A Framework for the Study of "Mercury Jars" and Other Stoneware from the Temasek Period of Singapore, alongside 12th to 14th-century Stoneware from Kota Cina, Sumatra



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This dissertation is dedicated to all those who have come before and live on in what they have left behind

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Abstract

This dissertation concerns the study of stoneware vessels, an often-overlooked corpus of material in Southeast Asian archaeology due to the relative ease with which peculiarities in earthenware clay can be studied and the intricate decorations and glazes of porcelains are more easily catalogued and correlated. These so-called "functional" and "trade" wares are used as proxies to investigate trends of ceramic production, trade and exchange in Southeast Asia during the 12^{th}-15^{th} centuries, a period marked by the fragmentation of centralised political control and the emergence of "atomistic" trading-posts and city-states such as Kota Cina and Singapore, which are taken as the temporal ends of this period in this study. It may be hoped that through the high-resolution scanning electron microscope study of these materials, that in addition to insights on these aforementioned trends, so as to demonstrate the further potential of this overlooked material in future studies of Southeast Asian history.

Contents

1 Introduction **1**

1.1 Trade and Exchange in Southeast Asia, 12^{th}–15^{th} Centuries 2

1.2 Ceramics in 12^{th}–15^{th} Century Southeast Asia 5

1.2.1 Overview 5

1.2.2 Earthenware 6

1.2.2.1 Earthenware in Singapore 6

1.2.2.2 Earthenware in Kota Cina 8

1.2.3 Porcelain 9

1.2.3.1 Porcelain in Singapore 9

1.2.3.2 Porcelain in Kota Cina 10

1.2.4 Stoneware 11

1.2.4.1 Stoneware forms and classification 11

1.2.4.2 Chemistry of high-fired ceramics 14

1.2.4.3 Chemistry of ceramic glazes 17

1.3 Archaeological Ceramic Analysis in Singapore and Kota Cina 18

1.3.1 Study of Fine Paste Earthenwares in Kota Cina 18

1.3.2 Study of Greenwares in Singapore 19

2 Sites **21**

2.1 Kota Cina (KTC) 21

2.2 Singapore (STA) 24

3 Research Design **27**

3.1 Aims 27

3.2 Materials 28

3.2.1 Buff ware 29

3.2.2 Brittle ware 29

3.2.3 Mercury jars 30

3.2.4 Images . . . 30
3.2.4.1 Buff ware . . . 31
3.2.4.2 Brittle ware . . . 33
3.2.4.3 Mercury and Tempered jars . . . 35
3.3 Methods . . . 37
3.3.1 Organisation . . . 37
3.3.2 Visual examination . . . 38
3.3.3 X-Ray Fluorescence . . . 39
3.3.4 Sub-sampling . . . 39
3.3.5 Scanning electron microscope (SEM) – Electron microprobe analysis . . . 40

4 Results **41**
4.1 Visual examination . . . 41
4.1.1 Body fabrics . . . 41
4.1.1.1 Buff ware . . . 42
4.1.1.2 Brittle ware . . . 43
4.1.1.3 Mercury jars . . . 44
4.1.2 Glazes . . . 44
4.1.2.1 Buff ware . . . 45
4.1.2.2 Brittle ware . . . 46
4.1.2.3 Mercury jars . . . 46
4.2 XRF analysis . . . 47
4.3 SEM semi-quantification calibration . . . 48
4.4 SEM micro-textural examination . . . 49
4.4.1 Phases and features . . . 49
4.5 SEM semi-quantitative body analysis . . . 53
4.5.1 Overview . . . 53
4.5.2 Al_2O_3 . . . 58
4.5.2.1 STA . . . 58
4.5.2.2 KTC . . . 61
4.5.2.3 Inter-site analysis . . . 64
4.5.3 Fe_2O_3 . . . 66
4.5.3.1 STA . . . 66
4.5.3.2 KTC . . . 69
4.5.3.3 Inter-site analysis . . . 72

4.5.4 K_2O . . . 75
4.5.4.1 STA . . . 75
4.5.4.2 KTC . . . 78
4.5.4.3 Inter-site analysis . . . 82
4.5.5 Summary . . . 84
4.6 SEM semi-quantitative glaze analysis . . . 85
4.6.1 Overview . . . 85
4.6.2 CaO . . . 86
4.6.2.1 STA and MgO . . . 86
4.6.2.2 KTC multi-glazed sherds . . . 87
4.6.3 K_2O . . . 87
4.6.4 PbO . . . 87
4.6.5 Fe_2O_3 and MnO . . . 88
4.6.6 Summary . . . 89

5 Discussion **90**
5.1 Body fabrics . . . 90
5.1.1 Fe_2O_3 vs. Al_2O_3/SiO_2 . . . 92
5.1.2 K_2O vs. Al_2O_3/SiO_2 . . . 95
5.2 Glazes . . . 97
5.2.1 K_2O vs. CaO . . . 98
5.2.2 MgO and P_2O_5 vs. CaO . . . 100
5.2.3 PbO . . . 103
5.2.4 Fe_2O_3 . . . 103
5.3 Summary . . . 105
5.3.1 KTC and STA . . . 105
5.3.2 Southeast Asia and China . . . 106

6 Conclusions **107**
6.1 Trade and Exchange of Stoneware (and More) in Southeast Asia, 12^{th}–15^{th} Centuries . . . 107
6.2 Future Directions for Ceramic Analysis in Southeast Asian Archaeology 109

Bibliography **111**

A Statistical Tests **114**
A.1 Tests for Normal Distribution 115
A.2 Pairwise t-tests 128
A.2.1 Combined (Al_2O_3) 151
A.2.2 Combined (Fe_2O_3) 152
A.2.3 Combined (K_2O) 154
A.3 Linear regression tests 155
A.3.1 MgO vs. CaO 155
A.3.2 P_2O_5 vs. CaO 155

B Semi-Quantitative SEM Data **156**
B.1 STA . . . . .
B.1.1 Body fabrics (varied count) . . . . .
B.1.2 Body fabrics . . . . .
B.1.3 Glazes . . . . .
B.2 KTC . . . . .
B.2.1 Body fabrics . . . . .
B.2.2 Glazes . . . . .
B.3 Chinese ware (Wood, 1999) . . . . .
B.3.1 Clays . . . . .
B.3.2 Body fabrics . . . . .
B.3.3 Glazes . . . . .

C EDXRF Results

List of Figures

1.1 Map of Singapore and Kota Cina, amongst other Malay ports of the 10^{th}–14^{th} centuries. Modified from Heng (2009). 1
1.2 Typology of "mercury jars". In Wong (2016). 13
1.3 ernary diagram of Fe_2O_3,CaO,MgO–Al_2O_3,TiO_2–K_2O,Na_2O. In Fiori et al. (1989). 14
1.4 A simplified *chaîne opératoire* of glazed and unglazed ceramic production. 16

2.1 Map of Kota Cina, amongst other Southeast Asian kingdoms and ports of the 11^{th}–13^{th}centuries. In Miksic (2013). 21
2.2 Map of Singapore, amongst other sites of the Malay Archipelago in the 14^{th}–16^{th} centuries. In Miksic (2013). 24
2.3 Map of 14^{th}-century archaeological sites in Singapore. In Miksic (2013). 25

3.1 STA buff wares. 31
3.2 KTC buff wares. 32
3.3 STA brittle wares. 33
3.4 KTC buff wares. 34
3.5 STA brittle wares. 35
3.6 KTC mercury jars and tempered jars. 36
3.7 Workflow of this project. 37
3.8 Workflow of the visual examination of the KTC and STA sherds. . . . 38

4.1 SEM images of quartz, titanium, and zircon grains. 49
4.2 SEM images of iron grains, vitrified phases, and mullite 50
4.3 Fe_2O_3% vs. Al_2O_3% scatterplots, STA and KTC 55
4.4 K_2O% vs. Al_2O_3% scatterplots, STA and KTC 56
4.5 Al_2O_3% by category stripchart, STA 59
4.6 Al_2O_3% by category stripchart, KTC 62
4.7 Al_2O_3% by category stripchart; KTC and STA combined 64
4.8 Fe_2O_3% by category stripchart; Fe_2O_3% vs. Al_2O_3% scatterplot, STA 67

4.9 Fe_2O_3% by category stripchart; Fe_2O_3% vs. Al_2O_3% scatterplot, KTC 70
4.10 Fe_2O_3% by category stripchart; KTC and STA combined 72
4.11 K_2O% by category stripchart; K_2O% vs. Al_2O_3% scatterplot, STA . . 76
4.12 K_2O% by category stripchart; K_2O% vs. Al_2O_3% scatterplot, KTC . 79
4.13 K_2O% by category stripchart; KTC and STA combined 82
4.14 Fe_2O_3 and MnO by site stripcharts 88

5.1 Fe_2O_3% vs. Al_2O_3/SiO_2 scatterplot, KTC 92
5.2 K_2O % vs. Al_2O_3/SiO_2 scatterplot, KTC 95
5.3 K_2O% vs. CaO% scatterplots 98
5.4 MgO% vs. CaO% scatterplots 100
5.5 P_2O_5% vs. CaO% scatterplots 101
5.6 Fe_2O_3 by site stripchart 103

List of Tables

1.1 Summary of earthenware, stoneware, and porcelain 15

3.1 Types and numbers of ceramic sherds in St. Andrew's Cathedral and Kota Cina obtained from the NUS-NTU Archaeological Laboratory in Singapore. 28
3.2 List of buff ware fabric groups from STA and KTC. 29
3.3 List of brittle ware fabric groups from STA and KTC. 29
3.4 List of mercury jar fabric groups from STA and KTC. 30

4.1 Colour variation seen in buff ware fabric groups from STA and KTC. 42
4.2 Colour variation seen in brittle ware fabric groups from STA and KTC. 43
4.3 Colour variation in mercury jar fabric groups from STA and KTC. . . 44
4.4 Colour variation seen in buff ware glazes from STA and KTC. 45
4.5 Colour variation seen in brittle ware glazes from STA and KTC. . . . 46
4.6 Means and standard deviations of major elements in STA-MER-B body fabrics as a test for count length. 48
4.7 Frequency table of these three features in STA sherds. 51
4.8 Oxides commonly found in ceramic bodies and their significance in SEM semi-quantitative analysis 53
4.9 Legend for Section 4.5 54
4.10 Mean ($\pm$1sd) Al_2O_3% of STA ceramic body-fabrics. 58
4.11 p-values of pairwise t-tests between categories and outliers. 58
4.12 p-values of pairwise t-tests between a) Buff ware, b) Brittle ware, c) Mercury jar fabric groups concerning mean Al_2O_3%. 60
4.13 Mean ($\pm$1sd) Al_2O_3% of KTC ceramic body-fabrics. 61
4.14 p-values of pairwise t-tests between KTC categories concerning mean Al_2O_3%. 61
4.15 p-values of pairwise t-tests between KTC a) Buff ware, b) Brittle ware, c) Mercury jar, d) Tempered jar fabric groups concerning mean Al_2O_3%. 63

4.16 p-values of pairwise t-tests between KTC and STA wares, concerning mean Al_2O_3%. 65
4.17 Mean (±1sd) Fe_2O_3% of STA ceramic body-fabrics. 66
4.18 p-values of pairwise t-tests between categories and outliers concerning mean Fe_2O_3% 66
4.19 p-values of pairwise t-tests between a) Buff ware, b) Brittle ware, c) Mercury jar fabric groups concerning mean Fe_2O_3%. 68
4.20 Mean (±1sd) Fe_2O_3% of KTC ceramic body-fabrics. 69
4.21 p-values of pairwise t-tests between KTC categories and outliers, concerning mean Fe_2O_3%. 69
4.22 p-values of pairwise t-tests between KTC a) Buff ware, b) Brittle ware, c) Mercury jar, d) Tempered jar fabric groups concerning mean Fe_2O_3%. 71
4.23 p-values of pairwise t-tests between KTC and STA wares, concerning mean Fe_2O_3%. 73
4.24 Mean (±1sd) K_2O% of STA ceramic body-fabrics. 75
4.25 p-values of pairwise t-tests between categories and outliers concerning mean K_2O%. 75
4.26 p-values of pairwise t-tests between a) Buff ware, b) Brittle ware, c) Mercury jar fabric groups concerning mean K_2O%. 77
4.27 Mean (±1sd) K_2O% of KTC ceramic body-fabrics. 78
4.28 p-values of pairwise t-tests between KTC categories concerning mean K_2O%. 78
4.29 p-values of pairwise t-tests between KTC a) Buff ware, b) Brittle ware, c) Mercury jar, d) Tempered jar fabric groups concerning mean K_2O%. 80
4.30 p-values of pairwise t-tests between KTC and STA wares, concerning mean K_2O%. 82
4.31 Oxides commonly found in ceramic glazes and their significance in SEM semi-quantitative analysis 85
4.32 Mean (±1sd) of the oxides of Mg, P, K, Ca, Mn, Fe and Pb, expressed in compound% at STA and KTC. Full results are in **Appendix B**. . 86

5.1 Oxides commonly found in ceramic bodies and their significance in SEM semi-quantitative analysis 90
5.2 Legend for Figures 5.1(a) and 5.2(a) 93
5.3 Legend for Chapter 5 scatterplots 93

5.4 Oxides commonly found in ceramic glazes and their significance in SEM semi-quantitative analysis 97
5.5 Linear regression tests on the combined KTC and STA MgO vs. CaO and P_2O_5 vs. CaO trend-lines. 102

Chapter 1

Introduction

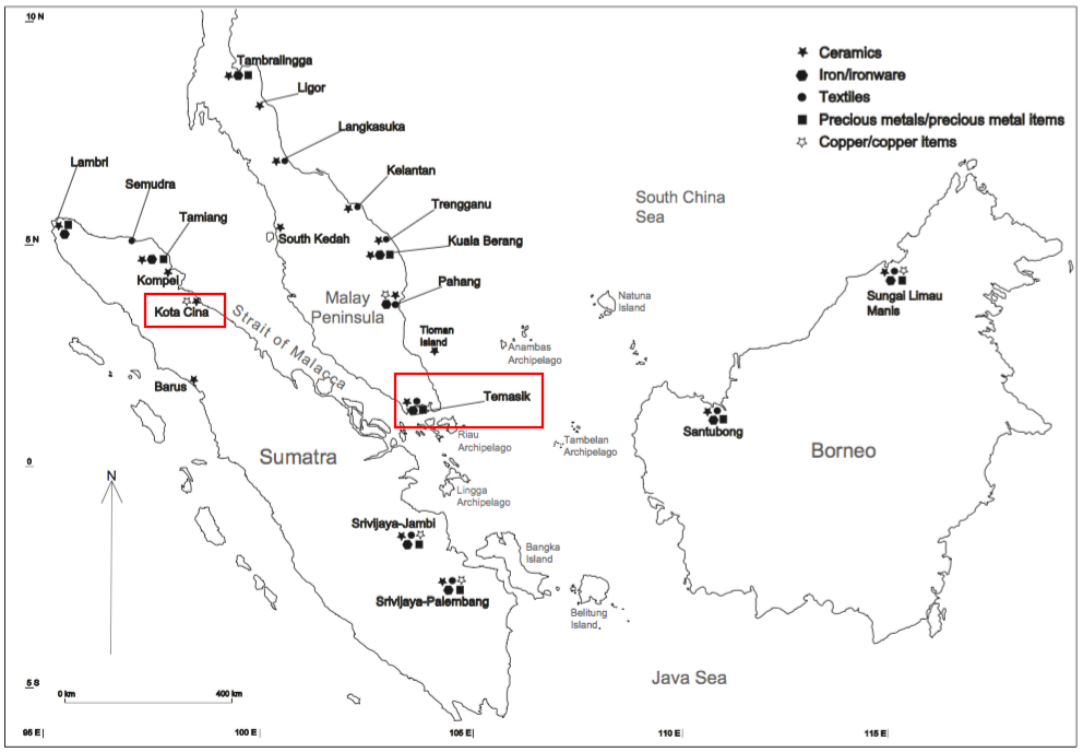


Figure 1.1: Singapore, rendered here as *Temasik*, and Kota Cina (*enclosed in* ***red boxes***), amongst other Malay ports of the 10^{th}–14^{th} centuries (Heng, 2009, 151).

This dissertation encompasses the study of stoneware – high-fired ceramics that, due to their relative "coarseness" and general variability in quality compared to porcelain, have come be less well studied and understood – in the context of patterns of trade and contact between China and Southeast Asia during shifts in the political centralisation and fragmentation of both regions.

It may be hoped that inferences concerning stoneware ceramic clays and glazes may be reached through the qualitative and quantitative analysis of material from Kota Cina, a 12^{th}–14^{th} century trading post formed from the coalescence of foreign merchant interest and local systems of social organisation, alongside Singapore, a 14^{th}–15^{th} century mercantile city-state which prospered from its geographical location linking the Andaman and South China Seas.

This research is intended to fill gaps not only in terms of the range of materials lent to serious scientific study at both sites, but also in demonstrating the utility of high-resolution scientific analysis to Singaporean archaeology, as this project is, to my knowledge, the first to employ scanning electron microscope analysis on ceramics of this period to this extent. I hope to demonstrate that this level of precision may inform us more about issues of trade and exchange than previous forms of analysis have on these materials.

1.1 Trade and Exchange in Southeast Asia, 12^{th}–15^{th} Centuries

These vessels excavated from Singapore and Sumatra comprise one aspect of the network of goods and ideas traded in Southeast Asia during three centuries reflective of evolving attitudes concerning trade and exchange within and beyond the region. Regional thassalocracies and mainland polities played various rôles in the production, distribution and use of ceramics, metals, foodstuffs amongst other materials, with the South China Sea acting as a conduit for these entanglements with mainland China (Heng, 2009, 2-4) (Miksic, 2013, 93-109).

The significance of the Imperial Chinese production and exchange of these materials almost cannot be overstated due to the masses of Chinese ceramics in Southeast Asia, to the extent that sites are largely dated by their correlations with Chinese typology sequences. Ceramics are the main material used to study entanglements between Southeast Asia and China due to the taphonomic biases involved in the tropical and marine environments in which these traded goods would be deposited, which degrade many other types of materials (Miksic, 2013, 289-290).

The period encompassed by this study contains shifts in trade policy both within and between dynasties, and these must be elaborated upon to contextualise the studied sites, their broader region and their material culture. At the turn of the 12^{th} century, the Song Dynasty was in crisis. Northern China had been overrun by Jurchen invaders, and soon the entire country would be conquered by the Mongols

(Miksic, 2013, 99-103). Although the dominance of Confucian ideals had enforced a general reticence towards engagement with foreign powers, limiting trade to a tributary system where gifts were received from polities in Southeast Asia, the loss of Northern China meant that trade became necessary for survival and soon restrictions were loosened, accelerating of engagement with Southeast Asia's regional powers (Heng, 2009, 95-110).

This policy, however, was not enough to reverse the fortunes of the Song Dynasty, which was eventually conquered by the Mongols. The Mongol rulers discontinued diplomatic policies of their predecessors and pursued political as opposed to economic goals in their (re-)establishment of diplomatic ties with the Malay polities, a state of affairs which persisted until they were eventually deposed by the native Han population (Heng, 2009, 109-110). The ascendancy of the Ming Dynasty in 1368 and the re-enactment of Confucian values led to an overall withdrawal of China from the region, in what has been termed the "Ming gap" in Southeast Asian trade (Heng, 2009, 190) (Miksic, 2013, 199).

The two sites discussed in this dissertation represent two temporal ends of the dissolution of the empires of the past such as the Angkor and Srivijayan polities and the fragmentation of the region into individual trading posts and city-states (Miksic, 2013, 103-107). Kota Cina's occupation period highlights this earlier phase at the twilight of the earlier thassalocracies and the role of Chinese merchants in shaping settlements and patterns of trade and exchange (Miksic, 2013, 121-125), while Singapore is emblematic of the latter multipolar period (Miksic, 2013, 20). The city-state of Singapore benefited from increased volumes of trade into and within Southeast Asia and eventually entered mythopoeic literature as a pseudo-legendary kingdom (Miksic, 2013, 153-154).

Although Kota Cina is only known from the archaeological record as it is not mentioned in any ancient textual sources (Miksic, 2013, 121-123), Singapore holds a particular position in the *Malay Annals*. In these accounts, which evolved through centuries of transcription and embellishment, Singapura was founded by a Sang Nila Utama and ruled for five generations until the actions of its fifth ruler Parameswara, or Iskandar Shah, led to reprisals from either the Majapahit Empire (modern Indonesia and Malaysia) or Siam (modern Thailand) and the abandonment of Singapura, a direct antecedent to the founding of the Melaka Sultanate, one of the powers active in Southeast Asia prior to European colonisation of the region (Miksic, 2013, 146-154).

Due to the fictional nature of some aspects of Singapura's narrative, such as Sang Nila Utama saving his ship from a storm by casting his crown into the sea and

naming the island after an Asiatic lion, a species whose distribution never extended east of India (Miksic, 2013, 150-151), Singapore's historicity remained unclear until the emergence of archaeological evidence of a deep engagement with external trade partners, in addition to the palatial structures upon the so-called "Forbidden Hill", which also became the basis of the British colony of Singapore (Miksic, 2013, 229).

Singapore hence represents the post-Srivijayan norms of political fragmentation in archipelagic Southeast Asia, as unlike the Majapahit Empire or the Johor Sultanate, the Singaporean rulers never held suzerainty over any external territories (Xin, 2015, 352-355); however, it existed contemporaneously with numerous *mainland* kingdoms which had arisen following the decline of the Khmer Empire. Foremost amongst these was the Ayutthaya Kingdom, which might be identified with the "Siamese" held responsible for Singapore's downfall (Miksic, 2013, 162-163;356-357); Siam also included kiln complexes at Sisatchanalai famous for stoneware production (Grave et al., 2000, 170-172).

In summary, Kota Cina was contemporary both with the dying embers of the Srivijayan thassalocracy and the sharp increase in the Song Dynasty's final engagements with Southeast Asia, whilst Singapore represents the shifts from Chinese re-engagement in trade with the region to the Ming Dynasty's isolationist policies alongside the multipolar status quo giving way to the re-emergence of thassolcratic empires in the Malay Archipelago. It is hence these contexts within which the sherds in this study are situated.

1.2 Ceramics in 12^{th}–15^{th} Century Southeast Asia

Trade networks in Southeast Asia involved a wide variety of materials; however, it is ceramics which have come to dominate studies of its material culture, due to its resistance to taphonomic processes and pre-existing biases within the field to porcelain and emphases on seriation and typology of vessels and sherds (Miksic, 2013, 290-291). This study hence is to some extent a product of these biases, and necessitates a brief discussion of ceramic types.

1.2.1 Overview

Ceramics are crucial to understanding trade and exchange in Southeast Asia due to their variety of styles and forms (Heng, 2009, 171-190); their importance increased as Imperial Chinese authorities enacted bans on the transmission of cash into the region, cueing the use of ceramics as a substitute (Heng, 2009, 173). Archaeological ceramics may be correlated to securely dated sequences, and hence both dates and the provenance of the newly discovered deposit may be determined. Inferences are usually extended to encompass the entirety of their deposits or the entire site, and a certain interpretative bias hence arises from the ubiquity of ceramic artefacts.

Within this cultural-historical model, correlations can be made essentially on stylistic grounds. This is particularly useful in situations where destructive sub-sampling is impossible due to conservation concerns, and all conclusions must be made through visual examination. However, geological and chemical data derived from archaeological science are able to provide independent lines of evidence for the *chaîne opératoire* of ceramic production (Kingery, 1982, 37-38).

Ceramics in the archaeological record may be broadly grouped into earthenware, stoneware and porcelain, a schematic applied by Miksic (2013) to all Singaporean material, and also used beyond the city-state, as seen in Heng (2009). Although the focus of this dissertation is on stoneware, it is worthwhile to discuss the use of this "culture-history" model in its applications to earthenware and porcelain in Singapore and Kota Cina, before discussing the archaeological science of their stonewares and potential areas for application of high-resolution analytical methods.

1.2.2 Earthenware

Earthenware is typified by its porousness and softness relative to stoneware and porcelain (Hamer, 1975, 111). Earthenware clays are more commonplace than the more refined clays needed for "high-fired" ceramics (Hamer, 1975, 60), and earthenware is hence generally assumed to reflect local pottery traditions (Miksic, 2013, 266-267).

1.2.2.1 Earthenware in Singapore

Earthenware is hence used to represent "local production" at Singapore in Miksic (2013)'s study; he categorises the Singaporean corpus by variation in body fabrics, first by temper then by surface treatment:

- Fine Quartz Temper
  - unslipped
  - pink/white slip
  - brown slip
  - red slip/paint
  - thin-bodied paddle-marked
- Other temper
  - Mica
  - Pyrite
- Fine Paste
- Chalky
- Eavesboard
- Brick
- Burnished
- Red

This classification is made possible by the mechanics of pot forming and firing; temper (non-plastic inclusions) is primarily found in earthenware due to its already relatively heterogenous and porous matrix, and confers certain properties to the body fabric, such as improving its workability or altering the fabric's porosity, shrinkage or glaze fit during firing (Hamer, 1975, 120).

Although visible to the naked eye, temper is better studied using exposed sherd surfaces, and ideally under a microscope with polarised light after a suitable thin-section of 30μm thickness has been sawn from it, permitting identification of individual minerals. This mineralogical analysis is difficult for high-fired ceramics as their less porous and more homogeneous matrices do not permit inclusions of such size, necessitating higher-resolution study under instruments such as the scanning-electron microscope (Reedy, 2008, 113-122).

Miksic (2013) focuses on the distinction between the tempered sherds and the "fine-paste" ceramics, noting the concentration of the latter in the Fort Canning area corresponding to the ancient palatial complex and correlating it with differences observed in forms and decorations. These three classifications: body fabric, form, and decoration, hence can be combined with geographical data and compared with sequences from other sites to draw inferences concerning status, interconnectivity and functionality.

Miksic (2013) next catalogues these latter two properties (forms and decorations), a process which does not necessitate destructive sub-sampling unlike visual or thin-section petrography. Most vessels are classified as "cooking pots" and "containers", and relationships are made utilising data concerning external decorations to pottery traditions of the immediate region, but also as far as Zhejiang in southeast China (Miksic, 2013, 269-275).

1.2.2.2 Earthenware in Kota Cina

In Kota Cina, the absence of suitable earthenware clays for fine-paste ware within the immediate vicinity is hence already suggestive of connexions with pottery-producing regions in Sumatra, or possibly beyond, and adds a dimension to Miksic and Teck (1992)'s investigation into the earthenwares of Kota Cina.

- Sand Temper
  - unslipped
  - white slip
  - red slip
- Other temper
  - Shell
- Fine Paste

Although Miksic and Teck (1992) also catalogue the forms in which these earthenwares manifest, little stylistic comparison is used to date or provenance the earthenware; it is instead the porcelain at the site which is used for both (*see below*, **Section 1.3.1**), and the classifications at Kota Cina are instead used as a prelude to the application of X-Ray Fluorescence in an attempt to chemically characterise the fine-paste ware and provenance its production.

1.2.3 Porcelain

Porcelain and stoneware are differentiated from earthenware by their relative hardness caused by their lower porosity, and are typified as "high-fired ceramics" . Within this era, porcelain production is linked to Chinese kilns (Hamer, 1975, 285-286). This is sensible given their effective monopoly due to their mastery of the requisite technical knowledge and their wealth of kaolinite, the essential mineral ingredient which imbues hardness and the characteristic white lustre to the ceramic fabric; Western attempts at porcelain would not succeed until the 16^{th}-17^{th} centuries (Hamilton, 1982, 8-9).

The evolution of archaeology from antiquarianism means that Chinese porcelains of the historic period have been used to form coherent sequences which can be used in dating and provenancing archaeological finds (Wood, 1999), and it is this purpose for which these porcelains are used in examinations of the *longue durée* of Chinese interaction with Southeast Asia with regards to both terrestrial sites and shipwrecks (Heng, 2009, 171-172) (Miksic, 2013, 103-104;133-140).

Specific porcelains of interest are **whiteware** (including *qingbai*) and **greenware** which, beyond simply representing different production sequences, also reflect the socio-political context in which ceramics were traded during this period. Whiteware, with its uniform and lustrous body and glaze fabrics, is the archetypical white porcelain, and was mainly produced by the Guangdong kilns and channelled through Guangzhou during the Song Dynasty (Heng, 2009, 174-175). Fujian and Zhejiang-produced greenware and celadon ceramics began to overtake whiteware production during the Southern Song and Yuan Dynasties, a trend which correlates with the rise of Quanzhou at the expense of Guangzhou as the chief port for Southeast Asian-bound traders (Heng, 2009, 175-178).

1.2.3.1 Porcelain in Singapore

Greenwares dominate the ceramic record in Singapore, reflecting its temporal position in the shift from Guangzhou to Quanzhou and changes in ceramic production from Guangdong to Fujian and Zhejiang. Most greenwares were bowls bearing stamped motifs, a change from earlier sites with moulded decorations. Greenwares in Singaporean sites also included plates, lidded jars, jarlets and incense burners (Miksic, 2013, 295-301).

Also present in Singapore are whitewares and *qingbai*, some of which have been connected to Yuan-era kilns, especially Dehua, by their white glazes and *shu-fu* stamps. Special access to the Chinese market by the Fort Canning elites has been

inferred from rare forms such as an intricately decorated porcelain pillow and enormous porcelain vessels with incised designs. "Grey ware", similar to but distinct from whiteware, suggests connections with Fujian kilns (Miksic, 2013, 301-304).

The *terminus ante quem* of Singapore's zenith can be inferred from the presence of Ming blue-and-white porcelains; the absolute latest dates for Singapore's use as a trading port (derived from Late Ming-style sherds) postdate its fall as recorded in the Malay Annals and Portuguese sources, and even the conquest of the Johor Sultanate, its successor state, to the Dutch in 1511 (Miksic, 2013, 310).

1.2.3.2 Porcelain in Kota Cina

Kota Cina is essentially dated by the correlation of its numerous Song Dynasty porcelain sherds to existing typologies. The sheer volume of porcelain presents indicates extensive use as a trading post, perhaps representing the entanglement of itinerant Chinese merchants and local authorities, and a prelude to the stockade-settlements erected by Ming-era merchants (Miksic, 2013, 121-125).

The porcelain at Kota Cina is reflective of an earlier point in the trends manifesting at Singapore; while the majority of porcelain is Fujian-produced greenwares, Kota Cina whiteware sherds are those from the Guangdong kilns, suggesting that they had not been totally eclipsed yet by Fujian (Heng, 2009, 178). The presence of "grey wares" nevertheless suggests that the Fujian kilns were beginning to push into the whiteware trade (Miksic, 2013, 304). Greenware decorations included the aforementioned sculpted fish motif, which were used to date the site to the Song Dynasty. This site also suggests Chinese awareness of their target markets, seen in the emulation of Southeast Asian earthenware forms such as a porcelain *kendi*, a small handled jar (Miksic, 2013, 127).

1.2.4 Stoneware

Stoneware is divided by both Heng (2009) and Miksic (2013) into "fine" and "coarse" material. As "coarse" material is typified as "functional ware", it lacks the attention porcelain garners, but also cannot be studied as easily as earthenware using mineralogy due to the filtering out of characteristic minerals during stoneware clay production and depletion of such minerals during their firing (Reedy, 2008, 113-117). This state of affairs is summarised thusly by Miksic (2013):

> The stonewares from Singapore still remain to be analyzed in detail. This is an important if somewhat prosaic task.

If stoneware cannot be correlated to sequences as readily as porcelain, nor can it be studied like earthenware with this wealth of mineralogical knowledge, what lines of evidence ought to be best pursued? We must (as we have done for the other ceramics) first discuss what variability is evident to the naked eye, then turn to their chemistry and microstructure to explore further lines of evidence which we may use to characterise these "trade wares".

1.2.4.1 Stoneware forms and classification

Miksic (2013) associates "fine" and "coarse" stoneware with the broad categories of "buff" and "brittle" ware, and concurs with Heng (2009) in associating these different types of stoneware with different production sites, forms and functions; however, he also emphasises that these two categories, although easily differentiated, also have considerable variation within them. As both publications lack visual aids, it is difficult to evaluate the coherence of these equivalences. Nevertheless, this broad categorisation is an organic starting-point for visual examination, as differences are obvious to the naked eye of both the potter and the eventual examiner of such material.

Heng (2009) elaborates upon the economics of this "buff-brittle" dichotomy, noting that the trade in high-value "fine" ware increased in volume and proportion during the post-Srivijayan fragmentation as consumers within the Malay Archipelago engaged in direct trade with the Imperial Chinese kilns, moving away from provincial-level trade dominated by "coarse ware".

Buff ware or "fine" ware, is characterised by a lack of temper or other non-plastic inclusions, and may be associated with a brown glaze, and also apparently manifests in a greater variety of forms and shapes than brittle ware (Miksic, 2013, 322). Its production is associated by both Heng (2009) and Miksic (2013) with the Guangdong and Fujian kilns, which allegedly represent "national"-level production.

Brittle ware or "coarse" ware, is characterised by the *presence* of these inclusions; Miksic (2013) theorises that these permit firing at higher temperatures than the buff wares, which is true as far as sand is concerned, but obviously varies depending on the nature of the inclusions (Hamer, 1975, 149). These are generally taken to be fairly uniform storage jars and are defines by Heng (2009) as the "second level" of Chinese-driven trade in this period.

Mercury jars or "bottles" are considered by Miksic (2013) to be a type of brittle ware due to their relatively heterogeneous composition, and are present within the region throughout the occupational period of both Kota Cina and Singapore. Mercury jars are characterised by their narrow bases, tapered sides leading to broad shoulders which close up to a fairly narrow mouth. Wong (2016) has gathered data from kiln and deposit sites to sequence the evolution of these jars (**Figure 1.2**).

Despite their ubiquity in the region, the contents of mercury jars curiously still remain an unresolved debate. The relative lack of heed paid to refining their body fabrics have led both Miksic (2013) and Wong (2016) to conclude that their unique shape must relate more to functionality than artistry, but the authors sharply differ following this point. Miksic (2013) and Wong (2016) both invoke metallurgical wisdom, the former concluding that the shape of the vessels would have lent strength and stability to them, and permitted them to containerise the dense liquid with the narrow opening preventing toxic mercury from escaping, whilst the latter states that the wide shoulders and narrow necks of the bottles would instead have rendered the mercury within susceptible to overflowing.

Wong (2016) notes that mercury mining and mercury jar production areas did not correlate; Miksic (2013) suggests that they were brought together in an intermediate location prior to being shipped out to consumers.

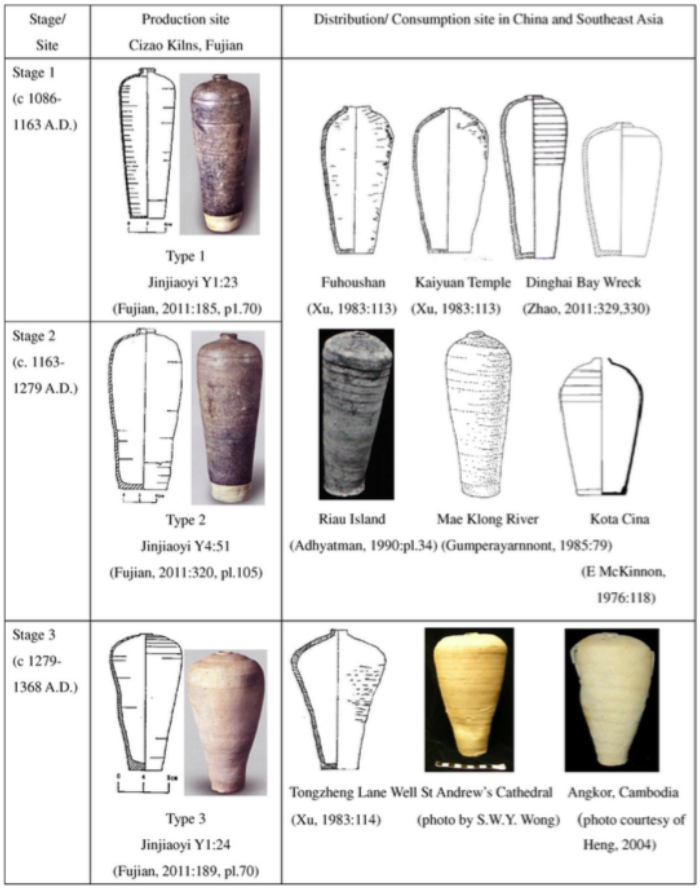


Figure 1.2: The stages in the evolution of mercury jars through the 11^{th}–14^{th} centuries in Southeast Asian trade (Wong, 2016, 14).

As regards the utility of mercury in the region, the metal has historically been widely traded in China and Southeast Asia, and was used in the metallurgical extraction of gold and gilding of copper, alongside medicinal purposes recorded in ancient texts; mercury and its ore, cinnabar, were also highly symbolic in contemporary Chinese mysticism (Miksic, 2013, 316-318).

Further complicating the issue is the known reuses of these durable, widely produced, bottles for other particulate or liquid goods. Wong (2016) concedes that these vessels might have been initially used to containerise mercury, but focuses on parallels to wine jars and Southeast Asian demand for Chinese wine to construct an argument for their employment within this trade, a conclusion also reached by (Heng, 2009); wine is acknowledged as a potential substance transported within these bottles by Miksic (2013), who nevertheless emphasises that the shape of these vessels speaks to a singular initial purpose, as opposed to a generic container.

1.2.4.2 Chemistry of high-fired ceramics

Earthenware, stoneware and porcelain are generally differentiated by the firing temperatures of the ceramics, which are governed by their chemical compositions to a large extent (Pollard and Heron, 2008, 115-118).

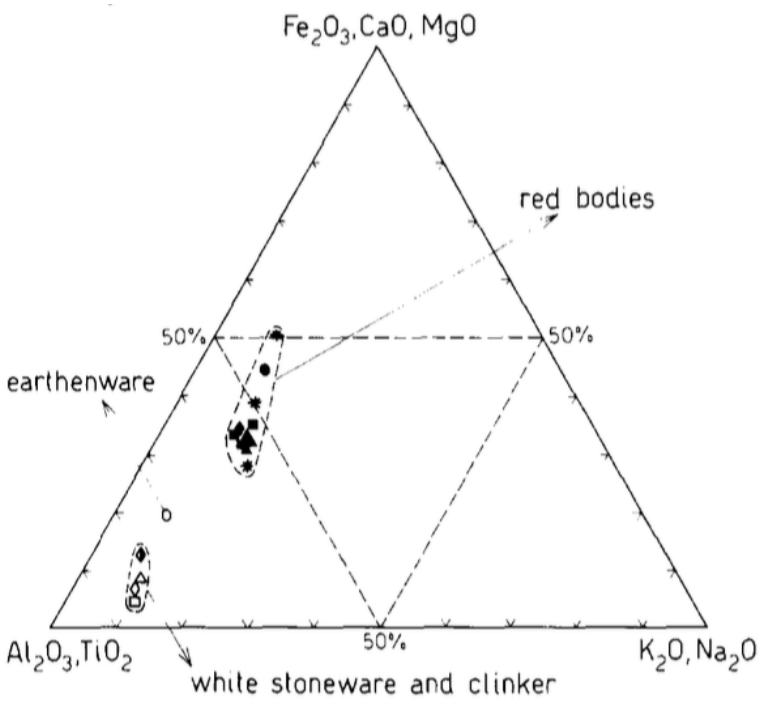


Figure 1.3: Ternary diagram of Fe_2O_3,CaO,MgO–Al_2O_3,TiO_2–K_2O,Na_2O, with earthenware, stoneware and "clinkers" amongst the "tout venant" tiles marked. (Fiori et al., 1989, 465)

Some of the more important oxides involved in ceramic firing are those of **aluminium**, **iron**, and **potassium** (see **Figure 1.3**, where their ratios are used to characterise various ceramics), with **silicon**-based grains and clays forming most of the balance (Pollard and Heron, 2008, 117). Aluminium oxides are considered "refractory" and permit firing at higher temperatures (Hamer, 1975, 249); on the whole, porcelain contains more aluminium content than stoneware and stoneware likewise contains more than earthenware (Pollard and Heron, 2008, 117-118).

These refractory properties are engaged during *vitrification*, or the state at which the fluxes within the body interact with the heat of the kiln and the ceramic fabric weakens as the silica melts and flows between individual clay particles. Here it is alumina which acts as the chief determinant of the matrix's thermal shock resistance;

effects of other oxides range from the beneficial lime and potash which contribute to slow and prolonged vitrification to permit the slow filling of these gaps, to those of iron oxide, which instead prematurely encourage total vitrification, which left unchecked can lead to bloating of the body fabric and in the worst situations the total failure of the vessel being fired as its weight causes the weakened structure to collapse upon itself (Hamer, 1975, 27-28;201-202;311).

Ceramic body colours are direct products of the balances necessary to achieve success in these various firing conditions. In general pink-orange earthenware fabric results from the oxidation of its ferrous components whereas greyish-black fabrics and the classic black colouration of Attic pottery are the result of firing in reducing conditions (Hamer, 1975, 247-248); green-white and white porcelains are products of refined kaolinite fabric and glazes, and the reducing conditions under which they were fired (Hamilton, 1982, 40-41). Porousness and particulate composition of these fabrics also influence their strength and hardness (Hamer, 1975, 77-85).

In summary, stoneware encompasses high-fired ceramics distinguished from porcelain by relatively low alumina content, and more heterogeneous microstructure (Hamer, 1975, 285-286) (Pollard and Heron, 2008, 117-118). Their relatively tough but "coarse" fabric lend themselves to their observed uses in mass-produced storage and transport vessels. Normally, their status as high-fired ceramics would imply contact with facilities mixing clays in the correct proportions or areas with naturally amenable existing rocks and sediments such as Southern China, but Southeast Asia also contains numerous amenable clays (Hamilton, 1982, 34) (Wood, 1999, 28).

Ceramic type	Features
Earthenware	Low-fired (<1100°C), iron-rich, porous and soft; typically used for storage and domestic purposes
Stoneware	High-fired (>1200°C), higher in alumina and lower in iron-oxides than earthenware, typically harder and less porous; used as evidence for trade if stoneware clays are scarce around the vessels' depositional context
Porcelain	High-fired (>1300°C), less porous, harder, higher in potassic content, and more homogeneous than stoneware, usually fired in reducing conditions; usually taken to be prestige wares, styles and fashions used for temporal and geographical provenancing

Table 1.1: Summary of key physical and social properties of earthenware, stoneware, and porcelain.

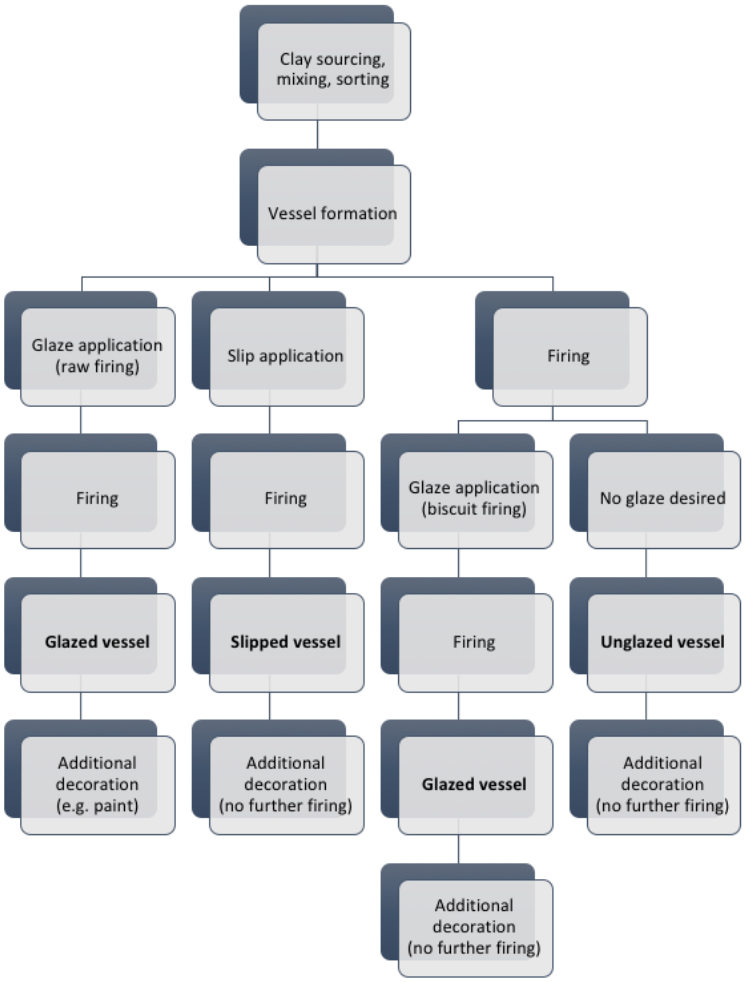


Figure 1.4: A simplified *chaîne opératoire* of glazed and unglazed ceramic production.

1.2.4.3 Chemistry of ceramic glazes

A common ceramic decoration is **glaze**: the application of a layer of material which liquefies under heat to form a glassy surface. This effect may occur either during the firing of the moulded clay ("raw glazing") or on separately, after once the body is already fired ("biscuit firing"); see **Figure 1.4** (Hamer, 1975, 24-25;144-147).

As the total vitrification of the glaze is desired, the required properties of the glaze fabric differ from those of the ceramic body. A key ingredient is *fluxing agents*: alkaline oxides which adjust the melting point of the silica-rich matrix and enable this total vitrification. Some common fluxing agents are **sodium**, **calcium**, **potassium**, **magnesium**, **iron** and **lead** oxides (Hamer, 1975, 132-133;144-147).

These alkaline oxides must be extracted from organic sources or selectively mined, and thus glazes reflect the resource areas to which production sites had access. Lime, a common fluxing agent in Southern Chinese glazes, is derived from plant ash or limestone (Wood, 1999, 29-33). Another crucial fluxing agent is potash; this appears to be an indigenous Chinese innovation, especially popular during the 13^{th}–14^{th} centuries (Wood, 1999, 216). Lead oxides are easily derived from many ores and lend themselves well to low-fired glazes, and have been employed in Chinese glazes since the Warring States period (Wood, 1999, 191).

Besides fluxing agents, another crucial component of glazes is their *colourants*, other oxides which alter their reflected colours. Iron is particularly versatile in this latter role, being able to produce a multitude of colours with different reflective properties depending on firing conditions (Hamer, 1975, 160-165;206) (Hamilton, 1982, 113-117). These properties were known to, and extensively exploited by, Chinese potters (Wood, 1999, 164).

These glazes have been documented in great detail by Wood (1999). While the focus is on porcelain, the glazes represented within this corpus are representative of the technologies and raw materials available to Chinese potters of these times. Wood (1999)'s derivation of the various oxides and their proportions will be highly instructive in the elemental analysis of the glazes seen in Singapore and Kota Cina.

1.3 Archaeological Ceramic Analysis in Singapore and Kota Cina

This dissertation is written with the intent to supplement existing scientific methods already used on these other two materials. Despite limited access to the same sorts of high-end analysis commonplace to ceramics of other regions, researchers in Singapore have gone to great lengths to attempt to piece together ceramic production sequences and derive meaning from conclusions reached through archaeological science concerning trade and exchange of earthenware and porcelain in this critical period of Southeast Asian history – but not, it seems, for stoneware (Miksic, 2013, 323).

I shall review the EDXRF-driven studies into the fine-paste wares of Kota Cina by Miksic and Teck (1992) and that of the greenwares of Singapore by Stulemeijer (2011), which essentially reflect the extents of scientific investigation into the Singapore and Kota Cina corpus as of the time of writing.

Energy-dispersive X-Ray Fluorescence (EDXRF) is generally employed in the study of an object's outer layers. As these layers are bombarded with X-rays, electrons are evacuated from inner shells; atoms emit characteristic and unique energies as electrons fall from valence shells to occupy the voids left by these evacuated inner shells. These unique energies permit the determination of the elemental composition of the target area. This analysis is essentially non-destructive and may be performed on a whole, undivided surface, a feature which endears itself to conservators. Its key limitation is the limited penetration of the X-Rays, preventing an in-depth analysis of the matrix (Pollard and Heron, 2008, 41-49).

1.3.1 Study of Fine Paste Earthenwares in Kota Cina

Miksic and Teck (1992) aimed to resolve archaeological questions concerning the fine-paste earthenware of Kota Cina, which were unlikely to originate from the immediate environs of Northern Sumatra due to the paucity of suitable clay there. Working on EDXRF data derived from archaeological earthenware of Southern Thailand and Eastern Java, along with modern ceramics in Palembang, Sumatra, Miksic and Teck (1992) measured the elemental proportions of 12 elements using EDXRF in an attempt to characterise them into groups which, in theory, ought to correlate to their origin.

The method used to form these groups was **principal component analysis**, a statistical technique intended to identify combinations of these variables which may

be used to distinguish clusters of these data points, and account for as much of the variation observed with them as much as possible. Two iterations of principal components (one with all 12 elements, one with only 5) were used to demonstrate that the Kota Cina wares grouped more coherently with the Eastern Java material than the Southern Thailand earthenware, as does the modern Palembang material (Miksic and Teck, 1992, 70-74).

These results overturned their hypothesis that the material originated from Southern Thailand, made on the grounds of geographical proximity; Miksic and Teck (1992) muse that Kota Cina may in fact have been in competition with port-cities in Southern Thailand and had deeper connections with the Malay Archipelago exceeding its known participation in pre-existing spice trade networks.

The provenancing of archaeological material is a contentious topic and relies upon properties which vary less within sites than between them (Waksman, 2017, 148-149). In many respects, this project parallels the strengths and weaknesses of Mommsen et al. (1992), which similarly utilises principal component analysis to distinguish between compositional datasets, collected by neutron-activation analysis, of "Mycenaean" type-sherds at Tell el-Amarna; unless these properties can be unerringly correlated to the actual clay compositions as opposed to proxies such as fired products and wasters (Waksman, 2017, 158-159), the picture revealed concerning ceramic production is highly constrained to their final depositions, with little consideration as to processes and technologies contributing to these variations.

1.3.2 Study of Greenwares in Singapore

Greenwares form a considerable majority of porcelain remains in Singapore, contextualising it within the eclipsing of Guangzhou and the Guangdong kilns by Quanzhou and the Fujian kilns. However, the continued presence of whitewares indicates that the former had not been totally superseded yet, and it is reasonable to consider that the greenwares may have been produced from multiple kilns iduring this period of Singaporean history.

Stulemeijer (2011) aimed to examine the variation within Singaporean greenwares, with the explicit aim of characterising this variation only relative to Singapore, as equivalent data from the Chinese kiln sites was not available. Their provenance was instead determined through stylistic analysis by four specialists, and comparing the chemical data with the stylistic groups to see if they agreed (Stulemeijer, 2011, 93). The colours of the ceramic fabrics were also quantitatively measured (Stulemeijer, 2011, 40-43).

Five trace elements were ultimately chosen for this study – Rubidium(Rb) , Strontium(Sr), Yttrium(Y) , Zirconium(Zr), and Niobium(Nb) – as these have no known physical effects on ceramic matrices, their concentrations are assumed to be passive properties of their origins and are therefore amenable to provenancing (Stulemeijer, 2011, 47-49). Instead of principal component analysis, ternary graphs were employed to highlight the variation of these elements. No correlation was found with colour; Rb, Sr and Zr were determined as the most useful in making quantitative distinctions, and scatterplots were used to further explore these (Stulemeijer, 2011, 48-71).

The majority of the sherds were stylistically assigned to Zhejiang, which correlated with their grouping into a fairly coherent Rb-Zr-Sr cluster (Stulemeijer, 2011, 98-99). Stulemeijer (2011) concludes that the Singaporean corpus suggests no fewer than three different origins for its greenwares, one of which is probably Zhejiang.

Similar to the study by Miksic and Teck (1992), the entire conclusion is prefigured upon correctly identifying these trace elements as being characteristic of their ultimate origins, which is an oversimplification of the numerous processes involved in selecting and processing clays prior to firing and distribution (Waksman, 2017, 158-159), and far more seriously entirely glosses over elements which would have been informative of such issues, such as silicon, aluminium, iron, and potassium.

Chapter 2

Sites

2.1 Kota Cina (KTC)



Figure 2.1: Kota Cina (*circled*), amongst other Southeast Asian ports and kingdoms of the 11^{th}–13^{th} centuries (Miksic, 2013, 103).

Kota Cina (lit. "**Chinese Fort**") is an archaeological site in northern Sumatra, notable for its vast array of Chinese-style ceramics. It is not mentioned within ancient sources; Marco Polo's later account of the region states that there was little sign of settlement in North Sumatra when he arrived there with some Chinese sojourners, necessitating the construction of one by his entourage (Miksic, 2013, 121-123).

Coinage and porcelain from Kota Cina (alongside one radiocarbon date) have been dated to Southern Song Dynasty, which also overlaps with the post-Srivijayan fragmentation (Miksic, 2013, 121-125). This period of crisis and political dissolution is marked by the elevated roles of individual merchants, breaking free from former formalised state-based missions and no longer negotiating with a hegemonic power in overall control of the archipelago. It may be that trade was more driven by market forces, than by state ideology or policy – inasmuch as these can be separated in this period (Heng, 2009, 104-106).

This site does not enter recorded history until the 19^{th} century, where an officer of the East India Company encountered it during a survey of Northern Sumatra; the name appears to have derived from a folk-memory of Chinese settlers expelling its Indian inhabitants, only to receive divine retribution in the form of a plague of shellfish in practically every one of their crevices, a ordeal so onerous that they were forced to leave (McKinnon, 1984, 6-8).

Minus these fantastical elements, Chinese and Indian co-habitation was proven to some extent through the 1969–1977 excavations of McKinnon (1984). There, he determined that the pre-modern settlement occupied one long episode from the 12^{th}–14^{th} centuries, where settlers associated with massive volumes of Chinese-style ceramics interacted with others possessing Buddhist imagery of the Chola dynasty Tamils. This interaction of cultures is also evidenced through the wealth of Chinese and Sri-Lankan coinage at the site confirming the 12^{th}-century dates (McKinnon, 1984, vi;79-83;106-112;313-317).

The site's *terminus ante quem* was determined from high-fired porcelains. McKinnon (1984) states that the overall lack of Ming blue-white porcelain indicates an abandonment of the site prior to its mass production, and settles on 1380 as the latest possible date for its overall abandonment. Taken together, these date Kota Cina to the gap in political centralisation in the Malay Archipelago between the fall of the Srivijayan system and the rise of the Majapahit Empire (Miksic, 2013, 106-111;184-187), and may speak to trends concerning these interactions between Indian and Chinese settlers and traders in the economy of Southeast Asia.

Kota Cina hence represents the coalescence of trends in both the Indian Ocean and the South China Sea. Merchants were quick to seize the opportunities presented by the weakening Srivijayan control, leading the proliferation of trading posts on the east coast of the Andaman Sea, which, in addition to providing established bases for the cyclical trade routes, also permitted access to markets controlled by local polities, further contributing to this "atomistic" political map so characteristic of this period of Southeast Asian history (McKinnon, 1984, 361-366) (Miksic, 2013, 126).

Given its position within this greater socio-political context, one may expect to see non-elite trade, whose range is governed by market forces and the availability of the market by the merchants who channelled its stonewares, tempered by the tastes of the local populace.

2.2 Singapore (STA)



Figure 2.2: Singapore (*circled*), amongst other Southeast Asian ports and kingdoms of the 14^{th}–16^{th} centuries (Miksic, 2013, 147).

The antiquity of **Singapore**, also known as **"Temasek"** (Heng, 2009, 16), is primarily suggested by the 15^{th}-century *Malay Annals*, a series of pseudo-historical records which represent an evolving body of literature over time, not unlike the *Annales Cambriae* and *Historia Brittonum* concerning British history both compiled by the 11^{th} century (Higham, 2012). There, its history, especially its collapse under Parameswara, its fifth and final king, is chiefly used as polemic. The nature of the *Malay Annals*, in addition to the fantastical elements of its portrayal of Singapore, have cast doubt on the historicity of the Kingdom of Singapura in this period (Miksic, 2013, 146-154;229).

However, archaeological proof of Singapore's material wealth and social complexity has emerged since the late 1980s following punctuated explorations since British colonisation, and it is now the most extensively studied city of 14^{th}-century Southeast Asia (Miksic, 2013, 146-154;440). Initial archaeological investigations followed from the British settlement of Fort Canning, built over the alleged ancient palace complex known as "Forbidden Hill", and Thai and Yuan Dynasty ceramics were found in a stratigraphic layer comprising a dark sediment now known as the **"Temasek layer"** confirming the antiquity of its occupation (Lim, 2017, 31); numerous excavations of Fort Canning contributed further pieces of this picture (Miksic, 2013, 222-240).



Figure 2.3: St. Andrew's Cathedral (*circled*), amongst other 14^{th}-century archaeological sites in Singapore (Miksic, 2013, 213).

Further investigations ensued along the Singapore River, the main system connecting the ancient settlement of Singapore with the sea, mostly spurred by redevelopment of colonial-era structures which now overlay the older sites. These have helped in determining the extent of the 14^{th}–15^{th} century settlement, and in examining variation in concentrations of artefacts, with implications on social stratification in the island kingdom. St. Andrew's Cathedral, erected by the British in 1863, was one such site (Miksic, 2013, 240-263).

The vast majority of artefacts found in this "Temasek layer" are ceramics. The concentrations of porcelain and gold on the Fort Canning site, alongside the known presence of earthworks comprising the "Old Lines" (or defensive walls, albeit now understood to be agricultural works) of Singapore, have been used to surmise that the residents of the "Forbidden Hill" enjoyed a privileged status relative to the lowland

settlers, and the variety and volumes of ceramics have also been used to argue that Singapore received Chinese imports on a considerable scale, relative to Kota Cina (Heng, 2009, 184-186) (Miksic, 2013, 210-217;222;434-440).

In summary, Singaporean trade reflects Yuan-era trends of the decline of the Guangdong kilns exported through Guangzhou and the rise of Fujian kiln exports channelled through Quanzhou, and the city-state may have been an exporter of earthenware, along with numerous organic products (Heng, 2009, 171-181) (Miksic, 2013, 210-222;285-287;434-440). Singapore primarily capitalised on its geographic location to prosper through entrepôt trade; no evidence has been found for great religious or political significance for the site, unlike the capitals of its successor-states, the Melaka and Johor Sultanates (Xin, 2015, 352-355).

With regards to the *terminus post quem* and *terminus ante quem* of Singapore as a whole, the former may be inferred from the presence of Song Dynasty coins, with the caveat that coins remained in circulation long after their minting, and historical records note that Chinese copper coins only became widely traded as currency between Malay Archipelago polities in the 14^{th} century; the latter is difficult to precisely pinpoint, but porcelains of the late Ming Dynasty have been found in Empress Place, another riverine settlement, indicating that Singapore received some foreign imports, albeit on a considerably reduced scale, long after the alleged catastrophic conquest recorded in the *Malay Annals* (Miksic, 2013, 310;330-336).

To summarise, the St. Andrew's Cathedral site may be perceived as a non-elite settlement within the autonomous Kingdom of Singapura, containing material typical of the realm as a whole, and it may be hoped that studying its stoneware might reveal facets of the socioeconomic dynamics concerning the trade in which this mercantile island-kingdom was deeply engaged, and apparently dependent upon.

Although STA is considered to be non-elite, as it exists in the shadow of the "Forbidden Hill" palace, one may expect a broader range of goods than at KTC, whereupon markets accessible to the Singaporean elites expanded their *clientèle* to the outlying settlements.

Chapter 3

Research Design

3.1 Aims

- To what extent is the visual variation within and between the "Buff Ware", "Brittle Ware" and "Mercury Jars" at both sites also evident in their microstructure and elemental composition?
  - Can we infer differences in production (raw material, quality control, techniques) from these variations?
- To what extent can we observe variation in ceramic fabrics and compositions between 12^{th}–14^{th} century Kota Cina and 14^{th}–15^{th} century Singapore on any of these levels, and infer differences in stoneware production and trade dynamics, *vis-à-vis* Chinese ceramic industries?
- Can we discern if "Mercury jars" contained mercury, by identifying traces of mercury on their interior surfaces?

In addition to these research questions, the lack of previous study of stoneware on this resolution suggests a need to develop a framework to enable further research concerning ceramic production and distribution on this overlooked body of material. This may prove useful not merely for the wealth of stoneware currently stored within the NUS-NTU Archaeological Laboratory, but for numerous other contemporary vessels and sherds which generally are only broadly classified as "trade wares".

3.2 Materials

The material for this project comprises the following:

Ceramic Types	No.	SEM samples
St. Andrew's Cathedral (STA)		
Buff ware	21	19
Brittle ware	25	19
Mercury jars	22	10
Kota Cina (KTC)		
Buff ware	10	10
Brittle jarlets	10	10
Tempered jars	5	5
Mercury jars	18	12

Table 3.1: Types and numbers of ceramic sherds in St. Andrew's Cathedral and Kota Cina obtained from the NUS-NTU Archaeological Laboratory in Singapore.

The STA sherds were taken from its salvage; hence there was little information concerning its context besides the general area of the 14^{th}-15^{th} century "Temasek layer" from which it was excavated. I opted to essentially randomly sample from the bags, aiming to gain as wide a variety as I could visibly discern of sherds and glazes in terms of size, thickness, and colour.

The KTC sherds were a relatively narrow sub-sample as they were effectively the remnants of past investigations now held in the NUS-NTU Archaeological Laboratory. This sample represents a majority of their collection, with the mercury jar sherds being a 100% sample. On the whole, the KTC sherds are smaller than the STA ones; this might introduce a sampling bias concerning the range of forms and vessels.

The material is subdivided within each of the major categories into "fabric groups". A more extensive description of the sorting process may be found under **Section 3.3.2**. A sub-sample of the above was chosen for scanning electron microscope analysis; all glazed sherds were sampled and (usually) a maximum of three sherds from unglazed fabric groups were selected.

3.2.1 Buff ware

Fabric group	Description	No.	SEM
STA-BUF-AA	Brown glaze, exterior	4	4
STA-BUF-AB	Brown glaze, interior	2	2
STA-BUF-BA	Red slip and brown glaze, exterior	1	1
STA-BUF-BB	Red slip and brown glaze, exterior	1	1
STA-BUF-CA	Grey slip/glaze, exterior	1	1
STA-BUF-CB	Grey slip/glaze, both sides	2	1
STA-BUF-D	Unglazed yellowish fabric	3	3
STA-BUF-E	Unglazed grey fabric	5	4
STA-BUF-F	Unglazed fabric, pores on both sides	1	1
STA-BUF-G	"Earthenware"-like fabric	1	1
KTC-BUF-A	Glazed, red-pink fabric	2	2
KTC-BUF-B	Glazed exterior, grey fabric	1	1
KTC-BUF-C	Glazed on both sides, grey fabric	4	4
KTC-BUF-D	Glazed with multiple patterns	3	3

Table 3.2: List of buff ware fabric groups from STA and KTC.

3.2.2 Brittle ware

Fabric group	Description	No.	SEM
STA-BRI-A	Unglazed, grey fabric	7	3
STA-BRI-B	Dark exterior, grey fabric	2	2
STA-BRI-C	Pores on both sides	5	3
STA-BRI-D	Yellowish-green glaze, exterior	6	6
STA-BRI-E	Striations similar to mercury jars	1	1
STA-BRI-F	Extremely eroded interior	1	1
STA-BRI-G	Reddish-pink fabric	2	2
STA-BRI-H	Two fabric colours, glazed interior	1	1
KTC-BRI-A	Green glaze, exterior	4	4
KTC-BRI-B	Deformations due to firing	2	2
KTC-BRI-C	Brown glaze, exterior	1	1
KTC-BRI-D	Mottled surface	1	1
KTC-BRI-E	Two fabric colours	1	1
KTC-BRI-F	Black glaze, interior and exterior	1	1
KTC-TMP-A	Green glaze, exterior	1	1
KTC-TMP-B	Brown-green glaze, exterior; speckled interior	1	1
KTC-TMP-C	Brown glaze, exterior	3	3

Table 3.3: List of brittle ware fabric groups from STA and KTC.

3.2.3 Mercury jars

Fabric group	Description	No.	SEM
STA-MER-A	Dark grey surface, exterior	11	4
STA-MER-B	Brown-grey surface, both sides	6	3
STA-MER-C	Grey body, black pores on interior	5	3
KTC-MER-A	Grey fabric with yellow surface colouration	6	4
KTC-MER-B	Grey fabric, unglazed	6	3
KTC-MER-C	Grey-yellow fabric, unglazed	4	3
KTC-MER-D	Dark fabric, unglazed	1	1
KTC-MER-E	Light grey fabric, unglazed	1	1

Table 3.4: List of mercury jar fabric groups from STA and KTC.

3.2.4 Images

Following these sherds' organisation within a database (*see below*, **"Organisation"**) I engaged the help of Mr. Ian Cartwright of the University of Oxford Institute of Archaeology in order to take consistent, high-quality photographs of these sherds to reduce confusion down the line; representatives of these fabric groups are reproduced below to demonstrate these distinctions as described in the previous sections.

3.2.4.1 Buff ware

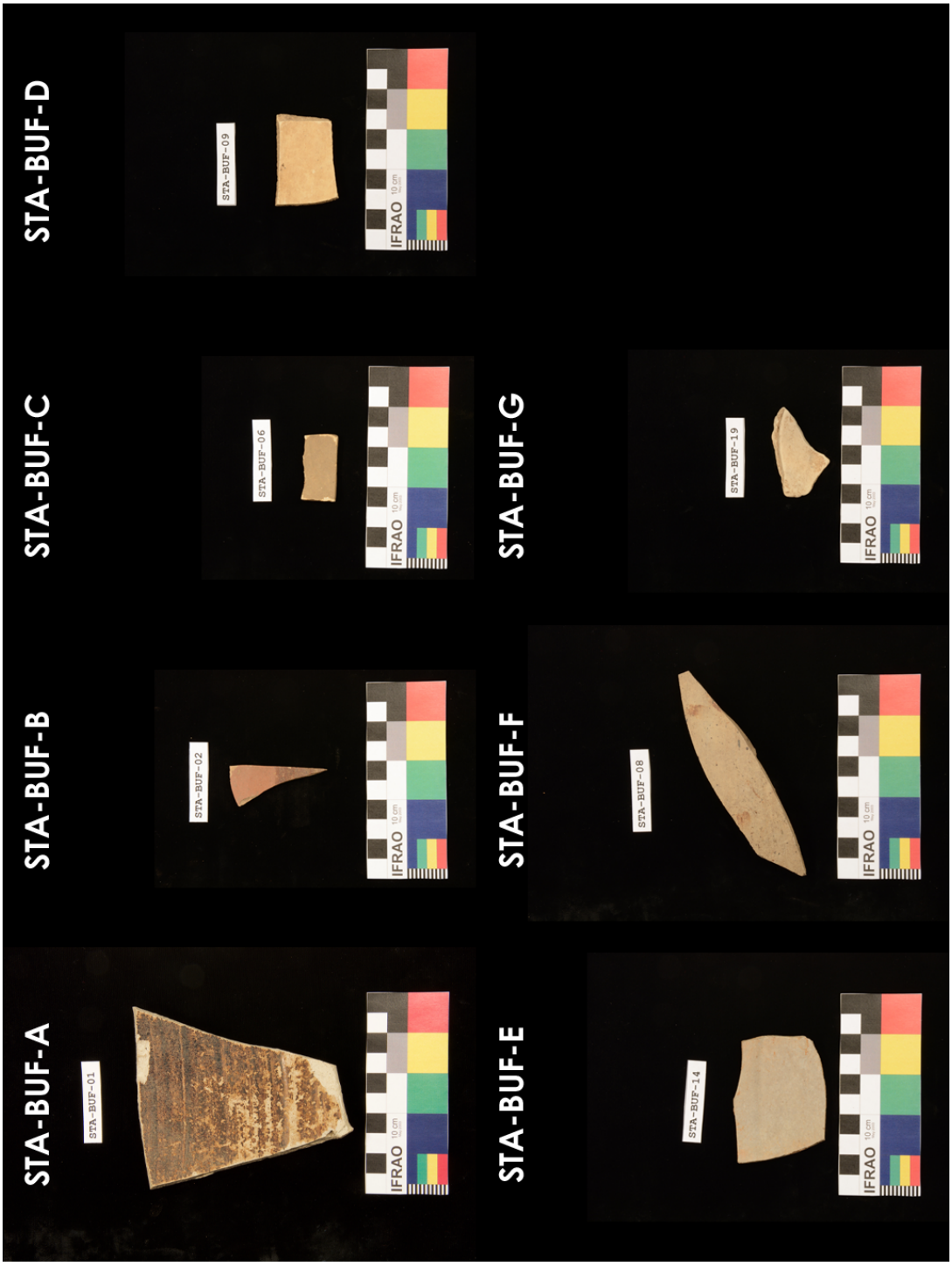


Figure 3.1: STA buff wares by fabric group.

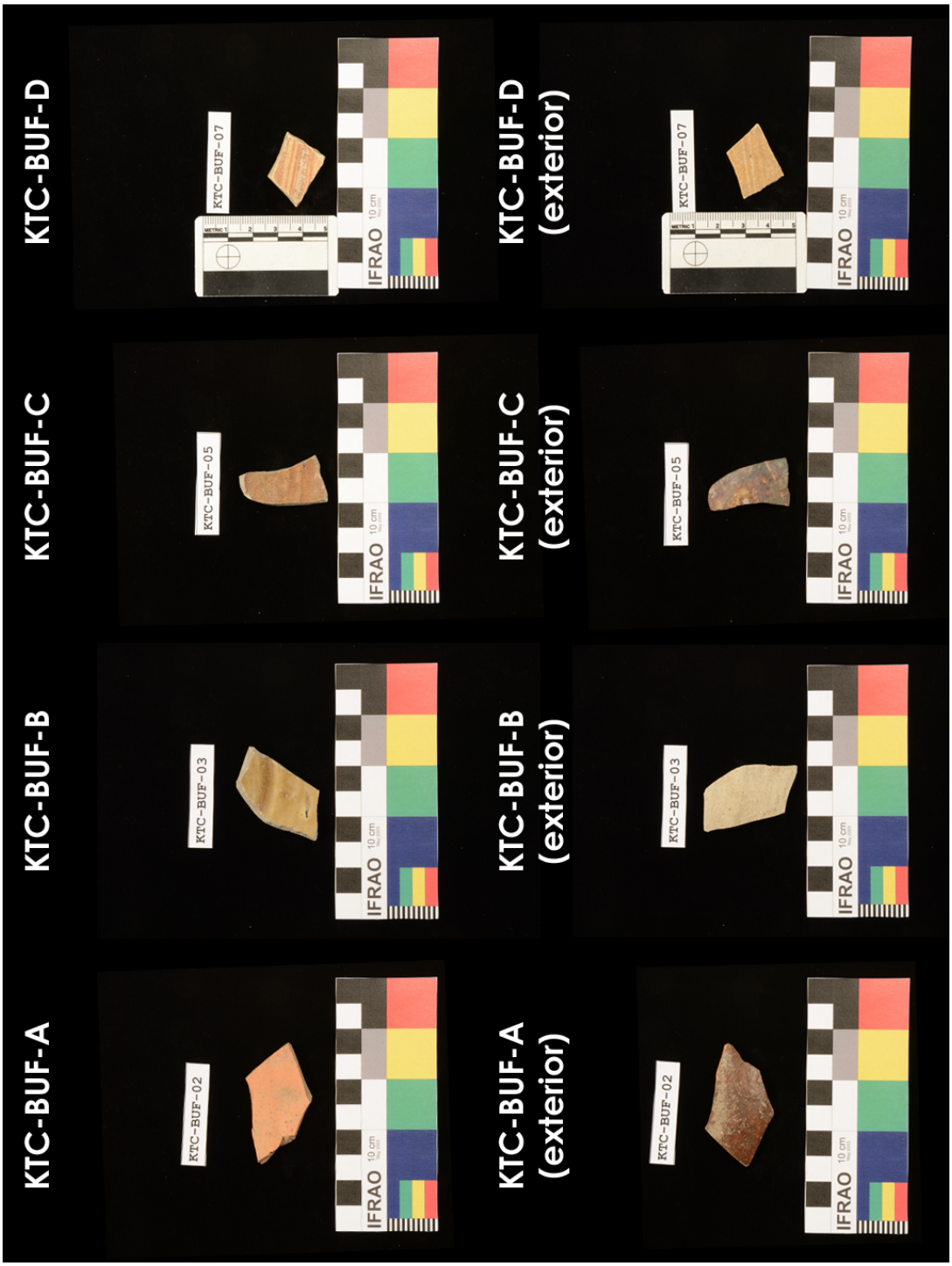


Figure 3.2: KTC buff wares by fabric group.

3.2.4.2 Brittle ware

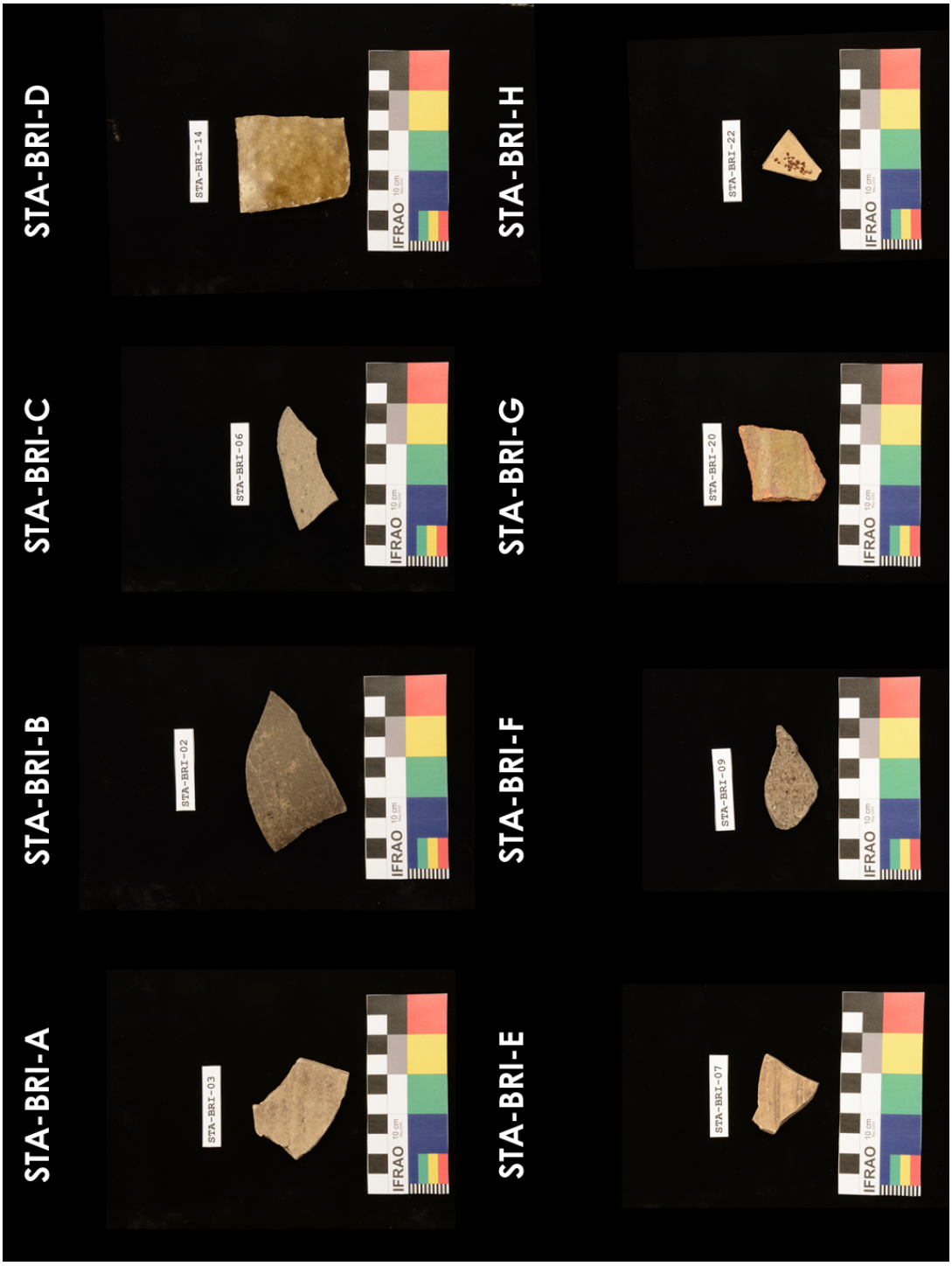


Figure 3.3: STA brittle wares by fabric group.

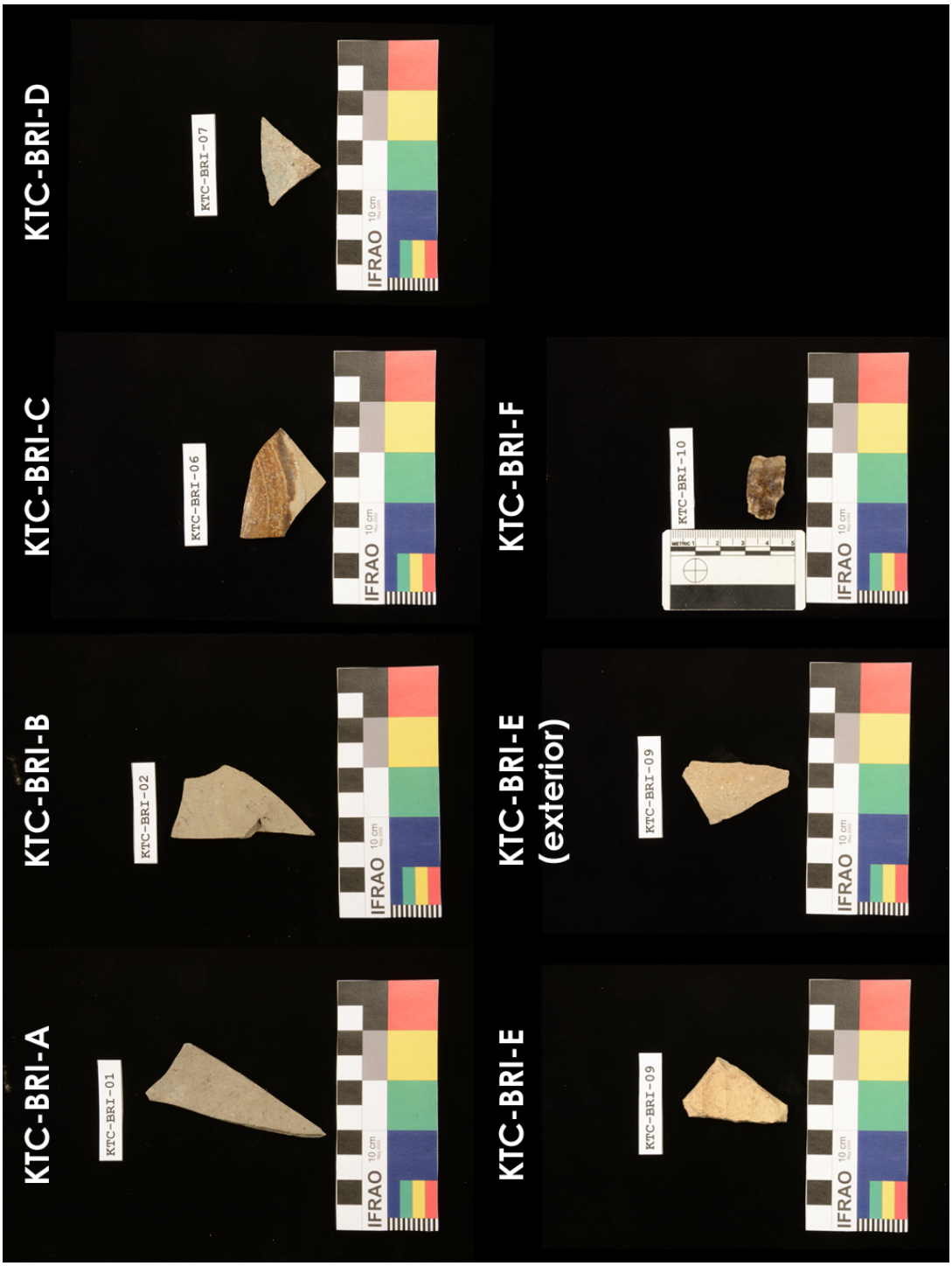


Figure 3.4: KTC buff wares by fabric group; tempered jars are included below, along with mercury jars.

3.2.4.3 Mercury and Tempered jars



Figure 3.5: STA mercury jars by fabric group.

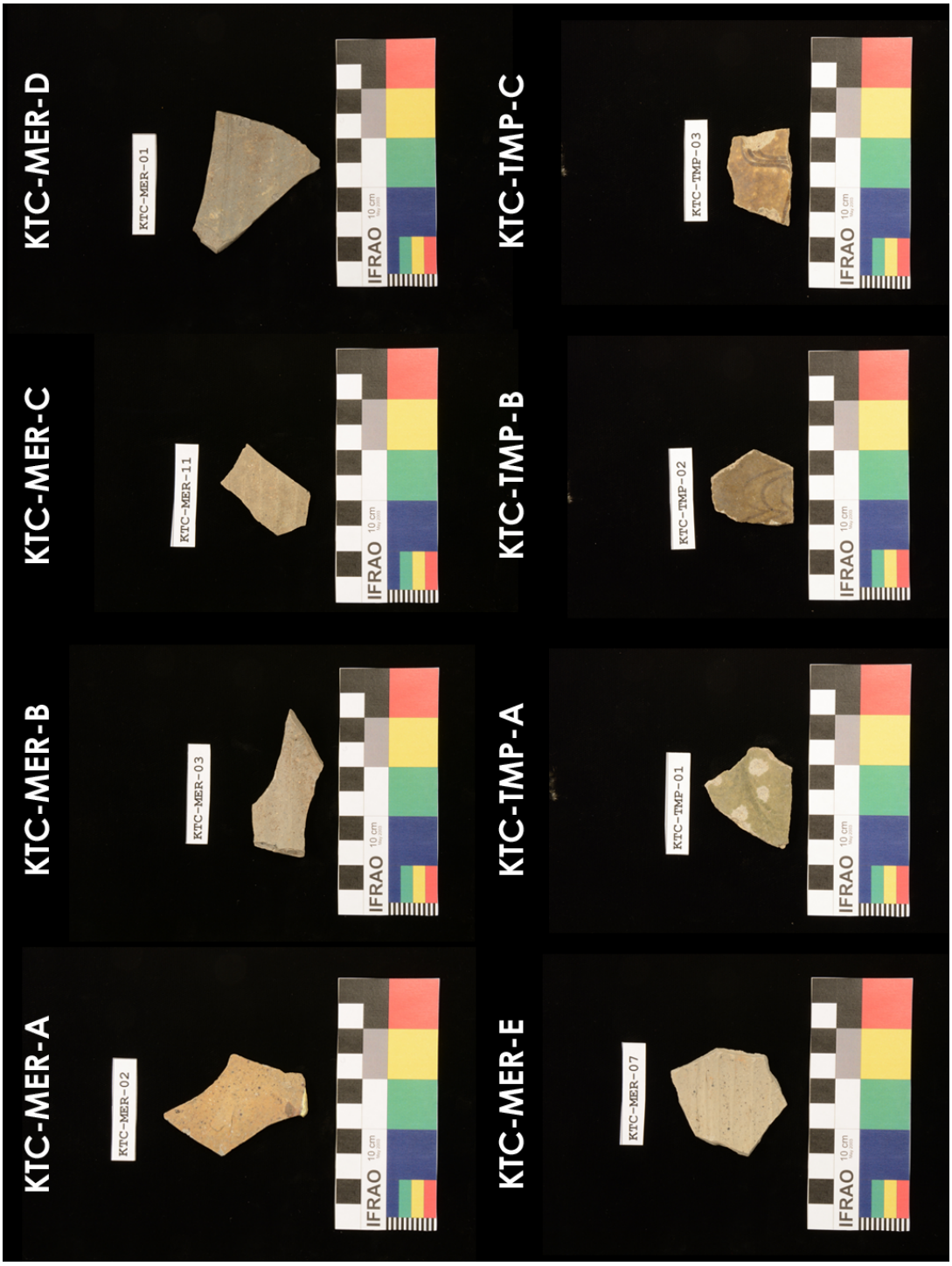


Figure 3.6: KTC mercury and tempered jars by fabric group.

3.3 Methods

As this project is aimed at discerning variation on a range of scales, it is only appropriate that the sherds are examined on a set of increasing resolutions.

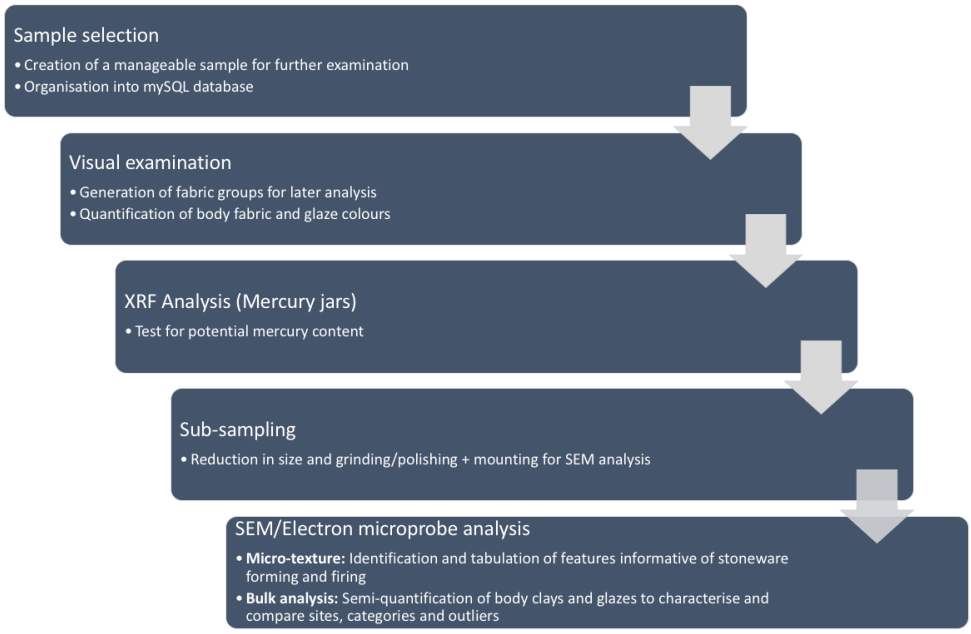


Figure 3.7: The workflow of this project, with aims at each level elaborated upon.

3.3.1 Organisation

In order to logically organise these sherds and permit further sorting and characterisation, I consulted with Mr. Antonis Dimopoulos, a DPhil candidate pursuing ancient DNA research at RLAHA, and enquired as to the suitability of the MySQL database which he was employing to organise his ancient DNA samples. Finding it to be appropriate, I readily adopted his system with help from Mr. Devesh Batra, a DPhil candidate at the Oxford Big Data Institute, utilising the MySQL graphics user interface Sequel Pro.

Under this system, sherds and subsequent subsamples may be associated with multiple data sheets containing information about their fabric group, colour, compositional sample, microstructure, etc. The database permits the recording of these aforementioned properties, and also enables quick referencing from one sheet to another through indices, and its one-to-one and one-to-many capabilities have proved invaluable in documenting these features.

3.3.2 Visual examination

The first step in this project was to sort the sherds into the various fabric groups seen above. These fabric groups were also intended to facilitate subsequent steps such as sub-sampling and SEM analysis.

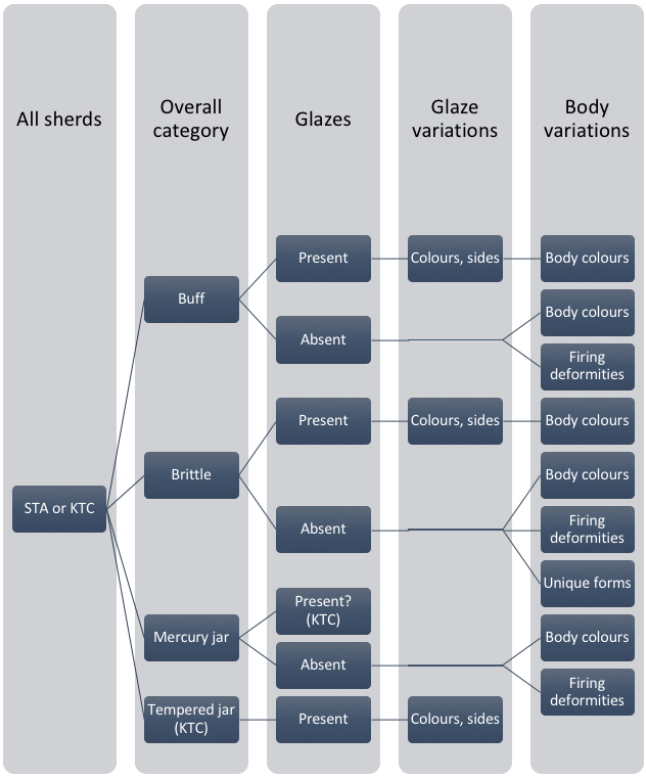


Figure 3.8: The workflow of the visual examination employed in this project.

Groups were made first by similarity in glazes and then body fabrics, such that the glazes could all be studied together. This may lead to greater heterogeneity within the glazed fabric groups than the unglazed groups as the same glazes may have been applied on multiple body compositions; compositional analysis may hence reveal if this is the case, or if sherds intended for the same glaze were all made together.

A Munsell colour-chart was employed to objectively quantify the various observable body fabrics, as is common in archaeological ceramic studies (Whitbread, 2017, 203); Stulemeijer (2011) employs this methodology in his characterisation of Singaporean greenwares, for example. All of the sherds were measured in this way, then those which were sub-sampled, with new colour measurements taken from the freshly-sawn surfaces.

3.3.3 X-Ray Fluorescence

Please see **Section 1.3** for an explanation of the principles upon which XRF operates.

XRF was selected as a means to study the contents of mercury jars. Although the mechanical properties of elemental mercury such as its non-wetting nature at room temperature (Aligizaki, 2005, 61) probably dictate otherwise, prolonged containerisation of mercury in these relatively porous wares might have resulted in its retention as mercury vapour; Raman spectroscopy is able to detect cinnabar residues on archaeological pottery (Mioč et al., 2004), and XRF analysis is able to detect mercury in Mexican gall-ink (García et al., 2014), as well as mercury-vapour in modern contaminated soils (McComb et al., 2014). Benefits of XRF in this context were the relative ease of its use and availability within RLAHA, and its not requiring any destructive sub-sampling.

Both the interior and exterior surfaces of the mercury jars were analysed (for a standardised period of at least 360 seconds) to reduce the possibility of false positives; if unambiguous mercury peaks could be identified this methodology would be extended to the rest of the corpus.

3.3.4 Sub-sampling

Lengths were cut from the larger sherds using a coarse saw (and selected sherds with a diamond-wafer fine saw thereafter) and left to dry, with the samples intended for SEM analysis subsequently snapped using a pair of pliers.

Cutting fresh sections of the sherds permitted a more accurate measurement of the body fabric, as the newly exposed surface has been subject to fewer taphonomic processes. Glazed sherds required cutting with a fine saw to ensure that glazes were on the same plane as the rest of the sherd.

3.3.5 Scanning electron microscope (SEM) – Electron microprobe analysis

Sherd fragments were then ground down to ensure flatness, and then embedded into epoxy resin to permit their study within the SEM, a technique whose chief strengths are its ability to collect high-resolution data concerning the micro-texture and elemental composition of properly prepared ceramic sherds (Tite et al., 1982). A vacuum chamber was used to extract the bubbles from the epoxy, and then the resin containing the sherds were ground and polished before being carbon-coated to avoid surfaces being charged by exposure to the electron beam and thus becoming unable to reflect a coherent signal (Reed, 2005, 156-157).

Once inside the JSM-5910 SEM, the electron beam was used to generate images of the microstructure of the sherd fragments in secondary emissions mode; as the brightness of backscatter-emissions is a function of the atomic number of the area being scanned, it was used as an proxy for the variations in atomic masses across the study area (Reed, 2005, 54-57).

Looking at the generated backscatter image, I utilised the analysis software INCA 5.05, to generate target areas by drawing rectangles or polygons on its render, and hence measure the electron signal returned from the sherd surface of these areas in semi-quantification mode, following the example of Tite et al. (1982); due to the roughness of the surfaces being studied, full quantification is desirable or feasible (Loehman, 2010, 271).

Composition was measured in conditions of **15kV** and **1mA** using one 100x view at the centre (approx. 1.4mm^2) and three 250x views (approx. 0.2mm^2) at the centre and diagonally opposite corners of sherds, avoiding phases which could bias measurements such as large silicon/quartz grains or brightly-rendered crystals. Individual features were then targeted, measured and recorded. Glazes were measured by sampling three areas: the contiguously bright glaze areas the more porous body fabric, and the interface connecting them.

Chapter 4

Results

4.1 Visual examination

Visual examination of the sherds produced the fabric groups mentioned in **"Materials"**. Some of the visible trends shall be briefly discussed here.

4.1.1 Body fabrics

One discriminant between fabric groups, evident both to those making ceramics and those studying them later, is that of colour, which is linked to the composition of the body fabric and its firing conditions.

There were three major colour groups: reddish-pink, yellowish, and grey-white. **Reddish-pink colouration**, seen in **KTC-BUF-A** and **STA-BRI-G** (**Figures 3.2, 3.3**) may indicate the use of laterite, an iron-rich soil-type oxidising conditions within the kiln, or very strongly oxidising conditions without necessitating high ferrous content.

Yellowish and grey-white fabrics may be used as a proxy for oxidising or reducing kiln conditions, with yellowish fabrics characteristic of the former and vice versa; compare and contrast **STA-BUF-D** and **STA-BUF-E** (**Figure 3.1**). Different colour grades may hence reflect the same body chemistry but different firing conditions (Hamer, 1975, 211-212;248). These conditions also have implications on the strength of the ceramics, as the yellowish fabrics were all more easily cut and snapped than the harder grey-white ones. Some sherds demonstrate *both* colour groups simultaneously, indicating that parts of the sherd were exposed to different conditions within the kiln.

Another observed feature was **iron spots**, which appear as black dots. These are characteristic of iron oxide-rich areas which generate localised fluxing conditions, and

emerge as crystallised areas on the fabric (Hamer, 1975, 165). These are common to most categories, but were particularly prevalent amongst the mercury jars (**Figures 3.5, 3.6**), suggesting that iron spots were not issues which led stoneware producers or distributors to reject them at any stage until their eventual discard, furthering the notion that stoneware fulfilled a basic commercial need and their appearance was not as treasured as contemporary porcelains.

Some sherds stand out due to firing faults; some of which, such as those leading to erosion of the ceramic body, were so egregious that they were categorised separately into their own fabric group (e.g. **STA-BRI-F** and **KTC-BRI-B**; **Figures 3.3, 3.4**). Firing flaws may emerge for a variety of reasons, but premature vitrification caused by inappropriate firing schedules for a given composition is certainly a leading cause of bloated ceramics; it is therefore entirely possible to attain a range of quality for the same body chemistry based on varied firing conditions, and within the same kiln based on varied ceramic formulae fired therein (Hamer, 1975, 27-28).

Evidently, the broad variety in quality seen in this corpus lends weight to the concept that stonewares were given less priority, at least on the end of the recipient, in terms of superficial appearance and further underscores their role as "trade wares" whose form was secondary to the function of bringing goods from source to destination.

4.1.1.1 Buff ware

Fabric group	Darkest/least saturated	Brightest/most saturated
STA-BUF-AA	10YR6/1 (gray)	10YR8/2 (white)
STA-BUF-AB	10YR6/1	10YR8/2
STA-BUF-BA	10YR6/3 (pale brown)	–
STA-BUF-BB	10YR6/1 (light gray)	–
STA-BUF-CA	10YR6/1	–
STA-BUF-CB	10YR7/1 (light gray)	10YR8/2
STA-BUF-D	10YR7/2 (light gray)	10YR8/3 (white)
STA-BUF-E	10YR5/1 (gray)	10YR8/1 (white)
STA-BUF-F	10YR8/1 (white)	–
STA-BUF-G	10YR7/2	–
KTC-BUF-A	5YR7/3 (pink)	10YR7/1
KTC-BUF-B	10YR7/1 (light grey)	–
KTC-BUF-C	10YR6/2 (l.brownish grey)	10YR7/2
KTC-BUF-D	10YR6/2	10YR7/2

Table 4.1: Colour variation seen in buff ware fabric groups from STA and KTC.

KTC-BUF-A is notable for its reddish-pink fabric, which may be suggestive of ferrous content or strongly oxidising firing conditions; this bears investigation under the SEM to resolve the possibilities. The yellowish fabrics of **STA-BUF-D** are characteristic of firing in oxidising environments, and they were also softer and more easily cut. **STA-BUF-G** was notably very soft and lightweight compared to stoneware sherds of similar size; it may be a misclassified fine-paste earthenware.

4.1.1.2 Brittle ware

Fabric group	Darkest/least saturated	Brightest/most saturated
STA-BRI-A	10YR6/2 (l.brownish gray)	10YR7/2 (light gray)
STA-BRI-B	10YR7/2	–
STA-BRI-C	10YR5/2 (grayish brown)	10YR7/2
STA-BRI-D	10YR7/2	–
STA-BRI-E	10YR7/1 (light gray)	10YR8/2 (white)
STA-BRI-F	10YR7/1 (light gray)	–
STA-BRI-G	7.5YR7/4 (pink)	–
STA-BRI-H	10YR7/3 (v.pale brown)	–
KTC-BRI-A	10YR6/1 (light gray)	10YR7/1 (light gray)
KTC-BRI-B	10YR6/1	10YR7/2
KTC-BRI-C	10YR8/1 (white)	–
KTC-BRI-D	10YR7/1	–
KTC-BRI-E	10YR7/1	10YR8/3 (v.pale brown)
KTC-BRI-F	10YR5/1 (gray)	–
KTC-TMP-A	10YR7/1	–
KTC-TMP-B	10YR7/2	–
KTC-TMP-C	10YR7/1	10YR8/1 (white)

Table 4.2: Colour variation seen in brittle ware fabric groups from STA and KTC.

STA-BRI-G is unique at STA in its reddish-pink fabric (7.5YR-7.4) suggestive of a wholly different clay source, likely containing a high concentration of laterite; as above, this may be resolved by semi-quantitative SEM analysis.

4.1.1.3 Mercury jars

Fabric group	Darkest/least saturated	Brightest/most saturated
STA-MER-A	10YR5/1 (gray)	10YR8/1 (white)
STA-MER-B	10YR7/1 (light gray)	10YR7/2 (light gray)
STA-MER-C	10YR7/1	10YR8/2 (white)
KTC-MER-A	10YR7/1	10YR8/1
KTC-MER-B	10YR7/1	10YR7/2
KTC-MER-C	10YR6/1 (light gray)	10YR7/2
KTC-MER-D	10YR7/1	–
KTC-MER-E	10YR8/1	–

Table 4.3: Colour variation in mercury jar fabric groups from STA and KTC.

The main distinguishing characteristic of mercury jars appears to be the presence of numerous iron spots on their surfaces, compared to sherds from other categories.

4.1.2 Glazes

This corpus demonstrates glazes of numerous colours and applications, and curiously enough contains numerous sherds with glazed *interiors*.

While the aesthetic quality of exterior glazes is self-evident, the labour and material expenditure made whilst glazing interiors, as seen in STA buff wares and **KTC-BUF-C and D** (**Figures 3.1, 3.2**) raises questions as to motives for doing so. While glaze is one means of waterproofing or sealing the interior of earthenwares, stonewares ought to be sufficiently hard to avoid necessitating glazes for this function. Aesthetically speaking, glazes may be used to conceal coarse body fabrics, with the extremely thick Southern Song Guan ware glazes masking wafer-thin body fabrics as an extreme manifestation of this trend (Wood and Li, 2015, 628-629).

Overall, based on the limited sample available from both sites, there appears to be a strong continuity of technology between the sites, but a wider range of artistic expression in terms of glazes is evident in KTC whilst the wares in STA demonstrate less variation. These may be reflective of changes in ceramic fashion over time, or differences between localities; the former is perhaps more likely than the latter given the prominence of Singapore relative to Kota Cina, but it remains to be seen if these visual differences also manifest in compositional recipes; these can be examined through SEM-microprobe analysis.

4.1.2.1 Buff ware

Fabric group	Darkest	/ least saturated	Brightest/most saturated
STA-BUF-AA	10YR2/2	(v.dark brown)	10YR4/2 (d.grayish brown)
STA-BUF-AB	10YR3/2	(v.dark grayish brown)	–
STA-BUF-BA	7.5YR4/4	(brown)	10YR3/2
STA-BUF-BB	10YR3/2		10YR5/4 (yellowish brown)
STA-BUF-CA	10YR4/2		–
STA-BUF-CB	10YR5/1	(gray)	10YR6/2 (l. brownish gray)
STA-BUF-G	10YR6/1		–
KTC-BUF-A	7.5YR3/2	(dark brown)	–
KTC-BUF-B	2.5Y 6/4	(l.yellowish brown)	–
KTC-BUF-C (int.)	10YR4/3	(d.brownish grey)	10YR5/4
KTC-BUF-C (ext.)	7.5YR6/2	(l.brown)	10YR6/3 (pale brown)
KTC-BUF-D (int.)	10YR6/2		10YR7/2
KTC-BUF-D (ext.)	2.5Y 6/4	(l.olive brown)	10YR6/4

Table 4.4: Colour variation seen in buff ware glazes from STA and KTC. See **Figures 3.1 and 3.2** for examples of these glazes.

The STA glazes are generally reddish-brown. The KTC material demonstrates a greater range of colours between and within its sherds. The KTC ware demonstrates a trend not seen in STA; namely, sherds with *different* glazes on their interiors and exteriors.

This trend suggests possibilities which range from wholly different initial compositions applied to the opposite sides, to variable exposures to oxidising or reducing conditions or temperatures, to differently applied thicknesses of the same glaze, to any combination of the above. At any rate, this curious decision bears further investigation via SEM into its production and potential reasons for such a technological choice.

The STA corpus also contains slipped ware and several sherds in **STA-BUF-C** with a distinctly opaque layer on top of the body. This unique grey surface treatment deserves study unto itself under the SEM and electron-microprobe to unpack the technologies involved in its production.

4.1.2.2 Brittle ware

Fabric group	Darkest	/ least saturated	Brightest/most saturated
STA-BRI-D	2.5Y5/4	(l.olive brown)	10YR5/3 (brown)
STA-BRI-H	10YR6/2	(l.brownish gray)	–
KTC-BRI-A	2.5Y 6/2	(l. brownish gray)	2.5Y 7/2 (l.gray)
KTC-BRI-C	10YR3/6	(d.yellowish brown)	–
KTC-BRI-F	2.5Y 4/2	(d.grayish brown)	10YR5/2 (grayish brown)
KTC-TMP-A	5Y 5/2	(olive gray)	–
KTC-TMP-B	5Y 4/2	(olive gray)	10YR6/3 (pale brown)
KTC-TMP-C	10YR4/2	(d. grayish brown)	10YR5/2

Table 4.5: Colour variation seen in brittle ware glazes from STA and KTC. See **Figures 3.3 and 3.4** for examples of these glazes.

The glazes on the STA brittle-ware comprise reddish and olive-green brown, as do the KTC materials. However, the KTC ceramics also contain one black-glazed sherd, and the tempered jars all show opaque glazes and patterns not seen in the rest of the corpus; the three sherds in **KTC-TMP-C** may be from the same vessel. This last hypothesis can be tested through comparing compositional data collected during the SEM phase of examination.

4.1.2.3 Mercury jars

None of the mercury jars, be they at STA or KTC, seemingly possessed any glaze; however, the sherds of **KTC-MER-A** (**Figure 3.6**) all have a consistent yellowish surface which may be indicative of a degraded glaze; semi-quantification elemental comparison with the body-glaze interfaces of other sherds would be necessary to determine if this is the case.

4.2 XRF analysis

The analysis was undertaken with the specific intention of finding mercury or mercury-vapour which might have leached onto the coarse surfaces of the mercury jars. Of the 40 mercury jar sherds analysed with the XRF, none of them returned any mercury peaks. This leads to one of two conclusions:

1. There is no mercury to be found on the interior surfaces of the mercury jars, indicating there is no physical evidence for their use for containerising mercury.

2. If there *is* mercury retained on the interior surfaces of the mercury jars, it is in concentrations which are not easily detectable by XRF.

    - i.e. its presence is at $\leq$0.2–1 weight% at its most optimistic for relatively unprepared samples such as these (Pollard and Heron, 2008, 44)

These results demonstrate at the very least that XRF cannot be used in this fashion to prove that these vessels contained mercury, perhaps necessitating its identification via SEM-microprobe analysis, which would be able to identify mercury-rich phases via backscatter imaging as mercury's high atomic number would be reflected as a bright tincture on the rendered image (Reed, 2005, 54-57). As SEM-microprobe analysis is more time-consuming and requires more preparation than XRF, this is unfortunate news for future researchers who may wish to resolve this question but are short on time or resources for dedicated microprobe analysis.

Otherwise, we may potentially turn to other forms of higher-resolution elemental analysis such as mass spectrometry, which are able to discern much lower elemental concentrations (Pollard and Heron, 2008, 27-31). As for the other potential contents such as wine, organic residues cannot be discerned by either XRF or SEM-microprobe analyses; liquid, gas or supercritical fluid chromatography would be far more suitable for this task (Pollard and Heron, 2008, 66-74).

4.3 SEM semi-quantification calibration

As mentioned in **Section 3.3.5**, I have opted for semi-quantification compositional analysis due to the relative coarseness of this material, as full quantification would not discern meaningful enough amounts of detail to justify the extent of this measure.

A necessary component of SEM studies is the determination of the length of time for which backscatter electrons are measured. Ideally, it should strike a balance between the rigorousness demanded of the project and the constraints of time to perform analyses on all desired samples. I opted to test if resolution improves appreciably from 30s to 50s to 100s, utilising the first set of body-fabric samples in **STA-MER-B**.

Sherd	Count time (s)	Al_2O_3%	sd	K_2O%	sd	Fe_2O_3%	sd
STA-MER-03	30	19.7	0.6	3.5	0.3	2.3	0.1
	50	19.5	0.5	3.6	0.2	2.3	0.1
	100	19.5	0.4	3.6	0.2	2.3	0.2
means of all counts		*19.6*	*0.1*	*3.5*	*<0.1*	*2.3*	*<0.1*
STA-MER-04	30	20.3	0.3	3.2	0.1	2.0	0.1
	50	20.4	0.1	3.2	0.1	1.9	<0.1
	100	20.3	0.2	3.1	<0.1	2.0	0.1
means of all counts		*20.3*	*<0.1*	*3.2*	*<0.1*	*1.9*	*<0.1*
STA-MER-05	30	20.4	0.4	3.2	0.1	2.2	<0.1
	50	20.3	0.4	3.2	0.1	2.3	0.1
	100	20.4	0.4	3.2	0.1	2.2	0.1
means of all counts		*20.4*	*<0.1*	*3.2*	*<0.1*	*2.2*	*0.1*
STA-MER-B	30	20.1	0.5	3.3	0.2	2.1	0.1
(fabric group)	50	20.1	0.6	3.3	0.2	2.2	0.2
	100	20.1	0.5	3.3	0.2	2.2	0.2
means of all counts		*20.1*	*<0.1*	*3.3*	*<0.1*	*2.2*	*<0.1*

Table 4.6: Means and standard deviations of semi-quantitative measurements in STA-MER-B body fabrics (averaged from four SEM views: $1 \cdot 100\times$, $3 \cdot 250\times$) as a test for count time, reported in compound% as normalised via stoichiometry in INCA.

Evidently, there is little to be gained by doubling count time from 50s to 100s, although despite time constraints, it was decided to remain at 50s due to the difficulties in picking up on minor elements within the 30s timeframe.

4.4 SEM micro-textural examination

As this form of analysis involves both qualitative and (semi-)quantitative aspects, I shall first outline some of the observed features within the ceramic micro-textures.

4.4.1 Phases and features

I was only able to do this form of in-depth analysis for the STA sherds within the time-frame allotted for an MSc dissertation; although I had intended to continue this same methodology with the KTC sherds it was apparent that the process of browsing through the sherd surface and collecting individual microprobe readings would result in very little time left for meaningful bulk analysis; as all compositional data was routed through the same two terminals, it was impossible to concurrently achieve these aims.

I would not presume that my cataloguing of these features is in any way exhaustive as identification of these phases is ultimately subject to the attentiveness of the SEM operator and their ability to discern meaningful variations in micro-texture.

Nevertheless, the presence or absence of certain features has the potential, in skilled hands, to reveal a great deal about the formation and firing of ceramics. It may be hoped that my findings will demonstrate the utility of this qualitative visual-based analysis and spur further work on ceramics studies at this resolution.

The following were observed in practically all STA sherds:

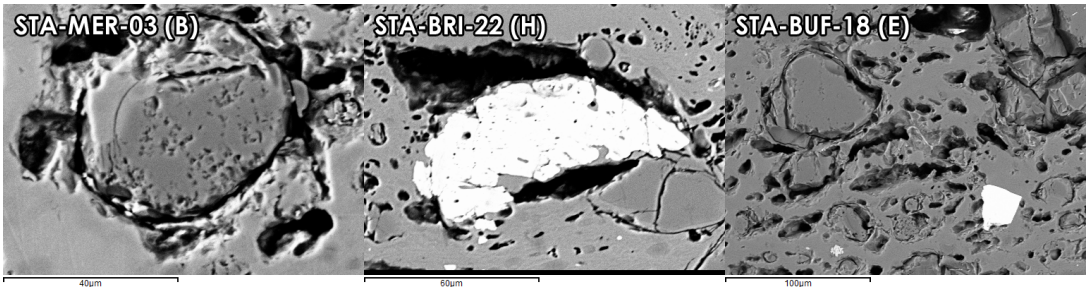


Figure 4.1: a) Quartz grain, characterised by its shape and silicon concentration; b) Titanium grain, shaded brightly in backscatter mode; c) Zirconium and other concentrations of heavy elements in brightly shaded grains.

These have relatively few implications concerning ceramic formation or firing, and are present essentially due to either their ubiquity (quartz) or their toughness and non-reactivity (titanium and zircons). However, some sherds contain quartz grains

of considerable size (up to 600μm), suggestive of less heed taken in homogenising particle size during clay production.

The following features were observed in some sherds:

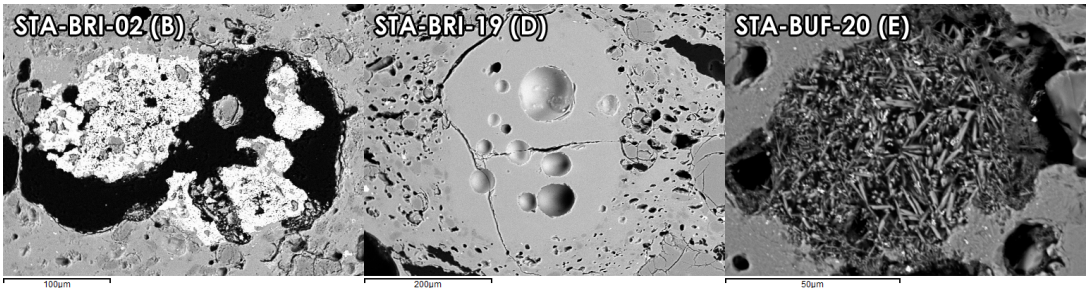


Figure 4.2: a) Concentrations of iron crystals possibly produced during the cooling process; b) phase at total vitrification; c) mullite.

Each of these features is suggestive of various aspects of the production and firing sequence:

- **Iron crystals**, already indicative of concentrations of the element and its oxides, are termed *"secondary"* if they are produced during the cooling phase of ceramic production and are hence indicative of a longer cooling cycle as these require time to emerge. These may be associated with iron spots if these concentrations are drawn to the surface during reduction firing.

- The following are associated with physical and chemical transformations which occur as the vessel approaches vitrification:

  - **Total vitrification**, denoted by the presence of bubbles in the fabric, has implications on the strength and stability of the body fabric and is often indicative of high concentrations of fluxing agents such as potassium.

  - **Mullite** is an aluminium-rich crystalline mineral which may be formed during firing, and is considered "refractory" as it appreciably improves the thermal shock resistance of body fabrics. Its presence may suggest an enhanced knowledge of chemical recipes in ceramics.

With the above caveats in mind, let us examine these frequency distributions and attempt to derive meaning from them. While far from exhaustive, correlations of the former may suggest less heed taken in homogenising the material or selecting against

iron-rich clays (whether by choice or by geological constraint), and the latter two of the firing schedules undertaken by the stoneware potters.

Fabric Group	Sherd	Vitrification	Iron crystals	Mullite
STA-BUF-D	STA-BUF-09	0	3	0
	STA-BUF-15	0	1	0
	STA-BUF-16	0	2	0
STA-BUF-E	STA-BUF-14	0	11	0
	STA-BUF-18	0	2	2
	STA-BUF-21	0	3	4
STA-BUF-F	STA-BUF-08	0	9	0
STA-BUF-G	STA-BUF-19	0	4	4
STA-BRI-B	STA-BRI-01	1	5	1
	STA-BRI-02	0	9	0
STA-BRI-C	STA-BRI-04	1	12	2
	STA-BRI-06	2	4	2
	STA-BRI-13	1	7	1
STA-BRI-D	STA-BRI-05	5	6	1
	STA-BRI-14	2	11	0
	STA-BRI-15	1	4	0
	STA-BRI-17	3	14	0
	STA-BRI-19	5	5	0
	STA-BRI-21	4	5	0
STA-BRI-E	STA-BRI-07	0	4	0
STA-BRI-F	STA-BRI-09	4	3	4
STA-BRI-H	STA-BRI-22	0	5	2
STA-MER-A	STA-MER-22	0	1	0
STA-MER-B	STA-MER-03	3	3	0

Table 4.7: Frequency table of these three features in STA sherds.

Iron crystals are most populous amongst brittle ware, with a majority of its sherds represented here, compared to the lower frequencies seen in buff ware and mercury jars; more brittle ware vessels may have been left to cool for longer after firing, permitting the formation of secondary iron crystals.

Vitrification bubbles are present in brittle ware and mercury jars but not buff ware, perhaps speaking to a similar production and firing sequence for the former two groups. As concerns mullite, as is to be expected for high-fired ceramics, some of its crystals are emergent on the exposed surfaces; however, as these are less visible than either of the other two features, there may be many other such formations which have been missed.

Therefore, it might be concluded that by sheer frequency of iron crystals and vitrification phases in brittle ware that there is a case to be made that brittle wares may have utilised the most iron-rich clays amongst these three categories and that concentrations of iron oxide, in addition to recrystallising during cooling or manifesting as iron spots, may have accelerated the clay matrix's total vitrification, which would also account for the numerous firing flaws manifest amongst its sherds.

With this as a baseline, it may also be surmised that either due to differences in firing temperature or increased aluminium content that buff wares exhibit more mullite and less vitrification, and the opposite case might also be true for mercury jars. These are only tentative conclusions, which must be tested against the SEM-microprobe results.

Nevertheless, it may be hoped that based on these sets of results, the utility of such meticulous micro-texture based analysis may inform future ceramic studies, perhaps also incorporating element-mapping on a more extensive scale amongst all studied sherds. Certainly, a detailed map of even *one* exposed ceramic sherd would inform us greatly as to the level of variability to be expected within a sherd and expand enquiries as to the expectations of stoneware clays and firing.

4.5 SEM semi-quantitative body analysis

4.5.1 Overview

My full data is presented in **Appendix B**. All elements were normalised by stoichiometry with oxygen (compound%) in INCA. For the purposes of this comparison, I have to chosen to focus on aluminium, iron and potassium; all other chosen elements had mean values of $\leq$1% and are less likely to have had a significant impact on the firing or quality of the ceramic body.

Aluminium, even outside of visible mullite formations, contributes refractory properties to ceramics, and iron and potassium conversely act as fluxing agents. As silicon is the most abundant element in clays and ceramic fabrics, this often leads to it simply being the balance of the rest of the elements; hence, its compositional proportions are not focused upon in my analysis.

Oxide	Significance
$\mathbf{Al_2O_3}$	Refractory properties, addition above naturally occurring levels indicative of deliberate clay mixing
$\mathbf{Fe_2O_3}$	Naturally occurring fluxing agent, usually selected against as part of the high-fired clay production sequence
$\mathbf{K_2O}$	Naturally occurring fluxing agent desired in the forms of feldspars and "china stone" to produce clay that vitrify over long periods of time in the kiln to produce hard body fabrics
$\mathbf{SiO_2}$	Majority oxide/element in sediments used in ceramics, forms balance of elemental composition; may also be present in the form of quartz-grain inclusions *(not statistically analysed in this chapter)*

Table 4.8: Reiteration of important oxides used in this study as proxies for quality control and variability in production sequences. Oxide details from Hamer (1975) and Hamilton (1982).

In order to determine if outliers were the result of "natural" variation as opposed to anomalous concentrations, Shapiro-Wilk tests for normal distribution were applied within each category and fabric group, and measurements either excluded as outliers or groups subdivided into subgroups based on whether the outliers were uniformly confined to whole sherds or fabric groups/sub-groups. Here it is assumed, much like in a great deal of archaeological metrics (Shennan, 1997, 73-74), that exhibiting a normal distribution is an adequate representation of naturally occurring variation within sherds and categories.

Pairwise *t*-tests (i.e. tests of all possible combinations between set categories) were subsequently performed at a 5% confidence level to determine if groups could be separated on a statistically significant basis, with *p*-value adjustments determined by a one-way ANOVA test. If the p-value equalled or exceeded 0.05, this indicated that the groups were not statistically distinct, and *vice versa* (Shennan, 1997, 82-92). All statistical tests were conducted in R 3.3.3.

Before exploring each oxide component in detail, let us examine the overall trends presented at each site and gain some first impressions. Due to its relative abundance, Al_2O_3 will serve as the base-line upon which both Fe_2O_3 and K_2O shall be plotted. [1]

- Buff ware
- " outliers
- Brittle ware
- " outliers
- Mercury jars
- " outliers
- Tempered jars

Table 4.9: Legend for Section 4.5, concerning KTC and STA values plotted on Fe_2O_3, K_2O, and Al_2O_3 scatterplots and graphs.

[1] The axes, although reporting values of Al_2O_3%, Fe_2O_3%, and K_2O% (and in **Chapter 5**, Al_2O_3/SiO_2 [*no units*], CaO%, MgO% and P_2O_5%) all read "Al", "Fe", and "K" (and correspondingly, "Al/Si", "Ca", "Mg", and "P") due to font limitations in R 3.3.3.

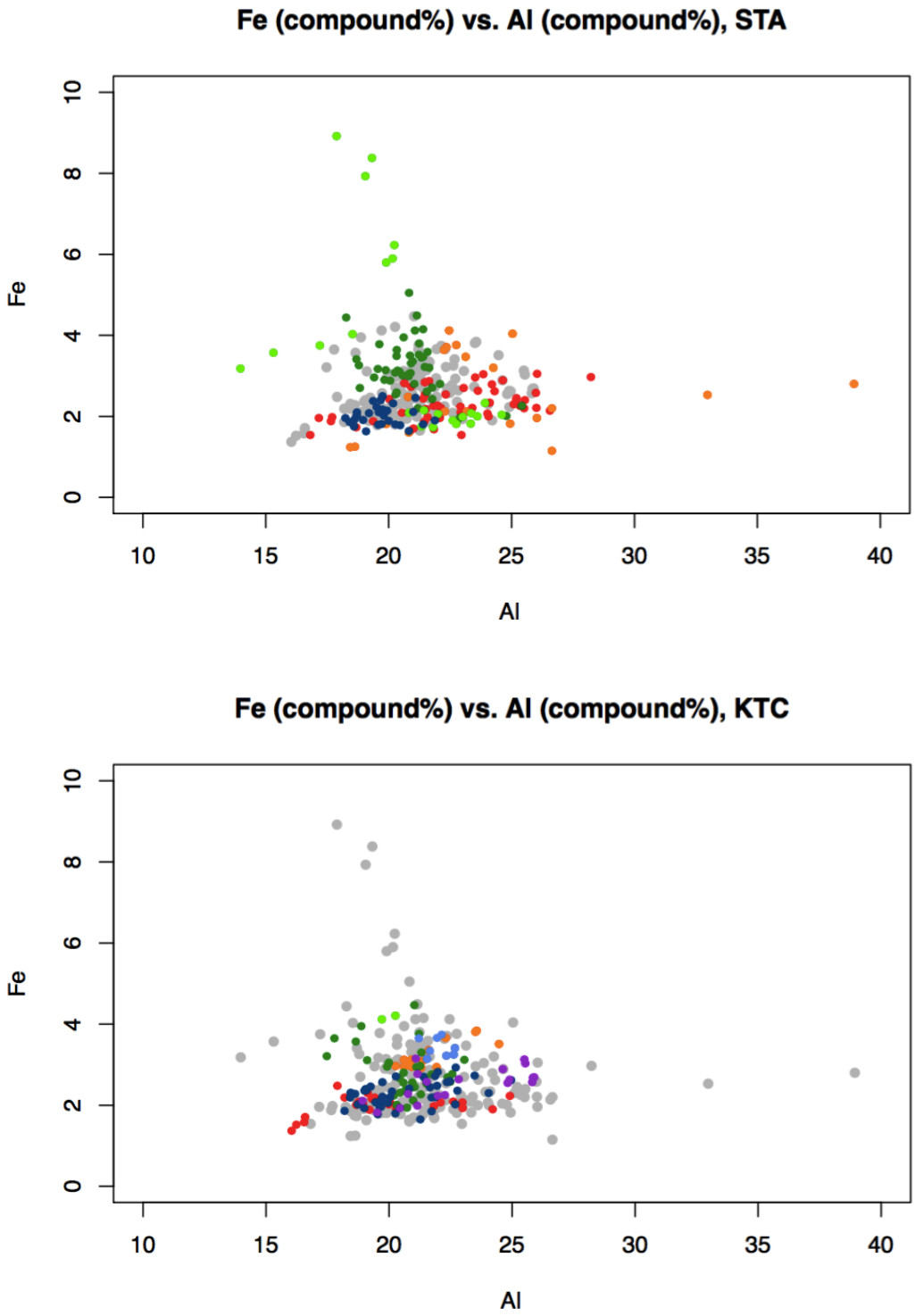
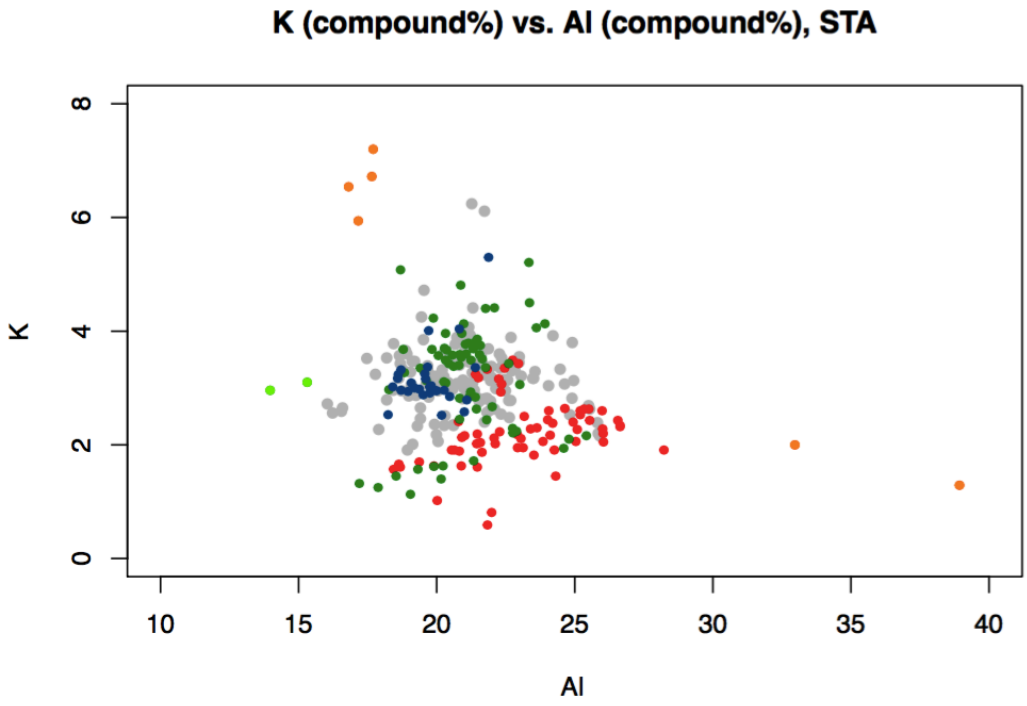


Figure 4.3: Scatterplots of Fe_2O_3% vs. Al_2O_3% at both sites; KTC points are shaded in grey on the STA graph, and *vice versa*.



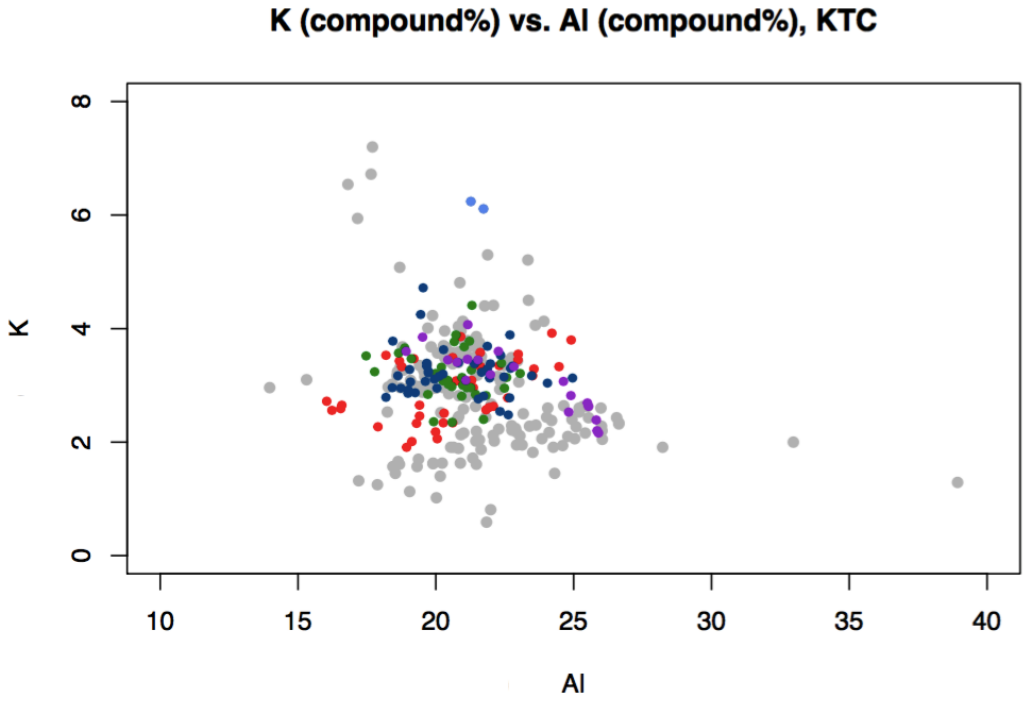


Figure 4.4: Scatterplots of K_2O% vs. Al_2O_3% at both sites; KTC points are shaded in grey on the STA graph, and *vice versa*.

We may note several suggestive trends. On the whole, the values exhibited by these body fabrics fall roughly within the remit of what is to be expected of high-fired ceramics but also demonstrate considerable variation within these technological bounds. The extent to which these sherds match up to our expectations of Chinese ceramic industries will be discussed in **Section 5.1**. All trends observed at this stage will have to be tested statistically.

Firstly STA demonstrates more outliers in all three oxides than KTC, and in many cases these are to more extreme extents. Even putting these aside, the variability of the rest of the sherds also seems to be greater at STA than KTC.

With regards to individual categories, a case may be made that the groups in STA are more strongly discernible on the basis of these three oxides. Evidently, buff wares span a broader range of Al_2O_3% than either brittle ware or mercury jars; the brittle ware at STA is distinguished from both other categories by elevated Fe_2O_3% and K_2O%. While these broad trends are also visible at KTC, the groups are much less discernible as their overlaps are considerable.

One final trend of interest, and which may prove instructive especially in the differences between the sites, is that of the titular mercury jars. While at KTC mercury jar distributions of both Fe_2O_3% vs. Al_2O_3% and K_2O% vs. Al_2O_3% appear to have considerable overlaps with the other categories, they are instead highly concentrated at STA; furthermore, it seems that STA mercury-jars share Fe_2O_3% affinities with STA buff ware, and K_2O% with STA brittle ware. These trends will have to be further tested.

With these in mind, let us set about examining these groupings and distinctions; given the number of variables and samples involved, it would be simplest to test each oxide at once using pairwise t-tests comparing all combinations of identified categories, fabric groups, and outliers, bearing in mind these larger trends and groupings with each test.

4.5.2 Al_2O_3

The second-most abundant element in all body fabrics was aluminium; as explained above its variation is strongly correlated with the refractory nature of the ceramic during firing. Hence this may be taken as one proxy for the "quality" of these stoneware vessels.

4.5.2.1 STA

Category	Al_2O_3%	Category	Al_2O_3%	Category	Al_2O_3%
Buff ware	22.6 ± 2.5	**Brittle ware**	21.1 ± 1.7	**Mercury jars**	19.8 ± 0.9
STA-BUF-A	24.1 ± 1.8	STA-BRI-A	23.0 ± 1.2	STA-MER-A	20.4 ± 0.9
STA-BUF-B	23.1 ± 1.6	STA-BRI-B	20.7 ± 1.8	STA-MER-B	19.8 ± 0.2
		*STA-BRI-02**	13.9 ± 1.1		
STA-BUF-C	21.8 ± 0.4	STA-BRI-C	20.9 ± 0.5	STA-MER-C	19.0 ± 0.5
STA-BUF-06	17.3 ± 0.4				
*STA-BUF-12**	35.3 ± 1.6				
STA-BUF-D	21.7 ± 2.3	STA-BRI-D	20.9 ± 1.2		
STA-BUF-E	23.0 ± 2.7	STA-BRI-E	21.3 ± 0.4		
STA-BUF-F	21.3 ± 0.5	STA-BRI-F	19.3 ± 0.7		
STA-BUF-G	20.7 ± 1.5	STA-BRI-G	19.0 ± 0.6		
		STA-BRI-H	24.0 ± 1.3		

Table 4.10: Mean Al_2O_3% (± 1 standard deviation) of STA ceramic body-fabrics. *Italicised* entries are outliers within their fabric groups, those with additional asterisks (*) are outliers within their categories.

```
              Brittle Buff    Mercury jar STA-BRI-02(B)
Buff          1.8e-05 -       -           -
Mercury jar   0.0027  1.0e-09 -           -
STA-BRI-02(B) 4.3e-11 9.4e-15 1.1e-07     -
STA-BUF-12(C) < 2e-16 < 2e-16 < 2e-16     < 2e-16

P value adjustment method: none
```

Table 4.11: *p*-values of pairwise t-tests between categories and outliers.

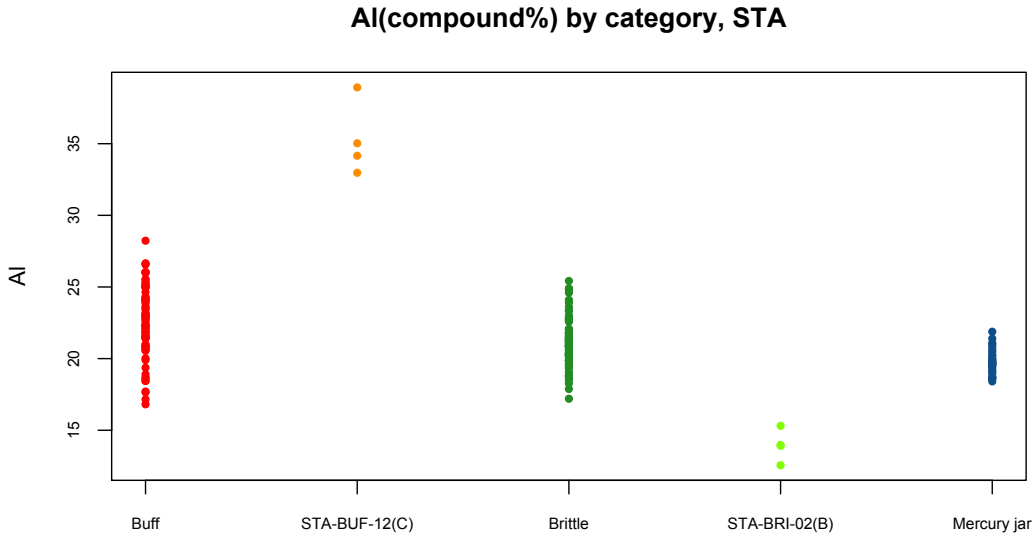


Figure 4.5: Stripchart of Al_2O_3% by category, along with outliers.

All of the categories and their outliers – **STA-BUF-12(C)** and **STA-BUF-02(B)** – are statistically distinct from each other. Brittle ware contains more Al_2O_3% than mercury jars, and buff ware contains more Al_2O_3% than brittle ware on average.

With the exceptions of **STA-BUF-06(C)** and **STA-BRI-02(B)**, all of these body-fabrics are higher in Al_2O_3% content than naturally occurring stoneware clays in Southern China (Wood, 1999, 29), possibly indicating some level of artificial addition of kaolin-rich clay to meet the requisite compositions, or simply different clay sources and production centres, even outside of China; it will be necessary to compare Chinese ceramics with clays to see if they directly correspond, or also demonstrate such addition.

Performing the same statistical tests *within* the fabric groups reveals further trends:

	STA-BUF-06(C)	STA-BUF-12(C)	STA-BUF-A	STA-BUF-B	STA-BUF-C	STA-BUF-D	STA-BUF-E	STA-BUF-F
STA-BUF-12(C)	< 2e-16	-	-	-	-	-	-	-
STA-BUF-A	2.3e-08	7.7e-16	-	-	-	-	-	-
STA-BUF-B	1.1e-05	4.2e-15	0.2250	-	-	-	-	-
STA-BUF-C	0.0024	2.1e-14	0.0334	0.2763	-	-	-	-
STA-BUF-D	0.0003	< 2e-16	0.0011	0.1294	0.9609	-	-	-
STA-BUF-E	3.3e-06	< 2e-16	0.0813	0.8701	0.2861	0.1039	-	-
STA-BUF-F	0.0085	3.4e-15	0.0077	0.1135	0.6631	0.6281	0.1079	-
STA-BUF-G	0.0201	8.6e-16	0.0022	0.0515	0.4468	0.3776	0.0448	0.7442

P value adjustment method: none

	STA-BRI-02(B)	STA-BRI-A	STA-BRI-B	STA-BRI-C	STA-BRI-D	STA-BRI-E	STA-BRI-F	STA-BRI-G
STA-BRI-A	< 2e-16	-	-	-	-	-	-	-
STA-BRI-B	2.5e-12	0.00049	-	-	-	-	-	-
STA-BRI-C	< 2e-16	2.7e-05	0.65960	-	-	-	-	-
STA-BRI-D	< 2e-16	2.5e-06	0.62789	0.98306	-	-	-	-
STA-BRI-E	1.0e-13	0.00828	0.43812	0.60970	0.59485	-	-	-
STA-BRI-F	3.0e-09	2.5e-07	0.08953	0.01300	0.00783	0.01478	-	-
STA-BRI-G	1.9e-10	7.6e-11	0.02025	0.00037	7.8e-05	0.00166	0.69818	-
STA-BRI-H	< 2e-16	0.14501	7.0e-05	1.1e-05	3.4e-06	0.00093	1.0e-07	5.1e-10

P value adjustment method: none

	STA-MER-A	STA-MER-B
STA-MER-B	0.0264	-
STA-MER-C	1e-05	0.0081

P value adjustment method: none

Table 4.12: p-values of pairwise t-tests between a) Buff ware, b) Brittle ware, c) Mercury jar fabric groups concerning mean Al_2O_3%.

STA-BUF-A has an appreciably high-alumina concentration relative to the other buff wares. The same trend holds for **STA-BRI-A**. Overall the distinction of buff wares from brittle and mercury jars is vindicated, and perhaps surprisingly mercury jars also prove distinct from buff ware; however, we must resist over-interpretation of these statistical differences given that the observed variances may not be particularly useful in terms of ceramic performance.

4.5.2.2 KTC

Category	Al_2O_3%	Category	Al_2O_3%	Category	Al_2O_3%
Buff ware	20.6 ± 2.2	**Brittle ware**	20.7 ± 1.2	**Mercury jars**	21.0 ± 1.7
KTC-BUF-A	22.3 ± 1.4	KTC-BRI-A	21.0 ± 1.0	KTC-MER-A	20.5 ± 1.4
KTC-BUF-B	23.8 ± 1.0	KTC-BRI-B	21.0 ± 1.2	KTC-MER-B	22.1 ± 0.4
				KTC-MER-18(B)	19.0 ± 0.4
KTC-BUF-C	19.3 ± 2.0	KTC-BRI-C	20.6 ± 0.5	KTC-MER-C	21.8 ± 2.0
KTC-BUF-D	20.1 ± 1.4	KTC-BRI-D	18.2 ± 1.2	KTC-MER-D	21.7 ± 0.4
		KTC-BRI-E	20.8 ± 0.3	KTC-MER-E	19.2 ± 0.9
		KTC-BRI-F	21.2 ± 0.1		
		Tempered jars	21.2 ± 0.1		
		KTC-TMP-A	22.0 ± 0.8		
		KTC-TMP-B	20.8 ± 1.1		
		KTC-TMP-C	25.7 ± 0.5		
		KTC-TMP-06(C)	20.7 ± 1.2		

Table 4.13: Mean Al_2O_3% (± 1 standard deviation) of KTC ceramic body-fabrics. *Italicised* entries are outliers within their fabric groups, those with additional asterisks (*) are outliers within their categories.

```
             Brittle Buff    Mercury jar
Buff         0.81350 -       -
Mercury jar  0.51795 0.36291 -
Tempered jar 4.2e-05 1.6e-05 0.00017

P value adjustment method: none
```

Table 4.14: *p*-values of pairwise t-tests between KTC categories concerning mean Al_2O_3%.

It initially seems that (except for tempered jars) the three other major categories cannot be differentiated meaningfully. However, we must beware of jumping to conclusions, as the patterns seen both within the sub-categories and the scatterplots suggest that the apparently normal distribution may in fact be more nuanced than first meets the eye.

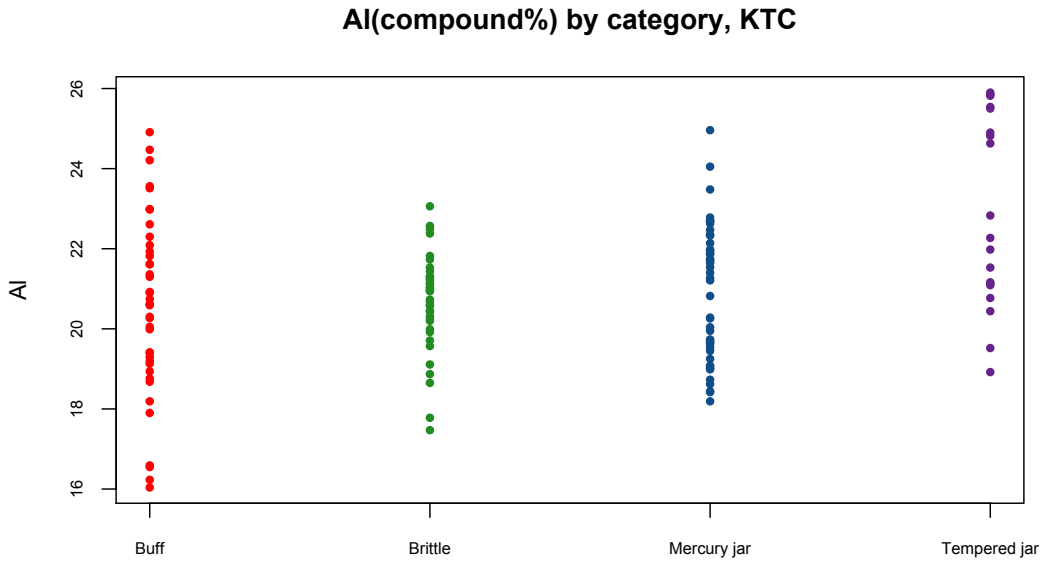


Figure 4.6: Stripchart of Al_2O_3% by category, along with outliers.

Evidently, all four categories seem to have at least two different peaks as concerns mean Al_2O_3%, most obviously seen in the mercury jars and tempered jars but also more subtly in the buff and brittle wares.

While the consistency of this pattern may suggest the existence of at least two discrete sets of clay sources, it is evident that they do not strongly correspond to differences seen in the other oxides (**Figures 4.3 and 4.4**). It is, of course, entirely possible that the clay sources differ only by alumina content.

```
           KTC-BUF-A KTC-BUF-B KTC-BUF-C
KTC-BUF-B 0.07856   -         -
KTC-BUF-C 0.00122   4.3e-05   -
KTC-BUF-D 0.00066   2.6e-05   0.80369

           KTC-BRI-A KTC-BRI-B KTC-BRI-C KTC-BRI-D KTC-BRI-E
KTC-BRI-B 0.98532   -         -         -         -
KTC-BRI-C 0.44517   0.48432   -         -         -
KTC-BRI-D 4.5e-06   2.2e-05   0.00064   -         -
KTC-BRI-E 0.60734   0.63485   0.84101   0.00037   -
KTC-BRI-F 0.78434   0.81137   0.43072   0.00015   0.54559

           KTC-MER-18 (B) KTC-MER-A KTC-MER-B KTC-MER-C KTC-MER-D
KTC-MER-A 0.04852        -         -         -         -
KTC-MER-B 0.00059        0.01148   -         -         -
KTC-MER-C 0.00092        0.01966   0.57021   -         -
KTC-MER-D 0.00599        0.11009   0.65008   0.98045   -
KTC-MER-E 0.86328        0.07698   0.00104   0.00168   0.00940

           KTC-TMP-03 (C)  KTC-TMP-A KTC-TMP-B
KTC-TMP-A 0.067            -         -
KTC-TMP-B 0.905            0.083     -
KTC-TMP-C 2.6e-07          3.9e-05   3.2e-07

P value adjustment method: none
```

Table 4.15: *p*-values of pairwise t-tests between KTC a) Buff ware, b) Brittle ware, c) Mercury jar, d) Tempered jar fabric groups concerning mean Al_2O_3%.

Buff wares seem to divided into the higher-Al_2O_3 **KTC-BUF-A** and **B**, and the lower-Al_2O_3 **KTC-BUF-C** and **D**. It is the latter two fabric groups which display the dazzling multicoloured glazes, which raises questions concerning the intentionality of glazes and surface treatment *vis-à-vis* the perennial question of "quality". **KTC-BRI-D** is significantly lower in alumina content than the rest of the brittle ware.

Within mercury jars, **KTC-MER-A**, **E**, and perhaps **KTC-MER-18(B)** might be representative of a low-alumina clay. If the yellow colouration on the exteriors of the KTC-MER-A sherds is indicative of a degraded glaze, there may be parallels with the KTC buff wares.

My visual characterisation of the tempered jars appears to have misclassified **KTC-TMP-03(C)**, as it shares more affinities (alumina-wise) with the other two sherds, despite the visual patterns among the glazes.

4.5.2.3 Inter-site analysis

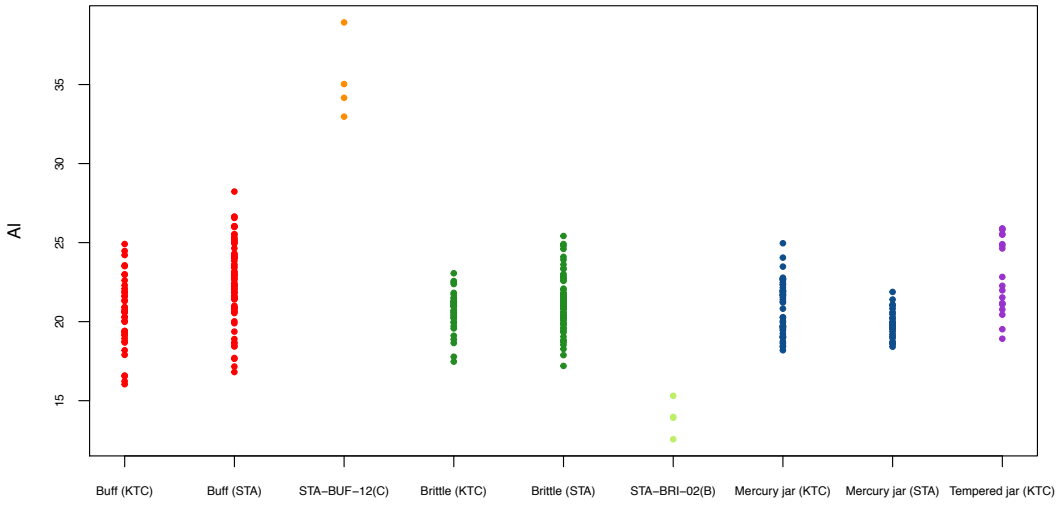


Figure 4.7: Stripchart of Al_2O_3% by category, along with outliers.

```
                            Brittle (KTC) Brittle (STA) Brittle (STA), STA-BRI-02(B)
Brittle (STA)               0.24339       -             -
Brittle (STA), STA-BRI-02(B) 1.5e-10      3.4e-12       -
Buff (KTC)                  0.82082       0.14523       2.4e-10
Buff (STA)                  1.4e-06       8.1e-06       < 2e-16
Buff (STA), STA-BUF-12(C)   < 2e-16       < 2e-16       < 2e-16
Mercury jar (KTC)           0.53465       0.59395       2.1e-11
Mercury jar (STA)           0.07022       0.00186       2.7e-08
Tempered jar (KTC)          6.3e-05       0.00050       1.4e-15
                            Buff (KTC) Buff (STA) Buff (STA), STA-BUF-12(C)
Brittle (STA)               -          -          -
Brittle (STA), STA-BRI-02(B) -         -          -
Buff (KTC)                  -          -          -
Buff (STA)                  2.0e-07    -          -
Buff (STA), STA-BUF-12(C)   < 2e-16    < 2e-16    -
Mercury jar (KTC)           0.38200    6.8e-06    < 2e-16
Mercury jar (STA)           0.10329    1.3e-10    < 2e-16
Tempered jar (KTC)          2.3e-05    0.53595    < 2e-16
                            Mercury jar (KTC) Mercury jar (STA)
Brittle (STA)               -                 -
Brittle (STA), STA-BRI-02(B) -                -
Buff (KTC)                  -                 -
Buff (STA)                  -                 -
Buff (STA), STA-BUF-12(C)   -                 -
Mercury jar (KTC)           -                 -
Mercury jar (STA)           0.01312           -
Tempered jar (KTC)          0.00025           1.1e-07

P value adjustment method: none
```

Table 4.16: p-values of pairwise t-tests between KTC and STA wares, concerning mean Al_2O_3%.

Comparing between categories at different sites, the increased Al_2O_3% within STA buff ware compared to KTC is apparently statistically significant, perhaps suggesting changes in ceramic recipes over time or between target markets. This pattern does not hold for the brittle wares, which are statistically indistinguishable in terms of Al_2O_3% between sites. Tempered jars at KTC do not correlate with any other category besides STA buff ware.

Considering the correlation of these trends with the contemporary stylistic shifts in mercury jars, the reduced variability in alumina content at STA relative to KTC might suggest a coalescence in mercury jar production within the later period. These trends bear further investigation with regards to ferrous and potassic content.

4.5.3 Fe_2O_3

As the next most-abundant naturally occurring element after aluminium as well as a common fluxing agent, the ferrous content of these stoneware body fabrics bears investigation. Ideally, high concentrations should be selected against to prevent premature total vitrification, which can lead to bloating or even total firing failure. Hence, it may considered a counterpart to alumina in that its abundance thus bears an inverse relation to firing quality.

4.5.3.1 STA

Category	Fe_2O_3%	Category	Fe_2O_3%	Category	Fe_2O_3%
Buff ware	2.2 ± 0.5	**Brittle ware**	3.2 ± 0.6	**Mercury jars**	2.0 ± 0.2
STA-BUF-A	2.4 ± 0.4	*STA-BRI-A**	2.1 ± 0.2	STA-MER-A	2.0 ± 0.3
STA-BUF-B	2.3 ± 0.5	STA-BRI-B	3.8 ± 0.5	STA-MER-B	2.1 ± 0.2
*STA-BUF-02**	3.8 ± 0.2				
STA-BUF-C	2.2 ± 0.4	STA-BRI-C	3.4 ± 0.4	STA-MER-C	2.1 ± 0.3
STA-BUF-D	2.2 ± 0.5	STA-BRI-D	3.1 ± 0.5		
		*STA-BRI-17**	1.8 ± 0.1		
*STA-BUF-E**	1.8 ± 0.4	STA-BRI-E	3.3 ± 1.3		
*STA-BUF-20**	3.6 ± 0.4				
STA-BUF-F	2.6 ± 0.4	STA-BRI-F	3.2 ± 0.2		
STA-BUF-G	2.1 ± 0.4	*STA-BRI-G**	6.4 ± 1.9		
		STA-BRI-H	2.0 ± 0.2		

Table 4.17: Mean Fe_2O_3% (± 1 standard deviation) of STA ceramic body-fabrics. *Italicised* entries are outliers within their fabric groups, those with additional asterisks (*****) are outliers within their categories.

	Brittle	Buff	Mercury jar	STA-BRI-17(D)	STA-BRI-A	STA-BRI-G	STA-BUF-02(B)	STA-BUF-20(E)
Buff	3.7e-11	-	-	-	-	-	-	-
Mercury jar	1.9e-13	0.03776	-	-	-	-	-	-
STA-BRI-17(D)	3.5e-05	0.12843	0.57298	-	-	-	-	-
STA-BRI-A	8.2e-07	0.22252	0.89850	0.56012	-	-	-	-
STA-BRI-G	< 2e-16	< 2e-16	< 2e-16	< 2e-16	< 2e-16	-	-	-
STA-BUF-02(B)	0.05194	5.4e-06	1.6e-07	9.5e-06	3.6e-06	1.6e-10	-	-
STA-BUF-20(E)	0.29133	0.00070	4.6e-05	0.00027	0.00025	2.4e-10	0.61114	-
STA-BUF-E	1.9e-10	0.01102	0.30974	0.91734	0.36123	< 2e-16	7.4e-08	1.5e-05

P value adjustment method: none

Table 4.18: p-values of pairwise t-tests between categories and outliers concerning mean Fe_2O_3% .

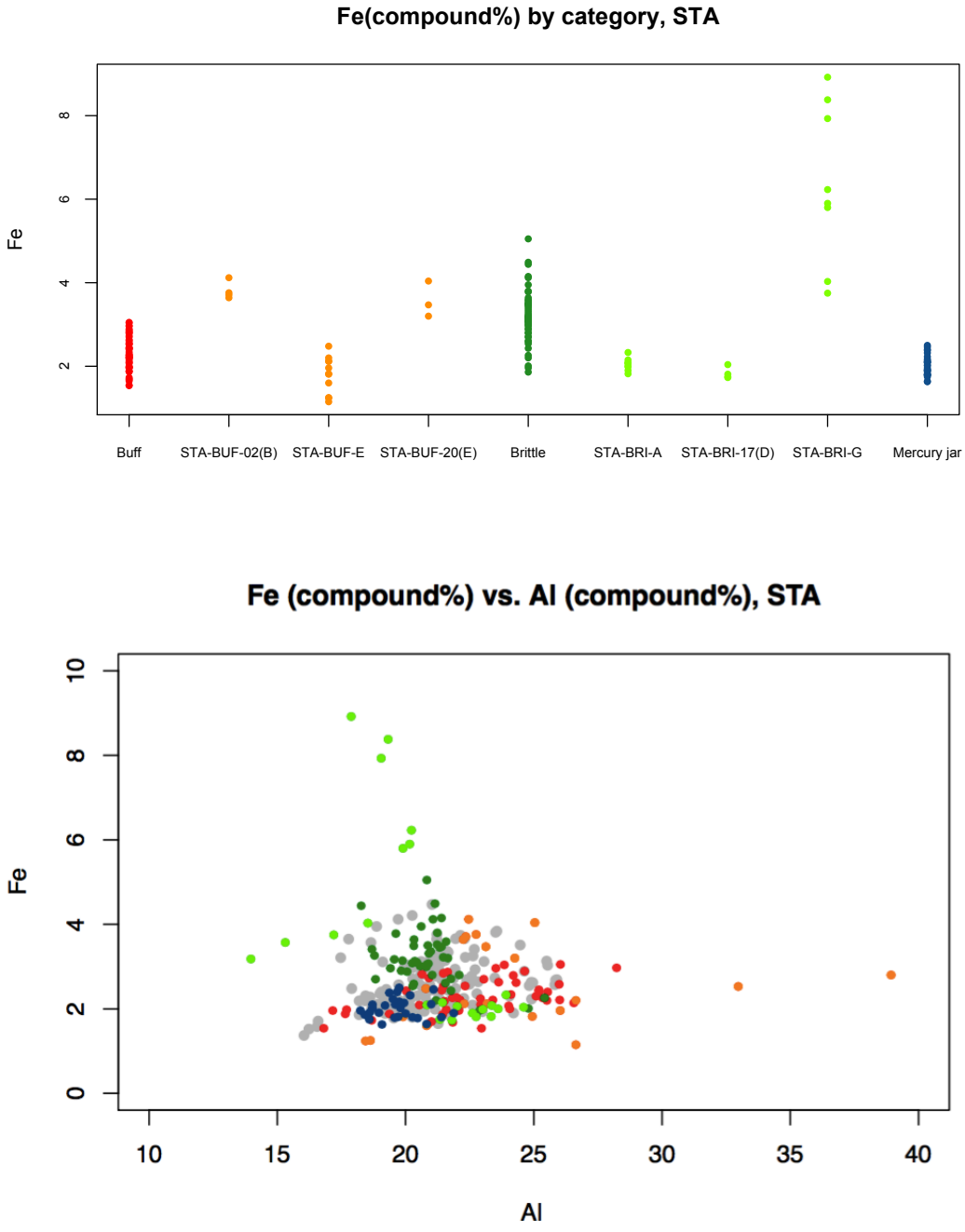


Figure 4.8: a) Stripchart of Fe_2O_3% by category along with outliers; b) Scatterplot of the above vs. Al_2O_3%, with KTC values in the background.

We can see that *both* major categories of buff and brittle, distinguishable by more iron-oxide in the latter, have significant outliers, with **STA-BRI-G**'s case vindicating the hypothesis that its clay matrix was derived from laterite soils.

Amongst buff wares, **STA-BUF-02(B)** and **STA-BUF-20(E)** have high Fe_2O_3%, hewing much closer to brittle wares; the rest of **STA-BUF-E** has uncharacteristically low Fe_2O_3%, even for buff ware. This can also be seen among the brittle wares, where **STA-BRI-A** and **STA-BRI-17(D)** conversely have significantly low Fe_2O_3%. Although mercury jars have a lower Fe_2O_3% than either buff or brittle ware, it is not statistically distinct from the former. However, as with alumina, this commonality alone may be insufficient to declare mercury jars as sharing some or all of the same *chaîne opératoire* as buff ware.

	STA-BUF-02(B)	STA-BUF-20(E)	STA-BUF-A	STA-BUF-B	STA-BUF-C	STA-BUF-D	STA-BUF-E	STA-BUF-F
STA-BUF-20(E)	0.44856	-	-	-	-	-	-	-
STA-BUF-A	4.2e-08	2.2e-05	-	-	-	-	-	-
STA-BUF-B	1.2e-06	7.9e-05	0.48607	-	-	-	-	-
STA-BUF-C	1.0e-08	4.1e-06	0.21464	0.86396	-	-	-	-
STA-BUF-D	8.4e-09	3.7e-06	0.21939	0.88885	0.96392	-	-	-
STA-BUF-E	7.4e-12	8.1e-09	0.00017	0.05954	0.02298	0.01775	-	-
STA-BUF-F	8.4e-05	0.00261	0.41442	0.24282	0.11889	0.12190	0.00140	-
STA-BUF-G	1.2e-06	5.5e-05	0.26774	0.68754	0.75442	0.72900	0.21706	0.13981

	STA-BRI-17(D)	STA-BRI-A	STA-BRI-B	STA-BRI-C	STA-BRI-D	STA-BRI-E	STA-BRI-F	STA-BRI-G
STA-BRI-A	0.65854	-	-	-	-	-	-	-
STA-BRI-B	0.00056	0.00024	-	-	-	-	-	-
STA-BRI-C	0.00177	0.00050	0.29881	-	-	-	-	-
STA-BRI-D	0.00426	0.00128	0.11134	0.49294	-	-	-	-
STA-BRI-E	0.01215	0.01175	0.36052	0.91726	0.72539	-	-	-
STA-BRI-F	0.02100	0.02235	0.25512	0.71362	0.94014	0.82981	-	-
STA-BRI-G	4.1e-13	3.8e-16	5.2e-07	1.9e-11	1.3e-13	4.8e-08	1.8e-08	-
STA-BRI-H	0.73891	0.96020	0.00166	0.00579	0.01366	0.02803	0.04622	1.8e-12

P value adjustment method: none

	STA-MER-A	STA-MER-B
STA-MER-B	0.76	-
STA-MER-C	0.76	0.84

P value adjustment method: holm

Table 4.19: *p*-values of pairwise t-tests between a) Buff ware, b) Brittle ware, c) Mercury jar fabric groups concerning mean Fe_2O_3%.

Only **STA-BUF-B** and **G** have statistically similar mean Fe_2O_3% to **STA-BUF-E**; within the brittle wares, **STA-BRI-H**'s low Fe_2O_3% may speak to greater affinities with buff ware than brittle ware. Unlike with alumina, mercury jar groups cannot be distinguished based on their ferrous content. This trend bears further investigation alongside that of potassium.

4.5.3.2 KTC

Category	Fe_2O_3%	Category	Fe_2O_3%	Category	Fe_2O_3%
Buff ware	2.0 ± 0.3	**Brittle ware**	3.0 ± 1.2	**Mercury jars**	2.3 ± 0.3
*KTC-BUF-A**	3.5 ± 0.3	KTC-BRI-A	2.8 ± 0.2	KTC-MER-A	2.3 ± 0.4
		*KTC-BRI-08(A)**	4.2 ± 0.1	*KTC-MER-05(A)**	3.3 ± 0.1
KTC-BUF-B	2.0 ± 0.2	KTC-BRI-B	2.8 ± 0.2	KTC-MER-B	2.2 ± 0.2
KTC-BUF-C	1.8 ± 0.3	KTC-BRI-C	2.1 ± 0.2	KTC-MER-C	2.3 ± 0.3
*KTC-BUF-CA**	3.0 ± 0.1				
KTC-BUF-D	2.1 ± 0.2	KTC-BRI-D	3.6 ± 0.3	*KTC-MER-D**	3.6 ± 0.2
		KTC-BRI-E	2.4 ± 0.2	KTC-MER-E	2.0 ± 0.1
		KTC-BRI-F	3.8 ± 0.6		
		Tempered jars	2.5 ± 0.4		
		KTC-TMP-A	2.3 ± 0.3		
		KTC-TMP-B	2.1 ± 0.2		
		KTC-TMP-C	2.7 ± 0.3		

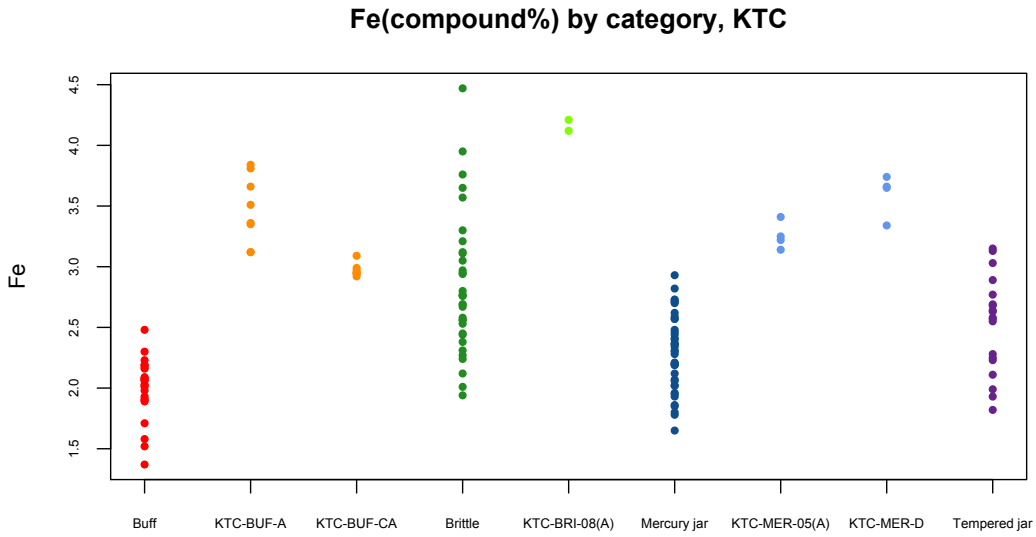
Table 4.20: Mean Fe_2O_3% (± 1 standard deviation) of KTC ceramic body-fabrics. *Italicised* entries are outliers within their fabric groups, those with additional asterisks (*) are outliers within their categories.

	Brittle	Buff	KTC-BRI-08 (A)	KTC-BUF-A	KTC-BUF-CA	KTC-MER-05 (A)	KTC-MER-D	Mercury jar
Buff	5.8e-08	-	-	-	-	-	-	-
KTC-BRI-08 (A)	0.02109	2.3e-05	-	-	-	-	-	-
KTC-BUF-A	0.09342	3.2e-07	0.19302	-	-	-	-	-
KTC-BUF-CA	0.84923	0.00094	0.02834	0.15343	-	-	-	-
KTC-MER-05 (A)	0.51925	0.00070	0.11958	0.59943	0.50331	-	-	-
KTC-MER-D	0.10928	2.1e-05	0.33036	0.75904	0.13970	0.47147	-	-
Mercury jar	6.0e-06	0.09553	0.00018	1.2e-05	0.01396	0.00682	0.00029	-
Tempered jar	0.00976	0.01200	0.00126	0.00103	0.13090	0.04906	0.00418	0.21301

Table 4.21: *p*-values of pairwise t-tests between KTC categories and outliers, concerning mean Fe_2O_3%.

Fe_2O_3% appears to be a more promising discriminant among the KTC categories. As with STA, the brittle wares have a greater mean Fe_2O_3% than the buff wares; unlike STA where both are enriched in iron oxide relative to mercury jars, the mercury jars have Fe_2O_3% values between these two categories, as do tempered jars.

KTC-BUF-A and two sherds within C (hence "**CA**") appear to have greater affinity with brittle wares than buff wares due to their higher ferrous component, as do **KTC-MER-05(A)** and **KTC-MER-D** relative to the other mercury jars.



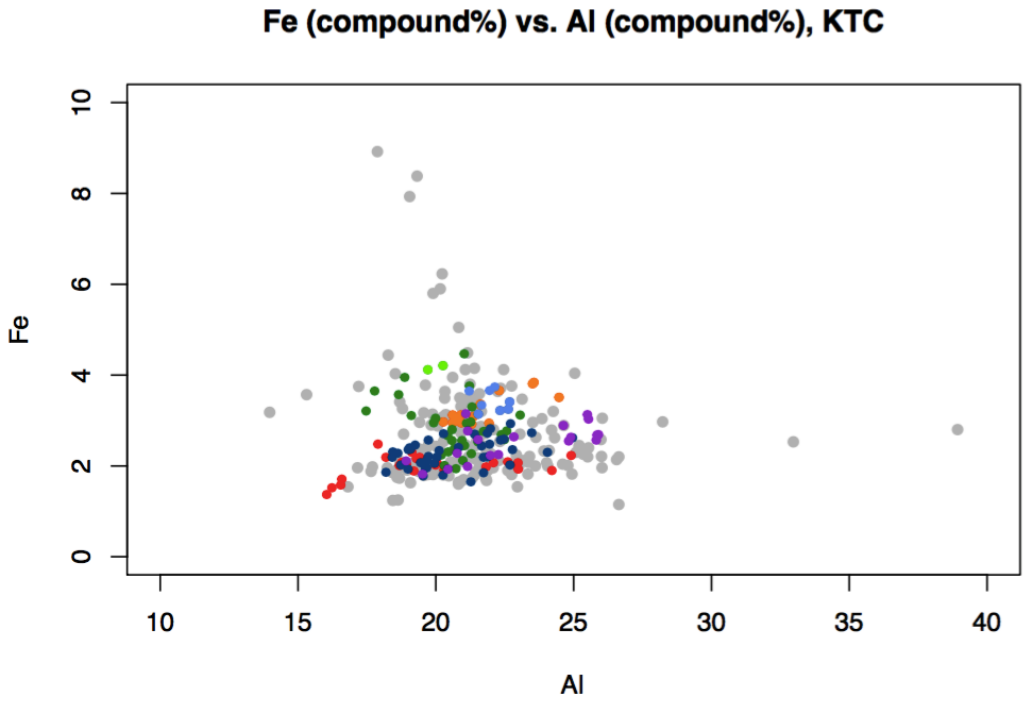


Figure 4.9: a) Stripchart of Fe_2O_3% by category, along with outliers; b) Scatterplot of the above vs. Al_2O_3%, with STA values in the background.

The pinkish fabrics in KTC apparently do *not* denote the use of laterite clays as they did for **STA-BRI-G**. Unlike STA, mercury jars do not cluster strongly and separately from the other body fabrics.

```
          KTC-BUF-A KTC-BUF-B KTC-BUF-C
KTC-BUF-B 0.07856   -         -
KTC-BUF-C 0.00122   4.3e-05   -
KTC-BUF-D 0.00066   2.6e-05   0.80369

          KTC-BRI-A KTC-BRI-B KTC-BRI-C KTC-BRI-D KTC-BRI-E
KTC-BRI-B 0.98532   -         -         -         -
KTC-BRI-C 0.44517   0.48432   -         -         -
KTC-BRI-D 4.5e-06   2.2e-05   0.00064   -         -
KTC-BRI-E 0.60734   0.63485   0.84101   0.00037   -
KTC-BRI-F 0.78434   0.81137   0.43072   0.00015   0.54559

          KTC-MER-18 (B) KTC-MER-A KTC-MER-B KTC-MER-C KTC-MER-D
KTC-MER-A 0.04852        -         -         -         -
KTC-MER-B 0.00059        0.01148   -         -         -
KTC-MER-C 0.00092        0.01966   0.57021   -         -
KTC-MER-D 0.00599        0.11009   0.65008   0.98045   -
KTC-MER-E 0.86328        0.07698   0.00104   0.00168   0.00940

          KTC-TMP-03 (C)  KTC-TMP-A KTC-TMP-B
KTC-TMP-A 0.067           -         -
KTC-TMP-B 0.905           0.083     -
KTC-TMP-C 2.6e-07         3.9e-05   3.2e-07

P value adjustment method: none
```

Table 4.22: *p*-values of pairwise t-tests between KTC a) Buff ware, b) Brittle ware, c) Mercury jar, d) Tempered jar fabric groups concerning mean Fe_2O_3%.

Despite the enrichment of **KTC-BUF-A** and **CA** relative to the other buff wares, they notably do not cluster together, forming grounds for the suggestion that the corpus represents not just two but possibly *three* different production centres, albeit based on four out of ten sherds.

These risks are highlighted with the issues encountered with the brittle wares, where almost no fabric groups cluster with each other. Unlike the buff ware outliers, **KTC-MER-A** and **D** do group together. **KTC-TMP-C**'s differences from the other two tempered-jar sherds are further emphasised with their statistical separation concerning Fe_2O_3%.

4.5.3.3 Inter-site analysis

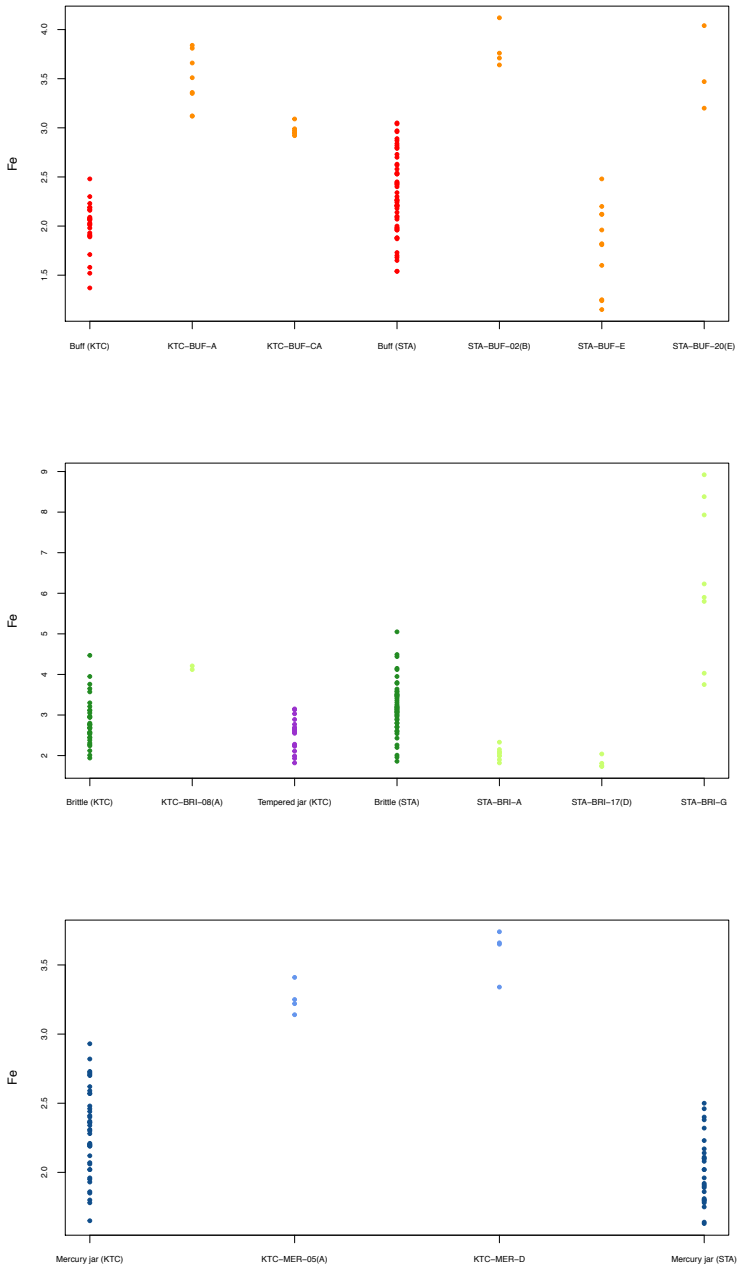


Figure 4.10: Stripchart of Fe_2O_3% by category at KTC and STA, along with outliers.

	Brittle (KTC)	Brittle (STA)	Buff (KTC)	Buff (STA)	KTC-BRI-08(A)	KTC-BUF-A
Brittle (STA)	0.00314	-	-	-	-	-
Buff (KTC)	5.3e-09	< 2e-16	-	-	-	-
Buff (STA)	1.0e-05	2.6e-15	0.01331	-	-	-
KTC-BRI-08(A)	0.00051	0.00939	3.4e-08	1.3e-06	-	-
KTC-BUF-A	0.00208	0.15040	2.4e-11	1.3e-08	0.09200	-
KTC-BUF-CA	0.52612	0.31233	1.7e-05	0.00186	0.00448	0.06459
KTC-MER-05(A)	0.12823	0.79691	1.0e-05	0.00057	0.04386	0.49686
KTC-MER-D	0.00594	0.12824	2.8e-08	3.1e-06	0.20782	0.69154
Mercury jar (KTC)	1.1e-05	1.8e-14	0.03087	0.79572	1.0e-06	1.1e-08
Mercury jar (STA)	2.7e-09	< 2e-16	0.89384	0.01434	3.7e-08	1.9e-11
STA-BRI-17(D)	0.00031	9.6e-07	0.55661	0.07336	4.0e-07	4.7e-07
STA-BRI-A	6.8e-05	4.7e-09	0.80870	0.15094	3.4e-07	3.9e-08
STA-BRI-G	< 2e-16	< 2e-16	< 2e-16	< 2e-16	1.6e-07	< 2e-16
STA-BUF-02(B)	0.00047	0.02200	4.5e-10	6.9e-08	0.42712	0.29103
STA-BUF-20(E)	0.01967	0.21416	1.3e-06	6.1e-05	0.21026	0.77891
STA-BUF-E	2.2e-08	2.8e-14	0.28596	0.00271	8.2e-09	2.4e-11
Tempered jar (KTC)	0.03676	3.8e-06	0.00112	0.14069	2.8e-05	2.0e-05

	KTC-BUF-CA	KTC-MER-05(A)	KTC-MER-D	Mercury jar (KTC)	Mercury jar (STA)
Brittle (STA)	-	-	-	-	-
Buff (KTC)	-	-	-	-	-
Buff (STA)	-	-	-	-	-
KTC-BRI-08(A)	-	-	-	-	-
KTC-BUF-A	-	-	-	-	-
KTC-BUF-CA	-	-	-	-	-
KTC-MER-05(A)	0.38656	-	-	-	-
KTC-MER-D	0.05586	0.35154	-	-	-
Mercury jar (KTC)	0.00143	0.00045	2.4e-06	-	-
Mercury jar (STA)	1.8e-05	1.2e-05	3.0e-08	0.03465	-
STA-BRI-17(D)	0.00053	0.00013	2.4e-06	0.09516	0.50711
STA-BRI-A	0.00047	0.00013	1.1e-06	0.20815	0.88069
STA-BRI-G	< 2e-16	< 2e-16	2.3e-16	< 2e-16	< 2e-16
STA-BUF-02(B)	0.01081	0.13335	0.56768	5.5e-08	4.6e-10
STA-BUF-20(E)	0.09659	0.42754	0.94475	4.8e-05	1.4e-06
STA-BUF-E	4.2e-06	2.4e-06	7.9e-09	0.00565	0.23180
Tempered jar (KTC)	0.05049	0.01078	0.00020	0.10699	0.00118

	STA-BRI-17(D)	STA-BRI-A	STA-BRI-G	STA-BUF-02(B)	STA-BUF-20(E)	STA-BUF-E
Brittle (STA)	-	-	-	-	-	-
Buff (KTC)	-	-	-	-	-	-
Buff (STA)	-	-	-	-	-	-
KTC-BRI-08(A)	-	-	-	-	-	-
KTC-BUF-A	-	-	-	-	-	-
KTC-BUF-CA	-	-	-	-	-	-
KTC-MER-05(A)	-	-	-	-	-	-
KTC-MER-D	-	-	-	-	-	-
Mercury jar (KTC)	-	-	-	-	-	-
Mercury jar (STA)	-	-	-	-	-	-
STA-BRI-17(D)	-	-	-	-	-	-
STA-BRI-A	0.49290	-	-	-	-	-
STA-BRI-G	< 2e-16	< 2e-16	-	-	-	-
STA-BUF-02(B)	1.5e-07	3.9e-08	2.1e-14	-	-	-
STA-BUF-20(E)	1.6e-05	1.5e-05	3.9e-14	0.54961	-	-
STA-BUF-E	0.90280	0.28250	< 2e-16	1.6e-10	3.0e-07	-
Tempered jar (KTC)	0.01636	0.02435	< 2e-16	9.8e-06	0.00129	0.00026

Table 4.23: p-values of pairwise t-tests between KTC and STA wares, concerning mean Fe_2O_3%.

The ferrous content of both buff and brittle wares increased by statistically significant amounts from KTC and STA, which is unusual considering that alumina also increased for both materials between sites. Mercury jars *decreased* in ferrous content while also decreasing in alumina, suggesting the opposite trend to both other categories. The only category at STA with which KTC tempered jars corresponds is its buff wares; it does not match any other STA categories or outliers.

None of the buff ware outliers at either site correspond to the bulk of buff wares at the other besides **STA-BUF-E** with KTC buff wares. Similarly, it appears that the brittle-ware and mercury jar outliers are exceptions at both sites, indicating that their grouping outside the main categories must be explained by means other than those of ingression of new production centres to the markets of KTC, or the resilience of old kilns at STA.

4.5.4 K_2O

Potassium in the form of potash (or *potassa*) found in feldspars, is almost as abundant as iron in these stonewares, and also has implications concerning the performance of the clay matrix during firing. Feldspars convey hardness and act as fluxing agents; it is in fact the primary agent in achieving prolonged vitrification in homogeneous, non-porous porcelain bodies (Hamer, 1975, 231-232).

4.5.4.1 STA

Category	K_2O%	Category	K_2O%	Category	K_2O%
Buff ware	2.2 ± 0.6	**Brittle ware**	3.2 ± 0.9	**Mercury jars**	3.0 ± 0.2
STA-BUF-A	2.3 ± 0.4	STA-BRI-A	3.5 ± 0.9	STA-MER-A	2.9 ± 0.3
STA-BUF-B	2.8 ± 0.5	STA-BRI-B	2.9 ± 0.2	STA-MER-B	3.0 ± 0.2
STA-BUF-C	2.6 ± 0.7	STA-BRI-C	3.6 ± 0.2	STA-MER-C	3.1 ± 0.2
*STA-BUF-06**	6.6 ± 0.5				
STA-BUF-D	1.9 ± 0.3	STA-BRI-D	3.5 ± 0.8		
		STA-BRI-17	1.8 ± 0.1		
STA-BUF-E	2.1 ± 0.3	STA-BRI-E	3.0 ± 0.3		
STA-BUF-F	2.1 ± 0.1	STA-BRI-F	4.2 ± 0.7		
STA-BUF-G	0.9 ± 0.3	STA-BRI-G	1.4 ± 0.2		
		STA-BRI-H	2.2 ± 0.1		

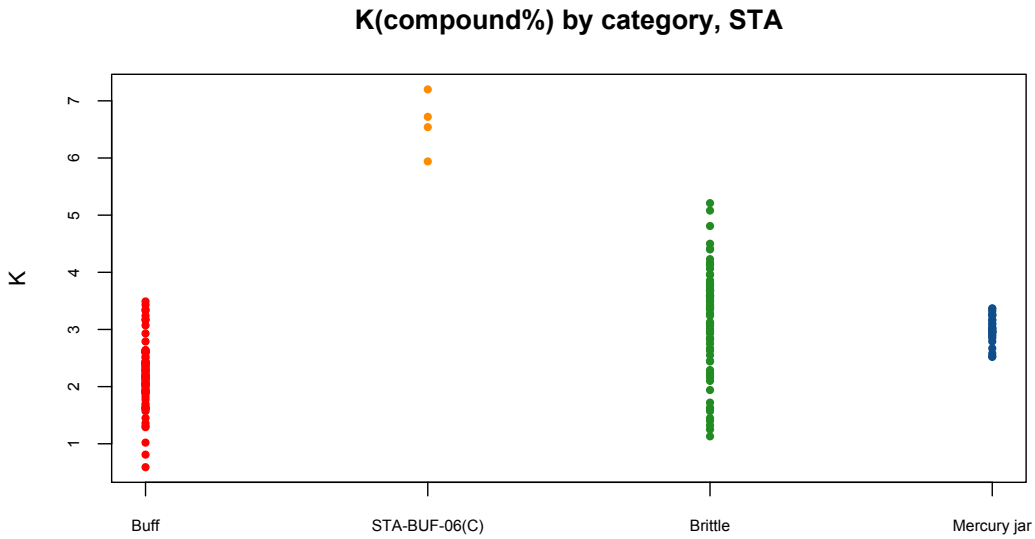
Table 4.24: Mean K_2O% (± 1 standard deviation) of STA ceramic body-fabrics. *Italicised* entries are outliers within their fabric groups, those with additional asterisks (*) are outliers within their categories.

```
               Brittle Buff    Mercury jar
Buff           8.6e-15 -       -
Mercury jar    0.28    6.5e-07 -
STA-BUF-06(C) < 2e-16 < 2e-16 < 2e-16

P value adjustment method: none
```

Table 4.25: *p*-values of pairwise t-tests between categories and outliers concerning mean K_2O%.

There are relatively few outliers in terms of K_2O%, with only **STA-BUF-06(C)** truly standing out with its anomalously high potassic content (6.6%). Brittle-wares which have the highest mean potassic content outside of this one sherd, which curiously correlates to their overall highest ferrous content. Mercury jars are statistically indistinguishable from brittle-wares as both share a relatively high K_2O%, in contrast to their readily grouping with the buff-wares in low Fe_2O_3%.



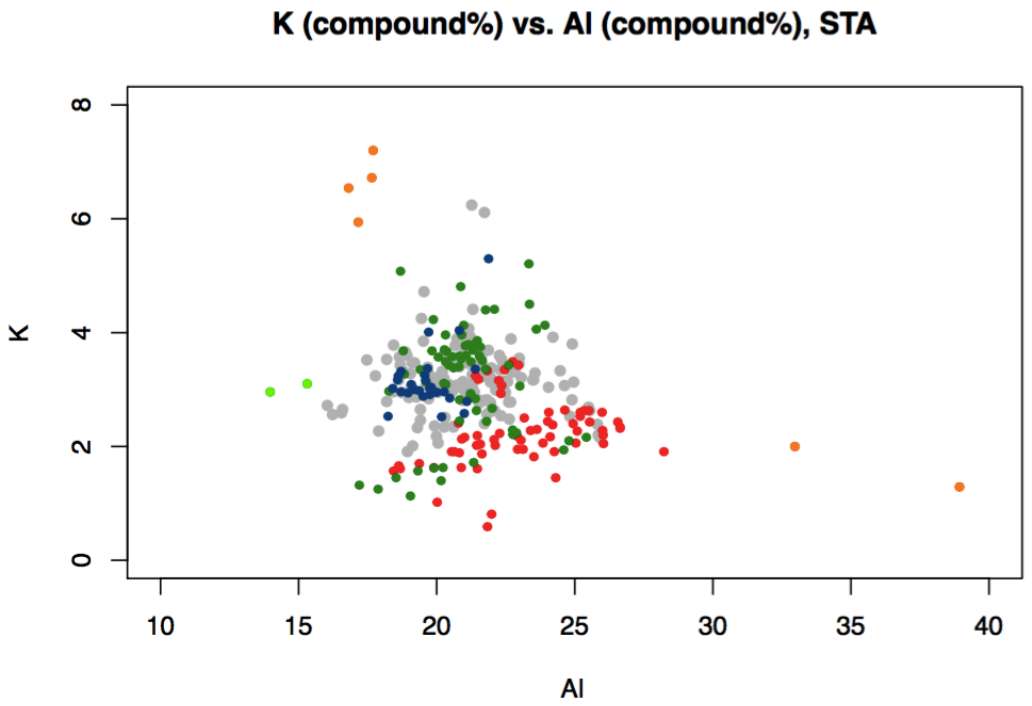


Figure 4.11: a) Stripchart of K_2O% by category along with outliers; b) Scatterplot of the above vs. Al_2O_3%, with KTC values in the background.

```
          STA-BUF-06(C) STA-BUF-A STA-BUF-B STA-BUF-C STA-BUF-D STA-BUF-E STA-BUF-F
STA-BUF-A < 2e-16       -         -         -         -         -         -
STA-BUF-B < 2e-16       0.00914   -         -         -         -         -
STA-BUF-C < 2e-16       0.19583   0.26583   -         -         -         -
STA-BUF-D < 2e-16       0.00266   8.1e-06   0.00062   -         -         -
STA-BUF-E < 2e-16       0.03851   0.00011   0.00652   0.27475   -         -
STA-BUF-F < 2e-16       0.23010   0.00564   0.05656   0.44134   0.96204   -
STA-BUF-G < 2e-16       3.2e-08   3.8e-10   1.8e-08   0.00022   9.3e-06   0.00029

P value adjustment method: none

          STA-BRI-A STA-BRI-B STA-BRI-C STA-BRI-D STA-BRI-E STA-BRI-F STA-BRI-G
STA-BRI-B 0.02771   -         -         -         -         -         -
STA-BRI-C 0.86181   0.01687   -         -         -         -         -
STA-BRI-D 0.87249   0.01834   0.71089   -         -         -         -
STA-BRI-E 0.12474   0.82242   0.09404   0.12062   -         -         -
STA-BRI-F 0.06586   0.00086   0.08216   0.03682   0.00617   -         -
STA-BRI-G 8.8e-11   3.6e-06   2.6e-11   2.0e-12   4.7e-05   1.2e-10   -
STA-BRI-H 0.00021   0.04656   0.00012   0.00010   0.05521   1.0e-05   0.03976

P value adjustment method: none

           STA-MER-A STA-MER-B
STA-MER-B 0.49      -
STA-MER-C 0.49      0.82

P value adjustment method: holm
```

Table 4.26: *p*-values of pairwise t-tests between a) Buff ware, b) Brittle ware, c) Mercury jar fabric groups concerning mean K_2O%.

Within the buff wares, there appear to be two sub-groups: the low-K_2O **STA-BUF-D**, **E** and **F**, and the high-K_2O **STA-BUF-A** and **C**; **STA-BUF-B** appears to be an unusually high-K_2O group, even outside of the latter, and **STA-BUF-G** is the sherd with the lowest K_2O% out of the entire corpus, perhaps reflecting its more earthenware-like characteristics.

There appears to be a similar bifurcation among the brittle wares, with **STA-BRI-B** and **E** forming a low-K_2O group and the rest forming a high-K_2O group, besides **STA-BRI-G**. **STA-BRI-H** has a potassic component much more similar to buff-wares than those of the brittle-wares, furthering the hypothesis that it is probably misclassified. Mercury jar fabric groups are statistically indistinguishable from each other in terms of K_2O%.

4.5.4.2 KTC

Category	K_2O%	Category	K_2O%	Category	K_2O%
Buff ware	2.9 ± 0.6	**Brittle ware**	3.2 ± 0.5	**Mercury jars**	3.2 ± 0.4
*KTC-BUF-A**	3.4 ± 0.2	KTC-BRI-A	3.2 ± 0.2	KTC-MER-A	3.2 ± 0.5
KTC-BUF-B	3.7 ± 0.2	KTC-BRI-B	2.6 ± 0.3	KTC-MER-B	3.2 ± 0.2
KTC-BUF-C	2.9 ± 0.4	KTC-BRI-C	3.4 ± 0.3	KTC-MER-C	3.2 ± 0.3
KTC-BUF-D	2.4 ± 0.3	KTC-BRI-D	3.5 ± 0.2	KTC-MER-D	3.3 ± 0.5
		KTC-BRI-E	3.0 ± 0.1>	KTC-MER-E	2.9 ± 0.1
		KTC-BRI-F	4.0 ± 0.4		
		Tempered jars	3.2 ± 0.6		
		KTC-TMP-A	3.3 ± 0.3		
		KTC-TMP-B	3.6 ± 0.2		
		KTC-TMP-C	2.9 ± 0.6		

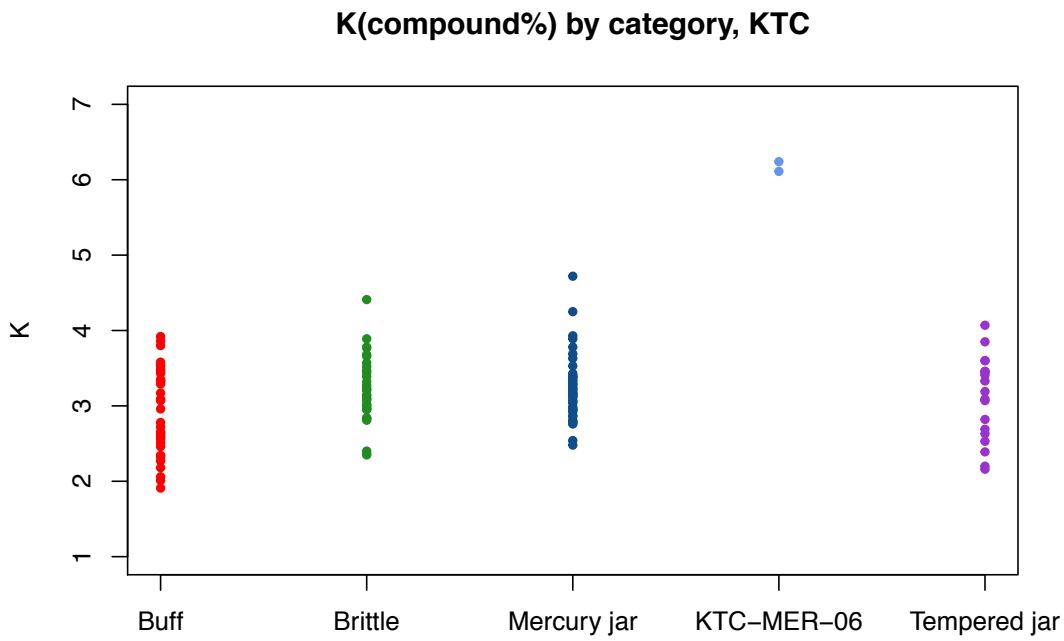
Table 4.27: Mean K_2O% (± 1 standard deviation) of KTC ceramic body-fabrics. *Italicised* entries are outliers within their fabric groups, those with additional asterisks (*) are outliers within their categories.

```
             Brittle Buff   Mercury jar
Buff         0.0176  -      -
Mercury jar  0.7958  0.0064 -
Tempered jar 0.5974  0.1578 0.4531

P value adjustment method: none
```

Table 4.28: *p*-values of pairwise t-tests between KTC categories concerning mean K_2O%.

K_2O% appears to be a strong discriminant only between buff wares and the other categories (besides tempered jars); however, as with alumina, the apparent homogeneity of K_2O% belies a more nuanced picture than initially seems, and appears to further corroborate the emerging narrative of multiple production sites.



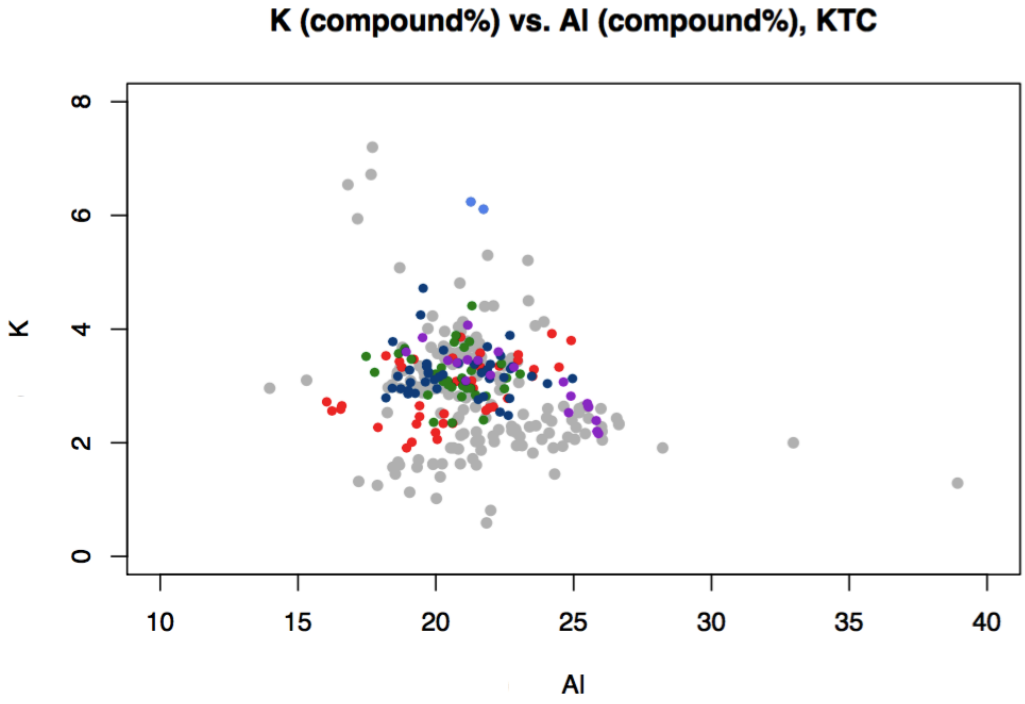


Figure 4.12: a) Stripchart of K_2O% by category, along with outliers;
b) Scatterplot of the above, with STA values in the background.

```
          KTC-BUF-A KTC-BUF-B KTC-BUF-C
KTC-BUF-B 0.22329   -         -
KTC-BUF-C 0.00058   0.00013   -
KTC-BUF-D 4.2e-08   6.3e-08   0.00031

          KTC-BRI-A KTC-BRI-B KTC-BRI-C KTC-BRI-D KTC-BRI-E
KTC-BRI-B 0.00096   -         -         -         -
KTC-BRI-C 0.24491   0.00084   -         -         -
KTC-BRI-D 0.09125   0.00021   0.66285   -         -
KTC-BRI-E 0.35760   0.08201   0.10380   0.04236   -
KTC-BRI-F 0.00068   1.8e-06   0.03270   0.07733   0.00064

P value adjustment method: none

          KTC-MER-A KTC-MER-B KTC-MER-C KTC-MER-D
KTC-MER-B 0.94      -         -         -
KTC-MER-C 0.88      0.84      -         -
KTC-MER-D 0.82      0.87      0.75      -
KTC-MER-E 0.21      0.21      0.28      0.24

P value adjustment method: none

          KTC-MER-A KTC-MER-B KTC-MER-C KTC-MER-D
KTC-MER-B 1         -         -         -
KTC-MER-C 1         1         -         -
KTC-MER-D 1         1         1         -
KTC-MER-E 1         1         1         1

P value adjustment method: holm

          KTC-TMP-A KTC-TMP-B
KTC-TMP-B 0.517     -
KTC-TMP-C 0.193     0.029

P value adjustment method: none

          KTC-TMP-A KTC-TMP-B
KTC-TMP-B 0.517     -
KTC-TMP-C 0.387     0.088

P value adjustment method: holm
```

Table 4.29: *p*-values of pairwise t-tests between KTC a) Buff ware, b) Brittle ware, c) Mercury jar, d) Tempered jar fabric groups concerning mean K_2O%.

Among the buff wares, only the high-K_2O **KTC-BUF-A** and **B** group together; **KTC-BUF-C** and **D**, while both lower in potassic content than the former two fabric groups, do not cluster with each other, furthering the suggestion that at the very least the buff wares represent at least *three* different production sites.

Although there appear to be similar low-K_2O outliers among the tempered jars, these are not statistically distinct from the rest of their respective categories. The first two analyses in **KTC-MER-06(C)** are abnormally high (**6.11%;6.24%**). As the other two analyses fit neatly within the range of the rest of the mercury jars, their significance is unclear. It may simply be that the centre of the sherd was anomalously high in potassic content.

KTC-BRI-B is a low-K_2O outlier, and the case may either be that the rest cluster into a bimodal distribution, or that **KTC-BRI-F** is the opposite in that it represents a high-K_2O ceramic. At any rate, it appears to be that the brittle wares, like the buff wares but through a different pattern, represent at least three different clays and/or production centres.

4.5.4.3 Inter-site analysis

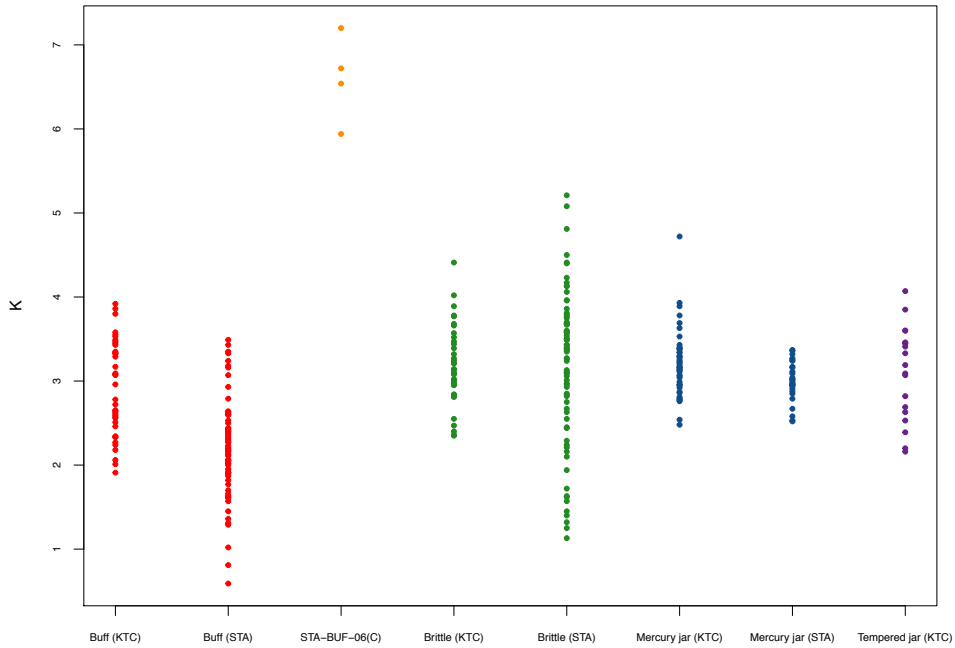


Figure 4.13: Stripchart of potash by category, along with outliers.

	Brittle (KTC)	Brittle (STA)	Buff (KTC)	Buff (STA)
Brittle (STA)	0.917	-	-	-
Buff (KTC)	0.060	0.038	-	-
Buff (STA)	2.3e-14	< 2e-16	7.1e-09	-
Mercury jar (KTC)	0.839	0.728	0.030	< 2e-16
Mercury jar (STA)	0.242	0.222	0.581	1.1e-08
STA-BUF-06(C)	< 2e-16	< 2e-16	< 2e-16	< 2e-16
Tempered jar (KTC)	0.678	0.708	0.265	2.2e-08
	Mercury jar (KTC)	Mercury jar (STA)	STA-BUF-06(C)	
Brittle (STA)	-	-	-	
Buff (KTC)	-	-	-	
Buff (STA)	-	-	-	
Mercury jar (KTC)	-	-	-	
Mercury jar (STA)	0.163	-	-	
STA-BUF-06(C)	< 2e-16	< 2e-16	-	
Tempered jar (KTC)	0.555	0.557	< 2e-16	

P value adjustment method: none

Table 4.30: p-values of pairwise t-tests between KTC and STA wares, concerning mean $K_2O\%$.

The brittle wares are statistically indistinguishable in terms of $K_2O\%$ between sites. Unlike with the other two oxides, potassic content reduces from KTC to STA buff wares. Mean $K_2O\%$ reduces from KTC mercury jars to STA mercury jars as well.

However, underlying these is also the fact that variability increases considerably from KTC to STA with, the notable recurring exception of mercury jars, further underscoring the idea that mercury jar production became increasingly monopolised between the periods and market concerns represented by the two sites. Unsurprisingly, **STA-BUF-06(C)** is an outlier of all other categories.

4.5.5 Summary

Therefore, what can now be stated concerning these trends identified earlier? The greater number of outliers at STA, confirmed via statistical tests, demonstrates greater heterogeneity in ceramic production amongst the vessels received there, as do the more pronounced statistical differences amongst all three studied oxides. Some of the outliers, such as the high-Al_2O_3 **STA-BUF-12**, the high-Fe_2O_3 **STA-BRI-G** and the high-K_2O **STA-BUF-06** bear further investigation.

Concerning the categories of buff and brittle wares, at both sites it is the brittle wares which contain more Fe_2O_3 and K_2O content; only at STA do buff wares show a greater Al_2O_3 content (the two categories are indistinguishable at KTC.) The case may be made for the concrete existence of these two different categories, with their visual differences vindicated in their composition. Notably, there is no strong correlation between anomalous flux content and final quality with regards to firing defects, suggesting that errors were more likely committed within the kiln or in vessel formation than during clay preparation. Between sites, Al_2O_3% increased from KTC to STA in buff and brittle wares, as did Fe_2O_3%; K_2O%, however, dropped from KTC to STA in these wares. Moreover, the variance in all of these increased between sites, suggesting a broader range of goods imported into Singapore relative to Kota Cina.

The apparent coalescence of mercury jars' consistency at STA relative to KTC is somewhat vindicated. At both sites, mercury jars have more statistically similar Fe_2O_3 concentrations to buff wares and share a similar relationship with brittle wares concerning K_2O%. Seeing as they conversely remain distinct from the other categories in these metrics, it may be that mercury jars represent a divergent *chaîne opératoire* of Southeast Asian stonewares, similar but not identical to those of buff and brittle wares. However, it is only at STA that a much greater consistency of Al_2O_3% was achieved, suggesting that one set of clay sources or kilns had come to dominate mercury jar production for Singapore in specific or the late 14^{th} century in general.

It is clear that there are statistically significant differences in oxide levels between categories and between sites, and there are several notable outliers. However, we must be wary of over-interpretation considering that although statistically different, *numerically* these differences manifest on the magnitude of 1-2% in general. Therefore it is imperative to compare these distributions with the variability of ceramics produced at known kilns and to determine if these statistical distinctions are on the same magnitude as those between archaeologically discernible kilns and wares. This will be followed up in **Chapter 5 ("Discussion").**

4.6 SEM semi-quantitative glaze analysis

4.6.1 Overview

SEM analysis of glazes necessitates measurement of a different set of elements from body-fabrics due the different mechanisms involved in firing glazes. As the intended goal is the achievement of a totally vitrified outer layer, it is fluxing agents to which we must turn to discern variation in glaze production sequences.

I have chosen to focus primarily on **calcium**, **potassium** and **lead** due to their relative abundances within this corpus and their known uses in Chinese kilns. **Iron** will also be discussed as its relative abundance suggests that it is the primary colourant used in this corpus. Other oxides found in similar proportions to these were those of **magnesium**, **phosphorous**, and **manganese**, all of which have various useful properties in glazes (Hamer, 1975, 42;56;161-164;176;188;193-195; 221-222;231-232).

Oxide	Significance
MgO	Fluxing agent between 1170°C-1230°C; late fluidity permits strong adhesion to contours of stoneware body-fabrics
P_2O_5	Fluxing agent, commonly associated with plant ash when it is burnt to produce lime; acts as an opacifier in opalescent Chinese "chun" glazes
K_2O	Fluxing agent, derived from feldspars and plant ash; commonly used in glazes as well as body fabrics to ensure slow and steady vitrification
CaO	Fluxing agent, usually derived from plant ash or limestone, desired to produce glazes that vitrify at 1100°C or higher
MnO	Colourant, generally producing brown, black and purple glazes; exclusively found as monoxide above 1080°C
Fe_2O_3	Colourant, able to produce numerous colours in other oxide forms depending on oxidation number
PbO	Fluxing agent, relatively commonly mined and cheap to produce glazes; stable up to 1100°C as raw glaze

Table 4.31: Oxides used in this study as proxies for variability in raw materials in glaze production sequences. Oxide details from Hamer (1975) and Hamilton (1982).

Fabric Group	Sherd	MgO%	P_2O_5%	K_2O%	CaO%	MnO%	Fe_2O_3%	PbO%
STA-BUF-AA	STA-BUF-03	3.5±0.2	3.3±0.1	2.3±0.1	**12.6**±0.4	0.4±0.1	7.1±0.4	–
	STA-BUF-05	3.3±0.1	2.5±0.3	2.9±0.1	**10.9**±0.3	0.5±0.1	5.9±0.1	–
	STA-BUF-07	2.9±0.3	2.2±0.7	3.0±0.3	**7.4**±0.8	0.6±0.1	5.2±0.7	–
	STA-BUF-11	4.1±0.2	3.1±0.1	2.5±0.2	**16.5**±0.2	1.1±0.1	4.0±0.1	–
STA-BUF-AB	STA-BUF-01	2.0±0.3	2.9±0.6	2.6±0.3	**7.3**±1.0	0.3±0.1	6.5±0.3	–
	STA-BUF-04	3.6±0.1	4.3±0.1	2.0±0.1>	**12.3**±0.2	0.5±0.1	6.6±0.4	–
STA-BUF-B	STA-BUF-02	1.1±0.8	1.1±0.9	**6.4**±0.5	2.1±0.9	0.7±0.5	3.4±0.3	–
	STA-BUF-10	2.3±0.8	2.8±0.5	2.7±0.8	**7.0**±4.9	0.2±0.1	8.1±0.6	–
STA-BUF-C	STA-BUF-06	1.6±0.3	1.0±0.2	**5.6**±0.4	**8.2**±1.3	0.7±0.2	1.6±0.5	–
	STA-BUF-12E	0.6±0.1>	0.2±0.1	**3.9**±0.3	0.4±0.2	0.0±0.1	3.0±0.5	–
	STA-BUF-12I	0.7±0.1	0.3±0.2	**2.0**±0.6	0.7±0.3	0.0±0.1	3.4±0.1	–
	STA-BUF-13	3.4±1.1	4.3±0.4	2.8±0.3	**10.2**±0.6	2.2±0.9	4.5±0.4	–
STA-BRI-D	STA-BRI-05	3.7±0.1	1.9±0.1	4.7±0.3	**11.5**±0.4	1.3±0.2	3.8±0.3	–
	STA-BRI-14	4.0±0.2	2.5±0.5	5.4±0.3	**14.3**±0.5	1.6±0.1	2.6±0.2	–
	STA-BRI-15	4.3±0.2	4.7±0.2	3.5±0.2	**15.1**±1.3	1.4±0.1	5.1±0.4	–
	STA-BRI-17	4.9±0.1	4.1±0.2	3.3±0.2	**16.3**±0.3	1.7±0.2	3.1±0.1	–
	STA-BRI-19	3.9±0.3	2.8±0.2	3.6±0.3	**15.6**±0.8	1.5±0.1	3.3±0.1>	–
	STA-BRI-21	**9.0**±0.1	4.8±0.5	3.0±0.1	**13.2**±0.9	1.8±0.1>	2.1±0.1>	–
STA-BRI-G	STA-BRI-20	2.0±0.5	0.7±0.1	2.0±0.6	**5.1**±1.5	0.2±0.2	3.4±0.2	**20.6**±2.0
STA-BRI-H	STA-BRI-22	2.9±0.2	2.2±0.6	2.3±0.3	**11.1**±0.5	0.5±0.2	6.5±0.4	–
KTC-BUF-A	KTC-BUF-01	3.9±1.0	3.0±1.2	4.2±1.0	**12.9**±2.7	1.4±0.4	4.6±0.1	–
KTC-BUF-B	KTC-BUF-03	2.4±0.5	1.8±0.6	3.5±0.2	**12.2**±0.8	1.4±0.2	1.9±0.1	–
KTC-BUF-C	KTC-BUF-04	2.9±0.2	2.5±0.3	2.2±0.2	**14.2**±1.1	0.4±0.1>	4.1±0.7	–
	KTC-BUF-05	3.8±0.2	3.0±0.1	3.0±0.6	**14.1**±0.8	2.4±0.2	9.7±1.2	–
	KTC-BUF-06	4.3±0.2	3.2±0.3	2.7±0.2	**14.5**±0.9	2.0±0.1	1.8±0.1	–
	KTC-BUF-08	3.3±0.3	3.3±0.3	3.4±0.2	**14.1**±1.0	2.7±0.2	2.1±0.4	–
KTC-BUF-D	KTC-BUF-07E	2.6±0.1	2.9±0.2	2.3±0.2	**17.6**±0.9	0.2±0.1	5.5±0.1	–
	KTC-BUF-07I	1.8±0.4	1.5±0.2	2.0±0.2	**10.2**±3.1	0.2±0.1	3.8±0.4	–
	KTC-BUF-09E	2.6±0.1	2.6±0.1	2.2±0.2	**15.6**±0.7	0.3±0.1>	5.4±0.5	–
	KTC-BUF-09I	1.8±0.4	2.3±0.7	2.6±0.4	**6.1**±2.9	0.1±0.1	5.0±0.2	–
	KTC-BUF-10E	2.7±0.7	1.3±0.4	3.0±0.4	**7.6**±1.1	1.0±0.3	4.0±0.9	–
	KTC-BUF-10I	4.5±0.2	2.1±0.1	2.8±0.1	**16.0**±0.9	1.8±0.1	4.3±0.1	–
KTC-BRI-F	KTC-BRI-10E	2.5±0.5	1.6±0.8	**6.5**±0.7	**9.4**±1.0	1.3±0.1	2.8±0.5	–
	KTC-BRI-10I	3.2±0.8	2.5±0.4	3.6±0.4	**9.4**±1.4	1.5±0.3	3.3±0.2	–
KTC-MER-A	KTC-MER-02	2.2±0.1	3.0±0.2	1.4±0.1	**11.6**±0.3	1.9±0.1	5.6±0.3	–
	KTC-MER-04	3.6±0.9	1.3±1.0	3.3±0.7	**9.5**±3.1	2.0±0.5	2.6±0.3	–
KTC-TMP-A	KTC-TMP-01	4.7±0.2	3.7±0.1	3.4±0.1	**18.3**±0.7	1.3±0.1	2.9±0.1	–
KTC-TMP-B	KTC-TMP-02	3.4±1.5	2.3±1.2	3.9±0.4	**11.9**±6.1	1.1±0.4	2.7±0.6	–
KTC-TMP-C	KTC-TMP-03	4.7±0.1	3.4±0.2	3.6±0.1	**16.2**±0.2	2.0±0.1	3.6±0.1	–
	KTC-TMP-04	3.9±0.2	3.1±0.3	4.4±0.5	**14.4**±0.8	1.9±0.2	3.4±0.1	–
	KTC-TMP-05	4.1±0.2	2.9±0.1	4.1±0.3	**14.1**±0.8	1.8±0.1	3.2±0.3	–

Table 4.32: Mean (±1sd) of the oxides of Mg, P, K, Ca, Mn, Fe and Pb, expressed in compound% at STA and KTC. Full results are in **Appendix B**.

4.6.2 CaO

The majority of the STA glazes and all KTC glazes appear to have calcium as their primary fluxing agent. This is entirely consistent with the extensive use of lime in Chinese glazes (Wood, 1999, 30-33), and may be seen as indicative of the kilns making these glazes borrowing from the same pottery traditions.

The yellowish colouration on surfaces of **KTC-MER-A** sherds contains CaO% values very similar to the KTC glazes, with no other factors in this consideration excluding the possibility that these are the retained interfaces of degraded glazes. This aligns with the known preponderance of glazed mercury jars in earlier periods (Wong, 2016, 14).

4.6.2.1 STA and MgO

Only **STA-BRI-21(D)** appears to have a concentration of MgO comparable to its CaO content. At 9.0%, this exceeds all other MgO proportions amongst both bodies and glazes, indicating the deliberate addition of magnesia far above

naturally-occurring levels and potentially a production sequence divergent from the rest of the brittle wares.

4.6.2.2 KTC multi-glazed sherds

KTC-BUF-C and **D** were noted during visual examination for the use of visually different glazes on their interiors and exteriors, with the latter even expressing multicoloured patterns in some cases. Under the SEM, only the latter groups' glazes were discernible in backscatter mode.

It is evident that there is about a 7-9% difference in CaO concentrations between the surfaces of **KTC-BUF-D**, suggesting that there is a substantial difference in the lime content of their glazes. **KTC-BUF-07** and **09** have more lime on their exteriors, whilst **10** has more on its interior. These trends open questions concerning the motivations of potters formulating entirely different compositions of glazes for the same vessel.

4.6.3 K_2O

Minus the one lead-glazed sherd, all sherds not utilising lime glazes instead used potash as their chief fluxing agent. These belong exclusively to **STA-BUF-02(B)**, **06(C)**, and **12(C)** all of which are relatively matte. Although **STA-BUF-13(C)** was sorted with the latter two sherds in the same group, its matte "glaze " is calcium-rich, in keeping with the majority of the corpus.

The use of potash in glazes was not unknown to Chinese potters, but was not their sole domain either (Wood, 1999, 215-216). Evidently STA demonstrates a somewhat greater variability than KTC in overall terms concerning main fluxes.

4.6.4 PbO

Among the entire corpus, the sole lead fluxed glaze was that of **STA-BRI-20(G)**. This, combined with the sherd's uniquely high ferrous proportions in their body fabric, suggest that it represents a unique ceramic tradition at STA.

4.6.5 Fe_2O_3 and MnO

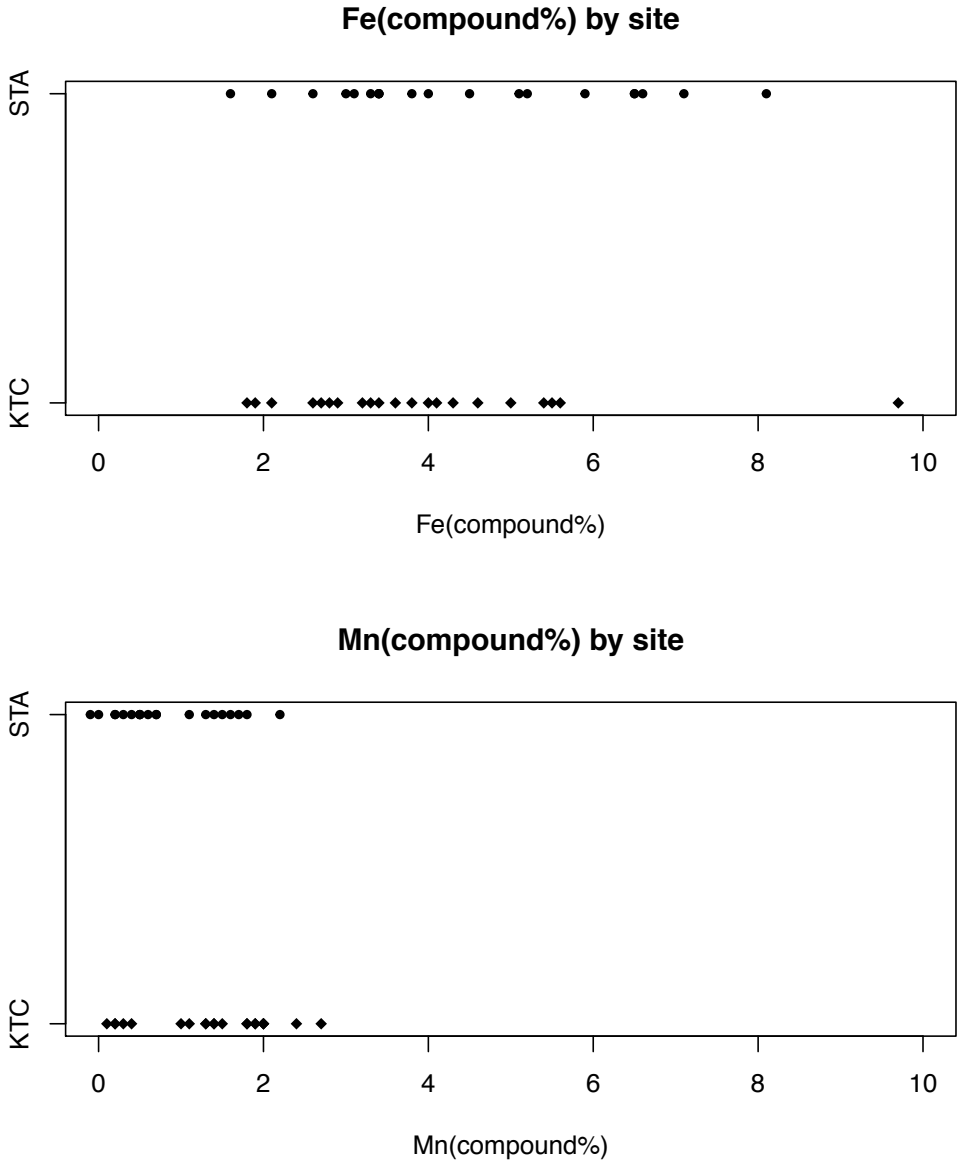


Figure 4.14: a) Stripchart of Fe_2O_3 by site; b) Stripchart of MnO by site.

The versatility of both iron and manganese oxides as colourants, as explained above, was well-known to contemporary potters. Almost all glazes contained at least 2.0% Fe_2O_3 and at most 2.0% MnO, indicating that the former and not the latter is serving as the primary colourant for practically all sherds.

4.6.6 Summary

It is evident that the sherds in KTC and STA share a great deal in common with regards to glaze technology, given the preponderance of lime glazes in similar proportions. However, STA that demonstrates a greater variety of fluxes, also encompassing potassic, lead and apparently magnesia-based glazes, furthering the idea, first seen in the body fabrics, that its *clientèle* represented a broader range of market interests and ceramic fashions. The pattern seen at KTC of different glaze formulations on interiors and exteriors is a curious one, and may hopefully be picked up on in the future.

Overall, the suite of technologies is broadly compatible with the range demonstrated by Chinese potters in the historical period; however, this does not unto itself denote a Chinese origin for these glazes given their widespread influence in the region along with independent developments. Much like the body fabrics, comparing the precise proportions used in the Southeast Asian glazes with those measured by Wood (1999) will prove instructive in characterising similarities and differences between the Southeast Asian and Chinese contexts.

Chapter 5

Discussion

5.1 Body fabrics

Now, we shall aim to contextualise the elemental compositions and variations found within and between the archaeological sites within the greater context of ceramics being traded at the time. To make archaeological sense of this data, it has been re-plotted on slightly different axes, utilising the known properties and attitudes concerning the various oxides used in stoneware and porcelain production.

Oxide	Significance
$\mathbf{Al_2O_3}$	Refractory properties, addition above naturally occurring levels indicative of deliberate clay mixing
$\mathbf{Fe_2O_3}$	Naturally occurring fluxing agent, usually selected against as part of the high-fired clay production sequence
$\mathbf{K_2O}$	Naturally occurring fluxing agent desired in the forms of feldspars and "china stone" to produce clay that vitrify over long periods of time in the kiln to produce hard body fabrics
$\mathbf{SiO_2}$	Majority oxide/element in sediments used in ceramics, forms balance of elemental composition; may also be present in the form of quartz-grain inclusions

Table 5.1: Reiteration of important oxides used in this study as proxies for quality control and variability in production sequences. Oxide details from Hamer (1975) and Hamilton (1982).

The new x-axis will be $\mathbf{Al_2O_3}$ / $\mathbf{SiO_2}$ (*no units*)[1], which is simply the ratio of alumina to silica and acts as a proxy for refinement of the bulk of the clay matrix prior to forming and firing, against which Fe_2O_3% may be plotted to examine purification in terms of impurity screening, and K_2O% for addition of plant ash or other potassic fluxes.

There exist numerous analyses in Wood (1999) concerning Chinese high-fired ceramics, and it is these normalised results (also expressed in compound%) of selected porcelains and stonewares which have been employed, primarily of Southern China in keeping with the research questions concerning trade and exchange from Guangzhou and Quanzhou. It is necessary to qualify that several biases are inherited from the use of this text as the main body of comparison, namely the focus on porcelains and Chinese produce; nevertheless, it will suffice as a reflection of ceramic technologies available to contemporary potters.

This comparison will be based on the pure similarity in compositional proportions as there exist insufficient data points to conduct full statistical analysis and pairwise t-tests; therefore, all the similarity between points suggests is the *possibility* that the technologies and recipes underlying these ceramic formulae came from the same body of knowledge.

[1]The axes, similar to those in **Chapter 4**, although reporting values of Al_2O_3/SiO_2, Fe_2O_3%, K_2O%, CaO%, MgO% and P_2O_5%) all read "Al/Si", "Fe", "K", "Ca", "Mg", and "P") due to font limitations in R 3.3.3.

5.1.1 Fe_2O_3 vs. Al_2O_3/SiO_2

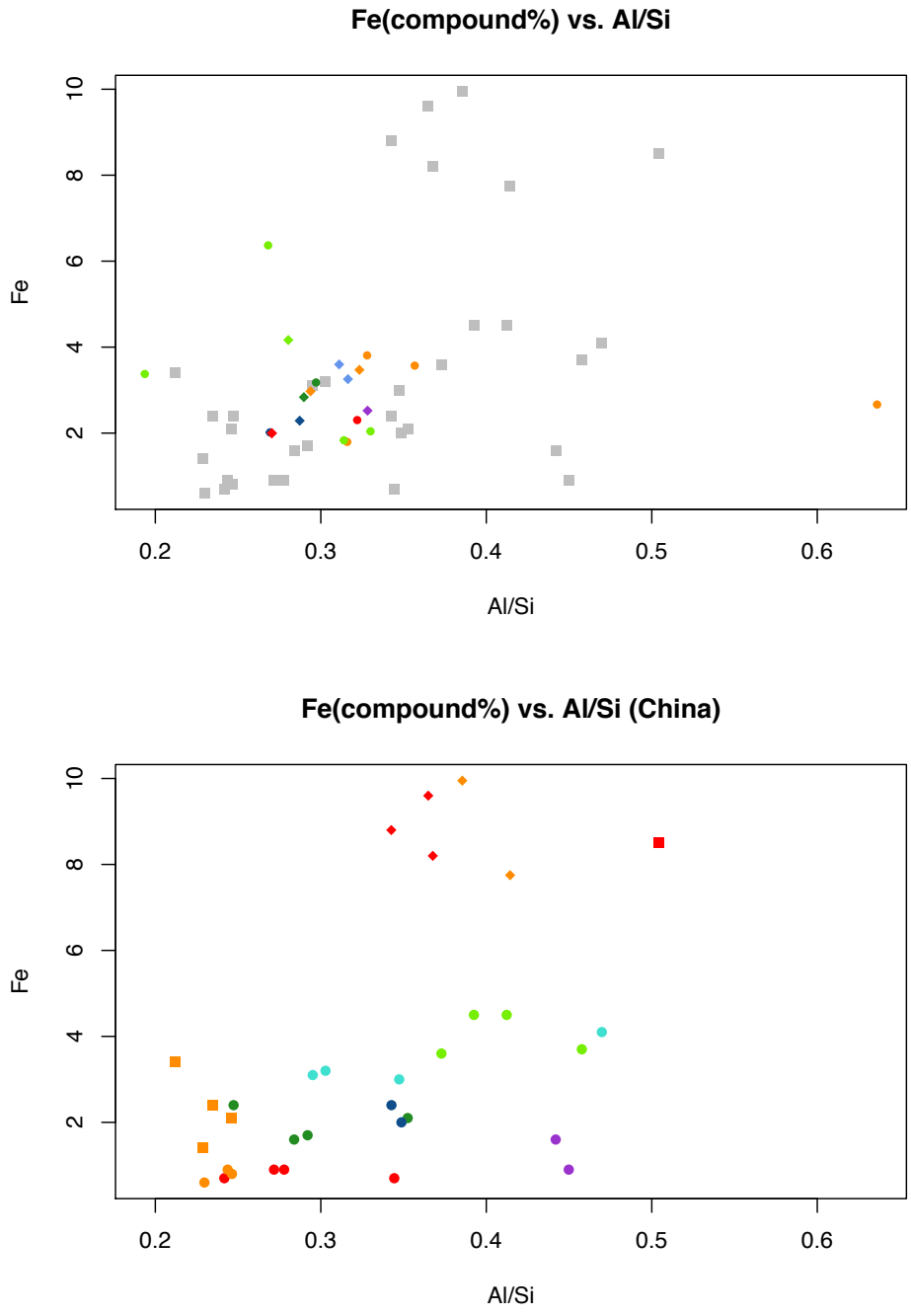


Figure 5.1: a) Scatterplot of mean STA (circles) and KTC (lozenges) Fe_2O_3% vs. Al_2O_3/SiO_2 values, compared to known Chinese clays and ceramics compositions (grey squares). b) Scatterplot of Chinese clays and ceramics, differentiated by ware and location. See legend (*below*) for explanation concerning symbols and colours.

KTC	STA	Category
♦	●	Buff ware
♦	●	" outliers
♦	●	Brittle ware
♦	●	" outliers
♦	●	Mercury jars
♦		" outliers
♦		Tempered jars

Table 5.2: Legend for Figures 5.1(a) and 5.2 (a), concerning KTC and STA mean values plotted on Fe_2O_3 vs. Al_2O_3/ SiO_2 and K_2O vs. Al_2O_3/ SiO_2 graphs.

Porcelain	Stoneware	Clay
● Jingdezhen (and celadons)	♦ Jian ware	■ Fujian Neolithic Clay
● Jingdezhen Yingqing ware	♦ Yixing red stoneware	■ Southern China Stoneware clay
● Longquan (and celadons)	♦ Ding glazes	■ "
● Longquan Guan ware		
● Hangzhou Guan ware		
● Dayao ware	♦ Northern Cizhou glazes	
● Jizhou ware		

Table 5.3: Legend for the scatterplots in this chapter, concerning values of Southeast Asian and Chinese body and glaze compositions.

With regards to ferrous content *vis-à-vis* the alumina/silica ratio, we can see that kilns on the whole tend to be differentiated by their Fe_2O_3 concentrations whilst variability in both contemporary firings and trends over time is more discernible by the change in Al_2O_3/SiO_2.

We can see that the group with which the KTC and STA stonewares shares the most affinity in both dimensions is that of the Hangzhou Guan wares. Totally equating them with the production sequences represented by the Hangzhou kilns would, however, be fallacious as Guan wares are a precise formulation derived from the need for the retention of exterior quality despite an artificial dearth of clay materials for the bodies, hence the infamously thick glazes (Wood and Li, 2015, 628-629).

The other kilns with which the KTC and STA wares broadly correlate are Longquan, with their distribution essentially being neatly sandwiched between the Longquan porcelains, their Dayao celadons and Longquan Guan wares. Hence it is possible that the Chinese ceramics at both sites derived from the same technological suite available to the Longquan potters, a conclusions which dovetails neatly with the known trends concerning the rise of Zhejiang kilns channelled through Quanzhou over the period represented by both sites. The ferrous proportions of Jingdezhen wares suggest a more concerted effort in selecting against these than at the other kilns.

KTC and STA wares notably are strongly differentiated from the high-Fe_2O_3 stonewares such as the Fujian-made Jian and Jiangsu-made Yixing wares; even the lateritic stonewares of **STA-BRI-G** do not demonstrate either the ferrous component or alumina/silicon ratio seen in those technological traditions.

It is evident that **STA-BUF-12(C)** is truly exceptional in terms of its alumina content and probably represents a clay source which cannot be correlated with any of the kilns in this study. **STA-BRI-02(B)** represents the opposite scenario, where it has a smaller alumina content than the lower bound of the Southern Chinese stoneware clays surveyed by Wood (1999).

However, before concluding that the Longquan kilns are the most likely candidate for the production sequences evidenced by the KTC and STA, let us look at the potassic content for further clues as to the *chaînes opératoires* concerning these stonewares.

5.1.2 K_2O vs. Al_2O_3/SiO_2

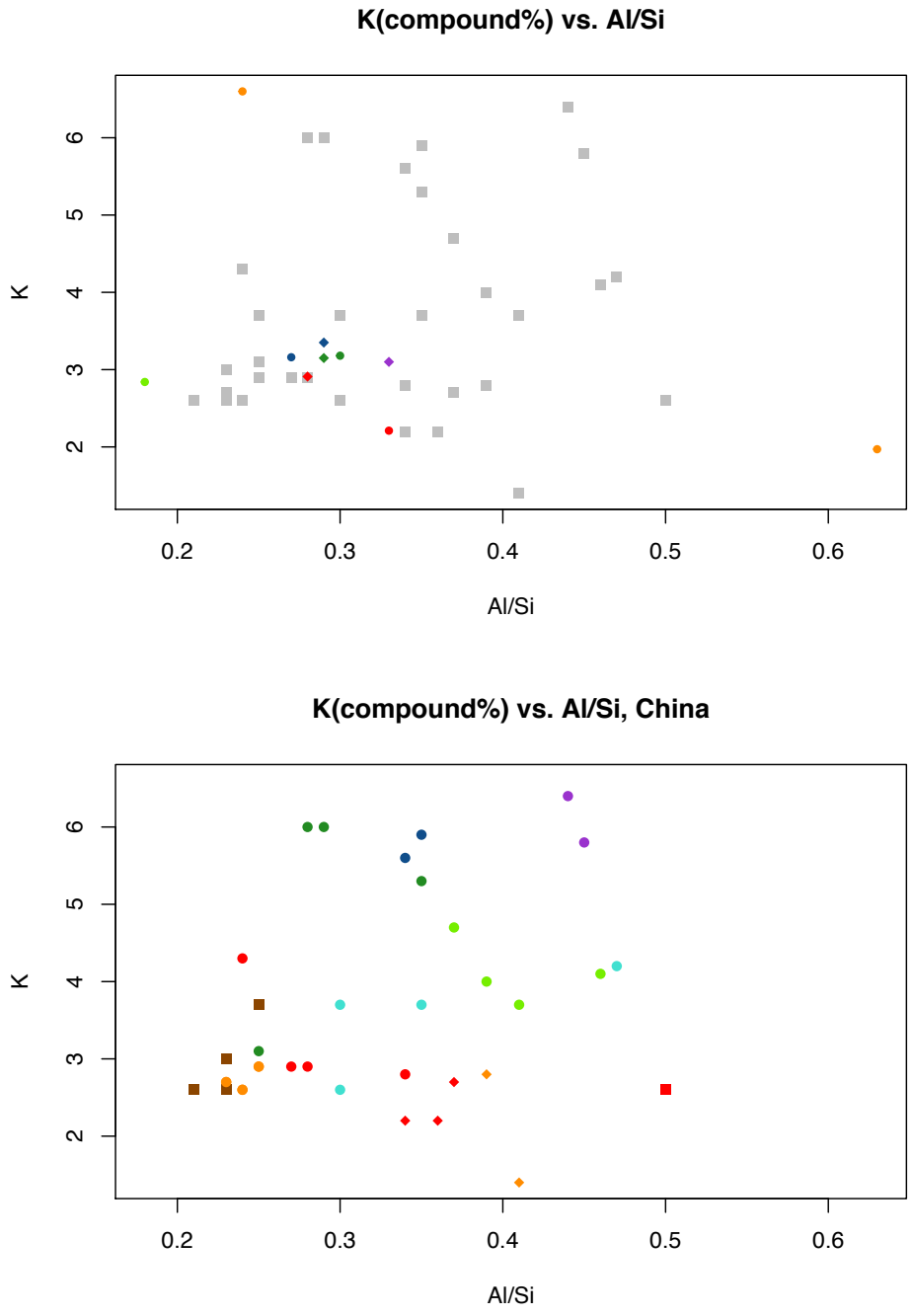


Figure 5.2: a) Scatterplot of mean STA (circles) and KTC (lozenges) K_2O% vs. Al_2O_3/SiO_2 values, compared to known Chinese clays and ceramics compositions (grey squares). b) Scatterplot of Chinese clays and ceramics, differentiated by ware and location. See legend (*above*) for explanation concerning symbols and colours.

The K_2O content of the various body ceramics reveals a somewhat more nuanced picture than the Fe_2O_3 plot alone. Potassic content appears to be more variable over time than ferrous content within the same kiln. It is important to recall that potash generally needs to be added to clays as a flux, necessitating an externally derived source beyond certain levels.

The range with which the KTC and STA corpus groups the best is the Hangzhou Guan wares, but its doubtful candidature has already been outlined above. Outside of this particular "match", the situation diametrically flips compared with the Fe_2O_3% vs. Al_2O_3/SiO_2 plot. Now, it is Jingdezhen with which the KTC and STA ceramics correspond best, as both have less potassic content than the Longquan wares. However, this is insufficient grounds to totally reject the premise outlined above.

Differences in potassic content are more suggestive of *technological* as opposed to geological differences; the Jingdezhen and the Southeast Asian K_2O% values notably are well within the natural ranges expressed by the surveyed clays. It may be that the KTC and STA wares were made in a similar fashion to the Longquan porcelains, with the latter containing additional potash-rich materials relative to the stonewares to permit porcelain firing. Naturally, the *opposite* conclusion may be true, namely that the KTC and STA wares are derived from the same source as the Jingdezhen porcelains but less well-selected against ferrous impurities; this theory, however, raises questions as to why then their alumina content is relatively higher than most of the Jingdezhen porcelains. The sole potassic outlier, **STA-BUF-06(C)**, is not very far off from the Longquan kilns' K_2O% vs. Al_2O_3/SiO_2 distributions.

It may be hoped that with future studies concerning these kinds of material in both China and Southeast Asia, that the compositions of these neglected "trade" stonewares may one day be similarly plotted and possibly be used to distinguish not only between source recipes but their distributions within their target markets, permitting the direct connection of ceramic sources with their ultimate destinations. Undoubtedly the addition of this independent line of evidence will allow future researchers to confirm or develop theories and trends concerning the ceramics of Southeast Asia.

5.2 Glazes

It is worthwhile to evaluate the KTC and STA glazes and compare them with their contemporary technologies to examine plausible antecedents for the production sequence seen in the sherds at both sites. The data, as above, has been plotted with data from Wood (1999) to this end.

The first plots entail **K_2O% vs. CaO%** and are aimed at exploring the range of glaze technologies available to Chinese potters of the time. While the majority of Chinese glazes utilised lime as their primary flux, potash was also frequently used; the sherds seen in KTC and STA demonstrate that their mixture is viable as a glaze. Hence, plotting Southeast Asian and Chinese potash vs. lime ratios ought to show which technologies share the most similarity.

The next two plots, concerning **MgO%** and **P_2O_5% vs. CaO%** are intended to address a perennial debate concerning sources of lime and potash. Burnt plant ash and limestone were both lime sources well-known to Chinese potters before and during KTC and STA's habitation, and identifying which contributed to the flux has implications on connections to the relevant mining and forestry industry. MgO and P_2O_5 are taken as proxies for plant ash due to their presence in minerals found in organic matter.

Iron oxides were also employed as colourants by Chinese potters, and comparing their use within China to Southeast Asia would similarly allow the exploration of glaze technologies in the region; finally, the unique lead glaze in STA bears further investigation.

Oxide	Significance
MgO	Fluxing agent between 1170°C-1230°C; late fluidity permits strong adhesion to contours of stoneware body-fabrics
P_2O_5	Fluxing agent, commonly associated with plant ash when it is burnt to produce lime; acts as an opacifier in opalescent Chinese "chun" glazes
K_2O	Fluxing agent, derived from feldspars and plant ash; commonly used in glazes as well as body fabrics to ensure slow and steady vitrification
CaO	Fluxing agent, usually derived from plant ash or limestone, desired to produce glazes that vitrify at 1100°C or higher
Fe_2O_3	Colourant, able to produce numerous colours in other oxide forms depending on oxidation number
PbO	Fluxing agent, relatively commonly mined and cheap to produce glazes; stable up to 1100°C as raw glaze

Table 5.4: Oxides used in this study as proxies for variability in raw materials in glaze production sequences. Oxide details from Hamer (1975) and Hamilton (1982).

5.2.1 K_2O vs. CaO

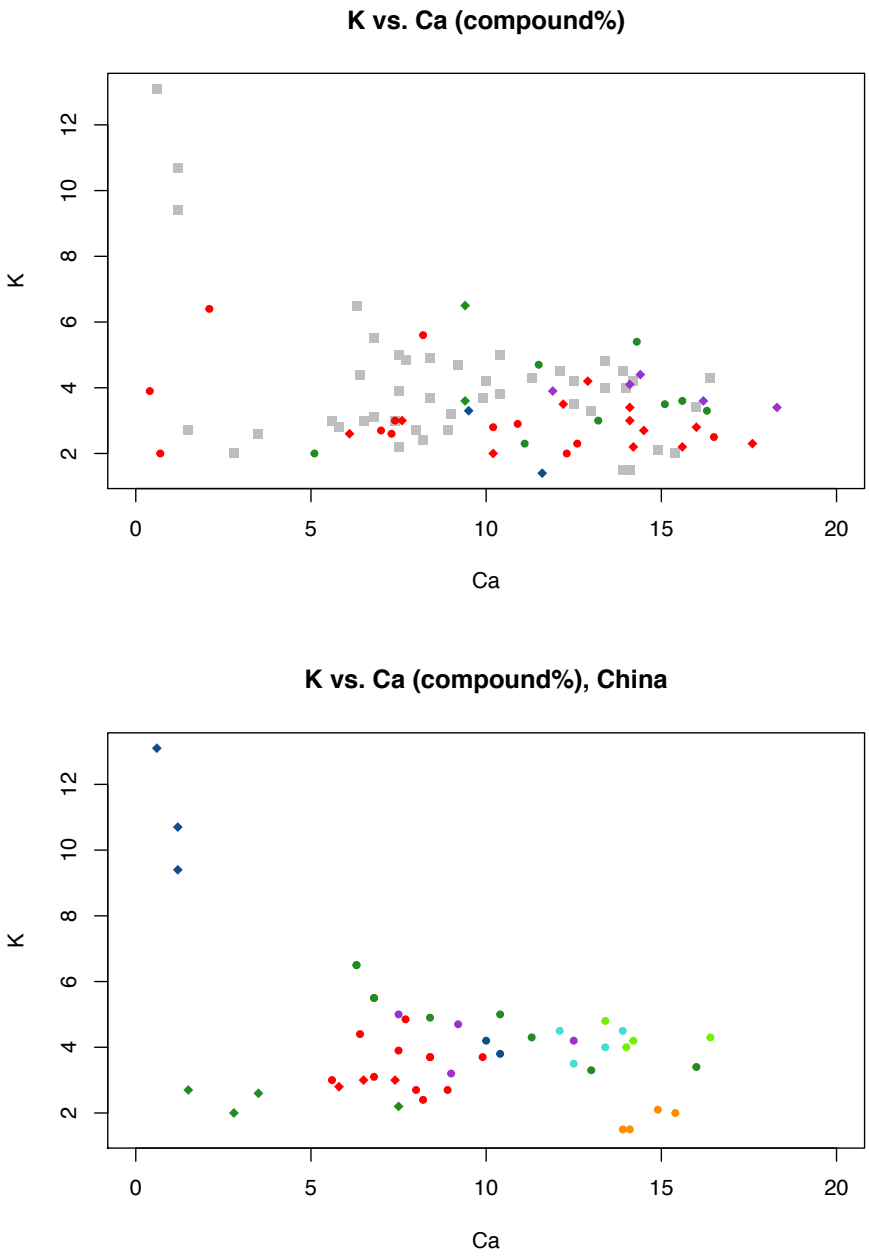


Figure 5.3: a) Scatterplot of mean STA (circles) and KTC (lozenges) K_2O% vs. CaO% values, compared to known Chinese glazes (grey squares). b) Scatterplot of Chinese glazes, differentiated by ware and location. See legend (*above*) for explanation concerning symbols and colours.

The glazes seen at STA and KTC exhibit K_2O and CaO proportions largely similar to those seen within the remit of contemporary Chinese pottery; even the low-calcia high-potash buff wares at STA share antecedents with some of the alkali-glazes seen in China. Thus far, the idea that the Southeast Asian sherds are compatible with the technologies witness in Chinese kilns is vindicated; however, they exhibit somewhat greater variability than their Chinese counterparts, with the KTC buff wares' differences between sherd sizes marking an extreme of this trend.

It is due to this variability that difficulties emerge concerning the ability to pinpoint any one kiln as being the most representative of ceramic industries supplying Singapore and Sumatra, even given evidence from the body-fabric affinities.

5.2.2 MgO and P_2O_5 vs. CaO

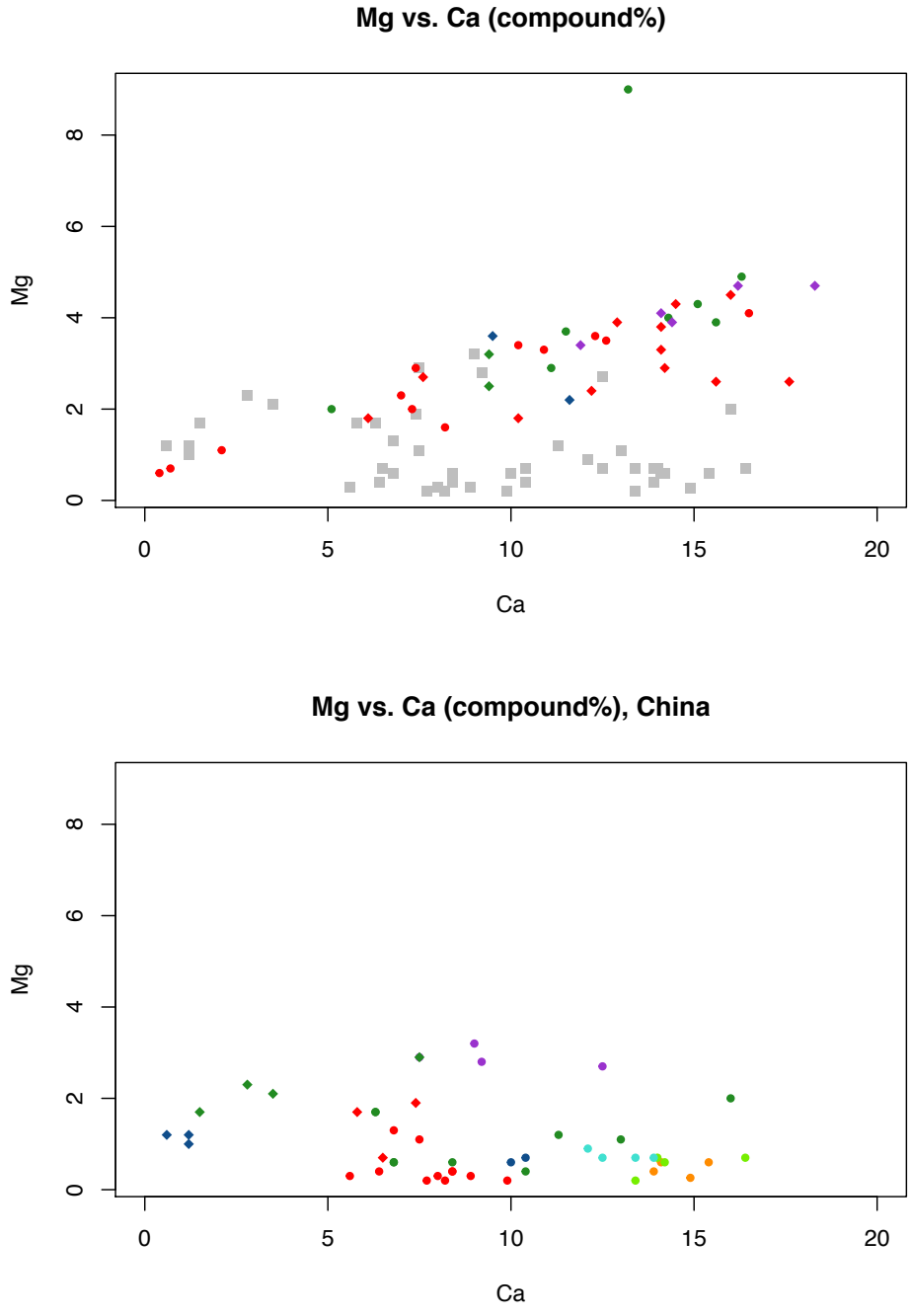


Figure 5.4: a) Scatterplot of mean STA (circles) and KTC (lozenges) MgO% vs. CaO% values, compared to known Chinese glazes (grey squares). b) Scatterplot of Chinese glazes, differentiated by ware and location. See legend (*above*) for explanation concerning symbols and colours.

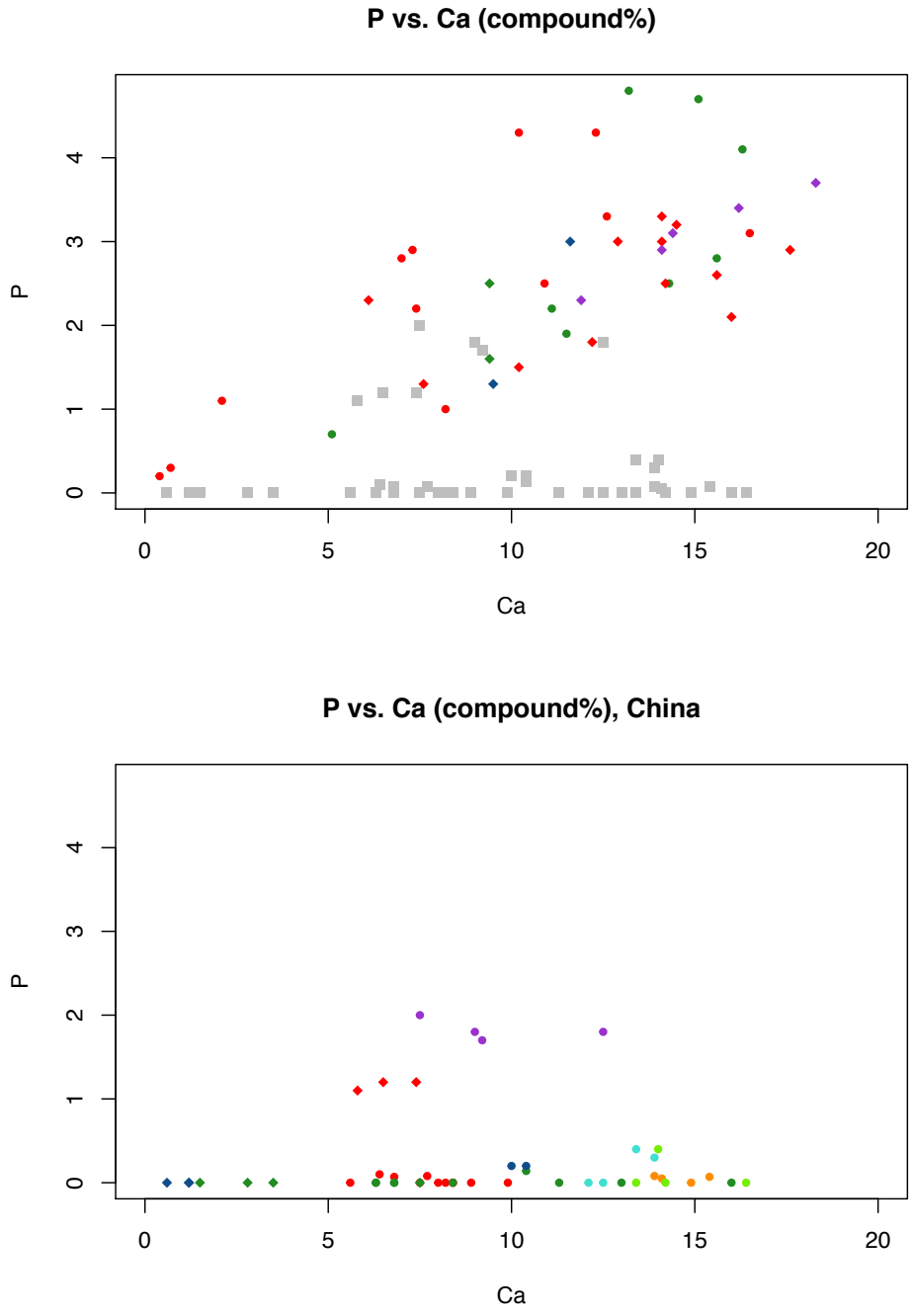


Figure 5.5: a) Scatterplot of mean STA (circles) and KTC (lozenges) P_2O_5% vs. CaO% values, compared to known Chinese glazes (grey squares). b) Scatterplot of Chinese glazes, differentiated by ware and location. See legend (*above*) for explanation concerning symbols and colours.

Unlike the K_2O vs. CaO plot, the Southeast Asian material stands in stark contrast with the surveyed Chinese ceramics due to their relatively elevated MgO and P_2O_5 content. The only wares with similar glazes differ in body composition; these were the high-iron Jian ware and the high-alumina, high-potash Jizhou ware. It is necessary to temper previous deductions with the caveats that while the Jingdezhen and Longquan kilns share body-ceramic technology with the Southeast Asian sherds, other formulae must be found for their glazes.

Curiously enough, MgO and P_2O_5 both appear to exhibit statistically significant linear correlations with CaO, suggesting that more plant ash was being used for lime content in Southeast Asian glazes compared to the corpus surveyed by Wood (1999). Given the amount of expenditure concerning appropriate flora for such a purpose, this raises further questions concerning market trends of the era.

```
Call:
lm(formula = Mg ~ Ca, data = combinedglazes_graph_KCa[1:41, ])

Residuals:
    Min      1Q  Median      3Q     Max
-1.9860 -0.2801  0.0113  0.2931  5.3728

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.75079    0.46572   1.612    0.115
Ca           0.21791    0.03815   5.713  1.3e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.063 on 39 degrees of freedom
Multiple R-squared:  0.4556,Adjusted R-squared:  0.4416
F-statistic: 32.63 on 1 and 39 DF,  p-value: 1.298e-06

Call:
lm(formula = P ~ Ca, data = combinedglazes_graph_KCa[1:41, ])

Residuals:
     Min       1Q   Median       3Q      Max
-1.25645 -0.60153 -0.05482  0.33311  1.94814

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.58518    0.35392   1.653    0.106
Ca           0.17320    0.02899   5.975 5.61e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.8076 on 39 degrees of freedom
Multiple R-squared:  0.4779,Adjusted R-squared:  0.4645
F-statistic:  35.7 on 1 and 39 DF,  p-value: 5.612e-07
```

Table 5.5: Linear regression tests on the combined KTC and STA MgO vs. CaO and P_2O_5 vs. CaO trend-lines.

5.2.3 PbO

With regards to the lead flux in **STA-BRI-20(G)**, its mean value of **20.6(±2.0)%** PbO, while comparable to early Chinese lead-glazes, is considerably lower than contemporary ones (Wood, 1999, 191-196;206-210). Given the profusion of this technology and its relative ease of use, combined with the incompatibility of **STA-BRI-G** with Chinese iron-rich body-ceramics, this gives decreasing grounds to necessitate a Chinese origin for this one sherd.

5.2.4 Fe_2O_3

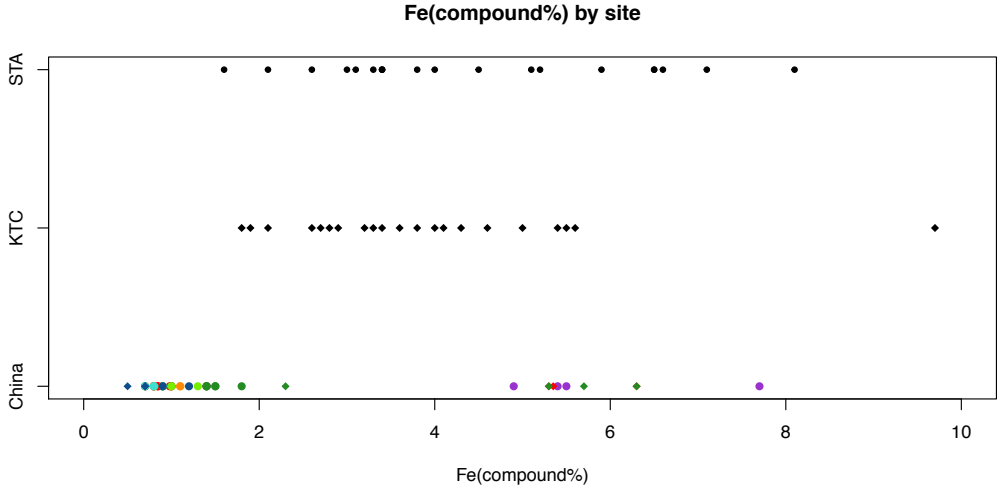


Figure 5.6: Stripchart of Fe_2O_3 by site; please see **Table 5.3** (*above*) for a legend explaining symbols and colours.

While for the most part the STA and KTC body-fabrics expressed ferrous components in line with Chinese ceramics and clays, here many of their Fe_2O_3% values fall directly into the gap between low-iron and high-iron oxide Chinese glazes.

Among the types analysed by Wood (1999), it appears that Jizhou ware, Jian ware and Ding glazes correspond best with the Southeast Asian glazes – categories that, much like with the MgO and P_2O_5 values, share little affinity with their body compositions. The formerly straightforward Jingdezhen-Longquan dichotomy is further challenged with this added dimension of glaze technologies.

It may be that the glazes seen in Southeast Asia represent a different market with different demands from Chinese customers, influencing technologies employed by

kilns. Conversely, these may be glaze recipes not from China, but of outlying kilns in Southeast Asia – one candidate is Sisatchanalai in Thailand, a prolific contemporary stoneware producer (Grave et al., 2000) – and the body fabrics in fact represent their products, which have successfully copied Chinese body-ceramics but not their glazes, either by choice or due to geological limitations.

Either way, these data, in conjunction with the other information from the glazes, have opened up considerable questions as to the technologies contributing to the corpus in Singapore and Sumatra and their potential origins, and it may be hoped that future work on these under-appreciated vessels may open up new lines of evidence.

5.3 Summary

5.3.1 KTC and STA

Overall, what can these SEM data and scatterplots truly inform us about the nature of, and changes in, stoneware production between 12^{th}-14^{th} century Sumatra and 14^{th}-15^{th} century Singapore? Having established that the suite of body ceramics available at both sites fits (for the most part) within the remit of contemporary Chinese kilns, what further detail can be teased out of the variations in measured oxides in both the body fabrics and glazes?

Comparing the means of the various metrics (Al_2O_3, Fe_2O_3, K_2O) chosen to explore the "quality" and production of these stonewares is perhaps most instructive in the identification of outliers which speak to the relative diversity of products received at both ports. Here, STA contains slightly more exceptions to the general ceramic ranges; its outliers are also more dramatic, such as the extremely Al_2O_3-rich **STA-BUF-12(C)**, Al_2O_3-poor **STA-BRI-02(B)**, Fe_2O_3-rich **STA-BRI-G** and K_2O-rich **STA-BUF-06(C)**. Compounded with the presence of potassic and lead alkali glazes, these trends suggest a more diverse clientèle being served in Singapore than Kota Cina.

In practically all categories and metrics, the STA material evinces greater variability despite the alleged longer habitation period at KTC. Although we should be forewarned of over-interpretation as STA buff and brittle-ware samples outnumber KTC ones two-to-one, this may suggest that the greater volume of trade seen at STA also correlates to a broader range of source markets, speaking to diversity not only of recipients but of producers in this transition through the "decentralised" period of Southeast Asian political history.

There, of course, remain major exceptions – here, it is the titular "mercury jars" which prove a surprising contrast to the overall trend. Despite similar sample sizes, it is now the KTC mercury jars which show considerably more variability and outliers than the STA ones. Combined with the knowledge that the **KTC-MER-A** sherds demonstrate the retention of glazed jars into its period of habitation, this suggests that by STA's occupation that mercury jar production had become monopolised, likely by just one kiln, and further implies that whichever industry these jars facilitated had also similarly coalesced.

5.3.2 Southeast Asia and China

With regards to the exact relationship between the Southeast Asian material and the known products of Chinese kilns, the results of their comparison seem to fraught with contradictions despite the initial apparent compatibility of their technologies.

For the most part, the body ceramics seen in KTC and STA, while divergent within Southeast Asia to some extent, are fairly conservative in their formulation *vis-à-vis* known Chinese ceramic formulae, minus the occasional outlier, some of which also fall within the range established by some of the Chinese stonewares.

This contrasts considerably with the patterns seen in the glazes, in which despite sharing affinities in overall lime / lime-alkali flux formulation, the Southeast Asian sherds differ massively from Chinese norms with regards to magnesia and phosphoric content, not to mention the divergent proportions of iron-oxide colourants employed. Several causes for these dramatic divergences may be propounded:

- These are Chinese wares which have been glazed with formulae which have yet to be scientifically recorded.
- These are ceramics which have managed to replicate Chinese ware, but use glazes of different flux formulation.
  - Plant-ash flux formulae were chosen due to a lack of limestone in the region.
  - Plant-ash flux formulae were chosen due to prevailing ceramic technological traditions.

The second hypothesis may be dismissed due to the vast abundance of limestone seams and karsts in the region (Gillieson, 2005, 174). Between the other two hypotheses, the first is essentially an argument from lack of evidence; conversely, it is known that wood-ash glazes have employed extensively in Southeast Asia from at least the Angkorean period, lending weight to this theory (Miksic, 2009, 51).

Ideally, a broader investigation utilising element quantification aimed at Southeast Asian stoneware bodies, along with wood-ash and limestone fluxes, would be able to provide a suitable corpus to compare these technologies. This would help to establish if the "Chinese" nature of the KTC and STA bodies may be accounted for by less distant kilns, in which case more questions are opened concerning how and where trade links fuelling the economies of these two sites truly lay in these critical centuries.

Chapter 6

Conclusions

The implications of this study are clear: it is possible to make distinctions within and between KTC and STA stoneware, and to compare these with contemporary Chinese kiln technologies, on an objective, statistically sound, level based on the chemistry of their vessels, little-studied on a rigorous scientific basis till now.

The next challenge is equally clear: to what extent are these statistical distinctions archaeologically useful? I have hoped to demonstrate that the clustering and shifts in means of key oxide components of body chemistry have suggested changes in ceramic production and diversification in market-demand from KTC to STA with the notable exception of the coalescence of the mercury-jar industry, and that although the ceramic body technologies at both bear superficial similarities to Chinese recipes that their glaze formulations belie a more nuanced picture, even suggesting at the emergence of kilns outside the Chinese main complexes.

Beyond this picture painted by this body and glaze stoichiometry, what further impact can this study have concerning the archaeology of Southeast Asia's antiquity? To this end we must return to the axioms upon which this study is based, namely the study of economic and social networks in the region in accordance with the state of scientific investigation of its material history.

6.1 Trade and Exchange of Stoneware (and More) in Southeast Asia, 12^{th}–15^{th} Centuries

In summing up the patterns of human behaviour which can be inferred from the stoichiometry of these sherds and the implications on the historic antiquity of Southeast Asia, it is worthwhile to take a step back and look at these patterns in the larger context of trade and exchange within the region.

Trade channels and connexions existed as more than just means of conveying stoneware (or goods contained therein) from one point to another. Similarly, it would be fallacious to assume every site was a scale-model microcosm of overall trends, even when attempting to differentiate Kota Cina and Singapore by both geographical and temporal distance. Stoneware hence only tell us part – albeit a hitherto overlooked part – of the dynamics which governed people's lives in these times.

Firstly, even within ceramics it is clear that earthenware, stoneware, and porcelain fulfilled very different roles in society, which also undoubtedly differed by the various strata between and within elites and non-elites. Although I have assumed that both Kota Cina and St. Andrew's Cathedral are non-elite settlements, I have invoked STA's proximity to elites resident on "Forbidden Hill" to account for its greater variability. Having demonstrated that we may have to look beyond surveyed Chinese kilns for the source of the glazed sherds (not to mention the compositional outliers), further questions are raised concerning the means (i.e. upon which ships) from and through which they were brought from kilns to ports, and onwards dispersed to settlements. Although shipwrecks can tell us much about the ratios of ceramic vessels upon them, it is necessary to assume their representativeness of trade in the region as a whole.

This brings us to a more contentious issue: namely, the *un*-representativeness of pottery with regards to trade and exchange as a whole. Inasmuch as ceramics are highly versatile in use and highly taphonomically resistant, permitting study of their essentially unaltered body and glaze fabrics centuries from their final discard or archival, pots cannot be eaten, shaped into (dedicated) tools or learnt from (except perhaps by imitation.) As Fahy (2014) surmises concerning contemporary maritime shipwrecks, ceramics benefit from the wealth of existing literature, whilst metal artefacts and ingots, and especially organic remains, are generally sidelined.

Unsurprisingly, a comprehensive picture only can only truly emerge through the analysis of these multiple dimensions, perhaps first through simple comparison of terrestrial and maritime deposits and seeing if settlements, or combinations of settlements, can account for the volumes of trade seen on the seas; following this, real efforts will have to made concerning the bio-archaeology and materials science of the more perishable goods to gain understandings as to their norms and variability concerning both producers and recipients.

Perhaps through harmonising all of these, it may one day be possible to gain a fleeting glance of the most ephemeral exchanged commodities – the ideologies and philosophies which were espoused, shared, and debated by the inhabitants of these polities, through using these more tangible lines of evidence as proxies.

6.2 Future Directions for Ceramic Analysis in Southeast Asian Archaeology

Inasmuch as I have in the course of this dissertation attempted to be comprehensive in my analyses, is it undeniable that the conclusions made at all levels suffer from investigative biases (even beyond those concerning the material of choice, as outlined above), which only magnify at the higher resolutions.

Each SEM-electron microprobe analysis area ranges from about $0.2mm^2$ to $1.4mm^2$. Even with four electron images per cut sherd, this still makes their total a subsample of a sample of a broken sherd, which is unto itself a subsample of (in the context of this study) an unstratified salvage deposit. While it may be hoped that intra-sherd variation remains below the error-margin of the analysis anyway (as wild fluctuations within the same fabric increase the risk of vessel failure during firing), this nevertheless remains an assumption.

How may these limitations then be resolved? It would seem unproductive to take multiple samples per sherd, at least with the current semi-quantitative regime imposed by the mechanical limitations of the SEM. There exist other options such as a specialised electron microprobe, such as that employed by RLAHA's tephrochronology laboratory (Smith, 2017), or perhaps even mass, absorption or emission-spectrometry for very fine distinctions in elemental proportions (Pollard and Heron, 2008, 21-41). Counter-arguments to using these are their cost and relative time-consumption, while the quicker SEM analysis also permits a visual study of the microstructure as seen in **Section 4.4**. Nevertheless, future pilot studies may aim to determine the utility of these other methods in characterising commonalities and differences in ceramic and glaze production.

Even then, such data would be limited in value without a similar basis for comparison; Wood (1999) cites all his oxide proportions to 1 decimal place, and increasing resolution of new measurements beyond those would not be useful. In order to make a truly instructive conclusions from such data once a preferred method is settled upon, a whole suite of material from a variety of contexts – Chinese and Southeast Asian, terrestrial and shipwreck – will have to be sampled for body and glaze compositions, perhaps finally resolving mysteries concerning ceramic traditions and transmission thereof in both knowledge and produce; the addition of data from local kilns will make considerable progress towards overturning Sinocentric models and assumptions concerning high-fired ceramics.

In conclusion, I sincerely hope that this study does not just vindicate the choice of analytical and statistical techniques used to evaluate the material, but also opens up new avenues and possibilities concerning such high-resolution scientific studies of ceramics. In this way, the field may hope to utilise the vast wealth of material culture available to its dedicated researchers to investigate this region and its history, not merely in terms of its stoneware or ceramic corpus, but to form a complete picture – or as close to one as we may realistically achieve – of life in and beyond this Chinese stockade in Sumatra and the illustrious, if all too brief, Kingdom of Singapore.

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Appendix A

Statistical Tests

A.1 Tests for Normal Distribution

STA (Al_2O_3)

Buff ware

```
Shapiro-Wilk normality test

data:  Al[stabody$Type == "Buff"]
W = 0.87073, p-value = 8.624e-07

data:  Al[stabody$Type == "Buff" & Al < 30]
W = 0.98493, p-value = 0.5069

data:  Al[stabody$Type == "Buff" & Al > 30]
W = 0.90034, p-value = 0.4327

data:  Al[stabody$Sample == "STA-BUF-A"]
W = 0.97571, p-value = 0.8056

data:  Al[stabody$Sample == "STA-BUF-B"]
W = 0.92627, p-value = 0.4828

data:  Al[stabody$Sample == "STA-BUF-C"]
W = 0.83024, p-value = 0.02111

data:  Al[stabody$Sample == "STA-BUF-C" & Al < 20]
W = 0.8921, p-value = 0.3929

data:  Al[stabody$Sample == "STA-BUF-C" & Al > 20 & Al < 30]
W = 0.91511, p-value = 0.5099

data:  Al[stabody$Sample == "STA-BUF-C" & Al > 30]
W = 0.90034, p-value = 0.4327

data:  Al[stabody$Sample == "STA-BUF-D"]
W = 0.96435, p-value = 0.8436

data:  Al[stabody$Sample == "STA-BUF-E"]
W = 0.94788, p-value = 0.4568

data:  Al[stabody$Sample == "STA-BUF-F"]
W = 0.90311, p-value = 0.4467

data:  Al[stabody$Sample == "STA-BUF-G"]
W = 0.88326, p-value = 0.3527
```


Brittle ware

```
Shapiro-Wilk normality test

data:  Al[stabody$Type == "Brittle"]
W = 0.91376, p-value = 8.268e-05

data:  Al[stabody$Type == "Brittle" & Al > 15.5]
W = 0.97823, p-value = 0.2541

data:  Al[stabody$Sample == "STA-BRI-A"]
W = 0.97181, p-value = 0.9042

data:  Al[stabody$Sample == "STA-BRI-B"]
W = 0.90867, p-value = 0.3448

data:  Al[stabody$Sample == "STA-BRI-C"]
W = 0.97365, p-value = 0.9451

data:  Al[stabody$Sample == "STA-BRI-D"]
W = 0.94027, p-value = 0.1654

data:  Al[stabody$Sample == "STA-BRI-E"]
W = 0.94518, p-value = 0.6862

data:  Al[stabody$Sample == "STA-BRI-F"]
W = 0.78573, p-value = 0.079

data:  Al[stabody$Sample == "STA-BRI-G"]
W = 0.93096, p-value = 0.5249

data:  Al[stabody$Sample == "STA-BRI-H"]
W = 0.85054, p-value = 0.2279
```

Mercury jars

```
Shapiro-Wilk normality test

data:  Al[stabody$Type == "Mercury jar"]
W = 0.97149, p-value = 0.5609

data:  Al[stabody$Sample == "STA-MER-A"]
W = 0.97289, p-value = 0.9386

data:  Al[stabody$Sample == "STA-MER-B"]
W = 0.7221, p-value = 0.001634

data:  Al[stabody$Sample == "STA-MER-B" & Al > 19]
W = 0.8761, p-value = 0.1428

data:  Al[stabody$Sample == "STA-MER-C"]
W = 0.8933, p-value = 0.2157
```


STA (Fe_2O_3)

Buff ware

```
Shapiro-Wilk normality test

data:  Fe[stabody$Type == "Buff"]
W = 0.89154, p-value = 5.445e-06

data:  Fe[stabody$Type == "Buff" & Fe < 3.25]
W = 0.9874, p-value = 0.7602

data:  Fe[stabody$Type == "Buff" & Fe > 3.25 & Fe < 4.25]
W = 0.97664, p-value = 0.959

data:  Fe[stabody$Sample == "STA-BUF-A"]
W = 0.8578, p-value = 0.003061

data:  Fe[stabody$Sample == "STA-BUF-A" & Fe < 3.4]
W = 0.98424, p-value = 0.9765

data:  Fe[stabody$Sample == "STA-BUF-B"]
W = 0.89747, p-value = 0.2741

data:  Fe[stabody$Sample == "STA-BUF-C"]
W = 0.89258, p-value = 0.1272

data:  Fe[stabody$Sample == "STA-BUF-D"]
W = 0.89701, p-value = 0.1451

data:  Fe[stabody$Sample == "STA-BUF-E"]
W = 0.82293, p-value = 0.005582

data:  Fe[stabody$Sample == "STA-BUF-E" & Fe < 2]
W = 0.8778, p-value = 0.2169

data:  Fe[stabody$Sample == "STA-BUF-E" & Fe > 2 & Fe < 6]
W = 0.86946, p-value = 0.1489

data:  Fe[stabody$Sample == "STA-BUF-F"]
W = 0.72427, p-value = 0.0215

data:  Fe[stabody$Sample == "STA-BUF-F" & Fe > 2]
W = 0.88107, p-value = 0.3275

data:  Fe[stabody$Sample == "STA-BUF-G"]
W = 0.9084, p-value = 0.4739
```

Brittle ware

```
Shapiro-Wilk normality test

data:  Fe[stabody$Type == "Brittle"]
W = 0.8107, p-value = 2.088e-08
```

```
data:  Fe[stabody$Type == "Brittle" & Fe < 5]
W = 0.96517, p-value = 0.0606

data:  Fe[stabody$Type == "Brittle" & Fe > 5]
W = 0.86342, p-value = 0.1044

data:  Fe[stabody$Sample == "STA-BRI-A"]
W = 0.79492, p-value = 0.008064

data:  Fe[stabody$Sample == "STA-BRI-A" & Fe < 2.4]
W = 0.96896, p-value = 0.8857

data:  Fe[stabody$Sample == "STA-BRI-B"]
W = 0.98871, p-value = 0.9928

data:  Fe[stabody$Sample == "STA-BRI-C"]
W = 0.93593, p-value = 0.4472

data:  Fe[stabody$Sample == "STA-BRI-D"]
W = 0.96578, p-value = 0.5648

data:  Fe[stabody$Sample == "STA-BRI-E"]
W = 0.90189, p-value = 0.4405

data:  Fe[stabody$Sample == "STA-BRI-F"]
W = 0.98542, p-value = 0.933

data:  Fe[stabody$Sample == "STA-BRI-G"]
W = 0.92606, p-value = 0.481

data:  Fe[stabody$Sample == "STA-BRI-H"]
W = 0.92334, p-value = 0.5558
```

Mercury jars

```
Shapiro-Wilk normality test

data:  Fe[stabody$Type == "Mercury jar"]
W = 0.91492, p-value = 0.01735

data:  Fe[stabody$Type == "Mercury jar" & Fe < 2.75]
W = 0.95551, p-value = 0.2716

data:  Fe[stabody$Sample == "STA-MER-A"]
W = 0.90321, p-value = 0.1745

data:  Fe[stabody$Sample == "STA-MER-B"]
W = 0.87377, p-value = 0.1106

data:  Fe[stabody$Sample == "STA-MER-C"]
W = 0.94565, p-value = 0.6425
```


STA (K_2O)

Buff ware

```
Shapiro-Wilk normality test

data:  K[stabody$Type == "Buff"]
W = 0.71318, p-value = 3.301e-11

data:  K[stabody$Type == "Buff" & K < 5]
W = 0.97587, p-value = 0.1561

data:  K[stabody$Sample == "STA-BUF-A"]
W = 0.94964, p-value = 0.2662

data:  K[stabody$Sample == "STA-BUF-B"]
W = 0.89245, p-value = 0.2466

data:  K[stabody$Sample == "STA-BUF-C"]
W = 0.86371, p-value = 0.05442

data:  K[stabody$Sample == "STA-BUF-D"]
W = 0.97491, p-value = 0.9549

data:  K[stabody$Sample == "STA-BUF-E"]
W = 0.94505, p-value = 0.4155

data:  K[stabody$Sample == "STA-BUF-F"]
W = 0.96721, p-value = 0.8241

data:  K[stabody$Sample == "STA-BUF-G"]
W = 0.99353, p-value = 0.9748
```

Brittle ware

```
Shapiro-Wilk normality test

data:  K[stabody$Type == "Brittle"]
W = 0.96972, p-value = 0.06917

data:  K[stabody$Sample == "STA-BRI-A"]
W = 0.94354, p-value = 0.563

data:  K[stabody$Sample == "STA-BRI-B"]
W = 0.90532, p-value = 0.3223

data:  K[stabody$Sample == "STA-BRI-C"]
W = 0.97795, p-value = 0.9741

data:  K[stabody$Sample == "STA-BRI-D"]
W = 0.9298, p-value = 0.0965

data:  K[stabody$Sample == "STA-BRI-E"]
W = 0.78194, p-value = 0.07358
```

```
data:  K[stabody$Sample == "STA-BRI-F"]
W = 0.84626, p-value = 0.2143

data:  K[stabody$Sample == "STA-BRI-G"]
W = 0.94119, p-value = 0.6228

data:  K[stabody$Sample == "STA-BRI-H"]
W = 0.96916, p-value = 0.8363
```

Mercury jars

```
Shapiro-Wilk normality test

data:  K[stabody$Type == "Mercury jar"]
W = 0.73857, p-value = 4.544e-06

data:  K[stabody$Type == "Mercury jar" & K < 4]
W = 0.9531, p-value = 0.2368

data:  K[stabody$Sample == "STA-MER-A"]
W = 0.76909, p-value = 0.00426

data:  K[stabody$Sample == "STA-MER-A" & K < 4]
W = 0.97028, p-value = 0.8934
t
data:  K[stabody$Sample == "STA-MER-B"]
W = 0.90219, p-value = 0.2315

data:  K[stabody$Sample == "STA-MER-C"]
W = 0.90412, p-value = 0.2769
```


KTC (Al_2O_3)

Buff ware

```
Shapiro-Wilk normality test

data:  Al[ktcbodytrimmed$Type == "Buff"]
W = 0.98116, p-value = 0.7325

data:  Al[ktcbodytrimmed$Sample == "KTC-BUF-A"]
W = 0.93171, p-value = 0.5317

data:  Al[ktcbodytrimmed$Sample == "KTC-BUF-B"]
W = 0.8581, p-value = 0.2535

data:  Al[ktcbodytrimmed$Sample == "KTC-BUF-C"]
W = 0.89636, p-value = 0.0703

data:  Al[ktcbodytrimmed$Sample == "KTC-BUF-D"]
W = 0.91797, p-value = 0.2696
```

Brittle ware

```
Shapiro-Wilk normality test

data:  Al[ktcbodytrimmed$Type == "Brittle"]
W = 0.88267, p-value = 0.001006

data:  Al[ktcbodytrimmed$Type == "Brittle" & Al > 16]
W = 0.94952, p-value = 0.101

data:  Al[ktcbodytrimmed$Sample == "KTC-BRI-A"]
W = 0.80268, p-value = 0.002956

data:  Al[ktcbodytrimmed$Sample == "KTC-BRI-A" & Al > 16]
W = 0.97043, p-value = 0.8644

data:  Al[ktcbodytrimmed$Sample == "KTC-BRI-A"]
W = 0.80268, p-value = 0.002956

data:  Al[ktcbodytrimmed$Sample == "KTC-BRI-B"]
W = 0.9728, p-value = 0.9107

data:  Al[ktcbodytrimmed$Sample == "KTC-BRI-C"]
W = 0.9152, p-value = 0.5104

data:  Al[ktcbodytrimmed$Sample == "KTC-BRI-D"]
W = 0.90056, p-value = 0.4338

data:  Al[ktcbodytrimmed$Sample == "KTC-BRI-E"]
W = 0.8728, p-value = 0.3088

data:  Al[ktcbodytrimmed$Sample == "KTC-BRI-F"]
W = 0.95922, p-value = 0.6116
```

Mercury jars

```
Shapiro-Wilk normality test

data:  Al[ktcbodytrimmed$Type == "Mercury jar"]
W = 0.95684, p-value = 0.07523

data:  Al[ktcbodytrimmed$Sample == "KTC-MER-A"]
W = 0.9168, p-value = 0.1498

data:  Al[ktcbodytrimmed$Sample == "KTC-MER-B"]
W = 0.85877, p-value = 0.04719

data:  Al[ktcbodytrimmed$Sample == "KTC-MER-B" & Al < 21]
W = 0.97113, p-value = 0.8825

data:  Al[ktcbodytrimmed$Sample == "KTC-MER-B" & Al > 21]
W = 0.91911, p-value = 0.4625

data:  Al[ktcbodytrimmed$Sample == "KTC-MER-C"]
W = 0.97769, p-value = 0.9727

data:  Al[ktcbodytrimmed$Sample == "KTC-MER-D"]
W = 0.96156, p-value = 0.7887

data:  Al[ktcbodytrimmed$Sample == "KTC-MER-E"]
W = 0.95453, p-value = 0.7445
```

Tempered jars

```
Shapiro-Wilk normality test

data:  Al[ktcbodytrimmed$Type == "Tempered jar" & Al < 23]
W = 0.96895, p-value = 0.8757

data:  Al[ktcbodytrimmed$Type == "Tempered jar" & Al > 23]
W = 0.86393, p-value = 0.1314

data:  Al[ktcbodytrimmed$Sample == "KTC-TMP-A"]
W = 0.99995, p-value = 0.9869

data:  Al[ktcbodytrimmed$Sample == "KTC-TMP-B"]
W = 0.96498, p-value = 0.8102

data:  Al[ktcbodytrimmed$Sample == "KTC-TMP-C"]
W = 0.8034, p-value = 0.01024

data:  Al[ktcbodytrimmed$Sample == "KTC-TMP-C" & Al < 22]
W = 0.77266, p-value = 0.06155

data:  Al[ktcbodytrimmed$Sample == "KTC-TMP-C" & Al > 22]
W = 0.86393, p-value = 0.1314
```


KTC (Fe_2O_3)

Buff ware

```
Shapiro-Wilk normality test

data:  Fe[ktcbodytrimmed$Type == "Buff"]
W = 0.92022, p-value = 0.007825

data:  Fe[ktcbodytrimmed$Type == "Buff" & Fe < 2.6]
W = 0.93346, p-value = 0.1165

data:  Fe[ktcbodytrimmed$Sample == "KTC-BUF-A"]
W = 0.91436, p-value = 0.3858

data:  Fe[ktcbodytrimmed$Sample == "KTC-BUF-B"]
W = 0.91336, p-value = 0.5004

data:  Fe[ktcbodytrimmed$Sample == "KTC-BUF-C"]
W = 0.88283, p-value = 0.04295

data:  Fe[ktcbodytrimmed$Sample == "KTC-BUF-C" & Fe < 2.5]
W = 0.956, p-value = 0.7713

data:  Fe[ktcbodytrimmed$Sample == "KTC-BUF-C" & Fe > 2.5]
W = 0.65715, p-value = 0.0007313

data:  Fe[ktcbodytrimmed$Sample == "KTC-BUF-C" & Fe > 2.5 & Fe < 3.3]
W = 0.81042, p-value = 0.05185

data:  Fe[ktcbodytrimmed$Sample == "KTC-BUF-D"]
W = 0.92589, p-value = 0.3386
```

Brittle ware

```
Shapiro-Wilk normality test

data:  Fe[ktcbodytrimmed$Type == "Brittle"]
W = 0.96724, p-value = 0.3387

data:  Fe[ktcbodytrimmed$Sample == "KTC-BRI-A"]
W = 0.87356, p-value = 0.03084

data:  Fe[ktcbodytrimmed$Sample == "KTC-BRI-A" & Fe > 2 & Fe < 4]
W = 0.9505, p-value = 0.6059

data:  Fe[ktcbodytrimmed$Sample == "KTC-BRI-B"]
W = 0.98504, p-value = 0.9737


data:  Fe[ktcbodytrimmed$Sample == "KTC-BRI-C"]
W = 0.86413, p-value = 0.2753

data:  Fe[ktcbodytrimmed$Sample == "KTC-BRI-D"]
W = 0.98007, p-value = 0.9024
```

```
data:  Fe[ktcbodytrimmed$Sample == "KTC-BRI-E"]
W = 0.98031, p-value = 0.9038

data:  Fe[ktcbodytrimmed$Sample == "KTC-BRI-F"]
W = 0.98501, p-value = 0.7656
```

Mercury jars

```
Shapiro-Wilk normality test

data:  Fe[ktcbodytrimmed$Type == "Mercury jar"]
W = 0.93151, p-value = 0.007754

data:  Fe[ktcbodytrimmed$Type == "Mercury jar" & Fe < 3]
W = 0.98525, p-value = 0.872

data:  Fe[ktcbodytrimmed$Type == "Mercury jar" & Fe > 3]
W = 0.90619, p-value = 0.328

data:  Fe[ktcbodytrimmed$Sample == "KTC-MER-A"]
W = 0.93022, p-value = 0.2457

data:  Fe[ktcbodytrimmed$Sample == "KTC-MER-B"]
W = 0.97709, p-value = 0.9693

data:  Fe[ktcbodytrimmed$Sample == "KTC-MER-C"]
W = 0.97068, p-value = 0.9178

data:  Fe[ktcbodytrimmed$Sample == "KTC-MER-D"]
W = 0.82005, p-value = 0.1433

data:  Fe[ktcbodytrimmed$Sample == "KTC-MER-E"]
W = 0.96634, p-value = 0.8187
```

Tempered jars

```
Shapiro-Wilk normality test

data:  Fe[ktcbodytrimmed$Type == "Tempered jar"]
W = 0.95818, p-value = 0.537

data:  Fe[ktcbodytrimmed$Sample == "KTC-TMP-A"]
W = 0.97771, p-value = 0.7138

data:  Fe[ktcbodytrimmed$Sample == "KTC-TMP-B"]
W = 0.86024, p-value = 0.2611

data:  Fe[ktcbodytrimmed$Sample == "KTC-TMP-C"]
W = 0.93264, p-value = 0.4089
```


KTC (K_2O)

Buff ware

```
Shapiro-Wilk normality test

data:  K[ktcbodytrimmed$Type == "Buff"]
W = 0.9553, p-value = 0.1155

data:  K[ktcbodytrimmed$Sample == "KTC-BUF-A"]
W = 0.89346, p-value = 0.2519

data:  K[ktcbodytrimmed$Sample == "KTC-BUF-B"]
W = 0.93746, p-value = 0.6389

data:  K[ktcbodytrimmed$Sample == "KTC-BUF-C"]
W = 0.93363, p-value = 0.2781

data:  K[ktcbodytrimmed$Sample == "KTC-BUF-D"]
W = 0.95781, p-value = 0.7521
```

Brittle ware

```
Shapiro-Wilk normality test

data:  K[ktcbodytrimmed$Type == "Brittle"]
W = 0.97494, p-value = 0.5575

data:  K[ktcbodytrimmed$Sample == "KTC-BRI-A"]
W = 0.95209, p-value = 0.5234

data:  K[ktcbodytrimmed$Sample == "KTC-BRI-B"]
W = 0.8575, p-value = 0.1807

data:  K[ktcbodytrimmed$Sample == "KTC-BRI-C"]
W = 0.86013, p-value = 0.2607

data:  K[ktcbodytrimmed$Sample == "KTC-BRI-D"]
W = 0.89556, p-value = 0.4093

data:  K[ktcbodytrimmed$Sample == "KTC-BRI-E"]
W = 0.86337, p-value = 0.2725

data:  K[ktcbodytrimmed$Sample == "KTC-BRI-F"]
W = 0.85055, p-value = 0.2419
```

Mercury jars

```
Shapiro-Wilk normality test

data:  K[ktcbodytrimmed$Type == "Mercury jar"]
W = 0.70939, p-value = 1.952e-08

data:  K[ktcbodytrimmed$Type == "Mercury jar" & K < 4]
W = 0.98127, p-value = 0.6844

data:  K[ktcbodytrimmed$Type == "Mercury jar" & K > 4]
W = 0.85928, p-value = 0.2577

data:  K[ktcbodytrimmed$Sample == "KTC-MER-A"]
W = 0.9075, p-value = 0.106

data:  K[ktcbodytrimmed$Sample == "KTC-MER-B"]
W = 0.84523, p-value = 0.03207

data:  K[ktcbodytrimmed$Sample == "KTC-MER-B" & K < 4]
W = 0.94063, p-value = 0.5279

data:  K[ktcbodytrimmed$Sample == "KTC-MER-C"]
W = 0.66464, p-value = 0.0003928

data:  K[ktcbodytrimmed$Sample == "KTC-MER-C" & K < 6]
W = 0.91134, p-value = 0.2903

data:  K[ktcbodytrimmed$Sample == "KTC-MER-D"]
W = 0.95999, p-value = 0.7788

data:  K[ktcbodytrimmed$Sample == "KTC-MER-E"]
W = 0.93512, p-value = 0.6248
```

Tempered jars

```
Shapiro-Wilk normality test

data:  K[ktcbodytrimmed$Type == "Tempered jar"]
W = 0.95856, p-value = 0.5444

data:  K[ktcbodytrimmed$Sample == "KTC-TMP-A"]
W = 0.99954, p-value = 0.9592

data:  K[ktcbodytrimmed$Sample == "KTC-TMP-B"]
W = 0.8999, p-value = 0.4306

data:  K[ktcbodytrimmed$Sample == "KTC-TMP-C"]
W = 0.9475, p-value = 0.6008
```


A.2 Pairwise t-tests

STA (Al_2O_3)

```
> mean(Al[stabodyAltrimmed$Type=="Buff"]) = 22.56789
> sd(Al[stabodyAltrimmed$Type=="Buff"]) = 2.497943

> mean(Al[stabodyAltrimmed$Type=="STA-BUF-12(C)"]) = 35.2725
> sd(Al[stabodyAltrimmed$Type=="STA-BUF-12(C)"]) = 2.580392

> mean(Al[stabodyAltrimmed$Type=="Brittle"]) = 21.08667
> sd(Al[stabodyAltrimmed$Type=="Brittle"]) = 1.700757

> mean(Al[stabodyAltrimmed$Type=="STA-BRI-02(B)"]) = 13.94
> sd(Al[stabodyAltrimmed$Type=="STA-BRI-02(B)"]) = 1.122883

> mean(Al[stabodyAltrimmed$Type=="Mercury jar"]) = 19.791
> sd(Al[stabodyAltrimmed$Type=="Mercury jar"]) = 0.8852638

> summary(aov(Al~Sample, data=stabodyAltrimmed))
             Df Sum Sq Mean Sq F value Pr(>F)
Sample       20 1504.7   75.24   32.98 <2e-16 ***
Residuals   164  374.1    2.28
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(stabodyAltrimmed, pairwise.t.test(x=Al, g=Type, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Al and Type

             Brittle Buff    Mercury jar STA-BRI-02(B)
Buff         1.8e-05 -       -           -
Mercury jar  0.0027  1.0e-09 -           -
STA-BRI-02(B) 4.3e-11 9.4e-15 1.1e-07     -
STA-BUF-12(C) < 2e-16 < 2e-16 < 2e-16     < 2e-16

P value adjustment method: none
```

Buff ware

```
> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-A"]) = 24.10625
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-A"]) = 1.809261

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-B"]) = 23.10875
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-B"]) = 1.563617

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-C"]) = 21.7675
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-C"]) = 0.4095831

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-06(C)"]) = 17.33
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-06(C)"]) = 0.4237137
```

```
> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-12(C)"]) = 35.2725
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-12(C)"]) = 2.580392

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-D"]) = 21.71083
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-D"]) = 2.262145

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-E"]) = 22.96688
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-E"]) = 2.658126

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-F"]) = 21.15
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-F"]) = 0.4490731

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-G"]) = 20.6875
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BUF-G"]) =1.490579

> summary(aov(Al~Sample, data=stabodyAltrimmed_intra[Type=="Buff",]))
            Df Sum Sq Mean Sq F value Pr(>F)
Sample       8  818.3  102.29   25.67 <2e-16 ***
Residuals   71  283.0    3.99
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(stabodyAltrimmed[Type=="Buff",],
pairwise.t.test(x=Al, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Al and Sample

             STA-BUF-06(C) STA-BUF-12(C) STA-BUF-A STA-BUF-B STA-BUF-C STA-BUF-D STA-BUF-E STA-BUF-F
STA-BUF-12(C) < 2e-16       -            -         -         -         -         -         -
STA-BUF-A     2.3e-08       7.7e-16      -         -         -         -         -         -
STA-BUF-B     1.1e-05       4.2e-15      0.2250    -         -         -         -         -
STA-BUF-C     0.0024        2.1e-14      0.0334    0.2763    -         -         -         -
STA-BUF-D     0.0003        < 2e-16      0.0011    0.1294    0.9609    -         -         -
STA-BUF-E     3.3e-06       < 2e-16      0.0813    0.8701    0.2861    0.1039    -         -
STA-BUF-F     0.0085        3.4e-15      0.0077    0.1135    0.6631    0.6281    0.1079    -
STA-BUF-G     0.0201        8.6e-16      0.0022    0.0515    0.4468    0.3776    0.0448    0.7442

P value adjustment method: none
```

Brittle ware

```
> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-A"]) = 23.01273
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-A"]) = 1.20809

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-B"]) = 20.645
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-B"]) =  1.830674

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-02(B)"]) =  13.94
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-02(B)"]) = 1.122883

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-C"]) =  20.9275
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-C"]) = 0.4937081
```



```
> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-D"]) = 20.93583
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-D"]) = 1.216095

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-E"]) = 21.255
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-E"]) =  0.3875994

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-F"]) =  19.2975
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-F"]) = 0.6453617

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-G"]) = 19.03375
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-G"]) = 1.100622

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-H"]) = 23.965
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-BRI-H"]) = 1.342299

> summary(aov(Al~Sample, data=stabodyAltrimmed_intra[Type=="Brittle",]))
            Df Sum Sq Mean Sq F value Pr(>F)
Sample       8  317.4   39.68   32.45 <2e-16 ***
Residuals   66   80.7    1.22
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(stabodyAltrimmed[Type=="Brittle",],
pairwise.t.test(x=Al, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Al and Sample

          STA-BRI-02(B) STA-BRI-A STA-BRI-B STA-BRI-C STA-BRI-D STA-BRI-E STA-BRI-F STA-BRI-G
STA-BRI-A < 2e-16       -         -         -         -         -         -         -
STA-BRI-B 2.5e-12       0.00049   -         -         -         -         -         -
STA-BRI-C < 2e-16       2.7e-05   0.65960   -         -         -         -         -
STA-BRI-D < 2e-16       2.5e-06   0.62789   0.98306   -         -         -         -
STA-BRI-E 1.0e-13       0.00828   0.43812   0.60970   0.59485   -         -         -
STA-BRI-F 3.0e-09       2.5e-07   0.08953   0.01300   0.00783   0.01478   -         -
STA-BRI-G 1.9e-10       7.6e-11   0.02025   0.00037   7.8e-05   0.00166   0.69818   -
STA-BRI-H < 2e-16       0.14501   7.0e-05   1.1e-05   3.4e-06   0.00093   1.0e-07   5.1e-10

P value adjustment method: none
```

Mercury jars

```
> mean(Al[stabodyAltrimmed_intra$Sample=="STA-MER-A"]) = 20.44083
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-MER-A"]) = 0.8690377

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-MER-B"]) = 19.79667
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-MER-B"]) = 0.2117782

> mean(Al[stabodyAltrimmed_intra$Sample=="STA-MER-C"]) = 18.95778
> sd(Al[stabodyAltrimmed_intra$Sample=="STA-MER-C"]) = 0.4719051

> summary(aov(Al~Sample, data=stabodyAltrimmed_intra[Type=="Mercury jar",]))
            Df Sum Sq Mean Sq F value   Pr(>F)
Sample       2  11.31   5.656   14.62 4.99e-05 ***
Residuals   27  10.45   0.387
---
```

```
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(stabodyAltrimmed[Type=="Mercury jar",],
pairwise.t.test(x=Al, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Al and Sample

          STA-MER-A STA-MER-B
STA-MER-B 0.0264    -
STA-MER-C 1e-05     0.0081

P value adjustment method: none
```


STA (Fe_2O_3)

```
> mean(Fe[stabodyFetrimmed$Type=="Buff"]) = 2.225556
> sd(Fe[stabodyFetrimmed$Type=="Buff"]) = 0.4564088

> mean(Fe[stabodyFetrimmed$Type=="STA-BUF-02(B)"]) = 3.8075
> sd(Fe[stabodyFetrimmed$Type=="STA-BUF-02(B)"]) =  0.2140677

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-E"]) = 1.795455
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-E"]) = 0.439508

> mean(Fe[stabodyFetrimmed$Type=="STA-BUF-20(E)"]) = 3.57
> sd(Fe[stabodyFetrimmed$Type=="STA-BUF-20(E)"]) = 0.4288356

> mean(Fe[stabodyFetrimmed$Type=="Brittle"]) =  3.175
> sd(Fe[stabodyFetrimmed$Type=="Brittle"]) = 0.5918536

> mean(Fe[stabodyFetrimmed$Type=="STA-BRI-A"]) = 2.046667
> sd(Fe[stabodyFetrimmed$Type=="STA-BRI-A"]) = 0.1467992

> mean(Fe[stabodyFetrimmed$Type=="STA-BRI-17(D)"]) = 1.8325
> sd(Fe[stabodyFetrimmed$Type=="STA-BRI-17(D)"]) = 0.1424488

> mean(Fe[stabodyFetrimmed$Type=="Mercury jar"]) = 2.016786
> sd(Fe[stabodyFetrimmed$Type=="Mercury jar"]) = 0.2431743

> summary(aov(Fe~Type, data=stabodyFetrimmed))
             Df Sum Sq Mean Sq F value Pr(>F)
Type          8 160.24  20.030   51.65 <2e-16 ***
Residuals   158  61.27   0.388
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(stabodyFetrimmed, pairwise.t.test(x=Fe, g=Type, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Fe and Type

             Brittle Buff    Mercury jar STA-BRI-17(D) STA-BRI-A STA-BRI-G STA-BUF-02(B) STA-BUF-20(E)
Buff         3.7e-11 -       -           -             -         -         -             -
Mercury jar  1.9e-13 0.03776 -           -             -         -         -             -
STA-BRI-17(D) 3.5e-05 0.12843 0.57298     -             -         -         -             -
STA-BRI-A    8.2e-07 0.22252 0.89850     0.56012       -         -         -             -
STA-BRI-G    < 2e-16 < 2e-16 < 2e-16     < 2e-16       < 2e-16   -         -             -
STA-BUF-02(B) 0.05194 5.4e-06 1.6e-07     9.5e-06       3.6e-06   1.6e-10   -             -
STA-BUF-20(E) 0.29133 0.00070 4.6e-05     0.00027       0.00025   2.4e-10   0.61114       -
STA-BUF-E    1.9e-10 0.01102 0.30974     0.91734       0.36123   < 2e-16   7.4e-08       1.5e-05
P value adjustment method: none
```

Buff ware

```
> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-A"]) = 2.409
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-A"]) = 0.3727127

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-B"]) = 2.2525
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-B"]) = 0.4882878

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-02(B)"]) = 3.8075
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-02(B)"]) = 0.2140677

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-C"]) = 2.211
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-C"]) = 0.378431

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-D"]) = 2.219091
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-D"]) = 0.4732326

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-E"]) = 1.795455
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-E"]) = 0.439508

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-20(E)"]) = 3.57
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-20(E)"]) = 0.4288356

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-F"]) = 2.5925
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-F"]) = 0.4111265

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-G"]) = 2.126667
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BUF-G"]) = 0.3950105

> summary(aov(Fe~Sample, data=stabodyFetrimmed_intra[Type=="Buff",]))
            Df Sum Sq Mean Sq F value   Pr(>F)
Sample       8  17.18  2.1476   12.92 1.12e-10 ***
Residuals   61  10.14  0.1662
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(stabodyFetrimmed[Type=="Buff",],
pairwise.t.test(x=Fe, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Fe and Sample

             STA-BUF-02(B) STA-BUF-20(E) STA-BUF-A STA-BUF-B STA-BUF-C STA-BUF-D STA-BUF-E STA-BUF-F
STA-BUF-20(E) 0.44856       -             -         -         -         -         -         -
STA-BUF-A     4.2e-08       2.2e-05       -         -         -         -         -         -
STA-BUF-B     1.2e-06       7.9e-05       0.48607   -         -         -         -         -
STA-BUF-C     1.0e-08       4.1e-06       0.21464   0.86396   -         -         -         -
STA-BUF-D     8.4e-09       3.7e-06       0.21939   0.88885   0.96392   -         -         -
STA-BUF-E     7.4e-12       8.1e-09       0.00017   0.05954   0.02298   0.01775   -         -
STA-BUF-F     8.4e-05       0.00261       0.41442   0.24282   0.11889   0.12190   0.00140   -
STA-BUF-G     1.2e-06       5.5e-05       0.26774   0.68754   0.75442   0.72900   0.21706   0.13981
```


Brittle ware

```
> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-A"]) = 2.046667
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-A"]) = 0.1467992

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-B"]) = 3.796
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-B"]) = 0.4987284

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-C"]) = 3.348333
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-C"]) = 0.4357404

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-D"]) = 3.144211
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-D"]) = 0.4791812

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-17(D)"]) = 1.8325
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-17(D)"]) = 0.1424488

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-E"]) = 3.3
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-E"]) = 1.301

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-F"]) = 3.1775
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-F"]) = 0.2154646

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-G"]) = 6.3675
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-G"]) = 1.922853

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-H"]) = 2.0225
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-BRI-H"]) = 0.1701715

> summary(aov(Fe~Sample, data=stabodyFetrimmed_intra[Type=="Brittle",]))
            Df Sum Sq Mean Sq F value   Pr(>F)
Sample       8 106.28  13.285   20.63 1.33e-14 ***
Residuals   60  38.64   0.644
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(stabodyFetrimmed[Type=="Brittle",],
pairwise.t.test(x=Fe, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Fe and Sample

             STA-BRI-17(D) STA-BRI-A STA-BRI-B STA-BRI-C STA-BRI-D STA-BRI-E STA-BRI-F STA-BRI-G
STA-BRI-A    0.65854       -         -         -         -         -         -         -
STA-BRI-B    0.00056       0.00024   -         -         -         -         -         -
STA-BRI-C    0.00177       0.00050   0.29881   -         -         -         -         -
STA-BRI-D    0.00426       0.00128   0.11134   0.49294   -         -         -         -
STA-BRI-E    0.01215       0.01175   0.36052   0.91726   0.72539   -         -         -
STA-BRI-F    0.02100       0.02235   0.25512   0.71362   0.94014   0.82981   -         -
STA-BRI-G    4.1e-13       3.8e-16   5.2e-07   1.9e-11   1.3e-13   4.8e-08   1.8e-08   -
STA-BRI-H    0.73891       0.96020   0.00166   0.00579   0.01366   0.02803   0.04622   1.8e-12

P value adjustment method: none
```

Mercury jars

```
> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-MER-A"]) = 1.945455
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-MER-A"]) = 0.2684907

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-MER-B"]) =  2.05
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-MER-B"]) = 0.198782

> mean(Fe[stabodyFetrimmed_intra$Sample=="STA-MER-C"]) =  2.074444
> sd(Fe[stabodyFetrimmed_intra$Sample=="STA-MER-C"]) = 0.2511031

> summary(aov(Fe~Sample, data=stabodyFetrimmed_intra[Type=="Mercury jar",]))
            Df Sum Sq Mean Sq F value Pr(>F)
Sample       2 0.0947 0.04736   0.788  0.466
Residuals   25 1.5019 0.06008

> with(stabodyFetrimmed[Type=="Mercury jar",],
pairwise.t.test(x=Fe, g=Sample, p.adjust="holm"))

Pairwise comparisons using t tests with pooled SD

data:  Fe and Sample

          STA-MER-A STA-MER-B
STA-MER-B 0.76      -
STA-MER-C 0.76      0.84

P value adjustment method: holm
```


STA (K_2O)

```
> mean(K[stabodyKtrimmed$Type=="Buff"]) = 2.192763
> sd(K[stabodyKtrimmed$Type=="Buff"]) = 0.571703

> mean(K[stabodyKtrimmed$Type=="Brittle"]) = 3.164267
> sd(K[stabodyKtrimmed$Type=="Brittle"]) = 0.9155491

> mean(K[stabodyKtrimmed$Type=="Mercury jar"]) = 2.996429
> sd(K[stabodyKtrimmed$Type=="Mercury jar"]) = 0.2337808

> mean(K[stabodyKtrimmed$Type=="STA-BUF-06(C)"]) = 6.6
> sd(K[stabodyKtrimmed$Type=="STA-BUF-06(C)"]) = 0.5207687

> summary(aov(K~Type, data=stabodyKtrimmed))
             Df Sum Sq Mean Sq F value Pr(>F)
Type          3  96.80   32.27   65.02 <2e-16 ***
Residuals   179  88.83    0.50
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(stabodyKtrimmed, pairwise.t.test(x=K, g=Type, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  K and Type

              Brittle Buff    Mercury jar
Buff          8.6e-15 -       -
Mercury jar   0.28    6.5e-07 -
STA-BUF-06(C) < 2e-16 < 2e-16 < 2e-16

P value adjustment method: none
```

Buff ware

```
> mean(K[stabodyKtrimmed$Sample=="STA-BUF-A"]) = 2.342917
> sd(K[stabodyKtrimmed$Sample=="STA-BUF-A"]) = 0.4106461

> mean(K[stabodyKtrimmed$Sample=="STA-BUF-B"]) = 2.80375
> sd(K[stabodyKtrimmed$Sample=="STA-BUF-B"]) =0.5287435

> mean(K[stabodyKtrimmed$Sample=="STA-BUF-C"]) = 2.5675
> sd(K[stabodyKtrimmed$Sample=="STA-BUF-C"]) = 0.7235972

> mean(K[stabodyKtrimmed$Sample=="STA-BUF-06(C)"]) = 6.6
> sd(K[stabodyKtrimmed$Sample=="STA-BUF-06(C)"]) = 0.5207687

> mean(K[stabodyKtrimmed$Sample=="STA-BUF-D"]) = 1.879167
> sd(K[stabodyKtrimmed$Sample=="STA-BUF-D"]) = 0.2666444

> mean(K[stabodyKtrimmed$Sample=="STA-BUF-E"]) = 2.05625
> sd(K[stabodyKtrimmed$Sample=="STA-BUF-E"]) = 0.3009513
```

```
> mean(K[stabodyKtrimmed$Sample=="STA-BUF-F"]) = 2.0675
> sd(K[stabodyKtrimmed$Sample=="STA-BUF-F"]) = 0.121758

> mean(K[stabodyKtrimmed$Sample=="STA-BUF-G"]) = 0.9325
> sd(K[stabodyKtrimmed$Sample=="STA-BUF-G"]) = 0.3068523

> summary(aov(K~Sample, data=stabodyKtrimmed_intra[Type=="Buff",]))
             Df Sum Sq Mean Sq F value Pr(>F)
Sample       7  86.36  12.336   69.49 <2e-16 ***
Residuals   72  12.78   0.178
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(stabodyKtrimmed_intra[Type=="Buff",],
pairwise.t.test(x=K, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  K and Sample

          STA-BUF-06(C) STA-BUF-A STA-BUF-B STA-BUF-C STA-BUF-D STA-BUF-E STA-BUF-F
STA-BUF-A < 2e-16       -         -         -         -         -
STA-BUF-B < 2e-16       0.00914   -         -         -         -
STA-BUF-C < 2e-16       0.19583   0.26583   -         -         -
STA-BUF-D < 2e-16       0.00266   8.1e-06   0.00062   -         -
STA-BUF-E < 2e-16       0.03851   0.00011   0.00652   0.27475   -         -
STA-BUF-F < 2e-16       0.23010   0.00564   0.05656   0.44134   0.96204   -
STA-BUF-G < 2e-16       3.2e-08   3.8e-10   1.8e-08   0.00022   9.3e-06   0.00029

P value adjustment method: none
```

Brittle ware

```
> mean(K[stabodyKtrimmed$Sample=="STA-BRI-A"]) = 3.524545
> sd(K[stabodyKtrimmed$Sample=="STA-BRI-A"]) = 0.8633929

> mean(K[stabodyKtrimmed$Sample=="STA-BRI-B"]) = 2.90875
> sd(K[stabodyKtrimmed$Sample=="STA-BRI-B"]) = 0.1869635

> mean(K[stabodyKtrimmed$Sample=="STA-BRI-C"]) = 3.5675
> sd(K[stabodyKtrimmed$Sample=="STA-BRI-C"]) = 0.218762

> mean(K[stabodyKtrimmed$Sample=="STA-BRI-D"]) = 3.49
> sd(K[stabodyKtrimmed$Sample=="STA-BRI-D"]) = 0.7594506

> mean(K[stabodyKtrimmed$Sample=="STA-BRI-E"]) = 2.99
> sd(K[stabodyKtrimmed$Sample=="STA-BRI-E"]) = 0.250998

> mean(K[stabodyKtrimmed$Sample=="STA-BRI-F"]) = 4.1675
> sd(K[stabodyKtrimmed$Sample=="STA-BRI-F"]) = 0.6612803

> mean(K[stabodyKtrimmed$Sample=="STA-BRI-G"]) = 1.42125
> sd(K[stabodyKtrimmed$Sample=="STA-BRI-G"]) = 0.1816148
```



```
> mean(K[stabodyKtrimmed$Sample=="STA-BRI-H"]) = 2.1775
> sd(K[stabodyKtrimmed$Sample=="STA-BRI-H"]) = 0.06130525

> summary(aov(K~Sample, data=stabodyKtrimmed_intra[Type=="Brittle",]))
             Df Sum Sq Mean Sq F value   Pr(>F)
Sample       7  38.79   5.542   15.98 3.71e-12 ***
Residuals   67  23.23   0.347
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(stabodyKtrimmed_intra[Type=="Brittle",],
pairwise.t.test(x=K, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  K and Sample

          STA-BRI-A STA-BRI-B STA-BRI-C STA-BRI-D STA-BRI-E STA-BRI-F STA-BRI-G
STA-BRI-B 0.02771   -         -         -         -         -         -
STA-BRI-C 0.86181   0.01687   -         -         -         -         -
STA-BRI-D 0.87249   0.01834   0.71089   -         -         -         -
STA-BRI-E 0.12474   0.82242   0.09404   0.12062   -         -         -
STA-BRI-F 0.06586   0.00086   0.08216   0.03682   0.00617   -         -
STA-BRI-G 8.8e-11   3.6e-06   2.6e-11   2.0e-12   4.7e-05   1.2e-10   -
STA-BRI-H 0.00021   0.04656   0.00012   0.00010   0.05521   1.0e-05   0.03976

P value adjustment method: none
```

Mercury jars

```
> mean(K[stabodyKtrimmed$Sample=="STA-MER-A"]) = 2.906
> sd(K[stabodyKtrimmed$Sample=="STA-MER-A"]) = 0.2782165

> mean(K[stabodyKtrimmed$Sample=="STA-MER-B"]) = 3.034444
> sd(K[stabodyKtrimmed$Sample=="STA-MER-B"]) = 0.2425444

> mean(K[stabodyKtrimmed$Sample=="STA-MER-C"]) = 3.058889
> sd(K[stabodyKtrimmed$Sample=="STA-MER-C"]) = 0.149369

> summary(aov(K~Sample, data=stabodyKtrimmed_intra[Type=="Mercury jar",]))
             Df Sum Sq Mean Sq F value Pr(>F)
Sample       2 0.1299 0.06495   1.206  0.316
Residuals   25 1.3458 0.05383
> with(stabodyKtrimmed_intra[Type=="Mercury jar",],
pairwise.t.test(x=K, g=Sample, p.adjust="holm"))

Pairwise comparisons using t tests with pooled SD

data:  K and Sample

          STA-MER-A STA-MER-B
STA-MER-B 0.49      -
STA-MER-C 0.49      0.82
P value adjustment method: holm
```

KTC (Al_2O_3)

```
> mean(Al[ktcbodyAltrimmed$Type=="Buff"]) = 20.5645
> sd(Al[ktcbodyAltrimmed$Type=="Buff"]) = 2.240102

> mean(Al[ktcbodyAltrimmed$Type=="Brittle"]) = 20.66432
> sd(Al[ktcbodyAltrimmed$Type=="Brittle"]) = 1.223087

> mean(Al[ktcbodyAltrimmed$Type=="Mercury jar"]) = 20.92809
> sd(Al[ktcbodyAltrimmed$Type=="Mercury jar"]) = 1.655002

> mean(Al[ktcbodyAltrimmed$Type=="Tempered jar"]) = 22.87474
> sd(Al[ktcbodyAltrimmed$Type=="Tempered jar"]) = 2.36843

> summary(aov(Al ~ Type, data= ktcbodyAltrimmed))
             Df Sum Sq Mean Sq F value   Pr(>F)
Type          3   78.7  26.245   7.656 8.99e-05 ***
Residuals   139  476.5   3.428
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(ktcbodyAltrimmed, pairwise.t.test(x=Al, g=Type, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Al and Type

             Brittle Buff    Mercury jar
Buff         0.81350 -       -
Mercury jar  0.51795 0.36291 -
Tempered jar 4.2e-05 1.6e-05 0.00017

P value adjustment method: none
```

Buff ware

```
> mean(Al[ktcbodyAltrimmed$Sample=="KTC-BUF-A"]) = 22.3225
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-BUF-A"]) = 1.389304

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-BUF-B"]) = 23.7725
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-BUF-B"]) = 0.9531833

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-BUF-C"]) = 19.2475
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-BUF-C"]) = 2.016808

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-BUF-D"]) = 20.07917
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-BUF-D"]) = 1.413786

> summary(aov(Al ~ Sample, data= ktcbodyAltrimmed[Type=="Buff",]))
            Df Sum Sq Mean Sq F value  Pr(>F)
Sample       3  62.32  20.773   12.23 1.7e-05 ***
Residuals   32  54.33   1.698
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(ktcbodyAltrimmed[Type=="Buff",],
```



```
pairwise.t.test(x=Al, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Al and Sample

          KTC-BUF-A KTC-BUF-B KTC-BUF-C
KTC-BUF-B 0.07856   -         -
KTC-BUF-C 0.00122   4.3e-05   -
KTC-BUF-D 0.00066   2.6e-05   0.80369

P value adjustment method: none
```

Brittle ware

```
> mean(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-A"]) = 21.028
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-A"]) = 1.030605

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-B"]) = 21.03571
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-B"]) = 1.179277

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-C"]) = 20.6325
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-C"]) = 0.4942587

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-D"]) = 18.1925
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-D"]) = 0.6734179

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-E"]) = 20.7625
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-E"]) = 0.2917048

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-F"]) = 21.18667
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-BRI-F"]) = 0.1429452

> summary(aov(Al ~ Sample, data= ktcbodyAltrimmed[Type=="Brittle",]))
            Df Sum Sq Mean Sq F value  Pr(>F)
Sample       5  28.25   5.650   6.841 0.00021 ***
Residuals   31  25.60   0.826
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(ktcbodyAltrimmed[Type=="Brittle",],
+ pairwise.t.test(x=Al, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Al and Sample

          KTC-BRI-A KTC-BRI-B KTC-BRI-C KTC-BRI-D KTC-BRI-E
KTC-BRI-B 0.98532   -         -         -         -
KTC-BRI-C 0.44517   0.48432   -         -         -
KTC-BRI-D 4.5e-06   2.2e-05   0.00064   -         -
KTC-BRI-E 0.60734   0.63485   0.84101   0.00037   -
KTC-BRI-F 0.78434   0.81137   0.43072   0.00015   0.54559
```

Mercury jars

```
> mean(Al[ktcbodyAltrimmed$Sample=="KTC-MER-A"]) = 20.51063
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-MER-A"]) = 1.379838

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-MER-B"]) = 22.12571
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-MER-B"]) = 0.3848747

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-MER-18 (B)"]) = 18.98
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-MER-18 (B)"]) = 0.4241855

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-MER-C"]) = 21.75917
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-MER-C"]) = 1.948283

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-MER-D"]) = 21.74
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-MER-D"]) = 0.4047221

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-MER-E"]) = 19.145
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-MER-E"]) = 0.8388285

> summary(aov(Al ~ Sample, data= ktcbodyAltrimmed[Type=="Mercury jar",]))
            Df Sum Sq Mean Sq F value   Pr(>F)
Sample       5  51.65  10.330   5.697 0.000444 ***
Residuals   41  74.34   1.813
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(ktcbodyAltrimmed[Type=="Mercury jar",],
pairwise.t.test(x=Al, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Al and Sample

          KTC-MER-18 (B) KTC-MER-A KTC-MER-B KTC-MER-C KTC-MER-D
KTC-MER-A 0.04852        -         -         -         -
KTC-MER-B 0.00059        0.01148   -         -         -
KTC-MER-C 0.00092        0.01966   0.57021   -         -
KTC-MER-D 0.00599        0.11009   0.65008   0.98045   -
KTC-MER-E 0.86328        0.07698   0.00104   0.00168   0.00940

P value adjustment method: none
```

Tempered jars

```
> mean(Al[ktcbodyAltrimmed$Sample=="KTC-TMP-A"]) = 21.98667
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-TMP-A"]) = 0.8400198

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-TMP-B"]) = 20.75
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-TMP-B"]) = 1.143066

> mean(Al[ktcbodyAltrimmed$Sample=="KTC-TMP-C"]) = 25.37
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-TMP-C"]) = 0.5113847
```



```
> mean(Al[ktcbodyAltrimmed$Sample=="KTC-TMP-03 (C) "]) = 20.675
> sd(Al[ktcbodyAltrimmed$Sample=="KTC-TMP-03 (C) "]) = 1.185819

> summary(aov(Al ~ Sample, data= ktcbodyAltrimmed[Type=="Tempered jar",]))
            Df Sum Sq Mean Sq F value   Pr(>F)
Sample       3  89.59  29.863   39.36 2.39e-07 ***
Residuals   15  11.38   0.759
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(ktcbodyAltrimmed[Type=="Tempered jar",],
pairwise.t.test(x=Al, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Al and Sample

          KTC-TMP-03 (C)  KTC-TMP-A KTC-TMP-B
KTC-TMP-A 0.067           -         -
KTC-TMP-B 0.905           0.083     -
KTC-TMP-C 2.6e-07         3.9e-05   3.2e-07

P value adjustment method: none
```

KTC (Fe_2O_3)

```
> mean(Fe[ktcbodyFetrimmed$Type=="Buff"]) = 1.9975
> sd(Fe[ktcbodyFetrimmed$Type=="Buff"]) = 0.2512966

> mean(Fe[ktcbodyFetrimmed$Type=="KTC-BUF-A"]) = 3.47125
> sd(Fe[ktcbodyFetrimmed$Type=="KTC-BUF-A"]) = 0.2832686

> mean(Fe[ktcbodyFetrimmed$Type=="KTC-BUF-CA"]) = 2.972857
> sd(Fe[ktcbodyFetrimmed$Type=="KTC-BUF-CA"]) = 0.05618846

> mean(Fe[ktcbodyFetrimmed$Type=="Brittle"]) = 3.025882
> sd(Fe[ktcbodyFetrimmed$Type=="Brittle"]) = 1.242976

> mean(Fe[ktcbodyFetrimmed$Type=="KTC-BRI-08 (A)"]) = 4.165
> sd(Fe[ktcbodyFetrimmed$Type=="KTC-BRI-08 (A)"]) = 0.06363961

> mean(Fe[ktcbodyFetrimmed$Type=="Mercury jar"]) = 2.28825
> sd(Fe[ktcbodyFetrimmed$Type=="Mercury jar"]) = 0.3147395

> mean(Fe[ktcbodyFetrimmed$Type=="KTC-MER-05 (A)"]) = 3.255
> sd(Fe[ktcbodyFetrimmed$Type=="KTC-MER-05 (A)"]) = 0.1132843

> mean(Fe[ktcbodyFetrimmed$Type=="KTC-MER-D"]) = 3.5975
> sd(Fe[ktcbodyFetrimmed$Type=="KTC-MER-D"]) = 0.1763283

> mean(Fe[ktcbodyFetrimmed$Type=="Tempered jar"]) = 2.522105
> sd(Fe[ktcbodyFetrimmed$Type=="Tempered jar"]) = 0.3956791

> summary(aov(Fe ~ Type, data= ktcbodyFetrimmed))
             Df Sum Sq Mean Sq F value   Pr(>F)
Type          8  36.32    4.54   10.09 6.21e-11 ***
Residuals   133  59.84    0.45
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(ktcbodyFetrimmed, pairwise.t.test(x=Fe, g=Type, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Fe and Type

              Brittle Buff    KTC-BRI-08 (A) KTC-BUF-A KTC-BUF-CA KTC-MER-05 (A) KTC-MER-D Mercury jar
Buff          5.8e-08 -       -              -         -          -              -         -
KTC-BRI-08 (A) 0.02109 2.3e-05 -              -         -          -              -         -
KTC-BUF-A     0.09342 3.2e-07 0.19302        -         -          -              -         -
KTC-BUF-CA    0.84923 0.00094 0.02834        0.15343   -          -              -         -
KTC-MER-05 (A) 0.51925 0.00070 0.11958       0.59943   0.50331    -              -         -
KTC-MER-D     0.10928 2.1e-05 0.33036        0.75904   0.13970    0.47147        -         -
Mercury jar   6.0e-06 0.09553 0.00018        1.2e-05   0.01396    0.00682        0.00029   -
Tempered jar  0.00976 0.01200 0.00126        0.00103   0.13090    0.04906        0.00418   0.21301
```


Buff ware

```
> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BUF-A"]) = 3.47125
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BUF-A"]) = 0.2832686

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BUF-B"]) = 2.0325
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BUF-B"]) = 0.1510794

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BUF-C"]) = 1.79375
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BUF-C"]) = 0.2933032

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BUF-CA"]) = 2.972857
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BUF-CA"]) = 0.05618846

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BUF-D"]) = 2.121667
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BUF-D"]) = 0.1536722

> summary(aov(Fe ~ Sample, data= ktcbodyFetrimmed[Type=="Buff",]))
            Df Sum Sq Mean Sq F value Pr(>F)
Sample       4 15.669   3.917   88.14 <2e-16 ***
Residuals   34  1.511   0.044
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(ktcbodyFetrimmed[Type=="Buff",],
pairwise.t.test(x=Fe, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Fe and Sample

           KTC-BUF-A KTC-BUF-B KTC-BUF-C KTC-BUF-CA
KTC-BUF-B  6.8e-13   -         -         -
KTC-BUF-C  < 2e-16   0.0731    -         -
KTC-BUF-CA 6.2e-05   3.2e-08   1.5e-12   -
KTC-BUF-D  1.1e-15   0.4688    0.0017    6.5e-10

P value adjustment method: none
```

Brittle ware

```
> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-A"]) = 2.750833
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-A"]) = 0.2266137

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-08 (A)"]) = 4.165
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-08 (A)"]) = 0.06363961

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-B"]) = 2.793333
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-B"]) = 0.2314879

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-C"]) = 2.115
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-C"]) = 0.1646208

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-D"]) = 3.595
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-D"]) = 0.3043572
```

```
> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-E"]) = 2.36
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-E"]) = 0.1899123

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-F"]) =3.843333
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-BRI-F"]) =0.5894348

> summary(aov(Fe ~ Sample, data= ktcbodyFetrimmed[Type=="Brittle",]))
            Df Sum Sq Mean Sq F value   Pr(>F)
Sample       6 11.764  1.9607   27.46 1.67e-10 ***
Residuals   28  1.999  0.0714
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(ktcbodyFetrimmed[Type=="Brittle",],
pairwise.t.test(x=Fe, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Fe and Sample

          KTC-BRI-08 (A) KTC-BRI-A KTC-BRI-B KTC-BRI-C KTC-BRI-D KTC-BRI-E
KTC-BRI-A 1.6e-07        -         -         -         -         -
KTC-BRI-B 8.5e-07        0.7528    -         -         -         -
KTC-BRI-C 1.3e-09        0.0003    0.0005    -         -         -
KTC-BRI-D 0.0202         7.6e-06   7.3e-05   1.6e-08   -         -
KTC-BRI-E 1.7e-08        0.0172    0.0180    0.2053    4.4e-07   -
KTC-BRI-F 0.1979         7.5e-07   6.1e-06   3.3e-09   0.2338    6.5e-08

P value adjustment method: none
```

Mercury jars

```
> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-A"]) = 2.260833
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-A"]) = 0.3718372

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-05 (A)"]) = 3.255
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-05 (A)"]) = 0.1132843

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-B"]) = 2.440833
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-B"]) = 0.2401688

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-C"]) = 2.256667
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-C"]) = 0.3060105

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-D"]) = 3.5975
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-D"]) = 0.1763283

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-E"]) = 2.0075
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-MER-E"]) = 0.1440775

> summary(aov(Fe ~ Sample, data= ktcbodyFetrimmed[Type=="Mercury jar",]))
            Df Sum Sq Mean Sq F value  Pr(>F)
Sample       5  9.484  1.8968   23.57 3.3e-11 ***
```



```
Residuals   42  3.379  0.0805
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(ktcbodyFetrimmed[Type=="Mercury jar",],
pairwise.t.test(x=Fe, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Fe and Sample

          KTC-MER-05 (A) KTC-MER-A KTC-MER-B KTC-MER-C KTC-MER-D
KTC-MER-A 3.1e-07        -         -         -         -
KTC-MER-B 1.2e-05        0.128     -         -         -
KTC-MER-C 2.9e-07        0.971     0.119     -         -
KTC-MER-D 0.095          3.3e-10   1.2e-08   3.1e-10   -
KTC-MER-E 1.9e-07        0.129     0.011     0.136     7.1e-10

P value adjustment method: none
```

Tempered jars

```
> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-TMP-A"]) = 2.286667
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-TMP-A"]) =  0.3286842

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-TMP-B"]) =  2.07
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-TMP-B"]) =0.2299275

> mean(Fe[ktcbodyFetrimmed$Sample=="KTC-TMP-C"]) = 2.731667
> sd(Fe[ktcbodyFetrimmed$Sample=="KTC-TMP-C"]) = 0.291168

> summary(aov(Fe ~ Sample, data= ktcbodyFetrimmed[Type=="Tempered jar",]))
            Df Sum Sq Mean Sq F value  Pr(>F)
Sample       2  1.511  0.7554   9.246 0.00214 **
Residuals   16  1.307  0.0817
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(ktcbodyFetrimmed[Type=="Tempered jar",],
pairwise.t.test(x=Fe, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Fe and Sample

          KTC-TMP-A KTC-TMP-B
KTC-TMP-B 0.336     -
KTC-TMP-C 0.028     0.001

P value adjustment method: none
```

KTC (K_2O)

```
> mean(K[ktcbodyKtrimmed$Type=="Buff"]) = 2.91225
> sd(K[ktcbodyKtrimmed$Type=="Buff"]) = 0.5584617

> mean(K[ktcbodyKtrimmed$Type=="Brittle"]) = 3.177105
> sd(K[ktcbodyKtrimmed$Type=="Brittle"]) = 0.4672166

> mean(K[ktcbodyKtrimmed$Type=="Mercury jar"]) = 3.204889
> sd(K[ktcbodyKtrimmed$Type=="Mercury jar"]) = 0.3958456

> mean(K[ktcbodyKtrimmed$Type=="Tempered jar"]) = 3.104737
> sd(K[ktcbodyKtrimmed$Type=="Tempered jar"]) = 0.5540594

> summary(aov(K ~ Type, data= ktcbodyKtrimmed))
             Df Sum Sq Mean Sq F value Pr(>F)
Type          3   2.13  0.7104   3.001 0.0327 *
Residuals   138  32.66  0.2367
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(ktcbodyKtrimmed,
pairwise.t.test(x=K, g=Type,
p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  K and Type

             Brittle Buff   Mercury jar
Buff         0.0176  -      -
Mercury jar  0.7958  0.0064 -
Tempered jar 0.5974  0.1578 0.4531

P value adjustment method: none
```

Buff ware

```
> mean(K[ktcbodyKtrimmed$Sample=="KTC-BUF-A"]) =  3.425
> sd(K[ktcbodyKtrimmed$Sample=="KTC-BUF-A"]) = 0.2152739

> mean(K[ktcbodyKtrimmed$Sample=="KTC-BUF-B"]) = 3.68
> sd(K[ktcbodyKtrimmed$Sample=="KTC-BUF-B"]) = 0.217409

> mean(K[ktcbodyKtrimmed$Sample=="KTC-BUF-C"]) = 2.875625
> sd(K[ktcbodyKtrimmed$Sample=="KTC-BUF-C"]) = 0.4268172

> mean(K[ktcbodyKtrimmed$Sample=="KTC-BUF-D"]) = 2.363333
> sd(K[ktcbodyKtrimmed$Sample=="KTC-BUF-D"]) =0.280627

> summary(aov(K ~ Sample, data= ktcbodyKtrimmed[Type=="Buff",]))
            Df Sum Sq Mean Sq F value   Pr(>F)
Sample       3  8.098  2.6994   23.91 1.09e-08 ***
Residuals   36  4.065  0.1129
```



```
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(ktcbodyKtrimmed[Type=="Buff",],
pairwise.t.test(x=K, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  K and Sample

          KTC-BUF-A KTC-BUF-B KTC-BUF-C
KTC-BUF-B 0.22329   -         -
KTC-BUF-C 0.00058   0.00013   -
KTC-BUF-D 4.2e-08   6.3e-08   0.00031

P value adjustment method: none
```

Brittle ware

```
> mean(K[ktcbodyKtrimmed$Sample=="KTC-BRI-A"]) = 3.176875
> sd(K[ktcbodyKtrimmed$Sample=="KTC-BRI-A"]) = 0.3708858

> mean(K[ktcbodyKtrimmed$Sample=="KTC-BRI-B"]) = 2.634286
> sd(K[ktcbodyKtrimmed$Sample=="KTC-BRI-B"]) = 0.3272541

> mean(K[ktcbodyKtrimmed$Sample=="KTC-BRI-C"]) = 3.395
> sd(K[ktcbodyKtrimmed$Sample=="KTC-BRI-C"]) = 0.3431715

> mean(K[ktcbodyKtrimmed$Sample=="KTC-BRI-D"]) = 3.4975
> sd(K[ktcbodyKtrimmed$Sample=="KTC-BRI-D"]) = 0.1811767

> mean(K[ktcbodyKtrimmed$Sample=="KTC-BRI-E"]) = 3.005
> sd(K[ktcbodyKtrimmed$Sample=="KTC-BRI-E"]) = 0.01914854

> mean(K[ktcbodyKtrimmed$Sample=="KTC-BRI-F"]) = 3.956667
> sd(K[ktcbodyKtrimmed$Sample=="KTC-BRI-F"]) = 0.3957693

> summary(aov(K ~ Sample, data= ktcbodyKtrimmed[Type=="Brittle",]))
            Df Sum Sq Mean Sq F value   Pr(>F)
Sample       5  4.605  0.9209   8.488 3.37e-05 ***
Residuals   32  3.472  0.1085
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(ktcbodyKtrimmed[Type=="Brittle",],
pairwise.t.test(x=K, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD
data:  K and Sample
          KTC-BRI-A KTC-BRI-B KTC-BRI-C KTC-BRI-D KTC-BRI-E
KTC-BRI-B 0.00096   -         -         -         -
KTC-BRI-C 0.24491   0.00084   -         -         -
KTC-BRI-D 0.09125   0.00021   0.66285   -         -
KTC-BRI-E 0.35760   0.08201   0.10380   0.04236   -
KTC-BRI-F 0.00068   1.8e-06   0.03270   0.07733   0.00064
P value adjustment method: none
```

Mercury jars

```
> mean(K[ktcbodyKtrimmed$Sample=="KTC-MER-A"]) = 3.22875
> sd(K[ktcbodyKtrimmed$Sample=="KTC-MER-A"]) = 0.5421424

> mean(K[ktcbodyKtrimmed$Sample=="KTC-MER-B"]) = 3.24
> sd(K[ktcbodyKtrimmed$Sample=="KTC-MER-B"]) = 0.2240089

> mean(K[ktcbodyKtrimmed$Sample=="KTC-MER-C"]) = 3.204
> sd(K[ktcbodyKtrimmed$Sample=="KTC-MER-C"]) = 0.3035421

> mean(K[ktcbodyKtrimmed$Sample=="KTC-MER-D"]) = 3.28
> sd(K[ktcbodyKtrimmed$Sample=="KTC-MER-D"]) = 0.5129003

> mean(K[ktcbodyKtrimmed$Sample=="KTC-MER-E"]) = 2.94
> sd(K[ktcbodyKtrimmed$Sample=="KTC-MER-E"]) = 0.1148913

> summary(aov(K ~ Sample, data= ktcbodyKtrimmed[Type=="Mercury jar",]))
            Df Sum Sq Mean Sq F value Pr(>F)
Sample       4  0.326 0.08148   0.496  0.739
Residuals   40  6.569 0.16422
> with(ktcbodyKtrimmed[Type=="Mercury jar",],
pairwise.t.test(x=K, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  K and Sample

          KTC-MER-A KTC-MER-B KTC-MER-C KTC-MER-D
KTC-MER-B 0.94      -         -         -
KTC-MER-C 0.88      0.84      -         -
KTC-MER-D 0.82      0.87      0.75      -
KTC-MER-E 0.21      0.21      0.28      0.24

P value adjustment method: none

> with(ktcbodyKtrimmed[Type=="Mercury jar",],
pairwise.t.test(x=K, g=Sample, p.adjust="holm"))

Pairwise comparisons using t tests with pooled SD

data:  K and Sample

          KTC-MER-A KTC-MER-B KTC-MER-C KTC-MER-D
KTC-MER-B 1         -         -         -
KTC-MER-C 1         1         -         -
KTC-MER-D 1         1         1         -
KTC-MER-E 1         1         1         1

P value adjustment method: holm
```


Tempered jars

```
> mean(K[ktcbodyKtrimmed$Sample=="KTC-TMP-A"]) = 3.326667
> sd(K[ktcbodyKtrimmed$Sample=="KTC-TMP-A"]) = 0.1350309

> mean(K[ktcbodyKtrimmed$Sample=="KTC-TMP-B"]) = 3.5775
> sd(K[ktcbodyKtrimmed$Sample=="KTC-TMP-B"]) = 0.1992277

> mean(K[ktcbodyKtrimmed$Sample=="KTC-TMP-C"]) = 2.891667
> sd(K[ktcbodyKtrimmed$Sample=="KTC-TMP-C"]) = 0.5864815

> summary(aov(K ~ Sample, data= ktcbodyKtrimmed[Type=="Tempered jar",]))
            Df Sum Sq Mean Sq F value Pr(>F)
Sample       2  1.587  0.7933   3.222 0.0667 .
Residuals   16  3.939  0.2462
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> with(ktcbodyKtrimmed[Type=="Tempered jar",],
pairwise.t.test(x=K, g=Sample, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  K and Sample

          KTC-TMP-A KTC-TMP-B
KTC-TMP-B 0.517     -
KTC-TMP-C 0.193     0.029

P value adjustment method: none

> with(ktcbodyKtrimmed[Type=="Tempered jar",],
pairwise.t.test(x=K, g=Sample, p.adjust="holm"))

Pairwise comparisons using t tests with pooled SD

data:  K and Sample

          KTC-TMP-A KTC-TMP-B
KTC-TMP-B 0.517     -
KTC-TMP-C 0.387     0.088

P value adjustment method: holm
```

A.2.1 Combined (Al_2O_3)

```
> summary(aov(Al ~ Type, data= combined_Al))
             Df Sum Sq Mean Sq F value Pr(>F)
Type          8   1278  159.70   42.84 <2e-16 ***
Residuals   319   1189    3.73
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(combined_Al, pairwise.t.test(x=Al, g=Type, p.adjust="none"))

                          Brittle (KTC) Brittle (STA) Brittle (STA), STA-BRI-02(B)
Brittle (STA)             0.24339       -             -
Brittle (STA), STA-BRI-02(B) 1.5e-10    3.4e-12       -
Buff (KTC)                0.82082       0.14523       2.4e-10
Buff (STA)                1.4e-06       8.1e-06       < 2e-16
Buff (STA), STA-BUF-12(C) < 2e-16       < 2e-16       < 2e-16
Mercury jar (KTC)         0.53465       0.59395       2.1e-11
Mercury jar (STA)         0.07022       0.00186       2.7e-08
Tempered jar (KTC)        6.3e-05       0.00050       1.4e-15
                          Buff (KTC) Buff (STA) Buff (STA), STA-BUF-12(C)
Brittle (STA)             -          -          -
Brittle (STA), STA-BRI-02(B) -       -          -
Buff (KTC)                -          -          -
Buff (STA)                2.0e-07    -          -
Buff (STA), STA-BUF-12(C) < 2e-16    < 2e-16    -
Mercury jar (KTC)         0.38200    6.8e-06    < 2e-16
Mercury jar (STA)         0.10329    1.3e-10    < 2e-16
Tempered jar (KTC)        2.3e-05    0.53595    < 2e-16
                          Mercury jar (KTC) Mercury jar (STA)
Brittle (STA)             -                 -
Brittle (STA), STA-BRI-02(B) -              -
Buff (KTC)                -                 -
Buff (STA)                -                 -
Buff (STA), STA-BUF-12(C) -                 -
Mercury jar (KTC)         -                 -
Mercury jar (STA)         0.01312           -
Tempered jar (KTC)        0.00025           1.1e-07

P value adjustment method: none
```


A.2.2 Combined (Fe_2O_3)

```
> summary(aov(Fe ~ Type, data= combined_Fe))
             Df Sum Sq Mean Sq F value Pr(>F)
Type         17 195.88  11.522   42.76 <2e-16 ***
Residuals   290  78.14   0.269
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(combined_Fe, pairwise.t.test(x=Fe, g=Type, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  Fe and Type


                  Brittle (KTC) Brittle (STA) Buff (KTC) Buff (STA) KTC-BRI-08(A) KTC-BUF-A
Brittle (STA)     0.00314       -             -         -          -             -
Buff (KTC)        5.3e-09       < 2e-16       -         -          -             -
Buff (STA)        1.0e-05       2.6e-15       0.01331   -          -             -
KTC-BRI-08(A)     0.00051       0.00939       3.4e-08   1.3e-06    -             -
KTC-BUF-A         0.00208       0.15040       2.4e-11   1.3e-08    0.09200       -
KTC-BUF-CA        0.52612       0.31233       1.7e-05   0.00186    0.00448       0.06459
KTC-MER-05(A)     0.12823       0.79691       1.0e-05   0.00057    0.04386       0.49686
KTC-MER-D         0.00594       0.12824       2.8e-08   3.1e-06    0.20782       0.69154
Mercury jar (KTC) 1.1e-05       1.8e-14       0.03087   0.79572    1.0e-06       1.1e-08
Mercury jar (STA) 2.7e-09       < 2e-16       0.89384   0.01434    3.7e-08       1.9e-11
STA-BRI-17(D)     0.00031       9.6e-07       0.55661   0.07336    4.0e-07       4.7e-07
STA-BRI-A         6.8e-05       4.7e-09       0.80870   0.15094    3.4e-07       3.9e-08
STA-BRI-G         < 2e-16       < 2e-16       < 2e-16   < 2e-16    1.6e-07       < 2e-16
STA-BUF-02(B)     0.00047       0.02200       4.5e-10   6.9e-08    0.42712       0.29103
STA-BUF-20(E)     0.01967       0.21416       1.3e-06   6.1e-05    0.21026       0.77891
STA-BUF-E         2.2e-08       2.8e-14       0.28596   0.00271    8.2e-09       2.4e-11
Tempered jar (KTC) 0.03676      3.8e-06       0.00112   0.14069    2.8e-05       2.0e-05
                  KTC-BUF-CA KTC-MER-05(A) KTC-MER-D Mercury jar (KTC) Mercury jar (STA)
Brittle (STA)     -          -             -         -                 -
Buff (KTC)        -          -             -         -                 -
Buff (STA)        -          -             -         -                 -
KTC-BRI-08(A)     -          -             -         -                 -
KTC-BUF-A         -          -             -         -                 -
KTC-BUF-CA        -          -             -         -                 -
KTC-MER-05(A)     0.38656    -             -         -                 -
KTC-MER-D         0.05586    0.35154       -         -                 -
Mercury jar (KTC) 0.00143    0.00045       2.4e-06   -                 -
Mercury jar (STA) 1.8e-05    1.2e-05       3.0e-08   0.03465           -
STA-BRI-17(D)     0.00053    0.00013       2.4e-06   0.09516           0.50711
STA-BRI-A         0.00047    0.00013       1.1e-06   0.20815           0.88069
STA-BRI-G         < 2e-16    < 2e-16       2.3e-16   < 2e-16           < 2e-16
STA-BUF-02(B)     0.01081    0.13335       0.56768   5.5e-08           4.6e-10
STA-BUF-20(E)     0.09659    0.42754       0.94475   4.8e-05           1.4e-06
STA-BUF-E         4.2e-06    2.4e-06       7.9e-09   0.00565           0.23180
Tempered jar (KTC) 0.05049   0.01078       0.00020   0.10699           0.00118
```

	STA-BRI-17(D)	STA-BRI-A	STA-BRI-G	STA-BUF-02(B)	STA-BUF-20(E)	STA-BUF-E
Brittle (STA)	-	-	-	-	-	-
Buff (KTC)	-	-	-	-	-	-
Buff (STA)	-	-	-	-	-	-
KTC-BRI-08(A)	-	-	-	-	-	-
KTC-BUF-A	-	-	-	-	-	-
KTC-BUF-CA	-	-	-	-	-	-
KTC-MER-05(A)	-	-	-	-	-	-
KTC-MER-D	-	-	-	-	-	-
Mercury jar (KTC)	-	-	-	-	-	-
Mercury jar (STA)	-	-	-	-	-	-
STA-BRI-17(D)	-	-	-	-	-	-
STA-BRI-A	0.49290	-	-	-	-	-
STA-BRI-G	< 2e-16	< 2e-16	-	-	-	-
STA-BUF-02(B)	1.5e-07	3.9e-08	2.1e-14	-	-	-
STA-BUF-20(E)	1.6e-05	1.5e-05	3.9e-14	0.54961	-	-
STA-BUF-E	0.90280	0.28250	< 2e-16	1.6e-10	3.0e-07	-
Tempered jar (KTC)	0.01636	0.02435	< 2e-16	9.8e-06	0.00129	0.00026

P value adjustment method: none

A.2.3 Combined (K_2O)

```
> summary(aov(K ~ Type, data= combined_K))
             Df Sum Sq Mean Sq F value Pr(>F)
Type          7  105.7  15.103   39.41 <2e-16 ***
Residuals   317  121.5   0.383
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> with(combined_K, pairwise.t.test(x=K, g=Type, p.adjust="none"))

Pairwise comparisons using t tests with pooled SD

data:  K and Type
```

	Brittle (KTC)	Brittle (STA)	Buff (KTC)	Buff (STA)
Brittle (STA)	0.917	-	-	-
Buff (KTC)	0.060	0.038	-	-
Buff (STA)	2.3e-14	< 2e-16	7.1e-09	-
Mercury jar (KTC)	0.839	0.728	0.030	< 2e-16
Mercury jar (STA)	0.242	0.222	0.581	1.1e-08
STA-BUF-06(C)	< 2e-16	< 2e-16	< 2e-16	< 2e-16
Tempered jar (KTC)	0.678	0.708	0.265	2.2e-08

	Mercury jar (KTC)	Mercury jar (STA)	STA-BUF-06(C)
Brittle (STA)	-	-	-
Buff (KTC)	-	-	-
Buff (STA)	-	-	-
Mercury jar (KTC)	-	-	-
Mercury jar (STA)	0.163	-	-
STA-BUF-06(C)	< 2e-16	< 2e-16	-
Tempered jar (KTC)	0.555	0.557	< 2e-16

P value adjustment method: none

A.3 Linear regression tests

A.3.1 MgO vs. CaO

```
Call:
lm(formula = Mg ~ Ca, data = combinedglazes_graph_KCa[1:41, ])

Residuals:
    Min      1Q  Median      3Q     Max
-1.9860 -0.2801  0.0113  0.2931  5.3728

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.75079    0.46572   1.612    0.115
Ca           0.21791    0.03815   5.713  1.3e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.063 on 39 degrees of freedom
Multiple R-squared:  0.4556,Adjusted R-squared:  0.4416
F-statistic: 32.63 on 1 and 39 DF,  p-value: 1.298e-06
```

A.3.2 P_2O_5 vs. CaO

```
Call:
lm(formula = P ~ Ca, data = combinedglazes_graph_KCa[1:41, ])

Residuals:
     Min       1Q   Median       3Q      Max
-1.25645 -0.60153 -0.05482  0.33311  1.94814

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.58518    0.35392   1.653    0.106
Ca           0.17320    0.02899   5.975 5.61e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.8076 on 39 degrees of freedom
Multiple R-squared:  0.4779,Adjusted R-squared:  0.4645
F-statistic:  35.7 on 1 and 39 DF,  p-value: 5.612e-07
```

Appendix B

Semi-Quantitative SEM Data

Sherd	Spectrum	Sample	Zoom	In sta	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total	Count
STA-MER-03	STA-MERQ-0304-01	STA-MER-B	100	Yes	0.00	0.00	20.15	73.43	0.00	3.61	0.00	0.61	0.00	2.21	100.00	30
STA-MER-03	STA-MERQ-0304-02	STA-MER-B	100	Yes	0.53	0.00	19.51	73.29	0.00	3.50	0.29	0.50	0.00	2.36	100.00	50
STA-MER-03	STA-MERQ-0304-03	STA-MER-B	100	Yes	0.56	0.00	19.71	72.77	0.00	3.77	0.00	0.70	0.00	2.50	100.00	100
STA-MER-03	STA-MERQ-0305-01	STA-MER-B	250	Yes	0.00	0.00	19.97	73.62	0.00	3.43	0.00	0.65	0.00	2.32	100.00	30
STA-MER-03	STA-MERQ-0305-02	STA-MER-B	250	Yes	0.53	0.00	19.32	73.78	0.00	3.46	0.00	0.56	0.00	2.35	100.00	50
STA-MER-03	STA-MERQ-0305-03	STA-MER-B	250	Yes	0.46	0.00	19.40	73.53	0.00	3.42	0.31	0.52	0.00	2.37	100.00	100
STA-MER-03	STA-MERQ-0306-01	STA-MER-B	250	Yes	0.00	0.00	18.78	73.84	0.00	3.89	0.40	0.69	0.00	2.40	100.00	30
STA-MER-03	STA-MERQ-0306-02	STA-MER-B	250	Yes	0.47	0.00	18.82	73.41	0.00	3.93	0.34	0.61	0.00	2.41	100.00	50
STA-MER-03	STA-MERQ-0306-03	STA-MER-B	250	Yes	0.52	0.00	18.96	73.70	0.00	3.82	0.32	0.34	0.00	2.34	100.00	100
STA-MER-03	STA-MERQ-0307-01	STA-MER-B	250	Yes	0.55	0.00	20.07	73.08	0.00	3.18	0.00	0.89	0.00	2.23	100.00	30
STA-MER-03	STA-MERQ-0307-02	STA-MER-B	250	Yes	0.46	0.00	20.21	73.10	0.00	3.32	0.00	0.74	0.00	2.17	100.00	50
STA-MER-03	STA-MERQ-0307-03	STA-MER-B	250	Yes	0.44	0.34	20.12	72.74	0.00	3.24	0.23	0.82	0.00	2.06	100.00	100
STA-MER-04	STA-MERQ-0408-01	STA-MER-B	100	Yes	0.00	0.00	20.04	74.52	0.00	3.29	0.00	0.00	0.00	2.15	100.00	30
STA-MER-04	STA-MERQ-0408-02	STA-MER-B	100	Yes	0.00	0.00	20.37	73.96	0.00	3.27	0.00	0.51	0.00	1.88	100.00	50
STA-MER-04	STA-MERQ-0408-03	STA-MER-B	100	Yes	0.34	0.32	20.31	73.01	0.00	3.14	0.26	0.47	0.00	2.13	100.00	100
STA-MER-04	STA-MERQ-0409-01	STA-MER-B	250	Yes	0.00	0.00	20.76	73.57	0.00	3.16	0.00	0.60	0.00	1.91	100.00	30
STA-MER-04	STA-MERQ-0409-02	STA-MER-B	250	Yes	0.48	0.43	20.23	73.35	0.00	3.06	0.00	0.58	0.00	1.87	100.00	50
STA-MER-04	STA-MERQ-0409-03	STA-MER-B	250	Yes	0.32	0.36	20.56	72.92	0.00	3.09	0.34	0.35	0.00	2.07	100.00	100
STA-MER-04	STA-MERQ-0410-01	STA-MER-B	250	Yes	0.00	0.00	20.26	73.99	0.00	3.16	0.00	0.64	0.00	1.95	100.00	30
STA-MER-04	STA-MERQ-0410-02	STA-MER-B	250	Yes	0.37	0.00	20.47	73.46	0.00	2.98	0.30	0.55	0.00	1.87	100.00	50
STA-MER-04	STA-MERQ-0410-03	STA-MER-B	250	Yes	0.30	0.40	20.29	73.38	0.00	3.06	0.25	0.50	0.00	1.81	100.00	100
STA-MER-04	STA-MERQ-0411-01	STA-MER-B	250	Yes	0.00	0.00	20.06	74.79	0.00	3.21	0.00	0.00	0.00	1.93	100.00	30
STA-MER-04	STA-MERQ-0411-02	STA-MER-B	250	Yes	0.00	0.00	20.35	74.42	0.00	3.31	0.00	0.00	0.00	1.92	100.00	50
STA-MER-04	STA-MERQ-0411-03	STA-MER-B	250	Yes	0.36	0.32	20.05	73.71	0.00	3.11	0.24	0.38	0.00	1.84	100.00	100
STA-MER-05	STA-MERQ-0512-01	STA-MER-B	100	Yes	0.44	0.44	19.76	73.91	0.00	3.34	0.00	0.00	0.00	2.12	100.00	30
STA-MER-05	STA-MERQ-0512-02	STA-MER-B	100	Yes	0.55	0.36	20.03	72.73	0.00	3.31	0.28	0.52	0.00	2.23	100.00	50
STA-MER-05	STA-MERQ-0512-03	STA-MER-B	100	Yes	0.34	0.30	19.85	73.42	0.00	3.37	0.25	0.36	0.00	2.11	100.00	100
STA-MER-05	STA-MERQ-0513-01	STA-MER-B	250	Yes	0.00	0.00	20.26	73.71	0.00	3.18	0.00	0.68	0.00	2.17	100.00	30
STA-MER-05	STA-MERQ-0513-02	STA-MER-B	250	Yes	0.45	0.00	19.95	73.32	0.00	3.23	0.00	0.53	0.00	2.52	100.00	50
STA-MER-05	STA-MERQ-0513-03	STA-MER-B	250	Yes	0.30	0.38	20.20	73.11	0.00	3.21	0.25	0.27	0.00	2.28	100.00	100
STA-MER-05	STA-MERQ-0514-01	STA-MER-B	250	Yes	0.00	0.00	20.72	73.36	0.00	3.11	0.00	0.64	0.00	2.16	100.00	30
STA-MER-05	STA-MERQ-0514-02	STA-MER-B	250	Yes	0.00	0.42	20.59	73.00	0.00	3.10	0.00	0.54	0.00	2.34	100.00	50
STA-MER-05	STA-MERQ-0514-03	STA-MER-B	250	Yes	0.31	0.26	20.73	72.36	0.00	3.17	0.23	0.75	0.00	2.19	100.00	100
STA-MER-05	STA-MERQ-0515-01	STA-MER-B	250	Yes	0.00	0.00	20.73	73.13	0.00	3.16	0.00	0.78	0.00	2.21	100.00	30
STA-MER-05	STA-MERQ-0515-02	STA-MER-B	250	Yes	0.56	0.34	20.82	72.05	0.00	3.23	0.00	0.73	0.00	2.26	100.00	50
STA-MER-05	STA-MERQ-0515-03	STA-MER-B	250	Yes	0.38	0.37	21.00	72.05	0.00	3.10	0.24	0.70	0.00	2.16	100.00	100

Sherd	Spectrum	Sample	Count	In stat	Al.mean	Al.sd	K.mean	K.sd	Fe.mean	Fe.sd
STA-MER-03	N/A	STA-MER-B	30	Yes	19.74	0.56	3.53	0.26	2.29	0.08
STA-MER-03	N/A	STA-MER-B	50	Yes	19.47	0.50	3.55	0.23	2.32	0.09
STA-MER-03	N/A	STA-MER-B	100	Yes	19.55	0.42	3.56	0.24	2.32	0.16
STA-MER-03	N/A	STA-MER-B	Means	Yes	19.59	0.12	3.55	0.01	2.31	0.01
STA-MER-04	N/A	STA-MER-B	30	Yes	20.28	0.29	3.21	0.05	1.99	0.10
STA-MER-04	N/A	STA-MER-B	50	Yes	20.36	0.09	3.16	0.14	1.89	0.02
STA-MER-04	N/A	STA-MER-B	100	Yes	20.30	0.18	3.10	0.03	1.96	0.14
STA-MER-04	N/A	STA-MER-B	Means	Yes	20.31	0.03	3.15	0.04	1.94	0.04
STA-MER-05	N/A	STA-MER-B	30	Yes	20.37	0.40	3.20	0.09	2.17	0.03
STA-MER-05	N/A	STA-MER-B	50	Yes	20.35	0.37	3.22	0.08	2.34	0.11
STA-MER-05	N/A	STA-MER-B	100	Yes	20.45	0.45	3.21	0.10	2.19	0.06
STA-MER-05	N/A	STA-MER-B	Means	Yes	20.39	0.04	3.21	0.01	2.23	0.08
STA-MER-B	N/A	STA-MER-B	30	Yes	20.13	0.51	3.31	0.22	2.15	0.14
STA-MER-B	N/A	STA-MER-B	50	Yes	20.06	0.55	3.31	0.24	2.18	0.23
STA-MER-B	N/A	STA-MER-B	100	Yes	20.10	0.54	3.29	0.25	2.16	0.19
STA-MER-B	N/A	STA-MER-B	Means	Yes	20.09	0.03	3.30	0.01	2.16	0.01

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
STA-BRI-03	STA-BRI-0301	STA-BRI-A	250	Yes	0.00	0.00	**24.91**	66.70	0.00	**3.39**	1.37	0.79	0.00	**2.84**	100.00
STA-BRI-03	STA-BRI-0302	STA-BRI-A	100	Yes	0.00	0.37	**24.10**	67.12	0.00	**3.24**	1.25	0.82	0.00	**3.11**	100.00
STA-BRI-03	STA-BRI-0303	STA-BRI-A	250	Yes	0.57	0.37	**23.01**	70.15	0.00	**3.06**	0.34	0.50	0.00	**1.99**	100.00
STA-BRI-03	STA-BRI-0304	STA-BRI-A	250	Yes	0.35	0.34	**22.61**	70.49	0.00	**3.43**	0.34	0.53	0.00	**1.90**	100.00
STA-BRI-12	STA-BRI-1205	STA-BRI-A	100	Yes	0.68	0.46	**23.61**	68.11	0.00	**4.06**	0.45	0.62	0.00	**2.00**	100.00
STA-BRI-12	STA-BRI-1206	STA-BRI-A	250	Yes	0.78	0.52	**23.36**	67.92	0.00	**4.50**	0.41	0.43	0.00	**2.08**	100.00
STA-BRI-12	STA-BRI-1207	STA-BRI-A	250	Yes	0.68	0.43	**23.92**	67.73	0.00	**4.13**	0.25	0.53	0.00	**2.33**	100.00
STA-BRI-12	STA-BRI-1208	STA-BRI-A	250	Yes	0.75	0.58	**23.34**	67.31	0.00	**5.21**	0.40	0.59	0.00	**1.82**	100.00
STA-BRI-16	STA-BRI-1610	STA-BRI-A	250	Yes	0.41	0.51	**20.83**	72.91	0.00	**2.45**	0.39	0.42	0.00	**2.09**	100.00
STA-BRI-16	STA-BRI-1611	STA-BRI-A	250	Yes	0.29	0.56	**22.01**	71.60	0.00	**2.67**	0.24	0.59	0.00	**2.06**	100.00
STA-BRI-16	STA-BRI-1612	STA-BRI-A	250	Yes	0.34	0.52	**21.44**	72.05	0.00	**2.63**	0.30	0.58	0.00	**2.15**	100.00
STA-BRI-01	STA-BRI-0101	STA-BRI-B	100	Yes	0.40	0.28	**20.33**	71.06	-0.17	**3.09**	0.35	0.72	0.28	**3.64**	100.00
STA-BRI-01	STA-BRI-0102	STA-BRI-B	250	Yes	0.24	0.26	**21.40**	69.96	0.06	**2.84**	0.39	0.76	-0.06	**4.15**	100.00
STA-BRI-01	STA-BRI-0103	STA-BRI-B	250	Yes	0.35	0.35	**18.27**	72.17	0.22	**2.97**	0.42	0.73	0.08	**4.44**	100.00
STA-BRI-01	STA-BRI-0104	STA-BRI-B	250	Yes	0.44	0.31	**22.58**	69.93	0.30	**3.01**	0.43	0.90	-0.10	**2.21**	100.00
STA-BRI-02	STA-BRI-0219	STA-BRI-B	100	Yes	0.72	0.65	**13.97**	76.30	0.11	**2.96**	0.73	1.22	0.16	**3.18**	100.00
STA-BRI-02	STA-BRI-0220	STA-BRI-B	250	Yes	0.82	0.66	**13.92**	74.82	0.27	**2.75**	0.61	0.89	0.14	**5.13**	100.00
STA-BRI-02	STA-BRI-0221	STA-BRI-B	250	Yes	0.87	0.65	**12.56**	75.57	0.29	**2.55**	0.64	0.71	0.24	**5.93**	100.00
STA-BRI-02	STA-BRI-0222	STA-BRI-B	250	Yes	0.99	0.71	**15.31**	74.90	-0.08	**3.10**	0.48	0.80	0.22	**3.57**	100.00
STA-BRI-04	STA-BRI-0401	STA-BRI-C	100	Yes	0.44	0.31	**20.91**	69.87	0.09	**3.96**	0.41	0.64	0.04	**3.31**	100.00
STA-BRI-04	STA-BRI-0402	STA-BRI-C	250	Yes	0.51	0.36	**21.33**	69.09	0.01	**3.69**	0.74	0.80	0.01	**3.45**	100.00
STA-BRI-04	STA-BRI-0403	STA-BRI-C	250	Yes	0.41	0.36	**21.07**	68.90	0.23	**3.60**	0.53	0.58	0.20	**4.12**	100.00
STA-BRI-04	STA-BRI-0404	STA-BRI-C	250	Yes	0.52	0.54	**21.04**	69.69	0.10	**3.77**	0.52	0.99	0.03	**2.80**	100.00
STA-BRI-06	STA-BRI-0614	STA-BRI-C	100	Yes	0.37	0.35	**20.26**	71.38	0.11	**3.11**	0.54	0.74	0.06	**3.08**	100.00
STA-BRI-06	STA-BRI-0615	STA-BRI-C	250	Yes	0.34	0.41	**20.57**	70.56	0.29	**3.58**	0.40	0.66	0.17	**3.01**	100.00
STA-BRI-06	STA-BRI-0616	STA-BRI-C	250	Yes	0.48	0.26	**21.24**	68.97	0.19	**3.49**	0.55	0.78	0.24	**3.80**	100.00
STA-BRI-06	STA-BRI-0617	STA-BRI-C	250	Yes	0.43	0.24	**20.06**	71.26	0.09	**3.57**	0.47	0.65	0.34	**2.88**	100.00
STA-BRI-13	STA-BRI-1331	STA-BRI-C	100	Yes	0.47	0.36	**20.81**	70.74	0.10	**3.40**	0.39	0.58	0.17	**2.99**	100.00
STA-BRI-13	STA-BRI-1332	STA-BRI-C	250	Yes	0.47	0.35	**21.58**	68.99	0.19	**3.75**	0.32	0.73	0.01	**3.59**	100.00
STA-BRI-13	STA-BRI-1333	STA-BRI-C	250	Yes	0.55	0.35	**20.61**	69.85	0.02	**3.38**	0.50	0.77	0.02	**3.95**	100.00
STA-BRI-13	STA-BRI-1334	STA-BRI-C	250	Yes	0.47	0.52	**21.65**	69.02	0.20	**3.51**	0.37	0.94	0.10	**3.20**	100.00
STA-BRI-05	STA-BRI-0501	STA-BRI-D	100	Yes	0.34	0.00	**20.32**	71.06	0.00	**3.49**	0.37	0.93	0.00	**3.49**	100.00
STA-BRI-05	STA-BRI-0502	STA-BRI-D	250	Yes	0.43	0.32	**21.15**	67.92	0.00	**3.79**	0.59	1.31	0.00	**4.49**	100.00
STA-BRI-05	STA-BRI-0503	STA-BRI-D	250	Yes	0.40	0.37	**21.55**	69.89	0.00	**3.59**	0.47	1.13	0.00	**2.61**	100.00
STA-BRI-05	STA-BRI-0504	STA-BRI-D	250	Yes	0.43	0.00	**21.47**	69.77	0.00	**3.86**	0.51	0.75	0.00	**3.22**	100.00

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
STA-BRI-14	STA-BRI-1421	STA-BRI-D	100	Yes	0.73	0.44	**20.36**	70.50	0.00	**3.67**	0.33	0.84	0.00	**3.13**	100.00
STA-BRI-14	STA-BRI-1422	STA-BRI-D	250	Yes	0.88	0.42	**20.32**	71.17	0.00	**3.96**	0.00	0.65	0.00	**2.59**	100.00
STA-BRI-14	STA-BRI-1423	STA-BRI-D	250	Yes	0.50	0.54	**20.44**	71.25	0.00	**3.43**	0.00	0.74	0.00	**3.10**	100.00
STA-BRI-14	STA-BRI-1424	STA-BRI-D	250	Yes	0.58	0.47	**19.82**	72.14	0.00	**4.17**	0.00	0.54	0.00	**2.28**	100.00
STA-BRI-15	STA-BRI-1543	STA-BRI-D	100	Yes	0.36	0.30	**19.56**	72.71	0.00	**3.27**	0.00	0.64	0.00	**3.17**	100.00
STA-BRI-15	STA-BRI-1544	STA-BRI-D	250	Yes	0.27	0.40	**18.83**	74.54	0.00	**3.27**	0.00	0.00	0.00	**2.70**	100.00
STA-BRI-15	STA-BRI-1545	STA-BRI-D	250	Yes	0.32	0.35	**20.28**	72.13	0.00	**3.70**	0.00	0.67	0.00	**2.54**	100.00
STA-BRI-15	STA-BRI-1546	STA-BRI-D	250	Yes	0.30	0.00	**20.83**	71.88	0.00	**3.59**	0.35	0.00	0.00	**3.05**	100.00
STA-BRI-17	STA-BRI-1701	STA-BRI-D	100	Yes	0.00	0.51	**21.34**	73.98	0.00	**1.72**	0.00	0.71	0.00	**1.75**	100.00
STA-BRI-17	STA-BRI-1702	STA-BRI-D	250	Yes	0.00	0.00	**24.60**	70.38	0.00	**1.94**	0.00	1.04	0.00	**2.04**	100.00
STA-BRI-17	STA-BRI-1703	STA-BRI-D	250	Yes	0.00	0.53	**21.81**	72.49	0.00	**2.44**	0.00	1.01	0.00	**1.73**	100.00
STA-BRI-17	STA-BRI-1704	STA-BRI-D	250	Yes	0.00	0.57	**22.75**	71.37	0.00	**2.29**	0.00	1.21	0.00	**1.81**	100.00
STA-BRI-19	STA-BRI-1921	STA-BRI-D	100	Yes	0.69	0.47	**20.98**	69.58	0.00	**4.13**	0.25	0.55	0.00	**3.36**	100.00
STA-BRI-19	STA-BRI-1922	STA-BRI-D	250	Yes	0.72	0.44	**20.87**	68.98	0.00	**4.81**	0.00	0.69	0.00	**3.50**	100.00
STA-BRI-19	STA-BRI-1923	STA-BRI-D	250	Yes	0.41	0.00	**19.41**	72.97	0.00	**3.35**	0.29	0.62	0.00	**2.96**	100.00
STA-BRI-19	STA-BRI-1924	STA-BRI-D	250	Yes	0.44	0.47	**21.77**	69.17	0.00	**4.40**	0.33	0.71	0.00	**2.71**	100.00
STA-BRI-21	STA-BRI-2142	STA-BRI-D	100	Yes	0.58	0.00	**21.40**	69.58	0.00	**3.81**	0.56	0.59	0.00	**3.47**	100.00
STA-BRI-21	STA-BRI-2143	STA-BRI-D	250	Yes	0.44	0.38	**19.62**	71.64	0.00	**3.13**	0.41	0.59	0.00	**3.78**	100.00
STA-BRI-21	STA-BRI-2144	STA-BRI-D	250	Yes	0.51	0.34	**22.09**	68.63	0.00	**4.41**	0.48	0.75	0.00	**2.80**	100.00
STA-BRI-21	STA-BRI-2145	STA-BRI-D	250	Yes	0.56	0.00	**20.89**	70.35	0.00	**3.54**	0.61	0.98	0.00	**3.07**	100.00
STA-BRI-07	STA-BRI-0737	STA-BRI-E	100	Yes	0.40	0.28	**21.23**	69.10	0.15	**2.93**	1.15	0.86	0.38	**3.52**	100.00
STA-BRI-07	STA-BRI-0738	STA-BRI-E	250	Yes	0.22	0.23	**20.83**	67.21	0.29	**2.82**	1.89	1.25	0.20	**5.05**	100.00
STA-BRI-07	STA-BRI-0739	STA-BRI-E	250	Yes	0.34	0.27	**21.19**	72.13	0.15	**2.85**	0.36	0.43	0.08	**2.20**	100.00
STA-BRI-07	STA-BRI-0740	STA-BRI-E	250	Yes	0.42	0.26	**21.77**	70.29	0.24	**3.36**	0.50	0.66	0.07	**2.43**	100.00
STA-BRI-09	STA-BRI-0955	STA-BRI-F	100	Yes	0.78	0.57	**18.79**	71.60	0.18	**3.68**	0.38	0.76	0.01	**3.26**	100.00
STA-BRI-09	STA-BRI-0956	STA-BRI-F	250	Yes	1.11	0.62	**18.69**	69.96	0.01	**5.08**	0.50	0.63	-0.02	**3.41**	100.00
STA-BRI-09	STA-BRI-0957	STA-BRI-F	250	Yes	0.69	0.61	**19.88**	70.49	-0.02	**4.23**	0.41	0.55	0.02	**3.14**	100.00
STA-BRI-09	STA-BRI-0958	STA-BRI-F	250	Yes	0.80	0.47	**19.83**	70.80	0.23	**3.68**	0.34	0.59	0.35	**2.90**	100.00
STA-BRI-20	STA-BRI-2001	STA-BRI-G	100	Yes	0.23	0.43	**18.53**	73.91	0.26	**1.45**	0.23	1.00	-0.07	**4.03**	100.00
STA-BRI-20	STA-BRI-2002	STA-BRI-G	250	Yes	0.17	0.49	**17.20**	75.88	0.42	**1.32**	0.07	0.65	0.04	**3.75**	100.00
STA-BRI-20	STA-BRI-2003	STA-BRI-G	250	Yes	0.08	0.48	**17.88**	70.15	0.17	**1.25**	0.06	1.04	-0.04	**8.92**	100.00
STA-BRI-20	STA-BRI-2004	STA-BRI-G	250	Yes	0.18	0.39	**19.05**	69.87	0.00	**1.13**	0.36	0.94	0.15	**7.93**	100.00
STA-BRI-23	STA-BRI-2323	STA-BRI-G	100	Yes	0.11	0.53	**19.90**	70.36	0.17	**1.62**	0.36	1.21	-0.05	**5.80**	100.00
STA-BRI-23	STA-BRI-2324	STA-BRI-G	250	Yes	0.18	0.37	**20.23**	69.14	0.53	**1.63**	0.28	1.15	0.26	**6.23**	100.00
STA-BRI-23	STA-BRI-2325	STA-BRI-G	250	Yes	0.09	0.59	**20.16**	69.76	0.32	**1.40**	0.30	1.38	0.09	**5.90**	100.00
STA-BRI-23	STA-BRI-2326	STA-BRI-G	250	Yes	0.12	0.24	**19.32**	68.71	0.38	**1.57**	0.25	1.13	-0.09	**8.38**	100.00
STA-BRI-22	STA-BRI-2218	STA-BRI-H	100	Yes	0.25	0.44	**22.89**	70.79	0.09	**2.24**	0.23	1.24	-0.13	**1.96**	100.00
STA-BRI-22	STA-BRI-2219	STA-BRI-H	250	Yes	0.09	0.50	**22.76**	71.30	0.12	**2.21**	0.27	1.15	-0.27	**1.86**	100.00
STA-BRI-22	STA-BRI-2220	STA-BRI-H	250	Yes	0.12	0.52	**24.79**	69.22	0.27	**2.10**	0.06	0.95	-0.03	**2.01**	100.00

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
STA-BRI-22	STA-BRI-2221	STA-BRI-H	250	Yes	0.21	0.51	**25.42**	67.30	0.28	**2.16**	0.31	1.53	0.02	**2.26**	100.00

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
STA-BUF-03	STA-BUF-0301	STA-BUF-AA	100	Yes	0.11	0.60	**21.64**	71.54	0.20	**1.87**	0.31	1.07	-0.21	**2.87**	100.00
STA-BUF-03	STA-BUF-0302	STA-BUF-AA	250	Yes	0.19	0.45	**21.47**	72.51	0.09	**1.61**	0.19	0.97	-0.01	**2.53**	100.00
STA-BUF-03	STA-BUF-0303	STA-BUF-AA	250	Yes	0.17	0.25	**24.31**	69.37	0.28	**1.45**	0.36	0.97	0.22	**2.62**	100.00
STA-BUF-03	STA-BUF-0304	STA-BUF-AA	250	Yes	0.20	0.48	**24.11**	68.34	0.09	**2.17**	0.49	1.92	-0.15	**2.34**	100.00
STA-BUF-05	STA-BUF-0518	STA-BUF-AA	100	Yes	0.08	0.46	**25.99**	66.35	0.30	**2.60**	0.31	1.28	0.02	**2.58**	100.00
STA-BUF-05	STA-BUF-0519	STA-BUF-AA	250	Yes	0.22	0.59	**26.56**	66.46	0.19	**2.43**	0.26	1.16	0.00	**2.14**	100.00
STA-BUF-05	STA-BUF-0520	STA-BUF-AA	250	Yes	0.15	0.56	**25.09**	68.36	0.09	**2.27**	0.36	1.23	-0.41	**2.30**	100.00
STA-BUF-05	STA-BUF-0521	STA-BUF-AA	250	Yes	0.24	0.63	**25.54**	67.33	0.04	**2.43**	0.28	0.88	0.21	**2.40**	100.00
STA-BUF-07	STA-BUF-0737	STA-BUF-AA	100	Yes	0.18	0.65	**24.02**	69.41	0.18	**2.44**	0.24	1.01	-0.19	**2.07**	100.00
STA-BUF-07	STA-BUF-0738	STA-BUF-AA	250	Yes	0.16	0.65	**25.20**	67.26	0.54	**2.60**	0.32	0.88	-0.05	**2.45**	100.00
STA-BUF-07	STA-BUF-0739	STA-BUF-AA	250	Yes	0.21	0.77	**22.65**	68.24	0.14	**2.40**	0.28	0.77	0.00	**4.55**	100.00
STA-BUF-07	STA-BUF-0740	STA-BUF-AA	250	Yes	0.12	0.77	**24.06**	69.10	0.06	**2.60**	0.18	1.02	0.09	**2.00**	100.00
STA-BUF-11	STA-BUF-1157	STA-BUF-AA	100	Yes	0.11	0.57	**22.08**	71.97	0.29	**2.12**	0.24	0.86	-0.19	**1.96**	100.00
STA-BUF-11	STA-BUF-1158	STA-BUF-AA	250	Yes	0.18	0.59	**22.96**	69.38	0.01	**3.43**	0.44	1.16	0.31	**1.54**	100.00
STA-BUF-11	STA-BUF-1159	STA-BUF-AA	250	Yes	0.19	0.35	**20.63**	69.51	0.12	**2.79**	0.48	0.76	0.22	**4.94**	100.00
STA-BUF-11	STA-BUF-1160	STA-BUF-AA	250	Yes	0.21	0.63	**21.85**	70.31	0.01	**2.16**	0.17	0.83	-0.06	**3.89**	100.00
STA-BUF-01	STA-BUF-0101	STA-BUF-AB	100	Yes	0.09	0.61	**25.51**	67.52	0.00	**2.63**	0.29	1.21	-0.07	**2.20**	100.00
STA-BUF-01	STA-BUF-0102	STA-BUF-AB	250	Yes	0.07	0.50	**25.01**	66.94	0.10	**2.61**	0.23	1.39	-0.25	**3.40**	100.00
STA-BUF-01	STA-BUF-0103	STA-BUF-AB	250	Yes	0.24	0.65	**25.34**	67.28	0.11	**2.63**	0.27	1.18	0.06	**2.26**	100.00
STA-BUF-01	STA-BUF-0104	STA-BUF-AB	250	Yes	0.20	0.55	**25.20**	67.12	0.24	**2.53**	0.40	1.41	-0.09	**2.42**	100.00
STA-BUF-04	STA-BUF-0424	STA-BUF-AB	100	Yes	0.02	0.54	**23.85**	69.03	0.17	**2.06**	0.32	0.93	0.04	**3.04**	100.00
STA-BUF-04	STA-BUF-0425	STA-BUF-AB	250	Yes	0.12	0.48	**23.05**	69.91	0.19	**2.11**	0.17	1.32	-0.05	**2.70**	100.00
STA-BUF-04	STA-BUF-0426	STA-BUF-AB	250	Yes	0.20	0.57	**28.23**	64.06	0.06	**1.91**	0.42	1.51	0.07	**2.97**	100.00
STA-BUF-04	STA-BUF-0427	STA-BUF-AB	250	Yes	0.11	0.65	**24.20**	68.17	0.05	**2.38**	0.23	1.51	-0.11	**2.79**	100.00
STA-BUF-02	STA-BUF-0201	STA-BUF-B	95	Yes	0.54	0.43	**22.35**	68.66	-0.04	**3.07**	0.34	0.82	0.13	**3.71**	100.00
STA-BUF-02	STA-BUF-0202	STA-BUF-B	250	Yes	0.37	0.37	**22.25**	68.79	0.28	**3.16**	0.36	0.61	0.18	**3.64**	100.00
STA-BUF-02	STA-BUF-0203	STA-BUF-B	250	Yes	0.52	0.24	**22.46**	68.61	-0.16	**3.35**	0.24	0.66	-0.03	**4.12**	100.00
STA-BUF-02	STA-BUF-0204	STA-BUF-B	250	Yes	0.49	0.33	**22.75**	67.76	0.25	**3.49**	0.35	0.63	0.18	**3.76**	100.00
STA-BUF-10	STA-BUF-1021	STA-BUF-B	100	Yes	0.20	0.53	**23.40**	69.78	0.18	**2.28**	0.19	1.17	0.06	**2.21**	100.00
STA-BUF-10	STA-BUF-1022	STA-BUF-B	250	Yes	0.06	0.62	**24.64**	67.49	0.36	**2.64**	0.24	1.21	-0.14	**2.89**	100.00
STA-BUF-10	STA-BUF-1023	STA-BUF-B	250	Yes	0.19	0.70	**26.01**	66.64	0.15	**2.28**	0.17	1.62	0.04	**2.21**	100.00
STA-BUF-10	STA-BUF-1024	STA-BUF-B	250	Yes	0.15	0.55	**21.01**	71.53	0.18	**2.16**	0.20	2.47	0.05	**1.70**	100.00
STA-BUF-06	STA-BUF-0601	STA-BUF-C	100	Yes	0.53	0.32	**17.65**	72.11	0.11	**6.72**	0.28	0.17	0.24	**1.88**	100.00
STA-BUF-06	STA-BUF-0602	STA-BUF-C	250	Yes	0.37	0.28	**17.70**	71.52	0.29	**7.20**	0.16	0.41	0.08	**1.98**	100.00
STA-BUF-06	STA-BUF-0603	STA-BUF-C	250	Yes	0.56	0.27	**16.81**	73.44	0.27	**6.54**	0.19	0.32	0.06	**1.54**	100.00
STA-BUF-06	STA-BUF-0604	STA-BUF-C	250	Yes	0.38	0.27	**17.16**	72.84	0.38	**5.94**	0.34	0.56	0.18	**1.96**	100.00

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
STA-BUF-12	STA-BUF-1226	STA-BUF-C	100	Yes	0.07	0.85	**34.16**	56.35	0.00	**2.36**	0.64	1.55	0.06	**3.96**	100.00
STA-BUF-12	STA-BUF-1227	STA-BUF-C	250	Yes	0.11	0.71	**35.03**	55.02	0.23	**2.21**	0.63	2.32	0.03	**3.70**	100.00
STA-BUF-12	STA-BUF-1228	STA-BUF-C	250	Yes	0.09	0.69	**38.93**	53.63	0.09	**1.29**	1.12	1.29	0.08	**2.80**	100.00
STA-BUF-12	STA-BUF-1229	STA-BUF-C	250	Yes	0.19	0.64	**32.97**	59.39	0.22	**2.00**	0.49	1.58	0.00	**2.53**	100.00
STA-BUF-13	STA-BUF-1346	STA-BUF-C	100	Yes	0.49	0.34	**21.83**	70.96	-0.05	**3.33**	0.28	0.52	0.05	**2.26**	100.00
STA-BUF-13	STA-BUF-1347	STA-BUF-C	250	Yes	0.40	0.41	**21.51**	71.31	0.00	**3.18**	0.30	0.85	-0.13	**2.18**	100.00
STA-BUF-13	STA-BUF-1348	STA-BUF-C	250	Yes	0.47	0.33	**22.32**	69.76	0.26	**2.93**	0.39	1.03	-0.03	**2.54**	100.00
STA-BUF-13	STA-BUF-1349	STA-BUF-C	250	Yes	0.41	0.29	**21.41**	70.85	0.17	**3.24**	0.45	0.68	0.06	**2.44**	100.00
STA-BUF-09	STA-BUF-0901	STA-BUF-D	100	Yes	0.09	0.55	**22.12**	71.40	0.24	**2.02**	0.30	1.19	-0.14	**2.21**	100.00
STA-BUF-09	STA-BUF-0902	STA-BUF-D	250	Yes	0.09	0.81	**21.45**	72.23	0.25	**2.02**	0.35	0.91	0.02	**1.87**	100.00
STA-BUF-09	STA-BUF-0903	STA-BUF-D	250	Yes	0.15	0.63	**22.93**	69.86	0.25	**1.95**	0.18	1.82	0.13	**2.10**	100.00
STA-BUF-09	STA-BUF-0904	STA-BUF-D	250	Yes	0.04	0.62	**23.52**	69.18	0.08	**1.82**	0.32	1.38	0.08	**2.96**	100.00
STA-BUF-15	STA-BUF-1514	STA-BUF-D	100	Yes	0.08	0.64	**22.92**	70.48	0.35	**2.18**	0.23	1.09	-0.20	**2.24**	100.00
STA-BUF-15	STA-BUF-1515	STA-BUF-D	250	Yes	0.12	0.59	**20.54**	73.35	0.19	**1.91**	0.17	0.98	0.06	**2.09**	100.00
STA-BUF-15	STA-BUF-1517	STA-BUF-D	250	Yes	0.03	0.61	**26.04**	66.36	0.30	**2.05**	0.16	1.52	-0.11	**3.05**	100.00
STA-BUF-15	STA-BUF-1518	STA-BUF-D	250	Yes	0.12	0.56	**23.63**	68.86	0.22	**2.30**	0.26	1.42	-0.01	**2.63**	100.00
STA-BUF-16	STA-BUF-1625	STA-BUF-D	100	Yes	0.15	0.55	**19.37**	74.65	-0.10	**1.70**	0.46	1.31	0.04	**1.88**	100.00
STA-BUF-16	STA-BUF-1626	STA-BUF-D	250	Yes	0.07	0.62	**18.68**	75.59	0.15	**1.61**	0.44	1.34	-0.23	**1.73**	100.00
STA-BUF-16	STA-BUF-1627	STA-BUF-D	250	Yes	0.06	0.54	**18.44**	73.98	0.13	**1.36**	0.40	1.23	0.15	**3.71**	100.00
STA-BUF-16	STA-BUF-1628	STA-BUF-D	250	Yes	0.22	0.53	**20.89**	72.91	0.37	**1.63**	0.32	1.41	0.09	**1.65**	100.00
STA-BUF-14	STA-BUF-1403	STA-BUF-E	100	Yes	-0.10	0.75	**26.03**	68.08	0.19	**2.20**	0.17	0.74	-0.02	**1.96**	100.00
STA-BUF-14	STA-BUF-1404	STA-BUF-E	250	Yes	0.26	0.51	**26.64**	66.84	0.02	**2.32**	0.26	1.09	-0.15	**2.20**	100.00
STA-BUF-14	STA-BUF-1405	STA-BUF-E	250	Yes	0.28	0.63	**24.94**	68.43	0.14	**2.40**	0.36	1.14	-0.13	**1.82**	100.00
STA-BUF-14	STA-BUF-1406	STA-BUF-E	250	Yes	0.24	0.46	**26.64**	67.76	0.03	**2.34**	0.20	1.05	0.14	**1.15**	100.00
STA-BUF-17	STA-BUF-1722	STA-BUF-E	100	Yes	0.28	0.37	**19.90**	74.81	0.23	**1.63**	0.16	0.80	0.00	**1.81**	100.00
STA-BUF-17	STA-BUF-1723	STA-BUF-E	250	Yes	0.24	0.45	**18.44**	77.36	-0.03	**1.57**	0.29	0.47	-0.04	**1.24**	100.00
STA-BUF-17	STA-BUF-1724	STA-BUF-E	250	Yes	0.08	0.63	**20.82**	73.22	0.20	**1.89**	0.43	1.05	0.07	**1.60**	100.00
STA-BUF-17	STA-BUF-1725	STA-BUF-E	250	Yes	0.09	0.40	**18.63**	76.58	0.06	**1.66**	0.09	1.30	-0.06	**1.25**	100.00
STA-BUF-18	STA-BUF-1840	STA-BUF-E	100	Yes	0.27	0.53	**23.17**	69.51	0.33	**2.50**	0.47	1.01	0.09	**2.12**	100.00
STA-BUF-18	STA-BUF-1841	STA-BUF-E	250	Yes	0.13	0.55	**20.79**	72.06	0.31	**2.41**	0.35	1.09	-0.16	**2.48**	100.00
STA-BUF-18	STA-BUF-1844	STA-BUF-E	250	Yes	0.19	0.42	**22.74**	69.06	-0.02	**2.06**	0.38	1.19	0.18	**3.80**	100.00
STA-BUF-18	STA-BUF-1845	STA-BUF-E	250	Yes	0.17	0.61	**22.28**	71.09	-0.02	**2.23**	0.41	1.01	0.11	**2.12**	100.00
STA-BUF-20	STA-BUF-2060	STA-BUF-E	100	Yes	0.25	0.43	**25.04**	66.16	0.35	**2.06**	0.16	1.28	0.23	**4.04**	100.00
STA-BUF-20	STA-BUF-2061	STA-BUF-E	250	Yes	0.23	0.37	**24.02**	65.06	0.29	**1.77**	0.18	1.20	0.13	**6.74**	100.00
STA-BUF-20	STA-BUF-2062	STA-BUF-E	250	Yes	0.18	0.38	**24.26**	68.02	0.35	**1.91**	0.32	1.36	0.03	**3.20**	100.00
STA-BUF-20	STA-BUF-2063	STA-BUF-E	250	Yes	0.19	0.36	**23.13**	68.85	0.19	**1.95**	0.26	1.36	0.24	**3.47**	100.00

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
STA-BUF-08	STA-BUF-0838	STA-BUF-F	100	Yes	0.30	0.67	**21.58**	71.91	-0.07	**2.04**	0.40	1.18	0.01	**1.98**	100.00
STA-BUF-08	STA-BUF-0839	STA-BUF-F	250	Yes	0.23	0.57	**21.47**	70.90	0.43	**2.19**	0.21	1.23	-0.06	**2.84**	100.00
STA-BUF-08	STA-BUF-0840	STA-BUF-F	250	Yes	0.15	0.62	**20.91**	71.58	0.38	**2.13**	0.28	1.10	0.10	**2.73**	100.00
STA-BUF-08	STA-BUF-0841	STA-BUF-F	250	Yes	0.24	0.57	**20.64**	72.58	0.01	**1.91**	0.26	1.12	-0.16	**2.82**	100.00
STA-BUF-19	STA-BUF-1901	STA-BUF-G	100	Yes	0.08	0.52	**20.02**	74.22	0.10	**1.02**	0.30	1.25	0.06	**2.43**	100.00
STA-BUF-19	STA-BUF-1902	STA-BUF-G	250	Yes	0.37	0.56	**18.90**	73.11	0.29	**1.31**	0.39	1.03	0.20	**3.84**	100.00
STA-BUF-19	STA-BUF-1903	STA-BUF-G	250	Yes	0.10	0.38	**21.84**	73.04	0.11	**0.59**	0.31	1.82	0.13	**1.68**	100.00
STA-BUF-19	STA-BUF-1904	STA-BUF-G	250	Yes	0.06	0.45	**21.99**	72.69	0.04	**0.81**	0.48	1.29	-0.08	**2.27**	100.00
STA-MER-10	STA-MER-1002	STA-MER-A	250	Yes	0.41	0.50	**20.60**	71.53	0.50	**2.67**	0.31	0.77	-0.02	**2.75**	100.00
STA-MER-10	STA-MER-1003	STA-MER-A	250	Yes	0.50	0.34	**20.18**	72.38	0.03	**2.52**	0.44	0.95	0.34	**2.32**	100.00
STA-MER-10	STA-MER-1004	STA-MER-A	250	Yes	0.37	0.11	**21.09**	71.64	0.33	**2.79**	0.26	0.77	0.19	**2.46**	100.00
STA-MER-11	STA-MER-1124	STA-MER-A	250	Yes	0.38	0.39	**19.08**	73.90	0.26	**3.09**	0.38	0.80	0.09	**1.63**	100.00
STA-MER-11	STA-MER-1125	STA-MER-A	250	Yes	0.34	0.45	**19.20**	73.81	0.19	**3.00**	0.44	0.58	-0.09	**2.08**	100.00
STA-MER-11	STA-MER-1126	STA-MER-A	250	Yes	0.39	0.37	**19.57**	73.89	0.08	**3.25**	0.28	0.36	0.01	**1.79**	100.00
STA-MER-16	STA-MER-1642	STA-MER-A	250	Yes	0.59	0.19	**21.88**	68.43	0.47	**5.30**	0.34	0.43	0.47	**1.90**	100.00
STA-MER-16	STA-MER-1643	STA-MER-A	250	Yes	0.42	0.56	**21.40**	71.99	0.08	**3.36**	0.41	0.11	-0.12	**1.80**	100.00
STA-MER-16	STA-MER-1644	STA-MER-A	250	Yes	0.23	0.43	**20.00**	73.32	0.22	**2.95**	0.41	0.68	-0.12	**1.89**	100.00
STA-MER-22	STA-MER-2262	STA-MER-A	250	Yes	0.57	0.41	**20.82**	71.67	0.17	**4.04**	0.29	0.50	-0.12	**1.64**	100.00
STA-MER-22	STA-MER-2266	STA-MER-A	250	Yes	0.38	0.34	**21.00**	72.62	-0.01	**2.58**	0.32	0.57	0.10	**2.11**	100.00
STA-MER-22	STA-MER-2267	STA-MER-A	250	Yes	0.29	0.30	**20.47**	73.22	0.17	**2.85**	0.35	0.52	0.06	**1.78**	100.00
STA-MER-03	STA-MER-0302	STA-MER-B	250	Yes	0.48	0.27	**19.58**	72.05	0.23	**3.27**	0.29	0.59	0.14	**3.11**	100.00
STA-MER-03	STA-MER-0303	STA-MER-B	250	Yes	0.53	0.34	**19.85**	71.73	0.34	**3.11**	0.33	0.91	0.11	**2.75**	100.00
STA-MER-03	STA-MER-0304	STA-MER-B	250	Yes	0.44	0.28	**19.67**	72.81	0.19	**3.37**	0.24	0.53	0.07	**2.40**	100.00
STA-MER-04	STA-MER-0427	STA-MER-B	250	Yes	0.31	0.35	**19.75**	73.44	0.24	**2.91**	0.23	0.43	0.17	**2.17**	100.00
STA-MER-04	STA-MER-0428	STA-MER-B	250	Yes	0.32	0.25	**19.80**	73.56	0.27	**3.04**	0.15	0.51	0.07	**2.02**	100.00
STA-MER-04	STA-MER-0429	STA-MER-B	250	Yes	0.27	0.32	**20.27**	73.31	0.19	**2.96**	0.17	0.58	0.14	**1.80**	100.00
STA-MER-05	STA-MER-0544	STA-MER-B	250	Yes	0.43	0.25	**19.60**	73.33	0.27	**3.16**	0.21	0.48	0.19	**2.10**	100.00
STA-MER-05	STA-MER-0545	STA-MER-B	250	Yes	0.34	0.23	**19.94**	73.29	0.18	**2.96**	0.18	0.50	0.23	**2.14**	100.00
STA-MER-05	STA-MER-0546	STA-MER-B	250	Yes	0.40	0.39	**18.24**	75.75	0.27	**2.53**	0.20	0.21	0.04	**1.96**	100.00
STA-MER-05	STA-MER-0547	STA-MER-B	250	Yes	0.54	0.32	**19.71**	72.74	0.18	**4.01**	0.17	0.38	0.14	**1.81**	100.00
STA-MER-02	STA-MER-0202	STA-MER-C	250	Yes	0.45	0.28	**19.75**	72.83	0.26	**3.02**	0.29	0.40	0.21	**2.50**	100.00
STA-MER-02	STA-MER-0203	STA-MER-C	250	Yes	0.44	0.29	**19.37**	73.66	0.21	**2.98**	0.23	0.45	-0.01	**2.38**	100.00
STA-MER-02	STA-MER-0204	STA-MER-C	250	Yes	0.38	0.32	**19.51**	73.60	0.28	**2.88**	0.20	0.55	0.05	**2.23**	100.00
STA-MER-06	STA-MER-0618	STA-MER-C	250	Yes	0.53	0.26	**18.41**	74.76	0.29	**3.02**	0.23	0.50	0.14	**1.86**	100.00
STA-MER-06	STA-MER-0619	STA-MER-C	250	Yes	0.42	0.22	**18.96**	74.42	0.24	**2.94**	0.25	0.58	0.05	**1.91**	100.00
STA-MER-06	STA-MER-0620	STA-MER-C	250	Yes	0.46	0.41	**18.61**	73.91	0.33	**3.24**	0.32	0.55	0.26	**1.92**	100.00
STA-MER-12	STA-MER-1237	STA-MER-C	250	Yes	0.44	0.32	**18.71**	73.57	0.14	**3.32**	0.30	1.17	0.00	**2.02**	100.00
STA-MER-12	STA-MER-1238	STA-MER-C	250	Yes	0.32	0.35	**18.71**	74.60	0.23	**2.96**	0.20	0.46	0.08	**2.10**	100.00
STA-MER-12	STA-MER-1239	STA-MER-C	250	Yes	0.38	0.35	**18.59**	74.48	0.28	**3.17**	0.21	0.57	0.22	**1.75**	100.00

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
KTC-BRI-01	KTC-BRI-0101	KTC-BRI-A	100	Yes	0.47	0.00	**22.57**	70.36	0.00	**3.14**	0.00	0.69	0.00	**2.77**	100.00
KTC-BRI-01	KTC-BRI-0102	KTC-BRI-A	250	Yes	0.70	0.37	**22.38**	69.48	0.00	**3.39**	0.34	0.63	0.00	**2.69**	100.00
KTC-BRI-01	KTC-BRI-0103	KTC-BRI-A	250	Yes	0.48	0.48	**22.49**	69.98	0.00	**2.95**	0.28	0.74	0.00	**2.58**	100.00
KTC-BRI-01	KTC-BRI-0104	KTC-BRI-A	250	Yes	0.40	0.39	**21.26**	71.45	0.00	**2.96**	0.00	0.57	0.00	**2.97**	100.00
KTC-BRI-04	KTC-BRI-0407	KTC-BRI-A	100	Yes	0.39	0.54	**19.99**	72.03	0.00	**3.21**	0.00	0.79	0.00	**3.05**	100.00
KTC-BRI-04	KTC-BRI-0408	KTC-BRI-A	250	Yes	0.51	0.40	**19.11**	72.76	0.00	**3.47**	0.00	0.64	0.00	**3.11**	100.00
KTC-BRI-04	KTC-BRI-0409	KTC-BRI-A	250	Yes	0.55	0.35	**20.67**	71.60	0.00	**3.77**	0.00	0.68	0.00	**2.38**	100.00
KTC-BRI-04	KTC-BRI-0410	KTC-BRI-A	250	Yes	0.40	0.64	**20.43**	71.66	0.00	**3.09**	0.40	0.71	0.00	**2.67**	100.00
KTC-BRI-05	KTC-BRI-0515	KTC-BRI-A	100	Yes	0.36	0.38	**20.95**	71.73	0.00	**3.14**	0.38	0.51	0.00	**2.56**	100.00
KTC-BRI-05	KTC-BRI-0516	KTC-BRI-A	250	Yes	0.00	0.48	**21.82**	71.28	0.00	**2.82**	0.31	0.53	0.00	**2.76**	100.00
KTC-BRI-05	KTC-BRI-0517	KTC-BRI-A	250	Yes	0.40	0.57	**21.12**	71.55	0.00	**2.96**	0.00	0.46	0.00	**2.94**	100.00
KTC-BRI-05	KTC-BRI-0518	KTC-BRI-A	250	Yes	0.52	0.50	**21.53**	70.63	0.00	**3.44**	0.41	0.43	0.00	**2.53**	100.00
KTC-BRI-08	KTC-BRI-0823	KTC-BRI-A	100	Yes	0.35	0.41	**20.26**	70.78	0.00	**3.08**	0.31	0.61	0.00	**4.21**	100.00
KTC-BRI-08	KTC-BRI-0824	KTC-BRI-A	250	Yes	0.33	0.44	**19.71**	71.78	0.00	**2.84**	0.27	0.51	0.00	**4.12**	100.00
KTC-BRI-08	KTC-BRI-0825	KTC-BRI-A	250	Yes	0.53	0.00	**15.01**	78.48	0.00	**4.02**	0.00	0.64	0.00	**1.33**	100.00
KTC-BRI-08	KTC-BRI-0826	KTC-BRI-A	250	Yes	0.35	0.48	**21.13**	71.74	0.00	**2.55**	0.00	0.71	0.00	**3.03**	100.00
KTC-BRI-02	KTC-BRI-0201	KTC-BRI-B	100	Yes	0.43	0.44	**20.94**	71.97	0.00	**2.81**	0.27	0.71	0.00	**2.44**	100.00
KTC-BRI-02	KTC-BRI-0202	KTC-BRI-B	250	Yes	0.00	0.45	**21.73**	71.97	0.00	**2.40**	0.00	0.70	0.00	**2.76**	100.00
KTC-BRI-02	KTC-BRI-0203	KTC-BRI-B	250	Yes	0.00	0.00	**23.06**	70.03	0.00	**3.21**	0.00	0.58	0.00	**3.12**	100.00
KTC-BRI-02	KTC-BRI-0204	KTC-BRI-B	250	Yes	0.00	0.38	**19.57**	67.79	0.00	**2.47**	0.00	0.50	0.00	**9.30**	100.00
KTC-BRI-03	KTC-BRI-0305	KTC-BRI-B	100	Yes	0.35	0.43	**21.44**	71.37	0.00	**2.84**	0.36	0.51	0.00	**2.69**	100.00
KTC-BRI-03	KTC-BRI-0307	KTC-BRI-B	250	Yes	0.00	0.42	**20.59**	72.86	0.00	**2.35**	0.44	0.54	0.00	**2.80**	100.00
KTC-BRI-03	KTC-BRI-0308	KTC-BRI-B	250	Yes	0.40	0.00	**19.92**	73.37	0.00	**2.36**	0.32	0.68	0.00	**2.95**	100.00
KTC-BRI-06	KTC-BRI-0610	KTC-BRI-C	100	Yes	0.41	0.36	**20.20**	72.47	0.00	**3.32**	0.27	0.73	0.00	**2.24**	100.00
KTC-BRI-06	KTC-BRI-0611	KTC-BRI-C	250	Yes	0.36	0.00	**20.31**	73.58	0.00	**3.10**	0.00	0.63	0.00	**2.01**	100.00
KTC-BRI-06	KTC-BRI-0612	KTC-BRI-C	250	Yes	0.44	0.00	**21.29**	72.25	0.00	**3.27**	0.00	0.48	0.00	**2.27**	100.00
KTC-BRI-06	KTC-BRI-0613	KTC-BRI-C	250	Yes	0.51	0.00	**20.73**	72.36	0.00	**3.89**	0.00	0.57	0.00	**1.94**	100.00
KTC-BRI-07	KTC-BRI-0701	KTC-BRI-D	100	Yes	0.76	0.51	**17.47**	73.54	0.28	**3.52**	0.27	0.59	-0.15	**3.21**	100.00
KTC-BRI-07	KTC-BRI-0702	KTC-BRI-D	250	Yes	0.45	0.54	**18.87**	71.10	0.00	**3.66**	0.34	0.85	0.23	**3.95**	100.00
KTC-BRI-07	KTC-BRI-0703	KTC-BRI-D	250	Yes	0.46	0.66	**18.65**	71.65	0.09	**3.57**	0.25	1.06	0.04	**3.57**	100.00
KTC-BRI-07	KTC-BRI-0704	KTC-BRI-D	250	Yes	0.50	0.52	**17.78**	73.44	-0.04	**3.24**	0.17	0.74	0.01	**3.65**	100.00
KTC-BRI-09	KTC-BRI-0905	KTC-BRI-E	100	Yes	0.46	0.27	**20.58**	72.14	0.09	**2.98**	0.33	0.69	-0.10	**2.56**	100.00
KTC-BRI-09	KTC-BRI-0906	KTC-BRI-E	250	Yes	0.38	0.20	**21.04**	71.64	0.15	**3.02**	0.29	0.85	-0.01	**2.45**	100.00
KTC-BRI-09	KTC-BRI-0907	KTC-BRI-E	250	Yes	0.36	0.38	**20.45**	72.71	-0.07	**3.02**	0.16	0.59	0.08	**2.31**	100.00
KTC-BRI-09	KTC-BRI-0908	KTC-BRI-E	250	Yes	0.56	0.29	**20.98**	71.32	0.07	**3.00**	0.18	1.18	0.32	**2.12**	100.00
KTC-BRI-10	KTC-BRI-1009	KTC-BRI-F	100	Yes	0.50	0.70	**21.22**	69.14	-0.17	**3.78**	0.30	0.67	0.10	**3.76**	100.00
KTC-BRI-10	KTC-BRI-1011	KTC-BRI-F	250	Yes	0.68	0.48	**21.31**	68.30	0.21	**4.41**	0.42	0.76	0.13	**3.30**	100.00
KTC-BRI-10	KTC-BRI-1012	KTC-BRI-F	250	Yes	0.57	0.65	**21.03**	68.38	0.05	**3.68**	0.30	0.60	0.27	**4.47**	100.00
KTC-BUF-01	KTC-BUF-0101	KTC-BUF-A	100	Yes	0.56	0.00	**21.62**	70.58	0.00	**3.33**	0.00	0.55	0.00	**3.36**	100.00

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
KTC-BUF-01	KTC-BUF-0102	KTC-BUF-A	250	Yes	0.51	0.44	**21.61**	69.97	0.00	**3.58**	0.00	0.53	0.00	**3.35**	100.00
KTC-BUF-01	KTC-BUF-0103	KTC-BUF-A	250	Yes	0.47	0.42	**20.90**	70.56	0.00	**3.86**	0.00	0.66	0.00	**3.12**	100.00
KTC-BUF-01	KTC-BUF-0104	KTC-BUF-A	250	Yes	0.48	0.40	**20.61**	71.91	0.00	**3.49**	0.00	0.00	0.00	**3.12**	100.00

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
KTC-BUF-02	KTC-BUF-0207	KTC-BUF-A	100	Yes	0.00	0.50	**23.51**	67.83	0.00	**3.17**	0.35	0.84	0.00	**3.81**	100.00
KTC-BUF-02	KTC-BUF-0208	KTC-BUF-A	250	Yes	0.00	0.64	**23.56**	67.33	0.00	**3.29**	0.36	0.98	0.00	**3.84**	100.00
KTC-BUF-02	KTC-BUF-0209	KTC-BUF-A	250	Yes	0.00	0.76	**22.30**	67.57	0.00	**3.35**	0.62	1.74	0.00	**3.66**	100.00
KTC-BUF-02	KTC-BUF-0210	KTC-BUF-A	250	Yes	0.00	0.45	**24.47**	66.56	0.00	**3.33**	0.37	1.31	0.00	**3.51**	100.00
KTC-BUF-03	KTC-BUF-0311	KTC-BUF-B	100	Yes	0.43	0.47	**22.99**	69.69	0.00	**3.55**	0.36	0.58	0.00	**1.93**	100.00
KTC-BUF-03	KTC-BUF-0312	KTC-BUF-B	250	Yes	0.51	0.00	**22.98**	69.79	0.00	**3.45**	0.37	0.84	0.00	**2.07**	100.00
KTC-BUF-03	KTC-BUF-0313	KTC-BUF-B	250	Yes	0.45	0.44	**24.21**	67.93	0.00	**3.92**	0.48	0.67	0.00	**1.90**	100.00
KTC-BUF-03	KTC-BUF-0314	KTC-BUF-B	250	Yes	0.00	0.51	**24.91**	67.35	0.00	**3.80**	0.37	0.83	0.00	**2.23**	100.00
KTC-BUF-04	KTC-BUF-0401	KTC-BUF-C	100	Yes	0.00	0.57	**20.61**	72.54	0.00	**2.34**	0.00	0.98	0.00	**2.95**	100.00
KTC-BUF-04	KTC-BUF-0402	KTC-BUF-C	250	Yes	0.00	0.68	**20.27**	72.62	0.00	**2.34**	0.00	1.12	0.00	**2.97**	100.00
KTC-BUF-04	KTC-BUF-0403	KTC-BUF-C	250	Yes	0.00	0.61	**21.93**	71.12	0.00	**2.61**	0.00	0.78	0.00	**2.94**	100.00
KTC-BUF-04	KTC-BUF-0404	KTC-BUF-C	250	Yes	0.00	0.61	**20.59**	72.00	0.00	**2.24**	0.00	1.13	0.00	**3.43**	100.00
KTC-BUF-05	KTC-BUF-0509	KTC-BUF-C	100	Yes	0.68	0.48	**16.55**	76.97	0.00	**2.59**	0.53	0.63	0.00	**1.58**	100.00
KTC-BUF-05	KTC-BUF-0510	KTC-BUF-C	250	Yes	0.62	0.50	**16.23**	77.53	0.00	**2.56**	0.44	0.60	0.00	**1.52**	100.00
KTC-BUF-05	KTC-BUF-0511	KTC-BUF-C	250	Yes	0.68	0.50	**16.59**	76.66	0.00	**2.65**	0.69	0.52	0.00	**1.71**	100.00
KTC-BUF-05	KTC-BUF-0512	KTC-BUF-C	250	Yes	0.87	0.32	**16.04**	77.55	0.00	**2.72**	0.61	0.52	0.00	**1.37**	100.00
KTC-BUF-06	KTC-BUF-0619	KTC-BUF-C	100	Yes	0.42	0.47	**20.74**	71.36	0.00	**3.08**	0.29	0.65	0.00	**2.99**	100.00
KTC-BUF-06	KTC-BUF-0620	KTC-BUF-C	250	Yes	0.42	0.45	**21.30**	70.85	0.00	**3.09**	0.27	0.69	0.00	**2.92**	100.00
KTC-BUF-06	KTC-BUF-0621	KTC-BUF-C	250	Yes	0.33	0.41	**20.92**	71.28	0.00	**3.07**	0.24	0.79	0.00	**2.95**	100.00
KTC-BUF-06	KTC-BUF-0622	KTC-BUF-C	250	Yes	0.38	0.47	**21.36**	71.02	0.00	**2.96**	0.20	0.53	0.00	**3.09**	100.00
KTC-BUF-08	KTC-BUF-0827	KTC-BUF-C	100	Yes	0.47	0.25	**18.68**	74.38	0.00	**3.43**	0.20	0.58	0.00	**2.01**	100.00
KTC-BUF-08	KTC-BUF-0828	KTC-BUF-C	250	Yes	0.46	0.25	**19.20**	73.88	0.00	**3.47**	0.27	0.57	0.00	**1.89**	100.00
KTC-BUF-08	KTC-BUF-0829	KTC-BUF-C	250	Yes	0.46	0.34	**18.76**	74.10	0.00	**3.33**	0.30	0.63	0.00	**2.08**	100.00
KTC-BUF-08	KTC-BUF-0830	KTC-BUF-C	250	Yes	0.44	0.41	**18.19**	74.46	0.00	**3.53**	0.21	0.56	0.00	**2.19**	100.00
KTC-BUF-07	KTC-BUF-0701	KTC-BUF-D	100	Yes	0.22	0.64	**21.82**	71.15	0.00	**2.57**	0.35	1.28	0.00	**1.98**	100.00
KTC-BUF-07	KTC-BUF-0702	KTC-BUF-D	250	Yes	0.00	0.75	**22.61**	70.19	0.00	**2.78**	0.30	1.28	0.00	**2.09**	100.00
KTC-BUF-07	KTC-BUF-0703	KTC-BUF-D	250	Yes	0.00	0.56	**20.30**	73.41	0.00	**2.51**	0.19	1.13	0.00	**1.91**	100.00
KTC-BUF-07	KTC-BUF-0704	KTC-BUF-D	250	Yes	0.00	0.77	**22.09**	70.89	0.00	**2.63**	0.29	1.26	0.00	**2.07**	100.00
KTC-BUF-09	KTC-BUF-0913	KTC-BUF-D	100	Yes	0.00	0.48	**19.13**	74.80	0.00	**2.01**	0.00	1.29	0.00	**2.30**	100.00
KTC-BUF-09	KTC-BUF-0914	KTC-BUF-D	250	Yes	0.00	0.55	**18.94**	75.41	0.00	**1.91**	0.00	1.15	0.00	**2.03**	100.00
KTC-BUF-09	KTC-BUF-0915	KTC-BUF-D	250	Yes	0.00	0.59	**19.99**	73.86	0.00	**2.18**	0.20	1.16	0.00	**2.02**	100.00
KTC-BUF-09	KTC-BUF-0916	KTC-BUF-D	250	Yes	0.00	0.68	**20.05**	74.00	0.00	**2.06**	0.00	1.16	0.00	**2.06**	100.00

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
KTC-BUF-10	KTC-BUF-1025	KTC-BUF-D	100	Yes	0.00	0.53	**19.41**	74.25	0.00	**2.46**	0.24	0.93	0.00	**2.17**	100.00
KTC-BUF-10	KTC-BUF-1026	KTC-BUF-D	250	Yes	0.22	0.51	**19.30**	74.01	0.00	**2.33**	0.30	1.17	0.00	**2.16**	100.00
KTC-BUF-10	KTC-BUF-1027	KTC-BUF-D	250	Yes	0.00	0.52	**19.41**	73.74	0.00	**2.65**	0.37	1.12	0.00	**2.19**	100.00
KTC-BUF-10	KTC-BUF-1028	KTC-BUF-D	250	Yes	0.00	0.60	**17.90**	75.45	0.00	**2.27**	0.23	1.06	0.00	**2.48**	100.00
KTC-MER-02	KTC-MER-0201	KTC-MER-A	100	Yes	0.32	0.00	**19.67**	73.50	0.00	**3.39**	0.33	0.67	0.00	**2.12**	100.00
KTC-MER-02	KTC-MER-0202	KTC-MER-A	250	Yes	0.40	0.45	**19.67**	73.52	0.00	**3.34**	0.24	0.41	0.00	**1.96**	100.00
KTC-MER-02	KTC-MER-0203	KTC-MER-A	250	Yes	0.38	0.35	**19.08**	74.00	0.00	**3.06**	0.24	0.51	0.00	**2.37**	100.00
KTC-MER-02	KTC-MER-0204	KTC-MER-A	250	Yes	0.38	0.33	**18.44**	74.10	0.00	**3.78**	0.00	0.67	0.00	**2.31**	100.00
KTC-MER-04	KTC-MER-0409	KTC-MER-A	100	Yes	0.49	0.37	**21.40**	70.56	0.00	**3.38**	0.35	0.77	0.00	**2.70**	100.00
KTC-MER-04	KTC-MER-0410	KTC-MER-A	250	Yes	0.50	0.00	**19.73**	72.81	0.00	**3.25**	0.35	0.79	0.00	**2.57**	100.00
KTC-MER-04	KTC-MER-0411	KTC-MER-A	250	Yes	0.73	0.34	**20.28**	71.37	0.00	**3.63**	0.33	0.61	0.00	**2.71**	100.00
KTC-MER-04	KTC-MER-0412	KTC-MER-A	250	Yes	0.43	0.41	**21.98**	70.03	0.00	**3.38**	0.00	0.94	0.00	**2.82**	100.00
KTC-MER-05	KTC-MER-0517	KTC-MER-A	100	Yes	0.47	0.00	**21.54**	71.27	0.00	**2.76**	0.33	0.50	0.00	**3.14**	100.00
KTC-MER-05	KTC-MER-0518	KTC-MER-A	250	Yes	0.42	0.00	**22.33**	70.89	0.00	**2.54**	0.00	0.61	0.00	**3.22**	100.00
KTC-MER-05	KTC-MER-0519	KTC-MER-A	250	Yes	0.49	0.00	**22.68**	69.64	0.00	**2.78**	0.34	0.66	0.00	**3.41**	100.00
KTC-MER-05	KTC-MER-0520	KTC-MER-A	250	Yes	0.35	0.33	**22.63**	70.05	0.00	**2.48**	0.30	0.61	0.00	**3.25**	100.00
KTC-MER-10	KTC-MER-1023	KTC-MER-A	100	Yes	0.43	0.32	**19.95**	73.78	0.00	**3.11**	0.00	0.35	0.00	**2.06**	100.00
KTC-MER-10	KTC-MER-1024	KTC-MER-A	250	Yes	0.34	0.32	**20.26**	73.47	0.00	**3.20**	0.00	0.61	0.00	**1.80**	100.00
KTC-MER-10	KTC-MER-1025	KTC-MER-A	250	Yes	0.58	0.36	**19.54**	72.42	0.00	**4.72**	0.00	0.60	0.00	**1.78**	100.00
KTC-MER-10	KTC-MER-1026	KTC-MER-A	250	Yes	0.32	0.46	**18.99**	74.81	0.00	**2.86**	0.00	0.64	0.00	**1.93**	100.00
KTC-MER-09	KTC-MER-0901	KTC-MER-B	100	Yes	0.44	0.40	**21.95**	70.57	0.00	**3.13**	0.39	0.63	0.00	**2.48**	100.00
KTC-MER-09	KTC-MER-0902	KTC-MER-B	250	Yes	0.39	0.38	**22.47**	70.11	0.00	**3.15**	0.27	0.64	0.00	**2.59**	100.00
KTC-MER-09	KTC-MER-0903	KTC-MER-B	250	Yes	0.00	0.48	**21.87**	71.11	0.00	**3.29**	0.00	0.53	0.00	**2.72**	100.00
KTC-MER-09	KTC-MER-0904	KTC-MER-B	250	Yes	0.54	0.42	**21.87**	70.17	0.00	**3.69**	0.32	0.80	0.00	**2.20**	100.00
KTC-MER-16	KTC-MER-1605	KTC-MER-B	100	Yes	0.42	0.35	**20.12**	73.07	0.00	**3.16**	0.00	0.54	0.00	**2.34**	100.00
KTC-MER-16	KTC-MER-1606	KTC-MER-B	250	Yes	0.57	0.57	**21.66**	70.65	0.00	**3.23**	0.00	0.88	0.00	**2.44**	100.00
KTC-MER-16	KTC-MER-1607	KTC-MER-B	250	Yes	0.59	0.58	**22.71**	68.69	0.00	**3.30**	0.35	0.85	0.00	**2.93**	100.00
KTC-MER-16	KTC-MER-1608	KTC-MER-B	250	Yes	0.55	0.00	**22.35**	70.19	0.00	**3.53**	0.29	0.52	0.00	**2.57**	100.00
KTC-MER-18	KTC-MER-1809	KTC-MER-B	100	Yes	0.46	0.45	**19.05**	73.64	0.00	**3.28**	0.27	0.45	0.00	**2.40**	100.00
KTC-MER-18	KTC-MER-1810	KTC-MER-B	250	Yes	0.33	0.32	**19.00**	75.07	0.00	**2.92**	0.00	0.00	0.00	**2.36**	100.00
KTC-MER-18	KTC-MER-1811	KTC-MER-B	250	Yes	0.61	0.00	**19.45**	72.78	0.00	**4.25**	0.39	0.46	0.00	**2.07**	100.00
KTC-MER-18	KTC-MER-1812	KTC-MER-B	250	Yes	0.32	0.00	**18.42**	75.18	0.00	**2.96**	0.29	0.65	0.00	**2.19**	100.00
KTC-MER-06	KTC-MER-0601	KTC-MER-C	100	Yes	0.95	0.35	**21.73**	68.18	0.00	**6.11**	0.27	0.55	0.00	**1.85**	100.00
KTC-MER-06	KTC-MER-0602	KTC-MER-C	250	Yes	0.56	0.00	**22.69**	69.77	0.00	**3.89**	0.28	0.79	0.00	**2.02**	100.00
KTC-MER-06	KTC-MER-0603	KTC-MER-C	250	Yes	0.52	0.34	**22.78**	69.61	0.00	**3.34**	0.28	0.78	0.00	**2.36**	100.00
KTC-MER-06	KTC-MER-0604	KTC-MER-C	250	Yes	1.06	0.33	**21.27**	68.71	0.00	**6.24**	0.00	0.74	0.00	**1.65**	100.00
KTC-MER-11	KTC-MER-1105	KTC-MER-C	100	Yes	0.56	0.00	**23.48**	68.97	0.00	**3.17**	0.34	0.75	0.00	**2.73**	100.00
KTC-MER-11	KTC-MER-1106	KTC-MER-C	250	Yes	0.41	0.42	**21.73**	70.84	0.00	**2.81**	0.37	1.23	0.00	**2.19**	100.00
KTC-MER-11	KTC-MER-1107	KTC-MER-C	250	Yes	0.46	0.00	**24.96**	67.63	0.00	**3.13**	0.33	0.87	0.00	**2.62**	100.00

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
KTC-MER-11	KTC-MER-1108	KTC-MER-C	250	Yes	0.43	0.43	**24.05**	68.75	0.00	**3.04**	0.33	0.65	0.00	**2.30**	100.00

Sherd	Spectrum	Sample	Zoom	In stats	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Total
KTC-MER-15	KTC-MER-1509	KTC-MER-C	100	Yes	0.35	0.00	**19.73**	73.47	0.00	**3.22**	0.35	0.68	0.00	**2.21**	100.00
KTC-MER-15	KTC-MER-1510	KTC-MER-C	250	Yes	0.43	0.34	**20.82**	71.75	0.00	**3.40**	0.00	0.85	0.00	**2.41**	100.00
KTC-MER-15	KTC-MER-1511	KTC-MER-C	250	Yes	0.00	0.00	**18.62**	74.74	0.00	**3.17**	0.60	0.59	0.00	**2.28**	100.00
KTC-MER-15	KTC-MER-1512	KTC-MER-C	250	Yes	0.38	0.00	**19.25**	74.28	0.00	**2.87**	0.31	0.45	0.00	**2.46**	100.00
KTC-MER-01	KTC-MER-0101	KTC-MER-D	100	Yes	0.51	0.00	**21.66**	70.21	0.00	**3.43**	0.27	0.58	0.00	**3.34**	100.00
KTC-MER-01	KTC-MER-0102	KTC-MER-D	250	Yes	0.37	0.39	**21.95**	70.13	0.00	**2.77**	0.00	0.74	0.00	**3.66**	100.00
KTC-MER-01	KTC-MER-0103	KTC-MER-D	250	Yes	0.53	0.35	**21.21**	69.13	0.00	**3.93**	0.30	0.91	0.00	**3.65**	100.00
KTC-MER-01	KTC-MER-0104	KTC-MER-D	250	Yes	0.36	0.00	**22.14**	70.06	0.00	**2.99**	0.00	0.71	0.00	**3.74**	100.00
KTC-MER-07	KTC-MER-0705	KTC-MER-E	100	Yes	0.41	0.00	**18.19**	75.92	0.00	**2.79**	0.35	0.47	0.00	**1.86**	100.00
KTC-MER-07	KTC-MER-0706	KTC-MER-E	250	Yes	0.36	0.00	**18.73**	75.50	0.00	**2.95**	0.00	0.44	0.00	**2.02**	100.00
KTC-MER-07	KTC-MER-0707	KTC-MER-E	250	Yes	0.43	0.38	**20.04**	73.40	0.00	**2.95**	0.00	0.60	0.00	**2.20**	100.00
KTC-MER-07	KTC-MER-0708	KTC-MER-E	250	Yes	0.48	0.35	**19.62**	74.04	0.00	**3.07**	0.00	0.49	0.00	**1.95**	100.00
KTC-TMP-01	KTC-TMP-0101	KTC-TMP-A	100	Yes	0.41	0.42	**21.98**	70.74	0.00	**3.19**	0.30	0.73	0.00	**2.23**	100.00
KTC-TMP-01	KTC-TMP-0103	KTC-TMP-A	250	Yes	0.33	0.45	**22.83**	69.47	0.00	**3.33**	0.33	0.63	0.00	**2.64**	100.00
KTC-TMP-01	KTC-TMP-0104	KTC-TMP-A	250	Yes	0.54	0.42	**21.15**	71.46	0.00	**3.46**	0.29	0.69	0.00	**1.99**	100.00
KTC-TMP-02	KTC-TMP-0209	KTC-TMP-B	100	Yes	0.45	0.35	**22.27**	70.14	0.00	**3.60**	0.32	0.63	0.00	**2.25**	100.00
KTC-TMP-02	KTC-TMP-0210	KTC-TMP-B	250	Yes	0.49	0.39	**20.44**	72.34	0.00	**3.45**	0.42	0.55	0.00	**1.93**	100.00
KTC-TMP-02	KTC-TMP-0211	KTC-TMP-B	250	Yes	0.53	0.46	**19.52**	72.13	0.00	**3.85**	0.92	0.54	0.24	**1.82**	100.00
KTC-TMP-02	KTC-TMP-0212	KTC-TMP-B	250	Yes	0.30	0.32	**20.77**	72.34	0.00	**3.41**	0.00	0.59	0.00	**2.28**	100.00
KTC-TMP-03	KTC-TMP-0317	KTC-TMP-C	100	Yes	0.52	0.36	**18.92**	73.69	0.00	**3.60**	0.27	0.53	0.00	**2.11**	100.00
KTC-TMP-03	KTC-TMP-0318	KTC-TMP-C	250	Yes	0.51	0.53	**21.53**	70.48	0.00	**3.45**	0.39	0.52	0.00	**2.58**	100.00
KTC-TMP-03	KTC-TMP-0319	KTC-TMP-C	250	Yes	0.49	0.40	**21.09**	70.67	0.00	**3.09**	0.47	0.64	0.00	**3.15**	100.00
KTC-TMP-03	KTC-TMP-0320	KTC-TMP-C	250	Yes	0.40	0.42	**21.16**	70.35	0.00	**4.07**	0.20	0.64	0.00	**2.77**	100.00
KTC-TMP-04	KTC-TMP-0425	KTC-TMP-C	100	Yes	0.55	0.51	**24.82**	67.96	0.00	**2.53**	0.55	0.53	0.00	**2.55**	100.00
KTC-TMP-04	KTC-TMP-0426	KTC-TMP-C	250	Yes	0.00	0.55	**25.85**	67.78	0.00	**2.20**	0.42	0.53	0.00	**2.68**	100.00
KTC-TMP-04	KTC-TMP-0427	KTC-TMP-C	250	Yes	0.00	0.72	**25.50**	66.56	0.00	**2.69**	0.65	0.77	0.00	**3.13**	100.00
KTC-TMP-04	KTC-TMP-0428	KTC-TMP-C	250	Yes	0.00	0.56	**24.90**	67.89	0.00	**2.82**	0.64	0.55	0.00	**2.63**	100.00
KTC-TMP-05	KTC-TMP-0535	KTC-TMP-C	100	Yes	0.00	0.47	**25.82**	67.80	0.00	**2.39**	0.38	0.58	0.00	**2.57**	100.00
KTC-TMP-05	KTC-TMP-0536	KTC-TMP-C	250	Yes	0.00	0.45	**25.90**	67.69	0.00	**2.16**	0.41	0.70	0.00	**2.69**	100.00
KTC-TMP-05	KTC-TMP-0537	KTC-TMP-C	250	Yes	0.00	0.45	**25.54**	67.37	0.00	**2.63**	0.41	0.57	0.00	**3.03**	100.00
KTC-TMP-05	KTC-TMP-0538	KTC-TMP-C	250	Yes	0.45	0.49	**24.63**	67.21	0.00	**3.07**	0.61	0.65	0.00	**2.89**	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
STA-BRI-0505	STA-BRI-D	Glaze	Yes	0.92	3.66	15.80	56.33	1.68	4.50	11.59	0.60	0.00	1.30	3.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-0506	STA-BRI-D	Glaze	Yes	0.99	3.87	14.93	56.03	1.98	4.45	12.04	0.61	0.00	1.10	4.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-0507	STA-BRI-D	Glaze	Yes	0.71	3.59	16.07	56.31	1.70	5.08	11.12	0.59	0.00	1.55	3.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-0507	STA-BRI-D	Glaze	Yes	0.88	3.71	15.85	55.62	1.92	4.57	11.23	0.86	0.00	1.31	4.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-0508	STA-BRI-D	Glaze	Yes	0.97	3.84	15.27	55.79	1.97	4.66	11.51	0.57	0.00	1.37	4.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1425	STA-BRI-D	Glaze	Yes	1.78	4.05	14.80	52.85	2.66	5.49	14.44	0.00	0.00	1.47	2.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1426	STA-BRI-D	Glaze	Yes	1.70	4.04	14.74	52.98	2.57	5.19	14.37	0.00	0.00	1.66	2.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1427	STA-BRI-D	Glaze	Yes	1.88	3.75	15.15	54.03	1.90	5.81	13.62	0.00	0.00	1.50	2.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1428	STA-BRI-D	Glaze	Yes	1.73	4.28	13.97	52.06	3.04	5.19	14.93	0.54	0.00	1.59	2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1547	STA-BRI-D	Glaze	Yes	0.55	4.52	14.13	50.88	4.52	3.50	15.57	0.00	0.00	1.48	4.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1548	STA-BRI-D	Glaze	Yes	0.78	4.29	14.96	51.02	4.57	3.69	14.58	0.00	0.00	1.40	4.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1549	STA-BRI-D	Glaze	Yes	0.72	4.01	15.39	51.45	4.69	3.57	13.60	0.00	0.00	1.27	5.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1550	STA-BRI-D	Glaze	Yes	0.59	4.48	13.95	49.03	4.93	3.26	16.58	0.00	0.00	1.51	5.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1705	STA-BRI-D	Glaze	Yes	0.00	4.80	13.71	51.95	3.85	3.44	16.49	0.67	0.00	1.99	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1706	STA-BRI-D	Glaze	Yes	0.00	5.06	13.54	52.13	4.13	3.39	16.32	0.81	0.00	1.45	3.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1707	STA-BRI-D	Glaze	Yes	0.00	5.04	13.49	52.25	4.20	3.02	16.40	0.74	0.00	1.73	3.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1708	STA-BRI-D	Glaze	Yes	0.00	4.84	13.90	52.42	4.10	3.27	15.87	0.93	0.00	1.67	3.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1925	STA-BRI-D	Glaze	Yes	0.00	3.89	14.71	54.46	2.68	3.54	15.26	0.71	0.00	1.52	3.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1926	STA-BRI-D	Glaze	Yes	0.00	4.39	14.03	53.06	3.01	3.27	16.73	0.57	0.00	1.63	3.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1927	STA-BRI-D	Glaze	Yes	0.65	3.81	14.24	54.47	2.62	3.89	14.91	0.55	0.00	1.54	3.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1928	STA-BRI-D	Glaze	Yes	0.00	3.69	14.26	54.81	2.72	3.71	15.53	0.56	0.00	1.39	3.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-2146	STA-BRI-D	Glaze	Yes	0.00	9.05	15.57	48.29	5.15	2.94	13.86	0.47	0.00	1.85	2.17	0.00	0.00	0.00	0.00	0.00	0.66	0.00	100.00
STA-BRI-2147	STA-BRI-D	Glaze	Yes	0.00	8.92	16.12	49.93	4.42	3.12	12.57	0.00	0.00	1.79	2.12	0.00	0.00	0.00	0.00	0.00	1.01	0.00	100.00
STA-BRI-2005	STA-BRI-G	Glaze	Yes	0.35	2.27	9.21	53.02	0.54	1.75	5.37	0.75	0.09	0.15	3.52	-0.10	0.50	-0.18	0.46	0.53	0.10	21.66	100.00
STA-BRI-2006	STA-BRI-G	Glaze	Yes	0.35	2.52	9.54	51.65	0.71	1.67	5.46	1.18	0.22	0.15	3.61	0.02	0.97	-0.13	0.86	0.59	0.37	20.26	100.00
STA-BRI-2007	STA-BRI-G	Glaze	Yes	0.20	2.51	9.36	53.41	0.71	1.93	5.08	0.69	0.06	0.09	3.44	0.33	0.76	-0.38	0.97	0.51	0.00	20.34	100.00
STA-BRI-2008	STA-BRI-G	Glaze	Yes	0.30	2.05	8.98	58.00	0.68	1.74	3.62	0.47	0.05	0.16	3.06	0.08	0.19	0.34	0.46	0.32	0.68	18.83	100.00
STA-BRI-2009	STA-BRI-G	Glaze	Yes	1.14	0.95	14.43	54.59	0.53	3.22	3.01	1.00	0.04	0.11	3.27	0.08	0.19	0.06	0.35	0.64	-0.42	16.81	100.00
STA-BRI-2010	STA-BRI-G	Glaze	Yes	0.63	2.33	8.31	51.01	0.79	1.68	7.36	0.72	0.15	0.41	3.43	0.22	0.87	-0.50	0.92	-0.03	-0.22	21.94	100.00
STA-BRI-2011	STA-BRI-G	Glaze	Yes	0.36	2.01	8.49	49.90	0.82	1.69	6.63	0.80	0.13	0.34	3.63	0.30	1.19	-0.36	0.63	-0.21	0.32	23.31	100.00
STA-BRI-2012	STA-BRI-G	Glaze	Yes	0.61	1.60	9.40	53.57	0.44	2.54	4.12	0.47	0.27	-0.08	3.47	0.04	0.84	0.03	0.38	0.72	0.22	21.35	100.00
STA-BRI-2222	STA-BRI-H	Glaze	Yes	0.20	2.72	13.36	59.90	1.79	2.10	11.41	0.58	-0.03	0.33	6.17	-0.08	0.36	0.63	0.11	0.37	0.05	0.02	100.00
STA-BRI-2223	STA-BRI-H	Glaze	Yes	0.04	2.98	12.20	60.78	2.66	2.55	10.75	0.58	0.05	0.59	6.75	0.18	-0.13	-0.25	-0.32	0.71	0.03	-0.16	100.00
STA-BUF-0305	STA-BUF-AA	Glaze	Yes	0.33	3.34	13.47	56.07	3.43	2.30	12.14	0.42	-0.04	0.39	6.72	0.21	0.68	-0.04	-0.15	0.84	0.10	-0.21	100.00
STA-BUF-0305	STA-BUF-AA	Glaze	Yes	0.51	3.47	14.23	54.66	3.20	2.38	12.67	0.66	-0.25	0.29	6.64	-0.10	0.62	0.28	0.14	0.64	-0.12	0.10	100.00
STA-BUF-0306	STA-BUF-AA	Glaze	Yes	0.17	3.72	13.77	54.36	3.40	2.15	13.01	0.41	0.21	0.46	7.40	0.12	0.04	-0.04	0.45	0.35	0.13	-0.11	100.00
STA-BUF-0307	STA-BUF-AA	Glaze	Yes	0.15	3.74	13.20	55.35	3.37	2.24	12.29	0.53	0.02	0.59	7.19	0.05	0.03	0.54	0.12	0.60	-0.07	0.04	100.00
STA-BUF-0308	STA-BUF-AA	Glaze	Yes	0.09	3.32	13.83	55.87	3.29	2.27	12.78	0.48	-0.02	0.37	7.49	-0.06	-0.10	-0.45	0.17	0.43	0.31	-0.07	100.00
STA-BUF-0522	STA-BUF-AA	Glaze	Yes	0.21	3.26	12.52	59.16	2.78	2.95	11.22	0.46	0.03	0.56	5.93	0.23	-0.03	0.07	-0.11	0.72	0.15	-0.11	100.00
STA-BUF-0523	STA-BUF-AA	Glaze	Yes	0.11	3.40	12.43	59.27	2.46	2.79	10.84	0.44	0.03	0.47	6.03	0.28	0.32	0.57	0.12	0.35	0.14	-0.05	100.00
STA-BUF-0524	STA-BUF-AA	Glaze	Yes	0.30	3.23	12.88	59.56	2.22	3.08	10.73	0.53	0.07	0.40	5.76	0.13	-0.05	-0.15	0.43	0.54	0.49	-0.15	100.00
STA-BUF-0741	STA-BUF-AA	Glaze	Yes	0.43	2.84	16.87	59.21	2.61	3.37	6.82	0.76	0.24	0.59	5.37	0.04	0.08	0.63	-0.06	-0.16	0.47	-0.11	100.00
STA-BUF-0742	STA-BUF-AA	Glaze	Yes	0.50	3.24	16.58	59.10	2.80	2.81	7.87	1.09	-0.02	0.52	5.89	-0.10	-0.26	-0.23	-0.04	0.36	-0.06	-0.07	100.00
STA-BUF-0743	STA-BUF-AA	Glaze	Yes	0.19	2.94	17.35	58.69	2.23	2.82	8.39	1.10	-0.07	0.70	5.36	-0.04	-0.06	-0.05	0.09	0.24	-0.04	0.15	100.00
STA-BUF-0744	STA-BUF-AA	Glaze	Yes	0.32	2.43	15.21	64.68	1.14	2.99	6.62	0.55	0.17	0.73	4.26	0.05	0.45	-0.07	0.30	-0.37	0.32	0.22	100.00
STA-BUF-1161	STA-BUF-AA	Glaze	Yes	0.21	4.31	14.47	52.27	2.92	2.48	16.53	0.55	0.04	0.95	3.80	0.21	-0.19	0.10	0.37	0.48	0.40	0.10	100.00
STA-BUF-1162	STA-BUF-AA	Glaze	Yes	0.28	3.97	14.73	52.25	3.15	2.65	16.76	1.05	-0.07	1.11	3.99	-0.20	-0.18	0.21	0.03	0.44	-0.11	-0.05	100.00
STA-BUF-1163	STA-BUF-AA	Glaze	Yes	0.33	4.06	14.04	52.46	3.27	2.33	16.56	0.90	0.15	1.05	4.13	-0.39	-0.09	0.02	0.20	0.77	0.12	0.09	100.00
STA-BUF-1164	STA-BUF-AA	Glaze	Yes	0.31	3.98	14.32	51.98	3.10	2.69	16.29	0.63	0.11	1.18	3.89	0.18	-0.04	0.18	0.13	0.98	0.30	-0.21	100.00
STA-BUF-0105	STA-BUF-AB	Glaze	Yes	0.26	1.73	15.78	62.76	2.13	2.94	6.20	0.70	0.29	0.33	6.14	0.12	0.02	0.62	0.02	0.38	-0.20	-0.22	100.00
STA-BUF-0106	STA-BUF-AB	Glaze	Yes	0.19	2.28	14.88	61.13	3.31	2.34	7.88	0.85	0.07	0.15	6.71	0.13	0.01	0.04	-0.03	-0.11	0.08	0.10	100.00
STA-BUF-0107	STA-BUF-AB	Glaze	Yes	0.19	2.08	14.38	61.70	3.12	2.38	7.83	0.85	0.01	0.32	6.55	0.13	-0.12	0.28	0.07	0.16	-0.07	0.12	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
STA-BUF-0428	STA-BUF-AB	Glaze	Yes	0.02	3.49	12.24	56.96	4.15	1.94	12.49	0.44	-0.05	0.54	6.84	0.10	0.01	0.22	0.26	0.20	0.28	-0.14	100.00
STA-BUF-0429	STA-BUF-AB	Glaze	Yes	0.10	3.69	12.50	56.90	4.35	2.00	12.19	0.48	-0.01	0.39	6.27	-0.01	-0.08	0.30	0.20	0.67	-0.02	0.11	100.00
STA-BUF-0205	STA-BUF-B	Glaze	Yes	1.29	0.77	20.83	63.13	0.56	6.72	1.81	0.78	-0.06	0.45	3.29	0.09	0.55	0.12	-0.13	-0.28	0.07	0.01	100.00
STA-BUF-0206	STA-BUF-B	Glaze	Yes	1.36	2.56	21.36	54.53	2.47	5.65	3.72	0.52	0.05	1.62	3.89	0.13	0.55	0.32	0.06	0.75	0.00	0.45	100.00
STA-BUF-0206	STA-BUF-B	Glaze	Yes	1.18	0.83	20.20	63.21	1.36	6.48	1.86	0.35	-0.33	0.82	3.31	-0.22	0.13	-0.15	0.16	0.42	0.23	0.15	100.00
STA-BUF-0207	STA-BUF-B	Glaze	Yes	1.32	0.50	21.33	64.40	0.27	6.35	1.48	0.56	0.06	0.44	3.59	-0.24	-0.01	-0.04	-0.17	-0.08	0.28	-0.05	100.00
STA-BUF-0208	STA-BUF-B	Glaze	Yes	1.27	1.04	22.73	61.33	0.59	6.78	1.80	0.29	-0.01	0.39	3.16	0.01	0.29	-0.09	-0.11	0.42	0.28	-0.16	100.00
STA-BUF-1025	STA-BUF-B	Glaze	Yes	0.38	1.57	18.11	62.01	2.63	3.51	2.54	0.59	-0.03	0.10	7.71	0.11	-0.11	-0.05	0.07	0.68	0.21	-0.03	100.00
STA-BUF-1026	STA-BUF-B	Glaze	Yes	0.33	1.80	19.02	60.43	2.23	3.34	3.06	0.51	0.16	0.07	8.40	0.18	-0.23	0.14	-0.07	0.17	0.47	-0.03	100.00
STA-BUF-1027	STA-BUF-B	Glaze	Yes	0.27	2.76	13.60	59.03	3.28	2.07	10.38	0.62	0.01	0.29	7.41	-0.05	-0.26	-0.11	-0.39	0.90	0.21	-0.02	100.00
STA-BUF-1028	STA-BUF-B	Glaze	Yes	0.29	3.18	12.83	56.92	3.05	1.99	11.89	0.69	0.06	0.24	8.77	-0.11	-0.29	-0.39	0.06	0.54	0.16	0.11	100.00
STA-BUF-0605	STA-BUF-C	Glaze	Yes	0.37	1.86	12.35	65.88	1.09	5.34	9.31	0.21	-0.01	0.74	1.57	-0.02	0.06	0.35	0.13	0.42	0.25	0.10	100.00
STA-BUF-0606	STA-BUF-C	Glaze	Yes	0.40	2.05	12.42	65.38	1.34	5.03	9.97	0.33	-0.19	0.80	2.56	0.05	-0.07	-0.31	-0.06	0.49	-0.13	-0.09	100.00
STA-BUF-0607	STA-BUF-C	Glaze	Yes	0.41	1.19	11.68	71.47	0.84	6.17	5.79	0.32	0.00	0.44	1.70	0.13	-0.23	0.39	-0.23	0.27	-0.22	-0.13	100.00
STA-BUF-0608	STA-BUF-C	Glaze	Yes	0.45	1.82	12.68	66.30	1.09	5.52	8.53	-0.04	-0.11	1.11	1.79	-0.14	0.25	0.17	-0.48	0.66	0.57	-0.18	100.00
STA-BUF-0609	STA-BUF-C	Glaze	Yes	0.47	1.60	12.55	67.53	0.99	5.67	7.99	-0.07	0.10	0.62	1.41	0.09	0.37	0.16	-0.15	0.55	0.12	0.00	100.00
STA-BUF-0610	STA-BUF-C	Glaze	Yes	0.39	1.48	12.29	67.61	1.03	5.81	7.52	-0.03	-0.08	0.68	1.31	0.07	0.16	0.30	0.08	1.07	0.41	-0.08	100.00
STA-BUF-0611	STA-BUF-C	Glaze	Yes	0.25	1.53	12.99	68.11	0.83	5.92	8.45	-0.27	0.01	0.72	1.13	-0.15	0.04	-0.35	0.03	0.47	0.35	-0.07	100.00
STA-BUF-1230	STA-BUF-C	Glaze	Yes	0.24	0.64	32.08	59.19	0.22	3.51	0.18	0.58	0.06	-0.07	2.60	-0.13	-0.17	0.34	-0.16	0.40	0.54	-0.07	100.00
STA-BUF-1231	STA-BUF-C	Glaze	Yes	0.21	0.59	31.46	58.64	0.17	4.00	0.42	2.50	-0.02	0.00	2.84	0.04	0.03	-0.08	-0.31	-0.14	-0.39	0.06	100.00
STA-BUF-1232	STA-BUF-C	Glaze	Yes	0.15	0.68	28.61	60.48	0.09	4.08	0.64	0.68	0.16	-0.21	3.64	0.03	0.04	0.51	0.35	-0.14	0.05	0.19	100.00
STA-BUF-1233	STA-BUF-C	Glaze	Yes	0.04	0.61	32.75	59.53	0.43	1.61	0.93	1.23	0.01	-0.02	3.44	-0.05	0.20	0.11	0.05	-1.18	0.15	0.14	100.00
STA-BUF-1234	STA-BUF-C	Glaze	Yes	0.02	0.76	30.57	61.00	0.16	2.46	0.48	1.25	0.07	0.06	3.33	0.00	-0.62	0.16	0.07	0.06	0.16	0.01	100.00
STA-BUF-1350	STA-BUF-C	Glaze	Yes	1.00	1.77	19.30	54.76	4.90	2.36	9.35	1.19	-0.16	0.78	5.04	-0.23	0.03	-0.26	0.23	0.00	0.03	-0.09	100.00
STA-BUF-1351	STA-BUF-C	Glaze	Yes	0.82	3.84	15.11	54.68	4.16	3.02	10.51	0.61	-0.17	2.84	4.10	0.09	0.10	-0.22	0.01	0.36	0.19	-0.07	100.00
STA-BUF-1352	STA-BUF-C	Glaze	Yes	0.74	3.80	15.40	53.20	4.13	2.95	10.76	0.46	0.07	2.36	4.43	0.22	-0.08	0.19	0.20	0.57	0.52	0.08	100.00
STA-BUF-1353	STA-BUF-C	Glaze	Yes	0.55	4.17	15.34	53.46	4.17	2.81	10.35	0.75	-0.14	2.70	4.43	-0.06	0.23	0.08	0.39	0.37	0.36	0.04	100.00
STA-BRI-0505	STA-BRI-D	Interface	Yes	0.00	0.00	19.34	72.21	0.00	0.84	2.27	0.00	0.00	0.00	5.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-0506	STA-BRI-D	Interface	Yes	1.31	0.73	19.50	66.17	0.00	7.16	3.30	0.00	0.00	0.00	1.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-0507	STA-BRI-D	Interface	Yes	0.00	0.00	26.21	57.42	0.00	1.74	3.10	1.63	0.00	0.00	9.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-0508	STA-BRI-D	Interface	Yes	0.00	0.00	23.04	60.50	0.00	5.97	4.04	0.00	0.00	0.00	6.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1425	STA-BRI-D	Interface	Yes	1.84	0.72	24.13	51.79	2.60	6.81	7.21	0.00	0.00	0.00	4.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1426	STA-BRI-D	Interface	Yes	2.46	1.05	20.54	59.47	0.00	8.42	5.48	0.00	0.00	0.00	1.04	0.00	0.00	0.00	1.54	0.00	0.00	0.00	100.00
STA-BRI-1427	STA-BRI-D	Interface	Yes	2.13	0.99	21.16	60.48	0.00	8.99	4.34	0.00	0.00	0.65	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1428	STA-BRI-D	Interface	Yes	1.97	1.23	22.46	58.02	0.00	6.89	6.15	0.00	0.00	0.00	3.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1547	STA-BRI-D	Interface	Yes	0.00	0.00	32.23	21.35	14.98	0.00	7.53	3.18	0.00	0.00	20.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1548	STA-BRI-D	Interface	Yes	0.00	0.00	36.97	36.72	5.02	0.00	3.97	0.00	0.00	0.00	17.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1549	STA-BRI-D	Interface	Yes	0.61	0.54	19.22	68.20	0.00	5.77	3.00	0.00	0.00	0.00	2.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1550	STA-BRI-D	Interface	Yes	0.69	4.13	14.54	49.71	3.82	4.31	14.36	0.00	0.00	1.53	6.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1705	STA-BRI-D	Interface	Yes	0.00	3.06	17.02	54.68	3.71	3.74	12.51	1.30	0.00	1.14	2.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1706	STA-BRI-D	Interface	Yes	0.00	2.55	17.57	56.20	3.45	3.80	11.74	0.97	0.00	0.73	2.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1707	STA-BRI-D	Interface	Yes	0.00	2.17	21.34	54.35	2.39	4.07	11.65	0.95	0.00	0.94	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1708	STA-BRI-D	Interface	Yes	0.00	1.69	21.08	54.71	3.49	3.47	11.93	0.97	0.00	0.00	2.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1925	STA-BRI-D	Interface	Yes	0.00	0.00	34.32	39.58	7.99	0.00	4.43	3.48	0.00	0.00	10.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1926	STA-BRI-D	Interface	Yes	0.00	0.00	38.45	31.45	8.90	0.00	4.49	3.64	0.00	0.00	13.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1927	STA-BRI-D	Interface	Yes	0.00	0.00	22.68	53.77	6.29	2.86	4.76	2.64	0.00	0.00	6.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1928	STA-BRI-D	Interface	Yes	0.00	0.00	33.33	44.47	6.78	0.00	3.82	0.00	0.00	0.00	11.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-2146	STA-BRI-D	Interface	Yes	0.00	0.00	31.36	44.42	3.37	0.00	4.35	3.43	0.00	1.41	11.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-2147	STA-BRI-D	Interface	Yes	0.00	0.00	32.16	40.47	8.64	1.43	6.60	2.68	0.00	0.00	8.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
STA-BRI-2005	STA-BRI-G	Interface	Yes	0.84	1.08	17.88	52.70	-0.02	1.31	6.98	0.53	0.09	-0.17	5.81	0.14	0.57	-0.01	0.49	-0.03	0.38	11.41	100.00
STA-BRI-2006	STA-BRI-G	Interface	Yes	0.77	0.51	20.35	56.19	0.21	3.01	2.94	1.21	-0.02	0.18	4.90	-0.04	0.19	-0.07	0.23	0.50	-0.26	9.21	100.00
STA-BRI-2007	STA-BRI-G	Interface	Yes	0.48	0.44	20.89	64.27	0.14	2.62	1.64	0.96	0.01	-0.18	3.05	0.12	-0.29	0.12	-0.09	0.32	0.03	5.47	100.00
STA-BRI-2008	STA-BRI-G	Interface	Yes	0.21	0.53	17.31	66.24	-0.05	2.47	1.57	0.96	-0.04	0.27	4.25	0.01	0.07	0.00	0.52	0.24	0.05	5.38	100.00
STA-BRI-2009	STA-BRI-G	Interface	Yes	0.99	0.65	17.38	52.17	0.34	3.37	1.90	0.83	0.02	-0.03	11.67	-0.07	0.50	-0.34	0.34	0.24	-0.07	10.11	100.00
STA-BRI-2010	STA-BRI-G	Interface	Yes	1.12	0.41	16.95	59.92	0.02	3.42	2.27	0.65	-0.12	-0.25	3.79	0.10	0.20	0.20	0.26	0.61	0.26	10.18	100.00
STA-BRI-2011	STA-BRI-G	Interface	Yes	1.01	0.48	14.40	62.73	0.10	3.23	2.09	1.55	0.10	0.40	4.27	0.28	0.33	-0.69	-0.14	0.23	0.06	9.56	100.00
STA-BRI-2012	STA-BRI-G	Interface	Yes	0.57	0.55	18.71	66.02	0.31	3.05	0.66	0.82	0.20	-0.16	3.46	0.05	0.40	0.07	-0.06	0.08	0.12	5.14	100.00
STA-BRI-2222	STA-BRI-H	Interface	Yes	0.66	2.68	9.77	58.53	2.68	2.47	5.40	2.18	-0.07	0.45	14.18	-0.32	-0.19	1.20	-0.37	-0.61	-0.42	1.79	100.00
STA-BRI-2223	STA-BRI-H	Interface	Yes	0.24	1.23	7.99	70.65	2.02	2.84	3.11	0.96	0.18	0.47	9.27	0.05	0.13	-0.57	0.15	0.42	0.42	0.44	100.00
STA-BRI-2223	STA-BRI-H	Interface	Yes	0.16	2.19	13.78	62.28	1.80	2.21	10.45	0.64	-0.01	0.40	5.65	0.00	-0.12	0.09	0.13	0.44	0.01	-0.10	100.00
STA-BRI-2223	STA-BRI-H	Interface	Yes	0.29	0.98	14.17	67.29	1.48	3.78	6.36	0.86	0.18	0.14	3.75	-0.05	-0.21	0.26	-0.23	0.57	0.08	0.31	100.00
STA-BUF-0306	STA-BUF-AA	Interface	Yes	0.00	3.55	9.74	60.73	3.25	3.01	7.34	1.05	0.16	0.53	9.91	-0.15	0.13	0.35	-0.24	0.52	0.02	0.11	100.00
STA-BUF-0307	STA-BUF-AA	Interface	Yes	-0.02	3.36	10.13	57.24	4.64	2.71	6.27	1.42	0.15	0.33	13.55	-0.08	0.04	-0.41	-0.04	0.04	0.47	0.23	100.00
STA-BUF-0522	STA-BUF-AA	Interface	Yes	0.32	3.00	13.68	60.65	2.20	2.51	10.91	0.84	-0.03	0.33	5.58	-0.11	-0.12	-0.36	0.16	0.49	-0.06	0.01	100.00
STA-BUF-0523	STA-BUF-AA	Interface	Yes	0.37	2.91	13.46	60.19	1.93	2.70	10.84	0.54	0.11	0.35	5.87	0.15	-0.41	0.08	0.14	0.32	0.41	0.05	100.00
STA-BUF-0524	STA-BUF-AA	Interface	Yes	0.58	2.58	14.13	62.59	1.29	2.68	9.92	0.83	0.02	0.34	5.23	-0.27	-0.06	-0.41	0.19	0.52	-0.38	0.22	100.00
STA-BUF-0741	STA-BUF-AA	Interface	Yes	0.23	0.65	25.60	65.45	0.34	3.38	1.38	1.17	0.40	-0.04	2.08	0.04	-0.14	-0.15	-0.06	-0.19	-0.22	0.10	100.00
STA-BUF-0742	STA-BUF-AA	Interface	Yes	0.37	0.86	24.28	65.13	0.48	3.53	2.29	0.74	0.17	0.26	1.98	-0.11	0.32	-0.53	-0.20	0.37	0.12	-0.04	100.00
STA-BUF-0743	STA-BUF-AA	Interface	Yes	0.32	0.94	21.58	64.01	0.84	3.40	4.55	0.81	0.07	0.31	2.13	-0.33	-0.04	0.49	0.11	0.38	0.58	-0.15	100.00
STA-BUF-0744	STA-BUF-AA	Interface	Yes	0.23	0.74	26.49	60.45	0.37	3.27	2.41	2.29	0.12	0.18	3.59	0.32	-0.02	-0.03	0.00	0.34	-0.62	-0.11	100.00
STA-BUF-1161	STA-BUF-AA	Interface	Yes	0.31	2.35	19.20	51.94	3.73	3.42	11.41	1.08	0.15	0.37	3.64	0.08	0.35	0.09	0.44	0.62	0.51	0.32	100.00
STA-BUF-1162	STA-BUF-AA	Interface	Yes	0.52	1.18	22.66	47.45	7.55	2.07	9.93	1.15	-0.30	0.30	6.32	-0.22	0.38	-0.38	0.63	0.51	0.23	0.02	100.00
STA-BUF-1162	STA-BUF-AA	Interface	Yes	-0.11	0.84	22.34	45.76	6.84	2.49	8.21	2.13	-0.22	0.82	11.33	-0.37	0.31	-1.07	1.69	-0.52	0.03	-0.50	100.00
STA-BUF-1163	STA-BUF-AA	Interface	Yes	0.33	0.83	22.33	43.83	9.69	2.37	8.93	1.76	0.02	0.31	7.14	0.04	-0.46	0.30	0.52	1.13	0.27	0.66	100.00
STA-BUF-1164	STA-BUF-AA	Interface	Yes	0.66	0.79	23.13	44.66	8.21	2.10	10.18	2.08	0.06	0.72	5.39	0.22	-0.22	0.17	0.85	0.39	-0.16	0.75	100.00
STA-BUF-0105	STA-BUF-AB	Interface	Yes	-0.12	1.69	10.66	68.00	2.85	3.45	2.83	1.53	-0.09	0.05	8.16	0.04	-0.04	-0.07	0.44	0.41	-0.14	0.35	100.00
STA-BUF-0106	STA-BUF-AB	Interface	Yes	0.16	2.24	11.36	66.11	3.15	2.84	4.52	1.58	0.08	0.31	6.92	0.21	0.32	-0.08	0.09	0.22	-0.29	0.26	100.00
STA-BUF-0106	STA-BUF-AB	Interface	Yes	0.11	1.65	11.18	70.24	2.65	2.96	4.18	1.04	0.08	0.50	5.54	0.25	0.17	-0.27	-0.13	-0.32	-0.35	0.53	100.00
STA-BUF-0428	STA-BUF-AB	Interface	Yes	-0.06	4.12	5.71	70.95	1.64	2.60	4.18	1.21	0.17	0.54	7.48	-0.06	0.63	0.29	0.17	0.06	0.01	0.35	100.00
STA-BUF-0429	STA-BUF-AB	Interface	Yes	0.37	2.54	5.99	72.77	1.70	2.89	3.54	1.23	0.02	0.26	7.93	0.14	-0.02	0.16	0.27	0.03	-0.36	0.54	100.00
STA-BUF-0429	STA-BUF-AB	Interface	Yes	0.22	2.87	8.21	70.48	2.32	2.90	6.62	0.91	-0.21	0.76	5.13	0.06	-0.53	-0.78	0.48	0.31	-0.15	0.39	100.00
STA-BUF-0205	STA-BUF-B	Interface	Yes	1.23	0.44	23.83	64.20	0.43	6.04	1.00	0.58	0.01	0.10	2.89	-0.05	0.04	-0.47	-0.25	0.05	0.03	-0.08	100.00
STA-BUF-0206	STA-BUF-B	Interface	Yes	1.02	1.10	26.74	59.42	0.14	5.49	2.03	0.46	-0.16	0.78	2.85	0.28	0.17	-0.22	-0.04	0.32	-0.27	-0.12	100.00
STA-BUF-0207	STA-BUF-B	Interface	Yes	1.04	0.57	27.93	59.11	0.04	5.67	0.88	1.00	-0.01	0.51	3.17	-0.02	0.00	-0.40	-0.09	0.61	0.09	-0.10	100.00
STA-BUF-0208	STA-BUF-B	Interface	Yes	0.79	0.48	22.54	65.46	0.39	5.34	0.78	0.69	0.17	0.13	2.85	0.07	0.46	0.03	-0.37	0.35	-0.24	0.09	100.00
STA-BUF-1025	STA-BUF-B	Interface	Yes	0.02	0.51	21.61	72.93	0.86	1.56	0.70	0.92	0.02	0.06	1.94	-0.11	0.07	-0.46	-0.57	0.17	-0.19	-0.05	100.00
STA-BUF-1026	STA-BUF-B	Interface	Yes	0.01	0.79	29.69	61.00	0.82	2.44	1.11	0.86	-0.06	0.20	3.34	-0.10	0.05	-0.28	-0.05	0.33	0.03	-0.18	100.00
STA-BUF-1027	STA-BUF-B	Interface	Yes	0.27	1.94	12.06	67.88	1.96	2.91	6.49	1.24	0.15	0.14	6.14	0.20	-0.21	-0.44	-0.75	0.02	-0.26	0.26	100.00
STA-BUF-1028	STA-BUF-B	Interface	Yes	0.19	2.62	12.62	61.45	2.16	2.19	7.48	1.12	-0.17	0.26	8.75	0.28	0.08	-0.01	0.28	-0.02	0.03	0.69	100.00
STA-BUF-0605	STA-BUF-C	Interface	Yes	0.43	0.86	13.83	69.21	1.09	7.10	5.07	-0.05	-0.03	0.40	1.53	0.06	0.07	0.14	-0.06	0.23	0.00	0.12	100.00
STA-BUF-0606	STA-BUF-C	Interface	Yes	0.37	0.73	16.01	69.43	0.86	6.66	4.24	0.15	-0.39	0.50	1.95	0.15	-0.45	-0.26	-0.62	0.57	-0.36	0.45	100.00
STA-BUF-0607	STA-BUF-C	Interface	Yes	0.47	0.25	17.93	71.71	0.23	6.60	1.27	0.40	-0.13	0.06	1.57	0.16	-0.44	-0.59	-0.11	0.41	0.03	0.18	100.00
STA-BUF-0608	STA-BUF-C	Interface	Yes	0.26	0.72	13.10	71.91	0.93	6.36	4.34	0.25	-0.26	0.29	1.29	-0.24	0.33	0.57	-0.28	0.46	0.10	-0.13	100.00
STA-BUF-0609	STA-BUF-C	Interface	Yes	0.34	0.43	12.80	74.64	0.85	6.45	2.71	0.22	-0.07	-0.05	1.79	-0.14	-0.43	-0.19	-0.34	0.52	0.32	0.15	100.00
STA-BUF-0610	STA-BUF-C	Interface	Yes	0.37	0.56	15.25	73.12	0.81	6.17	2.70	0.14	-0.09	0.00	1.28	-0.19	-0.03	0.27	-0.25	0.12	-0.59	0.38	100.00
STA-BUF-0611	STA-BUF-C	Interface	Yes	0.30	0.58	15.15	70.06	0.82	6.94	3.22	0.33	-0.22	0.19	1.41	0.07	0.28	0.07	-0.02	0.91	-0.26	0.15	100.00
STA-BUF-1230	STA-BUF-C	Interface	Yes	0.18	0.50	31.05	60.00	0.36	2.33	0.39	2.32	-0.17	-0.03	2.63	0.03	0.38	0.23	0.00	-0.49	-0.04	0.33	100.00
STA-BUF-1231	STA-BUF-C	Interface	Yes	0.05	0.66	32.50	59.78	0.23	2.86	0.25	1.05	0.10	-0.11	2.59	0.11	0.37	0.01	-0.41	-0.38	0.22	0.11	100.00
STA-BUF-1232	STA-BUF-C	Interface	Yes	-0.05	0.45	27.42	65.83	0.22	1.71	0.36	1.48	0.11	-0.11	2.22	0.18	0.04	0.06	-0.25	0.14	0.04	0.16	100.00
STA-BUF-1233	STA-BUF-C	Interface	Yes	0.05	0.28	35.00	58.10	0.51	0.95	0.41	1.25	0.27	0.00	2.37	0.12	0.32	0.08	-0.08	-0.40	0.65	0.12	100.00
STA-BUF-1234	STA-BUF-C	Interface	Yes	0.09	0.59	39.48	50.46	0.36	1.68	1.33	2.15	0.01	0.11	3.31	-0.18	0.89	-0.01	-0.49	-0.01	0.52	-0.29	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
STA-BUF-1350	STA-BUF-C	Interface	Yes	0.77	0.67	21.93	65.36	0.10	4.39	3.76	0.31	-0.01	0.29	1.27	-0.08	0.24	-0.13	0.26	0.37	0.55	-0.04	100.00
STA-BUF-1351	STA-BUF-C	Interface	Yes	0.98	1.68	18.21	58.69	3.08	2.79	8.55	0.26	0.14	0.91	3.47	0.14	-0.24	-0.08	0.31	0.28	0.80	0.01	100.00
STA-BUF-1351	STA-BUF-C	Interface	Yes	1.18	2.04	17.67	57.71	3.66	2.91	8.15	1.01	0.04	1.13	4.01	0.22	-0.16	-0.25	0.03	0.40	0.19	0.08	100.00
STA-BUF-1352	STA-BUF-C	Interface	Yes	0.92	1.18	18.69	53.14	6.04	2.51	8.11	1.27	0.18	0.93	5.57	-0.26	-0.03	0.42	0.17	0.47	0.52	0.16	100.00
STA-BUF-1353	STA-BUF-C	Interface	Yes	0.76	0.79	16.74	53.01	8.78	3.12	3.72	2.33	0.01	1.29	7.80	-0.24	-0.44	0.04	1.07	0.34	0.16	0.72	100.00
STA-BUF-1353	STA-BUF-C	Interface	Yes	1.16	1.16	19.29	52.24	5.29	2.22	9.14	0.83	0.20	1.54	5.73	0.03	0.02	0.29	0.25	0.24	0.30	0.07	100.00
STA-BRI-0505	STA-BRI-D	Body	Yes	0.46	0.33	22.24	68.96	0.00	5.42	0.00	0.00	0.00	0.00	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-0506	STA-BRI-D	Body	Yes	0.49	0.00	20.99	69.72	0.00	5.26	0.44	1.09	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-0507	STA-BRI-D	Body	Yes	0.46	0.00	21.56	69.68	0.00	4.60	0.50	0.97	0.00	0.00	2.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-0508	STA-BRI-D	Body	Yes	0.00	0.39	20.87	71.11	0.00	4.52	0.00	1.05	0.00	0.00	2.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1425	STA-BRI-D	Body	Yes	1.52	0.00	24.18	64.69	0.00	8.05	0.45	0.00	0.00	0.00	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1426	STA-BRI-D	Body	Yes	1.20	0.40	23.18	67.28	0.00	6.97	0.00	0.00	0.00	0.00	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1427	STA-BRI-D	Body	Yes	1.43	0.00	23.07	64.74	0.00	8.85	0.00	0.58	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1428	STA-BRI-D	Body	Yes	0.88	0.00	25.75	63.53	0.00	7.11	0.45	0.97	0.00	0.00	1.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1547	STA-BRI-D	Body	Yes	0.51	0.33	20.04	71.40	0.00	4.47	0.42	0.00	0.00	0.00	2.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1548	STA-BRI-D	Body	Yes	0.00	0.31	22.45	69.10	0.00	5.26	0.00	0.53	0.00	0.00	2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1549	STA-BRI-D	Body	Yes	0.36	0.29	21.02	69.46	0.00	4.24	0.00	1.42	0.00	0.00	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1550	STA-BRI-D	Body	Yes	0.68	0.34	20.31	68.83	0.00	6.42	1.45	0.00	0.00	0.00	1.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1705	STA-BRI-D	Body	Yes	0.00	0.00	20.68	71.71	0.00	4.02	1.45	0.90	0.00	0.00	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1706	STA-BRI-D	Body	Yes	0.00	0.00	18.60	75.87	0.00	3.63	0.44	0.49	0.00	0.00	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1707	STA-BRI-D	Body	Yes	0.00	0.50	24.20	67.77	0.00	4.21	0.45	0.88	0.00	0.00	1.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1708	STA-BRI-D	Body	Yes	0.00	0.42	25.38	67.04	0.00	4.37	0.55	0.93	0.00	0.00	1.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1925	STA-BRI-D	Body	Yes	0.00	0.33	18.36	73.90	0.00	4.63	0.54	0.52	0.00	0.00	1.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1926	STA-BRI-D	Body	Yes	0.65	0.40	20.47	69.10	0.00	5.85	1.18	0.49	0.00	0.00	1.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1927	STA-BRI-D	Body	Yes	0.00	0.49	20.20	70.69	0.00	5.36	0.45	0.83	0.00	0.00	1.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-1928	STA-BRI-D	Body	Yes	0.00	0.46	21.18	69.82	0.00	5.08	0.65	0.55	0.00	0.00	2.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-2146	STA-BRI-D	Body	Yes	0.00	1.02	21.46	67.16	0.00	5.62	1.79	0.66	0.00	0.00	2.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-2147	STA-BRI-D	Body	Yes	0.67	2.84	19.78	61.38	1.48	5.63	4.61	0.72	0.00	0.71	2.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
STA-BRI-2005	STA-BRI-G	Body	Yes	0.30	0.44	21.47	65.82	-0.02	2.10	0.68	0.78	-0.03	0.12	5.34	0.20	0.36	0.30	0.06	-0.14	0.12	2.12	100.00
STA-BRI-2006	STA-BRI-G	Body	Yes	0.37	0.53	23.55	65.16	0.19	2.16	0.18	0.70	0.11	-0.09	3.77	-0.14	0.76	0.53	0.05	0.13	-0.12	2.16	100.00
STA-BRI-2007	STA-BRI-G	Body	Yes	0.21	0.99	22.01	66.19	0.03	2.43	0.28	0.93	-0.07	0.16	4.89	0.32	0.21	-0.41	0.16	0.51	-0.10	1.26	100.00
STA-BRI-2008	STA-BRI-G	Body	Yes	0.19	0.53	22.83	66.22	0.29	1.82	0.28	1.01	0.12	-0.05	4.98	-0.06	0.27	-0.07	-0.25	0.22	-0.26	1.93	100.00
STA-BRI-2009	STA-BRI-G	Body	Yes	0.48	0.43	17.69	71.10	-0.03	2.25	0.26	0.91	-0.08	0.39	4.07	0.16	0.27	0.12	0.15	0.08	-0.34	2.07	100.00
STA-BRI-2010	STA-BRI-G	Body	Yes	0.35	0.52	20.40	64.69	0.13	2.31	0.27	0.70	0.31	-0.11	6.82	-0.08	0.49	0.31	0.45	0.02	0.09	2.32	100.00
STA-BRI-2011	STA-BRI-G	Body	Yes	0.27	0.36	12.62	75.46	0.07	1.95	0.66	4.02	-0.18	0.05	2.69	-0.13	-0.08	0.04	0.01	0.39	-0.21	2.01	100.00
STA-BRI-2012	STA-BRI-G	Body	Yes	0.47	0.40	18.41	71.62	0.22	2.04	0.10	0.94	-0.07	0.03	3.26	-0.08	-0.22	0.29	-0.03	0.22	-0.21	2.60	100.00
STA-BRI-2222	STA-BRI-H	Body	Yes	0.00	0.32	19.98	75.10	0.46	2.29	0.70	1.01	-0.02	0.06	1.44	0.07	-0.57	-0.39	-0.22	-0.17	-0.05	-0.01	100.00
STA-BRI-2223	STA-BRI-H	Body	Yes	0.16	0.47	26.95	64.49	0.43	3.03	1.04	1.06	-0.07	0.37	2.17	-0.22	-0.10	0.19	-0.01	0.02	0.03	-0.02	100.00
STA-BUF-0741	STA-BUF-AA	Body	Yes	0.15	0.65	26.35	66.91	0.15	2.78	0.29	1.29	0.03	-0.02	2.45	0.07	0.10	-0.75	-0.21	-0.01	-0.05	-0.19	100.00
STA-BUF-0742	STA-BUF-AA	Body	Yes	0.35	0.88	25.25	64.44	0.21	4.53	0.54	0.79	0.11	0.12	1.97	0.10	0.53	-0.24	-0.19	0.45	0.21	-0.03	100.00
STA-BUF-0743	STA-BUF-AA	Body	Yes	0.20	0.48	24.67	68.10	0.28	2.83	0.35	1.41	0.00	-0.02	2.00	0.01	-0.61	0.09	-0.14	0.34	-0.07	0.08	100.00
STA-BUF-0744	STA-BUF-AA	Body	Yes	0.14	0.70	27.46	65.25	0.04	2.93	0.15	0.62	-0.14	0.15	2.04	-0.14	0.35	-0.11	-0.05	0.22	0.38	0.03	100.00
STA-BUF-1161	STA-BUF-AA	Body	Yes	0.09	0.47	20.14	74.39	0.34	2.55	0.22	0.57	-0.04	0.07	1.73	-0.24	-0.12	0.10	-0.21	-0.26	0.22	-0.03	100.00
STA-BUF-1162	STA-BUF-AA	Body	Yes	0.22	0.28	19.78	71.14	0.44	3.98	1.48	0.82	-0.03	0.17	1.34	0.19	-0.11	-0.01	-0.21	0.65	-0.09	-0.02	100.00
STA-BUF-1163	STA-BUF-AA	Body	Yes	0.50	0.48	22.02	68.15	0.38	4.25	2.15	0.64	0.16	-0.10	1.35	0.07	0.31	-0.48	-0.12	0.55	-0.20	-0.13	100.00
STA-BUF-1164	STA-BUF-AA	Body	Yes	0.26	0.45	23.30	67.39	0.29	3.91	0.57	1.42	0.08	0.05	2.12	-0.02	0.79	-0.33	-0.14	0.22	-0.39	0.03	100.00
STA-BUF-0105	STA-BUF-AB	Body	Yes	0.12	0.67	28.56	63.05	0.45	2.52	0.75	1.33	0.06	0.00	3.17	0.16	-0.22	-0.16	-0.23	-0.23	-0.01	0.01	100.00
STA-BUF-0106	STA-BUF-AB	Body	Yes	0.01	0.67	27.27	65.04	0.04	2.62	0.92	1.20	-0.18	0.07	1.88	0.24	-0.16	0.56	0.18	0.07	-0.21	-0.23	100.00
STA-BUF-0107	STA-BUF-AB	Body	Yes	0.11	0.41	24.81	68.58	0.15	2.55	0.88	1.05	0.00	-0.01	1.97	-0.20	-0.31	-0.09	0.03	0.36	-0.34	0.05	100.00
STA-BUF-0428	STA-BUF-AB	Body	Yes	0.14	0.39	27.73	64.72	0.26	3.13	1.40	0.83	0.02	0.00	1.74	-0.01	0.07	0.06	-0.18	-0.25	0.15	-0.20	100.00
STA-BUF-0429	STA-BUF-AB	Body	Yes	-0.03	0.33	20.77	73.62	0.16	2.67	0.85	0.94	0.08	-0.03	1.58	0.03	-0.48	0.01	-0.32	0.19	-0.23	-0.14	100.00
STA-BUF-0205	STA-BUF-B	Body	Yes	0.82	0.42	26.81	62.92	0.00	3.96	0.22	0.53	0.14	0.16	4.36	-0.18	0.04	-0.57	-0.22	0.35	0.19	0.06	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
STA-BUF-0206	STA-BUF-B	Body	Yes	0.57	**0.29**	26.61	62.55	**0.23**	**4.38**	**0.63**	1.18	0.25	**0.04**	**2.87**	0.20	0.56	0.04	-0.26	0.09	-0.31	**0.09**	100.00
STA-BUF-0207	STA-BUF-B	Body	Yes	0.55	**0.30**	18.49	72.50	**0.10**	**4.18**	**0.62**	0.22	-0.09	**0.22**	**2.56**	-0.24	0.05	0.25	-0.01	-0.01	0.26	**0.07**	100.00
STA-BUF-0208	STA-BUF-B	Body	Yes	0.41	**0.38**	23.05	68.01	**0.20**	**4.29**	**0.46**	0.64	-0.04	**-0.03**	**2.75**	0.05	0.07	-0.23	-0.12	-0.07	0.31	**-0.12**	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
STA-BUF-1025	STA-BUF-B	Body	Yes	0.05	**0.55**	23.51	70.16	**0.51**	**1.46**	**0.28**	0.98	0.19	**0.01**	**1.53**	0.23	-0.01	0.55	-0.13	0.20	-0.08	**0.02**	100.00
STA-BUF-1026	STA-BUF-B	Body	Yes	0.16	**0.76**	28.02	65.22	**0.33**	**2.38**	**0.41**	0.83	0.04	**0.06**	**1.76**	-0.08	-0.10	0.00	0.06	0.38	-0.11	**-0.12**	100.00
STA-BUF-1027	STA-BUF-B	Body	Yes	0.10	**0.36**	19.47	73.20	**0.48**	**2.88**	**1.04**	0.65	-0.09	**-0.09**	**1.16**	-0.26	0.21	0.14	-0.15	0.79	0.00	**0.11**	100.00
STA-BUF-1028	STA-BUF-B	Body	Yes	0.17	**0.37**	22.69	69.18	**0.54**	**2.93**	**2.05**	0.79	0.02	**-0.15**	**1.39**	0.05	0.11	-0.16	-0.51	0.31	0.25	**0.01**	100.00
STA-BUF-0605	STA-BUF-C	Body	Yes	0.47	**0.19**	17.67	71.56	**0.33**	**6.91**	**1.30**	0.12	0.06	**-0.03**	**1.52**	-0.17	0.29	-0.05	-0.09	-0.13	0.07	**-0.03**	100.00
STA-BUF-0606	STA-BUF-C	Body	Yes	0.40	**0.41**	19.42	69.10	**0.50**	**6.15**	**0.81**	0.21	-0.21	**0.00**	**1.50**	0.11	0.37	0.21	-0.35	0.93	0.28	**0.18**	100.00
STA-BUF-0607	STA-BUF-C	Body	Yes	0.34	**0.33**	17.75	72.77	**-0.02**	**5.57**	**0.43**	0.51	-0.09	**0.16**	**1.88**	-0.04	0.37	0.06	0.11	0.23	-0.18	**-0.15**	100.00
STA-BUF-0608	STA-BUF-C	Body	Yes	0.28	**0.34**	17.30	72.19	**0.28**	**6.20**	**1.09**	0.47	-0.05	**-0.01**	**1.51**	-0.17	0.25	0.42	-0.17	0.26	-0.16	**-0.03**	100.00
STA-BUF-0609	STA-BUF-C	Body	Yes	0.11	**0.38**	16.99	71.57	**0.94**	**5.27**	**1.70**	0.23	0.08	**0.03**	**1.77**	0.15	0.21	0.41	-0.48	0.25	0.11	**0.28**	100.00
STA-BUF-0610	STA-BUF-C	Body	Yes	0.43	**0.13**	17.41	72.94	**-0.09**	**6.51**	**1.32**	0.20	-0.01	**0.07**	**1.14**	-0.15	-0.03	-0.14	-0.04	0.23	0.02	**0.07**	100.00
STA-BUF-0611	STA-BUF-C	Body	Yes	0.51	**0.31**	19.43	70.06	**0.18**	**6.77**	**1.26**	0.09	-0.20	**0.11**	**1.73**	-0.02	-0.07	-0.75	-0.29	0.36	0.37	**0.13**	100.00
STA-BUF-1230	STA-BUF-C	Body	Yes	0.08	**0.65**	28.60	63.05	**0.45**	**2.26**	**0.28**	1.21	-0.01	**0.06**	**2.44**	-0.08	0.26	0.37	-0.16	0.38	0.13	**0.03**	100.00
STA-BUF-1231	STA-BUF-C	Body	Yes	0.13	**0.74**	30.72	60.58	**0.06**	**3.04**	**0.25**	1.20	0.13	**-0.11**	**3.07**	-0.08	0.23	0.36	0.05	0.09	-0.34	**-0.12**	100.00
STA-BUF-1232	STA-BUF-C	Body	Yes	0.01	**0.41**	27.03	66.61	**0.36**	**1.29**	**0.35**	1.52	-0.03	**0.09**	**1.93**	0.10	0.12	-0.19	-0.28	0.12	0.14	**0.43**	100.00
STA-BUF-1233	STA-BUF-C	Body	Yes	0.04	**0.54**	35.78	57.85	**0.38**	**1.04**	**0.69**	1.35	0.11	**0.03**	**2.19**	-0.13	0.24	-0.36	-0.28	0.62	-0.16	**0.05**	100.00
STA-BUF-1234	STA-BUF-C	Body	Yes	0.07	**0.59**	41.59	50.58	**0.52**	**1.31**	**1.11**	1.77	-0.14	**-0.21**	**2.59**	-0.21	-0.06	-0.43	-0.41	0.28	0.78	**0.28**	100.00
STA-BUF-1350	STA-BUF-C	Body	Yes	0.23	**0.45**	22.52	70.69	**0.13**	**3.58**	**0.35**	0.32	-0.07	**0.22**	**2.18**	-0.31	-0.01	-0.15	-0.13	-0.04	0.05	**-0.01**	100.00
STA-BUF-1351	STA-BUF-C	Body	Yes	0.52	**0.59**	21.33	67.36	**0.27**	**4.22**	**2.51**	0.53	0.11	**0.46**	**1.79**	-0.05	-0.54	0.23	-0.23	0.88	0.20	**-0.17**	100.00
STA-BUF-1352	STA-BUF-C	Body	Yes	0.62	**0.61**	22.67	65.79	**0.20**	**4.78**	**2.48**	0.56	-0.10	**0.30**	**1.88**	-0.20	-0.24	0.22	0.17	0.20	0.08	**-0.02**	100.00
STA-BUF-1353	STA-BUF-C	Body	Yes	0.73	**0.57**	20.90	66.41	**0.57**	**4.01**	**2.56**	0.61	-0.16	**0.18**	**1.84**	0.18	-0.28	-0.08	1.82	0.25	0.10	**-0.21**	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
KTC-BRI-1013	KTC-BRI-F	Glaze	Yes	0.58	**4.05**	16.25	57.50	**2.71**	**3.14**	**10.49**	0.47	-0.01	**1.70**	**3.12**	-0.04	-0.07	-0.10	-0.33	0.27	0.33	**-0.07**	100.00
KTC-BRI-1014	KTC-BRI-F	Glaze	Yes	0.77	**2.52**	18.11	60.04	**1.99**	**4.00**	**7.83**	0.60	0.11	**1.21**	**3.20**	-0.09	0.03	-0.26	-0.25	0.23	0.09	**-0.11**	100.00
KTC-BRI-1015	KTC-BRI-F	Glaze	Yes	0.83	**3.11**	17.75	56.62	**2.70**	**3.53**	**9.74**	0.55	-0.07	**1.56**	**3.45**	0.07	-0.19	-0.11	-0.21	0.61	0.20	**-0.15**	100.00
KTC-BRI-1016	KTC-BRI-F	Glaze	Yes	0.81	**3.00**	15.16	58.13	**2.25**	**5.81**	**10.57**	0.21	-0.09	**1.40**	**2.28**	0.01	0.04	-0.05	-0.32	0.29	0.60	**-0.10**	100.00
KTC-BRI-1017	KTC-BRI-F	Glaze	Yes	1.52	**2.19**	17.08	56.15	**1.72**	**6.57**	**9.22**	0.46	0.08	**1.23**	**3.26**	0.00	0.06	-0.06	-0.11	0.34	0.38	**-0.10**	100.00
KTC-BRI-1018	KTC-BRI-F	Glaze	Yes	1.07	**2.21**	16.47	58.11	**0.71**	**7.26**	**8.55**	0.31	-0.02	**1.14**	**2.81**	-0.13	0.04	-0.10	0.72	0.52	0.48	**-0.15**	100.00
KTC-TMP-0105	KTC-BUF-A	Glaze	Yes	0.87	**4.63**	12.61	51.94	**3.86**	**3.46**	**14.84**	0.46	0.17	**1.71**	**4.53**	-0.04	-0.01	0.12	0.06	0.19	0.44	**0.18**	100.00
KTC-TMP-0106	KTC-BUF-A	Glaze	Yes	0.94	**3.22**	14.45	55.10	**2.22**	**4.86**	**10.99**	0.49	0.06	**1.08**	**4.61**	-0.02	0.07	0.38	0.56	0.81	0.08	**0.10**	100.00
KTC-TMP-0315	KTC-BUF-B	Glaze	Yes	0.69	**2.61**	14.89	59.39	**2.28**	**3.34**	**11.91**	0.54	-0.02	**1.52**	**2.04**	-0.13	0.10	-0.04	-0.07	0.75	0.11	**0.08**	100.00
KTC-TMP-0316	KTC-BUF-B	Glaze	Yes	0.44	**2.86**	14.16	58.52	**2.29**	**3.45**	**13.47**	0.49	0.09	**1.59**	**1.98**	0.03	-0.27	-0.19	0.21	0.64	0.30	**-0.04**	100.00
KTC-TMP-0317	KTC-BUF-B	Glaze	Yes	1.05	**1.81**	16.68	59.97	**0.97**	**3.82**	**11.55**	0.55	-0.10	**1.32**	**1.76**	-0.01	0.16	-0.01	0.15	0.26	0.00	**0.05**	100.00
KTC-TMP-0318	KTC-BUF-B	Glaze	Yes	0.81	**2.24**	16.93	58.54	**1.48**	**3.55**	**11.98**	0.37	0.11	**1.19**	**1.98**	0.12	-0.06	-0.12	0.08	0.62	0.09	**0.08**	100.00
KTC-BUF-0405	KTC-BUF-C	Glaze	Yes	0.03	**3.13**	13.16	57.05	**2.49**	**1.78**	**15.37**	0.50	0.05	**0.41**	**5.07**	-0.05	-0.03	0.11	0.50	0.10	0.37	**-0.04**	100.00
KTC-BUF-0406	KTC-BUF-C	Glaze	Yes	0.35	**3.05**	13.32	58.80	**2.18**	**2.28**	**13.94**	0.65	-0.01	**0.44**	**4.19**	-0.07	0.10	-0.01	0.49	0.39	-0.08	**-0.01**	100.00
KTC-BUF-0407	KTC-BUF-C	Glaze	Yes	0.13	**2.88**	13.72	58.64	**2.50**	**2.17**	**13.94**	0.92	0.05	**0.39**	**3.69**	0.09	0.04	0.07	0.33	0.28	0.11	**0.04**	100.00
KTC-BUF-0408	KTC-BUF-C	Glaze	Yes	0.25	**3.03**	13.57	57.83	**2.78**	**2.29**	**13.70**	0.76	0.00	**0.44**	**4.79**	0.01	0.05	0.15	0.05	0.29	0.00	**0.01**	100.00
KTC-BUF-0417	KTC-BUF-C	Glaze	Yes	0.44	**2.59**	10.50	64.23	**2.24**	**2.24**	**12.84**	0.58	0.03	**0.38**	**3.16**	0.04	0.01	-0.07	0.31	0.52	-0.02	**0.00**	100.00
KTC-BUF-0418	KTC-BUF-C	Glaze	Yes	0.23	**3.01**	12.28	58.18	**2.98**	**2.24**	**15.62**	0.67	0.16	**0.47**	**3.59**	0.03	0.04	-0.07	0.25	0.25	0.15	**-0.07**	100.00
KTC-BUF-0513	KTC-BUF-C	Glaze	Yes	1.02	**3.68**	12.02	50.89	**2.94**	**2.24**	**13.41**	0.30	0.02	**2.32**	**10.21**	0.15	0.11	-0.03	0.24	0.02	0.53	**-0.08**	100.00
KTC-BUF-0514	KTC-BUF-C	Glaze	Yes	0.88	**3.98**	11.48	49.72	**3.18**	**3.05**	**14.45**	0.46	-0.02	**2.31**	**9.57**	0.09	-0.05	-0.01	0.33	0.45	0.28	**-0.15**	100.00
KTC-BUF-0515	KTC-BUF-C	Glaze	Yes	0.73	**3.98**	10.93	47.83	**2.97**	**2.90**	**15.17**	0.30	0.02	**2.66**	**10.83**	-0.02	-0.03	0.04	0.55	0.41	0.59	**0.13**	100.00
KTC-BUF-0516	KTC-BUF-C	Glaze	Yes	1.18	**3.68**	12.11	51.57	**2.90**	**3.62**	**13.47**	0.37	-0.08	**2.24**	**8.13**	0.05	-0.01	-0.04	0.15	0.40	0.25	**0.02**	100.00
KTC-BUF-0623	KTC-BUF-C	Glaze	Yes	0.49	**4.38**	10.98	57.73	**3.55**	**2.69**	**15.14**	0.36	0.04	**2.05**	**1.89**	0.00	0.02	0.23	0.06	0.21	0.22	**-0.05**	100.00
KTC-BUF-0624	KTC-BUF-C	Glaze	Yes	0.63	**4.40**	10.46	58.97	**3.34**	**2.73**	**14.12**	0.26	0.10	**2.15**	**2.00**	-0.02	0.03	0.18	0.10	0.16	0.46	**-0.07**	100.00
KTC-BUF-0625	KTC-BUF-C	Glaze	Yes	0.60	**3.98**	11.41	59.96	**2.79**	**2.96**	**13.35**	0.15	0.04	**1.84**	**1.71**	-0.03	0.18	0.15	-0.09	0.39	0.42	**0.20**	100.00
KTC-BUF-0626	KTC-BUF-C	Glaze	Yes	0.58	**4.27**	11.87	57.66	**3.17**	**2.47**	**15.39**	0.53	0.02	**2.01**	**1.70**	-0.05	0.05	0.06	0.22	0.08	0.03	**-0.04**	100.00
KTC-BUF-0831	KTC-BUF-C	Glaze	Yes	0.65	**3.59**	12.28	55.03	**4.00**	**3.14**	**15.14**	0.46	-0.11	**2.73**	**1.88**	0.03	0.08	0.25	0.29	0.30	0.21	**0.05**	100.00
KTC-BUF-0832	KTC-BUF-C	Glaze	Yes	0.63	**3.52**	12.29	56.50	**3.36**	**3.44**	**14.79**	0.34	0.15	**2.51**	**1.80**	0.07	-0.01	-0.12	0.28	0.20	0.42	**-0.15**	100.00
KTC-BUF-0833	KTC-BUF-C	Glaze	Yes	0.57	**3.71**	12.54	56.20	**3.34**	**3.30**	**14.54**	0.25	-0.04	**2.64**	**1.87**	-0.07	0.10	0.06	0.18	0.47	0.38	**-0.04**	100.00
KTC-BUF-0834	KTC-BUF-C	Glaze	Yes	0.74	**3.42**	12.53	55.28	**3.49**	**3.26**	**15.12**	0.30	-0.01	**2.50**	**2.26**	-0.04	-0.03	-0.04	0.29	0.63	0.35	**-0.06**	100.00
KTC-BUF-0835	KTC-BUF-C	Glaze	Yes	0.60	**2.96**	12.81	57.96	**3.00**	**3.57**	**12.82**	0.38	0.01	**2.75**	**1.90**	0.04	0.02	-0.11	0.31	0.42	0.45	**0.10**	100.00
KTC-BUF-0836	KTC-BUF-C	Glaze	Yes	0.59	**2.99**	12.62	57.57	**2.93**	**3.36**	**12.60**	0.29	0.09	**2.97**	**2.93**	0.12	0.20	0.11	-0.03	0.46	0.25	**-0.06**	100.00
KTC-BUF-0837	KTC-BUF-C	Glaze	Yes	0.64	**3.27**	12.44	57.60	**3.20**	**3.44**	**13.99**	0.36	-0.02	**2.53**	**1.79**	0.04	0.08	-0.09	-0.02	0.68	0.16	**-0.10**	100.00
KTC-BUF-0838	KTC-BUF-C	Glaze	Yes	0.66	**3.10**	12.78	56.58	**3.01**	**3.60**	**13.67**	0.29	0.01	**2.58**	**2.07**	0.08	0.00	0.11	0.33	0.43	0.57	**0.14**	100.00
KTC-BUF-0705	KTC-BUF-D	Glaze	Yes	0.12	**1.89**	17.17	61.07	**1.67**	**2.15**	**10.04**	0.77	-0.03	**0.20**	**3.57**	0.03	0.06	0.11	0.22	0.54	0.44	**-0.02**	100.00
KTC-BUF-0706	KTC-BUF-D	Glaze	Yes	0.20	**2.34**	14.41	59.47	**1.72**	**1.78**	**14.34**	0.55	0.00	**0.24**	**4.16**	-0.03	0.04	-0.02	0.01	0.57	0.25	**-0.02**	100.00
KTC-BUF-0707	KTC-BUF-D	Glaze	Yes	0.11	**1.58**	19.54	60.85	**1.42**	**2.19**	**9.35**	0.98	0.00	**0.13**	**4.03**	-0.06	0.03	-0.20	-0.18	0.00	0.29	**-0.05**	100.00
KTC-BUF-0708	KTC-BUF-D	Glaze	Yes	0.17	**1.43**	14.03	69.79	**1.19**	**1.94**	**6.97**	0.61	0.01	**0.07**	**3.32**	0.01	-0.07	0.05	0.04	0.25	0.16	**0.01**	100.00
KTC-BUF-0709	KTC-BUF-D	Glaze	Yes	0.07	**2.70**	12.11	55.67	**2.75**	**2.48**	**17.08**	0.56	0.11	**0.20**	**5.51**	0.14	-0.06	-0.01	0.12	0.38	0.21	**-0.01**	100.00
KTC-BUF-0710	KTC-BUF-D	Glaze	Yes	0.09	**2.62**	11.56	55.13	**2.96**	**2.22**	**18.13**	0.68	-0.04	**0.17**	**5.58**	0.15	-0.02	0.03	0.10	0.57	0.14	**-0.06**	100.00
KTC-BUF-0711	KTC-BUF-D	Glaze	Yes	0.12	**2.64**	11.06	55.10	**3.09**	**2.03**	**18.61**	0.74	0.00	**0.33**	**5.48**	-0.02	0.03	0.12	0.28	0.33	0.06	**0.02**	100.00
KTC-BUF-0712	KTC-BUF-D	Glaze	Yes	0.10	**2.44**	10.82	58.08	**2.66**	**2.41**	**16.59**	0.76	0.06	**0.18**	**5.58**	0.06	0.02	0.00	-0.08	0.33	0.01	**-0.01**	100.00
KTC-BUF-0917	KTC-BUF-D	Glaze	Yes	0.25	**2.23**	15.56	60.85	**3.12**	**2.27**	**8.71**	0.98	0.03	**0.19**	**5.18**	0.09	0.01	0.08	0.07	0.42	-0.03	**0.01**	100.00
KTC-BUF-0918	KTC-BUF-D	Glaze	Yes	0.10	**2.00**	12.65	66.34	**2.55**	**2.44**	**7.18**	0.91	0.05	**0.15**	**5.23**	0.12	0.01	0.09	-0.06	0.39	0.04	**-0.20**	100.00
KTC-BUF-0919	KTC-BUF-D	Glaze	Yes	0.16	**1.70**	13.59	67.02	**2.05**	**2.35**	**6.61**	0.70	0.16	**0.00**	**4.99**	0.09	-0.16	-0.04	0.11	0.50	0.13	**0.04**	100.00
KTC-BUF-0920	KTC-BUF-D	Glaze	Yes	0.11	**1.25**	20.95	64.80	**1.48**	**3.16**	**2.07**	1.04	0.03	**0.03**	**4.68**	0.09	-0.04	-0.03	0.25	0.18	0.03	**-0.09**	100.00
KTC-BUF-0921	KTC-BUF-D	Glaze	Yes	0.19	**2.40**	12.57	57.74	**2.65**	**2.48**	**14.66**	0.71	0.08	**0.28**	**5.23**	0.02	0.12	-0.07	0.19	0.55	0.19	**0.02**	100.00
KTC-BUF-0922	KTC-BUF-D	Glaze	Yes	0.03	**2.60**	12.21	56.78	**2.75**	**2.00**	**16.38**	0.87	0.07	**0.24**	**5.21**	0.03	-0.01	0.11	0.21	0.53	0.11	**-0.10**	100.00
KTC-BUF-0923	KTC-BUF-D	Glaze	Yes	0.19	**2.60**	12.47	57.08	**2.50**	**2.10**	**15.78**	0.84	0.12	**0.30**	**5.15**	0.03	0.14	0.08	0.04	0.52	0.05	**0.01**	100.00
KTC-BUF-0924	KTC-BUF-D	Glaze	Yes	0.01	**2.74**	11.82	57.30	**2.65**	**2.07**	**15.49**	0.69	0.03	**0.26**	**6.13**	0.05	-0.10	-0.06	0.38	0.33	0.27	**-0.06**	100.00
KTC-BUF-1029	KTC-BUF-D	Glaze	Yes	0.19	**4.89**	12.14	53.15	**2.20**	**2.82**	**17.18**	0.65	0.11	**1.93**	**4.21**	-0.03	-0.10	0.13	-0.14	0.58	0.21	**-0.12**	100.00
KTC-BUF-1030	KTC-BUF-D	Glaze	Yes	0.19	**4.43**	13.08	54.54	**2.07**	**2.79**	**15.07**	0.68	0.08	**1.68**	**4.32**	0.08	-0.03	0.02	0.23	0.34	0.39	**0.03**	100.00
KTC-BUF-1031	KTC-BUF-D	Glaze	Yes	0.17	**4.43**	12.96	54.20	**1.96**	**2.79**	**16.01**	0.72	0.11	**1.75**	**4.39**	0.00	-0.11	-0.08	0.20	0.43	0.05	**0.03**	100.00
KTC-BUF-1032	KTC-BUF-D	Glaze	Yes	0.30	**4.35**	12.82	54.44	**2.14**	**2.94**	**15.72**	0.85	-0.02	**1.69**	**4.31**	0.09	-0.11	-0.05	0.18	0.52	-0.07	**-0.10**	100.00
KTC-BUF-1033	KTC-BUF-D	Glaze	Yes	0.19	**3.34**	16.18	59.57	**1.74**	**3.14**	**8.33**	0.90	-0.01	**1.23**	**4.61**	0.03	0.09	0.33	-0.04	0.22	0.14	**0.00**	100.00
KTC-BUF-1034	KTC-BUF-D	Glaze	Yes	0.19	**2.72**	16.21	61.63	**1.45**	**3.36**	**7.16**	1.00	0.05	**1.11**	**4.57**	-0.02	0.04	0.01	0.00	0.24	0.22	**0.06**	100.00
KTC-BUF-1035	KTC-BUF-D	Glaze	Yes	0.22	**1.71**	18.72	64.83	**0.70**	**3.17**	**6.20**	0.77	0.00	**0.59**	**2.69**	-0.04	-0.11	0.17	-0.14	0.45	0.07	**-0.01**	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
KTC-BUF-1036	KTC-BUF-D	Glaze	Yes	0.14	**3**	16.98	60.29	**1.48**	**2.37**	**8.65**	0.91	0.08	**1.17**	**4.13**	-0.03	-0.10	0.06	0.01	0.43	0.28	**-0.15**	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
KTC-MER-0205	KTC-MER-A	Glaze	Yes	0.00	2.19	19.13	54.82	2.87	1.27	11.21	0.79	0.00	2.04	5.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
KTC-MER-0206	KTC-MER-A	Glaze	Yes	0.00	2.36	18.40	54.39	3.19	1.35	11.54	0.82	0.00	2.04	5.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
KTC-MER-0207	KTC-MER-A	Glaze	Yes	0.00	2.10	18.31	55.46	2.88	1.39	12.03	0.73	0.00	1.79	5.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
KTC-MER-0208	KTC-MER-A	Glaze	Yes	0.00	2.34	18.95	54.59	2.89	1.52	11.53	0.80	0.00	1.87	5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
KTC-MER-0413	KTC-MER-A	Glaze	Yes	0.00	3.17	18.84	63.18	0.00	3.42	5.90	1.01	0.00	1.86	2.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
KTC-MER-0414	KTC-MER-A	Glaze	Yes	0.91	2.74	18.47	58.86	1.56	4.30	7.98	0.75	0.00	1.47	2.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
KTC-MER-0415	KTC-MER-A	Glaze	Yes	0.00	4.81	16.95	53.95	2.43	2.50	12.97	0.64	0.00	2.57	2.34	0.00	0.00	0.00	0.00	0.00	0.83	0.00	100.00
KTC-MER-0416	KTC-MER-A	Glaze	Yes	0.53	3.86	17.04	56.75	1.27	3.15	11.03	0.60	0.00	2.29	2.52	0.00	0.00	0.00	0.00	0.00	0.96	0.00	100.00
KTC-TMP-0105	KTC-TMP-A	Glaze	Yes	0.54	4.71	12.61	50.49	3.66	3.26	18.90	0.44	0.00	1.40	2.79	0.05	0.05	0.06	0.41	0.43	0.35	-0.15	100.00
KTC-TMP-0106	KTC-TMP-A	Glaze	Yes	0.69	4.71	12.92	50.79	3.68	3.48	17.58	0.34	0.00	1.23	2.93	-0.09	0.15	0.16	0.39	0.82	0.31	-0.08	100.00
KTC-TMP-0107	KTC-TMP-A	Glaze	Yes	0.69	4.44	13.06	51.46	3.52	3.50	17.92	0.30	0.04	1.33	2.87	0.09	-0.08	-0.04	0.14	0.33	0.39	0.04	100.00
KTC-TMP-0108	KTC-TMP-A	Glaze	Yes	0.59	4.86	12.75	50.22	3.75	3.24	18.86	0.50	-0.06	1.29	2.99	0.06	-0.01	0.03	0.22	0.45	0.05	0.18	100.00
KTC-TMP-0213	KTC-TMP-B	Glaze	Yes	0.51	4.50	13.80	52.14	3.11	3.63	16.45	0.59	0.03	1.35	2.83	0.06	0.01	0.07	0.38	0.39	0.14	-0.01	100.00
KTC-TMP-0214	KTC-TMP-B	Glaze	Yes	0.70	4.34	14.26	52.83	3.10	3.85	15.37	0.51	0.00	1.28	2.91	-0.03	0.15	0.12	0.14	0.13	0.41	-0.05	100.00
KTC-TMP-0215	KTC-TMP-B	Glaze	Yes	0.57	3.79	14.94	53.67	2.79	4.24	14.44	0.33	0.04	1.17	2.87	0.00	-0.12	0.06	0.45	0.48	0.41	-0.12	100.00
KTC-TMP-0216	KTC-TMP-B	Glaze	Yes	0.61	4.83	13.59	50.93	3.52	3.52	16.96	0.36	0.01	1.62	3.08	-0.04	-0.04	0.16	0.31	0.40	0.27	-0.08	100.00
KTC-TMP-0233	KTC-TMP-B	Glaze	Yes	0.72	1.61	20.33	64.08	0.49	4.52	4.43	0.41	-0.03	0.48	1.55	0.05	-0.14	-0.46	0.46	0.76	0.58	0.16	100.00
KTC-TMP-0234	KTC-TMP-B	Glaze	Yes	0.44	1.35	21.01	63.72	1.07	3.78	3.74	0.69	-0.06	0.67	3.11	0.09	-0.05	0.12	0.26	-0.07	0.27	-0.14	100.00
KTC-TMP-0321	KTC-TMP-C	Glaze	Yes	0.73	4.74	13.62	50.07	3.73	3.53	16.29	0.42	0.04	2.02	3.72	0.16	0.03	-0.09	0.19	0.42	0.41	-0.04	100.00
KTC-TMP-0322	KTC-TMP-C	Glaze	Yes	0.79	4.54	13.86	49.77	3.32	3.76	15.95	0.50	0.07	2.01	3.66	0.04	0.04	0.14	0.20	1.09	0.24	0.02	100.00
KTC-TMP-0323	KTC-TMP-C	Glaze	Yes	0.77	4.79	13.84	50.69	3.16	3.50	16.10	0.59	0.06	1.90	3.53	0.02	0.00	0.03	0.28	0.38	0.38	-0.03	100.00
KTC-TMP-0324	KTC-TMP-C	Glaze	Yes	0.87	4.53	13.76	49.94	3.54	3.62	16.28	0.49	0.00	1.98	3.45	0.09	0.09	-0.04	0.46	0.58	0.41	-0.04	100.00
KTC-TMP-0429	KTC-TMP-C	Glaze	Yes	1.07	4.17	13.44	52.82	3.27	3.91	14.98	0.26	-0.01	2.00	3.38	0.00	0.01	0.01	-0.21	0.40	0.47	0.02	100.00
KTC-TMP-0430	KTC-TMP-C	Glaze	Yes	0.85	4.05	14.06	51.47	2.98	4.17	15.22	0.37	0.08	2.08	3.21	0.12	-0.15	-0.14	0.47	0.73	0.30	0.14	100.00
KTC-TMP-0431	KTC-TMP-C	Glaze	Yes	0.72	3.74	13.23	53.78	3.30	4.97	13.79	0.33	0.07	1.71	3.43	-0.07	-0.12	0.01	-0.03	0.78	0.41	-0.06	100.00
KTC-TMP-0432	KTC-TMP-C	Glaze	Yes	0.65	3.82	13.32	54.58	2.72	4.72	13.57	0.39	-0.10	1.70	3.47	-0.07	0.08	-0.16	0.36	1.00	0.17	-0.23	100.00
KTC-TMP-0539	KTC-TMP-C	Glaze	Yes	0.88	4.35	13.08	53.01	2.98	4.16	14.69	0.46	-0.17	1.90	3.42	0.11	0.08	0.22	0.30	0.33	0.30	-0.12	100.00
KTC-TMP-0540	KTC-TMP-C	Glaze	Yes	0.71	4.23	13.60	52.34	3.02	4.09	14.97	0.45	0.05	1.69	3.44	0.02	0.38	0.22	0.21	0.58	0.08	-0.08	100.00
KTC-TMP-0541	KTC-TMP-C	Glaze	Yes	0.82	4.02	12.63	56.86	2.74	3.77	13.39	0.32	0.00	1.86	2.76	-0.13	-0.08	0.01	0.13	0.40	0.48	0.01	100.00
KTC-TMP-0542	KTC-TMP-C	Glaze	Yes	0.65	3.85	13.35	54.72	2.96	4.52	13.50	0.33	-0.03	1.84	3.29	-0.04	0.10	0.01	0.24	0.54	0.13	0.06	100.00
KTC-BRI-1013	KTC-BRI-F	Interface	Yes	0.55	0.72	21.25	66.56	0.01	4.94	1.89	0.61	-0.06	0.20	2.86	-0.02	-0.11	0.05	0.40	0.32	-0.01	-0.17	100.00
KTC-BRI-1014	KTC-BRI-F	Interface	Yes	0.69	0.40	19.99	70.04	-0.08	4.36	1.38	0.51	-0.04	0.04	2.21	0.08	-0.18	0.09	0.17	-0.02	0.38	-0.02	100.00
KTC-BRI-1015	KTC-BRI-F	Interface	Yes	0.61	0.69	22.19	64.85	0.15	5.13	2.63	0.66	-0.09	0.23	2.52	0.07	-0.17	0.30	-0.13	0.42	0.14	-0.20	100.00
KTC-BRI-1016	KTC-BRI-F	Interface	Yes	0.77	0.47	21.96	65.51	0.03	6.21	0.81	0.84	-0.05	0.03	3.00	-0.09	0.09	0.14	0.08	0.01	0.10	0.12	100.00
KTC-BRI-1017	KTC-BRI-F	Interface	Yes	0.75	0.53	21.29	63.68	0.00	8.12	0.96	1.01	-0.05	0.17	3.56	-0.10	0.01	-0.03	0.16	0.27	-0.22	-0.10	100.00
KTC-BRI-1018	KTC-BRI-F	Interface	Yes	1.27	0.52	19.66	63.95	-0.05	8.38	1.51	0.96	0.04	0.06	3.46	-0.18	-0.04	-0.09	0.17	0.29	0.02	0.07	100.00
KTC-TMP-0105	KTC-BUF-A	Interface	Yes	1.01	2.90	15.97	55.15	2.11	4.02	12.30	0.56	0.00	1.05	4.10	0.07	0.08	0.22	0.24	0.41	-0.15	-0.03	100.00
KTC-TMP-0106	KTC-BUF-A	Interface	Yes	1.39	1.62	18.47	55.55	1.31	4.65	10.46	0.28	0.01	0.57	4.99	0.26	-0.18	-0.05	-0.17	0.40	0.54	-0.10	100.00
KTC-TMP-0315	KTC-BUF-B	Interface	Yes	0.82	0.57	24.47	63.09	0.15	4.91	3.63	0.64	0.04	0.16	1.17	0.27	-0.14	-0.10	0.07	0.48	0.10	-0.33	100.00
KTC-TMP-0316	KTC-BUF-B	Interface	Yes	0.95	1.01	20.47	61.44	0.66	4.33	7.84	0.39	0.17	0.40	1.21	0.02	-0.16	0.11	0.12	0.38	0.70	-0.03	100.00
KTC-TMP-0317	KTC-BUF-B	Interface	Yes	0.49	0.67	22.54	64.05	0.47	5.32	3.88	0.51	0.13	0.24	1.17	-0.03	0.26	-0.02	-0.13	0.30	0.10	0.05	100.00
KTC-TMP-0318	KTC-BUF-B	Interface	Yes	0.46	0.46	25.17	64.32	0.13	5.29	1.90	0.64	-0.06	-0.02	1.28	-0.08	-0.02	-0.03	0.05	0.71	-0.15	-0.07	100.00
KTC-BUF-0405	KTC-BUF-C	Interface	Yes	-0.10	2.54	12.97	61.88	2.06	2.24	12.93	0.49	-0.05	0.44	3.83	-0.03	0.11	0.03	0.32	-0.02	0.19	0.16	100.00
KTC-BUF-0406	KTC-BUF-C	Interface	Yes	0.33	0.83	13.67	69.74	1.04	2.28	7.67	0.58	0.07	0.06	2.69	0.02	0.10	0.35	-0.28	0.35	0.40	0.10	100.00
KTC-BUF-0407	KTC-BUF-C	Interface	Yes	0.30	1.38	13.40	68.52	1.15	2.49	7.91	1.11	0.00	0.19	2.82	-0.06	-0.11	-0.15	0.31	0.45	0.08	0.22	100.00
KTC-BUF-0408	KTC-BUF-C	Interface	Yes	0.32	1.21	15.25	61.98	2.50	2.11	10.98	0.60	0.07	0.14	4.18	-0.01	0.06	-0.06	0.36	0.18	0.29	-0.14	100.00
KTC-BUF-0417	KTC-BUF-C	Interface	Yes	0.93	0.73	9.23	77.30	1.18	3.83	3.65	0.98	-0.09	0.17	1.66	-0.03	0.17	-0.02	-0.18	0.12	0.16	0.21	100.00
KTC-BUF-0418	KTC-BUF-C	Interface	Yes	0.56	1.07	16.42	62.04	2.81	2.21	10.76	0.78	0.03	0.14	2.47	0.01	0.09	0.04	0.04	0.45	0.02	0.07	100.00
KTC-BUF-0513	KTC-BUF-C	Interface	Yes	1.58	1.05	14.47	68.22	0.73	4.51	5.16	0.32	0.00	0.69	2.78	-0.03	0.06	0.02	0.08	0.13	0.33	-0.11	100.00
KTC-BUF-0514	KTC-BUF-C	Interface	Yes	0.95	1.74	11.13	66.34	1.41	4.74	7.02	0.34	-0.02	1.16	4.86	0.10	-0.10	0.00	-0.03	0.15	0.22	0.00	100.00
KTC-BUF-0515	KTC-BUF-C	Interface	Yes	1.59	1.70	15.13	59.40	0.83	6.43	7.87	0.37	0.03	1.23	4.83	-0.03	0.14	0.03	0.15	0.42	0.07	-0.17	100.00
KTC-BUF-0516	KTC-BUF-C	Interface	Yes	1.53	1.64	14.44	62.15	1.10	5.54	6.70	0.38	-0.03	1.21	4.63	0.05	0.10	0.19	0.10	0.13	0.29	-0.15	100.00
KTC-BUF-0623	KTC-BUF-C	Interface	Yes	0.72	1.61	15.62	65.02	1.06	4.31	8.09	0.34	-0.02	0.85	1.65	0.01	-0.04	0.14	0.12	0.34	0.23	-0.05	100.00
KTC-BUF-0624	KTC-BUF-C	Interface	Yes	0.82	1.80	16.28	62.22	1.43	4.15	8.66	0.35	0.10	0.87	2.25	0.00	0.16	0.17	0.17	0.23	0.29	0.06	100.00
KTC-BUF-0625	KTC-BUF-C	Interface	Yes	0.88	1.53	17.50	61.91	1.26	5.41	7.99	0.46	0.01	0.75	1.58	0.11	0.08	-0.01	-0.20	0.63	0.25	-0.13	100.00
KTC-BUF-0626	KTC-BUF-C	Interface	Yes	0.74	1.24	15.49	67.86	0.89	3.99	6.07	0.41	-0.04	0.69	2.06	0.02	0.01	-0.06	-0.02	0.49	0.28	-0.11	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
KTC-BUF-0831	KTC-BUF-C	Interface	Yes	0.95	**2.48**	14.19	59.91	**2.22**	**3.89**	**11.62**	0.25	0.03	**1.78**	**1.75**	0.08	-0.04	-0.09	0.14	0.29	0.59	**-0.05**	100.00
KTC-BUF-0832	KTC-BUF-C	Interface	Yes	0.98	**1.16**	15.51	65.77	**1.42**	**5.61**	**6.73**	0.37	0.02	**0.77**	**1.52**	0.04	-0.06	-0.03	-0.13	0.30	0.18	**-0.17**	100.00
KTC-BUF-0833	KTC-BUF-C	Interface	Yes	1.08	**1.95**	15.21	60.82	**1.76**	**4.56**	**9.93**	0.48	0.02	**1.40**	**1.74**	-0.08	0.02	0.04	0.22	0.53	0.31	**0.00**	100.00
KTC-BUF-0834	KTC-BUF-C	Interface	Yes	0.84	**2.35**	13.83	60.79	**1.87**	**3.80**	**11.42**	0.55	0.03	**1.77**	**2.43**	0.08	-0.08	-0.12	0.24	0.01	0.24	**-0.03**	100.00
KTC-BUF-0835	KTC-BUF-C	Interface	Yes	1.14	**1.56**	14.90	64.08	**1.29**	**3.61**	**9.76**	0.38	0.15	**1.28**	**1.53**	-0.03	0.00	-0.07	0.11	0.25	0.13	**-0.08**	100.00
KTC-BUF-0836	KTC-BUF-C	Interface	Yes	0.75	**0.59**	15.78	70.09	**0.52**	**4.86**	**4.91**	0.36	0.01	**0.67**	**1.31**	0.11	0.16	-0.19	-0.22	0.32	0.13	**-0.17**	100.00
KTC-BUF-0837	KTC-BUF-C	Interface	Yes	0.80	**0.75**	14.86	71.24	**0.32**	**4.87**	**4.53**	0.36	0.05	**0.48**	**1.07**	0.08	0.13	0.07	0.13	0.27	0.09	**-0.11**	100.00
KTC-BUF-0838	KTC-BUF-C	Interface	Yes	0.85	**0.60**	15.54	70.27	**0.29**	**5.22**	**4.86**	0.23	-0.03	**0.44**	**1.03**	0.08	0.05	0.05	-0.11	0.29	0.27	**0.06**	100.00
KTC-BUF-0705	KTC-BUF-D	Interface	Yes	0.08	**0.53**	21.87	70.55	**0.18**	**2.55**	**1.40**	0.98	0.01	**0.02**	**1.65**	0.00	0.03	0.01	-0.10	0.17	0.14	**-0.09**	100.00
KTC-BUF-0706	KTC-BUF-D	Interface	Yes	0.34	**1.24**	14.82	59.51	**3.82**	**1.66**	**13.96**	0.36	0.04	**0.23**	**3.13**	0.00	0.04	0.12	0.11	0.37	0.05	**0.18**	100.00
KTC-BUF-0707	KTC-BUF-D	Interface	Yes	0.06	**0.60**	22.01	69.97	**0.03**	**2.65**	**1.09**	1.07	0.02	**0.00**	**1.91**	0.02	-0.02	0.00	0.10	0.35	0.10	**0.05**	100.00
KTC-BUF-0708	KTC-BUF-D	Interface	Yes	0.02	**0.66**	25.38	66.41	**0.17**	**2.62**	**1.62**	0.98	-0.02	**0.13**	**2.17**	-0.15	-0.06	-0.18	0.05	0.18	0.02	**0.00**	100.00
KTC-BUF-0709	KTC-BUF-D	Interface	Yes	0.34	**1.32**	17.41	60.47	**1.15**	**2.71**	**11.78**	0.78	0.07	**0.15**	**3.67**	-0.13	0.10	0.02	0.04	0.36	-0.08	**-0.15**	100.00
KTC-BUF-0710	KTC-BUF-D	Interface	Yes	0.29	**1.05**	19.09	60.39	**0.85**	**3.03**	**10.48**	0.65	-0.01	**0.25**	**3.16**	0.06	0.13	0.06	-0.09	0.54	0.20	**-0.11**	100.00
KTC-BUF-0711	KTC-BUF-D	Interface	Yes	0.13	**1.51**	14.11	63.79	**1.60**	**2.56**	**11.64**	0.55	-0.05	**0.17**	**3.35**	0.06	-0.11	0.00	0.10	0.52	0.15	**-0.06**	100.00
KTC-BUF-0712	KTC-BUF-D	Interface	Yes	0.32	**1.24**	18.22	59.39	**1.33**	**2.53**	**12.40**	0.64	0.01	**0.01**	**3.51**	-0.02	-0.14	0.08	0.01	0.36	0.06	**0.05**	100.00
KTC-BUF-0917	KTC-BUF-D	Interface	Yes	0.09	**0.79**	20.34	67.19	**0.49**	**2.44**	**4.89**	1.09	0.03	**0.11**	**1.94**	0.02	-0.02	0.08	0.07	0.34	0.18	**-0.06**	100.00
KTC-BUF-0918	KTC-BUF-D	Interface	Yes	0.20	**1.34**	16.76	64.75	**1.51**	**2.28**	**7.71**	0.98	0.00	**0.12**	**3.97**	0.11	-0.03	-0.01	-0.09	0.21	0.17	**0.01**	100.00
KTC-BUF-0919	KTC-BUF-D	Interface	Yes	0.03	**0.92**	16.98	70.68	**0.58**	**2.35**	**4.59**	0.90	0.06	**0.14**	**2.32**	-0.09	-0.17	-0.03	0.20	0.54	0.16	**-0.17**	100.00
KTC-BUF-0920	KTC-BUF-D	Interface	Yes	0.00	**0.55**	21.51	71.20	**0.16**	**2.36**	**0.70**	1.25	-0.12	**0.03**	**1.93**	0.10	0.06	0.04	0.17	0.03	0.05	**-0.01**	100.00
KTC-BUF-0921	KTC-BUF-D	Interface	Yes	0.24	**1.17**	17.76	62.72	**1.03**	**2.96**	**9.79**	1.20	0.02	**0.14**	**2.91**	-0.02	0.06	-0.03	-0.13	0.45	-0.10	**-0.15**	100.00
KTC-BUF-0922	KTC-BUF-D	Interface	Yes	0.19	**1.55**	14.70	63.51	**1.27**	**2.43**	**11.49**	0.75	0.11	**0.16**	**2.94**	0.01	-0.05	0.28	0.25	0.39	0.16	**-0.13**	100.00
KTC-BUF-0923	KTC-BUF-D	Interface	Yes	0.24	**1.52**	15.98	61.11	**1.17**	**2.40**	**12.69**	0.72	-0.04	**0.08**	**3.27**	0.04	0.19	-0.02	0.02	0.37	0.29	**0.00**	100.00
KTC-BUF-0924	KTC-BUF-D	Interface	Yes	0.19	**1.68**	15.01	61.33	**1.60**	**2.37**	**12.54**	0.75	0.11	**0.17**	**3.68**	0.07	-0.04	0.01	-0.14	0.60	0.12	**-0.06**	100.00
KTC-BUF-1029	KTC-BUF-D	Interface	Yes	0.20	**1.03**	12.88	75.70	**0.47**	**2.94**	**3.70**	0.59	-0.02	**0.39**	**1.75**	0.00	0.05	0.14	-0.08	0.19	0.13	**-0.08**	100.00
KTC-BUF-1030	KTC-BUF-D	Interface	Yes	0.32	**3.00**	15.79	57.35	**1.38**	**3.23**	**12.77**	0.82	0.13	**1.22**	**3.19**	0.09	0.07	0.17	-0.02	0.52	-0.01	**-0.04**	100.00
KTC-BUF-1031	KTC-BUF-D	Interface	Yes	0.18	**1.86**	8.57	73.75	**1.05**	**2.81**	**7.79**	0.40	0.02	**0.81**	**2.03**	-0.01	0.13	0.13	0.00	0.50	0.16	**-0.18**	100.00
KTC-BUF-1032	KTC-BUF-D	Interface	Yes	0.43	**2.37**	17.02	58.84	**1.16**	**3.48**	**11.37**	0.79	0.05	**0.87**	**2.89**	0.19	0.02	0.17	-0.18	0.45	0.25	**-0.17**	100.00
KTC-BUF-1033	KTC-BUF-D	Interface	Yes	0.16	**1.13**	21.46	64.74	**0.28**	**3.41**	**5.10**	1.18	0.01	**0.35**	**2.24**	-0.04	-0.11	0.02	0.01	0.15	-0.02	**-0.06**	100.00
KTC-BUF-1034	KTC-BUF-D	Interface	Yes	0.11	**0.68**	18.83	72.64	**0.32**	**2.59**	**2.26**	0.63	0.05	**0.13**	**1.73**	0.02	0.03	-0.06	-0.09	0.25	0.02	**-0.12**	100.00
KTC-BUF-1035	KTC-BUF-D	Interface	Yes	0.09	**0.58**	14.95	78.29	**0.24**	**2.23**	**1.02**	0.62	0.06	**0.13**	**1.61**	0.11	-0.06	-0.08	-0.07	0.17	0.13	**-0.03**	100.00
KTC-BUF-1036	KTC-BUF-D	Interface	Yes	0.13	**1**	20.80	65.95	**0.06**	**2.73**	**5.31**	0.92	-0.03	**0.36**	**2.16**	0.14	0.04	0.08	0.02	0.28	-0.06	**-0.07**	100.00
KTC-MER-0205	KTC-MER-A	Interface	Yes	0.00	**1.25**	19.86	62.10	**1.10**	**2.30**	**8.52**	0.59	0.00	**1.35**	**2.92**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-MER-0206	KTC-MER-A	Interface	Yes	0.46	**1.50**	19.93	58.53	**1.83**	**1.53**	**11.16**	0.56	0.00	**1.28**	**3.23**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-MER-0207	KTC-MER-A	Interface	Yes	0.00	**0.91**	18.32	66.34	**0.00**	**2.77**	**7.79**	0.82	0.00	**0.90**	**2.14**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-MER-0208	KTC-MER-A	Interface	Yes	0.00	**1.14**	18.21	64.42	**1.11**	**2.74**	**8.01**	0.53	0.00	**0.99**	**2.85**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-MER-0414	KTC-MER-A	Interface	Yes	0.48	**0.34**	19.15	71.84	**0.00**	**4.94**	**1.47**	0.65	0.00	**0.00**	**1.13**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-MER-0415	KTC-MER-A	Interface	Yes	0.79	**1.34**	18.60	65.50	**0.00**	**4.90**	**6.09**	0.62	0.00	**0.95**	**1.21**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-MER-0416	KTC-MER-A	Interface	Yes	0.00	**0.00**	21.89	70.28	**0.00**	**4.94**	**0.83**	0.64	0.00	**0.00**	**1.42**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-TMP-0105	KTC-TMP-A	Interface	Yes	1.01	**1.93**	19.05	57.76	**1.28**	**5.78**	**9.85**	0.35	0.10	**0.56**	**1.80**	-0.02	-0.14	-0.13	0.00	0.61	0.38	**-0.15**	100.00
KTC-TMP-0106	KTC-TMP-A	Interface	Yes	0.78	**2.22**	18.07	56.07	**1.84**	**6.00**	**10.89**	0.50	-0.01	**0.65**	**2.29**	-0.03	-0.02	0.05	-0.05	0.63	0.22	**-0.09**	100.00
KTC-TMP-0107	KTC-TMP-A	Interface	Yes	1.01	**1.61**	18.39	59.94	**1.00**	**6.29**	**8.51**	0.44	0.08	**0.54**	**1.55**	-0.09	0.00	-0.06	0.14	0.40	0.20	**0.05**	100.00
KTC-TMP-0108	KTC-TMP-A	Interface	Yes	1.03	**2.48**	16.77	56.27	**1.92**	**5.37**	**11.73**	0.68	0.12	**0.75**	**1.95**	0.00	0.03	-0.08	0.23	0.55	0.28	**-0.08**	100.00
KTC-TMP-0213	KTC-TMP-B	Interface	Yes	0.89	**0.65**	19.41	65.87	**0.19**	**7.33**	**2.69**	0.63	0.07	**0.13**	**1.48**	0.07	0.04	0.11	0.07	0.54	-0.17	**0.00**	100.00
KTC-TMP-0214	KTC-TMP-B	Interface	Yes	1.06	**1.27**	17.38	61.15	**0.68**	**7.15**	**6.75**	0.54	0.00	**0.75**	**1.82**	0.04	0.10	0.19	0.34	0.72	0.23	**-0.16**	100.00
KTC-TMP-0215	KTC-TMP-B	Interface	Yes	0.49	**0.25**	15.53	76.46	**0.16**	**4.60**	**1.07**	0.40	0.03	**0.09**	**1.05**	0.02	-0.13	0.09	-0.40	0.33	-0.02	**-0.02**	100.00
KTC-TMP-0216	KTC-TMP-B	Interface	Yes	0.81	**1.31**	18.02	63.12	**0.60**	**6.79**	**5.89**	0.35	-0.06	**0.36**	**1.74**	0.10	-0.21	0.13	0.16	0.50	0.28	**0.12**	100.00
KTC-TMP-0233	KTC-TMP-B	Interface	Yes	0.57	**0.76**	22.80	65.61	**0.49**	**4.28**	**2.68**	0.31	-0.09	**0.29**	**1.91**	0.07	0.16	0.13	-0.22	0.07	0.39	**-0.22**	100.00
KTC-TMP-0234	KTC-TMP-B	Interface	Yes	0.32	**0.45**	22.69	69.97	**-0.04**	**3.33**	**1.13**	0.45	-0.01	**0.13**	**1.82**	0.02	-0.02	-0.03	0.07	-0.51	0.23	**0.00**	100.00
KTC-TMP-0321	KTC-TMP-C	Interface	Yes	1.21	**2.19**	16.63	58.44	**1.81**	**4.66**	**9.94**	0.64	-0.05	**1.03**	**2.65**	-0.07	-0.05	0.08	0.43	0.34	0.18	**-0.05**	100.00
KTC-TMP-0322	KTC-TMP-C	Interface	Yes	1.25	**2.31**	17.19	57.27	**1.99**	**4.31**	**10.63**	0.37	0.08	**1.11**	**2.65**	0.00	0.03	-0.04	0.19	0.25	0.43	**-0.04**	100.00
KTC-TMP-0323	KTC-TMP-C	Interface	Yes	1.08	**2.37**	17.33	56.02	**2.36**	**4.36**	**10.83**	0.46	0.13	**0.83**	**2.95**	0.07	0.06	0.11	-0.13	0.65	0.38	**0.11**	100.00
KTC-TMP-0324	KTC-TMP-C	Interface	Yes	1.13	**2.38**	16.70	55.82	**1.77**	**4.57**	**11.85**	0.56	0.05	**1.00**	**2.79**	0.05	-0.02	0.12	0.16	0.70	0.48	**-0.12**	100.00
KTC-TMP-0429	KTC-TMP-C	Interface	Yes	0.90	**1.60**	17.69	61.58	**1.17**	**5.82**	**7.00**	0.41	-0.08	**0.73**	**2.24**	0.02	-0.02	0.07	-0.14	0.66	0.31	**0.04**	100.00
KTC-TMP-0430	KTC-TMP-C	Interface	Yes	1.27	**1.50**	18.67	56.25	**2.13**	**4.89**	**10.50**	0.32	-0.01	**0.87**	**2.56**	-0.01	-0.07	0.02	0.62	0.62	0.07	**-0.20**	100.00
KTC-TMP-0431	KTC-TMP-C	Interface	Yes	1.31	**1.57**	18.06	58.61	**1.41**	**6.54**	**8.37**	0.57	-0.07	**0.78**	**2.12**	-0.17	0.09	0.11	0.22	0.31	0.01	**0.16**	100.00
KTC-TMP-0432	KTC-TMP-C	Interface	Yes	1.33	**1.71**	18.99	55.99	**2.01**	**4.98**	**10.52**	0.26	0.13	**0.84**	**2.42**	-0.03	-0.11	-0.04	-0.05	0.55	0.46	**0.05**	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
KTC-TMP-0539	KTC-TMP-C	Interface	Yes	1.24	**1.50**	17.94	61.42	**0.62**	**5.85**	**7.56**	0.44	0.03	**0.54**	**2.16**	-0.08	0.10	-0.09	0.29	0.29	0.26	**-0.08**	100.00
KTC-TMP-0540	KTC-TMP-C	Interface	Yes	1.51	**1.51**	18.61	55.87	**2.18**	**4.55**	**10.96**	0.67	-0.03	**0.65**	**2.98**	0.10	-0.15	0.09	0.12	-0.11	0.27	**0.23**	100.00
KTC-TMP-0541	KTC-TMP-C	Interface	Yes	1.31	**2.56**	16.93	55.30	**1.77**	**5.24**	**11.17**	0.41	0.00	**1.01**	**3.12**	0.15	-0.07	-0.04	0.51	0.52	0.18	**-0.05**	100.00
KTC-TMP-0542	KTC-TMP-C	Interface	Yes	1.22	**2.26**	17.42	56.12	**1.81**	**4.73**	**11.27**	0.26	0.03	**0.94**	**2.92**	-0.22	0.01	0.13	0.35	0.11	0.54	**0.10**	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
KTC-BRI-1013	KTC-BRI-F	Body	Yes	0.26	**0.64**	22.29	68.07	**0.04**	**3.60**	**0.48**	0.76	-0.06	**-0.03**	**3.85**	0.16	0.00	0.30	0.02	-0.35	0.08	**-0.12**	100.00
KTC-BRI-1014	KTC-BRI-F	Body	Yes	0.23	**0.48**	12.77	80.78	**0.15**	**2.67**	**0.19**	0.33	-0.02	**0.09**	**2.29**	0.20	0.12	-0.02	-0.13	-0.16	0.05	**-0.02**	100.00
KTC-BRI-1015	KTC-BRI-F	Body	Yes	0.36	**0.56**	20.11	70.68	**0.08**	**3.54**	**0.34**	0.64	0.03	**0.19**	**3.30**	0.23	0.19	-0.12	0.09	-0.23	-0.04	**0.04**	100.00
KTC-BRI-1016	KTC-BRI-F	Body	Yes	0.34	**0.57**	24.15	64.65	**0.22**	**5.15**	**0.34**	0.66	-0.11	**0.10**	**3.85**	-0.10	0.19	-0.17	-0.18	0.24	0.17	**-0.10**	100.00
KTC-BRI-1017	KTC-BRI-F	Body	Yes	0.41	**0.77**	20.97	67.84	**0.28**	**4.88**	**0.14**	0.32	0.06	**0.04**	**3.49**	0.03	0.18	0.08	0.10	0.01	0.31	**0.08**	100.00
KTC-BRI-1018	KTC-BRI-F	Body	Yes	0.30	**0.59**	15.87	74.11	**0.20**	**4.84**	**0.42**	0.62	-0.11	**0.13**	**2.74**	0.12	0.04	-0.29	0.03	0.85	-0.30	**-0.17**	100.00
KTC-TMP-0105	KTC-BUF-A	Body	Yes	0.39	**0.52**	19.41	70.13	**0.13**	**4.44**	**1.06**	0.41	0.09	**0.15**	**3.34**	0.06	0.01	-0.12	-0.15	0.07	0.20	**-0.13**	100.00
KTC-TMP-0106	KTC-BUF-A	Body	Yes	1.00	**0.54**	21.88	65.62	**0.17**	**5.78**	**1.78**	0.38	0.21	**0.13**	**2.83**	-0.11	0.14	0.13	0.04	-0.48	0.07	**-0.09**	100.00
KTC-TMP-0315	KTC-BUF-B	Body	Yes	0.30	**0.66**	22.90	68.71	**0.13**	**3.93**	**0.31**	0.59	0.03	**0.10**	**1.72**	-0.09	0.12	-0.10	-0.05	0.59	0.14	**0.00**	100.00
KTC-TMP-0316	KTC-BUF-B	Body	Yes	0.55	**0.35**	23.90	67.70	**0.21**	**4.42**	**0.53**	0.66	0.03	**0.05**	**1.60**	-0.02	0.10	0.10	-0.22	0.23	-0.25	**0.05**	100.00
KTC-TMP-0317	KTC-BUF-B	Body	Yes	0.42	**0.54**	25.28	66.70	**0.26**	**4.16**	**0.42**	0.50	-0.02	**-0.03**	**1.92**	-0.06	-0.24	-0.19	-0.08	0.40	0.07	**-0.02**	100.00
KTC-TMP-0318	KTC-BUF-B	Body	Yes	0.34	**0.56**	22.22	70.29	**-0.11**	**3.94**	**0.32**	0.58	-0.06	**-0.15**	**1.50**	0.12	0.02	-0.07	0.40	0.04	-0.10	**0.16**	100.00
KTC-BUF-0405	KTC-BUF-C	Body	Yes	0.17	**0.60**	17.12	74.61	**0.42**	**2.22**	**2.16**	0.74	0.04	**0.14**	**2.02**	0.08	-0.05	-0.09	-0.29	0.23	-0.04	**-0.10**	100.00
KTC-BUF-0406	KTC-BUF-C	Body	Yes	-0.04	**0.69**	22.17	66.63	**0.12**	**3.09**	**2.71**	1.12	0.07	**-0.06**	**2.91**	-0.01	-0.10	0.12	0.41	0.09	0.20	**-0.11**	100.00
KTC-BUF-0407	KTC-BUF-C	Body	Yes	0.18	**0.39**	14.55	78.03	**0.51**	**2.42**	**1.31**	0.72	0.06	**-0.04**	**2.15**	0.06	-0.07	-0.09	-0.10	0.17	0.00	**-0.26**	100.00
KTC-BUF-0408	KTC-BUF-C	Body	Yes	0.29	**0.63**	19.69	67.66	**0.64**	**3.07**	**4.76**	0.64	0.04	**-0.04**	**2.47**	0.01	-0.10	0.03	-0.11	0.34	0.08	**-0.09**	100.00
KTC-BUF-0417	KTC-BUF-C	Body	Yes	0.09	**0.50**	21.90	70.61	**0.24**	**3.00**	**0.47**	0.77	0.01	**0.04**	**2.67**	-0.08	0.06	-0.20	-0.18	0.24	0.00	**-0.12**	100.00
KTC-BUF-0418	KTC-BUF-C	Body	Yes	0.13	**0.47**	22.67	69.01	**0.06**	**2.96**	**0.56**	0.82	0.00	**0.05**	**2.78**	0.05	-0.04	0.03	0.17	0.00	0.24	**0.04**	100.00
KTC-BUF-0513	KTC-BUF-C	Body	Yes	0.66	**0.53**	16.35	75.88	**0.16**	**3.46**	**0.26**	1.29	-0.10	**0.08**	**1.31**	0.08	-0.10	0.03	-0.15	0.28	0.01	**-0.03**	100.00
KTC-BUF-0514	KTC-BUF-C	Body	Yes	0.37	**0.46**	15.69	77.48	**0.11**	**3.38**	**0.35**	0.61	-0.03	**0.06**	**1.37**	-0.09	0.12	0.01	-0.03	0.15	0.08	**-0.08**	100.00
KTC-BUF-0515	KTC-BUF-C	Body	Yes	2.33	**0.03**	17.53	65.82	**0.09**	**10.89**	**1.04**	0.03	-0.01	**0.15**	**1.19**	0.05	0.00	0.07	0.00	0.19	0.65	**-0.04**	100.00
KTC-BUF-0516	KTC-BUF-C	Body	Yes	0.65	**0.54**	19.36	72.47	**0.16**	**4.36**	**0.21**	0.52	-0.05	**0.07**	**1.40**	0.05	0.08	0.15	0.19	0.02	-0.05	**-0.12**	100.00
KTC-BUF-0623	KTC-BUF-C	Body	Yes	0.49	**0.54**	20.32	69.94	**0.28**	**4.05**	**0.67**	0.75	-0.01	**0.16**	**2.79**	0.06	-0.05	0.02	-0.14	0.02	0.14	**-0.04**	100.00
KTC-BUF-0624	KTC-BUF-C	Body	Yes	0.31	**0.57**	20.22	70.51	**0.20**	**4.05**	**0.53**	0.44	-0.07	**0.12**	**2.99**	0.06	-0.01	0.08	-0.10	0.04	0.07	**-0.01**	100.00
KTC-BUF-0625	KTC-BUF-C	Body	Yes	1.34	**0.50**	18.83	65.95	**0.47**	**8.93**	**2.20**	0.11	0.03	**0.21**	**1.01**	-0.10	-0.16	0.16	-0.04	0.25	0.40	**-0.08**	100.00
KTC-BUF-0626	KTC-BUF-C	Body	Yes	0.21	**0.41**	20.24	71.50	**0.26**	**3.40**	**0.27**	0.54	-0.02	**0.10**	**2.80**	0.01	0.05	0.05	-0.13	0.39	0.10	**-0.19**	100.00
KTC-BUF-0831	KTC-BUF-C	Body	Yes	0.79	**0.32**	17.20	70.04	**0.15**	**6.22**	**2.55**	0.45	-0.04	**0.19**	**1.70**	0.08	0.09	0.14	-0.05	0.16	-0.01	**0.02**	100.00
KTC-BUF-0832	KTC-BUF-C	Body	Yes	0.62	**0.37**	17.76	71.67	**0.19**	**5.74**	**0.87**	0.96	0.00	**0.08**	**1.81**	0.09	0.01	-0.11	-0.01	0.08	0.02	**-0.13**	100.00
KTC-BUF-0833	KTC-BUF-C	Body	Yes	0.62	**0.32**	16.67	72.84	**0.24**	**5.97**	**1.34**	0.36	0.07	**0.08**	**1.52**	-0.01	0.02	-0.18	-0.11	0.24	0.13	**-0.11**	100.00
KTC-BUF-0834	KTC-BUF-C	Body	Yes	0.68	**0.36**	18.82	69.63	**0.17**	**6.15**	**1.52**	0.34	0.02	**0.20**	**1.83**	-0.07	0.03	0.04	0.01	0.18	0.13	**-0.05**	100.00
KTC-BUF-0835	KTC-BUF-C	Body	Yes	0.54	**0.38**	17.71	73.89	**0.25**	**4.00**	**0.89**	0.52	0.07	**0.15**	**1.66**	0.04	0.03	-0.03	-0.12	0.06	-0.01	**-0.03**	100.00
KTC-BUF-0836	KTC-BUF-C	Body	Yes	0.48	**0.37**	19.53	71.94	**0.21**	**3.73**	**0.59**	0.81	-0.04	**0.10**	**2.03**	0.04	-0.04	0.05	0.02	0.20	0.09	**-0.11**	100.00
KTC-BUF-0837	KTC-BUF-C	Body	Yes	0.34	**0.41**	19.66	72.38	**0.17**	**3.72**	**0.30**	0.72	0.02	**-0.04**	**2.02**	0.04	0.23	-0.09	-0.12	0.19	0.21	**-0.16**	100.00
KTC-BUF-0838	KTC-BUF-C	Body	Yes	0.57	**0.39**	20.10	72.05	**0.17**	**4.28**	**0.48**	0.44	0.10	**-0.07**	**1.81**	-0.05	0.01	-0.11	-0.03	-0.11	0.12	**-0.14**	100.00
KTC-BUF-0705	KTC-BUF-D	Body	Yes	0.05	**0.78**	24.94	67.21	**0.20**	**2.85**	**0.45**	1.27	0.01	**0.04**	**2.33**	-0.05	0.00	-0.06	-0.07	0.05	-0.04	**0.04**	100.00
KTC-BUF-0706	KTC-BUF-D	Body	Yes	0.11	**0.75**	24.17	68.52	**0.09**	**2.90**	**0.27**	0.92	-0.08	**0.04**	**2.08**	0.07	-0.04	0.06	0.03	0.12	0.04	**-0.05**	100.00
KTC-BUF-0707	KTC-BUF-D	Body	Yes	0.10	**0.55**	19.68	74.48	**0.18**	**2.22**	**0.28**	0.88	0.03	**-0.01**	**1.83**	0.00	-0.14	0.00	0.05	0.03	0.00	**-0.16**	100.00
KTC-BUF-0708	KTC-BUF-D	Body	Yes	0.14	**0.78**	23.92	67.74	**0.06**	**2.72**	**0.39**	1.84	0.01	**-0.02**	**2.39**	-0.07	0.14	0.03	-0.10	0.14	-0.09	**-0.01**	100.00
KTC-BUF-0709	KTC-BUF-D	Body	Yes	0.06	**0.71**	21.67	70.55	**0.18**	**2.94**	**0.48**	1.26	-0.02	**0.02**	**2.00**	-0.01	-0.02	0.02	-0.23	0.21	0.13	**0.05**	100.00
KTC-BUF-0710	KTC-BUF-D	Body	Yes	0.19	**0.70**	24.43	67.46	**0.22**	**3.17**	**0.41**	1.02	0.03	**0.01**	**2.11**	-0.02	0.10	0.00	0.04	0.30	-0.04	**-0.13**	100.00
KTC-BUF-0711	KTC-BUF-D	Body	Yes	0.07	**0.65**	20.79	71.53	**0.17**	**2.63**	**0.47**	1.07	0.03	**-0.07**	**1.85**	0.17	-0.02	0.03	0.13	0.24	0.32	**-0.07**	100.00
KTC-BUF-0712	KTC-BUF-D	Body	Yes	0.04	**0.66**	24.60	66.78	**0.25**	**3.42**	**0.90**	1.13	-0.02	**0.08**	**2.09**	-0.04	-0.05	0.01	0.06	0.14	0.09	**-0.13**	100.00
KTC-BUF-0917	KTC-BUF-D	Body	Yes	-0.01	**0.67**	20.90	70.91	**0.34**	**2.58**	**1.16**	1.22	0.07	**0.08**	**2.00**	0.04	0.00	0.01	-0.22	0.32	0.08	**-0.13**	100.00
KTC-BUF-0918	KTC-BUF-D	Body	Yes	0.13	**0.47**	14.32	78.70	**0.33**	**1.91**	**1.43**	0.76	0.01	**-0.02**	**2.13**	-0.16	-0.08	0.04	0.04	0.07	0.13	**-0.21**	100.00
KTC-BUF-0919	KTC-BUF-D	Body	Yes	0.00	**0.64**	20.11	72.33	**0.37**	**2.21**	**0.71**	1.36	0.09	**-0.02**	**2.32**	-0.01	-0.07	0.03	-0.28	0.26	0.01	**-0.06**	100.00
KTC-BUF-0920	KTC-BUF-D	Body	Yes	-0.02	**0.57**	18.72	74.40	**0.20**	**2.10**	**0.38**	0.79	0.07	**0.03**	**2.20**	0.03	0.07	-0.02	-0.26	0.33	0.32	**0.07**	100.00
KTC-BUF-0921	KTC-BUF-D	Body	Yes	0.19	**0.67**	20.27	71.13	**0.18**	**2.94**	**0.79**	1.12	0.10	**0.06**	**2.17**	-0.08	0.01	0.06	0.05	0.42	0.16	**-0.23**	100.00
KTC-BUF-0922	KTC-BUF-D	Body	Yes	0.05	**0.57**	21.82	70.75	**0.21**	**3.09**	**0.58**	1.04	0.01	**-0.05**	**1.93**	0.06	0.04	0.00	-0.04	0.04	0.13	**-0.24**	100.00
KTC-BUF-0923	KTC-BUF-D	Body	Yes	0.06	**0.39**	20.33	70.52	**0.13**	**3.69**	**1.58**	1.10	0.03	**0.03**	**1.39**	0.04	0.06	0.11	0.01	0.52	0.16	**-0.15**	100.00
KTC-BUF-0924	KTC-BUF-D	Body	Yes	0.02	**0.51**	21.03	70.59	**0.28**	**3.44**	**1.01**	1.29	0.00	**-0.02**	**1.80**	-0.02	0.04	-0.03	-0.14	0.26	0.05	**-0.12**	100.00
KTC-BUF-1029	KTC-BUF-D	Body	Yes	0.16	**0.71**	19.27	73.39	**0.12**	**2.49**	**0.18**	1.05	0.07	**0.01**	**2.19**	0.06	0.01	-0.04	0.03	0.23	0.04	**0.03**	100.00
KTC-BUF-1030	KTC-BUF-D	Body	Yes	0.11	**0.22**	8.06	87.69	**0.10**	**1.85**	**0.37**	0.27	0.00	**-0.08**	**0.99**	0.03	0.04	0.01	-0.09	0.28	0.26	**-0.09**	100.00
KTC-BUF-1031	KTC-BUF-D	Body	Yes	0.20	**0.82**	9.96	79.80	**0.43**	**2.98**	**1.37**	2.10	0.02	**0.27**	**1.71**	0.12	0.08	0.11	-0.05	0.32	0.05	**-0.27**	100.00
KTC-BUF-1032	KTC-BUF-D	Body	Yes	0.19	**0.39**	13.26	79.83	**0.13**	**2.84**	**0.30**	1.07	-0.07	**0.03**	**1.50**	0.04	0.04	0.17	0.01	0.32	0.08	**-0.11**	100.00
KTC-BUF-1033	KTC-BUF-D	Body	Yes	0.21	**0.60**	21.48	69.87	**0.32**	**3.23**	**0.33**	1.00	0.02	**0.13**	**2.37**	0.11	0.06	0.15	-0.16	0.03	0.19	**0.06**	100.00
KTC-BUF-1034	KTC-BUF-D	Body	Yes	0.08	**0.69**	18.83	74.42	**0.32**	**2.51**	**0.35**	0.91	0.05	**-0.06**	**2.05**	-0.01	0.05	-0.21	-0.10	0.27	0.02	**-0.17**	100.00
KTC-BUF-1035	KTC-BUF-D	Body	Yes	0.00	**0.48**	17.18	76.70	**0.31**	**2.25**	**0.47**	0.70	0.06	**0.03**	**1.80**	0.07	0.04	0.10	-0.07	-0.03	0.08	**-0.18**	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
KTC-BUF-1036	KTC-BUF-D	Body	Yes	0.01	**1**	21.88	70.91	**0.19**	**2.78**	**0.70**	0.81	-0.08	**0.02**	**2.10**	0.04	0.07	0.02	-0.23	0.14	0.06	**-0.07**	100.00
KTC-MER-0205	KTC-MER-A	Body	Yes	0.00	**0.38**	21.57	71.40	**0.00**	**3.24**	**1.24**	0.44	0.00	**0.00**	**1.73**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-MER-0206	KTC-MER-A	Body	Yes	0.00	**0.62**	20.78	69.69	**0.00**	**3.58**	**3.51**	0.00	0.00	**0.36**	**1.46**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-MER-0207	KTC-MER-A	Body	Yes	0.00	**0.00**	14.46	80.57	**0.00**	**2.71**	**1.24**	0.00	0.00	**0.00**	**1.02**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-MER-0208	KTC-MER-A	Body	Yes	0.00	**0.41**	19.04	72.54	**0.00**	**3.88**	**2.15**	0.57	0.00	**0.00**	**1.40**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00

Spectrum	Sample	Phase	In stats.	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Mn	Fe	Co	Cu	Zn	Zr	Sn	Ba	Pb	Total
KTC-MER-0413	KTC-MER-A	Body	Yes	0.00	**0.00**	0.43	99.57	**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**	100.00
KTC-MER-0414	KTC-MER-A	Body	Yes	0.00	**0.41**	20.75	71.54	**0.00**	**3.72**	**0.45**	0.95	0.00	**0.00**	**2.16**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-MER-0415	KTC-MER-A	Body	Yes	0.00	**0.33**	22.58	69.09	**0.00**	**4.21**	**0.57**	0.77	0.00	**0.00**	**2.45**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-MER-0416	KTC-MER-A	Body	Yes	0.52	**0.35**	21.57	69.86	**0.00**	**4.47**	**0.36**	0.58	0.00	**0.00**	**2.29**	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	100.00
KTC-TMP-0105	KTC-TMP-A	Body	Yes	0.38	**0.44**	22.57	68.71	**0.15**	**4.37**	**0.30**	1.05	-0.05	**0.10**	**1.80**	0.05	0.02	0.09	0.03	0.02	0.02	**-0.03**	100.00
KTC-TMP-0106	KTC-TMP-A	Body	Yes	0.35	**0.45**	22.00	69.41	**0.24**	**4.17**	**0.29**	0.45	0.00	**0.11**	**1.76**	0.03	0.01	0.18	-0.01	0.41	0.30	**-0.14**	100.00
KTC-TMP-0107	KTC-TMP-A	Body	Yes	0.19	**0.53**	22.40	69.62	**0.06**	**3.79**	**0.32**	0.46	0.01	**-0.01**	**2.02**	0.08	0.11	-0.17	0.20	0.26	0.16	**-0.04**	100.00
KTC-TMP-0108	KTC-TMP-A	Body	Yes	0.34	**0.48**	23.43	68.34	**0.08**	**4.33**	**0.28**	0.62	0.07	**0.07**	**1.99**	-0.08	-0.06	0.06	-0.02	0.06	0.01	**0.01**	100.00
KTC-TMP-0213	KTC-TMP-B	Body	Yes	0.10	**0.35**	19.28	74.08	**-0.01**	**3.36**	**0.08**	0.60	0.04	**0.05**	**1.81**	0.20	-0.09	-0.02	0.03	0.01	0.24	**-0.12**	100.00
KTC-TMP-0214	KTC-TMP-B	Body	Yes	0.43	**0.34**	23.14	68.23	**0.31**	**5.15**	**0.27**	0.64	-0.03	**0.13**	**2.30**	-0.12	-0.03	-0.19	-0.12	-0.40	0.07	**-0.13**	100.00
KTC-TMP-0215	KTC-TMP-B	Body	Yes	0.20	**0.41**	22.29	70.42	**0.20**	**3.99**	**0.15**	0.45	0.06	**-0.02**	**2.21**	-0.05	-0.09	-0.15	-0.03	0.11	0.03	**-0.18**	100.00
KTC-TMP-0216	KTC-TMP-B	Body	Yes	0.20	**0.38**	15.53	76.36	**0.11**	**4.11**	**0.61**	0.74	0.03	**0.18**	**1.66**	0.00	-0.05	-0.01	0.02	0.16	0.08	**-0.11**	100.00
KTC-TMP-0233	KTC-TMP-B	Body	Yes	0.51	**0.57**	23.42	67.73	**-0.06**	**4.02**	**0.42**	0.33	-0.04	**0.28**	**2.22**	0.15	-0.16	0.28	0.45	0.11	-0.06	**-0.15**	100.00
KTC-TMP-0234	KTC-TMP-B	Body	Yes	0.52	**0.47**	21.99	70.66	**0.09**	**3.31**	**0.52**	0.67	-0.05	**-0.16**	**1.87**	-0.05	-0.01	0.06	-0.14	0.18	0.07	**0.00**	100.00
KTC-TMP-0321	KTC-TMP-C	Body	Yes	0.54	**0.48**	21.26	69.20	**0.09**	**4.76**	**0.27**	0.58	0.02	**0.13**	**2.37**	0.07	-0.07	0.27	-0.07	0.12	0.10	**-0.14**	100.00
KTC-TMP-0322	KTC-TMP-C	Body	Yes	0.47	**0.43**	23.02	68.19	**-0.01**	**4.79**	**0.44**	0.60	-0.07	**0.02**	**2.18**	-0.07	0.04	-0.05	0.02	0.07	0.07	**-0.14**	100.00
KTC-TMP-0323	KTC-TMP-C	Body	Yes	0.48	**0.54**	19.87	71.20	**0.15**	**4.51**	**0.40**	0.51	0.05	**-0.02**	**1.76**	-0.04	-0.06	0.26	0.01	0.33	0.13	**-0.09**	100.00
KTC-TMP-0324	KTC-TMP-C	Body	Yes	0.38	**0.56**	20.03	71.46	**0.26**	**3.91**	**0.40**	0.72	0.11	**0.04**	**2.29**	0.09	-0.11	-0.02	-0.14	0.08	0.10	**-0.17**	100.00
KTC-TMP-0429	KTC-TMP-C	Body	Yes	0.16	**0.60**	21.59	69.86	**0.30**	**3.00**	**0.79**	0.71	0.09	**0.09**	**2.80**	0.10	-0.12	0.19	-0.21	0.08	-0.07	**0.02**	100.00
KTC-TMP-0430	KTC-TMP-C	Body	Yes	0.25	**0.61**	22.22	67.68	**0.68**	**4.72**	**1.13**	0.69	0.02	**0.11**	**2.11**	-0.04	0.08	-0.22	0.03	0.03	-0.03	**-0.08**	100.00
KTC-TMP-0431	KTC-TMP-C	Body	Yes	0.98	**0.17**	20.35	65.31	**0.27**	**10.99**	**0.96**	0.35	-0.13	**-0.05**	**1.31**	0.03	-0.11	0.14	0.06	-0.12	-0.27	**-0.24**	100.00
KTC-TMP-0432	KTC-TMP-C	Body	Yes	0.14	**0.62**	23.14	68.28	**0.33**	**3.75**	**0.60**	0.70	0.06	**-0.01**	**2.48**	0.11	0.17	-0.01	0.09	-0.38	0.09	**-0.16**	100.00
KTC-TMP-0539	KTC-TMP-C	Body	Yes	0.30	**0.72**	21.36	68.81	**0.13**	**3.67**	**0.68**	0.67	0.05	**0.18**	**2.41**	0.17	-0.03	0.15	0.33	0.22	0.07	**0.12**	100.00
KTC-TMP-0540	KTC-TMP-C	Body	Yes	0.46	**0.37**	22.23	68.21	**0.63**	**4.42**	**1.11**	0.71	-0.05	**-0.02**	**2.23**	-0.19	0.16	0.29	-0.20	-0.19	-0.06	**-0.12**	100.00
KTC-TMP-0541	KTC-TMP-C	Body	Yes	0.30	**0.33**	21.71	67.60	**0.40**	**5.04**	**1.03**	0.58	0.04	**0.10**	**2.03**	-0.10	-0.13	0.10	0.16	0.58	0.24	**0.00**	100.00
KTC-TMP-0542	KTC-TMP-C	Body	Yes	0.39	**0.49**	23.71	67.52	**0.08**	**3.95**	**0.80**	0.65	0.03	**0.04**	**2.44**	0.07	0.03	-0.04	0.28	-0.30	-0.08	**-0.05**	100.00

Spectrum	Sample	Page_number	Phase	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Cu	Pb	Total
Dayao Celadons	DCel-01	80	Body	1.40	0.00	23.20	67.70	0.00	5.60	0.00	0.00	0.00	2.40	0.00	0.00	100
Dayao Celadons	DCel-02	80	Body	1.50	0.00	23.40	67.10	0.00	5.90	0.00	0.00	0.00	2.00	0.00	0.00	100
Hangzhou Guan ware	HG-01	82	Body	0.20	0.60	28.80	61.30	0.08	4.20	0.20	0.70	0.00	4.10	0.00	0.00	100
Hangzhou Guan ware	HG-02	82	Body	0.30	0.20	23.10	66.50	0.00	3.70	0.30	1.20	0.00	3.00	0.00	0.00	98
Hangzhou Guan ware	HG-03	82	Body	0.40	0.70	20.60	69.80	0.08	3.70	0.30	0.70	0.00	3.10	0.00	0.00	99
Hangzhou Guan ware	HG-04	82	Body	0.20	0.40	21.20	70.00	0.09	2.60	0.10	1.00	0.00	3.20	0.00	0.00	99
Jian ware	Jian-Song-01	148	Body	0.07	0.50	22.20	64.80	0.00	2.20	0.04	1.60	0.08	8.80	0.00	0.00	100
Jian ware	Jian-Song-02	148	Body	0.06	0.40	23.10	63.30	0.00	2.20	0.04	1.60	0.09	9.60	0.00	0.00	100
Jian ware	Jian-Song-03	148	Body	0.06	0.50	23.20	63.10	0.00	2.70	0.10	1.60	0.12	8.20	0.00	0.00	100
Jingdezhen	J-Hongwu	76	Body	1.75	0.20	18.20	75.30	0.06	4.30	0.65	0.00	0.05	0.70	0.00	0.00	101
Jingdezhen	J-Jiaqing	76	Body	2.40	0.10	23.90	69.40	0.06	2.80	0.20	0.02	0.12	0.70	0.00	0.00	100
Jingdezhen	J-Xuande	76	Body	2.00	0.53	20.00	73.60	0.00	2.90	0.50	0.00	0.00	0.90	0.00	0.00	100
Jingdezhen	J-Yuan	76	Body	1.80	0.10	20.20	72.70	0.04	2.90	0.20	0.50	0.08	0.90	0.00	0.00	99
Jingdezhen Yingqing ware	JY-01	51	Body	1.00	0.10	17.50	76.20	0.00	2.70	1.30	0.06	0.03	0.60	0.00	0.00	99
Jingdezhen Yingqing ware	JY-02	51	Body	1.20	0.03	18.40	75.50	0.02	2.60	0.60	0.10	0.03	0.90	0.00	0.00	99
Jingdezhen Yingqing ware	JY-03	51	Body	1.00	0.20	18.40	74.70	0.03	2.90	0.60	0.08	0.06	0.80	0.00	0.00	99
Jizhou ware	Jizhou-01	152	Body	0.40	0.30	27.80	61.80	0.20	5.80	0.10	1.10	0.01	0.90	0.00	0.00	98
Jizhou ware	Jizhou-02	152	Body	0.30	0.30	27.40	62.00	0.20	6.40	0.01	1.10	0.00	1.60	0.00	0.00	99
Longquan	L-Ming	76	Body	1.00	0.30	20.50	70.20	0.00	6.00	0.10	0.20	0.10	1.70	0.00	0.00	100
Longquan	L-S.Song-01	76	Body	0.20	0.70	18.30	74.00	0.00	3.10	0.30	0.40	0.15	2.40	0.00	0.00	100
Longquan	L-S.Song-02	76	Body	0.30	0.20	23.90	67.80	0.00	5.30	0.00	0.20	0.03	2.10	0.00	0.00	100
Longquan	L-Yuan	76	Body	0.80	0.70	20.10	70.80	0.00	6.00	0.10	0.16	0.07	1.60	0.00	0.00	100
Longquan Guan ware	LG-01	82	Body	0.10	0.60	25.20	64.20	0.13	4.00	0.20	0.80	0.00	4.50	0.00	0.00	100
Longquan Guan ware	LG-02	82	Body	0.10	0.50	28.70	62.70	0.00	4.10	0.50	0.00	0.00	3.70	0.00	0.00	100
Longquan Guan ware	LG-03	82	Body	0.20	0.20	24.20	64.90	0.00	4.70	0.50	0.00	0.04	3.60	0.00	0.00	98
Longquan Guan ware	LG-04	82	Body	0.20	0.30	26.10	63.30	0.00	3.70	0.50	0.00	0.00	4.50	0.00	0.00	99
Yixing red stonewares	YRS-01	148	Body	0.07	0.36	25.90	62.50	0.00	1.40	0.40	1.30	0.10	7.75	0.00	0.00	100
Yixing red stonewares	YRS-02	148	Body	0.07	0.60	23.40	60.70	0.00	2.80	0.20	1.15	0.02	9.95	0.00	0.00	99
Fujian Neolithic Clay	Fujian-Neo	148	Clay	0.40	0.70	29.00	57.50	0.00	2.60	0.40	0.80	0.04	8.50	0.00	0.00	100
Southern Stoneware Clays	SSC Eastern Han Yue	29	Clay	0.50	0.60	17.70	75.40	0.00	3.00	0.30	0.80	0.03	2.40	0.00	0.00	101
Southern Stoneware Clays	SSC Han Qingzhusi	29	Clay	0.00	0.60	17.50	76.60	0.03	2.60	0.01	1.00	0.00	1.40	0.00	0.00	100
Southern Stoneware Clays	SSC Tang Wenzhou	29	Clay	0.30	0.60	18.30	74.40	0.00	3.70	0.40	0.70	0.02	2.10	0.00	0.00	101
Southern Stoneware Clays	SSC Tang Yixing	29	Clay	0.80	0.50	16.20	76.40	0.04	2.60	0.30	1.00	0.01	3.40	0.00	0.00	101
Dayao Celadons	DCel-01	80	Glaze	0.14	0.60	14.30	67.20	0.20	4.20	10.00	0.07	0.00	1.20	0.00	0.00	98
Dayao Celadons	DCel-02	80	Glaze	0.15	0.70	15.50	68.10	0.20	3.80	10.40	0.02	0.00	0.90	0.00	0.00	100
Ding glazes	Ding-black	155	Glaze	0.70	2.90	16.70	63.50	0.00	2.20	7.50	0.70	0.00	5.30	0.00	0.00	100
Ding glazes	Ding-russet	155	Glaze	2.00	2.30	19.40	64.80	0.00	2.00	2.80	1.00	0.04	5.70	0.00	0.00	100
Ding glazes	Ding-russet	155	Glaze	1.80	1.70	17.60	69.10	0.00	2.70	1.50	1.00	0.10	6.30	0.00	0.00	102
Ding glazes	Ding-russet	155	Glaze	1.10	2.10	16.40	68.00	0.00	2.60	3.50	0.80	0.10	2.30	0.00	0.00	97
Hangzhou Guan ware	HG-01	82	Glaze	0.20	0.70	14.60	65.40	0.40	4.00	13.40	0.08	0.00	0.70	0.00	0.00	99
Hangzhou Guan ware	HG-02	82	Glaze	0.20	0.70	14.50	64.80	0.30	4.50	13.90	0.00	0.00	0.80	0.00	0.00	100
Hangzhou Guan ware	HG-03	82	Glaze	0.30	0.70	16.10	65.00	0.00	3.50	12.50	0.00	0.00	0.90	0.00	0.00	99
Hangzhou Guan ware	HG-04	82	Glaze	0.30	0.90	16.20	65.60	0.00	4.50	12.10	0.00	0.00	0.80	0.00	0.00	100
Jian ware	Jian-Song-01	148	Glaze	0.10	0.70	17.80	62.20	1.20	3.00	6.50	0.60	0.70	5.35	0.00	0.00	98
Jian ware	Jian-Song-02	148	Glaze	0.10	1.90	17.80	62.20	1.20	3.00	7.40	0.60	0.70	5.30	0.00	0.00	100
Jian ware	Jian-Song-03	148	Glaze	0.10	1.70	19.30	61.20	1.10	2.80	5.80	0.70	0.60	6.30	0.00	0.00	100
Jingdezhen	J-B&W-14C	177	Glaze	3.10	0.30	14.90	69.50	0.00	2.70	8.90	0.04	0.10	0.80	0.00	0.00	100
Jingdezhen	J-B&W-Xuande	179	Glaze	3.30	0.40	14.30	69.10	0.00	3.70	8.40	0.00	0.06	0.80	0.00	0.00	100
Jingdezhen	J-B&W-Yongle	178	Glaze	2.70	1.30	14.10	70.70	0.07	3.10	6.80	0.00	0.00	0.90	0.00	0.00	100

Spectrum	Sample	Page_number	Phase	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe	Cu	Pb	Total
Jingdezhen	J-celadon-Xuande	179	Glaze	1.90	1.10	14.30	69.30	0.00	3.90	7.50	0.00	0.00	1.40	0.00	0.00	99
Jingdezhen	J-Hongwu	76	Glaze	1.80	0.20	14.20	68.60	0.00	3.70	9.90	0.00	0.10	0.80	0.00	0.00	99
Jingdezhen	J-Jiaqing	76	Glaze	2.60	0.20	13.20	66.90	0.00	2.40	8.20	0.00	0.50	1.00	0.00	0.00	95
Jingdezhen	J-Shufu-14C	177	Glaze	3.50	0.30	15.60	72.00	0.00	3.00	5.60	0.00	0.10	0.85	0.00	0.00	101
Jingdezhen	J-Xuande	76	Glaze	3.30	0.40	14.30	69.10	0.00	3.70	8.40	0.00	0.06	0.80	0.00	0.00	100
Jingdezhen	J-Yuan	76	Glaze	3.10	0.30	14.90	69.50	0.00	2.70	8.00	0.00	0.10	0.84	0.00	0.00	99
Jingdezhen copper glazes	J-copper-red-Xuande	179	Glaze	2.40	0.20	13.90	69.70	0.08	4.85	7.70	0.08	0.10	0.70	0.30	0.00	100
Jingdezhen copper glazes	J-copper-red-Yongle	178	Glaze	2.60	0.40	14.00	70.90	0.10	4.40	6.40	0.05	0.00	0.98	0.30	0.00	100
Jingdezhen Yingqing ware	JY-01	51	Glaze	1.20	0.26	14.30	66.70	0.00	2.10	14.90	0.00	0.10	1.00	0.00	0.00	101
Jingdezhen Yingqing ware	JY-02	51	Glaze	0.60	0.40	15.20	66.70	0.08	1.50	13.90	0.07	0.06	1.10	0.00	0.00	100
Jingdezhen Yingqing ware	JY-03	51	Glaze	1.00	0.60	14.00	65.40	0.07	2.00	15.40	0.05	0.10	1.10	0.00	0.00	100
Jingdezhen Yingqing ware	JY-04	177	Glaze	2.70	0.60	13.80	65.80	0.05	1.50	14.10	0.06	0.10	0.80	0.00	0.00	100
Jizhou ware	Jishou-light-yellow	153	Glaze	0.30	2.70	14.60	56.80	1.80	4.20	12.50	0.70	1.10	4.90	0.00	0.00	100
Jizhou ware	Jizhou-brown-black-01	153	Glaze	0.25	3.20	13.80	60.30	1.80	3.20	9.00	0.50	0.80	5.50	0.00	0.00	98
Jizhou ware	Jizhou-brown-black-02	153	Glaze	0.30	2.80	14.30	59.30	1.70	4.70	9.20	0.70	1.10	5.40	0.00	0.00	100
Jizhou ware	Jizhou-splashed-black	153	Glaze	0.40	2.90	14.30	58.40	2.00	5.00	7.50	0.50	0.80	7.70	0.00	0.00	100
Longquan	L-Ming	76	Glaze	1.10	1.70	15.00	67.60	0.00	6.50	6.30	0.00	0.10	1.40	0.00	0.00	100
Longquan	L-S.Song-01	76	Glaze	1.00	1.20	14.20	66.40	0.00	4.30	11.30	0.03	0.36	1.00	0.00	0.00	100
Longquan	L-S.Song-02	76	Glaze	3.00	0.60	15.40	69.10	0.00	4.90	8.40	0.00	0.00	0.90	0.00	0.00	102
Longquan	L-Yuan	76	Glaze	1.20	0.60	16.70	67.40	0.00	5.50	6.80	0.20	0.42	1.50	0.00	0.00	100
Longquan Celadon	LCel-5D	78	Glaze	0.30	2.00	16.00	59.40	0.00	3.40	16.00	0.40	0.60	1.80	0.00	0.00	100
Longquan Celadon	LCel-Ming	78	Glaze	1.10	1.70	15.00	67.60	0.00	6.50	6.30	0.30	0.00	1.40	0.00	0.00	100
Longquan Celadon	LCel-N.Song	78	Glaze	0.60	1.10	16.80	63.20	0.00	3.30	13.00	0.20	0.40	1.40	0.00	0.00	100
Longquan Celadon	LCel-S.Song	78	Glaze	0.10	0.40	14.30	68.60	0.14	5.00	10.40	0.02	0.00	0.70	0.00	0.00	100
Longquan Celadon	LCel-Yuan	78	Glaze	1.10	0.60	16.70	67.40	0.00	5.50	6.80	0.20	0.40	1.50	0.00	0.00	100
Longquan Guan ware	LG-01	82	Glaze	0.30	0.70	12.20	64.30	0.00	4.30	16.40	0.00	0.00	1.30	0.00	0.00	100
Longquan Guan ware	LG-02	82	Glaze	0.20	0.70	16.10	63.00	0.40	4.00	14.00	0.08	0.00	1.00	0.00	0.00	99
Longquan Guan ware	LG-03	82	Glaze	0.30	0.20	14.70	66.00	0.00	4.80	13.40	0.00	0.01	0.80	0.00	0.00	100
Longquan Guan ware	LG-04	82	Glaze	0.20	0.60	15.70	63.30	0.00	4.20	14.20	0.20	0.00	0.90	0.00	0.00	99
Northern Cizhou glazes	C-blue-black	217	Glaze	1.90	1.20	1.60	64.10	0.00	13.10	0.60	0.10	4.40	0.70	0.40	11.20	99
Northern Cizhou glazes	C-blue-black	217	Glaze	1.80	1.20	1.80	61.70	0.00	10.70	1.20	0.10	4.90	0.70	0.50	14.80	99
Northern Cizhou glazes	C-dark green	217	Glaze	3.30	1.00	0.50	66.30	0.00	9.40	1.20	0.00	0.10	0.50	4.90	11.60	99

Appendix C

EDXRF Results

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-01-int
Output on Wed May 24 13:14:30 2017
Analysed on May 24, 2017 01:00:03 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 600secs Real time= 600secs Count Rate= 603c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

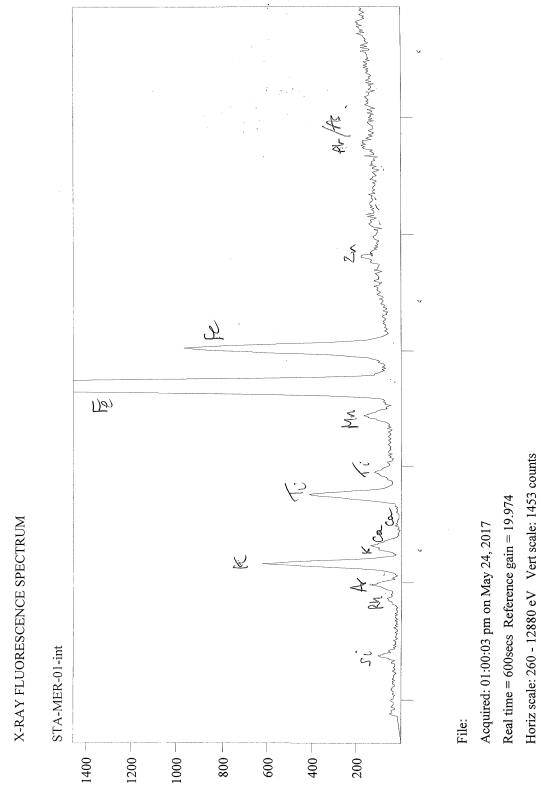
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	11	-0.824	1.08
S	Ka	s040216.prf	2007-2607	6645	11	-0.824	1.08
K	Ka	kox1.prf	3011-3611	37571	13	-1.762	33.75
Ca	Ka	caox1.prf	3389-3989	40399	13	-1.762	33.75
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.37
Mn	Ka	mn060212.prf	5594-6194	504611	5	0.716	0.90
Fe	Ka	fe060212.prf	6098-6698	591462	5	0.716	0.90
Cu	Ka	cu060212.prf	7740-8340	720275	5	0.716	0.90
Zn	Ka	zn060212.prf	8330-8930	778621	5	0.716	0.90
P	Ka	hm1007a.prf	1714-2314	1908	11	-0.824	1.08
Pb	La	PB070212.prf	10248-10848	190736	7	1.371	2.94
Sn	Ka	sn060606.prf	24594-25794	98621	6	-5.692	7.61
Au	La	au070212.prf	9411-10011	167291	6	0.759	3.08
Ag	Ka	ag070212.prf	21504-22704	187485	4	-5.600	15.28
Co	Ka	co060212.prf	6624-7224	589345	5	0.716	0.90
Ni	Ka	ni060212.prf	7171-7771	685242	5	0.716	0.90

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	351 ±38	1.08	0.32	6.24 ±1.35
S	Ka	0 ±30	1.08	< 0.76	< 0.76
K	Ka	5524 ±252	33.75	1.00	19.67 ±1.79
Ca	Ka	0 ±266	33.75	< 0.55	< 0.55
Ti	Ka	2585 ±67	0.37	0.30	5.83 ±0.30
Mn	Ka	871 ±75	0.90	0.07	1.44 ±0.25
Fe	Ka	45588 ±224	0.90	3.30	65.05 ±0.64
Cu	Ka	85 ±86	0.90	< 0.31	< 0.31
Zn	Ka	584 ±93	0.90	0.05	0.98 ±0.31
P	Ka	0 ±37	1.08	< 1.38	< 1.38
Pb	La	593 ±76	2.94	0.04	0.75 ±0.19
Sn	Ka	0 ±328	7.61	< 0.28	< 0.28
Au	La	37 ±67	3.08	< 0.22	< 0.22
Ag	Ka	14 ±454	15.28	< 0.40	< 0.40
Co	Ka	0 ±117	0.90	< 0.37	< 0.37
Ni	Ka	79 ±81	0.90	< 0.33	< 0.33
Totals				5.07	99.97

Note: Please disregard non-normalised results at the moment



File:
Acquired: 01:00:03 pm on May 24, 2017
Real time = 600secs Reference gain = 19.974
Horiz scale: 260 - 12880 eV Vert scale: 1453 counts

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-01-ext
Output on Wed May 24 13:57:31 2017
Analysed on May 24, 2017 01:45:28 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 600secs Real time= 600secs Count Rate= 670c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

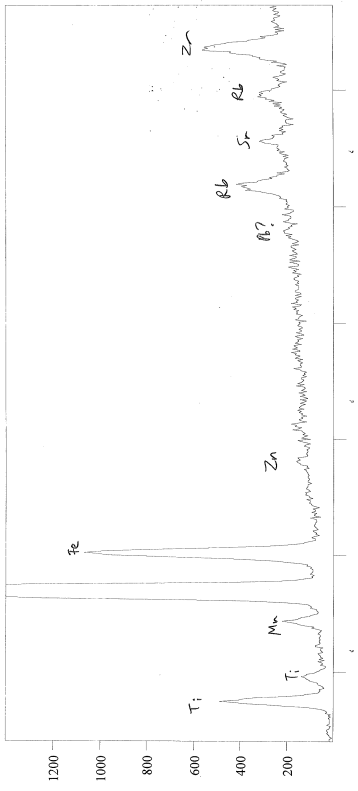
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	23	-1.152	1.61
S	Ka	s040216.prf	2007-2607	6645	23	-1.152	1.61
K	Ka	kox1.prf	3011-3611	37571	14	-2.035	39.93
Ca	Ka	caox1.prf	3389-3989	40399	14	-2.035	39.93
Ti	Ka	ti150114.prf	4208-4808	217533	6	-0.053	0.97
Mn	Ka	mn060212.prf	5594-6194	504611	8	0.795	0.82
Fe	Ka	fe060212.prf	6098-6698	591462	8	0.795	0.82
Cu	Ka	cu060212.prf	7740-8340	720275	8	0.795	0.82
Zn	Ka	zn060212.prf	8330-8930	778621	8	0.795	0.82
P	Ka	hm1007a.prf	1714-2314	1908	23	-1.152	1.61
Pb	La	PB070212.prf	10248-10848	190736	6	1.469	4.31
Sn	Ka	sn060606.prf	24594-25794	98621	6	5.683	6.16
Au	La	au070212.prf	9411-10011	167291	5	-0.070	4.47
Ag	Ka	ag070212.prf	21504-22704	187485	6	0.172	11.82
Co	Ka	co060212.prf	6624-7224	589345	8	0.795	0.82
Ni	Ka	ni060212.prf	7171-7771	685242	8	0.795	0.82

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	489 ±42	1.61	0.44	7.35 ±1.26
S	Ka	46 ±32	1.61	< 0.66	< 0.66
K	Ka	6517 ±293	39.93	1.17	19.71 ±1.77
Ca	Ka	0 ±310	39.93	< 0.51	< 0.51
Ti	Ka	3266 ±79	0.97	0.38	6.31 ±0.31
Mn	Ka	1122 ±73	0.82	0.09	1.58 ±0.21
Fe	Ka	52936 ±239	0.82	3.81	64.03 ±0.58
Cu	Ka	88 ±80	0.82	< 0.27	< 0.27
Zn	Ka	415 ±86	0.82	0.03	0.59 ±0.24
P	Ka	0 ±40	1.61	< 1.29	< 1.29
Pb	La	166 ±83	4.31	< 0.21	< 0.21
Sn	Ka	0 ±286	6.16	< 0.24	< 0.24
Au	La	0 ±78	4.47	< 0.19	< 0.19
Ag	Ka	480 ±401	11.82	0.02	0.42 ±0.70
Co	Ka	0 ±118	0.82	< 0.33	< 0.33
Ni	Ka	26 ±76	0.82	< 0.29	< 0.29
Totals				5.94	99.97

Note: Please disregard non-normalised results at the moment



File:
Acquired: 01:45:28 pm on May 24, 2017
Real time = 600secs Reference gain = 19.974
Horiz scale: 3820 - 16440 eV Vert scale: 1400 counts

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-02-int
Output on Wed May 24 14:12:24 2017
Analysed on May 24, 2017 02:05:16 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 400secs Real time= 400secs Count Rate= 780c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	18	-0.948	0.99
S	Ka	s040216.prf	2007-2607	6645	18	-0.948	0.99
K	Ka	kox1.prf	3011-3611	37571	19	-2.301	21.71
Ca	Ka	caox1.prf	3389-3989	40399	19	-2.301	21.71
Ti	Ka	ti150114.prf	4208-4808	217533	5	-0.032	0.87
Mn	Ka	mn060212.prf	5594-6194	504611	8	0.833	1.22
Fe	Ka	fe060212.prf	6098-6698	591462	8	0.833	1.22
Cu	Ka	cu060212.prf	7740-8340	720275	8	0.833	1.22
Zn	Ka	zn060212.prf	8330-8930	778621	8	0.833	1.22
P	Ka	hm1007a.prf	1714-2314	1908	18	-0.948	0.99
Pb	La	PB070212.prf	10248-10848	190736	7	-0.088	1.70
Sn	Ka	sn060606.prf	24594-25794	98621	4	-5.600	4.06
Au	La	au070212.prf	9411-10011	167291	6	0.746	1.93
Ag	Ka	ag070212.prf	21504-22704	187485	5	-5.650	8.89
Co	Ka	co060212.prf	6624-7224	589345	8	0.833	1.22
Ni	Ka	ni060212.prf	7171-7771	685242	8	0.833	1.22

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	365 ±34	0.99	0.58	4.87 ±0.91
S	Ka	0 ±25	0.99	< 0.45	< 0.45
K	Ka	4702 ±242	21.71	1.35	11.44 ±1.18
Ca	Ka	0 ±255	21.71	< 0.29	< 0.29
Ti	Ka	2237 ±64	0.87	0.35	2.97 ±0.17
Mn	Ka	1326 ±102	1.22	0.17	1.40 ±0.22
Fe	Ka	83474 ±306	1.22	9.20	77.90 ±0.57
Cu	Ka	27 ±114	1.22	< 0.18	< 0.18
Zn	Ka	806 ±124	1.22	0.12	1.03 ±0.32
P	Ka	0 ±33	0.99	< 0.89	< 0.89
Pb	La	376 ±58	1.70	0.04	0.36 ±0.11
Sn	Ka	68 ±194	4.06	< 0.18	< 0.18
Au	La	0 ±56	1.93	< 0.14	< 0.14
Ag	Ka	0 ±280	8.89	< 0.26	< 0.26
Co	Ka	0 ±158	1.22	< 0.31	< 0.31
Ni	Ka	30 ±110	1.22	< 0.22	< 0.22
Totals				11.81	99.98

Note: Please disregard non-normalised results at the moment

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-02-ext
Output on Wed May 24 14:26:01 2017
Analysed on May 24, 2017 02:18:12 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 400secs Real time= 400secs Count Rate= 653c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

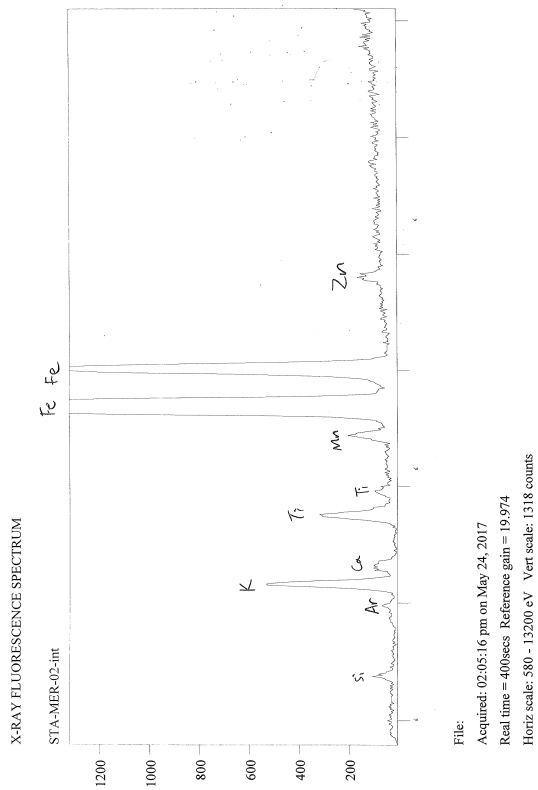
Fitting data

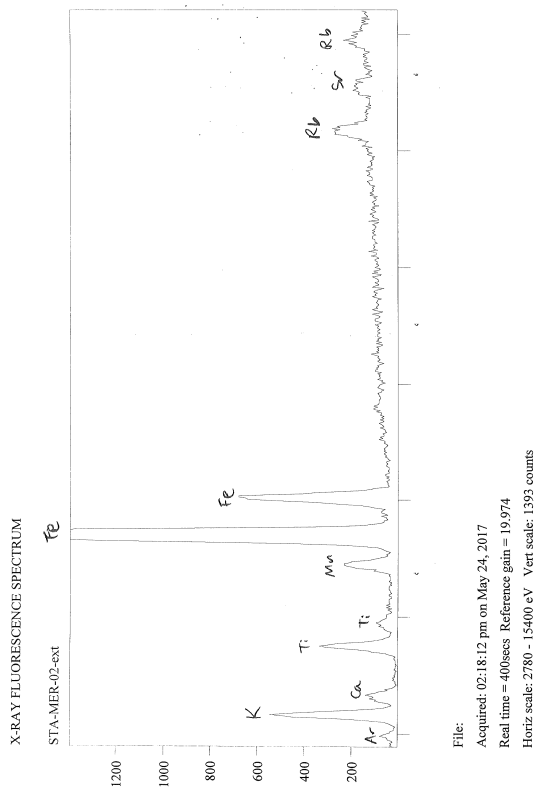
		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	7	-0.750	0.98
S	Ka	s040216.prf	2007-2607	6645	7	-0.750	0.98
K	Ka	kox1.prf	3011-3611	37571	18	-1.952	29.23
Ca	Ka	caox1.prf	3389-3989	40399	18	-1.952	29.23
Ti	Ka	ti150114.prf	4208-4808	217533	5	-0.025	0.51
Mn	Ka	mn060212.prf	5594-6194	504611	11	0.771	1.03
Fe	Ka	fe060212.prf	6098-6698	591462	11	0.771	1.03
Cu	Ka	cu060212.prf	7740-8340	720275	11	0.771	1.03
Zn	Ka	zn060212.prf	8330-8930	778621	11	0.771	1.03
P	Ka	hm1007a.prf	1714-2314	1908	7	-0.750	0.98
Pb	La	PB070212.prf	10248-10848	190736	6	1.465	3.80
Sn	Ka	sn060606.prf	24594-25794	98621	5	-0.074	4.95
Au	La	au070212.prf	9411-10011	167291	6	-0.755	2.73
Ag	Ka	ag070212.prf	21504-22704	187485	6	5.710	10.85
Co	Ka	co060212.prf	6624-7224	589345	11	0.771	1.03
Ni	Ka	ni060212.prf	7171-7771	685242	11	0.771	1.03

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	370 ±34	0.98	0.49	7.95 ±1.46
S	Ka	33 ±26	0.98	< 0.78	< 0.78
K	Ka	4725 ±218	29.23	1.29	20.99 ±1.94
Ca	Ka	26 ±230	29.23	< 0.67	< 0.67
Ti	Ka	2148 ±58	0.51	0.38	6.26 ±0.34
Mn	Ka	1615 ±72	1.03	0.21	3.35 ±0.30
Fe	Ka	33856 ±194	1.03	3.68	59.99 ±0.69
Cu	Ka	89 ±72	1.03	< 0.29	< 0.29
Zn	Ka	233 ±79	1.03	0.03	0.47 ±0.32
P	Ka	54 ±33	0.98	< 1.47	< 1.47
Pb	La	193 ±66	3.80	0.02	0.29 ±0.20
Sn	Ka	655 ±212	4.95	0.04	0.67 ±0.43
Au	La	0 ±60	2.73	< 0.22	< 0.22
Ag	Ka	0 ±331	10.85	< 0.41	< 0.41
Co	Ka	0 ±100	1.03	< 0.40	< 0.40
Ni	Ka	57 ±68	1.03	< 0.32	< 0.32
Totals				6.13	99.96

Note: Please disregard non-normalised results at the moment





SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-03-int
Output on Wed May 24 14:39:10 2017
Analysed on May 24, 2017 02:31:49 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 400secs Real time= 400secs Count Rate= 666c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

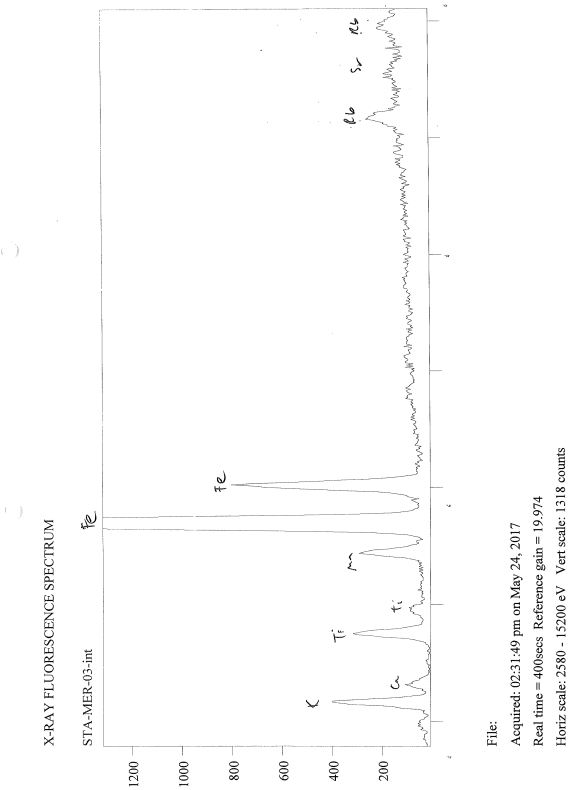
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	8	-0.778	1.36
S	Ka	s040216.prf	2007-2607	6645	8	-0.778	1.36
K	Ka	kox1.prf	3011-3611	37571	13	-1.907	38.92
Ca	Ka	caox1.prf	3389-3989	40399	13	-1.907	38.92
Ti	Ka	ti150114.prf	4208-4808	217533	10	-0.170	0.96
Mn	Ka	mn060212.prf	5594-6194	504611	8	0.798	1.36
Fe	Ka	fe060212.prf	6098-6698	591462	8	0.798	1.36
Cu	Ka	cu060212.prf	7740-8340	720275	8	0.798	1.36
Zn	Ka	zn060212.prf	8330-8930	778621	8	0.798	1.36
P	Ka	hm1007a.prf	1714-2314	1908	8	-0.778	1.36
Pb	La	PB070212.prf	10248-10848	190736	6	1.441	1.48
Sn	Ka	sn060606.prf	24594-25794	98621	5	5.635	4.47
Au	La	au070212.prf	9411-10011	167291	5	0.722	1.80
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.648	8.22
Co	Ka	co060212.prf	6624-7224	589345	8	0.798	1.36
Ni	Ka	ni060212.prf	7171-7771	685242	8	0.798	1.36

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	414 ±36	1.36	0.57	9.31 ±1.62
S	Ka	2 ±26	1.36	< 0.83	< 0.83
K	Ka	3580 ±155	38.92	1.00	16.39 ±1.42
Ca	Ka	0 ±160	38.92	< 0.53	< 0.53
Ti	Ka	2196 ±60	0.96	0.37	6.03 ±0.33
Mn	Ka	1963 ±77	1.36	0.24	3.95 ±0.31
Fe	Ka	37060 ±204	1.36	3.90	64.28 ±0.71
Cu	Ka	0 ±78	1.36	< 0.31	< 0.31
Zn	Ka	129 ±85	1.36	< 0.30	< 0.30
P	Ka	40 ±35	1.36	< 1.67	< 1.67
Pb	La	48 ±56	1.48	< 0.24	< 0.24
Sn	Ka	0 ±213	4.47	< 0.29	< 0.29
Au	La	0 ±57	1.80	< 0.23	< 0.23
Ag	Ka	0 ±269	8.22	< 0.42	< 0.42
Co	Ka	0 ±106	1.36	< 0.42	< 0.42
Ni	Ka	0 ±75	1.36	< 0.35	< 0.35
Totals				6.07	99.95

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-03-ext
Output on Wed May 24 14:48:58 2017
Analysed on May 24, 2017 02:41:26 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 400secs Real time= 400secs Count Rate= 717c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

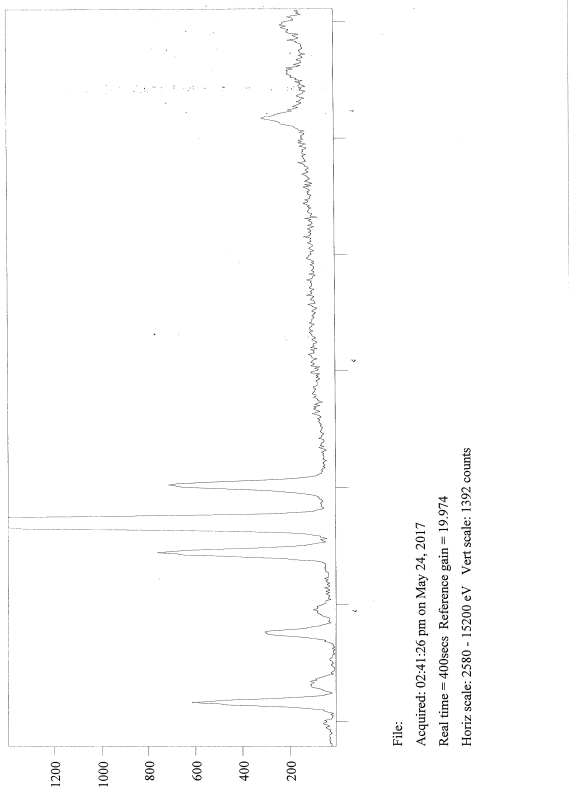
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	18	-0.955	1.01
S	Ka	s040216.prf	2007-2607	6645	18	-0.955	1.01
K	Ka	kox1.prf	3011-3611	37571	21	-2.347	16.40
Ca	Ka	caox1.prf	3389-3989	40399	21	-2.347	16.40
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	1.57
Mn	Ka	mn060212.prf	5594-6194	504611	8	0.783	0.76
Fe	Ka	fe060212.prf	6098-6698	591462	8	0.783	0.76
Cu	Ka	cu060212.prf	7740-8340	720275	8	0.783	0.76
Zn	Ka	zn060212.prf	8330-8930	778621	8	0.783	0.76
P	Ka	hm1007a.prf	1714-2314	1908	18	-0.955	1.01
Pb	La	PB070212.prf	10248-10848	190736	6	0.072	2.05
Sn	Ka	sn060606.prf	24594-25794	98621	5	-5.642	6.26
Au	La	au070212.prf	9411-10011	167291	5	-0.048	2.06
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.653	10.18
Co	Ka	co060212.prf	6624-7224	589345	8	0.783	0.76
Ni	Ka	ni060212.prf	7171-7771	685242	8	0.783	0.76

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	488 ±37	1.01	0.64	9.31 ±1.41
S	Ka	0 ±26	1.01	< 0.74	< 0.74
K	Ka	5046 ±259	16.40	1.38	20.25 ±2.08
Ca	Ka	19 ±275	16.40	< 0.60	< 0.60
Ti	Ka	2032 ±68	1.57	0.36	5.24 ±0.35
Mn	Ka	5578 ±95	0.76	0.69	10.11 ±0.34
Fe	Ka	35240 ±198	0.76	3.71	54.35 ±0.61
Cu	Ka	0 ±71	0.76	< 0.28	< 0.28
Zn	Ka	124 ±77	0.76	< 0.26	< 0.26
P	Ka	12 ±36	1.01	< 1.47	< 1.47
Pb	La	195 ±63	2.05	0.02	0.26 ±0.17
Sn	Ka	0 ±269	6.26	< 0.26	< 0.26
Au	La	92 ±57	2.06	< 0.20	< 0.20
Ag	Ka	395 ±323	10.18	0.03	0.44 ±0.71
Co	Ka	0 ±99	0.76	< 0.39	< 0.39
Ni	Ka	0 ±68	0.76	< 0.31	< 0.31
Totals				6.82	99.96

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-04-int
Output on Wed May 24 14:58:24 2017
Analysed on May 24, 2017 02:51:23 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 400secs Real time= 400secs Count Rate= 651c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	23	-1.102	1.30
S	Ka	s040216.prf	2007-2607	6645	23	-1.102	1.30
K	Ka	kox1.prf	3011-3611	37571	18	-1.839	15.11
Ca	Ka	caox1.prf	3389-3989	40399	18	-1.839	15.11
Ti	Ka	ti150114.prf	4208-4808	217533	6	-0.053	0.99
Mn	Ka	mn060212.prf	5594-6194	504611	12	1.058	1.01
Fe	Ka	fe060212.prf	6098-6698	591462	12	1.058	1.01
Cu	Ka	cu060212.prf	7740-8340	720275	12	1.058	1.01
Zn	Ka	zn060212.prf	8330-8930	778621	12	1.058	1.01
P	Ka	hm1007a.prf	1714-2314	1908	23	-1.102	1.30
Pb	La	PB070212.prf	10248-10848	190736	5	-1.440	5.85
Sn	Ka	sn060606.prf	24594-25794	98621	6	-0.102	4.16
Au	La	au070212.prf	9411-10011	167291	5	-0.726	2.37
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.656	11.21
Co	Ka	co060212.prf	6624-7224	589345	12	1.058	1.01
Ni	Ka	ni060212.prf	7171-7771	685242	12	1.058	1.01

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	392 ±35	1.30	0.52	9.88 ±1.76
S	Ka	0 ±27	1.30	< 1.02	< 1.02
K	Ka	3738 ±156	15.11	1.04	19.68 ±1.64
Ca	Ka	0 ±161	15.11	< 0.67	< 0.67
Ti	Ka	1504 ±56	0.99	0.26	4.96 ±0.37
Mn	Ka	685 ±61	1.01	0.08	1.57 ±0.28
Fe	Ka	31918 ±186	1.01	3.32	63.09 ±0.74
Cu	Ka	60 ±67	1.01	< 0.34	< 0.34
Zn	Ka	332 ±75	1.01	0.04	0.77 ±0.35
P	Ka	29 ±34	1.30	< 1.83	< 1.83
Pb	La	0 ±73	5.85	< 0.28	< 0.28
Sn	Ka	0 ±209	4.16	< 0.33	< 0.33
Au	La	0 ±55	2.37	< 0.25	< 0.25
Ag	Ka	0 ±346	11.21	< 0.47	< 0.47
Co	Ka	0 ±94	1.01	< 0.42	< 0.42
Ni	Ka	6 ±64	1.01	< 0.37	< 0.37
Totals				5.26	99.95

Note: Please disregard non-normalised results at the moment

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-04-ext
Output on Wed May 24 15:08:07 2017
Analysed on May 24, 2017 03:00:46 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 400secs Real time= 400secs Count Rate= 645c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

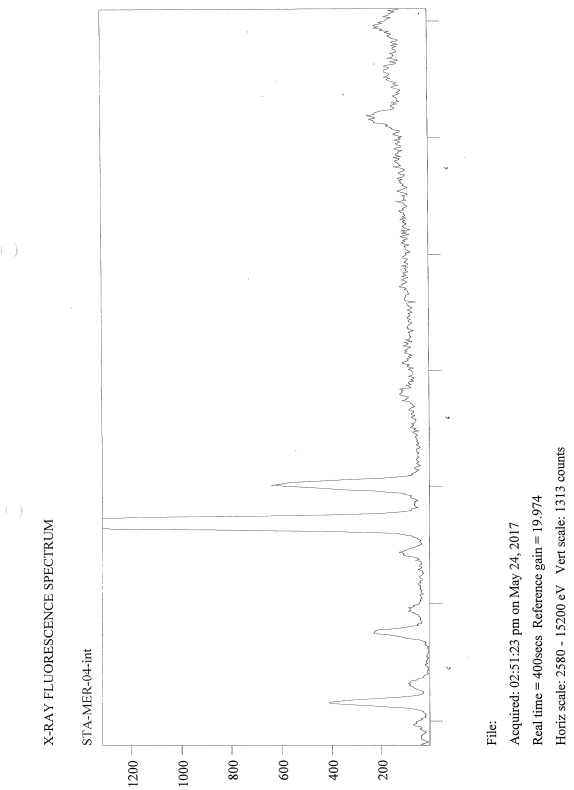
Fitting data

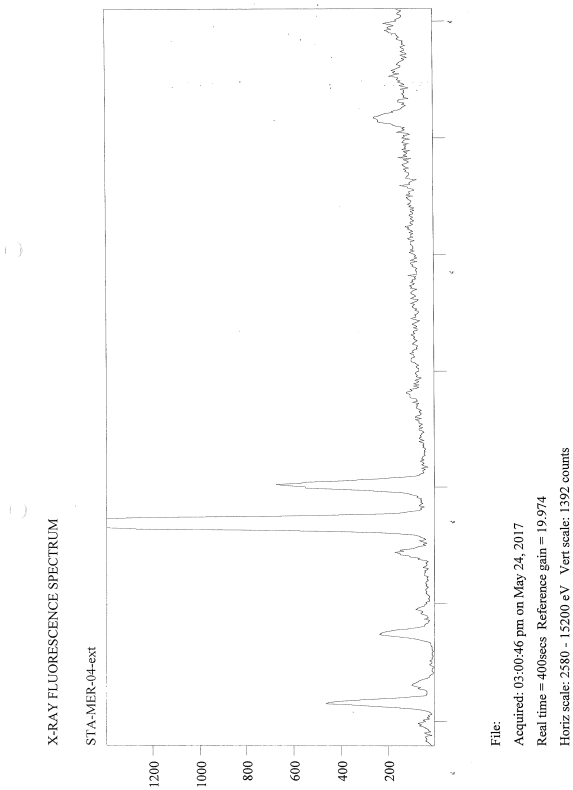
		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	4	-0.700	0.92
S	Ka	s040216.prf	2007-2607	6645	4	-0.700	0.92
K	Ka	kox1.prf	3011-3611	37571	17	-1.717	14.58
Ca	Ka	caox1.prf	3389-3989	40399	17	-1.717	14.58
Ti	Ka	ti150114.prf	4208-4808	217533	5	-0.017	0.24
Mn	Ka	mn060212.prf	5594-6194	504611	12	1.045	0.95
Fe	Ka	fe060212.prf	6098-6698	591462	12	1.045	0.95
Cu	Ka	cu060212.prf	7740-8340	720275	12	1.045	0.95
Zn	Ka	zn060212.prf	8330-8930	778621	12	1.045	0.95
P	Ka	hm1007a.prf	1714-2314	1908	4	-0.700	0.92
Pb	La	PB070212.prf	10248-10848	190736	6	1.474	4.88
Sn	Ka	sn060606.prf	24594-25794	98621	5	-0.069	4.32
Au	La	au070212.prf	9411-10011	167291	6	-0.749	2.12
Ag	Ka	ag070212.prf	21504-22704	187485	6	5.708	10.59
Co	Ka	co060212.prf	6624-7224	589345	12	1.045	0.95
Ni	Ka	ni060212.prf	7171-7771	685242	12	1.045	0.95

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	288 ±34	0.92	0.38	7.06 ±1.67
S	Ka	80 ±26	0.92	0.05	1.02 ±0.66
K	Ka	4275 ±171	14.58	1.15	21.67 ±1.73
Ca	Ka	0 ±177	14.58	< 0.68	< 0.68
Ti	Ka	1587 ±49	0.24	0.28	5.21 ±0.32
Mn	Ka	1020 ±65	0.95	0.13	2.36 ±0.30
Fe	Ka	30935 ±186	0.95	3.26	61.33 ±0.74
Cu	Ka	0 ±70	0.95	< 0.34	< 0.34
Zn	Ka	382 ±77	0.95	0.05	0.88 ±0.35
P	Ka	19 ±32	0.92	< 1.66	< 1.66
Pb	La	131 ±73	4.88	< 0.26	< 0.26
Sn	Ka	0 ±200	4.32	< 0.33	< 0.33
Au	La	20 ±57	2.12	< 0.24	< 0.24
Ag	Ka	75 ±328	10.59	< 0.46	< 0.46
Co	Ka	0 ±97	0.95	< 0.44	< 0.44
Ni	Ka	146 ±66	0.95	0.02	0.44 ±0.40
Totals				5.32	99.97

Note: Please disregard non-normalised results at the moment





SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-05-int
Output on Wed May 24 15:17:01 2017
Analysed on May 24, 2017 03:10:05 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 400secs Real time= 400secs Count Rate= 708c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

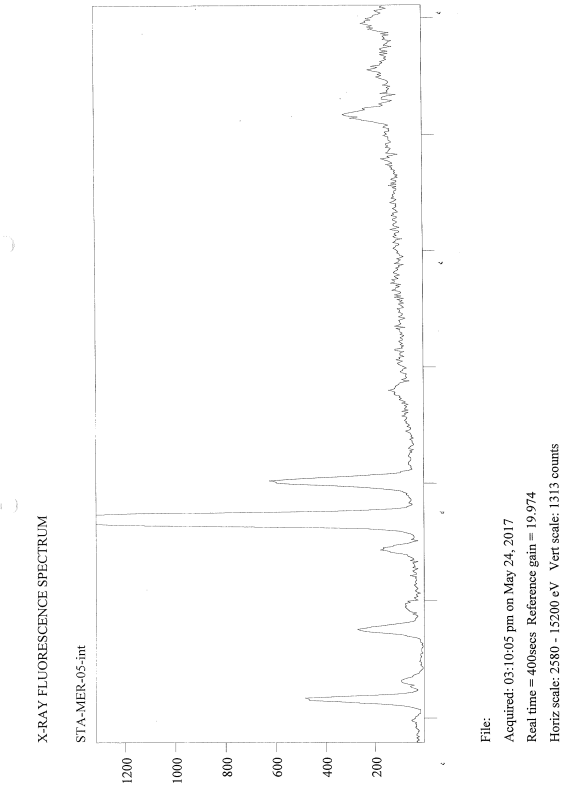
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	13	-0.899	1.66
S	Ka	s040216.prf	2007-2607	6645	13	-0.899	1.66
K	Ka	kox1.prf	3011-3611	37571	17	-2.022	22.09
Ca	Ka	caox1.prf	3389-3989	40399	17	-2.022	22.09
Ti	Ka	ti150114.prf	4208-4808	217533	5	0.033	0.96
Mn	Ka	mn060212.prf	5594-6194	504611	12	1.017	0.86
Fe	Ka	fe060212.prf	6098-6698	591462	12	1.017	0.86
Cu	Ka	cu060212.prf	7740-8340	720275	12	1.017	0.86
Zn	Ka	zn060212.prf	8330-8930	778621	12	1.017	0.86
P	Ka	hm1007a.prf	1714-2314	1908	13	-0.899	1.66
Pb	La	PB070212.prf	10248-10848	190736	6	0.096	3.67
Sn	Ka	sn060606.prf	24594-25794	98621	5	5.636	4.64
Au	La	au070212.prf	9411-10011	167291	6	0.760	3.23
Ag	Ka	ag070212.prf	21504-22704	187485	5	-5.652	9.60
Co	Ka	co060212.prf	6624-7224	589345	12	1.017	0.86
Ni	Ka	ni060212.prf	7171-7771	685242	12	1.017	0.86

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	465 ±39	1.66	0.59	11.10 ±1.86
S	Ka	29 ±30	1.66	< 1.03	< 1.03
K	Ka	4191 ±200	22.09	1.14	21.60 ±2.06
Ca	Ka	0 ±210	22.09	< 0.69	< 0.69
Ti	Ka	1778 ±59	0.96	0.31	5.92 ±0.39
Mn	Ka	1061 ±62	0.86	0.13	2.41 ±0.28
Fe	Ka	29802 ±181	0.86	3.06	57.93 ±0.70
Cu	Ka	0 ±65	0.86	< 0.34	< 0.34
Zn	Ka	454 ±73	0.86	0.05	0.99 ±0.32
P	Ka	0 ±38	1.66	< 2.00	< 2.00
Pb	La	28 ±67	3.67	< 0.28	< 0.28
Sn	Ka	0 ±218	4.64	< 0.33	< 0.33
Au	La	112 ±61	3.23	< 0.24	< 0.24
Ag	Ka	276 ±299	9.60	< 0.46	< 0.46
Co	Ka	0 ±93	0.86	< 0.42	< 0.42
Ni	Ka	43 ±63	0.86	< 0.37	< 0.37
Totals				5.28	99.95

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-05-ext
Output on Wed May 24 15:27:20 2017
Analysed on May 24, 2017 03:19:19 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 400secs Real time= 400secs Count Rate= 683c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

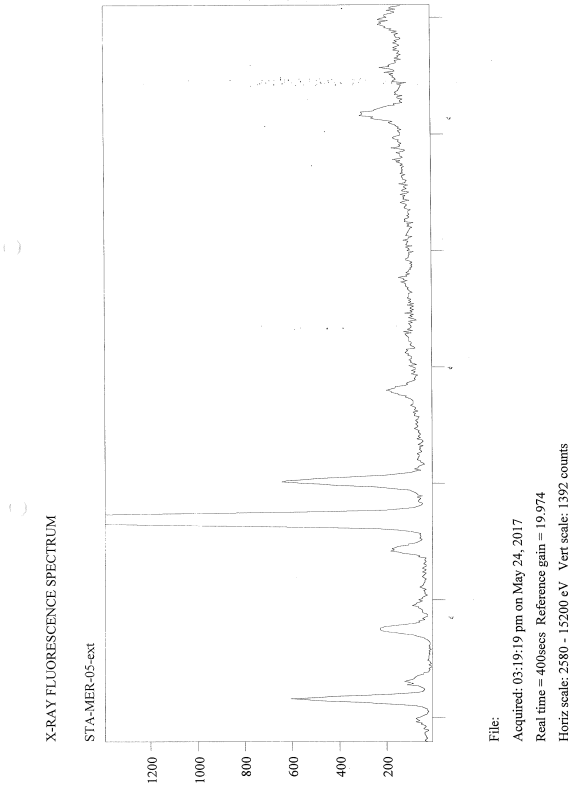
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	4	-0.700	1.30
S	Ka	s040216.prf	2007-2607	6645	4	-0.700	1.30
K	Ka	kox1.prf	3011-3611	37571	14	-1.833	29.97
Ca	Ka	caox1.prf	3389-3989	40399	14	-1.833	29.97
Ti	Ka	ti150114.prf	4208-4808	217533	5	0.034	1.01
Mn	Ka	mn060212.prf	5594-6194	504611	12	1.017	1.46
Fe	Ka	fe060212.prf	6098-6698	591462	12	1.017	1.46
Cu	Ka	cu060212.prf	7740-8340	720275	12	1.017	1.46
Zn	Ka	zn060212.prf	8330-8930	778621	12	1.017	1.46
P	Ka	hm1007a.prf	1714-2314	1908	4	-0.700	1.30
Pb	La	PB070212.prf	10248-10848	190736	9	1.531	2.41
Sn	Ka	sn060606.prf	24594-25794	98621	6	0.125	6.28
Au	La	au070212.prf	9411-10011	167291	6	0.756	2.80
Ag	Ka	ag070212.prf	21504-22704	187485	6	5.711	11.13
Co	Ka	co060212.prf	6624-7224	589345	12	1.017	1.46
Ni	Ka	ni060212.prf	7171-7771	685242	12	1.017	1.46

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	292 ±36	1.30	0.37	6.98 ±1.72
S	Ka	10 ±27	1.30	< 0.90	< 0.90
K	Ka	5049 ±234	29.97	1.34	25.23 ±2.34
Ca	Ka	0 ±246	29.97	< 0.77	< 0.77
Ti	Ka	1550 ±57	1.01	0.28	5.31 ±0.39
Mn	Ka	1138 ±73	1.46	0.14	2.68 ±0.34
Fe	Ka	28370 ±182	1.46	3.02	56.97 ±0.73
Cu	Ka	26 ±80	1.46	< 0.33	< 0.33
Zn	Ka	994 ±91	1.46	0.12	2.20 ±0.40
P	Ka	0 ±34	1.30	< 1.73	< 1.73
Pb	La	346 ±67	2.41	0.03	0.59 ±0.23
Sn	Ka	0 ±270	6.28	< 0.33	< 0.33
Au	La	21 ±61	2.80	< 0.25	< 0.25
Ag	Ka	222 ±331	11.13	< 0.47	< 0.47
Co	Ka	0 ±100	1.46	< 0.43	< 0.43
Ni	Ka	86 ±76	1.46	< 0.36	< 0.36
Totals				5.30	99.95

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-06-int
Output on Wed May 24 15:36:38 2017
Analysed on May 24, 2017 03:30:13 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 360secs Real time= 360secs Count Rate= 686c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

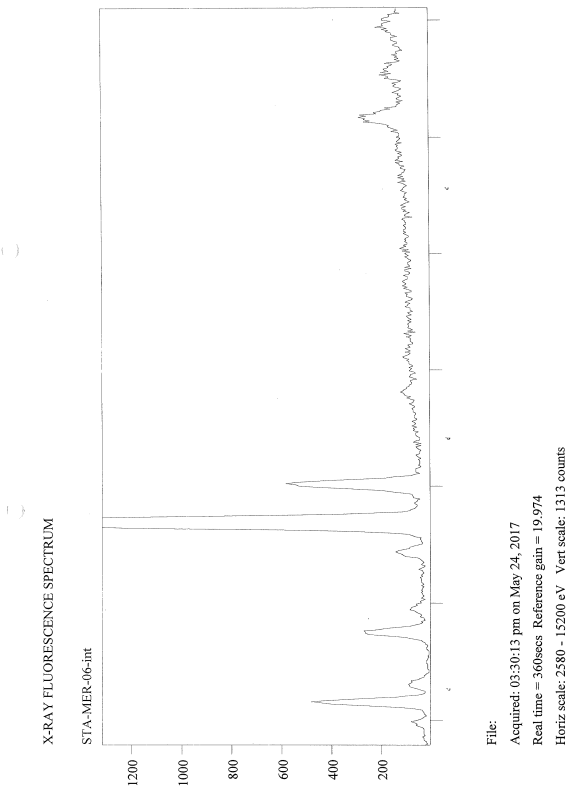
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	6	-0.737	1.20
S	Ka	s040216.prf	2007-2607	6645	6	-0.737	1.20
K	Ka	kox1.prf	3011-3611	37571	17	-1.816	17.15
Ca	Ka	caox1.prf	3389-3989	40399	17	-1.816	17.15
Ti	Ka	ti150114.prf	4208-4808	217533	5	0.028	0.71
Mn	Ka	mn060212.prf	5594-6194	504611	11	1.028	0.95
Fe	Ka	fe060212.prf	6098-6698	591462	11	1.028	0.95
Cu	Ka	cu060212.prf	7740-8340	720275	11	1.028	0.95
Zn	Ka	zn060212.prf	8330-8930	778621	11	1.028	0.95
P	Ka	hm1007a.prf	1714-2314	1908	6	-0.737	1.20
Pb	La	PB070212.prf	10248-10848	190736	5	1.435	4.40
Sn	Ka	sn060606.prf	24594-25794	98621	4	-5.600	5.02
Au	La	au070212.prf	9411-10011	167291	6	0.767	4.02
Ag	Ka	ag070212.prf	21504-22704	187485	6	5.701	9.19
Co	Ka	co060212.prf	6624-7224	589345	11	1.028	0.95
Ni	Ka	ni060212.prf	7171-7771	685242	11	1.028	0.95

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	256 ±32	1.20	0.37	6.67 ±1.67
S	Ka	0 ±24	1.20	< 0.93	< 0.93
K	Ka	4257 ±183	17.15	1.24	22.39 ±1.93
Ca	Ka	0 ±190	17.15	< 0.70	< 0.70
Ti	Ka	1835 ±56	0.71	0.35	6.39 ±0.39
Mn	Ka	875 ±59	0.95	0.12	2.20 ±0.30
Fe	Ka	28540 ±178	0.95	3.40	61.45 ±0.77
Cu	Ka	108 ±64	0.95	< 0.35	< 0.35
Zn	Ka	342 ±71	0.95	0.05	0.84 ±0.35
P	Ka	0 ±31	1.20	< 1.75	< 1.75
Pb	La	135 ±67	4.40	< 0.28	< 0.28
Sn	Ka	0 ±233	5.02	< 0.33	< 0.33
Au	La	0 ±61	4.02	< 0.26	< 0.26
Ag	Ka	184 ±288	9.19	< 0.47	< 0.47
Co	Ka	0 ±89	0.95	< 0.44	< 0.44
Ni	Ka	0 ±61	0.95	< 0.39	< 0.39
Totals				5.53	99.95

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-06-ext
Output on Wed May 24 15:45:35 2017
Analysed on May 24, 2017 03:38:42 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 360secs Real time= 360secs Count Rate= 640c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

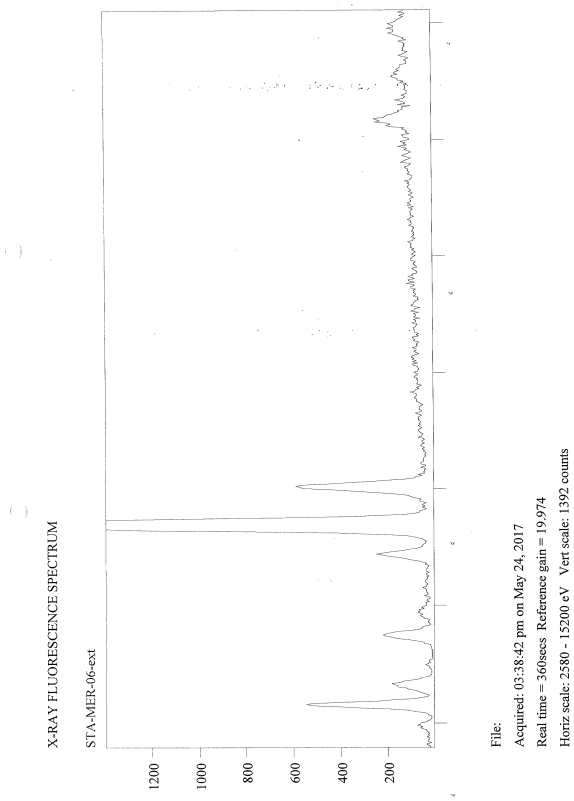
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	4	-0.700	1.44
S	Ka	s040216.prf	2007-2607	6645	4	-0.700	1.44
K	Ka	kox1.prf	3011-3611	37571	18	-1.820	15.93
Ca	Ka	caox1.prf	3389-3989	40399	18	-1.820	15.93
Ti	Ka	ti150114.prf	4208-4808	217533	7	-0.000	1.56
Mn	Ka	mn060212.prf	5594-6194	504611	11	1.060	0.98
Fe	Ka	fe060212.prf	6098-6698	591462	11	1.060	0.98
Cu	Ka	cu060212.prf	7740-8340	720275	11	1.060	0.98
Zn	Ka	zn060212.prf	8330-8930	778621	11	1.060	0.98
P	Ka	hm1007a.prf	1714-2314	1908	4	-0.700	1.44
Pb	La	PB070212.prf	10248-10848	190736	6	0.092	3.35
Sn	Ka	sn060606.prf	24594-25794	98621	5	-5.638	5.32
Au	La	au070212.prf	9411-10011	167291	6	-0.753	2.55
Ag	Ka	ag070212.prf	21504-22704	187485	5	-0.102	9.41
Co	Ka	co060212.prf	6624-7224	589345	11	1.060	0.98
Ni	Ka	ni060212.prf	7171-7771	685242	11	1.060	0.98

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	233 ±32	1.44	0.32	5.51 ±1.51
S	Ka	4 ±25	1.44	< 0.80	< 0.80
K	Ka	4874 ±240	15.93	1.37	23.26 ±2.29
Ca	Ka	636 ±254	15.93	0.21	3.59 ±2.87
Ti	Ka	1426 ±53	1.56	0.29	4.89 ±0.36
Mn	Ka	1543 ±67	0.98	0.22	3.67 ±0.32
Fe	Ka	28486 ±179	0.98	3.40	57.81 ±0.73
Cu	Ka	51 ±67	0.98	< 0.32	< 0.32
Zn	Ka	208 ±72	0.98	0.03	0.47 ±0.33
P	Ka	0 ±31	1.44	< 1.52	< 1.52
Pb	La	187 ±64	3.35	0.02	0.32 ±0.22
Sn	Ka	0 ±235	5.32	< 0.29	< 0.29
Au	La	71 ±54	2.55	< 0.23	< 0.23
Ag	Ka	239 ±268	9.41	< 0.41	< 0.41
Co	Ka	0 ±91	0.98	< 0.43	< 0.43
Ni	Ka	145 ±63	0.98	0.03	0.43 ±0.38
Totals				5.88	99.96

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-07-int
Output on Wed May 24 15:55:54 2017
Analysed on May 24, 2017 03:49:23 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 360secs Real time= 360secs Count Rate= 635c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

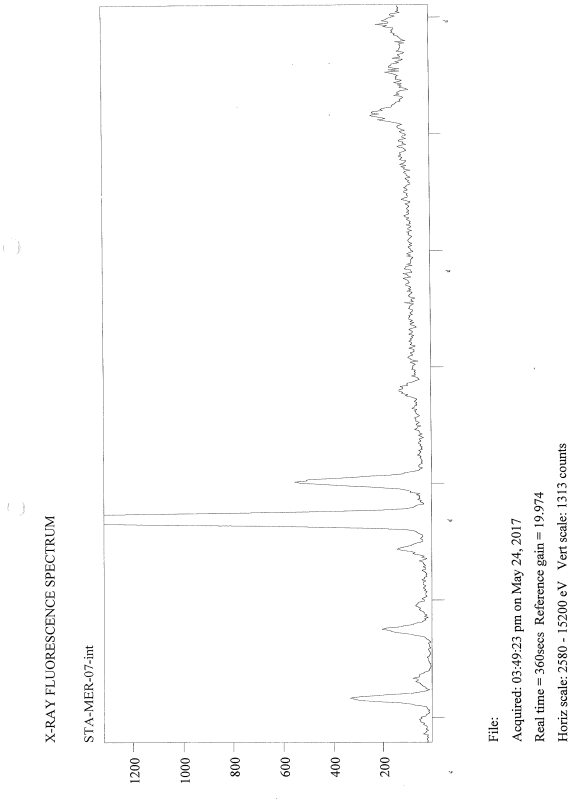
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	6	-0.742	1.57
S	Ka	s040216.prf	2007-2607	6645	6	-0.742	1.57
K	Ka	kox1.prf	3011-3611	37571	17	-1.529	11.05
Ca	Ka	caox1.prf	3389-3989	40399	17	-1.529	11.05
Ti	Ka	ti150114.prf	4208-4808	217533	5	0.028	0.69
Mn	Ka	mn060212.prf	5594-6194	504611	13	1.081	0.95
Fe	Ka	fe060212.prf	6098-6698	591462	13	1.081	0.95
Cu	Ka	cu060212.prf	7740-8340	720275	13	1.081	0.95
Zn	Ka	zn060212.prf	8330-8930	778621	13	1.081	0.95
P	Ka	hm1007a.prf	1714-2314	1908	6	-0.742	1.57
Pb	La	PB070212.prf	10248-10848	190736	5	0.063	3.52
Sn	Ka	sn060606.prf	24594-25794	98621	5	-5.638	5.19
Au	La	au070212.prf	9411-10011	167291	6	0.084	2.82
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.644	6.87
Co	Ka	co060212.prf	6624-7224	589345	13	1.081	0.95
Ni	Ka	ni060212.prf	7171-7771	685242	13	1.081	0.95

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	299 ±32	1.57	0.45	9.26 ±1.98
S	Ka	8 ±26	1.57	< 1.09	< 1.09
K	Ka	3014 ±140	11.05	0.93	19.24 ±1.79
Ca	Ka	19 ±145	11.05	< 0.68	< 0.68
Ti	Ka	1225 ±48	0.69	0.24	4.87 ±0.38
Mn	Ka	784 ±59	0.95	0.11	2.18 ±0.33
Fe	Ka	26113 ±170	0.95	3.02	62.59 ±0.81
Cu	Ka	29 ±64	0.95	< 0.40	< 0.40
Zn	Ka	633 ±72	0.95	0.09	1.79 ±0.41
P	Ka	31 ±31	1.57	< 2.01	< 2.01
Pb	La	0 ±67	3.52	< 0.34	< 0.34
Sn	Ka	0 ±247	5.19	< 0.38	< 0.38
Au	La	0 ±56	2.82	< 0.30	< 0.30
Ag	Ka	92 ±219	6.87	< 0.54	< 0.54
Co	Ka	0 ±88	0.95	< 0.48	< 0.48
Ni	Ka	44 ±61	0.95	< 0.44	< 0.44
Totals			4.83	99.94	

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-07-ext
Output on Wed May 24 16:04:48 2017
Analysed on May 24, 2017 03:57:44 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 360secs Real time= 360secs Count Rate= 716c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

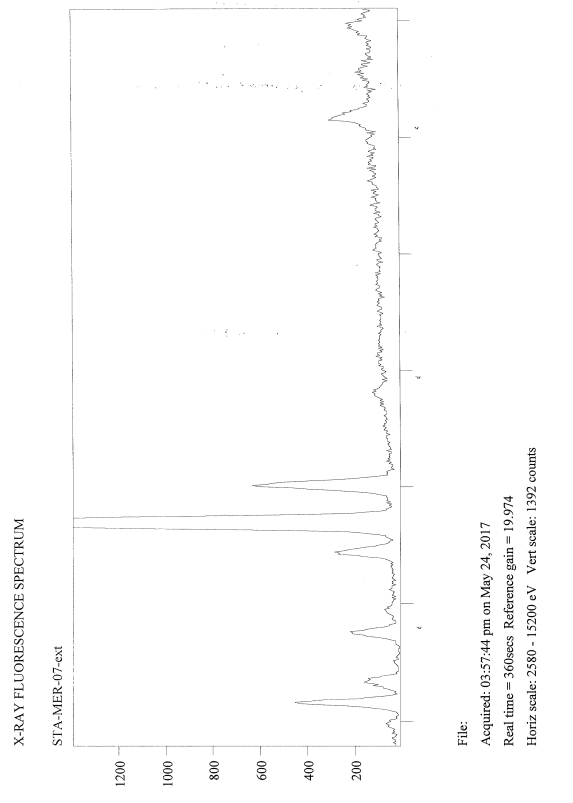
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	13	-0.905	1.78
S	Ka	s040216.prf	2007-2607	6645	13	-0.905	1.78
K	Ka	kox1.prf	3011-3611	37571	18	-1.746	14.48
Ca	Ka	caox1.prf	3389-3989	40399	18	-1.746	14.48
Ti	Ka	ti150114.prf	4208-4808	217533	5	-0.033	0.92
Mn	Ka	mn060212.prf	5594-6194	504611	11	0.944	1.35
Fe	Ka	fe060212.prf	6098-6698	591462	11	0.944	1.35
Cu	Ka	cu060212.prf	7740-8340	720275	11	0.944	1.35
Zn	Ka	zn060212.prf	8330-8930	778621	11	0.944	1.35
P	Ka	hm1007a.prf	1714-2314	1908	13	-0.905	1.78
Pb	La	PB070212.prf	10248-10848	190736	18	1.762	2.25
Sn	Ka	sn060606.prf	24594-25794	98621	5	5.637	4.82
Au	La	au070212.prf	9411-10011	167291	6	0.068	1.86
Ag	Ka	ag070212.prf	21504-22704	187485	4	-5.600	9.18
Co	Ka	co060212.prf	6624-7224	589345	11	0.944	1.35
Ni	Ka	ni060212.prf	7171-7771	685242	11	0.944	1.35

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	316 ±34	1.78	0.45	7.68 ±1.65
S	Ka	0 ±28	1.78	< 0.96	< 0.96
K	Ka	4034 ±193	14.48	1.17	19.96 ±1.91
Ca	Ka	680 ±204	14.48	0.22	3.74 ±2.24
Ti	Ka	1431 ±52	0.92	0.28	4.83 ±0.35
Mn	Ka	1910 ±74	1.35	0.26	4.47 ±0.35
Fe	Ka	29276 ±182	1.35	3.42	58.51 ±0.73
Cu	Ka	67 ±72	1.35	< 0.34	< 0.34
Zn	Ka	341 ±80	1.35	0.05	0.77 ±0.36
P	Ka	51 ±33	1.78	< 1.66	< 1.66
Pb	La	0 ±57	2.25	< 0.27	< 0.27
Sn	Ka	110 ±224	4.82	< 0.31	< 0.31
Au	La	0 ±55	1.86	< 0.25	< 0.25
Ag	Ka	0 ±301	9.18	< 0.46	< 0.46
Co	Ka	0 ±96	1.35	< 0.44	< 0.44
Ni	Ka	80 ±68	1.35	< 0.34	< 0.34
Totals			5.84	99.96	

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-08-int
Output on Wed May 24 16:13:08 2017
Analysed on May 24, 2017 04:06:25 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 360secs Real time= 360secs Count Rate= 630c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

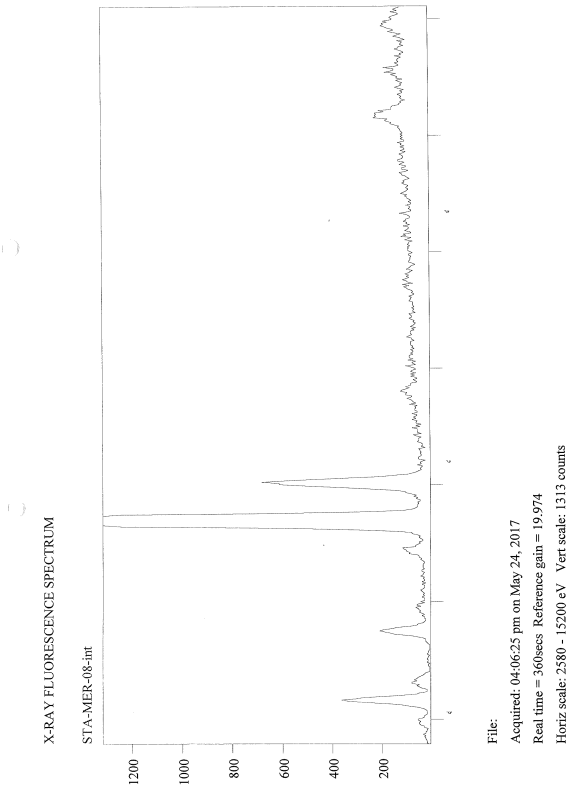
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	4	-0.700	1.02
S	Ka	s040216.prf	2007-2607	6645	4	-0.700	1.02
K	Ka	kox1.prf	3011-3611	37571	19	-2.089	18.43
Ca	Ka	caox1.prf	3389-3989	40399	19	-2.089	18.43
Ti	Ka	ti150114.prf	4208-4808	217533	6	-0.053	0.96
Mn	Ka	mn060212.prf	5594-6194	504611	13	0.936	2.02
Fe	Ka	fe060212.prf	6098-6698	591462	13	0.936	2.02
Cu	Ka	cu060212.prf	7740-8340	720275	13	0.936	2.02
Zn	Ka	zn060212.prf	8330-8930	778621	13	0.936	2.02
P	Ka	hm1007a.prf	1714-2314	1908	4	-0.700	1.02
Pb	La	PB070212.prf	10248-10848	190736	6	1.475	5.01
Sn	Ka	sn060606.prf	24594-25794	98621	6	5.669	4.30
Au	La	au070212.prf	9411-10011	167291	6	-0.760	3.23
Ag	Ka	ag070212.prf	21504-22704	187485	4	-5.600	9.20
Co	Ka	co060212.prf	6624-7224	589345	13	0.936	2.02
Ni	Ka	ni060212.prf	7171-7771	685242	13	0.936	2.02

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	291 ±31	1.02	0.45	8.28 ±1.76
S	Ka	0 ±23	1.02	< 0.94	< 0.94
K	Ka	3024 ±151	18.43	0.95	17.26 ±1.72
Ca	Ka	0 ±157	18.43	< 0.62	< 0.62
Ti	Ka	1322 ±46	0.96	0.25	4.60 ±0.32
Mn	Ka	675 ±78	2.02	0.09	1.69 ±0.39
Fe	Ka	30798 ±193	2.02	3.66	66.66 ±0.84
Cu	Ka	0 ±91	2.02	< 0.38	< 0.38
Zn	Ka	397 ±99	2.02	0.06	1.05 ±0.52
P	Ka	0 ±29	1.02	< 1.82	< 1.82
Pb	La	26 ±66	5.01	< 0.30	< 0.30
Sn	Ka	305 ±200	4.30	0.02	0.41 ±0.54
Au	La	0 ±53	3.23	< 0.27	< 0.27
Ag	Ka	11 ±276	9.20	< 0.49	< 0.49
Co	Ka	0 ±110	2.02	< 0.47	< 0.47
Ni	Ka	25 ±86	2.02	< 0.39	< 0.39
Totals				5.49	99.94

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-08-ext
Output on Wed May 24 16:21:20 2017
Analysed on May 24, 2017 04:14:38 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.974ev/ch
Live time= 360secs Real time= 360secs Count Rate= 645c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

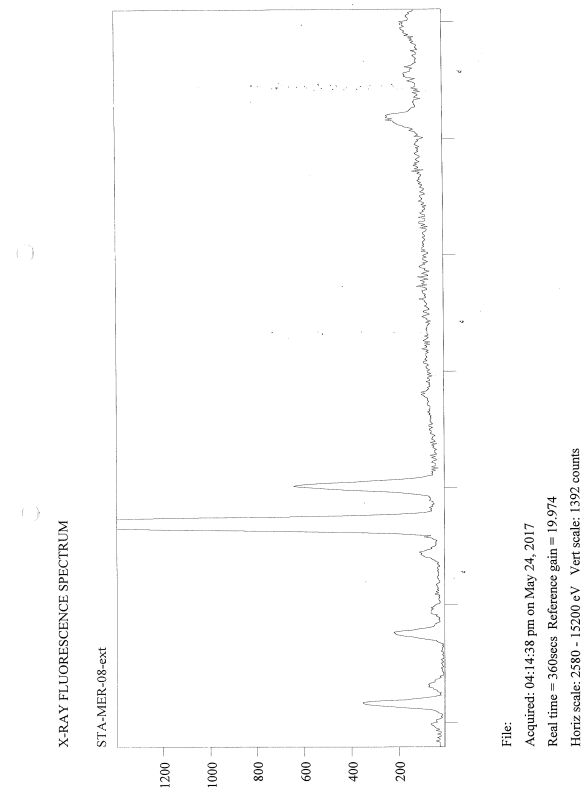
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	5	-0.717	1.00
S	Ka	s040216.prf	2007-2607	6645	5	-0.717	1.00
K	Ka	kox1.prf	3011-3611	37571	18	-1.709	22.19
Ca	Ka	caox1.prf	3389-3989	40399	18	-1.709	22.19
Ti	Ka	ti150114.prf	4208-4808	217533	5	-0.023	0.46
Mn	Ka	mn060212.prf	5594-6194	504611	10	0.936	2.22
Fe	Ka	fe060212.prf	6098-6698	591462	10	0.936	2.22
Cu	Ka	cu060212.prf	7740-8340	720275	10	0.936	2.22
Zn	Ka	zn060212.prf	8330-8930	778621	10	0.936	2.22
P	Ka	hm1007a.prf	1714-2314	1908	5	-0.717	1.00
Pb	La	PB070212.prf	10248-10848	190736	6	1.475	5.12
Sn	Ka	sn060606.prf	24594-25794	98621	6	0.134	7.14
Au	La	au070212.prf	9411-10011	167291	6	0.768	4.10
Ag	Ka	ag070212.prf	21504-22704	187485	5	-5.649	8.53
Co	Ka	co060212.prf	6624-7224	589345	10	0.936	2.22
Ni	Ka	ni060212.prf	7171-7771	685242	10	0.936	2.22

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	226 ±32	1.00	0.35	6.24 ±1.77
S	Ka	15 ±24	1.00	< 0.93	< 0.93
K	Ka	3348 ±141	22.19	1.03	18.21 ±1.53
Ca	Ka	0 ±145	22.19	< 0.61	< 0.61
Ti	Ka	1524 ±51	0.46	0.29	5.20 ±0.35
Mn	Ka	655 ±66	2.22	0.09	1.65 ±0.33
Fe	Ka	30830 ±187	2.22	3.78	66.93 ±0.81
Cu	Ka	80 ±75	2.22	< 0.37	< 0.37
Zn	Ka	255 ±81	2.22	0.04	0.67 ±0.42
P	Ka	11 ±30	1.00	< 1.71	< 1.71
Pb	La	198 ±72	5.12	0.02	0.39 ±0.28
Sn	Ka	499 ±330	7.14	0.04	0.67 ±0.89
Au	La	14 ±61	4.10	< 0.26	< 0.26
Ag	Ka	39 ±282	8.53	< 0.50	< 0.50
Co	Ka	0 ±99	2.22	< 0.46	< 0.46
Ni	Ka	21 ±72	2.22	< 0.41	< 0.41
Totals				5.65	99.95

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-09-int
Output on Thu May 25 09:10:28 2017
Analysed on May 25, 2017 09:03:50 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 582c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

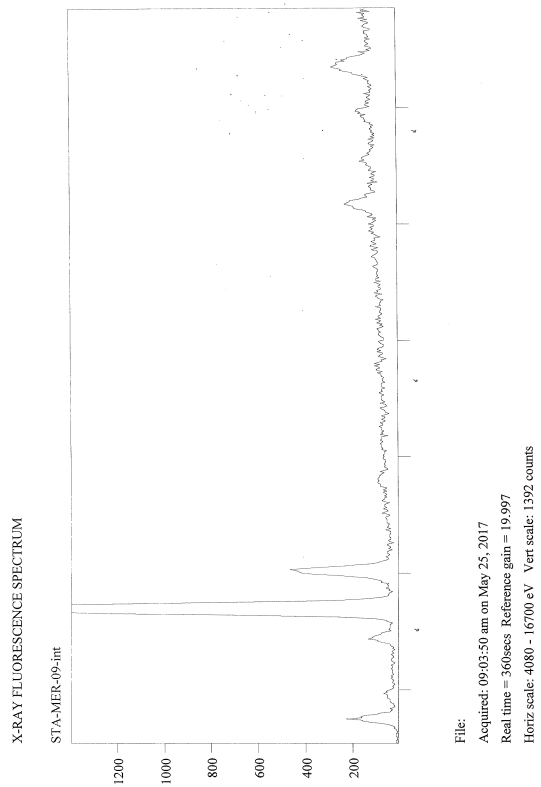
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	4	-0.700	1.44
S	Ka	s040216.prf	2007-2607	6645	4	-0.700	1.44
K	Ka	kox1.prf	3011-3611	37571	25	-2.287	11.62
Ca	Ka	caox1.prf	3389-3989	40399	25	-2.287	11.62
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.70
Mn	Ka	mn060212.prf	5594-6194	504611	11	0.271	0.95
Fe	Ka	fe060212.prf	6098-6698	591462	11	0.271	0.95
Cu	Ka	cu060212.prf	7740-8340	720275	11	0.271	0.95
Zn	Ka	zn060212.prf	8330-8930	778621	11	0.271	0.95
P	Ka	hm1007a.prf	1714-2314	1908	4	-0.700	1.44
Pb	La	PB070212.prf	10248-10848	190736	6	-0.106	4.45
Sn	Ka	sn060606.prf	24594-25794	98621	5	-5.639	5.59
Au	La	au070212.prf	9411-10011	167291	6	0.754	2.61
Ag	Ka	ag070212.prf	21504-22704	187485	4	-5.600	7.12
Co	Ka	co060212.prf	6624-7224	589345	11	0.271	0.95
Ni	Ka	ni060212.prf	7171-7771	685242	11	0.271	0.95

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	193 ±30	1.44	0.29	6.45 ±2.01
S	Ka	0 ±26	1.44	< 1.24	< 1.24
K	Ka	2927 ±138	11.62	0.90	19.77 ±1.86
Ca	Ka	44 ±143	11.62	< 0.80	< 0.80
Ti	Ka	1301 ±47	0.70	0.26	5.73 ±0.41
Mn	Ka	766 ±59	0.95	0.11	2.43 ±0.37
Fe	Ka	22932 ±161	0.95	2.85	62.51 ±0.88
Cu	Ka	0 ±65	0.95	< 0.44	< 0.44
Zn	Ka	311 ±71	0.95	0.04	0.97 ±0.44
P	Ka	0 ±30	1.44	< 2.09	< 2.09
Pb	La	291 ±69	4.45	0.03	0.69 ±0.33
Sn	Ka	441 ±243	5.59	0.03	0.73 ±0.80
Au	La	0 ±51	2.61	< 0.30	< 0.30
Ag	Ka	316 ±226	7.12	0.03	0.64 ±0.91
Co	Ka	0 ±85	0.95	< 0.51	< 0.51
Ni	Ka	23 ±62	0.95	< 0.46	< 0.46
Totals				4.56	99.94

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-09-ext
Output on Thu May 25 09:19:02 2017
Analysed on May 25, 2017 09:12:07 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 653c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

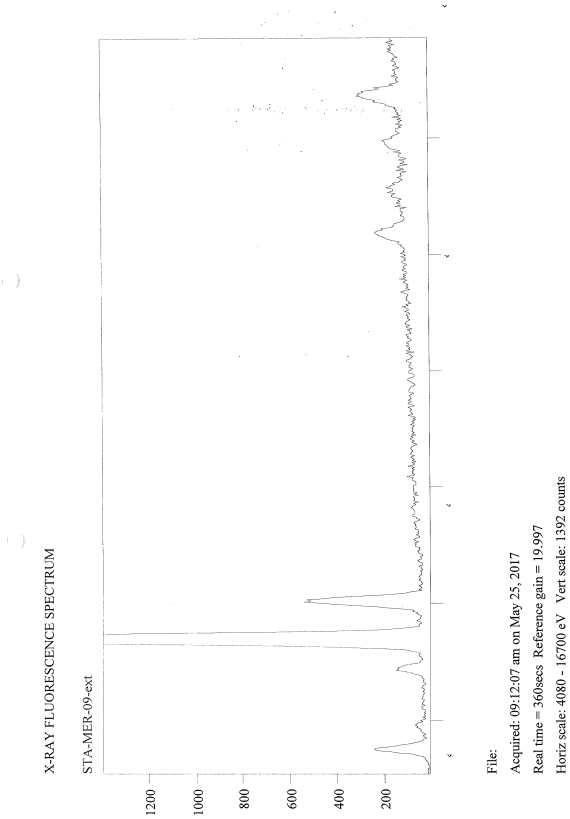
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	31	-1.356	1.43
S	Ka	s040216.prf	2007-2607	6645	31	-1.356	1.43
K	Ka	kox1.prf	3011-3611	37571	19	-2.199	19.31
Ca	Ka	caox1.prf	3389-3989	40399	19	-2.199	19.31
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.25
Mn	Ka	mn060212.prf	5594-6194	504611	8	0.197	0.88
Fe	Ka	fe060212.prf	6098-6698	591462	8	0.197	0.88
Cu	Ka	cu060212.prf	7740-8340	720275	8	0.197	0.88
Zn	Ka	zn060212.prf	8330-8930	778621	8	0.197	0.88
P	Ka	hm1007a.prf	1714-2314	1908	31	-1.356	1.43
Pb	La	PB070212.prf	10248-10848	190736	4	-1.400	3.87
Sn	Ka	sn060606.prf	24594-25794	98621	4	-5.600	4.91
Au	La	au070212.prf	9411-10011	167291	6	-0.756	2.82
Ag	Ka	ag070212.prf	21504-22704	187485	5	0.098	8.62
Co	Ka	co060212.prf	6624-7224	589345	8	0.197	0.88
Ni	Ka	ni060212.prf	7171-7771	685242	8	0.197	0.88

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	281 ±32	1.43	0.41	7.78 ±1.77
S	Ka	33 ±26	1.43	< 1.01	< 1.01
K	Ka	3744 ±172	19.31	1.13	21.28 ±1.96
Ca	Ka	0 ±179	19.31	< 0.73	< 0.73
Ti	Ka	1631 ±50	0.25	0.33	6.14 ±0.38
Mn	Ka	981 ±58	0.88	0.14	2.62 ±0.31
Fe	Ka	26521 ±172	0.88	3.21	60.60 ±0.79
Cu	Ka	164 ±62	0.88	0.03	0.49 ±0.37
Zn	Ka	120 ±67	0.88	< 0.33	< 0.33
P	Ka	32 ±31	1.43	< 1.77	< 1.77
Pb	La	32 ±63	3.87	< 0.29	< 0.29
Sn	Ka	287 ±227	4.91	0.02	0.38 ±0.60
Au	La	0 ±55	2.82	< 0.26	< 0.26
Ag	Ka	410 ±264	8.62	0.03	0.66 ±0.85
Co	Ka	0 ±87	0.88	< 0.46	< 0.46
Ni	Ka	109 ±59	0.88	< 0.38	< 0.38
Totals				5.30	99.95

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-10-int
Output on Thu May 25 09:26:42 2017
Analysed on May 25, 2017 09:20:28 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 721c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	27	-1.191	1.00
S	Ka	s040216.prf	2007-2607	6645	27	-1.191	1.00
K	Ka	kox1.prf	3011-3611	37571	18	-2.051	21.15
Ca	Ka	caox1.prf	3389-3989	40399	18	-2.051	21.15
Ti	Ka	ti150114.prf	4208-4808	217533	5	-0.711	0.43
Mn	Ka	mn060212.prf	5594-6194	504611	7	0.220	1.40
Fe	Ka	fe060212.prf	6098-6698	591462	7	0.220	1.40
Cu	Ka	cu060212.prf	7740-8340	720275	7	0.220	1.40
Zn	Ka	zn060212.prf	8330-8930	778621	7	0.220	1.40
P	Ka	hm1007a.prf	1714-2314	1908	27	-1.191	1.00
Pb	La	PB070212.prf	10248-10848	190736	4	-1.400	2.30
Sn	Ka	sn060606.prf	24594-25794	98621	6	-5.661	3.38
Au	La	au070212.prf	9411-10011	167291	6	0.749	2.20
Ag	Ka	ag070212.prf	21504-22704	187485	6	5.704	9.80
Co	Ka	co060212.prf	6624-7224	589345	7	0.220	1.40
Ni	Ka	ni060212.prf	7171-7771	685242	7	0.220	1.40

Results (5 iterations)

		Ints	Fit	~%	%Norm	±2sigma
Si	Ka	320 ±33	1.00	0.51	6.68	±1.38
S	Ka	0 ±25	1.00	< 0.74	< 0.74	
K	Ka	3714 ±182	21.15	1.16	15.19	±1.49
Ca	Ka	0 ±191	21.15	< 0.48	< 0.48	
Ti	Ka	2122 ±59	0.43	0.39	5.10	±0.28
Mn	Ka	565 ±80	1.40	0.08	1.03	±0.29
Fe	Ka	44671 ±226	1.40	5.39	70.44	±0.71
Cu	Ka	63 ±93	1.40	< 0.28	< 0.28	
Zn	Ka	388 ±100	1.40	0.06	0.76	±0.39
P	Ka	46 ±31	1.00	< 1.35	< 1.35	
Pb	La	511 ±64	2.30	0.06	0.76	±0.19
Sn	Ka	0 ±173	3.38	< 0.27	< 0.27	
Au	La	93 ±54	2.20	< 0.21	< 0.21	
Ag	Ka	0 ±298	9.80	< 0.39	< 0.39	
Co	Ka	0 ±120	1.40	< 0.39	< 0.39	
Ni	Ka	44 ±88	1.40	< 0.31	< 0.31	
Totals				7.64	99.96	

Note: Please disregard non-normalised results at the moment

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-10-ext
Output on Thu May 25 09:34:40 2017
Analysed on May 25, 2017 09:28:06 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 610c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

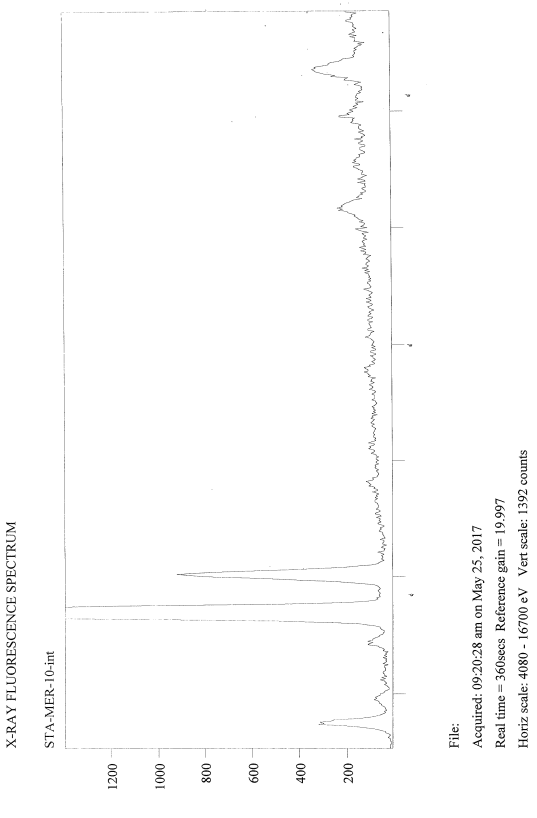
Fitting data

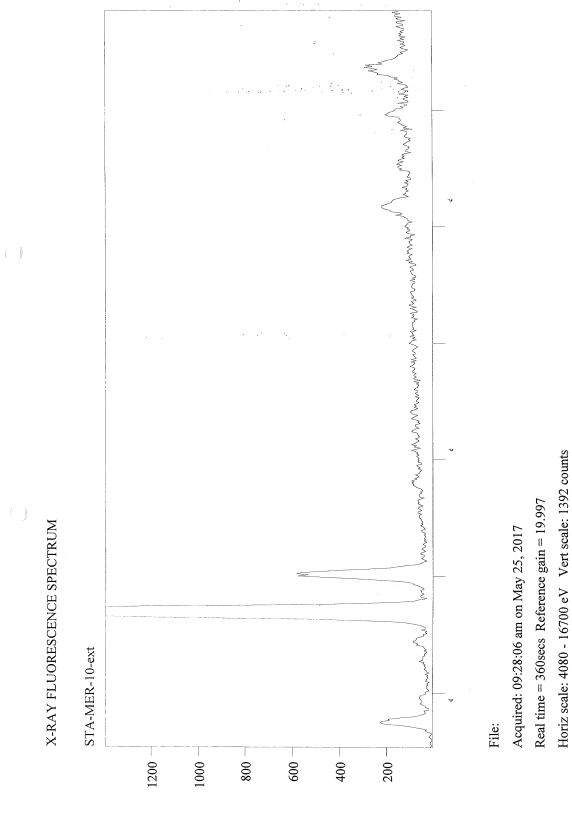
		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	20	-1.008	1.17
S	Ka	s040216.prf	2007-2607	6645	20	-1.008	1.17
K	Ka	kox1.prf	3011-3611	37571	16	-2.250	32.02
Ca	Ka	caox1.prf	3389-3989	40399	16	-2.250	32.02
Ti	Ka	ti150114.prf	4208-4808	217533	15	-0.913	0.97
Mn	Ka	mn060212.prf	5594-6194	504611	9	0.242	1.76
Fe	Ka	fe060212.prf	6098-6698	591462	9	0.242	1.76
Cu	Ka	cu060212.prf	7740-8340	720275	9	0.242	1.76
Zn	Ka	zn060212.prf	8330-8930	778621	9	0.242	1.76
P	Ka	hm1007a.prf	1714-2314	1908	20	-1.008	1.17
Pb	La	PB070212.prf	10248-10848	190736	4	-1.400	2.36
Sn	Ka	sn060606.prf	24594-25794	98621	6	0.109	4.75
Au	La	au070212.prf	9411-10011	167291	5	0.066	3.94
Ag	Ka	ag070212.prf	21504-22704	187485	4	-5.600	8.45
Co	Ka	co060212.prf	6624-7224	589345	9	0.242	1.76
Ni	Ka	ni060212.prf	7171-7771	685242	9	0.242	1.76

Results (6 iterations)

		Ints	Fit	~%	%Norm	±2sigma
Si	Ka	285 ±31	1.17	0.43	8.02	±1.74
S	Ka	20 ±24	1.17	< 0.93	< 0.93	
K	Ka	3489 ±141	32.02	1.07	20.06	±1.62
Ca	Ka	0 ±144	32.02	< 0.71	< 0.71	
Ti	Ka	1540 ±55	0.97	0.31	5.75	±0.41
Mn	Ka	533 ±72	1.76	0.08	1.41	±0.38
Fe	Ka	27572 ±182	1.76	3.34	62.64	±0.83
Cu	Ka	62 ±84	1.76	< 0.36	< 0.36	
Zn	Ka	331 ±90	1.76	0.05	0.86	±0.47
P	Ka	12 ±31	1.17	< 1.80	< 1.80	
Pb	La	16 ±55	2.36	< 0.28	< 0.28	
Sn	Ka	281 ±214	4.75	0.02	0.38	±0.57
Au	La	0 ±69	3.94	< 0.27	< 0.27	
Ag	Ka	505 ±261	8.45	0.04	0.83	±0.85
Co	Ka	0 ±103	1.76	< 0.46	< 0.46	
Ni	Ka	69 ±80	1.76	< 0.39	< 0.39	
Totals				5.33	99.95	

Note: Please disregard non-normalised results at the moment





SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-11-int
Output on Mon Jun 05 12:21:39 2017
Analysed on Jun 05, 2017 12:14:08 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=20.003ev/ch
Live time= 360secs Real time= 360secs Count Rate= 863c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	26	-1.245	1.84
S	Ka	s040216.prf	2007-2607	6645	26	-1.245	1.84
K	Ka	kox1.prf	3011-3611	37571	23	-2.336	13.92
Ca	Ka	caox1.prf	3389-3989	40399	23	-2.336	13.92
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.62
Mn	Ka	mn060212.prf	5594-6194	504611	10	0.422	1.04
Fe	Ka	fe060212.prf	6098-6698	591462	10	0.422	1.04
Cu	Ka	cu060212.prf	7740-8340	720275	10	0.422	1.04
Zn	Ka	zn060212.prf	8330-8930	778621	10	0.422	1.04
P	Ka	hm1007a.prf	1714-2314	1908	26	-1.245	1.84
Pb	La	PB070212.prf	10248-10848	190736	6	-0.090	3.23
Sn	Ka	sn060606.prf	24594-25794	98621	6	-5.682	5.99
Au	La	au070212.prf	9411-10011	167291	4	-0.700	3.70
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.648	8.25
Co	Ka	co060212.prf	6624-7224	589345	10	0.422	1.04
Ni	Ka	ni060212.prf	7171-7771	685242	10	0.422	1.04

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	233 ±32	1.84	0.44	3.05 ±0.84
S	Ka	0 ±26	1.84	< 0.45	< 0.45
K	Ka	3317 ±173	13.92	1.06	7.37 ±0.77
Ca	Ka	173 ±181	13.92	0.05	0.33 ±0.70
Ti	Ka	1606 ±53	0.62	0.26	1.80 ±0.12
Mn	Ka	1406 ±92	1.04	0.20	1.36 ±0.18
Fe	Ka	96610 ±323	1.04	11.97	83.15 ±0.56
Cu	Ka	930 ±104	1.04	0.20	1.35 ±0.30
Zn	Ka	841 ±110	1.04	0.15	1.07 ±0.28
P	Ka	9 ±31	1.84	< 0.76	< 0.76
Pb	La	266 ±63	3.23	0.04	0.26 ±0.12
Sn	Ka	31 ±263	5.99	< 0.18	< 0.18
Au	La	0 ±60	3.70	< 0.13	< 0.13
Ag	Ka	0 ±257	8.25	< 0.25	< 0.25
Co	Ka	0 ±154	1.04	< 0.30	< 0.30
Ni	Ka	133 ±97	1.04	0.03	0.22 ±0.33
Totals				14.39	99.98

Note: Please disregard non-normalised results at the moment

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-11-ext
Output on Mon Jun 05 12:28:25 2017
Analysed on Jun 05, 2017 12:21:48 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=20.003ev/ch
Live time= 360secs Real time= 360secs Count Rate= 670c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	24	-1.174	1.76
S	Ka	s040216.prf	2007-2607	6645	24	-1.174	1.76
K	Ka	kox1.prf	3011-3611	37571	16	-1.873	22.59
Ca	Ka	caox1.prf	3389-3989	40399	16	-1.873	22.59
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.67
Mn	Ka	mn060212.prf	5594-6194	504611	9	0.178	1.13
Fe	Ka	fe060212.prf	6098-6698	591462	9	0.178	1.13
Cu	Ka	cu060212.prf	7740-8340	720275	9	0.178	1.13
Zn	Ka	zn060212.prf	8330-8930	778621	9	0.178	1.13
P	Ka	hm1007a.prf	1714-2314	1908	24	-1.174	1.76
Pb	La	PB070212.prf	10248-10848	190736	6	-1.464	3.69
Sn	Ka	sn060606.prf	24594-25794	98621	5	0.075	5.06
Au	La	au070212.prf	9411-10011	167291	6	0.770	4.40
Ag	Ka	ag070212.prf	21504-22704	187485	6	0.138	7.57
Co	Ka	co060212.prf	6624-7224	589345	9	0.178	1.13
Ni	Ka	ni060212.prf	7171-7771	685242	9	0.178	1.13

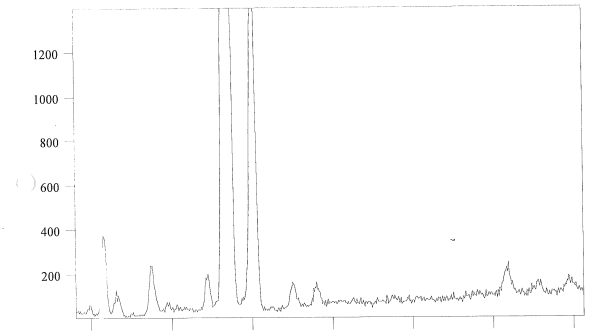
Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	278 ±34	1.76	0.41	7.38 ±1.81
S	Ka	78 ±27	1.76	0.06	1.08 ±0.75
K	Ka	3308 ±169	22.59	1.01	18.05 ±1.84
Ca	Ka	178 ±178	22.59	0.06	1.03 ±2.05
Ti	Ka	1531 ±51	0.67	0.29	5.22 ±0.35
Mn	Ka	1263 ±71	1.13	0.17	3.07 ±0.35
Fe	Ka	29674 ±184	1.13	3.47	62.06 ±0.77
Cu	Ka	136 ±77	1.13	0.02	0.38 ±0.43
Zn	Ka	352 ±83	1.13	0.05	0.87 ±0.41
P	Ka	0 ±33	1.76	< 1.80	< 1.80
Pb	La	181 ±65	3.69	0.02	0.34 ±0.24
Sn	Ka	200 ±238	5.06	< 0.34	< 0.34
Au	La	0 ±67	4.40	< 0.25	< 0.25
Ag	Ka	265 ±248	7.57	< 0.47	< 0.47
Co	Ka	0 ±99	1.13	< 0.45	< 0.45
Ni	Ka	150 ±73	1.13	0.03	0.49 ±0.48
Totals				5.59	99.97

Note: Please disregard non-normalised results at the moment

X-RAY FLUORESCENCE SPECTRUM

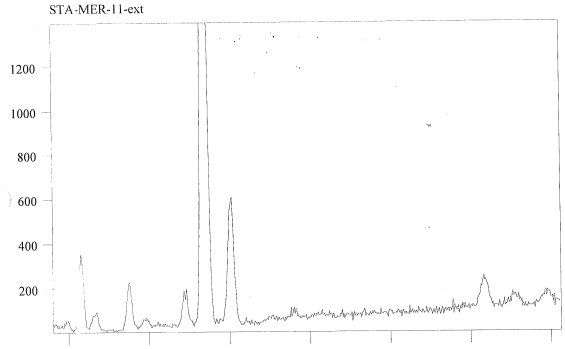
STA-MER-11-int



File:
Acquired: 12:14:08 pm on Jun 05, 2017
Real time = 360secs Reference gain = 20.003
Horiz scale: 2620 - 15240 eV Vert scale: 1392 counts

X-RAY FLUORESCENCE SPECTRUM

STA-MER-11-ext



File:
Acquired: 12:21:48 pm on Jun 05, 2017
Real time = 360secs Reference gain = 20.003
Horiz scale: 2620 - 15240 eV Vert scale: 1393 counts

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-12-int
Output on Thu May 25 09:57:40 2017
Analysed on May 25, 2017 09:51:02 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 539c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

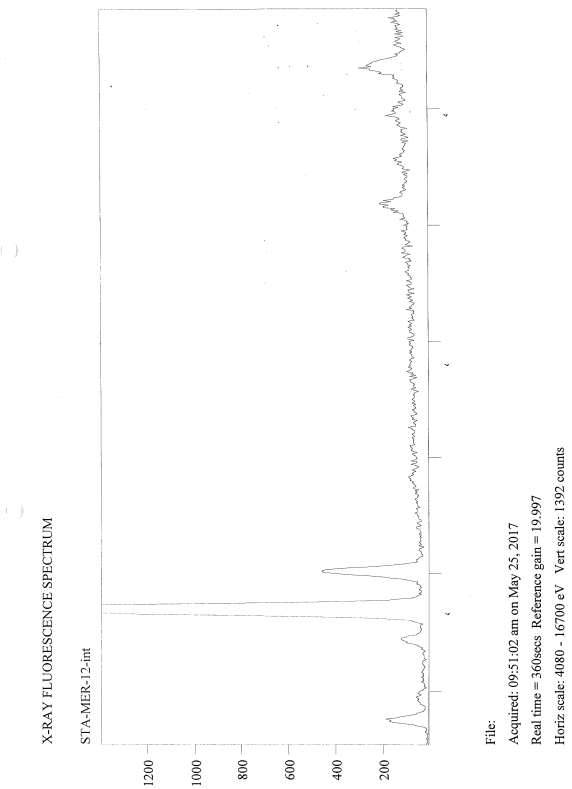
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	19	-0.969	0.98
S	Ka	s040216.prf	2007-2607	6645	19	-0.969	0.98
K	Ka	kox1.prf	3011-3611	37571	28	-2.446	8.97
Ca	Ka	caox1.prf	3389-3989	40399	28	-2.446	8.97
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	1.32
Mn	Ka	mn060212.prf	5594-6194	504611	14	0.345	0.96
Fe	Ka	fe060212.prf	6098-6698	591462	14	0.345	0.96
Cu	Ka	cu060212.prf	7740-8340	720275	14	0.345	0.96
Zn	Ka	zn060212.prf	8330-8930	778621	14	0.345	0.96
P	Ka	hm1007a.prf	1714-2314	1908	19	-0.969	0.98
Pb	La	PB070212.prf	10248-10848	190736	6	-0.061	1.51
Sn	Ka	sn060606.prf	24594-25794	98621	5	-0.065	3.86
Au	La	au070212.prf	9411-10011	167291	4	-0.700	2.45
Ag	Ka	ag070212.prf	21504-22704	187485	5	0.098	8.67
Co	Ka	co060212.prf	6624-7224	589345	14	0.345	0.96
Ni	Ka	ni060212.prf	7171-7771	685242	14	0.345	0.96

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	230 ±29	0.98	0.34	8.33 ±2.10
S	Ka	33 ±23	0.98	< 1.15	< 1.15
K	Ka	2501 ±116	8.97	0.77	18.63 ±1.73
Ca	Ka	81 ±118	8.97	< 0.79	< 0.79
Ti	Ka	1221 ±47	1.32	0.23	5.65 ±0.43
Mn	Ka	782 ±58	0.96	0.11	2.60 ±0.39
Fe	Ka	22186 ±159	0.96	2.62	63.54 ±0.91
Cu	Ka	51 ±64	0.96	< 0.44	< 0.44
Zn	Ka	175 ±69	0.96	0.02	0.59 ±0.47
P	Ka	36 ±27	0.98	< 2.08	< 2.08
Pb	La	231 ±52	1.51	0.02	0.59 ±0.26
Sn	Ka	7 ±181	3.86	< 0.40	< 0.40
Au	La	0 ±53	2.45	< 0.32	< 0.32
Ag	Ka	0 ±280	8.67	< 0.60	< 0.60
Co	Ka	0 ±84	0.96	< 0.53	< 0.53
Ni	Ka	29 ±61	0.96	< 0.49	< 0.49
Totals				4.12	99.93

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-12-ext
Output on Thu May 25 10:07:26 2017
Analysed on May 25, 2017 09:59:55 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 681c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

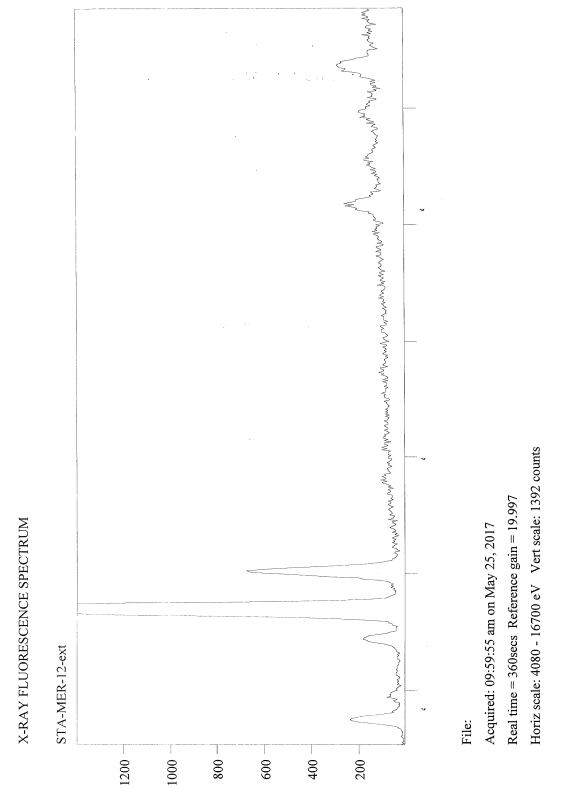
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	25	-1.090	1.03
S	Ka	s040216.prf	2007-2607	6645	25	-1.090	1.03
K	Ka	kox1.prf	3011-3611	37571	23	-2.751	15.37
Ca	Ka	caox1.prf	3389-3989	40399	23	-2.751	15.37
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.38
Mn	Ka	mn060212.prf	5594-6194	504611	14	0.325	1.10
Fe	Ka	fe060212.prf	6098-6698	591462	14	0.325	1.10
Cu	Ka	cu060212.prf	7740-8340	720275	14	0.325	1.10
Zn	Ka	zn060212.prf	8330-8930	778621	14	0.325	1.10
P	Ka	hm1007a.prf	1714-2314	1908	25	-1.090	1.03
Pb	La	PB070212.prf	10248-10848	190736	31	2.203	2.70
Sn	Ka	sn060606.prf	24594-25794	98621	5	-5.642	6.49
Au	La	au070212.prf	9411-10011	167291	6	0.757	2.95
Ag	Ka	ag070212.prf	21504-22704	187485	6	5.686	6.69
Co	Ka	co060212.prf	6624-7224	589345	14	0.325	1.10
Ni	Ka	ni060212.prf	7171-7771	685242	14	0.325	1.10

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	264 ±33	1.03	0.40	6.34 ±1.58
S	Ka	17 ±26	1.03	< 0.85	< 0.85
K	Ka	4039 ±237	15.37	1.22	19.32 ±2.27
Ca	Ka	212 ±251	15.37	0.07	1.11 ±2.62
Ti	Ka	1627 ±52	0.38	0.32	5.06 ±0.32
Mn	Ka	1244 ±68	1.10	0.18	2.80 ±0.31
Fe	Ka	33079 ±193	1.10	4.02	63.92 ±0.75
Cu	Ka	23 ±72	1.10	< 0.32	< 0.32
Zn	Ka	248 ±78	1.10	0.04	0.56 ±0.35
P	Ka	0 ±31	1.03	< 1.60	< 1.60
Pb	La	221 ±56	2.70	0.02	0.38 ±0.19
Sn	Ka	415 ±275	6.49	0.03	0.48 ±0.64
Au	La	42 ±53	2.95	< 0.23	< 0.23
Ag	Ka	0 ±224	6.69	< 0.44	< 0.44
Co	Ka	0 ±98	1.10	< 0.43	< 0.43
Ni	Ka	71 ±68	1.10	< 0.35	< 0.35
Totals				6.29	99.96

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-13-int
Output on Thu May 25 10:15:06 2017
Analysed on May 25, 2017 10:08:22 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 563c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

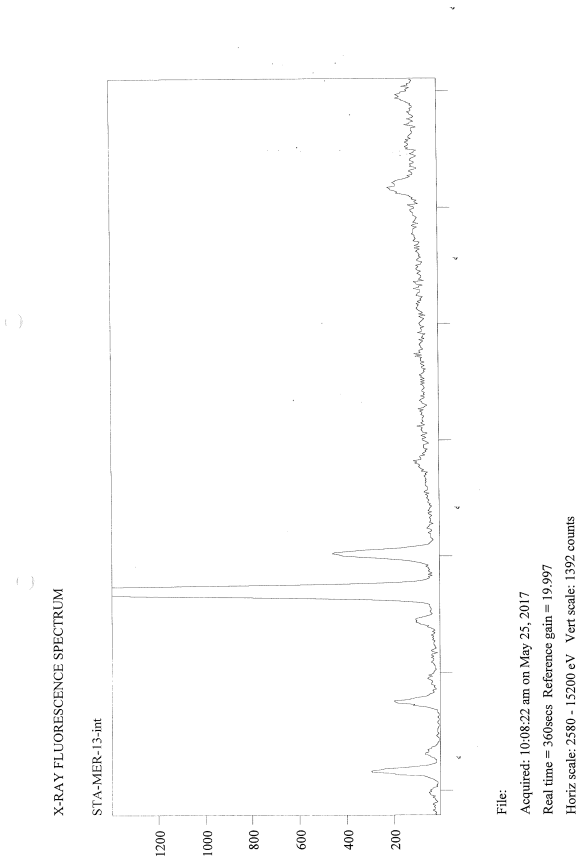
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	31	-1.315	1.39
S	Ka	s040216.prf	2007-2607	6645	31	-1.315	1.39
K	Ka	kox1.prf	3011-3611	37571	22	-1.797	7.85
Ca	Ka	caox1.prf	3389-3989	40399	22	-1.797	7.85
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.25
Mn	Ka	mn060212.prf	5594-6194	504611	17	0.401	1.31
Fe	Ka	fe060212.prf	6098-6698	591462	17	0.401	1.31
Cu	Ka	cu060212.prf	7740-8340	720275	17	0.401	1.31
Zn	Ka	zn060212.prf	8330-8930	778621	17	0.401	1.31
P	Ka	hm1007a.prf	1714-2314	1908	31	-1.315	1.39
Pb	La	PB070212.prf	10248-10848	190736	6	1.465	3.86
Sn	Ka	sn060606.prf	24594-25794	98621	5	-5.639	5.39
Au	La	au070212.prf	9411-10011	167291	5	0.058	3.06
Ag	Ka	ag070212.prf	21504-22704	187485	6	5.695	8.09
Co	Ka	co060212.prf	6624-7224	589345	17	0.401	1.31
Ni	Ka	ni060212.prf	7171-7771	685242	17	0.401	1.31

Results (6 iterations)

		Ints	Fit	-%	%Norm	±2sigma
Si	Ka	244 ±29	1.39	0.36	8.59	±2.04
S	Ka	0 ±24	1.39	< 1.23	< 1.23	
K	Ka	2740 ±136	7.85	0.83	19.80	±1.97
Ca	Ka	0 ±141	7.85	< 0.75	< 0.75	
Ti	Ka	1278 ±43	0.25	0.24	5.83	±0.39
Mn	Ka	677 ±67	1.31	0.09	2.20	±0.44
Fe	Ka	22217 ±164	1.31	2.59	62.01	±0.92
Cu	Ka	50 ±76	1.31	< 0.44	< 0.44	
Zn	Ka	316 ±83	1.31	0.04	1.03	±0.54
P	Ka	28 ±29	1.39	< 2.11	< 2.11	
Pb	La	27 ±61	3.86	< 0.35	< 0.35	
Sn	Ka	163 ±244	5.39	< 0.40	< 0.40	
Au	La	41 ±51	3.06	< 0.31	< 0.31	
Ag	Ka	0 ±250	8.09	< 0.59	< 0.59	
Co	Ka	0 ±92	1.31	< 0.52	< 0.52	
Ni	Ka	108 ±72	1.31	0.02	0.47	±0.62
Totals				4.18	99.93	

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-13-ext
Output on Thu May 25 10:22:45 2017
Analysed on May 25, 2017 10:16:11 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 642c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

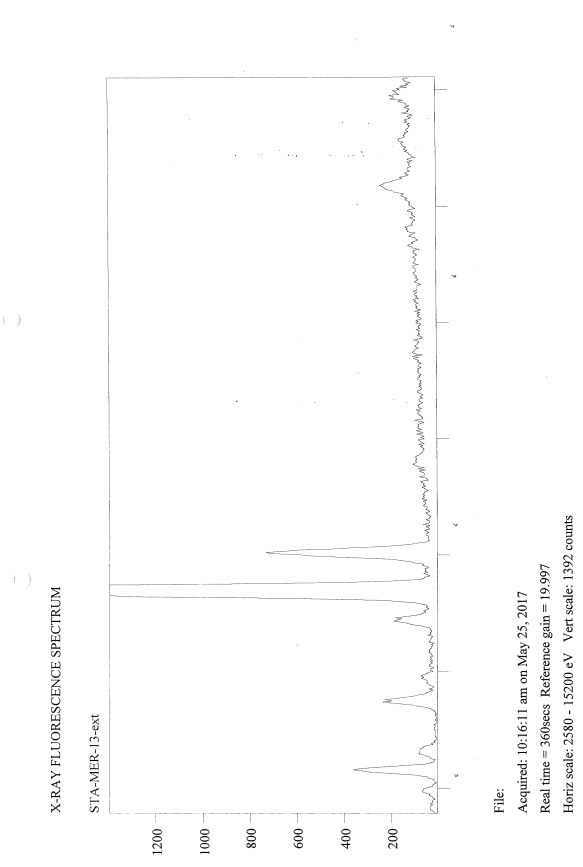
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	10	-0.812	1.22
S	Ka	s040216.prf	2007-2607	6645	10	-0.812	1.22
K	Ka	kox1.prf	3011-3611	37571	21	-1.779	9.52
Ca	Ka	caox1.prf	3389-3989	40399	21	-1.779	9.52
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	1.18
Mn	Ka	mn060212.prf	5594-6194	504611	13	0.349	1.66
Fe	Ka	fe060212.prf	6098-6698	591462	13	0.349	1.66
Cu	Ka	cu060212.prf	7740-8340	720275	13	0.349	1.66
Zn	Ka	zn060212.prf	8330-8930	778621	13	0.349	1.66
P	Ka	hm1007a.prf	1714-2314	1908	10	-0.812	1.22
Pb	La	PB070212.prf	10248-10848	190736	6	1.454	2.66
Sn	Ka	sn060606.prf	24594-25794	98621	5	-5.636	4.77
Au	La	au070212.prf	9411-10011	167291	10	0.855	2.25
Ag	Ka	ag070212.prf	21504-22704	187485	6	5.689	7.15
Co	Ka	co060212.prf	6624-7224	589345	13	0.349	1.66
Ni	Ka	ni060212.prf	7171-7771	685242	13	0.349	1.66

Results (5 iterations)

		Ints	Fit	-%	%Norm	±2sigma
Si	Ka	203 ±30	1.22	0.32	5.37	±1.59
S	Ka	9 ±23	1.22	< 0.84	< 0.84	
K	Ka	3428 ±158	9.52	1.03	17.30	±1.59
Ca	Ka	109 ±164	9.52	0.03	0.58	±1.74
Ti	Ka	1487 ±52	1.18	0.27	4.61	±0.32
Mn	Ka	1253 ±91	1.66	0.17	2.93	±0.43
Fe	Ka	33563 ±205	1.66	4.04	67.95	±0.83
Cu	Ka	20 ±102	1.66	< 0.35	< 0.35	
Zn	Ka	317 ±109	1.66	0.05	0.80	±0.55
P	Ka	0 ±29	1.22	< 1.62	< 1.62	
Pb	La	135 ±62	2.66	< 0.27	< 0.27	
Sn	Ka	125 ±209	4.77	< 0.32	< 0.32	
Au	La	0 ±55	2.25	< 0.26	< 0.26	
Ag	Ka	279 ±245	7.15	< 0.46	< 0.46	
Co	Ka	0 ±120	1.66	< 0.46	< 0.46	
Ni	Ka	124 ±97	1.66	0.02	0.42	±0.65
Totals				5.95	99.96	

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-14-int
Output on Thu May 25 10:31:00 2017
Analysed on May 25, 2017 10:24:05 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 744c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

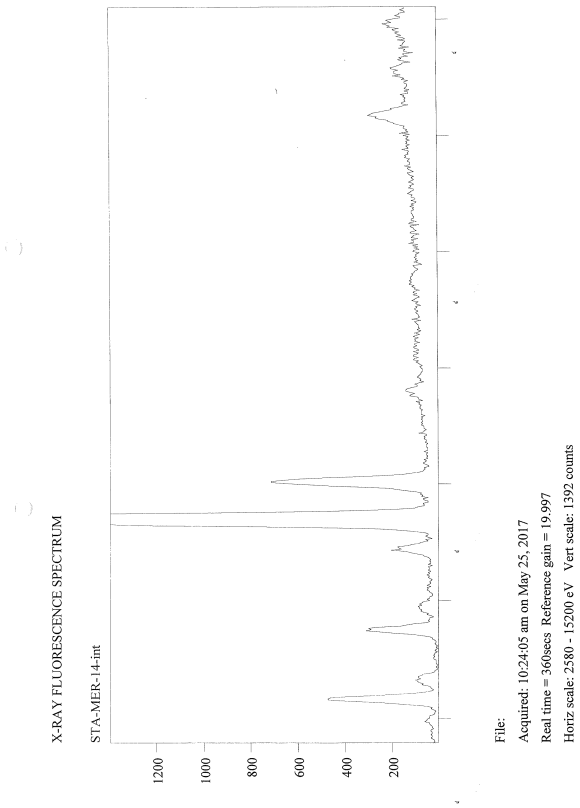
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	12	-0.839	0.98
S	Ka	s040216.prf	2007-2607	6645	12	-0.839	0.98
K	Ka	kox1.prf	3011-3611	37571	15	-1.572	12.61
Ca	Ka	caox1.prf	3389-3989	40399	15	-1.572	12.61
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	5.71
Mn	Ka	mn060212.prf	5594-6194	504611	12	0.445	0.99
Fe	Ka	fe060212.prf	6098-6698	591462	12	0.445	0.99
Cu	Ka	cu060212.prf	7740-8340	720275	12	0.445	0.99
Zn	Ka	zn060212.prf	8330-8930	778621	12	0.445	0.99
P	Ka	hm1007a.prf	1714-2314	1908	12	-0.839	0.98
Pb	La	PB070212.prf	10248-10848	190736	5	1.419	1.34
Sn	Ka	sn060606.prf	24594-25794	98621	4	-5.600	5.99
Au	La	au070212.prf	9411-10011	167291	6	0.760	3.20
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.651	9.54
Co	Ka	co060212.prf	6624-7224	589345	12	0.445	0.99
Ni	Ka	ni060212.prf	7171-7771	685242	12	0.445	0.99

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	335 ±35	0.98	0.49	7.26 ±1.52
S	Ka	0 ±26	0.98	< 0.81	< 0.81
K	Ka	4696 ±236	12.61	1.41	20.75 ±2.09
Ca	Ka	97 ±249	12.61	< 0.59	< 0.59
Ti	Ka	2034 ±65	5.71	0.39	5.78 ±0.37
Mn	Ka	1231 ±67	0.99	0.17	2.51 ±0.27
Fe	Ka	35474 ±198	0.99	4.21	62.14 ±0.69
Cu	Ka	19 ±71	0.99	< 0.31	< 0.31
Zn	Ka	522 ±79	0.99	0.07	1.06 ±0.32
P	Ka	0 ±33	0.98	< 1.57	< 1.57
Pb	La	287 ±59	1.34	0.03	0.44 ±0.18
Sn	Ka	25 ±266	5.99	< 0.28	< 0.28
Au	La	0 ±63	3.20	< 0.23	< 0.23
Ag	Ka	224 ±320	9.54	< 0.41	< 0.41
Co	Ka	0 ±100	0.99	< 0.40	< 0.40
Ni	Ka	34 ±68	0.99	< 0.34	< 0.34
Totals				6.78	99.96

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-14-ext
Output on Thu May 25 10:39:09 2017
Analysed on May 25, 2017 10:32:35 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 696c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

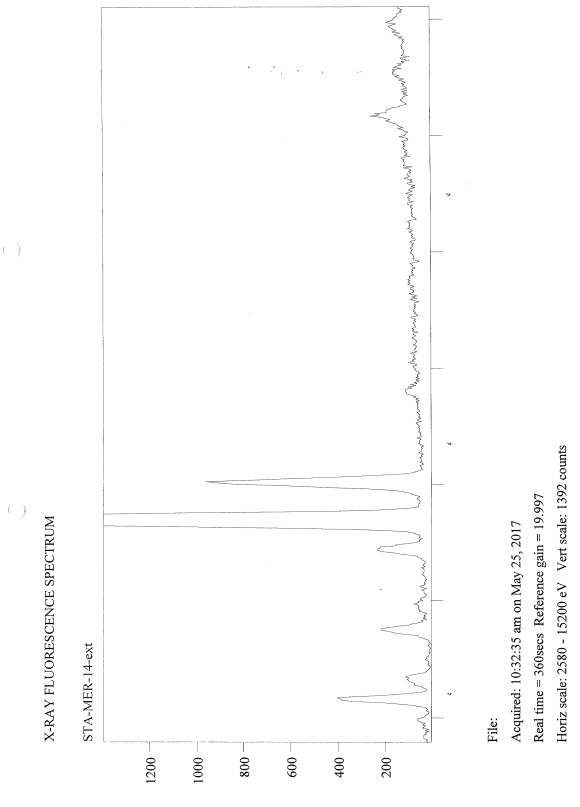
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	21	-1.014	0.99
S	Ka	s040216.prf	2007-2607	6645	21	-1.014	0.99
K	Ka	kox1.prf	3011-3611	37571	15	-2.387	38.30
Ca	Ka	caox1.prf	3389-3989	40399	15	-2.387	38.30
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	1.37
Mn	Ka	mn060212.prf	5594-6194	504611	15	0.423	1.04
Fe	Ka	fe060212.prf	6098-6698	591462	15	0.423	1.04
Cu	Ka	cu060212.prf	7740-8340	720275	15	0.423	1.04
Zn	Ka	zn060212.prf	8330-8930	778621	15	0.423	1.04
P	Ka	hm1007a.prf	1714-2314	1908	21	-1.014	0.99
Pb	La	PB070212.prf	10248-10848	190736	6	1.457	2.94
Sn	Ka	sn060606.prf	24594-25794	98621	4	5.600	4.62
Au	La	au070212.prf	9411-10011	167291	5	0.723	1.91
Ag	Ka	ag070212.prf	21504-22704	187485	5	0.089	7.05
Co	Ka	co060212.prf	6624-7224	589345	15	0.423	1.04
Ni	Ka	ni060212.prf	7171-7771	685242	15	0.423	1.04

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	229 ±30	0.99	0.38	4.86 ±1.27
S	Ka	0 ±24	0.99	< 0.73	< 0.73
K	Ka	3695 ±170	38.30	1.13	14.63 ±1.35
Ca	Ka	318 ±178	38.30	0.10	1.26 ±1.41
Ti	Ka	1382 ±53	1.37	0.25	3.25 ±0.25
Mn	Ka	1608 ±77	1.04	0.22	2.89 ±0.28
Fe	Ka	45811 ±224	1.04	5.57	71.84 ±0.70
Cu	Ka	85 ±78	1.04	< 0.27	< 0.27
Zn	Ka	461 ±84	1.04	0.07	0.94 ±0.34
P	Ka	22 ±29	0.99	< 1.24	< 1.24
Pb	La	183 ±59	2.94	0.02	0.28 ±0.18
Sn	Ka	86 ±207	4.62	< 0.27	< 0.27
Au	La	0 ±50	1.91	< 0.20	< 0.20
Ag	Ka	64 ±222	7.05	< 0.39	< 0.39
Co	Ka	0 ±112	1.04	< 0.40	< 0.40
Ni	Ka	52 ±75	1.04	< 0.32	< 0.32
Totals				7.74	99.96

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-15-int
Output on Thu May 25 10:47:16 2017
Analysed on May 25, 2017 10:40:56 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 728c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

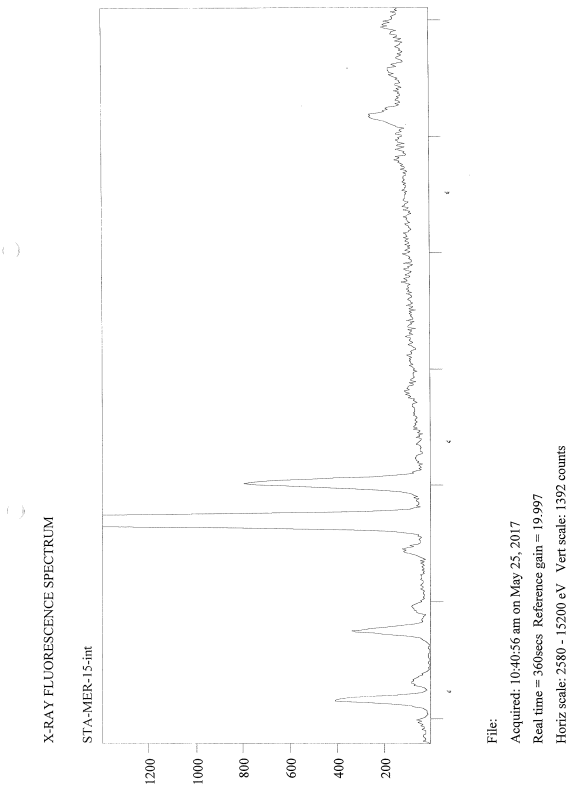
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	9	-0.797	1.32
S	Ka	s040216.prf	2007-2607	6645	9	-0.797	1.32
K	Ka	kox1.prf	3011-3611	37571	14	-1.928	75.39
Ca	Ka	caox1.prf	3389-3989	40399	14	-1.928	75.39
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	2.51
Mn	Ka	mn060212.prf	5594-6194	504611	13	0.406	1.01
Fe	Ka	fe060212.prf	6098-6698	591462	13	0.406	1.01
Cu	Ka	cu060212.prf	7740-8340	720275	13	0.406	1.01
Zn	Ka	zn060212.prf	8330-8930	778621	13	0.406	1.01
P	Ka	hm1007a.prf	1714-2314	1908	9	-0.797	1.32
Pb	La	PB070212.prf	10248-10848	190736	5	1.437	5.00
Sn	Ka	sn060606.prf	24594-25794	98621	5	5.630	3.32
Au	La	au070212.prf	9411-10011	167291	6	0.756	2.86
Ag	Ka	ag070212.prf	21504-22704	187485	4	-5.600	10.27
Co	Ka	co060212.prf	6624-7224	589345	13	0.406	1.01
Ni	Ka	ni060212.prf	7171-7771	685242	13	0.406	1.01

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	261 ±34	1.32	0.41	6.02 ±1.57
S	Ka	0 ±26	1.32	< 0.84	< 0.84
K	Ka	3734 ±171	75.39	1.13	16.55 ±1.52
Ca	Ka	0 ±178	75.39	< 0.53	< 0.53
Ti	Ka	2104 ±59	2.51	0.38	5.60 ±0.31
Mn	Ka	747 ±65	1.01	0.10	1.51 ±0.26
Fe	Ka	39097 ±207	1.01	4.69	68.61 ±0.73
Cu	Ka	167 ±73	1.01	0.03	0.42 ±0.36
Zn	Ka	275 ±80	1.01	0.04	0.60 ±0.35
P	Ka	3 ±32	1.32	< 1.52	< 1.52
Pb	La	135 ±71	5.00	< 0.25	< 0.25
Sn	Ka	152 ±167	3.32	< 0.29	< 0.29
Au	La	23 ±60	2.86	< 0.23	< 0.23
Ag	Ka	148 ±318	10.27	< 0.43	< 0.43
Co	Ka	0 ±105	1.01	< 0.42	< 0.42
Ni	Ka	225 ±70	1.01	0.04	0.65 ±0.40
Totals				6.83	99.96

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-15-ext
Output on Thu May 25 10:54:58 2017
Analysed on May 25, 2017 10:48:24 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 686c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

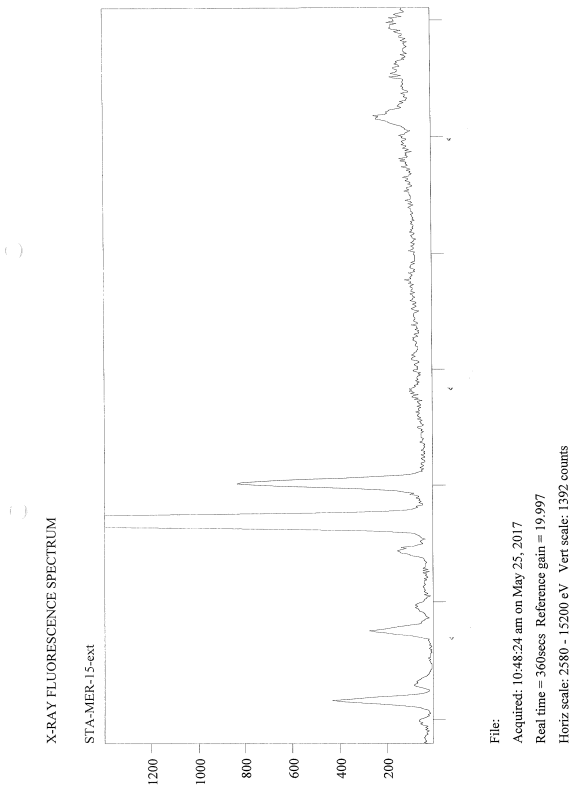
Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	10	-0.821	1.42
S	Ka	s040216.prf	2007-2607	6645	10	-0.821	1.42
K	Ka	kox1.prf	3011-3611	37571	17	-2.125	24.73
Ca	Ka	caox1.prf	3389-3989	40399	17	-2.125	24.73
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	3.30
Mn	Ka	mn060212.prf	5594-6194	504611	14	0.489	1.53
Fe	Ka	fe060212.prf	6098-6698	591462	14	0.489	1.53
Cu	Ka	cu060212.prf	7740-8340	720275	14	0.489	1.53
Zn	Ka	zn060212.prf	8330-8930	778621	14	0.489	1.53
P	Ka	hm1007a.prf	1714-2314	1908	10	-0.821	1.42
Pb	La	PB070212.prf	10248-10848	190736	5	1.432	3.72
Sn	Ka	sn060606.prf	24594-25794	98621	5	5.637	4.81
Au	La	au070212.prf	9411-10011	167291	6	-0.751	2.33
Ag	Ka	ag070212.prf	21504-22704	187485	6	0.136	7.41
Co	Ka	co060212.prf	6624-7224	589345	14	0.489	1.53
Ni	Ka	ni060212.prf	7171-7771	685242	14	0.489	1.53

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	175 ±31	1.42	0.29	4.08 ±1.45
S	Ka	25 ±27	1.42	< 0.82	< 0.82
K	Ka	3637 ±156	24.73	1.10	15.70 ±1.35
Ca	Ka	0 ±161	24.73	< 0.51	< 0.51
Ti	Ka	1692 ±58	3.30	0.31	4.36 ±0.30
Mn	Ka	1018 ±79	1.53	0.15	2.06 ±0.32
Fe	Ka	41070 ±217	1.53	5.10	72.46 ±0.77
Cu	Ka	0 ±88	1.53	< 0.32	< 0.32
Zn	Ka	246 ±94	1.53	0.04	0.56 ±0.42
P	Ka	0 ±30	1.42	< 1.39	< 1.39
Pb	La	166 ±64	3.72	0.02	0.28 ±0.22
Sn	Ka	0 ±207	4.81	< 0.31	< 0.31
Au	La	0 ±55	2.33	< 0.23	< 0.23
Ag	Ka	322 ±237	7.41	0.03	0.46 ±0.67
Co	Ka	0 ±115	1.53	< 0.43	< 0.43
Ni	Ka	29 ±84	1.53	< 0.35	< 0.35
Totals				7.03	99.96

Note: Please disregard non-normalised results at the moment



SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-16-int
Output on Thu May 25 11:03:10 2017
Analysed on May 25, 2017 10:56:34 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 621c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	7	-0.750	0.98
S	Ka	s040216.prf	2007-2607	6645	7	-0.750	0.98
K	Ka	kox1.prf	3011-3611	37571	29	-2.607	9.45
Ca	Ka	caox1.prf	3389-3989	40399	29	-2.607	9.45
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.24
Mn	Ka	mn060212.prf	5594-6194	504611	14	0.379	1.08
Fe	Ka	fe060212.prf	6098-6698	591462	14	0.379	1.08
Cu	Ka	cu060212.prf	7740-8340	720275	14	0.379	1.08
Zn	Ka	zn060212.prf	8330-8930	778621	14	0.379	1.08
P	Ka	hm1007a.prf	1714-2314	1908	7	-0.750	0.98
Pb	La	PB070212.prf	10248-10848	190736	5	-1.437	4.80
Sn	Ka	sn060606.prf	24594-25794	98621	5	0.079	5.64
Au	La	au070212.prf	9411-10011	167291	6	-0.751	2.35
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.644	6.98
Co	Ka	co060212.prf	6624-7224	589345	14	0.379	1.08
Ni	Ka	ni060212.prf	7171-7771	685242	14	0.379	1.08

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	285 ±31	0.98	0.46	8.78 ±1.91
S	Ka	11 ±25	0.98	< 1.08	< 1.08
K	Ka	2341 ±136	9.45	0.75	14.39 ±1.67
Ca	Ka	64 ±141	9.45	< 0.58	< 0.58
Ti	Ka	1544 ±49	0.24	0.29	5.58 ±0.35
Mn	Ka	650 ±64	1.08	0.09	1.74 ±0.34
Fe	Ka	29408 ±182	1.08	3.53	68.12 ±0.84
Cu	Ka	33 ±72	1.08	< 0.39	< 0.39
Zn	Ka	234 ±79	1.08	0.03	0.67 ±0.45
P	Ka	9 ±31	0.98	< 1.98	< 1.98
Pb	La	74 ±68	4.80	< 0.32	< 0.32
Sn	Ka	455 ±241	5.64	0.03	0.66 ±0.70
Au	La	0 ±53	2.35	< 0.29	< 0.29
Ag	Ka	195 ±239	6.98	< 0.53	< 0.53
Co	Ka	0 ±96	1.08	< 0.48	< 0.48
Ni	Ka	104 ±69	1.08	< 0.42	< 0.42
Totals				5.18	99.94

Note: Please disregard non-normalised results at the moment

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-16-ext
Output on Thu May 25 11:11:38 2017
Analysed on May 25, 2017 11:04:59 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 682c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

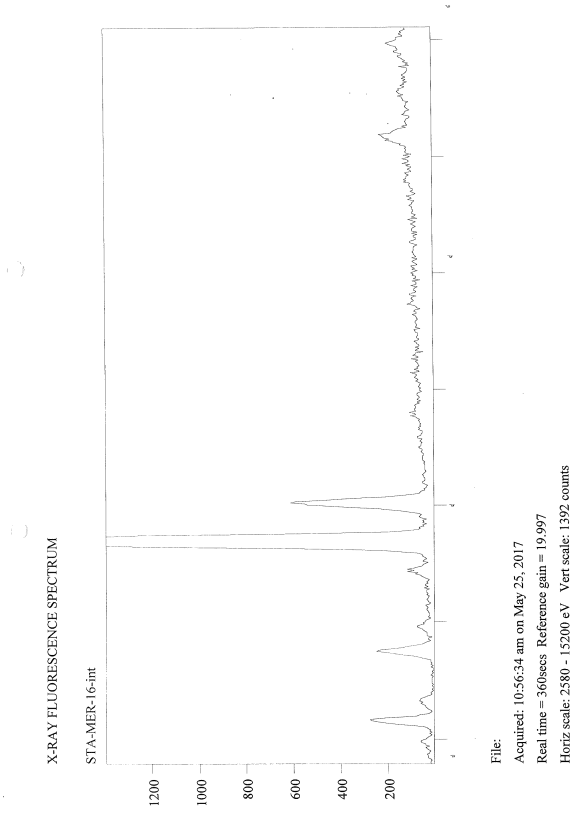
Fitting data

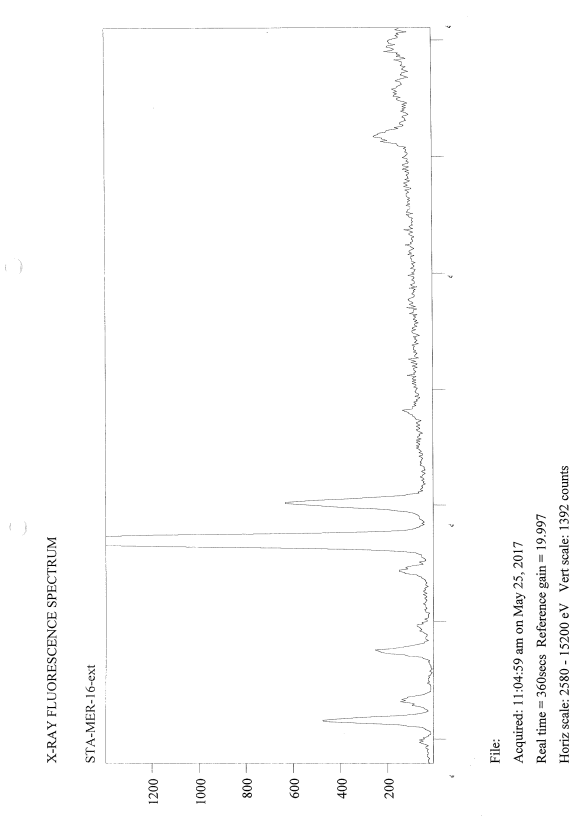
		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	5	-0.716	0.97
S	Ka	s040216.prf	2007-2607	6645	5	-0.716	0.97
K	Ka	kox1.prf	3011-3611	37571	19	-2.410	23.59
Ca	Ka	caox1.prf	3389-3989	40399	19	-2.410	23.59
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.43
Mn	Ka	mn060212.prf	5594-6194	504611	13	0.455	0.93
Fe	Ka	fe060212.prf	6098-6698	591462	13	0.455	0.93
Cu	Ka	cu060212.prf	7740-8340	720275	13	0.455	0.93
Zn	Ka	zn060212.prf	8330-8930	778621	13	0.455	0.93
P	Ka	hm1007a.prf	1714-2314	1908	5	-0.716	0.97
Pb	La	PB070212.prf	10248-10848	190736	6	1.463	3.53
Sn	Ka	sn060606.prf	24594-25794	98621	4	-5.600	4.73
Au	La	au070212.prf	9411-10011	167291	5	0.732	3.61
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.653	10.15
Co	Ka	co060212.prf	6624-7224	589345	13	0.455	0.93
Ni	Ka	ni060212.prf	7171-7771	685242	13	0.455	0.93

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	242 ±33	0.97	0.36	5.98 ±1.63
S	Ka	6 ±25	0.97	< 0.87	< 0.87
K	Ka	4221 ±216	23.59	1.24	20.88 ±2.14
Ca	Ka	352 ±228	23.59	0.12	1.96 ±2.54
Ti	Ka	1577 ±50	0.43	0.31	5.28 ±0.33
Mn	Ka	933 ±67	0.93	0.13	2.22 ±0.32
Fe	Ka	30189 ±184	0.93	3.66	61.58 ±0.75
Cu	Ka	128 ±73	0.93	0.02	0.34 ±0.39
Zn	Ka	397 ±80	0.93	0.05	0.92 ±0.37
P	Ka	0 ±31	0.97	< 1.64	< 1.64
Pb	La	206 ±59	3.53	0.02	0.36 ±0.21
Sn	Ka	362 ±231	4.73	0.03	0.43 ±0.55
Au	La	103 ±60	3.61	< 0.23	< 0.23
Ag	Ka	0 ±308	10.15	< 0.47	< 0.47
Co	Ka	0 ±97	0.93	< 0.44	< 0.44
Ni	Ka	38 ±69	0.93	< 0.36	< 0.36
Totals				5.94	99.96

Note: Please disregard non-normalised results at the moment





SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-17-int
Output on Thu May 25 11:19:28 2017
Analysed on May 25, 2017 11:13:11 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 642c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	4	-0.700	1.30
S	Ka	s040216.prf	2007-2607	6645	4	-0.700	1.30
K	Ka	kox1.prf	3011-3611	37571	23	-1.773	7.41
Ca	Ka	caox1.prf	3389-3989	40399	23	-1.773	7.41
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.31
Mn	Ka	mn060212.prf	5594-6194	504611	13	0.403	0.95
Fe	Ka	fe060212.prf	6098-6698	591462	13	0.403	0.95
Cu	Ka	cu060212.prf	7740-8340	720275	13	0.403	0.95
Zn	Ka	zn060212.prf	8330-8930	778621	13	0.403	0.95
P	Ka	hm1007a.prf	1714-2314	1908	4	-0.700	1.30
Pb	La	PB070212.prf	10248-10848	190736	5	1.429	3.04
Sn	Ka	sn060606.prf	24594-25794	98621	5	-0.083	6.18
Au	La	au070212.prf	9411-10011	167291	4	-0.700	3.07
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.650	9.07
Co	Ka	co060212.prf	6624-7224	589345	13	0.403	0.95
Ni	Ka	ni060212.prf	7171-7771	685242	13	0.403	0.95

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	184 ±31	1.30	0.28	5.67 ±1.91
S	Ka	0 ±25	1.30	< 1.07	< 1.07
K	Ka	2940 ±146	7.41	0.88	17.63 ±1.75
Ca	Ka	0 ±152	7.41	< 0.65	< 0.65
Ti	Ka	1698 ±52	0.31	0.31	6.26 ±0.38
Mn	Ka	607 ±60	0.95	0.09	1.70 ±0.34
Fe	Ka	27659 ±176	0.95	3.35	66.96 ±0.85
Cu	Ka	58 ±69	0.95	< 0.41	< 0.41
Zn	Ka	422 ±75	0.95	0.06	1.23 ±0.44
P	Ka	0 ±30	1.30	< 1.89	< 1.89
Pb	La	220 ±58	3.04	0.02	0.49 ±0.26
Sn	Ka	26 ±267	6.18	< 0.39	< 0.39
Au	La	0 ±57	3.07	< 0.31	< 0.31
Ag	Ka	172 ±261	9.07	< 0.57	< 0.57
Co	Ka	0 ±93	0.95	< 0.50	< 0.50
Ni	Ka	24 ±66	0.95	< 0.46	< 0.46
Totals				5.00	99.94

Note: Please disregard non-normalised results at the moment

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-17-ext
Output on Thu May 25 11:28:00 2017
Analysed on May 25, 2017 11:21:30 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 660c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	6	-0.751	2.37
S	Ka	s040216.prf	2007-2607	6645	6	-0.751	2.37
K	Ka	kox1.prf	3011-3611	37571	22	-1.986	10.53
Ca	Ka	caox1.prf	3389-3989	40399	22	-1.986	10.53
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.73
Mn	Ka	mn060212.prf	5594-6194	504611	12	0.475	0.96
Fe	Ka	fe060212.prf	6098-6698	591462	12	0.475	0.96
Cu	Ka	cu060212.prf	7740-8340	720275	12	0.475	0.96
Zn	Ka	zn060212.prf	8330-8930	778621	12	0.475	0.96
P	Ka	hm1007a.prf	1714-2314	1908	6	-0.751	2.37
Pb	La	PB070212.prf	10248-10848	190736	4	-1.400	3.00
Sn	Ka	sn060606.prf	24594-25794	98621	5	0.068	4.16
Au	La	au070212.prf	9411-10011	167291	6	0.752	2.47
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.654	10.41
Co	Ka	co060212.prf	6624-7224	589345	12	0.475	0.96
Ni	Ka	ni060212.prf	7171-7771	685242	12	0.475	0.96

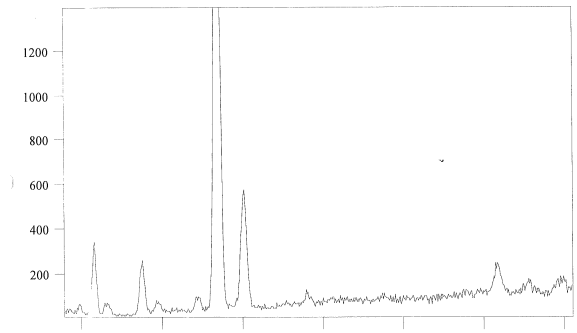
Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	244 ±33	2.37	0.37	7.29 ±1.97
S	Ka	0 ±28	2.37	< 1.12	< 1.12
K	Ka	3169 ±134	10.53	0.95	18.89 ±1.60
Ca	Ka	79 ±138	10.53	< 0.65	< 0.65
Ti	Ka	1623 ±54	0.73	0.30	6.05 ±0.40
Mn	Ka	773 ±63	0.96	0.11	2.12 ±0.34
Fe	Ka	27479 ±176	0.96	3.26	64.79 ±0.83
Cu	Ka	79 ±69	0.96	< 0.40	< 0.40
Zn	Ka	289 ±75	0.96	0.04	0.81 ±0.42
P	Ka	37 ±33	2.37	< 1.88	< 1.88
Pb	La	15 ±61	3.00	< 0.32	< 0.32
Sn	Ka	244 ±185	4.16	< 0.37	< 0.37
Au	La	0 ±54	2.47	< 0.29	< 0.29
Ag	Ka	0 ±327	10.41	< 0.54	< 0.54
Co	Ka	0 ±92	0.96	< 0.48	< 0.48
Ni	Ka	50 ±66	0.96	< 0.44	< 0.44
Totals				5.03	99.94

Note: Please disregard non-normalised results at the moment

X-RAY FLUORESCENCE SPECTRUM

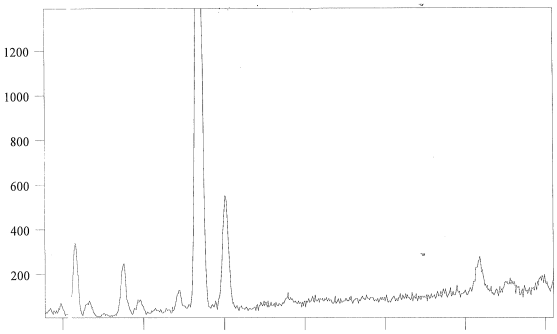
STA-MER-17-int



File:
Acquired: 11:13:11 am on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2580 - 15200 eV Vert scale: 1392 counts

X-RAY FLUORESCENCE SPECTRUM

STA-MER-17-ext



File:
Acquired: 11:21:30 am on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2560 - 15180 eV Vert scale: 1385 counts

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-18-int
Output on Thu May 25 11:35:59 2017
Analysed on May 25, 2017 11:29:40 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 604c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	6	-0.734	1.00
S	Ka	s040216.prf	2007-2607	6645	6	-0.734	1.00
K	Ka	kox1.prf	3011-3611	37571	20	-2.039	14.74
Ca	Ka	caox1.prf	3389-3989	40399	20	-2.039	14.74
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.40
Mn	Ka	mn060212.prf	5594-6194	504611	13	0.466	0.76
Fe	Ka	fe060212.prf	6098-6698	591462	13	0.466	0.76
Cu	Ka	cu060212.prf	7740-8340	720275	13	0.466	0.76
Zn	Ka	zn060212.prf	8330-8930	778621	13	0.466	0.76
P	Ka	hm1007a.prf	1714-2314	1908	6	-0.734	1.00
Pb	La	PB070212.prf	10248-10848	190736	16	1.709	2.23
Sn	Ka	sn060606.prf	24594-25794	98621	5	5.639	5.43
Au	La	au070212.prf	9411-10011	167291	6	-0.738	1.30
Ag	Ka	ag070212.prf	21504-22704	187485	5	-0.101	9.24
Co	Ka	co060212.prf	6624-7224	589345	13	0.466	0.76
Ni	Ka	ni060212.prf	7171-7771	685242	13	0.466	0.76

Results (6 iterations)

		Ints	Fit	~%	%Norm	±2sigma
Si	Ka	270 ±30	1.00	0.41	8.42	±1.87
S	Ka	24 ±23	1.00	< 1.04	< 1.04	
K	Ka	2704 ±116	14.74	0.84	17.25	±1.48
Ca	Ka	29 ±119	14.74	< 0.64	< 0.64	
Ti	Ka	1577 ±53	0.40	0.30	6.12	±0.41
Mn	Ka	376 ±55	0.76	0.05	1.06	±0.31
Fe	Ka	26833 ±171	0.76	3.17	65.43	±0.83
Cu	Ka	0 ±65	0.76	< 0.41	< 0.41	
Zn	Ka	340 ±71	0.76	0.05	0.98	±0.41
P	Ka	0 ±29	1.00	< 2.00	< 2.00	
Pb	La	305 ±56	2.23	0.03	0.67	±0.25
Sn	Ka	0 ±246	5.43	< 0.38	< 0.38	
Au	La	0 ±51	1.30	< 0.29	< 0.29	
Ag	Ka	283 ±255	9.24	< 0.54	< 0.54	
Co	Ka	0 ±88	0.76	< 0.48	< 0.48	
Ni	Ka	65 ±62	0.76	< 0.44	< 0.44	
Totals				4.85	99.94	

Note: Please disregard non-normalised results at the moment

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-18-ext
Output on Thu May 25 11:44:15 2017
Analysed on May 25, 2017 11:37:55 am
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 606c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	11	-0.820	1.02
S	Ka	s040216.prf	2007-2607	6645	11	-0.820	1.02
K	Ka	kox1.prf	3011-3611	37571	19	-1.806	13.60
Ca	Ka	caox1.prf	3389-3989	40399	19	-1.806	13.60
Ti	Ka	ti150114.prf	4208-4808	217533	15	-0.243	1.10
Mn	Ka	mn060212.prf	5594-6194	504611	14	0.429	0.94
Fe	Ka	fe060212.prf	6098-6698	591462	14	0.429	0.94
Cu	Ka	cu060212.prf	7740-8340	720275	14	0.429	0.94
Zn	Ka	zn060212.prf	8330-8930	778621	14	0.429	0.94
P	Ka	hm1007a.prf	1714-2314	1908	11	-0.820	1.02
Pb	La	PB070212.prf	10248-10848	190736	6	0.076	2.30
Sn	Ka	sn060606.prf	24594-25794	98621	6	-5.674	4.90
Au	La	au070212.prf	9411-10011	167291	5	-0.726	2.45
Ag	Ka	ag070212.prf	21504-22704	187485	5	-5.644	7.13
Co	Ka	co060212.prf	6624-7224	589345	14	0.429	0.94
Ni	Ka	ni060212.prf	7171-7771	685242	14	0.429	0.94

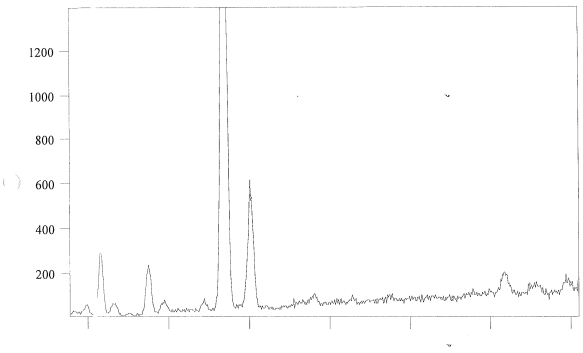
Results (5 iterations)

		Ints	Fit	~%	%Norm	±2sigma
Si	Ka	261 ±30	1.02	0.34	6.62	±1.52
S	Ka	6 ±24	1.02	< 0.88	< 0.88	
K	Ka	4648 ±219	13.60	1.26	24.53	±2.31
Ca	Ka	862 ±233	13.60	0.28	5.53	±2.99
Ti	Ka	1618 ±52	1.10	0.34	6.51	±0.42
Mn	Ka	596 ±57	0.94	0.08	1.62	±0.31
Fe	Ka	23318 ±162	0.94	2.76	53.62	±0.74
Cu	Ka	0 ±64	0.94	< 0.33	< 0.33	
Zn	Ka	520 ±72	0.94	0.06	1.23	±0.34
P	Ka	4 ±30	1.02	< 1.60	< 1.60	
Pb	La	158 ±55	2.30	0.01	0.28	±0.20
Sn	Ka	135 ±224	4.90	< 0.30	< 0.30	
Au	La	0 ±56	2.45	< 0.24	< 0.24	
Ag	Ka	102 ±234	7.13	< 0.44	< 0.44	
Co	Ka	0 ±86	0.94	< 0.44	< 0.44	
Ni	Ka	60 ±61	0.94	< 0.35	< 0.35	
Totals				5.14	99.96	

Note: Please disregard non-normalised results at the moment

X-RAY FLUORESCENCE SPECTRUM

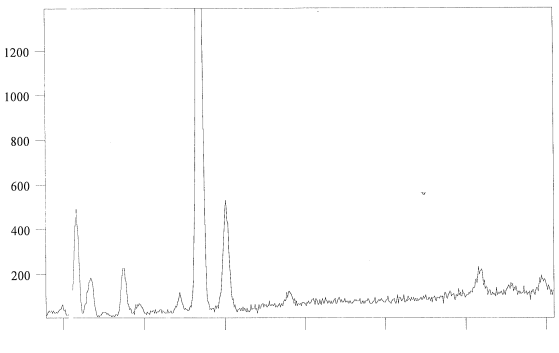
STA-MER-18-int



File:
Acquired: 11:29:40 am on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2560 - 15180 eV Vert scale: 1392 counts

X-RAY FLUORESCENCE SPECTRUM

STA-MER-18-ext



File:
Acquired: 11:37:55 am on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2560 - 15180 eV Vert scale: 1385 counts

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-19-int
Output on Thu May 25 13:08:05 2017
Analysed on May 25, 2017 12:57:55 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 622c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	16	-0.976	1.73
S	Ka	s040216.prf	2007-2607	6645	16	-0.976	1.73
K	Ka	kox1.prf	3011-3611	37571	21	-1.737	8.93
Ca	Ka	caox1.prf	3389-3989	40399	21	-1.737	8.93
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.16
Mn	Ka	mn060212.prf	5594-6194	504611	14	0.366	0.98
Fe	Ka	fe060212.prf	6098-6698	591462	14	0.366	0.98
Cu	Ka	cu060212.prf	7740-8340	720275	14	0.366	0.98
Zn	Ka	zn060212.prf	8330-8930	778621	14	0.366	0.98
P	Ka	hm1007a.prf	1714-2314	1908	16	-0.976	1.73
Pb	La	PB070212.prf	10248-10848	190736	6	1.455	2.73
Sn	Ka	sn060606.prf	24594-25794	98621	6	-0.103	4.26
Au	La	au070212.prf	9411-10011	167291	6	-0.764	3.71
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.640	5.90
Co	Ka	co060212.prf	6624-7224	589345	14	0.366	0.98
Ni	Ka	ni060212.prf	7171-7771	685242	14	0.366	0.98

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	312 ±33	1.73	0.47	9.17 ±1.94
S	Ka	4 ±26	1.73	< 1.04	< 1.04
K	Ka	2993 ±131	8.93	0.94	18.24 ±1.60
Ca	Ka	11 ±134	8.93	< 0.66	< 0.66
Ti	Ka	1536 ±49	0.16	0.30	5.86 ±0.37
Mn	Ka	799 ±57	0.98	0.11	2.17 ±0.31
Fe	Ka	26860 ±172	0.98	3.21	62.55 ±0.80
Cu	Ka	27 ±63	0.98	< 0.37	< 0.37
Zn	Ka	343 ±69	0.98	0.05	0.93 ±0.37
P	Ka	21 ±32	1.73	< 1.91	< 1.91
Pb	La	172 ±59	2.73	0.02	0.35 ±0.24
Sn	Ka	478 ±205	4.26	0.03	0.67 ±0.57
Au	La	0 ±53	3.71	< 0.28	< 0.28
Ag	Ka	224 ±201	5.90	< 0.51	< 0.51
Co	Ka	0 ±88	0.98	< 0.47	< 0.47
Ni	Ka	75 ±60	0.98	< 0.42	< 0.42
Totals				5.12	99.94

Note: Please disregard non-normalised results at the moment

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-19-ext
Output on Thu May 25 13:15:35 2017
Analysed on May 25, 2017 01:09:09 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 664c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	4	-0.700	0.99
S	Ka	s040216.prf	2007-2607	6645	4	-0.700	0.99
K	Ka	kox1.prf	3011-3611	37571	16	-2.822	33.48
Ca	Ka	caox1.prf	3389-3989	40399	16	-2.822	33.48
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.38
Mn	Ka	mn060212.prf	5594-6194	504611	13	0.417	0.99
Fe	Ka	fe060212.prf	6098-6698	591462	13	0.417	0.99
Cu	Ka	cu060212.prf	7740-8340	720275	13	0.417	0.99
Zn	Ka	zn060212.prf	8330-8930	778621	13	0.417	0.99
P	Ka	hm1007a.prf	1714-2314	1908	4	-0.700	0.99
Pb	La	PB070212.prf	10248-10848	190736	6	-0.101	4.05
Sn	Ka	sn060606.prf	24594-25794	98621	4	-5.600	4.36
Au	La	au070212.prf	9411-10011	167291	6	-0.751	2.31
Ag	Ka	ag070212.prf	21504-22704	187485	5	-0.102	9.44
Co	Ka	co060212.prf	6624-7224	589345	13	0.417	0.99
Ni	Ka	ni060212.prf	7171-7771	685242	13	0.417	0.99

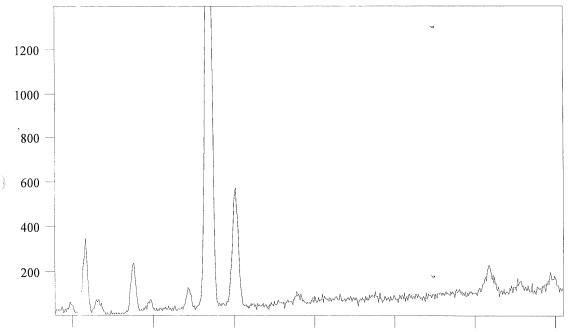
Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	241 ±32	0.99	0.38	7.18 ±1.91
S	Ka	2 ±25	0.99	< 1.06	< 1.06
K	Ka	2923 ±197	33.48	0.91	17.19 ±2.32
Ca	Ka	47 ±208	33.48	< 0.71	< 0.71
Ti	Ka	1368 ±48	0.38	0.26	4.95 ±0.35
Mn	Ka	1154 ±70	0.99	0.16	3.05 ±0.37
Fe	Ka	28600 ±182	0.99	3.44	65.33 ±0.83
Cu	Ka	54 ±76	0.99	< 0.39	< 0.39
Zn	Ka	354 ±84	0.99	0.05	0.99 ±0.47
P	Ka	0 ±31	0.99	< 2.01	< 2.01
Pb	La	7 ±66	4.05	< 0.32	< 0.32
Sn	Ka	0 ±194	4.36	< 0.38	< 0.38
Au	La	0 ±55	2.31	< 0.30	< 0.30
Ag	Ka	475 ±270	9.44	0.04	0.83 ±0.94
Co	Ka	0 ±97	0.99	< 0.48	< 0.48
Ni	Ka	118 ±73	0.99	0.02	0.44 ±0.54
Totals				5.26	99.95

Note: Please disregard non-normalised results at the moment

X-RAY FLUORESCENCE SPECTRUM

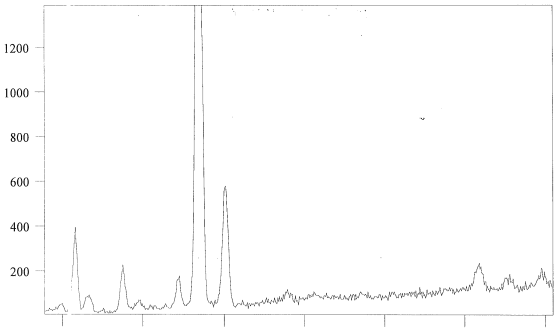
STA-MER-19-int



File:
Acquired: 12:57:55 pm on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2560 - 15180 eV Vert scale: 1392 counts

X-RAY FLUORESCENCE SPECTRUM

STA-MER-19-ext



File:
Acquired: 01:09:09 pm on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2560 - 15180 eV Vert scale: 1385 counts

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-20-int
Output on Thu May 25 13:23:29 2017
Analysed on May 25, 2017 01:16:46 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 657c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	25	-1.180	1.54
S	Ka	s040216.prf	2007-2607	6645	25	-1.180	1.54
K	Ka	kox1.prf	3011-3611	37571	19	-1.797	12.19
Ca	Ka	caox1.prf	3389-3989	40399	19	-1.797	12.19
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	0.39
Mn	Ka	mn060212.prf	5594-6194	504611	14	0.356	1.01
Fe	Ka	fe060212.prf	6098-6698	591462	14	0.356	1.01
Cu	Ka	cu060212.prf	7740-8340	720275	14	0.356	1.01
Zn	Ka	zn060212.prf	8330-8930	778621	14	0.356	1.01
P	Ka	hm1007a.prf	1714-2314	1908	25	-1.180	1.54
Pb	La	PB070212.prf	10248-10848	190736	6	1.453	2.50
Sn	Ka	sn060606.prf	24594-25794	98621	4	-5.600	4.82
Au	La	au070212.prf	9411-10011	167291	6	0.759	3.15
Ag	Ka	ag070212.prf	21504-22704	187485	4	-5.600	8.68
Co	Ka	co060212.prf	6624-7224	589345	14	0.356	1.01
Ni	Ka	ni060212.prf	7171-7771	685242	14	0.356	1.01

Results (6 iterations)

		Ints	Fit	~%	%Norm	±2sigma
Si	Ka	286 ±32	1.54	0.44	7.66	±1.71
S	Ka	0 ±26	1.54	< 0.96	< 0.96	
K	Ka	3362 ±160	12.19	1.03	18.12	±1.72
Ca	Ka	0 ±167	12.19	< 0.63	< 0.63	
Ti	Ka	1587 ±51	0.39	0.30	5.26	±0.34
Mn	Ka	707 ±64	1.01	0.10	1.70	±0.31
Fe	Ka	31555 ±188	1.01	3.73	65.43	±0.78
Cu	Ka	79 ±71	1.01	< 0.35	< 0.35	
Zn	Ka	412 ±79	1.01	0.06	1.03	±0.39
P	Ka	38 ±32	1.54	< 1.76	< 1.76	
Pb	La	180 ±57	2.50	0.02	0.34	±0.22
Sn	Ka	195 ±214	4.82	< 0.32	< 0.32	
Au	La	0 ±59	3.15	< 0.26	< 0.26	
Ag	Ka	259 ±256	8.68	< 0.48	< 0.48	
Co	Ka	0 ±97	1.01	< 0.45	< 0.45	
Ni	Ka	127 ±68	1.01	0.02	0.42	±0.45
Totals				5.70	99.95	

Note: Please disregard non-normalised results at the moment

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-20-ext
Output on Thu May 25 13:30:44 2017
Analysed on May 25, 2017 01:24:17 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 695c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	16	-0.964	1.60
S	Ka	s040216.prf	2007-2607	6645	16	-0.964	1.60
K	Ka	kox1.prf	3011-3611	37571	17	-2.234	29.45
Ca	Ka	caox1.prf	3389-3989	40399	17	-2.234	29.45
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	1.73
Mn	Ka	mn060212.prf	5594-6194	504611	15	0.426	1.95
Fe	Ka	fe060212.prf	6098-6698	591462	15	0.426	1.95
Cu	Ka	cu060212.prf	7740-8340	720275	15	0.426	1.95
Zn	Ka	zn060212.prf	8330-8930	778621	15	0.426	1.95
P	Ka	hm1007a.prf	1714-2314	1908	16	-0.964	1.60
Pb	La	PB070212.prf	10248-10848	190736	6	0.111	4.89
Sn	Ka	sn060606.prf	24594-25794	98621	5	5.633	3.98
Au	La	au070212.prf	9411-10011	167291	6	-0.748	2.03
Ag	Ka	ag070212.prf	21504-22704	187485	5	5.650	8.96
Co	Ka	co060212.prf	6624-7224	589345	15	0.426	1.95
Ni	Ka	ni060212.prf	7171-7771	685242	15	0.426	1.95

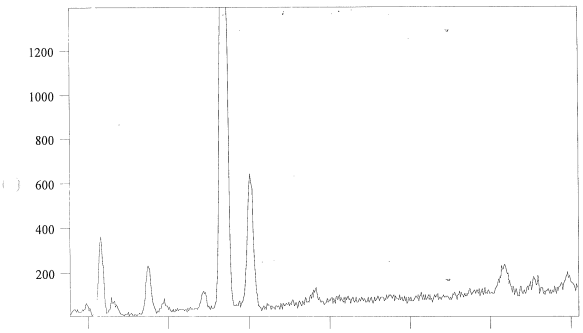
Results (5 iterations)

		Ints	Fit	~%	%Norm	±2sigma
Si	Ka	309 ±34	1.60	0.45	7.24	±1.59
S	Ka	0 ±25	1.60	< 0.84	< 0.84	
K	Ka	4550 ±222	29.45	1.36	21.87	±2.13
Ca	Ka	44 ±234	29.45	< 0.67	< 0.67	
Ti	Ka	1659 ±55	1.73	0.32	5.20	±0.35
Mn	Ka	1053 ±67	1.95	0.15	2.33	±0.30
Fe	Ka	32498 ±191	1.95	3.85	61.83	±0.73
Cu	Ka	34 ±73	1.95	< 0.32	< 0.32	
Zn	Ka	448 ±79	1.95	0.06	0.98	±0.35
P	Ka	6 ±32	1.60	< 1.53	< 1.53	
Pb	La	297 ±78	4.89	0.03	0.49	±0.26
Sn	Ka	0 ±173	3.98	< 0.30	< 0.30	
Au	La	0 ±52	2.03	< 0.23	< 0.23	
Ag	Ka	0 ±277	8.96	< 0.44	< 0.44	
Co	Ka	0 ±99	1.95	< 0.42	< 0.42	
Ni	Ka	55 ±69	1.95	< 0.35	< 0.35	
Totals				6.23	99.95	

Note: Please disregard non-normalised results at the moment

X-RAY FLUORESCENCE SPECTRUM

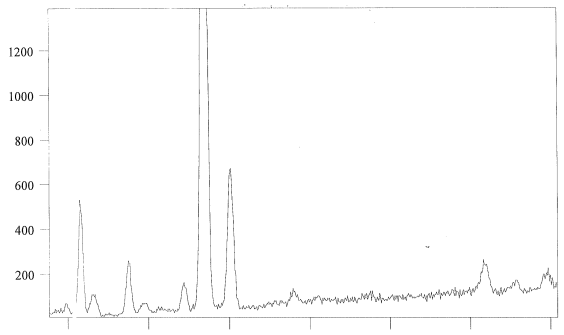
STA-MER-20-int



File:
Acquired: 01:16:46 pm on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2560 - 15180 eV Vert scale: 1392 counts

X-RAY FLUORESCENCE SPECTRUM

STA-MER-20-ext



File:
Acquired: 01:24:17 pm on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2540 - 15160 eV Vert scale: 1385 counts

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-21-int
Output on Thu May 25 13:38:26 2017
Analysed on May 25, 2017 01:32:02 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 629c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data.

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	4	-0.700	0.92
S	Ka	s040216.prf	2007-2607	6645	4	-0.700	0.92
K	Ka	kox1.prf	3011-3611	37571	25	-2.566	13.14
Ca	Ka	caox1.prf	3389-3989	40399	25	-2.566	13.14
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	1.50
Mn	Ka	mn060212.prf	5594-6194	504611	12	0.385	0.95
Fe	Ka	fe060212.prf	6098-6698	591462	12	0.385	0.95
Cu	Ka	cu060212.prf	7740-8340	720275	12	0.385	0.95
Zn	Ka	zn060212.prf	8330-8930	778621	12	0.385	0.95
P	Ka	hm1007a.prf	1714-2314	1908	4	-0.700	0.92
Pb	La	PB070212.prf	10248-10848	190736	4	-1.400	2.07
Sn	Ka	sn060606.prf	24594-25794	98621	5	5.638	5.31
Au	La	au070212.prf	9411-10011	167291	6	0.757	2.91
Ag	Ka	ag070212.prf	21504-22704	187485	6	0.144	8.24
Co	Ka	co060212.prf	6624-7224	589345	12	0.385	0.95
Ni	Ka	ni060212.prf	7171-7771	685242	12	0.385	0.95

Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	187 ±29	0.92	0.31	4.25 ±1.32
S	Ka	41 ±23	0.92	< 0.70	< 0.70
K	Ka	3502 ±192	13.14	1.07	14.66 ±1.61
Ca	Ka	50 ±202	13.14	< 0.48	< 0.48
Ti	Ka	2122 ±60	1.50	0.38	5.28 ±0.30
Mn	Ka	590 ±69	0.95	0.09	1.17 ±0.27
Fe	Ka	42259 ±216	0.95	5.31	73.03 ±0.75
Cu	Ka	83 ±79	0.95	< 0.28	< 0.28
Zn	Ka	268 ±85	0.95	0.04	0.59 ±0.37
P	Ka	5 ±27	0.92	< 1.22	< 1.22
Pb	La	131 ±55	2.07	< 0.23	< 0.23
Sn	Ka	337 ±225	5.31	0.03	0.38 ±0.51
Au	La	0 ±55	2.91	< 0.21	< 0.21
Ag	Ka	432 ±249	8.24	0.04	0.59 ±0.68
Co	Ka	0 ±110	0.95	< 0.41	< 0.41
Ni	Ka	109 ±76	0.95	< 0.32	< 0.32
Totals				7.27	99.96

Note: Please disregard non-normalised results at the moment

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-21-ext
Output on Thu May 25 13:47:39 2017
Analysed on May 25, 2017 01:39:27 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 613c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data.

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	10	-0.872	2.87
S	Ka	s040216.prf	2007-2607	6645	10	-0.872	2.87
K	Ka	kox1.prf	3011-3611	37571	5	-0.779	22.61
Ca	Ka	caox1.prf	3389-3989	40399	5	-0.779	22.61
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	2.20
Mn	Ka	mn060212.prf	5594-6194	504611	15	0.442	1.66
Fe	Ka	fe060212.prf	6098-6698	591462	15	0.442	1.66
Cu	Ka	cu060212.prf	7740-8340	720275	15	0.442	1.66
Zn	Ka	zn060212.prf	8330-8930	778621	15	0.442	1.66
P	Ka	hm1007a.prf	1714-2314	1908	10	-0.872	2.87
Pb	La	PB070212.prf	10248-10848	190736	5	1.426	2.49
Sn	Ka	sn060606.prf	24594-25794	98621	6	5.662	3.47
Au	La	au070212.prf	9411-10011	167291	6	0.755	2.68
Ag	Ka	ag070212.prf	21504-22704	187485	5	0.086	6.72
Co	Ka	co060212.prf	6624-7224	589345	15	0.442	1.66
Ni	Ka	ni060212.prf	7171-7771	685242	15	0.442	1.66

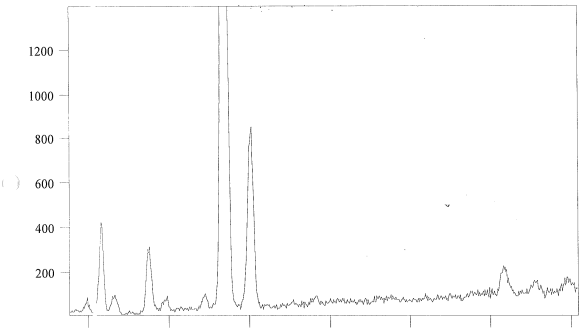
Results (5 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	175 ±32	2.87	0.21	2.23 ±0.81
S	Ka	0 ±27	2.87	< 0.40	< 0.40
K	Ka	4878 ±348	22.61	1.11	11.81 ±1.69
Ca	Ka	10876 ±384	22.61	2.71	28.75 ±2.03
Ti	Ka	1964 ±65	2.20	0.45	4.77 ±0.32
Mn	Ka	6260 ±101	1.66	0.93	9.86 ±0.32
Fe	Ka	31108 ±191	1.66	3.86	40.92 ±0.50
Cu	Ka	130 ±76	1.66	0.02	0.19 ±0.22
Zn	Ka	188 ±82	1.66	0.02	0.23 ±0.20
P	Ka	95 ±32	2.87	0.08	0.85 ±0.57
Pb	La	169 ±58	2.49	0.01	0.16 ±0.11
Sn	Ka	0 ±159	3.47	< 0.14	< 0.14
Au	La	0 ±54	2.68	< 0.11	< 0.11
Ag	Ka	296 ±214	6.72	0.02	0.23 ±0.33
Co	Ka	0 ±99	1.66	< 0.30	< 0.30
Ni	Ka	7 ±72	1.66	< 0.17	< 0.17
Totals				9.44	99.99

Note: Please disregard non-normalised results at the moment

X-RAY FLUORESCENCE SPECTRUM

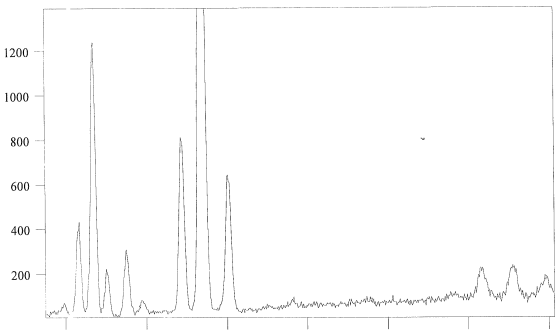
STA-MER-21-int



File:
Acquired: 01:32:02 pm on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2540 - 15160 eV Vert scale: 1392 counts

X-RAY FLUORESCENCE SPECTRUM

STA-MER-21-ext



File:
Acquired: 01:39:27 pm on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2500 - 15120 eV Vert scale: 1384 counts

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-22-int
Output on Thu May 25 13:54:42 2017
Analysed on May 25, 2017 01:48:14 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 592c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	5	-0.715	0.81
S	Ka	s040216.prf	2007-2607	6645	5	-0.715	0.81
K	Ka	kox1.prf	3011-3611	37571	16	-1.968	25.26
Ca	Ka	caox1.prf	3389-3989	40399	16	-1.968	25.26
Ti	Ka	ti150114.prf	4208-4808	217533	4	-0.700	1.14
Mn	Ka	mn060212.prf	5594-6194	504611	13	0.439	0.94
Fe	Ka	fe060212.prf	6098-6698	591462	13	0.439	0.94
Cu	Ka	cu060212.prf	7740-8340	720275	13	0.439	0.94
Zn	Ka	zn060212.prf	8330-8930	778621	13	0.439	0.94
P	Ka	hm1007a.prf	1714-2314	1908	5	-0.715	0.81
Pb	La	PB070212.prf	10248-10848	190736	6	-1.470	4.39
Sn	Ka	sn060606.prf	24594-25794	98621	6	5.665	3.85
Au	La	au070212.prf	9411-10011	167291	4	-0.700	2.45
Ag	Ka	ag070212.prf	21504-22704	187485	6	5.693	7.82
Co	Ka	co060212.prf	6624-7224	589345	13	0.439	0.94
Ni	Ka	ni060212.prf	7171-7771	685242	13	0.439	0.94

Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	260 ±29	0.81	0.39	7.89 ±1.76
S	Ka	0 ±22	0.81	< 1.00	< 1.00
K	Ka	3029 ±126	25.26	0.92	18.48 ±1.54
Ca	Ka	1 ±129	25.26	< 0.66	< 0.66
Ti	Ka	1455 ±50	1.14	0.27	5.49 ±0.38
Mn	Ka	675 ±61	0.94	0.09	1.85 ±0.33
Fe	Ka	27603 ±174	0.94	3.25	65.21 ±0.82
Cu	Ka	0 ±68	0.94	< 0.41	< 0.41
Zn	Ka	359 ±74	0.94	0.05	1.02 ±0.42
P	Ka	0 ±29	0.81	< 1.93	< 1.93
Pb	La	43 ±66	4.39	< 0.31	< 0.31
Sn	Ka	146 ±179	3.85	< 0.33	< 0.33
Au	La	59 ±55	2.45	< 0.28	< 0.28
Ag	Ka	0 ±245	7.82	< 0.51	< 0.51
Co	Ka	0 ±91	0.94	< 0.48	< 0.48
Ni	Ka	109 ±65	0.94	< 0.43	< 0.43
Totals				4.99	99.94

Note: Please disregard non-normalised results at the moment

SEMI-QUANTITATIVE ANALYSIS
Id:STA-MER-22-ext
Output on Thu May 25 14:01:56 2017
Analysed on May 25, 2017 01:55:33 pm
Source spectrum: Unsaved spectrum
Method file: cuslag-1.cfg
Method desc: Cu slag semi-quant -1
Zero strobe=0ev Reference gain=19.997ev/ch
Live time= 360secs Real time= 360secs Count Rate= 632c/s
Tube=Rh_40KV Current=0.30mA Incident=45 TakeOff=90 Form=Solid

Fitting data

		Profiles	Fit region	PrfInts	Iter	Delta(ch)	Fit
Si	Ka	si150114.prf	1439-2039	1866	6	-0.735	1.09
S	Ka	s040216.prf	2007-2607	6645	6	-0.735	1.09
K	Ka	kox1.prf	3011-3611	37571	19	-1.725	8.85
Ca	Ka	caox1.prf	3389-3989	40399	19	-1.725	8.85
Ti	Ka	ti150114.prf	4208-4808	217533	11	-0.166	0.96
Mn	Ka	mn060212.prf	5594-6194	504611	13	0.430	0.72
Fe	Ka	fe060212.prf	6098-6698	591462	13	0.430	0.72
Cu	Ka	cu060212.prf	7740-8340	720275	13	0.430	0.72
Zn	Ka	zn060212.prf	8330-8930	778621	13	0.430	0.72
P	Ka	hm1007a.prf	1714-2314	1908	6	-0.735	1.09
Pb	La	PB070212.prf	10248-10848	190736	5	-0.060	3.27
Sn	Ka	sn060606.prf	24594-25794	98621	5	5.639	5.34
Au	La	au070212.prf	9411-10011	167291	6	0.757	2.87
Ag	Ka	ag070212.prf	21504-22704	187485	5	-5.644	6.94
Co	Ka	co060212.prf	6624-7224	589345	13	0.430	0.72
Ni	Ka	ni060212.prf	7171-7771	685242	13	0.430	0.72

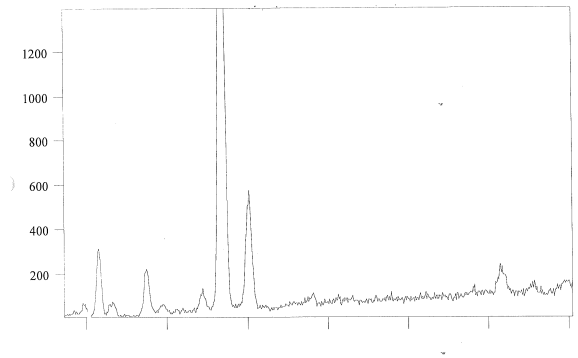
Results (6 iterations)

		Ints	Fit	~%	%Norm ±2sigma
Si	Ka	277 ±32	1.09	0.42	7.79 ±1.80
S	Ka	39 ±25	1.09	< 0.97	< 0.97
K	Ka	3093 ±148	8.85	0.93	17.38 ±1.66
Ca	Ka	151 ±153	8.85	0.05	0.89 ±1.80
Ti	Ka	1663 ±53	0.96	0.31	5.79 ±0.37
Mn	Ka	880 ±62	0.72	0.12	2.24 ±0.32
Fe	Ka	29580 ±182	0.72	3.49	64.98 ±0.80
Cu	Ka	90 ±68	0.72	< 0.36	< 0.36
Zn	Ka	333 ±73	0.72	0.05	0.87 ±0.38
P	Ka	0 ±30	1.09	< 1.85	< 1.85
Pb	La	0 ±60	3.27	< 0.31	< 0.31
Sn	Ka	0 ±231	5.34	< 0.34	< 0.34
Au	La	34 ±58	2.87	< 0.27	< 0.27
Ag	Ka	0 ±230	6.94	< 0.50	< 0.50
Co	Ka	0 ±93	0.72	< 0.46	< 0.46
Ni	Ka	3 ±65	0.72	< 0.41	< 0.41
Totals				5.37	99.95

Note: Please disregard non-normalised results at the moment

X-RAY FLUORESCENCE SPECTRUM

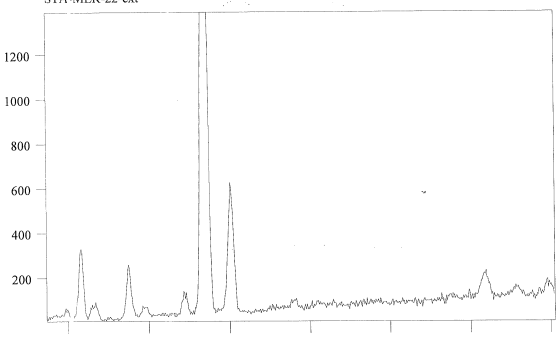
STA-MER-22-int



File:
Acquired: 01:48:14 pm on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2460 - 15080 eV Vert scale: 1392 counts

X-RAY FLUORESCENCE SPECTRUM

STA-MER-22-ext



File:
Acquired: 01:55:33 pm on May 25, 2017
Real time = 360secs Reference gain = 19.997
Horiz scale: 2460 - 15080 eV Vert scale: 1384 counts