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Zircon Trace Element Variation from Mono Craters (California) Ashes and Domes as Recorders of Temporal Changes in the Rhyolite Magma System

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ZIRCON TRACE ELEMENT VARIATION FROM MONO CRATERS
(CALIFORNIA) ASHES AND DOMES AS RECORDERS OF TEMPORAL
CHANGES IN THE RHYOLITE MAGMA SYSTEM

A Thesis

Presented to

The Faculty of the Department of Geology

San José State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Natalie Baker

December 2019

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The Designated Thesis Committee Approves the Thesis Titled

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December 2019

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ABSTRACT

ZIRCON TRACE ELEMENT VARIATION FROM MONO CRATERS (CALIFORNIA) ASHES AND DOMES AS RECORDERS OF TEMPORAL CHANGES IN THE RHYOLITE MAGMA SYSTEM

by Natalie Baker

The Pleistocene to Holocene Mono Craters in eastern California comprise at least 28 high-silica rhyolite domes, lava flows and tephra cones. To examine the geochemical evolution of the magma system, trace elements were analyzed on crystal rims of zircons separated from juvenile pumice clasts from 5 ashes in the correlative Wilson Creek Formation (spanning from 62 to 21 ka) and from 3 rhyolite domes (21, 12.5, and 7 ka). Rare earth element (REE) patterns show similar overall shapes with prominent negative Eu anomalies, indicative of similar geochemical environments of zircon crystallization, but variation in key trace elements and ratios indicate that eruptions tapped discrete magma bodies within a larger rhyolite system. Ti-in-zircon temperatures ($T_{\text{Ti,zrc}}$) are predominantly 650°C to 750°C; similar to zircon-saturation temperatures. Zircons were stored at relatively cool but not necessarily subsolidus temperatures. Comparison of zircon rims with a subset of sectioned interiors for the 12.5 and 7 ka domes show decreasing Hf and increasing Eu/Eu*, Ti, and Th/U, consistent with a temperature increase prior to eruption. These observations indicate that heat from mafic injection helped maintain the magma system and possibly triggered eruptions. Zircon-melt partition coefficients (K_{DS}) were also obtained by analyzing coexisting rhyolite glasses from each unit. The values are generally consistent with published partition coefficients and thus may be useful for modeling melt compositions for zircons.

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INTRODUCTION

In central California along the eastern Sierra Nevada and at the east edge of the Basin and Range province, lies a region of silicic volcanism associated with the Long Valley caldera region (Kistler, 1966; Hildreth, 2004). At least six distinct eruptive foci have been described by Hildreth (2004), all dominated by silicic magmatism. Though all volcanic episodes were driven by extension and associated basaltic intrusion into the deep crust, each focus of silicic magmatism is spatially, temporally, and compositionally discrete (Hildreth, 2004), including the area of this study, the Holocene Mono-Inyo chain, which is comprised of approximately 36 predominantly rhyolitic domes, cones, tephra rings, and vents (Figure 1) with some minor basalt (Hildreth, 2004; Bursik et al., 2014).

The Mono-Inyo Chain is located approximately 25 km northwest of the Long Valley Caldera rim (Figure 1), with several eruptions in the chain having occurred within the last 1,000 years. The Mono Craters, specifically, comprises 28 domes and associated tephra and ash deposits (Hildreth, 2004; Marcaida et al., 2014). All but one of the 28 domes are composed of compositionally uniform high-silica rhyolite that has erupted as pumiceous and dense glassy lava (Kelleher and Cameron, 1990); one dome is composed of dacite.

Recent stratigraphic, geochronological, and geochemical data collection in the Mono-Inyo Chain has correlated dome eruptions with individual ash units surrounding the Mono Craters (Figure 2; Reid et al., 2010; Vazquez and Lidzbarski, 2012; Bursik et al., 2014; Marcaida et al., 2014; Marcaida et al., 2019). These efforts to match domes and flows to tephras has helped to refine the volcanic-stratigraphic history of the region, and provided greater insight into past eruptions of the Mono Craters, both spatially and

temporally, as well as how, and possibly when future eruptions might occur in the Mono-Inyo Chain.

Figure 1. Geologic map of the Mono Lake basin. Late Quaternary volcanics shown, along with the Wilson Creek formation and Quaternary lacustrine deposits, as well as adjacent pre-Quaternary plutonic and volcanic units. Inset shows Mono Craters location relative to Long Valley caldera and other eastern Sierra Nevada structures (Marcaida et al., 2014) [adapted from Kistler (1966), Lajoie (1968), Bailey (1989), Hildreth (2004)].

Figure 2. Geologic map of the Mono Craters volcanic chain. Refer to Figure 1 for approximate coordinates. Distinct petrologic units based on Wood (1983) and Kelleher and Cameron (1990). Dome numbers and available age data indicated from K-Ar on sanidine (Dalrymple, 1967), recalibrated hydration-rind ages (Bursik and Sieh, 1989), Ar-Ar on sanidine (Hu et al., 1994), U-Th on allanite (Reid, 2003). Red stars indicate sampled sites (Marcaida, 2015); black box indicates newly recognized Dome “32” that crosscuts Dome 24 (Marcaida et al., 2019).

This newly developed and more comprehensive geochronological data set for the Mono Craters affords the opportunity to better evaluate how the most recently active part of the rhyolite magma system in the Long Valley region has developed and evolved over time, particularly with regard to possible magma reservoirs that fed the eruptions. To do this, the trace element record of zircons from domes and ashes that have been previously dated by U-series geochronology or correlated to dated eruptions using titanomagnetite geochemistry were examined.

Igneous Minerals as Recorders of Magmatic Processes

In recent years, isotope and trace element analysis of common minerals in igneous rocks has greatly contributed to the understanding of crustal magmatism (e.g. Vazquez and Reid, 2002; Watson et al., 2005; Davidson et al., 2007; Costa et al., 2008; Barth and Wooden, 2010; Reid et al., 2010; Cooper and Kent, 2014; Barnes et al., 2016). In order to use individual minerals to track magma evolution in an igneous system, two assumptions must be made. First, juvenile crystals reflect the chemical composition of the host magma from which they form initially, and second, changes that affect the host magma (e.g. temperature changes, new magmatic inputs) will then be reflected in the crystals/crystal layers that subsequently grow in the magma (Davidson et al., 2007). Specific temporal and chemical information for many elements is preserved at the grain scale as the crystal grows. The elemental (and possibly isotopic) zoning directly reflects variations in magma sources and/or magmatic processes (e.g. crystallization, mixing of new magma inputs, and crystal transfer). When this information is obtained from several crystals within individual samples, it can provide a powerful and detailed record of

magmatic processes and evolution of magma from its deep source to the subvolcanic realm.

Zircon was the primary mineral used for this Master's project. Given its high and variable trace element concentrations (e.g. Hoskin and Schaltegger, 2003), its well characterized chemical behavior in crustal magmas (Watson and Harrison, 1983; Harrison et al., 2005; Harrison et al., 2007), its physical and chemical resilience through crustal recycling (through sedimentary, metamorphic, and magmatic processes), and preeminence as the geochronometer of choice for dating igneous rocks, zircon is one of the best minerals to examine the evolution of crustal magma systems, and indeed the evolution of the continental crust (e.g. Cavosie et al., 2006; Hawkesworth and Kemp, 2006; Kemp et al., 2007; Barth and Wooden, 2010; Barboni et al., 2013). Because zircon is a ubiquitous mineral in the crust, individual crystals can be readily obtained and examined from most common igneous rocks (Hawkesworth and Kemp, 2006). Most importantly, zircon can provide a record of chemical and thermal history of magma systems since it can be placed in an absolute geochronological framework (e.g. Claiborne et al., 2010; Reid et al., 2011).

GEOLOGICAL BACKGROUND

Geologic Setting

The Long Valley volcanic field in eastern California is situated along an active transtensional zone in the Sierra Nevada-Basin and Range transition (Figure 1; Bailey, 1989; Hildreth, 2004). Bounded by the Mesozoic Sierra Nevada batholith, Tertiary

volcanic rocks, and parallel normal faulting, the Mono-Inyo Craters extend north-northwest of Long Valley Caldera, from north to south (Bursik et al., 2014).

Volcanism began in this area around 4.5 Ma (Table 1), when large-scale normal faulting formed the eastern Sierra range-front. Early “precaldern” volcanism in this region is marked by mafic to mafic-intermediate lavas until around 2.5 Ma (Bailey, 2004), likely caused by decompression melting that accompanied regional transtension/extension. After a period of predominantly basaltic magmatism, basaltic magma that was intruded into the deep crust likely caused significant crustal melting that drove high silica magmatism in the Long Valley region (Hildreth, 2004).

Table 1. Eruptive events of Long Valley volcanic field. Note: Foci shown from oldest to most recent (Hildreth, 2004).

Focus	Time	Magma Type
Pre-caldern	3.5 Ma - 2.5 Ma	dacite
Glass Mountain	2.2 Ma - 0.79 Ma	high-silica rhyolite vents
Collapse of Long Valley Caldera	0.76 Ma	compositionally zoned rhyolite (Bishop Tuff)
Mammoth Mountain	110 ka - 57 ka	trachydacite/alkalic rhyodacite & mafic vents
Mono Craters	~62 ka - 0.65 ka	high silica rhyolite, one dacite
Mono Lake	14 ka - 0.25 ka	basalt, dacite, and low-silica rhyolite

Beginning ~2.2 Ma, rhyolitic volcanism dominated the region, most notably the Glass Mountain and Bishop Tuff eruptions. Over a period of ~1.1 million years, two significant events in the Glass Mountain volcanic complex in the eastern Long Valley volcanic field erupted ~100 km³ with at least 30 ultra-high silica rhyolites (Metz and Mahood, 1985). The initial sporadic eruptions between 2.1 and 1.2 Ma likely tapped from multiple discrete sources, given variable incompatible element abundances and little compositional homogeneity among the at least 24 eruptive events (Hildreth, 2004). The second succession of 35 eruptive events (1.2 to 0.79 Ma) produced more chemically evolved and compositionally uniform rhyolites from a presumably more uniform/single magma source. Progressive magma generation and continued normal faulting in the Long Valley region continued until the caldera forming Bishop Tuff erupted 0.76 Ma; this eruption produced ~600 km³ of compositionally zoned, high-silica rhyolite (73-78% SiO₂) (Metz and Mahood, 1985; Hildreth, 2004). “Early rhyolite,” defined by Bailey (1976) as phenocryst-poor, mostly homogenous rhyolite, erupted in the 100,000 year interval following the caldera collapse, is believed to have caused intracaldera resurgence from magma upwelling. Post-caldera faulting and sill injection likely contributed to resurgent doming in the vicinity of the former magma chamber, where uplift in the caldera is attributed to the “early rhyolite” magma (Bailey, 2004; Hildreth, 2004).

The Mono-Inyo chain represents the youngest magmatic focus in the region and may still be underlain by magma. Geophysical anomalies suggest magma may in fact currently underlie the Mono Basin (Rinehart et al., 1964; Peacock et al., 2015). Due to the inferred connection between regional earthquakes and subsequent eruptions,

volcanism in the Mono Craters is believed to originate from magma, radially spreading by dikes beneath the domes and vents that formed from tectonic extension (Bursik et al., 2014).

Previous Work

Aqueduct construction in the vicinity of Mono Lake for Los Angeles, California in the early 1930s provided a window for the relative age correlation of the depositional order of the volcanic, lacustrine, and glacial stratigraphy in the region (Jacques, 1940). Putnam (1938) relied on relative field correlations of known glacial moraines to infer the Late Pleistocene age of the Mono Craters volcanoes. Pumice and ash deposits readily crop out within lacustrine stratigraphy, suggesting volcanic activity began during “the high stand of Mono Lake” (Putnam, 1938). Bailey (1976) posited three magma sources for Mono Craters based on field relations, with one “magma chamber” beneath Long Valley caldera, one associated with a ring-fracture zone originally proposed by Kistler (1966), and a possible magma chamber west of Mono Lake (Wood, 1983).

Wood (1983) mapped the Mono Craters and associated tephras for what is now considered Domes 3-30 south of Mono Lake, and utilized obsidian hydration-rind dating to estimate ages of the Mono Craters and their associated tephra units. Based on a hydration rate of $5 \text{ microns}^2/1,000 \text{ years}$ (Friedman, 1968), relative ages were determined for 26 of the domes (Wood, 1983) and the relative geochronology was utilized to determine extrusion rates of the Mono Craters domes and lava flows. The majority of the tephra associated with Mono Craters was erupted within the last 10,000 years, with

upwards of 0.5 km³ erupting in the last 600 years (Wood, 1983; Bursik and Sieh, 1986; Kelleher and Cameron, 1990).

Kelleher and Cameron (1990) carried out a petrologic analysis of Quaternary high-silica magmatism in the region by comparing whole rock geochemistry for units from Mono Craters, the Inyo chain, and Paoha Island (Figure 1) with the mapping and hydration rind studies of Wood (1983) and Bursik and Sieh (1989) to posit three textural and mineralogical subdivisions among Mono Craters high silica rhyolites (e.g. porphyritic, sparsely porphyritic, and aphyric, where porphyritic domes are classified based on dominant mafic silicate mineralogy, either biotite, orthopyroxene, or fayalitic olivine phenocrysts) that correlate to relative ages of the domes (Figure 2). Biotite-bearing porphyritic domes were emplaced prior to the fayalite and orthopyroxene porphyritic domes, followed by the sparsely porphyritic domes, and then two magmatic pulses of the aphyric lavas. In addition to these textural variations, mafic enclaves with chilled margins are present in Mono domes (Kelleher and Cameron, 1990; Bray et al., 2017). Whole rock chemical analyses were conducted to further analyze the geochemical characteristics of the Mono Craters. Little silica variation exists among the Mono Craters domes, excluding the one dacitic dome; the 27 ultra high-silica domes exhibit only a 1.5% SiO₂ variation. Trace element geochemical results are divided by porphyritic mineralogical classifications, with sparsely porphyritic and aphyric units coupled with the fayalite-bearing data (Kelleher and Cameron, 1990; Bray et al., 2017).

OBJECTIVES

The overall goal of this study is to decipher the temporal record of magmatic processes of the Late Pleistocene Mono Craters rhyolite eruptive center by comparing rare earth element (REE) and other trace element data for rims and sectioned grains of zircons from ashes and domes that have either been dated by radiometric means, or can be correlated unambiguously (in the case of zircons from the ashes) to previously dated domes. Specifically, the objectives of this study were to:

1. Obtain a high quality set of trace element analyses of zircon rims and glasses from Mono Craters (assuming outer surfaces of crystals correspond to the zircon growth environment just prior to eruption).
2. Use the trace element record of zircon rims to examine the temporal evolution and fluctuations of the Mono Craters magma system at times of eruption from the earliest Pleistocene eruptions to more recent Holocene eruptions.
3. Compare conditions inferred from sectioned zircon interiors and rims to examine the changing conditions of the magmatic environment during early growth of zircon versus just prior to eruption.
4. Obtain a set of zircon-melt partition coefficients (K_{DS}) using zircon rims and glass to compare the existing K_{DS} and assess variability.

ZIRCON AS A RECORDER OF MAGMATIC PROCESSING

The study of accessory minerals in igneous rocks over the last 40 years has contributed greatly to petrologic understanding of large, complex magma systems, both ancient and presently active systems. Given its ubiquitous occurrence in the continental

crust, resilience to chemical and physical weathering and melting events, high concentration of key trace elements, and incorporation of U and near-total exclusion of Pb, zircon, especially, has been interrogated extensively as a recorder of magmatic processes (Cherniak and Watson, 2003; Davis et al., 2003; Hanchar and Watson, 2003; Hoskin and Schaltegger, 2003).

In silicic magma systems, zircon stability is governed by the concentration of Zr in the melt, the composition of the melt, and temperature, as shown by Watson and Harrison's (1983) experiments that led to their well-known zircon saturation model:

$$\ln D_{Zr}^{zircon/melt} = (-3.80 - [0.85(M - 1)]) + \frac{12900}{T},$$

where $D_{Zr}^{zircon/melt}$ is the concentration of Zr in zircon relative to the melt, temperature is in Kelvin, and M is the cation ratio $[(Na + K + Ca)/(Al \cdot Si)]$ (Watson and Harrison, 1983). A felsic melt that is initially undersaturated in zircon will cool and crystallize to reach saturation in zircon once the melt Zr concentration is high enough. If the melt is zircon-saturated when formed, then it will not dissolve zircon crystals, but will instead allow for new zircon nucleation onto any pre-existing zircon crystals that get incorporated into the magma, producing older cores with later magmatic overgrowths (Watson and Harrison, 1983; Hanchar and Watson, 2003). In some cases, these cores are much older than the overgrowths (many tens of millions or even billions of years, 'xenocrysts'), whereas in other cases they may be only slightly older (on the order of 10^4 to 10^5 years). In the latter case, the zircons are presumed to have crystallized from a magma pulse that is related to, but antecedent to that in which the zircons ultimately

completed their growth. Such zircons (or zones within zircons) are commonly referred to as ‘antecrysts’ (Hildreth, 2004; Miller et al., 2007).

One other important aspect of zircon solubility that bears noting is that in the case of zircon-saturated and crystal poor glassy rocks (like high-silica rhyolites), the expression presented by Watson and Harrison (1983) can be solved for temperature and used as an igneous geothermometer:

$$T_{zrc,sat} = 12,900 / [2.95 + 0.85M + \ln (\frac{496000}{Zr})].$$

In this expression, Zr is the concentration of Zr in glass in parts per million and 496,000 is the concentration of Zr in zircon in parts per million. This geothermometer and a more recent re-calibration (Boehnke et al., 2013) was utilized in this study to determine zircon saturation temperatures for the Mono Craters magma system, which, because they are crystal poor, zircon saturated and glassy, provides an estimate of eruption temperature.

Ti-in-Zircon Geothermometry

Although the general conditions favoring growth or dissolution of zircon have been known for decades from Watson and Harrison’s experiments, the temperature at which zircons actually grow within any particular magmatic system was not well established until the advent of Ti-in-zircon thermometry (Watson et al., 2005; Ferry and Watson, 2007).

Titanium is very insoluble in zircon and therefore occurs in very low abundance (in the Henry’s Law region— typically a few ppm to a few tens of ppm). However, the concentration of Ti in zircon has a strong and systematic temperature dependence as demonstrated by Watson et al. (2005). The most widely used calibration of the

thermometer [Ferry and Watson (2007)] expresses the solubility of Ti in zircon as a function of temperature and activity of SiO₂ and TiO₂ in the coexisting melt as follows:

$$\log(\text{ppm Ti}) = 5.711 - \frac{4800}{T(K) - \log(a\text{SiO}_2)} - \log(a\text{TiO}_2).$$

Importantly, the thermometer is only very weakly pressure dependent (Ferriss et al., 2008). Thus, provided one has a reasonable estimate of silica and titania activity when zircon was growing, this expression can be used to determine the temperature of zircon growth. The use of the thermometer requires a measurement technique with high enough abundance sensitivity to measure very low concentrations of Ti in zircon, (e.g. ion microprobe or laser ablation ICP-MS). Because each zone in the crystal reflects the trace element composition of the host magma at the time of crystallization of that zone (Claiborne et al., 2010), the ability to link temperature with trace element variation and absolute age (via *in situ* U-Pb or U-series dating) provides a powerful way to examine magma evolution of crustal silicic magma systems (e.g. Claiborne et al., 2010; Cooper and Kent, 2014; Klemetti and Clynne, 2014; Matthews et al., 2015; Stelten et al., 2015).

METHODS

Sampling and Unit Descriptions

Samples for this thesis project were originally collected by M. Marcaida and J. Vazquez as part of a project undertaken by the USGS California Volcano Observatory to better chronicle the eruptive history of the Mono Craters area. The samples come from ash beds in the Pleistocene sedimentary units proximal to the Mono Craters and from several of the rhyolite domes. The preserved Pleistocene lakebed of Mono Lake immediately north-northwest of present-day Mono Lake comprises the most complete

stratigraphic record of the Mono Craters, containing the Wilson Creek Formation, Pleistocene lacustrine sediments, and high silica, pumiceous tephra, belonging to past eruptions from Mono Craters (Figure 3; Lajoie, 1968; Vazquez and Lidzbarski, 2012; Marcaida, 2014).

Prior attempts at dating the Wilson Creek deposits assumed that interbedded rhyolite layers belong to Mono Craters eruptions that were less than 20 ka (Dalrymple, 1967; Wood, 1983; Bursik and Sieh, 1989; Hu et al., 1994; Wilson and Hildreth, 1997; Marcaida, 2015). Based on mapping, whole rock chemistry, and ^{14}C dating of ostracods in lacustrine sediments, previous workers concluded that there was no overlap in the eruptions of Mono Craters and the Wilson Creek Formation deposits (Lajoie, 1968; Kelleher and Cameron, 1990). However, more recent accessory mineral spot analyses on zircon and titanomagnetite from multiple ashes deposited in Wilson Creek Formation yield ages greater than >20 ka (Reid, 2003; Vazquez and Lidzbarski, 2012; Marcaida, 2014). Thus, the Wilson Creek Formation is now considered to provide a record of Mono Craters volcanism extending more than 50 ka.

For the present thesis, the ash numbering sequence used by Vazquez and Lidzbarski (2012) and Marcaida et al. (2014) is used to examine zircons for changes in the magma system during eruptions of Mono Craters (Figure 3). Vazquez and Lidzbarski (2012) sampled directly from outcrop bluffs at the type locality of the Wilson Creek formation immediately north of Mono Lake using ^{238}U - ^{230}Th SIMS on zircon and allanite to establish high resolution tephrochronology for ashes 1-19 (Figure 3). Marcaida et al., (2014) and Marcaida (2015) linked several of these ash deposits to individual dome

eruptions using titanomagnetite mineral chemistry and additional ^{238}U - ^{230}Th SIMS geochronology on several of the domes. This study utilizes the samples and new age determinations by Vazquez and Lidzbarski (2012) (Table 2), Marcaida et al. (2014), and Marcaida (2015), as well as earlier age information to examine temporal variations in trace element chemistry of zircon and glass in samples from Mono Craters.

Figure 3. Stratigraphic section of the Wilson Creek formation. Sediments and tephras located along Wilson Creek. Correlative tephra ages and approximate scale shown (at right). Chen et al., 1996; Vazquez and Lidzbarski, 2012; Zimmerman et al., 2006; Cox et al., 2012. Modified from Marcaida et al. (2014). USGS photo by M. Nathenson (2011). Used with permission of M. Marcaida.

Table 2. Dome and ash units in this study, by approximate age. Ages determined from zircon and allanite rims (Vazquez and Lidzbarski, 2012).

Unit	Approximate Age (ka)
Dome 6	7
Dome 30	12.5
Dome 11	21
Ash 3	21
Ash 4	22
Ash 7	27
Ash 11	38
Ash 15	40
Ash 17	59
Ash 19	62

SIMS Trace Element Analysis

For the purposes of this project, zircons were analyzed from selected ash and dome units (zircons and glasses) that had been previously prepared for SIMS ^{238}U - ^{230}Th dating and methods are detailed in these studies (Reid et al., 2011; Vazquez and Lidzbarski, 2012; Marcaida et al., 2014).

Zircon crystals were either mounted into indium (In) metal for analysis of crystal surfaces (3 mounts) or in epoxy and polished to expose interiors for sectioned analysis (1 mount). Trace elements were measured using the Stanford-USGS SHRIMP-RG using a primary O^{2-} beam at a mass resolution of greater than 10,000 in order to avoid isobaric interferences on the REE. For all analyses (surfaces or interiors), the surface of the

sample was first cleaned by rastering the primary beam for approximately 10 seconds. Zircon trace element analysis followed the analytical protocols of Barth and Wooden (2010), standardizing trace element concentrations relative to MADDER, an in-house, homogenous zircon utilized at the Stanford-USGS SHRIMP-RG calibrated relative to MAD-green (Bacon et al., 2012). Titanium concentrations were calculated relative to standard SL13, where $Ti = 6.14 \pm 0.01$ (Hiess et al., 2008). Raw data from the SHRIMP were converted to interelement ratios using the Squid2.51 program (Ludwig and Center, 2009).

Sample analyses were completed for zircon in four campaigns on the SHRIMP, (October and November 2014, May and June 2015). One mount was analyzed per scheduled session, where each analytical session lasted approximately 24-48 hours. Spot analyses were selected the first day of each session for their respective units. Spots were chosen based on prior ^{238}U - ^{230}Th SIMS spot analysis localities (visible marks on the micron-scale mount screen), and also on spot mapping of CL images acquired prior to each scheduled session. Additional spots were determined while operating the SHRIMP, with at least 1 spot (preferably 2 to 3) per viable zircon. “Viable” zircons were estimated based on general observable properties at the micrometer level, such as external crystal shape, internal crystal structure from CL imaging, and surface area of zircon grain remaining after ^{238}U - ^{230}Th SIMS spot analysis (see Appendix A). Zircon trace element (including all rare earth element) concentrations were compiled for each analytical spot for the sampled units. Each template included results from the respective scheduled analytical session.

Crystal rim data were obtained for 7 ash units and 3 dome units. Additional sectioned interior data were obtained for 2 of the dome units. All results were compiled with spots denoted for each analysis (see Appendix B for full list of sample and standard data for zircon). After data reduction, every analysis was inspected for data quality. Where spots had exceedingly high potassium (K), aluminum (Al), sodium (Na), or calcium (Ca) concentrations, namely orders of magnitude variation among other spots from same unit, the spot was assumed to be contaminated by either glass or mineral inclusions rather than zircon; these analyses were discarded.

Glass Analyses

Two glass mounts were made from hand-picked glass for six ash units and two dome units. Glass analyses were also analyzed by the SHRIMP-RG at the same mass resolution as zircon and concentrations were calibrated to a suite of RLS high-silica rhyolite glasses using concentrations from Macdonald et al. (1992). The images of the mounted glass samples are included in Appendix C of this study. Trace element and REE concentrations for the glass are assumed to be in approximate equilibrium with the surface zircon analyses.

Raw glass data from six ash and two dome units included major and trace element analyses, and are included in Appendix D. Known standards (NIST-611, NIST2, MACUSANI, RLS-37, RLS-76, RLS132, RLS140, and RLS-158) were used to calculate elemental concentrations from oxide data relative to the molecular weight of silica (SiO_2). Concentrations of standards were plotted relative to normalized silica ($^{30}\text{SiO}_2$), where isotopic ratios with known elemental and silica concentrations per each standard

(⁹⁰Zr, ¹³⁸Ba, ¹³⁹La, ¹⁴⁶Nd, ¹⁴⁷Sm, ¹⁵¹Eu, ¹⁴⁷GdO, ¹⁷⁵TbO, ¹⁸¹HoO, ¹⁸²ErO, ¹⁸⁵TmO, ¹⁸⁸YbO, ²⁴⁸ThO, ²⁵⁴UO, ¹⁴⁰Ce) were normalized to the isotopic ratio output from the SHRIMP.

The respective slope for each linear plot was then multiplied by the elemental/isotopic ratio output to SiO₂ and by the SiO₂ value for ultra-high- SiO₂ rhyolite, e.g. 77 wt.%.

Oxide outputs were multiplied by their respective atomic ratios to yield elemental concentrations for glass samples (Appendix D).

Titania and Silica Activity in the Melt

From previous work, titania (TiO₂) activity in the melt was estimated from co-existing titanomagnetites (e.g. solid solution of Fe-Ti oxide compositions of spinels, magnetite, and ulvöspinel). Marcaida et al. (2014) determined pre-eruption temperatures and oxygen fugacities for several of the Wilson Creek tephra using the Ghiorso and Evans (2008) Fe-Ti oxide geothermometer, which allows the titania activity in the melt to be constrained (Ghiorso and Guilda, 2013), assuming that the Fe-Ti oxides are crystallizing when zircon starts crystallizing. Based on these calculations for the ashes and domes analyzed in this study, titania activity was estimated to be 0.3 ($a_{\text{TiO}_2} = 0.3$). This value was used to calculate Ti-in-zircon model temperatures reported in the results. The Ti-in-zircon thermometer also requires an estimate of silica activity (see above). The Mono Craters rhyolites are saturated in quartz; therefore, silica activity equals 1 ($a_{\text{SiO}_2} = 1$).

RESULTS

The results of all trace element analyses for zircons and glasses from all ash and dome samples that are the subject of this study are summarized below and tabulated in

Appendices B and D.

Rare Earth Element Patterns for Zircons and Glasses

Chondrite-normalized REE patterns for zircon from Mono Craters tephra deposits from the Wilson Creek formation and three Late Pleistocene to Holocene domes are presented in Figure 4 (a through j), with complete data in Appendix B. REE patterns for Mono Craters zircons are typical for igneous zircon, with generally curved middle rare earth elements (MREE) to heavy rare earth elements (HREE) and prominent negative Eu anomalies and positive Ce anomalies. Intrasample variation in REE concentrations for zircon surfaces is variable. For example, chondrite-normalized concentrations from Ash 19 (62 ka) and Ash 17 (59 ka) show spot to spot variation of approximately an order of magnitude, with markedly less variation in surface analyses from eruptions that span from 40 ka to 7 ka, with the exception of Ash 3 (21 ka).

Chondrite-normalized REE patterns for rhyolite glasses are presented in Figure 5 with complete data in Appendix E. The glass data are compared with whole-rock data for Mono Craters rhyolites from Kelleher and Cameron (1990). The glass data, like the whole rock data of Kelleher and Cameron (1990), show similar MREE and HREE with deep negative Eu anomalies but distinctly flatter LREE patterns.

Figure 4. Chondrite normalized REE plots for zircon from Mono Craters. Rare earth element plots from tephra deposits (Wilson Creek formation) and 3 Late Pleistocene to Holocene domes. Black lines show each surface analysis, blue lines indicate average zircon REE, and orange dashed line denotes average glass REE for correlative glass sample (where available). Dome 6 (7 ka) and Dome 11 (21 ka) include sectioned analyses, with red dashed lines showing sectioned zircon averages. Dome 11 is correlated by age and titanomagnetite geochemistry to Ash 3 (Marcaida et al., 2014).

Figure 5. REE plot for Mono Craters glass and whole rock samples. Chondrite-normalized REE plots for Mono Craters glass averages (Ash 3-19, Domes 6 and 11; orange dashes) and whole rocks from Kelleher and Cameron (1990; gray lines).

Trace Element Variation

Binary plots of key trace element concentrations and trace element ratios for zircon (e.g. Claiborne et al., 2010; Barth and Wooden, 2010; Rivera et al., 2016) show systematic variation and variable degrees of scatter (Figures 6a-o) and reveal important trace element variation that is difficult to discern from the REE patterns.

Figure 6. Zircon trace element geochemistry for ash and dome units. Plotted points represent surface analyses unless noted otherwise (a through o).

Generally, Ti, Eu/Eu* (chondrite-normalized Eu divided by the Euclidean distance between the concentrations of gadolinium and samarium), and Th/U show decreasing trends with Hf (Figures 6a-c), whereas Th, U, Lu, U/Yb, and Yb/Gd show increasing trends with Hf (Figures 6d-h). Ce, Sm, and Ce/Sm are weakly to uncorrelated with Hf (Figures 6i-k). Th is also positively correlated with U (Figure 6l). On some plots, the data appear to diverge on two separate trends away from a cloud where most of the data plot, e.g. Th vs. Hf (Figure 6a), U vs. Hf (Figure 6b), and Sm vs. Hf (Figure 6e). Hafnium and U show increasing trends with Th/Y (Figure 6m and 6n), whereas Eu/Eu* shows decreasing trends with Th/Y (Figure 6o); in general, the diverging trends are most clearly evident but still scattered on these plots with Th/Y.

Plots of key elements versus Ti-in-zircon model temperatures (Figures 7a-e) show that the diverging trends observed on the other plots are correlated with temperature and that the dispersion decreases (i.e. trends converge) at lower temperatures. It is also important to note that trends for individual samples tend to either cluster tightly together (e.g. Ash 11 and the sectioned interiors from Domes 6 and 11) at low temperature or define more coherent trends over a range of temperatures (e.g. Ash 3, Ash 15) than when considering all the data together. This trend is also observed on the element-element, element-ratio, and ratio-ratio plots.

Figure 7. Ti-in-zircon temperatures versus trace elements. Corresponding ash and dome units included for respective trace element plot (a-e).

DISCUSSION

The Mono system, excluding one dacite dome, is comprised of high-silica rhyolite domes and ashes that have been definitively linked to the Mono Craters volcanic chain. As noted earlier, all of the high-silica rhyolites have similar major element compositions but distinct mineralogy and textures that generally correlate with distinct ages (e.g. Kelleher and Cameron, 1990). Trace element and moderate whole rock isotopic variability, as well as the presence of mafic enclaves, indicate that the system is, in general, open and subject to rhyolite replenishments, as well as mafic recharge (Bursik and Sieh, 1989; Kelleher and Cameron, 1990; Marcaida et al., 2014; Bray et al., 2017).

Zircon Trace Element Variation as Recorders of Fluctuating Magmatic Conditions for the Mono Craters

Trace element variation in zircon illuminates key aspects of the rhyolite system. Importantly, because this study focused on ashes from the Wilson Creek formation, the work herein provides a more complete geochemical history of Mono Craters over a longer time period than for just the Holocene eruptions, which were the focus of most previous work.

Most of the data presented above and discussed more below are for zircon rims, which most closely represent the geochemical environment of the crystal during the ‘final stages’ of growth prior to eruption. However, the ion beam penetrates the zircon to a depth of 1-2 micrometers, and thus the analysis represents some integrated average over that depth range. The absolute amount of time represented by this few micrometers of growth is difficult to evaluate and depends on the crystal growth rate of zircon, which can

vary over four orders of magnitude and depends on many factors that are difficult to constrain from this study (e.g. volume of melt in which zircon resides, temperature in the melt volume, whether the melt is moving relative to the crystal interface; e.g. Watson, 1996). Using the range of growth rates reported in Watson (1996), a 1-2 μm rim could grow in as little as 30 years to as long as 300,000 years, where calculated zircon growth rates range from 10^{-13} microns/second to 10^{-9} microns/second at the low and high ends, respectively. In this study, the 300,000-year growth time is likely a severe overestimation given that many of the cores that were analyzed for Mono Craters zircons were 75,000 years or younger (Vazquez and Lidzbarski, 2012). 300,000 years is also an order of magnitude longer than the entire duration over which the Mono Craters have been active. It is also worth noting that for one sample examined in this study (Dome 11), the surfaces of the same zircons analyzed were used to extract an isochron that is considered to ‘date’ the eruption (Marcaida et al., 2019). Thus, although it is not possible to determine how much time is actually averaged by analysis of zircon rims, the constraints noted suggest *maximum* time scales that are more on the order of millennial.

In the two samples where the cores/interiors of sectioned grains have been analyzed (Dome 11 and Dome 6), a direct comparison can be made between core and rim data to determine the evolution of the crystal. Core analyses represent the chemical environment from which the zircon interiors initially formed, which may differ from that at eruption, and as noted above, may predate the final environment of growth by several tens of thousands of years.

REE zircon plots show overall similar shapes and average patterns and are characterized by prominent negative Eu anomalies of similar magnitude, indicating broadly similar chemical environments of zircon crystallization just prior to eruption from the earliest manifestations of the Mono Craters to the most recent eruptions. Different degrees of pattern dispersion could be from local heterogeneity reflecting small scale variability in chemical environment of zircon crystallization.

Variation in REEs and other zircon-compatible trace elements between different samples is more easily visualized in the binary plots (Figures 6, 7), which reveal important subtleties and details that are not apparent in the REE patterns. The generally tight clustering of many samples on binary plots and noted in the Results is, like the narrowly distributed REE patterns, attributed to crystallization in an overall geochemically similar environment, but not necessarily a temperature-invariant environment. As shown in previous work (Claiborne et al., 2018), increasing Hf in zircon correlates with increasing silica, decreasing Eu/Eu*, increasing Th/U, and decreasing Ti (and therefore temperature); thus, increasing Hf concentration is an index of crystal fractionation in zircon (Claiborne et al., 2010; Barth and Wooden, 2010). In general, the Mono Craters zircons show Ti (and Ti-in-zircon model temperatures), Eu/Eu*, and Th/U decreasing as Hf increases (Figures 6a-c, Figure 7a) indicating greater degrees of fractionation at lower temperature, which would be consistent generally with down-temperature crystal-liquid fractionation preserved in the zircons. The range of Ti-in-zircon model temperatures spans over 200°C. In some cases, individual samples tend to cluster over a narrower range of temperature and Hf [cf. Dome 6 (7 ka) and Ash 11 (38

ka), Figures 6d, i-j, Figure 7a], whereas zircons from other samples capture $> 100^{\circ}\text{C}$ of the temperature variation observed [cf. Ash 3 (21ka) and Ash 17 (59 ka), Figures 6e-h, Figure 7a]. Eutectic-like crystallization characterized by low and invariant Ti (and Ti-in-zircon model temperature), Th/U, and Eu/Eu* with increasing Hf (cf. Claiborne et al., 2010), is seen only in the data for Ash 19 (62 ka) and Ash 15 (40 ka). These variations in the temperature environment for different samples appear to mostly explain the diverging trends noted earlier in the Results on some binary plots (e.g. Eu/Eu* vs. Hf, Th/U vs. Hf, Th vs. Hf, U vs. Hf, , Hf vs Th/Y, Figures 6b-e, Figure 6m), but the same samples do not necessarily define divergent trends on all plots (e.g. compare Eu/Eu* vs. Th/Y and U/Yb vs. Hf with Eu/Eu* vs. Hf and Th/U vs. Hf, Figures 6o and 6g, Figures 6b and 6c). Where clear trends on binary plots are observable, individual samples often define unique trends (e.g. Eu/Eu* vs. Hf, Ti-in-zircon temp vs. U; Figure 6b, Figure 7e).

Th/Y has been shown to track fractionation in zircons from the Yellowstone system (Rivera et al., 2016) but may not be as clear an indicator of fractionation for the Mono Craters, where other factors (e.g. variable crystallization of allanite, in which Th is strongly compatible, relative to zircon) may be important. A comparison of REE concentrations for Mono Craters glass relative to whole rock data from Kelleher and Cameron (1990) (Figure 5) showed that average glasses from dome and ash units exhibited deeper Eu anomalies and lower light REE (LREE) contents relative to whole rock Mono Craters data. Lower LREE in Mono Craters glasses relative to whole rock analyses is a clear indicator of allanite fractionation, and allanite is common in Mono Craters rhyolites (Vazquez and Lidzbarski, 2012).

Some of the variable trends and scatter observed could be attributable to non-equilibrium trace element partitioning effects (e.g. Reid et al., 2011). However, the major element composition of the rhyolites is very homogeneous, whereas modal mineralogy varies considerably across the lifetime of the Mono Craters and thus more likely dominates the trace element variability of zircon as it does in the bulk rhyolites (e.g. Kelleher and Cameron, 1990).

Taken together, the data suggest a rhyolite system showing appreciable temporal variability that reflects fluctuating conditions in a larger rhyolite magma body, and/or a temporally and spatially poorly integrated magma system, where individual eruptions tapped discrete rhyolite bodies. The latter would be consistent with the temporally variable mineralogy of the ashes and dome units.

Comparison of cores and rims in the two cases where data are available (Domes 6 and 11) also provides important information about the temporal evolution of the rhyolite system for these two eruptions (Figure 8). Sectioned zircon interiors from Dome 6 (7 ka) and Dome 11 (21 ka) give Ti-in-zircon model temperatures that range from about 660°C to 690°C. These temperatures are predominantly at or below zircon saturation temperatures, which range from 725°C to 692°C using the calibrations of Watson and Harrison (1983) and the more recent calibration of Boehnke et al. (2013), respectively. In contrast, the rims of the zircons from both eruptions have distinctly higher Ti-in-zircon model temperatures and lower Hf than the sectioned interiors that are generally at or above the zircon saturation temperature. The rims also have higher (though more scattered) Th/U and Eu/Eu* than their respective interiors (Figure 9). These time-

dependent geochemical shifts strongly suggest that the rhyolite system in these two instances was one in which zircon grew predominantly in a cooler environment ('cold storage'; cf. Cooper and Kent, 2014) and then experienced an influx of heat prior to eruption. Such a scenario would be consistent with the reported occurrence of quenched mafic magmatic enclaves in Holocene eruptions of the Mono Craters (Bray et al., 2017).

Figure 8. Titanium versus hafnium for ash and dome units from Mono Craters zircons. Ti-in-zircon temperature contours from the Ferry and Watson (2007) geothermometer. Titania activity estimated from coexisting Fe-Ti oxides (Marcaida et al., 2014). (a) All zircons analyses. (b) Comparison of sectioned and surface values for domes 11 and 6. Thick arrow shows temporal shift to lower Hf and higher Ti (and higher temperature). Inset shows cathodoluminescence (CL) images of sectioned zircons from dome 6. Note typical oscillatory and sector zoning typical of igneous zircon and also absence of CL-bright edges. It is important to also note that few interior U-Th ages are at secular equilibrium (<1%). Maximum measured U-Th age is ca. 60 ka. The zircons have very few old, inherited cores.

Figure 9. Rim to interior trace element comparison. Surface and sectioned interior analyses for Eu/Eu^* and Th/U versus Hf for Dome 6 and 11 only (a and b).

Cathodoluminescence images of sectioned zircons from these eruptions do not display bright edges that would be indicative of generally lower U, Th, Hf, and higher Ti, nor do they show obvious textures indicative of an up-temperature shift prior to eruption (e.g. resorption followed by overgrowths; inset of Figure 8b). The up-temperature shift observed in trace element data is confined to the outermost rims and thus must have occurred ‘relatively close’ to the time of eruption. Given the overall eruption time span of the Mono Craters, and the uncertainties associated with zircon growth rates discussed above, the thermal rejuvenation could have occurred from weeks or months to perhaps as long as a few millennia.

Whether thermal rejuvenation served as a trigger in other eruptions is harder to assess and would require more data from sectioned interiors. In some cases, rims from zircons from other eruptions yield relatively cool Ti-in-zircon model temperatures, comparable to

the sectioned interiors of Domes 6 and 11 (e.g. Ashes 11 and 7; Figure 8a), whereas in other cases they yield distinctly elevated temperatures (e.g. Ash 17; Figure 8a).

Zircon-Melt Partitioning

In addition to examining the trace elements in zircon as recorders of fluctuating magmatic conditions, the data generated in this study can be used to calculate zircon-melt partition coefficients (K_D) for those elements where both zircon and glass concentration data were obtained (Table 2). The partition coefficient is defined simply as the concentration in the solid (zircon) divided by the concentration in the liquid (glass) and assuming equilibrium between zircon and melt ($K_D = \text{conc.}_{\text{zircon}}/\text{conc.}_{\text{glass}}$).

For the REEs, a lattice strain fit (Blundy and Wood, 1994) was done to assess how well the empirically determined average partition coefficients determined here fit the ideal lattice strain model (Figure 10). Mismatch between predicted K_D and observed K_D for Eu and Ce is common owing to multiple valence states of Eu and Ce (Hanchar and van Westrenen, 2007); these elements are therefore excluded from the fit. La and Sm also appear to deviate appreciably from the predicted relationship and are excluded from the model fit as well. Because La concentration is exceedingly low in zircon, the poor fit for La is likely attributable to the inability of the ion probe to accurately measure La concentrations. The poor fit to Sm is more challenging to explain, but like La, appears to be systematic. The temperature used for the fits was the average zircon saturation temperature (976 K).

Figure 10. Onuma diagram for Mono Craters. Onuma diagram and lattice strain fit (Blundy and Wood, 1994) to REE partition coefficient determined from average REE concentrations for zircon and glass.

The K_{DS} determined in this study can be compared to other relatively recent K_{DS} (Colombini et al., 2011; Stelten et al., 2015) and the widely used values from Sano et al. (2002). In general, the values are similar to the values from the Sano et al. (2002) and Colombini et al. (2011) but deviate significantly from those of Stelten et al. (2015) (Table 3, Figure 11). This deviation may be because the rhyolites at Yellowstone that were studied by Stelten et al. (2015), represent a hotter and drier magma system than those studied by Sano et al. (2002), Colombini et al. (2011), and the Mono Craters. Nevertheless, the agreement with the Sano et al. (2002) and Colombini et al. (2011) partition coefficients provides some reassurance that the values determined in this study may also be useful for trace element modeling of melts from zircon trace element data.

Table 3. Mono Craters K_D s compared to other published silicic magma K_D s. Average K_D s were used where multiple units were available for each study (Colombini et al., 2011; Sano et al., 2002; Stelten et al., 2015).

Unit	Ce K_D	Nd K_D	Sm K_D	Eu K_D	Gd K_D
Mono Craters	0.79	0.05	0.50	2.91	11.89
Highland Range volcanic sequence (Colombini et al., 2011)	1.24	0.06	0.78	2.47	8.33
Torihamada dacite pyroclastic pumice (Sano et al., 2002)	0.36	0.08	0.80	1.22	8.00
Yellowstone (Stelten et al., 2015)	0.16	0.03	0.41	0.67	3.77

Unit	Tb K_D	Dy K_D	Er K_D	Tm K_D	Yb K_D
Mono Craters	25.61	51.22	151.00	196.96	256.56
Highland Range volcanic sequence (Colombini et al., 2011)	20.67	39.33	125.67	173.33	198.67
Torihamada dacite pyroclastic pumice (Sano et al., 2002)	20.70	45.90	136.00	197.00	277.00
Yellowstone (Stelten et al., 2015)	7.77	14.07	40.00	53.67	66.67

Figure 11. Plot of K_{DS} against Mono Craters. K_{DS} for silicic magma systems versus Mono Craters shown for available REE on logarithmic scale (Colombini et al., 2011; Sano et al., 2002; Stelten et al., 2015).

Finally, the K_{DS} for Mono Craters rhyolites were also compared to model K_{DS} using the empirically derived equations from Claiborne et al. (2018) (Table 4). The Claiborne et al. (2018) equations were developed to allow users to estimate the REE content of a zircon based solely on the Ti concentration, which Claiborne et al. (2018) showed is correlated to REE concentration (power-law fits of Ti and REE concentration for each individual REE). These calculations were carried out to better assess the validity of this new empirical model for inverting REE concentrations to reconstruct melt compositions from Ti concentration in zircon. The calculated K_{DS} using the Ti concentrations from the Mono Craters zircons and the Claiborne et al. (2018) equations yield systematically higher values than the actual K_{DS} determined from Mono Craters data in this study (Table 4).

Table 4. Observed and estimated K_D s for Mono Craters. Observed partition coefficients from Mono Craters data for each element shown with model partition coefficients estimated from Claiborne et al. (2018). Model K_D s were determined for each zircon surface analytical spot (Appendix H), with the average for each ash and dome unit shown.

Unit	Ce K_D		Nd K_D	Nd K_D		Sm K_D
	Ce K_D	Model		Model	Sm K_D	Model
Ash 3	0.86	0.59	0.08	0.10	0.72	1.48
Ash 4	0.79	0.63	0.03	0.11	0.40	1.58
Ash 7	0.39	0.65	0.02	0.11	0.28	1.65
Ash 11	0.39	0.80	0.02	0.14	0.30	2.09
Ash 17	1.58	0.46	0.07	0.08	0.65	1.09
Ash 19	0.72	0.58	0.03	0.10	0.45	1.43
Dome 6	0.85	0.52	0.07	0.09	0.63	1.26
Dome 11	0.73	0.50	0.05	0.08	0.62	1.21

Unit	Eu K_D		Gd K_D	Gd K_D		Tb K_D
	Eu K_D	Model		Model	Tb K_D	Model
Ash 3	5.02	2.03	12.58	19.96	27.18	53.05
Ash 4	2.42	2.14	9.06	21.30	21.34	56.63
Ash 7	1.65	2.20	6.03	22.44	12.08	59.76
Ash 11	1.12	2.58	8.19	29.58	20.09	79.42
Ash 17	4.49	1.68	16.15	13.88	33.65	36.42
Ash 19	2.49	2.01	12.59	18.96	27.84	50.21
Dome 6	3.97	1.85	13.90	16.34	26.93	43.08
Dome 11	2.12	1.80	16.60	15.70	35.79	41.35

Unit	Dy K_D	Dy K_D Model	Er K_D	Er K_D Model	Tm K_D	Tm K_D Model
Ash 3	48.74	121.07	134.51	471.15	167.67	654.77
Ash 4	44.23	129.24	121.72	502.23	157.17	698.61
Ash 7	23.98	137.73	75.56	538.94	95.07	746.79
Ash 11	41.48	191.44	137.36	772.82	194.08	1052.52
Ash 17	66.14	77.40	196.05	286.11	279.79	409.19
Ash 19	58.32	111.95	160.46	427.71	226.62	600.62
Dome 6	53.42	93.77	160.42	352.31	193.45	499.35
Dome 11	73.50	89.75	221.90	336.71	261.85	477.61

Unit	Yb K_D	Yb K_D Model	Th K_D	Th K_D Model	U K_D	U K_D Model
Ash 3	212.51	956.22	29.19	35.28	182.28	292.93
Ash 4	203.10	1016.56	27.27	37.68	213.68	311.89
Ash 7	126.14	1098.88	9.97	40.02	84.58	335.88
Ash 11	259.62	1628.29	17.25	54.79	178.31	489.42
Ash 17	369.94	549.30	32.17	23.12	185.23	173.15
Ash 19	293.52	849.87	23.69	32.90	187.82	263.25
Dome 6	252.29	687.90	30.08	27.78	174.94	214.99
Dome 11	335.38	656.71	41.85	26.61	224.29	205.35

Additionally, the model K_D s were used to calculate model REE melt concentrations by solving the K_D equation for melt REE; $\text{conc.}_{\text{melt}} = \text{conc.}_{\text{solid}}/K_D$, where $\text{conc.}_{\text{solid}}$ is the average concentration for each REE measured for the zircons from each sample and K_D is the model K_D from Table 4. These model melts were then compared with actual average REE glass concentrations in the Mono Craters samples on chondrite-normalized REE plots (Figures 12a-h). Model glass concentrations show similar LREE and HREE contents and Eu anomalies as in the actual glasses for each glass and dome unit; however, the majority of the model glass concentrations also show a Tb spike and a significant Dy drop. The cause of these odd spikes in the REE patterns is not clear but suggests that the

Claiborne et al. (2018) equations may not adequately reproduce model melt compositions in all cases and should be used with caution.

Figure 12. REE plots for Mono Craters and model. Chondrite-normalized REE element plots for Mono Craters glass (orange) and model melt concentrations (blue dashed) using the equations of Claiborne et al. (2018).

CONCLUSIONS

This study reports new trace element zircon data for ashes from the Wilson Creek formation and several domes of the correlative Mono Craters that had been previously dated. The primary conclusions are as follows:

1. Trace element data for Mono Craters on zircon, coupled with Pleistocene to Holocene chronology and correlative glass analyses, suggest an overall similar, “long-term,” pre-eruption geochemical environment, but with important modest variations in $T_{\text{Ti,zrc}}$ temperature and key trace elements and ratios. The observed temporal variability suggests fluctuating magmatic conditions in a larger rhyolite magma/mush body and/or a temporally and spatially poorly integrated magma system, where individual eruptions tapped discrete rhyolite bodies.
2. Relatively low $T_{\text{Ti,zrc}}$ and homogeneous trace element geochemistry from sectioned interiors of zircons from two of the youngest domes indicate that, at least in these cases, zircon grew initially under conditions of zircon saturation in rhyolite that was stored at relatively cool (but not subsolidus) temperatures between 650-700°C. Up-temperature signatures (decreasing Hf, increasing Ti, Th/U, Eu/Eu*) recorded by comparison of the sectioned interiors of zircons from these two domes to their outermost crystal rims indicate that eruptions were typically preceded by brief inputs of heat that possibly triggered eruption.
3. Zircon-melt K_{DS} determined from zircon and coexisting glass trace element concentrations are similar to values reported in the literature for similar rhyolite

systems and thus may be useful for modeling melt compositions from zircon trace element analyses.

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APPENDICES

APPENDIX A: Cathodoluminescence images with Indexed Analysis Spots

Dome 6 row 1 (SHRIMP trace element spots in purple.)

Dome 30 (US09) (SHRIMP trace element spots in white.)

Ash 3 (US08)

[SHRIMP trace element spots in blue (Ash 3) and purple (Dome 11).]

Dome 11

Ash 17 (US05b)

(SHRIMP trace element spots in blue.)

APPENDIX B: SHRIMP Trace Element in Zircon Data

Highlighted fields not included in results, likely inclusions or feldspars.

	Li	Be	B	F	Na	Al	P	K	Ca	Sc	48Ti
DOME6-1.2	0.10	0.01	0.08	13.11	6.21	10.13	302.22	1.02	12.47	65.58	2.75
DOME6-10.1	0.00	0.06	0.01	5.20	2.93	6.44	262.18	0.47	10.07	46.23	2.61
DOME6-10.2	0.01	0.00	0.03	2.09	6.14	12.35	621.18	0.63	11.57	50.74	2.62
DOME6-11.1	0.00	1.35	0.01	9.13	2.78	8.52	411.32	0.32	12.12	47.23	2.43
DOME6-11.2	0.00	12.72	0.03	5.97	3.46	6.92	333.62	0.43	11.46	67.56	2.92
DOME6-12.1	0.00	0.06	0.00	5.67	2.84	7.89	282.33	0.42	10.50	69.63	3.28
DOME6-12.2	0.00	0.01	0.01	6.50	2.89	13.49	542.81	0.61	14.94	56.07	2.89
DOME6-13.1	0.00	0.09	0.01	5.81	2.85	7.63	289.48	0.49	12.39	53.34	2.85
DOME6-13.2	0.00	0.09	0.01	9.86	2.53	7.12	289.44	0.52	7.44	44.63	3.19
DOME6-2.1	11.09	0.04	0.03	10.23	3.68	11.32	698.90	0.66	19.88	54.21	2.15
DOME6-2.2	73.62	0.32	0.04	7.84	4.06	9.01	602.75	0.68	15.76	85.88	3.33
DOME6-2.3	38.78	0.06	0.01	11.58	4.41	7.59	510.41	0.66	8.99	69.91	2.16
DOME6-3.1	3.16	0.69	0.00	22.72	6.07	9.23	633.04	0.73	19.28	64.20	3.49
DOME6-3.2	2.63	0.12	0.01	7.84	4.74	8.15	446.62	0.64	20.06	64.94	2.67
DOME6-4.1	0.00	0.25	0.00	5.87	3.65	6.24	337.97	0.68	14.42	55.75	2.94
DOME6-4.2	0.00	0.37	0.03	8.85	3.57	8.48	443.14	0.64	12.33	66.30	4.64
DOME6-5.1	0.01	0.02	0.15	35.05	3.67	27.99	771.49	0.71	19.37	55.38	2.22
DOME6-5.2	0.01	0.01	0.04	6.05	3.60	6.87	262.86	0.61	11.51	45.51	3.73
DOME6-5.3	0.01	0.05	0.00	5.15	3.19	6.31	279.90	0.51	14.86	51.06	2.74
DOME6-6.1	0.00	0.00	0.01	5.51	3.64	12.49	496.77	0.62	10.44	51.51	2.39
DOME6-6.2	0.00	0.40	0.03	7.25	2.62	10.25	336.81	0.49	9.45	57.73	2.94
DOME6-7.1	3.22	0.01	0.01	5.98	3.40	9.14	586.91	0.95	9.97	47.99	1.46

	Li	Be	B	F	Na	Al	P	K	Ca	Sc	48Ti
DOME6-7.2	6.16	0.13	0.02	10.48	2.99	7.88	509.75	0.80	6.61	79.93	2.46
DOME6-7.3	0.34	0.02	0.01	5.66	2.68	6.52	268.66	0.41	13.51	41.78	2.66
DOME6-8.1	0.00	0.35	0.00	7.45	4.21	7.71	309.13	0.80	18.50	53.31	2.37
DOME6-8.2	0.00	0.00	0.01	4.12	2.92	10.44	569.53	0.57	11.42	61.31	2.42
DOME6-9.1	1.67	0.01	0.00	5.88	13.88	133.14	376.27	73.01	12.84	37.29	1.47
DOME6-9.2	0.02	0.03	0.08	7.53	9.08	8.28	305.79	1.11	35.43	60.76	1.97
US44-DOME6-1.1	0.00	0.47	0.15	4.22	2.29	19.81	284.68	0.10	0.63	33.62	1.24
US44-DOME6-1.2	0.00	0.90	0.08	25.89	0.17	17.17	309.10	0.03	0.21	34.44	1.27
US44-DOME6-1.3	0.01	1.32	0.08	29.49	1.74	26.29	286.46	0.08	0.55	34.23	1.24
US44-DOME6-4.1	0.00	1.31	0.11	28.42	7.97	20.24	293.60	0.29	3.57	30.99	2.32
US44-DOME6-2.1	0.00	0.59	0.38	42.71	3.24	21.93	226.47	0.16	2.79	25.58	1.33
US44-DOME6-2.2	0.00	1.61	0.10	17.19	4.48	26.03	267.47	0.22	1.25	31.39	6.47
US44-DOME6-7.1	0.00	1.69	0.04	2.91	0.57	6.99	253.59	0.02	14.25	28.71	1.17
US44-DOME6-6.1	0.00	0.40	0.13	6.85	3.62	17.94	208.15	0.29	0.43	35.89	1.40
US09-1.1	0.69	0.05	0.37	491.21	16.34	464.70	654.68	172.50	31.82	50.26	3.98
US09-2.1	2.68	0.01	0.06	26.98	0.45	5.74	457.59	0.28	0.29	31.65	1.21
US09-3.1	0.00	0.09	0.03	120.02	1.70	8.88	267.97	1.04	2.36	26.73	1.25
US09-4.1	1.17	0.00	0.01	74.86	0.62	6.99	699.70	0.45	0.27	55.58	1.79
US09-5.1	0.01	1.13	0.09	41.32	0.90	10.37	655.38	4.06	0.58	43.53	1.45
US09-6.1	0.08	0.02	0.10	48.84	1.49	8.52	658.84	0.39	0.86	51.64	1.86
US09-7.1	1.11	0.00	0.07	58.51	1.01	7.91	604.78	0.33	0.44	38.84	1.21
US08B-1.1	0.00	0.00	0.01	12.98	2.97	9.28	758.26	1.35	1.93	53.77	1.71
US08B-2.1	0.03	0.01	0.09	13.23	5.37	14.82	899.43	2.86	3.59	67.00	1.79
US08B-3.1	0.77	0.10	0.08	7.54	50.48	72.07	416.49	9.89	4.77	78.29	4.03

	Li	Be	B	F	Na	Al	P	K	Ca	Sc	48Ti
US08B-3.2	0.12	0.03	0.09	5.04	3.01	16.40	526.41	2.68	2.49	56.66	3.79
US08B-4.1	0.07	0.01	0.06	5.48	3.96	11.62	342.95	1.33	2.00	55.02	2.26
US08B-4.2	0.05	0.05	0.07	2.00	3.48	7.88	303.04	1.52	2.77	42.71	2.15
US08B-5.1	0.02	0.06	0.17	11.63	4.55	14.92	263.20	2.14	5.50	37.23	3.99
US08B-6.1	0.00	0.02	0.05	9.80	3.39	10.61	222.15	1.36	2.35	43.55	3.32
US08B-6.2	0.11	0.10	0.09	12.05	3.42	12.49	477.91	1.10	2.26	66.66	3.65
US08B-7.1	0.01	0.01	0.07	9.09	3.60	10.97	661.47	1.34	1.87	52.98	1.56
US08B-7.2	0.05	0.06	0.10	6.58	3.38	10.82	408.98	1.33	1.55	51.44	2.22
US08B-8.1	0.06	0.04	0.09	6.87	3.40	8.63	877.95	1.55	2.29	77.04	1.92
US08B-9.1	0.03	0.10	0.16	10.33	5.17	10.11	342.59	2.15	3.24	50.49	1.99
US08B-10.1	0.08	0.06	0.08	13.13	7.18	9.16	355.63	1.65	3.86	42.53	1.69
US08B-10.2	0.00	0.01	0.09	18.80	5.18	9.53	299.13	2.08	3.33	51.71	2.18
US08B-11.1	0.05	0.14	0.14	11.47	3.93	15.00	572.22	0.65	2.61	82.76	2.95
US08B-11.2	0.04	0.00	0.11	9.45	2.00	14.84	212.84	0.39	1.41	51.65	6.68
US08B-11.3	0.20	0.02	0.07	13.41	5.58	42.76	352.29	11.65	1.90	80.22	5.83
US08B-12.1	0.00	0.00	0.08	10.03	5.13	14.86	725.18	1.24	4.02	53.81	2.28
US08B-13.1	0.03	0.01	0.15	9.05	4.83	17.22	749.38	6.83	2.07	58.35	1.89
US08B-13.2	0.02	0.09	0.15	12.16	3.06	14.17	933.27	0.92	1.69	86.33	5.17
US08B-14.1	0.21	0.22	0.11	9.13	6.28	13.43	435.21	2.21	3.25	46.02	2.28
US08B-15.1	0.06	0.16	0.05	8.50	4.77	8.52	399.91	1.06	2.11	67.05	2.51
US08B-16.1	0.07	0.05	0.31	15.68	14.85	144.32	985.84	52.16	3.49	75.36	1.84
US08B-18.1	0.12	0.19	0.22	7.24	33.39	235.71	688.36	142.18	4.17	61.98	2.17
US08B-19.1	0.04	0.00	0.10	5.63	8.09	21.75	274.45	10.80	3.95	52.94	4.91
US08B-19.2	0.02	0.22	0.16	10.06	3.07	12.06	727.16	1.29	2.94	112.02	8.41
US08B-20.1	0.11	0.16	0.07	8.72	5.18	10.49	519.14	1.78	3.69	72.02	2.37
US08B-21.1	0.02	0.06	0.04	10.93	4.77	7.48	558.97	0.93	2.47	78.59	3.08

	Li	Be	B	F	Na	Al	P	K	Ca	Sc	48Ti
US08B-22.1	0.04	0.02	0.10	12.64	6.28	10.98	337.82	1.32	4.47	49.03	2.70
US08B-23.1	9.40	0.78	6.67	15.32	5562.74	13536.32	190.25	8923.48	292.80	25.52	28.70
US08B-23.2	0.09	0.04	0.10	8.85	6.92	10.43	380.92	2.78	3.43	88.52	2.83
US08B-24.1	0.06	0.61	0.09	11.33	6.06	13.30	356.02	1.44	3.04	58.35	3.09
US08B-24.2	0.01	0.01	0.06	4.97	3.53	8.79	364.97	0.70	2.25	52.36	2.86
US08B-25.1	1.06	0.54	2.78	12.13	965.48	3457.16	436.49	2074.01	71.54	45.47	7.74
US08B-25.2	0.00	0.11	0.14	8.33	2.15	10.59	464.01	0.60	1.88	64.48	3.97
US08B-26.1	0.04	0.19	0.04	5.64	5.28	7.85	397.35	1.59	2.65	67.83	1.75
US08B-27.1	0.02	0.00	0.06	3.59	4.74	10.52	458.09	0.65	3.23	59.36	2.10
US08B-27.2	0.02	0.00	0.09	5.04	4.46	10.67	750.94	1.10	2.71	70.15	2.72
US08B-23.3	0.04	0.06	0.12	12.17	6.29	9.50	328.29	1.73	3.07	72.85	2.30
US08b_GERONIMO-1.1	0.01	0.36	0.12	113.28	1.74	11.59	339.33	1.19	1.90	35.19	1.34
US08b_GERONIMO-2.1	0.03	0.10	0.11	54.89	2.12	14.20	384.59	1.30	1.17	35.20	1.22
US08b_GERONIMO-3.1	0.05	0.03	0.16	71.49	2.30	25.14	1048.41	4.83	2.59	70.23	2.73
US08b_GERONIMO-4.1	0.04	0.06	0.15	87.11	1.68	16.44	189.00	0.76	0.79	27.73	1.96
US08b_GERONIMO-5.1	0.01	0.21	0.11	21.02	1.20	29.20	198.84	10.56	0.59	31.42	2.04
US08b_GERONIMO-6.1	0.11	0.09	0.44	85.90	0.62	74.22	438.62	0.97	2.59	46.34	9.63
US08bAPPLE-1.1	0.04	0.00	0.07	116.54	0.85	15.99	853.15	0.46	1.65	54.81	1.30
US08bAPPLE-2.1	0.01	0.00	0.07	78.62	0.41	18.30	706.87	0.37	0.90	48.43	1.30
US08bAPPLE-3.1	0.01	0.03	0.06	93.75	1.35	15.43	857.73	1.23	1.35	56.28	1.93
US08bAPPLE-4.1	0.05	0.01	0.03	114.23	1.46	11.55	920.20	1.07	1.93	56.85	1.29
US08bAPPLE-5.1	0.04	0.05	0.07	150.08	0.82	11.68	985.96	0.57	1.94	61.74	1.23
DOME11-1.1	0.20	0.19	0.03	7.07	2.36	7.74	596.36	0.55	13.01	80.91	3.34
DOME11-1.2	0.15	0.05	0.02	6.72	3.05	5.39	776.19	0.41	7.42	81.56	2.92
DOME11-10.1	0.00	0.08	0.00	8.43	2.35	6.92	469.65	0.52	7.99	82.80	3.06

	Li	Be	B	F	Na	Al	P	K	Ca	Sc	48Ti
DOME11-10.2	0.00	0.04	0.03	5.32	2.55	8.25	277.78	0.54	11.35	36.85	2.03
DOME11-11.1	0.04	0.08	0.02	5.28	4.33	15.72	873.15	1.15	17.66	101.35	3.50
DOME11-11.2	0.72	8.26	0.00	4.42	34.11	137.43	286.84	86.69	111.33	48.72	3.33
DOME11-2.1	0.00	0.05	0.05	8.78	2.77	6.04	471.17	0.42	7.61	101.30	2.55
DOME11-2.2	0.00	0.01	0.14	25.56	4.78	18.02	399.35	0.89	83.43	79.88	2.82
DOME11-3.1	1.81	0.20	0.21	47.07	17.88	60.59	334.73	2.98	47.94	52.56	2.77
DOME11-3.2	7.54	0.06	0.11	126.45	14.56	32.95	339.74	22.62	998.43	57.97	2.81
DOME11-4.1	0.00	0.14	0.04	9.20	5.38	9.43	1038.14	1.03	11.24	109.42	3.30
DOME11-4.2	0.00	0.08	0.00	6.37	6.78	5.54	324.87	1.19	15.96	43.43	2.11
DOME11-5.1	0.01	0.00	0.03	3.78	4.61	12.57	540.21	0.84	11.98	52.20	1.88
DOME11-5.2	0.00	0.05	0.09	19.25	3.86	9.94	320.03	2.48	22.11	67.41	2.23
DOME11-6.1	0.00	0.28	0.03	9.75	3.23	7.50	362.93	0.56	8.78	57.92	2.71
DOME11-6.2	0.01	0.02	0.00	5.00	3.45	12.04	788.61	0.68	10.80	61.66	2.39
DOME11-7.1	0.14	0.05	0.01	5.05	3.71	11.63	297.03	0.63	16.39	44.76	2.47
DOME11-7.2	2.19	0.09	0.08	5.40	3.51	8.10	407.37	0.53	8.78	59.48	3.72
DOME11-8.1	0.02	0.01	0.00	2.91	2.46	8.71	244.41	0.60	10.66	62.69	8.55
DOME11-9.1	0.43	0.34	0.01	15.36	2.86	8.33	444.08	1.25	44.68	63.37	4.05
DOME11-9.2	0.26	0.01	0.00	2.91	2.79	8.70	742.79	0.58	10.17	55.76	1.60
US43-DOME11-1.1	0.06	3.21	0.06	8.90	0.66	29.55	315.98	0.08	0.14	41.45	1.11
US43-DOME11-10.1	0.02	0.09	0.18	12.54	3.11	21.10	894.77	0.77	0.62	57.80	1.16
US43-DOME11-11.1	0.00	0.01	0.04	7.50	3.27	13.75	618.53	0.06	0.12	41.16	1.10
US43-DOME11-12.1	0.01	0.39	0.12	11.31	6.05	21.26	914.91	2.42	2.28	58.23	1.20
US43-DOME11-13.1	0.37	0.49	0.06	29.73	0.52	18.96	766.46	0.04	0.24	50.61	1.05
US43-DOME11-14.1	33.04	0.38	0.15	14.67	0.31	37.29	734.99	0.14	0.47	46.29	0.95
US43-DOME11-14.2	29.39	0.32	0.04	24.84	0.31	16.54	720.64	0.03	0.33	55.13	1.23
US43-DOME11-15.1	0.00	0.10	0.05	10.33	2.02	19.24	762.14	0.46	1.35	53.29	1.14

	Li	Be	B	F	Na	Al	P	K	Ca	Sc	48Ti
US43-DOME11-16.1	0.01	0.03	0.04	18.90	3.36	14.25	678.08	0.15	0.73	43.86	1.37
US43-DOME11-17.1	0.02	0.25	0.04	4.87	1.29	17.34	815.51	0.07	0.39	44.03	1.32
US43-DOME11-18.1	0.12	0.33	0.04	25.87	1.35	17.88	901.84	0.41	0.65	68.10	1.39
US43-DOME11-19.1	0.00	0.12	0.16	60.90	0.40	19.57	697.35	0.07	0.68	52.76	1.13
US43-DOME11-2.1	0.01	0.79	0.10	17.13	1.54	22.26	300.50	1.19	1.10	42.62	1.21
US43-DOME11-20.1	0.00	0.25	0.09	31.57	1.27	21.38	725.64	1.05	0.59	41.38	1.13
US43-DOME11-20.2	0.00	0.34	0.06	5.08	0.15	15.26	810.76	0.03	0.18	59.93	1.35
US43-DOME11-21.1	0.10	0.25	0.04	36.18	0.16	15.84	849.80	0.04	0.28	57.68	1.02
US43-DOME11-22.1	0.00	0.12	0.09	9.15	3.15	18.23	902.52	0.13	0.68	67.13	1.20
US43-DOME11-23.1	0.01	0.51	0.05	5.17	0.19	13.81	932.39	0.05	0.74	67.61	1.31
US43-DOME11-24.1	0.16	1.07	0.19	9.55	7.14	25.44	301.09	1.42	15.60	35.59	1.71
US43-DOME11-25.1	7.19	0.27	0.05	14.25	0.98	14.56	817.57	0.24	0.27	65.79	1.23
US43-DOME11-26.1	0.00	0.22	0.07	8.61	0.39	17.81	899.60	0.09	0.41	77.15	1.29
US43-DOME11-27.1	0.05	0.53	0.04	10.62	1.48	12.49	728.84	1.08	0.32	50.13	1.06
US43-DOME11-28.1	0.00	0.00	0.03	1.43	0.36	13.99	620.84	0.03	0.17	46.39	1.22
US43-DOME11-3.1	0.02	0.25	0.19	31.69	2.00	17.93	798.08	0.47	0.28	50.38	1.36
US43-DOME11-30.1	0.06	0.91	0.18	44.60	7.50	49.18	504.35	0.33	0.69	60.74	1.40
US43-DOME11-30.2	0.01	0.01	0.01	38.48	2.67	11.84	699.57	0.06	0.22	45.51	1.01
US43-DOME11-31.1	0.52	0.06	8.74	11.89	143.65	744.05	15.59	21.90	6.01	3.05	18.47
US43-DOME11-34.1	0.60	8.36	0.03	2.57	0.94	16.50	230.11	0.08	0.12	33.83	0.88
US43-DOME11-34.2	0.16	0.08	0.16	53.76	3.91	18.03	454.92	0.08	0.31	39.64	1.23
US43-DOME11-34.3	1.15	0.27	0.22	14.44	2.31	20.63	324.65	0.33	0.53	48.28	1.81
US43-DOME11-35.1	0.00	0.06	0.06	9.96	4.58	14.62	807.15	0.18	0.57	61.36	1.17
US43-DOME11-36.1	0.01	0.28	0.06	21.39	1.19	14.26	880.48	0.05	0.24	62.41	1.10
US43-DOME11-37.1	0.02	0.11	0.21	13.07	2.87	19.49	802.54	0.66	1.58	66.84	1.42
US43-DOME11-38.1	0.15	0.35	0.04	10.33	1.70	27.54	815.03	0.15	0.46	56.09	1.08

	Li	Be	B	F	Na	Al	P	K	Ca	Sc	48Ti
US43-DOME11-39.1	0.01	1.75	0.04	4.37	1.50	12.84	263.14	0.40	0.82	31.86	1.25
US43-DOME11-4.1	0.03	0.08	0.05	15.79	0.44	15.86	881.28	0.03	0.12	67.92	2.07
US43-DOME11-40.1	0.00	0.03	0.06	40.33	4.78	14.10	762.81	0.51	1.10	55.37	1.10
US43-DOME11-41.1	0.00	0.04	0.04	24.42	0.93	16.49	712.08	0.05	0.40	51.96	1.38
US43-DOME11-42.1	0.08	0.14	0.04	18.20	0.62	14.39	455.46	0.05	0.25	42.59	1.02
US43-DOME11-43.1	0.00	0.04	0.02	23.03	0.29	15.68	808.56	0.10	0.54	56.47	1.10
US43-DOME11-5.1	0.00	1.88	0.11	17.15	0.63	14.86	390.49	0.04	0.29	46.68	1.02
US43-DOME11-6.1	0.00	0.05	0.05	6.04	0.59	12.83	647.96	0.03	0.23	43.71	0.92
US43-DOME11-7.1	0.00	0.22	0.03	50.53	0.19	14.00	981.40	0.04	0.53	73.32	1.32
US43-DOME11-8.1	0.00	0.01	0.11	0.99	0.52	20.95	604.85	0.11	0.50	45.49	1.73
US43-DOME11-9.1	0.00	0.02	0.03	13.49	1.27	13.80	614.63	0.05	0.77	42.76	0.86
A4WCF-1.1	10.67	0.05	0.15	52.47	1.13	19.34	95.13	3.59	1.54	34.01	2.32
A4WCF-2.1	0.00	0.03	0.06	18.24	0.65	8.58	942.99	0.80	0.37	66.77	1.40
A4WCF-3.1	0.04	0.01	0.12	99.40	1.12	23.56	843.44	1.22	1.95	64.14	1.99
A4WCF-4.1	0.01	0.03	0.04	27.74	0.41	13.46	963.79	0.80	0.28	70.47	1.58
A4WCF-5.1	0.12	0.01	0.45	124.39	0.66	12.58	923.62	1.38	1.01	64.38	2.71
US27-07B-1.1	0.01	0.00	0.03	13.19	11.38	16.73	686.13	3.11	59.55	57.96	1.64
US27-07B-1.2	0.01	0.00	0.04	16.16	11.45	14.74	610.40	6.25	14.98	48.98	1.42
US27-07B-2.1	0.01	0.00	0.04	20.19	5.34	50.73	805.10	1.60	3.40	65.84	1.94
US27-07B-3.1	0.02	0.00	0.05	10.64	10.54	19.73	636.34	6.18	8.56	53.12	1.65
US27-07B-4.1	2.04	0.07	0.05	8.48	2.10	16.23	168.87	1.70	4.09	35.95	3.46
US27-07B-5.1	0.00	0.00	0.05	16.14	3.08	15.09	523.72	1.44	7.80	47.16	1.51
US01-1.1	0.00	0.00	0.03	75.70	0.98	8.91	536.40	11.46	0.77	38.25	1.10

	Li	Be	B	F	Na	Al	P	K	Ca	Sc	48Ti
US01-2.1	0.04	0.01	0.03	22.40	0.36	6.67	678.43	0.52	0.20	47.42	1.13
US01-3.1	0.02	0.01	0.03	48.25	0.35	13.25	737.05	0.26	0.38	45.65	1.23
US01-4.1	0.02	0.01	0.05	42.23	1.82	8.05	609.58	2.18	0.50	47.46	1.36
US01-5.1	0.00	0.00	0.06	90.06	0.40	11.14	688.85	0.22	0.21	49.42	1.22
US01-6.1	0.00	0.00	0.04	44.55	1.31	5.50	678.05	0.97	0.31	45.57	1.47
US01-7.1	0.02	0.00	0.04	155.77	0.89	10.48	655.90	0.63	0.55	44.74	1.35
US01-TOP-1.1	0.05	0.00	0.29	254.37	1.95	17.97	643.19	3.28	2.06	45.23	1.92
US01-TOP-2.1	0.01	0.00	0.05	38.22	0.32	6.60	620.11	0.16	0.31	39.50	1.20
US01-TOP-3.1	0.03	0.00	0.04	32.49	0.60	8.84	644.44	0.36	0.59	45.02	1.22
US01-TOP-4.1	0.01	0.00	0.06	39.88	1.14	8.78	602.85	0.40	0.62	39.05	1.15
US01-TOP-5.1	0.18	0.01	0.08	55.05	1.25	9.71	801.18	0.59	0.68	59.56	1.42
US27-15A-1.1	0.00	0.00	0.06	13.34	2.82	58.18	1021.04	16.49	4.92	97.70	2.25
US27-15A-2.1	0.01	0.00	0.03	8.24	0.74	20.53	736.09	1.62	2.02	73.26	1.66
US27-15A-3.1	0.01	0.02	0.00	13.62	0.37	18.32	740.95	0.50	1.15	70.42	2.18
US27-15B-2.1	0.00	0.10	0.10	83.61	3.19	146.69	760.63	33.28	12.02	123.26	3.63
US27-15B-3.1	0.01	0.00	0.00	10.17	0.23	13.40	560.66	3.23	1.60	53.14	2.02
US27-15C-1.1	0.01	0.00	0.00	9.49	1.58	121.66	375.03	4.53	4.08	66.19	1.80
US27-15C-2.1	0.02	0.00	0.29	8.46	2.99	311.03	1026.36	10.08	8.24	79.41	2.46
US27-15C-4.1	0.00	0.04	0.00	11.55	0.59	84.49	453.10	1.57	3.45	81.16	2.07
US27-15C-5.1	0.00	0.00	0.00	29.98	0.83	156.67	1092.80	3.08	5.50	99.90	2.08
US27-15C-6.1	0.00	15.27	0.00	0.00	7.66	978.26	1379.76	27.14	47.71	131.46	0.00
US27-15C-7.1	0.00	0.08	0.08	6.28	0.89	68.66	771.96	2.11	2.47	61.64	2.51
US27-15C-6.1...dup1	0.08	3.66	0.08	25.58	0.43	58.71	955.41	0.85	4.62	96.70	2.67
US27-15C-6.1...dup2	0.01	3.92	0.00	11.08	0.24	53.11	819.38	1.89	2.38	112.01	3.06

	Li	Be	B	F	Na	Al	P	K	Ca	Sc	48Ti
US05B-1.1	0.30	0.06	0.50	7.77	154.57	652.53	272.06	335.09	24.82	63.47	6.50
US05B-1.2	0.01	0.02	0.06	5.16	3.96	7.74	316.34	1.35	2.14	81.52	3.11
US05B-3.1	0.04	0.05	0.21	9.30	5.57	15.67	406.31	1.94	4.50	92.13	3.25
US05B-3.2	0.06	0.02	0.06	15.45	5.61	10.92	443.85	1.30	4.88	86.71	3.29
US05B-4.1	12.78	0.36	11.23	119.58	6347.96	27878.05	118.31	13363.98	620.47	28.37	78.21
US05B-5.1	6.05	0.11	2.84	35.31	1069.45	4976.07	300.61	2142.95	121.15	72.65	29.49
US05B-5.2	0.01	0.02	0.07	9.03	3.53	8.07	685.41	0.67	2.46	93.22	3.26
US05B-7.1	0.02	0.01	0.07	4.93	4.75	15.99	711.43	10.16	2.38	80.27	2.07
US05B-8.1	0.02	0.01	0.06	8.09	5.77	10.96	244.54	1.03	2.62	49.41	2.23
US05B-8.2	0.07	0.02	0.11	19.20	3.96	18.06	364.25	2.51	46.13	77.08	6.95
US05B-8.3	0.04	0.00	0.04	7.45	4.19	13.11	255.93	2.12	2.95	52.09	566.59
US05B-9.1	0.02	2.69	0.18	7.96	4.86	12.62	1202.74	1.70	2.36	129.49	6.84
US05B-10.1	0.04	0.11	0.06	6.24	4.50	7.18	351.01	0.73	1.74	92.31	2.78
US05B-11.1	0.02	6.20	0.04	6.03	3.12	8.93	270.96	1.06	2.33	107.61	3.02
US05B-11.2	0.07	0.19	0.05	9.29	3.18	7.97	1130.16	1.07	2.20	86.59	4.65
US05B-12.1	0.11	0.03	0.08	6.17	8.05	10.75	305.97	8.69	5.29	77.54	3.37
US05B-13.1	0.02	0.04	0.10	4.65	13.52	79.02	295.70	67.63	3.10	67.75	3.06
US05B-13.2	0.06	0.05	0.10	6.94	3.33	7.87	376.85	0.74	2.29	95.19	6.87
US05B-14.1	0.01	0.01	0.05	6.27	6.08	7.13	250.45	1.01	5.41	78.36	2.65
US05B-14.2	0.01	0.05	0.08	7.74	2.15	7.80	315.50	0.74	1.65	100.69	2.90
US05B-14.3	0.00	0.01	0.08	8.68	4.90	7.91	387.01	0.91	3.74	76.41	3.10
US05B-15.1	0.00	0.04	0.03	4.01	6.18	7.49	326.73	1.31	7.25	52.64	3.67
US05B-16.1	0.05	0.06	0.14	7.58	3.47	9.45	324.42	1.43	1.76	92.48	4.26
US05B-16.2	0.28	0.15	0.09	9.45	46.83	189.89	833.74	112.89	9.30	150.46	9.73
US05B-1.1...dup1	0.00	0.01	0.03	70.85	0.61	9.10	865.91	1.38	0.87	88.81	2.44
US05B-2.1	0.00	0.00	0.02	56.90	0.48	9.88	545.96	1.28	1.84	56.76	4.87

	Li	Be	B	F	Na	Al	P	K	Ca	Sc	48Ti
US05B-3.1...dup1	0.01	0.00	0.16	133.20	1.22	11.63	728.88	2.77	1.98	84.56	2.36
US05B-4.1...dup1	0.00	0.03	0.04	18.56	0.24	6.82	718.57	0.62	0.48	69.05	1.98
US05B-4.2	0.09	0.08	0.07	5.06	3.24	8.12	268.98	0.98	2.11	114.87	3.17
US05B-5.1...dup1	0.01	0.05	0.07	21.04	0.61	6.19	284.76	8.27	0.91	53.37	1.99
US05B-8.4	0.00	0.00	0.07	5.37	3.16	9.51	560.05	0.67	2.04	73.97	2.99
US27-03A-10.1	0.16	0.13	0.01	11.38	0.48	11.91	787.77	2.04	1.55	88.64	2.08
US27-03A-10.2	0.04	0.04	0.04	7.95	0.88	18.44	807.83	1.60	2.95	95.53	1.99
US27-03A-13.1	0.32	0.22	0.00	14.14	6.15	27.39	904.38	5.52	10.23	104.55	2.49
US27-03A-14.1	0.02	0.07	0.05	139.49	2.21	25.93	825.90	33.83	8.58	108.72	2.17
US27-03A-19.1	0.30	0.00	0.02	13.53	10.43	23.82	781.58	20.53	17.85	87.80	1.90
US27-03A-20.1	0.05	0.02	0.03	26.23	5.50	14.68	624.56	2.88	1.76	75.15	1.95
US27-03A-20.2	0.05	0.00	0.08	18.15	2.94	13.83	629.19	1.09	4.79	62.84	1.82
US27-03A-21.1	0.03	0.07	0.00	10.85	1.20	14.87	665.71	3.43	1.01	72.40	1.55
US27-03A-22.1	0.96	0.13	3.95	176861.13	2149.41	436.15	907.24	601.47	105511.44	80.76	197.60
US27-03A-6.1	0.98	0.35	0.07	26.61	1.37	15.41	607.28	0.53	3.26	107.72	2.53
US27-03A-8.1	0.03	0.06	0.02	19.35	1.14	27.65	786.05	5.75	3.21	94.66	2.10
US27-03A-9.1	0.22	0.05	0.06	16.95	0.88	12.33	456.76	3.66	3.05	92.13	2.07
US27-03B-1.1	0.02	0.15	0.10	13.21	0.16	16.62	826.11	0.48	0.84	114.25	2.61
US27-03B-10.1	0.07	0.05	0.11	16.58	20.68	86.03	857.64	44.39	9.57	107.66	2.56
US27-03B-11.1	0.00	1.13	0.04	7.43	9.72	47.11	924.71	9.34	4.88	182.07	3.45
US27-03B-12.1	0.00	0.00	0.00	8.71	1.46	152.61	570.10	3.09	4.63	51.36	2.40
US27-03B-13.1	0.05	0.03	0.00	7.08	0.54	31.74	866.81	8.12	5.10	93.73	2.31
US27-03B-2.1	0.06	0.01	0.14	14.25	264.99	15.94	770.85	12.43	513.68	81.34	1.97
US27-03B-3.1	0.02	0.03	0.00	11.14	7.55	62.51	642.79	6.45	4.64	86.01	2.15
US27-03B-4.1	0.03	0.14	0.06	10.04	6.78	131.61	1203.12	6.07	6.92	137.65	2.77

	Li	Be	B	F	Na	Al	P	K	Ca	Sc	48Ti
US27-03B-5.1	0.00	0.00	0.00	8.83	4.25	46.92	765.01	10.85	4.01	120.28	2.75
US27-03B-6.1	0.01	0.12	0.25	121.76	19.88	72.53	709.45	419.38	65.86	169.91	8.28
US27-03B-7.1	0.05	0.00	0.14	3.97	0.56	57.77	882.33	1.20	1.59	106.74	2.18
US27-03B-7.2	0.00	0.09	0.00	15.83	1.58	161.25	861.76	2.77	8.41	101.38	1.93
US27-03B-9.1	0.01	0.00	0.15	8.03	0.99	26.77	657.15	3.08	2.89	94.73	2.14

	49Ti	Fe	Y	Nb	La	Ce	Nd	Sm	Eu	Gd	Ho
DOME6-1.2	2.41	0.64	1290.18	69.69	0.01	59.93	0.34	1.11	0.12	11.71	42.64
DOME6-10.1	3.34	131.48	981.16	9.01	0.01	18.23	0.82	2.38	0.21	23.94	40.21
DOME6-10.2	2.24	2.41	900.99	3.33	0.01	10.85	0.59	1.87	0.22	19.57	36.22
DOME6-11.1	2.12	16.45	1511.37	7.35	0.01	19.79	2.22	4.67	0.42	44.01	66.31
DOME6-11.2	2.93	11.37	1806.57	21.96	0.21	33.93	2.24	4.38	0.28	42.32	75.47
DOME6-12.1	3.13	0.42	1212.43	16.20	0.01	23.35	1.00	2.88	0.30	30.17	50.80
DOME6-12.2	2.96	0.46	846.07	3.46	0.01	11.57	0.61	1.75	0.22	19.49	35.91
DOME6-13.1	2.78	0.60	1368.35	13.89	0.02	25.96	1.04	3.41	0.26	35.32	56.88
DOME6-13.2	3.17	0.47	2169.56	5.61	0.01	24.45	4.54	9.02	1.01	79.24	96.20
DOME6-2.1	2.08	0.50	1423.00	11.83	0.01	15.63	0.58	2.53	0.25	29.74	60.25
DOME6-2.2	3.19	0.47	2763.78	41.38	0.02	44.05	1.52	5.18	0.42	64.22	118.37
DOME6-2.3	2.36	1.22	2589.34	56.65	0.01	29.16	0.89	4.36	0.23	61.43	109.51
DOME6-3.1	3.73	5.37	4103.82	98.17	0.02	57.95	1.82	7.34	0.33	95.19	169.24
DOME6-3.2	2.86	1.39	1922.31	18.68	0.01	25.61	1.53	4.58	0.31	50.42	82.77
DOME6-4.1	3.21	7.68	1232.84	15.05	0.01	22.06	0.98	2.75	0.23	33.45	54.44
DOME6-4.2	5.18	48.08	2211.28	24.66	0.02	57.65	2.17	5.63	0.54	65.25	89.73
DOME6-5.1	1.92	8.85	1344.37	10.67	0.01	12.13	0.53	2.16	0.22	27.10	51.68
DOME6-5.2	3.72	1.67	728.00	5.48	0.02	27.13	1.25	2.50	0.29	23.77	35.59
DOME6-5.3	2.71	8.36	1106.64	11.20	0.01	20.14	0.77	2.71	0.20	27.65	45.93
DOME6-6.1	2.69	0.39	779.31	4.69	0.01	10.51	0.51	1.69	0.18	19.21	33.45
DOME6-6.2	2.95	25.79	1387.35	14.53	0.01	28.69	1.17	3.43	0.24	35.27	57.15
DOME6-7.1	1.23	0.40	1953.30	10.87	0.01	12.54	1.14	4.62	0.35	51.48	90.30
DOME6-7.2	2.50	0.59	2836.66	59.21	0.01	33.08	0.94	4.50	0.30	62.20	116.66
DOME6-7.3	2.79	1.70	1093.51	10.74	0.01	20.33	0.85	2.61	0.21	25.78	45.84
DOME6-8.1	2.32	23.44	1727.74	9.24	0.01	21.87	2.30	5.57	0.41	51.07	77.49

	49Ti	Fe	Y	Nb	La	Ce	Nd	Sm	Eu	Gd	Ho
DOME6-8.2	2.52	0.42	955.56	5.42	0.01	11.47	0.66	2.09	0.20	22.36	40.57
DOME6-9.1	1.95	2.68	2608.45	13.59	0.02	16.11	1.86	6.12	0.36	61.75	105.16
DOME6-9.2	1.95	0.46	1585.62	26.81	0.01	18.75	0.46	2.03	0.15	28.17	69.54
US44-DOME6-1.1	1.18	1.06	2928.08	13.91	0.01	17.73	2.09	7.16	0.35	71.82	126.72
US44-DOME6-1.2	1.15	0.68	2851.18	13.65	0.01	16.71	1.88	6.34	0.32	66.80	115.72
US44-DOME6-1.3	1.27	1.48	3010.85	14.87	0.01	18.32	1.99	6.87	0.36	73.40	124.31
US44-DOME6-4.1	2.00	45.75	2872.37	13.86	0.02	17.09	2.09	6.54	0.34	66.19	110.03
US44-DOME6-2.1	1.15	10.46	2092.18	9.38	0.03	12.24	1.12	4.56	0.23	45.66	77.13
US44-DOME6-2.2	6.90	14.72	2457.00	11.79	0.01	13.31	1.39	5.30	0.28	51.86	87.90
US44-DOME6-7.1	1.16	6.61	2653.07	12.40	0.02	16.31	1.86	6.12	0.33	61.89	99.55
US44-DOME6-6.1	1.47	2.52	2214.54	9.01	0.01	16.41	1.66	5.56	0.34	59.88	102.09
US09-1.1	4.24	39.11	1370.07	14.27	0.11	14.36	0.64	2.02	0.14	22.04	51.56
US09-2.1	1.24	0.78	1006.73	13.11	0.04	7.56	0.29	1.20	0.08	15.57	39.77
US09-3.1	1.25	0.31	1972.70	12.09	0.01	12.10	0.93	3.46	0.20	32.52	61.51
US09-4.1	1.87	0.15	1484.62	12.69	0.01	15.29	0.58	2.17	0.18	25.61	54.67
US09-5.1	1.61	0.43	1761.07	21.66	0.02	10.97	0.31	1.97	0.09	26.36	64.56
US09-6.1	1.81	0.34	1463.46	12.92	0.03	15.93	0.66	2.23	0.18	25.43	57.81
US09-7.1	0.99	0.66	1222.19	14.39	0.03	8.49	0.27	1.34	0.07	17.44	46.13
US08B-1.1	1.61	1.07	1619.72	15.45	0.04	13.16	0.27	2.06	0.15	22.03	61.78
US08B-2.1	1.58	3.04	2406.52	27.23	0.07	13.88	0.42	2.20	0.12	34.50	89.36
US08B-3.1	4.09	6.99	2584.62	27.85	0.06	44.90	1.75	5.11	0.60	48.34	98.13
US08B-3.2	3.61	4.76	2752.61	36.10	0.08	35.55	1.14	4.47	0.43	51.01	105.32
US08B-4.1	2.16	1.37	1947.27	27.68	0.05	28.58	0.87	2.84	0.31	36.76	76.56
US08B-4.2	1.78	1.07	1547.69	23.51	0.04	22.00	0.57	2.40	0.29	28.64	63.66

	49Ti	Fe	Y	Nb	La	Ce	Nd	Sm	Eu	Gd	Ho
US08B-5.1	4.23	3.28	1268.93	17.02	0.04	19.54	0.65	2.15	0.19	22.32	47.90
US08B-6.1	3.71	1.33	962.08	9.69	0.05	27.16	1.21	3.16	0.35	24.22	38.89
US08B-6.2	3.44	0.84	4241.85	14.71	0.04	54.86	7.23	13.94	1.98	114.57	173.06
US08B-7.1	1.65	1.10	1546.92	17.06	0.03	11.64	0.45	1.98	0.14	21.85	58.27
US08B-7.2	1.91	1.25	1907.12	26.95	0.04	27.29	0.77	3.20	0.28	35.63	74.93
US08B-8.1	1.96	1.09	3098.48	40.37	0.01	24.55	0.70	3.37	0.25	49.51	121.01
US08B-9.1	1.56	1.76	1988.44	31.12	0.02	24.75	0.56	3.24	0.23	37.62	81.06
US08B-10.1	1.83	1.13	1935.76	32.42	0.03	20.02	0.51	2.41	0.27	34.41	73.77
US08B-10.2	1.89	1.49	1862.88	26.38	0.02	26.44	0.55	3.23	0.28	34.60	74.91
US08B-11.1	3.31	0.46	4521.65	92.08	0.08	56.61	1.32	7.18	0.49	89.81	178.94
US08B-11.2	6.87	0.50	1298.68	2.10	0.13	16.29	2.14	4.50	1.61	41.03	52.52
US08B-11.3	5.30	1.92	3159.31	6.66	0.18	47.90	10.18	16.51	2.83	117.69	131.13
US08B-12.1	2.15	1.31	1744.78	12.83	0.13	14.33	0.47	2.37	0.26	32.11	70.91
US08B-13.1	1.85	2.03	1800.29	16.44	0.07	12.50	0.44	2.35	0.17	26.07	66.85
US08B-13.2	5.62	0.95	5195.89	97.42	0.10	88.86	1.85	9.28	0.89	112.22	209.80
US08B-14.1	1.88	4.06	3058.11	16.41	0.05	19.83	2.10	6.15	0.52	67.27	122.57
US08B-15.1	2.46	0.97	2635.59	42.60	0.01	36.08	0.81	4.01	0.33	49.03	105.27
US08B-16.1	1.54	7.51	2808.95	36.86	0.04	15.02	0.33	3.03	0.12	38.42	107.75
US08B-18.1	1.32	11.90	3265.79	26.15	0.08	19.94	1.33	5.57	0.35	59.47	125.60
US08B-19.1	4.53	2.51	992.81	8.10	0.06	38.35	1.70	3.02	0.67	25.13	40.16
US08B-19.2	7.60	1.14	5448.72	13.86	0.11	55.69	14.05	28.99	9.04	213.57	225.68
US08B-20.1	2.07	1.36	3775.72	82.57	0.03	43.45	1.02	5.71	0.34	73.95	150.62
US08B-21.1	3.33	0.82	3460.34	60.98	0.03	58.41	1.24	6.14	0.61	74.97	142.76
US08B-22.1	2.82	1.18	1735.14	24.24	0.04	28.63	0.96	2.90	0.33	34.91	68.79
US08B-23.1	30.22	636.45	1157.69	25.02	0.81	18.25	1.42	2.13	0.16	22.36	47.72
US08B-23.2	2.28	1.93	2323.58	42.75	0.05	28.05	0.68	2.65	0.28	37.10	86.98

	49Ti	Fe	Y	Nb	La	Ce	Nd	Sm	Eu	Gd	Ho
US08B-24.1	3.32	1.19	1955.30	25.60	0.04	29.29	0.74	3.04	0.31	38.20	78.05
US08B-24.2	2.67	0.66	2105.25	26.91	0.04	32.43	0.81	3.59	0.46	40.12	81.61
US08B-25.1	8.11	251.90	4287.97	26.44	0.34	22.97	2.47	8.43	0.49	91.29	169.95
US08B-25.2	4.07	0.83	1966.71	7.50	0.04	34.38	3.63	7.16	1.40	54.33	77.25
US08B-26.1	2.02	0.97	2825.86	60.89	0.03	25.77	0.60	3.27	0.21	49.94	108.87
US08B-27.1	2.14	0.74	1801.34	24.88	0.03	20.44	0.52	2.55	0.27	32.15	69.82
US08B-27.2	2.46	0.98	1622.10	11.29	0.04	20.83	0.74	3.14	0.41	29.91	63.82
US08B-23.3	2.46	1.58	2352.72	42.52	0.01	24.94	0.48	2.98	0.21	35.62	92.38
US08b_GERONIMO-1.1	1.17	0.26	3048.69	14.72	0.02	17.32	2.04	6.93	0.41	67.63	122.34
US08b_GERONIMO-2.1	1.41	0.52	3668.36	20.58	0.03	17.16	1.90	7.58	0.38	78.94	145.84
US08b_GERONIMO-3.1	2.46	12.45	3135.71	38.09	0.06	17.55	0.65	2.71	0.23	42.66	116.10
US08b_GERONIMO-4.1	1.92	1.82	1429.09	7.39	0.03	12.43	0.74	3.27	0.32	33.94	56.90
US08b_GERONIMO-5.1	2.07	2.75	2010.47	12.63	0.05	13.07	1.15	4.38	0.31	47.14	93.85
US08b_GERONIMO-6.1	9.68	88.41	3051.01	18.54	0.61	26.54	3.15	7.38	0.58	65.11	119.88
US08bAPPLE-1.1	1.50	1.98	2474.32	29.59	0.04	12.72	0.47	2.05	0.15	35.73	95.58
US08bAPPLE-2.1	1.00	2.23	1957.00	23.94	0.03	10.60	0.25	1.98	0.09	26.58	77.42
US08bAPPLE-3.1	2.24	3.63	2421.62	29.96	0.04	13.83	0.34	2.96	0.20	40.10	103.94
US08bAPPLE-4.1	1.38	1.44	2453.04	28.16	0.05	12.78	0.41	2.41	0.14	37.47	97.68
US08bAPPLE-5.1	1.15	0.97	2359.17	28.61	0.03	11.75	0.39	2.08	0.10	29.10	80.36
DOME11-1.1	3.39	0.36	3021.67	50.87	0.01	53.12	1.46	6.66	0.55	80.52	132.36
DOME11-1.2	2.90	0.30	2682.86	38.83	0.01	41.68	1.50	5.43	0.45	65.24	112.47
DOME11-10.1	3.37	0.27	2439.36	35.08	0.01	39.77	0.94	4.23	0.42	54.14	102.26
DOME11-10.2	2.05	0.27	1185.25	11.39	0.01	18.52	0.69	2.48	0.20	26.14	49.76
DOME11-11.1	3.87	0.67	1237.64	5.49	0.01	24.58	1.05	2.97	0.42	26.23	42.58
DOME11-11.2	3.83	95.81	991.02	9.96	0.02	24.56	1.12	2.80	0.30	27.90	41.61

	49Ti	Fe	Y	Nb	La	Ce	Nd	Sm	Eu	Gd	Ho
DOME11-2.1	2.44	0.43	1684.87	25.33	0.01	43.91	0.87	2.93	0.10	37.41	68.17
DOME11-2.2	2.55	3.04	1398.34	16.84	0.06	36.42	0.84	2.71	0.07	29.97	55.17
DOME11-3.1	3.41	9.09	2172.29	7.11	0.03	20.55	2.27	7.40	0.99	64.23	97.90
DOME11-3.2	2.83	9.10	1142.68	16.71	0.09	15.31	0.77	1.99	0.21	22.69	46.13
DOME11-4.1	2.67	0.46	2324.38	17.22	0.02	31.97	1.45	6.11	0.62	74.78	161.00
DOME11-4.2	2.38	0.31	1236.24	15.46	0.01	19.15	0.62	2.18	0.23	27.63	51.33
DOME11-5.1	1.99	0.56	1021.44	7.56	0.01	8.08	0.28	1.39	0.15	18.84	41.57
DOME11-5.2	2.18	0.76	2079.67	33.51	0.03	25.61	0.75	3.42	0.29	42.90	84.74
DOME11-6.1	2.51	0.35	1525.08	23.30	0.01	26.84	0.69	3.10	0.29	39.81	69.61
DOME11-6.2	2.52	0.57	1337.97	8.16	0.01	13.67	0.50	2.42	0.25	26.52	55.77
DOME11-7.1	2.68	0.47	1304.13	15.07	0.01	18.75	0.73	2.41	0.23	28.78	54.97
DOME11-7.2	3.78	0.54	1459.81	15.06	0.01	34.37	1.12	3.59	0.45	38.84	60.95
DOME11-8.1	7.82	0.51	1217.90	1.91	0.02	10.35	2.95	5.18	1.77	39.08	50.10
DOME11-9.1	3.90	0.86	2089.45	24.03	0.04	57.98	1.56	5.07	0.99	57.76	91.63
DOME11-9.2	1.65	0.47	1284.15	9.42	0.01	10.05	0.37	1.51	0.23	24.48	60.40
US43-DOME11-1.1	1.20	1.97	3386.50	19.17	0.02	15.38	1.27	6.09	0.37	68.50	128.67
US43-DOME11-10.1	1.35	3.84	2411.98	28.95	0.03	13.89	0.43	2.48	0.17	41.47	103.50
US43-DOME11-11.1	1.18	4.11	1223.12	15.23	0.03	7.34	0.17	1.42	0.09	18.08	48.56
US43-DOME11-12.1	1.14	4.27	2091.96	23.93	0.03	9.75	0.31	1.81	0.09	25.97	66.41
US43-DOME11-13.1	1.15	4.34	1822.74	23.03	0.03	9.61	0.32	1.89	0.11	27.58	74.90
US43-DOME11-14.1	0.98	2.53	1480.43	16.41	0.03	8.22	0.30	1.71	0.12	23.38	59.73
US43-DOME11-14.2	1.04	3.67	1534.17	17.47	0.03	8.52	0.29	1.52	0.09	24.14	59.61
US43-DOME11-15.1	1.18	6.29	1851.19	23.94	0.02	10.84	0.31	1.92	0.13	30.09	81.86
US43-DOME11-16.1	1.41	4.85	1467.66	23.44	0.02	8.42	0.22	1.27	0.09	19.23	52.26
US43-DOME11-17.1	1.03	3.65	1468.76	15.23	0.03	7.55	0.24	1.65	0.11	22.22	59.30
US43-DOME11-18.1	1.38	4.80	2713.11	33.21	0.02	14.99	0.43	2.75	0.14	41.84	102.22

	49Ti	Fe	Y	Nb	La	Ce	Nd	Sm	Eu	Gd	Ho
US43-DOME11-19.1	1.07	4.23	1811.27	22.86	0.03	10.48	0.41	2.21	0.11	32.36	90.80
US43-DOME11-2.1	1.07	2.40	2589.64	11.04	0.03	19.71	2.15	6.68	0.65	63.14	108.19
US43-DOME11-20.1	1.06	13.15	1537.79	17.96	0.02	10.08	0.38	1.92	0.12	32.43	81.85
US43-DOME11-20.2	1.40	3.70	2563.17	38.26	0.03	25.06	0.57	3.71	0.24	57.29	125.75
US43-DOME11-21.1	1.08	4.01	1771.59	20.72	0.01	9.31	0.31	1.57	0.10	26.91	69.81
US43-DOME11-22.1	1.11	2.05	2348.58	30.82	0.01	14.14	0.41	2.48	0.15	39.91	107.86
US43-DOME11-23.1	1.16	4.35	2495.68	29.66	0.03	13.93	0.51	2.68	0.16	39.89	102.07
US43-DOME11-24.1	1.76	8.08	2195.58	10.51	0.02	21.06	1.71	6.00	0.63	57.40	94.28
US43-DOME11-25.1	1.27	3.62	1727.01	21.68	0.04	9.84	0.27	1.78	0.11	29.70	79.75
US43-DOME11-26.1	1.37	1.84	2874.30	37.44	0.02	17.99	0.54	3.38	0.23	47.81	122.89
US43-DOME11-27.1	0.99	1.78	1533.72	16.47	0.02	9.11	0.25	1.69	0.11	28.77	73.30
US43-DOME11-28.1	1.26	3.64	1433.54	14.59	0.02	10.60	0.38	2.02	0.15	27.26	68.70
US43-DOME11-3.1	1.26	84.64	1471.54	16.52	0.02	7.79	0.30	1.36	0.09	22.55	58.97
US43-DOME11-30.1	1.28	2.77	2008.07	23.21	0.03	13.46	0.49	2.93	0.16	45.48	115.36
US43-DOME11-30.2	0.92	4.05	1550.78	18.65	0.02	8.22	0.26	1.45	0.08	23.80	65.62
US43-DOME11-31.1	10.84	10.37	122.87	1.88	0.11	1.86	0.50	0.12	1.09	0.47	2.54
US43-DOME11-34.1	0.90	0.76	1944.78	12.31	0.02	11.66	0.37	2.48	0.15	26.23	57.21
US43-DOME11-34.2	1.40	2.19	977.88	10.10	0.02	7.09	0.25	1.08	0.11	16.38	45.26
US43-DOME11-34.3	1.57	0.40	2878.22	11.55	0.02	23.09	2.62	7.75	0.70	76.49	121.00
US43-DOME11-35.1	1.06	2.30	2120.64	28.37	0.02	11.65	0.33	2.11	0.12	31.78	83.37
US43-DOME11-36.1	1.08	1.97	1818.33	19.50	0.02	9.12	0.29	1.90	0.10	24.58	64.05
US43-DOME11-37.1	1.58	3.63	2018.66	22.07	0.02	13.17	0.43	2.21	0.14	29.22	69.16
US43-DOME11-38.1	1.27	1.15	2069.39	17.96	0.02	11.51	0.67	3.38	0.20	45.27	99.40
US43-DOME11-39.1	1.31	3.37	2290.70	9.95	0.02	15.36	1.38	5.09	0.44	49.87	82.60
US43-DOME11-4.1	2.53	4.92	2159.99	26.82	0.03	12.90	0.42	2.42	0.15	37.82	99.09
US43-DOME11-40.1	1.07	3.95	1881.06	22.87	0.02	10.15	0.31	1.97	0.11	30.50	82.44

	49Ti	Fe	Y	Nb	La	Ce	Nd	Sm	Eu	Gd	Ho
US43-DOME11-41.1	1.30	3.14	1685.49	18.51	0.02	10.24	0.36	1.84	0.13	30.68	76.12
US43-DOME11-42.1	1.28	5.08	1559.20	18.58	0.02	11.07	0.41	2.02	0.15	30.10	78.05
US43-DOME11-43.1	0.96	3.82	1631.07	16.68	0.02	9.88	0.27	1.69	0.16	25.69	64.80
US43-DOME11-5.1	0.89	1.26	4092.86	23.87	0.02	19.29	2.17	8.48	0.39	90.66	166.40
US43-DOME11-6.1	1.03	1.31	1136.63	12.19	0.03	5.84	0.12	1.05	0.08	16.16	43.78
US43-DOME11-7.1	1.27	4.29	2751.23	35.13	0.04	15.95	0.49	2.84	0.16	43.60	111.63
US43-DOME11-8.1	1.39	1.16	1128.79	13.24	0.03	6.54	0.21	1.29	0.10	15.78	45.62
US43-DOME11-9.1	1.01	4.41	1182.19	16.57	0.02	5.90	0.14	1.10	0.09	15.09	42.70
A4WCF-1.1	2.43	6.86	675.68	5.46	0.04	47.66	0.51	1.81	0.70	19.31	38.38
A4WCF-2.1	1.28	0.37	2939.88	38.24	0.01	16.98	0.51	3.02	0.14	43.60	113.65
A4WCF-3.1	2.16	5.22	2688.54	34.50	0.06	16.31	0.53	2.80	0.18	37.60	100.49
A4WCF-4.1	1.78	3.44	2996.44	37.22	0.03	17.39	0.52	2.92	0.17	43.25	113.86
A4WCF-5.1	2.54	2.30	2378.67	26.16	0.03	16.72	0.66	2.38	0.22	38.06	90.93
US27-07B-1.1	1.39	1.13	1272.51	8.59	0.02	8.74	0.37	1.73	0.18	20.70	47.19
US27-07B-1.2	1.51	0.60	1062.82	7.89	0.00	8.28	0.31	1.52	0.14	18.19	40.47
US27-07B-2.1	2.05	1.25	1955.91	18.17	0.11	15.09	0.58	2.51	0.31	38.02	79.45
US27-07B-3.1	1.58	2.04	1245.68	8.38	0.01	8.98	0.39	1.98	0.16	23.32	51.03
US27-07B-4.1	3.30	10.47	879.69	1.47	0.02	32.01	0.67	2.31	1.07	18.12	28.32
US27-07B-5.1	1.51	0.84	837.78	4.71	0.01	6.52	0.24	1.12	0.11	13.03	31.73
US01-1.1	1.28	0.38	1289.49	13.15	0.04	7.39	0.22	1.12	0.15	18.80	51.37
US01-2.1	1.47	0.36	1546.91	15.42	0.03	10.23	0.29	1.81	0.20	22.44	59.33
US01-3.1	1.35	0.21	1538.51	13.42	0.02	8.80	0.26	1.50	0.16	23.24	55.64
US01-4.1	1.38	0.53	1601.13	17.10	0.03	10.47	0.34	1.87	0.20	23.72	66.94

	49Ti	Fe	Y	Nb	La	Ce	Nd	Sm	Eu	Gd	Ho
US01-5.1	1.36	0.24	1609.10	16.15	0.02	10.10	0.20	1.52	0.17	22.12	58.34
US01-6.1	1.93	0.25	1439.35	13.93	0.03	9.50	0.26	1.34	0.17	20.93	55.56
US01-7.1	1.22	0.39	1425.64	15.85	0.02	9.49	0.33	1.59	0.19	23.32	63.18
US01-TOP-1.1	2.24	3.41	1371.00	17.78	0.06	9.81	0.45	1.51	0.17	20.41	56.86
US01-TOP-2.1	1.01	0.19	1267.41	13.67	0.02	8.83	0.18	1.40	0.19	20.23	57.36
US01-TOP-3.1	1.43	0.33	1357.04	16.64	0.01	9.98	0.24	1.37	0.15	20.09	51.77
US01-TOP-4.1	1.15	0.35	1291.46	13.28	0.03	8.07	0.26	1.47	0.16	21.26	55.52
US01-TOP-5.1	1.41	0.38	2190.38	22.25	0.04	14.95	0.47	2.19	0.29	31.21	83.27
US27-15A-1.1	2.30	0.73	2501.34	19.81	0.13	28.99	0.77	2.76	0.44	33.31	121.28
US27-15A-2.1	1.75	0.29	1376.15	11.45	0.04	15.32	0.29	1.91	0.37	29.17	67.39
US27-15A-3.1	1.99	0.51	1548.58	11.76	0.02	16.53	0.40	2.08	0.31	26.15	61.02
US27-15B-2.1	3.15	2.09	4157.93	59.61	0.19	75.88	1.96	5.67	0.96	87.71	138.97
US27-15B-3.1	2.22	0.39	1096.66	5.42	0.01	12.63	0.47	1.94	0.32	16.26	40.03
US27-15C-1.1	1.19	1.13	1982.95	33.11	0.13	22.98	0.93	1.99	0.34	30.65	97.34
US27-15C-2.1	1.85	2.50	3315.59	27.26	0.06	39.45	1.33	4.51	0.60	47.30	112.98
US27-15C-4.1	2.17	0.98	2057.15	22.70	0.17	22.13	0.58	2.28	0.41	33.18	78.88
US27-15C-5.1	2.03	1.71	3333.70	34.47	0.23	39.70	0.84	3.12	0.45	51.96	123.78
US27-15C-6.1	0.00	3.30	6703.27	62.19	0.00	75.86	0.00	8.68	1.03	70.81	198.93
US27-15C-7.1	2.51	1.20	1944.36	17.08	0.18	24.27	1.37	2.98	0.57	36.63	71.70
US27-15C-6.1...dup1	2.08	1.56	2232.90	16.28	0.10	24.70	0.98	3.04	0.51	41.71	97.32
US27-15C-6.1...dup2	3.28	1.05	2682.67	26.28	0.13	31.20	0.95	3.35	0.46	51.86	108.46
US05B-1.1	5.95	42.38	2240.97	14.25	0.14	35.77	1.76	4.72	1.00	45.46	86.02
US05B-1.2	3.97	1.00	1446.42	18.22	0.04	29.22	0.36	2.13	0.49	21.33	54.08
US05B-3.1	3.21	2.04	2382.07	32.92	0.03	47.87	0.91	3.86	0.61	45.13	93.95

	49Ti	Fe	Y	Nb	La	Ce	Nd	Sm	Eu	Gd	Ho
US05B-3.2	3.78	4.21	2681.01	43.19	0.07	47.70	0.70	3.64	0.65	49.44	107.09
US05B-4.1	79.56	1655.31	822.84	17.24	1.22	25.58	2.35	1.98	0.26	15.33	33.55
US05B-5.1	28.93	172.41	1628.55	16.88	1.33	39.35	1.58	2.48	0.55	28.76	60.42
US05B-5.2	3.13	0.64	1904.31	10.22	0.02	40.93	1.34	4.15	1.24	38.32	75.19
US05B-7.1	1.77	1.88	1762.91	16.06	0.03	20.07	0.37	2.02	0.33	23.90	65.52
US05B-8.1	2.04	0.89	1207.27	15.08	0.02	21.42	0.35	1.88	0.34	19.89	45.45
US05B-8.2	7.15	4.43	2217.22	33.42	0.25	38.86	0.96	2.96	0.50	38.57	85.91
US05B-8.3	568.05	805.46	966.77	11.30	0.04	23.74	0.48	1.62	0.49	17.06	37.42
US05B-9.1	7.25	1.27	5916.01	32.29	0.04	252.15	5.86	14.73	4.68	133.72	225.15
US05B-10.1	3.06	0.61	2272.26	33.19	0.05	36.06	0.63	2.46	0.50	34.61	85.99
US05B-11.1	2.88	1.24	1640.16	22.34	0.05	26.02	0.49	1.98	0.42	23.37	60.98
US05B-11.2	4.37	1.03	3212.71	22.83	0.06	65.72	2.39	6.25	1.35	65.05	115.99
US05B-12.1	3.20	4.67	1473.68	20.42	0.04	26.71	0.65	2.25	0.44	23.61	56.11
US05B-13.1	3.65	6.09	1497.52	16.36	0.03	32.67	0.74	2.53	0.44	25.52	55.78
US05B-13.2	7.06	0.57	2663.47	32.75	0.02	123.70	2.45	6.09	1.56	60.20	100.36
US05B-14.1	2.83	0.97	1433.35	20.61	0.03	25.09	0.44	1.86	0.36	20.78	54.36
US05B-14.2	2.87	0.98	2028.70	30.34	0.03	30.75	0.53	2.00	0.47	28.06	75.85
US05B-14.3	3.61	0.77	2115.77	30.32	0.01	48.75	0.90	3.47	0.68	42.06	83.98
US05B-15.1	3.94	1.23	1695.40	7.37	0.04	26.93	2.55	4.97	1.60	46.30	70.78
US05B-16.1	4.66	1.78	1610.35	19.69	0.02	27.63	0.90	2.58	0.55	25.01	59.09
US05B-16.2	9.96	13.25	4551.14	44.46	0.07	220.67	6.35	14.29	3.66	111.10	167.48
US05B-1.1...dup1	2.46	0.69	2021.07	16.71	0.05	20.30	0.39	2.31	0.34	28.66	71.04
US05B-2.1	4.38	6.26	1107.90	9.34	0.04	11.00	0.29	1.11	0.24	15.19	38.69
US05B-3.1...dup1	2.39	0.82	1724.94	17.60	0.03	18.90	0.41	2.04	0.33	25.38	66.78
US05B-4.1...dup1	2.32	1.20	1603.18	10.89	0.03	13.97	0.33	1.75	0.28	24.72	65.62
US05B-4.2	3.08	1.52	1855.92	28.36	0.02	28.94	0.57	2.39	0.49	25.52	70.51

	49Ti	Fe	Y	Nb	La	Ce	Nd	Sm	Eu	Gd	Ho
US05B-5.1...dup1	1.91	2.58	2460.21	10.76	0.07	20.62	1.25	5.02	0.71	49.41	94.24
US05B-8.4	3.35	0.81	1317.64	9.24	0.01	27.52	0.76	2.42	0.51	24.51	52.33
US27-03A-10.1	2.00	0.41	1779.74	14.19	0.01	18.22	0.40	2.04	0.37	28.21	68.30
US27-03A-10.2	1.78	0.45	1759.87	14.92	0.02	17.93	0.39	1.97	0.38	28.25	66.15
US27-03A-13.1	2.01	0.56	2142.54	18.93	0.04	22.83	0.51	2.67	0.41	34.39	75.79
US27-03A-14.1	1.80	0.55	1990.97	16.08	0.02	20.48	0.40	2.43	0.44	29.04	71.23
US27-03A-19.1	1.80	0.42	1532.82	10.47	0.03	13.41	0.36	1.86	0.27	24.44	58.81
US27-03A-20.1	2.12	1.16	1278.52	9.02	0.01	13.52	0.34	1.76	0.35	25.66	64.39
US27-03A-20.2	1.62	0.89	1135.95	6.60	0.01	12.00	0.28	1.69	0.35	24.65	60.24
US27-03A-21.1	1.61	0.36	1056.77	7.97	0.01	10.44	0.19	1.21	0.18	14.72	39.89
US27-03A-22.1	170.27	111.58	1479.79	11.46	3.30	66.19	9.60	6.01	0.79	30.83	65.16
US27-03A-6.1	2.41	0.72	2015.82	24.86	0.02	24.96	0.49	2.62	0.42	29.41	79.30
US27-03A-8.1	1.90	0.59	1635.95	13.99	0.02	18.10	0.46	2.28	0.41	31.77	75.10
US27-03A-9.1	2.16	0.44	1584.56	11.15	0.01	17.00	0.37	1.95	0.37	29.67	70.45
US27-03B-1.1	2.85	0.93	2012.07	16.44	0.08	20.68	0.58	2.42	0.40	24.57	73.01
US27-03B-10.1	2.73	1.42	2567.09	21.77	0.10	27.89	0.74	3.21	0.53	40.99	108.78
US27-03B-11.1	3.45	0.84	3482.55	28.06	0.10	39.84	1.10	3.86	0.87	54.92	126.46
US27-03B-12.1	2.05	1.83	1218.76	11.39	0.14	21.73	0.86	1.27	0.22	10.90	42.21
US27-03B-13.1	2.71	0.64	2224.68	17.66	0.05	20.03	0.73	2.21	0.51	32.65	85.22
US27-03B-2.1	1.94	2.21	1238.65	8.94	0.07	12.33	0.31	1.33	0.27	18.51	43.18
US27-03B-3.1	1.97	0.78	1584.40	12.11	0.08	17.48	0.39	2.04	0.35	25.70	57.82
US27-03B-4.1	2.46	1.17	3717.21	30.26	0.13	38.06	0.82	4.02	0.71	55.78	132.13
US27-03B-5.1	2.37	1.22	2760.47	29.02	0.14	25.28	0.72	2.80	0.46	33.37	102.44
US27-03B-6.1	6.33	4.66	3940.48	46.99	0.10	67.08	1.81	5.66	0.95	62.68	143.03
US27-03B-7.1	2.08	0.60	2423.28	23.14	0.12	22.05	0.78	1.92	0.44	32.57	74.92

	49Ti	Fe	Y	Nb	La	Ce	Nd	Sm	Eu	Gd	Ho
US27-03B-7.2	1.16	1.27	3296.56	41.07	0.20	38.27	1.04	4.37	0.73	75.10	164.48
US27-03B-9.1	2.10	0.41	1994.02	16.68	0.04	19.33	0.46	2.13	0.34	26.53	76.20

	Tb	Dy	Er	Tm	Yb	Lu	Hf	Pb	Th	U
DOME6-1.2	5.72	86.64	266.45	80.58	823.80	177.76	12967.11	0.00	1151.62	1987.65
DOME6-10.1	9.06	108.52	190.03	41.79	334.48	61.48	8757.36	0.00	278.08	545.21
DOME6-10.2	7.44	99.91	181.40	37.81	336.23	64.62	8119.42	0.00	161.18	387.77
DOME6-11.1	14.54	170.05	288.53	62.54	492.18	83.48	7613.02	0.00	289.34	548.49
DOME6-11.2	15.94	201.90	349.42	73.67	602.77	106.59	9432.11	0.00	470.39	1047.21
DOME6-12.1	10.20	131.85	252.78	51.80	458.52	86.48	8266.85	0.00	293.80	615.67
DOME6-12.2	7.54	96.86	171.19	34.23	337.91	63.95	8942.08	0.00	106.12	305.45
DOME6-13.1	12.54	155.90	269.24	60.32	483.01	85.83	9478.71	0.00	314.28	685.49
DOME6-13.2	22.60	249.76	391.71	79.19	664.17	115.55	7446.39	0.00	339.11	508.51
DOME6-2.1	12.33	161.31	306.17	66.28	567.22	103.29	10193.63	0.00	439.42	977.82
DOME6-2.2	25.26	278.58	476.75	92.07	906.47	150.13	9539.31	0.05	1120.52	2329.33
DOME6-2.3	23.98	302.87	520.98	113.41	866.36	149.45	9758.62	0.00	2313.39	3553.57
DOME6-3.1	35.21	447.86	830.35	185.67	1491.87	258.30	11808.77	0.00	1983.76	3616.60
DOME6-3.2	19.06	226.98	403.62	85.74	683.84	123.00	9747.09	0.00	533.10	1075.89
DOME6-4.1	11.43	147.08	261.38	52.11	471.29	86.10	10465.68	0.00	517.77	889.42
DOME6-4.2	21.29	249.99	406.55	88.46	674.45	118.31	8980.11	0.00	1168.99	1406.13
DOME6-5.1	10.24	132.93	247.15	52.91	462.22	83.45	9115.79	0.00	255.29	625.51
DOME6-5.2	8.35	97.30	167.49	35.39	302.90	55.88	8335.44	0.00	200.72	337.89
DOME6-5.3	9.93	124.75	221.48	43.57	379.92	69.29	8678.26	0.00	341.85	669.56
DOME6-6.1	6.66	90.39	167.15	38.43	326.87	60.02	7868.96	0.00	122.54	347.53
DOME6-6.2	12.59	156.03	259.48	52.07	443.32	78.54	8881.06	0.00	778.61	1144.18
DOME6-7.1	18.85	238.78	439.35	98.97	788.83	139.25	9743.25	0.00	452.91	1052.42
DOME6-7.2	24.73	318.72	578.14	124.38	1017.26	174.91	9824.88	0.00	1450.57	2728.94
DOME6-7.3	9.74	120.57	214.42	44.63	366.45	66.67	8854.74	0.02	402.23	747.11
DOME6-8.1	17.14	216.08	357.27	70.22	630.01	112.43	9122.16	0.00	353.84	642.50

	Tb	Dy	Er	Tm	Yb	Lu	Hf	Pb	Th	U
DOME6-8.2	8.30	108.25	202.93	44.58	382.80	70.78	8618.07	0.00	142.53	422.45
DOME6-9.1	23.21	291.21	480.17	90.71	829.41	143.49	10021.93	0.02	704.08	1441.18
DOME6-9.2	12.75	169.59	366.73	80.22	716.05	133.94	10855.25	0.00	330.23	1026.03
US44-DOME6-1.1	26.70	311.53	568.07	118.38	939.68	161.33	12523.76	0.03	578.85	1232.56
US44-DOME6-1.2	24.98	292.85	541.20	117.17	930.48	159.78	12314.07	0.00	526.82	1140.99
US44-DOME6-1.3	27.65	310.90	575.84	112.58	964.28	169.50	12283.94	0.05	582.59	1254.25
US44-DOME6-4.1	23.79	267.16	488.63	100.42	826.04	146.83	12337.07	0.03	495.67	1087.09
US44-DOME6-2.1	17.29	193.91	360.45	75.96	612.18	108.26	11610.44	0.03	331.34	776.15
US44-DOME6-2.2	18.64	210.51	377.47	74.12	633.44	109.44	13021.67	0.05	267.07	650.47
US44-DOME6-7.1	21.14	241.69	439.89	87.04	724.14	128.11	11488.08	0.03	396.49	880.18
US44-DOME6-6.1	22.32	264.28	477.16	97.05	807.47	147.27	12592.98	0.27	493.13	1030.01
US09-1.1	10.09	117.94	250.35	54.74	474.17	89.61	10635.73	0.38	210.45	745.90
US09-2.1	6.92	88.69	191.38	41.33	370.05	69.77	10873.28	0.05	145.24	606.79
US09-3.1	12.92	146.79	274.78	61.26	485.88	86.71	11114.43	0.30	197.31	580.73
US09-4.1	9.94	119.87	256.36	56.10	498.88	92.30	9227.75	0.10	244.04	732.29
US09-5.1	10.86	140.49	310.04	69.64	609.03	115.70	11819.66	0.33	289.79	1157.20
US09-6.1	10.87	133.07	278.54	62.88	540.12	100.38	9525.64	0.06	258.23	797.43
US09-7.1	7.96	99.84	225.11	53.44	446.28	86.82	10372.01	0.16	124.69	544.49
US08B-1.1	10.90	137.78	297.01	68.54	575.77	109.78	11064.50	0.03	277.19	936.75
US08B-2.1	15.31	203.63	420.20	93.19	823.09	151.35	12247.41	0.00	495.81	1707.32
US08B-3.1	18.52	233.88	444.26	96.27	804.19	148.53	10543.16	0.03	528.24	1155.17
US08B-3.2	21.85	258.65	489.49	107.23	866.30	157.44	11538.88	0.00	967.41	2194.71
US08B-4.1	15.48	181.98	348.10	78.44	640.90	117.05	12314.70	0.03	554.09	1435.18
US08B-4.2	12.52	155.26	296.39	61.87	541.51	100.45	11568.74	0.00	547.89	1263.42

	Tb	Dy	Er	Tm	Yb	Lu	Hf	Pb	Th	U
US08B-5.1	9.44	113.83	224.78	49.80	409.07	76.52	11196.64	0.00	262.49	721.93
US08B-6.1	8.74	99.81	172.80	37.46	298.65	56.32	9029.93	0.03	165.46	322.45
US08B-6.2	42.32	450.76	741.11	149.79	1206.07	211.76	10631.92	0.00	782.82	1115.41
US08B-7.1	9.76	133.15	277.46	64.54	543.50	105.39	11922.31	0.00	232.91	905.97
US08B-7.2	15.54	188.67	352.50	75.77	643.08	114.39	11436.33	0.00	720.53	1620.33
US08B-8.1	22.63	287.03	574.13	125.50	1058.73	190.06	11007.33	0.00	793.47	2114.58
US08B-9.1	15.70	187.74	366.47	80.69	678.85	123.34	11005.33	0.03	558.97	1583.22
US08B-10.1	15.74	182.96	352.30	74.76	601.85	108.80	11307.82	0.00	909.33	2101.52
US08B-10.2	14.55	191.46	359.88	80.67	670.92	119.05	11986.58	0.03	452.41	1364.25
US08B-11.1	33.74	427.80	763.86	167.87	1320.99	239.24	14349.05	0.00	2714.92	4551.82
US08B-11.2	11.98	133.06	219.26	45.45	371.20	69.15	10358.82	0.03	108.60	176.56
US08B-11.3	31.75	340.74	525.59	110.08	863.66	157.36	10217.99	0.00	384.28	480.40
US08B-12.1	11.86	152.46	308.55	72.27	606.11	112.06	14905.79	0.00	295.89	986.89
US08B-13.1	12.16	154.56	322.81	72.84	619.73	115.39	11190.14	0.03	308.68	1034.94
US08B-13.2	42.51	503.88	884.45	182.44	1490.94	259.25	13834.31	0.00	4879.18	5551.07
US08B-14.1	25.35	298.03	545.19	113.83	947.14	169.22	11226.39	0.00	548.12	1281.55
US08B-15.1	20.76	255.25	473.02	109.85	851.37	155.51	11647.91	0.00	679.53	1939.61
US08B-16.1	18.84	243.17	523.66	118.14	987.49	178.68	11163.09	0.03	597.04	1935.29
US08B-18.1	24.55	297.35	577.25	127.89	1043.34	188.04	12460.84	0.11	631.49	1748.48
US08B-19.1	8.85	100.84	178.50	38.01	328.61	61.81	9245.92	0.00	206.89	362.40
US08B-19.2	65.46	638.43	918.61	178.07	1405.95	243.93	7271.45	0.00	664.07	596.24
US08B-20.1	30.46	358.23	674.55	147.60	1174.32	204.95	12806.28	0.00	2220.31	4053.23
US08B-21.1	30.28	357.89	638.03	137.87	1096.47	192.26	10799.73	0.00	1988.01	3229.52
US08B-22.1	13.52	159.43	299.13	64.59	529.38	100.32	11831.91	0.03	628.62	1228.77
US08B-23.1	8.95	106.79	204.50	43.51	354.50	65.25	6709.64	1.22	494.48	1131.65
US08B-23.2	14.73	199.70	423.94	96.07	825.11	154.45	11144.01	0.00	377.87	1195.39

	Tb	Dy	Er	Tm	Yb	Lu	Hf	Pb	Th	U
US08B-24.1	15.27	186.73	349.35	75.91	649.70	117.93	13993.74	0.03	398.70	1172.49
US08B-24.2	16.63	203.12	374.72	82.46	690.81	126.79	12226.68	0.00	656.81	1491.46
US08B-25.1	34.81	413.99	742.49	154.19	1251.18	218.39	11544.04	0.33	930.26	2174.75
US08B-25.2	18.76	201.65	335.45	71.34	589.58	106.25	8547.58	0.00	289.36	444.96
US08B-26.1	21.04	255.69	521.94	117.72	980.49	176.62	12330.23	0.00	771.49	2433.08
US08B-27.1	13.50	162.33	324.86	71.99	618.59	114.96	11361.16	0.00	362.21	1127.28
US08B-27.2	12.56	154.27	306.03	70.11	587.83	112.24	9765.64	0.00	302.20	794.56
US08B-23.3	16.05	216.55	440.63	100.00	850.35	154.85	11806.36	0.02	437.36	1429.52
US08b_GERONIMO-1.1	27.03	301.55	556.69	117.54	943.21	170.30	11183.18	0.10	584.03	1341.03
US08b_GERONIMO-2.1	30.74	353.22	652.98	137.09	1102.68	195.90	11698.25	0.34	738.35	1818.17
US08b_GERONIMO-3.1	21.09	272.38	582.95	129.34	1113.76	202.23	11956.29	0.19	791.51	2429.87
US08b_GERONIMO-4.1	13.09	145.00	266.68	57.50	472.86	86.06	11585.34	0.20	198.49	449.49
US08b_GERONIMO-5.1	19.71	224.28	431.52	94.24	757.60	135.45	11447.86	0.17	406.78	1044.76
US08b_GERONIMO-6.1	25.65	303.19	546.14	118.08	934.35	162.26	10646.41	1.06	610.50	1444.12
US08bAPPLE-1.1	17.12	223.47	494.85	106.96	920.07	166.63	13108.41	0.27	511.74	1767.68
US08bAPPLE-2.1	13.20	179.70	389.95	88.35	744.13	140.59	12374.04	0.46	394.10	1550.69
US08bAPPLE-3.1	19.07	236.16	501.63	108.01	971.80	177.18	14321.30	0.51	736.74	2447.17
US08bAPPLE-4.1	16.55	218.66	455.13	100.68	853.24	156.18	12646.27	0.17	610.43	2029.18
US08bAPPLE-5.1	14.01	185.28	389.93	86.87	739.39	141.22	11985.91	0.12	427.88	1511.91
DOME11-1.1	30.47	371.19	595.52	115.51	975.88	169.13	10131.53	0.00	3363.19	3548.52
DOME11-1.2	23.77	302.92	509.25	111.68	832.27	148.34	9460.60	0.02	2143.81	2541.62
DOME11-10.1	20.39	256.69	498.91	106.82	894.29	159.53	10085.93	0.00	696.67	1582.39
DOME11-10.2	10.23	130.82	238.46	53.60	436.68	79.68	10173.84	0.00	256.39	583.81
DOME11-11.1	9.49	112.41	209.20	44.40	394.08	73.57	9171.44	0.00	176.97	359.74
DOME11-11.2	9.92	114.84	196.87	44.06	350.19	60.62	8830.85	0.00	433.07	650.27

	Tb	Dy	Er	Tm	Yb	Lu	Hf	Pb	Th	U
DOME11-2.1	13.86	186.37	334.76	73.57	606.00	112.10	10074.59	0.11	794.62	1427.09
DOME11-2.2	11.14	146.02	251.68	54.68	461.97	85.78	10652.56	0.09	651.19	1251.63
DOME11-3.1	21.04	242.97	386.41	78.09	611.94	106.23	10927.90	0.03	254.99	468.35
DOME11-3.2	8.68	117.74	247.56	56.06	481.86	92.07	9647.89	0.02	210.66	674.60
DOME11-4.1	31.16	432.63	793.48	171.42	1532.29	300.27	19563.74	0.00	1087.13	2343.13
DOME11-4.2	10.88	140.45	252.36	55.47	440.68	80.95	9895.17	0.00	505.31	971.40
DOME11-5.1	7.71	102.67	203.55	41.78	398.24	76.61	10189.13	0.00	168.54	573.58
DOME11-5.2	17.61	226.14	408.19	85.10	734.41	130.46	9274.21	0.00	581.25	1547.91
DOME11-6.1	14.86	185.61	328.01	72.28	562.10	100.77	10140.87	0.02	807.45	1408.81
DOME11-6.2	10.69	142.20	280.18	61.49	534.07	102.32	9935.58	0.00	271.43	731.61
DOME11-7.1	11.03	139.48	262.07	59.92	486.56	85.38	11402.56	0.03	311.32	794.82
DOME11-7.2	14.03	170.55	298.74	62.84	521.37	94.52	10281.61	0.00	577.59	913.41
DOME11-8.1	12.28	138.08	224.18	43.29	389.03	73.28	7125.96	0.03	87.77	133.48
DOME11-9.1	20.47	253.10	423.18	96.24	736.22	127.74	8921.35	0.03	1404.73	1666.72
DOME11-9.2	10.50	140.70	302.26	68.97	577.05	110.15	11614.52	0.00	281.06	915.55
US43-DOME11-1.1	27.74	324.30	590.96	125.94	978.95	170.01	13530.65	0.06	629.72	1464.16
US43-DOME11-10.1	17.80	237.45	509.09	116.17	941.69	174.34	13457.86	0.02	742.20	2179.97
US43-DOME11-11.1	8.80	112.76	249.78	60.05	494.59	94.17	12131.62	0.16	208.89	856.03
US43-DOME11-12.1	11.58	152.17	304.41	75.28	623.88	120.30	13088.10	1.61	449.54	1415.12
US43-DOME11-13.1	12.83	166.29	376.84	84.10	711.78	131.57	13005.12	0.07	456.58	1609.81
US43-DOME11-14.1	10.26	135.43	295.06	65.94	562.75	108.49	12820.19	0.15	286.41	1087.38
US43-DOME11-14.2	10.52	136.55	297.53	69.02	578.02	110.11	12216.25	0.03	297.96	1092.54
US43-DOME11-15.1	13.94	189.72	410.72	93.23	783.13	147.30	12565.90	0.12	518.57	1784.43
US43-DOME11-16.1	8.85	113.77	249.03	57.69	467.95	88.06	12710.35	0.04	237.51	940.11
US43-DOME11-17.1	10.39	136.13	297.90	69.33	569.55	106.82	12767.32	0.13	337.16	1156.66
US43-DOME11-18.1	18.43	246.42	505.58	113.30	943.44	169.71	12594.56	0.63	802.62	2198.21

	Tb	Dy	Er	Tm	Yb	Lu	Hf	Pb	Th	U
US43-DOME11-19.1	16.16	213.44	454.24	98.78	822.58	149.83	12822.84	0.17	534.09	1669.95
US43-DOME11-2.1	24.02	271.91	490.41	107.05	840.77	149.42	11623.53	0.17	496.81	971.01
US43-DOME11-20.1	14.63	194.21	411.35	92.45	780.50	140.73	11884.41	0.24	609.33	1666.34
US43-DOME11-20.2	25.38	319.37	618.17	142.85	1135.89	203.34	12991.69	0.02	1138.60	3055.34
US43-DOME11-21.1	11.89	160.20	344.12	81.47	651.55	123.61	12106.61	0.11	386.06	1278.03
US43-DOME11-22.1	18.11	244.39	532.45	122.16	991.99	180.60	13098.15	0.06	684.41	2048.69
US43-DOME11-23.1	18.10	239.91	499.27	113.45	912.11	166.52	12527.25	0.30	721.13	2072.09
US43-DOME11-24.1	20.89	243.42	438.25	97.52	758.84	137.96	12017.31	0.14	524.15	1000.95
US43-DOME11-25.1	13.13	182.00	395.26	94.32	738.67	139.29	13035.51	0.20	484.66	1700.64
US43-DOME11-26.1	22.11	285.44	598.80	136.36	1075.82	192.25	13247.11	0.19	724.65	2043.37
US43-DOME11-27.1	13.13	173.32	374.03	85.29	719.53	131.59	12445.14	0.02	509.72	1545.45
US43-DOME11-28.1	12.43	156.02	339.00	78.04	640.17	117.17	11791.90	0.02	416.64	1188.85
US43-DOME11-3.1	10.23	135.07	289.27	61.86	573.69	108.83	12758.54	0.13	415.71	1375.11
US43-DOME11-30.1	20.25	262.83	545.67	123.60	1011.79	183.97	14448.70	0.09	839.24	2224.25
US43-DOME11-30.2	11.44	152.63	333.71	73.52	648.99	121.38	13366.70	0.04	455.48	1596.42
US43-DOME11-31.1	0.33	4.76	10.03	1.57	20.67	3.87	180.86	11.19	11.12	41.79
US43-DOME11-34.1	11.01	132.36	255.39	52.43	455.10	79.81	13056.54	0.09	185.38	565.65
US43-DOME11-34.2	7.96	102.27	226.67	51.83	439.39	83.11	12376.71	0.14	198.03	782.62
US43-DOME11-34.3	28.12	325.87	564.49	121.50	957.97	170.09	12593.17	0.24	660.39	1191.93
US43-DOME11-35.1	14.59	196.28	417.93	95.53	804.45	145.42	12471.71	0.12	505.59	1608.33
US43-DOME11-36.1	10.99	145.26	324.51	73.88	624.01	118.75	13236.86	0.30	446.47	1534.20
US43-DOME11-37.1	12.19	159.81	339.65	74.49	653.21	122.40	12317.16	0.34	459.17	1311.22
US43-DOME11-38.1	19.82	243.63	472.57	105.46	846.87	152.39	12434.84	0.05	653.65	1642.21
US43-DOME11-39.1	17.69	203.50	369.09	78.17	634.20	110.26	11932.22	0.07	338.58	710.73
US43-DOME11-4.1	17.83	235.19	510.25	115.74	975.58	181.39	13586.45	0.04	771.78	2243.97
US43-DOME11-40.1	14.35	193.37	412.00	92.65	782.72	142.22	12393.15	0.10	582.21	1815.08

	Tb	Dy	Er	Tm	Yb	Lu	Hf	Pb	Th	U
US43-DOME11-41.1	13.44	175.45	373.25	82.94	725.00	130.24	14394.86	0.06	448.10	1431.90
US43-DOME11-42.1	13.90	185.58	396.17	86.73	751.65	137.04	12133.07	0.05	460.75	1372.59
US43-DOME11-43.1	11.17	147.68	317.13	69.75	611.05	112.86	12552.40	0.05	317.62	1042.88
US43-DOME11-5.1	37.15	430.86	796.27	172.11	1328.30	228.93	12931.90	0.08	1026.99	2325.14
US43-DOME11-6.1	7.31	104.58	229.48	51.42	467.29	86.24	11960.99	0.13	197.16	872.92
US43-DOME11-7.1	19.65	253.73	524.45	114.96	955.32	167.61	12144.28	0.10	634.33	1832.75
US43-DOME11-8.1	7.44	99.04	225.09	49.24	452.44	85.11	13534.60	0.16	169.41	805.20
US43-DOME11-9.1	6.93	94.98	207.98	47.63	413.76	77.65	11881.10	0.16	141.57	659.68
A4WCF-1.1	7.23	86.69	186.60	42.98	391.23	77.15	12397.78	21.92	649.94	1460.75
A4WCF-2.1	19.88	256.98	535.80	121.22	1011.08	181.09	11956.54	0.00	721.79	2258.70
A4WCF-3.1	17.27	218.38	455.58	101.58	846.74	154.49	11311.19	0.18	554.72	1769.45
A4WCF-4.1	20.45	267.94	549.03	127.06	1047.37	189.15	11599.69	0.19	748.96	2262.68
A4WCF-5.1	17.65	222.53	462.87	102.39	874.76	161.80	10698.44	0.19	564.98	1595.90
US27-07B-1.1	8.37	107.14	234.47	53.01	453.22	77.48	9895.42	0.08	202.10	604.55
US27-07B-1.2	7.49	98.40	207.31	46.11	397.82	75.82	9560.66	0.02	145.75	541.82
US27-07B-2.1	13.52	170.41	349.54	76.24	662.52	130.19	14976.19	0.15	419.11	1254.33
US27-07B-3.1	10.27	119.53	256.61	58.06	478.09	89.19	10126.47	0.03	250.98	783.63
US27-07B-4.1	6.36	70.98	118.44	23.64	213.71	40.24	11055.89	5.00	186.39	296.48
US27-07B-5.1	5.86	80.47	165.81	36.20	330.83	64.54	9123.19	0.00	127.87	454.96
US01-1.1	8.98	119.65	261.35	60.96	543.82	98.14	12096.70	0.09	229.40	982.21
US01-2.1	10.09	133.16	283.19	64.48	575.58	104.69	10945.85	0.17	266.30	1002.91
US01-3.1	9.39	126.46	272.04	61.93	531.53	101.20	11259.35	0.21	329.03	1061.01
US01-4.1	11.46	153.22	334.72	73.53	644.35	120.60	11154.51	0.51	387.92	1285.37

	Tb	Dy	Er	Tm	Yb	Lu	Hf	Pb	Th	U
US01-5.1	10.06	130.91	290.71	64.38	564.34	106.51	10901.41	0.25	281.89	991.11
US01-6.1	9.32	123.79	277.32	63.41	549.67	103.68	11028.84	0.11	257.50	969.00
US01-7.1	10.67	141.53	316.47	70.76	620.22	118.13	10727.82	0.21	375.53	1257.30
US01-TOP-1.1	9.63	130.37	287.75	65.80	565.65	107.64	9980.91	0.02	314.71	1064.76
US01-TOP-2.1	10.01	132.23	284.69	65.86	568.27	105.93	10391.17	0.45	341.28	1117.89
US01-TOP-3.1	9.27	116.40	253.48	56.41	496.75	93.48	10790.35	0.00	244.67	887.50
US01-TOP-4.1	9.45	127.23	278.08	64.59	554.31	103.18	11002.54	1.31	305.97	1084.96
US01-TOP-5.1	15.70	193.35	414.21	93.22	807.69	149.75	10794.16	0.66	492.79	1508.21
US27-15A-1.1	20.88	229.22	580.78	127.34	1117.39	211.50	22097.37	0.52	739.52	2009.10
US27-15A-2.1	11.95	153.42	355.62	87.55	729.05	142.05	11387.11	0.20	698.13	1597.07
US27-15A-3.1	10.47	138.21	300.42	68.77	588.90	109.55	10201.24	0.08	390.29	1008.97
US27-15B-2.1	22.29	244.14	513.89	106.56	882.10	161.98	12458.81	0.95	971.70	2065.50
US27-15B-3.1	7.21	107.72	209.08	45.18	408.16	79.42	8852.85	0.02	215.47	571.52
US27-15C-1.1	11.75	172.93	339.48	75.15	678.73	148.78	21504.22	0.00	599.03	1812.98
US27-15C-2.1	14.69	159.05	304.20	79.20	567.18	140.03	15110.17	0.53	545.09	1069.33
US27-15C-4.1	13.45	166.06	302.91	71.59	573.87	118.00	16272.06	0.27	498.97	1245.71
US27-15C-5.1	15.37	206.90	392.31	95.19	736.61	156.09	18905.61	0.31	653.91	1540.74
US27-15C-6.1	11.59	262.93	453.19	71.98	780.95	172.25	27277.70	0.00	1485.33	2052.08
US27-15C-7.1	11.84	154.73	282.88	67.77	523.63	105.61	14270.37	0.00	333.34	765.47
US27-15C-6.1...dup1	16.64	205.85	427.66	103.26	843.56	167.06	14225.38	0.15	700.74	1665.30
US27-15C-6.1...dup2	18.93	230.84	518.18	126.76	975.29	194.97	17584.45	0.00	832.28	2134.34
US05B-1.1	17.17	203.09	381.33	86.70	713.56	131.48	11006.12	0.07	519.43	971.01
US05B-1.2	10.11	120.12	274.17	62.43	565.84	110.12	11557.64	0.03	325.42	817.54
US05B-3.1	18.64	223.36	434.98	96.78	810.76	148.69	11610.05	0.00	856.77	1939.85

	Tb	Dy	Er	Tm	Yb	Lu	Hf	Pb	Th	U
US05B-3.2	21.45	263.63	504.58	110.30	931.14	166.64	13364.75	0.00	2139.50	3614.05
US05B-4.1	5.72	69.33	133.75	31.29	258.46	48.20	4459.71	3.76	245.76	653.77
US05B-5.1	11.92	147.56	301.76	69.71	588.19	110.34	11872.28	0.19	399.09	896.91
US05B-5.2	15.31	182.11	368.85	79.69	730.61	137.68	8590.97	0.03	579.63	967.20
US05B-7.1	11.28	145.48	310.79	71.96	622.66	119.42	10761.61	0.00	415.64	1206.14
US05B-8.1	8.68	108.98	224.70	49.38	429.25	81.49	11570.99	0.00	463.45	1082.72
US05B-8.2	16.09	205.64	406.75	90.11	753.91	139.49	12305.81	0.00	1040.13	2405.54
US05B-8.3	6.99	86.98	183.16	39.06	359.43	69.40	10199.14	0.07	188.62	433.03
US05B-9.1	49.88	562.69	1011.02	219.33	1825.99	325.43	8013.98	0.00	2159.00	2298.59
US05B-10.1	15.85	198.83	420.18	91.67	818.60	148.30	11644.88	0.03	747.46	1869.79
US05B-11.1	10.17	131.33	303.67	69.98	619.04	121.65	11197.60	0.02	241.30	689.13
US05B-11.2	24.46	290.99	534.45	113.89	955.90	166.32	7480.37	0.00	626.43	993.47
US05B-12.1	9.96	130.43	279.76	65.66	571.37	109.64	10951.00	0.00	358.84	987.42
US05B-13.1	10.90	136.83	270.09	62.85	537.19	98.57	12030.67	0.00	438.03	967.17
US05B-13.2	21.07	248.86	462.76	103.29	878.75	161.26	11347.20	0.00	1564.32	1828.23
US05B-14.1	9.03	121.49	274.83	63.29	570.64	108.31	10296.77	0.02	282.22	799.21
US05B-14.2	12.24	162.75	362.59	84.24	728.72	136.37	10940.97	0.07	412.66	1136.37
US05B-14.3	16.53	202.18	388.26	85.69	725.28	131.25	11580.71	0.03	1383.75	2272.70
US05B-15.1	17.27	185.61	332.02	68.75	595.43	103.92	9212.63	0.00	299.09	483.92
US05B-16.1	10.51	132.86	297.31	69.56	595.34	115.62	9942.59	0.00	245.53	690.83
US05B-16.2	37.94	415.81	759.52	161.75	1384.58	251.60	8191.52	0.02	4968.73	3147.88
US05B-1.1...dup1	12.25	158.00	341.07	79.12	685.03	130.51	10638.15	0.37	455.13	1305.66
US05B-2.1	6.47	85.05	191.84	44.95	387.94	75.12	10904.49	0.26	171.94	634.20
US05B-3.1...dup1	11.08	148.99	323.91	75.70	662.95	126.69	10111.42	0.16	429.14	1252.51
US05B-4.1...dup1	11.76	150.13	329.40	76.69	643.28	123.45	11036.85	0.30	468.06	1305.72
US05B-4.2	11.66	155.75	358.43	83.43	768.08	144.44	10944.05	0.00	345.09	1014.17

	Tb	Dy	Er	Tm	Yb	Lu	Hf	Pb	Th	U
US05B-5.1...dup1	20.11	229.66	445.92	97.29	781.46	145.48	11380.54	0.02	490.03	1085.34
US05B-8.4	9.96	124.76	252.53	56.38	523.07	98.70	10466.55	0.00	305.69	640.47
US27-03A-10.1	12.38	165.38	340.82	83.47	666.21	124.34	9318.18	0.05	448.58	1180.42
US27-03A-10.2	11.23	157.91	330.58	82.53	650.51	121.68	10556.62	0.03	435.88	1197.58
US27-03A-13.1	12.96	169.29	346.56	81.25	662.84	123.67	10732.76	0.08	426.03	1002.14
US27-03A-14.1	12.07	163.16	357.39	83.64	722.61	133.74	10307.64	0.07	466.57	1239.74
US27-03A-19.1	9.94	133.41	299.82	67.67	583.61	114.77	11823.14	0.00	409.19	1127.57
US27-03A-20.1	11.93	163.41	328.73	72.32	646.21	119.56	8685.24	0.15	486.18	1167.43
US27-03A-20.2	11.37	152.33	305.85	71.56	604.17	111.55	8371.40	0.02	468.80	1139.15
US27-03A-21.1	6.80	98.60	218.97	52.18	455.30	88.11	9631.37	0.03	243.71	863.60
US27-03A-22.1	13.52	179.19	365.57	77.17	754.11	143.09	11715.18	1.30	549.56	1455.51
US27-03A-6.1	14.23	209.70	440.59	94.77	904.94	172.63	10323.67	0.09	520.22	1333.48
US27-03A-8.1	13.25	161.87	361.30	88.56	755.96	136.87	10110.02	0.07	500.79	1315.80
US27-03A-9.1	13.42	179.23	381.83	97.97	811.33	152.81	9578.67	0.05	638.07	1536.54
US27-03B-1.1	12.54	179.95	385.14	84.30	786.80	145.69	14212.71	0.00	495.00	1515.08
US27-03B-10.1	18.29	220.30	479.00	107.69	910.56	172.36	13329.61	0.20	734.87	1696.99
US27-03B-11.1	21.22	250.93	520.88	130.10	1023.42	202.50	13961.03	0.00	809.45	1494.65
US27-03B-12.1	4.39	60.94	119.66	31.79	279.86	62.86	13192.72	0.00	180.20	437.03
US27-03B-13.1	14.34	175.31	413.34	103.32	841.55	167.95	12741.42	0.00	801.30	1810.62
US27-03B-2.1	7.32	89.40	209.53	48.47	407.54	79.42	9844.72	0.00	219.35	716.14
US27-03B-3.1	9.92	124.42	271.86	61.36	554.09	107.48	13813.98	0.12	282.98	839.05
US27-03B-4.1	20.89	259.01	572.92	126.36	1088.12	222.19	17828.37	0.32	919.48	2256.09
US27-03B-5.1	16.18	217.48	434.48	97.73	826.17	160.39	15738.54	0.00	748.93	1797.83
US27-03B-6.1	21.21	274.65	489.61	99.21	882.44	162.96	9426.41	0.23	912.52	2160.81
US27-03B-7.1	12.00	162.60	310.23	73.56	617.90	124.36	14604.09	0.17	427.27	1155.78

	Tb	Dy	Er	Tm	Yb	Lu	Hf	Pb	Th	U
US27-03B-7.2	19.17	272.71	527.33	125.12	949.63	205.26	17368.74	0.00	915.16	1880.92
US27-03B-9.1	12.55	155.10	352.91	87.32	692.79	127.64	11820.68	0.04	441.58	1259.32

	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)
DOME6-1.2	0.04	97.77	0.75	7.48	2.11	58.85
DOME6-10.1	0.04	29.74	1.78	16.05	3.78	120.28
DOME6-10.2	0.03	17.70	1.30	12.62	3.98	98.33
DOME6-11.1	0.02	32.29	4.86	31.54	7.54	221.16
DOME6-11.2	0.87	55.36	4.91	29.58	5.01	212.66
DOME6-12.1	0.04	38.09	2.19	19.44	5.29	151.63
DOME6-12.2	0.03	18.88	1.34	11.83	3.86	97.93
DOME6-13.1	0.07	42.35	2.28	23.06	4.70	177.47
DOME6-13.2	0.06	39.88	9.94	60.98	17.91	398.17
DOME6-2.1	0.06	25.50	1.27	17.07	4.44	149.43
DOME6-2.2	0.07	71.85	3.33	35.00	7.46	322.73
DOME6-2.3	0.04	47.56	1.94	29.48	4.12	308.70
DOME6-3.1	0.10	94.53	3.97	49.57	5.95	478.33
DOME6-3.2	0.04	41.77	3.34	30.95	5.55	253.36
DOME6-4.1	0.04	35.98	2.14	18.61	4.14	168.10
DOME6-4.2	0.07	94.05	4.75	38.07	9.61	327.91
DOME6-5.1	0.04	19.79	1.17	14.57	3.88	136.16
DOME6-5.2	0.07	44.25	2.73	16.90	5.20	119.44
DOME6-5.3	0.04	32.86	1.69	18.28	3.63	138.92
DOME6-6.1	0.03	17.14	1.12	11.41	3.26	96.51
DOME6-6.2	0.03	46.80	2.55	23.20	4.25	177.24
DOME6-7.1	0.03	20.45	2.50	31.21	6.22	258.71
DOME6-7.2	0.03	53.96	2.07	30.44	5.35	312.54
DOME6-7.3	0.05	33.16	1.86	17.60	3.74	129.53
DOME6-8.1	0.05	35.67	5.04	37.62	7.36	256.65

	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)
DOME6-8.2	0.04	18.71	1.45	14.12	3.48	112.34
DOME6-9.1	0.10	26.28	4.08	41.32	6.39	310.32
DOME6-9.2	0.02	30.59	1.01	13.74	2.69	141.58
US44-DOME6-1.1	0.06	28.93	4.58	48.40	6.24	360.90
US44-DOME6-1.2	0.06	27.25	4.12	42.81	5.63	335.68
US44-DOME6-1.3	0.06	29.89	4.34	46.43	6.37	368.85
US44-DOME6-4.1	0.06	27.88	4.57	44.18	6.03	332.59
US44-DOME6-2.1	0.13	19.96	2.44	30.79	4.17	229.47
US44-DOME6-2.2	0.05	21.72	3.05	35.84	4.97	260.62
US44-DOME6-7.1	0.07	26.61	4.06	41.37	5.90	311.01
US44-DOME6-6.1	0.05	26.77	3.63	37.57	6.00	300.90
US09-1.1	0.46	23.43	1.39	13.64	2.54	110.74
US09-2.1	0.16	12.34	0.64	8.09	1.36	78.26
US09-3.1	0.05	19.74	2.04	23.37	3.47	163.44
US09-4.1	0.04	24.94	1.27	14.68	3.18	128.71
US09-5.1	0.10	17.90	0.69	13.30	1.59	132.49
US09-6.1	0.12	25.98	1.45	15.09	3.14	127.76
US09-7.1	0.12	13.86	0.58	9.04	1.33	87.62
US08B-1.1	0.17	21.47	0.59	13.92	2.72	110.73
US08B-2.1	0.28	22.64	0.91	14.87	2.11	173.36
US08B-3.1	0.26	73.24	3.82	34.51	10.70	242.94
US08B-3.2	0.33	57.99	2.50	30.19	7.72	256.32
US08B-4.1	0.21	46.62	1.91	19.19	5.57	184.74
US08B-4.2	0.15	35.90	1.24	16.19	5.10	143.90

	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)
US08B-5.1	0.18	31.88	1.43	14.54	3.34	112.15
US08B-6.1	0.19	44.30	2.64	21.33	6.19	121.71
US08B-6.2	0.16	89.49	15.83	94.17	35.16	575.71
US08B-7.1	0.12	18.98	0.98	13.35	2.50	109.82
US08B-7.2	0.17	44.52	1.67	21.60	4.89	179.06
US08B-8.1	0.05	40.05	1.54	22.76	4.39	248.81
US08B-9.1	0.07	40.37	1.24	21.88	4.12	189.03
US08B-10.1	0.14	32.66	1.13	16.29	4.79	172.92
US08B-10.2	0.08	43.12	1.20	21.84	4.98	173.89
US08B-11.1	0.35	92.35	2.89	48.49	8.71	451.32
US08B-11.2	0.55	26.57	4.68	30.42	28.65	206.19
US08B-11.3	0.76	78.13	22.28	111.58	50.28	591.42
US08B-12.1	0.54	23.38	1.03	16.01	4.59	161.35
US08B-13.1	0.28	20.39	0.96	15.89	3.02	131.00
US08B-13.2	0.43	144.96	4.04	62.67	15.76	563.90
US08B-14.1	0.22	32.36	4.60	41.54	9.25	338.02
US08B-15.1	0.06	58.86	1.78	27.07	5.81	246.36
US08B-16.1	0.18	24.51	0.72	20.44	2.05	193.07
US08B-18.1	0.33	32.53	2.90	37.62	6.28	298.87
US08B-19.1	0.26	62.57	3.71	20.38	11.84	126.31
US08B-19.2	0.47	90.85	30.75	195.85	160.57	1073.21
US08B-20.1	0.13	70.88	2.23	38.59	6.01	371.60
US08B-21.1	0.14	95.28	2.72	41.46	10.81	376.72
US08B-22.1	0.17	46.71	2.10	19.57	5.81	175.41
US08B-23.1	3.44	29.78	3.11	14.39	2.84	112.37
US08B-23.2	0.22	45.76	1.49	17.91	4.99	186.42

	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)
US08B-24.1	0.15	47.78	1.62	20.52	5.44	191.98
US08B-24.2	0.17	52.91	1.77	24.25	8.15	201.63
US08B-25.1	1.42	37.47	5.40	56.95	8.71	458.72
US08B-25.2	0.16	56.09	7.94	48.35	24.92	273.00
US08B-26.1	0.11	42.04	1.31	22.12	3.77	250.96
US08B-27.1	0.13	33.34	1.14	17.25	4.72	161.58
US08B-27.2	0.16	33.98	1.62	21.18	7.20	150.29
US08B-23.3	0.06	40.69	1.05	20.16	3.82	179.00
US08b_GERONIMO-1.1	0.10	28.25	4.46	46.81	7.35	339.87
US08b_GERONIMO-2.1	0.12	28.00	4.16	51.20	6.79	396.70
US08b_GERONIMO-3.1	0.27	28.63	1.42	18.33	4.02	214.39
US08b_GERONIMO-4.1	0.14	20.27	1.63	22.12	5.69	170.57
US08b_GERONIMO-5.1	0.20	21.32	2.51	29.62	5.48	236.87
US08b_GERONIMO-6.1	2.59	43.29	6.90	49.84	10.29	327.19
US08bAPPLE-1.1	0.16	20.75	1.03	13.87	2.66	179.56
US08bAPPLE-2.1	0.12	17.30	0.55	13.36	1.60	133.56
US08bAPPLE-3.1	0.16	22.57	0.75	19.99	3.47	201.49
US08bAPPLE-4.1	0.22	20.85	0.91	16.26	2.51	188.28
US08bAPPLE-5.1	0.13	19.17	0.84	14.03	1.73	146.21
DOME11-1.1	0.05	86.66	3.19	45.03	9.72	404.65
DOME11-1.2	0.05	67.99	3.29	36.72	7.96	327.85
DOME11-10.1	0.04	64.88	2.07	28.57	7.39	272.05
DOME11-10.2	0.05	30.20	1.50	16.78	3.57	131.36
DOME11-11.1	0.06	40.09	2.30	20.09	7.41	131.82
DOME11-11.2	0.08	40.07	2.44	18.93	5.41	140.20

	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)
DOME11-2.1	0.05	71.63	1.89	19.77	1.71	187.97
DOME11-2.2	0.24	59.42	1.84	18.34	1.21	150.59
DOME11-3.1	0.14	33.53	4.97	50.03	17.63	322.78
DOME11-3.2	0.38	24.97	1.70	13.46	3.78	114.03
DOME11-4.1	0.08	52.15	3.18	41.28	11.08	375.76
DOME11-4.2	0.04	31.24	1.35	14.74	4.15	138.84
DOME11-5.1	0.02	13.18	0.62	9.41	2.63	94.67
DOME11-5.2	0.12	41.77	1.64	23.10	5.06	215.56
DOME11-6.1	0.03	43.79	1.51	20.95	5.17	200.06
DOME11-6.2	0.04	22.31	1.09	16.37	4.43	133.26
DOME11-7.1	0.04	30.59	1.60	16.30	4.14	144.60
DOME11-7.2	0.06	56.07	2.44	24.27	7.91	195.19
DOME11-8.1	0.08	16.88	6.45	34.99	31.45	196.41
DOME11-9.1	0.16	94.58	3.41	34.26	17.55	290.26
DOME11-9.2	0.03	16.39	0.82	10.18	4.04	123.04
US43-DOME11-1.1	0.08	25.08	2.78	41.13	6.65	344.23
US43-DOME11-10.1	0.11	22.66	0.95	16.74	3.04	208.39
US43-DOME11-11.1	0.11	11.97	0.37	9.60	1.61	90.87
US43-DOME11-12.1	0.12	15.90	0.67	12.20	1.66	130.49
US43-DOME11-13.1	0.12	15.67	0.71	12.79	1.90	138.59
US43-DOME11-14.1	0.11	13.41	0.65	11.52	2.08	117.50
US43-DOME11-14.2	0.12	13.89	0.63	10.30	1.64	121.31
US43-DOME11-15.1	0.10	17.69	0.69	12.95	2.26	151.18
US43-DOME11-16.1	0.07	13.74	0.49	8.59	1.65	96.63
US43-DOME11-17.1	0.13	12.31	0.52	11.15	1.89	111.65
US43-DOME11-18.1	0.09	24.46	0.94	18.60	2.47	210.23

	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)
US43-DOME11-19.1	0.13	17.09	0.89	14.93	2.00	162.61
US43-DOME11-2.1	0.11	32.15	4.70	45.13	11.51	317.30
US43-DOME11-20.1	0.08	16.45	0.82	12.97	2.18	162.94
US43-DOME11-20.2	0.11	40.88	1.24	25.09	4.18	287.90
US43-DOME11-21.1	0.05	15.19	0.67	10.61	1.77	135.23
US43-DOME11-22.1	0.04	23.07	0.90	16.77	2.66	200.53
US43-DOME11-23.1	0.11	22.73	1.11	18.13	2.80	200.45
US43-DOME11-24.1	0.10	34.35	3.75	40.56	11.26	288.45
US43-DOME11-25.1	0.15	16.05	0.58	12.05	1.95	149.25
US43-DOME11-26.1	0.09	29.34	1.18	22.83	4.02	240.25
US43-DOME11-27.1	0.10	14.86	0.55	11.44	1.93	144.59
US43-DOME11-28.1	0.09	17.30	0.84	13.66	2.60	137.00
US43-DOME11-3.1	0.10	12.71	0.67	9.17	1.64	113.33
US43-DOME11-30.1	0.11	21.96	1.07	19.82	2.86	228.56
US43-DOME11-30.2	0.08	13.41	0.56	9.82	1.42	119.61
US43-DOME11-31.1	0.46	3.04	1.10	0.82	19.30	2.37
US43-DOME11-34.1	0.10	19.02	0.82	16.75	2.74	131.82
US43-DOME11-34.2	0.08	11.57	0.55	7.33	1.94	82.31
US43-DOME11-34.3	0.09	37.67	5.72	52.34	12.50	384.37
US43-DOME11-35.1	0.06	19.01	0.72	14.25	2.08	159.70
US43-DOME11-36.1	0.07	14.88	0.64	12.86	1.78	123.50
US43-DOME11-37.1	0.09	21.48	0.94	14.91	2.52	146.82
US43-DOME11-38.1	0.08	18.77	1.47	22.81	3.52	227.50
US43-DOME11-39.1	0.07	25.06	3.02	34.41	7.79	250.60
US43-DOME11-4.1	0.13	21.04	0.91	16.38	2.73	190.07
US43-DOME11-40.1	0.10	16.56	0.68	13.32	1.96	153.24

	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)
US43-DOME11-41.1	0.07	16.71	0.78	12.41	2.39	154.18
US43-DOME11-42.1	0.07	18.05	0.89	13.68	2.64	151.23
US43-DOME11-43.1	0.08	16.12	0.58	11.41	2.90	129.10
US43-DOME11-5.1	0.10	31.46	4.74	57.30	6.89	455.56
US43-DOME11-6.1	0.12	9.53	0.27	7.11	1.37	81.22
US43-DOME11-7.1	0.16	26.01	1.06	19.16	2.82	219.07
US43-DOME11-8.1	0.12	10.67	0.46	8.70	1.86	79.31
US43-DOME11-9.1	0.06	9.62	0.30	7.42	1.60	75.82
A4WCF-1.1	0.15	77.74	1.11	12.23	12.47	97.02
A4WCF-2.1	0.04	27.71	1.11	20.40	2.46	219.10
A4WCF-3.1	0.24	26.61	1.17	18.91	3.19	188.93
A4WCF-4.1	0.13	28.37	1.13	19.72	2.98	217.36
A4WCF-5.1	0.11	27.28	1.44	16.05	3.86	191.23
US27-07B-1.1	0.10	14.25	0.80	11.67	3.20	104.04
US27-07B-1.2	0.01	13.50	0.69	10.24	2.57	91.41
US27-07B-2.1	0.45	24.62	1.28	16.98	5.57	191.05
US27-07B-3.1	0.05	14.65	0.85	13.41	2.77	117.17
US27-07B-4.1	0.08	52.21	1.46	15.64	18.97	91.05
US27-07B-5.1	0.04	10.63	0.53	7.57	1.95	65.48
US01-1.1	0.18	12.06	0.48	7.56	2.66	94.48
US01-2.1	0.11	16.69	0.63	12.20	3.51	112.78
US01-3.1	0.09	14.35	0.57	10.16	2.84	116.81
US01-4.1	0.15	17.08	0.75	12.63	3.49	119.22

	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)
US01-5.1	0.10	16.47	0.43	10.30	3.04	111.13
US01-6.1	0.11	15.49	0.57	9.08	2.97	105.20
US01-7.1	0.07	15.49	0.73	10.76	3.36	117.18
US01-TOP-1.1	0.24	16.01	0.99	10.18	3.04	102.57
US01-TOP-2.1	0.07	14.40	0.40	9.46	3.42	101.68
US01-TOP-3.1	0.03	16.27	0.52	9.23	2.75	100.98
US01-TOP-4.1	0.13	13.16	0.57	9.95	2.78	106.86
US01-TOP-5.1	0.17	24.40	1.02	14.77	5.08	156.85
US27-15A-1.1	0.55	47.29	1.69	18.65	7.80	167.40
US27-15A-2.1	0.19	25.00	0.63	12.89	6.60	146.58
US27-15A-3.1	0.07	26.97	0.88	14.05	5.56	131.43
US27-15B-2.1	0.79	123.79	4.29	38.33	16.97	440.75
US27-15B-3.1	0.04	20.60	1.02	13.13	5.65	81.71
US27-15C-1.1	0.57	37.48	2.04	13.44	5.96	154.04
US27-15C-2.1	0.27	64.36	2.91	30.49	10.62	237.70
US27-15C-4.1	0.71	36.10	1.26	15.41	7.26	166.73
US27-15C-5.1	0.98	64.76	1.83	21.05	8.01	261.10
US27-15C-6.1		123.75		58.62	18.38	355.84
US27-15C-7.1	0.76	39.59	2.99	20.16	10.10	184.08
US27-15C-6.1...dup1	0.43	40.29	2.14	20.53	9.11	209.62
US27-15C-6.1...dup2	0.56	50.89	2.08	22.63	8.10	260.59
US05B-1.1	0.60	58.35	3.86	31.87	17.81	228.46
US05B-1.2	0.15	47.67	0.79	14.39	8.64	107.18
US05B-3.1	0.12	78.09	2.00	26.09	10.78	226.79

	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)
US05B-3.2	0.28	77.82	1.54	24.57	11.55	248.43
US05B-4.1	5.16	41.73	5.15	13.40	4.68	77.02
US05B-5.1	5.63	64.20	3.46	16.75	9.77	144.51
US05B-5.2	0.07	66.77	2.93	28.07	22.09	192.57
US05B-7.1	0.12	32.73	0.80	13.63	5.81	120.10
US05B-8.1	0.08	34.95	0.77	12.72	6.10	99.97
US05B-8.2	1.07	63.39	2.09	20.01	8.97	193.80
US05B-8.3	0.18	38.72	1.06	10.94	8.63	85.73
US05B-9.1	0.17	411.34	12.83	99.55	83.15	671.98
US05B-10.1	0.19	58.82	1.38	16.64	8.81	173.93
US05B-11.1	0.21	42.44	1.06	13.39	7.52	117.44
US05B-11.2	0.26	107.21	5.22	42.24	23.96	326.87
US05B-12.1	0.19	43.57	1.42	15.17	7.79	118.64
US05B-13.1	0.13	53.30	1.62	17.07	7.87	128.23
US05B-13.2	0.10	201.80	5.35	41.12	27.78	302.49
US05B-14.1	0.11	40.92	0.96	12.54	6.45	104.42
US05B-14.2	0.12	50.16	1.17	13.54	8.37	141.00
US05B-14.3	0.05	79.52	1.98	23.44	12.10	211.34
US05B-15.1	0.16	43.93	5.58	33.57	28.45	232.68
US05B-16.1	0.06	45.08	1.97	17.42	9.73	125.68
US05B-16.2	0.29	359.98	13.89	96.58	64.98	558.30
US05B-1.1...dup1	0.23	33.12	0.86	15.63	6.12	144.04
US05B-2.1	0.18	17.95	0.64	7.50	4.19	76.35
US05B-3.1...dup1	0.12	30.83	0.90	13.77	5.85	127.55
US05B-4.1...dup1	0.13	22.79	0.72	11.84	4.93	124.23
US05B-4.2	0.08	47.21	1.24	16.13	8.75	128.23

	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)
US05B-5.1...dup1	0.29	33.64	2.74	33.90	12.63	248.32
US05B-8.4	0.06	44.89	1.66	16.38	9.00	123.15
US27-03A-10.1	0.04	29.73	0.88	13.80	6.57	141.74
US27-03A-10.2	0.10	29.25	0.86	13.34	6.74	141.95
US27-03A-13.1	0.18	37.24	1.12	18.07	7.37	172.81
US27-03A-14.1	0.07	33.40	0.88	16.45	7.74	145.91
US27-03A-19.1	0.13	21.88	0.79	12.55	4.82	122.80
US27-03A-20.1	0.04	22.06	0.74	11.88	6.21	128.96
US27-03A-20.2	0.03	19.58	0.62	11.44	6.15	123.89
US27-03A-21.1	0.05	17.03	0.42	8.17	3.25	73.99
US27-03A-22.1	13.91	107.98	21.01	40.58	14.01	154.93
US27-03A-6.1	0.08	40.72	1.08	17.71	7.50	147.78
US27-03A-8.1	0.07	29.52	1.02	15.40	7.29	159.65
US27-03A-9.1	0.06	27.73	0.81	13.21	6.62	149.09
US27-03B-1.1	0.32	33.73	1.27	16.34	7.03	123.47
US27-03B-10.1	0.44	45.49	1.62	21.68	9.38	206.00
US27-03B-11.1	0.43	64.99	2.40	26.05	15.44	275.98
US27-03B-12.1	0.58	35.45	1.87	8.57	3.96	54.76
US27-03B-13.1	0.22	32.67	1.59	14.94	9.14	164.07
US27-03B-2.1	0.28	20.11	0.68	9.02	4.75	93.00
US27-03B-3.1	0.32	28.51	0.86	13.80	6.28	129.13
US27-03B-4.1	0.54	62.08	1.80	27.15	12.62	280.33
US27-03B-5.1	0.57	41.24	1.58	18.94	8.16	167.71
US27-03B-6.1	0.40	109.42	3.96	38.21	16.95	314.96
US27-03B-7.1	0.50	35.97	1.70	12.97	7.79	163.67

	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)
US27-03B-7.2	0.85	62.44	2.27	29.53	13.03	377.37
US27-03B-9.1	0.17	31.53	1.01	14.36	6.12	133.31

	Tb (ch)	Dy (ch)	Ho (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
DOME6-1.2	158.38	352.19	780.89	1665.31	3262.54	5116.75	7226.18
DOME6-10.1	250.97	441.14	736.52	1187.68	1691.99	2077.49	2499.19
DOME6-10.2	206.16	406.12	663.46	1133.74	1530.68	2088.40	2626.90
DOME6-11.1	402.78	691.24	1214.42	1803.30	2532.11	3057.03	3393.47
DOME6-11.2	441.58	820.74	1382.19	2183.87	2982.69	3743.94	4333.12
DOME6-12.1	282.49	535.99	930.41	1579.89	2097.34	2847.93	3515.56
DOME6-12.2	208.84	393.73	657.69	1069.93	1385.72	2098.80	2599.70
DOME6-13.1	347.41	633.74	1041.70	1682.77	2442.03	3000.05	3489.09
DOME6-13.2	625.97	1015.29	1761.83	2448.20	3205.89	4125.26	4697.03
DOME6-2.1	341.48	655.75	1103.52	1913.55	2683.49	3523.11	4198.91
DOME6-2.2	699.61	1132.44	2167.97	2979.72	3727.70	5630.23	6103.04
DOME6-2.3	664.40	1231.19	2005.70	3256.13	4591.37	5381.12	6075.03
DOME6-3.1	975.36	1820.56	3099.55	5189.70	7516.98	9266.25	10499.97
DOME6-3.2	527.97	922.67	1515.93	2522.60	3471.28	4247.46	4999.85
DOME6-4.1	316.61	597.87	997.05	1633.65	2109.71	2927.25	3499.97
DOME6-4.2	589.81	1016.23	1643.33	2540.91	3581.54	4189.16	4809.23
DOME6-5.1	283.66	540.38	946.59	1544.71	2142.27	2870.92	3392.13
DOME6-5.2	231.43	395.54	651.74	1046.83	1432.98	1881.37	2271.63
DOME6-5.3	275.02	507.13	841.27	1384.26	1763.82	2359.73	2816.74
DOME6-6.1	184.42	367.45	612.57	1044.70	1555.81	2030.23	2439.85
DOME6-6.2	348.74	634.26	1046.74	1621.77	2108.03	2753.52	3192.69
DOME6-7.1	522.13	970.65	1653.76	2745.93	4007.07	4899.57	5660.75
DOME6-7.2	685.02	1295.63	2136.69	3613.40	5035.52	6318.42	7110.32
DOME6-7.3	269.89	490.12	839.58	1340.10	1806.79	2276.11	2710.01
DOME6-8.1	474.92	878.38	1419.31	2232.94	2842.91	3913.09	4570.13

	Tb (ch)	Dy (ch)	Ho (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
DOME6-8.2	230.01	440.03	743.01	1268.33	1804.85	2377.65	2877.03
DOME6-9.1	642.89	1183.76	1926.05	3001.06	3672.64	5151.64	5832.86
DOME6-9.2	353.18	689.40	1273.67	2292.04	3247.70	4447.49	5444.80
US44-DOME6-1.1	739.50	1266.37	2320.90	3550.46	4792.55	5836.55	6557.93
US44-DOME6-1.2	691.90	1190.44	2119.43	3382.48	4743.77	5779.37	6495.12
US44-DOME6-1.3	765.82	1263.83	2276.76	3599.01	4557.78	5989.31	6890.25
US44-DOME6-4.1	659.11	1086.02	2015.26	3053.93	4065.59	5130.70	5968.70
US44-DOME6-2.1	479.00	788.26	1412.66	2252.81	3075.22	3802.36	4400.62
US44-DOME6-2.2	516.40	855.75	1609.93	2359.17	3000.62	3934.38	4448.89
US44-DOME6-7.1	585.48	982.47	1823.20	2749.34	3523.75	4497.76	5207.61
US44-DOME6-6.1	618.26	1074.31	1869.73	2982.27	3928.96	5015.35	5986.68
US09-1.1	279.37	479.45	944.31	1564.71	2216.16	2945.17	3642.71
US09-2.1	191.72	360.52	728.34	1196.14	1673.35	2298.45	2836.02
US09-3.1	357.98	596.69	1126.61	1717.37	2480.14	3017.87	3524.95
US09-4.1	275.47	487.27	1001.35	1602.27	2271.11	3098.66	3752.09
US09-5.1	300.95	571.08	1182.50	1937.78	2819.42	3782.77	4703.16
US09-6.1	300.99	540.94	1058.81	1740.90	2545.62	3354.75	4080.48
US09-7.1	220.45	405.86	844.94	1406.95	2163.59	2771.92	3529.28
US08B-1.1	301.87	560.07	1131.44	1856.31	2774.70	3576.21	4462.65
US08B-2.1	424.05	827.78	1636.61	2626.25	3772.68	5112.35	6152.61
US08B-3.1	513.10	950.74	1797.17	2776.60	3897.60	4995.00	6037.73
US08B-3.2	605.13	1051.44	1928.94	3059.33	4341.26	5380.75	6399.91
US08B-4.1	428.81	739.77	1402.21	2175.64	3175.72	3980.74	4758.26
US08B-4.2	346.71	631.12	1166.00	1852.43	2504.66	3363.43	4083.46

	Tb (ch)	Dy (ch)	Ho (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
US08B-5.1	261.53	462.72	877.26	1404.89	2016.30	2540.80	3110.70
US08B-6.1	242.21	405.72	712.27	1079.97	1516.74	1854.96	2289.39
US08B-6.2	1172.42	1832.38	3169.63	4631.91	6064.41	7491.12	8607.98
US08B-7.1	270.41	541.26	1067.21	1734.11	2612.86	3375.78	4284.25
US08B-7.2	430.42	766.93	1372.29	2203.11	3067.49	3994.27	4650.06
US08B-8.1	626.85	1166.77	2216.28	3588.34	5080.79	6575.99	7725.89
US08B-9.1	434.96	763.18	1484.67	2290.43	3267.00	4216.44	5013.74
US08B-10.1	435.91	743.72	1351.17	2201.86	3026.75	3738.21	4422.74
US08B-10.2	403.08	778.28	1372.00	2249.26	3265.81	4167.23	4839.56
US08B-11.1	934.70	1739.03	3277.31	4774.12	6796.35	8204.92	9725.39
US08B-11.2	331.95	540.89	961.83	1370.40	1840.13	2305.58	2810.86
US08B-11.3	879.63	1385.13	2401.66	3284.92	4456.87	5364.34	6396.83
US08B-12.1	328.42	619.74	1298.72	1928.42	2925.71	3764.67	4555.19
US08B-13.1	336.73	628.30	1224.39	2017.57	2949.03	3849.27	4690.53
US08B-13.2	1177.47	2048.28	3842.52	5527.84	7386.08	9260.52	10538.43
US08B-14.1	702.35	1211.52	2244.93	3407.42	4608.55	5882.88	6878.70
US08B-15.1	574.98	1037.62	1928.04	2956.35	4447.38	5288.01	6321.47
US08B-16.1	521.88	988.51	1973.50	3272.88	4782.91	6133.45	7263.52
US08B-18.1	680.01	1208.76	2300.28	3607.83	5177.68	6480.36	7644.06
US08B-19.1	245.28	409.92	735.46	1115.63	1538.93	2041.04	2512.47
US08B-19.2	1813.30	2595.26	4133.29	5741.31	7209.28	8732.61	9915.70
US08B-20.1	843.71	1456.22	2758.68	4215.96	5975.78	7293.93	8331.39
US08B-21.1	838.81	1454.82	2614.69	3987.67	5581.70	6810.39	7815.30
US08B-22.1	374.40	648.07	1259.94	1869.59	2614.83	3288.07	4078.02
US08B-23.1	247.96	434.11	874.06	1278.14	1761.50	2201.86	2652.56
US08B-23.2	408.14	811.79	1593.11	2649.62	3889.64	5124.90	6278.38

	Tb (ch)	Dy (ch)	Ho (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
US08B-24.1	423.10	759.06	1429.47	2183.45	3073.35	4035.41	4794.08
US08B-24.2	460.60	825.71	1494.61	2341.97	3338.57	4290.76	5154.13
US08B-25.1	964.21	1682.89	3112.70	4640.55	6242.31	7771.28	8877.46
US08B-25.2	519.67	819.70	1414.92	2096.56	2888.40	3661.99	4318.92
US08B-26.1	582.83	1039.39	1993.98	3262.13	4766.04	6090.01	7179.70
US08B-27.1	373.87	659.87	1278.69	2030.39	2914.56	3842.16	4673.09
US08B-27.2	347.93	627.09	1168.84	1912.71	2838.38	3651.09	4562.55
US08B-23.3	444.49	880.30	1691.90	2753.94	4048.48	5281.67	6294.59
US08b_GERONIMO-1.1	748.74	1225.80	2240.72	3479.32	4758.80	5858.47	6922.61
US08b_GERONIMO-2.1	851.50	1435.85	2671.08	4081.12	5550.01	6848.92	7963.37
US08b_GERONIMO-3.1	584.24	1107.22	2126.44	3643.44	5236.34	6917.79	8220.68
US08b_GERONIMO-4.1	362.47	589.43	1042.19	1666.72	2327.84	2937.03	3498.20
US08b_GERONIMO-5.1	546.07	911.70	1718.94	2696.98	3815.26	4705.62	5506.04
US08b_GERONIMO-6.1	710.55	1232.49	2195.54	3413.37	4780.40	5803.39	6595.94
US08bAPPLE-1.1	474.36	908.42	1750.64	3092.83	4330.56	5714.71	6773.59
US08bAPPLE-2.1	365.62	730.50	1417.94	2437.16	3576.81	4621.93	5715.17
US08bAPPLE-3.1	528.37	959.99	1903.62	3135.19	4372.91	6036.05	7202.32
US08bAPPLE-4.1	458.40	888.85	1789.01	2844.55	4076.08	5299.60	6348.69
US08bAPPLE-5.1	387.98	753.18	1471.76	2437.07	3517.04	4592.48	5740.46
DOME11-1.1	844.01	1508.89	2424.16	3721.99	4676.61	6061.39	6875.10
DOME11-1.2	658.36	1231.39	2059.95	3182.79	4521.46	5169.41	6030.08
DOME11-10.1	564.86	1043.47	1872.87	3118.17	4324.54	5554.58	6484.95
DOME11-10.2	283.44	531.78	911.41	1490.40	2170.12	2712.33	3238.93
DOME11-11.1	262.87	456.94	779.85	1307.49	1797.38	2447.72	2990.64
DOME11-11.2	274.77	466.83	762.13	1230.42	1783.80	2175.10	2464.10

	Tb (ch)	Dy (ch)	Ho (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
DOME11-2.1	384.01	757.62	1248.48	2092.25	2978.66	3763.95	4557.06
DOME11-2.2	308.62	593.56	1010.45	1573.02	2213.76	2869.41	3486.80
DOME11-3.1	582.87	987.67	1793.04	2415.08	3161.54	3800.86	4318.48
DOME11-3.2	240.32	478.63	844.85	1547.25	2269.81	2992.93	3742.87
DOME11-4.1	863.29	1758.67	2948.77	4959.26	6940.01	9517.36	12206.07
DOME11-4.2	301.27	570.92	940.03	1577.22	2245.73	2737.12	3290.46
DOME11-5.1	213.44	417.34	761.35	1272.17	1691.36	2473.52	3114.10
DOME11-5.2	487.71	919.28	1552.07	2551.17	3445.52	4561.58	5303.31
DOME11-6.1	411.67	754.51	1274.96	2050.07	2926.12	3491.30	4096.46
DOME11-6.2	296.18	578.04	1021.52	1751.13	2489.48	3317.22	4159.45
DOME11-7.1	305.57	567.00	1006.73	1637.92	2425.80	3022.09	3470.75
DOME11-7.2	388.69	693.28	1116.22	1867.12	2544.32	3238.33	3842.37
DOME11-8.1	340.14	561.32	917.57	1401.13	1752.66	2416.36	2978.69
DOME11-9.1	567.15	1028.88	1678.16	2644.85	3896.32	4572.80	5192.55
DOME11-9.2	290.91	571.96	1106.30	1889.15	2792.43	3584.16	4477.59
US43-DOME11-1.1	768.46	1318.31	2356.56	3693.47	5098.80	6080.41	6910.85
US43-DOME11-10.1	493.13	965.25	1895.64	3181.80	4703.04	5849.02	7086.88
US43-DOME11-11.1	243.71	458.37	889.32	1561.13	2431.26	3072.01	3828.03
US43-DOME11-12.1	320.79	618.58	1216.28	1902.53	3047.61	3875.01	4890.26
US43-DOME11-13.1	355.45	675.97	1371.84	2355.23	3404.88	4421.00	5348.34
US43-DOME11-14.1	284.10	550.51	1094.01	1844.10	2669.55	3495.34	4410.32
US43-DOME11-14.2	291.33	555.09	1091.72	1859.54	2794.44	3590.17	4476.08
US43-DOME11-15.1	386.28	771.20	1499.23	2566.99	3774.59	4864.16	5987.65
US43-DOME11-16.1	245.28	462.46	957.22	1556.44	2335.72	2906.54	3579.48
US43-DOME11-17.1	287.82	553.37	1086.15	1861.86	2807.03	3537.56	4342.35
US43-DOME11-18.1	510.39	1001.70	1872.19	3159.84	4587.21	5859.87	6898.89

	Tb (ch)	Dy (ch)	Ho (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
US43-DOME11-19.1	447.69	867.66	1662.94	2838.99	3999.03	5109.20	6090.72
US43-DOME11-2.1	665.38	1105.33	1981.45	3065.08	4334.17	5222.15	6074.11
US43-DOME11-20.1	405.34	789.47	1499.09	2570.92	3742.95	4847.80	5720.65
US43-DOME11-20.2	702.91	1298.27	2303.14	3863.58	5783.27	7055.24	8265.68
US43-DOME11-21.1	329.49	651.24	1278.66	2150.73	3298.56	4046.88	5024.77
US43-DOME11-22.1	501.68	993.44	1975.51	3327.79	4945.79	6161.43	7341.40
US43-DOME11-23.1	501.33	975.25	1869.34	3120.43	4592.97	5665.31	6768.95
US43-DOME11-24.1	578.64	989.53	1726.78	2739.05	3948.09	4713.26	5608.21
US43-DOME11-25.1	363.70	739.84	1460.62	2470.39	3818.43	4588.01	5662.39
US43-DOME11-26.1	612.36	1160.32	2250.72	3742.52	5520.60	6682.11	7815.18
US43-DOME11-27.1	363.69	704.55	1342.58	2337.70	3453.08	4469.16	5349.10
US43-DOME11-28.1	344.30	634.23	1258.28	2118.74	3159.47	3976.18	4762.87
US43-DOME11-3.1	283.49	549.05	1079.97	1807.92	2504.47	3563.30	4424.05
US43-DOME11-30.1	560.99	1068.42	2112.81	3410.41	5004.18	6284.38	7478.47
US43-DOME11-30.2	316.87	620.44	1201.79	2085.69	2976.53	4031.02	4934.03
US43-DOME11-31.1	9.19	19.33	46.51	62.71	63.42	128.36	157.49
US43-DOME11-34.1	304.89	538.05	1047.78	1596.18	2122.50	2826.68	3244.44
US43-DOME11-34.2	220.44	415.73	828.95	1416.71	2098.52	2729.11	3378.55
US43-DOME11-34.3	778.87	1324.69	2216.19	3528.09	4919.13	5950.10	6914.18
US43-DOME11-35.1	404.21	797.89	1526.98	2612.07	3867.74	4996.61	5911.58
US43-DOME11-36.1	304.56	590.51	1173.15	2028.19	2991.25	3875.86	4827.24
US43-DOME11-37.1	337.60	649.62	1266.59	2122.83	3015.65	4057.23	4975.58
US43-DOME11-38.1	549.10	990.36	1820.49	2953.53	4269.78	5260.04	6194.52
US43-DOME11-39.1	489.95	827.22	1512.88	2306.79	3164.68	3939.15	4481.93
US43-DOME11-4.1	494.04	956.06	1814.90	3189.08	4685.86	6059.48	7373.50
US43-DOME11-40.1	397.39	786.05	1509.93	2575.03	3750.98	4861.60	5781.26

	Tb (ch)	Dy (ch)	Ho (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
US43-DOME11-41.1	372.35	713.20	1394.06	2332.82	3357.92	4503.08	5294.43
US43-DOME11-42.1	385.07	754.40	1429.58	2476.07	3511.45	4668.63	5570.77
US43-DOME11-43.1	309.46	600.34	1186.76	1982.07	2823.86	3795.35	4587.63
US43-DOME11-5.1	1029.16	1751.47	3047.64	4976.69	6967.82	8250.30	9305.92
US43-DOME11-6.1	202.58	425.14	801.90	1434.22	2081.91	2902.42	3505.84
US43-DOME11-7.1	544.43	1031.43	2044.52	3277.83	4654.16	5933.68	6813.61
US43-DOME11-8.1	206.13	402.59	835.46	1406.84	1993.70	2810.17	3459.62
US43-DOME11-9.1	191.90	386.09	782.01	1299.89	1928.27	2569.94	3156.37
A4WCF-1.1	200.24	352.40	702.91	1166.25	1739.99	2430.03	3136.11
A4WCF-2.1	550.62	1044.63	2081.46	3348.77	4907.53	6280.03	7361.25
A4WCF-3.1	478.38	887.72	1840.47	2847.40	4112.51	5259.27	6280.08
A4WCF-4.1	566.34	1089.21	2085.30	3431.46	5143.93	6505.42	7689.13
A4WCF-5.1	488.85	904.61	1665.34	2892.92	4145.31	5433.27	6577.43
US27-07B-1.1	231.86	435.52	864.20	1465.46	2146.23	2815.05	3149.44
US27-07B-1.2	207.40	400.00	741.24	1295.70	1866.85	2470.95	3082.05
US27-07B-2.1	374.43	692.73	1455.18	2184.61	3086.46	4115.01	5292.40
US27-07B-3.1	284.41	485.89	934.66	1603.84	2350.76	2969.51	3625.45
US27-07B-4.1	176.21	288.55	518.66	740.22	956.96	1327.37	1635.84
US27-07B-5.1	162.29	327.12	581.21	1036.28	1465.70	2054.86	2623.69
US01-1.1	248.88	486.37	940.78	1633.41	2468.12	3377.77	3989.27
US01-2.1	279.56	541.30	1086.56	1769.96	2610.71	3575.06	4255.84
US01-3.1	260.00	514.06	1018.98	1700.26	2507.39	3301.41	4113.86
US01-4.1	317.33	622.83	1225.98	2091.99	2977.12	4002.19	4902.54

	Tb (ch)	Dy (ch)	Ho (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
US01-5.1	278.74	532.15	1068.54	1816.91	2606.49	3505.24	4329.73
US01-6.1	258.18	503.23	1017.53	1733.23	2567.12	3414.12	4214.58
US01-7.1	295.69	575.30	1157.21	1977.91	2864.73	3852.30	4801.89
US01-TOP-1.1	266.75	529.96	1041.41	1798.46	2663.93	3513.34	4375.60
US01-TOP-2.1	277.37	537.51	1050.48	1779.32	2666.48	3529.65	4306.04
US01-TOP-3.1	256.70	473.16	948.17	1584.24	2283.97	3085.41	3799.90
US01-TOP-4.1	261.74	517.18	1016.93	1737.97	2615.12	3442.89	4194.13
US01-TOP-5.1	434.79	785.96	1525.05	2588.78	3774.20	5016.73	6087.56
US27-15A-1.1	578.44	931.77	2221.25	3629.85	5155.41	6940.33	8597.52
US27-15A-2.1	331.14	623.68	1234.31	2222.60	3544.63	4528.25	5774.48
US27-15A-3.1	290.02	561.84	1117.57	1877.65	2784.37	3657.75	4453.13
US27-15B-2.1	617.32	992.44	2545.26	3211.80	4314.04	5478.88	6584.74
US27-15B-3.1	199.74	437.89	733.21	1306.77	1829.06	2535.18	3228.64
US27-15C-1.1	325.36	702.98	1782.80	2121.76	3042.36	4215.69	6047.78
US27-15C-2.1	406.85	646.56	2069.18	1901.27	3206.48	3522.85	5692.20
US27-15C-4.1	372.63	675.05	1444.65	1893.20	2898.21	3564.41	4796.77
US27-15C-5.1	425.86	841.06	2267.10	2451.97	3853.80	4575.19	6345.16
US27-15C-6.1	321.05	1068.83	3643.44	2832.43	2914.16	4850.59	7002.02
US27-15C-7.1	328.06	628.99	1313.18	1767.98	2743.52	3252.39	4293.23
US27-15C-6.1...dup1	460.88	836.77	1782.41	2672.90	4180.68	5239.51	6790.89
US27-15C-6.1...dup2	524.44	938.39	1986.38	3238.64	5132.04	6057.67	7925.59
US05B-1.1	475.53	825.57	1575.39	2383.32	3510.16	4432.07	5344.77
US05B-1.2	280.17	488.29	990.48	1713.57	2527.41	3514.52	4476.51
US05B-3.1	516.44	907.99	1720.77	2718.60	3918.32	5035.78	6044.23

	Tb (ch)	Dy (ch)	Ho (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
US05B-3.2	594.20	1071.65	1961.42	3153.63	4465.63	5783.47	6774.03
US05B-4.1	158.56	281.85	614.50	835.94	1266.74	1605.34	1959.32
US05B-5.1	330.21	599.86	1106.66	1886.01	2822.07	3653.38	4485.42
US05B-5.2	423.98	740.30	1377.06	2305.34	3226.12	4537.93	5596.86
US05B-7.1	312.40	591.36	1199.96	1942.43	2913.54	3867.42	4854.30
US05B-8.1	240.56	443.00	832.49	1404.38	1999.05	2666.15	3312.53
US05B-8.2	445.65	835.94	1573.52	2542.21	3648.26	4682.67	5670.15
US05B-8.3	193.53	353.57	685.28	1144.75	1581.46	2232.47	2821.15
US05B-9.1	1381.74	2287.35	4123.58	6318.90	8879.70	11341.55	13228.76
US05B-10.1	438.97	808.26	1574.92	2626.10	3711.20	5084.45	6028.37
US05B-11.1	281.63	533.85	1116.78	1897.96	2833.20	3844.98	4944.96
US05B-11.2	677.64	1182.88	2124.36	3340.30	4610.97	5937.24	6761.04
US05B-12.1	275.93	530.21	1027.62	1748.50	2658.24	3548.87	4456.99
US05B-13.1	302.01	556.22	1021.57	1688.04	2544.35	3336.58	4006.91
US05B-13.2	583.76	1011.62	1838.06	2892.26	4181.66	5458.06	6555.40
US05B-14.1	250.26	493.85	995.64	1717.68	2562.19	3544.37	4402.91
US05B-14.2	339.10	661.57	1389.17	2266.16	3410.40	4526.20	5543.54
US05B-14.3	457.76	821.87	1538.11	2426.60	3469.37	4504.85	5335.29
US05B-15.1	478.53	754.52	1296.40	2075.12	2783.38	3698.34	4224.21
US05B-16.1	291.02	540.08	1082.24	1858.21	2816.36	3697.77	4700.09
US05B-16.2	1050.88	1690.29	3067.45	4747.01	6548.39	8599.89	10227.83
US05B-1.1...dup1	339.27	642.29	1301.15	2131.68	3203.04	4254.84	5305.13
US05B-2.1	179.12	345.72	708.52	1198.98	1819.78	2409.56	3053.79
US05B-3.1...dup1	306.85	605.63	1223.02	2024.41	3064.85	4117.68	5149.85
US05B-4.1...dup1	325.86	610.30	1201.92	2058.77	3104.77	3995.55	5018.27
US05B-4.2	322.86	633.12	1291.38	2240.20	3377.82	4770.66	5871.41

	Tb (ch)	Dy (ch)	Ho (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
US05B-5.1...dup1	557.06	933.59	1726.07	2787.00	3938.74	4853.81	5913.81
US05B-8.4	275.83	507.14	958.46	1578.32	2282.67	3248.86	4012.34
US27-03A-10.1	342.89	672.28	1250.85	2130.15	3379.45	4137.98	5054.57
US27-03A-10.2	311.17	641.92	1211.60	2066.14	3341.22	4040.46	4946.35
US27-03A-13.1	359.11	688.16	1388.03	2166.02	3289.59	4117.03	5027.32
US27-03A-14.1	334.43	663.24	1304.50	2233.67	3386.23	4488.26	5436.39
US27-03A-19.1	275.46	542.33	1077.13	1873.85	2739.83	3624.91	4665.43
US27-03A-20.1	330.47	664.27	1179.34	2054.57	2927.75	4013.76	4860.29
US27-03A-20.2	315.01	619.22	1103.27	1911.58	2897.07	3752.60	4534.39
US27-03A-21.1	188.27	400.79	730.50	1368.56	2112.39	2827.96	3581.78
US27-03A-22.1	374.59	728.43	1193.48	2284.80	3124.42	4683.93	5816.62
US27-03A-6.1	394.22	852.45	1452.37	2753.70	3836.86	5620.76	7017.36
US27-03A-8.1	367.12	658.00	1375.43	2258.14	3585.47	4695.40	5563.76
US27-03A-9.1	371.67	728.56	1290.34	2386.44	3966.35	5039.32	6211.84
US27-03B-1.1	347.46	731.51	1337.14	2407.10	3413.04	4886.93	5922.33
US27-03B-10.1	506.67	895.52	1992.28	2993.77	4359.95	5655.68	7006.49
US27-03B-11.1	587.68	1020.03	2316.10	3255.50	5267.09	6356.66	8231.84
US27-03B-12.1	121.54	247.71	773.05	747.84	1287.06	1738.29	2555.36
US27-03B-13.1	397.14	712.66	1560.73	2583.39	4183.01	5227.02	6827.13
US27-03B-2.1	202.66	363.42	790.89	1309.53	1962.18	2531.29	3228.30
US27-03B-3.1	274.70	505.75	1059.06	1699.14	2484.21	3441.54	4369.23
US27-03B-4.1	578.61	1052.87	2419.99	3580.72	5115.79	6758.53	9031.93
US27-03B-5.1	448.26	884.06	1876.14	2715.52	3956.62	5131.46	6519.81
US27-03B-6.1	587.47	1116.45	2619.53	3060.06	4016.61	5480.96	6624.19
US27-03B-7.1	332.38	660.99	1372.18	1938.95	2978.27	3837.88	5055.21

	Tb (ch)	Dy (ch)	Ho (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
US27-03B-7.2	531.02	1108.59	3012.47	3295.78	5065.59	5898.29	8344.01
US27-03B-9.1	347.52	630.49	1395.58	2205.70	3535.28	4303.05	5188.50

APPENDIX C: Glass images with Indexed Analysis Spots

Dome 6

Dome 11

Ash 3

Ash 4

Ash 7

Ash 11

APPENDIX D: SHRIMP Trace Element in Glass Data

Glass analyses for Mono Craters with standards. Percent errors indicated.

Spot Name	90 /30	% err	138 /30	% err	139 /30	% err	140 /30	% err
NIST-611-1.4	0.020718	0.67	0.085493	0.35	0.048564	0.31	0.041075	0.33
MACUSANI-1.3	0.000493	3.25	0.000140	6.10	0.000071	5.61	0.000136	4.04
RLS37-1.3	0.016069	0.59	0.063005	0.31	0.003145	0.87	0.005894	0.64
RLS140-1.3	0.005397	1.01	0.033465	0.41	0.002324	1.01	0.003845	0.78
A3.1	0.005334	1.45	0.002722	2.02	0.001802	1.63	0.003609	1.16
A3.2	0.005148	1.46	0.002687	2.02	0.001697	1.67	0.003405	1.18
A3.1...dup1	0.003508	1.58	0.001430	2.47	0.001010	1.92	0.002013	1.36
A3.3	0.002643	1.38	0.001145	2.09	0.000724	1.72	0.001481	1.21
A3.4	0.002706	1.43	0.001226	2.12	0.000802	1.72	0.001563	1.23
A3.5	0.002634	1.38	0.001185	2.05	0.000753	1.69	0.001549	1.18
A3.6	0.003021	1.30	0.001477	1.85	0.000809	1.64	0.001700	1.13
A3.7	0.002734	1.37	0.001045	2.21	0.000790	1.66	0.001545	1.19
A3.8	0.002780	1.38	0.001036	2.25	0.000756	1.73	0.001576	1.20
A3.9	0.002453	1.48	0.002921	1.36	0.000715	1.80	0.001327	1.32
A3.10	0.006836	1.03	0.075242	0.33	0.001125	1.66	0.002012	1.24
A3.11	0.000012	30	0.043173	0.52	0.000823	2.40	0.000385	3.51
A3.12	0.000027	27	0.071090	0.54	0.001171	2.64	0.000619	3.63
A4.1	0.004331	1.55	0.001292	2.84	0.001578	1.68	0.002501	1.34
A4.2	0.003784	1.72	0.001409	2.81	0.000991	2.19	0.001984	1.55
A4.3	0.002959	1.54	0.000858	2.86	0.000727	2.03	0.001553	1.39
A4.4	0.000024	18	0.027901	0.52	0.000049	8.03	0.000070	6.69

Spot Name	90 /30	% err	138 /30	% err	139 /30	% err	140 /30	% err
A4.5	0.002674	1.41	0.000838	2.51	0.000678	1.83	0.001481	1.24
A4.6	0.002767	1.39	0.000713	2.73	0.000633	1.90	0.001339	1.31
A4.7	0.002809	1.44	0.000774	2.74	0.000693	1.90	0.001488	1.30
A4.8	0.002789	1.44	0.000820	2.65	0.000675	1.91	0.001442	1.31
A4.9	0.002959	1.49	0.000763	2.93	0.000688	2.02	0.001455	1.39
A4.10	0.005786	1.48	0.001753	2.68	0.001532	1.88	0.003290	1.28
A7.1	0.003245	2.37	0.004862	1.94	0.000955	2.86	0.002010	1.97
A7.2	0.004204	1.65	0.006148	1.36	0.001322	1.92	0.002567	1.38
A7.3	0.004086	1.67	0.009239	1.12	0.001325	1.92	0.002574	1.38
A7.4	0.004371	1.60	0.006750	1.29	0.001371	1.87	0.002715	1.33
A7.5	0.004499	1.47	0.007318	1.15	0.001438	1.70	0.002767	1.23
A7.6	0.004216	1.46	0.006209	1.20	0.001199	1.79	0.002513	1.24
A7.7	0.004109	1.48	0.006121	1.22	0.001215	1.79	0.002490	1.25
A7.8	0.002993	1.48	0.005997	1.05	0.000884	1.78	0.001694	1.29
A7.9	0.002964	1.41	0.004074	1.21	0.000759	1.83	0.001585	1.27
A7.10	0.002844	1.39	0.003699	1.22	0.000749	1.78	0.001498	1.26
A7.11	0.002760	1.39	0.003706	1.20	0.000777	1.72	0.001581	1.21
A7.12	0.002871	1.40	0.003698	1.23	0.000750	1.79	0.001575	1.23
A11.1	0.002762	1.44	0.005931	0.99	0.000833	1.72	0.001665	1.22
A11.2	0.002519	1.48	0.005767	0.98	0.000789	1.73	0.001620	1.21
A11.3	0.002569	1.49	0.012256	0.69	0.000752	1.80	0.001459	1.29
A11.4	0.002758	1.41	0.003725	1.22	0.000848	1.67	0.001666	1.19
A11.5	0.002600	1.43	0.005237	1.01	0.000773	1.72	0.001519	1.23
A11.6	0.002595	1.48	0.005623	1.01	0.000798	1.75	0.001592	1.24

Spot Name	90 /30	% err	138 /30	% err	139 /30	% err	140 /30	% err
A11.7	0.002603	1.48	0.005382	1.03	0.000777	1.77	0.001562	1.25
A11.8	0.002648	1.46	0.005564	1.01	0.000797	1.74	0.001612	1.23
A11.9	0.002631	1.46	0.005067	1.05	0.000824	1.71	0.001654	1.21
A11.10	0.002720	1.46	0.005350	1.04	0.000865	1.70	0.001679	1.22
A11.11	0.002205	1.62	0.020427	0.54	0.000592	2.05	0.001151	1.47
A11.12	0.002751	1.46	0.005054	1.08	0.000835	1.74	0.001616	1.25
A11.13	0.000056	13	0.036720	0.54	0.000541	2.84	0.000266	4.04
A11.14	0.000032	18	0.031869	0.59	0.000711	2.54	0.000258	4.21
NIST2.1	0.015323	0.81	0.070351	0.39	0.038290	0.35	0.031752	0.38
NIST2.2	0.015631	0.73	0.063733	0.38	0.035097	0.34	0.030207	0.36
NIST2.3	0.016073	0.73	0.064746	0.38	0.036824	0.33	0.031218	0.36
NIST2.4	0.016516	0.72	0.065488	0.38	0.037051	0.33	0.031471	0.36
NIST2.5	0.016097	0.72	0.064105	0.37	0.036404	0.33	0.030698	0.36
NIST2.6	0.016212	0.73	0.065918	0.37	0.036730	0.33	0.030877	0.36
D6.1	0.003206	1.29	0.000726	2.70	0.000978	1.52	0.001935	1.08
D6.2	0.002965	1.35	0.001805	1.73	0.000882	1.62	0.001728	1.16
D6.3	0.003023	1.30	0.000715	2.67	0.000873	1.58	0.001781	1.11
D6.4	0.003153	1.30	0.000710	2.73	0.000874	1.61	0.001787	1.13
D6.5	0.003048	1.32	0.000744	2.67	0.000913	1.58	0.001836	1.11
D6.6	0.002791	1.42	0.002006	1.67	0.000824	1.71	0.001594	1.23
D6.7	0.003111	1.29	0.000709	2.69	0.000980	1.50	0.001850	1.09
D6.8	0.003197	1.29	0.000551	3.09	0.001005	1.50	0.001979	1.07
D6.9	0.002986	1.34	0.000481	3.34	0.000926	1.58	0.001858	1.12
D6.10	0.003014	1.33	0.000515	3.22	0.000907	1.59	0.001816	1.13

Spot Name	90 /30	% err	138 /30	% err	139 /30	% err	140 /30	% err
D6.11	0.003021	1.32	0.000550	3.08	0.000927	1.55	0.001781	1.12
D6.12	0.003259	1.32	0.000757	2.73	0.000994	1.56	0.001929	1.12
D6.13	0.003191	1.32	0.000637	2.95	0.000884	1.64	0.001862	1.13
D6.14	0.003082	1.35	0.000695	2.84	0.000855	1.68	0.001820	1.15
D19.1	0.003009	1.33	0.016941	0.57	0.001367	1.29	0.002399	0.98
D19.2	0.003150	1.30	0.016482	0.57	0.001385	1.28	0.002385	0.98
D19.3	0.003142	1.30	0.016933	0.57	0.001370	1.29	0.002367	0.99
D19.4	0.003153	1.37	0.020131	0.55	0.001358	1.37	0.002355	1.04
D19.5	0.003106	1.30	0.016301	0.57	0.001381	1.28	0.002439	0.96
D19.6	0.003113	1.30	0.017664	0.55	0.001399	1.27	0.002456	0.96
D19.7	0.003103	1.30	0.016992	0.56	0.001355	1.29	0.002428	0.96
D19.9	0.000014	29	0.103818	0.36	0.001128	2.11	0.001059	2.18
D19.10	0.003168	1.34	0.017534	0.57	0.001412	1.31	0.002476	0.99
D19.11	0.003348	1.30	0.017128	0.58	0.001530	1.26	0.002687	0.95
D19.12	0.000011	27	0.017394	0.69	0.000348	3.15	0.000317	3.29
D19.13	0.003179	1.28	0.018078	0.54	0.001445	1.24	0.002482	0.95
D19.14	0.003167	1.29	0.016932	0.57	0.001438	1.26	0.002515	0.95
A17.1	0.002709	1.45	0.005696	1.00	0.000913	1.63	0.001665	1.21
A17.2	0.002839	1.37	0.005436	0.99	0.000948	1.55	0.001659	1.18
A17.3	0.002946	1.39	0.009376	0.78	0.000968	1.58	0.001760	1.17
A17.4	0.002773	1.41	0.005946	0.96	0.000978	1.55	0.001817	1.14
A17.5	0.000915	2.83	0.057535	0.37	0.000226	3.73	0.000171	4.29
A17.6	0.002708	1.38	0.005952	0.94	0.000921	1.55	0.001622	1.17
A17.7	0.002803	1.40	0.006140	0.95	0.000957	1.57	0.001682	1.19

Spot Name	90 /30	% err	138 /30	% err	139 /30	% err	140 /30	% err
A17.8	0.002788	1.40	0.005961	0.96	0.000920	1.59	0.001659	1.19
A17.9	0.003096	1.39	0.006275	0.98	0.001065	1.55	0.001850	1.18
A17.10	0.002730	1.41	0.005551	0.99	0.000928	1.58	0.001708	1.17
A17.11	0.002770	1.41	0.006120	0.95	0.000927	1.59	0.001694	1.18
A17.12	0.002781	1.48	0.006018	1.01	0.000947	1.66	0.001732	1.23
A19.4	0.003063	1.37	0.003898	1.22	0.001101	1.50	0.001965	1.12
A19.5	0.002885	1.34	0.003756	1.18	0.001003	1.49	0.001776	1.12
A19.6	0.002806	1.38	0.003005	1.34	0.000896	1.60	0.001650	1.18
A19.9	0.002953	1.37	0.003973	1.19	0.001025	1.53	0.001846	1.14
A19.10	0.002764	1.40	0.003969	1.17	0.001022	1.51	0.001815	1.13
A19.11	0.003085	1.37	0.003823	1.23	0.001082	1.52	0.001938	1.13
A19.12	0.002703	1.39	0.003719	1.18	0.001010	1.48	0.001789	1.12
A19.13	0.002803	1.36	0.004132	1.12	0.001030	1.47	0.001862	1.10
A19.14	0.002763	1.38	0.003863	1.17	0.000961	1.54	0.001825	1.12
NIST1.1	0.016064	0.74	0.064577	0.38	0.035644	0.34	0.030204	0.37
A19.15	0.000052	8.91	0.000000	100	0.000000	100	0.000001	45
A19.16	0.002808	1.37	0.003900	1.16	0.001031	1.48	0.001839	1.11
A19.17	0.003046	1.33	0.003695	1.21	0.001017	1.50	0.001856	1.11
A19.18	0.002871	1.36	0.003763	1.19	0.001017	1.50	0.001808	1.13
A19.19	0.002852	1.39	0.003731	1.21	0.001035	1.51	0.001892	1.12
A19.20	0.002862	1.38	0.003584	1.23	0.001027	1.50	0.001867	1.12
A19.21	0.000129	5.16	0.000002	45	0.000000	100	0.000000	58
A19.22	0.002855	1.38	0.003499	1.24	0.000963	1.55	0.001773	1.14
RLS-158-1	0.002952	1.35	0.121005	0.23	0.001543	1.22	0.002532	0.95

Spot Name	90 /30	% err	138 /30	% err	139 /30	% err	140 /30	% err
RLS-158-2	0.002996	1.36	0.118856	0.23	0.001563	1.23	0.002480	0.98
RLS-158-3	0.002853	1.35	0.111894	0.23	0.001465	1.23	0.002453	0.95
RLS-158-4	0.003037	1.35	0.122668	0.23	0.001579	1.22	0.002603	0.95
RLS-158-5	0.002841	1.37	0.115519	0.23	0.001475	1.24	0.002452	0.96
RLS-140-1	0.004692	1.09	0.026327	0.47	0.001866	1.13	0.003146	0.87
RLS-140-2	0.004468	1.07	0.025025	0.46	0.001793	1.11	0.003101	0.84
RLS-140-3	0.004457	1.07	0.024528	0.46	0.001780	1.11	0.003060	0.85
RLS-140-4	0.004512	1.05	0.024729	0.46	0.001769	1.10	0.003018	0.85
RLS-140-5	0.004823	1.08	0.026831	0.47	0.001848	1.14	0.003227	0.87
RLS-132-1	0.028226	0.44	0.000852	2.46	0.002060	1.04	0.004326	0.72
RLS-132-2	0.027330	0.44	0.000833	2.45	0.001984	1.04	0.004195	0.72
RLS-132-3	0.027148	0.44	0.000814	2.47	0.001914	1.06	0.004127	0.72
RLS-132-4	0.028314	0.43	0.000804	2.52	0.002019	1.05	0.004328	0.72
RLS-132-5	0.026908	0.44	0.000797	2.49	0.001933	1.05	0.004129	0.72
RLS-76-75-1	0.004837	1.02	0.000119	6.50	0.001894	1.07	0.003548	0.78
RLS-76-75-2	0.004837	1.04	0.000114	6.73	0.001989	1.06	0.003585	0.79
RLS-76-75-3	0.004841	1.02	0.000103	7.00	0.001857	1.08	0.003573	0.78
RLS-76-75-4	0.004797	1.04	0.000069	8.67	0.001949	1.07	0.003628	0.79
RLS-76-75-5	0.004634	1.04	0.000110	6.74	0.001904	1.07	0.003492	0.79
RLS-76-75-6	0.004719	1.03	0.000081	7.81	0.001894	1.06	0.003404	0.80
RLS-37-1	0.013555	0.62	0.047781	0.34	0.002388	0.96	0.004560	0.70
RLS-37-2	0.014127	0.63	0.049511	0.35	0.002520	0.98	0.004722	0.71
RLS-37-3	0.013200	0.63	0.046258	0.35	0.002391	0.97	0.004596	0.70
RLS-37-4	0.013070	0.65	0.046562	0.35	0.002328	1.00	0.004449	0.73

Spot Name	90 /30	% err	138 /30	% err	139 /30	% err	140 /30	% err
RLS-37-5	0.013478	0.64	0.045963	0.35	0.002434	0.98	0.004631	0.71
MACUSANI-1	0.000493	3.53	0.000093	8.14	0.000054	6.99	0.000109	4.92
MACUSANI-2	0.000455	3.82	0.000072	9.62	0.000053	7.30	0.000103	5.26
MACUSANI-3	0.000434	3.88	0.000118	7.43	0.000049	7.54	0.000106	5.14
MACUSANI-4	0.000481	3.61	0.000100	7.91	0.000058	6.77	0.000112	4.90
MACUSANI-5	0.000505	3.61	0.000101	8.08	0.000051	7.41	0.000110	5.07
NIST-611-1	0.014930	0.78	0.056325	0.41	0.031436	0.37	0.026653	0.39
NIST-611-2	0.015804	0.77	0.061386	0.40	0.034128	0.36	0.028218	0.39
NIST-611-3	0.014874	0.76	0.058555	0.40	0.032708	0.35	0.027477	0.38
NIST-611-4	0.015163	0.76	0.058385	0.40	0.032731	0.35	0.027427	0.38
NIST-611-5	0.015952	0.76	0.061379	0.40	0.034193	0.35	0.028063	0.39

Spot Name	146 /30	% err	147 /30	% err	151 /30	% err	174 /30	% err
NIST-611-1.4	0.009517	0.65	0.009791	0.64	0.034177	0.25	0.006129	0.56
MACUSANI-								
1.3	0.000026	9.17	0.000060	6.11	0.000009	10	0.000005	14
RLS37-1.3	0.000709	1.83	0.000214	3.33	0.000123	2.82	0.000164	2.60
RLS140-1.3	0.000365	2.53	0.000112	4.57	0.000010	10	0.000034	5.65
A3.1	0.000447	3.27	0.000188	5.03	0.000011	13	0.000071	5.61
A3.2	0.000417	3.35	0.000161	5.39	0.000012	13	0.000069	5.63
A3.1...dup1	0.000243	3.92	0.000113	5.75	0.000006	16	0.000045	6.23
A3.3	0.000182	3.43	0.000100	4.64	0.000005	13	0.000035	5.36
A3.4	0.000201	3.42	0.000107	4.68	0.000007	12	0.000038	5.40
A3.5	0.000181	3.43	0.000100	4.61	0.000006	12	0.000033	5.49
A3.6	0.000191	3.37	0.000107	4.51	0.000003	16	0.000038	5.18
A3.7	0.000169	3.59	0.000089	4.95	0.000004	14	0.000032	5.67
A3.8	0.000192	3.42	0.000099	4.76	0.000005	13	0.000036	5.42
A3.9	0.000151	3.90	0.000089	5.10	0.000009	10	0.000031	5.90
A3.10	0.000214	3.81	0.000081	6.16	0.000081	3.96	0.000038	6.16
A3.11	0.000051	9.63	0.000028	13	0.000069	5.31	0.000002	35
A3.12	0.000082	9.95	0.000031	16	0.000097	5.87	0.000003	38
A4.1	0.000287	3.94	0.000135	5.74	0.000010	14	0.000044	6.90
A4.2	0.000233	4.51	0.000118	6.34	0.000006	18	0.000036	7.88
A4.3	0.000195	3.93	0.000106	5.33	0.000005	16	0.000043	5.68
A4.4	0.000063	7.07	0.000008	20	0.000011	11	0.000000	100
A4.5	0.000185	3.50	0.000089	5.05	0.000005	14	0.000034	5.54
A4.6	0.000171	3.65	0.000093	4.94	0.000005	14	0.000035	5.51

Spot Name	146 /30	% err	147 /30	% err	151 /30	% err	174 /30	% err
A4.7	0.000193	3.59	0.000108	4.80	0.000006	13	0.000038	5.51
A4.8	0.000181	3.70	0.000080	5.55	0.000004	17	0.000033	5.87
A4.9	0.000191	3.83	0.000090	5.59	0.000004	18	0.000036	6.05
A4.10	0.000447	3.47	0.000196	5.23	0.000014	13	0.000083	5.49
A7.1	0.000233	5.79	0.000103	8.71	0.000009	19	0.000031	11
A7.2	0.000278	4.18	0.000111	6.62	0.000011	13	0.000047	6.92
A7.3	0.000277	4.20	0.000122	6.31	0.000020	10	0.000045	7.11
A7.4	0.000293	4.04	0.000132	6.01	0.000011	13	0.000040	7.43
A7.5	0.000301	3.71	0.000148	5.28	0.000013	11	0.000050	6.24
A7.6	0.000297	3.59	0.000134	5.33	0.000013	11	0.000044	6.34
A7.7	0.000273	3.76	0.000144	5.17	0.000013	11	0.000046	6.23
A7.8	0.000207	3.67	0.000101	5.24	0.000011	10	0.000032	6.34
A7.9	0.000182	3.73	0.000100	5.04	0.000007	13	0.000031	6.19
A7.10	0.000181	3.61	0.000094	5.01	0.000007	11	0.000028	6.23
A7.11	0.000188	3.49	0.000086	5.17	0.000010	9.81	0.000031	5.90
A7.12	0.000181	3.63	0.000095	5.01	0.000006	13	0.000035	5.66
A11.1	0.000190	3.59	0.000089	5.26	0.000010	9.95	0.000029	6.26
A11.2	0.000185	3.56	0.000090	5.10	0.000008	11	0.000026	6.52
A11.3	0.000166	3.82	0.000098	4.97	0.000013	8.89	0.000028	6.34
A11.4	0.000182	3.60	0.000092	5.06	0.000007	12	0.000035	5.58
A11.5	0.000176	3.60	0.000088	5.08	0.000008	11	0.000028	6.14
A11.6	0.000182	3.66	0.000095	5.06	0.000008	11	0.000033	5.90
A11.7	0.000189	3.59	0.000087	5.27	0.000008	11	0.000030	6.15
A11.8	0.000165	3.82	0.000089	5.22	0.000008	11	0.000028	6.30

Spot Name	146 /30	% err	147 /30	% err	151 /30	% err	174 /30	% err
A11.9	0.000172	3.73	0.000099	4.92	0.000008	11	0.000028	6.27
A11.10	0.000183	3.69	0.000094	5.13	0.000008	11	0.000028	6.44
A11.11	0.000122	4.52	0.000081	5.55	0.000017	7.85	0.000022	7.33
A11.12	0.000170	3.84	0.000091	5.26	0.000006	13	0.000031	6.15
A11.13	0.000037	11	0.000018	15	0.000048	6.12	0.000001	41
A11.14	0.000041	11	0.000021	15	0.000038	7.02	0.000001	58
NIST2.1	0.007479	0.76	0.007792	0.74	0.027618	0.28	0.004845	0.65
NIST2.2	0.007166	0.71	0.007334	0.70	0.025118	0.27	0.004146	0.64
NIST2.3	0.007246	0.72	0.007649	0.70	0.026201	0.26	0.004353	0.63
NIST2.4	0.007340	0.71	0.007672	0.69	0.026145	0.26	0.004247	0.64
NIST2.5	0.007363	0.70	0.007487	0.69	0.025840	0.26	0.004334	0.62
NIST2.6	0.007461	0.70	0.007574	0.70	0.025934	0.26	0.004195	0.64
D6.1	0.000204	3.33	0.000102	4.71	0.000004	15	0.000032	5.74
D6.2	0.000194	3.44	0.000087	5.14	0.000007	12	0.000027	6.31
D6.3	0.000207	3.25	0.000098	4.73	0.000003	18	0.000029	5.89
D6.4	0.000195	3.41	0.000097	4.84	0.000003	17	0.000023	6.74
D6.5	0.000209	3.29	0.000093	4.95	0.000003	18	0.000029	6.02
D6.6	0.000189	3.56	0.000092	5.10	0.000009	11	0.000022	7.13
D6.7	0.000209	3.24	0.000099	4.71	0.000003	16	0.000029	5.94
D6.8	0.000211	3.27	0.000102	4.70	0.000003	17	0.000035	5.50
D6.9	0.000223	3.21	0.000106	4.66	0.000004	16	0.000041	5.12
D6.10	0.000217	3.25	0.000094	4.94	0.000003	19	0.000029	6.10
D6.11	0.000186	3.46	0.000092	4.93	0.000003	16	0.000031	5.76
D6.12	0.000214	3.36	0.000104	4.81	0.000003	19	0.000026	6.52

Spot Name	146 /30	% err	147 /30	% err	151 /30	% err	174 /30	% err
D6.13	0.000204	3.41	0.000100	4.88	0.000004	15	0.000033	5.80
D6.14	0.000211	3.37	0.000090	5.15	0.000005	15	0.000032	5.88
D19.1	0.000238	3.09	0.000089	5.05	0.000014	8.22	0.000026	6.37
D19.2	0.000231	3.14	0.000093	4.94	0.000012	8.81	0.000028	6.17
D19.3	0.000211	3.29	0.000106	4.63	0.000010	9.54	0.000022	6.90
D19.4	0.000207	3.50	0.000103	4.96	0.000014	8.77	0.000027	6.65
D19.5	0.000228	3.14	0.000108	4.56	0.000010	9.85	0.000024	6.57
D19.6	0.000229	3.12	0.000096	4.81	0.000011	8.96	0.000027	6.22
D19.7	0.000234	3.09	0.000090	4.98	0.000009	10	0.000023	6.70
D19.9	0.000081	7.88	0.000042	11	0.000171	3.48	0.000001	45
D19.10	0.000227	3.26	0.000102	4.87	0.000011	9.68	0.000026	6.54
D19.11	0.000248	3.13	0.000099	4.95	0.000012	9.05	0.000032	5.96
D19.12	0.000034	10	0.000031	11	0.000070	4.51	0.000001	50
D19.13	0.000241	3.03	0.000096	4.80	0.000008	10	0.000028	6.11
D19.14	0.000250	3.01	0.000106	4.62	0.000010	9.49	0.000025	6.55
A17.1	0.000178	3.70	0.000096	5.03	0.000010	10	0.000025	6.73
A17.2	0.000170	3.67	0.000091	5.00	0.000008	11	0.000025	6.51
A17.3	0.000179	3.67	0.000093	5.08	0.000010	9.73	0.000026	6.61
A17.4	0.000171	3.70	0.000099	4.88	0.000010	9.71	0.000024	6.73
A17.5	0.000017	13	0.000038	9.13	0.000052	5.01	0.000001	50
A17.6	0.000175	3.56	0.000093	4.88	0.000010	9.76	0.000021	6.99
A17.7	0.000176	3.66	0.000089	5.15	0.000010	9.84	0.000026	6.54
A17.8	0.000147	3.98	0.000084	5.26	0.000009	10	0.000022	6.97
A17.9	0.000187	3.70	0.000097	5.14	0.000010	10	0.000026	6.83

Spot Name	146 /30	% err	147 /30	% err	151 /30	% err	174 /30	% err
A17.10	0.000168	3.72	0.000082	5.31	0.000008	11	0.000024	6.68
A17.11	0.000163	3.78	0.000094	5.00	0.000011	9.35	0.000023	6.88
A17.12	0.000169	3.93	0.000095	5.23	0.000009	11	0.000027	6.71
A19.4	0.000189	3.61	0.000088	5.30	0.000008	11	0.000030	6.16
A19.5	0.000190	3.42	0.000080	5.27	0.000009	9.95	0.000024	6.56
A19.6	0.000174	3.63	0.000083	5.25	0.000008	11	0.000026	6.42
A19.9	0.000190	3.54	0.000100	4.88	0.000007	12	0.000024	6.79
A19.10	0.000191	3.49	0.000090	5.07	0.000011	9.21	0.000027	6.34
A19.11	0.000205	3.47	0.000101	4.95	0.000009	11	0.000026	6.68
A19.12	0.000178	3.53	0.000085	5.10	0.000010	9.76	0.000028	6.12
A19.13	0.000183	3.49	0.000087	5.06	0.000010	9.67	0.000030	5.87
A19.14	0.000193	3.43	0.000084	5.18	0.000010	9.73	0.000026	6.43
NIST1.1	0.007021	0.73	0.007347	0.72	0.025396	0.27	0.004520	0.63
A19.15	0.000000	100	0.000000	71	0.000000	100	0.000000	100
A19.16	0.000189	3.45	0.000082	5.24	0.000009	9.95	0.000027	6.21
A19.17	0.000189	3.48	0.000084	5.22	0.000007	11	0.000026	6.36
A19.18	0.000191	3.46	0.000089	5.06	0.000009	10	0.000024	6.59
A19.19	0.000200	3.43	0.000088	5.15	0.000012	9.05	0.000028	6.28
A19.20	0.000193	3.46	0.000103	4.74	0.000008	11	0.000025	6.62
A19.21	0.000000	100	0.000000	58	0.000000	58	0.000000	100
A19.22	0.000184	3.54	0.000090	5.07	0.000008	11	0.000024	6.66
RLS-158-1	0.000237	3.11	0.000100	4.78	0.000024	6.30	0.000027	6.23
RLS-158-2	0.000241	3.14	0.000098	4.93	0.000024	6.42	0.000029	6.20
RLS-158-3	0.000237	3.06	0.000093	4.88	0.000027	5.81	0.000028	6.05

Spot Name	146 /30	% err	147 /30	% err	151 /30	% err	174 /30	% err
RLS-158-4	0.000238	3.15	0.000103	4.77	0.000024	6.38	0.000031	5.99
RLS-158-5	0.000237	3.09	0.000091	4.99	0.000024	6.20	0.000026	6.40
RLS-140-1	0.000287	2.87	0.000103	4.78	0.000007	12	0.000035	5.57
RLS-140-2	0.000278	2.81	0.000109	4.47	0.000008	11	0.000029	5.94
RLS-140-3	0.000287	2.75	0.000104	4.58	0.000008	11	0.000025	6.35
RLS-140-4	0.000282	2.75	0.000088	4.92	0.000008	10	0.000029	5.81
RLS-140-5	0.000292	2.87	0.000109	4.69	0.000011	9.62	0.000035	5.67
RLS-132-1	0.000463	2.18	0.000168	3.62	0.000061	3.87	0.000102	3.18
RLS-132-2	0.000431	2.23	0.000174	3.51	0.000060	3.85	0.000103	3.11
RLS-132-3	0.000412	2.27	0.000146	3.82	0.000059	3.86	0.000100	3.15
RLS-132-4	0.000456	2.19	0.000161	3.69	0.000059	3.90	0.000108	3.07
RLS-132-5	0.000414	2.27	0.000167	3.57	0.000063	3.71	0.000105	3.07
RLS-76-75-1	0.000336	2.54	0.000134	4.01	0.000002	21	0.000071	3.77
RLS-76-75-2	0.000347	2.52	0.000137	4.02	0.000002	21	0.000066	3.96
RLS-76-75-3	0.000343	2.51	0.000138	3.96	0.000003	17	0.000063	3.99
RLS-76-75-4	0.000346	2.53	0.000141	3.97	0.000003	18	0.000066	3.97
RLS-76-75-5	0.000340	2.52	0.000130	4.06	0.000003	17	0.000061	4.05
RLS-76-75-6	0.000320	2.58	0.000128	4.08	0.000002	21	0.000059	4.10
RLS-37-1	0.000505	2.08	0.000190	3.39	0.000090	3.17	0.000112	3.01
RLS-37-2	0.000567	2.05	0.000202	3.43	0.000102	3.09	0.000133	2.89
RLS-37-3	0.000532	2.05	0.000184	3.49	0.000083	3.33	0.000118	2.98
RLS-37-4	0.000544	2.07	0.000182	3.58	0.000091	3.25	0.000124	2.95
RLS-37-5	0.000558	2.04	0.000183	3.55	0.000092	3.23	0.000120	3.01
MACUSANI-1	0.000022	11	0.000055	6.88	0.000007	12	0.000005	16

Spot Name	146 /30	% err	147 /30	% err	151 /30	% err	174 /30	% err
MACUSANI-2	0.000020	12	0.000050	7.58	0.000013	9.49	0.000003	21
MACUSANI-3	0.000022	11	0.000043	8.02	0.000008	12	0.000003	19
MACUSANI-4	0.000023	11	0.000055	6.96	0.000008	11	0.000004	18
MACUSANI-5	0.000020	12	0.000044	7.99	0.000009	12	0.000005	17
NIST-611-1	0.006300	0.78	0.006483	0.77	0.022357	0.29	0.004092	0.67
NIST-611-2	0.006960	0.76	0.006996	0.76	0.024085	0.28	0.004418	0.66
NIST-611-3	0.006389	0.76	0.006694	0.74	0.022559	0.28	0.003892	0.67
NIST-611-4	0.006393	0.76	0.006634	0.75	0.022639	0.28	0.003906	0.67
NIST-611-5	0.006672	0.77	0.006924	0.75	0.023489	0.28	0.004185	0.66

Spot Name	175 /30	% err	178 /30	% err	181 /30	% err	182 /30	% err
NIST-611-1.4	0.021725	0.31	0.004697	0.63	0.016210	0.35	0.004713	0.63
MACUSANI-								
1.3	0.000004	15	0.000005	15	0.000005	14	0.000003	20
RLS37-1.3	0.000104	3.27	0.000142	2.79	0.000105	3.25	0.000087	3.56
RLS140-1.3	0.000023	6.85	0.000030	6.05	0.000027	6.35	0.000022	7.11
A3.1	0.000046	6.95	0.000075	5.45	0.000059	6.16	0.000049	6.70
A3.2	0.000044	7.09	0.000062	5.94	0.000053	6.41	0.000035	7.93
A3.1...dup1	0.000026	8.14	0.000044	6.31	0.000028	7.83	0.000032	7.41
A3.3	0.000021	6.85	0.000036	5.28	0.000022	6.82	0.000022	6.76
A3.4	0.000022	7.01	0.000036	5.54	0.000027	6.40	0.000025	6.62
A3.5	0.000023	6.64	0.000034	5.39	0.000026	6.20	0.000023	6.52
A3.6	0.000024	6.57	0.000040	5.01	0.000027	6.15	0.000025	6.33
A3.7	0.000020	7.05	0.000030	5.82	0.000024	6.51	0.000019	7.36
A3.8	0.000023	6.73	0.000032	5.72	0.000025	6.50	0.000021	7.03
A3.9	0.000020	7.33	0.000032	5.77	0.000025	6.58	0.000018	7.65
A3.10	0.000020	8.45	0.000032	6.68	0.000026	7.39	0.000023	7.85
A3.11	0.000000	71	0.000000	100	0.000001	50	0.000000	100
A3.12	0.000001	71	0.000001	58	0.000002	41	0.000000	100
A4.1	0.000035	7.72	0.000048	6.55	0.000037	7.52	0.000038	7.39
A4.2	0.000029	8.81	0.000037	7.72	0.000037	7.77	0.000022	10
A4.3	0.000028	7.11	0.000038	6.06	0.000032	6.59	0.000027	7.20
A4.4	0.000000	100	0.000000	100	0.000001	50	0.000000	100
A4.5	0.000023	6.83	0.000033	5.65	0.000024	6.66	0.000020	7.34
A4.6	0.000022	6.97	0.000030	5.95	0.000026	6.44	0.000017	7.91

Spot Name	175 /30	% err	178 /30	% err	181 /30	% err	182 /30	% err
A4.7	0.000023	7.11	0.000034	5.82	0.000027	6.50	0.000027	6.51
A4.8	0.000022	7.28	0.000033	5.89	0.000024	6.93	0.000018	7.91
A4.9	0.000023	7.50	0.000039	5.76	0.000027	6.97	0.000027	6.93
A4.10	0.000052	6.94	0.000078	5.66	0.000062	6.35	0.000044	7.54
A7.1	0.000022	13	0.000040	9.58	0.000021	13	0.000027	12
A7.2	0.000029	8.85	0.000046	7.05	0.000034	8.17	0.000029	8.84
A7.3	0.000033	8.28	0.000039	7.62	0.000034	8.20	0.000025	9.45
A7.4	0.000029	8.74	0.000046	6.99	0.000033	8.17	0.000031	8.51
A7.5	0.000036	7.32	0.000049	6.28	0.000043	6.71	0.000032	7.76
A7.6	0.000032	7.43	0.000045	6.28	0.000035	7.13	0.000030	7.77
A7.7	0.000031	7.63	0.000053	5.80	0.000034	7.28	0.000029	7.91
A7.8	0.000021	7.80	0.000033	6.24	0.000022	7.63	0.000023	7.56
A7.9	0.000022	7.27	0.000031	6.19	0.000025	6.87	0.000022	7.39
A7.10	0.000019	7.65	0.000029	6.11	0.000026	6.56	0.000017	8.17
A7.11	0.000021	7.14	0.000029	6.05	0.000023	6.79	0.000021	7.05
A7.12	0.000020	7.55	0.000028	6.31	0.000020	7.43	0.000019	7.65
A11.1	0.000022	7.15	0.000033	5.92	0.000021	7.41	0.000021	7.43
A11.2	0.000020	7.43	0.000028	6.20	0.000022	6.98	0.000017	8.08
A11.3	0.000016	8.33	0.000029	6.30	0.000018	8.03	0.000017	8.11
A11.4	0.000019	7.55	0.000030	6.08	0.000021	7.24	0.000019	7.54
A11.5	0.000015	8.39	0.000026	6.38	0.000023	6.85	0.000017	7.91
A11.6	0.000021	7.37	0.000032	5.99	0.000024	6.88	0.000017	8.17
A11.7	0.000018	7.96	0.000030	6.12	0.000023	7.04	0.000018	7.86
A11.8	0.000020	7.45	0.000028	6.38	0.000028	6.38	0.000017	8.17

Spot Name	175 /30	% err	178 /30	% err	181 /30	% err	182 /30	% err
A11.9	0.000021	7.23	0.000026	6.50	0.000022	7.18	0.000018	7.79
A11.10	0.000019	7.81	0.000029	6.30	0.000025	6.76	0.000018	8.02
A11.11	0.000014	9.13	0.000022	7.26	0.000015	8.81	0.000015	8.85
A11.12	0.000021	7.50	0.000028	6.47	0.000022	7.35	0.000015	8.73
A11.13	0.000001	50	0.000001	45	0.000001	45	0.000000	100
A11.14	0.000001	50	0.000000	71	0.000001	38	0.000000	100
NIST2.1	0.018192	0.35	0.003947	0.71	0.013504	0.40	0.004047	0.71
NIST2.2	0.015786	0.34	0.003580	0.69	0.011257	0.40	0.003246	0.72
NIST2.3	0.015524	0.35	0.003546	0.70	0.011528	0.40	0.003421	0.71
NIST2.4	0.015167	0.35	0.003451	0.71	0.011302	0.40	0.003041	0.75
NIST2.5	0.016229	0.34	0.003478	0.69	0.011592	0.39	0.003173	0.73
NIST2.6	0.015548	0.35	0.003551	0.69	0.011943	0.39	0.003386	0.71
D6.1	0.000019	7.39	0.000032	5.71	0.000025	6.55	0.000016	8.01
D6.2	0.000020	7.37	0.000027	6.30	0.000022	6.95	0.000016	8.17
D6.3	0.000019	7.39	0.000030	5.84	0.000019	7.39	0.000016	7.96
D6.4	0.000022	6.97	0.000029	6.01	0.000019	7.45	0.000015	8.42
D6.5	0.000019	7.47	0.000027	6.28	0.000023	6.77	0.000018	7.62
D6.6	0.000014	8.92	0.000022	7.20	0.000016	8.26	0.000012	9.54
D6.7	0.000021	6.95	0.000028	6.02	0.000022	6.80	0.000016	7.96
D6.8	0.000022	6.95	0.000031	5.82	0.000020	7.33	0.000019	7.52
D6.9	0.000027	6.35	0.000037	5.40	0.000029	6.10	0.000024	6.67
D6.10	0.000018	7.67	0.000028	6.23	0.000022	6.95	0.000016	8.19
D6.11	0.000019	7.47	0.000029	5.97	0.000017	7.74	0.000018	7.52
D6.12	0.000017	8.14	0.000029	6.23	0.000019	7.60	0.000015	8.61

Spot Name	175 /30	% err	178 /30	% err	181 /30	% err	182 /30	% err
D6.13	0.000020	7.50	0.000030	6.08	0.000024	6.84	0.000017	8.08
D6.14	0.000022	7.21	0.000032	5.90	0.000021	7.36	0.000017	8.05
D19.1	0.000018	7.63	0.000027	6.24	0.000020	7.19	0.000015	8.36
D19.2	0.000015	8.36	0.000023	6.79	0.000016	8.17	0.000017	7.93
D19.3	0.000016	8.09	0.000020	7.23	0.000015	8.48	0.000015	8.36
D19.4	0.000015	8.92	0.000023	7.16	0.000018	8.09	0.000016	8.61
D19.5	0.000014	8.77	0.000022	6.98	0.000018	7.65	0.000015	8.42
D19.6	0.000016	8.14	0.000024	6.58	0.000016	7.99	0.000014	8.48
D19.7	0.000014	8.62	0.000023	6.73	0.000017	7.76	0.000014	8.64
D19.9	0.000000	100	0.000000	100	0.000001	45	0.000000	71
D19.10	0.000014	8.92	0.000024	6.92	0.000020	7.58	0.000019	7.75
D19.11	0.000020	7.60	0.000023	7.05	0.000018	7.96	0.000016	8.42
D19.12	0.000000	100	0.000000	71	0.000001	45	0.000000	100
D19.13	0.000018	7.50	0.000025	6.40	0.000018	7.60	0.000015	8.45
D19.14	0.000016	8.11	0.000024	6.59	0.000017	7.83	0.000013	9.05
A17.1	0.000015	8.84	0.000025	6.77	0.000018	7.91	0.000016	8.32
A17.2	0.000013	8.96	0.000025	6.58	0.000016	8.22	0.000018	7.75
A17.3	0.000016	8.36	0.000021	7.37	0.000016	8.36	0.000014	9.00
A17.4	0.000020	7.50	0.000025	6.66	0.000018	7.83	0.000015	8.42
A17.5	0.000000	71	0.000000	100	0.000001	45	0.000001	45
A17.6	0.000015	8.42	0.000027	6.19	0.000014	8.48	0.000013	8.80
A17.7	0.000013	9.05	0.000025	6.64	0.000017	8.08	0.000015	8.54
A17.8	0.000021	7.26	0.000025	6.61	0.000016	8.19	0.000017	8.09
A17.9	0.000020	7.70	0.000024	7.11	0.000020	7.72	0.000015	8.85

Spot Name	175 /30	% err	178 /30	% err	181 /30	% err	182 /30	% err
A17.10	0.000015	8.51	0.000024	6.77	0.000018	7.65	0.000016	8.11
A17.11	0.000016	8.36	0.000026	6.43	0.000018	7.74	0.000015	8.52
A17.12	0.000021	7.63	0.000024	7.05	0.000019	7.93	0.000017	8.58
A19.4	0.000020	7.60	0.000026	6.61	0.000020	7.52	0.000021	7.47
A19.5	0.000019	7.48	0.000026	6.35	0.000017	7.72	0.000014	8.66
A19.6	0.000017	7.91	0.000023	6.87	0.000017	8.01	0.000016	8.20
A19.9	0.000018	7.91	0.000027	6.47	0.000018	7.93	0.000017	8.20
A19.10	0.000018	7.76	0.000025	6.53	0.000019	7.57	0.000016	8.22
A19.11	0.000017	8.28	0.000025	6.82	0.000021	7.50	0.000020	7.67
A19.12	0.000016	8.03	0.000023	6.67	0.000017	7.83	0.000013	8.96
A19.13	0.000013	8.84	0.000022	6.86	0.000017	7.76	0.000017	7.85
A19.14	0.000016	8.09	0.000025	6.47	0.000017	7.85	0.000017	7.98
NIST1.1	0.016639	0.34	0.003642	0.70	0.012876	0.38	0.003694	0.69
A19.15	0.000000	100	0.000000	100	0.000000	50	0.000000	100
A19.16	0.000017	7.83	0.000029	6.02	0.000017	7.85	0.000015	8.35
A19.17	0.000017	7.98	0.000025	6.59	0.000020	7.23	0.000018	7.72
A19.18	0.000016	8.06	0.000025	6.50	0.000021	7.09	0.000015	8.39
A19.19	0.000015	8.49	0.000031	5.97	0.000020	7.36	0.000016	8.26
A19.20	0.000015	8.39	0.000023	6.87	0.000021	7.14	0.000019	7.58
A19.21	0.000000	100	0.000000	100	0.000000	100	0.000000	50
A19.22	0.000018	7.72	0.000026	6.48	0.000017	7.91	0.000018	7.83
RLS-158-1	0.000019	7.41	0.000030	5.97	0.000020	7.29	0.000020	7.36
RLS-158-2	0.000018	7.77	0.000028	6.24	0.000019	7.72	0.000018	7.79
RLS-158-3	0.000019	7.48	0.000024	6.61	0.000023	6.73	0.000018	7.58

Spot Name	175 /30	% err	178 /30	% err	181 /30	% err	182 /30	% err
RLS-158-4	0.000016	8.17	0.000029	6.17	0.000021	7.28	0.000018	7.72
RLS-158-5	0.000019	7.41	0.000025	6.46	0.000022	6.97	0.000020	7.35
RLS-140-1	0.000018	7.77	0.000027	6.43	0.000020	7.45	0.000019	7.63
RLS-140-2	0.000019	7.32	0.000027	6.19	0.000021	7.05	0.000017	7.72
RLS-140-3	0.000019	7.23	0.000026	6.29	0.000019	7.33	0.000017	7.79
RLS-140-4	0.000019	7.24	0.000026	6.23	0.000019	7.28	0.000015	8.11
RLS-140-5	0.000020	7.52	0.000028	6.28	0.000021	7.32	0.000023	6.98
RLS-132-1	0.000072	3.79	0.000120	2.93	0.000091	3.36	0.000089	3.39
RLS-132-2	0.000074	3.67	0.000124	2.84	0.000096	3.22	0.000088	3.38
RLS-132-3	0.000077	3.58	0.000116	2.93	0.000097	3.20	0.000091	3.31
RLS-132-4	0.000068	3.89	0.000120	2.92	0.000089	3.40	0.000085	3.48
RLS-132-5	0.000075	3.64	0.000117	2.91	0.000086	3.40	0.000090	3.33
RLS-76-75-1	0.000054	4.34	0.000063	4.01	0.000051	4.46	0.000050	4.48
RLS-76-75-2	0.000052	4.47	0.000074	3.74	0.000054	4.37	0.000044	4.83
RLS-76-75-3	0.000045	4.74	0.000076	3.64	0.000053	4.36	0.000047	4.64
RLS-76-75-4	0.000048	4.62	0.000075	3.72	0.000050	4.53	0.000045	4.77
RLS-76-75-5	0.000052	4.41	0.000077	3.62	0.000049	4.53	0.000043	4.82
RLS-76-75-6	0.000044	4.74	0.000069	3.79	0.000051	4.42	0.000041	4.90
RLS-37-1	0.000079	3.59	0.000110	3.05	0.000081	3.55	0.000068	3.86
RLS-37-2	0.000087	3.56	0.000123	3.00	0.000085	3.60	0.000075	3.85
RLS-37-3	0.000077	3.68	0.000112	3.05	0.000091	3.39	0.000077	3.67
RLS-37-4	0.000076	3.77	0.000116	3.06	0.000083	3.62	0.000069	3.96
RLS-37-5	0.000083	3.61	0.000111	3.12	0.000084	3.59	0.000073	3.85
MACUSANI-1	0.000004	17	0.000005	16	0.000005	16	0.000002	25

Spot Name	175 /30	% err	178 /30	% err	181 /30	% err	182 /30	% err
MACUSANI-2	0.000003	22	0.000004	18	0.000003	21	0.000002	24
MACUSANI-3	0.000003	19	0.000005	17	0.000003	22	0.000003	21
MACUSANI-4	0.000003	22	0.000005	17	0.000004	19	0.000002	24
MACUSANI-5	0.000004	18	0.000004	18	0.000004	18	0.000003	23
NIST-611-1	0.014726	0.37	0.003227	0.75	0.011336	0.41	0.003364	0.73
NIST-611-2	0.015958	0.36	0.003416	0.74	0.012216	0.41	0.003568	0.73
NIST-611-3	0.015107	0.35	0.003270	0.73	0.011314	0.40	0.003164	0.74
NIST-611-4	0.014218	0.36	0.003092	0.75	0.010711	0.41	0.003123	0.75
NIST-611-5	0.015494	0.36	0.003304	0.74	0.011731	0.41	0.003362	0.74

Spot Name	185 /30	% err	188 /30	% err	248 /30	% err	254 /30	% err
NIST-611-1.4	0.010489	0.43	0.002094	0.94	0.016820	0.58	0.017508	0.57
MACUSANI-								
1.3	0.000001	45	0.000001	36	0.000023	12	0.000545	2.39
RLS37-1.3	0.000033	5.81	0.000038	5.39	0.000185	4.24	0.000072	6.79
RLS140-1.3	0.000010	10	0.000011	10	0.000520	2.51	0.000175	4.32
A3.1	0.000017	12	0.000025	9.37	0.000975	2.62	0.000394	4.11
A3.2	0.000013	13	0.000026	9.26	0.000953	2.63	0.000350	4.33
A3.1...dup1	0.000012	12	0.000011	13	0.000847	2.48	0.000291	4.24
A3.3	0.000008	11	0.000008	11	0.000558	2.32	0.000207	3.81
A3.4	0.000010	10	0.000011	10	0.000583	2.38	0.000210	3.96
A3.5	0.000007	12	0.000009	11	0.000598	2.24	0.000208	3.79
A3.6	0.000009	11	0.000011	9.73	0.000605	2.24	0.000232	3.62
A3.7	0.000005	14	0.000010	10	0.000627	2.21	0.000212	3.79
A3.8	0.000007	12	0.000008	11	0.000596	2.30	0.000219	3.79
A3.9	0.000007	12	0.000011	9.71	0.000585	2.35	0.000203	3.99
A3.10	0.000007	15	0.000008	14	0.000129	5.79	0.000061	8.45
A3.11	0.000000	100	0.000000	100	0.000000	100	0.000000	100
A3.12	0.000000	100	0.000000	100	0.000000	100	0.000000	100
A4.1	0.000008	16	0.000018	11	0.000764	2.86	0.000302	4.54
A4.2	0.000012	14	0.000014	12	0.000640	3.22	0.000254	5.12
A4.3	0.000008	13	0.000012	11	0.000689	2.47	0.000247	4.13
A4.4	0.000000	100	0.000000	100	0.000000	100	0.000000	100
A4.5	0.000008	11	0.000013	8.96	0.000572	2.36	0.000209	3.89
A4.6	0.000010	11	0.000011	9.81	0.000545	2.42	0.000215	3.85

Spot Name	185 /30	% err	188 /30	% err	248 /30	% err	254 /30	% err
A4.7	0.000009	11	0.000012	9.95	0.000590	2.43	0.000213	4.04
A4.8	0.000009	11	0.000013	9.39	0.000573	2.46	0.000216	4.00
A4.9	0.000009	12	0.000011	11	0.000626	2.51	0.000238	4.06
A4.10	0.000021	11	0.000024	10	0.001037	2.70	0.000397	4.35
A7.1	0.000007	23	0.000013	17	0.000479	4.77	0.000168	8.06
A7.2	0.000012	14	0.000009	16	0.000706	3.11	0.000252	5.20
A7.3	0.000010	15	0.000013	13	0.000690	3.15	0.000244	5.30
A7.4	0.000009	16	0.000013	13	0.000750	2.99	0.000261	5.06
A7.5	0.000009	15	0.000011	13	0.000769	2.75	0.000284	4.52
A7.6	0.000010	13	0.000014	11	0.000718	2.73	0.000278	4.39
A7.7	0.000012	12	0.000018	10	0.000756	2.67	0.000259	4.57
A7.8	0.000009	12	0.000010	12	0.000516	2.75	0.000200	4.42
A7.9	0.000006	14	0.000009	11	0.000572	2.49	0.000191	4.30
A7.10	0.000005	15	0.000009	11	0.000523	2.51	0.000183	4.24
A7.11	0.000008	12	0.000010	10	0.000512	2.50	0.000188	4.13
A7.12	0.000005	14	0.000010	10	0.000552	2.46	0.000200	4.08
A11.1	0.000007	13	0.000008	12	0.000536	2.53	0.000186	4.29
A11.2	0.000007	13	0.000008	12	0.000533	2.48	0.000191	4.15
A11.3	0.000005	16	0.000008	12	0.000513	2.57	0.000189	4.23
A11.4	0.000007	12	0.000009	11	0.000576	2.39	0.000195	4.11
A11.5	0.000006	13	0.000008	11	0.000522	2.48	0.000168	4.36
A11.6	0.000006	14	0.000009	11	0.000520	2.56	0.000182	4.32
A11.7	0.000006	13	0.000009	11	0.000521	2.55	0.000161	4.59
A11.8	0.000007	13	0.000007	13	0.000532	2.52	0.000181	4.32

Spot Name	185 /30	% err	188 /30	% err	248 /30	% err	254 /30	% err
A11.9	0.000004	17	0.000007	12	0.000518	2.55	0.000178	4.34
A11.10	0.000008	12	0.000006	13	0.000539	2.54	0.000190	4.28
A11.11	0.000005	16	0.000004	17	0.000431	2.84	0.000151	4.80
A11.12	0.000008	13	0.000009	11	0.000520	2.60	0.000183	4.39
A11.13	0.000000	100	0.000000	100	0.000001	100	0.000001	100
A11.14	0.000000	100	0.000000	100	0.000000	100	0.000000	100
NIST2.1	0.009476	0.47	0.001744	1.07	0.013829	0.66	0.014056	0.66
NIST2.2	0.006364	0.52	0.001301	1.13	0.013442	0.62	0.013675	0.61
NIST2.3	0.007865	0.48	0.001628	1.02	0.014506	0.60	0.014159	0.61
NIST2.4	0.007453	0.49	0.001585	1.04	0.014742	0.60	0.014557	0.60
NIST2.5	0.006575	0.51	0.001535	1.04	0.013987	0.60	0.013904	0.60
NIST2.6	0.007444	0.49	0.001596	1.03	0.013964	0.61	0.014136	0.61
D6.1	0.000006	14	0.000012	9.45	0.000571	2.36	0.000191	4.07
D6.2	0.000005	15	0.000007	12	0.000527	2.47	0.000197	4.04
D6.3	0.000008	12	0.000006	13	0.000560	2.34	0.000182	4.10
D6.4	0.000006	13	0.000008	11	0.000560	2.38	0.000194	4.05
D6.5	0.000005	14	0.000009	11	0.000586	2.33	0.000190	4.09
D6.6	0.000005	15	0.000004	16	0.000527	2.53	0.000175	4.38
D6.7	0.000006	13	0.000008	11	0.000539	2.39	0.000188	4.04
D6.8	0.000007	13	0.000007	12	0.000557	2.38	0.000197	4.00
D6.9	0.000009	11	0.000012	9.29	0.000555	2.41	0.000196	4.05
D6.10	0.000005	15	0.000008	12	0.000531	2.46	0.000181	4.21
D6.11	0.000007	13	0.000008	11	0.000582	2.32	0.000198	3.98
D6.12	0.000005	15	0.000010	11	0.000611	2.35	0.000207	4.04

Spot Name	185 /30	% err	188 /30	% err	248 /30	% err	254 /30	% err
D6.13	0.000005	15	0.000007	12	0.000566	2.43	0.000198	4.10
D6.14	0.000005	15	0.000008	12	0.000571	2.43	0.000186	4.25
D19.1	0.000004	17	0.000007	12	0.000528	2.46	0.000165	4.39
D19.2	0.000004	16	0.000009	11	0.000515	2.49	0.000164	4.41
D19.3	0.000004	16	0.000006	13	0.000514	2.49	0.000171	4.33
D19.4	0.000004	16	0.000006	14	0.000582	2.47	0.000192	4.30
D19.5	0.000005	15	0.000006	13	0.000519	2.46	0.000156	4.49
D19.6	0.000006	14	0.000007	13	0.000522	2.45	0.000156	4.47
D19.7	0.000003	18	0.000006	13	0.000510	2.48	0.000154	4.50
D19.9	0.000000	100	0.000000	100	0.000000	100	0.000000	100
D19.10	0.000005	15	0.000009	11	0.000539	2.50	0.000173	4.41
D19.11	0.000007	13	0.000006	14	0.000569	2.44	0.000183	4.30
D19.12	0.000000	71	0.000000	100	0.000000	100	0.000000	100
D19.13	0.000005	15	0.000005	14	0.000514	2.46	0.000159	4.42
D19.14	0.000004	15	0.000006	14	0.000524	2.46	0.000173	4.28
A17.1	0.000005	15	0.000007	13	0.000554	2.48	0.000200	4.13
A17.2	0.000005	15	0.000007	13	0.000587	2.34	0.000216	3.85
A17.3	0.000005	15	0.000006	14	0.000587	2.40	0.000197	4.14
A17.4	0.000006	13	0.000006	13	0.000626	2.29	0.000226	3.81
A17.5	0.000000	71	0.000000	58	0.000010	21	0.000003	39
A17.6	0.000005	15	0.000005	15	0.000573	2.33	0.000204	3.90
A17.7	0.000006	13	0.000009	11	0.000596	2.35	0.000199	4.07
A17.8	0.000006	14	0.000006	13	0.000573	2.38	0.000205	3.98
A17.9	0.000006	14	0.000007	13	0.000655	2.34	0.000250	3.79

Spot Name	185 /30	% err	188 /30	% err	248 /30	% err	254 /30	% err
A17.10	0.000005	15	0.000007	12	0.000560	2.41	0.000212	3.91
A17.11	0.000006	14	0.000008	12	0.000607	2.32	0.000198	4.07
A17.12	0.000007	14	0.000008	13	0.000570	2.53	0.000196	4.32
A19.4	0.000008	12	0.000010	11	0.000665	2.28	0.000208	4.07
A19.5	0.000008	12	0.000008	11	0.000607	2.26	0.000198	3.96
A19.6	0.000006	13	0.000008	11	0.000573	2.37	0.000190	4.12
A19.9	0.000006	13	0.000008	11	0.000632	2.30	0.000211	3.97
A19.10	0.000007	13	0.000008	12	0.000660	2.22	0.000209	3.94
A19.11	0.000006	14	0.000010	11	0.000653	2.31	0.000240	3.80
A19.12	0.000005	15	0.000008	11	0.000620	2.24	0.000190	4.05
A19.13	0.000005	15	0.000007	12	0.000596	2.29	0.000193	4.02
A19.14	0.000006	13	0.000008	11	0.000614	2.27	0.000191	4.08
NIST1.1	0.008399	0.47	0.001687	1.02	0.014197	0.61	0.014138	0.61
A19.15	0.000000	100	0.000000	100	0.000000	100	0.000000	100
A19.16	0.000007	12	0.000007	12	0.000578	2.34	0.000186	4.11
A19.17	0.000007	12	0.000008	11	0.000611	2.29	0.000194	4.06
A19.18	0.000007	12	0.000009	11	0.000642	2.23	0.000213	3.87
A19.19	0.000007	13	0.000010	11	0.000623	2.30	0.000222	3.84
A19.20	0.000005	15	0.000008	11	0.000613	2.30	0.000198	4.05
A19.21	0.000000	100	0.000000	100	0.000000	100	0.000000	100
A19.22	0.000007	13	0.000008	12	0.000625	2.27	0.000215	3.87
RLS-158-1	0.000007	12	0.000011	9.79	0.000248	3.59	0.000109	5.41
RLS-158-2	0.000007	13	0.000011	10	0.000250	3.64	0.000103	5.68
RLS-158-3	0.000008	11	0.000009	10	0.000238	3.61	0.000102	5.51

Spot Name	185 /30	% err	188 /30	% err	248 /30	% err	254 /30	% err
RLS-158-4	0.000008	12	0.000011	9.90	0.000273	3.47	0.000095	5.87
RLS-158-5	0.000009	11	0.000009	11	0.000241	3.63	0.000102	5.56
RLS-140-1	0.000006	14	0.000009	11	0.000480	2.62	0.000191	4.16
RLS-140-2	0.000007	12	0.000009	11	0.000458	2.59	0.000173	4.21
RLS-140-3	0.000007	12	0.000010	10	0.000477	2.53	0.000172	4.20
RLS-140-4	0.000008	11	0.000009	10	0.000466	2.53	0.000162	4.30
RLS-140-5	0.000007	12	0.000010	10	0.000485	2.64	0.000171	4.44
RLS-132-1	0.000030	5.85	0.000045	4.80	0.000520	2.44	0.000182	4.11
RLS-132-2	0.000035	5.32	0.000048	4.57	0.000536	2.37	0.000193	3.94
RLS-132-3	0.000037	5.22	0.000044	4.73	0.000496	2.45	0.000178	4.10
RLS-132-4	0.000031	5.74	0.000043	4.89	0.000528	2.41	0.000194	3.98
RLS-132-5	0.000033	5.50	0.000046	4.65	0.000510	2.42	0.000180	4.07
RLS-76-75-1	0.000014	8.51	0.000020	7.02	0.000634	2.18	0.000211	3.78
RLS-76-75-2	0.000017	7.83	0.000023	6.74	0.000636	2.21	0.000231	3.66
RLS-76-75-3	0.000019	7.37	0.000022	6.74	0.000622	2.21	0.000236	3.58
RLS-76-75-4	0.000018	7.65	0.000023	6.68	0.000618	2.24	0.000230	3.67
RLS-76-75-5	0.000015	8.19	0.000019	7.26	0.000640	2.17	0.000233	3.60
RLS-76-75-6	0.000016	7.86	0.000021	6.88	0.000597	2.24	0.000226	3.63
RLS-37-1	0.000023	6.65	0.000028	5.99	0.000169	4.26	0.000062	7.05
RLS-37-2	0.000028	6.25	0.000031	5.95	0.000190	4.19	0.000062	7.33
RLS-37-3	0.000027	6.17	0.000033	5.65	0.000188	4.08	0.000060	7.22
RLS-37-4	0.000026	6.50	0.000030	6.00	0.000160	4.52	0.000049	8.14
RLS-37-5	0.000023	6.83	0.000029	6.14	0.000156	4.56	0.000056	7.62
MACUSANI-1	0.000001	35	0.000001	45	0.000014	16	0.000465	2.81

Spot Name	185 /30	% err	188 /30	% err	248 /30	% err	254 /30	% err
MACUSANI-2	0.000001	50	0.000001	41	0.000022	14	0.000482	2.88
MACUSANI-3	0.000001	38	0.000001	33	0.000023	13	0.000457	2.93
MACUSANI-4	0.000001	45	0.000001	35	0.000025	12	0.000472	2.82
MACUSANI-5	0.000001	35	0.000001	33	0.000024	13	0.000505	2.80
NIST-611-1	0.007444	0.50	0.001490	1.10	0.011942	0.68	0.011957	0.68
NIST-611-2	0.007781	0.50	0.001533	1.10	0.013269	0.65	0.013116	0.66
NIST-611-3	0.007244	0.50	0.001572	1.04	0.012445	0.65	0.012516	0.65
NIST-611-4	0.007091	0.50	0.001420	1.10	0.012208	0.66	0.012574	0.65
NIST-611-5	0.007554	0.50	0.001545	1.08	0.012442	0.67	0.012563	0.66

Data reduction for glass samples by normalizing glass standards to known silica concentrations.

Standards	90Zr/30Si	%error	Zr ppm	SiO2	SiO2 normalized
NIST-611-1.4	0.0207	0.67	440	69.975	1.4497
MACUSANI-1.3	0.0005	3.25	25	72.32	0.0356
RLS37-1.3	0.0161	0.59	565	74.9	1.2035
RLS140-1.3	0.0054	1.01	146	75.8	0.4091
NIST2.1	0.0153	0.81	440	70	1.0726
NIST2.2	0.0156	0.73	440	70	1.0942
NIST2.3	0.0161	0.73	440	70	1.1251
NIST2.4	0.0165	0.72	440	70	1.1561
NIST2.5	0.0161	0.72	440	70	1.1268
NIST2.6	0.0162	0.73	440	70	1.1348
NIST1.1	0.0161	0.74	440	70	1.1245
RLS-158-1	0.0030	1.35	88	76.6	0.2261
RLS-158-2	0.0030	1.36	88	76.6	0.2295
RLS-158-3	0.0029	1.35	88	76.6	0.2186
RLS-158-4	0.0030	1.35	88	76.6	0.2327
RLS-158-5	0.0028	1.37	88	76.6	0.2176
RLS-140-1	0.0047	1.09	146	75.8	0.3556
RLS-140-2	0.0045	1.07	146	75.8	0.3387
RLS-140-3	0.0045	1.07	146	75.8	0.3379
RLS-140-4	0.0045	1.05	146	75.8	0.3420
RLS-140-5	0.0048	1.08	146	75.8	0.3656
RLS-132-1	0.0282	0.44	928	75.7	2.1367
RLS-132-2	0.0273	0.44	928	75.7	2.0689

Standards	90Zr/30Si	%error	Zr ppm	SiO2	SiO2 normalized
RLS-132-3	0.0271	0.44	928	75.7	2.0551
RLS-132-4	0.0283	0.43	928	75.7	2.1434
RLS-132-5	0.0269	0.44	928	75.7	2.0370
RLS-76-75-1	0.0048	1.02	176	77	0.3724
RLS-76-75-2	0.0048	1.04	176	77	0.3724
RLS-76-75-3	0.0048	1.02	176	77	0.3727
RLS-76-75-4	0.0048	1.04	176	77	0.3694
RLS-76-75-5	0.0046	1.04	176	77	0.3568
RLS-76-75-6	0.0047	1.03	176	77	0.3634
RLS-37-1	0.0136	0.62	565	74.9	1.0153
RLS-37-2	0.0141	0.63	565	74.9	1.0581
RLS-37-3	0.0132	0.63	565	74.9	0.9887
RLS-37-4	0.0131	0.65	565	74.9	0.9790
RLS-37-5	0.0135	0.64	565	74.9	1.0095
MACUSANI-1	0.0005	3.53	25	72.32	0.0357
MACUSANI-2	0.0005	3.82	25	72.32	0.0329
MACUSANI-3	0.0004	3.88	25	72.32	0.0314
MACUSANI-4	0.0005	3.61	25	72.32	0.0348
MACUSANI-5	0.0005	3.61	25	72.32	0.0365
NIST-611-1	0.0149	0.78	440	69.975	1.0447
NIST-611-2	0.0158	0.77	440	69.975	1.1059
NIST-611-3	0.0149	0.76	440	69.975	1.0408
NIST-611-4	0.0152	0.76	440	69.975	1.0610
NIST-611-5	0.0160	0.76	440	69.975	1.1162

Standards	138Ba/30Si	%error	Ba ppm	SiO2	SiO2 normalized
NIST-611-1.4	0.0855	0.35	415.9	69.975	5.9824
MACUSANI-1.3	0.0001	6.10	1.7	72.32	0.0101
RLS37-1.3	0.0630	0.31	615	74.9	4.7190
RLS140-1.3	0.0335	0.41	310	75.8	2.5366
NIST2.1	0.0704	0.39	415.9	70	4.9246
NIST2.2	0.0637	0.38	415.9	70	4.4613
NIST2.3	0.0647	0.38	415.9	70	4.5323
NIST2.4	0.0655	0.38	415.9	70	4.5842
NIST2.5	0.0641	0.37	415.9	70	4.4874
NIST2.6	0.0659	0.37	415.9	70	4.6143
NIST1.1	0.0646	0.38	415.9	70	4.5204
RLS-158-1	0.1210	0.23	1370	76.6	9.2690
RLS-158-2	0.1189	0.23	1370	76.6	9.1043
RLS-158-3	0.1119	0.23	1370	76.6	8.5711
RLS-158-4	0.1227	0.23	1370	76.6	9.3964
RLS-158-5	0.1155	0.23	1370	76.6	8.8488
RLS-140-1	0.0263	0.47	310	75.8	1.9956
RLS-140-2	0.0250	0.46	310	75.8	1.8969
RLS-140-3	0.0245	0.46	310	75.8	1.8592
RLS-140-4	0.0247	0.46	310	75.8	1.8745
RLS-140-5	0.0268	0.47	310	75.8	2.0338
RLS-132-1	0.0009	2.46	8	75.7	0.0645
RLS-132-2	0.0008	2.45	8	75.7	0.0630
RLS-132-3	0.0008	2.47	8	75.7	0.0616
RLS-132-4	0.0008	2.52	8	75.7	0.0608

Standards	$^{138}\text{Ba}/^{30}\text{Si}$	%error	Ba ppm	SiO₂	SiO₂ normalized
RLS-132-5	0.0008	2.49	8	75.7	0.0604
RLS-76-75-1	0.0001	6.50	1.1	77	0.0092
RLS-76-75-2	0.0001	6.73	1.1	77	0.0088
RLS-76-75-3	0.0001	7.00	1.1	77	0.0079
RLS-76-75-4	0.0001	8.67	1.1	77	0.0053
RLS-76-75-5	0.0001	6.74	1.1	77	0.0085
RLS-76-75-6	0.0001	7.81	1.1	77	0.0063
RLS-37-1	0.0478	0.34	615	74.9	3.5788
RLS-37-2	0.0495	0.35	615	74.9	3.7084
RLS-37-3	0.0463	0.35	615	74.9	3.4647
RLS-37-4	0.0466	0.35	615	74.9	3.4875
RLS-37-5	0.0460	0.35	615	74.9	3.4426
MACUSANI-1	0.0001	8.14	1.7	72.32	0.0067
MACUSANI-2	0.0001	9.62	1.7	72.32	0.0052
MACUSANI-3	0.0001	7.43	1.7	72.32	0.0085
MACUSANI-4	0.0001	7.91	1.7	72.32	0.0072
MACUSANI-5	0.0001	8.08	1.7	72.32	0.0073
NIST-611-1	0.0563	0.41	415.9	69.975	3.9414
NIST-611-2	0.0614	0.40	415.9	69.975	4.2955
NIST-611-3	0.0586	0.40	415.9	69.975	4.0974
NIST-611-4	0.0584	0.40	415.9	69.975	4.0855
NIST-611-5	0.0614	0.40	415.9	69.975	4.2950

Standards	¹³⁹La/³⁰Si	% error	La ppm	SiO₂	SiO₂ normalized
NIST-611-1.4	0.0486	0.31	436.6	69.975	3.3983
MACUSANI-1.3	0.0001	5.61	2.4	72.32	0.0051
RLS37-1.3	0.0031	0.87	56	74.9	0.2356
RLS140-1.3	0.0023	1.01	32	75.8	0.1762
NIST2.1	0.0383	0.35	436.6	70	2.6803
NIST2.2	0.0351	0.34	436.6	70	2.4568
NIST2.3	0.0368	0.33	436.6	70	2.5777
NIST2.4	0.0371	0.33	436.6	70	2.5936
NIST2.5	0.0364	0.33	436.6	70	2.5483
NIST2.6	0.0367	0.33	436.6	70	2.5711
NIST1.1	0.0356	0.34	436.6	70	2.4951
RLS-158-1	0.0015	1.22	27	76.6	0.1182
RLS-158-2	0.0016	1.23	27	76.6	0.1197
RLS-158-3	0.0015	1.23	27	76.6	0.1122
RLS-158-4	0.0016	1.22	27	76.6	0.1210
RLS-158-5	0.0015	1.24	27	76.6	0.1130
RLS-140-1	0.0019	1.13	32	75.8	0.1414
RLS-140-2	0.0018	1.11	32	75.8	0.1359
RLS-140-3	0.0018	1.11	32	75.8	0.1349
RLS-140-4	0.0018	1.10	32	75.8	0.1341
RLS-140-5	0.0018	1.14	32	75.8	0.1401
RLS-132-1	0.0021	1.04	39	75.7	0.1559
RLS-132-2	0.0020	1.04	39	75.7	0.1502
RLS-132-3	0.0019	1.06	39	75.7	0.1449
RLS-132-4	0.0020	1.05	39	75.7	0.1529

Standards	$^{139}\text{La}/^{30}\text{Si}$	% error	La ppm	SiO₂	SiO₂ normalized
RLS-132-5	0.0019	1.05	39	75.7	0.1463
RLS-76-75-1	0.0019	1.07	13.3	77	0.1458
RLS-76-75-2	0.0020	1.06	13.3	77	0.1531
RLS-76-75-3	0.0019	1.08	13.3	77	0.1430
RLS-76-75-4	0.0019	1.07	13.3	77	0.1500
RLS-76-75-5	0.0019	1.07	13.3	77	0.1466
RLS-76-75-6	0.0019	1.06	13.3	77	0.1458
RLS-37-1	0.0024	0.96	56	74.9	0.1789
RLS-37-2	0.0025	0.98	56	74.9	0.1887
RLS-37-3	0.0024	0.97	56	74.9	0.1791
RLS-37-4	0.0023	1.00	56	74.9	0.1743
RLS-37-5	0.0024	0.98	56	74.9	0.1823
MACUSANI-1	0.0001	6.99	2.4	72.32	0.0039
MACUSANI-2	0.0001	7.30	2.4	72.32	0.0039
MACUSANI-3	0.0000	7.54	2.4	72.32	0.0036
MACUSANI-4	0.0001	6.77	2.4	72.32	0.0042
MACUSANI-5	0.0001	7.41	2.4	72.32	0.0037
NIST-611-1	0.0314	0.37	436.6	69.975	2.1997
NIST-611-2	0.0341	0.36	436.6	69.975	2.3881
NIST-611-3	0.0327	0.35	436.6	69.975	2.2887
NIST-611-4	0.0327	0.35	436.6	69.975	2.2903
NIST-611-5	0.0342	0.35	436.6	69.975	2.3926

Standards	$^{146}\text{Nd}/^{30}\text{Si}$	% error	Nd ppm	SiO₂	SiO₂ normalized
NIST-611-1.4	0.0095	0.65	430	69.975	0.6660
MACUSANI-1.3	0.0000	9.17	0.81	72.32	0.0019
RLS37-1.3	0.0007	1.83	63	74.9	0.0531
RLS140-1.3	0.0004	2.53	25	75.8	0.0277
NIST2.1	0.0075	0.76	430	70	0.5235
NIST2.2	0.0072	0.71	430	70	0.5016
NIST2.3	0.0072	0.72	430	70	0.5072
NIST2.4	0.0073	0.71	430	70	0.5138
NIST2.5	0.0074	0.70	430	70	0.5154
NIST2.6	0.0075	0.70	430	70	0.5223
NIST1.1	0.0070	0.73	430	70	0.4915
RLS-158-1	0.0002	3.11	18	76.6	0.0181
RLS-158-2	0.0002	3.14	18	76.6	0.0185
RLS-158-3	0.0002	3.06	18	76.6	0.0182
RLS-158-4	0.0002	3.15	18	76.6	0.0182
RLS-158-5	0.0002	3.09	18	76.6	0.0181
RLS-140-1	0.0003	2.87	25	75.8	0.0218
RLS-140-2	0.0003	2.81	25	75.8	0.0210
RLS-140-3	0.0003	2.75	25	75.8	0.0217
RLS-140-4	0.0003	2.75	25	75.8	0.0214
RLS-140-5	0.0003	2.87	25	75.8	0.0222
RLS-132-1	0.0005	2.18	32	75.7	0.0350
RLS-132-2	0.0004	2.23	32	75.7	0.0326
RLS-132-3	0.0004	2.27	32	75.7	0.0312
RLS-132-4	0.0005	2.19	32	75.7	0.0345

Standards	¹⁴⁶Nd/³⁰Si	% error	Nd ppm	SiO₂	SiO₂ normalized
RLS-132-5	0.0004	2.27	32	75.7	0.0313
RLS-76-75-1	0.0003	2.54	12.7	77	0.0259
RLS-76-75-2	0.0003	2.52	12.7	77	0.0267
RLS-76-75-3	0.0003	2.51	12.7	77	0.0264
RLS-76-75-4	0.0003	2.53	12.7	77	0.0267
RLS-76-75-5	0.0003	2.52	12.7	77	0.0262
RLS-76-75-6	0.0003	2.58	12.7	77	0.0246
RLS-37-1	0.0005	2.08	63	74.9	0.0378
RLS-37-2	0.0006	2.05	63	74.9	0.0424
RLS-37-3	0.0005	2.05	63	74.9	0.0398
RLS-37-4	0.0005	2.07	63	74.9	0.0407
RLS-37-5	0.0006	2.04	63	74.9	0.0418
MACUSANI-1	0.0000	11	0.81	72.32	0.0016
MACUSANI-2	0.0000	12	0.81	72.32	0.0015
MACUSANI-3	0.0000	11	0.81	72.32	0.0016
MACUSANI-4	0.0000	11	0.81	72.32	0.0017
MACUSANI-5	0.0000	12	0.81	72.32	0.0015
NIST-611-1	0.0063	0.78	430	69.975	0.4409
NIST-611-2	0.0070	0.76	430	69.975	0.4870
NIST-611-3	0.0064	0.76	430	69.975	0.4470
NIST-611-4	0.0064	0.76	430	69.975	0.4473
NIST-611-5	0.0067	0.77	430	69.975	0.4669

Standards	$^{146}\text{Nd}/^{30}\text{Si}$	% error	Nd ppm	SiO₂	SiO₂ normalized
RLS37-1.3	0.0007	1.8294	63	74.9	0.0531
RLS140-1.3	0.0004	2.5301	25	75.8	0.0277
RLS-158-1	0.0002	3.1064	18	76.6	0.0181
RLS-158-2	0.0002	3.1366	18	76.6	0.0185
RLS-158-3	0.0002	3.057	18	76.6	0.0182
RLS-158-4	0.0002	3.1463	18	76.6	0.0182
RLS-158-5	0.0002	3.0918	18	76.6	0.0181
RLS-140-1	0.0003	2.8659	25	75.8	0.0218
RLS-140-2	0.0003	2.8093	25	75.8	0.0210
RLS-140-3	0.0003	2.7542	25	75.8	0.0217
RLS-140-4	0.0003	2.7533	25	75.8	0.0214
RLS-140-5	0.0003	2.8676	25	75.8	0.0222
RLS-132-1	0.0005	2.1841	32	75.7	0.0350
RLS-132-2	0.0004	2.2293	32	75.7	0.0326
RLS-132-3	0.0004	2.2737	32	75.7	0.0312
RLS-132-4	0.0005	2.1928	32	75.7	0.0345
RLS-132-5	0.0004	2.2683	32	75.7	0.0313
RLS-76-75-1	0.0003	2.5364	12.7	77	0.0259
RLS-76-75-2	0.0003	2.5245	12.7	77	0.0267
RLS-76-75-3	0.0003	2.5093	12.7	77	0.0264
RLS-76-75-4	0.0003	2.5301	12.7	77	0.0267
RLS-76-75-5	0.0003	2.5175	12.7	77	0.0262
RLS-76-75-6	0.0003	2.5788	12.7	77	0.0246
RLS-37-1	0.0005	2.0833	63	74.9	0.0378
RLS-37-2	0.0006	2.0491	63	74.9	0.0424

Standards	$^{146}\text{Nd}/^{30}\text{Si}$	% error	Nd ppm	SiO₂	SiO₂ normalized
RLS-37-3	0.0005	2.0513	63	74.9	0.0398
RLS-37-4	0.0005	2.0702	63	74.9	0.0407
RLS-37-5	0.0006	2.0379	63	74.9	0.0418

Standards	$^{147}\text{Sm}/^{30}\text{Si}$	% error	Sm ppm	SiO₂	SiO₂ normalized
NIST-611-1.4	0.0098	0.64	450.6	69.975	0.6851
MACUSANI-1.3	0.0001	6.11	0.63	72.32	0.0043
RLS37-1.3	0.0002	3.33	14.4	74.9	0.0160
RLS140-1.3	0.0001	4.57	4.6	75.8	0.0085
NIST2.1	0.0078	0.74	450.6	70	0.5454
NIST2.2	0.0073	0.70	450.6	70	0.5134
NIST2.3	0.0076	0.70	450.6	70	0.5354
NIST2.4	0.0077	0.69	450.6	70	0.5370
NIST2.5	0.0075	0.69	450.6	70	0.5241
NIST2.6	0.0076	0.70	450.6	70	0.5301
NIST1.1	0.0073	0.72	450.6	70	0.5143
RLS-158-1	0.0001	4.78	3.7	76.6	0.0076
RLS-158-2	0.0001	4.93	3.7	76.6	0.0075
RLS-158-3	0.0001	4.88	3.7	76.6	0.0071
RLS-158-4	0.0001	4.77	3.7	76.6	0.0079
RLS-158-5	0.0001	4.99	3.7	76.6	0.0069
RLS-140-1	0.0001	4.78	4.6	75.8	0.0078
RLS-140-2	0.0001	4.47	4.6	75.8	0.0083
RLS-140-3	0.0001	4.58	4.6	75.8	0.0079
RLS-140-4	0.0001	4.92	4.6	75.8	0.0067
RLS-140-5	0.0001	4.69	4.6	75.8	0.0083
RLS-132-1	0.0002	3.62	11	75.7	0.0127
RLS-132-2	0.0002	3.51	11	75.7	0.0132
RLS-132-3	0.0001	3.82	11	75.7	0.0111
RLS-132-4	0.0002	3.69	11	75.7	0.0122

Standards	$^{147}\text{Sm}/^{30}\text{Si}$	% error	Sm ppm	SiO₂	SiO₂ normalized
RLS-132-5	0.0002	3.57	11	75.7	0.0127
RLS-76-75-1	0.0001	4.01	3.4	77	0.0103
RLS-76-75-2	0.0001	4.02	3.4	77	0.0106
RLS-76-75-3	0.0001	3.96	3.4	77	0.0106
RLS-76-75-4	0.0001	3.97	3.4	77	0.0108
RLS-76-75-5	0.0001	4.06	3.4	77	0.0100
RLS-76-75-6	0.0001	4.08	3.4	77	0.0098
RLS-37-1	0.0002	3.39	14.4	74.9	0.0142
RLS-37-2	0.0002	3.43	14.4	74.9	0.0151
RLS-37-3	0.0002	3.49	14.4	74.9	0.0137
RLS-37-4	0.0002	3.58	14.4	74.9	0.0136
RLS-37-5	0.0002	3.55	14.4	74.9	0.0137
MACUSANI-1	0.0001	6.88	0.63	72.32	0.0040
MACUSANI-2	0.0000	7.58	0.63	72.32	0.0036
MACUSANI-3	0.0000	8.02	0.63	72.32	0.0031
MACUSANI-4	0.0001	6.96	0.63	72.32	0.0040
MACUSANI-5	0.0000	7.99	0.63	72.32	0.0032
NIST-611-1	0.0065	0.77	450.6	69.975	0.4536
NIST-611-2	0.0070	0.76	450.6	69.975	0.4895
NIST-611-3	0.0067	0.74	450.6	69.975	0.4684
NIST-611-4	0.0066	0.75	450.6	69.975	0.4642
NIST-611-5	0.0069	0.75	450.6	69.975	0.4845

Standards	$^{147}\text{Sm}/^{30}\text{Si}$	% error	Sm ppm	SiO₂	SiO₂ normalized
RLS37-1.3	0.0002	3.3272	14.4	74.9	0.0160
RLS140-1.3	0.0001	4.5748	4.6	75.8	0.0085
RLS-158-1	0.0001	4.7845	3.7	76.6	0.0076
RLS-158-2	0.0001	4.9275	3.7	76.6	0.0075
RLS-158-3	0.0001	4.8803	3.7	76.6	0.0071
RLS-158-4	0.0001	4.7682	3.7	76.6	0.0079
RLS-158-5	0.0001	4.9939	3.7	76.6	0.0069
RLS-140-1	0.0001	4.7803	4.6	75.8	0.0078
RLS-140-2	0.0001	4.473	4.6	75.8	0.0083
RLS-140-3	0.0001	4.5795	4.6	75.8	0.0079
RLS-140-4	0.0001	4.9214	4.6	75.8	0.0067
RLS-140-5	0.0001	4.689	4.6	75.8	0.0083
RLS-132-1	0.0002	3.6213	11	75.7	0.0127
RLS-132-2	0.0002	3.5104	11	75.7	0.0132
RLS-132-3	0.0001	3.819	11	75.7	0.0111
RLS-132-4	0.0002	3.691	11	75.7	0.0122
RLS-132-5	0.0002	3.5656	11	75.7	0.0127
RLS-76-75-1	0.0001	4.0138	3.4	77	0.0103
RLS-76-75-2	0.0001	4.0171	3.4	77	0.0106
RLS-76-75-3	0.0001	3.9572	3.4	77	0.0106
RLS-76-75-4	0.0001	3.9676	3.4	77	0.0108
RLS-76-75-5	0.0001	4.0631	3.4	77	0.0100
RLS-76-75-6	0.0001	4.0834	3.4	77	0.0098
RLS-37-1	0.0002	3.3936	14.4	74.9	0.0142
RLS-37-2	0.0002	3.4334	14.4	74.9	0.0151

Standards	$^{147}\text{Sm}/^{30}\text{Si}$	% error	Sm ppm	SiO₂	SiO₂ normalized
RLS-37-3	0.0002	3.489	14.4	74.9	0.0137
RLS-37-4	0.0002	3.5794	14.4	74.9	0.0136
RLS-37-5	0.0002	3.554	14.4	74.9	0.0137

Standards	¹⁵¹Eu/³⁰Si	% error	Eu ppm	SiO₂	SiO₂ normalized
NIST-611-1.4	0.0342	0.25	429.5	69.975	2.3915
MACUSANI-1.3	0.0000	10	0.02	72.32	0.0007
RLS37-1.3	0.0001	2.82	2.26	74.9	0.0092
RLS140-1.3	0.0000	10	0.22	75.8	0.0007
NIST2.1	0.0276	0.28	429.5	70	1.9333
NIST2.2	0.0251	0.27	429.5	70	1.7583
NIST2.3	0.0262	0.26	429.5	70	1.8341
NIST2.4	0.0261	0.26	429.5	70	1.8301
NIST2.5	0.0258	0.26	429.5	70	1.8088
NIST2.6	0.0259	0.26	429.5	70	1.8153
NIST1.1	0.0254	0.27	429.5	70	1.7777
RLS-158-1	0.0000	6.30	0.54	76.6	0.0018
RLS-158-2	0.0000	6.42	0.54	76.6	0.0018
RLS-158-3	0.0000	5.81	0.54	76.6	0.0021
RLS-158-4	0.0000	6.38	0.54	76.6	0.0018
RLS-158-5	0.0000	6.20	0.54	76.6	0.0019
RLS-140-1	0.0000	12	0.22	75.8	0.0005
RLS-140-2	0.0000	11	0.22	75.8	0.0006
RLS-140-3	0.0000	11	0.22	75.8	0.0006
RLS-140-4	0.0000	10	0.22	75.8	0.0006
RLS-140-5	0.0000	9.62	0.22	75.8	0.0008
RLS-132-1	0.0001	3.87	1.44	75.7	0.0046
RLS-132-2	0.0001	3.85	1.44	75.7	0.0045
RLS-132-3	0.0001	3.86	1.44	75.7	0.0045
RLS-132-4	0.0001	3.90	1.44	75.7	0.0045

Standards	¹⁵¹Eu/³⁰Si	% error	Eu ppm	SiO₂	SiO₂ normalized
RLS-132-5	0.0001	3.71	1.44	75.7	0.0048
RLS-76-75-1	0.0000	21	0.1	77	0.0002
RLS-76-75-2	0.0000	21	0.1	77	0.0002
RLS-76-75-3	0.0000	17	0.1	77	0.0002
RLS-76-75-4	0.0000	18	0.1	77	0.0002
RLS-76-75-5	0.0000	17	0.1	77	0.0002
RLS-76-75-6	0.0000	21	0.1	77	0.0001
RLS-37-1	0.0001	3.17	2.26	74.9	0.0067
RLS-37-2	0.0001	3.09	2.26	74.9	0.0077
RLS-37-3	0.0001	3.33	2.26	74.9	0.0062
RLS-37-4	0.0001	3.25	2.26	74.9	0.0068
RLS-37-5	0.0001	3.23	2.26	74.9	0.0069
MACUSANI-1	0.0000	12	0.02	72.32	0.0005
MACUSANI-2	0.0000	9.49	0.02	72.32	0.0009
MACUSANI-3	0.0000	12	0.02	72.32	0.0006
MACUSANI-4	0.0000	11	0.02	72.32	0.0006
MACUSANI-5	0.0000	12	0.02	72.32	0.0006
NIST-611-1	0.0224	0.29	429.5	69.975	1.5644
NIST-611-2	0.0241	0.28	429.5	69.975	1.6853
NIST-611-3	0.0226	0.28	429.5	69.975	1.5786
NIST-611-4	0.0226	0.28	429.5	69.975	1.5841
NIST-611-5	0.0235	0.28	429.5	69.975	1.6437

Standards	174GdO/30Si	% error	GdO ppm	SiO2	SiO2 normalized
NIST-611-1.4	0.0061	0.56	423	69.975	0.4288
MACUSANI-1.3	0.0000	14	0.72	72.32	0.0004
RLS37-1.3	0.0002	2.60	11	74.9	0.0123
RLS140-1.3	0.0000	5.65	3.6	75.8	0.0026
NIST2.1	0.0048	0.65	423	70	0.3392
NIST2.2	0.0041	0.64	423	70	0.2902
NIST2.3	0.0044	0.63	423	70	0.3047
NIST2.4	0.0042	0.64	423	70	0.2973
NIST2.5	0.0043	0.62	423	70	0.3034
NIST2.6	0.0042	0.64	423	70	0.2936
NIST1.1	0.0045	0.63	423	70	0.3164
RLS-158-1	0.0000	6.23	3.7	76.6	0.0021
RLS-158-2	0.0000	6.20	3.7	76.6	0.0022
RLS-158-3	0.0000	6.05	3.7	76.6	0.0022
RLS-158-4	0.0000	5.99	3.7	76.6	0.0023
RLS-158-5	0.0000	6.40	3.7	76.6	0.0020
RLS-140-1	0.0000	5.57	3.6	75.8	0.0027
RLS-140-2	0.0000	5.94	3.6	75.8	0.0022
RLS-140-3	0.0000	6.35	3.6	75.8	0.0019
RLS-140-4	0.0000	5.81	3.6	75.8	0.0022
RLS-140-5	0.0000	5.67	3.6	75.8	0.0026
RLS-132-1	0.0001	3.18	9.9	75.7	0.0077
RLS-132-2	0.0001	3.11	9.9	75.7	0.0078
RLS-132-3	0.0001	3.15	9.9	75.7	0.0076
RLS-132-4	0.0001	3.07	9.9	75.7	0.0082

Standards	174GdO/30Si	% error	GdO ppm	SiO2	SiO2 normalized
RLS-132-5	0.0001	3.07	9.9	75.7	0.0080
RLS-76-75-1	0.0001	3.77	3.6	77	0.0055
RLS-76-75-2	0.0001	3.96	3.6	77	0.0051
RLS-76-75-3	0.0001	3.99	3.6	77	0.0049
RLS-76-75-4	0.0001	3.97	3.6	77	0.0051
RLS-76-75-5	0.0001	4.05	3.6	77	0.0047
RLS-76-75-6	0.0001	4.10	3.6	77	0.0045
RLS-37-1	0.0001	3.01	11	74.9	0.0084
RLS-37-2	0.0001	2.89	11	74.9	0.0100
RLS-37-3	0.0001	2.98	11	74.9	0.0088
RLS-37-4	0.0001	2.95	11	74.9	0.0093
RLS-37-5	0.0001	3.01	11	74.9	0.0090
MACUSANI-1	0.0000	16	0.72	72.32	0.0003
MACUSANI-2	0.0000	21	0.72	72.32	0.0002
MACUSANI-3	0.0000	19	0.72	72.32	0.0003
MACUSANI-4	0.0000	18	0.72	72.32	0.0003
MACUSANI-5	0.0000	17	0.72	72.32	0.0003
NIST-611-1	0.0041	0.67	423	69.975	0.2863
NIST-611-2	0.0044	0.66	423	69.975	0.3092
NIST-611-3	0.0039	0.67	423	69.975	0.2724
NIST-611-4	0.0039	0.67	423	69.975	0.2733
NIST-611-5	0.0042	0.66	423	69.975	0.2928

Standards	175TbO/30Si	% error	TbO ppm	SiO2	SiO2 normalized
NIST-611-1.4	0.0217	0.31	446	69.975	1.5202
MACUSANI-1.3	0.0000	15		72.32	
RLS37-1.3	0.0001	3.27	2.6	74.9	0.0078
RLS140-1.3	0.0000	6.85	0.67	75.8	0.0018
NIST2.1	0.0182	0.35	446	70	1.2735
NIST2.2	0.0158	0.34	446	70	1.1050
NIST2.3	0.0155	0.35	446	70	1.0867
NIST2.4	0.0152	0.35	446	70	1.0617
NIST2.5	0.0162	0.34	446	70	1.1360
NIST2.6	0.0155	0.35	446	70	1.0883
NIST1.1	0.0166	0.34	446	70	1.1648
RLS-158-1	0.0000	7.41	0.69	76.6	0.0015
RLS-158-2	0.0000	7.77	0.69	76.6	0.0014
RLS-158-3	0.0000	7.48	0.69	76.6	0.0014
RLS-158-4	0.0000	8.17	0.69	76.6	0.0013
RLS-158-5	0.0000	7.41	0.69	76.6	0.0015
RLS-140-1	0.0000	7.77	0.67	75.8	0.0014
RLS-140-2	0.0000	7.32	0.67	75.8	0.0014
RLS-140-3	0.0000	7.23	0.67	75.8	0.0015
RLS-140-4	0.0000	7.24	0.67	75.8	0.0014
RLS-140-5	0.0000	7.52	0.67	75.8	0.0015
RLS-132-1	0.0001	3.79	2.3	75.7	0.0054
RLS-132-2	0.0001	3.67	2.3	75.7	0.0056
RLS-132-3	0.0001	3.58	2.3	75.7	0.0059
RLS-132-4	0.0001	3.89	2.3	75.7	0.0051

Standards	175TbO/30Si	% error	TbO ppm	SiO2	SiO2 normalized
RLS-132-5	0.0001	3.64	2.3	75.7	0.0057
RLS-76-75-1	0.0001	4.34	0.7	77	0.0041
RLS-76-75-2	0.0001	4.47	0.7	77	0.0040
RLS-76-75-3	0.0000	4.74	0.7	77	0.0034
RLS-76-75-4	0.0000	4.62	0.7	77	0.0037
RLS-76-75-5	0.0001	4.41	0.7	77	0.0040
RLS-76-75-6	0.0000	4.74	0.7	77	0.0034
RLS-37-1	0.0001	3.59	2.6	74.9	0.0059
RLS-37-2	0.0001	3.56	2.6	74.9	0.0065
RLS-37-3	0.0001	3.68	2.6	74.9	0.0058
RLS-37-4	0.0001	3.77	2.6	74.9	0.0057
RLS-37-5	0.0001	3.61	2.6	74.9	0.0062
MACUSANI-1	0.0000	17		72.32	
MACUSANI-2	0.0000	22		72.32	
MACUSANI-3	0.0000	19		72.32	
MACUSANI-4	0.0000	22		72.32	
MACUSANI-5	0.0000	18		72.32	
NIST-611-1	0.0147	0.37	446	69.975	1.0305
NIST-611-2	0.0160	0.36	446	69.975	1.1166
NIST-611-3	0.0151	0.35	446	69.975	1.0571
NIST-611-4	0.0142	0.36	446	69.975	0.9949
NIST-611-5	0.0155	0.36	446	69.975	1.0842

Standards	178DyO/30Si	% error	DyO ppm	SiO2	SiO2 normalized
NIST-611-1.4	0.0047	0.63	434.8	69.975	0.3287
MACUSANI-1.3	0.0000	15	0.79	72.32	0.0003
RLS37-1.3	0.0001	2.79			
RLS140-1.3	0.0000	6.05	0.8	75.8	0.0023
NIST2.1	0.0039	0.71	434.8	70	0.2763
NIST2.2	0.0036	0.69	434.8	70	0.2506
NIST2.3	0.0035	0.70	434.8	70	0.2482
NIST2.4	0.0035	0.71	434.8	70	0.2416
NIST2.5	0.0035	0.69	434.8	70	0.2434
NIST2.6	0.0036	0.69	434.8	70	0.2486
NIST1.1	0.0036	0.70	434.8	70	0.2549
RLS-158-1	0.0000	5.97	3.4	76.6	0.0023
RLS-158-2	0.0000	6.24	3.4	76.6	0.0022
RLS-158-3	0.0000	6.61	3.4	76.6	0.0018
RLS-158-4	0.0000	6.17	3.4	76.6	0.0022
RLS-158-5	0.0000	6.46	3.4	76.6	0.0019
RLS-140-1	0.0000	6.43	0.8	75.8	0.0020
RLS-140-2	0.0000	6.19	0.8	75.8	0.0020
RLS-140-3	0.0000	6.29	0.8	75.8	0.0019
RLS-140-4	0.0000	6.23	0.8	75.8	0.0019
RLS-140-5	0.0000	6.28	0.8	75.8	0.0022
RLS-132-1	0.0001	2.93	15.3	75.7	0.0091
RLS-132-2	0.0001	2.84	15.3	75.7	0.0094
RLS-132-3	0.0001	2.93	15.3	75.7	0.0088
RLS-132-4	0.0001	2.92	15.3	75.7	0.0091

Standards	178DyO/30Si	% error	DyO ppm	SiO2	SiO2 normalized
RLS-132-5	0.0001	2.91	15.3	75.7	0.0088
RLS-76-75-1	0.0001	4.01	4.8	77	0.0048
RLS-76-75-2	0.0001	3.74	4.8	77	0.0057
RLS-76-75-3	0.0001	3.64	4.8	77	0.0059
RLS-76-75-4	0.0001	3.72	4.8	77	0.0058
RLS-76-75-5	0.0001	3.62	4.8	77	0.0059
RLS-76-75-6	0.0001	3.79	4.8	77	0.0053
RLS-37-1	0.0001	3.05			
RLS-37-2	0.0001	3.00			
RLS-37-3	0.0001	3.05			
RLS-37-4	0.0001	3.06			
RLS-37-5	0.0001	3.12			
MACUSANI-1	0.0000	16	0.79	72.32	0.0003
MACUSANI-2	0.0000	18	0.79	72.32	0.0003
MACUSANI-3	0.0000	17	0.79	72.32	0.0003
MACUSANI-4	0.0000	17	0.79	72.32	0.0003
MACUSANI-5	0.0000	18	0.79	72.32	0.0003
NIST-611-1	0.0032	0.75			
NIST-611-2	0.0034	0.74			
NIST-611-3	0.0033	0.73			
NIST-611-4	0.0031	0.75			
NIST-611-5	0.0033	0.74			

Standards	$^{182}\text{ErO}/^{30}\text{Si}$	% error	ErO ppm	SiO₂	SiO₂ normalized
NIST-611-1.4	0.0047	0.63	434.7	69.975	0.3298
MACUSANI-1.3	0.0000	20	0.35	72.32	0.0002
RLS37-1.3	0.0001	3.56			
RLS140-1.3	0.0000	7.11	0.6	75.8	0.0016
NIST2.1	0.0040	0.71	434.7	70	0.2833
NIST2.2	0.0032	0.72	434.7	70	0.2272
NIST2.3	0.0034	0.71	434.7	70	0.2395
NIST2.4	0.0030	0.75	434.7	70	0.2129
NIST2.5	0.0032	0.73	434.7	70	0.2221
NIST2.6	0.0034	0.71	434.7	70	0.2370
NIST1.1	0.0037	0.69	434.7	70	0.2586
RLS-158-1	0.0000	7.36	2.3	76.6	0.0015
RLS-158-2	0.0000	7.79	2.3	76.6	0.0014
RLS-158-3	0.0000	7.58	2.3	76.6	0.0014
RLS-158-4	0.0000	7.72	2.3	76.6	0.0014
RLS-158-5	0.0000	7.35	2.3	76.6	0.0015
RLS-140-1	0.0000	7.63	0.6	75.8	0.0014
RLS-140-2	0.0000	7.72	0.6	75.8	0.0013
RLS-140-3	0.0000	7.79	0.6	75.8	0.0013
RLS-140-4	0.0000	8.11	0.6	75.8	0.0011
RLS-140-5	0.0000	6.98	0.6	75.8	0.0017
RLS-132-1	0.0001	3.39	11.5	75.7	0.0068
RLS-132-2	0.0001	3.38	11.5	75.7	0.0066
RLS-132-3	0.0001	3.31	11.5	75.7	0.0069
RLS-132-4	0.0001	3.48	11.5	75.7	0.0064

Standards	$^{182}\text{ErO}/^{30}\text{Si}$	% error	ErO ppm	SiO₂	SiO₂ normalized
RLS-132-5	0.0001	3.33	11.5	75.7	0.0068
RLS-76-75-1	0.0001	4.48	3.4	77	0.0039
RLS-76-75-2	0.0000	4.83	3.4	77	0.0034
RLS-76-75-3	0.0000	4.64	3.4	77	0.0036
RLS-76-75-4	0.0000	4.77	3.4	77	0.0035
RLS-76-75-5	0.0000	4.82	3.4	77	0.0033
RLS-76-75-6	0.0000	4.90	3.4	77	0.0032
RLS-37-1	0.0001	3.86			
RLS-37-2	0.0001	3.85			
RLS-37-3	0.0001	3.67			
RLS-37-4	0.0001	3.96			
RLS-37-5	0.0001	3.85			
MACUSANI-1	0.0000	25	0.35	72.32	0.0001
MACUSANI-2	0.0000	24	0.35	72.32	0.0002
MACUSANI-3	0.0000	21	0.35	72.32	0.0002
MACUSANI-4	0.0000	24	0.35	72.32	0.0002
MACUSANI-5	0.0000	23	0.35	72.32	0.0002
NIST-611-1	0.0034	0.73	434.7	69.975	0.2354
NIST-611-2	0.0036	0.73	434.7	69.975	0.2497
NIST-611-3	0.0032	0.74	434.7	69.975	0.2214
NIST-611-4	0.0031	0.75	434.7	69.975	0.2185
NIST-611-5	0.0034	0.74	434.7	69.975	0.2352

Standards	185TmO/30Si	% error	TmO ppm	SiO2	SiO2 normalized
NIST-611-1.4	0.0105	0.43	422.5	69.975	0.7340
MACUSANI-1.3	0.0000	45			
RLS37-1.3	0.0000	5.81	1.16	74.9	0.0025
RLS140-1.3	0.0000	10	0.4	75.8	0.0008
NIST2.1	0.0095	0.47	422.5	70	0.6634
NIST2.2	0.0064	0.52	422.5	70	0.4455
NIST2.3	0.0079	0.48	422.5	70	0.5505
NIST2.4	0.0075	0.49	422.5	70	0.5217
NIST2.5	0.0066	0.51	422.5	70	0.4602
NIST2.6	0.0074	0.49	422.5	70	0.5211
NIST1.1	0.0084	0.47	422.5	70	0.5880
RLS-158-1	0.0000	12	0.41	76.6	0.0005
RLS-158-2	0.0000	13	0.41	76.6	0.0005
RLS-158-3	0.0000	11	0.41	76.6	0.0006
RLS-158-4	0.0000	12	0.41	76.6	0.0006
RLS-158-5	0.0000	11	0.41	76.6	0.0007
RLS-140-1	0.0000	14	0.4	75.8	0.0004
RLS-140-2	0.0000	12	0.4	75.8	0.0006
RLS-140-3	0.0000	12	0.4	75.8	0.0006
RLS-140-4	0.0000	11	0.4	75.8	0.0006
RLS-140-5	0.0000	12	0.4	75.8	0.0006
RLS-132-1	0.0000	5.85	1.71	75.7	0.0023
RLS-132-2	0.0000	5.32	1.71	75.7	0.0027
RLS-132-3	0.0000	5.22	1.71	75.7	0.0028
RLS-132-4	0.0000	5.74	1.71	75.7	0.0024

Standards	185TmO/30Si	% error	TmO ppm	SiO2	SiO2 normalized
RLS-132-5	0.0000	5.50	1.71	75.7	0.0025
RLS-76-75-1	0.0000	8.51			
RLS-76-75-2	0.0000	7.83			
RLS-76-75-3	0.0000	7.37			
RLS-76-75-4	0.0000	7.65			
RLS-76-75-5	0.0000	8.19			
RLS-76-75-6	0.0000	7.86			
RLS-37-1	0.0000	6.65	1.16	74.9	0.0017
RLS-37-2	0.0000	6.25	1.16	74.9	0.0021
RLS-37-3	0.0000	6.17	1.16	74.9	0.0021
RLS-37-4	0.0000	6.50	1.16	74.9	0.0019
RLS-37-5	0.0000	6.83	1.16	74.9	0.0017
MACUSANI-1	0.0000	35			
MACUSANI-2	0.0000	50			
MACUSANI-3	0.0000	38			
MACUSANI-4	0.0000	45			
MACUSANI-5	0.0000	35			
NIST-611-1	0.0074	0.50	422.5	69.975	0.5209
NIST-611-2	0.0078	0.50	422.5	69.975	0.5445
NIST-611-3	0.0072	0.50	422.5	69.975	0.5069
NIST-611-4	0.0071	0.50	422.5	69.975	0.4962
NIST-611-5	0.0076	0.50	422.5	69.975	0.5286

Standards	188YbO/30Si	% error	YbO ppm	SiO2	SiO2 normalized
NIST-611-1.4	0.0021	0.94	462.7	69.975	0.1465
MACUSANI-1.3	0.0000	36	0.39	72.32	0.0001
RLS37-1.3	0.0000	5.39	9.7	74.9	0.0028
RLS140-1.3	0.0000	10	2.7	75.8	0.0008
NIST2.1	0.0017	1.07	462.7	70	0.1221
NIST2.2	0.0013	1.13	462.7	70	0.0910
NIST2.3	0.0016	1.02	462.7	70	0.1140
NIST2.4	0.0016	1.04	462.7	70	0.1109
NIST2.5	0.0015	1.04	462.7	70	0.1075
NIST2.6	0.0016	1.03	462.7	70	0.1117
NIST1.1	0.0017	1.02	462.7	70	0.1181
RLS-158-1	0.0000	9.79	2.8	76.6	0.0009
RLS-158-2	0.0000	10	2.8	76.6	0.0008
RLS-158-3	0.0000	10	2.8	76.6	0.0007
RLS-158-4	0.0000	9.90	2.8	76.6	0.0009
RLS-158-5	0.0000	11	2.8	76.6	0.0007
RLS-140-1	0.0000	11	2.7	75.8	0.0007
RLS-140-2	0.0000	11	2.7	75.8	0.0007
RLS-140-3	0.0000	10	2.7	75.8	0.0007
RLS-140-4	0.0000	10	2.7	75.8	0.0007
RLS-140-5	0.0000	10	2.7	75.8	0.0008
RLS-132-1	0.0000	4.80	12.5	75.7	0.0034
RLS-132-2	0.0000	4.57	12.5	75.7	0.0036
RLS-132-3	0.0000	4.73	12.5	75.7	0.0034
RLS-132-4	0.0000	4.89	12.5	75.7	0.0032

Standards	$^{188}\text{YbO}/^{30}\text{Si}$	% error	YbO ppm	SiO₂	SiO₂ normalized
RLS-132-5	0.0000	4.65	12.5	75.7	0.0035
RLS-76-75-1	0.0000	7.02	3.8	77	0.0016
RLS-76-75-2	0.0000	6.74	3.8	77	0.0017
RLS-76-75-3	0.0000	6.74	3.8	77	0.0017
RLS-76-75-4	0.0000	6.68	3.8	77	0.0018
RLS-76-75-5	0.0000	7.26	3.8	77	0.0015
RLS-76-75-6	0.0000	6.88	3.8	77	0.0016
RLS-37-1	0.0000	5.99	9.7	74.9	0.0021
RLS-37-2	0.0000	5.95	9.7	74.9	0.0023
RLS-37-3	0.0000	5.65	9.7	74.9	0.0024
RLS-37-4	0.0000	6.00	9.7	74.9	0.0023
RLS-37-5	0.0000	6.14	9.7	74.9	0.0021
MACUSANI-1	0.0000	45	0.39	72.32	0.0000
MACUSANI-2	0.0000	41	0.39	72.32	0.0001
MACUSANI-3	0.0000	33	0.39	72.32	0.0001
MACUSANI-4	0.0000	35	0.39	72.32	0.0001
MACUSANI-5	0.0000	33	0.39	72.32	0.0001
NIST-611-1	0.0015	1.10	462.7	69.975	0.1042
NIST-611-2	0.0015	1.10	462.7	69.975	0.1073
NIST-611-3	0.0016	1.04	462.7	69.975	0.1100
NIST-611-4	0.0014	1.10	462.7	69.975	0.0993
NIST-611-5	0.0015	1.08	462.7	69.975	0.1081

Standards	248ThO/30Si	% error	ThO ppm	SiO2	SiO2 normalized
NIST-611-1.4	0.0168	0.58	463.1	69.975	1.1770
MACUSANI-1.3	0.0000	12	1.3	72.32	0.0016
RLS37-1.3	0.0002	4.24	7.5	74.9	0.0139
RLS140-1.3	0.0005	2.51	17.2	75.8	0.0394
NIST2.1	0.0138	0.66	463.1	70	0.9681
NIST2.2	0.0134	0.62	463.1	70	0.9409
NIST2.3	0.0145	0.60	463.1	70	1.0154
NIST2.4	0.0147	0.60	463.1	70	1.0319
NIST2.5	0.0140	0.60	463.1	70	0.9791
NIST2.6	0.0140	0.61	463.1	70	0.9775
NIST1.1	0.0142	0.61	463.1	70	0.9938
RLS-158-1	0.0002	3.59	8.4	76.6	0.0190
RLS-158-2	0.0003	3.64	8.4	76.6	0.0192
RLS-158-3	0.0002	3.61	8.4	76.6	0.0182
RLS-158-4	0.0003	3.47	8.4	76.6	0.0209
RLS-158-5	0.0002	3.63	8.4	76.6	0.0184
RLS-140-1	0.0005	2.62	17.2	75.8	0.0364
RLS-140-2	0.0005	2.59	17.2	75.8	0.0347
RLS-140-3	0.0005	2.53	17.2	75.8	0.0362
RLS-140-4	0.0005	2.53	17.2	75.8	0.0353
RLS-140-5	0.0005	2.64	17.2	75.8	0.0367
RLS-132-1	0.0005	2.44	18	75.7	0.0394
RLS-132-2	0.0005	2.37	18	75.7	0.0406
RLS-132-3	0.0005	2.45	18	75.7	0.0376
RLS-132-4	0.0005	2.41	18	75.7	0.0399

Standards	$^{248}\text{ThO}/^{30}\text{Si}$	% error	ThO ppm	SiO₂	SiO₂ normalized
RLS-132-5	0.0005	2.42	18	75.7	0.0386
RLS-76-75-1	0.0006	2.18	19	77	0.0488
RLS-76-75-2	0.0006	2.21	19	77	0.0490
RLS-76-75-3	0.0006	2.21	19	77	0.0479
RLS-76-75-4	0.0006	2.24	19	77	0.0476
RLS-76-75-5	0.0006	2.17	19	77	0.0493
RLS-76-75-6	0.0006	2.24	19	77	0.0460
RLS-37-1	0.0002	4.26	7.5	74.9	0.0126
RLS-37-2	0.0002	4.19	7.5	74.9	0.0142
RLS-37-3	0.0002	4.08	7.5	74.9	0.0141
RLS-37-4	0.0002	4.52	7.5	74.9	0.0119
RLS-37-5	0.0002	4.56	7.5	74.9	0.0117
MACUSANI-1	0.0000	16	1.3	72.32	0.0010
MACUSANI-2	0.0000	14	1.3	72.32	0.0016
MACUSANI-3	0.0000	13	1.3	72.32	0.0016
MACUSANI-4	0.0000	12	1.3	72.32	0.0018
MACUSANI-5	0.0000	13	1.3	72.32	0.0017
NIST-611-1	0.0119	0.68	463.1	69.975	0.8356
NIST-611-2	0.0133	0.65	463.1	69.975	0.9285
NIST-611-3	0.0124	0.65	463.1	69.975	0.8709
NIST-611-4	0.0122	0.66	463.1	69.975	0.8542
NIST-611-5	0.0124	0.67	463.1	69.975	0.8706

Standards	254UO/30Si	% error	UO ppm	SiO2	SiO2 normalized
NIST-611-1.4	0.0175	0.57	462.9	69.975	1.2251
MACUSANI-1.3	0.0005	2.39	21	72.32	0.0394
RLS37-1.3	0.0001	6.79	2.1	74.9	0.0054
RLS140-1.3	0.0002	4.32	7.1	75.8	0.0133
NIST2.1	0.0141	0.66	462.9	70	0.9839
NIST2.2	0.0137	0.61	462.9	70	0.9572
NIST2.3	0.0142	0.61	462.9	70	0.9911
NIST2.4	0.0146	0.60	462.9	70	1.0190
NIST2.5	0.0139	0.60	462.9	70	0.9733
NIST2.6	0.0141	0.61	462.9	70	0.9895
NIST1.1	0.0141	0.61	462.9	70	0.9896
RLS-158-1	0.0001	5.41	3.2	76.6	0.0084
RLS-158-2	0.0001	5.68	3.2	76.6	0.0079
RLS-158-3	0.0001	5.51	3.2	76.6	0.0078
RLS-158-4	0.0001	5.87	3.2	76.6	0.0073
RLS-158-5	0.0001	5.56	3.2	76.6	0.0078
RLS-140-1	0.0002	4.16	7.1	75.8	0.0144
RLS-140-2	0.0002	4.21	7.1	75.8	0.0131
RLS-140-3	0.0002	4.20	7.1	75.8	0.0131
RLS-140-4	0.0002	4.30	7.1	75.8	0.0123
RLS-140-5	0.0002	4.44	7.1	75.8	0.0129
RLS-132-1	0.0002	4.11	6.4	75.7	0.0138
RLS-132-2	0.0002	3.94	6.4	75.7	0.0146
RLS-132-3	0.0002	4.10	6.4	75.7	0.0134
RLS-132-4	0.0002	3.98	6.4	75.7	0.0147

Standards	254UO/30Si	% error	UO ppm	SiO2	SiO2 normalized
RLS-132-5	0.0002	4.07	6.4	75.7	0.0136
RLS-76-75-1	0.0002	3.78	8.6	77	0.0163
RLS-76-75-2	0.0002	3.66	8.6	77	0.0178
RLS-76-75-3	0.0002	3.58	8.6	77	0.0182
RLS-76-75-4	0.0002	3.67	8.6	77	0.0177
RLS-76-75-5	0.0002	3.60	8.6	77	0.0180
RLS-76-75-6	0.0002	3.63	8.6	77	0.0174
RLS-37-1	0.0001	7.05	2.1	74.9	0.0046
RLS-37-2	0.0001	7.33	2.1	74.9	0.0046
RLS-37-3	0.0001	7.22	2.1	74.9	0.0045
RLS-37-4	0.0000	8.14	2.1	74.9	0.0037
RLS-37-5	0.0001	7.62	2.1	74.9	0.0042
MACUSANI-1	0.0005	2.81	21	72.32	0.0336
MACUSANI-2	0.0005	2.88	21	72.32	0.0348
MACUSANI-3	0.0005	2.93	21	72.32	0.0331
MACUSANI-4	0.0005	2.82	21	72.32	0.0341
MACUSANI-5	0.0005	2.80	21	72.32	0.0365
NIST-611-1	0.0120	0.68	462.9	69.975	0.8367
NIST-611-2	0.0131	0.66	462.9	69.975	0.9178
NIST-611-3	0.0125	0.65	462.9	69.975	0.8758
NIST-611-4	0.0126	0.65	462.9	69.975	0.8798
NIST-611-5	0.0126	0.66	462.9	69.975	0.8791

Standards	¹⁴⁰Ce/³⁰Si	% error	Ce ppm	SiO₂	SiO₂ normalized
NIST-611-1.4	0.0411	0.33	443.3	69.975	2.8742
MACUSANI-1.3	0.0001	4.04	7.8	72.32	0.0098
RLS37-1.3	0.0059	0.64	101	74.9	0.4414
RLS140-1.3	0.0038	0.78	60	75.8	0.2915
NIST2.1	0.0318	0.38	443.3	70	2.2227
NIST2.2	0.0302	0.36	443.3	70	2.1145
NIST2.3	0.0312	0.36	443.3	70	2.1852
NIST2.4	0.0315	0.36	443.3	70	2.2029
NIST2.5	0.0307	0.36	443.3	70	2.1489
NIST2.6	0.0309	0.36	443.3	70	2.1614
NIST1.1	0.0302	0.37	443.3	70	2.1143
RLS-158-1	0.0025	0.95	49	76.6	0.1940
RLS-158-2	0.0025	0.98	49	76.6	0.1900
RLS-158-3	0.0025	0.95	49	76.6	0.1879
RLS-158-4	0.0026	0.95	49	76.6	0.1994
RLS-158-5	0.0025	0.96	49	76.6	0.1878
RLS-140-1	0.0031	0.87	60	75.8	0.2385
RLS-140-2	0.0031	0.84	60	75.8	0.2350
RLS-140-3	0.0031	0.85	60	75.8	0.2320
RLS-140-4	0.0030	0.85	60	75.8	0.2288
RLS-140-5	0.0032	0.87	60	75.8	0.2446
RLS-132-1	0.0043	0.72	91	75.7	0.3275
RLS-132-2	0.0042	0.72	91	75.7	0.3176
RLS-132-3	0.0041	0.72	91	75.7	0.3124
RLS-132-4	0.0043	0.72	91	75.7	0.3277

Standards	$^{140}\text{Ce}/^{30}\text{Si}$	% error	Ce ppm	SiO₂	SiO₂ normalized
RLS-132-5	0.0041	0.72	91	75.7	0.3125
RLS-76-75-1	0.0035	0.78	32	77	0.2732
RLS-76-75-2	0.0036	0.79	32	77	0.2761
RLS-76-75-3	0.0036	0.78	32	77	0.2751
RLS-76-75-4	0.0036	0.79	32	77	0.2793
RLS-76-75-5	0.0035	0.79	32	77	0.2689
RLS-76-75-6	0.0034	0.80	32	77	0.2621
RLS-37-1	0.0046	0.70	101	74.9	0.3415
RLS-37-2	0.0047	0.71	101	74.9	0.3537
RLS-37-3	0.0046	0.70	101	74.9	0.3442
RLS-37-4	0.0044	0.73	101	74.9	0.3332
RLS-37-5	0.0046	0.71	101	74.9	0.3469
MACUSANI-1	0.0001	4.92	7.8	72.32	0.0079
MACUSANI-2	0.0001	5.26	7.8	72.32	0.0075
MACUSANI-3	0.0001	5.14	7.8	72.32	0.0077
MACUSANI-4	0.0001	4.90	7.8	72.32	0.0081
MACUSANI-5	0.0001	5.07	7.8	72.32	0.0079
NIST-611-1	0.0267	0.39	443.3	69.975	1.8650
NIST-611-2	0.0282	0.39	443.3	69.975	1.9746
NIST-611-3	0.0275	0.38	443.3	69.975	1.9227
NIST-611-4	0.0274	0.38	443.3	69.975	1.9192
NIST-611-5	0.0281	0.39	443.3	69.975	1.9637

Elemental plots for glass standards data reduction. Slope used to determine elemental values relative to silica for glass samples.

Glass samples for respective dome and ash units, by element and element oxides. *Highlighted fields calibrated to RLS, Macusani, and NIST (removed). **RLS calibrated only.

	Zr ppm	Ba ppm	La ppm	Nd ppm*	Nd ppm**	Sm ppm*	Sm ppm**	Eu ppm	GdO ppm
A3.1	179.49	27.64	23.71	29.15	38.54	12.41	10.87	0.21	7.34
A3.2	173.22	27.28	22.33	27.22	35.99	10.66	9.34	0.22	7.17
A3.1...dup1	118.04	14.52	13.29	15.85	20.96	7.46	6.53	0.11	4.66
A3.3	88.93	11.62	9.53	11.91	15.75	6.58	5.76	0.10	3.62
A3.4	91.05	12.45	10.55	13.10	17.33	7.09	6.21	0.13	3.92
A3.5	88.63	12.03	9.91	11.84	15.66	6.63	5.81	0.11	3.44
A3.6	101.64	15.00	10.64	12.49	16.51	7.06	6.18	0.06	3.92
A3.7	91.99	10.61	10.40	11.06	14.63	5.87	5.14	0.08	3.29
A3.8	93.56	10.52	9.95	12.57	16.62	6.56	5.75	0.10	3.73
A3.9	82.54	29.66	9.40	9.86	13.03	5.85	5.12	0.17	3.20
A3.10	230.03	764.07	14.80	13.94	18.44	5.38	4.71	1.48	3.95
A3.11	0.41	438.42	10.83	3.33	4.41	1.88	1.65	1.27	0.18
A3.12	0.89	721.90	15.40	5.36	7.09	2.04	1.79	1.77	0.28
A4.1	145.74	13.12	20.76	18.71	24.74	8.93	7.82	0.17	4.53
A4.2	127.32	14.31	13.04	15.24	20.16	7.81	6.84	0.11	3.71
A4.3	99.56	8.71	9.56	12.70	16.79	6.97	6.11	0.09	4.51
A4.4	0.80	283.32	0.64	4.11	5.43	0.53	0.47	0.20	0.00
A4.5	89.97	8.51	8.91	12.06	15.95	5.87	5.14	0.08	3.58
A4.6	93.10	7.24	8.33	11.16	14.75	6.17	5.40	0.09	3.64
A4.7	94.51	7.86	9.12	12.62	16.69	7.13	6.24	0.11	3.98
A4.8	93.86	8.33	8.88	11.79	15.58	5.29	4.63	0.07	3.47

	Zr ppm	Ba ppm	La ppm	Nd ppm*	Nd ppm**	Sm ppm*	Sm ppm**	Eu ppm	GdO ppm
A4.9	99.56	7.75	9.06	12.48	16.50	5.94	5.20	0.07	3.72
A4.10	194.71	17.80	20.15	29.16	38.55	12.98	11.37	0.25	8.65
A7.1	109.21	49.38	12.57	15.18	20.07	6.79	5.94	0.16	3.27
A7.2	141.46	62.43	17.40	18.16	24.01	7.33	6.42	0.20	4.93
A7.3	137.48	93.82	17.43	18.09	23.92	8.09	7.09	0.36	4.68
A7.4	147.08	68.55	18.04	19.13	25.29	8.72	7.64	0.20	4.19
A7.5	151.38	74.31	18.93	19.63	25.95	9.81	8.59	0.25	5.16
A7.6	141.88	63.05	15.78	19.40	25.65	8.88	7.78	0.23	4.61
A7.7	138.25	62.16	15.98	17.85	23.60	9.54	8.36	0.23	4.83
A7.8	100.72	60.89	11.63	13.50	17.85	6.71	5.87	0.21	3.37
A7.9	99.75	41.37	9.99	11.89	15.72	6.59	5.77	0.12	3.20
A7.10	95.71	37.57	9.86	11.81	15.61	6.20	5.43	0.13	2.95
A7.11	92.86	37.63	10.23	12.28	16.23	5.65	4.95	0.18	3.18
A7.12	96.60	37.55	9.86	11.81	15.61	6.28	5.50	0.11	3.62
A11.1	92.93	60.23	10.96	12.41	16.41	5.86	5.14	0.19	3.04
A11.2	84.78	58.56	10.39	12.07	15.96	5.96	5.22	0.14	2.67
A11.3	86.44	124.46	9.89	10.85	14.34	6.47	5.67	0.23	2.93
A11.4	92.80	37.83	11.16	11.86	15.69	6.08	5.33	0.12	3.67
A11.5	87.48	53.18	10.17	11.51	15.22	5.85	5.12	0.15	2.93
A11.6	87.31	57.10	10.50	11.88	15.71	6.28	5.50	0.14	3.39
A11.7	87.58	54.65	10.23	12.31	16.27	5.77	5.05	0.14	3.11
A11.8	89.10	56.50	10.48	10.76	14.23	5.85	5.13	0.15	2.95
A11.9	88.54	51.46	10.84	11.23	14.85	6.55	5.73	0.14	2.96

	Zr ppm	Ba ppm	La ppm	Nd ppm*	Nd ppm**	Sm ppm*	Sm ppm**	Eu ppm	GdO ppm
A11.10	91.53	54.33	11.38	11.94	15.79	6.24	5.46	0.15	2.90
A11.11	74.21	207.43	7.79	7.94	10.50	5.33	4.67	0.30	2.25
A11.12	92.57	51.32	10.99	11.10	14.68	6.01	5.26	0.11	3.22
A11.13	1.88	372.88	7.12	2.43	3.21	1.21	1.06	0.87	0.13
A11.14	1.07	323.62	9.35	2.65	3.51	1.41	1.23	0.70	0.07
D6.1	107.87	7.38	12.87	13.30	17.58	6.74	5.90	0.08	3.34
D6.2	99.78	18.33	11.60	12.69	16.78	5.76	5.05	0.12	2.80
D6.3	101.72	7.26	11.49	13.54	17.91	6.47	5.67	0.05	3.06
D6.4	106.08	7.21	11.49	12.72	16.82	6.39	5.59	0.06	2.42
D6.5	102.57	7.55	12.02	13.63	18.02	6.12	5.36	0.05	3.03
D6.6	93.91	20.37	10.84	12.34	16.32	6.08	5.33	0.16	2.29
D6.7	104.69	7.20	12.89	13.63	18.02	6.53	5.72	0.06	3.02
D6.8	107.56	5.60	13.22	13.76	18.19	6.75	5.91	0.06	3.62
D6.9	100.48	4.89	12.18	14.54	19.23	6.98	6.11	0.07	4.26
D6.10	101.43	5.23	11.94	14.15	18.72	6.20	5.43	0.05	2.99
D6.11	101.67	5.58	12.20	12.16	16.08	6.07	5.32	0.06	3.26
D6.12	109.67	7.69	13.08	13.98	18.49	6.89	6.03	0.05	2.75
D6.13	107.36	6.47	11.63	13.34	17.64	6.59	5.78	0.08	3.42
D6.14	103.69	7.06	11.25	13.80	18.25	5.98	5.24	0.08	3.37
D19.1	101.24	172.03	17.99	15.57	20.59	5.88	5.15	0.25	2.72
D19.2	106.00	167.37	18.22	15.06	19.91	6.16	5.39	0.22	2.90
D19.3	105.73	171.95	18.02	13.78	18.22	7.03	6.16	0.19	2.32
D19.4	106.10	204.42	17.87	13.51	17.86	6.81	5.96	0.25	2.78

	Zr ppm	Ba ppm	La ppm	Nd ppm*	Nd ppm**	Sm ppm*	Sm ppm**	Eu ppm	GdO ppm
D19.5	104.52	165.54	18.17	14.87	19.66	7.15	6.27	0.17	2.53
D19.6	104.75	179.37	18.41	14.93	19.74	6.37	5.58	0.21	2.80
D19.7	104.43	172.55	17.83	15.27	20.19	5.96	5.22	0.16	2.42
D19.9	0.48	1054.24	14.84	5.27	6.96	2.78	2.44	3.13	0.12
D19.10	106.60	178.05	18.58	14.83	19.61	6.71	5.88	0.19	2.74
D19.11	112.65	173.93	20.14	16.19	21.40	6.52	5.71	0.22	3.31
D19.12	0.38	176.63	4.57	2.22	2.94	2.04	1.79	1.27	0.07
D19.13	106.96	183.57	19.01	15.76	20.84	6.36	5.57	0.15	2.88
D19.14	106.57	171.94	18.92	16.34	21.61	7.02	6.15	0.19	2.56
A17.1	91.17	57.84	12.01	11.61	15.35	6.36	5.57	0.18	2.61
A17.2	95.53	55.20	12.48	11.09	14.66	6.04	5.29	0.15	2.62
A17.3	99.14	95.22	12.74	11.67	15.43	6.17	5.40	0.19	2.68
A17.4	93.32	60.38	12.87	11.18	14.78	6.52	5.71	0.19	2.52
A17.5	30.78	584.26	2.98	1.13	1.49	2.49	2.18	0.94	0.06
A17.6	91.12	60.44	12.12	11.44	15.13	6.15	5.39	0.18	2.20
A17.7	94.31	62.35	12.59	11.49	15.20	5.87	5.14	0.18	2.67
A17.8	93.83	60.53	12.11	9.58	12.67	5.55	4.86	0.17	2.32
A17.9	104.19	63.73	14.02	12.18	16.10	6.41	5.61	0.19	2.66
A17.10	91.88	56.37	12.22	10.94	14.47	5.42	4.75	0.14	2.52
A17.11	93.20	62.14	12.19	10.67	14.11	6.18	5.41	0.20	2.40
A17.12	93.60	61.11	12.46	11.02	14.57	6.30	5.52	0.17	2.81
A19.4	103.05	39.58	14.49	12.36	16.34	5.81	5.09	0.15	3.16
A19.5	97.06	38.14	13.19	12.43	16.44	5.28	4.62	0.17	2.50

	Zr ppm	Ba ppm	La ppm	Nd ppm*	Nd ppm**	Sm ppm*	Sm ppm**	Eu ppm	GdO ppm
A19.6	94.44	30.52	11.79	11.39	15.06	5.51	4.83	0.15	2.71
A19.9	99.38	40.34	13.49	12.41	16.41	6.60	5.78	0.13	2.51
A19.10	93.02	40.30	13.45	12.45	16.46	5.96	5.22	0.21	2.80
A19.11	103.81	38.82	14.23	13.41	17.74	6.68	5.85	0.16	2.69
A19.12	90.94	37.76	13.29	11.61	15.35	5.63	4.93	0.18	2.87
A19.13	94.33	41.96	13.56	11.94	15.78	5.74	5.03	0.18	3.13
A19.14	92.98	39.23	12.64	12.57	16.62	5.58	4.88	0.18	2.66
A19.15	1.77	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00
A19.16	94.48	39.61	13.57	12.36	16.34	5.43	4.75	0.17	2.83
A19.17	102.51	37.52	13.38	12.37	16.36	5.57	4.88	0.13	2.75
A19.18	96.62	38.22	13.38	12.47	16.48	5.89	5.16	0.16	2.55
A19.19	95.98	37.88	13.62	13.03	17.23	5.84	5.11	0.22	2.88
A19.20	96.30	36.40	13.52	12.61	16.68	6.79	5.95	0.14	2.56
A19.21	4.33	0.02	0.00	0.01	0.01	0.03	0.03	0.00	0.00
A19.22	96.06	35.54	12.67	11.99	15.85	5.92	5.19	0.15	2.52

Trace element concentrations for glass samples determined from stoichiometric ratios. Highlighted fields not included, likely feldspars.

Spot Name	Zr	Ba	La	Ce	Nd	Sm	Eu	Gd	Tb	Dy	Er	Tm	Yb
A3.1	179.49	27.64	23.71	57.49	38.54	10.87	0.21	6.66	1.25	8.61	6.69	0.88	7.30
A3.2	173.22	27.28	22.33	54.23	35.99	9.34	0.22	6.51	1.18	7.14	4.69	0.68	7.36
A3.1...dup													
1	118.04	14.52	13.29	32.07	20.96	6.53	0.11	4.23	0.71	5.03	4.27	0.64	3.18
A3.3	88.93	11.62	9.53	23.59	15.75	5.76	0.10	3.29	0.58	4.14	2.96	0.43	2.31
A3.4	91.05	12.45	10.55	24.90	17.33	6.21	0.13	3.56	0.61	4.12	3.38	0.54	3.17
A3.5	88.63	12.03	9.91	24.67	15.66	5.81	0.11	3.12	0.61	3.95	3.17	0.38	2.49
A3.6	101.64	15.00	10.64	27.07	16.51	6.18	0.06	3.56	0.64	4.66	3.42	0.48	3.09
A3.7	91.99	10.61	10.40	24.61	14.63	5.14	0.08	2.99	0.56	3.46	2.53	0.27	2.85
A3.8	93.56	10.52	9.95	25.10	16.62	5.75	0.10	3.38	0.63	3.70	2.87	0.38	2.33
A3.9	82.54	29.66	9.40	21.14	13.03	5.12	0.17	2.91	0.54	3.71	2.48	0.39	3.28
A3.10	230.03	764.07	14.80	32.04	18.44	4.71	1.48	3.58	0.55	3.73	3.16	0.35	2.17
A3.11	0.41	438.42	10.83	6.13	4.41	1.65	1.27	0.17	0.01	0.03	0.00	0.00	0.00
A3.12	0.89	721.90	15.40	9.85	7.09	1.79	1.77	0.25	0.02	0.13	0.05	0.02	0.00
A4.1	145.74	13.12	20.76	39.83	24.74	7.82	0.17	4.11	0.95	5.58	5.14	0.44	5.15
A4.2	127.32	14.31	13.04	31.61	20.16	6.84	0.11	3.37	0.78	4.29	2.99	0.63	4.15
A4.3	99.56	8.71	9.56	24.74	16.79	6.11	0.09	4.09	0.75	4.39	3.65	0.43	3.36
A4.4	0.80	283.32	0.64	1.12	5.43	0.47	0.20	0.00	0.00	0.02	0.00	0.00	0.00
A4.5	89.97	8.51	8.91	23.59	15.95	5.14	0.08	3.25	0.62	3.81	2.65	0.43	3.80
A4.6	93.10	7.24	8.33	21.33	14.75	5.40	0.09	3.31	0.59	3.45	2.30	0.51	3.19
A4.7	94.51	7.86	9.12	23.69	16.69	6.24	0.11	3.61	0.62	3.94	3.70	0.49	3.38

Spot Name	Zr	Ba	La	Ce	Nd	Sm	Eu	Gd	Tb	Dy	Er	Tm	Yb
A4.8	93.86	8.33	8.88	22.97	15.58	4.63	0.07	3.15	0.59	3.82	2.49	0.47	3.76
A4.9	99.56	7.75	9.06	23.17	16.50	5.20	0.07	3.38	0.63	4.54	3.68	0.50	3.19
A4.10	194.71	17.80	20.15	52.41	38.55	11.37	0.25	7.85	1.42	9.01	5.95	1.10	6.99
A7.1	109.21	49.38	12.57	32.01	20.07	5.94	0.16	2.97	0.60	4.56	3.63	0.37	3.67
A7.2	141.46	62.43	17.40	40.89	24.01	6.42	0.20	4.48	0.79	5.26	3.92	0.63	2.69
A7.3	137.48	93.82	17.43	40.99	23.92	7.09	0.36	4.25	0.90	4.52	3.44	0.54	3.87
A7.4	147.08	68.55	18.04	43.24	25.29	7.64	0.20	3.80	0.79	5.25	4.15	0.46	3.78
A7.5	151.38	74.31	18.93	44.07	25.95	8.59	0.25	4.68	0.98	5.63	4.33	0.46	3.17
A7.6	141.88	63.05	15.78	40.02	25.65	7.78	0.23	4.19	0.88	5.20	3.99	0.55	3.94
A7.7	138.25	62.16	15.98	39.66	23.60	8.36	0.23	4.38	0.84	6.16	3.89	0.64	5.19
A7.8	100.72	60.89	11.63	26.99	17.85	5.87	0.21	3.06	0.58	3.85	3.08	0.49	2.75
A7.9	99.75	41.37	9.99	25.25	15.72	5.77	0.12	2.91	0.61	3.55	2.92	0.34	2.72
A7.10	95.71	37.57	9.86	23.87	15.61	5.43	0.13	2.68	0.51	3.40	2.23	0.26	2.48
A7.11	92.86	37.63	10.23	25.19	16.23	4.95	0.18	2.89	0.57	3.35	2.90	0.42	3.01
A7.12	96.60	37.55	9.86	25.08	15.61	5.50	0.11	3.28	0.53	3.22	2.57	0.29	2.92
A11.1	92.93	60.23	10.96	26.52	16.41	5.14	0.19	2.76	0.61	3.76	2.80	0.39	2.20
A11.2	84.78	58.56	10.39	25.81	15.96	5.22	0.14	2.43	0.54	3.28	2.26	0.35	2.24
A11.3	86.44	124.46	9.89	23.23	14.34	5.67	0.23	2.66	0.44	3.29	2.32	0.25	2.43
A11.4	92.80	37.83	11.16	26.53	15.69	5.33	0.12	3.33	0.52	3.43	2.61	0.39	2.73
A11.5	87.48	53.18	10.17	24.20	15.22	5.12	0.15	2.66	0.41	3.01	2.30	0.33	2.40
A11.6	87.31	57.10	10.50	25.35	15.71	5.50	0.14	3.08	0.57	3.64	2.30	0.31	2.65
A11.7	87.58	54.65	10.23	24.88	16.27	5.05	0.14	2.82	0.49	3.48	2.47	0.33	2.55
A11.8	89.10	56.50	10.48	25.67	14.23	5.13	0.15	2.67	0.55	3.19	2.28	0.36	1.95

Spot Name	Zr	Ba	La	Ce	Nd	Sm	Eu	Gd	Tb	Dy	Er	Tm	Yb
A11.9	88.54	51.46	10.84	26.34	14.85	5.73	0.14	2.69	0.58	3.05	2.49	0.22	2.16
A11.10	91.53	54.33	11.38	26.74	15.79	5.46	0.15	2.64	0.52	3.37	2.44	0.41	1.86
A11.11	74.21	207.43	7.79	18.34	10.50	4.67	0.30	2.04	0.38	2.54	2.00	0.26	1.23
A11.12	92.57	51.32	10.99	25.75	14.68	5.26	0.11	2.93	0.57	3.23	2.08	0.40	2.67
A11.13	1.88	372.88	7.12	4.24	3.21	1.06	0.87	0.11	0.02	0.12	0.00	0.01	0.00
A11.14	1.07	323.62	9.35	4.11	3.51	1.23	0.70	0.06	0.02	0.05	0.00	0.01	0.00
D6.1	107.87	7.38	12.87	30.82	17.58	5.90	0.08	3.03	0.53	3.73	2.22	0.30	3.41
D6.2	99.78	18.33	11.60	27.53	16.78	5.05	0.12	2.54	0.54	3.12	2.18	0.26	2.01
D6.3	101.72	7.26	11.49	28.37	17.91	5.67	0.05	2.77	0.51	3.45	2.17	0.41	1.86
D6.4	106.08	7.21	11.49	28.46	16.82	5.59	0.06	2.19	0.59	3.37	2.01	0.33	2.35
D6.5	102.57	7.55	12.02	29.24	18.02	5.36	0.05	2.75	0.51	3.08	2.46	0.28	2.62
D6.6	93.91	20.37	10.84	25.39	16.32	5.33	0.16	2.08	0.38	2.49	1.66	0.27	1.29
D6.7	104.69	7.20	12.89	29.46	18.02	5.72	0.06	2.74	0.58	3.26	2.19	0.33	2.40
D6.8	107.56	5.60	13.22	31.52	18.19	5.91	0.06	3.29	0.59	3.59	2.51	0.35	2.03
D6.9	100.48	4.89	12.18	29.60	19.23	6.11	0.07	3.86	0.72	4.24	3.26	0.47	3.59
D6.10	101.43	5.23	11.94	28.93	18.72	5.43	0.05	2.71	0.49	3.17	2.15	0.27	2.26
D6.11	101.67	5.58	12.20	28.37	16.08	5.32	0.06	2.96	0.51	3.37	2.49	0.36	2.34
D6.12	109.67	7.69	13.08	30.72	18.49	6.03	0.05	2.50	0.46	3.34	2.05	0.27	2.92
D6.13	107.36	6.47	11.63	29.65	17.64	5.78	0.08	3.11	0.54	3.46	2.30	0.28	2.13
D6.14	103.69	7.06	11.25	28.99	18.25	5.24	0.08	3.06	0.59	3.71	2.34	0.27	2.39
D19.1	101.24	172.03	17.99	38.21	20.59	5.15	0.25	2.47	0.50	3.14	2.05	0.20	2.14
D19.2	106.00	167.37	18.22	37.99	19.91	5.39	0.22	2.63	0.41	2.65	2.28	0.22	2.65
D19.3	105.73	171.95	18.02	37.70	18.22	6.16	0.19	2.11	0.44	2.34	2.06	0.21	1.84

Spot Name	Zr	Ba	La	Ce	Nd	Sm	Eu	Gd	Tb	Dy	Er	Tm	Yb
D19.4	106.10	204.42	17.87	37.52	17.86	5.96	0.25	2.53	0.40	2.66	2.16	0.23	1.82
D19.5	104.52	165.54	18.17	38.84	19.66	6.27	0.17	2.30	0.37	2.48	2.00	0.26	1.68
D19.6	104.75	179.37	18.41	39.11	19.74	5.58	0.21	2.54	0.43	2.77	1.95	0.30	1.89
D19.7	104.43	172.55	17.83	38.67	20.19	5.22	0.16	2.19	0.38	2.66	1.89	0.17	1.68
D19.9	0.48	1054.24	14.84	16.87	6.96	2.44	3.13	0.11	0.00	0.00	0.06	0.00	0.00
D19.10	106.60	178.05	18.58	39.44	19.61	5.88	0.19	2.49	0.38	2.71	2.54	0.27	2.49
D19.11	112.65	173.93	20.14	42.80	21.40	5.71	0.22	3.01	0.53	2.62	2.15	0.37	1.63
D19.12	0.38	176.63	4.57	5.06	2.94	1.79	1.27	0.06	0.00	0.04	0.00	0.02	0.00
D19.13	106.96	183.57	19.01	39.54	20.84	5.57	0.15	2.62	0.50	2.92	1.96	0.26	1.49
D19.14	106.57	171.94	18.92	40.06	21.61	6.15	0.19	2.33	0.44	2.80	1.74	0.24	1.65
A17.1	91.17	57.84	12.01	26.51	15.35	5.57	0.18	2.37	0.40	2.85	2.21	0.28	1.96
A17.2	95.53	55.20	12.48	26.42	14.66	5.29	0.15	2.38	0.36	2.84	2.40	0.25	1.88
A17.3	99.14	95.22	12.74	28.04	15.43	5.40	0.19	2.43	0.44	2.39	1.88	0.26	1.72
A17.4	93.32	60.38	12.87	28.94	14.78	5.71	0.19	2.29	0.53	2.85	2.09	0.35	1.86
A17.5	30.78	584.26	2.98	2.73	1.49	2.18	0.94	0.06	0.01	0.02	0.10	0.02	0.13
A17.6	91.12	60.44	12.12	25.84	15.13	5.39	0.18	2.00	0.40	3.11	1.80	0.26	1.33
A17.7	94.31	62.35	12.59	26.79	15.20	5.14	0.18	2.42	0.36	2.87	2.03	0.35	2.53
A17.8	93.83	60.53	12.11	26.42	12.67	4.86	0.17	2.11	0.56	2.86	2.24	0.32	1.74
A17.9	104.19	63.73	14.02	29.46	16.10	5.61	0.19	2.42	0.55	2.72	2.06	0.31	2.14
A17.10	91.88	56.37	12.22	27.21	14.47	4.75	0.14	2.28	0.41	2.71	2.22	0.25	2.04
A17.11	93.20	62.14	12.19	26.98	14.11	5.41	0.20	2.17	0.42	3.04	2.03	0.30	2.24
A17.12	93.60	61.11	12.46	27.58	14.57	5.52	0.17	2.55	0.57	2.82	2.23	0.35	2.17
A19.4	103.05	39.58	14.49	31.30	16.34	5.09	0.15	2.87	0.54	3.04	2.78	0.41	2.79

Spot Name	Zr	Ba	La	Ce	Nd	Sm	Eu	Gd	Tb	Dy	Er	Tm	Yb
A19.5	97.06	38.14	13.19	28.29	16.44	4.62	0.17	2.27	0.50	2.96	1.87	0.40	2.27
A19.6	94.44	30.52	11.79	26.28	15.06	4.83	0.15	2.46	0.47	2.62	2.15	0.34	2.44
A19.9	99.38	40.34	13.49	29.41	16.41	5.78	0.13	2.27	0.48	3.06	2.23	0.34	2.44
A19.10	93.02	40.30	13.45	28.91	16.46	5.22	0.21	2.54	0.49	2.92	2.16	0.35	2.31
A19.11	103.81	38.82	14.23	30.87	17.74	5.85	0.16	2.45	0.46	2.87	2.66	0.32	2.90
A19.12	90.94	37.76	13.29	28.49	15.35	4.93	0.18	2.61	0.44	2.68	1.74	0.25	2.39
A19.13	94.33	41.96	13.56	29.66	15.78	5.03	0.18	2.84	0.36	2.54	2.28	0.24	2.13
A19.14	92.98	39.23	12.64	29.06	16.62	4.88	0.18	2.41	0.44	2.91	2.24	0.34	2.38
A19.15	1.77	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A19.16	94.48	39.61	13.57	29.30	16.34	4.75	0.17	2.57	0.47	3.34	2.04	0.39	1.96
A19.17	102.51	37.52	13.38	29.56	16.36	4.88	0.13	2.49	0.46	2.83	2.43	0.39	2.38
A19.18	96.62	38.22	13.38	28.79	16.48	5.16	0.16	2.31	0.45	2.90	2.04	0.37	2.53
A19.19	95.98	37.88	13.62	30.14	17.23	5.11	0.22	2.62	0.41	3.55	2.17	0.37	2.75
A19.20	96.30	36.40	13.52	29.73	16.68	5.95	0.14	2.32	0.42	2.64	2.54	0.27	2.39
A19.21	4.33	0.02	0.00	0.01	0.01	0.03	0.00	0.00	0.00	0.00	0.04	0.00	0.00
A19.22	96.06	35.54	12.67	28.24	15.85	5.19	0.15	2.29	0.49	2.95	2.37	0.36	2.30

REE concentrations for glass samples normalized to CHUR.

Spot Name	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)	Tb (ch)	Dy (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
	100.0											
A3.1	4	93.78	84.34	73.46	3.67	33.48	34.61	35.01	41.78	35.80	45.34	--
A3.2	94.23	88.47	78.76	63.11	3.90	32.72	32.78	29.02	29.33	27.48	45.71	--
A3.1...dup1	56.06	52.31	45.87	44.12	2.04	21.26	19.77	20.43	26.70	25.94	19.72	--
A3.3	40.21	38.48	34.46	38.93	1.78	16.51	16.08	16.82	18.49	17.58	14.34	--
A3.4	44.51	40.61	37.91	41.94	2.26	17.88	16.82	16.74	21.13	21.88	19.67	--
A3.5	41.82	40.25	34.27	39.23	1.94	15.69	17.01	16.05	19.81	15.54	15.47	--
A3.6	44.90	44.16	36.12	41.79	1.13	17.89	17.71	18.93	21.38	19.54	19.16	--
A3.7	43.87	40.14	32.00	34.74	1.43	15.00	15.40	14.08	15.83	10.77	17.67	--
A3.8	41.99	40.95	36.36	38.83	1.71	16.99	17.50	15.04	17.94	15.43	14.50	--
A3.9	39.67	34.49	28.52	34.62	3.07	14.61	15.04	15.08	15.50	15.81	20.39	--
Ash 3 Average	54.73	51.36	44.86	45.08	2.29	20.20	20.27	19.72	22.79	20.58	23.20	--
A4.1	87.61	64.98	54.14	52.82	3.09	20.65	26.25	22.67	32.10	17.97	31.96	--
A4.2	55.03	51.56	44.10	46.21	1.97	16.92	21.52	17.43	18.70	25.43	25.80	--
A4.3	40.34	40.35	36.75	41.26	1.60	20.57	20.87	17.83	22.79	17.28	20.89	--
A4.5	37.61	38.49	34.90	34.75	1.48	16.35	17.08	15.50	16.56	17.41	23.58	--
A4.6	35.13	34.79	32.28	36.48	1.52	16.62	16.48	14.04	14.34	20.71	19.79	--
A4.7	38.48	38.65	36.52	42.18	2.03	18.15	17.30	16.03	23.11	19.85	21.01	--
A4.8	37.46	37.47	34.10	31.28	1.21	15.83	16.37	15.53	15.54	18.95	23.37	--
A4.9	38.22	37.80	36.10	35.12	1.21	16.98	17.56	18.47	23.00	20.18	19.82	--
A4.10	85.03	85.50	84.36	76.81	4.45	39.47	39.25	36.64	37.21	44.62	43.39	--
Ash 4 Average	50.55	47.73	43.69	44.10	2.06	20.17	21.41	19.35	22.60	22.49	25.51	--

Spot Name	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)	Tb (ch)	Dy (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
A7.1	53.05	52.21	43.93	40.16	2.77	14.93	16.72	18.54	22.69	14.86	22.78	--
A7.2	73.40	66.70	52.54	43.36	3.61	22.50	21.85	21.37	24.53	25.68	16.72	--
A7.3	73.56	66.87	52.33	47.88	6.46	21.35	25.04	18.37	21.52	21.92	24.02	--
A7.4	76.12	70.54	55.34	51.62	3.62	19.12	21.98	21.33	25.94	18.76	23.50	--
A7.5	79.86	71.89	56.79	58.06	4.36	23.52	27.14	22.91	27.05	18.59	19.71	--
A7.6	66.57	65.29	56.12	52.57	4.14	21.04	24.32	21.15	24.91	22.40	24.49	--
A7.7	67.44	64.70	51.65	56.48	4.07	22.03	23.33	25.05	24.32	25.74	32.26	--
A7.8	49.09	44.03	39.07	39.68	3.69	15.36	16.12	15.64	19.22	19.73	17.10	--
A7.9	42.15	41.19	34.40	38.97	2.14	14.61	16.81	14.43	18.24	13.64	16.92	--
A7.10	41.59	38.93	34.16	36.71	2.40	13.46	14.18	13.82	13.94	10.34	15.39	--
A7.11	43.16	41.09	35.52	33.45	3.18	14.51	15.74	13.63	18.10	16.94	18.72	--
A7.12	41.61	40.92	34.16	37.13	1.95	16.49	14.73	13.10	16.08	11.79	18.16	--
Ash 7 Average	58.97	55.36	45.50	44.67	3.53	18.24	19.83	18.28	21.38	18.37	20.81	--
A11.1	46.24	43.26	35.91	34.70	3.31	13.86	16.84	15.26	17.48	15.61	13.66	--
A11.2	43.82	42.10	34.92	35.27	2.44	12.19	14.91	13.32	14.15	14.21	13.93	--
A11.3	41.74	37.90	31.38	38.31	4.10	13.34	12.26	13.36	14.50	10.07	15.08	--
A11.4	47.08	43.28	34.33	35.99	2.17	16.72	14.53	13.94	16.32	15.60	16.93	--
A11.5	42.92	39.48	33.30	34.59	2.62	13.38	11.41	12.25	14.38	13.38	14.88	--
A11.6	44.32	41.36	34.37	37.16	2.53	15.48	15.72	14.82	14.36	12.53	16.46	--
A11.7	43.15	40.59	35.61	34.11	2.56	14.18	13.46	14.13	15.47	13.48	15.81	--
A11.8	44.23	41.88	31.14	34.64	2.68	13.44	15.24	12.96	14.24	14.61	12.09	--
A11.9	45.72	42.97	32.50	38.74	2.49	13.50	16.10	12.40	15.58	8.89	13.43	--
A11.10	48.01	43.62	34.55	36.90	2.66	13.25	14.32	13.68	15.22	16.74	11.54	--

Spot Name	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)	Tb (ch)	Dy (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
A11.11	32.87	29.91	22.97	31.56	5.39	10.24	10.49	10.33	12.52	10.34	7.63	--
A11.12	46.39	42.00	32.12	35.56	1.90	14.70	15.70	13.12	12.97	16.25	16.57	--
Ash 11												
Average	43.87	40.70	32.76	35.63	2.90	13.69	14.25	13.30	14.77	13.48	14.00	--
D6.1	54.32	50.28	38.48	39.87	1.34	15.21	14.54	15.16	13.89	12.12	21.18	--
D6.2	48.94	44.91	36.71	34.11	2.12	12.79	14.89	12.68	13.60	10.34	12.51	--
D6.3	48.49	46.28	39.18	38.30	0.88	13.94	14.07	14.01	13.59	16.46	11.58	--
D6.4	48.50	46.43	36.81	37.79	1.06	11.02	16.39	13.69	12.57	13.27	14.57	--
D6.5	50.71	47.69	39.43	36.20	0.94	13.83	14.25	12.54	15.36	11.45	16.28	--
D6.6	45.72	41.42	35.71	35.99	2.82	10.45	10.58	10.11	10.39	11.04	8.02	--
D6.7	54.40	48.06	39.42	38.62	1.09	13.76	15.97	13.24	13.66	13.54	14.89	--
D6.8	55.79	51.43	39.80	39.96	1.04	16.53	16.42	14.58	15.70	14.37	12.58	--
D6.9	51.39	48.29	42.07	41.31	1.26	19.42	20.00	17.24	20.36	19.09	22.28	--
D6.10	50.37	47.19	40.95	36.71	0.82	13.63	13.68	12.90	13.44	10.80	14.04	--
D6.11	51.48	46.28	35.18	35.93	1.13	14.86	14.04	13.70	15.55	14.43	14.55	--
D6.12	55.18	50.11	40.45	40.75	0.90	12.55	12.82	13.60	12.83	10.73	18.16	--
D6.13	49.07	48.37	38.59	39.02	1.43	15.62	14.87	14.08	14.35	11.21	13.25	--
D6.14	47.48	47.29	39.94	35.38	1.51	15.35	16.22	15.10	14.60	10.79	14.85	--
Dome 6												
Average	50.85	47.43	38.77	37.85	1.31	14.21	14.91	13.76	14.28	12.83	14.91	--
D19.1	75.91	62.34	45.05	34.79	4.49	12.39	13.72	12.75	12.79	8.16	13.29	--
D19.2	76.89	61.98	43.56	36.43	3.92	13.23	11.42	10.76	14.23	8.73	16.47	--
D19.3	76.03	61.50	39.88	41.63	3.35	10.60	12.27	9.53	12.85	8.53	11.45	--

Spot Name	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)	Tb (ch)	Dy (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
D19.4	75.39	61.20	39.07	40.30	4.41	12.70	11.20	10.82	13.50	9.50	11.32	--
D19.5	76.68	63.36	43.02	42.33	3.10	11.55	10.28	10.09	12.50	10.69	10.45	--
D19.6	77.69	63.81	43.19	37.68	3.71	12.78	11.84	11.27	12.22	11.95	11.75	--
D19.7	75.25	63.09	44.17	35.24	2.92	11.03	10.56	10.80	11.80	6.78	10.46	--
D19.10	78.42	64.34	42.90	39.74	3.44	12.50	10.65	11.02	15.85	10.98	15.48	--
D19.11	84.96	69.82	46.84	38.59	3.95	15.11	14.72	10.64	13.44	14.93	10.12	--
D19.13	80.23	64.49	45.60	37.61	2.70	13.16	13.89	11.86	12.24	10.47	9.28	--
D19.14	79.82	65.36	47.28	41.53	3.36	11.70	12.12	11.39	10.89	9.67	10.23	--
Dome 11 Average	77.93	63.75	43.69	38.72	3.58	12.43	12.06	10.99	12.94	10.04	11.85	--
A17.1	50.69	43.25	33.59	37.66	3.14	11.90	10.95	11.59	13.84	11.31	12.20	--
A17.2	52.64	43.10	32.09	35.75	2.72	11.94	10.00	11.55	15.01	10.27	11.68	--
A17.3	53.74	45.74	33.77	36.51	3.40	12.23	12.13	9.71	11.72	10.57	10.69	--
A17.4	54.29	47.21	32.33	38.57	3.33	11.49	14.70	11.58	13.04	14.01	11.56	--
A17.6	51.15	42.15	33.11	36.40	3.11	10.03	10.99	12.65	11.26	10.53	8.24	--
A17.7	53.12	43.70	33.25	34.73	3.25	12.18	10.08	11.67	12.69	14.03	15.73	--
A17.8	51.08	43.09	27.72	32.86	2.98	10.58	15.51	11.62	13.99	12.78	10.78	--
A17.9	59.15	48.06	35.24	37.93	3.35	12.15	15.19	11.07	12.88	12.42	13.32	--
A17.10	51.54	44.38	31.66	32.07	2.44	11.47	11.23	11.03	13.86	10.14	12.68	--
A17.11	51.45	44.01	30.87	36.58	3.58	10.93	11.76	12.37	12.70	12.06	13.91	--
A17.12	52.56	44.99	31.87	37.28	2.96	12.80	15.75	11.45	13.96	14.22	13.51	--
Ash 17 Average	52.86	44.52	32.32	36.03	3.12	11.61	12.57	11.48	13.18	12.03	12.21	--

Spot Name	La (ch)	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)	Tb (ch)	Dy (ch)	Er (ch)	Tm (ch)	Yb (ch)	Lu (ch)
A19.4	61.15	51.06	35.75	34.38	2.71	14.40	14.99	12.34	17.38	16.61	17.31	--
A19.5	55.67	46.15	35.97	31.24	3.00	11.41	13.96	12.02	11.66	16.38	14.11	--
A19.6	49.75	42.88	32.95	32.61	2.70	12.35	12.91	10.65	13.47	13.93	15.14	--
A19.9	56.90	47.98	35.91	39.08	2.37	11.43	13.39	12.43	13.96	13.71	15.12	--
A19.10	56.75	47.16	36.01	35.24	3.65	12.77	13.52	11.87	13.51	14.29	14.34	--
A19.11	60.06	50.36	38.81	39.52	2.80	12.29	12.72	11.65	16.60	12.78	18.03	--
A19.12	56.06	46.48	33.59	33.33	3.11	13.10	12.08	10.91	10.87	10.31	14.83	--
A19.13	57.21	48.38	34.54	33.96	3.19	14.29	10.02	10.33	14.23	9.76	13.22	--
A19.14	53.35	47.41	36.36	32.99	3.19	12.13	12.17	11.82	13.99	13.95	14.76	--
A19.16	57.24	47.79	35.76	32.12	3.04	12.92	12.94	13.58	12.73	15.72	12.15	--
A19.17	56.46	48.23	35.79	32.95	2.35	12.53	12.65	11.52	15.17	15.99	14.76	--
A19.18	56.44	46.97	36.07	34.88	2.91	11.61	12.35	11.80	12.76	14.99	15.69	--
A19.19	57.47	49.17	37.70	34.55	3.83	13.15	11.45	14.42	13.55	15.02	17.07	--
A19.20	57.03	48.50	36.50	40.19	2.47	11.67	11.54	10.72	15.85	10.99	14.83	--
A19.22	53.46	46.08	34.68	35.06	2.74	11.51	13.61	11.99	14.80	14.68	14.26	--
Ash 19												
Average	56.33	47.64	35.76	34.81	2.94	12.50	12.69	11.87	14.04	13.94	15.04	--

APPENDIX E: REE Data Comparison

Whole rock REE data normalized to CHUR from Kelleher and Cameron (1990) and glass data (this study).

Sample	Unit description	Ce (ch)	Nd (ch)	Sm (ch)	Eu (ch)	Gd (ch)	Dy (ch)	Er (ch)	Yb (ch)
M19-1	biotite-bearing	47.000	18.100	3.620	0.310	3.000	3.370	2.300	2.230
M24-1	biotite-bearing	50.000	19.300	4.050	0.260	3.410	3.850	2.360	2.520
M14-1A	opx-bearing	69.600	26.600	5.020	0.200	3.940	4.190	2.560	2.670
M29-2	fayalite-bearing	49.200	20.500	4.450	0.140	3.960	4.210	2.620	2.770
M28(m22-1)	fayalite-bearing	53.000	23.000	4.790	0.150	4.040	4.490	2.720	2.870
M3(m1-2)	aphyric	50.600	21.700	4.580	0.150	3.900	4.360	2.590	2.780
Ash 3	glass average	51.364	44.862	45.076	2.294	20.202	19.722	22.790	23.198
Ash 4	glass average	47.732	43.695	44.103	2.062	20.171	19.348	22.596	25.513
Ash 7	glass average	55.363	45.501	44.673	3.532	18.243	18.279	21.378	20.814
Ash 11	glass average	40.695	32.758	35.628	2.905	13.689	13.297	14.766	14.000
Ash 17	glass average	44.517	32.319	36.031	3.115	11.608	11.480	13.177	12.210
Ash 19	glass average	47.640	35.759	34.808	2.938	12.504	11.871	14.035	15.041
Dome 6	glass average	47.429	38.766	37.853	1.309	14.211	13.759	14.279	14.909
Dome 11	glass average	63.754	43.689	38.716	3.579	12.431	10.994	12.937	11.846

APPENDIX F: Zircon Saturation Temperatures

Zircon Saturation temperatures determined for Kelleher and Cameron (1990) whole rock analyses using molar fractions. Two models for temperature shown (Watson and Harrison, 1983; Boehnke et al., 2013).

Sample	Unit	Zr	SiO2	TiO2	Al2O3	Fe2O3	MnO
M19-1	Biotite-bearing rhyolite	108	76.38	0.09	13.20	1.15	0
M24-1	Biotite-bearing rhyolite	103	76.60	0.07	12.92	1.21	0
M11-1	Biotite-bearing rhyolite	109	76.98	0.06	12.61	1.19	0
M11-3	Biotite-bearing rhyolite	115	76.20	0.06	12.57	1.20	0
M12-1A	Mono Craters	126	66.76	0.84	14.91	4.59	0
M12-2A	Mono Craters	125	68.30	0.78	14.40	4.19	0
Neg-RD2	Negit Island	274	65.05	0.81	16.71	4.55	0
Pao3	Paoha Island	325	71.79	0.20	15.02	2.27	0
M14-1A	opx-bearing	138	75.99	0.08	13.12	1.46	0
M18-1A	opx-bearing	137	75.48	0.08	13.21	1.44	0
M29-2	Fayalite-bearing	127	76.56	0.07	12.91	1.31	0
M28(m22-1)	Fayalite-bearing	125	76.59	0.07	13.02	1.23	0
M16-1	Sparsely porphyritic	106	76.51	0.08	13.00	1.27	0
M8-3	Sparsely porphyritic	117	76.74	0.06	12.62	1.24	0
M23-1	Sparsely porphyritic	118	76.51	0.07	12.92	1.31	0
M22-1	Aphyric	119	76.25	0.07	12.91	1.30	0
M3(m1-2)	Aphyric	123	76.44	0.07	13.11	1.25	0

Sample	Unit	MgO	CaO	Na2O	K2O	P2O5	total mol	M
M19-1	Biotite-bearing rhyolite	0.04	0.72	3.52	4.86	0.05	1.78	1.31
M24-1	Biotite-bearing rhyolite	0.04	0.72	3.52	4.87	0.05	1.78	1.34
M11-1	Biotite-bearing rhyolite	0.05	0.63	3.77	4.67	0.03	1.78	1.37
M11-3	Biotite-bearing rhyolite	0.01	0.60	3.57	4.60	1.19	1.76	1.32
M12-1A	Mono Craters	1.99	3.52	3.68	3.54	0.15	1.78	1.75
M12-2A	Mono Craters	1.65	2.99	3.78	3.76	0.15	1.78	1.71
Neg-RD2	Negit Island	1.37	3.31	4.42	3.47	0.30	1.79	1.69
Pao3	Paoha Island	0.15	1.02	4.25	5.22	0.08	1.79	1.45
M14-1A	opx-bearing	0.04	0.65	3.61	4.99	0.06	1.78	1.34
M18-1A	opx-bearing	0.12	0.91	3.73	4.96	0.06	1.78	1.41
M29-2	Fayalite-bearing	0.01	0.61	3.80	4.69	0.03	1.78	1.35
M28(m22-1)	Fayalite-bearing	0.05	0.60	3.73	4.70	0.01	1.78	1.32
M16-1	Sparsely porphyritic	0.05	0.67	3.59	4.77	0.06	1.78	1.32
M8-3	Sparsely porphyritic	0.04	0.81	3.68	4.79	0.02	1.78	1.40
M23-1	Sparsely porphyritic	0.06	0.62	3.63	4.83	0.05	1.78	1.33
M22-1	Aphyric	0.13	0.85	3.61	4.79	0.08	1.78	1.38
M3(m1-2)	Aphyric	0.04	0.62	3.73	4.73	0.01	1.78	1.32

Sample	Unit	W&H_1983	Boehnke_2013	W&H_1983	Boehnke_2013	Total
		Saturation T, K	Saturation T, K	Saturation T, C	Saturation T, C	
M19-1	Biotite-bearing rhyolite	1032.38	984.09	759.38	711.09	100
M24-1	Biotite-bearing rhyolite	1026.68	976.73	753.68	703.73	100
M11-1	Biotite-bearing rhyolite	1029.12	978.62	756.12	705.62	100
M11-3	Biotite-bearing rhyolite	1036.84	988.95	763.84	715.95	100
M12-1A	Mono Craters	1014.42	950.94	741.42	677.94	100
M12-2A	Mono Craters	1016.61	954.56	743.61	681.56	100
Neg-RD2	Negit Island	1085.37	1033.71	812.37	760.71	100
Pao3	Paoha Island	1120.76	1083.56	847.76	810.56	100
M14-1A	opx-bearing	1050.62	1004.30	777.62	731.30	100
M18-1A	opx-bearing	1044.87	995.44	771.87	722.44	100
M29-2	Fayalite-bearing	1043.28	995.64	770.28	722.64	100
M28(m22-1)	Fayalite-bearing	1043.74	996.94	770.74	723.94	100
M16-1	Sparsely porphyritic	1030.16	981.24	757.16	708.24	100
M8-3	Sparsely porphyritic	1032.52	981.52	759.52	708.52	100
M23-1	Sparsely porphyritic	1038.21	990.22	765.21	717.22	100
M22-1	Aphyric	1035.75	986.02	762.75	713.02	100
M3(m1-2)	Aphyric	1042.29	995.21	769.29	722.21	100

APPENDIX G: Partition coefficients for Mono Craters from zircon and glass data.

Partition coefficients determined from average zircon surface and glass data.

	La	Ce	Nd	Sm	Eu	Gd	Tb	Dy
Zircon								
Ash 3	0.26	44.27	3.52	32.58	11.51	254.23	550.98	961.14
Ash 4	0.14	37.54	1.19	17.46	4.99	182.73	456.88	855.71
Ash 7	0.12	21.64	0.93	12.59	5.84	110.04	239.43	438.30
Ash 11	0.12	15.99	0.64	10.52	3.24	112.14	286.31	551.59
Ash 17	0.18	70.27	2.34	23.33	13.98	187.49	423.06	759.30
Ash 19	0.26	34.25	1.20	15.53	7.32	157.43	353.25	692.24
Dome 6	0.08	40.45	2.57	23.72	5.20	197.50	401.47	735.04
Dome 11	0.07	46.66	2.23	23.95	7.59	206.33	431.79	808.05
Glass								
Ash 3	54.73	51.36	44.86	45.08	2.29	20.20	20.27	19.72
Ash 4	50.55	47.73	43.69	44.10	2.06	20.17	21.41	19.35
Ash 7	58.97	55.36	45.50	44.67	3.53	18.24	19.83	18.28
Ash 11	43.87	40.70	32.76	35.63	2.90	13.69	14.25	13.30
Ash 17	52.86	44.52	32.32	36.03	3.12	11.61	12.57	11.48
Ash 19	56.33	47.64	35.76	34.81	2.94	12.50	12.69	11.87
Dome 6	50.85	47.43	38.77	37.85	1.31	14.21	14.91	13.76
Dome 11	77.93	63.75	43.69	38.72	3.58	12.43	12.06	10.99

	Ho	Er	Tm	Yb	Lu	Th	U	Zr	Ba
Zircon									
Ash 3	1781.80	2767.60	3889.51	4929.75	5850.30	716.40	1582.24	--	--
Ash 4	1675.10	2737.36	4009.85	5181.60	6208.80	648.08	1869.50	--	--
Ash 7	849.19	1387.69	1978.83	2625.46	3234.81	222.03	655.96	--	--
Ash 11	1091.47	1851.04	2717.12	3634.68	4447.58	318.92	1101.02	--	--
Ash 17	1446.92	2358.69	3416.27	4517.02	5489.39	672.25	1332.83	--	--
Ash 19	1432.67	2237.19	3408.61	4414.90	5589.51	521.12	1315.99	--	--
Dome 6	1261.79	2058.38	2884.19	3761.52	4433.96	597.07	1151.58	--	--
Dome 11	1368.38	2227.07	3101.79	3972.81	4766.41	787.02	1294.18	--	--
Glass									
Ash 3	--	22.79	20.58	23.20	--	24.55	8.68	110.91	17.13
Ash 4	--	22.60	22.49	25.51	--	23.77	8.75	115.37	10.40
Ash 7	--	21.38	18.37	20.81	--	22.28	7.76	121.03	57.39
Ash 11	--	14.77	13.48	14.00	--	18.49	6.17	87.94	72.25
Ash 17	--	13.18	12.03	12.21	--	20.90	7.20	94.66	63.21
Ash 19	--	14.04	13.94	15.04	--	22.00	7.01	96.73	38.12
Dome 6	--	14.28	12.83	14.91	--	19.85	6.58	103.46	8.42
Dome 11	--	12.94	10.04	11.85	--	18.81	5.77	105.96	176.43

	La	Ce	Nd	Sm	Eu	Gd	Tb	Dy
Kd= Cs/Cl								
Ash 3	0.005	0.86	0.08	0.72	5.02	12.58	27.18	48.74
Ash 4	0.003	0.79	0.03	0.40	2.42	9.06	21.34	44.23
Ash 7	0.002	0.39	0.02	0.28	1.65	6.03	12.08	23.98
Ash 11	0.003	0.39	0.02	0.30	1.12	8.19	20.09	41.48
Ash 17	0.003	1.58	0.07	0.65	4.49	16.15	33.65	66.14
Ash 19	0.005	0.72	0.03	0.45	2.49	12.59	27.84	58.32
Dome 6	0.002	0.85	0.07	0.63	3.97	13.90	26.93	53.42
Dome 11	0.001	0.73	0.05	0.62	2.12	16.60	35.79	73.50

	Ho	Er	Tm	Yb	Lu	Th	U	Zr	Ba
Kd= Cs/Cl									
Ash 3	--	134.51	167.67	212.51	--	29.19	182.28	--	--
Ash 4	--	121.72	157.17	203.10	--	27.27	213.68	--	--
Ash 7	--	75.56	95.07	126.14	--	9.97	84.58	--	--
Ash 11	--	137.36	194.08	259.62	--	17.25	178.31	--	--
Ash 17	--	196.05	279.79	369.94	--	32.17	185.23	--	--
Ash 19	--	160.46	226.62	293.52	--	23.69	187.82	--	--
Dome 6	--	160.42	193.45	252.29	--	30.08	174.94	--	--
Dome 11	--	221.90	261.85	335.38	--	41.85	224.29	--	--

APPENDIX H: Model partition coefficients for Mono Craters from titania concentrations.

Partition coefficients per each element determined using titania concentration model (Claiborne et al., 2018).

Spot Name	48Ti	Th K_D	U K_D	Ce K_D	Nd K_D	Sm K_D	Eu K_D
US08B-1.1	1.708	41.503	348.295	0.673	0.114	1.706	2.26
US08B-2.1	1.794	39.565	328.610	0.653	0.111	1.646	2.21
US08B-3.2	3.789	19.024	134.841	0.408	0.067	0.954	1.55
US08B-4.1	2.258	31.587	249.862	0.565	0.095	1.392	1.98
US08B-4.2	2.153	33.083	264.338	0.582	0.098	1.441	2.02
US08B-5.1	3.987	18.099	126.902	0.395	0.064	0.919	1.51
US08B-6.1	3.321	21.648	157.787	0.443	0.073	1.051	1.65
US08B-6.2	3.648	19.746	141.087	0.418	0.068	0.981	1.58
US08B-7.1	1.562	45.294	387.379	0.712	0.121	1.820	2.36
US08B-7.2	2.216	32.164	255.428	0.571	0.096	1.411	2.00
US08B-8.1	1.921	36.988	302.758	0.625	0.106	1.565	2.14
US08B-9.1	1.986	35.812	291.091	0.612	0.103	1.528	2.10
US08B-10.1	1.692	41.893	352.280	0.677	0.115	1.718	2.27
US08B-10.2	2.176	32.740	261.005	0.578	0.097	1.430	2.01
US08B-11.1	2.954	24.275	181.378	0.477	0.079	1.144	1.74
US08B-11.2	6.679	10.923	68.652	0.286	0.046	0.631	1.19
US08B-11.3	5.831	12.476	80.706	0.311	0.050	0.697	1.26
US08B-12.1	2.275	31.348	247.566	0.562	0.094	1.384	1.97
US08B-13.1	1.890	37.580	308.669	0.631	0.107	1.584	2.15
US08B-13.2	5.175	14.023	93.036	0.336	0.054	0.760	1.34
US08B-14.1	2.282	31.261	246.728	0.561	0.094	1.381	1.97
US08B-15.1	2.511	28.466	220.161	0.528	0.088	1.288	1.88

Spot Name	48Ti	Th K_D	U K_D	Ce K_D	Nd K_D	Sm K_D	Eu K_D
US08B-19.1	4.907	14.771	99.108	0.347	0.056	0.790	1.37
US08B-19.2	8.407	8.720	52.196	0.247	0.039	0.534	1.06
US08B-20.1	2.370	30.124	235.861	0.548	0.092	1.344	1.93
US08B-21.1	3.079	23.311	172.661	0.465	0.077	1.110	1.71
US08B-22.1	2.698	26.530	202.077	0.505	0.084	1.222	1.82
US08B-23.2	2.835	25.278	190.536	0.490	0.081	1.179	1.78
US08B-24.1	3.089	23.239	172.011	0.464	0.077	1.108	1.71
US08B-24.2	2.857	25.086	188.784	0.487	0.081	1.172	1.77
US08B-25.2	3.967	18.190	127.680	0.396	0.065	0.923	1.52
US08B-26.1	1.754	40.436	337.434	0.662	0.112	1.673	2.23
US08B-27.1	2.095	33.983	273.106	0.592	0.100	1.470	2.05
US08B-27.2	2.723	26.294	199.895	0.502	0.083	1.214	1.81
US08B-23.3	2.302	30.991	244.141	0.558	0.093	1.372	1.96
Ash 3 Average		27.613	215.544	0.511	0.085	1.244	1.82
US05B-1.2	3.112	23.069	170.478	0.462	0.076	1.101	1.70
US05B-3.1	3.247	22.128	162.061	0.450	0.074	1.068	1.67
US05B-3.2	3.294	21.818	159.300	0.446	0.073	1.057	1.66
US05B-5.2	3.262	22.033	161.212	0.448	0.074	1.064	1.66
US05B-7.1	2.067	34.434	277.523	0.597	0.100	1.484	2.06
US05B-8.1	2.228	32.004	253.882	0.570	0.096	1.406	1.99
US05B-8.2	6.950	10.505	65.474	0.279	0.044	0.613	1.16
US05B-9.1	6.839	10.673	66.745	0.282	0.045	0.620	1.17
US05B-10.1	2.782	25.741	194.798	0.495	0.082	1.195	1.79
US05B-11.1	3.019	23.763	176.742	0.471	0.078	1.126	1.73
US05B-11.2	4.646	15.584	105.784	0.359	0.058	0.822	1.41
US05B-12.1	3.366	21.363	155.267	0.440	0.072	1.040	1.64

Spot Name	48Ti	Th K_D	U K_D	Ce K_D	Nd K_D	Sm K_D	Eu K_D
US05B-13.2	6.868	10.628	66.404	0.281	0.045	0.618	1.17
US05B-14.1	2.651	26.989	206.339	0.511	0.085	1.238	1.83
US05B-14.2	2.897	24.741	185.627	0.483	0.080	1.160	1.76
US05B-14.3	3.104	23.124	170.976	0.462	0.076	1.103	1.70
US05B-15.1	3.667	19.644	140.199	0.417	0.068	0.977	1.57
US05B-16.1	4.262	16.955	117.213	0.379	0.062	0.876	1.47
US05B-1.1...dup1	2.438	29.295	227.989	0.538	0.090	1.316	1.91
US05B-2.1	4.867	14.891	100.094	0.349	0.056	0.795	1.38
US05B-3.1...dup1	2.360	30.242	236.982	0.549	0.092	1.347	1.94
US05B-4.1...dup1	1.984	35.848	291.453	0.613	0.103	1.529	2.10
US05B-4.2	3.174	22.628	166.527	0.456	0.075	1.086	1.69
US05B-5.1...dup1	1.986	35.802	290.995	0.612	0.103	1.528	2.10
US05B-8.4	2.990	23.989	178.788	0.473	0.078	1.134	1.73
Ash 17 Average		23.116	173.154	0.457	0.075	1.092	1.68
A4WCF-1.1	2.316	30.804	242.349	0.556	0.093	1.366	1.96
A4WCF-2.1	1.398	50.505	442.248	0.763	0.131	1.974	2.48
A4WCF-3.1	1.987	35.798	290.959	0.612	0.103	1.528	2.10
A4WCF-4.1	1.576	44.902	383.298	0.708	0.121	1.809	2.35
A4WCF-5.1	2.715	26.367	200.576	0.503	0.084	1.217	1.81
Ash 4 Average		37.675	311.886	0.628	0.106	1.579	2.14
US01-1.1	1.100	63.837	588.081	0.887	0.154	2.350	2.78
US01-2.1	1.133	62.030	567.895	0.871	0.151	2.301	2.74
US01-3.1	1.230	57.228	514.865	0.827	0.143	2.167	2.64
US01-4.1	1.363	51.772	455.788	0.776	0.133	2.011	2.51
US01-5.1	1.218	57.806	521.199	0.832	0.144	2.183	2.65
US01-6.1	1.474	47.946	415.142	0.738	0.126	1.899	2.42

Spot Name	48Ti	Th K_D	U K_D	Ce K_D	Nd K_D	Sm K_D	Eu K_D
US01-7.1	1.353	52.140	459.732	0.779	0.134	2.022	2.52
US01-TOP-1.1	1.918	37.047	303.353	0.626	0.106	1.567	2.14
US01-TOP-2.1	1.196	58.828	532.437	0.842	0.145	2.212	2.67
US01-TOP-3.1	1.217	57.849	521.674	0.833	0.144	2.184	2.65
US01-TOP-4.1	1.146	61.326	560.064	0.865	0.150	2.281	2.73
US01-TOP-5.1	1.423	49.616	432.794	0.755	0.129	1.948	2.46
Ash 11 Average		54.785	489.419	0.803	0.138	2.094	2.58
US08b_GERONIMO-1.1	1.336	52.778	466.582	0.785	0.135	2.040	2.54
US08b_GERONIMO-2.1	1.223	57.552	518.416	0.830	0.143	2.176	2.65
US08b_GERONIMO-3.1	2.734	26.188	198.917	0.501	0.083	1.211	1.81
US08b_GERONIMO-4.1	1.955	36.360	296.519	0.618	0.104	1.546	2.12
US08b_GERONIMO-5.1	2.039	34.890	282.002	0.602	0.101	1.499	2.08
US08b_GERONIMO-6.1	9.625	7.637	44.425	0.227	0.036	0.484	1.00
US08bAPPLE-1.1	1.297	54.340	483.437	0.800	0.138	2.085	2.57
US08bAPPLE-2.1	1.300	54.223	482.165	0.799	0.137	2.081	2.57
US08bAPPLE-3.1	1.929	36.844	301.326	0.624	0.105	1.561	2.13
US08bAPPLE-4.1	1.294	54.470	484.839	0.801	0.138	2.088	2.58
US08bAPPLE-5.1	1.230	57.223	514.811	0.827	0.143	2.167	2.64
Ash 3 Average		42.955	370.313	0.674	0.115	1.721	2.24
US09-2.1	1.209	58.212	525.654	0.836	0.144	2.194	2.66
US09-3.1	1.250	56.334	505.102	0.819	0.141	2.141	2.62
US09-4.1	1.788	39.695	329.928	0.654	0.111	1.650	2.21
US09-5.1	1.451	48.688	422.976	0.746	0.128	1.921	2.44
US09-6.1	1.857	38.237	315.249	0.639	0.108	1.605	2.17
US09-7.1	1.206	58.355	527.224	0.837	0.145	2.198	2.66
Dome 30 Average		49.920	437.689	0.755	0.129	1.952	2.46

Spot Name	48Ti	Th K_D	U K_D	Ce K_D	Nd K_D	Sm K_D	Eu K_D
US27-03A-10.1	2.083	34.180	275.037	0.594	0.100	1.476	2.06
US27-03A-10.2	1.987	35.786	290.838	0.612	0.103	1.527	2.10
US27-03A-13.1	2.493	28.666	222.040	0.531	0.089	1.295	1.89
US27-03A-20.1	1.949	36.469	297.604	0.619	0.105	1.549	2.12
US27-03A-20.2	1.818	39.043	323.349	0.647	0.110	1.630	2.19
US27-03A-21.1	1.554	45.526	389.797	0.714	0.122	1.827	2.36
US27-03A-6.1	2.528	28.275	218.362	0.526	0.088	1.282	1.88
US27-03A-8.1	2.100	33.902	272.320	0.591	0.099	1.467	2.05
US27-03A-9.1	2.072	34.347	276.672	0.596	0.100	1.481	2.06
US27-03B-1.1	2.608	27.421	210.367	0.516	0.086	1.253	1.85
US27-03B-12.1	2.400	29.744	232.246	0.544	0.091	1.331	1.92
US27-03B-13.1	2.309	30.904	243.310	0.557	0.093	1.369	1.96
US27-03B-3.1	2.153	33.091	264.409	0.582	0.098	1.441	2.02
US27-03B-4.1	2.768	25.875	196.030	0.497	0.082	1.200	1.80
US27-03B-5.1	2.747	26.070	197.829	0.499	0.083	1.206	1.80
US27-03B-7.1	2.182	32.662	260.246	0.577	0.097	1.427	2.01
US27-03B-7.2	1.929	36.838	301.270	0.623	0.105	1.561	2.13
US27-03B-9.1	2.137	33.325	266.685	0.585	0.098	1.449	2.03
Ash 19 Average		32.896	263.245	0.578	0.097	1.432	2.01
US27-07B-1.1	1.639	43.214	365.840	0.691	0.117	1.758	2.30
US27-07B-1.2	1.425	49.577	432.384	0.754	0.129	1.947	2.46
US27-07B-2.1	1.941	36.624	299.146	0.621	0.105	1.554	2.13
US27-07B-3.1	1.649	42.957	363.197	0.688	0.117	1.750	2.30
US27-07B-4.1	3.459	20.798	150.289	0.432	0.071	1.020	1.62
US27-07B-5.1	1.507	46.926	404.427	0.728	0.124	1.869	2.40
Ash 7 Average		40.016	335.881	0.652	0.111	1.650	2.20

Spot Name	48Ti	Th K_D	U K_D	Ce K_D	Nd K_D	Sm K_D	Eu K_D
US27-15A-2.1	1.656	42.771	361.285	0.686	0.117	1.744	2.29
US27-15A-3.1	2.176	32.752	261.121	0.578	0.097	1.430	2.01
US27-15B-3.1	2.016	35.280	285.837	0.606	0.102	1.511	2.09
US27-15C-1.1	1.803	39.361	326.555	0.651	0.110	1.640	2.20
US27-15C-4.1	2.066	34.448	277.658	0.597	0.100	1.485	2.06
US27-15C-5.1	2.083	34.170	274.940	0.594	0.100	1.476	2.06
US27-15C-7.1	2.508	28.496	220.442	0.529	0.088	1.289	1.88
US27-15C-6.1...dup1	2.673	26.769	204.298	0.508	0.084	1.230	1.83
US27-15C-6.1...dup2	3.057	23.474	174.130	0.467	0.077	1.116	1.72
Ash 15 Average		33.058	265.141	0.580	0.097	1.436	2.02
DOME11-1.1	3.336	21.549	156.914	0.442	0.073	1.047	1.65
DOME11-1.2	2.915	24.594	184.283	0.481	0.080	1.155	1.75
DOME11-10.1	3.057	23.475	174.136	0.467	0.077	1.116	1.72
DOME11-10.2	2.034	34.977	282.857	0.603	0.102	1.502	2.08
DOME11-11.1	3.499	20.568	148.267	0.429	0.070	1.011	1.61
DOME11-2.1	2.553	28.004	215.824	0.523	0.087	1.273	1.87
DOME11-2.2	2.819	25.411	191.756	0.491	0.081	1.184	1.78
DOME11-4.1	3.301	21.773	158.899	0.445	0.073	1.055	1.65
DOME11-4.2	2.111	33.737	270.707	0.589	0.099	1.462	2.04
DOME11-5.1	1.880	37.793	310.797	0.634	0.107	1.591	2.16
DOME11-5.2	2.226	32.024	254.077	0.570	0.096	1.406	1.99
DOME11-6.1	2.712	26.394	200.820	0.503	0.084	1.218	1.82
DOME11-6.2	2.393	29.835	233.103	0.545	0.091	1.334	1.93
DOME11-7.1	2.469	28.938	224.607	0.534	0.089	1.304	1.90
DOME11-7.2	3.722	19.359	137.736	0.413	0.068	0.967	1.56
DOME11-8.1	8.555	8.572	51.124	0.245	0.039	0.527	1.05

Spot Name	48Ti	Th K_D	U K_D	Ce K_D	Nd K_D	Sm K_D	Eu K_D
DOME11-9.1	4.045	17.846	124.748	0.392	0.064	0.910	1.50
DOME11-9.2	1.603	44.161	375.626	0.700	0.119	1.786	2.33
Dome 11 Average		26.612	205.349	0.500	0.083	1.214	1.80
DOME6-1.2	2.749	26.052	197.656	0.499	0.083	1.206	1.80
DOME6-10.2	2.620	27.306	209.296	0.515	0.086	1.249	1.85
DOME6-11.1	2.427	29.432	229.282	0.540	0.090	1.321	1.91
DOME6-11.2	2.924	24.519	183.604	0.480	0.079	1.153	1.75
DOME6-12.1	3.275	21.942	160.401	0.447	0.074	1.061	1.66
DOME6-12.2	2.886	24.835	186.488	0.484	0.080	1.164	1.76
DOME6-13.1	2.851	25.136	189.238	0.488	0.081	1.174	1.77
DOME6-13.2	3.186	22.545	165.777	0.455	0.075	1.083	1.68
DOME6-2.1	2.149	33.155	265.030	0.583	0.098	1.443	2.03
DOME6-2.2	3.327	21.607	157.424	0.443	0.073	1.049	1.65
DOME6-2.3	2.163	32.942	262.964	0.580	0.097	1.436	2.02
DOME6-3.1	3.487	20.640	148.900	0.430	0.071	1.014	1.61
DOME6-3.2	2.666	26.845	205.003	0.509	0.085	1.233	1.83
DOME6-4.1	2.937	24.412	182.628	0.479	0.079	1.149	1.75
DOME6-5.1	2.217	32.149	255.283	0.571	0.096	1.410	2.00
DOME6-5.2	3.730	19.323	137.417	0.412	0.067	0.965	1.56
DOME6-5.3	2.741	26.118	198.272	0.500	0.083	1.208	1.81
DOME6-6.1	2.394	29.827	233.032	0.544	0.091	1.334	1.93
DOME6-7.1	1.456	48.528	421.277	0.744	0.127	1.916	2.44
DOME6-7.2	2.455	29.092	226.064	0.536	0.089	1.309	1.90
DOME6-7.3	2.656	26.941	205.896	0.510	0.085	1.236	1.83
DOME6-8.2	2.421	29.493	229.865	0.541	0.090	1.323	1.92
DOME6-9.2	1.970	36.099	293.931	0.615	0.104	1.537	2.11

Spot Name	48Ti	Th K_D	U K_D	Ce K_D	Nd K_D	Sm K_D	Eu K_D
Dome 6 Average		27.780	214.988	0.518	0.086	1.260	1.85

Spot Name	48Ti	Gd K_D	Tb K_D	Dy K_D	Er K_D	Tm K_D	Yb K_D
US08B-1.1	1.708	23.245	61.928	142.873	559.012	774.701	1138.978
US08B-2.1	1.794	22.296	59.323	135.862	528.837	734.998	1071.563
US08B-3.2	3.789	11.780	30.717	62.883	226.114	328.440	421.035
US08B-4.1	2.258	18.324	48.452	107.202	407.227	573.713	803.977
US08B-4.2	2.153	19.078	50.510	112.553	429.700	603.687	852.891
US08B-5.1	3.987	11.279	29.370	59.668	213.398	310.902	395.076
US08B-6.1	3.321	13.184	34.499	72.038	262.679	378.593	496.469
US08B-6.2	3.648	12.169	31.762	65.395	236.093	342.167	441.511
US08B-7.1	1.562	25.084	66.991	156.637	618.695	852.907	1273.365
US08B-7.2	2.216	18.615	49.247	109.264	415.874	585.256	822.767
US08B-8.1	1.921	21.025	55.838	126.568	489.080	682.507	983.331
US08B-9.1	1.986	20.442	54.240	122.339	471.086	658.678	943.629
US08B-10.1	1.692	23.435	62.451	144.286	565.111	782.712	1152.646
US08B-10.2	2.176	18.905	50.039	111.324	424.531	596.801	841.618
US08B-11.1	2.954	14.567	38.240	81.263	300.016	429.432	574.583
US08B-11.2	6.679	7.264	18.654	35.075	118.768	178.382	207.432
US08B-11.3	5.831	8.156	21.022	40.342	138.582	206.480	245.781
US08B-12.1	2.275	18.203	48.122	106.349	403.655	568.942	796.229
US08B-13.1	1.890	21.318	56.641	128.703	498.184	694.546	1003.476
US08B-13.2	5.175	9.031	23.350	45.620	158.708	234.808	285.298
US08B-14.1	2.282	18.159	48.002	106.038	402.352	567.200	793.403
US08B-15.1	2.511	16.736	44.127	96.089	360.922	511.675	704.055
US08B-19.1	4.907	9.449	24.467	48.183	168.573	248.623	304.855
US08B-19.2	8.407	5.970	15.234	27.674	91.449	139.228	155.619
US08B-20.1	2.370	17.582	46.431	101.987	385.432	544.562	756.797

Spot Name	48Ti	Gd K_D	Tb K_D	Dy K_D	Er K_D	Tm K_D	Yb K_D
US08B-21.1	3.079	14.062	36.874	77.874	286.248	410.726	545.659
US08B-22.1	2.698	15.739	41.419	89.224	332.590	473.516	643.533
US08B-23.2	2.835	15.090	39.658	84.800	314.448	448.993	605.045
US08B-24.1	3.089	14.024	36.771	77.621	285.220	409.327	543.505
US08B-24.2	2.857	14.991	39.388	84.125	311.689	445.256	599.209
US08B-25.2	3.967	11.329	29.503	59.985	214.646	312.626	397.618
US08B-26.1	1.754	22.723	60.496	139.012	542.373	752.823	1101.759
US08B-27.1	2.095	19.529	51.743	115.774	443.285	621.767	882.583
US08B-27.2	2.723	15.618	41.088	88.390	329.163	468.889	636.247
US08B-23.3	2.302	18.022	47.629	105.076	398.328	561.820	784.682
Ash 3 Average		16.184	42.692	93.374	352.345	498.162	691.606
US05B-1.2	3.112	13.935	36.529	77.022	282.795	406.027	538.426
US05B-3.1	3.247	13.438	35.187	73.722	269.461	387.854	510.581
US05B-3.2	3.294	13.274	34.743	72.635	265.081	381.875	501.463
US05B-5.2	3.262	13.388	35.051	73.388	268.115	386.017	507.777
US05B-7.1	2.067	19.755	52.360	117.392	450.120	630.853	897.557
US05B-8.1	2.228	18.534	49.026	108.692	413.473	582.052	817.546
US05B-8.2	6.950	7.022	18.012	33.666	113.517	170.896	197.372
US05B-9.1	6.839	7.119	18.269	34.231	115.619	173.894	201.392
US05B-10.1	2.782	15.331	40.311	86.437	321.153	458.064	619.243
US05B-11.1	3.019	14.300	37.515	79.463	292.697	419.494	559.191
US05B-11.2	4.646	9.901	25.674	50.978	179.388	263.720	326.426
US05B-12.1	3.366	13.033	34.091	71.042	258.677	373.122	488.159
US05B-13.2	6.868	7.093	18.200	34.079	115.055	173.090	200.313
US05B-14.1	2.651	15.976	42.062	90.849	339.277	482.538	657.774
US05B-14.2	2.897	14.811	38.900	82.907	306.715	438.518	588.706

Spot Name	48Ti	Gd K_D	Tb K_D	Dy K_D	Er K_D	Tm K_D	Yb K_D
US05B-14.3	3.104	13.964	36.607	77.217	283.583	407.099	540.076
US05B-15.1	3.667	12.114	31.614	65.039	234.677	340.221	438.599
US05B-16.1	4.262	10.656	27.696	55.708	197.830	289.358	363.506
US05B-1.1...dup1	2.438	17.160	45.281	99.036	373.153	528.100	730.331
US05B-2.1	4.867	9.516	24.647	48.598	170.172	250.858	308.036
US05B-3.1...dup1	2.360	17.642	46.594	102.406	387.180	546.902	760.570
US05B-4.1...dup1	1.984	20.460	54.290	122.471	471.646	659.420	944.862
US05B-4.2	3.174	13.703	35.901	75.476	276.539	397.507	525.346
US05B-5.1...dup1	1.986	20.437	54.226	122.304	470.938	658.482	943.303
US05B-8.4	2.990	14.418	37.836	80.258	295.928	423.883	565.981
Ash 17 Average		13.879	36.425	77.401	286.111	409.194	549.301
A4WCF-1.1	2.316	17.927	47.371	104.409	395.539	558.090	778.644
A4WCF-2.1	1.398	27.581	73.880	175.650	702.022	961.447	1463.137
A4WCF-3.1	1.987	20.435	54.221	122.291	470.883	658.409	943.181
A4WCF-4.1	1.576	24.895	66.469	155.209	612.477	844.777	1259.300
A4WCF-5.1	2.715	15.656	41.191	88.650	330.233	470.334	638.521
Ash 4 Average		21.299	56.626	129.242	502.231	698.612	1016.557
US01-1.1	1.100	33.826	91.196	224.744	921.309	1244.082	1972.799
US01-2.1	1.133	32.990	88.872	218.057	891.121	1205.401	1901.845
US01-3.1	1.230	30.754	82.663	200.332	811.575	1103.145	1716.040
US01-4.1	1.363	28.183	75.544	180.291	722.508	988.027	1510.148
US01-5.1	1.218	31.024	83.413	202.461	821.094	1115.409	1738.184
US01-6.1	1.474	26.359	70.506	166.300	660.921	907.999	1369.234
US01-7.1	1.353	28.357	76.027	181.640	728.469	995.753	1523.853
US01-TOP-1.1	1.918	21.055	55.919	126.783	489.996	683.719	985.357
US01-TOP-2.1	1.196	31.502	84.738	206.231	837.974	1137.136	1777.510

Spot Name	48Ti	Gd K_D	Tb K_D	Dy K_D	Er K_D	Tm K_D	Yb K_D
US01-TOP-3.1	1.217	31.044	83.469	202.621	821.808	1116.328	1739.846
US01-TOP-4.1	1.146	32.664	87.965	215.454	879.397	1190.360	1874.351
US01-TOP-5.1	1.423	27.157	72.709	172.398	687.700	942.842	1430.352
Ash 11 Average		29.576	79.419	191.443	772.823	1052.517	1628.293
US08b_GERONIMO-1.1	1.336	28.659	76.862	183.978	738.820	1009.162	1547.675
US08b_GERONIMO-2.1	1.223	30.905	83.084	201.526	816.913	1110.023	1728.455
US08b_GERONIMO-3.1	2.734	15.563	40.939	88.016	327.628	466.815	632.984
US08b_GERONIMO-4.1	1.955	20.714	54.985	124.309	479.462	669.776	962.091
US08b_GERONIMO-5.1	2.039	19.982	52.983	119.028	457.047	640.053	912.756
US08b_GERONIMO-6.1	9.625	5.319	13.524	24.073	78.416	120.343	131.416
US08bAPPLE-1.1	1.297	29.397	78.904	189.712	764.255	1042.071	1606.356
US08bAPPLE-2.1	1.300	29.342	78.751	189.280	762.336	1039.590	1601.922
US08bAPPLE-3.1	1.929	20.954	55.642	126.050	486.872	679.586	978.453
US08bAPPLE-4.1	1.294	29.458	79.073	190.187	766.368	1044.802	1611.240
US08bAPPLE-5.1	1.230	30.751	82.656	200.314	811.494	1103.040	1715.852
Ash 3 Average		23.731	63.400	148.770	589.965	811.387	1220.836
US09-2.1	1.209	31.214	83.939	203.957	827.788	1124.027	1753.769
US09-3.1	1.250	30.335	81.502	197.042	796.889	1084.211	1681.931
US09-4.1	1.788	22.360	59.498	136.333	530.859	737.663	1076.071
US09-5.1	1.451	26.714	71.487	169.010	672.812	923.479	1396.342
US09-6.1	1.857	21.643	57.531	131.072	508.308	707.920	1025.918
US09-7.1	1.206	31.280	84.124	204.484	830.146	1127.063	1759.263
Dome 30 Average		27.258	73.014	173.650	694.467	950.727	1448.882
US27-03A-10.1	2.083	19.628	52.013	116.482	446.274	625.742	889.130
US27-03A-10.2	1.987	20.429	54.205	122.247	470.697	658.162	942.771
US27-03A-13.1	2.493	16.838	44.405	96.798	363.860	515.624	710.359

Spot Name	48Ti	Gd K_D	Tb K_D	Dy K_D	Er K_D	Tm K_D	Yb K_D
US27-03A-20.1	1.949	20.768	55.134	124.703	481.135	671.992	965.784
US27-03A-20.2	1.818	22.040	58.619	133.979	520.757	724.348	1053.578
US27-03A-21.1	1.554	25.196	67.300	157.482	622.378	857.719	1281.701
US27-03A-6.1	2.528	16.638	43.860	95.409	358.109	507.893	698.023
US27-03A-8.1	2.100	19.489	51.633	115.486	442.068	620.148	879.919
US27-03A-9.1	2.072	19.711	52.241	117.080	448.804	629.104	894.673
US27-03B-1.1	2.608	16.199	42.668	92.380	345.591	491.047	671.245
US27-03B-12.1	2.400	17.389	45.904	100.633	379.795	537.008	744.636
US27-03B-13.1	2.309	17.978	47.510	104.766	397.034	560.090	781.880
US27-03B-3.1	2.153	19.082	50.520	112.579	429.811	603.835	853.133
US27-03B-4.1	2.768	15.401	40.499	86.910	323.091	460.684	623.353
US27-03B-5.1	2.747	15.502	40.774	87.599	325.918	464.506	629.354
US27-03B-7.1	2.182	18.866	49.932	111.044	423.353	595.231	839.051
US27-03B-7.2	1.929	20.951	55.635	126.030	486.786	679.472	978.263
US27-03B-9.1	2.137	19.199	50.841	113.416	433.339	608.533	860.836
Ash 19 Average		18.961	50.205	111.946	427.711	600.619	849.872
US27-07B-1.1	1.639	24.077	64.218	149.076	585.840	809.906	1199.217
US27-07B-1.2	1.425	27.139	72.658	172.257	687.079	942.034	1428.931
US27-07B-2.1	1.941	20.845	55.345	125.261	483.513	675.140	971.033
US27-07B-3.1	1.649	23.953	63.875	148.145	581.804	804.615	1190.136
US27-07B-4.1	3.459	12.732	33.280	69.067	250.759	362.286	471.756
US27-07B-5.1	1.507	25.870	69.157	162.581	644.640	886.780	1332.196
Ash 7 Average		22.436	59.756	137.731	538.939	746.793	1098.878
US27-15A-2.1	1.656	23.862	63.627	147.470	578.881	800.782	1183.564
US27-15A-3.1	2.176	18.911	50.055	111.367	424.710	597.040	842.009
US27-15B-3.1	2.016	20.177	53.515	120.427	462.973	647.919	925.777

Spot Name	48Ti	Gd K_D	Tb K_D	Dy K_D	Er K_D	Tm K_D	Yb K_D
US27-15C-1.1	1.803	22.196	59.048	135.127	525.682	730.840	1064.537
US27-15C-4.1	2.066	19.762	52.379	117.441	450.329	631.130	898.015
US27-15C-5.1	2.083	19.623	52.000	116.446	446.123	625.540	888.798
US27-15C-7.1	2.508	16.751	44.168	96.195	361.361	512.266	704.997
US27-15C-6.1...dup1	2.673	15.863	41.755	90.071	336.075	478.219	650.951
US27-15C-6.1...dup2	3.057	14.148	37.105	78.447	288.570	413.883	550.527
Ash 15 Average		19.033	50.406	112.555	430.523	604.180	856.575
DOME11-1.1	3.336	13.131	34.358	71.693	261.293	376.699	493.590
DOME11-1.2	2.915	14.734	38.692	82.387	304.597	435.647	584.238
DOME11-10.1	3.057	14.148	37.106	78.449	288.579	413.896	550.547
DOME11-10.2	2.034	20.026	53.102	119.340	458.368	641.807	915.656
DOME11-11.1	3.499	12.609	32.949	68.263	247.541	357.877	465.104
DOME11-2.1	2.553	16.499	43.483	94.449	354.137	502.552	689.517
DOME11-2.2	2.819	15.159	39.845	85.269	316.368	451.591	609.107
DOME11-4.1	3.301	13.250	34.679	72.476	264.444	381.005	500.138
DOME11-4.2	2.111	19.406	51.407	114.894	439.569	616.825	874.453
DOME11-5.1	1.880	21.424	56.929	129.469	501.459	698.874	1010.730
DOME11-5.2	2.226	18.544	49.054	108.764	413.775	582.456	818.204
DOME11-6.1	2.712	15.669	41.228	88.744	330.617	470.852	639.337
DOME11-6.2	2.393	17.435	46.029	100.955	381.132	538.800	747.519
DOME11-7.1	2.469	16.977	44.783	97.764	367.870	521.010	718.972
DOME11-7.2	3.722	11.961	31.203	64.049	230.742	334.811	430.521
DOME11-8.1	8.555	5.882	15.003	27.182	89.656	136.639	152.269
DOME11-9.1	4.045	11.142	29.001	58.792	209.942	306.128	388.049
DOME11-9.2	1.603	24.537	65.483	152.519	600.778	829.472	1232.880
Dome 11 Average		15.696	41.352	89.748	336.715	477.608	656.713

Spot Name	48Ti	Gd K_D	Tb K_D	Dy K_D	Er K_D	Tm K_D	Yb K_D
DOME6-1.2	2.749	15.492	40.747	87.533	325.647	464.138	628.777
DOME6-10.2	2.620	16.140	42.507	91.974	343.914	488.787	667.664
DOME6-11.1	2.427	17.230	45.470	99.522	375.171	530.808	734.675
DOME6-11.2	2.924	14.695	38.586	82.125	303.527	434.195	581.980
DOME6-12.1	3.275	13.340	34.921	73.069	266.828	384.261	505.099
DOME6-12.2	2.886	14.860	39.033	83.239	308.073	440.359	591.572
DOME6-13.1	2.851	15.017	39.458	84.300	312.404	446.225	600.721
DOME6-13.2	3.186	13.658	35.782	75.182	275.352	395.889	522.866
DOME6-2.1	2.149	19.114	50.608	112.807	430.772	605.116	855.232
DOME6-2.2	3.327	13.162	34.441	71.894	262.103	377.807	495.273
DOME6-2.3	2.163	19.007	50.316	112.047	427.570	600.850	848.244
DOME6-3.1	3.487	12.647	33.053	68.515	248.549	359.258	467.186
DOME6-3.2	2.666	15.902	41.861	90.340	337.182	479.711	653.308
DOME6-4.1	2.937	14.639	38.435	81.747	301.987	432.107	578.735
DOME6-5.1	2.217	18.607	49.226	109.210	415.649	584.956	822.278
DOME6-5.2	3.730	11.941	31.150	63.921	230.232	334.108	429.474
DOME6-5.3	2.741	15.527	40.841	87.769	326.615	465.447	630.833
DOME6-6.1	2.394	17.431	46.018	100.928	381.021	538.652	747.281
DOME6-7.1	1.456	26.638	71.275	168.423	670.234	920.125	1390.463
DOME6-7.2	2.455	17.056	44.998	98.313	370.146	524.065	723.864
DOME6-7.3	2.656	15.952	41.996	90.680	338.583	481.601	656.293
DOME6-8.2	2.421	17.261	45.555	99.741	376.080	532.027	736.632
DOME6-9.2	1.970	20.584	54.630	123.370	475.469	664.487	953.286
Dome 6 Average		16.343	43.083	93.767	352.309	499.347	687.902

Partition coefficients determined for Mono Craters from surface zircon and glass data (actual) and from titania concentrations using the Claiborne et al., 2018 model.

Mono Craters (actual)						
Unit	Ce	Nd	Sm	Eu	Gd	Tb
Ash 3	0.86	0.08	0.72	5.02	12.58	27.18
Ash 4	0.79	0.03	0.40	2.42	9.06	21.34
Ash 7	0.39	0.02	0.28	1.65	6.03	12.08
Ash 11	0.39	0.02	0.30	1.12	8.19	20.09
Ash 17	1.58	0.07	0.65	4.49	16.15	33.65
Ash 19	0.72	0.03	0.45	2.49	12.59	27.84
Dome 6	0.85	0.07	0.63	3.97	13.90	26.93
Dome 11	0.73	0.05	0.62	2.12	16.60	35.79
⁴⁸Ti Claiborne et al., 2018 (model)						
Unit	Ce K_D	Nd K_D	Sm K_D	Eu K_D	Gd K_D	Tb K_D
Ash 3	0.59	0.10	1.48	2.03	19.96	53.05
Ash 4	0.63	0.11	1.58	2.14	21.30	56.63
Ash 7	0.65	0.11	1.65	2.20	22.44	59.76
Ash 11	0.80	0.14	2.09	2.58	29.58	79.42
Ash 17	0.46	0.08	1.09	1.68	13.88	36.42
Ash 19	0.58	0.10	1.43	2.01	18.96	50.21
Dome 6	0.52	0.09	1.26	1.85	16.34	43.08
Dome 11	0.50	0.08	1.21	1.80	15.70	41.35

Mono Craters (actual)						
Unit	Dy	Er	Tm	Yb	Th	U
Ash 3	48.74	134.51	167.67	212.51	29.19	182.28
Ash 4	44.23	121.72	157.17	203.10	27.27	213.68
Ash 7	23.98	75.56	95.07	126.14	9.97	84.58
Ash 11	41.48	137.36	194.08	259.62	17.25	178.31
Ash 17	66.14	196.05	279.79	369.94	32.17	185.23
Ash 19	58.32	160.46	226.62	293.52	23.69	187.82
Dome 6	53.42	160.42	193.45	252.29	30.08	174.94
Dome 11	73.50	221.90	261.85	335.38	41.85	224.29
48Ti Claiborne et al., 2018 (model)						
Unit	Dy K_D	Er K_D	Tm K_D	Yb K_D	Th K_D	U K_D
Ash 3	121.07	471.15	654.77	956.22	35.28	292.93
Ash 4	129.24	502.23	698.61	1016.56	37.68	311.89
Ash 7	137.73	538.94	746.79	1098.88	40.02	335.88
Ash 11	191.44	772.82	1052.52	1628.29	54.79	489.42
Ash 17	77.40	286.11	409.19	549.30	23.12	173.15
Ash 19	111.95	427.71	600.62	849.87	32.90	263.25
Dome 6	93.77	352.31	499.35	687.90	27.78	214.99
Dome 11	89.75	336.71	477.61	656.71	26.61	205.35

Glass concentration estimations based on model K_d 's from Claiborne et al., (2018) and Mono Craters surface zircon analyses. Chondrite-normalized values where indicated (Anders and Grevesse, 1989).

	La	Ce	Nd	Sm	Eu	Gd	Tb
Zircon surfaces							
Ash 3	0.062	27.103	1.578	4.807	0.630	50.478	98.095
Ash 4	0.032	23.014	0.544	2.584	0.281	36.363	91.460
Ash 7	0.029	13.268	0.427	1.863	0.329	21.897	46.366
Ash 11	0.029	9.802	0.292	1.557	0.183	22.317	59.594
Ash 17	0.044	49.265	1.255	3.820	0.881	39.606	81.419
Ash 19	0.064	23.288	0.606	2.489	0.448	33.103	81.646
Dome 6	0.020	24.436	1.204	3.618	0.295	40.239	70.405
Dome 11	0.021	27.534	1.071	3.660	0.445	41.300	74.444
Model K_{Ds}							
Ash 3	0.005	0.592	0.100	1.483	2.034	19.957	53.046
Ash 4	0.003	0.628	0.106	1.579	2.141	21.299	56.626
Ash 7	0.002	0.652	0.111	1.650	2.201	22.436	59.756
Ash 11	0.003	0.803	0.138	2.094	2.577	29.576	79.419
Ash 17	0.003	0.457	0.075	1.092	1.680	13.879	36.425
Ash 19	0.005	0.578	0.097	1.432	2.014	18.961	50.205
Dome 6	0.002	0.518	0.086	1.260	1.851	16.343	43.083
Dome 11	0.001	0.500	0.083	1.214	1.799	15.696	41.352

	La	Ce	Nd	Sm	Eu	Gd	Tb
Calculated glass concentrations							
Ash 3	12.958	45.759	15.782	3.242	0.310	2.529	1.849
Ash 4	11.980	36.620	5.121	1.637	0.131	1.707	1.615
Ash 7	13.975	20.337	3.860	1.129	0.149	0.976	0.776
Ash 11	10.398	12.214	2.115	0.744	0.071	0.755	0.750
Ash 17	12.656	107.846	16.626	3.497	0.524	2.854	2.235
Ash 19	13.734	40.263	6.244	1.738	0.222	1.746	1.626
Dome 6	12.168	47.207	13.961	2.873	0.160	2.462	1.634
Dome 11	23.612	55.033	12.866	3.016	0.247	2.631	1.800

	Dy	Ho	Er	Tm	Yb	Lu
<hr/> Zircon surfaces <hr/>						
Ash 3	19.936	237.768	447.239	97.175	802.954	145.622
Ash 4	16.494	210.505	437.978	99.043	834.238	152.737
Ash 7	8.644	107.822	222.030	48.877	422.699	79.576
Ash 11	10.336	135.690	296.166	67.113	585.183	109.410
Ash 17	15.950	193.419	387.569	86.449	744.548	138.006
Ash 19	13.316	174.878	366.639	85.510	721.857	139.199
Dome 6	14.856	185.419	335.625	72.051	614.931	110.509
Dome 11	15.515	196.937	352.397	75.661	630.351	115.444
<hr/> Model K_{DS} <hr/>						
Ash 3	121.072	--	471.155	654.775	956.221	--
Ash 4	129.242	--	502.231	698.612	1016.557	--
Ash 7	137.731	--	538.939	746.793	1098.878	--
Ash 11	191.443	--	772.823	1052.517	1628.293	--
Ash 17	77.401	--	286.111	409.194	549.301	--
Ash 19	111.946	--	427.711	600.619	849.872	--
Dome 6	93.767	--	352.309	499.347	687.902	--
Dome 11	89.748	--	336.715	477.608	656.713	--

	Dy	Ho	Er	Tm	Yb	Lu
Calculated glass concentrations						
Ash 3	0.165	--	0.949	0.148	0.840	--
Ash 4	0.128	--	0.872	0.142	0.821	--
Ash 7	0.063	--	0.412	0.065	0.385	--
Ash 11	0.054	--	0.383	0.064	0.359	--
Ash 17	0.206	--	1.355	0.211	1.355	--
Ash 19	0.119	--	0.857	0.142	0.849	--
Dome 6	0.158	--	0.953	0.144	0.894	--
Dome 11	0.173	--	1.047	0.158	0.960	--

	La	Ce	Nd	Sm	Eu	Gd	Tb
Calculated glass concentrations (chondrite-normalized)							
Ash 3	54.673	74.648	34.534	21.903	5.502	12.710	51.225
Ash 4	50.547	59.739	11.206	11.061	2.332	8.579	44.741
Ash 7	58.965	33.177	8.445	7.629	2.654	4.904	21.494
Ash 11	43.874	19.925	4.627	5.026	1.259	3.792	20.786
Ash 17	53.402	175.932	36.380	23.631	9.311	14.340	61.918
Ash 19	57.950	65.682	13.662	11.745	3.950	8.773	45.049
Dome 6	51.340	77.010	30.550	19.409	2.835	12.372	45.268
Dome 11	99.628	89.776	28.153	20.378	4.390	13.222	49.868
Observed glass (chondrite-normalized)							
Ash 3	54.731	51.364	44.862	45.076	2.294	20.202	20.270
Ash 4	50.547	47.732	43.695	44.103	2.062	20.171	21.409
Ash 7	58.965	55.363	45.501	44.673	3.532	18.243	19.828
Ash 11	43.874	40.695	32.758	35.628	2.905	13.689	14.248
Ash 17	52.857	44.517	32.319	36.031	3.115	11.608	12.571
Ash 19	56.332	47.640	35.759	34.808	2.938	12.504	12.687
Dome 6	50.845	47.429	38.766	37.853	1.309	14.211	14.909
Dome 11	77.934	63.754	43.689	38.716	3.579	12.431	12.063

	Dy	Ho	Er	Tm	Yb	Lu
Calculated glass concentrations (chondrite-normalized)						
Ash 3	0.669	--	5.933	6.008	5.216	--
Ash 4	0.519	--	5.450	5.740	5.097	--
Ash 7	0.255	--	2.575	2.650	2.389	--
Ash 11	0.219	--	2.395	2.582	2.232	--
Ash 17	0.838	--	8.466	8.553	8.419	--
Ash 19	0.484	--	5.358	5.764	5.276	--
Dome 6	0.644	--	5.954	5.842	5.552	--
Dome 11	0.703	--	6.541	6.414	5.962	--
Observed glass (chondrite-normalized)						
Ash 3	19.722	--	22.790	20.576	23.198	--
Ash 4	19.348	--	22.596	22.489	25.513	--
Ash 7	18.279	--	21.378	18.366	20.814	--
Ash 11	13.297	--	14.766	13.476	14.000	--
Ash 17	11.480	--	13.177	12.031	12.210	--
Ash 19	11.871	--	14.035	13.942	15.041	--
Dome 6	13.759	--	14.279	12.831	14.909	--
Dome 11	10.994	--	12.937	10.037	11.846	--