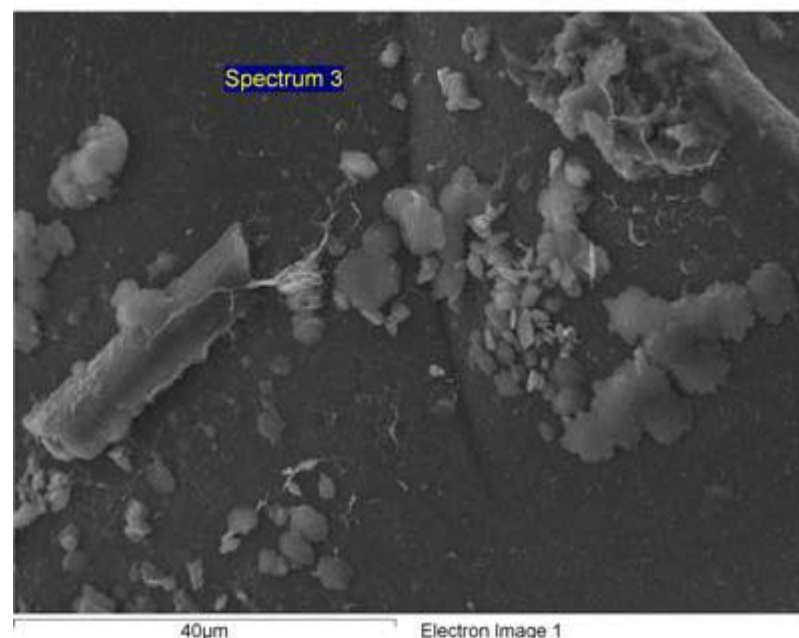
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

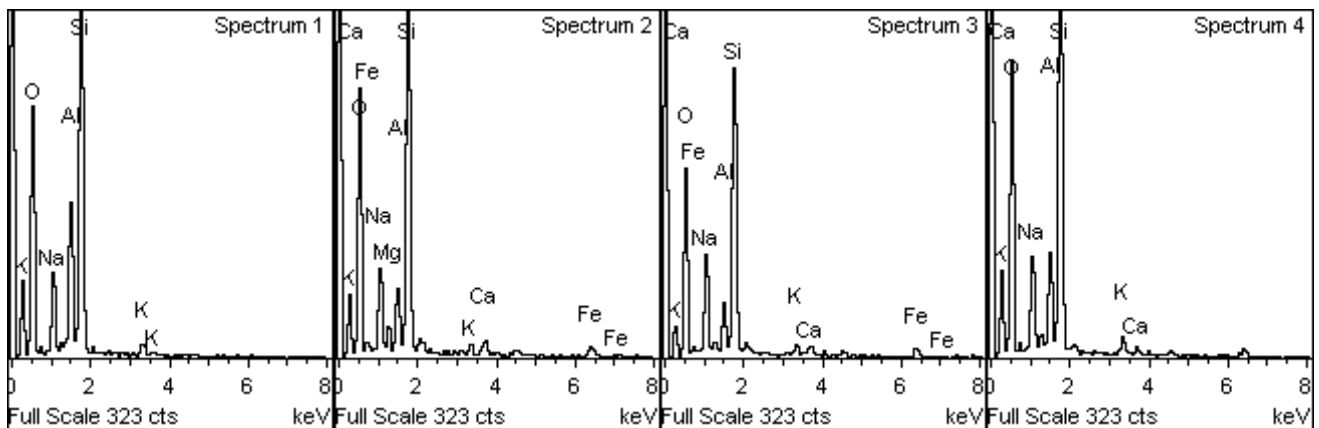
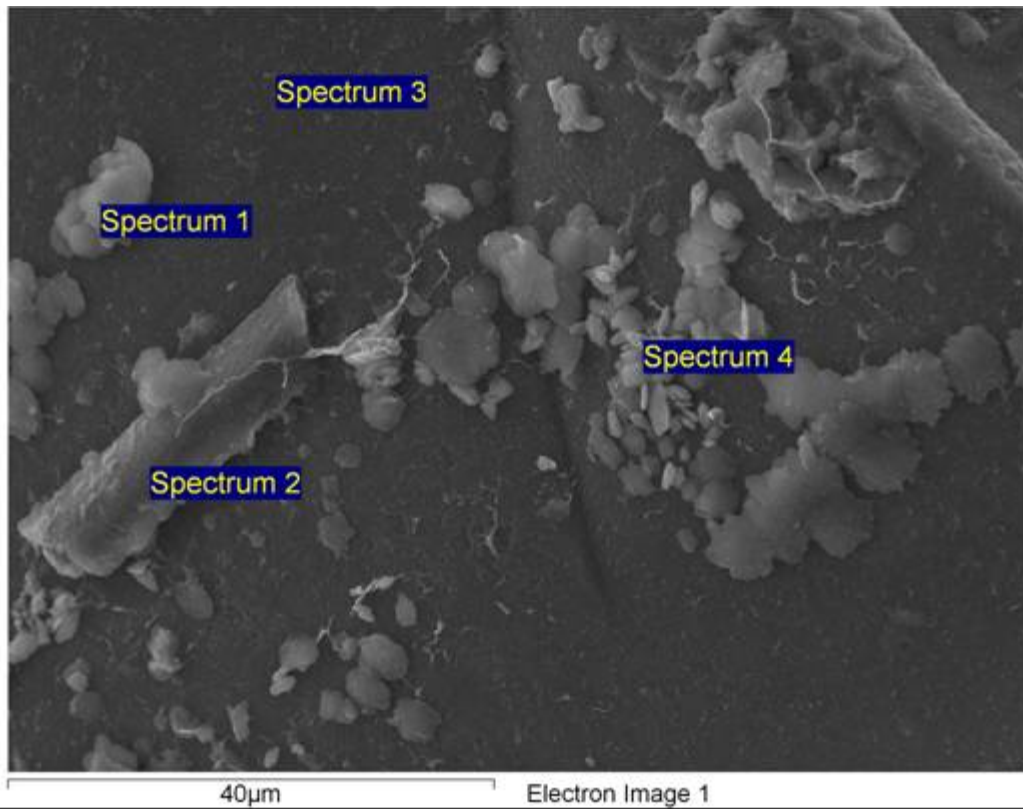
Element	Weight%	Atomic%	Compd%	Formula
Na K	11.27	10.45	15.19	Na ₂ O
Al K	4.14	3.27	7.82	Al ₂ O ₃
Si K	28.86	21.90	61.74	SiO ₂
K K	1.62	0.88	1.95	K ₂ O
Ca K	2.00	1.06	2.79	CaO
Fe K	7.35	2.80	10.51	Fe ₂ O ₃
O	44.77	59.64		
Totals	100.00			



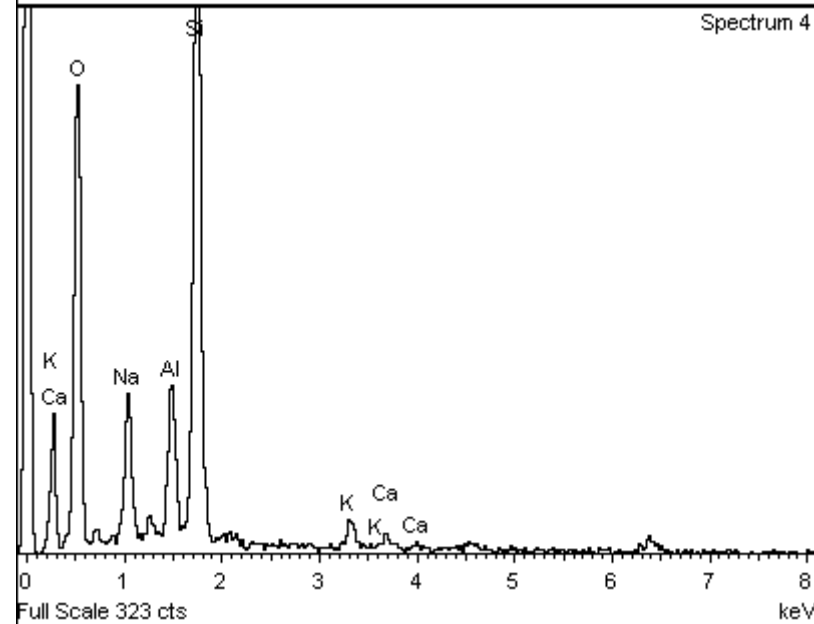
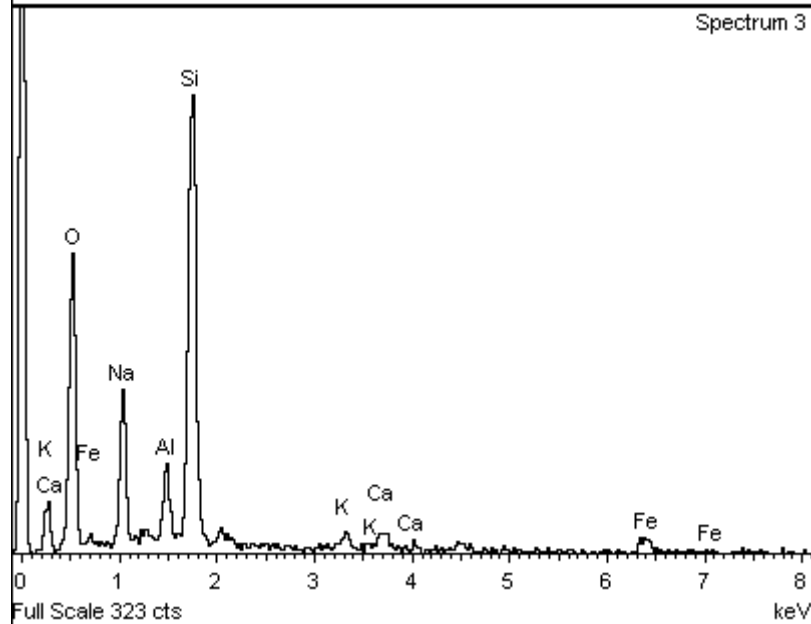
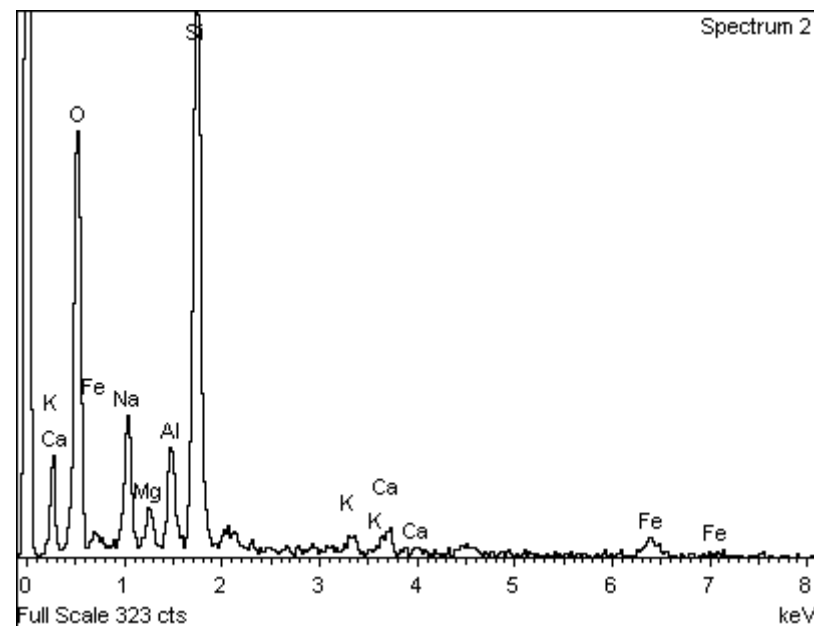
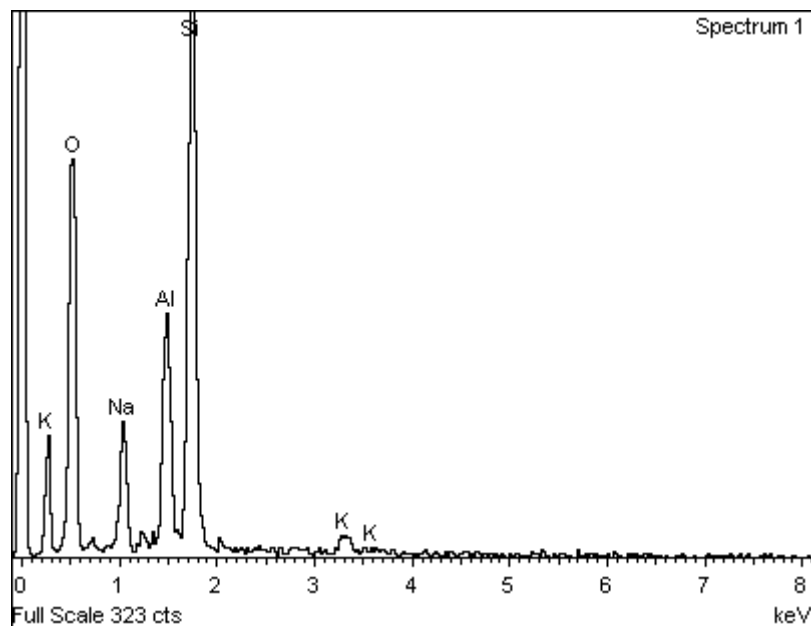
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PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME A88Si-15.



PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME A88Si-15.



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PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME A88Si-15.

Project: PCT SURFACE CORROSION 2
Owner: cavinm
Site: Site of Interest 1

Sample: A88 Si-15
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ca	Fe	O	Total
Spectrum 1	Yes	7.35		10.69	31.63	1.85			48.48	100.00
Spectrum 2	Yes	7.86	1.89	4.63	29.79	1.66	2.47	5.82	45.87	100.00
Spectrum 3	Yes	11.27		4.14	28.86	1.62	2.00	7.35	44.77	100.00
Spectrum 4	Yes	8.00		7.21	32.81	2.67	1.58		47.74	100.00
Max.		11.27	1.89	10.69	32.81	2.67	2.47	7.35	48.48	
Min.		7.35	1.89	4.14	28.86	1.62	1.58	5.82	44.77	

All results in weight%

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PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME A88Si-15.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

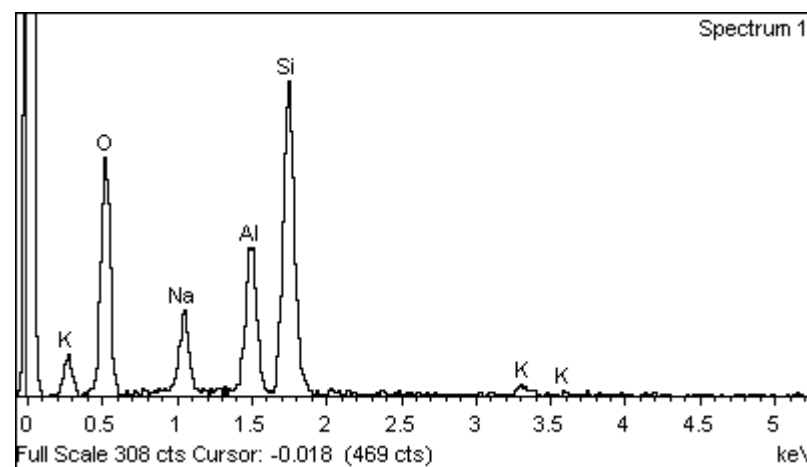
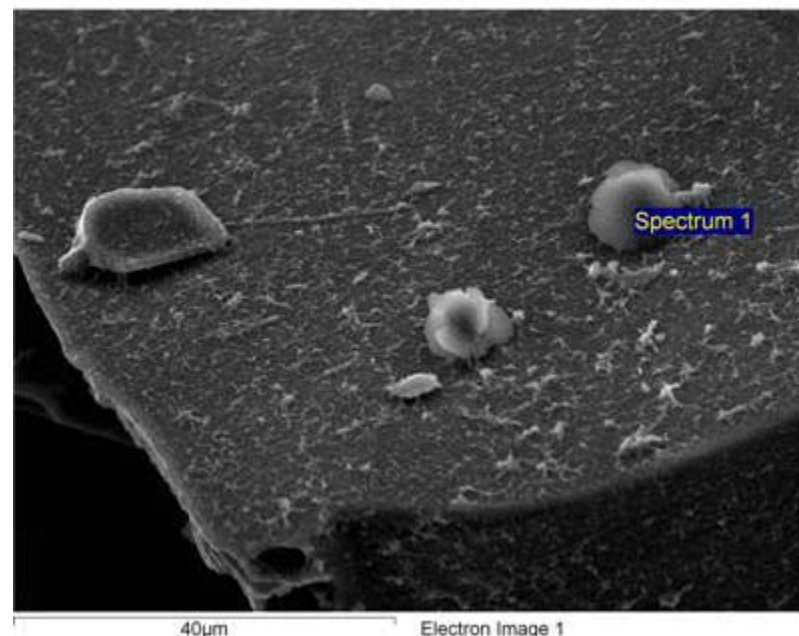
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.67	6.78	10.34	Na ₂ O
Al K	12.38	9.33	23.39	Al ₂ O ₃
Si K	30.04	21.74	64.27	SiO ₂
K K	1.66	0.86	2.00	K ₂ O
O	48.25	61.29		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME A88Si-15.

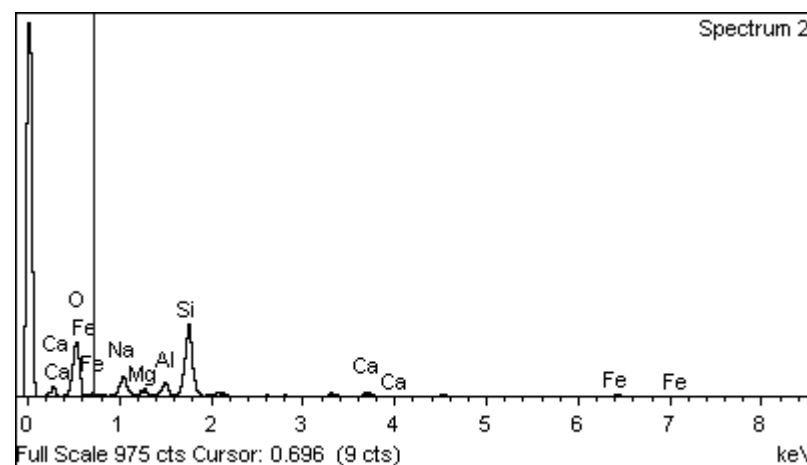
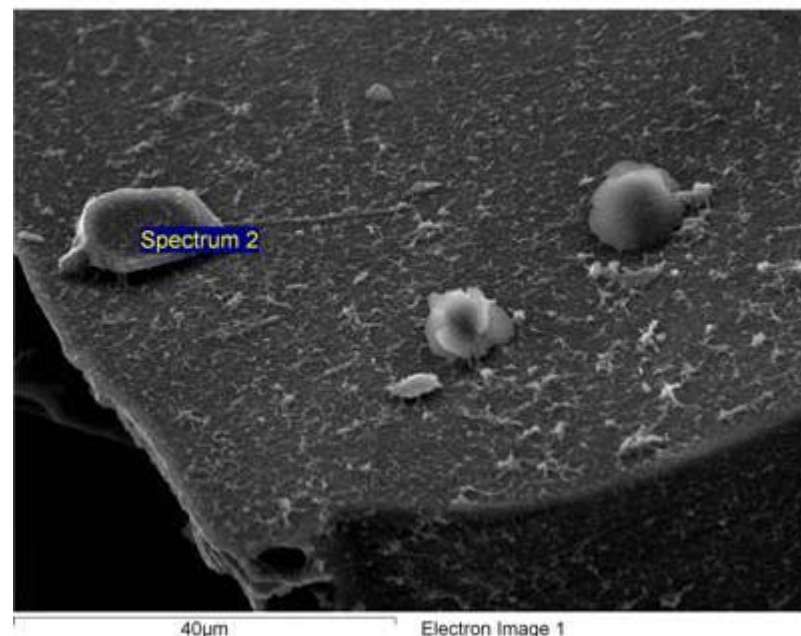
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.64	7.99	11.64	Na ₂ O
Mg K	2.36	2.06	3.91	MgO
Al K	4.38	3.45	8.27	Al ₂ O ₃
Si K	28.62	21.65	61.22	SiO ₂
Ca K	2.89	1.53	4.04	CaO
Fe K	7.63	2.90	10.91	Fe ₂ O ₃
O	45.49	60.42		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME A88Si-15.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

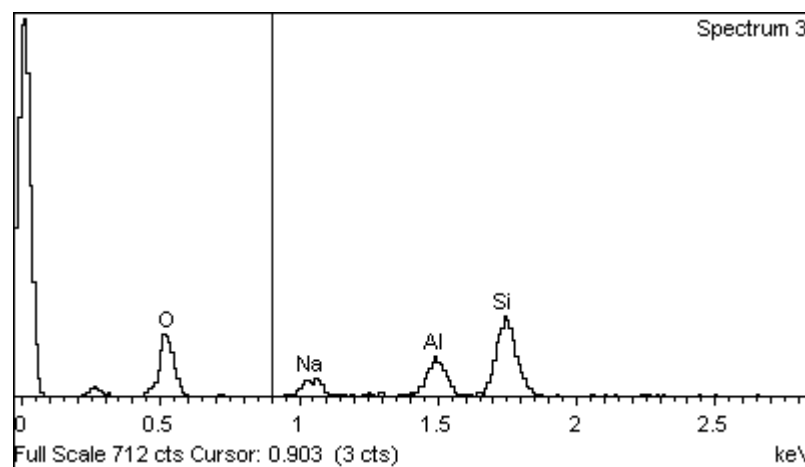
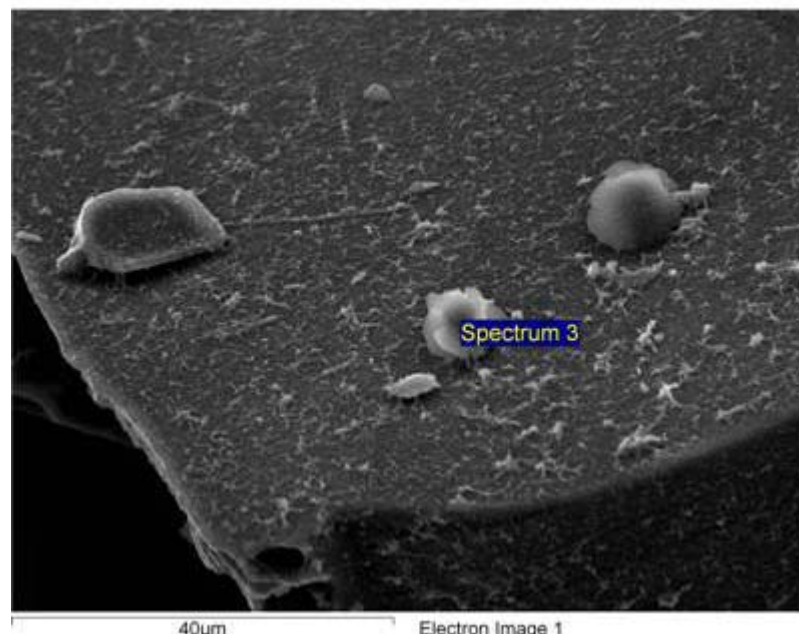
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.14	6.26	9.62	Na ₂ O
Al K	12.18	9.10	23.01	Al ₂ O ₃
Si K	31.49	22.62	67.37	SiO ₂
O	49.19	62.02		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME A88Si-15.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

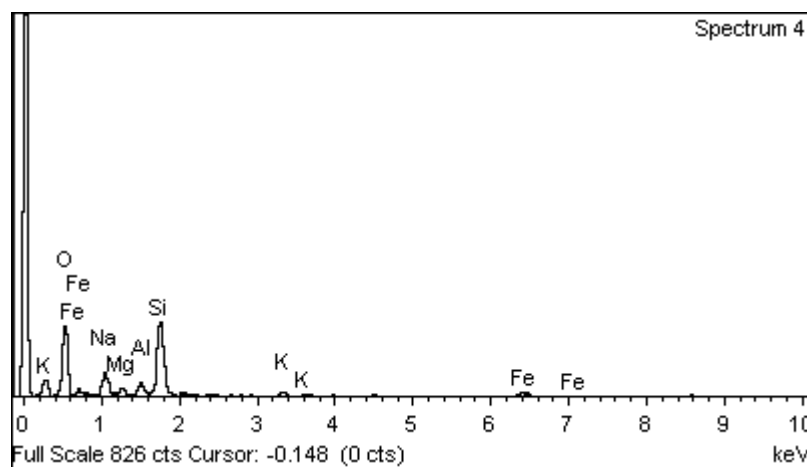
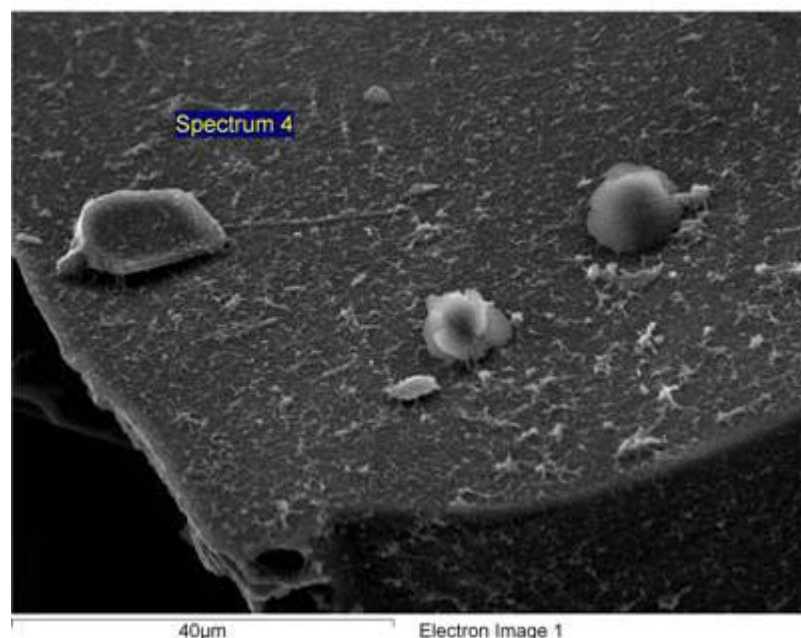
Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

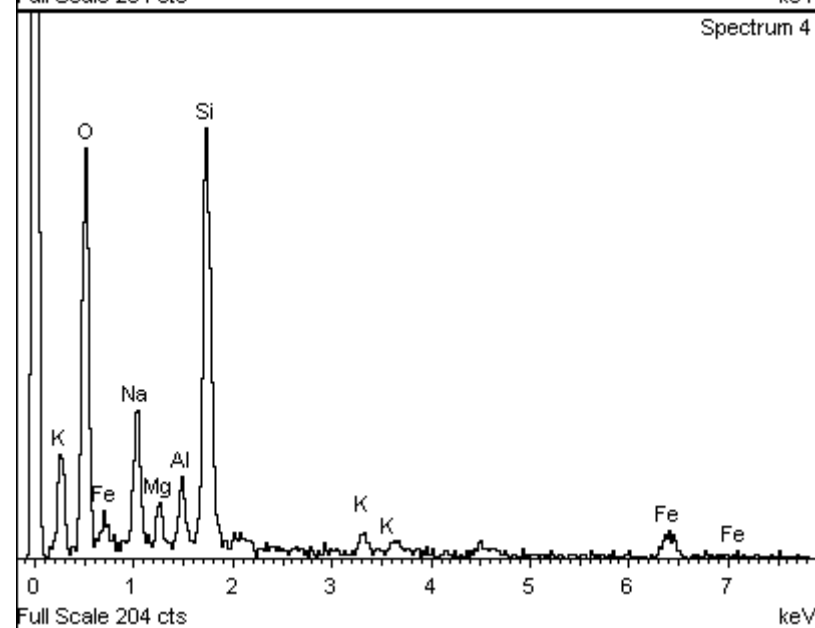
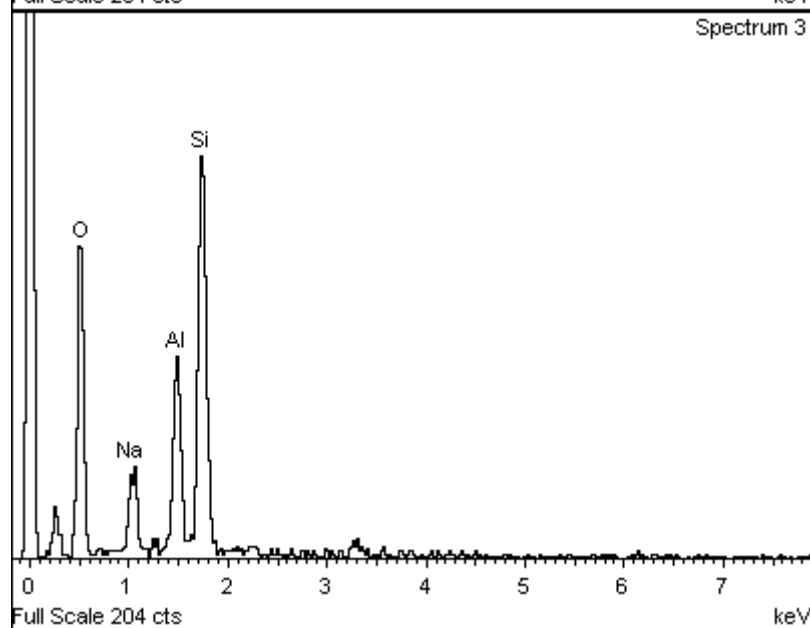
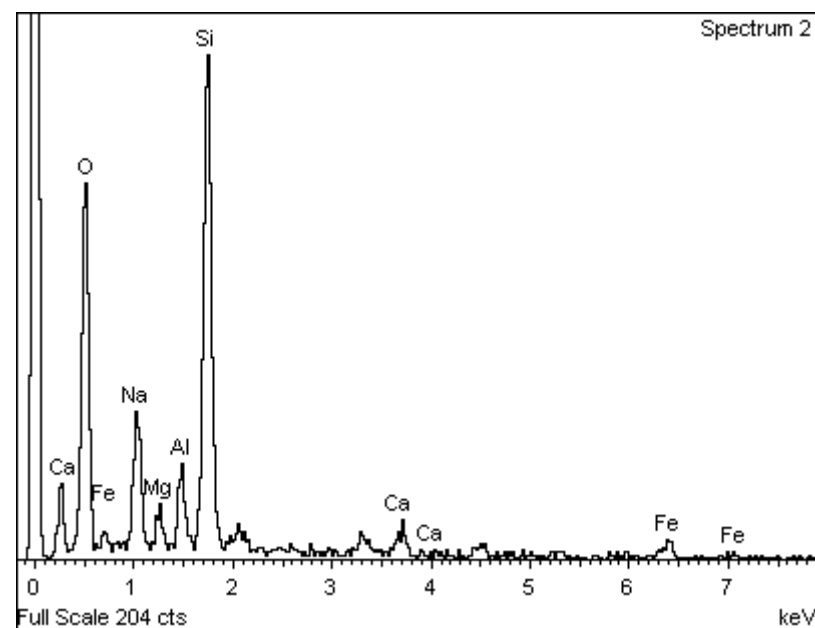
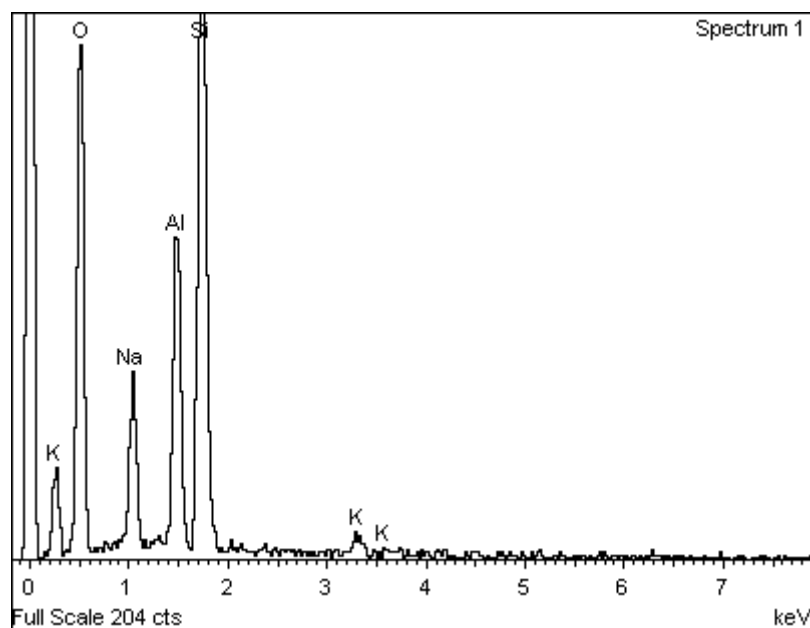
K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	9.17	8.61	12.36	Na ₂ O
Mg K	2.86	2.54	4.74	MgO
Al K	3.77	3.02	7.13	Al ₂ O ₃
Si K	27.01	20.76	57.79	SiO ₂
K K	2.56	1.42	3.09	K ₂ O
Fe K	10.42	4.03	14.90	Fe ₂ O ₃
O	44.21	59.64		
Totals	100.00			



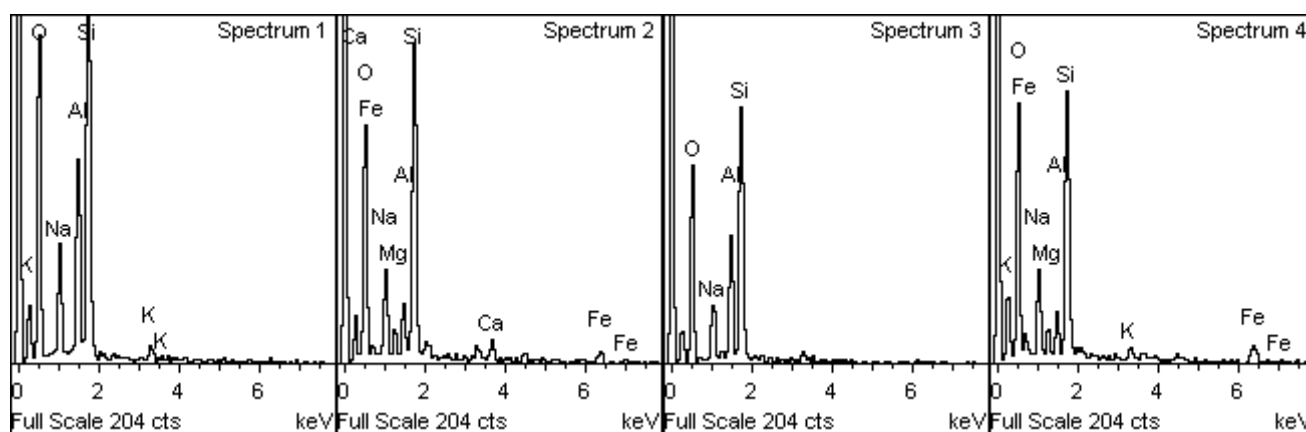
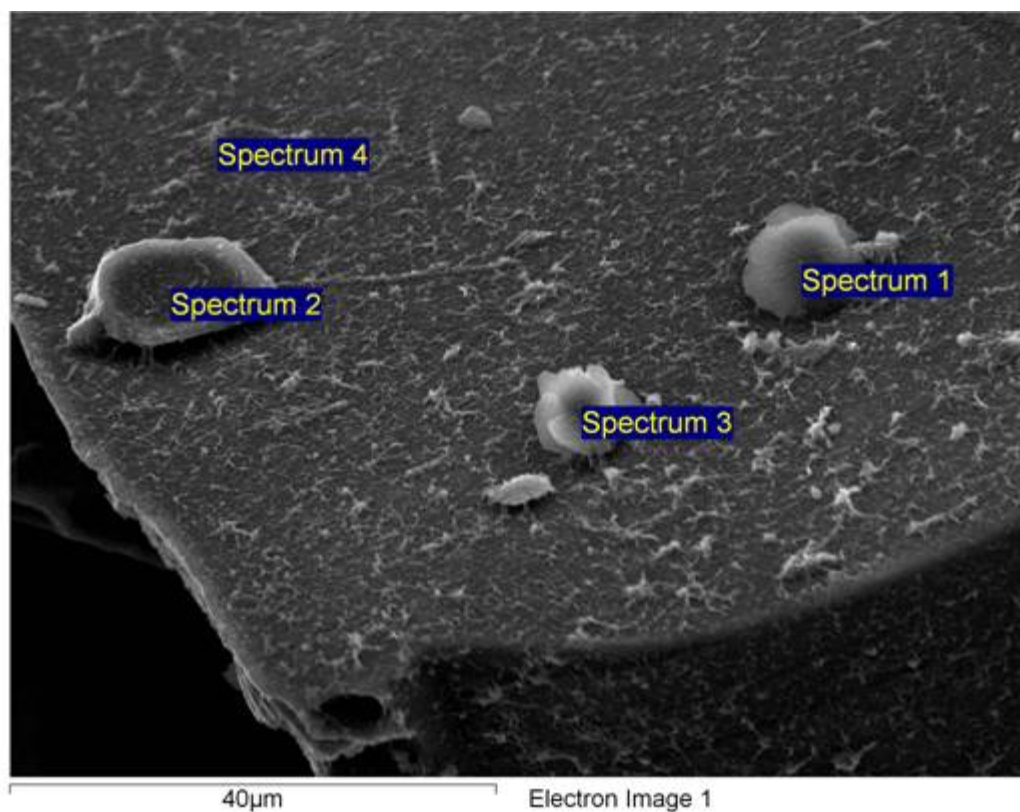
PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME A88Si-15.



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PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME A88Si-15.



PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME A88Si-15.

Project: PCT SURFACE CORROSION 2
Owner: cavinm
Site: Site of Interest 2

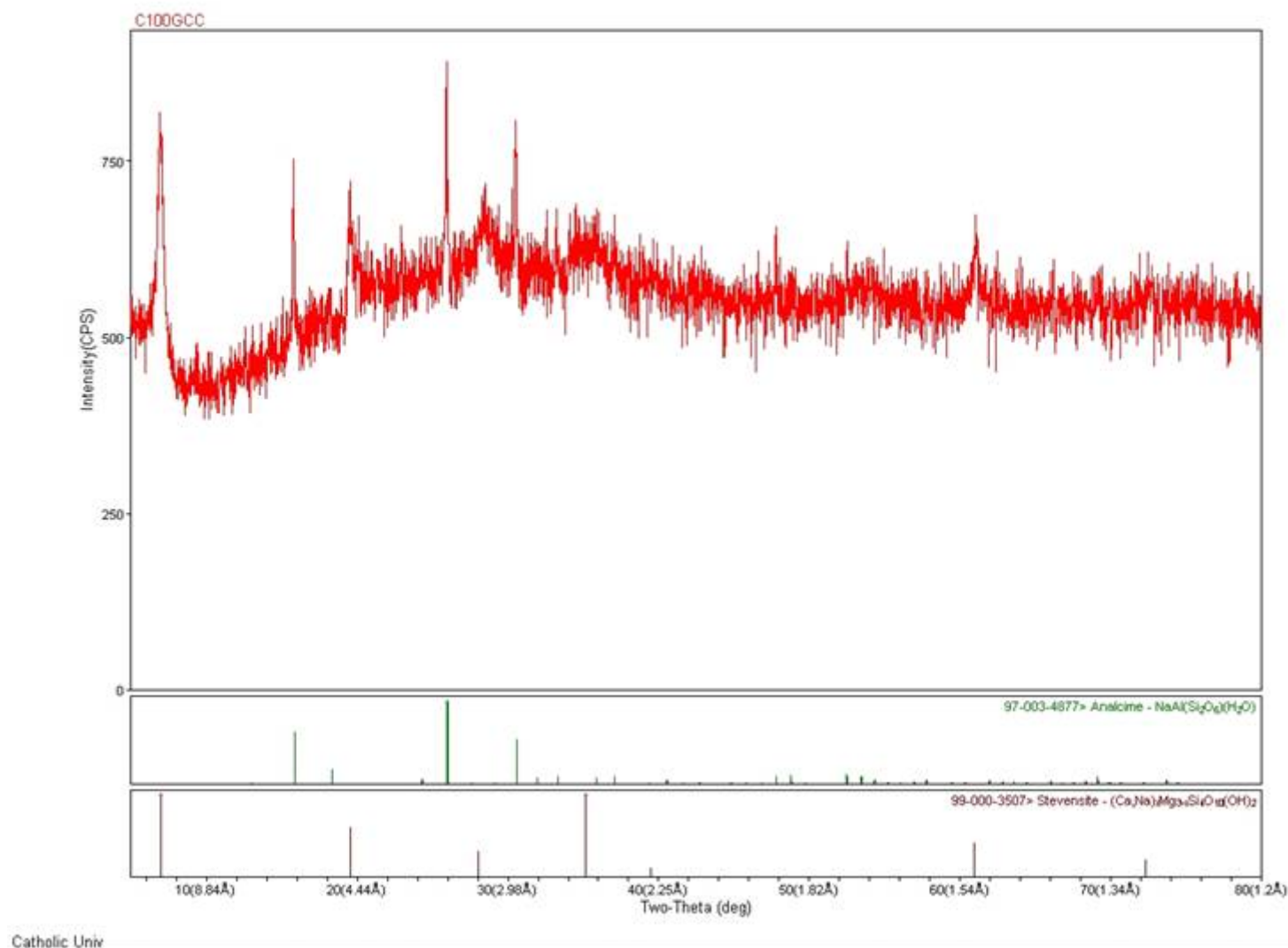
Sample: A88 Si-15
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ca	Fe	O	Total
Spectrum 1	Yes	7.67		12.38	30.04	1.66			48.25	100.00
Spectrum 2	Yes	8.64	2.36	4.38	28.62		2.89	7.63	45.49	100.00
Spectrum 3	Yes	7.14		12.18	31.49				49.19	100.00
Spectrum 4	Yes	9.17	2.86	3.77	27.01	2.56		10.42	44.21	100.00
Max.		9.17	2.86	12.38	31.49	2.56	2.89	10.42	49.19	
Min.		7.14	2.36	3.77	27.01	1.66	2.89	7.63	44.21	

All results in weight%

**XRD powder patterns (raw data and best match) and SEM/EDS analysis of glass C100GCC,
collected from 90°C PCT-B vessel after 3701 days**



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME C100GCC.

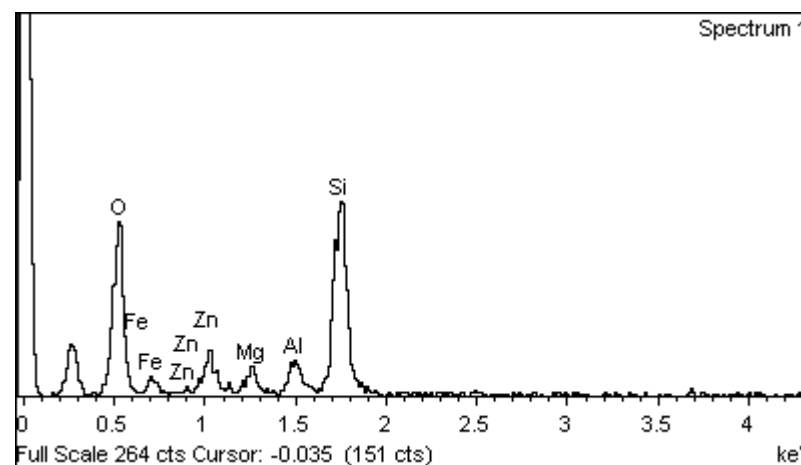
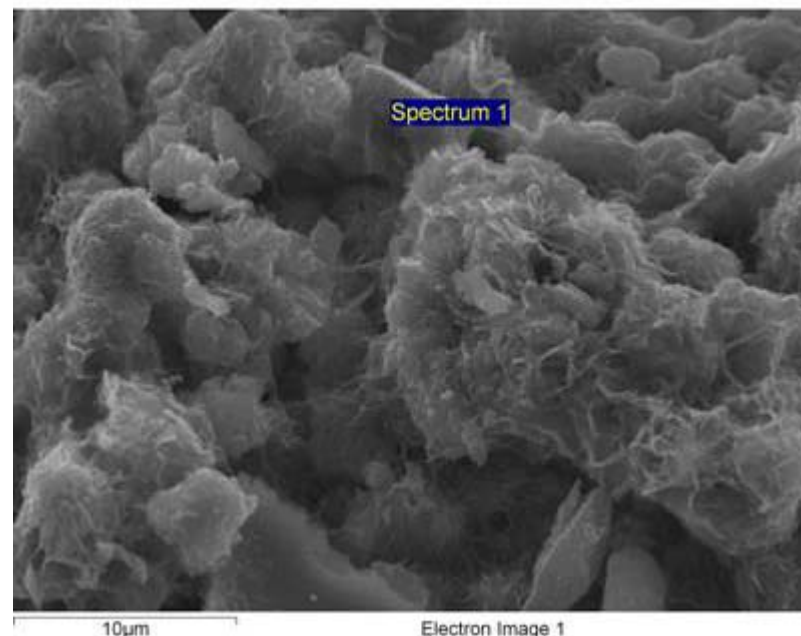
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Mg K	3.41	3.22	5.65	MgO
Al K	4.07	3.46	7.70	Al ₂ O ₃
Si K	27.12	22.15	58.02	SiO ₂
Fe K	10.51	4.32	15.03	Fe ₂ O ₃
Zn L	10.92	3.83	13.60	ZnO
O	43.96	63.02		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME C100GCC.

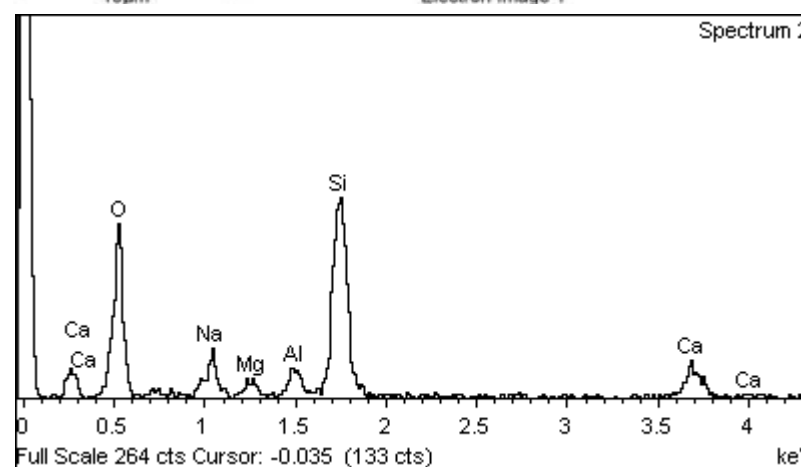
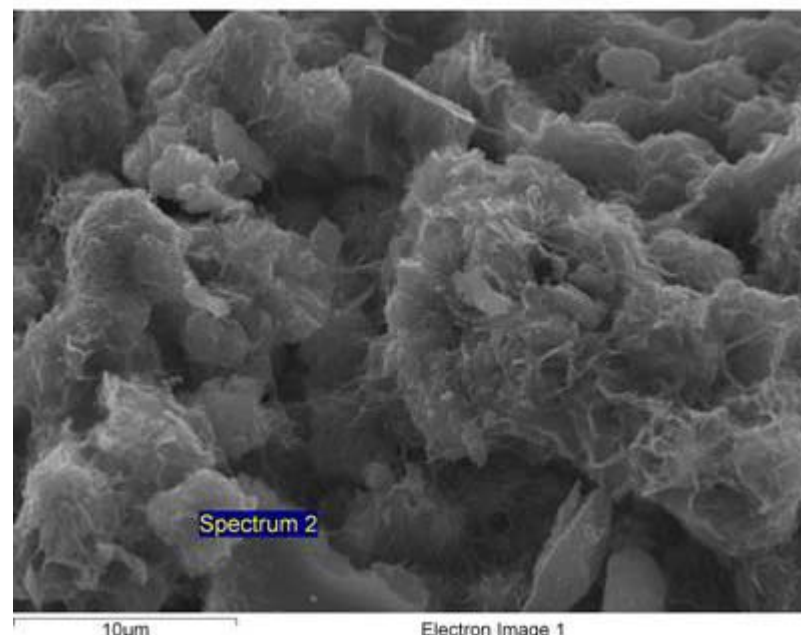
Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
 Mg MgO 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM
 Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.33	4.85	7.19	Na ₂ O
Mg K	2.23	1.92	3.69	MgO
Al K	4.03	3.12	7.61	Al ₂ O ₃
Si K	31.68	23.61	67.78	SiO ₂
Ca K	9.81	5.12	13.73	CaO
O	46.92	61.37		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME C100GCC.

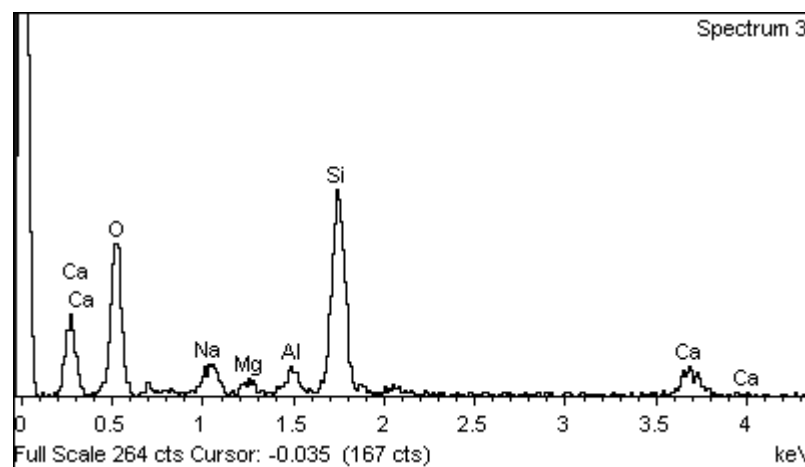
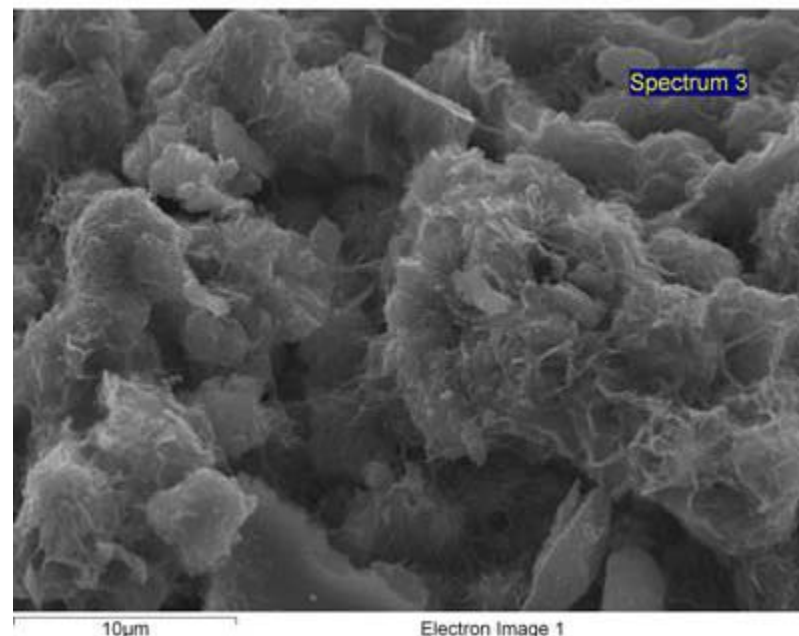
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.37	4.87	7.23	Na ₂ O
Mg K	2.22	1.90	3.68	MgO
Al K	3.43	2.65	6.48	Al ₂ O ₃
Si K	32.64	24.25	69.82	SiO ₂
Ca K	9.14	4.76	12.79	CaO
O	47.21	61.57		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME C100GCC.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

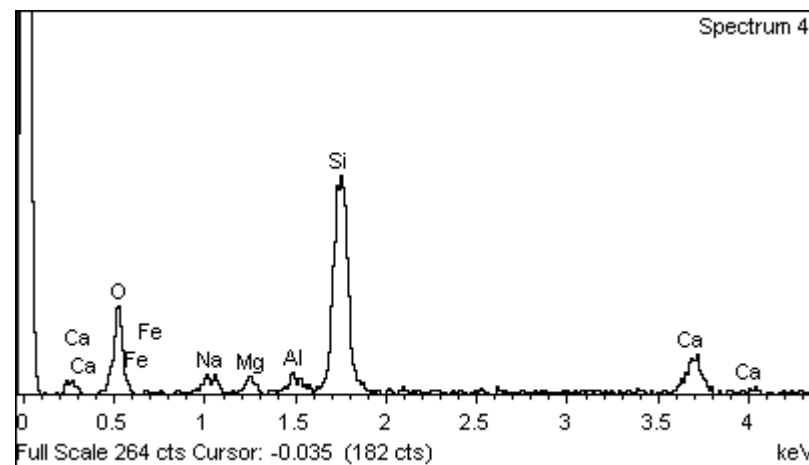
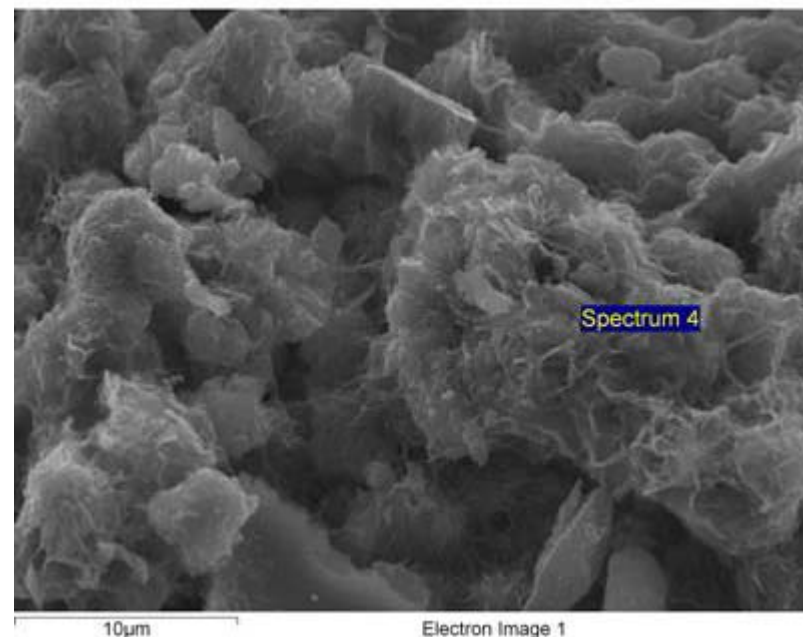
Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	2.35	2.28	3.17	Na ₂ O
Mg K	2.00	1.83	3.32	MgO
Al K	1.67	1.38	3.16	Al ₂ O ₃
Si K	28.24	22.40	60.42	SiO ₂
Ca K	10.17	5.65	14.23	CaO
Fe K	10.98	4.38	15.70	Fe ₂ O ₃
O	44.58	62.07		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME C100GCC.

Spectrum processing :
Peak possibly omitted : 6.400 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

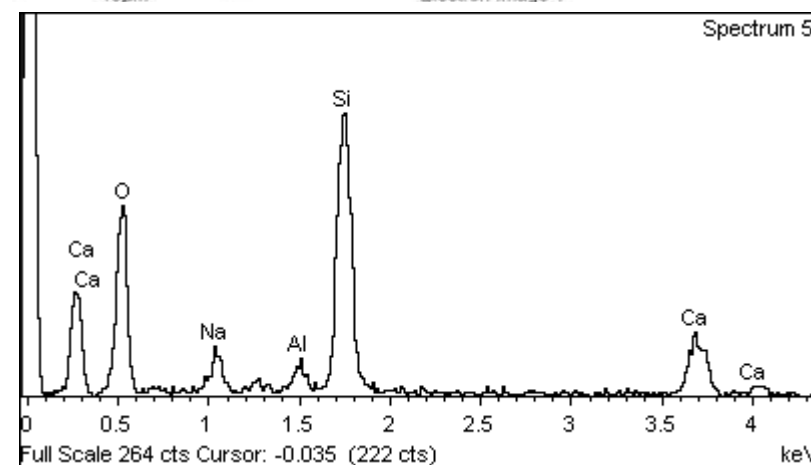
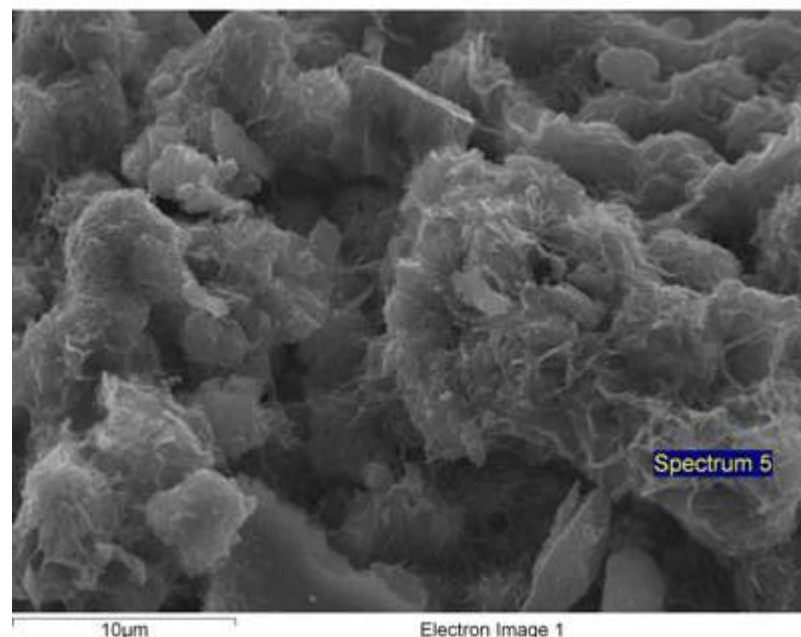
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

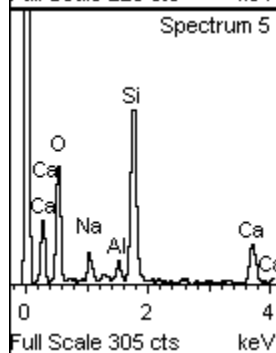
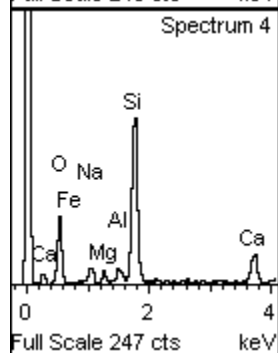
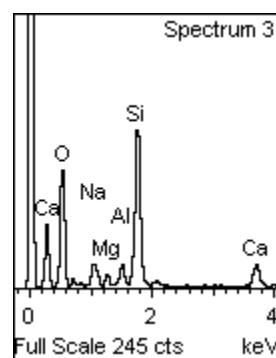
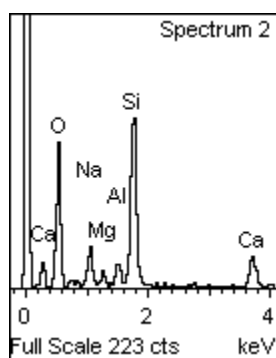
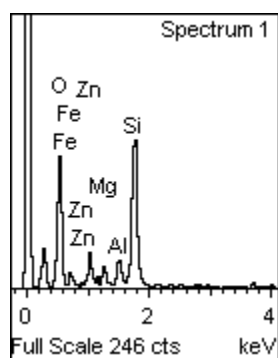
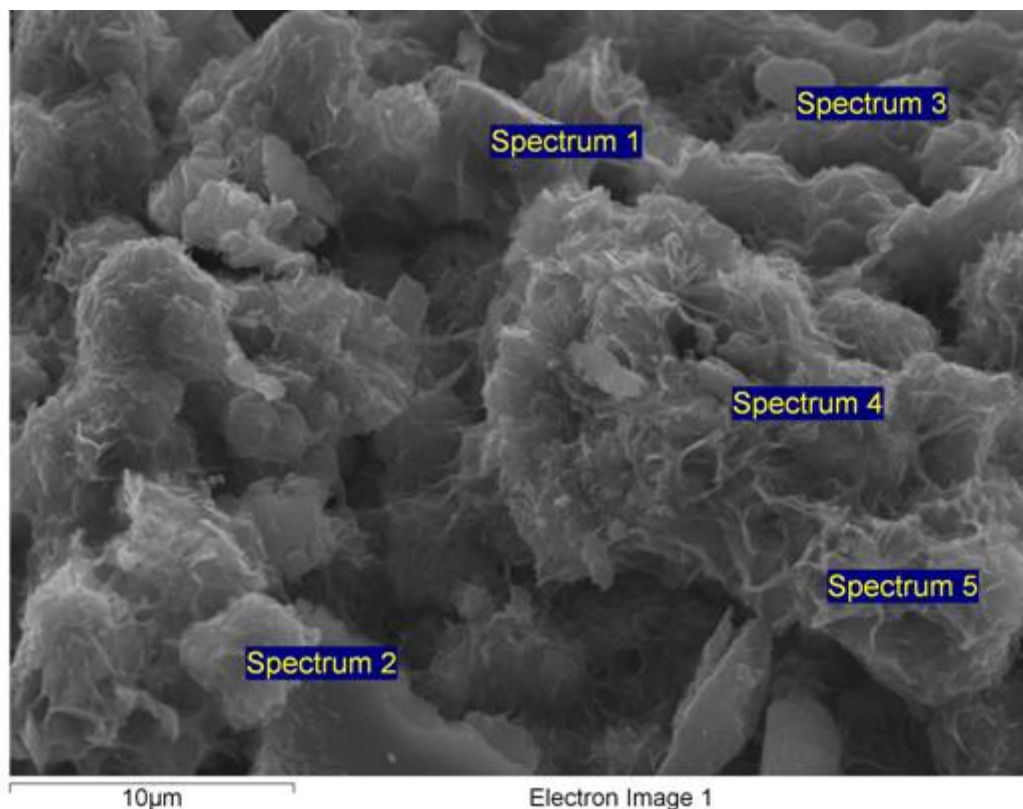
Si SiO₂ 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.14	4.78	6.93	Na ₂ O
Al K	2.59	2.06	4.90	Al ₂ O ₃
Si K	31.43	23.91	67.23	SiO ₂
Ca K	14.96	7.98	20.93	CaO
O	45.87	61.27		
Totals	100.00			



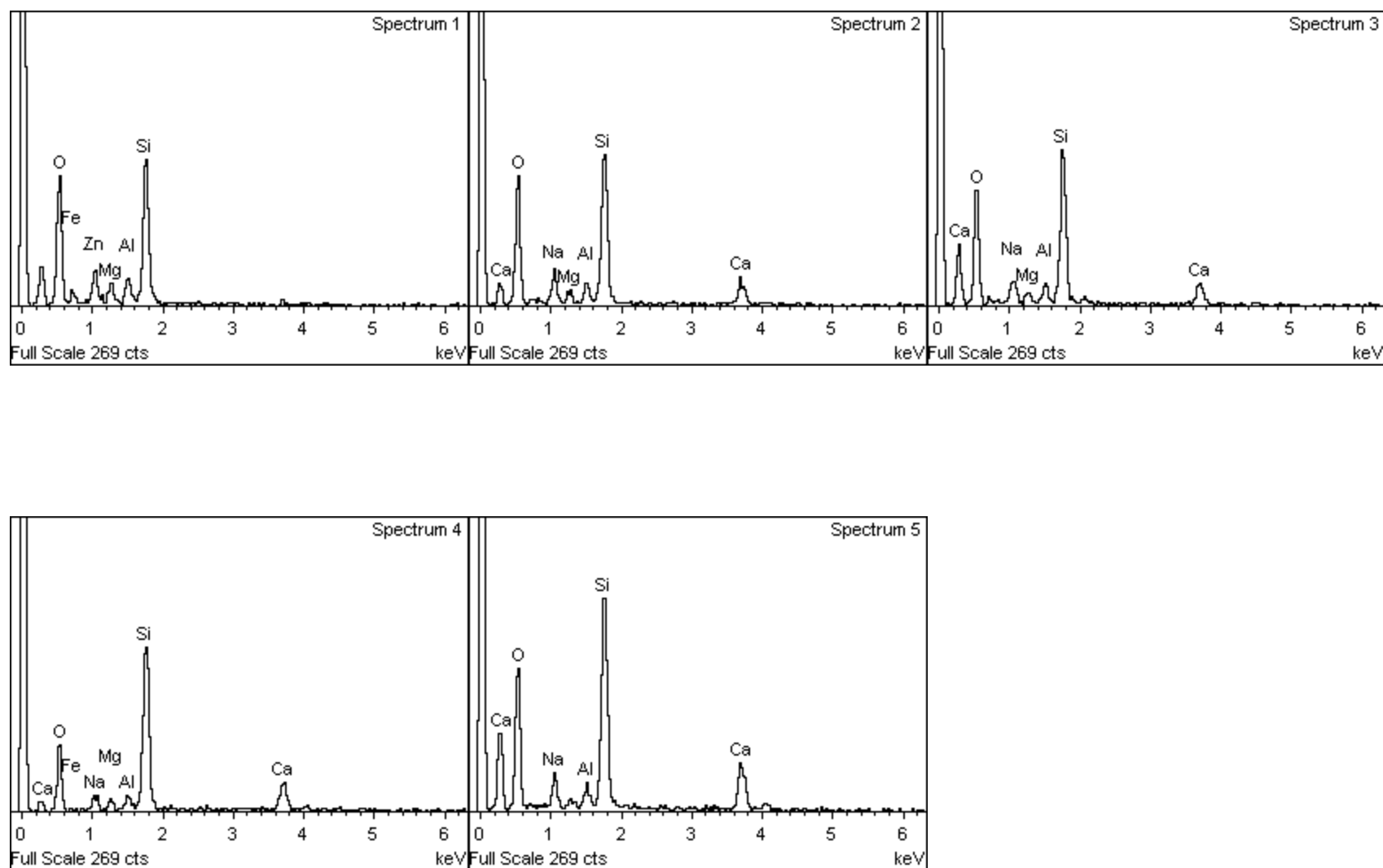
PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME C100GCC.



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME C100GCC.



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME C100GCC.

Project: PCT SURFACE CORROSION 1
Owner: cavinm
Site: Site of Interest 1

Sample: C100GCC
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Ca	Fe	Zn	O	Total
Spectrum 1	Yes		3.41	4.07	27.12		10.51	10.92	43.96	100.00
Spectrum 2	Yes	5.33	2.23	4.03	31.68	9.81			46.92	100.00
Spectrum 3	Yes	5.37	2.22	3.43	32.64	9.14			47.21	100.00
Spectrum 4	Yes	2.35	2.00	1.67	28.24	10.17	10.98		44.58	100.00
Spectrum 5	Yes	5.14		2.59	31.43	14.96			45.87	100.00
Max.		5.37	3.41	4.07	32.64	14.96	10.98	10.92	47.21	
Min.		2.35	2.00	1.67	27.12	9.14	10.51	10.92	43.96	

All results in weight%

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PCT SURFACE CORROSION. . FILE 1. ROI 2. GLASS NAME C100GCC.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

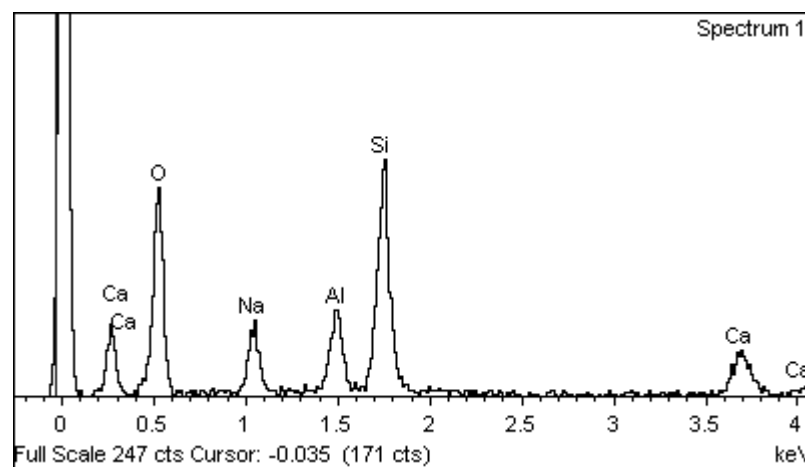
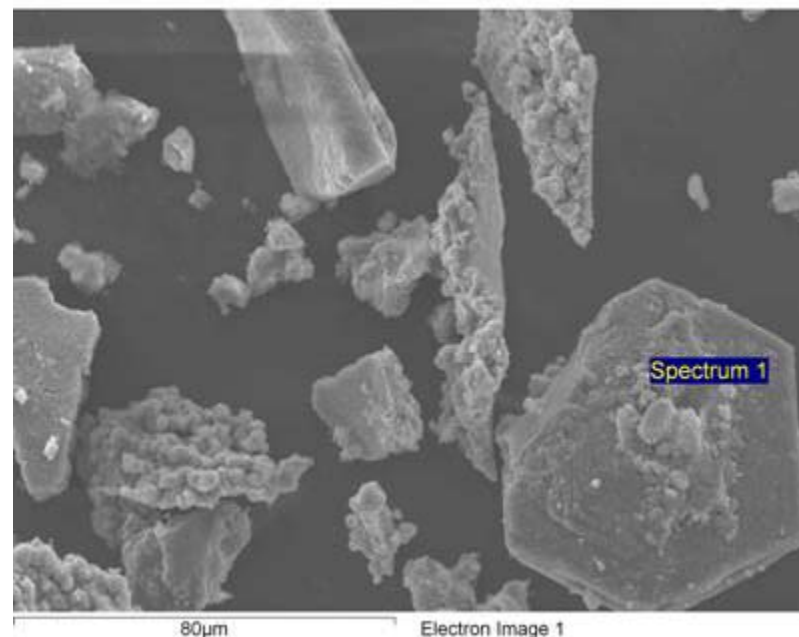
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.83	8.08	11.90	Na ₂ O
Al K	8.54	6.66	16.14	Al ₂ O ₃
Si K	26.87	20.13	57.49	SiO ₂
Ca K	10.34	5.43	14.47	CaO
O	45.41	59.71		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME C100GCC.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

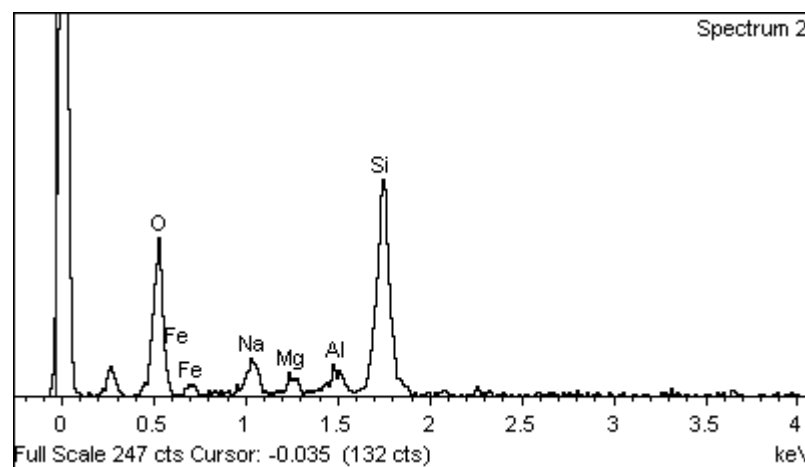
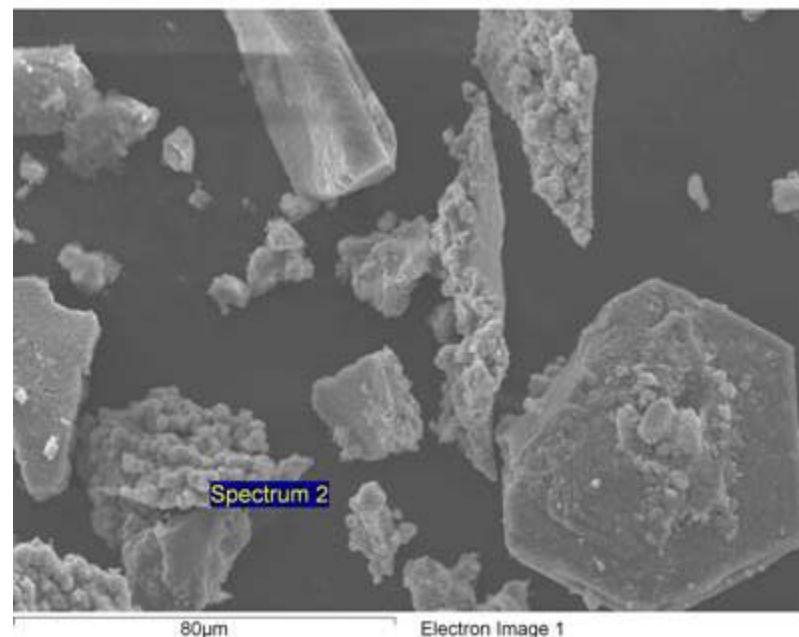
Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.00	5.48	8.09	Na ₂ O
Mg K	2.53	2.19	4.19	MgO
Al K	2.94	2.29	5.56	Al ₂ O ₃
Si K	33.00	24.69	70.59	SiO ₂
Fe K	8.10	3.05	11.57	Fe ₂ O ₃
O	47.44	62.31		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME C100GCC.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

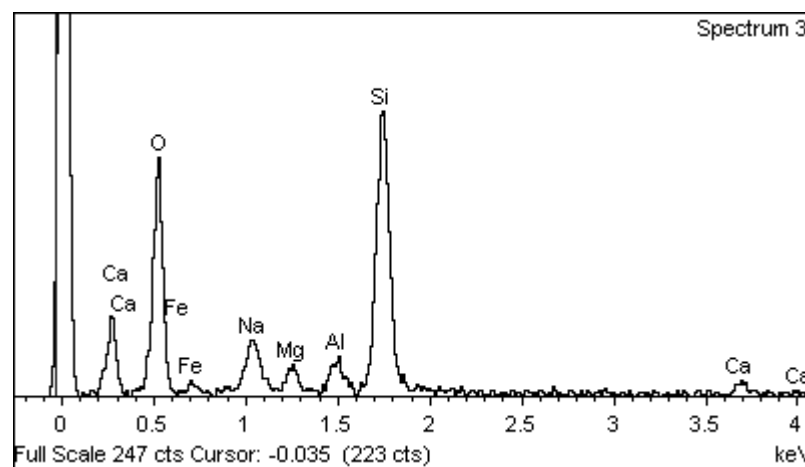
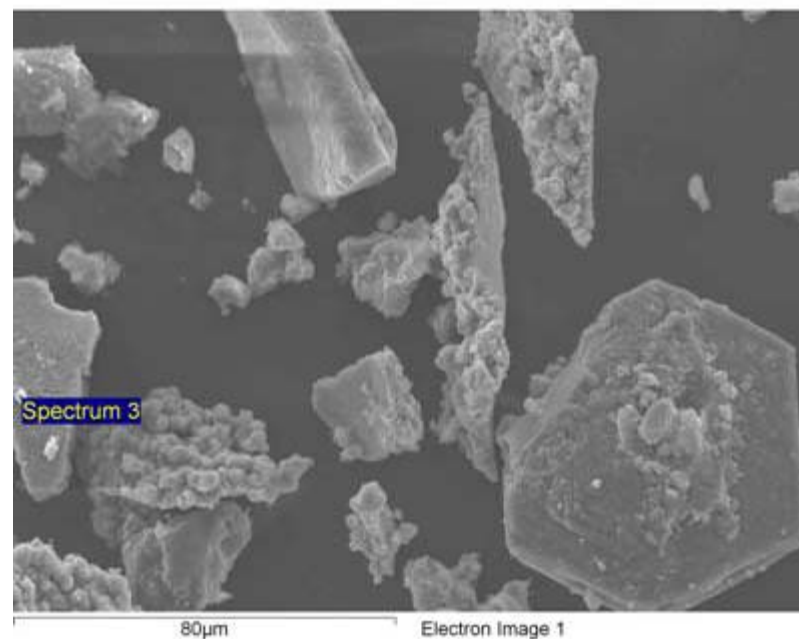
Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.84	5.44	7.88	Na ₂ O
Mg K	2.79	2.45	4.62	MgO
Al K	3.10	2.45	5.85	Al ₂ O ₃
Si K	30.22	23.02	64.66	SiO ₂
Ca K	2.72	1.45	3.81	CaO
Fe K	9.23	3.53	13.19	Fe ₂ O ₃
O	46.10	61.65		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME C100GCC.

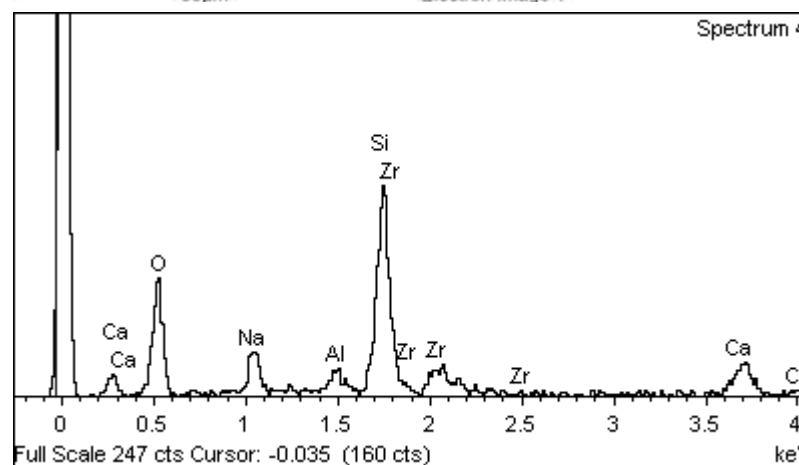
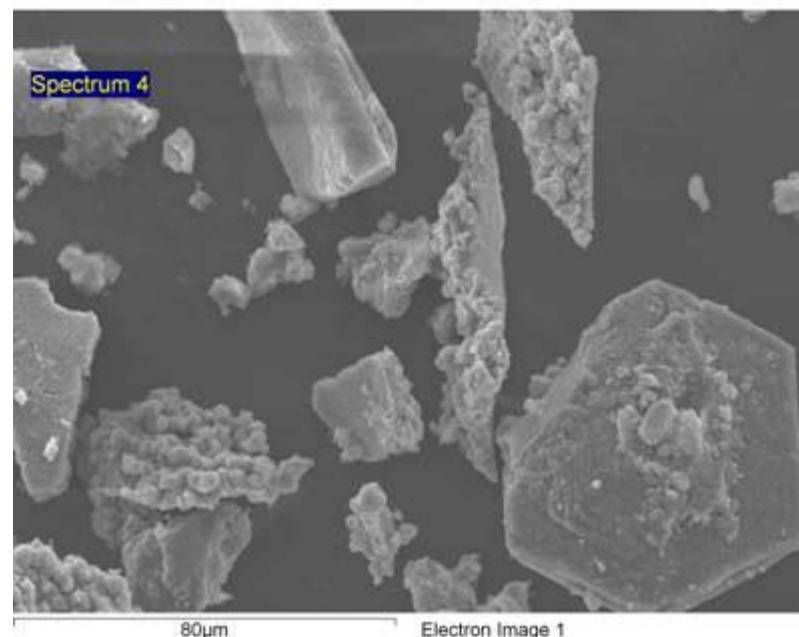
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 2

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

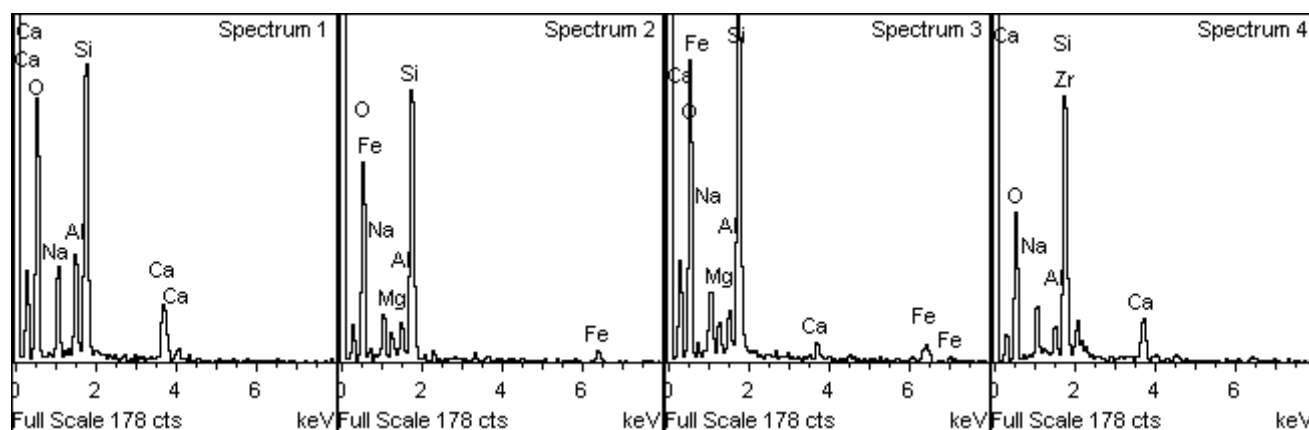
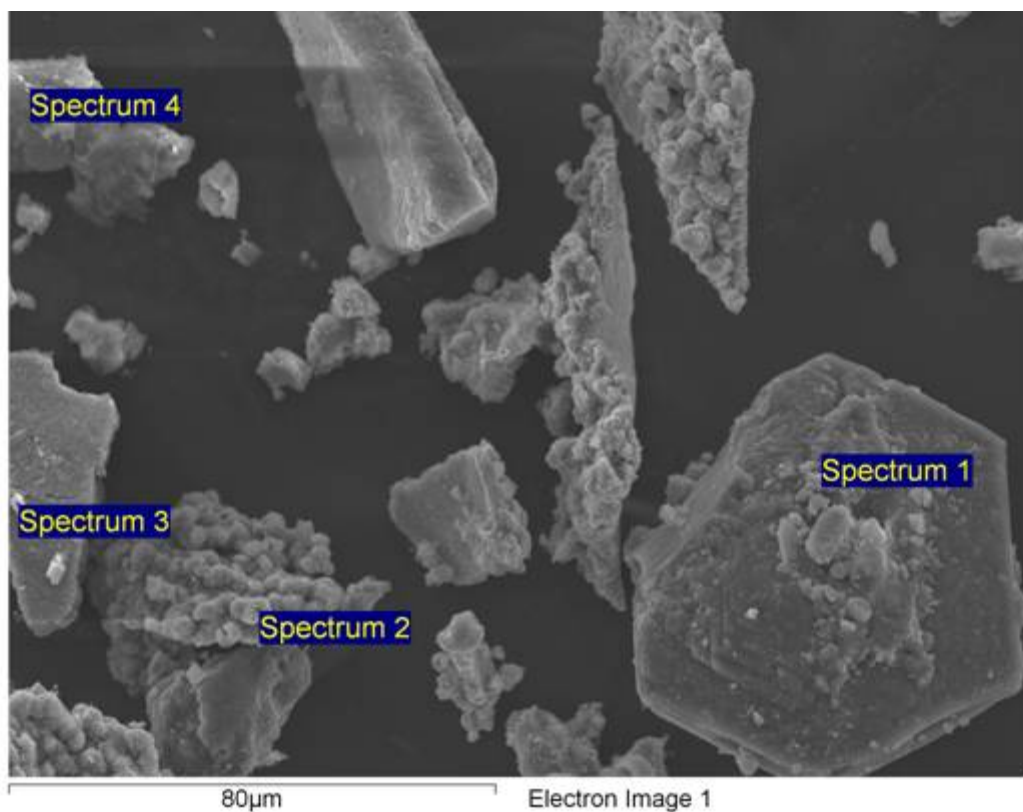
Element	Weight%	Atomic%	Compd%	Formula
Na K	7.41	7.33	9.99	Na ₂ O
Al K	2.43	2.05	4.59	Al ₂ O ₃
Si K	26.72	21.62	57.17	SiO ₂
Ca K	9.47	5.37	13.25	CaO
Zr L	11.10	2.77	15.00	ZrO ₂
O	42.86	60.87		
Totals	100.00			



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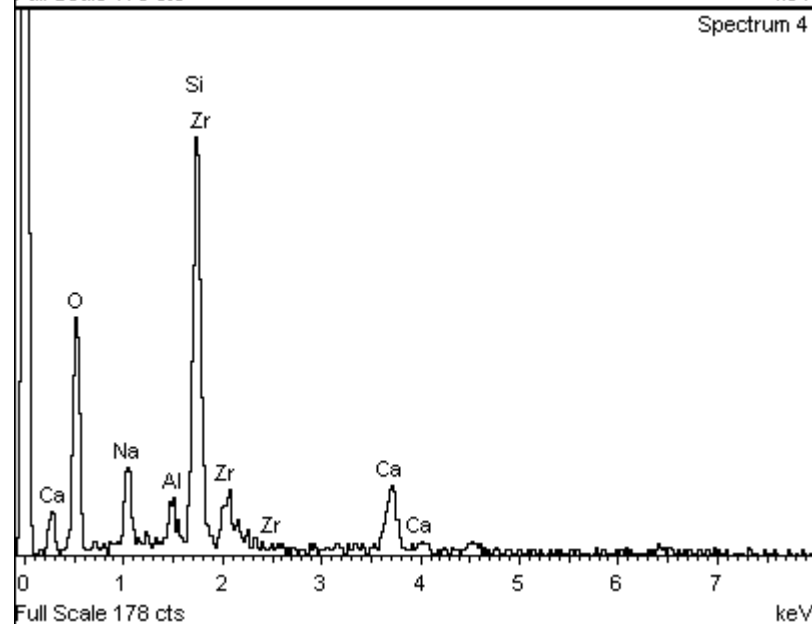
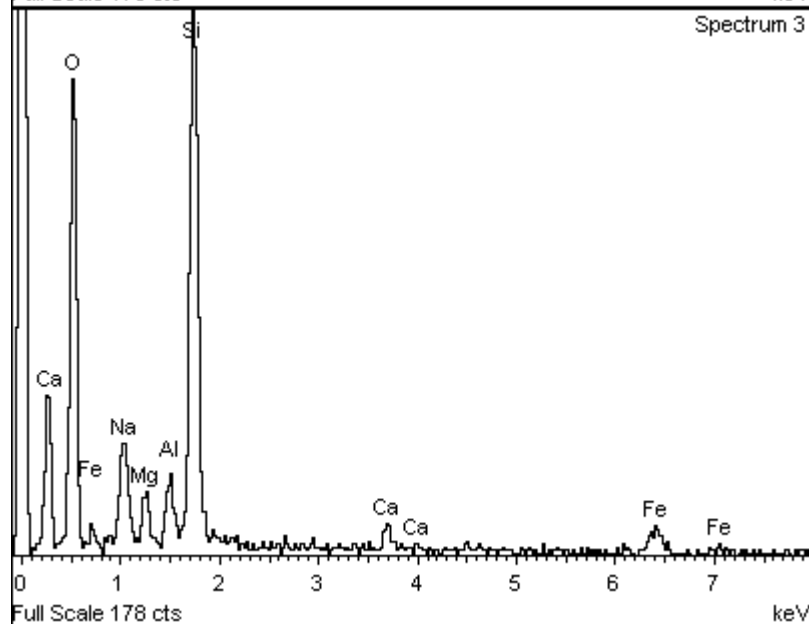
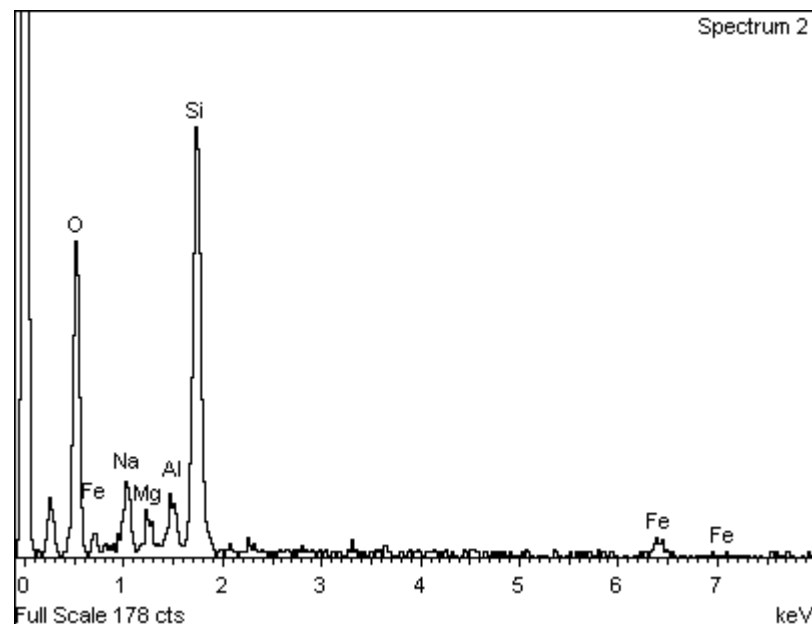
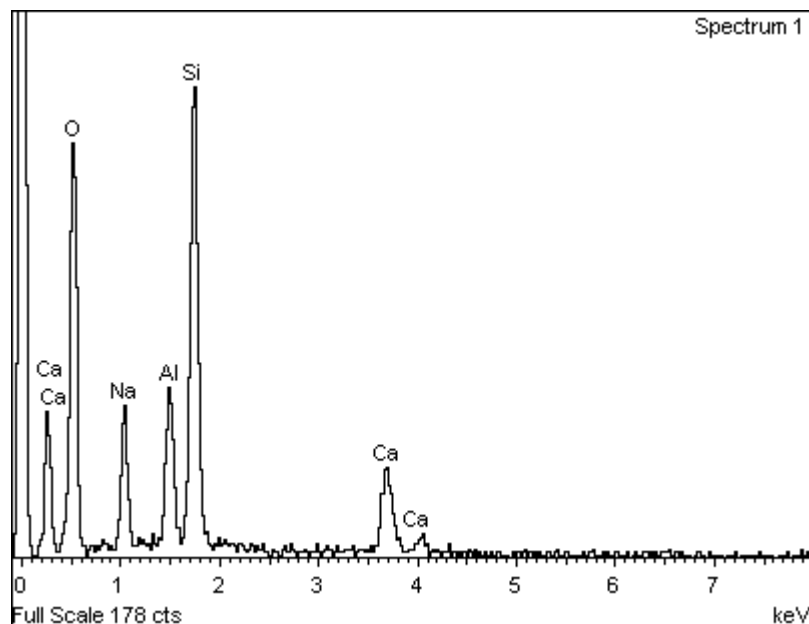
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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME C100GCC.



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME C100GCC.



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME C100GCC.

Project: PCT SURFACE CORROSION 1
Owner: cavinm
Site: Site of Interest 2

Sample: C100GCC
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Ca	Fe	Zr	O	Total
Spectrum 1	Yes	8.83		8.54	26.87	10.34			45.41	100.00
Spectrum 2	Yes	6.00	2.53	2.94	33.00		8.10		47.44	100.00
Spectrum 3	Yes	5.84	2.79	3.10	30.22	2.72	9.23		46.10	100.00
Spectrum 4	Yes	7.41		2.43	26.72	9.47		11.10	42.86	100.00
Max.		8.83	2.79	8.54	33.00	10.34	9.23	11.10	47.44	
Min.		5.84	2.53	2.43	26.72	2.72	8.10	11.10	42.86	

All results in weight%

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PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME C100GCC.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

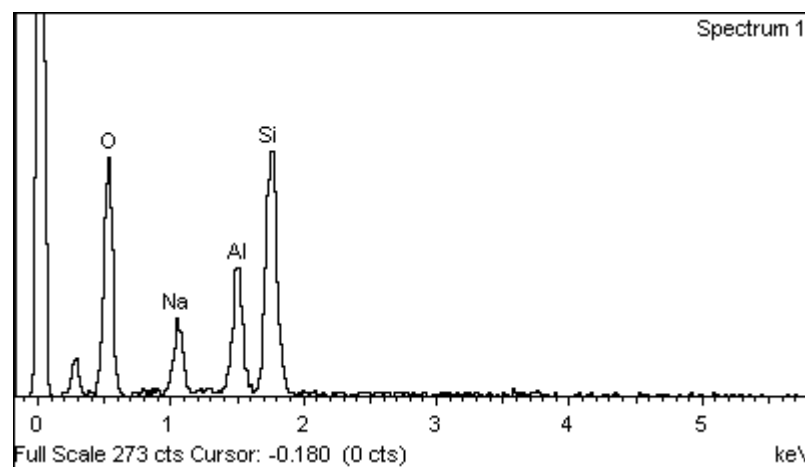
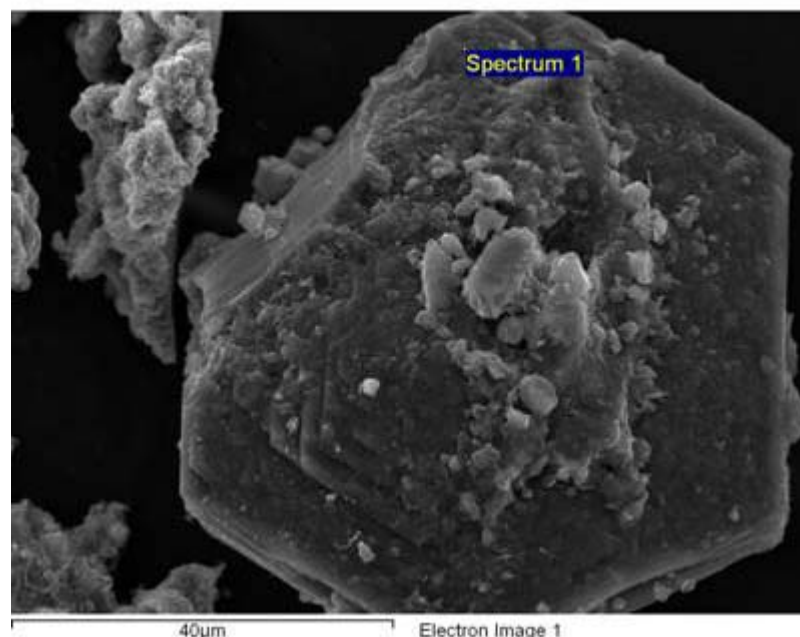
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.82	7.74	11.89	Na ₂ O
Al K	12.58	9.42	23.78	Al ₂ O ₃
Si K	30.07	21.62	64.34	SiO ₂
O	48.52	61.23		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME C100GCC.

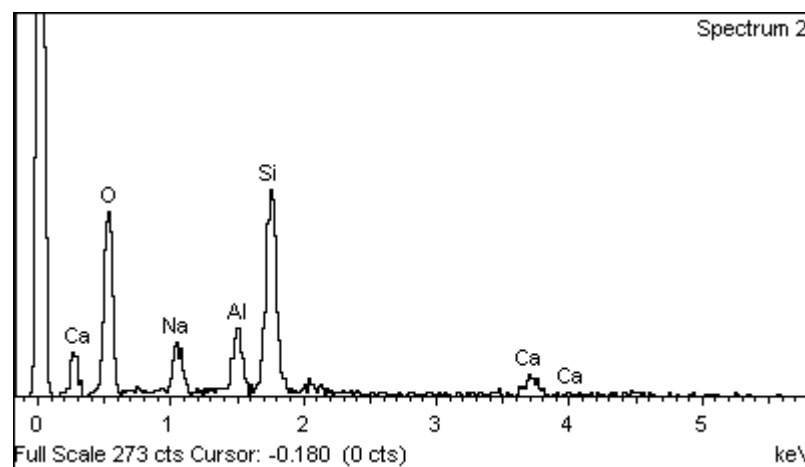
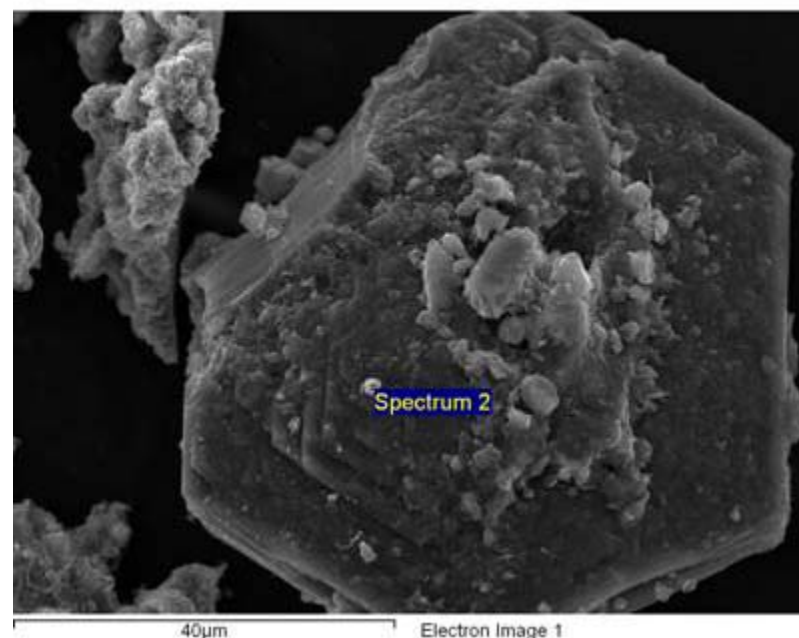
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.92	7.10	10.68	Na ₂ O
Al K	8.12	6.20	15.34	Al ₂ O ₃
Si K	30.96	22.72	66.24	SiO ₂
Ca K	5.54	2.85	7.75	CaO
O	47.46	61.13		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME C100GCC.

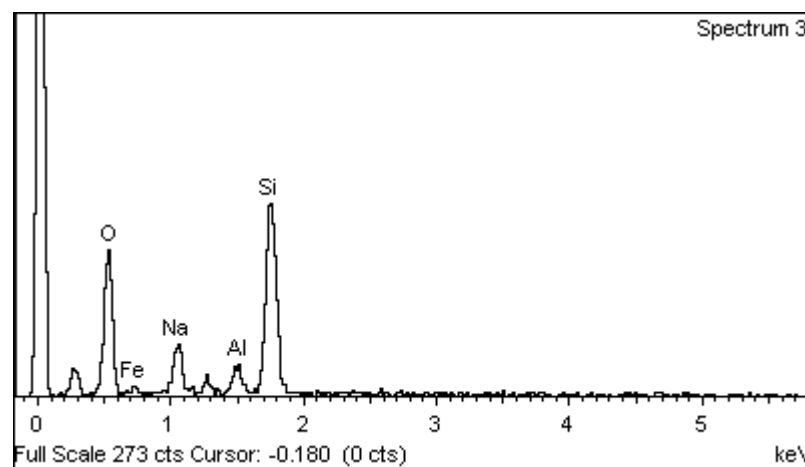
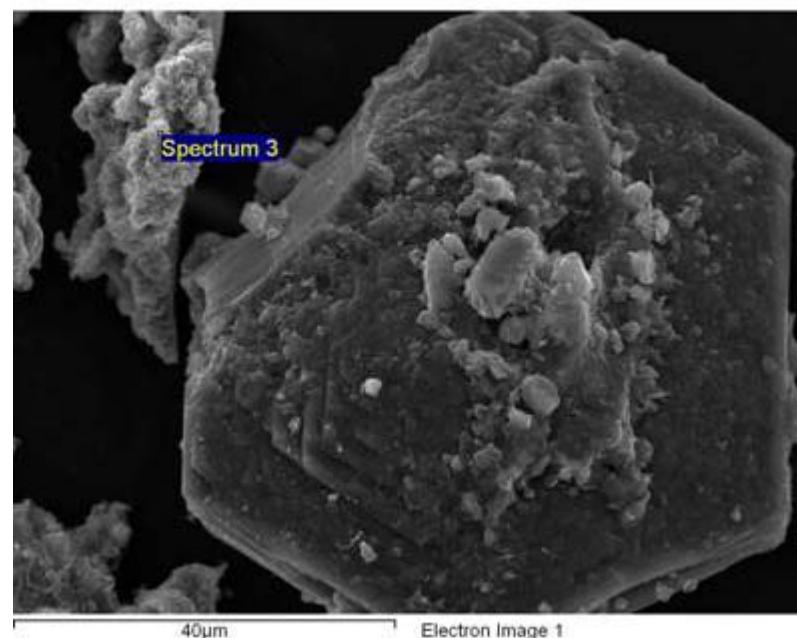
Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM
 Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.88	8.24	11.97	Na ₂ O
Al K	3.81	3.01	7.20	Al ₂ O ₃
Si K	30.72	23.34	65.73	SiO ₂
Fe K	10.57	4.04	15.11	Fe ₂ O ₃
O	46.02	61.37		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME C100GCC.

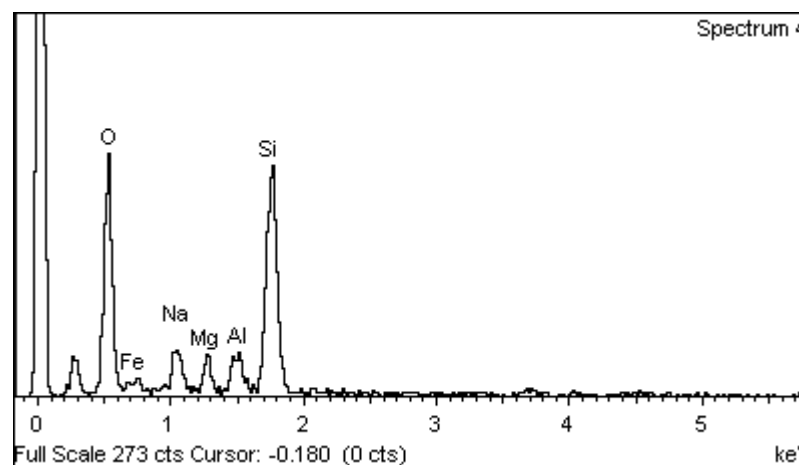
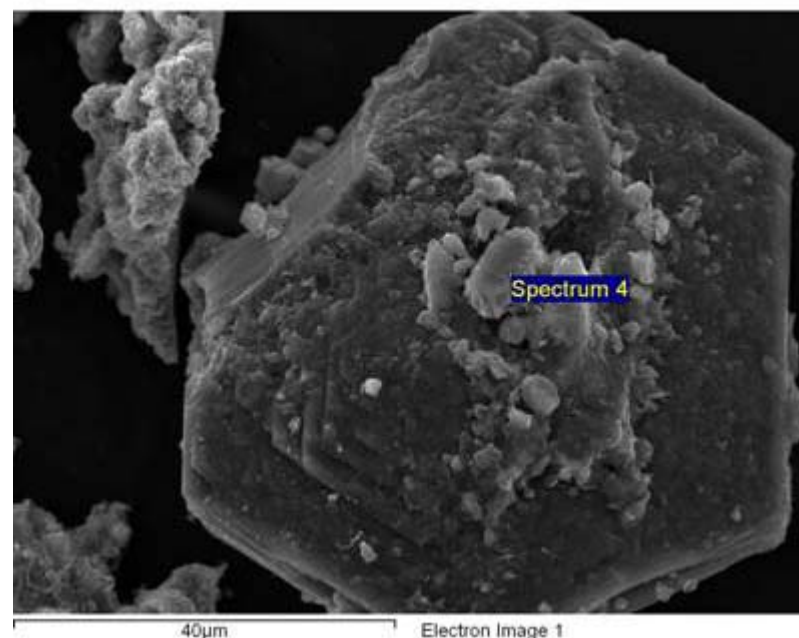
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

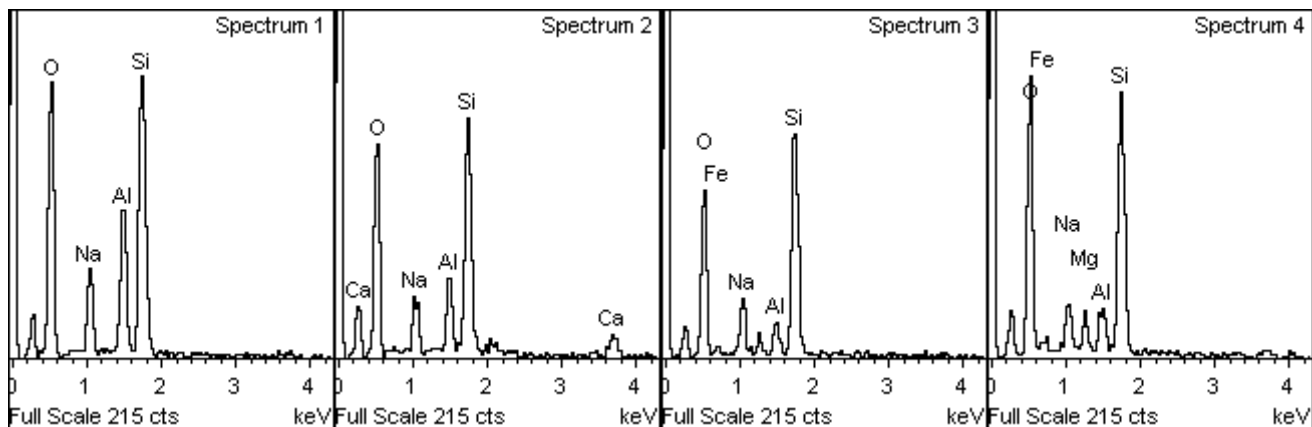
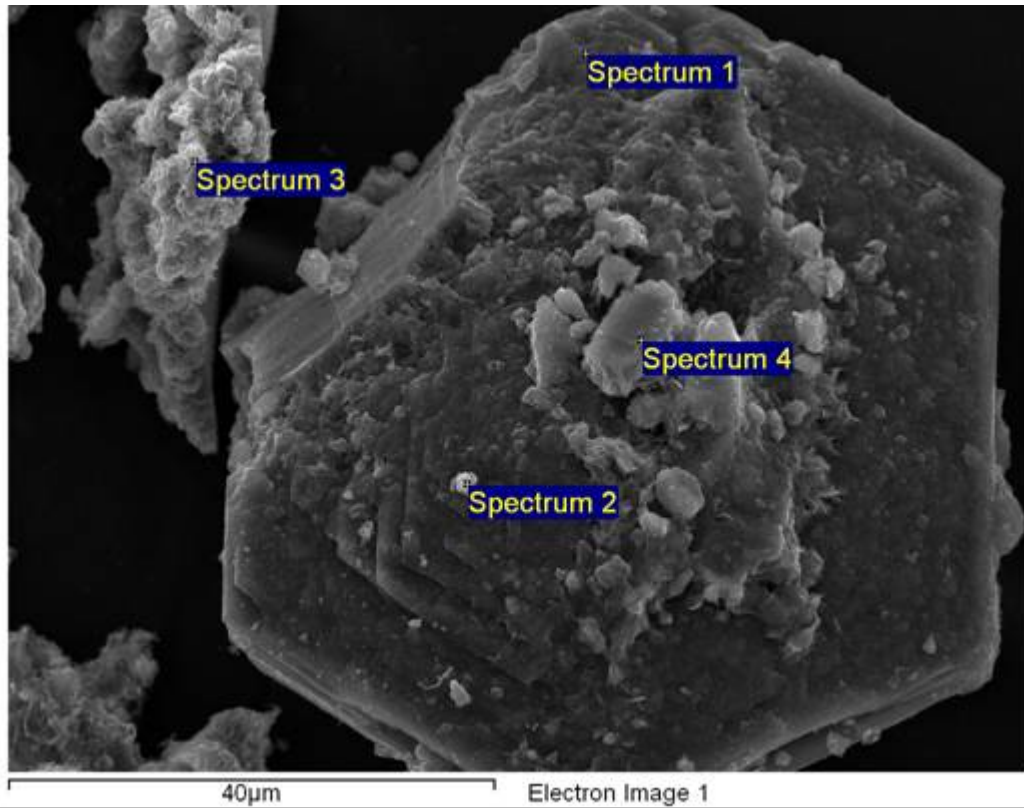
Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

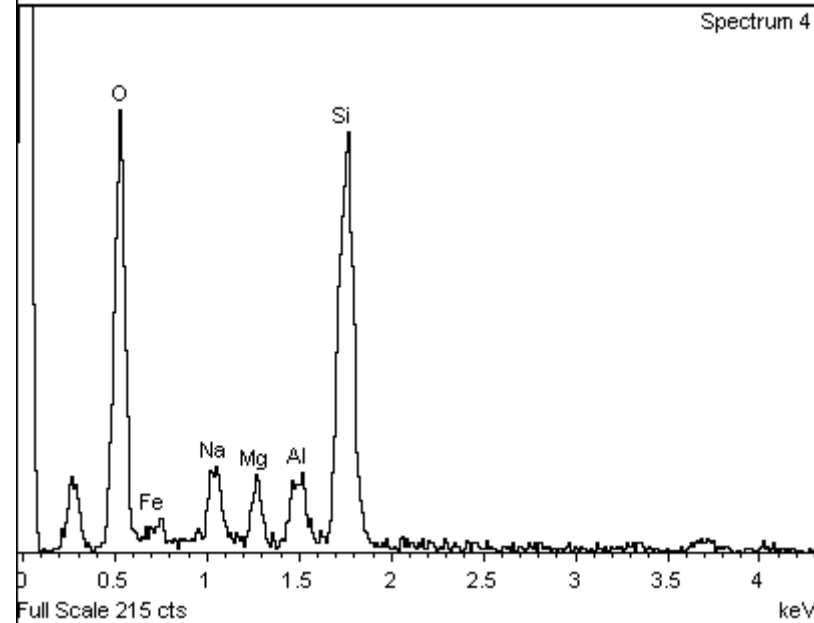
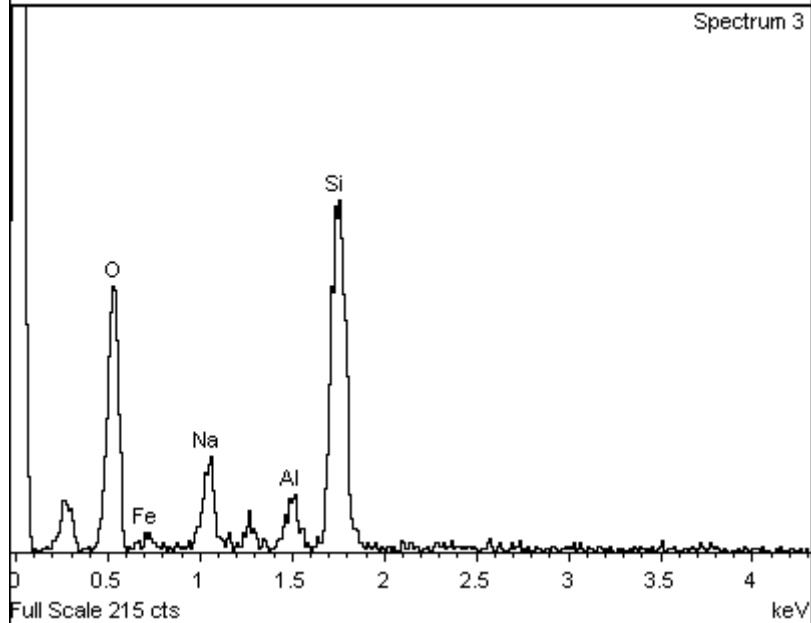
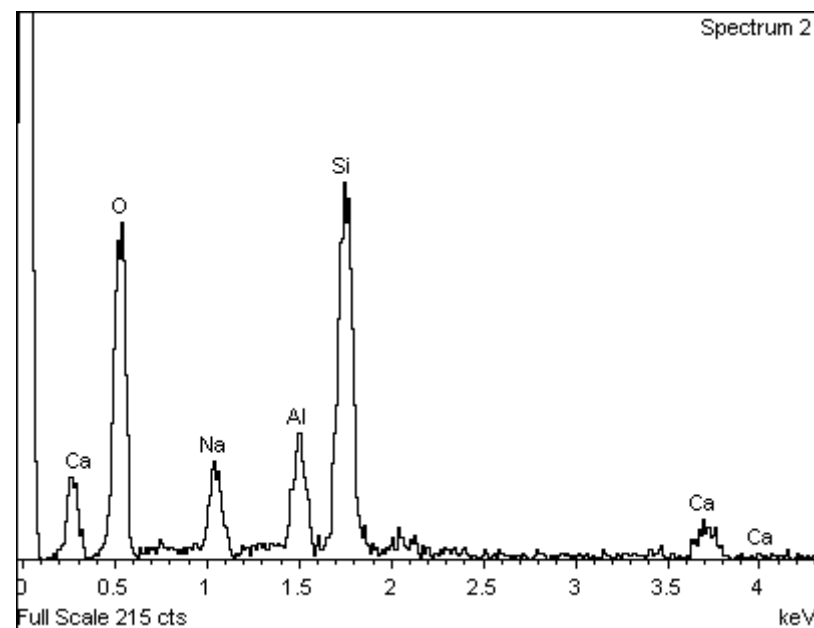
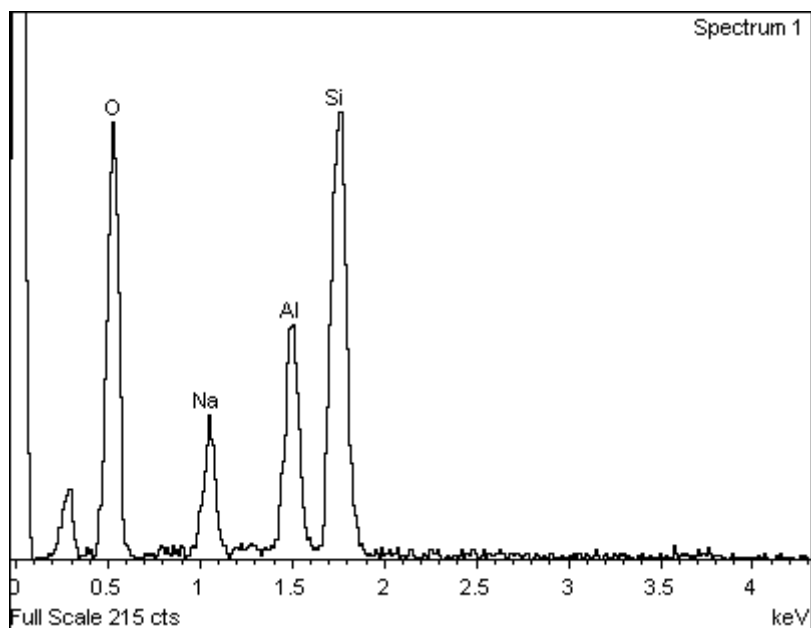
Element	Weight%	Atomic%	Compd%	Formula
Na K	6.08	5.60	8.19	Na ₂ O
Mg K	4.57	3.98	7.57	MgO
Al K	4.40	3.46	8.32	Al ₂ O ₃
Si K	29.18	22.02	62.43	SiO ₂
Fe K	9.43	3.58	13.48	Fe ₂ O ₃
O	46.34	61.37		
Totals	100.00			



PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME C100GCC.



PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME C100GCC.



PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME C100GCC.

Project: PCT SURFACE CORROSION 1
Owner: cavinm
Site: Site of Interest 3

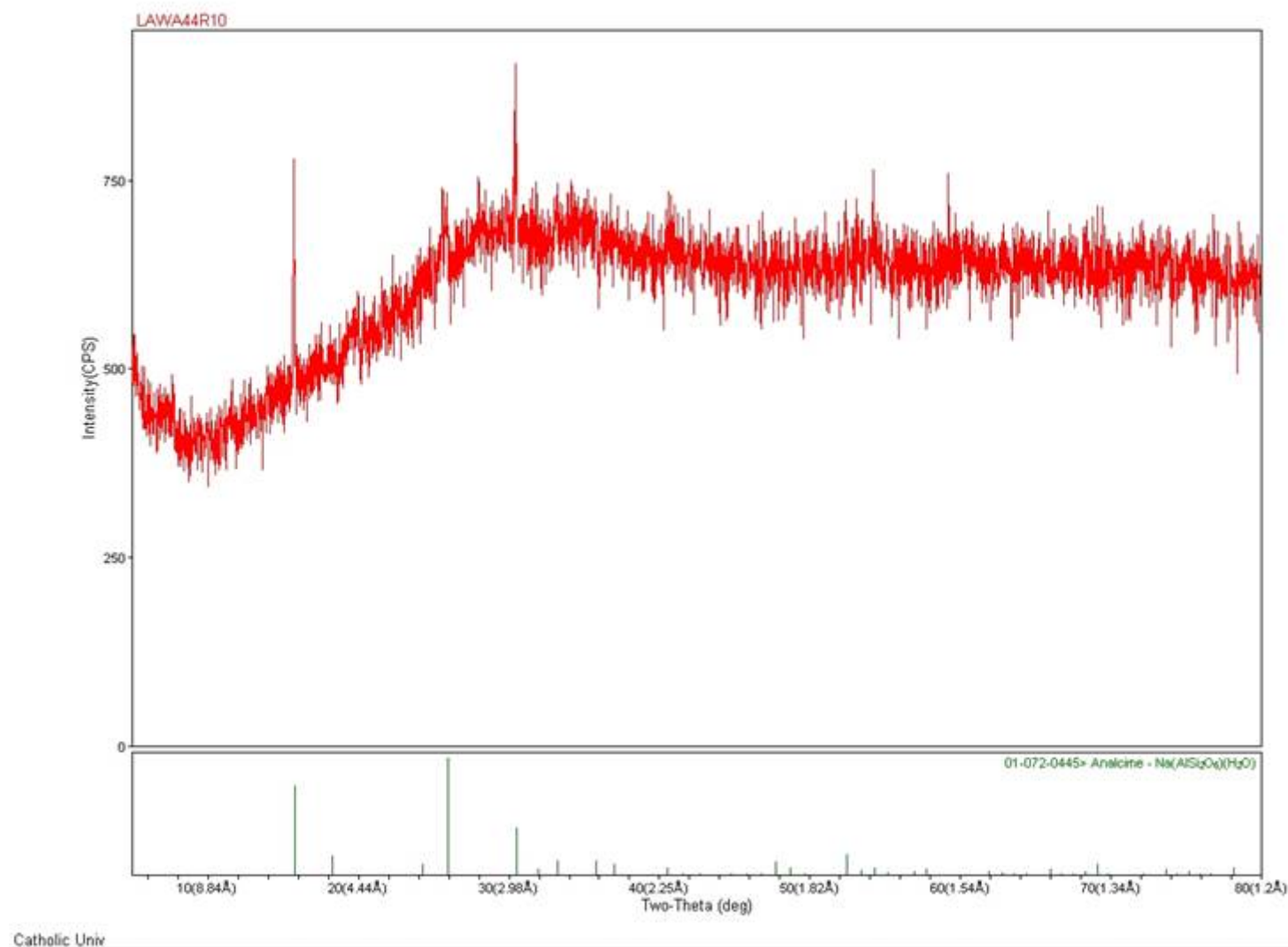
Sample: C100GCC
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Ca	Fe	O	Total
Spectrum 1	Yes	8.82		12.58	30.07			48.52	100.00
Spectrum 2	Yes	7.92		8.12	30.96	5.54		47.46	100.00
Spectrum 3	Yes	8.88		3.81	30.72		10.57	46.02	100.00
Spectrum 4	Yes	6.08	4.57	4.40	29.18		9.43	46.34	100.00
Max.		8.88	4.57	12.58	30.96	5.54	10.57	48.52	
Min.		6.08	4.57	3.81	29.18	5.54	9.43	46.02	

All results in weight%

**XRD powder patterns (raw data and best match) and SEM/EDS analysis of glass LAWA44R10,
collected from 90°C PCT-B vessel after 3275 days**



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA44R10.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

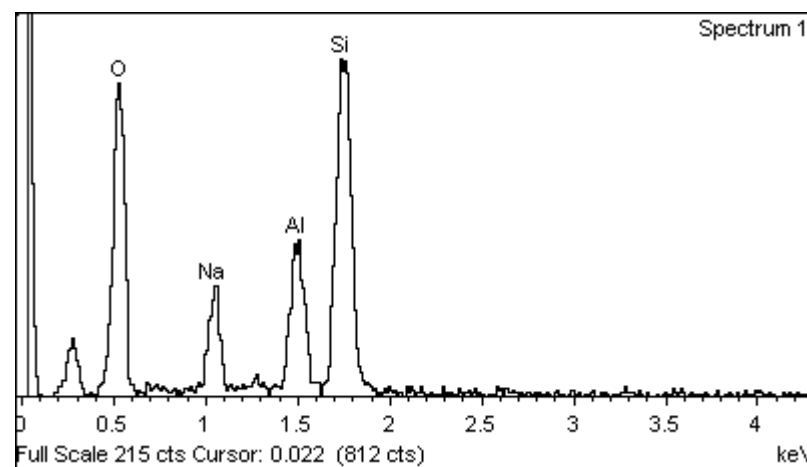
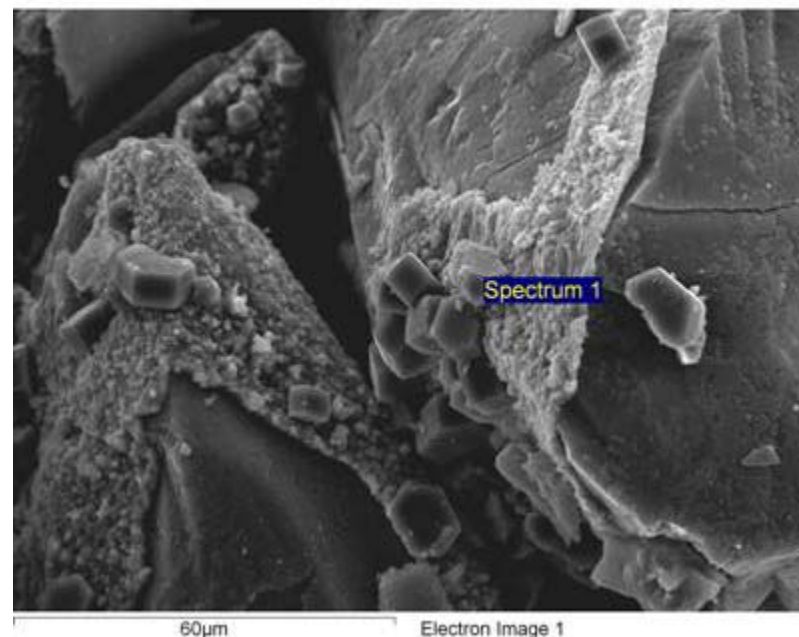
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	10.02	8.80	13.50	Na ₂ O
Al K	11.23	8.40	21.21	Al ₂ O ₃
Si K	30.52	21.93	65.28	SiO ₂
O	48.24	60.87		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA44R10.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

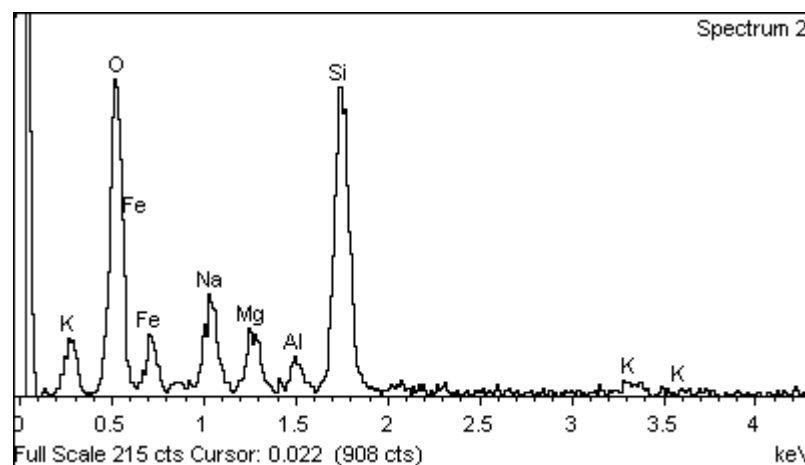
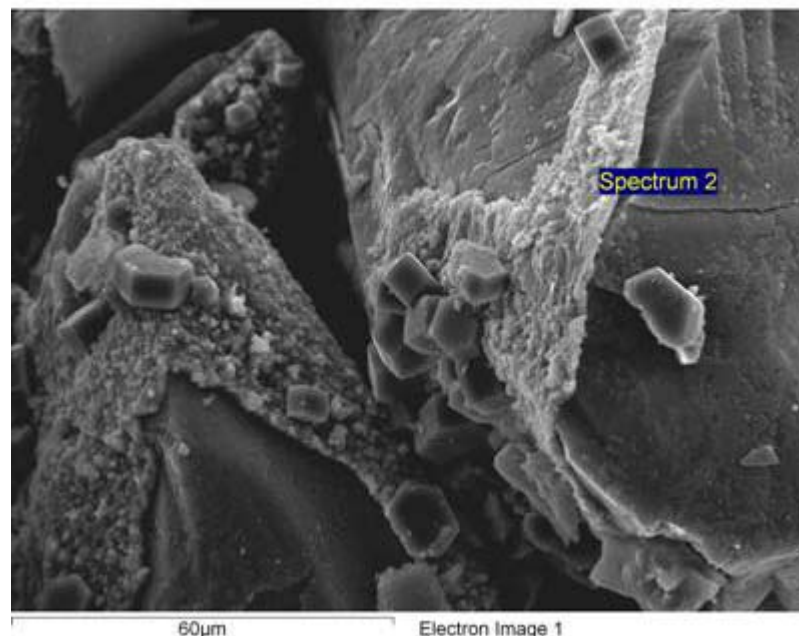
Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.93	7.68	10.69	Na ₂ O
Mg K	4.91	4.49	8.14	MgO
Al K	2.20	1.82	4.17	Al ₂ O ₃
Si K	23.96	18.99	51.26	SiO ₂
K K	1.64	0.93	1.98	K ₂ O
Fe K	16.62	6.63	23.77	Fe ₂ O ₃
O	42.73	59.45		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA44R10.

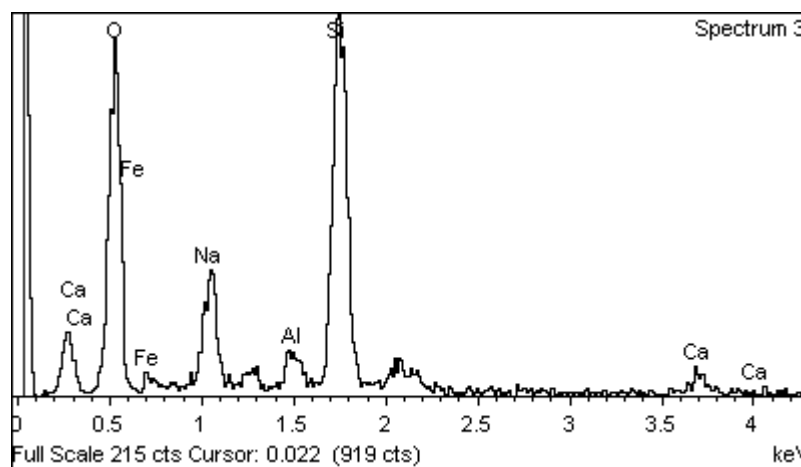
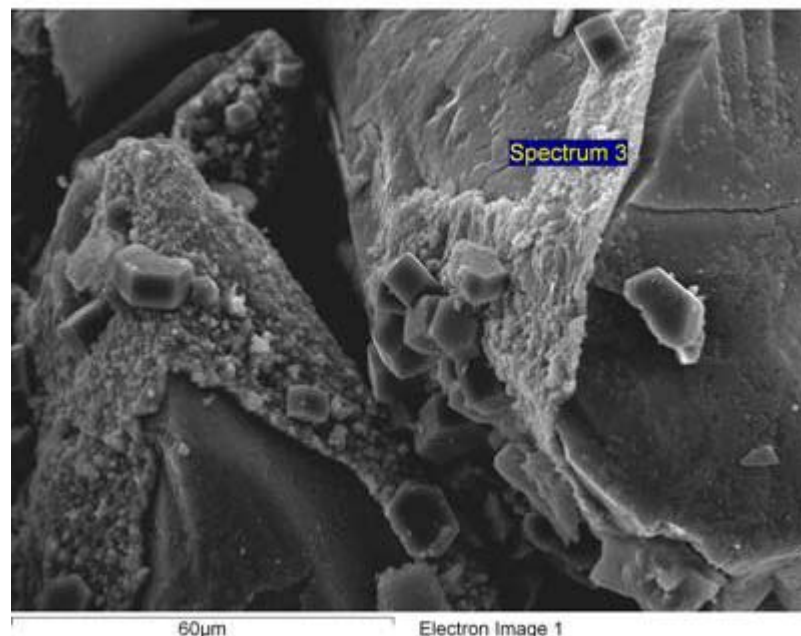
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	10.85	10.05	14.63	Na ₂ O
Al K	2.51	1.98	4.74	Al ₂ O ₃
Si K	30.50	23.13	65.26	SiO ₂
Ca K	2.69	1.43	3.77	CaO
Fe K	8.12	3.09	11.60	Fe ₂ O ₃
O	45.32	60.32		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA44R10.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

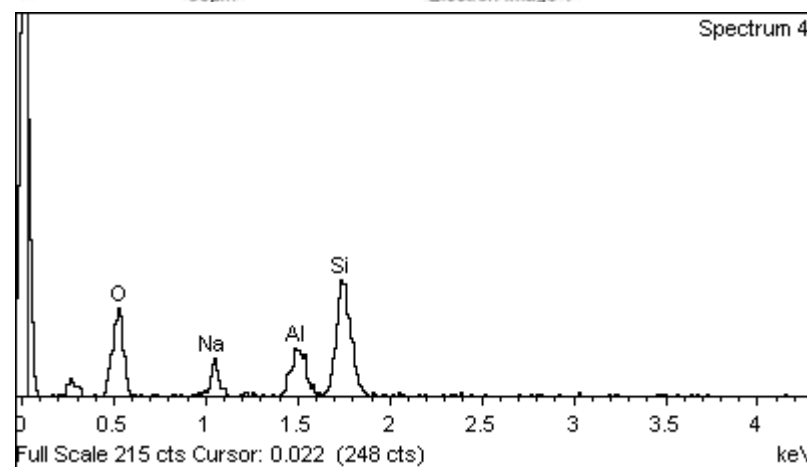
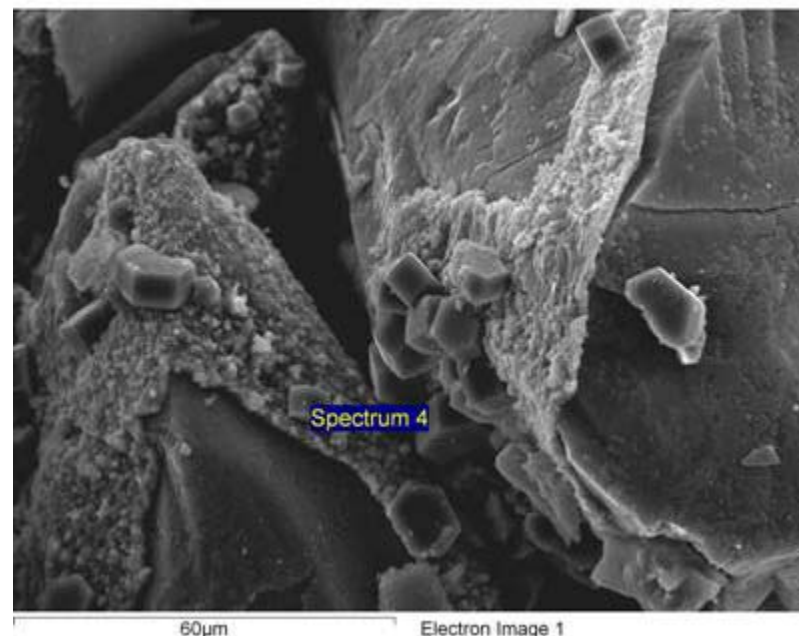
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

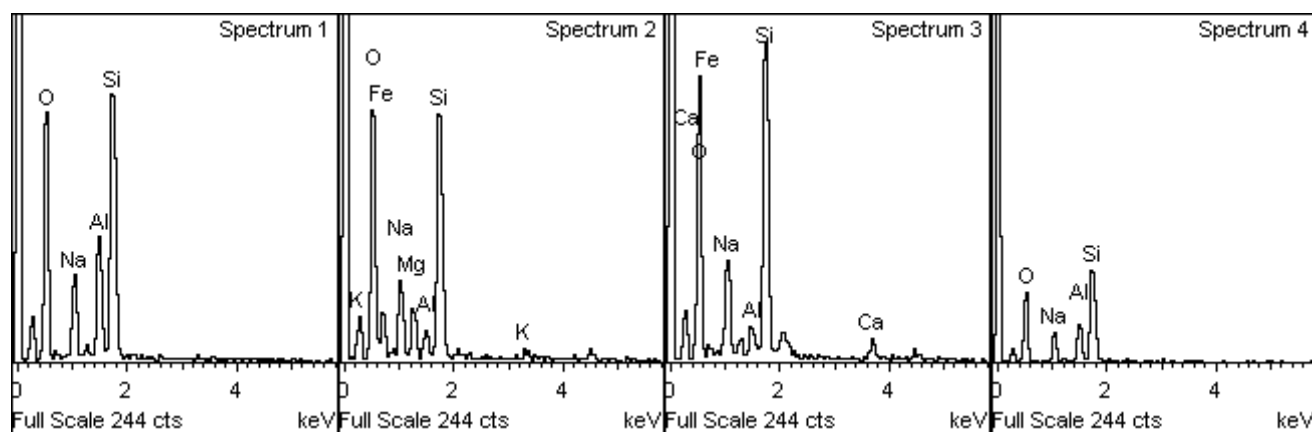
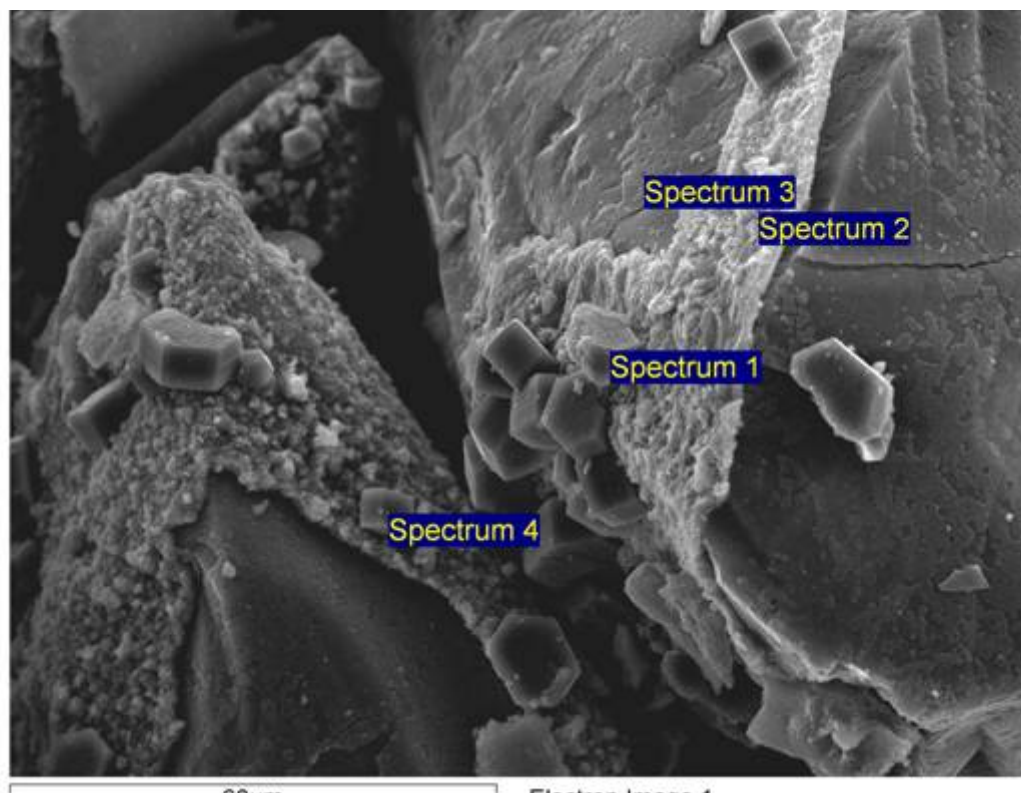
Element	Weight%	Atomic%	Compd%	Formula
Na K	9.42	8.27	12.69	Na ₂ O
Al K	10.88	8.14	20.56	Al ₂ O ₃
Si K	31.20	22.42	66.75	SiO ₂
O	48.50	61.18		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA44R10.

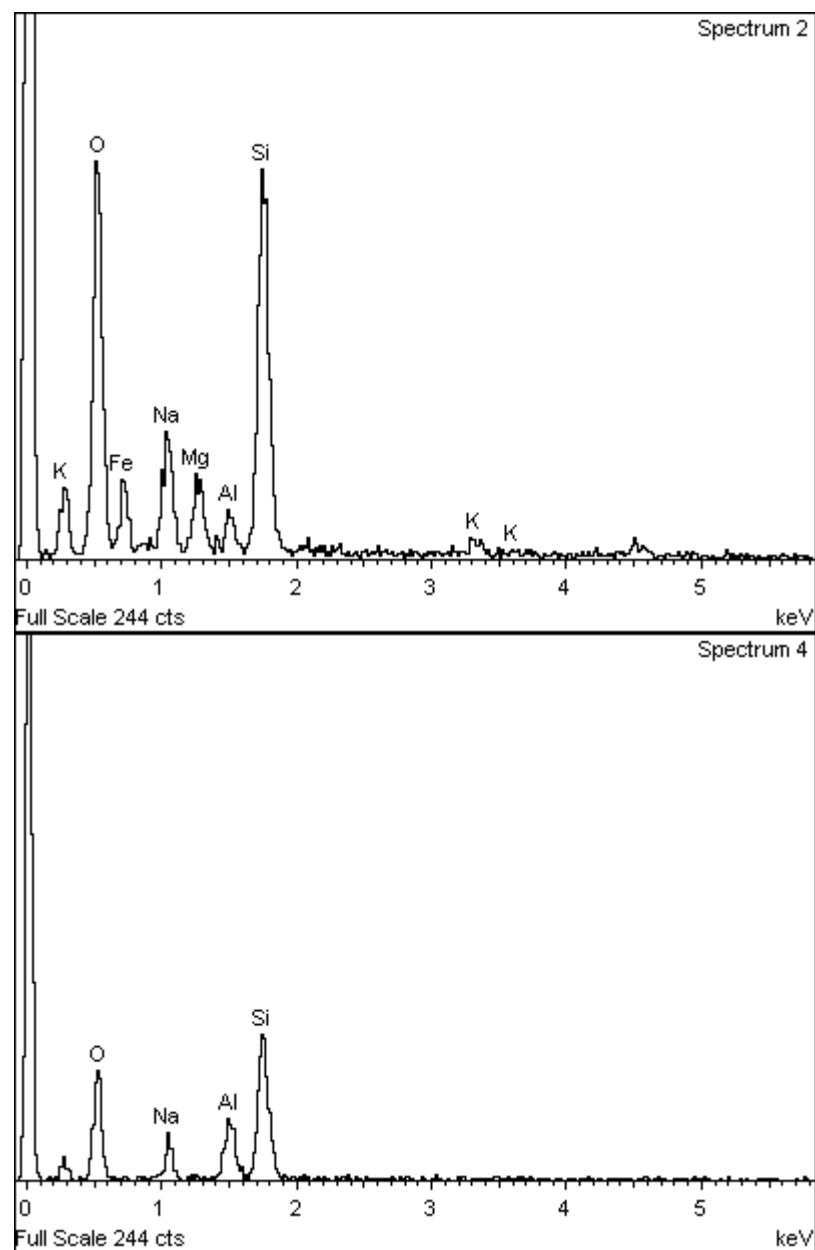
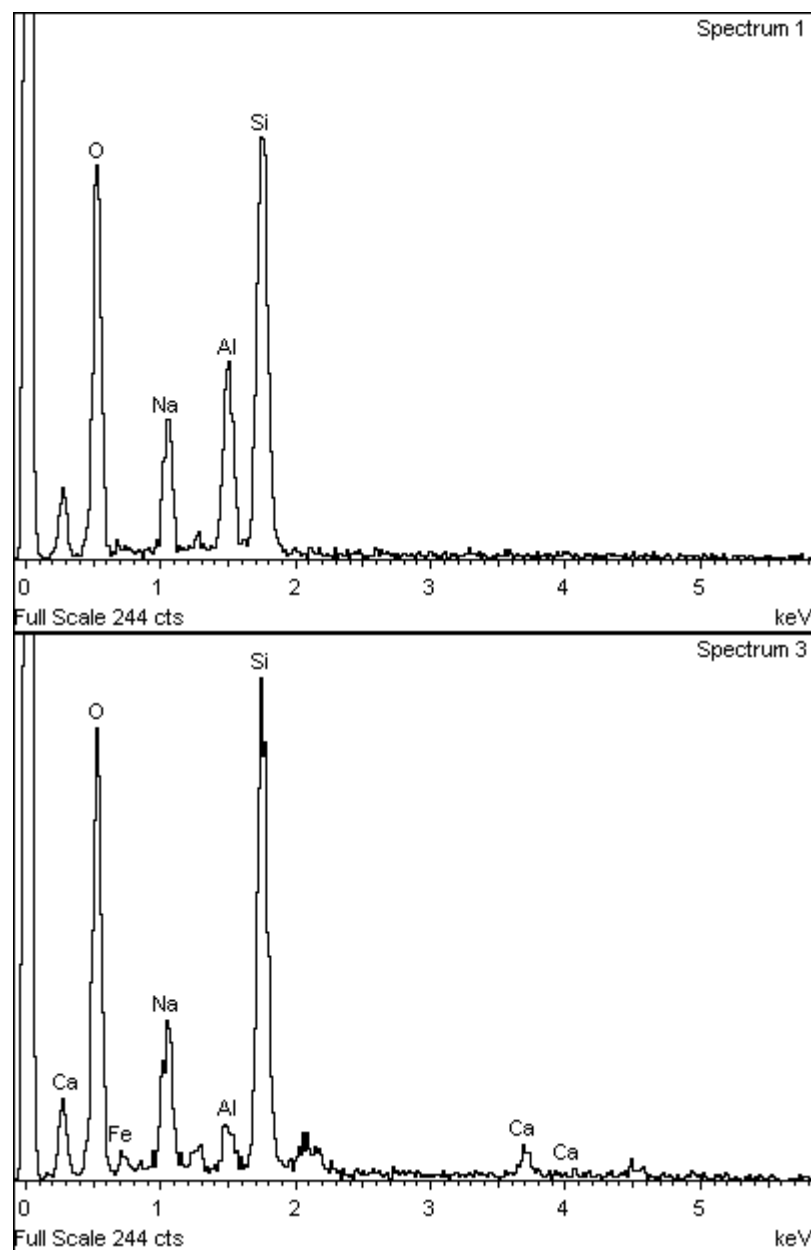


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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA44R10.



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA44R10.

Project: PCT SURFACE CORROSION 1
Owner: cavinm
Site: Site of Interest 1

Sample: LAWA 44 R10
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ca	Fe	O	Total
Spectrum 1	Yes	10.02		11.23	30.52				48.24	100.00
Spectrum 2	Yes	7.93	4.91	2.20	23.96	1.64		16.62	42.73	100.00
Spectrum 3	Yes	10.85		2.51	30.50		2.69	8.12	45.32	100.00
Spectrum 4	Yes	9.42		10.88	31.20				48.50	100.00
Max.		10.85	4.91	11.23	31.20	1.64	2.69	16.62	48.50	
Min.		7.93	4.91	2.20	23.96	1.64	2.69	8.12	42.73	

All results in weight%

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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA44R10.

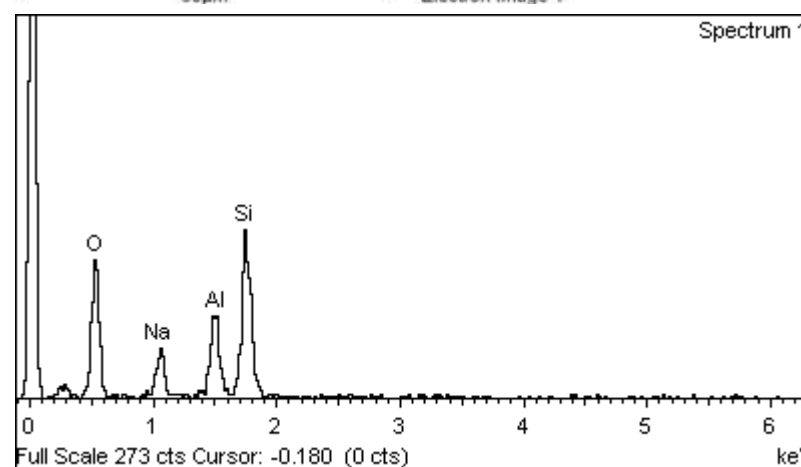
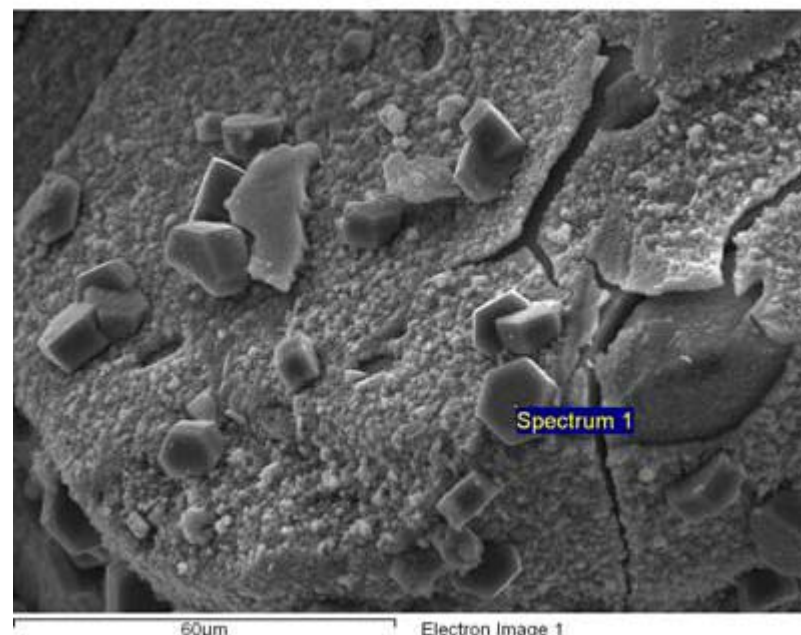
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.29	7.28	11.17	Na ₂ O
Al K	12.20	9.12	23.05	Al ₂ O ₃
Si K	30.75	22.09	65.78	SiO ₂
O	48.76	61.51		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA44R10.

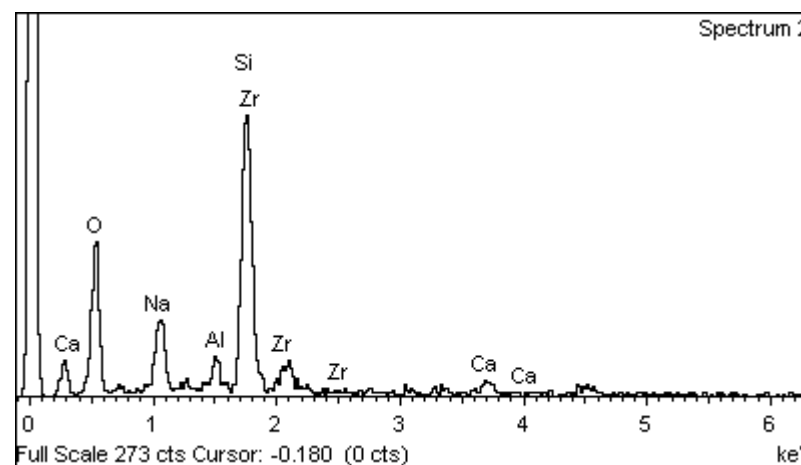
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 2

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	9.08	8.64	12.24	Na ₂ O
Al K	2.78	2.25	5.24	Al ₂ O ₃
Si K	30.45	23.71	65.14	SiO ₂
Ca K	3.03	1.65	4.24	CaO
Zr L	9.72	2.33	13.13	ZrO ₂
O	44.94	61.42		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA44R10.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

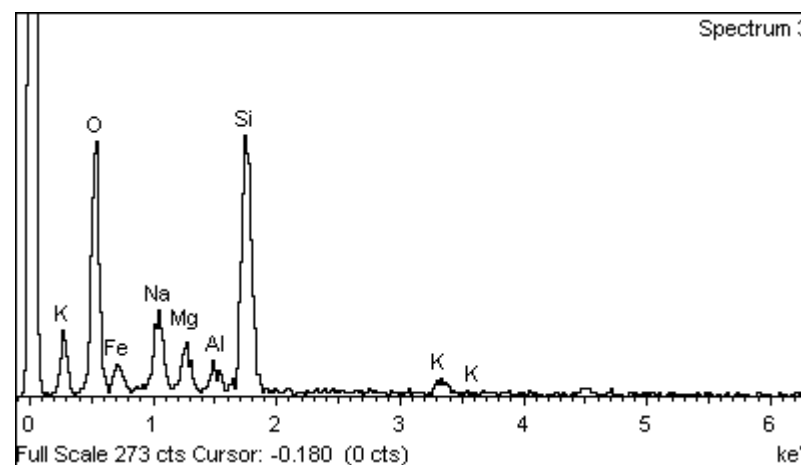
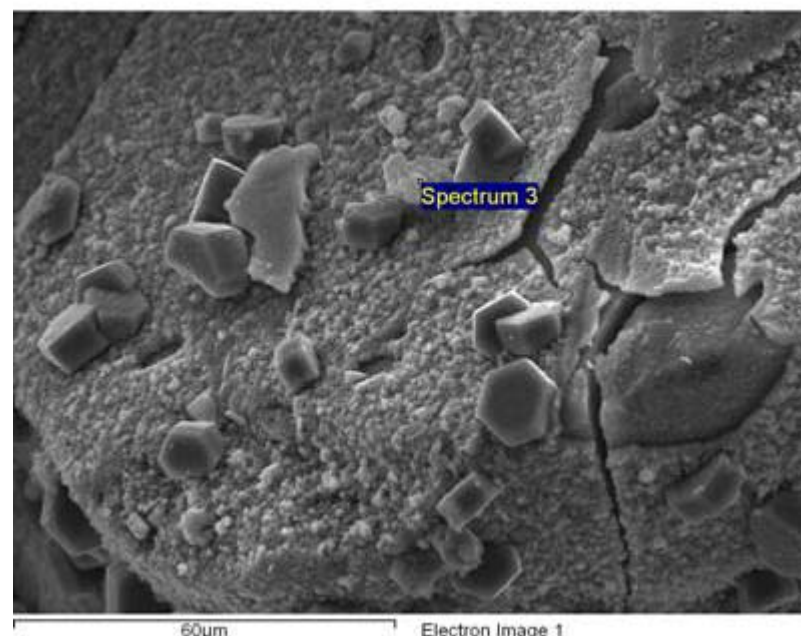
Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.40	8.19	11.32	Na ₂ O
Mg K	4.20	3.87	6.96	MgO
Al K	1.52	1.26	2.87	Al ₂ O ₃
Si K	24.04	19.18	51.42	SiO ₂
K K	2.16	1.24	2.61	K ₂ O
Fe K	17.36	6.97	24.82	Fe ₂ O ₃
O	42.32	59.29		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA44R10.

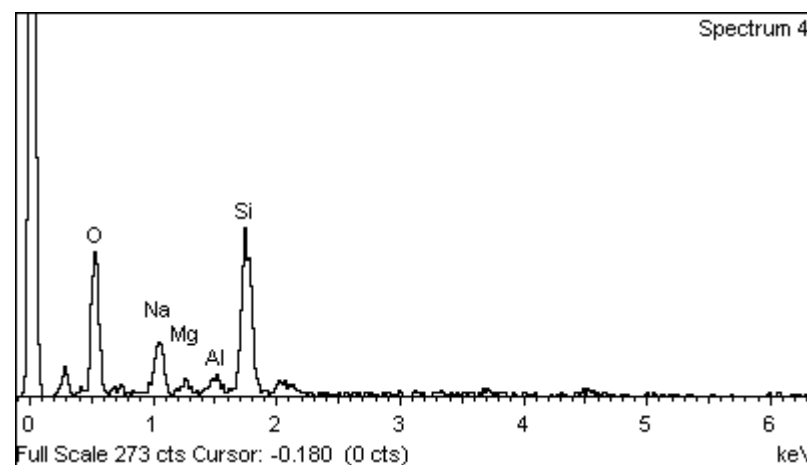
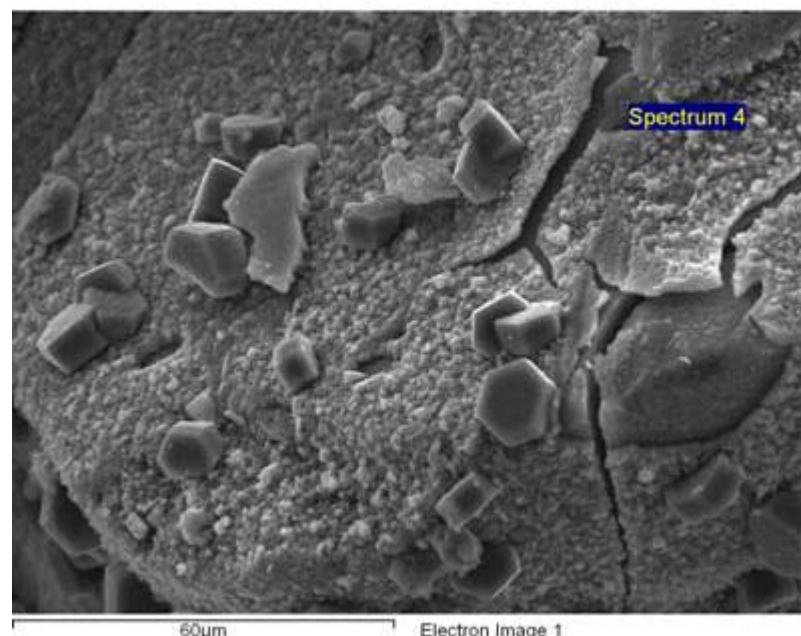
Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
 Mg MgO 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	11.22	9.83	15.13	Na ₂ O
Mg K	2.82	2.34	4.68	MgO
Al K	2.69	2.01	5.09	Al ₂ O ₃
Si K	35.11	25.18	75.10	SiO ₂
O	48.16	60.64		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA44R10.

Spectrum processing :
Peak possibly omitted : 3.320 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

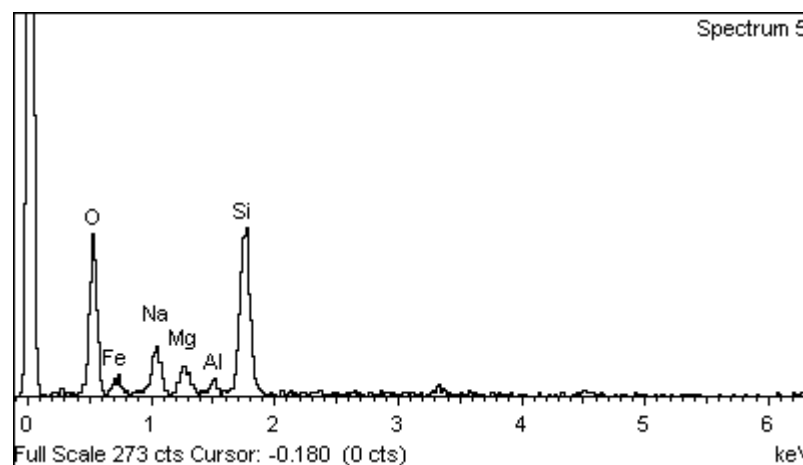
Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

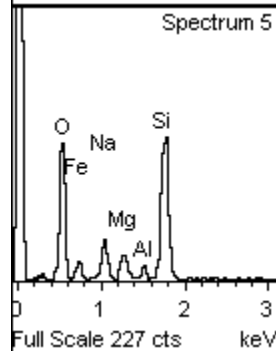
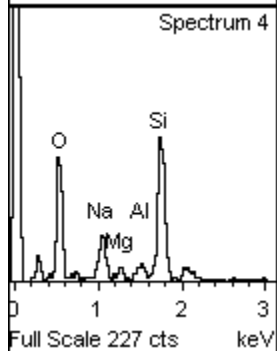
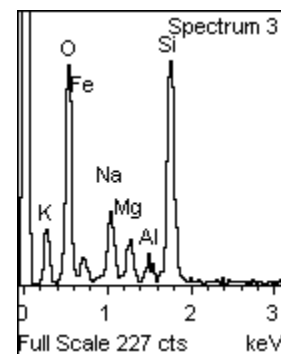
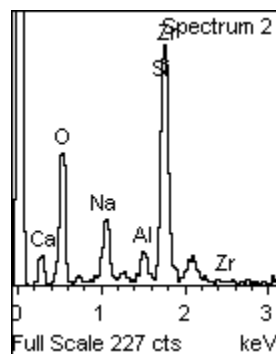
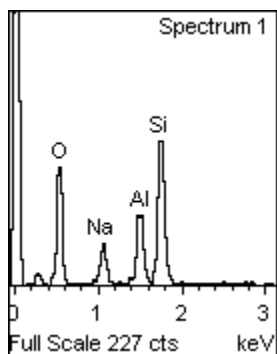
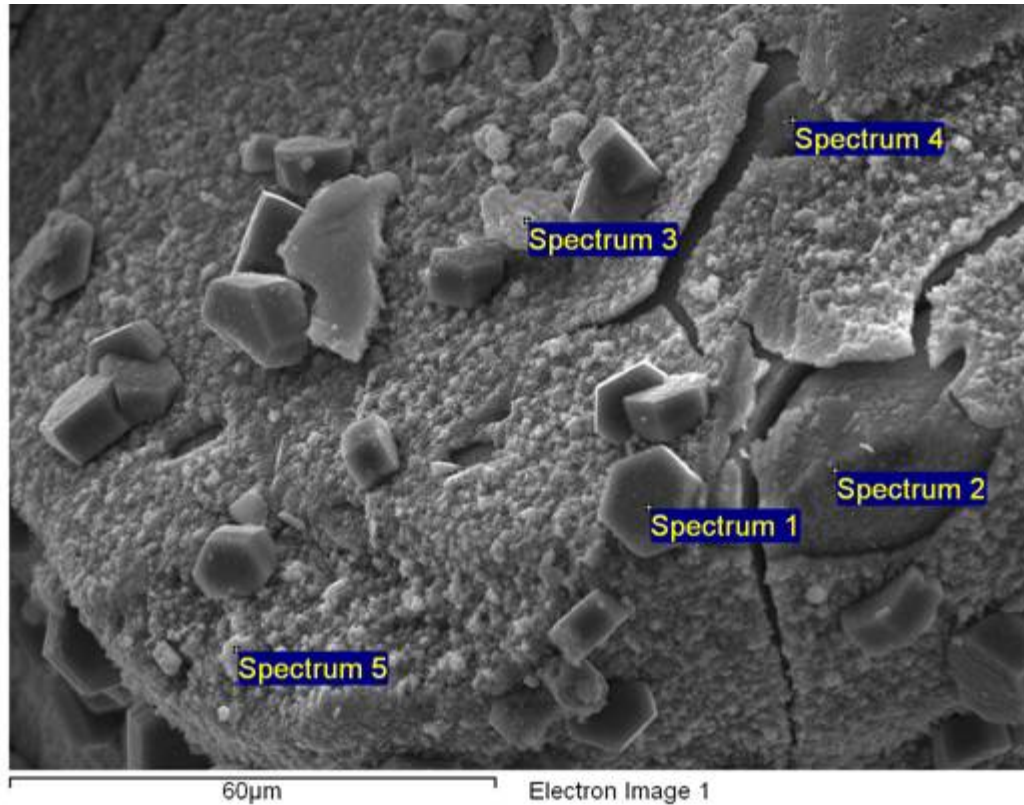
Element	Weight%	Atomic%	Compd%	Formula
Na K	7.81	7.43	10.52	Na ₂ O
Mg K	4.46	4.01	7.39	MgO
Al K	1.37	1.11	2.59	Al ₂ O ₃
Si K	27.05	21.07	57.86	SiO ₂
Fe K	15.13	5.93	21.63	Fe ₂ O ₃
O	44.19	60.44		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA44R10.

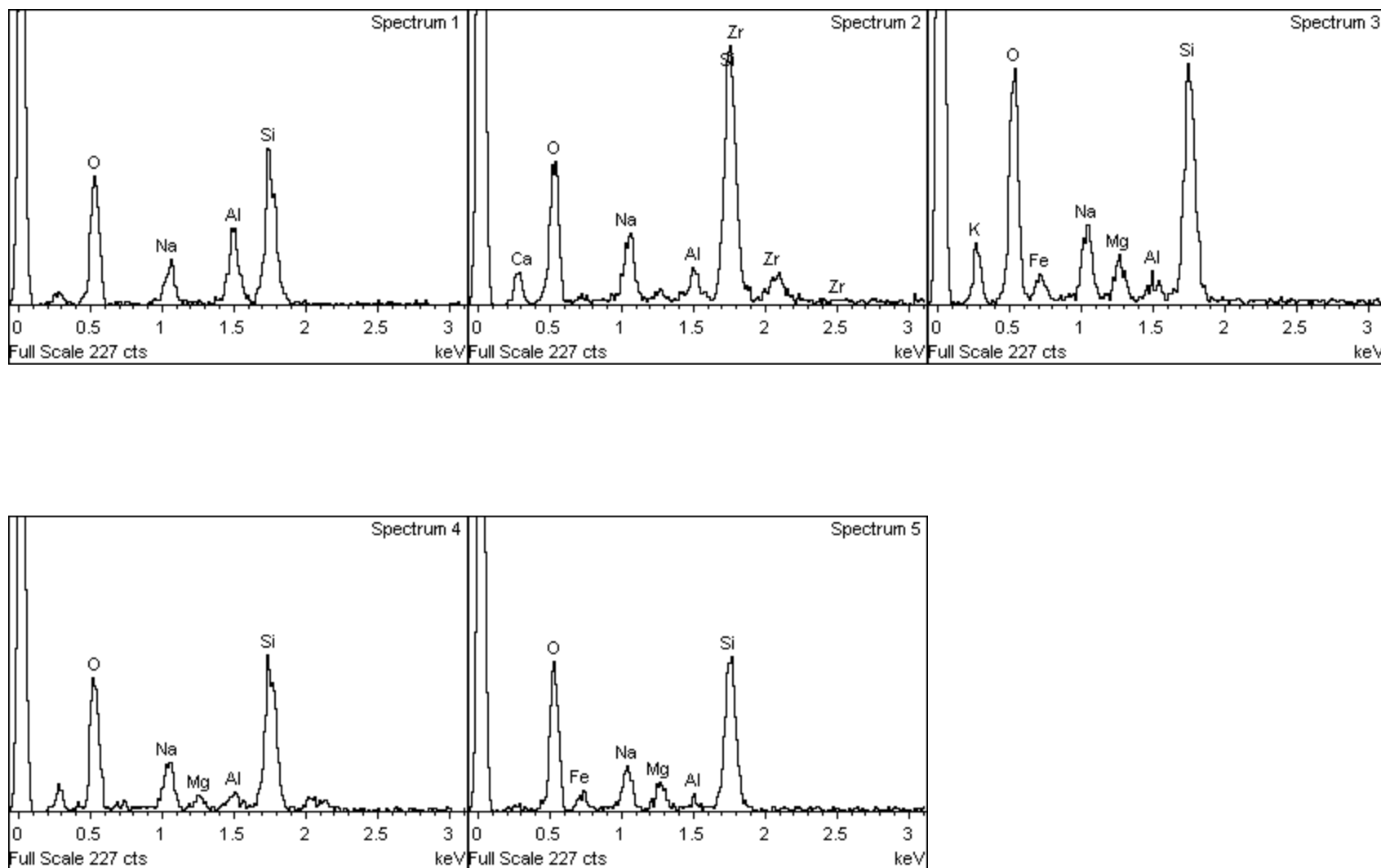


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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA44R10.



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA44R10.

Project: PCT SURFACE CORROSION 1
 Owner: cavinm
 Site: Site of Interest 2

Sample: LAWA 44 R10
 Type: Default
 ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ca	Fe	Zr	O	Total
Spectrum 1	Yes	8.29		12.20	30.75					48.76	100.00
Spectrum 2	Yes	9.08		2.78	30.45		3.03		9.72	44.94	100.00
Spectrum 3	Yes	8.40	4.20	1.52	24.04	2.16		17.36		42.32	100.00
Spectrum 4	Yes	11.22	2.82	2.69	35.11					48.16	100.00
Spectrum 5	Yes	7.81	4.46	1.37	27.05			15.13		44.19	100.00
Max.		11.22	4.46	12.20	35.11	2.16	3.03	17.36	9.72	48.76	
Min.		7.81	2.82	1.37	24.04	2.16	3.03	15.13	9.72	42.32	

All results in weight%

PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME LAWA44R10.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

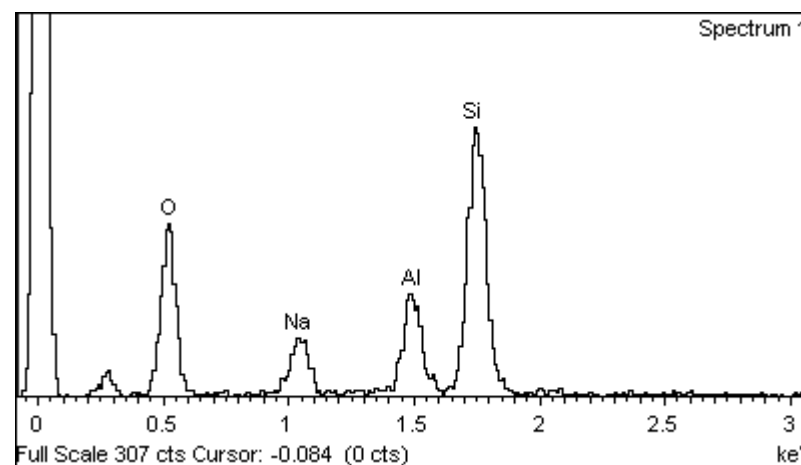
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

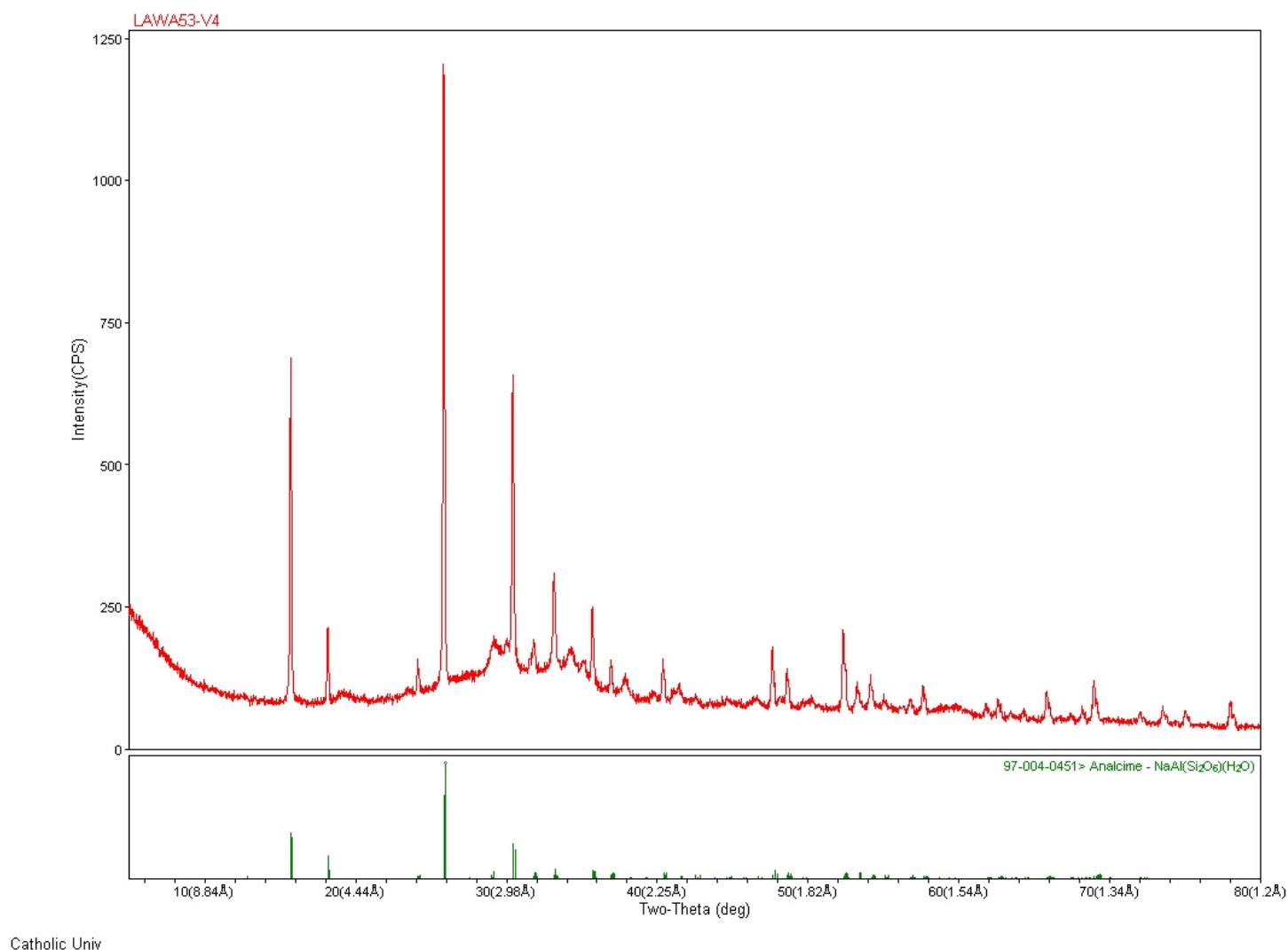
Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.28	6.38	9.81	Na ₂ O
Al K	9.87	7.37	18.65	Al ₂ O ₃
Si K	33.44	24.00	71.54	SiO ₂
O	49.41	62.25		
Totals	100.00			



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**XRD powder patterns (raw data and best match) and SEM/EDS analysis of glass LAWA53,
collected from 90 °C PCT-B vessel after 2949 days**



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PCT SURFACE CORROSION. FILE 5. ROI 1. GLASS NAME LAWA53.

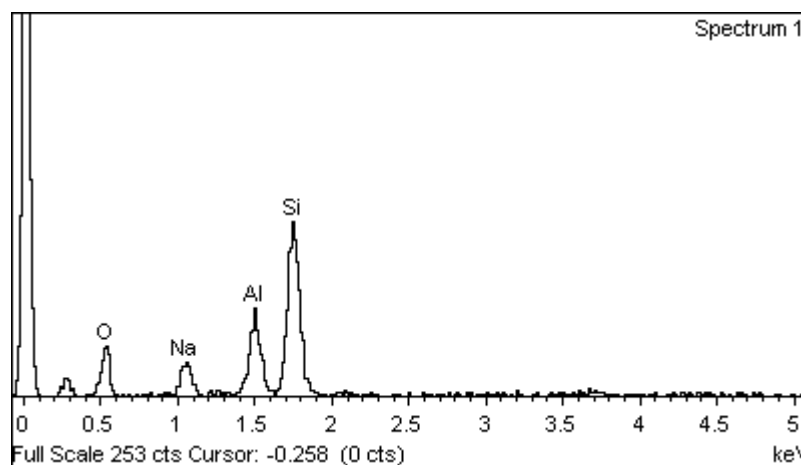
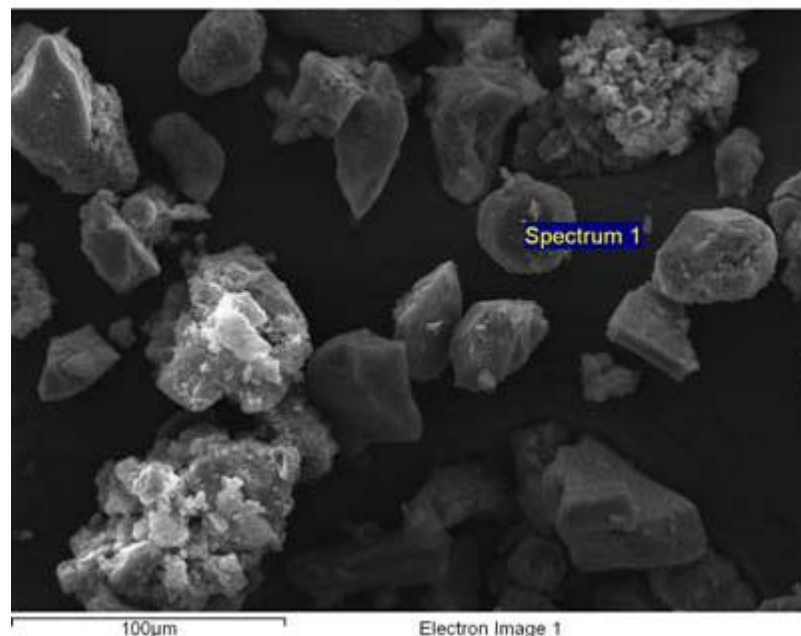
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.27	7.26	11.15	Na ₂ O
Al K	11.54	8.63	21.80	Al ₂ O ₃
Si K	31.34	22.52	67.05	SiO ₂
O	48.85	61.60		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 5. ROI 1. GLASS NAME LAWA53.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

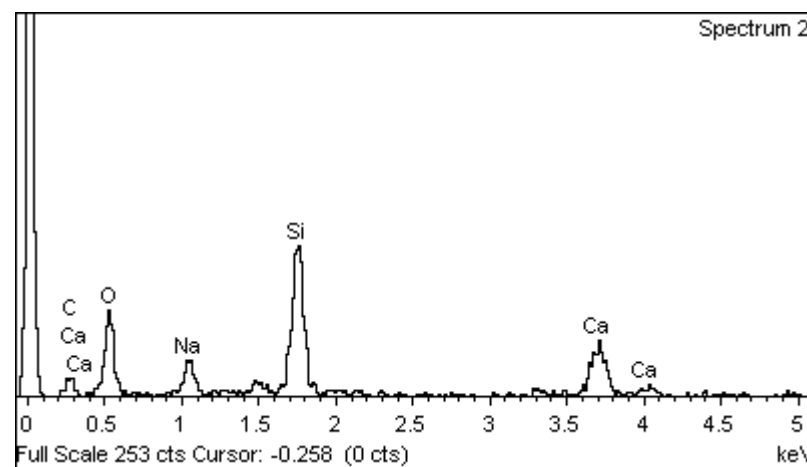
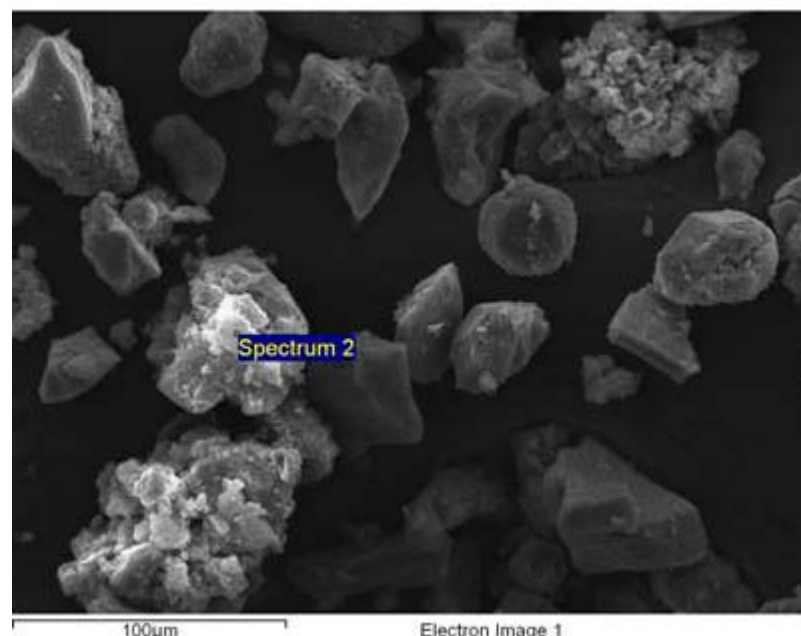
Standard :

Na Albite 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

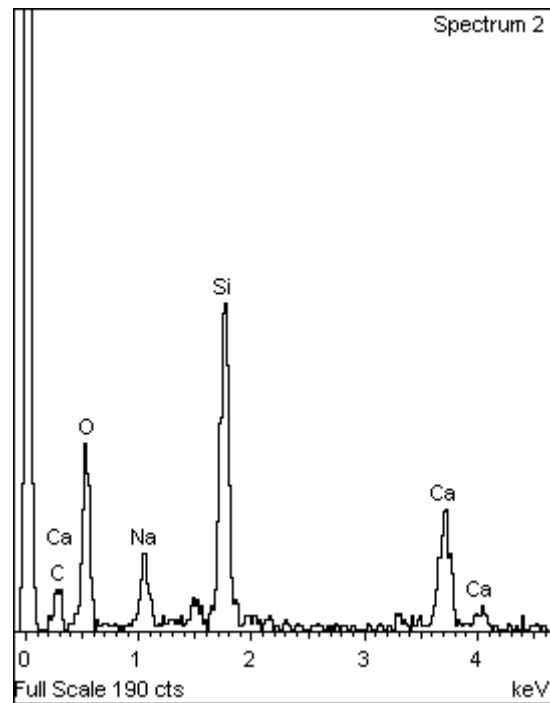
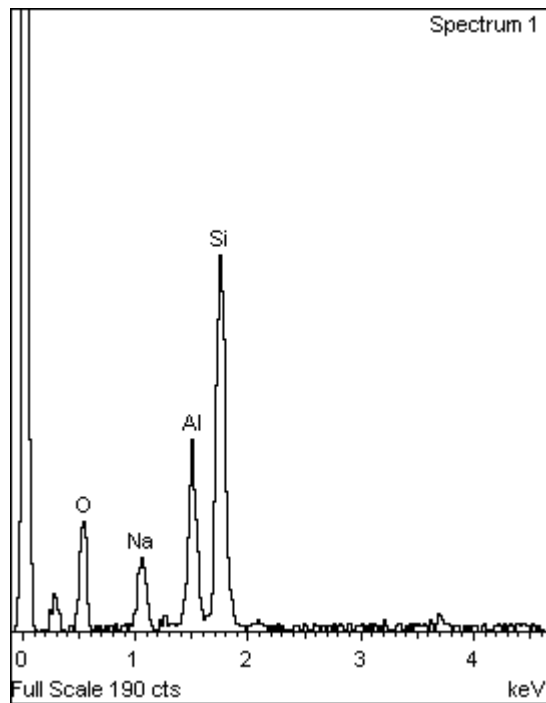
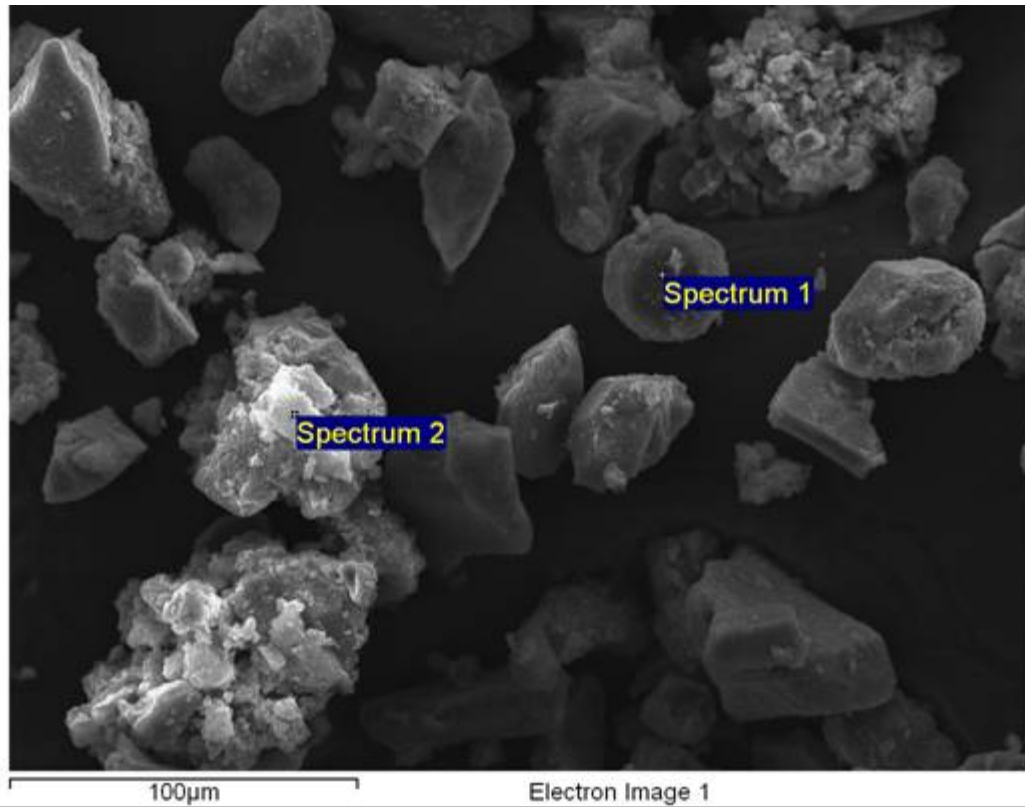
Element	Weight%	Atomic%	Compd%	Formula
Na K	9.98	9.38	13.46	Na ₂ O
Si K	29.28	22.51	62.64	SiO ₂
Ca K	17.08	9.20	23.90	CaO
O	43.65	58.91		
Totals	100.00			



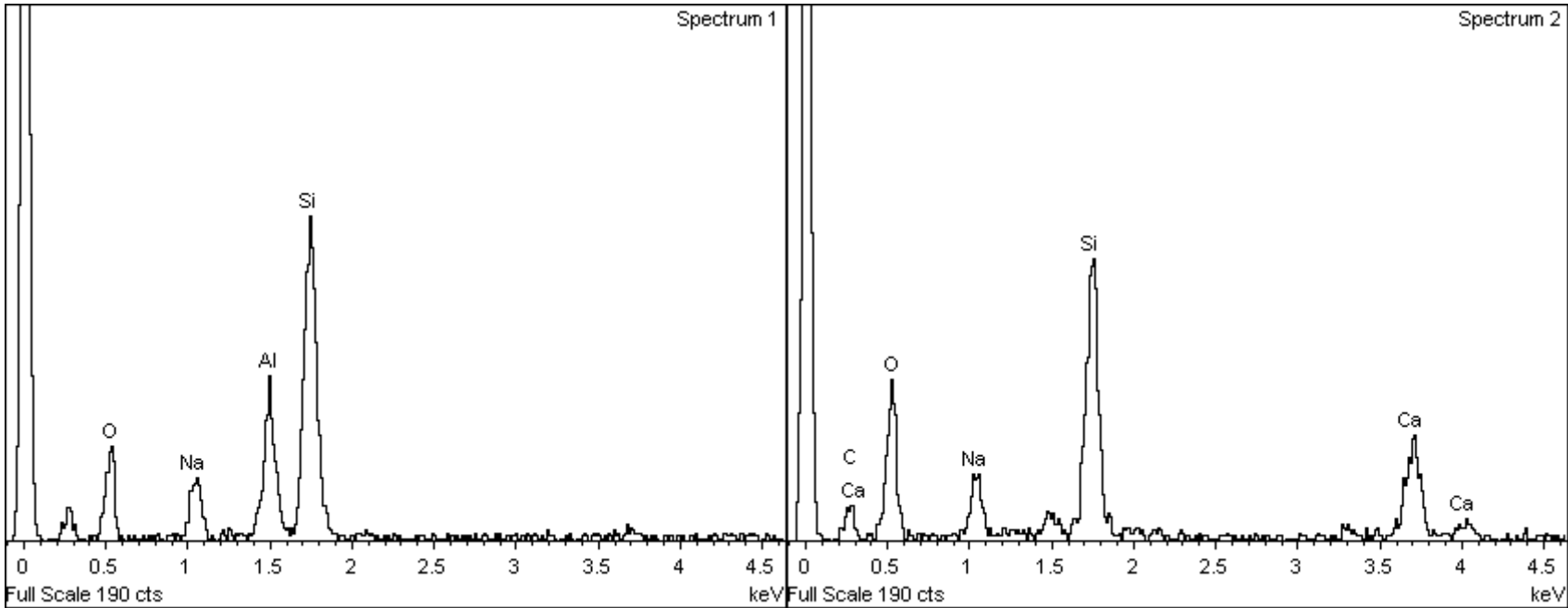
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PCT SURFACE CORROSION. FILE 5. ROI 1. GLASS NAME LAWA53.



PCT SURFACE CORROSION. FILE 5. ROI 1. GLASS NAME LAWA53.



Project: PCT SURFACE CORROSION 5
Owner: cavinm
Site: Site of Interest 1

Sample: LAWA 53
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Al	Si	Ca	O	Total
Spectrum 1	Yes	8.27	11.54	31.34		48.85	100.00
Spectrum 2	Yes	9.98		29.28	17.08	43.65	100.00
Max.		9.98	11.54	31.34	17.08	48.85	
Min.		8.27	11.54	29.28	17.08	43.65	

All results in weight%



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PCT SURFACE CORROSION. FILE 5. ROI 2. GLASS NAME LAWA53.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

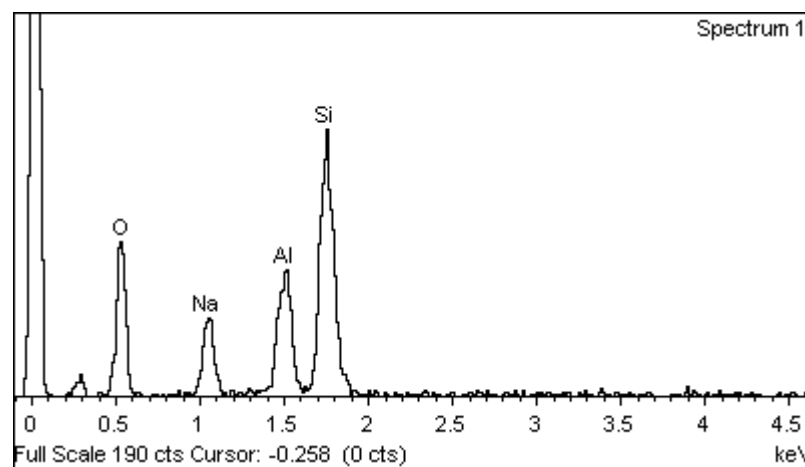
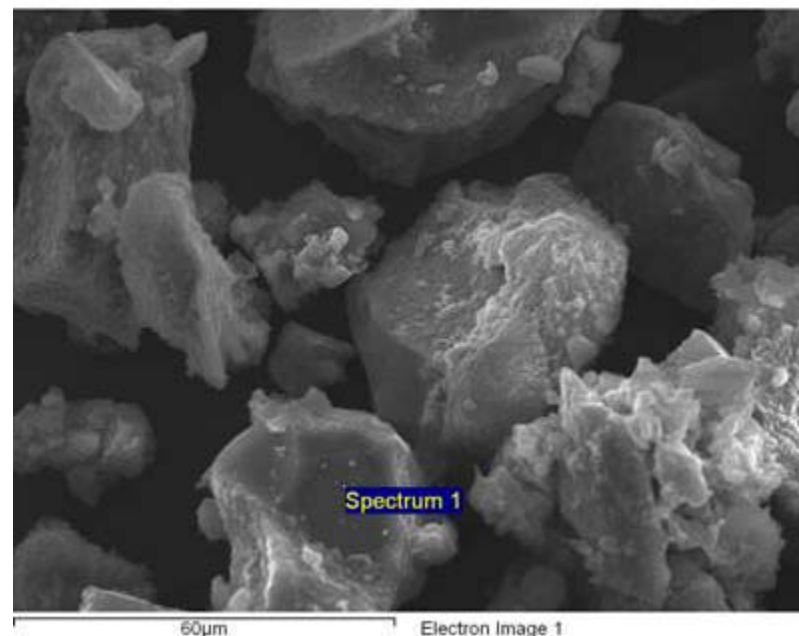
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	11.52	10.13	15.53	Na ₂ O
Al K	11.94	8.94	22.56	Al ₂ O ₃
Si K	28.94	20.82	61.91	SiO ₂
O	47.60	60.11		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 5. ROI 2. GLASS NAME LAWA53.

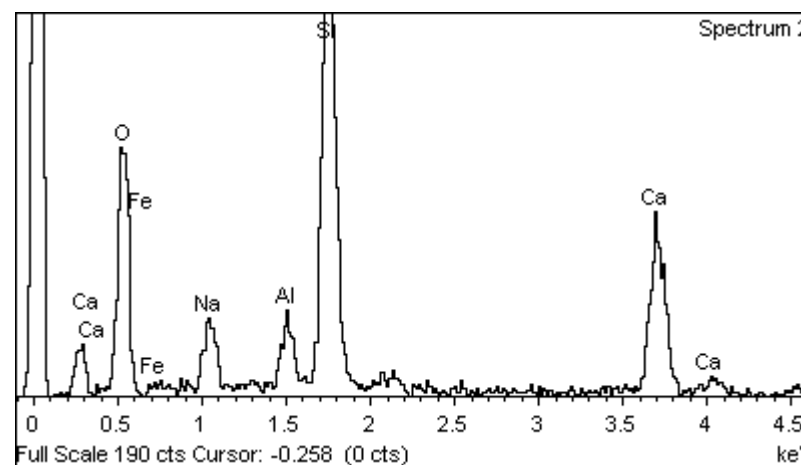
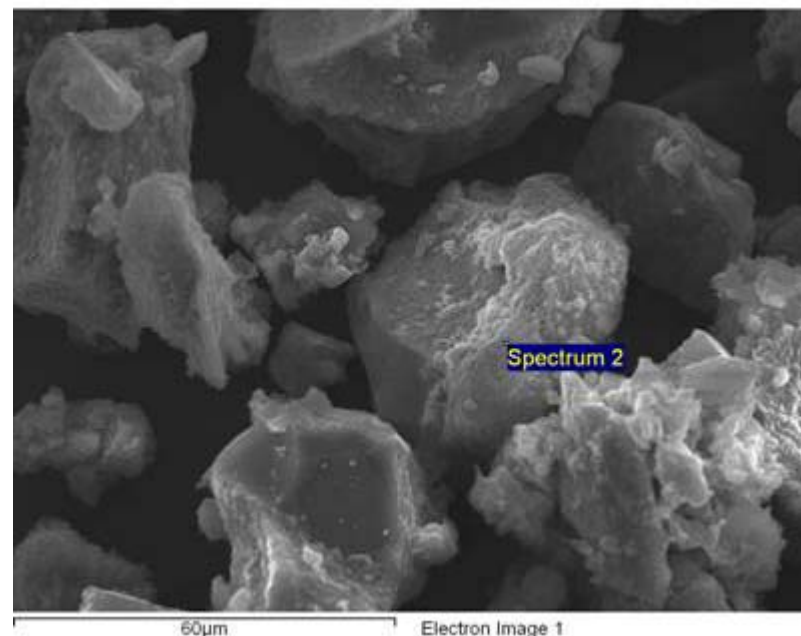
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.93	5.62	7.99	Na ₂ O
Al K	3.51	2.83	6.62	Al ₂ O ₃
Si K	27.98	21.70	59.87	SiO ₂
Ca K	14.98	8.14	20.96	CaO
Fe K	3.19	1.24	4.56	Fe ₂ O ₃
O	44.41	60.47		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 5. ROI 2. GLASS NAME LAWA53.

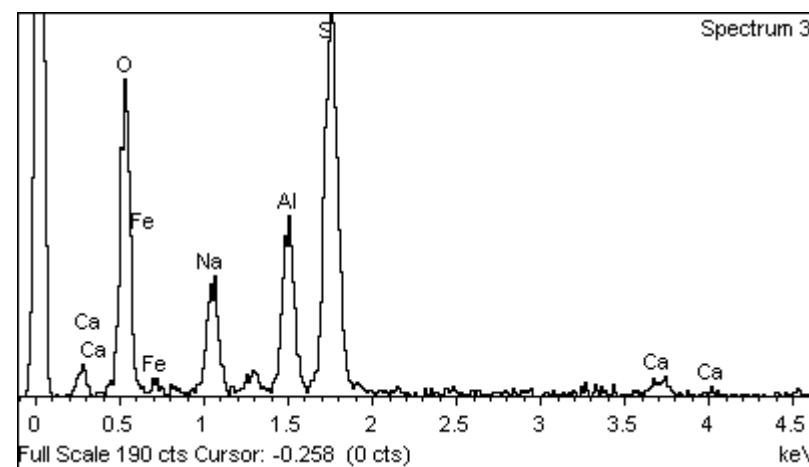
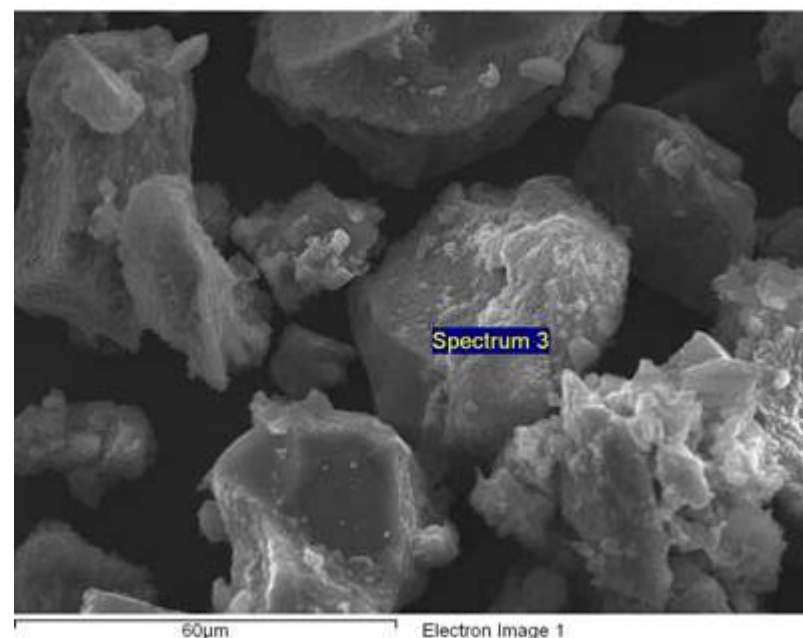
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	10.38	9.35	13.99	Na ₂ O
Al K	10.94	8.40	20.68	Al ₂ O ₃
Si K	27.17	20.04	58.12	SiO ₂
Ca K	1.39	0.72	1.95	CaO
Fe K	3.69	1.37	5.27	Fe ₂ O ₃
O	46.43	60.12		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 5. ROI 2. GLASS NAME LAWA53.

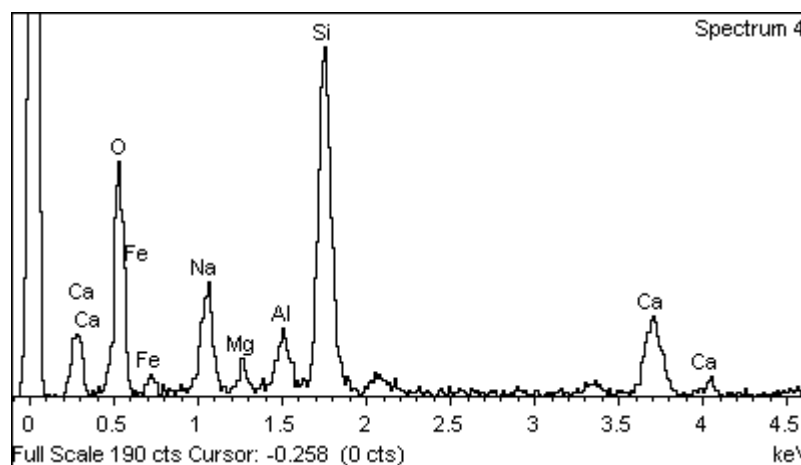
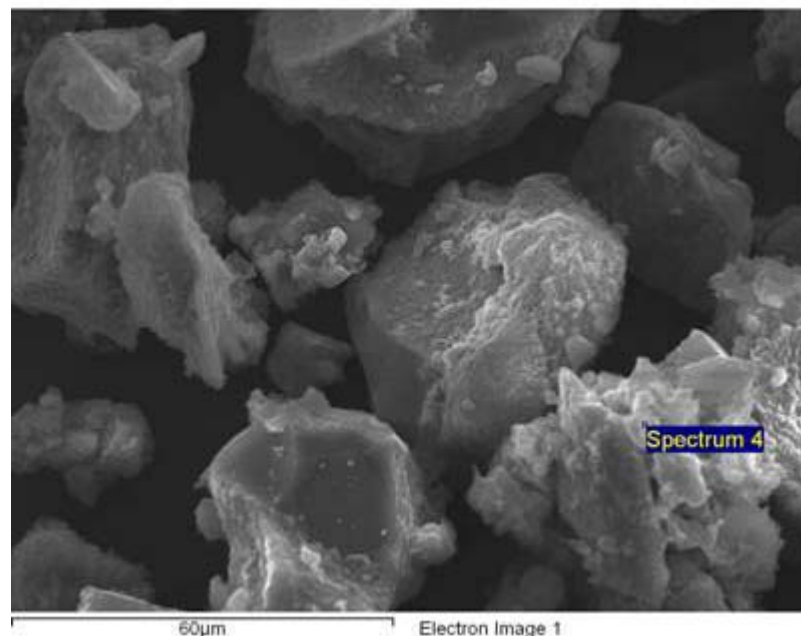
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

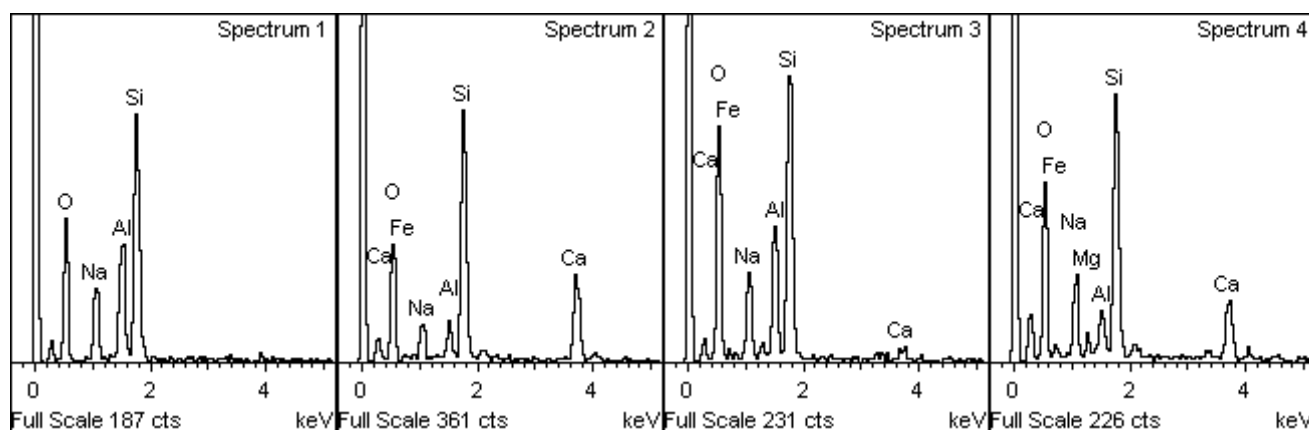
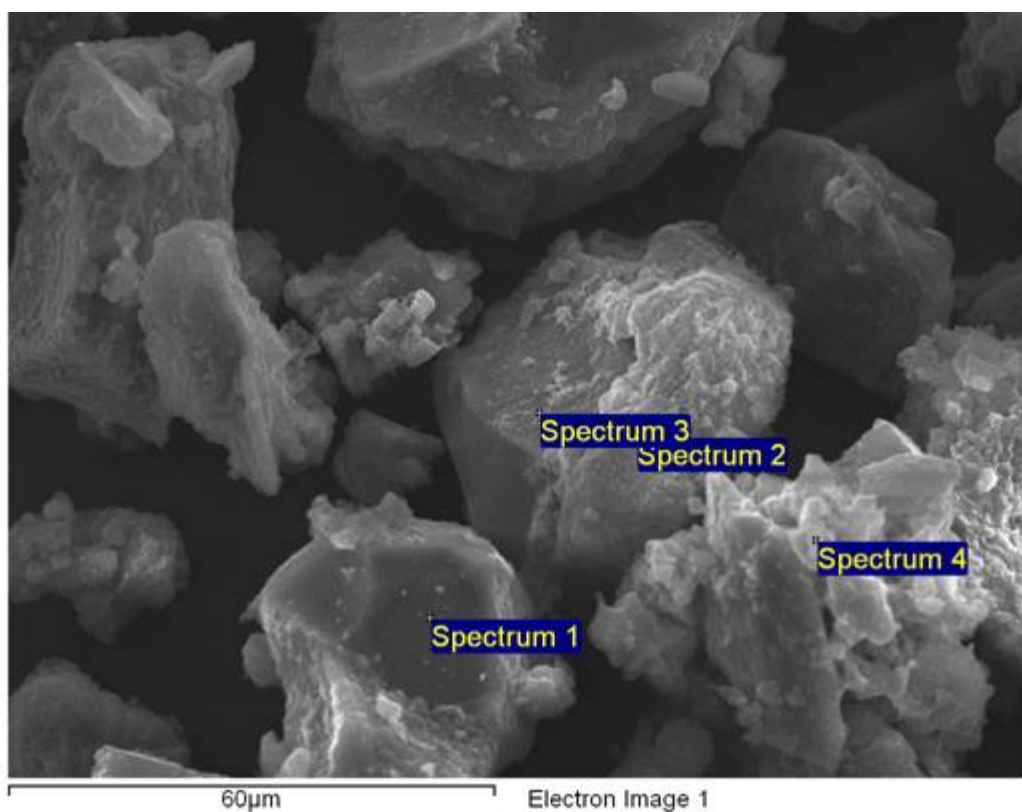
Element	Weight%	Atomic%	Compd%	Formula
Na K	10.70	10.20	14.42	Na ₂ O
Mg K	2.29	2.07	3.80	MgO
Al K	3.67	2.98	6.93	Al ₂ O ₃
Si K	23.70	18.50	50.71	SiO ₂
Ca K	8.00	4.38	11.20	CaO
Fe K	9.05	3.55	12.94	Fe ₂ O ₃
O	42.58	58.33		
Totals	100.00			



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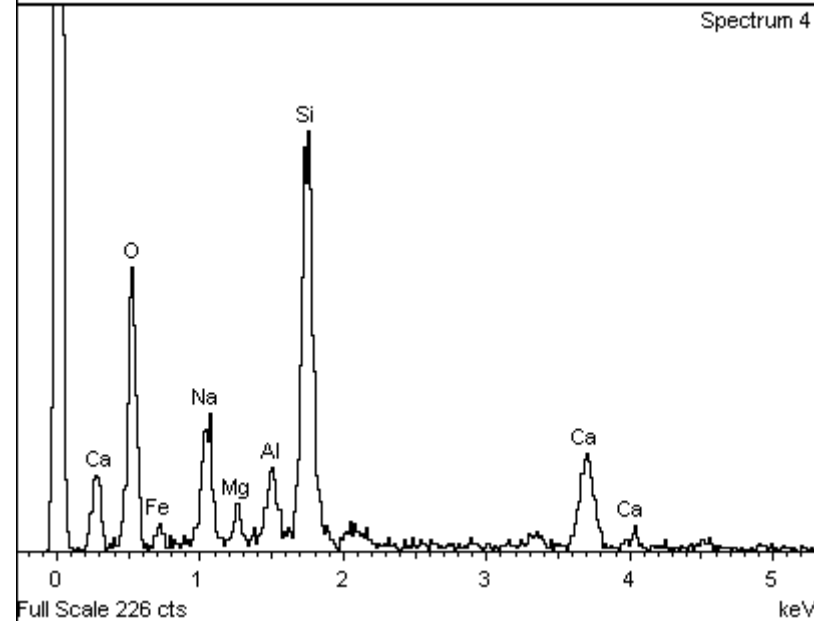
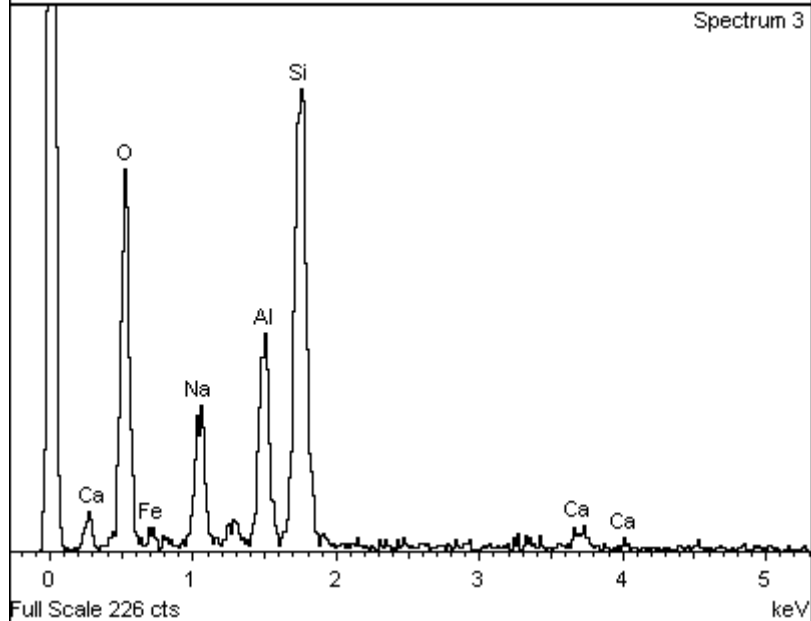
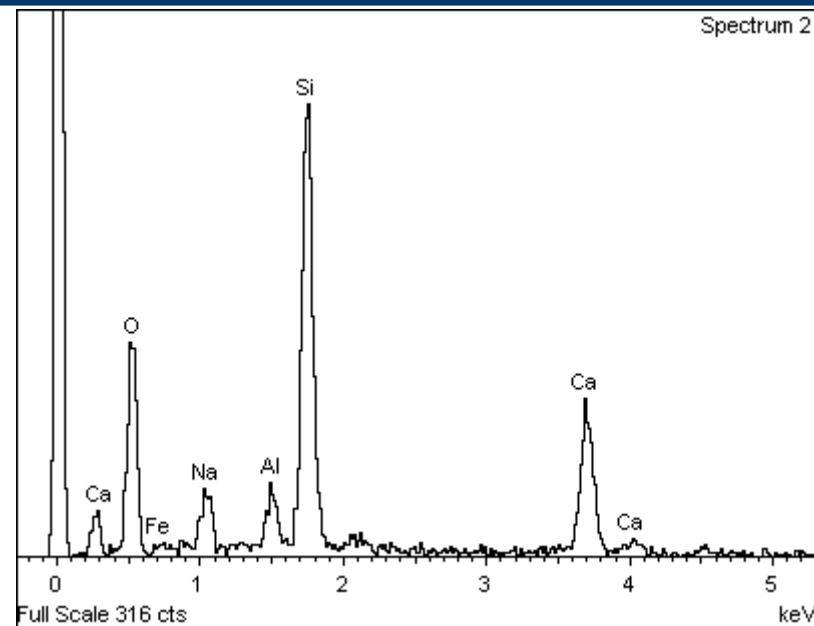
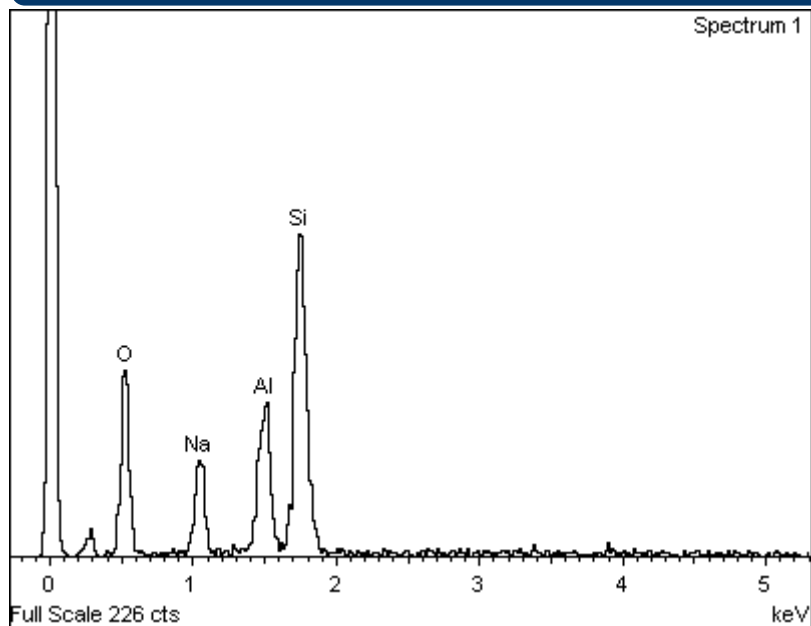
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PCT SURFACE CORROSION. FILE 5. ROI 2. GLASS NAME LAWA53.



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PCT SURFACE CORROSION. FILE 5. ROI 2. GLASS NAME LAWA53.



PCT SURFACE CORROSION. FILE 5. ROI 2. GLASS NAME LAWA53.

Project: PCT SURFACE CORROSION 5
Owner: cavinm
Site: Site of Interest 2

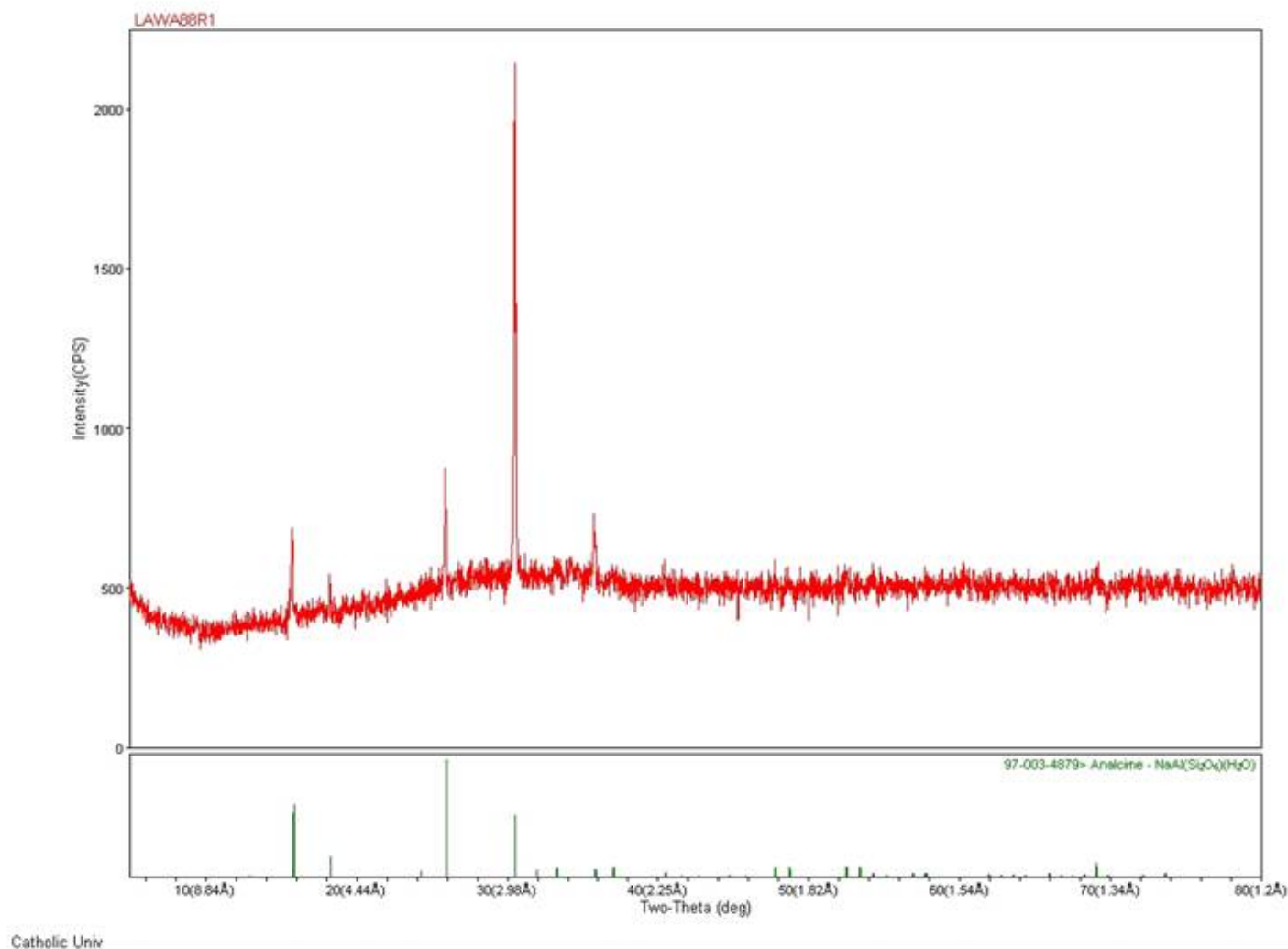
Sample: LAWA 53
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Ca	Fe	O	Total
Spectrum 1	Yes	11.52		11.94	28.94			47.60	100.00
Spectrum 2	Yes	5.93		3.51	27.98	14.98	3.19	44.41	100.00
Spectrum 3	Yes	10.38		10.94	27.17	1.39	3.69	46.43	100.00
Spectrum 4	Yes	10.70	2.29	3.67	23.70	8.00	9.05	42.58	100.00
Max.		11.52	2.29	11.94	28.94	14.98	9.05	47.60	
Min.		5.93	2.29	3.51	23.70	1.39	3.19	42.58	

All results in weight%

XRD powder patterns (raw data and best match) and SEM/EDS analysis of glass LAWA88R1,



collected from 90°C PCT-B vessel after 3275 days.

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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA88R1.

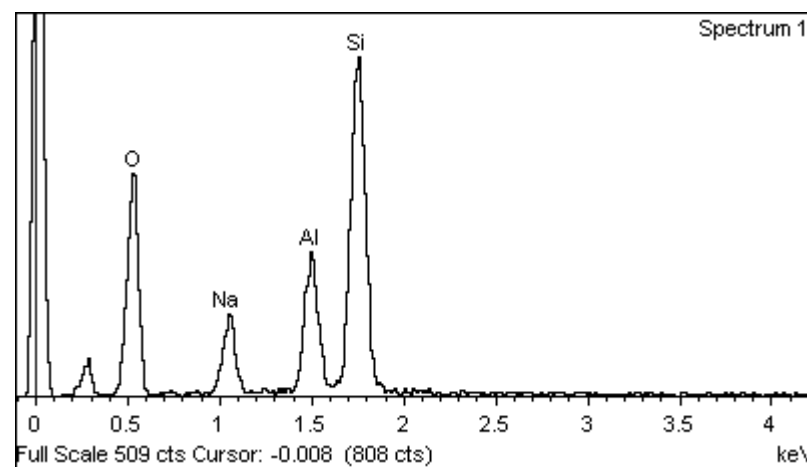
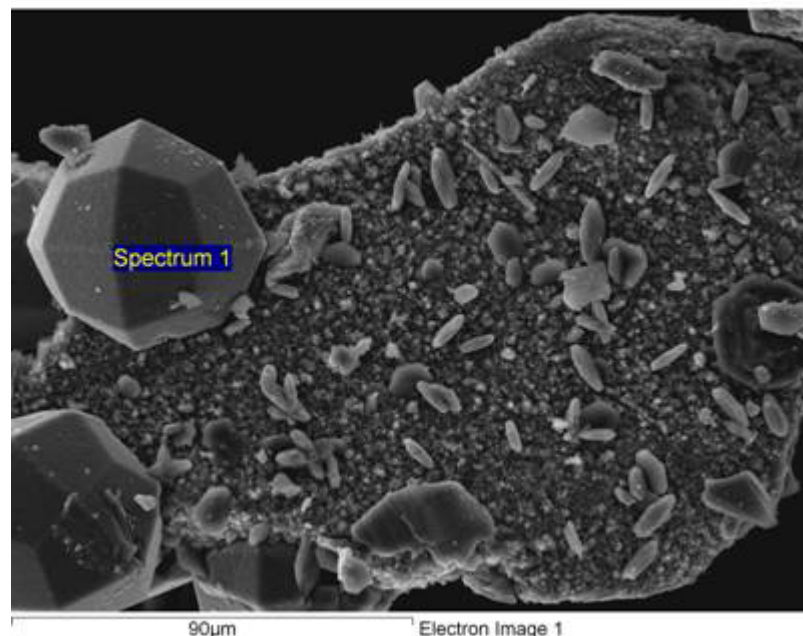
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.81	6.85	10.52	Na ₂ O
Al K	10.64	7.95	20.10	Al ₂ O ₃
Si K	32.43	23.28	69.38	SiO ₂
O	49.12	61.92		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA88R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

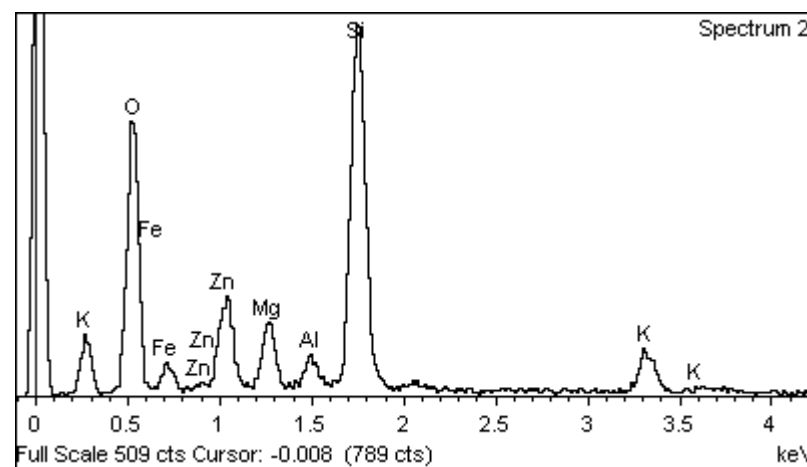
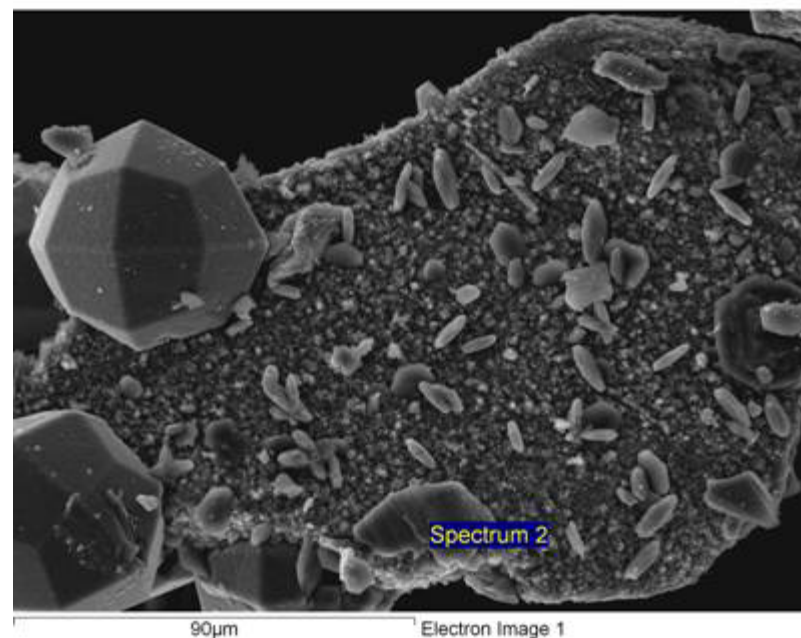
Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Mg K	4.77	4.75	7.91	MgO
Al K	1.67	1.49	3.15	Al ₂ O ₃
Si K	22.69	19.54	48.53	SiO ₂
K K	4.16	2.57	5.01	K ₂ O
Fe K	13.95	6.04	19.95	Fe ₂ O ₃
Zn L	12.41	4.59	15.45	ZnO
O	40.35	61.01		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA88R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

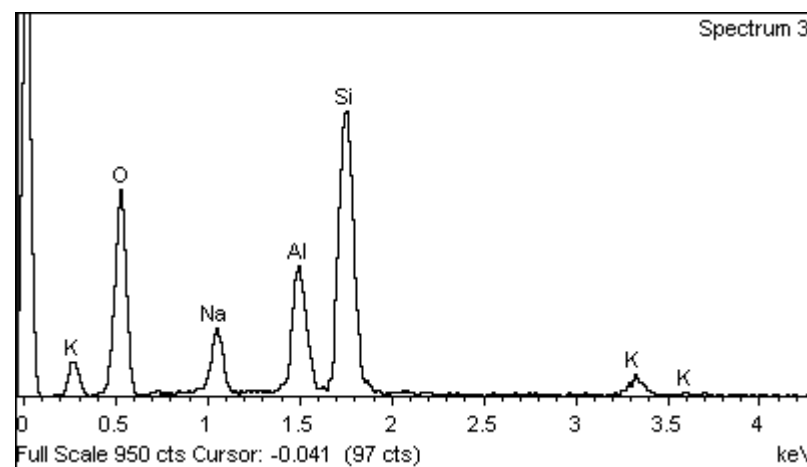
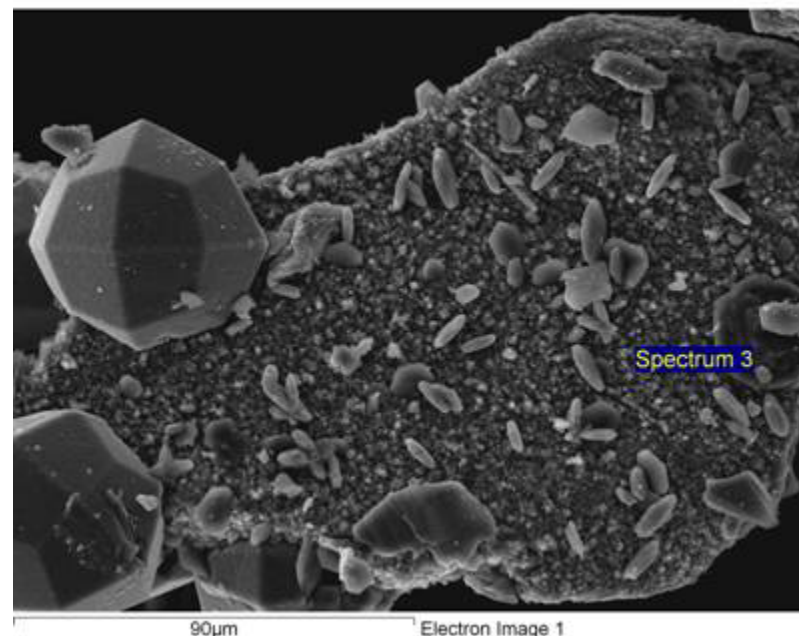
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.05	6.27	9.50	Na ₂ O
Al K	10.77	8.16	20.34	Al ₂ O ₃
Si K	30.93	22.53	66.17	SiO ₂
K K	3.31	1.73	3.98	K ₂ O
O	47.95	61.31		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA88R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

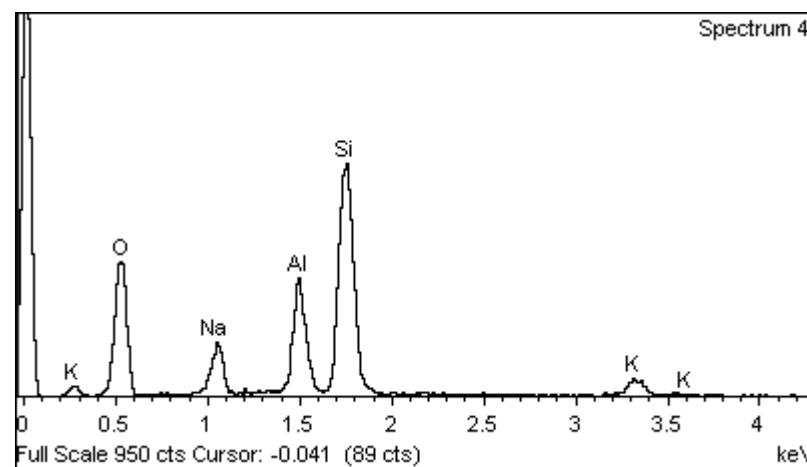
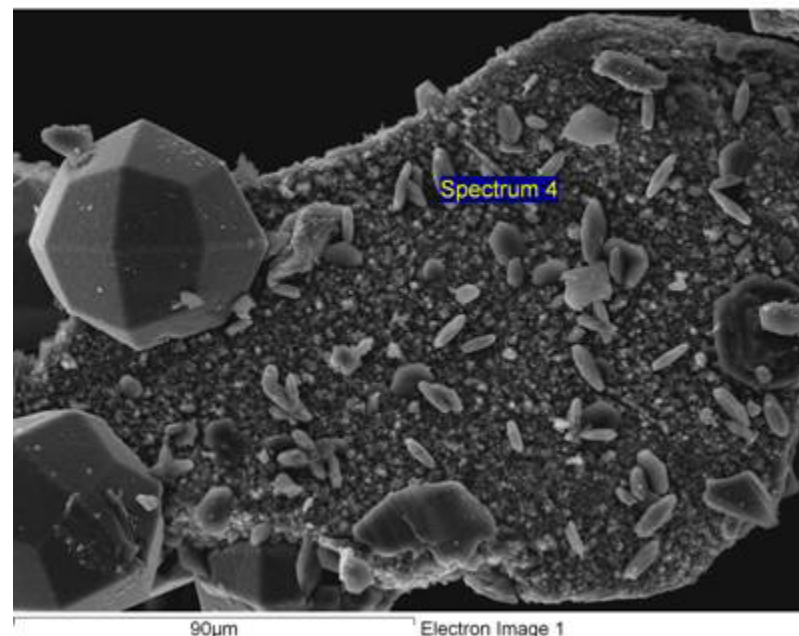
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.76	6.02	9.12	Na ₂ O
Al K	11.38	8.63	21.50	Al ₂ O ₃
Si K	30.47	22.22	65.19	SiO ₂
K K	3.48	1.82	4.20	K ₂ O
O	47.90	61.30		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA88R1.

Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

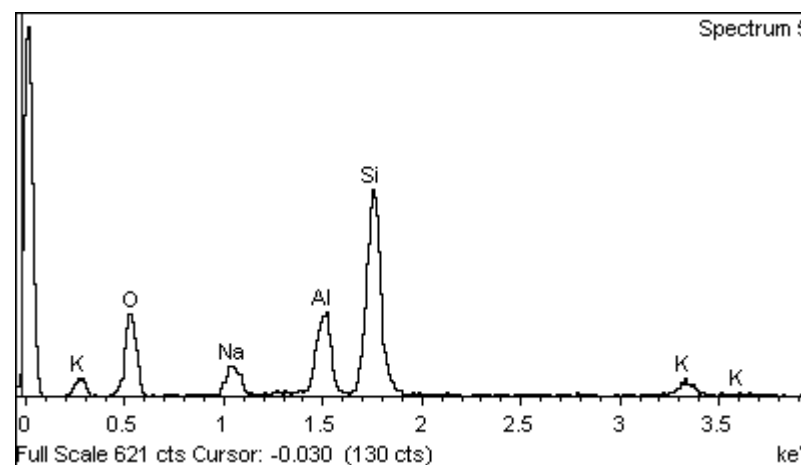
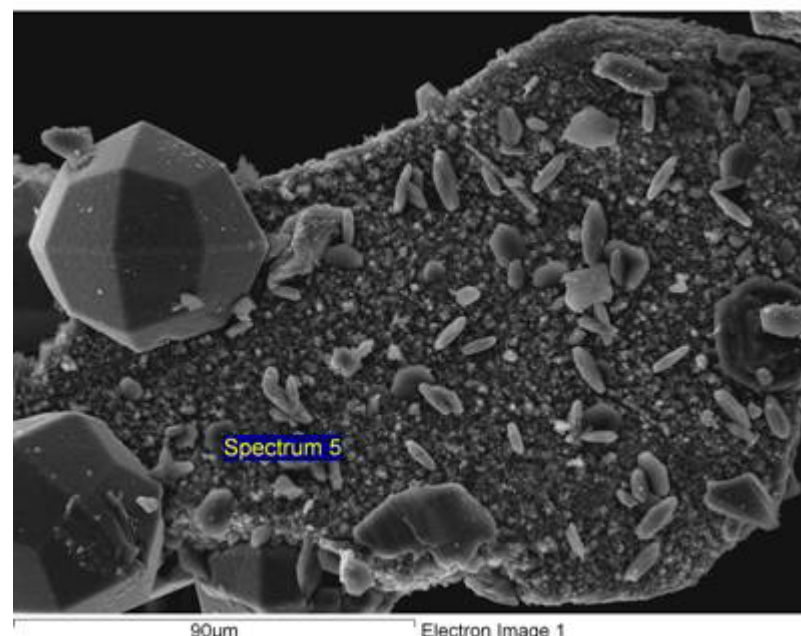
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.17	4.61	6.97	Na ₂ O
Al K	11.13	8.46	21.04	Al ₂ O ₃
Si K	31.41	22.94	67.21	SiO ₂
K K	3.98	2.09	4.79	K ₂ O
O	48.30	61.91		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA88R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

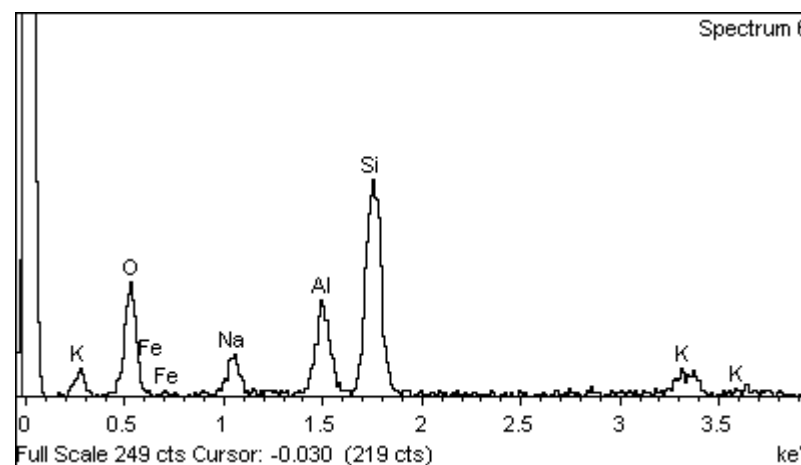
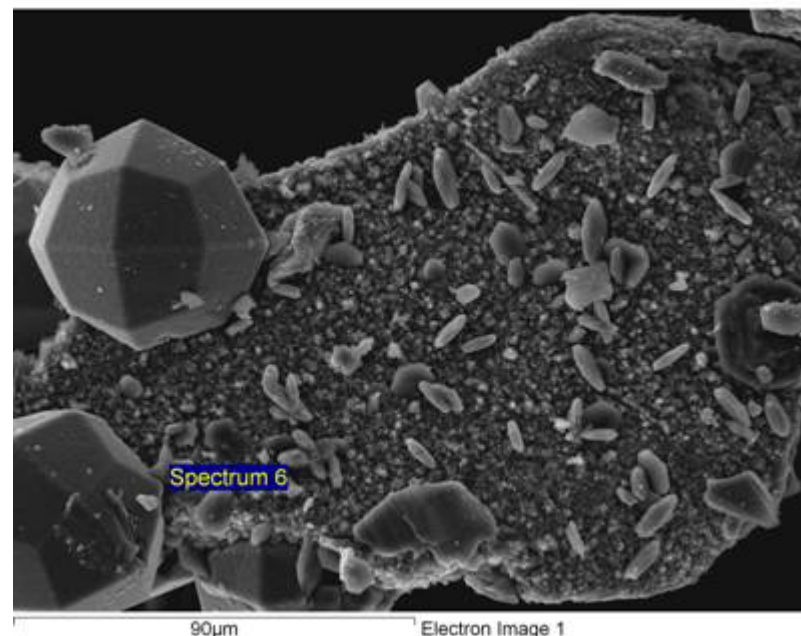
Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.11	5.01	6.89	Na ₂ O
Al K	8.04	6.71	15.19	Al ₂ O ₃
Si K	23.04	18.48	49.29	SiO ₂
K K	3.97	2.28	4.78	K ₂ O
Fe K	16.69	6.73	23.86	Fe ₂ O ₃
O	43.16	60.78		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA88R1.

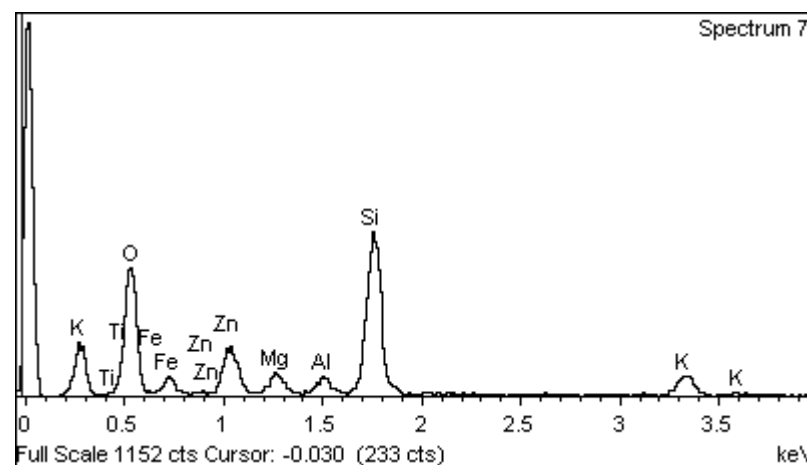
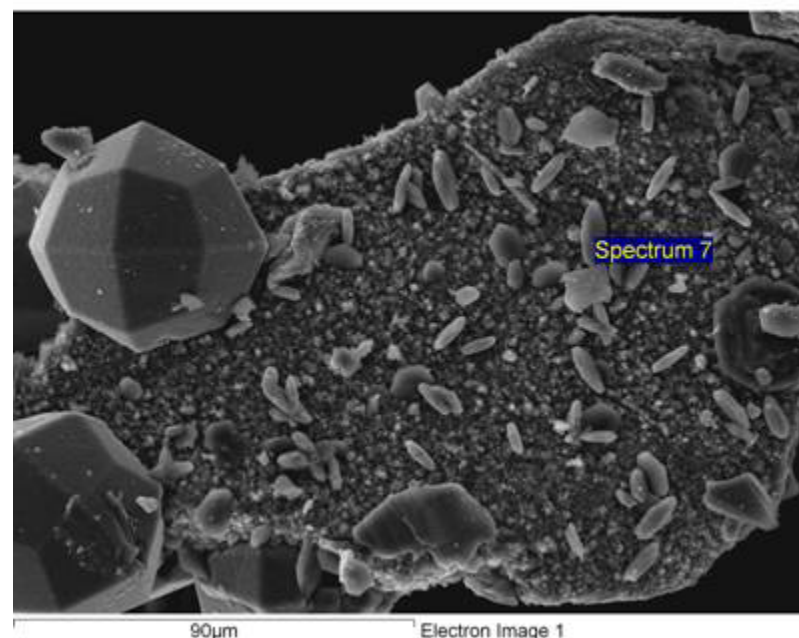
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Mg K	3.06	3.09	5.08	MgO
Al K	2.09	1.90	3.95	Al ₂ O ₃
Si K	22.06	19.27	47.20	SiO ₂
K K	4.61	2.89	5.55	K ₂ O
Ti K	1.97	1.01	3.28	TiO ₂
Fe K	12.07	5.30	17.26	Fe ₂ O ₃
Zn L	14.21	5.33	17.69	ZnO
O	39.93	61.21		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA88R1.

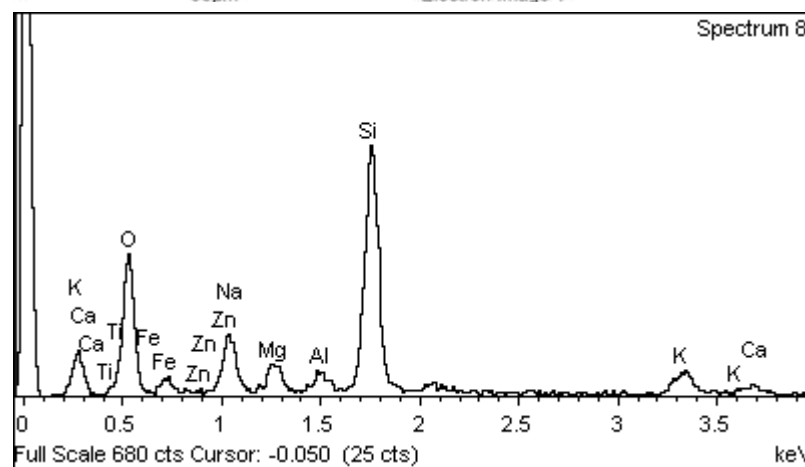
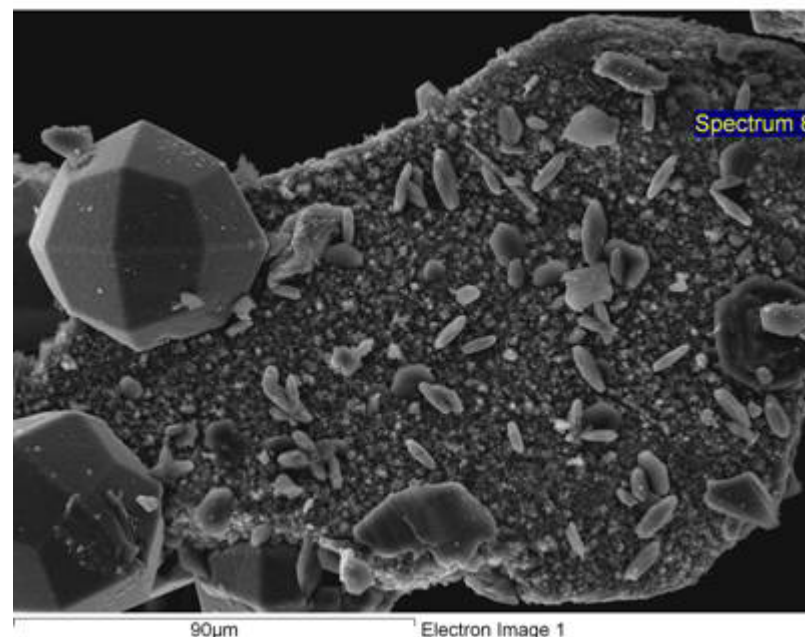
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

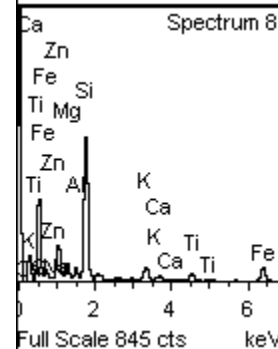
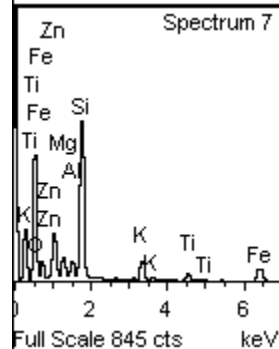
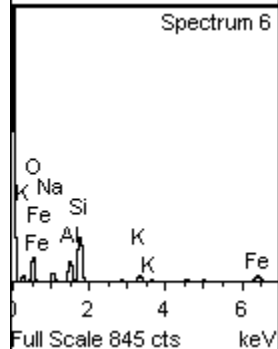
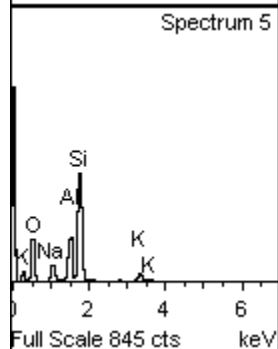
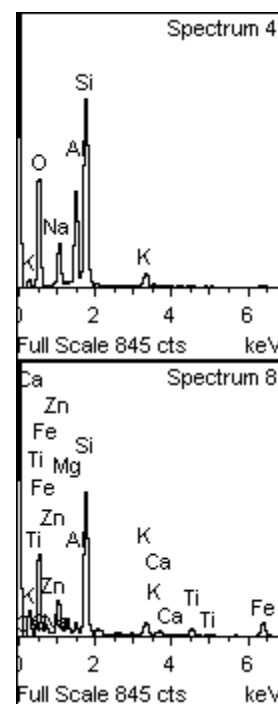
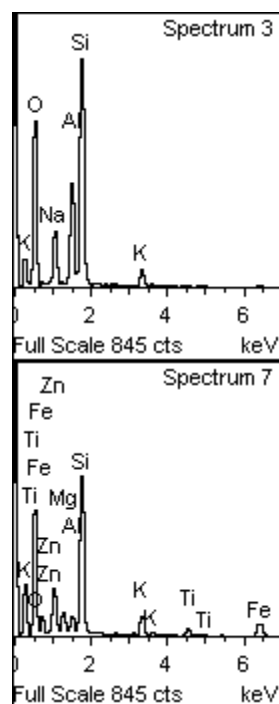
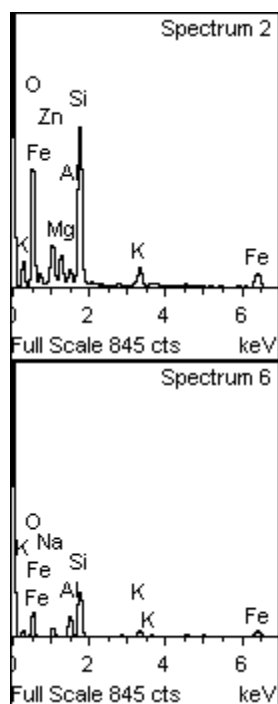
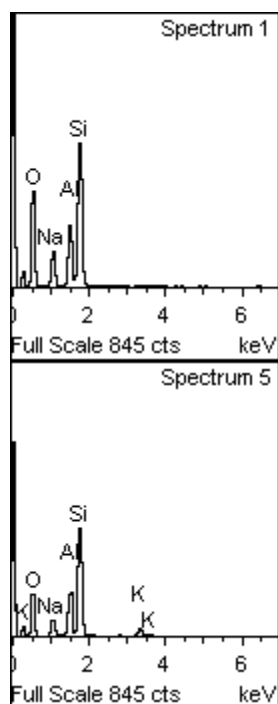
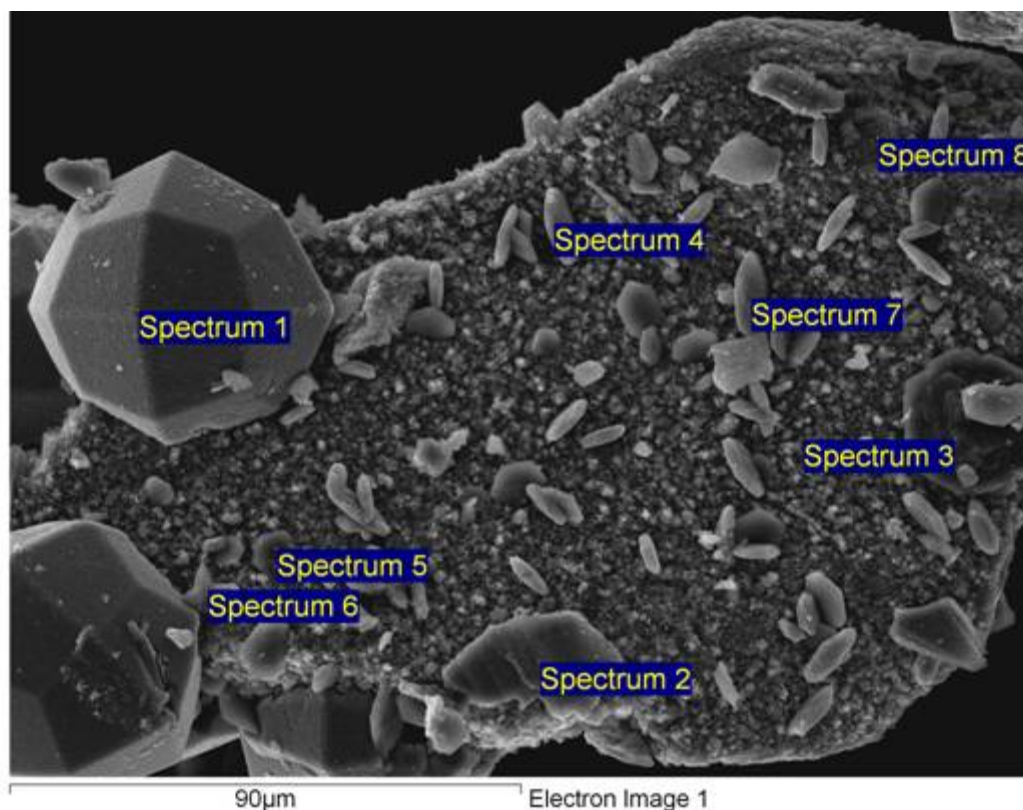
Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Ti Ti 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zn Zn 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.50	4.61	6.07	Na ₂ O
Mg K	2.97	2.87	4.92	MgO
Al K	1.56	1.36	2.94	Al ₂ O ₃
Si K	22.18	18.59	47.46	SiO ₂
K K	3.46	2.08	4.16	K ₂ O
Ca K	1.42	0.83	1.98	CaO
Ti K	3.28	1.61	5.47	TiO ₂
Fe K	12.93	5.45	18.49	Fe ₂ O ₃
Zn L	6.84	2.46	8.51	ZnO
O	40.87	60.13		
Totals	100.00			



Inca

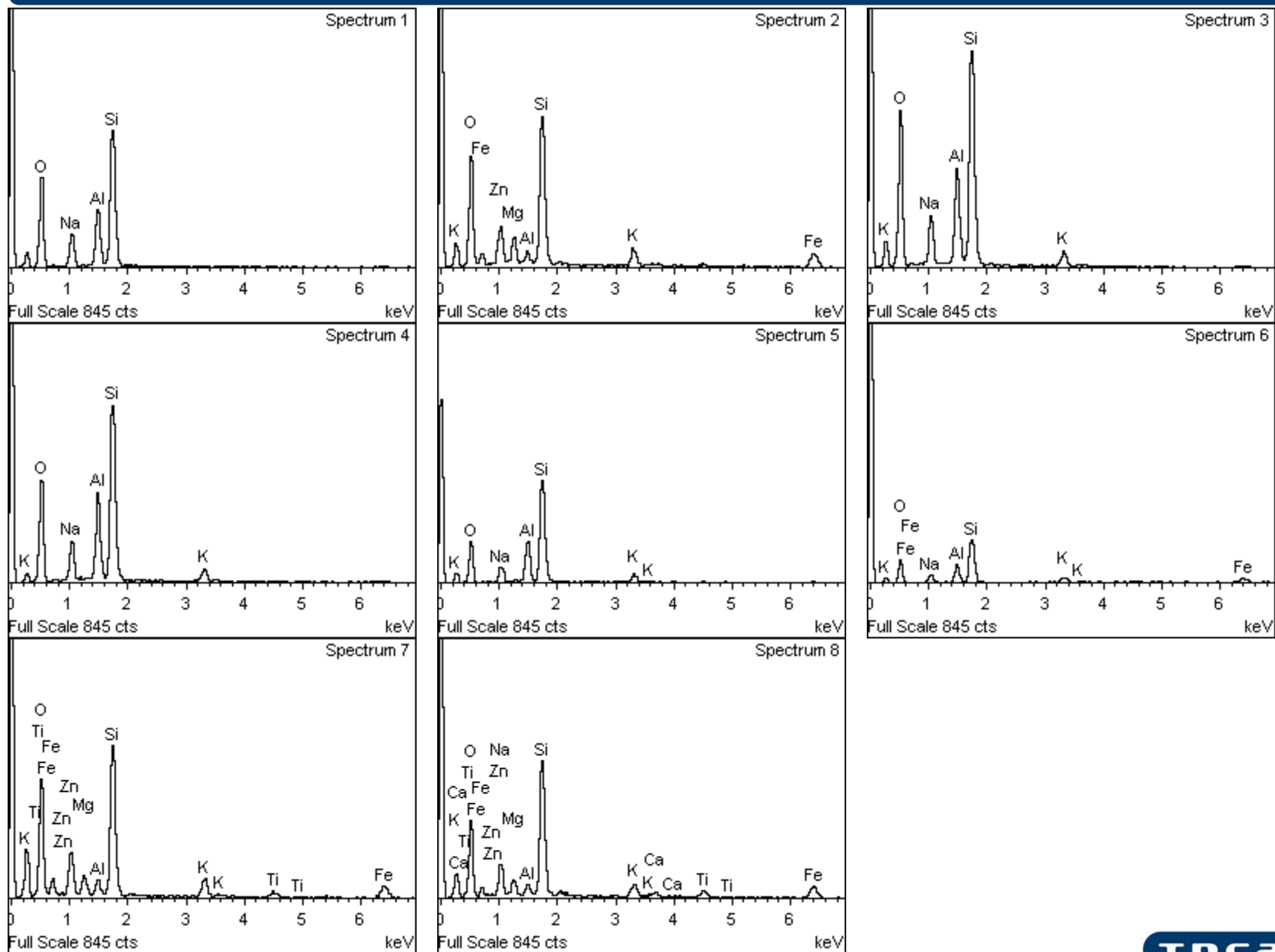
PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA88R1.



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PCT SURFACE CORROSION. FILE 1. ROI 1. GLASS NAME LAWA88R1.



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PCT SURFACE CORROSION 1. FILE 1. ROI 1. GLASS NAME LAWA88R1.

Project: PCT SURFACE CORROSION 1
Owner: cavinm
Site: Site of Interest 1

Sample: LAWA 88 R1
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ca	Ti	Fe	Zn	O	Total
Spectrum 1	Yes	7.81		10.64	32.43						49.12	100.00
Spectrum 2	Yes		4.77	1.67	22.69	4.16			13.95	12.41	40.35	100.00
Spectrum 3	Yes	7.05		10.77	30.93	3.31					47.95	100.00
Spectrum 4	Yes	6.76		11.38	30.47	3.48					47.90	100.00
Spectrum 5	Yes	5.17		11.13	31.41	3.98					48.30	100.00
Spectrum 6	Yes	5.11		8.04	23.04	3.97			16.69		43.16	100.00
Spectrum 7	Yes		3.06	2.09	22.06	4.61		1.97	12.07	14.21	39.93	100.00
Spectrum 8	Yes	4.50	2.97	1.56	22.18	3.46	1.42	3.28	12.93	6.84	40.87	100.00
Max.		7.81	4.77	11.38	32.43	4.61	1.42	3.28	16.69	14.21	49.12	
Min.		4.50	2.97	1.56	22.06	3.31	1.42	1.97	12.07	6.84	39.93	

All results in weight%

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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA88R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

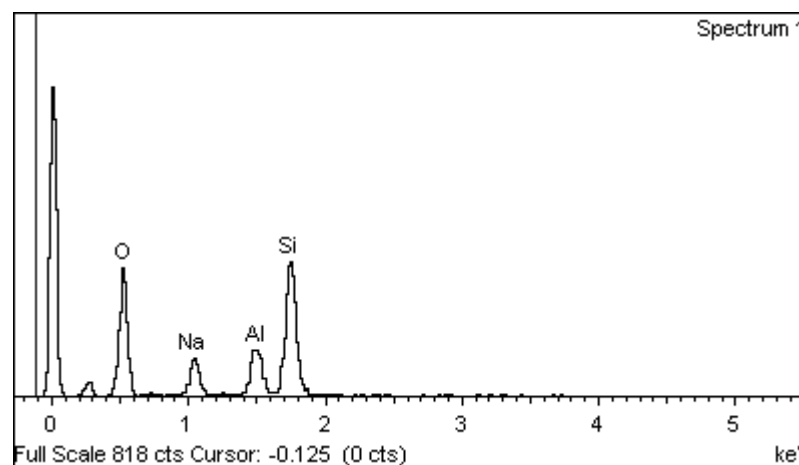
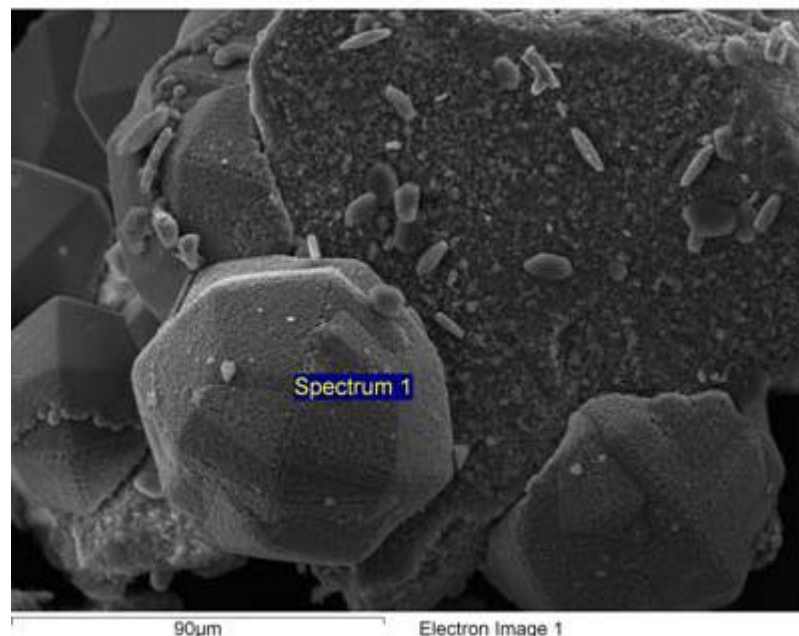
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	9.25	8.12	12.47	Na ₂ O
Al K	9.49	7.09	17.93	Al ₂ O ₃
Si K	32.53	23.36	69.59	SiO ₂
O	48.72	61.42		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA88R1.

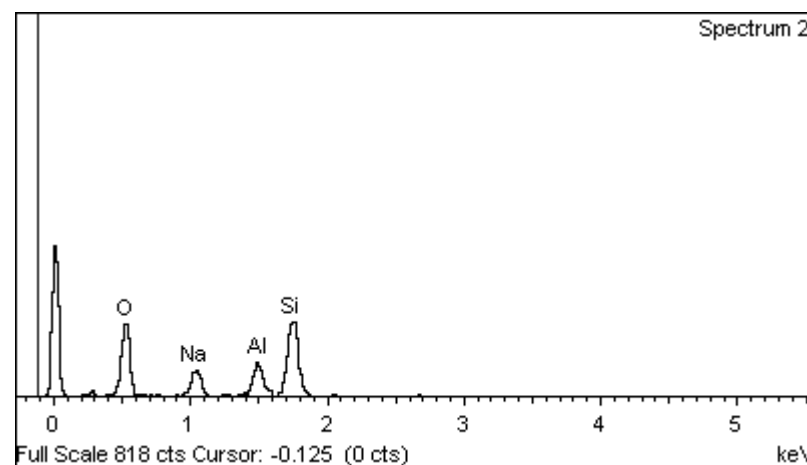
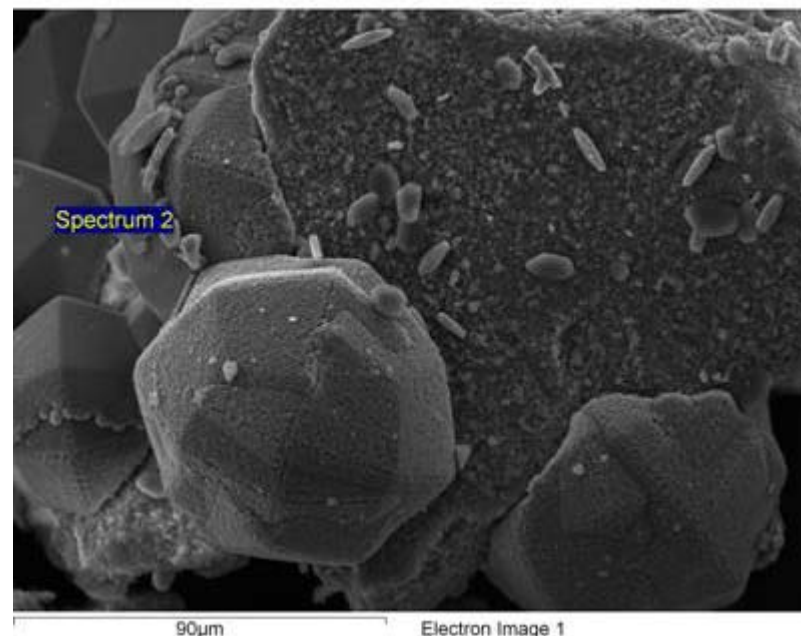
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	10.72	9.41	14.45	Na2O
Al K	10.16	7.60	19.19	Al2O3
Si K	31.02	22.30	66.36	SiO2
O	48.10	60.70		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA88R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

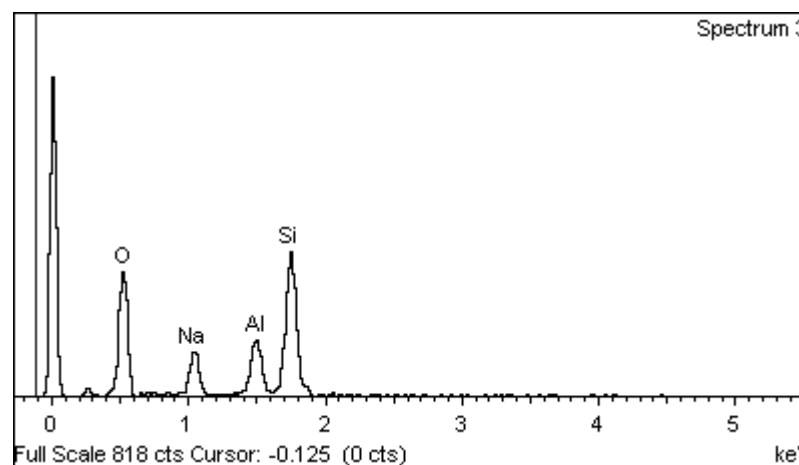
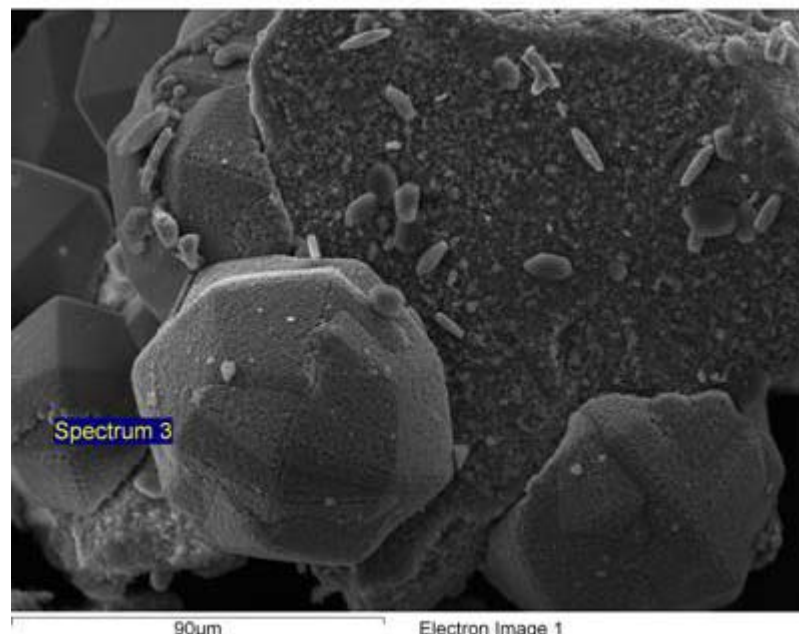
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	10.30	9.04	13.88	Na ₂ O
Al K	10.13	7.58	19.15	Al ₂ O ₃
Si K	31.31	22.50	66.98	SiO ₂
O	48.26	60.88		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA88R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

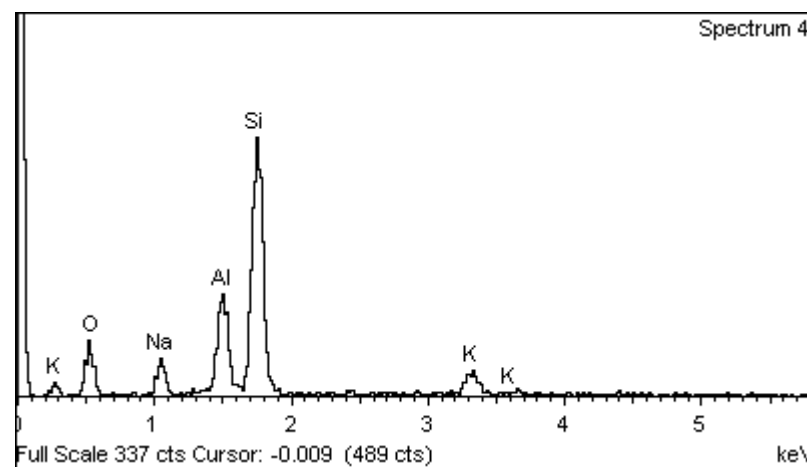
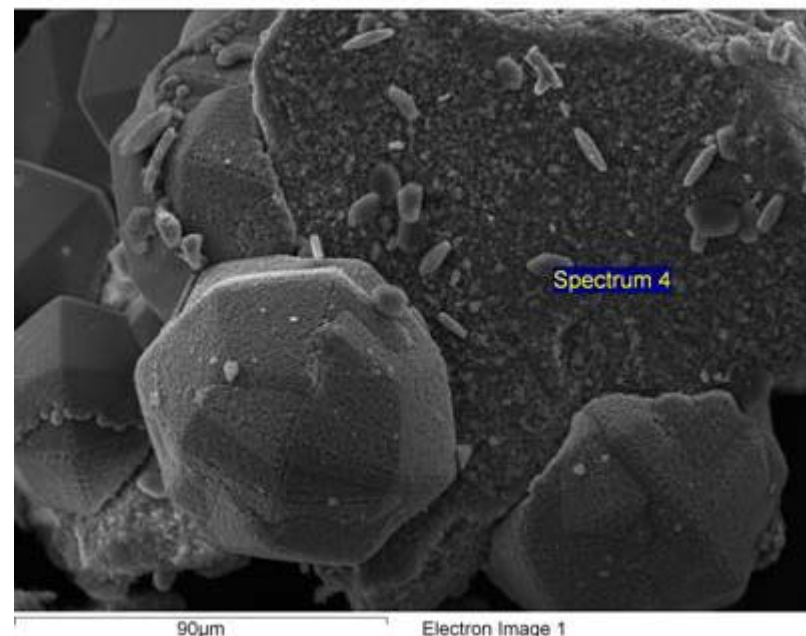
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.68	4.18	6.30	Na ₂ O
Al K	9.96	7.60	18.83	Al ₂ O ₃
Si K	32.29	23.64	69.07	SiO ₂
K K	4.82	2.53	5.80	K ₂ O
O	48.26	62.04		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA88R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

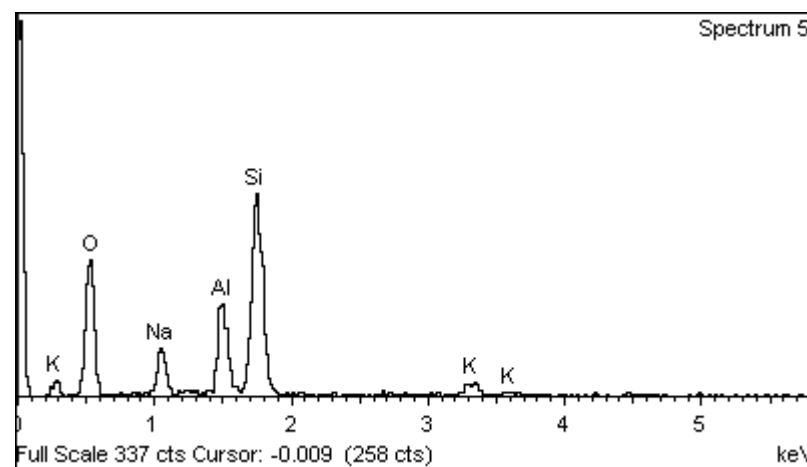
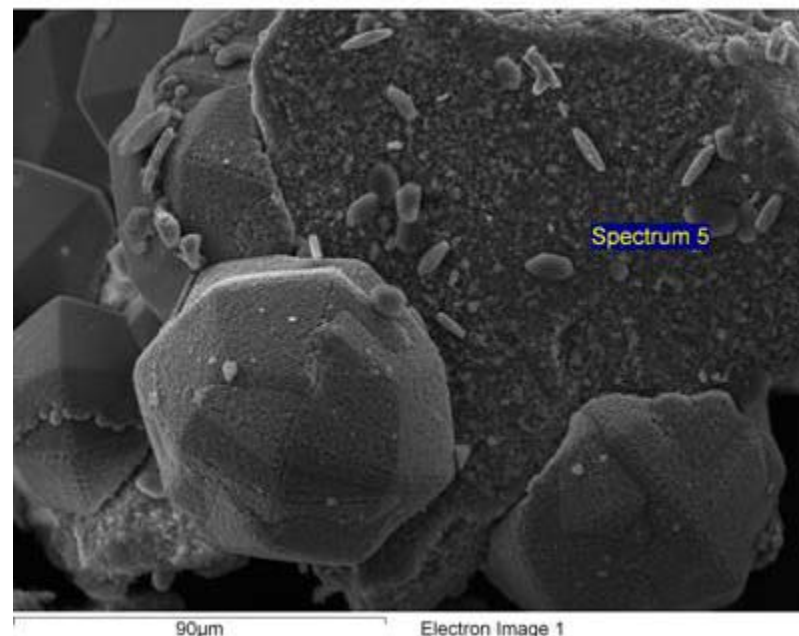
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.55	6.73	10.18	Na ₂ O
Al K	11.76	8.93	22.22	Al ₂ O ₃
Si K	29.63	21.61	63.38	SiO ₂
K K	3.51	1.84	4.22	K ₂ O
O	47.56	60.90		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA88R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

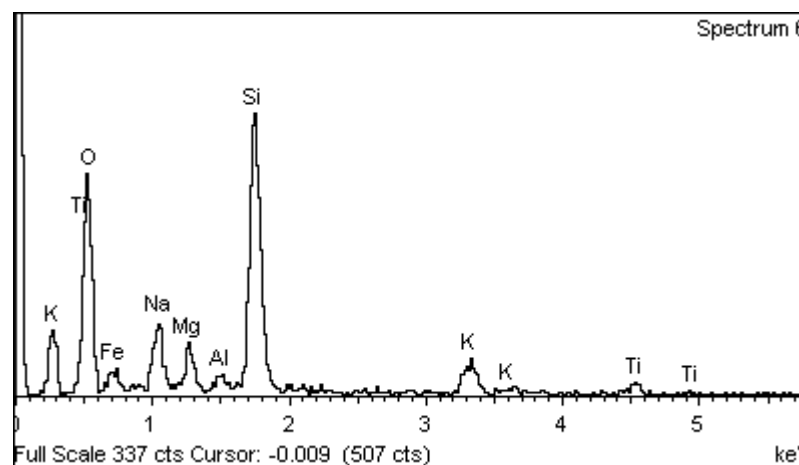
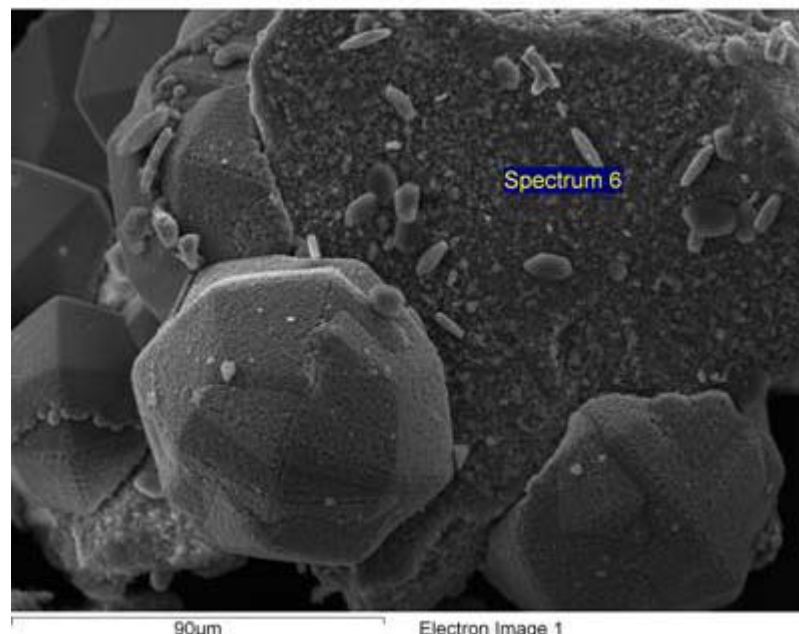
Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Ti Ti 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.33	6.26	8.53	Na ₂ O
Mg K	3.83	3.58	6.35	MgO
Al K	1.05	0.89	1.99	Al ₂ O ₃
Si K	23.46	18.99	50.18	SiO ₂
K K	4.75	2.76	5.72	K ₂ O
Ti K	3.02	1.44	5.04	TiO ₂
Fe K	15.52	6.32	22.18	Fe ₂ O ₃
O	42.04	59.76		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA88R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

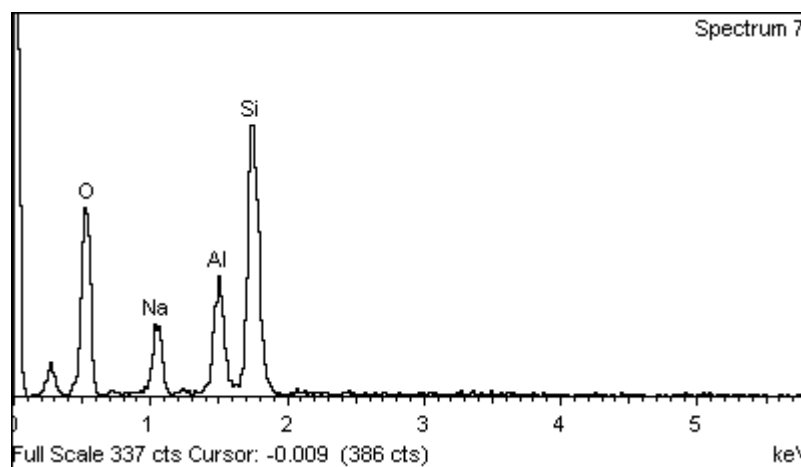
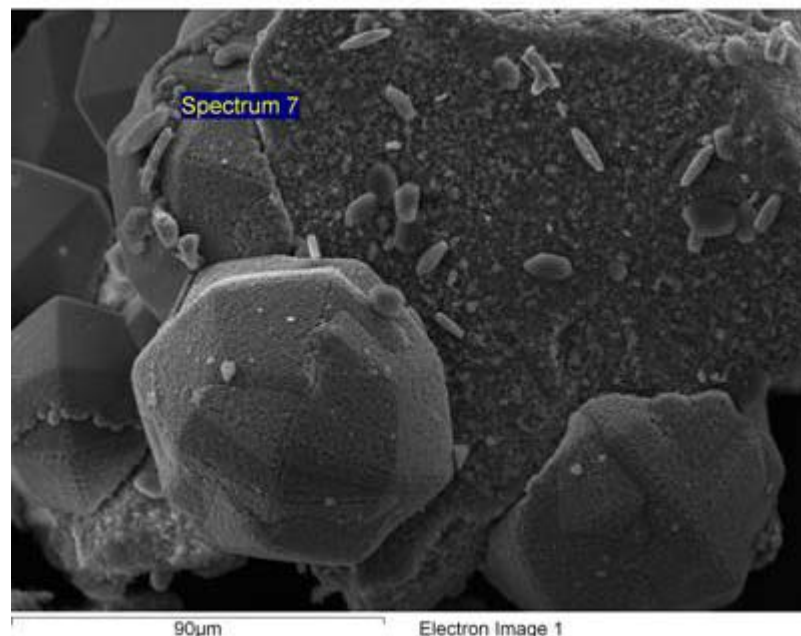
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	8.90	7.80	11.99	Na ₂ O
Al K	10.19	7.62	19.25	Al ₂ O ₃
Si K	32.14	23.08	68.76	SiO ₂
O	48.77	61.49		
Totals	100.00			

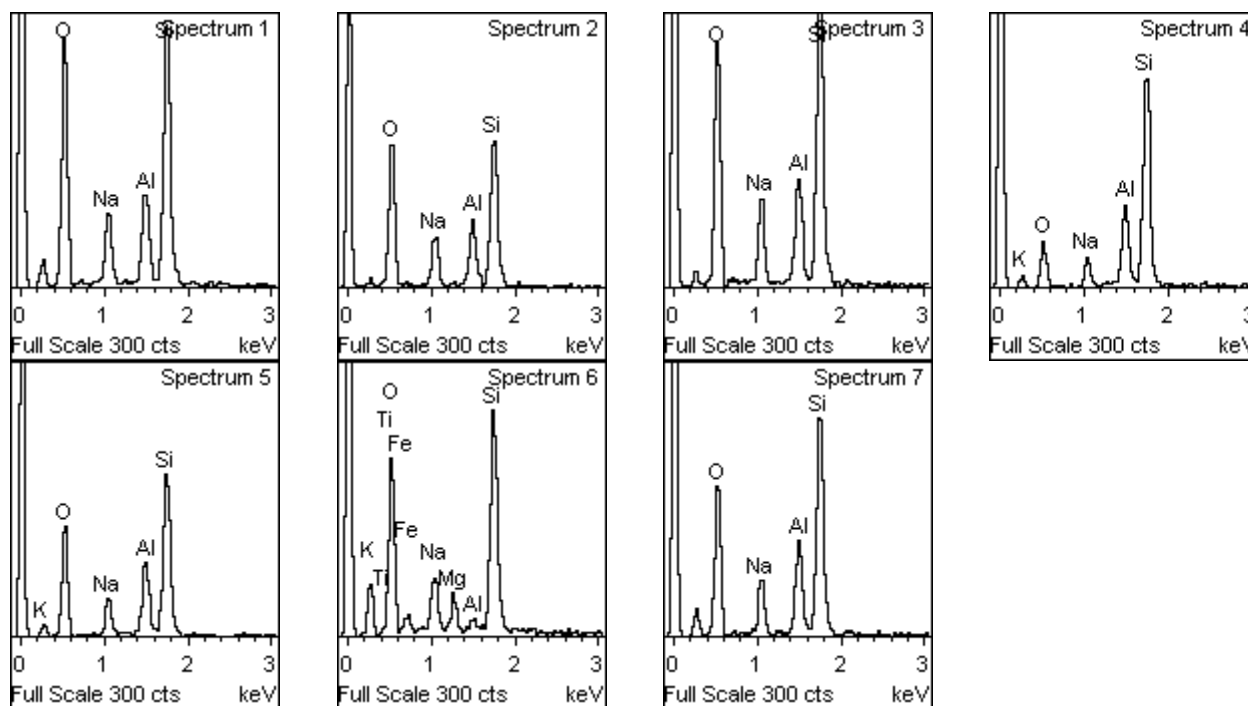
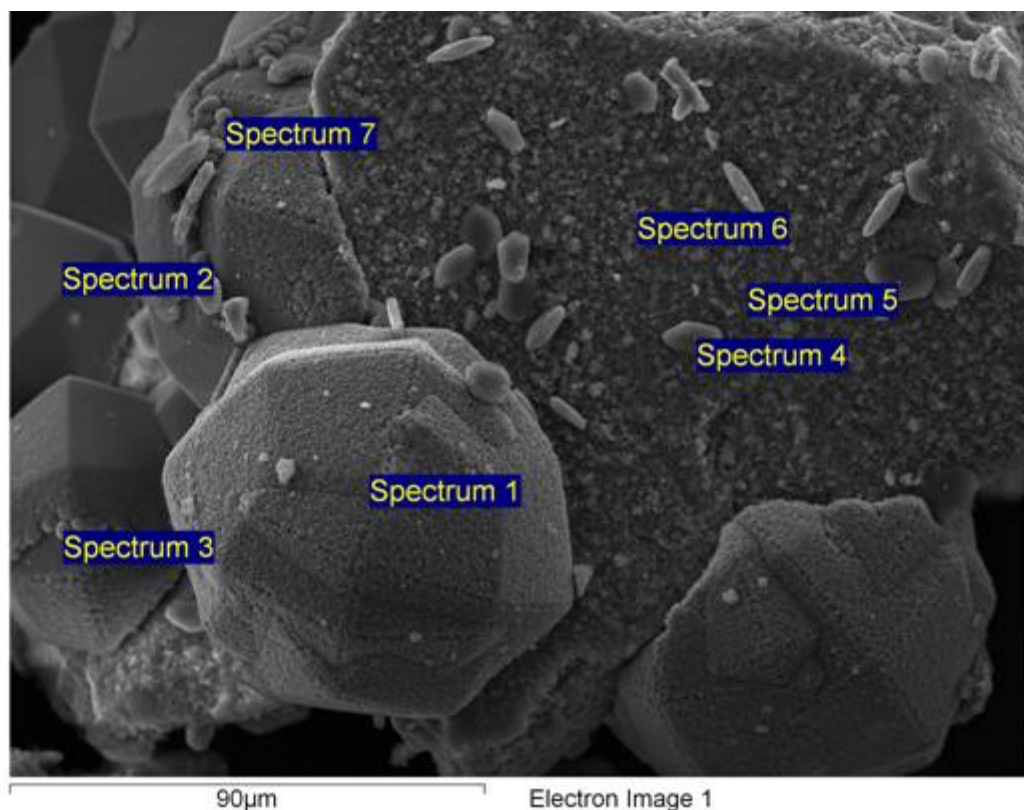


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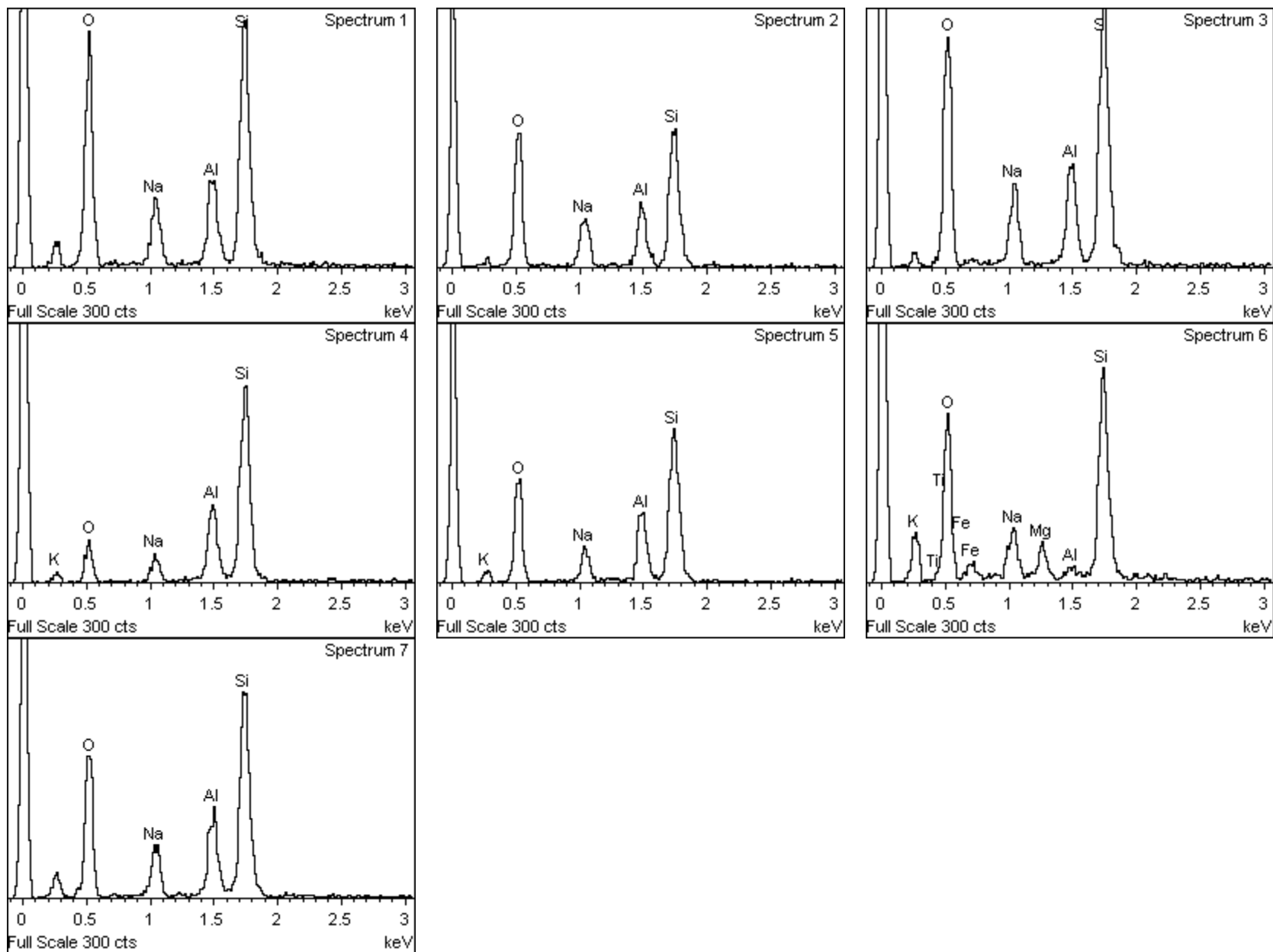
PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA88R1.



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA88R1.



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PCT SURFACE CORROSION. FILE 1. ROI 2. GLASS NAME LAWA88R1.

Project: PCT SURFACE CORROSION 1
Owner: cavinm
Site: Site of Interest 2

Sample: LAWA 88 R1
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ti	Fe	O	Total
Spectrum 1	Yes	9.25		9.49	32.53				48.72	100.00
Spectrum 2	Yes	10.72		10.16	31.02				48.10	100.00
Spectrum 3	Yes	10.30		10.13	31.31				48.26	100.00
Spectrum 4	Yes	4.68		9.96	32.29	4.82			48.26	100.00
Spectrum 5	Yes	7.55		11.76	29.63	3.51			47.56	100.00
Spectrum 6	Yes	6.33	3.83	1.05	23.46	4.75	3.02	15.52	42.04	100.00
Spectrum 7	Yes	8.90		10.19	32.14				48.77	100.00
Max.		10.72	3.83	11.76	32.53	4.82	3.02	15.52	48.77	
Min.		4.68	3.83	1.05	23.46	3.51	3.02	15.52	42.04	

All results in weight%

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PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME LAWA88R1.

Spectrum processing :
Peak possibly omitted : 6.400 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

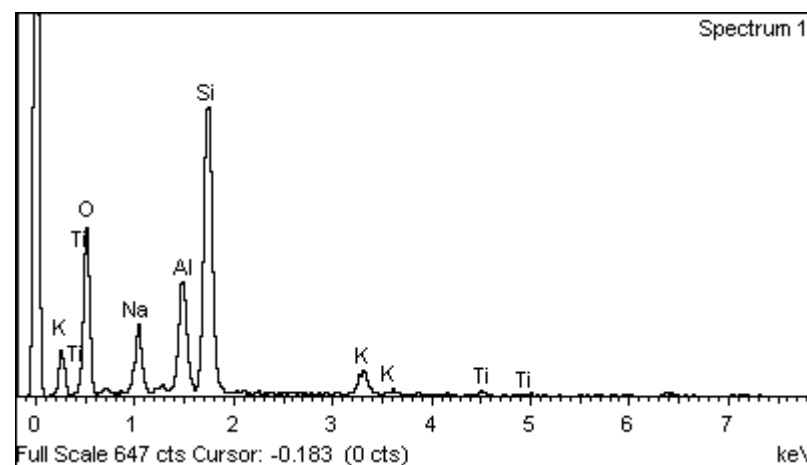
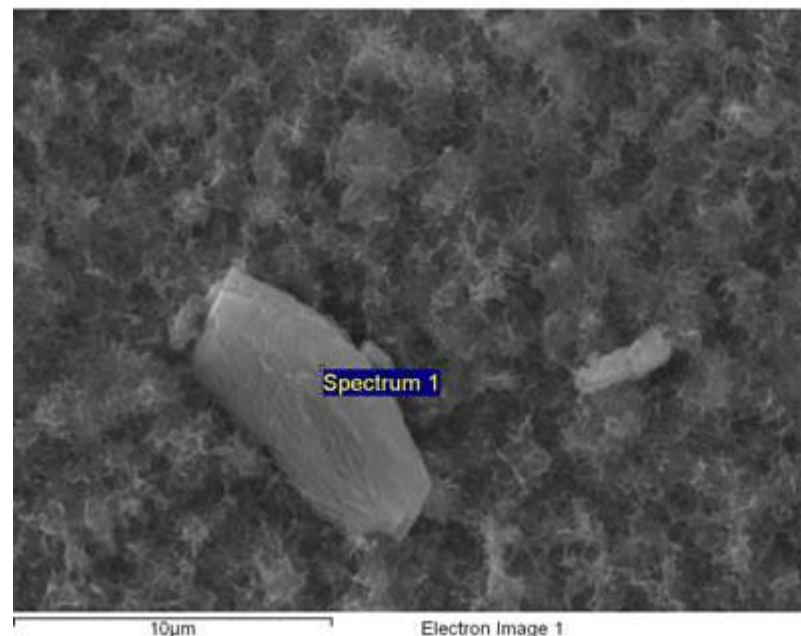
Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Ti Ti 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.61	5.94	8.91	Na ₂ O
Al K	9.39	7.20	17.75	Al ₂ O ₃
Si K	30.73	22.61	65.75	SiO ₂
K K	4.47	2.36	5.39	K ₂ O
Ti K	1.32	0.57	2.21	TiO ₂
O	47.47	61.31		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME LAWA88R1.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

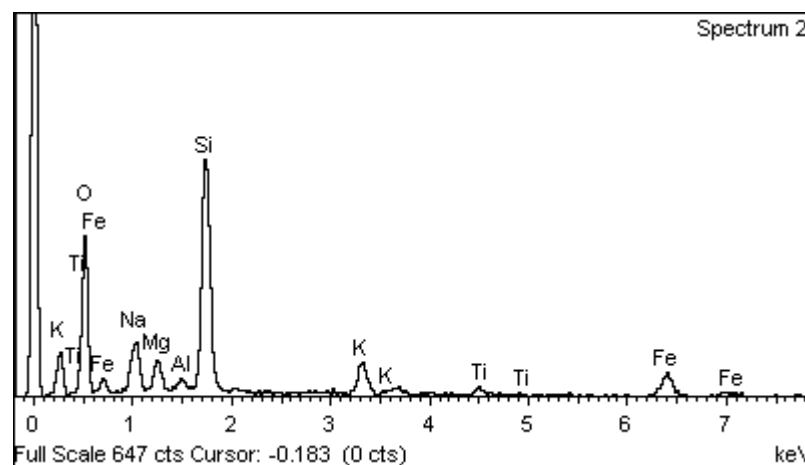
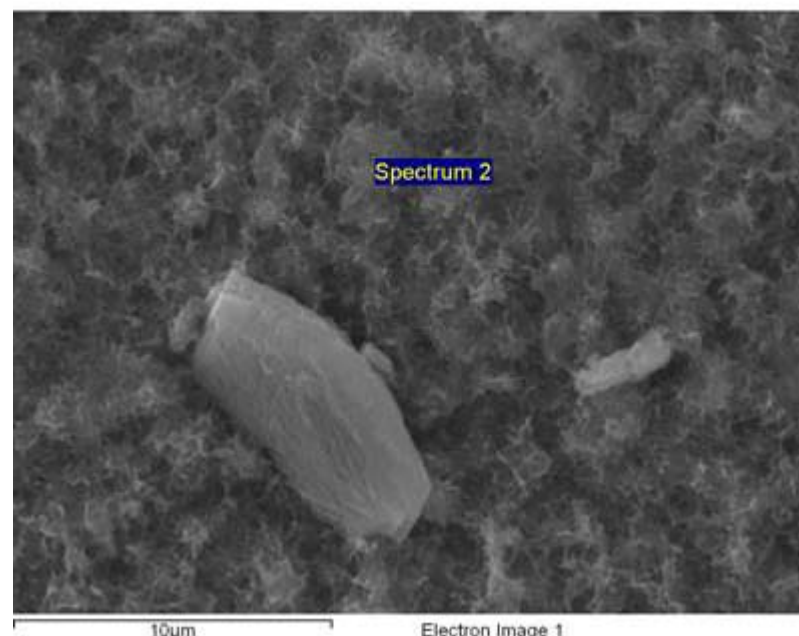
Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Ti Ti 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

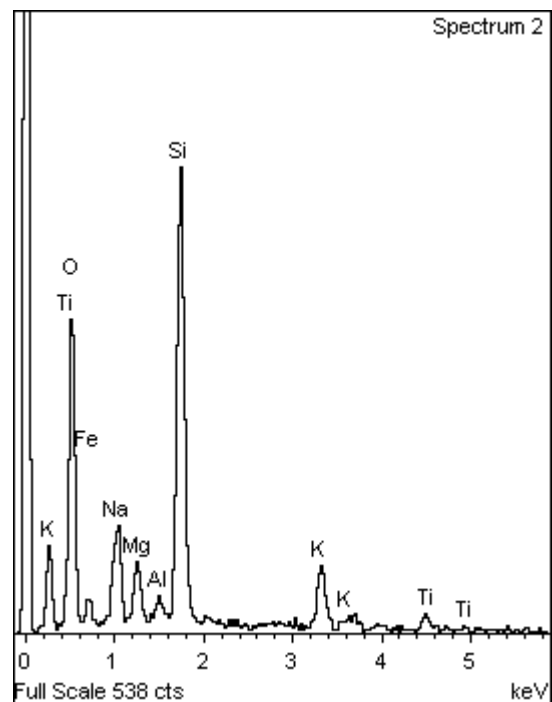
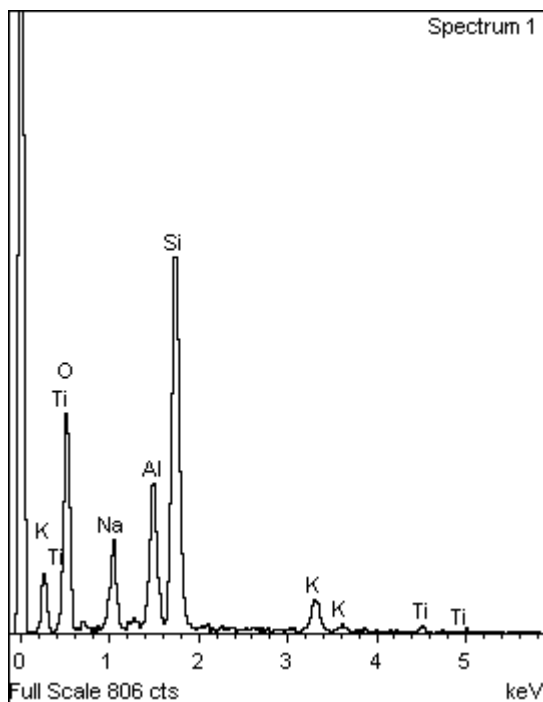
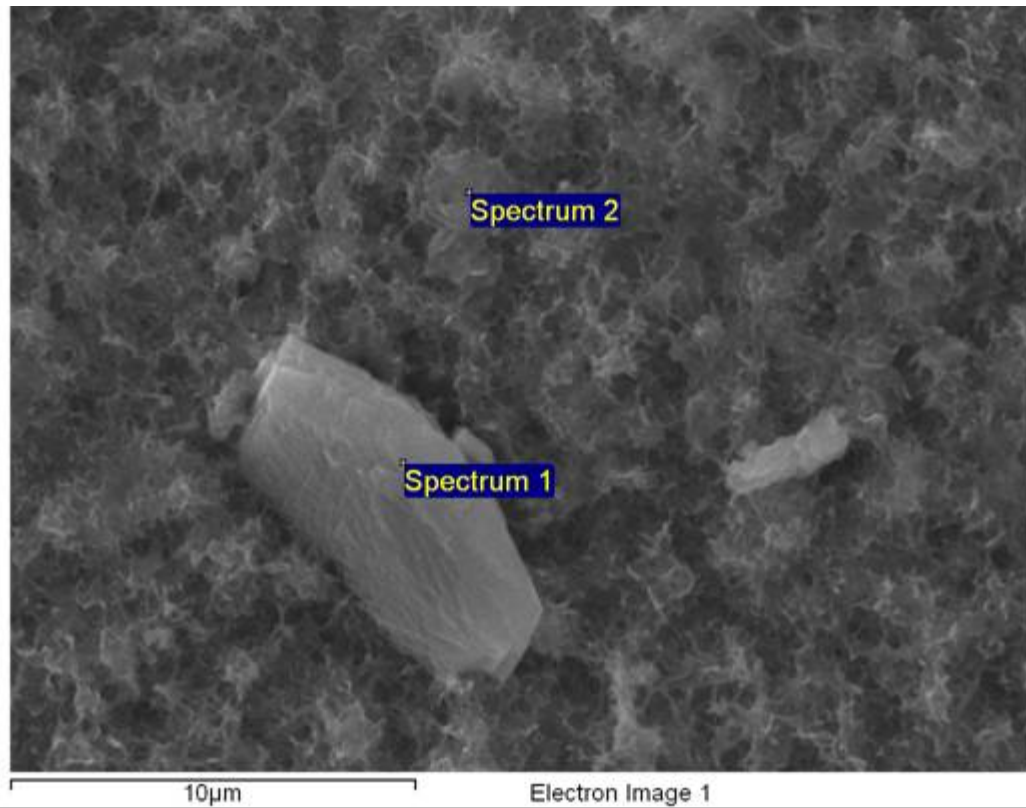
Element	Weight%	Atomic%	Compd%	Formula
Na K	5.61	5.57	7.57	Na ₂ O
Mg K	3.29	3.08	5.45	MgO
Al K	0.99	0.84	1.88	Al ₂ O ₃
Si K	24.28	19.70	51.93	SiO ₂
K K	5.54	3.23	6.67	K ₂ O
Ti K	2.37	1.13	3.95	TiO ₂
Fe K	15.78	6.44	22.55	Fe ₂ O ₃
O	42.15	60.03		
Totals	100.00			



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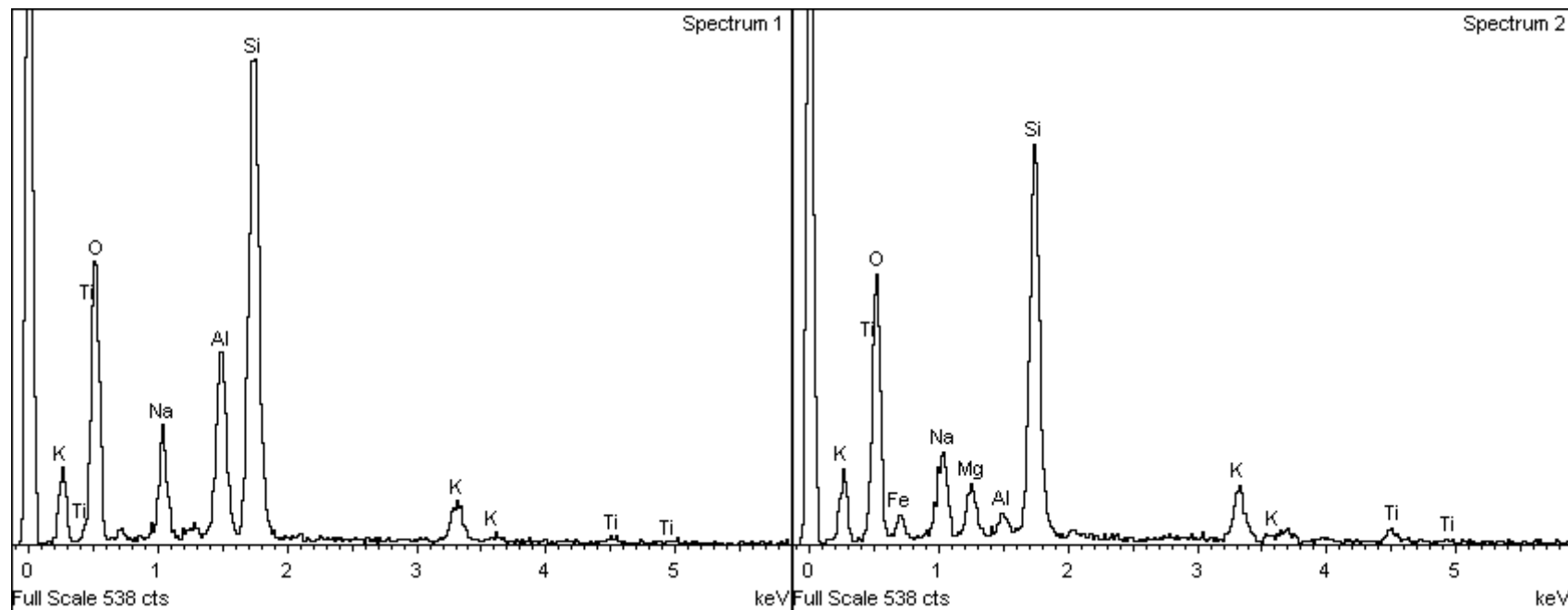
PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME LAWA88R1.



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PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME LAWA88R1.



PCT SURFACE CORROSION. FILE 1. ROI 3. GLASS NAME LAWA88R1.

Project: PCT SURFACE CORROSION 1
Owner: cavinm
Site: Site of Interest 3

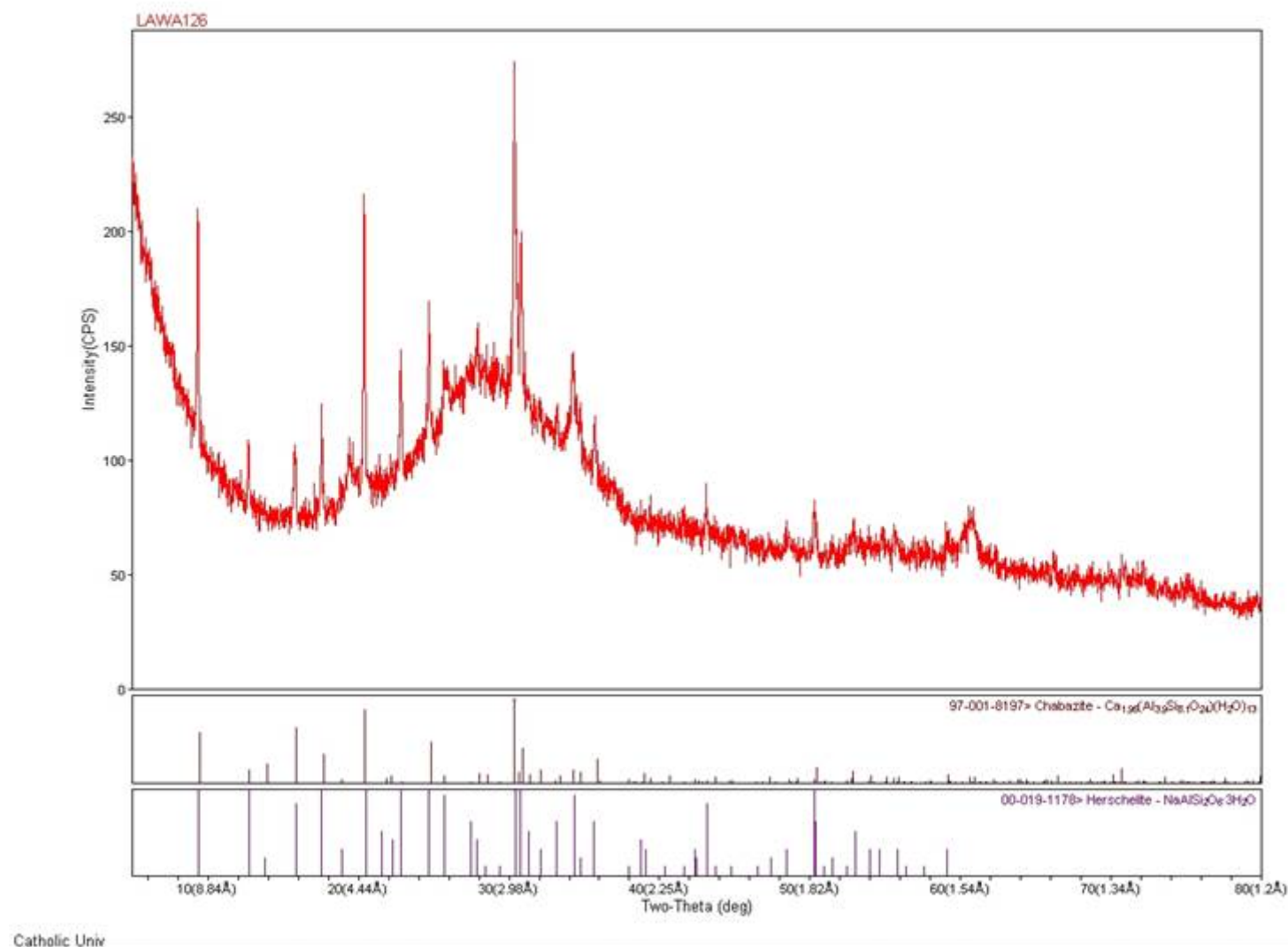
Sample: LAWA 88 R1
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Ti	Fe	O	Total
Spectrum 1	Yes	6.61		9.39	30.73	4.47	1.32		47.47	100.00
Spectrum 2	Yes	5.61	3.29	0.99	24.28	5.54	2.37	15.78	42.15	100.00
Max.		6.61	3.29	9.39	30.73	5.54	2.37	15.78	47.47	
Min.		5.61	3.29	0.99	24.28	4.47	1.32	15.78	42.15	

All results in weight%

**XRD powder patterns (raw data and best match) and SEM/EDS analysis of glass LAWA126,
collected from 90°C PCT-B vessel after 3134 days.**



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PCT SURFACE CORROSION. FILE 2. ROI 1.GLASS NAME LAWA126.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

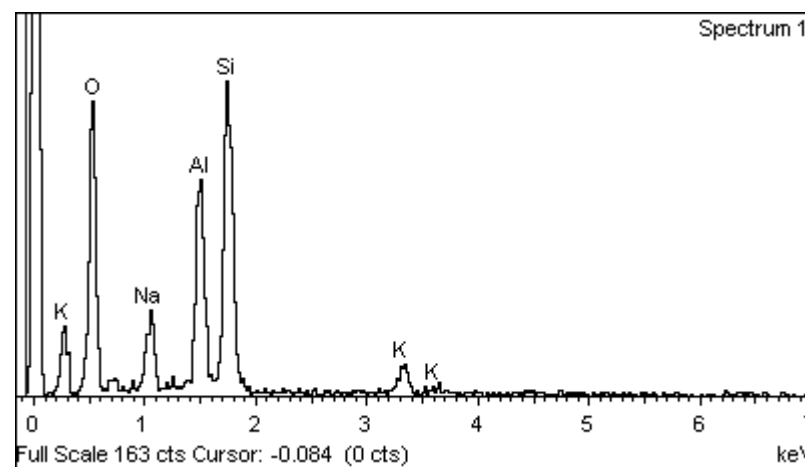
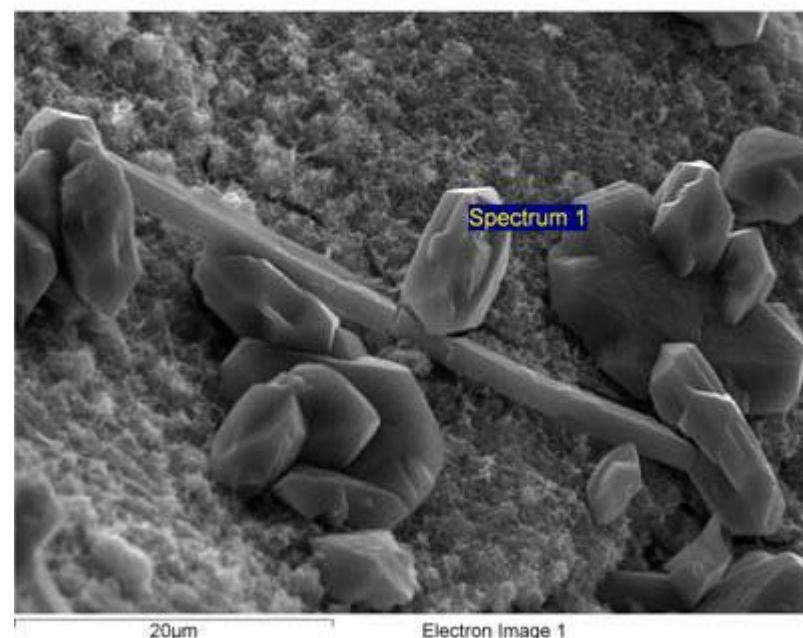
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.95	6.22	9.36	Na ₂ O
Al K	14.88	11.35	28.11	Al ₂ O ₃
Si K	26.75	19.60	57.22	SiO ₂
K K	4.40	2.32	5.31	K ₂ O
O	47.02	60.51		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 1.GLASS NAME LAWA126.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 2

Standard :

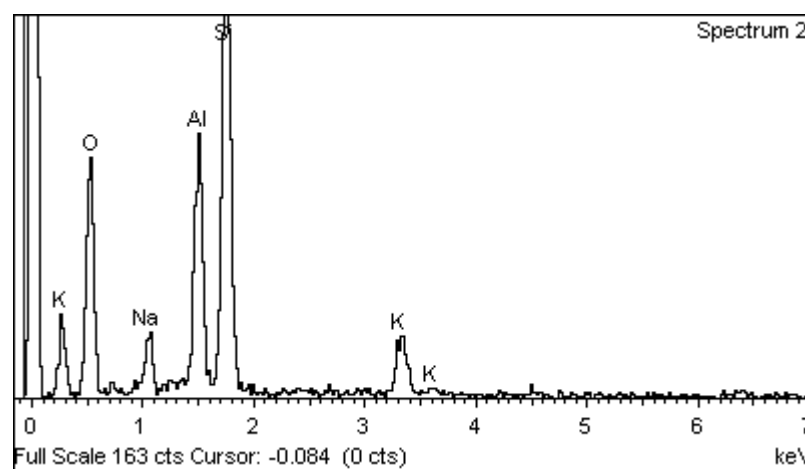
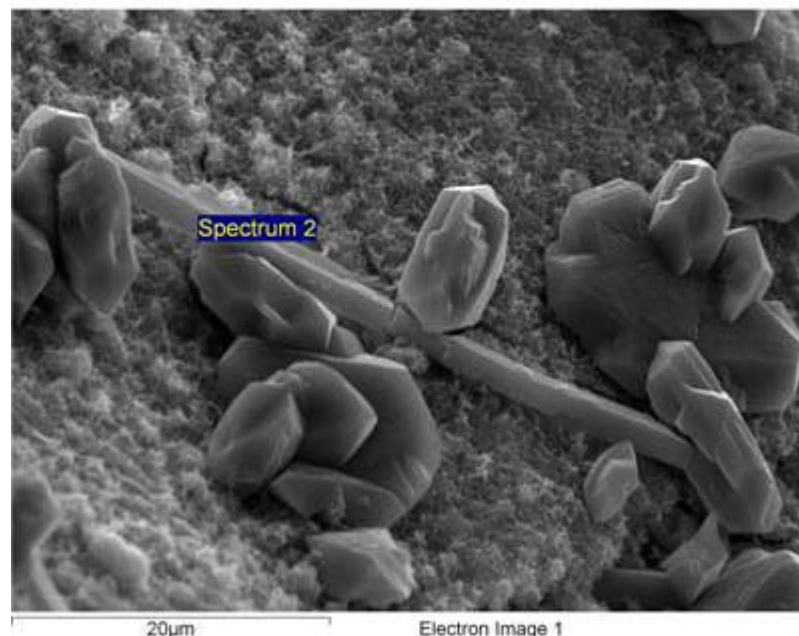
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.27	3.86	5.76	Na ₂ O
Al K	13.37	10.28	25.25	Al ₂ O ₃
Si K	28.56	21.10	61.09	SiO ₂
K K	6.55	3.48	7.90	K ₂ O
O	47.25	61.29		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 1.GLASS NAME LAWA126.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

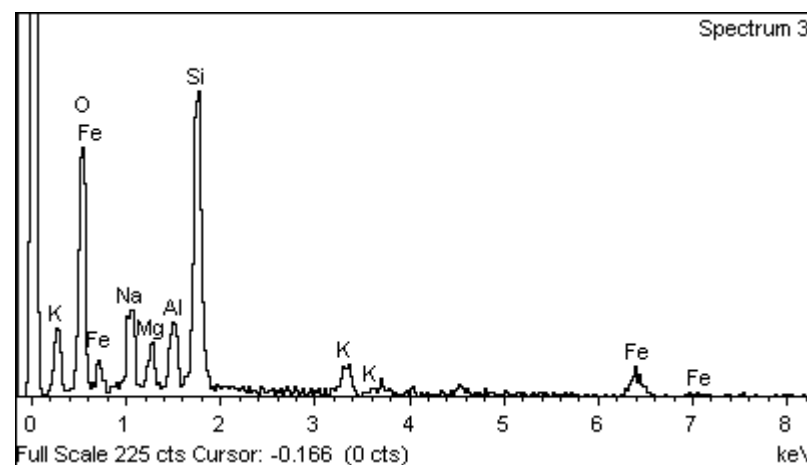
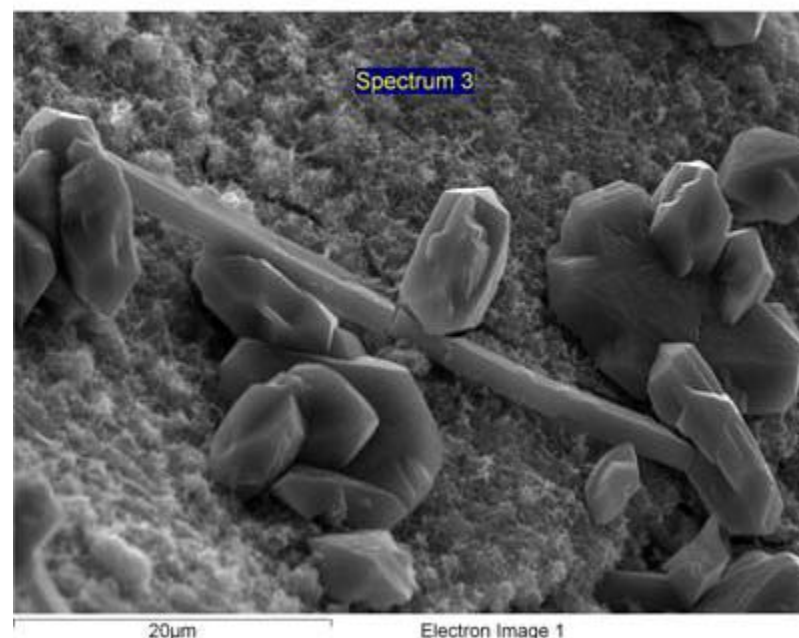
Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.51	7.13	10.13	Na ₂ O
Mg K	3.22	2.89	5.33	MgO
Al K	5.35	4.33	10.11	Al ₂ O ₃
Si K	25.09	19.49	53.68	SiO ₂
K K	3.76	2.10	4.53	K ₂ O
Fe K	11.35	4.44	16.23	Fe ₂ O ₃
O	43.72	59.63		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 1.GLASS NAME LAWA126.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

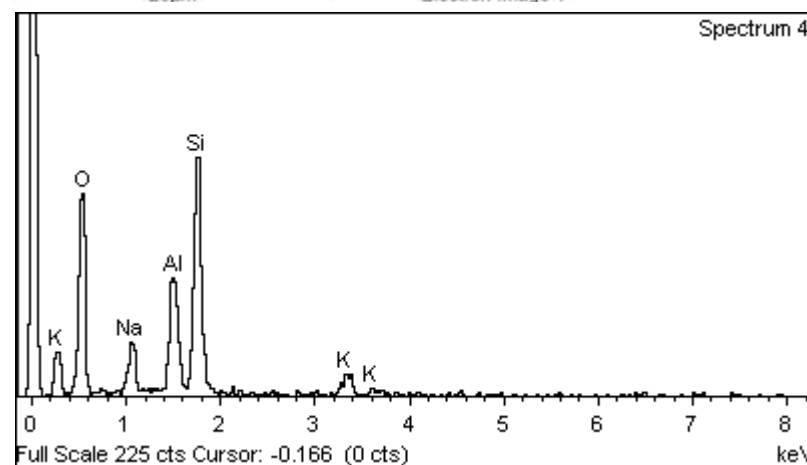
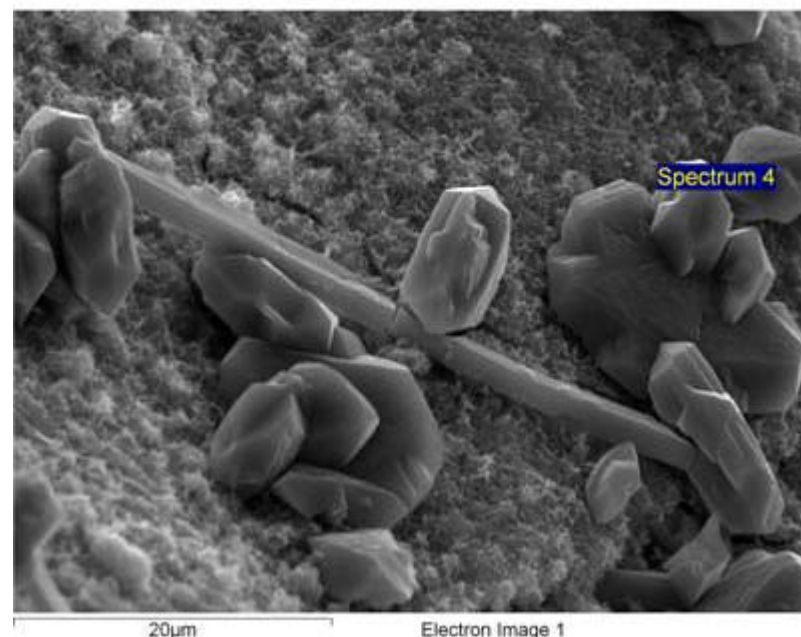
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

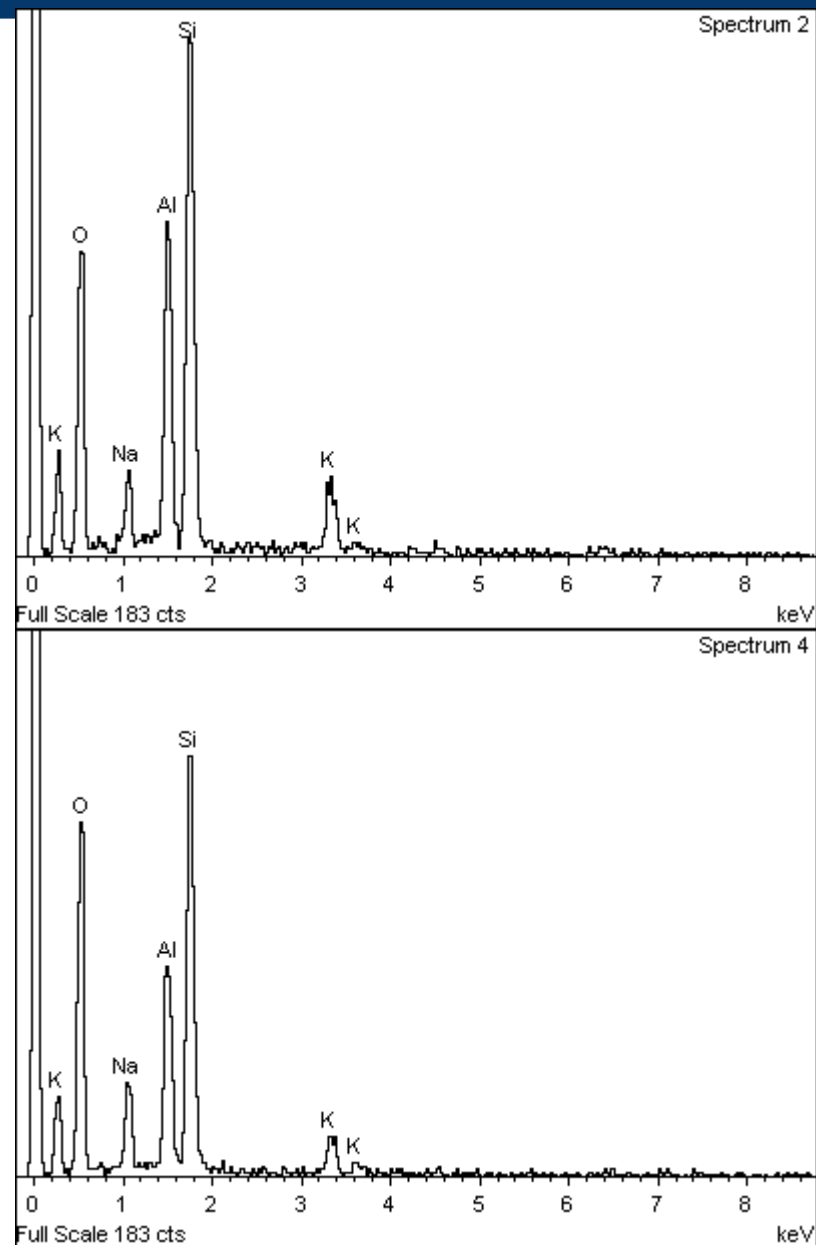
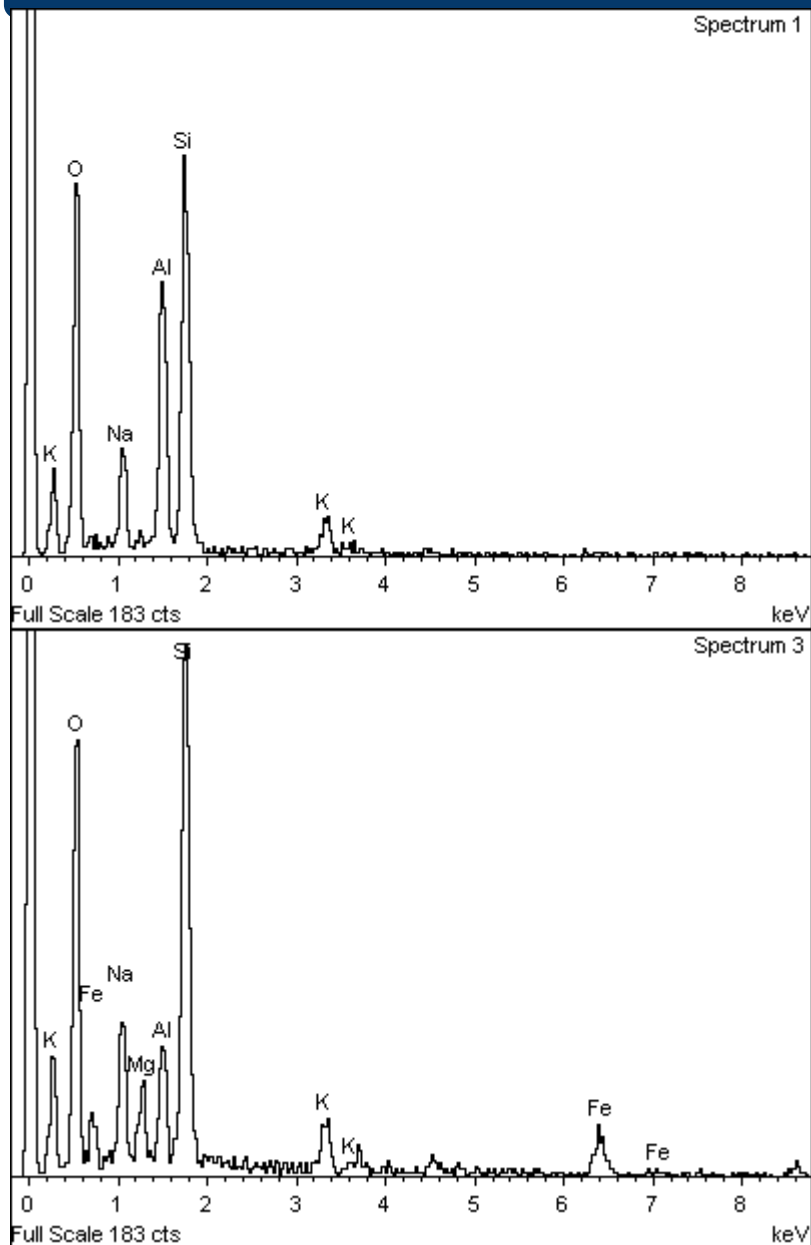
Element	Weight%	Atomic%	Compd%	Formula
Na K	6.64	5.94	8.95	Na ₂ O
Al K	12.08	9.21	22.83	Al ₂ O ₃
Si K	29.33	21.49	62.75	SiO ₂
K K	4.54	2.39	5.47	K ₂ O
O	47.40	60.96		
Totals	100.00			



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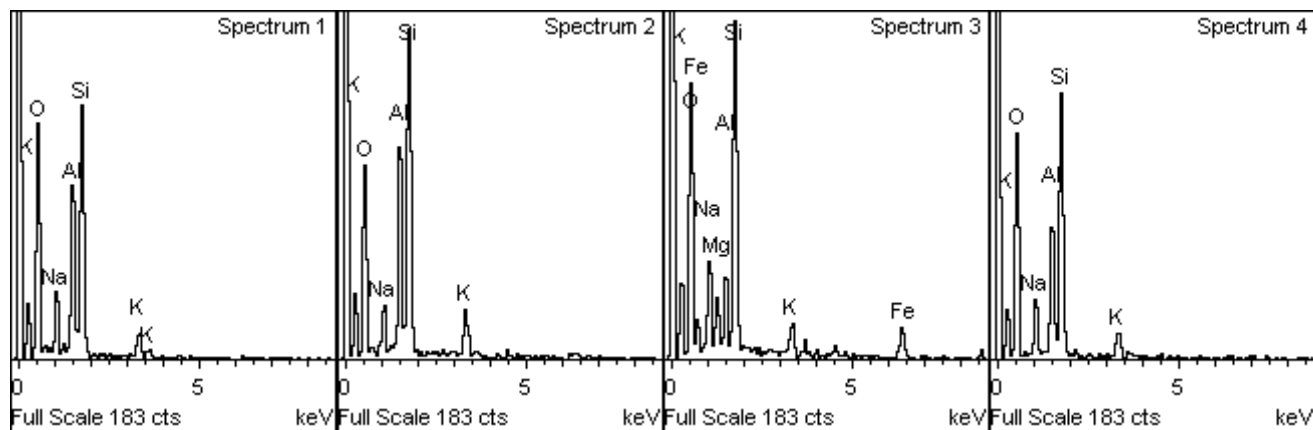
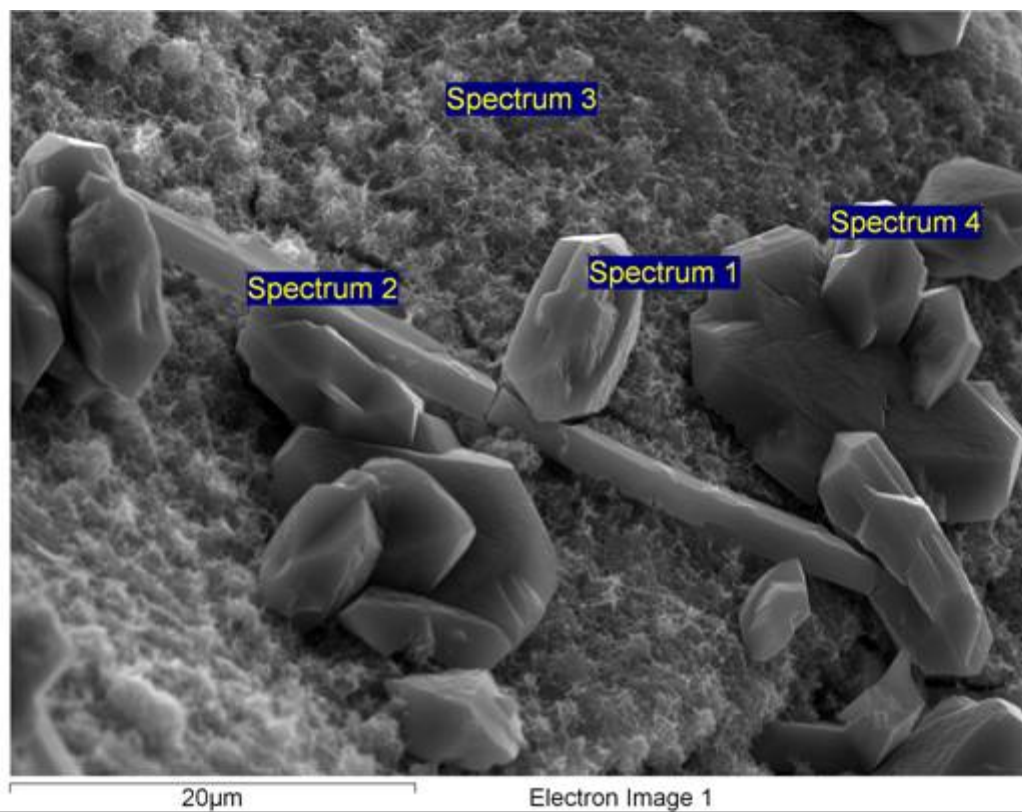
PCT SURFACE CORROSION. FILE 2. ROI 1.GLASS NAME LAWA126.



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PCT SURFACE CORROSION. FILE 2. ROI 1.GLASS NAME LAWA126.



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PCT SURFACE CORROSION. FILE 1. ROI 2.GLASS NAME LAWA126.

Project: PCT SURFACE CORROSION 2
Owner: cavinm
Site: Site of Interest 1

Sample: LAWA 126
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	K	Fe	O	Total
Spectrum 1	Yes	6.95		14.88	26.75	4.40		47.02	100.00
Spectrum 2	Yes	4.27		13.37	28.56	6.55		47.25	100.00
Spectrum 3	Yes	7.51	3.22	5.35	25.09	3.76	11.35	43.72	100.00
Spectrum 4	Yes	6.64		12.08	29.33	4.54		47.40	100.00
Max.		7.51	3.22	14.88	29.33	6.55	11.35	47.40	
Min.		4.27	3.22	5.35	25.09	3.76	11.35	43.72	

All results in weight%

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PCT SURFACE CORROSION. FILE 2. ROI 2.GLASS NAME LAWA126.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

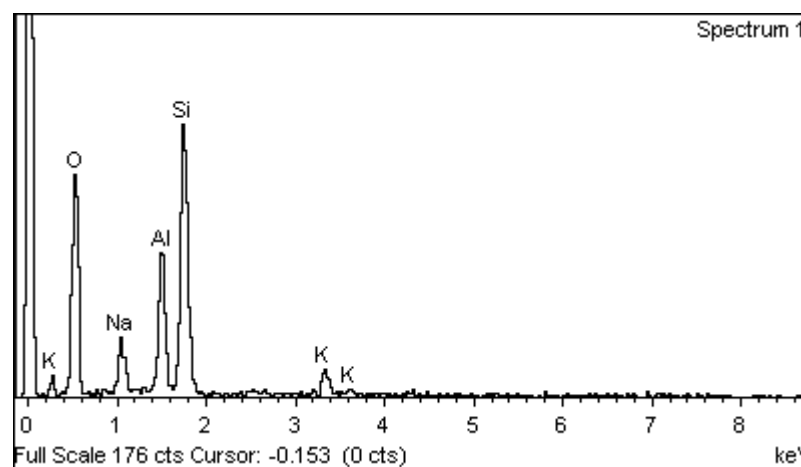
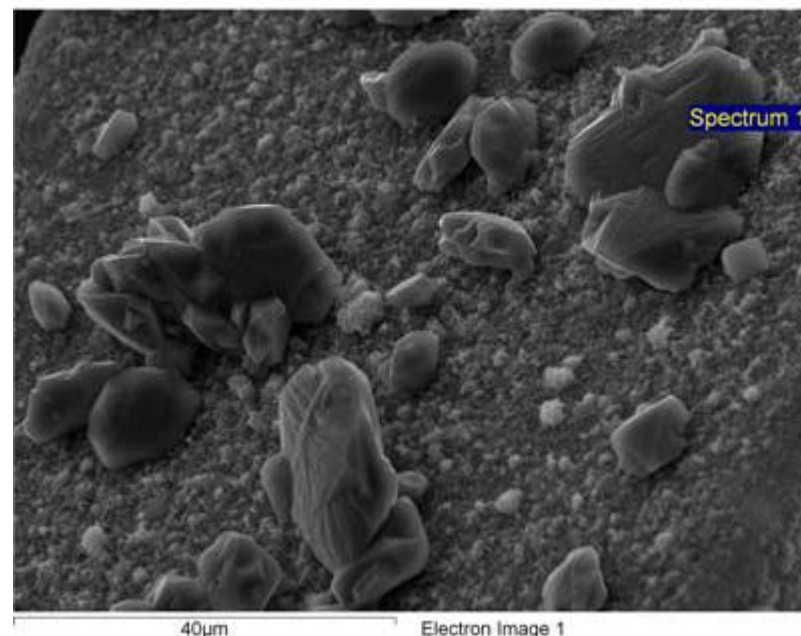
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.61	5.04	7.57	Na ₂ O
Al K	11.66	8.92	22.03	Al ₂ O ₃
Si K	29.86	21.95	63.87	SiO ₂
K K	5.42	2.86	6.53	K ₂ O
O	47.45	61.23		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 2.GLASS NAME LAW126.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

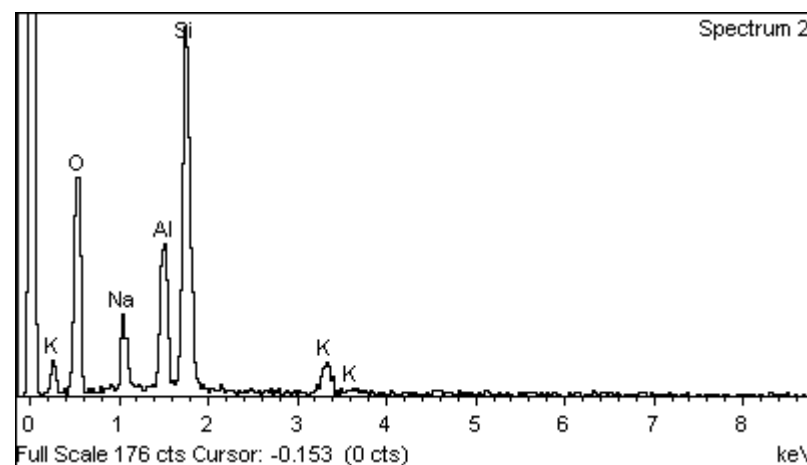
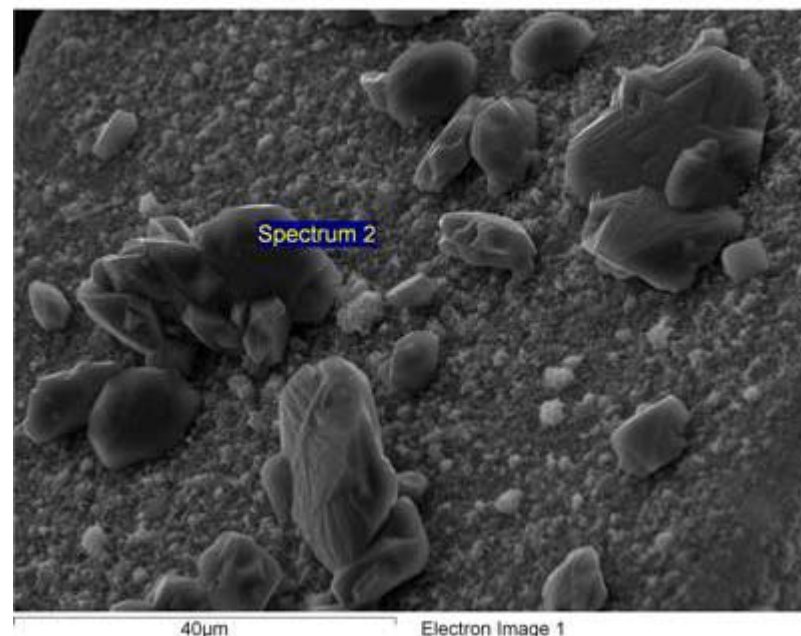
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.03	5.38	8.13	Na ₂ O
Al K	10.74	8.16	20.29	Al ₂ O ₃
Si K	31.25	22.81	66.86	SiO ₂
K K	3.92	2.06	4.72	K ₂ O
O	48.06	61.59		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 2.GLASS NAME LAWA126.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

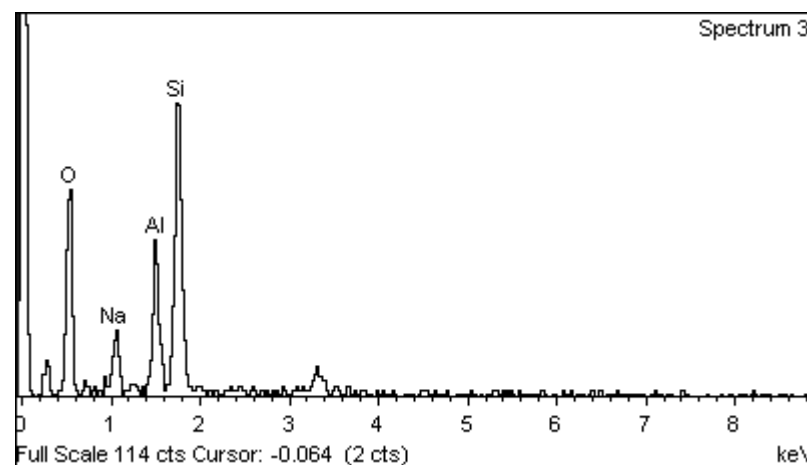
Standard :

Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.64	5.82	8.95	Na ₂ O
Al K	12.35	9.23	23.34	Al ₂ O ₃
Si K	31.65	22.73	67.71	SiO ₂
O	49.36	62.22		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 2.GLASS NAME LAWA126.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

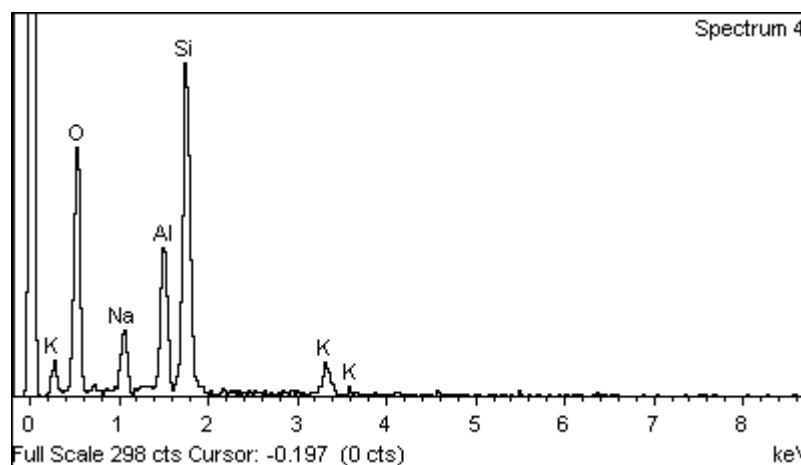
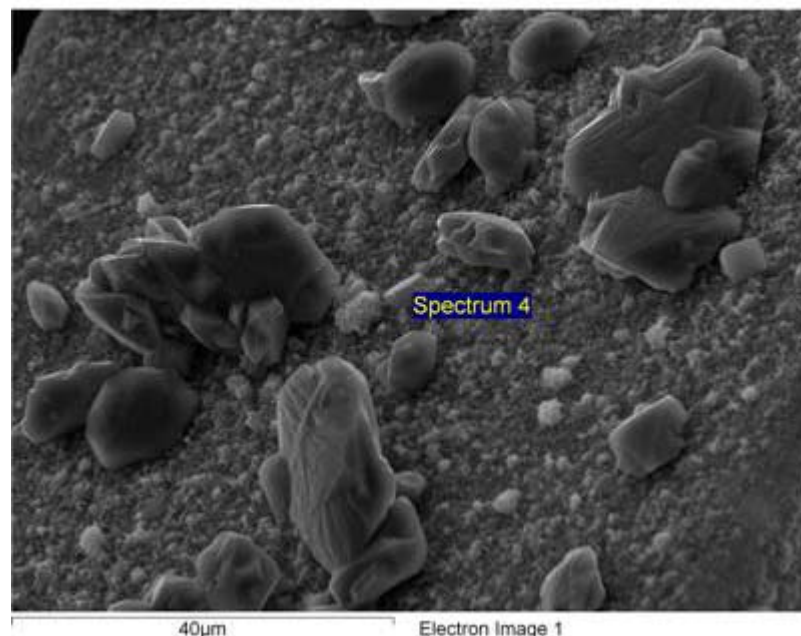
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

K MAD-10 Feldspar 1-Jun-1999 12:00 AM

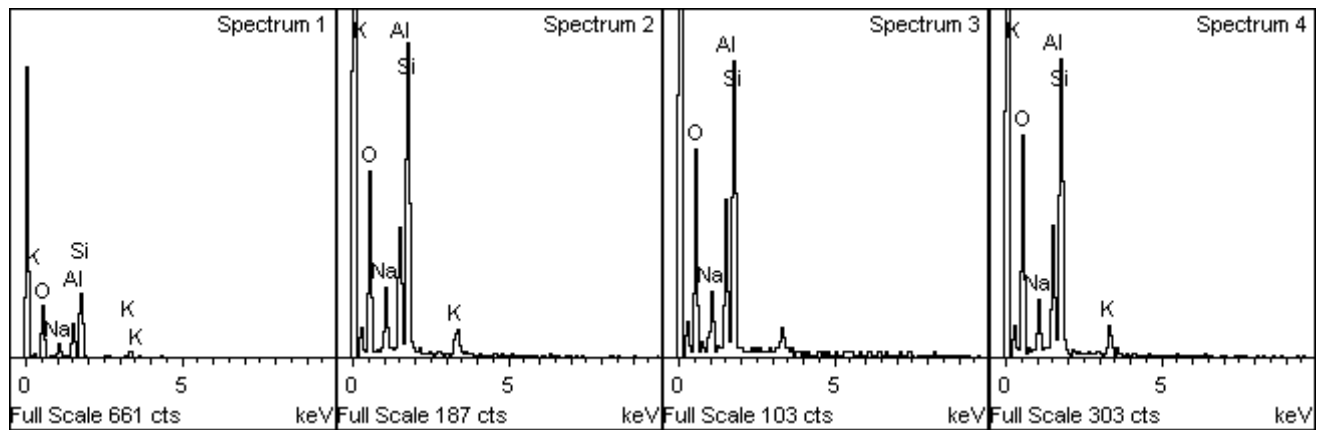
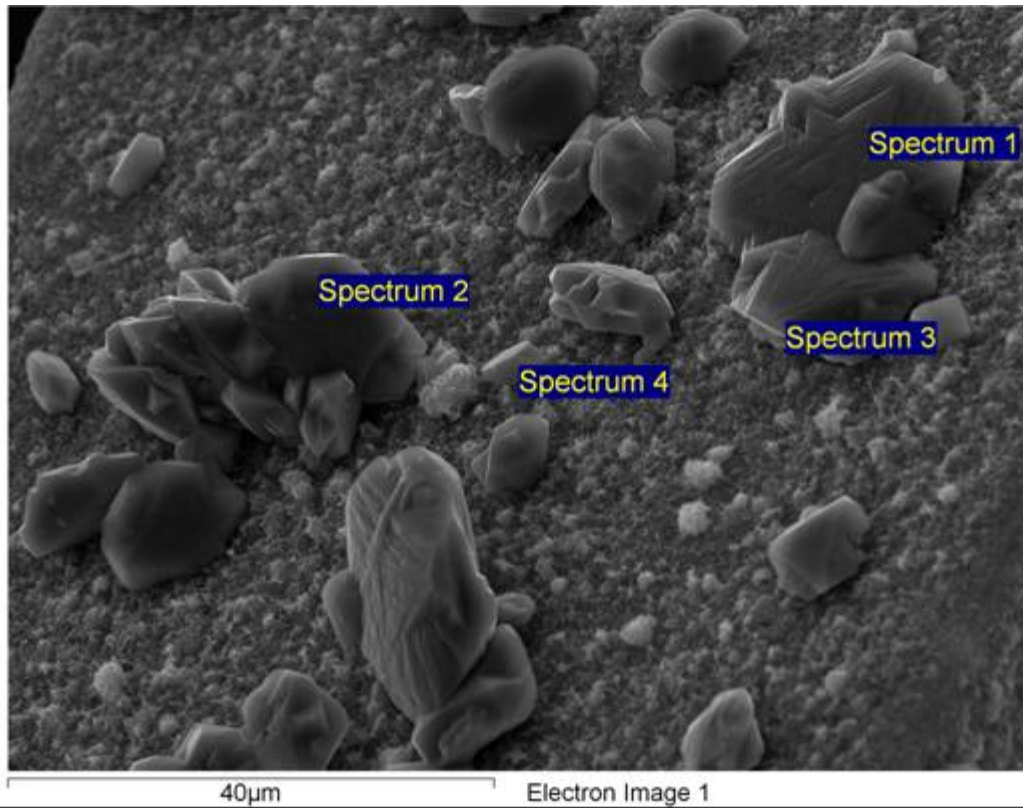
Element	Weight%	Atomic%	Compd%	Formula
Na K	6.41	5.74	8.64	Na ₂ O
Al K	11.23	8.56	21.21	Al ₂ O ₃
Si K	30.21	22.13	64.63	SiO ₂
K K	4.58	2.41	5.52	K ₂ O
O	47.57	61.17		
Totals	100.00			



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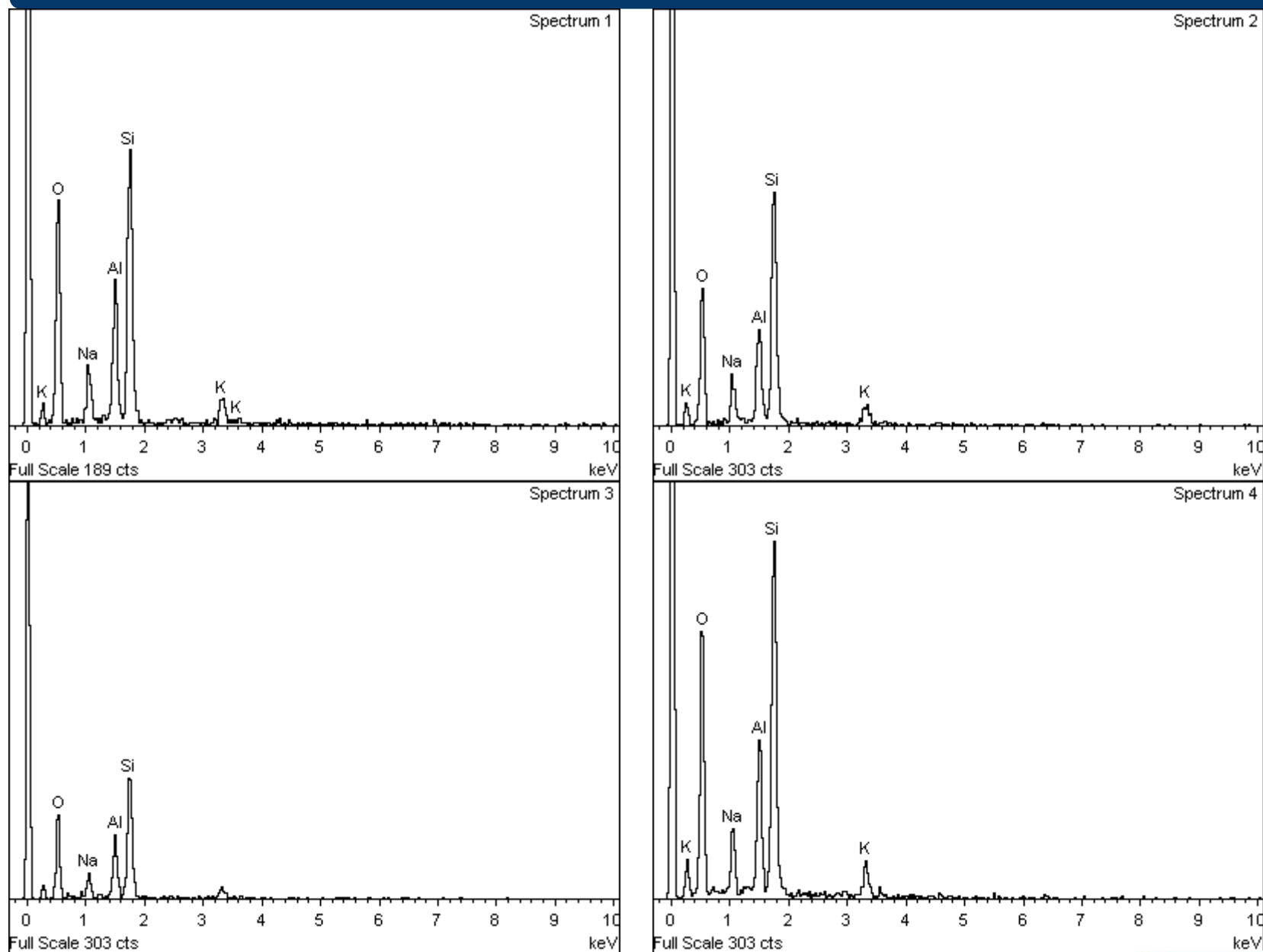
PCT SURFACE CORROSION. FILE 2. ROI 2.GLASS NAME LAWA126.



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PCT SURFACE CORROSION. FILE 2. ROI 2.GLASS NAME LAWA126.



B-203

Inca

PCT SURFACE CORROSION. FILE 2. ROI 2.GLASS NAME LAWA126.

Project: PCT SURFACE CORROSION 2
Owner: cavinm
Site: Site of Interest 2

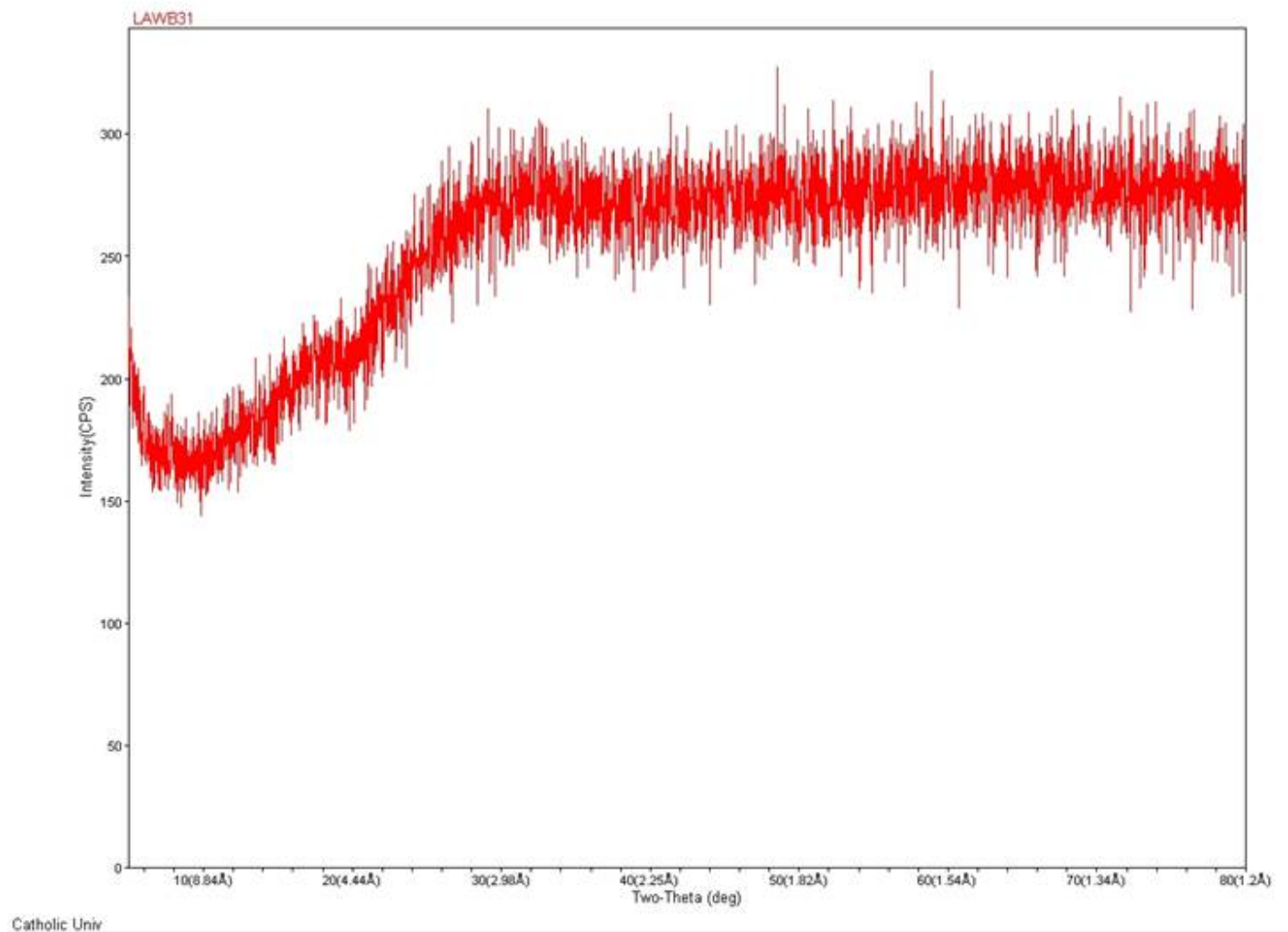
Sample: LAWA 126
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Al	Si	K	O	Total
Spectrum 1	Yes	5.61	11.66	29.86	5.42	47.45	100.00
Spectrum 2	Yes	6.03	10.74	31.25	3.92	48.06	100.00
Spectrum 3	Yes	6.64	12.35	31.65		49.36	100.00
Spectrum 4	Yes	6.41	11.23	30.21	4.58	47.57	100.00
Max.		6.64	12.35	31.65	5.42	49.36	
Min.		5.61	10.74	29.86	3.92	47.45	

All results in weight%

**XRD powder patterns (raw data) and SEM/EDS analysis of glass LAWB31,
collected from 90°C PCT-B vessel after 3982 days.**



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB31.

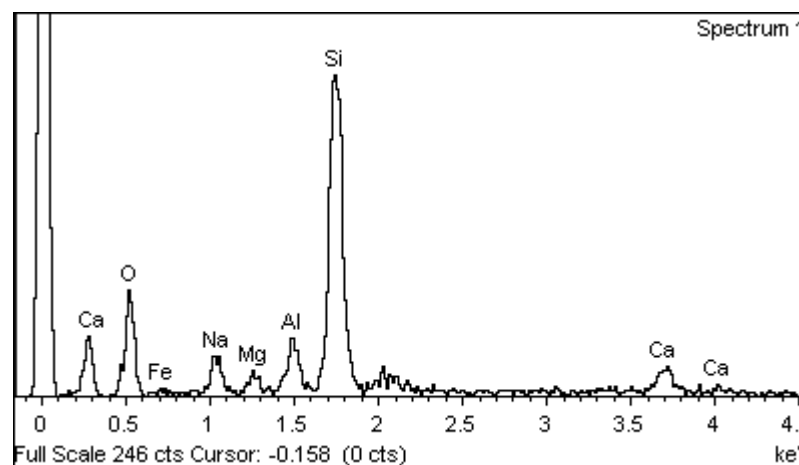
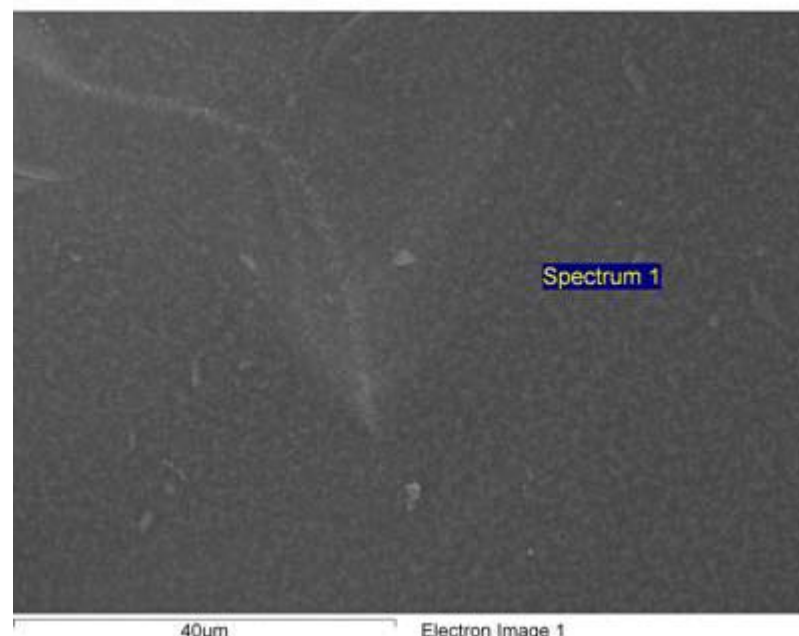
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.08	3.82	5.50	Na ₂ O
Mg K	1.70	1.50	2.81	MgO
Al K	3.91	3.12	7.39	Al ₂ O ₃
Si K	30.21	23.18	64.64	SiO ₂
Ca K	4.74	2.55	6.63	CaO
Fe K	9.11	3.52	13.03	Fe ₂ O ₃
O	46.25	62.30		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB31.

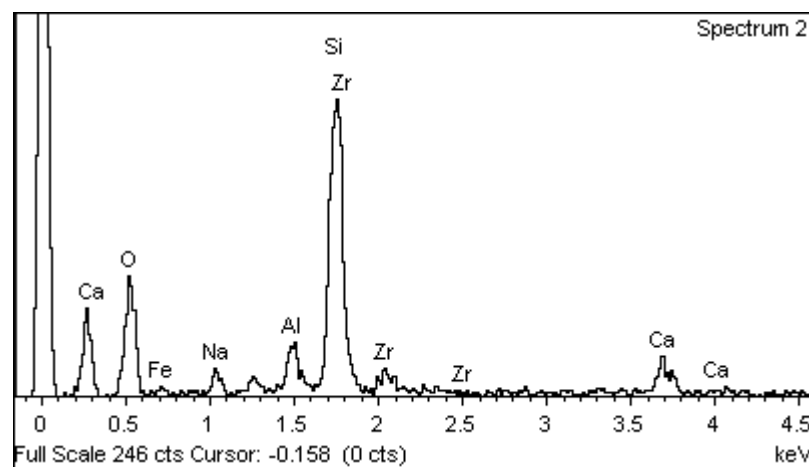
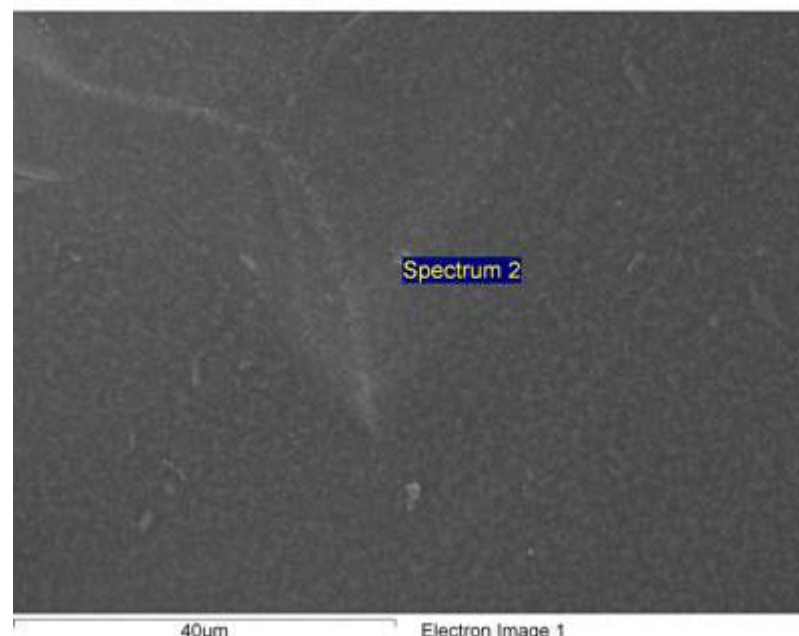
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 2

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

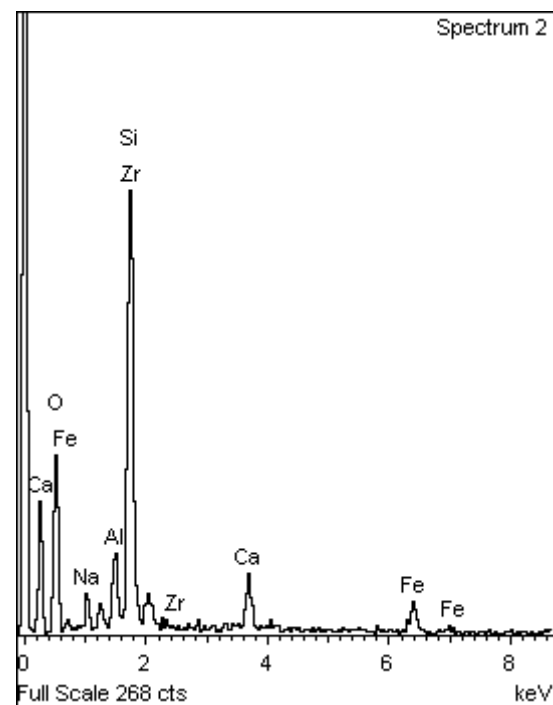
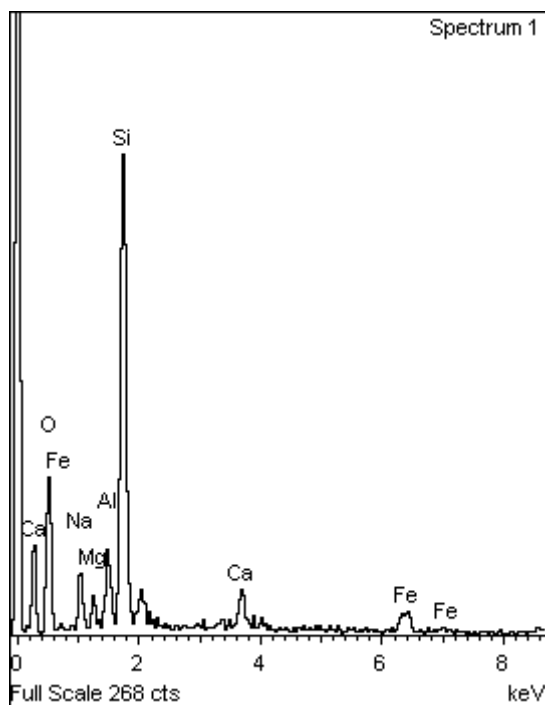
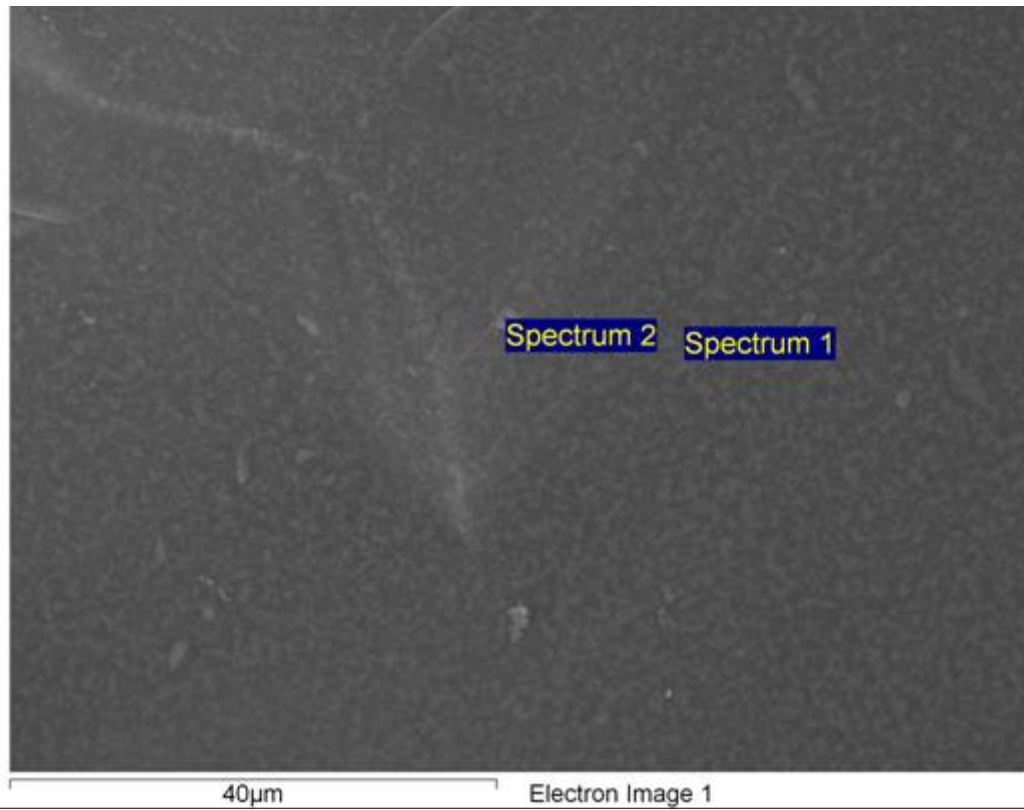
Element	Weight%	Atomic%	Compd%	Formula
Na K	2.76	2.77	3.73	Na ₂ O
Al K	3.48	2.97	6.57	Al ₂ O ₃
Si K	26.73	21.89	57.19	SiO ₂
Ca K	5.34	3.06	7.47	CaO
Fe K	11.42	4.70	16.33	Fe ₂ O ₃
Zr L	6.45	1.63	8.71	ZrO ₂
O	43.81	62.98		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB31.



Inca

PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB31.

Project: PCT SURFACE CORROSION 4
Owner: cavinm
Site: Site of Interest 1

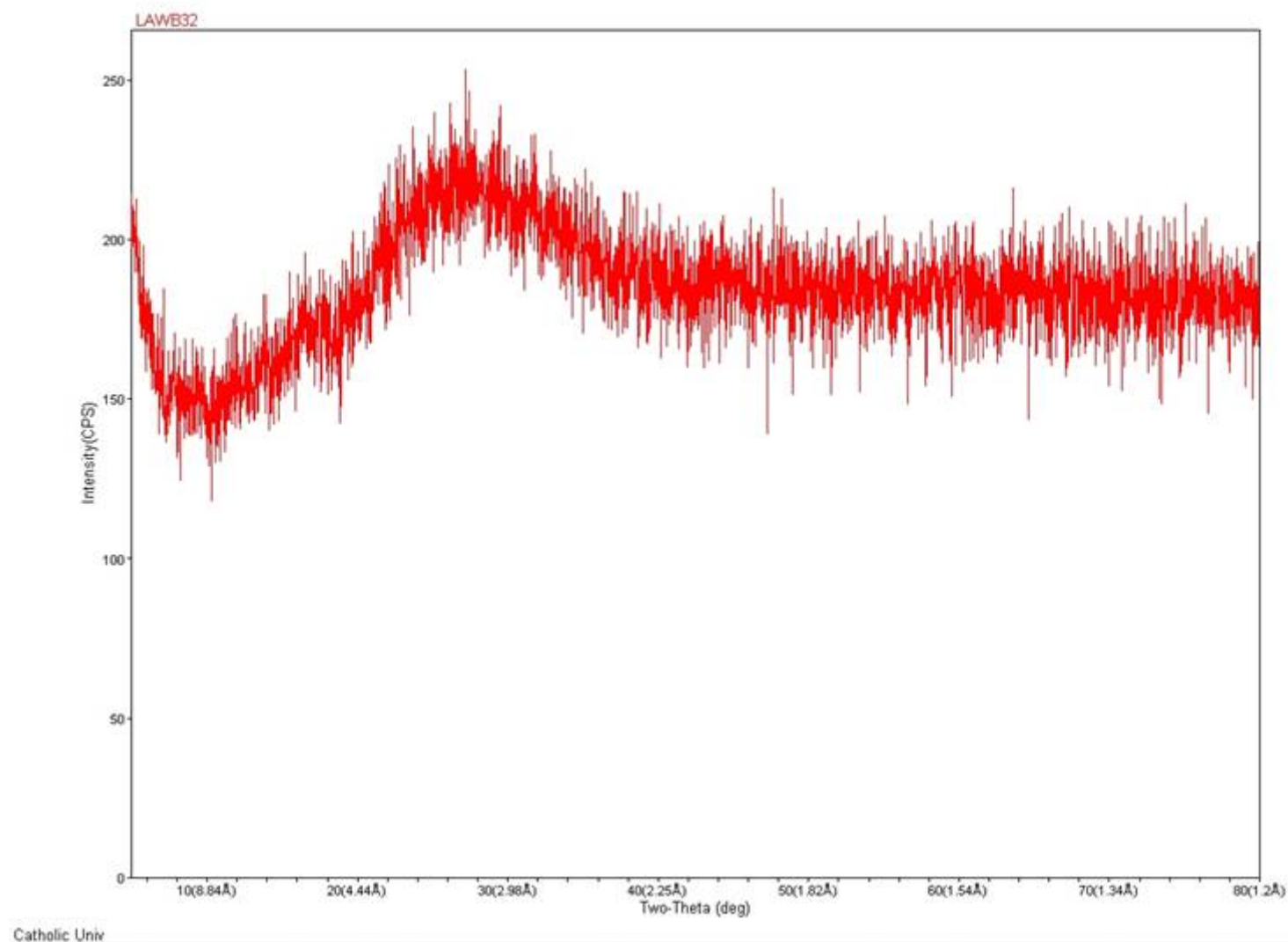
Sample: LAWB 31
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Ca	Fe	Zr	O	Total
Spectrum 1	Yes	4.08	1.70	3.91	30.21	4.74	9.11		46.25	100.00
Spectrum 2	Yes	2.76		3.48	26.73	5.34	11.42	6.45	43.81	100.00
Max.		4.08	1.70	3.91	30.21	5.34	11.42	6.45	46.25	
Min.		2.76	1.70	3.48	26.73	4.74	9.11	6.45	43.81	

All results in weight%

**XRD powder patterns (raw data) and SEM/EDS analysis of glass LAWB32,
collected from 90°C PCT-B vessel after 3982 days.**



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB32.

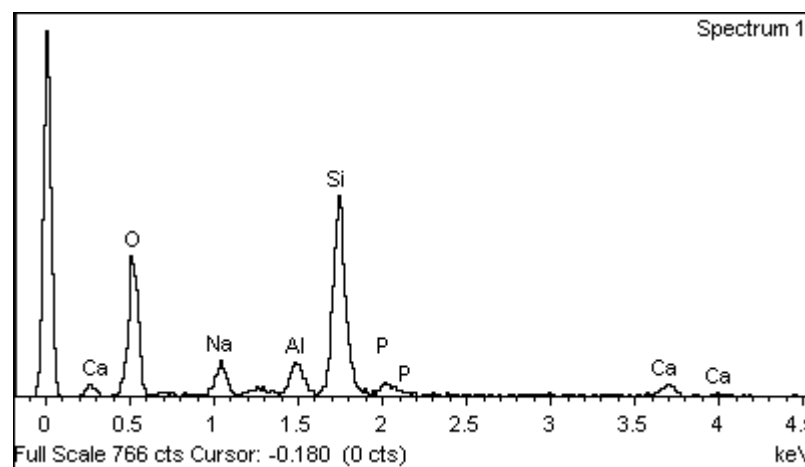
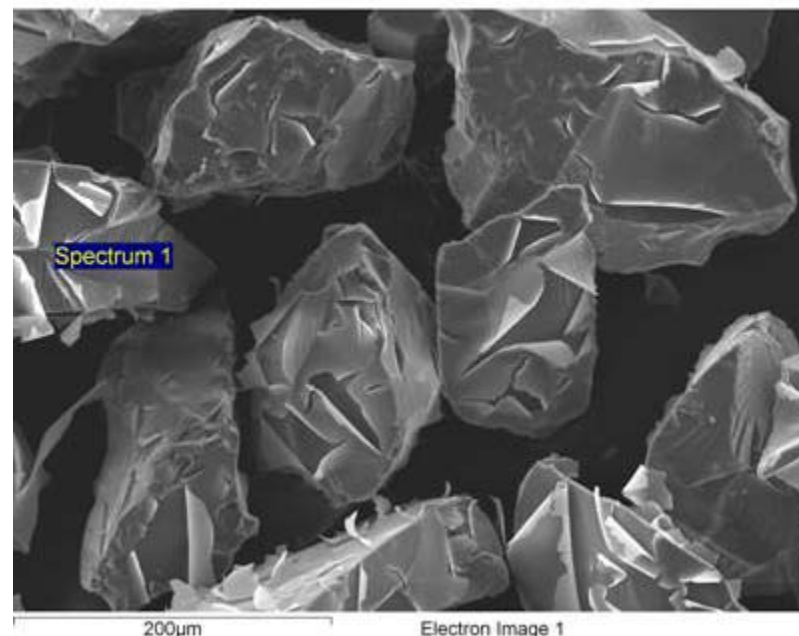
Spectrum processing :
Peak possibly omitted : 6.385 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
P GaP 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.90	5.25	7.95	Na ₂ O
Al K	4.78	3.62	9.03	Al ₂ O ₃
Si K	33.52	24.43	71.70	SiO ₂
P K	2.37	1.56	5.42	P ₂ O ₅
Ca K	4.21	2.15	5.90	CaO
O	49.23	62.98		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB32.

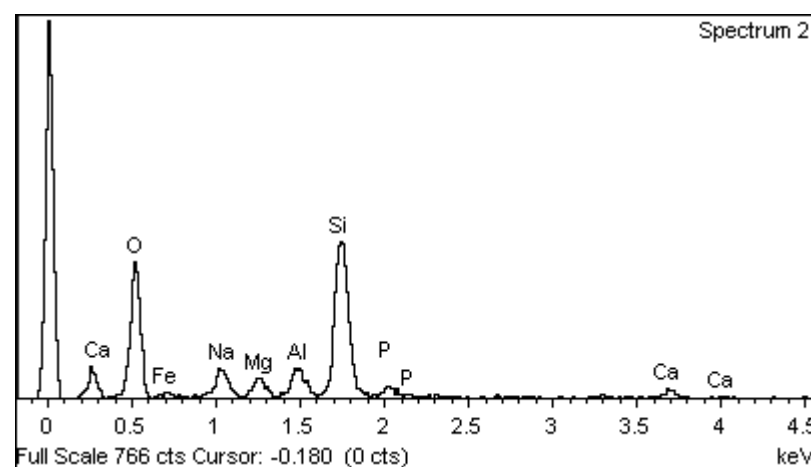
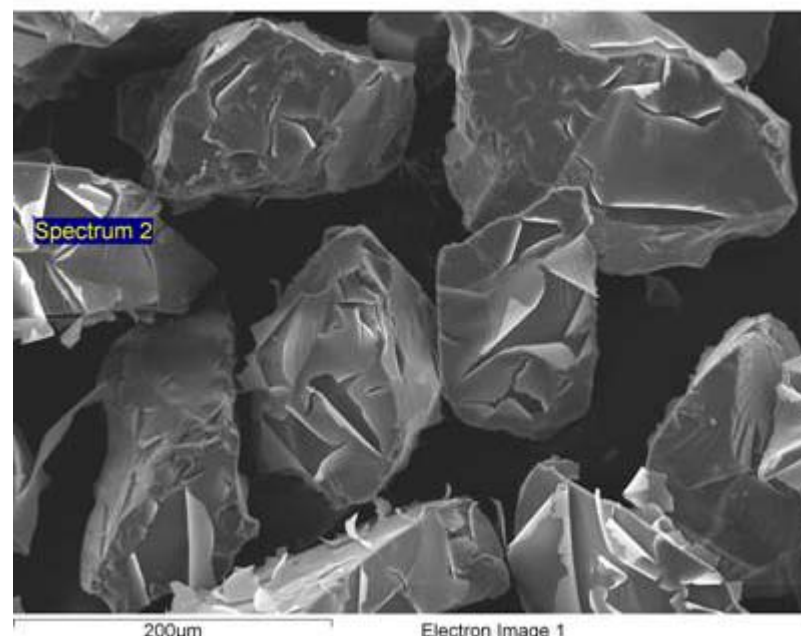
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
P GaP 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.94	4.50	6.66	Na ₂ O
Mg K	3.24	2.79	5.37	MgO
Al K	4.20	3.26	7.94	Al ₂ O ₃
Si K	29.75	22.16	63.63	SiO ₂
P K	2.24	1.52	5.14	P ₂ O ₅
Ca K	2.99	1.56	4.18	CaO
Fe K	4.95	1.85	7.08	Fe ₂ O ₃
O	47.69	62.37		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB32.

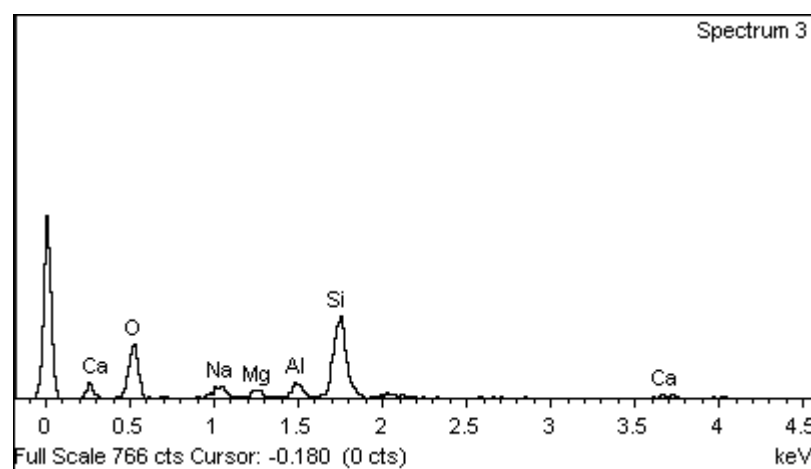
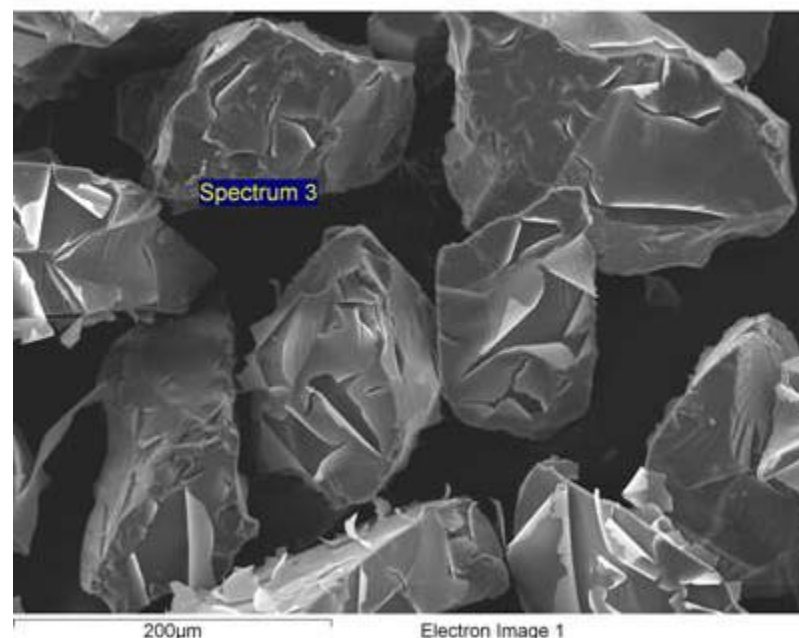
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.31	3.83	5.81	Na ₂ O
Mg K	3.15	2.65	5.23	MgO
Al K	4.88	3.70	9.23	Al ₂ O ₃
Si K	34.66	25.22	74.16	SiO ₂
Ca K	3.99	2.03	5.58	CaO
O	49.00	62.57		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB32.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

Mg MgO 1-Jun-1999 12:00 AM

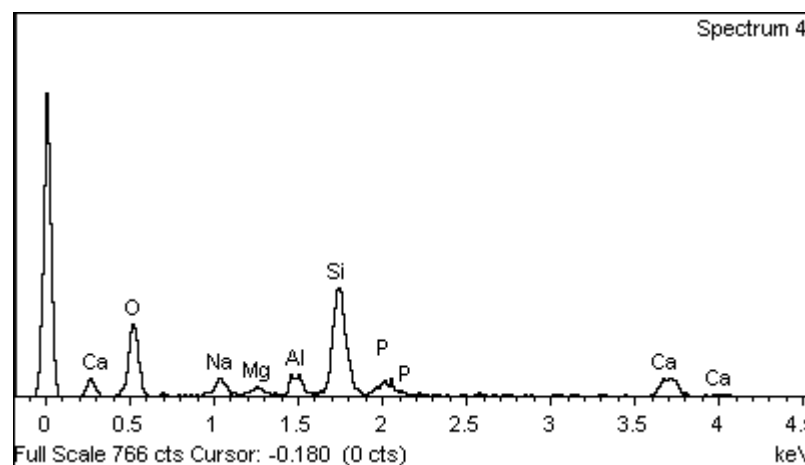
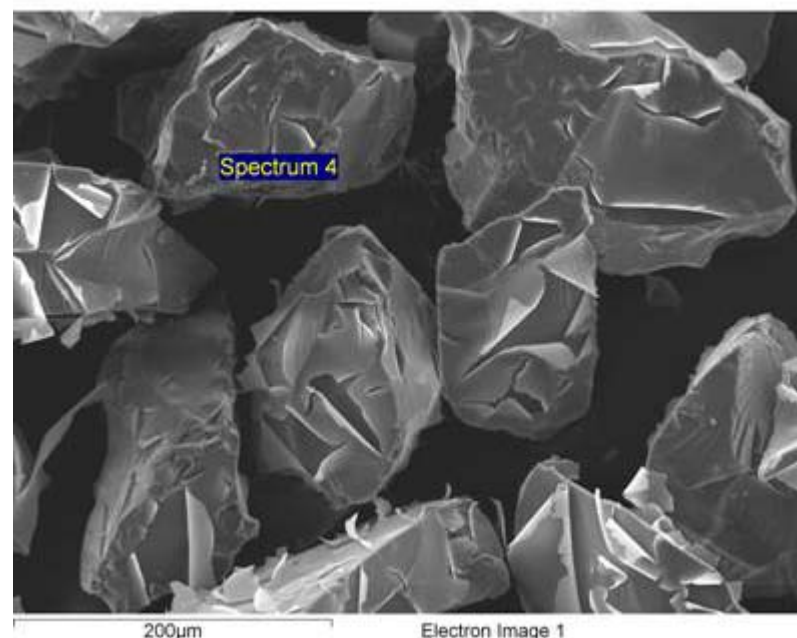
Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

P GaP 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

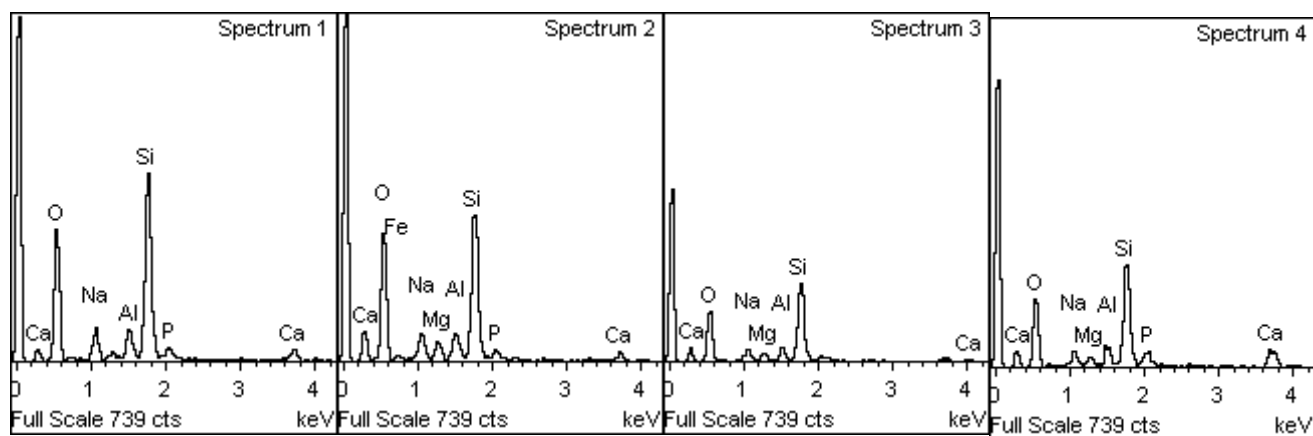
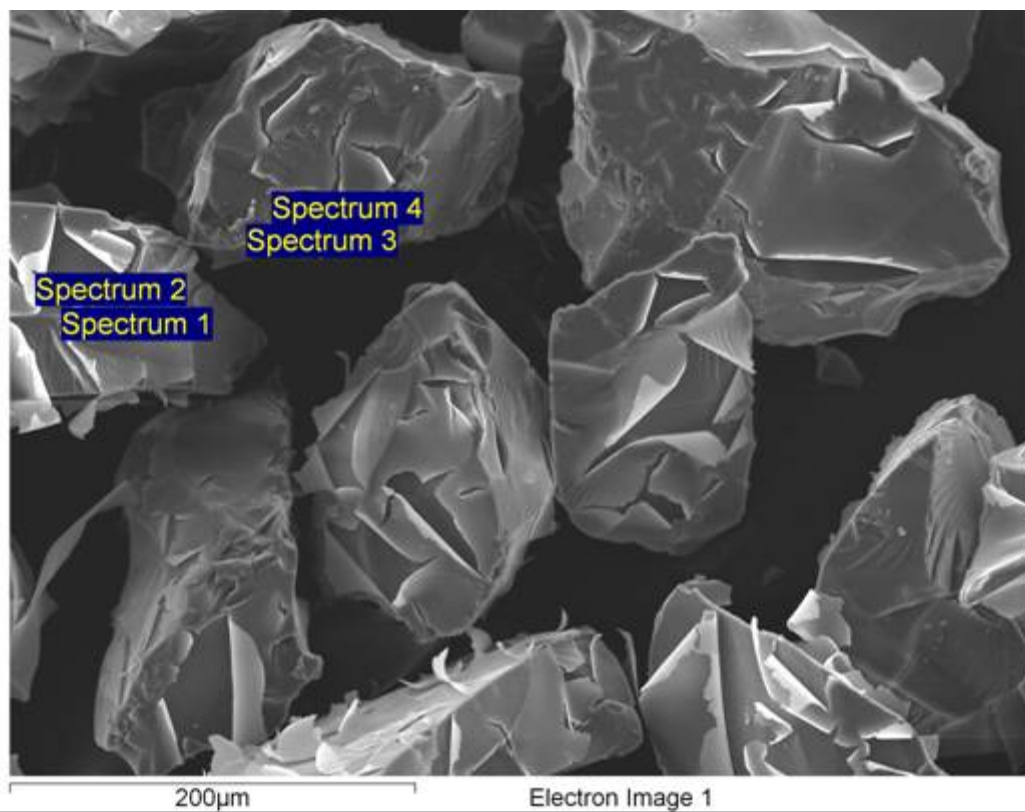
Element	Weight%	Atomic%	Compd%	Formula
Na K	4.03	3.67	5.43	Na ₂ O
Mg K	1.80	1.55	2.99	MgO
Al K	4.47	3.47	8.44	Al ₂ O ₃
Si K	27.32	20.41	58.45	SiO ₂
P K	4.56	3.09	10.44	P ₂ O ₅
Ca K	10.19	5.33	14.26	CaO
O	47.64	62.47		
Totals	100.00			



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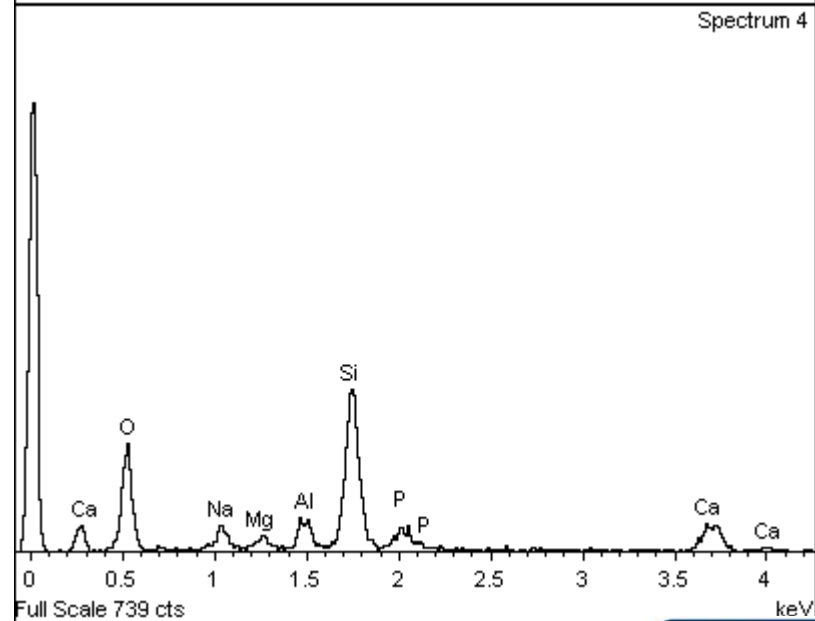
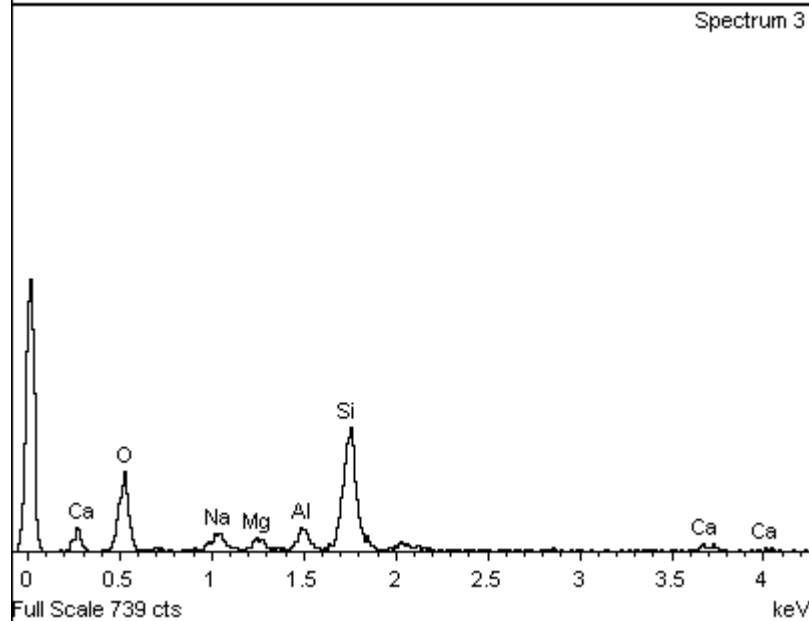
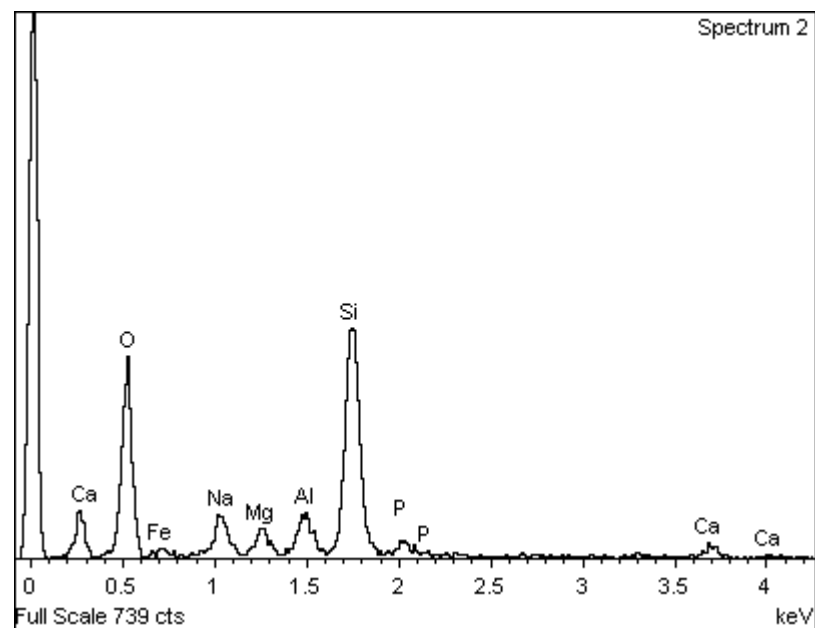
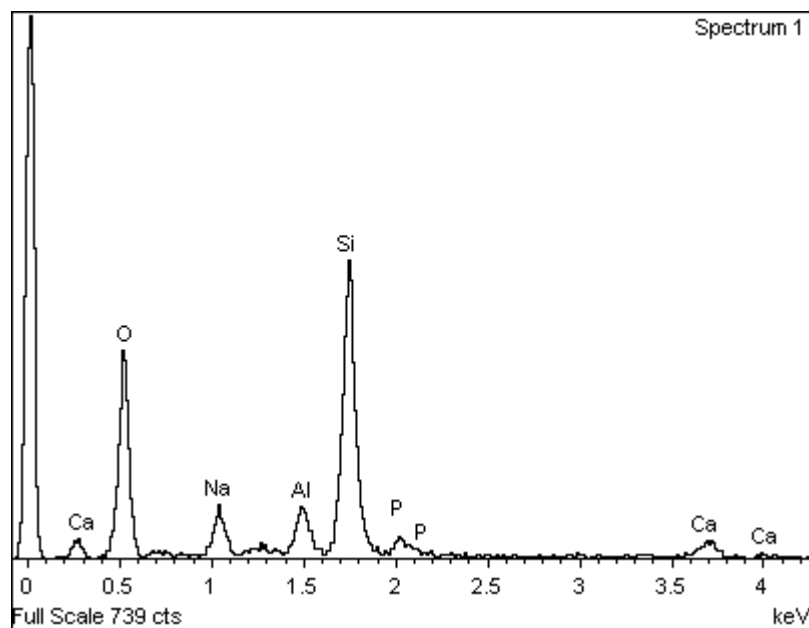
*ILAW Glass Testing for Disposal at IDF
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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB32.



Inca

PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB32.



PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB32.

Project: PCT SURFACE CORROSION 4
Owner: cavinm
Site: Site of Interest 1

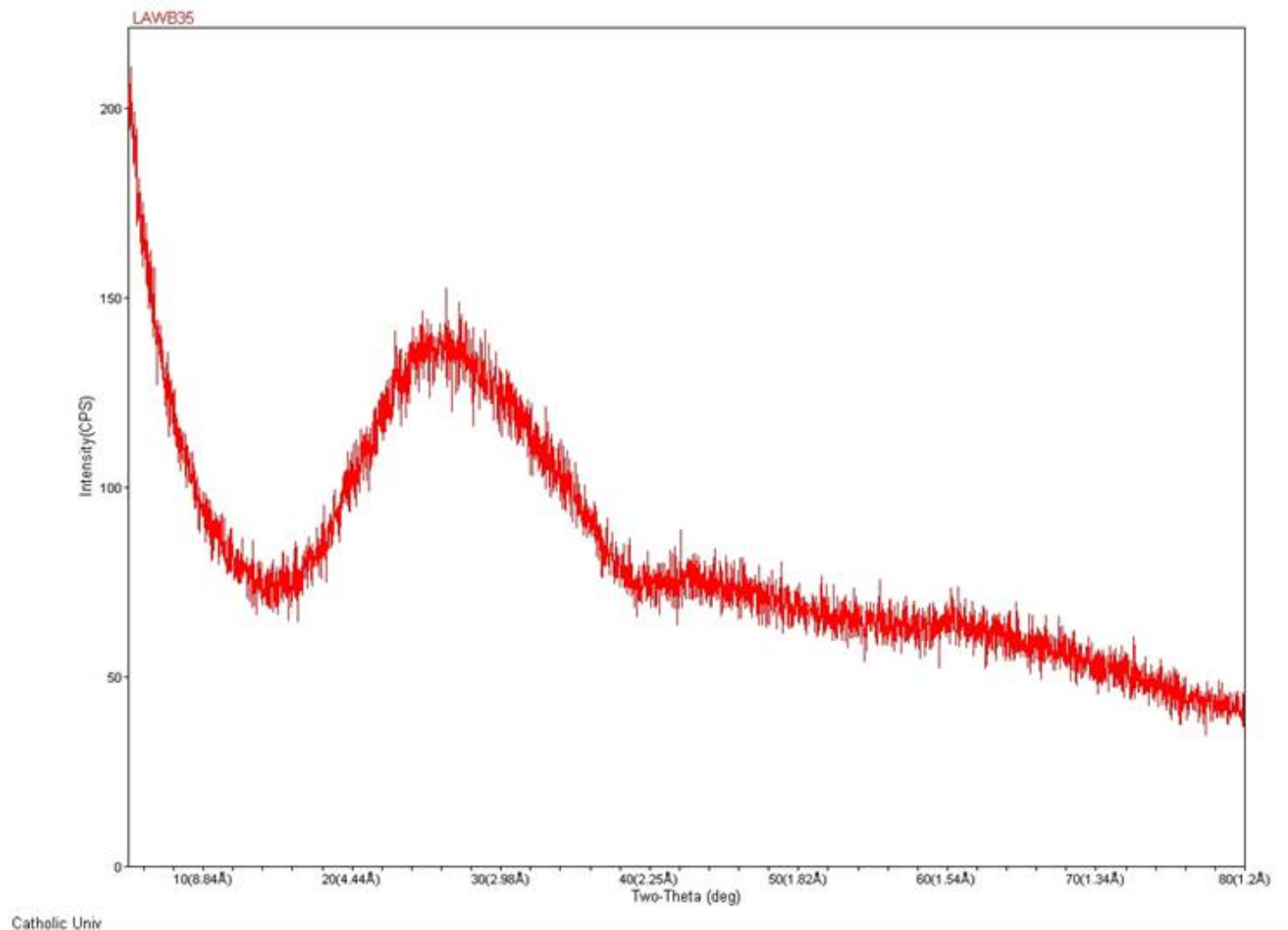
Sample: LAWB 32
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	P	Ca	Fe	O	Total
Spectrum 1	Yes	5.90		4.78	33.52	2.37	4.21		49.23	100.00
Spectrum 2	Yes	4.94	3.24	4.20	29.75	2.24	2.99	4.95	47.69	100.00
Spectrum 3	Yes	4.31	3.15	4.88	34.66		3.99		49.00	100.00
Spectrum 4	Yes	4.03	1.80	4.47	27.32	4.56	10.19		47.64	100.00
Max.		5.90	3.24	4.88	34.66	4.56	10.19	4.95	49.23	
Min.		4.03	1.80	4.20	27.32	2.24	2.99	4.95	47.64	

All results in weight%

**XRD powder patterns (raw data) and SEM/EDS analysis of glass LAWB35,
collected from 90°C PCT-B vessel after 3982 days.**



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB35.

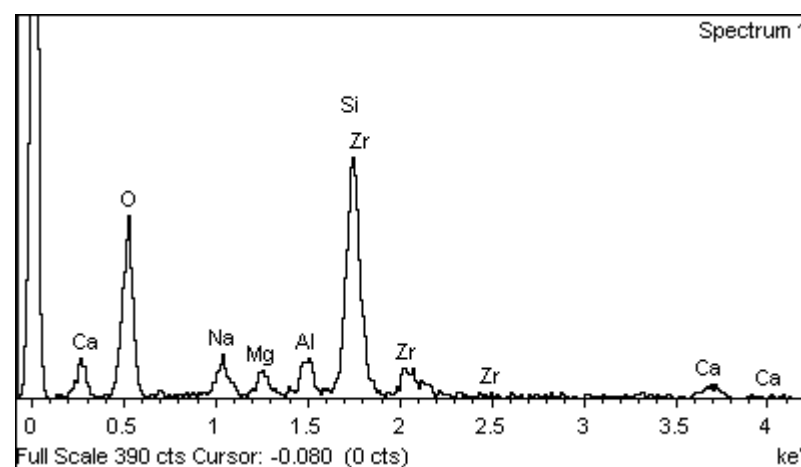
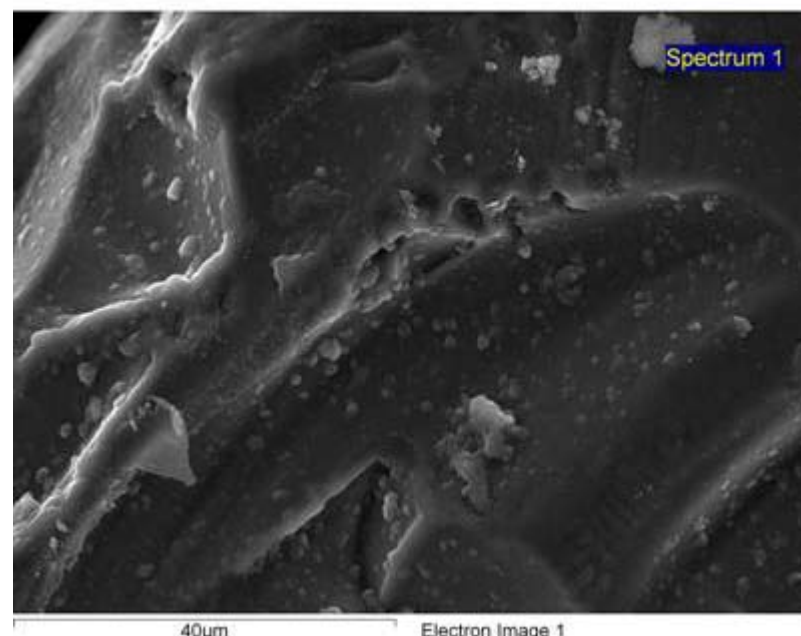
Spectrum processing :
Peak possibly omitted : 6.430 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 2

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.10	3.94	5.53	Na ₂ O
Mg K	2.54	2.30	4.21	MgO
Al K	4.22	3.45	7.97	Al ₂ O ₃
Si K	29.49	23.14	63.08	SiO ₂
Ca K	3.29	1.81	4.60	CaO
Zr L	10.82	2.61	14.61	ZrO ₂
O	45.55	62.75		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB35.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

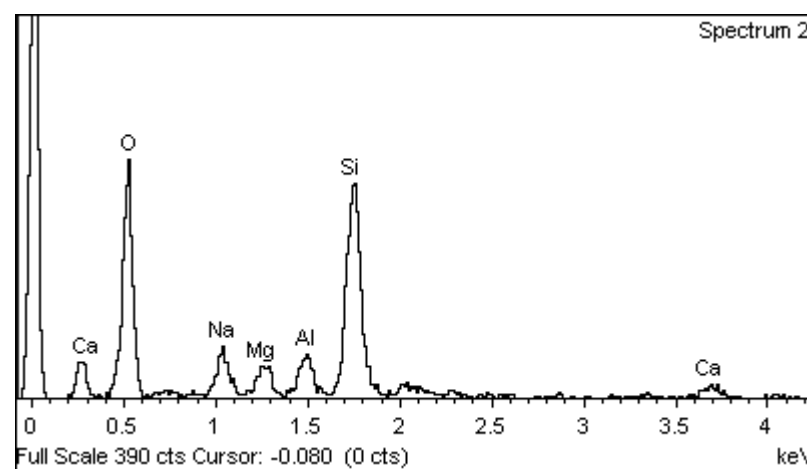
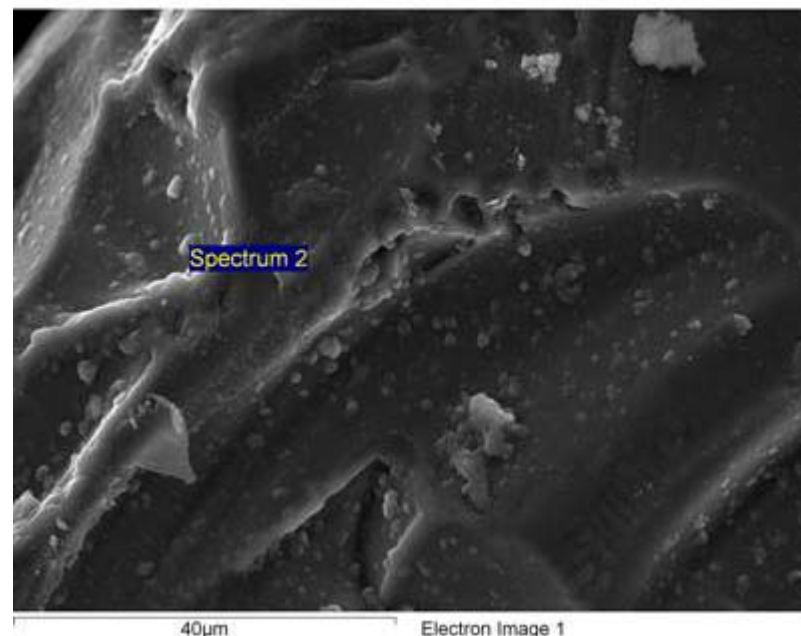
Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.55	5.82	8.83	Na ₂ O
Mg K	4.08	3.43	6.77	MgO
Al K	5.28	3.99	9.98	Al ₂ O ₃
Si K	32.60	23.68	69.73	SiO ₂
Ca K	3.35	1.70	4.68	CaO
O	48.14	61.38		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB35.

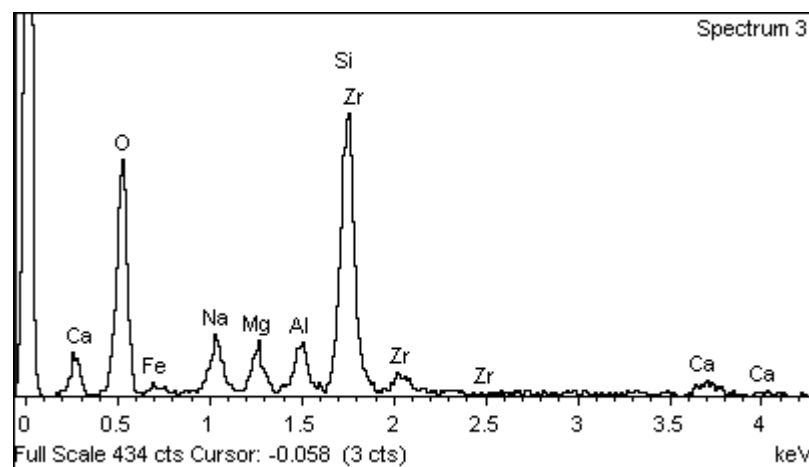
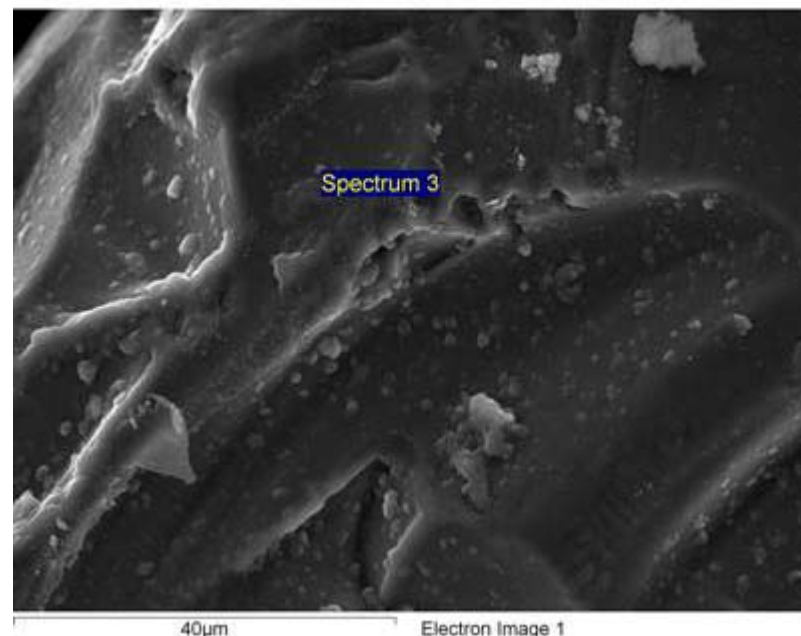
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 2

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.20	4.93	7.01	Na ₂ O
Mg K	4.42	3.97	7.34	MgO
Al K	3.97	3.21	7.50	Al ₂ O ₃
Si K	27.80	21.59	59.47	SiO ₂
Ca K	2.53	1.37	3.53	CaO
Fe K	4.98	1.95	7.12	Fe ₂ O ₃
Zr L	5.94	1.42	8.03	ZrO ₂
O	45.16	61.56		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB35.

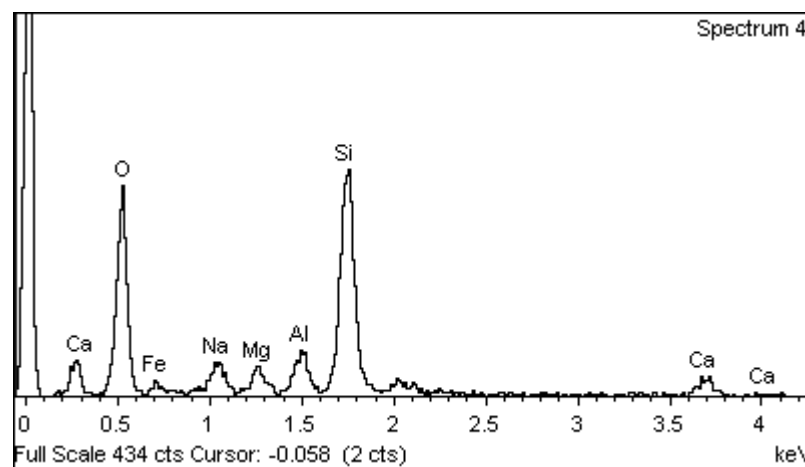
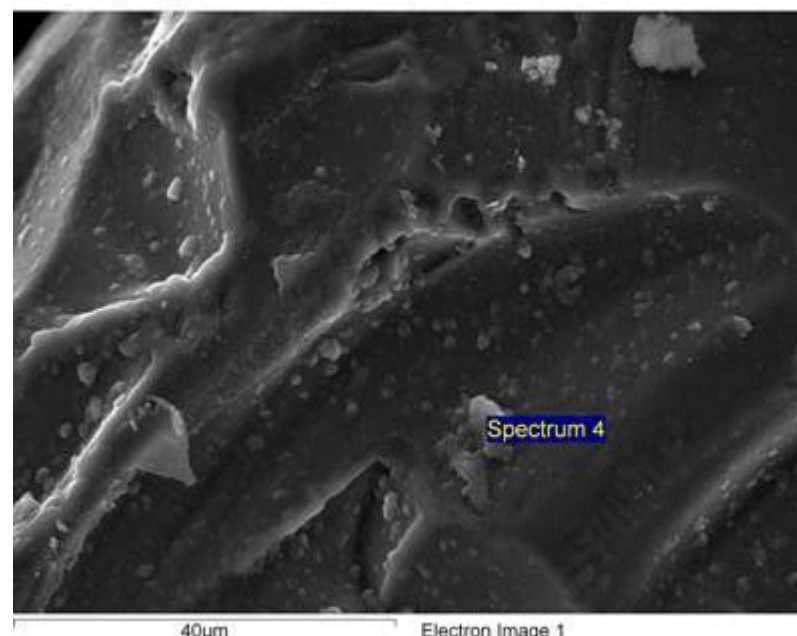
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

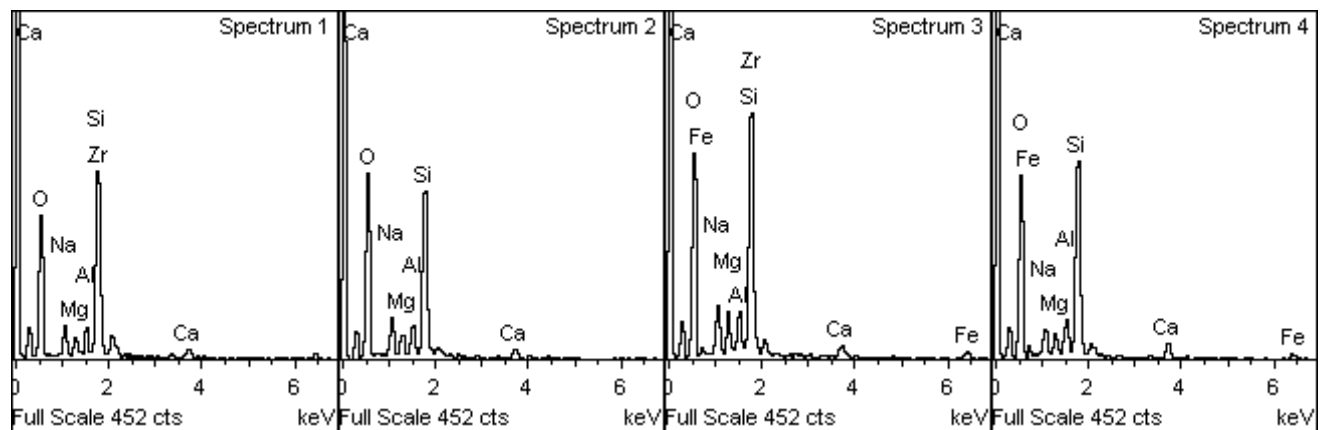
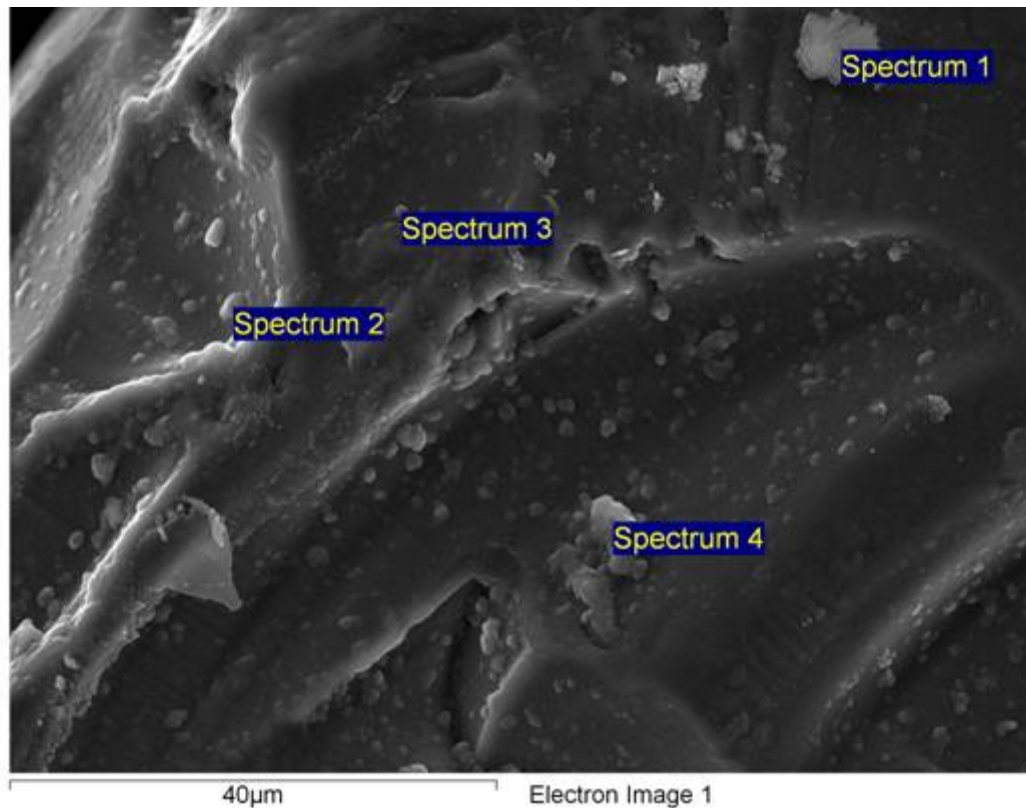
Element	Weight%	Atomic%	Compd%	Formula
Na K	4.47	4.10	6.03	Na ₂ O
Mg K	3.22	2.79	5.34	MgO
Al K	4.69	3.66	8.85	Al ₂ O ₃
Si K	30.88	23.16	66.07	SiO ₂
Ca K	4.61	2.42	6.44	CaO
Fe K	5.08	1.92	7.26	Fe ₂ O ₃
O	47.05	61.95		
Totals	100.00			



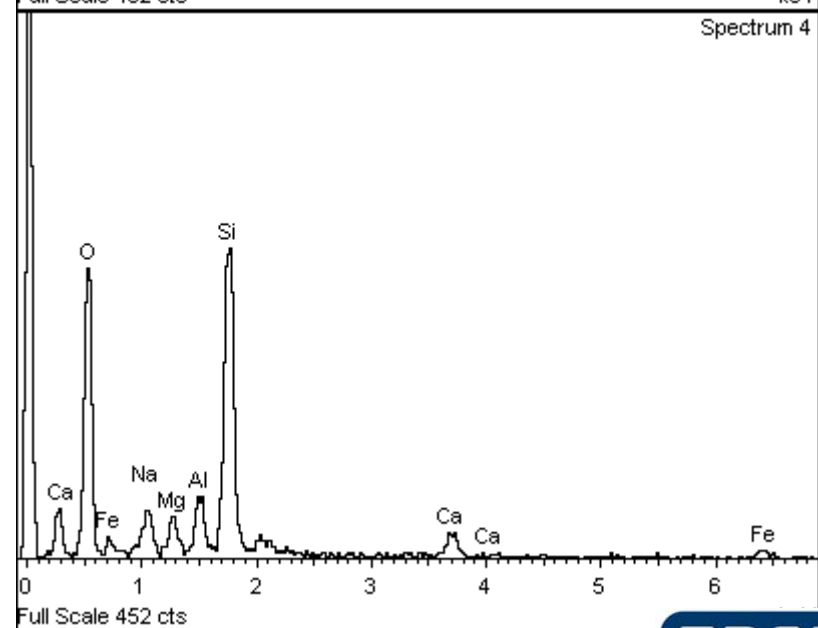
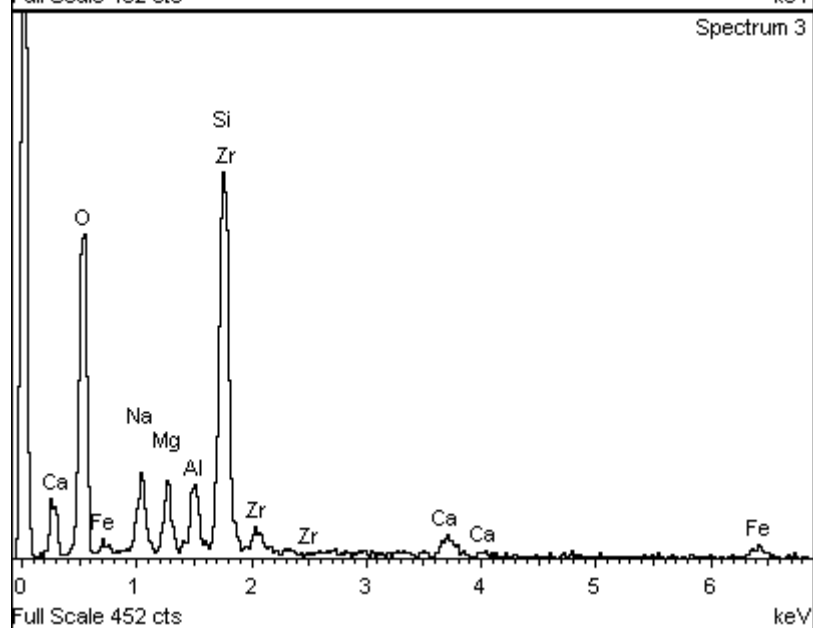
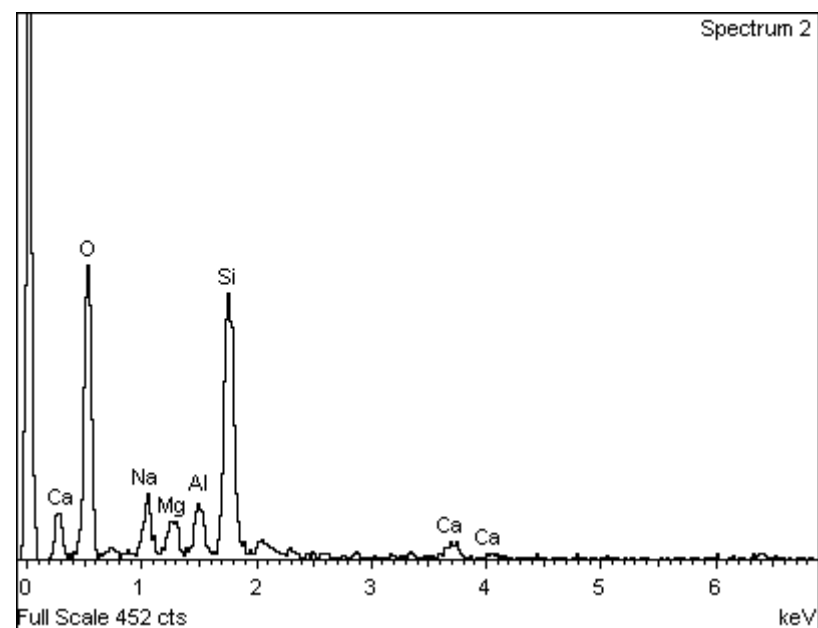
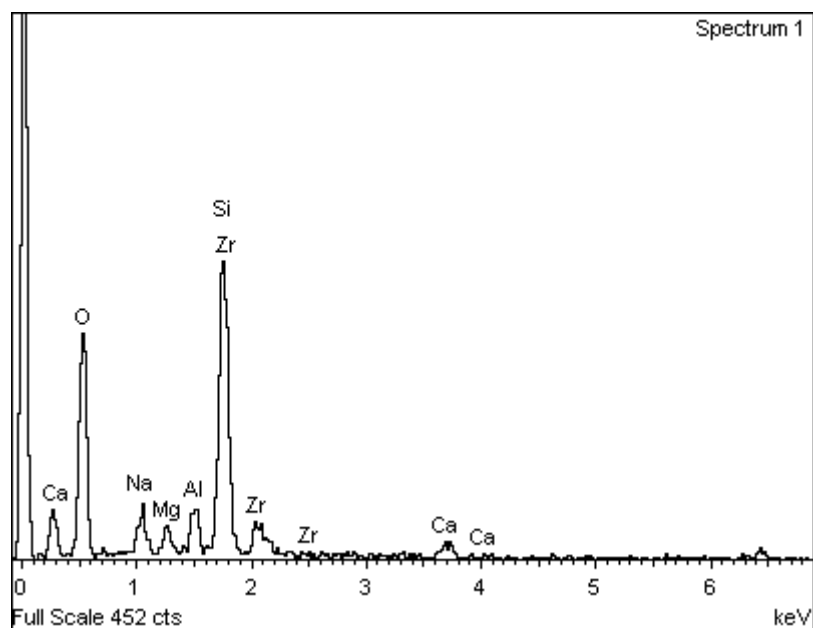
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*ILAW Glass Testing for Disposal at IDF
Final Report, VSL-11R2270-1, Rev. 0*

PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB35.



PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB35.



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*ILAW Glass Testing for Disposal at IDF
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PCT SURFACE CORROSION. FILE 4. ROI 1. GLASS NAME LAWB35.

Project: PCT SURFACE CORROSION 4
Owner: cavinm
Site: Site of Interest 1

Sample: LAWB 35
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Ca	Fe	Zr	O	Total
Spectrum 1	Yes	4.10	2.54	4.22	29.49	3.29		10.82	45.55	100.00
Spectrum 2	Yes	6.55	4.08	5.28	32.60	3.35			48.14	100.00
Spectrum 3	Yes	5.20	4.42	3.97	27.80	2.53	4.98	5.94	45.16	100.00
Spectrum 4	Yes	4.47	3.22	4.69	30.88	4.61	5.08		47.05	100.00
Max.		6.55	4.42	5.28	32.60	4.61	5.08	10.82	48.14	
Min.		4.10	2.54	3.97	27.80	2.53	4.98	5.94	45.16	

All results in weight%

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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME LAWB35.

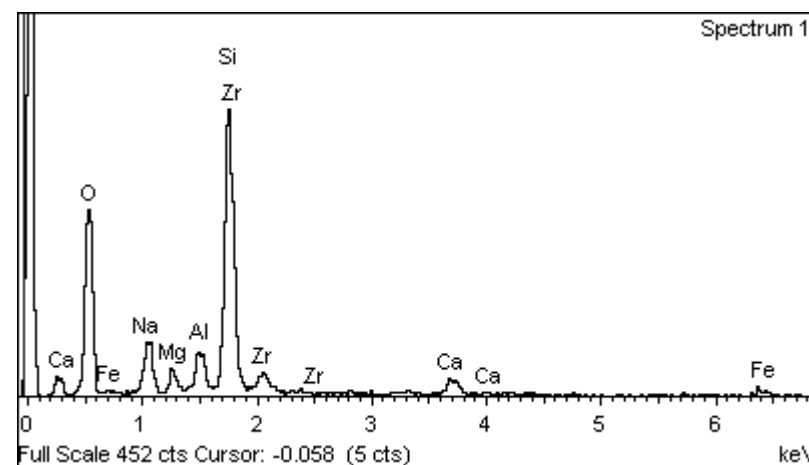
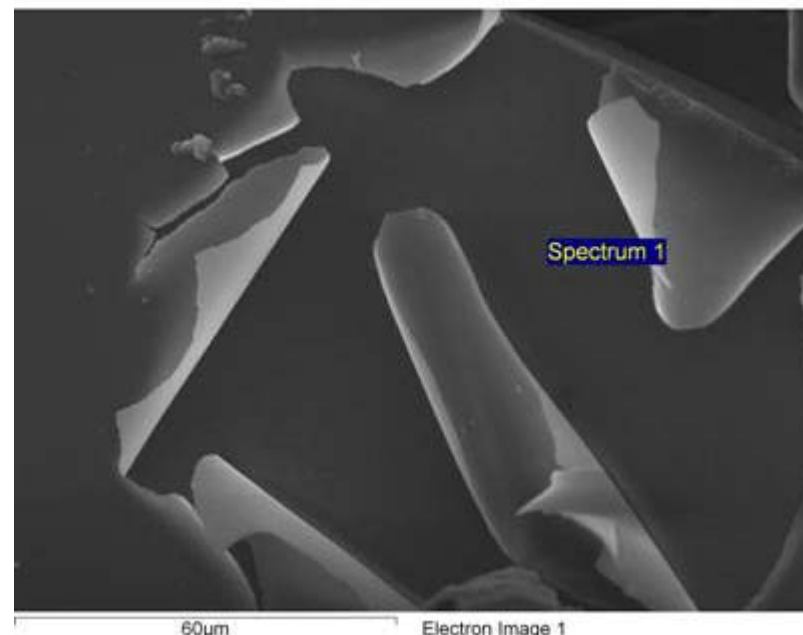
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	6.34	6.02	8.55	Na ₂ O
Mg K	2.44	2.19	4.05	MgO
Al K	3.64	2.95	6.88	Al ₂ O ₃
Si K	28.56	22.21	61.09	SiO ₂
Ca K	3.54	1.93	4.95	CaO
Fe K	4.69	1.83	6.71	Fe ₂ O ₃
Zr L	5.76	1.38	7.78	ZrO ₂
O	45.03	61.48		
Totals	100.00			



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ILAW Glass Testing for Disposal at IDF
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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME LAWB35.

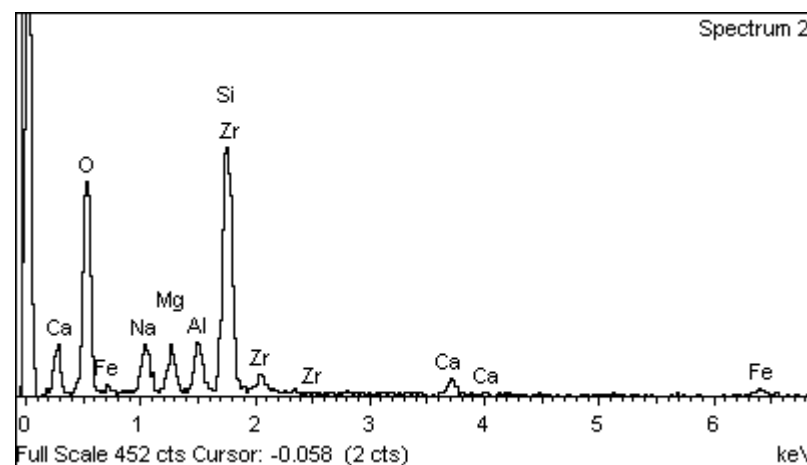
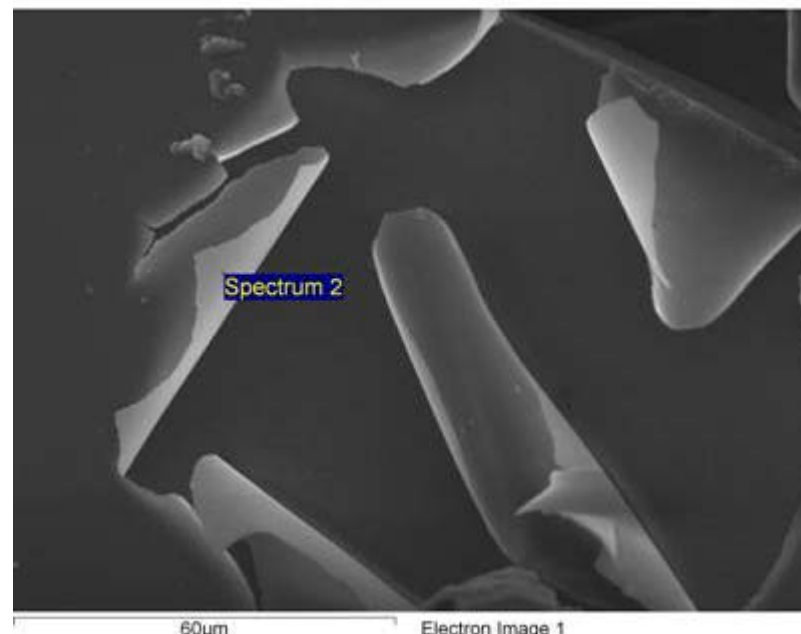
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.35	5.05	7.22	Na ₂ O
Mg K	4.26	3.80	7.06	MgO
Al K	4.53	3.64	8.56	Al ₂ O ₃
Si K	27.71	21.41	59.28	SiO ₂
Ca K	2.96	1.60	4.14	CaO
Fe K	4.75	1.84	6.78	Fe ₂ O ₃
Zr L	5.16	1.23	6.97	ZrO ₂
O	45.29	61.43		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME LAWB35.

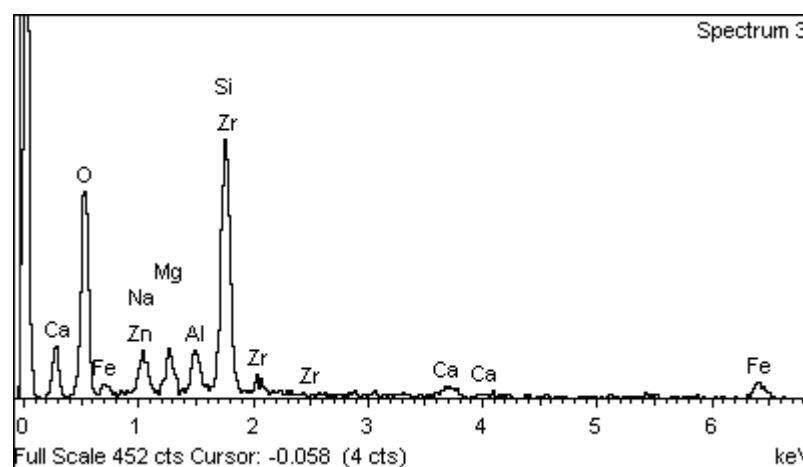
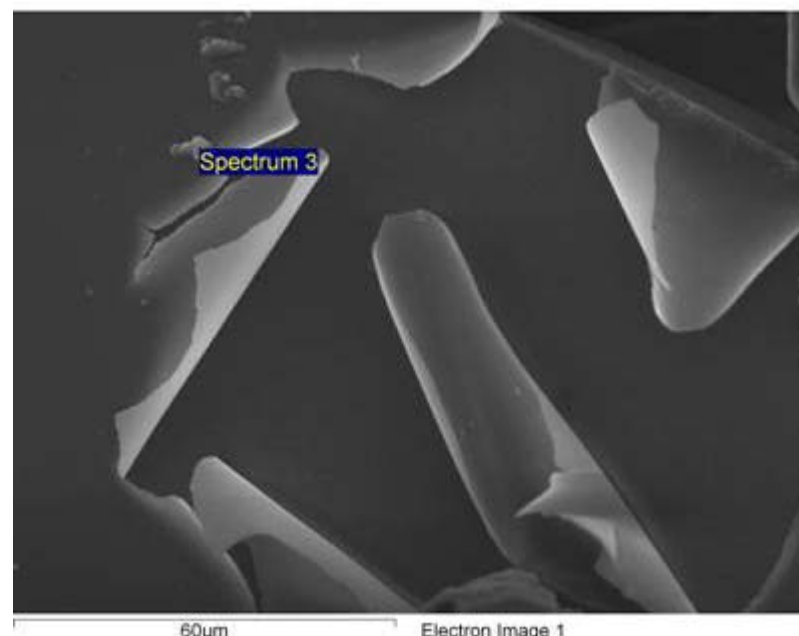
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
Mg MgO 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM
Zn Zn 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

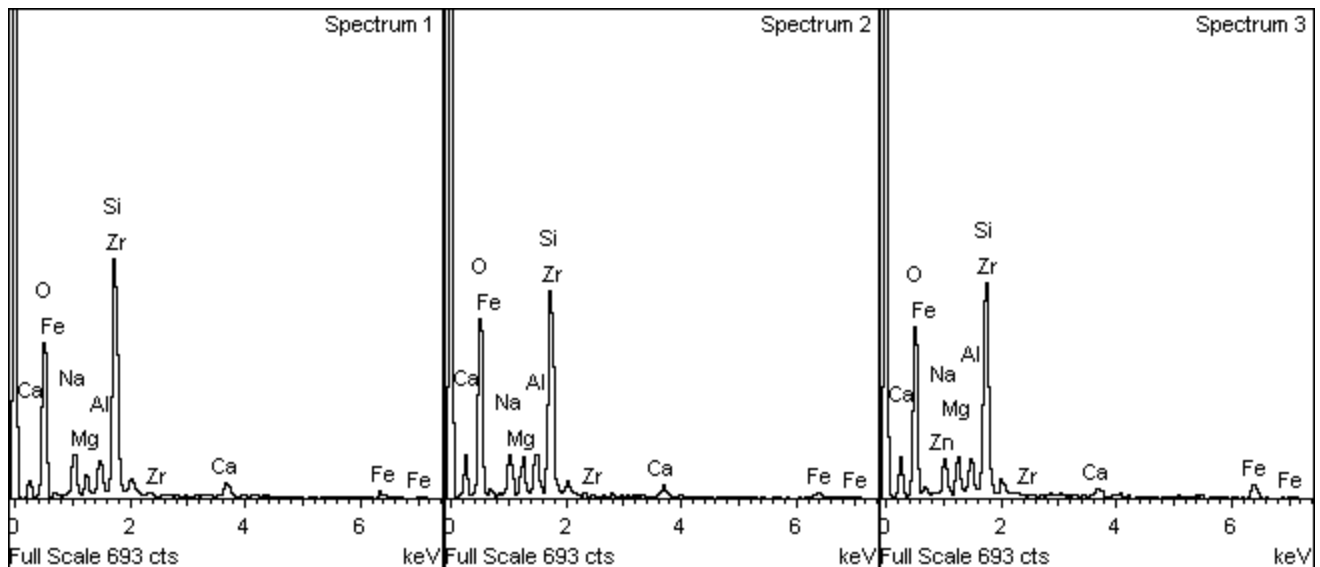
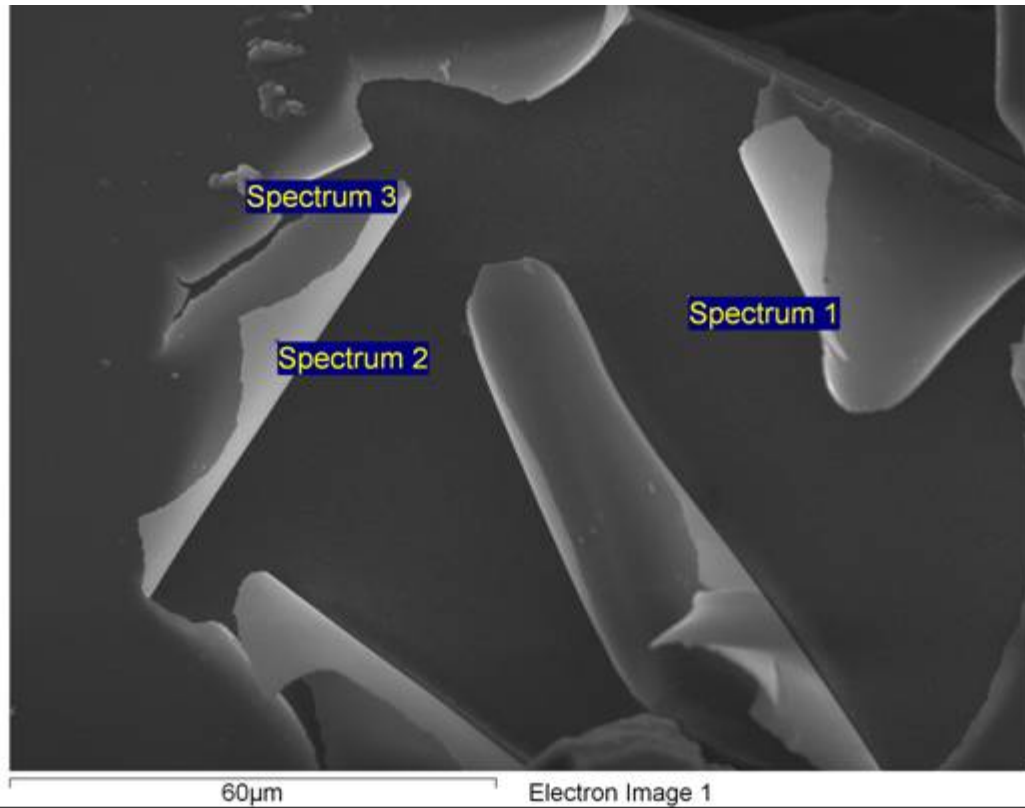
Element	Weight%	Atomic%	Compd%	Formula
Na K	2.75	2.74	3.70	Na ₂ O
Mg K	4.19	3.95	6.94	MgO
Al K	3.86	3.28	7.30	Al ₂ O ₃
Si K	24.65	20.12	52.74	SiO ₂
Ca K	1.51	0.86	2.11	CaO
Fe K	10.81	4.44	15.46	Fe ₂ O ₃
Zn L	5.09	1.78	6.33	ZnO
Zr L	4.01	1.01	5.41	ZrO ₂
O	43.13	61.81		
Totals	100.00			



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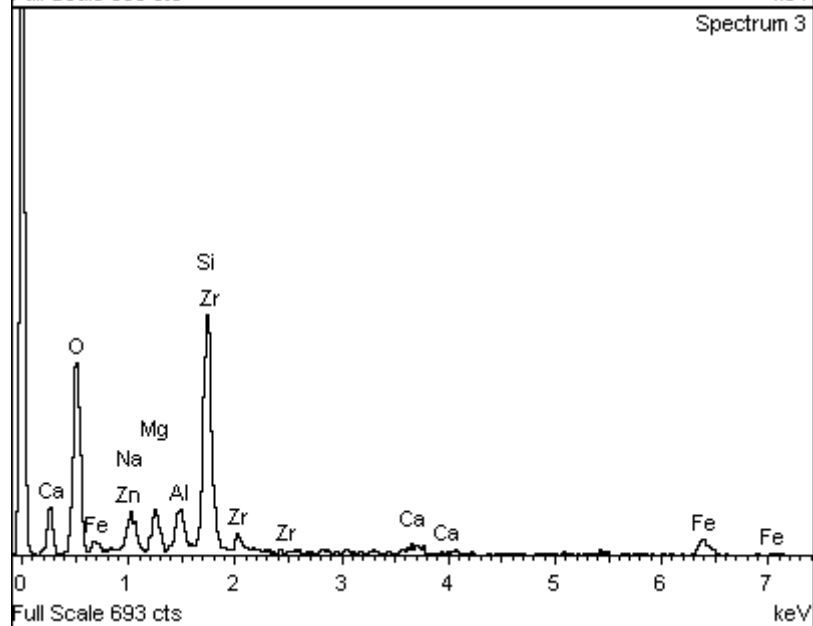
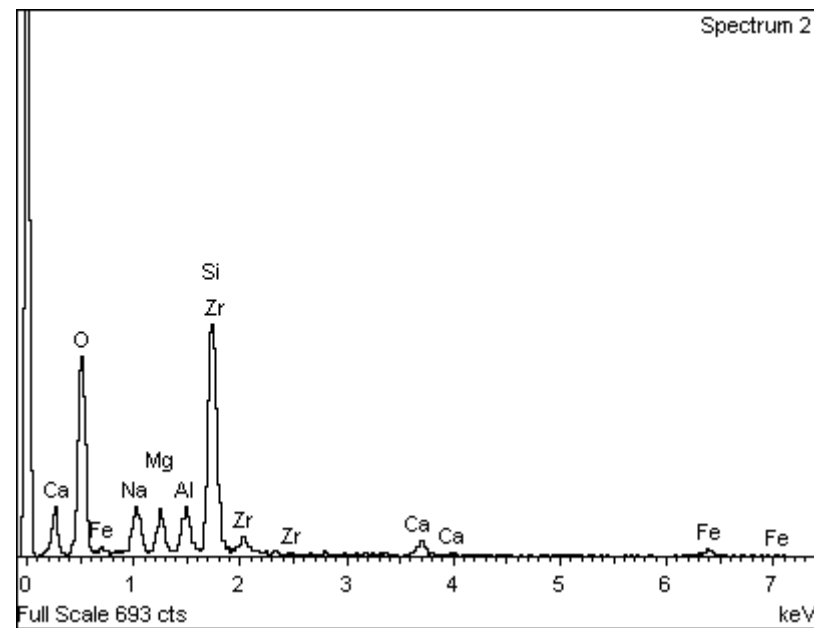
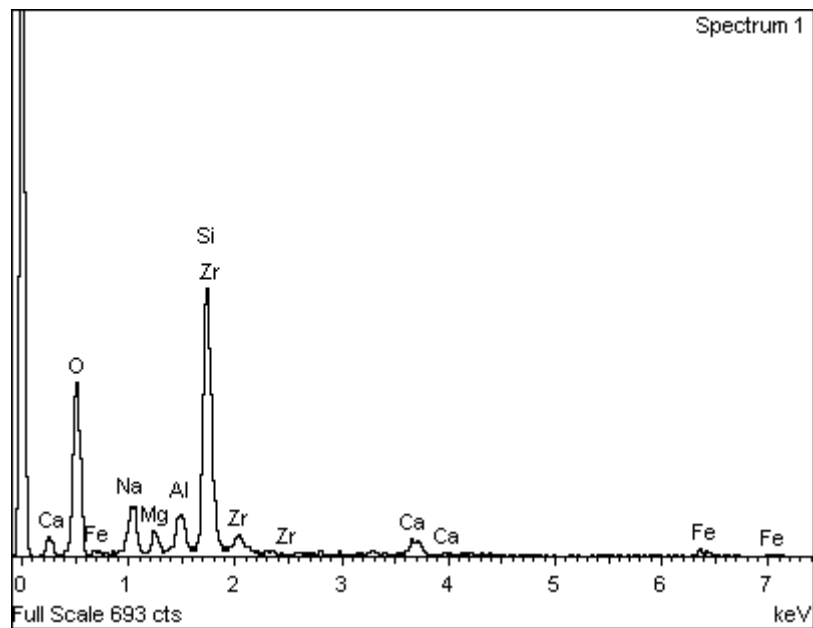
*ILAW Glass Testing for Disposal at IDF
Final Report, VSL-11R2270-1, Rev. 0*

PCT SURFACE CORROSION. FILE 4. ROI 2. GLASS NAME LAWB35.



Inca

PCT SURFACE CORROSION 4. ROI 2. GLASS NAME LAWB35.



B-230

PCT SURFACE CORROSION 4. ROI 2. GLASS NAME LAWB35.

Project: PCT SURFACE CORROSION 4
Owner: cavinm
Site: Site of Interest 2

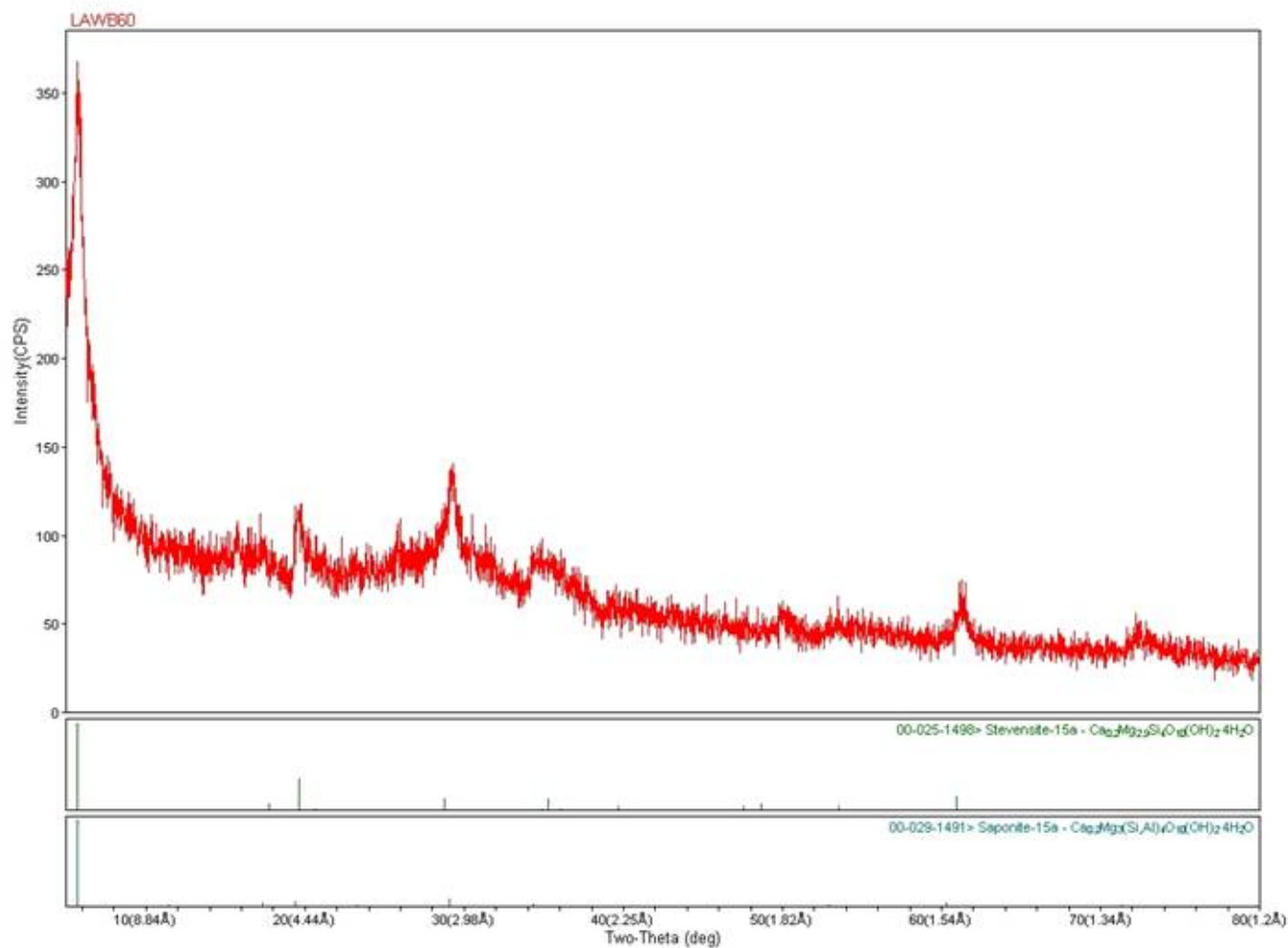
Sample: LAWB 35
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Ca	Fe	Zn	Zr	O	Total
Spectrum 1	Yes	6.34	2.44	3.64	28.56	3.54	4.69		5.76	45.03	100.00
Spectrum 2	Yes	5.35	4.26	4.53	27.71	2.96	4.75		5.16	45.29	100.00
Spectrum 3	Yes	2.75	4.19	3.86	24.65	1.51	10.81	5.09	4.01	43.13	100.00
Max.		6.34	4.26	4.53	28.56	3.54	10.81	5.09	5.76	45.29	
Min.		2.75	2.44	3.64	24.65	1.51	4.69	5.09	4.01	43.13	

All results in weight%

**XRD powder patterns (raw data and best match) and SEM/EDS analysis of glass LAWB60,
collected from 90°C PCT-B vessel after 3086 days.**



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PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME LAWB60.

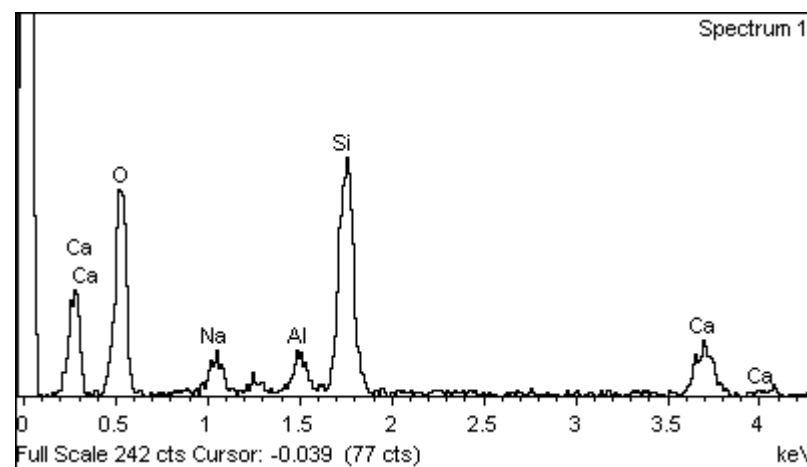
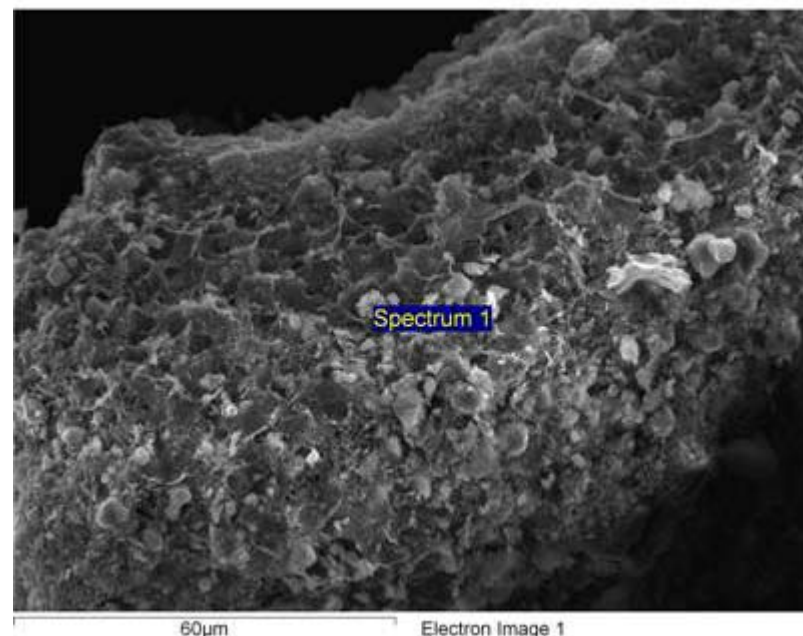
Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM
 Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.07	4.68	6.83	Na ₂ O
Al K	4.12	3.24	7.78	Al ₂ O ₃
Si K	31.23	23.60	66.80	SiO ₂
Ca K	13.29	7.04	18.59	CaO
O	46.30	61.44		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME LAWB60.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

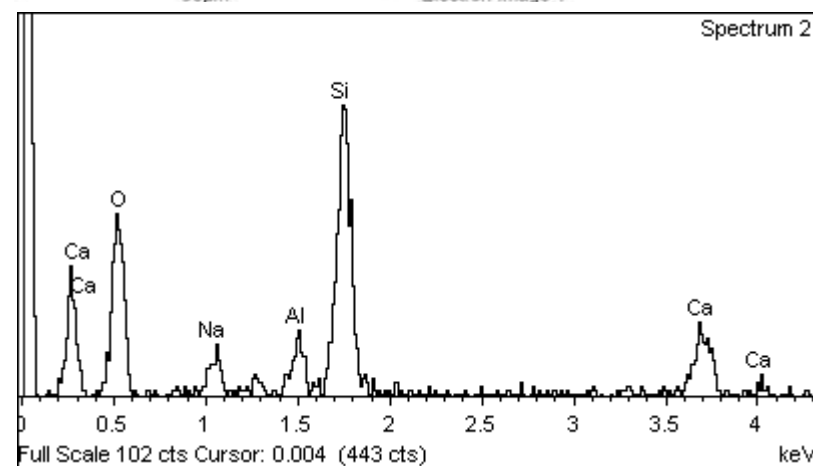
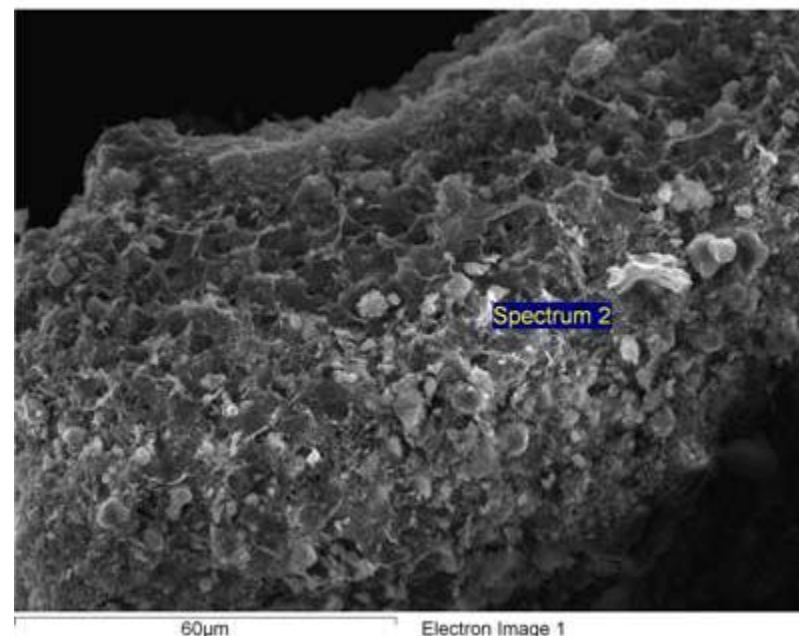
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.79	5.38	7.81	Na ₂ O
Al K	4.96	3.93	9.38	Al ₂ O ₃
Si K	29.15	22.17	62.36	SiO ₂
Ca K	14.62	7.79	20.45	CaO
O	45.48	60.72		
Totals	100.00			



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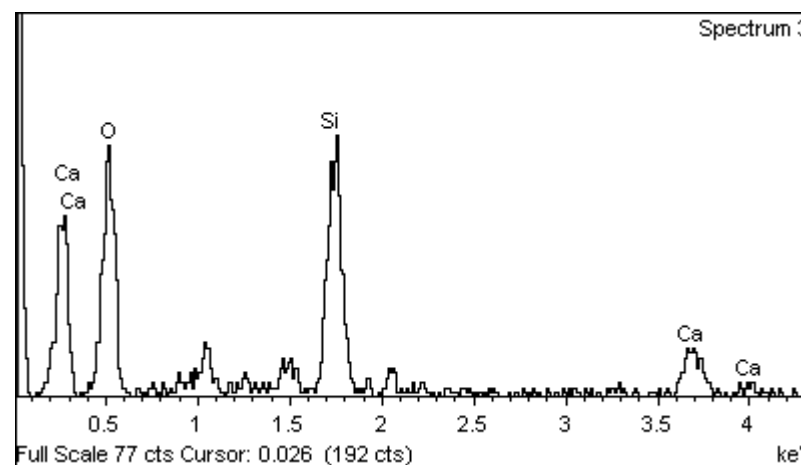
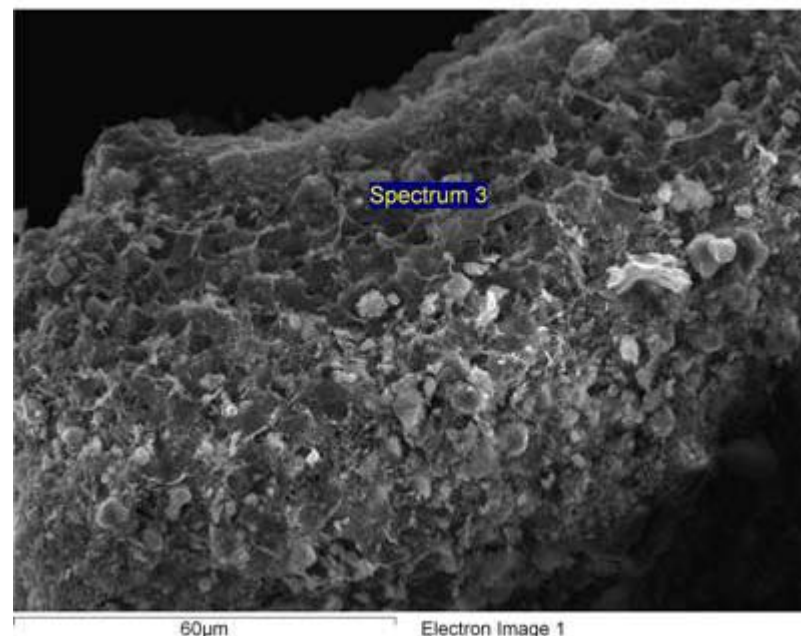
PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME LAWB60.

Spectrum processing :
Peak possibly omitted : 1.055 keV

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 2

Standard :
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Si K	36.06	27.51	77.14	SiO ₂
Ca K	16.34	8.74	22.86	CaO
O	47.60	63.75		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME LAWB60.

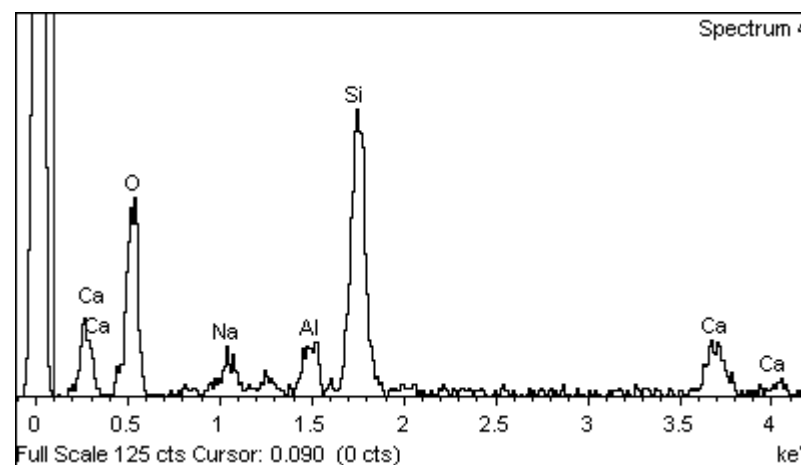
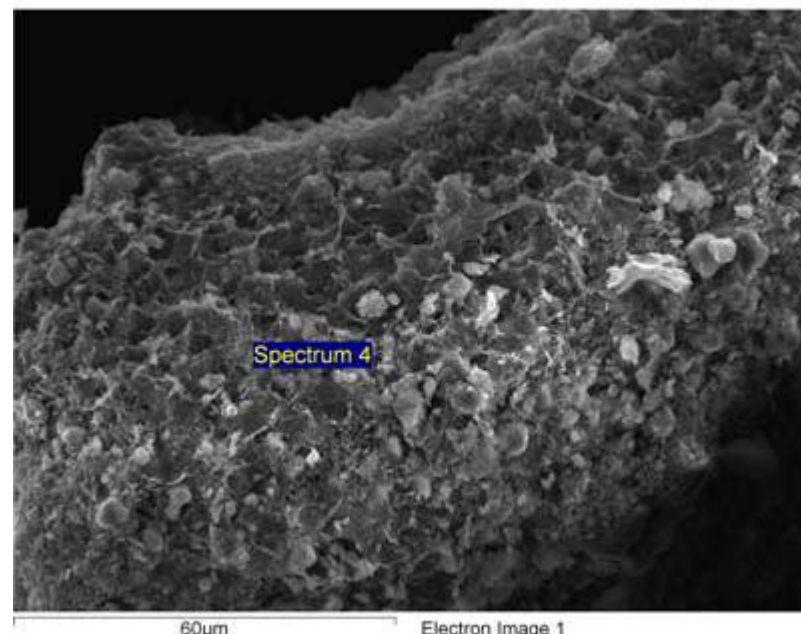
Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM
 Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.43	4.06	5.97	Na ₂ O
Al K	4.96	3.88	9.37	Al ₂ O ₃
Si K	31.90	23.96	68.25	SiO ₂
Ca K	11.73	6.17	16.41	CaO
O	46.98	61.93		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME LAWB60.

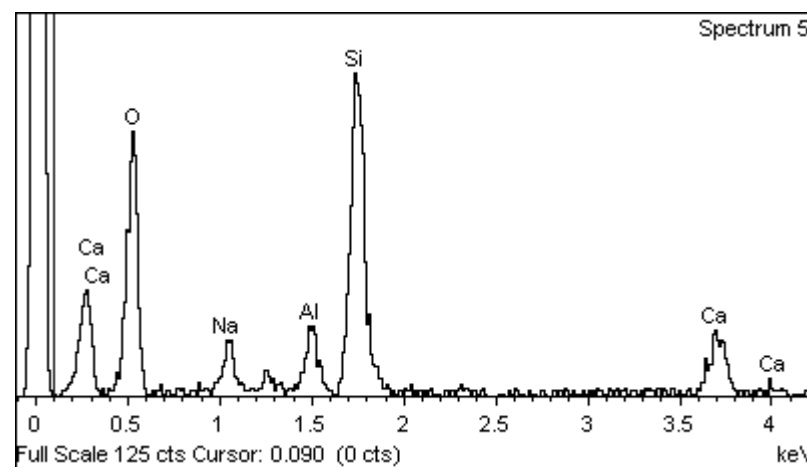
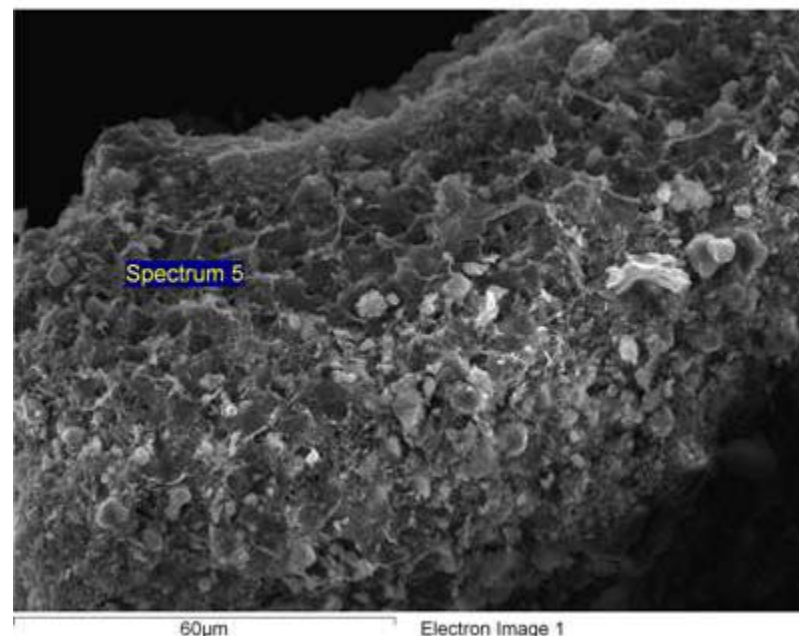
Spectrum processing :
 No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
 Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM
 Al Al₂O₃ 1-Jun-1999 12:00 AM
 Si SiO₂ 1-Jun-1999 12:00 AM
 Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.74	5.28	7.73	Na ₂ O
Al K	5.13	4.03	9.70	Al ₂ O ₃
Si K	30.50	22.98	65.25	SiO ₂
Ca K	12.37	6.53	17.31	CaO
O	46.25	61.18		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME LAWB60.

Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 3

Standard :

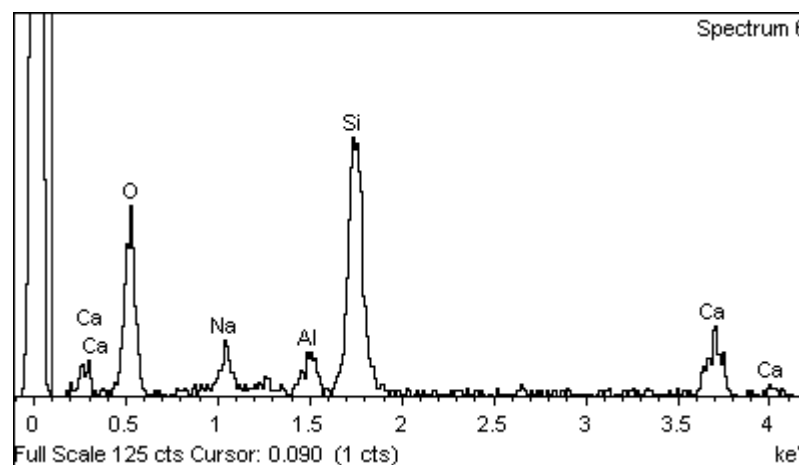
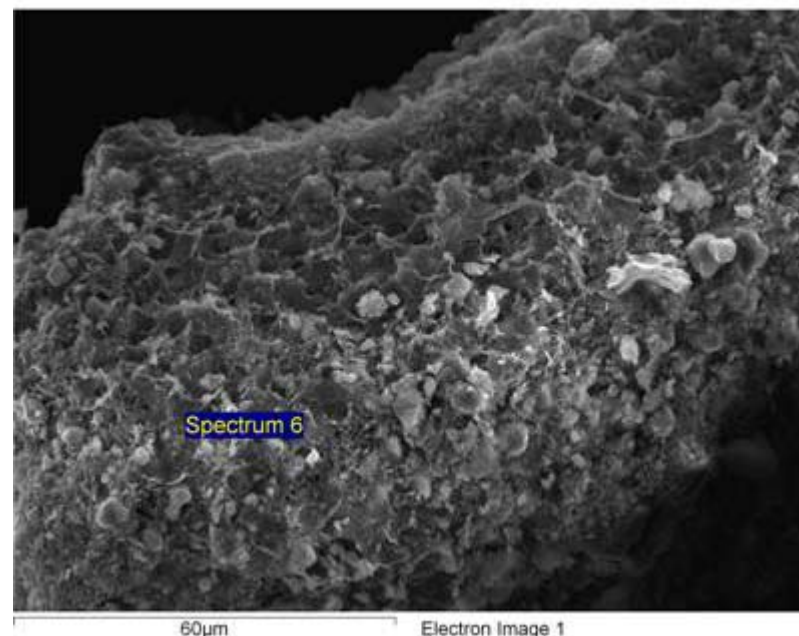
Na Albite 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

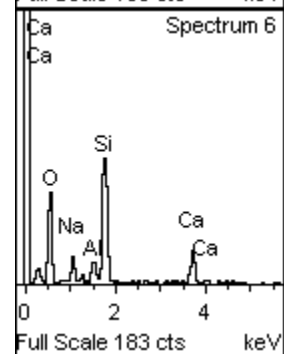
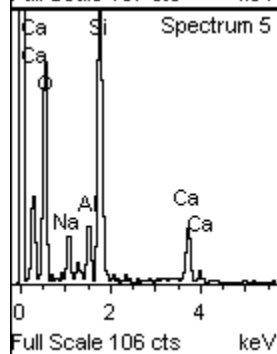
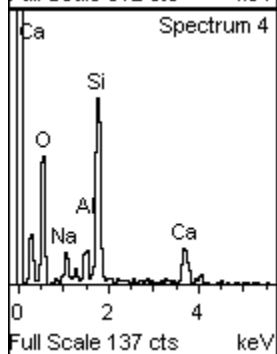
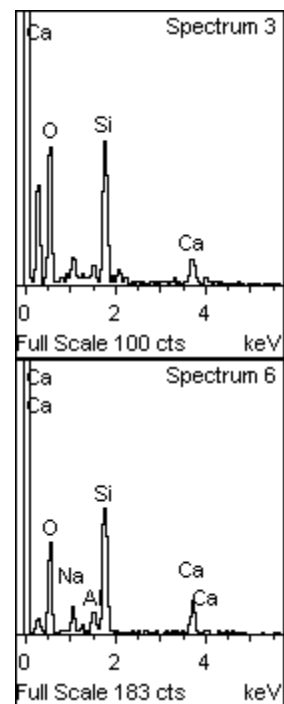
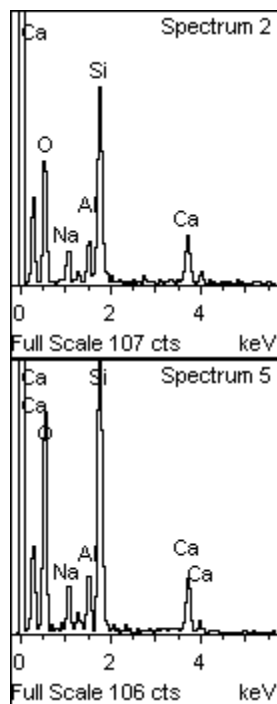
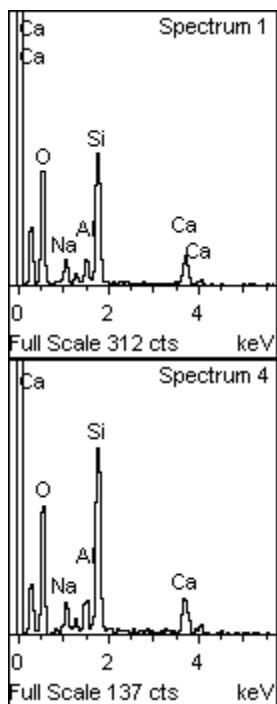
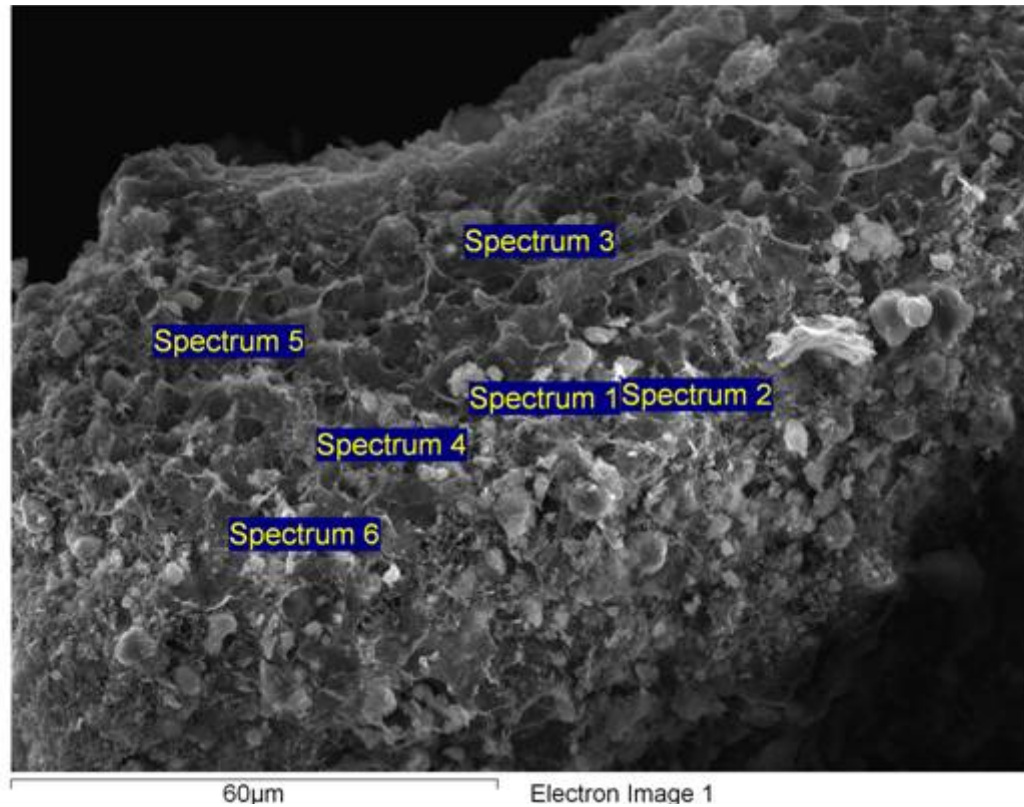
Si SiO₂ 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	5.75	5.35	7.75	Na ₂ O
Al K	3.89	3.08	7.34	Al ₂ O ₃
Si K	30.02	22.84	64.22	SiO ₂
Ca K	14.78	7.88	20.68	CaO
O	45.56	60.85		
Totals	100.00			



PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME LAWB60.



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PCT SURFACE CORROSION. FILE 2. ROI 1. GLASS NAME LAWB60.

Project: PCT SURFACE CORROSION 2
Owner: cavinm
Site: Site of Interest 1

Sample: LAWB 60
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Al	Si	Ca	O	Total
Spectrum 1	Yes	5.07	4.12	31.23	13.29	46.30	100.00
Spectrum 2	Yes	5.79	4.96	29.15	14.62	45.48	100.00
Spectrum 3	Yes			36.06	16.34	47.60	100.00
Spectrum 4	Yes	4.43	4.96	31.90	11.73	46.98	100.00
Spectrum 5	Yes	5.74	5.13	30.50	12.37	46.25	100.00
Spectrum 6	Yes	5.75	3.89	30.02	14.78	45.56	100.00
Max.		5.79	5.13	36.06	16.34	47.60	
Min.		4.43	3.89	29.15	11.73	45.48	

All results in weight%

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PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME LAWB60.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

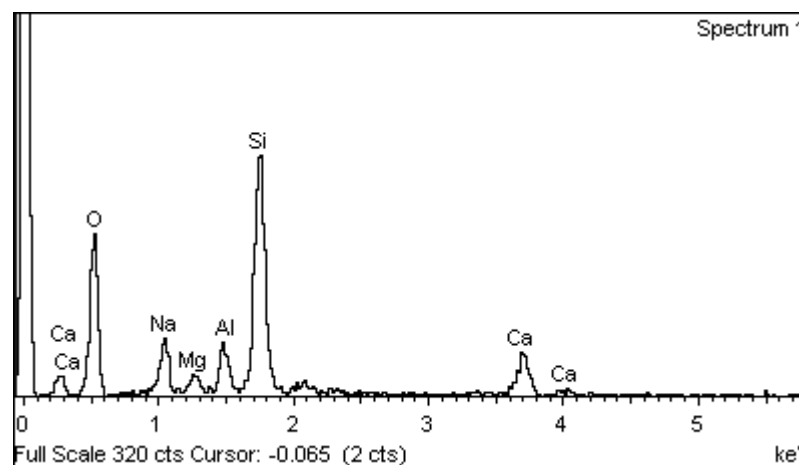
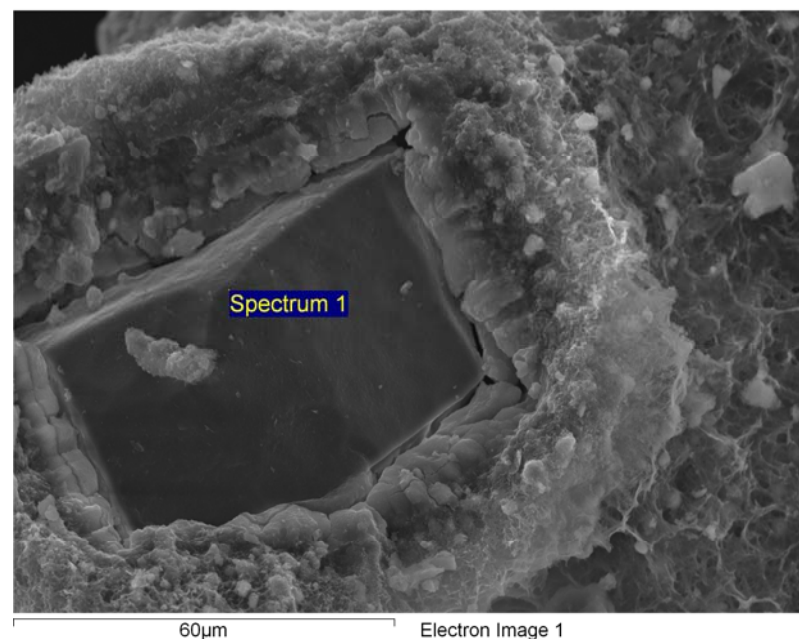
Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	7.03	6.43	9.48	Na ₂ O
Mg K	1.78	1.54	2.96	MgO
Al K	5.18	4.03	9.78	Al ₂ O ₃
Si K	29.44	22.03	62.99	SiO ₂
Ca K	10.57	5.54	14.79	CaO
O	45.99	60.42		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME LAWB60.

Spectrum processing :

No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)

Number of iterations = 3

Standard :

Na Albite 1-Jun-1999 12:00 AM

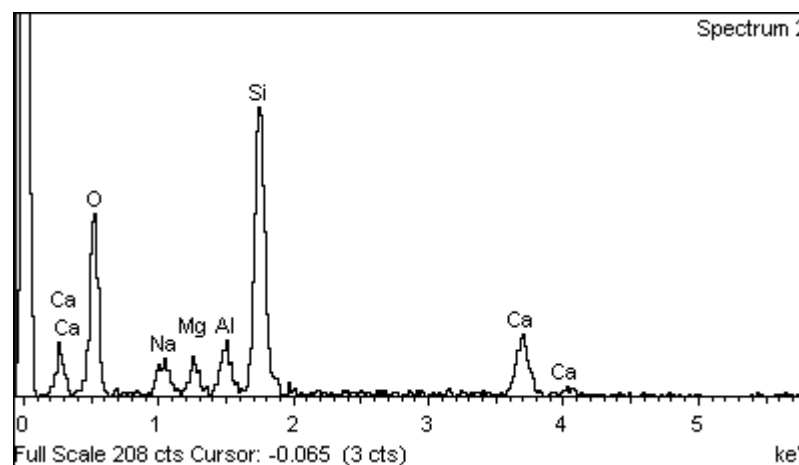
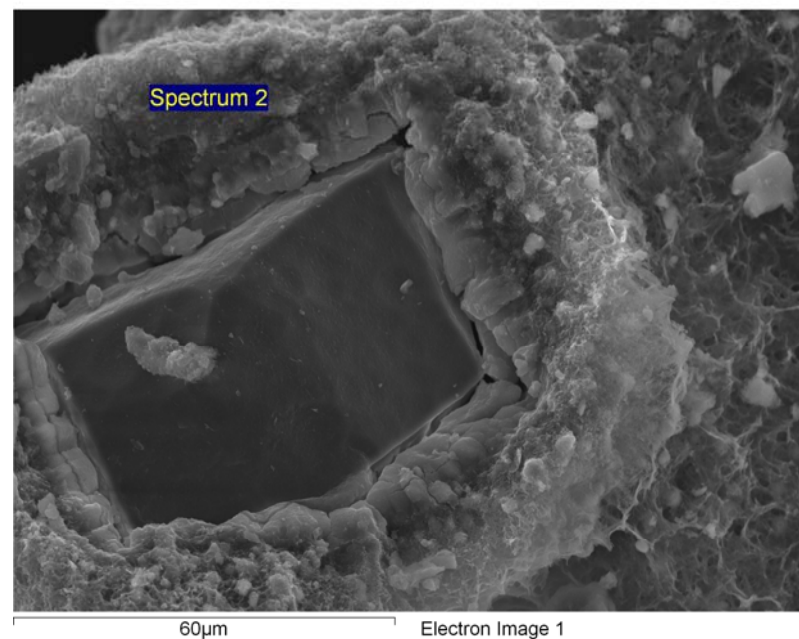
Mg MgO 1-Jun-1999 12:00 AM

Al Al₂O₃ 1-Jun-1999 12:00 AM

Si SiO₂ 1-Jun-1999 12:00 AM

Ca Wollastonite 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	2.76	2.54	3.72	Na ₂ O
Mg K	3.02	2.63	5.01	MgO
Al K	4.17	3.27	7.88	Al ₂ O ₃
Si K	30.78	23.18	65.85	SiO ₂
Ca K	12.53	6.61	17.54	CaO
O	46.73	61.77		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME LAWB60.

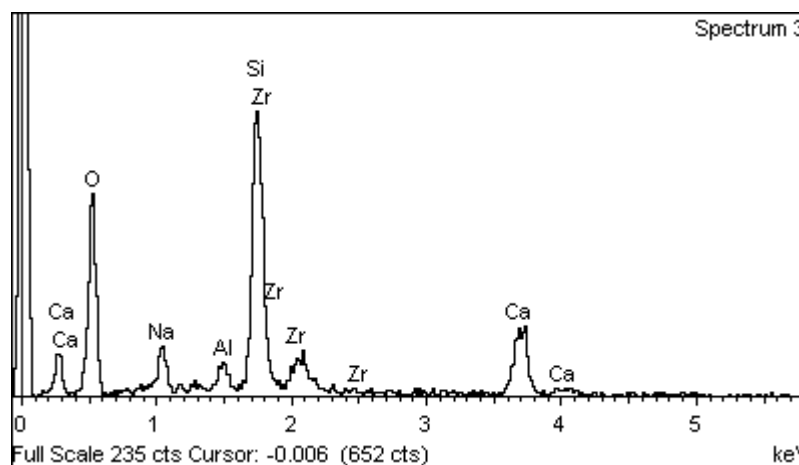
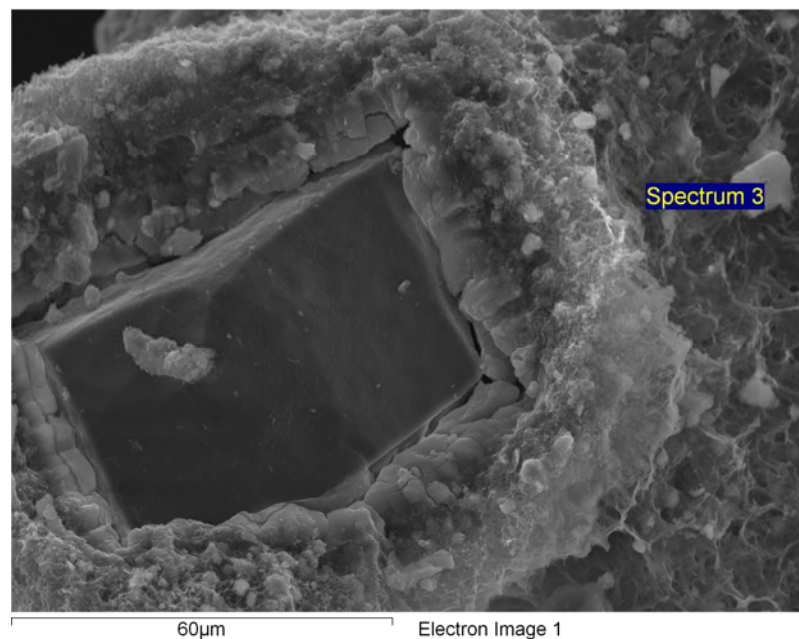
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 2

Standard :

Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	4.77	4.78	6.43	Na ₂ O
Al K	2.16	1.85	4.09	Al ₂ O ₃
Si K	26.06	21.38	55.76	SiO ₂
Ca K	14.16	8.14	19.81	CaO
Zr L	10.30	2.60	13.91	ZrO ₂
O	42.54	61.26		
Totals	100.00			



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PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME LAWB60.

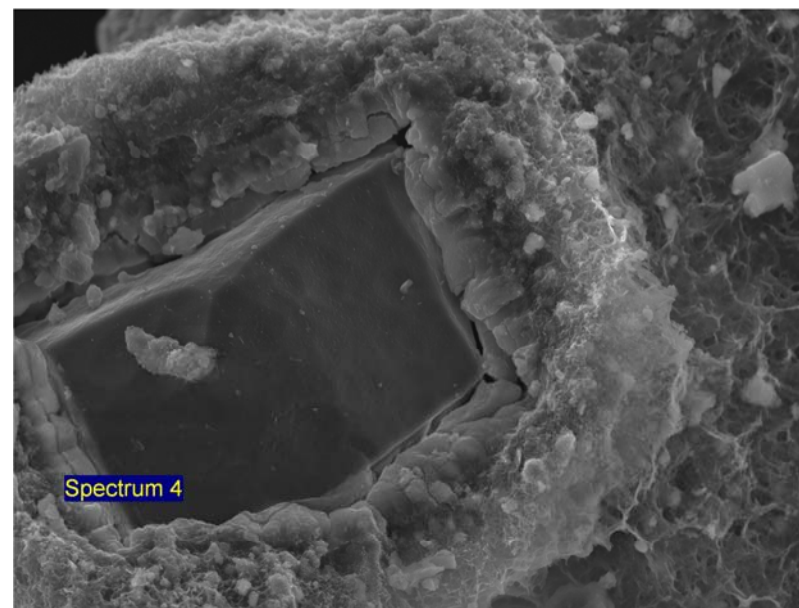
Spectrum processing :
No peaks omitted

Processing option : Oxygen by stoichiometry (Normalised)
Number of iterations = 2

Standard :

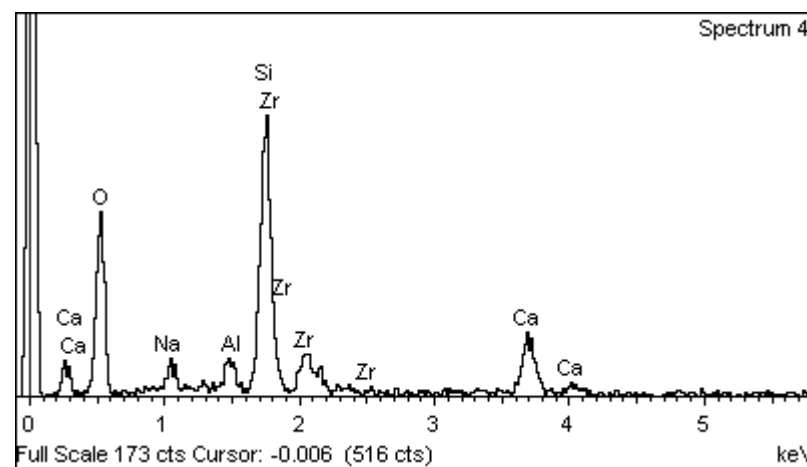
Na Albite 1-Jun-1999 12:00 AM
Al Al₂O₃ 1-Jun-1999 12:00 AM
Si SiO₂ 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Zr Zr 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%	Compd%	Formula
Na K	3.63	3.70	4.89	Na ₂ O
Al K	2.82	2.44	5.32	Al ₂ O ₃
Si K	25.29	21.08	54.10	SiO ₂
Ca K	12.80	7.48	17.91	CaO
Zr L	13.16	3.38	17.78	ZrO ₂
O	42.30	61.92		
Totals	100.00			



60µm

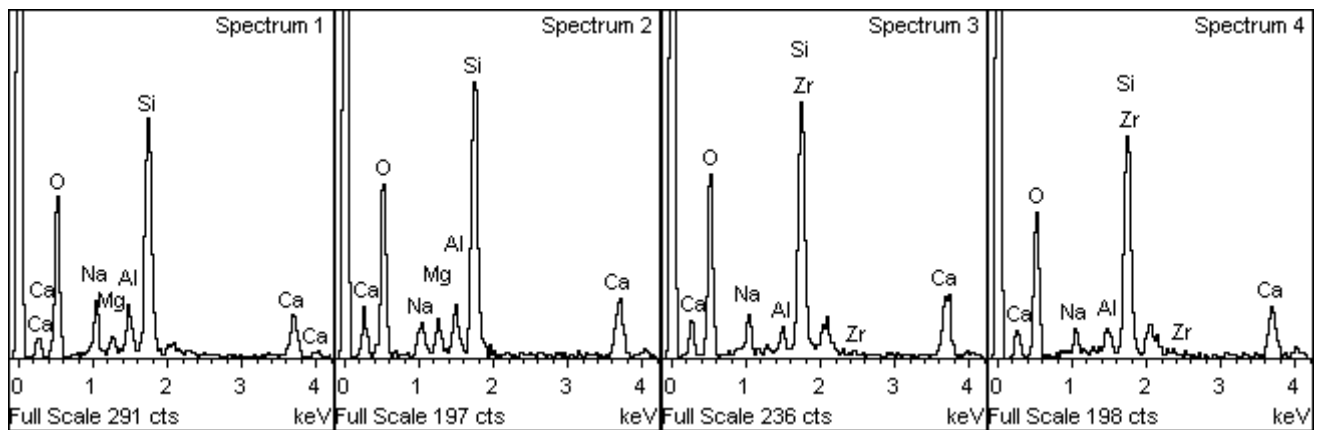
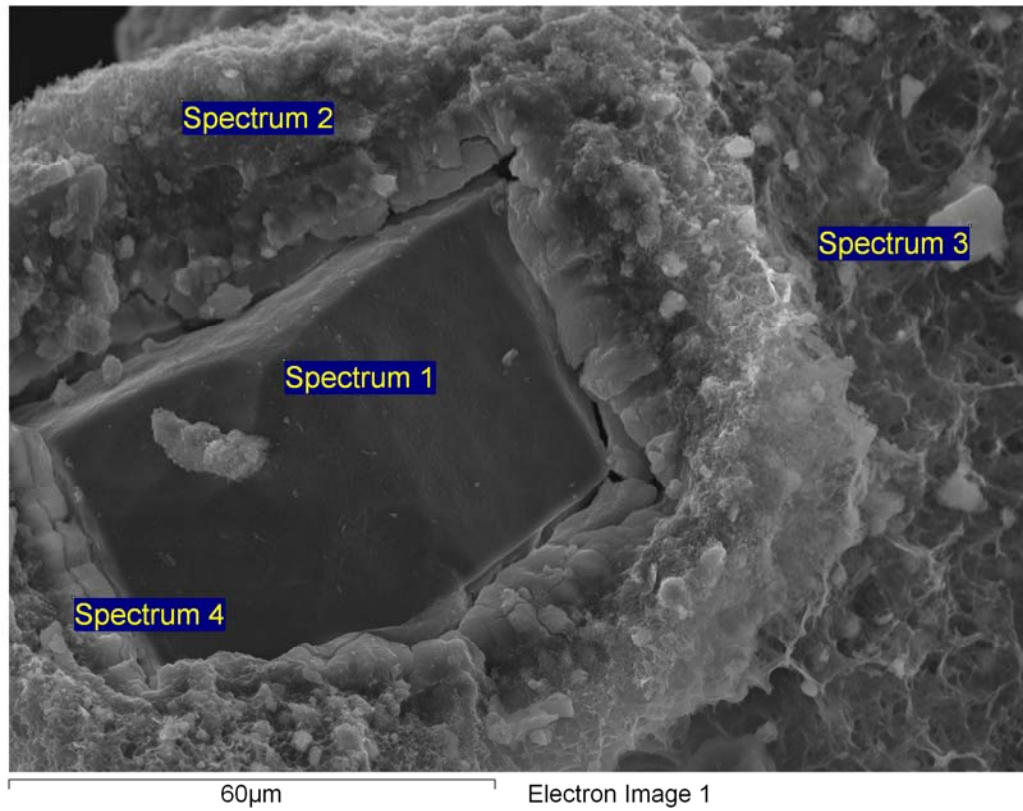
Electron Image 1



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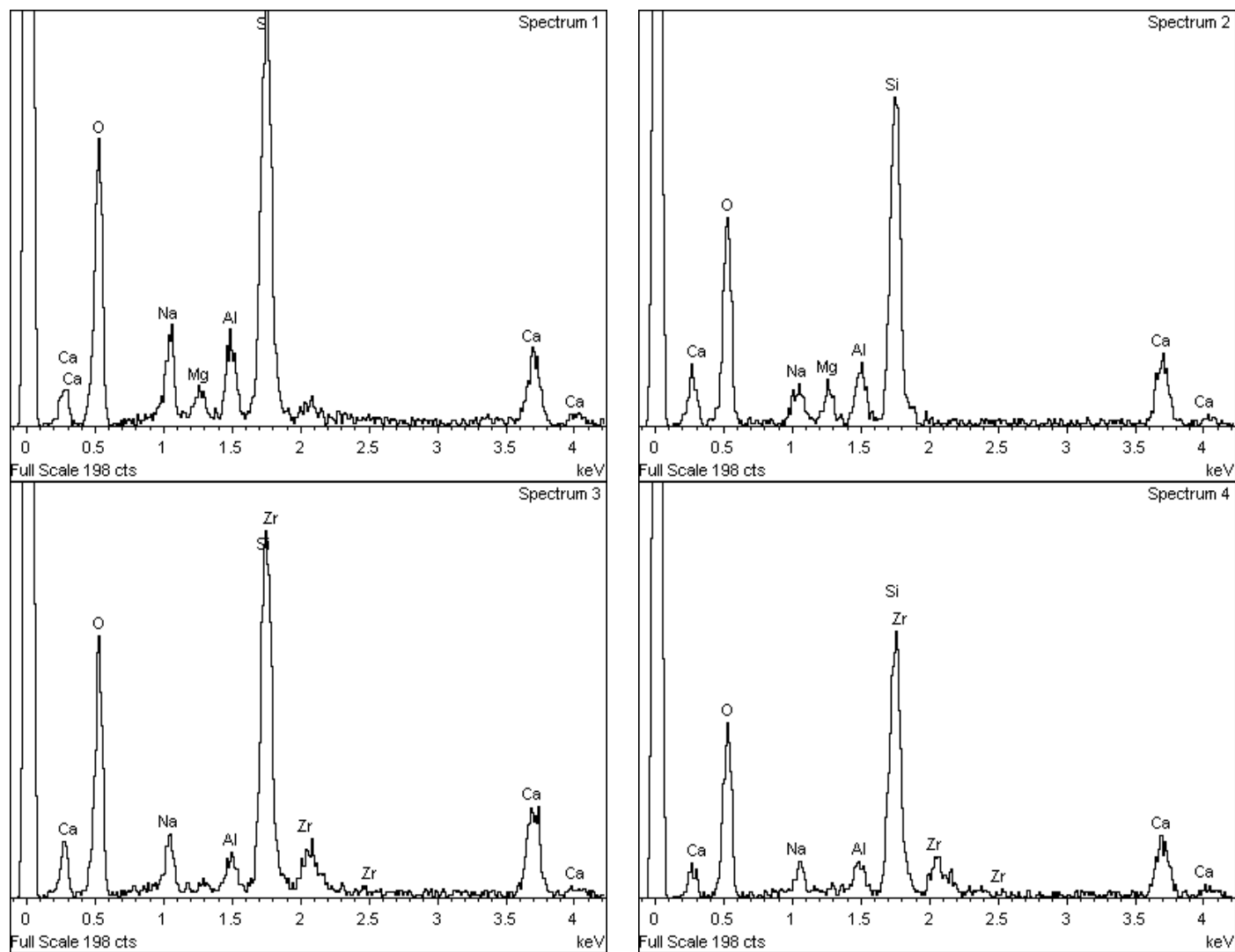
PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME LAWB60.



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PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME LAWB60.



PCT SURFACE CORROSION. FILE 2. ROI 2. GLASS NAME LAWB60.

Project: PCT SURFACE CORROSION 2
Owner: cavinm
Site: Site of Interest 2

Sample: LAWB 60
Type: Default
ID:

Processing option : Oxygen by stoichiometry (Normalised)

Spectrum	In stats.	Na	Mg	Al	Si	Ca	Zr	O	Total
Spectrum 1	Yes	7.03	1.78	5.18	29.44	10.57		45.99	100.00
Spectrum 2	Yes	2.76	3.02	4.17	30.78	12.53		46.73	100.00
Spectrum 3	Yes	4.77		2.16	26.06	14.16	10.30	42.54	100.00
Spectrum 4	Yes	3.63		2.82	25.29	12.80	13.16	42.30	100.00
Max.		7.03	3.02	5.18	30.78	14.16	13.16	46.73	
Min.		2.76	1.78	2.16	25.29	10.57	10.30	42.30	

All results in weight%

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APPENDIX C

Results from PCT-B Tests on the Ten Selected LAW Glasses

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	pH	Norm. B Release, [g/l]	Li Norm. Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]
IDF1B2CCC	6/22/2010	2000	40	S	6/29/2010	7	4.54	4.71	0.13	-	-	-	-	45.75	15.48	10.58	0.208	-	0.247	0.083
IDF1B2CCC	6/22/2010	2000	40	S	7/20/2010	28	6.71	5.40	0.16	-	-	-	-	64.39	25.35	10.67	0.238	-	0.347	0.136
IDF1B2CCC	6/22/2010	2000	40	S	8/17/2010	56	8.34	5.50	-	-	-	-	-	83.90	29.42	10.77	0.243	-	0.452	0.158
IDF1B2CCC	6/22/2010	2000	40	S	10/20/2010	120	8.88	7.36	-	-	-	-	-	103.01	34.97	10.85	0.325	-	0.555	0.188
IDF1B2CCC	6/22/2010	2000	40	S	12/20/2010	181	9.70	9.54	0.26	-	-	-	-	104.30	41.03	11.06	0.421	-	0.562	0.220
IDF2G9CCC	6/22/2010	2000	40	S	6/29/2010	7	2.22	4.32	0.33	-	5.64	-	-	40.31	14.47	10.66	0.164	-	0.259	0.076
IDF2G9CCC	6/22/2010	2000	40	S	7/20/2010	28	3.19	5.54	-	-	8.92	-	-	58.06	23.51	10.75	0.210	-	0.373	0.124
IDF2G9CCC	6/22/2010	2000	40	S	8/17/2010	56	3.91	6.27	0.12	-	10.42	-	-	74.29	27.47	10.81	0.238	-	0.477	0.145
IDF2G9CCC	6/22/2010	2000	40	S	10/20/2010	120	3.03	9.16	-	-	2.54	-	-	94.16	33.41	10.88	0.348	-	0.604	0.176
IDF2G9CCC	6/22/2010	2000	40	S	12/20/2010	181	3.93	11.53	0.37	-	12.07	-	-	104.73	40.30	11.10	0.437	-	0.672	0.212
IDF3F7CCC	6/22/2010	2000	40	S	6/29/2010	7	1.52	-	2.39	-	-	2.95	-	12.37	10.68	10.15	0.000	0.146	0.139	0.054
IDF3F7CCC	6/22/2010	2000	40	S	7/20/2010	28	1.36	-	3.09	-	-	4.41	-	17.79	14.07	10.23	0.000	0.218	0.200	0.072
IDF3F7CCC	6/22/2010	2000	40	S	8/17/2010	56	1.55	5.29	3.45	-	-	5.84	-	24.37	19.32	10.32	0.179	0.289	0.274	0.098
IDF3F7CCC	6/22/2010	2000	40	S	10/20/2010	120	-	11.36	3.51	-	-	8.55	-	46.86	28.16	10.42	0.385	0.423	0.526	0.143
IDF3F7CCC	6/22/2010	2000	40	S	12/20/2010	181	1.21	18.51	3.92	-	-	13.44	-	62.72	42.04	10.66	0.628	0.665	0.705	0.214
IDF4A15CCC	7/14/2010	2000	40	S	7/21/2010	7	3.27	-	0.14	-	-	-	-	34.62	11.31	10.52	0.000	-	0.194	0.062
IDF4A15CCC	7/14/2010	2000	40	S	8/11/2010	28	5.35	4.54	-	-	-	-	-	55.60	16.86	10.61	0.170	-	0.312	0.092
IDF4A15CCC	7/14/2010	2000	40	S	9/8/2010	56	5.83	5.07	0.19	-	-	-	-	58.18	20.44	10.81	0.190	-	0.327	0.112
IDF4A15CCC	7/14/2010	2000	40	S	11/11/2010	120	6.16	4.11	-	-	-	-	-	74.95	24.29	10.87	0.154	-	0.421	0.133
IDF4A15CCC	7/14/2010	2000	40	S	1/10/2011	180	5.42	10.47	-	-	-	-	-	87.17	30.88	11.05	0.392	-	0.490	0.169
IDF5A20CCC	7/14/2010	2000	40	S	7/21/2010	7	2.31	-	0.13	-	-	-	-	49.12	17.00	10.58	0.000	-	0.276	0.086
IDF5A20CCC	7/14/2010	2000	40	S	8/11/2010	28	3.64	6.87	-	-	-	-	-	73.84	25.90	10.68	0.253	-	0.415	0.131
IDF5A20CCC	7/14/2010	2000	40	S	9/8/2010	56	3.78	8.26	0.33	-	-	-	-	81.71	30.13	10.92	0.304	-	0.459	0.153
IDF5A20CCC	7/14/2010	2000	40	S	11/11/2010	120	3.17	7.68	-	-	-	-	-	105.91	37.99	11.11	0.283	-	0.595	0.192
IDF5A20CCC	7/14/2010	2000	40	S	1/10/2011	180	1.90	12.28	-	-	-	-	-	118.63	47.71	11.22	0.453	-	0.666	0.242
IDF6D6CCC	7/14/2010	2000	40	S	7/21/2010	7	2.41	4.28	1.54	-	-	-	-	37.71	11.28	10.37	0.140	-	0.231	0.065
IDF6D6CCC	7/14/2010	2000	40	S	8/11/2010	28	3.10	7.06	1.69	-	-	-	-	57.77	13.56	10.47	0.231	-	0.354	0.078
IDF6D6CCC	7/14/2010	2000	40	S	9/8/2010	56	2.84	10.51	2.01	-	-	-	-	62.09	16.65	10.57	0.344	-	0.380	0.096
IDF6D6CCC	7/14/2010	2000	40	S	11/11/2010	120	1.84	13.87	0.87	-	-	-	-	100.49	24.80	10.77	0.454	-	0.616	0.143
IDF6D6CCC	7/14/2010	2000	40	S	1/10/2011	180	-	21.11	1.01	-	-	-	-	105.87	32.50	10.85	0.690	-	0.649	0.187
IDF7E12CCC	6/22/2010	2000	40	S	6/29/2010	7	1.44	-	2.60	-	-	1.89	-	18.77	11.33	10.11	0.000	0.163	0.158	0.059
IDF7E12CCC	6/22/2010	2000	40	S	7/20/2010	28	1.39	-	3.40	-	-	2.26	-	27.43	15.56	10.17	0.000	0.195	0.231	0.081
IDF7E12CCC	6/22/2010	2000	40	S	8/17/2010	56	1.75	5.83	3.44	-	-	3.36	-	37.55	20.27	10.22	0.191	0.291	0.316	0.105
IDF7E12CCC	6/22/2010	2000	40	S	10/20/2010	120	-	11.15	3.42	-	-	3.08	-	53.87	25.20	10.32	0.366	0.266	0.454	0.131
IDF7E12CCC	6/22/2010	2000	40	S	12/20/2010	181	1.51	14.32	3.96	-	-	5.13	-	62.41	31.95	10.58	0.470	0.444	0.526	0.166
IDF8A125CCC	6/22/2010	2000	40	S	6/29/2010	7	1.67	6.11	0.13	-	5.28	-	-	38.91	20.83	10.37	0.206	-	0.262	0.104
IDF8A125CCC	6/22/2010	2000	40	S	7/20/2010	28	1.67	9.46	0.13	-	7.60	-	-	57.17	33.27	10.45	0.319	-	0.385	0.166
IDF8A125CCC	6/22/2010	2000	40	S	8/17/2010	56	1.92	11.26	0.51	-	8.91	-	-	75.55	37.95	10.54	0.380	-	0.509	0.190
IDF8A125CCC	6/22/2010	2000	40	S	10/20/2010	120	-	19.80	-	-	1.81	-	-	101.95	49.13	10.61	0.668	-	0.687	0.246
IDF8A125CCC	6/22/2010	2000	40	S	12/20/2010	181	1.12	36.79	-	1.22	14.20	-	0.66	144.55	81.64	10.88	1.241	-	0.974	0.408
IDF9A187CCC	7/14/2010	2000	40	S	7/21/2010	7	2.73	15.47	1.28	-	-	-	-	60.42	14.64	10.62	0.390	-	0.354	0.090
IDF9A187CCC	7/14/2010	2000	40	S	8/11/2010	28	2.79	25.96	1.33	-	2.41	-	-	101.40	19.80	10.75	0.655	-	0.594	0.122
IDF9A187CCC	7/14/2010	2000	40	S	9/8/2010	56	2.41	31.40	1.46	-	2.30	-	-	114.20	24.38	10.85	0.792	-	0.669	0.150
IDF9A187CCC	7/14/2010	2000	40	S	11/11/2010	120	-	71.32	0.71	-	2.20	-	-	223.54	50.01	11.17	1.799	-	1.310	0.308
IDF9A187CCC	7/14/2010	2000	40	S	1/10/2011	180	-	98.12	1.27	-	-	-	-	296.78	67.48	11.23	2.475	-	1.739	0.416
IDF10Zr6CCC	7/14/2010	2000	40	S	7/21/2010	7	1.40	5.57	-	-	-	-	-	31.41	12.43	10.11	0.152	-	0.199	0.068
IDF10Zr6CCC	7/14/2010	2000	40	S	8/11/2010	28	1.63	11.65	-	-	-	-	-	56.37	17.34	10.28	0.319	-	0.357	0.095
IDF10Zr6CCC	7/14/2010	2000	40	S	9/8/2010	56	1.56	14.16	0.23	-	-	-	-	57.44	17.65	10.41	0.388	-	0.364	0.097
IDF10Zr6CCC	7/14/2010	2000	40	S	11/11/2010	120	-	11.60	-	-	-	-	-	70.71	21.50	10.62	0.317	-	0.448	0.118
IDF10Zr6CCC	7/14/2010	2000	40	S	1/10/2011	180	-	17.80	-	-	-	-	-	69.45	28.30	10.71	0.487	-	0.440	0.156

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Zn (PCT ppm)	Zr (PCT ppm)	pH	Norm. B Release, [g/l]	Li Norm. Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]
IDF1B2CCC	6/16/2010	2000	90	S	6/23/2010	7	21.40	23.35	0.27	-	-	-	0.28	233.79	79.65	2.11	0.68	11.58	1.030	-	1.261	0.427
IDF1B2CCC	6/16/2010	2000	90	S	7/14/2010	28	25.32	43.53	0.13	-	-	-	0.46	333.36	95.90	3.14	1.50	11.72	1.921	-	1.797	0.515
IDF1B2CCC	6/16/2010	2000	90	S	8/11/2010	56	28.13	53.51	0.37	-	-	-	0.52	397.20	103.30	-	1.70	11.81	2.361	-	2.142	0.554
IDF1B2CCC	6/16/2010	2000	90	S	10/14/2010	120	37.91	67.56	-	-	-	-	-	515.15	124.62	-	0.62	11.96	2.981	-	2.778	0.669
IDF1B2CCC	6/16/2010	2000	90	S	12/13/2010	180	38.89	79.00	-	-	-	-	-	591.79	127.17	-	-	12.07	3.485	-	3.191	0.682
IDF2G9CCC	6/16/2010	2000	90	S	6/23/2010	7	10.76	37.43	0.14	-	43.64	-	-	248.59	81.89	0.55	-	11.66	1.420	-	1.596	0.431
IDF2G9CCC	6/16/2010	2000	90	S	7/14/2010	28	13.29	62.46	0.18	-	67.26	-	-	354.90	102.48	0.57	-	11.81	2.369	-	2.278	0.539
IDF2G9CCC	6/16/2010	2000	90	S	8/11/2010	56	14.72	71.30	0.14	-	74.61	-	-	416.60	108.40	-	-	11.92	2.705	-	2.674	0.571
IDF2G9CCC	6/16/2010	2000	90	S	10/14/2010	120	20.02	82.36	-	-	113.78	-	-	537.84	117.85	-	-	12.04	3.124	-	3.452	0.620
IDF2G9CCC	6/16/2010	2000	90	S	12/13/2010	180	19.72	92.64	-	-	106.5	-	-	594.96	132.80	-	-	12.11	3.514	-	3.819	0.699
IDF3F7CCC	6/16/2010	2000	90	S	6/23/2010	7	6.59	7.79	3.83	-	-	11.60	-	53.55	36.46	-	-	11.05	0.264	0.574	0.602	0.186
IDF3F7CCC	6/16/2010	2000	90	S	7/14/2010	28	8.71	13.49	3.70	-	2.29	17.47	-	68.33	43.88	-	-	11.18	0.457	0.865	0.768	0.223
IDF3F7CCC	6/16/2010	2000	90	S	8/11/2010	56	10.28	14.25	3.97	-	1.95	19.52	-	82.91	48.34	-	-	11.27	0.483	0.966	0.931	0.246
IDF3F7CCC	6/16/2010	2000	90	S	10/14/2010	120	12.62	16.02	4.00	-	-	25.04	-	100.15	65.40	-	-	11.43	0.543	1.239	1.125	0.333
IDF3F7CCC	6/16/2010	2000	90	S	12/13/2010	180	11.57	13.24	4.14	-	-	22.31	-	108.99	53.05	-	-	11.54	0.449	1.104	1.224	0.270
IDF4A15CCC	7/13/2010	2000	90	S	7/20/2010	7	17.78	25.26	0.30	-	2.49	-	0.50	195.30	64.96	-	-	11.52	0.946	-	1.097	0.355
IDF4A15CCC	7/13/2010	2000	90	S	8/10/2010	28	20.55	41.23	0.23	-	3.24	-	0.66	272.70	78.20	-	-	11.66	1.544	-	1.532	0.427
IDF4A15CCC	7/13/2010	2000	90	S	9/7/2010	56	21.69	49.79	0.25	-	3.81	-	0.62	326.30	82.93	-	-	11.81	1.865	-	1.833	0.453
IDF5A20CCC	7/13/2010	2000	90	S	7/20/2010	7	9.11	26.88	0.10	-	2.64	-	-	196.00	78.53	-	-	11.58	0.991	-	1.101	0.398
IDF5A20CCC	7/13/2010	2000	90	S	8/10/2010	28	10.76	48.68	0.14	-	3.60	-	-	301.40	107.00	-	-	11.68	1.794	-	1.693	0.542
IDF5A20CCC	7/13/2010	2000	90	S	9/7/2010	56	10.92	55.88	0.23	-	4.01	-	-	353.10	112.50	-	-	11.88	2.059	-	1.983	0.570
IDF6D6CCC	7/13/2010	2000	90	S	7/20/2010	7	17.68	21.07	0.91	-	-	-	-	162.80	40.63	-	-	11.15	0.689	-	0.997	0.234
IDF6D6CCC	7/13/2010	2000	90	S	8/10/2010	28	22.56	32.74	0.56	-	-	-	-	219.10	51.90	-	-	11.54	1.071	-	1.342	0.299
IDF6D6CCC	7/13/2010	2000	90	S	9/7/2010	56	21.69	35.48	0.56	-	-	-	-	245.10	55.98	-	-	11.65	1.160	-	1.502	0.323
IDF7E12CCC	6/16/2010	2000	90	S	6/23/2010	7	13.02	-	1.77	-	-	4.65	-	69.80	32.04	-	-	10.95	0.000	0.402	0.588	0.166
IDF7E12CCC	6/16/2010	2000	90	S	7/14/2010	28	16.89	10.15	1.36	-	2.15	7.09	-	95.12	40.75	-	-	11.08	0.333	0.613	0.801	0.212
IDF7E12CCC	6/16/2010	2000	90	S	8/11/2010	56	19.36	11.27	1.44	-	1.99	8.03	-	107.70	42.62	-	-	11.21	0.370	0.694	0.907	0.221
IDF7E12CCC	6/16/2010	2000	90	S	10/14/2010	120	23.74	12.67	0.71	-	-	9.96	-	128.85	61.45	-	-	11.40	0.416	0.861	1.086	0.319
IDF7E12CCC	6/16/2010	2000	90	S	12/13/2010	180	21.30	10.57	0.97	-	-	8.20	-	156.28	51.58	-	-	11.51	0.347	0.709	1.317	0.268
IDF8A125CCC	6/16/2010	2000	90	S	6/23/2010	7	8.13	59.95	0.41	1.70	32.48	-	0.54	254.98	100.32	1.28	0.45	11.28	2.022	-	1.718	0.501
IDF8A125CCC	6/16/2010	2000	90	S	7/14/2010	28	9.67	97.71	0.31	2.22	48.46	-	0.58	372.60	125.92	1.50	0.81	11.45	3.295	-	2.511	0.629
IDF8A125CCC	6/16/2010	2000	90	S	8/11/2010	56	11.72	120.20	0.30	2.15	58.73	-	0.51	471.20	139.00	-	0.62	11.61	4.054	-	3.176	0.695
IDF8A125CCC	6/16/2010	2000	90	S	10/14/2010	120	14.85	159.35	-	1.34	88.04	-	-	589.70	117.59	-	-	11.75	5.374	-	3.974	0.588
IDF8A125CCC	6/16/2010	2000	90	S	12/13/2010	180	13.74	160.94	-	-	77.49	-	-	664.08	161.61	-	-	11.88	5.428	-	4.476	0.808
IDF9A187CCC	7/13/2010	2000	90	S	7/20/2010	7	11.00	86.15	0.97	-	6.22	-	-	298.30	63.09	-	-	11.65	2.173	-	1.748	0.389
IDF9A187CCC	7/13/2010	2000	90	S	8/10/2010	28	13.71	99.28	0.92	-	6.89	-	-	340.20	77.22	-	-	11.83	2.504	-	1.994	0.476
IDF9A187CCC	7/13/2010	2000	90	S	9/7/2010	56	13.41	97.67	0.84	-	7.12	-	-	356.50	77.12	-	-	11.93	2.463	-	2.089	0.476
IDF10Zr6CCC	7/13/2010	2000	90	S	7/20/2010	7	5.68	57.85	0.68	1.65	3.51	-	0.65	189.20	54.69	-	-	10.88	1.583	-	1.199	0.301
IDF10Zr6CCC	7/13/2010	2000	90	S	8/10/2010	28	5.49	107.50	0.25	1.27	4.48	-	0.39	294.50	67.46	-	0.31	11.33	2.942	-	1.866	0.371
IDF10Zr6CCC	7/13/2010	2000	90	S	9/7/2010	56	5.22	127.70	0.14	1.20	4.86	-	0.38	356.10	69.36	-	-	11.46	3.494	-	2.257	0.382

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Glass ID	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Zr (PCT ppm)	pH	Norm. B Release, [g/l]	Li Norm. Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]
IDF1B2CCC	6/24/2010	20000	90	S	7/1/2010	7	33.39	96.25	-	-	2.19	-	0.46	934.76	141.48	-	12.32	4.246	-	5.040	0.759
IDF1B2CCC	6/24/2010	20000	90	S	7/22/2010	28	44.49	165.90	0.23	-	3.37	-	-	1,502.0	196.90	-	12.61	7.319	-	8.098	1.056
IDF1B2CCC	6/24/2010	20000	90	S	8/19/2010	56	46.07	202.10	0.26	-	3.91	-	-	1,662.0	219.20	0.14	12.72	8.916	-	8.961	1.176
IDF1B2CCC	6/24/2010	20000	90	S	10/22/2010	120	47.36	272.21	-	-	2.83	-	-	2,443.5	276.6	-	12.91	12.009	-	13.174	1.484
IDF1B2CCC	6/24/2010	20000	90	S	12/22/2010	181	20.84	398.48	-	-	-	-	-	3,316.9	375.1	-	12.94	17.580	-	17.883	2.012
IDF2G9CCC	6/24/2010	20000	90	S	7/1/2010	7	9.93	185.50	-	-	197.6	-	-	1,147.7	212.54	-	12.45	7.037	-	7.367	1.119
IDF2G9CCC	6/24/2010	20000	90	S	7/22/2010	28	12.17	268.10	0.24	-	266.1	-	-	1,616.0	287.30	-	12.68	10.170	-	10.372	1.512
IDF2G9CCC	6/24/2010	20000	90	S	8/19/2010	56	14.99	299.50	0.16	-	306.7	-	-	1,739.0	317.20	-	12.77	11.361	-	11.162	1.670
IDF2G9CCC	6/24/2010	20000	90	S	10/22/2010	120	15.06	377.61	-	-	387.2	-	-	2,446.0	405.30	-	12.95	14.324	-	15.700	2.133
IDF3F7CCC	6/24/2010	20000	90	S	7/1/2010	7	12.03	45.43	1.81	-	4.24	51.75	-	212.42	103.33	-	11.85	1.540	2.561	2.386	0.526
IDF3F7CCC	6/24/2010	20000	90	S	7/22/2010	28	16.04	50.60	2.24	-	4.45	71.68	-	307.60	131.90	-	12.18	1.715	3.548	3.455	0.671
IDF3F7CCC	6/24/2010	20000	90	S	8/19/2010	56	15.90	54.30	2.46	-	5.11	74.02	-	294.50	143.40	-	12.26	1.841	3.663	3.308	0.730
IDF3F7CCC	6/24/2010	20000	90	S	10/22/2010	120	17.80	71.04	2.35	-	4.40	104.94	-	448.49	175.37	-	12.45	2.408	5.194	5.038	0.893
IDF4A15CCC	7/15/2010	20000	90	S	7/22/2010	7	27.24	101.10	0.31	-	9.58	-	-	892.60	126.30	-	12.32	3.786	-	5.013	0.690
IDF4A15CCC	7/15/2010	20000	90	S	8/1/2010	28	38.57	172.40	0.28	-	14.09	-	-	1,333.0	178.10	-	12.51	6.456	-	7.486	0.973
IDF4A15CCC	7/15/2010	20000	90	S	9/9/2010	56	41.12	193.70	0.31	-	15.07	-	-	1,434.0	194.90	-	12.58	7.254	-	8.054	1.065
IDF4A15CCC	7/15/2010	20000	90	S	11/12/2010	120	33.46	289.91	-	-	21.43	-	-	2,617.7	259.08	-	12.84	10.857	-	14.702	1.415
IDF4A15CCC	7/15/2010	20000	90	S	1/11/2011	180	12.13	539.29	-	-	29.18	-	-	2,957.3	347.63	-	12.91	20.196	-	16.609	1.899
IDF5A20CCC	7/15/2010	20000	90	S	7/22/2010	7	7.87	153.10	0.34	-	12.23	-	-	1,096.0	223.50	-	12.38	5.642	-	6.155	1.132
IDF5A20CCC	7/15/2010	20000	90	S	8/12/2010	28	11.26	214.00	0.73	-	16.60	-	-	1,566.0	311.90	-	12.58	7.886	-	8.795	1.580
IDF5A20CCC	7/15/2010	20000	90	S	9/9/2010	56	12.10	221.10	0.21	-	15.59	-	-	1,550.0	320.50	-	12.66	8.147	-	8.705	1.623
IDF5A20CCC	7/15/2010	20000	90	S	11/12/2010	120	17.17	355.78	-	-	24.69	-	-	3,075.3	491.16	-	12.88	13.110	-	17.272	2.488
IDF5A20CCC	7/15/2010	20000	90	S	1/11/2011	180	8.13	349.92	-	-	26.30	2.11	-	2,506.0	463.36	-	12.93	12.894	-	14.074	2.347
IDF6D6CCC	7/15/2010	20000	90	S	7/22/2010	7	18.55	122.00	1.55	-	4.11	-	-	781.10	127.20	-	12.25	3.989	-	4.786	0.733
IDF6D6CCC	7/15/2010	20000	90	S	8/12/2010	28	20.51	166.90	1.58	-	5.18	-	-	1,149.0	181.50	-	12.42	5.457	-	7.040	1.046
IDF6D6CCC	7/15/2010	20000	90	S	9/9/2010	56	23.14	217.80	2.60	-	7.43	-	-	1,331.0	265.50	-	12.45	7.121	-	8.155	1.529
IDF6D6CCC	7/15/2010	20000	90	S	11/12/2010	120	11.31	3,965	4.37	-	105.01	8.45	-	15,724	686.46	-	12.83	129.647	-	96.337	3.954
IDF6D6CCC	7/15/2010	20000	90	S	1/11/2011	180	17.73	19,949	13.79	10.54	499.0	75.80	-	54,113	1,405.7	-	12.95	652.253	-	331.538	8.098
IDF7E12CCC	6/24/2010	20000	90	S	7/1/2010	7	16.44	61.08	1.31	-	6.85	31.11	-	401.70	116.66	-	11.81	2.003	2.690	3.384	0.606
IDF7E12CCC	6/24/2010	20000	90	S	7/22/2010	28	18.75	62.93	2.48	-	7.41	37.90	-	504.90	143.00	-	12.11	2.064	3.277	4.253	0.743
IDF7E12CCC	6/24/2010	20000	90	S	8/19/2010	56	12.98	78.05	2.92	-	9.28	42.80	-	573.70	164.30	-	12.21	2.560	3.701	4.833	0.853
IDF7E12CCC	6/24/2010	20000	90	S	10/22/2010	120	11.83	170.69	2.44	-	15.19	87.93	-	1,148.0	212.02	-	12.41	5.598	7.602	9.671	1.101
IDF7E12CCC	6/24/2010	20000	90	S	12/22/2010	181	8.49	15,666	10.83	5.65	497.2	2,027.9	-	24,133	869.51	-	12.53	513.789	175.335	203.304	4.516
IDF8A125CCC	6/24/2010	20000	90	S	7/1/2010	7	2.65	991.73	0.23	-	419.39	-	-	3,359.4	749.37	-	12.42	33.445	-	22.641	3.745
IDF8A125CCC	6/24/2010	20000	90	S	7/22/2010	28	2.50	1,424.0	0.36	-	544.2	-	-	4,743.0	1,040.0	-	12.58	48.023	-	31.965	5.198
IDF8A125CCC	6/24/2010	20000	90	S	8/19/2010	56	2.97	1,358.0	0.69	-	606.1	-	-	4,351.0	969.5	-	12.67	45.797	-	29.323	4.845
IDF8A125CCC	6/24/2010	20000	90	S	10/22/2010	120	0.66	2,098	0.13	-	794.11	2.85	-	7,707.7	1,442.2	-	12.85	70.752	-	51.946	7.208
IDF8A125CCC	6/24/2010	20000	90	S	12/22/2010	181	2.28	3,487	0.11	1.27	8,023	9.84	-	8,154.6	1,368.1	0.65	12.92	117.590	-	54.958	6.837
IDF9A187CCC	7/15/2010	20000	90	S	7/22/2010	7	13.41	463.5	1.90	-	26.45	-	-	1,467.0	147.80	-	12.42	11.690	-	8.597	0.911
IDF9A187CCC	7/15/2010	20000	90	S	8/12/2010	28	15.60	586.1	2.28	-	36.33	-	-	2,040.0	203.10	-	12.65	14.782	-	11.955	1.252
IDF9A187CCC	7/15/2010	20000	90	S	9/9/2010	56	10.12	763.4	2.12	-	43.70	-	-	2,162.0	264.80	-	12.75	19.253	-	12.670	1.633
IDF9A187CCC	7/15/2010	20000	90	S	11/12/2010	120	10.34	8,078	12.31	1.08	491.91	12.36	-	22,906	749.43	-	12.93	203.717	-	134.240	4.621
IDF9A187CCC	7/15/2010	20000	90	S	1/11/2011	180	12.19	16,790	20.14	4.56	891.15	47.00	-	41,420	831.62	-	12.97	423.446	-	242.739	5.128
IDF10Zr6CCC	7/15/2010	20000	90	S	7/22/2010	7	3.25	372.30	0.47	2.65	14.44	-	1.02	1,127.0	126.40	-	11.95	10.187	-	7.142	0.695
IDF10Zr6CCC	7/15/2010	20000	90	S	8/12/2010	28	3.73	560.70	1.79	-	20.42	-	-	1,625.0	177.70	-	12.15	15.342	-	10.298	0.978
IDF10Zr6CCC	7/15/2010	20000	90	S	9/9/2010	56	3.68	608.90	0.27	-	19.56	-	-	1,659.0	177.80	-	12.24	16.661	-	10.513	0.978
IDF10Zr6CCC	7/15/2010	20000	90	S	11/12/2010	120	2.59	1,077.5	-	-	22.98	-	-	2,743.5	213.99	-	12.43	29.483	-	17.386	1.177
IDF10Zr6CCC	7/15/2010	20000	90	S	1/11/2011	180	-	738.91	-	-	16.05	1.94	-	2,266.1	173.34	-	12.46	20.219	-	14.361	0.954

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Glass ID	Test	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Zr (PCT ppm)	pH	Norm. B Release, [g/l]	Li Norm. Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]
IDF1B2CCC1	A	9/21/2010	20000	120	S	9/28/2010	7	62.31	211.10	0.10	-	5.06	-	-	2,201.0	244.3	-	12.66	9.313	-	11.867	1.311
IDF1B2CCC1	A	9/21/2010	20000	120	S	10/19/2010	28	62.51	304.50	0.23	-	9.80	-	-	2,922.0	347.7	-	12.84	13.434	-	15.754	1.865
IDF1B2CCC1	A	9/21/2010	20000	120	S	11/16/2010	56	27.52	475.60	0.56	-	7.73	-	-	4,262.0	462.2	0.51	12.94	20.983	-	22.979	2.480
IDF1B2CCC1	A	9/21/2010	20000	120	S	1/18/2011	119	10.87	2,683.1	1.13	-	29.88	-	-	12,155	1,622.4	0.56	13.14	118.372	-	65.534	8.704
IDF2G9CCC2	A	9/21/2010	20000	120	S	9/28/2010	7	31.19	280.80	0.12	-	394.1	-	-	2,442.0	322.30	-	12.77	10.652	-	15.674	1.696
IDF2G9CCC2	A	9/21/2010	20000	120	S	10/19/2010	28	33.40	306.00	0.39	-	493.9	-	-	2,697.0	372.10	-	12.92	11.608	-	17.311	1.958
IDF2G9CCC2	A	9/21/2010	20000	120	S	11/16/2010	56	18.27	426.90	1.01	-	603.5	-	-	3,975.0	560.20	-	12.98	16.194	-	25.514	2.949
IDF2G9CCC2	A	9/21/2010	20000	120	S	1/18/2011	119	11.50	936.47	1.19	-	1,035	-	-	6,064.5	1,456.6	-	13.17	35.524	-	38.925	7.666
IDF3F7CCC2	A	9/21/2010	20000	120	S	9/28/2010	7	20.46	42.66	2.12	-	6.06	64.36	-	342.30	112.20	-	12.11	1.446	3.185	3.845	0.571
IDF3F7CCC2	A	9/21/2010	20000	120	S	10/19/2010	28	22.61	71.55	2.59	-	8.82	92.39	-	505.30	175.80	-	12.21	2.426	4.573	5.676	0.895
IDF3F7CCC2	A	9/21/2010	20000	120	S	11/16/2010	56	11.59	4,062	9.23	-	221.90	1,473.0	-	6,827.0	425.40	1.11	12.46	137.707	72.900	76.684	2.165
IDF4A15CCC	A	9/21/2010	20000	120	S	9/28/2010	7	53.94	172.40	0.29	-	21.80	-	-	1,890.0	194.00	-	12.61	6.456	-	10.615	1.060
IDF4A15CCC	A	9/21/2010	20000	120	S	10/19/2010	28	54.51	250.40	0.45	-	27.17	-	-	2,434.0	276.20	-	12.81	9.377	-	13.670	1.509
IDF4A15CCC	A	9/21/2010	20000	120	S	11/16/2010	56	33.95	288.50	0.68	-	27.05	-	-	2,959.0	324.70	-	12.93	10.804	-	16.618	1.774
IDF4A15CCC	A	9/21/2010	20000	120	S	1/18/2011	119	16.82	949.64	1.07	-	62.83	-	-	6,099.0	1,541.17	-	13.12	35.563	-	34.253	8.418
IDF5A20CCC	A	9/21/2010	20000	120	S	9/28/2010	7	24.49	243.20	0.24	-	23.00	-	-	2,087.0	318.90	-	12.64	8.962	-	11.721	1.615
IDF5A20CCC	A	9/21/2010	20000	120	S	10/19/2010	28	21.37	278.20	0.53	-	25.27	-	-	2,776.0	425.40	-	12.85	10.251	-	15.591	2.155
IDF5A20CCC	A	9/21/2010	20000	120	S	11/16/2010	56	13.10	401.40	1.13	-	39.04	-	-	4,025.0	621.80	-	12.96	14.791	-	22.605	3.150
IDF5A20CCC	A	9/21/2010	20000	120	S	1/18/2011	119	7.31	954.40	1.19	-	61.17	-	-	6,380.9	1,784.9	-	13.22	35.169	-	35.836	9.041
IDF6D6CCC	B	9/22/2010	20000	120	S	9/29/2010	7	38.48	167.30	0.81	-	8.30	-	-	1,653.0	215.80	-	12.52	5.470	-	10.128	1.243
IDF6D6CCC	B	9/22/2010	20000	120	S	10/20/2010	28	22.78	333.50	1.74	-	10.65	-	-	2,357.0	406.90	-	12.71	10.904	-	14.441	2.344
IDF6D6CCC	B	9/22/2010	20000	120	S	11/17/2010	56	13.51	20,333	8.49	1.85	514.0	4.89	0.50	41,990	1,674.0	2.54	12.88	664.819	-	257.263	9.643
IDF7E12CCC	B	9/22/2010	20000	120	S	9/29/2010	7	32.81	54.82	1.08	-	10.69	35.00	-	692.90	164.00	-	12.26	1.798	3.026	5.837	0.852
IDF7E12CCC	B	9/22/2010	20000	120	S	10/20/2010	28	26.01	131.50	1.64	-	15.65	56.90	-	1,018.0	241.90	-	12.46	4.313	4.920	8.576	1.257
IDF7E12CCC	B	9/22/2010	20000	120	S	11/17/2010	56	6.86	19,308	16.74	2.18	1,080	1,945.0	0.38	40,664	1,342.0	2.35	12.58	633.234	168.165	342.566	6.971
IDF8A125CCC	B	9/22/2010	20000	120	S	9/29/2010	7	13.45	384.40	0.17	-	196.10	-	-	1,996.0	313.4	-	12.38	12.963	-	13.452	1.566
IDF8A125CCC	B	9/22/2010	20000	120	S	10/20/2010	28	12.07	638.50	0.32	1.16	265.9	-	-	2,570.0	524.6	-	12.53	21.533	-	17.320	2.622
IDF8A125CCC	B	9/22/2010	20000	120	S	11/17/2010	56	2.60	1,084.0	0.98	-	443.7	-	-	4,387.0	1,057.0	-	12.67	36.557	-	29.566	5.283
IDF8A125CCC	B	9/22/2010	20000	120	S	1/19/2011	119	2.51	2,866.1	1.78	1.70	938.0	-	0.43	9,099.3	2,487	0.45	12.77	96.654	-	61.325	12.429
IDF9A187CCC	B	9/22/2010	20000	120	S	9/29/2010	7	34.71	402.80	0.57	-	42.41	-	-	2,155.0	222.20	-	12.46	10.159	-	12.629	1.370
IDF9A187CCC	B	9/22/2010	20000	120	S	10/20/2010	28	15.22	959.80	2.88	-	66.64	-	-	3,478.0	403.10	0.15	12.66	24.206	-	20.382	2.485
IDF9A187CCC	B	9/22/2010	20000	120	S	11/17/2010	56	11.46	4,784	7.69	-	295.8	-	0.50	12,145	614.10	0.58	12.77	120.653	-	71.175	3.786
IDF10Zr6CCC	B	9/22/2010	20000	120	S	9/29/2010	7	6.41	571.60	0.26	-	23.35	-	-	1,967.0	151.90	-	12.21	15.641	-	12.465	0.836
IDF10Zr6CCC	B	9/22/2010	20000	120	S	10/20/2010	28	8.46	756.60	0.40	2.16	31.66	-	-	2,236.0	208.60	0.54	12.42	20.703	-	14.170	1.148
IDF10Zr6CCC	B	9/22/2010	20000	120	S	11/17/2010	56	7.82	832.30	0.75	-	33.12	-	0.22	2,727.0	340.30	0.58	12.54	22.774	-	17.281	1.872
IDF10Zr6CCC	B	9/22/2010	20000	120	S	1/19/2011	119	1.87	789.01	0.94	-	17.59	-	-	2,540.9	505.30	0.74	12.66	21.590	-	16.102	2.780

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Glass ID	Test	Immersion Date	S/V	Temp (°C)	Vessel	Sampling Date	Period	Al (PCT ppm)	B (PCT ppm)	Ca (PCT ppm)	Fe (PCT ppm)	K (PCT ppm)	Li (PCT ppm)	Mg (PCT ppm)	Na (PCT ppm)	Si (PCT ppm)	Zr (PCT ppm)	pH	Norm. B Release, [g/l]	Li Norm. Release, [g/l]	Na Norm. Release, [g/l]	Si Norm. Release, [g/l]
ANL-LRM-2	A	6/22/2010	2000	40	S	6/29/2010	7	2.04	-	0.24	-	-	-	-	22.83	14.50	-	9.78	-	-	0.15	0.06
ANL-LRM-2	A	6/22/2010	2000	40	S	7/20/2010	28	2.93	-	-	-	-	-	-	36.28	25.68	-	10.88	-	-	0.24	0.10
ANL-LRM-2	A	6/22/2010	2000	40	S	8/17/2010	56	3.60	5.17	0.28	-	-	-	-	45.60	29.68	-	10.08	0.21	-	0.31	0.12
ANL-LRM-2	A	6/22/2010	2000	40	S	10/20/2010	120	2.41	7.92	-	-	-	-	-	57.06	36.07	-	10.15	0.32	-	0.38	0.14
ANL-LRM-2	A	6/22/2010	2000	40	S	12/20/2010	181	3.37	12.57	-	-	-	-	-	69.69	47.69	-	10.42	0.51	-	0.47	0.19
ANL-LRM-2	B	7/14/2010	2000	40	S	7/21/2010	7	1.64	-	-	-	-	-	-	19.67	12.66	-	9.76	-	-	0.13	0.05
ANL-LRM-2	B	7/14/2010	2000	40	S	8/11/2010	28	3.21	-	0.11	-	-	-	-	33.42	22.52	-	9.87	-	-	0.23	0.09
ANL-LRM-2	B	7/14/2010	2000	40	S	9/8/2010	56	3.37	4.85	0.22	-	-	-	-	36.95	23.54	-	10.08	0.20	-	0.25	0.09
ANL-LRM-2	B	7/14/2010	2000	40	S	11/11/2010	120	2.82	-	-	-	-	-	-	52.30	29.89	-	10.17	-	-	0.35	0.12
ANL-LRM-2	B	7/14/2010	2000	40	S	1/10/2011	180	1.74	7.06	-	-	-	-	-	50.82	39.60	-	10.27	0.28	-	0.34	0.15
ANL-LRM-2	A	6/16/2010	2000	90	S	6/23/2010	7	14.85	30.67	0.52	2.72	5.10	-	-	163.94	84.11	1.65	11.03	1.23	-	1.10	0.33
ANL-LRM-2	A	6/16/2010	2000	90	S	7/14/2010	28	19.03	69.31	0.26	3.62	10.26	-	0.34	312.00	114.75	2.26	11.22	2.79	-	2.10	0.45
ANL-LRM-2	A	6/16/2010	2000	90	S	8/11/2010	56	23.73	101.10	0.27	4.06	13.05	-	0.37	456.20	131.50	2.11	11.53	4.07	-	3.07	0.51
ANL-LRM-2	A	6/16/2010	2000	90	S	10/14/2010	120	31.90	144.10	-	4.96	19.18	-	-	651.08	109.69	1.65	11.71	5.80	-	4.39	0.43
ANL-LRM-2	A	6/16/2010	2000	90	S	12/13/2010	180	31.00	170.37	-	5.50	12.80	-	-	762.91	165.99	1.86	11.92	6.86	-	5.14	0.65
ANL-LRM-2	B	7/13/2010	2000	90	S	7/20/2010	7	13.77	29.96	0.52	2.22	5.47	-	-	157.60	81.11	-	11.01	1.21	-	1.06	0.32
ANL-LRM-2	B	7/13/2010	2000	90	S	8/10/2010	28	18.49	68.29	0.28	3.23	9.07	-	0.25	295.60	116.30	2.35	11.24	2.75	-	1.99	0.45
ANL-LRM-2	B	7/13/2010	2000	90	S	9/7/2010	56	20.55	91.96	2.14	3.57	11.59	-	0.43	390.80	123.30	2.36	11.54	3.70	-	2.63	0.48
ANL-LRM-2	A	6/24/2010	20000	90	S	7/1/2010	7	11.09	168.05	-	1.91	22.87	-	0.22	843.04	224.78	0.81	12.05	6.77	-	5.68	0.87
ANL-LRM-2	A	6/24/2010	20000	90	S	7/22/2010	28	20.42	360.90	0.73	1.27	42.01	-	0.24	1,753.0	347.80	-	12.32	14.53	-	11.81	1.35
ANL-LRM-2	A	6/24/2010	20000	90	S	8/19/2010	56	19.77	448.60	0.24	-	49.60	-	-	1,830.0	328.20	-	12.46	18.06	-	12.33	1.28
ANL-LRM-2	A	6/24/2010	20000	90	S	10/22/2010	120	5.32	954.83	0.12	-	137.98	4.36	-	4,132.0	1,562.0	-	12.58	38.44	9.39	27.85	6.08
ANL-LRM-2	A	6/24/2010	20000	90	S	12/22/2010	181	1.68	2,161.2	-	-	164.13	11.76	-	7,378.0	2,667.7	0.51	12.72	87.00	25.32	49.72	10.38
ANL-LRM-2	B	7/15/2010	20000	90	S	7/22/2010	7	8.09	169.80	0.27	1.32	22.09	-	0.22	865.0	249.50	-	12.03	6.84	-	5.83	0.97
ANL-LRM-2	B	7/15/2010	20000	90	S	8/12/2010	28	13.84	337.30	0.81	-	40.95	-	-	1,517.0	330.50	-	12.34	13.58	-	10.22	1.29
ANL-LRM-2	B	7/15/2010	20000	90	S	9/9/2010	56	18.06	439.20	0.14	-	47.82	-	-	1,732.0	366.60	-	12.45	17.68	-	11.67	1.43
ANL-LRM-2	B	7/15/2010	20000	90	S	11/12/2010	120	10.08	1,063.8	-	-	97.43	1.70	-	4,451.9	1,242.0	-	12.58	42.83	3.66	30.00	4.83
ANL-LRM-2	B	7/15/2010	20000	90	S	1/11/2011	180	-	1,220.3	-	-	151.43	1.56	-	6,062	2,362.6	-	12.71	49.13	3.36	40.86	9.19
ANL-LRM-2	A	9/21/2010	20000	120	S	9/28/2010	7	33.13	472.30	0.12	1.49	70.76	-	-	2,543	399.10	-	12.52	19.01	-	17.14	1.55
ANL-LRM-2	A	9/21/2010	20000	120	S	10/19/2010	28	51.90	10,506	5.26	11.42	1,436	136.20	0.34	28,842	9,960	12.66	12.73	422.95	293.22	194.38	38.74
ANL-LRM-2	A	9/21/2010	20000	120	S	11/16/2010	56	106.80	18,766	8.45	32.55	2,192	265.10	1.02	68,396	28,960	62.73	12.86	755.48	570.72	460.95	112.65
ANL-LRM-2	B	9/22/2010	20000	120	S	9/29/2010	7	32.21	482.90	0.12	1.20	71.00	-	-	2,586	378.90	-	12.53	19.44	-	17.43	1.47
ANL-LRM-2	B	9/22/2010	20000	120	S	10/20/2010	28	15.80	6,415.0	2.76	5.53	728.8	51.35	0.35	27,211	12,644	3.25	12.71	258.25	110.55	183.39	49.19
ANL-LRM-2	B	9/22/2010	20000	120	S	11/17/2010	56	156.10	19,824	10.52	29.75	2,439	296.50	1.08	70,508	36,461	79.07	12.85	798.07	638.32	475.19	141.83

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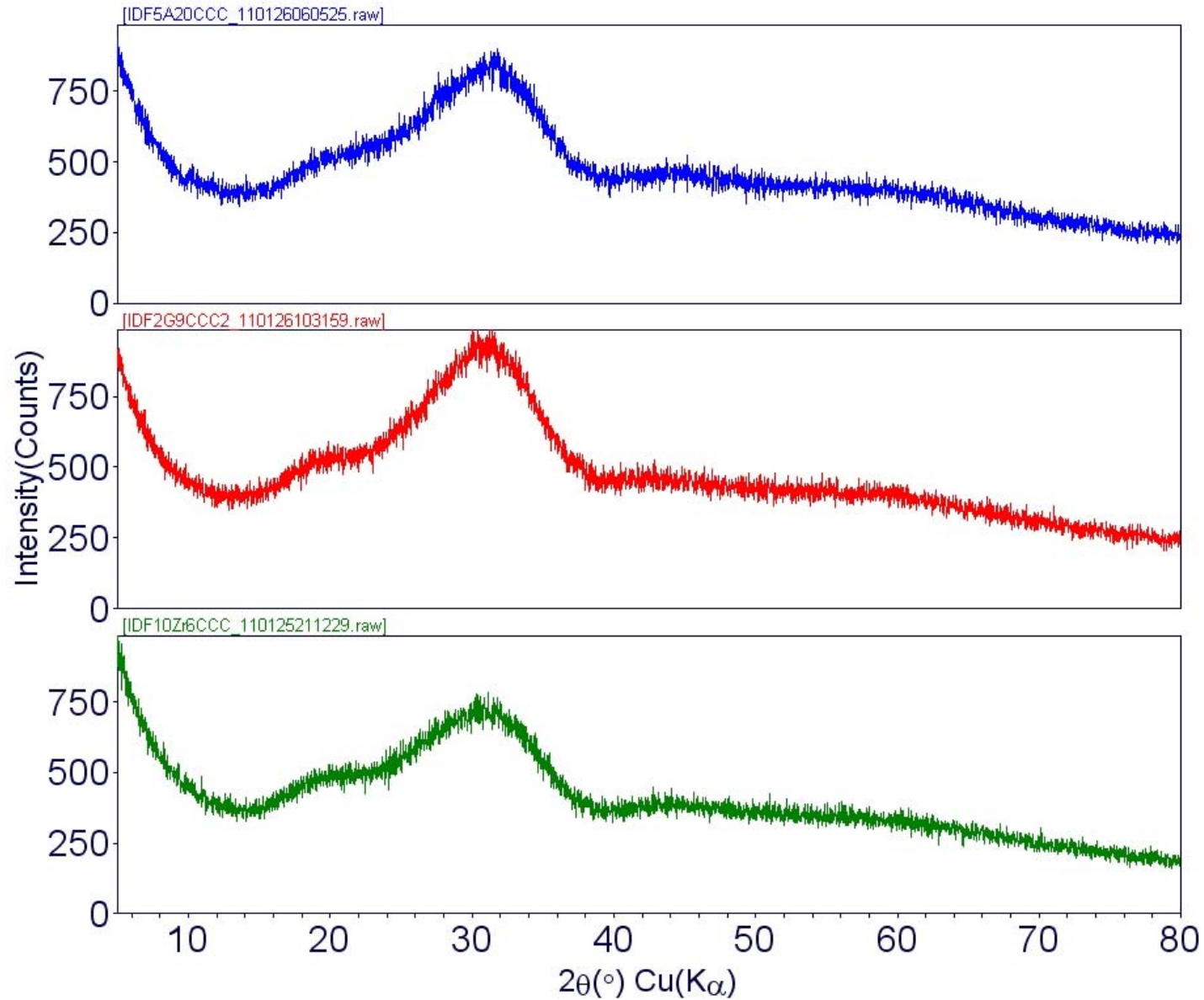
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APPENDIX D

Results from XRD Analysis of Reacted Glasses from PCT-B Tests (120°C, 20,000 m⁻¹ S/V) on the Ten Selected LAW Glasses

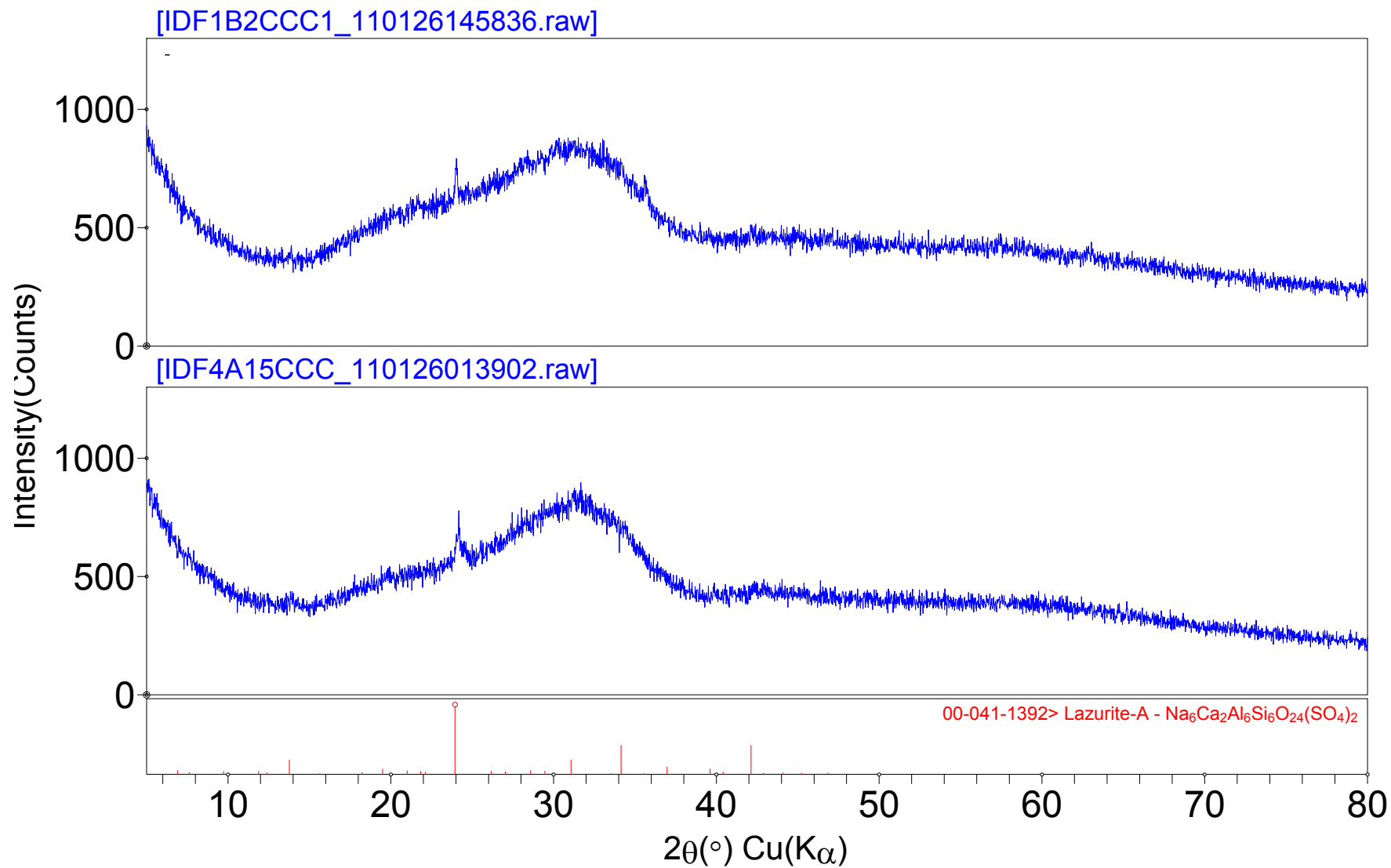
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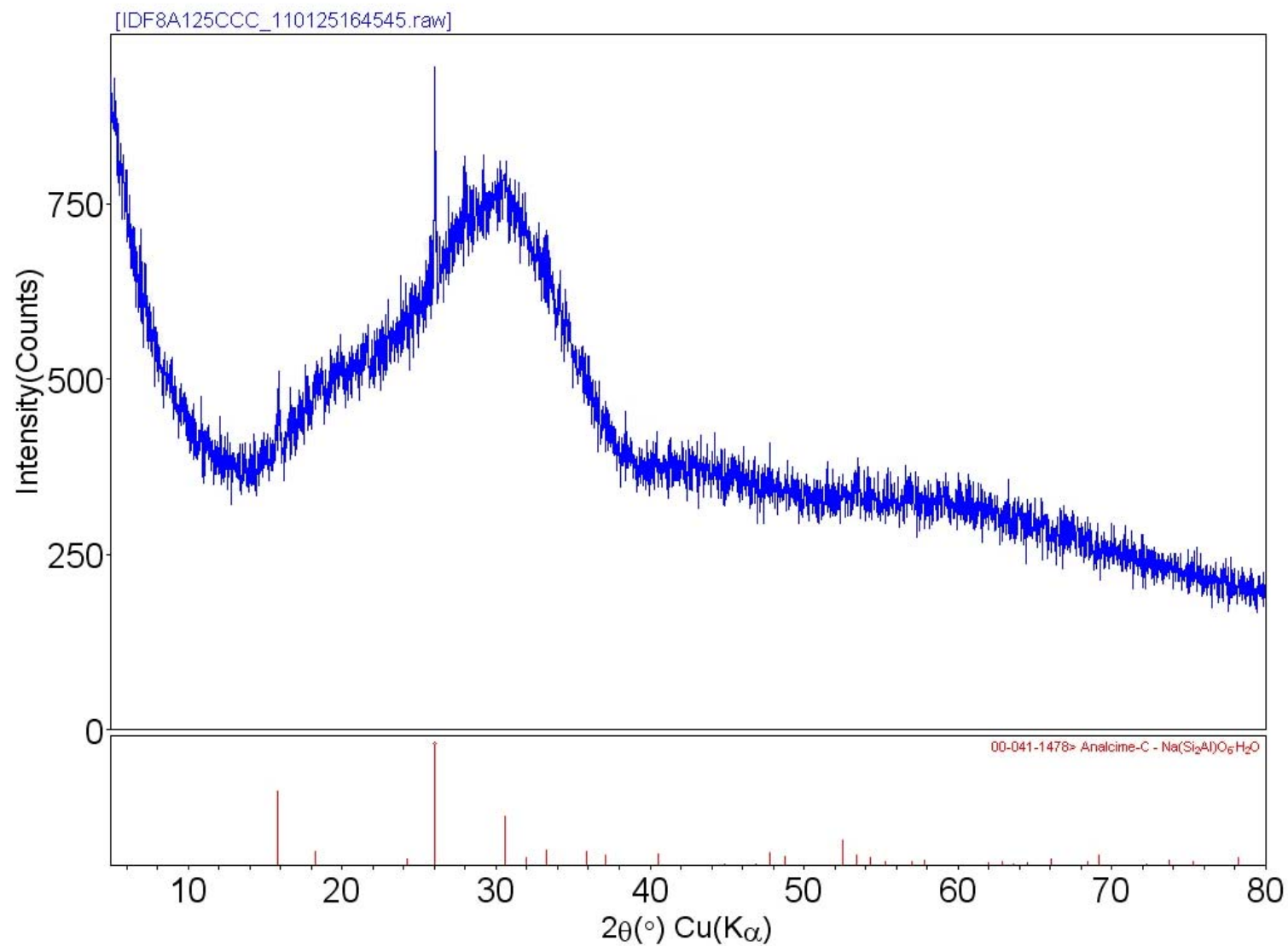
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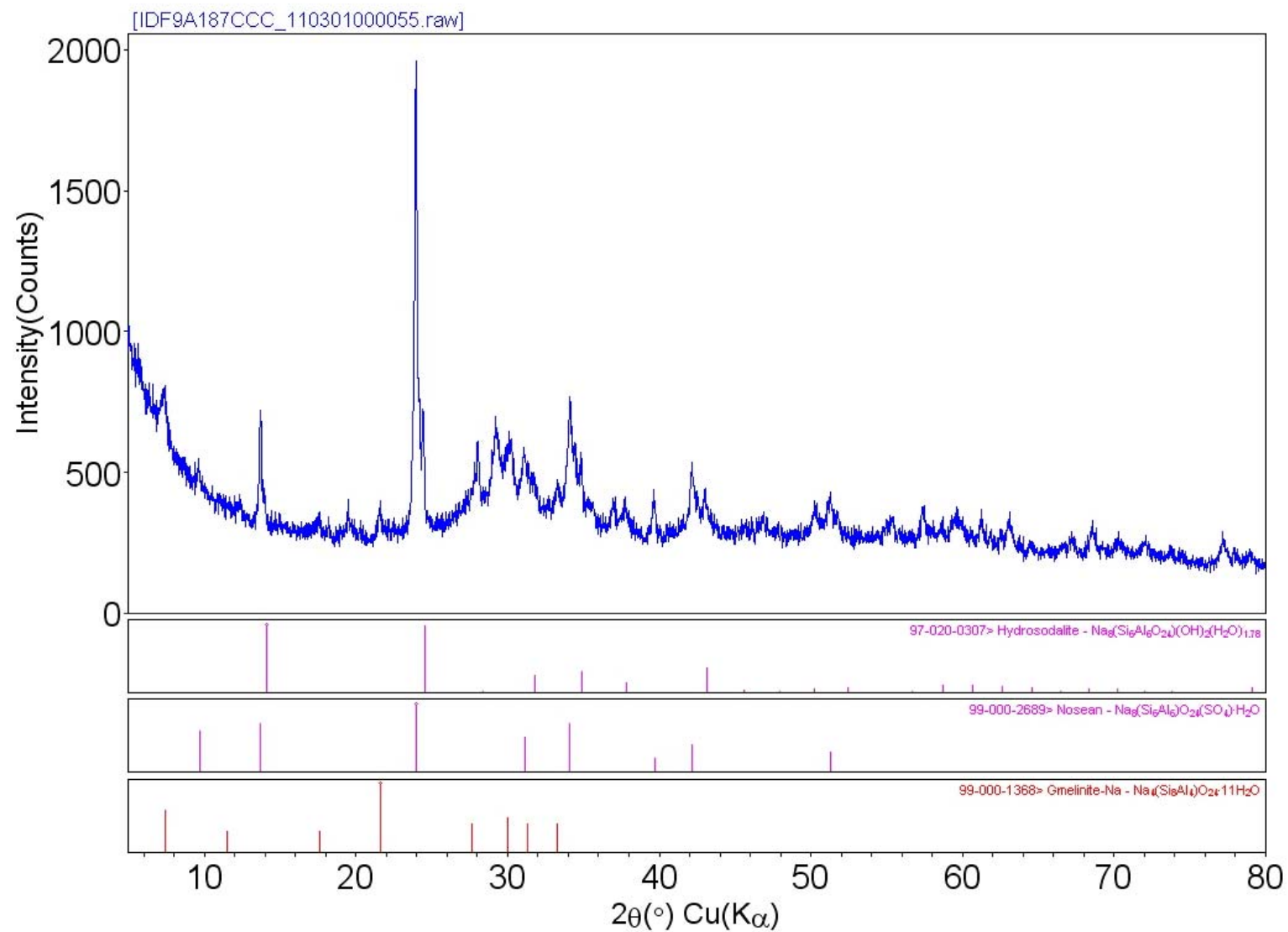
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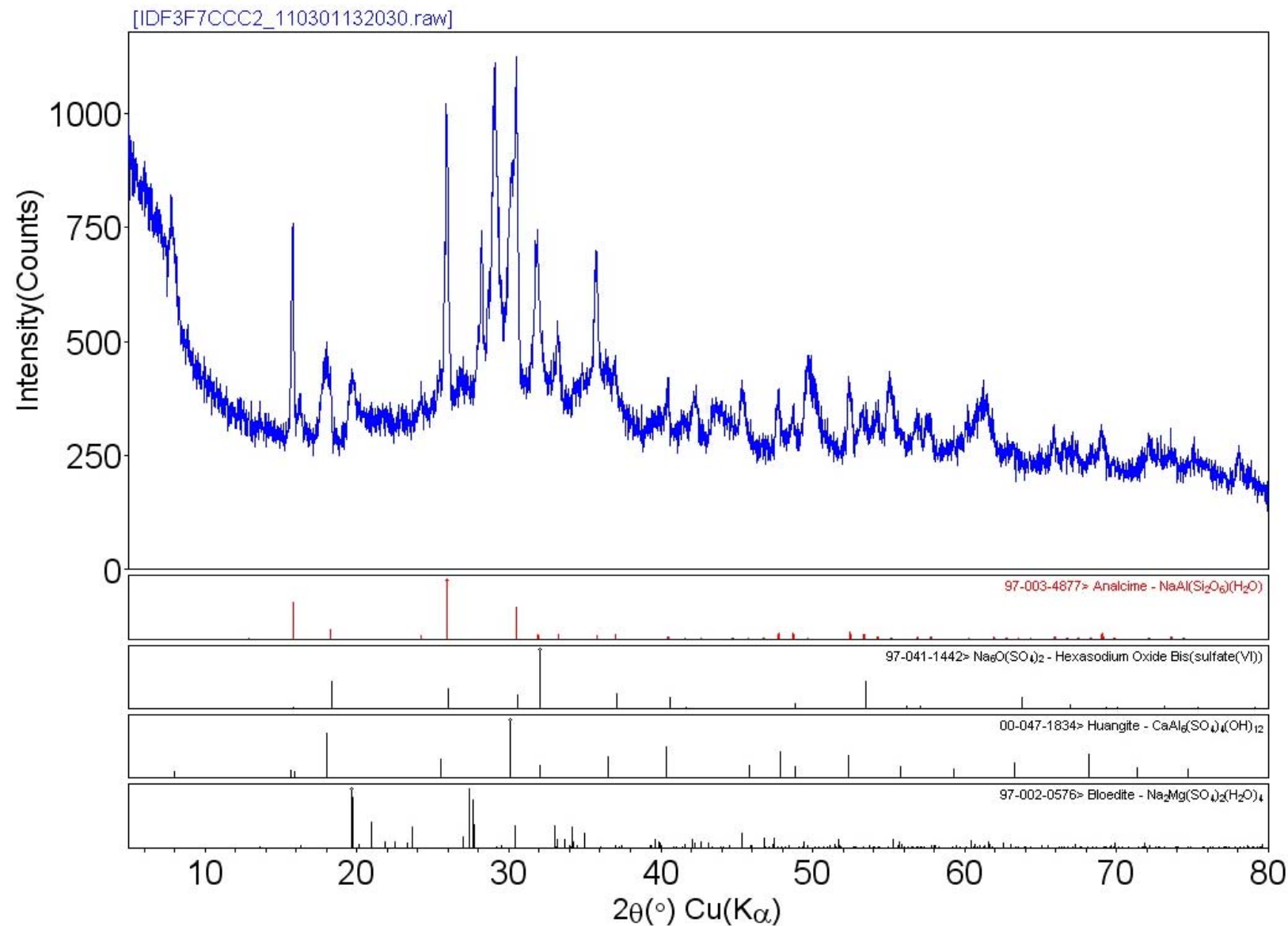
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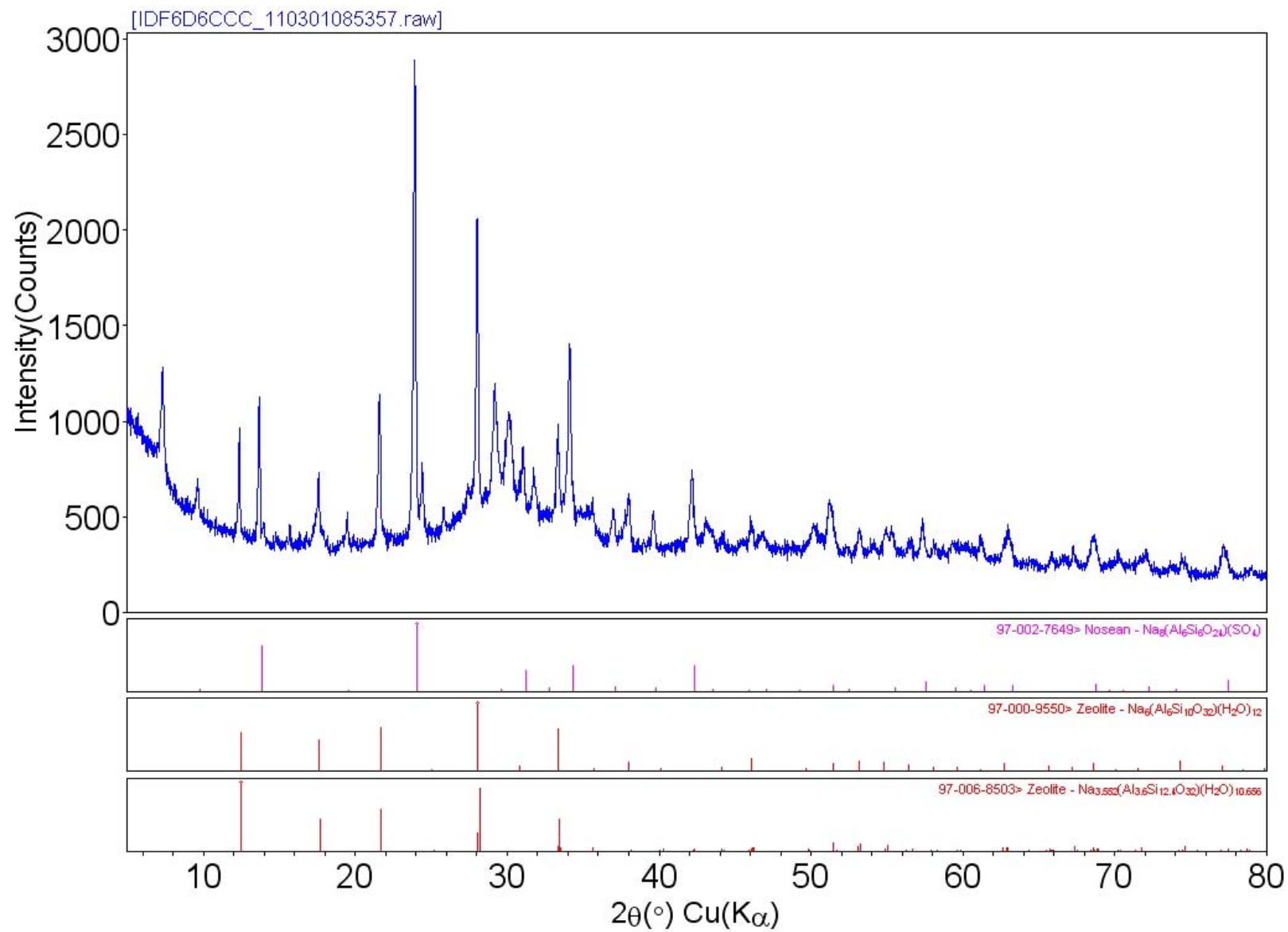
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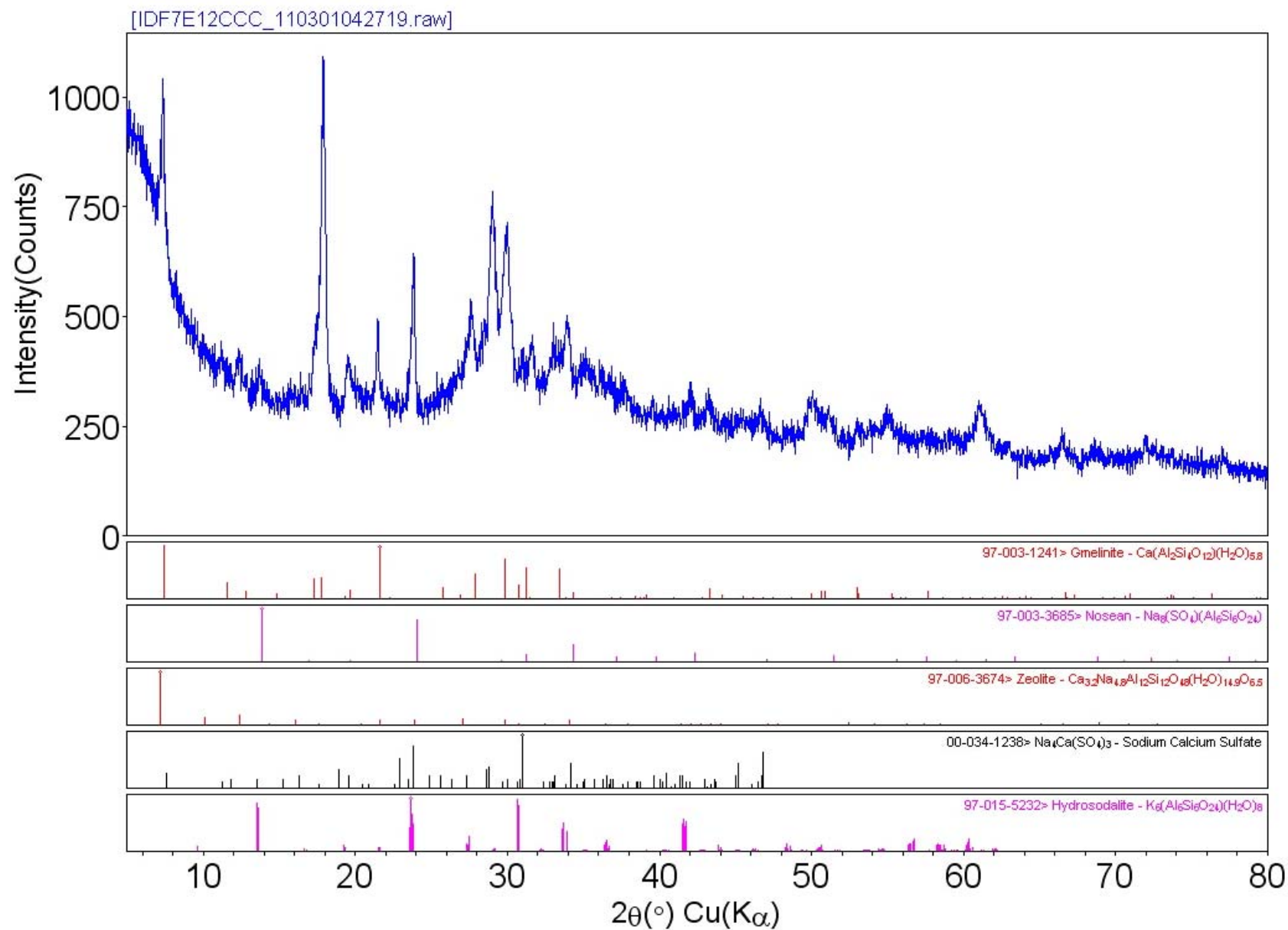
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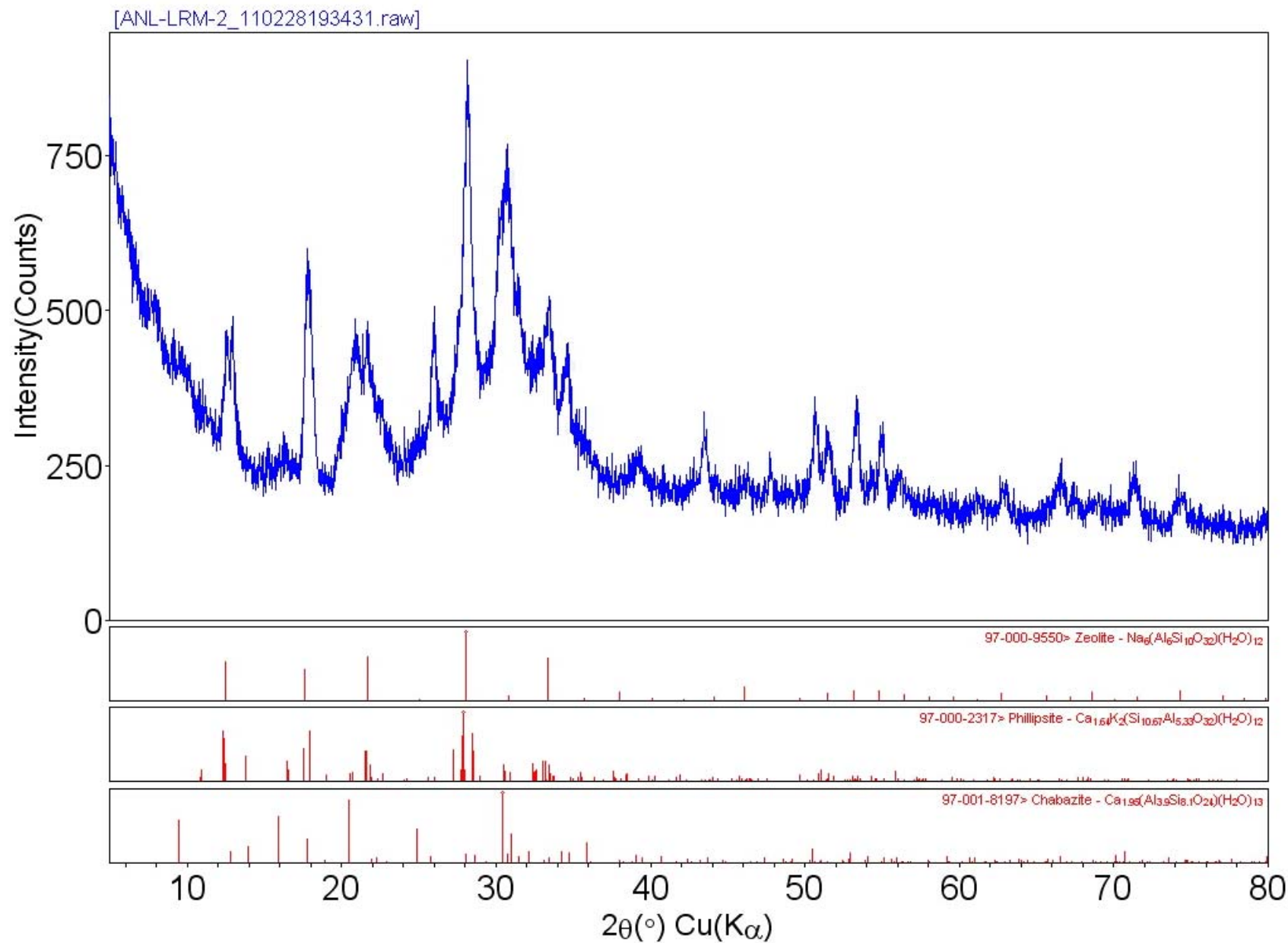
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APPENDIX E

Results from SPFT Tests on Three of the Ten Selected LAW Glasses

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ILAW Glass Testing for Disposal at IDF
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Table E1. SPFT Results for IDF1-B2 Glass

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #1																
SPFT-004-A-Blank-1	0	90	5.04E-05	-	7	-	-	0.0319	-	< -0.0081	-	1.2714	-	0.1773	-	-
SPFT-004-A-Blank-2	0	90	5.04E-05	-	7	-	-	0.0073	-	< -0.0238	-	0.7689	-	0.1075	-	-
SPFT-004-A-Blank-3	0	90	5.04E-05	-	7	-	-	0.0014	-	< -0.0241	-	0.8166	-	0.1054	-	-
SPFT-004-A-2	0	90	5.04E-05	0.40	7	0.7484	0.016	4.3523	0.5887	0.1099	0.0069	42.0754	0.6949	1.5791	0.0235	5.35E-08
SPFT-004-A-4	0	90	5.04E-05	0.79	7	0.7433	0.016	7.5447	1.0284	0.2314	0.0145	67.9859	1.1414	2.1188	0.0328	5.69E-08
SPFT-004-A-5	0	90	5.04E-05	0.99	7	0.7382	0.016	8.3885	1.1491	0.1199	0.0076	73.0828	1.2343	2.3012	0.0360	4.28E-08
SPFT-004-A-10	0	90	5.04E-05	1.98	7	0.7249	0.016	10.5281	1.4609	0.1328	0.0085	89.5978	1.5366	2.0671	0.0324	3.81E-08
SPFT-004-A-13	0	90	5.04E-05	2.58	7	0.7071	0.016	9.8734	1.3927	0.1834	0.0119	85.8130	1.4954	1.9510	0.0309	5.17E-08
SPFT-004-A-15	0	90	5.04E-05	2.98	7	0.6965	0.015	9.4814	1.3507	0.1581	0.0104	81.2737	1.4293	1.8363	0.0292	3.96E-08
SPFT-004-A-17	0	90	5.04E-05	3.37	7	0.6883	0.015	9.3537	1.3430	0.1801	0.0119	81.7858	1.4499	1.8063	0.0289	5.38E-08
SPFT-004-A-20	0	90	5.04E-05	3.97	7	0.6783	0.015	9.1286	1.3234	0.1603	0.0107	81.0620	1.4509	1.9249	0.0313	6.42E-08
SPFT-004-A-23	0	90	5.04E-05	4.56	7	0.6662	0.015	9.4059	1.3802	0.1639	0.0111	81.2800	1.4724	1.8671	0.0307	4.64E-08
SPFT-004-A-24	0	90	5.04E-05	4.76	7	0.6582	0.015	8.7750	1.2977	0.1955	0.0133	77.3428	1.4113	1.8022	0.0297	5.72E-08
SPFT-004-A-25	0	90	5.04E-05	4.96	7	0.6545	0.015	8.5351	1.2670	0.1984	0.0136	76.6285	1.4034	1.8271	0.0303	6.87E-08
SPFT-004-A-33	0	90	5.04E-05	6.55	7	0.6374	0.014	8.7754	1.3259	0.2070	0.0144	76.1360	1.4191	1.9984	0.0340	4.69E-08
Exp. #2																
SPFT-004-B-Blank-1	0	90	5.04E-05	-	8	-	-	0.0722	-	< 0.0039	-	1.4219	-	0.1549	-	-
SPFT-004-B-Blank-2	0	90	5.04E-05	-	8	-	-	0.0033	-	< -0.0368	-	0.8545	-	0.2340	-	-
SPFT-004-B-Blank-3	0	90	5.04E-05	-	8	-	-	0.0011	-	< -0.0370	-	0.8015	-	0.2289	-	-
SPFT-004-B-2	0	90	5.04E-05	0.40	8	0.7496	0.016	1.2098	0.1548	0.6089	0.0378	23.4897	0.3755	2.7331	0.0433	1.11E-07
SPFT-004-B-3	0	90	5.04E-05	0.60	8	0.7488	0.016	1.5426	0.2003	0.7771	0.0483	28.2418	0.4566	3.3188	0.0531	1.29E-07
SPFT-004-B-5	0	90	5.04E-05	0.99	8	0.7476	0.016	2.1335	0.2811	0.9571	0.0595	32.9945	0.5381	3.9708	0.0641	1.29E-07
SPFT-004-B-6	0	90	5.04E-05	1.19	8	0.7462	0.016	2.2534	0.2978	1.0299	0.0641	34.3027	0.5611	4.1805	0.0678	1.33E-07
SPFT-004-B-12	0	90	5.04E-05	2.38	8	0.7429	0.016	2.2633	0.3001	1.1073	0.0689	32.5185	0.5323	4.2034	0.0683	1.17E-07
SPFT-004-B-13	0	90	5.04E-05	2.58	8	0.7491	0.016	2.2157	0.2919	1.0759	0.0670	31.9569	0.5198	4.1095	0.0664	1.15E-07
SPFT-004-B-15	0	90	5.04E-05	2.98	8	0.7381	0.016	2.1940	0.2918	1.1163	0.0695	31.9121	0.5241	4.1384	0.0675	1.17E-07
SPFT-004-B-17	0	90	5.04E-05	3.37	8	0.7363	0.016	2.1045	0.2800	1.1154	0.0694	30.3170	0.4975	4.0540	0.0662	1.09E-07
SPFT-004-B-20	0	90	5.04E-05	3.97	8	0.7342	0.016	2.0429	0.2720	1.1018	0.0686	29.3758	0.4823	4.0422	0.0661	1.06E-07
SPFT-004-B-23	0	90	5.04E-05	4.56	8	0.7317	0.016	1.9191	0.2555	1.1078	0.0690	27.8462	0.4569	3.9549	0.0648	1.01E-07
SPFT-004-B-24	0	90	5.04E-05	4.76	8	0.7301	0.016	1.8313	0.2437	1.0895	0.0678	26.6435	0.4367	3.9045	0.0640	9.71E-08
SPFT-004-B-25	0	90	5.04E-05	4.96	8	0.7293	0.016	1.8500	0.2465	1.0996	0.0684	27.1072	0.4451	3.9099	0.0642	9.99E-08
Exp. #3																
SPFT-004-C-Blank-1	0	90	5.04E-05	-	9	-	-	0.0395	-	< 0.0055	-	1.4196	-	0.1543	-	-
SPFT-004-C-Blank-2	0	90	5.04E-05	-	9	-	-	0.0015	-	< -0.0106	-	0.8906	-	0.0723	-	-
SPFT-004-C-Blank-3	0	90	5.04E-05	-	9	-	-	< 0.0004	-	< -0.0103	-	0.8828	-	0.0062	-	-
SPFT-004-C-2	0	90	5.04E-05	0.40	9	0.4996	0.011	0.5230	0.0988	1.0042	0.0884	13.1672	0.2968	3.7740	0.0911	9.55E-08

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #3 (cont.)																
SPFT-004-C-4	0	90	5.04E-05	0.79	9	0.4991	0.011	0.7488	0.1450	1.7326	0.1530	16.6812	0.3858	5.3931	0.1320	1.16E-07
SPFT-004-C-5	0	90	5.04E-05	0.99	9	0.4986	0.011	0.8853	0.1730	1.5842	0.1399	17.0330	0.3950	5.6096	0.1376	1.07E-07
SPFT-004-C-9	0	90	5.04E-05	1.79	9	0.4976	0.011	0.9962	0.1959	1.7300	0.1531	17.9298	0.4183	6.4122	0.1580	1.07E-07
SPFT-004-C-13	0	90	5.04E-05	2.58	9	0.4959	0.011	0.9889	0.1949	1.7408	0.1544	16.5572	0.3843	6.4543	0.1594	9.14E-08
SPFT-004-C-15	0	90	5.04E-05	2.98	9	0.4947	0.011	0.9317	0.1834	1.6643	0.1478	16.0805	0.3728	6.0813	0.1502	9.13E-08
SPFT-004-C-17	0	90	5.04E-05	3.37	9	0.4939	0.011	0.9750	0.1925	1.7505	0.1556	15.7837	0.3657	6.4261	0.1591	8.35E-08
SPFT-004-C-20	0	90	5.04E-05	3.97	9	0.4929	0.011	0.9511	0.1879	1.7208	0.1532	14.8836	0.3432	6.3092	0.1564	7.49E-08
SPFT-004-C-23	0	90	5.04E-05	4.56	9	0.4917	0.011	0.9485	0.1877	1.7268	0.1540	14.5317	0.3348	6.2956	0.1563	7.10E-08
SPFT-004-C-24	0	90	5.04E-05	4.76	9	0.4909	0.011	0.8844	0.1746	1.6220	0.1448	12.9012	0.2935	5.9294	0.1471	5.73E-08
SPFT-004-C-25	0	90	5.04E-05	4.96	9	0.4905	0.011	0.8669	0.1711	1.6050	0.1433	12.8327	0.2919	5.8440	0.1450	5.83E-08
SPFT-004-C-33	0	90	5.04E-05	6.55	9	0.4889	0.011	0.9016	0.1787	1.6534	0.1480	13.1900	0.3017	6.0641	0.1510	5.93E-08
Exp. #4																
SPFT-004-D-Blank-1	0	90	5.04E-05	-	10	-	-	< 0.0206	-	< 0.0021	-	1.4232	-	0.1591	-	-
SPFT-004-D-Blank-2	0	90	5.04E-05	-	10	-	-	< 0.0006	-	< -0.0128	-	0.8411	-	0.1223	-	-
SPFT-004-D-Blank-3	0	90	5.04E-05	-	10	-	-	< 0.0001	-	< -0.0117	-	0.8902	-	0.1191	-	-
SPFT-004-D-2	0	90	5.04E-05	0.40	10	0.4998	0.011	0.6113	0.1206	0.7297	0.0644	11.0315	0.2426	4.2155	0.1021	6.14E-08
SPFT-004-D-4	0	90	5.04E-05	0.79	10	0.4992	0.011	0.8596	0.1714	1.2903	0.1141	13.6882	0.3100	5.4544	0.1334	6.97E-08
SPFT-004-D-5	0	90	5.04E-05	0.99	10	0.4986	0.011	1.0587	0.2123	1.9548	0.1730	14.6449	0.3344	6.2345	0.1531	6.15E-08
SPFT-004-D-9	0	90	5.04E-05	1.79	10	0.4974	0.011	1.1800	0.2375	2.0361	0.1805	14.8234	0.3395	6.9003	0.1702	5.13E-08
SPFT-004-D-13	0	90	5.04E-05	2.58	10	0.4953	0.011	1.2102	0.2443	2.0347	0.1809	14.2696	0.3263	6.9712	0.1725	4.13E-08
SPFT-004-D-15	0	90	5.04E-05	2.98	10	0.4938	0.011	1.1981	0.2423	2.0416	0.1819	14.0196	0.3207	6.9844	0.1732	3.94E-08
SPFT-004-D-17	0	90	5.04E-05	3.37	10	0.4928	0.011	1.1873	0.2404	2.0381	0.1818	13.3654	0.3044	6.9505	0.1725	3.22E-08
SPFT-004-D-20	0	90	5.04E-05	3.97	10	0.4915	0.011	1.2172	0.2470	2.0719	0.1852	13.3556	0.3047	7.1351	0.1775	2.90E-08
SPFT-004-D-22	0	90	5.04E-05	4.36	10	0.4902	0.011	1.2058	0.2451	2.0599	0.1844	12.9328	0.2944	7.0768	0.1764	2.48E-08
SPFT-004-D-24	0	90	5.04E-05	4.76	10	0.4892	0.011	1.1816	0.2404	2.0197	0.1811	12.4433	0.2823	6.9542	0.1735	2.11E-08
SPFT-004-D-25	0	90	5.04E-05	4.96	10	0.4884	0.011	1.1990	0.2443	2.0472	0.1837	12.5700	0.2858	7.0287	0.1756	2.09E-08
SPFT-004-D-33	0	90	5.04E-05	6.55	10	0.4861	0.011	1.2129	0.2480	2.0471	0.1843	12.5105	0.2852	7.0811	0.1775	1.87E-08
Exp. #5																
SPFT-004-E-Blank-1	0	90	5.04E-05	-	11	-	-	< 0.0021	-	0.0081	-	1.8008	-	0.1916	-	-
SPFT-004-E-Blank-2	0	90	5.04E-05	-	11	-	-	< 0.0003	-	0.0003	-	2.0177	-	0.0353	-	-
SPFT-004-E-Blank-3	0	90	5.04E-05	-	11	-	-	< -0.0001	-	< 0.0003	-	2.1319	-	0.0361	-	-
SPFT-004-E-2	0	90	5.04E-05	0.40	11	0.4993	0.011	1.0939	0.2231	2.0254	0.1786	22.4429	0.5217	6.7522	0.1653	1.50E-07
SPFT-004-E-4	0	90	5.04E-05	0.79	11	0.4981	0.011	1.8193	0.3719	3.0969	0.2740	35.2815	0.8476	11.1811	0.2773	2.39E-07
SPFT-004-E-5	0	90	5.04E-05	0.99	11	0.4968	0.011	2.1561	0.4416	3.0402	0.2694	37.5017	0.9053	11.9549	0.2973	2.33E-07
SPFT-004-E-9	0	90	5.04E-05	1.79	11	0.4937	0.011	3.0697	0.6316	4.7433	0.4225	49.1412	1.2056	16.3654	0.4105	2.89E-07
SPFT-004-E-13	0	90	5.04E-05	2.58	11	0.4876	0.011	3.8427	0.7972	5.2883	0.4750	54.4466	1.3517	18.2401	0.4619	2.79E-07

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #5 (cont.)																
SPFT-004-E-15	0	90	5.04E-05	2.98	11	0.4827	0.011	3.6933	0.7715	5.1186	0.4629	56.0032	1.4012	19.1876	0.4894	3.17E-07
SPFT-004-E-17	0	90	5.04E-05	3.37	11	0.4794	0.010	3.9312	0.8250	5.2590	0.4778	58.3183	1.4678	19.7833	0.5071	3.23E-07
SPFT-004-E-20	0	90	5.04E-05	3.97	11	0.4749	0.010	4.1840	0.8835	5.5182	0.5045	61.4786	1.5595	20.7457	0.5353	3.40E-07
SPFT-004-E-23	0	90	5.04E-05	4.36	11	0.4704	0.010	4.1712	0.8865	5.3284	0.4902	61.6675	1.5745	20.8988	0.5428	3.46E-07
SPFT-004-E-24	0	90	5.04E-05	4.76	11	0.4667	0.010	4.2236	0.9023	5.3703	0.4967	60.3521	1.5480	20.3531	0.5312	3.25E-07
SPFT-004-E-25	0	90	5.04E-05	4.96	11	0.4639	0.010	4.2801	0.9180	5.4213	0.5034	60.9551	1.5701	20.8311	0.5460	3.28E-07
SPFT-004-E-33	0	90	5.04E-05	6.55	11	0.4538	0.010	5.2837	1.1502	5.8178	0.5483	69.6806	1.8285	22.9559	0.6111	3.41E-07
Exp. #6																
SPFT-004-F-Blank-1	0	90	5.04E-05	-	12	-	-	< 0.1381	-	0.0236	-	1.9705	-	0.1726	-	-
SPFT-004-F-Blank-2	0	90	5.04E-05	-	12	-	-	0.0229	-	0.0550	-	2.3817	-	0.5530	-	-
SPFT-004-F-Blank-3	0	90	5.04E-05	-	12	-	-	0.0184	-	0.0077	-	2.0773	-	0.3898	-	-
SPFT-004-F-2	0	90	5.04E-05	0.40	12	0.4989	0.011	3.0472	0.5946	6.4446	0.5687	46.5826	1.1278	20.0423	0.5006	2.68E-07
SPFT-004-F-4	0	90	5.04E-05	0.79	12	0.4951	0.011	6.0309	1.2106	11.7349	1.0426	83.3508	2.0679	37.0918	0.9350	4.31E-07
SPFT-004-F-5	0	90	5.04E-05	0.99	12	0.4910	0.011	7.2285	1.4647	13.3508	1.1931	96.5722	2.4173	43.1920	1.0956	4.79E-07
SPFT-004-F-9	0	90	5.04E-05	1.79	12	0.4795	0.010	11.5531	2.3956	18.6460	1.6937	136.8840	3.5022	62.3235	1.6080	5.57E-07
SPFT-004-F-10	0	90	5.04E-05	1.98	12	0.4670	0.010	11.8862	2.5094	18.8643	1.7440	142.3320	3.7084	64.5104	1.6941	6.03E-07
SPFT-004-F-15	0	90	5.04E-05	2.98	12	0.4490	0.010	14.3109	3.1076	20.7412	1.9686	165.0430	4.4228	74.2024	2.0011	6.62E-07
SPFT-004-F-17	0	90	5.04E-05	3.37	12	0.4270	0.010	15.0802	3.3876	20.8694	2.0481	167.8830	4.6527	76.0463	2.1206	6.37E-07
SPFT-004-F-20	0	90	5.04E-05	3.97	12	0.4107	0.009	15.2540	3.5176	20.7017	2.0853	172.5690	4.9105	76.2831	2.1835	7.01E-07
SPFT-004-F-22	0	90	5.04E-05	4.36	12	0.3938	0.009	16.2108	3.8464	20.5291	2.1266	176.0880	5.1541	76.8977	2.2636	6.58E-07
SPFT-004-F-24	0	90	5.04E-05	4.76	12	0.3790	0.009	17.9118	4.3631	19.5835	2.0808	169.7040	5.0931	74.1243	2.2380	3.67E-07
SPFT-004-F-25	0	90	5.04E-05	4.96	12	0.3680	0.009	15.2636	3.7869	19.8926	2.1558	175.7200	5.3807	75.3189	2.3194	8.02E-07
SPFT-004-F-33	0	90	5.04E-05	6.55	12	0.3346	0.008	17.3939	4.6029	18.0926	2.0887	178.2940	5.8177	72.2617	2.3706	6.11E-07
Exp. #7																
SPFT-005-A-Blank-1	0	70	4.75E-05	-	7	-	-	0.0621	-	<-0.0017	-	1.4736	-	0.1912	-	-
SPFT-005-A-Blank-2	0	70	4.75E-05	-	7	-	-	0.0629	-	<-0.0087	-	1.4767	-	0.2089	-	-
SPFT-005-A-Blank-3	0	70	4.75E-05	-	7	-	-	0.0251	-	<-0.0074	-	1.2931	-	0.1665	-	-
SPFT-005-A-3	0	70	4.75E-05	0.46	7	1.0008	0.022	1.6192	0.1497	0.0468	0.0019	23.6576	0.2638	0.9620	0.0091	5.74E-08
SPFT-005-A-6	0	70	4.75E-05	0.93	7	0.9988	0.022	2.4970	0.2344	0.0952	0.0040	32.7177	0.3720	1.2921	0.0131	6.92E-08
SPFT-005-A-9	0	70	4.75E-05	1.39	7	0.9962	0.021	2.7754	0.2616	0.0978	0.0041	34.8015	0.3975	1.2927	0.0131	6.84E-08
SPFT-005-A-13	0	70	4.75E-05	2.00	7	0.9930	0.021	2.7112	0.2560	0.1075	0.0045	31.8269	0.3628	1.0984	0.0108	5.37E-08
SPFT-005-A-17	0	70	4.75E-05	2.62	7	0.9893	0.021	2.8247	0.2676	0.1272	0.0053	32.2107	0.3683	1.0578	0.0103	5.07E-08
SPFT-005-A-21	0	70	4.75E-05	4.42	7	0.9824	0.021	2.6043	0.2474	0.0312	0.0013	27.8379	0.3174	0.8834	0.0083	3.52E-08
SPFT-005-A-27	0	70	4.75E-05	5.17	7	0.9754	0.021	2.4574	0.2342	0.1413	0.0060	25.4511	0.2900	0.8142	0.0075	2.81E-08
SPFT-005-A-34	0	70	4.75E-05	6.22	7	0.9709	0.021	2.3057	0.2200	0.1050	0.0045	24.4733	0.2790	0.8284	0.0075	2.97E-08
SPFT-005-A-41	0	70	4.75E-05	7.27	7	0.9658	0.021	2.1697	0.2074	0.0988	0.0042	22.1156	0.2513	0.8193	0.0074	2.21E-08

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #7 (cont.)																
SPFT-005-A-48	0	70	4.75E-05	8.32	7	0.9611	0.021	2.0545	0.1967	0.0813	0.0035	20.4864	0.2322	0.7981	0.0072	1.79E-08
SPFT-005-A-53	0	70	4.75E-05	12.68	7	0.9496	0.021	1.9950	0.1923	0.0662	0.0029	18.4730	0.2093	0.8740	0.0082	8.53E-09
SPFT-005-A-59	0	70	4.75E-05	13.58	7	0.9384	0.021	2.0049	0.1949	0.0736	0.0032	18.3695	0.2097	0.8957	0.0085	7.45E-09
SPFT-005-A-62	0	70	4.75E-05	14.03	7	0.9355	0.021	1.9774	0.1925	0.0653	0.0028	18.2362	0.2084	0.9259	0.0089	8.02E-09
SPFT-005-A-68	0	70	4.75E-05	16.21	7	0.9296	0.021	2.1333	0.2090	0.0703	0.0031	19.8040	0.2289	1.0142	0.0100	9.99E-09
SPFT-005-A-73	0	70	4.75E-05	16.96	7	0.9230	0.020	2.1477	0.2115	0.0730	0.0032	19.7412	0.2292	0.9956	0.0098	8.90E-09
Exp. #8																
SPFT-005-B-Blank-1	0	70	4.75E-05	-	8	-	-	0.0954	-	<0.0000	-	1.4669	-	0.2251	-	-
SPFT-005-B-Blank-2	0	70	4.75E-05	-	8	-	-	0.0987	-	<-0.0060	-	1.4938	-	0.2784	-	-
SPFT-005-B-Blank-3	0	70	4.75E-05	-	8	-	-	0.0264	-	<-0.0087	-	1.3346	-	0.1728	-	-
SPFT-005-B-2	0	70	4.75E-05	0.31	8	1.0009	0.022	0.2361	0.0134	0.1117	0.0047	7.8925	0.0763	0.8433	0.0070	3.16E-08
SPFT-005-B-5	0	70	4.75E-05	0.77	8	1.0006	0.022	0.5836	0.0468	0.3169	0.0132	16.1909	0.1750	2.0642	0.0215	6.45E-08
SPFT-005-B-9	0	70	4.75E-05	1.39	8	1.0000	0.022	0.5826	0.0467	0.5545	0.0231	17.1089	0.1859	2.4415	0.0260	7.00E-08
SPFT-005-B-13	0	70	4.75E-05	2.00	8	0.9993	0.022	0.5818	0.0466	0.5426	0.0226	14.8755	0.1593	2.3842	0.0253	5.67E-08
SPFT-005-B-17	0	70	4.75E-05	2.62	8	0.9987	0.022	0.5663	0.0451	0.6157	0.0257	14.8357	0.1588	2.6568	0.0285	5.72E-08
SPFT-005-B-21	0	70	4.75E-05	4.42	8	0.9991	0.022	0.5598	0.0445	0.5087	0.0212	12.2059	0.1276	2.6063	0.0279	4.18E-08
SPFT-005-B-26	0	70	4.75E-05	5.02	8	0.9963	0.022	0.4732	0.0362	0.6692	0.0279	11.0439	0.1137	2.5126	0.0268	3.90E-08
SPFT-005-B-34	0	70	4.75E-05	6.22	8	0.9956	0.022	0.4671	0.0354	0.6500	0.0271	10.4251	0.1062	2.5520	0.0270	3.56E-08
SPFT-005-B-41	0	70	4.75E-05	7.27	8	0.9947	0.022	0.4323	0.0321	0.6236	0.0260	9.4617	0.0948	2.3825	0.0249	3.15E-08
SPFT-005-B-49	0	70	4.75E-05	8.47	8	0.9939	0.022	0.4075	0.0297	0.5822	0.0243	8.6291	0.0849	2.2864	0.0238	2.78E-08
SPFT-005-B-53	0	70	4.75E-05	12.68	8	0.9922	0.022	0.3815	0.0272	0.5932	0.0247	7.5307	0.0718	2.2844	0.0238	2.24E-08
SPFT-005-B-59	0	70	4.75E-05	13.58	8	0.9906	0.022	0.3771	0.0268	0.6591	0.0275	7.4938	0.0714	2.3034	0.0240	2.24E-08
SPFT-005-B-62	0	70	4.75E-05	14.03	8	0.9902	0.022	0.3647	0.0256	0.5847	0.0244	7.3054	0.0691	2.2656	0.0236	2.19E-08
SPFT-005-B-68	0	70	4.75E-05	16.21	8	0.9894	0.022	0.3782	0.0269	0.6286	0.0262	7.6694	0.0735	2.4136	0.0253	2.34E-08
SPFT-005-B-73	0	70	4.75E-05	16.96	8	0.9885	0.022	0.4029	0.0293	0.6573	0.0274	7.8127	0.0752	2.5467	0.0269	2.31E-08
Exp. #9																
SPFT-005-C-Blank-1	0	70	4.75E-05	-	9	-	-	0.1021	-	< 0.0062	-	1.4542	-	0.2586	-	-
SPFT-005-C-Blank-2	0	70	4.75E-05	-	9	-	-	0.0297	-	ND	-	1.4335	-	0.3064	-	-
SPFT-005-C-Blank-3	0	70	4.75E-05	-	9	-	-	0.0262	-	<-0.0084	-	1.3102	-	0.1748	-	-
SPFT-005-C-2	0	70	4.75E-05	0.31	9	1.0002	0.022	0.2464	0.0139	0.2862	0.0117	6.7272	0.0627	1.2663	0.0120	2.46E-08
SPFT-005-C-5	0	70	4.75E-05	0.77	9	0.9999	0.022	0.5220	0.0404	0.5667	0.0234	11.8878	0.1242	2.8159	0.0303	4.22E-08
SPFT-005-C-9	0	70	4.75E-05	1.39	9	0.9994	0.022	0.5397	0.0421	0.9563	0.0396	12.8140	0.1352	3.5181	0.0387	4.69E-08
SPFT-005-C-13	0	70	4.75E-05	2.00	9	0.9987	0.022	0.6013	0.0481	0.9450	0.0392	11.7639	0.1228	3.6033	0.0397	3.76E-08
SPFT-005-C-17	0	70	4.75E-05	2.62	9	0.9979	0.021	0.6654	0.0543	0.1474	0.0059	11.8900	0.1244	3.8887	0.0431	3.53E-08

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ² s ⁻¹
Exp. #9 (cont)																
SPFT-005-C-20	0	70	4.75E-05	4.03	9	0.9966	0.021	0.6918	0.0569	1.0089	0.0419	10.5163	0.1081	4.2024	0.0469	2.58E-08
SPFT-005-C-27	0	70	4.75E-05	5.17	9	0.9950	0.021	0.5620	0.0444	1.1056	0.0460	9.0289	0.0905	3.9866	0.0444	2.32E-08
SPFT-005-C-34	0	70	4.75E-05	6.22	9	0.9938	0.021	0.5314	0.0485	1.0929	0.0455	8.9301	0.0896	4.0479	0.0446	2.07E-08
SPFT-005-C-41	0	70	4.75E-05	7.27	9	0.9928	0.021	0.4719	0.0428	0.4088	0.0169	7.8978	0.0773	3.4848	0.0379	1.74E-08
SPFT-005-C-48	0	70	4.75E-05	8.32	9	0.9919	0.021	0.4946	0.0450	0.9963	0.0415	7.3654	0.0710	3.5910	0.0392	1.31E-08
SPFT-005-C-53	0	70	4.75E-05	12.68	9	0.9893	0.021	0.4910	0.0447	0.9905	0.0413	6.7194	0.0634	3.6552	0.0400	9.39E-09
SPFT-005-C-59	0	70	4.75E-05	13.58	9	0.9869	0.021	0.4865	0.0443	0.9959	0.0416	6.6943	0.0632	3.6997	0.0406	9.47E-09
SPFT-005-C-63	0	70	4.75E-05	14.18	9	0.9861	0.021	0.5861	0.0540	0.8619	0.0360	6.8819	0.0655	3.9199	0.0433	5.74E-09
SPFT-005-C-68	0	70	4.75E-05	16.21	9	0.9848	0.021	0.5104	0.0467	1.0953	0.0459	6.8123	0.0647	3.8415	0.0424	9.03E-09
SPFT-005-C-73	0	70	4.75E-05	16.96	9	0.9834	0.021	0.5482	0.0504	1.0834	0.0454	9.0849	0.0921	4.0070	0.0444	2.10E-08
Exp. #10																
SPFT-005-D-Blank-1	0	70	4.75E-05	-	10	-	-	0.0710	-	0.0029	-	1.4362	-	0.2969	-	-
SPFT-005-D-Blank-2	0	70	4.75E-05	-	10	-	-	0.1103	-	<0.0023	-	1.4412	-	0.3614	-	-
SPFT-005-D-Blank-3	0	70	4.75E-05	-	10	-	-	0.0258	-	<-0.0089	-	1.3301	-	0.1752	-	-
SPFT-005-D-2	0	70	4.75E-05	0.31	10	0.4996	0.011	0.2851	0.0374	0.4953	0.0411	4.7453	0.0788	2.0132	0.0400	2.08E-08
SPFT-005-D-5	0	70	4.75E-05	0.77	10	0.4993	0.011	0.5111	0.0858	0.7817	0.0650	6.6127	0.1233	3.0264	0.0641	1.89E-08
SPFT-005-D-9	0	70	4.75E-05	1.39	10	0.4988	0.011	0.5706	0.0980	1.0714	0.0893	7.6898	0.1491	3.9033	0.0850	2.57E-08
SPFT-005-D-11	0	70	4.75E-05	1.70	10	0.4982	0.011	0.6071	0.1054	1.1134	0.0929	7.6182	0.1475	4.0678	0.0890	2.12E-08
SPFT-005-C-17	0	70	4.75E-05	2.62	10	0.4974	0.011	0.6864	0.1216	1.0063	0.0840	7.3267	0.1407	3.9160	0.0855	9.58E-09
SPFT-005-D-21	0	70	4.75E-05	4.42	10	0.4956	0.011	0.6933	0.1230	1.1558	0.0967	6.5380	0.1221	4.2267	0.0931	-4.56E-10
SPFT-005-C-27	0	70	4.75E-05	5.17	10	0.4939	0.011	0.5787	0.0996	1.1069	0.0928	6.2485	0.1155	4.1037	0.0904	7.96E-09
SPFT-005-D-34	0	70	4.75E-05	6.22	10	0.4930	0.011	0.6008	0.0953	1.1523	0.0968	6.1380	0.1129	4.1215	0.0901	8.85E-09
SPFT-005-D-41	0	70	4.75E-05	7.27	10	0.4919	0.011	0.5733	0.0901	1.0964	0.0923	5.7536	0.1038	3.8889	0.0846	6.90E-09
SPFT-005-D-48	0	70	4.75E-05	8.32	10	0.4908	0.011	0.5774	0.0910	1.0654	0.0898	5.7134	0.1030	3.7754	0.0820	6.02E-09
SPFT-005-D-53	0	70	4.75E-05	12.68	10	0.4881	0.011	0.5671	0.0894	1.0761	0.0910	7.3070	0.1419	3.7846	0.0826	2.65E-08
SPFT-005-D-59	0	70	4.75E-05	13.58	10	0.4854	0.011	0.5852	0.0932	1.1140	0.0946	7.2799	0.1418	3.9517	0.0869	2.44E-08
SPFT-005-D-63	0	70	4.75E-05	14.18	10	0.4846	0.011	0.6646	0.1090	0.9297	0.0790	7.5136	0.1476	4.0631	0.0897	1.95E-08
SPFT-005-D-68	0	70	4.75E-05	16.21	10	0.4832	0.011	0.5780	0.0921	1.2138	0.1034	7.4659	0.1468	4.0150	0.0887	2.75E-08
SPFT-005-D-73	0	70	4.75E-05	16.96	10	0.4817	0.010	0.6209	0.1008	1.2090	0.1032	ND	-	4.1720	0.0927	1.49E-07
Exp. #11																
SPFT-005-E-Blank-1	0	70	4.75E-05	-	11	-	-	0.0434	-	0.0059	-	2.3242	-	0.2783	-	-
SPFT-005-E-Blank-2	0	70	4.75E-05	-	11	-	-	0.0664	-	<-0.0002	-	2.2646	-	0.2133	-	-
SPFT-005-E-Blank-3	0	70	4.75E-05	-	11	-	-	0.0223	-	0.0012	-	2.8681	-	0.1914	-	-
SPFT-005-E-3	0	70	4.75E-05	0.46	11	0.5005	0.011	0.5630	0.0977	1.0989	0.0910	13.7676	0.2728	3.8959	0.0865	8.81E-08
SPFT-005-E-5	0	70	4.75E-05	0.77	11	0.5000	0.011	0.7627	0.1362	1.0917	0.0905	17.5304	0.3625	4.9471	0.1115	1.14E-07

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #11 (cont.)																
SPFT-005-E-9	0	70	4.75E-05	1.39	11	0.4990	0.011	0.9525	0.1729	2.0550	0.1710	19.2509	0.4040	6.0780	0.1385	1.16E-07
SPFT-005-E-15	0	70	4.75E-05	2.31	11	0.4972	0.011	1.0980	0.2014	1.9032	0.1588	20.6477	0.4383	6.6089	0.1515	1.19E-07
SPFT-005-E-17	0	70	4.75E-05	2.62	11	0.4956	0.011	1.1079	0.2037	1.9351	0.1618	20.9876	0.4474	6.7303	0.1547	1.23E-07
SPFT-005-E-21	0	70	4.75E-05	4.42	11	0.4926	0.011	1.2157	0.2255	1.6837	0.1412	22.3605	0.4822	7.1709	0.1658	1.29E-07
SPFT-005-E-27	0	70	4.75E-05	5.17	11	0.4889	0.011	1.3031	0.2437	2.3276	0.1964	23.0455	0.5011	7.3157	0.1702	1.30E-07
SPFT-005-E-35	0	70	4.75E-05	6.37	11	0.4858	0.011	1.4267	0.2667	2.1706	0.1954	25.1417	0.5548	7.9457	0.1869	1.45E-07
SPFT-005-E-41	0	70	4.75E-05	7.27	11	0.4823	0.011	1.4713	0.2768	2.1778	0.1970	25.5615	0.5677	8.0610	0.1906	1.46E-07
SPFT-005-E-48	0	70	4.75E-05	8.32	11	0.4788	0.010	1.6082	0.3052	2.2317	0.2028	25.9506	0.5800	8.3878	0.1995	1.38E-07
SPFT-005-E-54	0	70	4.75E-05	12.83	11	0.4679	0.010	1.7099	0.3304	2.2576	0.2084	26.1048	0.5928	8.7793	0.2123	1.32E-07
SPFT-005-E-58	0	70	4.75E-05	13.43	11	0.4577	0.010	1.7714	0.3478	2.2861	0.2141	26.7412	0.6177	8.9188	0.2189	1.36E-07
SPFT-005-E-63	0	70	4.75E-05	14.18	11	0.4550	0.010	1.7474	0.3443	1.3246	0.1246	27.8737	0.6489	9.0838	0.2240	1.53E-07
SPFT-005-E-68	0	70	4.75E-05	16.21	11	0.4492	0.010	1.7937	0.3568	2.7537	0.2612	26.9752	0.6314	9.0267	0.2245	1.38E-07
SPFT-005-E-73	0	70	4.75E-05	16.96	11	0.4433	0.010	1.8801	0.3780	2.3943	0.2291	38.0116	0.9215	9.4312	0.2368	2.74E-07
Exp. #12																
SPFT-005-F-Blank-1	0	70	4.75E-05	-	12	-	-	0.1043	-	0.0219	-	2.3146	-	1.3344	-	-
SPFT-005-F-Blank-2	0	70	4.75E-05	-	12	-	-	0.1332	-	0.0259	-	2.2541	-	3.7751	-	-
SPFT-005-F-Blank-3	0	70	4.75E-05	-	12	-	-	0.0656	-	0.0008	-	3.4510	-	0.2134	-	-
SPFT-005-F-3	0	70	4.75E-05	0.46	12	0.4995	0.011	1.2986	0.2272	3.0108	0.2494	21.8325	0.4656	9.3861	0.1622	1.20E-07
SPFT-005-F-5	0	70	4.75E-05	0.77	12	0.4982	0.011	2.0135	0.3655	3.8120	0.3168	29.4620	0.6484	13.4849	0.2599	1.42E-07
SPFT-005-F-9	0	70	4.75E-05	1.39	12	0.4958	0.011	2.7724	0.5136	6.3795	0.5332	38.7814	0.8737	18.8506	0.3888	1.81E-07
SPFT-005-F-13	0	70	4.75E-05	2.00	12	0.4918	0.011	3.3307	0.6250	7.1281	0.5992	44.4767	1.0155	22.3357	0.4745	1.97E-07
SPFT-005-F-17	0	70	4.75E-05	2.62	12	0.4871	0.011	3.8537	0.7314	8.0091	0.6778	49.4264	1.1419	25.4846	0.5536	2.07E-07
SPFT-005-F-21	0	70	4.75E-05	4.42	12	0.4754	0.010	4.7608	0.9239	8.9773	0.7724	55.7342	1.3159	29.7155	0.6664	1.97E-07
SPFT-005-F-27	0	70	4.75E-05	5.17	12	0.4622	0.010	4.9077	0.9712	9.6160	0.8432	59.1397	1.4262	31.2276	0.7169	2.29E-07
SPFT-005-F-34	0	70	4.75E-05	6.22	12	0.4520	0.010	5.4604	1.0964	10.5247	0.9364	68.7579	1.6931	35.8920	0.8149	3.00E-07
SPFT-005-F-41	0	70	4.75E-05	7.27	12	0.4394	0.010	5.7971	1.1880	10.4689	0.9493	69.9505	1.7563	36.2647	0.8401	2.86E-07
SPFT-005-F-48	0	70	4.75E-05	8.32	12	0.4258	0.010	6.2570	1.3117	10.8543	1.0051	72.4077	1.8586	37.7735	0.8977	2.75E-07
SPFT-005-F-53	0	70	4.75E-05	12.68	12	0.3871	0.009	6.7452	1.5092	11.4072	1.1258	76.8381	2.1057	40.8572	1.0434	3.00E-07
SPFT-005-F-59	0	70	4.75E-05	13.58	12	0.3489	0.008	6.7651	1.6224	11.4553	1.2117	78.4687	2.3062	41.1414	1.1269	3.44E-07
SPFT-005-F-63	0	70	4.75E-05	14.18	12	0.3369	0.008	8.2699	2.0372	11.4740	1.2421	82.5656	2.4871	43.7133	1.2327	2.26E-07
SPFT-005-F-68	0	70	4.75E-05	16.21	12	0.3156	0.008	7.2833	1.8698	12.1827	1.3777	86.6787	2.7309	43.0026	1.2646	4.33E-07
SPFT-005-F-73	0	70	4.75E-05	16.96	12	0.2937	0.008	7.4481	2.0072	12.9173	1.5330	97.1721	3.2216	45.8091	1.4219	6.11E-07
Exp. #13																
SPFT-005-G-Blank-1	1	70	-	-	9	-	-	0.0927	-	<0.0020	-	1.2701	-	1.3475	-	-
SPFT-005-G-Blank-2	1	70	-	-	9	-	-	0.0158	-	<0.0003	-	1.2367	-	1.1838	-	-
SPFT-005-G-Blank-3	1	70	-	-	9	-	-	0.0203	-	<0.0080	-	1.1532	-	1.0359	-	-

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #13 (cont.)																
SPFT-005-G-3	1	70	6.48E-05	0.46	9	0.4998	0.011	0.2620	0.0444	0.4297	0.0487	6.4039	0.1685	2.6707	0.0428	6.24E-08
SPFT-005-G-5	1	70	6.48E-05	0.77	9	0.4997	0.011	0.3722	0.0734	0.6691	0.0759	7.3812	0.2006	3.5486	0.0712	6.40E-08
SPFT-005-G-9	1	70	6.48E-05	1.39	9	0.4991	0.011	0.3885	0.0777	0.6766	0.0768	7.2339	0.1959	3.5814	0.0724	5.95E-08
SPFT-005-G-15	1	70	6.48E-05	2.31	9	0.4976	0.011	0.3929	0.0790	0.6837	0.0778	6.5716	0.1745	3.5752	0.0723	4.80E-08
SPFT-005-G-17	1	70	6.48E-05	2.62	9	0.4970	0.011	0.4240	0.0873	0.1357	0.0153	6.3114	0.1660	3.6284	0.0741	3.96E-08
SPFT-005-G-21	1	70	6.48E-05	4.42	9	0.4935	0.011	0.4246	0.0879	0.6189	0.0708	5.6705	0.1456	3.9160	0.0838	2.91E-08
SPFT-005-G-27	1	70	6.48E-05	5.17	9	0.4923	0.011	0.3172	0.0595	0.7283	0.0835	4.9817	0.1230	3.6504	0.0753	3.20E-08
SPFT-005-G-34	1	70	6.48E-05	6.22	9	0.4883	0.011	0.2969	0.0751	0.6870	0.0793	4.5399	0.1101	3.6617	0.0814	1.76E-08
SPFT-005-G-41	1	70	6.48E-05	7.27	9	0.4833	0.011	0.3054	0.0779	0.6714	0.0781	4.1476	0.0977	3.5913	0.0797	9.96E-09
SPFT-005-G-52	1	70	6.48E-05	12.53	9	0.4754	0.010	0.3447	0.0894	0.7024	0.0826	5.3568	0.1398	3.5718	0.0799	2.53E-08
SPFT-005-G-59	1	70	6.48E-05	13.58	9	0.4657	0.010	0.3649	0.0962	0.6777	0.0808	5.2326	0.1375	3.5401	0.0799	2.08E-08
SPFT-005-G-63	1	70	6.48E-05	14.18	9	0.4525	0.010	0.3751	0.1009	0.5875	0.0714	5.4809	0.1488	3.7709	0.0895	2.41E-08
SPFT-005-G-68	1	70	6.48E-05	16.21	9	0.4375	0.010	0.3324	0.0910	0.7339	0.0912	5.7884	0.1632	3.9267	0.0970	3.64E-08
Exp. #14																
SPFT-005-H-Blank-1	30	70	6.48E-05	-	9	-	-	0.0390	-	0.0239	-	1.5124	-	37.1271	-	-
SPFT-005-H-Blank-2	30	70	6.48E-05	-	9	-	-	0.0268	-	0.0200	-	1.4757	-	37.1790	-	-
SPFT-005-H-Blank-3	30	70	6.48E-05	-	9	-	-	0.0275	-	0.0204	-	1.4924	-	37.2928	-	-
SPFT-005-H-1	30	70	6.48E-05	0.15	9	0.5004	0.011	0.0755	0.0096	0.0635	0.0076	4.4805	0.0963	33.7010	-	4.36E-08
SPFT-005-H-7	30	70	6.48E-05	1.08	9	0.5002	0.011	0.1772	0.0363	0.1133	0.0171	7.7005	0.2008	35.0131	-	8.28E-08
SPFT-005-H-9	30	70	6.48E-05	1.39	9	0.4999	0.011	0.1994	0.0421	0.1142	0.0173	7.5488	0.1960	35.8843	-	7.74E-08
SPFT-005-H-13	30	70	6.48E-05	2.00	9	0.4997	0.011	0.2137	0.0459	0.1143	0.0173	7.0236	0.1790	35.7342	-	6.70E-08
SPFT-005-H-17	30	70	6.48E-05	2.62	9	0.4994	0.011	0.1946	0.0409	0.1046	0.0155	6.6193	0.1659	37.6499	0.0169	6.29E-08
SPFT-005-H-21	30	70	6.48E-05	4.42	9	0.4989	0.011	0.1852	0.0384	BL	-	5.7075	0.1364	41.8222	0.1521	4.93E-08
SPFT-005-H-27	30	70	6.48E-05	5.17	9	0.4984	0.011	0.1268	0.0231	BL	-	4.7578	0.1056	39.2696	0.0695	4.15E-08
SPFT-005-H-35	30	70	6.48E-05	6.37	9	0.4983	0.011	0.0821	0.0145	BL	-	4.0094	0.0824	38.9354	0.0570	3.42E-08
SPFT-005-H-41	30	70	6.48E-05	7.27	9	0.4981	0.011	0.1011	0.0195	BL	-	3.5406	0.0672	39.1182	0.0629	2.40E-08
SPFT-005-H-53	30	70	6.48E-05	12.68	9	0.4979	0.011	0.1519	0.0329	BL	-	3.1592	0.0548	43.7838	0.2143	1.10E-08
SPFT-005-H-59	30	70	6.48E-05	13.58	9	0.4964	0.011	0.2091	0.0481	BL	-	3.1538	0.0547	48.7901	0.3775	3.35E-09
SPFT-005-H-63	30	70	6.48E-05	14.18	9	0.4955	0.011	0.2249	0.0523	BL	-	3.3327	0.0606	54.1899	0.5537	4.20E-09
Exp. #15																
SPFT-005-I-Blank-1	60	70	6.48E-05	-	9	-	-	0.0413	-	0.0455	-	1.4676	-	74.1914	-	-
SPFT-005-I-Blank-2	60	70	6.48E-05	-	9	-	-	0.0308	-	0.0428	-	1.4338	-	73.6577	-	-
SPFT-005-I-Blank-3	60	70	6.48E-05	-	9	-	-	<0.0166	-	0.0383	-	1.5872	-	76.5374	-	-
SPFT-005-I-1	60	70	6.48E-05	0.15	9	0.9998	0.022	0.1154	0.0097	BL	-	6.0941	0.0751	65.9466	-	3.29E-08
SPFT-005-I-5	60	70	6.48E-05	0.77	9	0.9996	0.022	0.2548	0.0280	BL	-	10.8930	0.1530	71.6794	-	6.29E-08
SPFT-005-I-9	60	70	6.48E-05	1.39	9	0.9992	0.022	0.2341	0.0253	BL	-	11.4313	0.1618	71.4512	-	6.87E-08

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #15 (cont.)																
SPFT-005-I-13	60	70	6.48E-05	2.00	9	0.9989	0.022	0.2461	0.0269	BL	-	10.4222	0.1455	72.8369	-	5.97E-08
SPFT-005-I-17	60	70	6.48E-05	2.62	9	0.9985	0.022	0.2521	0.0277	BL	-	9.3418	0.1279	76.9461	0.0446	5.04E-08
SPFT-005-I-21	60	70	6.48E-05	4.42	9	0.9979	0.021	0.2040	0.0214	BL	-	7.4441	0.0971	83.2348	0.1465	3.81E-08
SPFT-005-I-27	60	70	6.48E-05	5.17	9	0.9974	0.021	0.1374	0.0126	BL	-	6.1992	0.0769	78.9382	0.0769	3.24E-08
SPFT-005-I-34	60	70	6.48E-05	6.22	9	0.9973	0.021	0.1159	0.0112	BL	-	5.7778	0.0706	79.4014	0.0931	2.99E-08
SPFT-005-I-41	60	70	6.48E-05	7.27	9	0.9971	0.021	0.1255	0.0125	BL	-	4.9479	0.0572	78.4232	0.0772	2.25E-08
SPFT-005-I-53	60	70	6.48E-05	12.68	9	0.9968	0.021	0.1137	0.0109	BL	-	4.2419	0.0457	71.0094	-	1.75E-08
SPFT-005-I-59	60	70	6.48E-05	13.58	9	0.9955	0.021	0.1499	0.0157	BL	-	4.1080	0.0435	69.4389	-	1.40E-08
SPFT-005-I-63	60	70	6.48E-05	14.18	9	0.9952	0.021	0.1393	0.0143	0.0678	0.0014	4.1169	0.0437	77.4250	0.0611	1.48E-08
SPFT-005-I-68	60	70	6.48E-05	16.21	9	0.9950	0.021	0.0875	0.0075	0.0635	0.0012	4.0839	0.0432	71.7397	-	1.80E-08
SPFT-005-I-73	60	70	6.48E-05	16.96	9	0.9947	0.021	0.1019	0.0094	0.0770	0.0020	4.5675	0.0510	72.2664	-	2.10E-08
Exp. #16																
SPFT-005-J-Blank-1	90	70	6.48E-05	-	9	-	-	<-0.0407	-	0.0692	-	1.5862	-	111.9900	-	-
SPFT-005-J-Blank-2	90	70	6.48E-05	-	9	-	-	0.0232	-	0.0656	-	1.5833	-	109.5940	-	-
SPFT-005-J-Blank-3	90	70	6.48E-05	-	9	-	-	<-0.0013	-	0.0596	-	1.7176	-	112.8300	-	-
SPFT-005-J-1	90	70	6.48E-05	0.15	9	0.9992	0.022	< 0.0043	0.0006	BL	-	6.0129	0.0719	100.3220	-	3.59E-08
SPFT-005-J-5	90	70	6.48E-05	0.77	9	0.9991	0.022	0.1166	0.0153	BL	-	11.4265	0.1599	110.0990	-	7.27E-08
SPFT-005-J-9	90	70	6.48E-05	1.39	9	0.9989	0.022	0.0931	0.0122	BL	-	11.8754	0.1672	112.0280	0.0006	7.80E-08
SPFT-005-J-13	90	70	6.48E-05	2.00	9	0.9987	0.022	0.1058	0.0139	BL	-	11.4684	0.1606	113.0690	0.0175	7.38E-08
SPFT-005-J-17	90	70	6.48E-05	2.62	9	0.9986	0.021	0.0964	0.0127	BL	-	9.3761	0.1266	116.8760	0.0791	5.73E-08
SPFT-005-J-21	90	70	6.48E-05	4.42	9	0.9983	0.021	0.0591	0.0078	BL	-	7.3802	0.0942	122.8580	0.1760	4.35E-08
SPFT-005-J-27	90	70	6.48E-05	5.17	9	0.9982	0.021	0.0755	0.0099	BL	-	6.1934	0.0749	116.5530	0.0739	3.27E-08
SPFT-005-J-34	90	70	6.48E-05	6.22	9	0.9980	0.021	0.0862	0.0083	BL	-	5.9473	0.0709	118.3050	0.1411	3.15E-08
SPFT-005-J-41	90	70	6.48E-05	7.27	9	0.9979	0.021	0.0545	0.0041	BL	-	4.7504	0.0515	117.2900	0.1247	2.38E-08
SPFT-005-J-53	90	70	6.48E-05	12.68	9	0.9977	0.021	0.0500	0.0035	BL	-	3.8722	0.0372	112.7610	0.0513	1.70E-08
SPFT-005-J-59	90	70	6.48E-05	13.58	9	0.9975	0.021	0.0500	0.0035	BL	-	3.7943	0.0360	115.3280	0.0929	1.63E-08
SPFT-005-J-63	90	70	6.48E-05	14.18	9	0.9975	0.021	0.0588	0.0047	BL	-	4.0074	0.0394	111.1880	0.0258	1.75E-08
SPFT-005-J-68	90	70	6.48E-05	16.21	9	0.9974	0.021	0.0500	0.0035	BL	-	3.7447	0.0352	112.6250	0.0491	1.59E-08
SPFT-005-J-74	90	70	6.48E-05	17.11	9	0.9973	0.021	0.0548	0.0042	BL	-	7.7279	0.0999	114.0860	0.0728	4.82E-08
Exp. #17																
SPFT-005-K-Blank-1	120	70	6.48E-05	-	9	-	-	0.0495	-	0.0890	-	1.7483	-	137.1220	-	-
SPFT-005-K-Blank-3	120	70	6.48E-05	-	9	-	-	<-0.0125	-	0.0734	-	1.8823	-	142.0640	-	-
SPFT-005-K-1	120	70	6.48E-05	0.15	9	1.9999	0.043	0.1431	0.0061	0.0798	-	7.9273	0.0507	100.3220	-	-
SPFT-005-K-5	120	70	6.48E-05	0.77	9	1.9995	0.043	0.4678	0.0274	0.1228	0.0010	18.9400	0.1410	110.0990	-	-
SPFT-005-K-10	120	70	6.48E-05	1.54	9	1.9985	0.043	0.4204	0.0243	0.1070	0.0005	21.1484	0.1592	112.0280	0.0003	6.78E-08
SPFT-005-K-13	120	70	6.48E-05	2.00	9	1.9979	0.043	0.4185	0.0242	0.1020	0.0004	21.5583	0.1626	113.0690	0.0087	6.96E-08

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #17 (cont.)																
SPFT-005-K-17	120	70	6.48E-05	2.62	9	1.9974	0.043	0.3692	0.0210	BL	0.0003	19.3216	0.1442	116.8760	0.0396	6.20E-08
SPFT-005-K-21	120	70	6.48E-05	4.42	9	1.9967	0.043	0.2232	0.0114	0.1156	0.0008	15.5040	0.1129	122.8580	0.0880	5.11E-08
SPFT-005-K-28	120	70	6.48E-05	5.17*	9	1.9962	0.043	0.1127	0.0042	BL	-	10.6653	0.0732	116.5530	0.0370	3.48E-08
Exp. #18																
SPFT-005-L-Blank-1	140	70	6.48E-05	-	9	-	-	<-0.0052	-	0.0620	-	2.0626	-	156.0320	-	-
SPFT-005-L-Blank-2	140	70	6.48E-05	-	9	-	-	0.0330	-	0.0575	-	1.9536	-	160.5510	-	-
SPFT-005-L-Blank-3	140	70	6.48E-05	-	9	-	-	0.0285	-	0.0560	-	1.6216	-	140.3560	-	-
SPFT-005-L-2	140	70	6.48E-05	0.15	9	1.9998	0.043	0.1725	0.0113	BL	-	16.6894	0.1187	145.0720	-	5.40E-08
SPFT-005-L-5	140	70	6.48E-05	0.77	9	1.9995	0.043	0.3030	0.0199	BL	0.0006	24.9147	0.1855	156.3830	-	8.33E-08
SPFT-005-L-9	140	70	6.48E-05	1.54	9	1.9990	0.043	0.2243	0.0147	BL	-	25.1107	0.1871	146.3140	-	8.68E-08
SPFT-005-L-13	140	70	6.48E-05	2.00	9	1.9986	0.043	0.1987	0.0130	BL	-	23.7171	0.1758	147.2940	-	8.19E-08
SPFT-005-L-17	140	70	6.48E-05	2.62	9	1.9983	0.043	0.1914	0.0126	BL	0.0009	21.3952	0.1570	162.7740	0.0546	7.27E-08
SPFT-005-L-21	140	70	6.48E-05	4.42	9	1.9977	0.043	0.1581	0.0104	BL	0.0006	17.4625	0.1251	168.8790	0.1040	5.77E-08
SPFT-005-L-27	140	70	6.48E-05	5.17	9	1.9972	0.043	0.1095	0.0072	BL	-	14.2971	0.0994	149.2650	-	4.64E-08
SPFT-005-L-34	140	70	6.48E-05	6.22	9	1.9969	0.043	0.1403	0.0073	BL	-	10.8501	0.0750	144.0750	0.0301	3.40E-08
SPFT-005-L-35	140	70	6.48E-05	6.37	9	1.9967	0.043	0.1375	0.0072	BL	0.0001	10.0918	0.0688	146.8920	0.0529	3.10E-08
SPFT-005-L-41	140	70	6.48E-05	7.27	9	1.9966	0.043	0.1203	0.0060	BL	-	8.0497	0.0522	143.9730	0.0293	2.32E-08
SPFT-005-L-59	140	70	6.48E-05	13.58	9	1.9957	0.043	0.1160	0.0057	BL	-	5.8974	0.0348	149.4540	0.0737	1.46E-08
SPFT-005-L-63	140	70	6.48E-05	14.18	9	1.9948	0.043	0.1340	0.0069	BL	0.0007	5.8475	0.0344	157.9370	0.1424	1.38E-08
SPFT-005-L-68	140	70	6.48E-05	16.21	9	1.9945	0.043	0.1042	0.0050	BL	-	5.4546	0.0312	158.3120	0.1455	1.32E-08
SPFT-005-L-74	140	70	6.48E-05	16.96	9	1.9942	0.043	0.1106	0.0054	BL	-	6.9707	0.0435	150.5870	0.0829	1.92E-08
Exp. #19																
SPFT-006-A-Blank-1	0	40	-	-	7	-	-	<-0.0237	-	<-0.0165	-	0.1569	-	0.0304	-	-
SPFT-006-A-Blank-2	0	40	-	-	7	-	-	< 0.0084	-	<-0.0172	-	0.1592	-	0.0417	-	-
SPFT-006-A-Blank-3	0	40	-	-	7	-	-	<-0.0191	-	<-0.0123	-	0.1343	-	0.0848	-	-
SPFT-006-A-Blank-4	0	40	-	-	7	-	-	<-0.0028	-	<-0.0132	-	0.0076	-	0.1534	-	-
SPFT-006-A-1	0	40	3.89E-05	0.50	7	1.0030	0.022	0.1511	0.0119	0.0952	0.0034	3.9187	0.0367	0.1649	0.0008	1.25E-08
SPFT-006-A-2	0	40	3.89E-05	0.99	7	1.0029	0.022	0.2452	0.0192	0.0978	0.0035	5.3406	0.0506	0.1975	0.0011	1.58E-08
SPFT-006-A-21	0	40	3.89E-05	9.94	7	1.0031	0.022	0.3435	0.0270	0.1050	0.0038	6.1318	0.0582	0.1758	0.0009	1.57E-08
SPFT-006-A-23	0	40	3.89E-05	10.93	7	0.9973	0.022	0.3257	0.0257	BL	-	5.5231	0.0525	0.2210	0.0013	1.35E-08
SPFT-006-A-27	0	40	3.89E-05	12.42	7	0.9966	0.021	0.3311	0.0261	BL	-	5.7949	0.0552	0.2165	0.0013	1.46E-08
SPFT-006-A-29	0	40	3.89E-05	13.41	7	0.9959	0.021	0.3097	0.0244	BL	-	5.2127	0.0495	0.1928	0.0010	1.26E-08
SPFT-006-A-32	0	40	3.89E-05	14.90	7	0.9953	0.021	0.2797	0.0221	BL	-	4.4925	0.0425	0.1961	0.0011	1.03E-08
SPFT-006-A-34	0	40	3.89E-05	15.89	7	0.9947	0.021	0.2847	0.0225	BL	-	4.6739	0.0443	0.2076	0.0012	1.10E-08
SPFT-006-A-37	0	40	3.89E-05	17.38	7	0.9941	0.021	0.2711	0.0214	BL	-	4.7982	0.0456	0.2298	0.0014	1.22E-08
SPFT-006-A-39	0	40	3.89E-05	18.37	7	0.9935	0.021	0.3140	0.0248	BL	-	5.0690	0.0482	0.2467	0.0016	1.18E-08

*The experiment was terminated early due to technical difficulties.

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #19 (cont.)																
SPFT-006-A-42	0	40	3.89E-05	19.86	7	0.9928	0.021	0.3291	0.0260	BL	-	4.4894	0.0426	0.2441	0.0016	8.33E-09
SPFT-006-A-47	0	40	3.89E-05	22.34	7	0.9918	0.021	0.2821	0.0223	BL	-	3.5457	0.0334	0.2930	0.0020	5.57E-09
SPFT-006-A-50	0	40	3.89E-05	23.83	7	0.9909	0.021	0.2721	0.0215	BL	-	2.9904	0.0280	0.2048	0.0012	3.23E-09
SPFT-006-A-52	0	40	3.89E-05	24.82	7	0.9904	0.021	0.2463	0.0195	BL	-	2.9400	0.0275	0.2419	0.0015	4.01E-09
SPFT-006-A-54	0	40	3.89E-05	25.81	7	0.9899	0.021	0.2427	0.0192	BL	-	2.6266	0.0244	0.2286	0.0014	2.61E-09
SPFT-006-A-57	0	40	3.89E-05	27.30	7	0.9895	0.021	0.2020	0.0160	BL	-	2.8320	0.0264	0.2288	0.0007	5.25E-09
SPFT-006-A-59	0	40	3.89E-05	28.29	7	0.9890	0.021	0.2566	0.0203	BL	-	3.3746	0.0318	0.2869	0.0013	5.75E-09
SPFT-006-A-62	0	40	3.89E-05	29.78	7	0.9885	0.021	0.2179	0.0173	BL	-	3.0050	0.0281	0.2989	0.0014	5.47E-09
SPFT-006-A-64	0	40	3.89E-05	30.77	7	0.9881	0.021	0.1967	0.0156	BL	-	2.6993	0.0252	0.3033	0.0015	4.81E-09
Exp. #20																
SPFT-006-B-Blank-4	0	40	3.89E-05	-	8	-	-	< -0.0021	-	< -0.0127	-	0.0036	-	< 0.0258	-	-
SPFT-006-B-57	0	40	3.89E-05	27.30**	8	1.0046	0.022	0.0778	0.0061	BL	-	1.4614	0.0141	0.4495	0.0041	4.05E-09
SPFT-006-B-59	0	40	3.89E-05	28.29	8	0.9935	0.022	0.0796	0.0063	BL	-	1.3935	0.0135	0.4124	0.0037	3.65E-09
SPFT-006-B-60	0	40	3.89E-05	28.79	8	0.9934	0.022	0.0759	0.0060	BL	-	1.3695	0.0133	0.3737	0.0034	3.68E-09
SPFT-006-B-62	0	40	3.89E-05	29.78	8	0.9933	0.022	0.0740	0.0058	BL	-	1.3386	0.0130	0.3283	0.0029	3.61E-09
SPFT-006-B-64	0	40	3.89E-05	30.77	8	0.9932	0.022	0.0622	0.0049	BL	-	1.0233	0.0099	0.2850	0.0025	2.53E-09
SPFT-006-B-65	0	40	3.89E-05	31.27	8	0.9931	0.022	0.0684	0.0054	BL	-	1.0864	0.0105	0.3548	0.0032	2.59E-09
Exp. #21																
SPFT-006-C-Blank-1	0	40	3.89E-05	-	9	-	-	0.0433	-	< -0.0087	-	0.1408	-	0.0571	-	-
SPFT-006-C-Blank-2	0	40	3.89E-05	-	9	-	-	< -0.0127	-	< 0.0040	-	0.1119	-	0.0426	-	-
SPFT-006-C-Blank-3	0	40	3.89E-05	-	9	-	-	< -0.0066	-	< -0.0062	-	0.0668	-	0.0652	-	-
SPFT-006-C-1	0	40	3.89E-05	0.50	9	0.4999	0.011	BL	-	0.0155	0.0011	1.2587	0.0218	0.1094	0.0010	1.10E-08
SPFT-006-C-2	0	40	3.89E-05	0.99	9	0.4999	0.011	0.0568	0.0021	0.0277	0.0019	1.7286	0.0309	0.1455	0.0017	1.45E-08
SPFT-006-C-21	0	40	3.89E-05	9.94	9	0.4999	0.011	BL	-	0.0115	0.0008	1.2153	0.0215	0.6250	0.0113	1.08E-08
SPFT-006-C-23	0	40	3.89E-05	10.93	9	0.4999	0.011	BL	-	0.1831	0.0125	1.0814	0.0189	0.6332	0.0115	9.50E-09
SPFT-006-C-27	0	40	3.89E-05	12.42	9	0.4999	0.011	BL	-	0.1502	0.0103	0.9534	0.0164	0.6217	0.0112	8.25E-09
SPFT-006-C-29	0	40	3.89E-05	13.41	9	0.4999	0.011	BL	-	0.1637	0.0112	0.9227	0.0158	0.6087	0.0110	7.95E-09
SPFT-006-C-32	0	40	3.89E-05	14.90	9	0.4999	0.011	BL	-	0.0151	0.0010	0.7771	0.0130	0.5369	0.0096	6.52E-09
SPFT-006-C-34	0	40	3.89E-05	15.89	9	0.4999	0.011	BL	-	0.1240	0.0085	0.8356	0.0141	0.5884	0.0106	7.09E-09
SPFT-006-C-37	0	40	3.89E-05	17.38	9	0.4999	0.011	BL	-	0.1707	0.0117	0.8168	0.0137	0.5564	0.0100	6.91E-09
SPFT-006-C-39	0	40	3.89E-05	18.37	9	0.4999	0.011	0.0762	0.0120	BL	-	0.9148	0.0156	0.7153	0.0126	1.83E-09
SPFT-006-C-42	0	40	3.89E-05	19.86	9	0.4997	0.011	0.0709	0.0112	0.0166	0.0011	0.8407	0.0151	0.6667	0.0117	1.97E-09
SPFT-006-C-47	0	40	3.89E-05	22.34	9	0.4995	0.011	0.0541	0.0085	0.0684	0.0047	0.6585	0.0115	0.5418	0.0093	1.51E-09
SPFT-006-C-50	0	40	3.89E-05	23.83	9	0.4993	0.011	0.0533	0.0084	0.0607	0.0041	0.6605	0.0116	0.5286	0.0090	1.60E-09
SPFT-006-C-52	0	40	3.89E-05	24.82	9	0.4992	0.011	BL	-	0.1988	0.0136	0.6519	0.0114	0.5346	0.0091	5.74E-09
SPFT-006-C-54	0	40	3.89E-05	25.81	9	0.4991	0.011	0.0558	0.0088	0.1596	0.0109	0.7192	0.0127	0.5939	0.0103	1.98E-09

**Samples collected prior to Day #27 were discarded due to technical difficulties.

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #21 (cont.)											-					
SPFT-006-C-57	0	40	3.89E-05	27.30	9	0.4990	0.011	0.0727	0.0115	BL	-	0.8075	0.0144	0.6711	0.0118	1.50E-09
SPFT-006-C-60	0	40	3.89E-05	28.79	9	0.4988	0.011	0.0705	0.0111	0.0816	0.0056	0.7880	0.0141	0.6639	0.0116	1.48E-09
SPFT-006-C-64	0	40	3.89E-05	30.77	9	0.4986	0.011	0.0700	0.0110	0.0906	0.0062	0.8136	0.0146	0.6740	0.0118	1.78E-09
Exp. #22																
SPFT-006-D-Blank-1	0	40	3.89E-05	-	10	-	-	< 0.0070	-	< -0.0067	-	0.1553	-	0.0385	-	-
SPFT-006-D-Blank-2	0	40	3.89E-05	-	10	-	-	< -0.0363	-	< 0.0055	-	0.1139	-	0.0503	-	-
SPFT-006-D-Blank-3	0	40	3.89E-05	-	10	-	-	< -0.0411	-	0.0089	-	0.0480	-	0.0918	-	-
SPFT-006-D-Blank-4	0	40	3.89E-05	-	10	-	-	< -0.0061	-	0.0130	-	0.0044	-	< 0.0933	-	-
SPFT-006-D-1	0	40	3.89E-05	0.50	10	0.4995	0.011	0.0326	0.0040	0.0223	0.0015	1.0806	0.0211	0.1609	0.0018	8.57E-09
SPFT-006-D-2	0	40	3.89E-05	0.99	10	0.4995	0.011	0.0338	0.0042	0.0499	0.0034	1.2935	0.0252	0.2361	0.0033	1.06E-08
SPFT-006-D-21	0	40	3.89E-05	9.94	10	0.4986	0.011	0.1120	0.0177	0.3336	0.0224	2.0387	0.0368	1.2002	0.0220	9.61E-09
SPFT-006-D-23	0	40	3.89E-05	10.93	10	0.4977	0.011	0.1160	0.0183	0.0663	0.0042	1.9059	0.0342	1.1106	0.0203	7.99E-09
SPFT-006-D-27	0	40	3.89E-05	12.42	10	0.4974	0.011	0.1112	0.0176	0.0718	0.0045	1.9064	0.0342	1.1619	0.0213	8.38E-09
SPFT-006-D-29	0	40	3.89E-05	13.41	10	0.4972	0.011	0.0980	0.0155	0.0556	0.0034	1.7681	0.0315	1.1016	0.0201	8.07E-09
SPFT-006-D-32	0	40	3.89E-05	14.90	10	0.4970	0.011	0.1002	0.0158	0.1498	0.0099	1.7408	0.0310	1.0863	0.0198	7.63E-09
SPFT-006-D-34	0	40	3.89E-05	15.89	10	0.4968	0.011	0.0932	0.0147	0.3885	0.0263	1.8165	0.0325	1.1906	0.0219	8.94E-09
SPFT-006-D-37	0	40	3.89E-05	17.38	10	0.4966	0.011	0.0959	0.0152	0.1316	0.0086	1.6326	0.0289	1.0322	0.0188	6.91E-09
SPFT-006-D-39	0	40	3.89E-05	18.37	10	0.4964	0.011	0.1218	0.0193	0.0511	0.0031	1.8877	0.0360	1.2935	0.0234	8.42E-09
SPFT-006-D-42	0	40	3.89E-05	19.86	10	0.4961	0.011	0.1211	0.0192	0.1062	0.0069	1.8891	0.0361	1.3052	0.0237	8.50E-09
SPFT-006-D-47	0	40	3.89E-05	22.34	10	0.4958	0.011	0.0849	0.0134	0.1222	0.0080	1.5372	0.0292	1.1110	0.0199	7.92E-09
SPFT-006-D-50	0	40	3.89E-05	23.83	10	0.4955	0.011	0.0736	0.0117	0.1478	0.0098	1.2425	0.0234	1.0984	0.0197	5.91E-09
SPFT-006-D-52	0	40	3.89E-05	24.82	10	0.4953	0.011	0.0769	0.0122	0.1772	0.0118	1.1841	0.0223	1.1423	0.0205	5.07E-09
SPFT-006-D-54	0	40	3.89E-05	25.81	10	0.4952	0.011	0.0671	0.0106	0.4880	0.0331	1.1372	0.0214	1.1145	0.0200	5.39E-09
SPFT-006-D-57	0	40	3.89E-05	27.30	10	0.4950	0.011	0.1583	0.0251	0.0299	0.0017	1.0877	0.0212	1.0923	0.0195	-
SPFT-006-D-59	0	40	3.89E-05	28.29	10	0.4946	0.011	0.1769	0.0281	0.1471	0.0097	1.1061	0.0216	1.2267	0.0222	-
SPFT-006-D-62	0	40	3.89E-05	29.78	10	0.4943	0.011	0.1479	0.0235	0.1111	0.0073	0.8742	0.0171	1.0761	0.0192	-
SPFT-006-D-64	0	40	3.89E-05	30.77	10	0.4940	0.011	0.1108	0.0176	0.0516	0.0032	0.7224	0.0141	0.8909	0.0156	-
Exp. #23																
SPFT-006-E-Blank-1	0	40	-	-	11	-	-	0.0342	-	0.0058	-	0.1735	-	0.0605	-	-
SPFT-006-E-Blank-2	0	40	-	-	11	-	-	< -0.0262	-	0.0086	-	0.1119	-	0.0580	-	-
SPFT-006-E-Blank-3	0	40	-	-	11	-	-	< -0.0073	-	0.0052	-	0.0620	-	0.1815	-	-
SPFT-006-E-Blank-4	0	40	-	-	11	-	-	< -0.0074	-	< 0.0005	-	0.0942	-	< 0.1110	-	-
SPFT-006-E-1	0	40	3.89E-05	0.50	11	0.5011	0.011	0.1329	0.0155	0.3354	0.0224	2.7483	0.0534	1.0559	0.0185	1.91E-08
SPFT-006-E-2	0	40	3.89E-05	0.99	11	0.5009	0.011	0.2507	0.0340	0.6845	0.0462	4.2422	0.0825	1.9037	0.0349	2.44E-08
SPFT-006-E-21	0	40	3.89E-05	9.94	11	0.4980	0.011	0.3523	0.0556	0.8319	0.0596	4.8790	0.0930	2.6798	0.0501	1.88E-08
SPFT-006-E-23	0	40	3.89E-05	10.93	11	0.4944	0.011	0.3491	0.0553	0.8165	0.0588	4.8083	0.0921	2.6323	0.0494	1.85E-08
SPFT-006-E-27	0	40	3.89E-05	12.42	11	0.4878	0.011	0.3838	0.0614	0.8836	0.0643	5.0118	0.0970	2.8768	0.0547	1.79E-08

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #23 (cont)																
SPFT-006-E-29	0	40	3.89E-05	13.41	11	0.4799	0.010	0.3748	0.0606	0.8638	0.0635	4.9224	0.0962	2.7899	0.0536	1.79E-08
SPFT-006-E-31	0	40	3.89E-05	14.41	11	0.4713	0.010	0.3814	0.0624	0.8899	0.0662	5.0026	0.0990	2.8891	0.0562	1.84E-08
SPFT-006-E-34	0	40	3.89E-05	15.89	11	0.4619	0.010	0.3655	0.0606	0.9366	0.0707	5.1720	0.1038	2.8110	0.0554	2.17E-08
SPFT-006-E-37	0	40	3.89E-05	17.38	11	0.4520	0.010	0.3614	0.0608	0.9350	0.0716	5.1146	0.1041	2.7360	0.0546	2.18E-08
SPFT-006-E-39	0	40	3.89E-05	18.37	11	0.4416	0.010	0.3373	0.0577	0.8714	0.0642	4.6476	0.0970	2.7938	0.0550	1.98E-08
SPFT-006-E-42	0	40	3.89E-05	19.86	11	0.4308	0.010	0.4350	0.0756	0.8173	0.0607	4.4982	0.0954	2.6852	0.0536	9.94E-09
SPFT-006-E-47	0	40	3.89E-05	22.34	11	0.4159	0.010	0.3948	0.0702	0.6192	0.0459	3.7800	0.0818	1.9948	0.0398	5.83E-09
SPFT-006-E-50	0	40	3.89E-05	23.83	11	0.4013	0.009	0.3610	0.0658	0.5598	0.0414	3.2082	0.0709	1.9043	0.0387	2.58E-09
SPFT-006-E-52	0	40	3.89E-05	24.82	11	0.3869	0.009	0.3268	0.0610	0.5197	0.0384	2.9804	0.0674	1.7184	0.0354	3.21E-09
SPFT-006-E-54	0	40	3.89E-05	25.81	11	0.3732	0.009	0.3131	0.0599	0.5293	0.0438	3.1281	0.0725	1.7419	0.0368	6.37E-09
SPFT-006-E-57	0	40	3.89E-05	27.30	11	0.3594	0.009	0.2776	0.0544	0.6874	0.0584	3.6556	0.0884	2.3503	0.0541	1.71E-08
SPFT-006-E-59	0	40	3.89E-05	28.29	11	0.3466	0.008	0.3120	0.0627	0.7352	0.0640	3.8375	0.0951	2.5288	0.0599	1.63E-08
SPFT-006-E-62	0	40	3.89E-05	29.78	11	0.3315	0.008	0.3199	0.0662	0.7525	0.0674	3.9351	0.1005	2.7531	0.0674	1.73E-08
SPFT-006-E-64	0	40	3.89E-05	30.77	11	0.3155	0.008	0.3460	0.0740	0.7449	0.0690	3.8343	0.1012	2.5761	0.0650	1.37E-08
Exp. #24																
SPFT-006-F-Blank-1	0	40	-	-	12	-	-	0.0632	-	0.0073	-	0.4628	-	0.2632	-	-
SPFT-006-F-Blank-2	0	40	-	-	12	-	-	< 0.0013	-	0.0150	-	0.1755	-	0.1768	-	-
SPFT-006-F-Blank-3	0	40	-	-	12	-	-	< 0.0029	-	0.0065	-	0.0934	-	0.5876	-	-
SPFT-006-F-Blank-4	0	40	-	-	12	-	-	0.0291	-	0.0060	-	0.0921	-	< 0.2232	-	-
SPFT-006-F-1	0	40	3.89E-05	0.50	12	0.5010	0.011	0.2042	0.0222	0.4455	0.0328	3.6246	0.0621	1.4783	0.0235	2.01E-08
SPFT-006-F-2	0	40	3.89E-05	0.99	12	0.5009	0.011	0.2941	0.0363	0.6292	0.0465	5.0325	0.0898	1.9953	0.0336	2.69E-08
SPFT-006-F-21	0	40	3.89E-05	9.94	12	0.4942	0.011	0.8380	0.1327	1.8973	0.1413	11.0012	0.2180	6.1343	0.1165	4.30E-08
SPFT-006-F-23	0	40	3.89E-05	10.93	12	0.4858	0.011	0.7851	0.1257	1.771	0.1319	10.1917	0.2043	5.6810	0.1088	3.96E-08
SPFT-006-F-27	0	40	3.89E-05	12.42	12	0.4712	0.010	0.6282	0.1026	1.4799	0.1101	9.5409	0.1952	4.4492	0.0862	4.66E-08
SPFT-006-F-29	0	40	3.89E-05	13.41	12	0.4582	0.010	0.6383	0.1062	1.4458	0.1076	9.4488	0.1970	4.5507	0.0899	4.57E-08
SPFT-006-F-32	0	40	3.89E-05	14.90	12	0.4433	0.010	0.7645	0.1301	1.7018	0.1267	9.6274	0.2051	5.5359	0.1126	3.78E-08
SPFT-006-F-34	0	40	3.89E-05	15.89	12	0.4243	0.010	0.8762	0.1536	2.2227	0.1656	11.5539	0.2535	6.5584	0.1381	5.03E-08
SPFT-006-F-37	0	40	3.89E-05	17.38	12	0.4003	0.009	0.9257	0.1687	2.3301	0.1737	11.6267	0.2652	6.9197	0.1517	4.86E-08
SPFT-006-F-39	0	40	3.89E-05	18.37	12	0.3735	0.009	0.8635	0.1645	ND	0.1567	11.3603	0.2691	6.8867	0.1484	5.27E-08
SPFT-006-F-42	0	40	3.89E-05	19.86	12	0.3463	0.008	0.9005	0.1804	ND	0.1497	11.3157	0.2819	6.5073	0.1467	5.11E-08
SPFT-006-F-47	0	40	3.89E-05	22.34	12	0.3157	0.008	0.7375	0.1571	ND	0.1273	10.2699	0.2719	5.1319	0.1198	5.78E-08
SPFT-006-F-50	0	40	3.89E-05	23.83	12	0.2886	0.007	0.6904	0.1561	ND	0.1112	9.0386	0.2538	4.8131	0.1182	4.92E-08
SPFT-006-F-52	0	40	3.89E-05	24.82	12	0.2611	0.007	0.6591	0.1592	ND	0.1071	8.5014	0.2550	4.7083	0.1233	4.82E-08
SPFT-006-F-54	0	40	3.89E-05	25.81	12	0.2336	0.006	0.6247	0.1557	ND	0.1036	7.9483	0.2566	4.5277	0.1270	5.08E-08
SPFT-006-F-57	0	40	3.89E-05	27.30	12	0.2073	0.006	0.5836	0.1569	1.3571	0.1009	7.7674	0.2715	4.4694	0.1481	5.77E-08
SPFT-006-F-59	0	40	3.89E-05	28.29	12	0.1818	0.005	0.6521	0.1924	1.5123	0.1125	8.3011	0.3169	5.0596	0.1841	6.26E-08

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #24 (cont)																
SPFT-006-F-62	0	40	3.89E-05	29.78	12	0.1515	0.005	0.7834	0.2631	1.7502	0.1303	9.5610	0.4127	6.1230	0.2536	7.53E-08
SPFT-006-F-64	0	40	3.89E-05	30.77	12	0.1138	0.004	0.8153	0.3319	1.8939	0.1411	9.9568	0.5206	6.4071	0.3219	9.49E-08
Exp. #25																
SPFT-006-G-Blank-1	1	40	-	-	9	-	-	< -0.0014	-	< -0.0000	-	0.0861	-	1.1383	-	-
SPFT-006-G-Blank-2	1	40	-	-	9	-	-	< -0.0239	-	< -0.0011	-	0.0664	-	1.1114	-	-
SPFT-006-G-Blank-3	1	40	-	-	9	-	-	< -0.0118	-	< -0.0187	-	0.0620	-	2.3253	-	-
SPFT-006-G-4	1	40	1.30E-05	1.98	9	0.5012	0.011	0.0868	0.0045	0.1568	0.0038	3.0989	0.0203	1.7252	0.0039	7.92E-09
SPFT-006-G-11	1	40	1.11E-05	5.46	9	0.5010	0.011	0.1583	0.0071	0.3105	0.0064	3.7659	0.0211	2.1654	0.0057	7.05E-09
SPFT-006-G-14	1	40	1.28E-05	6.97	9	0.5008	0.011	0.1856	0.0096	0.3298	0.0078	3.6351	0.0235	2.2929	0.0075	7.01E-09
SPFT-006-G-17	1	40	1.05E-05	8.45	9	0.5007	0.011	0.1967	0.0084	0.3752	0.0073	3.7497	0.0199	2.5391	0.0074	5.82E-09
SPFT-006-G-23	1	40	1.07E-05	10.93	9	0.5005	0.011	0.2036	0.0088	0.4037	0.0080	3.4777	0.0187	2.5657	0.0077	5.02E-09
SPFT-006-G-26	1	40	1.18E-05	11.93	9	0.5003	0.011	0.2388	0.0114	0.4038	0.0088	3.3268	0.0199	2.7443	0.0095	4.26E-09
SPFT-006-G-29	1	40	8.50E-06	13.41	9	0.5002	0.011	0.2562	0.0088	0.4214	0.0066	3.4070	0.0146	3.0272	0.0081	2.94E-09
SPFT-006-G-31	1	40	1.01E-05	14.41	9	0.5001	0.011	0.2405	0.0098	0.4305	0.0080	3.2166	0.0164	2.9803	0.0093	3.32E-09
SPFT-006-G-33	1	40	1.17E-05	15.40	9	0.5000	0.011	0.2408	0.0113	0.4552	0.0098	3.2221	0.0190	3.1503	0.0118	3.86E-09
SPFT-006-G-36	1	40	9.07E-06	16.89	9	0.4998	0.011	0.2448	0.0090	0.4482	0.0075	3.2646	0.0150	3.1896	0.0093	3.03E-09
SPFT-006-G-57	1	40	1.28E-05	27.30	9	0.4993	0.011	0.1547	0.0079	0.3961	0.0094	2.4682	0.0156	3.1975	0.0056	3.86E-09
SPFT-006-G-61	1	40	1.05E-05	29.29	9	0.4988	0.011	0.1726	0.0073	0.3918	0.0076	2.3318	0.0121	3.1849	0.0045	2.42E-09
SPFT-006-G-63	1	40	9.22E-06	30.28	9	0.4987	0.011	0.1845	0.0068	0.4234	0.0072	2.4853	0.0113	3.2559	0.0043	2.26E-09
Exp. #26																
SPFT-006-H-Blank-1	15	40	-	-	9	-	-	< -0.0014	-	0.0048	-	0.2933	-	15.2917	-	-
SPFT-006-H-Blank-2	15	40	-	-	9	-	-	< -0.0203	-	0.0017	-	0.2486	-	15.3262	-	-
SPFT-006-H-Blank-3	15	40	-	-	9	-	-	< 0.0017	-	< -0.0026	-	0.2723	-	-	-	-
SPFT-006-H-1	15	40	8.50E-06	0.50	9	0.4996	0.011	0.0335	0.0012	0.0136	0.0002	1.2165	0.0041	16.5471	0.0053	1.47E-09
SPFT-006-H-4	15	40	8.35E-06	1.98	9	0.4996	0.011	0.0574	0.0019	0.0540	0.0008	2.6959	0.0103	16.9243	0.0067	4.19E-09
SPFT-006-H-5	15	40	9.22E-06	2.48	9	0.4996	0.011	0.0783	0.0029	0.0747	0.0012	3.1050	0.0132	15.7865	0.0022	5.19E-09
SPFT-006-H-6	15	40	9.22E-06	2.98	9	0.4995	0.011	0.0953	0.0036	0.0986	0.0016	3.5190	0.0152	16.3494	0.0048	5.84E-09
SPFT-006-H-8	15	40	9.50E-06	3.97	9	0.4995	0.011	0.1155	0.0044	0.1394	0.0024	3.7314	0.0167	16.7605	0.0069	6.15E-09
SPFT-006-H-9	15	40	9.07E-06	4.46	9	0.4995	0.011	0.1289	0.0047	0.1365	0.0022	3.7631	0.0161	16.1059	0.0036	5.69E-09
SPFT-006-H-10	15	40	9.65E-06	4.96	9	0.4994	0.011	0.1279	0.0050	0.1432	0.0025	3.7326	0.0169	15.6958	0.0019	6.00E-09
SPFT-006-H-12	15	40	9.22E-06	5.95	9	0.4994	0.011	0.1397	0.0052	0.1609	0.0027	3.8254	0.0166	16.5042	0.0055	5.73E-09
SPFT-006-H-14	15	40	9.94E-06	6.94	9	0.4993	0.011	0.1456	0.0059	0.1763	0.0032	3.9849	0.0187	15.9194	0.0030	6.46E-09
SPFT-006-H-21	15	40	1.09E-05	9.94	9	0.4992	0.011	0.1490	0.0066	0.1820	0.0036	3.5870	0.0184	16.1674	0.0047	5.93E-09
SPFT-006-H-23	15	40	9.79E-06	10.93	9	0.4991	0.011	0.1438	0.0057	0.2062	0.0037	3.6185	0.0166	16.0833	0.0038	5.49E-09
SPFT-006-H-26	15	40	1.04E-05	11.93	9	0.4990	0.011	0.1588	0.0067	0.1898	0.0036	3.5529	0.0173	16.5543	0.0065	5.32E-09
SPFT-006-H-29	15	40	1.01E-05	13.41	9	0.4989	0.011	0.1534	0.0063	0.2006	0.0037	3.4069	0.0160	16.6518	0.0068	4.91E-09
SPFT-006-H-32	15	40	1.01E-05	14.90	9	0.4988	0.011	0.1482	0.0061	0.1944	0.0036	3.1662	0.0148	16.5978	0.0065	4.40E-09

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #26 (cont)																
SPFT-006-H-36	15	40	9.94E-06	16.89	9	0.4987	0.011	0.1570	0.0063	0.2001	0.0036	3.0178	0.0138	17.3110	0.0100	3.78E-09
SPFT-006-H-39	15	40	9.07E-06	18.37	9	0.4986	0.011	0.1269	0.0046	0.1903	0.0032	2.8825	0.0120	17.0834	-	3.73E-09
SPFT-006-H-42	15	40	9.36E-06	19.86	9	0.4985	0.011	0.1343	0.0050	0.1901	0.0033	2.7449	0.0117	16.7554	-	3.37E-09
SPFT-006-H-49	15	40	9.07E-06	23.33	9	0.4984	0.011	0.1495	0.0054	0.1997	0.0034	2.6195	0.0108	17.5846	-	2.70E-09
SPFT-006-H-51	15	40	9.50E-06	24.33	9	0.4982	0.011	0.1529	0.0058	0.1871	0.0033	2.4542	0.0105	17.1357	-	2.36E-09
SPFT-006-H-54	15	40	8.78E-06	25.81	9	0.4982	0.011	0.1578	0.0056	0.1939	0.0032	2.5122	0.0100	17.6632	0.0002	2.22E-09
SPFT-006-H-55,56	15	40	9.36E-06	26.56	9	0.4981	0.011	0.1674	0.0063	0.1884	0.0033	2.4683	0.0104	17.5130	-	2.08E-09
SPFT-006-H-59,60	15	40	8.64E-06	28.54	9	0.4980	0.011	0.1789	0.0062	0.1925	0.0031	2.3860	0.0093	18.1422	0.0023	1.54E-09
SPFT-006-H-63,64	15	40	8.50E-06	31.02	9	0.4978	0.011	0.1899	0.0065	0.1850	0.0029	2.3066	0.0088	18.3601	0.0031	1.15E-09
Exp. #27																
SPFT-006-I-Blank-1	30	40	-	-	9	-	-	< -0.0110	-	< 0.0039	-	0.4575	-	31.5471	-	-
SPFT-006-I-Blank-2	30	40	-	-	9	-	-	< -0.0260	-	< 0.0018	-	0.4111	-	31.6562	-	-
SPFT-006-I-Blank-3	30	40	-	-	9	-	-	< 0.0049	-	< 0.0022	-	0.4172	-	30.4409	-	-
SPFT-006-I-2	30	40	9.22E-06	0.99	9	0.9998	0.022	0.0857	0.0016	BL	-	2.4546	0.0047	28.3315	-	1.57E-09
SPFT-006-I-4	30	40	8.93E-06	1.98	9	0.9997	0.022	0.1405	0.0025	BL	-	3.9502	0.0079	30.3848	-	2.72E-09
SPFT-006-I-5	30	40	9.22E-06	2.48	9	0.9997	0.022	0.1301	0.0024	BL	-	4.7845	0.0101	30.1871	-	3.89E-09
SPFT-006-I-7	30	40	9.22E-06	3.47	9	0.9997	0.022	0.1460	0.0027	BL	-	6.0986	0.0132	30.6688	-	5.28E-09
SPFT-006-I-8	30	40	9.22E-06	3.97	9	0.9996	0.022	0.1446	0.0027	BL	-	6.5010	0.0142	30.4932	-	5.77E-09
SPFT-006-I-9	30	40	9.36E-06	4.46	9	0.9996	0.022	0.1424	0.0027	BL	-	6.5881	0.0146	30.1547	-	5.98E-09
SPFT-006-I-10	30	40	9.22E-06	4.96	9	0.9997	0.022	0.1370	0.0026	BL	-	6.4073	0.0139	29.2229	-	5.73E-09
SPFT-006-I-12	30	40	9.85E-06	5.95	9	0.9996	0.022	0.1296	0.0026	BL	-	6.2264	0.0144	29.4522	-	5.97E-09
SPFT-006-I-15	30	40	1.01E-05	7.44	9	0.9994	0.022	0.1388	0.0028	BL	-	6.4900	0.0155	29.1391	-	6.35E-09
SPFT-006-I-21	30	40	1.05E-05	9.94	9	0.9993	0.022	0.1177	0.0025	BL	-	5.9419	0.0147	30.4392	-	6.12E-09
SPFT-006-I-23	30	40	9.36E-06	10.93	9	0.9992	0.022	0.1021	0.0019	BL	-	5.8460	0.0128	30.2869	-	5.48E-09
SPFT-006-I-26	30	40	1.01E-05	11.93	9	0.9992	0.022	0.1049	0.0021	BL	-	5.8540	0.0138	31.0256	-	5.88E-09
SPFT-006-I-29	30	40	9.50E-06	13.41	9	0.9991	0.022	0.1005	0.0019	BL	-	5.5699	0.0124	31.0864	-	5.25E-09
SPFT-006-I-31	30	40	9.50E-06	14.41	9	0.9991	0.022	0.0866	0.0017	BL	-	5.3484	0.0118	31.5514	-	5.11E-09
SPFT-006-I-34	30	40	9.94E-06	15.89	9	0.9991	0.022	0.0745	0.0015	BL	-	5.0287	0.0116	32.3666	-	5.06E-09
SPFT-006-I-37	30	40	9.94E-06	17.38	9	0.9990	0.022	0.0677	0.0014	BL	-	4.6277	0.0106	31.5796	-	4.62E-09
SPFT-006-I-39	30	40	9.07E-06	18.37	9	0.9990	0.022	0.0901	0.0016	BL	-	4.4802	0.0093	31.5670	-	3.91E-09
SPFT-006-I-45	30	40	1.02E-05	21.35	9	0.9989	0.022	0.1219	0.0024	BL	-	4.1629	0.0097	31.9234	0.0038	3.66E-09
SPFT-006-I-49	30	40	1.14E-05	23.33	9	0.9987	0.022	0.1350	0.0030	BL	-	4.2026	0.0109	33.3654	0.0083	3.98E-09
SPFT-006-I-52	30	40	1.09E-05	24.82	9	0.9986	0.022	0.1220	0.0026	BL	-	3.5958	0.0088	32.0013	0.0043	3.13E-09
SPFT-006-I-54	30	40	1.09E-05	25.81	9	0.9986	0.022	0.1082	0.0023	BL	-	3.5321	0.0086	32.5005	0.0056	3.19E-09
SPFT-006-I-55,56	30	40	8.64E-06	26.56	9	0.9985	0.022	0.1099	0.0018	BL	-	3.8108	0.0074	33.8816	0.0074	2.81E-09
SPFT-006-I-59,60	30	40	9.65E-06	28.54	9	0.9985	0.022	0.1039	0.0019	BL	-	3.4462	0.0074	32.9947	0.0062	2.75E-09
SPFT-006-I-64,65	30	40	9.65E-06	31.02	9	0.9984	0.021	0.0947	0.0018	BL	-	3.3898	0.0073	34.7129	0.0103	2.77E-09

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #28																
SPFT-006-J-Blank-1	45	40	-	-	9	-	-	< -0.0160	-	0.0086	-	0.6238	-	48.0295	-	-
SPFT-006-J-Blank-2	45	40	-	-	9	-	-	< -0.0300	-	0.0081	-	0.6056	-	47.8924	-	-
SPFT-006-J-Blank-3	45	40	-	-	9	-	-	0.0410	-	0.0097	-	0.6462	-	47.3009	-	-
SPFT-006-J-2	45	40	9.22E-06	0.99	9	0.9995	0.022	0.0218	0.0004	BL	-	3.3155	0.0063	47.0443	-	2.97E-09
SPFT-006-J-4	45	40	9.65E-06	1.98	9	0.9995	0.022	0.0625	0.0012	BL	-	5.6883	0.0124	47.5780	-	5.62E-09
SPFT-006-J-6	45	40	9.22E-06	2.98	9	0.9995	0.022	0.0700	0.0013	BL	-	6.5607	0.0139	47.1914	-	6.33E-09
SPFT-006-J-7	45	40	9.36E-06	3.47	9	0.9995	0.022	0.0698	0.0013	BL	-	6.8402	0.0148	47.1657	-	6.76E-09
SPFT-006-J-9	45	40	9.07E-06	4.46	9	0.9995	0.022	0.0662	0.0012	BL	-	6.5349	0.0136	46.7493	-	6.23E-09
SPFT-006-J-12	45	40	9.50E-06	5.95	9	0.9995	0.022	0.0749	0.0014	BL	-	6.7891	0.0149	44.9232	-	6.75E-09
SPFT-006-J-15	45	40	8.78E-06	7.46	9	0.9995	0.022	0.0751	0.0013	BL	-	6.6737	0.0135	45.7069	-	6.11E-09
SPFT-006-J-20	45	40	9.36E-06	9.45	9	0.9995	0.022	0.0599	0.0011	BL	-	6.1782	0.0132	46.9392	-	6.07E-09
SPFT-006-J-23	45	40	8.93E-06	10.93	9	0.9995	0.022	0.0744	0.0013	BL	-	5.8150	0.0118	45.2594	-	5.24E-09
SPFT-006-J-26	45	40	9.79E-06	11.93	9	0.9995	0.022	0.0710	0.0014	BL	-	6.1658	0.0138	44.7607	-	6.22E-09
SPFT-006-J-29	45	40	9.36E-06	13.41	9	0.9995	0.022	0.0599	0.0011	BL	-	5.5343	0.0117	47.3043	-	5.30E-09
SPFT-006-J-31	45	40	9.22E-06	14.41	9	0.9995	0.022	0.0533	0.0010	BL	-	5.3486	0.0110	46.8581	-	5.06E-09
SPFT-006-J-34	45	40	8.78E-06	15.89	9	0.9995	0.022	0.0510	0.0009	BL	-	5.4315	0.0107	48.4508	0.0011	4.94E-09
SPFT-006-J-37	45	40	9.22E-06	17.38	9	0.9995	0.022	BL	-	BL	-	4.8956	0.0100	47.8347	-	-
SPFT-006-J-39	45	40	9.07E-06	18.37	9	0.9995	0.022	0.0929	0.0010	BL	-	4.6141	0.0091	46.3589	-	4.11E-09
SPFT-006-J-42	45	40	9.22E-06	19.86	9	0.9995	0.022	0.0934	0.0010	BL	-	4.5987	0.0092	45.7475	-	4.15E-09
SPFT-006-J-49	45	40	9.07E-06	23.33	9	0.9995	0.022	0.0933	0.0010	BL	-	4.1298	0.0080	47.8564	-	3.54E-09
SPFT-006-J-52	45	40	9.50E-06	24.82	9	0.9995	0.022	0.0918	0.0010	BL	-	3.9155	0.0079	46.3615	-	3.47E-09
SPFT-006-J-54	45	40	9.36E-06	25.81	9	0.9995	0.022	0.0876	0.0009	BL	-	3.9135	0.0077	47.0267	-	3.45E-09
SPFT-006-J-55,56	45	40	9.36E-06	26.56	9	0.9995	0.022	0.0920	0.0010	BL	-	3.7963	0.0075	46.3332	-	3.27E-09
SPFT-006-J-59,60	45	40	9.07E-06	28.54	9	0.9995	0.022	0.1053	0.0012	BL	-	3.5767	0.0067	46.5134	-	2.79E-09
SPFT-006-J-64,65	45	40	9.22E-06	31.02	9	0.9995	0.022	0.1044	0.0012	BL	-	3.4384	0.0065	46.5708	-	2.68E-09
Exp. #29																
SPFT-006-K-Blank-1	60	40	-	-	9	-	-	< 0.0049	-	0.0165	-	0.9292	-	72.7718	-	-
SPFT-006-K-Blank-2	60	40	-	-	9	-	-	< -0.0331	-	0.0133	-	0.8966	-	71.3803	-	-
SPFT-006-K-Blank-3	60	40	-	-	9	-	-	< -0.0134	-	0.0130	-	0.8744	-	70.3945	-	-
SPFT-006-K-Blank-4	60	40	-	-	9	-	-	< 0.0034	-	0.0077	-	0.8291	-	67.0063	-	-
SPFT-006-K-2	60	40	9.65E-06	0.99	9	2.0000	0.043	0.0748	0.0007	BL	-	4.5733	0.0045	67.0616	-	1.88E-09
SPFT-006-K-4	60	40	1.12E-05	1.98	9	1.9999	0.043	0.1321	0.0015	BL	-	8.3662	0.0106	70.7854	-	4.58E-09
SPFT-006-K-7	60	40	9.07E-06	3.47	9	1.9999	0.043	0.1811	0.0017	BL	-	12.3929	0.0132	71.1186	-	5.80E-09
SPFT-006-K-8	60	40	9.65E-06	3.97	9	1.9998	0.043	0.1810	0.0018	BL	-	12.7281	0.0144	72.0856	0.0000	6.37E-09
SPFT-006-K-9	60	40	9.65E-06	4.46	9	1.9997	0.043	0.1829	0.0018	BL	-	13.9966	0.0160	72.5091	0.0005	7.14E-09
SPFT-006-K-12	60	40	9.99E-06	5.95	9	1.9997	0.043	0.1614	0.0016	BL	-	13.6527	0.0161	67.7172	-	7.29E-09
SPFT-006-K-15	60	40	9.50E-06	7.44	9	1.9996	0.043	0.1448	0.0014	BL	-	12.9882	0.0145	68.8688	-	6.61E-09

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #29 (cont.)																
SPFT-006-K-20	60	40	9.36E-06	9.45	9	1.9995	0.043	0.0907	0.0009	BL	-	9.8360	0.0106	59.8883	-	4.89E-09
SPFT-006-K-23	60	40	9.07E-06	10.93	9	1.9994	0.043	0.1089	0.0010	BL	-	11.2590	0.0119	69.4169	-	5.48E-09
SPFT-006-K-27	60	40	9.79E-06	12.42	9	1.9994	0.043	0.0909	0.0009	BL	-	10.8622	0.0123	69.4963	-	5.75E-09
SPFT-006-K-29	60	40	9.65E-06	13.41	9	1.9993	0.043	0.0895	0.0009	BL	-	10.1870	0.0113	71.1915	-	5.26E-09
SPFT-006-K-31	60	40	9.50E-06	14.41	9	1.9993	0.043	0.0801	0.0008	BL	-	9.6814	0.0105	71.0361	-	4.92E-09
SPFT-006-K-34	60	40	8.50E-06	15.89	9	1.9992	0.043	0.0794	0.0007	BL	-	9.7376	0.0095	74.9270	0.0030	4.43E-09
SPFT-006-K-37	60	40	9.35E-06	17.38	9	1.9992	0.043	0.0600	0.0006	BL	-	8.6012	0.0091	70.9377	-	4.29E-09
SPFT-006-K-39	60	40	9.94E-06	18.37	9	1.9992	0.043	0.0836	0.0008	BL	-	8.4923	0.0096	71.1915	0.0010	4.40E-09
SPFT-006-K-42	60	40	1.02E-05	19.86	9	1.9991	0.043	0.1109	0.0011	BL	-	7.8464	0.0090	71.0361	0.0008	3.96E-09
SPFT-006-K-49	60	40	9.36E-06	23.33	9	1.9990	0.043	0.0906	0.0009	BL	-	7.4782	0.0078	74.9270	0.0053	3.51E-09
SPFT-006-K-52	60	40	9.07E-06	24.82	9	1.9989	0.043	0.0750	0.0007	BL	-	6.9144	0.0069	70.9377	0.0006	3.14E-09
SPFT-006-K-57	60	40	9.79E-06	27.30	9	1.9989	0.043	0.0695	0.0007	BL	-	6.5360	0.0071	71.1915	0.0051	3.23E-09
SPFT-006-K-59	60	40	8.50E-06	28.29	9	1.9988	0.043	0.0961	0.0008	BL	-	6.3003	0.0059	71.0361	0.0043	2.56E-09
SPFT-006-K-61	60	40	9.22E-06	29.29	9	1.9988	0.043	0.1139	0.0010	BL	-	6.4352	0.0065	74.9270	0.0091	2.77E-09
SPFT-006-K-65	60	40	1.08E-05	31.27	9	1.9987	0.043	0.1213	0.0013	BL	-	5.9552	0.0070	70.9377	0.0053	2.88E-09
Exp. #30																
SPFT-006-L-Blank-1	75	40	-	-	9	-	-	< -0.0031	-	0.0133	-	1.0839	-	87.7061	-	-
SPFT-006-L-Blank-2	75	40	-	-	9	-	-	< -0.0217	-	0.0137	-	1.0878*	-	87.4039	-	-
SPFT-006-L-Blank-3	75	40	-	-	9	-	-	< -0.0100	-	0.0184	-	1.1168	-	90.1521	-	-
SPFT-006-L-Blank-4	75	40	-	-	9	-	-	0.0305	-	0.0114	-	0.9978	-	80.2082	-	-
SPFT-006-L-1	75	40	9.79E-06	0.99	9	2.0001	0.043	0.1225	0.0012	BL	-	6.1941	0.0063	79.7330	-	2.57E-09
SPFT-006-L-6	75	40	1.04E-05	1.98	9	2.0000	0.043	0.1771	0.0019	BL	-	12.5022	0.0150	86.5573	-	6.60E-09
SPFT-006-L-7	75	40	1.05E-05	3.47	9	1.9999	0.043	0.1690	0.0018	BL	-	13.3597	0.0163	85.2852	-	7.31E-09
SPFT-006-L-9	75	40	1.11E-05	3.97	9	1.9998	0.043	0.1492	0.0017	BL	-	12.5791	0.0161	83.8208	-	7.27E-09
SPFT-006-L-12	75	40	1.15E-05	4.46	9	1.9998	0.043	0.1406	0.0016	BL	-	12.5999	0.0168	82.8743	-	7.62E-09
SPFT-006-L-15	75	40	1.18E-05	4.96	9	1.9998	0.043	0.1318	0.0016	BL	-	11.8658	0.0161	84.2588	-	7.31E-09
SPFT-006-L-20	75	40	1.02E-05	7.44	9	1.9997	0.043	0.1197	0.0012	BL	-	11.3721	0.0133	86.5190	-	6.07E-09
SPFT-006-L-23	75	40	8.93E-06	10.93	9	1.9995	0.043	0.1125	0.0010	BL	-	10.8696	0.0110	84.9980	-	5.05E-09
SPFT-006-L-26	75	40	1.05E-05	11.93	9	1.9994	0.043	0.1118	0.0012	BL	-	10.4498	0.0124	87.5287	-	5.66E-09
SPFT-006-L-27	75	40	9.36E-06	12.42	9	1.9994	0.043	0.1084	0.0010	BL	-	9.6710	0.0102	84.7664	-	4.60E-09
SPFT-006-L-29	75	40	1.05E-05	13.41	9	1.9994	0.043	0.0994	0.0011	BL	-	9.5003	0.0112	84.7664	-	5.10E-09
SPFT-006-L-31	75	40	9.94E-06	14.41	9	1.9993	0.043	0.0903	0.0009	BL	-	9.1977	0.0102	86.1253	-	4.67E-09
SPFT-006-L-34	75	40	9.65E-06	15.89	9	1.9993	0.043	0.0904	0.0009	BL	-	8.5283	0.0091	87.3989	-	4.12E-09
SPFT-006-L-37	75	40	1.04E-05	17.38	9	1.9992	0.043	0.0785	0.0008	BL	-	11.9106	0.0142	85.4329	-	6.73E-09
SPFT-006-L-39	75	40	8.64E-06	18.37	9	1.9992	0.043	0.0813	0.0007	BL	-	8.8931	0.0085	84.7664	-	3.93E-09
SPFT-006-L-42	75	40	1.01E-05	19.86	9	1.9991	0.043	0.0751	0.0008	BL	-	8.2646	0.0091	86.1253	-	4.22E-09

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Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #30 (cont.)																
SPFT-006-L-49	75	40	9.36E-06	23.33	9	1.9991	0.043	0.0734	0.0007	BL	-	7.9179	0.0081	87.3989	-	3.72E-09
SPFT-006-L-52	75	40	9.50E-06	24.82	9	1.9990	0.043	0.0668	0.0006	BL	-	7.2832	0.0074	85.4329	-	3.42E-09
SPFT-006-L-54	75	40	9.30E-06	25.81	9	1.9990	0.043	0.0598	0.0006	BL	-	7.0754	0.0070	84.7664	-	3.26E-09
SPFT-006-L-57	75	40	9.65E-06	27.30	9	1.9989	0.043	0.0911	0.0006	BL	-	6.3960	0.0066	84.7664	0.0055	3.02E-09
SPFT-006-L-59	75	40	8.93E-06	28.29	9	1.9989	0.043	0.1315	0.0009	BL	-	6.1763	0.0059	86.1253	0.0066	2.49E-09
SPFT-006-L-61	75	40	8.93E-06	29.29	9	1.9988	0.043	0.1643	0.0012	BL	-	6.3829	0.0061	87.3989	0.0080	2.45E-09
Exp. #31																
SPFT-007-A-Blank-1	1	90	-	-	9	-	-	<0.0046	-	<-0.0038	-	0.1703	-	1.0542	-	-
SPFT-007-A-Blank-2	1	90	-	-	9	-	-	<-0.0092	-	-	-	0.0014	-	0.9344	-	-
SPFT-007-A-Blank-3	1	90	-	-	9	-	-	0.1858	-	<-0.0174	-	0.0491	-	1.1895	-	-
SPFT-007-A-2	1	90	6.48E-05	0.56	9	0.4985	0.011	1.7017	0.4463	0.6376	0.0727	19.8456	0.6401	4.6496	0.1144	9.75E-08
SPFT-007-A-6	1	90	6.48E-05	1.67	9	0.4944	0.011	1.7770	0.4687	0.8087	0.0927	18.7879	0.6090	5.6965	0.1491	7.06E-08
SPFT-007-A-10	1	90	6.48E-05	2.78	9	0.4892	0.011	1.4857	0.3944	0.6341	0.0732	15.6847	0.5110	5.5311	0.1448	5.87E-08
SPFT-007-A-15	1	90	6.48E-05	4.17	9	0.4842	0.011	1.3781	0.3683	0.9853	0.1145	14.1543	0.4638	5.7008	0.1514	4.81E-08
SPFT-007-A-18	1	90	6.48E-05	5.00	9	0.4802	0.010	1.1574	0.3108	1.1448	0.1338	12.2800	0.4039	5.5061	0.1457	4.68E-08
SPFT-007-A-22	1	90	6.48E-05	6.39	9	0.4768	0.010	1.2018	0.2752	0.6936	0.0814	11.7178	0.3910	5.4907	0.1436	5.83E-08
SPFT-007-A-26	1	90	6.48E-05	7.23	9	0.4740	0.010	0.8995	0.1941	1.3282	0.1566	10.9088	0.3654	5.5689	0.1468	8.62E-08
SPFT-007-A-27	1	90	6.48E-05	7.51	9	0.4727	0.010	1.2170	0.2810	1.0444	0.1621	10.8895	0.3692	5.7020	0.1516	4.44E-08
SPFT-007-A-31	1	90	6.48E-05	8.62	9	0.4712	0.010	0.8773	0.1888	0.4317	0.0511	10.0005	0.3361	5.0670	0.1305	7.41E-08
Exp. #32																
SPFT-007-B-Blank-1	40	90	-	-	9	-	-	<-0.1598	-	0.0042	-	0.2520	-	46.5865	-	-
SPFT-007-B-Blank-2	40	90	-	-	9	-	-	<-0.0044	-	0.0061	-	0.0722	-	44.3208	-	-
SPFT-007-B-Blank-3	40	90	-	-	9	-	-	0.0213	-	0.0263	-	0.1184	-	45.0226	-	-
SPFT-007-B-2	40	90	6.48E-05	0.56	9	0.499	0.011	1.8526	0.4867	0.3233	0.0362	19.2221	0.6165	50.3255	0.1211	6.53E-08
SPFT-007-B-6	40	90	6.48E-05	1.67	9	0.493	0.011	2.5887	0.6852	0.4801	0.0539	21.2471	0.6874	51.7886	0.1697	1.10E-09
SPFT-007-B-10	40	90	6.48E-05	2.78	9	0.486	0.011	2.3329	0.6240	0.5112	0.0575	19.0360	0.6215	53.6977	0.2345	-
SPFT-007-B-15	40	90	6.48E-05	4.17	9	0.478	0.010	2.3012	0.6226	0.5400	0.0607	18.4068	0.6075	55.6059	0.3008	-
SPFT-007-B-18	40	90	6.48E-05	5.00	9	0.471	0.010	2.0431	0.5581	0.4970	0.0559	16.6895	0.5554	55.1569	0.2886	-
SPFT-007-B-22	40	90	6.48E-05	6.39	9	0.464	0.010	2.0200	0.5510	0.5043	0.0542	15.1629	0.5130	57.2054	0.4140	-
SPFT-007-B-26	40	90	6.48E-05	7.23	9	0.458	0.010	1.8358	0.5046	0.4735	0.0507	14.1923	0.4841	59.0279	0.4801	-
SPFT-007-B-28	40	90	6.48E-05	7.78	9	0.455	0.010	2.0118	0.5565	0.4989	0.0573	13.6526	0.4730	59.3963	0.4954	-
SPFT-007-B-31	40	90	6.48E-05	8.62	9	0.450	0.010	1.7418	0.4844	0.4683	0.0501	13.5434	0.4675	62.8950	0.6203	-
Exp. #33																
SPFT-007-C-Blank-1	80	90	-	-	9	-	-	<-0.1163	-	0.0307	-	0.5490	-	89.1784	-	-
SPFT-007-C-Blank-2	80	90	-	-	9	-	-	<-0.0060	-	0.0235	-	0.1424	-	85.2275	-	-
SPFT-007-C-Blank-3	80	90	-	-	9	-	-	0.0936	-	0.0237	-	0.3268	-	87.8089	-	-

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #33 (cont.)																
SPFT-007-C-3	80	90	6.48E-05	0.83	9	0.9953	0.021	3.9735	0.5230	0.2799	0.0142	35.9552	0.5765	95.7851	0.1072	2.69E-08
SPFT-007-C-6	80	90	6.48E-05	1.67	9	0.9851	0.021	4.6731	0.6193	0.2515	0.0127	36.6277	0.5915	97.3153	0.1329	-
SPFT-007-C-10	80	90	6.48E-05	2.78	9	0.9621	0.021	4.1553	0.5595	0.2417	0.0123	32.1553	0.5264	98.9083	0.1615	-
SPFT-007-C-15	80	90	6.48E-05	4.17	9	0.9279	0.020	4.1144	0.5675	0.2497	0.0131	30.7077	0.5145	102.3940	0.2247	-
SPFT-007-C-18	80	90	6.48E-05	5.00	9	0.8832	0.020	3.6837	0.5251	0.2532	0.0137	28.0234	0.4844	103.1840	0.2461	-
SPFT-007-C-22	80	90	6.48E-05	6.39	9	0.8291	0.019	3.3390	0.4825	0.2626	0.0154	24.6258	0.4469	107.7970	0.3664	-
SPFT-007-C-26	80	90	6.48E-05	7.23	9	0.7735	0.018	2.9868	0.4505	0.2615	0.0160	23.5569	0.4474	106.9100	0.3667	-
SPFT-007-C-28	80	90	6.48E-05	7.78	9	0.7152	0.017	3.4074	0.5437	0.3103	0.0163	23.4123	0.4734	109.2510	0.4337	-
SPFT-007-C-31	80	90	6.48E-05	8.62	9	0.7121	0.017	3.0061	0.4792	0.3060	0.0201	22.2900	0.4470	107.3820	0.3970	-
Exp. #34																
SPFT-007-D-Blank-1	100	90	-	-	9	-	-	<-0.1999	-	0.0401	-	0.5962	-	114.8470	-	-
SPFT-007-D-Blank-2	100	90	-	-	9	-	-	<-0.0075	-	0.0287	-	0.1798	-	106.3460	-	-
SPFT-007-D-Blank-3	100	90	-	-	9	-	-	0.0898	-	0.0259	-	0.2163	-	114.9170	-	-
SPFT-007-D-2	100	90	6.48E-05	0.56	9	0.9980	0.022	3.2964	0.4330	0.2248	0.0105	31.9665	0.5097	121.9230	0.1140	3.86E-08
SPFT-007-D-6	100	90	6.48E-05	1.67	9	0.9883	0.021	4.5064	0.5958	0.1741	0.0077	36.7651	0.5915	125.0480	0.1657	-
SPFT-007-D-10	100	90	6.48E-05	2.78	9	0.9748	0.021	4.1138	0.5490	0.1627	0.0071	32.1802	0.5213	129.8370	0.2460	-
SPFT-007-D-15	100	90	6.48E-05	4.17	9	0.9602	0.021	4.1328	0.5571	0.1820	0.0083	30.7347	0.5025	131.9360	0.2834	-
SPFT-007-D-18	100	90	6.48E-05	5.00	9	0.9478	0.021	3.6575	0.4973	0.1954	0.0092	28.0404	0.4615	132.7600	0.2997	-
SPFT-007-D-22	100	90	6.48E-05	6.39	9	0.9367	0.021	3.5603	0.4756	0.2327	0.0123	25.7734	0.4332	133.3280	0.3110	-
SPFT-007-D-26	100	90	6.48E-05	7.23	9	0.9260	0.020	3.4084	0.4583	0.2655	0.0143	24.0944	0.4079	134.1730	0.3278	-
SPFT-007-D-27	100	90	6.48E-05	7.51	9	0.9207	0.020	3.4247	0.4381	0.3031	0.0158	23.6677	0.4063	133.5980	0.3192	-
SPFT-007-D-31	100	90	6.48E-05	8.62	9	0.9138	0.020	2.9689	0.4011	0.3134	0.0174	22.5446	0.3848	133.9850	0.3275	-
Exp. #35																
SPFT-007-E-Blank-1	120	90	-	-	9	-	-	0.0863	-	0.0666	-	0.6213	-	135.6120	-	-
SPFT-007-E-Blank-2	120	90	-	-	9	-	-	<-0.0087	-	0.0324	-	0.2373	-	126.6440	-	-
SPFT-007-E-Blank-3	120	90	-	-	9	-	-	<-0.0803	-	0.0574	-	0.6677	-	132.5760	-	-
SPFT-007-E-2	120	90	6.48E-05	0.56	9	1.9952	0.043	5.4210	0.3506	0.2281	0.0047	50.7878	0.4076	146.5130	0.1006	2.87E-08
SPFT-007-E-6	120	90	6.48E-05	1.67	9	1.9803	0.043	6.9953	0.4563	0.1867	0.0036	54.8942	0.4432	148.9080	0.1206	-
SPFT-007-E-10	120	90	6.48E-05	2.78	9	1.9592	0.042	6.5946	0.4329	0.2096	0.0043	48.7626	0.3959	160.5770	0.2172	-
SPFT-007-E-15	120	90	6.48E-05	4.17	9	1.9370	0.042	6.1889	0.4091	0.1980	0.0040	46.4166	0.3795	155.4300	0.1763	-
SPFT-007-E-18	120	90	6.48E-05	5.00	9	1.9182	0.042	5.9136	0.3931	0.2070	0.0042	42.4004	0.3485	155.5330	0.1783	-
SPFT-007-E-22	120	90	6.48E-05	6.39	9	1.9009	0.042	5.3086	0.3603	0.2472	0.0054	40.3876	0.3337	155.0680	0.1755	-
SPFT-007-E-26	120	90	6.48E-05	7.23	9	1.8843	0.041	5.2231	0.3566	0.2758	0.0063	38.0408	0.3158	156.5760	0.1892	-
SPFT-007-E-28	120	90	6.48E-05	7.78	9	1.8741	0.041	5.2833	0.3620	0.2805	0.0065	35.9947	0.3026	156.3400	0.2007	-
SPFT-007-E-31	120	90	6.48E-05	8.62	9	1.8646	0.041	4.5846	0.3152	0.3463	0.0085	35.1912	0.2938	157.8090	0.2010	-
Exp. #36																
SPFT-007-F-Blank-1	140	90	-	-	9	-	-	0.2885	-	0.0597	-	0.7498	-	142.1250	-	-

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #36 (cont)																
SPFT-007-F-Blank-2	140	90	-	-	9	-	-	< -0.0088	-	0.0408	-	0.3576	-	149.9260	-	-
SPFT-007-F-Blank-3	140	90	-	-	9	-	-	< -0.0170	-	0.0666	-	0.7515	-	159.2300	-	-
SPFT-007-F-2	140	90	6.48E-05	0.56	9	1.9950	0.043	5.8763	0.3839	0.2516	0.0054	53.7169	0.4306	174.0750	0.1896	2.35E-08
SPFT-007-F-6	140	90	6.48E-05	1.67	9	1.9798	0.043	7.3233	0.4815	0.1895	0.0036	57.8460	0.4665	210.4970	0.4871	-
SPFT-007-F-10	140	90	6.48E-05	2.78	9	1.9585	0.042	6.8254	0.4518	0.1623	0.0029	51.0290	0.4138	194.3170	0.3580	-
SPFT-007-F-15	140	90	6.48E-05	4.17	9	1.9363	0.042	6.3613	0.4242	0.1806	0.0034	48.4805	0.3958	203.1790	0.4339	-
SPFT-007-F-18	140	90	6.48E-05	5.00	9	1.9175	0.042	6.1779	0.4146	0.1717	0.0032	44.6244	0.3662	202.8010	0.4336	-
SPFT-007-F-22	140	90	6.48E-05	6.39	9	1.8995	0.042	5.6025	0.3781	0.1542	0.0027	41.9293	0.3459	191.8580	0.3447	-
SPFT-007-F-26	140	90	6.48E-05	7.23	9	1.8825	0.041	5.0982	0.3459	0.1634	0.0030	39.5128	0.3275	197.0710	0.3907	-
SPFT-007-F-27	140	90	6.48E-05	7.51	9	1.8743	0.041	5.3866	0.3538	0.1576	0.0027	39.0669	0.3281	198.5290	0.4042	-
SPFT-007-F-31	140	90	6.48E-05	8.62	9	1.8642	0.041	5.0985	0.3482	0.1520	0.0026	36.7450	0.3061	179.7540	0.2465	-
Exp. #37																
SPFT-008-A-Blank-1	0	23	-	-	7	-	-	0.0066	-	< -0.0147	-	0.0013	-	0.1055	-	-
SPFT-008-A-Blank-2	0	23	-	-	7	-	-	0.0003	-	< -0.0091	-	< 0.0004	-	0.1094	-	-
SPFT-008-A-Blank-3	0	23	-	-	7	-	-	-	-	-	-	-	-	-	-	-
SPFT-008-A-2	0	23	9.50E-06	2.98	7	0.9995	0.022	0.1233	0.0022	< -0.0093	-	3.5171	0.0084	0.3046	0.0005	3.08E-09
SPFT-008-A-5	0	23	9.65E-06	8.93	7	0.9993	0.022	0.1649	0.0031	< -0.0023	-	4.2488	0.0103	0.3392	0.0006	3.61E-09
SPFT-008-A-7	0	23	9.65E-06	13.77	7	0.9989	0.022	0.1628	0.0031	< 0.0003	-	3.7390	0.0090	0.3468	0.0006	3.01E-09
SPFT-008-A-10	0	23	1.01E-05	19.00	7	0.9986	0.022	0.1453	0.0028	< 0.0007	-	2.5880	0.0065	0.2706	0.0004	1.86E-09
SPFT-008-A-12	0	23	9.36E-06	21.67	7	0.9983	0.021	0.1617	0.0029	0.0038	-	2.4600	0.0058	0.2197	0.0003	1.42E-09
SPFT-008-A-14	0	23	9.65E-06	25.63	7	0.9981	0.021	0.1435	0.0027	0.0056	-	2.1389	0.0052	0.1726	0.0002	1.26E-09
SPFT-008-A-17	0	23	9.65E-06	31.59	7	0.9979	0.021	0.1390	0.0026	0.0104	0.0001	1.9977	0.0048	0.1508	0.0001	1.13E-09
SPFT-008-A-20	0	23	9.36E-06	37.54	7	0.9975	0.021	0.1379	0.0025	0.0142	0.0001	1.8835	0.0044	0.1398	0.0001	9.70E-10
SPFT-008-A-22	0	23	9.50E-06	41.51	7	0.9973	0.021	0.0998	0.0019	0.0217	0.0002	1.8232	0.0043	0.1385	0.0001	1.22E-09
SPFT-008-A-24	0	23	9.65E-06	45.47	7	0.9971	0.021	0.0995	0.0019	0.0224	0.0002	1.7233	0.0042	0.1393	0.0001	1.12E-09
SPFT-008-A-25	0	23	9.36E-06	47.46	7	0.9970	0.021	0.0994	0.0019	0.0230	0.0002	1.6927	0.0040	0.1383	0.0001	1.05E-09
SPFT-008-A-27	0	23	9.50E-06	51.43	7	0.9969	0.021	0.0965	0.0019	0.0224	0.0002	1.6054	0.0038	0.1420	0.0001	9.93E-10
Exp. #38																
SPFT-008-B-Blank-1	0	23	-	-	8	-	-	< -0.0027	-	< -0.0009	-	< -0.0002	-	< 0.0007	-	-
SPFT-008-B-Blank-2	0	23	-	-	8	-	-	0.0016	-	< -0.0091	-	0.0016	-	0.0080	-	-
SPFT-008-B-Blank-3	0	23	-	-	8	-	-	-	-	-	-	-	-	-	-	-
SPFT-008-B-2	0	23	9.36E-06	2.98	8	0.9997	0.022	0.0604	0.0011	0.0170	0.0001	2.2993	0.0053	0.4307	0.0010	2.11E-09
SPFT-008-B-5	0	23	9.79E-06	8.93	8	0.9995	0.022	0.0692	0.0014	0.0443	0.0004	2.5519	0.0062	0.4324	0.0010	2.43E-09
SPFT-008-B-7	0	23	9.50E-06	13.77	8	0.9994	0.022	0.0618	0.0012	0.0523	0.0004	2.2158	0.0052	0.4771	0.0011	2.03E-09
SPFT-008-B-9	0	23	9.50E-06	17.74	8	0.9993	0.022	0.0554	0.0011	0.0544	0.0005	1.9680	0.0046	0.5190	0.0012	1.80E-09
SPFT-008-B-12	0	23	9.36E-06	21.67	8	0.9992	0.022	0.0401	0.0008	0.0341	0.0003	1.3223	0.0031	0.4934	0.0011	1.15E-09
SPFT-008-B-14	0	23	9.50E-06	25.63	8	0.9991	0.022	0.0391	0.0008	0.0442	0.0004	1.2520	0.0029	0.3960	0.0009	1.10E-09

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #38 (cont)																
SPFT-008-B-17	0	23	9.65E-06	31.59	8	0.9991	0.022	0.0379	0.0007	0.0468	0.0004	1.1310	0.0027	0.3335	0.0008	9.78E-10
SPFT-008-B-20	0	23	9.50E-06	37.54	8	0.9990	0.022	0.0377	0.0007	0.0645	0.0005	1.1300	0.0026	0.3196	0.0007	9.64E-10
SPFT-008-B-22	0	23	9.50E-06	41.51	8	0.9989	0.022	0.0423	0.0008	0.0501	0.0004	1.1394	0.0027	0.3276	0.0008	9.70E-10
SPFT-008-B-24	0	23	9.65E-06	45.47	8	0.9988	0.022	0.0414	0.0008	0.0600	0.0005	1.0985	0.0027	0.3304	0.0008	9.43E-10
SPFT-008-B-25	0	23	9.36E-06	47.46	8	0.9988	0.022	0.0420	0.0008	0.0639	0.0005	1.0908	0.0026	0.3357	0.0008	9.00E-10
SPFT-008-B-27	0	23	9.50E-06	51.43	8	0.9987	0.022	0.0404	0.0007	0.0602	0.0005	1.0483	0.0025	0.3368	0.0008	8.79E-10
Exp. #39																
SPFT-008-C-Blank-1	0	23	-	-	9	-	-	0.0013	-	< -0.0154	-	0.0010	-	0.0187	-	-
SPFT-008-C-Blank-2	0	23	-	-	9	-	-	<0.0037	-	<-0.0094	-	0.0073	-	0.0884	-	-
SPFT-008-C-Blank-3	0	23	-	-	9	-	-	-	-	-	-	-	-	-	-	-
SPFT-008-C-2	0	23	9.50E-06	2.98	9	1.0001	0.022	0.0560	0.00105	0.0356	0.0003	1.8883	0.0045	0.4435	0.0010	1.75E-09
SPFT-008-C-5	0	23	9.65E-06	8.93	9	1.0000	0.022	0.0637	0.00122	0.0804	0.0007	1.9829	0.0048	0.5776	0.0013	1.82E-09
SPFT-008-C-7	0	23	9.65E-06	13.77	9	0.9998	0.022	0.0614	0.00117	0.0924	0.0008	1.6835	0.0041	0.6489	0.0015	1.48E-09
SPFT-008-C-10	0	23	9.22E-06	19.00	9	0.9997	0.022	0.0507	0.00092	0.1036	0.0009	1.3846	0.0032	0.6893	0.0015	1.16E-09
SPFT-008-C-12	0	23	8.64E-06	21.67	9	0.9996	0.022	0.0533	0.00091	0.0617	0.0005	1.1242	0.0024	0.6232	0.0013	7.78E-10
SPFT-008-C-14	0	23	9.94E-06	25.63	9	0.9996	0.022	0.0552	0.00108	0.0937	0.0009	1.0178	0.0025	0.5654	0.0014	7.41E-10
SPFT-008-C-17	0	23	1.01E-05	31.59	9	0.9994	0.022	0.0614	0.00123	0.1041	0.0010	0.9746	0.0025	0.5586	0.0014	6.33E-10
SPFT-008-C-20	0	23	8.64E-06	37.54	9	0.9993	0.022	0.0670	0.00115	0.1000	0.0008	0.9500	0.0021	0.5732	0.0012	4.66E-10
SPFT-008-C-22	0	23	1.04E-05	41.51	9	0.9991	0.022	0.0675	0.00141	0.0987	0.0010	0.9525	0.0025	0.5972	0.0013	5.46E-10
SPFT-008-C-24	0	23	9.65E-06	45.47	9	0.9990	0.022	0.0745	0.00145	0.1378	0.0012	0.9394	0.0023	0.6303	0.0013	4.24E-10
SPFT-008-C-25	0	23	9.65E-06	47.46	9	0.9989	0.022	0.0747	0.00145	0.1510	0.0014	0.9382	0.0023	0.6389	0.0013	4.20E-10
SPFT-008-C-27	0	23	9.94E-06	51.43	9	0.9988	0.022	0.0760	0.00152	0.1471	0.0014	0.9308	0.0023	0.6526	0.0014	4.10E-10
SPFT-008-C-2	0	23	9.50E-06	2.98	9	1.0001	0.022	0.0560	0.00105	0.0356	0.0003	1.8883	0.0045	0.4435	0.0010	1.75E-09
Exp. #40																
SPFT-008-D-Blank-1	0	23	-	-	10	-	-	< -0.0013	-	<-0.0156	-	< 0.0003	-	0.0342	-	-
SPFT-008-D-Blank-2	0	23	-	-	10	-	-	<-0.0004	-	<-0.0029	-	0.0018	-	0.0322	-	-
SPFT-008-D-Blank-3	0	23	-	-	10	-	-	-	-	-	-	-	-	-	-	-
SPFT-008-D-3	0	23	9.22E-06	4.96	10	0.5001	0.011	0.0241	0.0009	0.0399	0.0006	0.8007	0.0037	0.5421	0.0023	1.43E-09
SPFT-008-D-5	0	23	8.78E-06	8.93	10	0.5000	0.011	0.0431	0.0015	0.0726	0.0011	0.8615	0.0038	0.6757	0.0028	1.16E-09
SPFT-008-D-7	0	23	9.79E-06	13.77	10	0.4999	0.011	0.0618	0.0025	0.1103	0.0019	0.8217	0.0040	0.8409	0.0039	8.16E-10
SPFT-008-D-10	0	23	9.50E-06	19.00	10	0.4998	0.011	0.0826	0.0032	0.1199	0.0020	0.7718	0.0037	1.0454	0.0048	2.68E-10
SPFT-008-D-12	0	23	1.02E-05	21.67	10	0.4996	0.011	0.0901	0.0037	0.1598	0.0029	0.6602	0.0034	1.0235	0.0051	-
SPFT-008-D-14	0	23	9.79E-06	25.63	10	0.4995	0.011	0.0923	0.0037	0.0851	0.0015	0.6573	0.0032	0.9065	0.0043	-
SPFT-008-D-17	0	23	1.01E-05	31.59	10	0.4993	0.011	0.1070	0.0044	0.2040	0.0036	0.7038	0.0036	0.8954	0.0043	-
SPFT-008-D-20	0	23	1.01E-05	37.54	10	0.4990	0.011	0.1098	0.0045	0.1882	0.0033	0.7054	0.0036	0.8646	0.0042	-

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #40 (cont)																
SPFT-008-D-22	0	23	9.36E-06	41.51	10	0.4988	0.011	0.1132	0.0043	0.1673	0.0027	0.7485	0.0035	0.9058	0.0041	-
SPFT-008-D-24	0	23	8.78E-06	45.47	10	0.4986	0.011	0.1156	0.0041	0.2211	0.0034	0.7479	0.0033	0.9134	0.0039	-
SPFT-008-D-25	0	23	9.79E-06	47.46	10	0.4984	0.011	0.1174	0.0047	0.2189	0.0037	0.7478	0.0037	0.9310	0.0044	-
SPFT-008-D-27	0	23	1.01E-05	51.43	10	0.4983	0.011	0.1167	0.0048	0.2144	0.0038	0.7465	0.0038	0.9261	0.0045	-
Exp. #41																
SPFT-008-E-Blank-1	0	23	-	-	11	-	-	0.0329	-	< -0.0016	-	0.0320	-	0.0073	-	-
SPFT-008-E-Blank-2	0	23	-	-	11	-	-	0.0008	-	0.0005	-	0.0171	-	0.0345	-	-
SPFT-008-E-Blank-3	0	23	-	-	11	-	-	-	-	-	-	-	-	-	-	-
SPFT-008-E-2	0	23	8.78E-06	2.98	11	0.4999	0.011	0.1617	0.0046	0.4038	0.0066	2.6299	0.0116	1.6013	0.0070	3.51E-09
SPFT-008-E-5	0	23	9.79E-06	8.93	11	0.4996	0.011	0.2317	0.0079	0.5049	0.0092	4.3770	0.0215	1.9192	0.0094	6.87E-09
SPFT-008-E-7	0	23	9.65E-06	13.77	11	0.4992	0.011	0.2118	0.0070	0.4356	0.0078	4.0888	0.0198	1.7965	0.0086	6.46E-09
SPFT-008-E-10	0	23	9.94E-06	19.00	11	0.4988	0.011	0.1943	0.0065	0.3905	0.0072	3.7073	0.0185	1.5988	0.0079	6.04E-09
SPFT-008-E-12	0	23	9.65E-06	21.67	11	0.4985	0.011	0.1992	0.0065	0.3856	0.0069	3.3726	0.0163	1.4047	0.0067	4.95E-09
SPFT-008-E-14	0	23	9.65E-06	25.63	11	0.4983	0.011	0.1776	0.0057	0.3510	0.0063	2.9420	0.0142	1.2183	0.0058	4.32E-09
SPFT-008-E-17	0	23	8.93E-06	31.59	11	0.4980	0.011	0.1683	0.0049	0.3372	0.0056	2.8886	0.0129	1.1371	0.0050	4.04E-09
SPFT-008-E-20	0	23	9.79E-06	37.54	11	0.4977	0.011	0.1644	0.0052	0.3349	0.0061	2.7191	0.0134	1.0758	0.0052	4.09E-09
SPFT-008-E-22	0	23	9.50E-06	41.51	11	0.4974	0.011	0.1255	0.0036	0.3362	0.0057	2.7248	0.0131	1.1042	0.0052	4.78E-09
SPFT-008-E-24	0	23	9.36E-06	45.47	11	0.4972	0.011	0.1282	0.0036	0.3429	0.0058	2.7218	0.0129	1.1325	0.0053	4.65E-09
SPFT-008-E-25	0	23	9.36E-06	47.46	11	0.4971	0.011	0.1375	0.0040	0.3621	0.0061	2.7677	0.0131	1.1681	0.0055	4.58E-09
SPFT-008-E-27	0	23	9.94E-06	51.43	11	0.4969	0.011	0.1412	0.0044	0.3740	0.0067	2.5010	0.0125	1.0841	0.0054	4.11E-09
Exp. #42																
SPFT-008-F-Blank-1	0	23	-	-	12	-	-	< -0.0061	-	0.0089	-	0.0966	-	0.0349	-	-
SPFT-008-F-Blank-2	0	23	-	-	12	-	-	0.0092	-	0.0011	-	0.0535	-	0.0609	-	-
SPFT-008-F-Blank-3	0	23	-	-	12	-	-	-	-	-	-	-	-	-	-	-
SPFT-008-F-2	0	23	9.65E-06	2.98	12	0.4996	0.011	0.3286	0.0128	0.8960	0.0150	4.9658	0.0235	3.4320	0.0164	5.38E-09
SPFT-008-F-5	0	23	9.65E-06	8.93	12	0.4986	0.011	0.6346	0.0248	1.5914	0.0268	9.8402	0.0472	5.4589	0.0262	1.12E-08
SPFT-008-F-7	0	23	1.02E-05	13.77	12	0.4971	0.011	0.6906	0.0287	0.6320	0.0112	10.3386	0.0527	5.2222	0.0266	1.21E-08
SPFT-008-F-12	0	23	9.65E-06	21.67	12	0.4952	0.011	0.6931	0.0273	1.6838	0.0285	10.0906	0.0486	5.4791	0.0264	1.07E-08
SPFT-008-F-14	0	23	9.22E-06	25.63	12	0.4935	0.011	0.6684	0.0252	1.5750	0.0256	9.5748	0.0441	5.1754	0.0239	9.55E-09
SPFT-008-F-17	0	23	9.79E-06	31.59	12	0.4921	0.011	0.6573	0.0263	1.5642	0.0270	9.3923	0.0461	5.1375	0.0252	9.93E-09
SPFT-008-F-20	0	23	9.79E-06	37.54	12	0.4904	0.011	0.6747	0.0271	1.5596	0.0270	9.4430	0.0464	5.0689	0.0249	9.73E-09
SPFT-008-F-22	0	23	9.65E-06	41.51	12	0.4890	0.011	0.6321	0.0247	1.6501	0.0258	8.7615	0.0426	4.9127	0.0237	8.99E-09
SPFT-008-F-24	0	23	9.42E-06	45.47	12	0.4880	0.011	0.6612	0.0253	1.6538	0.0253	9.1978	0.0437	5.2536	0.0248	9.27E-09
SPFT-008-F-25	0	23	9.65E-06	47.46	12	0.4872	0.011	0.6841	0.0268	1.6975	0.0267	9.4302	0.0460	5.4031	0.0262	9.63E-09
SPFT-008-F-27	0	23	9.65E-06	51.43	12	0.4863	0.011	0.7139	0.0281	0.0784	-	10.0612	0.0491	4.9228	0.0239	1.06E-08
Exp. #43																
SPFT-008-G-Blank-1	1	23	-	-	9	-	-	< -0.0125	-	< -0.0177	-	0.049	-	1.2711	-	-

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #43 (cont.)																
SPFT-008-G-Blank-1	1	23	-	-	9	-	-	< -0.0125	-	< -0.0177	-	0.049	-	1.2711	-	-
SPFT-008-G-Blank-2	1	23	-	-	9	-	-	0.0188	-	<0.0009	-	0.0092	-	1.3122	-	-
SPFT-008-G-Blank-3	1	23	-	-	9	-	-	0.0018	-	<-0.0046	-	0.0027	-	1.3359	-	-
SPFT-008-G-2	1	23	1.04E-05	2.98	9	4.0005	0.086	0.1733	0.0009	0.0682	0.0002	6.549	0.0042	2.6481	0.0009	1.67E-09
SPFT-008-G-5	1	23	9.79E-06	8.93	9	4.0001	0.086	0.2045	0.0010	0.1473	0.0003	7.754	0.0047	2.9114	0.0010	1.87E-09
SPFT-008-G-7	1	23	9.50E-06	13.77	9	3.9997	0.086	0.1346	0.0006	0.1433	0.0003	5.411	0.0032	2.6343	0.0008	1.28E-09
SPFT-008-G-10	1	23	1.08E-05	19.00	9	3.9994	0.086	0.1111	0.0006	0.0946	0.0002	4.5341	0.0031	2.3516	0.0007	1.24E-09
SPFT-008-G-12	1	23	9.50E-06	21.67	9	3.9992	0.086	0.1114	0.0005	0.1424	0.0003	4.4383	0.0026	2.5200	0.0007	1.06E-09
SPFT-008-G-14	1	23	1.07E-05	25.63	9	3.9991	0.086	0.0949	0.0005	0.1463	0.0003	4.0551	0.0027	2.6590	0.0009	1.10E-09
SPFT-008-G-17	1	23	9.94E-06	31.59	9	3.9989	0.086	0.0796	0.0004	0.1409	0.0003	3.4631	0.0022	3.2547	0.0012	8.82E-10
SPFT-008-G-20	1	23	9.79E-06	37.54	9	3.9987	0.086	0.0730	0.0004	0.1314	0.0003	2.7748	0.0017	3.3045	0.0012	6.74E-10
SPFT-008-G-22	1	23	8.78E-06	41.51	9	3.9986	0.086	0.1037	0.0004	0.1469	0.0003	2.5790	0.0014	2.9249	0.0009	5.21E-10
SPFT-008-G-24	1	23	1.04E-05	45.47	9	3.9984	0.086	0.1031	0.0004	0.1655	0.0004	2.5536	0.0017	2.8563	0.0010	6.09E-10
SPFT-008-G-25	1	23	9.63E-06	47.46	9	3.9983	0.086	0.1024	0.0004	0.1720	0.0004	2.5126	0.0015	2.9131	0.0010	5.55E-10
SPFT-008-G-27	1	23	9.94E-06	51.43	9	3.9982	0.086	0.1151	0.0005	0.2043	0.0004	2.8328	0.0018	3.0732	0.0011	6.40E-10
Exp. #44																
SPFT-008-H-Blank-1	15	23	-	-	9	-	-	0.0090	-	< -0.0097	-	0.1884	-	20.1299	-	-
SPFT-008-H-Blank-2	15	23	-	-	9	-	-	0.0026	-	<-0.0039	-	0.1935	-	18.0780	-	-
SPFT-008-H-Blank-3	15	23	-	-	9	-	-	0.0035	-	<-0.0040	-	0.1934	-	17.4264	-	-
SPFT-008-H-2	15	23	1.04E-05	2.98	9	3.9995	0.086	0.2123	0.0011	0.0504	0.0001	7.6742	0.0048	20.1299	0.0013	1.90E-09
SPFT-008-H-5	15	23	9.79E-06	8.93	9	3.9991	0.086	0.1827	0.0009	0.0812	0.0002	7.6854	0.0047	19.3945	0.0008	1.92E-09
SPFT-008-H-7	15	23	9.50E-06	13.77	9	3.9988	0.086	0.1410	0.0006	0.0788	0.0002	6.3745	0.0037	19.9328	0.0011	1.52E-09
SPFT-008-H-10	15	23	1.08E-05	19.00	9	3.9985	0.086	0.0999	0.0005	0.0233	0.0001	5.1864	0.0034	20.1972	0.0014	1.44E-09
SPFT-008-H-12	15	23	9.50E-06	21.67	9	3.9984	0.086	0.0869	0.0004	0.0447	0.0001	4.5438	0.0026	21.1646	0.0018	1.11E-09
SPFT-008-H14	15	23	1.07E-05	25.63	9	3.9982	0.086	0.0781	0.0004	0.0518	0.0001	4.0883	0.0026	20.8141	0.0018	1.11E-09
SPFT-008-H-17	15	23	9.94E-06	31.59	9	3.9981	0.086	0.0631	0.0003	0.0276	0.0001	3.3497	0.0019	19.7349	0.0010	8.43E-10
SPFT-008-H-20	15	23	9.79E-06	37.54	9	3.9980	0.086	0.0654	0.0003	0.0103	0.0000	3.1412	0.0018	18.3364	0.0002	7.61E-10
SPFT-008-H-22	15	23	9.65E-06	41.51	9	3.9978	0.086	0.0660	0.0003	0.0616	0.0001	3.0812	0.0017	17.8526	-	7.14E-10
SPFT-008-H-24	15	23	9.65E-06	45.47	9	3.9977	0.086	0.0726	0.0003	0.0658	0.0001	3.0485	0.0017	18.1877	0.0001	6.88E-10
SPFT-008-H-25	15	23	9.22E-06	47.46	9	3.9976	0.086	0.0840	0.0004	0.0313	0.0001	3.1029	0.0017	19.3778	0.0007	6.46E-10
SPFT-008-H-27	15	23	9.36E-06	51.43	9	3.9975	0.086	0.0939	0.0004	0.0621	0.0001	3.1355	0.0017	19.6795	0.0009	6.43E-10
Exp. #45																
SPFT-008-I-Blank-1	30	23	-	-	9	-	-	0.0037	-	< -0.0042	-	0.3826	-	36.7180	-	-
SPFT-008-I-Blank-2	30	23	-	-	9	-	-	0.0084	-	< -0.0009	-	0.3948	-	37.0840	-	-
SPFT-008-I-Blank-3	30	23	-	-	9	-	-	0.0013	-	0.0019	-	0.1231	-	32.8705	-	-
SPFT-008-I-2	30	23	9.50E-06	2.98	9	3.9997	0.086	0.1702	0.00080	0.0394	0.0001	7.4272	0.0040	38.4939	0.0011	1.63E-09
SPFT-008-I-5	30	23	9.65E-06	8.93	9	3.9994	0.086	0.1339	0.00064	0.0384	0.0001	7.2123	0.0040	37.9508	0.0007	1.68E-09

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #45 (cont.)																
SPFT-008-I-7	30	23	9.65E-06	13.77	9	3.9992	0.086	0.0980	0.00046	0.0283	0.0001	5.7580	0.0032	39.4487	0.0016	1.40E-09
SPFT-008-I-10	30	23	9.79E-06	19.00	9	3.9990	0.086	0.0717	0.00034	0.0149	0.0000	4.8321	0.0027	38.9632	0.0014	1.20E-09
SPFT-008-I-12	30	23	9.22E-06	21.67	9	3.9989	0.086	0.0604	0.00026	0.0086	0.0000	4.1409	0.0022	39.0855	0.0014	9.58E-10
SPFT-008-I-14	30	23	9.36E-06	25.63	9	3.9988	0.086	0.0529	0.00023	0.0114	0.0000	3.7575	0.0020	39.4681	0.0016	8.78E-10
SPFT-008-I-17	30	23	9.36E-06	31.59	9	3.9987	0.086	0.0480	0.00021	0.0078	0.0000	3.4374	0.0018	40.1630	0.0020	7.96E-10
SPFT-008-I-20	30	23	9.36E-06	37.54	9	3.9986	0.086	0.0381	0.00016	0.0107	0.0000	2.8310	0.0014	37.9030	0.0007	6.40E-10
SPFT-008-I-22	30	23	9.36E-06	41.51	9	3.9986	0.086	0.0431	0.00016	0.0174	0.0000	2.7976	0.0014	36.9631	-	6.26E-10
SPFT-008-I-24	30	23	9.36E-06	45.47	9	3.9985	0.086	0.0442	0.00017	0.0170	0.0000	2.7241	0.0014	35.7746	-	6.02E-10
SPFT-008-I-25	30	23	9.07E-06	47.46	9	3.9985	0.086	0.0446	0.00017	0.0199	0.0000	2.6571	0.0013	37.0970	0.0000	5.63E-10
SPFT-008-I-27	30	23	9.36E-06	51.43	9	3.9984	0.086	0.0465	0.00018	0.0241	0.0000	2.5020	0.0012	36.5715	-	5.31E-10
Exp. #46																
SPFT-008-J-Blank-1	45	23	-	-	9	-	-	0.0112	-	0.0026	-	0.5789	-	51.9393	-	-
SPFT-008-J-Blank-2	45	23	-	-	9	-	-	< 0.0001	-	0.0007	-	0.0961	-	44.3140	-	-
SPFT-008-J-Blank-3	45	23	-	-	9	-	-	<0.0002	-	0.0021	-	0.0944	-	44.3218	-	-
SPFT-008-J-2	45	23	9.45E-06	2.98	9	3.9995	0.086	0.1955	0.00088	0.0362	0.0001	8.2810	0.0047	59.4944	0.0045	1.90E-09
SPFT-008-J-5	45	23	9.50E-06	8.93	9	3.9992	0.086	0.1308	0.00058	0.0259	0.0000	7.6109	0.0043	58.7965	0.0041	1.87E-09
SPFT-008-J-7	45	23	9.36E-06	13.77	9	3.9990	0.086	0.0925	0.00038	0.0173	0.0000	6.4207	0.0035	60.2307	0.0048	1.58E-09
SPFT-008-J-10	45	23	9.79E-06	19.00	9	3.9989	0.086	0.0592	0.00024	BL	-	4.8046	0.0026	59.5772	0.0047	1.18E-09
SPFT-008-J-12	45	23	9.36E-06	21.67	9	3.9988	0.086	0.0528	0.00020	BL	-	4.2260	0.0021	61.1757	0.0054	9.77E-10
SPFT-008-J-14	45	23	9.50E-06	25.63	9	3.9987	0.086	0.0500	0.00019	BL	-	3.9306	0.0020	60.8397	0.0053	9.10E-10
SPFT-008-J-17	45	23	9.50E-06	31.59	9	3.9987	0.086	0.0432	0.00015	BL	-	3.5502	0.0018	60.3846	0.0050	8.13E-10
SPFT-008-J-20	45	23	9.50E-06	37.54	9	3.9986	0.086	0.0385	0.00013	BL	-	3.2274	0.0016	60.9436	0.0053	7.27E-10
SPFT-008-J-22	45	23	9.50E-06	41.51	9	3.9985	0.086	0.0400	0.00019	BL	-	3.1630	0.0018	59.7546	0.0092	8.22E-10
SPFT-008-J-24	45	23	9.36E-06	45.47	9	3.9985	0.086	0.0372	0.00018	BL	-	2.9285	0.0017	57.6516	0.0078	7.47E-10
SPFT-008-J-25	45	23	9.36E-06	47.46	9	3.9984	0.086	0.0355	0.00017	BL	-	2.7315	0.0015	56.5215	0.0071	6.93E-10
SPFT-008-J-27	45	23	9.36E-06	51.43	9	3.9984	0.086	0.0342	0.00016	BL	-	2.4499	0.0014	52.6954	0.0049	6.13E-10
Exp. #47																
SPFT-008-K-Blank-1	52.5	23	-	-	9	-	-	0.0148	-	0.0099	-	0.6627	-	55.8650	-	-
SPFT-008-K-Blank-2	52.5	23	-	-	9	-	-	< 0.0001	-	0.0025	-	0.1113	-	52.1671	-	-
SPFT-008-K-Blank-3	52.5	23	-	-	9	-	-	0.0000	-	0.0040	-	0.1100	-	51.7969	-	-
SPFT-008-K-2	52.5	23	9.50E-06	2.98	9	3.9997	0.086	0.2099	0.00094	0.0431	0.0001	8.5518	0.0050	66.1273	0.0061	2.06E-09
SPFT-008-K-5	52.5	23	9.50E-06	8.93	9	3.9994	0.086	0.1349	0.00058	0.0351	0.0001	7.4388	0.0044	66.1258	0.0061	1.90E-09
SPFT-008-K-7	52.5	23	9.79E-06	13.77	9	3.9992	0.086	0.0912	0.00038	0.0235	0.0000	6.0592	0.0036	66.2277	0.0063	1.64E-09
SPFT-008-K-10	52.5	23	9.94E-06	19.00	9	3.9991	0.086	0.0638	0.00025	0.0129	0.0000	5.0447	0.0031	66.0408	0.0063	1.42E-09
SPFT-008-K-12	52.5	23	8.93E-06	21.67	9	3.9990	0.086	0.0541	0.00018	0.0104	0.0000	4.4590	0.0024	66.4923	0.0059	1.13E-09
SPFT-008-K-14	52.5	23	9.50E-06	25.63	9	3.9989	0.086	0.0469	0.00015	0.0123	0.0000	3.9847	0.0023	65.6191	0.0058	1.08E-09
SPFT-008-K-17	52.5	23	9.79E-06	31.59	9	3.9989	0.086	0.0410	0.00013	BL	-	3.6523	0.0022	65.8261	0.0061	1.03E-09

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Table E1. SPFT Results for IDF1-B2 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #47 (cont.)																
SPFT-008-K-20	52.5	23	9.36E-06	37.54	9	3.9988	0.086	0.0386	0.00011	0.0105	0.0000	3.3693	0.0019	65.5450	0.0057	9.04E-10
SPFT-008-K-22	52.5	23	9.79E-06	41.51	9	3.9987	0.086	0.0391	0.00019	BL	-	3.6523	0.0022	65.8261	0.0083	9.95E-10
SPFT-008-K-24	52.5	23	9.36E-06	45.47	9	3.9987	0.086	0.0381	0.00018	0.0105	0.0000	3.3693	0.0019	65.5450	0.0078	8.70E-10
SPFT-008-K-25	52.5	23	9.79E-06	47.46	9	3.9986	0.086	0.0384	0.00019	BL	-	3.6523	0.0022	65.8261	0.0083	9.97E-10
SPFT-008-K-27	52.5	23	9.36E-06	51.43	9	3.9986	0.086	0.0335	0.00016	0.0105	0.0000	3.3693	0.0019	65.5450	0.0078	8.81E-10
Exp. #48																
SPFT-008-L-Blank-1	60	23	-	-	9	-	-	0.0178	-	0.0101	-	0.7686	-	74.7650	-	-
SPFT-008-L-Blank-2	60	23	-	-	9	-	-	< -0.0001	-	0.0005	-	0.1527	-	62.6720	-	-
SPFT-008-L-Blank-3	60	23	-	-	9	-	-	<-0.0002	-	0.0021	-	0.1350	-	59.6384	-	-
SPFT-008-L-2	60	23	9.36E-06	2.98	9	3.9990	0.086	0.1754	0.00075	0.0371	0.0001	7.6427	0.0040	75.7837	0.0006	1.63E-09
SPFT-008-L-5	60	23	9.50E-06	8.93	9	3.9988	0.086	0.1183	0.00048	0.0273	0.0000	7.3332	0.0039	75.5959	0.0005	1.70E-09
SPFT-008-L-7	60	23	9.50E-06	13.77	9	3.9986	0.086	0.0869	0.00033	0.0204	0.0000	5.8992	0.0031	75.5792	0.0005	1.37E-09
SPFT-008-L-10	60	23	9.65E-06	19.00	9	3.9985	0.086	0.0612	0.00021	BL	-	4.8750	0.0025	75.1542	0.0002	1.14E-09
SPFT-008-L-12	60	23	9.07E-06	21.67	9	3.9984	0.086	0.0553	0.00017	BL	-	4.3469	0.0020	74.7369	0.0000	9.37E-10
SPFT-008-L-14	60	23	1.07E-05	25.63	9	3.9984	0.086	0.0502	0.00017	0.0110	0.0000	4.0135	0.0022	75.0998	0.0002	1.00E-09
SPFT-008-L-17	60	23	9.50E-06	31.59	9	3.9983	0.086	0.0440	0.00013	BL	-	3.5731	0.0017	73.9416	-	7.77E-10
SPFT-008-L-19	60	23	9.07E-06	35.55	9	3.9982	0.086	0.0446	0.00012	BL	-	3.6114	0.0016	76.1106	0.0008	7.51E-10
SPFT-008-L-22	60	23	9.22E-06	41.51	9	3.9982	0.086	0.0429	0.00020	0.0101	0.0000	3.3845	0.0019	78.7752	0.0093	8.38E-10
SPFT-008-L-24	60	23	9.42E-06	45.47	9	3.9981	0.086	0.0407	0.00019	0.0110	0.0000	3.2055	0.0018	76.6576	0.0082	8.09E-10
SPFT-008-L-25	60	23	9.07E-06	47.46	9	3.9980	0.086	0.0353	0.00016	BL	-	2.7439	0.0015	66.3757	0.0021	6.59E-10
SPFT-008-L-27	60	23	9.26E-06	51.43	9	3.9980	0.086	0.0346	0.00016	BL	-	2.5529	0.0014	72.0777	0.0054	6.19E-10

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Table E2. SPFT Results for IDF2-G9 Glass.

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #49																
SPFT-004-H-Blank-1	0	90	-	-	9	-	-	0.0371	-	<-0.0064	-	1.2754	-	0.4198	-	-
SPFT-004-H-Blank-2	0	90	-	-	9	-	-	<0.0002	-	<-0.0096	-	0.8541	-	0.0116	-	-
SPFT-004-H-Blank-3	0	90	-	-	9	-	-	<-0.0001	-	<-0.0096	-	0.9261	-	0.0182	-	-
SPFT-004-H-2	0	90	5.04E-05	0.40	9	0.4995	0.011	0.7828	0.1310	0.7561	0.1061	13.1361	0.3700	4.1744	0.0934	1.20E-07
SPFT-004-H-4	0	90	5.04E-05	0.79	9	0.4988	0.011	1.1209	0.1905	1.1543	0.1621	16.9871	0.4906	6.1994	0.1439	1.51E-07
SPFT-004-H-5	0	90	5.04E-05	0.99	9	0.4982	0.011	1.3280	0.2271	1.1409	0.1603	16.8717	0.4874	6.5960	0.1539	1.31E-07
SPFT-004-H-9	0	90	5.04E-05	1.79	9	0.4969	0.011	1.4175	0.2433	1.2955	0.1824	17.1796	0.4978	7.2409	0.1702	1.28E-07
SPFT-004-H-13	0	90	5.04E-05	2.58	9	0.4949	0.011	1.3346	0.2293	1.2750	0.1800	15.4928	0.4462	7.1103	0.1674	1.09E-07
SPFT-004-H-15	0	90	5.04E-05	2.98	9	0.4934	0.011	1.3306	0.2291	1.2873	0.1821	15.1657	0.4368	7.1757	0.1694	1.05E-07
SPFT-004-H-17	0	90	5.04E-05	3.37	9	0.4925	0.011	1.2977	0.2235	1.2826	0.1816	14.7561	0.4245	7.1156	0.1681	1.01E-07
SPFT-004-H-20	0	90	5.04E-05	3.97	9	0.4913	0.011	1.2831	0.2213	1.2902	0.1830	13.6776	0.3912	7.0997	0.1680	8.55E-08
SPFT-004-H-23	0	90	5.04E-05	4.56	9	0.4899	0.011	1.2575	0.2171	1.2743	0.1811	13.4567	0.3849	7.0675	0.1675	8.44E-08
SPFT-004-H-24	0	90	5.04E-05	4.76	9	0.4890	0.011	1.1844	0.2044	1.2149	0.1729	12.4961	0.3550	6.7168	0.1588	7.58E-08
SPFT-004-H-25	0	90	5.04E-05	4.96	9	0.4886	0.011	1.2347	0.2135	1.2549	0.1787	12.7871	0.3644	6.9581	0.1650	7.60E-08
SPFT-004-H-33	0	90	5.04E-05	6.55	9	0.4866	0.011	1.2104	0.2097	1.2415	0.1772	12.3345	0.3511	6.8479	0.1627	7.11E-08
Exp. #50																
SPFT-006-B2-Blank-1	0	40	-	-	9	-	-	< -0.0383	-	< -0.0109	-	0.1219	-	0.0449	-	-
SPFT-006-B2-Blank-2	0	40	-	-	9	-	-	< -0.0226	-	< -0.0103	-	0.0852	-	0.0353	-	-
SPFT-006-B2-Blank-3	0	40	-	-	9	-	-	< -0.0310	-	< -0.0079	-	0.0501	-	0.0928	-	-
SPFT-006-B2-Blank-4	0	40	-	-	9	-	-	< -0.0001	-	< -0.0121	-	0.0065	-	<-0.0001	-	-
SPFT-006-B2-1	0	40	4.03E-05	0.50	9	0.5010	0.011	0.0457	0.0064	BL	-	1.4317	0.0326	1.1944	0.0228	1.32E-08
SPFT-006-B2-2	0	40	4.03E-05	0.99	9	0.5009	0.011	0.0775	0.0109	BL	-	1.7224	0.0398	1.008	0.0191	1.46E-08
SPFT-006-B2-4	0	40	4.03E-05	1.98	9	0.5008	0.011	0.0865	0.0121	BL	-	1.8159	0.0422	1.2554	0.0240	1.51E-08
SPFT-006-B2-5	0	40	4.03E-05	2.48	9	0.5007	0.011	0.0819	0.0115	BL	-	1.7223	0.0398	1.2801	0.0245	1.43E-08
SPFT-006-B2-6	0	40	4.03E-05	2.98	9	0.5006	0.011	0.065	0.0091	BL	-	1.3814	0.0314	1.4161	0.0272	1.12E-08
SPFT-006-B2-7	0	40	4.03E-05	3.47	9	0.5006	0.011	0.0881	0.0123	BL	-	1.4740	0.0337	1.4074	0.0270	1.07E-08
SPFT-006-B2-8	0	40	4.03E-05	3.97	9	0.5005	0.011	0.0737	0.0103	BL	-	1.3234	0.0299	1.4691	0.0283	9.86E-09
SPFT-006-B2-9	0	40	4.03E-05	4.46	9	0.5004	0.011	BL	-	BL	-	1.1018	0.0244	1.6536	0.0319	1.23E-08
SPFT-006-B2-10	0	40	4.03E-05	4.96	9	0.5004	0.011	BL	-	BL	-	1.3286	0.0301	1.5394	0.0297	1.51E-08
SPFT-006-B2-11	0	40	4.03E-05	5.46	9	0.5004	0.011	BL	-	BL	-	1.1790	0.0263	1.6054	0.0310	1.32E-08
SPFT-006-B2-14	0	40	4.03E-05	6.97	9	0.5003	0.011	BL	-	BL	-	0.8202	0.0183	1.7606	0.0343	9.21E-09
SPFT-006-B2-15	0	40	4.03E-05	7.46	9	0.5002	0.011	BL	-	BL	-	0.8782	0.0198	1.8583	0.0362	9.94E-09
SPFT-006-B2-17	0	40	4.03E-05	8.45	9	0.5002	0.011	BL	-	BL	-	0.8163	0.0182	2.0657	0.0403	9.17E-09
SPFT-006-B2-21	0	40	4.03E-05	9.94	9	0.5001	0.011	BL	-	BL	-	0.6797	0.0148	1.8420	0.0359	7.45E-09
SPFT-006-B2-23	0	40	4.03E-05	10.93	9	0.5000	0.011	BL	-	BL	-	0.6679	0.0145	1.5771	0.0306	7.31E-09
SPFT-006-B2-27	0	40	4.03E-05	12.42	9	0.4999	0.011	BL	-	BL	-	0.6195	0.0133	1.1776	0.0227	6.70E-09

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Table E2. SPFT Results for IDF2-G9 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #50 (cont)																
SPFT-006-B2-29	0	40	4.03E-05	13.41	9	0.4999	0.011	BL	-	BL	-	0.6751	0.0147	0.8972	0.0171	7.40E-09
SPFT-006-B2-32	0	40	4.03E-05	14.90	9	0.4998	0.011	BL	-	0.1079	0.0121	0.6004	0.0128	0.7929	0.0151	6.46E-09
SPFT-006-B2-34	0	40	4.03E-05	15.89	9	0.4997	0.011	BL	-	BL	-	0.6436	0.0139	0.8240	0.0157	7.00E-09
SPFT-006-B2-37	0	40	4.03E-05	17.88	9	0.4996	0.011	BL	-	BL	-	0.6163	0.0132	0.7733	0.0147	6.66E-09
SPFT-006-B2-39	0	40	4.03E-05	18.37	9	0.4995	0.011	BL	-	BL	-	0.6303	0.0145	0.8127	0.0143	7.28E-09
SPFT-006-B2-43	0	40	4.03E-05	20.36	9	0.4994	0.011	BL	-	BL	-	0.6411	0.0147	0.8465	0.0150	7.42E-09
SPFT-006-B2-47	0	40	4.03E-05	22.34	9	0.4992	0.011	BL	-	BL	-	0.5800	0.0132	0.8329	0.0147	6.65E-09
SPFT-006-B2-50	0	40	4.03E-05	23.83	9	0.4990	0.011	BL	-	BL	-	0.6148	0.0141	0.7800	0.0137	7.09E-09
SPFT-006-B2-52	0	40	4.03E-05	24.82	9	0.4989	0.011	BL	-	BL	-	0.6060	0.0139	0.7544	0.0132	6.98E-09
SPFT-006-B2-57	0	40	4.03E-05	27.30	9	0.4987	0.011	0.0973	0.0136	BL	-	0.5140	0.0127	0.6308	0.0126	-
SPFT-006-B2-59	0	40	4.03E-05	28.29	9	0.4984	0.011	0.0974	0.0137	BL	-	0.5362	0.0132	0.6262	0.0125	-
SPFT-006-B2-62	0	40	4.03E-05	29.78	9	0.4982	0.011	0.0897	0.0126	BL	-	0.4872	0.0120	0.5748	0.0114	-
SPFT-006-B2-64	0	40	4.03E-05	30.77	9	0.4980	0.011	0.0801	0.0112	BL	-	0.4331	0.0107	0.5158	0.0103	-
Exp. #51																
SPFT-007-B2-Blank-1	1	90	-	-	9	-	-	< 0.0012	-	0.0484	-	0.1670	-	0.9377	-	-
SPFT-007-B2-Blank-2	1	90	-	-	9	-	-	< 0.0121	-	< -0.0231	-	0.0238	-	1.2080	-	-
SPFT-007-B2-Blank-3	1	90	-	-	9	-	-	0.0035	-	<-0.0092	-	0.0011	-	0.9828	-	-
SPFT-007-B2-2	1	90	6.48E-05	0.56	9	0.4980	0.011	2.9635	0.6702	0.4071	0.0607	21.9118	0.8481	5.3719	0.1411	8.95E-08
SPFT-007-B2-6	1	90	6.48E-05	1.67	9	0.4916	0.011	3.2425	0.7397	0.5172	0.0800	21.4475	0.8373	6.5780	0.1810	4.91E-08
SPFT-007-B2-10	1	90	6.48E-05	2.78	9	0.4792	0.010	2.6828	0.6224	0.5537	0.0877	17.2592	0.6851	6.1954	0.1717	3.15E-08
SPFT-007-B2-15	1	90	6.48E-05	4.17	9	0.4608	0.010	2.3258	0.5539	0.8109	0.1359	16.2486	0.6620	6.4151	0.1836	5.44E-08
SPFT-007-B2-18	1	90	6.48E-05	5.00	9	0.4392	0.010	2.0260	0.4982	0.7824	0.1350	13.7239	0.5772	5.9645	0.1740	3.98E-08
SPFT-007-B2-22	1	90	6.48E-05	6.12	9	0.4138	0.009	2.1100	0.5370	0.5455	0.1044	12.1253	0.5316	5.8800	0.1780	-
SPFT-007-B2-26	1	90	6.48E-05	7.23	9	0.4086	0.009	1.7596	0.4511	0.1930	0.0373	10.6290	0.4699	5.2859	0.1579	9.46E-09
SPFT-007-B2-27	1	90	6.48E-05	7.51	9	0.4056	0.009	1.8637	0.4804	0.6359	0.1069	10.4147	0.4616	5.5361	0.2020	-
SPFT-007-B2-28	1	90	6.48E-05	7.78	9	0.4050	0.009	1.8008	0.4645	0.5253	0.1020	10.5634	0.4698	5.5290	0.1677	2.66E-09
Exp. #52																
SPFT-007-J-Blank-1	40	90	-	-	9	-	-	0.0619	-	< -0.0112	-	0.1074	-	46.0452	-	-
SPFT-007-J-Blank-2	40	90	-	-	9	-	-	< 0.0056	-	0.0155	-	0.1219	-	44.0111	-	-
SPFT-007-J-Blank-3	40	90	-	-	9	-	-	<-0.0115	-	0.0027	-	0.0941	-	45.3978	-	-
SPFT-007-J-2	40	90	6.48E-05	0.56	9	0.4975	0.011	3.9034	0.8760	0.1020	0.0169	22.6327	0.8731	51.2722	0.2002	-
SPFT-007-J-6	40	90	6.48E-05	1.67	9	0.4878	0.011	5.2730	1.2017	0.1661	0.0281	28.9456	1.1326	52.8021	0.2525	-
SPFT-007-J-10	40	90	6.48E-05	2.78	9	0.4748	0.010	4.4136	1.0228	0.1721	0.0297	24.6988	0.9833	53.9283	0.2943	-
SPFT-007-J-15	40	90	6.48E-05	4.17	9	0.4629	0.010	3.5669	0.8391	0.1204	0.0210	21.5001	0.8699	53.5144	0.2854	-
SPFT-007-J-18	40	90	6.48E-05	5.00	9	0.4537	0.010	3.2541	0.7752	0.1822	0.0324	18.5923	0.7618	54.6678	0.3286	-
SPFT-007-J-22	40	90	6.48E-05	6.12	9	0.4468	0.010	2.7357	0.6571	0.1519	0.0272	16.0873	0.6653	55.2645	0.3525	4.13E-09
SPFT-007-J-26	40	90	6.48E-05	7.23	9	0.4402	0.010	2.2190	0.5367	0.1086	0.0195	14.0665	0.5869	54.5176	0.3301	2.53E-08

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Table E2. SPFT Results for IDF2-G9 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #52 (cont)																
SPFT-007-J-28	40	90	6.48E-05	7.78	9	0.5001	0.011	2.3177	0.5199	0.1699	0.0260	12.4240	0.4737	53.2953	0.2615	-
SPFT-007-J-31	40	90	6.48E-05	8.62	9	0.4321	0.010	2.0921	0.5119	0.1319	0.0241	12.7120	0.5366	56.9093	0.4184	1.24E-08
Exp. #53																
SPFT-007-K-Blank-1	80	90	-	-	9	-	-	0.0648	-	0.0077	-	0.1999	-	93.1268	-	-
SPFT-007-K-Blank-2	80	90	-	-	9	-	-	0.2212	-	0.0134	-	0.2811	-	89.6245	-	-
SPFT-007-K-Blank-3	80	90	-	-	9	-	-	<-0.0116	-	0.0133	-	0.1856	-	90.0380	-	-
SPFT-007-K-2	80	90	6.48E-05	0.56	9	0.9960	0.021	6.1576	0.6804	0.0783	0.0057	35.2669	0.6786	98.2969	0.1109	-
SPFT-007-K-6	80	90	6.48E-05	1.67	9	0.9821	0.021	7.4942	0.8394	0.0626	0.0044	41.9960	0.8166	102.0420	0.1725	-
SPFT-007-K-10	80	90	6.48E-05	2.78	9	0.9636	0.021	6.4257	0.7265	BL	-	36.4544	0.7172	103.0710	0.1915	-
SPFT-007-K-15	80	90	6.48E-05	4.17	9	0.9454	0.021	5.9191	0.6765	BL	-	33.6501	0.6701	106.3690	0.2487	-
SPFT-007-K-18	80	90	6.48E-05	5.00	9	0.9308	0.021	4.9905	0.5737	BL	-	28.5543	0.5739	103.5060	0.2033	8.46E-11
SPFT-007-K-21	80	90	6.48E-05	5.84	9	0.9214	0.020	4.5803	0.5287	BL	-	26.8806	0.5436	106.3500	0.2526	7.49E-09
SPFT-007-K-26	80	90	6.48E-05	7.23	9	0.9107	0.020	3.7905	0.4380	BL	-	23.5777	0.4799	104.9930	0.2315	2.11E-08
SPFT-007-K-27	80	90	6.48E-05	7.51	9	0.9034	0.020	3.6961	0.4195	BL	-	21.4030	0.4367	99.5248	0.1384	8.65E-09
SPFT-007-K-31	80	90	6.48E-05	8.62	9	0.8980	0.020	3.2646	0.3784	0.0305	0.0021	20.7418	0.4256	103.4260	0.2068	2.38E-08
Exp. #54																
SPFT-007-L-Blank-1	100	90	-	-	9	-	-	0.3060	-	0.0545	-	0.3680	-	114.0080		
SPFT-007-L-Blank-2	100	90	-	-	9	-	-	0.1637	-	0.0174	-	0.2295	-	110.1730		
SPFT-007-L-Blank-3	100	90	-	-	9	-	-	<-0.0117	-	0.0229	-	0.1896	-	104.0460		
SPFT-007-L-2	100	90	6.48E-05	0.56	9	0.9962	0.021	5.8024	0.6297	BL	-	34.0075	0.6530	114.3720	0.0365	1.17E-08
SPFT-007-L-6	100	90	6.48E-05	1.67	9	0.9821	0.021	7.8917	0.8743	BL	-	44.4383	0.8632	119.9020	0.1263	-
SPFT-007-L-10	100	90	6.48E-05	2.78	9	0.9629	0.021	6.7980	0.7594	BL	-	38.0737	0.7485	124.0100	0.1953	-
SPFT-007-L-15	100	90	6.48E-05	4.17	9	0.9440	0.021	6.1935	0.6986	BL	-	35.5374	0.7075	126.7390	0.2432	4.50E-09
SPFT-007-L-18	100	90	6.48E-05	5.00	9	0.9288	0.020	5.4081	0.6131	BL	-	31.0362	0.6239	126.0100	0.2336	5.41E-09
SPFT-007-L-23	100	90	6.48E-05	6.39	9	0.9170	0.020	4.1194	0.4643	BL	-	26.6818	0.5401	123.5230	0.1935	3.81E-08
SPFT-007-L-26	100	90	6.48E-05	7.23	9	0.9064	0.020	4.1529	0.4720	BL	-	25.1190	0.5120	127.1860	0.2575	2.02E-08
SPFT-007-L-27	100	90	6.48E-05	7.51	9	0.9012	0.020	3.8442	0.4364	BL	-	22.0298	0.4500	116.0050	0.0666	6.83E-09
SPFT-007-L-31	100	90	6.48E-05	8.62	9	0.8958	0.020	3.3401	0.3770	BL	-	21.4821	0.4405	122.1150	0.1723	3.19E-08
Exp. #55																
SPFT-008-B2-Blank-1	0	23	-	-	9	-	-	<-0.0023	-	<-0.0135	-	0.0021	-	0.4657	-	-
SPFT-008-B2-Blank-2	0	23	-	-	9	-	-	<-0.0002	-	<-0.0040	-	0.0012	-	0.4831	-	-
SPFT-008-B2-2	0	23	9.36E-06	2.98	9	1.0004	0.022	0.0958	0.0016	0.0089	-	1.3128	0.0037	1.2843	0.0019	1.05E-09
SPFT-008-B2-5	0	23	9.50E-06	8.93	9	1.0002	0.022	0.1196	0.0020	0.0385	0.0005	1.3376	0.0038	1.4220	0.0022	9.08E-10
SPFT-008-B2-7	0	23	9.50E-06	13.77	9	1.0000	0.022	0.1112	0.0018	0.0483	0.0006	1.1445	0.0032	1.5886	0.0026	7.03E-10
SPFT-008-B2-10	0	23	9.94E-06	19.00	9	0.9998	0.022	0.0970	0.0017	0.0487	0.0006	0.8781	0.0026	1.4166	0.0023	4.62E-10
SPFT-008-B2-12	0	23	9.22E-06	21.67	9	0.9996	0.022	0.0874	0.0014	0.0413	0.0005	0.7757	0.0021	1.0687	0.0014	3.64E-10

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Table E2. SPFT Results for IDF2-G9 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #55 (cont.)																
SPFT-008-B2-14	0	23	9.50E-06	25.63	9	0.9995	0.022	0.0812	0.0013	0.0533	0.0007	0.7041	0.0020	0.9270	0.0011	3.25E-10
SPFT-008-B2-17	0	23	9.65E-06	31.59	9	0.9993	0.022	0.0751	0.0013	0.0562	0.0007	0.6271	0.0018	0.8394	0.0009	2.70E-10
SPFT-008-B2-20	0	23	9.50E-06	37.54	9	0.9991	0.022	0.0679	0.0011	0.0523	0.0006	0.5558	0.0016	0.8055	0.0008	2.24E-10
SPFT-008-B2-22	0	23	9.50E-06	41.51	9	0.9990	0.022	0.0742	0.0012	0.0631	0.0008	0.5639	0.0017	0.8567	0.0009	2.14E-10
SPFT-008-B2-24	0	23	9.50E-06	45.47	9	0.9989	0.022	0.0748	0.0012	0.0648	0.0009	0.5536	0.0016	0.8841	0.0009	1.94E-10
SPFT-008-B2-25	0	23	9.36E-06	47.46	9	0.9988	0.022	0.0745	0.0012	0.0646	0.0008	0.5392	0.0016	0.9038	0.0010	1.73E-10
SPFT-008-B2-27	0	23	9.50E-06	51.43	9	0.9987	0.022	0.0763	0.0013	0.0646	0.0009	0.5302	0.0016	0.9281	0.0010	1.47E-10

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Table E3. SPFT Results for IDF3-F7 Glass.

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #56																
SPFT-004-G-Blank-1	0	90	-	-	9	-	-	0.0470	-	<-0.0008	-	1.4135	-	0.1534	-	-
SPFT-004-G-Blank-2	0	90	-	-	9	-	-	<0.0005	-	<-0.0092	-	0.8942	-	0.0114	-	-
SPFT-004-G-Blank-3	0	90	-	-	9	-	-	<0.0004	-	<-0.0102	-	1.0206	-	0.0090	-	-
SPFT-004-G-2	0	90	5.04E-05	0.40	9	0.4980	0.011	0.8304	0.1233	1.1555	0.1286	4.0255	0.1355	5.1828	0.1216	6.14E-09
SPFT-004-G-4	0	90	5.04E-05	0.79	9	0.4974	0.011	1.1444	0.1729	1.5927	0.1774	4.7687	0.1742	7.0880	0.1678	6.68E-10
SPFT-004-G-5	0	90	5.04E-05	0.99	9	0.4968	0.011	1.3911	0.2120	1.6579	0.1848	4.8064	0.1763	7.3945	0.1753	-
SPFT-004-G-9	0	90	5.04E-05	1.79	9	0.4956	0.011	1.4684	0.2245	1.7395	0.1942	4.9402	0.1836	7.8359	0.1863	-
SPFT-004-G-13	0	90	5.04E-05	2.58	9	0.4938	0.011	1.3988	0.2140	1.6694	0.1868	4.5424	0.1633	7.4352	0.1770	-
SPFT-004-G-15	0	90	5.04E-05	2.98	9	0.4924	0.011	1.4513	0.2228	1.7182	0.1926	4.5524	0.1641	7.7148	0.1842	-
SPFT-004-G-17	0	90	5.04E-05	3.37	9	0.4915	0.011	1.4493	0.2227	1.7189	0.1930	4.6555	0.1697	7.7253	0.1847	-
SPFT-004-G-20	0	90	5.04E-05	3.97	9	0.4903	0.011	1.3372	0.2052	1.5959	0.1794	4.5673	0.1654	7.0943	0.1695	-
SPFT-004-G-23	0	90	5.04E-05	4.56	9	0.4890	0.011	1.4406	0.2221	1.7022	0.1917	4.6146	0.1681	7.6317	0.1830	-
SPFT-004-G-24	0	90	5.04E-05	4.76	9	0.4881	0.011	1.2375	0.1900	1.5172	0.1711	3.7518	0.1230	6.6931	0.1602	-
SPFT-004-G-25	0	90	5.04E-05	4.96	9	0.4877	0.011	1.3738	0.2118	1.6391	0.1849	4.3916	0.1567	7.3606	0.1767	-
SPFT-004-G-33	0	90	5.04E-05	6.55	9	0.4857	0.011	1.3833	0.2139	1.6190	0.1832	4.4857	0.1621	7.2959	0.1756	-
Exp. #57																
SPFT-006-B1-Blank-1	0	40	-	-	9	-	-	< -0.0060	-	< -0.0073	-	0.0766	-	< 0.0277	-	-
SPFT-006-B1-Blank-2	0	40	-	-	9	-	-	< -0.0196	-	< -0.0091	-	0.0891	-	0.0461	-	-
SPFT-006-B1-Blank-3	0	40	-	-	9	-	-	< -0.0289	-	< -0.0086	-	0.0389	-	0.1832	-	-
SPFT-006-B1-Blank-4	0	40	-	-	9	-	-	< -0.0001	-	< -0.0121	-	0.0065	-	< -0.0001	-	-
SPFT-006-B1-1	0	40	4.03E-05	0.50	9	0.5009	0.011	0.1270	0.0159	0.0944	0.0078	0.5767	0.0210	0.6373	0.0117	2.57E-09
SPFT-006-B1-2	0	40	4.03E-05	0.99	9	0.5008	0.011	0.1933	0.0242	0.2028	0.0167	0.7721	0.0292	1.1065	0.0207	2.52E-09
SPFT-006-B1-4	0	40	4.03E-05	1.98	9	0.5005	0.011	0.2288	0.0287	0.2903	0.0239	0.8687	0.0333	1.4728	0.0278	2.32E-09
SPFT-006-B1-5	0	40	4.03E-05	2.48	9	0.5002	0.011	0.2140	0.0268	0.2741	0.0225	0.7553	0.0285	1.4286	0.0270	8.58E-10
SPFT-006-B1-7	0	40	4.03E-05	3.47	9	0.4999	0.011	0.2643	0.0331	0.3039	0.0250	0.7385	0.0278	1.4709	0.0278	-
SPFT-006-B1-8	0	40	4.03E-05	3.97	9	0.4996	0.011	0.2364	0.0297	0.2701	0.0222	0.6974	0.0261	1.3061	0.0246	-
SPFT-006-B1-9	0	40	4.03E-05	4.46	9	0.4994	0.011	0.2144	0.0269	0.2565	0.0211	0.7000	0.0262	1.2783	0.0241	-
SPFT-006-B1-10	0	40	4.03E-05	4.96	9	0.4992	0.011	0.2165	0.0272	0.2887	0.0238	0.8867	0.0341	1.3601	0.0257	3.48E-09
SPFT-006-B1-12	0	40	4.03E-05	5.95	9	0.4989	0.011	0.2088	0.0262	0.3058	0.0252	0.6437	0.0239	1.3972	0.0264	-
SPFT-006-B1-14	0	40	4.03E-05	6.97	9	0.4986	0.011	0.1815	0.0228	0.2109	0.0174	0.6805	0.0249	1.4977	0.0280	1.06E-09
SPFT-006-B1-15	0	40	4.03E-05	7.46	9	0.4983	0.011	0.1655	0.0208	0.3333	0.0275	0.6930	0.0255	1.4789	0.0276	2.34E-09
SPFT-006-B1-17	0	40	4.03E-05	8.45	9	0.4981	0.011	0.1475	0.0185	0.2500	0.0206	0.6406	0.0232	1.3716	0.0256	2.37E-09
SPFT-006-B1-21	0	40	4.03E-05	9.94	9	0.4978	0.011	0.1206	0.0152	BL	-	0.5207	0.0182	1.0566	0.0195	1.53E-09
SPFT-006-B1-23	0	40	4.03E-05	10.93	9	0.4976	0.011	0.1273	0.0160	0.2963	0.0244	0.5751	0.0205	1.2538	0.0233	2.26E-09
SPFT-006-B1-27	0	40	4.03E-05	12.42	9	0.4973	0.011	0.1317	0.0166	0.2353	0.0193	0.5590	0.0198	1.1282	0.0209	1.64E-09
SPFT-006-B1-29	0	40	4.03E-05	13.41	9	0.4970	0.011	0.1192	0.0150	BL	-	0.5102	0.0178	0.9835	0.0181	1.39E-09
SPFT-006-B1-32	0	40	4.03E-05	14.90	9	0.4968	0.011	0.1155	0.0145	0.2331	0.0193	0.5440	0.0192	0.9870	0.0182	2.35E-09

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Table E3. SPFT Results for IDF3-F7 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate $\times 10^5$ m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #57 (cont)																
SPFT-006-B1-34	0	40	4.03E-05	15.89	9	0.4965	0.011	0.1635	0.0206	0.1829	0.0151	0.6220	0.0225	1.3515	0.0253	9.64E-10
SPFT-006-B1-37	0	40	4.03E-05	17.38	9	0.4961	0.011	0.1632	0.0206	0.3546	0.0293	0.7339	0.0273	1.4258	0.0267	3.36E-09
SPFT-006-B1-39	0	40	4.03E-05	18.37	9	0.4958	0.011	0.1582	0.0200	BL	-	0.6215	0.0263	1.3520	0.0226	3.19E-09
SPFT-006-B1-42	0	40	4.03E-05	19.86	9	0.4954	0.011	0.1613	0.0204	0.3061	0.0253	0.6233	0.0264	1.3623	0.0228	3.03E-09
SPFT-006-B1-47	0	40	4.03E-05	22.34	9	0.4949	0.011	0.1538	0.0194	0.1125	0.0093	0.5871	0.0249	1.3372	0.0224	2.74E-09
SPFT-006-B1-50	0	40	4.03E-05	23.83	9	0.4943	0.011	0.1629	0.0206	0.1160	0.0096	0.5964	0.0253	1.3248	0.0221	2.36E-09
SPFT-006-B1-52	0	40	4.03E-05	24.82	9	0.4940	0.011	0.1374	0.0174	0.1586	0.0131	0.5437	0.0230	1.3162	0.0220	2.86E-09
SPFT-006-B1-54	0	40	4.03E-05	25.81	9	0.4937	0.011	0.1559	0.0197	0.1957	0.0162	0.5963	0.0253	1.3357	0.0224	2.80E-09
SPFT-006-B1-57	0	40	4.03E-05	27.30	9	0.4934	0.011	0.1813	0.0229	BL	-	0.5632	0.0239	1.1516	0.0224	4.82E-10
SPFT-006-B1-59	0	40	4.03E-05	28.29	9	0.4929	0.011	0.2050	0.0260	BL	-	0.5741	0.0244	1.2237	0.0238	-
SPFT-006-B1-62	0	40	4.03E-05	29.78	9	0.4926	0.011	0.1565	0.0198	BL	-	0.5221	0.0222	1.0147	0.0197	1.18E-09
SPFT-006-B1-64	0	40	4.03E-05	30.77	9	0.4922	0.011	0.1647	0.0209	BL	-	1.4461	0.0614	1.0323	0.0201	2.04E-08
Exp. #58																
SPFT-007-B1-Blank-1	1	90	-	-	9	-	-	< 0.0019	-	< -0.0097	-	0.1946	-	1.1501	-	-
SPFT-007-B1-Blank-2	1	90	-	-	9	-	-	< 0.0047	-	< -0.0188	-	0.0350	-	1.1786	-	-
SPFT-007-B1-Blank-3	1	90	-	-	9	-	-	0.0117	-	< -0.0088	-	0.0023	-	0.9788	-	-
SPFT-007-B1-2	1	90	6.48E-05	0.56	9	0.5005	0.011	0.8383	0.1684	0.6413	0.0847	2.8305	0.1780	6.0601	0.1505	4.82E-09
SPFT-007-B1-6	1	90	6.48E-05	1.67	9	0.4988	0.011	0.9893	0.1993	0.8855	0.1169	2.9663	0.1876	7.3485	0.1904	-
SPFT-007-B1-10	1	90	6.48E-05	2.78	9	0.4953	0.011	0.9630	0.1949	0.8894	0.1174	2.8240	0.1788	7.4224	0.1936	-
SPFT-007-B1-14	1	90	6.48E-05	3.89	9	0.4893	0.011	1.0551	0.2153	1.0697	0.1412	2.9741	0.1906	8.1570	0.2180	-
SPFT-007-B1-18	1	90	6.48E-05	5.00	9	0.4806	0.010	0.9484	0.1958	0.7120	0.0940	2.5862	0.1660	7.4782	0.1993	-
SPFT-007-B1-22	1	90	6.48E-05	6.39	9	0.4698	0.010	1.1188	0.2346	0.8002	0.1056	2.6577	0.1735	7.8654	0.2147	-
SPFT-007-B1-26	1	90	6.48E-05	7.23	9	0.4551	0.010	0.9946	0.2130	-	-	2.4617	0.1631	7.0194	0.1917	-
SPFT-007-B1-28	1	90	6.48E-05	7.78	9	0.4398	0.010	1.0853	0.2378	0.8833	0.1166	2.5498	0.1734	7.7813	0.2215	-
SPFT-007-B1-29	1	90	6.48E-05	8.06	9	0.4219	0.010	1.0998	0.2472	0.9921	0.1468	2.4555	0.1832	7.6504	0.2243	-
Exp. #59																
SPFT-007-G-Blank-1	40	90	-	-	9	-	-	ND	-	0.0675	-	0.4665	-	45.6902	-	-
SPFT-007-G-Blank-2	40	90	-	-	9	-	-	< -0.0261	-	0.0744	-	0.4154	-	43.6230	-	-
SPFT-007-G-Blank-3	40	90	-	-	9	-	-	< -0.0109	-	0.0064	-	0.0724	-	42.8190	-	-
SPFT-007-G-2	40	90	6.48E-05	0.56	9	0.4996	0.011	1.1446	0.2309	0.2481	0.0233	3.2156	0.1877	49.0154	0.1338	-
SPFT-007-G-7	40	90	6.48E-05	1.95	9	0.4976	0.011	0.8605	0.1740	0.3230	0.0332	2.4376	0.1354	52.3846	0.2379	-
SPFT-007-G-10	40	90	6.48E-05	2.78	9	0.4957	0.011	0.7075	0.1435	0.3100	0.0315	2.1221	0.1143	53.9495	0.2868	-
SPFT-007-G-15	40	90	6.48E-05	3.89	9	0.4942	0.011	0.6775	0.1377	0.3003	0.0302	2.0458	0.1094	59.0172	0.4441	-
SPFT-007-G-18	40	90	6.48E-05	5.00	9	0.4927	0.011	0.6154	0.1253	0.2691	0.0261	1.9025	0.0998	63.5347	0.5850	-
SPFT-007-G-22	40	90	6.48E-05	6.39	9	0.4910	0.011	0.6266	0.1279	0.2239	0.0202	1.9320	0.1020	76.4386	0.9871	-

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Table E3. SPFT Results for IDF3-F7 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #59 (cont)																
SPFT-007-G-26	40	90	6.48E-05	7.23	9	0.4895	0.011	0.5908	0.1208	0.1511	0.0106	1.9003	0.1001	65.3517	0.6441	-
SPFT-007-G-27	40	90	6.48E-05	7.51	9	0.4888	0.011	0.6961	0.1425	0.1289	0.0084	1.5974	0.0794	55.9687	0.3524	-
SPFT-007-G-31	40	90	6.48E-05	8.62	9	0.4879	0.011	0.5433	0.1113	0.2818	0.0278	1.7594	0.0906	38.7232	-	-
Exp. #60																
SPFT-007-H-Blank-1	80	90	-	-	9	-	-	< 0.0057	-	0.0423	-	0.5605	-	94.6784	-	-
SPFT-007-H-Blank-2	80	90	-	-	9	-	-	< -0.0105	-	0.0165	-	0.1548	-	88.8299	-	-
SPFT-007-H-Blank-3	80	90	-	-	9	-	-	< -0.1653	-	0.0369	-	0.5261	-	89.2828	-	-
SPFT-007-H-2	80	90	6.48E-05	0.56	9	1.0000	0.022	1.1550	0.1159	0.1262	0.0057	4.6306	0.1382	99.4951	0.1153	1.12E-08
SPFT-007-H-6	80	90	6.48E-05	1.67	9	0.9979	0.021	1.1515	0.1157	0.1122	0.0048	4.1358	0.1216	101.4500	0.1455	2.99E-09
SPFT-007-H-10	80	90	6.48E-05	2.78	9	0.9954	0.021	0.9624	0.0967	0.0958	0.0037	3.4394	0.0982	101.4770	0.1461	7.38E-10
SPFT-007-H-15	80	90	6.48E-05	3.89	9	0.9931	0.021	0.9443	0.0951	0.0888	0.0033	3.2998	0.0936	104.7830	0.1973	-
SPFT-007-H-18	80	90	6.48E-05	5.00	9	0.9910	0.021	0.8393	0.0845	0.0822	0.0028	2.9600	0.0822	104.3790	0.1914	-
SPFT-007-H-22	80	90	6.48E-05	6.39	9	0.9888	0.021	0.7843	0.0797	0.0847	0.0030	2.8132	0.0773	105.3390	0.2065	-
SPFT-007-H-26	80	90	6.48E-05	7.23	9	0.9870	0.021	0.6751	0.0687	0.0742	0.0023	2.6576	0.0721	105.8670	0.2149	1.74E-09
SPFT-007-H-27	80	90	6.48E-05	7.51	9	0.9861	0.021	0.8875	0.0903	0.0657	0.0019	2.3915	0.0620	106.0910	0.2185	-
SPFT-007-H-31	80	90	6.48E-05	8.62	9	0.9850	0.021	0.7202	0.0733	0.0758	0.0024	2.6484	0.0719	107.3230	0.2378	-
Exp. #61																
SPFT-007-I-Blank-1	100	90	-	-	9	-	-	< -0.0915	-	0.0526	-	0.5452	-	115.8810	-	-
SPFT-007-I-Blank-2	100	90	-	-	9	-	-	< -0.0107	-	0.0271	-	0.1862	-	111.1600	-	-
SPFT-007-I-Blank-3	100	90	-	-	9	-	-	< -0.1735	-	0.0514	-	0.5273	-	114.9850	-	-
SPFT-007-I-2	100	90	6.48E-05	0.56	9	0.9994	0.022	0.9934	0.1002	0.1128	0.0040	4.2496	0.1256	122.9750	0.1158	1.28E-08
SPFT-007-I-7	100	90	6.48E-05	1.67	9	0.9976	0.021	1.0082	0.1018	0.1025	0.0033	3.7635	0.1093	123.2580	0.1203	3.76E-09
SPFT-007-I-10	100	90	6.48E-05	2.78	9	0.9953	0.021	0.8810	0.0891	0.0918	0.0026	3.2581	0.0923	124.1890	0.1348	1.62E-09
SPFT-007-I-15	100	90	6.48E-05	3.89	9	0.9932	0.021	0.8796	0.0891	0.0929	0.0027	3.1455	0.0886	129.6410	0.2190	-
SPFT-007-I-20	100	90	6.48E-05	5.56	9	0.9909	0.021	0.6941	0.0704	0.0915	0.0026	2.7956	0.0769	129.2340	0.2131	3.25E-09
SPFT-007-I-22	100	90	6.48E-05	6.39	9	0.9889	0.021	0.7411	0.0753	0.0970	0.0030	2.7777	0.0764	131.8650	0.2540	5.41E-10
SPFT-007-I-26	100	90	6.48E-05	7.23	9	0.9876	0.021	0.6886	0.0700	0.0970	0.0030	2.6175	0.0710	126.4700	0.1708	4.78E-10
SPFT-007-I-28	100	90	6.48E-05	7.78	9	0.9865	0.021	0.9295	0.0946	0.0911	0.0026	2.7599	0.0759	127.4980	0.1868	-
SPFT-007-I-31	100	90	6.48E-05	8.62	9	0.9853	0.021	0.6546	0.0667	0.1022	0.0034	2.5276	0.0680	130.2190	0.2291	6.77E-10
Exp. #62																
SPFT-008-B1-Blank-1	0	23	-	-	9	-	-	<-0.0003	-	< -0.0144	-	0.0212	-	0.0756	-	-
SPFT-008-B1-Blank-2	0	23	-	-	9	-	-	<0.0014	-	< -0.0090	-	0.0019	-	0.0793	-	-
SPFT-008-B1-2	0	23	9.22E-06	2.98	9	0.9993	0.022	0.1529	0.0022	0.0438	0.0004	0.4896	0.0023	1.0605	0.0022	3.02E-11
SPFT-008-B1-5	0	23	9.79E-06	8.93	9	0.9989	0.022	0.2306	0.0035	0.0083	0.0001	0.6580	0.0033	1.5291	0.0034	-
SPFT-008-B1-7	0	23	9.36E-06	13.77	9	0.9984	0.021	0.2544	0.0037	0.1742	0.0017	0.6382	0.0030	1.7781	0.0038	-
SPFT-008-B1-10	0	23	1.02E-05	19.00	9	0.9979	0.021	0.2120	0.0034	0.1727	0.0018	0.5337	0.0027	1.6363	0.0038	-

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Table E3. SPFT Results for IDF3-F7 Glass (cont.)

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[B] ppm	B Rate g m ⁻² d ⁻¹	[Al] ppm	Al Rate g m ⁻² d ⁻¹	[Na] ppm	Na Rate g m ⁻² d ⁻¹	[Si] ppm	Si Rate g m ⁻² d ⁻¹	IEX Rate mol m ⁻² s ⁻¹
Exp. #62 (cont)																
SPFT-008-B1-12	0	23	9.50E-06	21.67	9	0.9975	0.021	0.2000	0.0030	0.0763	0.0007	0.5078	0.0024	1.5552	0.0033	-
SPFT-008-B1-14	0	23	9.50E-06	25.63	9	0.9972	0.021	0.2050	0.0030	0.1820	0.0018	0.4987	0.0024	1.5200	0.0033	-
SPFT-008-B1-17	0	23	9.79E-06	31.59	9	0.9968	0.021	0.2082	0.0032	0.2360	0.0024	0.4831	0.0024	1.5029	0.0033	-
SPFT-008-B1-20	0	23	9.50E-06	37.54	9	0.9963	0.021	0.2092	0.0031	0.2052	0.0020	0.4915	0.0023	1.4865	0.0032	-
SPFT-008-B1-22	0	23	9.65E-06	41.51	9	0.9958	0.021	0.2203	0.0033	0.2165	0.0023	0.4698	0.0024	1.4506	0.0031	-
SPFT-008-B1-24	0	23	9.22E-06	45.47	9	0.9955	0.021	0.2219	0.0032	0.2470	0.0025	0.5387	0.0026	1.4622	0.0030	-
SPFT-008-B1-25	0	23	9.50E-06	47.46	9	0.9952	0.021	0.2157	0.0032	0.2133	0.0022	0.4729	0.0023	1.4645	0.0031	-
SPFT-008-B1-27	0	23	9.07E-06	51.43	9	0.9950	0.021	0.2165	0.0031	0.2475	0.0025	0.4780	0.0023	1.4864	0.0030	-

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Table E4. Re Results for IDF1-B2 Glass

Sample ID	Inf [Si] ppm	T °C	Flow Rate m ³ /d	Time days	pH at 23°C	Glass Mass g	SA m ²	[Re] ppm	Re Rate g m ⁻² d ⁻¹
Exp. #6									
SPFT-004-F-Blank-2	0	90	-	-	12	-	-	0.0000	-
SPFT-004-F-Blank-3	0	90	-	-	12	-	-	0.0000	-
SPFT-004-F6,F7,F8.	0	90	5.04E-05	1.59	12	0.4815	0.010	0.3439	1.5457
SPFT-004-F11,F12	0	90	5.04E-05	2.38	12	0.4555	0.010	0.4776	2.2275
SPFT-004-F13,F14	0	90	5.04E-05	2.78	12	0.4298	0.010	0.4789	2.3217
SPFT-004-F18,F19	0	90	5.04E-05	3.77	12	0.4069	0.009	0.5138	2.5834
Exp. #12									
SPFT-005-F-BLANK-3	0	70	-	-	12	-	-	< 0.0010	
SPFT-005-F6,F7,F8	0	70	4.75E-05	1.23	12	0.4969	0.011	0.1055	0.4336
SPFT-005-F11,F12	0	70	4.75E-05	1.85	12	0.4907	0.011	0.1158	0.4804
SPFT-005-F14,F15,F16	0	70	4.75E-05	2.47	12	0.4853	0.011	0.1389	0.5813
SPFT-005-F-18	0	70	4.75E-05	3.25	12	0.4794	0.010	0.1308	0.5516
SPFT-005-F-20	0	70	4.75E-05	4.03	12	0.4705	0.010	0.1594	0.6817
SPFT-005-F28,F29,F30	0	70	4.75E-05	5.62	12	0.4513	0.010	0.1892	0.8327
SPFT-005-F35,F36,F37	0	70	4.75E-05	6.67	12	0.4368	0.010	0.1963	0.8832
SPFT-005-F43,F44,F45	0	70	4.75E-05	7.87	12	0.4225	0.010	0.1831	0.8420
SPFT-005-F60,F61,F62	0	70	4.75E-05	14.03	12	0.3326	0.008	0.1957	1.0558
SPFT-005-F65,F66,F67	0	70	4.75E-05	16.06	12	0.3113	0.008	0.2180	1.2299
SPFT-005-F71,F72	0	70	4.75E-05	16.81	12	0.2789	0.007	0.2239	1.3594
SPFT-005-F74,F75	0	70	4.75E-05	17.26	12	0.2792	0.007	0.2066	1.2529
Exp. #31									
SPFT-007-A-Blank-2	1	90	-	-	9	-	-	< -0.0008	-
SPFT-007-A-27	1	90	6.48E-05	7.51	9	0.4727	0.010	2.90E-02	0.1697
Exp. #32									
SPFT-007-B-Blank-2	40	90	-	-	9	-	-	< -0.0011	-
SPFT-007-B-28	40	90	6.48E-05	7.78	9	0.4545	0.010	0.0104	0.0624