THERMAL AND HYDROTHERMAL INFLUENCE OF RAPAKIVI IGNEOUS ACTIVITY ON LATE-SVECOFENNIAN GRANITES IN SOUTHEASTERN FINLAND

Master's Thesis
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February 2017

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VILLAR, ARTURO: Thermal and hydrothermal influence of rapakivi igneous activity on late-Svecofennian granites in southeastern Finland.

Master's Thesis: 80 pages, 6 appendices.
Geology and Mineralogy
February 2017

The recent discovery of polymetallic vein mineralizations around the Sarvlaxviken Bay (westernmost part of the Wiborg Batholith, SE Finland) has challenged the common assumption that Finnish rapakivi granites are metal-infertile and encouraged further exploration activities in the area. New discoveries have been made since then, including an ore boulder with a Zn-rich greisen alteration zone. Subsequent geochemical data of glacial till have revealed high metal concentrations northwest of the ore boulder (south of Lake Lillträsket), where the bedrock is part of the Svecofennian domain, close to the Wiborg Batholith. The present study reviews the geological features of the Svecofennian rocks to locate the source of the ore boulder and evaluate the ore potential of these rocks.

Two study areas were used for this project. The first one comprises a roughly 1 km^2 large zone south of Lake Lillträsket, while the second one covers an E-W profile that spans from Lillträsket to 16 km into the west. These two study areas were defined to find evidence of alteration on a local and a regional level respectively.

The examination of thin sections revealed K-feldspar transformations in the Svecofennian rocks, from a low thermal state (microcline) to a high thermal state (orthoclase). This disturbance, caused by the thermal effect of the rapakivi magmatism, is also reflected by strong readjustments in the isotopic system of four samples of the Svecofennian granite, as they yielded rapakivi (c. 1.6-1.4 Ga) Rb-Sr ages.

Field observations and whole-rock geochemistry show that the bedrock in both study areas was originally composed of late-orogenic Svecofennian granites. However, the bedrock in the Lillträsket area displays an intense red coloration (produced by Fe oxides) around quartz veins and intertwined fractures as opposed to the whitish tone of the late-orogenic granites elsewhere. This feature is coupled with signs of K-metasomatism and higher contents of Fe, Rb, Th, Ti, Zr, Hf, Y, Zn, Be, Sc and Ag in the reddened granite.

Numerous glacial till samples have been collected in the area of Lillträsket, for which geochemical data show high contents of Fe, Hf, Rb, Th, Y, Zr, As, Be, Cu, In, Li, Mo, Sn, W and Zn. The magnetic susceptibility and the Fe contents in the glacial till match with the ground magnetic features of the bedrock, indicating that these anomalies are extremely local.

The evidence obtained in this project indicates that the rapakivi igneous activity had a significant impact in the Svecofennian granites, especially in the Lillträsket area, where hydrothermal alteration processes took place. It is suggested that the infiltrating fluid, responsible for such alteration, has a rapakivi origin and that the metal anomalies found in the Lillträsket area are linked to the mineralized systems of the Sarvlaxviken area.

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1. INTRODUCTION

Finnish rapakivi granites are metaluminous to peraluminous A-type granites formed at 1.67-1.47 Ga over a period of continental extension that followed the succession of the Svecofennian orogenies in Fennoscandia (Rämö and Haapala, 2005). They are present as large batholiths and small intrusions in the southern part of the country, from Karelia in the east to the Åland islands in the west. Although the occurrence of rapakivi granites is well known in other Precambrian provinces around the world, Finland is often recognized as the worldwide reference area for these rocks. From the earliest review, performed at the end of the 18th century, to the latest studies of recent decades, the immense contribution made by Finnish geologists as to the knowledge of rapakivi granites is indisputable.

Despite the fact that several ore deposits are linked to the presence of rapakivi granites around the world (e.g. Russia, Brazil, Ukraine, Australia, USA), the common belief that Finnish rapakivi granites are metal-infertile has driven away much of the interest in exploring these rocks for economic purposes. However, the discovery of a series of metal-rich mineralizations in the westernmost part of the Wiborg Batholith, including the first known occurrence of roquesite in Finland (Sundblad et al., 2008; Cook et al., 2011), has changed much of this perception while promoting further exploration activities in the area.

The progress made in recent years as to the understanding of these ore occurrences is remarkable. In a recently published paper, Valkama et al. (2016) describes a complex system of metal-bearing quartz and greisen veins around the Sarvlaxviken Bay with high contents of a number of metals (Li, As, W, Zn, Mn, Pb, Zn, Cu, In, Mo, Bi and Be). The formation of these veins is linked to the emplacement of the latest rapakivi granite phases and associated hydrothermal activity, which led to the development of various alteration assemblages with specific metal associations.

While the Sarvlaxviken Bay has remained as the main exploration target during the last years, the discovery of an ore boulder southeast of Lake Lillträsket (within neighbouring Svecofennian granites) has increased the interest also in this area. In this boulder, a 50 cm wide greisen alteration zone, rich in Zn, cuts a granite with an assemblage similar to that of the ore-mineralized rapakivi granites. Subsequent geochemical analyses of glacial till have shown that the area of Lillträsket not only holds high contents of Zn, but also high concentrations in many other metals (W, As, Fe, Pb, Ag, Mo, In, Be and Bi).

The aim of this study is to: (1) evaluate the thermal influence of the Wiborg Batholith into the Svecofennian granites; (2) review the petrological and geochemical features of the Svecofennian granites; (3) investigate the metal anomalies displayed by the glacial till in Lilträsket; (4) find an explanation as to the source for such anomalies.

The first approach regarding the thermal influence of the rapakivi granites into the Svecofennian rocks follows the research performed by Vorma (1972). He noted that the Svecofennian granitoids had transformed their microcline grains into orthoclase close to the Wiborg Batholith, defining a 5-10 km wide thermal aureole around it. The collection of samples for Rb-Sr age determinations was done in regard to the previous feature. Even though this method has long been replaced by more reliable isotopic systems for dating igneous rocks, it still remains as an effective way to date metamorphic and alteration events. In addition to the observations made in the field, whole-rock samples were collected for geochemical analyses within an area that extends from the contact with the rapakivi granites to 16 km into the west. However, as the inception of this work regards to the high metal concentrations in the soil of the Lillträsket area, the main focus of this thesis lies in that zone.

2. GEOLOGICAL SETTING

2.1 Evolution of the Fennoscandian Shield

2.1.1 Creation and evolution of the Archaean crust

The genesis and evolution of the oldest material in the Fennoscandian Shield has been a problematic subject to interpret for geologists. The complexity of the processes that took place during the Archaean Eon, in addition to the limited presence of recognizable Archaean material in the field, are accountable for such issue. Isotopic age determinations and geological observations have revealed, however, the presence of Archaean crust in Lapland, Karelia and the Kola Peninsula (Gaál and Gorbatschev, 1987).

Martin (1987) proposed a model to describe the earliest formation of an Archaean substratum in the Fennoscandian Shield. Based on his interpretation, a primitive tholeitic crust was transformed into a series of tonalities, trondhjemites and granodiorites during the Saamian orogeny at 3.1-2.9 Ga. The precise extent of these rocks under the late-Archaean and Paleoproterozoic cover remains unclear. However, numerous isotopic age determinations have confirmed their presence in Lapland and Karelia, while analogue geological systems in the Kola Peninsula have suggested their occurrence there too (Gaál and Gorbatschev, 1987). The Lopian rocks, which comprise a belt of high-grade gneisses and a series of granitoid intrusions and greenstone belts formed at 2.9-2.6 Ga (Keller et al., 1977), are the expression of the last event responsible for the formation of the Archaean crust in the Fennoscandian Shield.

The end of the Archaean was followed by a period of stabilization at 2.5-2.1 Ga. The cratonization of the primitive crust included a number of rift events that led to the creation of new igneous material. Sedimentary processes took place while the previously formed continent experienced a period of peneplanation that lasted several hundreds of million years. The breakup of the Archaean continent at 2.06 Ga culminated this period, bringing a new scenario in which simultaneous orogenies would intervene in the creation of a new continent called Fennoscandia (Lahtinen et al., 2005).

2.1.2 Microcontinent accretion stage: Onset of the Svecofennian orogenies

The breakup of the Archaean continent at 2.06 Ga created a new context in which the previously formed crust was split in two different members by a N-S trending active plate boundary (Figure 1A). The eastern fragment, known as the Karelian craton, performed as a fixed plate around which further crustal fragments amalgamated in a series of orogenies between 1.96 and 1.87 Ga (Lahtinen et al., 2005).

According to their nature and location with regard to the emplacement of the Karelian craton, the crustal fragments involved in the evolution of the Fennoscandian Shield at that time can be divided into three groups (Norrbotten microcontinent, Kola craton and Keitele, Bothnia and Bergslagen microcontinents). The Norrbotten microcontinent is the expression of the western fragment split at 2.06 Ga from the primitive Archaean craton.

A separate example of Archaean crust, known as the Kola craton, approached the Karelian member from the northeast. The last group includes three microcontinents (Keitele, Bothnia and Bergslagen) formed at 2.1-1.89 Ga. A number of island arcs, attached to some of these crustal fragments, represent pieces of material formed prior to 1.92 Ga (Lahtinen et al., 2005).

Three orogenic episodes were responsible for the crustal amalgamation that took place at 1.96-1.87 Ga around the Karelian craton. Evidence for subduction-related arc magmatism along the northeastern margin of the Karelian craton (e.g. Barling et al., 1997; Daly et al., 2001) has been interpreted as a result of its convergence with the Kola craton at 1.96-1.91 Ga (Lapland-Kola orogeny [Figure 1B]). Before the docking of the Archaean fragments ceased in the east a new orogeny dawned at 1.92-1.89 Ga in the west, leading to the collision of the Norrbotten and Keitele microcontinents with the Karelian craton as well as the accretion of the Bothnian microcontinent in the southwest (Lapland-Savo orogeny [Figures 1C and 1D]). The crustal fragments that were active thus far were already in place when a new tectonic stage developed at 1.89 Ga in the south. The Bergslagen microcontinet was to collide with the accreted crustal fragments through an orogeny that ended up at 1.87 Ga (Fennian orogeny [Figures 1E and 1F]). A period of extension, due to a large-scale orogenic collapse, affected the recently created continent between 1.87 and 1.85 Ga (Figures 2A and 2B). As a result, the thickness of the crustal basement decreased considerably in the south, providing perfect conditions for the development of granites and migmatites through further orogenies.

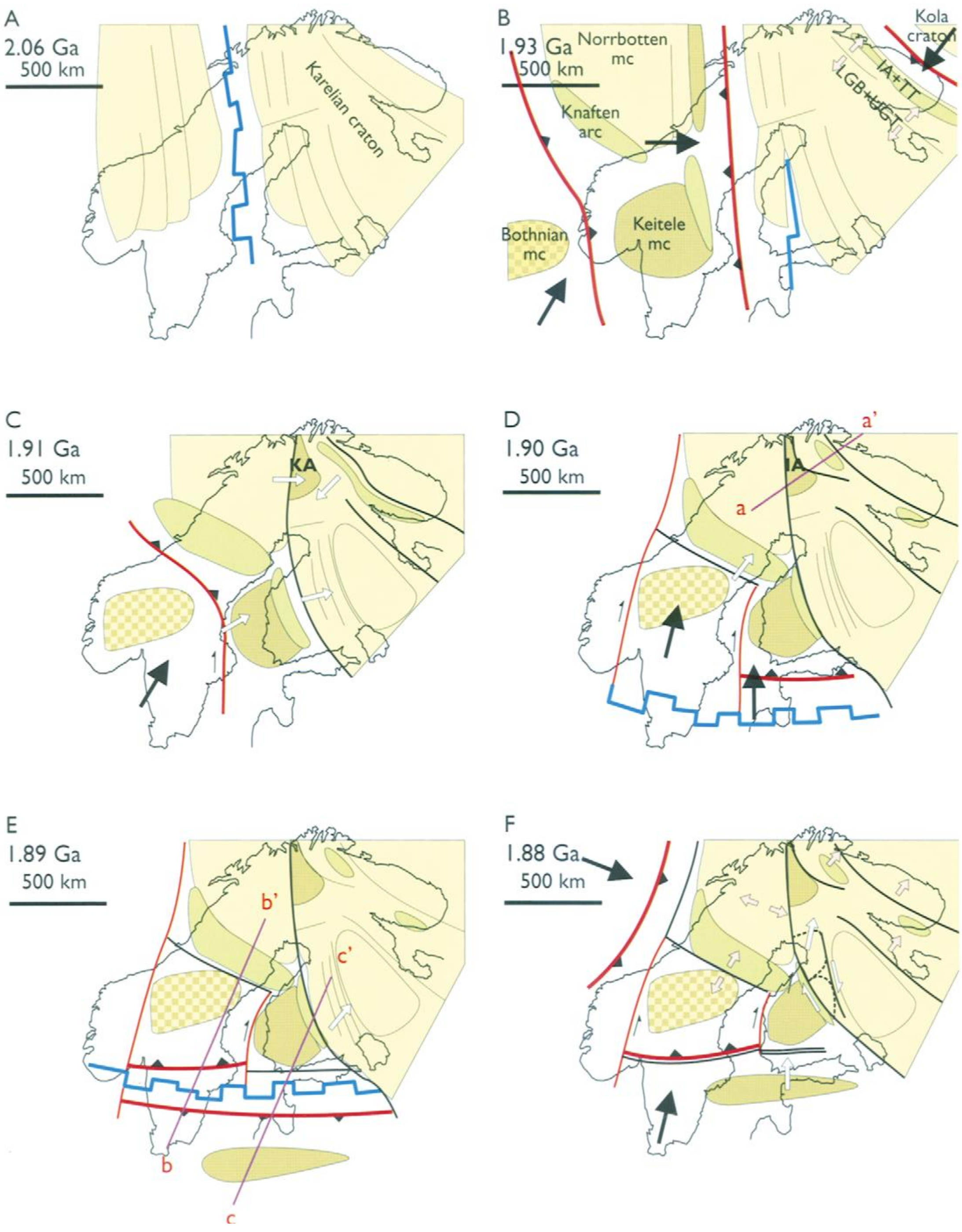


Figure 1: Evolution of the Fennoscandian Shield between 2.06 and 1.88 Ga (Lahtinen et al., 2005).

2.1.3 Continental collision stage: Offset of the Svecofennian orogenies

By the end of the Fennian orogeny at 1.87 Ga a considerable part of the present Fennoscandian shield was already formed. At 1.84 Ga, the boundaries between the members amalgamated around the Karelian craton were stabilized, except for the southernmost members, which were reworked by the tectonic events that were to come.

The presence of 1.84-1.80 Ga collisional granites in southern Finland and central Sweden, in addition to the presence of a series of 1.85-1.79 Ga continental-arc volcanic and plutonic rocks located south-west of the Fennoscandian Shield, depict a complex evolution that involved the collision between the continent of Sarmatia and the south-eastern margin of Fennoscandia (Svecobaltic orogeny [Figure 2C]). Prior to the end of the Svecobaltic orogeny, a collision between Amazonia and Fennoscandia took place at 1.82-1.79 Ga in the northwest, leading to the development of igneous and metamorphic processes among the deformation zones under a high temperature and low- to intermediate-pressure regime (Nordic orogeny [Figures 2D and 2E]). A large-scale orogenic collapse took place between 1.79 and 1.77 Ga, followed by a phase of stabilization (Figure 2F) (Lahtinen et al., 2005).

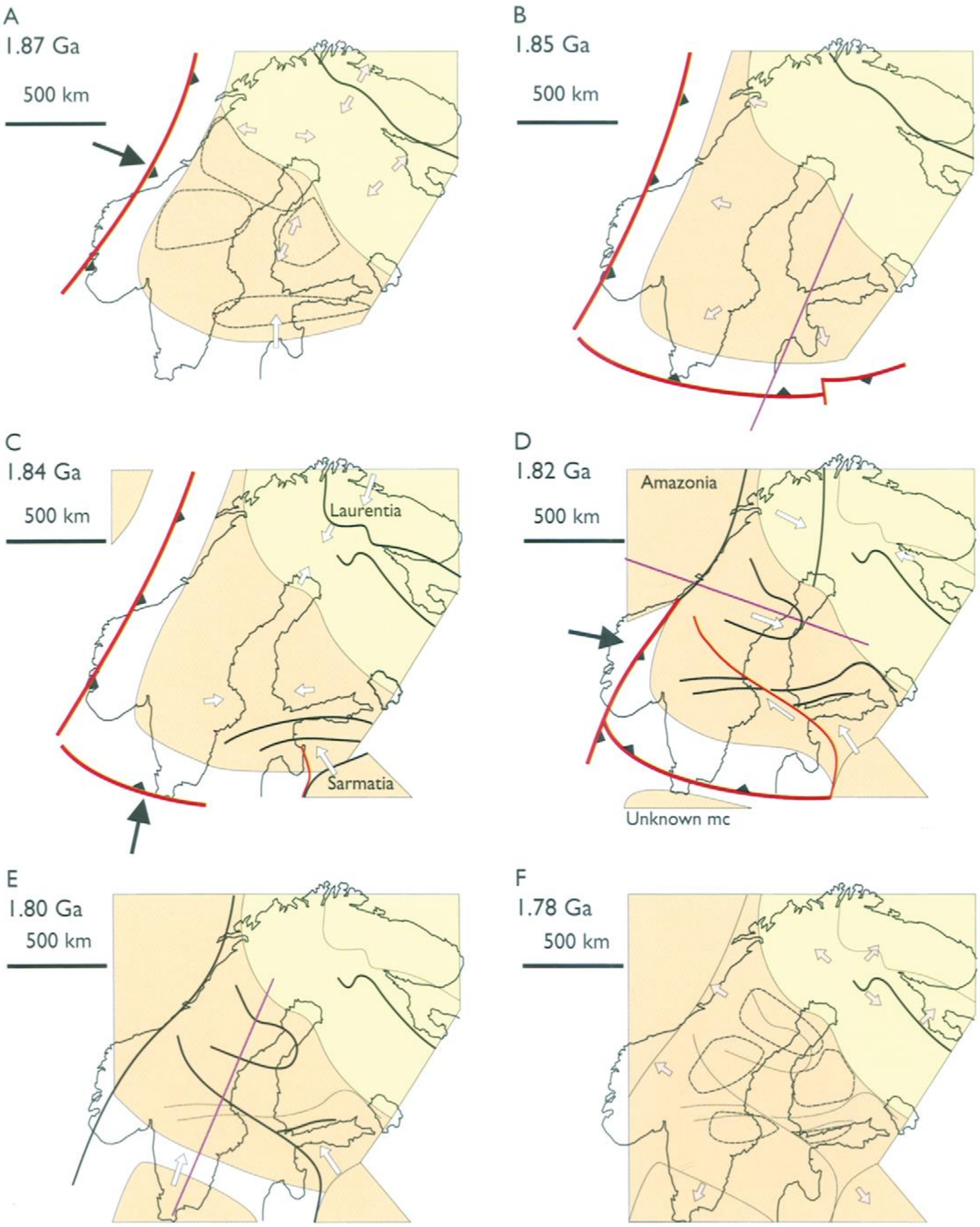


Figure 2: Evolution of the Fennoscandian Shield between 1.87 and 1.78 Ga (Lahtinen et al., 2005).

2.1.4 Later events regarding crustal growth in the Fennoscandian Shield

The end of the Nordic orogeny at 1.79 Ga culminated the period responsible for the creation of most of the Fennoscandian Shield. However, the rapakivi magmatism and the Gothian orogeny represent two significant episodes accountable for crustal growth succeeding the Svecofennian events.

The rapakivi granites comprise a number of batholiths and plutons that intruded Fennoscandia, from contemporary central Sweden to the Russian Karelia, at 1.67-1.47 Ga. The origin of these rocks is related to anatexis of the deep crust under an extensional tectonic regime (Rämö and Haapala, 2005). The Gothian rocks, on the other hand, dominate the southwestern part of the Fennoscandian Shield. They were formed as the result of a series of igneous and sedimentary episodes developed at 1.73-1.55 Ga (Lahtinen et al., 2005).

Further tectonic events, including the Hallandian (1.5-1.4 Ga), Sveconorwegian-Grenvillian (1.25-0.9 Ga) and Caledonian (0.6-0.4 Ga) orogenies, reworked the previously formed material. However, the importance of these events regarding the growth of new continental crust was minimal, leaving the Fennoscandian Shield with no major additions once the Gothian stage concluded (Gaál and Gorbatchsev, 1987).

2.2 Proterozoic granitoids of Finland

The Proterozoic granitoids of Finland have formerly been classified attending at their relation to the orogenic episodes that followed the Svecokarelian orogeny (Nurmi and Haapala, 1986). According to this, the Proterozoic granitoids of Finland are divided into four groups: synorogenic (synkinematic), late-orogenic (late-kinematic) and post-orogenic (post-kinematic) Svecokarelian granitoids plus the anorogenic rapakivi granites of southern Finland (Vaasjoki, 1977). The spatial distribution of the Proterozoic granitoids mentioned above is seen in Figure 3.

The radiometric ages obtained from previous investigations, based on U-Pb analyses in zircons, provide a range of time intervals for each granitoid group. The synorogenic granitoids display ages from 1.86 to 1.9 Ga (e.g. Aho, 1979; Simonen, 1980; Neuvonen et al., 1981). The ages for the late-orogenic granites range from 1.8 to 1.85 Ga (e.g. Vaasjoki, 1981; Hopgood et al., 1983; Korsman et al., 1984; Kurhila et al., 2011). The post-orogenic granitoids show ages of approximately 1.8 Ga (e.g. Vaasjoki, 1977; Korsman et al. 1984). The anorogenic rapakivi granites intruded between 1.67 and 1.47 Ga ago (Rämo and Haapala, 2005).

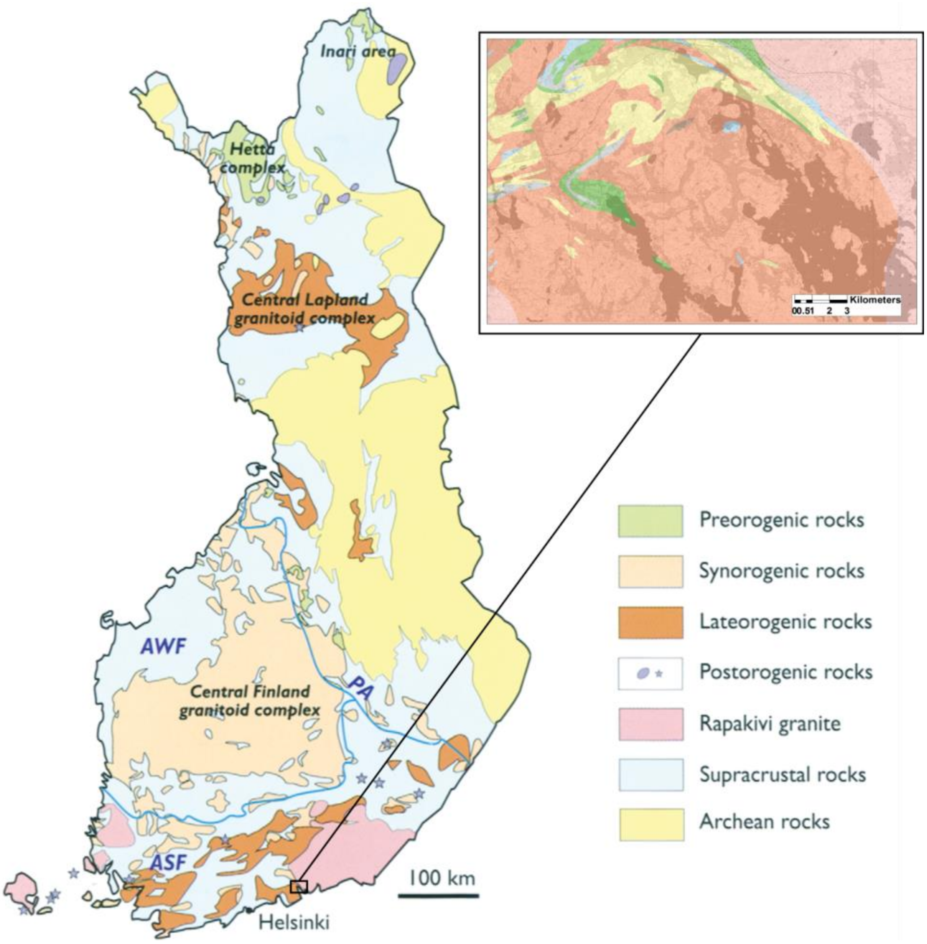


Figure 3: Map showing the Proterozoic rocks of Finland. Modified after Lahtinen et al. (2005). The rectangle delimits the study area (legend in Figure 8, page 20).

2.2.1 Late-orogenic granites in southern Finland

The late-orogenic granites of Finland form a roughly 500 km long and 100 km wide area displaying an E-NE trend in the southernmost part of the country (Figure 3). According to Simonen (1960), who described them as granites of the "microcline province", the formation of these granites is linked to the last phase of the Svecofennide orogeny. Their genesis is explained as a consequence of partial melting in Svecokarelian mica gneisses and schists, taking place either as diapiric bodies or as the neosome of migmatites (Simonen, 1960; Nironen, 2005). The development of the late-orogenic granites is an expression of the peak of the Svecokarelian metamorphism at 1.81–1.85 Ga under a high temperature–low pressure regime (Korsman, 1977; Korsman, et al., 1984).

The late-orogenic granites exhibit a limited range of compositions, occurring as monzogranites or syenogranites. The texture displayed by this unit includes non-foliated or weakly foliated suites with some pegmatitic varieties related to them. Their mineral assemblage includes microcline, quartz, plagioclase (An_{15-25}) and small amounts of biotite while almandine garnet, cordierite, sillimanite, muscovite, zircon, apatite, tourmaline and opaque phases are the most common accessory minerals in these rocks. Pronounced differences in both chemical and mineralogical compositions make these potassium-rich granites a specific member of the Finnish Proterozoic granitoids, with no mafic or intermediate rocks related to them (Simonen, 1960).

3. THE USE OF ISOTOPE GEOLOGY AS A DATING TOOL: AN INTRODUCTION TO GEOCHRONOLOGY

3.1 Key aspects of geochronology

3.1.1 Radioactive decay

The field of isotope geology studies the evolution of nuclides (atomic species defined by their nuclear structure and their nuclear energy state) over time, discerning between specimens that keep their nuclear structure with no detectable variations, i.e. stable nuclides, and unstable specimens whose nuclear structure is spontaneously adjusted towards a state of stability. The accomplishment of the nuclear equilibrium and the processes involved in it constitute what is known as radioactive decay.

The stability of a given nuclide relies on its nuclear composition, which is defined by a particular number of protons (Z) and neutrons (N) in the nucleus of the atom (the sum of both parameters constitutes the atomic mass [A] of the nuclide). Looking at the chart of nuclides in Figure 4, where Z is plotted against N for all known nuclides, it is possible to observe that the stable specimens (marked as filled squares) define a “path of stability” around which the unstable specimens are positioned. This path defines a neutron/proton ratio that corresponds to the greatest state of stability, a ratio that changes as the atomic mass increases from $N = Z$ for nuclides of low atomic mass to $N/Z = 1.5$ for nuclides located at the far end of the chart. Nuclides located outside the path of stability will have transformed their nuclear structure in order to attain a N/Z ratio that fits the best arrangement according to their position in the chart (Dickin, 2005). All processes involved in the radioactive decay of an unstable nuclide include the emission of particles and energy of different nature (depending on their position relative to the path of stability). These processes will be further explained below.

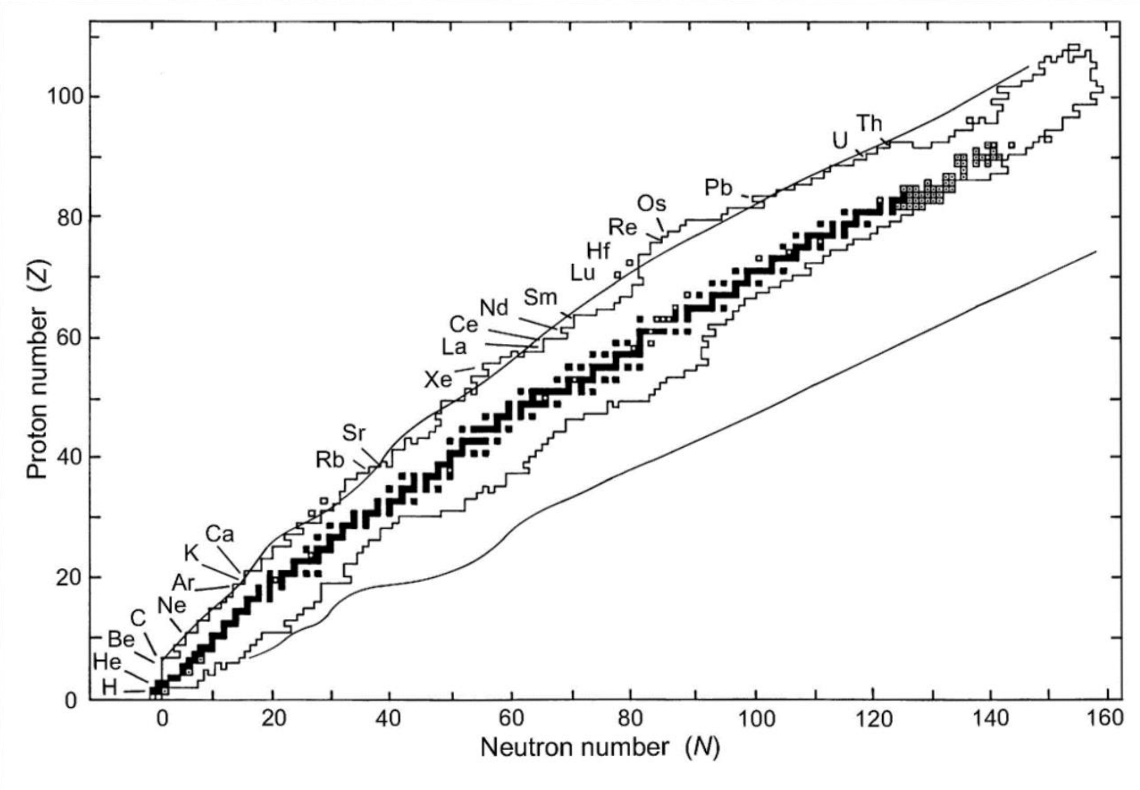


Figure 4: The chart of nuclides. Stable nuclides are marked as filled squares. The envelope defines the theoretical limits of nuclide stability (Dickin, 2005).

Unstable nuclides of low atomic mass (A < Bi), located on either side of the field of stability, decay by processes in which protons are transformed into neutrons and vice versa. Since these processes do not involve a change in the atomic mass of both the parent nuclide and its final product, unstable isotopes move through diagonal lines of equal atomic mass in the chart of nuclides, towards the most stable N/Z ratio according to their position in the chart (Figure 5), and develop different mechanisms depending on whether they have a deficiency in protons or in neutrons. In such way, unstable isotopes deficient in protons (located on the right side of the field of stability) will reach the stability by transforming a neutron into a proton and an electron, which ultimately is removed from the core as a β^- particle along with an anti-neutrino. On the other hand, unstable isotopes deficient in neutrons (located on the left side of the field of stability) reach the stability by two different ways. The first one consists on the emission of a positively charged electron (β^+) along with a neutrino while the second way involves the capture of an orbital electron in order to transform a nuclear proton into a neutron (Dickin, 2005).

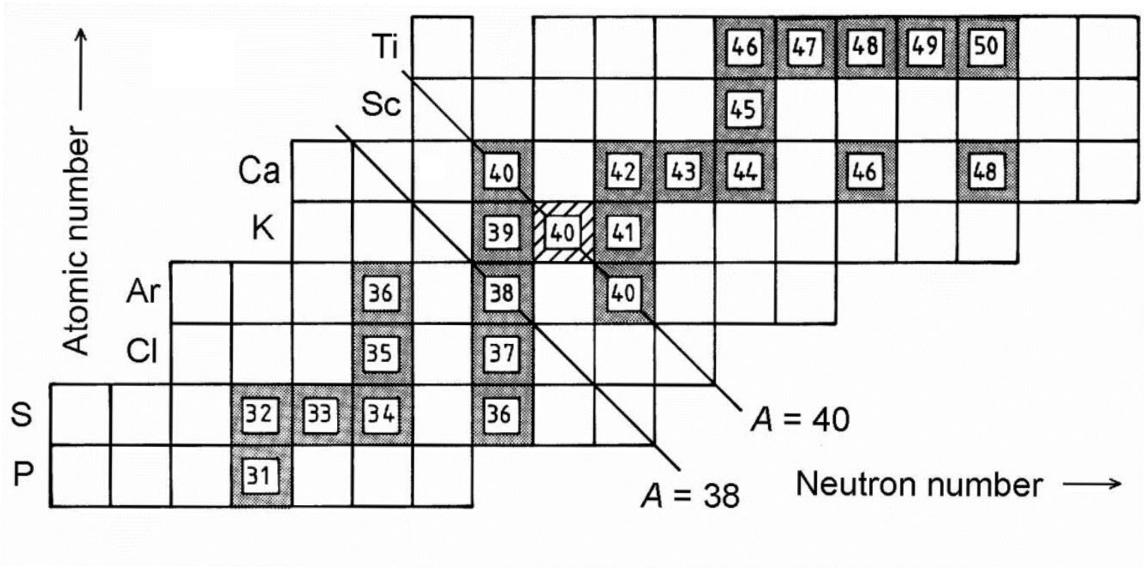


Figure 5: Augmented section of the chart of nuclides. Stable nuclides are shaded while the long-lived unstable nuclide ^{40}K appears hatched. Diagonal lines represent positions of constant atomic mass (A) (Dickin, 2005).

The way heavy nuclides (A ≥ Bi) decay differs substantially from the processes in which nuclides of low atomic mass are involved. In this case, the unstable nuclides emit two protons and two neutrons (α particle), resulting in a significant loss of atomic mass while moving through the neutron-rich side of the chart, where they ultimately undergo β decay (Figure 6) (Dickin, 2005).

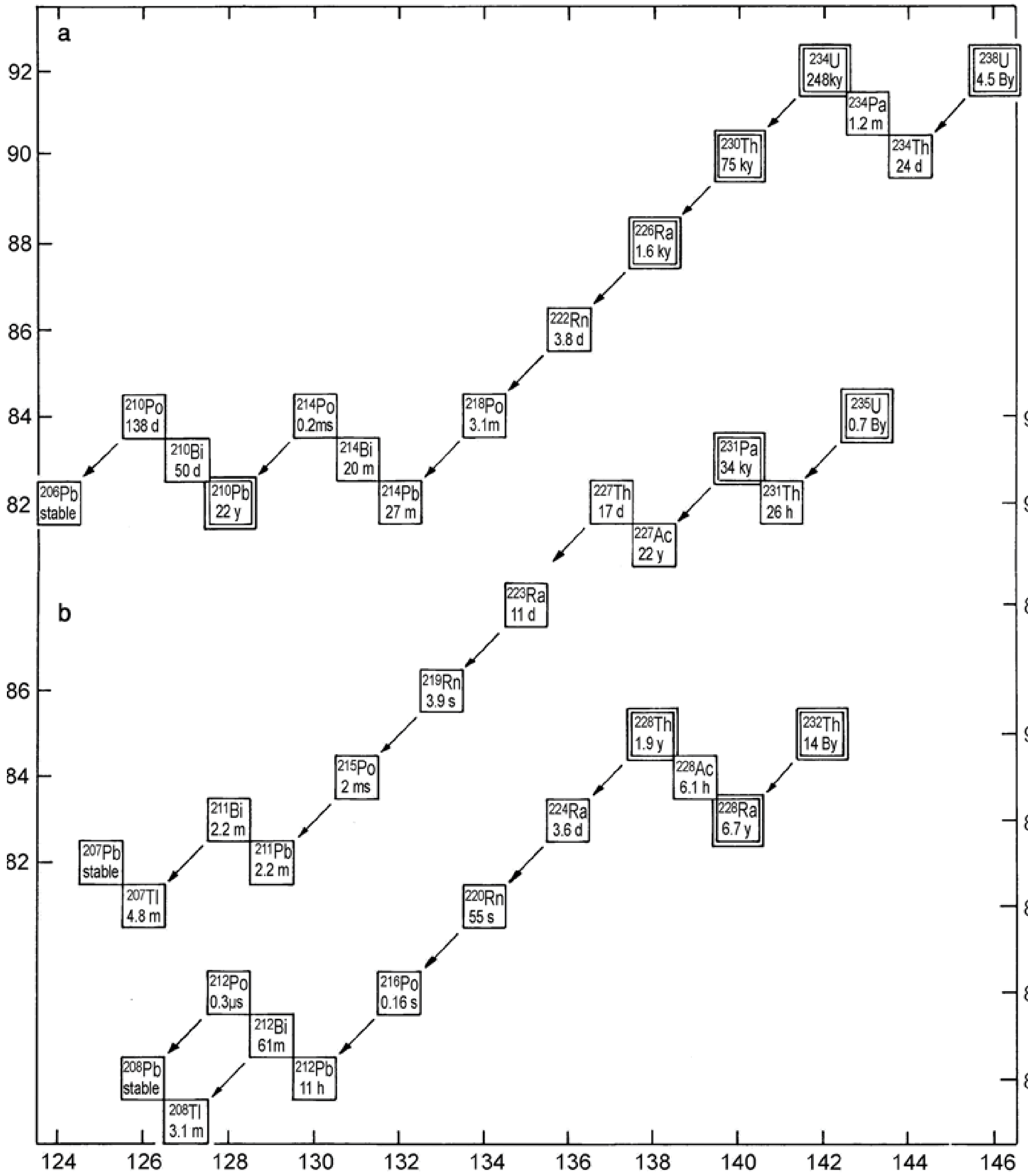


Figure 6: Augmented section of the chart of nuclides for the U-Th series. Unstable nuclides combine α (↙) and β (↖) decay (Dickin, 2005).

3.1.2 The law of radioactive decay

The use of isotope dating in geochronology is based on the assumption that the process of radioactive decay is exponential and independent of chemical or physical conditions (Rutherford and Soddy, 1902). It is, therefore, possible to state that the rate of decay of any parent radionuclide has remained constant through the history of the Earth.

This theory has been verified by calibrating some of the isotopic systems used in geochronology against coral growth bands, tree rings and rates of sea-floor spreading. In addition, the consistency of numerous decay constants has been confirmed by contrasting the isotopic ages obtained for certain geological systems using separate dating methods. On the other hand, it has been noted that the nuclear stability of some radionuclides is affected by physical conditions when electron-capture decay processes are involved, yet its influence is insignificant compared to the experimental errors obtained in the laboratory (Dickin, 2005).

Considering the steadiness and independence from external conditions of the radiometric systems, the number of nuclides (ΔN) that decay during a time interval (Δt) is proportional to the total number of radionuclides (N) present at time t:

[Equation 1]

$$\frac{\Delta N}{\Delta t} = -\lambda N$$

where λ is the decay constant and ΔN/Δt the rate of change of the amount of parent nuclides. The fundamental equation of radioactive decay can be obtained by integrating [Eq. 1] from *t* = 0 to *t* into:

[Equation 2]

$$N = N_0 \, e^{-\lambda t}$$

where the number of atoms present at time *t* = 0 is N_0. Considering that the number of radiogenic daughter atoms produced (*D*) is equivalent to the number of parent atoms consumed ($N_0 - N$), [Eq. 2] can be converted to

[Equation 3]

$$D = N\left(e^{\lambda t} - 1\right)$$

An ideal situation would be a crystallizing mineral in which the only nuclide absorbed is the radioactive isotope. Moreover, the content of both parent and daughter nuclides should change only by means of radioactive decay as soon as the mineral/rock is formed.

The first assumption is never realized under real conditions in geological systems, whereas the second one is not fulfilled in most of the cases (Jäger, 1979). Thus, under certain circumstances, the behaviour of a given isotopic system in a mineral or a rock is linked to the evolution of the geological system to which it belongs. The way geological processes affect the distribution of parent and daughter nuclides within a rock for the Rb-Sr system will be further discussed in the next section.

3.2 The Rb-Sr method

Rubidium is an alkali metal that occurs in nature either as ^{85}Rb or ^{87}Rb, the latter being radioactive (Dickin, 2005). The nuclear arrangement of ^{87}Rb (37 protons and 50 neutrons) resembles a N/Z ratio of 1.35, making it an unstable isotope. In order to achieve a state of stability, ^{87}Rb decays to the stable isotope ^{87}Sr by emission of a β particle and an anti-neutrino, keeping a constant atomic mass while adjusting its N/Z ratio to a fixed value of 1.29. Despite the difficulties of determining the decay constant of ^{87}Rb, with a number of values obtained by different authors (e.g. Flynn and Glendenin, 1959; Brinkman et al., 1965; Neumann and Huster, 1976; Davis et al., 1977), a general agreement of using a λ value of 1.42×10^{-11} yr^{-1} and $t_{1/2}$ of 48.8 Byr was accepted by an international convention (Steiger and Jäger, 1977). Due to its long half-life and the fact that average strontium contains about 7% of ^{87}Sr, the Rb/Sr ratios in the minerals/rocks have to be high in order to obtain appropriate results, especially for young specimens whose content of non-radiogenic ^{87}Sr may overprint the quantity of radiogenic strontium (Jäger, 1979).

The formula of radioactive decay [Eq. 3] can be modified into [Eq. 4] if we consider that the number of daughter isotopes at time $t = 0$ is D_0. Therefore, the total amount of daughter isotopes D at time t is given by the following formula:

[Equation 4]

$$D = D_0 + N\left(e^{\lambda t} - 1\right)$$

Hence the formula of radioactive decay for the rubidium-strontium isotopic system is

[Equation 5]

$$^{87}Sr = {}^{87}Sr_I + {}^{87}Rb(e^{\lambda t} - 1)$$

where ^{87}Sr is the number of daughter isotopes produced by the decay of ^{87}Rb at time *t* and $^{87}Sr_I$ is the number of ^{87}Sr present at time *t* = 0. The precise measurement of absolute isotope concentrations is difficult so isotope ratios are used instead, leading to the formula

[Equation 6]

$$\left(\frac{^{87}Sr}{^{86}Sr}\right)_P = \left(\frac{^{87}Sr}{^{86}Sr}\right)_I + \frac{^{87}Rb}{^{86}Sr}\left(e^{\lambda t} - 1\right)$$

The ratios $\left(^{87}Sr/^{86}Sr\right)_P$ and $\left(^{87}Rb/^{86}Sr\right)_I$ can be measured by mass spectrometry whereas the initial ratio $\left(^{87}Sr/^{86}Sr\right)_I$ and *t* remain unknown.

When looking at [Eq. 6] it can be noticed that its arrangement resembles that of a straight line, which is

[Equation 7]

$$y = c + xm$$

With this approach, the unknowns of [Eq. 6] can be obtained by plotting in a bivariate diagram the measured values of $^{87}Sr/^{86}Sr$ (*y*) and $^{87}Rb/^{86}Sr$ (*x*) from a series of minerals or rocks. These values define a line called “isochron”, where the initial $^{87}Sr/^{86}Sr$ ratio is the intercept (*c*) and $e^{\lambda t}$ - 1 is the slope of the line (*m*). Therefore, knowing *m* and *λ,* the age *t* can be calculated by the formula

[Equation 8]

$$t = \frac{1}{\lambda}\, ln(m + 1)$$

The evolution of a suite of igneous rocks regarding the production of radiogenic isotopes over time is best understood by reviewing Figure 7. At the time of crystallization (*t* = 0), all three rocks have the same initial $^{87}Sr/^{86}Sr$ ratio. However, due to variations in their modal mineral composition, each rock has different concentrations of Rb and Sr and thereby a different $^{87}Rb/^{86}Sr$ ratio. Thus, samples *a, b* and *c* plot as separate points along a horizontal line. The production of radiogenic Sr starts once each rock has become a closed system, being the amount of ^{87}Sr produced by radioactive decay proportional to the content of ^{87}Rb present in the rock. Starting with time $t = 0$ to $t = 1000$ Ma, the points move along straight lines with a slope of -1 as a single ^{87}Rb nuclide decays to a single ^{87}Sr nuclide (Rollinson, 1993).

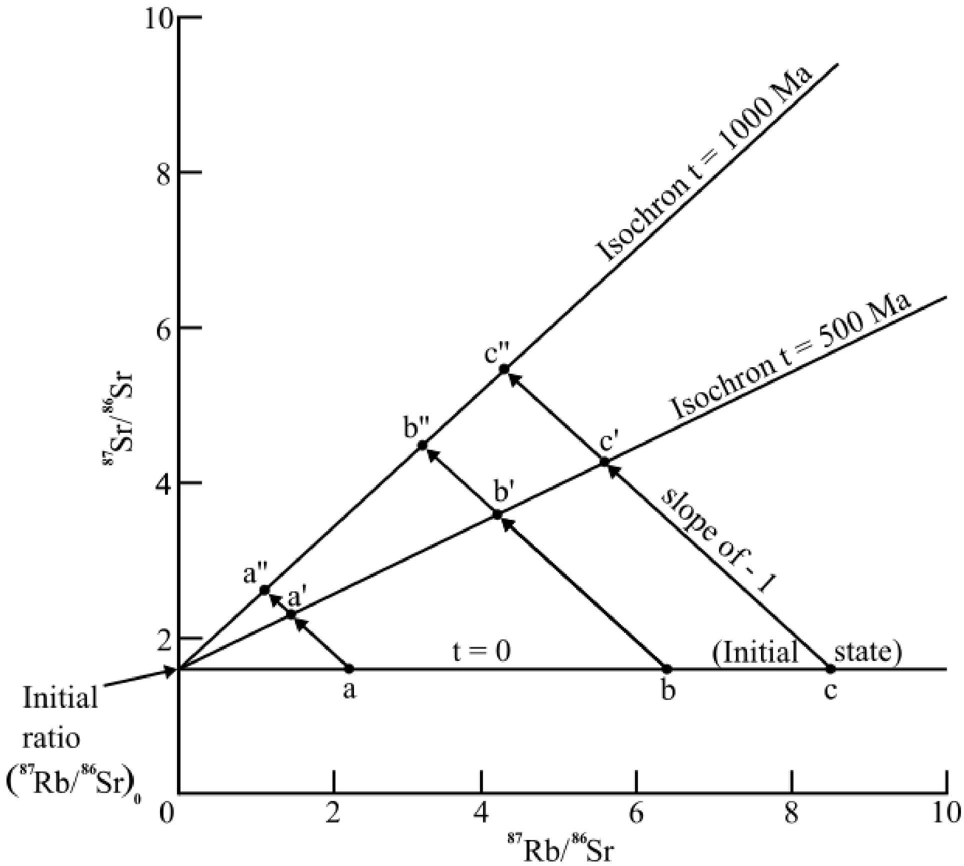


Figure 7: Schematic isochron diagram. Samples a, b and c have the same initial $^{87}Sr/^{86}Sr$ ratio at $t = 0$. At time $t = 500$ and $t = 1000$ Ma they move along straight lines (a-a'-a''; b-b'-b''; c-c'-c'') with a slope of -1 as a single ^{87}Rb nuclide decays to a single ^{87}Sr nuclide (Rollinson, 1993).

Keeping in mind the mechanism by which radioactive decay takes place in geological systems we ought to assume that a suite of co-genetic samples is required to obtain suitable crystallization ages. Moreover, we have to expect that there has not been an exchange of parent-daughter nuclides within the rocks by any other way than radioactive decay. Nonetheless, Rb and Sr are rather mobile elements so the isotopic system may be altered by a subsequent metamorphic event or by the influx of fluids. The way Rb and Sr are redistributed during thermal events is of critical importance considering that minerals and whole-rock isotopic systems react differently to such episodes. Radiogenic Sr holds unstable lattice locations in minerals with high contents of Rb such as biotite and K-feldspar. Therefore, under the influence of a thermal pulse, Sr is released from these minerals and assimilated by adjacent Ca-rich constituents such as plagioclase or apatite, which ultimately act as Sr recipients, whereas the rock may remain as an effectively closed system (Dickin, 2005). Separate isochrons can be calculated for minerals and rocks, providing ages that do not necessarily represent the time of crystallization.

The primary feature that controls the retentiveness of a radiogenic nuclide in a mineral is temperature. In this regard, the concept of blocking temperature, defined by Dodson (1973), becomes of significant importance. The blocking temperature is described as the temperature below which an isotopic system is switched on. Different minerals hold different blocking temperatures for each isotopic system. Hence, knowing the blocking temperature of a particular mineral for the Rb-Sr isotopic system, we can obtain meaningful information about the cooling history of a rock that has been subjected to a thermal event by assembling an isochron for that specific mineral. In that case, the age is calculated by a two-point isochron using the isotopic ratios of the mineral in question and the whole rock. The age obtained by this approach will not correspond to the time of crystallization of the rock but with the time when that particular mineral cooled down below its blocking temperature, following the culmination of the thermal pulse to which was subjected (Jäger, 1979; Rollinson, 1993; Dickin, 2006).

All factors considered, the Rb-Sr isotopic system is a versatile technique that can provide different sorts of information regarding the evolution of a geological system. It can be applied to whole-rock samples and individual minerals, with the additional advantage of involving rock-forming minerals in the process, such as mica and feldspars. The results obtained by this method have to be treated carefully since, under the influence of a thermal episode, the Rb-Sr system behave differently in specific minerals compared to the whole rock, the latter being much more stable to such disturbances. Besides, if a thermal event is followed by an influx of fluids, it can lead to a complete readjustment of the isotopic system. However, if an isochron can be obtained from a suite of samples it can be related to a definitive event, such as the age of crystallization, the age of metamorphism or the age of alteration (Rollinson, 1993). In this regard, the measure of the Mean Squares of Weighted Deviates or MSWD (statistical parameter that evaluates the rightness of fit of an isochron) becomes of great importance. If the scatter of an isochron produces a MSWD below 2.5 it can be referred to analytical miscalculations (Brooks et al., 1972), yet, if the MSWD is higher than 2.5, geological reasons have to be considered for such errors. Therefore, the results obtained from isochron calculations and the evolution of the geological system have to be taken into consideration in order to get proper information from the Rb-Sr data.

4. MATERIALS AND METHODS

4.1 Data collection and sampling

Data collection was carried out at various field campaigns between July 2013 and November 2014. The collection of whole-rock samples was matched with multiple field observations, including petrological and structural features. Additional information was integrated from the results of the Field Course in Ore Prospecting, arranged by the University of Turku in 2010, 2012 and 2013.

This project was conducted using two specific areas of study. The first one corresponds to a 16 km long E-W profile arranged around the vicinity of Pernaja, between Porvoo and Loviisa, hereinafter referred as to the “Pernaja area” (Figure 8A). The second one comprises a 1km^2 large section located south of Lake Lillträsket, hereinafter referred as to the “Lillträsket area” (Figure 8B). The bedrock in both study areas constitute late-orogenic Svecofennian granites. However, since preliminary alteration features were found south of Lake Lillträsket, the constitution of a separate study area was considered necessary (the Lillträsket area).

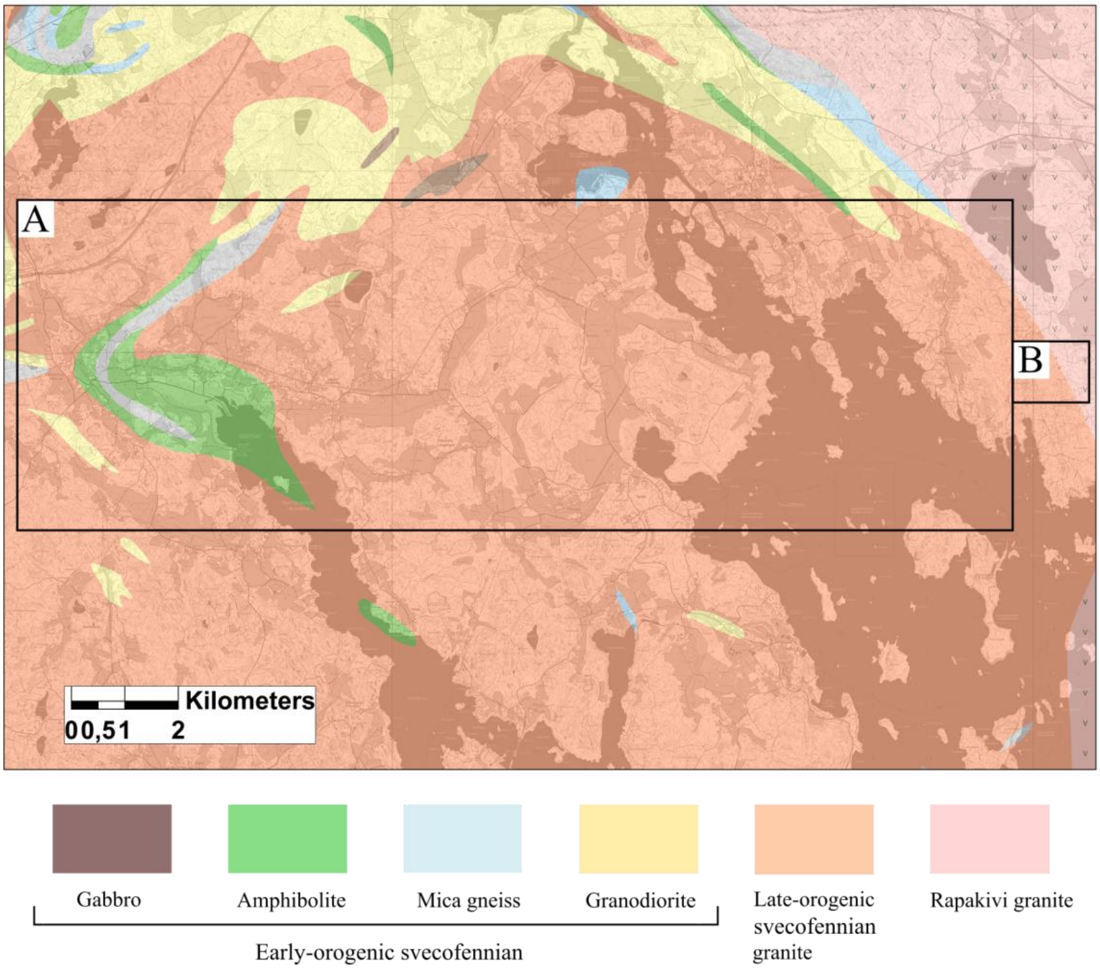


Figure 8: Bedrock map displaying the study area (A: Pernaja area; B: Lillträsket area). Modified from the GTK Bedrock Map of Finland. Courtesy of the Geological Survey of Finland.

A total of 85 rock samples were collected, of which 33 were processed at the University of Turku for their use through further analyses. From the gathered material, 25 thin sections were produced, 31 samples were prepared for subsequent geochemical analysis whilst 4 were selected for isotope studies. In addition to that, the geochemical results of 476 analysed soil samples, collected in the Field Course in Ore Prospecting, were used. The sample coordinates were obtained with a handheld GPS device according to the Finnish Grid coordinate system, zone 3 (KKJ).

4.2 Analytical methods

4.2.1 Thin section microscopy

A comprehensive petrographic examination of 25 thin sections was done using a transmitted light petrographic microscope. The distribution of the specimens covers the two study areas but most of the samples are, however, concentrated to the Lillträsket area. Appendix 1 includes a list of all samples used in this study and their coordinates.

4.2.2 Geochemical analyses

The geochemical data of glacial till is a valuable way to identify the sources for potential ore deposits. The first soil sampling campaign was performed in the summer of 2010 by Turun yliopisto students David García Balbuena and Martín Heredia Bilbao, within the Lillträsket area, with the purpose to locate the source of a Zn-rich ore boulder discovered in 2009 by Åbo Akademi student Niklas Nygård. Due to the promising results obtained from those samples, further sampling campaigns were carried out during the Field Course in Ore Prospecting in 2010, 2012 and 2013.

The soil samples were collected in 100 m and 20 m grids in order to: (1) identify potential soil anomalies; (2) delimit the anomalies detected by the 100 m grids. Once collected, the soil samples were handled at the field sites prior to their analysis in the laboratories. As part of their treatment, the samples were dried in a sauna located within the facilities of the basecamp. Then, the dried samples were sieved up to 250 microns and put in plastic bags (with a minimum amount of 20 g per bag).

As to the whole-rock samples, they were treated at the University of Turku. All samples were cleaned of their weathered surfaces by cutting them with a diamond saw. An exhaustive cleaning process, including ultrasound-cleaning equipment, was done aiming to avoid potential contaminations.

A total of 507 samples, including whole-rock and glacial till samples, were sent to the Activation Laboratories Ltd. in Canada. The analyses of the glacial till samples were carried out following the “Ultratrace 3” package, which includes Total Digestion ICP-

ICP/MS plus INAA. The analyses requested for the whole-rock samples were the "4Litho" package, which uses WRA-ICP for major elements and ICP-MS for trace elements. Code "4F" was requested for the analysis of F and FeO by FUS-ISE and TITR respectively. Additionally, it was demanded the application of the "RX1" package on every sample, which crushes the rock up to 2mm and then pulverizes the material left up to 105 microns using mild steel.

4.2.3 Rb-Sr analyses

Rb and Sr isotopes were analysed at the Institute of Precambrian Geology and Geochronology in St. Petersburg, Russia. The samples used in this study were analysed for Rb and Sr concentrations by isotope dilution. The $^{87}Sr/^{86}Sr$ and $^{87}Rb/^{86}Sr$ ratios were determined by using a Finnigan MAT-261 multicollector mass spectrometer equipped with eight cups. Calculations were performed in selected minerals (plagioclase and biotite) and whole rocks with an accuracy of ± 0.5 % for Rb and Sr, ± 1 % for $^{87}Rb/^{86}Sr$ and ± 0.01 % for $^{87}Sr/^{86}Sr$ (2σ).

5. RESULTS

5.1 Field observations

Two lithological units dominate the area located south of Lake Lillträsket, late-orogenic Svecofennian granites in the west, which constitute the main target of this research, and anorogenic rapakivi granites in the east, comprising the westernmost part of the Wiborg Batholith. The Lillträsket area is crossed by a NW-SE trending line that marks the contact between the two lithologies (Figure 8B).

Preliminary field observations made by Villar (2013) in the Lillträsket area suggested the presence of various rock units within the area represented by the late-orogenic Svecofennian granites. However, the information obtained from geochemical data and thin section microscopy (sections 5.2 and 5.3 of this thesis) has proven this assumption to be false and, therefore, confirmed the presence of a single rock unit. Nonetheless, differences in the colour displayed by the late-orogenic granites in the Lillträsket area are strong enough to be mistakenly identified as separate lithologies. The way this feature is present in the granites is further explained below.

The colours displayed by the late-orogenic granites in the Lillträsket area range from clean-white (which is the predominant tone of the bedrock) via orange shades to an exceptionally intense reddish appearance. The presence of reddened frames becomes prominent around quartz veins and intertwined fracture systems. Whitish quartz veins form these structures with a variety of thicknesses ranging from 0.5 to 5 cm. The orientation of these quartz veins remains consistent through the area, varying from N 20º W to N 30º W, while the intertwined associated fractures are grouped in two different systems, displaying orientations of N 60º W and N 40º E respectively. Even if it is not a common feature, epidote is present close to some of these systems (Figure 9). Based on the field observations, the reddened zones appear along the fractured segments of the bedrock, where they reach the highest intensity, while they faint to lighter tones when moving towards the unbroken parts of the bedrock. The extent of the reddish coloration depicts an irregular arrangement through the region, with places where the reddened tone goes more than a meter into the bedrock and places where this coloration only reaches a few centimetres (Figure 10). This phenomenon has been observed exclusively in the Lillträsket area, while the outcrops located in the Pernaja area form rather homogeneous leucogranites.

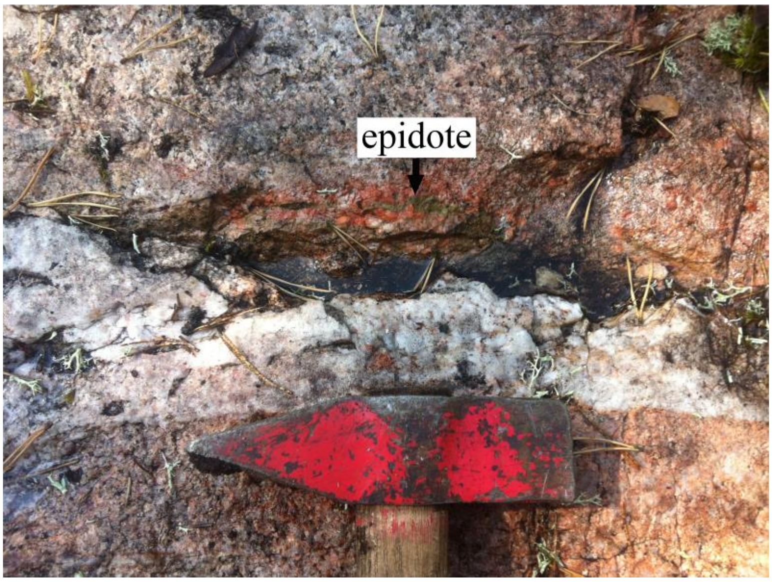


Figure 9: Reddened granite around a quartz vein. Epidote is visible next to the vein. Coordinates: X = 3452555 Y = 6701081.

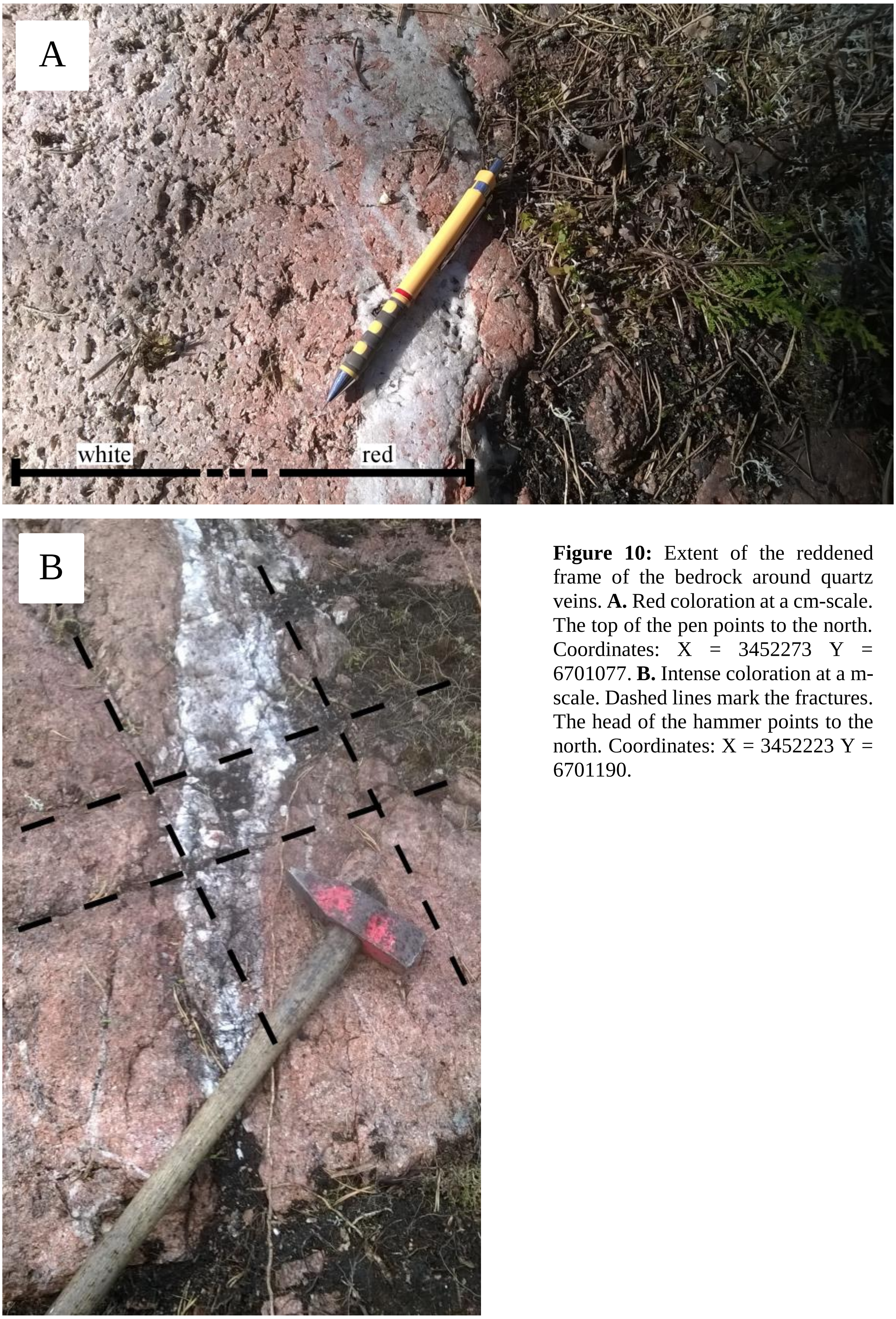


Figure 10: Extent of the reddened frame of the bedrock around quartz veins. **A.** Red coloration at a cm-scale. The top of the pen points to the north. Coordinates: X = 3452273 Y = 6701077. **B.** Intense coloration at a m-scale. Dashed lines mark the fractures. The head of the hammer points to the north. Coordinates: X = 3452223 Y = 6701190.

5.2 Petrography

Variations in the mineral composition of the rocks are rather small. The contents of quartz, K-feldspar and plagioclase remain consistent all in all, covering up to 95 % of the mineral assemblage. The presence of mafic minerals remains constant too, comprising about 5 % of the constituents. However, significant differences have been observed when looking at the mode of occurrence of K-feldspar, with microcline and orthoclase grains unequally distributed through the samples. A detailed description of the textural features, in addition to the microcline-orthoclase distribution, is shown below.

5.2.1 Textural features and mineral composition

The rock suites present a classic hypidiomorphic texture with their main mineral constituents homogeneously distributed (Figure 11). No foliation or any expression of deformation has been observed in the samples. CIPW values (Appendix 2) match the visual estimations done by transmitted light microscopy, where the average mineral composition (Table 1) shows a preponderance of K-feldspar over plagioclase.

Table 1: Average mineral contents of the granite studied in thin sections.

Mineral	Content
Quartz	30 %
K-feldspar	35 %
Plagioclase	28 %
Biotite	5 %
Accesories	2 %

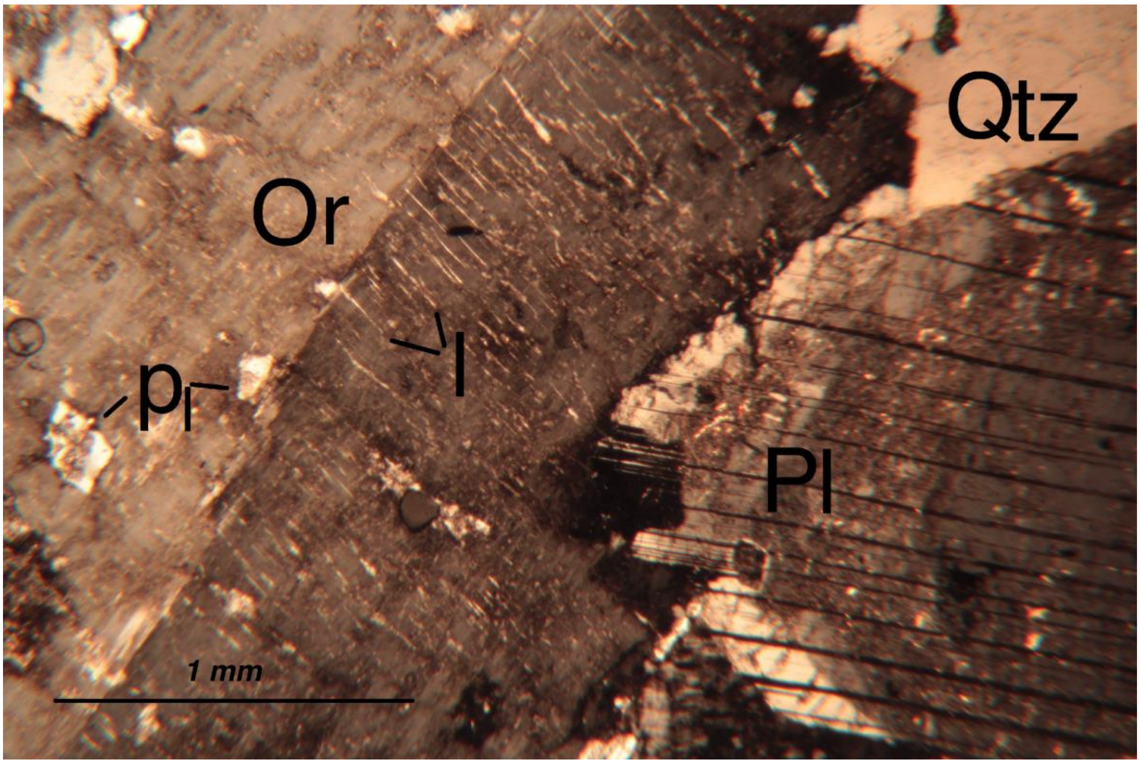


Figure 11: Microphoto on subhedral to anhedral orthoclase, plagioclase and quartz grains displaying an hypidiomorphic texture. Small inclusions of plagioclase can be observed within the orthoclase grain. Sample AV031 in cross-polarized light.

K-feldspar is present as both microcline and orthoclase grains (see the section "Microcline-Orthoclase transition" for detailed information). Their sizes range from 1 to 6 mm long and 0.5 to 4 mm wide. Intergrowth textures are common in the K-feldspar grains, displaying a perthite-type of configuration with regular and oriented exolution lamellae ranging from 0.01 to 0.1 mm width and 0.1 to 0.5 mm length. Poikilitic textures are also common, with small grains of plagioclase, frequently altered to sericite, embedded in bigger K-feldspar grains (Figures 11 and 12). Quartz grains range in sizes from 2 to 3 mm. As to the plagioclase grains, their sizes are slightly smaller than those of the K-feldspar grains. They often display a dusty look due to the presence of sericite, which is significantly prominent in the samples collected in the Lillträsket area, near the Wiborg Batholith (Figure 13). Myrmekitic textures are common, with quartz intergrowths in plagioclase grains adjacent to K-feldspar grains (Figure 14).

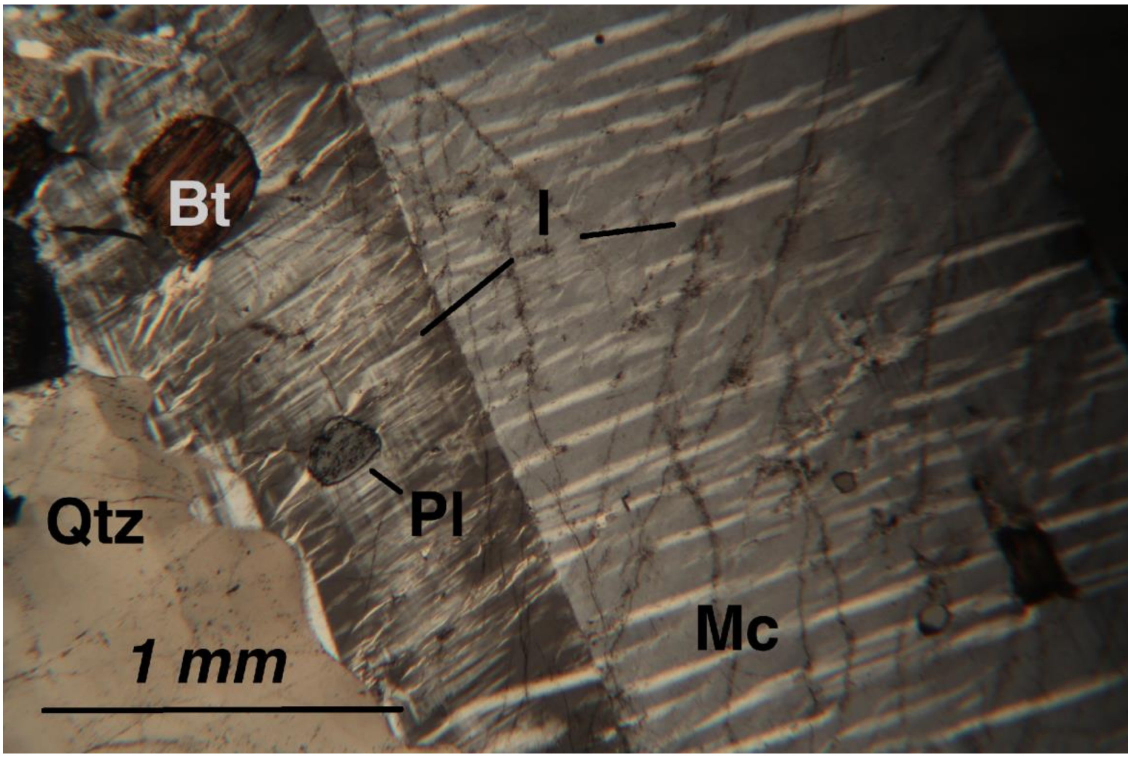


Figure 12: A large microcline grain with small inclusions of plagioclase and biotite. Regular exolution lamellae are present within the crystal, making difficult to see the characteristic crosshatched twinning underneath. Sample AV058 in cross-polarized light.

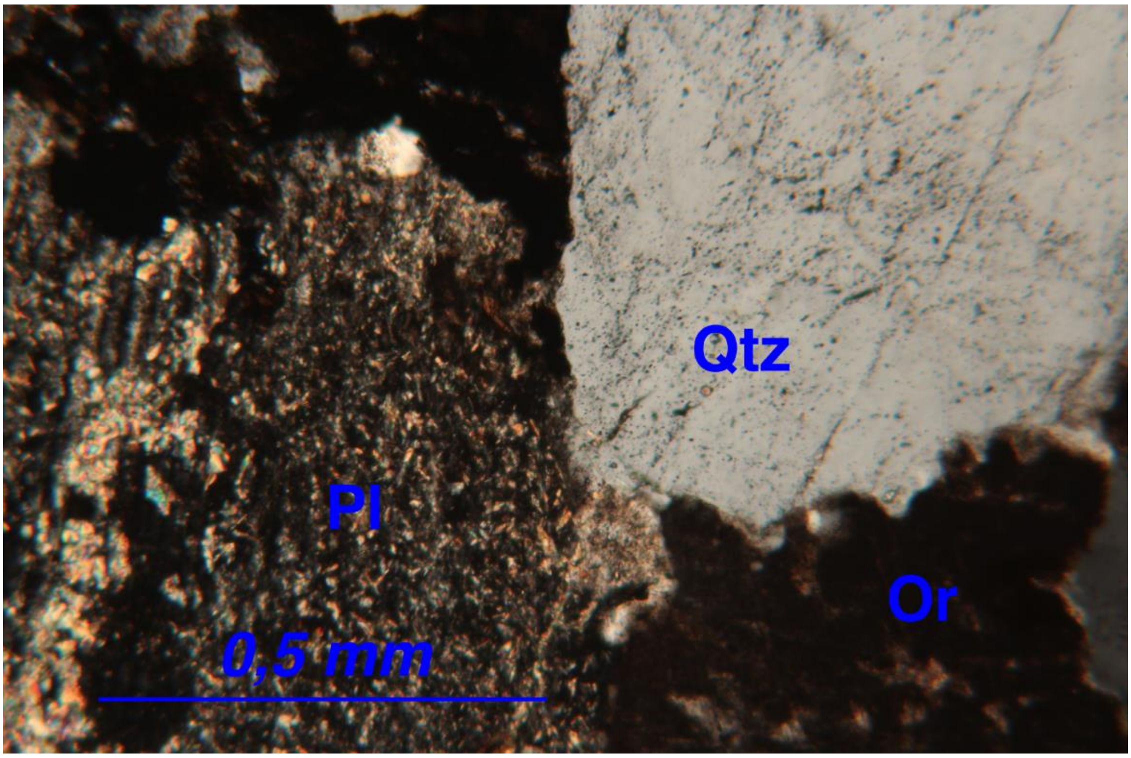


Figure 13: Grains of quartz, plagioclase and orthoclase. The plagioclase is strongly altered, with sericite dominating the entire grain. Sample AV006 in cross-polarized light.

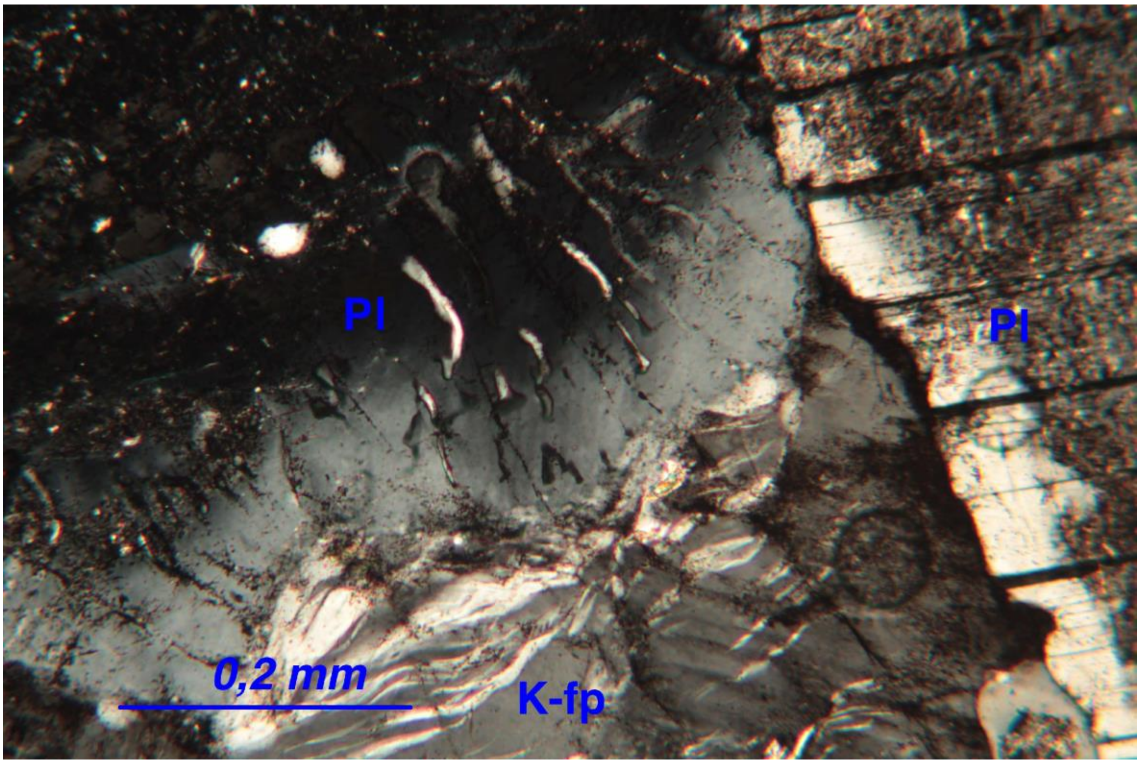


Figure 14: Quartz intergrowth within a plagioclase grain in contact with a K-feldspar grain. Sample AV031 in cross-polarized light.

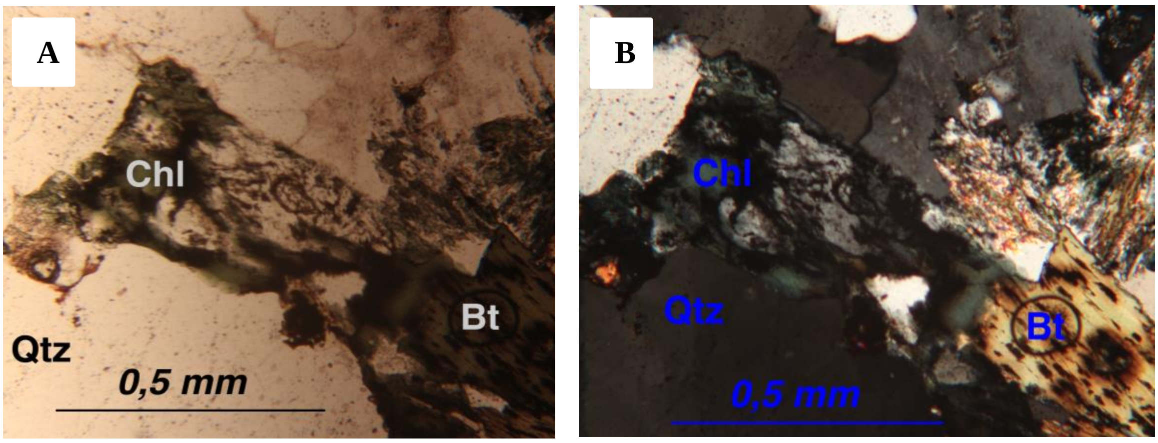


Figure 15: A biotite grain partially altered to chlorite. **A.** Sample AV016 in plane-polarized light. **B.** Sample AV016 in cross-polarized light.

Biotite is the predominant mafic mineral in these granites. It is partially or totally altered to chlorite in many samples and often includes small zircons surrounded by a dark halo (Figure 15). Muscovite can be seen in some specimens although their occurrence is rather small. As for the accessory minerals, almandine garnets are the most common. Fine-grained Fe oxides are present in many of the specimens from the Lillträsket area (Figure 16). They are frequently included within porous K-feldspar grains, micro-fractures and grain boundaries.

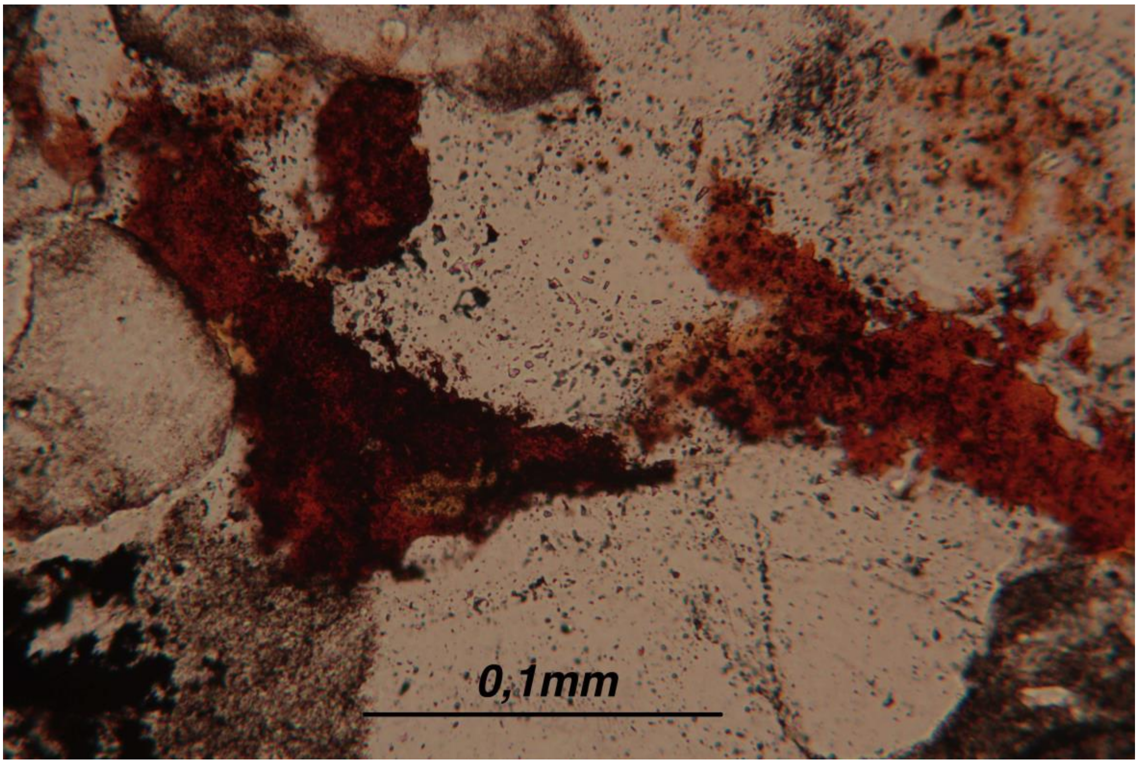


Figure 16: Fine-grained iron oxides. Sample AV019 in plane-polarized light.

5.2.2 Microcline-Orthoclase transition

The way K-feldspar grains are present in the samples depends on their relative position to the Wiborg Batholith. It is possible to discern between specimens where nearly all K-feldspar grains are microcline, samples where microcline is absent (and replaced by orthoclase) and samples with an intermediate arrangement amongst these two members. According to Steiger and Hart (1967), three different zones can be defined in regard to the distribution of microcline and orthoclase in the rocks. A complete description of each zone is shown below. In addition to that, Figure 17 displays a bedrock map where the studied samples are grouped based on the K-feldspar distribution.

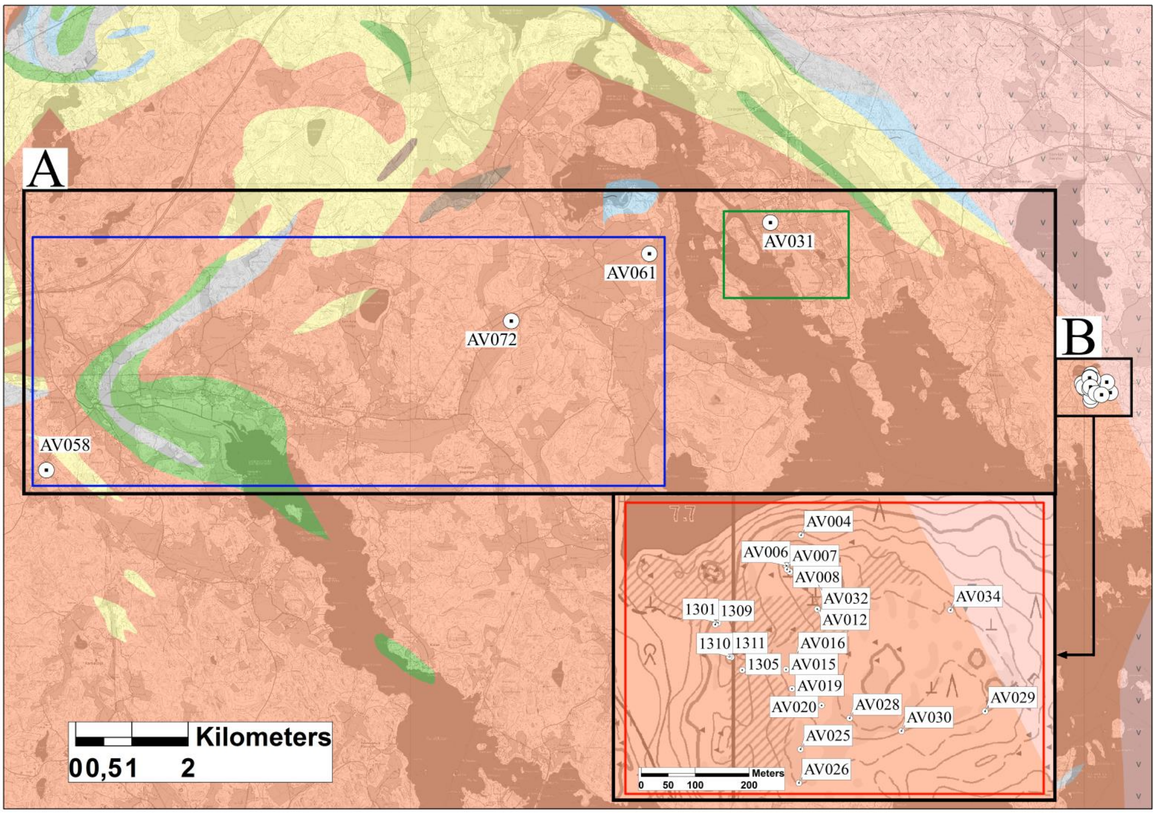


Figure 17: Bedrock map showing the microcline-orthoclase zones. Black lines delimit the study areas (A: Pernaja area; B: Lillträsket area). Microcline zone: blue line; Transition zone: green line; Orthoclase zone: red line. Base map modified from the GTK Bedrock Map of Finland. Courtesy of the Geological Survey of Finland.

5.2.2.1 The microcline zone

The microcline zone represents an area where microcline is the principal K-feldspar phase. Most of the K-feldspar grains within this group show well-defined crosshatched twinning in a clear transparent fashion (Figure 18). Some of the grains display sections with both twinned and untwinned areas, indicating the presence of the monoclininc phase (orthoclase). However, their occurrence is rather small. Samples AV058, AV072 and AV061 belong to this group. They are located 18, 10 and 6.5 km west of the Wiborg Batholith respectively.

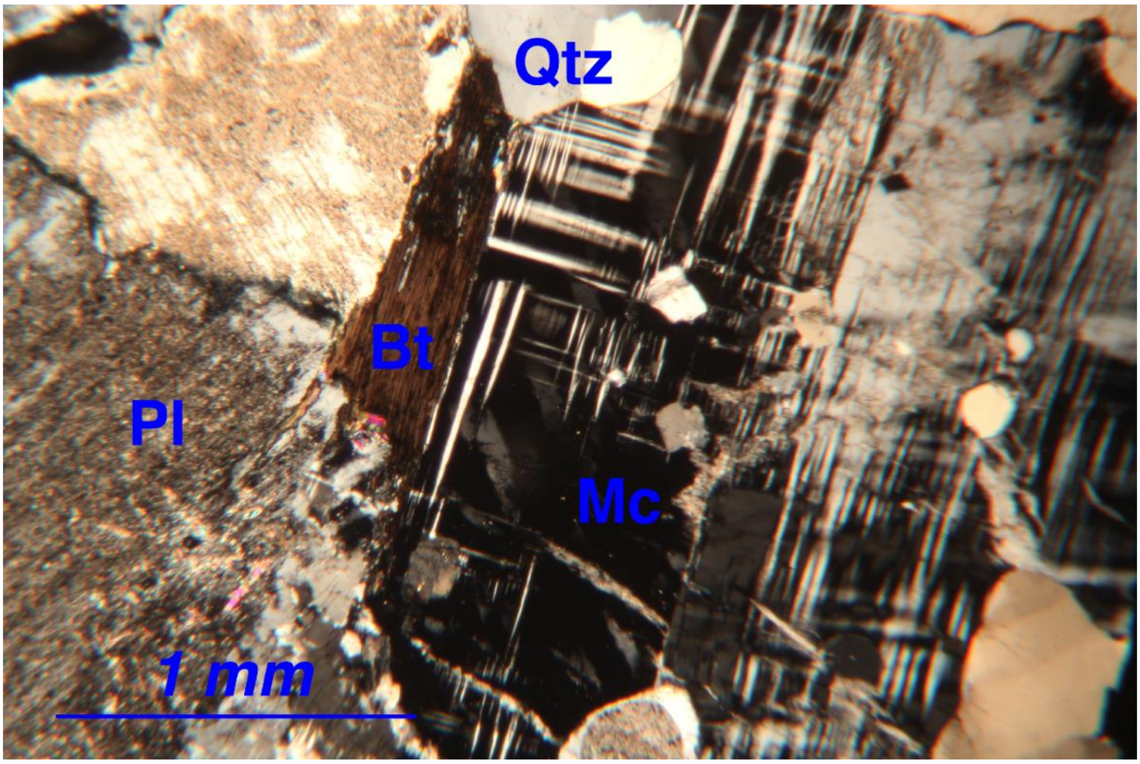


Figure 18: Representative example of a rock with an unaltered microcline grain displaying its characteristic crosshatched twinning. Sample AV072 in cross-polarized light.

5.2.2.2 The transition zone

The transition zone has been defined as the area where microcline coexists with more than 20 % of orthoclase. This area has been subjectively delimited in regard to the mineral assemblage of the two extreme members (the microcline zone and the orthoclase zone). Many of the K-feldspar grains in the transition zone show a clear crosshatched twinning. Nonetheless, the monoclinic phase (orthoclase) is obviously more abundant than in the microcline zone. Most of the K-feldspar grains are altered in some way, displaying a dusty look that becomes more prominent in the orthoclase grains. Sample AV031 belongs to this member. It is located 4 km west of the Wiborg Batholith.

5.2.2.3 The orthoclase zone

The orthoclase zone represents the area adjacent to the intrusive contact of the Wiborg Batholith, where orthoclase is the exclusive K-feldspar phase. Nearly all orthoclase grains are strongly altered in this area, displaying a turbid look that in most cases makes impossible to distinguish any kind of twinning underneath. Many orthoclase grains exhibit a diffuse extinction that may be mistaken as a weak crosshatched twinning. A significant number of samples contain altered K-feldspar grains with a distinct reddish tone caused by the presence of minute Fe oxides (Figure 19). Strongly altered plagioclase grains often occur as xenoblastic filling within large orthoclase grains. All samples collected in the Lillträsket area belong to this group.

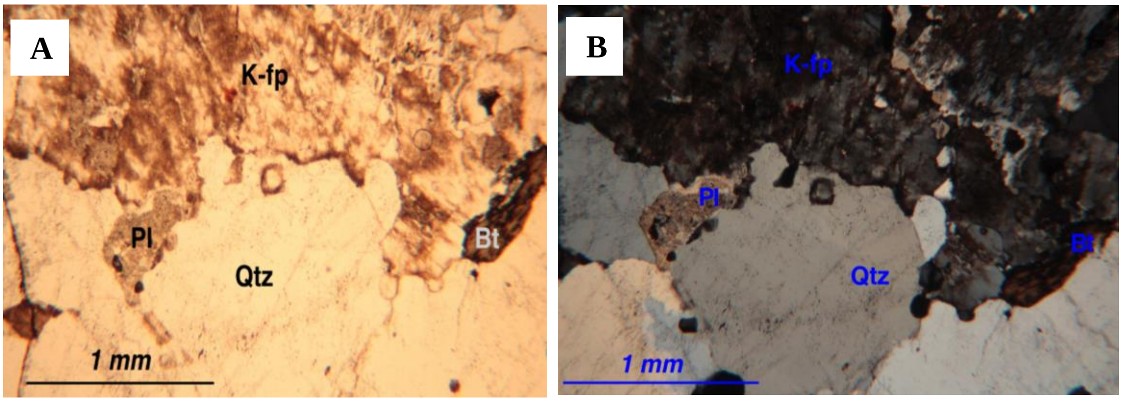


Figure 19: Microphoto of reddened and significantly altered K-feldspar grains. **A.** Sample AV019 in plane-polarized light. **B.** Sample AV019 in cross-polarized light.

5.3 Geochemistry

5.3.1 Whole rock samples

The geochemical data presented in this section are based on whole-rock geochemical analyses performed on 31 rock samples, of which 24 were collected in the Lillträsket area and 7 were collected in the Pernaja area. The precise location of each sample is shown in Figure 20. Table 2 displays a set of statistical parameters regarding the concentration of SiO_2, K_2O, Na_2O, CaO and Fe_2O_3(T). Full analytical results are given in Appendix 3, where major elements are reported as weight percent of oxides and trace element concentrations are shown in ppm.

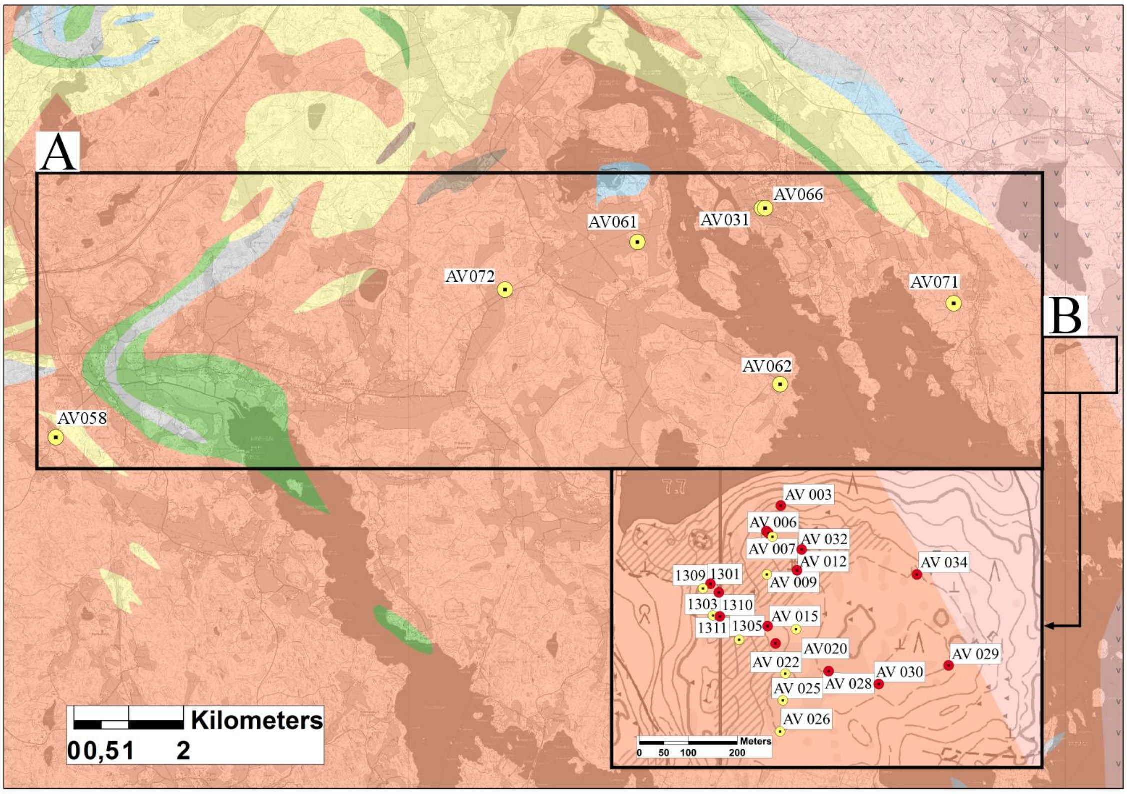


Figure 20: Bedrock map displaying the location of the analysed samples. Black lines delimit the study areas (A: Pernaja area; B: Lillträsket area). Yellow marks represent late-orogenic normal leucogranites; red marks represent late-orogenic red-stained granites. Modified from the GTK Bedrock Map of Finland. Courtesy of the Geological Survey of Finland.

5.3.1.1 Major elements

Table 2: Statistical parameters of selected elements. Concentrations are given by weight percent of oxides.

	Mean	Median	Std. Deviation	Range	Minimum	Maximum
SiO_2	74.62	75.04	1.95	8.74	69.65	78.39
K_2O	5.64	5.61	0.70	2.82	4.18	7.00
Na_2O	2.88	2.87	0.23	1.07	2.40	3.47
CaO	0.50	0.53	0.19	0.69	0.21	0.90
Fe_2O_3(T)	2.41	2.37	0.53	2.46	1.31	3.77

The late-orogenic granites are characterized by their high silica content, which shows a limited compositional range (from 73 to 75 wt%) in most samples. Nevertheless, three of the analysed specimens have extraordinary high SiO_2 contents, all surpassing a weight percentage of 77, while two of the samples display contents below 70 wt%. The marked siliceous nature of these rocks becomes evident when looking at the T.A.S. diagram of Cox et al. (1979) in Figure 21, where nearly all samples fit well into the subalkaline series field for granites.

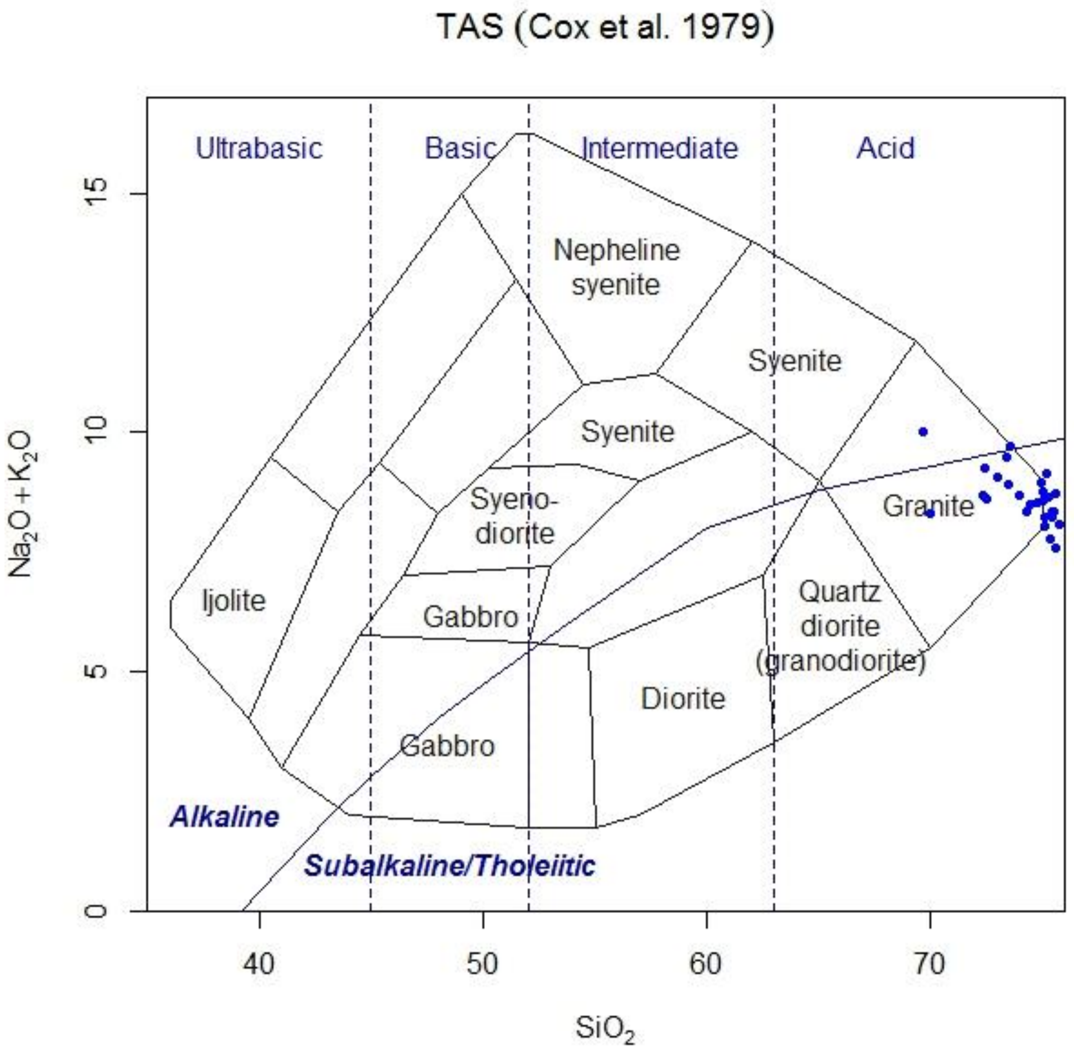


Figure 21: T.A.S. classification diagram of Cox et al. (1979) for plutonic rocks.

Another specific feature of these granites is the high contents of K_2O and low contents of Na_2O and CaO. Most of the samples display K_2O contents ranging from 5 to 6 wt%. Five specimens display K_2O contents below 5 wt%, while nine have contents above 6 wt%, including samples AV028 and 1301, which have extraordinary high K_2O contents (6.98 and 7 wt% respectively). The average K_2O content for the late-orogenic granites is 5.64 wt%. As to the sodium content, most of the samples display values between 2.75 and 3 wt%, while eight of them have slightly higher values. Sample AV026 is an exception, having the highest Na_2O content (3.47 wt%) and the lowest K_2O content (4.18 wt%). The average Na_2O content for the granites is 2.88 wt%. The K/Na ratio displayed by these rocks can be appreciated by looking at the diagram of Chappell and White (1974) for I- and S- type granite classification (Figure 22), where nearly all samples plot within the S-type field.

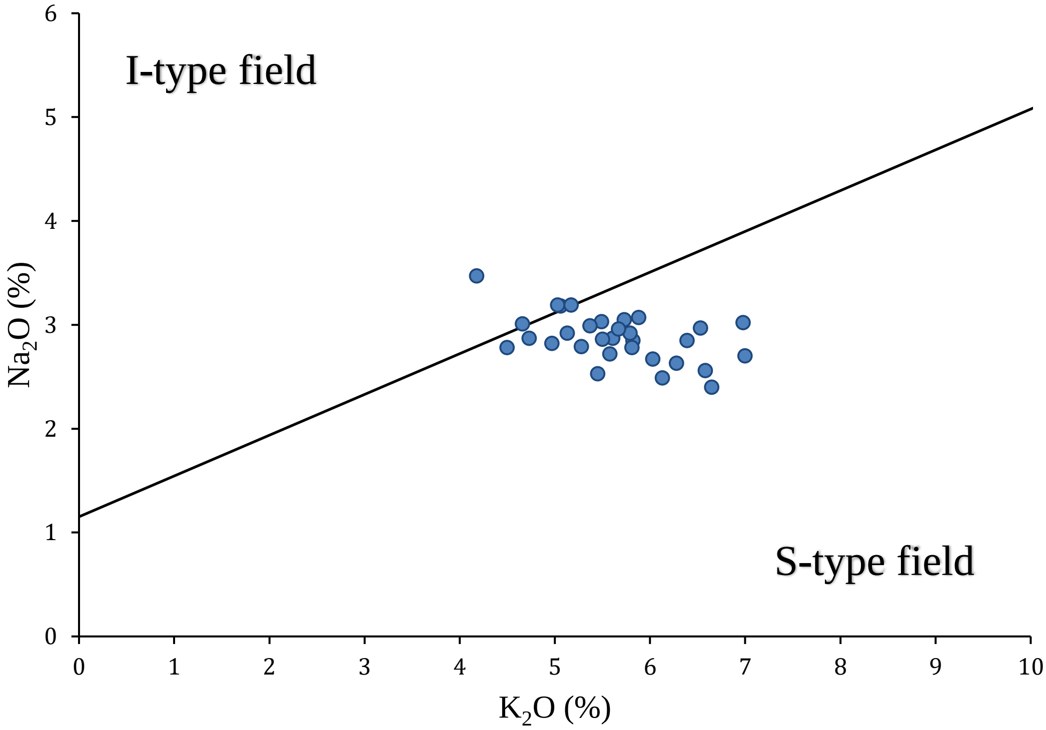


Figure 22: K_2O – Na_2O classification diagram for I- and S-type granites (Chappel and White, 1974).

As mentioned above, the CaO content in the late-orogenic granites is rather low, from 0.3 to 0.6 wt%. Chappel and White (2001) noted that the CaO-FeO system is more effective than the Na_2O- K_2O system to discern between I- and S-type granites. In Figure 23 CaO is plotted against total FeO. which shows that while FeO content varies through the samples CaO remains constant, placing the granites at the bottom of the diagram within the S-type field.

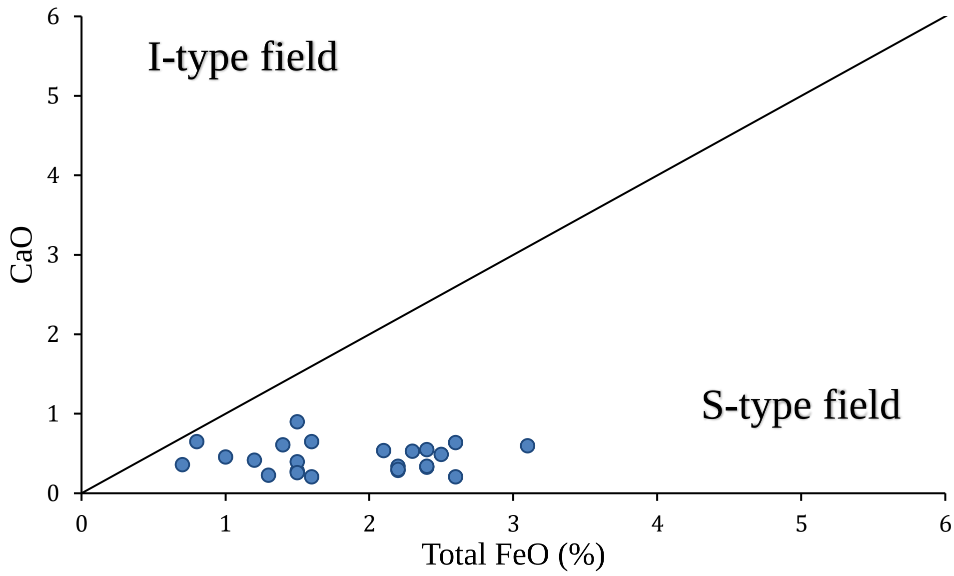


Figure 23: Total FeO – CaO classification diagram for I- and S-type granites (Chappel and White, 2001).

Because of the low Na_2O and CaO contents in the late-orogenic granites, they are oversaturated in aluminium. Figure 24 shows a frequency histogram where the Aluminium Saturation Index (Zen, 1986) is plotted for all samples, showing that the mol. Al/(Ca/2 + Na + K) content has a limited range of values (from 1.05 to 1.2), which according to Chappell and White (1974) is a typical feature of S-type granites as they are peraluminous.

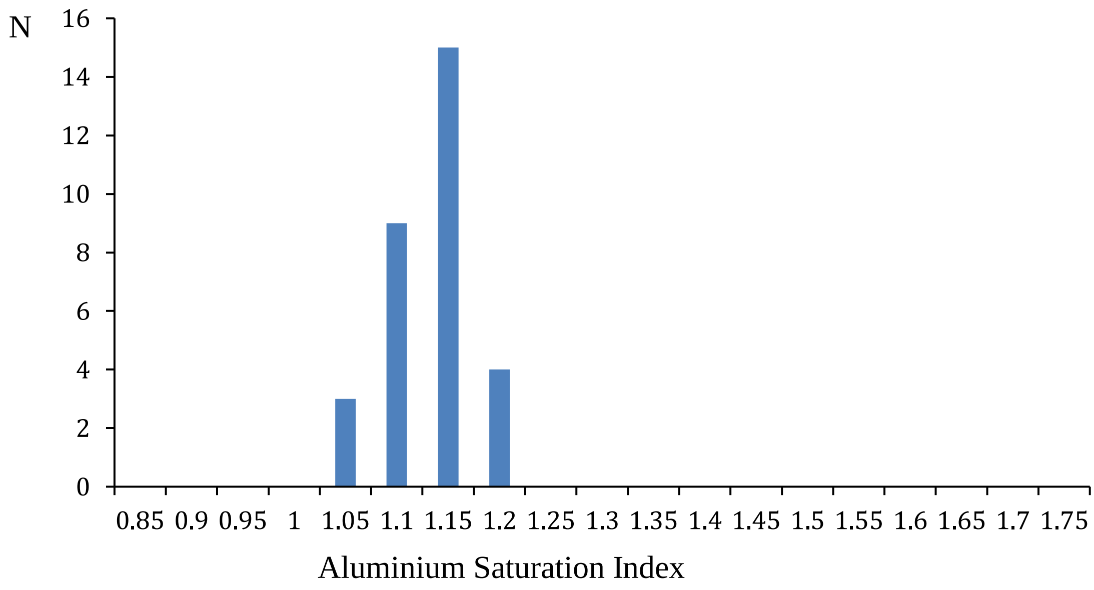


Figure 24: Aluminium Saturation Index (Zen, 1986) values for the late-orogenic granites of the Lillträsket and Pernaja areas.

5.3.1.2 Trace elements

Variations in the chemical composition of trace elements are shown in Figure 25. Additionally, various statistical parameters are outlined in Table 3, including mean, median, minimum and maximum concentrations, range of variation and standard variation. Element concentrations are given in parts per million (ppm).

Table 3: Statistical parameters of whole-rock trace element concentrations (ppm).

Element	Mean	Median	Std. Deviation	Range	Minimum	Maximum
Sc	3.48	3.00	1.16	6	1	7
Be	1.65	2.00	0.77	3.5	0.5	4
V	7.21	7.00	3.15	12.5	2.5	15
Cr	41.61	10.00	67.49	230	10	240
Co	1.29	1.00	0.92	4.5	0.5	5
Ni	10.00	10.00	0.00	0	10	10
Cu	14.84	5.00	34.81	185	5	190
Zn	43.23	40.00	21.16	85	15	100
Ga	22.16	21.00	5.19	29	16	45
Ge	1.74	2.00	0.44	1	1	2
As	2.73	2.50	0.86	3.5	2.5	6
Rb	312.55	323.00	66.77	262	173	435
Sr	44.65	45.00	6.46	29	28	57
Y	23.71	20.00	13.44	77	5	82
Zr	123.52	114.00	45.35	172	45	217
Nb	33.52	20.00	53.08	309	2	311
Mo	2.13	1.00	2.95	10	1	11
Ag	2.28	2.60	1.48	5.05	0.25	5.3
In	0.10	0.10	0.00	0	0.1	0.1
Sn	5.45	4.00	3.99	19.5	0.5	20
Sb	0.47	0.25	0.27	0.85	0.25	1.1
Cs	3.05	2.90	1.19	4.5	1.2	5.7
Ba	226.55	215.00	67.97	286	96	382
Hf	4.25	4.10	1.31	4.5	2	6.5
Ta	25.06	3.40	76.09	428.6	0.4	429
W	4.00	2.00	12.11	69.5	0.5	70
Tl	2.13	2.10	0.56	2.4	1	3.4
Pb	37.87	37.00	12.24	57	16	73
Bi	0.24	0.20	0.14	0.6	0.2	0.8
Th	34.73	32.90	14.98	60	3.9	63.9
U	14.33	8.10	30.38	176.3	2.7	179

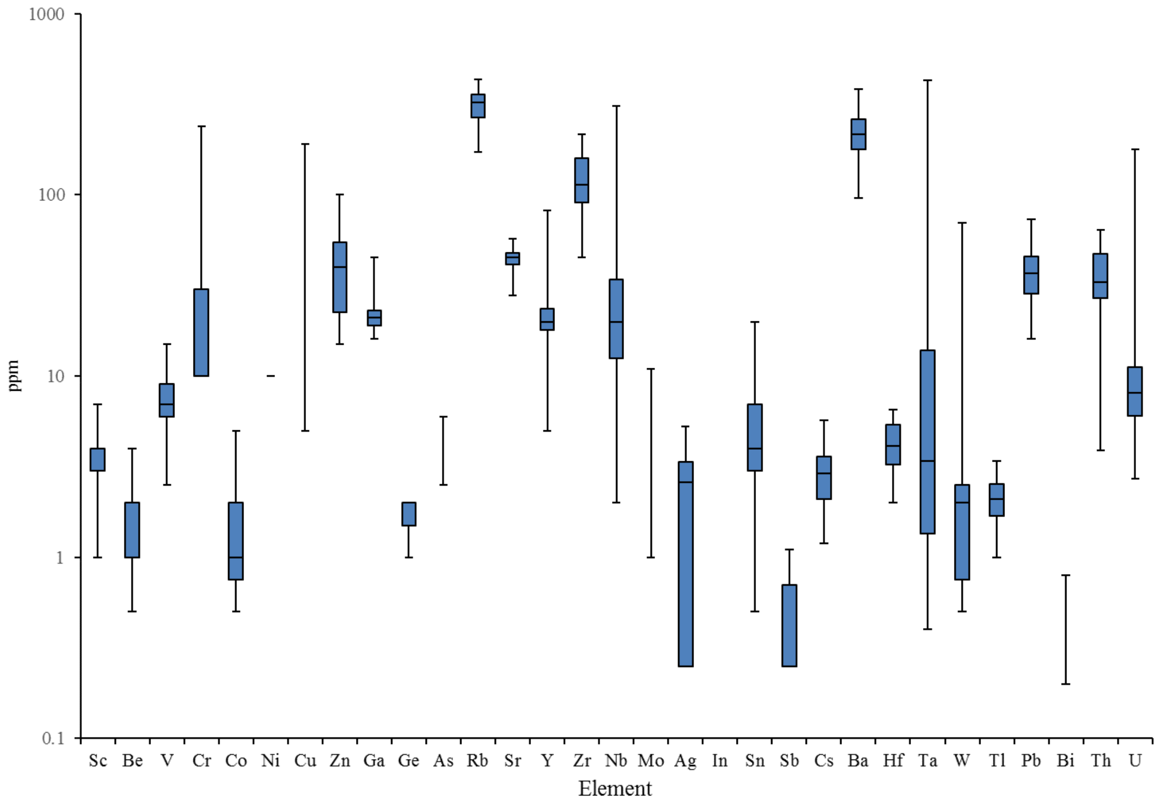
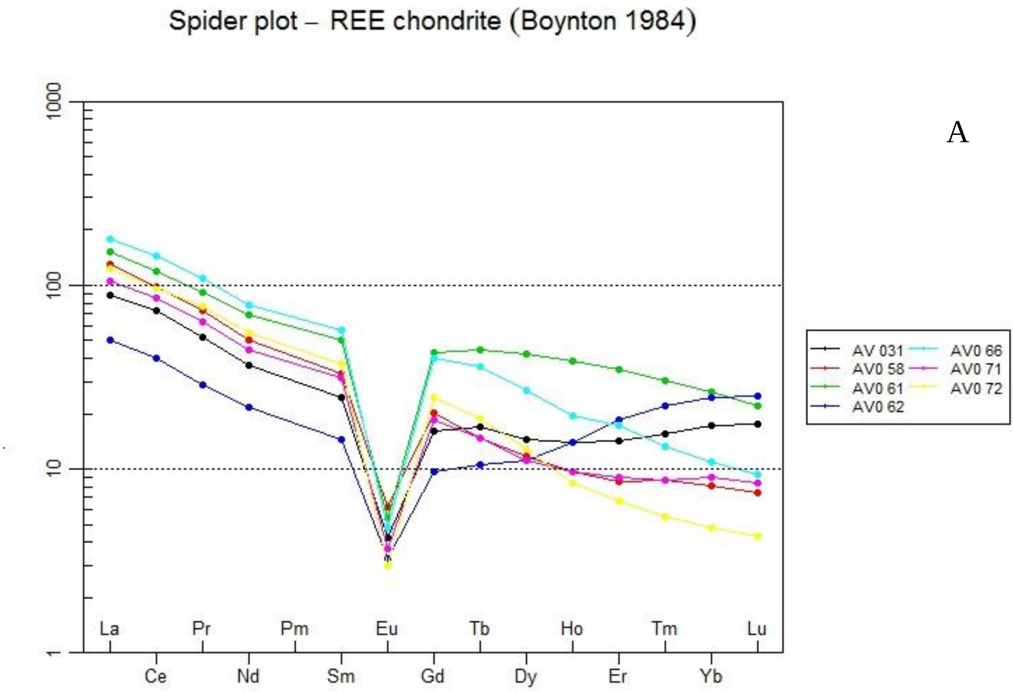


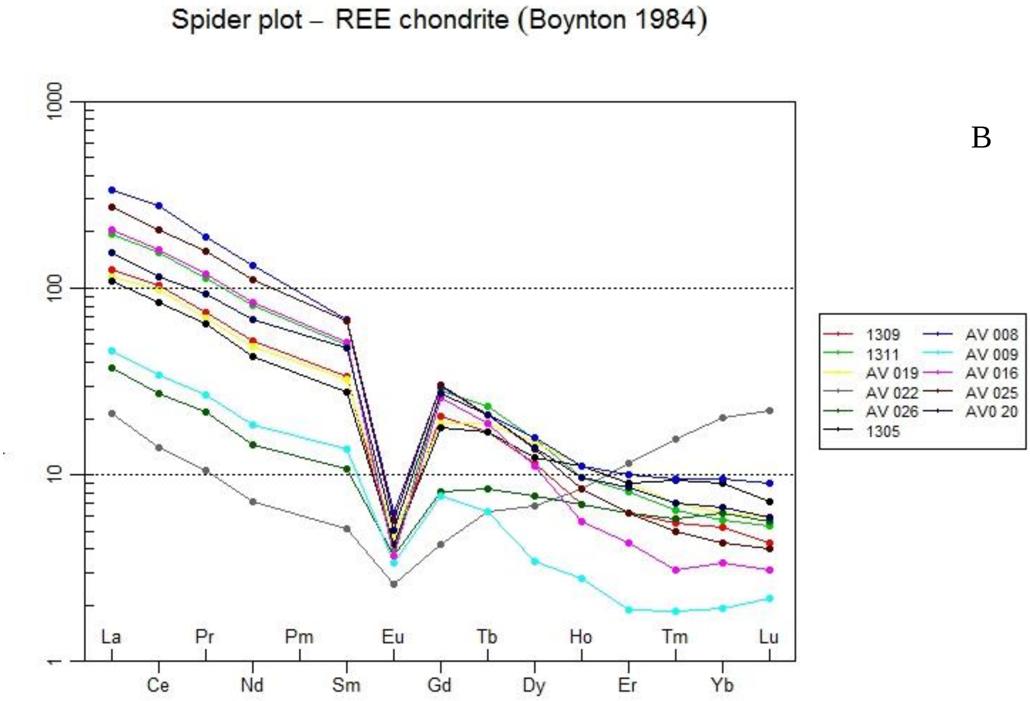
Figure 25: Box-plot diagram showing trace element variations in all samples. Whiskers indicate maximum and minimum concentrations; box indicates concentrations between quartiles 1 and 3; line within the box indicates median. Concentrations are given in ppm.

5.3.1.3 Rare-earth elements (REE)

Chondrite-normalized REE concentrations are displayed in Figure 26. The results are presented in three diagrams due to the large number of samples. Figure 26A includes samples collected in the Pernaja area, while Figures 26B and 26C include the 24 samples collected in the Lillträsket area. Full analytical results are given in Appendix 4, including REE concentrations and ratios expressed by means of *x*-times chondrite based on the standards published by Boynton (1984).


Spider plot – REE chondrite (Boynton 1984)
1000
100
10
1
La
Ce
Pr
Nd
Pm
Sm
Eu
Gd
Tb
Dy
Ho
Er
Tm
Yb
Lu
AV 031
AV0 58
AV0 61
AV0 62
AV0 66
AV0 71
AV0 72

A


Spider plot – REE chondrite (Boynton 1984)
1000
100
10
1
La
Ce
Pr
Nd
Pm
Sm
Eu
Gd
Tb
Dy
Ho
Er
Tm
Yb
Lu
1309
1311
AV 019
AV 022
AV 026
1305
AV 008
AV 009
AV 016
AV 025
AV0 20

B

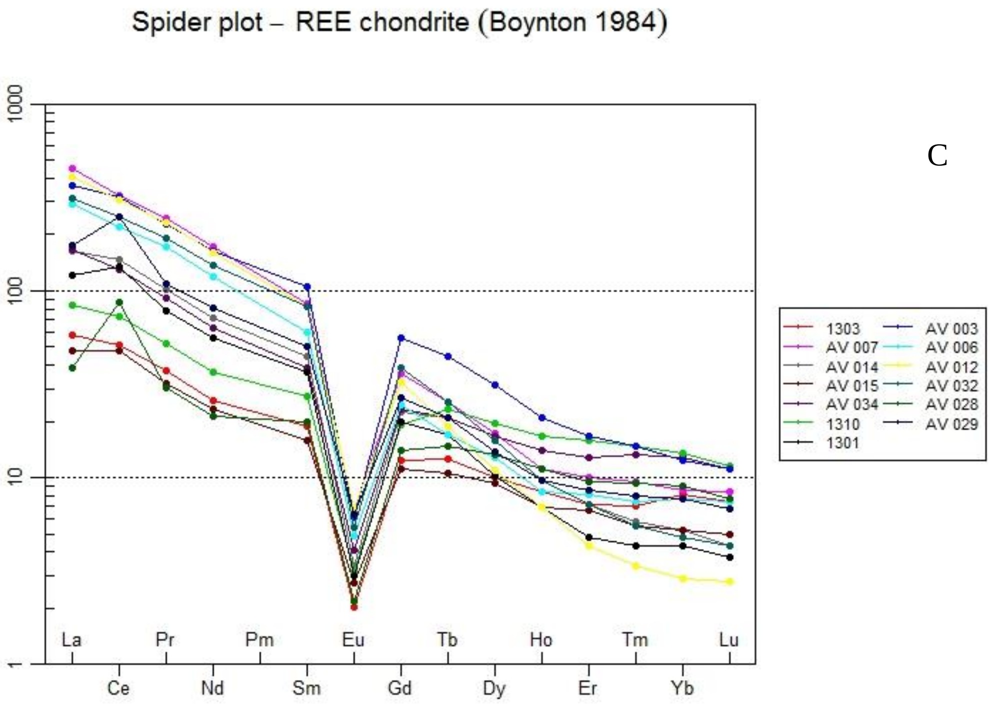


Figure 26: REE chondrite-normalized diagrams (Boynton, 1984). **A.** Leucogranites of Pernaja. **B.** Leucogranites of Lillträsket. **C.** Red-stained granites of Lillträsket.

The REE contents of the late-orogenic granites show a large range of compositions (∑REE = 37 – 573 ppm). Most of the samples display the characteristic REE granite pattern described by Cullers and Graf (1984), with higher concentrations of LREE than HREE (average $(La/Yb)_{cn}$ = 26.82) and pronounced negative Eu anomalies (average $(Eu/Eu^*)_{cn}$ = 0.17). However, some samples display REE patterns that differ from the typical granite pattern, which will be further described below.

The fractionation of REE in samples AV062 and AV031 (belonging to the population of leucogranites of the Pernaja area) display distinct HREE trends. While there is a continuous decrease in their LREE concentrations, the trends displayed by their HREE concentrations exhibit a flat pattern in sample AV031 and a progressive increase in sample AV062. This feature is expressed by their $(La/Yb)_{cn}$ ratios, with lower values than those recorded in most of the other samples (5.09 and 2.05 respectively). Samples AV009 and AV026 (belonging to the population of leucogranites of the Lillträsket area) display a typical REE granite pattern, although their overall REE concentrations are rather low

(∑REE = 64 and 56 ppm respectively) as well as their Eu anomalies ($(Eu/Eu^*)_{cn}$ = 0.33 and 0.39 respectively). Samples AV029, 1301 and AV028 (belonging to the population of the red-stained granite of the Lillträsket area) display proper REE granite patterns too, however, all of them have positive Ce anomalies ($(La/Ce)_{cn}$ = 0.71, 0.91 and 0.45 respectively). Sample AV022 (belonging to the population of leucogranites of the Lillträsket area) has the most distinct REE pattern, with low LREE concentrations and a progressive increase of HREE ($(La/Yb)_{cn}$ = 1.06). This sample has the lowest Eu anomaly, with a $(Eu/Eu^*)_{cn}$ ratio of 0.55, and the lowest total REE content (37 ppm).

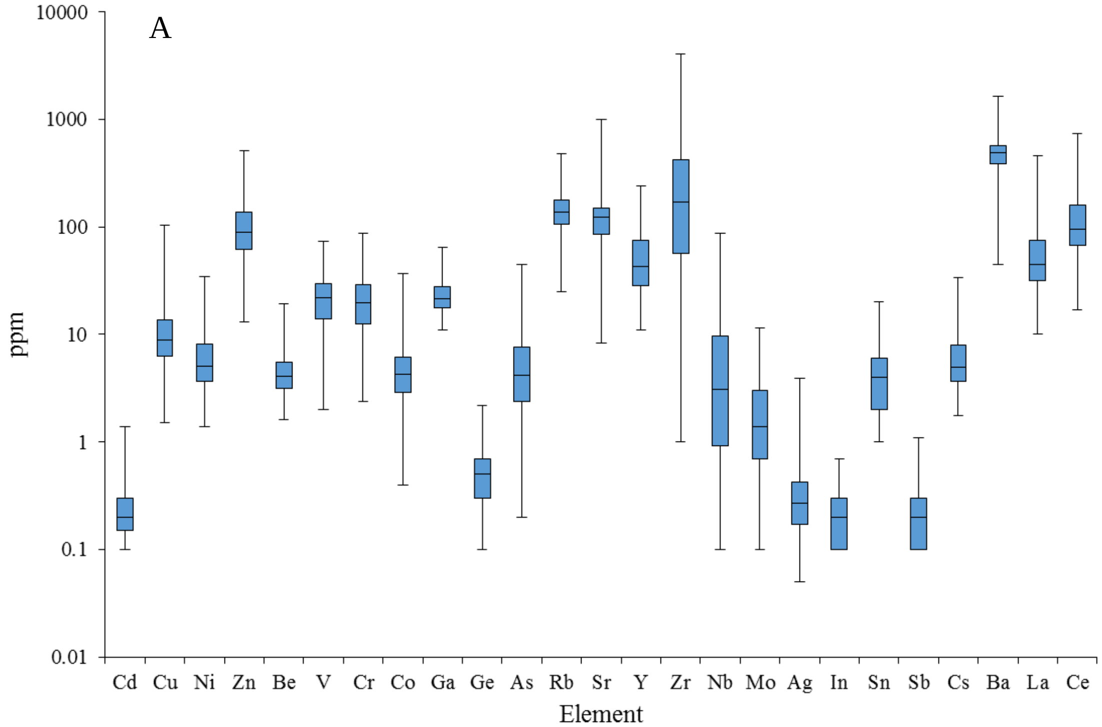
5.3.2 Glacial till samples

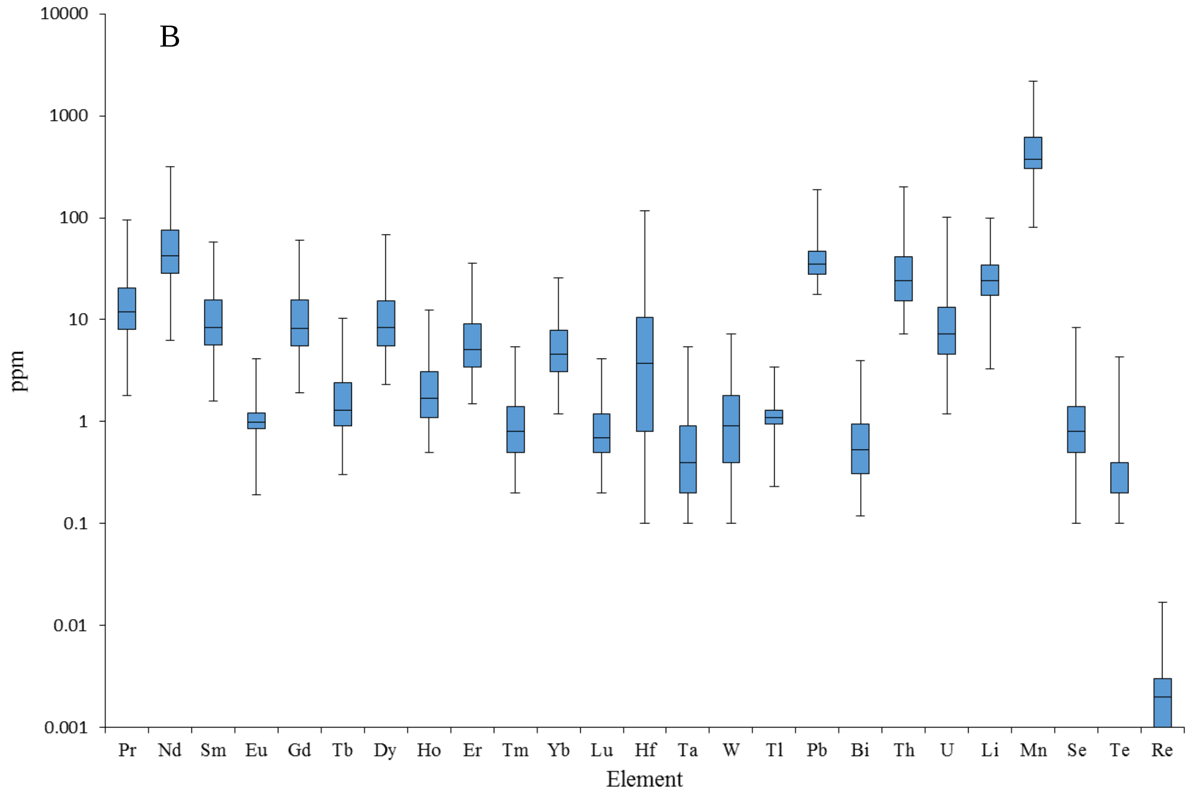
Geochemical data for the 476 glacial till samples collected in the Lillträsket area are summarized in Table 4. The analytical results obtained for each element are shown by mean, minimum and maximum concentrations along with other statistical parameters. Trace element concentrations are given in parts per million (ppm), whereas Na, Mg, Al, K, Ca and Fe are expressed as percentages. In addition, the geochemical information is displayed through a series of box-plot diagrams in Figures 27A, 27B and 27C. Full analytical results are given in Appendix 5.

Table 4: Statistical parameters of glacial till element concentrations. N indicates number of samples above detection limits. Concentrations are given in ppm except for *, which are given in percentages.

Element	N	Mean	Median	Std. Deviation	Range	Minimum	Maximum
Cd	403	0.25	0.20	0.15	1.30	0.10	1.40
Cu	476	11.46	8.90	9.85	102.50	1.50	104.00
Ni	476	6.66	5.10	4.68	32.80	1.40	34.20
Zn	476	111.11	89.30	74.30	499.80	13.20	513.00
Be	476	4.65	4.10	2.10	17.80	1.60	19.40
V	469	23.71	22.00	12.95	71.00	2.00	73.00
Cr	475	22.16	19.50	12.71	85.60	2.40	88.00
Co	476	5.06	4.30	3.46	36.70	0.40	37.10
Ga	476	23.53	21.60	7.99	54.00	11.10	65.10
Ge	462	0.52	0.50	0.32	2.10	0.10	2.20
As	461	6.10	4.20	6.00	44.70	0.20	44.90
Rb	476	144.45	137.50	69.13	459.20	24.80	484.00
Sr	476	120.58	123.00	59.95	991.70	8.30	1000.00
Y	476	58.84	43.15	42.27	228.10	10.90	239.00
Zr	476	321.91	170.50	433.22	4079.00	1.00	4080.00
Nb	462	7.39	3.10	10.79	87.50	0.10	87.60
Mo	422	2.08	1.40	1.93	11.50	0.10	11.60
Ag	424	0.36	0.27	0.34	3.87	0.05	3.92
In	273	0.22	0.20	0.11	0.60	0.10	0.70
Sn	339	4.39	4.00	3.32	19.00	1.00	20.00
Sb	191	0.25	0.20	0.17	1.00	0.10	1.10

Cs	476	7.16	4.97	5.60	32.03	1.77	33.80
Ba	476	470.36	491.50	140.64	1585.00	45.00	1630.00
La	476	61.27	45.10	49.26	445.00	10.00	455.00
Ce	476	132.91	96.05	108.34	719.90	17.10	737.00
Pr	476	16.62	11.80	13.44	93.70	1.80	95.50
Nd	476	60.17	42.35	48.20	312.70	6.30	319.00
Sm	476	12.20	8.40	9.78	55.80	1.60	57.40
Eu	476	1.12	0.99	0.48	3.95	0.19	4.14
Gd	476	12.07	8.15	9.84	58.00	1.90	59.90
Tb	476	1.90	1.30	1.54	10.00	0.30	10.30
Dy	476	12.04	8.30	9.56	65.90	2.30	68.20
Ho	476	2.44	1.70	1.88	12.00	0.50	12.50
Er	476	7.15	5.10	5.36	34.50	1.50	36.00
Tm	476	1.08	0.80	0.79	5.20	0.20	5.40
Yb	476	6.17	4.60	4.37	24.50	1.20	25.70
Lu	476	0.97	0.70	0.67	3.90	0.20	4.10
Hf	406	8.12	3.75	12.05	115.90	0.10	116.00
Ta	209	0.70	0.40	0.79	5.30	0.10	5.40
W	276	1.34	0.90	1.30	7.10	0.10	7.20
Tl	476	1.16	1.10	0.40	3.21	0.23	3.44
Pb	476	39.73	35.30	16.54	172.30	17.70	190.00
Bi	476	0.70	0.54	0.52	3.86	0.12	3.98
Th	476	35.45	24.20	31.14	192.70	7.30	200.00
U	476	11.72	7.20	12.97	99.80	1.20	101.00
Li	476	28.06	24.25	16.14	95.30	3.30	98.60
Mn	476	499.66	377.00	314.61	2089.00	81.00	2170.00
Se	391	1.20	0.80	1.17	8.30	0.10	8.40
Te	112	0.36	0.20	0.49	4.20	0.10	4.30
Re	267	0.00	0.00	0.00	0.02	0.00	0.02
Na*	476	1.47	1.53	0.42	2.59	0.13	2.72
Mg*	476	0.34	0.30	0.19	1.81	0.03	1.84
Al*	473	6.04	5.92	0.98	6.72	3.00	9.72
K*	476	1.95	2.06	0.82	3.91	0.19	4.10
Ca*	476	0.98	0.97	0.37	3.37	0.14	3.51
Fe*	476	4.29	3.59	2.69	16.89	0.41	17.30


A
10000
1000
100
10
1
0.1
0.01
ppm
Cd Cu Ni Zn Be V Cr Co Ga Ge As Rb Sr Y Zr Nb Mo Ag In Sn Sb Cs Ba La Ce
Element


B
10000
1000
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1
0.1
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0.001
ppm
Pr Nd Sm Eu Gd Tb Dy Ho Er Tm Yb Lu Hf Ta W Tl Pb Bi Th U Li Mn Se Te Re
Element

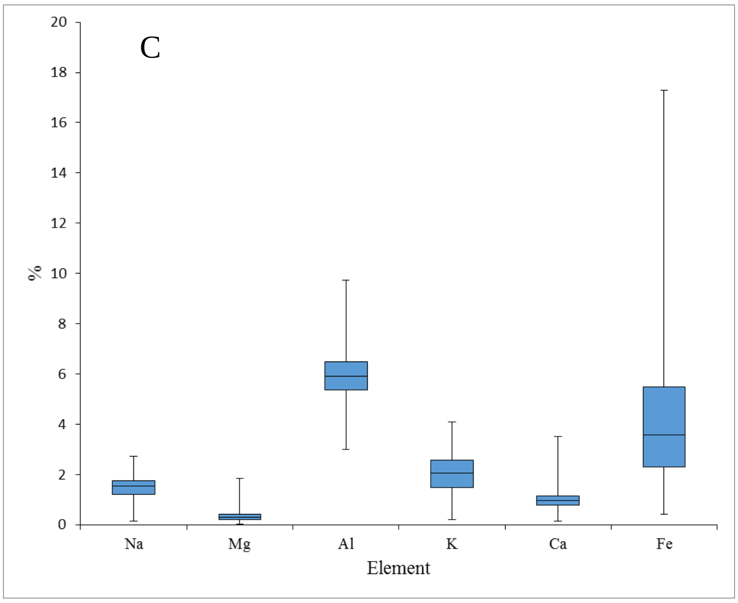


Figure 27: Box-plot diagram showing element variations in the glacial till. Whiskers indicate maximum and minimum concentrations; box indicates concentrations between quartiles 1 and 3; line within the box indicates median. **A** and **B** concentrations are given in ppm while **C** concentrations are given in percentages.

5.4 Rb-Sr isotopes

Rb-Sr isotopic concentrations and ^{87}Rb/^{86}Sr - ^{87}Sr/^{87}Sr ratios have been measured in four samples, including whole-rock and mineral separates (plagioclase and biotite). The location of the samples is shown in Figure 28. Full analytical data are given in Appendix 6.

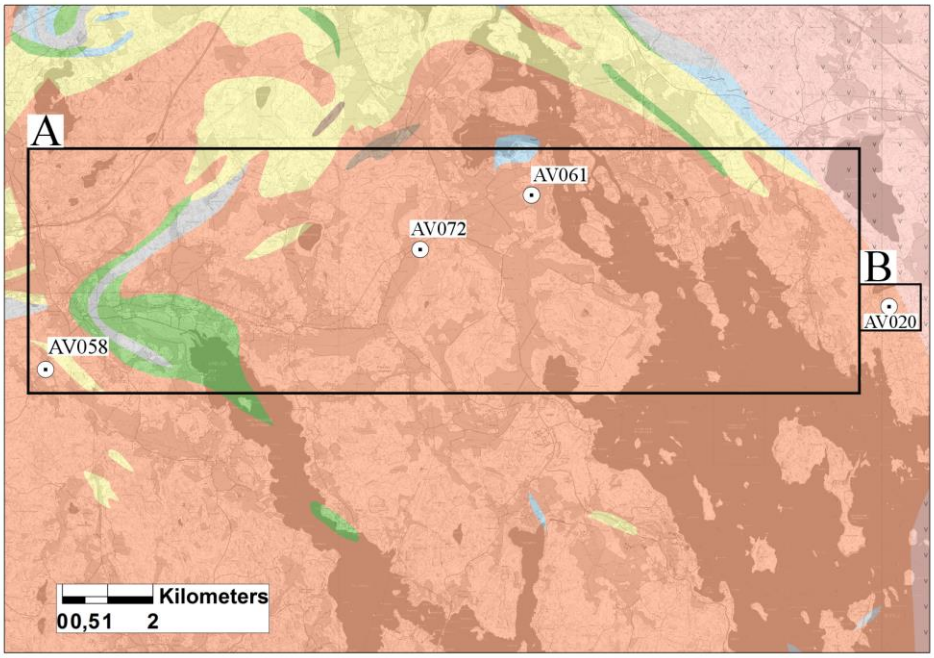


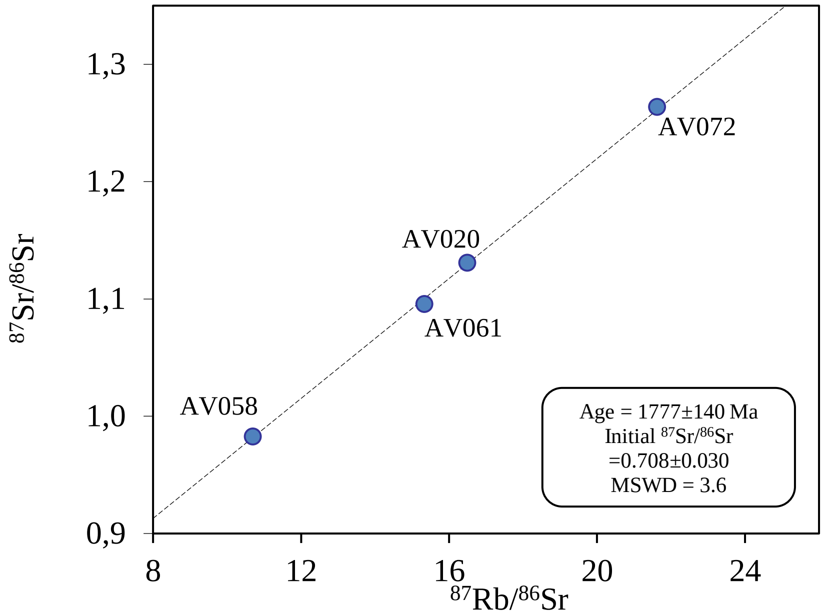
Figure 28: Bedrock map displaying the location of the samples analysed for Rb-Sr isotopic concentrations. Black lines delimit the study areas (A: Pernaja area; B: Lillträsket area). Modified from the GTK Bedrock Map of Finland. Courtesy of the Geological Survey of Finland.

5.4.1 Whole-rock isochrons

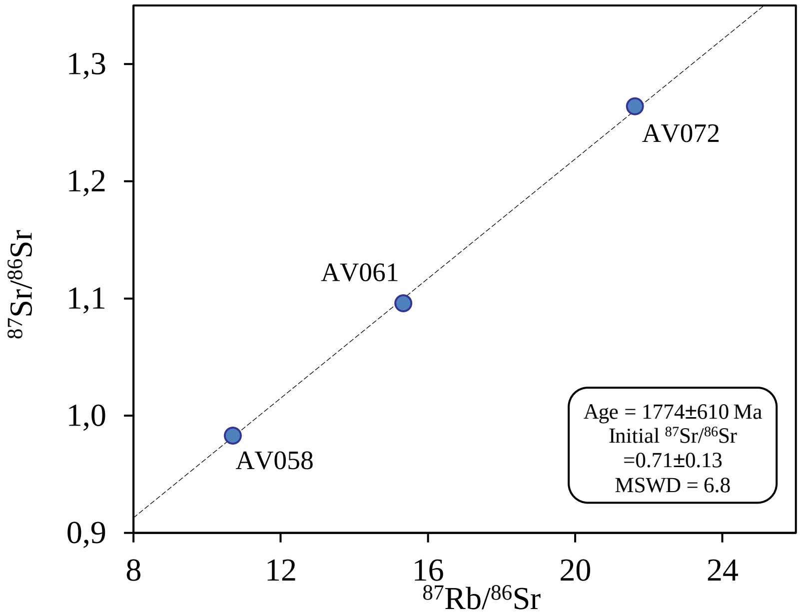
The four samples analysed for whole-rock Rb-Sr isotopic concentrations yield a regression line that gives an age of 1777 ± 140 Ma with an initial $^{87}Sr/^{86}Sr$ ratio of 0.708 ± 0.030 (Figure 29A). The scatter of points within the diagram is expressed by a MSWD value of 3.6 which, according to Brooks et al. (1972), exceeds what can be referred to analytical miscalculations. Since samples AV058, AV072, AV061 and AV020 all belong to the same lithological unit, variations in the initial $^{87}Sr/^{86}Sr$ ratios of the rocks must be accountable for the assemblage of such an errorchron.

Three additional combinations have been made in an attempt to obtain regression lines with suitable MSWD values. Samples AV058, AV072 and AV061 yield a regression line that gives an age of 1774 ± 610 Ma (Figure 29B). The initial $^{87}Sr/^{86}Sr$ ratio given by the intercept of the regression line is 0.71 ± 0.13. The scatter of points is expressed by a MSWD value of 6.8, which leaves no doubt as to its lack of reliability. On the other hand, samples AV058, AV072 and AV020 yield a regression line with an acceptable MSWD value (0.09). The calculated isochron gives an age of 1785 ± 35 Ma and an initial $^{87}Sr/^{86}Sr$ ratio of 0.7082 ± 0.0074 (Figure 29C). By plotting data for samples AV072, AV061 and AV020, a regression line is obtained with a MSWD value of 2.4 that yields an age of 1846 ± 74 Ma (Figure 29D). Despite the adequate MSWD value, the intercept of the regression line gives an initial $^{87}Sr/^{86}Sr$ ratio of 0.690 ± 0.019. This initial ratio is lower than the lowest possible $^{87}Sr/^{86}Sr$ ratio of 0.69898 ± 3 given by accurate Rb-Sr measurements on meteorite and lunar material (Papanastassiou and Wasserburg, 1971) according to the BABI standards (Basaltic Achondrite Best Initial). The results obtained by these samples are, therefore, based on an errorchron and the given age lacks any geological meaning.

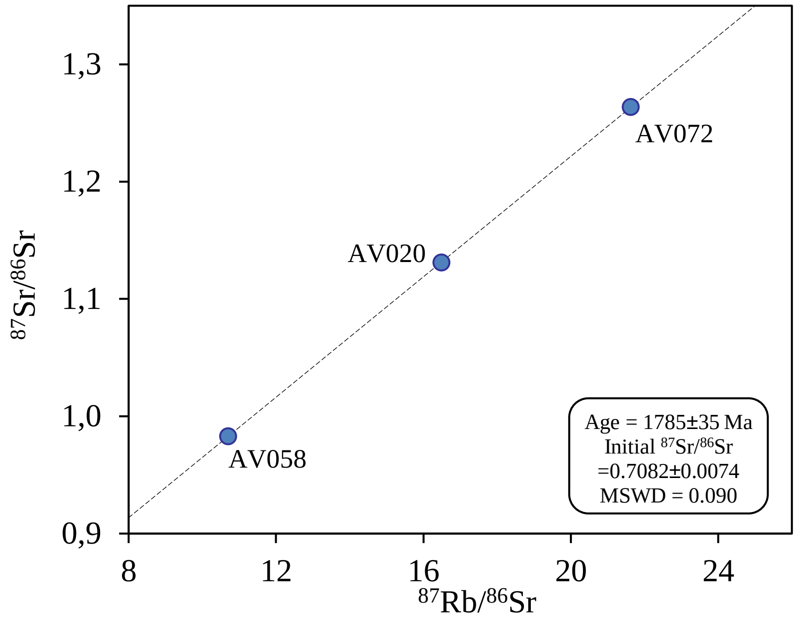
A


1,3
1,2
1,1
1,0
0,9
8
12
16
20
24
87Rb/86Sr
87Sr/86Sr
AV072
AV020
AV061
AV058
Age = 1777±140 Ma
Initial 87Sr/86Sr
=0.708±0.030
MSWD = 3.6

B


1,3
1,2
1,1
1,0
0,9
8
12
16
20
24
87Rb/86Sr
87Sr/86Sr
AV072
AV061
AV058
Age = 1774±610 Ma
Initial 87Sr/86Sr
=0.71±0.13
MSWD = 6.8

C



D

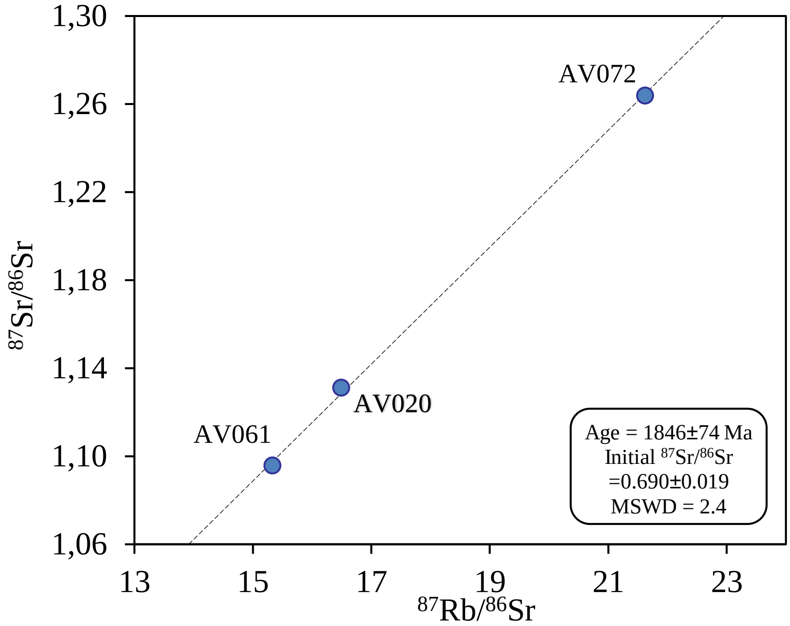
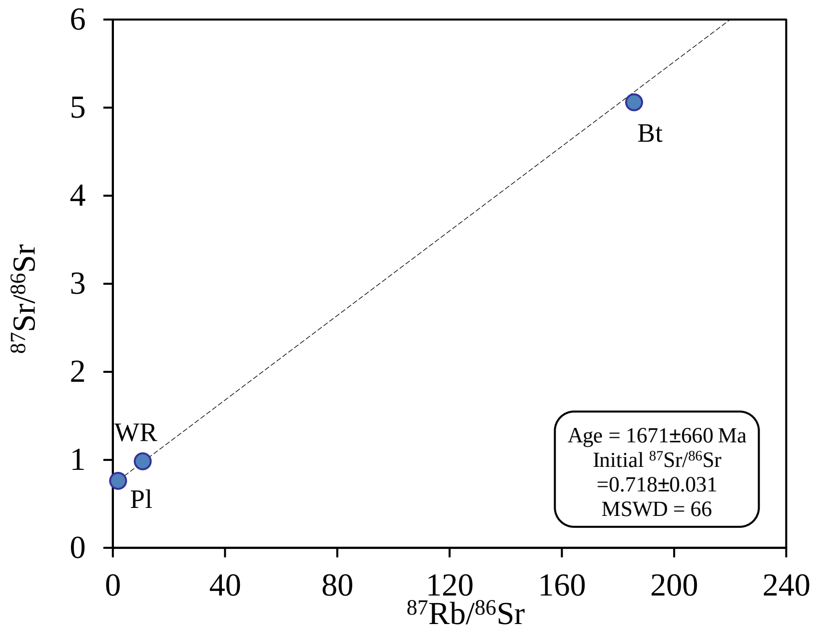


Figure 29: Rb-Sr isochron diagrams for whole-rock samples.

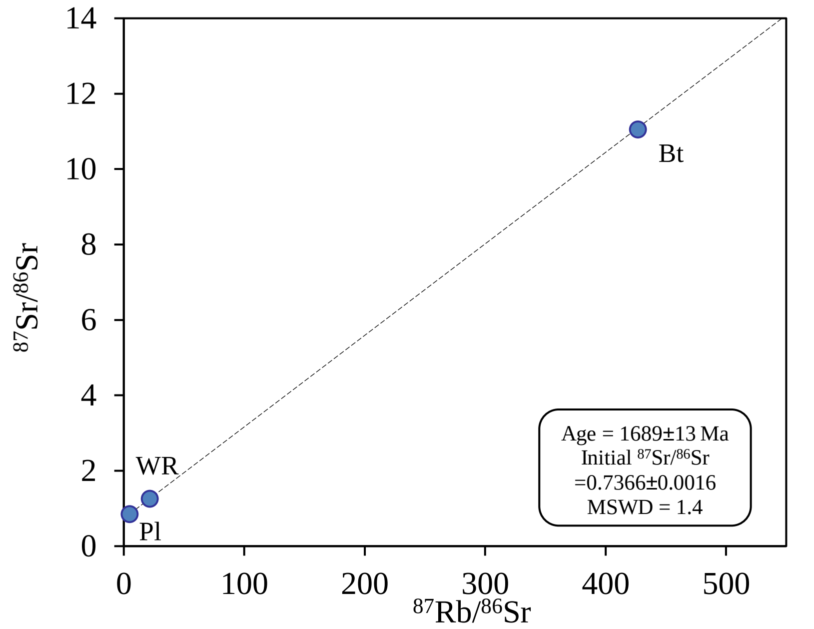
5.4.2 Whole-rock - plagioclase - biotite isochrons

The isochrons calculated from whole-rock along with plagioclase and biotite separates yield values that, in most cases, show strong readjustments within their Rb-Sr isotopic compositions. Sample AV058 yields an age of 1671 ± 660 Ma, a MSWD value of 66 and an initial $^{87}Sr/^{86}Sr$ ratio of 0.718 ± 0.031 (Figure 30A). Sample AV072 yields an age of 1689 ± 13 Ma, a MSWD value of 1.4 and an initial $^{87}Sr/^{86}Sr$ ratio of 0.7366 ± 0.0016 (Figure 30B). The isochron calculated for sample AV061 yields an age of 1634 ± 34 Ma, a MSWD value of 117 and an initial $^{87}Sr/^{86}Sr$ ratio of 0.722 ± 0.043 (Figure 30C). Sample AV020 yields an age of 1500 ± 580 Ma, a MSWD value of 52 and an initial $^{87}Sr/^{86}Sr$ ratio of 0.766 ± 0.065 (Figure 30D).

A



B



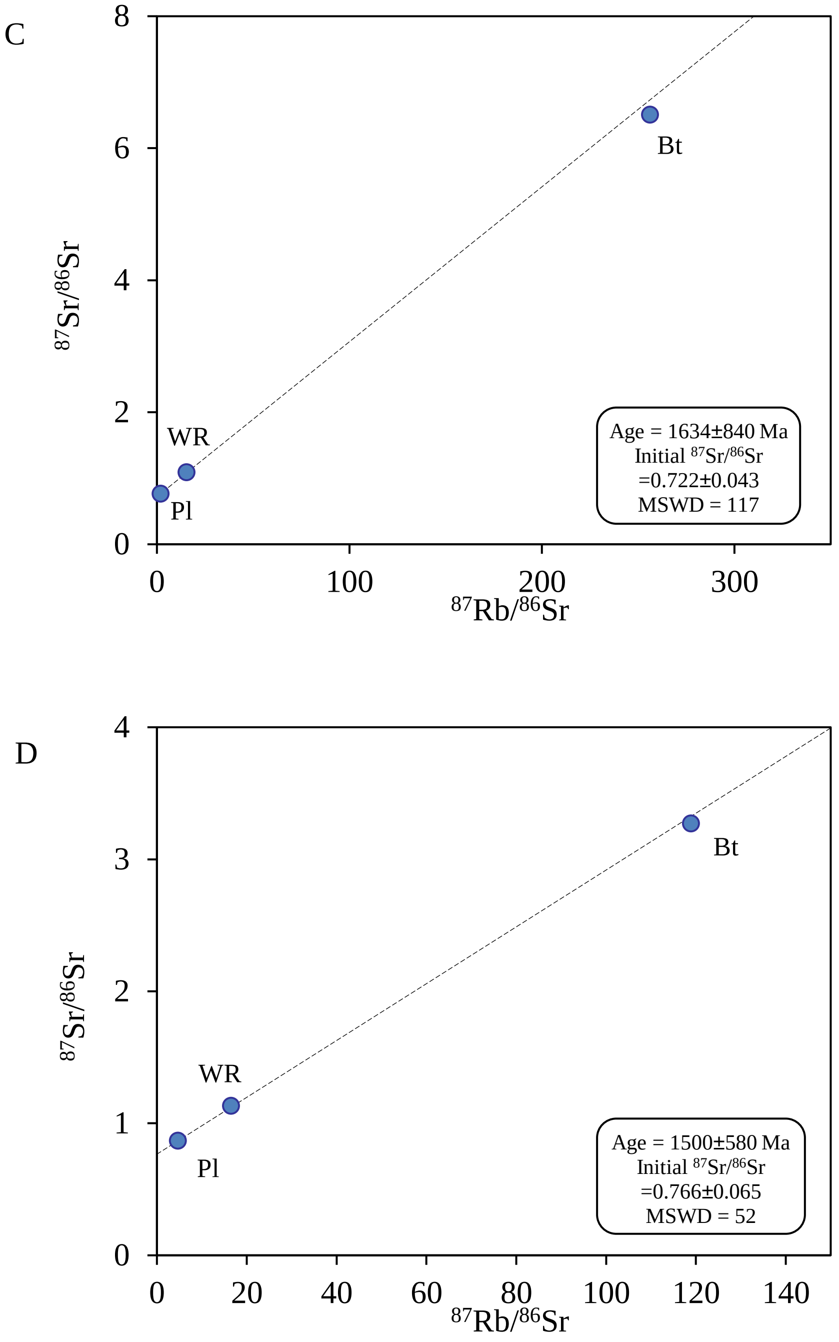
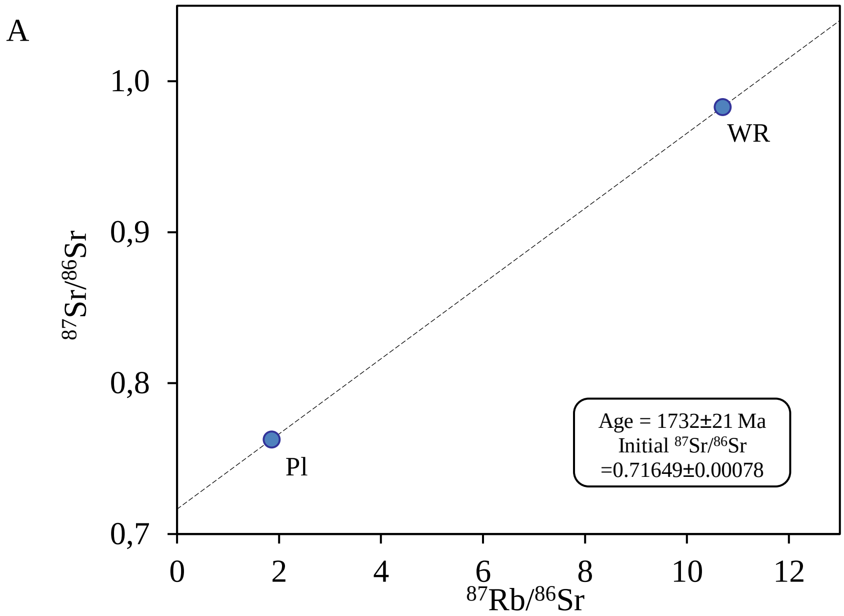
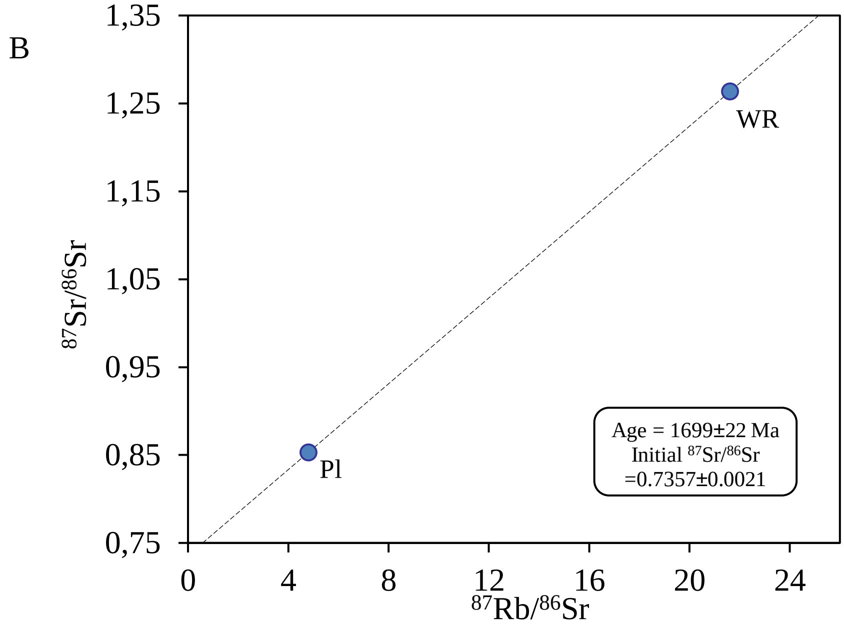


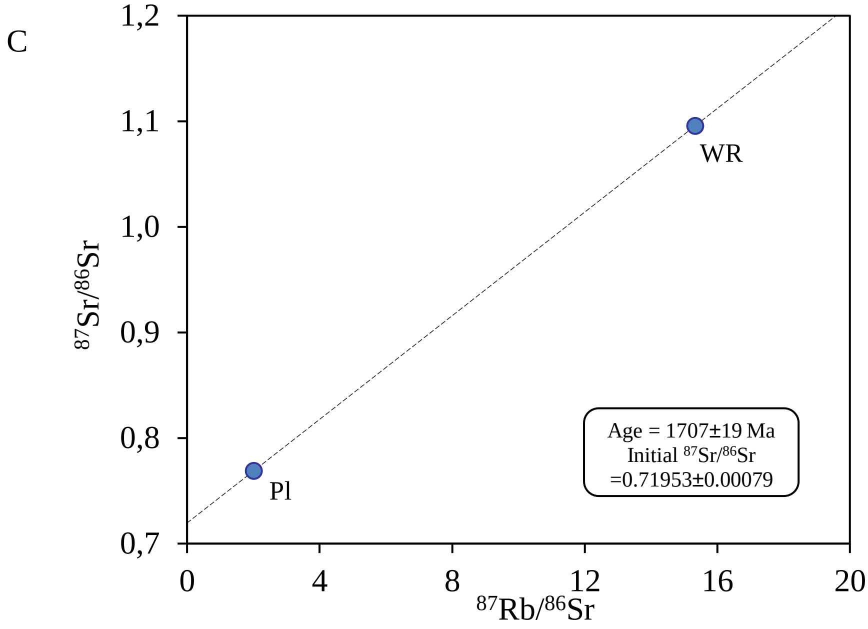
Figure 30: Rb-Sr isochron diagrams for whole-rock, plagioclase and biotite separates. **A.** Sample AV058. **B.** Sample AV072. **C.** Sample AV061. **D.** Sample AV020.

5.4.3 Whole-rock - plagioclase isochrons

The two-point isochron in sample AV058, calculated for the whole-rock and plagioclase Rb-Sr isotopic concentrations, yields an age of 1732 ± 21 Ma with an initial $^{87}Sr/^{86}Sr$ ratio of 0.71649 ± 0.00078 (Figure 31A). Sample AV072 yields an apparent age for plagioclase of 1699 ± 22 Ma with an initial $^{87}Sr/^{86}Sr$ ratio of 0.7357 ± 0.0021 (Figure 31B). The two-point isochron calculated for sample AV061 yields an age of 1707 ± 19 Ma and an initial $^{87}Sr/^{86}Sr$ ratio of 0.71953 ± 0.00079 (Figure 31C). The whole-rock - plagioclase isochron in sample AV020 yields a significantly lower age (1561 ± 22 Ma) with an initial $^{87}Sr/^{86}Sr$ ratio of 0.7614 ± 0.0020 (Figure 31D).







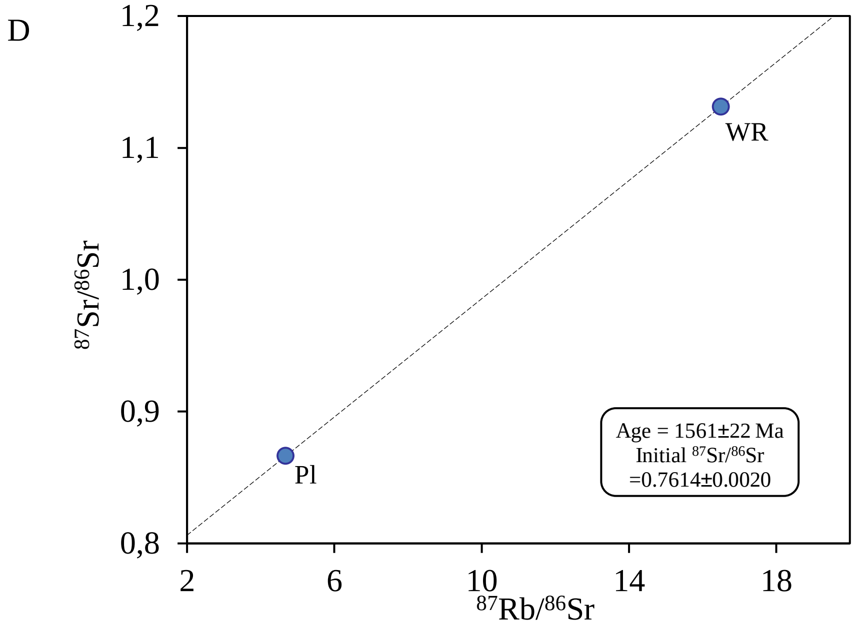
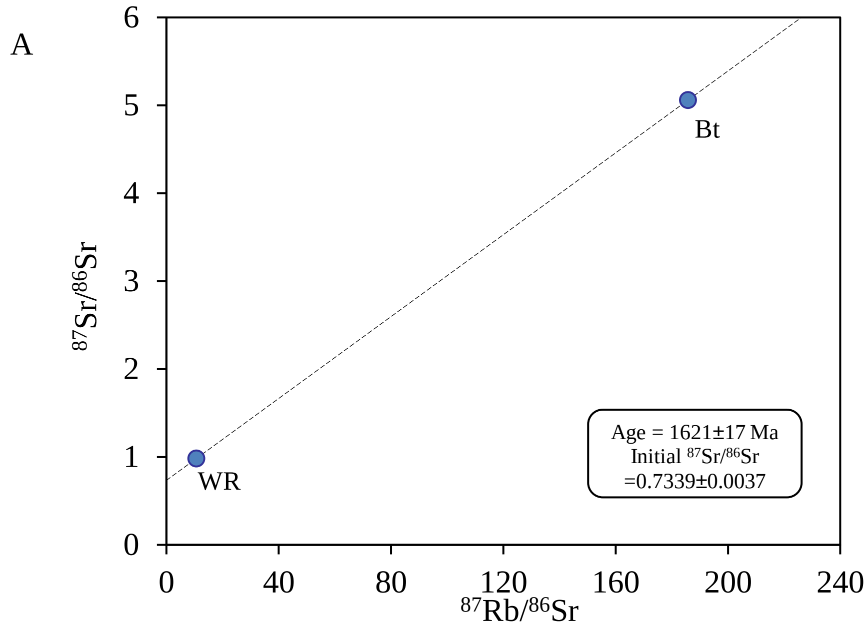


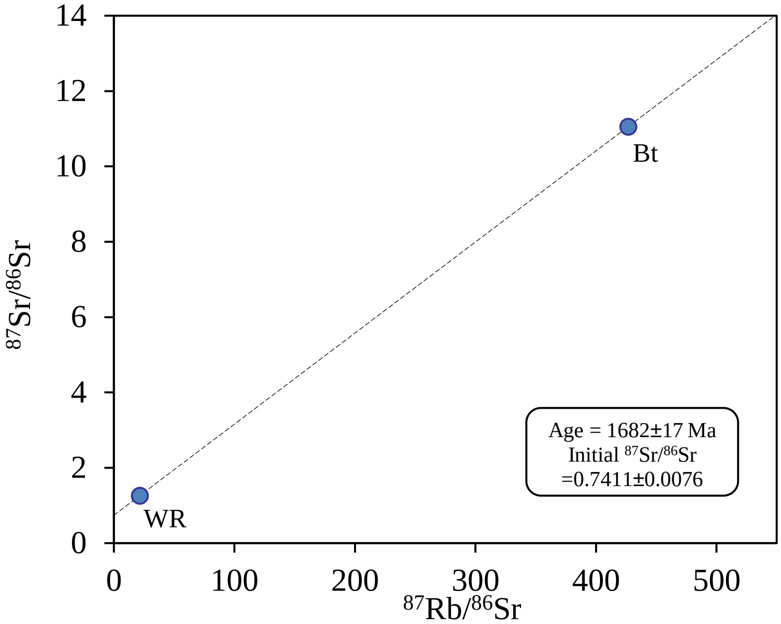
Figure 31: Rb-Sr isochron diagrams for whole-rock and plagioclase separates. **A.** Sample AV058. **B.** Sample AV072. **C.** Sample AV061. **D.** Sample AV020.

5.4.4 Whole-rock - biotite isochrons

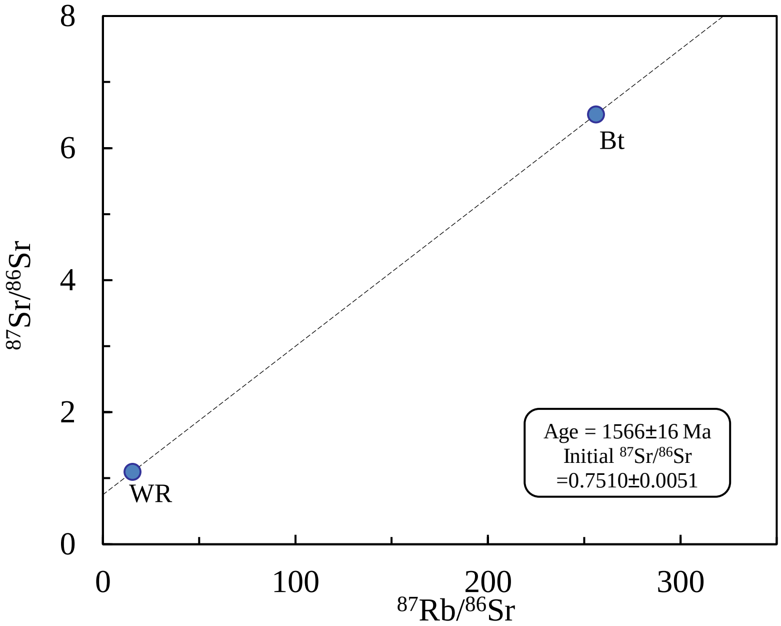
The apparent ages obtained from the whole-rock and biotite separates are younger than those obtained from whole-rock and plagioclase. This is expected considering that the blocking temperature of plagioclase in the Rb-Sr system is higher than the blocking temperature of biotite. The isochron calculated for sample AV058 yields an age of 1621 ± 17 Ma and an initial $^{87}Sr/^{86}Sr$ ratio of 0.7339 ± 0.0037 (Figure 32A). Sample AV072 yields a biotite age of 1682 ± 17 Ma with an initial $^{87}Sr/^{86}Sr$ ratio of 0.7411 ± 0.0076 (Figure 32B). The apparent age of biotite in sample AV061 is 1566 ± 16 Ma and the initial $^{87}Sr/^{86}Sr$ ratio is 0.7510 ± 0.0051 (Figure 32C). The lowest biotite age was obtained in sample AV020 (1455 ± 17 Ma) with an initial $^{87}Sr/^{86}Sr$ ratio of 0.7867 ± 0.0055 (Figure 32D).



B


14
12
10
8
6
4
2
0
87Sr/86Sr
Bt
WR
Age = 1682±17 Ma
Initial 87Sr/86Sr
=0.7411±0.0076
0
100
200
300
400
500
87Rb/86Sr

C


8
6
4
2
0
87Sr/86Sr
Bt
WR
Age = 1566±16 Ma
Initial 87Sr/86Sr
=0.7510±0.0051
0
100
200
300
87Rb/86Sr

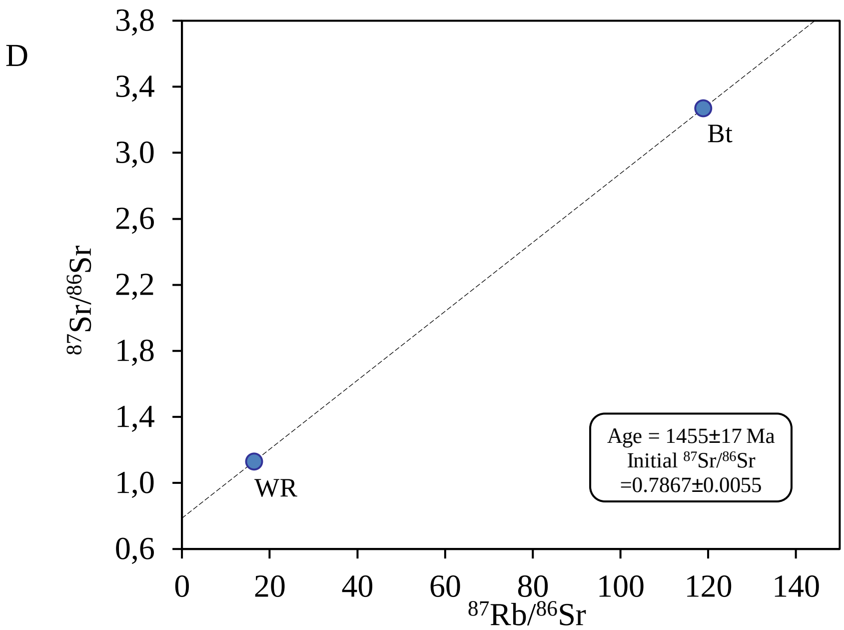


Figure 32: Rb-Sr isochron diagrams for whole-rock and biotite separates. **A.** Sample AV058. **B.** Sample AV072. **C.** Sample AV061. **D.** Sample AV020.

6. DISCUSSION

6.1 Thermal influence of the rapakivi intrusions into the late-orogenic granites

6.1.1 Microcline-Orthoclase transition

The study of thin sections has shown that two K-feldspar phases (microcline and orthoclase) are present in the late-orogenic granites of the Lillträsket and Pernaja areas. According to the dominant K-feldspar phase in each sample, they have been grouped into three populations (microcline zone, transition zone and orthoclase zone), which are termed as zones as the rocks included in each of them define specific areas.

The late-orogenic granites of southern Finland are well known for being microcline-bearing (Simonen, 1960; Vorma, 1972; Nurmi and Haapala, 1986). Thus, we can assume that the late-orogenic granites belonging to the microcline zone have largely retained their primary configuration. In contrast, the granites belonging to the orthoclase zone have largely been transformed, inasmuch as orthoclase is the exclusive K-feldspar phase they have.

K-feldspar transformation, from a low thermal state (microcline) to a high thermal state (orthoclase) in rocks intruded by igneous bodies, is an expression of thermal metamorphism that already was studied in the Svecofennian granitoids surrounding the Wiborg Batholith (Vorma, 1972) as well as in other geological provinces (e.g. Hart, 1964; Steiger and Hart, 1967). This alteration process involves a readjustment of the K-feldspar constituents of a rock owing to the heat generated by the intrusive; the reactions taking place in a solid state when temperatures exceed 350-400 ºC (Steiger and Hart, 1967; Vorma 1972).

Based on the distribution of the K-feldspar zones relative to the position of the rapakivi intrusions (Onas massif and Wiborg Batholith) and, according to the mechanism by which K-feldspar re-equilibration takes place in the country rocks, some observations can be drawn. The late-orogenic granites of the Lillträsket and Pernaja areas have undergone an alteration process triggered by the thermal input of the rapakivi intrusives. Since all the studied samples display a K-feldspar readjustment to some extent, both study areas exceeded temperatures above 350-400ºC. However, the extent of the alteration depends on the temperature distribution within the country rock, which is itself dependent on the shape and size of the intrusives and the distance that separates them from the country rocks. The fact that sample AV058 (located 4 km away from the Onas massif) has been mildly altered, considering that orthoclase is present on a small extent, while sample AV061 (located 4 km away from the Wiborg Batholith) has been significantly altered supports this idea. The presence of an area with an intermediate K-feldspar distribution (transition zone) indicates that the alteration process corresponds to a continuous type of transformation. Finally, the orthoclase zone indicates the presence of a 1-4 km wide thermal aureole (the distance that separates the transition zone from the orthoclase zone). This area was submitted to high temperatures over a sufficiently long period to produce a complete K-feldspar readjustment.

6.1.2 Rb-Sr ages

The results obtained from whole-rock isochron calculations are rather conflicting. Only one of the four regression lines yields a proper isochron (AV058-AV072-AV020; Figure 29C). The regression line calculated with samples AV020, AV061 and AV072 (Figure

29D) gives an extraordinary low initial $^{87}Sr/^{86}Sr$ ratio (0.690 ± 0.019). Using samples AV058, AV072 and AV061 (Figure 29B), the scatter of the points in the isochron diagram is too large (MSWD = 6.8). Therefore, in both cases the ages are obviously obtained from errorchrons. The regression line calculated from samples AV058, AV072, AV061 and AV020 (Figure 29A) has a MSWD value of 3.6 that, although being higher than what can be regarded to analytical miscalculations (2.5, according to Brooks et al., 1972), is close to being adequate. If sample AV061 is omitted, the whole-rock isochron yields an age of 1785 ± 35 Ma with a MSWD value of 0.9. It can thus be concluded that the Rb-Sr isotopic composition has been disturbed in most samples by a later event following the granite emplacement. The contrasting results obtained by using multiple sample combinations indicate that such a disturbance affected each sample to a variable extent.

Rutherford and Soddy spelled out already in 1902 that the production of radiogenic isotopes is a constant and exponential process independent of physical or chemical conditions. If the mineral constituents of a rock hold a common $^{87}Sr/^{86}Sr$ ratio at time $t = 0$, the regression line calculated from these constituents will thus produce a proper isochron regardless of their initial $^{87}Rb/^{86}Sr$ ratios. The regression lines calculated from whole-rock, plagioclase and biotite isotopic compositions show that these constituents have evolved separately from each other in samples AV058 (Figure 30A), AV061 (Figure 30C) and AV020 (Figure 30D) as they all have produced substantial MSWD values (66, 117 and 52 respectively). However, the isochron calculated for sample AV072 (Figure 30B) gives a MSWD value of 1.4, indicating that the plagioclase and biotite constituents have evolved simultaneously with the whole-rock as to the production of radiogenic Sr. The issue at stake is whether the initial $^{87}Sr/^{86}Sr$ ratio in sample AV072 is that of the time of emplacement ($t = 0$) or the result of a subsequent readjustment.

The Rb-Sr age obtained for sample AV072 is 1689 ± 13 Ma. U-Pb measurements indicate, though, that the late-orogenic granites were formed at 1.85-1.79 Ga (e.g. Vaasjoki, 1981; Hopgood et al., 1983; Korsman et al., 1984; Kurhila et al., 2011). This means that the Rb-Sr age obtained from sample AV072 does not resemble its time of crystallization and, therefore, that its initital $^{87}Sr/^{86}Sr$ ratio has been readjusted. The question now is why sample AV072 has produced an isochron while samples AV058, AV061 and AV020 have not, considering that all of them have had their Rb-Sr isotopic compositions altered by a later thermal event. The key to answer such a question is given by the blocking temperature of each component used in these calculations (whole-rock and plagioclase and biotite separates).

According to Dodson (1973), the blocking temperature of a mineral or a rock is the temperature below which a particular isotopic system is closed to element mobility after being reset by a thermal event. In the case of the Rb-Sr isotopic system, the blocking temperature of biotite (300 ± 50 ºC) is lower than the whole-rock and plagioclase blocking temperatures (Jäger, 1979; Ganguly and Ruiz, 1987). If a rock is subjected to a thermal pulse that exceeds its blocking temperature, the age given by the regression line will reflect the age of alteration as long as the rock cools down fast. However, if the thermal pulse lasts for a long time, the components with higher blocking temperatures (whole-rock and plagioclase) will have their radiometric clock switched on before those with lower blocking temperatures (biotite) and, therefore, the isotopic system will evolve separately among them. In this regard, the ages given by the plagioclase and biotite isochron calculations tell us at what time each rock cooled down below the blocking temperatures of these minerals.

The ages given by whole-rock - plagioclase regression lines (plagioclase ages) in samples AV058 (Figure 31A), AV072 (Figure 31B), AV061 (Figure 31C) and AV020 (Figure 31D) are 1732 ± 21, 1699 ± 22, 1707 ± 19 and 1561 ± 22 Ma respectively. As to the ages given by whole-rock - biotite regression lines (biotite ages), they are 1621 ± 17 (Figure 32A), 1682 ± 17 (Figure 32B), 1566 ± 16 (Figure 32C) and 1455 ± 17 Ma (Figure 32D). The order at which the samples have cooled down depends on which mineral is chosen. According to the plagioclase ages, the order is as follows: AV058, AV061, AV072 and AV020. On the other hand, the order according to the biotite ages is: AV072, AV058, AV061 and AV020. It is important to remind that, while being subjected to a thermal pulse, K-rich minerals like biotite leach ^{87}Sr, as they hold unstable lattice positions in the crystalline structure. However, the radiogenic Sr leached from the biotite grains does not leave the rock. Instead, adjacent Ca-rich minerals like plagioclase assimilate it, since ^{87}Sr and Ca have similar atomic properties (Rollinson, 1993; Dickin, 2006). The transfer of ^{87}Sr from biotite to plagioclase produces a clockwise rotation of the regression line in the isochron diagram (whole-rock-plagioclase regression line) and, therefore, the plagioclase age increases. The question about which mineral ages (plagioclase or biotite ages) reveal the real cooling history of the area can now be resolved.

Plagioclase ages increase to a higher extent in rocks that have been exposed to c. 300 - 500 ºC temperatures (a range defined by the blocking temperatures of plagioclase and biotite) (Jäger, 1979; Ganguly and Ruiz, 1987) for longer time periods, considering that the plagioclase has absorbed greater amounts of ^{87}Sr. Sample AV072 has the highest biotite age (1621 ± 17 Ma) while its plagioclase age (1699 ± 22 Ma) is slightly lower than those of samples AV058 and AV061 (1732 ± 21 and 1707 ± 19 Ma respectively) despite being closer to the heat sources (the Onas massif and the Wiborg Batholith). As a consequence, they should have cooled down after sample AV072. However, samples AV058 and AV061 have lower biotite ages (1621 ± 17 and 1566 ± 16 Ma respectively) than sample AV072 (1682 ± 17 Ma). The difference between the plagioclase and biotite ages is larger in samples AV058 and AV061, indicating that they have been exposed to temperatures c. 300 - 500 ºC for a longer time than sample AV072. On this basis, the plagioclase ages given by samples AV058 and AV061 are less reliable than the one given by sample AV072 as these rocks have absorbed more ^{87}Sr and, consequently, their real plagioclase ages are most likely to be lower than that of sample AV072.

In view of the above, sample AV072 remains as the least exposed example to the thermal effect of the rapakivi intrusions. The whole-rock - biotite regression line obtained from this sample indicates that it cooled down below c. 300 ºC at 1682 ± 17 Ma. Sample AV072 has registered the smallest difference between its plagioclase and biotite ages, which explains why it is the only one that has been able to produce an adequate whole-rock - plagioclase - biotite isochron. The age given by this isochron (1689 ± 13 Ma) can be related to the onset of the thermal alteration produced by the rapakivi intrusions. The biotite age of sample AV058 (1621 ± 17 Ma) is slightly lower than that of sample AV072. This indicates that sample AV058 has been slightly more exposed to the thermal influence of the rapakivi intrusions than sample AV072 (probably the Onas massif rather than the Wiborg Batholith). The biggest difference between plagioclase and biotite ages was recorded by sample AV061, which means that it has been subjected to temperatures > 300 ºC longer than any other rock. Lastly, sample AV020 can be considered as the most exposed example to the influence of the Wiborg Batholith both in time and intensity. The fact that sample AV020 has the lowest biotite age (1455 ± 17 Ma) indicates that it was the last one to cool down. Its plagioclase age (1561 ± 22 Ma), however, indicates that it has been exposed to temperatures exceeding 500 ºC (blocking temperature of plagioclase) for a longer time than any other sample. Following the interpretation drawn in this section, Figure 33 displays a schematic drawing explaining the thermal effect of the rapakivi intrusions into the analysed samples.

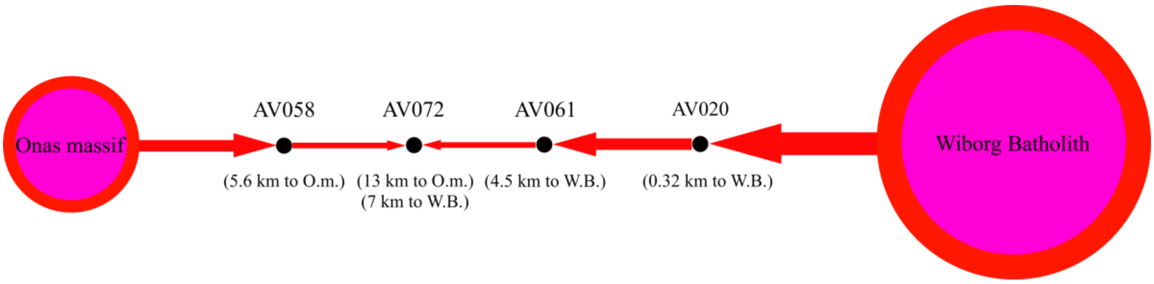


Figure 33: Schematic drawing of the thermal influence of the rapakivi intrusions into the analysed samples according to their Rb-Sr isotopic features.

6. 2 Evidence for hydrothermal alteration in the Lillträsket area

6.2.1 Evidence from wall-rock alteration based on field and petrographic observations

The effect of hydrothermal alteration in crystalline rocks is frequently expressed by significant variations in the colour of their mineral constituents. Red-staining of the wall-rock is often related to oxidation around fractures and Fe enrichment (Drake et al., 2008). This is a common feature in the Lillträsket area, where the bedrock locally displays an intense red tone around quartz veins and intertwined fractures in contrast to the standard whitish appearance displayed by the “regular” late-orogenic granite of the region.

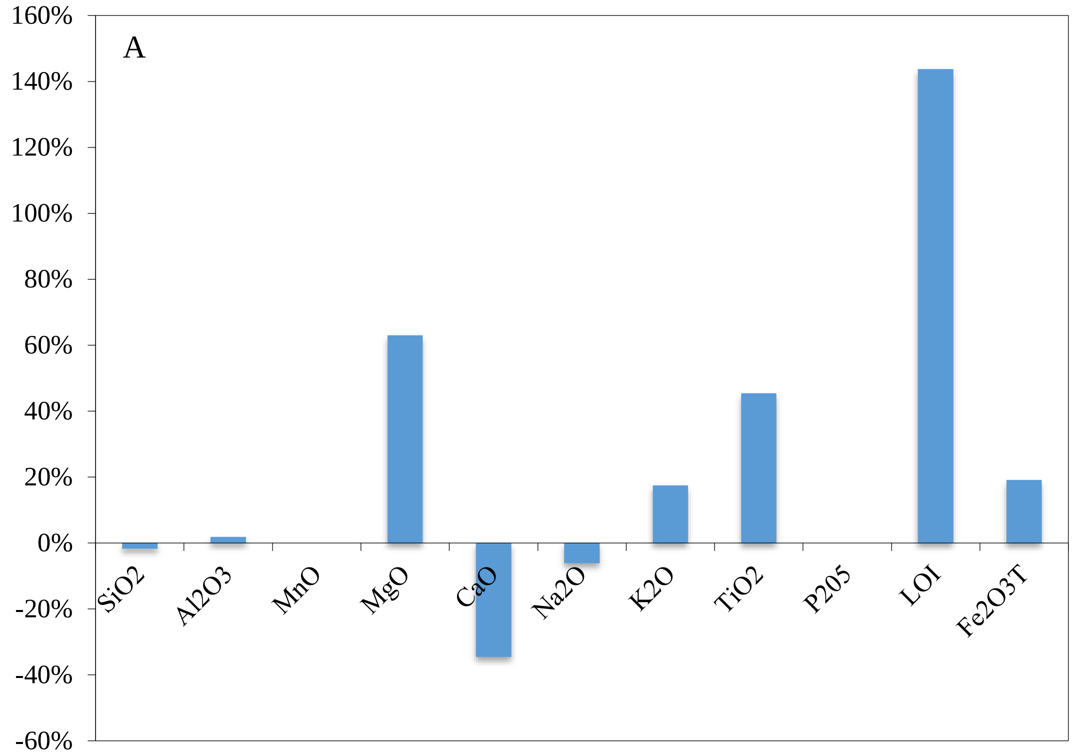
According to the observations made by several authors (e.g. Drake et al., 2008; Plümper and Putnis, 2009; Sandström and Annersten, 2010), the reddish appearance displayed by hydrothermally altered granites is caused by the presence of sub-microscopic hematite grains in porous alkali feldspar grains and in microfractures. These Fe-oxides precipitate from an Fe-rich fluid following its circulation through the fractures that traverse the rocks (Putnis et al., 2007). Examined under the microscope, the red-stained granite of the Lillträsket area exhibit minute Fe oxides within K-feldspar grains, along grain boundaries and in microfractures, creating an overall turbid appearance, which, in turn, results in the distinct red tone observed at a macroscopic scale. In view of the above, it can be inferred that the reddened granite of the Lillträsket area is a product of alteration caused by the activity of a hydrothermal fluid, a circulation which has been favoured by the presence of fractures.

6.2.2 Geochemical evidence

6.2.2.1 Major and trace elements

Overall, the major element geochemistry of the late-orogenic granites in both study areas display similar element contents to those reported by Nurmi and Haapala (1986) for the late-orogenic granites elsewhere in southern Finland. The concentrations of SiO_2 are in most cases high and restricted to 73-75 wt%. Average K_2O contents are high (5.64 wt%), while CaO and Na_2O are low (0.5 wt% and 2.88 wt% respectively). Consequently, the Na_2O/K_2O ratios are rather low (on average = 0.51) as expected for S-type granites (Chappel and White, 1974). Differences in element concentrations are, however, quite significant between the red-stained granite of the Lillträsket area and its unaltered counterpart.

Figure 34 displays variations in the chemical compostition of the altered (red-stained) granite compared to the unaltered (leucocratic) granite of the Lillträsket area. These variations have been adjusted using Gresens' method to evaluate element mobility in metasomatic systems (Gresens, 1967). The purpose of this method is to avoid potential disturbances in the geochemistry of an altered rock on account of mass and volume changes produced during alteration. The variation in the chemical composition of the altered rocks is correlated with the concentration of certain immobile elements in their unaltered equivalents. There are several elements that are considered to be immobile during hydrothermal alteration, e.g. Ti, Zr, Hf, Ta, Nb, Al, Y and P, which are commonly used as reference elements when this method is applied. The concentrations of some of these "immobile" elements vary substantially between the altered and unaltered granites of the Lillträsket area and, therefore, only elements for which concentrations are similar in both granite populations have been used as certain immobile elements (Si, Al and P) in regard to the application of Gresens' method.



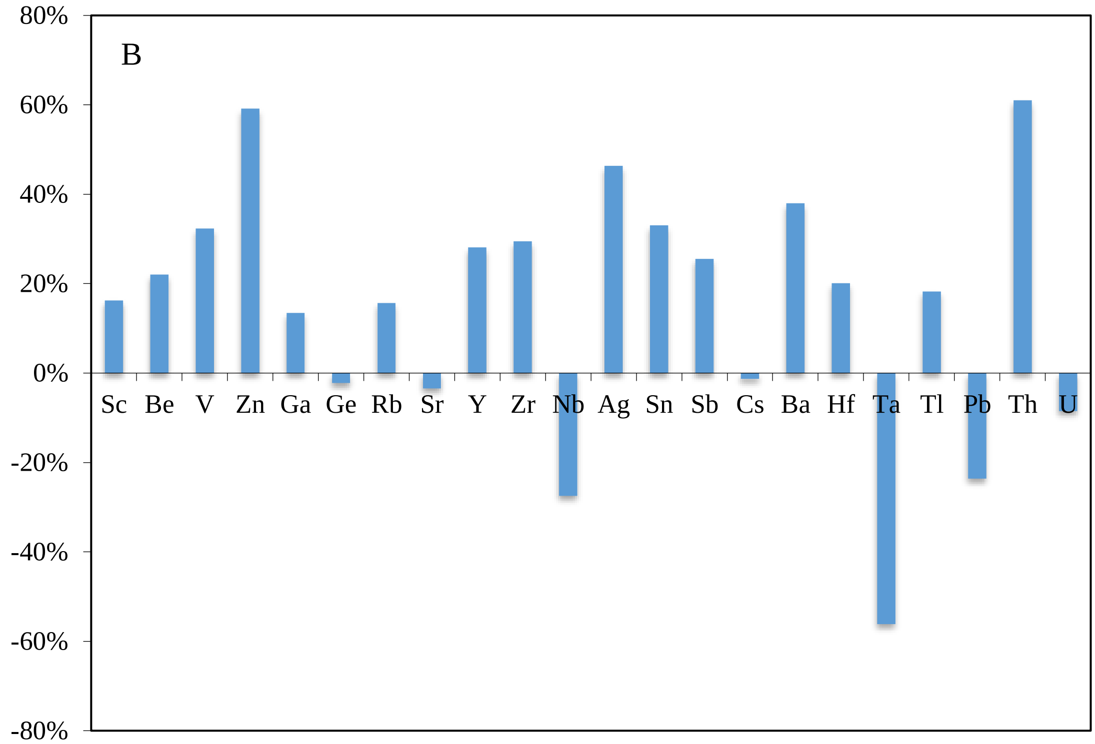


Figure 34: Variations in average element concentrations between the red-stained and the leucocratic granites of the Lillträsket area, corrected to changes in Si, Al and P. **A.** Major elements and LOI. **B.** Trace elements.

The red-stained granite of the Lillträsket area has extraordinary high K_2O concentrations, with an average content of 6.14 wt% and a maximum content of 7 wt% (sample 1301). Even though high K_2O contents are common in both (altered and unaltered) late-orogenic granite populations, the concentrations displayed by the reddened granite of the Lillträsket area differ substantially from those of the leucocratic granite. Furthermore, there is a correlation between K_2O enrichment (average increase of 17.45 %) and Na_2O depletion (average decrease of 6 %) in the altered granites, which links the alteration process responsible for the reddening of the granites to K-metasomatism.

The compositional differentiation between the granites of the Lillträsket area (leucocratic and red-stained) with respect to the K_2O and Na_2O contents can be visualized by using the "igneous spectrum" of Hughes (1972), Figure 35. This diagram has been used to evaluate the effect of Na- and K-metasomatism in crystalline rocks by several authors (e.g. Baker, 1985; Oen, 1986; Wilson et al., 1987; Sundblad et al., 1997). The envelope of the diagram defines an "igneous spectrum" that represents a wide range of unaltered igneous rocks. Data plot outside the "igneous spectrum" if: (1) the rock has undergone metasomatic processes; and/or (2) the Na_2O-K_2O contents of the rock are uncommonly high or low compared to the composition of the rocks used to build up the envelope. Due to the distinct high K_2O and low Na_2O contents of the late-orogenic granites, both the altered and the unaltered varieties plot outside the igneous spectrum. However, the leucocratic granite of the Lilträsket area defines a field that diverges from the one held by the red-stained granite, the latter being in a more K-rich part of the diagram. This supports the idea of an alteration process that has caused the reddening of the rocks and produced K-metasomatism as well, not to mention that this association has already been observed in other geological environments (Ennis et al., 2000).

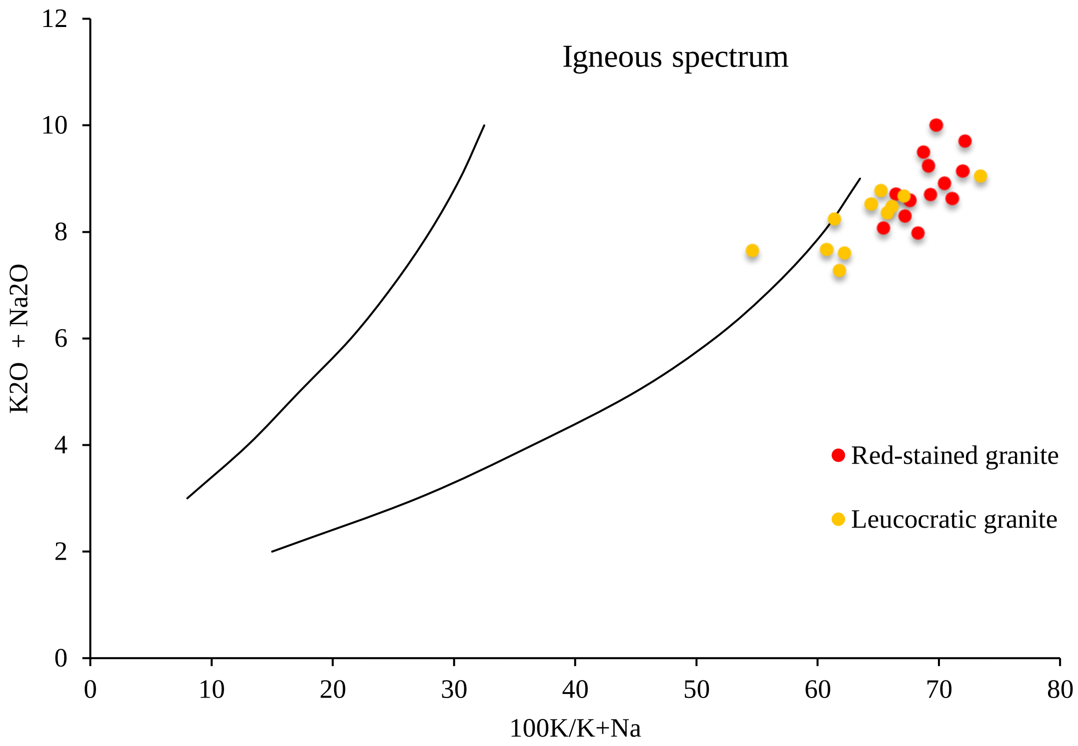


Figure 35: Igneous spectrum diagram (Hughes, 1972) for the granites of the Lillträsket area.

Correlation between some of the elements that are enriched/depleted in the red-stained granite of the Lillträsket area, compared to the leucocratic granite of the Lillträsket area, represent further evidence for hydrothermal alteration in the system. For instance, the red-stained granite display higher contents of K, Rb and Ba. These elements have a similar ionic size and charge, so when a hydrothermal fluid mobilizes them they often display similar variation patterns in the altered rock (Sandström and Annersten, 2010). The decrease of Ca and Na contents in the red-stained granites is an effect of plagioclase saussuritization. These elements, which were removed from the red-stained granite, could have re-crystallized partially as hydrated minerals like epidote and sericite. The fact that the red-stained granite is enriched in volatiles, as it is indicated by its higher LOI content, supports this idea.

A thoughtful examination of the Fe content in the late-orogenic granites of the Lillträsket area is required to understand how the reddening process took place. According to Nakano et al. (2005), the Fe source required for the precipitation of hematite grains within altered feldspar grains might come from: (1) an internal source (e.g. Fe leached from the breakdown of biotite and/or Fe released during feldspar re-equilibration while being substituted by Al in tetrahedral positions); (2) an external source (e.g. an infiltrating hydrothermal fluid that is enriched in Fe). Biotite grains are partially and/or totally chloritized in many of the altered specimens, which means that part of the Fe required for hematite precipitation was released by this replacement reaction. As to the possibility of Fe being leaked during feldspar transformations, nothing can be concluded without knowing the Fe content in feldspars. The feasibility of an exotic Fe-rich fluid as the source for the hematite precipitation seems, however, rather possible if we compare the Fe content of the late-orogenic granites in Lillträsket. The average Fe content of the leucogranite is 2.25 wt%. On the other hand, the red-stained granite has an average Fe content of 2.65 wt%, which, after being corrected by Gresens' method, is a 19 % higher than the average Fe content of the leucocratic granite. According to Plümpers and Putnis (2009), an internal Fe source is expected when the variation in the Fe content between the altered and the unaltered rocks is minimal, otherwise, an external Fe source has to be taken into consideration. It seems clear then that the infiltrating fluid transported important amounts of Fe prior to its interaction with the granites of the Lillträsket area, which ultimately resulted in the precipitation of Fe-oxides in the altered rocks and, therefore, in the acquisition of their distinct red tone.

Elements like Ti, Zr, Hf and Y display higher concentrations in the red-stained granite of the Lillträsket area and, nevertheless, they are thought to be immobile in hydrothermal systems. Despite this common assumption, some studies have demonstrated that these elements may indeed be highly mobile under certain conditions, especially when the hydrothermal activity is related to the presence of F-rich alkali igneous rocks (e.g. Rubin et al., 1993; Van Baalen, 1993). The F content in the late-orogenic granites of the Lillträsket and Pernaja areas lies below the detection limit in all samples (< 0.01 wt%). In view of the above, the infiltrating fluid necessarily had to interact with another geological unit, presumably rich in F, in order to modify the Ti, Zr, Hf and Y contents of the altered granite in the Lillträsket area.

Valkama et al. (2016) has reported the presence of multiple polymetallic quartz and greisen veins associated with intense hydrothermal alteration in the neighbouring rapakivi granites. A potential connection between the alteration processes in the Lillträsket area and the hydrothermal activity developed in the rapakivi granites seems more than reasonable given the correlation between some of the high element concentrations displayed by the red-stained granite and the proper geochemistry of the rapakivi granites (Wiborgite and Marviken granites). This correlation can be found in elements like Sc, Be, Zn, Rb, Y, Zr, Sn, Ba, Hf and Th, with high contents in both the red-stained granite of the Lillträsket area and the rapakivi granites. It is of particular interest that the adjacent rapakivi units are F-rich (Nygård, 2016), a fundamental element required for the mobilization of Ti, Zr, Hf and Y by a hydrothermal fluid, suggesting that the infiltrating fluid in the Lillträsket area has a rapakivi origin.

6.2.2.2 Rare Earth Elements (REE)

Granitic rocks often display REE patterns with a distinct enrichment in LREE compared to HREE and pronounced Eu anomalies (Cullers and Graf, 1984). This style of REE fractionation is seen in most of the late-orogenic granites of the Lillträsket area, although some specimens display REE patterns that are slightly different. Samples 1301, AV028 and AV028 have all positive Ce anomalies, which express oxidation of Ce^{3+} to Ce^{4+}. Aside from that, the REE patterns displayed by the granites do not reveal significant variations in their REE concentrations that can be related to hydrothermal alteration.

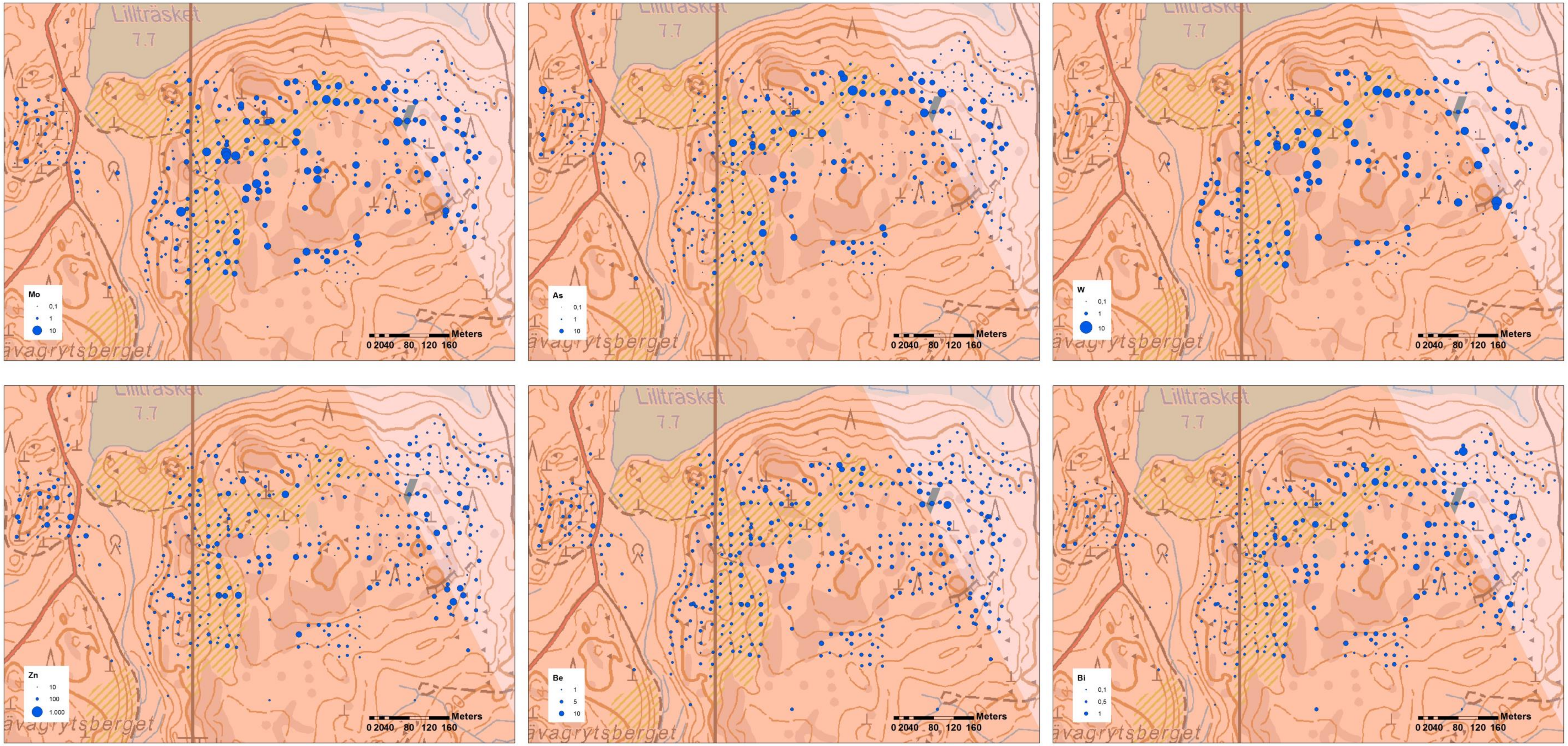
6.3. Geochemical and magnetic features of the glacial till in the Lillträsket area: a link between hydrothermal alteration and high metal concentrations in the bedrock

The systematic collection of glacial till and its geochemical character provide meaningful information about the chemical features of the underlying rocks. This procedure, which is extensively used in the Nordic countries, is an effective way to discover potential ore deposits and recognize the processes involved in their formation.

A significant number of glacial till samples in the Lillträsket area display high metal concentrations of As, Be, Bi, Cu, In, Li, Mo, Sn, W and Zn. As can be seen in Figures 36 and 37, these metal anomalies can be correlated with high contents in elements like Fe, Hf, Rb, Th, Y and Zr. As pointed out in the previous section, the red-stained granite of the Lillträsket area is enriched in the latter group of elements and such an enrichment is related to hydrothermal alteration. This aspect is of paramount importance since it establishes a link between the hydrothermal alteration developed in the red-stained granite of the Lillträsket area and the metal anomalies in the glacial till.

The dispersion of the weathered rock, caused by glacial transport, must be taken into consideration when reviewing the geochemistry of the till. In this regard, the contrast between the Fe content of the glacial till, its magnetic susceptibility and the ground magnetic features of the bedrock serve as a way to estimate the distance between the samples and their source. Considering that the magnetic anomalies found in the bedrock (Figure 38B) (Martínez, in prep.) match with high magnetic susceptibility values in the soil along with high Fe contents (Vind, 2014) (Figure 38A), it can be concluded that the soil anomalies are extremely local (≤ 20 m).

Numerous high element concentrations found in the glacial till match with high metal contents in the neighbouring rapakivi granites (Valkama et al., 2016), including high concentrations of As, Be, Bi, Cu, In, Li, Mo, Sn, W and Zn. This aspect represents further evidence of the relation between the hydrothermal process developed in the Lillträsket area and the adjacent rapakivi units.


Lillträsket
7.7
Mo
0,1
1
10
As
0,1
1
10
W
0,1
1
10
Zn
10
100
1.000
Be
1
5
10
Bi
0,1
0,5
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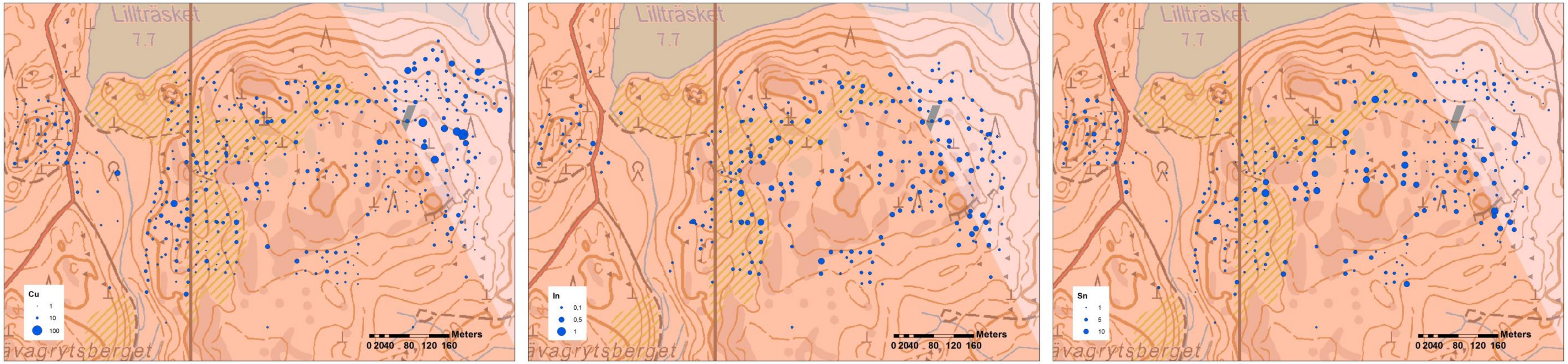


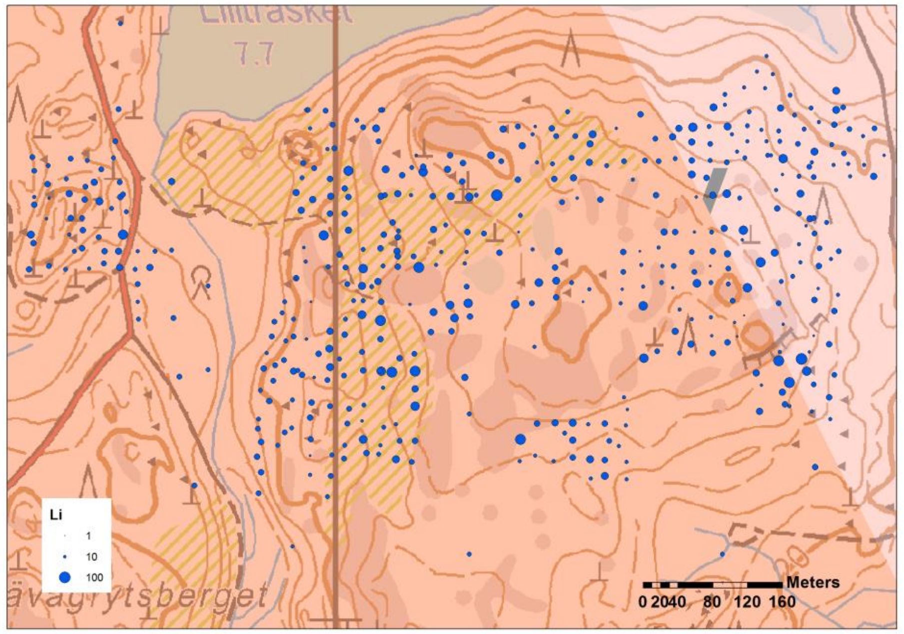
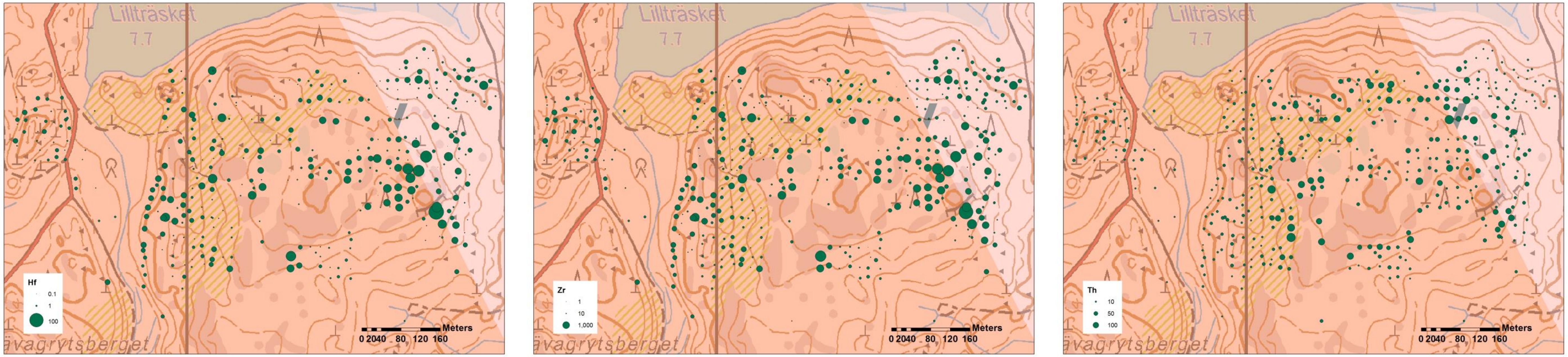


Figure 36: Chemical concentrations of selected metals in the glacial till of the Lillträsket area.



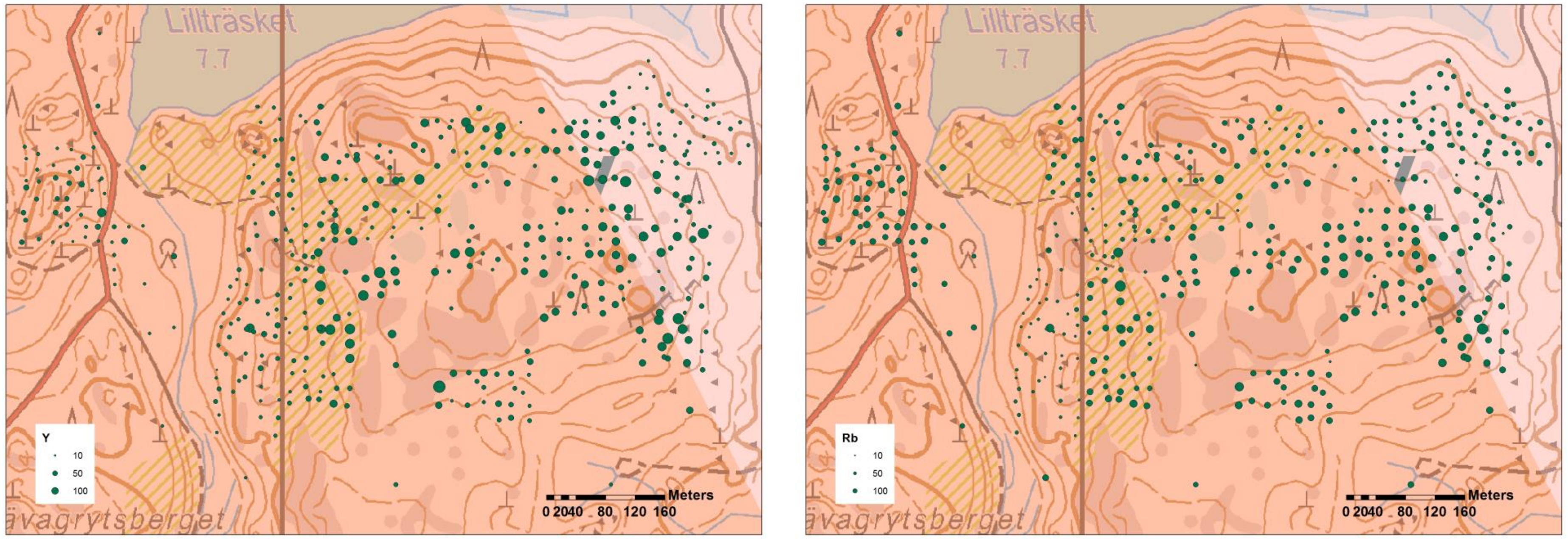
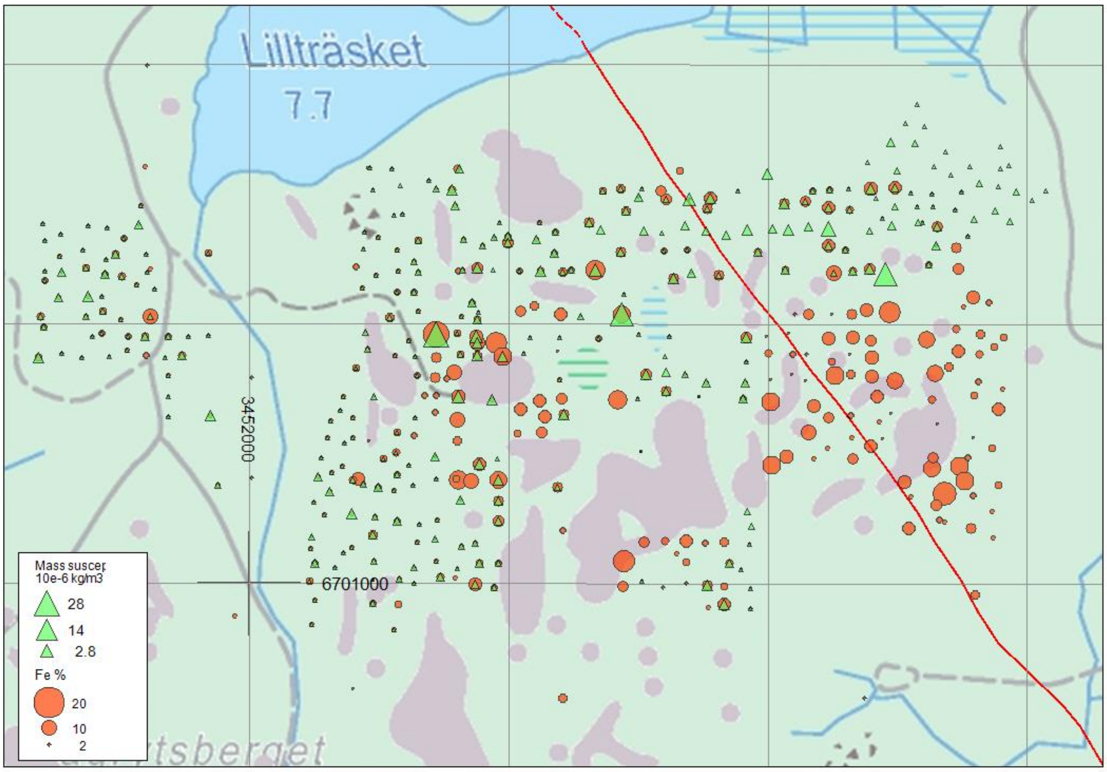


Figure 37: Chemical concentrations of selected elements in the glacial till of the Lillträsket area.

A



B

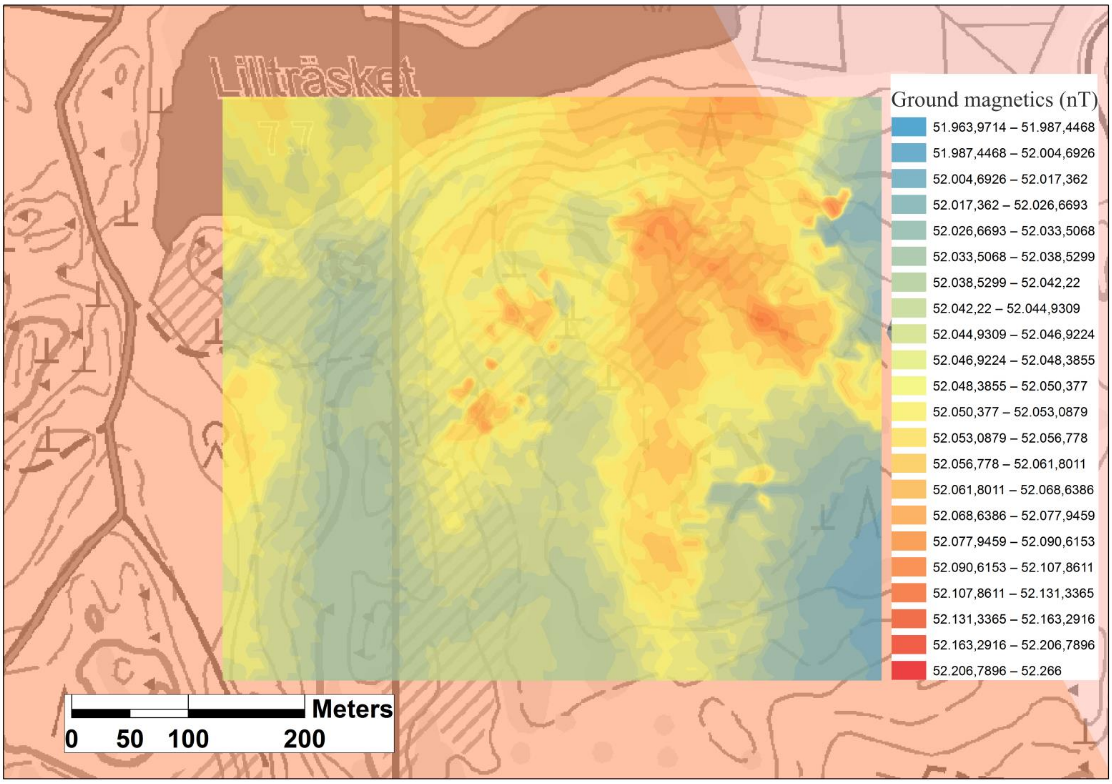


Figure 38: A. Fe content and magnetic susceptibility in the glacial till of the Lillträsket area (Vind, 2014). The red line marks the contact between the late-orogenic Svecofennian granites and the rapakivi granites. **B.** Ground magnetic map of the Lillträsket area (Martínez, in prep.).

7. CONCLUSIONS

Based on the observations made in this study, the following conclusions can be drawn:

1. The ≈ 1.8 Ga late-orogenic granites of the Pernaja and Lillträsket areas have been subject to significant alteration processes caused by the thermal output of the rapakivi intrusives at ≈ 1.6 Ga.

2. The rapakivi-related thermal influence on the late-orogenic granites depends strongly on: (1) the distance that separates the country rocks (late-orogenic granites) from the intrusives (Onas massif and Wiborg Batholith) and (2) the size of the intrusives.

3. The emplacement of the Wiborg Batholith caused the most relevant transformations observed in the late-orogenic granites. The microcline-orthoclase thermal aureole (1-4 km wide) located outside the Wiborg Batholith is the main expression of these transformations.

4. The strong readjustments in the Rb-Sr isotopic system of the late-orogenic granite, which yielded c. 1.6-1.4 Ga ages, also reflect the disturbance created by the thermal influence of the rapakivi intrusives. This disturbance increases from the location of the least altered specimen (sample AV072; 13 km east of the Onas massif and 7 km west of the Wiborg Batholith) towards the intrusives, being especially intense immediately outside the Wiborg Batholith (sample AV020; 0.32 km west of the Wiborg Batholith).

5. The late-orogenic granites of the Lillträsket area, which are located within the thermal aureole, were also subject to hydrothermal alteration processes. The infiltrating hydrothermal fluid, which emanated from the adjacent rapakivi granites (mainly the Marviken granites), produced significant changes in the geochemistry of the altered granites.

6. The metal anomalies in the glacial till reveal the presence of metallic mineralizations in the Lillträsket area. These mineralizations are most likely to be analogous to those found in the neighbouring rapakivi granites (the Sarvlaxviken Bay).

ACKNOWLEDMENTS

This research would never have happened without the financial support of the K. H. Renlund foundation, for which I am very grateful. I would also like to thank all the staff from the Department of Geology at the University of Turku, in particular to Mr. Arto Peltola, who was very patient while teaching me how to produce high-quality thin sections, and to Dr. Markku Väisänen, who was very thoughtful and helped me in many ways during my stay at the Department of Geology. Kiitos paljon! My special thanks go to Dr. Kiril Lokhov, Dr. Sergey Malyshev and Dr. Valeriy Savatenkov from the Institute of Precambrian Geology and Geochronology in St. Petersburg, Russia. The Rb-Sr analyses they performed and the great assistance they provided in this matter were crucial for the good outcome of this project. I am really grateful to Diego Martínez Fernández, Emil Nygård, Aleksis Vigdorciks and Johannes Vind for the great summer we spent together doing fieldwork, and for all the experiences we have lived together as friends afterwards. I want to thank my friend David García Balbuena as well, for he made me feel welcomed to Finland when I most needed it. I wish to offer my most profound thanks to Cristina Peña Arce, whose love and support was of critical importance at the latest stage of this journey. I want to express my heartfelt thanks to Prof. Krister Sunblad, who gave me the opportunity of carrying out this research, made me a better geologist and, most importantly, took care of me in a really caring way. For that I am forever grateful.

Finalmente quisiera dedicar esta tesis a mi padre, José Manuel Villar Otero. Por tantos y tan importantes motivos te estoy agradecido, pero especialmente por tu amor incondicional, por el apoyo que me has brindado en el pasado y por el que sin duda me darás en el futuro. Gracias papá.

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Appendix 1 – Whole-rock sampling locations, study areas and analyses performed

Sample ID	Coordinates		Study area		Analyses performed		
	X	Y	Lillträsket	Pernaja	Microscopy	Geochemistry	Rb-Sr
AV031	3446563	6704123		✓	✓	✓	
1309	3452115	6701257	✓		✓	✓	
1311	3452141	6701197	✓		✓	✓	
AV019	3452257	6701137	✓		✓	✓	
AV022	3452281	6701078	✓			✓	
AV026	3452270	6700961	✓		✓	✓	
1305	3452165	6701172	✓		✓	✓	
AV008	3452253	6701356	✓		✓	✓	
AV009	3452243	6701288	✓			✓	
AV016	3452263	6701197	✓		✓	✓	
AV025	3452273	6701024	✓		✓	✓	
1303	3452139	6701246	✓			✓	
AV007	3452248	6701360	✓		✓	✓	
AV014	3452220	6701194	✓			✓	
AV015	3452246	6701173	✓		✓	✓	
AV034	3452551	6701284	✓		✓	✓	
1310	3452145	6701196	✓		✓	✓	
1301	3452120	6701260	✓		✓	✓	
AV003	3452274	6701424	✓			✓	
AV006	3452247	6701367	✓		✓	✓	
AV012	3452304	6701286	✓		✓	✓	
AV032	3452306	6701332	✓		✓	✓	
AV028	3452364	6701082	✓		✓	✓	
AV029	3452615	6701095	✓		✓	✓	
AV020	3452312	6701106	✓		✓	✓	✓
AV058	3433664	6699716		✓	✓	✓	✓
AV061	3444406	6703568		✓	✓	✓	✓
AV062	3446910	6700853		✓		✓	
AV066	3446541	6704089		✓		✓	
AV071	3450000	6702391		✓		✓	
AV072	3441946	6702369		✓	✓	✓	✓
AV030	3452460	6701058	✓		✓		
AV004	3452274	6701424	✓		✓		

Appendix 2 – CIPW Normative compositions

Sample ID	Q	C	Or	Ab	An	Hy	Mt	Il	Hm	Ru	Py	Sum
AV031	32.51	0.74	34.75	25.98	3.22	1.43	0.61	0.04	0.00	0.00	0.01	99.29
1309	34.45	1.61	29.90	26.91	3.03	2.97	0.36	0.24	0.00	0.00	0.01	99.49
1311	32.76	1.96	33.15	24.29	2.43	5.25	0.00	0.29	0.00	0.00	0.01	100.13
AV019	34.25	1.15	32.50	24.20	2.73	4.88	0.00	0.21	0.00	0.00	0.01	99.93
AV022	40.65	1.70	27.54	25.47	2.28	1.99	0.52	0.02	0.00	0.00	0.01	100.17
AV026	37.29	1.51	24.70	29.36	4.47	3.05	0.15	0.12	0.00	0.00	0.01	100.65
1305	33.33	1.74	33.86	25.81	1.39	2.92	0.90	0.21	0.00	0.00	0.01	100.17
AV008	31.04	1.23	39.30	20.31	1.44	3.98	0.83	0.32	0.00	0.00	0.01	98.44
AV009	42.02	1.20	26.59	23.52	3.22	3.35	0.04	0.10	0.00	0.00	0.01	100.06
AV016	37.58	1.43	27.95	24.29	2.68	4.15	0.77	0.34	0.00	0.00	0.01	99.20
AV025	31.30	1.69	34.39	24.12	3.18	5.22	0.00	0.28	0.00	0.00	0.01	100.18
1303	40.22	0.57	32.21	21.41	2.08	2.74	0.81	0.18	0.00	0.00	0.01	100.23
AV007	31.50	1.65	37.11	22.25	1.69	3.89	1.28	0.41	0.00	0.00	0.01	99.79
AV014	37.30	1.66	31.20	23.61	1.98	2.38	1.23	0.31	0.00	0.00	0.01	99.68
AV015	34.49	1.64	34.22	24.71	1.04	3.17	0.35	0.24	0.00	0.00	0.01	99.87
AV034	28.35	1.13	38.59	25.13	1.49	4.49	0.00	0.15	0.00	0.00	0.01	99.35
1310	29.53	1.51	37.76	24.12	1.29	2.69	0.91	0.21	0.00	0.00	0.01	98.03
1301	29.47	0.80	41.37	22.85	1.14	2.26	1.22	0.27	0.00	0.00	0.02	99.39
AV003	27.53	1.66	32.98	23.02	2.98	7.88	0.48	0.60	0.00	0.00	0.01	97.13
AV006	30.67	2.02	35.64	22.59	1.64	4.93	0.42	0.40	0.00	0.00	0.01	98.31
AV012	31.58	1.48	36.23	21.07	1.69	4.63	0.42	0.37	0.00	0.00	0.01	97.47
AV032	32.21	0.72	38.89	21.66	1.04	5.23	0.00	0.31	0.00	0.00	0.01	100.06
AV028	22.98	2.06	41.25	25.55	1.79	2.72	1.89	0.28	0.34	0.00	0.01	98.86
AV029	33.23	0.65	34.34	23.52	2.63	4.65	0.38	0.38	0.00	0.00	0.01	99.80
AV020	34.42	1.00	32.44	25.64	2.93	0.72	0.00	0.04	0.00	0.11	0.00	97.30
AV058	37.64	1.24	29.37	23.86	4.47	0.60	0.00	0.08	0.00	0.03	0.00	97.29
AV061	35.47	0.82	29.73	26.99	3.97	0.75	0.00	0.05	0.00	0.08	0.00	97.86
AV062	35.98	0.99	31.74	25.30	2.93	0.54	0.00	0.05	0.00	0.00	0.00	97.52
AV066	36.37	1.05	30.32	24.71	3.57	0.97	0.00	0.06	0.00	0.19	0.00	97.24
AV071	34.21	1.29	30.55	26.99	3.27	0.50	0.00	0.07	0.00	0.09	0.00	96.98
AV072	34.53	1.02	33.51	25.05	3.27	0.62	0.00	0.04	0.00	0.07	0.00	98.12

Appendix 3 – Whole-rock geochemistry

			Sample ID					
			AV031	1309	1311	AV019	AV022	AV026
	Detection Limit	Analysis Method	Concentrations					
Cd	0.5	TD-ICP	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cu	1	TD-ICP	11	4	4	1	3	1
Ni	1	TD-ICP	3	3	6	3	3	4
Zn	1	TD-ICP	24	56	59	61	15	32
S	0.001	TD-ICP	0.007	0.006	0.006	0.004	0.005	0.006
Ag	0.3	TD-ICP	< 0.3	< 0.3	0.3	< 0.3	< 0.3	< 0.3
Pb	5	TD-ICP	41	28	33	33	28	39
F	0.01	FUS-ISE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
FeO	0.1	TITR	0.8	1.4	2.5	2.4	1	1.5
SiO2	0.01	FUS-ICP	74.95	75.08	74.48	75.41	77.92	76.84
Al2O3	0.01	FUS-ICP	13.34	13.43	13.64	12.81	12.53	13.38
Fe2O3	0.01	FUS-ICP	0.42	0.25	< 0.01	< 0.01	0.36	0.1
MnO	0.001	FUS-ICP	0.029	0.033	0.027	0.049	0.066	0.021
MgO	0.01	FUS-ICP	0.12	0.31	0.35	0.23	0.14	0.18
CaO	0.01	FUS-ICP	0.65	0.61	0.49	0.55	0.46	0.9
Na2O	0.01	FUS-ICP	3.07	3.18	2.87	2.86	3.01	3.47
K2O	0.01	FUS-ICP	5.88	5.06	5.61	5.5	4.66	4.18
TiO2	0.001	FUS-ICP	0.021	0.128	0.153	0.111	0.009	0.061
P205	0.01	FUS-ICP	0.04	0.06	0.05	0.05	0.06	0.05
LOI		FUS-ICP	0.26	0.67	0.65	0.43	0.32	-2.24
LOI2		FUS-ICP	0.17	0.51	0.37	0.16	0.2	-2.4
Total	0.01	FUS-ICP	99.67	100.4	100.9	100.4	100.7	98.6
Total 2	0.01	FUS-ICP	99.58	100.2	100.6	100.2	100.5	98.43
Fe2O3(T)	0.01	FUS-ICP	1.31	1.81	2.54	2.42	1.47	1.77
Sc	1	FUS-ICP	2	3	4	4	3	2
Be	1	FUS-ICP	2	3	2	1	1	2
V	5	FUS-ICP	13	6	9	8	< 5	6
Cr	20	FUS-MS	20	< 20	30	< 20	< 20	< 20
Co	1	FUS-MS	< 1	< 1	1	< 1	< 1	< 1
Ni	20	FUS-MS	< 20	< 20	< 20	< 20	< 20	< 20
Cu	10	FUS-MS	< 10	< 10	< 10	< 10	< 10	< 10
Zn	30	FUS-MS	< 30	40	40	30	< 30	< 30
Ga	1	FUS-MS	19	24	24	21	18	21
Ge	1	FUS-MS	2	2	2	2	2	2
As	5	FUS-MS	6	< 5	< 5	< 5	< 5	< 5
Rb	2	FUS-MS	380	342	361	284	232	222
Sr	2	FUS-ICP	46	46	44	46	46	47
Y	2	FUS-ICP	30	18	22	23	18	15
Zr	4	FUS-ICP	58	119	151	94	50	85
Nb	1	FUS-MS	4	311	41	36	7	11
Mo	2	FUS-MS	< 2	< 2	< 2	< 2	< 2	< 2
Ag	0.5	FUS-MS	< 0.5	3.3	4	2.3	2.1	2.1
In	0.2	FUS-MS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	1	FUS-MS	< 1	20	6	5	2	2
Sb	0.5	FUS-MS	< 0.5	0.7	0.9	0.5	0.5	< 0.5
Cs	0.5	FUS-MS	2.8	5.5	3.7	2	1.8	3.1
Ba	3	FUS-ICP	194	171	231	215	148	123
La	0.1	FUS-MS	27.2	38.9	60.4	35.9	6.6	11.6
Ce	0.1	FUS-MS	58.6	83.9	124	78.8	11.3	22
Pr	0.05	FUS-MS	6.38	9.09	13.8	8.41	1.28	2.63
Nd	0.1	FUS-MS	22.1	31.1	48.7	29.1	4.3	8.7
Sm	0.1	FUS-MS	4.8	6.6	9.6	6.3	1	2.1
Eu	0.05	FUS-MS	0.31	0.29	0.29	0.35	0.19	0.27
Gd	0.1	FUS-MS	4.2	5.3	7.3	4.9	1.1	2.1
Tb	0.1	FUS-MS	0.8	0.8	1.1	0.9	0.3	0.4
Dy	0.1	FUS-MS	4.7	3.7	5	4.8	2.2	2.5
Ho	0.1	FUS-MS	1	0.5	0.7	0.8	0.6	0.5
Er	0.1	FUS-MS	3	1.3	1.7	1.9	2.4	1.3
Tm	0.05	FUS-MS	0.5	0.18	0.21	0.23	0.5	0.19
Yb	0.1	FUS-MS	3.6	1.1	1.2	1.3	4.2	1.3
Lu	0.04	FUS-MS	0.57	0.14	0.17	0.19	0.71	0.18
Hf	0.2	FUS-MS	2	4.8	5.3	3.2	2.1	3.3
Ta	0.1	FUS-MS	0.6	429	15.1	33.8	7.4	1
W	1	FUS-MS	1	5	3	2	2	1
Tl	0.1	FUS-MS	1.1	2.5	2.7	1.9	1.6	1.7
Pb	5	FUS-MS	46	43	40	41	29	54
Bi	0.4	FUS-MS	0.8	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Th	0.1	FUS-MS	19.6	27.6	40.7	26.3	3.9	8.2
U	0.1	FUS-MS	4.6	21.3	8.1	6.7	2.7	8.3

			Sample ID					
			1305	AV008	AV009	AV016	AV025	1303
	Detection Limit	Analysis Method	Concentrations					
Cd	0.5	TD-ICP	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cu	1	TD-ICP	6	4	18	1	2	31
Ni	1	TD-ICP	5	4	6	4	4	11
Zn	1	TD-ICP	52	51	24	64	52	41
S	0.001	TD-ICP	0.006	0.004	0.006	0.005	0.006	0.007
Ag	0.3	TD-ICP	< 0.3	0.4	< 0.3	0.9	< 0.3	< 0.3
Pb	5	TD-ICP	30	27	26	31	37	11
F	0.01	FUS-ISE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
FeO	0.1	TITR	1.5	2.2	1.6	2.1	2.6	1.2
SiO2	0.01	FUS-ICP	75.04	72.96	78.39	75.56	73.98	78.09
Al2O3	0.01	FUS-ICP	13.47	12.9	11.83	12.25	13.84	11.4
Fe2O3	0.01	FUS-ICP	0.62	0.57	0.03	0.53	< 0.01	0.56
MnO	0.001	FUS-ICP	0.027	0.037	0.017	0.023	0.029	0.024
MgO	0.01	FUS-ICP	0.33	0.25	0.2	0.4	0.26	0.45
CaO	0.01	FUS-ICP	0.28	0.29	0.65	0.54	0.64	0.42
Na2O	0.01	FUS-ICP	3.05	2.4	2.78	2.87	2.85	2.53
K2O	0.01	FUS-ICP	5.73	6.65	4.5	4.73	5.82	5.45
TiO2	0.001	FUS-ICP	0.111	0.168	0.051	0.179	0.148	0.094
P205	0.01	FUS-ICP	0.06	0.04	0.04	0.05	0.08	0.05
LOI		FUS-ICP	0.59	0.54	0.65	0.61	0.55	0.55
LOI2		FUS-ICP	0.42	0.29	0.47	0.38	0.26	0.42
Total	0.01	FUS-ICP	101	99.27	100.9	100.1	100.8	101
Total 2	0.01	FUS-ICP	100.8	99.02	100.7	99.86	100.5	100.8
Fe2O3(T)	0.01	FUS-ICP	2.28	3.02	1.81	2.87	2.62	1.9
Sc	1	FUS-ICP	4	4	1	4	4	3
Be	1	FUS-ICP	3	1	2	< 1	1	2
V	5	FUS-ICP	9	6	5	10	6	6
Cr	20	FUS-MS	20	< 20	< 20	30	30	30
Co	1	FUS-MS	< 1	1	< 1	1	1	2
Ni	20	FUS-MS	< 20	< 20	< 20	< 20	< 20	< 20
Cu	10	FUS-MS	< 10	< 10	< 10	< 10	< 10	30
Zn	30	FUS-MS	40	40	< 30	50	40	70
Ga	1	FUS-MS	19	25	20	23	23	19
Ge	1	FUS-MS	1	2	2	2	2	1
As	5	FUS-MS	< 5	< 5	< 5	< 5	< 5	< 5
Rb	2	FUS-MS	326	398	211	272	349	338
Sr	2	FUS-ICP	47	45	39	44	49	36
Y	2	FUS-ICP	22	22	5	13	18	17
Zr	4	FUS-ICP	110	173	86	156	128	80
Nb	1	FUS-MS	18	30	9	25	20	45
Mo	2	FUS-MS	< 2	< 2	< 2	< 2	< 2	< 2
Ag	0.5	FUS-MS	< 0.5	3.4	2.4	2.6	2.7	3.9
In	0.2	FUS-MS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	1	FUS-MS	3	9	3	2	4	7
Sb	0.5	FUS-MS	< 0.5	0.7	0.6	< 0.5	< 0.5	0.9
Cs	0.5	FUS-MS	2.6	2.8	4.2	2	3.2	2.2
Ba	3	FUS-ICP	231	299	167	180	239	169
La	0.1	FUS-MS	33.6	103	14.4	63.5	84.1	18
Ce	0.1	FUS-MS	67.5	222	27.8	129	167	41.7
Pr	0.05	FUS-MS	7.87	22.8	3.26	14.4	19.1	4.53
Nd	0.1	FUS-MS	25.7	79.3	11.1	50.3	67.1	15.5
Sm	0.1	FUS-MS	5.4	13.2	2.7	10	13	3.7
Eu	0.05	FUS-MS	0.31	0.46	0.25	0.27	0.42	0.15
Gd	0.1	FUS-MS	4.6	7.7	2	6.7	7.9	3.2
Tb	0.1	FUS-MS	0.8	1	0.3	0.9	1	0.6
Dy	0.1	FUS-MS	4	5.1	1.1	3.6	4.4	3.2
Ho	0.1	FUS-MS	0.8	0.8	0.2	0.4	0.6	0.6
Er	0.1	FUS-MS	1.9	2.1	0.4	0.9	1.3	1.5
Tm	0.05	FUS-MS	0.3	0.31	0.06	0.1	0.16	0.23
Yb	0.1	FUS-MS	1.9	2	0.4	0.7	0.9	1.7
Lu	0.04	FUS-MS	0.23	0.29	0.07	0.1	0.13	0.24
Hf	0.2	FUS-MS	3.2	5.5	3	4.9	4.4	2.7
Ta	0.1	FUS-MS	2	10.8	0.9	1.5	5.3	45.3
W	1	FUS-MS	< 1	2	2	2	2	3
Tl	0.1	FUS-MS	1.9	2.9	1.7	1.9	2.3	2.7
Pb	5	FUS-MS	41	30	28	35	46	18
Bi	0.4	FUS-MS	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Th	0.1	FUS-MS	27	44.1	9.5	40.1	39.4	23
U	0.1	FUS-MS	12	4.9	4	8.8	12.7	6.5

			Sample ID					
			AV007	AV014	AV015	AV034	1310	1301
	Detection Limit	Analysis Method	Concentrations					
Cd	0.5	TD-ICP	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cu	1	TD-ICP	2	3	6	3	1	308
Ni	1	TD-ICP	3	4	5	4	4	5
Zn	1	TD-ICP	64	57	48	50	53	57
S	0.001	TD-ICP	0.003	0.005	0.005	0.007	0.007	0.01
Ag	0.3	TD-ICP	0.5	0.5	0.4	0.3	< 0.3	< 0.3
Pb	5	TD-ICP	24	31	12	49	34	21
F	0.01	FUS-ISE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
FeO	0.1	TITR	2.2	1.5	1.6	2.2	1.5	1.3
SiO2	0.01	FUS-ICP	73.45	75.75	75.61	73.38	72.42	73.59
Al2O3	0.01	FUS-ICP	13.39	12.69	13.09	13.63	13.59	13.24
Fe2O3	0.01	FUS-ICP	0.88	0.85	0.24	< 0.01	0.63	0.84
MnO	0.001	FUS-ICP	0.04	0.018	0.016	0.029	0.027	0.025
MgO	0.01	FUS-ICP	0.35	0.23	0.25	0.22	0.24	0.31
CaO	0.01	FUS-ICP	0.34	0.4	0.21	0.3	0.26	0.23
Na2O	0.01	FUS-ICP	2.63	2.79	2.92	2.97	2.85	2.7
K2O	0.01	FUS-ICP	6.28	5.28	5.79	6.53	6.39	7
TiO2	0.001	FUS-ICP	0.218	0.161	0.128	0.081	0.109	0.143
P205	0.01	FUS-ICP	0.05	0.06	0.06	0.04	0.05	0.06
LOI		FUS-ICP	0.6	0.7	0.62	0.6	0.54	0.69
LOI2		FUS-ICP	0.35	0.53	0.44	0.36	0.37	0.55
Total	0.01	FUS-ICP	100.7	100.6	100.7	100.1	98.78	100.3
Total 2	0.01	FUS-ICP	100.4	100.4	100.5	99.88	98.62	100.1
Fe2O3(T)	0.01	FUS-ICP	3.33	2.52	2.02	2.34	2.3	2.28
Sc	1	FUS-ICP	5	3	3	2	3	3
Be	1	FUS-ICP	1	2	2	2	2	1
V	5	FUS-ICP	6	9	15	7	8	10
Cr	20	FUS-MS	20	< 20	< 20	< 20	< 20	< 20
Co	1	FUS-MS	1	1	1	5	1	1
Ni	20	FUS-MS	< 20	< 20	< 20	< 20	< 20	< 20
Cu	10	FUS-MS	< 10	< 10	< 10	< 10	< 10	190
Zn	30	FUS-MS	50	50	< 30	40	70	50
Ga	1	FUS-MS	25	23	20	22	23	19
Ge	1	FUS-MS	2	2	1	2	2	1
As	5	FUS-MS	< 5	< 5	< 5	< 5	< 5	< 5
Rb	2	FUS-MS	359	320	328	373	435	428
Sr	2	FUS-ICP	55	45	43	42	41	42
Y	2	FUS-ICP	24	19	18	29	39	14
Zr	4	FUS-ICP	217	159	113	114	72	114
Nb	1	FUS-MS	36	26	17	11	28	30
Mo	2	FUS-MS	< 2	< 2	< 2	< 2	< 2	< 2
Ag	0.5	FUS-MS	4.2	3.3	5.3	1.7	3.3	3.9
In	0.2	FUS-MS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	1	FUS-MS	8	3	4	7	8	4
Sb	0.5	FUS-MS	0.8	0.7	1.1	< 0.5	0.8	0.9
Cs	0.5	FUS-MS	2.7	3.1	2.9	4.9	4.7	1.8
Ba	3	FUS-ICP	345	241	250	269	211	252
La	0.1	FUS-MS	139	50.2	14.9	51.9	25.8	37.8
Ce	0.1	FUS-MS	263	119	38.3	105	59.3	108
Pr	0.05	FUS-MS	30	12.3	3.89	11.2	6.34	9.6
Nd	0.1	FUS-MS	103	42.6	14	37.7	21.9	33.8
Sm	0.1	FUS-MS	16.6	8.7	3.1	7.6	5.3	7.2
Eu	0.05	FUS-MS	0.49	0.25	0.2	0.3	0.23	0.22
Gd	0.1	FUS-MS	9.3	5.8	2.9	6	5	5.1
Tb	0.1	FUS-MS	1.2	1	0.5	1	1.1	0.8
Dy	0.1	FUS-MS	5.6	4.4	3	5.4	6.3	3.3
Ho	0.1	FUS-MS	0.8	0.7	0.5	1	1.2	0.5
Er	0.1	FUS-MS	2.1	1.5	1.4	2.7	3.3	1
Tm	0.05	FUS-MS	0.31	0.19	0.18	0.43	0.48	0.14
Yb	0.1	FUS-MS	1.8	1.1	1.1	2.7	2.8	0.9
Lu	0.04	FUS-MS	0.27	0.14	0.16	0.36	0.37	0.12
Hf	0.2	FUS-MS	6.5	5.3	3.4	4.2	2.7	3.8
Ta	0.1	FUS-MS	6.7	3.2	12.5	2.3	7.2	9.4
W	1	FUS-MS	4	2	70	1	3	4
Tl	0.1	FUS-MS	2.6	2.1	1.8	2.4	2.9	3.4
Pb	5	FUS-MS	28	37	22	48	41	34
Bi	0.4	FUS-MS	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Th	0.1	FUS-MS	56.1	42.5	28.8	54.8	27.2	37.8
U	0.1	FUS-MS	4.7	10.5	13.2	6.6	7.2	7.5

			Sample ID					
			AV003	AV006	AV012	AV032	AV028	AV029
	Detection Limit	Analysis Method	Concentrations					
Cd	0.5	TD-ICP	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cu	1	TD-ICP	3	2	7	2	2	6
Ni	1	TD-ICP	3	5	6	3	3	4
Zn	1	TD-ICP	106	67	67	61	38	80
S	0.001	TD-ICP	0.005	0.005	0.004	0.004	0.003	0.005
Ag	0.3	TD-ICP	< 0.3	0.5	< 0.3	< 0.3	< 0.3	< 0.3
Pb	5	TD-ICP	5	23	34	28	8	34
F	0.01	FUS-ISE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
FeO	0.1	TITR	3.1	2.4	2.4	2.6	0.7	2.3
SiO2	0.01	FUS-ICP	69.99	72.37	72.46	75.2	69.65	75.02
Al2O3	0.01	FUS-ICP	13.27	13.54	12.83	12.44	15.24	12.48
Fe2O3	0.01	FUS-ICP	0.33	0.29	0.29	< 0.01	1.64	0.26
MnO	0.001	FUS-ICP	0.042	0.036	0.025	0.029	0.023	0.035
MgO	0.01	FUS-ICP	1.17	0.42	0.3	0.27	1.09	0.37
CaO	0.01	FUS-ICP	0.6	0.33	0.34	0.21	0.36	0.53
Na2O	0.01	FUS-ICP	2.72	2.67	2.49	2.56	3.02	2.78
K2O	0.01	FUS-ICP	5.58	6.03	6.13	6.58	6.98	5.81
TiO2	0.001	FUS-ICP	0.315	0.209	0.195	0.161	0.149	0.201
P205	0.01	FUS-ICP	0.06	0.05	0.05	0.05	0.06	0.06
LOI		FUS-ICP	1.3	0.95	0.77	0.57	1.46	0.72
LOI2		FUS-ICP	0.95	0.68	0.5	0.28	1.38	0.46
Total	0.01	FUS-ICP	98.83	99.55	98.56	101	100.4	100.8
Total 2	0.01	FUS-ICP	98.48	99.28	98.29	100.7	100.4	100.5
Fe2O3(T)	0.01	FUS-ICP	3.77	2.96	2.96	2.89	2.42	2.82
Sc	1	FUS-ICP	7	5	4	5	3	3
Be	1	FUS-ICP	2	2	1	2	4	2
V	5	FUS-ICP	13	6	7	7	12	8
Cr	20	FUS-MS	< 20	< 20	30	30	< 20	20
Co	1	FUS-MS	3	1	1	1	< 1	1
Ni	20	FUS-MS	< 20	< 20	< 20	< 20	< 20	< 20
Cu	10	FUS-MS	< 10	< 10	< 10	< 10	< 10	< 10
Zn	30	FUS-MS	100	60	60	50	< 30	70
Ga	1	FUS-MS	33	23	22	22	45	22
Ge	1	FUS-MS	2	2	2	2	2	2
As	5	FUS-MS	< 5	< 5	< 5	6	< 5	< 5
Rb	2	FUS-MS	306	334	221	308	385	300
Sr	2	FUS-ICP	37	49	53	38	28	55
Y	2	FUS-ICP	42	20	13	20	22	19
Zr	4	FUS-ICP	165	191	195	175	112	202
Nb	1	FUS-MS	51	76	45	32	32	16
Mo	2	FUS-MS	< 2	< 2	< 2	< 2	< 2	< 2
Ag	0.5	FUS-MS	3.2	3.6	3.6	2.8	1.9	2.9
In	0.2	FUS-MS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	1	FUS-MS	10	7	4	13	7	10
Sb	0.5	FUS-MS	0.6	0.6	< 0.5	< 0.5	< 0.5	< 0.5
Cs	0.5	FUS-MS	1.7	3.1	1.5	3.8	3	3.1
Ba	3	FUS-ICP	201	327	309	275	382	345
La	0.1	FUS-MS	113	90.1	125	97	12.1	54.7
Ce	0.1	FUS-MS	259	178	247	202	70.1	202
Pr	0.05	FUS-MS	28	20.9	28.1	23.5	3.7	13.4
Nd	0.1	FUS-MS	97.9	71.8	96.4	82.6	12.7	48.1
Sm	0.1	FUS-MS	20.6	11.7	16	16.1	3.9	9.9
Eu	0.05	FUS-MS	0.45	0.36	0.5	0.4	0.16	0.47
Gd	0.1	FUS-MS	14.5	6.4	8.4	10.1	3.6	6.9
Tb	0.1	FUS-MS	2.1	0.8	0.9	1.2	0.7	1
Dy	0.1	FUS-MS	10.1	4.1	3.5	5.1	4.3	4.4
Ho	0.1	FUS-MS	1.5	0.6	0.5	0.7	0.8	0.7
Er	0.1	FUS-MS	3.5	1.7	0.9	1.5	2	1.8
Tm	0.05	FUS-MS	0.48	0.24	0.11	0.18	0.3	0.26
Yb	0.1	FUS-MS	2.6	1.6	0.6	1	1.9	1.6
Lu	0.04	FUS-MS	0.36	0.24	0.09	0.14	0.25	0.22
Hf	0.2	FUS-MS	5.8	5.7	5.9	5.6	4	6.1
Ta	0.1	FUS-MS	3.4	92.7	41	16.1	19.2	2.5
W	1	FUS-MS	2	3	2	1	2	1
Tl	0.1	FUS-MS	2.5	2.5	1.7	2.2	2.7	2.3
Pb	5	FUS-MS	16	26	34	28	19	37
Bi	0.4	FUS-MS	0.7	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Th	0.1	FUS-MS	63.9	49.9	47.6	48.6	30.7	55.1
U	0.1	FUS-MS	12.1	6.9	5.6	4.9	10.4	10.2

			Sample ID						
			AV020	AV058	AV061	AV062	AV066	AV071	AV072
	Detection Limit	Analysis Method	Concentrations						
Cd	0.5	TD-ICP							
Cu	1	TD-ICP							
Ni	1	TD-ICP							
Zn	1	TD-ICP							
S	0.001	TD-ICP							
Ag	0.3	TD-ICP							
Pb	5	TD-ICP							
F	0.01	FUS-ISE							
FeO	0.1	TITR							
SiO2	0.01	FUS-ICP	74.74	75.34	75.43	75.49	75.1	74.26	75.23
Al2O3	0.01	FUS-ICP	13	12.9	12.97	12.79	12.72	13.33	13.23
Fe2O3	0.01	FUS-ICP							
MnO	0.001	FUS-ICP	0.02	0.037	0.022	0.072	0.028	0.034	0.018
MgO	0.01	FUS-ICP	0.29	0.24	0.3	0.18	0.39	0.2	0.25
CaO	0.01	FUS-ICP	0.59	0.9	0.8	0.59	0.72	0.66	0.66
Na2O	0.01	FUS-ICP	3.03	2.82	3.19	2.99	2.92	3.19	2.96
K2O	0.01	FUS-ICP	5.49	4.97	5.03	5.37	5.13	5.17	5.67
TiO2	0.001	FUS-ICP	0.134	0.073	0.106	0.025	0.225	0.127	0.093
P205	0.01	FUS-ICP	0.06	0.04	0.06	0.04	0.04	0.07	0.06
LOI		FUS-ICP	0.74	0.46	0.67	0.52	0.6	0.5	0.61
LOI2		FUS-ICP							
Total	0.01	FUS-ICP	100.2	99.8	101	100.3	100.9	100	101
Total 2	0.01	FUS-ICP							
Fe2O3(T)	0.01	FUS-ICP	2.13	2	2.37	2.19	3.02	2.46	2.21
Sc	1	FUS-ICP	3	2	4	5	4	3	3
Be	1	FUS-ICP	1	1	2	1	1	< 1	1
V	5	FUS-ICP	6	6	< 5	< 5	7	< 5	< 5
Cr	20	FUS-MS	190	< 20	210	< 20	220	< 20	240
Co	1	FUS-MS	2	2	2	1	2	2	2
Ni	20	FUS-MS	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	10	FUS-MS	10	< 10	10	80	10	< 10	10
Zn	30	FUS-MS	50	< 30	50	< 30	70	60	40
Ga	1	FUS-MS	21	17	19	16	20	21	18
Ge	1	FUS-MS	1	1	1	1	2	2	2
As	5	FUS-MS	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	2	FUS-MS	273	206	265	173	389	323	248
Sr	2	FUS-ICP	45	57	48	48	52	40	31
Y	2	FUS-ICP	21	21	82	25	46	19	19
Zr	4	FUS-ICP	105	97	160	45	120	87	96
Nb	1	FUS-MS	15	6	14	2	18	16	11
Mo	2	FUS-MS	9	< 2	9	< 2	11	< 2	10
Ag	0.5	FUS-MS	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
In	0.2	FUS-MS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	1	FUS-MS	3	< 1	3	6	3	3	2
Sb	0.5	FUS-MS	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	0.5	FUS-MS	2.4	1.2	5.7	3.5	5.4	1.6	2.7
Ba	3	FUS-ICP	206	254	178	132	188	195	96
La	0.1	FUS-MS	48.4	40.1	47	15.5	54.8	32.6	38.5
Ce	0.1	FUS-MS	92.5	79.5	96.8	32.4	116	68.8	77.6
Pr	0.05	FUS-MS	11.3	8.87	11.2	3.52	13.3	7.69	9.29
Nd	0.1	FUS-MS	40.6	30.3	41.2	12.9	47	26.8	33.1
Sm	0.1	FUS-MS	9.3	6.4	9.8	2.8	11.1	6.1	7.3
Eu	0.05	FUS-MS	0.37	0.46	0.4	0.24	0.35	0.27	0.22
Gd	0.1	FUS-MS	7.1	5.2	11.2	2.5	10.3	4.8	6.4
Tb	0.1	FUS-MS	1	0.7	2.1	0.5	1.7	0.7	0.9
Dy	0.1	FUS-MS	4.5	3.8	13.5	3.6	8.6	3.6	4.1
Ho	0.1	FUS-MS	0.7	0.7	2.8	1	1.4	0.7	0.6
Er	0.1	FUS-MS	1.8	1.8	7.3	3.9	3.6	1.9	1.4
Tm	0.05	FUS-MS	0.23	0.28	0.98	0.72	0.43	0.28	0.18
Yb	0.1	FUS-MS	1.4	1.7	5.5	5.1	2.3	1.9	1
Lu	0.04	FUS-MS	0.19	0.24	0.71	0.81	0.3	0.27	0.14
Hf	0.2	FUS-MS	4.1	3.8	6.3	2	5.1	3.5	3.7
Ta	0.1	FUS-MS	1.4	0.4	1.3	0.4	2.2	1.2	1
W	1	FUS-MS	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tl	0.1	FUS-MS	1.8	1.2	1.7	1	2.6	2.1	1.6
Pb	5	FUS-MS	46	45	73	36	60	45	48
Bi	0.4	FUS-MS	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Th	0.1	FUS-MS	32.9	28.9	47.9	9.7	46.7	28	30
U	0.1	FUS-MS	9.6	14.1	179	3.2	21	8.9	7.9

Appendix 4 – Chondrite normalized REE concentrations and ratios

Sample ID	LaN	CeN	PrN	NdN	SmN	EuN	GdN
AV 031	87.74	72.53	52.30	36.83	24.62	4.22	16.22
1309	125.48	103.84	74.51	51.83	33.85	3.95	20.46
1311	194.84	153.47	113.12	81.17	49.23	3.95	28.19
AV019	115.81	97.53	68.93	48.50	32.31	4.76	18.92
AV022	21.29	13.99	10.49	7.17	5.13	2.59	4.25
AV026	37.42	27.23	21.56	14.50	10.77	3.67	8.11
1305	108.39	83.54	64.51	42.83	27.69	4.22	17.76
AV008	332.26	274.75	186.89	132.17	67.69	6.26	29.73
AV009	46.45	34.41	26.72	18.50	13.85	3.40	7.72
AV016	204.84	159.65	118.03	83.83	51.28	3.67	25.87
AV025	271.29	206.68	156.56	111.83	66.67	5.71	30.50
1303	58.07	51.61	37.13	25.83	18.97	2.04	12.36
AV007	448.39	325.50	245.90	171.67	85.13	6.67	35.91
AV014	161.94	147.28	100.82	71.00	44.62	3.40	22.39
AV015	48.07	47.40	31.89	23.33	15.90	2.72	11.20
AV034	167.42	129.95	91.80	62.83	38.97	4.08	23.17
1310	83.23	73.39	51.97	36.50	27.18	3.13	19.31
1301	121.94	133.66	78.69	56.33	36.92	2.99	19.69
AV003	364.52	320.55	229.51	163.17	105.64	6.12	55.99
AV006	290.65	220.30	171.31	119.67	60.00	4.90	24.71
AV012	403.23	305.69	230.33	160.67	82.05	6.80	32.43
AV032	312.90	250.00	192.62	137.67	82.56	5.44	39.00
AV028	39.03	86.76	30.33	21.17	20.00	2.18	13.90
AV029	176.45	250.00	109.84	80.17	50.77	6.40	26.64
AV020	156.13	114.48	92.62	67.67	47.69	5.03	27.41
AV058	129.36	98.39	72.71	50.50	32.82	6.26	20.08
AV061	151.61	119.80	91.80	68.67	50.26	5.44	43.24
AV062	50.00	40.10	28.85	21.50	14.36	3.27	9.65
AV066	176.77	143.56	109.02	78.33	56.92	4.76	39.77
AV071	105.16	85.15	63.03	44.67	31.28	3.67	18.53
AV072	124.19	96.04	76.15	55.17	37.44	2.99	24.71

Sample ID	TbN	DyN	HoN	ErN	TmN	YbN	LuN
AV031	16.88	14.60	13.93	14.29	15.43	17.23	17.70
1309	16.88	11.49	6.96	6.19	5.56	5.26	4.35
1311	23.21	15.53	9.75	8.10	6.48	5.74	5.28
AV019	18.99	14.91	11.14	9.05	7.10	6.22	5.90
AV022	6.33	6.83	8.36	11.43	15.43	20.10	22.05
AV026	8.44	7.76	6.96	6.19	5.86	6.22	5.59
1305	16.88	12.42	11.14	9.05	9.26	9.09	7.14
AV008	21.10	15.84	11.14	10.00	9.57	9.57	9.01
AV009	6.33	3.42	2.79	1.91	1.85	1.91	2.17
AV016	18.99	11.18	5.57	4.29	3.09	3.35	3.11
AV025	21.10	13.67	8.36	6.19	4.94	4.31	4.04
1303	12.66	9.94	8.36	7.14	7.10	8.13	7.45
AV007	25.32	17.39	11.14	10.00	9.57	8.61	8.39
AV014	21.10	13.67	9.75	7.14	5.86	5.26	4.35
AV015	10.55	9.32	6.96	6.67	5.56	5.26	4.97
AV034	21.10	16.77	13.93	12.86	13.27	12.92	11.18
1310	23.21	19.57	16.71	15.71	14.82	13.40	11.49
1301	16.88	10.25	6.96	4.76	4.32	4.31	3.73
AV003	44.30	31.37	20.89	16.67	14.82	12.44	11.18
AV006	16.88	12.73	8.36	8.10	7.41	7.66	7.45
AV012	18.99	10.87	6.96	4.29	3.40	2.87	2.80
AV032	25.32	15.84	9.75	7.14	5.56	4.79	4.35
AV028	14.77	13.35	11.14	9.52	9.26	9.09	7.76
AV029	21.10	13.67	9.75	8.57	8.03	7.66	6.83
AV020	21.10	13.98	9.75	8.57	7.10	6.70	5.90
AV058	14.77	11.80	9.75	8.57	8.64	8.13	7.45
AV061	44.30	41.93	39.00	34.76	30.25	26.32	22.05
AV062	10.55	11.18	13.93	18.57	22.22	24.40	25.16
AV066	35.87	26.71	19.50	17.14	13.27	11.01	9.32
AV071	14.77	11.18	9.75	9.05	8.64	9.09	8.39
AV072	18.99	12.73	8.36	6.67	5.56	4.79	4.35

Sample ID	Eu_Eu_	LaN_YbN	LaN_SmN	CeN_YbN	CeN_SmN	EuN_YbN	Sum_REE
AV 031	0.211	5.094	3.565	4.21	2.946	0.245	137.76
1309	0.15	23.842	3.707	19.729	3.068	0.75	182.9
1311	0.106	33.934	3.958	26.729	3.117	0.687	274.17
AV 019	0.193	18.618	3.584	15.679	3.019	0.766	173.88
AV 022	0.554	1.059	4.152	0.696	2.727	0.129	36.68
AV 026	0.393	6.016	3.475	4.377	2.528	0.591	55.77
1305	0.19	11.923	3.914	9.189	3.017	0.464	154.91
AV 008	0.14	34.721	4.908	28.712	4.059	0.654	460.06
AV 009	0.329	24.271	3.355	17.977	2.485	1.777	64.04
AV 016	0.101	61.159	3.994	47.668	3.113	1.097	280.87
AV 025	0.127	63	4.069	47.996	3.1	1.327	367.11
1303	0.133	7.139	3.06	6.345	2.72	0.251	94.85
AV 007	0.121	52.063	5.267	37.794	3.824	0.774	573.47
AV 014	0.108	30.768	3.63	27.983	3.301	0.646	247.88
AV 015	0.204	9.132	3.023	9.006	2.982	0.517	84.13
AV 034	0.136	12.959	4.296	10.059	3.334	0.316	233.29
1310	0.137	6.212	3.062	5.478	2.7	0.234	139.42
1301	0.111	28.316	3.302	31.04	3.62	0.695	208.48
AV 003	0.08	29.301	3.451	25.767	3.034	0.492	554.09
AV 006	0.127	37.966	4.844	28.776	3.672	0.64	388.54
AV 012	0.132	140.457	4.914	106.483	3.726	2.37	528
AV 032	0.096	65.397	3.79	52.25	3.028	1.137	441.52
AV 028	0.131	4.294	1.952	9.543	4.338	0.239	116.51
AV 029	0.174	23.049	3.476	32.656	4.924	0.835	345.45
AV0 20	0.139	23.308	3.274	17.09	2.4	0.752	219.39
AV0 58	0.244	15.903	3.941	12.096	2.998	0.769	180.05
AV0 61	0.117	5.761	3.017	4.552	2.384	0.207	250.49
AV0 62	0.277	2.049	3.482	1.643	2.793	0.134	85.49
AV0 66	0.1	16.063	3.105	13.046	2.522	0.433	271.18
AV0 71	0.153	11.568	3.362	9.366	2.722	0.404	156.41
AV0 72	0.098	25.956	3.317	20.072	2.565	0.626	180.73

Appendix 5 – Glacial till geochemistry

Sample ID	PERN10071	PERN10072	PERN10073	PERN10077	PERN10079	PERN10080	PERN10082
Coordinates							
X	3452700	3451899	3452659	3452663	3452661	3452680	3452593
Y	6700990	6701401	6701122	6701154	6701203	6701690	6700890
Concentrations							
Cd	0.3	0.1	0.5	0.2	0.5	0.1	0.1
Cu	10.5	6.8	8.2	9.2	13.7	4.9	7.4
Ni	5.9	5.3	5.8	5.4	3.7	6.3	6.5
Zn	157	95.8	159	36.2	202	52.6	62
Be	5.4	4	5.8	4.5	6.1	2.9	3.9
V	23	8	26	24	11	11	5
Cr	22.8	20.9	43.2	34.7	14.3	13.7	16.9
Co	6.6	3.5	5.5	1.2	7.8	3.3	3.4
Ga	26.9	21.5	30.4	44	48.9	19.7	21.8
Ge	0.6	0.3	1.6	0.6	0.6	0.3	0.2
As	3.6	4.1	5	0.5	4.6	2.7	0.5
Rb	226	164	176	218	251	176	171
Sr	133	168	65.5	39.1	56.7	188	160
Y	86.9	39.8	103	52.9	147	23.6	34.4
Zr	541	20	1820	857	15	123	86
Nb	3.2	2.4	87.6	3.2	1.3	0.6	0.2
Mo	0.6		5.8	2.5	0.4		
Ag	0.28	0.15	0.27	0.19	0.23	0.52	0.1
In	0.2	0.1	0.3	0.1	0.4		
Sn	3	1	18	3	4	1	
Sb	0.2		0.4	0.2	0.1		
Cs	9.02	5.12	15.2	8.53	21.2	3.39	4.21
Ba	518	515	375	312	313	604	589
La	79.9	37.2	37.5	20	98.6	21.8	39.6
Ce	182	79.6	107	41.1	233	45	77.2
Pr	23.9	10.1	16	4.6	32.3	5.7	9.4
Nd	90	37.9	66.1	16.1	128	21.1	34.2
Sm	17.9	7.4	15.9	3.6	26.9	4.3	6.5
Eu	1.33	0.93	1.05	0.48	1.51	0.84	0.98
Gd	16	6.6	15.7	4.2	25	3.9	6.3
Tb	2.4	1	2.7	1	3.9	0.6	0.9
Dy	15.4	6.8	18.8	7.9	25.2	4	6
Ho	3.2	1.5	4.2	1.9	5.4	0.9	1.2
Er	9.8	4.6	13.4	7.1	15.9	2.6	3.8
Tm	1.4	0.7	2.2	1.2	2.4	0.4	0.6
Yb	9.1	4.8	14.4	8.8	15.6	2.6	3.9
Lu	1.4	0.7	2.2	1.4	2.3	0.4	0.6
Hf	10.7	0.3	51.9	14.4	0.1	1.6	1.5
Ta	0.2	0.2	5.4	0.5			
W	0.2	0.1	7.2	0.2			
Tl	1.32	1.07	1.65	1.44	1.63	1.04	1.19
Pb	39.6	37.5	46.7	56.3	78.3	23.2	31.6
Bi	0.63	0.51	0.56	2.07	1.59	0.19	0.36
Th	24.4	17.9	21.2	42.2	49.5	10.6	14.4
U	12.6	4.6	6.7	22.6	17.7	2.2	7.4
Li	30.7	24.3	13.1	11	21.8	13.1	20.3
Na	1.69	1.8	1.44	1.8	1.19	2.13	1.98
Mg	0.4	0.4	0.3	0.2	0.5	0.3	0.3
Al	6.07	5.84	3.73	6.69	5.52	6.13	6.57
K	2.7	2.5	1.8	2.9	1.9	3.1	3
Ca	1.3	1	1.3	0.2	1.7	1.1	0.9
Mn	703	377	835	122	834	319	369
Fe	5.72	2.84	6.93	1.17	10.6	1.79	2.22
Se	0.8	0.6	1.4	0.6	2.2	0.4	0.3
Te	0.3	0.1	1	0.3	0.1	0.1	0.2
Re		0.001	0.002		0.003	0.004	

Sample ID							
	PERN10083	PERN10085	PERN10087	PERN10088	PERN10089	PERN10090	PERN10091
Coordinates							
X	3452662	3452482	3452302	3452702	3452689	3452658	3452099
Y	6701076	6701799	6700890	6701811	6701267	6701178	6700899
Concentrations							
Cd	0.3	0.1	0.1	0.2	0.2	0.2	0.1
Cu	14.1	4.6	7	3.8	8.8	8.6	4.4
Ni	4.2	6.1	2.7	5.1	4.7	11.5	4.9
Zn	214	65.2	50	66.5	64	48.4	50
Be	6.1	3.2	4.3	2.9	4.3	2.7	3.3
V	28	27	19	9	4	57	10
Cr	25	30.4	9	16	39.7	40.9	18.4
Co	8.3	2.8	1.7	3.2	2.3	4.2	3.2
Ga	33.3	18.6	34.9	20.1	30.3	36.1	21
Ge		0.2	0.5	0.3	0.3	0.5	0.4
As		2.8	3.3			4.5	0.7
Rb	279	120	118	158	150	134	180
Sr	107	184	81.9	168	101	74.1	150
Y	140	25.2	41.3	39.1	50.5	22.9	22.3
Zr	59	29	10	316	512	312	264
Nb	0.9	3.4	2.4	0.4	0.5	3.6	0.9
Mo	0.5	3.6	0.5			2.1	0.3
Ag	0.25	0.2	0.12	0.13	0.17	0.15	0.23
In	0.5		0.1		0.1	0.1	
Sn	5		2			8	2
Sb	0.1	0.1	0.2			0.4	0.1
Cs	22.6	3.45	4.75	3.36	4.52	7.9	3.64
Ba	537	583	354	585	460	338	565
La	127	27.7	55.6	32.4	47.3	20.4	19.4
Ce	257	55.2	112	72.1	96.7	39.2	40
Pr	35.3	6.8	13.4	9.2	12.2	4.4	5.1
Nd	130	24.8	48	35.2	44.4	15.7	19.3
Sm	26.6	5	9.4	7.3	9	3.4	4.1
Eu	1.63	0.95	0.99	0.97	1.11	0.77	0.82
Gd	25.9	4.6	8.9	7.3	9	3.6	4.1
Tb	4.1	0.7	1.4	1.1	1.4	0.6	0.7
Dy	26.5	4.6	8.7	7.1	9.4	4.1	4.2
Ho	5.5	1	1.7	1.5	2	0.9	0.9
Er	15.9	2.9	4.9	4.6	6.4	2.9	2.7
Tm	2.4	0.4	0.7	0.7	1	0.5	0.4
Yb	15.7	2.8	4.4	4.6	6.8	3.1	2.6
Lu	2.4	0.4	0.6	0.7	1.1	0.5	0.4
Hf				7.3	12.7	9.2	7.2
Ta		0.1	0.1			0.2	
W		0.6	0.2			0.2	
Tl	1.78	1	0.74	0.88	1.02	0.81	1.14
Pb	60.3	24.1	41.2	27.6	33.4	49.2	23.9
Bi	1.27	0.25	0.95	0.26	0.45	0.6	0.23
Th	80.4	11.9	33	14	26.9	23	8.2
U	15.2	3	13.2	3.6	8	6.3	2.9
Li	43.5	18.1	19.7	11.2	11.3	24.1	15
Na	1.34	2.01	1.08	1.84	2.29	1.77	2.07
Mg	0.3	0.3	0.2	0.3	0.2	0.6	0.3
Al	5.35	6.41	6.35	5.9	6.86	6.96	6.47
K	2.3	1.8	1.8	2.8	2.6	2.1	3.3
Ca	1.4	1	0.5	1.2	1.2	1.1	0.9
Mn	894	272	227	468	352	273	293
Fe	7.34	2.3	5.45	2.47	2.56	5.23	1.85
Se	1.9	0.3	0.6	0.3	0.3	0.4	
Te	0.1	0.6		0.2	0.4	0.2	0.2
Re		0.001				0.001	

Sample ID	PERN10092	PERN10093	PERN10094	PERN10095	PERN10096	PERN10098	PERN10100
Coordinates							
X	3451900	3452588	3452658	3451986	3452800	3452609	3452683
Y	6701595	6701777	6701112	6700969	6701696	6701709	6701225
Concentrations							
Cd	0.2	0.2	0.8	0.2	0.1	0.1	0.4
Cu	6.3	7.2	17.3	7.5	5.4	5.6	5.3
Ni	9	9.3	3.7	8.1	4.4	7.4	3.2
Zn	102	111	367	84.8	56.7	55.3	194
Be	3.3	3.7	7.3	3.5	3.3	2.8	7.8
V	34	21	26	32	20	14	6
Cr	27.8	44.7	7.6	20.9	11.4	23.2	6.4
Co	4.8	4.8	11	5.2	3	4.4	7.1
Ga	20.6	26	29.4	21.4	20.6	22.9	34.1
Ge	0.4	0.4	0.9	0.2	0.2	0.4	0.5
As	2.3	3.8	5	9.9	3.9		1.4
Rb	139	193	136	112	131	150	258
Sr	164	220	46	135	164	206	98.9
Y	28.3	32.7	162	21.1	28.1	24	142
Zr	340	43	4080	501	181	70	1410
Nb	6	0.9	70.7	19	10	0.2	0.7
Mo	1	0.4	3.6	1.3	0.9		
Ag	0.2	0.16	0.62	0.13	0.07	0.16	0.26
In			0.4				0.3
Sn	4	1	10	4	1		1
Sb	0.2		0.1	0.2			
Cs	4.93	6.05	16.3	5.11	3.72	3.96	17.3
Ba	529	752	322	509	627	615	436
La	29.4	35.7	112	18.8	26	28.4	72.4
Ce	60.8	74.1	264	39.6	55.3	57.5	194
Pr	7.6	9.1	35.4	5.2	7.1	7	28.9
Nd	28.6	33.7	137	19.5	27.2	26.5	117
Sm	5.8	6.8	30.1	4.2	5.7	5.2	26.2
Eu	0.89	1.2	1.36	0.65	1.06	1.01	1.68
Gd	5.5	6.6	31.5	4	5.5	4.9	25.5
Tb	0.8	1	5	0.6	0.9	0.7	4
Dy	5.3	6.4	32.1	4	5.2	4.3	25.4
Ho	1.1	1.3	6.7	0.8	1.1	0.9	5.3
Er	3.3	4	20.5	2.6	3.4	2.6	16.4
Tm	0.5	0.6	3.1	0.4	0.5	0.4	2.5
Yb	3.3	3.9	20	2.9	3.5	2.7	16.4
Lu	0.5	0.6	3.2	0.5	0.6	0.4	2.6
Hf	8	0.5	116	14.7	1.4	1.1	38.3
Ta	0.3		4.1	2.4	1.2		
W	0.7		3.5	1	0.6		
Tl	0.88	1.22	1.52	1.16	1.12	0.98	1.41
Pb	27.9	34.5	56	31.9	28.8	25.5	27.7
Bi	0.35	0.46	0.86	0.53	0.28	0.25	0.29
Th	16.7	16.5	89.4	10.7	9.4	13.7	13.9
U	3.9	4	12.4	2.9	2.7	3.2	8
Li	27.2	23.9	85.2	28.2	14.3	17.3	16
Na	1.74	2.41	1.33	1.94	2.11	2.21	1.95
Mg	0.5	0.5	0.5	0.4	0.3	0.5	0.5
Al	6.56	8.15	4.11	5.03	6.54	7.35	5.9
K	2.6	3.5	1.6	1.7	2.1	2.9	2.5
Ca	1	1.3	1.8	0.8	1	1.1	2.1
Mn	358	410	1300	373	350	319	1230
Fe	2.89	3.39	11	2.77	2.2	2.28	7.98
Se	0.3	0.5	1.3	0.3	0.2		1
Te	0.2	0.2	2.4	0.2	0.2	0.2	0.7
Re			0.002	0.001	0.001		0.003

Sample ID	PERN10105	PERN10106	PERN10108	PERN10109	PERN10120	PERN10129	PERN10131
Coordinates							
X	3452500	3452636	3452520	3452632	3452670	3452502	3452539
Y	6701222	6701054	6701242	6701098	6701060	6701197	6701260
Concentrations							
Cd	0.3	0.3		0.3	0.2	0.1	0.1
Cu	6	11.1	7.5	7.1	5.2	6.2	20.7
Ni	4.1	1.5	2.2	3	2.8	2.4	5.9
Zn	121	194	25.3	225	85.2	30.9	99.1
Be	5.7	5.2	3.4	6.5	4.6	5.2	5
V	10			15	7	5	42
Cr	49.5	14.4	9.3	31.1	9.5	6	88
Co	4.8	6.5	1	6.4	3	1.2	3.2
Ga	40.5	28.7	23.9	32.8	24.7	32.1	24.3
Ge	0.4	0.4	0.2	0.8	0.4	0.4	0.4
As	1.4			3	3.5	2.8	15
Rb	277	288	161	280	197	287	104
Sr	88.8	97	112	79	132	77.4	65.7
Y	94.3	95.5	23.3	102	62.5	55.7	49.7
Zr	623	54	146	487	139	379	56
Nb	2.5	1.5	0.1	5.2	0.5	0.5	7
Mo	0.1	0.2		2			5.9
Ag	0.32	0.35	0.11	0.22	0.28	0.1	0.39
In	0.2	0.3		0.3	0.1		0.2
Sn	1	2		6	2	2	4
Sb							0.6
Cs	26	15.2	4.51	19.4	6.25	6.95	5.99
Ba	397	440	574	409	522	482	270
La	48.3	77.2	19.7	67.2	53.3	33.1	59.9
Ce	120	194	36.3	166	116	71.4	129
Pr	17.2	24.7	4.2	23.4	14.8	8.6	15.9
Nd	69.6	98.8	15.3	95	55.1	32	59
Sm	15.7	20.5	3.1	20.7	11.3	7.1	11.9
Eu	1.05	1.28	1.02	1.32	1.17	0.86	1.12
Gd	15.4	19.1	3.2	20.7	10.8	6.9	11.1
Tb	2.6	2.8	0.5	3.1	1.7	1.2	1.7
Dy	17.1	18.7	3.8	19.7	10.9	8.7	10.4
Ho	3.6	3.7	0.9	4	2.3	2.1	2
Er	11.5	11.1	3	12.4	7.3	7.3	5.9
Tm	1.8	1.7	0.5	1.9	1.2	1.3	0.9
Yb	11.7	12.2	3.9	12.6	7.5	8.5	5.6
Lu	1.8	1.9	0.6	2	1.2	1.3	0.8
Hf	13	0.2	2.7	6	2.2	11.1	0.3
Ta	0.2			1.2			0.1
W	0.3		0.1	0.3			1.3
Tl	1.84	1.7	1.04	1.92	1.25	1.92	0.76
Pb	39.9	50.5	33	50.8	34.3	37.4	42.6
Bi	0.99	0.48	0.54	1.01	0.55	0.64	1.09
Th	15.1	46.3	9.3	43.4	21	32.3	65.8
U	7	7.4	5.1	6.5	5.9	10.6	11.4
Li	14.8	43.1	11.4	38	15.3	12.1	29.8
Na	1.52	1.83	2.02	1.53	1.94	2.53	0.9
Mg	0.3	0.3	0.1	0.4	0.3	0.1	0.3
Al	5.19	6.31	5.77	5.98	5.86	6.9	7.19
K	2	2.7	3.2	2.5	2.8	4.1	1.3
Ca	1.2	1.3	0.6	1.4	1.1	0.5	0.6
Mn	699	751	311	1010	489	282	275
Fe	5	7.88	1.31	8.14	3.18	1.52	6.88
Se	1.1	1.8		0.9	0.4	0.4	1.7
Te	0.3		0.2	0.3	0.2	0.3	0.1
Re	0.002	0.002	0.001	0.002			

Sample ID	PERN10132	PERN10133	PERN10136	PERN10138	PERN10141	PERN10150	PERN10151
Coordinates							
X	3452674	3452670	3452617	3452502	3452536	3452526	3452524
Y	6701209	6701087	6701262	6701175	6701196	6701260	6701221
Concentrations							
Cd	0.2	0.6	0.4	0.4	0.2	0.1	0.2
Cu	8	24.2	15.4	22.8	6.7	36	6.4
Ni	20.8	2.8	3.1	3.2	2.3	4.3	3.8
Zn	71.4	478	304	264	26.1	65.8	108
Be	3	8.9	8.3	6.9	2	5.3	4.9
V	25	23	23	16	5	21	
Cr	82.7	11.9	7.2	25.2	4.4	21.5	9.7
Co	7.5	13.8	9.9	8	0.6	1.3	4
Ga	27.7	36	42.5	33.8	28.3	61.9	38.3
Ge	0.6	1	0.8	0.9	0.5	0.7	0.3
As	4.7		1.1	7.8	2	2.1	0.8
Rb	92.3	342	339	336	304	126	213
Sr	96.4	59.2	56.7	42	39.9	59.5	121
Y	53.7	199	149	118	29.9	131	65.6
Zr	110	1910	95	262	85	303	555
Nb	1.6	25.5	3.2	13.1	6.9	0.3	0.8
Mo	0.2	2.1	1.1	4.3	0.7	0.7	
Ag	0.15	0.31	0.34	0.17		0.39	0.18
In	0.2	0.5	0.4	0.3		0.2	0.2
Sn	4	12	7	13	3	2	1
Sb				0.3	0.2		1.1
Cs	3.56	26	28.4	31.4	6.3	7.15	12.8
Ba	278	344	300	290	222	432	518
La	51.5	165	107	139	27.6	69.9	47.1
Ce	111	318	258	281	61.4	132	107
Pr	14.2	45	36.1	35.8	6.9	15.5	14
Nd	53.1	192	144	133	24.5	54.3	54.6
Sm	11	39.3	31.2	26.3	5.8	11.6	12.3
Eu	1.13	1.4	1.56	1.54	0.29	1.17	1.33
Gd	10	32.3	30.5	26.3	5.9	13.7	13.1
Tb	1.6	5.1	4.6	3.9	0.9	2.7	2
Dy	9.9	34.5	28.8	24.4	5.6	20.2	13.4
Ho	2.1	7.2	5.9	4.9	1.1	4.7	2.8
Er	6.4	21	17.7	14.5	3.3	14.7	8.3
Tm	1	3.1	2.8	2.1	0.5	2.2	1.3
Yb	6.3	21.8	17.7	13.7	3.5	13.1	8.4
Lu	0.9	3.3	2.8	2.1	0.6	1.9	1.4
Hf	1.4	40.6	0.5	2.8	1.9	5.8	15.3
Ta		3.3	0.2	0.8	0.4		
W	0.1		0.2	2.5	0.7		
Tl	0.63	2.24	2.69	2.45	2.25	0.97	1.39
Pb	42.3	62.2	80.7	83	56.9	123	48.4
Bi	1.35	1.37	1.08	2.58	0.23	2.83	1.12
Th	30.9	118	65.3	142	30.3	51	18.8
U	14.1	12.3	9.1	13.9	7.3	19.3	7.3
Li	20.2	92.4	71.3	62.4	9.4	37.5	14.7
Na	1.21	1.39	1.2	0.88	2.72	1.2	2.01
Mg	1.1	0.55	0.6	0.4	0.1	0.2	0.3
Al	5.04	4.99	6.07	6.14	7.58	7.22	6.58
K	1.4	2.15	1.9	1.8	4.1	2.2	2.9
Ca	1.6	2.3	1.6	1	0.3	0.4	1.3
Mn	523	1590	1060	769	146	174	653
Fe	5.33	14.9	13.6	11.5	0.81	2.42	3.81
Se	0.5	3.7	1.4	1.1	0.4	0.7	0.3
Te	0.1	1.6		0.3		0.2	0.4
Re		0.002	0.005			0.003	

Sample ID	PERN10152	PERN10153	PERN10157	PERN10165	PERN10167	PERN10169	PERN10173
Coordinates							
X	3452537	3452610	3452503	3452684	3452523	3452618	3452681
Y	6701221	6701140	6701115	6701114	6701202	6701164	6701246
Concentrations							
Cd	0.2	0.1	0.3	0.4	0.1	0.2	0.1
Cu	5.5	12	16.3	22.1	6.6	8.3	7.5
Ni	4.3	3	3	3.7	2.8	2.5	3.7
Zn	41.8	34.7	259	403	46.8	17.2	32.7
Be	3.5	2.8	6.6	8.8	4.8	2.6	3.1
V	15	11	27	30		4	27
Cr	11.8	7.2	7.5	6.9	2.5	7.4	12.7
Co	2.5	1.5	8.7	11.9	1.9	0.7	1.7
Ga	31.6	29.4	43.3	31.2	48.3	27.3	35
Ge	0.5	0.3	1	0.9	0.4	0.3	0.4
As	5.4	1.7	2.3	14.7		2.5	9.5
Rb	109	143	297	282	200	215	136
Sr	125	85.1	61.6	51.1	106	61.8	85.1
Y	37.2	35.3	124	206	46.3	26.6	30.7
Zr	1460	126	254	678	45	322	47
Nb	19.6	0.8	4.3	23.8	0.2	0.4	4.6
Mo	0.9		2.1	2.7			2.3
Ag	0.27	0.24	0.21	0.13	0.08	0.09	0.15
In	0.1		0.4	0.5	0.1		0.1
Sn	4		8	9	1	2	1
Sb			0.2	0.1		0.1	0.3
Cs	4.9	2.99	25.7	23.9	11.2	2.92	5.33
Ba	437	434	327	327	477	510	429
La	36.9	32.2	106	165	38.8	10.2	29.7
Ce	75.8	66.6	233	387	81.3	17.1	61
Pr	9.4	8	30.8	50.8	9.8	1.8	7.4
Nd	34.1	28.6	116	195	36.3	6.3	26.6
Sm	6.9	5.8	24.2	41.5	8.1	1.6	6.1
Eu	0.87	0.83	1.42	1.73	1.13	0.76	0.87
Gd	6.7	5.6	24	40.5	8.1	2.1	6.1
Tb	1.1	0.9	3.7	6	1.3	0.5	1
Dy	7.1	5.8	23.5	37.5	8.7	3.8	6.3
Ho	1.5	1.3	4.9	8	1.9	0.9	1.3
Er	5	4.3	14.3	23.6	6	3.5	3.7
Tm	0.8	0.7	2.1	3.5	0.9	0.6	0.6
Yb	5.5	4.7	13.4	22.3	6.3	4.3	3.5
Lu	0.9	0.8	2.1	3.4	1	0.7	0.5
Hf	37.4	0.9	1.5	8.9	1.5	4.1	0.1
Ta	0.4		0.2	1.3			
W	0.3		0.3	3.2			1.8
Tl	0.93	1.04	2.07	2.06	1.24	1.41	0.85
Pb	55.5	39.3	66	55.4	72.9	41.5	39.2
Bi	0.95	0.61	2.57	1.31	1.35	0.67	0.83
Th	26.7	17.8	65.8	99	37.6	19.4	32.9
U	9.5	11.5	9.7	9.9	13.5	9.5	15.2
Li	22.7	5.9	68.9	98.6	20.3	3.3	12.9
Na	1.67	1.74	1.35	1.25	2	2.22	1.15
Mg	0.2	0.1	0.5	0.6	0.2	0.1	0.2
Al	5.01	5.97	5.86	5.05	7.2	6.53	6.72
K	1.9	2.2	2.1	2.1	3	4.1	2.3
Ca	0.7	0.7	1.6	2.1	0.8	0.3	0.5
Mn	630	292	924	1330	355	152	243
Fe	2.37	1.57	11.7	11.5	1.91	0.83	5.01
Se	0.8	0.2	1.4	1.8	0.3	0.2	0.9
Te	0.8		0.2	0.4		0.2	0.2
Re		0.001	0.002	0.001			0.002

Sample ID	PERN10174	PERN10175	PERN10176	PERN10180	PERN10183	PERN10186	PERN10193
Coordinates							
X	3452653	3452638	3452622	3452665	3452544	3452696	3452693
Y	6701236	6701084	6701196	6701062	6701171	6701054	6701122
Concentrations							
Cd	0.4	0.2	0.6	0.2	0.2	0.3	0.2
Cu	15.6	4.7	17.2	3.6	7.5	5.1	3.2
Ni	3.5	2.9	3.8	3	3.2	4.4	4.6
Zn	220	60.2	275	99.2	72.8	144	47
Be	4.9	3.6	7.5	4.2	7.6	6.2	2.7
V	21	6	35	3	36	9	7
Cr	9.8	3.7	8.7	21.4	13.6	9	17.3
Co	8.1	2.2	9.3	3.3	1.6	5.9	2.6
Ga	31.3	21.8	35.2	25.3	19.8	30.3	24.9
Ge	0.9	0.5	0.8	0.5	0.5	0.5	0.5
As	5.4		17	3	10.7	1.2	2.8
Rb	253	155	237	199	44.5	221	133
Sr	45.7	83	64.2	145	29.6	133	98.1
Y	110	46.5	125	48.1	66.1	105	33.6
Zr	632	52	2480	52	134	995	91
Nb	9	0.3	56	0.5	13	1	0.4
Mo	3.6		5.8		3.5		0.2
Ag	0.23	0.3	0.33	0.17	0.15	0.27	0.15
In	0.3	0.1	0.4	0.1	0.3	0.3	
Sn	7		10	1	3		2
Sb	0.3		0.2		0.6		
Cs	19.3	4.01	22.7	7.59	3.1	7.78	5.91
Ba	339	413	328	560	129	525	417
La	112	46.9	95	47.2	97.3	59.8	79.4
Ce	240	97	213	98.6	198	153	141
Pr	31.6	11.8	30.3	12.2	24.6	21.3	14.6
Nd	119	41.7	114	45.4	86	83.6	47
Sm	25.3	8.5	24.4	9.4	17.5	17.8	7.9
Eu	1.55	0.99	1.3	1.08	1.26	1.44	0.9
Gd	26.9	8.8	23	9.4	16.8	18.2	7.8
Tb	3.9	1.4	3.7	1.4	2.6	2.9	1.1
Dy	23.4	9	23.6	9.3	15.6	19.1	6.8
Ho	4.6	1.9	4.9	1.9	2.9	4	1.4
Er	12.9	5.7	15.5	5.6	7.5	12.1	4
Tm	2	0.9	2.4	0.9	1.1	1.9	0.6
Yb	12.4	5.5	15.3	5.6	5.9	11.6	4
Lu	2	0.9	2.3	0.9	0.8	1.7	0.6
Hf	5.1	0.3	67.1	0.4	3.5	23.9	1
Ta	0.3		2.9		0.5		
W	0.8		4.4		1.7		
Tl	1.73	0.99	2.13	1.23	0.34	1.18	0.87
Pb	64.9	34.5	57.8	38.1	57.8	29.2	38.3
Bi	1.78	0.47	0.78	0.51	1.14	0.41	0.84
Th	98.1	17.3	71.2	57	82	14.8	33.8
U	13.3	6.9	11.1	6	34.2	5.9	5.7
Li	49.9	9.7	68.8	31.7	12.3	15.6	9.2
Na	1.09	1.53	1.33	1.82	0.38	2.2	1.21
Mg	0.5	0.2	0.5	0.3	0.1	0.4	0.2
Al	6.01	4.95	4.05	6.26	6.51	6.32	4.61
K	2.2	2.4	2	3.1	0.6	3	2.2
Ca	1.3	0.9	1.7	1	0.2	1.8	0.8
Mn	853	374	986	451	123	869	404
Fe	10.4	3.09	10.4	4.04	8.59	5.88	3.73
Se	1.1	0.3	2	0.4	2.5	1.7	0.2
Te	0.4		1.1	0.1	0.1	0.5	
Re	0.002	0.002	0.002	0.001		0.004	0.002

Sample ID	PERN10221	PERN10227	PERN10230	PERN10241	PERN10250	PERN10276	PERN10299
Coordinates							
X	3451900	3451901	3451904	3452233	3452002	3452104	3452399
Y	6701800	6701499	6701303	6701710	6701797	6701804	6701720
Concentrations							
Cd	0.2		0.2	0.1	0.1	0.1	0.1
Cu	8.5	4.4	8.4	6.9	11.4	7	7.7
Ni	4.1	8.3	9.4	6.5	11	7.5	12.6
Zn	63.3	69.7	103	78.7	103	60.9	79.1
Be	4.3	2.9	2.7	2	4	2.2	2.3
V	8	36	21	12	27	25	34
Cr	12.5	17.3	25.2	19.1	22	22.4	44.7
Co	3.1	4.4	5.1	3.3	6.1	4.3	6.3
Ga	24.9	20.9	21.3	21.4	24.7	18.2	22.2
Ge	0.6	0.5	0.5	0.4	0.5	0.2	0.4
As	3.5	5.7		2.2	5.8	1.4	
Rb	190	140	166	120	146	101	142
Sr	126	187	177	187	155	132	202
Y	47.8	22.4	27.9	21.7	37	12.5	19.8
Zr	297	17	168	11	21	268	138
Nb	0.8	2.8	0.3	2.1	4.6	12.7	
Mo	0.1	0.5			0.1	0.8	1.3
Ag	0.1	0.1	0.21	0.19	0.1	0.14	0.15
In	0.1				0.1		
Sn	4		2			3	2
Sb		0.1			0.1	0.2	
Cs	7.01	4.1	4.12	3.26	7.07	3.04	3.79
Ba	508	549	598	579	569	500	605
La	56.8	29	31.7	28.8	45.6	12.3	26.3
Ce	114	58.1	64.7	57	93.3	25	52
Pr	14	6.9	7.7	6.8	11	3.2	6.2
Nd	49.2	25.2	27.6	25.2	40.2	12	23
Sm	9.4	4.8	5.3	5.1	7.9	2.6	4.5
Eu	1.03	0.88	0.81	0.95	1.08	0.54	0.87
Gd	9	4.4	5.4	4.8	7.7	2.5	4.1
Tb	1.4	0.6	0.8	0.7	1.2	0.4	0.6
Dy	8.6	4.1	5.1	4.1	7.2	2.4	3.7
Ho	1.8	0.8	1	0.8	1.5	0.5	0.8
Er	5.4	2.5	3	2.4	4.3	1.5	2.2
Tm	0.9	0.4	0.5	0.4	0.7	0.2	0.3
Yb	5.6	2.5	3	2.5	4.4	1.6	2.2
Lu	0.8	0.4	0.5	0.4	0.6	0.3	0.3
Hf	5.9		3.3			7.4	3.5
Ta		0.1		0.2	0.3	0.9	
W		0.2		0.2	0.4	0.8	
Tl	1.2	0.89	0.91	0.87	1.11	0.85	0.87
Pb	32.9	25.6	24.2	27.8	44.7	21.2	22.8
Bi	0.45	0.25	0.32	0.27	0.99	0.19	0.21
Th	19.4	13.2	13.4	13.2	28.8	7.3	12.4
U	10.3	3.3	3.2	3.2	8.6	1.4	2.6
Li	18.2	22.1	23.5	14.2	37.9	15.6	21.3
Na	1.74	1.97	1.83	1.94	1.7	1.79	1.98
Mg	0.3	0.5	0.5	0.4	0.6	0.3	0.65
Al	6.01	6.69	6.32	6.54	7.12	4.54	6.92
K	3	2.6	3	2.5	2.5	1.9	2.75
Ca	0.9	1.1	1.1	1.1	0.9	0.7	1.2
Mn	427	342	422	290	382	287	354
Fe	2.58	2.36	2.57	2.27	3.79	1.94	2.47
Se	0.6	0.3	0.3	0.2	0.6		
Te	0.3		0.2	0.1		0.2	
Re	0.001			0.002		0.001	

Sample ID	PERN10313	PERN10315	PERN10322	PERN10323	PERN10329	PERN10332	PERN10334
Coordinates							
X	3452601	3452699	3452378	3452713	3452198	3452197	3452093
Y	6700803	6700797	6700796	6701271	6701005	6701203	6700800
Concentrations							
Cd	0.2	0.1	0.4	0.2	0.2	0.4	0.2
Cu	8	7.2	8.2	6.5	6.5	10	15
Ni	5.5	4.5	2.6	3.6	4.7	3.3	15.5
Zn	57.1	61.1	170	109	82.2	286	66.5
Be	3.4	2.8	5	4.5	3.7	6.6	2.6
V	25	17	17	17	7	12	42
Cr	16.4	10.5	5.9	5.2	14.8	7.5	33.5
Co	3	3	5.7	4.5	4.1	9.3	7.4
Ga	21.6	17.9	26.1	23.2	24.7	33.3	20.9
Ge	0.2	0.3	1	0.4	0.5	0.9	0.6
As	6.3	3.4	4.9	8.7	3.4	0.5	8.5
Rb	139	124	216	105	177	352	146
Sr	148	140	86.2	67.8	134	79.2	151
Y	28	22.7	80.2	25.2	49.8	130	23.4
Zr	542	146	1460	339	398	270	229
Nb	8.7	4.7	41.1	8.3	0.6	4.3	5.7
Mo	1.1	1.1	2.3	1.8		0.3	1.3
Ag	0.2	0.12	0.29	0.17	0.15	0.13	0.16
In			0.2	0.1	0.1	0.3	
Sn	4	1	10	1	1	4	2
Sb			0.2				0.2
Cs	3.83	3.16	12.7	4.75	7.86	22.6	4.19
Ba	531	494	442	313	515	370	522
La	32	22.3	68.9	17.8	60.2	92.7	26.8
Ce	63.8	44.8	149	39	118	222	54.8
Pr	8.1	5.7	19.3	5.1	13.8	30.3	6.9
Nd	29.3	21.3	73.4	19.7	51.2	119	26.6
Sm	5.9	4.5	15.4	4.3	10	25.9	5.6
Eu	0.73	0.69	1.08	0.58	1.05	1.38	0.78
Gd	5.2	4.5	15.9	4.3	9.8	26.3	5.1
Tb	0.8	0.7	2.5	0.7	1.5	4.1	0.7
Dy	5.1	4.3	16	4.9	9.2	26.5	4.4
Ho	1	0.9	3.3	1	1.9	5.5	0.9
Er	3.2	2.7	9.8	3.1	5.8	16	2.6
Tm	0.5	0.4	1.5	0.5	0.9	2.3	0.4
Yb	3.2	2.7	9.4	3.3	5.7	15.1	2.5
Lu	0.5	0.4	1.4	0.5	0.9	2.4	0.4
Hf	13.6	1.3	39.4	9.5	10.9	4.9	6.3
Ta	0.3	0.3	2.4	0.4		0.3	
W	0.3	0.4	2.6	1.4		0.4	
Tl	1.08	0.88	1.48	0.8	1.18	2.35	0.96
Pb	31.1	24.5	43.4	39.2	33.3	52.1	27.2
Bi	0.35	0.27	0.82	0.72	0.43	1.11	0.26
Th	8	8.9	34.3	15.4	18.8	45.1	11.7
U	5.1	2.6	7.2	3.2	8	9.6	7.9
Li	19.7	16	41.6	21.2	22.2	41.1	23.5
Na	2.08	1.8	1.52	1.05	1.82	1.48	1.66
Mg	0.3	0.2	0.3	0.2	0.3	0.5	0.7
Al	5.04	5.23	5.22	4.96	6.2	5.56	6
K	2.3	2.4	2.7	1.5	2.9	2.4	2.7
Ca	0.8	0.9	1.3	0.6	1	1.9	0.9
Mn	298	330	735	630	440	1900	347
Fe	1.87	2.08	6.03	3.81	3.15	9.51	2.82
Se	0.5		0.8		0.5	1.1	0.7
Te	0.3	0.2	0.7	0.2	0.3	0.1	0.1
Re	0.001	0.001			0.001	0.002	

Sample ID	PERN10345	PERN10353	PERN10386	PERN10394	PERN10400	PERN10401	PERN10403
Coordinates							
X	3452201	3452494	3452199	3451996	3452698	3452605	3452544
Y	6701301	6700797	6701101	6700802	6701141	6701181	6701121
Concentrations							
Cd	0.2	0.1	0.2		0.1	0.3	0.1
Cu	8.9	8.7	10.6	3.2	9.2	2.8	6.9
Ni	4.6	5.8	5.5	5	2.5	2.8	2.6
Zn	110	147	117	44.9	32.8	143	66.8
Be	5	5.2	4.8	2.7	2.6	6.4	4.5
V	25	24	15	14	2	26	23
Cr	51.5	22.4	11.1	9.5	4.6	7.3	5
Co	4.1	5.7	7.6	2.5	1.6	6.5	1.8
Ga	25.7	23.1	23.9	21.5	19.7	35.9	27.8
Ge	0.5	0.5	0.7	0.4	0.3	0.8	0.8
As	5.5	2.1	5.8	0.3	1.1	4.5	6
Rb	178	168	189	170	174	251	129
Sr	135	107	95.6	145	75.2	88.5	84.4
Y	67.4	68.8	69.4	23.9	52.9	113	43
Zr	169	73	118	66	749	1820	40
Nb	13.3	14	1	0.3	0.8	6.5	0.4
Mo	2.6	1.2	0.7			1.4	2.7
Ag	0.15	0.16	0.21	0.1	0.16	0.29	0.14
In	0.2	0.2	0.2			0.3	0.2
Sn	2	1	3		1	3	
Sb	0.1	0.2	0.2				
Cs	6.61	7.12	10.7	3.39	2.63	16.3	4.24
Ba	495	435	423	536	451	389	371
La	78.1	57.9	79.1	24.1	26.9	71.6	46.8
Ce	155	141	169	49	56.7	177	99
Pr	20.2	17.6	20.7	5.9	7.3	23.7	12.3
Nd	71.9	65.5	75.5	21.1	27.1	91.4	43.9
Sm	13.7	14.1	15.1	4.2	5.6	20.2	9.2
Eu	1.05	1.09	1.2	0.71	0.76	1.32	0.97
Gd	12.3	13.8	14.8	4	5.8	21	8.3
Tb	1.9	2.2	2.3	0.7	1.1	3.4	1.3
Dy	12.2	14.2	14.3	4.4	8.6	22.6	8.4
Ho	2.6	2.9	2.8	0.9	2.1	4.8	1.7
Er	7.5	8.4	8.3	2.9	7.6	14.1	5.1
Tm	1.1	1.3	1.3	0.4	1.4	2.2	0.8
Yb	6.9	7.6	7.9	2.7	9.1	13.3	4.7
Lu	1	1.1	1.1	0.4	1.4	2	0.7
Hf	0.7	0.6	1.1	0.4	18.4	48.4	0.4
Ta	0.9	1				0.3	
W	1.2	1.2				0.4	1.2
Tl	1.15	1.08	1.28	1.03	1.17	1.56	0.86
Pb	33.7	34.7	45	22	28.9	40.7	40
Bi	0.69	0.59	0.84	0.2	0.28	0.58	0.65
Th	31.5	39.5	36.8	11.2	24.6	41.8	38.4
U	7.5	15.3	14.4	3.2	7.5	9.4	14.6
Li	41.1	43.2	29.2	14.9	5.6	23.4	20.3
Na	1.73	1.34	1.3	1.79	1.52	1.6	1.21
Mg	0.3	0.4	0.3	0.2	0.1	0.4	0.1
Al	5.89	6.52	5.75	5.91	4.99	6	6.86
K	2.5	2.3	2.3	3.1	3.2	2.3	2.1
Ca	1.1	1	0.9	0.8	0.5	1.7	0.6
Mn	455	546	645	262	356	857	252
Fe	3.77	5.36	4.69	1.91	1.88	7.56	2.95
Se	1.4	1.1	0.7		0.3	1	0.7
Te	0.1		0.2		0.4	0.9	0.2
Re			0.001	0.001		0.003	0.001

Sample ID	PERN10409	PERN10411	PERN10413	PERN10416	PERN10421	PERN10424	PERN10428
Coordinates							
X	3452726	3452699	3452599	3452722	3452581	3452564	3452579
Y	6701188	6701182	6701133	6701169	6701260	6701201	6701221
Concentrations							
Cd	0.2	0.1	0.3	0.3	0.2	0.3	
Cu	3.7	11.1	6	9.2	6.9	19.8	6.4
Ni	2.7	4	2.5	2.7	3.6	3	2.4
Zn	51.9	51.2	165	191	89.7	192	25.7
Be	2.4	3.9	5.3	5.1	4.7	8.2	3.3
V	22	33	17	25	28	25	2
Cr	15.4	19	4.2	20.8	27	9.3	5.7
Co	2	2.3	6.1	5.7	3.3	6.7	1.5
Ga	25.4	27.7	33.5	31.3	38.2	34.1	27
Ge	0.5	0.5	0.9	0.9	0.7	1.2	0.4
As	7.9	8.9	1.9	4.2	10.3	13.9	
Rb	119	84.3	227	289	191	191	113
Sr	83.9	62.9	57.3	115	208	42.7	112
Y	27	69.7	95	85.3	31.9	124	25.6
Zr	68	109	443	687	637	74	256
Nb	2	4.2	8.3	5.5	28.6	4.7	0.1
Mo	1.2	3.3	0.6	2	5.5	3.8	
Ag	0.12	0.24	0.21	0.29	0.26	0.39	0.09
In	0.1	0.1	0.3	0.3	0.1	0.4	
Sn		2	2	9	8	5	1
Sb	0.1	0.2		0.2	0.3		
Cs	4.54	4.35	17.6	13.6	7.04	16.3	1.77
Ba	384	247	320	463	577	238	496
La	27.3	55.7	68.9	57.9	28.7	107	20.5
Ce	58.8	145	159	152	61.2	270	38.8
Pr	7.1	20.1	22	19.3	7.2	33.9	4.4
Nd	26.9	75.6	83.8	77.6	27.5	127	16.1
Sm	5.7	17.3	18.1	16.4	5.7	27.7	3.4
Eu	0.81	1.52	1.16	1.14	1.01	1.65	1.04
Gd	5.5	15.9	19	15.2	5.8	27.7	3.8
Tb	0.8	2.6	3	2.3	0.9	4.5	0.6
Dy	5.1	16.2	19.2	15.3	6	29.2	4.5
Ho	1.1	3.2	4	3.2	1.2	5.8	1
Er	3.3	9.3	11.6	9.7	3.8	16.6	3.5
Tm	0.5	1.4	1.7	1.5	0.6	2.5	0.6
Yb	3.3	8.1	10.5	10.6	4.1	14.6	4
Lu	0.5	1.1	1.7	1.6	0.7	2.1	0.7
Hf	0.5	1.5	7	12.3	17	0.8	3.7
Ta			0.6	0.1	1	0.1	
W	0.3	1.4	0.5		0.9	0.4	
Tl	0.82	0.61	1.61	1.59	1.01	1.27	0.79
Pb	34.1	36.4	51.3	55.2	42.7	52	32.3
Bi	0.41	0.61	0.67	0.62	0.83	2.19	0.36
Th	19.6	38.5	38.5	66.7	19.7	125	12.7
U	4.3	24.3	8.5	6.6	3.7	28.3	6.3
Li	14.7	31.2	33.7	29	21.3	54.4	6.5
Na	1.17	0.87	1.23	1.81	2.52	0.74	1.87
Mg	0.2	0.2	0.3	0.3	0.2	0.4	0.1
Al	5.89	7.22	4.9	6.26	8.39	6.16	6.27
K	2	1.3	2.3	2.8	2.8	1.4	2.7
Ca	0.6	0.5	1.4	1.3	1.3	1.1	1.1
Mn	289	225	750	790	412	667	388
Fe	3.11	4.42	7.96	7.89	5.96	11.4	1.6
Se	0.6	1.5	1	2.3	1.4	1.4	
Te		0.1	0.2	0.6	0.8	0.1	
Re			0.003		0.001		0.002

Sample ID	PERN10436	PERN10437	PERN10441	PERN10445	PERN10447	PERN10449	PERN10451
Coordinates							
X	3452703	3452582	3452539	3452561	3452581	3452600	3452558
Y	6701195	6701121	6701146	6701214	6701141	6701200	6701237
Concentrations							
Cd	0.2	0.3	0.3	0.2	0.3	0.5	0.3
Cu	7.1	9.5	8.2	8	1.9	8.2	5.9
Ni	5.3	3	2.8	3.4	2.4	4.9	2.7
Zn	74.7	128	163	63.2	68.7	172	136
Be	4.4	4.7	5.1	3	4.3	5.8	5.2
V	10	26	11	26	18	35	22
Cr	17.4	7	5.3	18.4	9.7	10.5	5.8
Co	3.8	4.6	6.2	3	3.3	8.4	5.6
Ga	31.2	23.3	29.6	27.4	27.7	39.6	31.8
Ge	0.4	1.5	1	0.9	1.1	1.4	0.8
As	4	8.6	1.1	10.7	2.4	7.7	2.5
Rb	178	119	156	147	201	273	228
Sr	159	39.7	51.4	104	113	83.6	72.8
Y	58	76.7	96.2	42.3	58.9	119	84.6
Zr	995	1170	24	722	1220	2380	199
Nb	0.3	40.9	0.8	6.7	19.3	20.4	4.8
Mo		4.3	0.8	1.8	0.6	2	1
Ag	0.19	0.31	0.17	0.21	0.24	0.33	0.14
In	0.1	0.2	0.3	0.2	0.1	0.3	0.3
Sn		8	4	6	4	9	2
Sb		0.5		0.2	0.1	0.1	
Cs	3.8	10.2	13.1	5.84	4.79	18	15.1
Ba	666	194	260	419	505	460	364
La	40.2	73.8	86.4	34.9	33.3	69.3	56.2
Ce	93.8	162	191	83.1	79.6	173	137
Pr	12	20.6	24.6	10.5	10.6	23.3	18.8
Nd	46.2	76.7	92.2	39.9	40.3	90	72.7
Sm	9.7	16.1	19.5	8.5	8.9	19.8	16
Eu	1.25	1.08	1.17	0.93	0.88	1.41	1.09
Gd	9.6	15.9	20.2	7.9	8.8	19.9	16.9
Tb	1.5	2.6	3.2	1.3	1.5	3.3	2.7
Dy	10.3	16.6	19.8	8.1	10.3	21.3	16.9
Ho	2.2	3.3	4	1.7	2.3	4.6	3.5
Er	7.1	9.4	11.3	5.1	7.3	13.8	10.3
Tm	1.1	1.4	1.7	0.8	1.2	2.1	1.6
Yb	7.2	8.2	10	4.9	7.4	13.1	9.5
Lu	1.1	1.2	1.5	0.7	1.1	2	1.5
Hf	24.3	28.8	0.1	18.3	31.4	57.4	1.5
Ta		2.5			0.2	0.3	0.3
W		4.8		0.2	0.1	0.2	0.4
Tl	1.1	0.84	0.95	0.91	1.25	1.83	1.59
Pb	31.1	36.6	41.8	44.8	28	44.2	43.3
Bi	0.22	0.67	0.95	0.61	0.36	0.65	0.8
Th	14	67.6	31.4	38.8	16.4	25.8	34.8
U	6	13.9	17.3	6.3	4.8	9.7	6.3
Li	8.7	34.9	39.7	25.6	9.4	20.1	24.1
Na	2.41	0.66	0.93	1.4	2	1.64	1.22
Mg	0.3	0.3	0.4	0.2	0.2	0.5	0.4
Al	7.27	5.13	4.87	5.82	5.83	5.78	5.26
K	3.6	1.2	1.5	2.3	3.3	2.8	2.2
Ca	1.5	0.8	1.2	0.8	1.2	1.8	1.3
Mn	643	459	662	369	590	1040	692
Fe	3.63	6.66	9.43	4.38	3.36	8.38	8.08
Se	0.4	2	0.4	0.5	0.3	1.2	0.8
Te	0.4	0.5		0.2	0.5	0.9	0.1
Re	0.001		0.003	0.001	0.001	0.002	0.001

Sample ID							
	PERN10456	PERN10458	PERN10461	PERN10462	PERN10463	PERN10469	PERN10475
Coordinates							
X	3452690	3452607	3452580	3452582	3452498	3452557	3452717
Y	6701100	6701156	6701162	6701238	6701238	6701131	6701045
Concentrations							
Cd	0.4	0.2	0.3	0.4	0.2	0.2	0.2
Cu	12.7	3.6	5.2	8.9	14.1	7.5	2.4
Ni	3.3	2.5	2.8	2.7	2.2	4.6	3.5
Zn	337	65	85.3	210	32.5	97.7	78.9
Be	7.4	4.4	4.9	6.5	2.7	4.1	3.8
V	26	11	13	20	6	16	9
Cr	6.7	6.7	7.4	7.4	4	12.7	9.1
Co	10.3	2.8	3.9	7.2	1.4	4.3	3.4
Ga	33.9	25.6	30	28.8	26.4	23.1	23.6
Ge	1.5	0.7	1	0.8	0.4	0.8	0.4
As	6.7	2.8		9.2	0.5	3.2	3.2
Rb	484	184	198	249	192	145	175
Sr	64.8	108	98	73.4	88.8	110	139
Y	170	61.5	74.7	138	47.5	71.2	49.4
Zr	631	1280	1100	184	99	925	466
Nb	5.4	2.1	1.8	5.6	0.2	11.5	0.4
Mo	1.9	0.2	0.3	0.4		1	
Ag	0.27	0.22	0.3	0.17	0.1	0.18	0.15
In	0.4	0.1	0.2	0.3		0.1	0.1
Sn	11	3	5	5	2	5	
Sb			0.1			0.1	
Cs	26.5	3.17	7.42	16.5	5.82	7.19	4.47
Ba	385	523	479	338	446	451	491
La	124	37.6	51	109	45.6	92.4	34.7
Ce	287	88.2	116	246	93.8	190	80.9
Pr	37.8	11.4	15	32.1	11.7	23.8	10.6
Nd	147	43.9	56.3	121	41	85.7	40.2
Sm	30.8	9.3	12	24.7	8.8	16.9	8.8
Eu	1.59	1.17	1.26	1.37	0.83	1.44	1
Gd	30.9	9.4	12.4	24.9	8.3	17.1	8.6
Tb	4.7	1.5	2.1	4	1.3	2.5	1.4
Dy	30.1	10.4	13.9	25.1	8.3	14.6	8.8
Ho	6.3	2.4	3	5.3	1.7	2.9	1.8
Er	19.4	7.5	9.4	15.4	5	8.2	5.8
Tm	3	1.2	1.5	2.3	0.8	1.2	0.9
Yb	18.6	7.5	9.1	14.1	4.8	7.6	5.9
Lu	2.9	1.2	1.4	2.2	0.8	1.1	0.9
Hf	9.3	32	28.4	1.4	1.1	25.8	10.4
Ta	0.2			0.4		0.2	
W	0.3			0.9		0.1	
Tl	2.78	1.17	1.26	1.83	1.26	1.06	1.05
Pb	72.4	30.4	34.7	47.8	41.3	29.2	25.2
Bi	2.07	0.2	0.55	1.76	0.4	0.63	0.27
Th	105	15.3	27.4	61.2	33	34.8	16.8
U	14.2	6	7.8	8.5	9.8	12.3	4.4
Li	63	7.9	15.1	34.4	6.8	38.1	13
Na	1.25	1.98	1.79	1.51	1.59	1.54	1.87
Mg	0.6	0.2	0.2	0.5	0.1	0.3	0.3
Al	5.22	5.97	5.87	5.19	5.45	6.51	5.87
K	2.5	3.4	3	2.1	3.1	2.5	2.8
Ca	1.8	1.1	1.3	1.9	0.6	1	1.1
Mn	1190	538	695	924	331	528	541
Fe	11.6	3.01	4.15	8.46	1.67	3.14	2.85
Se	1.2	0.6	0.4	1.3		0.7	0.5
Te	0.4	0.5	0.5	0.2	0.1	0.4	0.2
Re	0.002		0.003	0.001	0.002	0.002	0.002

Sample ID	PERN10476	PERN10477	PERN10478	PERN10482	PERN10488	PERN10493	PERN10494
Coordinates							
X	3452727	3452718	3452722	3452716	3452595	3452561	3452599
Y	6701238	6701229	6701096	6701070	6701264	6701260	6701235
Concentrations							
Cd	0.2	0.2	0.2		0.3		0.3
Cu	5.4	14.3	4.5	5.4	9.3	6.2	10.1
Ni	3.9	2.8	4.3	8	3	4	7.3
Zn	108	51.4	117	145	189	32.8	165
Be	4.8	8.3	4.6	4.4	5.6	2.6	6.4
V	27	23	27	37	26	11	27
Cr	7.6	8.1	7.1	38.6	11.4	17.1	15.3
Co	5.2	5.1	4.5	3.9	6.4	2.1	5.6
Ga	31.1	18.1	25.3	21.9	35	26	38.9
Ge	0.6	0.7	0.7	0.4	0.9	0.3	1.1
As	11.5	15	6.8	5.3	10.9	1.6	5
Rb	127	35.9	150	155	228	164	239
Sr	71.8	24	142	175	54.4	123	119
Y	35.3	194	41.5	35	98.8	21.8	92.6
Zr	394	44	29	49	356	389	390
Nb	9.2	3	1.1	5.5	25.7	0.1	0.9
Mo	2	4.3	0.9	2.6	3.3		1.5
Ag	0.19	0.3	0.13	0.53	0.16	0.31	1.29
In	0.2	0.1	0.1		0.2		0.3
Sn	3	3		1	6	1	9
Sb	0.2	0.2		0.2	0.2		0.2
Cs	5.05	2.16	4.18	4.64	19.8	8.05	12.6
Ba	238	85	433	590	264	533	484
La	30.8	237	33.6	44.1	85.4	22.4	65.7
Ce	70.5	611	73.5	88.8	188	43.8	153
Pr	7.9	62.4	9.3	10.6	25	5.2	19.7
Nd	28.9	213	34.4	37.5	94.9	18.2	73.9
Sm	6	36.3	7.1	7.4	20	3.7	15.7
Eu	0.88	2.93	0.94	1.07	1.24	0.81	1.38
Gd	5.9	39.6	7.2	7.7	20.2	3.5	15.8
Tb	1	5.6	1.2	1.2	3	0.6	2.6
Dy	6.2	31.9	7.6	7.2	18.4	3.7	17.1
Ho	1.3	6.4	1.6	1.4	3.8	0.8	3.6
Er	4	17.2	4.8	4	11.2	2.6	10.7
Tm	0.6	2.3	0.8	0.6	1.7	0.4	1.7
Yb	3.8	12	4.7	3.6	10.6	2.9	10.3
Lu	0.6	1.7	0.7	0.5	1.7	0.4	1.6
Hf	10.2	1.1	0.3	0.3	4.1	8.9	5.3
Ta	0.3				0.6		
W	1.8	1.6		1	4.8		
Tl	0.75	0.28	0.87	0.98	1.68	1.17	1.52
Pb	44	37.1	35.6	27.1	58.3	29.8	43.4
Bi	1.35	0.93	0.73	0.39	1.08	0.99	0.9
Th	31.9	56.3	21.2	24	48.5	10.5	51.3
U	5.1	32.6	4.3	6.3	10.6	3.4	10.9
Li	23.2	15.7	24.8	34.7	36.5	9.3	42.6
Na	0.94	0.27	1.61	1.81	1.13	1.7	1.78
Mg	0.2	0.1	0.3	0.4	0.4	0.2	0.4
Al	6.45	8.95	6.44	7.39	5.36	5.41	7.16
K	1.1	0.4	2.2	2.8	1.7	2.9	2.7
Ca	0.6	0.2	1.05	1.1	1.2	0.8	1.5
Mn	570	200	670	307	726	319	673
Fe	4.69	4.22	4.6	3.17	8.46	1.81	7.04
Se		2.7		0.3	0.9		0.8
Te	0.2				0.2	0.2	0.2
Re					0.003		0.001

Sample ID							
	PERN10496	PERN10498	PERN10503	PERN10509	PERN10511	PERN10531	PERN10545
Coordinates							
X	3452716	3452580	3452200	3452600	3452002	3452103	3452704
Y	6701131	6701202	6701400	6701218	6701198	6701305	6701221
Concentrations							
Cd	0.1	0.3	0.3	0.3	0.2	0.2	0.1
Cu	7	6.3	4.4	5.3	34.9	12.5	16.5
Ni	4.7	2.4	5.9	3.3	18.1	18.6	4.7
Zn	130	117	134	188	44.7	141	116
Be	4.7	5.8	4.1	6.4	2.3	4.1	7.2
V	24	5	17	6	38	52	24
Cr	40.1	6.5	10.6	24.6	33.7	30.6	16
Co	5.1	4.3	4.7	6.3	4.5	14.6	4.2
Ga	21.3	30.7	21.7	36.5	14.9	25.5	26.9
Ge	0.7	0.6	0.6	0.9	0.4	0.6	0.8
As	4.8	1	2.7	2.9	6.4	4.8	11.1
Rb	195	172	175	303	83.2	186	118
Sr	127	90.1	109	71	82.8	176	73.5
Y	49.4	89.4	66.5	118	60	39.7	88.9
Zr	104	1100	1400	21	7	535	43
Nb	4	0.5	14.1	0.4	2.2	7.1	1.9
Mo	4	0.1	0.7	0.3	2.3	1.1	2.8
Ag	0.2	0.31	0.51	0.18	0.1	0.2	0.13
In	0.1	0.2	0.2	0.4			0.2
Sn	2	4	3	5	2	4	2
Sb	0.1				0.4	0.2	0.2
Cs	7.91	7.44	6.07	20.7	3.14	5.64	7.58
Ba	492	445	460	371	318	662	231
La	46.2	47.7	52.7	63.1	98.4	49.4	111
Ce	103	118	119	164	191	132	232
Pr	12.5	15.7	15.9	23.7	24.6	11.7	26.4
Nd	46.6	61.4	59.9	92.4	87.6	42.5	93
Sm	9.5	14.1	12.7	21.8	17	8.3	18.7
Eu	1.01	1.31	1.04	1.24	1.76	1.12	1.63
Gd	9.6	14.6	12.8	22.4	16	8.2	18.8
Tb	1.5	2.4	2	3.7	2.2	1.2	2.9
Dy	9.6	16.4	12.7	22.9	11.8	7.3	17.2
Ho	2	3.5	2.6	4.7	2.2	1.5	3.4
Er	5.8	11.1	7.7	13.9	6	4.3	9.4
Tm	0.9	1.8	1.3	2.2	0.8	0.7	1.4
Yb	5.3	12	7.8	13.4	4.7	4.1	8.3
Lu	0.8	2	1.2	2.1	0.7	0.6	1.2
Hf	0.6	29.1	36.1	0.2		13.1	0.4
Ta			0.8			0.1	
W	0.8		0.9		0.8	0.4	0.4
Tl	1.2	1.12	1.18	2.05	0.61	1.21	0.76
Pb	36.8	38.6	33	48.7	23.5	29.2	40.8
Bi	0.47	0.53	0.69	0.62	0.31	0.37	0.94
Th	33.5	30	28.1	27	20.4	28	52.4
U	6.6	9.4	6.2	7.7	32	6.6	25.1
Li	31.1	19.2	20.9	26	18.4	43.1	35
Na	1.5	1.75	1.54	1.44	0.85	1.89	0.92
Mg	0.3	0.3	0.3	0.4	0.3	0.8	0.2
Al	5.72	6	5.53	5.84	4.81	8.4	8.34
K	2.6	2.7	2.5	2.4	1.6	3.3	1.1
Ca	1	1.3	1.1	1.5	0.4	1.1	0.7
Mn	582	678	837	822	158	765	285
Fe	4.55	5.29	4.84	8.7	2.42	3.64	5.05
Se	0.2		0.1	0.9	0.8	0.2	0.9
Te		0.4	0.6			0.2	
Re	0.001	0.002	0.001	0.001	0.002	0.003	0.001

Sample ID	PERN10546	PERN10555	PERN10557	PERN10561	PERN10565	PERN10567	PERN10568
Coordinates							
X	3452705	3452558	3452105	3452103	3452698	3452698	3452002
Y	6701241	6701160	6701101	6701206	6701085	6701276	6701102
Concentrations							
Cd	0.2	0.3	0.4	0.1	0.3	0.3	0.1
Cu	11.2	4	8.5	3.8	5.6	8.7	4.9
Ni	4.4	2.7	3.7	2.3	4.4	3.4	7.4
Zn	120	147	212	36.3	130	183	83.7
Be	6.9	5.4	7.1	2.1	4.8	6.2	2.3
V	36	12	17	12	23	20	34
Cr	18	11.6	9.3	10.5	51.2	8.9	17.8
Co	3.9	6	7.9	1.4	5	6.3	3.8
Ga	35.4	30.6	32.1	18.2	23.1	32.2	18.9
Ge	0.4	1.2	1.1	0.4	1.1	0.9	0.6
As	9.6	6.5	2.3	2.9	3.8	3	3
Rb	84.4	263	303	149	173	284	138
Sr	80.5	82.7	88.6	102	123	85	177
Y	37.2	108	143	20.9	102	102	21.1
Zr	193	1290	1400	615	1020	216	134
Nb	2.2	1.6	0.8	8.3	12.8	1.3	2
Mo	3.2	0.4	0.6	0.7	3.4	1	0.7
Ag	0.49	0.23	0.34	0.13	0.61	0.17	0.16
In	0.2	0.3	0.4		0.2	0.3	
Sn		7	8	3	8	8	2
Sb			0.1		0.2	0.2	0.2
Cs	5.78	17.3	16.3	2.32	6.26	17.4	3.48
Ba	244	401	400	461	470	373	540
La	23.7	65.6	89.9	21.5	120	62.7	25.9
Ce	56.8	166	228	47	217	158	52.2
Pr	7.2	23.1	31.7	6	27.7	21.6	6.3
Nd	28	91.1	123	21.4	99.6	83.3	22.5
Sm	6.5	20.1	26.9	4.6	19	18.4	4.5
Eu	0.91	1.38	1.47	0.57	1.39	1.23	0.83
Gd	6.6	20.1	27.4	4.2	18.8	18.3	4.4
Tb	1.1	3.2	4.5	0.6	2.8	3	0.6
Dy	7.1	19.7	28	3.8	17.7	19.2	3.9
Ho	1.5	4.1	5.8	0.8	3.7	4	0.8
Er	4.6	12.2	16.9	2.4	10.7	11.7	2.4
Tm	0.7	1.9	2.5	0.4	1.6	1.8	0.4
Yb	4.4	12	15.6	2.6	9.8	11.1	2.4
Lu	0.7	1.9	2.4	0.4	1.5	1.7	0.4
Hf	3.5	34.9	38	16.5	26.6	2.4	2
Ta	0.2			0.2	0.6		
W	1.4			0.3	0.5		0.2
Tl	0.7	1.47	1.97	1.05	0.99	1.68	0.88
Pb	39.9	30.3	46.3	26.5	37.6	51.2	24
Bi	0.89	0.53	0.79	0.23	0.41	1.95	0.24
Th	23.4	14.3	33.5	12.5	28.6	39.7	12.2
U	4.1	7.6	8.3	3	7.1	7.3	4.2
Li	28.7	12.8	17.7	7.4	24.1	27.3	16.4
Na	1.04	1.5	1.51	1.57	1.57	1.32	1.75
Mg	0.2	0.4	0.5	0.1	0.3	0.4	0.4
Al	9.3	5.23	5.24	4.34	5.29	5.5	6.02
K	1.1	2.4	2.5	2.8	2.4	2.1	2.6
Ca	0.7	1.6	2	0.5	1.3	1.5	1.1
Mn	363	900	1070	266	608	867	305
Fe	5.76	6.66	8.52	1.69	3.8	8.32	2.09
Se	0.3	1.1	0.6		0.4	0.6	
Te	0.2	0.5	0.5	0.2	0.4		
Re	0.001	0.001	0.001	0.001	0.003	0.005	

Sample ID	PERN10576	PERN10592	PERN10593	PERN120114	PERN120115	PERN120116	PERN120117
Coordinates							
X	3452518	3452415	3452114	3452082	3452090	3452112	3452114
Y	6701123	6701398	6701400	6701015	6701030	6701242	6701226
Concentrations							
Cd	0.4	0.2	0.1	0.1			0.1
Cu	5.1	7.6	2.8	6	6.7	4.4	5.3
Ni	2.6	4.7	3.2	4	8.3	2.8	2.8
Zn	164	87.1	30.2	62.4	50	31.4	64.2
Be	6.3	5.7	3	3.9	3.4	2.6	3.6
V	20	16	2	18	33	11	22
Cr	7.2	65.2	11	13.7	29.1	9.6	12.2
Co	6.1	3.5	2.1	2.7	4.2	1.6	2.3
Ga	42	23.2	18	15	14.1	17.3	22.3
Ge	1.1	0.8	0.4	0.1	0.1	0.1	0.2
As	3.7	4	2.4	4.5	2.2	2.6	6.8
Rb	277	175	172	43.1	45.8	52.5	70
Sr	66.5	112	139	136	194	122	120
Y	115	70.3	21.4	31.5	31	21.1	37.8
Zr	876	417	354	1	12	30	15
Nb	1.1	0.6	0.1	1.7	1.4	1.4	1.2
Mo	0.7	2		1	1	0.5	1.1
Ag	0.22	0.2	0.13				
In	0.3	0.2					0.1
Sn	8	5				1	
Sb	0.1	0.1					
Cs	19.4	8.2	2.82	3.45	3.18	3.65	6.03
Ba	346	430	559	414	510	504	459
La	69.5	64.1	19	33.8	49.2	22	38
Ce	175	138	40.6	72.8	123	45.2	82.1
Pr	24.1	17.2	5	9.1	11.2	5.6	10.6
Nd	92.9	62.6	18.7	33.1	40.5	20.1	38.5
Sm	20.5	13.4	4.1	6.9	7.5	4	7.8
Eu	1.39	1.21	0.81	0.84	1	0.74	0.85
Gd	20.8	13.5	4	5.6	6.5	3.3	6.6
Tb	3.4	2.2	0.6	1	1	0.6	1.1
Dy	21.8	13.7	3.9	6.2	5.9	3.9	7.3
Ho	4.6	2.8	0.8	1.2	1.1	0.8	1.5
Er	13.8	8	2.5	3.6	3.3	2.6	4.4
Tm	2.1	1.2	0.4	0.6	0.5	0.4	0.7
Yb	12.8	7.6	2.5	3.8	3.3	2.9	4.8
Lu	2	1.1	0.4	0.6	0.5	0.4	0.7
Hf	22.4	6.7	9.3			0.3	
Ta							
W				0.3			
Tl	1.54	1.02	1.09	0.93	0.82	1.16	1.15
Pb	50.8	31.9	19.8	30.4	33.5	32.7	48.2
Bi	1.13	0.56	0.14	0.36	0.27	0.33	0.61
Th	28.6	36.5	8.3	21.2	17.6	11.8	22.8
U	11.1	11.7	3	13.3	10	3.2	7
Li	22.6	20.3	11.1	21	25.4	9.2	16.3
Na	1.33	1.59	1.9	1.72	2.02	1.69	1.6
Mg	0.4	0.3	0.2	0.21	0.4	0.12	0.2
Al	5.44	6.48	5.93	5.93	6.43	5.26	5.56
K	2.1	2.4	3.3	0.38	0.57	0.49	0.7
Ca	1.6	1	0.8	0.79	1.16	0.67	0.87
Mn	862	550	274	346	338	250	356
Fe	8.97	4.6	1.58	2.31	2.17	1.73	3.34
Se	0.7	0.3		0.3	0.4		0.7
Te	0.3	0.2	0.2				
Re	0.003	0.001		0.002			

Sample ID	PERN120118	PERN120119	PERN120120	PERN120121	PERN120122	PERN120123	PERN120124
Coordinates							
X	3452120	3452180	3452200	3452220	3452238	3452244	3452220
Y	6701180	6701240	6701241	6701232	6701232	6701219	6701220
Concentrations							
Cd		0.3	0.3	0.3	0.4	0.4	0.2
Cu	5.7	14.7	5.5	12.3	11.5	15.7	9.3
Ni	2.8	6.8	5.6	5.5	2.6	3.4	3.8
Zn	23.4	108	124	91.3	124	297	121
Be	2.2	7.7	5	7.3	7.3	8.2	5.6
V	6	59	6	40	50	25	20
Cr	14.5	20	10.6	27.3	17.4	7.7	8.9
Co	1.4	20.1	5.7	3.8	3.7	10.1	3.9
Ga	15	26.4	22.8	23	35.9	28.2	24.6
Ge	0.2	0.2	0.3	1.2	0.3	0.5	0.3
As	0.2	27.7	0.5	16.5	26.6	5.1	6
Rb	51.2	50	66.4	57.4	110	93.8	69.5
Sr	107	30.7	132	68.3	32.7	57.7	99.3
Y	27.8	39	78.2	91.3	80.2	144	64.2
Zr	181	8	651	585	8	20	16
Nb	0.7	13.7	0.9	30.8	12.2	2.1	1.6
Mo		8.3		8.5	8.8	1.5	2.2
Ag	0.07		0.15				0.12
In		0.3	0.2	0.3	0.3	0.4	0.2
Sn		4	1	7	3	2	
Sb		0.7		0.6	0.5		
Cs	2.66	3.23	10.3	5.58	10.9	21.6	8.26
Ba	421	143	496	257	176	281	411
La	31.5	66.5	65.2	103	110	138	53.9
Ce	66.8	132	147	215	217	324	127
Pr	8.3	15.2	19.9	28.5	27.5	42.1	16.6
Nd	29.8	52	78	101	95.7	163	62.9
Sm	6.1	9.4	15.7	20.3	18.6	32.1	13.4
Eu	0.63	0.69	1.06	1.33	1.03	1.43	1.08
Gd	4.9	7.9	13.9	17.1	15.3	27.1	11.2
Tb	0.8	1.3	2.4	3.1	2.7	4.7	2
Dy	5.1	8	15.3	19.1	16.3	29	12.9
Ho	1	1.6	3.1	3.6	3.2	5.8	2.6
Er	3	4.3	9.1	10.1	8.9	17.1	7.4
Tm	0.5	0.6	1.4	1.5	1.3	2.5	1.1
Yb	3.4	3.7	9.5	9.7	8.3	16.7	7.7
Lu	0.5	0.5	1.5	1.3	1.2	2.6	1.2
Hf	1.8		11.9	15.1			
Ta	0.1	0.2		2			
W		2.8		3.6	3.9		
Tl	1.13	0.48	1.28	0.66	0.69	1.89	1.25
Pb	28.9	88.9	28.5	46.3	62.4	62.2	43.3
Bi	0.19	1.71	0.38	0.96	1.84	1.61	0.82
Th	19.7	47.7	16.3	65.7	54.7	86	36.7
U	5.1	14	6.8	19.3	21.3	15.9	7.9
Li	6.9	18.9	32.6	33.4	22.5	91	29.9
Na	1.69	0.33	1.76	0.83	0.55	1.15	1.39
Mg	0.09	0.16	0.41	0.28	0.19	0.49	0.21
Al	5.11	4.15	5.82	6.23	4.69	4.76	5.74
K	0.48	0.5	0.56	0.58	0.62	0.4	0.5
Ca	0.59	0.28	1.44	0.77	0.7	1.94	0.93
Mn	276	1490	766	355	407	1150	505
Fe	1.47	17.3	4.69	9.79	13.6	11.6	5.32
Se	0.3	2.5	1.2	3.2	2.6	2.6	1.1
Te							
Re		0.001		0.002	0.003		

Sample ID	PERN120125	PERN120126	PERN120127	PERN120128	PERN120129	PERN120130	PERN120131
Coordinates							
X	3452203	3452180	3452162	3452179	3452190	3452234	3452201
Y	6701221	6701218	6701200	6701198	6701197	6701177	6701180
Concentrations							
Cd	0.1	0.2	0.1	0.3	0.1	0.2	0.5
Cu	9.2	17.7	7.3	12.3	6.4	6.6	8.5
Ni	2.9	22.3	4.2	8.3	4.9	3.1	3.4
Zn	52.3	206	70.6	184	73	66.3	277
Be	4.1	4	4	6.8	3.6	5.2	5.7
V	27	58	21	27	7	4	30
Cr	11.7	51.9	13.6	23.6	11.9	5.8	8.8
Co	2.1	13.9	2.9	7.7	3.3	2.9	8.2
Ga	23.8	25.5	22	22.6	26	21.9	29.9
Ge	0.1	0.4	0.6	0.5	0.5	0.2	1.4
As	9.7	7.8	6.2	6.4	3.4	0.5	12.8
Rb	91.2	71.9	67.1	73.2	63.1	43.2	114
Sr	99.2	115	134	140	127	109	63.8
Y	41.6	35.3	30.4	57.2	41.5	57.3	102
Zr	20	46	81	35	10	443	1680
Nb	2.8	1.8	6	4.4	0.9	0.3	31.7
Mo	3.7	1.1	1.5	0.7			3.6
Ag	0.07	0.38	0.09	0.08	0.13	0.17	
In	0.1	0.2	0.1	0.2	0.1	0.2	0.3
Sn	1	4	2	2	2		13
Sb							
Cs	6.23	6.53	4.31	5.43	7.94	3.96	24.7
Ba	389	468	490	431	488	445	302
La	51.1	53.8	27.9	50.9	46.4	47.1	75.7
Ce	108	102	60.8	117	100	105	182
Pr	13.3	12	7.7	14.7	12.2	13.8	25.9
Nd	48.4	43.2	28.9	54.5	44.5	51.7	99.7
Sm	9.4	7.7	6.1	11.2	8.6	10.7	20.8
Eu	0.95	0.84	0.87	1	0.94	1.06	1.11
Gd	8	6.3	5.1	9.3	7.3	8.8	17.8
Tb	1.4	1	0.9	1.7	1.3	1.6	3.1
Dy	8.7	6.4	5.8	10.7	8.1	10.4	20.2
Ho	1.7	1.3	1.2	2.2	1.7	2.2	4.1
Er	4.7	3.8	3.6	6.6	4.9	6.9	12
Tm	0.7	0.6	0.5	1	0.8	1.1	1.8
Yb	4.7	3.6	3.7	7	5.3	7.4	12.2
Lu	0.7	0.5	0.6	1	0.8	1.2	1.9
Hf	0.2	0.3	1.2			4.9	45.4
Ta			0.2	0.1			1.1
W	0.5		0.4	0.1			2.4
Tl	1.03	0.94	1.02	0.93	1.22	1.16	2.25
Pb	40.4	42.7	34.1	40.9	42.6	39.4	61.4
Bi	0.81	0.96	0.56	0.88	0.87	0.35	1.37
Th	29.8	29.5	25.1	48	24.9	19	36.7
U	10.1	7.1	4.5	6.5	9.1	6.8	8.7
Li	20.2	63.3	23.4	46.3	20.1	8.9	34.9
Na	1.24	1.08	1.8	1.63	1.79	2.01	1.2
Mg	0.16	0.89	0.23	0.43	0.24	0.19	0.41
Al	5.71	6.6	6.22	6.82	5.73	5.75	4.43
K	0.87	0.8	0.95	0.89	0.72	0.4	0.41
Ca	0.68	0.86	0.97	1.29	1.01	1.13	1.58
Mn	294	673	320	943	515	510	1380
Fe	4.53	6.29	3.66	6.05	3.93	3.07	8.84
Se	1.1	1	0.2	0.8	0.7	0.8	1.9
Te							0.2
Re	0.001		0.002	0.002	0.001	0.002	0.002

Sample ID	PERN120132	PERN120133	PERN120301	PERN120302	PERN120303	PERN120304	PERN120305
Coordinates							
X	3452180	3452169	3452072	3452077	3452079	3452089	3452091
Y	6701181	6701181	6701066	6701089	6701107	6701113	6701135
Concentrations							
Cd	0.2	0.2	0.1	0.1	0.1		0.1
Cu	3.4	3.7	8.6	11.4	5.2	20.4	7.6
Ni	4	3.9	8.5	5.9	4.5	13.1	5.1
Zn	104	83.5	92.2	80.7	60	70.2	45.9
Be	5	3.9	3.7	4.1	3.1	2.8	3.5
V	15	5	33	18	21	30	13
Cr	15.5	9	20.8	42.5	16.3	44	12.7
Co	4.7	3.7	4.5	3.7	2.8	6.7	3.3
Ga	16.2	16.1	17.8	19.2	16.7	16.8	15.1
Ge	0.2	0.2	0.1	0.2	0.1	0.5	0.5
As	3.4	0.7	7	2.7	4.4	1.6	2.4
Rb	59	47.3	54	41.3	40.2	53.5	31.8
Sr	130	135	160	138	131	210	155
Y	46.2	55.4	32.2	38.9	28.9	31.7	27.3
Zr	18	319	9	12	9	61	18
Nb	6.3	0.7	1.7	1.7	0.9	0.6	0.3
Mo	0.8		1.5	0.7	0.9	0.9	0.5
Ag		0.13			0.05		0.05
In	0.1	0.1		0.1			
Sn	1					2	
Sb							
Cs	3.15	2.54	4.46	4.92	3.83	4.48	3.21
Ba	424	416	498	438	478	604	546
La	42	41.9	41.8	51.6	32.9	45.5	36.4
Ce	96.2	95	96.5	106	68.9	97.6	76.5
Pr	11.9	12.4	10.5	13	8.4	11.6	8.5
Nd	43.9	46.2	38.2	45.7	30.7	42.9	30.2
Sm	9.1	9.3	7.4	8.5	6.1	8	5.7
Eu	1.03	0.94	0.89	0.81	0.79	1.08	0.88
Gd	7.7	7.9	5.9	6.8	5.2	6.5	4.7
Tb	1.4	1.4	1	1.2	0.9	1	0.8
Dy	8.7	9.8	6.2	7.3	5.5	6.1	5.1
Ho	1.8	2.1	1.2	1.4	1.1	1.2	1
Er	5.5	6.8	3.6	4.4	3.3	3.6	3.1
Tm	0.8	1.1	0.6	0.7	0.5	0.5	0.5
Yb	5.8	7.8	3.9	4.6	3.8	3.7	3.2
Lu	0.9	1.3	0.6	0.7	0.6	0.6	0.5
Hf		2				0.8	
Ta	0.3						
W	0.1		0.2				
Tl	0.87	0.86	0.9	0.99	1.04	0.89	1.05
Pb	27.4	25.8	30.6	31.2	31.3	25.6	26.2
Bi	0.47	0.28	0.43	0.49	0.32	0.32	0.32
Th	25.6	26.4	22.8	30.5	20.3	18.3	16.4
U	5.8	6.7	5.5	6.4	5.9	6.1	4
Li	19.7	17.5	33.4	27.6	25.5	22.9	18
Na	1.75	1.81	1.74	1.68	1.68	1.97	1.92
Mg	0.24	0.25	0.39	0.31	0.25	0.57	0.23
Al	5.69	5.57	6.32	5.54	5.35	6.34	5.61
K	0.61	0.44	0.65	0.4	0.47	0.84	0.47
Ca	0.99	1.06	1.02	0.98	0.87	1.39	0.94
Mn	827	996	380	496	341	368	270
Fe	3.76	3.9	3.2	3.58	2.73	2.83	1.98
Se	0.8	0.3	0.5	0.8	0.7	0.3	0.3
Te							
Re	0.003					0.001	0.001

Sample ID	PERN120601	PERN120602	PERN120603	PERN120604	PERN120605	PERN120828	PERN120829
Coordinates							
X	3452060	3452063	3452058	3452063	3452060	3452119	3452119
Y	6700960	6700984	6701002	6701019	6701045	6700981	6701003
Concentrations							
Cd	0.1	0.1	0.2	0.2	0.2	0.2	0.1
Cu	15.3	12.6	14.1	9.9	8.8	5	7.9
Ni	14.8	13.6	10.8	8.6	5.9	31.6	2.2
Zn	57.4	66.1	106	86.8	90.1	77	26.4
Be	2.6	3.2	4	4.4	3.3	3.6	1.6
V	48	46	43	34	19	39	8
Cr	36.5	36	34.6	22	16.9	26.1	9.4
Co	6.3	6.7	6.7	5.5	3.4	11.3	0.7
Ga	17.5	16.5	19.2	17.4	14.6	17.9	22.9
Ge	0.3	0.3	0.3	0.2	0.1	0.4	0.3
As	4.7	5	6.9	5.8	6	0.6	1.6
Rb	65.5	63	78.4	62.3	55.7	53.4	72.9
Sr	177	182	160	140	97.2	1000	57
Y	23.3	25.8	43.3	46.5	10.9	33.9	23.2
Zr	352	253	290	401	608	72	151
Nb	1.6	2.3	2	6.5	19.9	1.1	15.7
Mo	0.6	0.9	1.2	1.8	1.4	0.3	0.9
Ag	0.05						
In			0.1	0.1			
Sn	1	2	4	5	4		3
Sb					0.2		0.2
Cs	4.15	4.56	7.18	5.81	3.52	3.09	3.04
Ba	578	608	493	491	407	1630	218
La	32.1	33.3	44.9	55.7	10	45.2	37.5
Ce	65	83.7	95.4	117	26.4	133	80.3
Pr	7.7	8.1	11.8	13.8	2.7	21.5	9.5
Nd	28.4	29.7	44.2	50.5	10.1	89.8	33.2
Sm	5.3	5.7	8.4	9.6	2.2	15.7	6.8
Eu	0.84	0.89	0.87	0.94	0.27	3.94	0.33
Gd	4.4	4.9	7.4	8.3	1.9	10.9	5.8
Tb	0.7	0.8	1.2	1.4	0.3	1.4	0.9
Dy	4.3	5	8	8.5	2.3	7.2	4.8
Ho	0.8	1	1.6	1.7	0.5	1.3	0.8
Er	2.6	2.9	4.9	5	1.5	3.5	2.2
Tm	0.4	0.4	0.8	0.8	0.3	0.5	0.3
Yb	2.7	2.9	5.2	5.2	2	3.1	1.9
Lu	0.4	0.4	0.8	0.8	0.3	0.4	0.3
Hf	7.7	5.6	4.1	6.4	16.5	0.8	4.1
Ta		0.1		0.3	1.4		1.1
W				0.3	1.8		1.1
Tl	0.9	0.94	1.03	1.09	0.99	0.72	1.56
Pb	21.7	23.1	31.1	29.1	28.9	37.2	44.4
Bi	0.23	0.25	0.46	0.46	0.42	0.44	0.23
Th	18	19.6	27.4	27.8	7.4	10.9	32.3
U	5.6	6.9	6.7	8.8	2.5	4.5	15.1
Li	25.6	29.6	35.2	29.6	20.1	13.3	4.4
Na	1.84	1.87	1.72	1.71	1.79	1.75	2.03
Mg	0.64	0.61	0.6	0.47	0.18	1.84	0.06
Al	6.32	6.26	6.07	5.88	3	6.14	5.92
K	0.85	0.77	0.83	0.65	0.57	1.26	0.79
Ca	1.08	1.14	1.16	1.09	0.5	3.51	0.26
Mn	350	344	468	447	277	653	137
Fe	2.92	3.34	4.47	3.69	1.94	4.11	0.75
Se	0.8	0.6	1.3	1	0.5	0.6	1.9
Te							
Re	0.001	0.001	0.001	0.001			0.001

Sample ID	PERN120830	PERN120831	PERN120832	PERN120833	PERN120834	PERN120835	PERN120836
Coordinates							
X	3452120	3452119	3452121	3452124	3452129	3452115	3452110
Y	6701022	6701047	6701064	6701093	6701120	6701137	6701096
Concentrations							
Cd	0.2	0.2		0.3	0.2	0.2	0.1
Cu	15.3	12.9	10.4	16.1	9.1	50.5	11.9
Ni	4.7	5.4	4.9	5.4	7.5	3	4.2
Zn	51.4	122	100	99.9	135	50.5	107
Be	3.7	4.4	4.1	4.5	4.9	2.7	4.3
V	19	11	24	11	28	11	19
Cr	12.6	69.3	17.6	14.9	73.9	10.9	13.1
Co	2.1	4.7	3.3	4	4.6	1.7	3
Ga	18.7	22.2	18.4	19.7	18.4	18.9	17.5
Ge	0.5	0.8	0.5	0.7	0.2	0.7	0.6
As	5.4	3.7	4.4	0.8	8.7	1.6	4.9
Rb	32.3	42.8	37.2	45.4	39.9	52	33.1
Sr	109	99	125	111	121	102	118
Y	26.2	67.2	32.9	71.7	34.1	38.9	40.4
Zr	101	61	89	819	122	798	115
Nb	6.6	3.1	5.8	4.5	9.7	16.4	5.8
Mo	1.5	3.6	1.2	0.8	9.6	1	1.9
Ag				0.09			
In		0.2	0.1	0.2	0.1		0.1
Sn	2	4	2	3	2	4	1
Sb	0.3	0.2	0.2	0.1	0.2	0.2	0.2
Cs	3.08	8.62	4.84	3.61	5.38	2.8	4.14
Ba	408	437	459	507	483	436	449
La	31.7	59	34.2	55.7	36.9	40.3	42.8
Ce	66	135	74.4	133	80	87.8	96.1
Pr	8.3	17.5	8.9	17.7	9.4	10.6	11.6
Nd	29.3	68.5	33	68.8	34.3	38.9	42.3
Sm	6.2	13.6	6.6	13.9	6.7	8	8.5
Eu	0.79	0.96	0.82	1.08	0.93	0.69	0.88
Gd	5.2	12.2	5.8	12.3	6.2	7	7.4
Tb	0.9	2.2	1	2.2	1.1	1.2	1.3
Dy	5.3	13.2	6.3	13.5	6.8	7.3	8
Ho	1	2.7	1.3	2.7	1.4	1.4	1.6
Er	3.1	7.9	3.8	8.2	4.2	4.3	4.8
Tm	0.5	1.2	0.6	1.2	0.6	0.7	0.8
Yb	3.2	7.9	4	8.4	4.2	4.4	5
Lu	0.5	1.3	0.6	1.3	0.6	0.7	0.8
Hf	2.3	0.4	0.6	22.6	1.4	22.7	0.9
Ta	0.5			0.2	0.2	0.8	
W	0.8		0.8	0.2	1.6	0.8	1
Tl	0.89	1.38	0.99	1.15	1.01	1.36	0.98
Pb	45.3	44.9	43.9	39	33	38	35.2
Bi	0.47	0.68	0.43	0.28	0.61	0.19	0.41
Th	31.4	38.2	33.4	24	22.4	28.8	35.7
U	17.1	7.2	6.5	6.1	11.3	8.2	6.8
Li	24	31.6	29.3	9.4	30.5	8.9	30.2
Na	1.52	1.59	1.55	1.82	1.53	1.96	1.54
Mg	0.17	0.29	0.25	0.24	0.25	0.12	0.2
Al	6.86	5.18	6.57	5.22	6.37	5.6	5.63
K	0.42	0.45	0.52	0.66	0.5	0.81	0.49
Ca	0.61	1.17	0.82	1.26	0.77	0.71	0.83
Mn	245	627	342	632	403	353	382
Fe	3.15	5.68	3.61	4.01	4.23	1.88	3.51
Se	1.2	1	0.8	1.4	1.1	0.9	1.1
Te							
Re					0.017	0.001	

Sample ID	PERN121018	PERN121019	PERN121020	PERN121021	PERN121022	PERN121023	PERN121121
Coordinates							
X	3452078	3452075	3452069	3452066	3452062	3452059	3452087
Y	6701157	6701140	6701121	6701103	6701078	6701034	6701167
Concentrations							
Cd	0.2	0.1	0.1	0.1	0.1	0.2	0.1
Cu	10	10.6	6	14.4	15.7	8.9	11.5
Ni	7.7	7.7	4.8	5.3	5.5	10.3	7
Zn	60.4	74.9	45.1	93.4	70.3	66.6	83.1
Be	3.6	3.7	2.8	3.5	3.5	3.2	3.1
V	29	25	24	22	21	40	22
Cr	18.3	19.1	15.8	17.1	15.6	22.2	13
Co	4.2	3.8	2.8	2.5	3.5	4.7	4.2
Ga	17.6	17.8	18.7	21.3	17.1	17.9	16.9
Ge	0.3	0.3	0.6	0.4	0.6	0.5	0.7
As	3.8	5.6	3.9	3.6	4.1	2.8	4.5
Rb	45.5	53.9	39.9	33.4	55.7	40.8	34.2
Sr	178	161	162	118	169	190	156
Y	27.3	26.4	27.2	24.9	30.2	24.3	19.1
Zr	407	521	658	486	550	382	252
Nb	18	19.3	23.1	20.3	15.7	17.1	9.6
Mo	2.5	3.7	1.4	1.4	1.2	1.8	2
Ag							
In							
Sn	4	4	5	4	4	3	3
Sb	0.2	0.2	0.2	0.3	0.1	0.2	0.2
Cs	3.93	3.57	2.8	3.82	3.69	3.87	3.33
Ba	605	591	572	458	558	614	594
La	26.1	23.7	29.5	30.6	36.3	28	18
Ce	57.8	49.5	60.8	60.1	84.1	56.5	37.7
Pr	6.7	6.1	7.5	7.8	8.7	6.8	4.6
Nd	25.3	22.9	27.6	28.1	31.6	25.1	17.3
Sm	5	4.7	5.5	5.5	6	5	3.5
Eu	0.88	0.81	0.85	0.64	0.92	0.89	0.8
Gd	4.5	4.1	4.8	4.7	5.3	4.4	3.1
Tb	0.8	0.7	0.8	0.8	0.9	0.7	0.5
Dy	5.1	4.8	4.9	4.9	5.5	4.6	3.4
Ho	1.1	1	1	1	1.1	1	0.8
Er	3.2	3.2	3.2	3	3.6	2.8	2.2
Tm	0.5	0.5	0.5	0.5	0.6	0.4	0.4
Yb	3.2	3.2	3.5	3.1	3.7	2.9	2.2
Lu	0.5	0.5	0.6	0.5	0.6	0.4	0.3
Hf	11.8	14.1	17.8	13.4	14.4	11	5.2
Ta	1.4	1.4	1.5	1.2	0.8	1.2	0.3
W	2.3	1.5	2.9	1.3	2.6	1.4	0.7
Tl	1.09	1.11	1.04	1	1.07	0.93	1.07
Pb	24.9	26.2	30.5	32.4	28.2	24	23.9
Bi	0.27	0.25	0.3	0.45	0.31	0.24	0.19
Th	13.7	10.4	15.1	21.2	18	13.3	8
U	4.3	2.9	4.6	4.2	6	4.5	2.3
Li	22.8	24.2	14.7	34.2	21.2	24.8	21
Na	2.2	2.14	1.97	1.62	2.12	2.09	2
Mg	0.35	0.28	0.24	0.26	0.29	0.47	0.25
Al	6.16	6.26	5.89	5.19	6.22	6.64	5.9
K	0.71	0.82	0.66	0.46	0.8	0.6	0.5
Ca	1.17	1	1.02	0.72	1.04	1.17	0.88
Mn	322	347	373	311	345	340	305
Fe	2.74	2.77	2.43	2.69	2.33	2.73	2.19
Se	0.5		0.6	0.6	0.4	0.4	0.6
Te							
Re	0.002	0.001		0.002			0.001

Sample ID	PERN121122	PERN121123	PERN121124	PERN121125	PERN121126	PERN121127	PERN121128
Coordinates							
X	3452090	3452103	3452100	3452100	3452100	3452099	3452098
Y	6701180	6701207	6701160	6701140	6701100	6701067	6701035
Concentrations							
Cd	0.2	0.2	0.1	0.2	0.2	0.2	0.1
Cu	19	10.9	8.4	12.8	12.9	10.7	9
Ni	6.2	6.1	3.9	10.1	5.5	4.1	3.9
Zn	109	95.1	85.9	109	157	72.7	66.1
Be	3.6	4.3	3.8	3.2	5.7	3.9	4
V	18	30	22	45	28	16	19
Cr	15.9	18.9	12.5	29.5	18.6	13.1	9.3
Co	4.8	3.8	2.7	4.7	4.3	2.3	2.7
Ga	18	20.2	18	19.9	23.8	20.1	18.9
Ge	0.8	0.4	0.6	0.8	0.9	0.7	0.5
As	2.9	6.4	5.9	4.4	7.7	4.9	3.9
Rb	43.4	36.6	36.9	42.5	54.2	43.1	24.8
Sr	145	142	153	152	156	118	131
Y	41.9	40.5	24.6	28.7	52.3	32.8	36.6
Zr	694	298	397	642	808	529	23
Nb	9.6	12.1	17.2	25.7	32.2	24.9	3.3
Mo	0.8	2.3	1.4	1.9	2	1.9	0.9
Ag							
In		0.1			0.2		
Sn	3	2	4	4	6	5	
Sb	0.1	0.1	0.2	0.4	0.4	0.3	
Cs	3.33	4.96	3.71	3.48	6.21	3.53	2.71
Ba	537	500	541	542	590	478	485
La	39	45.1	28.1	35.1	49.8	32.7	37.4
Ce	84.2	95.4	58.2	72	111	70.5	79.8
Pr	10.3	11.6	6.6	8.6	13.8	8.4	9.7
Nd	38.9	42.5	24	31.5	51.6	30.7	35.4
Sm	7.8	8.3	4.6	6.2	10.4	6.2	7.1
Eu	0.91	0.93	0.86	0.88	1.13	0.77	0.88
Gd	7.3	7.2	4.1	5.5	9.5	5.3	6.3
Tb	1.2	1.2	0.7	0.9	1.6	0.9	1.1
Dy	7.9	7.4	4.6	5.5	10.2	6.1	6.9
Ho	1.6	1.5	0.9	1.1	2.1	1.3	1.5
Er	4.9	4.7	3	3.4	6.2	4	4.5
Tm	0.8	0.7	0.5	0.5	1	0.6	0.7
Yb	4.9	4.7	2.9	3.5	6.1	4.3	4.6
Lu	0.8	0.7	0.5	0.5	0.9	0.7	0.7
Hf	19	6.2	9.8	17	20.7	13	0.2
Ta	0.5	0.3	1.1	1.2	1.8	1.2	0.1
W	0.6	1.5	2.6	1.3	2.7	1.6	0.4
Tl	1.07	0.96	1.08	0.79	1.25	1.1	0.96
Pb	27.6	37.7	28.1	32.7	44.2	34.7	35.5
Bi	0.22	0.43	0.37	0.31	0.91	0.5	0.4
Th	20.4	29.4	15.4	19.9	34	27.2	23.7
U	4.8	13.2	4.2	5.7	9	5.7	10.1
Li	18.8	29.7	19	27.8	40.5	19.1	20.8
Na	1.96	1.66	1.89	1.64	1.95	1.72	1.77
Mg	0.3	0.29	0.18	0.42	0.29	0.17	0.21
Al	5.79	6.39	5.99	6.73	7.08	5.76	5.98
K	0.63	0.52	0.56	0.69	0.8	0.64	0.36
Ca	1.08	0.97	0.86	0.98	1.06	0.74	0.92
Mn	566	457	269	406	485	346	414
Fe	2.88	4.19	2.7	3.39	4.79	3.02	3.21
Se	0.7	1.3	1.2	0.7	1.8	1	0.9
Te							
Re				0.001			0.001

Sample ID	PERN121129	PERN121130	PERN121131	PERN121132	PERN121133	PERN121134	PERN121135
Coordinates							
X	3452139	3452143	3452144	3452142	3452139	3452142	3452141
Y	6700956	6700980	6701004	6701060	6701090	6701105	6701126
Concentrations							
Cd	0.2	0.2	0.2	0.1	0.2	0.3	0.2
Cu	24.7	10.8	10.5	8.3	8.4	40.3	14.4
Ni	8.9	7	5.2	4.9	5.7	27.6	18.4
Zn	75.4	80.9	90.5	94.2	108	138	153
Be	3.1	3.9	3.6	3.9	4.5	5.8	4.5
V	15	36	26	15	23	63	72
Cr	25.6	20.4	17	12.5	15.9	48.9	46.1
Co	4.3	4.2	3	3.6	4.7	10.9	8.1
Ga	22.9	21	22.4	23	22.8	22.3	22.7
Ge	0.7	0.6	0.3	0.7	0.3	0.9	0.4
As	2.7	9.6	5.6	2.9	4.2	4.7	6.6
Rb	33.1	29.6	32.8	38.3	34.9	52.2	88.7
Sr	167	115	121	124	134	113	126
Y	31.6	46.3	23.6	39.1	39.6	66.1	31.7
Zr	80	235	42	78	131	415	551
Nb	2.3	19.3	4.5	2.6	7.6	22.9	23.7
Mo	0.6	3.9	1.8	0.5	1.7	1.5	2.3
Ag							
In		0.1		0.1	0.1	0.1	0.1
Sn	4	7		3	1	5	4
Sb	0.2	0.4	0.2	0.2	0.1	0.3	0.3
Cs	4.5	4.59	4.29	5.96	2.92	6.03	5.21
Ba	572	303	470	475	462	603	549
La	42.3	78.6	29.7	33.1	31.6	154	37.5
Ce	81.5	139	62.1	74.8	70.5	314	79.5
Pr	9.8	15.7	7.2	9.5	9.1	30.5	9.3
Nd	35.5	54.8	25.7	35.8	35	100	34.3
Sm	6.4	9.6	5	7.3	7.2	16.6	6.6
Eu	0.87	0.88	0.76	0.82	0.88	1.49	0.83
Gd	5.6	8.6	4.2	6.7	6.4	13.9	6.2
Tb	0.9	1.4	0.7	1.1	1.1	2.2	1
Dy	5.8	8.6	4.5	7.2	7.3	13.4	6.4
Ho	1.2	1.7	0.9	1.5	1.5	2.5	1.3
Er	3.6	4.9	2.8	4.5	4.7	7	3.8
Tm	0.5	0.7	0.4	0.7	0.7	1	0.6
Yb	3.4	4.2	2.8	4.7	4.8	6.1	3.8
Lu	0.5	0.6	0.4	0.7	0.7	0.8	0.6
Hf	1	6.6	0.4	0.6	1.5	11.5	15.2
Ta	0.1	1			0.2	1.6	1.1
W		4.1	0.9	0.1	0.8	1.8	1.5
Tl	0.96	0.66	1	1.2	0.94	1.13	0.87
Pb	32	32.3	38.1	39.9	32.6	30.7	28
Bi	0.48	0.69	0.51	0.38	0.35	0.41	0.35
Th	15	19.4	21.7	19.1	17	30.7	19.5
U	6.1	11.2	6.4	6.9	3.6	23	6.5
Li	21.2	26.6	20.2	24.1	22.3	50.9	50.7
Na	1.85	1.21	1.52	1.64	1.8	1.37	1.35
Mg	0.38	0.33	0.19	0.25	0.26	0.79	0.74
Al	6.15	4.61	6.58	5.74	6.46	7.77	7.47
K	0.42	0.38	0.46	0.44	0.52	0.59	1.3
Ca	1.03	0.88	0.7	0.94	1.01	0.78	0.83
Mn	358	290	285	429	706	398	452
Fe	3.16	4.65	3.25	3.95	3.29	4.01	4.89
Se	1	1.4	0.9	0.7	0.8	1.4	1.3
Te							0.1
Re	0.001	0.003			0.002		

Sample ID							
	PERN121136	PERN121137	PERN121138	PERN121139	PERN121140	PERN121141	PERN133001
Coordinates							
X	3452142	3452140	3452135	3452163	3452153	3452160	3452583
Y	6701146	6701220	6701256	6701262	6701234	6701219	6701403
Concentrations							
Cd	0.2	0.1	0.2	0.1	0.2	0.1	0.4
Cu	10.3	18	16.7	14.9	14.3	20.5	53.2
Ni	6.2	7.6	16.3	20.4	14.2	5.8	7.8
Zn	145	55.3	162	113	73.5	74.3	200
Be	4.5	2.9	6.5	3.3	3.6	4	6.7
V	29	18	27	62	45	13	31
Cr	18.8	23.6	28.3	36.7	29.6	14.8	22.8
Co	4.8	3.1	22.5	9.2	7.4	3	10.4
Ga	18.6	16	18.1	19.6	18.3	18.1	23.3
Ge	0.5	0.3	0.6	0.9	0.6	0.7	0.4
As	14.5	4.8	4.8	3	3.1	1.8	9
Rb	52.7	29.4	36.1	40	78.2	43.5	148
Sr	119	111	123	180	198	156	111
Y	42.1	28.7	62.4	24.5	29.6	34.5	95.6
Zr	733	31	459	274	319	477	76
Nb	28.1	3.4	4.2	13.6	3.8	7.3	8.7
Mo	2.2	3.5	1	1.1	0.9	1.3	1.8
Ag			0.09				0.49
In	0.2	0.1	0.2				0.2
Sn	7	1	2	3	3	4	2
Sb	0.3	0.1	0.1	0.2	0.2	0.1	
Cs	6.22	3.81	4.37	4.98	4.26	3.03	7.09
Ba	448	426	441	658	627	573	492
La	40.2	38.4	73.7	37	43.4	31.6	102
Ce	87.8	74.7	161	72.1	123	67.5	221
Pr	11.1	9	17.3	8.5	9.9	8.7	29.3
Nd	41.3	32.4	62.1	30.2	35.5	32.6	107
Sm	7.9	6.2	11.7	5.7	6.7	6.6	21.9
Eu	0.79	0.82	1.05	0.87	1.02	0.95	1.47
Gd	7	5.6	10.4	4.8	6	5.9	23
Tb	1.2	0.9	1.7	0.8	0.9	1	3.5
Dy	7.6	5.7	11.6	4.7	5.9	6.5	22.4
Ho	1.6	1.2	2.4	0.9	1.2	1.4	4.6
Er	5.1	3.4	7.2	2.9	3.5	4.1	13
Tm	0.8	0.5	1.1	0.4	0.5	0.6	1.9
Yb	5.1	3.4	6.9	2.7	3.4	4.1	11.9
Lu	0.8	0.5	1	0.4	0.5	0.6	1.9
Hf	18.2	0.2	10.4	7.7	9.2	11.6	0.4
Ta	1.4		0.2	0.7		0.3	
W	2.5	0.7		0.8	0.1	0.3	1
Tl	0.93	0.86	0.86	0.98	0.89	1.08	1.26
Pb	45	37.4	32.8	24	26.4	26.5	53.6
Bi	0.7	0.38	0.56	0.3	0.32	0.24	1.15
Th	21.6	19.2	41.4	19.4	22.2	14.8	80
U	4.8	11.7	10.6	4.9	5.2	3.8	17.4
Li	39.6	17.5	78.5	40.3	35	23.9	44.8
Na	1.48	1.43	1.39	1.75	1.96	2.16	1.32
Mg	0.32	0.2	0.54	0.85	0.66	0.25	0.44
Al	5.42	5.4	7.13	7.01	7.27	6.02	5.96
K	0.74	0.38	0.48	0.61	1.41	0.71	1.92
Ca	0.89	0.7	0.93	1.14	1.14	1.05	1.36
Mn	503	318	1370	407	375	375	1300
Fe	4.54	3.36	5.35	3.54	3.06	2.43	6.39
Se	0.9	0.7	1.1	0.5	0.9	0.7	1.8
Te							
Re	0.002		0.002				

Sample ID	PERN133002	PERN133003	PERN133004	PERN133005	PERN133006	PERN133007	PERN133008
Coordinates							
X	3452596	3452624	3452660	3452676	3452695	3452671	3452642
Y	6701406	6701398	6701402	6701394	6701402	6701417	6701425
Concentrations							
Cd	0.3	0.4	0.3	0.3	0.2	0.3	0.2
Cu	29.1	23.5	11.2	15.6	11.9	40.5	23.4
Ni	6.2	4.4	14.4	7	9.1	7	5.4
Zn	70.2	108	129	65.7	77.9	101	62.2
Be	3.9	4.8	3.7	3.7	3	3	2.9
V	9	17	45	18	25	30	14
Cr	32.5	12.5	32.8	30.6	18.8	20.6	13
Co	3.5	4.2	6.8	3.3	4.3	4.5	2.6
Ga	12.6	14.4	17	13.4	13.6	15.2	12.3
Ge	0.1				0.1	0.3	
As	0.2	4.3	4.5	3.1	3.1	4.3	4.5
Rb	123	103	137	133	128	132	126
Sr	145	115	137	143	161	157	136
Y	53.1	34	38.6	31.5	27.1	37.6	21.7
Zr	349	536	309	457	226	205	69
Nb	0.1	10.9	10.6	1.7	2.2	2.8	2.4
Mo		1	1.5	0.6	0.8	0.9	0.9
Ag	0.34	0.78	0.7	0.42	1.95	0.69	0.34
In	0.1	0.1	0.1				
Sn	1	2	2	2	2	1	
Sb							
Cs	2.63	2.98	5.7	4.25	4.11	4.55	3.06
Ba	591	526	598	611	612	603	581
La	40.7	21.3	37.6	32.8	33.6	33.5	20.9
Ce	96.9	48.8	80.2	68.6	79.3	71.2	44.8
Pr	12.9	6.3	10.2	8.4	8	9	5.3
Nd	48.2	23.2	36.3	30.3	28.4	32.8	19.1
Sm	10.5	5.4	7.8	6.1	5.6	6.9	4
Eu	1.15	0.67	0.92	0.99	0.91	0.85	0.74
Gd	10.9	5.9	7.9	6.2	6	7.2	4.2
Tb	1.8	1	1.3	1	0.9	1.1	0.7
Dy	11.5	7	8.4	6.5	5.7	7.5	4.4
Ho	2.5	1.5	1.7	1.4	1.2	1.5	0.9
Er	7.5	4.5	5.2	4.2	3.4	4.7	2.8
Tm	1.1	0.7	0.8	0.7	0.5	0.7	0.4
Yb	7	4.6	4.7	4.2	3.2	4.4	2.7
Lu	1.1	0.8	0.8	0.7	0.5	0.7	0.4
Hf	4.5	12.1	3.1	8.4	3.7	2	0.3
Ta		0.4	0.4			0.1	
W		0.5	1				0.3
Tl	1.18	1.16	1.15	1.3	1.15	1.15	1.12
Pb	31.2	32.3	31.3	30.6	31.9	33	27.6
Bi	3.98	0.5	1.42	0.4	1.29	0.51	0.94
Th	20	13.1	18.4	14.9	15.1	15.7	9
U	5.9	3.9	5.3	4.5	4.8	4.7	2.9
Li	15.1	18.3	42.2	21.4	21.6	21.7	13.4
Na	1.71	1.6	1.38	1.61	1.61	1.59	1.53
Mg	0.26	0.22	0.55	0.27	0.35	0.35	0.17
Al	5.07	4.48	5.95	5.26	5.27	5.18	4.68
K	1.97	1.61	1.82	1.88	1.98	2.18	2.13
Ca	1.16	0.85	0.99	0.92	0.94	1.09	0.81
Mn	601	652	531	350	322	372	289
Fe	3.1	3.2	3.87	2.2	2.55	2.86	2.08
Se	0.3	0.2	0.7	0.8	0.2	0.9	0.4
Te			0.5				
Re			0.003	0.001	0.001	0.003	

Sample ID	PERN133009	PERN133010	PERN133011	PERN133012	PERN133013	PERN133014	PERN133015
Coordinates							
X	3452618	3452596	3452633	3452651	3452644	3452732	3452724
Y	6701426	6701418	6701444	6701441	6701462	6701403	6701400
Concentrations							
Cd	0.2	0.4	0.2	0.2	0.2	0.3	0.3
Cu	20.1	13.6	13.5	9	10.8	22.8	59.5
Ni	5.2	9.9	4.4	6.1	3.9	15.8	22
Zn	49.4	106	55	66.8	64	73.5	136
Be	2.6	4.4	2.7	2.8	2.7	2.7	3.3
V	14	10	13	17	14	22	35
Cr	12.8	24.6	10.9	13.4	7.5	29.6	42.4
Co	2.6	6.4	2.3	2.7	2.2	6.7	11.9
Ga	12.7	16.9	12.6	13.7	13.5	16	18.9
Ge	0.3	0.3	0.2			0.1	0.4
As	2.9	1.7	1.9	4.8	3.4	1.9	1.3
Rb	131	127	143	129	118	131	151
Sr	181	128	152	159	160	138	118
Y	24.8	80.5	24	25	24	32.9	26.7
Zr	107	589	281	86	61	476	218
Nb	0.8	0.9	2	2.7	1.9	0.3	0.4
Mo	0.2		0.5	1.2	0.8		
Ag	0.25	0.65	0.35	0.21	0.14	0.34	0.24
In		0.1					
Sn		3	2				2
Sb							
Cs	2.82	3.21	3.01	3.06	2.65	4.53	6.37
Ba	646	487	610	607	596	634	617
La	26.9	86.6	27	25.6	25.7	40	32.4
Ce	56.3	171	57.7	54.3	54.3	72.1	73.7
Pr	6.6	22.4	6.6	6.5	6.5	9.8	7.9
Nd	23.7	78.4	23.4	23.6	23.1	34.7	28.3
Sm	4.8	15.9	4.7	4.8	4.7	6.7	5.7
Eu	0.9	1.39	0.84	0.89	0.89	0.93	0.83
Gd	5.1	16.5	4.9	5	4.9	6.9	5.8
Tb	0.8	2.6	0.7	0.8	0.7	1	0.9
Dy	5.2	16.7	4.8	5	4.7	6.7	5.5
Ho	1.1	3.5	1	1	1	1.4	1.1
Er	3.2	10.5	3	3.1	3	4.1	3.3
Tm	0.5	1.6	0.5	0.5	0.5	0.6	0.5
Yb	3.1	10.4	2.9	3	2.8	3.7	3
Lu	0.5	1.7	0.5	0.5	0.5	0.6	0.5
Hf	1	11.2	5.1	0.5		12.2	6
Ta							
W				0.3	0.2		
Tl	1.08	0.94	1.13	1.1	1.05	1.22	1.34
Pb	35.2	36.2	28	28.3	27	26.5	27.7
Bi	0.3	1.04	0.22	0.72	0.26	0.6	0.4
Th	11.6	36.1	10.1	10.5	9.6	13.7	15.1
U	5.2	11.5	2.9	3.1	3.2	6.3	6.3
Li	13.4	18.7	13.5	13.3	12.9	24.8	50.7
Na	1.81	1.37	1.68	1.66	1.65	1.49	1.23
Mg	0.21	0.35	0.18	0.2	0.17	0.55	0.8
Al	5.24	5.4	4.88	4.96	5.02	5.56	5.97
K	2.52	1.99	2.5	2.18	1.82	2.06	2.32
Ca	1.05	1.13	0.9	0.95	0.92	0.86	0.76
Mn	293	1520	273	319	314	426	526
Fe	1.94	5.59	1.76	2.13	1.8	3	3.34
Se		1.3	0.4	0.3	0.5	0.4	0.7
Te							
Re		0.003		0.002	0.003	0.004	

Sample ID	PERN133016	PERN133017	PERN133018	PERN133019	PERN133020	PERN133021	PERN133022
Coordinates							
X	3452724	3452704	3452722	3452739	3452768	3452755	3452733
Y	6701422	6701386	6701383	6701378	6701379	6701370	6701350
Concentrations							
Cd	0.3	0.3	0.3	0.3	0.3	0.6	0.3
Cu	17.7	9.8	13.7	12.6	10.4	7.9	7.2
Ni	24.3	5.2	10.3	10.4	12.9	5.9	11.6
Zn	111	55.7	84.9	122	88.2	74.5	146
Be	3	2.8	4.6	3.2	2.6	3.7	3.2
V	21	16	9	27	31	16	25
Cr	47.2	13	22	25.2	29	18.5	29.1
Co	10.1	2.7	5	5.2	5.4	3.7	5.3
Ga	19.3	14.3	15	17	16.4	15.9	15
Ge	0.2	0.2	0.3	0.5	0.4		0.1
As	2	6.4	1.1	5.4	3	2.4	1.8
Rb	166	148	161	138	135	106	106
Sr	150	161	151	180	177	145	158
Y	31.5	22	40.9	32.1	28.3	46.1	39.6
Zr	319	468	732	248	346	1450	274
Nb	0.4	11.2		0.6	0.3	1.2	0.6
Mo		0.8		0.1	0.2	0.2	
Ag	0.7	0.8	0.24	0.35	0.32	0.9	0.23
In							
Sn		3		2	1	2	1
Sb							
Cs	6.05	3.08	4.22	4.29	4.61	2.81	3.97
Ba	670	640	654	604	624	552	556
La	33.8	18.1	31.7	36.2	30.1	30.2	46
Ce	69.2	40.3	73.3	74	66.1	73.2	96.7
Pr	8.7	4.7	9	9.2	7.4	8.6	11.7
Nd	31.5	17	32.4	33.6	26.3	31.9	40.5
Sm	6.4	3.7	7	6.7	5.4	6.9	8
Eu	0.87	0.71	0.93	0.91	0.82	0.77	0.88
Gd	6.5	4	7.2	6.9	5.7	7.6	8.1
Tb	1	0.6	1.1	1	0.9	1.2	1.2
Dy	6.2	4.2	7.8	6.4	5.5	8.5	7.5
Ho	1.3	0.9	1.7	1.3	1.1	1.9	1.6
Er	3.8	2.7	5.2	3.9	3.4	5.7	4.7
Tm	0.6	0.4	0.8	0.6	0.5	0.9	0.8
Yb	3.6	2.6	5	3.6	3.2	6.1	4.7
Lu	0.6	0.4	0.9	0.6	0.5	1.1	0.8
Hf	8.3	12.3	19.7	4	8.9	38.2	3.2
Ta		0.4					
W		1	0.4				
Tl	1.32	1.15	1.32	0.91	1.01	1.04	0.81
Pb	29.1	29.7	29.3	28.2	28.3	24.1	26.1
Bi	0.58	0.32	0.5	0.37	0.47	0.21	0.5
Th	15.1	8.4	11.6	14.1	15.3	13.9	20.8
U	8.4	2.2	5.2	3.8	4.6	4.8	6.7
Li	45.2	12.8	31.9	27.6	26.4	16.2	25
Na	1.46	1.83	2.19	1.66	1.68	1.72	1.44
Mg	0.84	0.18	0.37	0.48	0.49	0.29	0.44
Al	6.14	4.83	5.95	5.68	5.7	4.81	5.31
K	2.69	2.74	3.1	2.29	2.46	1.57	1.59
Ca	1.03	0.98	1.14	1.25	1.12	1.11	1.09
Mn	492	332	612	470	363	680	750
Fe	3.88	1.95	3.18	3.14	2.96	2.89	3.86
Se	0.3	0.4	0.7	0.6	0.4	0.6	0.4
Te						0.2	
Re	0.004	0.003		0.003	0.001	0.001	

Sample ID	PERN133023	PERN133024	PERN133025	PERN133026	PERN133027	PERN133028	PERN133029
Coordinates							
X	3452719	3452699	3452694	3452681	3452656	3452637	3452616
Y	6701360	6701352	6701275	6701281	6701287	6701225	6701251
Concentrations							
Cd	0.2	0.3	0.5	0.3	0.8	1.4	0.7
Cu	7.1	25.6	104	70.4	50.4	62.8	44.3
Ni	7.8	34.2	7.9	6.1	5.8	6.8	6
Zn	107	150	248	161	216	382	135
Be	2.3	3.5	9.3	7.5	5.2	7.6	5
V	25	43	35	30	35	37	15
Cr	18.7	43	23.8	20.3	17.6	16	13.7
Co	4	14.9	12.2	4.1	6.8	12.1	4.8
Ga	14.1	21.3	21.7	27.5	35	37.1	27.2
Ge		0.2	0.2	0.2	0.8	1.1	0.7
As	2.7	1.9	21.6	9.9	5.7	8.6	5
Rb	122	141	84.6	126	204	319	178
Sr	153	128	63.9	72.2	74.4	51.9	85.9
Y	25.4	39.2	110	73.4	96.6	169	76.1
Zr	85	364	73	220	1300	2410	1220
Nb	2.2		3.1	3.1	11	74.5	11.3
Mo	0.6		4.5	2.8	3.1	5.5	1.1
Ag	0.18	0.3	0.32	0.4	1.3	3.92	1.19
In			0.3	0.2	0.3	0.5	0.2
Sn			1		9	13	4
Sb			0.1		0.1		0.5
Cs	3.34	6.46	5.91	7.68	17.8	28.5	8.71
Ba	562	686	289	318	376	343	488
La	28.3	58.5	110	64.1	79	183	42.8
Ce	58.5	128	261	152	175	376	111
Pr	7	12.9	32	20.3	24.7	53.4	15.8
Nd	25	44.6	114	71.7	92.8	194	61.2
Sm	5.1	8.2	23.1	14.9	19.3	38.8	13.7
Eu	0.83	0.98	1.81	1.37	1.17	1.78	1.04
Gd	5.2	8.5	24.5	15.4	19.6	40.3	14.5
Tb	0.8	1.2	3.9	2.4	3	5.9	2.4
Dy	4.9	7.4	24.9	15.6	19.3	36.5	15.7
Ho	1	1.5	4.9	3.2	4	7.5	3.3
Er	3	4.4	14.1	9.3	11.2	21.1	10
Tm	0.5	0.6	2.1	1.4	1.7	3.1	1.6
Yb	2.8	4	12.3	8.3	10.4	18.8	9.7
Lu	0.5	0.7	1.9	1.3	1.8	3.1	1.7
Hf	0.3	8.6	1	5.1	29	69	33
Ta						3.3	0.1
W	0.2		4.7	1.5		3.6	
Tl	0.94	1.21	0.74	0.93	1.35	2.67	1.47
Pb	24.8	28.2	65.2	49.4	57.8	79.4	48.1
Bi	0.28	0.49	2.23	1.16	0.79	0.97	0.5
Th	11.5	23	90.4	42.7	31.6	110	16.2
U	3	6.4	21	13.5	11.5	15.7	5.4
Li	18.4	46.5	37.8	27.7	31.4	75.2	10.5
Na	1.51	1.15	0.83	0.95	1.11	1.14	1.56
Mg	0.33	1.12	0.31	0.22	0.4	0.58	0.29
Al	5.01	7.2	7.41	7.84	4.73	5.11	4.41
K	1.86	2	1.17	1.36	1.88	1.97	2.4
Ca	0.99	0.84	0.79	0.71	1.4	2.07	1.43
Mn	419	722	772	435	761	1290	736
Fe	2.19	4.87	7.18	5.44	9.18	12.8	5.41
Se		0.3	3	1.4	1.3	3	1
Te					0.2	0.6	0.2
Re	0.004	0.002	0.001	0.001	0.004	0.006	0.003

Sample ID	PERN133030	PERN134001	PERN134002	PERN134003	PERN134004	PERN134005	PERN134006
Coordinates							
X	3452699	3452645	3452619	3452598	3452579	3452558	3452539
Y	6701258	6701348	6701345	6701340	6701342	6701342	6701344
Concentrations							
Cd	0.5	0.3	0.4	0.6	0.2	0.3	0.3
Cu	40.1	5	9.9	22.2	6.1	9	13.7
Ni	9.2	4.5	4.9	5.7	6.2	4.4	3.7
Zn	110	91.2	146	98	43	129	79.9
Be	5.3	4.3	5.5	11.5	3	5.1	4.4
V	27	22	20	42	12	17	29
Cr	25.3	14.4	11.2	21.8	12.2	12	17.4
Co	4.6	3.5	5.7	14.5	2.7	6.9	3.4
Ga	39.7	19.1	37.6	20.5	14.2	35	27.9
Ge	0.7		0.4	0.4	0.2	0.5	0.2
As	3	7.5	4	34.5	0.7	4.8	18.5
Rb	224	93.8	233	53.6	131	224	112
Sr	161	100	65.1	30.1	142	87.9	46.9
Y	49.9	27.6	111	161	28.8	72.9	58
Zr	818	510	190	27	121	31	20
Nb	15.9	24	7.9	1.1	0.7	3.6	3.4
Mo	1.6	2.5	1.2	3.7	0.3	0.4	3.1
Ag	0.99	1.08	0.42	0.58	0.2	0.35	0.35
In	0.2	0.1	0.3	0.3		0.2	0.2
Sn	13	6	2	3	1	5	3
Sb	0.2	0.4		0.3			0.3
Cs	15.1	4.07	18.1	3.2	3.11	11.8	6.31
Ba	543	425	355	143	586	456	194
La	33.8	21.1	91.6	235	34.7	74.5	84.2
Ce	75.7	47.7	193	555	75.1	166	160
Pr	9.7	5.9	27.2	57.3	8	18.8	19.3
Nd	35.5	21.5	101	195	28	64.6	66.9
Sm	7.8	4.7	21.4	39.1	5.5	13	13.1
Eu	1.04	0.66	1.35	2.53	0.85	1.06	0.99
Gd	8.3	4.9	22.2	42	5.7	13.8	14
Tb	1.4	0.8	3.5	6.5	0.8	2.1	2.1
Dy	9.2	5.4	22	39.7	5.5	14.1	13.1
Ho	2	1.2	4.6	7.4	1.1	2.8	2.5
Er	6	3.5	13.1	19.7	3.4	8.5	7
Tm	1	0.5	1.9	2.8	0.5	1.3	1
Yb	6.3	3.4	11.6	16	3.3	7.8	5.7
Lu	1.1	0.6	1.9	2.2	0.6	1.3	0.9
Hf	21.2	13.3	0.8	0.2	1.4		
Ta	0.8	1.4	0.3			0.2	
W	0.6	2.5		0.6			1.5
Tl	1.43	0.92	1.91	0.43	1.08	1.73	0.6
Pb	37.3	35.2	54.4	41.5	24.6	52.4	46.3
Bi	0.78	0.73	0.85	1.59	0.34	1.34	1.6
Th	17.2	15.4	42	154	17.6	57.6	55.9
U	5.5	3.2	12.5	74.6	4.5	12.4	26.7
Li	24.2	16.6	22	23.6	17.2	29.1	16.7
Na	2.02	1.28	1.31	0.31	1.57	1.45	0.65
Mg	0.32	0.17	0.35	0.17	0.22	0.24	0.18
Al	6.78	4.27	5.09	7.04	4.97	5.96	5.09
K	2.34	1.15	1.83	0.49	2.13	2.55	0.86
Ca	1.58	0.63	1.48	0.26	0.84	0.77	0.55
Mn	574	383	705	545	321	624	316
Fe	4.37	3.24	6.49	8.43	1.96	5.22	6.55
Se	1	0.4	2.1	4.5		0.9	2.7
Te	0.1	0.2					
Re	0.003	0.002	0.003	0.001	0.004	0.002	0.004

Sample ID	PERN134007	PERN134008	PERN134009	PERN134010	PERN134011	PERN134012	PERN134013
Coordinates							
X	3452520	3452504	3452480	3452460	3452440	3452420	3452398
Y	6701341	6701342	6701341	6701336	6701340	6701345	6701338
Concentrations							
Cd	0.3	0.4	0.3	0.3	0.3	0.5	0.3
Cu	14.4	22.9	13.9	10.2	23.7	12.5	13.7
Ni	5.3	4.1	4.4	6.8	7.4	5.8	3.5
Zn	139	116	110	76	158	88.6	43
Be	6.6	5.5	4.5	3.7	9.8	5	3.2
V	32	27	28	26	45	56	18
Cr	18.9	27.8	16.2	16.4	26.5	17.1	11.6
Co	6.2	3.4	3.7	3.2	5.1	3	1.7
Ga	29.7	20.5	25.1	33.1	24	53.8	18.2
Ge	0.4	0.3	0.3	0.1	0.3	0.1	0.1
As	11.5	22.6	17.3	9.7	25.5	44.9	7.9
Rb	191	101	102	107	101	134	114
Sr	79.4	35.5	45.7	73	59.3	73.4	99.8
Y	98.3	106	70.7	47.4	109	56.9	34.8
Zr	241	488	133	187	434	629	397
Nb	12.9	23.7	14.6	11.1	11.2	40.6	7.5
Mo	3.3	4	5.1	3.4	7	8.2	2.9
Ag	0.84	1.17	0.71	0.58	0.99	1.88	0.54
In	0.2	0.3	0.2	0.2	0.3	0.2	
Sn	6	5	5	4	3	18	5
Sb	0.2	0.4	0.3	0.4	0.4	0.4	0.1
Cs	10	8.13	10.2	6.66	5.68	9.56	3.65
Ba	346	184	221	303	277	364	444
La	90.4	115	90.3	56.5	87	61.8	28.3
Ce	208	255	174	115	231	122	69.3
Pr	27.6	36.2	22.7	15.2	30	15.2	9.4
Nd	99.3	130	79.5	53.8	109	53.8	34.6
Sm	20.6	28.4	15.8	11.3	24.4	11.1	8
Eu	1.53	2.01	1.13	1.05	1.89	0.99	0.9
Gd	21.1	27.6	16.3	11.4	24.6	11.5	7.8
Tb	3.3	4.4	2.4	1.7	4	1.8	1.3
Dy	21.1	26.8	15.1	10.7	26.4	11.6	8.3
Ho	4.2	4.9	3	2	5.1	2.4	1.6
Er	12	13.6	8.1	5.5	14.7	6.8	4.7
Tm	1.8	1.9	1.2	0.8	2.2	1	0.7
Yb	10.7	11.4	6.9	4.9	13.3	6.3	4.4
Lu	1.7	1.6	1.1	0.8	1.9	1	0.7
Hf	2.4	13.3	1.2	2.1	10.8	17.3	10.6
Ta	0.1	1.3	0.2	0.2	0.3	2	0.3
W	1.9	3.8	3	2.7	5.6	6	1.1
Tl	1.15	0.74	0.74	0.8	0.74	1.13	0.98
Pb	53.9	56.8	55.3	48.4	68.4	80	38
Bi	1.29	1.25	1.33	1.26	1.72	3.05	0.71
Th	61.4	115	41.2	39.1	121	34.6	28.6
U	17.5	39.2	16.8	13.2	35.2	9.1	13.4
Li	27.7	25	28.6	21	37.5	24.5	17.4
Na	1.16	0.61	0.65	0.8	0.74	0.96	1.24
Mg	0.31	0.2	0.24	0.24	0.27	0.22	0.14
Al	6.57	8.02	5.06	5.51	9.44	4.73	5.59
K	1.6	0.92	1.02	1.29	1.2	1.32	1.63
Ca	1.06	0.59	0.63	0.66	0.52	0.71	0.57
Mn	581	372	350	365	317	351	224
Fe	6.88	6.39	7.26	4.69	8.71	8	2.85
Se	2.4	4.3	2.1	2.1	2.2	0.6	1.5
Te							
Re	0.001	0.001	0.001	0.004	0.002		0.001

Sample ID	PERN134014	PERN134015	PERN135001	PERN135002	PERN135003	PERN135004	PERN135005
Coordinates							
X	3452380	3452339	3452779	3452756	3452738	3452721	3452696
Y	6701340	6701341	6701348	6701337	6701338	6701337	6701340
Concentrations							
Cd	0.4	0.3	0.2	0.2	0.2	0.2	0.2
Cu	9.2	11.1	7.5	9.2	11.4	7.4	8.7
Ni	7.7	5.1	4.7	3.9	5	3.7	4.8
Zn	48.5	132	44.8	46.3	85.3	58.8	45.9
Be	3.1	3.7	2.6	2.8	2.7	2.8	3
V	12	22	14	13	17	13	10
Cr	17.8	8.8	8.5	9.1	12.6	10.8	11.1
Co	2.6	4.6	2.3	2.5	3.1	2.3	2.4
Ga	27.1	25.6	14.5	14.9	15.8	15.5	15.3
Ge		0.2		0.1	0.2	0.4	0.4
As	1.7	7.2	4.4	3	4.4	3.3	2.7
Rb	189	165	134	136	145	147	155
Sr	98.7	70.3	156	159	148	150	168
Y	40.9	43.9	28.8	26.6	26.6	26.2	34.3
Zr	555	12	173	182	90	120	271
Nb	1.6	0.2	3.6	3.3	2.6	1.5	0.9
Mo	0.7	1.2	1.1	0.6	0.7	0.5	0.3
Ag	0.51	0.25	0.29	0.29	0.26	0.24	0.31
In		0.2					
Sn	5			1			2
Sb							
Cs	9.57	7.85	2.88	2.87	3.2	3.05	2.91
Ba	477	331	596	622	600	607	642
La	34.7	49.9	29.1	26.8	23.1	23.7	38.5
Ce	74.7	104	61.7	59.2	49.8	52.8	90.2
Pr	9.4	12.6	7.6	6.7	6	6	9.8
Nd	33.4	43.3	27.2	24	21.7	22.1	34.4
Sm	7	8.9	5.6	4.9	4.7	4.5	6.6
Eu	0.83	0.77	0.9	0.88	0.83	0.79	0.99
Gd	7.1	9.1	5.6	5.1	4.8	4.8	7
Tb	1.2	1.4	0.9	0.8	0.8	0.8	1
Dy	7.7	8.8	5.7	5.2	5	4.9	6.3
Ho	1.6	1.8	1.2	1.1	1.1	1	1.3
Er	5.1	5.2	3.5	3.1	3.1	3.2	3.8
Tm	0.8	0.8	0.5	0.5	0.5	0.5	0.6
Yb	5.2	4.9	3.2	3	3	3	3.5
Lu	0.9	0.8	0.6	0.5	0.5	0.5	0.6
Hf	9.4	0.2	1.1	1.9	0.5	0.9	4.9
Ta				0.1			
W			0.3	0.1			
Tl	1.53	1.21	1.09	1.1	1.1	1.06	1.11
Pb	35.6	47.1	28.9	31	33	27.3	29
Bi	0.57	0.94	0.33	0.29	0.37	0.28	0.3
Th	23.2	47.4	13.8	12.7	10.6	10.5	13.1
U	8	11.1	3.1	2.7	2.9	3.5	3.8
Li	13.7	25	10.9	12	13.5	12.6	12.8
Na	1.57	1.08	1.71	1.73	1.67	1.67	1.82
Mg	0.19	0.21	0.18	0.19	0.19	0.17	0.19
Al	5.28	5.95	5.16	5.2	5.19	5.07	5.39
K	1.96	1.74	2.12	2.34	2.5	2.57	2.8
Ca	0.79	0.61	0.97	0.99	0.89	0.89	0.98
Mn	358	1750	303	290	352	320	300
Fe	2.72	4.11	1.89	1.74	2.31	2.02	1.86
Se	0.2	0.1					
Te							
Re	0.004	0.001	0.004	0.003		0.001	0.004

Sample ID	PERN135006	PERN135007	PERN135008	PERN130107	PERN130108	PERN130109	PERN130110
Coordinates							
X	3452698	3452740	3452767	3452579	3452558	3452536	3452516
Y	6701323	6701324	6701324	6701361	6701363	6701369	6701367
Concentrations							
Cd	0.2	0.2	0.3	0.3	0.2	0.2	0.3
Cu	16.6	9.1	31.4	12.5	22.8	19.2	10.1
Ni	11.4	5.1	21.8	5.1	8.1	8.5	4.7
Zn	108	58.7	111	116	145	133	148
Be	2.9	3.1	3.2	8.4	8.8	11	6.4
V	38	13	55	24	43	39	31
Cr	24.5	7.8	35.6	34.3	24.3	30.9	10.2
Co	5.1	2.8	8.7	8.2	7.4	5.8	5.9
Ga	16.3	14.5	22.1	21.7	20.9	20.8	32.8
Ge	0.2		0.3	0.3	0.3	0.4	0.3
As	3.2	3.8	1.9	15.1	23.1	14.7	8.8
Rb	122	127	137	118	87.3	86.2	155
Sr	169	143	140	102	66.4	66.9	93.6
Y	28.2	28.4	29.2	127	134	136	53.4
Zr	156	40	428	54	128	42	3
Nb	0.8	1.4	0.4	7.8	2.1	1.3	0.5
Mo	0.4	0.8	0.3	3.1	5.1	5.3	3
Ag	0.27	0.2	0.4	0.5	0.52	0.46	0.39
In				0.2	0.3	0.2	0.2
Sn	2		2				
Sb				0.3	0.2	0.3	
Cs	4.05	3.3	6.32	4.18	4.59	4.85	7.96
Ba	604	574	634	441	294	308	426
La	34.2	32.2	37.5	215	88	151	52
Ce	73.6	68.1	69.9	399	241	347	111
Pr	8.1	8.1	8.4	48	35.3	45.6	14.2
Nd	28.3	28.2	29.4	162	129	154	50.3
Sm	5.6	5.6	5.7	28.5	30.2	30.6	9.7
Eu	0.81	0.88	0.78	2.36	2.28	2.34	1.13
Gd	6	5.7	5.9	31.6	30.3	33.8	11
Tb	0.9	0.9	0.8	4.5	5.5	5.3	1.7
Dy	5.4	5.5	5.4	27.4	36	31.4	10.6
Ho	1.1	1.1	1.1	5.5	7.1	6.2	2.3
Er	3.3	3.3	3.3	15.1	20.6	17	6.4
Tm	0.5	0.5	0.5	2.2	3.1	2.5	1
Yb	3	3.2	3.1	10.2	15.6	12.1	5.1
Lu	0.5	0.5	0.5	1.6	2.3	1.7	0.8
Hf	2.1		8.7	0.4	1.5	0.4	
Ta							
W				1.9	2.8	1.8	0.2
Tl	0.86	1.02	1.13	1.03	0.77	0.65	1.2
Pb	28.2	26.1	32.5	37.6	42.5	44.5	62
Bi	0.29	0.44	0.45	1.06	1.23	1.57	1.53
Th	14.6	12.9	16.2	72.2	111	113	40.3
U	4.3	3.5	4.8	23.8	62.9	40.1	6.9
Li	27.7	13	43.1	25.6	36.4	40.4	27.3
Na	1.52	1.57	1.28	1.25	0.8	0.68	1.18
Mg	0.49	0.17	0.88	0.19	0.32	0.31	0.25
Al	5.56	5.11	6.67	6.51	8.17	7.39	6.18
K	2.23	1.85	2.01	1.7	1.18	1.09	1.57
Ca	1.03	0.9	0.86	0.68	0.6	0.48	0.8
Mn	323	425	460	743	551	275	533
Fe	2.53	2.18	3.85	4.86	7.71	6.46	6.13
Se			0.3	2.4	2.5	2.9	0.6
Te				0.1			
Re	0.002	0.003	0.004	0.001	0.001	0.001	0.007

Sample ID							
	PERN130112	PERN130113	PERN130114	PERN130115	PERN130116	PERN130117	PERN130203
Coordinates							
X	3452471	3452444	3452424	3452402	3452375	3452363	3452139
Y	6701379	6701372	6701370	6701370	6701372	6701359	6701355
Concentrations							
Cd	0.1	0.3	0.3	0.2	0.2	0.3	
Cu	1.5	21.2	32	17.8	6.7	10.7	5.8
Ni	2.6	8.3	5.1	4.5	4.2	4.6	4.4
Zn	21.1	224	87.8	97.4	56.3	121	52.4
Be	2.5	10.3	8.4	10.6	3.6	4.9	2.9
V	8	41	19	49	12	27	4
Cr	15.6	12.9	17.4	41.2	9.3	18.1	8.9
Co	1.2	11.5	3.2	2.8	2.1	3.9	2.3
Ga	15.9	20.3	19.5	21.7	26.2	34.6	18.7
Ge		0.5	0.8	0.4	0.2	0.1	0.3
As	0.9	11.9	3.1	29.3	2.1	8.9	0.5
Rb	102	88	63.3	40.8	140	173	135
Sr	138	66.3	60.1	31.7	112	70.5	144
Y	15.7	169	97	140	39.2	43.7	28.4
Zr	365	100	304	132	61	5	161
Nb	1.6	2.2	1.3	4	5.7	0.2	0.8
Mo	1.6	6.1	2.5	6.1	0.2	2.8	
Ag	0.26	0.36	0.47	0.31	0.28	0.34	0.19
In		0.3	0.2	0.3		0.2	
Sn							
Sb				0.2			
Cs	3.33	5.74	4.65	2.72	8.02	10.6	2.74
Ba	583	302	243	123	537	302	603
La	19.7	166	176	135	34	45.8	21.4
Ce	35.8	463	331	350	70.9	93	46
Pr	4.2	51.2	41.8	49.3	9.2	11.9	5.9
Nd	14.5	185	142	173	32.3	41.6	20.6
Sm	2.7	38.4	26.7	36.1	6.7	8.4	4.5
Eu	0.78	2.77	1.95	2.61	1	0.86	0.85
Gd	2.9	43.9	29.2	37.2	7.5	9.1	4.7
Tb	0.4	6.7	4.2	5.9	1.2	1.4	0.8
Dy	2.9	41.1	23.3	37	7.8	9.3	4.9
Ho	0.6	8.4	4.4	7	1.7	1.9	1.1
Er	2	23.5	11.2	19.4	5.2	5.5	3.4
Tm	0.3	3.6	1.6	2.8	0.8	0.9	0.6
Yb	1.9	17.6	7.4	13.6	4.4	4.3	2.9
Lu	0.3	2.7	1.2	2	0.7	0.7	0.5
Hf	5.4	1	5.5	3.1	0.2		1.5
Ta					0.5		
W		1.2		2.7	0.5	1.3	
Tl	1.18	0.84	0.67	0.37	1.64	1.49	1.21
Pb	24.8	63	53.6	55.2	43.6	68.1	25.9
Bi	0.24	1.79	0.57	1.69	0.66	1.57	0.2
Th	12	119	95	127	21.6	58.1	8.4
U	3.3	41.4	37.5	58	7.8	14	2.8
Li	11	48.6	23.7	25.8	14.8	39.2	12.7
Na	1.6	0.85	0.92	0.38	1.76	1.15	2
Mg	0.13	0.36	0.25	0.18	0.2	0.26	0.17
Al	4.96	7.68	5.89	9.05	5.85	6.46	5.69
K	1.49	1.05	0.92	0.54	1.78	1.67	2.34
Ca	0.68	0.8	0.65	0.28	0.84	0.65	0.91
Mn	222	767	296	184	302	697	419
Fe	0.88	7.63	2.47	7.37	2.17	5.34	1.94
Se		2.2	2	2.7	0.6	0.6	0.1
Te		0.1					
Re	0.002		0.003	0.001	0.002	0.006	

Sample ID	PERN130210	PERN130211	PERN130218	PERN130225	PERN130226	PERN130233	PERN130240
Coordinates							
X	3452453	3452214	3452220	3452426	3452219	3452222	3452409
Y	6701297	6701271	6701254	6701299	6701238	6701115	6701294
Concentrations							
Cd	0.4	0.2	0.1	0.3	0.2	0.5	0.1
Cu	5.3	9.9	12.4	4.1	17.2	11.4	6.7
Ni	3.1	7.2	5.2	2.8	5.5	4.1	3.5
Zn	171	140	120	45.1	86.1	201	103
Be	5.7	3.6	6.3	3.4	6.3	6.1	5.7
V	6	29	26	8	44	25	14
Cr	26.4	19.5	29.9	9.8	27.2	12	18.3
Co	6.2	4.4	4.2	1.8	3.1	6.2	3
Ga	46.1	26.6	19.3	21.6	24.7	29	39.3
Ge	0.4	0.6	0.4	0.3	0.4	0.5	0.4
As	0.7	5.5	9.8	1.2	18.3	4	9.5
Rb	197	155	125	131	101	209	203
Sr	92.5	136	121	100	46.8	73.4	96.8
Y	81.1	44.2	59.3	33.1	111	108	67
Zr	886	28	21	1000	198	41	14
Nb	0.5	5.2	1.2	2.6	19.9	13.7	9.5
Mo	0.1	1	3	0.5	11.6	0.8	0.4
Ag	0.47	0.29	0.24	0.51	0.8	0.75	0.49
In	0.2	0.1	0.1		0.3	0.3	0.2
Sn					6		
Sb		0.1			0.7	0.1	0.2
Cs	19.2	8.26	6.26	4.37	6.75	13.8	10.4
Ba	489	543	495	534	244	377	422
La	57.7	49.1	66.6	23	113	91.1	53.4
Ce	128	95.7	133	50.4	230	190	112
Pr	18.3	12.4	16.7	6.5	33.6	27.3	14.6
Nd	67	42.9	59.6	23.9	116	100	54.6
Sm	14.2	8.3	11.4	5.1	23.9	20.7	11.1
Eu	1.36	0.98	1.19	0.8	1.68	1.28	1.05
Gd	15.1	8.8	12.9	5.7	25.2	22.9	12.5
Tb	2.4	1.3	2	0.9	4.2	3.5	2
Dy	14.9	8.3	12.3	6	25.7	22.1	12.8
Ho	3.2	1.7	2.5	1.3	4.9	4.5	2.7
Er	9.7	5	6.8	4.1	13.6	13	8
Tm	1.5	0.8	1.1	0.7	2	2	1.3
Yb	7.9	3.8	5.1	3.8	9.7	10.1	6.3
Lu	1.3	0.6	0.8	0.7	1.4	1.6	1.1
Hf	19.8	0.2		24.5	3.3	0.2	
Ta		0.1			0.5	0.7	0.4
W		0.5	0.6		3.8	0.9	0.7
Tl	1.41	1.19	1.14	1.39	0.67	1.65	1.62
Pb	58.2	40.2	32.9	29.9	46	64.5	63.7
Bi	0.82	0.72	0.61	0.21	1.31	0.89	0.93
Th	18.9	19.4	46.7	16.9	93.2	41.7	42.1
U	11.2	7.6	15.2	4.8	39.7	12.3	7.4
Li	33.7	28.9	33.7	7.5	38.6	29.1	25.2
Na	1.81	1.52	1.4	1.68	0.51	1.12	1.64
Mg	0.39	0.37	0.26	0.13	0.23	0.37	0.24
Al	6.3	5.55	6.03	5.03	6.5	4.72	5.94
K	2.21	1.96	1.88	1.83	1.02	1.75	2.13
Ca	1.51	1.08	0.85	0.77	0.41	1.4	1.06
Mn	831	414	347	371	199	809	441
Fe	6	3.88	4.49	1.86	8.18	7.7	6.24
Se	0.9	0.5	1.1	0.7	3.6	0.6	0.6
Te							
Re	0.003				0.001		0.001

Sample ID	PERN130241	PERN130245	PERN130248	PERN130255	PERN130256	PERN130263	PERN130270
Coordinates							
X	3452213	3452147	3452218	3452334	3452222	3452218	3452310
Y	6701099	6701356	6701039	6701302	6701020	6700999	6701302
Concentrations							
Cd	0.3	0.1	0.1	0.6	0.2	0.4	
Cu	14.5	3.7	7.2	25.7	12.7	9.5	17.2
Ni	5.3	4.4	4.9	4.3	3.6	4.1	5.9
Zn	312	76	63.5	513	87.4	247	60.7
Be	10	3.5	2.7	8.7	4.3	6.8	4.2
V	22	12	23	28	24	27	40
Cr	12.4	22.3	12.9	18.3	11.3	18.4	24.2
Co	8.4	3.5	2.5	14.2	2.9	7.3	2.2
Ga	27.4	19.2	30.8	34.2	23.7	29.4	17.1
Ge	0.8	0.3	0.6	1	0.3	0.5	0.5
As	12.5	1.6	5.6	2.4	11.9	10.5	12
Rb	187	134	108	329	113	256	89.4
Sr	50.5	143	94.6	53.5	61	72.5	106
Y	182	40	31.3	180	54.9	105	65.1
Zr	58	55	11	639	58	16	8
Nb	0.8	4.7	0.8	2.6	1	2	0.6
Mo	2	2.1	1.5	2.9	4.4	3.9	4.5
Ag	0.33	0.26	0.16	0.42	0.3	0.25	0.17
In	0.4		0.1	0.5	0.2	0.3	
Sn				5			
Sb			0.1		0.1		
Cs	17.5	3.39	4.34	26.5	5.86	19.9	2.66
Ba	305	604	412	378	240	373	362
La	207	41.3	45.4	157	55.3	82	72.9
Ce	436	88.8	88.1	336	117	180	155
Pr	55.5	10.3	10.6	46.8	15.4	25.7	22.6
Nd	196	36.1	36.3	177	54.8	96.3	79.8
Sm	38.9	7	7.1	35.6	11.4	20.2	17.6
Eu	2.22	1.03	0.85	1.72	1.07	1.21	1.49
Gd	44.2	7.8	7.4	39.8	12.1	21.9	17.2
Tb	6.8	1.2	1.1	5.8	1.9	3.5	2.7
Dy	41.7	7.8	6.5	37	12.3	21.7	16.3
Ho	8.1	1.6	1.3	7.8	2.4	4.4	3.1
Er	23.2	4.8	3.6	22.3	6.7	12.8	8.7
Tm	3.4	0.8	0.6	3.5	1	1.9	1.3
Yb	16.8	3.7	2.7	17.3	5.1	9.6	6.3
Lu	2.6	0.6	0.5	3	0.8	1.6	0.9
Hf	0.3			9.7	0.6		
Ta		0.2					
W		0.2	0.6		1	1	0.3
Tl	1.45	1.29	0.95	3.18	0.81	2.01	0.68
Pb	85.4	25.5	44.2	65.6	46.9	56.1	34.2
Bi	0.86	0.21	0.9	0.81	0.8	0.8	0.53
Th	98.1	23.6	28.2	125	84.1	51.1	45.1
U	49.1	5.2	9.8	17.2	16.8	26.8	49.7
Li	84.6	25.6	15.3	98.2	23.7	44.2	21.1
Na	0.9	1.96	1.13	1.08	0.84	1.07	1.13
Mg	0.44	0.23	0.25	0.63	0.17	0.4	0.21
Al	6.93	5.84	5.39	5.28	7.79	5.7	6.24
K	1.62	2.21	1.73	1.93	1.22	1.71	1.45
Ca	1.22	0.97	0.65	2	0.56	1.38	0.64
Mn	790	355	282	1330	404	825	203
Fe	9.64	2.07	3.14	13	4.32	8.47	3.76
Se	3.3	0.5		2.2	0.6	1.2	0.8
Te							
Re	0.006		0.002	0.001			0.003

Sample ID	PERN130294	PERN130305	PERN130310	PERN130335	PERN130354	PERN130360	PERN130361
Coordinates							
X	3452319	3452240	3452240	3452236	3452422	3452400	3452358
Y	6701258	6701060	6701020	6700996	6701322	6701321	6701320
Concentrations							
Cd		0.2	0.1	0.4	0.2	0.1	0.3
Cu	5	18	7.7	4.3	7.1	24	8.7
Ni	5.9	11.7	5.1	4.4	7.1	13.2	4.1
Zn	51.7	138	81.6	91	111	106	177
Be	3.6	6.5	4.4	3.8	4.9	4.2	6.1
V	16	43	27	26	19	22	26
Cr	32.4	38.3	17.8	31.2	25.2	24.4	20.2
Co	2.8	6	3.4	3.6	4.5	7.3	4.7
Ga	15.5	21.6	38	38.9	29.2	23.9	24.2
Ge	0.5	0.4	0.5	0.6	0.5	0.3	0.4
As	3	28.5	5.9	6.4	2.5	2.1	10.6
Rb	111	83.7	121	171	108	111	138
Sr	158	57.2	94.5	100	98.3	131	64.7
Y	25	139	54.3	49.6	77.3	59.6	71.2
Zr	41	143	123	826	30	66	10
Nb	0.4	14.5	12.1	28.3	5.7	0.7	1.2
Mo	1.3	5.8	2.5	4.1	0.3		3.5
Ag	0.52	0.41	0.34	0.85	0.24	0.15	0.32
In		0.3	0.2	0.2	0.2	0.1	0.2
Sn			7	10	3		
Sb		0.4	0.3	0.2			
Cs	3.1	5.37	11.7	12.8	6.29	4.49	8.22
Ba	546	263	381	423	372	491	324
La	28.5	136	67.4	42.6	98.9	64	90.5
Ce	63.1	323	131	89.4	187	127	167
Pr	7	46.3	16.7	11.7	25.5	16.4	22.7
Nd	24.6	161	58.8	43	91.2	60.3	78.9
Sm	4.9	35.2	11.4	8.6	17.7	11.7	15.3
Eu	0.94	2.28	1.24	1	1.48	1.23	1.13
Gd	5.2	34.6	12	9.5	19.3	12.6	16.5
Tb	0.8	5.7	1.9	1.5	2.8	1.9	2.5
Dy	5.2	34.4	11.2	9.9	17.1	12.4	15.1
Ho	1.1	6.6	2.3	2.1	3.3	2.4	2.9
Er	3.1	18.6	6.5	6.3	9.3	6.7	8.2
Tm	0.5	2.8	1	1	1.4	1.1	1.2
Yb	2.4	13.2	4.8	4.8	6.6	5.2	5.8
Lu	0.4	1.9	0.8	0.8	1.1	0.8	0.9
Hf	0.2	1.4	2.7	18.9	0.1	0.4	
Ta			0.6	1.5	0.2		
W		3.1	2.2	3.5	0.3		1.9
Tl	1.07	0.67	1.25	1.64	1	1.04	1.04
Pb	30.2	49.3	46.4	49.5	48.1	32.4	49.9
Bi	0.4	1.22	1.04	1.22	0.8	0.5	1.17
Th	21.2	200	47.1	36.9	45	30.7	64.1
U	4.8	72	15.4	12.6	17	11	16.3
Li	23.2	62.3	33.9	26.5	39.7	35.9	32.8
Na	1.79	0.68	1.32	1.37	1.18	1.51	0.99
Mg	0.22	0.44	0.31	0.29	0.38	0.82	0.25
Al	6.45	8.23	6.25	5.72	6.81	6.45	5.92
K	1.84	1.18	1.39	1.56	1.57	1.75	1.47
Ca	0.9	0.56	0.91	0.95	1.08	1.39	0.75
Mn	235	355	360	420	528	511	699
Fe	1.81	7.14	3.78	4.03	3.91	3.78	6.02
Se		4.1	0.8	0.7	0.7		0.8
Te							
Re				0.002	0.005	0.001	

Sample ID	PERN130369	PERN130375	PERN130376	PERN130384	PERN130385	PERN130393	PERN130399
Coordinates							
X	3452294	3452327	3452145	3452119	3452239	3452240	3452240
Y	6701318	6701348	6701383	6701379	6701120	6701100	6701080
Concentrations							
Cd	0.2	0.3	0.1	0.1		0.3	0.2
Cu	15.4	11.7	4.9	3.7	4.8	31.3	15.1
Ni	6.5	6	8.6	4.7	10.9	3.6	6.5
Zn	104	182	88.3	43.2	58.4	432	120
Be	4	9.1	3.6	3.3	2.7	7.8	7.5
V	35	34	19	12	29	10	33
Cr	26.2	19.1	35.8	26	20.8	7.5	24.9
Co	4	4.7	3.6	2.6	4	11	3.9
Ga	25.6	29.4	16.7	15.5	21	33	19.2
Ge	0.4	0.4	0.3	0.1	0.1	0.7	0.4
As	3.3	11.5	2.5	1.4	2	2.9	16.2
Rb	131	119	96.3	110	102	258	71.4
Sr	129	76	163	145	139	53	40.8
Y	38.7	84.8	24.2	18.4	28.9	192	153
Zr	4	37	178	283	17	7	100
Nb	0.2	1.4	7.4	11.4	1.3	1.3	4
Mo	3.5	2.5	2.7	2.2	1.6	0.5	5.1
Ag	0.28	0.5	0.35	0.35	0.13	0.12	0.26
In	0.1	0.2				0.6	0.2
Sn				3			
Sb			0.2	0.1			0.2
Cs	6.57	6.71	3.03	2.82	4.28	19.6	4.41
Ba	441	349	587	550	538	359	184
La	45.3	113	21.5	12.7	39.3	142	142
Ce	88.1	211	45.7	31.3	77.4	335	372
Pr	11.3	29.3	5.7	3.5	9.6	48.1	48.3
Nd	38.5	99	21	13.1	34.1	188	169
Sm	7.6	20	4.2	2.8	6.8	39.5	37.3
Eu	0.95	1.29	0.89	0.64	0.96	1.5	2.54
Gd	8	20.2	4.7	3.2	7.1	43.7	39.2
Tb	1.2	3.2	0.7	0.5	1	6.6	6.5
Dy	8	18.7	4.9	3.6	6.2	42.2	39.4
Ho	1.6	3.6	1	0.7	1.2	8.6	7.6
Er	4.7	9.7	3	2.3	3.4	24.7	21.4
Tm	0.7	1.4	0.5	0.3	0.5	3.7	3.2
Yb	3.6	6.6	2.2	1.8	2.6	17.8	15
Lu	0.6	1	0.4	0.3	0.4	3	2.1
Hf		0.3	2.4	6.6			1
Ta			0.2	0.7			
W	0.2	1.1	0.5	0.7			1.9
Tl	1.1	1.07	1.17	1.18	1.05	2.53	0.53
Pb	39.1	54.3	22.4	21.1	35.4	70.8	58.2
Bi	0.71	1.18	0.18	0.15	0.49	1.18	1.13
Th	37	89.4	13	10.3	23.8	76.7	152
U	8.2	18.3	2.1	1.3	20.5	17.9	78.3
Li	30.9	48.5	27	14.7	22.6	88.1	37.9
Na	1.41	1.08	1.97	1.97	1.4	1.14	0.51
Mg	0.36	0.29	0.29	0.2	0.42	0.55	0.26
Al	6.03	7.62	5.91	4.94	6.15	5.45	9.72
K	1.6	1.52	1.59	1.66	1.6	1.73	0.89
Ca	1.01	0.63	1.02	0.89	0.85	1.8	0.44
Mn	392	644	299	232	308	1170	301
Fe	3.79	6.12	1.93	1.5	2.03	11.2	6.31
Se		0.6			0.9	1.4	3.8
Te							
Re		0.002	0.003	0.004	0.003	0.001	0.001

Sample ID	PERN130403	PERN130408	PERN130414	PERN130516	PERN130419	PERN130425	PERN130426
Coordinates							
X	3452490	3452110	3452142	3452683	3452159	3452681	3452225
Y	6701320	6701322	6701321	6701304	6701310	6701324	6701325
Concentrations							
Cd	0.3		0.3		0.3	0.2	0.1
Cu	8.2	5.7	8.5	7	7.3	9.6	5.7
Ni	2.6	5.1	11.5	9.3	9.5	4.5	3.6
Zn	64.4	65.1	103	255	126	93	71.8
Be	3	3.1	3.2	7.6	3.9	7.2	4.1
V	24	11	26	38	28	34	20
Cr	11.6	8.8	29.8	31.7	26.3	21.2	12.9
Co	1.7	2.5	6	11.9	6.6	16.4	2.7
Ga	31.8	16.9	19.3	25.7	18.7	24.9	22.2
Ge	0.2	0.2	0.5	0.2	0.2	0.3	0.2
As	20.6	1	1.5	15.1	3.1	19.4	6.2
Rb	63.5	122	115	103	112	49.3	142
Sr	30.7	158	180	85.2	129	40	124
Y	33.8	14.8	38.1	44.2	38.5	48.9	43.9
Zr	26	143	732	50	904	25	25
Nb	3.6	4.8	0.5	9.6	12.5	1.4	1.3
Mo	2.2	0.4	0.1	4.6	1	4	1.9
Ag	0.36	0.26	0.36	0.29	0.62	0.19	0.32
In	0.2			0.2		0.2	0.1
Sn		2			4		
Sb	0.7	0.1		0.2			
Cs	3.8	3.07	3.63	4.52	4.41	2.18	5.81
Ba	136	670	630	364	492	159	523
La	33.4	15.4	38.6	43.5	31.7	57.7	45.3
Ce	71.1	29.1	77.7	94.2	67.2	115	98.8
Pr	9.2	3.5	9.9	10.7	8.1	14.2	12.3
Nd	32.7	12.5	35.1	37.8	30	49.1	44.2
Sm	7	2.6	6.8	7.4	6	10.1	9.4
Eu	0.8	0.84	0.98	1.04	0.73	1.06	1.04
Gd	7.5	2.8	7.2	8.4	7.1	11.1	9.4
Tb	1.2	0.4	1.1	1.3	1.1	1.8	1.6
Dy	7.7	2.8	7.2	9	7.1	10.8	9.9
Ho	1.5	0.6	1.5	1.8	1.5	2.2	2
Er	4	1.7	4.5	5.3	4.5	5.9	5.9
Tm	0.6	0.3	0.7	0.8	0.7	0.9	0.9
Yb	2.9	1.3	3.6	3.8	3.6	3.9	4.5
Lu	0.5	0.2	0.6	0.6	0.6	0.6	0.7
Hf		2.8	15.4	0.5	20.2	0.5	
Ta		0.2		0.1	0.4		
W	1.7	1.1		3.1	0.6	0.8	
Tl	0.44	1.29	1.07	0.82	1.1	0.45	1.38
Pb	37.8	23.1	23.5	54.3	25.2	56.7	32.6
Bi	1.25	0.2	0.23	1.56	0.28	1.22	0.56
Th	38.9	7.8	19.4	55	18.3	65.8	57.9
U	15.6	1.5	4.8	7.4	4	26.2	13.4
Li	14.4	17.1	31	51.6	32.4	19	32.3
Na	0.45	2.09	1.91	0.95	1.63	0.44	1.55
Mg	0.12	0.18	0.54	0.35	0.39	0.15	0.18
Al	6.68	5.97	6.18	7.53	5.07	8.31	6.53
K	0.68	2.17	2.03	1.41	1.47	0.56	1.99
Ca	0.35	0.92	1.26	0.69	0.99	0.35	0.75
Mn	171	172	587	1590	612	1310	269
Fe	5.27	1.17	2.78	6.99	2.98	6.03	3.18
Se	1.3		0.1	0.7		1	0.2
Te							
Re	0.002			0.003		0.002	

Sample ID							
	PERN130433	PERN130444	PERN130445	PERN130455	PERN130470	PERN130471	PERN130505
Coordinates							
X	3452249	3452662	3452277	3452575	3452558	3452198	3452195
Y	6701329	6701326	6701332	6701322	6701326	6701364	6701379
Concentrations							
Cd	0.3		0.1		0.3	0.1	0.2
Cu	13.4	7	7.5	9.5	16.8	9.5	11.4
Ni	11.7	4.1	8.6	6.1	8.1	4.4	9.8
Zn	363	46.6	150	74.7	198	102	206
Be	10.8	2.4	4	6.1	11.1	3.7	5.2
V	56	12	24	18	29	20	19
Cr	26.9	11.1	41.1	31	37.6	13.7	24.2
Co	9.2	2.2	5	4.2	14	3.7	7.5
Ga	28.2	20.1	19.6	18.7	19.5	21.4	18.5
Ge	0.3	0.3	0.5	0.7	0.5	0.1	0.5
As	14.1	2.3	3.2	8.1	17.1	7.4	1.6
Rb	127	142	139	115	86	133	118
Sr	80.7	134	172	127	56.7	125	146
Y	85.5	26.6	53.2	106	140	50.7	67.9
Zr	22	9	13	94	54	38	294
Nb	0.4	1.5	3.6	1.9	2.3	6.4	1
Mo	4.2		0.5	1.7	3.9	2.5	0.7
Ag	0.23	0.11	0.27	0.2	0.29	0.3	0.19
In	0.2			0.1	0.3	0.1	0.2
Sn							1
Sb					0.1		
Cs	7.04	5.62	5.64	3.73	6.14	8.37	4.93
Ba	316	593	541	549	275	550	538
La	97.5	26.5	60.8	81.6	151	53.8	66
Ce	198	54.2	126	204	426	113	138
Pr	24.9	6.6	15.3	27.4	36	15.3	17.9
Nd	87.6	23.3	54.9	98.2	133	54.6	63.6
Sm	17.6	4.7	11	19.9	25.6	11.2	12.4
Eu	1.42	0.9	1.09	1.84	1.91	0.97	1.17
Gd	18.8	4.9	12	22.4	31	11.4	13.2
Tb	3	0.8	1.9	3.7	4.8	1.8	2.1
Dy	19.1	5.1	11.6	24.5	32	11.6	14.1
Ho	3.7	1.1	2.2	4.9	6.2	2.3	2.8
Er	10.4	3.4	6.3	14.1	17.4	6.7	8.7
Tm	1.5	0.5	0.9	2.1	2.7	1	1.3
Yb	7.2	2.6	4.3	9.6	12	4.9	6.3
Lu	1.1	0.5	0.7	1.4	1.8	0.8	1.1
Hf	0.2			0.6	0.1		3
Ta		0.1	0.2			0.2	
W	0.9		0.2		0.4	0.8	
Tl	0.94	1.32	1.05	1.05	0.77	1.66	1.17
Pb	59.7	29.9	28.6	28.3	48.9	37.5	31.4
Bi	1.41	0.61	0.47	0.62	1.42	0.59	0.33
Th	97.2	12.9	28.1	58.7	112	25.3	40.6
U	40.1	3.9	8.2	23.9	28.7	5.6	8.6
Li	62.3	10.4	40.1	34.7	51.3	27.8	44.5
Na	0.83	1.54	1.77	1.52	0.74	1.58	1.69
Mg	0.38	0.2	0.38	0.24	0.33	0.26	0.42
Al	8.84	5.17	6.29	6.45	6.86	5.32	5.8
K	1.26	2.1	1.98	1.92	1.12	1.5	1.69
Ca	0.68	0.83	1.26	0.8	0.78	0.99	1.24
Mn	574	295	422	293	588	428	903
Fe	7.23	2.03	3.38	3.79	8.03	3.47	4.77
Se	0.7			1.1	1.7		0.3
Te							
Re		0.001	0.001		0.002	0.003	0.001

Sample ID	PERN130506	PERN130507	PERN130511	PERN130513	PERN130533	PERN130534	PERN130540
Coordinates							
X	3452582	3452563	3452180	3452517	3452122	3452143	3452163
Y	6701302	6701300	6701380	6701302	6701297	6701301	6701300
Concentrations							
Cd	0.4	0.2		0.4	0.1	0.1	0.2
Cu	20	17.4	4.4	5.9	9.4	6.2	7.4
Ni	5.9	3.4	7.3	4.5	14.3	11.6	11.8
Zn	149	46.8	91	111	172	127	102
Be	10.1	13	3.7	5.6	2.8	3.6	3.5
V	28	62	26	22	45	46	26
Cr	22.3	39.1	38.5	31.5	21.2	37	45.3
Co	37.1	3.4	3.6	4.3	6.6	5.4	6.2
Ga	19.3	15.2	17.6	29.5	17.2	19.4	18.5
Ge	0.3	0.5	0.1	0.6	0.4	0.2	0.6
As	10.7	32.9	3.4	2.8	1.5	3.6	1.5
Rb	115	24.8	103	123	85.5	91.4	109
Sr	53.5	8.3	166	117	177	181	150
Y	135	212	21	72.2	28.3	28.6	31.5
Zr	74	201	23	755	9	13	423
Nb	5.7	16.1	2.6	12	1.1	1.7	0.6
Mo	5	8.8	2.8	1.3	0.6	2.3	1.1
Ag	0.46	0.59	0.16	0.6	0.15	0.3	0.25
In	0.2	0.4		0.2			
Sn		4		3			
Sb	0.3	0.6					
Cs	6.55	2.02	3.61	12.8	3.67	4.4	4.54
Ba	198	45	612	452	592	610	617
La	177	175	24.2	68	41.4	39.8	34.9
Ce	424	479	52.3	144	83.3	77.8	68.4
Pr	43.5	67.4	5.6	19.2	9.4	9.3	8.3
Nd	154	254	19.7	70.9	32.8	32.7	29.4
Sm	29.8	56.9	4	14.5	6.1	6.4	5.8
Eu	2.2	4.14	0.89	1.33	0.95	0.98	0.94
Gd	34.4	59.9	4.4	15.9	6.3	6.4	6.1
Tb	5.3	10.3	0.7	2.5	0.9	0.9	0.9
Dy	33.3	68.2	4.4	16.1	5.8	6	6.3
Ho	6	12.5	0.9	3.2	1.2	1.2	1.3
Er	16.8	36	2.7	9.1	3.3	3.4	3.9
Tm	2.4	5.4	0.4	1.4	0.5	0.5	0.6
Yb	10.7	25.1	2	6.6	2.3	2.6	2.8
Lu	1.6	3.6	0.3	1.1	0.4	0.4	0.5
Hf	0.6	6.7		13.5			8.7
Ta		0.7		0.6			
W	1.6	3	0.5	1	0.2	0.2	
Tl	0.71	0.23	1.18	1.34	0.9	0.95	1.23
Pb	36.1	53.3	27.8	40.9	20.6	28.1	24.4
Bi	1.03	1.88	0.3	0.91	0.24	0.32	0.22
Th	81.8	200	13	41.6	16.1	16.7	16.1
U	31.4	78.7	4.3	12.4	4.3	4.9	4.1
Li	36.5	11.1	24	32.6	36.2	39	35
Na	0.6	0.13	1.8	1.47	1.59	1.65	1.77
Mg	0.25	0.07	0.28	0.34	0.56	0.51	0.48
Al	7.74	9.25	6.09	6.11	6.12	6.63	6
K	0.8	0.19	1.76	1.42	1.5	1.63	1.72
Ca	0.66	0.15	0.96	1.3	1.15	1.12	1
Mn	2170	181	322	642	325	351	427
Fe	5.08	9.86	2.15	4.34	2.68	3.17	2.63
Se	3.7	5.3		1.4			
Te	0.1	0.1					
Re	0.007	0.003	0.006	0.002	0.003		0.002

Sample ID	PERN130543	PERN130560	PERN130561	PERN130567	PERN130570	PERN130578	PERN130579
Coordinates							
X	3452655	3452205	3452220	3452235	3452613	3452260	3452281
Y	6701308	6701302	6701304	6701302	6701299	6701301	6701301
Concentrations							
Cd	0.2		0.6		0.4	0.2	0.3
Cu	16.5	4.5	9	4.5	78.1	8.2	22.9
Ni	3	5.1	3.8	3.5	11.3	4.4	9.3
Zn	45.6	67.3	249	31.9	194	60.5	141
Be	5.3	4.6	6	2.7	19.4	5	8.2
V	23	15	17	6	33	31	40
Cr	26.5	37.4	11.6	10.7	48.1	16.1	27.4
Co	1.9	2.9	7.4	1.7	9.8	2.6	4.7
Ga	14.1	17.1	28.9	16.1	47.7	22	23.2
Ge	0.3	0.4	0.6	0.2	0.7	0.5	0.3
As	12.9	6.1	2	0.3	8.8	10.9	9.6
Rb	37.7	103	216	109	72.3	107	102
Sr	17.2	143	81	144	40.8	130	122
Y	118	44.2	109	20.6	201	69.3	99.8
Zr	85	31	1600	140	9	65	46
Nb	7.9	0.3	3.7	0.4	0.2	3.7	2.1
Mo	4.2	0.8	0.5		5.7	5.4	3.6
Ag	0.43	0.13	0.78	0.12	1.27	0.27	0.44
In	0.2	0.1	0.3		0.4	0.1	0.2
Sn	1						
Sb	0.3					0.1	0.1
Cs	2.76	3.82	17.2	3.59	10.7	5.42	6.98
Ba	78	522	367	621	256	498	422
La	130	54.1	61.2	25.8	455	83.8	146
Ce	325	114	149	48.8	737	166	241
Pr	41.3	12.8	21.6	5.7	95.5	23.4	34.6
Nd	148	44.9	83.9	19.7	319	83	121
Sm	31.9	8.7	18.5	3.8	57.4	16.2	23.4
Eu	2.35	1.05	1.1	0.82	3.77	1.55	1.92
Gd	34.3	9.1	20.5	3.9	58.6	16.4	24.6
Tb	5.4	1.5	3.4	0.6	8.3	2.5	3.7
Dy	34.6	9.4	23.1	3.9	48.1	15.6	22.8
Ho	6.3	1.9	4.6	0.8	8.9	3.1	4.3
Er	17	5.6	14.2	2.5	23.6	8.7	11.9
Tm	2.5	0.8	2.2	0.4	3.1	1.3	1.7
Yb	11.2	4.1	10.6	2	13.6	5.8	7.6
Lu	1.6	0.6	1.8	0.3	2.1	0.9	1.2
Hf	2		36	1		0.2	0.3
Ta	0.2						
W	1.8					1	2.3
Tl	0.34	1.07	1.91	1.21	0.71	1.23	1
Pb	36.3	29.5	32.1	25.7	190	39	44.8
Bi	0.81	0.58	0.63	0.21	2.23	0.74	0.99
Th	95.3	37.8	26.6	10.1	143	52.5	74.5
U	54.3	10.4	7.4	3.7	101	18.1	42
Li	12	24.9	37.1	14.9	21.3	31.1	46.5
Na	0.24	1.63	1.42	1.72	0.46	1.49	1.29
Mg	0.11	0.25	0.41	0.16	0.18	0.23	0.37
Al	10.0	5.72	4.61	5.21	7.11	6.23	6.92
K	0.37	1.71	1.38	1.84	0.89	1.54	1.53
Ca	0.24	0.93	1.69	0.79	0.35	0.82	0.91
Mn	139	338	1050	224	197	311	327
Fe	3.82	3.14	7.32	1.15	5.53	4.04	4.3
Se	4.2		0.6		3.4	1.1	2.1
Te							
Re	0.002		0.008		0.005	0.005	0.003

Sample ID	PERN130585	PERN130588	PERN130601	PERN130608	PERN130611	PERN130616	PERN130617
Coordinates							
X	3452302	3452598	3452280	3452295	3452663	3452116	3452137
Y	6701300	6701304	6701348	6701339	6701344	6701400	6701399
Concentrations							
Cd	0.4	0.3	0.2	0.1	0.2	0.1	0.1
Cu	22.1	9.1	15	9.3	26.2	12.2	4.1
Ni	16.6	7.2	13.3	8.6	25.5	9.6	7.8
Zn	129	194	76.6	77.9	163	61.1	72.2
Be	5.7	6.2	3.2	3.3	5.7	3.1	3.4
V	61	37	39	39	41	25	8
Cr	58.9	24.1	47.2	27	50.7	16.6	25.9
Co	8.6	7.8	5	3.8	12.4	4.8	4.3
Ga	22.4	33	17	31.9	22.4	17.5	16.8
Ge	0.5	0.4	0.2	0.6	0.5	0.2	0.4
As	12.9	12.7	5	8	2.7	3.1	0.9
Rb	120	227	101	93.3	130	109	118
Sr	132	91.7	175	105	120	167	156
Y	114	78.8	33.6	33.8	100	25.1	34.2
Zr	447	248	68	20	644	266	70
Nb	22.7	12.4	4.9	3.1	2.6	8.6	0.9
Mo	4.5	3.2	3.5	2.4	0.3	1.1	0.4
Ag	0.64	0.66	0.27	0.16	0.45	0.34	0.2
In	0.2	0.3		0.1	0.2		
Sn	4	4			2	3	
Sb	0.3	0.3	0.2	0.2			
Cs	5.61	14.1	3.5	4.75	6.33	3.69	3.38
Ba	458	386	540	386	553	645	562
La	157	82.5	49	61.4	87.8	31.1	29.1
Ce	313	160	99	112	190	83.7	63.6
Pr	41.4	20.2	12.1	14	25.2	7.4	8.1
Nd	140	72.4	41.7	48.3	87.9	26.2	29.9
Sm	27.3	14.3	8.2	9.2	18.1	5	6
Eu	2.14	1.16	1.02	0.94	1.84	0.97	0.96
Gd	28.5	15.9	8.2	9.4	18.8	5.5	6.3
Tb	4.2	2.4	1.2	1.3	3.2	0.8	1
Dy	26.2	16	7.4	7.9	20.9	5.1	6.8
Ho	4.9	3.2	1.4	1.4	4.3	1	1.4
Er	13.7	9.3	4.1	3.8	12.6	3	4.2
Tm	1.9	1.4	0.6	0.6	1.9	0.4	0.6
Yb	9.2	6.6	2.9	2.5	10.8	2.2	3.1
Lu	1.4	1.1	0.4	0.4	1.7	0.3	0.5
Hf	7.2	1.7	0.4		0.9	5.9	0.6
Ta	0.3					0.2	
W	3.3	2	0.8	0.4		0.6	
Tl	0.94	1.32	0.86	0.79	1.13	1.25	1.12
Pb	31.9	53.9	23.7	40.2	35.3	24.6	23.9
Bi	1.03	0.94	0.38	1.15	0.67	0.21	0.23
Th	63.7	60.2	23.7	35.8	41.6	11.5	12.2
U	34.7	12	15.1	13.6	18	2.7	3
Li	54.8	58.5	29.2	31	62.4	25.4	24.2
Na	1.35	1.11	1.71	1	1.21	1.91	1.86
Mg	0.76	0.44	0.5	0.44	0.81	0.36	0.33
Al	7.14	5.85	6.83	6.2	7.81	6.04	5.81
K	1.92	1.8	1.92	1.55	1.82	1.82	2.02
Ca	1.2	1.22	1.15	0.79	0.98	1.01	1.09
Mn	578	744	323	278	1090	277	351
Fe	5.46	7.36	2.53	3.9	6.7	2.06	2.27
Se	1.8	1.1	0.2	0.5	1.8		
Te							
Re	0.004	0.006	0.007	0.008		0.002	

Sample ID	PERN130623	PERN130626	PERN130627	PERN130629	PERN130631	PERN130632	PERN130637
Coordinates							
X	3452173	3452649	3452693	3452249	3452202	3452236	3452241
Y	6701388	6701348	6701335	6701335	6701400	6701334	6701348
Concentrations							
Cd			0.2	0.2	0.1	0.1	
Cu	13	3.5	12	8.6	9.9	7.5	4.6
Ni	11	3.1	15.3	5.8	5	3.5	2.7
Zn	61.7	50	69.3	123	83	57.6	25.3
Be	2.6	3.2	2.9	5.8	3.4	4	2.3
V	29	6	40	31	11	7	8
Cr	26.1	19.7	30	36.8	10.5	42.9	7.8
Co	5.1	1.9	6.1	5.4	2.9	2.2	1.1
Ga	16.5	15.8	16.6	23.9	16.6	19.8	17.9
Ge	0.3	0.3	0.5	0.4	0.3	0.2	0.2
As	1	2.2	2.5	5.9	2	2.2	0.2
Rb	99.6	117	97.9	144	123	118	110
Sr	214	148	197	123	155	127	110
Y	25.8	21.7	40.9	68	26.7	40.4	21.7
Zr	23	42	287	100	130	27	198
Nb	0.4	0.8	2.3	3.5	0.8	3.9	1.1
Mo		0.5	0.6	4.2	0.3	0.1	0.2
Ag	0.1	0.08	0.19	0.26	0.17	0.14	0.19
In				0.1			
Sn			2				
Sb				0.2	0.2	0.1	
Cs	3.42	3	4	5.98	3.67	4.93	3.78
Ba	655	618	665	444	606	541	570
La	32.9	20.8	71.3	86.9	29.7	47.2	26.5
Ce	67.7	42.6	140	168	64	94.3	51.9
Pr	7.8	5.2	15.8	21	7.2	12	6.3
Nd	28	18.3	52.9	73.4	25.8	41.9	22.1
Sm	5.5	3.7	9	14.1	5.1	8.3	4.4
Eu	1.06	0.92	1.18	1.26	0.91	0.98	0.75
Gd	5.8	3.8	9.5	15.3	5.2	8.6	4.4
Tb	0.8	0.6	1.3	2.2	0.8	1.3	0.6
Dy	5.3	4.3	7.9	14.3	5.3	8.2	4.2
Ho	1.1	0.9	1.5	2.8	1.1	1.6	0.9
Er	3.2	2.8	4.3	8	3.2	4.8	2.7
Tm	0.5	0.4	0.6	1.2	0.5	0.7	0.4
Yb	2.2	2.2	2.9	5.9	2.4	3.4	2.2
Lu	0.4	0.4	0.4	1	0.4	0.6	0.4
Hf			6.7	0.6	1.5		1.8
Ta						0.3	
W				1.2		0.2	
Tl	0.99	1.29	1.02	1.18	1.28	1.3	1.38
Pb	23	25.4	23.4	46.8	29.6	33.2	30.8
Bi	0.18	0.3	0.23	0.64	0.29	0.39	0.25
Th	11.5	10.6	21.1	50	17.4	18.7	13.9
U	3.2	3.6	8.7	18.6	3.5	9.3	4.6
Li	20.1	14.6	25	30.8	27.9	20.7	7.8
Na	1.97	1.88	1.77	1.46	1.87	1.59	1.37
Mg	0.5	0.14	0.56	0.3	0.22	0.18	0.11
Al	6.24	5.64	6.53	6.57	5.91	5.78	4.86
K	1.89	2.01	1.83	1.88	2.06	1.8	1.73
Ca	1.38	0.79	1.19	1.05	0.91	0.79	0.61
Mn	326	228	306	586	309	303	217
Fe	2.1	1.45	2.21	3.94	1.98	2.3	1.1
Se				0.3			
Te							
Re	0.003	0.003	0.005	0.003	0.004	0.007	0.004

Sample ID	PERN130638	PERN130641	PERN130647	PERN130653	PERN130656	PERN130661	PERN130662
Coordinates							
X	3452159	3452610	3452142	3452421	3452111	3452421	3452421
Y	6701281	6701352	6701281	6701041	6701339	6701021	6701001
Concentrations							
Cd	0.2		0.1	0.2	0.2	0.2	0.1
Cu	8.7	6.4	9.5	15.7	14.7	7	18.6
Ni	12	5.5	5	4	11.4	4.6	16.4
Zn	167	41.2	103	207	85.1	131	51.3
Be	4.3	2.9	4.9	8.4	3	6	2.7
V	15	6	18	22	38	28	16
Cr	38.7	7.2	28.7	14.3	30.7	29.5	28.3
Co	6.6	2	4.5	8	5.5	3.4	6.7
Ga	19.5	14.9	19.6	29.7	17.9	27.8	14.7
Ge	0.4	0.2	0.5	0.6	0.3	0.2	0.3
As	0.6	1.1	6.4	12.4	3.3	11.6	1.6
Rb	123	109	151	215	125	160	120
Sr	145	155	137	78.1	179	108	165
Y	63.4	26.1	50.1	111	27.9	44.4	35.7
Zr	261	19	30	65	465	112	198
Nb	8.6	1.1	4.9	1.9	12.2	10.1	0.8
Mo	0.3		3	3.8	1.2	4.6	0.2
Ag	0.35	0.15	0.22	0.29	0.48	0.49	0.21
In	0.1		0.1	0.3		0.2	
Sn				2	3		
Sb			0.1	0.1	0.3	0.5	
Cs	3.98	2.71	7.05	16.7	4	6.24	5.25
Ba	531	633	543	390	643	493	711
La	50.4	28.8	56.4	118	33.4	50.9	57.8
Ce	107	67.9	112	227	67.1	101	121
Pr	14.1	7	13.6	30.3	8	12	14.8
Nd	50.8	24.2	46.8	106	28.7	42.1	51.7
Sm	10.3	4.7	9.3	21.7	5.6	8.4	10
Eu	1.11	0.97	1.06	1.5	0.92	0.99	1.14
Gd	11	5.1	9.6	23.1	5.9	8.8	8.9
Tb	1.8	0.8	1.5	3.7	0.9	1.4	1.3
Dy	12.3	5.1	9.8	23.6	5.5	9.4	7.6
Ho	2.6	1	2	4.7	1.1	1.8	1.5
Er	8	3.2	6	13.7	3.3	5.4	4.3
Tm	1.3	0.5	0.9	2	0.5	0.8	0.6
Yb	6.3	2.5	4.4	9.5	2.5	4	3.4
Lu	1.1	0.4	0.7	1.5	0.4	0.6	0.7
Hf	2.7			0.3	10.4	0.9	5.1
Ta	0.5					0.1	
W	0.1		0.5	0.2	0.5	2.1	
Tl	1.06	1.15	1.36	1.83	1.16	1.23	1.12
Pb	25.7	25	39.7	64.1	25.2	54.7	27
Bi	0.28	0.2	0.6	1.44	0.24	0.83	0.26
Th	24.3	11	34.3	94.6	17.1	42.8	15.9
U	7.3	4	10.7	31.1	4.1	16.4	10
Li	35.5	15.2	32.2	49.9	25.9	39.1	28.9
Na	1.69	1.83	1.66	1.19	1.8	1.42	1.29
Mg	0.53	0.18	0.25	0.31	0.49	0.24	0.54
Al	6.04	5.43	5.88	6.17	6.32	6.45	6.11
K	2.04	2	2	1.71	2.11	2.22	2.1
Ca	1.28	0.88	0.97	1.09	1.17	0.78	0.81
Mn	766	245	424	847	378	375	263
Fe	3.94	1.44	3.65	7.71	2.44	4.7	2.16
Se	0.2		0.2	0.9		1.2	0.9
Te							
Re	0.006	0.006	0.004	0.003	0.003	0.004	0.003

Sample ID	PERN130668	PERN130671	PERN130677	PERN130683	PERN130693	PERN130698	PERN130702
Coordinates							
X	3452399	3452124	3452163	3452401	3452412	3452206	3452299
Y	6700997	6701333	6701330	6701041	6701029	6701332	6701197
Concentrations							
Cd	0.2	0.1	0.2	0.3	0.2	0.4	0.3
Cu	9	8.2	9.7	7.6	5.8	8.7	4.1
Ni	3	5.3	15.2	4.7	3.1	3.8	4.6
Zn	74	79.7	253	166	86.8	79	85.4
Be	3.6	3.8	5.7	6	3.9	5.4	4.7
V	9	22	44	26	18	19	27
Cr	16.3	13.3	43.3	12.8	23.6	16.6	29.8
Co	2.1	3.2	9.3	3.7	2.3	2.7	3.4
Ga	27.8	21.6	20	28.2	40.1	24.3	48.9
Ge	0.3	0.2	0.2	0.3	0.6	0.7	0.3
As	1.7	3.5	7.9	10.8	8.2	6.3	6.2
Rb	176	151	134	123	179	164	206
Sr	83.7	134	136	55.2	94.8	119	113
Y	48	33.4	46.4	47.5	46.1	104	51.6
Zr	20	23	12	48	123	343	791
Nb	5.4	3.1	2.6	1.1	3	6.5	45.3
Mo		0.8	3.4	3.8	1.9	2.1	4.5
Ag	0.24	0.19	0.5	0.18	0.29	0.34	0.97
In	0.1		0.1	0.2	0.1	0.1	0.2
Sn					7	3	15
Sb					0.2	0.1	0.4
Cs	9.16	7.07	6.21	7.71	10.3	8.55	15.2
Ba	450	534	591	254	497	554	426
La	60.4	40.1	65.9	58.9	40.9	154	44.3
Ce	112	82.9	129	114	84.9	291	95.9
Pr	15	10.4	15.2	14.7	10.6	39.9	12.3
Nd	51.5	35.9	51.7	52	38	132	45.4
Sm	9.9	7.3	10.1	10.5	7.9	23.2	9.5
Eu	0.93	0.87	1.11	0.92	0.96	1.79	1.16
Gd	10.1	7.2	10.4	10.9	8.6	24.2	10.3
Tb	1.5	1.1	1.5	1.7	1.4	3.7	1.6
Dy	10.1	7	9.8	10.9	9.2	23.7	11.1
Ho	2	1.4	1.9	2.1	1.9	4.5	2.2
Er	5.9	4	5.5	5.9	5.6	12.8	6.7
Tm	0.9	0.6	0.8	0.9	0.9	1.8	1
Yb	4.4	3	3.9	4.2	4.4	8.6	5.2
Lu	0.8	0.5	0.6	0.7	0.7	1.3	0.8
Hf				0.6	1.1	4.2	19.4
Ta	0.4	0.2					2.5
W	0.4	0.2	0.9	1.4		0.3	4.9
Tl	1.64	1.29	1.13	0.99	1.69	1.44	1.36
Pb	48.9	32	42.3	65.2	61.6	43.4	59.7
Bi	0.54	0.44	0.61	1.05	0.95	0.8	1.26
Th	26.1	25.6	46.8	60.5	29.3	59.2	30
U	9.2	6.7	16.8	57.5	10.4	25.5	12
Li	14.9	27.3	74.7	37.5	22	51.2	28.1
Na	1.44	1.65	1.44	0.73	1.68	1.55	1.47
Mg	0.23	0.36	0.62	0.24	0.29	0.22	0.31
Al	5.63	5.94	6.59	7.67	6.56	6.2	6.99
K	2.1	2.27	2.08	1.27	2.2	2.39	2.13
Ca	0.81	0.89	1.02	0.53	0.87	0.77	1.07
Mn	349	348	563	371	386	306	451
Fe	2.17	2.83	4.3	5.23	3.43	3.2	3.35
Se	0.2			0.7	0.5	0.7	1
Te							
Re	0.005	0.006	0.004	0.006	0.004	0.003	0.008

Sample ID	PERN130708	PERN130712	PERN130720	PERN130725	PERN130734	PERN130752	PERN130754
Coordinates							
X	3452204	3452221	3452109	3452301	3452440	3452402	3452303
Y	6701257	6701261	6701285	6701178	6701194	6701185	6701163
Concentrations							
Cd	0.2	0.1	0.2	0.2	0.3	0.3	0.5
Cu	7.7	4.6	5.9	19.8	5.6	6.7	4.7
Ni	11.4	3.9	10.9	13.5	4.6	4	4.3
Zn	84.6	61.3	105	260	71.4	89	128
Be	3.2	3.6	4.9	9.9	5.1	4.5	6.2
V	42	14	29	26	10	40	29
Cr	38	25.5	21.5	35.6	31.8	17.4	28.5
Co	5	2.4	11.4	11.3	2.9	3.2	4.3
Ga	17.9	15.7	15	21.7	33.6	65.1	39.9
Ge	0.2	0.2	0.2	0.6	0.7	0.5	0.6
As	4.6	2.7	3	14.6	1.7	19.9	10.5
Rb	110	124	95.5	144	203	171	222
Sr	173	137	160	106	108	59.5	93
Y	35.3	32	53.1	142	55.5	60.3	82
Zr	342	171	99	72	408	643	1180
Nb	17.4	6.5	2.2	1.9	0.6	15.5	40.8
Mo	2.5	1.9	0.7	1.9	0.8	7.3	4.9
Ag	0.46	0.23	0.14	0.15	0.28	0.59	1.16
In				0.3	0.1	0.3	0.2
Sn	3			1	7	16	16
Sb	0.3			0.1	0.1	0.6	0.4
Cs	4.09	3.55	3.09	6.7	11	12.8	16.7
Ba	618	543	516	451	505	318	424
La	45.2	36.6	54.4	119	42.3	65	75.8
Ce	89.8	70.9	173	288	88.6	127	153
Pr	11.3	8.8	13.7	36.4	11.6	16.8	20.3
Nd	38.7	30.6	48.7	127	42.4	57.7	74.9
Sm	7.6	5.9	9.7	27.5	8.8	11.8	15
Eu	1.05	0.89	1.15	2.02	1.11	1.1	1.24
Gd	7.6	6.1	10.6	28	9.3	12.2	16.1
Tb	1.2	1	1.6	5.1	1.6	2	2.5
Dy	7.5	6.5	10.8	34.5	10.8	13	17
Ho	1.4	1.3	2.2	6.6	2.3	2.6	3.4
Er	4.3	4	6.6	19.9	7.2	7.4	10.3
Tm	0.6	0.6	1	2.9	1.1	1.1	1.6
Yb	3.1	3.2	5	14.5	5.8	5.5	7.9
Lu	0.5	0.5	0.8	2.1	1	0.9	1.3
Hf	8	1.4	0.3	0.4	8	14.7	28.7
Ta	1.2	0.2	0.1			0.4	1
W	1.4	0.7				1.7	3.4
Tl	1	1.2	0.95	1.1	1.85	1.19	1.97
Pb	31.1	30	27.8	65.4	45.5	62.7	62.9
Bi	0.31	0.28	0.28	1.37	0.76	2.04	1.27
Th	21.2	20	30.5	128	25.2	45.5	47
U	9.4	8	9.5	24.2	7.4	15.2	17.2
Li	33.9	18.3	40.9	71.4	15.1	30.2	34
Na	1.62	1.63	1.55	1.25	1.86	0.96	1.57
Mg	0.55	0.22	0.44	0.48	0.26	0.26	0.31
Al	6.24	5.31	6.79	7.85	6.11	5.59	6.34
K	2.11	1.81	1.59	2.1	2.33	1.82	2.16
Ca	1.16	0.9	1.07	0.97	1.09	0.76	1.23
Mn	335	326	689	716	445	392	584
Fe	2.6	1.78	2.86	7	3.03	6.12	6.24
Se	0.4		0.5	2	0.4	1.1	1.5
Te							
Re	0.005	0.01	0.002	0.003	0.007	0.007	0.003

Sample ID	PERN130756	PERN130779	PERN130781	PERN130785	PERN130787	PERN130789	PERN130797
Coordinates							
X	3452402	3452401	3452297	3452405	3452302	3452361	3452297
Y	6701204	6701219	6701093	6701238	6701051	6701279	6701224
Concentrations							
Cd	0.6	0.3	0.3		0.4	0.2	0.2
Cu	21.4	4.7	13.3	5.2	25.7	5.7	2.5
Ni	5.6	6.4	3.2	9.2	3.3	4.4	1.7
Zn	132	61.6	76.2	71.3	81.8	43.1	24
Be	7.9	3.5	6.2	4.5	5.8	4.8	4.5
V	30	10	17	23	21	20	7
Cr	16	37.6	15.9	38.5	17.9	26.9	8.8
Co	4	3.6	2.5	4.1	2.4	1.8	0.6
Ga	33.2	23.9	30.6	22.4	14.1	36.3	26.2
Ge	0.6	0.4	0.8	0.8	0.3	1.7	1.2
As	14.3	0.7	10	4.5	23.3	3	0.4
Rb	209	130	142	152	36.8	170	198
Sr	115	149	69.9	165	19.6	148	137
Y	171	38.1	119	50.7	59.3	35.6	20.6
Zr	724	587	68	151	189	568	512
Nb	29.2	1.5	0.9	14.9	14.3	37.7	33.6
Mo	7.3	0.5	3.2	2.7	5.8	6.7	3
Ag	1.13	0.37	0.36	0.54	0.46	1.19	1.04
In	0.2		0.2	0.1	0.2		
Sn	11			3	5	15	7
Sb	0.4		0.2		0.9	0.3	0.2
Cs	11.1	4.66	6.39	4.63	2.58	7.38	4.04
Ba	443	581	356	564	77	554	674
La	231	48.5	121	77.4	88.9	34.1	25.9
Ce	469	104	254	149	182	65	43.9
Pr	61.2	13.7	37.8	19	24	7.9	4.8
Nd	219	48.8	134	66	82	27.1	15.2
Sm	42.4	9.4	28.2	12.6	16.8	5.6	2.8
Eu	2.81	1.1	2.11	1.28	1.28	1.09	1.02
Gd	43.8	9.1	28.5	12.4	15.9	5.8	3
Tb	6.6	1.3	4.7	1.9	2.5	1	0.5
Dy	41.9	8.5	30.8	10.7	14.7	6.6	3.4
Ho	8	1.7	5.8	2.1	2.8	1.5	0.8
Er	22.4	4.9	17	6.1	7.3	4.9	2.9
Tm	3.2	0.8	2.5	0.9	1.1	0.8	0.5
Yb	14.6	3.8	12.2	4.8	5.4	4.8	3.1
Lu	2.3	0.6	1.7	0.8	0.8	0.9	0.6
Hf	16	13.7	0.5	1.4	5.7	12.4	9.2
Ta	0.4			0.8	0.9	2.4	2.2
W	2.7			1.2	3.5	6.2	4.1
Tl	1.48	1.27	1.15	1.35	0.35	1.53	1.63
Pb	68.7	44.5	56.9	43.1	57.6	71.7	40.7
Bi	1.2	0.48	1.26	0.49	0.98	1.53	0.29
Th	60.4	16.6	97.6	25.1	120	20.2	10.3
U	36.7	8.7	56.6	14.5	59.4	7.5	5.1
Li	46.6	31.3	42.9	49.6	17.4	21.5	15.1
Na	1.39	1.71	1.12	1.74	0.23	2.1	2.28
Mg	0.31	0.32	0.16	0.38	0.09	0.17	0.04
Al	7.01	5.8	6.59	6.43	10.0	6.8	6.99
K	2.19	2.23	1.82	2.67	0.39	2.94	3.63
Ca	0.99	0.97	0.59	1.03	0.19	1.09	0.74
Mn	478	409	304	368	160	377	246
Fe	5.56	2.44	5.91	2.34	3.87	1.66	0.77
Se	2.6		2	0.3	4.3		
Te		0.6					
Re	0.006	0.008	0.002				

Sample ID	PERN130801	PERN130804	PERN130809	PERN130811	PERN130815	PERN130817	PERN130821
Coordinates							
X	3452203	3452433	3452420	3452375	3452204	3452200	3452382
Y	6701081	6701180	6701202	6701240	6701036	6701015	6701202
Concentrations							
Cd	0.1	0.1		0.2	0.3	0.2	0.4
Cu	9.6	3.9	7.6	3.7	6.5	2.4	17.2
Ni	4.5	1.4	6.4	2.2	2.9	3.3	5.2
Zn	74.3	13.5	61	29.2	62.5	47	151
Be	3.6	1.7	3.5	4.6	3.2	3	9.9
V	18	6	19	10	16	14	35
Cr	25.1	10.4	29.6	11.3	33.6	15.3	22.1
Co	3.4	0.4	2.9	1	2.2	2.3	4.6
Ga	24.5	27.9	17.7	28.1	19.6	18.5	30.9
Ge	0.8	0.4	0.2	1.4	0.9	0.2	1.4
As	5.7	2.4	5.3	1.6	6.9	3	15.3
Rb	193	231	149	193	119	164	126
Sr	132	34.6	162	116	84.7	143	77.2
Y	47.1	25.3	32.4	31.1	31.2	23.9	153
Zr	89	170	221	556	617	545	174
Nb	9.4	23.7	7.7	37	25.5	14.2	17.1
Mo	1.6	0.6	2.9	6.2	3.9	0.8	6.5
Ag	0.36	0.62	0.32	1.19	0.89	0.58	0.76
In					0.1		0.3
Sn	2	5	2	11	6	4	4
Sb		0.2		0.2	0.3		0.2
Cs	6.64	5.51	3.52	4.23	4.79	3.52	8.29
Ba	569	164	599	634	435	585	316
La	48.6	31.4	37.1	37.7	31.2	26.3	239
Ce	93.7	65.3	78.2	65.8	67.7	51.6	495
Pr	12	7.8	9.8	7.7	9	6.3	59
Nd	40.6	25.8	33.5	25.7	31.4	21.3	197
Sm	7.9	5.9	6.9	4.8	6.7	4.1	38.7
Eu	0.92	0.19	0.98	1.13	0.68	0.79	2.38
Gd	7.7	5.7	6.8	5.1	6.7	4.1	39.9
Tb	1.3	0.9	1.1	0.8	1.1	0.7	6.3
Dy	8.3	4.6	6.5	5.5	7.1	4.1	37.7
Ho	1.8	0.9	1.3	1.2	1.5	0.9	7.4
Er	5.6	2.7	3.9	3.9	4.3	2.8	20.3
Tm	0.9	0.4	0.6	0.7	0.6	0.4	2.9
Yb	4.6	2	3.3	3.9	3.6	2.6	15
Lu	0.8	0.3	0.5	0.7	0.6	0.4	2.2
Hf	0.5	4.7	2.2	10.6	16	12.3	2.3
Ta	0.4	1	0.1	2.3	1.5	0.5	0.3
W	1.1	0.8	0.9	4.2	2.3	1	3.1
Tl	1.49	2.3	1.31	1.64	1.27	1.36	1.16
Pb	33	45	32.4	53.1	34.9	27.7	74.5
Bi	0.59	0.14	0.41	0.89	0.51	0.35	0.98
Th	24.7	27.7	26.2	15.9	30.4	11.9	117
U	7.9	5.1	5.7	6.8	10	5.1	37.8
Li	14.5	6.7	18	14.4	18.7	13.8	53
Na	1.5	2.1	1.87	2.12	1.26	1.71	0.98
Mg	0.23	0.04	0.2	0.06	0.11	0.17	0.25
Al	5.6	6.52	5.91	6.77	4.19	5.45	7.19
K	2.96	2.44	2.24	3.38	1.55	2.56	1.14
Ca	0.83	0.24	0.98	0.74	0.55	0.81	0.77
Mn	377	83	283	248	260	270	416
Fe	2.44	0.41	1.97	1.07	3.11	1.79	7.13
Se	0.3				0.7		3.4
Te							
Re							

Sample ID	PERN130836	PERN130842	PERN130851	PERN130857	PERN130866	PERN130872	PERN130881
Coordinates							
X	3452164	3452162	3452159	3452158	3452184	3452180	3452179
Y	6701057	6701040	6701015	6701000	6701006	6701022	6701043
Concentrations							
Cd	0.1	0.1		0.1	0.2	0.2	0.2
Cu	3.6	10.6	4.5	5.1	7.4	23.4	1.9
Ni	6	12.2	3.8	6.8	5.1	17.9	2.8
Zn	88.5	85.3	50.2	68.2	121	145	31.1
Be	3.7	2.8	3.1	4.4	4.8	3.8	2.6
V	20	38	19	14	18	62	14
Cr	22.4	36.9	16.3	16.2	26.1	56.4	17
Co	3.5	5.8	2.5	4.1	4	8.1	1.9
Ga	18.1	19.5	18.9	20.7	22	19.3	16.3
Ge	0.7	0.7	0.5	0.8	0.9	0.5	0.7
As	2.7	1.6	5.9	3.1	6.3	6.2	1.7
Rb	167	140	168	176	196	110	144
Sr	162	185	146	165	127	165	142
Y	36.7	26.7	20.5	43.8	67.6	49.2	26.4
Zr	77	261	66	133	99	268	409
Nb	5.1	6.7	4	8.2	8.3	17.7	16.8
Mo	0.7	1.1	0.7	0.8	1.8	3.6	0.9
Ag	0.25	0.34	0.21	0.34	0.43	0.66	0.62
In					0.2		
Sn	1	2		2	2	4	3
Sb					0.1	0.3	
Cs	4.37	3.95	3.21	4.5	9.41	4.97	3.07
Ba	582	610	561	592	501	571	586
La	45.1	34.6	25.3	79.1	90.7	55	33.4
Ce	98.1	69.4	50.2	131	177	158	64.1
Pr	11.2	8.6	6.1	16.1	21.5	16.8	7.9
Nd	37.8	29.8	20.7	53.1	74.3	58.7	26.9
Sm	7.6	5.9	4.1	9.5	14.2	12.7	5.2
Eu	1	0.91	0.83	1.09	1.19	1.19	0.8
Gd	7.6	5.7	4.1	9.4	14.6	12.1	5.1
Tb	1.2	0.9	0.6	1.4	2.3	1.9	0.8
Dy	7.5	5.2	3.8	7.8	13.6	11.6	4.8
Ho	1.5	1.1	0.8	1.6	2.8	2.3	1
Er	4.4	3.2	2.5	4.6	8	6.7	3.1
Tm	0.7	0.5	0.4	0.7	1.2	1	0.5
Yb	3.7	2.6	2.2	3.6	6.4	5.5	2.7
Lu	0.6	0.4	0.4	0.6	1	0.8	0.5
Hf	0.4	4.8	0.3	1.1	0.4	6.4	7.4
Ta	0.2	0.3		0.4	0.2	0.9	1
W	0.6	0.4	0.5	0.7	1	1.5	1.8
Tl	1.34	1	1.27	1.36	1.42	1	1.23
Pb	34.6	25	35.7	38.3	44.2	31.8	24.3
Bi	0.28	0.24	0.37	0.41	0.63	0.37	0.19
Th	21	17.3	12.3	15.8	39.2	34.6	11.2
U	7.6	3.9	3.4	8.1	16.6	19.3	3.6
Li	25	25.3	17.4	27.6	35.5	54.5	7.1
Na	1.81	1.73	1.73	1.79	1.38	1.49	1.56
Mg	0.27	0.53	0.18	0.29	0.27	0.68	0.15
Al	6.38	6.56	5.76	6.43	5.75	7.26	5.12
K	3.03	2.7	3.09	3.16	2.54	1.69	2.09
Ca	1.01	1.14	0.81	0.99	0.97	0.95	0.83
Mn	319	340	246	327	387	320	270
Fe	2.25	2.58	2.41	2.34	4.78	3.49	1.49
Se					0.5	0.6	
Te							
Re							

Sample ID	PERN130890	PERN130905	PERN130906	PERN130907	PERN130911	PERN130913	PERN130921
Coordinates							
X	3452181	3452159	3452479	3452478	3452153	3452476	3452158
Y	6701061	6701142	6701214	6701194	6701114	6701178	6701095
Concentrations							
Cd	0.2	0.2	0.4	0.6	0.2	0.7	0.1
Cu	4.7	11.2	13.8	13.4	8.3	4.4	4.7
Ni	5.1	17.2	4.8	3.7	7.5	4.8	9.8
Zn	114	99.2	67.6	90	71.3	117	69.3
Be	4	3	5.1	4.9	3.5	5.9	2.9
V	16	61	18	14	22	21	37
Cr	26.4	43.5	27.1	15.8	31.6	18.4	42.3
Co	3.7	9.4	2.6	3.4	4	4.4	5.1
Ga	17.6	20.1	38.7	29.8	18.4	30	17.4
Ge	0.4	0.9	1.5	1.6	0.7	1.7	0.8
As	2.7	3.6	1.5	1.5	9.9	3.6	5.6
Rb	127	134	162	243	164	231	82
Sr	149	161	123	120	155	111	114
Y	43	27.6	66.3	54.3	24.6	85.9	13.6
Zr	308	242	810	907	409	1190	457
Nb	16.1	20.6	46.2	37.5	9.6	49.6	20.2
Mo	1.8	0.7	6.3	1.4	2.2	1.9	1.8
Ag	0.56	0.63	1.65	1.4	0.52	1.81	0.72
In			0.2	0.2		0.2	
Sn	2	2	16	7	3	11	4
Sb		0.1	0.2	0.2	0.1	0.3	0.2
Cs	2.79	4.32	10.6	8.97	4.39	8.18	3.52
Ba	496	603	491	570	591	494	475
La	37.3	34.4	84.3	40.4	30.3	63.5	11.2
Ce	82.8	70	149	93.1	63.8	144	28.8
Pr	10.6	8.4	18.1	12.7	7.2	20.5	3.3
Nd	38.4	29.3	59.9	47.1	24.8	75.9	11.7
Sm	8	5.8	11.1	10.1	4.9	16.4	2.7
Eu	0.98	0.77	1.19	1.14	0.87	1.26	0.38
Gd	8.2	5.5	11.8	10	4.8	16.7	2.7
Tb	1.3	0.8	1.9	1.6	0.8	2.7	0.5
Dy	8.1	5	11.8	10.4	4.6	16.9	2.9
Ho	1.8	1.1	2.6	2.3	1	3.6	0.6
Er	5.4	3.2	8	6.9	3	10.5	1.9
Tm	0.8	0.5	1.3	1.1	0.5	1.6	0.3
Yb	4.4	2.8	6.9	6.1	2.5	9.1	1.7
Lu	0.7	0.5	1.2	1.1	0.4	1.5	0.3
Hf	2.6	3.4	17.7	22.8	9.3	30.3	11.1
Ta	0.7	1.2	2.5	2.2	0.4	2.8	1.2
W	0.7	1.2	4.3	1.9	0.6	3.4	1.4
Tl	1.08	1.08	1.54	1.86	1.29	1.69	0.94
Pb	24.6	22.5	74.6	33.7	34.3	53.4	25.5
Bi	0.23	0.27	1.09	0.36	0.38	0.44	0.34
Th	15.5	14	29	14.9	20.5	23.3	9.6
U	3.6	3.6	14.9	4.8	4.4	6.3	3.4
Li	18.2	30.8	26.3	11.3	18.8	11.8	23
Na	1.76	1.45	1.62	1.99	1.74	1.86	1.46
Mg	0.24	0.75	0.2	0.22	0.27	0.3	0.3
Al	5.83	6.46	5.96	6.12	6.12	5.91	3.44
K	1.79	1.99	2.46	3.22	2.97	3.18	1.35
Ca	1.07	0.99	0.94	1.24	0.89	1.47	0.59
Mn	583	529	491	551	307	694	269
Fe	2.68	3.71	2.3	3.34	2.46	4.1	2.28
Se	0.2		0.3			1.3	
Te			0.1			0.2	
Re						0.001	

Sample ID	PERN130932	PERN130933	PERN130934	PERN130938	PERN130940	PERN130948	PERN130959
Coordinates							
X	3452282	3452480	3452484	3452285	3452482	3452280	3452270
Y	6701146	6701070	6701056	6701161	6701038	6701176	6701237
Concentrations							
Cd	0.7	0.2	0.1	0.4		0.4	0.3
Cu	6.2	9.9	10.1	15.1	3.8	27.4	10.8
Ni	3.4	2.4	2.4	6.8	3.7	8	4.3
Zn	169	49.5	30.3	224	48.2	205	58.1
Be	6.3	4.4	4.3	10.5	3.3	11.7	3.8
V	19	26	20	34	11	44	12
Cr	22.4	16.6	18	25.9	13.2	31.1	28.1
Co	6.8	1.6	1.1	7.5	2.2	6	1.7
Ga	52.4	28.1	11.1	28.8	17.1	29.1	23.4
Ge	1.3	0.6	0.4	1.1	0.7	1	1.4
As	2.4	21.8	16.5	16.2	2.1	22.5	5.5
Rb	168	83.5	29.1	167	149	128	155
Sr	78.6	34.5	12.6	78.5	140	72.9	102
Y	100	57.1	75.6	133	30.6	198	34.9
Zr	1440	205	172	222	94	373	531
Nb	18.6	19.6	11.7	18.4	6.1	25.5	41.4
Mo	2.3	5.8	5.8	5.5	0.7	9	3.8
Ag	1.11	0.75	0.57	0.69	0.35	0.92	1.32
In	0.3	0.3	0.2	0.3		0.3	
Sn	8	6	3	5	1	8	8
Sb		0.7	0.7	0.2		0.4	0.2
Cs	21.9	5.54	1.82	12.4	3.53	7.92	5.2
Ba	379	153	58	364	601	354	528
La	87.8	85.8	91.2	133	37	272	38.7
Ce	201	169	216	346	80.5	674	76.2
Pr	28	22.3	30.3	40	9.6	77.8	9.5
Nd	103	74.6	106	142	33.9	270	32.4
Sm	21.5	15.5	24.1	29.7	6.7	56	6.3
Eu	1.35	1.06	1.4	1.88	1.03	3.68	0.93
Gd	21.7	15.1	22.4	31	6.9	53.7	6.2
Tb	3.3	2.4	3.7	4.9	1.1	8.3	1
Dy	20.9	14.1	21.4	29.7	6.3	48.1	6.6
Ho	4.4	2.6	3.8	6.2	1.3	9.8	1.5
Er	12.9	6.9	10	17.8	3.9	27.8	4.8
Tm	1.9	1	1.5	2.7	0.6	4.1	0.8
Yb	10.6	4.9	7.3	13.8	3.3	20.1	4.5
Lu	1.8	0.7	1	2.2	0.5	3.1	0.8
Hf	36.8	3.3	4.8	2.6	1.1	7	10.3
Ta	0.8	0.7	0.6	0.4	0.3	0.8	2.6
W	1.4	2.7	1.5	2.9	0.5	4.4	4
Tl	1.65	0.6	0.25	1.44	1.37	1.1	1.44
Pb	62.7	65.1	41.2	62.7	29.4	68.3	38.8
Bi	1.37	1.31	0.88	1.62	0.37	1.46	0.64
Th	20.6	65	122	81.4	16.2	111	16.3
U	9.5	35.1	54.8	23.6	6.8	38.7	5.5
Li	34.1	14.6	7.9	61	16.3	61.6	12.8
Na	1.4	0.5	0.16	1.08	1.66	0.94	1.72
Mg	0.37	0.11	0.07	0.32	0.17	0.29	0.11
Al	5.54	5.27	8.89	7.58	5.54	8.22	5.2
K	1.48	0.67	0.3	1.82	2.59	1.66	2.67
Ca	1.55	0.37	0.14	1.06	0.83	0.71	0.8
Mn	967	169	81	583	254	374	358
Fe	7.1	7.45	4.54	7.68	1.63	7.52	1.72
Se	1.2	2.6	4.4	2.6		5	
Te	0.3						
Re		0.001				0.001	

Sample ID	PERN130960	PERN130965	PERN130967	PERN130977	PERN130978	PERN130983	PERN130985
Coordinates							
X	3452474	3452275	3452483	3452300	3452483	3452299	3452160
Y	6701014	6701268	6700996	6701260	6700976	6701237	6701160
Concentrations							
Cd	0.1	0.4		0.4	0.2	0.2	0.1
Cu	2.8	11	3.4	15.4	4.3	4.7	7.1
Ni	3.4	4.5	6.7	8.5	5.9	2.7	4.6
Zn	36.6	149	30.4	132	54.5	13.2	106
Be	3.1	5.1	2.8	6.7	3.3	3.4	3.5
V	11	6	7	40			14
Cr	15.5	7.3	5.8	19.9	5.1	10.3	17.6
Co	2.1	7.5	2.2	9	3	1	3.5
Ga	16.5	24.1	11.6	25.3	15.8	19.2	17.1
Ge	0.8	0.9	0.4	0.4	0.3	0.4	0.3
As	1.8	7.3	1.8	28.5	0.5	0.4	5.1
Rb	158	289	141	134	169	181	192
Sr	142	83.5	150	89.6	136	145	123
Y	28	89.4	28.5	51	37.8	23.6	27.8
Zr	262	5	42	11	138	681	72
Nb	9.3		0.3	19.7			2.1
Mo	0.7	0.7	0.5	4.8		0.3	3.1
Ag	0.42	0.63	0.32	1.09	0.3	0.42	0.34
In		0.4		0.3	0.1		0.1
Sn	2	6	3	12	13	6	2
Sb				0.5			0.1
Cs	3.35	21.1	3.8	8.86	7.84	7.18	6.01
Ba	586	519	667	419	757	684	610
La	39	88.4	43.7	90	43.5	36.7	33.6
Ce	74	221	86.1	169	90	66.3	69.7
Pr	9	29.3	11.3	20.3	12.3	7.9	9.1
Nd	31	109	38.8	67.6	43.7	25.9	31.4
Sm	6	22.9	7.7	12.7	8.8	4.7	6.4
Eu	0.93	1.51	1.2	1.17	1.23	1.05	0.99
Gd	6	20.7	6.6	11.5	7.7	4.1	5.5
Tb	0.9	3.4	1	1.8	1.3	0.6	0.9
Dy	5.4	20.8	6.4	11.2	8	4.4	5.8
Ho	1.1	4.4	1.3	2.3	1.7	1	1.2
Er	3.3	12.7	3.8	6.4	5.2	3.5	3.8
Tm	0.5	1.9	0.6	0.9	0.8	0.6	0.6
Yb	2.7	11	3.3	5.3	4.6	3.7	3.4
Lu	0.4	1.9	0.5	0.8	0.8	0.7	0.6
Hf	4.1		0.4		2.7	19.9	0.5
Ta	0.5						
W	0.7	0.4		5.1			1.2
Tl	1.33	1.9	1.31	0.99	1.53	1.4	1.36
Pb	30.7	54	30.3	65.1	33.3	43.7	41
Bi	0.37	1.18	0.34	2.42	0.47	0.77	0.8
Th	13.6	34.7	20.5	67.2	10	17.1	18.1
U	3.9	12.7	6.4	15	4.3	6.3	5
Li	16.3	20.6	13.7	34	14.2	13.9	19.1
Na	1.73	0.95	1.38	0.8	1.31	1.54	1.21
Mg	0.16	0.36	0.2	0.34	0.27	0.11	0.19
Al	5.4	5.35	5.65	6.36	5.78	6.32	6.43
K	3.01	2.01	2.45	1.51	2.45	2.87	2.72
Ca	0.86	1.19	0.82	0.7	0.85	0.77	0.67
Mn	238	1340	196	628	350	293	360
Fe	1.42	5.65	1.3	7.7	2.01	0.82	2.3
Se		2.9	0.5	2.2	1.1	0.2	0.6
Te							
Re		0.004	0.004	0.002	0.004	0.006	0.003

Sample ID	PERN130988	PERN131027	PERN131034	PERN131052	PERN131056	PERN131079	PERN131103
Coordinates							
X	3452479	3452499	3452397	3452378	3452358	3452341	3452179
Y	6701237	6701395	6701379	6701381	6701381	6701378	6701165
Concentrations							
Cd	0.5	0.3	0.3	0.2	0.4	0.3	0.3
Cu	8.4	11.1	19.7	5.6	14.6	16.8	16.8
Ni	5.8	5.5	6.7	2.3	3.4	9.8	24.1
Zn	149	118	146	17.1	82.8	112	135
Be	5.8	4.4	12.4	1.9	4.5	8.1	4
V	3	21	40	2	22	30	48
Cr		22.3	24.4	2.4	13.4	36.6	52.4
Co	5.9	5.2	14.5	0.8	1.5	4.4	9.8
Ga	25.2	27	26.6	21	30.5	27.2	21.9
Ge	1	0.8	1.3	0.2	0.4	0.9	1.2
As	1.3	6.9	19.9		14.6	11.3	3.4
Rb	323	188	47.8	141	73	125	143
Sr	58.7	83.6	32.9	88.9	33.3	95.2	103
Y	109	78.5	170	23.9	41.6	118	44.8
Zr	26	205	85	339	41	32	828
Nb	0.1	0.2	1	1.2	4.4	0.2	2.9
Mo	0.6	2.1	4.4	0.1	4.4	4.9	1.9
Ag	0.52	0.29	0.3	0.26	1.02	0.67	0.48
In	0.5	0.3	0.3		0.2	0.2	0.2
Sn	11	10		5	9	3	8
Sb					0.5		
Cs	25.5	13.2	3.32	4.24	3.62	6.13	7.14
Ba	466	492	148	577	162	388	608
La	110	91.3	248	35.2	66.6	189	59.5
Ce	275	208	545	66.5	133	404	137
Pr	36.6	26.8	65.7	8	16.6	48.5	15.2
Nd	134	95.7	221	26.2	54.4	164	52
Sm	27.8	19.6	42.1	4.7	11.6	31.7	10.5
Eu	1.61	1.33	2.97	0.73	0.92	2.03	0.93
Gd	24.8	17.6	37.4	4.1	10.2	27.8	9.1
Tb	4.1	2.8	5.7	0.7	1.8	4.2	1.5
Dy	25.3	17	32.1	4.2	10.1	24.5	9.5
Ho	5.4	3.6	6.3	0.9	1.9	4.8	2
Er	15.8	10.5	17.2	2.9	4.9	12.8	5.9
Tm	2.4	1.6	2.3	0.5	0.7	1.8	0.9
Yb	14.2	9	12	2.9	3.6	9.6	5.3
Lu	2.4	1.5	1.8	0.5	0.5	1.5	0.9
Hf	0.1	0.8	1.5	4.4	0.3	0.1	22.2
Ta				0.1			
W			1.3		2.9	1.7	
Tl	2.3	1.21	0.47	1.42	0.53	0.88	1.23
Pb	70.4	53.5	54.7	30.6	57.2	58.1	31.4
Bi	2.11	1.06	1.97	0.3	1.31	1.06	0.38
Th	67.8	38.8	71.6	24.6	56.6	66.4	25.5
U	11.2	12.7	41.4	7.6	27.3	38.2	10.5
Li	32.3	29.8	29.9	7.1	23.4	41.3	55.7
Na	0.97	0.91	0.3	1.22	0.41	0.89	0.96
Mg	0.37	0.36	0.17	0.07	0.12	0.33	0.99
Al	5.24	5.65	10.0	5.75	9.1	9.44	7.69
K	2.04	2.15	0.6	2.37	0.96	1.88	2.49
Ca	1.13	0.99	0.25	0.34	0.26	0.61	0.71
Mn	634	580	728	165	131	255	562
Fe	7.13	5.92	6.62	0.71	5.39	4.66	3.75
Se	2.9	2.5	5.8	0.3	3.7	4.4	1.4
Te							
Re	0.001	0.003	0.002	0.004	0.003		

Sample ID							
	PERN131106	PERN131113	PERN131116	PERN131120	PERN131124	PERN131132	PERN131139
Coordinates							
X	3452258	3452180	3452261	3452264	3452261	3452200	3452179
Y	6701145	6701101	6701168	6701222	6701263	6701158	6701122
Concentrations							
Cd	0.3	0.2	0.4		0.5	0.6	
Cu	15.7	12.4	14.5	3.4	12.1	12.2	11.2
Ni	4.1	10.4	6.6	3.6	5.8	3.6	10.9
Zn	63.9	70.2	168	18.4	177	319	67.1
Be	7.2	3.6	10.3	2.5	8.7	9.5	2.8
V	18	14	33		33	18	12
Cr	11.9	24.5	14.9	4.7	21.9	7.1	27.7
Co	3.1	5	8	1.7	11	11.3	4.3
Ga	20.7	18.4	29.5	16	32.2	28.7	14.9
Ge	1.2	0.6	0.8	0.3	0.5	1.8	0.4
As	13.1	1.4	20.3		15.3	2.9	5
Rb	114	179	204	163	218	480	131
Sr	75.1	135	88.3	167	84.6	53.2	142
Y	182	37	112	21	64.3	211	27.6
Zr	81	321	41	72	15	635	79
Nb	7.3		8.8		0.1	3.1	0.2
Mo	6.2	0.4	7.5		3.8	3.5	0.8
Ag	0.66	0.35	0.64	0.27	0.8	0.58	0.12
In	0.2	0.1	0.5		0.4	0.7	
Sn	5	5	10	1	4	20	2
Sb	0.7		0.2				
Cs	5.22	5.25	15.6	3.33	13.4	33.8	3.14
Ba	336	643	370	651	360	434	506
La	232	40.5	134	36.8	84.4	341	29.5
Ce	693	88.8	307	70.8	191	688	65.2
Pr	68.4	11.7	36.3	8.6	23.3	78.6	7.2
Nd	242	41.4	128	29.2	80.7	275	25.6
Sm	51.8	8.6	26.4	5.5	16.2	54.7	5
Eu	3.14	1.05	1.74	0.97	1.22	2.33	0.85
Gd	44	7.5	24	4.5	14.2	48.2	5.1
Tb	7.3	1.2	4	0.7	2.3	7.6	0.8
Dy	44	7.7	24.3	4	14.2	46.9	5.4
Ho	8.6	1.6	5	0.9	2.9	9.7	1.1
Er	24.5	4.7	14.1	2.6	8.4	28	3.5
Tm	3.7	0.7	2.1	0.4	1.2	4.2	0.5
Yb	19.9	4.2	11.7	2.5	7	23.9	2.7
Lu	2.9	0.7	1.9	0.4	1.1	4	0.5
Hf	0.6	7.1	0.2	0.7		10.5	0.8
Ta							
W	2.4		1.9		3.5		
Tl	0.85	1.3	1.47	1.24	1.09	3.44	0.89
Pb	61.4	27.5	70.3	28.1	66.5	73.1	23
Bi	0.86	0.28	1.86	0.27	1.77	1.96	0.25
Th	93.2	20.3	124	15.6	64.2	169	20.5
U	78	9.1	28.6	5	18.1	18.6	6.4
Li	31.9	32	48.5	13.8	39.9	85.2	24.6
Na	0.76	1.37	0.9	1.52	0.8	0.96	1.35
Mg	0.19	0.46	0.43	0.17	0.35	0.56	0.39
Al	8.35	6.63	8.67	6.05	7.75	5.39	5.42
K	1.66	3.01	1.63	2.77	1.45	2.26	2.39
Ca	0.55	0.81	1.06	0.8	0.88	1.71	0.8
Mn	224	325	580	212	1270	1230	295
Fe	4.66	2.13	7.87	0.91	6.94	9.79	2.04
Se	8.4	1	3.7		2.4	6.1	0.9
Te	4.3					0.1	
Re		0.005	0.001	0.001	0.001	0.001	

Sample ID	PERN131148	PERN131152	PERN131159	PERN131163	PERN131172	PERN131176	PERN131187
Coordinates							
X	3452680	3452441	3452201	3452659	3452200	3452644	3452622
Y	6701361	6701361	6701100	6701364	6701137	6701364	6701364
Concentrations							
Cd		0.1	0.3		0.2		0.1
Cu	10.3	15	14.7	8.3	4	4.9	7.6
Ni	11.7	6	3.5	10.1	3.2	3.4	2.8
Zn	65.8	141	397	56.1	190	42.7	56.2
Be	2.7	6.7	7.8	2.5	4.7	3.2	3.4
V	14	12	27	22	16	9	6
Cr	24.6	22.7	5.7	29.2	11.2	17.2	40
Co	5.5	4.9	19.5	4.4	4.7	2.1	2
Ga	14.9	19.9	31.5	15.1	26.1	14.9	22.9
Ge	0.3	0.5	0.7	0.4	0.7	0.6	0.5
As	2	6.2	3.5	1.9	2.8	2.6	1.4
Rb	129	126	315	136	253	154	172
Sr	187	112	43.6	190	103	148	110
Y	32.4	115	143	27.2	78.4	27.1	32.9
Zr	102	69	184	83	120	87	142
Nb		0.2	1.7	0.5	1.6	0.1	0.3
Mo	0.1	0.3	2.2	0.4	0.4	0.8	
Ag	0.17	0.19	0.28	0.18	0.24	0.13	0.3
In		0.3	0.4		0.2		
Sn	2	6	10	4	6	2	3
Sb							
Cs	3.65	4.44	27.4	3.77	14.3	2.49	6.14
Ba	593	455	289	588	429	565	442
La	45.1	101	138	38	64.5	28.4	28
Ce	117	229	264	82.9	136	61	56.1
Pr	10.4	33.2	39	8.5	19	7.1	7.1
Nd	35.6	125	145	29.9	71.1	25.1	25.6
Sm	6.6	26.9	29.1	5.5	14.1	4.9	5.3
Eu	0.98	1.97	1.42	0.94	1.1	0.92	0.87
Gd	7	25.7	30	5.7	15.1	5.2	5.5
Tb	1	4.5	4.7	0.8	2.3	0.8	0.9
Dy	6.3	29.1	29.5	5	14.9	4.9	6.1
Ho	1.2	5.8	6.1	1	3.1	1	1.3
Er	3.7	16.9	17.8	3	9	3.1	3.9
Tm	0.6	2.6	2.6	0.4	1.3	0.4	0.6
Yb	2.8	13.2	12.6	2.2	6.6	2.3	3
Lu	0.5	1.9	2.1	0.3	1.1	0.4	0.5
Hf	1.6	0.4	1	0.9	0.8	0.6	1.4
Ta							
W							
Tl	0.91	0.9	2.22	0.94	1.45	1	1.11
Pb	22.7	34.6	72.7	24.3	41.5	23.9	36.7
Bi	0.25	0.88	1.51	0.24	0.72	0.23	0.35
Th	18.5	83.5	67.7	15.7	28.5	13.8	14.6
U	5.8	32.3	16	3.9	9.8	4.5	6.5
Li	22.9	38.7	66.9	19	29.6	12.5	11.8
Na	1.56	1.21	0.79	1.51	1.22	1.53	1.59
Mg	0.51	0.34	0.51	0.42	0.32	0.16	0.17
Al	5.85	6.04	4.54	5.61	4.89	5.2	5.38
K	2.49	2.21	1.71	2.57	2.44	2.9	2.63
Ca	1.1	0.98	1.6	1.09	1.26	0.84	0.98
Mn	365	558	1600	240	632	240	296
Fe	2.32	5.91	12.1	1.84	5.77	1.61	1.66
Se	0.6	2.6	2.5	0.7	1	0.3	1
Te							
Re							

Sample ID	PERN131198	PERN131204	PERN131208	PERN131212	PERN131214	PERN131215	PERN131216
Coordinates							
X	3452604	3451844	3451895	3451921	3451918	3451893	3451921
Y	6701372	6701344	6701364	6701238	6701217	6701345	6701200
Concentrations							
Cd				0.1		0.1	
Cu	5	5.4	7.8	6.8	3.7	11.1	7.2
Ni	3.8	9.4	10.8	4.8	5.6	8.7	7.1
Zn	43	88.4	81.4	103	61.2	74.7	93.2
Be	3.1	2.8	2.7	3.3	2.9	2.9	3.5
V	4	35	45	24	18	24	30
Cr	19.5	25.6	35.2	10.3	20.9	20.6	20.4
Co	2	4.8	5.5	3.7	2.5	4.6	4.6
Ga	13.8	16.2	17.3	23.3	14.7	15.7	17.7
Ge	0.4	0.2	0.1	0.5	0.6	0.5	0.2
As	1.3	3.5	6	11.4	4	2.5	7.7
Rb	143	111	149	222	151	152	161
Sr	145	156	144	115	145	149	128
Y	28	22	24.8	43.3	21.8	29.1	30
Zr	39	379	71	3	33	306	8
Nb	0.2	12.4	3.2	0.9	0.7	0.3	
Mo	0.1	1.8	2.5	0.6	0.9	0.2	3.9
Ag	0.19	0.51	0.28	0.1	0.14	0.24	0.12
In				0.2			0.1
Sn	2	7	2		1	4	
Sb							
Cs	2.68	3.74	3.75	9.12	3.5	3.19	4.86
Ba	568	518	533	460	494	535	486
La	31.4	15.6	25.1	45	22.9	25.1	31.3
Ce	85.3	35.5	51	88.8	45.1	53.5	61.4
Pr	7.8	4.1	6.3	10.7	5.3	6.7	7.3
Nd	27.6	16.2	22.9	38.2	19.4	24.7	25.8
Sm	5.4	3.4	4.5	7.4	3.6	5	4.8
Eu	0.89	0.57	0.75	0.76	0.73	0.81	0.75
Gd	5.7	3.8	4.8	7.7	3.8	5.1	5.1
Tb	0.8	0.6	0.7	1.2	0.6	0.8	0.8
Dy	5.5	4.1	4.6	7.9	3.9	5.3	5.4
Ho	1.2	0.9	1	1.7	0.8	1.1	1.1
Er	3.4	2.6	2.8	5.2	2.5	3.3	3.5
Tm	0.5	0.4	0.4	0.8	0.4	0.5	0.5
Yb	2.5	2.1	2.1	4	2	2.6	2.7
Lu	0.4	0.3	0.4	0.6	0.3	0.4	0.5
Hf	0.5	8.5	0.2			5.6	
Ta		0.5	0.2				
W		0.5					
Tl	0.98	0.83	0.95	1.21	0.98	0.95	0.99
Pb	24.2	22.3	22.2	91.8	23.5	19.1	38.4
Bi	0.19	0.26	0.24	1.29	0.27	0.17	0.51
Th	13.2	13.8	10.3	19	12.7	13.4	16.4
U	5.1	2.2	3	5.6	3.9	2.7	5.2
Li	14.1	23.9	24.7	15.6	19.1	19.6	23.9
Na	1.51	1.46	1.3	1.15	1.39	1.45	1.29
Mg	0.17	0.42	0.51	0.33	0.25	0.41	0.36
Al	5.05	5.01	5.46	4.72	5.12	5.33	5.32
K	2.72	2.33	2.56	2.44	2.69	2.76	2.63
Ca	0.83	0.99	0.9	0.88	0.81	0.96	0.8
Mn	221	313	324	394	203	334	359
Fe	1.49	2.31	2.53	3.64	1.75	2.21	3.33
Se	0.4	0.3	0.4	0.7	0.8	0.5	0.4
Te							
Re							

Sample ID	PERN131217	PERN131220	PERN131224	PERN131227	PERN131235	PERN131237	PERN131239
Coordinates							
X	3451900	3451921	3451922	3451960	3451901	3451960	3452687
Y	6701317	6701180	6701160	6701318	6701300	6701239	6701378
Concentrations							
Cd							
Cu	11.4	7.8	11	8.7	13.9	8.1	6.1
Ni	13.1	4.9	12.8	10.3	18.8	10.5	8.3
Zn	61.6	40.7	60.8	117	91.2	60.9	70.3
Be	2.3	3.1	2.2	4.7	2	2.4	2.6
V	39	17	43	29	44	32	12
Cr	32.7	21.6	30.8	31.4	46.5	28.6	19.8
Co	6.1	2.4	5.8	6.4	7.7	4.8	4.2
Ga	16.4	15	15.3	20	15.9	16	16.1
Ge	0.5	0.3	0.4	0.6	0.2	0.3	0.3
As	1.6	4.6	1.9	2.9	3	1.7	1
Rb	127	167	125	166	119	137	142
Sr	198	142	206	136	191	202	164
Y	20.4	19	22	62.3	16.1	21.3	27.5
Zr	207	332	232	109	234	64	113
Nb	0.3	9.1	3.8	1.3	0.2		
Mo	0.1	2.2	0.4	0.6	0.2		
Ag	0.17	0.31	0.19	0.12	0.13	0.07	0.12
In				0.2			
Sn	4	7	6	3	3	2	3
Sb		0.1					
Cs	3.64	3.33	3.49	7.01	3.81	3.66	3.09
Ba	577	523	559	491	562	564	554
La	26	19.4	29.3	59.5	19.6	24.3	30.4
Ce	51.6	39	56.3	122	40.2	48.5	62.6
Pr	6.1	4.5	7.1	16	4.6	5.8	7.3
Nd	22.4	15.5	25.6	58.6	17.1	21.1	26.4
Sm	4.3	3.1	4.8	11	3.4	4.1	5
Eu	0.85	0.71	0.89	0.97	0.68	0.85	0.83
Gd	4.3	3.2	4.7	11.6	3.5	4.2	5.1
Tb	0.6	0.5	0.7	1.8	0.5	0.6	0.8
Dy	3.8	3.3	4.1	11.2	3	3.8	5
Ho	0.8	0.7	0.8	2.3	0.6	0.8	1
Er	2.2	2.2	2.4	6.9	1.7	2.3	3.1
Tm	0.3	0.4	0.4	1	0.3	0.4	0.5
Yb	1.6	1.8	1.7	4.9	1.3	1.8	2.3
Lu	0.3	0.3	0.3	0.8	0.2	0.3	0.4
Hf	4.5	7.3	5.2	0.9	5.1		1.4
Ta		0.2					
W		0.7					
Tl	0.85	1.12	0.83	1.04	0.84	0.9	0.86
Pb	18.8	22.5	19.4	31.2	17.7	21.6	21.7
Bi	0.2	0.26	0.21	0.51	0.23	0.22	0.19
Th	15	13.4	12.2	20.2	11.2	10.3	11.7
U	4	2.6	2.7	7.1	2.5	2.8	3.7
Li	22.8	14.2	21.7	37.3	29.5	20.1	17.4
Na	1.58	1.56	1.66	1.37	1.51	1.64	1.46
Mg	0.62	0.23	0.59	0.53	0.74	0.49	0.4
Al	5.95	5.13	5.95	5.66	5.93	5.91	5.7
K	2.58	3.05	2.49	2.6	2.45	2.63	2.64
Ca	1.22	0.76	1.31	1.13	1.13	1.2	0.98
Mn	302	219	304	403	355	278	356
Fe	2.27	1.66	2.07	4.52	2.49	2	2.1
Se	0.2	0.3	0.4	1.2	0.8	0.5	0.4
Te							
Re							

Sample ID	PERN131241	PERN131242	PERN131243	PERN131246	PERN131249	PERN131253	PERN131257
Coordinates							
X	3452658	3451908	3451839	3452638	3452622	3452599	3451904
Y	6701376	6701283	6701321	6701377	6701382	6701381	6701257
Concentrations							
Cd		0.1			0.5	0.4	0.3
Cu	13.1	7.3	9.9	3.5	5.3	10.7	19.4
Ni	10	11.3	10	3.1	5.8	4.2	11.9
Zn	67.6	72.1	76.3	37.3	156	250	378
Be	2.9	2.4	3	3.1	6	8.6	9.4
V	25	40	34	11	13	28	34
Cr	27.4	30.6	36.1	10.2	29.2	20.5	27.9
Co	4.9	4.9	4.3	2	8.1	13.4	14.7
Ga	16.4	15.6	15.4	15.4	16.8	23.7	26.7
Ge	0.4	0.3	0.3	0.2	0.4	0.7	0.6
As	4.9	2	4	2	1.6	4.2	4.3
Rb	154	126	132	160	94.1	136	211
Sr	143	201	188	158	120	85.1	110
Y	34.9	20.3	26.3	23.2	117	161	148
Zr	303	262	420	413	1420	1020	593
Nb	1.9	1.3	2.9	12.2	2.4	6.5	0.6
Mo	1.7	0.4	1.9	0.6	0.3	2	0.7
Ag	0.19	0.22	0.32	0.4	0.64	0.55	0.33
In					0.2	0.3	0.4
Sn	6	6	6	6	4	10	7
Sb				0.1			
Cs	3.88	3.54	3.16	2.85	2.03	7.32	13
Ba	557	582	566	568	355	377	365
La	37.1	25.4	31.8	22.9	82.1	134	105
Ce	75.5	50.3	66	46.4	189	290	226
Pr	8.7	6	7.4	5.6	25.5	39.9	31.9
Nd	31	21.7	26.8	21.1	93.6	153	121
Sm	6	4.1	5.1	3.9	19	30	25
Eu	0.92	0.8	0.85	0.84	1.36	1.55	1.42
Gd	6.3	4.1	5.1	4.2	19.4	32	26.5
Tb	1	0.6	0.8	0.7	3.3	4.8	4.2
Dy	6.3	3.8	4.7	4.2	21.9	31.3	27.4
Ho	1.3	0.8	1	0.9	4.6	6.6	5.8
Er	3.8	2.3	2.9	2.7	14.2	19.2	16.9
Tm	0.6	0.4	0.4	0.4	2.2	2.8	2.5
Yb	2.9	1.7	2.3	2.1	10.9	13.5	12.5
Lu	0.5	0.3	0.4	0.3	1.8	2.2	2
Hf	4.6	5.8	9.3	8.8	33	16.2	1.1
Ta				0.4			
W				0.6			
Tl	1.01	0.82	0.9	1.06	0.62	1.04	1.32
Pb	24.8	20.1	22.6	22.8	25.2	43.1	47.7
Bi	0.34	0.2	0.2	0.18	0.43	0.76	1.07
Th	14.9	12.2	15.7	11	34.1	101	45.6
U	4.6	2.6	7	2.7	12	17	9.2
Li	19.3	20.7	21.4	13.5	18.8	44.5	73.3
Na	1.47	1.61	1.64	1.66	1.18	1.11	1.16
Mg	0.33	0.51	0.45	0.19	0.42	0.49	0.81
Al	5.34	6.09	5.96	5.43	5.44	5.08	5.57
K	2.86	2.54	2.66	3.04	1.74	2.05	2.19
Ca	0.89	1.17	1.08	0.92	1.48	1.78	1.97
Mn	315	277	325	249	2070	1390	1010
Fe	2.17	2.12	2.09	1.44	7.7	8.63	9.62
Se	0.2	0.2	0.5	0.6	1.5	1.7	2
Te							
Re	0.002						0.004

Sample ID	PERN131261	PERN131263	PERN131264	PERN131266	PERN131272	PERN131276	PERN131283
Coordinates							
X	3452578	3452559	3451899	3452543	3451842	3451900	3451838
Y	6701381	6701380	6701238	6701379	6701304	6701219	6701217
Concentrations							
Cd							
Cu	6.1	24.1	13.7	10.8	14.6	23.1	7.3
Ni	7	27.8	8	8.8	5.7	24.3	9.7
Zn	52.8	180	180	121	243	121	76.7
Be	2.6	4.4	5.4	5.4	5.4	2.7	2.5
V	24	58	26	25	17	67	27
Cr	18.5	54	17.1	25.5	22.6	57.2	30.2
Co	3.3	10.9	6.3	5.1	5.4	10.4	4.4
Ga	14.9	21.3	19.2	18.3	19	19.6	15.2
Ge	0.2	0.3	0.4	0.5	0.5	0.8	0.5
As	3.3	3.2	5.1	9.7	9.8	3.4	2
Rb	112	139	202	147	201	159	138
Sr	165	107	137	118	117	175	182
Y	23.6	51.3	68	51	58.6	20.3	21.3
Zr	328	188	60	62	75	186	114
Nb	7.8	0.9	4.8	1.8	0.4	5	0.6
Mo	0.8	0.7	0.7	3.7	2.2	0.6	0.4
Ag	0.33	0.22	0.29	0.29	0.16	0.21	0.15
In			0.2	0.1	0.2		
Sn	6	4	4	3	6	5	3
Sb							
Cs	2.8	6.23	9.29	4.26	8.84	5.5	3.43
Ba	500	559	487	496	440	639	544
La	20.8	86.3	79.1	42.5	56.5	28.3	28.9
Ce	50.4	185	157	105	120	56.3	54.4
Pr	5.4	18.2	18.8	12.7	14.5	6.5	6.1
Nd	19.7	62.1	67.1	45.5	50.9	23	21.5
Sm	4	10.4	12.2	9.3	9.6	4.3	4.1
Eu	0.64	1.08	1.07	1.17	0.96	0.8	0.77
Gd	4.3	10.8	12.6	9.4	10.1	4.2	4.1
Tb	0.7	1.5	1.9	1.6	1.6	0.6	0.6
Dy	4.3	9.6	12.2	10.1	10.5	3.7	3.9
Ho	0.9	1.9	2.5	2.1	2.2	0.8	0.8
Er	2.6	5.3	7.2	6	6.7	2.3	2.4
Tm	0.4	0.8	1.1	0.9	1	0.3	0.4
Yb	2	3.6	5.3	4.6	4.9	1.6	1.8
Lu	0.3	0.6	0.8	0.7	0.8	0.3	0.3
Hf	6.8	3.8	0.2	0.3	0.3	4.3	1.1
Ta	0.2		0.2				
W							
Tl	0.77	0.96	1.24	0.94	1.26	1.07	0.92
Pb	21.4	31.8	38.6	31.3	42.9	22.1	19.8
Bi	0.18	0.42	0.75	0.73	0.82	0.31	0.19
Th	11.6	34.1	33.5	39.1	32.8	17.3	11.5
U	2.8	13.8	6.2	8.5	10	10	11.8
Li	17.4	69.4	42.3	38	40	37.9	19.9
Na	1.52	0.87	1.38	1.23	1.26	1.4	1.51
Mg	0.32	0.86	0.44	0.28	0.4	0.96	0.43
Al	4.88	7.36	5.32	6.63	5.26	6.89	5.62
K	2.49	2.36	2.8	2.55	2.56	2.95	2.63
Ca	0.96	0.6	1.1	0.68	0.92	1.07	1.01
Mn	258	347	424	322	421	374	293
Fe	1.72	4.03	4.28	3.84	4.59	3.8	1.99
Se	0.7	1.1	0.7	0.5	0.5	0.4	0.5
Te							
Re	0.001						

Sample ID	PERN131290	PERN131297	PERN131298	PERN131301	PERN131304	PERN131308	PERN131313
Coordinates							
X	3451848	3451844	3451842	3451863	3451800	3451941	3451798
Y	6701238	6701276	6701257	6701342	6701346	6701238	6701257
Concentrations							
Cd			0.1	0.1			0.3
Cu	6.8	8.3	6.5	7.6	4.7	5	8.1
Ni	10.5	6.6	3.1	11.3	8.6	5.3	9.7
Zn	74.1	132	82.4	60.9	111	59.1	263
Be	2.6	4.1	3.5	2.8	3.2	3.7	5.8
V	37	18	6	36	31	10	35
Cr	26.6	18.1	19.3	26.8	34.4	12.1	29
Co	4.9	4.5	2.7	5.7	4.9	2.7	8.8
Ga	16.4	17.3	21.5	16.4	17.1	16.1	20.3
Ge	0.5	0.4	0.6	0.4	0.3	0.4	0.5
As	2.1	3.9	1.8	2.5	30.2	3.9	10.1
Rb	125	167	185	126	145	166	122
Sr	192	133	113	193	163	147	105
Y	21.2	43.6	49	24	27.9	22.4	47.8
Zr	104	63	196	243	75	62	589
Nb	3.3	0.9	0.3	0.2	1.4		19.7
Mo	0.7	0.2	0.2	0.3	2.4	0.3	2.8
Ag	0.15	0.15	0.22	0.28	0.24	0.14	0.64
In		0.1	0.1				0.2
Sn	4	4	4	5	2	2	7
Sb							0.1
Cs	3.35	5.46	5.78	3.71	3.69	4.34	6.69
Ba	551	446	469	559	540	487	433
La	25.8	50.4	44.7	28.9	26.9	21.7	30.8
Ce	50.6	96.3	92.8	61	54.7	39.9	70.8
Pr	5.9	11.8	11.6	6.6	6.8	4.8	8.9
Nd	22	40.8	41.9	23.7	24.3	16.9	32.8
Sm	4.2	7.5	7.9	4.4	4.8	3.1	7.1
Eu	0.81	0.86	0.86	0.83	0.85	0.72	0.7
Gd	4.2	7.6	8.2	4.7	5	3.5	7.8
Tb	0.6	1.2	1.3	0.7	0.8	0.6	1.4
Dy	4	7.7	8.8	4.3	4.9	3.8	9
Ho	0.8	1.6	1.9	0.9	1	0.9	1.9
Er	2.3	4.9	5.8	2.5	3	2.7	5.8
Tm	0.4	0.8	0.9	0.4	0.5	0.4	0.9
Yb	1.7	3.9	4.7	1.9	2.3	2.1	4.3
Lu	0.3	0.7	0.8	0.3	0.4	0.4	0.7
Hf	0.9	0.2	1.6	5.1	0.5	0.7	13
Ta	0.2						1.2
W							1.6
Tl	0.79	1.09	1.26	0.81	0.95	1.08	1.01
Pb	21.2	32.4	35.3	20.6	24.5	27.8	40.8
Bi	0.19	0.52	0.49	0.21	0.23	0.42	0.63
Th	12.3	29.1	22.7	13.9	12.9	12.8	25.9
U	3.5	7	6	3.1	2.9	2.9	4.5
Li	20.4	29.3	12.4	21.8	24.9	19.9	50.5
Na	1.59	1.39	1.33	1.56	1.55	1.53	1.13
Mg	0.49	0.34	0.23	0.54	0.41	0.24	0.49
Al	6.11	5.32	4.85	6.09	5.78	5.28	4.95
K	2.51	2.57	2.83	2.53	2.64	2.92	2.26
Ca	1.16	0.9	0.93	1.13	1.06	0.77	1.03
Mn	303	425	436	302	355	218	802
Fe	2.12	3.59	2.6	2.17	2.26	2.13	4.78
Se	0.3	0.9	0.7	0.5	0.5		0.8
Te							
Re							0.001

Sample ID	PERN131316	PERN131317	PERN131327	PERN131331	PERN131348	PERN131352	PERN131354
Coordinates							
X	3451935	3451861	3451802	3451860	3451857	3452374	3451802
Y	6701219	6701312	6701291	6701297	6701276	6701178	6701300
Concentrations							
Cd	0.1				0.1	0.1	
Cu	5.9	6.9	4.5	10.3	8.6	6.5	2.2
Ni	6.8	10.5	5.6	6.5	4	8.8	3.5
Zn	269	105	179	148	72.3	120	41.8
Be	6.6	2.7	5.9	4.5	4.2	3.1	2.7
V	25	34	13	17	15	27	14
Cr	12	30.2	23.1	34.2	10.8	28.6	15.9
Co	5.9	4.6	5.2	5.1	3.3	4.6	2.1
Ga	20.6	15.6	19.8	17.7	16.2	16.3	14
Ge	0.3	0.2	0.5	0.5	0.5	0.5	0.2
As	5.7	2.8	2.3	6.8	10.1	2.8	2
Rb	203	121	169	189	170	127	131
Sr	114	193	123	132	135	168	124
Y	80.7	28.2	69.9	51.5	37.6	32	19.6
Zr	44	33	46	338	501	57	435
Nb	11.8	0.7	2.7	1.3	8.5	2.8	14.4
Mo	1	0.6	0.2	0.9	1.5	0.4	0.9
Ag	0.29	0.15	0.22	0.24	0.36	0.31	0.44
In	0.2		0.2	0.1			
Sn	3	1	6	4	8	2	6
Sb							0.1
Cs	11.2	3.1	5.23	7.46	4.55	3.47	2.75
Ba	466	544	459	479	453	505	469
La	79.6	35.1	55.2	46.9	39.2	37.4	18.2
Ce	161	71.2	123	102	81.9	76.9	38
Pr	20.8	8	16.2	12.3	8.8	9.1	5
Nd	75.1	28.9	60.5	44	30.4	32.7	17.8
Sm	14.1	5.4	12.4	8.5	5.7	6.2	3.6
Eu	1.13	0.91	1	0.95	0.79	0.87	0.5
Gd	14.8	5.6	12.6	9.1	6	6.2	3.6
Tb	2.3	0.8	2	1.5	1	1	0.6
Dy	14.9	5.1	13	9.6	6.7	6	3.6
Ho	3.1	1.1	2.8	2	1.5	1.3	0.7
Er	9.1	3	7.9	6.1	4.4	3.6	2.2
Tm	1.4	0.5	1.2	0.9	0.7	0.6	0.3
Yb	6.7	2.2	5.8	4.5	3.4	2.7	1.7
Lu	1.1	0.4	0.9	0.8	0.6	0.4	0.3
Hf	0.2		0.2	3.8	11.2	0.5	9.6
Ta	0.6		0.1		0.2	0.1	1
W							0.9
Tl	1.24	0.81	1.11	1.25	1.15	0.85	0.97
Pb	41.4	20.9	29	31.6	28	25.4	23.1
Bi	0.79	0.2	0.39	0.46	0.45	0.3	0.28
Th	37.7	13.1	28	29.8	24.1	17.9	15.1
U	7	3.1	4.4	5.7	5.7	6.9	2.5
Li	37.6	23.4	33.3	32	25	26.7	12.3
Na	1.26	1.59	1.41	1.43	1.52	1.49	1.48
Mg	0.4	0.48	0.4	0.37	0.28	0.44	0.18
Al	5.03	6.02	5.5	5.24	5.1	5.61	4.09
K	2.61	2.43	2.72	2.74	2.84	2.41	2.57
Ca	1.16	1.16	1.23	1.02	0.86	1.12	0.65
Mn	762	294	526	445	293	316	223
Fe	5.1	2.15	4.03	3.83	2.39	2.4	1.34
Se	0.7		0.9	0.2			
Te							
Re							

Sample ID	PERN131357	PERN131358	PERN131372	PERN131376	PERN131387	PERN131392	PERN131398
Coordinates							
X	3452377	3451858	3451802	3451857	3451865	3451801	3451796
Y	6701128	6701262	6701330	6701241	6701218	6701247	6701217
Concentrations							
Cd		0.1					
Cu	6.7	12.5	4.8	10.7	4.1	8.9	13.8
Ni	2.8	5.9	9.3	4.7	4.6	6	7.1
Zn	15.6	182	108	290	32.1	155	171
Be	3.8	5.5	3	5	2.4	4.3	4.6
V	10	9	34	16	14	26	18
Cr	18.6	21.9	33.1	13.5	25.5	16.6	24.2
Co	0.8	5.6	4.2	4.7	2.2	4.5	5.2
Ga	21.2	20.3	17.1	18.6	14.6	18.9	20.6
Ge	0.2	0.5	0.5	0.4	0.2	0.3	0.6
As	0.6	1.8	3.6	8.2	2	9.8	8.1
Rb	121	191	130	197	170	185	200
Sr	75.9	124	175	123	148	137	127
Y	31	69.9	25.7	45.3	14.1	37.4	51.1
Zr	82	32	20	28	169	94	8
Nb	0.7	3.4	3.7	3.6	4.8	4.3	2.9
Mo	3.9		1.4	1	2.1	1.3	0.2
Ag	0.15	0.23	0.22	0.21	0.2	0.24	0.13
In		0.2		0.1		0.1	0.2
Sn		4	2	4	6	5	3
Sb						0.1	
Cs	2.84	7.77	3.74	7.26	3.15	7.04	9.83
Ba	339	443	548	484	534	483	458
La	49.2	64	28.2	38.6	12.3	37	56.9
Ce	89.7	134	58.3	82.8	25.8	77.5	107
Pr	10.2	16.6	7	10.5	3	9.1	15.2
Nd	34	59.5	25.1	38.3	11.1	32.2	54.3
Sm	6.3	11.3	5	7.4	2.3	6.3	9.7
Eu	0.86	1.03	0.88	0.88	0.66	0.82	0.94
Gd	6.3	11.9	4.8	7.7	2.4	6.5	9.5
Tb	1	1.9	0.7	1.3	0.4	1	1.4
Dy	6.1	12.9	4.8	8.5	2.5	6.6	9.1
Ho	1.2	2.7	1	1.8	0.5	1.4	1.9
Er	3.6	8.1	2.8	5.4	1.6	4.1	5.7
Tm	0.5	1.3	0.4	0.8	0.2	0.6	0.9
Yb	2.6	6.2	2.1	4	1.2	3.1	4.4
Lu	0.4	1	0.3	0.6	0.2	0.5	0.7
Hf	0.5	0.1			3.5	0.7	
Ta		0.2	0.2	0.1			
W							
Tl	0.81	1.26	0.83	1.3	1.11	1.24	1.35
Pb	41.6	33.5	26	35.8	19.4	35.3	54.6
Bi	0.49	0.66	0.27	0.77	0.12	0.49	1.11
Th	36.6	45.8	13.1	22.1	7.3	23.7	26.2
U	14.3	8.2	3.7	5.8	1.2	5.9	5.5
Li	11.4	35.8	22.9	32.9	14.2	33.5	34
Na	1.18	1.35	1.49	1.4	1.6	1.38	1.32
Mg	0.08	0.44	0.43	0.33	0.21	0.34	0.36
Al	4.84	5.54	5.88	5.32	5.27	5.74	5.14
K	2.11	2.58	2.4	2.8	3.08	2.71	2.59
Ca	0.45	1.11	1.1	0.9	0.77	0.89	0.94
Mn	173	598	316	429	184	371	473
Fe	0.69	4.6	2.27	4	1.26	3.65	4.6
Se	0.5	0.6	0.5	0.6	0.7	0.6	0.4
Te							
Re				0.001			

Sample ID	PERN131401	PERN131402	PERN131403	PERN131404	PERN131405	PERN131406	PERN131407
Coordinates							
X	3451879	3451871	3451877	3451891	3451876	3451883	3451882
Y	6701332	6701317	6701295	6701287	6701254	6701238	6701224
Concentrations							
Cd	0.3	0.2	0.2	0.1	0.2	0.2	0.2
Cu	5.9	8.9	15.9	9.3	9	17.7	8.9
Ni	5	6.3	8.2	9.8	8.8	19.8	21.1
Zn	143	210	214	55.2	85.3	105	64.2
Be	4.4	5.1	5.7	3.2	3.3	3.2	2.5
V	30	31	14	31	25	73	39
Cr	20.1	42.2	22.4	46.5	29.7	53.2	37.1
Co	5.1	6.2	6.6	5.7	5.3	10.1	11.4
Ga	23.6	22.4	24.2	20.9	20	23.9	20.1
Ge	0.4	0.5	0.8	0.5	0.5	0.5	0.4
As	7.5	9.2	11.2	3.6	2.8	6.3	2.4
Rb	178	188	219	158	170	172	147
Sr	156	155	149	207	203	173	231
Y	49.6	56	59.2	25.4	35.7	26.7	19.8
Zr	14	101	87	220	68	279	241
Nb	0.8	7.4	6.1	0.3	0.4	3.7	0.7
Mo	1.8	2.7	0.8	0.9	0.2	1.9	0.3
Ag	0.29	0.25	0.2	0.12	0.16	0.34	0.13
In	0.2	0.2	0.2		0.1		
Sn		2	4	2	1	4	1
Sb			0.1				
Cs	7.73	9.15	9.97	4.45	4.65	5.65	4.3
Ba	513	506	532	582	612	593	624
La	59.7	63.8	68.2	34	46.2	41.4	28.4
Ce	128	141	148	71.1	98.8	83.4	59.1
Pr	15.2	16.5	17.7	8	11.5	9.9	7
Nd	56.8	62	65.9	30.1	41.6	37	26
Sm	11.3	12.4	12.9	5.9	8.4	7.2	5
Eu	1.01	1.02	1.04	0.94	1.03	1.01	0.9
Gd	9.3	10.3	11	5	7	5.8	4.3
Tb	1.5	1.6	1.7	0.8	1.1	0.8	0.6
Dy	9.6	10.7	11.1	4.8	7	5.2	3.9
Ho	2	2.2	2.3	1	1.4	1.1	0.8
Er	6.1	6.9	7.2	3.1	4.3	3.1	2.4
Tm	0.9	1	1.1	0.5	0.7	0.5	0.4
Yb	6	6.7	6.9	3	4.1	3.1	2.3
Lu	0.9	1.1	1.1	0.5	0.7	0.5	0.4
Hf		0.8	0.9	4.7	0.8	7.5	6.3
Ta		0.5	0.6			0.2	
W	0.7	0.8	0.5	0.1	0.1	0.3	0.2
Tl	1.13	1.22	1.4	0.99	1.02	1.05	0.9
Pb	42.1	39.6	46.4	24.2	26.2	32.6	22.1
Bi	0.58	0.61	0.86	0.31	0.27	0.38	0.22
Th	24.3	27.4	29.6	15.4	17.6	13.5	10.6
U	6.5	6.8	9.9	4.7	4.3	3.7	3.5
Li	27.4	43.3	44.5	21.8	23.8	32.5	24.8
Na	1.66	1.66	1.69	1.92	1.91	1.5	1.96
Mg	0.4	0.43	0.47	0.53	0.5	0.89	0.66
Al	6.24	6.16	6.13	6.86	6.76	7.16	6.86
K	2.22	2.36	3.03	3.06	3.08	2.91	2.88
Ca	1.13	1.26	1.14	1.19	1.21	1.06	1.38
Mn	653	670	735	351	417	539	376
Fe	3.95	4.69	5.08	2.81	2.96	3.91	2.71
Se	1.6	2.2	2	1.1	1.1	1.3	0.8
Te							
Re	0.003		0.003	0.001	0.002	0.001	0.004

Sample ID							
	PERN131408	PERN131409	PERN131410	PERN131411	PERN131412	PERN131413	PERN131414
Coordinates							
X	3451818	3451817	3451819	3451816	3451819	3451969	3451962
Y	6701336	6701315	6701299	6701275	6701221	6701094	6701161
Concentrations							
Cd	0.1	0.2	0.1	0.2	0.1	0.1	0.2
Cu	6.7	6.5	4.9	3.5	11.1	6.6	7.9
Ni	4	9.5	3.5	2.4	4.1	12.1	8.6
Zn	76.6	124	57	58.9	80	76.5	99.4
Be	3.9	3.6	3	4.5	4	2.7	3.7
V	16	41	24	14	16	29	24
Cr	27.8	35	35.8	21.1	28.1	33.3	38.9
Co	2.7	6	2.6	2.8	2.8	6.6	5.6
Ga	19.6	21.1	24	21.7	18.6	20.2	18.9
Ge	0.3	0.3	0.3	0.4	0.3	0.4	0.6
As	7.2	4	7.1	1.1	6.3	1.5	5
Rb	162	112	183	198	159	150	162
Sr	161	167	148	133	153	200	171
Y	30.8	32.4	30.7	41.7	28.6	20.6	24.4
Zr	49	563	401	374	17	96	33
Nb	3.5	13.7	5.6	0.2	1.7		1.4
Mo	3.1	1.6	2.5	0.2	3.8	0.1	0.8
Ag	0.13	0.47	0.19	0.15	0.28	0.18	0.21
In		0.1		0.1			
Sn		4	5	2			
Sb		0.1					
Cs	4.56	4.52	7.18	6.15	4.44	4.21	5.41
Ba	529	510	543	506	495	610	556
La	41.4	31	33	44.7	40	27.2	34.5
Ce	83.5	68.1	72.4	96	83.4	55.2	70.8
Pr	9.3	8.2	8.7	12.1	9.5	6.6	7.9
Nd	33.8	31.5	32.3	45.7	34.2	24.6	29.2
Sm	6.5	6.7	6.6	9.2	6.8	5.1	5.9
Eu	0.91	0.73	0.85	0.9	0.89	0.85	0.78
Gd	5.5	5.6	5.6	7.6	5.6	4.1	5
Tb	0.9	0.9	0.9	1.3	0.9	0.6	0.8
Dy	5.6	6.1	5.8	7.9	5.7	4	4.8
Ho	1.2	1.3	1.3	1.6	1.2	0.8	1
Er	3.8	4	4	5.2	3.5	2.6	3
Tm	0.6	0.6	0.6	0.8	0.6	0.4	0.5
Yb	3.6	3.8	4.1	5.3	3.5	2.5	2.9
Lu	0.6	0.6	0.7	0.9	0.6	0.4	0.5
Hf	0.2	12.9	6.2	5.1	0.1	1.8	0.3
Ta	0.2	0.5	0.4				0.2
W	0.9	1	0.8	0.1	0.7	0.1	0.2
Tl	1.16	0.89	1.32	1.3	1.1	0.94	0.96
Pb	32.4	25.5	38.8	37	31.9	23.8	32.6
Bi	0.41	0.29	0.9	0.37	0.99	0.23	0.4
Th	17.6	12.8	13.7	16.4	20	10.2	15.1
U	4.6	3.7	4.3	7	7	2.9	7.2
Li	20.2	31.7	11.1	11	25.2	22.8	24
Na	1.8	1.71	1.66	1.63	1.65	1.77	1.57
Mg	0.23	0.47	0.24	0.22	0.19	0.55	0.4
Al	5.85	5.6	5.72	5.37	5.91	6.41	5.94
K	2.3	1.94	2.26	2.56	2.19	2.82	2.8
Ca	0.89	1.12	0.86	0.95	0.79	1.14	0.97
Mn	354	494	422	535	303	409	406
Fe	2.17	3.37	2.43	2.6	2.46	2.71	3.39
Se	1	1	1	1.5	1.3	0.7	1
Te					0.1		
Re			0.003	0.005	0.001		0.002

Sample ID	PERN131423	PERN131424	PERN131425	PERN131426	PERN131427	PERN131428	PERN131429
Coordinates							
X	3452458	3452463	3452458	3452458	3452442	3452441	3452439
Y	6701040	6701020	6700998	6700980	6700977	6700999	6701039
Concentrations							
Cd	0.3	0.2	0.2	0.3	0.2	0.3	0.3
Cu	8.7	8.9	6.8	6.9	4.9	11.1	14.8
Ni	2.9	3.3	3	5	2.8	3.8	2
Zn	170	83.5	89.6	115	61.4	137	66
Be	5	4.8	4.8	4.7	3.9	5.8	4.2
V	22	13	11	15	9	8	15
Cr	15.4	35.2	20.7	25.4	33.6	16.3	19.1
Co	9.1	2.8	3.9	5.1	2.5	5.5	3.8
Ga	26.2	25.9	24	41.2	26.7	25.8	19.2
Ge	0.8	0.7	0.7	0.6	0.6	1	0.4
As	5.4	8	5.1	2.4	2.3	5	8.1
Rb	217	186	176	178	202	263	75
Sr	95.1	126	114	100	125	123	27.2
Y	65.3	44	52.5	60.2	43.4	79	49.4
Zr	4	12	168	197	103	28	56
Nb	0.4	4.4	2.2	0.4	1.6	1.1	2.6
Mo	1.7	1.4	0.5	0.2	0.3	0.5	4.6
Ag	0.29	0.28	0.23	0.3	0.28	0.15	0.28
In	0.3	0.2	0.2	0.2	0.1	0.2	0.2
Sn		2	4	4	2	5	1
Sb		0.2	0.1				0.3
Cs	11.7	6.07	5.74	8.73	5.45	17.2	4.64
Ba	429	505	495	371	447	530	117
La	90.1	81	60.6	70.3	45	105	74.5
Ce	201	137	129	149	100	228	157
Pr	22.7	15	15.2	17.7	12.2	25.8	19.5
Nd	83.2	52.7	55.7	64.8	44.9	96	69.1
Sm	16.6	9.5	11.5	13.5	9.8	18.4	14.6
Eu	1.14	1	1.02	0.94	0.89	1.33	1.07
Gd	13.9	8.6	10.2	11.5	8.4	17	12.2
Tb	2.3	1.3	1.6	1.9	1.3	2.5	2
Dy	14.1	8.1	10.2	11.8	8.6	15.6	11.9
Ho	2.8	1.7	2.1	2.5	1.8	3.1	2.2
Er	8	5	6.1	7.6	5.3	9	6
Tm	1.2	0.7	0.9	1.1	0.8	1.3	0.8
Yb	7.1	4.5	5.6	7.4	5.1	7.9	5.1
Lu	1.1	0.7	0.8	1.2	0.9	1.2	0.7
Hf			2.5	3.7	1.1	0.2	1.2
Ta		0.4	0.2		0.1	0.1	
W	0.2	0.6	0.4	0.1	0.1	0.2	1.9
Tl	1.15	1.11	1.08	1.03	1.18	1.58	0.45
Pb	44.5	46.2	40.4	51.3	38.7	44.3	50.6
Bi	0.75	1	0.74	1.23	0.56	0.82	0.89
Th	39	24.5	24.4	29.6	23	40.1	49.1
U	31.7	7.8	6.6	11.4	7	11.9	27.3
Li	30.6	25.6	32.9	45.2	15.6	44.7	13.7
Na	1.12	1.44	1.34	1.13	1.68	1.36	0.41
Mg	0.29	0.2	0.2	0.3	0.2	0.29	0.09
Al	5.76	5.61	6.07	6.47	6.21	6.2	8.42
K	2.28	2.84	2.67	1.94	2.91	2.78	0.7
Ca	0.98	0.77	0.77	0.81	0.92	1.01	0.29
Mn	1660	367	360	983	500	490	428
Fe	5.53	4.99	4.29	7.77	3.03	5.98	3.95
Se	2.2	1.5	1.9	2.1	1.5	2.7	3.6
Te							
Re	0.001		0.001	0.001	0.002		0.001

Sample ID							
	PERN131523	PERN131524	PERN131616	PERN131617	PERN131618	PERN131619	PERN131620
Coordinates							
X	3452360	3452355	3452380	3452378	3452361	3452359	3452337
Y	6700997	6701177	6701040	6701003	6701022	6701260	6701236
Concentrations							
Cd	0.4	0.5	0.4	0.1	0.8	0.3	
Cu	5.5	10.7	13.5	5.4	26.1	21.2	8.9
Ni	3.5	3.5	2.5	3.6	2.7	2	12.1
Zn	132	348	116	32.2	374	68.9	50.8
Be	5.2	7.4	5.5	3	9.2	8.8	2.6
V	19	16	27	11	33	61	28
Cr	13.7	24.8	17.4	41.7	21.2	28.1	45.9
Co	5.2	10.3	3.9	1.9	13.5	2	6.1
Ga	32.5	33.8	31.8	19.9	40.5	55.5	22.5
Ge	1.1	0.9	1.1	0.6	2.2	0.8	0.6
As	4.2	5	15.5	1.1	4.9	27.8	2.7
Rb	245	380	138	188	345	26.3	138
Sr	78.4	72.5	50.8	143	57.1	18.3	204
Y	95.8	114	97	23.1	239	77.9	23.2
Zr	1220	48	413	714	2450	129	212
Nb	10.3	2	15.7	1.2	17.4	26.7	0.4
Mo	2.4	1	6.7	1.6	5.3	6.1	0.2
Ag	0.4	0.17	0.52	0.16	0.62	0.52	0.06
In	0.3	0.4	0.3		0.6	0.4	
Sn	7	2	6	3	8	7	2
Sb			0.2			0.5	
Cs	15	23.6	8.62	3.71	24.9	2.01	5.05
Ba	349	387	245	592	371	74	614
La	81.1	80.3	108	27.9	337	155	36.9
Ce	192	211	260	55.2	712	328	73.8
Pr	25	28.7	32	6.6	85.1	38	8.7
Nd	96.5	114	121	24.3	312	136	32.4
Sm	20.6	24.2	26.5	4.9	56.6	27.2	6.1
Eu	1.25	1.19	1.53	0.82	2.36	1.71	0.86
Gd	18.5	22.5	22	4.3	49.2	22.6	5.2
Tb	2.9	3.5	3.7	0.6	7.5	3.4	0.7
Dy	18.1	22.8	22.3	4.2	46.7	19.5	4.2
Ho	3.7	4.6	4.1	0.9	9.3	3.4	0.9
Er	11.3	13.7	11.9	2.8	27.6	9.1	2.5
Tm	1.7	2	1.8	0.5	4.1	1.2	0.4
Yb	10.4	12.8	10.6	2.9	25.7	6.6	2.2
Lu	1.7	2.1	1.6	0.5	4.1	1	0.4
Hf	29.5	0.3	8.2	18.1	53.2	4.4	5.6
Ta	0.5	0.2	0.4		0.4	1.8	
W	0.7	0.2	3.1		0.4	1.7	
Tl	1.36	2.11	0.86	1.03	2.25	0.23	0.93
Pb	48	62.4	72.9	29.6	65.4	101	24.4
Bi	0.69	1.42	1.08	0.28	1.64	1.96	0.29
Th	20.3	47.6	63.2	10.3	124	96.5	15.3
U	10.7	6.8	50.2	4.6	21.8	26.7	4.5
Li	15.2	56.6	34.5	13.4	88.1	4.3	35.7
Na	1.22	1.06	0.89	1.67	1.17	0.18	1.77
Mg	0.32	0.49	0.23	0.16	0.64	0.03	0.57
Al	4.65	5.89	7.4	5.46	5.31	8.64	6.95
K	2	2.23	1.58	3.38	2.5	0.35	2.8
Ca	1.35	1.68	0.77	0.77	2.18	0.14	1.09
Mn	789	1310	472	373	1420	130	317
Fe	6.45	12.2	6.85	1.62	13.8	11.1	3.78
Se	3.2	4.2	5.5	1	8.1	5.1	0.8
Te		0.1			0.1		
Re	0.003	0.004	0.001			0.004	0.001

Appendix 6 – Rb-Sr isotopic concentrations and ratios

Sample ID		Rb ppm	Sr ppm	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$	+/-2s
AV020	WR	260.8	48	16.4942	1.131085	9
	Biotite	286.5	8.7	118.9222	3.269533	16
	Plagioclase	111.6	70	4.6783	0.866258	6
AV061	WR	249.1	49	15.3307	1.095719	8
	Biotite	700.2	12.4	256.0952	6.509313	16
	Plagioclase	51.5	74	2.0142	0.768956	5
AV072	WR	213.5	30	21.6251	1.263743	12
	Biotite	909.1	12.4	426.8912	11.059265	85
	Plagioclase	71.8	44	4.8045	0.853054	5
AV058	WR	198.6	55	10.7001	0.982977	7
	Biotite	628.1	13.9	185.8546	5.060697	18
	Plagioclase	56.6	89	1.8562	0.762720	6