The Relationship Between Hydrogen and Other Elements in Garnets from two Contact Metamorphic Localities

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ABSTRACT:

The mineral garnet is considered a nominally anhydrous mineral (NAM) that can sometimes accommodate hydrogen into its structure. This hydrogen can be measured using several different analytical techniques and is usually reported as water. The purpose of this study is to investigate the distribution of water in different compositions of garnet, and to look for evidence of what controls these concentrations. Garnets from two localities, one with almandine-rich garnet and one with grossular-andradite-rich garnet were studied and compared. Almandine-rich garnets were collected from Garnet Ledge, AK, and grossular-andradite-rich garnets from the Empire Mountain skarn, CA were provided by Dr. Jade Star Lackey at Pomona College. Almandine-rich garnets can sometimes accommodate up to 150 ppm water into their structure, while grossular-andradite-rich garnets have been found to have up to 12 weight percent water. Researchers do not fully understand what controls how water is incorporated into the structure of garnets, but there are several mechanisms that have been proposed. Among these, coupled substitutions between hydrogen and other elements such as titanium, boron, and lithium have been suggested and were investigated both within and between the two garnet localities. An almandine-rich garnet sample from Garnet Ledge and a grossular-andradite-rich garnet sample from Empire Mountain were analyzed for water using FTIR. The water concentrations range from 8.7 ppm-118 ppm +/- 6.5% (2 x relative standard deviation (RSD)) along a 4 mm traverse from garnet rim to garnet interior for the Garnet Ledge sample. The water concentrations for the Empire Mountain sample were found to range between 7170 ppm – 13500 ppm +/- 9.5 (2 RSD) along a 9.6 mm traverse from garnet rim to interior. Samples were also analyzed for lithium, boron, and titanium using EPMA and LA-ICP-MS along the same traverse lines. For Garnet Ledge, the lithium concentrations ranged from approximately 11 ppm to 26 ppm +/- 6.8% (2 RSD) and there was a correlation between moles of lithium and moles of hydrogen, but the molar ratio of the coupling was not 1:1 as would be expected if this were the primary control on water present in this sample. Titanium concentrations ranged from 36 ppm to 539 ppm +/- 6.8% (2 RSD). There was a correlation found between the moles of titanium and the moles of hydrogen present in the Garnet Ledge sample with a molar ratio of 1:1. This means that titanium is likely the primary control on water content in the Garnet Ledge sample. For the Empire Mountain sample, no elemental correlations between hydrogen and titanium, lithium, or boron were found. These data from the Empire Mountain sample and the lack of elemental correlations suggest there is no coupled substitution controlling the presence of water within this sample, despite the larger concentrations of water.

PLAIN LANGUAGE SUMMARY:

Exploration of the chemistry of garnet is significant because it tells us about conditions inside the earth during processes of mountain building. Garnets preserve chemical growth zones that can be read like tree rings to understand the conditions during the growth of the crystal. Hydrogen can be trapped in different zones during different growth stages and can act as an indicator of historic water present in the surrounding rocks. This is important to understand because as water moves through rocks it can concentrate and transport economically significant elements such as copper and gold. Garnet Ledge is historically significant as a garnet deposit that was commercially mined for abrasives, and near the Empire Mountain skarn is one of California's oldest, deepest, and most

lucrative gold mines (which is currently inactive). The water present in a garnet from Garnet Ledge, AK was measured using FTIR spectroscopy. These data show that there is water present in the garnet and that there is variability within the concentrations with respect to distance from rim of the crystal. Water concentration decreases from the core to the rim of the grain. Lithium, titanium, and boron concentrations were measured using EPMA and LA-ICP-MS. Moles of these elements were compared to moles of hydrogen to see if any correlations existed, and a strong correlation was found between hydrogen and titanium suggesting a coupled substitution between titanium and hydrogen is the primary control on water in garnets from Garnet Ledge. A sample from Empire Mountain skarn in CA was analyzed using FTIR spectroscopy to characterize the water present within the sample. This distribution of water is different from the Garnet Ledge sample in that it is more variable rather than a simple increase or decrease with distance to core. Titanium, lithium, and boron concentrations were measured using EPMA and LA-ICP-MS and there were no correlations found with hydrogen. This suggests there is a different control on water other than a coupled substitution between hydrogen and another element present in samples from Empire Mountain.

INTRODUCTION, MOTIVATION, AND RESEARCH OBJECTIVES

Problem/Broader Implications:

As a component of water, hydrogen (H) is one of the most significant elements to life on Earth. Water, and by extension H, is also geologically significant in a metamorphic context because it is a major component of metamorphic fluids (Yardley and Cleverley 2015). Fluid-movement through metamorphic rocks can have several impactful results such as transporting and concentrating ore minerals, affecting geochemical cycling of elements and compounds, and altering mineral reactions and resulting mineral assemblages (Yardley and Cleverley, 2015; Bebout and Penniston-Dorland, 2016). Metamorphic fluids can also transport heat, especially if they are channelized into fractures. Fractures act as conduits for fluid and allow for heat transfer farther into rock than would otherwise be possible (Bickle and McKenzie 1987). Understanding this process of fluid movement is therefore socially and economically significant and can affect our understanding of issues such as climate change, seismicity, and how economically significant minerals form. Hydrogen that is present in the structure of metamorphic garnets has the potential to act as a tracer for metamorphic fluids. In this paper, water is used to describe any H-bearing species that could form any phase of molecular H_2O, including structurally bound hydroxyl (OH) or H in garnet (Newcombe et al., 2023).

Why Garnets?:

The relationship between H and other elements within the structure of garnets is poorly understood within the scientific community. Garnets are a group of minerals with the general composition $X_3^{2+}\ Y_2^{3+}\ Si_3O_{12}$. There are a variety of elements that can be present in the X and Y sites which define the garnet species. Garnets are useful minerals to study because they readily preserve their chemical growth history through distinct chemical zonation (Baxter et al., 2017). These zones can

be characterized like the rings of trees to establish ages, compositions, and conditions of growth (Baxter et al., 2017). Garnets are also easy to study because they are common minerals on the Earth's surface and are found in a variety of geologic settings and rock types (Reynes et al., 2020). Additionally, garnets are considered nominally anhydrous minerals (NAM) which means that the structure does not typically incorporate H (Johnson, 2006). Therefore, when H is present, it is more likely to vary as a function of its external environment. Hydrogen present in the structure of garnets is reported as water and is typically found in concentrations less than 1,000 parts per million (ppm) but can be found up to about 10 weight percent in some uncommon instances (Beran and Libowitzky 2006; Rossman and Aines, 1991). Large concentrations of water within the structure of garnet are unusual and typically only found in calcium-rich (grossular-rich) garnets (Rossman and Aines, 1991).

Substitution of Hydrogen:

As water-rich fluids move through metamorphic rocks, there is the potential for H ions to be incorporated into the structure of garnets through several potential substitution mechanisms (Reynes et al., 2020). Understanding the process of H incorporation into garnets to use as a tracer for metamorphic fluids will strengthen the overall understanding of how these fluids move through metamorphic rocks.

There are several proposed mechanisms for H substitution garnets based on previous work. An example is the coupled substitution of titanium (Ti) and H for silicon (Si) and iron (Fe) (Reynes et al. 2020):

$$[2H^{+}]^{IV} + [2Ti^{4+}]^{VI} \rightarrow [Si^{4+}]^{IV} + [2Fe^{+3}]^{VI}.$$

The above equation has 4 cations on the reactant side (two H and two Ti) substituting for three cations on the product side (one Si and two Fe). This is permissible because of the size difference between H and Si. Up to four H cations can spatially fit into one Si site because Si is a larger element than H (atomic weights of 28.086 and 1.0078 respectively). In this coupled substitution mechanism, H and Ti would have an expected molar ratio of 1:1.

An example of this H and Ti coupled substitution can be seen in **Figure 1.** In **Figure 1,** the correlation between H_2O and TiO_2 are evident between the two concentration maps (Reynes et al. 2020). Zones of low H_2O correspond to zones of low TiO_2, and when moles of H are calculated and compared to moles of Ti, there is a 1:1 molar ratio.

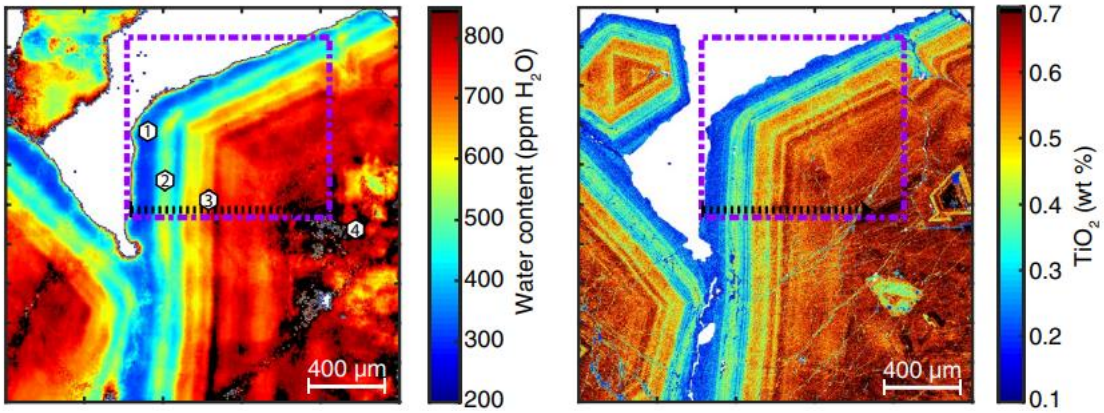

Figure 1: Concentration maps of H_2O content (left) and TiO_2 (right) showing a correlation in concentrations within zones of the same grain. The numbers present in the water content image were used for comparison of locations. Reynes et al., 2020.

Another proposed method of H substitution is that either lithium or boron is added to the structure of garnet in addition to the H (which ensures charge balance) (Lu and Keppler, 1997). These exchange reactions are:

$$[H^+]^i + [Li^+]^{VIII} \rightarrow [Mg^{2+}]^{VIII}$$

$$[H^+]^i + [B^{3+}]^{IV} \rightarrow [Si^{4+}]^{IV}$$

where i denotes an interstitial site.

A more thorough understanding of the mechanisms that allow for hydrogen substitutions within garnets will provide a better understanding of the role fluids play in the metamorphic process.

Research Objectives:

Garnets with different compositions from two contact metamorphic localities were studied and compared to garner a better understanding of the relationship between H and trace elements, like Ti, as well as whether this relationship varies with composition.

GEOLOGIC BACKGROUND AND CONTACT METAMORPHIC LOCALITIES

Garnet Ledge, Wrangell, Alaska:

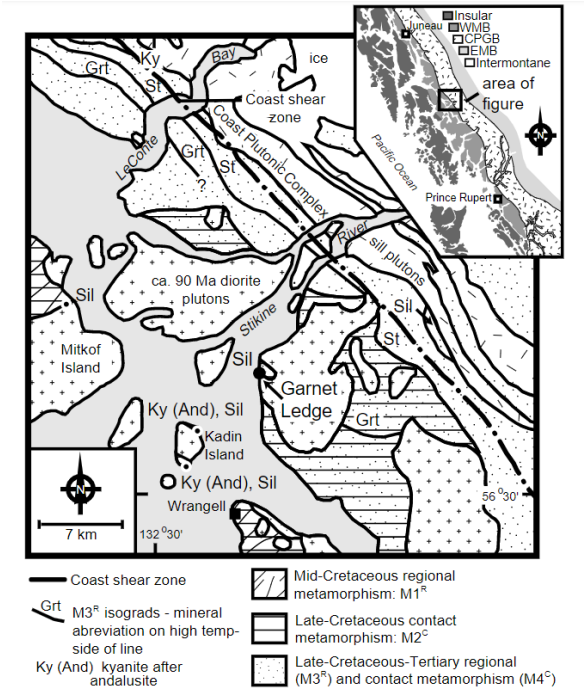

Figure 2: Map of the Garnet Ledge sample locality plus the regional geology. Stowell et al., 2001.

Garnet Ledge is in southeast Alaska (AK) roughly 12 km north of Wrangell. This region has a complicated geologic history characterized by a series of metamorphic episodes starting with the accretion of several geologically distinct terranes onto the North American plate (Stowell et al. 2001). The location of Garnet Ledge and the geologic context of the region can be seen in **Figure 2**. Garnet Ledge is located within the western metamorphic belt of the Coast Plutonic Complex that experienced contact metamorphism due to the intrusion of a diorite pluton around 90 Ma (Stowell et al., 2001). The garnets found here are almandine-rich and comprise 74% almandine, 18% pyrope, 5% grossular, and 3% spessartine compositions (Stowell et al. 2001). This garnet deposit was mined for industrial purposes from the early to mid-twentieth century due to the size and abundance of crystals. The samples from this locality were collected in 2021 with permission from the property owner.

Garnets from this locality were previously studied to determine ages as well as pressure (P)-temperature (T) conditions during garnet growth (Stowell et. al 2001). Garnets at this locality experienced increasing pressures and temperatures throughout the growth period; starting at 607°+/- 20° C and 5.5 kbar +/- 0.8 kbar (P-T conditions at the core of the garnets) and ending at P-T conditions of 678° +/- 58°C at 6.1 kbar +/- 0.9 kbar (P-T conditions at the rim of the garnets) (Stowell et al. 2001). These P-T constraints are based on the known thermobarometric constraints of mineral assemblages present both in the matrix and as inclusions within the garnets, and can be seen in **Figure 3.**

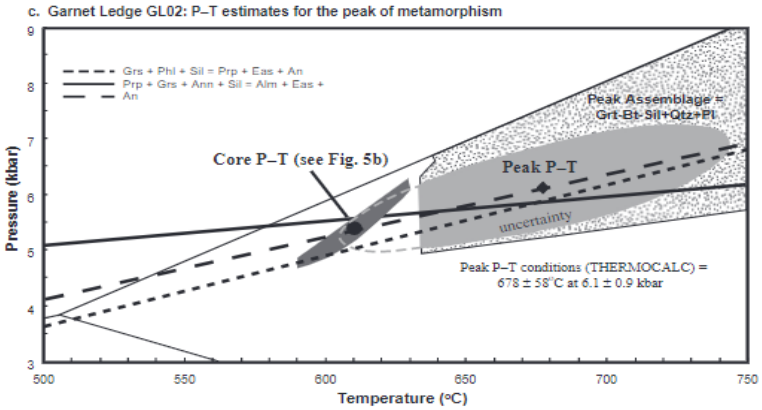

Figure 3: The P-T plot with the conditions for both the core growth and peak P-T for Garnet Ledge. Stowell et al., 2001.

Empire Mountain, CA:

Empire Mountain is in the Sierra Nevada range in California (CA). The sample locality is from a roof-pendant, or metamorphosed piece of country rock overlying an igneous intrusion. This can be seen in the geologic map of the region depicted in **Figure 4**. At Empire Mountain, the country rock comprises marine sedimentary rocks that were intruded by a quartz diorite roughly 109 Ma (D'Errico et al., 2012). Based on previous δO^{18} work there is evidence for episodic influx of both magmatic and meteoric water throughout the surrounding rock (D'Errico et al., 2012). The garnets found here are grossular-rich and are composed of 52% grossular, 45% andradite, and 3% spessartine compositions.

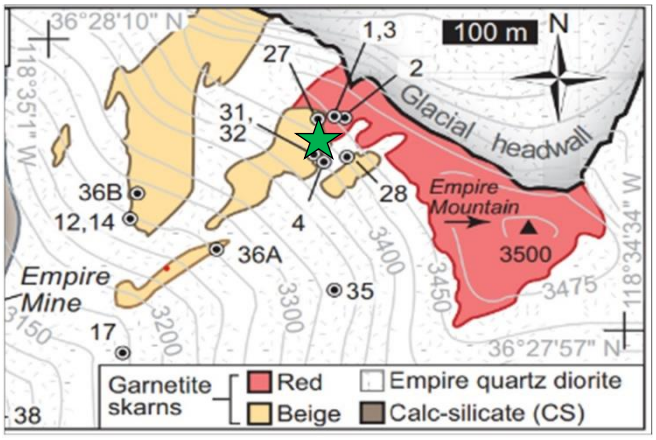

Figure 4: Geologic map of the Empire Mountain locality in CA. Sample location is shown with the green star. D'Errico et al., 2012.

Empire Mine, which is located to the southwest of the map area (with the mine label on the western edge of the map), is an inactive gold mine that is considered California's oldest, deepest, and most lucrative gold mines (California State Parks, 2023). This demonstrates the presence of economically significant ore minerals that are likely concentrated due to the interaction of fluids with the metamorphic process. The samples for this locality were provided by Professor Lackey at Pomona College.

HYPOTHESES

Hypothesis:

There will be a correlation in concentrations between H and Ti which will differ based on garnet composition (almandine-rich vs. grossular-andradite-rich).

Null Hypothesis:

There will be no difference in elemental correlations based on garnet composition.

It is also possible that the following could be found during analysis:

1. There is a relationship between hydrogen and another element other than titanium within the structure of the garnets, or

2. The relationship between hydrogen and other elements might not be detectable.

METHODS & UNCERTAINTIES

Sample Preparation:

Samples were prepared in several stages. Samples were first photographed, measured, and mounted in dental resin using one-inch rounds which can be seen in **Figure 5**. Once the dental resin cured, the samples were cut using a Buehler Isomet saw located in the Laboratory for Mineral Deposits Research at the University of Maryland (UMD). Samples were cut in <2 mm thick slices through the middle of the garnet grain. After slicing, the grains were polished on both sides using progressively finer grits until samples were transparent and pitting could no longer be seen under a 10x magnifying objective lens of a microscope. A fully prepared garnet grain from Garnet Ledge can be seen in **Figure 6.** The exact thickness of the samples varied based on individual sample characteristics and was measured using a Fowler Mitutoyo Absolute electronic drop micrometer to verify a uniform thickness across the grain. The mean thickness and the standard deviation (SD) were calculated from these measurements and the uncertainty was reported as 2*SD to ensure a 95% confidence interval. The thickness measurements are reported in **Appendix A.**

Figure 5: A portion of sample preparation. Garnets from Garnet Ledge were measured, photographed, and then mounted in dental resin.

Figure 6: The garnet slice from Garnet Ledge that was analyzed using FTIR, EPMA, and LA-ICP-MS. This slice is <2mm thick and has been polished on both sides.

Fourier Transform Infrared Spectroscopy (FTIR), UMD:

A Nicolet iN10 MX Infrared Imaging Microscope was used to measure water concentrations in the garnet samples. The sample from Garnet Ledge was analyzed using both line-profile and 2D mapping techniques. Spectra were measured from 11 points along a linear traverse from the rim towards the core with approximately 400 µm between each

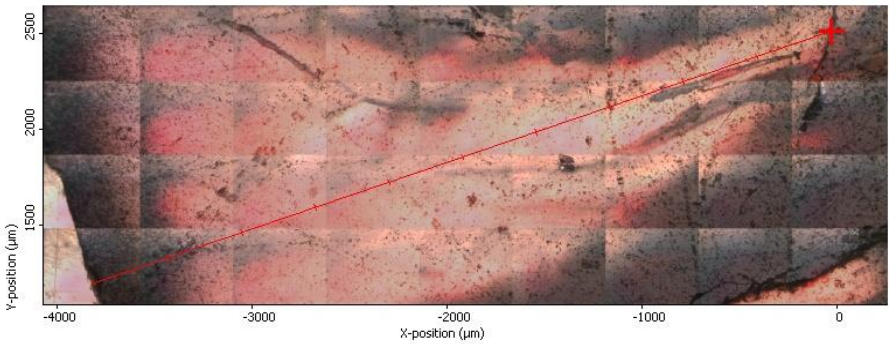

Figure 7: This figure shows the linear traverse collection point locations (denoted by small crosshatches along line) from rim (the south-west side of the grain) to interior for the Garnet Ledge sample.

point. This traverse extended from the rim to 0.4 cm inwards towards the core (total garnet diameter was 2 cm). Data were not collected all the way to the core of the grain because the core had too many inclusions which prevented an accurate characterization of water within the structure of the garnet. The locations of each sample point for the linear traverse (line-profile) of the Garnet

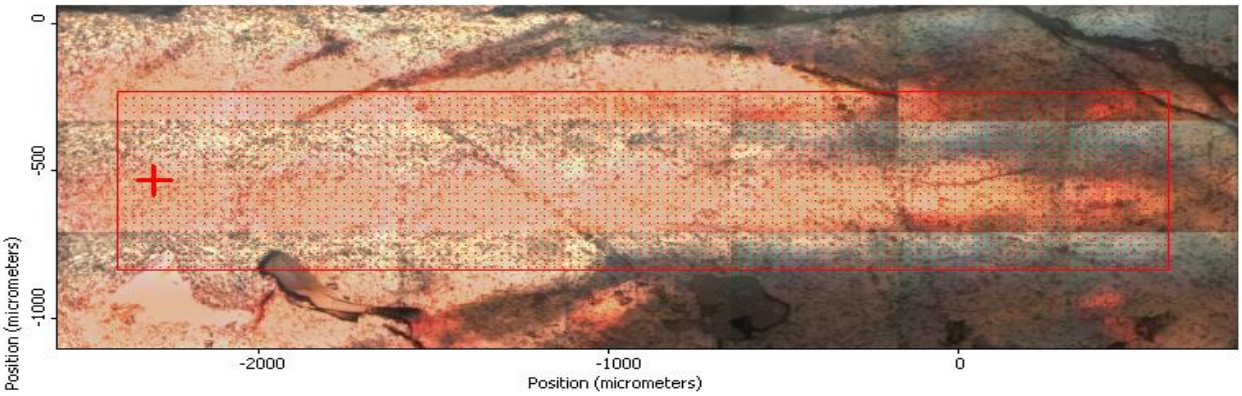

Figure 8: The location of the line array spectra points taken in the Garnet Ledge sample. Each dot represents a location where spectra data were collected.

Ledge locality can be seen in **Figure 7.** Spectra were also measured using a linear array technique that created a 2D map from approximately 2,880 point locations. These locations can be seen in **Figure 8**.

The sample from Empire Mountain was analyzed using a linear traverse comprising 25 points that are spaced roughly 400 µm apart totaling 0.96 cm from the rim towards the interior of the grain. The sample point locations can be seen in **Figure 9.** In **Figure 9**, the Northern edge of the image is the known rim of the garnet. At the rim, the garnet is located within a matrix of quartz. The traverse direction was selected because it runs approximately perpendicular to zoning near the rim that is visible with a backscattered electron image (BSE). This can be seen in **Figure 10**.

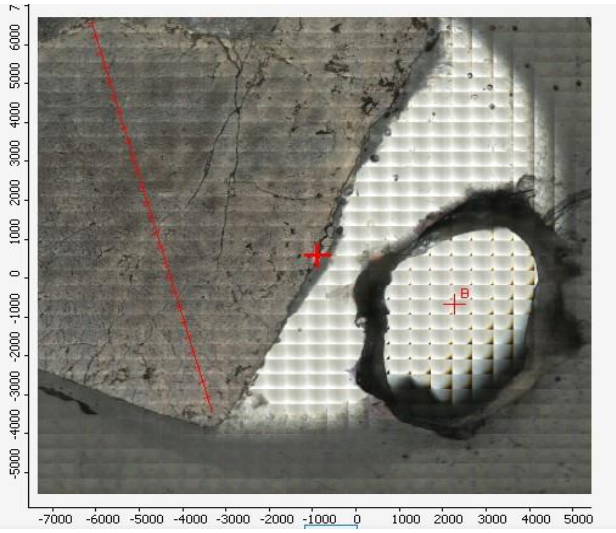

Figure 9: Linear traverse collection point locations (denoted by small crosshatches along line) from rim to interior for the Empire Mountain sample. Axes are in µm. The B denotes the location of the background point.

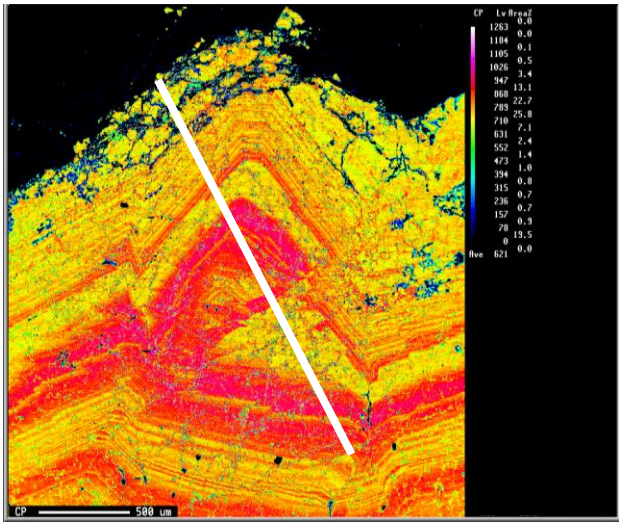

Figure 10: BSE image showing zoning present in Empire Mountain sample. The white line shows the traverse line location. Color scheme was adjusted to show differences in zonation easily.

Hydroxyl bonds in garnet absorb infrared light at frequencies ranging from 3500 to 3700 cm^{-1}, resulting in a series of absorbance peaks in FTIR spectra. The area under these peaks was integrated using the associated Thermo OMNIC Picta software and the concentration of water in garnets was calculated from these areas using the Beer Lambert law; $C_{H20}=Abs_{tot}*I$ (where C_{H2O} is the concentration of water in moles per liter, Abs_{tot} is the total integrated absorbance after normalization of the spectra to a unit thickness, and I is the integral molar absorption coefficient). The values of the integral molar absorption coefficient range between ~3630 L $mol^{-1}cm^{-2}$ for non-grossular garnet, and ~14400 L $mol^{-1}cm^{-2}$ for grossular-rich garnet (Maldener et al. 2003). For the calculation of water concentrations in the Garnet Ledge sample, an absorbance coefficient of 6340 L $mol^{-1}cm^{-2}$ was used. For the Empire Mountain sample which is grossular-rich in composition, an absorbance coefficient of 14400 L $mol^{-1}cm^{-2}$ was used.

The uncertainties associated with the FTIR analyses were determined through repeat analysis of standard garnet grains of similar composition. Two times the relative standard deviation (2 RSD) for this repeat analysis is 6.5%. for an almandine-rich garnet and 9.5% for a grossular-rich garnet. Additionally, there is a large potential for uncertainty when deciding which absorbance coefficient to use. This is because the full range of garnet chemistry has not been explored to determine integral molar absorption coefficients to apply to the measurement of the range of natural garnet compositions. However, all values of water concentrations from the same locality will be calculated using the same absorbance coefficient and these values will only be compared to each other. All the values will be inaccurate by the same factor but will have the precision cited above.

Electron microprobe (EPMA), UMD:

The electron microprobe is a JEOL JXA 8900R and is in the AIM laboratory in the Maryland Nanocenter at UMD. It was used to characterize the major element chemistry of the garnet samples from both localities using a 50 nA beam current, an accelerating potential of 20 keV, and 1µm beam diameter. The raw intensities were corrected for atomic numbers, absorption, and fluorescence with a ZAF algorithm. For the Garnet Ledge sample, data were collected from 64 sites in a linear traverse from the interior outwards with approximately 67 µm between each point. Garnet analyses were standardized as follows: 12442 garnet: Mg, ilmenite: Mn, Ti, Garnet-RV: Ca, Al, Fe, Si. The limit of detection for titanium oxide was 75 ppm. For the Empire Mountain sample, data were collected from 27 points in a linear traverse from the rim inwards with approximately 400 µm between each point. Garnet analyses were standardized as follows: 12442 garnet: Mg, ilmenite: Mn, Ti, Garnet-RV: Ca, Al, Fe, Si, NMNH 143968 garnet: pyrope end-member, and USGS GTAL garnet: spessartine end-member. The uncertainties present in the EPMA data collected were calculated automatically at the time of data collection by using the general formula for counting statistics; $2\sigma=2*N^{0.5N*100\%}$ (where N is the number of counts). For each sample, traverse end points were selected based on landmark features within the grain to ensure traverse line was co-located with the FTIR traverse line.

Laser ablation inductively-coupled plasma mass spectrometry (LA-ICP-MS), Penn State:

LA-ICP-MS was used to measure the trace element concentrations within the garnet samples from both localities at the same traverse locations that were characterized by the FTIR and EPMA using the LionChron facility at Penn State. As with the EPMA sample site selection, end points for the traverse were selected based on landmark features within each grain to ensure co-location. Data points were selected that were closest to the sample location points used for FTIR analysis. Analysis location points for the Garnet Ledge sample can be seen in **Figure 11** and for the Empire Mountain sample in **Figure 12**. Elements that were measured include Ti, Li, B, and rare earth elements. Samples were ablated in thin section using a Teledyne/Photon Machines Analyte G2 excimer laser ablation system with a Helex2 ablation cell, coupled to a Thermo Scientific iCAP-RQ ICPMS system for trace elements. The Ar sample gas flow for the experiment was 0.95 L/min, with total He gas flows from the laser at 0.44 L/min. Samples were run, with a 40 µm spot, 10 Hz repetition rate, 200 shots, and a laser fluence at the sample surface of 3.66 J/cm^2, yielding pit depths on the order of ~15-20 µm. The laser was first fired thrice with the same spot size to remove surface contamination, and this material was allowed to wash out for 15 s. Analyses of unknowns were bracketed by analyses of whole-rock glasses from the Max-Planck-Institut (Jochum et al., 2006) spanning a range of major-element compositions, including Gorgona Island komatiite G128-G, Kilauea basalt KL2-G, Alpine quartz diorite T1G, and Mt. St. Helens andesite StHs6/80-G. KL2-G was used as the primary reference material for all analyses. For trace-element quantification, 27Al (assuming 10.92 wt. % Al) or 29Si (assuming 16.93 wt. % Si) were used as an internal standard, with measured peaks on the iCAP-RQ at 7Li, 11B, 23Na, 24Mg, 27Al, 29Si, 31P, 43Ca, 45Sc, 49Ti, 51V, 52Cr, 55Mn, 57Fe, 89Y, 90Zr, 93Nb, 139La, 140Ce, 141Pr, 146Nd, 147Sm, 153Eu, 157Gd, 159Tb, 163Dy, 165Ho, 166Er, 169Tm, 172Yb, 175Lu, 178Hf, and 238U. Iolite version 4 (Paton et al., 2011) was used to correct measured isotopic ratios and elemental intensities for baselines, plasma-induced fractionation, and instrumental drift. The mean and standard error of the measured ratios of the backgrounds and peaks were calculated after rejection of outliers more than two standard errors beyond the mean. Using the same methods as applied to unknowns and treating all whole-rock glasses besides KL2-G as secondary reference materials, this routine typically yielded values accurate to within 5-10% for all elements. Methods provided by Josh Garber, Penn State University via personal

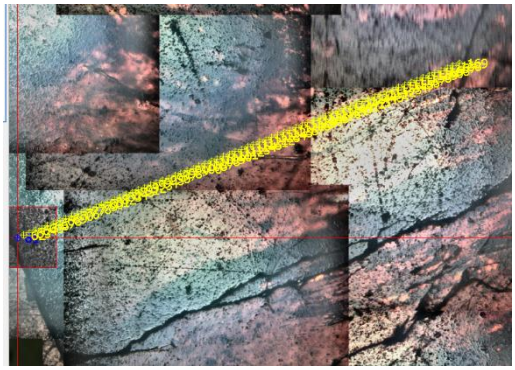

Figure 11: Each of the yellow crosses denotes where data were collected from the same traverse line as used for the LA-ICP-MS for the Garnet Ledge sample.

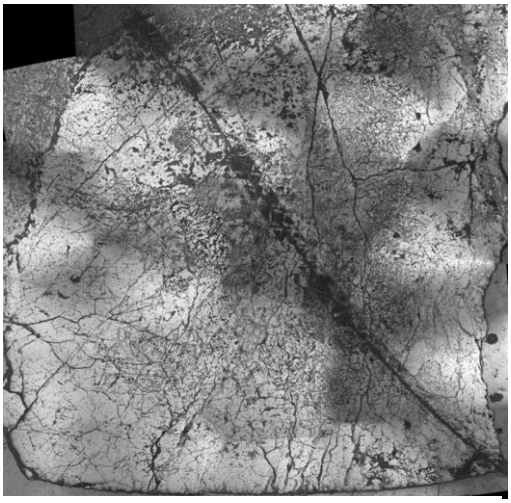

Figure 12: Reflected light image of the Empire Mountain grain. Dark line through the interior of the grain are ablated pits in the sample.

communication, 2023. Uncertainties present during the collection of laser ablation data were evaluated using National Institute for Standards and Technology (NIST) glass standards. The uncertainty for titanium measured through laser ablation was assessed using a NIST 612 glass standard. This NIST 612 glass standard was analyzed 25 times and was found to have a mean concentration of 43.7 ppm +/- 3ppm (2 SD). The relative standard deviation for this is 6.8%. This is comparable with the reported value of titanium in NIST 612 of 44 ppm (Jochum et al. 2011).

RESULTS:

Grain thickness for the Garnet Ledge sample was measured to be 1.3 mm +/- 0.055 mm (2 SD). The thickness of the grain from Empire Mountain was measured to be 0.99 mm +/- 0.056 mm (2 SD). Repeat thickness measurements for each sample are in **Table 1** in **Appendix A**.

FTIR:

The Garnet Ledge sample had inclusions and cracks concentrated near the core. These inclusions can be seen in the garnet slice used for analysis in **Figure 6** by the darker regions in the crystal towards the center of the grain. FTIR data were collected away from the cracks and inclusions to analyze only water that is incorporated in the garnet. The water concentrations in the Garnet Ledge sample calculated from the linear traverse data points are displayed in **Table 2** in **Appendix A**. The spectra locations for this traverse are shown in **Figure 7**. The lowest concentration (smallest peak) is from the point closest to the rim while the largest concentration (highest peak) is from the point closest to the interior. These data range from 8.7 ppm to 118 ppm +/- 6.5% (2 RSD).

For the Empire Mountain sample, data were collected along a linear traverse composed of 25 points spaced 400 µm apart. This traverse extends from the rim of the garnet towards the interior of the grain and can be seen in **Figure 9**. The concentrations of water from these 25 points are seen in **Table 2** in **Appendix A**. These concentrations range from 7170 ppm to 13500 ppm +/- 9.5% (2 RSD).

For the Garnet Ledge sample linear array data (locations of the 2,880 points are seen in **Figure 8**), a 3-D map of water concentrations was created (**Figure 13)** which shows the same trend through space as measured with the linear traverse. This further supports the trend of decreasing water concentrations from core to rim that is seen in the linear traverse data. In this figure, the red region indicates a portion of the spectra that were measured over a crack in the garnet and are therefore considered unreliable data and should not be considered.

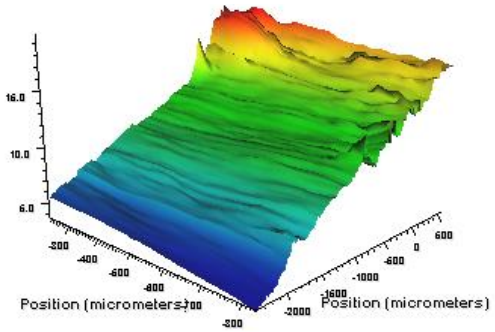

Figure 13: A 3-D representation of the absorbances correlating to water concentrations from the linear array data for the Garnet Ledge sample. Blue represents low values while orange and red represent high values.

EPMA:

For the Garnet Ledge sample, EPMA data for Ti were measured from 64 locations next to the linear traverse plotted for the FTIR. The TiO_2 concentrations in ppm collected from the EPMA for data points closest to the points taken with the FTIR are displayed in **Table 3** in **Appendix A**. **Figure 14** shows these Ti data and the FTIR data for water displayed graphically vs. distance and that these Ti concentration data are larger towards the interior of the grain and smaller towards the rim; like the trend in water concentrations measured with the FTIR. A detection of 0 means that the concentration of TiO_2 fell below the limit of detection.

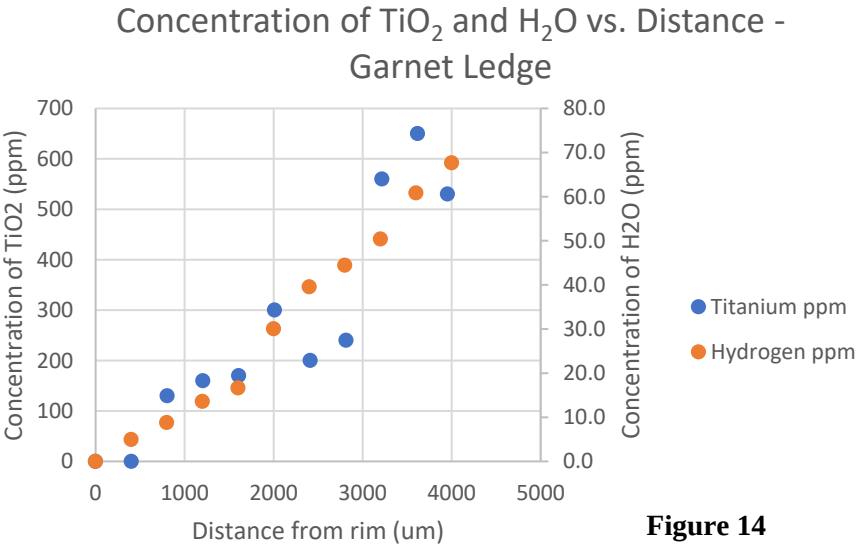

Figure 14

For the Empire Mountain sample, Ti concentrations were collected from 25 points along a linear traverse that followed the traverse collected by the FTIR. The TiO_2 concentrations in ppm collected from the electron probe are displayed in **Table 3** in **Appendix A**.

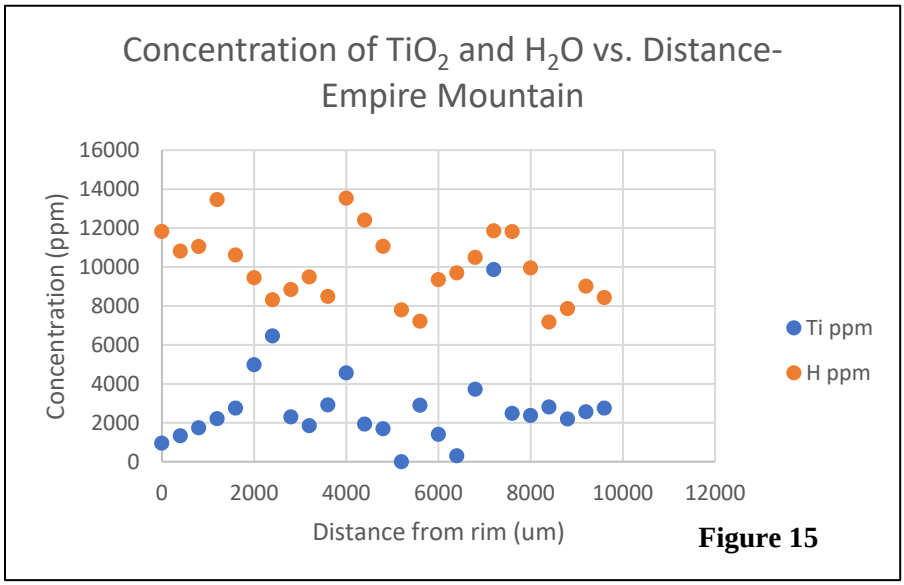

Figure 15

Figure 15 shows these probe data for Ti and FTIR data for water displayed graphically vs. distance. A detection of 0 means that the concentration of TiO_2 fell below the limit of detection.

Laser Ablation:

For the Garnet Ledge sample, LA-ICP-MS data were collected from 74 locations along the same linear traverse as used for the EPMA and FTIR. At each point, the concentrations of Ti, B, and Li were analyzed. The data for these data points which correspond to each of the FTIR data points are in **Table 4** in **Appendix A**. There is very little variation in the concentration of B, while the Ti concentrations range from 35.9 ppm to 538 ppm +/- 6.8% (2 RSD), and Li concentrations range from 11 ppm to 26.9 ppm +/- 6.8% (2 RSD).

LA-ICP-MS data were collected and analyzed from 220 locations along the 9600 µm traverse that was co-located with the EPMA and FTIR traverses. At each point, concentrations of Ti, B, and Li were analyzed among other trace elements. The data for the points corresponding to each of the FTIR data points are in **Table 5** in **Appendix A.** There is very little variation in the concentration of B, Ti concentrations range from 333 ppm to 6680 ppm +/- 6.8% (2 RSD), and Li concentrations range from 0.32 ppm to 6.90 ppm +/- 6.8% (2 RSD).

DISCUSSION:

The water content for the sample from Garnet Ledge, AK ranged from 8.7 ppm to 118 ppm +/- 6.5% (2 RSD). These concentrations decreased from the center of the grain out to the rim and are typical of almandine-rich garnets (almandine-rich garnets typically have water concentrations up to 150 ppm (Beran and Libowitzky 2006, Rossman and Aines, 1991)). This trend was evident in both the linear traverse and the linear array measured from 2,880 points. The water concentrations at the center of this garnet sample could not be characterized because of the extent of inclusions and cracks. Partitioning of water due to P-T conditions can be ruled out as an explanation for the trend seen in water concentrations for the Garnet Ledge sample. Typically, greater amounts of water are incorporated into garnet through partitioning as temperature and pressure increase (Lu and Keppler, 1997). The sample from Garnet Ledge displays the opposite trend; the greatest amount of water exists in the region of the grain that experienced the lowest P-T conditions. Therefore, partitioning due to P-T conditions during garnet growth can be excluded as an explanation for the water present in this grain.

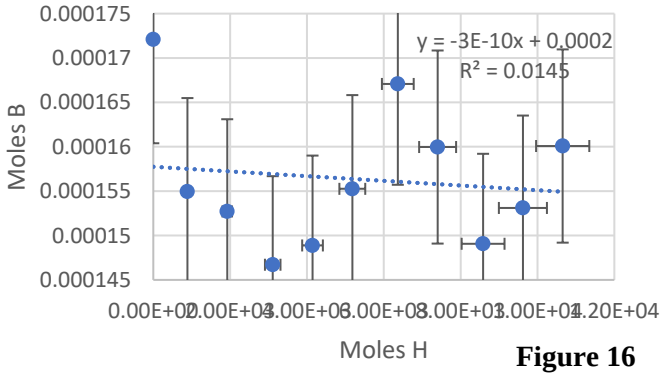

Figure 16

Concentrations of H, Li, Ti, and B were converted to moles to evaluate the molar ratios and look for evidence of substitution mechanisms. For the

Garnet Ledge sample, there was no correlation found between the molar concentration of H and B (**Figure 16**).

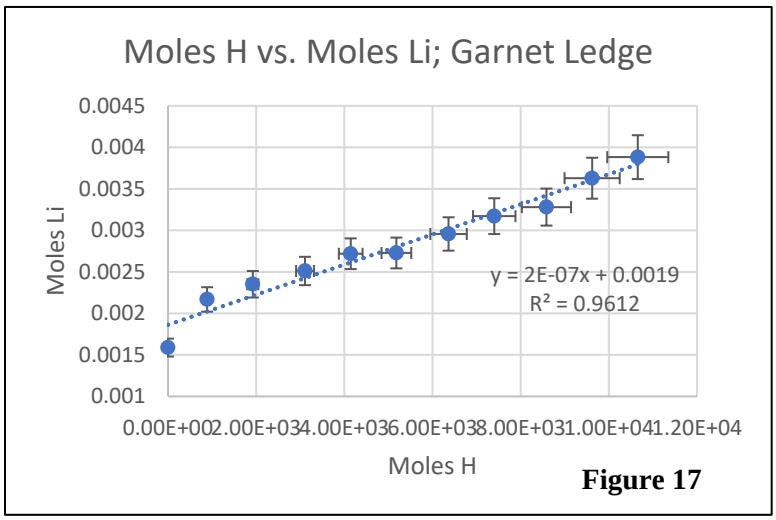

Figure 17

There was a strong correlation between the molar concentrations of H and Li, but there was not a 1:1 molar ratio as would be expected if a coupled substitution between H and Li were the primary mechanism of H incorporation (**Figure 17**).

There was a strong correlation between the moles of H and the moles of Ti. There is some variability in the absorbance coefficient that has been used for almandine-rich garnets which creates uncertainty in the correlation. When 6340 is used for the absorbance coefficient, there is a 1:1 molar ratio between H and Ti, as would be expected if a coupled substitution between H and Ti were the primary mechanism of H incorporation (**Figure 18**) (Maldener et al. 2003).

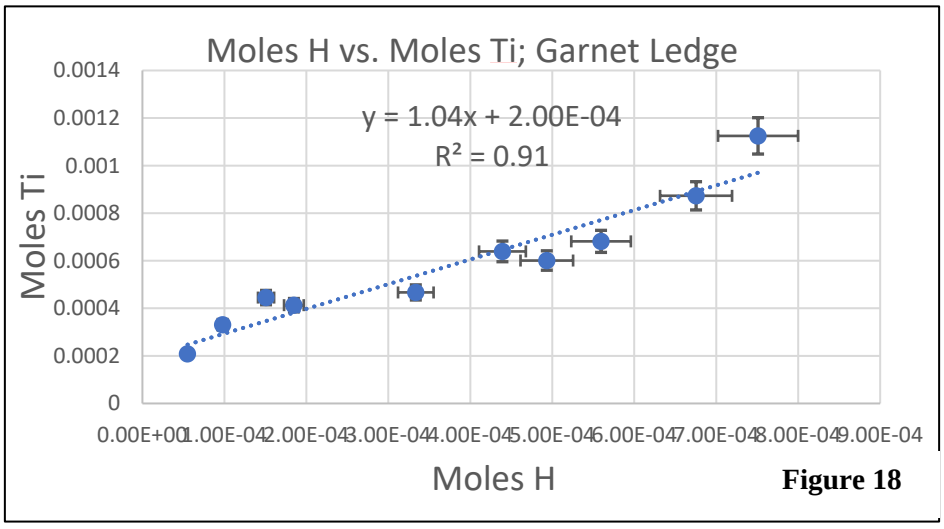

Figure 18

This correlation in data suggests that in the Garnet Ledge sample, there is a coupled substitution between Ti and H that is the primary control on water in the structure of this sample.

The water content for the sample from Empire Mountain, CA ranged from 7170 ppm to 13500 ppm +/- 9.5% (2 RSD). These concentrations displayed no discernible trend between rim and interior of the grain. Based on δO^{18} analyses of garnets from this locality, there is evidence for episodic influxes of meteoric water which could account for the fluctuations in concentration of water (D'Errico et al., 2012). P-T conditions have not yet been characterized for this sample site, so partitioning due to P-T conditions during growth cannot be assessed at this time.

As with the Garnet Ledge sample, concentrations of H, Li, Ti, and B were converted to moles to evaluate molar ratios and look for evidence of the proposed substitution mechanisms. For the Empire Mountain sample, there was no correlation found between moles of H and B (**Figure 19**).

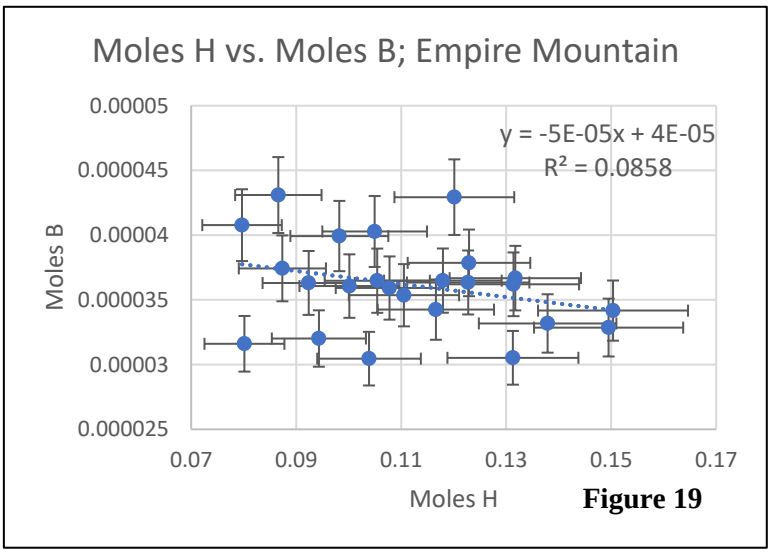

Figure 19

There was also no correlation between moles of H and moles of Li for the Empire Mountain sample (**Figure 20**).

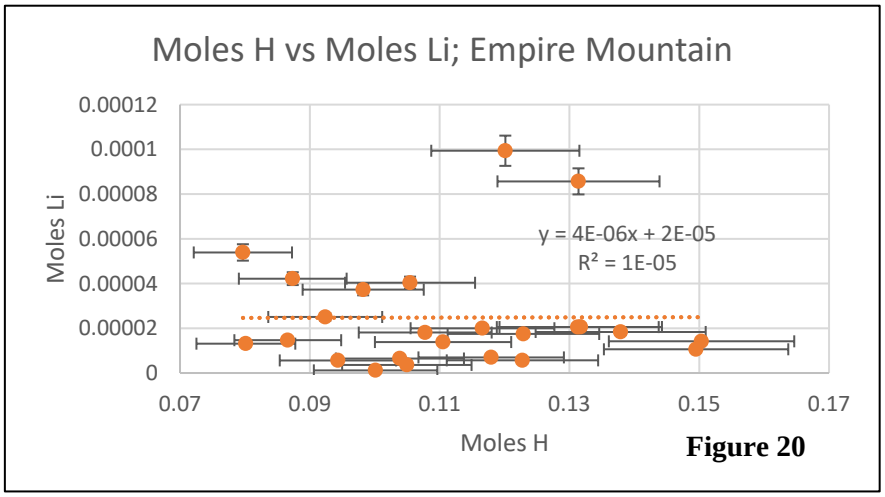

Figure 20

Lastly, there is also no correlation between moles of H and moles of Ti for the Empire Mountain sample (**Figure 21**).

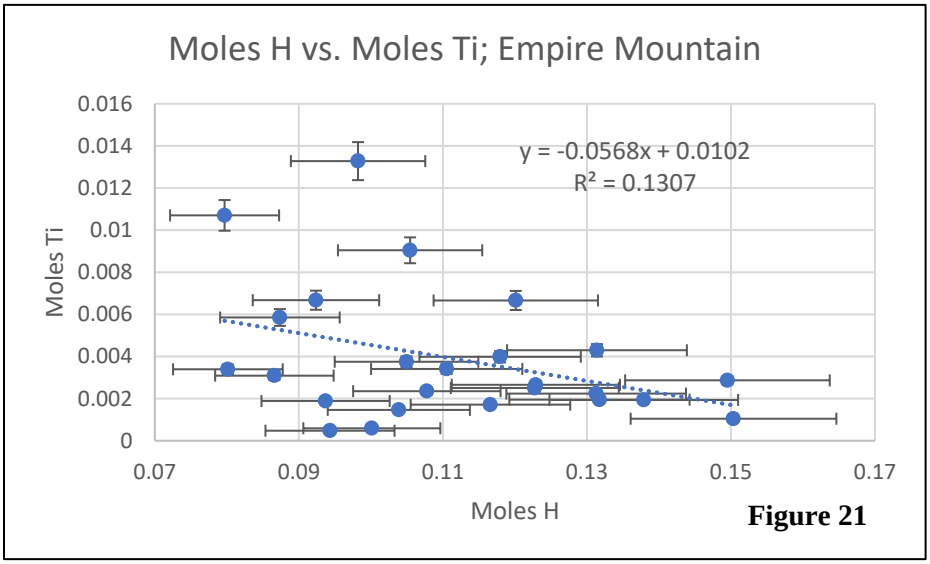

Figure 21

Based on the absence of molar correlations between H and other elements, there must be another mechanism which is not one of the substitution mechanisms proposed earlier. One additional incorporation mechanism to consider is a replacement of up to four H substituting into an Si site, without being correlated to another element. The moles of Si are so high within garnets that the analytical resolution is not fine enough to detect variations on the same scale as H.

In total, 32 elements were analyzed and compared to H with LA-ICP-MS, 7 of these were also characterized by EPMA for both garnet samples. This study focused on the B, Li, and Ti results because there have been previously proposed H substitution mechanisms including these elements. Additionally, for the purpose of this study, data points were removed that were associated with identified inclusions within the garnet. This study of correlations is only between elements within garnet, and does not evaluate the presence or effect of other phases. Ultimately, the data support the hypothesis in that there are correlations in concentrations between H and Ti for the almandine-rich Garnet Ledge sample, and this differed from the correlations in concentrations within the grossular-andradite-rich Empire Mountain sample (in that there were no correlations in the data that were collected, despite differences in water concentrations).

CONCLUSION:

This study evaluating H and its relationship with other elements within the structure of compositionally different garnets from two contact metamorphic localities was aimed at gaining a deeper understanding of the controls for H within garnets. The mineral garnet is considered nominally anhydrous, so when H is present, it is more likely to vary as a function of its external environment and can potentially be used as a tracer for fluid flow during the metamorphic process. Fluid-rock interactions during metamorphism can have significant impacts on the surrounding rock

and using H in garnets as a tracer for this fluid flow will contribute to understanding these types of interactions. However, before H can be used as a tracer for fluid flow, it is important first to understand how it is incorporated within the structure.

In the almandine-rich sample from Garnet Ledge, relationships were found between H and Ti, and H and Li. The molar relationship between H and Ti was roughly 1:1, indicating that a coupled substitution between H and Ti was likely the primary substitution mechanism and control for the H present within the structure. In the grossular-andradite-rich sample from Empire Mountain, there were no elemental correlations found between H and any other analyzed element. This indicates that there is another factor controlling the H present within this sample. The main limitation of this study is its limited scope. More investigations are required to determine what is controlling the H present within the Empire Mountain sample, and whether the Ti-H coupled substitution mechanism that is likely occurring within the Garnet Ledge sample is representative of all almandine-rich garnets or is isolated to this one locale. Additionally, more investigation could be performed to determine what is causing the variations in Ti present in the Garnet Ledge sample.

AKNOWLEDGEMENTS:

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BIBLIOGRAPHY:

Baxter, E. F., Caddick, M. J., & Dragovic, B. (2017). Garnet: A rock-forming mineral petrochronometer. *Reviews in Mineralogy and Geochemistry*, *83*(1), 469-533.

Beran, A., Libowitzky, E.; Water in Natural Mantle Minerals II: Olivine, Garnet and Accessory Minerals. *Reviews in Mineralogy and Geochemistry* 2006;; 62 (1): 169–191.

Bebout, G. E., & Penniston-Dorland, S. C. (2016). Fluid and mass transfer at subduction interfaces—The field metamorphic record. *Lithos*, *240*, 228-258.

Bickle, M. J., & McKenzie, D. (1987). The transport of heat and matter by fluids during metamorphism. *Contributions to Mineralogy and Petrology*, *95*, 384-392.

California State Parks, S. of C. (2023). *Empire Mine SHP 2023*. CA State Parks. http://parks.ca.gov/?page_id=499

D'Errico, M. E., Lackey, J. S., Surpless, B. E., Loewy, S. L., Wooden, J. L., Barnes, J. D., ... & Valley, J. W. (2012). A detailed record of shallow hydrothermal fluid flow in the Sierra Nevada magmatic arc from low-δ18O skarn garnets. *Geology*, *40*(8), 763-766.

Jochum, K. P., Stoll, B., Herwig, K., Willbold, M., Hofmann, A. W., Amini, M., ... & Woodhead, J. D. (2006). MPI-DING reference glasses for in situ microanalysis: New reference values for element concentrations and isotope ratios. *Geochemistry, Geophysics, Geosystems*, *7*(2).

Jochum, K. P., Weis, U., Stoll, B., Kuzmin, D., Yang, Q., Raczek, I., ... & Enzweiler, J. (2011). Determination of reference values for NIST SRM 610–617 glasses following ISO guidelines. *Geostandards and Geoanalytical Research*, *35*(4), 397-429.

Johnson, E. A. (2006). Water in nominally anhydrous crustal minerals: speciation, concentration, and geologic significance. *Reviews in Mineralogy and Geochemistry*, *62*(1), 117-154.

Lu, R., & Keppler, H. (1997). Water solubility in pyrope to 100 kbar. *Contributions to Mineralogy and Petrology*, *129*(1), 35-42.

Maldener, J., Hösch, A., Langer, K., & Rauch, F. (2003). Hydrogen in some natural garnets studied by nuclear reaction analysis and vibrational spectroscopy. *Physics and Chemistry of Minerals*, *30*, 337-344.

Newcombe, M. E., Nielsen, S. G., Peterson, L. D., Wang, J., Alexander, C. O. D., Sarafian, A. R., ... & Irving, A. J. (2023). Degassing of early-formed planetesimals restricted water delivery to Earth. *Nature*, 1-4.

Paton, C., Hellstrom, J., Paul, B., Woodhead, J., & Hergt, J. (2011). Iolite: Freeware for the visualisation and processing of mass spectrometric data. *Journal of Analytical Atomic Spectrometry*, *26*(12), 2508-2518.

Reynes, J. (2020) The Hydrogen incorporation into garnet studied by infrared spectroscopy. PhD thesis. University of Bern. 250 pp.

Reynes, J., Lanari, P., & Hermann, J. (2020). A mapping approach for the investigation of Ti–OH relationships in metamorphic garnet. *Contributions to Mineralogy and Petrology*, *175*(5), 46.

Rossman, G. R., & Aines, R. D. (1991). The hydrous components in garnets: Grossular-hydrogrossular. *American Mineralogist*, *76*(7-8), 1153-1164.

Stowell, H. H., Taylor, D. L., Tinkham, D. L., Goldberg, S. A., & Ouderkirk, K. A. (2001). Contact metamorphic P–T–t paths from Sm–Nd garnet ages, phase equilibria modelling and thermobarometry: Garnet Ledge, south-eastern Alaska, USA. *Journal of Metamorphic Geology*, *19*(6), 645-660.

Yardley, B. W., & Cleverley, J. S. (2015). The role of metamorphic fluids in the formation of ore deposits. London: The Geological Society of London publications.

APPENDIX A: DATA TABLES

Table 1: Grain thicknesses		
Trial	**Garnet Ledge (mm)**	**Empire Mountain (mm)**
1	1.3	0.98
2	1.3	1.0
3	1.3	1.0
4	1.3	1.0
5	1.2	0.93
6	1.3	1.0
7	1.3	
8	1.3	
9	1.3	
10	1.3	
11	1.1	
Mean	1.3	0.99
2 * SD	0.055	0.056

Table 2: Calculated water concentrations					
Garnet Ledge			**Empire Mountain**		
Distance from rim (μm)	**Peak area (cm^{-1})**	**Calculated H_2O concentration (ppm)**	**Distance from rim (μm)**	**Peak area (cm^{-1})**	**Calculated H_2O concentration (ppm)**
400	0.949	8.7	0	343.8	11800
800	1.69	15.4	400	314.3	10800
1200	2.60	23.7	800	321.2	11000
1600	3.19	29.1	1200	391.2	13500
2000	5.75	52.5	1600	308.6	10600
2400	7.57	69.1	2000	274.6	9450
2800	8.51	77.6	2400	241.7	8310
3200	9.65	88.0	2800	257	8840
3600	11.6	106	3200	275.9	9490
4000	12.9	118	3600	246.8	8490
			4000	393.4	13500
			4400	360.8	12400
			4800	321.6	11100
			5200	226.6	7790
			5600	209.7	7210
			6000	271.8	9350
			6400	282	9700
			6800	305.1	10500
			7200	344.7	11900
			7600	343.5	11800
			8000	289.2	9950
			8400	208.5	7170
			8800	228.6	7860
			9200	262	9010
			9600	245.2	8430

Table 3: EPMA results for TiO_2 concentrations

Garnet Ledge		Empire Mountain	
Distance from rim (μm)	**Concentration of TiO_2 (ppm)**	**Distance from rim (μm)**	**Concentration of TiO_2 (ppm)**
402	0	0	950
804	130	400	1330
1206	160	800	1740
1608	170	1200	2210
2010	300	1600	2750
2412	200	2000	4980
2814	240	2400	6460
3216	560	2800	2300
3618	650	3200	1850
3953	530	3600	2920
		4000	4560
		4400	1930
		4800	1690
		5200	0
		5600	2900
		6000	1400
		6400	300
		6800	3720
		7200	9870
		7600	2480
		8000	2370
		8400	2810
		8800	2190
		9200	2560
		9600	2750

Table 4: Concentrations of B, Ti, and Li with distance from garnet rim; Garnet Ledge			
Distance from rim (μm)	**B concentration (ppm)**	**Ti concentration (ppm)**	**Li concentration (ppm)**
0	1.9	35.9	11.0
400	1.7	99.9	15.0
800	1.7	158.3	16.3
1200	1.6	213.0	17.4
1600	1.6	197.8	18.9
2000	1.7	223.4	18.9
2400	1.8	306.0	20.5
2800	1.7	287.6	22.0
3200	1.6	326.2	22.8
3600	1.7	417.8	25.2
4000	1.7	538	26.9

Table 5: Concentrations of B, Ti, and Li with distance from garnet rim; Empire Mountain			
Distance from rim (µm)	**B concentration (ppm)**	**Ti concentration (ppm)**	**Li concentration (ppm)**
0	3.91	2060	5.95
406	4.64	3190	6.90
811	3.93	1110	0.39
1220	3.55	1370	0.74
1620	3.94	1910	0.48
1980	3.82	1730	0.32
2390	4.50	5150	3.71
2790	3.44	6680	3.63
3200	3.75	5220	1.89
3610	3.76	741	1.19
4010	4.25	979	0.93
4420	3.98	994	0.94
4820	4.36	1560	1.24
5180	3.44	1010	1.68
5990	2.55	486	0.99
6400	3.56	356	0.72
6810	3.75	1060	0.97
7210	3.34	601	0.90
7620	3.79	998	1.39
8020	3.51	938	0.95
8380	4.20	1760	0.65
8790	3.62	4190	2.30
9190	3.50	1950	2.77
9600	3.96	333	0.34

APPENDIX B: SUPPLEMENTARY INFORMATION

EPMA: Garnet Ledge sample, core to rim		
	Wt %	APFU
No.	TiO2	Ti
1	0.053	0.0032
2	0.061	0.0038
3	0.061	0.0038
4	0.072	0.0044
5	0.066	0.0040
6	0.065	0.0040
7	0.053	0.0032
8	0.044	0.0029
9	0.052	0.0033
10	0.034	0.0021
11	0.043	0.0027
12	0.056	0.0035
13	0.038	0.0023
14	0.044	0.0027
15	0.017	0.0011
16	0.031	0.0019
17	0.032	0.0020
18	0.024	0.0015
19	0.024	0.0015
20	0.027	0.0016
21	0.024	0.0015
22	0.023	0.0014
23	0.026	0.0016
24	0.02	0.0012
25	0.036	0.0023
26	0.026	0.0016
27	0.041	0.0025
28	0.030	0.0019
29	0.019	0.0011
30	0.030	0.0018
31	0.030	0.0018
32	0.046	0.0029
33	0.024	0.0015
34	0.023	0.0014
35	0.024	0.0015
36	0.017	0.0011
37	0.011	0.0007
38	0.010	--
39	0.018	0.0011
40	0.026	0.0016

EPMA: Garnet Ledge sample, continued		
	Wt %	APFU
No.	TiO2	Ti
41	0.040	0.0024
42	0.016	0.0010
43	0.017	0.0012
44	0.017	0.0011
45	0.031	0.0019
46	0.010	--
47	0.010	--
48	0.013	0.0008
49	0.027	0.0017
50	0.010	--
51	0.010	--
52	0.010	--
53	0.009	0.0005
54	BD	--
55	BD	--
56	BD	--
57	BD	--
58	BD	--
59	BD	--
60	BD	--
61	0.010	--
62	0.020	0.0012
63	0.019	0.0012
64	0.043	0.0027
65	0.027	0.0017
66	0.020	0.0013
67	0.035	0.0023
68	0.026	0.0015
69	0.033	0.0021
70	0.036	0.0024
71	0.064	0.0042
72	0.012	0.0008
73	BD	--
74	0.045	0.0029
75	BD	--
76	0.032	0.0022
77	0.019	0.0013
78	0.028	0.0017
79	0.021	0.0013
80	BD	--

LA-ICP-MS: Garnet Ledge							
Sample Point Number	1	2	3	4	5	6	7
H2O from FTIR (ppm)							8.7
Li7 (ppm)	1.10E+01	1.23E+01	1.24E+01	1.39E+01	1.40E+01	1.46E+01	1.50E+01
B11 (ppm)	1.86E+00	1.80E+00	1.73E+00	1.69E+00	1.67E+00	1.76E+00	1.68E+00
Na23 (ppm)	7.68E+01	8.82E+01	8.87E+01	9.60E+01	9.70E+01	9.99E+01	1.05E+02
Mg24 (ppm)	2.24E+04	2.44E+04	2.56E+04	2.64E+04	2.61E+04	2.62E+04	2.65E+04
Al27 (ppm)	8.89E+04	9.03E+04	9.06E+04	9.36E+04	9.14E+04	9.16E+04	9.01E+04
P31 (ppm)	5.32E+01	6.34E+01	6.18E+01	6.62E+01	7.39E+01	8.40E+01	8.50E+01
Ca43 (ppm)	1.04E+04	1.03E+04	1.01E+04	1.02E+04	9.86E+03	9.85E+03	1.00E+04
Sc45 (ppm)	1.74E+02	1.84E+02	1.78E+02	1.66E+02	1.61E+02	1.58E+02	1.51E+02
Ti49 (ppm)	3.59E+01	6.53E+01	5.99E+01	7.34E+01	9.30E+01	9.98E+01	1.00E+02
V51 (ppm)	3.87E+01	4.99E+01	5.04E+01	4.79E+01	5.18E+01	5.27E+01	5.24E+01
Cr52 (ppm)	5.70E+01	1.05E+02	1.30E+02	1.28E+02	1.24E+02	1.24E+02	1.30E+02
Mn55 (ppm)	5.12E+03	4.90E+03	5.12E+03	5.28E+03	5.40E+03	5.47E+03	5.74E+03
Fe57 (ppm)	1.90E+05	1.85E+05	1.87E+05	1.90E+05	1.91E+05	1.89E+05	1.88E+05
Y89 (ppm)	2.93E+02	3.88E+02	3.65E+02	3.93E+02	3.76E+02	3.70E+02	4.04E+02
Zr90 (ppm)	3.77E+00	6.38E+00	6.01E+00	5.72E+00	7.28E+00	7.82E+00	8.01E+00
Nb93 (ppm)	BD	BD	BD	BD	BD	BD	BD
La139 (ppm)	BD	BD	BD	BD	BD	BD	BD
Ce140 (ppm)	BD	BD	1.72E-03	BD	BD	3.10E-03	4.54E-03
Pr141 (ppm)	BD	BD	BD	BD	BD	BD	BD
Nd146 (ppm)	8.69E-02	1.24E-01	1.12E-01	1.56E-01	2.08E-01	1.66E-01	1.71E-01
Sm147 (ppm)	7.92E-01	1.17E+00	9.91E-01	1.32E+00	1.33E+00	1.62E+00	1.57E+00
Eu153 (ppm)	2.97E-01	4.01E-01	3.77E-01	4.90E-01	6.00E-01	5.59E-01	6.13E-01
Gd157 (ppm)	1.01E+01	1.41E+01	1.28E+01	1.40E+01	1.50E+01	1.55E+01	1.50E+01
Tb159 (ppm)	4.46E+00	5.85E+00	5.62E+00	6.09E+00	6.37E+00	6.38E+00	6.30E+00
Dy163 (ppm)	4.65E+01	6.11E+01	5.93E+01	6.15E+01	6.18E+01	6.05E+01	6.28E+01
Ho165 (ppm)	1.12E+01	1.52E+01	1.48E+01	1.46E+01	1.40E+01	1.36E+01	1.48E+01
Er166 (ppm)	2.78E+01	3.86E+01	3.84E+01	3.68E+01	3.37E+01	3.29E+01	3.88E+01
Tm169 (ppm)	2.95E+00	4.08E+00	3.95E+00	3.67E+00	3.23E+00	3.22E+00	4.20E+00
Yb172 (ppm)	1.57E+01	2.20E+01	2.09E+01	1.83E+01	1.49E+01	1.46E+01	1.99E+01
Lu175 (ppm)	1.80E+00	2.60E+00	2.70E+00	2.21E+00	1.73E+00	1.69E+00	2.33E+00
Hf178 (ppm)	8.51E-02	1.20E-01	1.25E-01	9.82E-02	1.23E-01	1.28E-01	1.83E-01
U238 (ppm)	8.64E-03	1.12E-02	1.59E-02	1.24E-02	1.43E-02	1.50E-02	2.54E-02

LA-ICP-MS: Garnet Ledge							
Sample Point Number	8	9	10	11	12	13	14
H2O from FTIR (ppm)							15.4
Li7 (ppm)	1.48E+01	1.46E+01	1.56E+01	1.49E+01	1.62E+01	1.75E+01	1.63E+01
B11 (ppm)	1.77E+00	1.83E+00	1.77E+00	1.70E+00	1.81E+00	1.59E+00	1.65E+00
Na23 (ppm)	1.04E+02	9.67E+01	1.02E+02	1.05E+02	1.14E+02	1.25E+02	1.13E+02
Mg24 (ppm)	2.61E+04	2.70E+04	2.66E+04	2.72E+04	2.73E+04	2.70E+04	2.74E+04
Al27 (ppm)	9.03E+04	9.04E+04	9.34E+04	9.43E+04	9.58E+04	9.09E+04	9.37E+04
P31 (ppm)	9.90E+01	8.48E+01	1.02E+02	8.61E+01	1.11E+02	1.31E+02	1.06E+02
Ca43 (ppm)	9.85E+03	9.84E+03	9.80E+03	1.00E+04	1.04E+04	1.01E+04	9.82E+03
Sc45 (ppm)	1.48E+02	1.44E+02	1.47E+02	1.43E+02	1.37E+02	1.35E+02	1.32E+02
Ti49 (ppm)	1.32E+02	1.17E+02	1.49E+02	1.33E+02	1.68E+02	2.30E+02	1.58E+02
V51 (ppm)	5.53E+01	5.45E+01	5.73E+01	5.53E+01	6.03E+01	6.95E+01	5.59E+01
Cr52 (ppm)	1.25E+02	1.22E+02	1.17E+02	1.19E+02	1.19E+02	1.14E+02	1.09E+02
Mn55 (ppm)	5.75E+03	6.11E+03	6.21E+03	6.39E+03	6.60E+03	6.43E+03	6.77E+03
Fe57 (ppm)	1.92E+05	1.95E+05	1.90E+05	1.94E+05	1.97E+05	1.95E+05	1.91E+05
Y89 (ppm)	3.23E+02	3.16E+02	3.20E+02	3.43E+02	3.40E+02	3.45E+02	3.30E+02
Zr90 (ppm)	9.91E+00	8.08E+00	1.06E+01	9.20E+00	1.10E+01	1.45E+01	1.03E+01
Nb93 (ppm)	BD	BD	BD	BD	3.63E-03	BD	BD
La139 (ppm)	BD	1.67E-03	BD	BD	1.22E-03	BD	BD
Ce140 (ppm)	BD	BD	3.99E-03	3.09E-03	8.31E-03	5.99E-03	5.60E-03
Pr141 (ppm)	8.42E-03	3.53E-03	BD	4.39E-03	4.23E-03	1.32E-02	8.04E-03
Nd146 (ppm)	2.22E-01	2.06E-01	2.16E-01	2.28E-01	2.51E-01	3.82E-01	2.75E-01
Sm147 (ppm)	1.68E+00	1.59E+00	1.58E+00	1.77E+00	2.05E+00	2.25E+00	2.08E+00
Eu153 (ppm)	6.19E-01	5.94E-01	6.34E-01	6.74E-01	7.64E-01	8.23E-01	7.57E-01
Gd157 (ppm)	1.47E+01	1.51E+01	1.48E+01	1.55E+01	1.66E+01	1.80E+01	1.64E+01
Tb159 (ppm)	5.98E+00	6.03E+00	5.89E+00	6.21E+00	6.27E+00	6.80E+00	6.32E+00
Dy163 (ppm)	5.43E+01	5.36E+01	5.24E+01	5.52E+01	5.62E+01	5.70E+01	5.36E+01
Ho165 (ppm)	1.14E+01	1.12E+01	1.12E+01	1.18E+01	1.15E+01	1.16E+01	1.08E+01
Er166 (ppm)	2.84E+01	2.69E+01	2.68E+01	3.00E+01	2.95E+01	2.89E+01	2.75E+01
Tm169 (ppm)	3.02E+00	2.78E+00	2.89E+00	3.37E+00	3.34E+00	3.32E+00	3.18E+00
Yb172 (ppm)	1.36E+01	1.29E+01	1.33E+01	1.57E+01	1.63E+01	1.57E+01	1.54E+01
Lu175 (ppm)	1.66E+00	1.41E+00	1.61E+00	1.92E+00	2.02E+00	1.94E+00	1.87E+00
Hf178 (ppm)	1.87E-01	1.25E-01	1.82E-01	1.77E-01	1.72E-01	2.46E-01	2.06E-01
U238 (ppm)	2.89E-02	2.10E-02	3.02E-02	1.99E-02	2.97E-02	4.18E-02	2.37E-02

LA-ICP-MS: Garnet Ledge							
Sample Point Number	15	16	17	18	19	20	21
H2O from FTIR (ppm)							
Li7 (ppm)	1.63E+01	1.60E+01	1.59E+01	1.66E+01	1.73E+01	1.60E+01	1.72E+01
B11 (ppm)	1.60E+00	1.74E+00	1.60E+00	1.56E+00	1.74E+00	1.55E+00	1.53E+00
Na23 (ppm)	1.12E+02	1.09E+02	1.08E+02	1.10E+02	1.13E+02	1.08E+02	1.09E+02
Mg24 (ppm)	2.65E+04	2.66E+04	2.71E+04	2.69E+04	2.75E+04	2.61E+04	2.73E+04
Al27 (ppm)	9.14E+04	9.07E+04	9.02E+04	9.25E+04	9.40E+04	9.08E+04	9.54E+04
P31 (ppm)	1.05E+02	1.00E+02	8.65E+01	9.86E+01	1.16E+02	9.93E+01	1.09E+02
Ca43 (ppm)	1.02E+04	9.86E+03	1.00E+04	1.02E+04	1.06E+04	9.87E+03	1.02E+04
Sc45 (ppm)	1.26E+02	1.23E+02	1.19E+02	1.19E+02	1.25E+02	1.20E+02	1.21E+02
Ti49 (ppm)	1.69E+02	1.31E+02	1.51E+02	1.58E+02	1.71E+02	1.63E+02	1.82E+02
V51 (ppm)	5.81E+01	5.35E+01	5.31E+01	5.59E+01	5.89E+01	5.65E+01	5.86E+01
Cr52 (ppm)	1.06E+02	1.07E+02	1.10E+02	1.02E+02	1.00E+02	9.41E+01	9.71E+01
Mn55 (ppm)	6.84E+03	7.04E+03	7.07E+03	7.20E+03	7.64E+03	7.44E+03	7.85E+03
Fe57 (ppm)	1.91E+05	1.93E+05	1.93E+05	1.86E+05	1.93E+05	1.87E+05	1.98E+05
Y89 (ppm)	3.30E+02	3.38E+02	3.36E+02	3.12E+02	2.96E+02	2.82E+02	2.84E+02
Zr90 (ppm)	1.05E+01	9.22E+00	9.40E+00	9.82E+00	1.05E+01	9.65E+00	1.08E+01
Nb93 (ppm)	BD	BD	5.04E-03	BD	4.36E-03	BD	BD
La139 (ppm)	BD	BD	BD	BD	BD	BD	1.32E-03
Ce140 (ppm)	4.82E-03	7.88E-03	5.66E-03	9.90E-03	4.24E-03	8.91E-03	BD
Pr141 (ppm)	8.80E-03	7.96E-03	1.35E-02	7.49E-03	1.33E-02	7.94E-03	1.02E-02
Nd146 (ppm)	3.57E-01	3.15E-01	2.92E-01	3.16E-01	3.71E-01	3.16E-01	3.10E-01
Sm147 (ppm)	2.01E+00	1.98E+00	2.13E+00	2.27E+00	2.29E+00	2.01E+00	2.17E+00
Eu153 (ppm)	7.61E-01	7.05E-01	7.53E-01	8.29E-01	8.06E-01	7.58E-01	7.51E-01
Gd157 (ppm)	1.70E+01	1.58E+01	1.66E+01	1.75E+01	1.68E+01	1.63E+01	1.67E+01
Tb159 (ppm)	6.49E+00	6.17E+00	6.39E+00	6.20E+00	6.30E+00	5.93E+00	5.97E+00
Dy163 (ppm)	5.54E+01	5.44E+01	5.39E+01	5.19E+01	5.07E+01	4.72E+01	4.71E+01
Ho165 (ppm)	1.10E+01	1.14E+01	1.11E+01	1.03E+01	9.57E+00	9.29E+00	9.20E+00
Er166 (ppm)	2.73E+01	2.93E+01	2.96E+01	2.63E+01	2.46E+01	2.38E+01	2.37E+01
Tm169 (ppm)	3.21E+00	3.72E+00	3.68E+00	3.30E+00	2.94E+00	2.99E+00	3.05E+00
Yb172 (ppm)	1.55E+01	1.84E+01	1.85E+01	1.63E+01	1.49E+01	1.56E+01	1.58E+01
Lu175 (ppm)	1.93E+00	2.35E+00	2.36E+00	2.22E+00	1.99E+00	1.98E+00	2.07E+00
Hf178 (ppm)	1.95E-01	1.59E-01	1.69E-01	1.62E-01	1.72E-01	1.71E-01	1.79E-01
U238 (ppm)	2.85E-02	2.18E-02	2.17E-02	2.59E-02	2.30E-02	3.50E-02	3.82E-02

LA-ICP-MS: Garnet Ledge							
Sample Point Number	22	23	24	25	26	27	28
H2O from FTIR (ppm)	23.7						
Li7 (ppm)	1.74E+01	1.72E+01	1.74E+01	1.64E+01	1.79E+01	1.79E+01	1.89E+01
B11 (ppm)	1.59E+00	1.99E+00	1.46E+00	1.54E+00	1.62E+00	1.67E+00	1.68E+00
Na23 (ppm)	1.10E+02	1.12E+02	1.12E+02	1.08E+02	1.13E+02	1.14E+02	1.23E+02
Mg24 (ppm)	2.72E+04	2.69E+04	2.73E+04	2.61E+04	2.73E+04	2.71E+04	2.71E+04
Al27 (ppm)	9.30E+04	9.42E+04	9.28E+04	8.93E+04	9.21E+04	9.07E+04	9.11E+04
P31 (ppm)	1.19E+02	1.25E+02	1.25E+02	1.14E+02	1.21E+02	1.29E+02	1.28E+02
Ca43 (ppm)	1.01E+04	1.07E+04	9.96E+03	9.69E+03	9.82E+03	9.96E+03	1.04E+04
Sc45 (ppm)	1.20E+02	1.22E+02	1.17E+02	1.12E+02	1.17E+02	1.19E+02	1.17E+02
Ti49 (ppm)	2.13E+02	2.10E+02	1.94E+02	1.85E+02	1.91E+02	2.07E+02	1.98E+02
V51 (ppm)	6.29E+01	6.43E+01	6.09E+01	5.75E+01	6.05E+01	6.33E+01	6.16E+01
Cr52 (ppm)	9.39E+01	9.84E+01	9.33E+01	8.77E+01	9.08E+01	8.83E+01	9.15E+01
Mn55 (ppm)	7.91E+03	8.10E+03	8.48E+03	8.26E+03	8.67E+03	8.84E+03	8.94E+03
Fe57 (ppm)	1.91E+05	1.97E+05	2.00E+05	1.87E+05	1.89E+05	1.89E+05	1.91E+05
Y89 (ppm)	2.82E+02	2.80E+02	2.87E+02	2.85E+02	2.83E+02	2.87E+02	3.14E+02
Zr90 (ppm)	1.21E+01	1.25E+01	1.12E+01	1.07E+01	1.15E+01	1.28E+01	1.20E+01
Nb93 (ppm)	BD	BD	BD	BD	BD	BD	BD
La139 (ppm)	2.65E-03	BD	BD	BD	BD	BD	1.27E-03
Ce140 (ppm)	9.85E-03	1.03E-02	6.57E-03	7.34E-03	1.04E-02	7.28E-03	1.10E-02
Pr141 (ppm)	1.35E-02	1.36E-02	1.40E-02	1.19E-02	1.16E-02	1.34E-02	1.19E-02
Nd146 (ppm)	3.85E-01	3.53E-01	3.66E-01	3.30E-01	3.58E-01	3.34E-01	3.34E-01
Sm147 (ppm)	2.30E+00	2.21E+00	2.22E+00	2.24E+00	2.17E+00	2.35E+00	2.43E+00
Eu153 (ppm)	8.44E-01	8.80E-01	8.76E-01	8.60E-01	8.28E-01	8.65E-01	9.18E-01
Gd157 (ppm)	1.67E+01	1.71E+01	1.77E+01	1.71E+01	1.64E+01	1.72E+01	1.83E+01
Tb159 (ppm)	6.04E+00	5.95E+00	6.07E+00	5.98E+00	5.90E+00	5.94E+00	6.36E+00
Dy163 (ppm)	4.65E+01	4.73E+01	4.81E+01	4.83E+01	4.70E+01	4.88E+01	5.10E+01
Ho165 (ppm)	9.05E+00	8.71E+00	8.89E+00	8.99E+00	8.80E+00	8.91E+00	9.65E+00
Er166 (ppm)	2.31E+01	2.31E+01	2.30E+01	2.38E+01	2.28E+01	2.33E+01	2.55E+01
Tm169 (ppm)	3.03E+00	3.03E+00	3.02E+00	3.01E+00	3.03E+00	3.11E+00	3.53E+00
Yb172 (ppm)	1.50E+01	1.55E+01	1.50E+01	1.59E+01	1.61E+01	1.61E+01	1.84E+01
Lu175 (ppm)	2.00E+00	2.00E+00	2.04E+00	2.06E+00	2.18E+00	2.16E+00	2.46E+00
Hf178 (ppm)	2.09E-01	2.15E-01	1.82E-01	1.90E-01	2.04E-01	2.09E-01	2.07E-01
U238 (ppm)	4.04E-02	4.79E-02	3.49E-02	3.29E-02	2.67E-02	3.87E-02	3.63E-02

LA-ICP-MS: Garnet Ledge							
Sample Point Number	29	30	31	32	33	34	35
H2O from FTIR (ppm)	29.1						
Li7 (ppm)	1.89E+01	1.86E+01	1.87E+01	1.89E+01	1.90E+01	1.90E+01	1.99E+01
B11 (ppm)	1.61E+00	1.74E+00	1.59E+00	1.75E+00	1.78E+00	1.93E+00	1.82E+00
Na23 (ppm)	1.17E+02	1.16E+02	1.20E+02	1.24E+02	1.26E+02	1.24E+02	1.28E+02
Mg24 (ppm)	2.62E+04	2.72E+04	2.68E+04	2.66E+04	2.67E+04	2.72E+04	2.71E+04
Al27 (ppm)	9.30E+04	9.47E+04	9.33E+04	9.39E+04	9.61E+04	9.23E+04	9.60E+04
P31 (ppm)	1.20E+02	1.26E+02	1.23E+02	1.25E+02	1.34E+02	1.28E+02	1.31E+02
Ca43 (ppm)	1.02E+04	1.02E+04	1.01E+04	9.80E+03	1.01E+04	1.04E+04	1.00E+04
Sc45 (ppm)	1.15E+02	1.17E+02	1.20E+02	1.19E+02	1.23E+02	1.19E+02	1.23E+02
Ti49 (ppm)	1.98E+02	2.02E+02	2.11E+02	2.12E+02	2.19E+02	2.17E+02	2.30E+02
V51 (ppm)	6.19E+01	6.34E+01	6.30E+01	6.38E+01	6.52E+01	6.56E+01	6.84E+01
Cr52 (ppm)	9.73E+01	1.01E+02	9.27E+01	9.87E+01	9.95E+01	1.06E+02	1.04E+02
Mn55 (ppm)	9.12E+03	9.41E+03	9.66E+03	9.67E+03	1.00E+04	1.05E+04	1.04E+04
Fe57 (ppm)	1.92E+05	1.93E+05	1.92E+05	1.91E+05	1.93E+05	1.96E+05	1.98E+05
Y89 (ppm)	3.42E+02	3.40E+02	3.19E+02	3.35E+02	3.45E+02	3.59E+02	3.43E+02
Zr90 (ppm)	1.17E+01	1.21E+01	1.27E+01	1.23E+01	1.31E+01	1.29E+01	1.36E+01
Nb93 (ppm)	BD	BD	BD	BD	BD	BD	BD
La139 (ppm)	BD	BD	BD	BD	BD	BD	BD
Ce140 (ppm)	7.39E-03	BD	6.54E-03	8.16E-03	1.32E-02	6.33E-03	9.05E-03
Pr141 (ppm)	1.21E-02	9.94E-03	1.06E-02	9.93E-03	1.10E-02	1.24E-02	1.43E-02
Nd146 (ppm)	3.33E-01	3.88E-01	3.76E-01	3.38E-01	3.87E-01	3.51E-01	3.94E-01
Sm147 (ppm)	2.42E+00	2.48E+00	2.25E+00	2.15E+00	2.34E+00	2.29E+00	2.50E+00
Eu153 (ppm)	8.43E-01	8.34E-01	8.24E-01	8.63E-01	8.09E-01	8.20E-01	8.43E-01
Gd157 (ppm)	1.74E+01	1.76E+01	1.74E+01	1.69E+01	1.71E+01	1.73E+01	1.72E+01
Tb159 (ppm)	6.66E+00	6.55E+00	6.30E+00	6.38E+00	6.28E+00	6.28E+00	6.36E+00
Dy163 (ppm)	5.49E+01	5.46E+01	5.08E+01	5.19E+01	5.35E+01	5.57E+01	5.42E+01
Ho165 (ppm)	1.08E+01	1.08E+01	9.78E+00	1.05E+01	1.08E+01	1.11E+01	1.06E+01
Er166 (ppm)	2.98E+01	3.01E+01	2.68E+01	2.94E+01	3.01E+01	3.26E+01	3.07E+01
Tm169 (ppm)	4.13E+00	4.20E+00	3.61E+00	3.98E+00	4.20E+00	4.68E+00	4.26E+00
Yb172 (ppm)	2.17E+01	2.23E+01	1.97E+01	2.27E+01	2.39E+01	2.59E+01	2.40E+01
Lu175 (ppm)	2.86E+00	3.04E+00	2.65E+00	2.86E+00	3.13E+00	3.36E+00	3.12E+00
Hf178 (ppm)	1.99E-01	2.09E-01	2.21E-01	2.10E-01	2.27E-01	2.10E-01	2.23E-01
U238 (ppm)	3.17E-02	3.41E-02	3.79E-02	3.29E-02	3.57E-02	3.91E-02	3.68E-02

LA-ICP-MS: Garnet Ledge							
Sample Point Number	36	37	38	39	40	41	42
H2O from FTIR (ppm)	52.5						
Li7 (ppm)	1.89E+01	1.98E+01	2.00E+01	1.99E+01	2.06E+01	1.98E+01	2.06E+01
B11 (ppm)	1.68E+00	1.76E+00	1.78E+00	1.72E+00	1.57E+00	1.63E+00	1.74E+00
Na23 (ppm)	1.19E+02	1.25E+02	1.19E+02	1.23E+02	1.24E+02	1.26E+02	1.24E+02
Mg24 (ppm)	2.67E+04	2.62E+04	2.62E+04	2.65E+04	2.74E+04	2.64E+04	2.61E+04
Al27 (ppm)	9.60E+04	9.36E+04	9.20E+04	9.63E+04	9.66E+04	9.41E+04	9.41E+04
P31 (ppm)	1.30E+02	1.35E+02	1.27E+02	1.33E+02	1.41E+02	1.60E+02	1.40E+02
Ca43 (ppm)	1.02E+04	1.06E+04	9.86E+03	1.01E+04	1.06E+04	1.04E+04	1.04E+04
Sc45 (ppm)	1.19E+02	1.20E+02	1.16E+02	1.17E+02	1.18E+02	1.15E+02	1.15E+02
Ti49 (ppm)	2.23E+02	2.31E+02	2.21E+02	2.35E+02	2.50E+02	2.67E+02	2.81E+02
V51 (ppm)	6.73E+01	6.74E+01	6.58E+01	6.67E+01	6.97E+01	7.44E+01	7.73E+01
Cr52 (ppm)	9.79E+01	9.86E+01	9.80E+01	9.55E+01	9.67E+01	9.82E+01	9.64E+01
Mn55 (ppm)	1.05E+04	1.05E+04	1.05E+04	1.09E+04	1.15E+04	1.14E+04	1.13E+04
Fe57 (ppm)	1.95E+05	1.98E+05	1.91E+05	1.91E+05	1.98E+05	1.92E+05	1.91E+05
Y89 (ppm)	3.33E+02	3.44E+02	3.40E+02	3.29E+02	3.25E+02	3.18E+02	3.17E+02
Zr90 (ppm)	1.32E+01	1.32E+01	1.34E+01	1.32E+01	1.39E+01	1.49E+01	1.51E+01
Nb93 (ppm)	BD	BD	BD	BD	BD	BD	BD
La139 (ppm)	BD	BD	BD	1.37E-03	BD	BD	BD
Ce140 (ppm)	8.31E-03	8.54E-03	1.31E-02	1.08E-02	1.45E-02	BD	1.23E-02
Pr141 (ppm)	1.18E-02	1.38E-02	1.37E-02	1.67E-02	1.87E-02	1.68E-02	1.91E-02
Nd146 (ppm)	3.65E-01	3.66E-01	3.55E-01	3.59E-01	3.79E-01	4.46E-01	4.56E-01
Sm147 (ppm)	2.50E+00	2.53E+00	2.60E+00	2.52E+00	2.69E+00	2.91E+00	2.97E+00
Eu153 (ppm)	8.77E-01	8.68E-01	8.93E-01	8.95E-01	9.23E-01	9.69E-01	1.04E+00
Gd157 (ppm)	1.87E+01	1.86E+01	1.82E+01	1.85E+01	1.91E+01	1.93E+01	2.04E+01
Tb159 (ppm)	6.35E+00	6.44E+00	6.45E+00	6.44E+00	6.36E+00	6.55E+00	6.68E+00
Dy163 (ppm)	5.30E+01	5.49E+01	5.39E+01	5.25E+01	5.17E+01	5.19E+01	5.30E+01
Ho165 (ppm)	1.04E+01	1.05E+01	1.05E+01	1.04E+01	1.02E+01	9.99E+00	9.98E+00
Er166 (ppm)	2.92E+01	2.97E+01	3.05E+01	3.00E+01	2.84E+01	2.81E+01	2.81E+01
Tm169 (ppm)	4.09E+00	4.12E+00	4.21E+00	4.04E+00	3.97E+00	3.78E+00	3.79E+00
Yb172 (ppm)	2.34E+01	2.42E+01	2.43E+01	2.43E+01	2.43E+01	2.33E+01	2.34E+01
Lu175 (ppm)	3.01E+00	3.18E+00	3.21E+00	3.16E+00	3.15E+00	3.14E+00	3.10E+00
Hf178 (ppm)	2.06E-01	2.31E-01	2.04E-01	2.14E-01	2.76E-01	2.32E-01	2.61E-01
U238 (ppm)	4.40E-02	5.66E-02	3.73E-02	4.78E-02	5.19E-02	5.67E-02	5.85E-02

LA-ICP-MS: Garnet Ledge							
Sample Point Number	43	44	45	46	47	48	49
H2O from FTIR (ppm)		69.1					
Li7 (ppm)	2.07E+01	2.05E+01	2.13E+01	2.12E+01	2.16E+01	2.12E+01	2.10E+01
B11 (ppm)	1.69E+00	1.81E+00	1.69E+00	1.55E+00	1.65E+00	1.61E+00	1.70E+00
Na23 (ppm)	1.33E+02	1.36E+02	1.37E+02	1.32E+02	1.38E+02	1.37E+02	1.35E+02
Mg24 (ppm)	2.59E+04	2.55E+04	2.63E+04	2.59E+04	2.71E+04	2.71E+04	2.63E+04
Al27 (ppm)	9.63E+04	9.47E+04	9.43E+04	9.65E+04	9.82E+04	9.90E+04	9.58E+04
P31 (ppm)	1.58E+02	1.65E+02	1.59E+02	1.41E+02	1.67E+02	1.51E+02	1.62E+02
Ca43 (ppm)	1.07E+04	1.08E+04	1.09E+04	1.05E+04	1.06E+04	1.06E+04	1.02E+04
Sc45 (ppm)	1.14E+02	1.16E+02	1.21E+02	1.18E+02	1.19E+02	1.16E+02	1.18E+02
Ti49 (ppm)	3.02E+02	3.06E+02	2.86E+02	2.63E+02	2.76E+02	2.63E+02	2.72E+02
V51 (ppm)	8.41E+01	8.41E+01	7.85E+01	7.51E+01	7.92E+01	7.57E+01	7.58E+01
Cr52 (ppm)	9.95E+01	1.03E+02	1.08E+02	1.07E+02	1.15E+02	1.12E+02	1.13E+02
Mn55 (ppm)	1.17E+04	1.21E+04	1.23E+04	1.23E+04	1.28E+04	1.28E+04	1.30E+04
Fe57 (ppm)	1.93E+05	1.95E+05	1.94E+05	1.94E+05	1.98E+05	1.95E+05	2.02E+05
Y89 (ppm)	3.40E+02	3.55E+02	3.84E+02	3.86E+02	4.10E+02	3.89E+02	4.08E+02
Zr90 (ppm)	1.67E+01	1.68E+01	1.56E+01	1.47E+01	1.53E+01	1.52E+01	1.49E+01
Nb93 (ppm)	4.56E-03	BD	BD	4.09E-03	4.27E-03	BD	4.18E-03
La139 (ppm)	2.29E-03	BD	1.40E-03	BD	1.40E-03	BD	BD
Ce140 (ppm)	1.03E-02	1.39E-02	BD	9.55E-03	8.78E-03	1.18E-02	1.24E-02
Pr141 (ppm)	1.80E-02	1.43E-02	1.71E-02	1.40E-02	1.57E-02	1.74E-02	1.30E-02
Nd146 (ppm)	5.34E-01	5.16E-01	4.79E-01	4.82E-01	4.07E-01	4.60E-01	4.74E-01
Sm147 (ppm)	3.11E+00	2.95E+00	2.87E+00	2.68E+00	2.92E+00	2.97E+00	2.75E+00
Eu153 (ppm)	1.08E+00	1.11E+00	1.02E+00	9.45E-01	9.82E-01	9.70E-01	9.37E-01
Gd157 (ppm)	2.18E+01	2.14E+01	2.10E+01	1.96E+01	2.06E+01	1.95E+01	1.99E+01
Tb159 (ppm)	7.16E+00	7.36E+00	7.38E+00	6.90E+00	7.27E+00	6.90E+00	6.91E+00
Dy163 (ppm)	5.63E+01	5.91E+01	5.99E+01	6.00E+01	6.23E+01	6.03E+01	6.12E+01
Ho165 (ppm)	1.06E+01	1.13E+01	1.22E+01	1.22E+01	1.31E+01	1.25E+01	1.29E+01
Er166 (ppm)	2.96E+01	3.11E+01	3.50E+01	3.63E+01	3.89E+01	3.65E+01	3.92E+01
Tm169 (ppm)	4.09E+00	4.24E+00	4.94E+00	5.13E+00	5.51E+00	5.21E+00	5.72E+00
Yb172 (ppm)	2.53E+01	2.69E+01	3.11E+01	3.32E+01	3.63E+01	3.47E+01	3.75E+01
Lu175 (ppm)	3.28E+00	3.51E+00	4.15E+00	4.37E+00	4.90E+00	4.66E+00	4.99E+00
Hf178 (ppm)	2.57E-01	2.39E-01	2.77E-01	2.46E-01	2.59E-01	2.61E-01	2.53E-01
U238 (ppm)	6.29E-02	7.60E-02	6.56E-02	6.01E-02	8.44E-02	5.39E-02	7.16E-02

LA-ICP-MS: Garnet Ledge							
Sample Point Number	50	51	52	53	54	55	56
H2O from FTIR (ppm)		77.6					
Li7 (ppm)	2.19E+01	2.20E+01	2.27E+01	2.16E+01	2.25E+01	2.23E+01	2.25E+01
B11 (ppm)	1.56E+00	1.73E+00	1.79E+00	1.52E+00	1.52E+00	1.55E+00	1.31E+00
Na23 (ppm)	1.38E+02	1.44E+02	1.46E+02	1.38E+02	1.45E+02	1.38E+02	1.32E+02
Mg24 (ppm)	2.63E+04	2.71E+04	2.65E+04	2.53E+04	2.66E+04	2.58E+04	2.59E+04
Al27 (ppm)	9.38E+04	9.73E+04	9.59E+04	9.22E+04	9.81E+04	9.38E+04	9.44E+04
P31 (ppm)	1.56E+02	1.64E+02	1.69E+02	1.64E+02	1.79E+02	1.70E+02	1.61E+02
Ca43 (ppm)	9.97E+03	1.09E+04	1.09E+04	1.03E+04	1.10E+04	1.03E+04	1.00E+04
Sc45 (ppm)	1.15E+02	1.16E+02	1.15E+02	1.09E+02	1.15E+02	1.15E+02	1.19E+02
Ti49 (ppm)	2.84E+02	2.88E+02	3.05E+02	2.88E+02	3.31E+02	3.33E+02	3.08E+02
V51 (ppm)	7.76E+01	7.92E+01	8.13E+01	7.84E+01	8.43E+01	8.02E+01	7.40E+01
Cr52 (ppm)	1.11E+02	1.12E+02	1.16E+02	1.10E+02	1.20E+02	1.09E+02	1.07E+02
Mn55 (ppm)	1.31E+04	1.34E+04	1.38E+04	1.35E+04	1.42E+04	1.41E+04	1.45E+04
Fe57 (ppm)	1.94E+05	1.95E+05	2.01E+05	1.88E+05	1.93E+05	1.91E+05	1.87E+05
Y89 (ppm)	3.97E+02	4.09E+02	4.18E+02	3.99E+02	4.07E+02	3.43E+02	3.16E+02
Zr90 (ppm)	1.53E+01	1.55E+01	1.61E+01	1.57E+01	1.76E+01	1.65E+01	1.55E+01
Nb93 (ppm)	5.54E-03	5.28E-03	6.75E-03	BD	6.07E-03	BD	BD
La139 (ppm)	BD	BD	BD	BD	BD	BD	BD
Ce140 (ppm)	1.05E-02	1.07E-02	1.01E-02	1.48E-02	1.23E-02	1.20E-02	1.54E-02
Pr141 (ppm)	1.41E-02	2.00E-02	1.94E-02	1.50E-02	1.62E-02	1.48E-02	2.13E-02
Nd146 (ppm)	4.75E-01	4.64E-01	4.42E-01	4.36E-01	4.60E-01	5.35E-01	4.27E-01
Sm147 (ppm)	2.75E+00	3.14E+00	2.82E+00	2.86E+00	2.91E+00	2.82E+00	2.68E+00
Eu153 (ppm)	9.68E-01	9.86E-01	1.01E+00	1.03E+00	1.20E+00	1.01E+00	9.79E-01
Gd157 (ppm)	1.98E+01	2.00E+01	2.03E+01	1.92E+01	2.09E+01	1.88E+01	1.69E+01
Tb159 (ppm)	7.00E+00	7.15E+00	7.23E+00	6.94E+00	7.14E+00	6.24E+00	5.78E+00
Dy163 (ppm)	6.02E+01	6.21E+01	6.23E+01	6.01E+01	6.18E+01	5.29E+01	4.78E+01
Ho165 (ppm)	1.25E+01	1.31E+01	1.33E+01	1.30E+01	1.32E+01	1.10E+01	1.00E+01
Er166 (ppm)	3.79E+01	3.86E+01	4.03E+01	3.87E+01	3.98E+01	3.31E+01	3.01E+01
Tm169 (ppm)	5.39E+00	5.58E+00	5.82E+00	5.63E+00	5.87E+00	4.87E+00	4.46E+00
Yb172 (ppm)	3.58E+01	3.74E+01	4.03E+01	3.87E+01	4.10E+01	3.30E+01	3.09E+01
Lu175 (ppm)	4.64E+00	4.88E+00	5.15E+00	4.90E+00	5.40E+00	4.46E+00	4.05E+00
Hf178 (ppm)	2.84E-01	2.69E-01	2.57E-01	2.63E-01	3.24E-01	2.83E-01	2.82E-01
U238 (ppm)	7.28E-02	7.12E-02	7.63E-02	6.59E-02	8.38E-02	8.44E-02	8.64E-02

LA-ICP-MS: Garnet Ledge							
Sample Point Number	57	58	59	60	61	62	63
H2O from FTIR (ppm)			88				
Li7 (ppm)	2.16E+01	2.26E+01	2.28E+01	2.35E+01	2.32E+01	2.24E+01	2.37E+01
B11 (ppm)	1.41E+00	1.53E+00	1.61E+00	1.38E+00	1.68E+00	1.61E+00	1.59E+00
Na23 (ppm)	1.33E+02	1.41E+02	1.35E+02	1.33E+02	1.34E+02	1.32E+02	1.29E+02
Mg24 (ppm)	2.56E+04	2.55E+04	2.51E+04	2.62E+04	2.63E+04	2.41E+04	2.51E+04
Al27 (ppm)	9.25E+04	9.57E+04	9.53E+04	9.43E+04	9.42E+04	9.05E+04	9.30E+04
P31 (ppm)	1.70E+02	1.83E+02	1.61E+02	1.70E+02	1.82E+02	1.83E+02	1.79E+02
Ca43 (ppm)	1.03E+04	1.04E+04	1.05E+04	1.03E+04	1.03E+04	9.60E+03	1.02E+04
Sc45 (ppm)	1.14E+02	1.16E+02	1.14E+02	1.16E+02	1.18E+02	1.09E+02	1.12E+02
Ti49 (ppm)	3.21E+02	3.49E+02	3.26E+02	3.33E+02	3.59E+02	3.54E+02	3.61E+02
V51 (ppm)	7.87E+01	8.23E+01	7.79E+01	7.79E+01	7.87E+01	8.09E+01	7.93E+01
Cr52 (ppm)	1.04E+02	1.09E+02	1.07E+02	1.05E+02	1.09E+02	1.06E+02	1.07E+02
Mn55 (ppm)	1.42E+04	1.49E+04	1.45E+04	1.48E+04	1.49E+04	1.44E+04	1.52E+04
Fe57 (ppm)	1.88E+05	1.91E+05	1.85E+05	1.91E+05	1.89E+05	1.83E+05	1.89E+05
Y89 (ppm)	2.92E+02	3.08E+02	3.03E+02	2.86E+02	2.71E+02	2.59E+02	2.59E+02
Zr90 (ppm)	1.66E+01	1.69E+01	1.65E+01	1.58E+01	1.73E+01	1.77E+01	1.77E+01
Nb93 (ppm)	5.09E-03	4.30E-03	BD	BD	2.21E-02	BD	1.05E-02
La139 (ppm)	BD	BD	BD	2.07E-03	BD	BD	BD
Ce140 (ppm)	1.24E-02	1.58E-02	1.30E-02	1.39E-02	2.08E-02	1.01E-02	1.14E-02
Pr141 (ppm)	2.25E-02	2.39E-02	1.52E-02	1.79E-02	2.08E-02	1.65E-02	2.12E-02
Nd146 (ppm)	4.86E-01	5.39E-01	4.95E-01	4.54E-01	4.32E-01	5.01E-01	4.80E-01
Sm147 (ppm)	2.67E+00	2.94E+00	2.75E+00	2.95E+00	2.89E+00	2.73E+00	3.15E+00
Eu153 (ppm)	9.67E-01	1.03E+00	1.01E+00	9.58E-01	9.35E-01	9.27E-01	9.87E-01
Gd157 (ppm)	1.76E+01	1.90E+01	1.84E+01	1.76E+01	1.67E+01	1.65E+01	1.70E+01
Tb159 (ppm)	5.80E+00	6.00E+00	5.85E+00	5.48E+00	5.23E+00	5.18E+00	5.16E+00
Dy163 (ppm)	4.66E+01	4.83E+01	4.76E+01	4.52E+01	4.20E+01	4.05E+01	4.10E+01
Ho165 (ppm)	9.47E+00	1.01E+01	9.97E+00	9.51E+00	8.83E+00	8.61E+00	8.63E+00
Er166 (ppm)	2.85E+01	3.07E+01	2.96E+01	2.77E+01	2.61E+01	2.60E+01	2.55E+01
Tm169 (ppm)	4.21E+00	4.45E+00	4.33E+00	4.28E+00	3.99E+00	3.89E+00	3.95E+00
Yb172 (ppm)	2.83E+01	3.14E+01	3.11E+01	2.94E+01	2.74E+01	2.71E+01	2.70E+01
Lu175 (ppm)	3.91E+00	4.20E+00	4.14E+00	3.93E+00	3.62E+00	3.64E+00	3.72E+00
Hf178 (ppm)	2.55E-01	2.84E-01	2.84E-01	2.97E-01	3.17E-01	2.96E-01	3.11E-01
U238 (ppm)	7.81E-02	1.03E-01	9.18E-02	9.78E-02	1.30E-01	1.17E-01	1.20E-01

LA-ICP-MS: Garnet Ledge							
Sample Point Number	64	65	66	67	68	69	70
H2O from FTIR (ppm)			106.3				
Li7 (ppm)	2.38E+01	2.55E+01	2.52E+01	2.43E+01	2.52E+01	2.43E+01	2.51E+01
B11 (ppm)	1.74E+00	1.83E+00	1.66E+00	1.84E+00	1.67E+00	1.66E+00	1.57E+00
Na23 (ppm)	1.33E+02	1.36E+02	1.38E+02	1.40E+02	1.44E+02	1.45E+02	1.50E+02
Mg24 (ppm)	2.57E+04	2.60E+04	2.50E+04	2.47E+04	2.49E+04	2.48E+04	2.54E+04
Al27 (ppm)	9.48E+04	9.74E+04	9.26E+04	9.52E+04	9.30E+04	9.32E+04	9.17E+04
P31 (ppm)	1.90E+02	1.95E+02	1.98E+02	2.02E+02	2.06E+02	2.07E+02	2.02E+02
Ca43 (ppm)	1.06E+04	1.03E+04	1.01E+04	1.04E+04	1.03E+04	9.81E+03	1.02E+04
Sc45 (ppm)	1.14E+02	1.17E+02	1.11E+02	1.11E+02	1.09E+02	1.09E+02	1.10E+02
Ti49 (ppm)	3.83E+02	4.40E+02	4.18E+02	4.37E+02	4.40E+02	4.36E+02	4.54E+02
V51 (ppm)	8.27E+01	9.12E+01	8.67E+01	9.17E+01	9.07E+01	8.62E+01	8.95E+01
Cr52 (ppm)	1.03E+02	1.08E+02	1.06E+02	1.09E+02	1.08E+02	1.03E+02	1.10E+02
Mn55 (ppm)	1.53E+04	1.60E+04	1.54E+04	1.58E+04	1.57E+04	1.56E+04	1.56E+04
Fe57 (ppm)	1.87E+05	1.90E+05	1.86E+05	1.85E+05	1.94E+05	1.84E+05	1.87E+05
Y89 (ppm)	2.49E+02	2.69E+02	2.55E+02	2.65E+02	2.67E+02	2.57E+02	2.71E+02
Zr90 (ppm)	1.84E+01	1.98E+01	1.91E+01	2.09E+01	2.16E+01	2.04E+01	2.11E+01
Nb93 (ppm)	1.28E-02	2.17E-02	1.14E-02	2.52E-02	1.20E-02	BD	2.19E-02
La139 (ppm)	BD	BD	BD	BD	BD	BD	BD
Ce140 (ppm)	1.32E-02	1.72E-02	1.28E-02	1.17E-02	1.60E-02	1.07E-02	1.50E-02
Pr141 (ppm)	2.34E-02	2.60E-02	1.82E-02	2.42E-02	1.70E-02	2.27E-02	2.08E-02
Nd146 (ppm)	4.79E-01	5.82E-01	5.60E-01	5.49E-01	6.28E-01	5.71E-01	5.38E-01
Sm147 (ppm)	2.94E+00	3.19E+00	2.88E+00	3.19E+00	3.12E+00	2.91E+00	3.03E+00
Eu153 (ppm)	1.09E+00	1.10E+00	9.63E-01	1.06E+00	1.09E+00	1.01E+00	1.07E+00
Gd157 (ppm)	1.76E+01	1.81E+01	1.71E+01	1.79E+01	1.81E+01	1.70E+01	1.76E+01
Tb159 (ppm)	5.23E+00	5.36E+00	5.26E+00	5.37E+00	5.31E+00	5.04E+00	5.35E+00
Dy163 (ppm)	3.99E+01	4.25E+01	4.03E+01	4.22E+01	4.19E+01	4.06E+01	4.20E+01
Ho165 (ppm)	8.20E+00	8.72E+00	8.40E+00	8.62E+00	8.86E+00	8.52E+00	8.99E+00
Er166 (ppm)	2.45E+01	2.60E+01	2.55E+01	2.66E+01	2.67E+01	2.57E+01	2.80E+01
Tm169 (ppm)	3.81E+00	4.04E+00	4.03E+00	4.07E+00	4.18E+00	4.08E+00	4.32E+00
Yb172 (ppm)	2.61E+01	2.82E+01	2.75E+01	2.89E+01	2.95E+01	2.85E+01	3.10E+01
Lu175 (ppm)	3.42E+00	3.67E+00	3.81E+00	3.94E+00	3.95E+00	3.87E+00	4.28E+00
Hf178 (ppm)	3.02E-01	3.61E-01	3.42E-01	3.61E-01	3.37E-01	3.59E-01	3.62E-01
U238 (ppm)	1.46E-01	1.53E-01	1.21E-01	1.31E-01	1.32E-01	1.51E-01	1.77E-01

LA-ICP-MS: Garnet Ledge				
Sample Point Number	71	72	73	74
H2O from FTIR (ppm)			118.2	
Li7 (ppm)	2.60E+01	2.81E+01	2.69E+01	2.64E+01
B11 (ppm)	1.74E+00	1.47E+00	1.73E+00	1.50E+00
Na23 (ppm)	1.56E+02	1.62E+02	1.57E+02	1.49E+02
Mg24 (ppm)	2.53E+04	2.54E+04	2.53E+04	2.56E+04
Al27 (ppm)	9.62E+04	9.65E+04	9.48E+04	9.51E+04
P31 (ppm)	2.28E+02	2.37E+02	2.47E+02	2.14E+02
Ca43 (ppm)	1.05E+04	1.03E+04	1.11E+04	1.05E+04
Sc45 (ppm)	1.19E+02	1.16E+02	1.16E+02	1.14E+02
Ti49 (ppm)	4.91E+02	5.18E+02	5.39E+02	4.93E+02
V51 (ppm)	9.46E+01	9.54E+01	9.59E+01	9.14E+01
Cr52 (ppm)	1.17E+02	1.18E+02	1.17E+02	1.16E+02
Mn55 (ppm)	1.64E+04	1.67E+04	1.64E+04	1.66E+04
Fe57 (ppm)	1.88E+05	1.92E+05	1.92E+05	1.84E+05
Y89 (ppm)	2.76E+02	2.83E+02	2.86E+02	2.79E+02
Zr90 (ppm)	2.28E+01	2.31E+01	2.36E+01	2.22E+01
Nb93 (ppm)	2.14E-02	4.96E-02	2.30E-02	2.12E-02
La139 (ppm)	BD	BD	1.43E-03	BD
Ce140 (ppm)	1.42E-02	1.51E-02	1.50E-02	2.33E-02
Pr141 (ppm)	1.87E-02	2.47E-02	2.01E-02	2.28E-02
Nd146 (ppm)	5.76E-01	5.88E-01	6.78E-01	6.30E-01
Sm147 (ppm)	2.98E+00	3.12E+00	3.25E+00	3.06E+00
Eu153 (ppm)	1.07E+00	1.11E+00	1.17E+00	1.08E+00
Gd157 (ppm)	1.78E+01	1.82E+01	1.85E+01	1.80E+01
Tb159 (ppm)	5.31E+00	5.80E+00	5.74E+00	5.35E+00
Dy163 (ppm)	4.29E+01	4.52E+01	4.56E+01	4.34E+01
Ho165 (ppm)	9.22E+00	9.49E+00	9.53E+00	9.28E+00
Er166 (ppm)	2.79E+01	2.96E+01	2.93E+01	2.86E+01
Tm169 (ppm)	4.41E+00	4.56E+00	4.69E+00	4.46E+00
Yb172 (ppm)	3.12E+01	3.20E+01	3.15E+01	3.12E+01
Lu175 (ppm)	4.35E+00	4.54E+00	4.38E+00	4.36E+00
Hf178 (ppm)	3.89E-01	4.32E-01	4.19E-01	3.76E-01
U238 (ppm)	1.64E-01	1.55E-01	1.79E-01	1.75E-01

EPMA: Empire Mountain sample, Wt %, core to rim							
No.	MgO	MnO	TiO2	Al2O3	FeO	CaO	SiO2
1	0.023	1.195	0.348	16.05	8.890	34.58	38.89
2	0.010	1.028	0.368	12.73	12.71	34.11	38.18
3	0.023	1.080	0.275	11.24	14.74	34.01	38.36
4	0.032	1.570	0.256	13.86	11.58	33.92	38.89
5	0.021	1.138	0.219	10.14	16.19	33.73	38.14
6	0.064	0.841	0.281	9.910	16.14	34.07	38.00
7	0.060	1.167	0.237	10.94	14.32	33.31	37.24
8	0.055	1.060	0.248	10.28	15.68	33.64	38.06
9	0.085	1.276	0.987	8.810	16.86	32.97	37.62
10	0.053	2.210	0.372	14.05	12.88	32.01	40.84
11	0.020	2.120	0.030	11.89	14.11	31.62	36.96
12	0.054	2.600	0.140	15.57	11.77	31.69	40.62
13	0.041	1.880	0.290	12.68	13.57	32.55	38.00
14	BD	0.037	BD	BD	0.236	0.126	101.7
15	0.033	2.380	0.169	13.02	13.18	32.12	37.66
16	0.037	2.320	0.193	13.61	12.90	31.82	39.11
17	0.027	1.880	0.456	10.82	15.34	32.80	37.52
18	0.030	1.940	0.292	11.06	15.48	32.54	37.56
19	0.047	2.380	0.185	12.21	14.82	30.65	37.46
20	0.057	2.160	0.230	12.60	13.29	31.79	37.04
21	0.072	1.820	0.646	12.57	13.01	33.03	37.70
22	0.054	2.130	0.498	13.36	13.11	32.35	39.43
23	0.040	2.330	0.275	14.40	11.46	32.30	37.98
24	0.037	2.480	0.221	15.38	10.93	31.78	38.70
25	0.031	2.370	0.174	13.14	12.57	31.44	38.04
26	0.013	2.400	0.133	12.50	14.39	31.79	38.58
27	0.032	2.480	0.095	13.30	13.19	32.02	38.11

LA-ICP-MS: Empire Mountain						
Sample point no.	1	2	3	4	5	6
Distance from Rim (µm)	10637.0	10592.0	10546.9	10501.8	10456.7	10411.7
Li7 (ppm)	1.48E+00	1.47E+00	1.05E+00	1.72E+00	2.27E+00	1.65E+00
B11 (ppm)	3.90E+00	3.75E+00	3.89E+00	4.12E+00	3.93E+00	4.32E+00
Na23 (ppm)	6.04E+02	3.54E+02	6.13E+02	2.43E+02	1.80E+02	6.03E+02
Mg24 (ppm)	2.39E+02	2.95E+02	2.77E+02	3.14E+02	3.04E+02	2.94E+02
Al27 (ppm)	6.89E+04	7.11E+04	7.01E+04	7.24E+04	7.09E+04	7.13E+04
P31 (ppm)	2.40E+01	3.35E-01	1.16E+01	6.64E+00	1.22E+01	1.52E+01
Ca43 (ppm)	2.34E+05	2.45E+05	2.37E+05	2.43E+05	2.34E+05	2.36E+05
Sc45 (ppm)	7.42E+00	4.52E+00	5.05E+00	4.41E+00	5.48E+00	5.70E+00
Ti49 (ppm)	1.16E+03	1.12E+03	1.11E+03	1.15E+03	1.20E+03	1.26E+03
V51 (ppm)	6.80E+01	5.55E+01	5.62E+01	5.47E+01	5.93E+01	6.08E+01
Cr52 (ppm)	5.16E+00	2.40E+00	3.41E+00	8.29E+01	1.83E+02	8.98E+01
Mn55 (ppm)	2.04E+04	1.99E+04	1.98E+04	2.08E+04	2.08E+04	2.06E+04
Fe57 (ppm)	1.06E+05	1.09E+05	1.08E+05	1.05E+05	1.00E+05	9.91E+04
Y89 (ppm)	2.50E+01	1.83E+01	1.95E+01	1.86E+01	2.03E+01	2.12E+01
Zr90 (ppm)	2.49E+01	2.85E+01	2.73E+01	2.83E+01	2.58E+01	2.51E+01
Nb93 (ppm)	8.78E+00	8.09E+00	8.09E+00	7.87E+00	7.87E+00	8.10E+00
La139 (ppm)	2.01E-02	1.30E-02	6.74E-03	1.04E-02	7.21E-03	9.82E-03
Ce140 (ppm)	1.66E-01	1.52E-01	1.72E-01	1.56E-01	1.43E-01	1.33E-01
Pr141 (ppm)	1.07E-01	9.40E-02	9.81E-02	1.13E-01	9.11E-02	1.01E-01
Nd146 (ppm)	1.49E+00	1.73E+00	1.56E+00	1.59E+00	1.33E+00	1.46E+00
Sm147 (ppm)	1.86E+00	2.45E+00	2.07E+00	2.47E+00	2.12E+00	2.33E+00
Eu153 (ppm)	4.38E-01	6.03E-01	5.54E-01	5.71E-01	5.68E-01	4.77E-01
Gd157 (ppm)	3.77E+00	4.25E+00	4.06E+00	3.83E+00	4.42E+00	3.80E+00
Tb159 (ppm)	7.02E-01	6.02E-01	5.81E-01	6.01E-01	5.85E-01	6.29E-01
Dy163 (ppm)	3.76E+00	3.45E+00	3.23E+00	3.81E+00	3.76E+00	3.95E+00
Ho165 (ppm)	8.57E-01	6.04E-01	6.49E-01	6.15E-01	7.08E-01	7.73E-01
Er166 (ppm)	2.68E+00	1.93E+00	2.01E+00	1.76E+00	2.18E+00	2.25E+00
Tm169 (ppm)	4.00E-01	2.35E-01	2.68E-01	2.59E-01	3.02E-01	3.31E-01
Yb172 (ppm)	3.04E+00	1.84E+00	2.07E+00	1.98E+00	2.21E+00	2.28E+00
Lu175 (ppm)	4.39E-01	2.72E-01	2.99E-01	2.30E-01	3.43E-01	3.84E-01
Hf178 (ppm)	7.12E-01	7.94E-01	7.76E-01	7.10E-01	7.83E-01	6.62E-01
U238 (ppm)	6.60E-01	9.21E-01	8.05E-01	9.87E-01	8.19E-01	6.91E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	7	8	9	10	11	12
Distance from Rim (µm)	10366.6	10321.5	10276.4	10231.4	10186.3	10141.2
Li7 (ppm)	9.12E-01	1.44E+00	1.17E+00	1.12E+00	1.22E+00	1.60E+00
B11 (ppm)	4.06E+00	3.71E+00	4.02E+00	4.42E+00	4.64E+00	4.52E+00
Na23 (ppm)	1.71E+03	5.35E+03	1.15E+03	5.43E+02	3.12E+02	6.11E+02
Mg24 (ppm)	2.91E+02	3.88E+02	2.15E+02	1.90E+02	2.18E+02	2.19E+02
Al27 (ppm)	7.43E+04	7.37E+04	6.26E+04	6.26E+04	6.55E+04	6.71E+04
P31 (ppm)	2.48E+01	-4.54E+00	3.25E+00	1.53E+01	3.54E+01	1.49E+01
Ca43 (ppm)	2.44E+05	2.20E+05	2.14E+05	2.29E+05	2.44E+05	2.39E+05
Sc45 (ppm)	5.93E+00	4.00E+00	6.45E+00	8.08E+00	9.92E+00	9.97E+00
Ti49 (ppm)	1.13E+03	9.13E+02	9.17E+02	1.16E+03	1.16E+03	2.22E+03
V51 (ppm)	6.19E+01	4.93E+01	5.70E+01	6.50E+01	7.10E+01	7.99E+01
Cr52 (ppm)	3.84E+01	5.85E+00	1.06E+01	1.19E+01	1.15E+02	1.46E+01
Mn55 (ppm)	2.10E+04	1.89E+04	1.84E+04	1.83E+04	2.07E+04	1.80E+04
Fe57 (ppm)	1.07E+05	9.55E+04	9.63E+04	1.06E+05	1.19E+05	1.11E+05
Y89 (ppm)	2.18E+01	1.63E+01	2.08E+01	2.51E+01	2.92E+01	2.87E+01
Zr90 (ppm)	2.48E+01	2.02E+01	1.77E+01	2.21E+01	2.26E+01	3.12E+01
Nb93 (ppm)	7.18E+00	7.40E+00	5.79E+00	6.50E+00	5.55E+00	9.46E+00
La139 (ppm)	9.10E-03	5.37E-03	1.12E-02	2.01E-02	1.46E-02	1.17E-02
Ce140 (ppm)	1.78E-01	1.19E-01	1.21E-01	1.73E-01	2.14E-01	2.06E-01
Pr141 (ppm)	1.19E-01	6.79E-02	8.62E-02	1.07E-01	1.22E-01	1.05E-01
Nd146 (ppm)	1.84E+00	9.92E-01	1.21E+00	1.30E+00	1.72E+00	1.28E+00
Sm147 (ppm)	2.47E+00	1.59E+00	1.83E+00	1.42E+00	1.72E+00	1.57E+00
Eu153 (ppm)	5.68E-01	3.93E-01	4.16E-01	3.65E-01	3.38E-01	3.42E-01
Gd157 (ppm)	4.37E+00	3.28E+00	3.07E+00	3.13E+00	3.65E+00	3.50E+00
Tb159 (ppm)	6.88E-01	5.08E-01	5.40E-01	5.84E-01	8.12E-01	6.45E-01
Dy163 (ppm)	3.48E+00	2.89E+00	3.52E+00	3.82E+00	4.57E+00	4.36E+00
Ho165 (ppm)	7.51E-01	5.25E-01	7.09E-01	8.42E-01	8.58E-01	9.66E-01
Er166 (ppm)	2.29E+00	1.53E+00	2.39E+00	2.56E+00	3.24E+00	3.12E+00
Tm169 (ppm)	4.11E-01	1.66E-01	3.38E-01	3.50E-01	5.06E-01	4.62E-01
Yb172 (ppm)	2.63E+00	1.47E+00	2.80E+00	3.11E+00	3.57E+00	3.49E+00
Lu175 (ppm)	3.78E-01	2.07E-01	4.21E-01	5.00E-01	5.38E-01	5.23E-01
Hf178 (ppm)	7.04E-01	5.62E-01	5.72E-01	6.99E-01	6.23E-01	1.11E+00
U238 (ppm)	8.49E-01	4.66E-01	5.09E-01	4.85E-01	5.69E-01	6.39E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	13	14	15	16	17	18
Distance from Rim (µm)	10096.1	10051.1	10006.0	9961.0	9915.9	9870.8
Li7 (ppm)	1.55E+00	1.34E+00	1.42E+00	1.14E+00	1.02E+00	1.32E+00
B11 (ppm)	4.33E+00	3.94E+00	4.58E+00	3.61E+00	4.27E+00	4.35E+00
Na23 (ppm)	3.13E+02	2.80E+01	4.36E+02	1.02E+03	6.51E+02	8.44E+02
Mg24 (ppm)	2.04E+02	1.77E+02	2.00E+02	1.60E+02	1.62E+02	1.73E+02
Al27 (ppm)	6.32E+04	6.09E+04	6.76E+04	6.66E+04	6.71E+04	6.85E+04
P31 (ppm)	4.54E+00	1.70E+01	1.59E+01	8.47E+00	1.13E+01	1.03E+01
Ca43 (ppm)	2.44E+05	2.48E+05	2.42E+05	2.36E+05	2.46E+05	2.41E+05
Sc45 (ppm)	1.08E+01	1.07E+01	8.43E+00	7.93E+00	7.73E+00	7.23E+00
Ti49 (ppm)	2.23E+03	2.37E+03	1.32E+03	9.03E+02	7.74E+02	8.94E+02
V51 (ppm)	8.31E+01	8.13E+01	7.06E+01	6.03E+01	6.17E+01	7.47E+01
Cr52 (ppm)	1.69E+01	2.17E+01	9.78E+00	7.67E+00	7.18E+00	5.83E+00
Mn55 (ppm)	1.77E+04	1.75E+04	1.96E+04	1.94E+04	1.96E+04	2.05E+04
Fe57 (ppm)	1.17E+05	1.21E+05	1.12E+05	1.13E+05	1.13E+05	1.10E+05
Y89 (ppm)	2.97E+01	2.92E+01	2.56E+01	2.32E+01	2.29E+01	2.25E+01
Zr90 (ppm)	3.20E+01	3.29E+01	2.24E+01	1.94E+01	1.71E+01	1.79E+01
Nb93 (ppm)	9.09E+00	9.63E+00	6.92E+00	4.81E+00	5.44E+00	5.72E+00
La139 (ppm)	1.64E-02	1.67E-02	1.70E-02	2.21E-02	1.35E-02	1.29E-02
Ce140 (ppm)	1.79E-01	1.23E-01	1.97E-01	1.81E-01	1.51E-01	1.79E-01
Pr141 (ppm)	1.21E-01	1.01E-01	1.03E-01	7.58E-02	9.00E-02	7.56E-02
Nd146 (ppm)	1.38E+00	1.17E+00	1.25E+00	1.31E+00	1.31E+00	1.19E+00
Sm147 (ppm)	1.61E+00	1.37E+00	1.80E+00	1.45E+00	1.66E+00	1.49E+00
Eu153 (ppm)	3.34E-01	3.00E-01	3.96E-01	3.41E-01	3.96E-01	3.70E-01
Gd157 (ppm)	3.28E+00	2.99E+00	3.15E+00	3.03E+00	3.27E+00	3.24E+00
Tb159 (ppm)	6.37E-01	5.94E-01	6.08E-01	5.21E-01	5.86E-01	5.50E-01
Dy163 (ppm)	4.41E+00	4.29E+00	4.01E+00	3.77E+00	3.73E+00	3.56E+00
Ho165 (ppm)	9.70E-01	1.00E+00	8.87E-01	7.66E-01	6.99E-01	8.26E-01
Er166 (ppm)	3.29E+00	3.37E+00	2.85E+00	2.37E+00	2.30E+00	2.25E+00
Tm169 (ppm)	4.45E-01	5.07E-01	4.13E-01	3.63E-01	3.69E-01	3.45E-01
Yb172 (ppm)	3.69E+00	3.67E+00	3.27E+00	2.68E+00	2.63E+00	2.53E+00
Lu175 (ppm)	6.08E-01	5.89E-01	4.82E-01	4.57E-01	3.99E-01	3.80E-01
Hf178 (ppm)	1.13E+00	1.08E+00	7.13E-01	5.98E-01	4.90E-01	6.18E-01
U238 (ppm)	6.05E-01	5.23E-01	5.00E-01	3.91E-01	4.74E-01	4.07E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	19	20	21	22	23	24
Distance from Rim (µm)	9825.7	9780.7	9735.6	9690.5	9645.4	9600.4
Li7 (ppm)	9.81E-01	1.40E+00	1.48E+00	7.21E-01	8.88E-01	3.38E-01
B11 (ppm)	4.03E+00	4.29E+00	4.03E+00	4.13E+00	4.07E+00	3.96E+00
Na23 (ppm)	2.71E+02	5.09E+01	4.92E+01	3.59E+01	2.79E+01	7.10E+00
Mg24 (ppm)	1.73E+02	1.38E+02	1.49E+02	1.44E+02	1.54E+02	1.36E+02
Al27 (ppm)	6.85E+04	6.50E+04	6.27E+04	6.01E+04	5.89E+04	6.36E+04
P31 (ppm)	6.29E+00	1.32E+00	1.23E+01	-4.38E+00	8.13E+00	5.62E+00
Ca43 (ppm)	2.43E+05	2.49E+05	2.44E+05	2.44E+05	2.46E+05	2.44E+05
Sc45 (ppm)	7.15E+00	7.50E+00	5.16E+00	7.42E+00	9.39E+00	4.15E+00
Ti49 (ppm)	7.12E+02	9.53E+02	1.10E+03	1.55E+03	1.97E+03	3.33E+02
V51 (ppm)	6.12E+01	6.00E+01	5.97E+01	6.80E+01	7.43E+01	3.26E+01
Cr52 (ppm)	6.93E+00	1.11E+01	8.07E+00	1.57E+01	1.65E+01	1.04E+01
Mn55 (ppm)	2.14E+04	1.94E+04	1.87E+04	1.79E+04	1.75E+04	1.84E+04
Fe57 (ppm)	1.12E+05	1.20E+05	1.17E+05	1.16E+05	1.22E+05	1.16E+05
Y89 (ppm)	2.13E+01	2.21E+01	2.01E+01	2.13E+01	2.58E+01	1.12E+01
Zr90 (ppm)	1.56E+01	1.85E+01	2.29E+01	2.38E+01	3.03E+01	1.67E+01
Nb93 (ppm)	3.65E+00	4.68E+00	5.82E+00	6.91E+00	9.13E+00	3.02E+00
La139 (ppm)	1.73E-02	1.62E-02	1.75E-02	1.42E-02	7.34E-03	6.11E-03
Ce140 (ppm)	1.59E-01	1.73E-01	1.14E-01	1.28E-01	1.50E-01	5.80E-02
Pr141 (ppm)	9.23E-02	8.21E-02	6.06E-02	7.09E-02	7.42E-02	3.66E-02
Nd146 (ppm)	1.17E+00	1.05E+00	7.56E-01	7.44E-01	8.82E-01	7.13E-01
Sm147 (ppm)	1.42E+00	1.22E+00	8.47E-01	8.69E-01	1.05E+00	1.07E+00
Eu153 (ppm)	3.69E-01	3.23E-01	1.87E-01	2.25E-01	2.20E-01	3.32E-01
Gd157 (ppm)	2.85E+00	2.69E+00	2.58E+00	2.15E+00	2.63E+00	2.52E+00
Tb159 (ppm)	5.61E-01	5.36E-01	4.79E-01	4.43E-01	4.90E-01	3.49E-01
Dy163 (ppm)	3.48E+00	3.55E+00	2.95E+00	3.66E+00	4.03E+00	2.52E+00
Ho165 (ppm)	7.13E-01	7.41E-01	6.90E-01	6.44E-01	8.22E-01	3.92E-01
Er166 (ppm)	2.12E+00	2.19E+00	2.01E+00	2.32E+00	2.57E+00	1.04E+00
Tm169 (ppm)	3.57E-01	3.21E-01	2.36E-01	3.66E-01	3.86E-01	1.05E-01
Yb172 (ppm)	2.31E+00	2.67E+00	2.13E+00	2.21E+00	2.74E+00	8.21E-01
Lu175 (ppm)	3.98E-01	4.16E-01	3.30E-01	3.45E-01	4.98E-01	1.34E-01
Hf178 (ppm)	4.83E-01	6.05E-01	6.25E-01	8.64E-01	1.05E+00	3.09E-01
U238 (ppm)	3.75E-01	4.34E-01	4.90E-01	3.95E-01	4.94E-01	3.15E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	25	26	27	28	29	30
Distance from Rim (µm)	9555.3	9510.2	9465.1	9420.1	9375.0	9329.9
Li7 (ppm)	8.24E-02	6.11E-01	1.27E+00	1.92E+00	1.70E+00	2.00E+00
B11 (ppm)	3.90E+00	3.49E+00	3.80E+00	4.30E+00	4.17E+00	3.96E+00
Na23 (ppm)	7.17E+00	8.35E+00	8.63E-01	2.57E+01	1.67E+01	6.92E+01
Mg24 (ppm)	1.44E+02	1.44E+02	1.88E+02	2.01E+02	2.49E+02	2.95E+02
Al27 (ppm)	6.51E+04	6.48E+04	6.87E+04	6.91E+04	6.93E+04	7.26E+04
P31 (ppm)	1.54E+01	3.73E+00	1.45E+01	1.86E+01	1.30E+01	1.91E+00
Ca43 (ppm)	2.46E+05	2.47E+05	2.44E+05	2.41E+05	2.41E+05	2.35E+05
Sc45 (ppm)	3.75E+00	2.97E+00	2.49E+00	2.24E+00	2.44E+00	2.87E+00
Ti49 (ppm)	2.84E+02	2.70E+02	7.34E+02	8.71E+02	9.32E+02	1.03E+03
V51 (ppm)	3.13E+01	3.22E+01	4.85E+01	5.48E+01	5.07E+01	4.80E+01
Cr52 (ppm)	1.09E+01	6.75E+00	4.80E+00	2.64E+00	3.33E+00	1.61E+00
Mn55 (ppm)	1.96E+04	1.87E+04	2.01E+04	1.99E+04	1.96E+04	1.99E+04
Fe57 (ppm)	1.18E+05	1.15E+05	1.12E+05	1.06E+05	1.06E+05	1.01E+05
Y89 (ppm)	1.01E+01	1.03E+01	1.41E+01	1.55E+01	1.54E+01	1.41E+01
Zr90 (ppm)	1.58E+01	1.38E+01	1.91E+01	2.03E+01	2.37E+01	2.36E+01
Nb93 (ppm)	2.84E+00	3.85E+00	6.49E+00	8.32E+00	9.05E+00	7.51E+00
La139 (ppm)	3.46E-03	8.94E-03	3.52E-03	2.04E-02	2.03E-02	6.81E-03
Ce140 (ppm)	3.96E-02	7.04E-02	4.11E-02	4.79E-02	9.43E-02	9.63E-02
Pr141 (ppm)	2.80E-02	2.93E-02	1.67E-02	2.36E-02	5.06E-02	5.46E-02
Nd146 (ppm)	4.52E-01	5.10E-01	3.88E-01	4.48E-01	8.60E-01	1.01E+00
Sm147 (ppm)	1.31E+00	1.11E+00	1.03E+00	8.57E-01	1.80E+00	2.11E+00
Eu153 (ppm)	2.59E-01	3.12E-01	2.69E-01	2.88E-01	4.10E-01	5.49E-01
Gd157 (ppm)	2.45E+00	2.88E+00	2.82E+00	2.92E+00	3.73E+00	4.05E+00
Tb159 (ppm)	3.90E-01	5.17E-01	5.36E-01	5.75E-01	5.45E-01	5.15E-01
Dy163 (ppm)	2.22E+00	2.51E+00	3.16E+00	3.24E+00	3.36E+00	2.95E+00
Ho165 (ppm)	3.55E-01	4.04E-01	5.01E-01	5.87E-01	5.28E-01	5.06E-01
Er166 (ppm)	8.26E-01	9.18E-01	1.31E+00	1.45E+00	1.39E+00	1.33E+00
Tm169 (ppm)	1.00E-01	8.60E-02	1.68E-01	1.67E-01	1.78E-01	2.13E-01
Yb172 (ppm)	6.31E-01	6.42E-01	9.76E-01	1.27E+00	1.17E+00	1.34E+00
Lu175 (ppm)	8.85E-02	6.83E-02	1.49E-01	1.42E-01	1.81E-01	1.47E-01
Hf178 (ppm)	2.23E-01	2.10E-01	5.00E-01	4.62E-01	5.17E-01	6.03E-01
U238 (ppm)	2.40E-01	2.76E-01	2.45E-01	3.11E-01	6.44E-01	7.56E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	31	32	33	34	35	36
Distance from Rim (µm)	9284.8	9239.8	9194.7	9149.7	9104.6	9059.5
Li7 (ppm)	1.46E+00	1.99E+00	2.77E+00	2.93E+00	3.99E+00	4.03E+00
B11 (ppm)	3.46E+00	3.78E+00	3.50E+00	4.05E+00	3.98E+00	4.48E+00
Na23 (ppm)	3.37E+03	3.62E+01	1.29E+01	3.13E+01	4.84E+01	5.43E+01
Mg24 (ppm)	2.82E+02	2.34E+02	2.38E+02	2.96E+02	3.22E+02	3.38E+02
Al27 (ppm)	7.11E+04	7.59E+04	7.77E+04	7.60E+04	7.54E+04	7.36E+04
P31 (ppm)	1.76E+01	2.50E+01	2.15E+01	2.01E+01	1.72E+01	7.55E+00
Ca43 (ppm)	2.22E+05	2.42E+05	2.42E+05	2.46E+05	2.45E+05	2.41E+05
Sc45 (ppm)	7.50E+00	2.24E+00	2.84E+00	3.44E+00	3.86E+00	4.76E+00
Ti49 (ppm)	1.30E+03	1.31E+03	1.95E+03	2.80E+03	3.22E+03	3.40E+03
V51 (ppm)	6.65E+01	4.59E+01	7.71E+01	8.99E+01	9.70E+01	9.32E+01
Cr52 (ppm)	5.83E+00	2.93E+00	-1.88E-02	7.74E-01	1.71E+00	2.19E+00
Mn55 (ppm)	1.84E+04	2.00E+04	1.86E+04	1.86E+04	1.82E+04	1.75E+04
Fe57 (ppm)	9.51E+04	9.40E+04	9.05E+04	9.32E+04	9.26E+04	9.55E+04
Y89 (ppm)	2.39E+01	1.40E+01	1.84E+01	2.18E+01	2.14E+01	2.21E+01
Zr90 (ppm)	2.31E+01	2.55E+01	2.95E+01	3.68E+01	3.83E+01	4.29E+01
Nb93 (ppm)	7.01E+00	8.80E+00	1.03E+01	1.48E+01	1.27E+01	1.39E+01
La139 (ppm)	1.71E-02	1.10E-03	3.12E-03	5.53E-03	9.75E-03	1.79E-02
Ce140 (ppm)	2.04E-01	8.13E-02	5.15E-02	7.11E-02	9.17E-02	1.32E-01
Pr141 (ppm)	1.24E-01	4.29E-02	3.36E-02	3.88E-02	4.81E-02	5.45E-02
Nd146 (ppm)	1.82E+00	9.23E-01	6.82E-01	1.05E+00	8.73E-01	1.32E+00
Sm147 (ppm)	2.28E+00	1.67E+00	1.54E+00	1.57E+00	1.81E+00	2.21E+00
Eu153 (ppm)	4.82E-01	4.54E-01	3.75E-01	4.24E-01	4.43E-01	4.85E-01
Gd157 (ppm)	3.54E+00	3.14E+00	2.88E+00	3.42E+00	3.36E+00	3.46E+00
Tb159 (ppm)	6.52E-01	3.84E-01	5.07E-01	5.88E-01	5.80E-01	6.03E-01
Dy163 (ppm)	3.85E+00	2.74E+00	2.58E+00	3.59E+00	3.27E+00	3.27E+00
Ho165 (ppm)	8.21E-01	5.40E-01	6.62E-01	7.12E-01	6.90E-01	7.60E-01
Er166 (ppm)	2.49E+00	1.42E+00	1.95E+00	2.04E+00	2.25E+00	2.12E+00
Tm169 (ppm)	3.67E-01	1.64E-01	2.80E-01	3.16E-01	3.56E-01	3.43E-01
Yb172 (ppm)	2.72E+00	1.30E+00	1.76E+00	2.19E+00	2.59E+00	2.10E+00
Lu175 (ppm)	4.66E-01	1.52E-01	2.92E-01	3.40E-01	3.16E-01	3.15E-01
Hf178 (ppm)	6.89E-01	6.30E-01	7.71E-01	1.16E+00	1.23E+00	1.44E+00
U238 (ppm)	7.54E-01	4.98E-01	4.24E-01	5.63E-01	6.81E-01	9.30E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	37	38	39	40	41	42
Distance from Rim (µm)	9014.4	8969.4	8924.3	8879.2	8834.1	8789.1
Li7 (ppm)	2.98E+00	3.16E+00	2.31E+00	2.55E+00	2.26E+00	2.30E+00
B11 (ppm)	4.30E+00	4.12E+00	4.49E+00	4.45E+00	4.04E+00	3.62E+00
Na23 (ppm)	4.91E+01	7.10E+01	6.33E+01	3.09E+02	1.01E+02	1.87E+01
Mg24 (ppm)	3.70E+02	4.15E+02	4.27E+02	3.96E+02	4.09E+02	4.16E+02
Al27 (ppm)	7.02E+04	6.75E+04	6.73E+04	6.63E+04	6.88E+04	6.63E+04
P31 (ppm)	7.17E+00	3.89E+00	6.52E+00	9.71E+00	1.49E+01	3.76E+00
Ca43 (ppm)	2.40E+05	2.45E+05	2.46E+05	2.41E+05	2.46E+05	2.37E+05
Sc45 (ppm)	5.81E+00	5.38E+00	1.04E+01	9.88E+00	7.77E+00	5.50E+00
Ti49 (ppm)	3.02E+03	4.01E+03	5.06E+03	4.56E+03	4.36E+03	4.19E+03
V51 (ppm)	8.72E+01	7.84E+01	9.53E+01	9.26E+01	9.07E+01	7.84E+01
Cr52 (ppm)	3.37E+00	2.29E+00	5.35E+00	6.14E+00	3.33E+00	3.75E+00
Mn55 (ppm)	1.73E+04	1.53E+04	1.59E+04	1.57E+04	1.62E+04	1.49E+04
Fe57 (ppm)	9.55E+04	1.00E+05	1.05E+05	1.04E+05	1.07E+05	9.83E+04
Y89 (ppm)	2.47E+01	2.24E+01	3.01E+01	3.19E+01	2.82E+01	2.24E+01
Zr90 (ppm)	4.54E+01	6.53E+01	7.48E+01	7.27E+01	7.31E+01	7.29E+01
Nb93 (ppm)	1.29E+01	1.68E+01	1.75E+01	1.64E+01	1.76E+01	1.78E+01
La139 (ppm)	3.33E-02	2.09E-02	1.95E-02	2.48E-02	1.59E-02	1.21E-02
Ce140 (ppm)	2.53E-01	3.07E-01	3.65E-01	3.22E-01	2.75E-01	3.02E-01
Pr141 (ppm)	1.62E-01	1.84E-01	2.40E-01	2.14E-01	1.98E-01	2.07E-01
Nd146 (ppm)	2.35E+00	3.17E+00	3.67E+00	3.46E+00	3.13E+00	3.40E+00
Sm147 (ppm)	3.04E+00	4.66E+00	4.92E+00	4.05E+00	4.14E+00	4.26E+00
Eu153 (ppm)	6.51E-01	9.02E-01	9.51E-01	9.70E-01	8.27E-01	8.25E-01
Gd157 (ppm)	4.50E+00	4.88E+00	5.20E+00	4.63E+00	4.63E+00	4.30E+00
Tb159 (ppm)	6.71E-01	6.59E-01	8.35E-01	6.77E-01	7.27E-01	6.12E-01
Dy163 (ppm)	3.94E+00	3.99E+00	4.50E+00	4.75E+00	4.36E+00	3.77E+00
Ho165 (ppm)	8.65E-01	7.69E-01	1.09E+00	9.99E-01	8.79E-01	7.68E-01
Er166 (ppm)	2.62E+00	2.39E+00	3.36E+00	3.19E+00	3.00E+00	2.43E+00
Tm169 (ppm)	3.14E-01	3.21E-01	5.00E-01	4.76E-01	4.46E-01	3.48E-01
Yb172 (ppm)	2.91E+00	2.38E+00	3.66E+00	4.04E+00	3.40E+00	2.62E+00
Lu175 (ppm)	4.28E-01	3.30E-01	5.53E-01	5.74E-01	5.10E-01	3.58E-01
Hf178 (ppm)	1.32E+00	1.74E+00	2.30E+00	2.08E+00	2.16E+00	2.07E+00
U238 (ppm)	1.52E+00	2.54E+00	3.27E+00	2.91E+00	2.63E+00	2.70E+00

LA-ICP-MS: Empire Mountain						
Sample point no.	43	44	45	46	47	48
Distance from Rim (µm)	8744.0	8698.9	8653.8	8608.8	8563.7	8518.6
Li7 (ppm)	3.74E+00	2.71E+00	3.14E+00	2.11E+00	1.77E+00	5.78E-01
B11 (ppm)	4.41E+00	4.25E+00	4.29E+00	4.05E+00	4.32E+00	4.65E+00
Na23 (ppm)	2.51E+01	3.67E+01	1.65E+01	2.97E+01	2.78E+01	3.63E+01
Mg24 (ppm)	5.02E+02	2.47E+02	1.91E+02	2.62E+02	2.93E+02	2.86E+02
Al27 (ppm)	5.57E+04	6.62E+04	6.71E+04	5.34E+04	4.57E+04	4.29E+04
P31 (ppm)	1.19E+01	-9.71E-01	2.35E+00	-8.75E-01	2.20E+01	1.20E+01
Ca43 (ppm)	2.48E+05	2.43E+05	2.53E+05	2.45E+05	2.53E+05	2.47E+05
Sc45 (ppm)	1.13E+01	1.03E+01	6.97E+00	1.11E+01	1.71E+01	1.24E+01
Ti49 (ppm)	5.12E+03	2.94E+03	3.10E+03	3.76E+03	3.15E+03	2.08E+03
V51 (ppm)	8.96E+01	7.37E+01	6.05E+01	6.84E+01	6.58E+01	5.85E+01
Cr52 (ppm)	7.61E+00	5.72E+00	4.17E+00	4.17E+00	4.76E+00	4.63E+00
Mn55 (ppm)	1.37E+04	1.56E+04	1.25E+04	1.09E+04	9.77E+03	1.00E+04
Fe57 (ppm)	1.26E+05	1.03E+05	1.05E+05	1.21E+05	1.40E+05	1.47E+05
Y89 (ppm)	2.75E+01	2.74E+01	2.04E+01	2.96E+01	3.21E+01	2.92E+01
Zr90 (ppm)	1.12E+02	6.15E+01	7.44E+01	1.01E+02	1.57E+02	1.48E+02
Nb93 (ppm)	1.80E+01	1.29E+01	1.29E+01	1.31E+01	1.23E+01	1.07E+01
La139 (ppm)	4.78E-02	2.58E-02	1.67E-02	4.46E-02	9.06E-02	1.50E-01
Ce140 (ppm)	1.31E+00	5.34E-01	2.71E-01	1.16E+00	2.28E+00	3.94E+00
Pr141 (ppm)	8.07E-01	3.49E-01	1.50E-01	6.58E-01	1.33E+00	1.91E+00
Nd146 (ppm)	1.05E+01	4.16E+00	2.76E+00	8.57E+00	1.22E+01	1.58E+01
Sm147 (ppm)	5.57E+00	2.44E+00	2.65E+00	4.22E+00	5.09E+00	4.62E+00
Eu153 (ppm)	1.06E+00	6.54E-01	6.40E-01	9.56E-01	1.00E+00	9.58E-01
Gd157 (ppm)	4.32E+00	3.10E+00	3.35E+00	4.47E+00	5.61E+00	4.74E+00
Tb159 (ppm)	6.64E-01	5.67E-01	5.36E-01	6.88E-01	8.71E-01	6.91E-01
Dy163 (ppm)	4.15E+00	4.23E+00	3.58E+00	4.65E+00	5.36E+00	4.55E+00
Ho165 (ppm)	8.37E-01	9.45E-01	7.36E-01	1.01E+00	1.06E+00	9.64E-01
Er166 (ppm)	2.78E+00	3.06E+00	2.06E+00	2.89E+00	3.36E+00	3.12E+00
Tm169 (ppm)	3.79E-01	4.48E-01	2.90E-01	4.70E-01	5.04E-01	5.05E-01
Yb172 (ppm)	3.07E+00	3.54E+00	1.99E+00	3.53E+00	3.56E+00	3.55E+00
Lu175 (ppm)	4.92E-01	5.31E-01	2.86E-01	5.65E-01	5.96E-01	5.63E-01
Hf178 (ppm)	3.31E+00	1.95E+00	2.31E+00	3.11E+00	4.79E+00	3.54E+00
U238 (ppm)	5.39E+00	1.82E+00	1.21E+00	2.59E+00	2.43E+00	2.36E+00

LA-ICP-MS: Empire Mountain						
Sample point no.	49	50	51	52	53	54
Distance from Rim (µm)	8473.5	8428.5	8383.4	8338.4	8293.3	8248.2
Li7 (ppm)	5.56E-01	1.83E+00	6.52E-01	9.61E-01	4.11E-01	4.93E-01
B11 (ppm)	4.19E+00	4.73E+00	4.20E+00	3.82E+00	4.10E+00	3.98E+00
Na23 (ppm)	1.73E+01	3.01E+01	1.13E+01	1.81E+02	4.72E+02	3.14E+01
Mg24 (ppm)	3.21E+02	2.05E+02	2.89E+02	2.31E+02	3.27E+02	3.53E+02
Al27 (ppm)	5.41E+04	6.26E+04	5.77E+04	5.70E+04	5.73E+04	5.19E+04
P31 (ppm)	1.52E+01	2.97E+00	-8.79E+00	4.17E-01	-3.09E+00	4.21E+00
Ca43 (ppm)	2.46E+05	2.48E+05	2.48E+05	2.34E+05	2.44E+05	2.48E+05
Sc45 (ppm)	7.42E+00	8.24E+00	8.61E+00	7.61E+00	5.46E+00	4.26E+00
Ti49 (ppm)	1.67E+03	1.83E+03	1.76E+03	1.63E+03	1.55E+03	1.55E+03
V51 (ppm)	4.93E+01	7.48E+01	5.94E+01	5.18E+01	4.76E+01	4.05E+01
Cr52 (ppm)	3.37E+00	4.17E+00	2.92E+00	2.75E+00	3.84E+00	2.03E+00
Mn55 (ppm)	1.04E+04	1.10E+04	1.09E+04	1.06E+04	1.07E+04	9.06E+03
Fe57 (ppm)	1.23E+05	1.17E+05	1.23E+05	1.10E+05	1.16E+05	1.31E+05
Y89 (ppm)	4.16E+01	3.19E+01	3.66E+01	3.49E+01	3.70E+01	3.34E+01
Zr90 (ppm)	1.22E+02	5.78E+01	9.21E+01	5.56E+01	9.88E+01	1.39E+02
Nb93 (ppm)	5.72E+00	9.50E+00	9.88E+00	7.71E+00	6.46E+00	1.13E+01
La139 (ppm)	2.04E-01	6.37E-02	1.58E-01	7.19E-02	1.58E-01	2.29E-01
Ce140 (ppm)	3.93E+00	1.17E+00	2.75E+00	1.55E+00	2.93E+00	4.94E+00
Pr141 (ppm)	1.70E+00	6.77E-01	1.21E+00	7.56E-01	1.28E+00	1.96E+00
Nd146 (ppm)	1.29E+01	7.72E+00	1.04E+01	7.36E+00	1.07E+01	1.44E+01
Sm147 (ppm)	4.55E+00	4.06E+00	4.12E+00	3.99E+00	3.60E+00	4.58E+00
Eu153 (ppm)	8.91E-01	8.31E-01	8.94E-01	7.33E-01	7.90E-01	9.51E-01
Gd157 (ppm)	4.97E+00	4.47E+00	5.19E+00	4.93E+00	4.51E+00	4.83E+00
Tb159 (ppm)	8.92E-01	7.35E-01	8.72E-01	8.44E-01	8.51E-01	7.80E-01
Dy163 (ppm)	5.90E+00	5.05E+00	5.64E+00	5.38E+00	5.24E+00	5.10E+00
Ho165 (ppm)	1.28E+00	1.06E+00	1.21E+00	1.17E+00	1.19E+00	1.05E+00
Er166 (ppm)	4.28E+00	3.15E+00	3.87E+00	3.56E+00	3.63E+00	3.43E+00
Tm169 (ppm)	6.19E-01	4.55E-01	5.53E-01	4.93E-01	5.93E-01	5.15E-01
Yb172 (ppm)	4.66E+00	3.56E+00	4.53E+00	4.01E+00	4.10E+00	3.48E+00
Lu175 (ppm)	7.22E-01	5.49E-01	6.66E-01	5.79E-01	6.78E-01	5.02E-01
Hf178 (ppm)	2.20E+00	1.48E+00	1.81E+00	1.23E+00	1.82E+00	2.12E+00
U238 (ppm)	1.19E+00	8.25E-01	1.11E+00	7.84E-01	9.47E-01	1.38E+00

LA-ICP-MS: Empire Mountain						
Sample point no.	55	56	57	58	59	60
Distance from Rim (µm)	8203.1	8158.1	8113.0	8067.9	8022.8	7977.8
Li7 (ppm)	6.57E-01	6.45E-01	1.24E+00	1.54E+00	9.47E-01	7.55E-01
B11 (ppm)	4.51E+00	3.69E+00	3.25E+00	3.69E+00	3.51E+00	3.76E+00
Na23 (ppm)	2.24E+01	2.05E+01	2.04E+01	3.36E+00	1.58E-01	2.13E+01
Mg24 (ppm)	2.99E+02	2.79E+02	2.35E+02	2.20E+02	2.40E+02	2.94E+02
Al27 (ppm)	5.22E+04	5.17E+04	6.95E+04	6.96E+04	7.04E+04	6.78E+04
P31 (ppm)	-5.90E+00	7.71E+00	9.97E+00	2.53E+00	2.17E+00	4.32E+00
Ca43 (ppm)	2.53E+05	2.51E+05	2.30E+05	2.33E+05	2.33E+05	2.40E+05
Sc45 (ppm)	8.41E+00	9.51E+00	3.29E+00	2.13E+00	2.51E+00	2.68E+00
Ti49 (ppm)	1.55E+03	1.74E+03	9.71E+02	9.16E+02	9.39E+02	1.02E+03
V51 (ppm)	5.78E+01	5.88E+01	5.48E+01	5.42E+01	4.99E+01	4.67E+01
Cr52 (ppm)	4.07E+00	4.18E+00	2.23E+00	2.57E+00	2.33E+00	2.24E+00
Mn55 (ppm)	1.06E+04	1.20E+04	1.88E+04	1.93E+04	1.92E+04	1.84E+04
Fe57 (ppm)	1.33E+05	1.33E+05	1.04E+05	1.03E+05	1.07E+05	1.08E+05
Y89 (ppm)	3.65E+01	3.30E+01	1.69E+01	1.53E+01	1.48E+01	1.40E+01
Zr90 (ppm)	1.01E+02	9.44E+01	2.33E+01	2.15E+01	2.34E+01	3.02E+01
Nb93 (ppm)	1.12E+01	1.03E+01	8.25E+00	8.87E+00	8.52E+00	8.29E+00
La139 (ppm)	1.94E-01	1.35E-01	4.43E-03	3.45E-03	1.08E-03	9.53E-03
Ce140 (ppm)	3.77E+00	3.26E+00	1.60E-01	9.78E-02	9.88E-02	1.48E-01
Pr141 (ppm)	1.72E+00	1.63E+00	8.10E-02	6.34E-02	6.01E-02	1.17E-01
Nd146 (ppm)	1.37E+01	1.42E+01	1.02E+00	8.77E-01	8.38E-01	1.41E+00
Sm147 (ppm)	4.37E+00	4.70E+00	1.17E+00	1.10E+00	1.30E+00	2.49E+00
Eu153 (ppm)	8.69E-01	1.02E+00	4.02E-01	3.20E-01	4.18E-01	5.29E-01
Gd157 (ppm)	5.20E+00	4.99E+00	3.60E+00	3.03E+00	3.38E+00	4.04E+00
Tb159 (ppm)	8.62E-01	7.99E-01	5.34E-01	5.32E-01	4.94E-01	4.95E-01
Dy163 (ppm)	5.96E+00	5.57E+00	3.25E+00	3.04E+00	2.88E+00	2.66E+00
Ho165 (ppm)	1.12E+00	9.94E-01	5.98E-01	5.08E-01	5.30E-01	4.91E-01
Er166 (ppm)	3.83E+00	3.47E+00	1.58E+00	1.48E+00	1.26E+00	1.28E+00
Tm169 (ppm)	5.18E-01	4.78E-01	2.05E-01	1.94E-01	1.61E-01	1.60E-01
Yb172 (ppm)	4.06E+00	3.71E+00	1.48E+00	1.13E+00	1.23E+00	1.18E+00
Lu175 (ppm)	6.00E-01	5.62E-01	2.01E-01	1.62E-01	1.38E-01	1.45E-01
Hf178 (ppm)	1.89E+00	1.98E+00	5.62E-01	5.19E-01	5.34E-01	7.55E-01
U238 (ppm)	1.34E+00	1.72E+00	5.15E-01	3.26E-01	4.51E-01	8.93E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	61	62	63	64	65	66
Distance from Rim (µm)	7932.7	7887.6	7842.5	7797.5	7752.4	7707.3
Li7 (ppm)	1.43E+00	1.69E+00	1.62E+00	1.27E+00	1.17E+00	1.14E+00
B11 (ppm)	3.30E+00	3.63E+00	3.95E+00	3.83E+00	3.60E+00	3.93E+00
Na23 (ppm)	2.69E+02	5.81E+00	3.28E+01	1.81E+01	1.14E+01	2.99E+01
Mg24 (ppm)	2.45E+02	2.88E+02	2.75E+02	2.52E+02	1.60E+02	1.65E+02
Al27 (ppm)	6.46E+04	7.17E+04	7.17E+04	6.79E+04	6.19E+04	6.12E+04
P31 (ppm)	1.08E+01	1.59E+01	1.57E+01	7.07E+00	1.71E+01	1.58E+01
Ca43 (ppm)	2.27E+05	2.32E+05	2.31E+05	2.36E+05	2.35E+05	2.41E+05
Sc45 (ppm)	6.06E+00	5.26E+00	6.14E+00	6.09E+00	5.61E+00	8.83E+00
Ti49 (ppm)	1.07E+03	1.08E+03	1.18E+03	1.11E+03	8.44E+02	1.63E+03
V51 (ppm)	6.02E+01	5.35E+01	5.89E+01	6.15E+01	5.45E+01	6.65E+01
Cr52 (ppm)	3.90E+00	1.98E+00	3.42E+00	3.41E+00	6.20E+00	1.39E+01
Mn55 (ppm)	1.88E+04	1.94E+04	1.97E+04	1.94E+04	1.88E+04	1.77E+04
Fe57 (ppm)	1.03E+05	9.89E+04	1.01E+05	1.02E+05	1.13E+05	1.18E+05
Y89 (ppm)	2.14E+01	1.82E+01	2.06E+01	2.11E+01	1.99E+01	2.29E+01
Zr90 (ppm)	2.36E+01	2.35E+01	2.54E+01	2.45E+01	1.83E+01	2.39E+01
Nb93 (ppm)	7.07E+00	6.50E+00	7.16E+00	7.65E+00	4.87E+00	7.28E+00
La139 (ppm)	1.03E-02	9.67E-03	1.58E-02	1.47E-02	1.65E-02	1.65E-02
Ce140 (ppm)	1.56E-01	1.80E-01	1.83E-01	1.79E-01	1.21E-01	1.23E-01
Pr141 (ppm)	9.38E-02	9.72E-02	9.99E-02	8.71E-02	5.48E-02	6.03E-02
Nd146 (ppm)	1.53E+00	1.35E+00	1.48E+00	1.32E+00	7.52E-01	8.07E-01
Sm147 (ppm)	1.87E+00	1.92E+00	2.10E+00	1.88E+00	1.02E+00	1.08E+00
Eu153 (ppm)	4.21E-01	4.98E-01	4.82E-01	4.28E-01	2.26E-01	2.30E-01
Gd157 (ppm)	3.49E+00	3.43E+00	3.77E+00	3.87E+00	2.49E+00	2.49E+00
Tb159 (ppm)	5.72E-01	5.38E-01	5.45E-01	5.53E-01	4.62E-01	4.82E-01
Dy163 (ppm)	3.19E+00	3.03E+00	3.63E+00	3.43E+00	3.28E+00	3.22E+00
Ho165 (ppm)	7.17E-01	6.34E-01	7.58E-01	6.76E-01	5.82E-01	7.08E-01
Er166 (ppm)	2.23E+00	1.84E+00	2.16E+00	2.09E+00	1.84E+00	2.32E+00
Tm169 (ppm)	3.16E-01	2.35E-01	3.29E-01	3.26E-01	2.67E-01	3.38E-01
Yb172 (ppm)	2.51E+00	1.88E+00	2.30E+00	2.31E+00	2.08E+00	2.17E+00
Lu175 (ppm)	4.08E-01	2.98E-01	3.39E-01	3.79E-01	2.89E-01	3.60E-01
Hf178 (ppm)	6.53E-01	6.03E-01	7.42E-01	6.37E-01	4.56E-01	7.74E-01
U238 (ppm)	6.47E-01	6.25E-01	7.71E-01	6.59E-01	3.35E-01	3.98E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	67	68	69	70	71	72
Distance from Rim (µm)	7662.2	7617.2	7572.1	7527.1	7482.0	7436.9
Li7 (ppm)	7.58E-01	1.39E+00	1.09E+00	1.43E+00	1.57E+00	1.64E+00
B11 (ppm)	4.38E+00	3.79E+00	4.12E+00	3.97E+00	3.76E+00	3.97E+00
Na23 (ppm)	2.17E+01	5.24E+01	4.00E+02	1.19E+03	1.49E+03	5.63E+02
Mg24 (ppm)	1.57E+02	1.92E+02	1.77E+02	2.02E+02	2.37E+02	1.90E+02
Al27 (ppm)	6.40E+04	6.42E+04	6.67E+04	6.88E+04	6.69E+04	6.87E+04
P31 (ppm)	7.95E+00	-2.27E+00	-1.91E+00	-1.40E+00	-3.66E+00	-6.34E+00
Ca43 (ppm)	2.32E+05	2.29E+05	2.32E+05	2.30E+05	2.25E+05	2.32E+05
Sc45 (ppm)	6.91E+00	7.92E+00	5.67E+00	7.38E+00	6.66E+00	6.30E+00
Ti49 (ppm)	7.34E+02	9.98E+02	7.18E+02	9.33E+02	1.09E+03	8.91E+02
V51 (ppm)	5.35E+01	6.29E+01	5.61E+01	6.50E+01	6.25E+01	6.14E+01
Cr52 (ppm)	7.46E+00	5.35E+00	4.43E+00	4.29E+00	4.21E+00	4.42E+00
Mn55 (ppm)	1.93E+04	2.05E+04	1.93E+04	1.97E+04	1.90E+04	2.03E+04
Fe57 (ppm)	1.08E+05	1.07E+05	1.07E+05	1.07E+05	9.80E+04	1.07E+05
Y89 (ppm)	1.97E+01	2.39E+01	2.09E+01	2.33E+01	2.21E+01	2.16E+01
Zr90 (ppm)	1.80E+01	1.74E+01	1.81E+01	1.92E+01	2.27E+01	1.99E+01
Nb93 (ppm)	4.40E+00	4.93E+00	5.61E+00	7.02E+00	6.92E+00	6.94E+00
La139 (ppm)	1.33E-02	1.37E-02	1.18E-02	7.96E-03	7.40E-03	1.08E-02
Ce140 (ppm)	1.75E-01	1.24E-01	1.33E-01	1.69E-01	1.67E-01	1.51E-01
Pr141 (ppm)	8.64E-02	6.68E-02	6.06E-02	9.94E-02	8.77E-02	8.19E-02
Nd146 (ppm)	1.04E+00	8.75E-01	1.01E+00	1.25E+00	1.38E+00	1.15E+00
Sm147 (ppm)	1.06E+00	1.10E+00	1.44E+00	1.53E+00	1.78E+00	1.32E+00
Eu153 (ppm)	3.11E-01	3.23E-01	3.64E-01	3.64E-01	4.01E-01	3.15E-01
Gd157 (ppm)	2.76E+00	3.13E+00	3.20E+00	3.13E+00	3.02E+00	3.27E+00
Tb159 (ppm)	5.05E-01	5.68E-01	5.79E-01	6.06E-01	5.61E-01	5.55E-01
Dy163 (ppm)	3.05E+00	3.84E+00	3.65E+00	3.91E+00	3.47E+00	3.47E+00
Ho165 (ppm)	6.45E-01	7.79E-01	6.70E-01	7.95E-01	7.08E-01	7.17E-01
Er166 (ppm)	2.03E+00	2.52E+00	1.95E+00	2.57E+00	2.40E+00	2.22E+00
Tm169 (ppm)	3.25E-01	3.52E-01	2.88E-01	4.04E-01	3.06E-01	3.05E-01
Yb172 (ppm)	2.16E+00	2.83E+00	2.27E+00	2.64E+00	2.54E+00	2.23E+00
Lu175 (ppm)	2.94E-01	4.06E-01	3.15E-01	4.23E-01	4.15E-01	3.77E-01
Hf178 (ppm)	4.66E-01	5.91E-01	4.45E-01	5.56E-01	6.83E-01	5.28E-01
U238 (ppm)	4.58E-01	3.62E-01	3.90E-01	4.11E-01	5.35E-01	3.92E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	73	74	75	76	77	78
Distance from Rim (µm)	7391.8	7346.8	7301.7	7256.6	7211.5	7166.5
Li7 (ppm)	1.89E+00	2.91E+00	3.95E+00	1.48E+00	9.01E-01	1.07E+00
B11 (ppm)	3.98E+00	3.26E+00	3.82E+00	3.81E+00	3.34E+00	3.80E+00
Na23 (ppm)	1.04E+03	3.19E+02	5.36E+02	4.93E+01	2.91E+01	2.06E+01
Mg24 (ppm)	1.99E+02	1.37E+03	5.84E+03	3.90E+02	2.02E+02	2.59E+02
Al27 (ppm)	6.98E+04	5.93E+04	6.23E+04	6.95E+04	6.56E+04	6.88E+04
P31 (ppm)	1.14E+01	1.06E+01	1.83E+01	6.09E+00	8.96E+00	6.27E+00
Ca43 (ppm)	2.31E+05	1.93E+05	2.15E+05	2.42E+05	2.31E+05	2.40E+05
Sc45 (ppm)	6.00E+00	3.86E+00	4.99E+00	2.62E+00	3.37E+00	2.68E+00
Ti49 (ppm)	1.00E+03	8.57E+02	1.02E+03	8.69E+02	6.01E+02	6.55E+02
V51 (ppm)	6.28E+01	4.46E+01	4.44E+01	5.24E+01	4.03E+01	4.67E+01
Cr52 (ppm)	5.85E+00	5.01E+00	3.42E+00	5.62E+00	5.75E+00	4.79E+00
Mn55 (ppm)	1.99E+04	1.66E+04	1.76E+04	1.98E+04	1.80E+04	1.99E+04
Fe57 (ppm)	1.04E+05	8.96E+04	1.03E+05	1.06E+05	1.06E+05	1.10E+05
Y89 (ppm)	2.17E+01	1.26E+01	1.28E+01	1.44E+01	1.28E+01	1.38E+01
Zr90 (ppm)	2.01E+01	1.85E+01	2.48E+01	1.94E+01	1.86E+01	1.62E+01
Nb93 (ppm)	7.85E+00	6.09E+00	7.80E+00	8.30E+00	6.05E+00	6.17E+00
La139 (ppm)	9.16E-03	1.24E-02	4.13E-03	2.64E-03	6.90E-04	3.28E-03
Ce140 (ppm)	1.31E-01	1.10E-01	9.94E-02	4.50E-02	5.39E-02	4.32E-02
Pr141 (ppm)	8.59E-02	5.60E-02	8.20E-02	2.26E-02	3.52E-02	2.21E-02
Nd146 (ppm)	1.02E+00	9.43E-01	1.13E+00	5.33E-01	6.13E-01	4.62E-01
Sm147 (ppm)	1.41E+00	1.50E+00	1.64E+00	1.19E+00	1.27E+00	9.36E-01
Eu153 (ppm)	3.45E-01	3.83E-01	4.10E-01	3.20E-01	2.93E-01	2.32E-01
Gd157 (ppm)	3.27E+00	2.99E+00	3.47E+00	2.97E+00	3.00E+00	2.80E+00
Tb159 (ppm)	5.63E-01	4.09E-01	4.49E-01	4.83E-01	4.56E-01	4.63E-01
Dy163 (ppm)	3.63E+00	2.48E+00	2.48E+00	2.68E+00	2.55E+00	2.63E+00
Ho165 (ppm)	7.73E-01	4.42E-01	4.37E-01	5.03E-01	4.30E-01	4.76E-01
Er166 (ppm)	2.11E+00	1.27E+00	1.23E+00	1.27E+00	1.07E+00	1.29E+00
Tm169 (ppm)	3.02E-01	1.93E-01	1.66E-01	1.57E-01	1.42E-01	1.57E-01
Yb172 (ppm)	2.50E+00	1.14E+00	1.06E+00	1.18E+00	1.19E+00	8.93E-01
Lu175 (ppm)	3.60E-01	1.69E-01	1.59E-01	1.44E-01	1.07E-01	1.33E-01
Hf178 (ppm)	5.46E-01	5.18E-01	6.09E-01	4.37E-01	3.79E-01	3.60E-01
U238 (ppm)	3.75E-01	5.29E-01	6.05E-01	2.96E-01	3.50E-01	2.68E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	79	80	81	82	83	84
Distance from Rim (µm)	7121.4	7076.3	7031.2	6986.2	6941.1	6896.1
Li7 (ppm)	1.39E+00	1.46E+00	1.39E+00	1.17E+00	1.35E+00	1.03E+00
B11 (ppm)	3.70E+00	3.75E+00	3.96E+00	3.70E+00	4.21E+00	3.98E+00
Na23 (ppm)	2.92E+01	3.20E+01	3.07E+01	1.11E+03	1.97E+01	7.51E+01
Mg24 (ppm)	2.32E+02	3.06E+02	2.94E+02	2.21E+02	3.00E+02	2.90E+02
Al27 (ppm)	7.00E+04	7.13E+04	7.39E+04	6.41E+04	6.99E+04	6.71E+04
P31 (ppm)	1.67E+01	1.40E+01	1.65E+01	1.05E+01	4.74E+00	9.81E+00
Ca43 (ppm)	2.33E+05	2.37E+05	2.34E+05	2.23E+05	2.33E+05	2.35E+05
Sc45 (ppm)	2.43E+00	3.43E+00	3.82E+00	9.70E+00	2.80E+00	4.97E+00
Ti49 (ppm)	8.19E+02	1.10E+03	1.07E+03	1.17E+03	1.02E+03	1.18E+03
V51 (ppm)	5.39E+01	5.17E+01	5.18E+01	6.18E+01	5.15E+01	5.52E+01
Cr52 (ppm)	2.90E+00	1.99E+00	2.45E+00	6.61E+00	4.44E+00	9.67E+00
Mn55 (ppm)	2.04E+04	2.03E+04	2.02E+04	1.62E+04	1.87E+04	1.91E+04
Fe57 (ppm)	1.02E+05	1.05E+05	9.71E+04	9.73E+04	9.88E+04	1.05E+05
Y89 (ppm)	1.49E+01	1.59E+01	1.68E+01	2.87E+01	1.48E+01	1.82E+01
Zr90 (ppm)	1.73E+01	2.53E+01	2.06E+01	2.12E+01	2.25E+01	2.92E+01
Nb93 (ppm)	7.27E+00	8.07E+00	6.76E+00	6.15E+00	8.08E+00	8.06E+00
La139 (ppm)	4.14E-03	1.57E-02	-1.94E-04	2.08E-02	7.52E-03	2.07E-02
Ce140 (ppm)	2.21E-02	1.44E-01	7.38E-02	2.85E-01	1.67E-01	2.21E-01
Pr141 (ppm)	2.09E-02	8.49E-02	6.00E-02	1.77E-01	1.23E-01	1.08E-01
Nd146 (ppm)	4.01E-01	1.18E+00	1.03E+00	2.36E+00	1.66E+00	1.65E+00
Sm147 (ppm)	1.07E+00	2.03E+00	2.03E+00	2.45E+00	2.61E+00	2.39E+00
Eu153 (ppm)	3.02E-01	5.51E-01	4.78E-01	5.41E-01	5.88E-01	6.02E-01
Gd157 (ppm)	2.43E+00	3.66E+00	3.44E+00	4.21E+00	4.07E+00	3.87E+00
Tb159 (ppm)	4.90E-01	5.40E-01	4.80E-01	7.53E-01	5.71E-01	5.48E-01
Dy163 (ppm)	2.80E+00	2.97E+00	3.15E+00	4.84E+00	2.93E+00	3.20E+00
Ho165 (ppm)	5.05E-01	4.60E-01	6.14E-01	9.57E-01	5.15E-01	5.14E-01
Er166 (ppm)	1.27E+00	1.41E+00	1.48E+00	3.26E+00	1.50E+00	1.68E+00
Tm169 (ppm)	1.70E-01	1.96E-01	1.78E-01	4.80E-01	1.79E-01	2.36E-01
Yb172 (ppm)	1.15E+00	1.29E+00	1.44E+00	3.51E+00	1.26E+00	1.70E+00
Lu175 (ppm)	1.47E-01	2.06E-01	2.22E-01	5.19E-01	1.77E-01	2.73E-01
Hf178 (ppm)	3.97E-01	6.23E-01	5.96E-01	6.34E-01	4.84E-01	8.23E-01
U238 (ppm)	2.53E-01	7.99E-01	5.59E-01	5.43E-01	7.03E-01	9.31E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	85	86	87	88	89	90
Distance from Rim (µm)	6851.0	6805.9	6760.8	6715.8	6670.7	6625.6
Li7 (ppm)	7.76E-01	9.70E-01	1.74E+00	1.26E+00	1.68E+00	2.03E+00
B11 (ppm)	3.99E+00	3.75E+00	3.45E+00	3.88E+00	4.11E+00	3.94E+00
Na23 (ppm)	1.94E+01	1.93E+02	1.57E+01	2.55E+01	2.37E+01	1.22E+02
Mg24 (ppm)	3.33E+02	2.95E+02	2.92E+02	3.00E+02	2.13E+02	2.95E+02
Al27 (ppm)	7.09E+04	6.80E+04	7.04E+04	7.13E+04	6.92E+04	7.13E+04
P31 (ppm)	-3.33E+00	8.50E+00	-4.73E+00	1.38E+01	1.33E+01	5.04E+00
Ca43 (ppm)	2.34E+05	2.28E+05	2.29E+05	2.33E+05	2.46E+05	2.35E+05
Sc45 (ppm)	2.22E+00	3.14E+00	2.60E+00	3.99E+00	1.32E+01	4.61E+00
Ti49 (ppm)	1.06E+03	1.06E+03	1.03E+03	1.13E+03	1.40E+03	1.12E+03
V51 (ppm)	4.72E+01	5.10E+01	4.58E+01	5.58E+01	6.62E+01	5.64E+01
Cr52 (ppm)	2.51E+00	4.72E+00	4.21E+00	4.76E+00	9.17E+00	3.76E+00
Mn55 (ppm)	1.94E+04	1.94E+04	1.97E+04	1.91E+04	1.62E+04	1.93E+04
Fe57 (ppm)	1.02E+05	9.87E+04	9.95E+04	9.76E+04	1.03E+05	9.94E+04
Y89 (ppm)	1.36E+01	1.58E+01	1.38E+01	1.74E+01	4.00E+01	1.91E+01
Zr90 (ppm)	2.70E+01	2.61E+01	2.38E+01	2.37E+01	2.56E+01	2.22E+01
Nb93 (ppm)	8.05E+00	7.58E+00	7.54E+00	8.09E+00	6.83E+00	7.02E+00
La139 (ppm)	5.05E-03	1.34E-02	3.89E-03	7.12E-03	3.02E-02	8.21E-03
Ce140 (ppm)	8.28E-02	1.10E-01	7.14E-02	1.68E-01	3.59E-01	1.92E-01
Pr141 (ppm)	5.70E-02	7.41E-02	5.12E-02	8.77E-02	2.02E-01	1.22E-01
Nd146 (ppm)	1.04E+00	1.21E+00	9.44E-01	1.56E+00	3.21E+00	1.63E+00
Sm147 (ppm)	2.38E+00	2.11E+00	1.91E+00	2.32E+00	3.55E+00	2.29E+00
Eu153 (ppm)	5.66E-01	5.03E-01	4.79E-01	4.94E-01	7.76E-01	5.59E-01
Gd157 (ppm)	3.87E+00	3.72E+00	3.53E+00	4.22E+00	5.68E+00	3.72E+00
Tb159 (ppm)	4.93E-01	5.61E-01	5.01E-01	5.65E-01	9.99E-01	5.81E-01
Dy163 (ppm)	2.57E+00	2.82E+00	2.90E+00	3.30E+00	6.63E+00	3.53E+00
Ho165 (ppm)	4.23E-01	5.96E-01	4.35E-01	6.07E-01	1.38E+00	6.22E-01
Er166 (ppm)	1.30E+00	1.60E+00	1.31E+00	1.81E+00	4.18E+00	1.69E+00
Tm169 (ppm)	1.68E-01	2.16E-01	1.65E-01	2.53E-01	6.52E-01	2.49E-01
Yb172 (ppm)	1.01E+00	1.62E+00	1.27E+00	1.84E+00	5.04E+00	2.29E+00
Lu175 (ppm)	1.65E-01	1.90E-01	1.69E-01	2.27E-01	7.42E-01	3.38E-01
Hf178 (ppm)	6.57E-01	5.98E-01	6.10E-01	6.24E-01	8.45E-01	6.22E-01
U238 (ppm)	8.35E-01	8.15E-01	5.66E-01	8.08E-01	6.56E-01	6.92E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	91	92	93	94	95	96
Distance from Rim (µm)	6580.5	6535.5	6490.4	6445.3	6400.2	6355.2
Li7 (ppm)	1.23E+00	1.59E+00	1.48E+00	9.80E-01	7.20E-01	3.59E-01
B11 (ppm)	3.47E+00	4.05E+00	4.10E+00	3.68E+00	3.56E+00	3.68E+00
Na23 (ppm)	1.92E+01	3.82E+01	1.69E+01	1.88E+01	2.56E+01	1.38E+01
Mg24 (ppm)	2.71E+02	2.58E+02	1.99E+02	1.89E+02	1.41E+02	1.36E+02
Al27 (ppm)	7.02E+04	6.99E+04	6.81E+04	6.55E+04	6.51E+04	6.36E+04
P31 (ppm)	6.57E+00	1.59E+01	-5.42E-01	2.64E+00	9.45E+00	8.87E+00
Ca43 (ppm)	2.23E+05	2.35E+05	2.29E+05	2.35E+05	2.36E+05	2.40E+05
Sc45 (ppm)	3.52E+00	3.18E+00	2.90E+00	3.29E+00	3.23E+00	4.18E+00
Ti49 (ppm)	9.67E+02	1.07E+03	9.34E+02	8.72E+02	3.56E+02	2.76E+02
V51 (ppm)	4.79E+01	5.06E+01	5.53E+01	5.20E+01	3.52E+01	2.88E+01
Cr52 (ppm)	3.23E+00	3.41E+00	3.21E+00	3.70E+00	4.15E+00	1.00E+01
Mn55 (ppm)	1.87E+04	1.85E+04	1.85E+04	1.84E+04	1.73E+04	1.72E+04
Fe57 (ppm)	9.47E+04	1.03E+05	9.90E+04	1.04E+05	1.11E+05	1.18E+05
Y89 (ppm)	1.56E+01	1.55E+01	1.61E+01	1.52E+01	1.17E+01	9.14E+00
Zr90 (ppm)	2.10E+01	2.61E+01	2.08E+01	2.01E+01	1.53E+01	1.92E+01
Nb93 (ppm)	6.31E+00	9.17E+00	8.54E+00	6.36E+00	4.66E+00	3.57E+00
La139 (ppm)	8.25E-03	1.67E-02	9.56E-04	7.84E-03	1.15E-02	1.18E-02
Ce140 (ppm)	1.21E-01	1.07E-01	5.87E-02	5.16E-02	7.17E-02	8.96E-02
Pr141 (ppm)	7.48E-02	6.16E-02	3.21E-02	3.68E-02	3.49E-02	4.90E-02
Nd146 (ppm)	1.22E+00	1.13E+00	6.19E-01	5.54E-01	7.27E-01	7.09E-01
Sm147 (ppm)	1.85E+00	1.70E+00	1.20E+00	1.07E+00	1.27E+00	1.29E+00
Eu153 (ppm)	3.87E-01	4.60E-01	3.23E-01	3.48E-01	3.23E-01	3.52E-01
Gd157 (ppm)	3.34E+00	3.73E+00	2.97E+00	2.71E+00	3.13E+00	2.96E+00
Tb159 (ppm)	4.75E-01	5.57E-01	5.70E-01	4.97E-01	4.69E-01	4.53E-01
Dy163 (ppm)	2.90E+00	3.08E+00	3.20E+00	2.93E+00	2.73E+00	2.29E+00
Ho165 (ppm)	5.07E-01	5.40E-01	5.20E-01	4.93E-01	4.38E-01	3.76E-01
Er166 (ppm)	1.49E+00	1.25E+00	1.47E+00	1.41E+00	9.83E-01	6.42E-01
Tm169 (ppm)	1.82E-01	1.86E-01	1.78E-01	1.59E-01	1.16E-01	1.00E-01
Yb172 (ppm)	1.34E+00	1.24E+00	1.43E+00	1.31E+00	8.24E-01	5.25E-01
Lu175 (ppm)	2.15E-01	2.01E-01	1.79E-01	1.84E-01	1.11E-01	6.85E-02
Hf178 (ppm)	5.97E-01	6.56E-01	5.28E-01	5.91E-01	2.53E-01	3.13E-01
U238 (ppm)	6.17E-01	7.69E-01	2.71E-01	3.17E-01	3.80E-01	4.67E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	97	98	99	100	101	102
Distance from Rim (µm)	6310.1	6265.0	6219.9	6174.9	6129.8	6084.8
Li7 (ppm)	4.51E-01	1.16E+00	8.06E-01	7.25E-01	1.22E+00	1.45E+00
B11 (ppm)	3.29E+00	4.06E+00	4.02E+00	3.70E+00	3.59E+00	3.07E+00
Na23 (ppm)	2.04E+01	2.79E+01	1.40E+01	2.12E+02	1.01E+02	3.28E+02
Mg24 (ppm)	1.35E+02	1.49E+02	1.75E+02	2.02E+02	1.61E+02	1.04E+02
Al27 (ppm)	6.08E+04	6.02E+04	6.44E+04	6.21E+04	5.52E+04	4.28E+04
P31 (ppm)	-8.50E-01	1.26E+01	1.87E+01	1.48E+01	9.56E+00	5.48E+00
Ca43 (ppm)	2.33E+05	2.32E+05	2.37E+05	2.26E+05	1.92E+05	1.58E+05
Sc45 (ppm)	3.35E+00	4.48E+00	2.89E+00	6.81E+00	6.47E+00	3.46E+00
Ti49 (ppm)	7.02E+02	1.24E+03	8.79E+02	8.73E+02	7.14E+02	4.41E+02
V51 (ppm)	4.02E+01	5.57E+01	4.86E+01	4.98E+01	4.90E+01	2.79E+01
Cr52 (ppm)	7.65E+00	5.40E+00	6.31E+00	6.74E+00	5.88E+00	1.15E+01
Mn55 (ppm)	1.71E+04	1.66E+04	1.78E+04	1.79E+04	1.58E+04	1.18E+04
Fe57 (ppm)	1.16E+05	1.17E+05	1.11E+05	1.14E+05	8.88E+04	7.92E+04
Y89 (ppm)	1.42E+01	1.91E+01	1.46E+01	1.85E+01	1.64E+01	8.71E+00
Zr90 (ppm)	2.48E+01	2.74E+01	2.26E+01	2.45E+01	1.27E+01	1.33E+01
Nb93 (ppm)	5.49E+00	7.19E+00	7.19E+00	5.98E+00	3.10E+00	2.96E+00
La139 (ppm)	1.49E-02	1.48E-02	-8.66E-05	7.41E-03	4.84E-03	2.10E-03
Ce140 (ppm)	9.89E-02	1.36E-01	3.43E-02	1.62E-01	1.22E-01	6.35E-02
Pr141 (ppm)	4.44E-02	6.10E-02	3.16E-02	1.17E-01	7.50E-02	2.95E-02
Nd146 (ppm)	5.88E-01	9.22E-01	4.20E-01	1.56E+00	1.06E+00	4.35E-01
Sm147 (ppm)	9.60E-01	9.69E-01	9.50E-01	1.64E+00	1.01E+00	7.09E-01
Eu153 (ppm)	2.09E-01	2.41E-01	2.58E-01	4.08E-01	3.00E-01	2.19E-01
Gd157 (ppm)	2.23E+00	2.32E+00	2.36E+00	3.38E+00	2.30E+00	1.95E+00
Tb159 (ppm)	4.12E-01	4.63E-01	4.48E-01	5.21E-01	3.94E-01	2.98E-01
Dy163 (ppm)	2.66E+00	2.83E+00	2.62E+00	3.32E+00	2.60E+00	1.80E+00
Ho165 (ppm)	4.83E-01	5.92E-01	4.71E-01	6.16E-01	5.41E-01	2.95E-01
Er166 (ppm)	1.32E+00	1.88E+00	1.26E+00	1.94E+00	1.66E+00	7.86E-01
Tm169 (ppm)	1.48E-01	2.64E-01	1.68E-01	2.69E-01	2.38E-01	8.39E-02
Yb172 (ppm)	1.10E+00	1.90E+00	1.17E+00	2.15E+00	1.97E+00	7.32E-01
Lu175 (ppm)	1.59E-01	2.74E-01	1.66E-01	2.80E-01	2.64E-01	9.28E-02
Hf178 (ppm)	5.15E-01	6.78E-01	5.38E-01	6.45E-01	4.26E-01	2.62E-01
U238 (ppm)	4.49E-01	4.53E-01	2.87E-01	6.38E-01	2.45E-01	2.87E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	103	104	105	106	107	108
Distance from Rim (µm)	6039.7	5994.6	5949.5	5904.5	5859.4	5814.3
Li7 (ppm)	1.19E+00	9.94E-01	1.43E+00	9.12E-01	7.58E-01	1.04E+00
B11 (ppm)	4.46E+00	2.55E+00	2.81E+00	3.42E+00	4.12E+00	4.28E+00
Na23 (ppm)	1.06E+02	1.29E+02	1.63E+02	4.96E+01	2.74E+01	2.13E+01
Mg24 (ppm)	1.50E+02	1.20E+02	1.55E+03	2.24E+02	1.67E+02	1.53E+02
Al27 (ppm)	5.47E+04	4.38E+04	4.00E+04	5.80E+04	5.59E+04	5.35E+04
P31 (ppm)	7.06E+00	1.67E+01	8.11E+00	9.79E+00	9.80E+00	9.61E+00
Ca43 (ppm)	2.47E+05	1.76E+05	1.48E+05	2.41E+05	2.43E+05	2.47E+05
Sc45 (ppm)	8.84E+00	4.55E+00	4.21E+00	1.34E+01	1.19E+01	8.02E+00
Ti49 (ppm)	3.10E+03	4.86E+02	6.76E+02	1.62E+03	2.73E+03	3.51E+03
V51 (ppm)	6.94E+01	4.05E+01	3.45E+01	7.09E+01	7.82E+01	7.44E+01
Cr52 (ppm)	4.05E+01	8.00E+00	4.38E+00	1.50E+01	2.61E+01	3.65E+01
Mn55 (ppm)	1.44E+04	1.15E+04	1.07E+04	1.59E+04	1.52E+04	1.35E+04
Fe57 (ppm)	1.25E+05	8.94E+04	6.95E+04	1.21E+05	1.25E+05	1.31E+05
Y89 (ppm)	2.15E+01	1.27E+01	1.02E+01	2.78E+01	2.64E+01	2.38E+01
Zr90 (ppm)	4.76E+01	1.26E+01	1.67E+01	2.88E+01	4.00E+01	5.21E+01
Nb93 (ppm)	1.24E+01	4.16E+00	5.05E+00	9.53E+00	1.15E+01	1.33E+01
La139 (ppm)	1.44E-02	1.67E-02	9.68E-03	2.23E-02	2.28E-02	5.15E-03
Ce140 (ppm)	6.77E-02	2.31E-01	2.29E-01	4.82E-01	1.67E-01	4.52E-02
Pr141 (ppm)	3.02E-02	1.28E-01	1.10E-01	2.31E-01	1.01E-01	2.60E-02
Nd146 (ppm)	5.54E-01	1.63E+00	1.06E+00	2.25E+00	1.00E+00	4.19E-01
Sm147 (ppm)	7.59E-01	1.88E+00	1.49E+00	1.47E+00	1.09E+00	5.73E-01
Eu153 (ppm)	1.48E-01	5.35E-01	3.19E-01	3.62E-01	2.43E-01	1.73E-01
Gd157 (ppm)	2.25E+00	2.76E+00	2.21E+00	3.18E+00	2.33E+00	1.87E+00
Tb159 (ppm)	4.27E-01	4.60E-01	3.26E-01	5.65E-01	5.40E-01	4.37E-01
Dy163 (ppm)	3.12E+00	2.45E+00	2.02E+00	4.16E+00	3.88E+00	3.46E+00
Ho165 (ppm)	6.58E-01	4.37E-01	3.32E-01	8.45E-01	9.24E-01	8.21E-01
Er166 (ppm)	2.07E+00	1.15E+00	1.01E+00	2.91E+00	2.89E+00	2.37E+00
Tm169 (ppm)	3.09E-01	1.46E-01	1.54E-01	4.28E-01	3.77E-01	3.18E-01
Yb172 (ppm)	2.30E+00	1.11E+00	8.70E-01	3.08E+00	2.84E+00	2.57E+00
Lu175 (ppm)	3.65E-01	1.60E-01	1.46E-01	4.82E-01	4.75E-01	3.86E-01
Hf178 (ppm)	1.43E+00	3.45E-01	4.26E-01	9.32E-01	1.35E+00	1.67E+00
U238 (ppm)	4.83E-01	6.55E-01	5.65E-01	7.30E-01	6.44E-01	5.06E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	109	110	111	112	113	114
Distance from Rim (µm)	5769.2	5724.2	5453.8	5408.7	5363.6	5318.5
Li7 (ppm)	9.48E-01	6.52E-01	1.58E+00	9.23E-01	7.57E-01	1.18E+00
B11 (ppm)	4.13E+00	4.61E+00	4.34E+00	3.88E+00	4.40E+00	4.40E+00
Na23 (ppm)	1.91E+01	3.81E+01	7.34E+01	4.49E+01	2.58E+01	3.30E+01
Mg24 (ppm)	1.34E+02	1.08E+02	2.32E+02	1.94E+02	2.19E+02	1.96E+02
Al27 (ppm)	5.03E+04	5.05E+04	5.07E+04	5.08E+04	5.30E+04	5.21E+04
P31 (ppm)	1.06E+01	1.51E+00	2.23E+01	8.37E+00	1.64E+01	2.95E+00
Ca43 (ppm)	2.47E+05	2.46E+05	2.45E+05	2.41E+05	2.56E+05	2.49E+05
Sc45 (ppm)	7.47E+00	3.43E+00	4.83E+00	3.54E+00	4.49E+00	8.02E+00
Ti49 (ppm)	3.38E+03	2.33E+03	2.33E+03	2.10E+03	2.59E+03	3.29E+03
V51 (ppm)	6.49E+01	6.50E+01	6.43E+01	6.02E+01	6.50E+01	6.87E+01
Cr52 (ppm)	2.20E+01	8.12E+00	1.74E+01	7.96E+00	2.18E+01	2.14E+01
Mn55 (ppm)	1.32E+04	1.41E+04	1.36E+04	1.35E+04	1.49E+04	1.35E+04
Fe57 (ppm)	1.37E+05	1.36E+05	1.32E+05	1.34E+05	1.42E+05	1.32E+05
Y89 (ppm)	2.50E+01	2.97E+01	2.79E+01	2.87E+01	2.92E+01	2.60E+01
Zr90 (ppm)	4.69E+01	3.17E+01	3.56E+01	2.84E+01	3.20E+01	4.35E+01
Nb93 (ppm)	1.22E+01	8.84E+00	8.79E+00	8.18E+00	9.59E+00	1.28E+01
La139 (ppm)	6.73E-03	2.02E-02	6.99E-03	5.31E-03	-4.83E-06	9.66E-04
Ce140 (ppm)	8.03E-02	1.66E-01	9.75E-02	5.75E-02	6.21E-02	9.06E-02
Pr141 (ppm)	4.13E-02	5.79E-02	4.70E-02	3.03E-02	3.57E-02	4.86E-02
Nd146 (ppm)	4.88E-01	7.81E-01	5.98E-01	6.65E-01	5.62E-01	5.90E-01
Sm147 (ppm)	9.05E-01	9.00E-01	7.95E-01	8.36E-01	6.20E-01	8.64E-01
Eu153 (ppm)	1.17E-01	1.30E-01	1.44E-01	1.22E-01	9.46E-02	1.19E-01
Gd157 (ppm)	2.14E+00	2.12E+00	2.38E+00	2.41E+00	2.00E+00	2.38E+00
Tb159 (ppm)	5.09E-01	5.70E-01	5.23E-01	5.31E-01	5.34E-01	5.19E-01
Dy163 (ppm)	3.64E+00	4.25E+00	3.77E+00	4.31E+00	4.07E+00	4.05E+00
Ho165 (ppm)	8.60E-01	9.24E-01	8.47E-01	8.28E-01	8.87E-01	8.43E-01
Er166 (ppm)	2.50E+00	3.02E+00	2.67E+00	2.56E+00	2.78E+00	2.57E+00
Tm169 (ppm)	3.68E-01	4.07E-01	3.69E-01	3.85E-01	4.05E-01	3.64E-01
Yb172 (ppm)	2.53E+00	2.98E+00	2.66E+00	2.75E+00	3.13E+00	2.51E+00
Lu175 (ppm)	3.45E-01	4.48E-01	4.03E-01	4.13E-01	4.22E-01	4.19E-01
Hf178 (ppm)	1.58E+00	8.63E-01	1.07E+00	7.41E-01	1.03E+00	1.53E+00
U238 (ppm)	3.80E-01	4.79E-01	4.24E-01	2.93E-01	2.78E-01	4.14E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	115	116	117	118	119	120
Distance from Rim (µm)	5273.5	5228.4	5183.3	5138.2	5093.2	5048.1
Li7 (ppm)	1.02E+00	1.29E+00	1.68E+00	2.56E+00	1.34E+00	1.85E+00
B11 (ppm)	4.66E+00	3.91E+00	3.44E+00	3.65E+00	3.74E+00	3.87E+00
Na23 (ppm)	1.30E+01	2.35E+01	1.00E+01	3.80E+01	8.69E+00	2.01E+00
Mg24 (ppm)	1.99E+02	2.34E+02	2.53E+02	3.24E+02	3.20E+02	3.31E+02
Al27 (ppm)	6.07E+04	6.59E+04	7.13E+04	6.93E+04	7.09E+04	7.29E+04
P31 (ppm)	-3.27E+00	1.73E+01	-1.02E+00	8.05E+00	3.15E-01	-7.68E-01
Ca43 (ppm)	2.37E+05	2.29E+05	2.36E+05	2.27E+05	2.32E+05	2.37E+05
Sc45 (ppm)	8.08E+00	9.43E+00	5.46E+00	4.46E+00	2.94E+00	2.63E+00
Ti49 (ppm)	1.48E+03	1.09E+03	1.10E+03	1.62E+03	1.56E+03	1.43E+03
V51 (ppm)	6.22E+01	6.64E+01	6.12E+01	6.20E+01	5.74E+01	5.71E+01
Cr52 (ppm)	1.95E+01	5.52E+00	3.75E+00	3.05E+00	1.83E+00	2.64E+00
Mn55 (ppm)	1.80E+04	1.88E+04	2.03E+04	1.86E+04	1.82E+04	1.95E+04
Fe57 (ppm)	1.20E+05	1.08E+05	1.03E+05	9.96E+04	9.74E+04	9.95E+04
Y89 (ppm)	2.37E+01	2.57E+01	1.96E+01	1.78E+01	1.59E+01	1.53E+01
Zr90 (ppm)	2.59E+01	2.14E+01	2.27E+01	2.95E+01	3.13E+01	2.60E+01
Nb93 (ppm)	7.62E+00	7.12E+00	8.49E+00	1.00E+01	1.01E+01	8.04E+00
La139 (ppm)	2.44E-02	1.75E-02	1.52E-02	9.64E-03	4.20E-03	2.20E-03
Ce140 (ppm)	1.65E-01	2.63E-01	1.65E-01	1.15E-01	7.41E-02	4.67E-02
Pr141 (ppm)	6.50E-02	1.42E-01	9.01E-02	9.25E-02	4.94E-02	4.74E-02
Nd146 (ppm)	9.70E-01	1.79E+00	1.19E+00	1.30E+00	1.10E+00	8.96E-01
Sm147 (ppm)	1.27E+00	1.67E+00	1.71E+00	1.98E+00	2.15E+00	1.91E+00
Eu153 (ppm)	2.58E-01	3.71E-01	3.63E-01	4.89E-01	5.08E-01	4.87E-01
Gd157 (ppm)	2.76E+00	3.19E+00	3.07E+00	3.94E+00	3.86E+00	3.83E+00
Tb159 (ppm)	5.33E-01	6.78E-01	5.84E-01	5.76E-01	5.99E-01	5.71E-01
Dy163 (ppm)	3.60E+00	4.10E+00	3.47E+00	3.17E+00	3.20E+00	2.94E+00
Ho165 (ppm)	7.38E-01	8.74E-01	6.59E-01	6.46E-01	5.24E-01	5.19E-01
Er166 (ppm)	2.54E+00	2.74E+00	1.85E+00	1.62E+00	1.26E+00	1.44E+00
Tm169 (ppm)	3.83E-01	4.26E-01	2.81E-01	2.55E-01	1.91E-01	2.05E-01
Yb172 (ppm)	2.41E+00	3.03E+00	1.97E+00	1.82E+00	1.30E+00	1.26E+00
Lu175 (ppm)	4.18E-01	4.86E-01	2.86E-01	2.64E-01	1.53E-01	1.66E-01
Hf178 (ppm)	8.16E-01	6.58E-01	5.63E-01	8.16E-01	7.83E-01	6.06E-01
U238 (ppm)	7.24E-01	5.05E-01	5.50E-01	8.10E-01	8.34E-01	6.22E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	121	122	123	124	125	126
Distance from Rim (µm)	5003.0	4957.9	4912.9	4867.8	4822.7	4777.6
Li7 (ppm)	1.69E+00	2.00E+00	1.57E+00	1.21E+00	1.24E+00	2.39E+00
B11 (ppm)	3.88E+00	3.86E+00	3.68E+00	4.09E+00	4.36E+00	3.24E+00
Na23 (ppm)	1.20E+01	1.23E+01	1.77E+01	2.36E+01	2.02E+01	1.79E+02
Mg24 (ppm)	3.25E+02	3.39E+02	2.98E+02	2.65E+02	2.98E+02	1.77E+03
Al27 (ppm)	7.31E+04	7.24E+04	7.24E+04	6.73E+04	6.63E+04	6.65E+04
P31 (ppm)	-9.78E-01	-8.35E-01	5.00E+00	-3.36E+00	1.78E+01	1.37E+01
Ca43 (ppm)	2.37E+05	2.37E+05	2.44E+05	2.31E+05	2.33E+05	2.29E+05
Sc45 (ppm)	2.81E+00	2.75E+00	1.08E+01	8.55E+00	1.20E+01	8.50E+00
Ti49 (ppm)	1.46E+03	1.52E+03	1.62E+03	1.27E+03	1.56E+03	1.33E+03
V51 (ppm)	5.63E+01	6.00E+01	6.81E+01	6.77E+01	6.96E+01	6.08E+01
Cr52 (ppm)	2.58E+00	1.62E+00	4.26E+00	6.91E+00	4.01E+00	4.27E+00
Mn55 (ppm)	1.86E+04	1.99E+04	1.86E+04	1.93E+04	1.78E+04	1.83E+04
Fe57 (ppm)	9.67E+04	9.54E+04	1.03E+05	1.05E+05	1.06E+05	1.07E+05
Y89 (ppm)	1.50E+01	1.52E+01	2.62E+01	2.58E+01	2.88E+01	2.09E+01
Zr90 (ppm)	2.71E+01	2.59E+01	2.84E+01	2.50E+01	3.20E+01	2.90E+01
Nb93 (ppm)	9.17E+00	8.76E+00	7.06E+00	7.34E+00	8.26E+00	9.60E+00
La139 (ppm)	1.04E-03	1.13E-03	1.69E-02	1.81E-02	1.93E-02	2.23E-02
Ce140 (ppm)	4.53E-02	5.46E-02	3.50E-01	2.26E-01	3.21E-01	1.99E-01
Pr141 (ppm)	5.21E-02	4.11E-02	1.92E-01	1.32E-01	1.87E-01	1.32E-01
Nd146 (ppm)	1.00E+00	8.47E-01	2.89E+00	1.75E+00	2.71E+00	1.81E+00
Sm147 (ppm)	1.93E+00	2.20E+00	2.29E+00	2.01E+00	2.91E+00	2.33E+00
Eu153 (ppm)	5.45E-01	4.26E-01	5.93E-01	4.92E-01	6.36E-01	5.93E-01
Gd157 (ppm)	3.73E+00	3.54E+00	3.90E+00	3.84E+00	4.42E+00	3.47E+00
Tb159 (ppm)	5.92E-01	5.74E-01	6.79E-01	6.02E-01	7.46E-01	6.19E-01
Dy163 (ppm)	2.97E+00	2.97E+00	3.76E+00	4.13E+00	4.37E+00	3.73E+00
Ho165 (ppm)	5.40E-01	5.51E-01	9.00E-01	7.84E-01	9.47E-01	6.86E-01
Er166 (ppm)	1.46E+00	1.60E+00	2.84E+00	2.58E+00	3.19E+00	2.19E+00
Tm169 (ppm)	1.92E-01	1.87E-01	4.52E-01	3.91E-01	5.12E-01	3.44E-01
Yb172 (ppm)	1.20E+00	1.30E+00	3.42E+00	2.87E+00	3.97E+00	2.33E+00
Lu175 (ppm)	1.48E-01	1.65E-01	5.61E-01	4.50E-01	5.90E-01	3.56E-01
Hf178 (ppm)	6.87E-01	7.24E-01	8.64E-01	7.43E-01	1.03E+00	8.58E-01
U238 (ppm)	7.05E-01	6.32E-01	6.94E-01	6.15E-01	1.04E+00	7.56E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	127	128	129	130	131	132
Distance from Rim (µm)	4732.6	4687.5	4642.5	4597.4	4552.3	4507.2
Li7 (ppm)	4.33E+00	1.40E+00	1.36E+00	1.55E+00	1.62E+00	1.28E+00
B11 (ppm)	2.69E+00	4.06E+00	3.57E+00	3.31E+00	3.33E+00	3.35E+00
Na23 (ppm)	9.47E+02	2.52E+01	4.78E+01	3.13E+01	3.94E+01	1.77E+01
Mg24 (ppm)	6.46E+03	2.78E+02	2.76E+02	2.55E+02	2.31E+02	2.32E+02
Al27 (ppm)	5.27E+04	7.01E+04	6.51E+04	6.85E+04	6.65E+04	6.72E+04
P31 (ppm)	2.05E+01	1.22E+01	1.03E+01	8.85E+00	8.21E+00	1.44E+01
Ca43 (ppm)	1.65E+05	2.32E+05	2.22E+05	2.27E+05	2.31E+05	2.32E+05
Sc45 (ppm)	1.03E+01	2.55E+00	6.48E+00	6.61E+00	7.73E+00	1.01E+01
Ti49 (ppm)	7.93E+02	9.30E+02	1.00E+03	9.15E+02	1.15E+03	1.14E+03
V51 (ppm)	5.24E+01	5.65E+01	6.34E+01	6.07E+01	6.45E+01	6.29E+01
Cr52 (ppm)	4.52E+00	3.75E+00	1.19E+01	6.17E+00	5.94E+00	5.58E+00
Mn55 (ppm)	1.53E+04	1.94E+04	1.90E+04	2.02E+04	1.88E+04	1.85E+04
Fe57 (ppm)	8.65E+04	1.02E+05	1.02E+05	9.80E+04	1.06E+05	1.06E+05
Y89 (ppm)	1.55E+01	1.53E+01	2.10E+01	2.09E+01	2.29E+01	2.56E+01
Zr90 (ppm)	1.84E+01	2.13E+01	1.83E+01	1.62E+01	2.36E+01	2.25E+01
Nb93 (ppm)	6.17E+00	8.49E+00	7.13E+00	5.55E+00	8.85E+00	6.83E+00
La139 (ppm)	1.39E-02	3.13E-03	1.38E-02	1.67E-02	8.70E-03	1.59E-02
Ce140 (ppm)	9.80E-02	3.40E-02	2.57E-01	1.48E-01	1.60E-01	2.39E-01
Pr141 (ppm)	5.56E-02	1.44E-02	1.25E-01	8.54E-02	8.98E-02	1.48E-01
Nd146 (ppm)	6.84E-01	3.95E-01	1.38E+00	1.38E+00	1.52E+00	2.12E+00
Sm147 (ppm)	9.69E-01	9.29E-01	1.19E+00	1.15E+00	1.76E+00	1.85E+00
Eu153 (ppm)	2.34E-01	2.21E-01	3.75E-01	3.13E-01	4.11E-01	4.47E-01
Gd157 (ppm)	2.50E+00	2.79E+00	2.86E+00	2.66E+00	3.43E+00	3.58E+00
Tb159 (ppm)	3.83E-01	5.45E-01	5.52E-01	5.36E-01	6.22E-01	6.27E-01
Dy163 (ppm)	2.44E+00	2.87E+00	3.30E+00	3.37E+00	3.95E+00	4.04E+00
Ho165 (ppm)	4.53E-01	5.51E-01	6.94E-01	6.28E-01	7.40E-01	8.42E-01
Er166 (ppm)	1.42E+00	1.37E+00	1.88E+00	2.24E+00	2.34E+00	2.91E+00
Tm169 (ppm)	2.13E-01	1.54E-01	2.95E-01	2.91E-01	3.34E-01	4.31E-01
Yb172 (ppm)	1.51E+00	1.20E+00	2.44E+00	2.64E+00	2.55E+00	2.95E+00
Lu175 (ppm)	2.57E-01	2.14E-01	3.55E-01	3.84E-01	4.05E-01	4.54E-01
Hf178 (ppm)	5.30E-01	5.40E-01	5.82E-01	5.31E-01	6.59E-01	6.11E-01
U238 (ppm)	2.65E-01	2.34E-01	3.56E-01	2.93E-01	4.42E-01	5.12E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	133	134	135	136	137	138
Distance from Rim (µm)	4462.2	4417.1	4372.0	4326.9	4281.9	4236.8
Li7 (ppm)	1.27E+00	9.45E-01	1.06E+00	8.64E-01	6.49E-01	9.16E-01
B11 (ppm)	3.59E+00	3.98E+00	3.61E+00	4.17E+00	4.08E+00	4.00E+00
Na23 (ppm)	1.77E+01	1.17E+01	1.08E+01	1.63E+01	-3.73E+00	2.95E+01
Mg24 (ppm)	1.83E+02	2.55E+02	2.41E+02	1.91E+02	1.39E+02	1.39E+02
Al27 (ppm)	6.85E+04	6.77E+04	6.87E+04	6.82E+04	6.46E+04	6.31E+04
P31 (ppm)	1.33E+01	2.38E+01	1.52E+01	1.04E+01	1.15E+01	1.14E+01
Ca43 (ppm)	2.32E+05	2.36E+05	2.29E+05	2.34E+05	2.46E+05	2.36E+05
Sc45 (ppm)	3.69E+00	5.57E+00	5.41E+00	4.89E+00	3.59E+00	7.21E+00
Ti49 (ppm)	9.26E+02	9.94E+02	9.66E+02	7.94E+02	2.68E+02	4.80E+02
V51 (ppm)	5.40E+01	5.36E+01	5.60E+01	5.56E+01	2.96E+01	4.36E+01
Cr52 (ppm)	5.91E+00	4.80E+00	4.53E+00	5.85E+00	8.62E+00	8.02E+00
Mn55 (ppm)	1.87E+04	1.89E+04	1.89E+04	1.97E+04	1.83E+04	1.75E+04
Fe57 (ppm)	1.07E+05	1.09E+05	1.03E+05	1.06E+05	1.18E+05	1.15E+05
Y89 (ppm)	1.58E+01	1.93E+01	1.98E+01	1.74E+01	9.74E+00	1.77E+01
Zr90 (ppm)	1.97E+01	2.45E+01	2.01E+01	1.54E+01	1.55E+01	1.81E+01
Nb93 (ppm)	6.52E+00	7.92E+00	5.91E+00	4.70E+00	2.77E+00	3.99E+00
La139 (ppm)	1.01E-02	1.51E-02	6.95E-03	1.13E-02	1.07E-06	1.65E-02
Ce140 (ppm)	7.80E-02	1.47E-01	1.46E-01	1.13E-01	3.50E-02	1.66E-01
Pr141 (ppm)	4.94E-02	8.83E-02	8.08E-02	5.16E-02	3.31E-02	9.62E-02
Nd146 (ppm)	6.38E-01	1.40E+00	1.53E+00	7.25E-01	6.35E-01	1.13E+00
Sm147 (ppm)	1.11E+00	2.06E+00	1.94E+00	1.05E+00	9.65E-01	1.30E+00
Eu153 (ppm)	2.84E-01	5.23E-01	4.21E-01	2.74E-01	2.72E-01	3.59E-01
Gd157 (ppm)	2.72E+00	3.43E+00	3.32E+00	2.83E+00	2.52E+00	2.99E+00
Tb159 (ppm)	5.04E-01	5.90E-01	5.35E-01	5.04E-01	3.88E-01	5.47E-01
Dy163 (ppm)	2.92E+00	3.49E+00	3.04E+00	3.13E+00	2.14E+00	3.07E+00
Ho165 (ppm)	5.09E-01	7.14E-01	6.63E-01	6.40E-01	3.72E-01	5.96E-01
Er166 (ppm)	1.37E+00	2.01E+00	2.06E+00	1.63E+00	7.29E-01	1.55E+00
Tm169 (ppm)	2.08E-01	2.97E-01	2.77E-01	2.33E-01	6.76E-02	2.24E-01
Yb172 (ppm)	1.46E+00	2.23E+00	2.11E+00	1.53E+00	4.43E-01	1.85E+00
Lu175 (ppm)	1.93E-01	3.13E-01	3.63E-01	2.86E-01	6.98E-02	2.61E-01
Hf178 (ppm)	5.28E-01	6.29E-01	4.75E-01	4.76E-01	2.98E-01	3.96E-01
U238 (ppm)	2.96E-01	6.76E-01	4.85E-01	2.88E-01	2.69E-01	4.23E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	139	140	141	142	143	144
Distance from Rim (µm)	4191.7	4146.6	4101.6	4056.5	4011.4	3966.3
Li7 (ppm)	7.63E-01	1.50E+00	1.15E+00	9.84E-01	9.33E-01	7.86E-01
B11 (ppm)	3.78E+00	3.85E+00	4.03E+00	3.69E+00	4.25E+00	4.05E+00
Na23 (ppm)	5.94E+01	3.93E+01	3.55E+01	5.30E+01	3.33E+01	2.41E+01
Mg24 (ppm)	1.50E+02	1.85E+02	1.86E+02	1.74E+02	1.52E+02	1.58E+02
Al27 (ppm)	6.49E+04	6.95E+04	6.81E+04	6.47E+04	6.09E+04	6.01E+04
P31 (ppm)	1.57E+01	-2.19E+00	8.27E+00	8.88E+00	8.40E+00	8.98E+00
Ca43 (ppm)	2.40E+05	2.38E+05	2.31E+05	2.38E+05	2.41E+05	2.52E+05
Sc45 (ppm)	7.13E+00	5.11E+00	8.93E+00	5.33E+00	4.69E+00	8.27E+00
Ti49 (ppm)	5.98E+02	8.43E+02	9.96E+02	5.00E+02	9.79E+02	2.31E+03
V51 (ppm)	5.15E+01	5.52E+01	6.85E+01	4.30E+01	5.64E+01	6.54E+01
Cr52 (ppm)	1.53E+01	8.85E+00	8.80E+00	9.77E+00	7.63E+00	2.16E+01
Mn55 (ppm)	1.91E+04	1.97E+04	1.98E+04	1.93E+04	1.79E+04	1.62E+04
Fe57 (ppm)	1.12E+05	1.06E+05	1.07E+05	1.13E+05	1.18E+05	1.23E+05
Y89 (ppm)	1.96E+01	1.84E+01	2.55E+01	1.43E+01	1.86E+01	1.89E+01
Zr90 (ppm)	1.44E+01	1.76E+01	1.79E+01	1.27E+01	2.15E+01	3.40E+01
Nb93 (ppm)	3.98E+00	6.03E+00	4.47E+00	2.67E+00	5.28E+00	1.06E+01
La139 (ppm)	1.45E-02	1.44E-02	2.09E-02	1.19E-02	1.46E-02	2.11E-03
Ce140 (ppm)	1.77E-01	1.28E-01	2.22E-01	7.61E-02	8.53E-02	2.39E-02
Pr141 (ppm)	1.07E-01	6.00E-02	1.13E-01	4.21E-02	3.73E-02	1.28E-02
Nd146 (ppm)	1.22E+00	9.50E-01	1.57E+00	8.02E-01	6.91E-01	3.10E-01
Sm147 (ppm)	1.31E+00	1.31E+00	1.43E+00	1.05E+00	7.56E-01	7.04E-01
Eu153 (ppm)	3.20E-01	3.17E-01	3.91E-01	2.96E-01	2.34E-01	1.54E-01
Gd157 (ppm)	2.84E+00	2.98E+00	3.07E+00	2.25E+00	2.31E+00	1.74E+00
Tb159 (ppm)	5.81E-01	5.26E-01	6.37E-01	4.16E-01	4.33E-01	4.53E-01
Dy163 (ppm)	3.54E+00	3.26E+00	3.99E+00	2.78E+00	2.98E+00	2.97E+00
Ho165 (ppm)	6.71E-01	5.87E-01	8.19E-01	4.97E-01	6.13E-01	7.20E-01
Er166 (ppm)	2.12E+00	1.83E+00	2.60E+00	1.47E+00	1.90E+00	1.85E+00
Tm169 (ppm)	2.92E-01	2.35E-01	3.85E-01	1.66E-01	2.62E-01	2.47E-01
Yb172 (ppm)	2.09E+00	1.99E+00	3.17E+00	1.60E+00	1.93E+00	1.76E+00
Lu175 (ppm)	3.60E-01	3.06E-01	4.82E-01	2.01E-01	3.03E-01	2.69E-01
Hf178 (ppm)	4.12E-01	4.63E-01	7.22E-01	3.21E-01	5.48E-01	1.13E+00
U238 (ppm)	4.14E-01	2.98E-01	4.09E-01	2.65E-01	2.74E-01	3.00E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	145	146	147	148	149	150
Distance from Rim (µm)	3921.3	3876.2	3831.2	3786.1	3741.0	3695.9
Li7 (ppm)	6.78E-01	1.40E+00	1.09E+00	5.53E-01	1.02E+00	4.51E-01
B11 (ppm)	3.91E+00	3.46E+00	4.09E+00	3.86E+00	4.18E+00	3.66E+00
Na23 (ppm)	1.09E+01	1.90E+01	3.25E+01	6.82E+00	2.08E+01	8.63E+00
Mg24 (ppm)	1.51E+02	1.46E+02	1.50E+02	1.38E+02	1.35E+02	1.30E+02
Al27 (ppm)	6.04E+04	5.81E+04	6.21E+04	6.19E+04	6.43E+04	6.42E+04
P31 (ppm)	3.70E+00	1.21E+01	9.21E+00	5.52E+00	-3.26E+00	-6.33E+00
Ca43 (ppm)	2.46E+05	2.38E+05	2.41E+05	2.40E+05	2.40E+05	2.39E+05
Sc45 (ppm)	5.80E+00	6.30E+00	2.64E+00	7.70E+00	6.07E+00	3.43E+00
Ti49 (ppm)	1.83E+03	1.86E+03	9.35E+02	6.34E+02	5.63E+02	2.55E+02
V51 (ppm)	6.30E+01	6.36E+01	5.44E+01	4.36E+01	4.12E+01	2.86E+01
Cr52 (ppm)	1.53E+01	1.84E+01	6.17E+00	8.18E+00	9.21E+00	8.76E+00
Mn55 (ppm)	1.62E+04	1.64E+04	1.82E+04	1.65E+04	1.70E+04	1.75E+04
Fe57 (ppm)	1.24E+05	1.22E+05	1.17E+05	1.16E+05	1.17E+05	1.16E+05
Y89 (ppm)	1.88E+01	1.81E+01	1.64E+01	1.78E+01	1.49E+01	9.33E+00
Zr90 (ppm)	3.41E+01	3.06E+01	1.90E+01	1.94E+01	1.96E+01	1.61E+01
Nb93 (ppm)	9.95E+00	9.47E+00	4.94E+00	3.63E+00	3.32E+00	2.82E+00
La139 (ppm)	3.25E-03	4.74E-03	2.25E-03	9.30E-04	1.02E-02	5.37E-03
Ce140 (ppm)	2.57E-02	4.11E-02	3.78E-02	8.08E-02	9.13E-02	4.15E-02
Pr141 (ppm)	2.21E-02	2.40E-02	2.19E-02	4.97E-02	8.21E-02	2.62E-02
Nd146 (ppm)	3.06E-01	2.93E-01	2.97E-01	1.00E+00	9.41E-01	4.69E-01
Sm147 (ppm)	7.01E-01	6.55E-01	5.71E-01	1.67E+00	1.31E+00	1.05E+00
Eu153 (ppm)	1.50E-01	1.33E-01	1.42E-01	3.34E-01	3.15E-01	2.78E-01
Gd157 (ppm)	2.07E+00	1.94E+00	2.06E+00	2.92E+00	2.74E+00	2.53E+00
Tb159 (ppm)	4.19E-01	4.59E-01	4.01E-01	5.17E-01	4.39E-01	3.64E-01
Dy163 (ppm)	3.17E+00	2.84E+00	2.61E+00	2.97E+00	2.72E+00	2.09E+00
Ho165 (ppm)	6.32E-01	6.32E-01	5.43E-01	6.34E-01	5.23E-01	3.35E-01
Er166 (ppm)	1.85E+00	1.77E+00	1.53E+00	1.94E+00	1.60E+00	8.19E-01
Tm169 (ppm)	2.75E-01	2.25E-01	2.13E-01	2.50E-01	2.28E-01	7.91E-02
Yb172 (ppm)	1.80E+00	1.87E+00	1.54E+00	1.76E+00	1.53E+00	5.06E-01
Lu175 (ppm)	2.81E-01	2.54E-01	2.02E-01	2.43E-01	2.71E-01	6.55E-02
Hf178 (ppm)	9.77E-01	8.68E-01	4.93E-01	4.25E-01	4.55E-01	2.49E-01
U238 (ppm)	3.07E-01	2.76E-01	1.99E-01	3.43E-01	3.76E-01	2.94E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	151	152	153	154	155	156
Distance from Rim (µm)	3650.9	3605.8	3560.7	3515.6	3470.6	3425.5
Li7 (ppm)	3.91E-01	1.19E+00	1.33E+00	1.54E+00	1.15E+00	1.64E+00
B11 (ppm)	3.46E+00	3.76E+00	3.93E+00	3.81E+00	3.68E+00	3.84E+00
Na23 (ppm)	7.57E+00	8.13E+00	1.58E+01	2.77E+01	8.10E+00	1.52E+01
Mg24 (ppm)	1.45E+02	1.83E+02	2.08E+02	2.52E+02	3.15E+02	3.15E+02
Al27 (ppm)	6.51E+04	6.73E+04	7.07E+04	6.84E+04	7.05E+04	7.07E+04
P31 (ppm)	-6.58E+00	-1.01E+01	3.30E+00	1.72E+01	1.77E+01	1.85E+01
Ca43 (ppm)	2.40E+05	2.39E+05	2.36E+05	2.34E+05	2.29E+05	2.35E+05
Sc45 (ppm)	2.77E+00	2.84E+00	2.40E+00	5.38E+00	3.43E+00	7.19E+00
Ti49 (ppm)	2.29E+02	7.41E+02	7.52E+02	1.10E+03	1.45E+03	2.01E+03
V51 (ppm)	3.00E+01	4.84E+01	5.00E+01	5.67E+01	5.31E+01	6.95E+01
Cr52 (ppm)	7.39E+00	5.56E+00	4.18E+00	4.05E+00	5.58E+00	4.91E+00
Mn55 (ppm)	1.88E+04	1.97E+04	2.01E+04	1.94E+04	1.91E+04	1.83E+04
Fe57 (ppm)	1.16E+05	1.10E+05	1.06E+05	1.06E+05	9.69E+04	1.01E+05
Y89 (ppm)	9.46E+00	1.33E+01	1.47E+01	1.83E+01	1.44E+01	2.25E+01
Zr90 (ppm)	1.24E+01	1.69E+01	1.88E+01	2.29E+01	2.76E+01	3.57E+01
Nb93 (ppm)	3.09E+00	5.42E+00	7.50E+00	8.17E+00	8.97E+00	1.17E+01
La139 (ppm)	3.11E-03	1.09E-03	9.52E-04	1.04E-02	1.03E-03	9.99E-03
Ce140 (ppm)	3.63E-02	2.19E-02	5.32E-02	1.18E-01	4.09E-02	1.73E-01
Pr141 (ppm)	2.42E-02	2.18E-02	2.51E-02	6.26E-02	4.10E-02	1.17E-01
Nd146 (ppm)	5.39E-01	3.81E-01	3.71E-01	1.04E+00	7.82E-01	1.67E+00
Sm147 (ppm)	1.05E+00	8.86E-01	8.90E-01	1.68E+00	1.90E+00	2.65E+00
Eu153 (ppm)	2.92E-01	2.50E-01	2.46E-01	3.59E-01	4.71E-01	5.79E-01
Gd157 (ppm)	2.49E+00	2.55E+00	2.81E+00	3.09E+00	3.66E+00	4.45E+00
Tb159 (ppm)	4.49E-01	4.23E-01	5.29E-01	5.36E-01	5.42E-01	6.63E-01
Dy163 (ppm)	2.36E+00	2.66E+00	2.92E+00	3.32E+00	2.87E+00	4.04E+00
Ho165 (ppm)	3.63E-01	4.67E-01	5.14E-01	6.60E-01	5.14E-01	7.20E-01
Er166 (ppm)	8.11E-01	1.08E+00	1.40E+00	1.72E+00	1.45E+00	2.27E+00
Tm169 (ppm)	9.52E-02	1.44E-01	1.69E-01	2.60E-01	1.45E-01	2.96E-01
Yb172 (ppm)	5.01E-01	9.83E-01	9.56E-01	1.97E+00	1.23E+00	2.55E+00
Lu175 (ppm)	5.05E-02	1.24E-01	1.46E-01	3.09E-01	1.68E-01	3.89E-01
Hf178 (ppm)	1.76E-01	4.39E-01	5.10E-01	6.71E-01	8.03E-01	1.03E+00
U238 (ppm)	2.17E-01	1.79E-01	2.75E-01	4.97E-01	6.91E-01	1.02E+00

LA-ICP-MS: Empire Mountain						
Sample point no.	157	158	159	160	161	162
Distance from Rim (µm)	3380.4	3335.3	3290.3	3245.2	3200.2	3155.1
Li7 (ppm)	2.90E+00	3.07E+00	2.73E+00	2.80E+00	1.89E+00	2.45E+00
B11 (ppm)	3.72E+00	3.61E+00	3.83E+00	3.94E+00	3.75E+00	3.74E+00
Na23 (ppm)	3.97E+01	4.16E+01	3.90E+01	1.57E+01	2.26E+01	2.88E+01
Mg24 (ppm)	2.15E+02	2.53E+02	3.31E+02	3.52E+02	4.60E+02	4.70E+02
Al27 (ppm)	6.82E+04	7.22E+04	6.91E+04	7.02E+04	6.65E+04	6.50E+04
P31 (ppm)	4.80E+00	2.50E+01	4.82E+00	8.64E+00	1.23E+01	1.37E+01
Ca43 (ppm)	2.30E+05	2.38E+05	2.43E+05	2.38E+05	2.46E+05	2.33E+05
Sc45 (ppm)	1.56E+01	1.38E+01	1.19E+01	7.14E+00	8.33E+00	6.94E+00
Ti49 (ppm)	2.09E+03	2.30E+03	4.06E+03	4.33E+03	5.22E+03	5.10E+03
V51 (ppm)	7.68E+01	9.35E+01	1.06E+02	8.97E+01	8.45E+01	8.05E+01
Cr52 (ppm)	2.28E+01	8.65E+00	7.18E+00	8.69E+00	6.47E+00	6.96E+00
Mn55 (ppm)	1.63E+04	1.81E+04	1.64E+04	1.65E+04	1.42E+04	1.36E+04
Fe57 (ppm)	9.72E+04	9.66E+04	1.03E+05	9.36E+04	1.04E+05	9.84E+04
Y89 (ppm)	3.44E+01	3.41E+01	3.10E+01	2.19E+01	2.22E+01	2.15E+01
Zr90 (ppm)	3.23E+01	2.80E+01	4.88E+01	4.97E+01	8.39E+01	8.43E+01
Nb93 (ppm)	7.74E+00	7.92E+00	1.62E+01	1.71E+01	1.94E+01	1.97E+01
La139 (ppm)	3.78E-02	2.58E-02	1.78E-02	6.35E-03	2.16E-02	2.34E-02
Ce140 (ppm)	5.56E-01	4.27E-01	1.74E-01	1.04E-01	3.45E-01	3.50E-01
Pr141 (ppm)	3.43E-01	2.68E-01	1.34E-01	5.98E-02	2.18E-01	2.22E-01
Nd146 (ppm)	4.93E+00	3.18E+00	2.04E+00	1.31E+00	3.52E+00	3.75E+00
Sm147 (ppm)	2.55E+00	2.15E+00	2.49E+00	2.04E+00	4.85E+00	4.80E+00
Eu153 (ppm)	6.10E-01	5.49E-01	5.30E-01	4.83E-01	8.94E-01	9.75E-01
Gd157 (ppm)	3.42E+00	3.53E+00	3.96E+00	3.61E+00	5.43E+00	4.64E+00
Tb159 (ppm)	6.01E-01	6.92E-01	7.15E-01	5.69E-01	6.88E-01	6.48E-01
Dy163 (ppm)	5.12E+00	4.38E+00	4.72E+00	3.49E+00	3.77E+00	3.62E+00
Ho165 (ppm)	1.18E+00	1.15E+00	1.05E+00	7.64E-01	7.74E-01	7.30E-01
Er166 (ppm)	4.13E+00	3.85E+00	3.27E+00	2.04E+00	2.15E+00	2.27E+00
Tm169 (ppm)	6.79E-01	6.17E-01	5.46E-01	3.41E-01	3.32E-01	2.79E-01
Yb172 (ppm)	5.38E+00	4.51E+00	4.10E+00	2.67E+00	2.28E+00	2.22E+00
Lu175 (ppm)	8.60E-01	7.80E-01	6.22E-01	3.53E-01	3.35E-01	3.34E-01
Hf178 (ppm)	1.10E+00	1.07E+00	1.64E+00	1.71E+00	2.37E+00	2.34E+00
U238 (ppm)	5.72E-01	5.33E-01	9.86E-01	9.78E-01	3.14E+00	3.92E+00

LA-ICP-MS: Empire Mountain						
Sample point no.	163	164	165	166	167	168
Distance from Rim (µm)	3110.0	3064.9	3019.9	2974.8	2929.7	2884.6
Li7 (ppm)	3.14E+00	4.14E+00	2.32E+00	2.05E+00	2.15E+00	1.98E+00
B11 (ppm)	3.54E+00	4.30E+00	4.70E+00	3.89E+00	4.07E+00	4.24E+00
Na23 (ppm)	2.03E+01	5.34E+01	3.44E+01	2.84E+01	1.65E+01	2.50E+01
Mg24 (ppm)	5.25E+02	5.11E+02	4.84E+02	4.67E+02	4.94E+02	5.20E+02
Al27 (ppm)	6.42E+04	6.23E+04	6.84E+04	6.47E+04	6.68E+04	6.76E+04
P31 (ppm)	7.31E+00	1.12E+01	8.11E+00	8.71E+00	8.15E+00	3.81E+00
Ca43 (ppm)	2.45E+05	2.49E+05	2.47E+05	2.43E+05	2.48E+05	2.47E+05
Sc45 (ppm)	1.11E+01	1.37E+01	1.00E+01	7.45E+00	7.17E+00	7.77E+00
Ti49 (ppm)	6.77E+03	7.01E+03	5.43E+03	5.16E+03	5.37E+03	6.11E+03
V51 (ppm)	9.50E+01	1.00E+02	8.99E+01	7.91E+01	8.04E+01	9.02E+01
Cr52 (ppm)	8.15E+00	1.21E+01	6.89E+00	5.88E+00	6.31E+00	7.10E+00
Mn55 (ppm)	1.31E+04	1.35E+04	1.46E+04	1.40E+04	1.32E+04	1.32E+04
Fe57 (ppm)	1.05E+05	1.11E+05	1.03E+05	1.01E+05	1.04E+05	1.03E+05
Y89 (ppm)	2.36E+01	2.61E+01	2.63E+01	2.10E+01	2.26E+01	2.48E+01
Zr90 (ppm)	1.08E+02	1.09E+02	7.92E+01	8.01E+01	9.86E+01	1.11E+02
Nb93 (ppm)	2.29E+01	2.30E+01	1.81E+01	1.91E+01	2.18E+01	2.30E+01
La139 (ppm)	1.19E-02	3.07E-02	2.09E-02	1.52E-02	1.81E-02	2.71E-02
Ce140 (ppm)	3.37E-01	4.63E-01	3.67E-01	3.18E-01	4.74E-01	4.50E-01
Pr141 (ppm)	2.33E-01	2.91E-01	2.14E-01	2.22E-01	2.99E-01	3.28E-01
Nd146 (ppm)	4.25E+00	4.48E+00	3.79E+00	3.55E+00	4.76E+00	4.44E+00
Sm147 (ppm)	5.49E+00	5.13E+00	4.93E+00	5.17E+00	5.53E+00	5.80E+00
Eu153 (ppm)	1.03E+00	1.16E+00	9.65E-01	1.04E+00	1.10E+00	1.17E+00
Gd157 (ppm)	5.58E+00	5.25E+00	4.96E+00	5.35E+00	5.38E+00	5.21E+00
Tb159 (ppm)	6.72E-01	7.21E-01	6.83E-01	6.94E-01	7.07E-01	7.12E-01
Dy163 (ppm)	4.22E+00	4.31E+00	4.31E+00	4.06E+00	4.19E+00	4.07E+00
Ho165 (ppm)	8.11E-01	7.86E-01	8.78E-01	7.48E-01	7.85E-01	7.85E-01
Er166 (ppm)	2.52E+00	2.63E+00	2.66E+00	2.10E+00	2.35E+00	2.53E+00
Tm169 (ppm)	3.67E-01	4.19E-01	4.30E-01	2.67E-01	3.49E-01	3.62E-01
Yb172 (ppm)	2.29E+00	2.91E+00	3.20E+00	2.31E+00	2.39E+00	2.55E+00
Lu175 (ppm)	3.48E-01	4.59E-01	4.08E-01	3.02E-01	3.30E-01	3.63E-01
Hf178 (ppm)	3.24E+00	3.53E+00	2.37E+00	2.38E+00	2.79E+00	3.30E+00
U238 (ppm)	4.75E+00	5.17E+00	3.41E+00	3.48E+00	4.64E+00	4.97E+00

LA-ICP-MS: Empire Mountain						
Sample point no.	169	170	171	172	173	174
Distance from Rim (µm)	2839.6	2794.5	2749.4	2704.3	2659.3	2614.2
Li7 (ppm)	2.59E+00	3.63E+00	3.93E+00	3.05E+00	3.79E+00	2.21E+00
B11 (ppm)	4.32E+00	3.44E+00	4.52E+00	3.46E+00	4.38E+00	4.54E+00
Na23 (ppm)	3.56E+01	6.59E+01	6.63E+01	7.04E+01	1.13E+02	2.13E+01
Mg24 (ppm)	5.17E+02	5.10E+02	5.12E+02	4.49E+02	4.66E+02	4.65E+02
Al27 (ppm)	6.69E+04	6.40E+04	6.11E+04	6.49E+04	6.69E+04	6.60E+04
P31 (ppm)	8.60E+00	3.54E+00	8.02E+00	8.08E+00	2.27E+00	2.83E+00
Ca43 (ppm)	2.46E+05	2.43E+05	2.52E+05	2.46E+05	2.42E+05	2.50E+05
Sc45 (ppm)	8.71E+00	1.19E+01	1.31E+01	1.09E+01	8.66E+00	7.23E+00
Ti49 (ppm)	6.36E+03	6.68E+03	7.10E+03	5.48E+03	5.86E+03	4.82E+03
V51 (ppm)	9.23E+01	9.69E+01	9.71E+01	8.88E+01	8.84E+01	7.87E+01
Cr52 (ppm)	7.50E+00	8.61E+00	9.50E+00	7.29E+00	6.31E+00	4.92E+00
Mn55 (ppm)	1.38E+04	1.34E+04	1.35E+04	1.40E+04	1.39E+04	1.40E+04
Fe57 (ppm)	1.03E+05	1.06E+05	1.12E+05	1.04E+05	1.04E+05	1.10E+05
Y89 (ppm)	2.34E+01	2.57E+01	2.71E+01	2.68E+01	2.45E+01	2.25E+01
Zr90 (ppm)	9.77E+01	1.03E+02	1.29E+02	9.17E+01	1.05E+02	9.18E+01
Nb93 (ppm)	2.23E+01	2.26E+01	2.65E+01	1.97E+01	2.21E+01	1.97E+01
La139 (ppm)	1.71E-02	2.65E-02	6.93E-02	3.70E-02	9.35E-02	2.41E-02
Ce140 (ppm)	2.96E-01	3.81E-01	5.86E-01	4.24E-01	5.48E-01	4.74E-01
Pr141 (ppm)	2.18E-01	2.60E-01	3.46E-01	2.39E-01	2.86E-01	3.09E-01
Nd146 (ppm)	3.76E+00	4.34E+00	5.03E+00	4.21E+00	4.46E+00	4.78E+00
Sm147 (ppm)	4.91E+00	5.39E+00	5.40E+00	4.70E+00	4.93E+00	4.98E+00
Eu153 (ppm)	9.56E-01	1.07E+00	1.08E+00	9.32E-01	9.89E-01	9.98E-01
Gd157 (ppm)	5.46E+00	5.78E+00	5.45E+00	4.60E+00	4.96E+00	4.41E+00
Tb159 (ppm)	6.94E-01	7.48E-01	7.15E-01	6.35E-01	6.41E-01	6.18E-01
Dy163 (ppm)	3.84E+00	4.37E+00	4.41E+00	4.49E+00	4.34E+00	4.30E+00
Ho165 (ppm)	8.58E-01	8.52E-01	1.00E+00	9.35E-01	8.16E-01	7.89E-01
Er166 (ppm)	2.45E+00	2.80E+00	2.88E+00	3.08E+00	2.58E+00	2.41E+00
Tm169 (ppm)	3.35E-01	4.39E-01	4.32E-01	4.74E-01	3.40E-01	3.65E-01
Yb172 (ppm)	2.68E+00	2.74E+00	3.16E+00	3.37E+00	2.70E+00	2.48E+00
Lu175 (ppm)	3.36E-01	4.34E-01	4.51E-01	4.70E-01	4.04E-01	3.68E-01
Hf178 (ppm)	2.97E+00	3.25E+00	3.89E+00	2.85E+00	3.07E+00	2.70E+00
U238 (ppm)	4.27E+00	4.94E+00	6.06E+00	3.82E+00	4.61E+00	3.48E+00

LA-ICP-MS: Empire Mountain						
Sample point no.	175	176	177	178	179	180
Distance from Rim (µm)	2569.1	2524.0	2479.0	2433.9	2388.9	2343.8
Li7 (ppm)	5.58E+00	2.30E+00	2.60E+00	1.74E+00	3.71E+00	4.23E+00
B11 (ppm)	4.01E+00	3.79E+00	4.33E+00	3.93E+00	4.50E+00	5.08E+00
Na23 (ppm)	2.15E+01	5.62E+01	1.77E+01	1.32E+01	4.33E+01	4.99E+01
Mg24 (ppm)	3.43E+02	1.99E+02	2.01E+02	2.19E+02	3.26E+02	3.93E+02
Al27 (ppm)	6.38E+04	6.59E+04	6.67E+04	5.84E+04	5.22E+04	5.48E+04
P31 (ppm)	-3.60E+00	-5.72E+00	2.90E+00	-2.93E+00	4.65E+00	6.97E+00
Ca43 (ppm)	2.42E+05	2.43E+05	2.46E+05	2.40E+05	2.51E+05	2.64E+05
Sc45 (ppm)	9.12E+00	7.02E+00	8.18E+00	4.34E+00	9.95E+00	6.59E+00
Ti49 (ppm)	4.97E+03	2.64E+03	3.60E+03	3.19E+03	5.15E+03	4.89E+03
V51 (ppm)	6.38E+01	6.91E+01	6.19E+01	5.27E+01	8.07E+01	6.95E+01
Cr52 (ppm)	1.28E+01	1.04E+01	1.34E+01	5.57E+00	1.13E+01	6.73E+00
Mn55 (ppm)	1.46E+04	1.35E+04	1.17E+04	9.44E+03	9.37E+03	1.08E+04
Fe57 (ppm)	1.04E+05	1.01E+05	1.04E+05	1.08E+05	1.24E+05	1.34E+05
Y89 (ppm)	1.73E+01	1.89E+01	1.81E+01	1.78E+01	2.41E+01	2.28E+01
Zr90 (ppm)	1.14E+02	6.08E+01	8.26E+01	1.04E+02	1.20E+02	1.42E+02
Nb93 (ppm)	2.09E+01	1.16E+01	1.38E+01	1.55E+01	2.04E+01	1.75E+01
La139 (ppm)	4.65E-02	2.55E-02	6.44E-03	2.04E-02	4.13E-02	7.64E-02
Ce140 (ppm)	9.83E-01	3.36E-01	2.15E-01	4.53E-01	8.35E-01	1.52E+00
Pr141 (ppm)	6.62E-01	1.98E-01	1.32E-01	3.12E-01	5.89E-01	9.62E-01
Nd146 (ppm)	7.73E+00	2.45E+00	2.33E+00	4.74E+00	7.65E+00	1.14E+01
Sm147 (ppm)	3.48E+00	1.94E+00	2.33E+00	3.78E+00	4.49E+00	4.43E+00
Eu153 (ppm)	5.98E-01	5.01E-01	5.35E-01	9.36E-01	9.24E-01	1.07E+00
Gd157 (ppm)	2.18E+00	2.62E+00	3.49E+00	3.88E+00	4.56E+00	3.60E+00
Tb159 (ppm)	4.04E-01	4.45E-01	5.31E-01	5.26E-01	6.62E-01	5.61E-01
Dy163 (ppm)	2.76E+00	2.91E+00	2.86E+00	3.23E+00	4.18E+00	3.38E+00
Ho165 (ppm)	5.34E-01	5.71E-01	5.63E-01	5.66E-01	8.25E-01	7.06E-01
Er166 (ppm)	2.00E+00	2.09E+00	1.83E+00	1.65E+00	2.58E+00	2.18E+00
Tm169 (ppm)	2.64E-01	2.83E-01	2.30E-01	2.49E-01	3.76E-01	3.64E-01
Yb172 (ppm)	2.16E+00	1.81E+00	1.71E+00	1.47E+00	2.61E+00	2.73E+00
Lu175 (ppm)	2.98E-01	2.93E-01	2.41E-01	2.37E-01	3.61E-01	3.37E-01
Hf178 (ppm)	3.52E+00	1.87E+00	2.75E+00	3.03E+00	3.83E+00	4.16E+00
U238 (ppm)	4.32E+00	1.06E+00	1.14E+00	2.26E+00	3.12E+00	4.19E+00

LA-ICP-MS: Empire Mountain						
Sample point no.	181	182	183	184	185	186
Distance from Rim (µm)	2298.7	2253.6	2208.6	2163.5	2118.4	2073.3
Li7 (ppm)	1.54E+00	6.68E-01	4.88E-02	-1.28E-02	2.22E-01	2.82E-01
B11 (ppm)	4.84E+00	4.52E+00	4.47E+00	4.69E+00	3.99E+00	4.20E+00
Na23 (ppm)	1.69E+01	7.25E+00	1.88E+00	6.12E+00	7.37E+00	3.16E+01
Mg24 (ppm)	4.03E+02	4.01E+02	3.43E+02	3.46E+02	2.76E+02	3.46E+02
Al27 (ppm)	4.16E+04	4.00E+04	3.82E+04	4.33E+04	5.01E+04	5.26E+04
P31 (ppm)	-7.83E+00	9.73E-01	2.88E+00	5.28E+00	5.78E+00	9.17E+00
Ca43 (ppm)	2.62E+05	2.51E+05	2.51E+05	2.59E+05	2.47E+05	2.53E+05
Sc45 (ppm)	1.05E+01	7.78E+00	6.15E+00	3.47E+00	1.94E+00	3.46E+00
Ti49 (ppm)	4.08E+03	2.80E+03	1.71E+03	1.71E+03	1.59E+03	1.59E+03
V51 (ppm)	6.38E+01	3.88E+01	3.34E+01	3.28E+01	2.90E+01	3.61E+01
Cr52 (ppm)	1.12E+01	5.66E+00	4.78E+00	3.16E+00	4.30E-02	9.71E-01
Mn55 (ppm)	7.99E+03	7.41E+03	7.26E+03	7.81E+03	8.12E+03	8.55E+03
Fe57 (ppm)	1.56E+05	1.51E+05	1.52E+05	1.47E+05	1.33E+05	1.31E+05
Y89 (ppm)	1.87E+01	1.43E+01	1.38E+01	1.74E+01	2.29E+01	3.25E+01
Zr90 (ppm)	2.39E+02	2.37E+02	1.88E+02	1.80E+02	1.38E+02	1.38E+02
Nb93 (ppm)	1.71E+01	1.17E+01	9.81E+00	1.17E+01	9.47E+00	1.02E+01
La139 (ppm)	1.38E-01	1.67E-01	2.39E-01	2.26E-01	1.75E-01	2.33E-01
Ce140 (ppm)	3.42E+00	3.78E+00	5.59E+00	6.35E+00	4.66E+00	5.29E+00
Pr141 (ppm)	2.04E+00	1.93E+00	2.78E+00	3.02E+00	2.44E+00	2.25E+00
Nd146 (ppm)	1.98E+01	1.62E+01	2.04E+01	2.22E+01	1.95E+01	1.65E+01
Sm147 (ppm)	5.30E+00	4.10E+00	5.20E+00	5.17E+00	5.73E+00	4.43E+00
Eu153 (ppm)	1.16E+00	9.28E-01	1.07E+00	1.16E+00	1.17E+00	9.40E-01
Gd157 (ppm)	4.06E+00	3.37E+00	3.81E+00	4.43E+00	4.48E+00	4.97E+00
Tb159 (ppm)	5.70E-01	4.30E-01	5.00E-01	5.80E-01	7.77E-01	8.56E-01
Dy163 (ppm)	3.42E+00	2.84E+00	2.82E+00	3.33E+00	4.35E+00	5.51E+00
Ho165 (ppm)	5.92E-01	5.06E-01	4.76E-01	5.91E-01	7.44E-01	1.11E+00
Er166 (ppm)	1.93E+00	1.53E+00	1.22E+00	1.64E+00	2.18E+00	3.30E+00
Tm169 (ppm)	2.55E-01	1.97E-01	1.74E-01	2.31E-01	2.98E-01	4.47E-01
Yb172 (ppm)	1.91E+00	1.49E+00	1.24E+00	1.54E+00	2.10E+00	2.89E+00
Lu175 (ppm)	2.75E-01	2.20E-01	1.96E-01	2.22E-01	3.39E-01	4.65E-01
Hf178 (ppm)	7.07E+00	6.84E+00	4.71E+00	3.56E+00	2.71E+00	2.54E+00
U238 (ppm)	4.18E+00	3.04E+00	2.94E+00	2.55E+00	1.74E+00	1.38E+00

LA-ICP-MS: Empire Mountain						
Sample point no.	187	188	189	190	191	192
Distance from Rim (µm)	2028.3	1983.2	1938.1	1893.0	1848.0	1802.9
Li7 (ppm)	2.51E-01	3.20E-01	9.33E-01	1.76E+00	9.48E-01	7.17E-01
B11 (ppm)	4.35E+00	3.82E+00	4.16E+00	4.24E+00	3.55E+00	3.82E+00
Na23 (ppm)	1.72E+01	2.80E+01	1.69E+01	2.74E+01	2.43E+01	1.45E+01
Mg24 (ppm)	3.76E+02	3.80E+02	2.88E+02	2.57E+02	2.64E+02	2.51E+02
Al27 (ppm)	5.33E+04	5.56E+04	6.22E+04	6.36E+04	6.00E+04	6.18E+04
P31 (ppm)	2.33E+00	2.23E-01	5.41E+00	6.64E+00	6.95E+00	1.29E+01
Ca43 (ppm)	2.54E+05	2.43E+05	2.47E+05	2.52E+05	2.49E+05	2.48E+05
Sc45 (ppm)	5.55E+00	4.38E+00	4.72E+00	4.94E+00	4.85E+00	3.52E+00
Ti49 (ppm)	1.80E+03	1.73E+03	2.19E+03	2.02E+03	1.92E+03	1.70E+03
V51 (ppm)	4.19E+01	3.86E+01	5.12E+01	5.09E+01	4.59E+01	3.51E+01
Cr52 (ppm)	1.68E+00	2.56E+00	4.01E+00	4.20E+00	4.66E+00	3.41E+00
Mn55 (ppm)	8.87E+03	8.93E+03	9.58E+03	1.01E+04	8.76E+03	8.61E+03
Fe57 (ppm)	1.27E+05	1.16E+05	1.11E+05	1.11E+05	1.12E+05	1.11E+05
Y89 (ppm)	3.76E+01	3.76E+01	3.07E+01	2.84E+01	2.68E+01	2.90E+01
Zr90 (ppm)	1.68E+02	1.50E+02	1.02E+02	7.79E+01	7.56E+01	7.09E+01
Nb93 (ppm)	9.78E+00	9.00E+00	7.39E+00	6.97E+00	1.33E+01	1.12E+01
La139 (ppm)	2.85E-01	3.04E-01	1.18E-01	6.85E-02	5.39E-02	4.96E-02
Ce140 (ppm)	4.97E+00	4.27E+00	2.08E+00	1.59E+00	1.31E+00	1.57E+00
Pr141 (ppm)	2.08E+00	1.87E+00	9.90E-01	8.11E-01	8.26E-01	9.28E-01
Nd146 (ppm)	1.56E+01	1.46E+01	9.29E+00	8.28E+00	9.55E+00	9.56E+00
Sm147 (ppm)	4.87E+00	5.17E+00	4.11E+00	3.68E+00	4.04E+00	4.07E+00
Eu153 (ppm)	9.62E-01	8.90E-01	9.00E-01	7.97E-01	7.82E-01	6.79E-01
Gd157 (ppm)	5.10E+00	5.11E+00	4.74E+00	4.30E+00	3.73E+00	4.28E+00
Tb159 (ppm)	8.42E-01	9.18E-01	7.46E-01	7.03E-01	7.25E-01	6.84E-01
Dy163 (ppm)	5.81E+00	6.11E+00	5.14E+00	4.46E+00	4.10E+00	4.72E+00
Ho165 (ppm)	1.32E+00	1.25E+00	9.68E-01	9.04E-01	9.34E-01	9.49E-01
Er166 (ppm)	4.10E+00	4.00E+00	3.24E+00	3.03E+00	2.59E+00	3.03E+00
Tm169 (ppm)	5.55E-01	5.36E-01	4.66E-01	4.04E-01	4.21E-01	5.04E-01
Yb172 (ppm)	4.62E+00	3.86E+00	3.01E+00	3.07E+00	2.94E+00	2.92E+00
Lu175 (ppm)	6.37E-01	5.65E-01	4.31E-01	4.55E-01	4.04E-01	4.25E-01
Hf178 (ppm)	3.31E+00	2.64E+00	2.95E+00	2.34E+00	2.29E+00	1.83E+00
U238 (ppm)	1.47E+00	1.32E+00	8.77E-01	8.19E-01	7.66E-01	6.13E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	193	194	195	196	197	198
Distance from Rim (µm)	1757.8	1712.7	1667.7	1622.6	1577.6	1532.5
Li7 (ppm)	1.77E+00	1.62E+00	1.07E+00	4.85E-01	5.24E-01	7.27E-01
B11 (ppm)	3.47E+00	3.30E+00	4.07E+00	3.94E+00	3.88E+00	3.93E+00
Na23 (ppm)	5.48E+01	1.83E+01	2.15E+01	1.44E+01	2.27E+01	2.67E+01
Mg24 (ppm)	2.20E+02	2.44E+02	2.48E+02	3.33E+02	3.13E+02	3.21E+02
Al27 (ppm)	6.37E+04	6.60E+04	5.90E+04	5.47E+04	5.28E+04	5.36E+04
P31 (ppm)	1.54E+01	9.61E-01	-7.65E-01	-8.22E+00	2.23E-01	5.28E+00
Ca43 (ppm)	2.45E+05	2.52E+05	2.54E+05	2.55E+05	2.52E+05	2.52E+05
Sc45 (ppm)	5.15E+00	2.14E+00	6.69E+00	4.88E+00	4.22E+00	7.55E+00
Ti49 (ppm)	1.82E+03	1.54E+03	1.78E+03	1.91E+03	1.53E+03	1.74E+03
V51 (ppm)	5.43E+01	3.90E+01	5.67E+01	4.71E+01	4.22E+01	5.10E+01
Cr52 (ppm)	4.30E+00	1.46E+00	4.10E+00	2.25E+00	2.96E+00	4.63E+00
Mn55 (ppm)	1.02E+04	9.51E+03	8.50E+03	7.58E+03	7.56E+03	8.69E+03
Fe57 (ppm)	1.07E+05	1.07E+05	1.21E+05	1.25E+05	1.26E+05	1.29E+05
Y89 (ppm)	3.48E+01	2.96E+01	3.12E+01	2.46E+01	2.40E+01	2.81E+01
Zr90 (ppm)	5.52E+01	5.58E+01	7.03E+01	9.15E+01	7.51E+01	7.94E+01
Nb93 (ppm)	1.15E+01	1.22E+01	1.30E+01	1.59E+01	1.40E+01	1.54E+01
La139 (ppm)	6.02E-02	5.07E-02	8.71E-02	1.43E-01	1.21E-01	1.25E-01
Ce140 (ppm)	1.17E+00	1.33E+00	1.95E+00	3.34E+00	2.85E+00	2.80E+00
Pr141 (ppm)	7.71E-01	8.85E-01	1.09E+00	1.86E+00	1.53E+00	1.42E+00
Nd146 (ppm)	8.94E+00	1.08E+01	1.11E+01	1.58E+01	1.34E+01	1.26E+01
Sm147 (ppm)	4.92E+00	4.66E+00	4.51E+00	3.78E+00	4.33E+00	3.81E+00
Eu153 (ppm)	6.67E-01	8.02E-01	9.43E-01	8.12E-01	7.16E-01	7.70E-01
Gd157 (ppm)	5.66E+00	4.54E+00	4.52E+00	3.21E+00	4.04E+00	4.53E+00
Tb159 (ppm)	9.45E-01	7.74E-01	8.18E-01	6.12E-01	6.54E-01	7.37E-01
Dy163 (ppm)	5.41E+00	4.71E+00	4.84E+00	3.95E+00	4.10E+00	4.58E+00
Ho165 (ppm)	1.12E+00	1.07E+00	1.00E+00	8.37E-01	7.92E-01	9.55E-01
Er166 (ppm)	3.61E+00	3.11E+00	3.48E+00	2.57E+00	2.15E+00	2.89E+00
Tm169 (ppm)	4.93E-01	4.09E-01	5.06E-01	3.42E-01	3.12E-01	4.68E-01
Yb172 (ppm)	3.38E+00	2.84E+00	3.37E+00	2.59E+00	2.45E+00	3.12E+00
Lu175 (ppm)	5.04E-01	3.90E-01	5.35E-01	4.29E-01	3.67E-01	4.25E-01
Hf178 (ppm)	1.51E+00	1.37E+00	2.06E+00	2.75E+00	2.02E+00	2.11E+00
U238 (ppm)	6.94E-01	6.10E-01	1.05E+00	1.29E+00	8.84E-01	1.10E+00

LA-ICP-MS: Empire Mountain						
Sample point no.	199	200	201	202	203	204
Distance from Rim (µm)	1487.4	1442.3	1397.3	1352.2	1307.1	1262.0
Li7 (ppm)	1.55E+00	2.64E+00	3.28E+00	4.62E+00	2.78E+00	1.41E+00
B11 (ppm)	4.27E+00	3.59E+00	3.88E+00	4.30E+00	3.65E+00	3.97E+00
Na23 (ppm)	2.91E+01	8.94E+00	2.67E+01	1.53E+01	6.89E+00	3.85E+00
Mg24 (ppm)	2.52E+02	1.40E+02	1.27E+02	1.27E+02	1.24E+02	1.59E+02
Al27 (ppm)	6.72E+04	6.54E+04	6.72E+04	7.67E+04	6.97E+04	6.03E+04
P31 (ppm)	1.33E+01	1.51E+01	8.55E+00	1.09E+01	1.53E+01	8.83E+00
Ca43 (ppm)	2.56E+05	2.47E+05	2.49E+05	2.58E+05	2.48E+05	2.41E+05
Sc45 (ppm)	2.90E+00	2.26E+01	9.96E+00	2.13E+01	6.92E+00	5.70E+00
Ti49 (ppm)	1.52E+03	2.05E+03	2.23E+03	2.41E+03	2.25E+03	1.84E+03
V51 (ppm)	3.29E+01	7.83E+01	6.31E+01	7.89E+01	5.68E+01	5.86E+01
Cr52 (ppm)	2.38E+00	1.33E+01	9.03E+00	8.53E+00	6.72E+00	3.59E+00
Mn55 (ppm)	9.43E+03	9.62E+03	1.06E+04	1.16E+04	9.27E+03	7.57E+03
Fe57 (ppm)	1.06E+05	1.05E+05	9.79E+04	9.95E+04	9.64E+04	1.08E+05
Y89 (ppm)	2.73E+01	4.98E+01	3.59E+01	5.38E+01	2.13E+01	2.08E+01
Zr90 (ppm)	5.72E+01	4.95E+01	4.81E+01	3.32E+01	4.98E+01	7.28E+01
Nb93 (ppm)	1.39E+01	1.52E+01	1.23E+01	1.09E+01	1.05E+01	1.17E+01
La139 (ppm)	8.07E-02	2.98E-02	1.74E-02	3.34E-02	5.71E-03	2.69E-02
Ce140 (ppm)	1.39E+00	6.54E-01	4.50E-01	3.94E-01	2.59E-01	6.39E-01
Pr141 (ppm)	7.61E-01	4.36E-01	2.86E-01	3.06E-01	1.87E-01	4.33E-01
Nd146 (ppm)	8.34E+00	6.58E+00	4.63E+00	3.70E+00	2.90E+00	7.25E+00
Sm147 (ppm)	4.17E+00	5.38E+00	4.44E+00	4.07E+00	3.68E+00	4.88E+00
Eu153 (ppm)	5.92E-01	8.79E-01	7.75E-01	7.78E-01	7.96E-01	8.96E-01
Gd157 (ppm)	4.85E+00	7.36E+00	5.63E+00	6.74E+00	3.75E+00	3.92E+00
Tb159 (ppm)	8.62E-01	1.29E+00	8.70E-01	1.35E+00	6.17E-01	6.09E-01
Dy163 (ppm)	4.67E+00	8.32E+00	5.91E+00	8.26E+00	3.66E+00	3.65E+00
Ho165 (ppm)	9.49E-01	1.73E+00	1.08E+00	1.77E+00	7.26E-01	7.03E-01
Er166 (ppm)	2.87E+00	5.44E+00	3.59E+00	6.16E+00	2.08E+00	2.15E+00
Tm169 (ppm)	3.86E-01	7.99E-01	5.76E-01	9.65E-01	2.94E-01	2.80E-01
Yb172 (ppm)	2.80E+00	5.91E+00	3.75E+00	6.87E+00	2.08E+00	2.20E+00
Lu175 (ppm)	3.69E-01	8.52E-01	5.89E-01	1.07E+00	3.17E-01	2.67E-01
Hf178 (ppm)	1.35E+00	1.77E+00	1.83E+00	1.49E+00	2.35E+00	2.72E+00
U238 (ppm)	6.39E-01	7.38E-01	6.81E-01	6.43E-01	4.88E-01	6.11E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	205	206	207	208	209	210
Distance from Rim (µm)	1217.0	1171.9	1126.8	1081.7	1036.7	991.6
Li7 (ppm)	7.36E-01	7.73E-01	9.02E-01	2.72E-01	1.94E-01	1.76E-01
B11 (ppm)	3.55E+00	3.52E+00	2.91E+00	3.44E+00	3.62E+00	4.01E+00
Na23 (ppm)	3.76E+00	7.18E+00	1.61E+01	9.13E+00	5.75E+00	1.56E+01
Mg24 (ppm)	2.19E+02	2.97E+02	1.88E+02	2.85E+02	3.78E+02	3.04E+02
Al27 (ppm)	5.42E+04	5.27E+04	5.42E+04	4.66E+04	4.37E+04	4.91E+04
P31 (ppm)	1.02E+01	1.00E+01	-1.70E+00	8.31E-01	-3.31E+00	3.87E-01
Ca43 (ppm)	2.49E+05	2.58E+05	2.19E+05	2.51E+05	2.52E+05	2.44E+05
Sc45 (ppm)	3.56E+00	4.65E+00	4.30E+00	2.32E+00	3.82E+00	1.08E+01
Ti49 (ppm)	1.37E+03	1.64E+03	1.37E+03	9.42E+02	1.43E+03	1.42E+03
V51 (ppm)	4.41E+01	4.25E+01	4.35E+01	2.97E+01	4.04E+01	4.85E+01
Cr52 (ppm)	2.70E+00	2.16E+00	2.90E+00	1.37E+00	1.07E+00	2.10E+00
Mn55 (ppm)	7.20E+03	7.33E+03	7.72E+03	6.78E+03	6.24E+03	8.96E+03
Fe57 (ppm)	1.21E+05	1.31E+05	1.01E+05	1.38E+05	1.40E+05	1.32E+05
Y89 (ppm)	2.48E+01	3.45E+01	2.69E+01	3.41E+01	5.00E+01	5.27E+01
Zr90 (ppm)	7.72E+01	1.16E+02	5.98E+01	9.22E+01	1.53E+02	1.00E+02
Nb93 (ppm)	1.29E+01	1.57E+01	1.00E+01	1.52E+01	2.11E+01	1.82E+01
La139 (ppm)	6.95E-02	1.30E-01	7.59E-02	2.04E-01	2.85E-01	1.77E-01
Ce140 (ppm)	1.64E+00	3.14E+00	1.16E+00	4.29E+00	4.95E+00	2.91E+00
Pr141 (ppm)	1.05E+00	1.49E+00	6.55E-01	1.95E+00	1.83E+00	1.16E+00
Nd146 (ppm)	1.31E+01	1.42E+01	6.99E+00	1.54E+01	1.26E+01	9.30E+00
Sm147 (ppm)	4.86E+00	4.57E+00	3.80E+00	4.30E+00	3.98E+00	3.79E+00
Eu153 (ppm)	8.33E-01	8.31E-01	6.07E-01	7.67E-01	6.14E-01	6.86E-01
Gd157 (ppm)	4.12E+00	4.47E+00	4.19E+00	5.02E+00	4.87E+00	5.41E+00
Tb159 (ppm)	6.89E-01	8.14E-01	8.06E-01	8.71E-01	1.03E+00	1.07E+00
Dy163 (ppm)	4.39E+00	5.44E+00	4.59E+00	6.14E+00	8.09E+00	7.76E+00
Ho165 (ppm)	8.71E-01	1.13E+00	8.42E-01	1.12E+00	1.71E+00	1.79E+00
Er166 (ppm)	2.46E+00	3.28E+00	2.96E+00	3.28E+00	5.37E+00	6.10E+00
Tm169 (ppm)	3.20E-01	4.43E-01	4.06E-01	4.91E-01	8.15E-01	8.61E-01
Yb172 (ppm)	2.10E+00	3.34E+00	2.93E+00	3.17E+00	6.31E+00	6.14E+00
Lu175 (ppm)	2.94E-01	4.57E-01	4.44E-01	4.65E-01	8.54E-01	9.01E-01
Hf178 (ppm)	2.32E+00	2.88E+00	1.76E+00	1.79E+00	3.35E+00	2.38E+00
U238 (ppm)	8.19E-01	8.75E-01	5.24E-01	7.66E-01	7.53E-01	9.50E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	211	212	213	214	215	216
Distance from Rim (µm)	946.5	901.4	856.4	811.3	766.3	721.2
Li7 (ppm)	9.06E-01	4.39E-01	4.07E-01	3.92E-01	1.11E+00	3.19E+00
B11 (ppm)	4.05E+00	3.96E+00	4.68E+00	3.93E+00	3.41E+00	3.45E+00
Na23 (ppm)	6.91E+01	2.96E+02	6.86E+02	8.52E+01	2.77E+01	7.78E+02
Mg24 (ppm)	2.57E+02	2.58E+02	3.19E+02	3.24E+02	1.79E+02	1.40E+02
Al27 (ppm)	5.81E+04	4.80E+04	4.68E+04	5.35E+04	6.97E+04	7.87E+04
P31 (ppm)	3.02E+00	8.40E+00	-6.87E+00	1.44E+01	1.57E+01	1.03E+01
Ca43 (ppm)	2.54E+05	2.41E+05	2.55E+05	2.57E+05	2.45E+05	2.48E+05
Sc45 (ppm)	5.61E+00	2.44E+00	6.72E+00	2.52E+00	3.05E+00	8.37E+00
Ti49 (ppm)	1.61E+03	9.08E+02	1.45E+03	1.20E+03	1.03E+03	1.49E+03
V51 (ppm)	4.68E+01	2.97E+01	4.45E+01	2.86E+01	3.98E+01	6.31E+01
Cr52 (ppm)	1.68E+00	1.56E+00	3.84E+00	1.91E+00	4.06E+00	3.55E+00
Mn55 (ppm)	8.46E+03	7.25E+03	7.34E+03	7.84E+03	1.10E+04	1.25E+04
Fe57 (ppm)	1.20E+05	1.27E+05	1.43E+05	1.30E+05	9.47E+04	8.74E+04
Y89 (ppm)	3.54E+01	3.38E+01	4.92E+01	4.89E+01	2.98E+01	4.61E+01
Zr90 (ppm)	9.13E+01	8.16E+01	1.29E+02	1.06E+02	3.98E+01	2.81E+01
Nb93 (ppm)	1.40E+01	1.49E+01	1.78E+01	1.94E+01	5.79E+00	1.25E+01
La139 (ppm)	1.17E-01	1.72E-01	2.58E-01	1.68E-01	3.10E-02	2.42E-02
Ce140 (ppm)	2.08E+00	3.57E+00	4.76E+00	2.90E+00	6.28E-01	3.72E-01
Pr141 (ppm)	1.08E+00	1.70E+00	1.78E+00	1.17E+00	3.30E-01	2.77E-01
Nd146 (ppm)	1.06E+01	1.39E+01	1.20E+01	1.03E+01	4.50E+00	3.46E+00
Sm147 (ppm)	4.50E+00	4.28E+00	3.87E+00	4.98E+00	3.52E+00	4.24E+00
Eu153 (ppm)	7.56E-01	8.36E-01	6.51E-01	6.55E-01	5.99E-01	6.24E-01
Gd157 (ppm)	5.27E+00	4.82E+00	5.33E+00	5.57E+00	4.76E+00	6.37E+00
Tb159 (ppm)	8.75E-01	8.55E-01	1.07E+00	1.05E+00	9.13E-01	1.11E+00
Dy163 (ppm)	5.67E+00	5.88E+00	7.71E+00	7.71E+00	5.35E+00	7.60E+00
Ho165 (ppm)	1.12E+00	1.16E+00	1.67E+00	1.58E+00	1.05E+00	1.56E+00
Er166 (ppm)	3.62E+00	3.39E+00	5.63E+00	5.18E+00	2.80E+00	4.89E+00
Tm169 (ppm)	5.45E-01	5.28E-01	7.99E-01	7.33E-01	4.18E-01	7.50E-01
Yb172 (ppm)	3.40E+00	3.37E+00	5.84E+00	5.35E+00	2.78E+00	5.04E+00
Lu175 (ppm)	5.20E-01	4.52E-01	8.25E-01	6.88E-01	3.67E-01	8.15E-01
Hf178 (ppm)	2.45E+00	1.65E+00	3.05E+00	2.34E+00	1.12E+00	1.05E+00
U238 (ppm)	7.68E-01	6.95E-01	8.69E-01	5.84E-01	2.88E-01	3.08E-01

LA-ICP-MS: Empire Mountain						
Sample point no.	217	218	219	220	221	222
Distance from Rim (µm)	676.1	631.0	586.0	540.9	495.8	450.7
Li7 (ppm)	2.45E+00	4.42E+00	5.61E+00	5.11E+00	8.96E+00	7.21E+00
B11 (ppm)	3.65E+00	3.99E+00	3.88E+00	3.83E+00	4.97E+00	4.66E+00
Na23 (ppm)	1.21E+03	5.79E+01	6.12E+01	2.62E+01	3.46E+02	1.91E+02
Mg24 (ppm)	1.46E+02	1.21E+02	1.40E+02	1.24E+02	1.69E+02	1.51E+02
Al27 (ppm)	7.63E+04	7.44E+04	7.40E+04	7.61E+04	7.16E+04	7.69E+04
P31 (ppm)	6.58E+00	6.57E+00	7.39E+00	1.96E+01	-6.72E-01	8.11E+00
Ca43 (ppm)	2.36E+05	2.56E+05	2.48E+05	2.54E+05	2.39E+05	2.53E+05
Sc45 (ppm)	9.14E+00	1.75E+02	1.38E+02	1.11E+02	5.62E+01	6.28E+01
Ti49 (ppm)	1.05E+03	3.33E+03	4.30E+03	4.84E+03	3.99E+03	3.51E+03
V51 (ppm)	5.36E+01	1.47E+02	2.35E+02	1.66E+02	1.39E+02	1.58E+02
Cr52 (ppm)	4.81E+00	1.72E+01	2.66E+01	6.11E+01	1.85E+01	1.86E+01
Mn55 (ppm)	1.32E+04	9.91E+03	8.94E+03	8.71E+03	1.05E+04	1.10E+04
Fe57 (ppm)	7.82E+04	9.05E+04	8.35E+04	8.56E+04	8.59E+04	8.71E+04
Y89 (ppm)	4.37E+01	1.11E+02	2.42E+02	7.28E+01	5.57E+01	9.20E+01
Zr90 (ppm)	1.86E+01	2.87E+01	3.35E+01	3.34E+01	3.23E+01	3.17E+01
Nb93 (ppm)	8.63E+00	2.77E+01	5.53E+01	2.57E+01	1.47E+01	2.40E+01
La139 (ppm)	2.22E-02	2.10E-02	1.46E-02	1.43E-02	7.96E-02	1.11E-01
Ce140 (ppm)	3.82E-01	2.25E-01	2.08E-01	2.20E-01	9.38E-01	8.68E-01
Pr141 (ppm)	2.41E-01	1.97E-01	1.82E-01	1.52E-01	4.61E-01	4.14E-01
Nd146 (ppm)	3.43E+00	3.42E+00	2.98E+00	2.77E+00	5.41E+00	5.76E+00
Sm147 (ppm)	3.44E+00	4.02E+00	5.03E+00	4.24E+00	3.81E+00	4.87E+00
Eu153 (ppm)	5.46E-01	8.07E-01	6.89E-01	7.53E-01	8.50E-01	9.46E-01
Gd157 (ppm)	5.26E+00	6.95E+00	9.61E+00	6.34E+00	4.77E+00	7.81E+00
Tb159 (ppm)	1.01E+00	1.50E+00	2.86E+00	1.27E+00	8.58E-01	1.53E+00
Dy163 (ppm)	7.02E+00	1.16E+01	2.61E+01	9.39E+00	6.00E+00	1.14E+01
Ho165 (ppm)	1.43E+00	3.49E+00	7.83E+00	2.57E+00	1.74E+00	2.97E+00
Er166 (ppm)	4.85E+00	1.47E+01	3.25E+01	9.19E+00	7.00E+00	1.11E+01
Tm169 (ppm)	7.34E-01	2.81E+00	5.41E+00	1.63E+00	1.18E+00	1.92E+00
Yb172 (ppm)	5.57E+00	2.34E+01	4.30E+01	1.34E+01	9.87E+00	1.52E+01
Lu175 (ppm)	8.47E-01	3.99E+00	6.96E+00	2.10E+00	1.58E+00	2.60E+00
Hf178 (ppm)	6.01E-01	1.69E+00	2.40E+00	2.38E+00	1.85E+00	1.91E+00
U238 (ppm)	3.78E-01	5.18E-01	6.02E-01	5.91E-01	1.28E+00	1.46E+00

LA-ICP-MS: Empire Mountain						
Sample point no.	223	224	225	226	227	228
Distance from Rim (µm)	405.7	360.6	315.5	270.4	225.4	180.3
Li7 (ppm)	6.90E+00	6.06E+00	7.69E+00	7.88E+00	7.19E+00	9.74E+00
B11 (ppm)	4.64E+00	4.13E+00	4.16E+00	4.09E+00	4.04E+00	4.05E+00
Na23 (ppm)	1.55E+02	1.25E+02	1.76E+02	2.32E+02	1.41E+02	2.05E+02
Mg24 (ppm)	1.41E+02	1.13E+02	1.27E+02	1.54E+02	1.08E+02	1.37E+02
Al27 (ppm)	7.44E+04	8.03E+04	8.00E+04	7.75E+04	8.24E+04	8.29E+04
P31 (ppm)	-4.27E+00	2.44E+00	8.87E+00	1.14E+01	5.60E-01	1.93E+01
Ca43 (ppm)	2.45E+05	2.51E+05	2.42E+05	2.48E+05	2.50E+05	2.48E+05
Sc45 (ppm)	2.16E+01	2.14E+01	6.45E+01	3.92E+01	1.72E+01	1.31E+01
Ti49 (ppm)	3.19E+03	2.11E+03	2.95E+03	3.16E+03	2.87E+03	3.61E+03
V51 (ppm)	1.49E+02	1.50E+02	1.58E+02	1.51E+02	1.72E+02	1.99E+02
Cr52 (ppm)	1.03E+01	1.36E+01	9.70E+00	9.56E+00	4.54E+00	4.09E+00
Mn55 (ppm)	1.10E+04	1.10E+04	1.12E+04	1.17E+04	1.11E+04	1.08E+04
Fe57 (ppm)	8.03E+04	7.85E+04	7.30E+04	8.46E+04	7.60E+04	7.06E+04
Y89 (ppm)	9.93E+01	1.63E+02	1.78E+02	1.15E+02	1.28E+02	1.05E+02
Zr90 (ppm)	2.89E+01	2.40E+01	2.42E+01	2.81E+01	2.86E+01	2.87E+01
Nb93 (ppm)	2.48E+01	2.50E+01	3.89E+01	2.33E+01	3.66E+01	3.60E+01
La139 (ppm)	8.35E-02	4.51E-02	5.18E-02	8.33E-02	3.71E-02	3.55E-02
Ce140 (ppm)	7.53E-01	4.85E-01	4.40E-01	1.04E+00	2.99E-01	3.34E-01
Pr141 (ppm)	3.83E-01	2.61E-01	2.21E-01	4.48E-01	1.67E-01	1.91E-01
Nd146 (ppm)	4.66E+00	3.53E+00	2.94E+00	5.30E+00	2.34E+00	2.64E+00
Sm147 (ppm)	4.37E+00	5.89E+00	4.75E+00	4.51E+00	4.22E+00	3.15E+00
Eu153 (ppm)	8.80E-01	1.01E+00	7.34E-01	7.99E-01	8.67E-01	6.36E-01
Gd157 (ppm)	7.38E+00	1.20E+01	1.06E+01	8.16E+00	8.88E+00	5.85E+00
Tb159 (ppm)	1.59E+00	2.88E+00	2.21E+00	1.71E+00	1.93E+00	1.31E+00
Dy163 (ppm)	1.31E+01	2.11E+01	2.00E+01	1.39E+01	1.46E+01	1.22E+01
Ho165 (ppm)	3.37E+00	5.31E+00	5.31E+00	3.60E+00	4.10E+00	3.43E+00
Er166 (ppm)	1.18E+01	1.91E+01	2.26E+01	1.39E+01	1.52E+01	1.34E+01
Tm169 (ppm)	1.76E+00	3.31E+00	4.16E+00	2.34E+00	2.66E+00	2.35E+00
Yb172 (ppm)	1.32E+01	2.39E+01	3.45E+01	1.86E+01	2.04E+01	1.74E+01
Lu175 (ppm)	1.95E+00	3.74E+00	6.00E+00	3.11E+00	3.56E+00	2.78E+00
Hf178 (ppm)	1.40E+00	1.12E+00	1.44E+00	1.50E+00	1.32E+00	1.48E+00
U238 (ppm)	9.64E-01	6.85E-01	7.15E-01	1.19E+00	6.43E-01	4.69E-01

LA-ICP-MS: Empire Mountain				
Sample point no.	229	230	231	232
Distance from Rim (µm)	135.2	90.1	45.1	0.0
Li7 (ppm)	8.19E+00	7.08E+00	1.25E+01	5.95E+00
B11 (ppm)	4.80E+00	4.64E+00	4.10E+00	3.91E+00
Na23 (ppm)	2.10E+02	2.13E+02	1.17E+04	6.26E+03
Mg24 (ppm)	1.12E+02	7.48E+01	2.88E+02	1.35E+02
Al27 (ppm)	7.92E+04	7.97E+04	8.11E+04	8.38E+04
P31 (ppm)	1.52E+01	1.15E+01	9.45E+01	3.36E+01
Ca43 (ppm)	2.45E+05	2.43E+05	1.84E+05	2.13E+05
Sc45 (ppm)	2.25E+01	1.48E+01	4.58E+01	5.06E+01
Ti49 (ppm)	3.02E+03	1.89E+03	1.77E+03	2.06E+03
V51 (ppm)	2.06E+02	1.49E+02	1.08E+02	1.33E+02
Cr52 (ppm)	3.62E+00	2.76E+00	2.66E+01	2.92E+02
Mn55 (ppm)	9.62E+03	9.53E+03	8.80E+03	8.64E+03
Fe57 (ppm)	7.53E+04	6.78E+04	6.53E+04	5.83E+04
Y89 (ppm)	1.32E+02	1.53E+02	6.60E+01	1.25E+02
Zr90 (ppm)	2.57E+01	2.56E+01	1.97E+01	2.04E+01
Nb93 (ppm)	2.87E+01	2.49E+01	1.47E+01	4.79E+01
La139 (ppm)	1.30E-02	1.64E-02	1.06E-01	7.29E-02
Ce140 (ppm)	1.89E-01	1.14E-01	8.24E-01	3.25E-01
Pr141 (ppm)	1.21E-01	7.67E-02	3.77E-01	1.13E-01
Nd146 (ppm)	2.00E+00	1.33E+00	4.26E+00	1.88E+00
Sm147 (ppm)	4.51E+00	3.35E+00	2.82E+00	3.74E+00
Eu153 (ppm)	7.23E-01	5.84E-01	5.20E-01	6.39E-01
Gd157 (ppm)	1.04E+01	9.17E+00	4.77E+00	9.09E+00
Tb159 (ppm)	2.20E+00	2.21E+00	1.04E+00	1.94E+00
Dy163 (ppm)	1.77E+01	1.79E+01	7.93E+00	1.53E+01
Ho165 (ppm)	4.26E+00	4.87E+00	2.01E+00	3.88E+00
Er166 (ppm)	1.60E+01	1.85E+01	8.26E+00	1.51E+01
Tm169 (ppm)	2.54E+00	3.20E+00	1.33E+00	2.54E+00
Yb172 (ppm)	1.98E+01	2.56E+01	1.09E+01	2.04E+01
Lu175 (ppm)	3.20E+00	4.21E+00	1.91E+00	3.59E+00
Hf178 (ppm)	1.48E+00	9.85E-01	1.01E+00	1.19E+00
U238 (ppm)	4.18E-01	3.66E-01	1.00E+00	3.94E-01

APPENDIX C:

I pledge on my honor that I have not given or received any unauthorized assistance or plagiarized on this assignment.