

Akita University

RARE METAL MINERALIZATION OF THE KHALDZAN BURGEDEI
PERALKALINE COMPLEX, WESTERN MONGOLIA

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by

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ABSTRACT

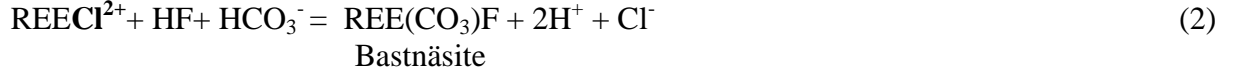
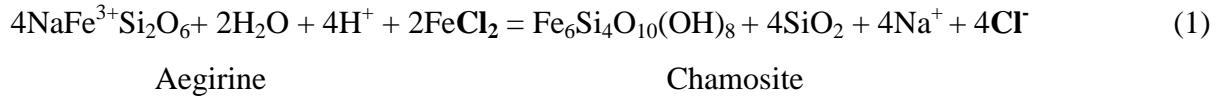
The Khaldzan Burgedei peralkaline complex in western Mongolia is an example of extreme enrichment of Zr, Nb, and REEs in A-type granite. The Khaldzan Burgedei was discovered by Kovalenko.V.I in 1984. Preliminary resources calculated (1989-1990) area total of 163.8 Mt resources at ZrO_2 (1.5 wt.%), Nb_2O_5 (0.2 wt.%), Ta_2O_5 (0.01 wt.%), REE_2O_3 (0.3 wt.%) and Y_2O_3 (0.11 wt.%) (Minin et al., 1991). The objectives of this study is to clarify petrology, mineralogy and geochemistry identify rare-metal bearing minerals, and discuss the genesis of HFSE and REEs mineralization based on the samples, which were collected from a drill holes and outcrops in the complex. The study was conducted on the basis of microscopic observations, X-ray diffractometry (XRD), scanning electron microscopy (SEM-EDS), X-ray fluorescence spectrometry (XRF), Inductively Coupled Plasma Mass Spectrometry (ICP-MS), electron probe microanalyser (EPMA), Fluid inclusion microthermometry and Laser Raman Spectra.

The studied area of the Khaldzan Burgedei complex consists of two main lithologic units of quartz syenite and granite are identified by the result of field and drill core observation. The quartz syenite is dominantly distributed in the study area and they are intruded by granite. A sharp contact between quartz syenite and granite is observed in the outcrops, and sometimes the contact between quartz syenite and granite shows a mingling characteristic. The zone, which has an average width of about 2-5.5m, consists of compositionally and texturally inhomogeneous rocks of syenite and pegmatite.

The quartz syenite is coarse-grained, mainly consists of K-feldspar, plagioclase, albite, ferrosilite, arfvedsonite, aegirine-augite, aegirine, and quartz with accessory apatite, rutile, zircon and pyrochlore. The granite is fine-grained, mainly consists of quartz, K-feldspar, albite, arfvedsonite and aegirine with accessory zircon and fersmite. The quartz syenite is occur in the all drill holes and most of drill core basically affected by metasomatism and some interval subsequent hydrothermal alteration with chamosite, nontronite, calcite, fluorite, pyrite, zircon and REE bearing minerals (synchysite, bastnasite, parasite and xenotime). The granite is occur several drill holes and upper part of the granite, in the drill holes becomes quartz rich compared to the lower part. The quartz rich part is related to fractionation. This part is sometimes associated with pegmatites that consist of amphibole, feldspar, and quartz with zircon and fersmite.

The bulk rock compositions of the drill core show metasomatized and subsequent hydrothermal alteration units, is enriched in Ca, Nb, Zr, and REE, fractionated unit because of

The reactions during the hydrothermal alteration are as follow:



Feldspars replaced by smectite (nontronite) and Fe-rich chlorite (chamosite) and hydrothermal minerals formed later than feldspar also includes HFSE and REE bearing minerals. Exsolving fluorine and sodium rich hydrothermal fluids leached HREEs from zircon and transported the host quartz syenite. This hydrothermal fluids reacted (Na metasomatism) with feldspars and Ca-bearing amphibole resulting in the precipitation of fluorite, calcite and HREE rich zircon as well as REE carbonates.

In summary, we propose a genetic model that the HFSE and REE mineralization of the complex we caused by extreme magmatic fractionation and subsequent Na metasomatism resulted in albitization and fluorite precipitation with extracted Ca^{2+} . Destabilized Zr-REE fluoride complexes resulted in zircon and REE minerals precipitation.

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1 Introduction

1.1 Introduction

1.1.1 Definition and characteristic of REE

Rare earth elements (REE) include 17 elements, including the 15 lanthanides (57La to 71Lu), scandium (21Sc) and yttrium (39Y) ([Castor & Hedrick, 2006](#)). Rare earth elements are divided into light rare earth elements (LREE) and heavy rare earth elements (HREE). LREE consists of seven elements from lanthanum through to europium, and HREE consists of eight elements from gadolinium to lutetium, and often yttrium is included in HREE because of its similarity in physical and chemical behavior with HREE. In rock-forming minerals, rare earth elements typically occur in compounds as trivalent cations in carbonates, oxides, phosphates, and silicates in rocks. As refined metals, the REE are lustrous, iron grey to silvery in appearance. They are characteristically soft, malleable, ductile and typically reactive. The electron structure of REE gives them some unusual magnetic and optical properties. The REE with the exception of Sc, Y, La, Yb, and Lu are strongly paramagnetic and have strong magnetic anisotropy ([Gupta Krishnamurthy, 2005](#)).

1.1.2 Use of REE

Rare earth metals and alloys that contain them are used in many devices that people use every day such as computer memory, DVDs, rechargeable batteries, cell phones, catalytic converters, magnets, fluorescent lighting, hybrid cars and much more. During the past thirty years, there has been an explosion in demand for many items that require rare earth metals. The use of rare earth elements in computers has grown almost as fast as cell phones. Many rechargeable batteries are made with rare earth compounds. All of these products are expected to experience rising demand.

1.1.3 Mineralogy

REE occur in wide range of mineral types including halides, carbonates, oxides, phosphates, and silicates. Around 200 minerals are known to contain REEs are presently known. However, only a few minerals are economically viable for mining, which are bastnasite, monazite, xenotime, and REE-bearing clay minerals ([Castor & Hedrick, 2006](#)). Extraction of a potentially economic REE resource strongly depends on its REE mineralogy. Table-1 lists minerals that have yielded REE commercially or have a potential for production in the future.

Table 1. A selection REE-bearing minerals of economic

Mineral Name	Mineral Formula	Approximate REO%
Aeschynite	$(\text{Ce,Ca,Fe,Th})(\text{Ti,Nb})_2(\text{O,OH})_6$	36
Allanite (orthite)	$(\text{Ca,Ce,Y})_2(\text{Al,Fe})_3(\text{SiO}_4)_3(\text{OH})$	30
Apatite	$\text{Ca}_5(\text{PO}_4)_3(\text{F,Cl,OH})$	19
Bastnasite	$\text{Ce,LnCO}_3\text{F}$	75
Brannerite	$(\text{U,Ca,Y,Ce})(\text{Ti,Fe})_2\text{O}_6$	9
Britholite	$(\text{Ca,Ce})_5(\text{SiO}_4,\text{PO}_4)_3(\text{OH,F})$	32
Cerianite	$(\text{Ce,Th})\text{O}_2$	81
Eudialyte	$\text{Na}_4(\text{CaCe})_2(\text{Fe,Mn})_3\text{ZrSi}_8\text{O}_{22}(\text{OH,Cl})_2$	9
Euxenite	$(\text{Ln,Ca,U,Th})(\text{Nb,Ta,Ti})_2\text{O}_6$	24
Fergusonite	$\text{Ln}(\text{Nb,Ti})\text{O}_4$	53
Gadolinite	$\text{LnFeBe}_2\text{Si}_2\text{O}_{10}$	60
Hydroxylbastnasite	$\text{LnCO}_3(\text{OH,F})$	75
Kainosite	$\text{Ca}_2(\text{Y,Ln})_2\text{Si}_4\text{O}_{12}\text{CO}_3\cdot\text{H}_2\text{O}$	38
Loparite	$(\text{Ln,Na,Ca})(\text{Ti,Nb})\text{O}_3$	30
Monazite	$(\text{Ln,Th})\text{PO}_4$	65
Parisite	$\text{CaLn}_2(\text{CO}_3)_3\text{F}_2$	61
Samaraskite	$(\text{Ln,U,Fe})_3(\text{Nb,Ta,Ti})_5\text{O}_{16}$	24
Synchisite	$\text{CaLn}(\text{CO}_3)_2\text{F}$	51
Xenotime	YPO_4	61

Mineral formulae sourced from Clark 1993 and estimates of REO content based on www.webmineral.com composition

1.1.4 Major deposit classes

The REE occur in a wide range of igneous, sedimentary, and metamorphic rocks. The economic potential of an REE deposit is strongly influenced by its mineralogy and the geological processes from which it has formed. Deposits which have a spatial and genetic association with alkaline igneous rocks can be divided into two categories, one associated with carbonatites and related igneous rocks and the other with peralkaline igneous rocks ([Samson and Wood 2004](#)). REE can also be enriched in the calc-alkaline granitoids through the accumulation of REE-bearing minerals such as apatite, allanite, monazite, titanite, and

xenotime since they tend to remain in the melt until the late stages of magmatic differentiation ([Wilson, 1989](#); [Castor & Hedrick, 2006](#)). Recast studies at the Khaldzan Burgedei igneous complex in western Mongolia, classified into the alkaline igneous associated deposit type ([Kovalenko, 1995](#)).

The world distribution of REE deposits corresponding to the classification is shown in Table-2.

Table 2. Classification of rare earth elements ore deposits

Deposit Type	Typical grades and tonnage	Major Example
Carbonatite	A few 10s thousands of tones to several hundred million tones, 0.1-10% REO e.g. (Bayan Obo: 750 million tons at 4.1% REO)	Mountain Pass, USA; Bayan Obo, China;
Alkaline igneous rocks	Typically <100 million tones, <5% REO e.g (Thor Lake: 64.2 million tons at 1.3 % REO)	Thor Lake and Strange Lake, Canada; Lovozero, Russia; Pajarito Mountain, USA;
Hydrothermal deposits	Typically <1 million tones, 0.5-4.0% REO e.g (Lemhi Pass: 39 million tones at 0.51 % REO)	Karonge, South Africa; Lemhi Pass and Bear Lodge, USA;
Placer	10s to 300 million tones, <0.1% REO e.g. (Horse Creek: 19 million tones at 0.041%)	Carolina monazite belt and Horse Creek, USA; Chavara, India;
Ion adsorption clay	Most <10000 tones, 0.03-0.35% REO	Longnan Xunwu, China;

Number of documented occurrences, compiled from [Orris and Grauch, 2002](#)

1.1.5 Alkaline igneous rocks associated deposits

Although many REE deposits occur in peralkaline igneous rocks and resources can be large, most such deposits are relatively low in the grade. Many of the deposits referred to above are hosted by both silica-saturated and undersaturated peralkaline igneous intrusions. These lithologies are members of anorogenic suites, produced by magmas in rift environments.

Rocks classified as of A-type vary in composition from quartz syenites to peralkaline granites and their respective volcanic equivalents. They have relatively high alkali and low CaO contents, high FeO_t/MgO ratios, commonly elevated halogen concentrations, and are

characterized by high proportions of large-ion lithophile elements (LILE) and high-field strength elements (Eby, 1990; Bonin, 2007). High concentration of HFSE and REE in peralkaline granitic rocks has been reported from several igneous complexes such as Bokan Mountain, USA, Strange Lake, Canada, and Pitinga, Brazil. These granites generally form the latest fractionated parts of peralkaline complexes, which are enriched in incompatible elements (Salvi, S., and Williams Jones, A.E., 2005 and Jaroslav Dostal et al., 2014). Recast studies at Khaldzan Burgedei in western Mongolia show magmatic fractionation, metasomatism, and subsequent hydrothermal activity resulted in the concentration of Zr, Nb, and REE (Kovalenko 1995).

The Khaldzan Burgedei peralkaline complex is in an N-S trending Paleozoic rift in western Mongolia central and eastern Tuva (Figure 1.1-1). It is located about 45 km northeastern from the center of the Khovd town.

Several carbonatite and alkaline rocks are in the N-S trending Paleozoic rift zone. Those include carbonatite related Karasug (112-122Ma), Altay (219 Ma), Zashikhinsky and Angara Ilim (200-260 Ma), and alkaline complex related Ulug Tanzek (228-231 Ma), Bugseingol-Ovörmärat (396-400 Ma) and Aryskan (390-400Ma).

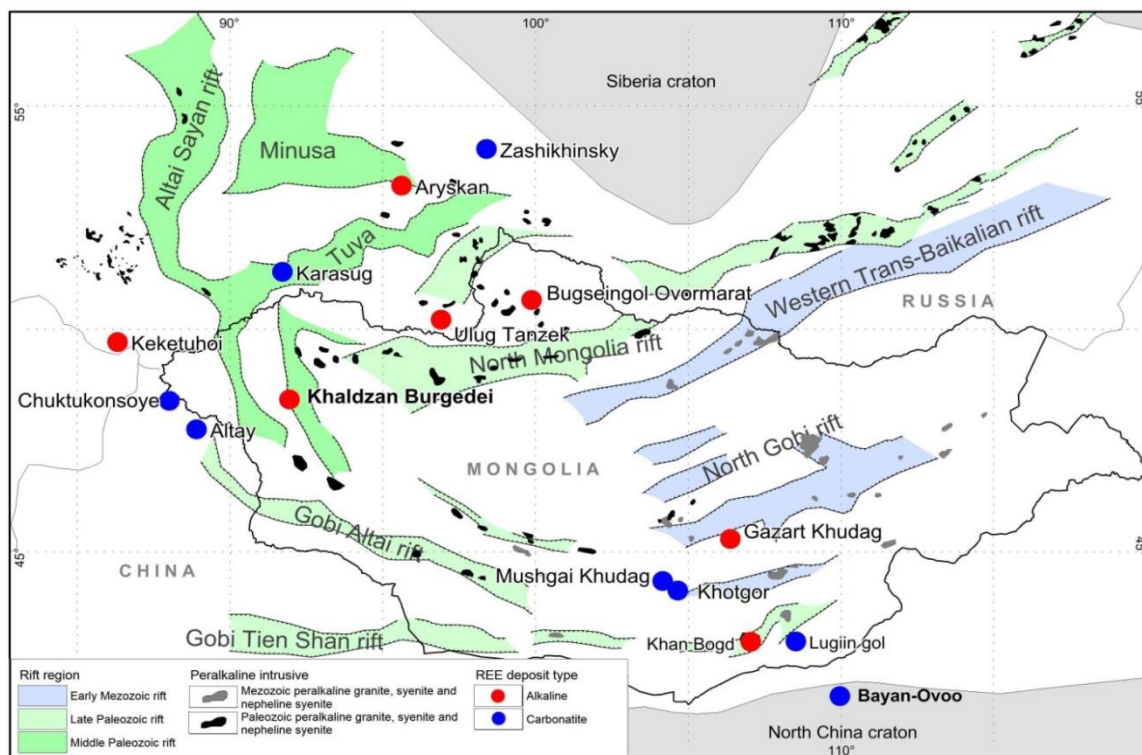


Figure 1.1-1. Distribution map of Paleozoic and Mesozoic alkaline complex and REE deposits or prospects in the north Asia showing location of study area. (modified by Yarmolyuk V.V. et al., 2014; and Kovalenko V.I. et al., 1995)

1.2 Review of previous study

The Khaldzan Burgedei prospect was discovered by Kovalenko.V.I in 1984. Prognostic resources of category P2 calculated (1989-1990) are total 163.8 Mt resources at 1.5 wt% ZrO₂, 0.2 wt% Nb₂O₅, 0.01wt% Ta₂O₅, 0.3 wt% REE₂O₃ and 0.11 wt% Y₂O₃ ([A.D.Minin, 1991](#)). However, after many years of intermittent exploration activities by several companies, the property was unexplored because of a combination of complex mineralogy and low metal prices. Mongolian Lantanoide Corporation owned the exploration license of the western part of the deposit and since 2009 conducted geological mapping and diamond drilling for rare earth elements exploration.

The geology and mineralization of the Khaldzan Burgedei complex have been studied by [Kovalenko V.I et al. \(1995\)](#), [Kemp U et al. \(2015\)](#), [Andreeva V.I et al. \(2016\)](#) and [Boguslaw B et al. \(2016\)](#). [Kovalenko et al. \(1995\)](#) discussed the HFSE enrichment in the complex was due mainly to fractionation of granitic magma, based on the melt inclusion geochemistry. [Kemp et al. \(2015\)](#), in contrast, argued that the HFSE mineralization was due to magmatic and subsequent hydrothermal processes, later of which contributed significantly to the enrichment of these elements. Based on geochronology data, they concluded that the complex was mineralized by the hydrothermal fluids related to a 325Ma carbonatite magma at depth. [Andreeva et al. \(2016\)](#) discussed the rare metal Zr-Nb-REE mineralization in the complex is related to the prolonged crystallization differentiation of melts and assimilation of enclosing carbonate rocks. [Boguslaw et al. \(2016\)](#) discussed the HFSE mineralization in the granite pegmatite was due to low-temperature alteration. They argued the hydrous fluids were poor in F and CO₂ but had high Ca contents.

1.3 Purpose of study

As described in the previous session, the proposed models for the HFSE mineralization at Khaldzan Burgedei are still controversial.

The aim of this study is to clarify petrology, mineralogy, and geochemistry, identify rare-metal bearing minerals, discusses the genesis of HFSE and rare earth mineralization based on the samples, which were collected from drill holes, and outcrops in the complex.

2 Geological settings, lithology and lithologic relation of the Khaldzan Burgedei complex

2.1 Tectonic setting and regional geology

Mongolian rare metal mineralization was formed in four main metallogenic epochs: middle Paleozoic, late Paleozoic, and early and late Mesozoic ([Kovalenko et al., 1995](#)). The study area is formed during the middle Paleozoic metallogenic epoch.

Most alkaline related REE deposits in worldwide are formed in association with rift-related magma. The Khaldzan Burgedei complex is located in N-S trending Paleozoic rift system in western Mongolia and eastern Tuva (Figure 1.1-1). The study area is in the Tsagaan Shiveet fault zone between the western part of the Lake terrain and the northwest of the Mongolian Altai ranges ([Badarch et al., 2002](#)) (Figure 2.1.-1). The Lake terrain consists mainly of Cambrian volcanic rocks (basalt, andesite, dacite) containing fragments of the ophiolite. Which consists of peridotite, layered gabbro, sheeted dikes, pillow lavas, and deep marine red chert. The ages of the ophiolites range from 576 to 522 Ma ([Badarch et al., 2002](#); [Kovalenko et al., 1996, 2004](#)). The ophiolite sequences are intruded by numerous granitoid bodies. The distribution of these Middle Paleozoic igneous rocks in the Lake terrain shows a petrochemical zonation defined by gradual change calc-alkaline to subalkaline, alkaline and ultimately peralkaline toward the northeast from the Mongolian Altay.

The Mongolian Altay and Khan Khohiy Ridge (northwestern Mongolia) is represented by REE-Zr-Nb mineralization in peralkaline granites, e.g, Khaldzan Burgedei, as well as in subvolcanic bodies of comendite and albite bearing nepheline syenite of the Khan-Khokhiy Ridge ([Kovalenko and Yamolyuk, 1995](#)).

Several peralkaline intrusive bodies are in the Lake terrain (such as Khaldzan Burgedei, Tsahir and Huren). That group intrusive body is 30 km long and up to 8 km wide and is elongated in northwest direction and subdivided two parts. The southern part is Khaldzan Burgedei and northern part is named Tsahir Zr-Nb-REE group occurrence (Figure 2.1-1).

The Khaldzan Burgedei intrusive complex formed at 391Ma to 395 Ma (392.2 ± 2.3 Ma for peralkaline granites of the second phase, 390.8 ± 1.2 Ma for syenites of the sixth phase) ([Kovalenko et al. 2004](#)).

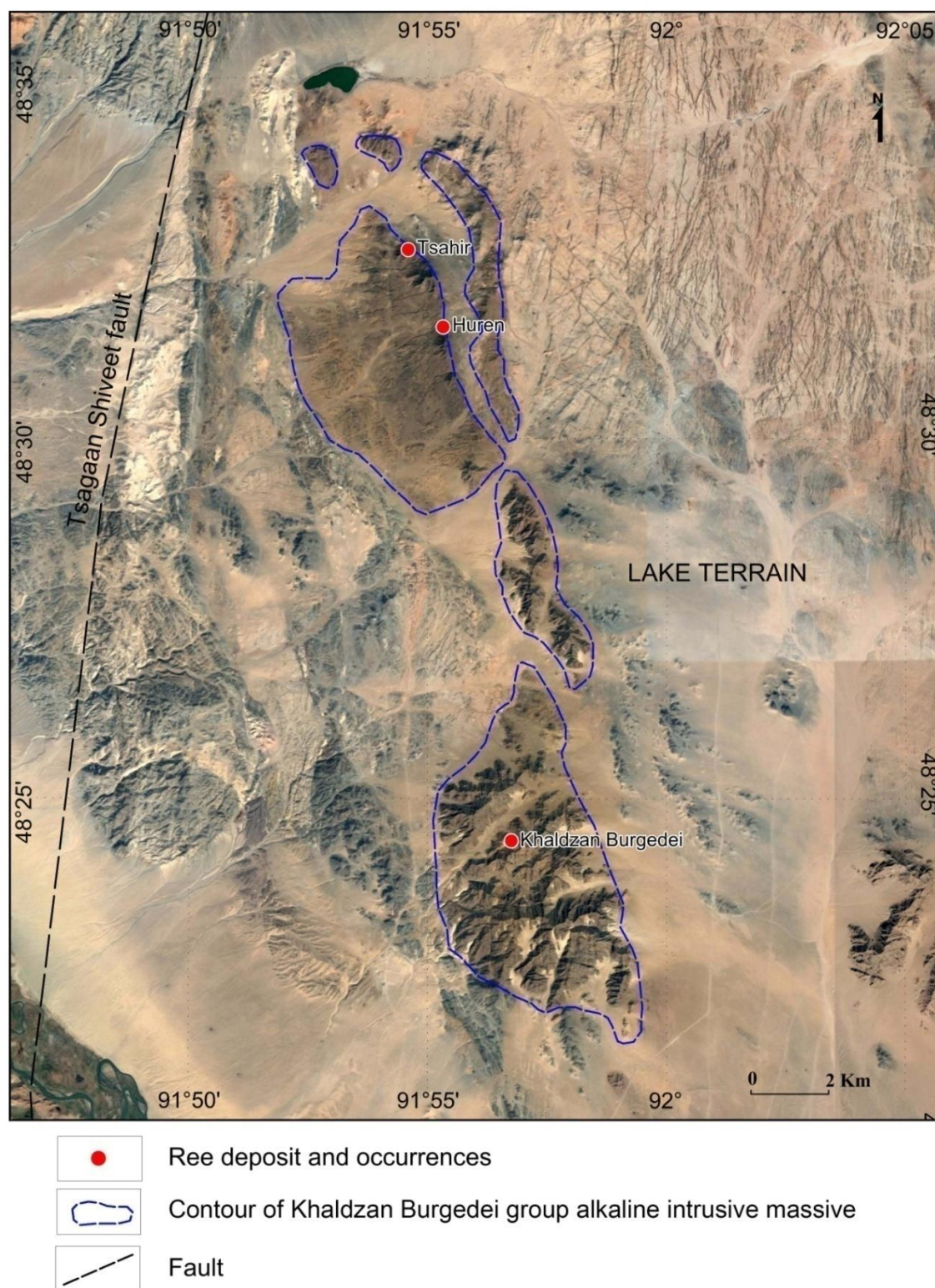


Figure 2.1-1 Distribution of Khaldzan Burgedei complex in the Google map.

2.2 Geology of the Khaldzan Burgedei complex

The Khaldzan Burgedei complex is oval, 7 km long and 5 km wide and elongated in the north-northwest direction. Geology around the complex consists of Vendian to lower Cambrian volcanic rocks (dark green-whitish green silicified basalt, andesite, and dacite) (546 ± 3 Ma Ar-Ar age on amphibole, [Kovalenko et al., 2004](#)), and lower Middle Devonian volcanoclastic strata, as well as Ordovician granite (Figure 2.2-1). The Khaldzan Burgedei complex has multiple intrusive phases which are subdivided into eight phases; (1) quartz syenite, (2) peralkaline granite (391 ± 2 Ma U-Pb data on zircon, [Kovalenko et al., 2004](#)), (3) dikes of peralkaline granite pegmatite and later ekerite and fine-grained peralkaline granite, (4) submeridional pantellerite dikes, (5) medium grained rare metal granite, (6) alkaline basalt and fine-grained gabbroic dikes (391 ± 1 Ma U-Pb data on zircon, [Kovalenko et al., 2004](#)), (7) fine-grained rare metal quartz-rich granite and (8) leucite basalt dike ([Kovalenko et al., 1995](#)). The complex is cut by late-stage numerous rhyolite dikes and pegmatite. The complex in the studied area consists of two main lithological units of quartz syenite and granite that belong to the intrusive phase first and seventh, respectively (Figure 2.2-1b). Rare metal bearing mineralization is disseminated the peralkaline granites of the seventh phase and metasomatized quartz syenite, which form a stock of 0.46 km^2 in area. The northern edge of the complex was cut and displaced by a right lateral strike-slip fault (Figure 2.2-1a).

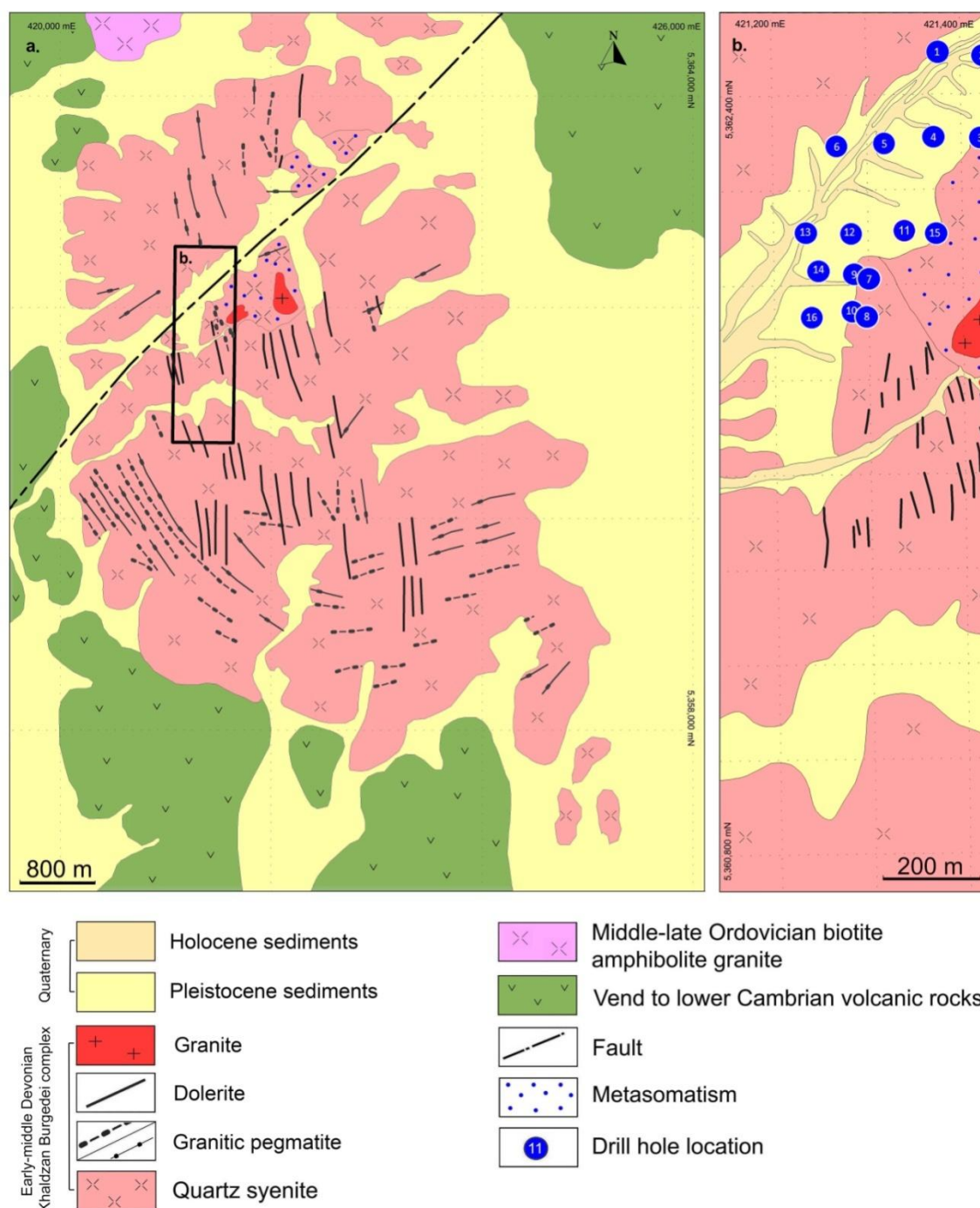


Figure 2.2-1 Geological map: (a) map of the Khaldzan Burgedtei deposit (based on the [Kovalenko et al. 1995](#)), (b) detailed map of the study area (modified after Mongolian Lantonoide Corporation., 2011).

2.3 Samples and Analytical methods

I conducted surface geological mapping in the area shown in Figure 2.3-1 in addition to reconnaissance investigation of the whole complex to confirm the relationships between the

intrusive rocks of different phases. Rock samples localities are shown in Figure 2.3-1. We also observed core samples drilled by Mongolian Lantanoide Corporation in 2011.

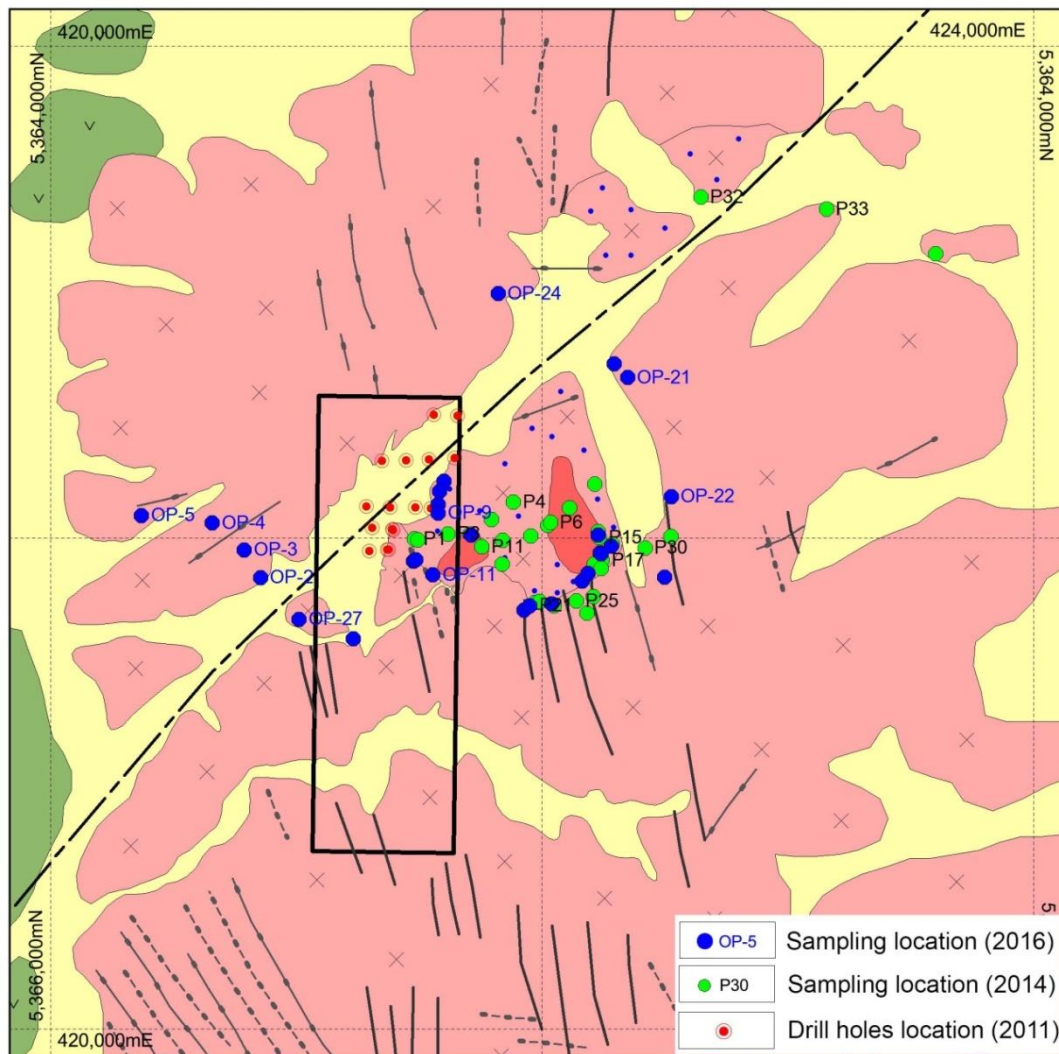


Figure 2.3-1. Sample localities of rock from the surface

Polished thin sections were prepared for 210 samples collected from the surface and the core. Petrographic and mineralogical studies were conducted for these thin sections with an optical microscope, SEM-EDS and EPMA. A Nikon Eclipse 100N POL microscope was used to observe properties of minerals under plane polar and crossed polars and to identify mineral and its assemblages. This study has been carried out at Akita University.

Major and associated minerals were identified by SEM-EDS, and by JEOL scanning electron microscope JSM-6610LV at accelerating voltage of 15 kV, beam current 20 nA, beam diameter 1-0 μm and counting times 100 sec. Identification of elements and their concentrations were performed using a program of Oxford Instruments.

Chemical compositions of mafic minerals and zircon grains were determined by a JEOL JXA-8530F electron probe microanalyser (EMPA) at AIST. For high precision and sensitivity, an acceleration voltage of 20kV, a beam diameter of 5 μm and counting times of 20 second were applied. The following peak position has been selected: the K series of X-ray spectra was used for Si, Al, Fe, Ca, Mn, Ti, P, and Na; the L series for Zr, REE, Hf and Nb; the M series for Th and U.

Laser Raman spectra of zircon were collected using a Renishaw RM200 Laser Raman Spectroscope at Akita University. The laser beam diameter was 0.1 μm and the collecting time was 10 s.

2.4 Lithology and lithologic relation of the Khaldzan Burgedei complex

2.4.1 Field observation of the study area

According to a geological mapping, later phase peralkaline granite surrounded by the first phase quartz syenite (Figure 2.4-1). Late stage numerous dyke and pegmatite are N-S trending. In the study area two main lithological units; quartz syenite, and granite are identified by the result of fieldwork and drill core observation. The contact between quartz syenite and granite were intruded by pegmatite sheet.



Figure 2.4.1-1. Image of display Khaldzan Burgedei complex (The top of the mountain is shown right side).

2.4.2 Lithology

2.4.2.1 Quartz syenite

On the surface, quartz syenite is exposed over most (90%) of the area of the Khaldzan Burgedei complex. The quartz syenite is dominantly distributed in the study area and they are intruded by granite (Figure 2.2-1b). A sharp contact between quartz syenite and granite is observed in the outcrops, and sometimes the contact between quartz syenite and granite shows a mingling characteristic. The zone, which has an average width of about 2-5.5m, consists of compositionally and texturally inhomogeneous rocks of syenite and pegmatite (Figure 2.4.2.1-1a). The quartz syenite occasionally contains pegmatite lenses (0.5x2.0 m). The rock exhibits a miarolitic texture filled with pegmatitic amphibole, feldspar, and quartz. The quartz syenite is heavily metasomatized near the boundary of granite.

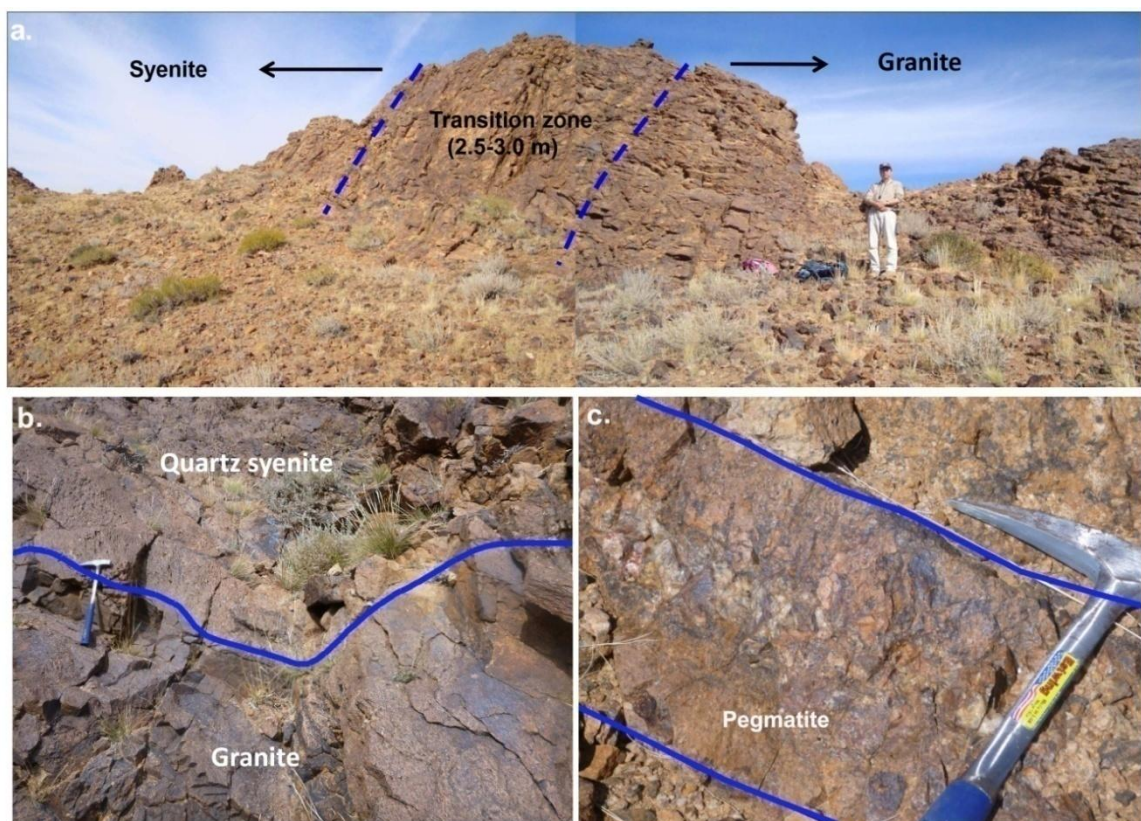


Figure 2.4.2.1-1 (a) Transition zone between quartz syenite and granite (b) A sharp contact between quartz syenite and granite, (c) Quartz syenite and granite is contacted with pegmatite vein.

Quartz syenite occurs all drill holes (15teen drill holes), and they show a various thickness of 0.0 to 300.0 m. The quartz syenite shows an equigranular texture and is composed of phenocrysts of coarse-grained amphibole, feldspar, and quartz with accessory minerals zircon and fersmite. Amphibole is up to 2 cm in length, black in color and is occasionally associated with a green-colored aegirine. Aegirine commonly occurs along the margins of amphibole. According to the previous researcher, [Kovalenko \(2004a\)](#) identified amphibole as arfvedsonite in all intrusive rocks. Feldspar is white in color, and commonly exhibits a zoned texture with red core and white rim when it is altered. Feldspar is intergrown with amphibole with a sub-parallel alignment. Quartz is anhedral and usually interstitial to amphibole and feldspar (Figure 2.4.2.1-2).

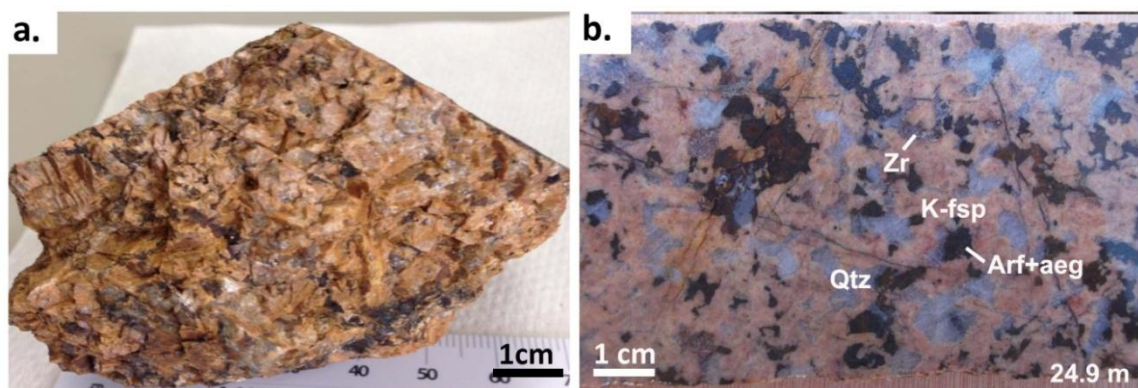


Figure 2.4.2.1-2 Quartz syenite. (a) Surface sample, (b) Core samples from BTDDH-11 depth-24.9 m. Abbreviations are: Aeg: aegirine, Arf: arfvedsonite, K-fsp: K-feldspar, Qtz: quartz, Zr: zircon.

The quartz syenite is in the drill holes BTDDH-2, 3, 4, 5, 7, 8, 9, 10, 11, 12, and 15 affected by weak to high metasomatism and hydrothermal alteration.

2.4.2.2 Granite

The granite is located in the central part of the Khaldzan Burgedei complex and occupied 4% of the complex. One of the granitic stocks present in the eastern margin of the study area (**Error! Reference source not found.**b). A sharp contact between quartz syenite and granite is observed in the outcrops, and chilled margin in the granite. This rock occurs in some drill holes BTDDH-3, 4, 7, 8, 11, 12, 15, and they show a various thickness of 15.0 to 290.0 m. The granite is fine to medium grained, pinkish gray or yellowish brown in color with rounded quartz, amphibole, and feldspar with accessory zircon and fluorite. Fine-grained interstitial quartz occurs in the rock.

The upper part of the granite, in the drill holes BTDDH-3, 7, 8, 11, and 15 becomes quartz-rich compared to the lower part. The quartz-rich part is related to fractionation. This part is sometimes associated with pegmatite's that consist of amphibole, feldspar, and quartz with zircon and fersmite.

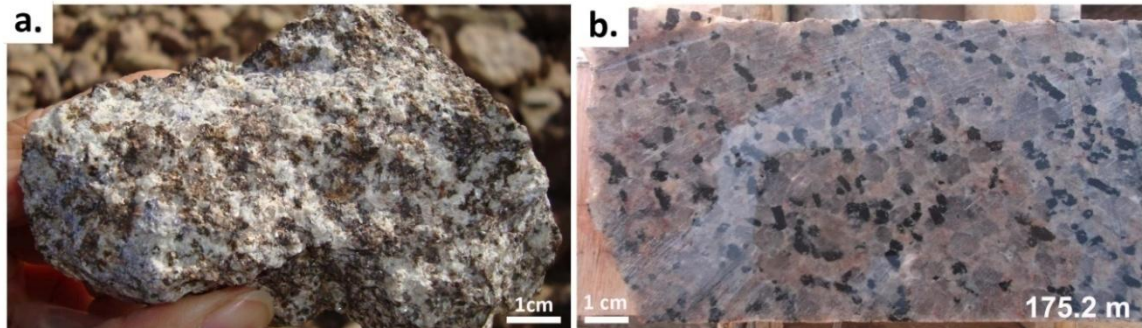


Figure 2.4.2.2-1 Granite. (a) Surface sample, (b) Core samples from BTDDH-11 depth-175.2 m.

2.4.2.3 Pegmatite

Pegmatite occurs as vein, miarolitic cavity, or irregular shape in the width of several tens cm (up to several meters), and they are found particularly near the boundary between quartz syenite and granite. The pegmatite is composed of abundant quartz, arfvedsonite, and feldspar and it may contain zircon and fersmite (Figure 2.4.2.3-1). The pegmatite occurs in some drill holes BTDDH-1, 11 and 15.

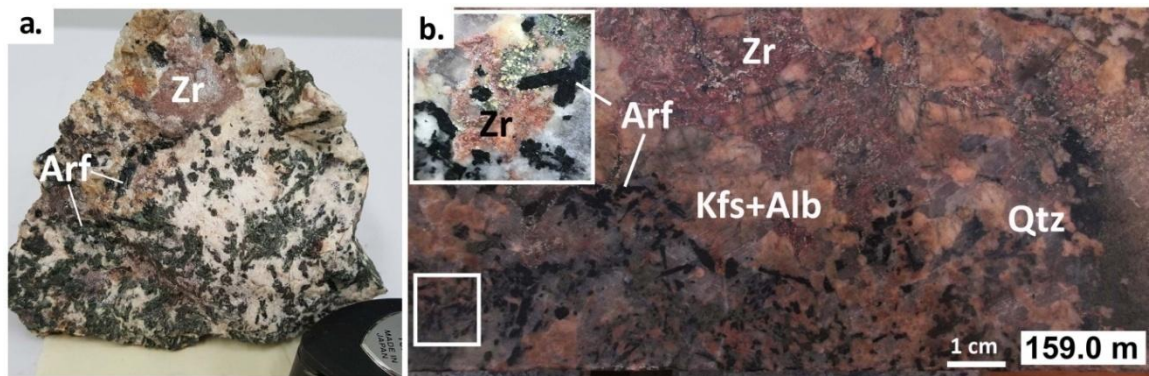


Figure 2.4.2.3-1 Pegmatite. (a) Surface sample, (b) Core samples from BTDDH-11 depth-159.0 m. Abbreviations are: Arf: arfvedsonite, K-fsp: K-feldspar, Alb: albite, Qtz: quartz, Zr: zircon.

2.5 Alteration

Main two types of alteration observed in the drill cores. They are metasomatic (dehydration) alteration and hydrothermal (hydration) alteration. Metasomatism is included hydrothermal

alteration, but alteration time is completely different. Metasomatism is original igneous minerals replaced by secondary minerals. It is the replacement of one mineral by other different minerals and chemical composition. The hydrothermal alteration is replacement of original minerals replaced by hydrous minerals. Big difference is during the metasomatism not so much contain hydrous minerals.

2.5.1 Metasomatic alteration (alkali metasomatism)

In the Khaldzan Burgedei complex is affected by alkali metasomatism. This aspect of metasomatism is characterized by Na bearing minerals, which are clearly in replacement relationships with primary igneous minerals. In the surface and drill holes observed metasomatic alteration. In the surface metasomatic alteration occurs mainly in the quartz syenite, and that metasomatized quartz syenite is controlled by NS to NE direction fault. The drill core observation and petrographic observations for the samples from the drill holes BTDDH-2, 3, 4, 5, 7, 8, 9, 10, 11, 12, and 15 show metasomatic alteration in several intervals. Albitization of the quartz syenite, in which plagioclase and K-feldspar is partly and totally replaced by albite and arfvedsonite by aegirine (Figure 2.5.1).

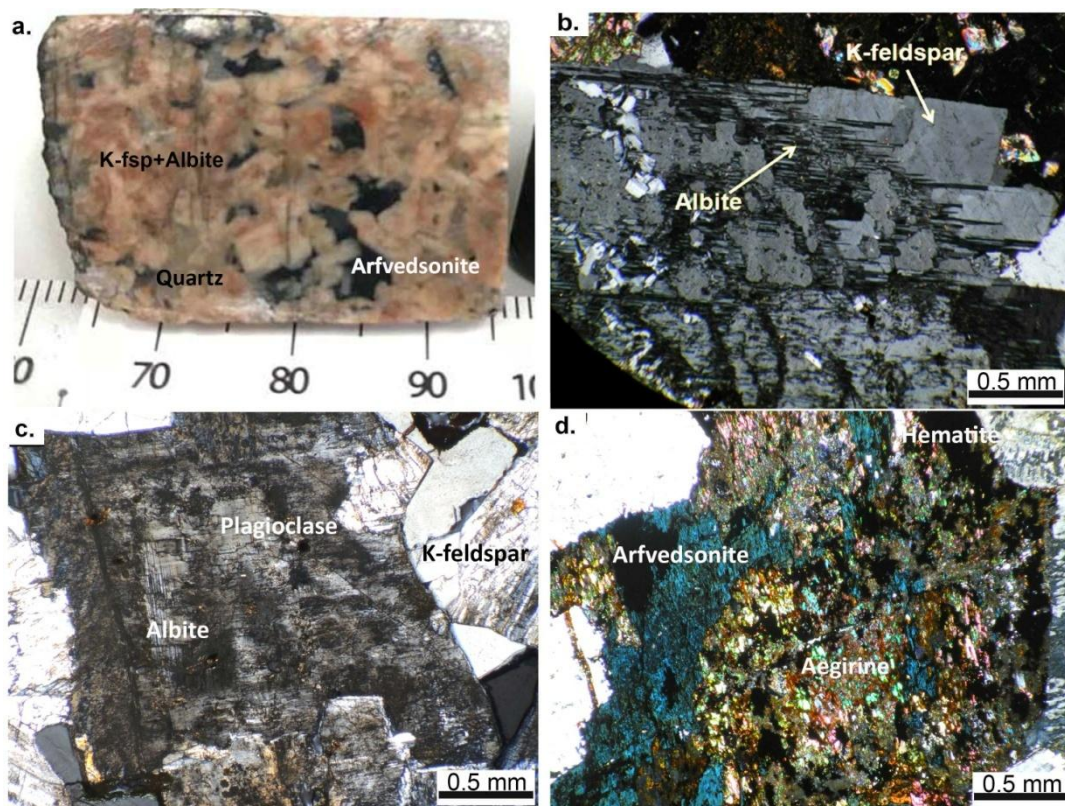


Figure 2.5.1 Metasomatic alteration in the quartz syenite. (a) Drill core samples. K-feldspar replaced by albite (BTDDH-11 99.5 m), (b) K-feldspar is replaced by albite (BTDDH-11

99.5m), (c) Plagioclase is replaced by albite (OP3 outcrop sample), (d) Arfvedsonite is replaced by aegirine, hematite and fluorite (BTDDH-11 25.4 m).

Albitization is characterized by reddish color by feldspar in the quartz syenite. In heavily metasomatized parts feldspars are totally replaced by albite. During microscopic observation, albitization show perthitic texture. In a few drill core sample occur plagioclase, but they already partly or totally replaced by albite. In the metasomatized units, unaltered arfvedsonite crystals are rare. Most of them have been partly or totally replaced by aegirine, and/or aegirine-augite with interstitial hematite, fluorite, calcite, zircon, ilmenite, and quartz.

2.5.2 Hydrothermal alteration

Four types of hydrothermal alteration are observed in the drill cores samples. They are chloritization, sericitization, fluoritization, and hematitization.

2.5.2.1 Chloritization

This alteration type is mainly observed in quartz syenite. In the drill cores observation for the samples from the drill holes BTDDH-1, 2, 4, 5, 11, 12 13 and 15 show chlorite alteration in several intervals. Chloritization is commonly associated with albite, hematite fluorite, calcite, and zircon (Figure 2.5.2.1). During microscopic observation after albitization, albite replaced by chlorite and sericite (Figure 2.5.2.1a, c and d). Sericite is usually overprinted by chlorite alteration. Amphibole replaced by chlorite. Chlorite is also commonly occurs as veins, veinlets and seams (Figure 2.5.2.1b, and e-f).

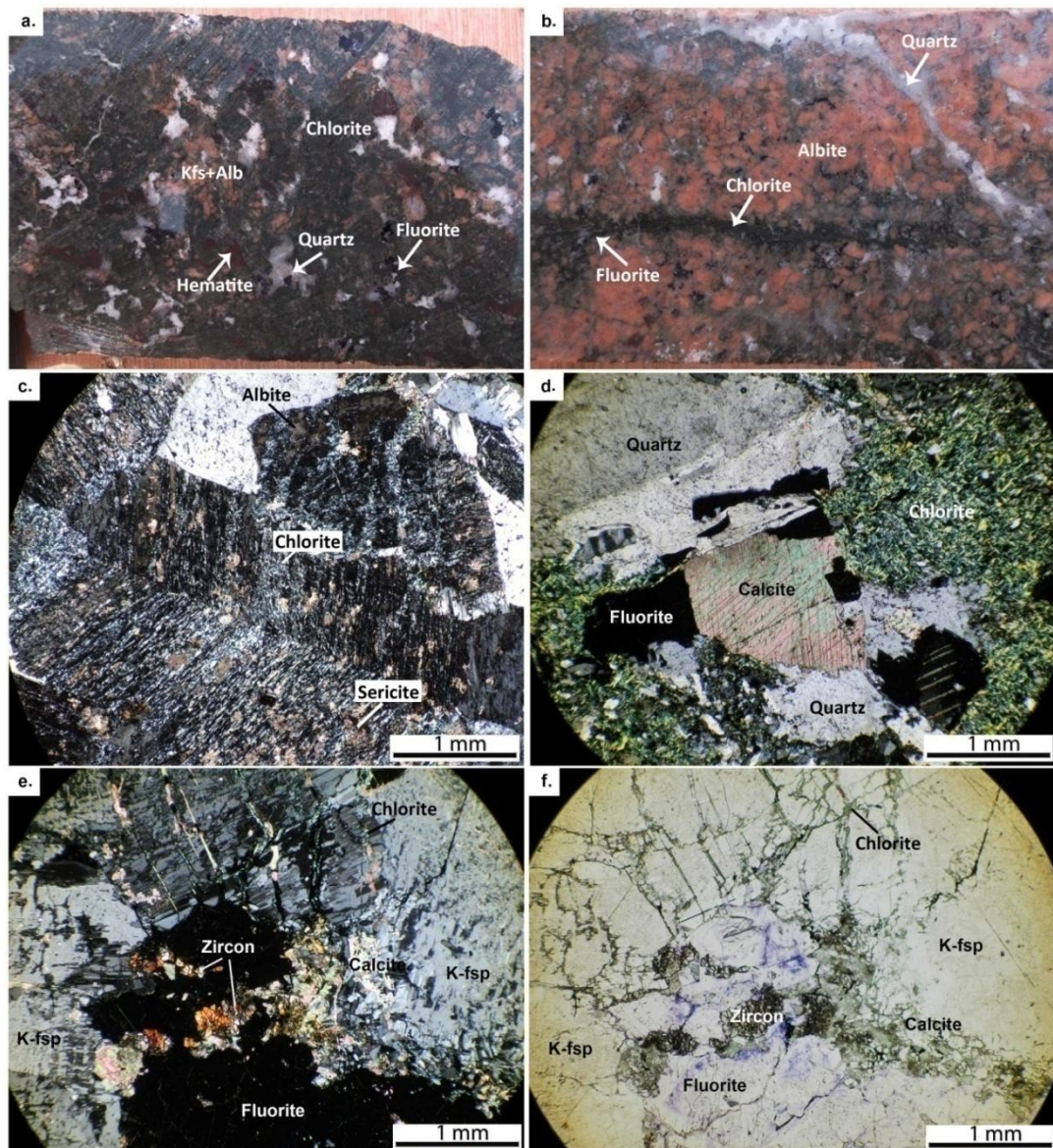


Figure 2.5.2.1 Chlorite alteration in the quartz syenite. Drill core samples image: (a) Feldspars altered by chlorite and sericite (BTDDH-11 87.5m), (b) Chlorite veinlets (BTDDH-11-85.7m), (c) Albite is replaced by chlorite and sericite (BTDDH-13 70.9 m), (d) Chlorite with fluorite and calcite (BTDDH-11 87.5m) (e-f) Chlorite is occurs along the fracture with fluorite, calcite, and zircon (BTDDH-11 89.2 m).

2.5.2.2 Sericitization

Sericite is a common alteration mineral of plagioclase in the areas. This alteration type is commonly observed in the quartz syenite most of drill holes BTDDH-1, 2, 3, 4, 5, 10, 11, 12, 13, 14, and 15. Plagioclase partly and totally replaced by sericite (Figure 2.5.2.2). In the albite and K-feldspar, sericite observed along the fractures.

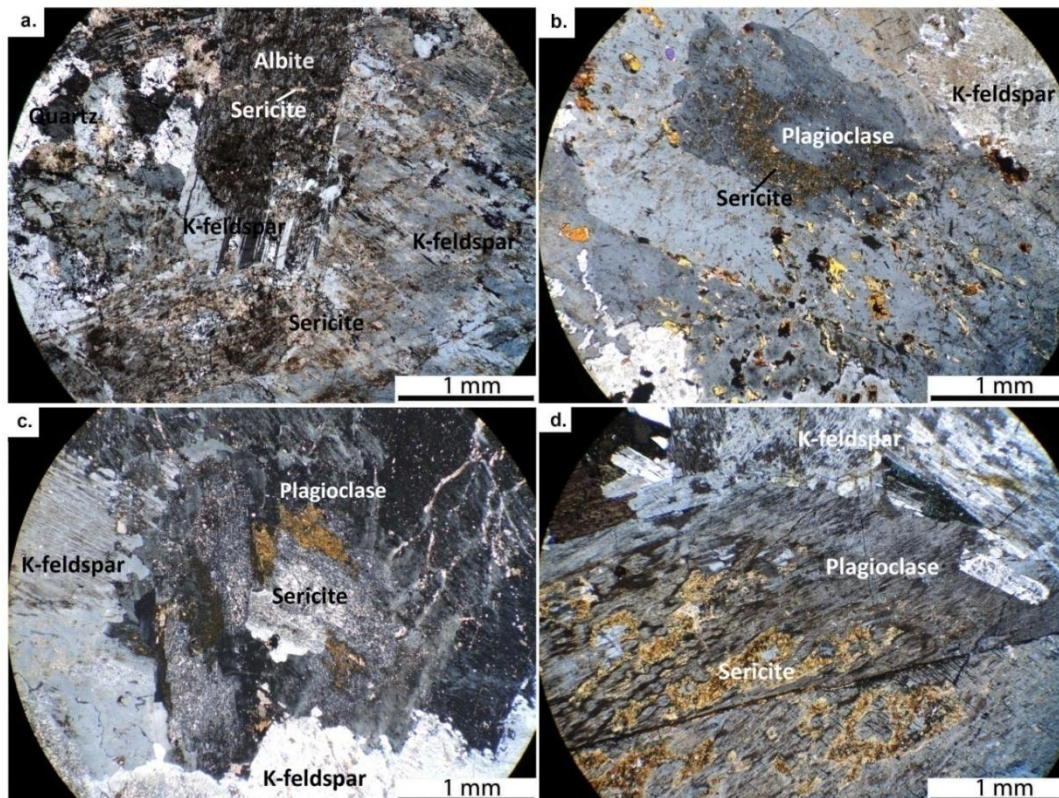


Figure 2.5.2.2 Occurrence of sericite in the quartz syenite. (a) feldspar altered by sericite with albitization (BTDDH-12 204m), (b) Plagioclase is replaced by sericite (BTDDH-14 267.2m), (c) Plagioclase is altered by sericite (BTDDH-14 191.1m), (d) Plagioclase is replaced by sericite BTDDH-10 131m.

2.5.2.3 Fluoritiazion

Fluorite occurs as veins, veinlets, lenses, and amphibole pseudomorphs with quartz as dissemination (Figure 2.5.2.3). Fluoritization occur in the drill holes BTDDH-3, 4, 6, 7, 8, 10, 11, 12 13, 14 and 15 and occur in quartz syenite, granite and pegmatite. Fluorite veins are subvertical up to 3 cm thick, associated with quartz, and hematite vein. Fluorite veins they mostly show anhedral and cubic zoning texture. The quartz-fluorite, fluorite veins are either barren or mineralized, with zircon, Nb minerals (fersmite and pyrochlore) and some REE bearing minerals (synchysite). The latter calcite is also commonly present together with fluorite veins.

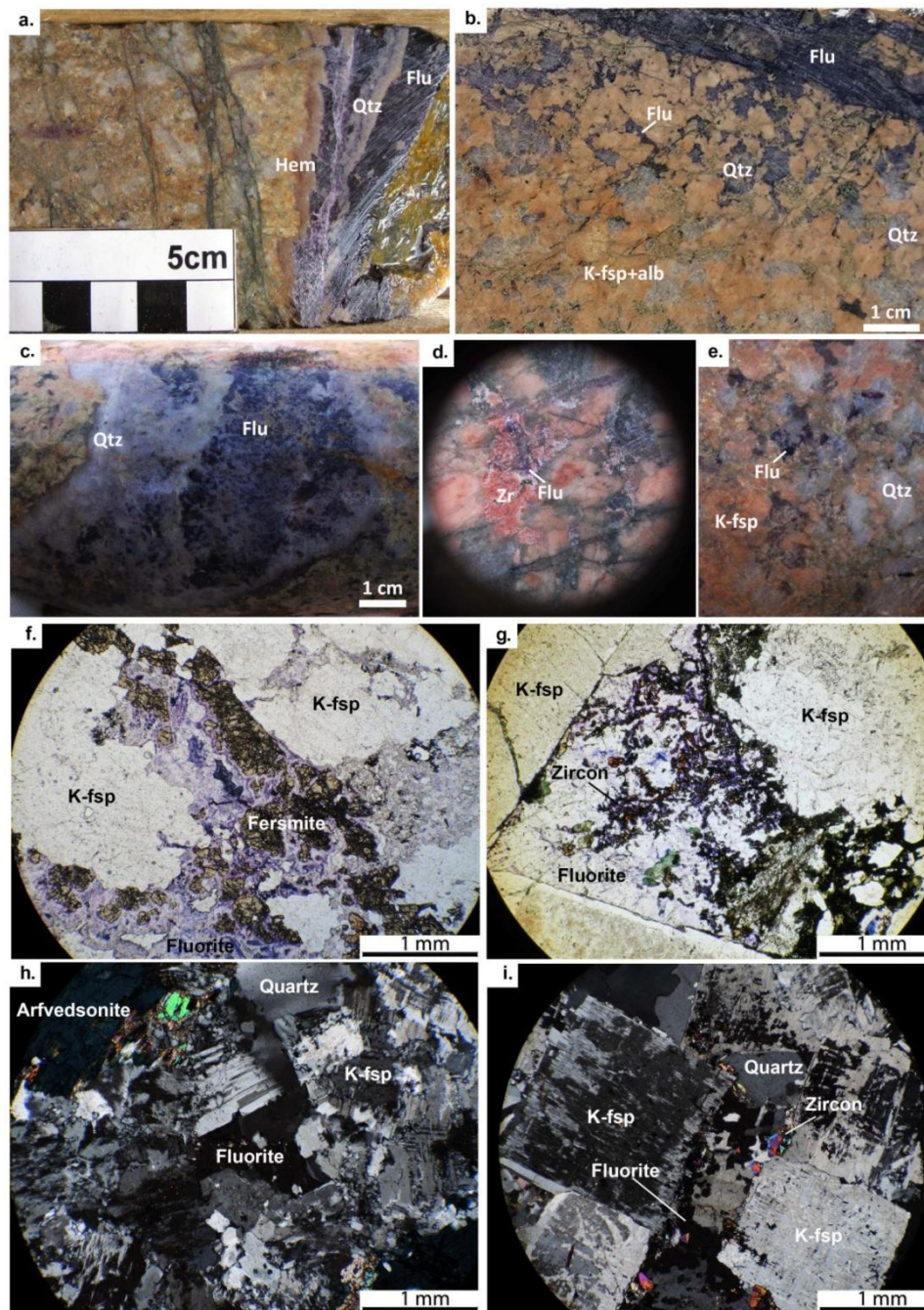


Figure 2.5.2.3 Occurrence of fluorite. (a) quartz-fluorite vein in the quartz syenite (BTDDH-3 91.4m), (b) Fluorite vein with fluorite dissemination in metasomatized quartz syenite (BTDDH-15 282.7m) (c) Quartz fluorite lenses in metasomatized quartz syenite. (BTDDH-11 60.4m), (d) Fluorite with zircon in heavily metasomatized and hydrothermal altered quartz syenite (BTDDH-11 82.9m), (e) Fluorite in the granite (BTDDH-3 47.6m), (f) Fluorite with fersmite in pegmatite (BTDDH-15 231.5m), (g) Amphibole pseudomorphs replaced with quartz-fluorite and zircon (BTDDH-11 85.7m), (h) Fluorite phenocrysts in granite (BTDDH-11 216.5m), (i) Quartz-fluorite with zircon in quartz syenite (BTDDH-11 131.2m).

2.5.2.4 Hematitization

Two-type hematitization occurs as vein, veinlets, and pseudomorphic replacement of amphiboles by hematite with quartz-zircon-fluorite in quartz syenite and granite. Hematitization is recognized in most of the drill holes BTDDH-1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 14 and 15. Hematite veins are up to 1 cm thick either barren or mineralized, with pyrite, chalcopyrite and zircon (Figure 2.5.2.4c and d). Commonly, aegirine in pseudomorphs of arfvedsonite contains submicroscopic hematite grains which give red coloration to zircon, ilmenite, and fluorite coated by hematite (Figure 2.5.2.4e and f).

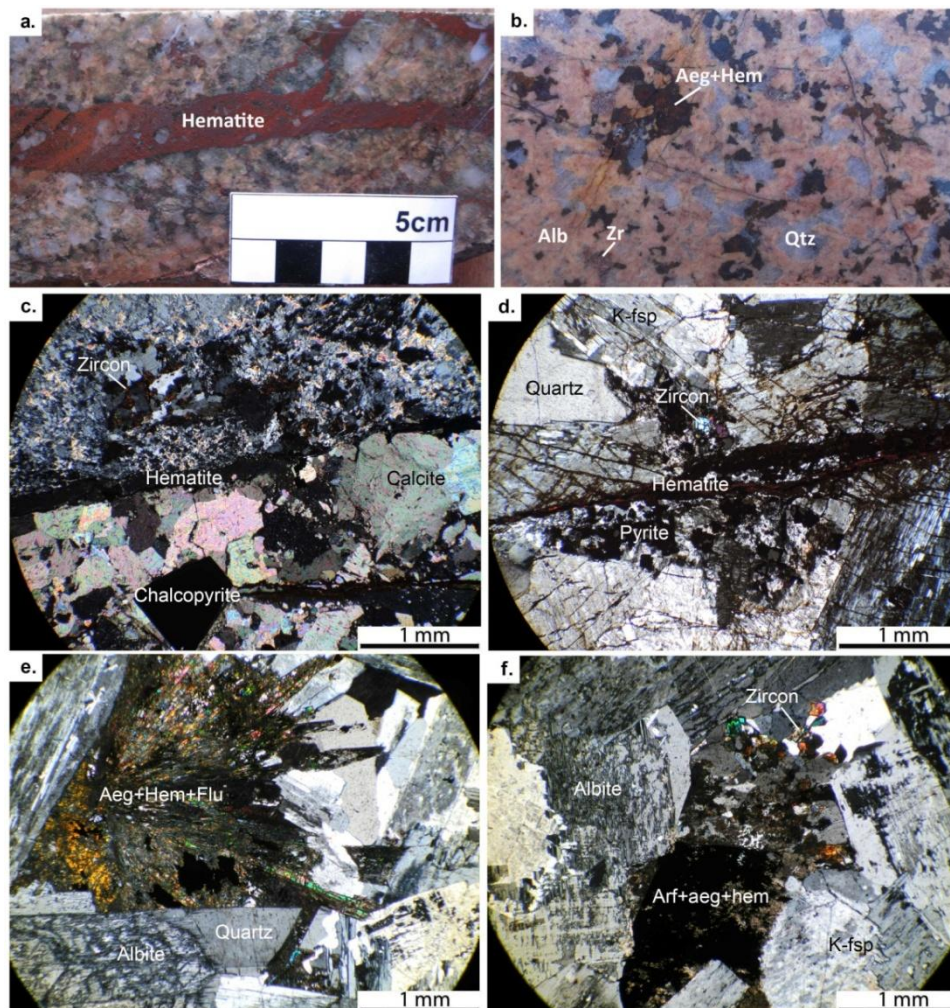


Figure 2.5.2.4 Occurrence of hematite. (a) Hematite vein in quartz syenite (BTDDH-4 271.5m), (b) Amphibole is replaced by hematite in metasomatized quartz syenite (BTDDH-11 24.9m), (c) Hematite-calcite vein with pyrite and chalcopyrite (BTDDH-3 88.5m), d. This rock hematite veinlets cut disseminated pyrite (BTDDH-7 9.9m), (e) Radial fibrous aegirine overgrown by hematite and fluorite (BTDDH-11 25.4m), (f) Arfvedsonite altered by aegirine, hematite, fluorite, zircon and quartz (BTDDH-11 64.3m).

3 Petrography and mineralogy

3.1 Petrography

The result of the core logging and petrographic study (point counting) in the drill holes show two distinctive igneous units; quartz syenite and granite (Figure 3.1-1).

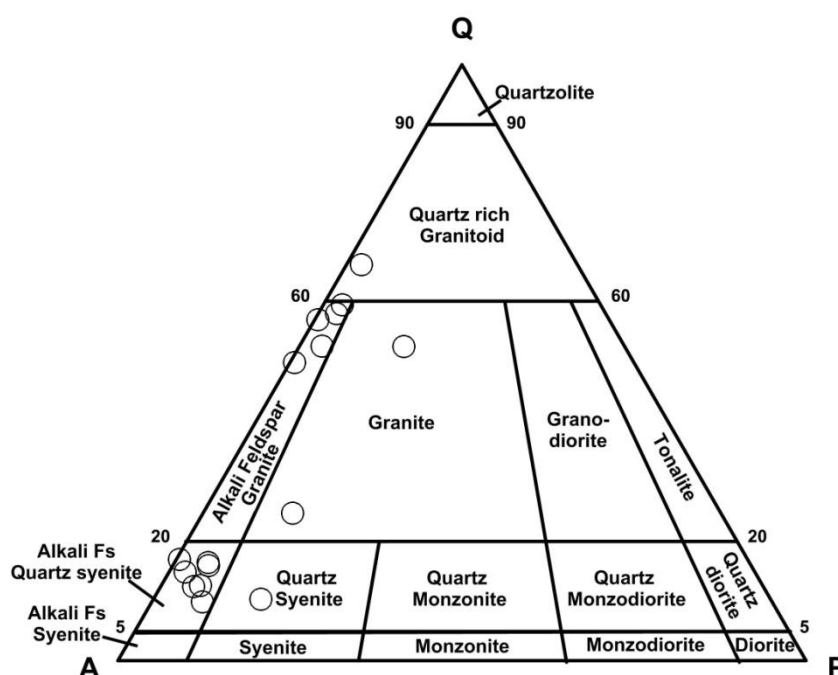


Figure 3.1-1 QAP diagram (Streckeisen, 1974) showing modal mineralization of syenite and granite of the Khaldzan Burgedei complex.

3.1.1 Quartz syenite and metasomatized quartz syenite

Quartz syenite: The rock is composed of alkali feldspar 75%, albite 5%, amphibole 5%, pyroxene 4%, quartz 12% and other accessory 4% (zircon, monazite, fluorapatite, pyrite, chalcopyrite, titanite and rutile). The quartz syenite is coarse grained, holocrystalline and equigranular in texture. Albite is generally euhedral to subhedral and K-feldspar is subhedral to anhedral and sometimes shows the twinning. Some euhedral albite is enclosed by K-feldspar, suggesting albite precipitation was earlier than K-feldspar. A part K-feldspar usually shows a decomposed texture into albite and K-feldspar. Plagioclase is subhedral, shows the twinning, replaced by albite and sericite. Amphibole includes arfvedsonite and ferrichterite. These mafic minerals are analyzed by EPMA and SEM-EDS to identify the chemical composition (Appendix 2 and 3). Arfvedsonite is generally anhedral, interstitial to albite. Arfvedsonite

replaced by aegirine, which includes titanite and apatite as an inclusion (Figure 3.1.1-1a). Ferrichterite is brown, yellowish-brown, brownish green in color, and partly replaced by aegirine. This mineral occurs with arfvedsonite. Zircon is euhedral to subhedral, coexisting with amphibole and feldspars (Figure 3.1.1-1b), that looks that Zr is looked slithery earlier than the zircon included in quartz (Figure 3.1.1-1c). Coarse euhedral fluorapatite occurs as an inclusion in K-feldspar and amphibole. Fersmite is euhedral to subhedral, coexisting with amphibole and feldspars. Concentric zoning is observed by SEM-EDS in fersmite in which rim part contains more Fe than core part. Monazite is subhedral and coexists with hematite, fluorite, and quartz (Figure 3.1.1-1e).

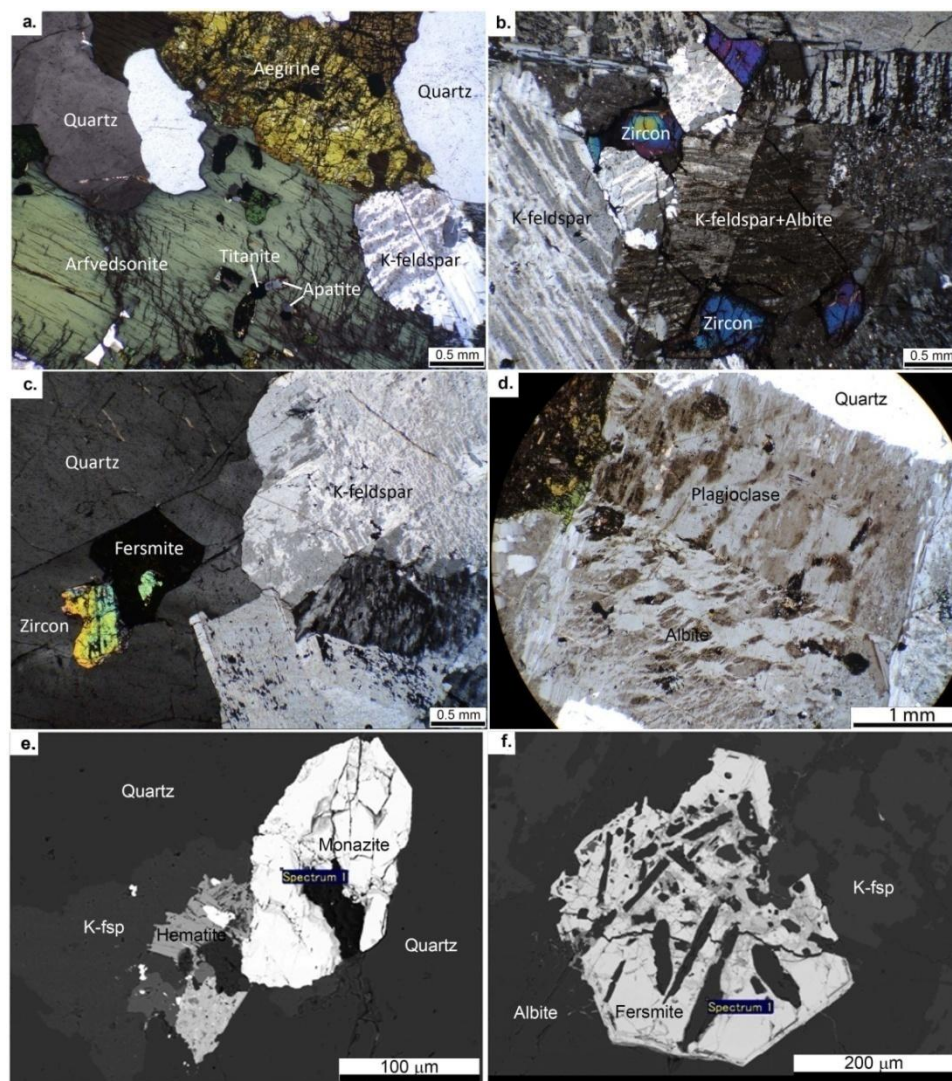


Figure 3.1.1-1 Photomicrographs of quartz syenite. (a) Arfvedsonite replaced by aegirine, and includes apatite and titanite, (b) K-feldspar is replaced by albite, zircon occurred in the feldspar (c) Quartz with zircon and fersmite, (d) Plagioclase is replaced by albite, (e) Quartz including monazite (f) Fersmite with albite inclusion.

Metasomatised quartz syenite: The metasomatized quartz syenite is medium-coarse grained, consist K-feldspar, albite, plagioclase, arfvedsonite, quartz, with accessory zircon, fluorite, pyrite, fersmite, pyrochlore, synchysite-(Ce), bastnesite, parisite, xenotime, titanite and rutile. This rock is holocrystalline and equigranular in texture. K-feldspar is subhedral to anhedral and albite is subhedral to euhedral. Nearly all plagioclase and K-feldspar are replaced by albite. Albitized feldspar contains sericite, Fe-rich chlorite (chamosite) and iron oxides. Amphiboles are subhedral to euhedral consist of darkish green arfvedsonite and darkish blue ferrorichterite. In the metasomatized part most of the amphibole from the rock is decomposed to secondary minerals including aegirine and hematite. An arfvedsonite crystal is completely decomposed and replaced by radial fibrous aegirine crystals, with interstitial fluorite, calcite, zircon, ilmenite, quartz and K-feldspar (Figure 3.1.1-2a and c). Quartz fills the space between major minerals. Zircon creates subhedral, euhedral crystal mostly coexists with quartz, fluorite, and hematite, sometimes coexists with amphibole and feldspars. In addition to this albitization, some parts are heavily altered and abundant fractured with chamosite, nontronite, calcite, hematite, fluorite, and quartz veinlets. These part more disseminated HFSE and REE minerals, such as zircon, fersmite, pyrochlore, synchysite, bastnäs site, parisite, and xenotime. Minerals in the micro fractures and alteration parts, are identified by SEM-EDS. Results of the analysis show the presence of synchysite-(Ce), bastnäs site and rutile (Figure 3.1.1-3). Pyrite veinlets cut feldspar crystal.

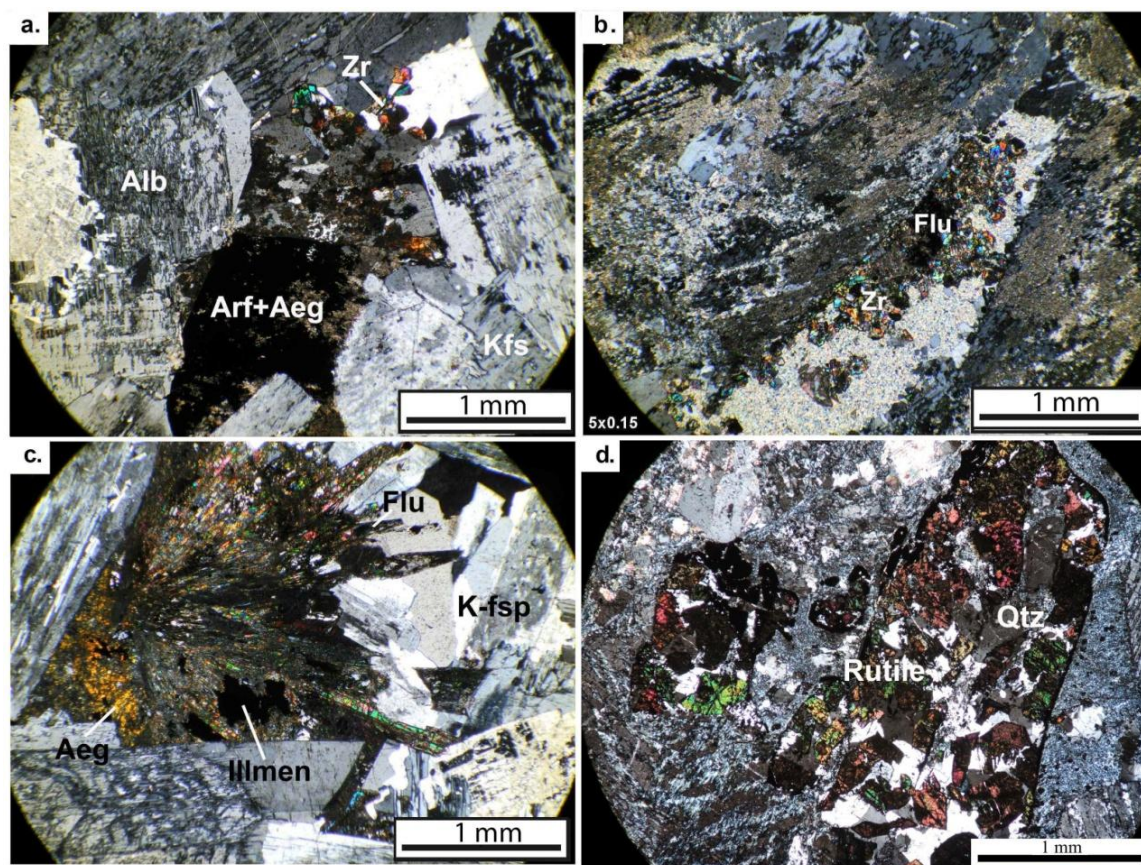


Figure 3.1.1-2 Photomicrographs of metasomatised quartz syenite. (a) K-feldspar replaced by albite and arfvedsonite by aegirin (BTDDH-11 64.3 m), (b) quartz syenite heavily altered with sericite, chlorite, with zircon, and fluorite (BTDDH-11 59.7 m) (c) Radial fibrous aegirine overgrown by fluorite and ilmenite (BTDDH-11 25.4 m) (d) Cluster of rutile with quartz (BTDDH-12 114.2 m).

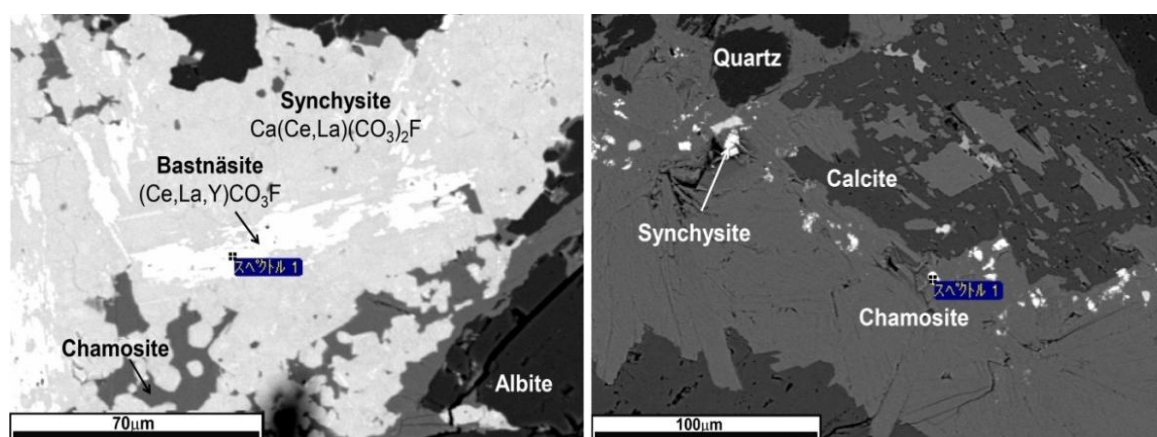


Figure 3.1.1-3 BSE images. (a) bastnäsite, synchysite and albite replaced by chamosite in metasomatized quartz syenite (b) Chamosite and calcite is coexisted and chamosite contain synchysite.

3.1.2 Granite and fractionation granite

Granite is fine to medium-grained, inequigranular texture, consist of the mainly quartz, microcline, albite, amphibole and accessory zircon, fluorite, pyrite, and Nb minerals (quartz 46%, alkali feldspar 39%, plagioclase 3%, amphibole 6%, pyroxene 3% and other accessory mineral 3%). Feldspar is subhedral to anhedral. Some feldspar crystals are cut by late stage quartz veinlets. Albite is containing euhedral darkish brown fersmite. Quartz occurs interstitial to feldspars. Abundant fine-grained recrystallized quartz is grown between the minerals. A small amount of amphibole occurs. Amphibole is identified as arfvedsonite (by EPMA analysis) (Appendix 2). Amphiboles are subhedral to anhedral, show twining and their marginal parts are replaced by aegirine and hematite (Figure 3.1.2-1a). Zircon occurs as rhombic to rounded crystals occupying spaces between quartz and feldspars and mostly includes quartz. Some zircon show intergrowth zoning with quartz and although some of them have porous cores (Figure 3.2.2-1c). Euhedral Nb minerals (fersmite and pyrochlore) occur as an inclusion in feldspars and amphibole (Figure 3.1.2-1f). They sometimes show a zoning texture, wide core and narrow rim (Figure 3.2.3-1). The rock is cut by late stage quartz veinlets. REE bearing minerals (synchysite) occur with amphibole and quartz.

The upper part of the granite, in the drill holes becomes quartz-rich compared to the lower part. The quartz-rich part is related to fractionation. Fractionated granite is generally mineral composition is same with granite. In this part, quartz more disseminated and enriched HFSE and REE.

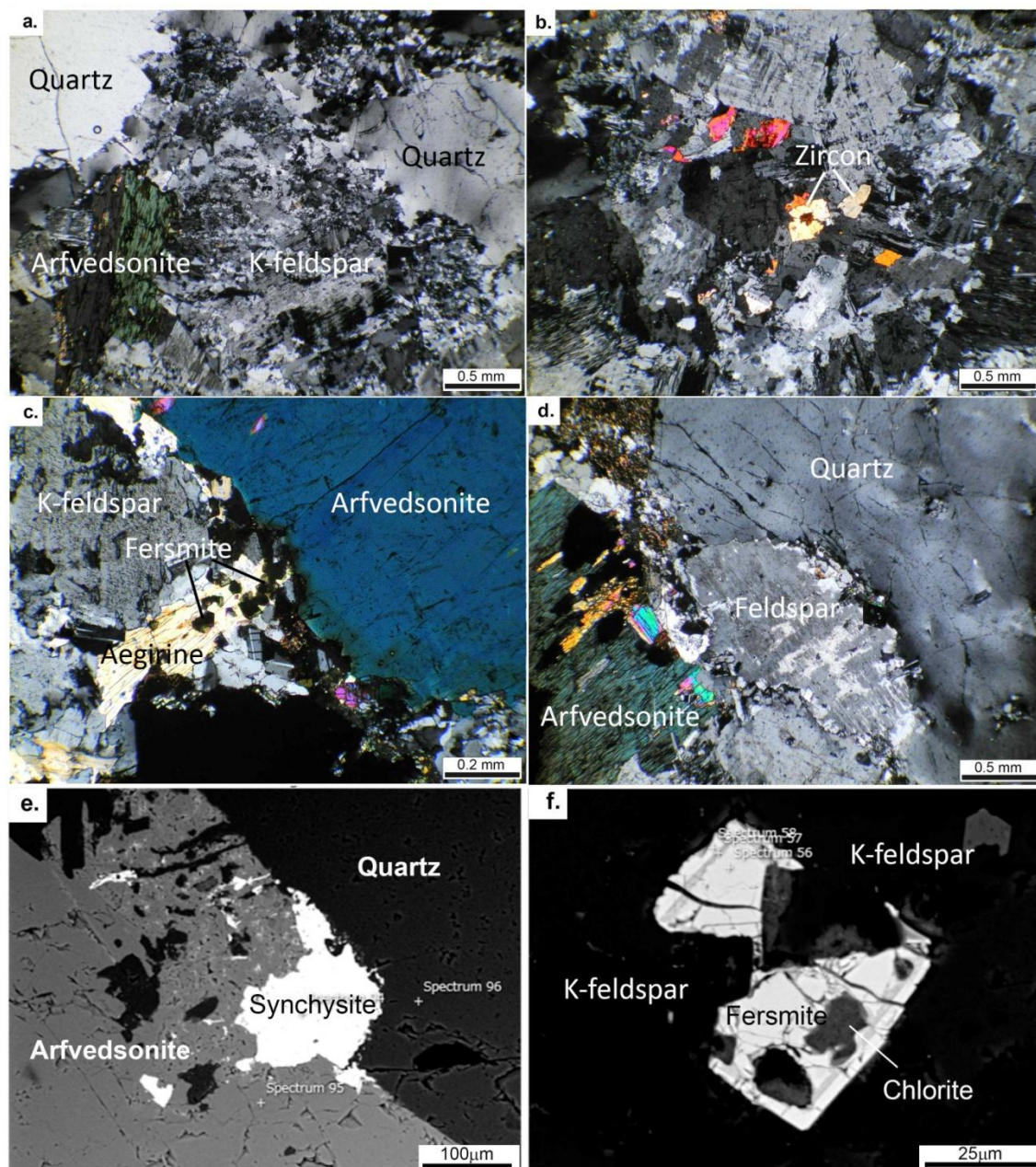


Figure 3.1.2-1 Granite. (a) Quartz is generally anhedral, filling the interstitial to other minerals, (b) Zircon coexisting with feldspar and quartz (c) Fersmite phenocryst included in aegirine, (d) Arfvedsonite replaced by aegirine. (e) Synchysite coexisting with arfvedsonite and quartz; f. Euhedral fersmite enclosed in feldspar.

3.2 Mineralogy

3.2.1 Amphibole and pyroxene

Amphibole (richterite and arfvedsonite) and pyroxene (aegirine-augite and aegirine) are major mafic minerals in the quartz syenite and richterite, arfvedsonite and aegirine are major mafic minerals in the granite.

Amphibole occupies up to 4.4% volume of the quartz syenite and 2 to 19% of the granite. Amphiboles are darkish green, green, bluish green, brown to brownish-red, or yellow, grey-brown, subhedral to anhedral, crystals (0.1 to 1cm), mostly homogeneous and sometimes show twinning. The EPMA results show wider variation in amphibole composition (sodic-calcic to sodic amphibole) in these rock units (Figure 3.2.1-1). They are ferrichterite ($\text{Na}_{2.08}\text{Ca}_{1.6}\text{Fe}^{2+}_{4.5}(\text{Si}_{7.2}\text{O}_{22})(\text{OH})_2$) and arfvedsonite ($\text{Na}_{2.5}\text{Fe}^{2+}_{3.4}\text{Fe}^{3+}_{0.9}\text{Si}_8\text{O}_{22}(\text{OH})_2$) (Figure 3.2.1-1, and Appendix-2). Arfvedsonite in quartz syenite is more enriched Ca (Figure 3.2.1-2). Quartz syenite and metasomatized quartz syenite contains sodic-calcic to sodic amphibole (richterite to arfvedsonite) (Figure 3.2.1-1 and 3.2.1-2). The core part of amphibole is more enriched in Ca, Fe, and other trace elements (Al, Ti and Mn) compared to rim part. The Na content of the amphibole negatively proportions to the Ca content in compliable.

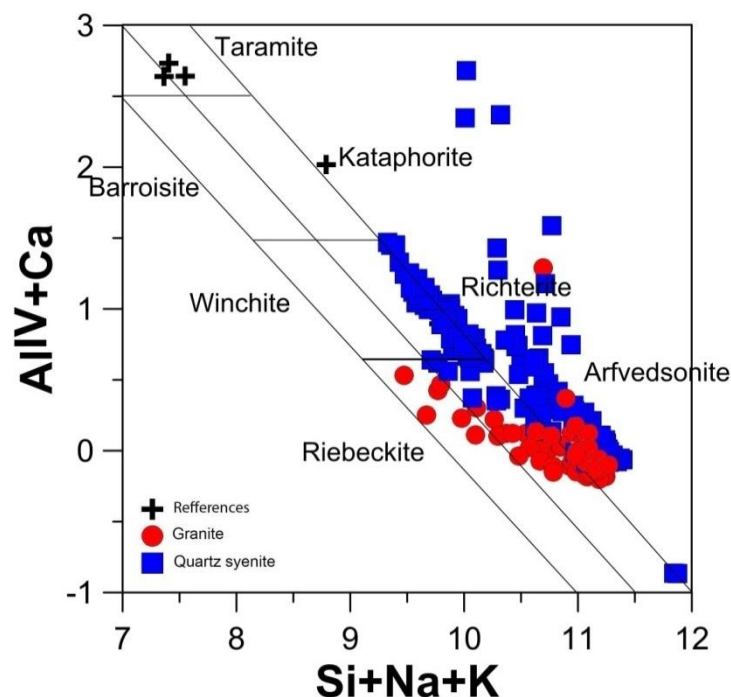


Figure 3.2.1-1 Amphibole $\text{Ca}+\text{Al}^{\text{iv}}$ and $\text{Si}+\text{Na}+\text{K}$ versus diagram ([Giret A. et al., 1980](#))

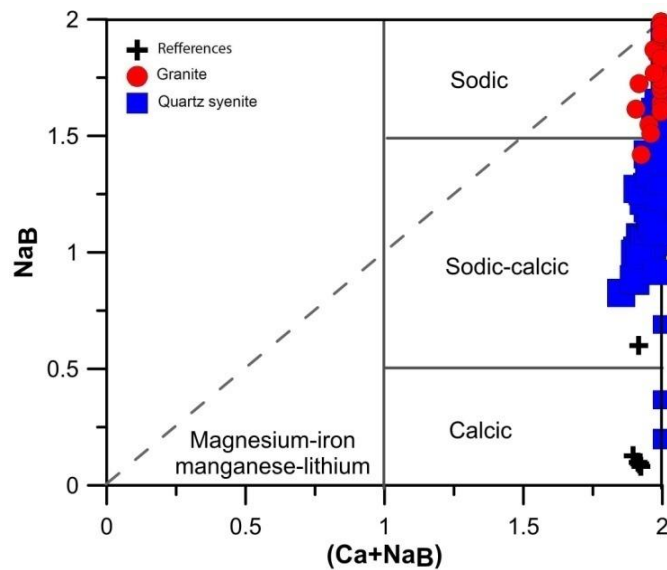


Figure 3.2.1-2 $\text{Na}_{(\text{B})}$ versus $\text{Ca}+\text{Na}_{(\text{B})}$ classification diagram for amphiboles ([Leake BE et al, 1997](#)).

Pyroxene occupies up to 4.6% volume of the quartz syenite and 0.6 to 10.9% of the granite. It occurs as isolated interstitial grains with yellowish green, green, blue, and yellow colour. It is subhedral to anhedral, and fibrous in form with 0.1 to 0.5cm in size. Textural evidence shows it crystallized after amphibole. Pyroxene commonly replaces amphiboles. They are identified by EPMA as aegirine-augite ($\text{Ca}_{0.38}\text{Na}_{0.64}(\text{Mg}_{0.00}\text{Fe}^{2+}_{0.30}\text{Fe}^{3+}_{0.63})\text{Si}_{1.98}\text{O}_6$) and aegirine ($\text{Na}_{1.05}\text{Fe}^{3+}_{1.07}\text{Si}_{1.96}\text{O}_6$) (Figure 3.2.1-3, and Appendix-3). Quartz syenite contains aegirine, aegirine-augite and granite is contain aegirine. Pyroxene in quartz syenite is more enriched Ca than those in granite (Figure 3.2.1-4).

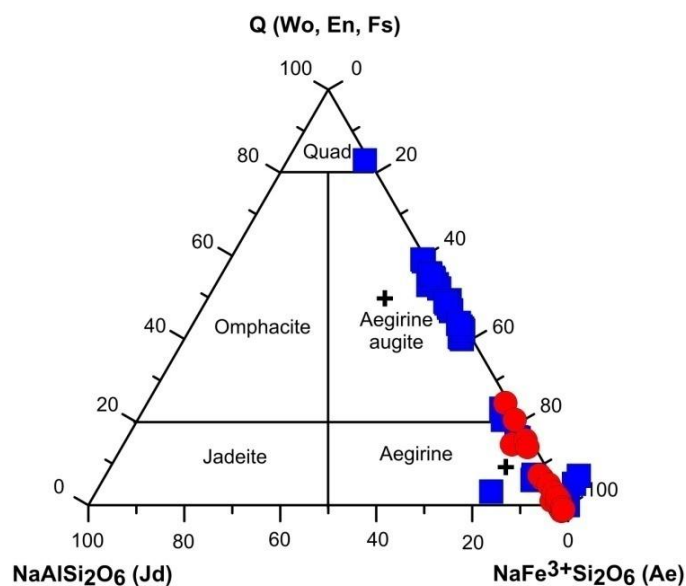


Figure 3.2.1-3 Pyroxene ternary diagram ([Nobuo Morimoto 1989](#)). (Quad- Ca-Mg-Fe pyroxenes, Wo-Wolastanite, En-Enstatite, Fs-Ferrosilite, Ae-Aegirine, Jd-Jadeite)

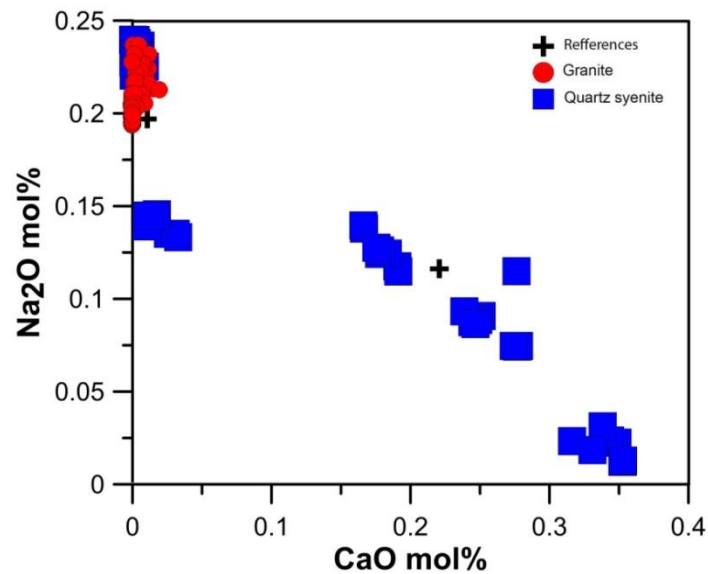


Figure 3.2.1-4 Na₂O and CaO versus diagram for pyroxene ([Stephenson, 1972](#))

3.2.2 Zircon

3.2.2.1 Occurrence

Zircon is the most common accessory mineral in the quartz syenite and granite in this drill hole. Based on the mineral paragenesis and texture, these zircons are classified into three types (Type-I, Type-II, and Type-III) and Type-I is subdivided into three sub-types.

Type-I zircon is observed in the quartz syenite and granite. It occurs in most of drill holes BTDDH-01, 02, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, and 14. Type-I zircon in the quartz syenite is generally isolated, and euhedral to subhedral in crystal form. They are 25–100 μm in size, enclosed by albite, K-feldspar, or quartz (Figure 3.2.2.1-1 a-h). The zircons hosted in feldspar (Ia) (Figure 3.2.2.1-1a) are earlier than those hosted in quartz (Ib) (Figure 3.2.2.1-1b). These zircons are commonly zoned, and metamict. Metamict zircon in the back scatter detector (BSE) image show darkish-grey, thin rim. Type-I zircons in granite (Ic) are also hosted in albite or K-feldspar, and less commonly quartz (Figure 3.2.2.1-1e and f). They are euhedral in shape, compact and homogenous, although some of them are porous. They are sometimes corroded from the rims and include thin quartz band(s) in their crystals in the granite (Figure 3.2.2.1-1e). This texture suggests that zircons crystallized when quartz was saturated in the granitic magma. In the Cathodoluminescence (CL) images, Type-I zircons show grey, darkish grey background and quartz, and albite shows a dark background (Figure 3.2.2.1-1d and h).

Type-II zircons are frequently observed in the quartz syenite and granite. It occurs in drill holes BTDDH-03, 04, 07, 08, 09, 10, 11, 12, and 15. They occur as subhedral to euhedral

20–150 μm size grains, with quartz, fluorite, and chlorite (Figure 3.2.2.1-1i to p). Zircons of this type are abundant in the metasomatized zone in the quartz syenite and upper part of the granite near the contact with the transition zone. Type-II zircons commonly form aggregates. These zircons enclose porous core parts (Type-I), and/or remnants of corroded xenotime-(Y) and synchysite-(Ce). Porous, inclusion-rich zircons with dark BSE intensity usually occur in central parts of grains (Figure 3.2.2.1-1i and m). In spite of the absence of clear zoning in zircons under BSE images, these zircons may have weak sector zoning and/or exsolution lamella, bright in color. Some zircons in the quartz syenite, show two clear stages of formation, inner lighter euhedral porous zircon (Type-I) enclosed by outer darker euhedral zircons (Type-II) with a distinct crystal boundary. These rims are heterogeneous in brightness with an irregular brightness boundary. The CL images show dark and grey background, corresponding to higher, and lower trace element contents ([Hoskin, 2003](#)), respectively, determined by EPMA. In addition, the image shows a halo in surrounding minerals. Radiation damage of the minerals surrounding zircons is in some cases visible in thin sections and is especially conspicuous in quartz (Figure 5.3.2.1-1p).

Type-III zircons are observed in the heavily hydrothermally altered zone in quartz syenite and pegmatite with Type-II zircons (Figure 3.2.2.1-1q to t). Zircons of this type are euhedral or anhedral, fine-grained, 10-30 μm in size and occur in amphibole pseudomorphs replaced by quartz with fluorite, chlorite, muscovite and hematite in addition to zircon. They are generally homogeneous, and some anhedral zircons have an envelope of synchysite-(Ce).

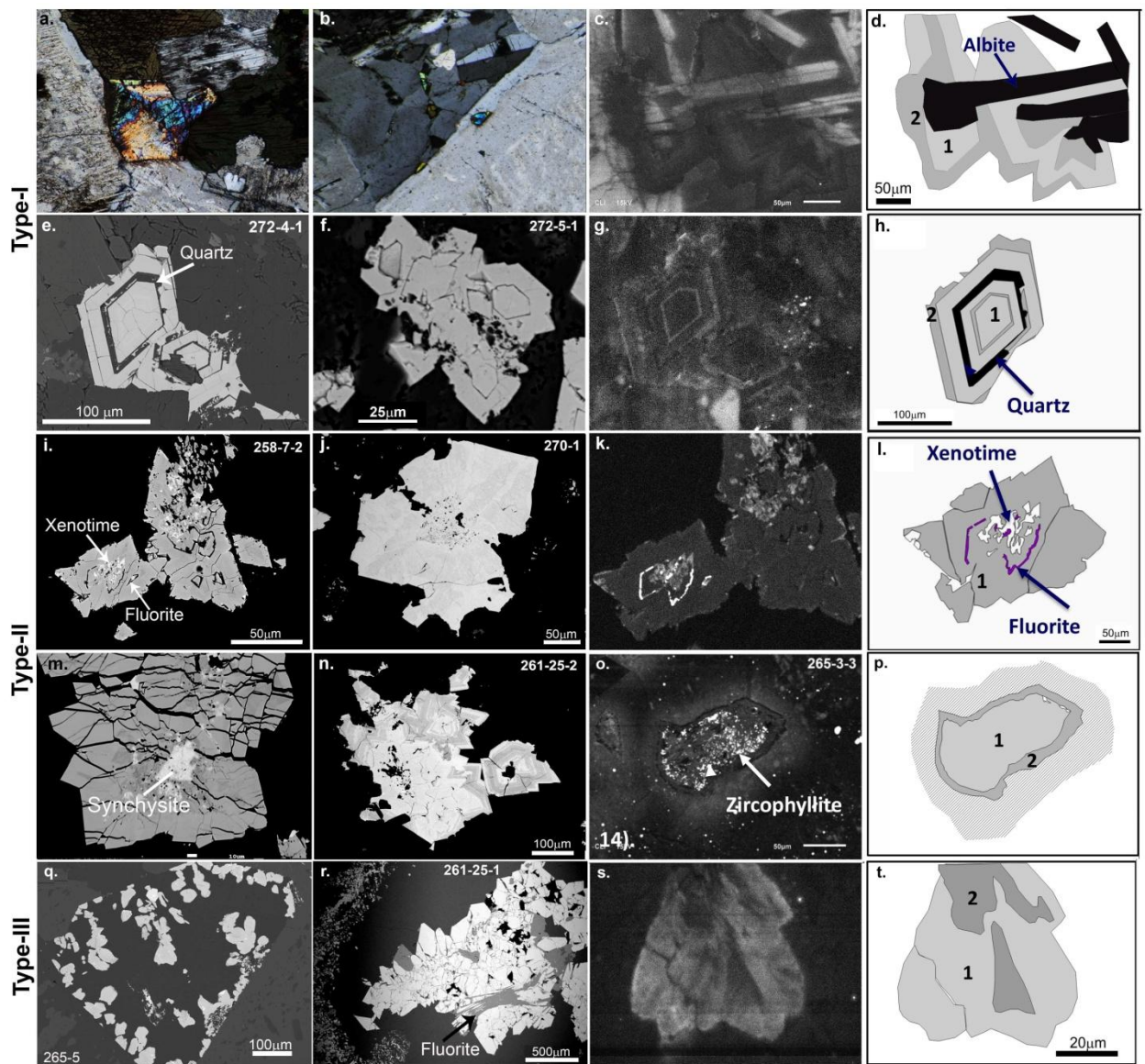


Figure 3.2.2.1-1 Zircon type and schematic drawings for cathodoluminescence images. (a,b) Type-Ia zircon from quartz syenite, zircon is show subhedral to euhedral shape, metamict zoning, and porous core. (c) Schematic drawing of Type-Ia zircons that consist of two domains, a bright CL domain 1, and grey CL domain 2. (d,e) Type-Ic zircon from granite. Zircon shows subhedral to euhedral shape and includes a thin quartz band. (f) Schematic drawing of Type-Ic zircons that consist of two domains, a grey CL domain 1, and bright CL domain 2. Two domains show zoning and contain dark quartz bands. (g,h), and (j,k) Type-II zircons from hydrothermal altered quartz syenite. These zircons show bright and dark color layered chemical zoning with porous cores. Xenotime and synchysite exist as inclusions in the zircon, (i) Schematic drawing of Type-II zircon. CL image shows dark grey solid domain 1, with white bright CL fluorite band (purple) and bright xenotime in the core, (l) Schematic drawing of Type-II zircon, with a grey CL euhedral core (domain 1), dark grey CL rim (domain 2) and whitish grey CL radiation halo in quartz (domain 3). Dark grey rim parts contain high Th concentration that attributed radiation halo. (m,n) Type-III zircons in the quartz syenite. Zircons are anhedral, fine-grained, and occur in an amphibole pseudomorph with quartz and fluorite. (o) Schematic drawing of Type-III zircons with anhedral grey and dark CL domains.

3.2.2.2 Chemistry

Representative chemical compositions of zircons are shown in Appendix-5 and Figure 3.2.2.2-1. Among the 198 zircon data, two data of which total exceeds 103 weight percent were excluded from the consideration.

The analytical data shows that only 40 data have the total between 99.00 and 101.00 wt%, and the others have the totals less than 99.00 wt%. The data of which total is less than 95 wt% is generally rich in U and Th, as well as FeO, suggesting metamictization with hematite and/or goethite. Zircons with low Zr content mainly occur in the metasomatized quartz syenite. These zircons contain abundant impurities such as Ca, Nb, Th, Fe, and REEs. Zircon in the granite shown opposite characteristic (Figure 3.2.2.2-1)

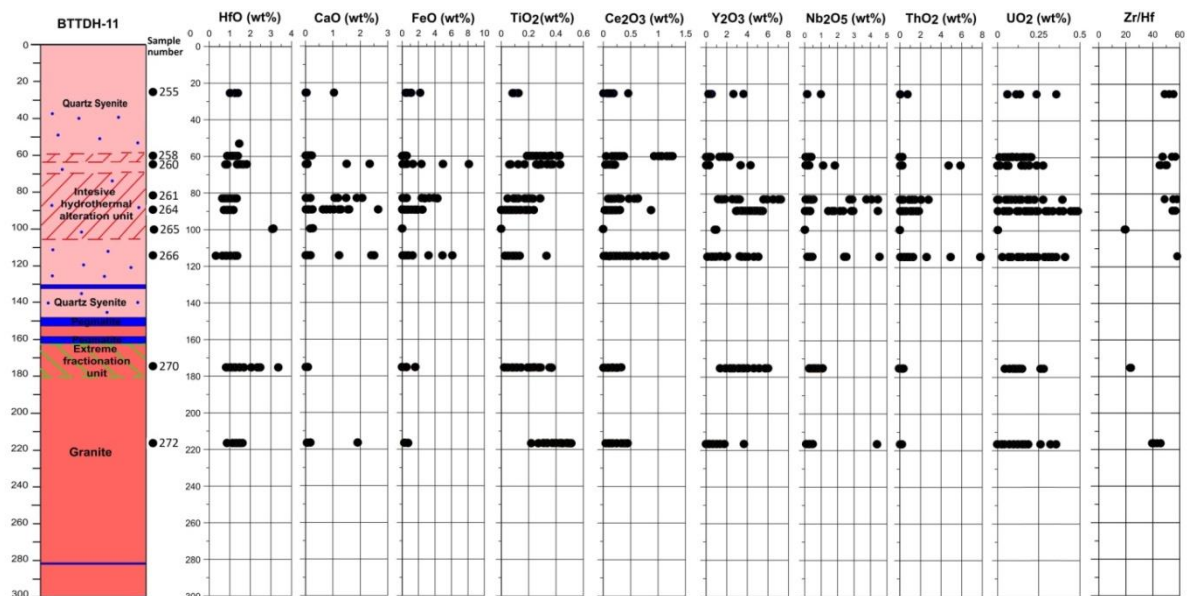


Figure 3.2.2.2-1 EPM analyses. Zircon in the Khaldzan Burgedei complex

Variation for Zr/Hf ratio is found: it is generally between 20 and 66, with most commonly average value at 46, suggesting significant fractionation between Zr and Hf (Figure 3.2.2.2-1 and Figure 3.2.2.2-2). Increasing Hf concentration is assumed to reflect increasing degrees of differentiation ([Linnen, R, 2002](#)). Zr/Hf ratio values around 20 are found in the Type-III zircon, lower than chondrite Zr/Hf value is suggesting higher fractionation ([Fernando, B. 2006](#)) and lower crystallization temperature ([Forester, H.J. 1999](#)). The ratio between Si and Zr + Hf shows that Si dominates over Zr + Hf constantly. This suggests that Zr and Hf are substituted by other elements such as REE because a negative linear correlation between Zr + Hf and REE is observed.

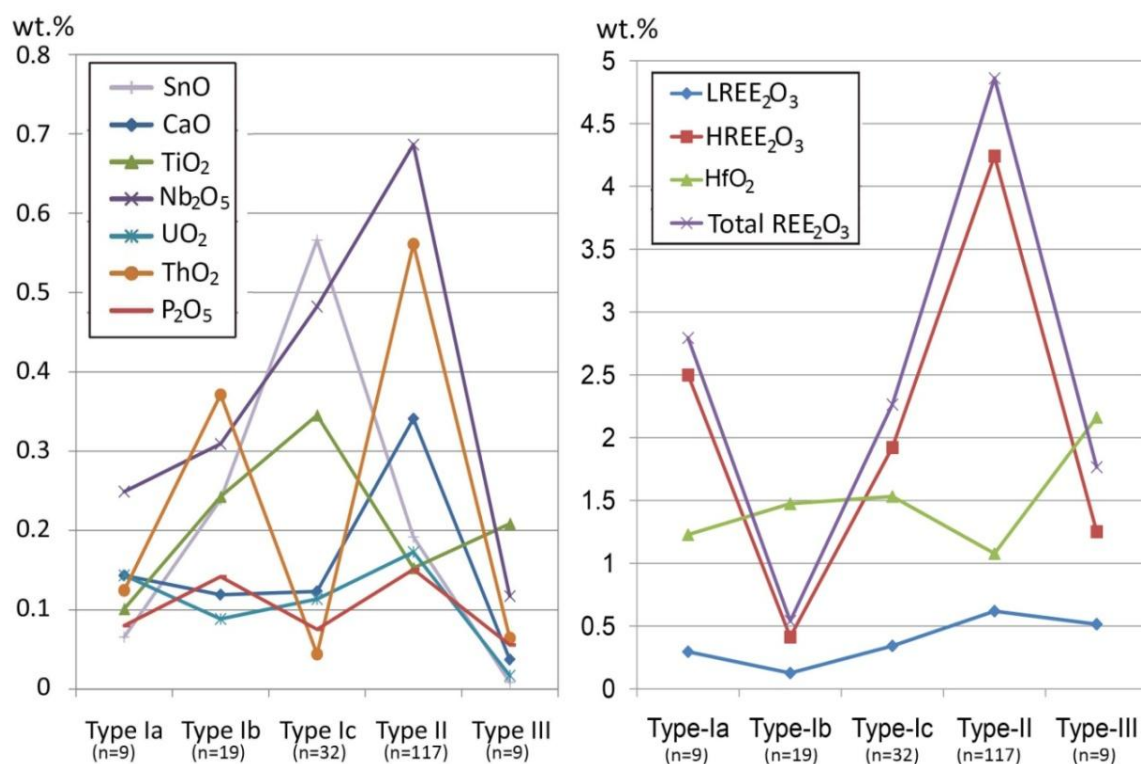


Figure 3.2.2.2-2 Zircon variation diagram

The amounts of CaO is generally less than 0.3 wt% on average (Table 3 and Figure 3.2.2.2-2), although 25 analyzed points in zircons contain 0.5–2.6 wt % (Figure 3.2.2.1-1). Such Ca-rich zircons occur as dark rims or internal bands in zircon grains in the metasomatized and hydrothermally altered quartz syenite. Only one quartz syenite sample from the heavily altered zone contains zircons with appreciable amounts (0.43–0.58 wt %) of Na₂O.

Type-III and Type-II zircons are highest (99.26 wt %) and lowest (96.66 wt %) in the average of analytical totals among these three types (Table 3). The contents of SnO₂ and TiO₂ in zircon increase from Type-Ia to Type-Ic through Type-Ib, but they are lower in Type-II than in Type-Ib and Type-Ic. The Nb₂O₅ content also increases from Type-Ia to Type-Ic, and it is highest in Type-II. The content of CaO and UO₂ are similar in Type-Ia, Ib and Ic zircons, respectively, and they are higher in Type-II than in Type-I zircons. Ca, Fe, Nb, and Th-rich zircons occur in the Type-II zircons in the metasomatized zone. ThO₂ and P₂O₅ contents are high in Type-Ib and Type-II, respectively. All these elements are lower in Type-III compared with Type-II, except TiO₂ (Figure 3.2.2.2-2). The total REE₂O₃ content in zircon is 2.50 wt % on average, and it is higher (4.22 wt %) in Type-II than Type-I (1.91 wt %) and Type-III (2.56 wt %). High-REE Type-II zircons mainly occur in the highly metasomatized part of the quartz

syenite (Figure 3.2.2.2-1). The LREE/HREE ratio is 0.14 for Type-Ib, 0.18 for Type-Ic, 0.19 for Type-Ia, 0.17 for Type-II, and 0.22 for Type-III. In general, HREE is more enriched in the core parts than the rim parts in Type-I zircons, whereas it is opposite in Type-II zircons.

Table 3. Average value of electron probe micro analyzer (EPMA) analysis data in zircon.

Type	Type-Ia		Type-Ib		Type-Ic		Type-II		Type-III	
comment	average	std	average	std	average	std	average	std	average	std
n	9		19		32		117		9	
SiO ₂	32.58	(0.461)	33.46	(0.412)	32.07	(0.707)	31.28	(2.931)	32.85	(0.568)
ZrO ₂	59.78	(1.221)	62.17	(1.028)	58.58	(1.535)	57.22	(5.543)	60.27	(1.294)
HfO ₂	1.23	(0.113)	1.47	(0.192)	1.53	(0.563)	1.08	(0.200)	2.16	(1.082)
Al ₂ O ₃	0.15	(0.078)	0.09	(0.047)	0.17	(0.067)	0.15	(0.133)	0.20	(0.087)
CaO	0.03	(0.013)	0.04	(0.023)	0.07	(0.041)	0.32	(0.555)	0.15	(0.116)
TiO ₂	0.10	(0.016)	0.28	(0.086)	0.36	(0.155)	0.18	(0.124)	0.17	(0.055)
Y ₂ O ₃	0.86	(1.143)	0.06	(0.096)	1.24	(1.841)	2.48	(2.079)	1.58	(0.099)
Nb ₂ O ₅	0.16	(0.027)	0.20	(0.049)	0.33	(0.147)	0.65	(1.144)	0.51	(0.419)
Ce ₂ O ₃	0.18	(0.217)	0.10	(0.049)	0.15	(0.133)	0.31	(0.300)	0.59	(0.042)
Nd ₂ O ₃	0.07	(0.128)	0.00	(0.000)	0.04	(0.067)	0.14	(0.181)	0.21	(0.064)
Gd ₂ O ₃	0.05	(0.091)	0.02	(0.027)	0.16	(0.224)	0.18	(0.128)	0.10	(0.035)
Dy ₂ O ₃	0.24	(0.137)	0.17	(0.049)	0.32	(0.155)	0.49	(0.322)	0.19	(0.028)
Ho ₂ O ₃	0.02	(0.029)	0.03	(0.039)	0.04	(0.051)	0.08	(0.071)	0.09	(0.049)
Er ₂ O ₃	0.32	(0.147)	0.06	(0.048)	0.15	(0.142)	0.44	(0.358)	0.31	(0.028)
Yb ₂ O ₃	1.05	(0.321)	0.09	(0.161)	0.18	(0.221)	0.75	(0.596)	0.65	(0.035)
UO ₂	0.12	(0.077)	0.09	(0.092)	0.11	(0.079)	0.15	(0.115)	0.04	(0.049)
ThO ₂	0.14	(0.261)	0.06	(0.073)	0.06	(0.058)	0.34	(0.582)	0.07	(0.035)
FeO	0.84	(0.625)	0.70	(0.746)	0.41	(0.147)	0.64	(0.935)	0.15	(0.007)
P ₂ O ₅	0.07	(0.032)	0.04	(0.027)	0.08	(0.063)	0.15	(0.192)	0.05	(0.053)
SnO ₂	0.07	(0.075)	0.32	(0.124)	0.60	(0.313)	0.24	(0.234)	0.00	(0.000)
Total	98.06		99.46		96.62		97.27		97.89	
LREE ₂ O ₃	0.28	(0.349)	0.11	(0.054)	0.1847	(0.148)	0.6185	(0.487)	0.445	(0.514)
HREE ₂ O ₃	1.45	(1.363)	0.33	(0.127)	1.7456	(2.139)	3.4871	(2.772)	1.0825	(1.251)
REE ₂ O ₃	1.73	(1.613)	0.43	(0.139)	1.9303	(2.137)	4.1056	(2.882)	1.5275	(1.764)
Structural formulae based on 4 oxygen atoms										
Si	1.023	(0.011)	1.025	(0.006)	1.018	(0.012)	0.999	(0.049)	1.016	(0.011)
Zr	0.915	(0.014)	0.929	(0.009)	0.907	(0.015)	0.891	(0.045)	0.936	(0.034)
Hf	0.011	(0.001)	0.013	(0.002)	0.014	(0.005)	0.010	(0.001)	0.011	(0.000)
Al	0.006	(0.003)	0.003	(0.002)	0.006	(0.003)	0.006	(0.006)	0.007	(0.003)
Ca	0.001	(0.000)	0.001	(0.001)	0.002	(0.001)	0.012	(0.022)	0.005	(0.004)
Ti	0.002	(0.000)	0.007	(0.002)	0.009	(0.004)	0.004	(0.003)	0.007	(0.003)
Y	0.015	(0.019)	0.001	(0.002)	0.021	(0.032)	0.044	(0.039)	0.026	(0.001)
Nb	0.002	(0.000)	0.003	(0.001)	0.005	(0.002)	0.010	(0.019)	0.008	(0.007)
Ce	0.002	(0.003)	0.001	(0.001)	0.002	(0.002)	0.004	(0.003)	0.007	(0.001)
Nd	0.001	(0.001)	0.000	(0.000)	0.000	(0.001)	0.002	(0.002)	0.003	(0.001)
Gd	0.000	(0.001)	0.000	(0.000)	0.002	(0.002)	0.002	(0.001)	0.001	(0.000)
Dy	0.002	(0.001)	0.002	(0.000)	0.003	(0.002)	0.005	(0.004)	0.002	(0.000)
Ho	0.000	(0.000)	0.000	(0.000)	0.000	(0.001)	0.001	(0.001)	0.001	(0.000)
Er	0.003	(0.001)	0.001	(0.000)	0.002	(0.001)	0.005	(0.004)	0.003	(0.000)
Yb	0.010	(0.003)	0.001	(0.001)	0.002	(0.002)	0.008	(0.006)	0.006	(0.000)
U	0.001	(0.001)	0.001	(0.002)	0.001	(0.001)	0.001	(0.001)	0.000	(0.000)
Th	0.001	(0.002)	0.000	(0.001)	0.000	(0.000)	0.003	(0.005)	0.001	(0.001)
Fe	0.022	(0.016)	0.018	(0.019)	0.011	(0.004)	0.018	(0.029)	0.002	(0.002)
P	0.002	(0.001)	0.001	(0.001)	0.002	(0.002)	0.004	(0.005)	0.003	(0.001)
Sn	0.001	(0.001)	0.004	(0.002)	0.007	(0.004)	0.003	(0.003)	0.000	(0.000)
Total	2.020		2.011		2.015		2.030		2.026	

3.2.2.3 Laser Raman spectroscopy

Results of the Raman spectra show three type zircons have a damaging effect of radiation. Each Si–O peak in the spectra is shifted from the original position and molecular water peaks are detected (Figure 3.2.2.3-1).

The Raman spectra of Type-I zircons show high Raman intensity and wave number shifts. The bands of the Si–O asymmetric stretching vibration at 1008 cm^{-1} are observed at 1001 cm^{-1} and the bands of the Si–O symmetric bending vibration are observed at 437 cm^{-1} . The strong Raman bands observed at 2237 and 2525 cm^{-1} are attributed to a Th compound. The molecular water vibration bands are observed at 3390 and 3600 cm^{-1} .

As shown in the Raman spectra, Type-II zircons show high Raman intensity and broad peaks. The bands of SiO_4 are observed at 978 cm^{-1} and 779 cm^{-1} and the bands of the Si–O symmetric bending vibration is observed at 437 cm^{-1} . The Th broad bands are observed at 2428 to 2465 cm^{-1} . The molecular water broad peak is observed between 3300 to 3700 cm^{-1} .

The Raman spectra of Type-III zircons show low intensity, and SiO_4 peaks are observed at 432 and 995 cm^{-1} . The Th bands are observed at 2032 , 2233 and 2507 cm^{-1} . The spectra show very low molecular water vibration peaks at 3405 and 3614 cm^{-1} .

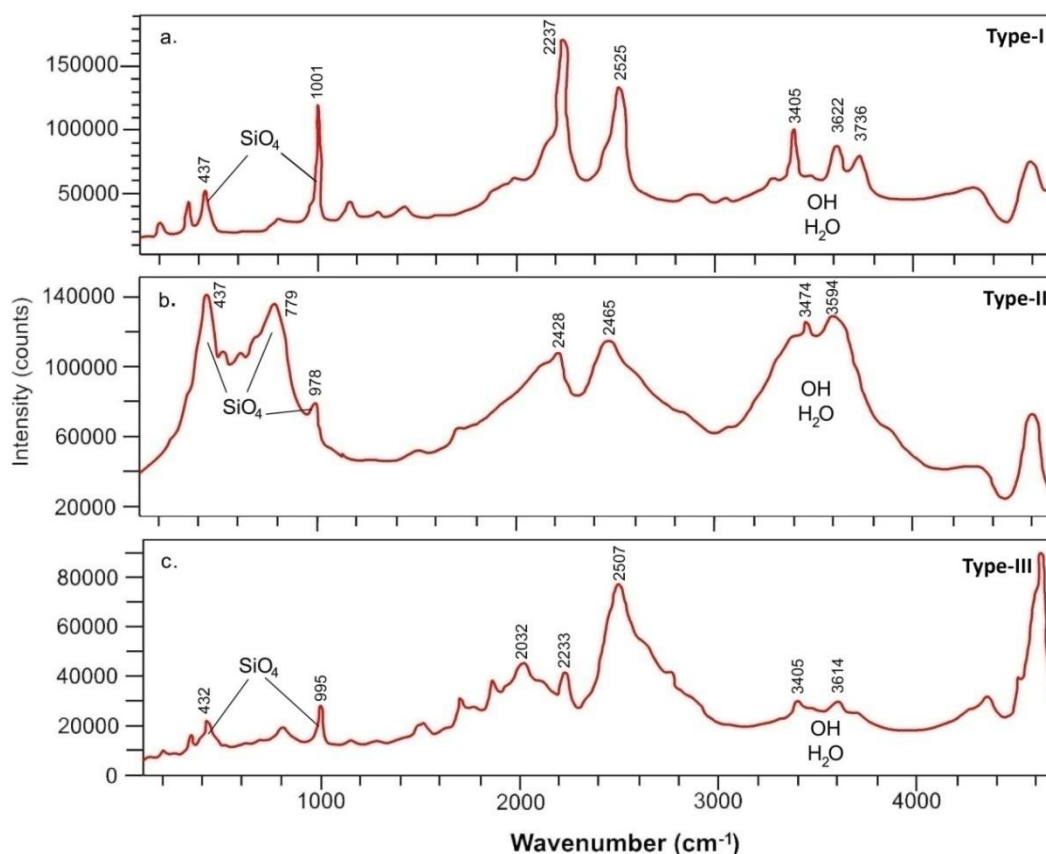


Figure 3.2.2.3-1 Raman spectra of zircons.

3.2.2.4 Age dating

Zircon age dating analyzed in the metasomatized quartz syenite of the Khaldzan Burgedei. Objective is to determine age of metasomatism. Represented zircon is subhedral to euhedral, and they show narrow rims (Figure 3.2.2.4-1). Results of age dating is U-Pb 397 ± 24 Ma.

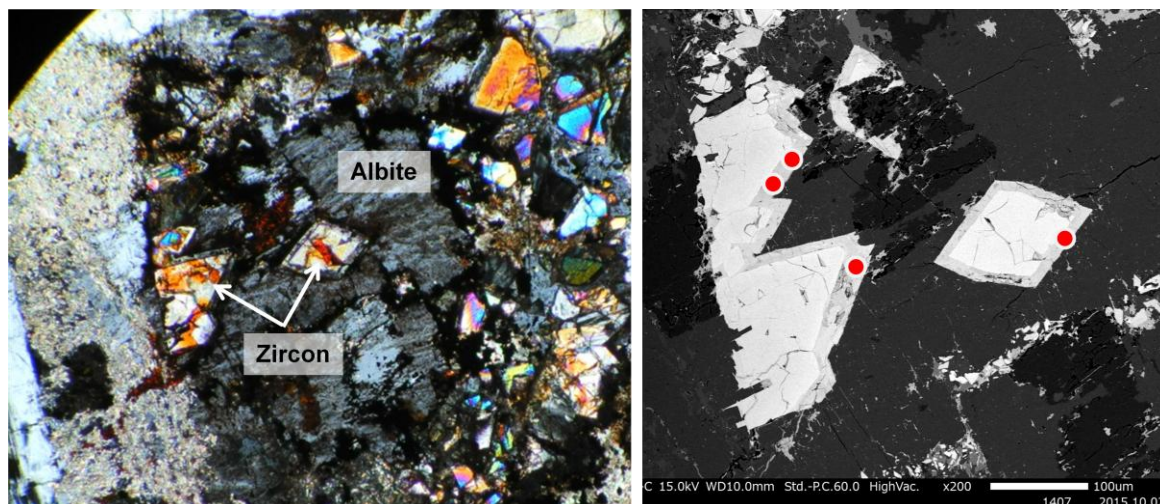


Figure 3.2.2.4-1 Zircon images and analyzed point location.

Table 4. Summary of zircon types and characteristics.

Zircon Type	Zoning	Chemical Composition (Average Anomaly by EPMA)	Molecular Water (by Laser Raman)	Origin
Type-I	Banded zoning with quartz	Y ₂ O ₃ 1.35 wt % ΣREE ₂ O ₃ 2.24 wt % Nb ₂ O ₅ 0.48 wt %	3390 and 3600 cm ⁻¹ vibration peak	Magmatic
Type-II	Oscillatory zoning with porous core	Y ₂ O ₃ 2.55 wt % ΣREE ₂ O ₃ 4.22 wt % Nb ₂ O ₅ 0.69 wt %	3250–3700 cm ⁻¹ broad peak	Magmatic-metasomatic U-Pb 397 ± 24 Ma
Type-III	Homogeneous	Y ₂ O ₃ 1.51 wt %	No peak	Metasomatic-hydrothermal

3.2.3 Fersmite

Fersmite [(Ca,Ce,Na)(Nb,Ta,Ti)₂(O,OH,F)₆] is one of the main accessory minerals after zircon in the quartz syenite, granite and pegmatite. It occurs in nine drill holes BTDDH-03, 04, 06, 07, 08, 09, 10, 11, and 15. Fersmite is creates 100-200 μm in size, subhedral to euhedral in shape with textures cubic, rhombic, prismatic, phenocrystals. They occur as an inclusion of feldspar, quartz or coexist with amphibole in quartz syenite and granite. In the pegmatite they mostly occurs inclusion of quartz and fluorite. Based on the texture fersmite is classified into

two types, they are concentric zoning is observed by SEM-EDS in fersmite. BSE image shows dark and bright zones (Figure 3.2.3-1). Bright part of the fersmite contains more Ce than dark part and dark part is more contain Fe and U (Table 5).

Table 5. Fersmite SEM-EDS analysis data (Measurement points show figure 3.2.3-1c).

Mineral	Fersmite	
	(Ca,Ce,Na)(Nb,Ta,Ti)₂(O,OHF)₆	
Point	1	2
F	4.92	
Na	7.14	0.20
Fe	0.86	2.18
Si	0.69	8.02
K		0.34
Ca	2.68	3.85
Ti	1.97	2.20
Nb	43.17	28.82
Ce	8.32	1.32
Nd	1.62	
Ta	2.99	3.32
U		22.82
O	26.57	28.90
Total	100	100

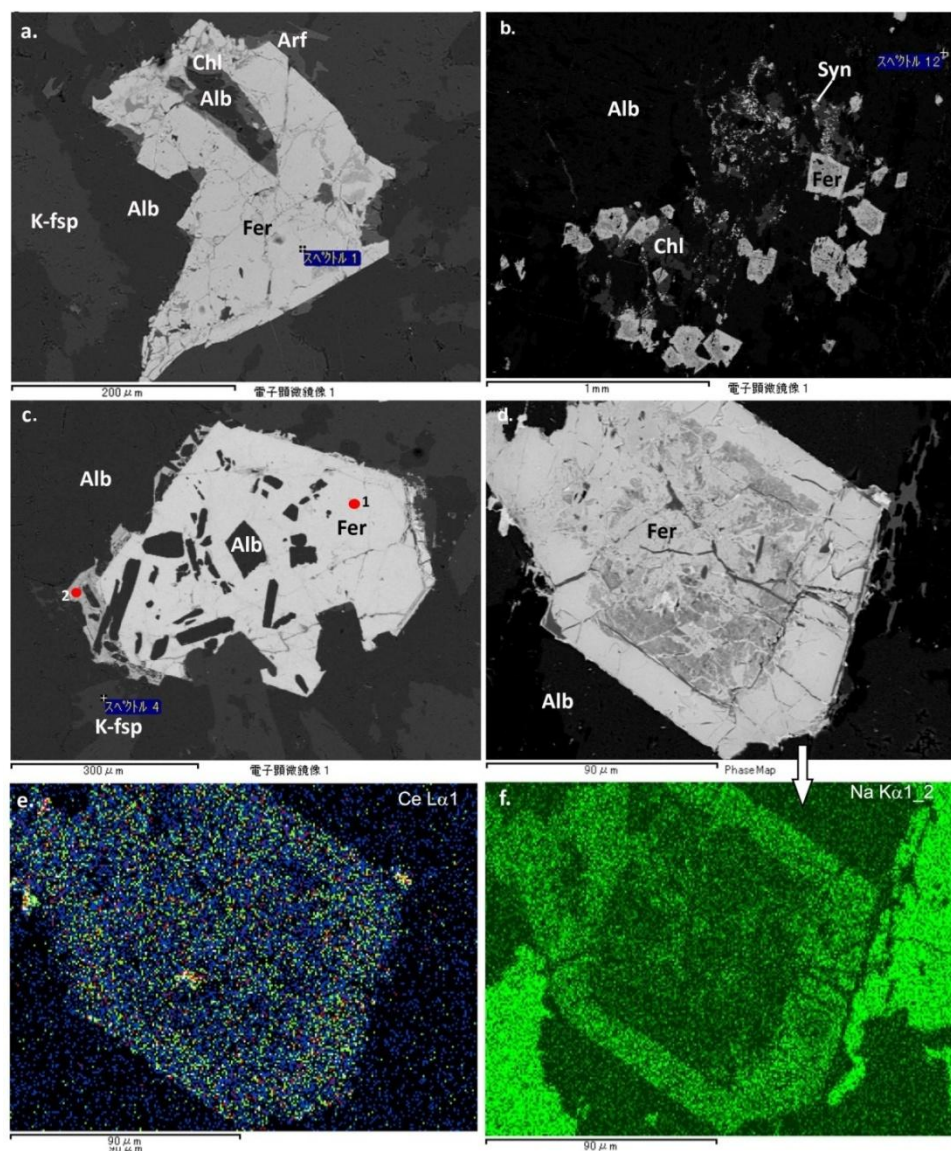


Figure 3.2.3-1 Back scattered electron (BSE) images of fersmite. (a) Fersmite from granite coexisted with feldspars (K-feldspar and albite) and arfvedsonite (BTDDH-11 175.2m). (b) Fersmite from quartz syenite. Fersmite inclusion of albite with some hydrothermal minerals (chlorite, fluorite and synchysite) (BTDDH-11 89.2m). (c) Fersmite in quartz syenite, show late hydrothermal narrow rim (BTDDH-11 157.4m) (d) Fersmite in quartz syenite, core part is corroded (BTDDH-11 89.2m).

4 Whole-rock geochemistry

4.1 Analytical method

Chemical composition of a total of 1305 samples collected from the six drill holes (BTDDH-03, 4, 7, 11, 12 and 15) was determined by XRF and ICPMS. The samples were basically collected from one meter core intervals. These samples were crushed and pulverized to conduct bulk X-ray diffraction (XRD) analysis. The XRD and ICP-MS analyses were conducted at the Geological Survey of Japan, AIST and Activation Laboratory, Canada, respectively.

4.2 Geochemistry

Major and trace elements have been determined for 1305 samples from the six drill holes (BTDDH-3 293; BTDDH-04 191; BTDDH-07 307; BTDDH-11 244; BTDDH-12 130; and BTDDH-15 138 samples). Representative whole-rock chemical compositions are presented in Appendix-1 and Figure 4.2-1. Loss on ignition (LOI) of the fresh samples ranges from 0.01 to 1.5 wt%. Altered rock samples were not plotted in the all classification diagrams using LOI whole (TAS, ASI, Harker and Tectonic discrimination diagram). In the minor elements interpretation using all six drill holes samples.

4.2.1 Major elements

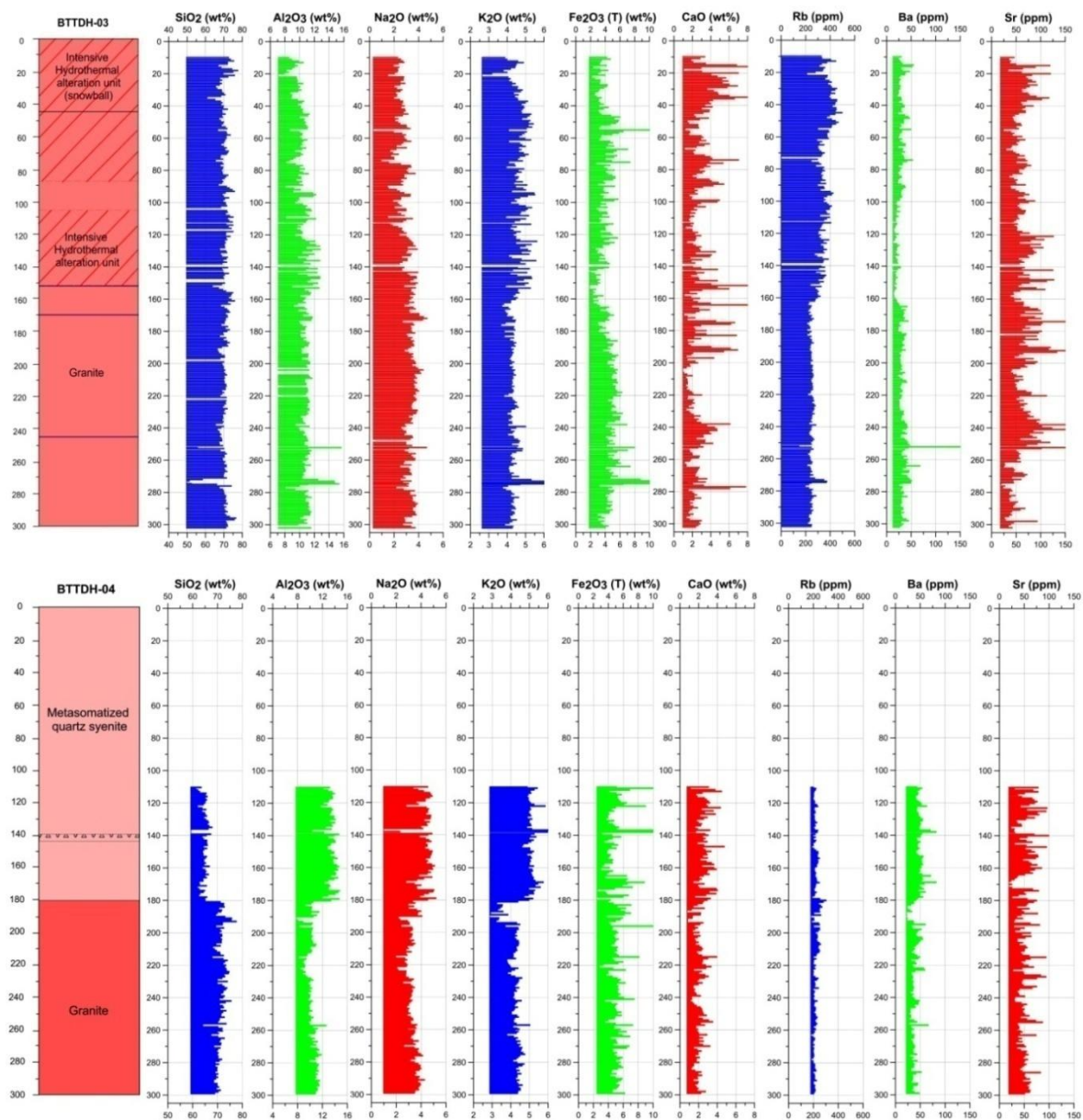
The samples of the quartz syenite have the compositions: SiO_2 (59.24-69.53 wt%), Al_2O_3 (8.54-15.12 wt%), Na_2O (0.98-6.38 wt%), K_2O (3.46-6.48 wt%), $\text{Fe}_2\text{O}_3(\text{T})$ (2.46-11.57 wt%), CaO (0.63-4.76 wt%), TiO_2 (0.09-0.48 wt%) and MgO (up to 0.24 wt%).

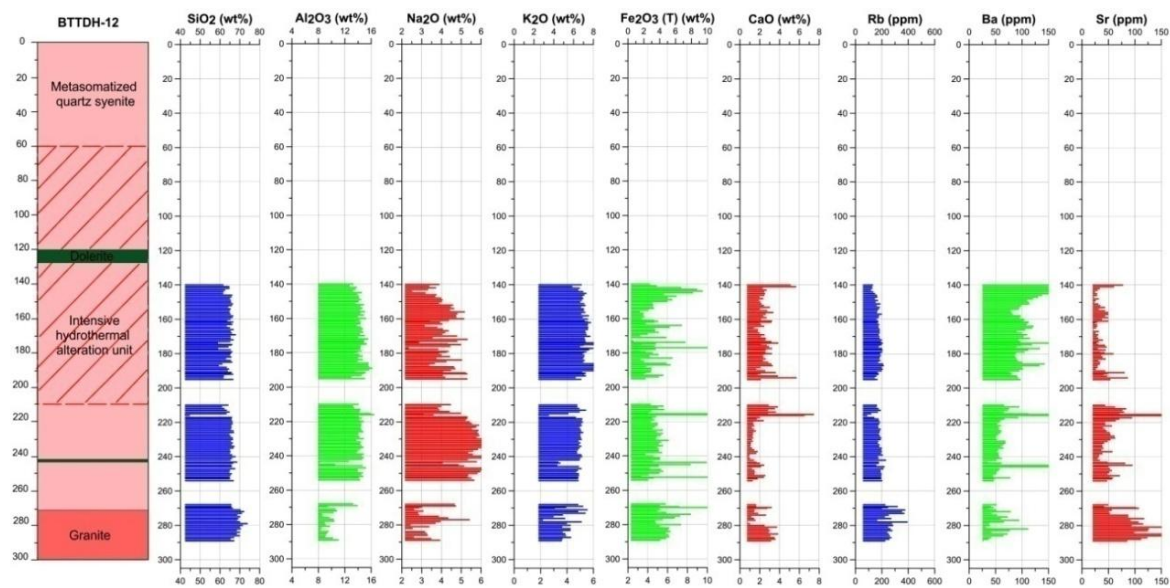
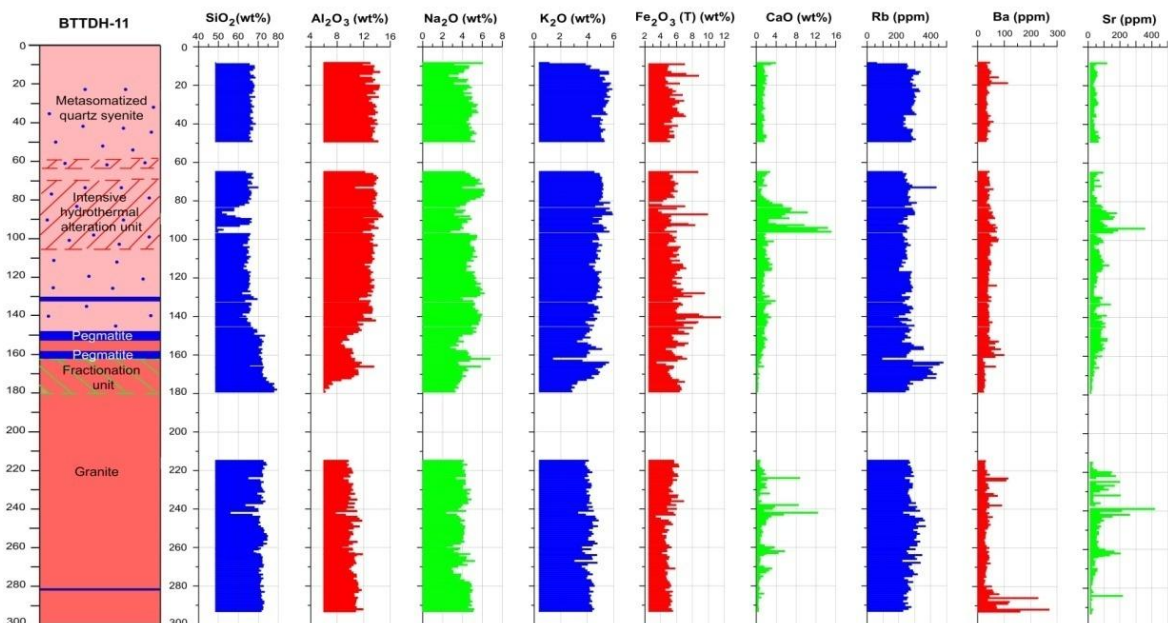
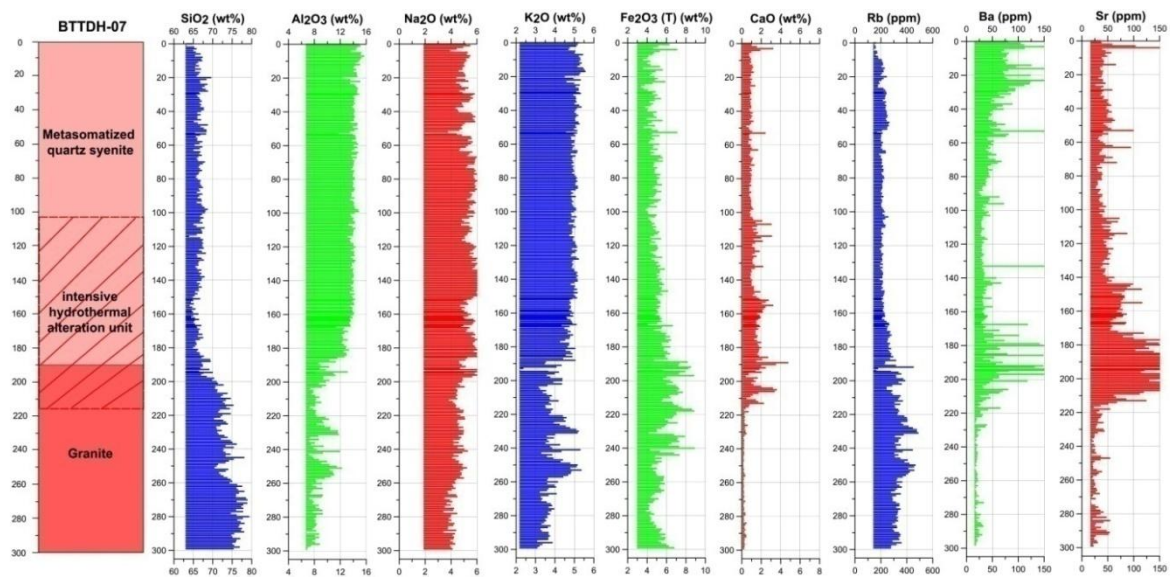
The granites have SiO_2 (65.61-79.3 wt%), Al_2O_3 (5.99-13.07 wt%), Na_2O (2.32-7.78 wt%), K_2O (1.39-5.61 wt%), $\text{Fe}_2\text{O}_3(\text{T})$ (2.55-10.43 wt%), CaO (0.12-3.57 wt%), TiO_2 (0.07-0.44 wt%) and MgO (up to 0.39 wt%) concentrations. The compositional characteristics of the quartz syenite and granite in the Khaldzan Burgedei complex, which include high SiO_2 , K_2O , and Na_2O , but depleted in Ba, Sr and Eu (Figure 4.2-6 and Figure 7.3-1). The concentrations of Ba (<113ppm) and Sr (<209) are low and abundances of Rb (196-453 ppm) are high, geochemical data is compared to [Joseph B et al., 1987](#).

Geochemical discrimination diagrams ([Pearce et al., 1984](#)) suggest a within plate granitic environment (Figure 4.2-2).

Most of the quartz syenite is plotted in the alkaline field and granite is plotted in subalkaline field in the TAS diagram (Figure 4.2-3). The agpaitic indices of the quartz syenite

and granite [Al/(Na+ K) molar ratio] varies from 0.5 to 1.0; thus, intrusive units are plotted in peralkaline field (Figure 4.2-4).





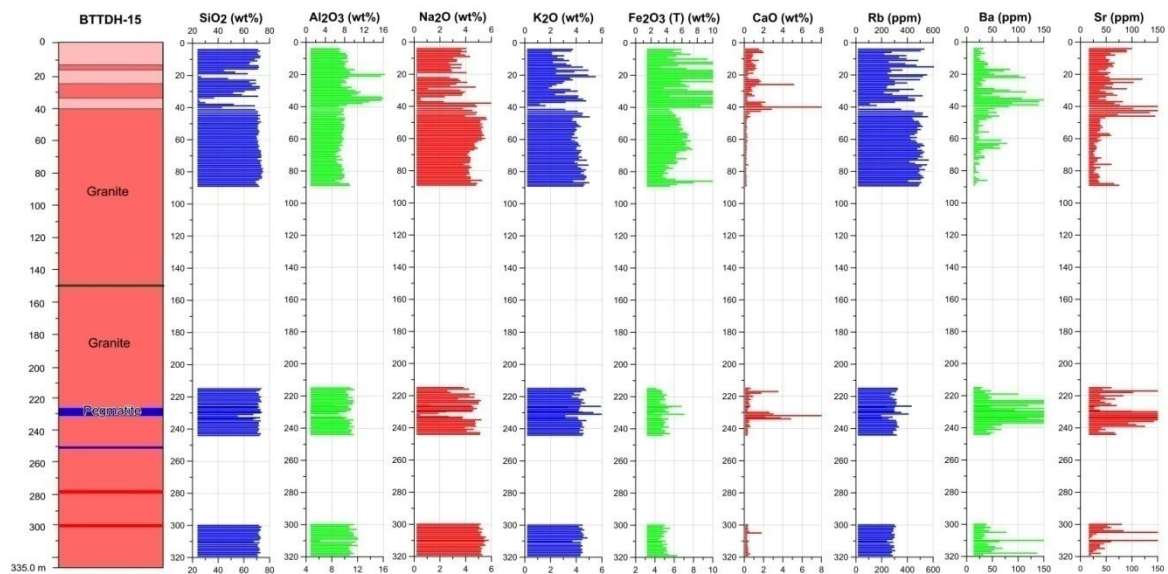


Figure 4.2-1 Variations in major elements concentration with depth (drill holes BTDDH-03, 04, 07, 11, 12 and 15)

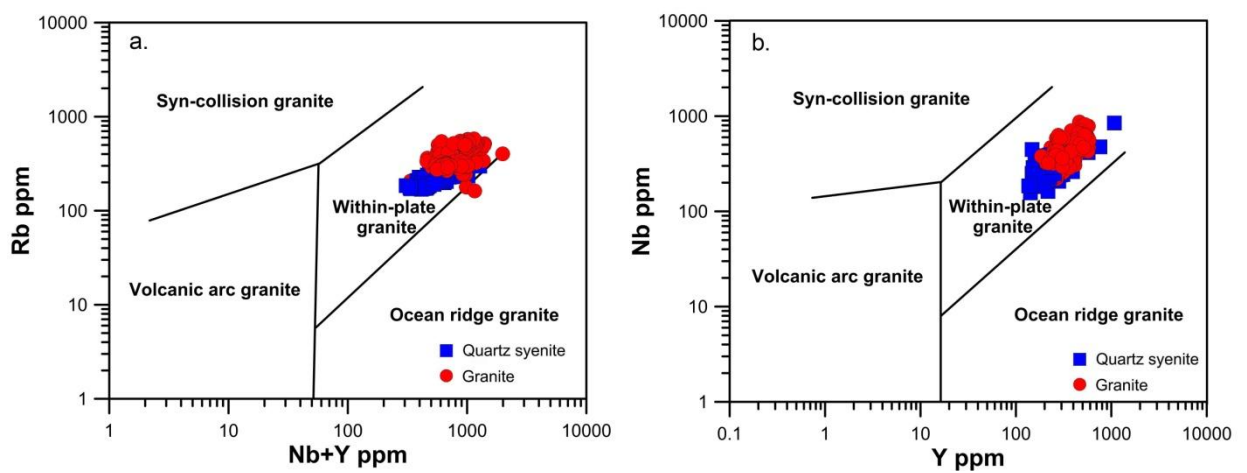


Figure 4.2-2 Tectonic discrimination diagram based on Rb vs. (Nb+Y) and Nb vs. Y (after [Pearce et al., 1984](#))

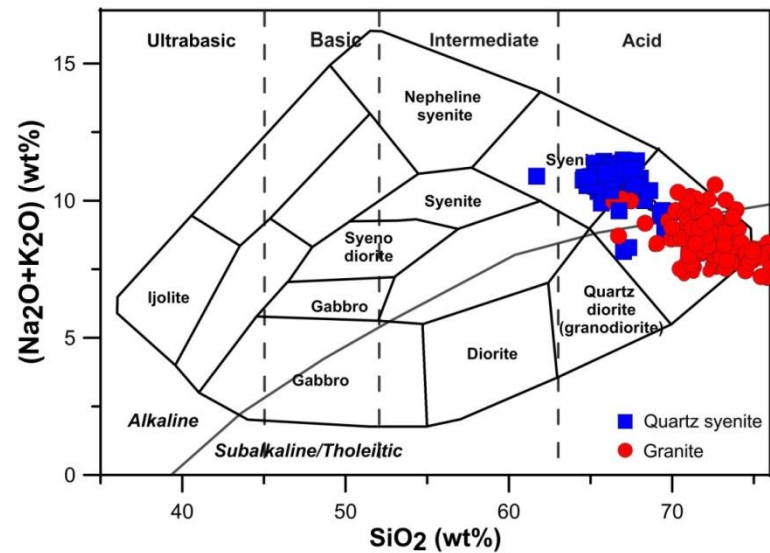


Figure 4.2-3 Total alkali-silica diagram (after [Wilson 1989](#))

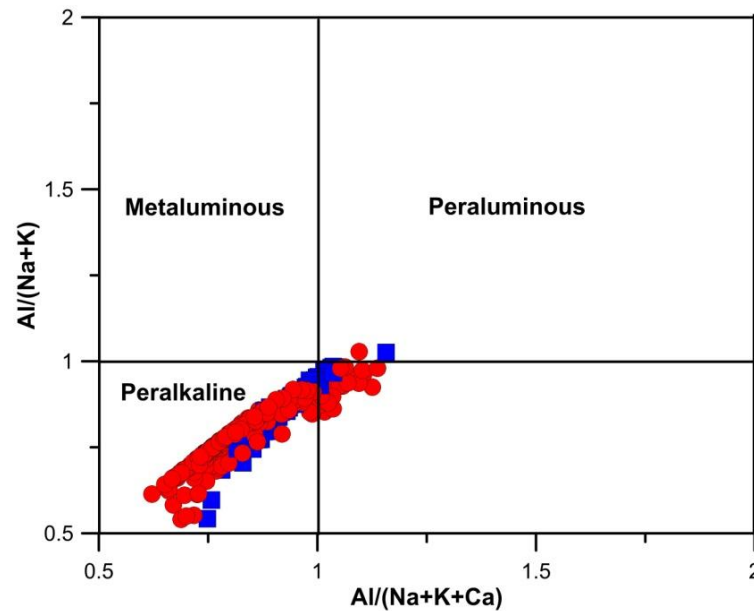


Figure 4.2-4 Aluminum Saturation Index versus molecular ratio ($Al/(Na+K)$) (after [Frost et al., 2001](#))

Harker diagram shows different chemical composition quartz syenite and granite (Figure 4.2-5). Analytical results major elements (Al_2O_3 , Na_2O , K_2O , total Fe_2O_3 , CaO , TiO_2 , and MnO) show linear trend printable silica concentration, while MgO and P_2O_5 are show unclear trend.

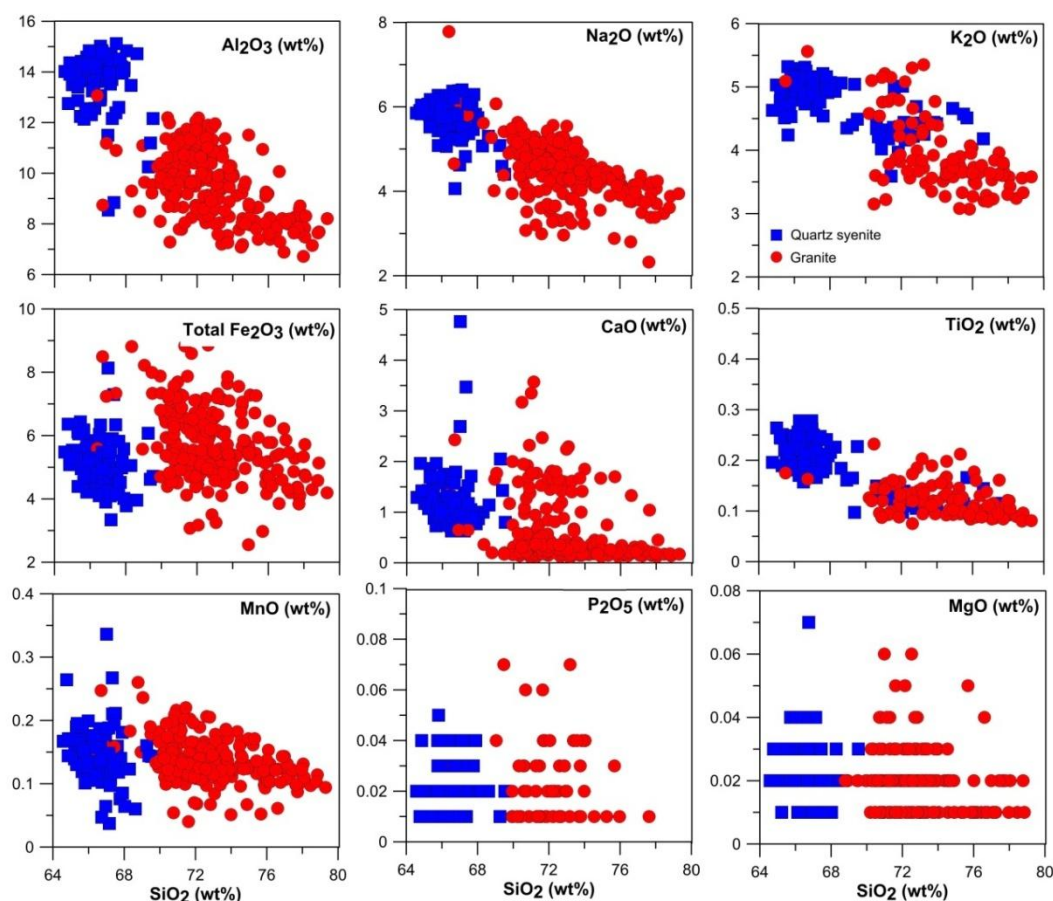


Figure 4.2-5 Harker diagram of Khaldzan Burgedei complex.

4.2.2 Minor elements

The distributions of HFSE and REE content in the quartz syenite, granite, and pegmatite are showed in Figure 4.2-6 and Figure 4.2-7. The result of the geochemical analysis shows total REEs (111.09-2882.8 ppm), Y (19.0-772.0 ppm), Zr (222.0-9680.0 ppm) and Nb (20.0-837.0 ppm) in the quartz syenite. The granite has total REEs (387.3-5603.1 ppm), Y (53.0-1092.0 ppm), Zr (516.0-7816.0 ppm) and Nb (235.0-829.0 ppm) concentrations. The pegmatite has total REEs (1139.91-2847.3 ppm), Y (208.0-643.0 ppm), Zr (1105.0-14900.0 ppm) and Nb (139.0-915.0 ppm) concentrations (Figure 4.2-7).

The bulk rock compositions of the drill cores show that the BTDDH-03 10-150.0 m, BTDDH-04 150.0-170.0m, BTDDH-07 103.0-218.0 and BTDDH-11 60.0-106.0 m interval, metasomatized, hydrothermal altered units are more enriched by Nb, Zr, Y and Ca, and depletion of SiO₂ and Na₂O. The hydrothermal alteration unit shows concentrations of total REEs (998.7-2882.8 ppm), Zr (945.00-8651.00 ppm), and Nb (308.00-574.00 ppm).

The interval between of the drill holes BTDDH-03 10-160.0 m, BTDDH-07 218.0-300.0 BTDDH-11 163.0-180.0m, BTDDH-12 270.0-290.0 m and BTDDH-15 10.0-40.0 m

fractionated granite units of high SiO_2 (71.5-79.3 wt%), are depleted in other major and minor elements (Al, Na, K, Ba and Sr), and is enriched in Rb (104.0-604.0 ppm), Ce (370.0-3010.0 ppm) and Nd (122.0-1250.0 ppm). The fractionation granite units are located in the upper part of granite, and show a concentration of total REEs (1030.3-6528.9 ppm), Zr (516.0-9988.0 ppm), and Nb (232.0-1010.0 ppm). The highest total REEs concentrations occur within the fractionated unit in the granite (Figure 4.2-6 and Figure 4.2-7). The high enrichment levels of HFSE and REE both within upper part of fractionated granite and pegmatite, which may reflect the high levels of rare elements enrichment attained during magmatic fractionation.

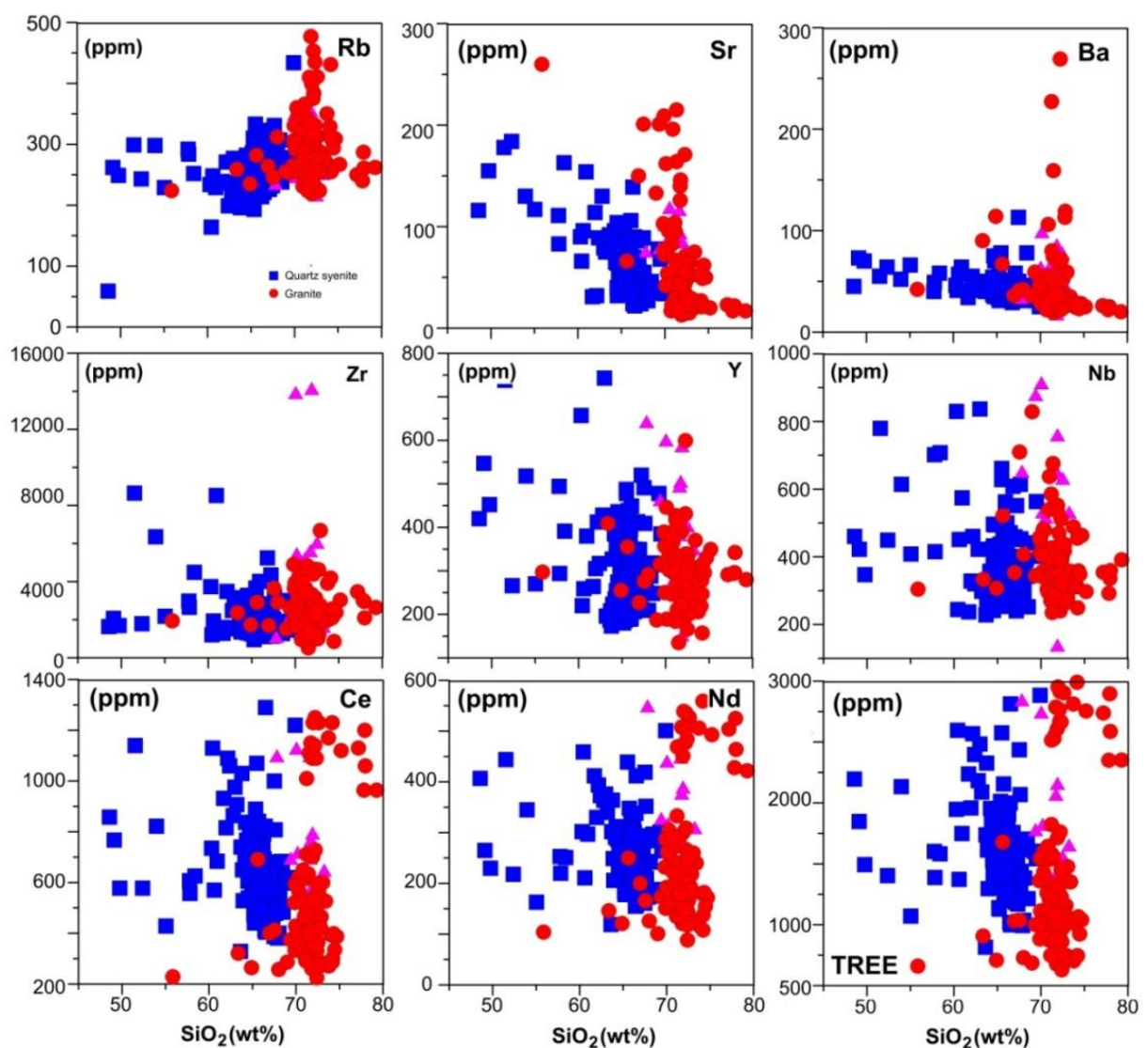
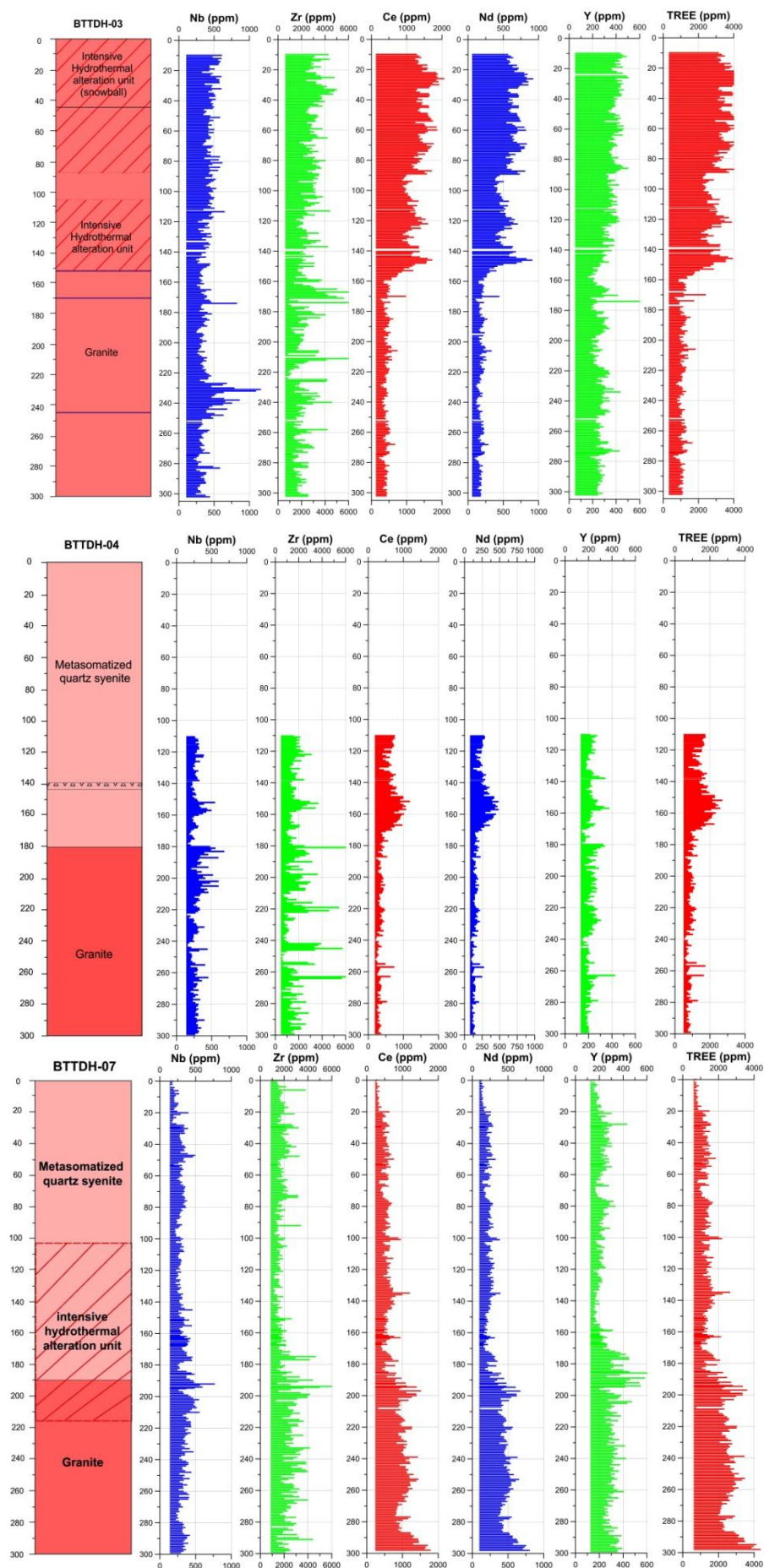


Figure 4.2-6 Harker diagram showing trace elements variation in the Khaldzan Burgedei complex.



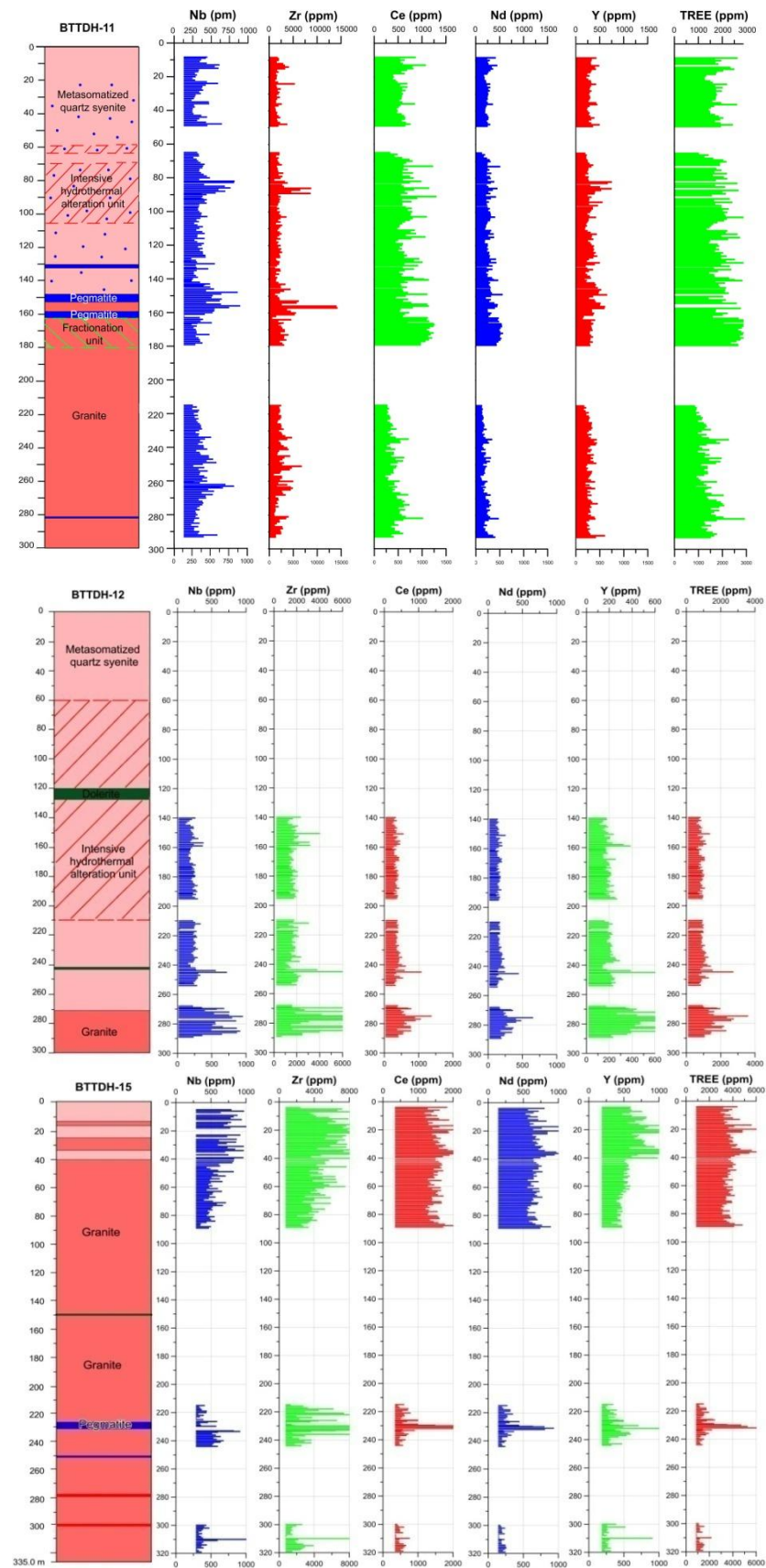


Figure 4.2-7 Variations in trace elements concentration with depth (drill holes BTDDH-03, 04, 07, 11, 12 and 15).

5 Trace element and cathodoluminescence of quartz

5.1 The application of cathodoluminescence and trace element to the study of quartz

Quartz is one of the most abundant minerals in quartz syenite and granite. Scanning Electron Microscope Cathodoluminescence (SEM-CL) is a sensitive technique for visualizing micro textures in minerals that are invisible in conventional transmitted or polarized-light microscopy ([Müller et al. 2000, 2002, 2003](#); [Götze et al., 2000](#); [Landtwing and Pettke, 2005](#)). The textures revealed by SEM-CL pictures, such as grain morphology, crystal growth zoning, alteration patterns, and dissolution/recrystallization features contribute to a better understanding of petrogenetic processes. For example, magmatic quartz, several generations of alteration-related quartz can be distinguished by SEM-CL imaging. Cathodoluminescence (CL) can be used to reveal growth zoning in quartz crystals or to identify quartz grains from different generations of crystallization which could not be easily distinguished by optical microscopy ([Götze et al. 2000](#)). The intensity of cathodoluminescence reflects structural and chemical variations within quartz, which are related to growth zoning or alteration features. A combination between SEM-CL and in situ EMPA analysis allows to quantitatively measuring the trace element chemistry of quartz in relation with SEM-CL textures. With a high spatial resolution ($<10\mu\text{m}$) making possible the analysis of fine structures, EPMA is the most reliable instrument to quantitatively measure trace element concentrations in quartz a range of a few 10's ppm.

This study focuses on trace elements (Ti, Al, K, Fe) in quartz and SEM-CL textures of these minerals in an attempt to document the formation history of quartz syenite and granite of the Khaldzan Burgedei complex. In addition to the detailed outcrop observation, following methods were applied in this study; electron probe microanalysis (EPMA) to determine the trace elements contents and cathodoluminescence (CL) which reveals growth patterns and structures within igneous quartz reflecting the magma crystallization history.

5.2 Samples and analytical methods

Quartz: Approximately, 100 μm thick, doubly polished seven thin sections of quartz from quartz syenite, granite and pegmatite were prepared drill hole BTDDH-11. Samples were analyzed by EPMA and SEM-CL imaging at Akita University. Thickness of coated carbon used for observation of CL image was about 15 μm .

Concentrations of Al, Ti, K, Fe and Ca of quartz were determined using a JEOL JXA-8800 electron probe microanalyzer at Akita University. For high precision and sensitivity, an

acceleration voltage of 20 kV, a beam current of 30 nA, a beam diameter of 5 μm and counting times for 15 s for Si and for 300 s for Al, Ti, K, Fe and Ca were applied. Limits of detection (3σ of single point background) were 18ppm for Al, 14ppm for Ti, 17ppm for K, 58ppm for Fe and 22ppm for Ca.

Scanning electron microscopy-Cathodoluminescence (SEM-CL) imaging was done using a JEOL scanning electron microscopes identify, equipped with a Gaten Mini-CL detector and photomultiplier. The SEM-CL technique has high spatial resolution and a range of beam currents and acceleration voltages that makes it useful in observation of minerals with weak luminescence (e.g. quartz). The thick sections were analyzed at 15 kV, with a beam current set at 20 nA to obtain optimal contrast in observed luminosity. In this method, grey-scale (“CL-dark”, “-grey” or “-bright”) images are produced, with apparent intensity of observed luminescence dependent on machine operating conditions, i.e. beam current, acceleration voltage, photomultiplier contrast and brightness.

5.3 Occurrence

Based on the CL texture studies, three major types of quartz were distinguished in the quartz syenite, granite and pegmatite. SEM-CL studies suggest the different quartz types and growth zoning of quartz reflect crystallization history of the rocks ([Breiter, 2006](#)).

Quartz syenite contains anhedral quartz interstitial to major minerals such as amphibole, pyroxene, and feldspars (K-feldspar, plagioclase and albite). Analyzed quartz shows lamellar, combed, and homogenous texture in the CL image. Totally, they show a grey and dark luminescence (Figure 5.3-1).

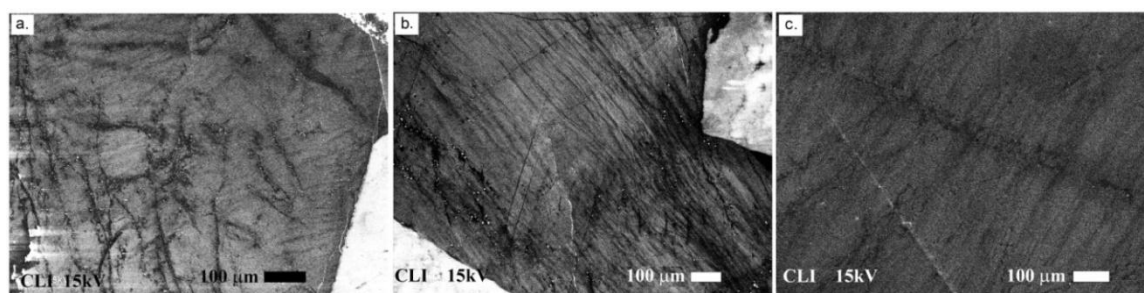


Figure 5.3-1 CL texture in quartz from quartz syenite and metasomatized quartz syenite at Khaldzan Burgedei. (a) cobweb texture (BTDDH-11, 99.5m), (b) lamellar (BTDDH-11, 99.5m), (c) lamellar texture (BTDDH-11, 25.4 m).

Granite contains anhedral quartz. Quartz occurs interstitial to amphibole, pyroxene, K-feldspars, and albite. Analyzed quartz shows cracked texture, weak lamellar and homogenous

texture and grey and dark luminescence (Figure 5.3-2). The above CL textures result from the initial conditions of quartz crystallization followed by secondary process such as fracturing, overgrowth, and recrystallization that modify the original texture.

Secondary textures include those that modified or overprinted previously existing primary quartz, because primary textures were developed during crystallization and secondary texture formed after growth. CL-dark luminescent, reflecting fracturing, homogenous and healing is most common secondary texture observed in quartz. In case of dense networks of microcracks a fracture, lamellar and homogenous pattern of dark contrasted polygons is developed. Homogeneous CL with dull luminescence (dark CL) can be caused by nearly complete removal of CL-activating defects from the crystal structure, as suggested by [Matter and Ramseyer \(1985\)](#).

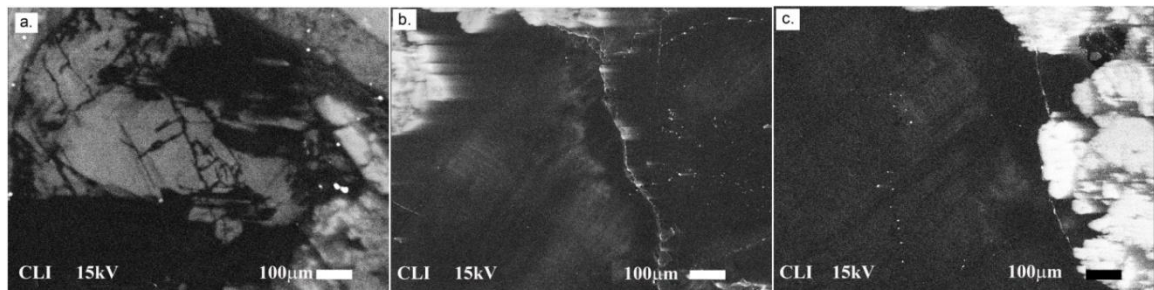


Figure 5.3-2 Textures observed by SEM-CL imaging in the quartz of granite at Khaldzan Burgedei. (a) cracked texture (BTDDH-11, 175.2 m), (b) lamellar (BTDDH-11, 216.5m) (c) lamellar texture (BTDDH-11, 290.4m).

A pegmatite contains euhedral to subhedral comb quartz. Most of quartz crystals show growth zoning texture. The core part shows a porous and micro cracked texture and a rim part shows growth zoning, overprinted and concentric zoned texture (Figure 5.3-3). The core part show bright and dark CL image. Rim parts are characterized by brightly luminescence and wavy zoned quartz with low CL contrasts.

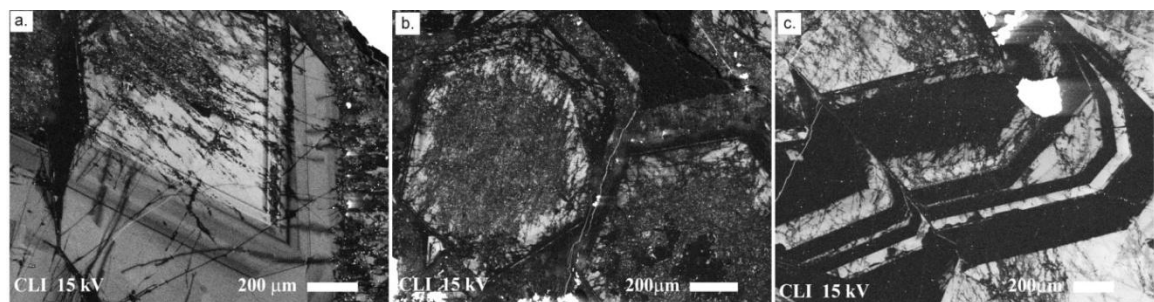
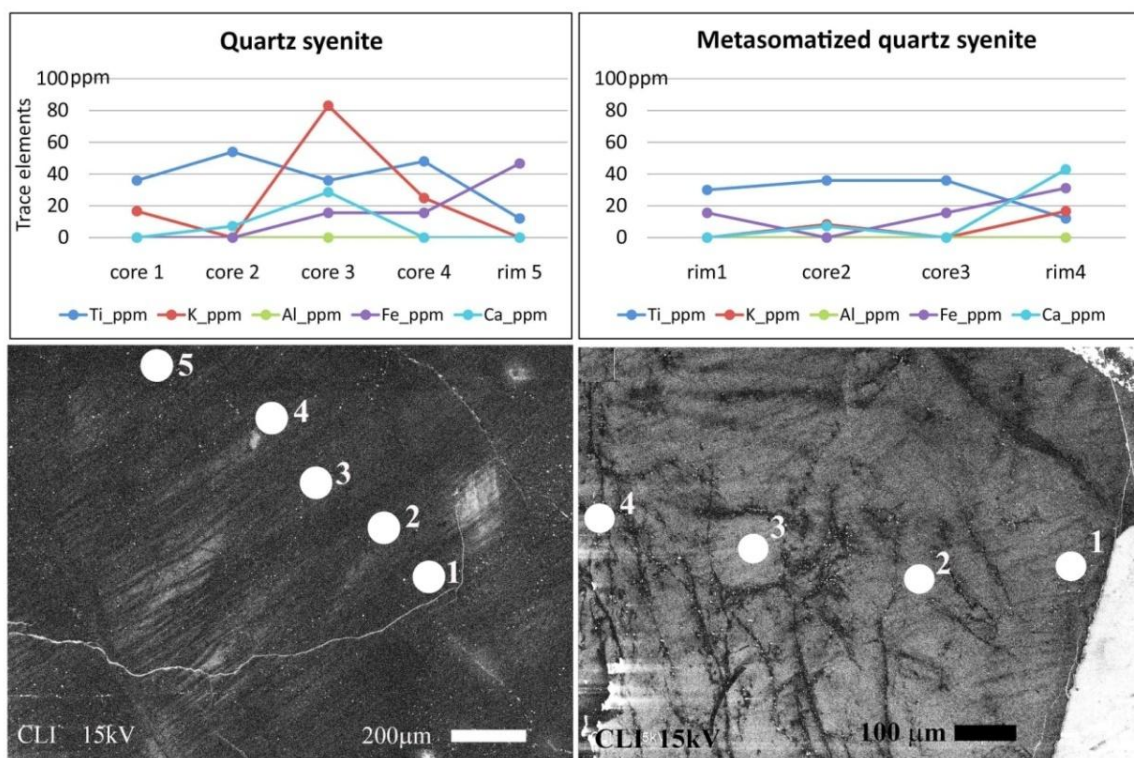


Figure 5.3-3 Textures observed by SEM-CL imaging in the quartz of pegmatite vein at Khaldzan Burgedei. (a-c) overgrowth, and overprinted zoning.

5.4 Trace elements of quartz

Representative results are presented in Appendix-4. Trace element abundances were determined in 119 analytical points in total amount the seven samples from quartz syenite (1), metasomatized quartz syenite (1), granite (2), fractionation granite (1) and pegmatite (2). To further distinguish different quartz types, we determined the Al, Ti, K, Ca and Fe concentration in quartz by EPMA. Result of the EPMA data show that these trace elements decrease from core to rim in the all quartz (Figure 5.4-1).

The anhedral quartz in the quartz syenite has Ti concentration is 12 to 66 ppm cores, 12 to 48 ppm rims, and metasomatized quartz syenite have 36 to 48 ppm cores, 12 to 42 ppm in rim. The anhedral quartz in the granite has Ti contents 12 to 102 ppm cores, up to 54 ppm rims, and fractionation granite have up to 72 ppm cores, 12 to 48 ppm rims. The pegmatite contains less than 54 ppm in cores and rim. These rock units are show low CL intensity. Quartz in pegmatite (Sample number 258 and 259) is characterized by high and variable concentration of trace elements, compared with quartz in the quartz syenite and granite. The pegmatite show highest Fe and Al concentrations, Al is 26,002 ppm and with clear overgrowth zones.



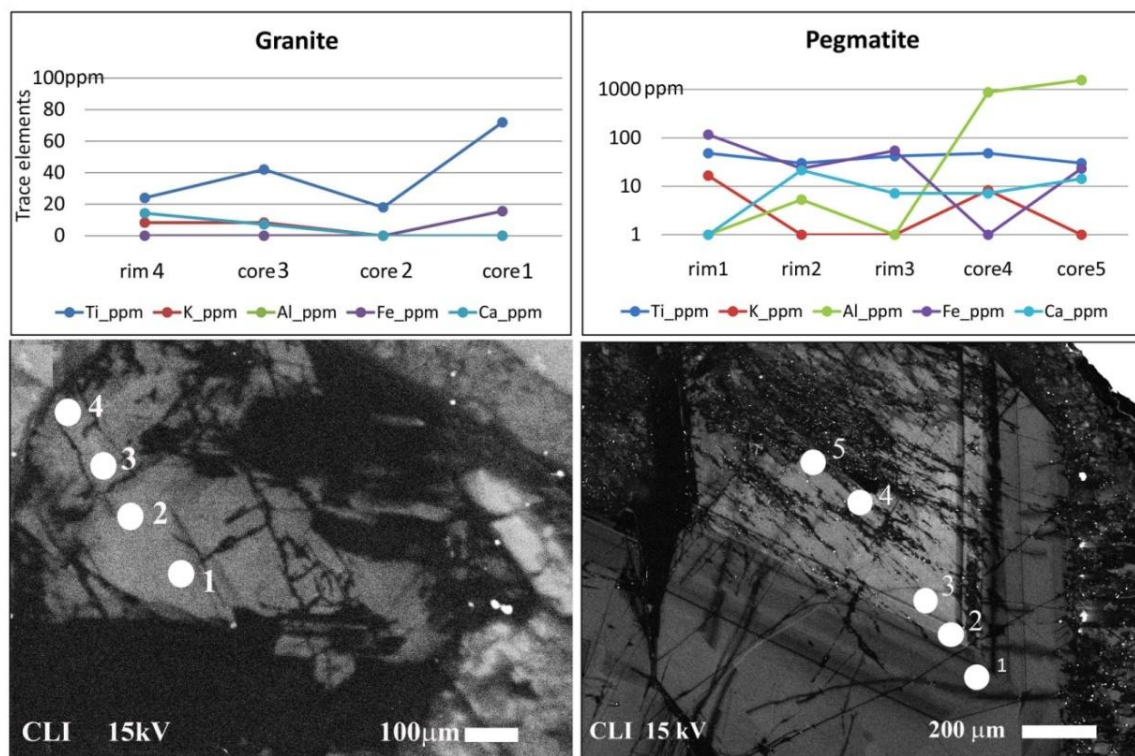


Figure 5.4-1 Trace elements profile and TitaniQ crystallization temperature of quartz in Khaldzan Burgedei complex.

6 Fluid inclusion study

6.1 Introduction

Hydrothermal fluid transport associated with magmatism is a key process in the formation of mineral deposits. Magmatic-hydrothermal ore deposits require interplay between regional tectonics, magma generation, emplacement into the upper crust, and complex chemical reactions between fluid and rock. The key role of hydrothermal fluids in the formation of ore deposits associated with shallow intrusions was recognized and various studies on fluid inclusions have demonstrated many common features among porphyry deposits worldwide ([Cline and Bodnar, 1994](#); [Beane and Bodnar, 1995](#)). Fluid inclusions are a small amount of fluids that are trapped within crystals during initial growth from solution. They are very abundant in common ore and gangue minerals. The most important applications of fluid inclusion are in understanding the process of ore deposition (chemical and physical conditions of ore-forming fluids) ([Roedder, 1984](#)).

In the study area Khaldzan Burgedei complex (quartz syenite and granite) is cut by several quartz-fluorite vein. The aim of this chapter is based on fluid inclusion

microthermometry to identify temperature and composition of fluids from hydrothermal vein at Khaldzan Burgedei complex areas.

6.2 Analytical methods

The fluid inclusions are hosted in quartz-fluorite vein. A total of more than 58 fluid inclusions from quartz and fluorite in the 4 samples were heated until homogenization occurred (2 samples from quartz-fluorite vein in quartz syenite, and samples from drill hole BTDDH-11 depth: 59.7 and 60.5 m and 2 outcrop samples from quartz-fluorite vein in granite.) Most analyzed inclusions were less than 10 microns in length. Fluid inclusion microthermometry was undertaken using a Linkam THMS 600 heating-freezing stage (with Olympus 50× long focus lens) at the Akita University. The thermocouple for the heating/ freezing stage was calibrated using melting temperature of metals and the ice melting temperature of pure water. Fluid inclusion types at room temperature, size of inclusions, homogenization temperature (T_h) and final ice melting temperature measurements were obtained. The salinity of inclusions was calculated from ice melting temperature according to the equation of [Bodnar \(1993\)](#). The precision of homogenization temperature and final ice melting temperature measurements was $\pm 1^\circ\text{C}$ and $\pm 0.1^\circ\text{C}$ respectively.

6.3 Fluid inclusion petrography

Fluid inclusions were identified in quartz-fluorite veins. In totally 60 fluid inclusions were measured. Fluid inclusions are measured were primary and secondary inclusions hosted in quartz-fluorite vein. The criteria by [Roedder \(1984\)](#) were applied to distinguish between the primary and secondary inclusions (Figure 6.3-1 and 6.3-2).

Fluid inclusions in quartz-fluorite vein in quartz syenite: In general, fluid inclusions quartz consist of liquid-rich two-phase inclusions ($L > V$) (Figure 6.3-1a-b). These inclusions are recognized as a product of secondary processes suffered from necking down. Secondary fluid inclusions trapped along the healed fractures were also identified in quartz. They are irregular to rounded in shape and up to 10 μm in length. The phase's ratios by volume % range are from L90-95: V10-5 (liquid-rich inclusions).

Fluid inclusions in fluorite consist of three-phase primary and secondary inclusion (Figure 6.3-1c-d). The primary inclusions are show irregular in shape and up to 15 μm in length, and phase's ratios by volume % range are from L60-90: V10-20 S10-20. Solids assumed to be halite. The secondary fluid inclusions trapped along the healed fractures were

also identified in fluorite. They are round in shape and up to 10 μm in length. The phase's ratios by volume % range are from L90-95: V10-5 (liquid-rich inclusions).

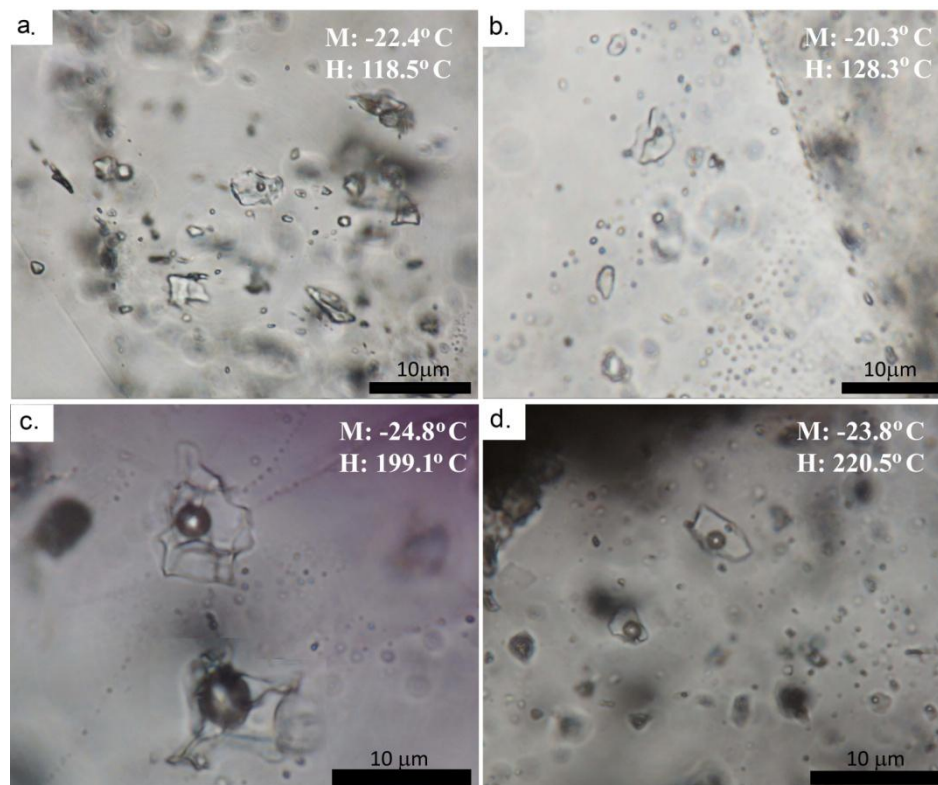


Figure 6.3-1 Fluid inclusions from quartz-fluorite vein in quartz syenite (BTDDH-11, depth 59.7m and 60.5m). **(a-b)** Fluid inclusion in quartz. Liquid-rich two-phase inclusions, **(c-d)** Fluid inclusion in fluorite. Liquid-rich two-phase inclusion.

Fluid inclusion in quartz-fluorite vein in granite: Fluid inclusions in a quartz can be classified as a liquid-vapor type based on their phase relationships at room temperature. Quartz crystals that host fluid inclusions are up to 1-3 mm in size. Fluid inclusions in quartz consist of vapor-rich two-phase primary inclusions ($L < V$). Typically they are formed surrounding quartz crystals, regular in shape and up to 15 μm in size and the vapor comprises 40-70% of the inclusion volume (Figure 6.3-2 a-b).

Fluorite crystals with size up to 2 mm, shows a zoning texture. Fluid inclusions in fluorite from the vein consist of liquid-rich two phase primary inclusions ($L > V$) which exhibit irregular, a negative crystal shape, and are up to 15 μm in size and inclusion are formed along the crystal (Figure 6.3-2 c-d). The phase's ratios by volume % range are from L70-90: V30-10.

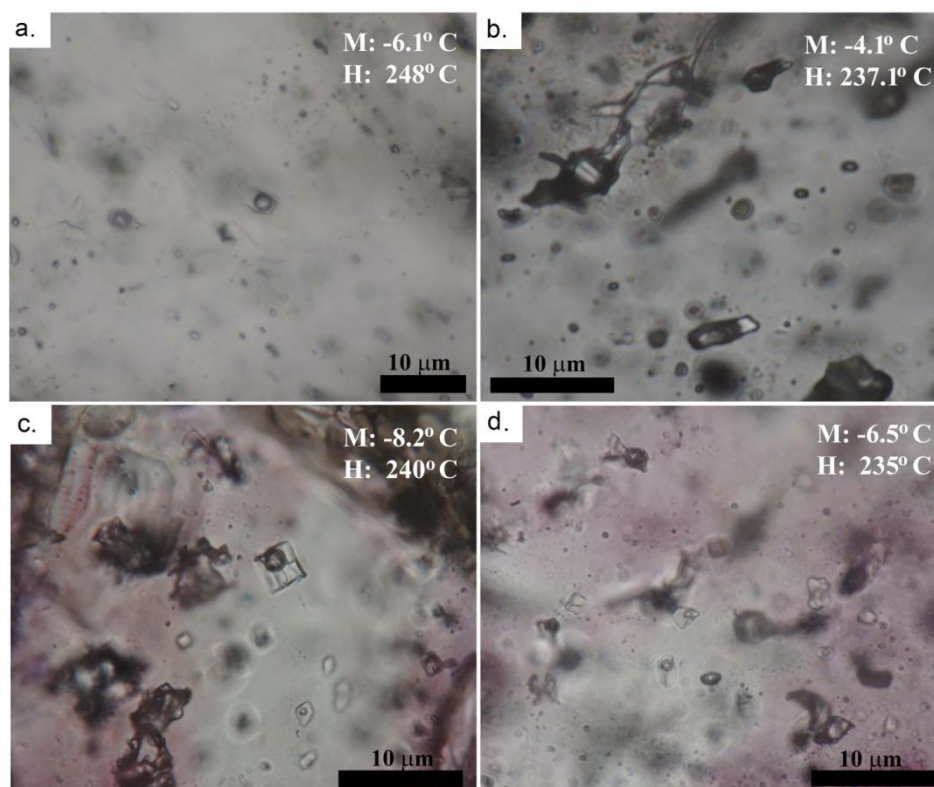


Figure 6.3-2. Fluid inclusions from a quartz-fluorite vein in granite. **(a-b)** Vapor-rich two-phase inclusions in quartz, **(c-d)** Liquid-rich two-phase inclusions in fluorite.

6.4 Fluid inclusion microthermometry and composition

The result of homogenization temperatures and salinities of fluid inclusions are presented in Appendix-6. Microthermometric data for the various types of inclusions are shown in composite diagrams in Figure 6.4-1 and Figure 6.4-2.

Two-phase inclusions in quartz from quartz syenite homogenize to a liquid phase at a temperature of between 85 to 145°C (Figure 6.4-1). Fluid inclusions display a range of final-ice melting temperature, from (-15°C) to (-25°C) corresponding to salinities from 18.6 wt% to 25.5 wt% NaCl equivalents (calculated using the equation by [Bodnar et al. \(1994\)](#)). Fluid inclusions in fluorite from quartz syenite homogenize in the range from 142°C to 315°C and salinity ranges from 5.1 to 25.5 wt.% NaCl equivalent within one sample (Figure 6.4-1). The final ice melting temperature (-12°C) to (-25°C) .

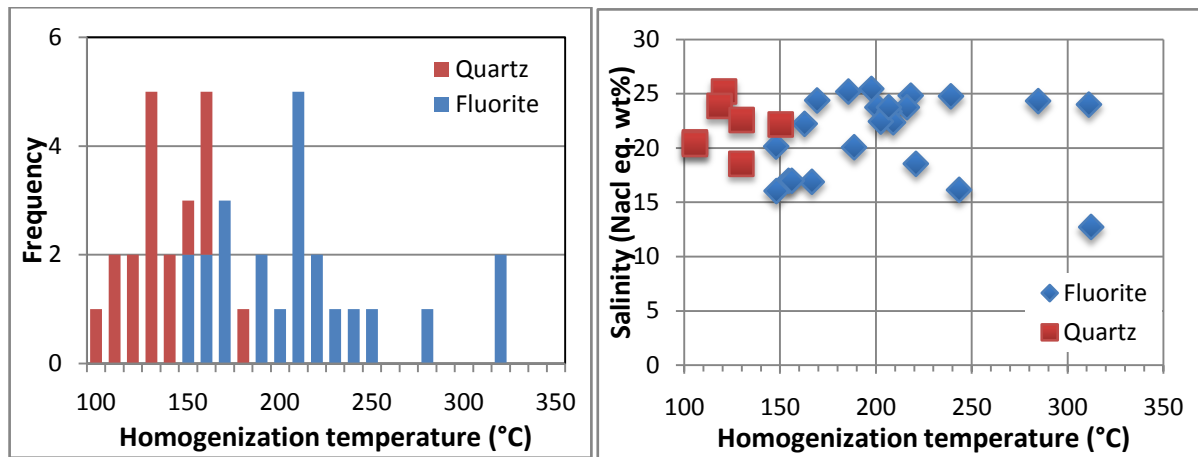


Figure 6.4-1. Histogram of homogenization temperatures and salinities of fluid inclusions in the pegmatite (BTDDH-11 59.7m and 60.5m).

Fluid inclusions in quartz from granite homogenization range from 235°C to 315°C. The ice in inclusions disappeared between (-4°C) to (-6°C), the corresponding salinity ranges from 6.6 to 9.3 wt% NaCl (Figure 6.4-2). Homogenization temperature of fluid inclusions in fluorite in the vein ranges from 121°C to 289°C and ice melting occurred between (-3°C) to (-13.6°C) corresponding salinity ranges from 4.8 to 11.9 wt. % NaCl with one exceptionally high salinity datum of 18.5wt.%.

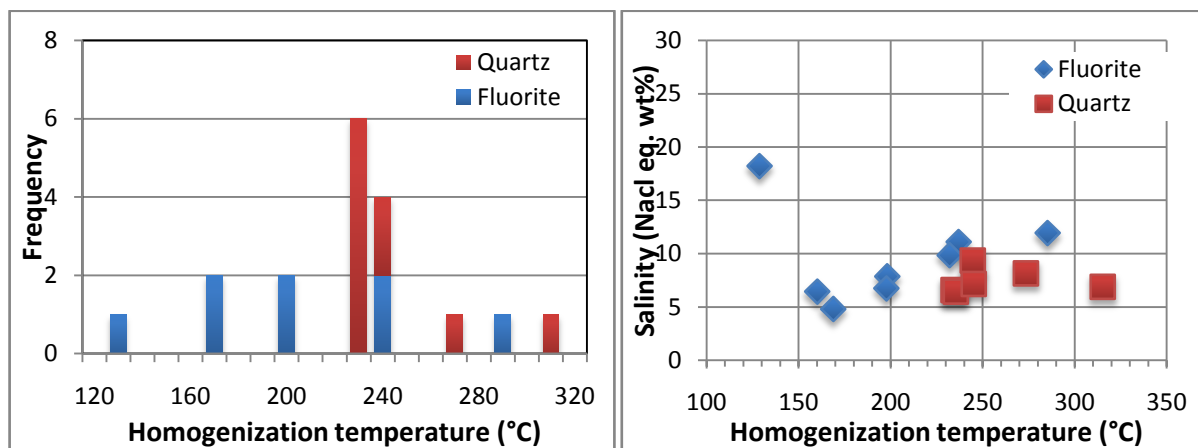


Figure 6.4-2. Histogram of homogenization temperatures and salinity of fluid inclusions in quartz- fluorite vein (outcrop samples).

Laser Raman spectroscopy results: Analysis of fluid inclusions from some fluorite revealed that the vapor phase contains $\text{CH}_4 \pm \text{CO}_2 + \text{H}_2\text{O}$ (Figure 6.4-3). Inclusions show a CH_4 peak between 2916 cm^{-1} and some part is show broad peak 2942 to 2976 cm^{-1} . These results

indicate that fluorite inclusions are filled by some methane. The result of Laser Raman all data are presented in Appendix-6.

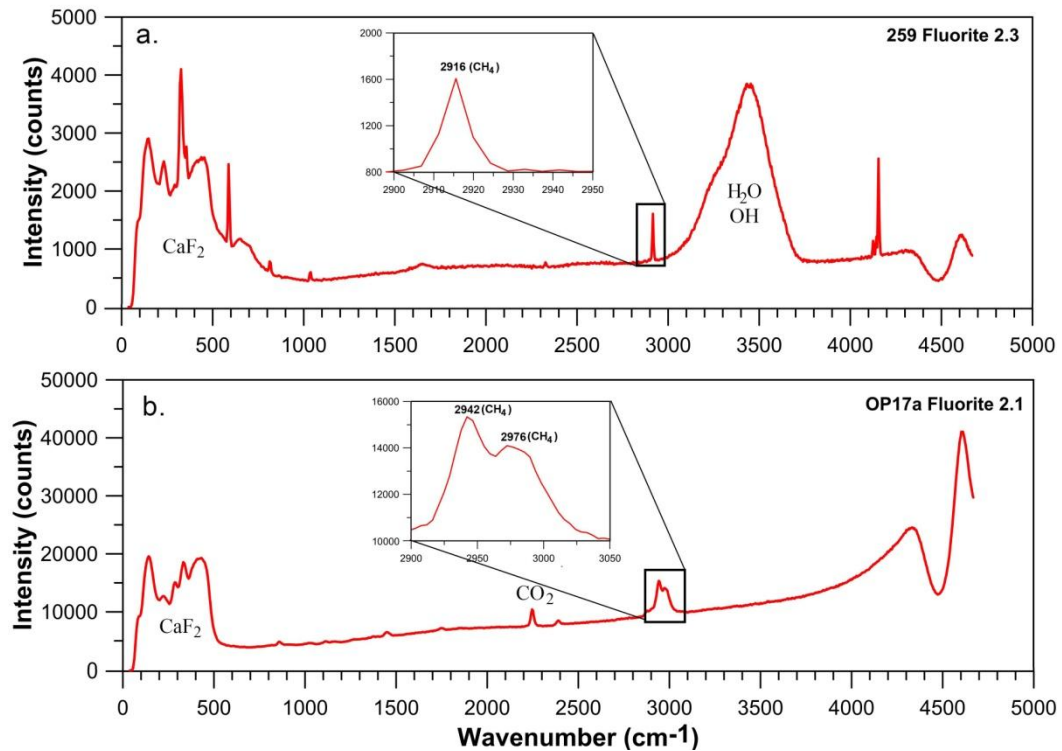


Figure 6.4-3 Raman spectra of fluid inclusion. a. fluorite inclusion from pegmatite; b. fluorite inclusion from quartz-fluorite vein.

Table 6. Summary of fluid inclusions analysis data

	Quartz-fluorite vein (in quartz syenite)		Quartz-fluorite vein (in granite)	
	Quartz	fluorite	Quartz	fluorite
Petrography	L-V, Liquid-rich	L-V-S, Liquid-rich	L - V, Vapor-rich	L - V, Liquid-rich
Homogenization T°C	85 to 145°C	142 to 315°C	235 to 277°C	121 to 289°C
Melting T°C	-14 to -24°C	-8 to -24°C	-3 to -5°C	-3 to -13°C
Salinity NaCl eq.wt%	18.6 to 25.5	12.7 to 25.5	6.6 to 9.3	4.8 to 11.9
Laser Raman Spectroscopy	Silica, CO ₂ and water peak	Fluorite, CO ₂ , CH ₄ and water peak	Silica, CO ₂ and water peak	Fluorite, CO ₂ , CH ₄ and water peak

7 Discussion: Genetic model for peralkaline granite and REE mineralization

7.1 Geochemical evolution of the Khaldzan Burgedei complex

The quartz syenite is the earlier than the granite in the intrusive phase. This relation is clearly show by field evidence and suggest, that the peralkaline magma evolved from quartz syenite to granite with time. This is supported by similar igneous mineral assemblies and chemical characteristics of the quartz syenite and granite. As well as the systematic change of major elements in the Harker diagrams, although these two rock units are distinct distinguished in the QAP diagram. The quartz syenite is medium-coarse grained, holocrystalline and equigranular in textures with sodic-calcic, sodic amphiboles (ferrorichterite and arfvedsonite) and pyroxene (aegirine-augite and aegirine) are coexisted with feldspars and some quartz. The granite is fine-medium grained, inequigranular textures with sodic arfvedsonite and aegirine, more quartz and some feldspar.

The whole rock compositions range between quartz syenite and granite (Figure 6.2-5 and Figure 6.2-6). Khaldzan Burgedei complex enriched by REE-Zr-Nb compared to standard igneous rocks (Table 7). The general compositional characteristics of quartz syenite and granite in the Khaldzan Burgedei complex, which include high SiO_2 , K_2O , Na_2O and Fe enriched HFSE and REE the original data should be show in the chapter of geochemistry. REE-Zr-Nb concentration increases with time and evolution of the Khaldzan Burgedei complex.

Table 7. Average compositions of various granite types compared with KB complex

	reference (B.W.Chapell 1987, Sarmistha, 2011)					KB complex				
	M-type	I-type	S-type	A-type	Syenite	Syenite	Granite	Fractionated granite	Pegmatite	Met.syenite
SiO_2	67.24	69.17	70.27	73.81	62.01	68.3	72.29	77.92	72.51	64.33
TiO_2	0.49	0.43	0.48	0.26	0.45	0.163	0.126	0.175	0.132	0.28
Al_2O_3	15.18	14.33	14.1	12.4	16.77	14.19	9.68	7.25	8.71	12.93
Fe_2O_3	1.94	1.04	0.56	1.24	1.84	5.09	6.05	6	6.06	6.35
MnO	0.11	0.07	0.06	0.06	0.1	0.046	0.149	0.14	0.192	0.18
MgO	1.73	1.42	1.42	0.2	0.89	<0.01	0.02	<0.01	0.02	0.05
CaO	4.27	3.2	2.03	0.75	3.4	1.08	1.8	0.33	1.42	2.99
Na_2O	3.97	3.13	2.41	4.07	4.57	4.94	4.29	3.55	4.09	5.73
K_2O	1.26	3.4	3.96	4.65	6.21	5.7	3.97	3.2	3.2	4.54
P_2O_5	0.09	0.11	0.15	0.04	0.43	0.01	<0.01	0.01	0.03	0.01
Rb	17.5	151	217	169	153	307	274	287	217	197
Ba	263	538	468	352	2477	31	44	25	78	46
Sr	282	247	120	48	1282	36	171	21	76	80
Pb	5	19	27	24	36.88	43	39	58	80	42

Th	1	18	18	23		51	37.1	36.4	36.8	53.3
U	0.4	4	4	5		15.3	13.2	13.8	24.3	16.6
Zr	108	151	165	528	22.45	1493	2407	2961	6072	2247
Nb	1.3	11	12	37	0.83	391	283	336	632	421
Y	22	28	32	75	3.06	288	282	296	404	356
Ce	16	64	64	137	3.14	683	330	1200	592	767
Zn	56	49	62	120	84.77	240	490	480	600	370
Ga	15	16	17	24.6	10.88	55	51	45	49	47

Differentiated rocks, such as peralkaline syenites and granites, amphibole evolves from barosite to katophorite, to winchite, to richterite and to arfvedsonite ([Griet A. et al., 1980](#)). These solid solution series issue from balanced substitutions such as $\text{CaAl}^{\text{IV}}=\text{NaSi}$ and $\text{Fe}^{3+}=\text{NaFe}^{2+}$, with a filling of the A sites by alkalis under a reducing condition. The Khaldzan Burgedei complex was rich in Fe and poor in Mg, the mafic minerals (ferichterite, arfvedsonite, aegirine and aegirine-augite) were very close to the Fe end members and as such they were last rock forming minerals to crystallize from the parent magma. This indicates show evolution of the magma changing to from sodic-calcic to more sodic composition during crystallization. Results of the EPMA data show that amphibole and aegirine in the quartz syenite contain more Ca and less Na than the granite (Appendix-2, 3, Figure 3.2.1-2, and Figure 3.2.1-4). That results show were precipitated of mafic minerals more lose Ca in the granite, during the granitic magma evolution and/or especially silica oversaturation.

7.2 Mineral paragenesis

Mineral assemblages and textural relationship from the petrography and SEM-EDS observation, Khaldzan Burgedei complex mineralization has two origins (magmatic and hydrothermal).

7.2.1 Magmatic REE/HFSE minerals

The magmatic model argues that REE/HFSE enrichments are mainly due to extensive fractional crystallization. The high enrichment levels of HFSE and REE both within upper part of fractionated granite and pegmatite, which may reflect the high levels of rare elements enrichment attained during magmatic fractionation (Figure 7.2-1 and Figure 7.3-2). Trace elements indicate that magmatic fractionation processes were Ba, Sr and Eu is depleted and enriched by Si, and LREE (Figure 7.3-1). The REE/HFSE minerals interpreted as magmatic are the fluorapatite, zircon (type-I and III), Nb minerals (fersmite, pyrochlore), monazite and Ti bearing minerals. The dominate minerals is zircon (type-I) and Nb minerals, which forms

interstitial intergrowths with feldspar and quartz and contains inclusions of euhedral albite and fragmented albitized K-feldspar and arfvedsonite. The primary magmatic accessory mineral paragenesis was extensively overprinted by hydrothermal events that remobilized and enriched the REE, HFSE, U and Th and produced new mineral assemblages. Most of REE, HFSE bearing minerals are post magmatic phases which pseudomorphically replaced primary minerals. The dominant zirconosilicate (elpidite) in quartz syenite and pegmatite is boat-shaped and is represented by pseudomorphs of zircon (type-III) quartz and fluorite.

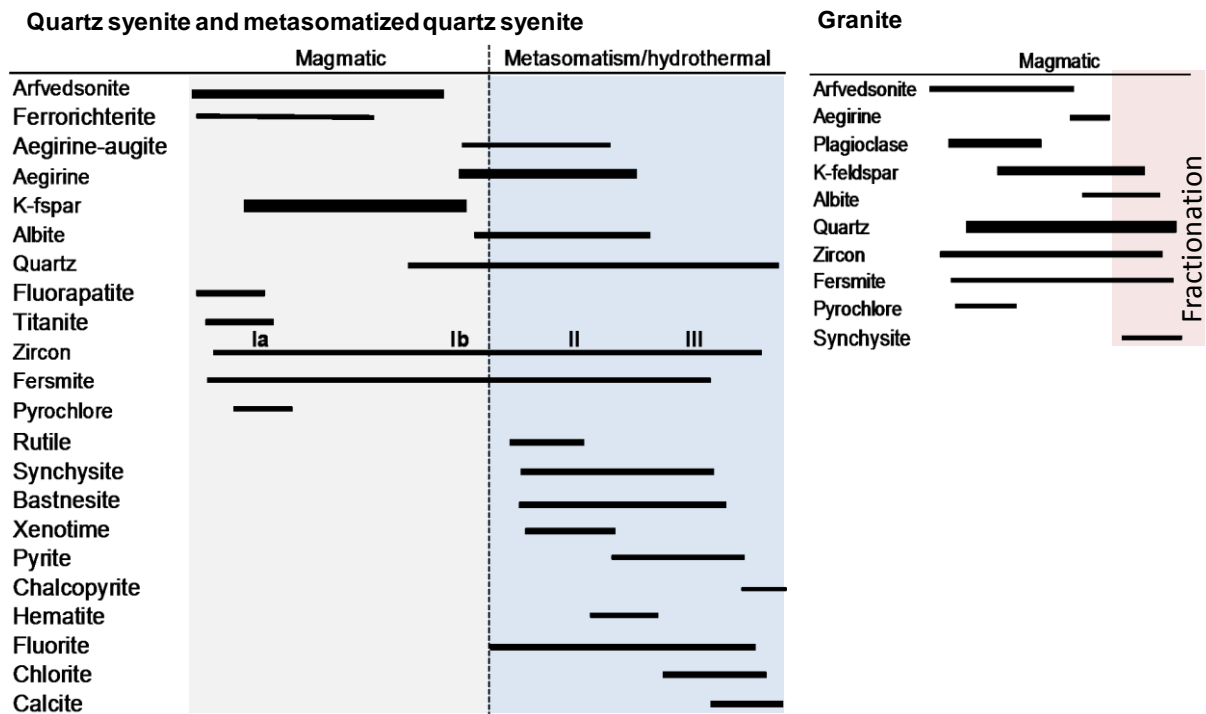


Figure 7.2.1 Generalized paragenetic sequence for the quartz syenite and granite.

7.2.2 Metasomatism/Hydrothermal REE/HFSE minerals

The metasomatism/hydrothermal model assumes REE/HFSE minerals enrichments are mainly due to higher temperature alkali and weak acidic hydrothermal condition (Figure 7.2.1). The results of geochemistry data relationships indicate where more heavily altered part is more concentrated by HFSE/REE-s. Secondary zirconosilicates (elpidite), zircon (Type-II), Nb-minerals and REE-bearing minerals (synchysite, bastnesite, and xenotime) occur as intensively hydrothermal alteration parts and late-stage vein assemblages in the quartz syenite, granite, and pegmatite. REE/HFSE-bearing minerals which occur as elongated crystal intergrowths that formed by replacement of albite and arfvedsonite during chemical dissolution-precipitation reactions (metasomatism) and filled microfractures. The microfractures occur in the feldspars, arfvedsonite/aegirine, with REE/HFSE-bearing minerals being accompanied by

quartz, fluorite, chamosite, nontronite, calcite, and hematite. Zircon and fersmite are the two main hosts of the heavy rare earth elements in the study area. During the metasomatism zircon and fersmite is core part is reacted with fluid, they show pores core texture. Significantly, the cores of these minerals are enriched by HREEs and sometimes occur xenotime. The strong correlations occur in between Zr, Nb and HREEs (Figure 7.2.2).

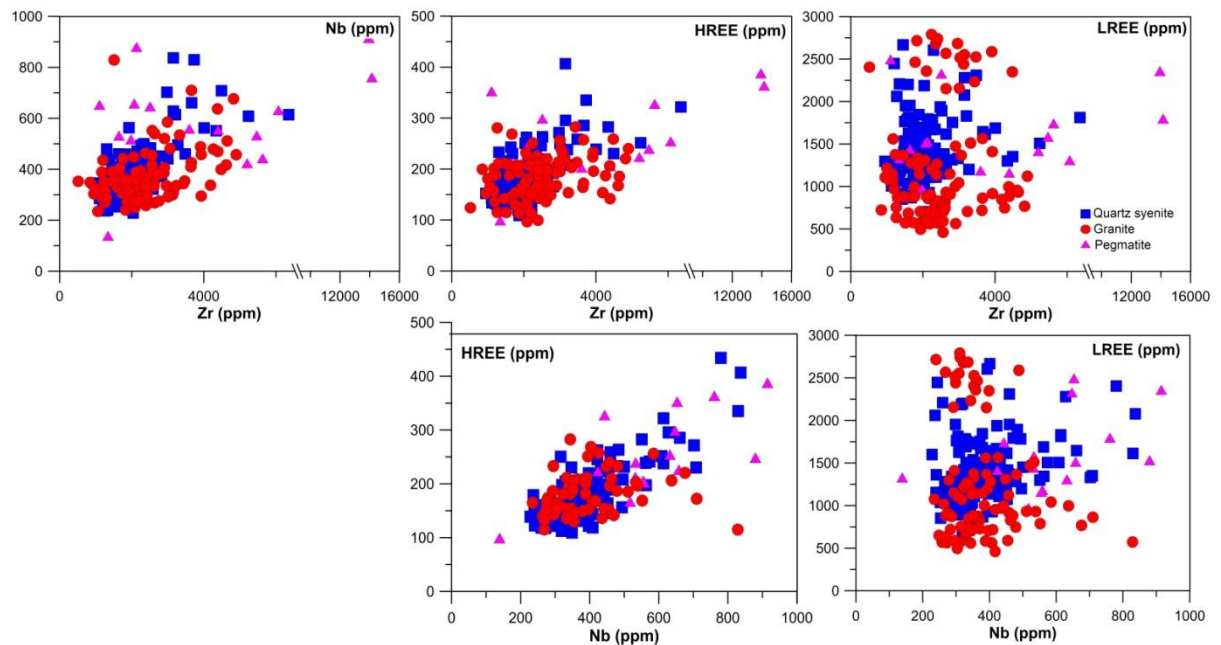


Figure 7.2.2 Zr and Nb versus diagram

7.3 Effect of magmatic fractionation

The noted depletion of Ba, Sr, and Eu in quartz syenite and granite is usually attributed to the fractionation of feldspars, whereas Rb is highly incompatible and gradually enriched in late stage melts (Abdel-Rahman, 2006; Cerny et al., 1985). Negative anomalies of Ba, Sr and Eu on the primitive mantle normalized spider diagram plots for the Khaldzan Burgedei complex reflect the fractionation of feldspar (Figure 7.3-1). These diagrams suggest this peralkaline magma solidified from fractionated melts.

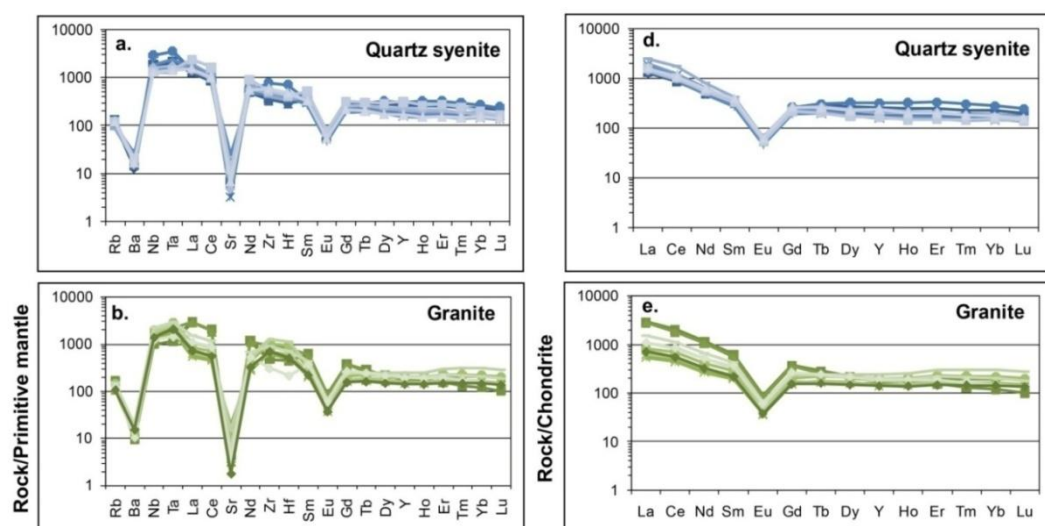


Figure 7.3-1. (a-b) Primitive mantle-normalized incompatible trace element patterns of Khaldzan Burgedei complex, (d-e) Chondrite-normalized REE patterns of Khaldzan Burgedei complex. ([Mc Donough and Sun, 1995](#))

The evolution of major and trace elements is consistent with fractional crystallization of peralkaline felsic magma. The fractionation of the granitic magma that accumulated HFSE and REEs at the top of the granitic stock and associated with pegmatites. This fractionated part is more enriched SiO_2 , Rb and depleted Ba, Sr content. This enrichment and depletion explained by separation of K-feldspar, as indicated by the decrease in K_2O concentration with increasing SiO_2 in the granites. These fractionated units extremely enriched by LREE (Figure 7.3-2).

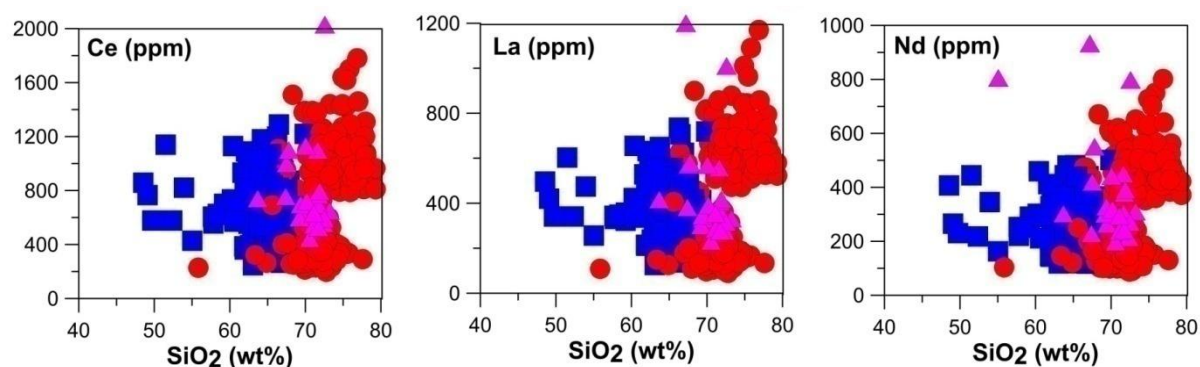


Figure 7.3-2 Variation diagram of LREE and HREE in the Khaldzan Burgedei complex

In the top of the granite and pegmatite, zircon (Type I and II), fersmite, pyrochlore and REE carbonates are present (Figure 7.3-3a). Type-I zircons crystallized with major minerals from an evolved peralkaline melt. Mineral paragenesis shows that zircon became saturated in

the quartz syenite magma before quartz saturation, resulting in the precipitation of Type-Ia zircons. Then this saturation continued until the end of the granite and pegmatite formation. During the fractionation of the magma from quartz syenite to granite, zircons (especially Type Ic zircon) became more enriched in Sn and HFSE (eg., Nb) (Figure 7.3-3b) in the fractionated granitic magma.

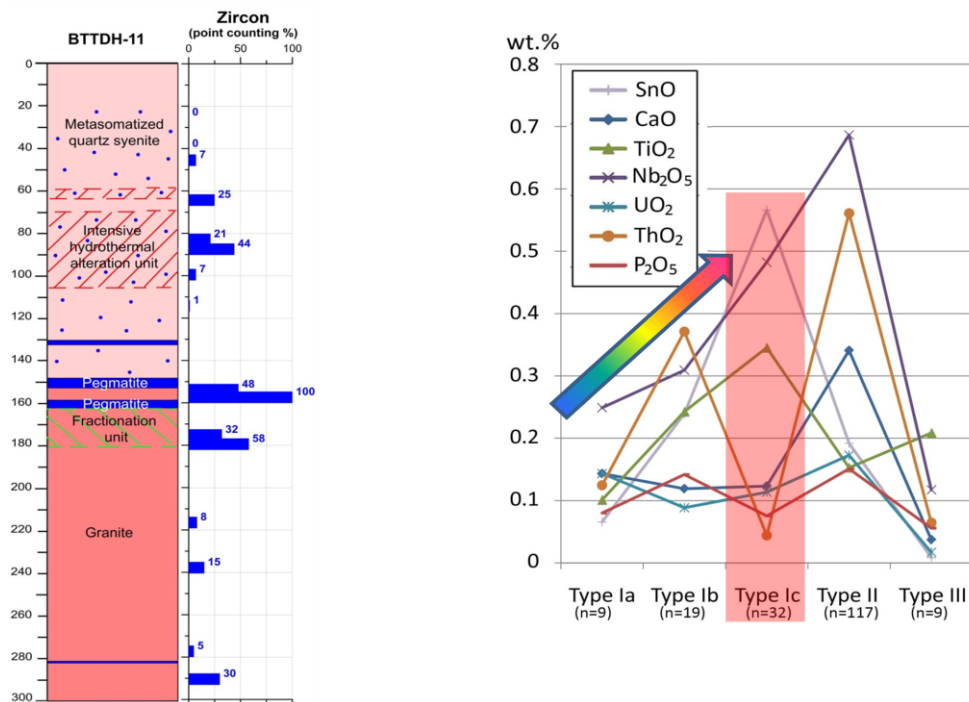
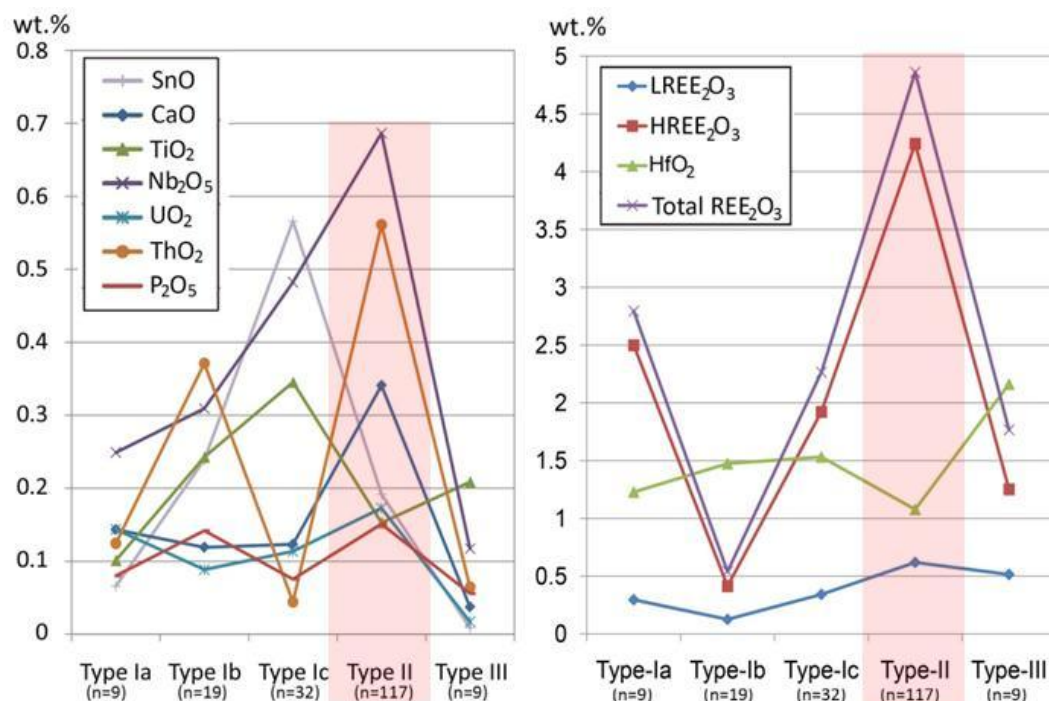


Figure 7.3-3. (a) present zircon (data from point counting), (b) zircon variation diagram.

7.4 Effect of metasomatism

K, Na, and Ca are most common elements transported during metasomatism. In the Khaldzan Burgedei complex is affected by Na metasomatism. The aspect of alkali metasomatism is characterized by Na-bearing minerals, which are clearly in replacement of plagioclase, alkali feldspar by albite. Albitization is a widespread process at Khaldzan Burgedei complex. In the metasomatized units, unaltered arfvedsonite is rare. Most of them have been partly or totally replaced by aegirine, and aegirine-augite with interstitial fluorite, zircon, ilmenite and quartz. The final products of the metasomatism are albite + quartz + fluorite + hematite + calcite + REE bearing minerals from the original assemblage of plagioclase + K-feldspar + amphibole + quartz + apatite in the quartz syenite (Figure 3.1.1-2 and Figure 3.1.1-1). This replacement indicates that Ca from plagioclase and Ca-bearing amphiboles were the source of Ca for fluorite, calcite and REE-bearing carbonates (chemical reaction 1 to 6). During the SEM-EDX analysis synchysite coexisted with arfvedsonite, aegirine and quartz (Figure 7.4-1). This

The petrography observation and bulk rock compositions are show several drill holes in some specific interval is intensely altered metasomatism, which precipitated abundant fluorite, zircon (Type II and III), fersmite, rutile and REE-bearing minerals (synchysite, bastnasite, parisite, and xenotime). The influence of metasomatism zoning zircon (type-II) is enriched by Nb_2O_5 , ThO_2 , CaO and REE_2O_3 (Figure 7.4-2) and porous zircon included xenotime and synchysite (Figure 3.2.2.1-1m and i). Metasomatic fluids reacted with Type-I zircons and extracted minor elements such as Th, U and P which reprecipitated in Type-II zircons, resulting in high concentration of these elements. The intimate association of fluorite with Type-II zircons and a higher concentration of Ca in Type II zircons suggest that an addition of Ca into the metasomatic fluids may have destabilized a zirconium-fluorite complex in the fluids, resulting in the precipitation of zircon and fluorite.



7.4-2. Zircon variation diagram

7.5 Effect of hydrothermal alteration

The hematization, fluoritization, chloritization (chamosite) and sericitization is most common and important alteration in the area. After metasomatism, albite altered by sericite and chlorite, and aegirine altered by chlorite. During this alteration, Cl formed from aegirine and this released Cl helped to transport REE (equation 1 and 3). Albite lines the fracture walls, followed by chamosite, sericite, fluorite, and calcite that successively fill the fracture.

Hydrothermal minerals formed later than albitization also include HFSE and REE bearing minerals (zircon, fersmite, synchysite, and xenotime). This overall paragenetic

sequence indicates that the hydrothermal fluids underwent successive decrease in a_{K}^{+}/a_{H}^{+} ratio and increase in a_{Ca}^{2+}/a_{H}^{+} ratio. Hydrothermal chlorite is only stable relative to biotite at lower temperature and lower K concentration in the fluid ($\alpha_{K^{+}} \approx 10^{-3}$ at 250°C and pH =4) (V.Moller et al., 2017). Thus, chamosite in the quartz syenite probably formed locally at low temperature during the main stage alteration (Na metasomatism) under a_{Ca}^{2+}/a_{H}^{+} . Bulk whole rock chemical analysis data show hydrothermally altered part Ca is also increased (Figure 4.2-1). Petrographic observation shows that chamosite occur with synchysite and bastnäsite (Figure 7.5-1). This indicates that HFSE and REE remobilization at low temperature.

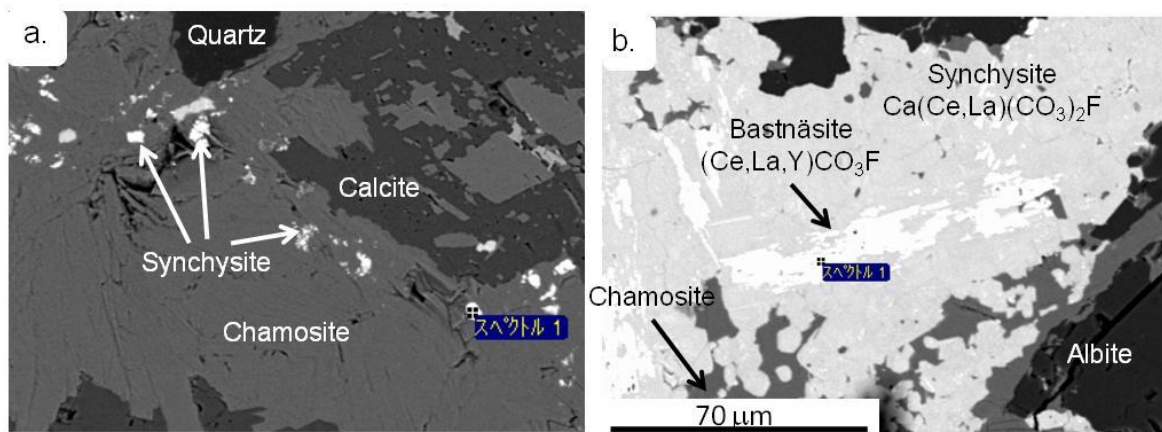


Figure 7.5-1 (a) hydrothermal chamosite included anhedral synchysite, (b) bastnäsite and synchysite surrounded by chamosite.

The recent experimental study about REE transportation in hydrothermal system has been done by A.E. Williams-Jones (2012). According to the experimental data, acidic and weak acidic hydrothermal condition, chlorine ions are important species for transporting REE. William Jones diagram show below 400°C chlorine is dominant REE (Figure 7.5-2). That transported REE in to this hydrothermal system finally precipitated bastnäsite and synchysite with chamosite.

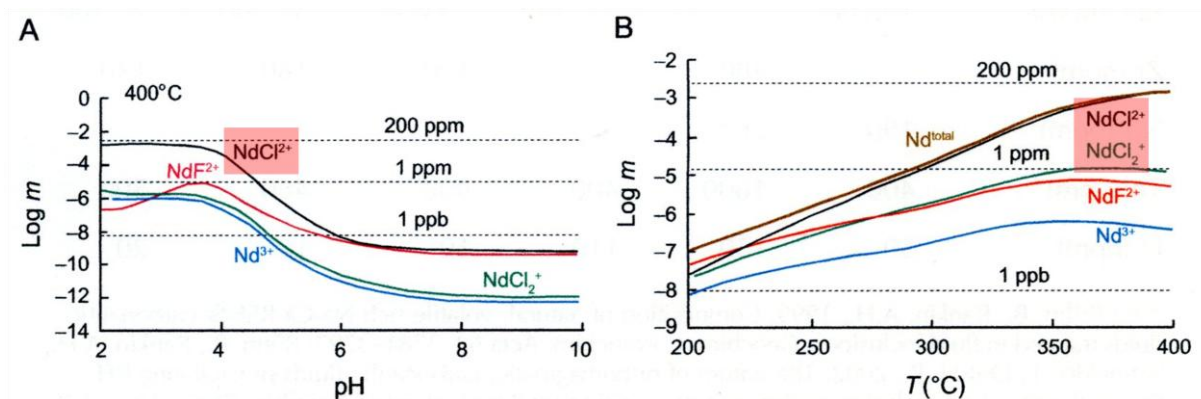


Figure 7.5-2 Comparison of solubility of Nd complex ions in hydrothermal solution.

localized LREE remobilization at low temperature. The quartz-fluorite, fluorite veins are either barren or mineralized, with zircon, Nb minerals (fersmite and pyrochlore) and some REE bearing minerals (synchysite). During this study, we did not identified fluorine content, but result of the previous researcher whole rock geochemistry fluorine anomaly is detected up to 42000 ppm (Kovalenko et al, 1995 and U. Kemp et al., 2015). The fluorite commonly associated with chloritization, calcite, quartz, and HFSE.

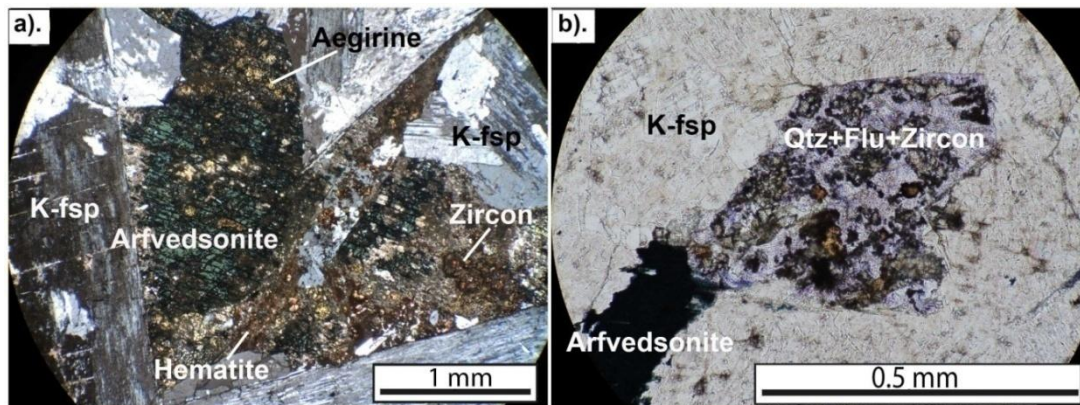


Figure 7.5-3 Effect of hydrothermal alteration. (a) Amphibole replaced by aegirine/hematite, aegirine replaced by zircon+quartz, (b) arfvedsonite pseudomorphs with quartz+ fluorite+ zircon.

7.6 Genetic model

Based on field observation, the mineral paragenesis, mineral chemistry, bulk-rock chemistry, and fluid inclusion study, we propose a genetic model for the formation of the Khaldzan Burgedei Zr-Nb-REE project area (Figure 7.6-1 and Figure 7.6-2).

Peralkaline magmatism in Paleozoic rift zone, peralkaline magma evolved from quartz syenite to granite associated pegmatite. The REE and HFSE mineralization associated with the peralkaline rocks (quartz syenite, granite, and pegmatite) is attributed to magmatic, metasomatic and hydrothermal processes. The magmatic process enriched HFSE and REE to the highly fractionated part of the granite and pegmatite. Highly fractionated, silica-saturated melts increased in the concentration of volatiles, significant amounts of halogens, particularly fluorine and incompatible elements in the fluid.

The hydrothermal activity started by alkali metasomatism followed by low temperature hydrothermal alteration. Exsolving fluorine and sodium rich hydrothermal fluids leached HREEs from zircon and transported the host quartz syenite. This hydrothermal fluids reacted (Na metasomatism) with feldspars and Ca-bearing amphibole resulting in the precipitation of fluorite and HREE rich zircon as well as REE carbonates. During the Na metasomatism, which are clearly in replacement relationships with primary magmatic minerals, replacement of plagioclase, K-feldspar by albite and other change is increasing amount of H₂O and/or "dry" volatiles include changing Ca-bearing amphibole by aegirine, as well as a series of F bearing mineral assemblages. After metasomatism, hydrothermal fluid formed chlorite, zircon, fluorite and quartz alteration in the metasomatized quartz syenite, this process is explained by replacement reactions related to low-temperature Ca-F acidic alteration.

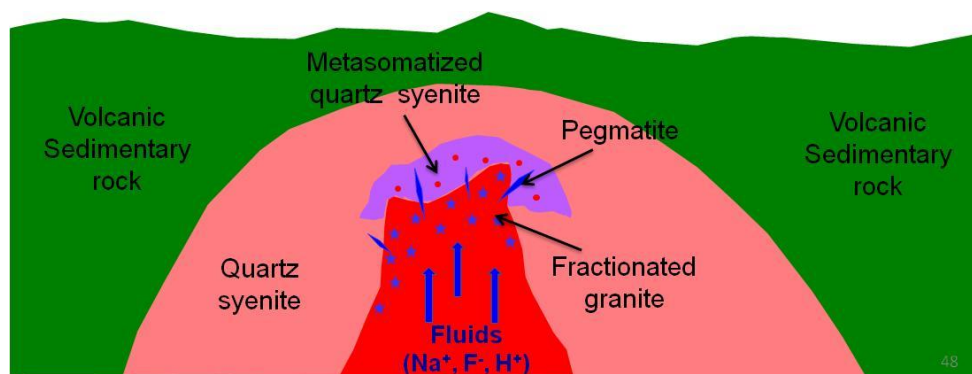


Figure 7.6-1 Genetic model of the Khaldzan Burgedei complex.

A previous research subdivided Khaldzan Burgedei complex eight phase's and determined the age of the second phase granite (392 ± 2.3 Ma) and sixth phase syenite (390 ± 1.2 Ma), 395.0 ± 1.3 Ma for quartz–zircon–orthite–epidote ore. All these data constrain the age of the massif within 391–395 Ma. Our zircon age dating for the zircon is 397 ± 24 Ma (zircon from metasomatized quartz syenite). This result shows still same quartz syenite and granite. This means metasomatism just going to the after intruded granitic magma.

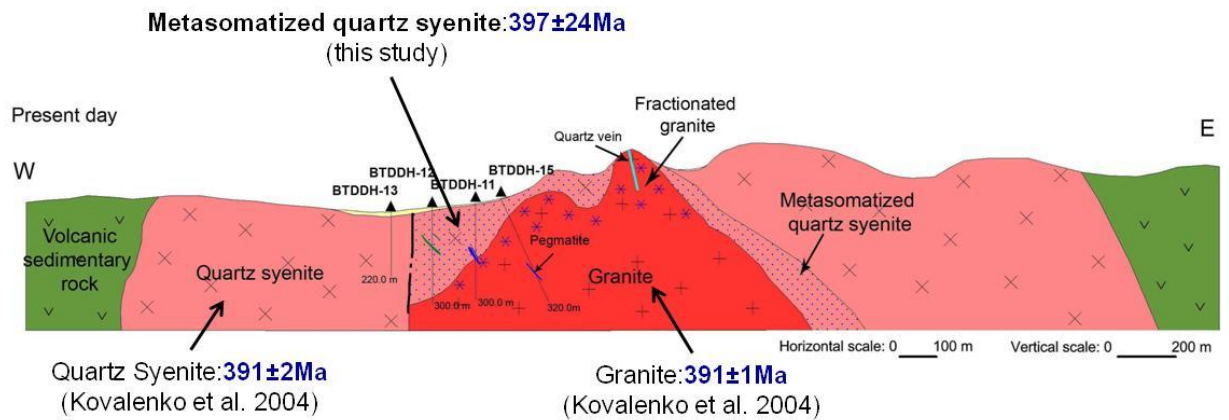


Figure 7.6-2 Present model of the Khaldzan Burgedei complex.

8 General Conclusion

The Khaldzan Burgedei peralkaline complex of the studied area consists of quartz syenite, and granite. These rock units show A type signature of within-plate setting. They are enriched in Zr, Nb and REEs. A variety of REE (synchysite, bastnesite, parasite, and xenotime), Nb-minerals (pyrochlore and fersmite) and zircon are identified in the metasomatized quartz syenite, granite and pegmatite. These HFSE and REE mineralization are attributed to magmatic and hydrothermal processes.

Three zircon types; magmatic (Type-I) magmatic-metasomatic (Type-II) and metasomatic-hydrothermal (Type-III), are recognized in the quartz syenite and granite of the Khaldzan Burgedei complex in Mongolia. These zircons record a magmatic evolution of the complex, such that the HFSE enrichments in the fractionated peralkaline granite, and redistribution of the minor elements such as Th, U, and REE during the subsequent metasomatism and hydrothermal alteration. Zircons are a good indicator to trace the behavior of HFSE and REE in the peralkaline magmatic-hydrothermal system.

Na and F metasomatism resulted in albitization and fluorite precipitation with extracted Ca^{2+} . Destabilized Zr-REE fluoride complexes resulted in fluorite, zircon and REE minerals precipitation.

Subsequent chlorine-rich hydrothermal alteration is characterized by hydrous minerals with REE mineralization

In summary, we propose a genetic model that the HFSE and REE mineralization of the complex we caused by extreme magmatic fractionation and subsequent Na and F metasomatism resulted in albitization and fluorite precipitation with extracted Ca^{2+} . Destabilized Zr-REE fluoride complexes resulted in zircon and REE minerals precipitation.

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Appendix 1

Bulk rock analysis from drill holes

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite													
Sample No.		10175	10176	10177	10178	10179	10180	10181	10182	10183	10184	10185	10186	10187	10188
from		9.9	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0
to		11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
(wt%)															
SiO ₂		72.59	73.57	75.43	71.98	71.96	66.89	68.58	74.38	77.63	74.98	69.58	75.86	72.26	67.77
Al ₂ O ₃		8.52	8.92	9.83	10.51	9.32	9.72	9.27	8.93	8.19	8.50	7.84	7.09	9.56	9.58
Fe ₂ O ₃ (T)		4.21	4.69	3.47	3.33	3.23	4.16	2.32	3.29	4.37	3.35	2.98	3.94	2.17	2.57
MnO		0.17	0.11	0.15	0.08	0.10	0.07	0.10	0.12	0.10	0.20	0.20	0.11	0.14	0.15
MgO		0.06	0.04	0.05	0.05	0.05	0.10	0.06	0.04	0.02	0.04	0.06	0.07	0.04	0.05
CaO		3.36	2.83	1.84	2.06	3.43	6.81	8.63	2.94	1.04	3.03	6.99	4.05	4.71	5.65
Na ₂ O		2.30	2.52	2.71	2.82	2.35	1.93	2.41	2.29	2.32	2.26	2.04	1.49	2.79	2.77
K ₂ O		3.88	3.99	4.58	4.89	4.51	4.46	4.43	4.18	3.79	3.99	3.17	2.63	4.05	4.17
TiO ₂		0.15	0.14	0.13	0.11	0.16	0.11	0.12	0.15	0.12	0.20	0.14	0.11	0.14	0.16
P ₂ O ₅		0.02	0.02	<0.01	0.01	<0.01	0.02	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
LOI		2.04	1.90	1.66	1.75	2.10	3.05	2.30	2.69	0.96	2.55	6.47	4.30	4.08	4.36
Total		97.27	98.73	99.86	97.58	97.22	97.32	98.22	99.02	98.54	99.09	99.47	99.65	99.95	97.22
(ppm)															
Sc		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Be		59	45	52	32	47	37	42	27	41	21	13	31	44	41
V		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ni		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu		10	10	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Zn		100	100	130	150	170	210	100	110	90	90	100	130	60	70
Ga		53	56	60	66	61	62	55	57	54	55	54	47	62	62
Ge		4	4	4	3	4	4	3	4	4	4	4	5	4	4
As		8	8	7	6	6	7	6	9	9	8	7	9	8	8
Rb		328	333	405	446	373	330	310	357	345	338	278	209	378	373
Sr		46	35	39	37	49	119	89	63	33	61	120	82	70	74
Zr		4288	3112	2951	4355	3624	2793	3023	2812	3625	2995	2618	2336	3223	3189
Nb		607	476	602	555	587	570	559	431	433	504	429	325	477	447
Mo		<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ag		n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
In		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn		39	50	40	40	46	40	34	47	44	45	31	36	35	32
Sb		1.6	1.4	1.1	1.5	0.9	0.7	0.9	1.5	1.3	1.2	0.8	0.8	0.8	0.7
Cs		<0.5	<0.5	<0.5	0.6	<0.5	0.8	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.6
Ba		30	24	27	29	32	55	52	29	32	47	38	37	28	25
Hf		98.8	69.9	66.1	100	84.6	63.3	68.9	67.4	85.4	67.3	61.8	52.7	75.6	70.9
Ta		46.4	32.8	41.8	42.5	398	38.3	38	34.6	31.5	34.7	30.2	25.1	36.5	36.4
W		<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1
Tl		0.6	0.4	0.4	0.5	0.3	0.3	0.3	0.5	0.3	0.4	0.4	0.2	0.3	0.3
Pb		30	26	17	14	26	35	26	34	33	40	20	17	21	26
Th		59.1	67.5	80.6	60	65	75	53.1	68.9	56.8	68.9	444	57	60.5	60.2
U		21.2	17.3	20.6	20.5	18.7	20.5	19.5	15.5	14.5	17.2	12.1	126	15.1	16.4
Bi		0.5	0.4	0.4	0.4	<0.4	0.4	<0.4	0.4	0.6	<0.4	<0.4	<0.4	<0.4	<0.4
Y		433	454	488	446	413	429	387	434	396	455	357	367	402	454
La		718	748	797	685	748	750	752	932	816	918	906	816	1060	1090
Ce		1280	1350	1410	1240	1320	1340	1300	1580	1430	1590	1570	1430	1830	1880
Pr		149	159	166	145	156	157	151	184	166	190	185	169	208	218
Nd		566	603	635	546	585	596	572	691	626	715	698	653	793	841
Sm		108	115	124	107	111	112	103	125	116	131	121	126	135	149
Eu		5.78	6.13	6.52	5.76	5.79	5.65	5.6	6.26	6.13	6.92	6.25	6.49	7.23	7.79
Gd		85.7	92.1	100	86.7	87.2	87.5	78.7	101	89.8	101	90.9	97.7	99.3	113
Tb		14	15	16.7	14.1	14.3	14.1	125	14.6	13.7	16.2	134	14.8	14.9	16
Dy		84.9	90.5	97.3	86.8	84.2	86.3	74.3	77.8	79.1	93.2	77.1	79.6	83.2	88.4
Ho		166	17	18.1	16.8	15.7	16.1	13.9	14.3	15	17.6	14.1	13.9	14.9	16
Er		50	50.2	51.9	51.3	46	46.7	41.2	38.3	44	48.2	38.9	37.1	41.6	45.2
Tm		7.66	7.29	7.29	7.7	6.54	6.38	6.1	5.55	6.61	6.8	5.32	4.94	5.73	6.39
Yb		47.5	43.8	44	48.2	39.7	39.2	37.8	34.5	39.7	42.3	32.1	30.2	34.8	39.4
Lu		6.67	5.97	5.71	6.62	5.45	5.12	5.15	4.91	5.52	5.7	4.39	406	4.87	5.26
TREE		3417.6	3573.4	3787.3	3312.7	3846.8	3559.2	3407.5	4107.2	3692.8	4167.1	4350.0	3792.8	4568.6	4779.1

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite													
Sample No.		10189	10190	10191	10192	10193	10194	10195	10196	10197	10198	10199	10200	10201	10202
from		24.0	25.0	26.0	27.0	28.0	29.0	30.0	31.0	32.0	33.0	34.0	35.0	36.0	37.0
to		25.0	26.0	27.0	28.0	29.0	30.0	31.0	32.0	33.0	34.0	35.0	36.0	37.0	38.0
(wt%)															
SiO ₂		68.92	67.60	68.82	67.62	65.52	66.27	68.75	68.90	69.86	70.66	68.39	60.87	65.20	68.28
Al ₂ O ₃		9.72	9.66	10.43	9.72	10.03	9.80	10.19	9.76	8.69	8.94	8.91	8.84	9.72	10.58
Fe ₂ O ₃ (T)		3.31	3.32	3.20	4.31	4.20	3.83	3.21	3.05	2.66	2.50	2.80	3.48	3.14	3.09
MnO		0.16	0.16	0.12	0.11	0.10	0.14	0.11	0.12	0.11	0.10	0.13	0.30	0.21	0.10
MgO		0.07	0.07	0.05	0.06	0.08	0.07	0.04	0.04	0.04	0.03	0.04	0.05	0.06	0.04
CaO		5.20	5.88	5.25	6.00	6.91	5.79	3.59	4.31	4.72	4.83	6.00	8.90	6.57	4.20
Na ₂ O		2.75	2.50	2.89	2.48	2.01	2.21	2.66	2.50	2.13	2.24	2.21	1.98	2.45	2.71
K ₂ O		4.09	4.25	4.45	4.25	4.58	4.55	4.83	4.73	4.35	4.61	4.41	4.55	4.59	5.12
TiO ₂		0.17	0.11	0.15	0.20	0.13	0.12	0.13	0.11	0.14	0.09	0.09	0.10	0.13	0.13
P ₂ O ₅		<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01	<0.01
LOI		4.47	5.10	4.33	5.00	4.77	5.28	3.36	3.99	4.20	4.16	5.09	7.95	5.96	3.78
Total		98.86	98.64	99.69	99.75	98.32	98.07	96.88	97.51	96.91	98.19	98.08	97.02	98.04	98.04
(ppm)															
Sc		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Be		35	22	26	26	31	39	28	32	24	15	26	13	36	49
V		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ni		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu		<10	<10	<10	<10	<10	<10	<10	20	10	<10	<10	<10	10	<10
Zn		100	60	60	60	70	70	70	60	50	50	50	50	50	70
Ga		64	63	67	62	66	63	66	62	57	57	54	52	60	68
Ge		4	4	4	4	4	4	4	4	4	4	3	3	3	4
As		7	9	8	7	10	8	9	7	7	7	6	6	7	7
Rb		358	392	411	381	402	412	454	439	406	439	400	392	404	455
Sr		82	90	73	93	77	70	61	62	74	77	91	117	102	71
Zr		3608	4791	3673	2362	3231	3212	3691	4136	3878	4985	4793	4345	4673	3561
Nb		599	527	570	570	575	361	471	458	602	466	415	489	510	514
Mo		<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ag		n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
In		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn		39	32	34	33	32	39	34	31	32	32	28	27	36	47
Sb		<0.5	1	0.9	1.3	1	0.7	0.9	0.8	1	1.1	0.9	0.6	0.8	0.6
Cs		0.6	0.7	0.7	0.9	1.1	1	0.8	0.9	0.8	0.8	0.7	0.7	0.8	1
Ba		28	26	25	25	28	27	27	24	25	24	22	29	30	30
Hf		82.1	107	79.7	52.7	72.8	73.4	83.1	94.2	87.6	US	107	97	107	84.4
Ta		45.7	36.8	40.2	38.1	38.7	27.6	36.5	33.5	44.1	33.7	30.6	34.5	38.3	38
W		1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	160	< 1
Tl		0.3	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.3	0.3	0.4	0.4
Pb		34	17	14	21	14	15	25	18	16	14	12	14	22	25
Th		74.7	45.8	62.1	76	60	48.3	55.5	53.2	54.9	40.3	43.2	42.1	47.6	76.4
U		20.2	20.6	19.1	14.9	18.6	14.6	18.7	18.2	20.4	19.3	17.1	18.4	18.5	18.3
Bi		<0.4	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.6	0.5	0.7	<0.4	<0.4	2.3	<0.4
Y		458	489	503	395	447	410	455	434	437	416	464	422	426	446
La		1050	1090	1190	1050	1110	1000	1110	972	943	760	747	800	939	955
Ce		1830	1870	2060	1830	1900	1730	1920	1670	1630	1290	1260	1370	1630	1650
Pr		206	217	240	215	221	204	223	189	188	150	145	155	189	188
Nd		795	827	921	824	853	764	852	723	706	570	559	597	703	717
Sm		140	144	162	146	150	134	149	129	123	99.5	101	104	122	128
Eu		7.53	7.32	8.76	7.49	7.77	6.77	7.74	6.86	6.27	5.34	5.46	5.32	6.44	6.91
Gd		117	106	124	107	112	99.3	112	98.5	93.9	77.5	81	79.1	93.7	98
Tb		15.6	152	17.6	15	15.9	14.1	165	14.3	14	12.3	12.8	12.6	13.4	15.6
Dy		85.8	90.1	98.3	82.1	89	79.3	90.1	81.8	84.2	72.6	78.3	73.2	77.6	87.6
Ho		16.3	17.1	17.7	14.1	16	14.1	16.6	15.7	15.8	14.9	15.7	14.5	14.9	16.2
Er		45.2	50.4	49.9	40	44.8	41	48.9	46.3	48	46.9	47.6	43.9	45.2	46
Tm		6.6	7.22	7	5.41	6.21	5.82	7.03	6.64	6.84	7.02	6.99	6.22	6.61	6.56
Yb		41.1	43.9	43.2	33	38.3	34	42	40.6	43	43.3	41.7	39.2	41	37.5
Lu		5.53	6.06	6	4.58	5.1	4.55	5.77	5.79	5.99	6.06	5.67	5.35	5.62	5.01
TREE		4662.4	4765.3	5220.6	4617.9	4820.5	4354.7	4852.9	4247.8	4169.6	3399.2	3384.7	3562.6	4304.5	4249.0

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite													
Sample No.	10203	10204	10205	10206	10207	10208	10209	10210	10211	10212	10213	10215	10216	10217	
from	38.0	39.0	40.0	41.0	42.0	43.0	44.0	45.0	46.0	47.0	48.0	49.0	50.0	51.0	
to	39.0	40.0	41.0	42.0	43.0	44.0	45.0	46.0	47.0	48.0	49.0	50.0	51.0	52.0	
(wt%)															
SiO2	69.18	68.42	69.83	69.56	71.98	69.00	69.18	70.80	68.96	69.39	67.36	68.30	69.94	69.49	
Al2O3	10.28	9.75	10.14	10.11	10.43	10.32	10.40	11.30	11.11	9.95	10.64	10.55	10.81	10.68	
Fe2O3(T)	3.31	3.78	3.11	4.41	3.76	3.06	3.17	3.43	4.75	6.01	5.20	5.81	5.72	5.43	
MnO	0.08	0.10	0.09	0.08	0.09	0.12	0.10	0.08	0.09	0.07	0.07	0.09	0.05	0.10	
MgO	0.03	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.05	0.05	0.09	0.09	0.06	0.05	
CaO	3.81	4.01	3.36	4.16	2.99	3.86	3.82	3.17	2.14	2.33	3.76	2.78	1.44	1.61	
Na2O	2.71	2.62	2.84	2.56	2.87	2.91	2.76	3.14	2.70	2.03	2.34	2.07	2.32	2.49	
K2O	4.99	4.77	4.90	4.92	4.84	4.76	4.79	5.30	5.21	5.08	4.80	5.25	5.16	5.43	
TiO2	0.11	0.11	0.10	0.08	0.12	0.13	0.10	0.12	0.10	0.13	0.10	0.11	0.12	0.12	
P2O5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
LOI	3.23	3.24	2.87	2.97	2.41	2.99	3.23	2.67	2.47	2.48	2.79	3.12	2.35	2.07	
Total	97.74	96.84	97.28	98.90	99.52	97.18	97.57	100.00	97.59	97.54	97.15	98.19	97.98	97.49	
(ppm)															
Sc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Be	53	33	25	48	47	28	25	38	32	28	18	24	24	24	
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Co	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Cu	<10	<10	<10	<10	<10	10	<10	<10	<10	<10	<10	<10	<10	<10	
Zn	70	80	90	120	120	110	100	90	110	120	120	110	120	110	
Ga	66	61	65	61	66	65	67	72	67	55	63	66	71	66	
Ge	4	4	4	4	4	4	4	4	4	4	4	5	5	5	
As	7	6	6	6	6	6	7	8	5	6	7	7	7	9	
Rb	453	441	438	416	448	451	443	498	440	394	372	412	443	466	
Sr	59	62	85	68	62	69	69	55	47	42	44	45	48	59	
Zr	3688	3734	3532	3937	2970	3410	3755	2682	2503	2524	2359	2617	3325	3389	
Nb	424	519	466	448	480	467	496	478	352	391	369	344	441	581	
Mo	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Ag	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Sn	45	32	45	28	62	44	42	63	33	34	29	34	36	32	
Sb	<0.5	1	0.8	1.2	1.2	1.2	1.2	1.5	8	<0.5	<0.5	<0.5	<0.5	<0.5	
Cs	1	0.8	0.9	1	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	1.1	0.9	
Ba	25	32	36	36	30	29	31	23	37	44	47	35	35	35	
Hf	90.7	86	85.1	90.8	71	80.5	90.4	67	55	57.9	50.6	62.7	76.1	78	
Ta	34.4	37.6	34.5	32.6	33.9	34	34.5	35.6	25.9	288	27.4	266	31.5	42	
W	70	<1	<1	<1	<1	64	<1	1	<1	<1	<1	<1	<1	<1	
Tl	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.7	0.4	0.4	0.4	0.3	0.5	0.5	
Pb	17	25	19	16	21	24	21	14	15	13	11	13	11	15	
Th	72	48	65.7	50.8	72.2	51.7	58.7	64.9	59.7	49.8	46.8	52.1	484	55.4	
U	17.6	18.4	17.4	19	16.9	18.7	17.9	16	13.2	15.2	16.3	14.7	16.8	20.7	
Bi		<0.4	<0.4	<0.4	0.5		0.4	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
Y	441	379	407	380	394	380	388	390	367	357	328	346	391	425	
La	948	781	846	736	851	829	937	961	809	792	826	940	939	949	
Ce	1620	1310	1440	1270	1440	1420	1620	1630	1360	1310	1380	1590	1600	1620	
Pr	188	151	166	148	168	164	187	183	159	151	158	180	184	187	
Nd	713	578	625	563	635	618	717	714	600	571	601	692	695	709	
Sm	128	101	111	99.8	116	108	125	124	106	101	104	119	119	123	
Eu	6.83	5.24	5.78	5.2	6.2	5.42	6.35	6.38	5.47	5.29	5.23	6.03	6.03	6.29	
Gd	96.1	77.1	85.4	76.8	91.1	81.3	92.2	102	79.2	79	76.9	92.6	88.2	93.1	
Tb	15.1	12.1	13.4	11.7	14.3	12.8	13.6	14.5	12.6	12.1	11.3	12.1	13.1	14.4	
Dy	87.3	73.1	79.4	71.4	82.9	75.5	79.2	75.3	72.9	696	64.7	66.9	75.9	85.5	
Ho	16.3	14	15.2	13.7	15	14.4	14.6	13.3	13.2	12.9	11.8	12.2	14.1	16.3	
Er	48.1	42.4	44.4	40.4	41.3	43	42.3	34.7	36.4	35.7	34.2	33	41.2	46.5	
Tm	6.88	6.34	6.31	5.89	5.37	6.17	6.07	4.72	4.87	4.82	4.77	4.58	5.81	6.59	
Yb	41.5	39.2	37.3	35.9	30.9	37.5	36.6	26.6	29.8	28.6	28.6	27.3	35.2	40.3	
Lu	5.48	5.45	4.81	4.89	3.88	4.98	4.93	3.71	3.82	3.78	3.83	3.35	4.82	5.44	
TREE	4256.3	3434.6	3737.8	3320.8	3755.1	3717.3	4113.3	4141.0	3520.7	3653.7	3457.3	4167.0	4477.8	4152.9	

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite													
Sample No.	10218	10219	10220	10221	10222	10223	10224	10225	10226	10227	10228	10229	10230	10231	
from	52.0	53.0	54.0	55.0	56.0	57.0	58.0	59.0	60.0	61.0	62.0	63.0	64.0	65.0	
to	53.0	54.0	55.0	56.0	57.0	58.0	59.0	60.0	61.0	62.0	63.0	64.0	65.0	66.0	
(wt%)															
SiO2	68.63	70.89	71.73	66.61	71.32	71.61	73.52	71.28	71.37	70.72	70.41	69.85	68.44	69.92	
Al2O3	10.91	11.08	11.02	8.60	10.01	10.35	10.31	10.01	10.25	10.99	10.46	10.26	10.36	10.08	
Fe2O3(T)	4.65	3.34	3.14	13.05	6.42	5.80	4.91	3.42	3.37	3.18	4.61	5.02	4.37	5.14	
MnO	0.10	0.07	0.08	0.13	0.09	0.14	0.09	0.10	0.12	0.11	0.10	0.09	0.12	0.09	
MgO	0.06	0.03	0.02	0.21	0.06	0.04	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.05	
CaO	2.62	2.62	2.70	1.22	1.69	1.75	1.61	2.98	3.18	2.91	3.47	2.70	3.85	3.28	
Na2O	2.99	3.04	3.31	0.29	1.95	2.64	2.95	2.78	2.86	3.02	3.37	2.74	2.58	2.18	
K2O	5.15	5.35	5.05	4.07	5.06	4.93	4.79	4.64	4.97	5.29	4.08	4.68	4.81	5.00	
TiO2	0.11	0.13	0.10	0.08	0.09	0.10	0.12	0.10	0.10	0.12	0.12	0.12	0.15	0.09	
P2O5	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	
LOI	3.00	2.35	2.27	4.58	2.71	2.38	1.76	2.85	2.79	2.46	2.64	2.46	3.16	2.91	
Total	98.23	98.92	99.42	98.85	99.41	99.73	100.10	98.21	99.04	98.83	99.29	97.95	97.88	98.74	
(ppm)															
Sc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Be	39	30	45	32	30	32	39	33	80	41	31	34	28	26	
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Co	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Cu	<10	<10	10	<10	<10	<10	<10	<10	<10	<10	10	<10	<10	<10	
Zn	130	80	80	340	160	210	170	90	90	100	110	100	90	110	
Ga	69	64	67	62	61	63	64	64	63	64	64	61	57	65	
Ge	5	5	5	8	6	5	6	4	5	5	5	5	5	5	
As	7	8	9	<5	8	8	10	<5	9	8	7	7	7	<5	
Rb	446	413	409	299	386	391	375	375	377	387	291	333	312	350	
Sr	61	50	55	24	39	46	42	62	51	68	56	50	53	41	
Zr	3210	3078	3204	2445	2851	2841	2758	3756	2678	3052	2723	3230	3359	4186	
Nb	432	485	427	413	464	407	418	499	415	489	411	425	454	444	
Mo	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Ag	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Sn	34	29	33	35	29	31	42	32	40	40	41	27	29	33	
Sb	<0.5	1.2	1.1	0.9	0.9	1	1	1	0.6	0.9	0.8	0.9	1.1	1.3	
Cs	0.9	0.8	0.7	2	1.3	0.9	0.7	0.8	0.6	0.6	0.7	0.7	0.7	1.2	
Ba	28	30	26	49	31	30	27	25	24	31	27	31	38	38	
Hf	73.7	69.1	74.4	68.9	64.5	63.2	62.3	104	62.8	69.9	64.7	75.2	72	117	
Ta	31.6	37.2	31.3	296	32.9	30.5	30.8	40.1	30.2	34.3	29.6	33.8	32.5	32.2	
W	14		<1		16	<1	<1		13	<1	<1	<1	2	8	
Tl	0.5	0.5	0.4	0.4	0.3	0.3	0.2	0.5	0.3	0.3	0.2	0.2	0.2	0.5	
Pb	14	13	21	23	16	18	30	26	26	39	28	18	13	12	
Th	50.3	54.4	46.2	43.6	46.4	46.2	58.3	46.8	74.4	60.2	68	42.2	74.1	36.5	
U	18.8	17	15	21.8	19.4	16	14.5	19.1	14.3	15.5	14.2	17.4	16.5	19.1	
Bi	0.5	<0.4	<0.4	<0.4	0.4	<0.4	<0.4	0.4	0.5	<0.4	0.5	0.4	<0.4	0.7	
Y	384	436	413	301	430	404	461	405	463	450	418	378	453	360	
La	986	984	1020	682	865	876	1060	879	1060	883	835	708	717	670	
Ce	1670	1690	1740	1240	1490	1520	1840	1570	1860	1590	1520	1320	1370	1340	
Pr	191	188	193	137	163	169	205	174	211	181	175	153	161	153	
Nd	728	729	745	539	628	663	797	695	818	700	685	597	641	622	
Sm	125	127	129	96.4	113	121	149	125	160	138	133	116	121	108	
Eu	6.07	6.1	6.29	4.77	5.48	5.79	7.4	5.99	8.31	7.32	7.26	6.25	6.98	6.08	
Gd	92	105	107	81.4	96.9	101	126	104	137	115	111	95.2	98	86.1	
Tb	13.6	14.6	143	10.8	13.5	13.6	16.5	13.3	17.8	15.2	14.6	12.4	13.2	10.5	
Dy	77.9	78.2	76.1	58.7	74	71.2	844	71.2	88.2	79.4	76.6	67.7	73.5	59.9	
Ho	14.4	14.4	14.1	10.9	14	13.1	14.7	13.5	14.7	14.5	13.9	12.9	14.2	12	
Er	41.1	39.5	38.2	32.1	39.1	35.6	38.6	40.6	35.7	38.2	36.6	37.4	40.2	38.4	
Tm	5.76	6.01	5.86	4.64	5.82	5.33	5.55	6.04	4.82	5.46	5.24	5.73	6.01	6.07	
Yb	35	36	35	28.1	34.1	32.2	33.8	37.4	26.8	32.4	31.4	36.6	37.6	38.2	
Lu	4.75	4.9	4.82	3.62	4.53	4.26	4.52	5.05	3.44	4.37	4.03	5.05	5.04	5.37	
TREE	4188.2	4282.2	4360.2	3385.0	3825.9	3869.8	4653.2	3986.9	4739.0	4098.6	3913.8	3390.3	3608.3	3368.1	

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite													
Sample No.	10232	10233	10234	10235	10236	10237	10238	10239	10240	10241	10242	10243	10244	10245	
from	66.0	67.0	68.0	69.0	70.0	71.0	72.0	73.0	74.0	75.0	76.0	77.0	78.0	79.0	
to	67.0	68.0	69.0	70.0	71.0	72.0	73.0	74.0	75.0	76.0	77.0	78.0	79.0	80.0	
(wt%)															
SiO2	71.45	70.61	72.56	72.14	71.47	68.23	68.06	69.46	65.38	69.08	69.66	68.05	69.55	69.37	
Al2O3	10.85	10.28	9.28	10.12	10.40	10.04	9.43	9.12	8.61	8.17	9.44	10.41	9.98	10.67	
Fe2O3(T)	4.07	7.05	5.51	5.09	3.95	5.59	5.16	4.00	4.86	7.34	2.75	4.64	3.82	4.25	
MnO	0.13	0.09	0.10	0.09	0.05	0.08	0.09	0.10	0.11	0.05	0.12	0.21	0.12	0.13	
MgO	0.03	0.04	0.08	0.09	0.04	0.08	0.08	0.07	0.10	0.06	0.04	0.07	0.04	0.04	
CaO	2.44	1.15	2.30	2.05	2.16	3.34	3.93	4.13	7.02	3.86	5.34	3.52	3.90	3.22	
Na2O	3.02	2.16	1.67	1.89	2.36	1.74	1.99	2.00	0.94	1.56	2.53	3.34	3.39	3.11	
K2O	4.63	4.77	4.63	4.89	5.15	4.96	4.67	4.57	4.84	4.08	4.39	4.45	3.95	4.91	
TiO2	0.12	0.12	0.10	0.13	0.13	0.12	0.11	0.13	0.11	0.10	0.12	0.16	0.11	0.14	
P2O5	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	0.01	0.01	<0.01	
LOI	2.43	2.07	3.02	2.55	2.05	3.54	3.55	3.71	5.27	3.03	4.52	3.85	3.23	3.15	
Total	99.17	98.35	99.27	99.04	97.76	97.73	97.09	97.28	97.24	97.34	98.91	98.71	98.11	98.99	
(ppm)															
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Be	27	30	151	64	44	109	59	27	40	28	28	27	23	30	
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Cu	< 10	< 10	<10	< 10	< 10	< 10	< 10	< 10	<10	< 10	< 10	<10	< 10	<10	
Zn	70	130	100	90	70	70	100	100	120	60	60	210	140	250	
Ga	62	62	58	64	63	62	66	57	60	48	57	67	61	64	
Ge	4	5	6	5	6	6	6	5	5	4	4	4	4	4	
As	6	<5	7	8	9	8	<5	7	8	6	6	<5	6	6	
Rb	301	302	310	327	353	336	327	2%	298	245	308	326	282	349	
Sr	39	29	43	48	56	67	52	68	72	50	72	80	70	66	
Zr	2909	2817	1821	2159	3154	2384	2887	2662	3391	2904	2495	2095	3123	2963	
Nb	380	381	353	335	483	459	394	405	451	394	448	580	357	562	
Mo	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Ag	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Sn	41	33	33	31	29	23	37	27	41	23	23	38	31	32	
Sb	0.7	<0.5	0.5	0.8	0.9	0.6	0.8	0.8	0.8	0.7	0.6	1.3	1	0.9	
Cs	0.8	1.4	1	1	0.8	1.3	1.3	0.6	0.9	<0.5	<0.5	0.5	<0.5	<0.5	
Ba	23	33	32	37	30	33	35	36	53	41	32	32	24	30	
Hf	65	59	42.1	52.8	73.7	54.8	82.6	62.2	88.2	61.8	57.8	58.2	72.3	65.3	
Ta	27.5	28.6	253	29.6	36.7	35.6	29.3	30.4	34.9	26.7	34.9	37.3	27	42.4	
W	1	< 1	< 1	2	9	<1	11	<1	1	2	<1	2	10	1	
Tl	0.3	0.4	0.2	0.5	0.2	0.3	0.5	0.2	0.2	0.1	0.2	0.5	0.2	0.2	
Pb	12	17	9	13	21	13	15	12	9	12	11	14	12	21	
Th	44.9	49.8	54	54.3	52.1	57.3	52.8	50.3	57.4	37	56.9	57.5	48.7	52.3	
U	14.1	15.4	13.4	15	18.5	18.6	19.6	16.5	19.4	16.2	18	17.2	16.6	20.3	
Bi	0.4	<0.4	<0.4	<0.4	0.6	<0.4	0.5	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
Y	375	388	335	375	395	408	374	359	361	337	348	364	356	416	
La	764	738	751	905	834	882	806	835	824	749	858	704	660	777	
Ce	1440	1380	1450	1760	1560	1700	1650	1590	1600	1300	1520	1320	1200	1430	
Pr	166	159	171	210	183	200	191	185	188	147	172	150	137	162	
Nd	651	634	690	831	729	801	796	748	748	575	669	593	531	631	
Sm	114	111	122	147	129	138	134	125	125	104	125	113	103	122	
Eu	6.35	6.33	7.21	8.47	7.42	8.39	7.62	6.95	6.93	5.08	5.72	5.03	5.01	6.48	
Gd	89.8	86.8	94.9	119	102	108	107	99.5	99.2	82.3	102	97.4	84.2	101	
Tb	11.8	11.4	11.8	14.8	13.1	14.4	13.2	12.7	13.6	10.5	12.7	13	11.3	13.8	
Dy	64.1	65.3	61.4	74.1	71.2	74.3	69.3	67.8	71.9	56	66.1	70.7	61.6	74.2	
Ho	12.1	12.4	10.9	14	13.5	13.9	13.3	12.6	13.5	10.6	12.1	13	12	13.8	
Er	33.6	34.6	27.9	35.6	38.3	38.8	41.9	34.3	37.3	29.6	33.3	37.3	35.4	37.9	
Tm	5.11	5.34	3.77	5.45	5.96	5.91	6.21	5.14	5.48	4.59	5.17	5.34	5.55	5.78	
Yb	31.5	31.5	21.9	32.4	37.1	35.9	37.8	30.6	31.8	27.1	31.7	32.3	32.6	34.4	
Lu	4.04	4.19	2.73	4.31	5	4.64	4.94	4.21	4.27	3.79	4.4	4.41	4.42	4.62	
TREE	3616.6	3527.5	3855.8	4350.9	3975.5	4262.2	4087.3	3958.4	3974.8	3311.1	2960.7	3377.5	3106.5	3681.7	

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite												
Sample No.	10246	10247	10248	10249	10250	10251	10252	10253	10254	10256	10257	10258	10259	10260
from	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0	91.0	92.0	93.0
to	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0	91.0	92.0	93.0	94.0
(wt%)														
SiO ₂	68.76	69.23	69.33	72.28	71.15	70.34	68.99	69.52	68.91	67.03	71.45	73.08	74.61	75.84
Al ₂ O ₃	9.91	10.42	11.20	9.78	10.17	10.21	9.53	10.30	9.87	10.42	8.03	9.20	10.12	9.08
Fe ₂ O ₃ (T)	5.23	4.00	4.34	4.91	5.33	5.33	5.00	3.72	3.95	2.95	5.28	3.76	3.66	3.82
MnO	0.14	0.11	0.17	0.12	0.08	0.12	0.14	0.08	0.13	0.13	0.07	0.07	0.05	0.06
MgO	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.06	0.04	0.06	0.06	0.05	0.03
CaO	2.75	3.33	3.08	2.43	1.98	2.41	3.84	4.07	4.83	5.43	4.25	3.13	2.21	2.54
Na ₂ O	2.99	3.12	3.73	2.81	2.80	3.01	2.54	2.73	2.53	2.71	1.45	1.55	2.21	2.44
K ₂ O	4.61	4.77	4.49	4.39	4.62	4.57	4.46	4.84	4.37	5.08	4.46	4.87	5.01	4.24
TiO ₂	0.12	0.14	0.13	0.12	0.15	0.14	0.15	0.11	0.13	0.13	0.08	0.08	0.09	0.14
P ₂ O ₅	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
LOI	2.75	3.00	2.96	2.30	1.89	2.28	3.20	3.28	3.98	4.14	3.23	2.72	1.94	1.92
Total	97.30	98.16	99.46	99.18	98.21	98.45	97.91	98.70	98.78	98.09	98.37	98.52	99.95	100.10
(ppm)														
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	32	36	22	20	25	40	24	38	45	29	36	24	22	17
V	<5	<5	<5	<5	<5	<5	<5	5	<5	<5	<5	<5	<5	<5
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu	< 10	<10	<10	<10	<10	<10	<10	<10	<10	< 10	< 10	< 10	< 10	< 10
Zn	300	170	250	150	120	210	170	50	60	70	120	90	70	100
Ga	65	67	72	58	58	61	62	66	62	64	49	55	54	54
Ge	4	4	4	5	4	5	4	5	4	4	5	4	4	4
As	<5	<5	<5	6	7	8	<5	8	7	8	<5	<5	6	<5
Rb	338	355	332	324	339	329	334	359	320	364	298	348	353	320
Sr	55	56	62	42	35	45	52	48	50	69	38	39	48	55
Zr	4020	3421	2886	3252	3509	3654	3151	2462	2906	3473	3438	3091	3359	2960
Nb	444	615	470	417	582	433	555	438	418	475	471	371	519	487
Mo	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	<2	<2
Ag	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	36	32	36	34	28	43	35	40	30	39	26	37	25	37
Sb	1.3	1.5	1.2	1.3	1.3	1.2	1.4	0.8	1.1	0.9	0.7	0.7	1	1.3
Cs	0.5	0.6	0.5	0.6	0.7	0.7	0.7	0.6	0.7	0.6	1.1	1.3	1	1.1
Ba	27	27	23	25	30	30	25	23	23	30	37	38	33	30
Hf	110	98.9	80.9	74.1	78.4	81.9	84.8	57.8	66.2	83.5	81.5	69.6	71.4	81.3
Ta	37.4	43	32.4	28.9	36.3	27.8	35.6	33.5	32.3	35	35.4	28.6	39.1	36.2
W	2	3	2	< 1	9	< 1	3	3	1	6	< 1	< 1	< 1	3
Tl	0.5	0.5	0.5	0.2	0.2	0.2	0.5	0.3	0.2	0.3	0.2	0.3	0.3	0.5
Pb	17	18	23	22	21	34	23	9	9	10	8	8	10	21
Th	50.3	48.9	50.4	63.8	53.2	80.4	75.6	73.3	54.8	51.3	43.1	48	57.3	50.5
U	22.4	23.7	20.2	16.1	18.3	17.9	20.7	17.6	18.7	18.5	16.6	17.2	18.1	19.5
Bi	0.5	<0.4	0.4	<0.4	0.6	<0.4	0.4	<0.4	<0.4	0.5	<0.4	0.5	<0.4	0.6
Y	367	387	377	393	440	455	501	430	408	391	314	334	332	322
La	703	701	649	586	619	604	666	907	798	835	566	606	572	575
Ce	1350	1370	1290	1140	1210	1170	1310	1710	1500	1570	983	956	914	873
Pr	153	157	147	134	140	137	151	198	173	182	111	104	100	98.4
Nd	611	641	593	540	557	546	612	806	697	730	443	405	385	382
Sm	117	121	111	101	102	105	110	137	119	122	78.8	70.7	70.9	70.3
Eu	6.01	6.3	5.99	5.76	5.86	6.26	5.8	6.91	6.05	6.12	4.42	4	3.79	3.73
Gd	97.4	103	92	84	83.4	89.4	94.5	112	94.1	96.5	66.2	61.6	60.9	61.5
Tb	12.8	13.5	12.2	12.2	12	13.7	14	14.7	12.9	12.8	9.5	9.7	9.6	9.7
Dy	67.8	74.5	68.2	69.5	71	80.4	86.2	80	70.9	71	55	58.6	55.9	57.9
Ho	12.4	14.2	13.3	13.7	14.5	15.8	17.8	14.7	13.6	13.4	10.8	11.9	11.1	11.7
Er	36.6	44	38.7	38.3	44.3	44	56.1	38.7	38.8	37.9	31.4	34.4	32.4	36.5
Tm	5.29	6.63	5.78	6.05	7.55	6.9	8.44	5.71	5.91	5.87	5.09	5.45	5.1	5.63
Yb	33	41.4	35.6	37	47.7	41.5	50.5	33.3	34.8	35.9	30.8	33.4	31.2	34.8
Lu	4.34	5.59	4.82	4.98	6.79	5.56	6.55	4.27	4.58	4.95	4.22	4.68	4.2	4.74
TREE	3437.1	3520.4	3301.9	3030.8	3212.5	3183.6	3514.6	4331.6	3817.1	3957.7	2603.5	2582.3	2502.5	2455.7

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite												
Sample No.	10261	10262	10263	10264	10265	10266	10267	10268	10269	10270	10271	10272	10273	10274
from	94.0	95.0	96.0	97.0	98.0	99.0	100.0	101.0	102.0	103.0	104.0	105.0	106.0	107.0
to	95.0	96.0	97.0	98.0	99.0	100.0	101.0	102.0	103.0	104.0	105.0	106.0	107.0	108.0
(wt%)														
SiO ₂	70.85	69.23	69.89	72.72	70.50	69.54	70.87	71.15	71.64	68.30	71.25	71.61	72.07	70.91
Al ₂ O ₃	11.79	12.18	11.85	9.84	9.92	9.65	9.33	10.40	10.99	10.74	11.46	11.62	10.71	10.98
Fe ₂ O ₃ (T)	4.42	3.30	3.77	3.65	5.74	5.16	3.36	4.06	3.28	4.28	2.78	3.07	4.19	4.32
MnO	0.07	0.09	0.10	0.07	0.13	0.17	0.10	0.06	0.06	0.10	0.05	0.04	0.06	0.07
MgO	0.06	0.04	0.03	0.03	0.05	0.07	0.05	0.06	0.04	0.07	0.04	0.05	0.06	0.06
CaO	2.25	2.55	1.65	1.94	1.88	4.95	4.71	2.90	2.51	3.42	2.12	2.47	1.79	2.29
Na ₂ O	2.80	3.34	3.31	2.55	2.54	1.89	2.27	2.40	2.61	2.01	2.97	2.99	2.26	2.54
K ₂ O	5.47	5.51	5.11	4.69	4.39	4.51	4.19	4.62	5.00	5.34	5.10	4.99	4.74	4.69
TiO ₂	0.15	0.08	0.09	0.11	0.14	0.13	0.15	0.09	0.11	0.11	0.08	0.10	0.10	0.12
P ₂ O ₅	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
LOI	2.27	2.47	1.85	1.74	2.26	4.02	3.07	2.23	2.06	3.15	1.89	1.54	1.90	2.40
Total	100.20	98.79	97.66	97.35	97.55	100.10	98.08	97.97	98.31	97.52	97.74	98.50	97.88	98.39
(ppm)														
Sc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Be	23	18	27	28	39	25	28	37	32	36	21	104	95	44
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr	<20	<20	30	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu	<10	<10	<10	<10	<10	70	<10	<10	<10	<10	<10	<10	<10	<10
Zn	130	280	260	220	330	290	280	270	230	210	260	230	210	210
Ga	70	69	72	58	60	59	57	62	66	64	70	70	65	68
Ge	4	3	3	3	4	4	3	3	3	3	3	3	4	4
As	<5	<5	5	6	<5	6	6	5	<5	6	<5	6	6	7
Rb	402	424	412	373	346	359	345	372	387	412	398	393	364	372
Sr	67	76	65	53	69	88	75	56	52	56	60	69	68	66
Zr	1723	3241	2933	3008	2945	3161	2972	3181	1928	3152	3787	3302	2165	2486
Nb	449	419	387	443	526	469	484	417	439	453	501	486	427	436
Mo	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ag	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	41	28	34	27	34	41	37	33	48	33	28	33	29	37
Sb	1	0.8	1.4	13	2.2	1.8	1.7	1.3	1.4	1.4	1.6	1.4	1.4	1.6
Cs	14	1.2	1.1	1.1	1	0.9	0.9	0.9	1	1	1.1	1	1	0.9
Ba	29	29	30	31	27	27	21	19	21	27	21	20	27	19
Hf	46.2	74.1	69.8	66.2	76.6	73.8	74.3	78.2	54.6	76.6	104	81.4	53.1	63.1
Ta	31.8	29.5	29.9	39.3	35	32.5	35	29.1	28.2	31.7	37.3	32.5	30.6	31.6
W	2	<1	6	2	3	3	2	2	4	2	2	3	3	3
Tl	0.7	0.4	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6
Pb	16	11	16	24	23	19	16	12	13	15	13	13	12	12
Th	76.1	49.9	56.4	59.6	49.9	53.5	598	42.2	70.5	55.1	40.2	53.2	66.4	49.7
U	18.2	18.3	15.6	18.3	18	196	19.4	19.8	17.8	22.8	24.3	19.3	15.4	14.7
Bi	<0.4	<0.4	<0.4	<0.4	0.4	<0.4	0.4	0.5	0.4	0.4	0.6	<0.4	<0.4	0.4
Y	389	354	324	423	335	351	374	362	339	375	386	405	339	366
La	718	676	618	542	601	594	571	559	639	613	679	669	671	782
Ce	1150	1040	983	883	932	981	957	933	1030	1020	1090	1110	1150	1330
Pr	126	112	105	95	105	106	105	101	115	112	121	122	125	146
Nd	502	431	407	367	408	413	405	392	461	445	474	476	494	575
Sm	92.3	77.3	73.3	70.1	74	75.4	74.5	69.8	84.7	79.6	82.6	83.9	87.8	101
Eu	4.99	4.43	4.06	4.03	4.03	4.5	4.52	4.18	4.74	4.69	4.38	4.85	4.85	5.48
Gd	82.4	66	66	67	64.5	68.4	69.1	63.8	75.8	71.6	70.5	76.2	76.3	87
Tb	12.8	10.2	10.6	11.8	9.7	11	11.2	10.2	11.6	11.4	10.4	11.7	11.7	12.8
Dy	71.1	61.9	63.2	73.2	58.2	64	65.8	61	64	66.7	62.4	69.1	66.6	71.3
Ho	13.5	12.4	12.5	15	11.9	12.6	13.3	12.4	11.7	13.4	13.1	13.4	11.8	13.1
Er	37.9	35.8	34.3	42.7	36.9	34.4	37.5	36.2	33	37.4	41.3	40.5	31.6	32.8
Tm	5.18	5.64	5.6	6.78	5.67	5.38	6.1	5.82	4.64	5.65	6.32	6.88	4.91	5.06
Yb	29.9	34	34.4	43.6	35.2	34.5	38.2	36.7	26.8	37.5	40.1	41.7	29.8	30.1
Lu	3.62	4.73	4.64	5.81	4.77	4.77	5.24	4.93	3.48	5.07	5.38	5.52	4.05	4.19
TREE	3095.3	2803.8	2639.0	2527.9	2588.9	2829.5	3162.4	2498.1	2807.9	2776.9	2955.1	2992.4	2999.7	3417.5

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite													
Sample No.	10275	10276	10277	10278	10279	10280	10281	10282	10283	10284	10285	10286	10287	10288	
from	108.0	109.0	110.0	111.0	112.0	113.4	114.0	115.0	116.0	117.0	118.0	119.0	120.0	121.0	
to	109.0	110.0	111.0	112.0	112.6	114.0	115.0	116.0	117.0	118.0	119.0	120.0	121.0	122.0	
(wt%)															
SiO2	73.15	75.08	72.07	72.84	74.71	71.19	74.96	72.47	74.05	74.59	75.03	71.09	70.98	73.43	
Al2O3	11.30	8.11	12.18	11.01	10.80	10.46	9.67	10.11	9.58	10.08	10.35	10.35	9.34	10.17	
Fe2O3(T)	3.53	4.52	3.17	3.50	3.27	5.06	4.35	3.90	3.99	4.06	3.28	4.68	4.94	3.38	
MnO	0.08	0.09	0.07	0.07	0.07	0.07	0.06	0.06	0.11	0.10	0.09	0.18	0.19	0.10	
MgO	0.04	0.04	0.03	0.04	0.04	0.07	0.07	0.06	0.04	0.04	0.04	0.05	0.04	0.04	
CaO	1.67	2.18	1.76	1.60	1.72	2.11	1.75	2.00	1.25	1.94	1.98	2.59	2.25	2.94	
Na2O	2.85	1.48	3.51	2.96	2.72	1.65	1.87	2.31	2.64	2.62	2.76	2.99	2.40	2.99	
K2O	5.18	3.93	5.01	4.69	4.39	5.29	4.24	4.51	4.17	4.33	4.72	4.48	4.34	4.48	
TiO2	0.09	0.13	0.10	0.11	0.10	0.08	0.16	0.09	0.12	0.12	0.10	0.15	0.12	0.17	
P2O5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
LOI	1.68	2.30	1.54	1.46	1.93	2.43	2.03	2.09	1.85	2.21	2.11	3.14	2.56	2.53	
Total	99.56	97.88	99.44	98.28	99.77	98.42	99.16	97.60	97.80	100.10	100.50	99.71	97.17	100.20	
(ppm)															
Sc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Be	25	31	25	22	28	28	29	26	19	43	36	24	41	45	
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Co	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Cu	<10	<10	<10	<10	<10	<10	<10	<10	20	<10	10	110	20	30	
Zn	170	250	170	240	230	350	300	290	380	280	230	440	500	360	
Ga	64	48	73	67	66	62	55	56	59	62	66	60	59	65	
Ge	3	4	4	4	4	4	3	4	4	3	3	4	4	3	
As	7	8	7	6	5	8	7	7	7	<5	<5	6	7	<5	
Rb	393	317	396	372	349	406	339	331	326	316	359	305	301	323	
Sr	52	53	56	49	45	53	46	51	52	51	62	77	57	126	
Zr	3492	3112	2803	2231	2235	4412	2338	2497	3103	2080	2212	1516	1852	2119	
Nb	470	406	448	502	344	647	466	453	421	488	467	329	266	423	
Mo	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Ag	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Sn	23	37	26	26	35	30	49	38	25	28	38	38	35	40	
Sb	1.8	1.9	1.8	1.2	1.1	1.6	1.5	1.3	1.4	1.2	1.6	9	0.9	1.1	
Cs	1	0.8	1	0.9	0.8	1.1	0.8	0.9	0.8	0.9	0.9	0.7	0.8	0.9	
Ba	20	24	19	18	19	21	20	18	17	15	15	17	24	18	
Hf	76.3	76.7	66.8	54	54.7	103	56.7	57.6	74	54.5	62.5	34.4	43.3	59.4	
Ta	33.8	29.5	33.8	38.1	24	50.8	356	332	34.7	34.9	34.5	21.3	23	30.7	
W	2	4	2	2	1	2	3	5	2	2	3	3	1	1	
Tl	0.6	0.5	0.6	0.6	0.5	1	0.7	0.6	0.5	0.5	0.6	0.5	0.5	0.6	
Pb	16	22	17	15	12	16	14	12	12	10	9	6	9	11	
Th	464	62.4	49.4	57.6	47.4	38.2	508	66.5	41.6	45	689	67.2	59.1	58.3	
U	17.3	17.1	172	17.3	13	33.5	199	17.7	16.1	17.3	16.8	10.5	13	13.4	
Bi	0.4	0.5	<0.4	0.4	<0.4	6	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
Y	403	354	409	361	327	394	293	401	351	369	410	420	401	428	
La	568	564	765	697	735	785	677	791	751	739	842	967	792	851	
Ce	1010	1020	1290	1170	1210	1240	1090	1260	1230	1230	1410	1530	1310	1430	
Pr	112	114	142	128	133	131	117	138	134	133	154	167	145	157	
Nd	439	447	562	501	529	507	450	530	523	533	613	659	579	640	
Sm	82.2	88.8	98	88.5	90.5	83.1	76	91.6	88.8	91.9	106	114	105	110	
Eu	4.62	5.23	5.41	4.74	4.93	4.49	4.22	5.09	4.91	5.12	5.79	6.48	6.16	6.16	
Gd	73.5	78.6	85.5	76.5	78.2	70.8	68.2	81.3	76.8	81.2	92.7	100	92.4	95.8	
Tb	11.7	12.3	13	12	11.4	10.3	9.7	12.2	11.3	11.7	134	14.6	13.7	13.9	
Dy	67.8	68.5	74.2	69.4	61.7	60.2	51.6	69.5	64.4	654	76.1	75.9	74.4	75.8	
Ho	13.2	12.4	13.8	13	11.2	12.2	9.6	13	12.5	12.6	14.5	13.3	13.7	14.3	
Er	37.9	33.6	40.6	36.8	30.3	41.3	26.4	38.3	36.3	37.3	42.6	34.2	35.9	40.3	
Tm	6.5	5.4	671	6.15	4.79	6.87	3.96	5.74	5.9	5.47	6.03	4.66	5.09	5.67	
Yb	41.7	33	40.6	37.2	28.2	44.2	24.6	32.5	36.3	33.2	33.9	25.7	29.6	34.1	
Lu	5.84	4.66	5.5	5.04	3.82	6.16	3.31	4.24	5.13	4.41	4.41	3.42	3.81	4.5	
TREE	3152.9	2729.0	3512.4	3081.2	3127.3	3241.3	3787.9	3650.5	3173.5	3210.7	4293.7	3972.0	3443.8	3737.2	

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite												
Sample No.	10289	10290	10291	10292	10293	10294	10296	10297	10298	10299	10300	10301	10302	10303
from	122.0	123.0	124.0	125.0	126.0	127.0	128.0	129.0	130.0	131.0	132.0	133.0	134.0	135.0
to	123.0	124.0	125.0	126.0	127.0	128.0	129.0	130.0	131.0	132.0	133.0	134.0	135.0	136.0
(wt%)														
SiO ₂	71.24	71.72	70.43	70.92	70.26	70.42	70.58	67.70	71.15	71.68	68.26	68.89	72.00	71.30
Al ₂ O ₃	10.32	10.71	12.09	11.28	12.15	12.72	10.90	12.81	11.67	10.32	11.96	11.19	9.70	10.86
Fe ₂ O ₃ (T)	5.67	4.50	3.77	5.22	4.56	3.59	3.72	2.67	3.03	2.86	3.53	3.83	3.19	3.93
MnO	0.15	0.12	0.11	0.13	0.13	0.10	0.10	0.08	0.10	0.10	0.09	0.09	0.09	0.09
MgO	0.04	0.04	0.03	0.03	0.04	0.06	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.02
CaO	2.37	2.39	2.28	1.38	2.03	2.33	2.96	2.73	2.85	4.53	2.33	4.08	3.90	1.75
Na ₂ O	3.16	3.27	3.41	3.54	3.53	3.74	3.08	3.89	3.09	2.99	3.41	3.34	2.62	3.08
K ₂ O	4.47	4.69	5.62	4.47	5.32	4.99	4.68	5.12	5.28	4.77	5.20	4.08	4.24	4.77
TiO ₂	0.16	0.12	0.10	0.10	0.12	0.10	0.15	0.11	0.11	0.11	0.11	0.10	0.10	0.09
P ₂ O ₅	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
LOI	2.65	2.68	2.52	2.14	2.35	2.37	2.36	2.32	2.69	3.27	2.48	2.67	2.81	1.88
Total	100.20	100.20	100.40	99.20	100.50	100.40	98.58	97.47	100.00	100.70	97.41	98.29	98.68	97.78
(ppm)														
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	31	44	85	21	103	276	35	22	34	23	28	13	13	15
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	20	<20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu	50	10	< 10	< 10	< 10	<10	20	<10	<10	<10	<10	<10	<10	<10
Zn	550	410	390	360	360	290	270	140	210	130	240	220	190	230
Ga	63	65	71	64	70	68	64	70	72	65	66	60	58	60
Ge	5	3	3	4	3	3	4	3	3	4	3	3	3	4
As	9	<5	<5	7	6	7	7	<5	<5	5	6	6	<5	6
Rb	309	323	390	344	370	322	343	345	371	342	352	272	293	336
Sr	89	107	79	57	100	78	105	83	86	91	85	73	76	55
Zr	2097	1812	1594	2043	2380	2385	3434	2453	2545	1880	2459	3599	3224	2780
Nb	404	364	430	272	349	304	453	392	465	325	381	516	419	440
Mo	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ag	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	40	46	31	32	33	33	29	30	58	44	33	28	29	21
Sb	1.2	1.1	1.1	1.4	1.2	0.8	1.7	1.3	1.5	0.6	1.4	1.5	1.3	1.4
Cs	0.9	0.9	1.2	0.9	0.9	0.9	1.1	1	1.1	0.8	1	0.7	0.8	0.9
Ba	20	17	16	13	21	26	22	20	21	18	21	25	18	19
Hf	51.4	51.3	44.6	44.8	57.7	55.3	83.3	56.3	74.2	50	59.1	80.4	91.8	65
Ta	29.4	25.2	28.9	20.6	24.5	23.5	35.3	29.8	33.4	23.7	27.8	37.8	31.3	32.5
W	2	2	2	3	1	3	< 1	< 1	1	< 1	4	1	2	1
Tl	0.4	0.5	0.6	0.5	0.6	0.5	0.6	0.6	0.6	0.4	0.5	0.4	0.5	0.5
Pb	14	10	10	12	12	9	17	13	13	9	11	15	14	17
Th	66.1	54.4	71.4	37.8	42.7	39.9	30.7	43.6	51.6	38.7	41.1	33.2	47.5	33.2
U	12.5	12.2	14.8	9.6	12.2	12.5	16.9	14.3	17.3	10	12.3	16.7	17.5	14.4
Bi	<0.4	<0.4	<0.4	<0.4	0.4	<0.4	0.6	<0.4	0.4	<0.4	0.4	0.5	0.5	0.5
Y	400	331	356	274	308	290	334	298	341	283	331	377	384	286
La	997	801	645	799	658	591	530	490	561	666	538	452	539	573
Ce	1600	1370	1110	1400	1140	1030	960	888	1060	1200	1000	871	1020	1030
Pr	177	151	127	156	127	115	108	99.9	119	137	114	99	116	117
Nd	702	607	511	620	505	452	415	386	461	539	442	384	466	458
Sm	119	103	94.4	100	85.1	77.9	77.8	72.4	87.9	97.8	85	73.3	88	81.8
Eu	6.68	5.22	5.26	5	4.5	4.27	4.54	4.15	4.79	4.97	4.79	4.41	4.86	4.48
Gd	103	84.4	82.5	81	71.3	66.3	66.8	62.7	77.4	78	74	65.5	76.6	68.7
Tb	14.3	11.6	12.4	10	10.3	9.4	10.3	9.8	11.3	10.3	11	10.4	11.3	9.4
Dy	76.4	63	68.9	50.8	56.8	51.1	58.6	54.2	61.7	52.2	60	59.5	64.7	51.8
Ho	13.3	11.3	12.9	9.4	10.8	9.5	11.9	10.5	11.8	8.8	11.4	12.3	13.2	10.2
Er	34.8	30.7	35.5	24.6	28.1	26.1	34.9	28.8	34.5	23.2	31.3	38.2	41	30.2
Tm	5.02	4.02	4.75	3.46	4.27	3.82	6.03	4.71	5.08	3	5.24	6.31	6.19	5.06
Yb	29.3	22.6	27.2	20	26.8	22.6	40.2	29.9	30.8	16.8	32.7	40.4	37.1	32.6
Lu	3.97	2.86	3.42	2.73	3.56	3.09	5.74	4.14	3.96	2.28	4.4	5.69	5	4.63
TREE	4126.1	3472.5	2932.1	3437.5	2921.0	2648.6	2530.4	2339.8	2752.0	3009.6	2611.9	2365.3	2731.2	2635.0

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite													
Sample No.	10304	10305	10306	10307	10308	10309	10310	10311	10312	10313	10314	10315	10316	10317	
from	136.0	137.0	138.0	140.4	141.0	142.0	143.4	144.0	145.0	146.0	147.0	148.0	149.0	150.0	
to	137.0	138.0	138.8	141.0	142.0	143.2	144.0	145.0	146.0	147.0	148.0	149.0	150.0	151.0	
(wt%)															
SiO2	69.57	71.57	69.19	72.10	68.84	69.43	69.70	72.65	70.34	69.55	69.98	69.04	69.34	70.45	
Al2O3	12.73	10.51	11.43	11.16	12.40	10.81	12.36	9.70	11.03	12.76	12.75	11.43	11.03	12.46	
Fe2O3(T)	3.05	4.24	4.55	4.46	3.74	2.81	2.01	2.54	3.32	2.73	2.77	3.27	2.91	3.27	
MnO	0.09	0.10	0.13	0.09	0.07	0.10	0.06	0.03	0.06	0.06	0.04	0.10	0.09	0.09	
MgO	0.03	0.03	0.04	0.05	0.06	0.04	0.01	0.01	0.03	0.02	0.03	0.04	0.03	0.03	
CaO	3.04	1.87	2.29	2.02	2.93	4.75	2.33	3.25	2.47	1.82	2.65	2.72	4.73	2.22	
Na2O	3.08	2.67	2.43	2.81	2.63	2.65	3.93	3.06	3.26	3.81	3.83	3.57	3.29	3.90	
K2O	5.57	4.69	4.99	4.57	5.22	4.30	5.08	4.16	4.54	5.31	5.34	4.89	4.52	5.15	
TiO2	0.09	0.09	0.16	0.11	0.07	0.07	0.08	0.08	0.10	0.08	0.06	0.07	0.10	0.10	
P2O5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
LOI	2.89	2.31	3.06	2.62	3.28	4.25	2.00	1.93	2.07	1.78	1.78	2.85	3.36	2.28	
Total	100.10	98.08	98.28	99.99	99.24	99.20	97.58	97.42	97.22	97.91	99.23	97.98	99.39	99.94	
(ppm)															
Sc	< 1	< 1	< 1	< 1	< 1	<]	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Be	15	31	46	11	24	82	12	19	28	14	22	34	31	28	
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Cu	<10	<10	<10	<10	<10	<10	< 10	<10	< 10	<10	< 10	< 10	<10	<10	
Zn	230	260	300	290	200	100	80	60	160	120	110	140	130	150	
Ga	68	61	63	72	75	64	71	55	68	78	75	69	62	70	
Ge	4	4	4	5	3	4	4	4	4	4	4	4	3	3	
As	5	7	6	6	<5	6	5	8	7	<5	6	8	<5	5	
Rb	385	346	341	327	356	307	358	282	320	365	354	341	303	346	
Sr	61	66	57	67	61	125	64	64	77	53	77	127	112	77	
Zr	2099	4229	2375	2136	1843	2306	2996	2072	2023	2310	2023	3089	1736	3028	
Nb	351	421	378	380	316	317	381	289	242	288	262	442	429	391	
Mo	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Ag	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Sn	32	31	30	21	29	19	15	27	23	27	26	29	21	28	
Sb	1.2	1.4	1.2	1	1.3	0.7	0.9	1.1	0.8	1	0.8	14	1.3	1.7	
Cs	0.9	0.9	0.9	0.8	0.8	0.7	1	0.7	0.7	0.8	0.8	0.8	0.7	0.8	
Ba	22	21	23	28	28	22	20	16	19	18	22	18	18	17	
Hf	50.2	106	55.7	48.1	49.1	53.8	65.2	53.9	46.1	60	50	70.8	40.3	724	
Ta	24.9	32.4	30.2	28.6	24.1	23.9	30.1	24.6	20.1	22.7	20.9	31	31.7	286	
W	< 1	1	1	2	3	< 1	< 1	2	< 1	< 1	< 1	2	3	< 1	
Tl	0.5	0.5	0.5	0.6	0.5	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.5	
Pb	14	14	13	12	8	10	12	10	10	11	9	12	12	15	
Th	37.7	46.9	42.9	53.5	45.8	29.3	29.2	34.7	30.1	29.1	33.4	28.1	32.9	33	
U	13.4	18.8	16.8	16.9	14.2	11.5	16.2	11.8	9.7	11	9.7	15.6	13.9	14.5	
Bi	0.5	0.6	<0.4	<0.4	<0.4	0.4	0.6	0.4	<0.4	0.4	<0.4	0.4	<0.4	0.5	
Y	286	381	335	358	296	281	317	299	285	281	289	336	257	268	
La	604	711	722	652	554	532	523	672	724	761	723	826	751	906	
Ce	1080	1340	1340	1360	1180	1140	1130	1370	1590	1720	1560	1550	1230	1160	
Pr	123	155	153	164	146	139	138	166	192	207	178	165	126	109	
Nd	491	633	618	675	628	586	576	680	827	909	760	684	496	411	
Sm	83.4	107	105	115	104	94.9	92.6	104	120	122	104	88.7	74.4	64.1	
Eu	4.3	6.24	5.67	7.11	6.28	5.43	5.18	5.7	5.82	5.68	5	4.5	3.82	3.47	
Gd	70.3	86.4	85.1	88.4	81.2	72.1	70.9	82.6	91.5	92.8	80.8	73.8	60.5	55.1	
Tb	9.8	11.9	11.5	11.3	10.1	8.6	8.6	9.7	10	9.7	9.3	88	7.9	7.6	
Dy	52.7	68	62.9	61.3	54.2	45.1	46.9	50.6	49	48.8	49	50.3	41.9	42.6	
Ho	10	13.7	11.9	11.6	9.7	8.6	9.6	9.3	8.5	8.6	8.6	10.2	7.6	8.6	
Er	29	41.8	34	33.3	27	25.3	30.5	26.4	23.8	25.1	23.5	32.1	22.4	26.4	
Tm	4.5	6.69	5.37	4.91	3.69	3.58	4.64	3.94	2.96	3.14	3.2	4.93	3.35	3.93	
Yb	27.3	40.4	33.4	30.7	21	21.4	30.7	22.8	17.6	18.4	18.6	30.9	19.6	23.7	
Lu	3.81	5.47	4.64	4.22	2.68	3.04	4.38	3.12	2.35	2.38	2.45	4.23	2.84	3.2	
TREE	2762.7	3447.4	3383.1	3444.7	3009.9	2853.8	2870.4	3380.7	3814.1	4080.4	3692.5	3743.8	3032.1	3192.5	

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite													
Sample No.	10318	10319	10320	10321	10322	10323	10324	10325	10326	10327	10328	10329	10330	10331	
from	151.0	152.0	153.0	154.0	155.0	156.0	157.0	158.0	159.0	160.0	161.0	162.0	163.0	164.0	
to	152.0	153.0	154.0	155.0	156.0	157.0	158.0	159.0	160.0	161.0	162.0	163.0	164.0	165.0	
(wt%)															
SiO2	68.93	63.79	67.17	69.44	71.13	74.89	74.13	73.67	72.57	74.02	75.88	72.07	73.47	68.27	
Al2O3	11.78	8.94	12.66	10.65	11.19	11.51	11.41	10.08	10.82	10.63	10.42	10.80	9.69	9.16	
Fe2O3(T)	2.93	1.86	1.82	2.71	2.28	2.55	2.29	3.70	2.89	2.31	3.03	2.37	2.83	3.20	
MnO	0.07	0.04	0.08	0.10	0.08	0.07	0.08	0.11	0.09	0.07	0.07	0.08	0.06	0.06	
MgO	0.03	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.03	
CaO	4.02	12.89	4.73	5.97	3.04	1.67	2.49	1.12	1.84	2.79	2.03	2.56	3.97	8.43	
Na2O	3.73	2.79	3.76	3.39	3.37	3.55	3.70	3.28	3.52	3.36	3.19	3.61	3.19	2.80	
K2O	4.95	3.92	5.27	4.58	4.58	4.66	4.44	4.33	4.56	4.46	4.20	4.19	3.82	3.71	
TiO2	0.12	0.09	0.11	0.12	0.12	0.13	0.12	0.10	0.10	0.09	0.09	0.09	0.12	0.13	
P2O5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	0.01	
LOI	3.10	3.52	2.89	3.68	2.33	1.51	1.91	1.68	1.90	2.16	1.84	2.14	2.72	3.77	
Total	99.66	97.85	98.51	100.70	98.12	100.60	100.60	98.06	98.30	99.91	100.80	97.92	99.88	99.56	
(ppm)															
Sc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Be	27	10	17	30	12	13	15	15	11	13	21	18	18	30	
V	<5	7	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	
Cr	<20	<20	<20	<20	<20	<20	<20	30	<20	<20	<20	<20	<20	<20	
Co	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Cu	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	
Zn	130	50	60	140	no	110	110	270	140	120	200	110	100	120	
Ga	66	47	68	59	58	62	63	57	57	55	55	60	48	41	
Ge	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
As	5	<5	<5	<5	<5	<5	<5	6	6	<5	6	<5	9	<5	
Rb	313	238	327	278	293	305	295	299	319	296	279	275	227	221	
Sr	60	54	91	109	58	44	45	38	45	59	46	65	65	64	
Zr	2136	1652	1669	1981	2018	2320	1478	2460	3706	3493	1320	2064	2770	3048	
Nb	344	322	303	297	318	337	284	305	329	304	351	253	299	299	
Mo	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	6	<2	<2	<2	
Ag	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Sn	30	22	24	19	18	21	21	26	24	20	21	19	21	21	
Sb	1.2	1.3	1	1	1.1	0.9	0.9	1.3	1.5	1.1	0.6	0.8	0.8	1.1	
Cs	0.7	0.5	0.7	0.6	0.6	0.6	0.6	0.7	0.8	0.7	0.7	0.7	<0.5	<0.5	
Ba	20	15	19	19	16	15	14	15	15	18	20	21	24	26	
Hf	56.2	38.1	40.1	47.6	48.8	54.1	35.2	58.3	83.7	82	30	49.2	67.3	69.6	
Ta	25.3	22.6	21.9	20.3	24.1	25.6	21.1	24.4	27.6	25.3	21.9	19.9	23.2	21.4	
W	<1	2	<1	<1	11	<1	<1	3	1	<1	5	<1	1	7	
Tl	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.4	0.3	0.3	
Pb	10	9	8	10	11	13	12	25	14	11	13	13	14	13	
Th	46.2	28.6	38.2	26.6	25.6	24.1	25.4	24.3	12.1	14.2	41.3	33.4	29.6	39.7	
U	10	9	9.4	9	9.6	113	7.9	12.4	13	10.6	8.9	10.3	11.9	9.7	
Bi	0.4	<0.4	<0.4	<0.4	0.7	0.4	0.5	<0.4	0.5	0.4	<0.4	<0.4	<0.4	<0.4	
Y	255	198	239	238	200	221	183	159	214	202	206	236	220	280	
La	898	791	948	606	502	488	461	342	323	173	166	223	257	243	
Ce	1070	912	1180	856	751	739	709	562	570	347	338	450	513	474	
Pr	100	84.3	113	85.9	76	74.5	72.8	58.5	61.1	38.7	38.2	52.4	59	56.4	
Nd	369	297	398	304	266	263	261	214	226	148	146	205	227	212	
Sm	59.6	47.1	63.8	49.7	44.6	45.4	45.2	37.3	42.8	31.5	32.7	43.1	48.8	47.7	
Eu	3.36	2.57	3.53	2.57	2.42	2.61	2.39	1.92	2.46	1.86	2.05	2.5	2.69	2.84	
Gd	54.5	411	52.7	42.6	37.1	39.1	37.9	33.9	39.5	27.7	30.6	39.3	42.1	45.5	
Tb	8	5.4	7.3	6.4	5.7	5.9	5.5	4.9	5.3	4.6	5.6	6.4	6.6	7.9	
Dy	44.5	29	39.7	37.4	32.6	33.6	29.3	26.6	30.4	29	33.5	38.8	36.7	46.6	
Ho	8.3	5.5	7.6	7.6	6.7	6.8	5.6	5	6.4	6.2	6.5	8.2	7.3	9.9	
Er	23	17	22.6	23.5	21.5	22.1	16.1	14.6	21	22.3	20.2	27.1	23.5	30.6	
Tm	3.52	2.61	3.2	3.53	3.35	3.44	2.29	2.25	3.66	3.75	2.95	4.2	3.64	5.04	
Yb	22	15.9	19	23	21.6	21.7	14.3	13.4	24.4	25.9	17.6	26.1	23.5	32.3	
Lu	2.99	2.26	2.61	3.24	3.1	3.21	2.08	1.87	3.62	3.85	2.38	3.62	3.32	4.76	
TREE	2847.4	2403.6	2959.4	2208.5	1924.4	2010.0	1801.7	1464.3	1508.1	1004.0	1019.5	1289.0	1407.5	1385.6	

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite					Pegmatite	Granite				Pegmatite	Granite			
Sample No.		10332	10333	10334	10335	10336	10337	10338	10339	10340	10341	10342	10343	10344		
from		165.0	166.0	167.0	168.0	169.0	170.0	171.0	172.0	173.0	174.0	175.0	176.0	177.0		
to		166.0	167.0	168.0	169.0	170.0	171.0	172.0	173.0	174.0	175.0	176.0	177.0	178.0		
(wt%)																
SiO ₂		70.15	71.59	72.52	73.22	70.88	71.83	72.04	70.93	70.89	70.37	70.32	68.50	72.13		
Al ₂ O ₃		10.62	10.94	9.78	10.87	11.18	10.40	11.74	11.66	11.53	9.87	10.06	10.33	10.90		
Fe ₂ O ₃ (T)		4.49	4.10	3.27	4.28	4.56	5.12	4.45	4.25	4.54	3.92	2.99	3.09	3.58		
MnO		0.11	0.14	0.10	0.05	0.11	0.14	0.11	0.12	0.09	0.07	0.09	0.09	0.09		
MgO		0.02	0.03	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.03		
CaO		1.91	2.69	3.87	2.75	2.32	1.07	1.45	2.30	1.44	4.55	6.61	6.17	2.91		
Na ₂ O		3.57	3.75	3.23	3.26	4.04	4.04	4.40	4.70	4.34	2.68	3.53	3.64	3.34		
K ₂ O		4.06	4.16	3.87	3.93	4.02	3.97	4.33	4.27	4.46	4.42	3.90	3.66	4.37		
TiO ₂		0.16	0.13	0.12	0.14	0.14	0.15	0.11	0.19	0.15	0.20	0.10	0.11	0.13		
P ₂ O ₅		0.02	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
LOI		2.00	2.39	2.71	1.81	1.54	1.34	1.27	1.64	1.61	2.48	2.78	2.59	2.05		
Total		97.11	99.94	99.51	100.30	98.81	98.09	99.93	100.10	99.08	98.59	100.40	98.22	99.54		
(ppm)																
Sc		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1		
Be		23	20	22	19	15	18	15	18	24	18	64	18	22		
V		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5		
Cr		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20		
Co		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1		
Ni		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20		
Cu		< 10	< 10	< 10	<10	<10	<10	< 10	<10	<10	<10	< 10	< 10	<10		
Zn		230	280	200	240	320	380	300	280	350	220	150	170	150		
Ga		48	49	46	46	51	50	52	49	51	44	48	50	44		
Ge		3	3	3	3	4	5	4	4	4	4	3	3	3		
As		8	11	6	<5	<5	7	5	<5	<5	<5	<5	<5	<5		
Rb		247	241	232	220	238	225	250	241	264	250	229	211	225		
Sr		77	94	99	67	104	58	88	101	74	165	103	100	68		
Zr		5006	3179	7816	4015	4220	4970	5582	929	1687	14900	879	1107	2617		
Nb		455	379	315	351	393	393	359	433	456	822	325	309	313		
Mo		<2	<2	<2	3	5	3	5	7	<2	<2	3	3	4		
Ag		n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	3.9			6.4				
In		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
Sn		34	24	23	22	22	26	25	30	28	47	28	28	28		
Sb		0.8	0.5	0.6	0.6	0.7	<0.5	<0.5	0.8	0.6	1.5	<0.5	0.6	0.7		
Cs		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5		
Ba		42	29	38	34	36	34	33	37	35	44	26	25	29		
Hf		115	72.5	188	88.1	97.5	117	131	23.3	39	338	22	30.5	59.5		
Ta		37.1	266	25.8	24.9	27.8	29.8	28.1	33.9	35.8	80.6	20.5	19.6	21		
W		4	6	2	2	3	<1	4	4	2	4	2	1	< 1		
Tl		0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3		
Pb		44	29	34	43	67	60	41	71	50	54	19	32	19		
Th		36.1	45	27.7	41.4	33.2	42.2	30.4	34.5	38.3	112	43.5	41.7	29.1		
U		18.7	15.1	15.1	13.8	14.7	13.2	17.8	10.5	12.3	48.2	9.5	10.9	11.8		
Bi		1.4	<0.4	0.4	<0.4	0.5	0.7	0.5	0.5	0.5	0.7	<0.4	<0.4	<0.4		
Y		303	342	325	311	278	414	291	183	227	811	234	208	190		
La		253	221	246	203	216	504	224	121	140	243	178	171	167		
Ce		522	465	508	424	446	977	453	256	302	533	360	351	342		
Pr		57.7	53.4	58.2	48.5	51.3	113	51.1	27.8	33.9	59.7	41.2	40.4	39.1		
Nd		211	199	221	185	196	440	193	101	125	222	162	155	151		
Sm		47.1	47.8	50.4	43.1	43	90	43.4	24.5	30.9	56.6	37.3	35.9	34.7		
Eu		2.92	3.05	3.23	2.8	2.63	5.06	2.54	1.52	1.93	5.09	2.07	2.02	2.08		
Gd		44.6	45.5	46.9	41	39.9	78.8	40.3	24.9	29.7	69.8	33.9	34.1	30.9		
Tb		7.8	8.5	8.1	7.6	6.9	12.2	7.1	4.6	5.9	18.2	6.1	6.2	5.2		
Dy		46.7	52.6	50.1	47.5	42.6	68.7	46	28.6	38.2	141	36.5	36.9	30.8		
Ho		10	11	10.9	9.9	9.3	13.8	10.3	6.1	8.1	34.6	7.6	7.5	6.4		
Er		32.6	34.7	38.2	32	31.6	43.4	35.6	19.8	25.9	131	24	22.9	20.9		
Tm		5.57	5.35	6.45	5.13	5.33	6.64	6.06	3.48	4.05	24.2	3.27	3.39	3.34		
Yb		37.4	33.9	44	33.5	37.2	43.7	42	22.8	26	171	19	21.4	21.6		
Lu		5.36	4.71	6.71	4.84	5.64	6.27	6.32	3.41	3.76	25.9	2.66	2.89	2.97		
TREE		1538.4	1692.7	1517.1	1342.8	1379.4	2659.5	1380.1	869.6	999.9	2230.2	1109.4	1068.8	1007.1		

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite													
Sample No.	10346	10347	10348	10349	10350	10351	10352	10353	10354	10355	10356	10357	10358	10359	
from	178.0	179.0	180.0	181.0	182.0	183.0	184.0	185.0	186.0	187.0	188.0	189.0	190.0	191.0	
to	179.0	180.0	181.0	182.0	183.0	184.0	185.0	186.0	187.0	188.0	189.0	190.0	191.0	192.0	
(wt%)															
SiO2	70.75	73.07	71.71	69.48	69.85	67.63	71.16	69.67	71.66	73.08	71.56	72.15	68.85	66.43	
Al2O3	10.73	10.71	10.09	10.74	10.05	10.14	10.84	10.51	10.89	11.30	11.17	11.12	10.59	10.19	
Fe2O3(T)	4.06	3.25	3.03	4.50	3.77	4.02	4.09	4.60	5.63	4.25	5.08	4.94	4.31	4.64	
MnO	0.11	0.08	0.12	0.18	0.18	0.11	0.12	0.17	0.16	0.08	0.13	0.11	0.13	0.18	
MgO	0.03	0.02	0.02	0.03	0.04	0.05	0.04	0.07	0.05	0.03	0.03	0.05	0.06	0.10	
CaO	2.13	2.29	3.51	2.26	3.50	6.80	2.18	2.92	1.45	2.14	1.53	1.81	4.04	6.13	
Na2O	3.43	3.37	3.45	3.70	3.00	3.10	3.47	3.34	3.61	3.48	3.60	3.61	3.36	3.14	
K2O	4.35	4.43	3.85	4.33	4.37	3.85	4.36	4.14	4.32	4.48	4.36	4.44	4.20	4.34	
TiO2	0.13	0.12	0.12	0.15	0.15	0.13	0.13	0.13	0.15	0.14	0.13	0.14	0.12	0.11	
P2O5	<0.01	<0.01	<0.01	<0.01	0.03	0.02	0.03	0.02	<0.01	0.02	0.01	0.02	0.03	<0.01	
LOI	1.82	1.52	1.87	2.04	2.36	2.57	2.29	2.73	1.98	1.64	1.59	1.53	2.41	3.09	
Total	97.55	98.84	97.77	97.41	97.29	98.43	98.72	98.30	99.90	100.60	99.20	99.91	98.10	98.35	
(ppm)															
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Be	12	11	12	18	30	34	19	78	126	110	139	88	92	106	
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
Cu	<10	< 10	<10	<10	< 10	<10	< 10	<10	<10	<10	< 10	<10	< 10	< 10	
Zn	140	140	130	240	180	160	260	240	440	200	350	210	220	210	
Ga	45	45	44	47	45	45	49	50	49	48	52	48	46	45	
Ge	3	3	3	3	3	3	3	3	3	3	3	3	3	2	
As	<5	<5	<5	7	<5	<5	<5	<5	8	7	9	5	<5	<5	
Rb	236	236	211	245	232	212	246	234	248	248	263	242	237	239	
Sr	78	62	102	96	115	92	68	95	64	68	56	73	120	116	
Zr	2224	1497	2832	3048	4022	1668	3586	2455	1927	1739	2456	2585	2348	1103	
Nb	350	291	403	464	363	323	396	430	370	343	360	400	309	279	
Mo	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Ag															
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Sn	35	24	22	43	27	28	29	28	29	25	27	28	21	18	
Sb	0.9	0.9	0.8	1	0.9	0.6	0.8	0.6	1	0.8	0.5	0.8	0.6	0.5	
Cs	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Ba	24	24	23	30	40	38	35	36	35	31	32	36	32	30	
Hf	53.3	32.9	69.2	67	99.3	40.2	83	58.7	44.9	39.3	54.9	61.6	56.5	25.7	
Ta	25.2	18.7	27	31.7	30	21.7	26.2	25.2	22.3	22.8	24.5	29.6	24.3	16.6	
W	4	< 1	<1	2	2	1	3	1	3	2	2	2	1	3	
Tl	0.4	0.3	0.3	0.4	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.2	
Pb	22	15	20	30	17	13	28	26	38	26	27	32	18	12	
Th	37.3	46.9	44.8	49.6	48.4	41.7	34.8	56	59.1	53.8	54.7	51.7	43.5	53.3	
U	13.3		11.4	17.1	14.5			15.9	15.8	14.6		17.5	14.8	10.8	
Bi	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
Y	205	186	225	293	283	232	237	332	306	294	299	280	309	323	
La	233	185	173	205	219	190	250	300	257	249	245	220	242	190	
Ce	460	380	361	410	451	384	509	609	513	499	489	449	487	394	
Pr	51	43.7	41.2	43.9	52.5	45.2	59.5	70.8	59.6	57.6	56.3	52.3	56.5	45.9	
Nd	192	168	155	160	197	171	226	269	229	217	210	193	212	174	
Sm	42.9	39	35.8	38.3	46.7	39.6	51.7	60.8	52.5	49.4	48.7	46.7	50.6	42.9	
Eu	2.66	2.28	2.28	2.44	2.71	2.38	3.08	3.69	3.18	3.06	3.07	2.92	3.21	2.85	
Gd	41	35.8	33.8	39.5	45.8	38	48.1	58.7	51.9	47.8	48.2	46.7	49.8	46.4	
Tb	6.5	6	6.3	7.5	8.2	6.7	8	10.2	9.4	8.9	9.1	8.7	9.3	9.4	
Dy	34.8	34.1	39.3	48.1	50.4	40.1	44.1	61.8	58.2	55.3	55.7	55.5	57.8	61	
Ho	6.9	6.7	8.3	10.5	11	8.1	8.4	12.2	11.7	11.1	10.7	11.9	12.3	13.2	
Er	20	20.8	28.4	35.2	33.5	23.2	24.1	359	32.8	31.5	31	33.7	34.3	36.7	
Tm	3.53	3.16	4.77	6.03	5.6	3.57	3.7	5.5	5.25	5.03	4.59	5.1	4.94	5.31	
Yb	20.1	20.8	32.4	42.7	38	22.6	23.6	34.4	32.6	29.7	29.2	32	29.9	30.5	
Lu	2.74	3.03	4.88	6.24	5.41	3.08	3.18	4.37	4.26	3.94	4.04	4.26	3.88	3.89	
TREE	1288.8	1084.9	1096.8	1283.4	1364.0	1141.8	1428.5	1769.6	1558.7	1488.6	1459.6	1377.0	1423.1	1268.6	

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite												
Sample No.	10360	10361	10362	10363	10364	10365	10366	10367	10368	10369	10370	10371	10372	10373
from	192.0	193.0	194.0	195.0	196.0	197.0	198.0	199.0	200.0	201.0	202.0	203.0	204.0	205.0
to	193.0	194.0	195.0	196.0	197.0	198.0	199.0	200.0	201.0	202.0	203.0	204.0	205.0	206.0
(wt%)														
SiO ₂	66.78	67.25	68.53	70.35	70.37	67.95	70.28	70.02	69.01	69.35	69.98	69.82	70.61	69.97
Al ₂ O ₃	10.30	10.19	11.17	11.12	11.08	10.23	11.12	11.38	11.38	10.88	11.03	11.01	11.26	11.08
Fe ₂ O ₃ (T)	3.67	4.51	4.89	5.73	5.41	4.84	5.24	4.30	4.27	5.11	4.58	5.12	5.65	5.32
MnO	0.12	0.15	0.14	0.19	0.17	0.19	0.16	0.17	0.18	0.17	0.15	0.14	0.14	0.13
MgO	0.06	0.07	0.06	0.06	0.06	0.07	0.05	0.06	0.05	0.06	0.03	0.02	0.02	0.03
CaO	6.92	5.40	2.06	1.87	1.34	4.34	1.42	2.30	2.59	1.68	1.78	1.35	0.97	0.96
Na ₂ O	2.83	3.17	3.55	3.42	3.55	3.36	3.61	3.73	3.77	3.46	3.77	3.93	4.38	4.08
K ₂ O	4.25	4.33	4.28	4.25	4.19	4.13	4.21	4.37	4.25	4.12	4.31	4.25	4.41	4.32
TiO ₂	0.13	0.12	0.14	0.15	0.14	0.12	0.14	0.13	0.13	0.14	0.13	0.14	0.15	0.13
P ₂ O ₅	0.01	<0.01	0.02	0.02	0.02	<0.01	0.02	0.02	0.01	<0.01	0.02	0.03	0.03	<0.01
LOI	2.75	3.27	2.68	2.97	3.05	3.25	2.54	3.18	3.38	2.61	2.22	1.84	1.47	1.61
Total	97.83	98.47	97.52	100.10	99.38	98.48	98.79	99.67	99.02	97.57	98.00	97.63	99.09	97.65
(ppm)														
Sc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Be	148	206	25	29	22	25	21	24	27	48	30	17	15	14
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Zn	220	210	280	370	360	300	290	290	290	310	330	350	370	390
Ga	43	46	49	48	49	46	47	49	47	47	49	51	49	49
Ge	2	2	2	3	3	2	3	2	2	3	3	4	4	4
As	7	7	<5	<5	<5	<5	6	<5	10	<5	<5	5	5	5
Rb	232	242	248	244	244	245	244	255	239	239	256	254	250	257
Sr	170	133	64	55	46	85	68	93	88	67	72	58	41	39
Zr	2190	1248	1413	2204	2175	1864	2057	2171	1968	1859	1796	1623	1742	1567
Nb	256	246	334	354	334	293	328	390	328	293	314	311	293	271
Mo	7	11	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ag														
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	20	18	25	33	31	32	31	27	29	31	28	35	39	30
Sb	0.5	<0.5	0.6	0.9	0.8	<0.5	0.8	0.5	0.7	0.7	<0.5	0.6	<0.5	<0.5
Cs	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ba	38	30	26	29	28	27	28	28	28	29	31	29	31	27
Hf	51.8	28.5	33.1	52.2	51.1	43.8	49.8	52	46.7	46.1	44.1	38.5	40.5	36.8
Ta	21.7	18.4	19	23.3	21.1	21.4	21	28.1	23.3	20.5	21.3	20.9	198	19.5
W	<1	<1	1	2	4	1	2	<1	5	2	<1	<1	<1	<1
Tl	0.2	0.4	0.3	0.3	0.3	0.4	0.2	0.3	0.2	0.3	0.3	0.2	0.3	0.3
Pb	17	15	11	20	18	16	15	13	34	14	25	38	33	31
Th	40.3	59.5	43.2	64.3	46.9	45.2	25.1	22.1	30.2	40.3	27	38.6	49.7	39.1
U	19.7	13.8	107	13.5	12.9	14.2	11.4	14.8	13.3	11.1	11.9	11.9	11.3	
Bi	0.7	0.5	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.6	<0.4	<0.4	0.5	0.4	0.4
Y	343	287	302	281	262	225	223	186	254	241	192	227	243	203
La	169	198	262	227	234	169	215	181	181	230	203	279	285	233
Ce	344	396	534	468	474	348	446	377	378	450	413	552	564	471
Pr	40.3	45.7	62	53.8	55.8	39.9	51	43.7	42.7	51.6	47.7	63	64.1	55.1
Nd	154	170	233	203j	212	148	190	159	162	194	178	233	245	214
Sm	38.2	40.9	55.1	48	49.8	36.6	44.7	36.3	38.6	44.4	39.6	48.8	54.2	47.1
Eu	2.54	2.51	3.43	3	3.05	2.3	2.73	2.22	2.42	2.8	2.52	3.05	3.29	2.85
Gd	43.3	41.6	55.5	48.6	49.2	37.9	44	35.8	39.2	44.7	37.9	47.2	51.5	43.2
Tb	8.9	8.2	9.9	9.1	8.9	7.1	7.5	6	7.1	7.6	6.3	7.7	8.4	6.8
Dy	63.9	53.7	61.2	56.3	52.9	41.9	44.1	35.5	44.7	45.7	36.7	43.2	46.7	37.6
Ho	13.7	10.5	12.6	11.7	10.9	7.7	8.7	7.2	9.7	9.3	7.3	8.4	8.9	7.1
Er	38.8	31.1	35.3	33	31.1	22.1	24.5	20.6	27.4	25.8	19.9	22.3	23.8	18.9
Tm	5.42	4.34	4.82	4.7	4.37	3.33	3.63	3.02	3.98	3.7	2.87	3.07	3.29	2.57
Yb	31.4	25.1	27.7	27.9	26.6	20.1	22.5	18.9	22.7	21.8	18.1	18.2	19.6	15.2
Lu	4.05	3.36	3.62	3.69	3.57	2.74	3.07	2.62	3.03	2.99	2.53	2.48	2.68	2.16
TREE	1190.6	1247.7	1633.0	1204.2	1393.9	1067.0	1247.1	1063.5	1128.7	1302.0	1161.3	1516.0	1751.3	1277.0

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite													
Sample No.		10374	10375	10376	10377	10378	10379	10380	10381	10382	10383	10384	10386	10387	10388
from		206.0	207.0	208.0	209.0	210.0	211.0	212.0	213.0	214.0	215.0	216.0	217.0	218.0	219.0
to		207.0	208.0	209.0	210.0	211.0	212.0	213.0	214.0	215.0	216.0	217.0	218.0	219.0	220.0
(wt%)															
SiO ₂		70.61	71.58	70.19	70.43	69.98	70.24	70.39	71.22	71.38	70.82	70.89	68.94	70.04	69.01
Al ₂ O ₃		11.24	11.17	11.37	11.69	10.73	10.67	10.90	10.90	11.28	11.02	11.10	11.09	11.01	10.81
Fe ₂ O ₃ (T)		5.52	5.00	4.86	4.84	5.52	5.50	5.67	4.98	5.38	5.31	5.36	5.57	6.25	5.48
MnO		0.14	0.15	0.13	0.12	0.14	0.13	0.14	0.14	0.13	0.14	0.14	0.15	0.15	0.17
MgO		0.02	0.04	0.04	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.03
CaO		1.08	1.40	1.99	1.28	1.43	1.44	1.48	1.48	1.29	1.48	1.37	1.65	1.91	2.08
Na ₂ O		4.19	3.66	3.74	3.84	3.60	3.70	3.85	3.60	3.69	3.67	3.87	4.01	3.73	3.78
K ₂ O		4.34	4.46	4.30	4.33	4.26	4.27	4.29	4.24	4.37	4.24	4.32	4.35	4.29	4.06
TiO ₂		0.14	0.14	0.13	0.13	0.21	0.20	0.19	0.14	0.13	0.14	0.13	0.16	0.15	0.14
P ₂ O ₅		0.02	<0.01	0.02	0.03	0.01	<0.01	0.02	0.02	0.01	0.01	<0.01	<0.01	0.03	0.02
LOI		1.57	2.28	2.46	1.79	1.80	1.81	1.72	1.94	1.70	2.24	1.54	1.57	2.09	2.44
Total		98.88	99.88	99.24	98.49	97.70	97.98	98.68	98.69	99.39	99.10	98.75	97.52	99.69	98.02
(ppm)															
Sc		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Be		18	17	21	22	22	29	32	15	26	19	26	33	45	57
V		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ni		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu		<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	40	<10	<10	<10
Zn		340	320	240	290	400	350	380	390	370	370	420	420	450	450
Ga		49	48	53	52	48	46	49	50	48	51	49	50	49	49
Ge		4	3	2	3	3	3	4	3	3	3	3	4	4	4
As		10	5	<5	<5	<5	6	6	<5	5	<5	5	8	7	6
Rb		250	257	263	259	253	244	246	254	253	257	256	257	242	238
Sr		43	50	63	46	64	55	47	50	48	51	51	70	81	80
Zr		3455	3399	815	3170	4888	6200	4090	2535	2233	1449	1678	1804	1328	1001
Nb		365	259	289	321	397	352	387	330	306	336	355	330	382	362
Mo		<2	<2	<2	<2	2	2	<2	<2	<2	<2	4	3	<2	<2
Ag				7.3											
In		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn		26	27	23	29	33	34	34	32	34	43	37	33	42	31
Sb		0.6	0.6	0.5	<0.5	0.8	0.6	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5
Cs		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ba		37	32	23	27	32	39	41	30	29	27	29	32	31	26
Hf		82.1	79.9	17.9	73.3	116	154	102	58.5	51.6	29.9	378	41.8	29.7	23
Ta		27.6	21	18.2	26.7	39.1	40	35.7	23.4	22.5	21	21.8	22.8	24.1	21.7
W		5	2	<1	2	5	1	<1	6	3	<1	<1	3	<1	<1
Tl		0.3	0.2	0.4	0.4	0.3	0.3	0.3	0.4	0.3	0.4	0.2	0.2	0.2	0.2
Pb		32	15	10	16	30	38	38	27	22	15	34	43	61	23
Th		36.3	33.1	21.1	43.6	33.7	31.2	30	49.4	529	37	368	36.5	63.9	49.3
U			14.3		17.1	196	22.4	19.7	19.2	142	11.9	14.8	15.5	164	13.6
Bi		0.5	<0.4	<0.4	<0.4	0.5	1	<0.4	<0.4	<0.4	0.6	<0.4	<0.4	0.4	<0.4
Y		281	260	175	204	249	225	207	231	210	207	234	246	295	295
La		389	285	213	182	286	237	290	189	238	191	197	201	252	243
Ce		734	565	435	372	566	489	582	388	476	378	408	419	508	491
Pr		86.3	66.7	49.3	43.1	65.3	56	68.5	44.8	54.8	43.8	48.1	49.5	60.8	56.6
Nd		331	257	186	161	247	211	257	169	210	165	186	189	234	217
Sm		69.8	56.2	40.2	37.4	52.5	46.8	56	39.7	46.1	36.9	42.9	44.1	54.3	50
Eu		4.18	3.41	2.29	2.4	3.24	2.93	3.28	2.39	2.88	2.25	2.61	2.81	3.41	3.37
Gd		64.6	53.8	36.3	37	48.4	45.6	49.8	38.2	43.8	35.7	42.2	44.2	52.1	50.3
Tb		9.4	8.5	5.9	6.6	7.7	7.4	7.5	6.9	7.2	6.3	7.1	7.5	9.1	8.9
Dy		52.9	47.8	33	38.9	44.2	41.7	39.2	41.8	40.3	37.2	41.6	43.4	54.6	53
Ho		10.5	9.4	5.9	7.3	8.8	8.7	7.7	8	7.8	6.6	8.5	9	11.2	10.9
Er		28.9	26.5	15.9	20.7	25.1	26	21.2	23.2	20.9	18.4	22.6	25.4	31.4	30.4
Tm		4.34	3.77	2.24	3.13	3.75	4.12	3.22	3.43	2.89	2.71	3.44	3.64	4.33	4.18
Yb		27.8	23	12.9	19.1	24.9	26.7	21.3	20.9	17.4	16.2	21.3	22.5	25.4	23.6
Lu		3.98	3.29	1.89	2.73	3.62	4.01	3.25	2.98	2.3	2.37	2.81	3.1	3.39	3
TREE		1997.0	1578.9	1150.5	1090.6	1734.5	1370.1	1587.5	1189.3	1956.6	1109.9	1520.8	1234.1	1697.0	1463.8

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology	Granite													
Sample No.	10389	10390	10391	10392	10393	10394	10395	10396	10397	10398	10399	10400	10401	10402
from	220.0	221.0	222.0	223.0	224.0	225.0	226.0	227.0	228.0	229.0	230.0	231.0	232.0	233.0
to	221.0	222.0	223.0	224.0	225.0	226.0	227.0	228.0	229.0	230.0	231.0	232.0	233.0	234.0
(wt%)														
SiO ₂	67.96	71.35	70.37	71.29	70.83	71.06	70.09	69.36	71.86	70.35	69.87	70.79	69.38	69.46
Al ₂ O ₃	10.28	11.05	11.16	11.30	11.31	11.05	11.10	10.98	11.28	11.27	10.97	11.16	10.87	10.11
Fe ₂ O ₃ (T)	6.07	5.01	5.01	4.36	4.96	4.82	5.18	5.40	4.84	4.74	5.49	6.31	4.94	6.05
MnO	0.17	0.15	0.17	0.15	0.13	0.15	0.13	0.15	0.12	0.14	0.17	0.18	0.15	0.11
MgO	0.05	0.03	0.03	0.03	0.02	0.05	0.02	0.03	0.02	0.03	0.02	0.02	0.02	0.03
CaO	3.01	1.49	1.43	2.15	2.00	2.22	1.88	1.56	2.12	1.30	1.63	1.80	2.11	2.86
Na ₂ O	3.56	3.69	3.81	3.77	3.55	3.46	3.42	3.40	3.46	3.89	3.84	3.79	3.52	3.17
K ₂ O	3.83	4.26	4.30	4.40	4.51	4.38	4.53	4.61	4.41	4.22	4.20	4.00	4.20	4.28
TiO ₂	0.13	0.14	0.14	0.14	0.15	0.14	0.15	0.19	0.16	0.15	0.19	0.23	0.22	0.17
P ₂ O ₅	<0.01	0.03	<0.01	0.01	0.03	0.02	0.02	<0.01	<0.01	<0.01	0.02	0.03	0.01	0.02
LOI	3.07	2.09	2.17	2.33	2.21	2.48	1.94	1.82	1.84	1.67	1.61	1.69	2.11	2.36
Total	98.15	99.28	98.62	99.95	99.70	99.82	98.45	97.51	100.10	97.77	98.01	99.99	97.54	98.62
(ppm)														
Sc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Be	55	29	33	34	32	28	23	23	18	26	23	25	44	50
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr	<20	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Zn	510	450	480	320	270	280	280	400	280	390	450	410	370	240
Ga	47	50	50	50	48	47	49	47	49	52	49	49	49	46
Ge	4	3	4	3	3	3	3	4	3	3	4	4	3	3
As	6	7	5	<5	<5	<5	<5	7	<5	6	<5	<5	6	<5
Rb	218	252	260	261	267	252	269	279	267	269	264	253	270	252
Sr	112	56	50	65	56	72	66	58	65	64	79	73	77	85
Zr	890	1125	976	654	845	4172	4106	1874	1787	1455	1820	2245	2616	1374
Nb	390	425	455	416	410	297	362	677	620	457	785	1160	1091	634
Mo	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ag	6.3		6.7	4.2	7.6									
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	42	35	35	29	36	27	31	36	40	39	52	45	47	33
Sb	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5
Cs	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ba	31	30	29	25	26	26	26	26	27	27	35	33	35	31
Hf	20.2	25.2	22.6	14.6	17.8	94.2	91.4	42	38.5	30.3	37	45.2	54.9	30.4
Ta	21.3	24.8	26.5	24.9	29	23	31.2	51.6	47.1	29	55.7	82.7	80.6	44.7
W	<1	<1	3	<1	2	<1	2	1	3	<1	1	1	1	1
Tl	0.2	0.2	0.3	0.3	0.4	0.5	0.4	0.5	0.4	0.4	0.3	0.4	0.4	0.4
Pb	39	37	42	24	15	19	18	41	36	40	35	30	38	18
Th	88.4	58.9	80.1	70.5	73.3	43.2	30.4	56.9	46.6	114	41.2	31.4	41.5	78.7
U	17.7	16.2	16.8	13.6	15.2	12.2	22.8	22	18.9	198	19.1	21.9	23.1	16.6
Bi	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.5	<0.4	<0.4	<0.4	0.5	<0.4
Y	334	336	345	307	331	240	272	282	227	272	300	310	378	290
La	232	225	189	178	196	208	203	193	154	120	160	209	206	208
Ce	473	466	394	374	411	418	404	412	324	260	335	423	427	419
Pr	56.5	54.7	45.2	42.4	46.9	49	44.3	46.8	36	29.7	36.3	43.4	45.7	45.7
Nd	220	207	169	160	173	186	159	169	127	108	126	140	154	162
Sm	53.9	51.6	45.6	42.1	43.9	40.7	36.7	43.4	30.8	29.3	30.3	28.8	35.5	37.8
Eu	3.45	3.39	3.06	2.79	2.87	2.71	2.65	2.94	2.09	1.91	1.96	1.79	2.4	2.28
Gd	54.9	55.1	50.1	44.6	47.7	38.1	36.7	44.2	31.8	31.1	31.3	29.3	38.5	37.6
Tb	10.2	10.1	10	8.4	9.5	6.7	6.8	8.3	6.4	6.7	6.9	6.4	8.3	7.5
Dy	64	62.6	66.6	55.4	63.3	40.3	44.3	51.8	41.5	45.2	48.4	47.9	62.2	50.4
Ho	13	12.6	13.7	11.4	12.5	8.9	9.5	10.7	9.1	10.2	11.5	11.8	14.3	114
Er	35	34	38.1	32.3	35	27.3	30.6	31	27.9	31.7	36.5	38.5	45.8	34.3
Tm	4.67	4.52	5.07	4.42	4.71	4.38	5.01	4.66	4.2	4.99	5.94	6.58	7.62	5.27
Yb	25.1	25.2	28.2	24.6	26.5	29.1	33.2	30	26.3	31.8	37.7	45	48.9	32.2
Lu	3.06	3.17	3.44	3.02	3.59	4.28	4.79	4.12	3.59	4.38	5.17	6.3	6.68	4.35
TREE	1539.9	1456.0	1359.6	1239.6	1339.6	1242.3	1203.7	1322.1	1053.4	1202.3	1141.9	1323.4	1410.6	1324.2

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology	Granite													
Sample No.	10403	10404	10405	10406	10407	10408	10409	10410	10411	10412	10413	10414	10415	10416
from	234.0	235.0	236.0	237.0	238.0	239.0	240.0	241.0	242.0	243.0	244.0	245.0	246.0	247.0
to	235.0	236.0	237.0	238.0	239.0	240.0	241.0	242.0	243.0	244.0	245.0	246.0	247.0	248.0
(wt%)														
SiO ₂	69.62	69.04	69.71	69.30	65.44	69.90	68.51	66.52	67.42	67.67	68.46	67.76	68.62	68.97
Al ₂ O ₃	10.40	10.38	10.50	10.75	9.40	11.28	9.82	9.95	10.54	10.72	10.45	10.87	10.95	11.05
Fe ₂ O ₃ (T)	5.97	5.92	5.30	4.27	6.93	3.99	4.82	5.26	4.67	5.27	4.84	5.39	4.06	4.33
MnO	0.17	0.13	0.17	0.17	0.14	0.11	0.13	0.15	0.13	0.07	0.10	0.11	0.09	0.09
MgO	0.03	0.02	0.04	0.02	0.04	0.06	0.07	0.06	0.06	0.05	0.06	0.04	0.02	0.05
CaO	2.16	2.67	2.45	2.92	6.10	3.58	4.42	4.66	4.70	3.81	4.03	3.17	3.20	2.40
Na ₂ O	3.48	3.42	3.33	3.51	2.85	2.95	2.56	2.71	2.95	2.97	2.81	3.46	3.52	3.31
K ₂ O	4.20	4.06	4.25	4.27	4.04	5.01	4.48	4.18	4.38	4.29	4.03	4.33	4.37	4.58
TiO ₂	0.19	0.14	0.15	0.17	0.21	0.19	0.21	0.16	0.14	0.16	0.18	0.15	0.15	0.14
P ₂ O ₅	0.02	0.01	0.02	0.04	<0.01	<0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.02	0.02
LOI	2.09	2.15	2.66	2.65	3.88	3.20	4.26	4.05	3.81	2.94	3.24	3.23	2.53	2.85
Total	98.32	97.95	98.59	98.07	99.03	100.30	99.31	97.72	98.83	97.98	98.23	98.55	97.53	97.77
(ppm)														
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	33	35	22	24	35	30	38	64	60	37	48	37	29	29
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	410	310	330	350	100	140	180	230	170	190	280	250	180	140
Ga	48	49	45	47	42	48	43	48	47	47	44	47	47	48
Ge	4	3	3	3	4	3	3	3	3	3	2	3	3	4
As	6	6	<5	<5	8	<5	<5	<5	<5	12	<5	<5	7	5
Rb	250	249	241	250	228	284	249	244	244	234	227	232	246	259
Sr	72	98	91	96	176	102	123	167	85	105	77	83	92	58
Zr	3349	1976	3562	2825	3144	2444	4563	2945	1551	2044	2339	1936	1703	2272
Nb	527	497	461	639	861	652	751	625	471	424	682	387	387	504
Mo	2	<2	<2	<2	5	3	3	<2	<2	<2	<2	<2	<2	<2
Ag														
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	40	32	32	30	38	30	34	41	29	29	28	32	35	30
Sb	<0.5	<0.5	0.5	<0.5	0.8	<0.5	0.5	<0.5	<0.5	0.8	0.6	<0.5	<0.5	<0.5
Cs	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	0.8	0.6	0.6	<0.5	<0.5	<0.5	<0.5	0.7
Ba	30	29	36	37	41	41	43	40	31	37	41	29	28	36
Hf	73.6	45.3	78.6	61.7	67.3	53.2	97.5	66.3	34.3	45.8	49.2	42	38.6	49.9
Ta	36.4	34	34.6	49.1	73.6	56	65.3	50.2	30.7	28.9	55.2	26.9	25.2	36.1
W	4	2	1	< 1	2	2	< 1	1	< 1	< 1	< 1	1	< 1	<]
Tl	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.3	0.4
Pb	31	22	24	35	24	33	16	13	15	15	16	13	24	19
Th	53.8	53	39.4	38	58.8	50.2	57.6	46.4	47	38.5	40.7	38.4	48.7	46.9
U	26.2	20.6	18.6	22.2	24.2	19.3	25.7	21.9	13.6	14.3	21.7	14.2	13.7	20.1
Bi	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.5	<0.4
Y	435	297	277	284	336	276	345	290	275	259	266	270	327	347
La	232	209	231	166	182	134	163	145	199	185	156	180	244	202
Ce	469	421	455	351	368	292	344	302	393	364	327	356	472	406
Pr	53.7	46.5	53	38.3	38.3	32.1	37	31.3	45.5	41.6	35.6	39.7	54.2	46.9
Nd	203	169	199	137	124	112	128	107	168	152	125	145	200	170
Sm	48.2	39.9	43.3	33	28.7	27.5	31.4	26.3	40.3	35.2	30	33.8	43.7	40.1
Eu	2.97	2.49	2.65	2.11	1.9	1.6	1.9	1.89	2.33	2.16	2.19	2.14	2.59	2.33
Gd	51.3	42.4	41.9	33.9	31.2	29.1	34.1	28.3	40	34.7	30.7	33.9	42.9	40.6
Tb	10.4	8	7.7	7	7.3	6.6	7.8	6.3	7.6	6.8	6.5	7	8.5	8.5
Dy	72.7	52.3	48.2	48.8	54.8	46.3	57.3	45.3	48.8	45.3	44.4	45.3	54.7	57.6
Ho	16.2	10.6	10.2	11.2	13.5	10.7	13.7	10.1	10.4	10.3	10.3	10.2	11.9	13
Er	50.2	32.3	31.1	34.9	46.7	33.9	44.6	33.1	29.6	30.4	32	31.5	35.5	40.5
Tm	8.36	4.67	4.64	5.64	7.59	5.21	7.28	5.19	4.17	4.47	5.17	4.44	5.3	6.34
Yb	53.8	27.4	28.9	35.8	48.4	31.7	46.5	31.2	24.1	26.3	32.4	26.3	31.6	39.8
Lu	7.1	3.7	3.92	4.81	6.58	4.3	6.22	4.39	3.12	3.61	4.46	3.45	4.16	5.26
TREE	1595.6	1316.9	1378.9	1156.0	1261.8	1036.1	1215.3	1036.3	1229.7	1136.1	1075.7	1120.4	1455.9	1336.8

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite												
Sample No.	10417	10418	10419	10420	10421	10422	10423	10424	10426	10427	10428	10429	10430	10431
from	248.0	249.0	250.0	251.0	252.2	252.8	254.0	255.0	256.0	257.0	258.0	259.0	260.0	261.0
to	249.0	250.0	251.0	252.2	252.8	254.0	255.0	256.0	257.0	258.0	259.0	260.0	261.0	262.0
(wt%)														
SiO ₂	68.96	67.41	67.63	69.44	55.74	70.03	68.00	70.56	71.46	70.25	70.34	69.26	69.43	70.69
Al ₂ O ₃	11.09	10.64	10.61	11.06	15.64	11.09	11.57	11.27	11.35	10.99	10.71	11.14	10.92	10.37
Fe ₂ O ₃ (T)	4.97	4.50	5.27	4.18	7.97	4.97	7.01	5.57	4.32	5.15	4.38	4.94	5.88	5.70
MnO	0.10	0.10	0.10	0.10	0.16	0.10	0.08	0.08	0.08	0.09	0.12	0.13	0.13	0.10
MgO	0.06	0.06	0.08	0.06	0.72	0.07	0.10	0.07	0.02	0.05	0.03	0.03	0.03	0.05
CaO	3.39	3.35	4.22	2.83	3.18	2.60	1.68	1.72	1.96	2.00	2.77	2.68	1.85	1.72
Na ₂ O	3.19	2.96	2.97	3.45	4.66	3.17	2.84	3.14	3.75	3.39	3.52	3.72	3.69	2.83
K ₂ O	4.68	4.63	4.25	4.59	4.53	4.84	4.81	4.48	4.24	4.17	4.26	4.40	4.25	4.20
TiO ₂	0.15	0.16	0.14	0.14	0.73	0.16	0.15	0.15	0.14	0.15	0.16	0.15	0.17	0.14
P ₂ O ₅	0.02	0.02	0.02	<0.01	0.56	0.02	0.01	0.03	0.02	0.05	0.04	0.02	0.03	0.02
LOI	3.69	3.73	3.94	2.92	4.78	3.51	3.27	2.16	1.98	2.50	2.76	2.74	2.02	2.63
Total	100.30	97.55	99.22	98.78	98.66	100.60	99.53	99.24	99.32	98.81	99.09	99.21	98.42	98.45
(ppm)														
Sc	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1
Be	50	44	27	29	8	20	28	22	19	29	19	19	19	27
V	<5	<5	<5	<5	12	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu	<10	<10	<10	<10	10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Zn	110	150	120	200	260	190	200	160	130	140	170	210	270	220
Ga	49	47	49	47	29	46	50	47	48	46	44	47	48	45
Ge	3	3	3	3	3	3	4	4	4	4	3	4	4	4
As	<5	<5	<5	6	<5	<5	<5	<5	<5	<5	5	<5	7	7
Rb	268	255	242	248	145	246	262	238	234	218	229	237	236	242
Sr	100	119	93	71	473	101	50	54	58	55	55	58	51	59
Zr	1850	2201	1503	1559	637	2095	1434	1903	1320	1617	4180	2407	2819	1882
Nb	631	452	484	325	109	323	335	313	290	266	431	402	345	315
Mo	<2	<2	<2	<2	5	<2	<2	<2	<2	<2	3	2	3	2
Ag					4.2									
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	30	29	25	32	12	34	25	27	27	32	29	29	33	27
Sb	<0.5	<0.5	<0.5	<0.5	11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cs	0.7	<0.5	1	<0.5	0.6	0.6	1.4	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	1
Ba	40	43	43	47	68	44	37	32	30	30	41	34	43	40
Hf	39.4	49.3	33.4	32.9	12	45.7	31.8	42.2	294	349	974	559	646	42.2
Ta	43.3	32.9	32.8	22.5	7	25.3	22.1	21.7	17.1	194	33.5	29.8	25.6	20.9
W	<1	1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1
Tl	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4	0.4	0.4	0.4	0.4
Pb	11	12	10	20	57	19	13	30	32	45	48	45	67	49
Th	43.1	47.6	42	50.8	9.7	44.3	43.7	50.3	49.3	60.3	42.3	38.3	39.7	46.6
U	19	19.6	16.8	14.9	4.7	13.8	13.4	14.6	11.8	13.1	164	15.2	15.7	13.6
Bi	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Y	302	305	234	250	53	227	225	265	254	290	259	212	246	261
La	198	197	182	200	67.4	244	193	235	196	253	272	244	275	253
Ce	395	399	371	400	136	478	398	474	401	496	529	472	529	498
Pr	44.4	46.5	42.8	46.6	15.9	56.1	47.3	56.2	47.1	58.4	60	54.4	61.1	57.8
Nd	158	172	159	175	61.3	214	183	214	183	220	223	204	228	215
Sm	37.3	39.9	36.1	41.9	13.2	46.8	43.2	49.5	44.3	52.3	49.1	45.1	51.2	49.5
Eu	2.47	2.61	2.39	2.55	2.36	2.82	2.64	2.92	2.71	3.26	3.03	2.81	3.08	2.96
Gd	38.5	39.3	35.5	41.4	11.3	44.3	41.7	46.8	43.2	51.3	46.3	42.3	47.6	47.9
Tb	7.8	7.9	6.9	7.5	1.9	7.3	7.2	8.2	7.8	9.1	8	6.9	8.2	8.4
Dy	53	53.2	42.9	46.4	10.8	42	42.6	48.4	46.4	53.4	47	39	44.8	48.5
Ho	11.8	12.2	9.1	9.4	2	8.1	8.3	9.6	9.2	10.4	9.9	7.7	8.7	9.7
Er	36.2	37.4	27.1	27.4	5.6	22.6	23.5	27.8	26.4	29.1	28.5	22.2	25	26.9
Tm	5.46	5.81	4.09	3.84	0.79	3.28	3.29	4.04	3.79	3.99	4.43	3.23	3.73	3.86
Yb	33.3	35.3	24.7	23.1	5	20.5	19.8	24.8	22.4	22.6	29	20.2	23.2	23.9
Lu	4.4	4.66	3.25	2.98	0.7	2.76	2.66	3.32	3.01	3.04	4.16	2.77	3.22	3.15
TREE	1254.0	1275.5	1131.3	1159.0	428.0	1371.5	1171.3	1413.6	1238.7	1676.3	1649.8	1333.2	1541.8	1467.8

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite													
Sample No.		10432	10433	10434	10435	10436	10437	10438	10439	10440	10441	10442	10443	10444	10445
from		262.0	263.0	264.0	265.0	266.0	267.0	268.0	269.0	270.0	271.0	272.0	273.0	274.0	274.6
to		263.0	264.0	265.0	266.0	267.0	268.0	269.0	270.0	271.0	272.0	273.0	274.0	274.6	275.0
(wt%)															
SiO ₂		70.04	71.37	71.38	70.19	70.71	71.74	70.17	69.82	69.72	71.50	58.40	51.23	49.65	52.38
Al ₂ O ₃		10.67	11.49	10.60	10.67	10.82	10.71	10.44	10.58	10.38	10.32	12.48	14.69	14.75	15.34
Fe ₂ O ₃ (T)		6.04	5.38	7.38	4.02	4.68	4.48	5.08	4.86	5.67	4.65	8.75	11.43	11.55	11.31
MnO		0.07	0.05	0.08	0.09	0.08	0.09	0.10	0.09	0.09	0.08	0.33	0.44	0.40	0.33
MgO		0.08	0.05	0.11	0.03	0.03	0.03	0.02	0.02	0.08	0.05	0.16	0.20	0.20	0.18
CaO		1.13	1.32	1.35	2.76	2.66	2.55	2.46	2.33	2.30	2.63	3.59	2.57	3.43	1.40
Na ₂ O		2.76	3.39	2.46	3.20	3.31	3.24	3.38	3.42	2.73	2.92	2.50	3.39	2.72	3.18
K ₂ O		4.50	4.32	4.10	4.07	4.11	4.12	4.34	4.22	4.63	4.22	5.31	6.82	7.34	7.38
TiO ₂		0.13	0.15	0.15	0.19	0.14	0.20	0.20	0.14	0.13	0.17	0.14	0.21	0.17	0.12
P ₂ O ₅		0.04	0.04	0.02	0.03	<0.01	0.04	0.04	<0.01	0.02	<0.01	0.04	0.02	0.03	0.02
LOI		2.69	1.85	2.67	2.45	2.40	2.41	2.29	2.29	3.09	2.61	6.56	7.13	10.45	6.24
Total		98.15	99.41	100.30	97.69	98.96	99.60	98.53	97.77	98.84	99.15	98.26	98.14	100.70	97.89
(ppm)															
Sc		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be		25	20	22	22	24	23	18	21	19	24	50	63	36	32
V		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu		<10	<10	< 10	< 10	10	< 10	< 10	<10	<10	< 10	< 10	< 10	< 10	< 10
Zn		120	90	150	110	100	120	160	80	80	100	320	390	380	340
Ga		45	48	43	44	45	46	49	48	46	47	64	73	67	72
Ge		4	4	4	3	3	3	3	3	3	4	3	3	2	3
As		6	<5	<5	5	<5	<5	7	<5	<5	<5	<5	<5	<5	<5
Rb		253	249	212	236	240	243	251	236	259	233	274	349	373	369
Sr		26	27	25	44	47	45	64	72	67	41	60	44	45	20
Zr		1468	1302	1392	2289	1657	1933	2647	2907	3073	1522	2089	2519	1238	1124
Nb		325	346	288	293	316	331	357	297	315	361	336	435	289	253
Mo		<2	<2	<2	5	3	4	3	<2	<2	<2	<2	<2	<2	<2
Ag															
In		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn		26	27	24	30	27	27	37	31	31	29	25	33	28	21
Sb		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.8	0.7	0.9	<0.5	<0.5
Cs		1.3	0.7	0.8	0.6	0.6	<0.5	0.5	<0.5	0.8	0.7	<0.5	0.6	0.6	0.5
Ba		43	39	68	39	32	46	45	30	41	43	47	51	49	49
Hf		33	28.5	31.3	51.6	38.5	43.9	63.3	67	71.6	36	48.3	58	28.7	25.3
Ta		22.1	19.4	18.5	21.6	21.3	22.9	27.9	22.2	25.3	25.4	24.7	31.5	22.2	14.9
W		< 1	< 1	< 1	< 1	< 1	< 1	< 1		1	< 1	< 1	2	5	2
Tl		0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.5	0.7	0.7	0.7
Pb		26	26	27	41	31	52	53	18	12	14	10	7	<5	<5
Th		476	61.5	42.7	47.8	47.8	52.7	46.1	38.4	36.8	63.5	47.4	58.2	55.8	69.9
U		13.7	13.5	11.4	142	11.9	13	16.5	13.8	14	162	21.6	20.9	15.3	18
Bi		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.5	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Y		250	266	238	260	259	333	325	260	230	292	359	427	337	307
La		201	188	153	206	185	266	337	234	202	213	183	241	243	212
Ce		399	381	314	410	371	518	662	460	417	429	388	508	501	434
Pr		46.2	43.7	36.9	48.4	42.8	60.6	75.6	52.4	47.5	48.4	46.3	596	59.2	50.9
Nd		173	164	140	181	163	230	285	195	178	178	183	234	226	198
Sm		40.8	39.9	35.6	43.1	39.5	53.1		43.9	40.5	42	47.2	59.8	57.9	52.2
Eu		2.48	2.47	2.27	2.59	2.56	3.27	3.68	2.75	2.13	2.68	3.05	4.26	3.62	3.22
Gd		39.6	39.6	35.7	41.7	39.2	51.8	57.4	43.1	38.8	43.9	48.7	62	59.1	53.8
Tb		7.5	7.6	7	7.8	7.5	10.1	10	7.2	6.9	8.5	9.7	11.6	10.6	9.7
Dy		46.9	51.3	44.6	49.4	47.2	63.6	58.8	45.4	41.9	52.8	60.8	74.2	64.8	59.6
Ho		9.4	10.2	9.5	10.3	10.2	13.8	12.4	8.9	8.9	10.6	13	15.5	13	11.8
Er		28.6	30.6	28.3	30.3	29.6	41	36.9	27.1	26.3	31.5	37.8	44.9	36.7	32.2
Tm		4.35	4.68	4.24	4.59	4.5	6.42	5.7	4.04	3.97	4.87	5.6	6.57	4.88	4.36
Yb		26.8	28.7	25.8	29.5	28.2	40.1	36.4	24.7	24.7	30.4	32.9	40.1	29.2	25.6
Lu		3.66	3.78	3.47	4.13	3.7	5.46	5.04	3.44	3.37	4.14	4.42	5.52	4.02	3.52
TREE		1650.8	1205.9	1019.8	1382.3	1175.3	1605.0	1832.8	1340.9	1206.6	1470.4	1291.7	2190.4	1526.7	1362.8

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite												
Sample No.	10446	10447	10448	10449	10450	10451	10452	10453	10454	10455	10456	10457	10458	10459
from	275.0	276.0	277.0	278.0	279.0	280.0	281.0	282.0	283.0	284.0	285.0	286.0	287.0	288.0
to	276.0	277.0	278.0	279.0	280.0	281.0	282.0	283.0	284.0	285.0	286.0	287.0	288.0	289.0
(wt%)														
SiO ₂	66.20	74.10	67.48	69.39	69.92	70.03	70.26	71.13	71.01	70.73	71.23	70.93	71.94	69.70
Al ₂ O ₃	11.09	9.98	8.04	9.34	11.12	10.86	10.63	11.07	11.58	10.80	10.74	11.19	11.23	11.13
Fe ₂ O ₃ (T)	6.38	3.18	4.89	4.37	5.16	5.02	4.56	4.00	4.39	4.21	4.30	4.92	4.21	4.89
MnO	0.17	0.08	0.08	0.12	0.13	0.12	0.12	0.09	0.09	0.08	0.12	0.08	0.12	0.09
MgO	0.10	0.04	0.07	0.05	0.02	0.05	0.05	0.02	0.02	0.03	0.05	0.03	0.02	0.02
CaO	2.04	3.22	7.80	6.08	1.55	1.95	2.17	2.48	2.19	2.93	2.19	1.68	2.02	1.72
Na ₂ O	2.97	3.15	2.15	2.76	3.68	3.29	3.29	3.77	3.47	3.51	3.48	3.68	3.90	3.79
K ₂ O	4.70	4.03	3.75	3.92	4.19	4.25	4.37	4.20	4.63	4.35	4.30	4.35	4.20	4.30
TiO ₂	0.16	0.13	0.10	0.12	0.13	0.13	0.12	0.15	0.16	1.12	0.13	0.14	0.15	0.13
P ₂ O ₅	0.02	0.02	0.02	0.02	<0.01	0.02	0.03	0.05	<0.01	0.02	0.03	0.04	0.03	0.04
LOI	3.67	2.45	3.57	3.98	1.92	2.43	2.57	2.20	2.04	2.36	2.47	1.70	2.05	1.79
Total	97.50	100.40	97.94	100.20	97.80	98.14	98.16	99.16	99.58	99.13	99.04	98.73	99.86	97.60
(ppm)														
Sc	< 1	< 1	<]	<]	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	49	24	20	21	22	18	19	20	18	22	21	15	18	16
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr	<20	<20	<20	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	<]	< 1	< 1	< 1	< 1	<]	< 1
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu	< 10	<10	<10	< 10	<10	<10	<10	<10	< 10	<10	< 10	<10	<10	<10
Zn	200	80	110	140	250	160	160	100	130	90	120	150	160	140
Ga	51	46	35	43	52	48	47	51	53	48	50	49	50	50
Ge	3	2	2	3	3	3	2	3	3	3	2	2	3	3
As	<5	<5	<5	<5	6	6	<5	<5	7	<5	<5	<5	<5	6
Rb	246	227	196	226	257	244	250	246	285	260	248	245	234	253
Sr	18	27	23	39	42	36	35	48	39	35	36	53	48	46
Zr	1690	1736	1499	1194	1313	2581	1992	2516	2545	1296	1376	1850	1624	1990
Nb	276	251	210	248	313	272	264	482	581	241	295	386	382	348
Mo	<2	<2	<2	<2	<2	3	3	<2	<2	3	<2	<2	<2	<2
Ag														
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	23	20	17	20	26	28	24	28	28	24	23	28	27	27
Sb	0.6	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cs	<0.5	<0.5	<0.5	0.7	<0.5	1.3	0.6	<0.5	0.6	0.5	<0.5	<0.5	<0.5	<0.5
Ba	31	25	32	31	28	34	35	31	42	30	30	30	31	28
Hf	38.2	39.5	34.9	25.3	29.2	56.7	44.1	57.7	57	29.8	30.6	40.7	37.1	44.2
Ta	20.2	16.7	15.3	16.1	18.7	19.7	18.2	39.9	47.1	14.7	20.1	25.5	25.1	23
W	< 1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	< 1	< 1
Tl	0.5	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Pb	<5	6	7	22	38	36	23	27	48	35	19	14	30	30
Th	42.7	38.9	36.9	35.1	42.8	41	44	46.5	46	46.4	41.8	54.2	49.6	51.5
U	9.2	105	7.9	11	11.3	13.3	12.3	16.2	17.3	9.5	13.1	11.7	15.4	13
Bi	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Y	303	254	180	218	271	242	263	240	305	254	236	276	252	263
La	190	162	101	138	182	182	187	244	189	177	207	232	219	213
Ce	395	328	212	280	362	368	382	501	400	361	427	476	435	433
Pr	45.3	36.8	24.2	31.3	39.7	41	42.8	56.5	44.6	41.6	48.4	54.1	48.5	49.5
Nd	173	134	91.8	114	145	148	161	205	161	156	182	202	177	184
Sm	42.4	31.4	22	27.3	33.4	34.2	36.6	44.6	36.9	38.2	41.5	46.6	39.3	42.2
Eu	2.82	2.35	1.52	1.66	2.13	2.13	2.27	2.64	2.36	2.38	2.45	2.88	2.5	2.65
Gd	43.7	33.4	22.7	28.3	35.5	34.4	37	41.1	37.6	38.2	40.3	46.1	39.6	40.9
Tb	8.4	6.4	4.5	5.4	7.1	6	7.3	7.2	7.4	7.2	7.1	8.4	7	7.6
Dy	53.2	41.6	30.2	34.6	47.2	38.8	46.3	42.3	49.6	46.3	43.7	51.4	44.1	47.9
Ho	11.3	8.7	6.8	7	9.4	8.3	9.9	8.8	10.4	9.4	8.9	10.2	8.7	10.2
Er	33.7	26.5	20.7	21	28.4	24.9	28.9	27	34.3	27.5	26	29.1	26.4	29.7
Tm	4.99	4.06	3.2	3.14	4.33	3.81	4.33	4.18	5.68	4.15	3.87	4.25	4.07	4.46
Yb	30.9	24.6	20.3	19.2	25.3	24.1	25.9	26.3	35.3	25.1	23.5	25.8	25.4	27.5
Lu	4.17	3.46	2.79	2.77	3.43	3.32	3.43	3.65	4.96	3.32	3.16	3.56	3.61	3.69
TREE	1224.1	1119.6	700.0	894.8	1146.4	1127.7	1172.6	1423.7	1297.7	1136.2	1238.8	1396.4	1293.8	1305.3

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-03)

Appendix 1.

Lithology		Granite												
Sample No.	10460	10461	10462	10463	10464	10465	10466	10467	10468	10469	10470	10471	10472	10473
from	289.0	290.0	291.0	292.0	293.0	294.0	295.0	296.0	297.0	298.0	299.0	300.0	301.0	302.0
to	290.0	291.0	292.0	293.0	294.0	295.0	296.0	297.0	298.0	299.0	300.0	301.0	302.0	302.4
(wt%)														
SiO ₂	71.17	70.17	70.77	71.93	70.46	71.31	73.17	76.61	75.68	71.09	71.53	71.89	72.05	71.15
Al ₂ O ₃	11.32	11.14	11.31	11.55	11.42	11.39	10.48	10.07	10.94	10.57	11.00	9.77	11.29	11.53
Fe ₂ O ₃ (T)	4.69	4.07	4.96	4.59	4.54	2.91	3.43	3.85	2.97	3.83	3.34	3.66	4.41	4.01
MnO	0.10	0.12	0.05	0.07	0.10	0.08	0.08	0.06	0.05	0.06	0.08	0.10	0.08	0.14
MgO	0.02	0.05	0.04	0.02	0.04	0.02	0.02	0.04	0.05	0.06	0.03	0.06	0.04	0.03
CaO	2.07	2.57	1.92	1.67	1.55	2.08	1.72	1.33	1.70	2.98	2.72	2.85	2.64	2.36
Na ₂ O	3.73	3.50	3.51	3.69	3.73	3.81	3.45	2.80	2.88	2.88	3.46	2.71	3.37	3.74
K ₂ O	4.40	4.46	4.21	4.37	4.40	4.29	4.15	4.18	4.51	4.27	4.12	3.87	4.32	4.28
TiO ₂	0.12	0.13	0.14	0.12	0.15	0.17	0.16	0.14	0.17	0.15	0.14	0.14	0.18	0.15
P ₂ O ₅	0.01	0.02	0.02	0.02	0.01	<0.01	0.03	<0.01	0.03	0.03	0.02	0.01	<0.01	0.02
LOI	1.96	2.54	1.58	1.54	1.82	1.92	1.81	1.37	1.59	2.28	2.11	2.65	2.17	2.34
Total	99.59	98.77	98.51	99.59	98.22	97.99	98.51	100.50	100.60	98.19	98.55	97.70	100.50	99.74
(ppm)														
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	17	42	27	43	32	20	14	16	17	15	20	22	21	20
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu	< 10	< 10	<10	<10	< 10	<10	< 10	<10	<10	< 10	< 10	<10	< 10	<10
Zn	140	160	160	160	150	60	70	90	90	110	70	100	90	110
Ga	52	50	50	51	52	50	46	43	46	46	47	43	50	50
Ge	3	3	3	2	2	2	3	3	2	3	2	3	3	3
As	6	<5	<5	7	<5	<5	<5	<5	<5	9	<5	<5	<5	5
Rb	249	253	238	259	247	246	227	224	235	236	230	217	249	246
Sr	43	68	58	41	38	41	35	26	28	93	45	39	34	42
Zr	1516	1839	2358	1944	2390	1638	2035	1591	1627	1613	1670	1887	2552	2538
Nb	308	360	357	374	381	302	290	261	267	299	313	237	375	438
Mo	<2	2	<2	<2	<2	<2	<2	<2	<2	11	<2	25	3	3
Ag														
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	24	25	30	25	33	24	24	21	21	21	21	23	28	27
Sb	<0.5	0.6	0.6	0.6	0.9	<0.5	<0.5	<0.5	<0.5	8	0.7	<0.5	<0.5	<0.5
Cs	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	0.6	<0.5
Ba	29	33	34	29	35	29	30	32	40	45	29	34	31	27
Hf	34	41	52.6	444	53.2	35.5	45.9	36	35.1	36.6	37.1	40.3	57.4	59.9
Ta	19.3	23.6	24.5	23.4	25.3	23.2	211	18.4	18.9	21.4	21.8	19.8	25.9	30.3
W	< 1	1	< 1	< 1	2	< 1	< 1	< 1	2	1	2	< 1	< 1	3
Tl	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.4	0.4
Pb	31	22	18	15	16	16	17	10	7	15	13	18	20	25
Th	48.5	56.9	42.7	47.8	52.7	45.8	46.6	42.3	42.7	40.7	42.4	46.3	50.1	29.1
U	13	12.2	12.8	13.2	14.3	12.1	11.3	11.3	118	117	11.6	14.3	15.7	15
Bi	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Y	301	274	284	269	282	241	263	248	239	237	235	242	284	244
La	187	213	216	188	208	206	220	178	158	215	202	216	218	214
Ce	366	435	443	369	425	418	437	353	315	435	408	442	430	427
Pr	41.8	49.3	50.4	41.4	49	47.3	49.4	40.9	35.9	50	45.8	48.7	49	48.8
Nd	157	187	191	155	183	181	186	152	133	186	172	176	183	176
Sm	36.7	43.1	43	36.2	43.3	40.4	42.1	35.8	32.1	42.3	38.5	40.2	41.7	38.2
Eu	2.35	2.63	2.74	2.34	2.76	2.45	2.54	2.18	2.17	2.45	2.41	2.34	2.85	2.58
Gd	37.9	41.4	42.9	37.3	43.6	40.1	42.4	37.6	34.1	40.5	38.6	38.1	44.1	38.6
Tb	7.2	7.8	8.1	7.4	8.3	7.3	7.9	6.9	6.4	7.1	6.8	6.8	8.1	6.8
Dy	50.1	48.9	50.7	47.8	53.1	45.6	49.5	43.6	41.6	43.6	41.8	41.6	50.3	42.9
Ho	104	10	10.7	9.9	11	9.6	10.6	8.7	8.5	9.2	8.7	8.7	10	8.5
Er	31.4	30.3	31.5	30.3	32.2	28.9	31.7	26	26.5	27.6	25.3	25.3	29.8	25.6
Tm	4.68	4.58	4.95	4.63	4.9	4.53	4.79	3.9	4.31	4.08	3.82	3.87	4.53	3.93
Yb	26.5	29.1	30.3	27.5	31.4	28.9	30.9	24.6	27.7	25.7	22.6	24.3	28.4	24.8
Lu	3.47	3.95	4.15	3.88	4.28	3.99	4.23	3.44	3.95	3.54	3.18	3.4	4.2	3.56
TREE	1204.1	1320.1	1328.5	1160.7	1278.5	1233.7	1486.3	1092.3	1104.2	1301.3	1173.1	1266.1	1320.7	1253.4

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Syenite										
Sample No.	10506	10507	10508	10509	10510	10511	10512	10513	10515	10516	10517	10518
from	110.4	111.0	112.0	113.0	114.0	114.9	116.0	117.0	118.0	119.0	120.0	121.0
to	111.0	112.0	113.0	114.0	114.9	116.0	117.0	118.0	119.0	120.0	121.0	122.0
(wt%)												
SiO ₂	63.48	61.24	62.11	62.82	65.46	65.21	65.89	65.09	65.66	65.15	64.96	64.35
Al ₂ O ₃	13.17	12.13	12.86	13.55	13.93	13.52	13.65	13.61	13.11	12.92	12.13	12.74
Fe ₂ O ₃ (T)	5.06	10.12	6.83	4.12	5.05	5.76	5.23	5.21	5.40	5.61	6.43	6.09
MnO	0.13	0.19	0.25	0.17	0.13	0.13	0.13	0.16	0.16	0.12	0.10	0.10
MgO	0.13	0.24	0.14	0.06	0.06	0.05	0.05	0.06	0.08	0.10	0.10	0.09
CaO	3.07	1.11	3.77	4.47	2.40	1.72	1.83	2.64	2.86	3.07	3.21	2.79
Na ₂ O	4.54	3.35	3.75	4.20	4.70	4.79	4.90	4.70	4.35	4.34	3.61	3.79
K ₂ O	4.89	5.43	5.26	5.05	5.09	4.94	4.90	4.95	4.94	4.99	5.06	5.25
TiO ₂	0.27	0.23	0.27	0.23	0.22	0.25	0.22	0.23	0.21	0.22	0.30	0.22
P ₂ O ₅	0.04	0.03	0.03	0.01	0.03	0.01	< 0.01	< 0.01	0.03	0.03	0.03	0.03
LOI	3.41	4.31	5.17	4.40	2.75	2.35	2.55	3.24	3.76	4.01	4.01	3.62
Total	98.17	98.39	100.40	99.09	99.81	98.75	99.38	99.87	100.50	100.50	99.94	99.06
(ppm)												
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	26	15	17	17	18	17	20	22	22	25	23	21
V	5	6	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	1	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	230	460	400	210	220	250	260	270	330	360	350	340
Ga	50	46	48	49	51	52	53	50	51	50	45	50
Ge	2	3	2	2	3	3	3	3	3	2	3	3
As	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	201	221	216	207	202	203	203	197	203	211	209	228
Sr	78	30	68	78	51	37	45	66	70	76	71	60
Zr	1560	2115	1831	2039	1743	2021	1769	2109	1729	2133	2386	1963
Nb	256	263	302	307	265	316	303	316	318	285	283	260
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	4	3	2
Ag												
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	27	33	23	19	19	23	18	15	17	26	28	24
Sb	1.1	1.1	1.3	1.3	1.6	2.6	1.8	1.9	1.6	0.8	1.2	1
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	43	53	48	44	46	45	41	41	42	47	51	52
Hf	37.7	44.6	39.7	43.5	35.9	44.9	39	45.7	37.4	46	53.5	44
Ta	19.6	20.5	19.5	21.4	18.9	20.6	20.6	22.1	20.4	20.2	21.8	19.8
W	6	2	3	2	4	6	30	4	3	2	2	5
Tl	0.6	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.3
Pb	11	7	12	11	7	8	8	9	8	8	9	7
Th	57.4	74.9	52.2	46.2	50.3	52.8	49.8	40.3	40	30.5	46.7	42.3
U	8.8	9.1	9.8	11.4	9.2	9.4	9.3	10.5	10	13.5	11.7	10.4
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.4	< 0.4	< 0.4
Y	212	272	251	224	239	257	226	225	232	220	257	225
La	408	385	408	379	358	384	392	401	367	229	359	361
Ce	752	733	751	697	661	700	720	719	675	442	648	647
Pr	81.9	82.6	82	75.8	72.2	75.8	76.9	76.7	72.6	48.8	70.7	69.3
Nd	278	290	282	254	251	255	262	258	243	171	243	237
Sm	49.2	52.4	49.9	45.7	45.3	46.6	45.5	47	44	33.1	43.3	40.8
Eu	3.11	3.2	2.93	2.89	2.74	3	2.82	2.89	2.66	2.08	2.56	2.51
Gd	43.5	46.1	43.9	39.7	39.8	40.7	39.6	39.8	39.9	30.8	39	36.2
Tb	7.1	7.7	7.3	6.7	6.9	7.6	6.8	7	7	5.8	7	6.3
Dy	40.1	45.1	42	39.7	40.6	46.3	41.1	41.4	41.3	36.3	42.7	37.9
Ho	7.8	9.2	8.5	7.7	8.1	9.2	8.1	8.2	8.3	7.5	8.7	7.5
Er	23.5	28.3	25	23.4	24	28.9	24.6	24.6	24.1	24.4	27.8	23.7
Tm	3.61	4.48	3.74	3.53	3.48	4.37	3.7	3.91	3.86	3.96	4.44	3.83
Yb	24.2	28.8	25.1	23.5	22.8	28	23.3	24.6	23.2	26.8	30.4	25.8
Lu	3.54	4.02	3.72	3.48	3.18	3.91	3.33	3.41	3.17	3.88	4.65	3.96
TREE	1725.56	1719.9	1735.09	1602.1	1539.1	1633.38	1649.75	1657.51	1555.09	1065.42	1531.25	1502.8

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Syenite									
Sample No.	10519	10520	10521	10522	10523	10524	10525	10526	10527	10528	10529
from	122.0	123.0	124.0	125.0	126.0	127.0	128.0	129.0	130.0	131.0	132.0
to	123.0	124.0	125.0	126.0	127.0	128.0	129.0	130.0	131.0	132.0	133.0
(wt%)											
SiO ₂	61.92	63.85	65.38	63.69	64.86	65.15	65.69	64.53	65.29	66.12	66.47
Al ₂ O ₃	11.62	13.43	13.67	13.41	13.33	13.12	13.89	13.80	14.08	13.14	14.00
Fe ₂ O ₃ (T)	9.00	4.96	4.39	4.75	4.01	4.14	3.89	3.99	3.73	4.75	3.97
MnO	0.15	0.09	0.11	0.15	0.11	0.11	0.07	0.09	0.07	0.07	0.06
MgO	0.14	0.05	0.06	0.06	0.06	0.06	0.03	0.05	0.04	0.06	0.06
CaO	2.97	4.35	2.29	3.59	2.65	3.80	2.15	2.94	2.54	1.78	1.99
Na ₂ O	2.78	4.43	4.61	4.54	4.54	4.39	4.79	4.77	4.73	4.24	4.69
K ₂ O	5.85	5.03	5.08	5.00	4.96	5.04	5.09	4.89	5.14	5.01	4.99
TiO ₂	0.22	0.26	0.19	0.21	0.18	0.21	0.17	0.20	0.17	0.17	0.17
P ₂ O ₅	0.01	0.02	0.03	0.03	0.02	0.02	< 0.01	0.03	0.03	0.02	< 0.01
LOI	4.94	3.71	3.26	4.66	3.64	4.40	2.78	3.31	3.06	2.92	2.82
Total	99.59	100.20	99.05	100.10	98.34	100.40	98.55	98.59	98.88	98.29	99.22
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	13	27	39	28	22	20	18	22	22	19	21
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	23	17	20	17	21	17	17	27	18
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	120	< 10	< 10	< 10	< 10	< 10
Zn	550	190	280	370	300	270	170	150	140	210	170
Ga	42	53	54	53	53	49	54	54	53	48	53
Ge	4	3	3	2	3	2	2	2	3	2	2
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	236	208	206	214	215	204	209	208	209	214	228
Sr	42	96	55	94	76	80	56	71	53	34	36
Zr	3091	2490	1715	1595	2201	1473	1535	1397	1198	2085	1284
Nb	385	378	268	266	329	258	242	261	229	240	305
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	23	21	16	19	23	23	22	19	17	14	13
Sb	2.1	1.6	1.4	1.1	1	1.1	0.8	1	1	0.9	1
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	63	43	43	42	46	46	47	50	55	54	49
Hf	69.4	55.8	37.2	33.8	49.3	32.5	33.7	29.9	25.6	45.8	27.8
Ta	25.7	26.9	17.7	16.8	23.9	16.4	16.2	17.6	16.4	18.1	21.6
W	3	4	287	224	226	206	232	199	189	311	206
Tl	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3
Pb	7	9	6	7	8	7	7	9	7	6	6
Th	26.8	30.8	37.4	31.1	38.4	35.2	28.7	32.7	38.1	27.9	29.7
U	12.1	12.8	8.4	9.1	13.3	7.8	8.2	8.5	8	8.9	10.4
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	251	199	192	196	211	179	176	187	184	177	177
La	215	281	338	213	247	298	328	365	317	165	235
Ce	387	501	609	405	491	570	605	655	574	304	438
Pr	42.1	52.3	65.4	46.2	57.3	64.1	66.5	72.3	61.5	33.4	48.6
Nd	147	175	223	168	207	226	234	254	214	119	171
Sm	26.5	30.7	39.3	33.7	43	41.4	42.4	45.7	38.2	23.5	33.6
Eu	1.76	1.91	2.36	2.07	2.68	2.45	2.47	2.7	2.33	1.55	2.11
Gd	25.6	26.6	33.3	30.7	39.5	37.6	35.4	39	34.4	22.7	30.8
Tb	5.6	5	5.7	5.4	6.9	6.1	5.8	6.3	5.8	4.6	5.6
Dy	36.1	31.8	32.6	32.1	38.9	33.2	31.5	34.1	33	30.1	33
Ho	8.3	6.7	6.4	6.7	7.8	6.3	6	6.5	6.6	6.4	6.8
Er	27.5	22.2	19.6	21	24.2	19.1	17.1	18.7	18.9	20.5	21.2
Tm	4.55	3.64	2.99	3.28	3.82	2.75	2.55	2.84	2.8	3.2	3.39
Yb	32	25.6	19.4	22.2	24	18.6	16.8	17.8	18.4	21.3	22.6
Lu	4.86	3.9	2.74	3.13	3.47	2.66	2.43	2.57	2.62	3.03	3.21
TREE	963.87	1167.35	1399.79	992.48	1196.57	1328.26	1395.95	1522.51	1329.55	758.28	1054.91

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Syenite									
Sample No.	10530	10531	10532	10533	10534	10535	10536	10537	10538	10539	10540
from	133.0	134.0	135.0	136.0	136.9	138.0	139.2	140.0	141.0	142.0	143.0
to	134.0	135.0	136.0	136.9	138.0	139.2	140.0	141.0	142.0	143.0	144.0
(wt%)											
SiO ₂	65.95	66.63	67.83	66.30	59.24	59.25	67.34	65.56	63.83	64.44	65.74
Al ₂ O ₃	13.43	13.60	12.48	13.44	10.30	12.21	14.65	13.88	12.87	13.74	14.02
Fe ₂ O ₃ (T)	4.58	4.85	5.40	5.09	11.57	10.87	3.14	4.51	5.69	4.55	3.92
MnO	0.07	0.07	0.07	0.06	0.18	0.17	0.05	0.07	0.10	0.08	0.06
MgO	0.06	0.06	0.07	0.06	0.17	0.18	0.03	0.04	0.07	0.06	0.04
CaO	2.35	2.23	1.61	1.88	3.22	1.68	2.71	3.04	2.44	2.72	2.48
Na ₂ O	4.43	4.51	3.99	4.15	0.98	2.29	4.88	4.56	3.85	4.36	4.63
K ₂ O	5.06	5.10	4.86	5.13	6.48	5.98	5.26	5.06	5.36	4.99	5.22
TiO ₂	0.20	0.21	0.17	0.22	0.18	0.18	0.16	0.19	0.18	0.18	0.19
P ₂ O ₅	0.02	0.02	0.01	0.03	0.03	0.03	0.04	0.03	0.04	0.01	0.03
LOI	3.22	3.03	2.93	2.80	6.89	5.59	2.59	3.38	3.60	3.27	2.92
Total	99.37	100.30	99.42	99.17	99.25	98.44	100.80	100.30	98.03	98.39	99.26
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	23	30	33	27	12	18	18	25	14	29	26
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	20	24	27	28	17	20	24	24	21	20	25
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	170	170	210	160	650	700	110	170	290	170	140
Ga	49	51	47	49	39	52	53	52	48	48	52
Ge	3	3	3	3	3	3	2	3	3	3	3
As	< 5	< 5	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	211	216	205	210	236	231	215	198	217	201	221
Sr	44	45	23	30	29	31	70	99	56	40	54
Zr	1370	1856	1727	1661	1724	2443	1423	1212	1304	1318	1734
Nb	273	256	271	291	295	322	219	222	222	199	241
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	17	21	20	24	20	19	17	21	20	21	24
Sb	0.7	0.9	0.8	0.9	1.2	0.9	< 0.5	0.5	0.9	< 0.5	0.7
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	51	49	48	48	70	82	53	50	50	42	44
Hf	29.4	38.9	36.2	37.3	37	53.3	28.9	24.3	28.6	29.4	38
Ta	18.1	17.7	20.9	21.5	19.8	24.8	14.3	13.6	14.7	14.2	16.8
W	205	279	344	325	208	154	261	247	260	237	270
Tl	0.3	0.2	0.3	0.3	0.5	0.5	0.3	0.3	0.3	0.3	0.2
Pb	7	7	6	8	27	6	6	9	6	6	6
Th	36.6	62.1	58.8	63.6	64.4	68.7	40.3	36.9	31.2	38	38.8
U	8.2	9.8	10.4	12.7	12.9	16.1	8.7	7.5	8	9.3	9.4
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	220	232	243	227	290	341	223	210	216	213	228
La	320	336	420	377	322	358	322	299	294	340	385
Ce	598	649	774	703	620	701	636	575	592	688	799
Pr	67.2	74.5	84.3	76.6	70.2	81.3	74.3	65	70	81.7	95.7
Nd	239	260	301	265	250	291	269	232	254	301	351
Sm	43.8	50.3	54.3	51.4	51.5	59.1	52.5	45.6	49.3	56.9	65.9
Eu	2.64	2.89	3.16	3.09	3	3.63	3.2	2.85	3.01	3.43	3.92
Gd	39.3	46.8	48	44.1	45.9	52.6	45.4	38.2	41.9	46.9	54.5
Tb	6.8	7.8	7.8	7.6	8.5	9.9	7.3	6.5	6.8	7.4	8.3
Dy	39.4	44.4	44	44	51.5	59.9	40	36.8	38.8	40.3	44.5
Ho	7.8	8.7	8.9	8.9	10.1	12.4	7.7	7.2	7.5	7.6	8.3
Er	23.3	27	27.9	27.8	30.1	39.1	22.5	21.2	22.9	21.4	24.1
Tm	3.5	4.22	4.37	4.26	4.28	5.95	3.29	3.02	3.46	3.11	3.38
Yb	22.3	26.9	28.2	27.1	26.9	38	20.8	19.6	21.8	19	22.3
Lu	3.21	3.76	3.78	3.83	3.56	5.24	2.94	2.78	3.09	2.73	3.15
TREE	1416.25	1542.27	1809.71	1643.68	1497.54	1717.12	1506.93	1354.75	1408.56	1619.47	1869.05

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Syenite									
Sample No.	10541	10542	10543	10544	10545	10546	10547	10548	10549	10550	10551
from	144.0	145.0	146.0	147.0	148.0	149.0	150.0	151.0	152.0	153.0	154.0
to	145.0	146.0	147.0	148.0	149.0	150.0	151.0	152.0	153.0	154.0	155.0
(wt%)											
SiO ₂	65.67	65.77	65.96	64.39	65.73	64.51	63.99	64.20	64.24	65.63	65.21
Al ₂ O ₃	14.08	13.36	13.23	12.81	12.81	13.40	13.85	13.82	13.23	13.97	14.37
Fe ₂ O ₃ (T)	3.40	4.74	5.27	4.39	5.03	3.93	3.82	3.83	4.31	4.17	3.93
MnO	0.08	0.06	0.07	0.12	0.09	0.08	0.11	0.10	0.11	0.09	0.06
MgO	0.03	0.05	0.04	0.04	0.06	0.04	0.03	0.04	0.04	0.03	0.05
CaO	2.93	1.83	2.59	4.76	2.50	2.73	3.34	2.82	2.94	2.45	2.98
Na ₂ O	4.81	4.38	4.51	4.50	4.31	4.62	4.90	4.85	4.82	4.74	4.72
K ₂ O	5.09	4.92	4.67	4.60	5.03	5.03	5.23	5.13	4.87	5.07	5.12
TiO ₂	0.18	0.18	0.25	0.31	0.17	0.19	0.18	0.21	0.21	0.22	0.17
P ₂ O ₅	0.02	< 0.01	0.02	0.02	0.02	0.04	0.02	0.01	0.03	0.01	0.02
LOI	3.04	2.86	2.95	4.53	3.46	3.25	3.58	3.46	3.43	3.13	3.33
Total	99.33	98.15	99.56	100.50	99.21	97.83	99.04	98.47	98.22	99.50	99.97
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	25	22	28	29	27	19	20	21	18	19	20
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	20	27	30	24	26	20	43	28	22	24	22
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	120	160	120	130	210	180	170	170	210	160	140
Ga	52	49	51	48	47	56	55	56	55	51	54
Ge	2	2	3	2	3	3	3	2	3	2	3
As	5	< 5	< 5	< 5	< 5	< 5	< 5	6	< 5	8	< 5
Rb	212	198	200	189	204	220	238	238	232	234	249
Sr	66	30	54	95	52	64	71	57	77	78	73
Zr	1746	1494	1573	1346	1642	1611	1480	2087	2934	3660	2664
Nb	253	222	260	277	222	250	286	303	545	387	319
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	4	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	19	19	23	24	21	20	19	25	28	27	24
Sb	< 0.5	0.5	0.9	0.6	< 0.5	1.2	1.2	2.5	1.5	1.3	0.7
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	50	46	44	45	48	45	41	42	46	56	54
Hf	38.7	31.7	34.3	29	36.4	34.8	32.3	48	69	78.8	55
Ta	16.6	14.8	13.3	15.6	15.4	15.4	19.7	22	43.6	30	23.1
W	217	235	313	278	316	249	295	280	236	252	215
Tl	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.6	0.4
Pb	11	6	8	14	7	8	8	9	10	12	8
Th	38.9	31.5	34.2	32	29.2	33.6	39	44.2	54.9	55.7	49
U	9.4	8.4	7.7	7.8	8.1	8.3	9.6	11.5	19.2	22.7	14.7
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.4
Y	205	180	223	227	205	232	223	240	277	268	251
La	405	305	381	419	312	463	493	450	596	456	475
Ce	777	633	762	828	630	987	995	900	1180	904	996
Pr	89.5	74.1	89.4	96.2	75.8	115	116	106	134	108	122
Nd	318	274	327	351	273	421	415	388	481	395	438
Sm	60.9	52.5	65	67	53.7	77.7	75.5	70.8	81.6	69.7	78.4
Eu	3.57	2.93	3.7	3.91	3.09	4.37	4.27	4	4.52	3.91	4.24
Gd	49.9	44.1	55.9	57.8	45.3	65.4	59.2	56.5	65.1	54.2	62.5
Tb	8	6.9	8.6	8.8	7.3	9.6	8.9	9.1	9.7	8	9.1
Dy	42	37.4	46.9	47.9	41.5	51.3	46.8	49.9	54.3	45.9	48.9
Ho	7.9	7	8.6	8.8	8	9.3	8.4	9.5	10.4	9.5	9.2
Er	23	20.2	24.1	25.1	23.4	26.5	23.8	27.7	31.4	30.8	26.4
Tm	3.46	2.93	3.57	3.66	3.4	3.8	3.32	4.19	4.83	5.14	3.89
Yb	22.2	19.3	22.4	23.6	22.5	24.2	20.8	27	31	32.6	24.5
Lu	3.13	2.72	3.3	3.46	3.12	3.38	2.89	4	4.25	4.39	3.58
TREE	1813.56	1482.08	1801.47	1944.23	1502.11	2261.55	2272.88	2106.69	2688.1	2127.14	2301.71

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Syenite									
Sample No.	10552	10553	10555	10556	10557	10558	10559	10560	10561	10562	10563
from	155.0	156.0	157.0	158.0	159.0	160.0	161.0	162.0	163.0	164.0	165.0
to	156.0	157.0	158.0	159.0	160.0	161.0	162.0	163.0	164.0	165.0	166.0
(wt%)											
SiO ₂	64.54	64.59	65.27	64.62	66.77	63.87	64.94	65.43	65.11	66.41	64.99
Al ₂ O ₃	13.62	13.69	13.77	14.29	14.64	14.19	14.49	13.88	14.17	14.11	13.33
Fe ₂ O ₃ (T)	4.60	4.49	4.56	3.46	3.22	4.14	2.96	4.59	4.10	3.76	6.46
MnO	0.09	0.09	0.09	0.08	0.05	0.12	0.09	0.09	0.07	0.09	0.11
MgO	0.07	0.07	0.07	0.04	0.02	0.05	0.03	0.06	0.04	0.04	0.08
CaO	2.16	2.82	3.38	3.64	2.35	3.64	3.91	2.97	2.89	3.15	2.52
Na ₂ O	4.36	4.55	4.43	4.84	5.09	4.87	4.95	4.55	4.77	4.50	3.81
K ₂ O	5.04	5.06	5.01	5.01	5.23	4.95	5.15	5.18	5.09	5.12	5.15
TiO ₂	0.23	0.19	0.17	0.19	0.18	0.22	0.20	0.18	0.19	0.21	0.24
P ₂ O ₅	0.03	0.01	0.02	0.02	0.02	0.03	0.01	0.03	< 0.01	0.03	0.03
LOI	3.30	3.49	3.70	3.57	2.45	4.04	3.51	3.34	3.15	3.45	3.80
Total	98.03	99.05	100.50	99.76	100.00	100.10	100.20	100.30	99.59	100.90	100.50
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	28	26	43	33	19	33	22	22	20	14	16
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	6
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	24	23	19	17	26	21	16	21	26	21	24
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	240	250	190	150	90	170	100	120	90	80	100
Ga	51	51	54	56	54	52	50	50	51	50	46
Ge	3	3	3	3	3	3	2	3	3	3	3
As	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	235	238	235	227	227	211	208	212	220	216	214
Sr	47	59	64	76	62	85	71	61	67	51	37
Zr	2290	3424	2140	1767	1188	1319	1413	1320	1314	1191	1560
Nb	339	432	492	419	372	312	244	218	238	228	264
Mo	< 2	< 2	< 2	< 2	< 2	< 2	2	2	4	3	3
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	25	27	25	22	22	20	17	20	19	18	20
Sb	1.5	1	1	0.9	0.9	1	0.9	0.7	0.6	0.6	0.9
Cs	< 0.5	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5	0.8
Ba	52	53	53	55	51	52	48	50	47	53	71
Hf	49.6	74.5	45.8	37.4	25.9	30.1	32.7	30.8	29.6	26.1	36.6
Ta	22.7	32.2	29.8	29.3	25.2	17.8	15.5	14.8	14.6	13.6	15
W	253	247	218	189	269	260	183	259	274	213	251
Tl	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.3
Pb	9	11	10	10	7	9	9	9	9	8	9
Th	46.4	65.4	102	98.5	44.8	42.2	47.4	36.1	29.5	24	19.7
U	14.3	19.5	18.4	17.5	14.1	9.3	8.4	8.1	8.3	7	8.5
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	264	328	374	303	218	236	213	230	214	211	207
La	494	482	540	436	371	484	459	453	469	473	475
Ce	1060	960	1070	866	729	1010	933	900	900	847	804
Pr	128	117	129	102	82.8	122	111	108	107	97.3	88.2
Nd	466	427	482	367	292	444	411	408	387	339	301
Sm	86.9	77.1	93.3	72.2	52.5	75.6	69.8	68.9	64.5	54.7	49.5
Eu	4.77	4.55	5.37	4.32	3.06	4.12	3.78	3.61	3.45	3.26	3.05
Gd	68.8	66.1	83.4	65.9	42.7	59.1	53.7	52.3	50.4	45.8	42.2
Tb	9.9	10.2	12.9	10.5	7	8.7	7.5	7.8	7.3	6.7	6.4
Dy	53.4	60.8	72.7	58.2	39.2	47.9	41.3	42.6	40.8	37.3	36.6
Ho	10.2	11.9	13.5	10.8	7.5	8.8	7.7	7.7	7.6	6.9	7
Er	29.9	35	35.4	28.6	20.8	24.9	21.9	21	20.8	18.2	20.3
Tm	4.68	5.33	4.74	3.73	2.91	3.49	3.13	2.73	2.9	2.46	3.02
Yb	29.7	32.1	25.2	21.2	17.3	19.8	19.2	16.1	17.5	14.5	19
Lu	4.29	4.34	3.28	2.92	2.47	2.98	2.76	2.37	2.61	2.15	2.93
TREE	2450.54	2293.42	2570.79	2049.37	1670.24	2315.39	2144.77	2094.11	2080.86	1948.27	1858.2

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Syenite									
Sample No.	10564	10565	10566	10567	10568	10569	10570	10571	10572	10573	10574
from	166.0	167.0	168.0	169.0	170.0	171.0	172.0	173.0	174.0	175.0	176.0
to	167.0	168.0	169.0	170.0	171.0	172.0	173.0	174.0	175.0	176.0	177.0
(wt%)											
SiO ₂	65.62	64.17	64.26	62.66	62.80	65.58	61.96	62.69	64.90	64.37	62.98
Al ₂ O ₃	14.49	13.84	12.89	12.25	13.04	13.26	12.95	12.93	14.76	14.52	14.04
Fe ₂ O ₃ (T)	3.56	6.57	6.29	8.85	6.57	5.86	7.23	4.84	2.53	3.61	3.83
MnO	0.06	0.10	0.08	0.12	0.10	0.08	0.12	0.11	0.09	0.11	0.09
MgO	0.04	0.09	0.08	0.14	0.10	0.07	0.11	0.10	0.05	0.04	0.07
CaO	2.06	2.31	2.04	1.39	2.60	1.89	2.06	3.90	4.03	3.13	3.87
Na ₂ O	4.88	4.21	3.66	2.77	3.47	4.00	3.63	3.67	5.04	4.97	4.61
K ₂ O	5.22	5.21	5.31	5.75	5.46	5.31	5.59	4.96	5.29	5.21	5.24
TiO ₂	0.19	0.21	0.22	0.20	0.19	0.20	0.19	0.18	0.18	0.21	0.23
P ₂ O ₅	0.01	< 0.01	0.03	< 0.01	0.06	0.03	0.02	0.03	< 0.01	0.02	< 0.01
LOI	2.67	3.71	3.37	4.55	4.32	3.21	4.30	4.96	3.96	3.66	4.30
Total	98.81	100.40	98.23	98.69	98.71	99.49	98.17	98.36	100.80	99.85	99.26
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	15	16	18	17	24	18	20	18	16	14	13
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	21	22	25	20	17	25	21	18	15	16	17
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	20	< 10	10	< 10
Zn	90	130	130	190	150	120	140	240	120	180	150
Ga	53	54	46	47	46	46	44	49	49	51	46
Ge	3	3	3	4	3	3	3	3	2	2	2
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	11	< 5	16	6
Rb	223	225	228	248	221	217	214	206	208	224	212
Sr	34	30	23	19	25	19	25	67	79	49	53
Zr	1293	2088	1984	1710	1105	870	1003	1016	1332	1745	1275
Nb	274	307	298	243	206	197	179	220	235	255	203
Mo	2	2	< 2	< 2	< 2	< 2	< 2	5	< 2	< 2	< 2
Ag						6.2					
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	16	18	19	17	13	12	12	14	14	20	16
Sb	0.6	0.7	0.7	0.7	0.6	0.7	0.6	0.9	0.6	1	< 0.5
Cs	< 0.5	0.8	0.7	1.4	0.8	0.6	1.1	< 0.5	< 0.5	< 0.5	< 0.5
Ba	53	55	52	82	58	48	52	57	46	60	49
Hf	29.8	46.7	45.5	37.6	24.8	19.2	21.3	22.6	28.5	40.2	28.4
Ta	17.6	21.6	21.1	15.9	14.7	11.2	12.7	14.1	15.8	18.8	14.4
W	242	220	257	219	197	308	233	192	183	192	198
Tl	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.2	0.3	0.3
Pb	8	8	7	6	< 5	< 5	7	325	14	98	11
Th	22	54.1	36.6	27.9	25.7	25.6	25.3	25.7	27.4	77.9	36.1
U	9	12.2	10.8	7.3	6.7	6	7.1	7.4	8.2	8.6	6.2
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	183	255	241	209	187	142	143	165	163	209	176
La	418	575	435	355	396	288	211	238	226	255	253
Ce	712	963	741	635	673	495	363	395	394	456	430
Pr	78.6	105	80.8	68.7	72.1	55.4	40.6	43.5	44.1	51	46.7
Nd	266	357	278	228	243	193	143	151	156	180	164
Sm	44.8	58.3	45.5	39.4	39.4	32.3	25.8	28.5	28.8	35.2	31.3
Eu	2.63	3.52	2.79	2.38	2.38	2	1.75	1.88	1.9	2.51	2.11
Gd	37.5	50.6	41.4	35.5	34.9	28	24.7	27.1	26.2	33.9	28.5
Tb	6	7.6	6.7	5.9	5.5	4.2	4.1	4.5	4.7	6	4.9
Dy	33.3	43.3	40.8	35	32.3	25.1	24.4	28.3	28.6	36.7	30.4
Ho	6.2	8.6	8.3	7.2	6.4	5	4.9	5.8	6	7.9	6.3
Er	17.2	26	25.8	21.7	18.6	14.8	15.2	17.2	19	24.5	19.6
Tm	2.65	4.09	3.91	3.34	2.8	2.25	2.35	2.6	3.07	4.04	3.23
Yb	16.8	26.8	24.2	21.5	16.8	14.1	15.3	17.2	20.6	26	20.1
Lu	2.49	3.93	3.64	3.09	2.48	2.19	2.36	2.48	3.08	3.81	3.12
TREE	1644.17	2232.74	1737.84	1461.71	1545.66	1161.34	878.46	963.06	962.05	1122.56	1043.26

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Granite											
Sample No.		10575	10576	10577	10578	10579	10580	10581	10582	10583	10584	10585	10586
from		177.0	178.0	179.0	180.0	181.0	182.0	183.0	184.0	185.0	186.0	187.0	188.0
to		178.0	179.0	180.0	181.0	182.0	183.0	184.0	185.0	186.0	187.0	188.0	189.0
(wt%)													
SiO2		62.47	65.73	65.01	65.05	71.12	72.57	72.47	72.80	70.55	71.76	71.43	69.93
Al2O3		12.92	11.92	14.70	13.36	10.52	10.19	9.19	10.31	10.23	10.18	11.45	10.14
Fe2O3(T)		6.69	5.99	2.46	4.27	3.97	4.67	7.05	5.19	6.33	5.57	6.22	6.99
MnO		0.12	0.17	0.10	0.15	0.14	0.15	0.15	0.11	0.13	0.11	0.13	0.18
MgO		0.12	0.14	0.03	0.05	0.03	0.04	0.04	0.03	0.05	0.02	0.02	0.04
CaO		2.78	1.59	3.26	2.93	2.52	2.39	1.87	1.41	2.62	1.23	0.76	2.23
Na2O		4.21	3.88	5.20	4.54	3.32	3.52	2.95	3.41	2.98	3.64	3.99	3.75
K2O		4.95	4.72	5.19	4.98	4.39	3.25	3.56	3.53	3.43	3.31	3.59	2.91
TiO2		0.20	0.18	0.18	0.22	0.23	0.16	0.25	0.17	0.10	0.12	0.15	0.14
P2O5		0.02	0.02	0.01	< 0.01	< 0.01	0.02	0.03	< 0.01	0.02	0.02	0.01	0.01
LOI		4.66	4.12	3.26	3.76	3.25	3.25	2.86	2.30	3.36	1.80	1.46	3.78
Total		99.14	98.45	99.39	99.31	99.47	100.20	100.40	99.24	99.81	97.75	99.21	100.10
(ppm)													
Sc		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be		14	10	19	25	21	31	36	24	23	20	20	20
V		< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr		< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co		16	22	17	24	51	33	43	39	31	42	35	32
Ni		< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn		260	250	110	300	240	320	400	310	370	340	440	450
Ga		47	41	50	56	52	53	48	50	51	52	59	51
Ge		2	2	2	2	3	3	3	2	2	3	4	3
As		< 5	< 5	< 5	< 5	6	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb		208	190	252	302	280	243	259	270	250	247	252	203
Sr		38	25	56	75	69	57	54	35	60	45	49	77
Zr		1379	1162	1446	2463	8388	1728	2485	2639	2885	2560	2038	1633
Nb		194	158	199	474	551	487	676	390	447	331	592	316
Mo		< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	2
Ag													
In		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn		20	16	20	35	47	34	47	42	25	27	33	34
Sb		< 0.5	0.5	0.9	1.7	2.1	1	1.6	1.3	1	0.6	0.6	0.9
Cs		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5	0.5	< 0.5	< 0.5	0.5	< 0.5
Ba		49	55	45	41	37	37	31	24	24	29	33	22
Hf		32.4	24.6	34.3	53.6	208	37	57.2	59.4	61.7	49.2	43.9	36.8
Ta		13.7	11.4	13.4	29.5	44.5	35.7	54.7	32.1	34.9	27.9	46.1	21.5
W		218	277	236	240	461	409	499	438	383	497	387	375
Tl		0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2
Pb		7	< 5	6	9	15	25	40	33	19	23	44	15
Th		28.8	34.8	37	64.7	68	52	48.6	31.9	34.4	38.2	40.7	33.9
U		6.8	6.1	5.9	15.5	21	18.2	21.2	13.1	18.6	18.4	17.3	8.5
Bi		< 0.4	< 0.4	< 0.4	< 0.4	0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y		171	172	142	322	338	300	265	236	275	239	270	183
La		340	235	179	189	211	174	180	128	169	207	254	96.8
Ce		555	391	334	393	449	371	403	281	362	402	528	215
Pr		59	41.8	38.5	47.7	54.4	46.4	50.4	34.2	43.7	45.5	62.2	26.9
Nd		207	150	138	177	204	173	191	128	163	159	225	104
Sm		36.6	28.2	27.2	42.5	45.3	42.5	46.4	31.8	36.2	32.7	48	27
Eu		2.54	1.97	1.81	2.87	3.17	2.52	2.81	2.04	2.26	2.04	2.89	1.8
Gd		32.7	26.7	25.3	43.9	47.2	42.3	44	32.1	36.4	32.4	45.4	27.7
Tb		5.1	4.5	4.3	8.5	8.2	7.9	7.9	6.3	6.8	6	7.6	5.1
Dy		29.8	26.7	25.8	52.3	53.5	47.2	45.4	38.1	42.2	37.5	44.9	31.1
Ho		5.9	5.4	5.2	11.3	12.3	9.8	9.2	7.7	9.3	8.4	9	6.2
Er		17.6	15.9	14.6	34.6	43.9	29.4	28.5	22.8	29.4	26.8	26.2	18
Tm		2.7	2.3	2.18	5.33	7.55	4.38	4.69	3.57	4.63	4.23	3.88	2.6
Yb		16.9	13.4	12.5	31.4	55	27.6	30.8	22.5	29.1	27	23.7	15.4
Lu		2.49	1.93	1.78	4.3	8.46	3.7	4.35	3.3	4.16	3.79	3.28	2.13
TREE		1313.33	944.8	810.17	1043.7	1202.98	981.7	1048.45	741.41	938.15	994.36	1284.05	579.73

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Granite											
Sample No.	10587	10588	10589	10590	10591	10592	10593	10595	10596	10597	10598	10599	10600
from	189.0	190.0	191.0	192.0	193.0	194.0	195.0	196.0	197.0	198.0	199.0	210.0	211.0
to	190.0	191.0	192.0	193.0	194.0	195.0	196.0	197.0	198.0	199.0	200.0	211.0	212.0
(wt%)													
SiO ₂	69.24	72.98	75.73	75.51	77.59	72.10	72.01	69.28	72.56	70.98	71.57	68.84	69.58
Al ₂ O ₃	11.08	10.52	7.75	8.04	8.87	10.41	10.23	8.28	10.42	10.33	10.24	10.14	10.32
Fe ₂ O ₃ (T)	6.14	3.74	5.90	5.60	4.96	4.08	4.31	10.87	4.55	4.48	5.08	5.07	5.16
MnO	0.18	0.09	0.14	0.12	0.12	0.12	0.16	0.26	0.16	0.15	0.16	0.14	0.13
MgO	0.04	0.02	0.02	0.02	0.02	0.03	0.04	0.10	0.04	0.04	0.05	0.06	0.05
CaO	2.19	1.34	1.33	0.82	0.81	2.48	2.15	1.56	1.89	1.62	1.33	2.44	2.30
Na ₂ O	3.71	4.07	2.16	2.29	2.91	3.04	3.06	2.38	3.27	3.33	3.25	2.99	2.78
K ₂ O	3.85	2.87	3.37	3.34	3.22	4.32	4.49	3.70	4.40	4.41	4.30	4.31	4.34
TiO ₂	0.12	0.13	0.15	0.12	0.11	0.12	0.14	0.24	0.18	0.10	0.14	0.11	0.14
P ₂ O ₅	0.03	0.02	0.02	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	3.90	2.12	2.14	1.79	1.95	2.94	3.06	3.97	2.82	3.00	3.08	3.78	3.64
Total	100.50	97.89	98.69	97.64	100.60	99.65	99.68	100.60	100.30	98.42	99.19	97.87	98.44
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	27	16	11	8	9	9	8	9	9	12	9	11	8
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	31	49	70	61	57	38	47	36	40	40	44	37	34
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	20	20	20	< 10	20	< 10	< 10	< 10	< 10
Zn	400	240	390	410	430	310	360	330	340	350	450	250	300
Ga	55	57	40	43	45	51	52	43	53	53	53	54	54
Ge	2	3	4	3	3	2	3	3	3	3	3	2	3
As	< 5	< 5	< 5	7	12	< 5	< 5	< 5	< 5	< 5	< 5	10	7
Rb	260	179	203	206	187	244	250	201	250	251	238	244	251
Sr	44	35	47	31	29	62	81	29	50	41	31	51	50
Zr	1598	3139	1130	864	2002	1309	2350	860	1186	3595	2201	1287	646
Nb	292	354	335	288	450	205	282	355	292	515	372	339	326
Mo	< 2	< 2	< 2	< 2	4	133	92	13	46	15	85	4	9
Ag				6.3				5.6					5
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	20	29	29	22	18	25	23	26	22	17	18	20	19
Sb	0.7	1.2	0.7	0.5	0.8	< 0.5	0.8	0.8	0.6	0.7	0.9	0.6	0.7
Cs	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	23	22	24	23	36	37	60	32	35	52	46	39	36
Hf	36.1	73.7	26.7	17.7	47.3	29.6	52.5	19.5	26.7	84	52.8	28.4	15.3
Ta	19.5	30.4	24.7	22.6	34.5	14.9	20	29.7	20.1	41.9	26.4	21.7	21.4
W	362	561	801	627	653	404	482	439	475	427	509	425	389
Tl	0.3	0.2	0.2	0.3	0.2	0.3	0.2	0.1	0.2	0.2	0.3	0.2	0.2
Pb	10	10	25	30	54	25	42	18	15	29	59	14	11
Th	35.8	37.6	43.2	40.2	25.1	41.7	113	35.7	47.8	23.9	27.1	75	50.1
U	8.4	15.5	10	9.6	12.9	8	13.5	9.3	9.9	16.7	15.1	14.1	10.6
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.5	0.7	0.5	< 0.4	< 0.4	< 0.4	< 0.4	0.5
Y	208	259	226	198	163	256	287	179	224	253	238	264	214
La	130	167	167	161	134	175	165	131	140	169	184	197	152
Ce	276	341	336	332	292	369	334	270	288	361	379	389	308
Pr	33.5	41.2	40.5	40.3	35.1	44.4	40	32.9	35.7	43.8	45.5	46.9	37.9
Nd	125	154	150	151	130	171	144	120	129	156	170	171	141
Sm	30	35.9	35.4	34.4	28.1	41.9	34.6	27.4	30.3	35.2	38.7	40	33.2
Eu	1.96	2.41	2.14	2.08	1.74	2.5	2.37	1.88	2.12	2.36	2.36	2.68	2.22
Gd	29.4	35.7	36.9	33.3	27.5	42	39.9	28.5	33.1	35.9	39	42	35.1
Tb	5.3	6.6	6.6	5.5	4.7	7.2	7.4	5	6.3	6.8	7	7.9	6.4
Dy	32.3	41.6	39.2	32.8	27.5	45.2	48.7	30.8	40.2	43	42.8	47.8	39.1
Ho	6.6	9.2	7.6	6.4	5.9	8.9	10.1	6.4	8.2	9.3	8.9	9.8	7.6
Er	19.8	28.9	21.4	17.7	17.6	24.5	30.3	19.6	24.2	28.7	27.1	29	21.8
Tm	3.1	4.65	3.09	2.43	2.81	3.39	4.51	2.89	3.43	4.4	4.02	4.2	2.79
Yb	18.8	29.2	18.3	14.4	17.9	18.9	27.4	18.3	22.5	28.3	25.6	25.6	16.4
Lu	2.66	4.11	2.61	1.97	2.64	2.61	3.93	2.7	3.16	4.23	3.56	3.54	2.19
TREE	714.42	901.47	866.74	835.28	727.49	956.5	892.21	697.37	766.21	927.99	977.54	1016.42	805.7

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology	Granite											
Sample No.	10601	10602	10603	10604	10605	10606	10607	10608	10609	10610	10611	10612
from	212.0	213.0	214.0	215.0	216.0	217.0	218.0	219.0	220.0	221.0	222.0	223.0
to	213.0	214.0	215.0	216.0	217.0	218.0	219.0	220.0	221.0	222.0	223.0	224.0
(wt%)												
SiO ₂	70.94	71.10	72.46	67.85	72.29	73.97	72.94	72.25	73.39	72.92	73.44	73.58
Al ₂ O ₃	10.14	9.57	9.47	8.16	9.38	9.06	8.84	9.06	9.21	9.13	8.44	8.87
Fe ₂ O ₃ (T)	4.80	5.08	5.37	8.12	4.50	4.82	5.94	5.33	3.31	2.83	4.64	6.28
MnO	0.12	0.16	0.15	0.24	0.14	0.11	0.11	0.12	0.07	0.11	0.15	0.13
MgO	0.05	0.07	0.09	0.18	0.09	0.05	0.07	0.06	0.03	0.04	0.11	0.13
CaO	1.77	1.93	2.34	3.96	3.00	2.45	2.41	2.35	2.74	3.34	2.79	1.46
Na ₂ O	3.21	2.78	2.88	1.94	2.68	2.86	2.65	2.77	2.89	2.81	2.04	2.15
K ₂ O	4.24	4.13	4.14	4.13	4.27	3.80	3.81	3.85	3.93	3.99	4.39	4.21
TiO ₂	0.11	0.11	0.12	0.10	0.09	0.13	0.09	0.09	0.09	0.11	0.09	0.08
P ₂ O ₅	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	2.68	3.41	3.61	6.09	4.17	3.38	3.85	3.78	2.88	3.62	4.30	3.91
Total	98.05	98.34	100.60	100.80	100.60	100.60	100.70	99.68	98.55	98.91	100.40	100.80
(ppm)												
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	12	12	34	8	19	11	35	18	13	13	7	10
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	42	41	37	27	36	51	46	42	49	45	45	36
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	290	330	300	280	240	160	200	210	70	90	170	210
Ga	52	49	51	42	47	44	43	45	48	46	41	44
Ge	3	2	2	2	2	2	2	2	2	2	2	2
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	245	227	222	200	222	203	201	199	218	205	215	196
Sr	43	46	60	94	62	52	44	48	58	69	46	27
Zr	739	1039	1794	918	3147	1539	2293	5409	2534	4576	2770	740
Nb	253	310	329	289	269	237	287	323	328	302	266	143
Mo	3	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	3
Ag	5		6									4.6
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	16	14	20	21	20	26	24	37	25	33	16	13
Sb	< 0.5	< 0.5	0.6	< 0.5	0.6	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	32	38	43	49	46	31	39	42	34	36	57	59
Hf	18	23.1	41.8	21.6	67.4	35.5	52.6	128	58.9	105	62.8	17.2
Ta	14.6	17.6	22.4	17	20.5	19.9	24.4	36.1	29.4	34.2	30.7	13.8
W	469	423	389	323	394	548	510	477	513	494	482	490
Tl	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Pb	9	11	16	10	17	10	12	18	12	14	12	8
Th	66.7	46.1	38.4	48.4	62.2	41.2	55.7	37.2	72.8	43.9	42.5	28.1
U	9.4	12.3	14.3	9.3	20.1	9.8	14.9	24.8	17.4	23.2	20.4	7.1
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	198	246	206	187	234	161	187	237	250	274	252	209
La	151	161	166	131	155	146	151	176	219	230	211	167
Ce	306	330	338	272	315	302	310	361	444	466	416	335
Pr	37.4	39.4	40.1	32.8	37.7	37.6	38.9	43.3	53.6	57.4	50.9	42
Nd	142	145	143	120	140	138	148	160	195	216	189	159
Sm	35.1	34.3	32.9	28.6	31.4	30.9	33.9	34.6	43.7	47.2	40.9	37.3
Eu	2.2	2.39	2.1	1.87	2.01	1.85	1.99	2.11	2.66	3.03	2.8	2.41
Gd	36	37.7	32.2	28.9	32	30.5	33.3	33.6	42.6	45.1	41.1	38.3
Tb	6.5	6.8	5.9	5.5	6.2	5.1	5.8	6.2	7.5	7.7	7.1	6.7
Dy	39.3	41.4	35.2	32.6	40	30.4	33.5	39.2	46.7	48.1	44.9	39.2
Ho	7.5	8.4	7.4	6.7	9.2	6.1	7.1	8.7	9.7	10.4	9.4	7.1
Er	21.6	24.9	22.8	19	31.8	18.4	21.7	28.9	30	34.4	29.8	18
Tm	2.97	3.4	3.32	2.81	5.25	2.6	3.05	4.34	4.63	5.3	4.5	2.3
Yb	18.2	19.8	21.3	15.6	34.8	16.2	17.9	26.5	28.8	31.2	27.5	13.1
Lu	2.42	2.77	2.92	2.11	4.86	2.18	2.42	3.49	3.93	3.94	3.64	1.66
TREE	808.19	857.26	853.14	699.49	845.22	767.83	808.56	927.94	1131.82	1205.77	1078.54	869.07

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology	Granite											
Sample No.	10613	10614	10615	10616	10617	10618	10619	10620	10621	10622	10623	10624
from	224.0	225.0	226.0	227.0	228.0	229.0	250.0	251.0	252.0	253.0	254.0	255.0
to	225.0	226.0	227.0	228.0	229.0	230.0	251.0	252.0	253.0	254.0	255.0	256.0
(wt%)												
SiO ₂	74.70	74.46	72.67	72.98	71.82	69.92	71.51	71.37	72.77	70.81	70.64	70.11
Al ₂ O ₃	9.26	8.85	9.25	9.57	10.15	10.51	9.72	10.05	10.52	10.12	10.14	9.78
Fe ₂ O ₃ (T)	3.95	4.04	3.71	4.55	5.20	5.62	5.19	5.76	4.92	4.83	4.01	3.54
MnO	0.07	0.06	0.07	0.08	0.07	0.05	0.08	0.08	0.09	0.10	0.15	0.19
MgO	0.05	0.03	0.04	0.05	0.05	0.02	0.04	0.06	0.04	0.03	0.05	0.06
CaO	2.32	2.02	2.68	3.05	2.65	2.02	2.52	2.85	1.95	2.41	3.08	3.52
Na ₂ O	2.79	2.78	2.77	2.77	2.98	3.39	3.12	2.89	3.15	3.31	3.36	3.15
K ₂ O	4.02	3.83	4.00	4.23	4.60	4.44	4.04	4.33	4.42	4.22	4.15	4.16
TiO ₂	0.09	0.10	0.11	0.09	0.13	0.13	0.12	0.11	0.11	0.13	0.12	0.17
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	3.00	2.53	3.03	3.45	3.16	2.11	2.72	3.20	2.43	2.70	3.65	4.10
Total	100.30	98.71	98.33	100.80	100.80	98.22	99.08	100.70	100.40	98.65	99.36	98.79
(ppm)												
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	15	18	21	23	8	10	14	8	12	11	13	17
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	56	65	46	37	40	50	62	47	46	43	48	47
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	110	80	90	80	60	40	40	50	70	90	140	140
Ga	46	45	45	48	52	52	49	50	50	50	51	50
Ge	2	2	2	2	2	2	3	2	2	3	2	3
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	201	198	197	213	238	228	216	220	231	224	212	219
Sr	48	49	83	94	75	47	51	60	42	55	73	87
Zr	1078	969	1676	1533	708	770	524	581	574	611	2762	3350
Nb	196	173	241	249	235	276	214	204	199	222	263	403
Mo	< 2	< 2	< 2	< 2	< 2	< 2	2	< 2	< 2	2	< 2	< 2
Ag		6.4			4.3	4.4	3.2	3.5	3.4	3.9		
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	22	22	23	21	28	25	21	19	20	26	21	23
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.8
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	39	32	33	35	35	33	28	31	31	28	37	43
Hf	22.9	21.4	38.6	36.3	17.1	17.6	11.7	13	12.4	13	64.2	77.8
Ta	15.2	12.8	18.9	19.2	17.1	17.5	11.7	12	10.1	12.7	17.8	30.5
W	593	655	506	397	430	513	646	505	475	434	512	505
Tl	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Pb	9	7	11	7	< 5	6	5	5	5	7	15	20
Th	69.9	47.9	42.7	45.6	56.3	46.1	36.8	36.7	41.4	52.3	30.6	28.2
U	9.7	8.8	19.3	10.8	8.7	9.4	9.1	6.1	6.2	8	9.7	15.1
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	1	< 0.4	< 0.4	< 0.4
Y	253	263	237	272	303	274	187	177	179	191	203	248
La	181	188	157	195	228	195	127	110	90.1	105	117	249
Ce	363	376	323	397	446	389	265	231	198	231	257	482
Pr	46	48.2	39.6	48.8	55.1	47.7	32.2	27.7	24.4	27.8	30.7	59.3
Nd	171	184	146	178	214	180	118	100	90.2	99.1	111	217
Sm	40	43.5	33.7	42.6	48.2	42.1	28.3	25.2	23.8	26.2	27.3	44.2
Eu	2.59	2.7	2.16	2.89	3.26	2.9	1.95	1.76	1.7	1.83	1.85	2.79
Gd	40.7	44.8	35.4	44.9	50.6	43.8	30.5	27.7	27.1	29.1	28.9	41.7
Tb	7.4	8.2	6.9	8.9	9.5	8.4	5.8	5.5	5.4	5.9	5.7	6.9
Dy	46.7	51	44.6	55.2	60.6	53.5	35.9	34.8	35.6	37.5	36.5	41.6
Ho	8.9	9.7	9	10	11.1	10.2	6.8	6.7	6.7	7.2	7.6	8.9
Er	25.2	28	26.6	24.5	28.1	27.1	18.9	19.2	19.2	20.5	25	28.7
Tm	3.47	3.8	3.67	3	3.35	3.52	2.77	2.78	2.88	3.04	4.06	4.7
Yb	20.7	22.9	22.8	16.8	18.4	20.7	18.5	19.2	19.9	21.5	29.5	31.4
Lu	2.74	3.02	2.95	2.33	2.41	2.76	2.87	2.82	2.95	3.31	4.43	4.64
TREE	959.4	1013.82	853.38	1029.92	1178.62	1026.68	694.49	614.36	547.93	618.98	686.54	1222.83

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Granite											
Sample No.	10625	10626	10627	10628	10629	10630	10631	10632	10633	10635	10636	10637	10638
from	256.0	257.0	258.0	259.0	259.6	260.4	261.0	262.0	263.0	264.0	265.0	266.0	267.0
to	257.0	258.0	259.0	259.6	260.4	261.0	262.0	263.0	264.0	265.0	266.0	267.0	268.0
(wt%)													
SiO ₂	73.50	64.07	70.24	71.98	71.51	72.10	69.82	70.48	67.40	70.18	72.78	71.15	70.70
Al ₂ O ₃	9.95	12.61	10.45	11.20	10.76	10.80	10.91	10.73	9.68	10.05	10.72	10.29	11.19
Fe ₂ O ₃ (T)	4.95	7.26	4.78	4.71	5.63	5.35	6.43	5.29	5.87	6.88	4.23	4.99	5.03
MnO	0.07	0.12	0.14	0.12	0.08	0.14	0.17	0.17	0.19	0.09	0.07	0.09	0.12
MgO	0.03	0.10	0.05	0.04	0.06	0.04	0.08	0.06	0.06	0.04	0.05	0.04	0.05
CaO	2.20	2.66	1.71	1.71	1.92	1.75	1.90	2.02	2.90	2.02	2.45	2.01	2.52
Na ₂ O	3.18	3.66	3.50	3.60	2.93	3.50	3.48	3.50	3.38	3.21	3.15	3.32	3.78
K ₂ O	4.30	5.03	4.11	4.34	4.46	4.22	4.41	4.31	3.79	4.15	4.37	4.26	4.50
TiO ₂	0.13	0.28	0.15	0.17	0.15	0.15	0.19	0.15	0.24	0.14	0.13	0.15	0.15
P ₂ O ₅	< 0.01	0.01	0.01	< 0.01	0.01	0.01	0.01	< 0.01	0.02	0.01	0.04	< 0.01	0.01
LOI	2.25	4.09	2.69	2.62	2.55	2.44	3.35	3.13	3.96	2.46	2.65	2.42	2.81
Total	100.60	99.88	97.84	100.50	100.10	100.50	100.70	99.85	97.49	99.23	100.60	98.72	100.90
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	14	16	13	13	11	15	13	12	26	42	24	21	26
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	61	21	39	48	34	46	42	46	39	47	48	46	46
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	80	120	350	270	150	290	310	250	210	90	70	90	80
Ga	50	49	48	49	50	46	49	45	48	45	48	47	46
Ge	2	4	3	3	3	3	3	3	3	3	3	3	2
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	6	< 5	< 5	< 5	< 5
Rb	229	219	201	215	218	202	210	201	181	198	211	208	198
Sr	36	38	40	39	35	42	46	41	74	37	45	38	46
Zr	640	1022	1568	1802	1325	1879	1240	1420	7729	5649	2013	1135	1468
Nb	195	289	300	289	245	245	289	262	448	316	358	236	296
Mo	3	5	2	< 2	< 2	3	3	2	< 2	< 2	< 2	< 2	< 2
Ag	3.9												
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	22	20	28	25	24	25	30	25	41	30	22	19	21
Sb	< 0.5	0.9	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.7	0.7	< 0.5	< 0.5	< 0.5
Cs	< 0.5	0.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	27	66	31	33	37	32	32	32	38	37	37	31	34
Hf	14.1	23.2	36.9	43.5	31.4	42.6	29.4	32.1	182	136	46.8	26.3	34.4
Ta	13.9	13.8	20.9	19.9	16.5	15.7	17.6	17.7	38.8	21.5	21.7	17.2	19.3
W	602	218	470	493	382	452	446	471	407	497	498	478	493
Tl	0.1	0.1	0.1	0.1	0.1	< 0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.4
Pb	6	7	8	8	7	9	8	9	14	7	7	6	5
Th	59.7	21.4	26	34.1	28.9	25.3	27.2	33.4	42	41.9	54.9	30.3	28.1
U	8.3	8	14.7	9.6	6.8	8.7	7.9	10.2	19.9	11.3	11.1	7.9	8.3
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.5	< 0.4	< 0.4	< 0.4	< 0.4
Y	166	201	196	180	200	191	184	180	425	275	255	196	234
La	114	445	175	162	153	147	130	130	341	179	166	160	146
Ce	236	732	329	305	288	279	248	255	626	350	338	309	288
Pr	28.7	80.8	38.1	36.1	33.7	32.8	28.6	29.3	71.6	40.6	41.1	36.5	34.1
Nd	105	274	135	128	121	119	99.3	104	249	146	147	131	118
Sm	25.6	44	29.5	27.1	26.6	26.3	22.8	22.6	51.7	32.8	35.7	29.6	26.5
Eu	1.61	2.78	1.91	1.81	1.85	1.82	1.64	1.56	3.19	2.53	2.5	1.97	1.83
Gd	26.4	39.8	29.2	28	28.4	26.7	24	24.5	53.9	34.6	37.7	31	28
Tb	4.9	6.4	5.5	5.2	5.3	5.1	5	4.8	10.2	6.9	7.1	5.8	5.6
Dy	31	37.6	34.4	32.2	34.7	33.3	32.2	30.9	68.5	44.6	45.5	35.7	36.9
Ho	6.4	7.3	7	6.6	7.1	6.8	6.6	6.5	16.1	9.9	9.3	7.1	7.6
Er	19.8	20.3	21	20	21.3	21.3	19.5	19.7	56.8	32.1	28.3	20.5	23.1
Tm	3.03	2.78	2.98	2.91	3.06	3.33	2.91	2.97	9.66	5.24	4.21	2.76	3.45
Yb	19.2	18.6	18.9	20.1	19.4	22	19.4	19	66.9	35.5	27.8	17.1	20.8
Lu	2.72	2.83	2.77	2.94	2.86	3.18	2.82	2.8	10.2	5.48	4.16	2.47	2.99
TREE	624.36	1714.19	830.26	777.96	746.27	727.63	642.77	653.63	1634.75	925.25	894.37	790.5	742.87

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Granite											
Sample No.	10639	10640	10641	10642	10643	10644	10645	10646	10647	10648	10649	10650	10651
from	268.0	269.0	270.0	271.0	272.0	273.0	274.0	275.0	276.0	277.0	278.0	279.0	280.0
to	269.0	270.0	271.0	272.0	273.0	274.0	275.0	276.0	277.0	278.0	279.0	280.0	281.0
(wt%)													
SiO ₂	71.44	71.31	68.51	71.10	70.18	69.72	70.33	69.95	70.27	70.24	71.74	70.76	69.10
Al ₂ O ₃	10.49	10.96	10.01	11.12	11.45	10.96	11.22	11.83	11.34	10.81	10.89	9.87	10.98
Fe ₂ O ₃ (T)	5.21	4.64	6.77	6.45	4.55	4.62	5.13	4.82	5.06	5.86	5.53	4.95	5.63
MnO	0.08	0.08	0.22	0.13	0.17	0.19	0.16	0.15	0.16	0.11	0.16	0.23	0.13
MgO	0.04	0.03	0.09	0.04	0.05	0.06	0.05	0.05	0.04	0.04	0.05	0.05	0.04
CaO	2.03	2.44	3.23	1.46	1.85	2.29	1.94	1.96	1.63	2.10	1.76	1.74	2.05
Na ₂ O	3.35	3.53	2.60	3.46	3.79	3.69	3.75	3.96	4.12	3.46	3.52	3.12	3.48
K ₂ O	4.33	4.51	4.43	4.61	4.56	4.53	4.66	4.76	4.49	4.40	4.30	4.11	4.34
TiO ₂	0.14	0.14	0.13	0.13	0.17	0.17	0.17	0.16	0.16	0.15	0.16	0.17	0.16
P ₂ O ₅	0.02	< 0.01	0.02	0.01	< 0.01	0.01	0.01	0.01	< 0.01	0.02	< 0.01	0.03	< 0.01
LOI	2.35	2.56	3.96	2.00	2.93	3.35	3.04	2.96	2.85	2.59	2.55	3.20	2.70
Total	99.48	100.20	99.97	100.50	99.70	99.60	100.50	100.60	100.10	99.76	100.70	98.22	98.60
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	24	22	16	13	19	18	16	16	20	19	15	21	19
V	< 5	< 5	< 5	< 5	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	46	47	40	42	57	38	43	38	45	39	42	47	47
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	60	50	480	210	270	180	230	200	300	220	310	340	240
Ga	45	46	44	46	46	45	46	47	49	46	44	46	48
Ge	2	3	4	3	3	3	3	3	3	3	3	3	3
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	7	< 5
Rb	195	206	194	204	201	198	201	204	204	198	184	198	200
Sr	33	49	53	35	43	55	53	58	51	48	57	51	49
Zr	1478	2384	821	1322	536	1344	2328	1784	608	1840	1249	2606	1402
Nb	288	273	237	310	198	240	302	264	229	332	227	265	309
Mo	< 2	< 2	< 2	3	3	3	2	< 2	2	2	2	< 2	< 2
Ag			5.4		3.6				4.3				
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	20	24	22	21	19	18	23	25	22	22	21	21	22
Sb	0.6	< 0.5	0.9	0.6	< 0.5	0.6	0.9	0.9	< 0.5	0.6	0.6	0.7	0.7
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	35	37	39	38	35	36	36	43	29	36	33	44	35
Hf	36.1	56.5	20.2	30	13.4	31.3	54.9	42.3	15.4	44.9	28	61.5	33.6
Ta	19.6	20.3	13.4	19.7	14.1	19.9	23.2	18.4	14.4	25	14.2	21.7	23.6
W	495	497	442	469	601	400	464	414	463	419	465	475	480
Tl	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3
Pb	6	7	10	9	6	8	13	18	19	18	14	18	18
Th	36.3	30.7	35.1	64.1	36.8	37.9	38	31.6	25.6	36	31.5	39.9	36.4
U	9.5	10.3	6.1	10.9	6.6	11.3	13.2	13.1	6.2	12.4	7.8	12.8	10.8
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	209	246	236	224	215	187	214	211	176	216	211	279	224
La	176	199	199	185	181	136	151	186	137	178	164	293	207
Ce	339	373	362	354	338	258	286	342	257	347	309	527	388
Pr	39.8	43.6	42.6	42	41.7	31.1	34.4	40.6	31.1	40.8	36.4	60.7	46.2
Nd	140	153	152	150	149	113	125	142	113	144	130	203	159
Sm	30.2	34	33.8	33.4	33.9	25.4	27.7	29.2	25.9	31.2	28.1	39.3	33.1
Eu	1.98	2.29	2.1	2.18	2.21	1.65	1.81	1.98	1.68	1.99	1.85	2.31	2.07
Gd	31.2	33.9	33	32.1	34	25	28	28.7	26.1	31.1	27.1	38	30.8
Tb	6.1	6.6	6.5	6.3	6.3	4.9	5.5	5.4	5	5.9	5.3	7.4	5.9
Dy	39.4	40.9	40.5	40.1	39.2	31.7	35.8	34.6	32.7	38.2	35	48.3	36.4
Ho	7.7	8.3	7.9	7.9	7.6	6.4	7.3	7	6.4	7.8	7	9.9	7.3
Er	22.7	25.3	21.9	23.6	21.2	20.2	22.4	21.3	17.9	24.7	20.5	31.7	22.6
Tm	3.44	4.03	3.22	3.6	2.98	3.23	3.56	3.35	2.47	3.91	2.91	4.79	3.5
Yb	21.9	25.9	18.7	22.9	17.9	21.6	24	21.7	15.5	25	18.4	29.3	22.5
Lu	3.24	3.75	2.73	3.37	2.63	3.21	3.53	3.16	2.35	3.63	2.73	4.38	3.35
TREE	862.66	953.57	925.95	906.45	877.62	681.39	756	866.99	674.1	883.23	788.29	1299.08	967.72

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Granite											
Sample No.	10652	10653	10654	10655	10656	10657	10658	10659	10660	10661	10662	10663	10664
from	281.0	282.0	283.0	284.0	285.0	286.0	287.0	288.0	289.0	290.0	291.0	292.0	293.0
to	282.0	283.0	284.0	285.0	286.0	287.0	288.0	289.0	290.0	291.0	292.0	293.0	294.0
(wt%)													
SiO ₂	70.53	69.06	69.87	69.75	69.81	69.03	70.20	69.40	70.14	69.29	68.50	68.52	69.88
Al ₂ O ₃	11.36	11.28	11.11	11.08	11.37	10.83	11.20	10.87	10.99	10.80	11.56	11.26	11.41
Fe ₂ O ₃ (T)	5.30	5.67	5.92	5.23	4.50	4.36	5.04	4.22	4.91	5.86	5.69	5.32	4.98
MnO	0.16	0.15	0.16	0.15	0.14	0.16	0.11	0.12	0.16	0.18	0.16	0.21	0.11
MgO	0.04	0.03	0.03	0.03	0.03	0.05	0.04	0.04	0.04	0.04	0.02	0.06	0.03
CaO	1.47	1.47	1.30	1.20	1.61	2.28	1.93	2.35	1.85	1.90	1.40	1.97	1.89
Na ₂ O	3.75	3.93	3.92	4.00	3.86	3.54	3.61	3.49	3.86	3.77	4.28	3.74	3.92
K ₂ O	4.72	4.61	4.40	4.27	4.46	4.32	4.55	4.35	4.35	4.26	4.45	4.32	4.40
TiO ₂	0.15	0.17	0.19	0.15	0.13	0.15	0.21	0.16	0.16	0.17	0.17	0.16	0.15
P ₂ O ₅	< 0.01	< 0.01	0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	0.01	< 0.01	0.02	< 0.01	0.01
LOI	3.03	2.72	2.63	2.14	2.69	3.76	3.04	3.12	3.04	3.26	2.50	3.74	2.84
Total	100.50	99.09	99.53	98.02	98.60	98.49	99.93	98.12	99.51	99.53	98.76	99.29	99.63
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	15	17	21	15	17	24	22	16	18	16	17	28	23
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	45	58	54	46	49	40	48	43	39	44	44	36	37
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	310	370	400	400	270	290	120	190	340	420	460	370	260
Ga	48	49	48	49	51	47	46	48	50	49	51	45	47
Ge	3	3	4	4	3	3	3	3	3	4	4	3	3
As	14	13	8	< 5	6	10	< 5	6	7	8	11	5	< 5
Rb	211	211	209	216	222	197	208	211	210	211	225	200	201
Sr	54	49	45	41	46	83	51	50	53	61	47	63	60
Zr	1192	1260	2156	1036	1619	2834	1903	1593	1742	2197	1063	1325	2580
Nb	299	273	309	280	265	304	306	258	282	394	296	274	301
Mo	3	3	4	2	< 2	3	2	< 2	2	< 2	4	< 2	9
Ag													
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	20	21	24	20	19	20	21	18	20	27	23	22	22
Sb	0.7	0.7	1	0.7	0.6	0.8	1.4	1.1	< 0.5	0.9	0.5	0.5	0.7
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	38	37	37	32	31	52	41	34	35	35	34	32	45
Hf	28.4	30	52.5	24.4	38.3	68.5	46.9	38.1	41.9	54	27.3	30	60.8
Ta	21	18.4	20.9	18.2	18	21.7	21.9	19.1	19.3	28.1	19.6	18.6	23.7
W	457	525	529	460	473	408	490	435	384	432	452	377	403
Tl	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Pb	12	17	32	25	15	114	16	18	26	42	54	16	25
Th	29.6	28.4	28.9	31.3	29.2	32.3	30.5	30.8	34.5	28.9	26.2	26.6	28.4
U	9.3	8.8	10.7	9	9.7	14.1	10.4	9	9.8	12	8.7	8.6	13.1
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.4
Y	176	211	199	175	166	219	191	173	187	187	183	176	193
La	132	148	153	124	139	176	142	156	156	138	168	133	166
Ce	254	276	288	238	260	336	270	292	295	262	320	252	310
Pr	29.1	32.9	34	28.1	30.3	40.5	32.2	34.3	34.2	31	37.4	29.3	35.4
Nd	103	115	121	99.9	106	142	115	122	118	109	128	103	123
Sm	23.4	26.7	26.6	23	22.7	30.8	25.8	26.3	25.3	24.2	28	23.4	26.8
Eu	1.61	1.87	1.82	1.5	1.54	2.04	1.61	1.59	1.66	1.64	1.78	1.48	1.82
Gd	22.6	26.1	26.9	23.1	22.4	30.3	24.9	25.7	26.2	23.7	27.8	23.3	25.7
Tb	4.7	5.4	5.3	4.7	4.5	5.8	4.9	5	5	4.8	5.5	4.6	4.9
Dy	29.6	34	33.8	30.7	28.3	37	32.2	31.1	31.7	30.6	33.8	29.3	32.3
Ho	5.8	6.8	6.9	5.9	5.8	7.8	6.7	6.1	6.3	6.3	6.5	5.7	6.6
Er	17.6	21.3	21.5	18	18	23.9	21.4	18.7	19.7	20.1	18.9	17.1	20.9
Tm	2.73	3.25	3.33	2.72	2.79	3.87	3.43	2.93	3.06	3.14	2.77	2.55	3.38
Yb	17.7	20.2	21.5	17.2	17.5	24.8	22.5	19	19.6	19.7	16.8	16.1	22.3
Lu	2.68	2.99	3.23	2.65	2.6	3.59	3.48	3.07	3.04	2.93	2.53	2.36	3.27
TREE	646.52	720.51	746.88	619.47	661.43	864.4	706.12	743.79	744.76	677.11	797.78	643.19	782.37

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology	Granite												
Sample No.	10665	10666	10667	10668	10669	10670	12273	12274	12275	12276	12277	12278	12279
from	294.0	295.0	296.0	297.0	298.0	299.0	200.0	201.0	202.0	203.0	204.0	205.0	206.0
to	295.0	296.0	297.0	298.0	299.0	300.0	201.0	202.0	203.0	204.0	205.0	206.0	207.0
(wt%)													
SiO ₂	69.86	70.54	69.49	71.21	70.29	68.91	70.77	71.75	71.83	71.17	71.73	71.54	71.60
Al ₂ O ₃	11.50	11.05	11.23	11.16	10.90	10.85	10.20	10.18	10.41	10.23	10.21	10.45	10.46
Fe ₂ O ₃ (T)	5.48	5.30	5.10	4.59	4.50	6.19	5.31	4.98	4.73	4.88	5.35	5.00	4.86
MnO	0.19	0.19	0.17	0.10	0.14	0.14	0.17	0.14	0.14	0.13	0.15	0.13	0.17
MgO	0.05	0.05	0.04	0.02	0.04	0.05	0.05	0.03	0.03	0.04	0.04	0.05	0.06
CaO	1.63	1.76	1.94	1.86	2.74	2.24	2.07	1.40	2.16	1.87	1.57	1.68	1.97
Na ₂ O	3.95	3.85	3.75	3.82	3.52	3.47	3.08	3.29	3.27	3.20	3.05	3.41	3.22
K ₂ O	4.62	4.41	4.51	4.52	4.39	4.37	4.30	4.22	4.33	4.21	4.29	4.41	4.43
TiO ₂	0.16	0.17	0.16	0.14	0.15	0.16	0.10	0.10	0.13	0.11	0.10	0.11	0.09
P ₂ O ₅	< 0.01	0.02	< 0.01	< 0.01	< 0.01	0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	3.30	3.21	3.28	2.37	3.32	2.98	2.81	2.39	2.63	2.23	2.86	2.39	2.97
Total	100.80	100.50	99.67	99.79	100.00	99.37	98.88	98.47	99.67	98.07	99.34	99.17	99.83
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	34	20	21	16	14	18	10	10	11	11	9	8	10
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	30	< 20	30	< 20	30	< 20
Co	38	43	37	46	38	43	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	70	20	20	30	10	< 10	< 10
Zn	470	360	340	180	190	210	340	320	260	260	370	260	330
Ga	49	47	49	48	46	46	50	55	55	57	53	59	57
Ge	3	3	3	2	2	3	2	2	2	2	2	2	2
As	6	7	< 5	7	< 5	6	< 5	< 5	< 5	< 5	14	6	< 5
Rb	212	209	212	216	211	203	217	230	233	232	225	232	247
Sr	56	59	58	62	61	51	63	45	64	52	36	36	47
Zr	1254	2151	2173	1558	1309	1607	2328	2069	1699	2986	2746	1947	2022
Nb	297	347	291	316	305	262	407	312	594	473	362	595	339
Mo	3	< 2	3	2	3	4	52	70	59	35	75	6	3
Ag													
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	22	27	24	21	20	21	15	18	23	21	16	20	16
Sb	0.8	0.7	0.6	0.5	< 0.5	< 0.5	1	1	1.3	1.1	1.3	1.3	1
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	44	35	36	33	38	48	43	41	43	53	55	50	47
Hf	30.4	51.5	50.7	36.9	30.3	37.5	49.4	49.1	38.8	71.4	67.8	50.6	45.9
Ta	20.2	25.1	21.7	21.9	21.3	18.9	28.1	18.9	35.6	30	20.8	38.5	18.1
W	399	432	397	469	378	435	1	2	3	2	3	3	2
Tl	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4
Pb	21	21	22	35	20	21	32	74	65	33	19	12	13
Th	25	25.9	26.9	35.4	32.5	29.6	80.3	48	87	115	27.9	41.5	42.1
U	8.6	10.3	10	10.9	8.9	9.4	15.4	9.2	15.1	16.2	11.5	18.7	12.3
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.5	< 0.4	0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	180	192	201	197	199	202	218	253	272	255	227	261	217
La	198	181	160	152	150	195	188	201	167	192	162	218	163
Ce	364	334	306	286	285	356	406	428	366	412	340	473	345
Pr	41.5	39	36.2	34.2	33	42.3	46.3	49.8	41.1	45.8	38.8	53.9	39.1
Nd	144	139	130	120	116	150	177	192	153	168	148	202	150
Sm	29.7	29.3	28.9	26	25.5	32.2	38.6	42.9	34.6	36.3	34.7	47.6	35.4
Eu	1.84	1.77	1.84	1.77	1.72	2.18	2.31	2.48	2.13	2.51	2.23	3.03	2.16
Gd	27.5	27.5	28.5	26.7	25.8	30.3	35.4	39.9	33.4	33.9	33.3	47	33.1
Tb	5.2	5.2	5.5	5.1	5.1	5.5	5.6	6.6	6.3	5.9	5.9	8.1	5.9
Dy	30.5	32.4	34.1	32.6	33.4	33.6	35.1	41.2	42.7	39.7	39.3	48.8	38.7
Ho	5.9	6.5	7	6.8	6.7	6.6	7.1	8.3	9.2	8.9	8.5	9.8	8.1
Er	16.9	19.5	21.3	21.2	20	19.9	21.5	25.1	29.3	29.4	27.7	28.3	26.3
Tm	2.54	2.98	3.32	3.28	3.03	2.98	3.3	3.61	4.48	4.67	4.23	3.95	4.11
Yb	15.3	19.4	20.6	20.8	18.9	18.9	20.8	21.8	26.3	30.1	27.1	22.4	24.9
Lu	2.3	2.89	3.14	3.1	2.92	2.83	2.88	3.08	3.63	4.35	3.98	3.12	3.54
TREE	885.18	840.44	786.4	739.55	727.07	898.29	989.89	1065.77	919.14	1013.53	875.74	1169	879.31

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology		Granite										
Sample No.	12280	12281	12282	12283	12284	12285	12286	12287	12288	12289	12290	12291
from	207.0	208.0	209.0	230.0	231.0	232.0	233.0	234.0	235.0	236.0	237.0	238.0
to	208.0	209.0	210.0	231.0	232.0	233.0	234.0	235.0	236.0	237.0	238.0	239.0
(wt%)												
SiO ₂	69.38	71.21	68.08	73.99	69.80	71.83	72.68	73.84	73.28	72.38	72.22	71.29
Al ₂ O ₃	10.98	10.83	9.99	9.98	9.72	10.03	9.89	10.30	9.93	10.17	9.71	10.03
Fe ₂ O ₃ (T)	4.77	4.36	5.24	5.39	6.26	5.11	5.35	5.21	5.42	5.19	5.31	5.58
MnO	0.13	0.13	0.13	0.05	0.09	0.08	0.13	0.13	0.11	0.12	0.12	0.14
MgO	0.04	0.03	0.08	0.03	0.07	0.03	0.03	0.03	0.03	0.02	0.02	0.04
CaO	1.66	2.06	2.30	1.85	2.40	1.95	1.42	1.41	1.61	1.49	1.66	1.77
Na ₂ O	3.51	3.35	2.90	3.23	2.53	3.14	3.30	3.47	3.24	3.33	3.27	3.20
K ₂ O	4.43	4.40	4.30	4.42	4.38	4.30	4.22	4.44	4.25	4.32	4.16	4.18
TiO ₂	0.11	0.10	0.12	0.11	0.10	0.11	0.11	0.11	0.11	0.12	0.11	0.13
P ₂ O ₅	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
LOI	2.47	2.42	5.66	1.30	2.65	1.62	1.14	1.12	1.53	1.40	1.34	1.56
Total	97.49	98.88	98.81	100.40	98.01	98.20	98.28	100.10	99.52	98.52	97.91	97.91
(ppm)												
Sc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Be	11	11	9	16	12	9	9	9	16	9	20	14
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr	40	<20	30	<20	<20	<20	40	<20	40	<20	40	<20
Co	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Zn	310	250	220	40	50	90	230	260	170	140	120	141
Ga	60	56	54	49	48	50	48	57	46	49	49	47
Ge	2	2	2	2	2	2	3	3	2	2	2	2
As	<5	6	<5	<5	<5	<5	8	10	<5	<5	<5	<5
Rb	258	242	237	207	213	214	210	241	197	210	205	200
Sr	40	53	56	45	45	48	75	66	40	36	38	40
Zr	2559	2532	1146	1017	835	1010	1129	1115	978	860	650	886
Nb	434	390	450	286	393	302	293	314	295	238	238	236
Mo	4	9	4	<2	2	<2	<2	<2	5	5	6	4
Ag					15.2				12.3	11	8.7	10.8
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	20	18	19	23	20	24	26	29	22	20	20	20
Sb	1.1	1.2	1.3	1	1	0.9	0.9	1.3	0.8	0.7	0.7	0.7
Cs	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ba	45	41	37	36	35	34	36	37	35	35	30	36
Hf	63.2	56.6	28.6	21.7	18	24.6	25.1	27.7	21.2	19.2	15.3	19.5
Ta	26.1	22.4	26.1	15	16.3	16.4	17.4	19.2	17.3	13.2	12.9	12.6
W	3	2	2	3	3	2	2	2	1	2	1	2
Tl	0.4	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.3	0.3	0.2
Pb	16	16	12	6	6	10	14	16	7	7	5	6
Th	41.2	74.5	49.4	44.1	34.3	48.2	48	49.6	49.1	42.1	56.9	40
U	14.8	15.6	13.3	8	8	13.1	11.3	12.9	11.1	11	8.3	6.9
Bi	<0.4	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Y	258	272	228	265	236	227	232	248	202	229	229	198
La	207	200	192	178	154	169	171	209	119	153	200	113
Ce	428	430	407	372	319	355	348	431	251	314	408	237
Pr	48	49.6	45.3	43.4	36.1	40.4	40.8	49.6	28.7	36.9	46.6	27.5
Nd	183	189	173	164	137	156	152	191	108	140	175	102
Sm	41.5	43.8	40.3	39.1	32	35.6	35.3	44.8	26.2	33.4	41.3	25.8
Eu	2.53	2.76	2.57	2.48	2.04	2.31	2.33	2.74	1.69	2.11	2.52	1.68
Gd	39.6	41.9	38.2	37.9	31.9	33.7	32.6	41.4	25.1	32.5	38.3	24.8
Tb	6.9	7.4	6.6	7	6.1	6.3	6.2	7.8	5	6.4	7.1	5.1
Dy	46	47.5	41.5	44.3	40.7	39.7	41.2	49.4	32.7	43.1	43.4	33.6
Ho	9.7	9.7	8.2	8.9	7.9	7.8	8.3	10	6.7	8.9	8.2	7.2
Er	31.3	29.8	24.8	26.1	23.3	23.4	25.2	29.8	20.8	26.1	22.4	23.1
Tm	4.93	4.53	3.65	3.68	3.28	3.43	3.77	4.36	3.19	3.67	3.13	3.63
Yb	31.2	27.9	21	21.6	19.6	21	23.2	26.7	19.4	21.1	17.6	23
Lu	4.54	3.91	2.94	2.91	2.66	2.89	3.23	3.55	2.68	2.91	2.49	3.18
TREE	1084.2	1087.8	1007.06	951.37	815.58	896.53	893.13	1101.15	650.16	824.09	1016.04	630.59

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-04)

Appendix 1

Lithology	Granite										
Sample No.	12292	12293	12294	12295	12296	12297	12298	12299	12300	12301	12302
from	239.0	240.0	241.0	242.0	243.0	244.0	245.0	246.0	247.0	248.0	249.0
to	240.0	241.0	242.0	243.0	244.0	245.0	246.0	247.0	248.0	249.0	250.0
(wt%)											
SiO ₂	72.82	72.25	70.72	75.50	73.16	70.80	72.13	72.52	71.06	73.44	72.16
Al ₂ O ₃	10.01	9.92	9.69	10.41	10.09	9.97	9.82	9.96	9.92	10.31	9.80
Fe ₂ O ₃ (T)	5.34	6.07	7.47	3.50	4.39	5.17	4.95	4.84	4.96	5.07	5.72
MnO	0.19	0.20	0.13	0.08	0.13	0.18	0.17	0.17	0.11	0.07	0.09
MgO	0.04	0.05	0.04	0.03	0.05	0.07	0.05	0.06	0.04	0.03	0.06
CaO	2.21	1.24	1.27	1.13	1.35	1.52	1.75	2.19	2.34	2.37	2.44
Na ₂ O	3.25	3.15	3.07	3.28	3.16	3.02	2.98	2.84	3.03	2.96	2.95
K ₂ O	4.17	4.12	4.21	4.57	4.34	4.25	4.20	4.37	4.22	4.16	4.04
TiO ₂	0.11	0.10	0.14	0.11	0.10	0.11	0.11	0.11	0.11	0.16	0.12
P ₂ O ₅	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
LOI	2.13	1.94	1.51	1.14	1.61	2.31	2.17	2.48	2.64	2.37	2.68
Total	100.30	99.04	98.26	99.74	98.38	97.39	98.33	99.54	98.45	100.90	100.10
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	12	11	12	14	11	10	10	13	18	13	15
V	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cr	40	<20	30	<20	40	30	40	<20	<20	<20	<20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cu	< 10	<10	<10	< 10	<10	50	< 10	<10	< 10	< 10	<10
Zn	200	270	190	160	200	760	330	170	80	50	60
Ga	49	47	48	51	49	49	47	49	49	48	47
Ge	2	2	3	3	3	3	2	2	2	2	2
As	<5	<5	<5	<5	<5	<5	<5	<5	<5	14	8
Rb	207	200	204	231	209	205	204	217	218	214	206
Sr	51	31	30	31	44	55	48	45	50	47	48
Zr	719	857	1075	3892	3670	3328	5724	3358	963	503	731
Nb	224	248	178	153	155	206	439	318	178	209	216
Mo	41	3	146	5	6	<2	5	<2	2	5	2
Ag	8.6	11.1							6.7	3.5	4.8
In	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	19	16	17	26	28	31	33	24	20	134	19
Sb	0.8	0.8	1	1	0.8	1	0.9	1.2	<0.5	0.7	0.6
Cs	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ba	33	36	39	48	46	46	38	40	30	30	30
Hf	15.4	19.3	27	94.1	85.7	76.7	133	79.6	22.8	12	16.1
Ta	12.1	16	14	14.4	15.1	17.6	42	24.1	11.6	14.6	11
W	1	1	2	2	1	2	2	3	2	2	2
Tl	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4
Pb	7	7	9	11	10	13	14	9	6	5	8
Th	32	23	25	19.5	16.8	20.1	18.7	21.8	18.7	17.8	21.3
U	7.8	8.5	8.4	12.3	12.9	13.3	25.8	14.9	7.7	6.2	7.1
Bi	<0.4	<0.4	0.8	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Y	158	144	151	182	157	195	135	196	196	202	212
La	102	93.5	145	131	152	187	123	137	123	125	151
Ce	220	197	290	261	304	373	261	286	240	243	288
Pr	25.2	22.4	33.5	30.8	35.3	43.3	28.7	32.8	29.9	30.8	36.7
Nd	93.1	82.9	128	118	133	167	104	123	110	113	136
Sm	22.9	20.6	27.9	26.4	28.3	36.1	21.7	28.8	26.8	27.3	32.4
Eu	1.5	1.32	1.61	1.55	1.71	2.17	1.36	1.71	1.81	1.9	2.13
Gd	22.5	19.4	25	23.2	24.9	32.3	19.1	26.7	27.4	27.6	32.1
Tb	4.4	4	4.2	4.4	4.5	5.5	3.5	5.4	5.9	6	6.6
Dy	28.7	26.1	26.1	30.9	27.2	34.5	22.6	34.8	36.6	36.7	39.6
Ho	6.1	5.6	5.4	7	5.4	6.9	4.7	7.3	7.2	7.1	7.5
Er	19.6	18.4	16.5	22.8	15.6	20.4	15	22.6	20.5	20.3	21.2
Tm	3.06	2.87	2.64	3.55	2.3	3.01	2.3	3.48	3.05	3.12	3.18
Yb	19.4	17.7	17.2	22.4	13.6	18	14.3	21.7	20.1	21.2	21
Lu	2.76	2.48	2.54	3.12	1.9	2.5	2.11	3.14	2.95	3.18	3.09
TREE	571.22	514.27	725.59	686.12	749.71	931.68	623.37	734.43	655.21	666.2	780.5

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)												APPENDIX 1
Lithology		Syenite										
Sample No.	10781	10782	10783	10784	10785	10786	10787	10788	10789	10790	10791	10792
from	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0
to	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0
(wt%)												
SiO2	64.71	63.08	65.11	65.74	64.86	65.54	66.76	65.3	67.29	66.93	67.19	66.13
Al2O3	14.81	15.05	14.55	14.33	13.58	15.19	15.08	15.64	15.21	14.99	14.81	14.29
Fe2O3(T)	6.02	6.27	5.1	4.57	7.08	5.28	4.64	4.51	4.1	3.97	3.56	4.29
MnO	0.234	0.219	0.225	0.094	0.237	0.247	0.087	0.088	0.107	0.111	0.059	0.072
MgO	0.03	0.03	0.04	0.04	0.05	0.04	0.04	0.04	0.03	0.03	0.04	0.06
CaO	0.99	0.97	1.51	3.2	1.86	0.95	0.71	0.7	0.79	0.91	0.86	0.92
Na2O	5.12	5.46	4.92	4.41	3.89	5.25	5.2	5.46	5.37	5.13	5.15	5.01
K2O	5.22	5.15	5.08	4.74	4.68	5.03	5	5.43	5.21	5.28	5.3	5.23
TiO2	0.222	0.213	0.186	0.174	0.251	0.187	0.205	0.246	0.159	0.158	0.172	0.155
P2O5	0.06	0.05	0.03	0.02	0.04	0.04	0.03	0.03	0.02	0.02	0.02	< 0.01
LOI	2.05	1.91	2.43	3.48	3.48	2.06	1.97	1.89	1.69	1.79	1.6	2.14
Total	99.47	98.4	99.18	100.8	100	99.82	99.71	99.33	99.97	99.32	98.75	98.32
(ppm)												
Sc	1	2	2	1	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1
Be	15	15	22	234	34	13	13	13	16	17	18	23
V	< 5	< 5	< 5	< 5	5	< 5	5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	27	21	21	15	16	21	26	22	23	21	25	27
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	110	110
Zn	220	210	200	170	180	170	200	200	180	210	190	200
Ga	44	42	45	45	43	48	48	49	50	48	51	53
Ge	3	4	3	3	3	3	3	3	3	3	2	3
As	< 5	7	5	9	7	< 5	8	5	< 5	< 5	< 5	8
Rb	161	147	157	158	144	168	169	156	175	178	204	207
Sr	36	37	58	103	187	38	45	56	44	48	37	40
Zr	1929	1362	1452	1528	2138	1518	3787	1748	1866	1701	1688	1582
Nb	184	167	172	144	201	186	258	202	265	221	202	195
Mo	5	6	7	27	13	9	14	9	3	7	2	4
Ag												
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	13	12	11	10	11	12	16	14	18	17	18	17
Sb	0.7	0.6	0.8	0.8	0.7	0.7	1.4	0.8	0.8	0.9	0.5	0.7
Cs	0.6	0.6	0.8	1	1	0.8	0.7	0.9	0.7	< 0.5	0.5	0.6
Ba	80	104	111	149	112	72	67	81	77	76	69	79
Hf	39.9	27.5	31	34.4	40	31.1	93	36.4	44.1	41.7	38.4	36.3
Ta	13.8	12.5	13.9	13.1	13.5	12.7	18.8	13.3	19.7	18.4	20.1	19
W	341	268	259	190	193	251	195	237	324	278	282	222
Tl	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.5
Pb	18	20	11	14	16	15	17	27	16	11	13	13
Th	21.6	16.6	22.5	21.1	18.9	17.8	19.8	20.9	30.5	29.7	32.6	32
U	6.3	5.6	7.7	10.9	8.1	6.2	9.7	7	7.9	8.4	9.5	9.6
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	161	128	163	184	170	147	159	147	179	183	183	199
La	154	125	140	138	176	148	136	189	146	158	152	173
Ce	298	246	287	279	346	297	265	345	278	293	297	336
Pr	36.6	31.4	36.6	34	43	37.2	32.6	40.2	33.3	36.4	34.7	39.2
Nd	137	118	136	129	160	140	117	138	124	133	130	146
Sm	28.6	25.1	29.4	28.3	33.8	28.9	24.7	26	25.5	28.3	26.7	29.7
Eu	2.27	2.12	2.34	2.66	2.51	2.14	2.02	2.05	2.13	2.21	2.1	2.18
Gd	26.7	22.5	28.2	27.2	31	27	24.2	24.5	25.7	27.1	26.2	27.5
Tb	4.7	4	5	5.1	5.6	4.7	4.6	4.4	4.9	5	4.7	5
Dy	28.9	23.3	30.5	32.2	33	27.2	27.9	25.7	30.7	31.7	29.4	31
Ho	5.6	4.5	5.9	6.5	6.4	5.2	5.7	5	6.2	6.3	6	6.3
Er	16.6	13.3	17.4	19.3	19.4	15.6	18.4	15.3	18.9	19	18.4	19.5
Tm	2.43	2.05	2.59	2.96	2.83	2.3	2.92	2.39	2.85	2.95	2.74	2.77
Yb	16.1	13.3	16.6	19.2	18.6	15.5	19.6	15.5	18.2	18	18.1	17.3
Lu	2.43	2.17	2.63	2.92	2.9	2.42	3.23	2.43	2.66	2.62	2.49	2.51
TREE	920.93	760.74	903.16	910.34	1051.04	900.16	842.87	982.47	898.04	946.58	933.53	1036.96

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10793	10795	10796	10797	10798	10799	10800	10801	10802	10803	10804
from	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.1	22.0
to	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.1	22.0	23.0
(wt%)											
SiO ₂	65.57	66.35	65.32	66.85	65.3	66.6	66.26	65.81	69.53	68.29	66.58
Al ₂ O ₃	14.99	14.19	13.92	14.36	14.01	14.47	14.5	14.58	12.16	13.47	15.02
Fe ₂ O ₃ (T)	3.94	4.31	5.27	3.54	5.57	4.83	4.48	4.21	4.71	5.05	4.76
MnO	0.094	0.101	0.172	0.141	0.093	0.093	0.107	0.144	0.143	0.123	0.123
MgO	0.04	0.04	0.03	0.03	0.03	0.01	0.02	0.02	0.03	0.03	0.02
CaO	0.77	1.04	1.14	1	0.96	1.2	0.9	0.9	0.8	1	0.83
Na ₂ O	4.96	5.02	4.86	4.87	4.56	4.95	5.06	5.08	4.4	5.07	5.32
K ₂ O	5.36	5.26	5.14	5.44	5.51	5.56	5.29	5.23	4.49	4.93	5.31
TiO ₂	0.151	0.19	0.221	0.211	0.21	0.256	0.191	0.196	0.227	0.226	0.206
P ₂ O ₅	0.01	0.03	0.02	0.02	0.03	0.05	0.03	0.05	0.02	0.02	0.03
LOI	1.73	1.75	1.92	1.66	1.99	1.64	1.52	1.59	1.59	1.51	1.53
Total	97.63	98.28	98.02	98.13	98.25	99.65	98.37	97.81	98.1	99.71	99.73
(ppm)											
Sc	< 1	< 1	1	< 1	1	1	< 1	1	< 1	< 1	< 1
Be	21	20	33	38	34	39	28	24	38	28	26
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	22	23	20	28	22	25	30	26	34	36	31
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	100	100	100	100	100	100	100	< 10	100	100	100
Zn	260	240	250	210	220	240	250	180	350	320	280
Ga	53	52	49	52	49	48	49	50	53	51	53
Ge	2	3	3	3	3	3	3	3	3	3	4
As	5	< 5	8	7	7	15	6	< 5	7	6	7
Rb	214	213	202	227	216	218	206	196	243	218	202
Sr	42	41	65	39	34	35	40	39	39	37	31
Zr	1632	1669	2080	1910	1994	2338	1992	1947	1946	2847	1649
Nb	199	201	257	249	231	205	192	240	396	286	184
Mo	9	6	8	12	16	8	8	6	8	6	6
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	17	19	20	20	18	16	11	13	21	26	12
Sb	0.6	0.7	1	1.7	1.7	1.1	0.8	0.8	0.8	0.9	0.8
Cs	0.6	0.6	1.1	0.8	1	0.8	0.6	0.6	3.6	0.7	0.8
Ba	74	76	125	95	201	80	69	72	123	74	78
Hf	39.1	42.1	50.8	44.2	40.6	46.9	35.8	38.7	42.4	59.8	30.7
Ta	20.3	17.7	26.1	23.6	21	18.7	19.1	18.6	34.6	24.1	16.2
W	235	264	262	281	279	350	342	267	374	275	297
Tl	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.3	0.4
Pb	14	14	22	18	12	10	8	10	12	11	10
Th	42.2	29.5	29.1	30.5	39.9	41.2	29.9	29.9	35.7	41.2	24.5
U	9.3	7.1	10.6	10.4	8.8	7.6	7.4	8.5	14.6	9.9	7.6
Bi	< 0.4	< 0.4	0.5	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	190	176	174	171	208	217	182	189	233	301	188
La	165	150	167	162	152	198	151	146	323	228	229
Ce	322	290	328	332	312	404	323	320	628	437	497
Pr	38	34.2	38.2	39.3	38.2	49.5	40.5	41.4	72	49.9	63.4
Nd	140	129	145	147	146	188	158	162	258	182	252
Sm	29.4	26.9	30.2	31.1	32.9	42.1	36	37.8	49.7	38.5	54.1
Eu	2.15	2	2.25	2.31	2.26	2.88	2.46	2.64	2.58	2.68	3.54
Gd	27.5	25.3	30.5	29.6	32.8	40.6	33.5	38.1	42.6	41.6	45.5
Tb	5	4.5	5.3	5.3	5.8	6.9	5.9	6.5	7	7.9	7
Dy	31.1	28.3	31.9	32.2	36.3	39.5	34.5	38.4	40.7	48.2	37
Ho	6.1	5.7	6.2	6.3	7	7.5	6.6	7.6	7.9	9.9	6.7
Er	18.7	17.4	18.4	18.4	20.6	22	19.4	21.9	22.9	29.1	18.9
Tm	2.75	2.55	2.72	2.81	2.93	3.36	2.81	3.18	3.5	4.37	2.68
Yb	17.6	17.1	17.2	17.8	19.1	21	18	19.4	23.7	26.3	17.3
Lu	2.45	2.56	2.63	2.79	2.65	2.94	2.49	2.83	3.38	3.58	2.46
TREE	997.75	911.51	999.5	999.91	1018.54	1245.28	1016.16	1036.75	1717.96	1410.03	1424.58

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10805	10806	10807	10808	10809	10810	10811	10812	10813	10814	10815
from	23.0	24.0	25.0	26.0	27.0	28.0	29.0	29.6	30.0	31.0	32.0
to	24.0	25.0	26.0	27.0	28.0	29.0	29.6	30.0	31.0	32.0	33.0
(wt%)											
SiO ₂	66.71	68.53	67.83	67.17	68.08	68.66	66.38	66.65	65.64	65.98	66.46
Al ₂ O ₃	13.41	14.18	14.36	14.65	14.56	14.54	14.43	14.84	14.28	13.96	14.14
Fe ₂ O ₃ (T)	5.84	4.53	3.72	3.34	3.61	4.01	4.84	4.41	4.54	5.04	4.73
MnO	0.119	0.082	0.067	0.037	0.081	0.093	0.163	0.133	0.119	0.176	0.151
MgO	0.06	0.04	0.04	0.03	0.02	0.02	0.06	0.04	0.03	0.02	0.03
CaO	0.93	0.86	1.34	0.79	0.86	0.88	0.91	0.94	0.73	0.83	0.79
Na ₂ O	4.37	4.64	4.78	5.32	5.06	4.62	4.87	5.8	5.64	5.48	5.66
K ₂ O	4.57	4.96	5.26	5.04	5.2	5.21	5.08	5.25	5.32	4.93	5.05
TiO ₂	0.215	0.203	0.224	0.188	0.199	0.184	0.18	0.179	0.182	0.206	0.194
P ₂ O ₅	< 0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	< 0.01
LOI	2.63	2.02	2.02	1.55	1.65	1.64	2.17	1.17	1.09	1.17	1.06
Total	98.88	100.1	99.66	98.12	99.33	99.88	99.09	99.44	97.58	97.81	98.27
(ppm)											
Sc	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	52	43	39	33	34	42	49	25	30	33	30
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	22	23	22	25	27	38	24	28	34	28	33
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	90	100	100	100	130	110	140	100	90	100	90
Zn	320	330	300	230	480	510	530	340	390	470	430
Ga	50	52	49	55	53	55	56	53	53	53	54
Ge	4	3	3	3	3	3	3	3	3	3	3
As	12	12	12	10	9	15	12	9	6	9	6
Rb	182	187	175	174	217	231	238	217	241	234	230
Sr	40	40	45	25	41	36	58	41	37	38	35
Zr	1754	1451	1780	1649	1424	2625	2755	2026	3185	2212	2085
Nb	225	183	175	163	228	337	332	286	390	336	336
Mo	6	7	8	9	9	9	5	44	4	4	2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	17	13	13	15	24	30	29	23	24	28	26
Sb	1.3	1	1	1	0.9	1	0.9	< 0.5	0.8	0.8	0.7
Cs	8.4	2.8	1.2	1.2	1.4	1.2	1.9	0.8	0.6	1	0.9
Ba	222	123	121	111	81	94	93	79	58	85	63
Hf	36.7	29.4	34.6	33.9	30.6	56	61.3	45	67.7	48.5	46.9
Ta	18.5	13.4	14.8	14.4	18.9	30	32.3	26.1	39	28	28.8
W	232	235	272	279	338	385	271	230	259	346	270
Tl	0.4	0.4	0.5	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4
Pb	5	7	29	14	146	123	28	63	46	64	62
Th	35.3	25.9	25.8	28.4	41.8	74.3	57.8	38.5	50.4	55.6	46.2
U	7.7	6.2	8.4	6.6	9.1	14.9	19.6	11.7	18.4	13.2	12.2
Bi	< 0.4	< 0.4	< 0.4	< 0.4	0.7	< 0.4	< 0.4	0.5	< 0.4	< 0.4	< 0.4
Y	253	214	214	220	271	432	303	213	258	279	240
La	273	203	194	195	255	286	296	195	268	258	223
Ce	524	433	428	442	546	586	626	400	519	500	438
Pr	61.1	54.1	55.3	56.8	67.6	72.1	76.4	48.2	61.1	59	52.1
Nd	227	213	219	225	262	276	287	181	218	221	199
Sm	47.2	45.7	47.5	49	57.3	61.9	61.6	38.5	45.9	47.5	44.8
Eu	2.82	2.83	2.84	2.92	3.37	3.82	4.18	2.34	3.01	2.97	2.88
Gd	43.9	41.2	43.8	44.1	51	61.9	57.3	34.7	42.9	47.7	43.1
Tb	7.2	6.8	7.2	7.5	8.5	11.6	9.9	6.1	7.7	8.3	7.4
Dy	42.9	38.3	41.4	41.9	50.3	73.9	57.7	36.8	46.7	50.5	44.6
Ho	8.4	7.5	7.6	8	9.8	14.6	11	7.3	8.9	10	8.6
Er	24.3	21.6	21.8	22.4	29.9	44.7	31.7	21.9	27	29.5	25.2
Tm	3.67	3.15	3.19	3.34	4.46	6.54	4.49	3.29	4.07	4.35	3.73
Yb	23.5	19.9	19.8	20.7	28.8	39.5	27	21	25.3	27.9	23
Lu	3.23	2.8	2.85	2.86	4.1	5.4	3.58	2.81	3.46	3.85	3.37
TREE	1545.22	1306.88	1308.28	1341.52	1649.13	1975.96	1856.85	1211.94	1539.04	1549.57	1358.78

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10816	10817	10818	10819	10820	10821	10822	10823	10824	10825	10826
from	33.0	34.0	35.0	36.0	37.0	38.0	39.0	40.0	41.0	42.0	43.0
to	34.0	35.0	36.0	37.0	38.0	39.0	40.0	41.0	42.0	43.0	44.0
(wt%)											
SiO ₂	66.62	67.07	66.51	66.94	66.68	67.6	67.61	66.9	65.91	66.77	65.97
Al ₂ O ₃	14.11	14.06	14.19	13.96	13.76	14.04	14.13	14.14	14	14.09	14.18
Fe ₂ O ₃ (T)	5.38	4.74	4.19	4.57	4.36	3.76	4.08	3.93	4.94	4.58	4.64
MnO	0.187	0.148	0.107	0.133	0.11	0.053	0.069	0.061	0.157	0.141	0.161
MgO	0.03	0.02	0.02	0.02	0.03	0.04	0.04	0.03	0.03	0.03	0.03
CaO	0.94	0.82	0.87	0.85	0.93	0.94	0.73	0.83	1.07	0.86	1.02
Na ₂ O	5.47	5.37	4.79	4.88	4.93	4.32	4.48	4.56	5.54	5.65	5.85
K ₂ O	5.07	5.05	5.09	4.99	5.23	5.35	5.11	5.04	4.98	5.07	5.18
TiO ₂	0.227	0.198	0.167	0.173	0.176	0.17	0.169	0.167	0.228	0.201	0.202
P ₂ O ₅	0.02	< 0.01	0.03	0.04	0.02	0.02	0.02	< 0.01	0.02	0.02	< 0.01
LOI	1.31	1.31	1.81	1.73	1.71	2.16	1.98	1.98	1.29	0.93	1.32
Total	99.37	98.8	97.76	98.3	97.94	98.45	98.41	97.65	98.15	98.33	98.56
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	35	29	34	28	43	52	46	52	32	30	27
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	27	25	34	25	31	31	29	24	24	29	28
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	100	90	100	100	100	100	100	100	100	100	100
Zn	570	400	400	400	450	380	400	440	530	430	530
Ga	55	52	54	54	54	54	52	54	54	55	53
Ge	3	3	3	3	3	3	3	3	3	3	3
As	8	5	9	7	13	11	11	17	8	6	6
Rb	229	212	237	228	238	234	232	238	243	242	249
Sr	42	40	50	48	51	56	47	46	51	57	49
Zr	1869	2359	1696	1895	2021	2047	2305	2202	2569	2994	2054
Nb	347	274	272	280	284	300	309	300	341	357	330
Mo	4	7	9	7	6	6	7	8	2	< 2	9
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	30	23	21	21	23	24	24	23	28	28	27
Sb	0.7	0.7	1	1	1	1	1.2	1.2	0.8	0.7	0.6
Cs	1	0.8	1	0.7	2	1	0.9	1.8	0.6	0.6	0.7
Ba	72	48	53	47	88	69	58	71	50	45	49
Hf	39.2	48.5	38.3	38.7	46.9	47.7	50.8	45.8	57.2	64.8	45
Ta	27.5	23.2	24.4	23.6	26.8	30.9	28.5	28.6	29.3	32.4	28.6
W	313	289	215	305	349	285	211	240	308	367	358
Tl	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.3
Pb	58	34	25	33	38	22	20	50	60	59	49
Th	52.3	51.9	40.9	45.7	38.9	47.5	42.4	58.2	47.2	37.6	40.8
U	11.8	11.5	12.6	11.4	16.5	17.7	17.9	19	15.3	16.9	12.6
Bi	< 0.4	< 0.4	< 0.4	< 0.4	0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	278	263	237	238	280	283	266	300	257	302	207
La	317	261	229	298	293	279	281	295	301	312	229
Ce	617	490	446	556	546	539	525	568	577	615	446
Pr	72.1	55.7	51.8	63.8	64.3	62.3	61.8	67.7	67.5	73.1	51.8
Nd	264	206	192	237	238	228	227	249	251	268	184
Sm	53.6	42.8	40.8	48.4	50.1	48	47.9	52.3	51.4	56	38
Eu	3.06	2.77	2.56	2.86	3.01	2.89	3.31	3	3.21	3.33	2.38
Gd	49	40.7	40.5	43.5	47.9	46.2	45.4	48.3	45.8	51.9	34.9
Tb	8.5	7.2	7.1	7.7	8.3	8.3	8	8.6	7.9	8.8	6.2
Dy	50.8	44.1	43.2	43.4	50.5	48.2	48.8	52	47	54	37
Ho	9.9	8.6	8.5	8.5	9.7	10	9.6	10.6	9.1	10.7	7.3
Er	28.5	25.4	25.5	25.2	29.4	30.6	28.8	31.6	26.8	30.5	22.6
Tm	4.25	3.7	3.55	3.54	4.35	4.38	4.21	4.56	3.81	4.36	3.31
Yb	26.8	24.1	23.6	23.4	27.4	27.8	26.7	29.6	25.1	28.6	22.8
Lu	3.88	3.56	3.44	3.52	3.8	3.99	3.83	4.29	3.7	3.94	3.34
TREE	1786.39	1478.63	1354.55	1602.82	1655.76	1621.66	1587.35	1724.55	1677.32	1822.23	1295.63

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)											APPENDIX 1
Lithology		Syenite									
Sample No.	10827	10828	10829	10830	10831	10832	10833	10835	10836	10837	10838
from	44.0	45.0	46.0	47.0	48.0	49.0	50.0	51.0	52.0	53.0	53.4
to	45.0	46.0	47.0	48.0	49.0	50.0	51.0	52.0	53.0	53.4	54.0
(wt%)											
SiO2	65.93	66.88	65	66.07	68.63	66.73	67.56	68.29	68.29	65.29	68.21
Al2O3	14.07	14.03	13.49	14.61	14.53	13.88	14.63	14.14	13.39	11.64	13.83
Fe2O3(T)	4.94	3.9	5.54	4.47	4.06	4.79	3.59	4.42	5.07	7.08	3
MnO	0.146	0.143	0.17	0.076	0.034	0.072	0.075	0.03	0.048	0.228	0.053
MgO	0.03	0.02	0.03	0.03	0.04	0.06	0.03	0.04	0.03	0.06	0.03
CaO	0.91	0.77	1.17	0.92	0.81	0.43	0.68	0.77	1.02	2.41	0.81
Na2O	5.63	5.76	5.84	5.03	4.88	4.74	4.83	4.62	3.74	1.91	4.42
K2O	5.06	5.01	5.03	5.19	5.25	5.03	5.08	4.96	5.13	4.55	5.12
TiO2	0.225	0.168	0.264	0.215	0.195	0.162	0.172	0.201	0.168	0.141	0.167
P2O5	0.02	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.03	0.02	0.03
LOI	1.21	1	1.12	1.76	1.71	1.94	1.89	2.06	2.39	4.42	2.03
Total	98.16	97.7	97.67	98.4	100.2	97.84	98.56	99.56	99.31	97.75	97.71
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	29	25	25	30	40	41	32	22	62	115	25
V	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	33	31	30	21	25	25	35	43	34	18	28
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	100	100	100	100	90	100	100	100	< 10	< 10	< 10
Zn	480	360	460	410	460	730	620	450	410	670	320
Ga	53	50	53	56	54	57	56	56	47	41	52
Ge	3	3	4	3	3	3	3	3	3	3	3
As	7	< 5	6	6	11	12	10	9	13	20	8
Rb	245	235	242	263	256	257	246	246	205	168	211
Sr	48	48	59	63	57	41	46	49	56	99	40
Zr	2390	2441	2368	1984	3279	2237	1695	1450	1631	1452	1698
Nb	342	285	386	491	459	330	324	353	256	196	307
Mo	3	7	5	6	2	8	7	3	6	16	4
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	26	22	27	26	27	23	26	26	20	14	21
Sb	0.9	0.6	0.9	0.8	1.1	1	0.7	0.9	1.2	0.7	1
Cs	0.7	0.5	0.6	0.8	1	1.6	0.8	0.6	1.3	2.7	0.5
Ba	47	42	41	49	57	74	58	45	65	199	42
Hf	53.8	50.6	54.6	44.9	67.3	51.4	40.6	31	34.9	31.6	34.5
Ta	30.8	25.9	31.9	46.1	39.5	28.1	27.5	23.7	18.3	13.8	27.2
W	237	342	360	268	294	241	305	335	363	197	354
Tl	0.4	0.3	0.4	0.3	0.4	0.4	0.4	0.4	0.6	0.4	0.4
Pb	58	48	56	51	39	30	51	24	21	29	20
Th	39.2	43.2	44.2	48.9	36.3	40.3	40.5	39.9	49	33.6	50.7
U	15	12.4	13	23.7	23.6	18.5	16.9	12.6	11.5	9.4	12.2
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	247	241	209	233	267	218	278	241	282	253	238
La	310	268	320	339	314	248	410	329	356	240	328
Ce	605	500	616	676	628	491	754	577	594	435	608
Pr	69.2	56.7	71.9	78.9	74.5	53.2	87.9	63.8	64.8	47.1	67.6
Nd	247	207	261	281	269	196	322	223	224	166	238
Sm	47.1	41.6	49.3	53.3	52	38.5	64.6	43.7	43.8	32.7	49.4
Eu	2.88	2.91	2.88	3.12	3.14	2.36	3.59	2.58	2.7	1.99	3
Gd	43.1	39.5	41.3	47.1	45	37	59.9	41.7	46	33.3	46.5
Tb	7.3	6.9	6.9	7.6	7.8	6.5	10	7.3	8.1	6.3	7.5
Dy	44	42.4	39.6	42.5	44	38.6	57.1	42.6	46.2	38.9	41.9
Ho	8.7	8.6	7.4	8.1	8.3	7.7	10.4	7.9	9.3	8.3	8.3
Er	26.2	26.5	22.5	23.5	23.7	23.5	28.8	22.7	27.4	24	24.2
Tm	4.01	4.05	3.44	3.49	3.49	3.54	3.97	3.37	4.11	3.61	3.68
Yb	26.1	27.2	24	22.9	22.3	22.2	24.5	21.9	25.5	21.6	22.2
Lu	3.71	3.65	3.62	3.26	3.13	3.19	3.37	3.13	3.55	3.04	3.03
TREE	1691.3	1476.01	1678.84	1822.77	1765.36	1389.29	2118.13	1630.68	1737.46	1314.84	1689.31

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10839	10840	10841	10842	10843	10844	10845	10846	10847	10848	10849
from	54.0	55.0	56.0	57.0	58.0	59.0	60.0	61.0	62.0	63.0	64.0
to	55.0	56.0	57.0	58.0	59.0	60.0	61.0	62.0	63.0	64.0	65.0
(wt%)											
SiO ₂	66.66	65.5	65.98	65.88	67.23	66.51	65.22	67.22	66.55	64.89	66.76
Al ₂ O ₃	14.23	14.29	14.33	13.77	14.42	14.68	13.95	14.56	14.15	13.7	14.72
Fe ₂ O ₃ (T)	4.45	5.25	4.46	4.69	4.25	4.1	5.23	4.61	4.54	5.05	4.27
MnO	0.144	0.335	0.199	0.128	0.107	0.113	0.153	0.106	0.109	0.081	0.102
MgO	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.01
CaO	0.7	0.71	0.74	0.96	0.63	0.63	0.87	0.87	0.98	1.65	0.84
Na ₂ O	4.82	5.51	5.57	5.28	5.64	5.52	5.27	5.12	4.68	4.6	5.62
K ₂ O	4.96	5.03	4.8	4.82	5	4.97	4.84	4.98	4.9	4.86	5.14
TiO ₂	0.172	0.193	0.193	0.176	0.166	0.157	0.228	0.212	0.186	0.231	0.192
P ₂ O ₅	< 0.01	0.02	< 0.01	< 0.01	< 0.01	0.04	0.02	0.03	< 0.01	0.02	< 0.01
LOI	1.81	1.63	1.39	2.12	1.4	1.42	1.91	1.79	2.16	2.43	1.41
Total	97.96	98.48	97.68	97.85	98.87	98.15	97.7	99.53	98.29	97.53	99.09
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	27	34	28	23	24	29	32	27	22	24	21
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	24	22	27	28	29	30	32	26	27	34	25
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	10	< 10	< 10
Zn	300	410	340	340	300	340	360	300	250	310	260
Ga	52	53	53	51	50	54	52	53	50	50	54
Ge	3	3	3	4	3	3	3	3	2	3	3
As	8	9	7	< 5	< 5	6	5	6	< 5	6	< 5
Rb	199	200	198	195	198	213	204	204	196	208	234
Sr	40	50	38	32	30	34	40	44	59	94	39
Zr	1439	1567	1895	1724	1936	1702	1808	1831	1368	2245	1968
Nb	269	306	323	291	276	290	311	270	243	276	306
Mo	9	9	7	2	6	6	7	7	7	8	11
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	19	20	22	22	21	22	24	18	16	20	19
Sb	0.9	0.6	0.6	0.6	0.6	< 0.5	0.5	0.6	0.7	1	< 0.5
Cs	1	1.6	0.9	0.6	0.6	0.9	0.9	0.7	< 0.5	0.6	0.7
Ba	51	81	76	39	40	52	47	51	41	46	37
Hf	31	33.7	40.7	36.5	40.3	38	37.9	38.2	27.5	47.6	41.3
Ta	18.5	19.9	22.3	18.6	19.5	22	21.2	18.4	16.4	19.7	22.1
W	306	282	344	345	351	397	343	324	354	318	313
Tl	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.3
Pb	31	52	51	20	44	44	35	22	11	19	32
Th	39	46.2	42.7	39.4	40	36.2	39.1	36.4	32	33.5	27.5
U	9.3	10.5	10.6	8.5	9.5	10.5	10	9.4	7.8	10.5	10.5
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	225	303	253	257	223	205	229	207	185	208	174
La	305	353	292	217	200	268	298	286	314	320	183
Ce	540	659	534	413	389	527	604	569	600	587	348
Pr	57.7	75.3	60.8	47.7	44.8	62	71.3	64.7	67.1	63.3	39.6
Nd	200	269	212	174	165	230	260	234	242	220	140
Sm	39.7	54.3	43.5	37.7	37.1	47	53.3	46	44.2	41	29.4
Eu	2.43	3.15	2.83	2.5	2.4	2.82	2.83	2.83	2.59	2.43	1.91
Gd	38.5	52	42	39.2	35.8	42.3	47.4	41.3	38.3	36	28
Tb	6.5	8.5	7.2	7	6.3	6.6	7.7	6.5	6	6	5
Dy	37.8	49.5	43.5	41.9	37.8	37.6	41.8	36.8	33.2	35.3	29.2
Ho	7.7	10	8.8	8.9	7.6	7.4	8.2	7.4	6.5	6.9	5.9
Er	23	29.1	26	26	23	21.1	23.5	21.5	18.9	20.6	17.2
Tm	3.56	4.29	3.95	3.91	3.52	3.09	3.47	3.19	2.77	3.27	2.66
Yb	21.5	25.7	24.1	24.3	22.2	19.2	21.2	20	17.9	19.6	17
Lu	2.99	3.54	3.49	3.38	3.11	2.85	3.11	2.95	2.67	2.88	2.57
TREE	1511.38	1899.38	1557.17	1303.49	1200.63	1481.96	1674.81	1549.17	1581.13	1572.28	1023.44

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10850	10851	10852	10853	10854	10855	10856	10857	10858	10859	10860
from	65.0	66.0	67.0	68.0	69.0	70.0	71.0	72.0	73.0	74.0	75.0
to	66.0	67.0	68.0	69.0	70.0	71.0	72.0	73.0	74.0	75.0	76.0
(wt%)											
SiO ₂	66.44	67.08	66.14	65.78	66.1	67.89	67.34	66.54	66.23	66.62	67.13
Al ₂ O ₃	14.46	13.67	14.42	13.79	14.14	14.04	14.03	13.97	13.83	13.66	14.12
Fe ₂ O ₃ (T)	4.65	4.31	5.36	5.57	5.12	5.58	4.67	4.66	4.57	4.99	4.79
MnO	0.138	0.135	0.169	0.172	0.144	0.181	0.21	0.134	0.142	0.148	0.141
MgO	< 0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02
CaO	0.8	0.72	0.86	1.11	1.03	0.95	0.88	1.26	0.76	0.92	0.99
Na ₂ O	5.4	5.25	5.96	5.87	5.81	5.8	5.77	5.25	5.13	5.76	5.88
K ₂ O	5.12	4.79	5.04	4.89	4.84	4.91	4.94	4.84	4.95	4.89	4.94
TiO ₂	0.176	0.174	0.222	0.235	0.213	0.211	0.189	0.2	0.189	0.207	0.206
P ₂ O ₅	0.04	0.03	0.02	0.03	0.02	0.02	0.04	0.02	0.02	0.03	0.03
LOI	1.47	1.62	1.04	1.03	1	0.98	1.07	1.53	1.49	0.85	0.83
Total	98.7	97.8	99.26	98.5	98.43	100.6	99.15	98.42	97.33	98.08	99.08
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	23	25	28	21	23	23	25	31	30	25	24
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	26	27	38	28	29	30	31	25	25	20	27
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	20	< 10	< 10	< 10	< 10	< 10	< 10	10	20	< 10	< 10
Zn	300	340	410	390	370	370	370	330	310	370	360
Ga	52	52	52	49	49	50	51	51	52	50	53
Ge	3	3	4	3	3	3	3	3	3	3	3
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	236	184	196	196	206	204	206	202	214	206	217
Sr	37	34	33	45	59	42	42	67	34	28	38
Zr	1739	1874	2085	2213	1933	2306	1836	2253	3163	3115	2189
Nb	284	323	352	342	331	342	326	305	337	351	340
Mo	10	9	4	8	4	3	6	5	7	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	21	21	24	21	19	19	19	20	22	20	23
Sb	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.7	0.8	0.9	0.6	< 0.5
Cs	0.9	0.8	0.8	0.6	0.7	0.7	0.8	1.4	0.9	0.5	0.6
Ba	42	48	57	40	42	55	67	60	47	40	41
Hf	35.8	41.5	45.6	47.4	42	50.4	37.7	46.8	73.9	69.4	45.6
Ta	19.7	22.2	24.3	23.8	22.5	24.9	21.8	22.1	24.9	24.9	21.9
W	312	340	453	400	374	381	375	312	347	279	321
Tl	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Pb	29	42	55	41	38	37	35	30	21	31	38
Th	29.2	38.2	44.1	28	28.7	28.2	27.9	35.9	28.1	29.2	40.3
U	10.4	10.3	11.6	11.4	11.3	11.9	10	11.8	14.5	13.2	9.5
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	172	232	278	161	165	165	165	180	180	186	219
La	170	266	302	205	206	190	212	232	227	225	261
Ce	330	513	597	417	395	370	433	461	436	439	508
Pr	37.9	59.5	70.2	48.6	45.3	42.5	51.2	53.4	49.3	49.8	58.1
Nd	133	214	251	172	159	152	180	186	171	178	205
Sm	28.5	43.7	52	33.6	31.6	31.6	35.4	36.6	33.6	35.8	42.3
Eu	1.84	2.88	3.21	2.01	1.99	1.89	2.17	2.14	2.17	2.18	2.66
Gd	27.2	42.4	49.5	29.9	29.1	29	31.7	32.9	29.1	32.2	39.9
Tb	4.8	7.2	8.5	5	5	4.9	5.3	5.4	5	5.5	6.8
Dy	28.2	43.7	49.6	28.7	29	29.8	30.3	31.5	31.2	32.6	39.1
Ho	5.7	8.4	9.7	5.8	5.9	6	5.9	6.3	6.6	6.6	7.6
Er	16.9	24.5	28.5	17.5	17.6	18.2	17.3	18.7	19.9	19.8	21.9
Tm	2.61	3.8	4.23	2.72	2.84	2.88	2.6	2.9	3.18	3.06	3.36
Yb	16.2	23.8	25.3	17.9	18	18.6	16.6	18.6	20.9	19.6	20.5
Lu	2.36	3.38	3.67	2.7	2.71	2.8	2.55	2.72	3.09	3.03	3.01
TREE	977.21	1488.26	1732.41	1149.43	1114.04	1065.17	1191.02	1270.16	1218.04	1238.17	1438.23

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10861	10862	10863	10864	10865	10866	10867	10868	10869	10870	10871
from	76.0	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0
to	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0
(wt%)											
SiO ₂	66.44	66.26	65.73	65.54	66.01	66.78	66.6	66.63	66.95	67.37	66.31
Al ₂ O ₃	13.97	13.89	13.82	14.14	14.17	13.82	13.97	13.9	13.82	14.1	14.16
Fe ₂ O ₃ (T)	4.73	4.71	5.31	4.96	5.24	4.97	4.96	5.01	5.48	4.72	4.55
MnO	0.15	0.158	0.158	0.145	0.168	0.156	0.146	0.136	0.169	0.149	0.107
MgO	0.02	0.02	0.04	0.03	0.04	0.02	0.02	0.02	0.02	0.02	0.01
CaO	0.79	0.89	0.98	0.88	0.94	0.89	0.88	0.76	0.93	0.75	0.74
Na ₂ O	5.77	5.98	5.72	5.73	5.81	6.12	5.86	5.77	5.88	5.82	5.97
K ₂ O	4.98	4.87	4.98	5.05	5.11	5.07	5.13	5.04	5.03	5.16	5.16
TiO ₂	0.197	0.216	0.223	0.207	0.225	0.194	0.19	0.185	0.223	0.204	0.183
P ₂ O ₅	0.04	0.02	< 0.01	0.02	0.01	0.02	0.01	0.02	0.03	0.01	0.01
LOI	0.8	0.82	1.03	0.99	1.08	0.84	0.53	0.56	0.86	0.96	0.98
Total	97.88	97.82	97.99	97.68	98.8	98.87	98.29	98.03	99.4	99.28	98.2
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	29	32	43	29	29	24	25	26	25	27	23
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	25	26	22	27	26	26	< 1	< 1	25	28	29
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	380	380	450	450	530	380	360	340	400	380	320
Ga	52	52	53	55	55	52	51	52	51	50	52
Ge	3	3	4	4	4	4	4	3	3	3	3
As	< 5	< 5	6	5	6	< 5	< 5	< 5	< 5	< 5	< 5
Rb	216	202	207	219	224	210	214	209	205	209	208
Sr	29	30	38	39	37	37	38	29	30	30	27
Zr	1867	1530	1459	1798	1761	1353	2053	1749	1223	1568	1909
Nb	376	341	323	352	360	296	315	288	276	269	289
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	28	28	27	28	31	25	22	23	22	24	20
Sb	0.7	< 0.5	0.5	< 0.5	0.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	0.7	< 0.5	0.9	0.9	0.9	0.5	0.5	1.2	0.5	0.8	0.7
Ba	49	41	43	42	45	39	36	38	36	37	31
Hf	40.7	30.7	31.2	37.2	34.8	28.1	44.7	36.2	24.2	31.8	40.7
Ta	26.8	22.5	23.3	24.6	22.2	20	21	20.2	16.7	18.8	19.8
W	336	333	314	322	295	345	9	2	304	342	347
Tl	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.2
Pb	50	57	47	64	71	53	56	48	39	43	56
Th	50	64.4	60.4	58.5	59.6	49.3	34.5	40.8	45.8	39.2	34.3
U	11.7	9.3	12.1	11	10.8	8.6	9.2	9.3	7.9	9.3	10.2
Bi	< 0.4	< 0.4	< 0.4	< 0.4	0.5	0.5	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	254	316	284	281	332	266	235	230	237	275	250
La	297	321	375	346	322	300	298	279	294	298	302
Ce	576	615	696	668	611	587	588	534	564	583	589
Pr	65.9	69.6	78.8	76.5	68.5	67.6	68.2	61.9	65.1	67.9	69.1
Nd	233	245	283	277	249	248	249	225	236	245	251
Sm	47.4	50.2	54.8	55.4	50	50.2	49.1	46.2	45.8	49.9	49
Eu	2.75	2.9	3.05	3.09	2.96	2.99	2.99	2.69	2.53	2.79	3.1
Gd	44.8	49.9	50.2	50.6	48.6	47.6	45	42.7	42	47.1	44.8
Tb	7.5	8.7	8.4	8.3	8.4	8	7.1	6.9	6.9	7.7	7.2
Dy	44.5	51.5	48.5	47	50.9	46.5	41	40.3	40	44.6	42
Ho	8.9	10.1	9.9	9.4	10.4	9.3	8	7.9	8	8.9	8.3
Er	26.5	29.2	28.7	27.6	31.3	27	23.4	23	22.8	26.1	24.8
Tm	3.8	4.3	4.23	4.06	4.63	4.01	3.61	3.48	3.39	3.83	3.77
Yb	24.2	25.9	25.5	25.4	28.4	24.5	22.3	21.6	20.8	23.6	22.8
Lu	3.41	3.63	3.69	3.59	4.02	3.49	3.22	3.11	3.04	3.44	3.25
TREE	1639.66	1802.93	1953.77	1882.94	1822.11	1692.19	1643.92	1527.78	1591.36	1686.86	1670.12

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10872	10873	10875	10876	10877	10878	10879	10880	10881	10882	10883
from	87.0	88.0	89.0	90.0	91.0	92.0	93.0	94.0	95.0	96.0	97.0
to	88.0	89.0	90.0	91.0	92.0	93.0	94.0	95.0	96.0	97.0	98.0
(wt%)											
SiO ₂	66.61	65.8	67.21	66.46	66.02	66.93	67.07	65.76	66.96	67.24	67.77
Al ₂ O ₃	14	13.65	13.7	13.64	14.12	13.44	13.9	14.11	14	14.14	14.19
Fe ₂ O ₃ (T)	4.96	5.42	4.9	4.79	4.65	4.13	5.37	5.1	4.66	4.25	4.98
MnO	0.122	0.101	0.097	0.105	0.106	0.169	0.132	0.127	0.064	0.126	0.076
MgO	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.01
CaO	0.72	0.92	0.76	0.73	0.85	0.89	0.9	0.92	0.89	0.92	1
Na ₂ O	5.83	5.43	5.62	5.56	5.47	5.2	5.78	5.9	5.65	5.37	5.46
K ₂ O	5.05	4.81	4.92	4.81	5.05	4.83	4.85	4.93	4.84	4.89	4.95
TiO ₂	0.189	0.217	0.179	0.185	0.221	0.206	0.239	0.218	0.198	0.227	0.184
P ₂ O ₅	0.01	< 0.01	0.01	0.03	0.02	0.02	0.04	0.04	< 0.01	0.01	0.03
LOI	1.02	1.34	1.21	1.32	1.33	1.62	1.14	1.12	1.35	1.41	1.27
Total	98.52	97.71	98.63	97.65	97.85	97.47	99.45	98.23	98.62	98.61	99.91
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	26	28	23	19	24	29	29	33	37	31	31
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	27	30	28	34	33	33	36	33	36	32	27
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	330	310	300	330	300	300	340	320	250	270	240
Ga	52	48	50	49	52	49	48	48	49	49	48
Ge	3	4	3	3	3	3	3	3	3	3	3
As	< 5	6	< 5	< 5	< 5	< 5	9	9	11	9	6
Rb	202	195	207	201	217	198	206	206	200	199	201
Sr	26	35	33	30	39	38	34	32	34	40	39
Zr	1639	1782	1288	1367	1401	3389	1447	1401	1489	1307	1144
Nb	271	228	246	231	305	277	256	209	216	210	224
Mo	8	7	10	11	7	3	< 2	< 2	2	5	3
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	18	18	18	17	21	20	19	23	18	18	15
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	0.9	1	0.9	0.8	0.9	1.4	0.8	0.6	1.1	1.1	2.1
Ba	29	31	23	25	28	63	44	44	41	72	32
Hf	33.2	33	28.6	27.3	29.4	69.8	30.6	29.4	31.1	27.7	25.2
Ta	17.9	15.2	16.8	15.4	20.9	24.4	20.9	18	15.7	14.7	15.9
W	349	187	339	224	211	197	340	224	327	432	388
Tl	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.3	0.4	0.3
Pb	52	40	38	41	43	34	48	46	37	36	33
Th	38.8	49.1	33.7	29.8	33.3	29.6	32.8	48.4	39.7	33.5	31.7
U	9.4	7.9	7.9	7.9	11.3	15.7	12.7	10.4	8.7	8.5	8.3
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	224	236	219	196	229	196	219	286	240	210	195
La	311	253	270	293	330	257	322	300	268	218	260
Ce	613	498	533	582	645	518	654	592	526	434	515
Pr	71.4	57.9	64	68.4	78.4	61.9	78.7	68.5	60.2	48.5	57.6
Nd	264	213	235	248	286	232	290	253	220	178	211
Sm	52.3	43.1	47.5	48.7	56.1	45.4	54.6	51.7	44.4	35.9	41.4
Eu	3	2.62	2.7	2.74	3	3.01	3.09	3.33	2.85	2.54	2.7
Gd	46.1	39.9	43	43.6	49.2	39.3	46.6	47.8	40.8	33	37.3
Tb	7	6.4	6.9	6.7	7.8	6.5	7.5	8.2	7	6	6.3
Dy	39.1	37.1	39.3	38.1	44.9	38.1	42.6	48.2	41.4	34.9	35.9
Ho	7.6	7.5	7.7	7.5	8.7	7.5	8.1	9.5	8.4	7.2	7.1
Er	21.3	22.6	22.6	22.1	24.8	21.7	23.4	27.9	25	21.6	20.7
Tm	3.23	3.49	3.38	3.32	3.67	3.25	3.42	4.26	3.95	3.24	3.1
Yb	19.9	21.9	20.6	20.1	21.8	20.5	22.1	27.1	23.7	21.1	19.8
Lu	2.87	3.17	2.96	3.01	3.12	3.07	3.14	3.87	3.36	2.93	2.81
TREE	1685.8	1445.68	1517.64	1583.27	1791.49	1453.23	1778.25	1731.36	1515.06	1256.91	1415.71

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10884	10885	10886	10887	10888	10889	10890	10891	10892	10893	10894
from	98.0	99.0	100.0	101.0	102.0	103.0	104.0	105.0	106.0	107.0	108.0
to	99.0	100.0	101.0	102.0	103.0	104.0	105.0	106.0	107.0	108.0	109.0
(wt%)											
SiO ₂	68.62	68.03	67.9	67.13	66.64	67.51	66.84	66.55	67.28	64.89	65.72
Al ₂ O ₃	14.72	14.83	14.15	13.52	13.67	13.99	13.85	14.19	14.17	13.19	13.78
Fe ₂ O ₃ (T)	3.96	3.78	4.01	4.09	4.94	4.81	4.11	4.21	4.42	4.73	4.47
MnO	0.06	0.064	0.085	0.188	0.134	0.211	0.114	0.121	0.126	0.174	0.17
MgO	0.02	0.01	0.02	0.04	0.02	0.02	0.04	0.05	0.04	0.05	0.03
CaO	1.14	0.87	0.77	0.87	0.81	1.03	1.13	2.06	1.38	3.03	1.53
Na ₂ O	5.3	5.74	5.82	5.2	5.69	5.36	4.8	4.98	5.41	4.74	5.4
K ₂ O	5.06	5.07	4.96	4.8	4.83	5.09	4.81	5	4.96	4.69	4.94
TiO ₂	0.184	0.216	0.209	0.207	0.2	0.212	0.198	0.168	0.166	0.202	0.167
P ₂ O ₅	0.02	0.02	0.04	0.04	0.02	0.02	< 0.01	0.03	0.03	0.03	< 0.01
LOI	1.44	1.17	0.99	1.34	1.02	1.3	2.19	2.62	1.68	3.48	2.1
Total	100.5	99.81	98.95	97.43	97.97	99.55	98.1	99.97	99.66	99.21	98.31
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	28	26	29	36	26	22	22	26	27	32	26
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	27	29	31	33	32	32	31	23	23	22	33
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	220	230	260	320	300	300	320	270	300	400	340
Ga	50	53	53	55	50	52	53	50	50	49	51
Ge	3	3	4	4	4	4	3	3	3	3	3
As	6	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	211	219	227	209	224	255	231	212	213	220	234
Sr	46	33	42	43	33	39	39	72	47	69	56
Zr	1589	1480	2052	1936	1420	1553	1742	2212	1879	1400	1650
Nb	223	282	319	290	222	303	294	328	279	321	335
Mo	4	4	< 2	6	3	7	8	5	5	5	7
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	18	19	21	18	16	18	17	17	19	18	19
Sb	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5	< 0.5	0.6	< 0.5	< 0.5	0.5
Cs	1	0.7	0.5	0.9	0.7	0.9	0.7	0.5	0.6	0.5	0.5
Ba	37	30	34	42	38	45	31	31	29	28	28
Hf	35.2	31.9	44.5	43.3	31.9	33.7	35.8	50.8	39.2	30.1	38.1
Ta	16.1	20.6	21.6	19.6	15.9	22	18.6	26.1	19.2	19.2	23
W	381	401	412	412	406	380	354	289	294	260	339
Tl	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.3
Pb	28	35	44	31	36	33	25	30	38	57	38
Th	31.2	39.3	44.9	35.2	31.9	27.4	32	32.4	38.7	30.9	35.2
U	10.4	10.9	12.6	11.6	9.9	12.3	11.7	13.6	10.3	9.8	12.4
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	218	222	243	244	167	172	187	212	241	176	222
La	262	322	453	493	298	236	250	336	326	312	290
Ce	516	621	873	947	647	449	502	650	631	626	622
Pr	59.6	69.4	97.1	106	75.5	48.8	54.6	71.2	68.7	69.4	73.1
Nd	220	241	339	381	273	166	191	251	245	251	273
Sm	44.1	47.7	62.8	68.8	51.5	32.2	35.8	47.5	47.9	50	56.4
Eu	2.66	2.94	3.61	3.87	3.01	2.06	2.43	2.96	2.97	3.04	3.26
Gd	38.8	41.3	53.5	59.2	41.2	29.3	32	42.8	44.3	42.3	48.4
Tb	6.5	6.9	8.6	9.2	6.4	5.3	5.8	7.2	7.7	6.7	8.2
Dy	38.4	39.8	46.8	52.1	36	31.5	33.7	42.3	43.1	36	45.5
Ho	7.6	7.7	8.8	9.8	6.8	6.4	6.7	8.3	8.4	6.9	8.7
Er	22.8	22.5	25.7	27.9	20.4	18.7	19.4	24.4	24.5	19.5	24.6
Tm	3.4	3.31	3.66	3.94	3.17	2.81	2.96	3.63	3.55	2.76	3.64
Yb	21.7	21.4	24.1	25.1	21	18.5	18.8	23.9	22.8	17.9	23.2
Lu	3.13	3.08	3.46	3.56	3.15	2.64	2.68	3.33	3.15	2.56	3.21
TREE	1464.69	1672.03	2246.13	2434.47	1653.13	1221.21	1344.87	1726.52	1720.07	1622.06	1705.21

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10895	10896	10897	10898	10899	10900	10901	10902	10903	10904	10905
from	109.0	110.0	111.0	112.0	113.0	114.0	115.0	116.0	117.0	118.0	119.0
to	110.0	111.0	112.0	113.0	114.0	115.0	116.0	117.0	118.0	119.0	120.0
(wt%)											
SiO ₂	67.82	66.91	67.16	67.19	65.79	63.81	66.72	67.41	67.14	67.41	67.2
Al ₂ O ₃	14.27	14	13.95	13.89	13.89	13.11	13.61	13.42	13.52	13.94	13.95
Fe ₂ O ₃ (T)	4.89	4.58	4.83	5.22	5.06	4.66	4.28	5.39	4.38	4.81	4.24
MnO	0.15	0.131	0.155	0.175	0.162	0.176	0.131	0.064	0.122	0.103	0.136
MgO	0.04	0.04	0.03	0.05	0.04	0.04	0.05	0.07	0.05	0.05	0.02
CaO	1	1.47	1.15	1.63	1.44	3.07	1.94	1.17	2.1	1.33	1.03
Na ₂ O	5.6	5.41	5.57	5.28	5.2	5.02	5.04	4.8	5.1	5.48	5.69
K ₂ O	5.05	4.87	4.84	4.88	4.85	4.72	4.96	4.91	4.91	5.02	5.03
TiO ₂	0.179	0.17	0.198	0.204	0.231	0.197	0.163	0.182	0.186	0.187	0.162
P ₂ O ₅	0.03	0.04	0.03	0.01	0.01	0.02	0.02	< 0.01	< 0.01	0.02	0.02
LOI	1.86	1.75	1.59	2.37	2.26	3.02	2.59	2.72	2.83	2.07	1.68
Total	100.9	99.37	99.51	100.9	98.93	97.84	99.5	100.1	100.4	100.4	99.17
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	28	24	21	24	22	38	33	40	39	39	36
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	25	22	27	26	26	21	29	38	40	29	29
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	350	310	300	320	320	280	290	330	250	320	270
Ga	50	48	47	48	51	50	52	50	50	50	52
Ge	3	3	3	3	3	3	3	3	3	3	3
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	7	5	< 5	< 5
Rb	231	202	199	201	215	199	206	205	203	200	207
Sr	37	54	40	55	52	87	62	52	58	41	47
Zr	1577	1576	1809	1458	1884	1582	1339	1605	1437	1591	1664
Nb	274	259	247	258	292	301	287	289	274	256	279
Mo	7	9	7	8	6	5	7	10	7	9	8
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	20	16	17	18	20	16	17	15	16	15	14
Sb	0.5	< 0.5	< 0.5	< 0.5	0.5	0.6	< 0.5	0.7	0.5	< 0.5	< 0.5
Cs	0.5	< 0.5	0.6	0.5	0.6	< 0.5	< 0.5	0.8	0.8	0.8	< 0.5
Ba	28	29	34	29	28	26	28	35	40	30	33
Hf	33.6	30.5	39.7	32.4	41.4	36.1	31.4	36.2	32.5	35.6	39.3
Ta	17.6	15.4	16.7	16.2	18.6	18.7	17.5	18	16.2	14.7	17.8
W	296	251	341	322	313	237	224	293	298	300	346
Tl	0.3	0.3	0.3	0.3	0.3	0.2	0.1	0.2	0.1	0.1	0.1
Pb	33	38	31	35	44	34	49	34	32	34	32
Th	35.3	41.8	30.9	29.1	34.9	30	34.7	31.9	30.9	30.7	32.7
U	10.8	9	9.1	8.5	9.4	9.2	9	11.2	9.3	8.5	9.1
Bi	< 0.4	< 0.4	< 0.4	< 0.4	0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	228	220	196	223	233	192	204	218	217	237	250
La	221	227	202	280	382	265	266	320	297	276	305
Ce	483	483	432	563	732	528	542	658	609	569	638
Pr	58	55.9	50.3	63.6	80.1	62.5	66.5	80.1	75.4	72	78.7
Nd	225	214	190	233	286	230	251	304	286	269	300
Sm	49	44.9	40.9	47	52.9	45	50.9	60.1	55.7	54	60.9
Eu	3.01	2.9	2.8	3.02	3.33	2.88	3.22	3.51	3.41	3.39	3.76
Gd	43.3	40.9	38	41.5	47.1	43.1	48.4	54.3	50.9	50.8	57.2
Tb	7.4	6.8	6.5	7.3	7.7	7	7.8	8.4	8.3	8.6	9.4
Dy	43.2	37.8	37.7	41.8	44.3	40.3	43.5	46.1	45.7	48.8	54.2
Ho	8.3	7.1	7.3	8.1	8.8	7.8	8.1	8.4	8.6	9.3	10.6
Er	23.7	20.3	21	23.3	25.5	22.7	23.5	23.8	25	27.2	31.4
Tm	3.44	3.02	3.15	3.32	3.67	3.36	3.4	3.52	3.66	3.95	4.64
Yb	21.9	19	20.1	21.3	24	20.7	20.7	20.3	22.1	24.2	26.8
Lu	3.08	2.74	2.86	3.03	3.46	3.07	2.92	2.85	3.2	3.35	3.73
TREE	1421.33	1385.36	1250.61	1562.27	1933.86	1473.41	1541.94	1811.38	1710.97	1656.59	1834.33

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10906	10907	10908	10909	10910	10911	10912	10913	10915	10916	10917
from	120.0	121.0	122.0	123.0	124.0	125.0	126.0	127.0	128.0	129.0	130.0
to	121.0	122.0	123.0	124.0	125.0	126.0	127.0	128.0	129.0	130.0	131.0
(wt%)											
SiO ₂	67.26	67.59	66.37	67.11	68.14	65.75	65.96	67.02	67.6	66.37	66.13
Al ₂ O ₃	14.27	13.94	13.62	14.09	14.04	14.16	13.6	13.89	14.27	14.1	13.71
Fe ₂ O ₃ (T)	4.98	5.05	5.07	4.89	4.28	4.58	4.86	5.52	4.41	4.71	5.15
MnO	0.154	0.15	0.151	0.119	0.124	0.155	0.159	0.157	0.13	0.116	0.134
MgO	0.01	0.03	0.02	0.05	0.03	0.02	0.02	0.02	0.02	0.03	0.01
CaO	1.03	1.28	1.31	1.8	1.3	1.02	1.47	1.16	1.05	1.06	1.07
Na ₂ O	5.92	5.8	5.66	5.44	5.71	5.41	5.61	6.3	5.91	5.57	6.03
K ₂ O	5.08	5.12	4.85	5.11	5.03	4.86	4.8	5.09	5.21	4.92	4.85
TiO ₂	0.182	0.187	0.186	0.181	0.206	0.197	0.187	0.234	0.177	0.19	0.226
P ₂ O ₅	< 0.01	0.02	0.02	0.02	< 0.01	< 0.01	0.02	< 0.01	< 0.01	0.02	0.02
LOI	1.18	1.63	1.51	2.04	1.63	1.83	1.81	1.13	1.22	1.56	1.09
Total	100.1	100.8	98.76	100.9	100.5	97.98	98.49	100.5	100	98.65	98.41
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	21	31	21	33	31	20	22	34	32	22	21
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	31	31	28	26	32	31	28	25	25	26	34
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	320	300	300	320	290	300	310	360	300	300	290
Ga	50	51	49	50	49	50	51	50	51	52	49
Ge	3	3	3	3	3	3	3	4	3	3	3
As	< 5	< 5	< 5	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5
Rb	217	203	189	199	200	216	207	203	208	208	195
Sr	42	47	46	60	50	50	55	49	48	53	42
Zr	1650	1878	1245	1547	1167	1106	1550	1555	1488	1505	1622
Nb	221	293	244	257	245	221	283	271	216	282	244
Mo	9	7	7	6	6	5	5	10	8	6	7
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	16	11	11	14	17	18	19	20	14	15	18
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.6	< 0.5	< 0.5	< 0.5	< 0.5
Cs	0.5	< 0.5	< 0.5	< 0.5	0.7	0.8	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	29	30	28	30	29	29	33	31	27	30	29
Hf	35.3	45.3	28.6	34.8	26.5	22.5	38.7	36	33.3	36.2	38.1
Ta	14.6	19.1	13.9	16.7	13.7	14	16.5	15.9	13.2	18.2	14.4
W	381	402	302	327	359	373	341	323	316	324	399
Tl	0.3	0.1	< 0.1	0.1	0.1	0.3	< 0.1	0.1	< 0.1	0.1	< 0.1
Pb	35	27	22	35	35	39	36	51	36	33	62
Th	29.8	22.2	28.3	27.6	25.9	35.3	32.9	37.8	31.4	32	33.4
U	8.6	10	7.3	8.7	8	8	9.1	8.7	7.6	9.7	7.9
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	193	151	179	190	181	206	220	217	224	187	193
La	250	275	288	278	223	312	274	319	314	328	351
Ce	554	563	595	554	457	665	554	647	634	626	668
Pr	67.4	66.8	73.4	66.6	55.8	75.9	66.9	79.2	78	73.5	80.1
Nd	257	242	271	247	211	287	253	290	296	261	289
Sm	52	42.9	53.1	47.3	41.7	56.8	50	58.5	58.3	48.6	52.1
Eu	3.1	2.62	3.12	3.06	2.43	3.23	3.09	3.47	3.42	3.01	3.09
Gd	42.2	37.3	47.1	42.9	38.7	47.5	46.9	54.9	55.1	43.1	45.7
Tb	6.3	6	7.4	7.2	6.5	7.1	8	8.6	8.8	7	7
Dy	37.8	34.7	40.4	39.8	36.5	39.1	47.4	47.5	47.6	39.6	38.5
Ho	7	6.7	7.3	7.6	7.1	7.2	9.3	8.8	8.8	7.6	7.2
Er	20.3	20	19.7	21.9	20.7	19.5	27.9	24.8	24.8	23.6	21.2
Tm	2.94	3.06	2.77	3.25	3.18	2.79	4.1	3.48	3.65	3.81	3.28
Yb	19	19.1	17.4	19.4	19.5	17.4	24.3	21.8	22.8	24.2	21.2
Lu	2.8	2.87	2.52	2.86	2.99	2.51	3.46	3.15	3.34	3.54	3.13
TREE	1514.84	1473.05	1607.21	1530.87	1307.1	1749.03	1592.35	1787.2	1782.61	1679.56	1783.5

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10918	10919	10920	10921	10922	10923	10924	10925	10926	10927	10928
from	131.0	132.0	133.0	134.0	135.0	136.0	137.0	138.0	139.0	140.0	141.0
to	132.0	133.0	134.0	135.0	136.0	137.0	138.0	139.0	140.0	141.0	142.0
(wt%)											
SiO ₂	66.25	65.43	65.84	66.95	66.28	66.97	66.63	67.8	67.08	66.98	65.8
Al ₂ O ₃	13.78	13.58	13.97	13.84	13.88	13.94	14	13.95	13.73	14	13.94
Fe ₂ O ₃ (T)	4.91	5.33	5.08	5.79	5.27	5.29	4.95	5.2	4.98	5.43	5.23
MnO	0.15	0.181	0.137	0.157	0.137	0.132	0.131	0.14	0.135	0.149	0.14
MgO	0.02	0.03	0.04	0.02	0.02	0.01	0.02	0.02	0.02	< 0.01	0.02
CaO	1.26	2.16	1.31	0.91	0.97	0.86	0.9	0.82	0.87	1.03	0.95
Na ₂ O	5.9	5.81	5.62	6.38	6.24	6.3	6.2	6.29	6.15	6.34	6.27
K ₂ O	4.92	4.88	4.84	4.96	4.99	5.13	5.08	5.16	5.08	5.14	5.16
TiO ₂	0.23	0.249	0.248	0.256	0.278	0.278	0.245	0.241	0.223	0.262	0.249
P ₂ O ₅	0.01	0.02	0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	0.01	< 0.01	< 0.01
LOI	1.26	2.14	1.63	0.9	1.08	0.95	0.91	0.83	0.87	0.93	0.86
Total	98.69	99.82	98.73	100.2	99.17	99.88	99.09	100.4	99.16	100.3	98.62
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	20	33	21	23	23	24	26	27	25	27	25
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	60	21	29	29	33	29	30	27	29	24	24
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	330	330	340	340	320	310	320	340	320	290	330
Ga	52	48	50	49	53	51	51	51	50	47	51
Ge	3	3	3	3	4	4	3	4	3	3	4
As	< 5	< 5	8	< 5	< 5	< 5	< 5	6	< 5	< 5	< 5
Rb	212	189	211	195	207	213	214	208	209	187	212
Sr	39	52	39	35	45	44	43	40	45	62	51
Zr	1837	1079	1212	1169	1100	1401	1900	1364	1414	1676	1024
Nb	295	273	240	253	319	287	308	307	271	268	288
Mo	7	7	8	9	5	8	9	7	7	8	11
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	18	13	14	13	14	15	17	17	15	15	19
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	< 0.5	< 0.5	0.6	0.5	0.6	< 0.5	0.5	0.5	0.5	< 0.5	0.5
Ba	32	30	321	29	33	32	35	34	33	57	32
Hf	45.8	24.5	23.2	27	25.7	31.9	41.6	30.7	32.7	35.5	24.3
Ta	17.3	15.4	15	15.4	18.4	17.2	18.3	20	15.7	16.6	16.7
W	358	286	314	364	360	362	380	332	377	314	308
Tl	0.1	0.1	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
Pb	31	37	34	54	31	33	23	37	41	31	36
Th	33.3	32.5	29.9	26.7	33.9	32	30.1	31.3	27.1	32.1	44
U	9.2	8.5	9.9	9.7	9.4	11.9	9.7	10.6	8.3	9.4	7.6
Bi	< 0.4	< 0.4	< 0.4	0.5	0.7	0.4	< 0.4	< 0.4	0.4	< 0.4	0.5
Y	203	189	194	150	179	173	171	167	160	190	159
La	343	392	392	423	736	624	469	404	377	448	438
Ce	629	732	720	715	1200	983	795	695	651	751	725
Pr	71.6	83.5	77.2	76	125	102	85.5	76.4	70.9	78.8	77.7
Nd	252	288	259	242	389	321	274	246	233	258	247
Sm	43.3	49.6	43	37	53.3	43.6	41.4	39.8	36.5	38.9	37
Eu	2.91	2.79	2.42	2.08	2.86	2.46	2.45	2.36	2.25	2.33	2.16
Gd	40.6	44.3	34.3	31.7	42.5	35.9	34.6	35.2	32	34.6	31.4
Tb	6.7	6.9	5.3	5.2	6.3	5.5	5.6	5.7	5.4	5.8	5.3
Dy	40.1	38.5	31.1	30.1	35.8	32.3	34.1	34	32.5	33.8	32.1
Ho	8.2	7.1	6.2	5.9	6.8	6.5	6.6	6.5	6.3	6.7	6.3
Er	24.9	20.7	18.5	18.1	19.7	20	19.8	19.8	18.6	20.3	18.6
Tm	3.91	3.01	2.89	2.94	2.88	3.37	3.12	3.16	2.88	3.23	2.96
Yb	24.5	19.1	18.5	19.6	18.7	22.2	20.4	20.7	18.1	21	19.5
Lu	3.59	2.9	2.71	3.07	2.83	3.41	3.17	3.18	2.79	3.26	2.99
TREE	1697.31	1879.4	1807.12	1761.69	2820.67	2378.24	1965.74	1758.8	1649.22	1895.72	1805.01

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10929	10930	10931	10932	10933	10934	10935	10936	10937	10938	10939
from	142.0	143.0	144.0	145.0	146.0	147.0	148.0	149.0	150.0	151.0	151.5
to	143.0	144.0	145.0	146.0	147.0	148.0	149.0	150.0	151.0	151.5	152.0
(wt%)											
SiO ₂	66.61	66.2	67.07	66.21	66.35	65.31	66	65.23	64.75	66.66	64.63
Al ₂ O ₃	13.88	13.57	13.96	13.71	14.02	13.4	14.12	13.7	13.85	14.22	13.9
Fe ₂ O ₃ (T)	5.49	5.7	5.22	5.49	5.4	6.11	5.31	5.54	4.85	4.97	4.74
MnO	0.145	0.148	0.147	0.157	0.143	0.156	0.15	0.155	0.137	0.171	0.154
MgO	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.03
CaO	0.98	0.95	1.22	1.21	1.2	1.86	1.26	1.07	1.48	1.69	1.89
Na ₂ O	6.37	6.04	6.26	6.12	6.24	5.94	6.17	6.06	5.7	5.55	5.16
K ₂ O	4.99	4.79	5.01	4.97	5.12	4.95	5.15	4.95	5.03	5.12	4.87
TiO ₂	0.269	0.256	0.25	0.246	0.222	0.251	0.226	0.244	0.207	0.207	0.201
P ₂ O ₅	0.01	0.02	< 0.01	0.02	0.01	0.02	0.01	0.02	0.02	0.02	< 0.01
LOI	0.94	0.9	1	0.94	0.91	1.14	1.17	1.07	1.82	2.16	2.68
Total	99.71	98.59	100.2	99.1	99.63	99.14	99.59	98.05	97.86	100.8	98.26
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	27	17	27	23	27	19	28	18	26	26	24
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	28	30	27	25	21	20	25	31	24	17	17
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	360	380	360	370	330	440	380	370	340	300	330
Ga	52	49	48	50	47	51	50	50	50	47	50
Ge	4	4	4	4	3	4	4	4	3	3	3
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	213	207	202	212	200	226	223	221	214	201	215
Sr	57	48	98	93	86	115	82	58	76	82	80
Zr	1554	1400	1762	1470	1393	1480	1226	1339	1592	2605	1930
Nb	322	291	345	451	258	298	259	278	338	341	407
Mo	12	5	10	14	8	11	10	11	18	15	9
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	26	12	20	22	16	18	19	17	13	14	12
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	0.7	0.8	0.9	0.5	< 0.5	< 0.5	0.5	0.5	< 0.5	< 0.5	< 0.5
Ba	46	67	49	39	33	38	34	36	30	32	31
Hf	38.5	34.8	43.1	37.5	31.2	37.5	27.9	33	37.4	56.2	48
Ta	18.8	17.4	22.5	29.9	17.3	20.1	14.8	19.3	23.4	25.4	29.6
W	320	359	345	327	262	259	314	360	300	193	229
Tl	0.2	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.2	0.1	0.2
Pb	34	51	53	65	40	77	61	31	60	39	58
Th	62.3	31.9	29.8	28	21.9	24.7	35.4	28.9	25.5	24.9	28.4
U	8.3	8.9	10	11.7	8.4	13.2	7.9	13.3	12.8	15.8	20
Bi	0.5	0.5	0.5	0.7	0.4	0.7	0.5	< 0.4	0.7	< 0.4	0.5
Y	197	154	164	150	161	178	170	156	148	165	156
La	475	391	435	420	350	346	309	277	340	307	357
Ce	781	653	702	685	565	574	505	459	554	507	590
Pr	82.2	68.9	75.1	73	62.9	64.4	54.5	50.7	59.3	54.6	62.6
Nd	262	223	245	245	221	223	184	174	198	183	210
Sm	40.4	33.6	36.7	37.6	35.6	38.3	30.8	29.9	32.1	30.5	33.9
Eu	2.45	2.05	2.21	2.2	2.17	2.34	2.02	1.95	2.1	2.16	2.33
Gd	37.5	28.6	32.7	32.8	31.5	34.5	28.7	28.1	28.2	27.8	31.2
Tb	6.6	5.1	5.2	5.3	4.9	5.4	5.2	4.9	4.9	4.6	5.1
Dy	38.4	31	32.5	30.6	28.5	32.3	32.1	30.6	28.6	28.3	30.9
Ho	7.5	6.3	6.4	5.9	5.5	6.5	6.5	6	5.6	5.9	6.2
Er	22.7	19.7	19.6	17.7	15.9	19.9	20	19	17.3	19.2	19.4
Tm	3.45	3.19	3.17	2.81	2.56	3.28	3.14	3.09	2.76	3.2	3.1
Yb	23.6	20.4	20.9	18.6	16.4	21.7	19.6	20.2	17.6	20.9	20.4
Lu	3.62	3.12	3.26	2.96	2.48	3.42	3.1	3.08	2.79	3.2	3.14
TREE	1983.42	1642.96	1783.74	1729.47	1505.41	1553.04	1373.66	1263.52	1441.25	1362.36	1531.27

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10940	10941	10942	10943	10944	10945	10946	10947	10948	10949	10950
from	152.0	153.0	154.0	155.0	156.0	157.0	158.0	158.7	159.0	160.0	161.0
to	153.0	154.0	155.0	156.0	157.0	158.0	158.7	159.0	160.0	161.0	161.8
(wt%)											
SiO ₂	64.84	64.29	65.01	63.94	64.63	65.44	64.44	64.72	64.76	66.23	64.81
Al ₂ O ₃	13.67	14.01	14.09	13.48	13.79	13.77	13.83	13.71	14.08	13.95	13.55
Fe ₂ O ₃ (T)	5.12	5.29	5.34	4.97	5.32	5.17	4.89	5	5.06	5.1	4.83
MnO	0.164	0.154	0.157	0.126	0.146	0.133	0.137	0.142	0.132	0.141	0.136
MgO	0.04	0.05	0.05	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04
CaO	2.74	2.43	2.02	3.2	2.4	2.26	2.05	2.07	2.11	1.57	1.79
Na ₂ O	4.95	5.18	5.3	4.67	5.03	4.78	5	4.95	5.23	5.51	5.28
K ₂ O	4.74	4.74	4.8	4.72	4.8	4.79	4.73	4.69	4.84	4.95	4.76
TiO ₂	0.219	0.219	0.218	0.209	0.198	0.187	0.171	0.205	0.192	0.234	0.213
P ₂ O ₅	< 0.01	0.01	< 0.01	< 0.01	0.03	0.01	0.02	0.03	0.03	0.02	0.03
LOI	3.21	3.11	3.06	3.28	3.34	2.95	2.88	3.09	2.87	2.11	2.01
Total	99.7	99.48	100.1	98.68	99.75	99.55	98.21	98.65	99.33	99.85	97.46
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	25	26	17	31	16	17	18	19	25	26	27
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	15	12	18	15	18	12	14	13	13	21	15
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	390	390	400	380	390	400	400	410	450	430	450
Ga	49	50	51	49	49	48	50	48	48	49	49
Ge	3	3	3	2	2	2	3	2	2	3	3
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	203	206	221	215	220	217	211	210	217	227	226
Sr	82	78	75	116	75	75	73	70	78	67	76
Zr	2059	1624	1318	1831	1470	1747	1727	2193	2010	1794	1835
Nb	327	330	342	443	311	270	285	292	326	303	280
Mo	7	4	6	8	13	7	9	9	7	11	12
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	13	17	20	18	18	21	20	24	21	21	26
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	48	30	31	32	32	50	35	30	32	30	33
Hf	47.8	38.4	33.7	45.6	33.5	38.1	41.7	47.8	45	40.4	45.2
Ta	21.8	21.7	21.4	30.1	23	18.1	19.9	17.4	20.8	21.8	18.2
W	214	164	231	198	224	157	189	160	167	272	207
Tl	0.2	0.1	0.1	0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1	0.3
Pb	42	42	62	32	48	54	35	59	58	73	67
Th	26.9	32.5	29.5	35.5	35.6	39.3	40.7	35.3	39.2	37.5	31.3
U	19	13.9	10.6	16.8	14.6	15	14.5	12.3	13.9	12.3	11.3
Bi	0.5	0.4	0.6	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	168	177	153	202	196	202	229	312	298	196	205
La	342	359	321	318	276	315	358	282	286	332	274
Ce	558	589	534	535	478	517	575	479	488	567	450
Pr	59.3	65.1	58	58.9	50.9	54.4	63	49.5	51.4	60	47.1
Nd	203	220	192	200	170	183	208	166	169	199	155
Sm	32.9	36.5	32.7	33.5	29.3	31.7	35.1	29.8	30.5	35.2	26.7
Eu	2.17	2.31	2.04	2.41	2	2.14	2.33	2.18	2.2	2.24	1.78
Gd	29.9	34.8	30.4	32.3	28.1	29.9	33.1	31.7	31.9	32.7	25
Tb	4.9	5.7	5.1	5.9	5.1	5.1	6.3	6.6	6.6	5.4	5.1
Dy	30.3	33.6	30.5	37.9	32.5	32.3	40.3	47.5	47.4	31.8	34.8
Ho	6.2	6.9	6.1	7.9	6.8	6.8	8.6	10.3	10.4	6.6	7.5
Er	19.8	20.9	18.5	24.9	20.7	20.4	26.2	32.1	31.7	20.8	23
Tm	3.09	3.25	2.8	3.88	3.25	3.26	3.83	4.96	4.83	3.53	3.46
Yb	19.6	20.5	18.6	24.2	20.3	19.7	23.8	30.2	29.4	23.3	22.2
Lu	3.06	3.11	2.81	3.67	2.98	2.89	3.37	4.15	4.14	3.66	3.06
TREE	1482.22	1577.67	1407.55	1490.46	1321.93	1425.59	1615.93	1487.99	1491.47	1519.23	1283.7

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10951	10952	10953	10955	10956	10957	10958	10959	10960	10961	10962
from	161.8	162.5	163.2	164.0	165.0	166.0	166.8	167.5	168.0	169.0	170.0
to	162.5	163.2	164.0	165.0	166.0	166.8	167.5	168.0	169.0	170.0	171.0
(wt%)											
SiO ₂	64.31	65.3	66.37	65.21	64.95	65.33	66.94	65.74	65.87	66.54	66.21
Al ₂ O ₃	13.84	13.36	13.54	13.51	13.3	13.44	13.52	11.28	12.54	12.37	13.12
Fe ₂ O ₃ (T)	5.27	5.22	5.46	5.28	5.48	4.99	4	6.62	5.52	5.42	4.62
MnO	0.128	0.144	0.146	0.139	0.15	0.134	0.133	0.198	0.144	0.057	0.115
MgO	0.05	0.05	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
CaO	1.9	1.87	1.65	1.43	1.46	1.46	1.75	1.85	1.47	1.65	1.37
Na ₂ O	4.91	5.02	5.7	5.86	5.71	5.6	4.93	4.74	5.41	5.22	5.14
K ₂ O	4.92	4.56	4.61	4.78	4.84	4.88	5.1	4.32	4.73	4.47	4.64
TiO ₂	0.218	0.244	0.261	0.245	0.223	0.19	0.146	0.255	0.197	0.191	0.177
P ₂ O ₅	0.01	0.02	0.01	0.02	0.02	0.03	0.01	0.01	< 0.01	0.01	< 0.01
LOI	2.81	2.96	1.8	1.4	1.72	1.95	2.54	2.77	1.81	1.79	2.06
Total	98.37	98.75	99.58	97.9	97.89	98.03	99.11	97.81	97.71	97.74	97.5
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	25	21	30	25	22	18	16	17	21	26	19
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	14	22	28	25	21	23	23	24	31	33	26
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	20	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	450	410	440	390	460	420	330	540	410	410	410
Ga	50	51	50	48	50	51	52	45	49	50	49
Ge	3	3	3	3	4	4	2	4	4	4	3
As	< 5	< 5	< 5	< 5	< 5	6	< 5	9	6	10	8
Rb	231	209	203	224	240	258	263	228	251	245	244
Sr	86	79	78	65	59	54	85	83	55	58	56
Zr	1511	1750	1915	1752	2147	1699	1364	2078	2169	1570	1516
Nb	373	338	425	391	411	379	388	377	357	306	310
Mo	3	19	14	12	9	15	13	15	10	9	6
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	24	20	20	24	33	24	17	27	16	19	24
Sb	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	< 0.5	0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.8	4.8	1.3
Ba	34	40	39	36	33	29	27	118	32	36	32
Hf	34.2	37.9	40.9	39.5	52.2	37.8	30.2	46.3	47.3	32.8	35.9
Ta	25.4	20	28.3	27.2	29.4	25.5	28	27.3	26.2	20.1	22
W	209	262	234	297	282	297	315	333	380	369	358
Tl	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.4
Pb	33	85	62	62	106	82	60	73	66	71	53
Th	40	44.5	46.3	41.8	41.8	42.5	35.2	40.7	39.5	39.4	46.4
U	13.4	12.9	16.8	13.8	12.9	12.2	15.1	15.7	14.5	10.6	11.4
Bi	< 0.4	< 0.4	< 0.4	0.8	0.6	0.6	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	203	231	262	226	226	213	246	264	258	263	230
La	351	455	558	384	337	313	227	316	212	208	236
Ce	600	757	935	642	553	529	418	563	399	391	429
Pr	60	77.5	97	67.7	56.3	54.5	45.3	61.6	44	43.9	49.4
Nd	195	249	311	224	185	188	159	215	155	157	175
Sm	31.9	39.8	51.5	40	33.2	35.5	33.6	47.5	35.9	35.5	37.7
Eu	2	2.38	3.02	2.53	2.13	2.24	2.27	3.04	2.39	2.34	2.39
Gd	29.7	36.1	45.6	37.4	32.2	34.6	34.3	45.8	37	36.7	36.9
Tb	5.4	6.3	7.5	6.4	6	5.9	6.2	7.3	6.7	6.5	6.7
Dy	34.8	38.8	44.9	38.8	37.1	35.4	39.3	42	40.6	38.5	39.1
Ho	7.3	7.9	9	7.8	7.6	7	8	8.1	8.3	7.7	7.7
Er	21.7	23.6	26.8	23	22.6	20.9	23.8	22.9	23.8	22.6	22.5
Tm	3.38	3.59	4.17	3.61	3.57	3.31	3.58	3.39	3.75	3.53	3.38
Yb	20.7	23.1	26.7	23.3	22.7	20.1	21.2	21	23.9	22	21.5
Lu	2.87	3.35	3.81	3.44	3.17	2.94	2.82	3.06	3.44	3.17	3.11
TREE	1568.75	1954.42	2386	1729.98	1527.57	1465.39	1270.37	1623.69	1253.78	1241.44	1300.38

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Syenite									
Sample No.	10963	10964	10965	10966	10967	10968	10969	10970	10971	10972	10973
from	171.0	172.0	173.0	174.0	175.0	176.0	177.0	178.0	179.0	180.0	181.0
to	172.0	173.0	174.0	175.0	176.0	177.0	178.0	179.0	180.0	181.0	182.0
(wt%)											
SiO ₂	66.26	67.24	66.06	67.44	66.59	65.45	65.65	65.74	65.31	64.77	66.12
Al ₂ O ₃	12.56	12.16	12.31	12.38	13.07	12.24	12.13	12.55	12.87	12.75	13.25
Fe ₂ O ₃ (T)	5.38	5.9	5.84	6.34	5.84	6.43	6.18	5.43	5.54	6.36	5.7
MnO	0.149	0.158	0.146	0.193	0.16	0.171	0.189	0.145	0.19	0.264	0.134
MgO	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.03
CaO	1.37	1.38	1.58	1.52	1.25	1.56	1.96	1.6	1.69	1.96	1.75
Na ₂ O	5.7	5.85	5.55	5.78	6.03	5.82	5.67	5.68	5.81	5.91	6.06
K ₂ O	4.79	4.63	4.91	4.76	4.73	4.51	4.24	4.72	4.7	4.63	5.03
TiO ₂	0.17	0.218	0.194	0.247	0.211	0.22	0.22	0.197	0.189	0.196	0.181
P ₂ O ₅	< 0.01	0.01	< 0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.01
LOI	1.4	1.1	1.23	1.14	1.14	1.22	1.58	1.22	1.26	1.38	1.21
Total	97.8	98.68	97.86	99.84	99.07	97.66	97.87	97.31	97.59	98.26	99.46
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	17	16	18	17	15	14	16	14	17	25	16
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	25	28	30	30	25	27	25	26	27	24	28
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	10	10	< 10	< 10	< 10	< 10	< 10
Zn	490	570	640	510	570	590	580	400	350	400	370
Ga	50	52	53	56	56	56	56	53	50	51	53
Ge	4	4	4	4	4	4	4	4	4	4	4
As	< 5	< 5	7	6	6	< 5	6	< 5	7	12	< 5
Rb	270	265	280	265	253	250	246	268	258	256	276
Sr	54	69	119	98	78	99	155	123	148	160	121
Zr	1802	2478	1773	2399	4644	2923	4124	1619	1719	1608	2054
Nb	338	375	369	373	453	433	446	331	272	245	264
Mo	5	< 2	< 2	< 2	2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	22	27	19	25	29	29	34	37	24	25	31
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	0.6	1.8	0.8	0.6	0.8	1.1	2.1	< 0.5	0.5	1.1	0.5
Ba	63	32	51	101	52	33	73	39	141	224	59
Hf	38.4	53.4	38.3	53.2	101	64	90	37.5	35.9	38.1	43.8
Ta	23.1	26	23.8	27.3	36.3	31.7	30.4	22.6	16.3	16.9	19.1
W	329	359	399	408	345	363	330	353	331	323	361
Tl	< 0.1	0.6	< 0.1	< 0.1	< 0.1	0.3	0.8	0.4	< 0.1	< 0.1	< 0.1
Pb	103	60	88	85	93	96	92	73	55	50	61
Th	47.5	43.8	52.7	69.1	56.6	55.1	70.9	49.2	31.2	32.7	39.7
U	13.8	15	12.5	14.9	21.4	18.9	21.4	14.1	9.7	10	12
Bi	0.6	< 0.4	< 0.4	< 0.4	0.6	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	283	331	376	420	366	445	448	299	289	315	399
La	217	279	301	331	349	360	385	473	263	281	426
Ce	420	531	577	635	676	687	719	882	483	528	784
Pr	48.1	62.4	68	74.6	80.9	80.6	83.4	94.9	54.8	60.2	88.9
Nd	175	230	262	277	313	303	315	348	197	224	332
Sm	38.3	51.8	57.9	59.5	66.9	64.7	66	65.2	38.4	44.4	68.2
Eu	2.45	3.27	3.67	3.77	3.97	3.98	3.98	3.54	2.54	2.73	3.95
Gd	39.1	53.5	60.4	61.2	61.9	65	64.8	60.5	38.8	42.1	64
Tb	7.2	8.7	9.6	10.6	9.3	10.8	10.6	9.7	6.6	7.2	9.6
Dy	43.4	50.2	55.2	62.7	53.7	62.7	63.3	54.2	41.1	44	54.2
Ho	8.5	9.4	10.4	12.2	10.6	12	12.8	10.6	8.4	8.9	10.5
Er	23.8	26.7	28.3	33.9	31.9	33.6	38.2	30.6	25	26	29.7
Tm	3.58	3.9	3.99	4.95	4.84	4.81	6.12	4.45	3.85	3.79	4.39
Yb	21.1	25.8	24.7	30.5	31.1	29.8	39.7	27.1	23.9	24.3	26.6
Lu	3.03	3.7	3.39	4.13	4.37	4.05	5.52	3.85	3.38	3.47	3.64
TREE	1333.56	1670.37	1841.55	2021.05	2063.48	2167.04	2261.42	2366.64	1478.77	1615.09	2304.68

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)											APPENDIX 1
Lithology		Syenite									Granite
Sample No.	10974	10975	10976	10977	10978	10979	10980	10981	10982	10983	10984
from	182.0	183.0	184.0	185.0	185.8	187.0	188.0	189.0	190.0	191.0	192.0
to	183.0	184.0	185.0	185.8	187.0	188.0	189.0	190.0	191.0	192.0	192.8
(wt%)											
SiO ₂	65.81	66.52	66.58	67.61	66.99	69.26	69.38	67.01	67.33	67.33	66.7
Al ₂ O ₃	12.47	12.88	12.91	12.6	11.5	10.25	11.19	8.54	8.84	10.19	8.74
Fe ₂ O ₃ (T)	5.67	6.04	6.33	5.82	5.86	6.07	4.62	8.13	7.29	7.18	8.49
MnO	0.143	0.135	0.146	0.159	0.187	0.16	0.144	0.336	0.267	0.237	0.247
MgO	0.03	0.03	0.03	0.02	< 0.01	< 0.01	< 0.01	0.02	0.01	< 0.01	< 0.01
CaO	1.7	1.65	1.58	1.71	2.69	2.05	1.43	4.76	3.47	1.94	2.43
Na ₂ O	5.74	5.99	5.96	6.01	5.22	5.08	4.59	4.62	4.82	5.1	4.65
K ₂ O	4.53	4.79	4.88	4.54	4.88	4.4	5.04	3.52	3.46	4.33	4.06
TiO ₂	0.184	0.186	0.19	0.2	0.175	0.165	0.097	0.171	0.156	0.204	0.449
P ₂ O ₅	0.03	< 0.01	0.01	< 0.01	< 0.01	0.01	< 0.01	0.01	0.02	0.02	0.03
LOI	1.24	1.1	1.14	1.09	1.25	1.11	1.03	1.28	1.41	1.48	1.23
Total	97.54	99.33	99.76	99.77	98.77	98.57	97.53	98.39	97.07	98.03	97.04
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	14	14	15	17	18	16	14	25	21	15	14
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	27	27	28	25	22	32	28	28	29	33	33
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	330	400	450	600	520	520	560	830	830	830	880
Ga	50	49	57	59	58	54	57	49	51	55	50
Ge	4	4	4	4	5	5	3	6	5	4	5
As	< 5	< 5	< 5	6	10	7	12	37	17	7	6
Rb	257	267	278	273	293	268	315	231	228	314	451
Sr	129	102	138	193	314	213	177	714	392	225	292
Zr	1860	1382	1656	2630	2184	1786	3273	2184	4383	3141	1398
Nb	276	243	368	439	481	367	368	417	467	476	765
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	26	23	40	47	40	53	18	46	48	37	60
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.7	< 0.5	0.6
Cs	0.7	0.5	0.7	3.3	2.2	2	1.6	3.6	3.3	9.6	40.7
Ba	64	37	34	78	148	53	31	45	69	56	148
Hf	43.7	29.6	34.7	60.8	51.9	38.1	70.3	49.6	102	68	30
Ta	18.2	16.9	24.7	29.5	30.8	23.3	26.7	28.2	34.6	35.5	49.3
W	359	360	367	337	306	429	398	418	412	493	512
Tl	0.5	< 0.1	< 0.1	0.4	0.9	< 0.1	< 0.1	0.6	0.4	1.7	6.9
Pb	33	47	67	80	169	95	99	100	121	82	76
Th	38.2	29.5	49.1	88	127	32	41.4	36	47.4	39.8	74.5
U	10.4	10.3	12	16.3	23.5	11.9	16.8	15.3	19.8	18.1	23.3
Bi	< 0.4	< 0.4	< 0.4	< 0.4	0.6	< 0.4	0.6	< 0.4	0.5	0.5	< 0.4
Y	317	296	399	447	772	371	256	581	454	423	534
La	282	229	257	302	413	414	292	545	435	436	593
Ce	502	419	496	597	818	784	553	961	796	781	1080
Pr	57.2	47.3	58.4	71.2	101	93.5	64.9	118	90.1	87	126
Nd	212	174	220	274	400	366	242	441	344	310	473
Sm	43.4	36.2	47.3	62.2	93.9	72.8	48.7	86.6	67.1	59.8	102
Eu	2.67	2.28	3.06	3.89	6.08	4.09	3.01	6.06	4.41	3.95	6.37
Gd	45.6	38.9	48.1	64.2	111	66.2	45.7	83.3	65	63.4	100
Tb	8.4	6.6	8.1	10.4	20.3	9.3	6.7	14.8	10.6	10.7	16.5
Dy	50.7	40.1	49.5	62.1	122	49.7	40.9	88.7	65.3	64.1	96.3
Ho	10	7.8	10	12	23.7	9.2	8.7	17.8	13.6	13	17.2
Er	28.3	21.9	29.1	34.5	68.1	24.8	26.9	50	41.3	36.7	44.7
Tm	4.01	3.12	4.05	5.12	8.91	3.37	4.36	6.81	6.22	5.34	5.68
Yb	25	18.4	21.4	29.5	46.9	19.4	27.4	38.9	38.2	33.7	31.1
Lu	3.63	2.7	2.75	3.84	5.83	2.74	4	5.01	5.35	4.82	4.09
TREE	1591.91	1343.3	1653.76	1978.95	3010.72	2290.1	1624.27	3043.98	2436.18	2332.51	3229.94

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Granite									
Sample No.	10985	10986	10987	10988	10989	10990	10991	10992	10993	10995	10996
from	192.8	194.0	194.6	195.0	196.0	197.0	198.0	199.0	200.0	201.0	202.0
to	194.0	194.6	195.0	196.0	197.0	198.0	199.0	200.0	201.0	202.0	203.0
(wt%)											
SiO ₂	69.05	66.4	69.93	67.45	66.91	68.33	70.27	69.77	70.92	71.21	72.69
Al ₂ O ₃	9.64	13.07	8.1	10.9	11.18	9.3	9.33	10.26	9.66	8.66	9.72
Fe ₂ O ₃ (T)	8.22	5.59	7.88	7.33	7.24	8.81	5.94	5.62	6.33	6.6	5.93
MnO	0.236	0.154	0.126	0.158	0.159	0.183	0.11	0.133	0.151	0.165	0.139
MgO	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.04
CaO	1.77	1.35	2	0.65	0.65	0.36	1.6	1.17	1.38	0.94	1.19
Na ₂ O	6.07	7.78	4.95	5.8	6.09	5.61	4.87	4.89	4.8	4.51	4.67
K ₂ O	2.36	2.19	3.64	4.19	3.97	3.56	3.74	4.37	4.36	3.9	4.35
TiO ₂	0.176	0.152	0.143	0.129	0.123	0.193	0.133	0.102	0.114	0.107	0.192
P ₂ O ₅	0.04	0.02	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	1.04	1.06	1.12	0.81	0.85	0.8	1.08	1.02	1.02	0.9	0.99
Total	98.6	97.76	97.92	97.42	97.18	97.17	97.09	97.34	98.74	96.98	99.91
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	13	14	14	14	14	13	14	15	18	15	19
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	20	< 20	< 20	< 20
Co	36	27	33	36	32	38	35	37	38	44	42
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	710	480	450	500	520	660	420	520	580	500	600
Ga	60	78	49	62	68	58	56	63	59	53	58
Ge	6	4	6	5	5	6	4	4	5	5	5
As	8	21	20	14	35	18	28	9	17	5	18
Rb	176	161	274	334	355	314	317	371	386	333	359
Sr	229	212	381	120	113	189	269	225	202	129	177
Zr	2477	7798	4990	3618	2512	1499	3358	4157	3985	3900	3074
Nb	557	593	482	365	260	318	330	394	430	462	544
Mo	< 2	< 2	6	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	30	34	38	30	21	31	30	36	35	38	33
Sb	< 0.5	< 0.5	< 0.5	0.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.6	< 0.5
Cs	6.8	5.8	0.8	1.6	0.6	0.8	0.6	1.9	1.8	1	0.8
Ba	131	340	170	81	57	173	62	62	50	117	44
Hf	56.7	173	109	89.5	68.2	39.4	85.1	104	95.8	77.6	33.3
Ta	39.9	43.9	35.4	31.2	21	21.2	27	28.8	32.7	45.2	35.7
W	502	370	461	449	423	478	490	466	455	530	414
Tl	1.2	0.9	< 0.1	0.4	0.2	0.2	0.2	0.7	0.6	0.5	0.2
Pb	56	38	142	22	50	58	38	31	49	60	58
Th	76.3	84	38.9	19.2	19.7	45.4	23.9	35.9	34.9	43.5	41
U	21.4	26.6	17.9	13.1	12	11.1	16.5	17.7	18	18.5	14
Bi	0.5	< 0.4	0.9	0.6	0.6	0.4	0.8	< 0.4	< 0.4	0.8	0.5
Y	411	546	414	234	196	288	259	323	383	370	353
La	449	626	817	577	565	899	667	809	807	716	514
Ce	807	1110	1390	955	893	1510	1100	1380	1390	1250	870
Pr	96.6	127	161	113	105	174	124	160	159	143	101
Nd	357	473	603	434	403	670	472	613	619	539	391
Sm	73.3	88.6	104	70.9	65.4	111	76.9	102	101	90.6	68.2
Eu	3.9	5.95	5.49	3.69	3.3	5.9	4.1	5.19	5.03	4.47	3.62
Gd	72.9	84.6	89.5	59.7	54.9	92	61.6	86.3	85	75	59
Tb	12.4	13.2	11.5	7.3	6.5	11.1	7.9	11.3	11.4	10.1	8.1
Dy	72	82.8	64.5	39.2	34.8	54.9	43.9	61	63.7	56.7	44
Ho	13.6	18.1	12.7	8.1	7	9.5	9.1	12.2	12.7	11.4	8.2
Er	37.2	57	38.7	25.2	22.9	25.5	29.4	38.2	38.7	34.1	22.8
Tm	5.17	9.34	6.09	4.29	3.74	3.39	4.66	5.79	5.91	5.05	3.13
Yb	32.5	62.7	40.4	27.8	25.9	22	30.6	37.4	38.8	32.7	18.6
Lu	4.51	9.09	6.03	4.39	3.83	3.19	4.43	5.38	5.57	4.71	2.63
TREE	2448.08	3313.38	3763.91	2563.57	2390.27	3879.48	2894.59	3649.76	3725.81	3342.83	2467.28

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Granite									
Sample No.	10997	10998	10999	11000	11001	11002	11003	11004	11005	11006	11007
from	203.0	204.0	205.0	206.0	207.0	208.0	209.0	210.0	211.0	212.0	213.0
to	204.0	205.0	206.0	207.0	208.0	209.0	210.0	211.0	212.0	213.0	214.0
(wt%)											
SiO ₂	70.55	70.47	71.13	70.99	73.71	72.49	71.92	74.55	73.26	72.52	72.97
Al ₂ O ₃	9.07	7.28	7.78	7.79	7.54	8.04	8.73	8.21	8.04	8.99	8.02
Fe ₂ O ₃ (T)	6.94	7.16	7.28	7.07	7.64	7.17	6.22	6.4	5.58	5.41	6.56
MnO	0.15	0.171	0.189	0.201	0.186	0.166	0.144	0.145	0.128	0.119	0.154
MgO	0.02	0.02	0.04	0.06	0.01	0.01	0.01	0.01	0.01	0.06	0.01
CaO	1.95	3.17	3.57	3.35	1.67	1.1	0.84	0.45	1.4	1.65	2.24
Na ₂ O	5.02	4.36	4.47	4.44	4.38	4.46	4.34	4.45	3.81	4.11	4.28
K ₂ O	3.6	3.15	3.22	3.53	3.35	3.56	3.82	3.7	3.72	4.17	3.67
TiO ₂	0.145	0.232	0.154	0.142	0.189	0.12	0.158	0.151	0.113	0.135	0.14
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	1.06	0.89	1.17	0.96	0.79	0.77	0.85	0.84	0.92	1.12	0.94
Total	98.47	96.9	99	98.53	99.46	97.89	97.02	98.91	96.99	98.29	98.99
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	25	102	35	29	23	25	33	26	21	19	19
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	32	30	30	42	47	45	53	64	62	51	55
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	10	10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	660	770	720	790	700	140	590	530	540	690	630
Ga	53	45	47	47	47	48	52	50	46	50	46
Ge	5	5	5	5	5	5	4	4	4	4	4
As	10	12	13	15	11	28	6	8	9	7	23
Rb	286	240	241	286	276	289	350	340	330	367	303
Sr	285	320	220	237	151	119	111	61	65	85	124
Zr	1293	2793	3047	2971	2283	2327	2771	2682	3298	2564	2445
Nb	479	481	467	491	513	444	419	553	367	317	365
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	45	40	36	35	31	18	32	31	40	27	32
Sb	0.7	1.4	1.8	0.8	0.8	< 0.5	< 0.5	0.6	< 0.5	0.7	< 0.5
Cs	0.6	0.5	0.6	0.8	0.6	0.9	0.9	0.8	1	0.7	0.9
Ba	38	30	32	80	69	63	42	26	46	37	31
Hf	74.5	77.1	77.1	54.2	56.9	36.1	69.2	87.5	71.4	63.7	45.1
Ta	36.2	33.6	36.2	42.4	31.9	36.6	42.4	28.7	24	27	29.2
W	418	404	461	479	541	15	654	666	599	595	653
Tl	0.2	< 0.1	0.2	0.1	0.1	0.2	0.3	0.2	0.3	0.2	0.1
Pb	99	35	72	98	57	33	84	37	63	119	143
Th	67.3	49.6	36.2	56.3	41.7	115	54	30	37.3	37.7	38.5
U	18.8	18.4	15.8	18.9	16.6	24.1	17.6	19.4	17.9	19.3	12.6
Bi	0.6	< 0.4	0.8	< 0.4	1	< 0.4	< 0.4	< 0.4	1	0.4	0.5
Y	267	471	433	297	323	297	257	283	348	312	377
La	647	566	530	548	532	176	571	472	473	537	563
Ce	1160	937	889	932	885	305	939	792	804	878	939
Pr	135	109	105	112	105	31.2	110	93.6	95.6	106	113
Nd	509	406	399	428	402	102	415	352	367	400	428
Sm	94.5	71.1	71.7	78.5	71.6	21	72.6	62.3	66.7	71.8	76.9
Eu	5.52	4.09	3.61	4.26	3.91	0.43	3.84	3.33	3.65	3.97	4.11
Gd	85.4	68.5	62.2	69.2	62.3	21.1	64.2	54.7	58.1	63.8	63.4
Tb	14.3	11.4	8.6	10.3	9.2	4.2	9.3	8.8	8.6	10.1	8.6
Dy	81.8	66.9	47.9	56.6	52.2	26.2	52.2	54.6	51.4	57.5	44.9
Ho	15.9	13.5	9.4	10.7	10.1	5.6	9.9	11.6	10.7	12	8
Er	46	42.1	29.5	31.1	28.6	17.6	28.5	36.9	32.9	36.5	23.3
Tm	6.92	6.43	4.64	4.63	4.25	2.93	4.31	5.94	4.96	5.64	3.5
Yb	44.5	40.4	29.6	28.6	27.6	19.7	29.6	38.1	31.3	37.2	22.9
Lu	6.29	5.42	4.2	4.21	3.89	2.92	4.37	5.43	4.44	5.26	3.27
TREE	3119.13	2818.84	2627.35	2615.1	2520.65	1032.88	2570.82	2274.3	2360.35	2536.77	2678.88

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Granite									
Sample No.	11008	11009	11010	11011	11012	11013	11014	11015	11016	11017	11018
from	214.0	215.0	216.0	217.0	218.0	219.0	220.0	221.0	222.0	223.0	224.0
to	215.0	216.0	217.0	218.0	219.0	220.0	221.0	222.0	223.0	224.0	225.0
(wt%)											
SiO ₂	75.24	73.38	74.35	71.69	71.31	74.53	72.34	71.88	70.2	72.6	73.35
Al ₂ O ₃	8.12	7.2	7.77	8.25	8.05	8.01	8.29	9.67	10.17	9.13	9.36
Fe ₂ O ₃ (T)	6.71	7.16	7.55	8.59	8.83	6.95	7	6.71	6.57	5.78	6.1
MnO	0.161	0.165	0.182	0.202	0.205	0.162	0.161	0.154	0.149	0.133	0.142
MgO	< 0.01	0.01	0.02	0.01	0.03	0.03	0.01	< 0.01	0.01	0.01	0.02
CaO	0.75	0.67	0.37	0.18	0.66	0.26	0.21	0.28	0.23	0.26	0.2
Na ₂ O	4.38	4.35	4.64	4.95	4.92	4.44	4.69	5.02	5.05	4.48	4.44
K ₂ O	3.79	3.48	3.51	3.87	3.78	3.77	3.67	4.39	4.58	4.43	4.53
TiO ₂	0.145	0.115	0.128	0.151	0.151	0.167	0.125	0.117	0.126	0.136	0.116
P ₂ O ₅	0.01	< 0.01	< 0.01	0.04	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	0.82	0.78	0.7	0.62	0.79	0.71	0.63	0.69	0.72	0.69	0.66
Total	100.1	97.32	99.23	98.55	98.73	99.02	97.13	98.92	97.8	97.64	98.91
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	18	24	18	14	16	22	32	22	22	20	24
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	64	46	45	46	36	47	50	43	41	53	50
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	570	600	680	670	530	510	470	460	430	500	550
Ga	46	43	47	50	48	46	48	57	58	54	54
Ge	4	5	5	5	5	5	5	5	4	4	4
As	8	7	9	11	6	< 5	10	13	< 5	< 5	6
Rb	347	303	310	332	340	329	324	378	399	402	403
Sr	67	50	35	22	54	33	28	39	37	35	31
Zr	1819	3255	3610	2336	3127	3154	2556	2538	2578	2627	2063
Nb	395	363	429	428	430	434	343	388	355	429	382
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	29	29	29	29	27	22	25	23	17	30	24
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	0.9	0.9	0.8	1.1	1.2	1	1.2	1.4	1.6	1.4	1.4
Ba	23	26	22	65	41	26	26	31	29	19	19
Hf	81.6	94.4	59.7	77.7	78	63.7	65.8	66.2	65.5	50.8	88.2
Ta	30	32.4	31.3	31.8	32.8	26.4	28.9	28.1	33.7	26	25.9
W	540	543	535	422	545	538	475	450	571	529	472
Tl	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.3	0.2
Pb	85	71	51	37	82	37	47	43	49	41	38
Th	49	38	45.6	40.8	30.4	36.7	33.4	36.6	28.1	62.6	32.1
U	15	17.1	14.5	16.8	16.4	13.9	14.6	15.2	16.9	14.1	16.3
Bi	< 0.4	0.4	< 0.4	< 0.4	< 0.4	0.5	< 0.4	0.4	< 0.4	< 0.4	0.5
Y	244	295	355	253	299	318	285	302	308	297	331
La	601	617	636	595	556	590	734	738	608	625	528
Ce	987	1040	1060	973	916	965	1260	1250	1060	1080	873
Pr	119	121	122	116	111	114	146	142	119	124	105
Nd	456	467	472	441	422	435	562	545	456	476	404
Sm	81.4	78.7	80.4	74.9	71.6	73.4	93.1	91.8	76.8	83.8	69.6
Eu	4.51	4.31	4.22	3.88	3.86	3.96	4.91	4.91	4.04	4.61	3.75
Gd	73.4	70.8	68.1	63	62.7	64.2	78.5	79.4	66.4	73.7	59.9
Tb	10.2	10.3	8.9	8.8	9	8.7	10	10	9.1	10.3	8.5
Dy	52.2	58.5	47.2	50.2	52.3	48.8	52.8	53.4	51.1	58.2	50.1
Ho	9.7	11.7	8.8	10.1	10.5	9.8	9.9	10.4	10.4	10.9	10.5
Er	27.8	35.9	25	32	32.2	29.9	28.5	30.4	32.2	30.3	33.2
Tm	4.21	5.68	3.75	5.18	4.98	4.6	4.24	4.62	5.1	4.41	5.41
Yb	28.7	37.2	24.3	34.6	33.3	29.5	27.1	30	35	26.6	36.4
Lu	4.27	5.52	3.73	5.15	4.94	4.28	3.92	4.51	5.08	3.63	5.42
TREE	2703.39	2858.61	2919.4	2665.81	2589.38	2699.14	3299.97	3296.44	2846.22	2908.45	2523.78

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Granite									
Sample No.	11019	11020	11021	11022	11023	11024	11025	11026	11027	11028	11029
from	225.0	226.0	227.0	228.0	229.0	230.0	231.0	232.0	233.0	234.0	235.0
to	226.0	227.0	228.0	229.0	230.0	231.0	232.0	233.0	234.0	235.0	236.0
(wt%)											
SiO ₂	73.8	71.9	70.78	70.95	72.21	71.07	71.42	72.89	73.72	71.94	74.55
Al ₂ O ₃	8.28	9.49	10.41	10.36	11.58	11.55	11.74	8.52	7.26	8.61	7.18
Fe ₂ O ₃ (T)	7.1	5.95	5.8	5.46	4.94	4.98	4.12	6.73	7.86	7.12	7.06
MnO	0.171	0.145	0.136	0.129	0.127	0.117	0.099	0.162	0.184	0.165	0.167
MgO	0.01	< 0.01	< 0.01	0.01	0.02	0.02	< 0.01	0.02	< 0.01	0.01	< 0.01
CaO	0.27	0.57	0.3	0.25	0.33	0.35	0.45	0.26	0.15	0.15	0.21
Na ₂ O	4.59	4.51	4.92	4.57	4.96	4.94	4.92	4.55	4.76	4.64	4.13
K ₂ O	3.92	4.22	4.54	4.76	5.08	5.21	5.15	3.99	3.56	3.93	3.57
TiO ₂	0.12	0.106	0.096	0.12	0.134	0.143	0.099	0.185	0.15	0.132	0.198
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01
LOI	0.67	0.86	0.75	0.73	0.67	0.76	0.8	0.66	0.72	0.68	0.68
Total	98.93	97.74	97.73	97.33	100	99.13	98.81	97.96	98.36	97.35	97.76
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	27	33	22	25	29	27	25	34	19	26	22
V	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	43	40	42	47	45	42	50	49	52	49	56
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	480	430	460	420	410	330	580	570	530	570	560
Ga	49	53	59	59	65	66	67	52	43	48	44
Ge	5	4	4	4	4	4	4	5	5	4	5
As	36	6	< 5	16	6	< 5	< 5	20	< 5	14	< 5
Rb	352	370	411	444	475	475	488	373	305	351	335
Sr	30	41	29	27	26	41	43	30	24	24	23
Zr	3583	2515	2756	2676	2018	2746	2133	2409	4136	3579	3261
Nb	353	339	323	352	346	385	300	343	414	304	466
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	23	20	35	39	33	29	38	33	27	36	31
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	1.4	1.4	1.8	2.1	2.3	2	2.8	1.8	2	2.8	2.4
Ba	18	16	39	36	21	27	21	19	22	21	17
Hf	60.3	65.9	66.8	52.1	66.7	56.4	61.4	106	69.9	81.1	73.9
Ta	24	25.7	27.1	25.5	28.4	21.9	27.7	34.3	24.9	39.3	26.2
W	459	500	480	530	487	505	506	566	518	574	509
Tl	0.6	0.3	0.4	0.4	0.4	0.4	0.3	0.2	0.3	0.3	0.2
Pb	51	35	58	49	51	48	79	162	33	33	70
Th	34.3	34.8	47.6	67	51.9	37.4	52.5	30	52.2	47.1	49.2
U	13	15.4	17	17.2	14.8	12	18.1	19.2	15.7	21.6	14.5
Bi	0.9	< 0.4	1.3	< 0.4	< 0.4	< 0.4	< 0.4	0.7	< 0.4	0.8	< 0.4
Y	321	275	309	363	276	326	262	413	322	350	327
La	534	588	581	619	667	509	642	624	634	606	591
Ce	885	958	949	1020	1110	828	1120	1030	1090	1020	1010
Pr	104	116	113	123	128	96.9	129	121	124	120	116
Nd	391	442	437	466	483	375	494	470	471	457	446
Sm	65.9	74.8	76.6	81.5	82.6	64.1	89.1	79.8	79.3	79	77.1
Eu	3.57	3.9	4.35	4.09	4.38	3.42	4.71	4.23	4.2	4.28	4.32
Gd	57.2	64.7	69.8	68.7	72.6	56.4	80	68.3	68.1	67.5	66.6
Tb	8.4	9.1	10.8	9.7	10.1	8.1	12.6	9.5	10	9.9	9.4
Dy	47	51.4	62	53	56.1	44.5	71.5	55.1	57.3	57.1	53.1
Ho	9.4	10.5	12.9	9.8	10.9	8.7	14.3	11.5	11.3	11.4	10.3
Er	28.4	32.1	38.2	27.6	32.6	25.9	42.7	36.6	34.4	34.9	30.4
Tm	4.43	5.14	5.58	3.75	4.8	3.65	6.18	5.8	5.25	5.54	4.58
Yb	28.3	33.2	35.4	23.2	31.3	23.1	37.7	39.3	34.3	37.8	29.5
Lu	4.25	4.91	4.93	3.21	4.49	3.26	5.24	5.92	4.91	5.52	4.18
TREE	2491.85	2668.75	2709.56	2875.55	2973.87	2376.03	3011.03	2974.05	2950.06	2865.94	2779.48

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Granite									
Sample No.	11030	11031	11032	11033	11035	11036	11037	11038	11039	11040	11041
from	236.0	237.0	238.0	239.0	240.0	241.0	242.0	243.0	244.0	245.0	246.0
to	237.0	238.0	239.0	240.0	241.0	242.0	243.0	244.0	245.0	246.0	247.0
(wt%)											
SiO ₂	74.98	76.09	73.17	75.32	72.63	72.62	73.2	74.47	73.17	78.04	75.31
Al ₂ O ₃	7.96	7.39	9.36	7.8	8.34	11.9	9.26	7.08	7.58	7.83	8.63
Fe ₂ O ₃ (T)	7.28	6.46	6.15	7.26	8.86	4.21	5.29	6.73	7.31	4.76	5.44
MnO	0.171	0.153	0.146	0.171	0.206	0.097	0.123	0.159	0.174	0.108	0.13
MgO	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01	0.01
CaO	0.17	0.19	0.17	0.19	0.19	0.13	0.21	0.19	0.17	0.13	0.15
Na ₂ O	4.56	4.15	4.93	4.46	5.01	5.27	4.85	4.17	4.55	4.06	4.32
K ₂ O	3.67	3.5	4.25	3.73	3.84	5.3	4.32	3.27	3.84	3.57	3.9
TiO ₂	0.128	0.177	0.144	0.212	0.173	0.075	0.094	0.164	0.203	0.092	0.094
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	0.57	0.63	0.55	0.61	0.65	0.58	0.72	0.66	0.61	0.63	0.63
Total	99.49	98.76	98.87	99.74	99.89	100.2	98.07	96.88	97.61	99.22	98.61
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	25	24	35	24	21	31	22	15	27	22	22
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	51	59	51	50	47	50	55	56	56	71	55
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	20	< 10	< 10	< 10
Zn	540	560	590	710	400	450	560	640	430	500	410
Ga	47	43	52	45	49	66	53	45	46	47	52
Ge	4	5	4	5	6	4	5	5	6	4	5
As	< 5	6	12	6	7	6	< 5	< 5	9	13	10
Rb	332	304	351	312	317	444	366	301	333	304	348
Sr	19	22	18	23	25	19	25	24	27	18	36
Zr	2943	3347	1840	3080	2753	1881	3819	3827	3098	2576	3456
Nb	348	348	291	265	307	365	396	393	363	307	313
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	31	40	45	34	23	28	26	40	24	34	23
Sb	< 0.5	< 0.5	< 0.5	0.8	< 0.5	0.6	1.4	0.6	< 0.5	< 0.5	< 0.5
Cs	2.8	3.3	2.9	2.6	2.6	3.1	2.4	3.4	3	2.7	2.4
Ba	19	16	18	21	19	19	18	21	21	20	20
Hf	74.5	46.8	66	62.9	42.2	88.9	84.6	73.8	60.9	79	73.9
Ta	28.1	19.3	23.5	21.9	26.7	32.4	36.6	29.4	23.1	24.6	29.4
W	603	552	528	527	545	588	598	581	753	571	558
Tl	0.4	0.4	0.3	0.4	0.5	0.4	0.3	0.3	0.2	0.3	0.4
Pb	41	68	47	69	48	35	35	63	33	47	37
Th	55.9	57.3	43.7	50	45.3	36.3	29	45.7	31.1	47.4	32.5
U	18.6	10.5	15.7	14.7	13.1	16.3	19.1	20.2	11.5	14.6	16.2
Bi	0.6	0.4	0.5	0.5	< 0.4	0.4	< 0.4	0.5	< 0.4	< 0.4	0.6
Y	307	351	311	327	421	302	315	301	371	286	319
La	595	612	635	844	701	656	725	721	593	658	653
Ce	963	1010	1040	1420	1180	1080	1190	1210	911	1080	1080
Pr	113	117	120	163	136	122	135	141	112	126	124
Nd	439	447	462	629	531	469	516	533	435	484	476
Sm	74	77.8	79.2	107	91.4	76.4	84.2	90	71.1	83	76.6
Eu	4.06	4.19	4.03	5.69	4.88	4.19	4.5	4.71	3.75	4.4	4.12
Gd	63.3	67.5	67	90.1	75.3	63.4	69.2	75.8	60.6	69.5	63.2
Tb	9.7	10.3	9.7	13.3	10.2	8.8	9.4	10.8	8.7	10	8.6
Dy	55.8	55.5	55.4	72.2	54.3	49.9	50.3	60.4	47.1	55.4	48.3
Ho	11.8	10.3	10.6	14	9.9	10.1	10.1	11.8	9	10.6	9.9
Er	36.4	27.3	30.2	40.2	26.3	31.4	31.3	34.5	26.1	30.8	31.5
Tm	5.73	3.61	4.15	5.87	3.57	4.88	4.97	5.13	3.89	4.47	4.93
Yb	38.3	21.7	26	35.6	21.4	32.6	34.1	31.9	25.1	28.5	33.5
Lu	5.45	2.94	3.59	4.81	2.74	4.75	5.24	4.65	3.65	4	4.89
TREE	2721.54	2818.14	2857.87	3771.77	3268.99	2915.42	3184.31	3235.69	2680.99	2934.67	2937.54

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Granite									
Sample No.	11042	11043	11044	11045	11046	11047	11048	11049	11050	11051	11052
from	247.0	248.0	249.0	250.0	251.0	252.0	253.0	254.0	255.0	256.0	257.0
to	248.0	249.0	250.0	251.0	252.0	253.0	254.0	255.0	256.0	257.0	258.0
(wt%)											
SiO ₂	74.04	73.21	71.29	70.91	70.34	73.9	73.25	71.52	71.88	72.65	73.7
Al ₂ O ₃	9.89	8.99	10.25	11.38	12.19	10.28	10.75	10.87	10.98	10.46	9.52
Fe ₂ O ₃ (T)	4.78	5.45	5.07	4.5	4.39	4.96	4.57	4.87	4.88	4.98	5.71
MnO	0.111	0.127	0.118	0.102	0.099	0.118	0.107	0.113	0.109	0.113	0.132
MgO	0.01	< 0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	< 0.01	0.02
CaO	0.18	0.12	0.13	0.13	0.14	0.18	0.15	0.18	0.26	0.31	0.16
Na ₂ O	4.58	4.56	4.89	4.83	5.2	4.89	4.67	4.78	4.78	4.67	4.97
K ₂ O	4.39	4.27	4.77	5.15	5.1	4.77	5.35	4.82	4.79	4.66	4.41
TiO ₂	0.119	0.121	0.093	0.087	0.12	0.094	0.135	0.161	0.088	0.119	0.111
P ₂ O ₅	0.04	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	0.01
LOI	0.73	0.69	0.59	0.69	0.58	0.8	0.7	0.67	0.68	0.77	0.65
Total	98.87	97.55	97.21	97.8	98.19	100	99.7	98.01	98.47	98.71	99.39
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	18	17	22	26	29	21	25	24	21	17	26
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	20	< 20	< 20	< 20	< 20	< 20	< 20
Co	55	54	53	49	42	50	55	50	48	44	54
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	20	< 10	< 10
Zn	480	480	440	430	460	450	450	420	370	480	470
Ga	59	55	62	67	71	60	62	64	63	56	56
Ge	4	5	5	4	4	5	4	5	4	4	4
As	6	7	< 5	6	7	14	6	9	8	5	15
Rb	405	379	417	465	454	409	456	421	408	390	366
Sr	54	35	24	21	20	21	21	28	38	32	28
Zr	3799	3954	2615	2835	1731	2830	2345	1722	1890	2721	2826
Nb	350	437	268	341	316	412	329	272	315	379	317
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	29	31	29	28	20	45	29	25	17	25	22
Sb	0.7	0.5	0.9	0.9	0.8	2.3	0.6	< 0.5	< 0.5	< 0.5	< 0.5
Cs	2.4	2.1	2.2	1.8	2	2.6	1.7	1.9	1.9	2	1.8
Ba	20	19	19	17	19	16	16	18	19	21	20
Hf	94	64.6	66.4	38.4	65	58.6	40.1	41.5	62.6	64.3	69.5
Ta	31.1	20.9	24	22.8	29.4	23.4	21.4	26.4	28.6	26	25.3
W	550	535	510	435	513	597	564	518	500	544	634
Tl	0.4	0.4	0.5	0.4	0.4	0.5	0.4	0.4	0.6	0.3	0.3
Pb	36	36	44	63	41	54	48	63	30	36	35
Th	26.1	37.1	42.2	47.4	34.7	58.9	37.1	36.6	22.7	36.9	34.9
U	17.9	13.9	14.4	10.2	15	14.7	12.5	13.1	12.3	15.2	13.9
Bi	< 0.4	< 0.4	< 0.4	1.3	1.4	< 0.4	0.5	< 0.4	< 0.4	0.6	< 0.4
Y	312	361	289	327	296	319	346	301	300	267	327
La	717	683	691	790	729	720	878	857	735	754	749
Ce	1160	1110	1120	1300	1180	1190	1440	1380	1190	1210	1220
Pr	134	127	130	149	135	137	165	158	141	143	140
Nd	522	489	508	577	517	527	651	603	538	544	538
Sm	84.2	79.3	85.1	95.6	84.3	86.4	105	95.9	84.2	87.1	85.5
Eu	4.58	4.1	4.56	5.08	4.38	4.63	5.27	5.09	4.44	4.64	4.39
Gd	68.7	65.3	70.8	76.4	69.1	71.3	85.3	78.2	69.9	71.9	68.7
Tb	9.7	8.9	9.8	10.3	9.3	10.4	10.8	10.1	9.2	9.6	9.3
Dy	56	47.9	53	53.5	50.5	59.2	56.5	53	46.2	52.6	51.7
Ho	11.6	9.1	10	9.5	10.1	11.4	10.3	9.4	8.5	10.1	10.4
Er	36.6	26.5	29.9	26	30.5	32.3	28.6	25.2	24.6	29.8	32.2
Tm	5.73	3.8	4.32	3.49	4.7	4.59	3.81	3.34	3.78	4.48	4.94
Yb	38.7	23.6	26.9	21.1	31.4	27.1	23.5	19.4	24.7	28.8	32.6
Lu	5.57	3.17	3.71	2.81	4.55	3.56	3.27	2.6	3.69	4.06	4.76
TREE	3166.38	3041.67	3036.09	3446.78	3155.83	3203.88	3812.35	3601.23	3183.21	3221.08	3278.49

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Granite									
Sample No.	11053	11054	11055	11056	11057	11058	11059	11060	11061	11062	11063
from	258.0	259.0	260.0	261.0	262.0	263.0	264.0	265.0	266.0	267.0	268.0
to	259.0	260.0	261.0	262.0	263.0	264.0	265.0	266.0	267.0	268.0	269.0
(wt%)											
SiO ₂	74.53	74.91	74.22	76.19	77.49	75.97	76.42	78.05	76.65	75.87	75.86
Al ₂ O ₃	8.04	8.23	9.12	7.58	8.27	9.19	7.69	7.48	7.29	9.26	9.08
Fe ₂ O ₃ (T)	5.65	5.66	5.35	5.78	5.28	5.18	5.35	5.72	5.42	4.74	4.49
MnO	0.13	0.129	0.123	0.131	0.119	0.12	0.121	0.131	0.123	0.108	0.098
MgO	0.02	0.01	< 0.01	0.01	< 0.01	< 0.01	0.01	0.02	0.01	< 0.01	0.01
CaO	0.18	0.13	0.16	0.15	0.19	0.15	0.14	0.17	0.19	0.13	0.22
Na ₂ O	4.38	4.24	4.32	4.07	4.15	4.32	4.02	3.7	3.75	4.38	4.47
K ₂ O	3.62	3.58	4.14	3.59	3.96	4.04	3.65	3.58	3.2	4.07	3.65
TiO ₂	0.133	0.093	0.155	0.16	0.161	0.093	0.13	0.12	0.103	0.084	0.089
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	0.64	0.65	0.68	0.71	0.67	0.65	0.72	0.66	0.69	0.63	0.7
Total	97.32	97.61	98.26	98.39	100.3	99.73	98.25	99.62	97.42	99.28	98.67
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	18	18	22	21	20	22	25	31	20	20	14
V	< 5	< 5	< 5	< 5	< 5	6	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	52	49	62	62	61	61	58	66	64	67	60
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	450	460	480	440	460	450	520	430	400	360	390
Ga	49	48	53	45	49	54	46	44	44	53	54
Ge	5	5	5	5	4	5	5	5	4	4	4
As	< 5	< 5	7	6	< 5	< 5	< 5	6	6	< 5	11
Rb	323	318	363	319	341	359	322	307	275	351	315
Sr	21	19	23	23	25	25	22	27	29	26	34
Zr	2769	3263	2484	3087	1767	2721	3247	1965	3978	2785	3047
Nb	325	261	328	373	404	265	404	394	270	258	288
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	20	29	27	28	25	28	27	28	21	20	23
Sb	< 0.5	0.6	0.6	0.9	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	1.8	1.8	2.2	1.8	2.3	1.8	1.4	1.7	1.7	1.6	1.7
Ba	20	21	22	19	17	21	18	16	18	19	19
Hf	73.9	59.8	75	46.1	59.1	78.3	48.6	90.6	63.8	72.2	54.8
Ta	22	24	29.2	27.9	23.7	32.1	30.1	26.1	21.3	25.4	20.4
W	544	685	691	723	656	624	729	661	684	618	699
Tl	0.3	0.4	0.3	0.3	0.4	0.3	0.2	0.2	0.3	0.3	0.2
Pb	69	40	43	38	31	46	77	23	27	22	33
Th	37.3	42.4	48.8	44.5	40.9	54.1	92	26.5	24.5	19.3	34.7
U	15.8	12.5	17.3	11.8	13.3	17	14.4	16.7	13.6	16.1	11.4
Bi	< 0.4	0.4	< 0.4	< 0.4	0.5	< 0.4	< 0.4	< 0.4	0.7	< 0.4	< 0.4
Y	314	315	349	402	317	274	298	357	254	316	268
La	699	774	709	699	657	604	677	638	631	661	549
Ce	1140	1270	1170	1150	1100	981	1150	1060	1040	1100	861
Pr	131	146	136	133	127	115	135	121	119	126	105
Nd	503	570	526	515	485	444	518	472	457	484	406
Sm	83	94.4	87.1	86.5	82.1	74.5	89.9	78.2	74.5	77.2	68.3
Eu	4.27	5.06	4.72	4.61	4.43	4.15	5.15	4.19	4.09	4.14	3.68
Gd	67.7	77.5	72.8	71.5	67.2	63.3	77	63.2	62.2	61.7	57.9
Tb	9.4	11.2	10.7	10	9.3	8.8	11.6	8.3	8.7	8.1	8.3
Dy	52.4	61.4	64.4	55.4	50	48.8	63.9	44.2	48.4	43.2	46.1
Ho	10.6	11.8	13.8	10.4	8.9	9.6	11.8	7.9	9.9	8.3	8.7
Er	32	35	45.1	29.7	24.8	29.5	31.5	21.6	30.1	24.3	25.2
Tm	5	5.32	7.26	4.34	3.58	4.52	4.19	2.97	4.77	3.6	3.78
Yb	32.5	32.3	48.6	27.6	19.6	29.9	23.7	17.6	31	23	24.1
Lu	4.54	4.5	6.92	3.93	2.76	4.29	3.02	2.43	4.42	3.29	3.46
TREE	3088.41	3413.48	3251.4	3202.98	2958.67	2695.36	3099.76	2898.59	2779.08	2943.83	2438.52

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Granite									
Sample No.	11064	11065	11066	11067	11068	11069	11070	11071	11072	11073	11075
from	269.0	270.0	271.0	272.0	273.0	274.0	275.0	276.0	277.0	278.0	279.0
to	270.0	271.0	272.0	273.0	274.0	275.0	276.0	277.0	278.0	279.0	280.0
(wt%)											
SiO ₂	78.46	78.84	76.02	78.78	77.74	77.24	77.77	75.91	77.72	74.52	76.07
Al ₂ O ₃	7.15	7.68	7.84	7.64	8.58	8.08	8.71	9.17	7.66	9.22	8.24
Fe ₂ O ₃ (T)	4.29	5.13	4.71	4.58	4.04	4.2	4.12	4.16	3.84	4.36	4.66
MnO	0.097	0.114	0.106	0.103	0.097	0.113	0.098	0.093	0.087	0.096	0.104
MgO	0.01	0.01	0.01	0.02	< 0.01	0.01	0.02	0.01	< 0.01	< 0.01	< 0.01
CaO	0.17	0.14	0.31	0.18	0.15	0.14	0.21	0.19	0.16	0.32	0.34
Na ₂ O	3.47	3.88	4.07	3.61	3.93	3.49	4.21	4.14	3.38	4.45	3.97
K ₂ O	3.24	3.33	3.27	3.56	3.77	3.84	3.65	3.95	3.8	3.63	3.73
TiO ₂	0.089	0.096	0.093	0.08	0.09	0.086	0.087	0.084	0.084	0.092	0.11
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	0.61	0.4	0.69	0.35	0.58	0.58	0.64	0.63	0.62	0.73	0.73
Total	97.59	99.63	97.14	98.9	98.99	97.78	99.51	98.34	97.36	97.43	97.96
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	23	24	15	18	19	27	23	18	16	16	13
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	20	< 20	< 20	< 20	< 20	< 20
Co	69	< 1	66	< 1	59	65	68	62	67	64	60
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	430	380	370	360	390	390	380	340	350	390	360
Ga	43	45	48	46	51	46	51	54	44	57	50
Ge	4	4	4	4	4	4	4	4	4	4	4
As	6	< 5	< 5	12	< 5	6	15	6	< 5	< 5	10
Rb	285	289	288	314	341	340	317	350	330	328	325
Sr	21	19	26	17	17	18	25	31	26	35	41
Zr	2241	2534	2518	2131	2279	1872	1616	2061	2968	1999	2015
Nb	286	317	258	258	271	223	247	235	256	219	265
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	25	25	19	36	27	30	27	19	28	25	20
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	3.1	1.8	2.4	2	2.7	2	1.6	1.7	1.4	2.6	1.8
Ba	23	18	17	22	33	21	17	19	16	17	19
Hf	63.6	64.3	51.4	57.6	41.2	41.9	50.4	69	49.9	51.5	58.3
Ta	23.9	19.9	21.3	21.2	16.1	16.2	17.9	24.2	18.4	20.5	25.9
W	10	663	17	697	701	705	615	745	700	653	684
Tl	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.6
Pb	32	21	27	39	72	31	142	30	28	34	47
Th	37.1	26.7	28.7	33.1	50.8	36.4	34.1	22.9	20.3	29.3	27.5
U	12	10.5	12.5	10.6	8.4	8.6	12.2	14.7	9.9	11.5	12.9
Bi	< 0.4	< 0.4	< 0.4	< 0.4	0.6	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	273	304	236	266	242	271	250	273	228	233	288
La	624	568	542	561	526	538	533	510	747	710	621
Ce	975	871	839	846	811	828	815	789	1220	1150	1000
Pr	118	107	103	105	100	101	99.4	94.3	140	132	114
Nd	456	418	390	408	391	392	384	360	548	515	430
Sm	77.6	67.6	65.8	70.6	70.7	68.8	64.2	60.7	86.2	81.7	68.6
Eu	4.1	3.68	3.58	3.74	4.09	3.8	3.48	3.06	4.3	4.36	3.92
Gd	65.5	55.9	55	58.7	63.4	59.6	54.7	48.9	68.4	66.5	58.3
Tb	9.4	7.5	8	8.4	9.5	8.5	8	7.1	8.3	9.2	7.8
Dy	52	39.7	44.7	42.5	50.4	43.9	44.6	38.6	41.5	48.8	41.5
Ho	9.9	7.4	8.7	7.7	8.8	7.8	8.5	7.4	7.2	9.1	7.8
Er	28.3	21.5	25.9	20.3	22.9	20.8	24	21.3	19.4	26.1	22.4
Tm	4.25	3.15	3.74	2.69	3.14	2.82	3.44	3.32	2.59	3.75	3.36
Yb	27.2	20.1	24.3	15.8	18.7	16.4	20.5	20.3	15.9	23.5	21.5
Lu	3.87	2.88	3.37	2.12	2.48	2.31	2.74	2.85	2.24	3.38	3.09
TREE	2728.12	2497.41	2353.09	2418.55	2324.11	2364.73	2315.56	2239.83	3139.03	3016.39	2691.27

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Granite									
Sample No.	11076	11077	11078	11079	11080	11081	11082	11083	11084	11085	11086
from	280.0	281.0	282.0	283.0	284.0	285.0	286.0	287.0	288.0	289.0	290.0
to	281.0	282.0	283.0	284.0	285.0	286.0	287.0	288.0	289.0	290.0	291.0
(wt%)											
SiO ₂	79.3	77.66	76.2	77.08	78.1	76.78	76.51	77.43	77.16	77.97	75.43
Al ₂ O ₃	8.21	7.85	8.14	8	8.31	8.21	7.91	7.64	8.19	6.72	8.66
Fe ₂ O ₃ (T)	4.19	4.34	4.39	4.31	4.7	4.6	4.92	4.86	5.47	5.33	5.21
MnO	0.094	0.099	0.103	0.107	0.11	0.102	0.121	0.122	0.131	0.123	0.116
MgO	< 0.01	< 0.01	< 0.01	0.01	< 0.01	0.01	< 0.01	0.02	0.01	0.01	< 0.01
CaO	0.17	0.17	0.19	0.15	0.45	0.31	0.21	0.24	0.32	0.19	0.26
Na ₂ O	3.94	3.8	3.99	3.79	4.24	4.15	3.76	3.72	4.37	3.38	4.28
K ₂ O	3.58	3.6	3.47	3.53	3.43	3.29	3.76	3.62	3.23	3.3	3.65
TiO ₂	0.081	0.107	0.088	0.084	0.105	0.138	0.088	0.095	0.115	0.121	0.099
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	0.67	0.69	0.71	0.62	0.75	0.71	0.6	0.58	0.7	0.6	0.71
Total	100.3	98.33	97.3	97.69	100.2	98.29	97.9	98.32	99.7	97.75	98.43
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	14	17	16	18	14	17	23	29	23	18	16
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	66	71	76	75	69	65	65	69	61	74	57
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	390	410	460	420	370	470	470	470	480	430	480
Ga	50	48	50	52	51	48	44	45	52	42	53
Ge	4	4	4	4	4	4	4	4	4	4	4
As	8	< 5	5	9	< 5	< 5	7	6	10	9	5
Rb	316	330	320	330	308	285	320	323	290	300	337
Sr	35	27	47	20	54	41	26	24	36	27	47
Zr	2548	3002	2789	896	2305	2718	1899	1845	3063	1367	3211
Nb	312	330	315	353	314	310	311	333	416	379	374
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag			7.3								
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	27	30	28	17	23	28	24	37	30	24	27
Sb	< 0.5	< 0.5	0.6	< 0.5	< 0.5	0.5	1	< 0.5	< 0.5	< 0.5	< 0.5
Cs	1.8	1.8	1.6	1.6	1.6	2.2	2.7	2.4	1.5	2	2.2
Ba	27	19	24	19	21	27	30	32	20	23	23
Hf	73.4	69.1	22.1	53	68.4	45.4	45.3	76.6	33.1	79.8	112
Ta	25.4	28.3	22.2	24	27.6	23.3	24.4	34.2	24.3	31	29.4
W	751	842	863	701	702	686	711	635	786	602	643
Tl	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.4	0.5	0.6	0.6
Pb	32	33	50	28	18	62	48	40	32	21	37
Th	28.3	29.9	42.5	22.7	21.3	63.8	45.4	46.7	55.9	17.7	20.5
U	14.2	14.7	10.3	14.4	13	13.7	12.6	17.2	11.1	15.3	16.9
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.5	< 0.4	1.2	0.5
Y	255	281	225	299	351	236	322	278	275	382	321
La	523	565	540	561	566	528	571	727	739	794	771
Ce	810	919	891	899	967	876	943	1220	1230	1310	1280
Pr	98.3	111	113	112	114	109	113	137	140	147	146
Nd	372	410	432	427	428	406	424	513	521	562	559
Sm	64.4	72	81.4	72.9	74.7	78.5	76	86.5	93	91.5	91.8
Eu	3.71	4.2	5.05	4.34	4.25	4.8	4.49	4.91	5.38	4.84	5.04
Gd	55.1	60.3	71.6	63.9	63.9	71.3	66.1	72.6	80.4	75	75.2
Tb	8.2	8.4	10.8	9.3	8.4	11	9.4	10.2	12.4	9.8	10.2
Dy	44.7	42.6	57.1	53	41.1	58.7	49.6	50.9	67.5	53.1	56.9
Ho	9.2	7.2	10	10.8	7.4	10.4	8.8	8.9	12.7	10.5	11.5
Er	28.3	18.4	25.8	33.6	20.9	26.8	24.5	22.6	36.2	32.3	35.3
Tm	4.4	2.38	3.37	5.49	3.08	3.4	3.51	2.95	5.08	5.12	5.53
Yb	28.7	13.8	18.8	35.6	20.2	19.5	21.6	17.1	30.6	33.2	36
Lu	4.19	1.79	2.46	5.25	2.92	2.54	3.08	2.33	4.28	4.89	5.29
TREE	2309.2	2517.07	2487.38	2592.18	2672.85	2441.94	2640.08	3153.99	3252.54	3515.25	3409.76

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-07)

APPENDIX 1

Lithology		Granite						
Sample No.	11087	11088	11089	11090	11091	11092	11093	11094
from	291.0	292.0	293.0	294.0	295.0	296.0	297.0	298.0
to	292.0	293.0	294.0	295.0	296.0	297.0	298.0	299.0
(wt%)								
SiO ₂	74.69	74.92	76.99	76.01	75.83	74.91	75.43	76.87
Al ₂ O ₃	8	8.68	8.07	7.61	8.03	8.78	7.39	6.88
Fe ₂ O ₃ (T)	5.84	5.37	5.86	5.78	5.13	5.45	5.93	6.22
MnO	0.132	0.124	0.143	0.137	0.121	0.124	0.136	0.143
MgO	< 0.01	0.01	0.02	0.02	0.01	< 0.01	0.01	< 0.01
CaO	0.41	0.44	0.25	0.25	0.2	0.25	0.26	0.22
Na ₂ O	4.09	4.2	4.17	3.91	4.12	4.3	3.89	3.97
K ₂ O	3.65	3.73	3.64	3.64	3.07	3.86	3.33	3.19
TiO ₂	0.103	0.121	0.107	0.104	0.092	0.103	0.127	0.111
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	0.83	0.73	0.64	0.68	0.54	0.65	0.68	0.68
Total	97.76	98.32	99.87	98.16	97.16	98.44	97.19	98.28
(ppm)								
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	14	26	28	21	21	18	22	13
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	56	60	57	58	59	56	61	68
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	500	540	500	460	460	520	510	550
Ga	49	55	51	49	51	57	49	44
Ge	5	5	5	5	5	5	5	5
As	15	11	11	8	< 5	7	9	23
Rb	349	346	334	341	287	357	318	276
Sr	53	51	26	23	23	28	30	21
Zr	4393	1326	1852	2340	1511	1944	2381	2483
Nb	346	324	393	325	347	315	360	326
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag								
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	32	27	25	25	28	27	23	21
Sb	0.7	0.5	< 0.5	1	< 0.5	0.6	< 0.5	< 0.5
Cs	2.1	4.1	3.2	2.2	2.1	3	2.2	2.2
Ba	23	30	24	19	21	20	18	18
Hf	33.1	46.3	58.8	37	49	59.3	62.4	53
Ta	21.8	26.4	22.3	24.4	22.1	26.6	25.3	21.7
W	622	660	624	646	588	648	782	649
Tl	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5
Pb	43	39	39	42	26	117	49	39
Th	51.7	61.2	33.6	36.1	30.5	53.7	33.4	27.8
U	12.8	13.4	12.1	10.9	12.1	14.6	14.3	12.1
Bi	< 0.4	< 0.4	< 0.4	0.4	< 0.4	< 0.4	0.4	< 0.4
Y	354	365	359	343	290	333	391	351
La	845	836	857	771	1090	1010	963	1170
Ce	1430	1440	1460	1290	1700	1640	1620	1780
Pr	162	165	166	148	193	186	184	204
Nd	617	631	640	564	749	727	702	801
Sm	105	108	108	93.2	121	120	116	130
Eu	5.79	6.24	6.4	5.64	7.18	7.29	6.99	7.59
Gd	90.4	88.8	90.2	78.1	102	100	97.3	106
Tb	12.5	12.1	12	10.2	12.1	13.2	12.2	12.9
Dy	64.8	63	61.4	51.8	58.2	67.4	62.3	64
Ho	11.6	11	10.9	9	10.2	11.7	10.8	10.9
Er	31.3	29.1	30.6	24.6	26.2	30.8	29.6	29.4
Tm	4.33	3.89	4.29	3.42	3.32	4.12	4.01	3.96
Yb	25	23.5	27	20.3	20	23.8	24.9	25.1
Lu	3.33	3.24	3.79	2.86	2.81	3.29	3.55	3.58
TREE	3762.05	3785.87	3836.58	3415.12	4385.01	4277.6	4227.65	4699.43

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Syenite													
Sample No.	11711	11712	11713	11715	11716	11717	11718	11719	11720	11721	11722	11723	11724	11725	
from	8.4	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	
to	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	
(wt%)															
SiO2	48.56	65.46	68.04	68.13	67.31	65.49	65.91	67.61	68.43	65.76	67.00	67.48	68.04	67.88	
Al2O3	12.93	11.74	13.55	13.38	13.42	14.39	13.25	11.30	13.17	13.64	13.33	12.16	14.36	14.30	
Fe2O3(T)	18.47	6.97	4.92	4.82	4.78	5.27	7.13	8.73	4.48	4.58	4.82	6.33	4.52	4.88	
MnO	0.22	0.04	0.03	0.05	0.07	0.12	0.15	0.12	0.22	0.08	0.19	0.02	0.02	0.05	
MgO	0.09	0.07	0.05	0.04	0.03	0.04	0.04	0.04	0.03	0.02	0.01	0.02	0.02	< 0.01	
CaO	3.83	2.90	1.33	1.40	1.57	1.68	1.45	2.21	1.76	1.93	1.66	2.00	1.23	1.67	
Na2O	6.02	3.13	4.65	4.59	4.18	4.09	3.58	2.58	3.54	4.52	4.35	3.09	4.64	4.89	
K2O	1.12	3.85	4.27	4.18	4.90	5.60	5.61	4.91	5.27	5.33	5.12	5.75	5.63	5.45	
TiO2	0.19	0.18	0.20	0.21	0.19	0.21	0.24	0.34	0.17	0.17	0.17	0.17	0.15	0.15	
P2O5	< 0.01	0.01	< 0.01	0.02	0.01	< 0.01	< 0.01	0.02	0.01	< 0.01	0.01	0.02	0.01	< 0.01	
LOI	5.98	3.19	1.92	1.91	1.80	2.13	2.04	2.43	2.45	1.90	1.86	2.53	1.66	1.51	
Total	97.41	97.54	98.96	98.72	98.26	99.02	99.41	100.30	99.53	97.93	98.53	99.57	100.30	100.80	
(ppm)															
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Be	248	51	30	34	20	21	17	14	29	21	17	12	17	43	
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5	
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Ni	< 20	< 20	60	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
Cu	10	< 10	160	< 10	< 10	20	10	10	20	< 10	< 10	20	10	10	
Ga	61	51	55	52	56	60	54	49	51	53	52	48	54	49	
Ge	6	5	4	4	4	4	4	5	3	3	3	3	3	3	
As	85	33	23	17	6	7	6	7	18	10	18	29	13	< 5	
Rb	59	249	255	248	301	333	322	287	278	290	268	283	304	280	
Sr	116	47	36	35	43	56	52	55	46	41	37	31	27	38	
Y	420	322	317	302	307	478	389	409	318	299	231	277	209	249	
Zr	1637	1918	1896	1452	2806	3157	4007	3210	1527	1850	1288	1542	1423	1424	
Nb	460	438	372	354	451	628	562	614	342	335	287	315	297	254	
Mo	14	3	< 2	< 2	< 2	2	3	3	4	< 2	< 2	< 2	< 2	< 2	
Ag															
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Sn	36	59	40	35	37	40	45	51	41	25	19	26	18	19	
Sb	2	1	1.2	1	0.9	0.8	0.9	1.2	0.7	0.9	0.8	0.8	0.9	< 0.5	
Cs	1.8	2.6	1.5	1.5	1	1	1.1	1	0.8	0.6	< 0.5	0.5	0.7	0.6	
Ba	45	31	36	36	43	50	48	42	78	43	51	113	46	33	
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.5	0.4	0.5	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	
La	496	303	386	319	343	557	422	498	387	343	368	269	255	211	
Ce	858	526	625	539	588	1070	787	808	674	556	628	387	400	381	
Pr	105	62	78	65.1	71.3	118	86.5	98.3	80.5	68.9	66.6	46.8	49.9	47.3	
Nd	407	229	284	242	256	439	323	352	297	256	234	161	175	173	
Sm	81.4	46.9	54.9	47.6	51.1	90.4	65	68.8	59.8	50.2	42.1	28	32.4	37.1	
Eu	5.59	2.92	3.32	2.85	3.26	5.6	4.07	4.42	3.73	3.59	2.42	1.64	1.91	2.36	
Gd	76.1	45.3	51.2	44.5	49.3	83.9	61	62.9	55.5	47.3	36.9	25.7	27.6	36	
Tb	12.5	8.2	8.9	7.8	8.8	14.8	10.9	11.2	9.6	8.2	6.2	5.3	5	6.7	
Dy	70.5	50.8	52.9	47	52.9	82.9	65.1	67.5	54.8	48.6	36.7	38.3	32.3	39.2	
Ho	13.1	10.3	10.3	9.5	10.1	15.5	12.8	13.1	10.1	9.6	7.3	8.8	6.9	7.8	
Er	34.9	29.5	28.5	27.4	30.5	42.8	37.4	37.2	28.3	27.5	21.9	27.2	21.3	22.9	
Tm	4.8	4.29	4.18	3.93	4.86	6.56	6.05	5.49	4.19	4.03	3.24	4	3.33	3.53	
Yb	27.2	26.2	25.9	24.2	31	43.3	40	35.4	23.4	24.8	20.6	23.5	22.2	22.1	
Lu	3.69	3.68	3.73	3.48	4.45	5.85	5.65	5.14	3.16	3.46	2.91	3.35	3.16	3.15	
Hf	41.8	49.1	46.8	35	69.6	76.3	97.8	78	36.9	45.3	31.4	37.2	34.6	32.2	
Ta	22.3	27.7	23.6	22.9	31.5	49.2	39.5	40	20.9	21.6	18.6	18	19.3	15.8	
W	22	11	10	11	4	4	3	4	3	3	4	4	3	14	
Tl	0.3	0.4	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.4	0.4	0.6	0.5	0.4	
Pb	27	8	26	16	17	26	31	30	19	10	10	38	13	31	
Th	57.2	40.9	47.7	43.5	61.5	110	65.8	68.3	48.5	43.4	42.2	42.8	42.6	39.4	
U	17.9	14.5	13	10.8	19	31.5	28.5	24.2	15.7	13.9	10.8	10.8	14.3	13	
Zn	390	180	210	120	130	130	180	160	170	190	240	130	160	170	

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology	Syenite													
Sample No.	11726	11727	11728	11729	11730	11731	11732	11733	11734	11735	11736	11737	11738	11739
from	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0	31.0	32.0	33.0	34.0	35.0
to	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0	31.0	32.0	33.0	34.0	35.0	36.0
(wt%)														
SiO ₂	67.34	67.67	66.79	65.28	68.30	65.74	66.69	65.97	66.63	67.72	66.24	66.78	67.15	65.77
Al ₂ O ₃	14.17	13.34	13.69	12.41	14.19	13.01	12.70	13.22	13.66	13.85	13.42	13.65	14.03	13.66
Fe ₂ O ₃ (T)	5.39	5.83	5.39	6.69	5.09	5.73	6.86	6.26	5.76	5.39	6.03	6.00	6.22	6.82
MnO	0.04	0.09	0.03	0.09	0.05	0.07	0.12	0.09	0.16	0.04	0.11	0.06	0.11	0.13
MgO	0.02	0.01	< 0.01	0.01	< 0.01	0.01	< 0.01	0.01	0.01	0.01	< 0.01	0.01	0.02	0.03
CaO	1.57	1.38	1.36	1.64	1.08	1.25	1.19	1.42	1.16	1.33	1.67	1.20	0.91	1.28
Na ₂ O	4.42	4.03	4.87	4.14	4.94	4.89	4.56	5.02	5.49	5.35	4.87	5.39	5.54	4.93
K ₂ O	5.86	5.60	5.41	5.48	5.70	5.26	5.60	5.51	5.40	5.34	5.16	5.18	5.35	5.49
TiO ₂	0.15	0.17	0.20	0.19	0.16	0.18	0.19	0.18	0.20	0.20	0.18	0.18	0.19	0.22
P ₂ O ₅	< 0.01	0.02	< 0.01	< 0.01	0.01	0.02	0.01	< 0.01	< 0.01	0.01	0.01	< 0.01	0.01	0.01
LOI	1.85	1.58	1.36	1.80	1.16	1.39	1.33	1.35	1.25	1.32	1.54	1.25	1.27	1.87
Total	100.80	99.70	99.13	97.75	100.70	97.55	99.25	99.04	99.72	100.60	99.25	99.70	100.80	100.20
(ppm)														
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	33	135	186	385	91	19	29	22	17	17	20	17	16	19
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	10
Ga	54	54	60	51	55	52	49	49	54	52	53	52	52	57
Ge	3	3	4	3	4	4	4	4	4	4	3	4	4	3
As	6	7	10	11	9	6	8	7	8	7	6	7	7	11
Rb	323	331	294	299	307	291	301	295	290	279	276	283	295	307
Sr	41	41	53	48	36	47	53	61	57	39	33	37	34	47
Y	304	313	413	308	288	274	316	283	266	284	293	275	254	417
Zr	1128	1732	5239	1376	1493	2287	1657	2036	1828	1436	2109	1548	1330	1306
Nb	289	453	608	437	391	381	401	346	369	296	285	272	240	479
Mo	< 2	< 2	< 2	4	2	< 2	< 2	3	5	5	4	5	6	5
Ag														
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	27	28	34	27	29	33	31	30	24	19	25	20	21	25
Sb	< 0.5	0.9	0.8	0.8	0.5	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	0.7	0.6	< 0.5	0.5	< 0.5	< 0.5	0.5	0.6	0.7	0.6	0.5	0.7	0.6	< 0.5
Ba	33	37	42	35	31	31	31	34	37	32	32	29	34	37
Bi	< 0.4	< 0.4	< 0.4	0.4	< 0.4	< 0.4	< 0.4	0.5	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.4
La	260	282	389	309	417	340	389	341	362	346	337	344	316	340
Ce	442	478	681	533	683	571	643	566	594	570	566	561	518	579
Pr	54.2	57.5	81	62.9	81.9	68	78.1	67.8	69.5	68.2	66.4	66.4	60.7	68.3
Nd	201	210	293	228	294	251	284	246	254	243	236	241	217	242
Sm	44.6	44.4	58.5	47.2	55.5	49.1	54.3	47.3	47.2	45.1	44.8	46	41.2	50
Eu	2.84	2.88	3.72	3.06	3.45	3.09	3.61	3.07	2.99	2.92	2.89	2.92	2.61	3.26
Gd	46.1	44.8	56	45	50.3	44.3	52.3	45	43.4	42.7	42.4	44.8	40.9	52.2
Tb	8.6	8.3	10.5	8.5	8.4	7.7	9.3	7.8	7.3	7.3	7.2	7.4	6.9	10.7
Dy	50.8	51.1	64.7	51.8	47.7	45.1	53.8	45.8	43.8	44.5	44.2	42.9	40.8	68.1
Ho	9.4	10.4	13.6	10.5	9.1	8.7	10.3	8.9	8.6	8.7	9	8.5	8.1	13.8
Er	25	31.7	43.4	31.2	24.9	24.7	28.7	26	25.5	26.4	27.8	24.3	22.8	40.1
Tm	3.35	5	7.25	4.84	3.52	3.57	4.17	3.77	3.97	4.05	4.31	3.6	3.33	6.02
Yb	19.2	33.1	48.8	30.4	21.5	22.1	26.2	23.5	26.1	25.7	27.5	23	21	36.7
Lu	2.59	4.69	7.15	4.31	2.93	3.17	3.83	3.35	3.79	3.83	4.03	3.35	3.11	5.12
Hf	27.2	40	132	33.4	35.9	58.3	40.9	49.7	43.9	33.3	49.2	35.8	31.3	29.7
Ta	16.7	27.4	43.3	29	26.7	24.5	27.5	22.4	24	19.3	18.5	17.7	16.1	26.6
W	2	2	2	2	2	1	1	< 1	1	< 1	< 1	< 1	< 1	1
Tl	0.5	0.4	0.5	0.5	0.4	0.4	0.5	0.4	0.4	0.5	0.4	0.5	0.5	0.4
Pb	24	29	56	49	43	51	67	59	56	51	28	42	45	94
Th	43.4	59.8	77.6	58.9	51	46.6	51	45.6	36.1	43.5	47.2	38.8	35.1	67.6
U	11.8	15.4	23.5	17.5	15.3	12.7	15.3	13.4	12.8	10.5	10.6	10.5	9.1	14.9
Zn	330	250	280	350	240	360	410	320	300	300	320	320	390	520

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Syenite													
Sample No.	11740	11741	11742	11743	11744	11745	11746	11747	11748	11749	11750	11751	11752	11753	
from	36.0	37.0	38.0	39.0	40.0	41.0	42.0	43.0	44.0	45.0	46.0	47.0	48.0	49.0	
to	37.0	38.0	39.0	40.0	41.0	42.0	43.0	44.0	45.0	46.0	47.0	48.0	49.0	50.0	
(wt%)															
SiO2	65.71	67.26	66.41	67.11	68.53	65.76	67.18	67.23	65.64	66.02	65.12	66.09	65.48	66.99	
Al2O3	12.63	13.24	13.90	13.59	14.03	12.90	13.62	13.40	13.60	13.26	13.23	13.13	13.41	14.13	
Fe2O3(T)	7.08	5.46	5.21	5.33	4.36	6.10	5.33	5.00	5.57	4.99	5.65	5.65	4.74	5.10	
MnO	0.10	0.13	0.18	0.04	0.30	0.23	0.06	0.09	0.13	0.11	0.13	0.14	0.11	0.14	
MgO	0.02	0.01	0.03	0.04	0.02	0.01	0.02	0.01	0.02	0.02	0.01	0.02	0.02	0.02	
CaO	1.48	1.41	1.65	1.08	1.19	1.39	1.22	1.18	1.29	1.30	1.95	1.96	1.43	1.62	
Na2O	4.90	4.62	4.59	4.35	4.77	4.57	4.89	4.64	5.14	5.34	4.93	4.75	4.77	5.23	
K2O	4.30	4.99	5.14	4.93	5.07	4.89	4.98	5.32	5.15	4.98	5.01	5.03	5.23	5.28	
TiO2	0.29	0.18	0.19	0.18	0.18	0.17	0.20	0.18	0.23	0.18	0.20	0.20	0.23	0.21	
P2O5	0.03	0.01	< 0.01	< 0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.01	< 0.01	0.01	< 0.01	
LOI	1.53	1.47	1.98	1.79	1.41	1.52	1.33	1.44	1.40	1.29	1.63	1.95	1.86	1.71	
Total	98.07	98.79	99.28	98.43	99.88	97.57	98.85	98.51	98.18	97.50	97.86	98.94	97.29	100.40	
(ppm)															
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Be	20	34	28	31	23	24	20	17	19	17	19	20	47	50	
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	23	< 1	
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
Cu	< 10	< 10	< 10	10	< 10	< 10	< 10	< 10	10	10	< 10	< 10	20	10	
Ga	57	51	53	51	51	47	51	51	55	53	51	54	59	51	
Ge	4	3	3	4	3	4	4	3	4	4	4	4	4	4	
As	11	8	< 5	< 5	< 5	7	< 5	< 5	< 5	< 5	< 5	< 5	7	8	
Rb	227	239	239	226	238	225	248	285	282	273	276	286	303	277	
Sr	49	24	34	30	39	36	34	39	60	43	63	72	58	63	
Y	439	277	236	221	248	277	263	294	377	311	262	311	487	349	
Zr	2520	1833	1106	1225	1266	1564	1472	1838	2213	1498	1639	2157	3662	1824	
Nb	484	275	285	257	252	253	267	375	455	347	318	441	661	459	
Mo	5	5	5	4	3	8	7	4	5	6	6	3	3	< 2	
Ag															
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Sn	22	20	16	17	17	17	18	25	36	28	33	40	42	36	
Sb	0.7	0.8	0.5	0.6	0.6	0.7	< 0.5	< 0.5	0.5	< 0.5	< 0.5	0.7	< 0.5	< 0.5	
Cs	< 0.5	0.5	< 0.5	0.8	0.6	0.9	0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5	0.5	< 0.5	
Ba	47	40	37	58	46	43	35	38	47	35	34	32	38	32	
Bi	0.5	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.6	0.5	0.7	0.6	0.5	0.9	1	0.8	
La	536	333	317	306	306	289	354	385	388	390	354	401	453	371	
Ce	841	539	501	463	483	469	563	615	640	631	564	650	749	640	
Pr	99.6	62.3	57.4	55.2	55	54	64	71	74.9	72	63.3	72.6	85.7	70.9	
Nd	348	217	198	190	188	185	224	246	259	250	220	242	293	240	
Sm	63.7	40.9	36.4	35	35.4	36.3	41.6	46	51.3	46	41.1	44.2	60.6	45.4	
Eu	4.06	2.66	2.5	2.4	2.36	2.63	2.61	2.72	3.43	2.96	2.54	2.85	4.08	2.94	
Gd	61.8	40.1	36	33.4	33.9	35.4	39	43.9	53.5	45.1	39.8	43.6	64.7	44.7	
Tb	11.1	7.2	6.5	5.9	6.3	6.8	7	8.1	9.9	8.3	7.1	8	13	9.2	
Dy	68.8	44	39.7	36	39.7	43.6	42.8	47.6	62.4	50.9	42.6	49.6	79.5	56.8	
Ho	14.7	9	7.8	7.3	8.2	9.3	8.4	9.6	12.6	10.3	8.6	10.2	15.8	11.8	
Er	46.2	27.4	23	22	24.6	28.1	25.1	28.3	37.9	30.5	25.8	29.9	47.4	34.8	
Tm	7.15	4.14	3.47	3.39	3.78	4.48	3.77	4.31	5.86	4.54	3.99	4.72	7.51	5.23	
Yb	46.7	25.6	22.5	20.8	23.7	28.3	24.1	28	36	27.8	25.3	29.7	50.3	32.7	
Lu	6.79	3.68	3.32	3.12	3.4	4.13	3.49	3.97	5.17	4.03	3.66	4.3	7.15	4.68	
Hf	58.9	43.7	27	31.1	31	38.3	35.7	45.4	53.1	36.2	38.6	53	89.1	42.9	
Ta	34.4	16.7	16.9	17	16.3	15.9	19.5	24.7	29.7	23.5	20.9	30.6	42.5	28.8	
W	3	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	241	7	
Tl	0.3	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.3	
Pb	53	22	30	60	59	34	51	51	78	48	45	64	85	64	
Th	50.8	48.8	39.2	39.2	40.9	52.7	39.4	45.8	55.6	51	43.5	61.1	88.1	56.4	
U	16.4	10.9	12.2	14.6	11.8	11	12.1	12.9	12.8	9.6	8.8	15.1	23.2	13.4	
Zn	280	250	310	280	290	200	220	310	470	380	330	370	370	320	

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Syenite													
Sample No.	11755	11756	11757	11758	11759	11760	11761	11762	11763	11764	11765	11766	11767	11768	
from	65.0	66.0	67.0	68.0	69.0	70.0	71.0	72.0	73.0	74.0	75.0	76.0	77.0	78.0	
to	66.0	67.0	68.0	69.0	70.0	71.0	72.0	73.0	74.0	75.0	76.0	77.0	78.0	79.0	
(wt%)															
SiO2	63.62	67.06	66.42	67.46	64.65	66.28	66.81	64.47	69.90	65.23	66.32	66.53	66.20	65.36	
Al2O3	12.13	13.36	13.82	14.09	13.83	13.57	13.79	13.43	10.60	13.45	13.71	13.96	13.89	13.63	
Fe2O3(T)	8.64	5.00	5.45	5.43	5.20	5.67	6.12	5.76	5.57	5.65	6.05	5.19	5.49	5.68	
MnO	0.21	0.17	0.16	0.13	0.13	0.17	0.16	0.15	0.14	0.14	0.15	0.13	0.16	0.14	
MgO	0.03	0.03	0.03	0.02	0.02	0.03	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.03	
CaO	2.67	2.11	1.74	1.11	1.51	1.42	1.25	2.06	0.34	1.04	0.86	0.75	0.96	1.42	
Na2O	4.24	4.70	4.82	5.21	5.73	5.54	5.91	5.28	3.92	6.17	6.18	6.00	6.09	5.79	
K2O	4.51	4.91	4.95	5.09	5.06	5.07	5.17	5.18	5.13	5.19	5.07	5.15	5.10	5.15	
TiO2	0.21	0.21	0.20	0.24	0.21	0.22	0.25	0.28	0.19	0.22	0.26	0.23	0.26	0.23	
P2O5	0.01	0.02	< 0.01	0.03	0.01	0.02	0.02	0.01	< 0.01	0.02	0.01	< 0.01	0.02	0.01	
LOI	2.93	2.86	2.17	1.65	1.54	1.53	1.09	1.37	1.71	0.70	0.66	0.88	1.05	1.28	
Total	99.20	100.40	99.75	100.40	97.88	99.50	100.60	98.03	97.52	97.84	99.29	98.85	99.23	98.72	
(ppm)															
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Be	34	30	25	24	20	21	24	21	27	22	22	20	28	24	
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
Co	< 1	19	< 1	< 1	21	30	< 1	< 1	38	< 1	< 1	25	32	27	
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
Cu	< 10	< 10	< 10	< 10	30	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	
Ga	43	48	49	48	51	50	51	51	60	51	50	49	52	51	
Ge	4	3	3	3	4	4	4	4	4	4	4	4	4	4	
As	5	< 5	< 5	< 5	< 5	< 5	< 5	6	6	< 5	< 5	< 5	< 5	< 5	
Rb	222	245	239	232	250	244	262	282	434	268	257	255	251	270	
Sr	92	56	45	33	69	36	33	80	34	36	24	22	35	52	
Y	186	218	206	210	235	243	276	354	314	253	250	230	251	186	
Zr	2037	2033	1308	1862	1603	1735	2011	2532	1449	1640	1667	1781	2822	1840	
Nb	319	339	343	266	310	332	364	421	401	390	351	346	371	409	
Mo	< 2	< 2	< 2	4	4	2	2	3	< 2	< 2	3	< 2	< 2	3	
Ag															
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Sn	28	24	23	18	21	28	35	34	28	39	29	24	31	36	
Sb	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	
Cs	1.6	0.8	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.5	0.9	0.8	0.7	0.5	< 0.5	0.7	
Ba	43	35	33	43	41	43	44	45	25	58	42	35	44	41	
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.5	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	
La	195	292	252	358	483	516	418	354	719	365	439	355	486	370	
Ce	328	480	412	572	728	791	657	605	1220	602	693	580	802	580	
Pr	36	53.4	45.8	65.2	83.3	89.3	73.2	69.4	135	69	79.4	65.7	92.6	65.1	
Nd	119	184	155	223	280	301	237	232	501	237	275	225	316	217	
Sm	23.6	34	28.9	37.9	47.7	50.2	42.9	48.1	87	43.7	47.2	41	53.1	37.3	
Eu	1.64	2.18	1.98	2.36	3.02	3.15	2.71	3.03	4.86	2.75	3	2.66	3.27	2.39	
Gd	23.5	32.6	28.6	35.2	44.7	46.2	40.6	47.4	77.4	41	43.4	39.4	48.8	34	
Tb	4.8	6.1	5.5	5.9	7.1	7.2	7.2	9.5	10.5	7.3	7.2	6.8	7.7	5.5	
Dy	30.5	37.4	34.2	34.7	40.7	41.4	45	59.5	57.2	43.6	43	40.1	44	31.3	
Ho	6.5	7.7	7.1	6.9	7.7	8.1	9.1	12.1	10.2	8.7	8.2	8	8.5	6.3	
Er	19.7	24.1	21.1	21	22.8	24	28.5	36.3	28.4	25.2	24.6	23.7	24.8	18.7	
Tm	3.18	3.85	3.36	3.36	3.46	3.56	4.51	5.85	4.01	3.74	3.69	3.72	3.75	2.79	
Yb	21.1	26.1	21	21.7	22.2	22.2	27.7	38.9	24.7	22.1	23.5	24	24.3	17.6	
Lu	3.17	3.74	3.17	3.31	3.35	3.23	3.96	5.64	3.53	3.27	3.37	3.54	3.52	2.67	
Hf	51.4	50.9	31.7	38.2	38.8	42.8	49.1	57.7	34.5	41.3	40.1	39.3	65.9	45.8	
Ta	21.4	23.8	21.2	19.5	22.1	22.7	23.7	31.7	33.7	28.2	23.8	26	25.8	27.5	
W	3	232	3	2	219	298	5	2	373	6	2	248	324	283	
Tl	0.3	0.4	0.4	0.3	0.4	0.3	0.4	0.4	0.6	0.4	0.4	0.4	0.4	0.4	
Pb	35	27	30	38	49	37	56	64	33	51	54	48	60	43	
Th	32	35.8	32	32.2	36.3	41.3	50	48.4	53.2	41	43.9	38.6	40.7	33.9	
U	10.2	13.5	11.2	8.7	9.5	10.3	13.3	17.7	13.3	12.8	13.2	14.2	15.8	12.3	
Zn	340	290	310	350	390	440	500	560	700	430	420	370	440	390	

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Syenite													
Sample No.	11769	11770	11771	11772	11773	11774	11775	11776	11777	11778	11779	11780	11781	11782	
from	79.0	80.0	81.0	82.0	82.8	84.0	85.0	86.0	87.0	88.0	89.0	89.4	90.0	91.0	
to	80.0	81.0	82.0	82.8	84.0	85.0	86.0	87.0	88.0	89.0	89.4	90.0	91.0	92.0	
(wt%)															
SiO2	66.21	64.68	65.27	62.98	60.29	57.81	57.76	51.51	53.95	58.40	60.93	66.51	65.63	66.50	
Al2O3	13.74	13.27	13.77	13.31	13.47	13.41	13.91	14.17	14.59	14.86	11.84	14.13	13.49	13.52	
Fe2O3(T)	4.67	4.22	2.48	4.06	7.00	5.95	3.59	4.05	9.87	5.23	4.94	4.12	5.27	5.14	
MnO	0.16	0.16	0.11	0.09	0.08	0.14	0.17	0.20	0.22	0.18	0.19	0.11	0.12	0.14	
MgO	0.02	0.02	0.02	0.04	0.08	0.07	0.05	0.05	0.11	0.06	0.03	0.02	0.02	0.02	
CaO	1.88	2.53	3.15	5.13	5.32	7.05	6.74	10.26	5.73	5.02	6.57	1.69	2.43	2.35	
Na2O	5.30	4.70	4.40	4.26	3.70	3.29	4.25	4.03	3.13	4.73	3.53	4.87	4.41	4.48	
K2O	5.01	4.87	5.69	5.19	4.57	5.66	5.36	5.84	5.90	5.09	4.42	5.07	4.84	4.83	
TiO2	0.22	0.28	0.23	0.35	0.30	0.19	0.30	0.41	0.35	0.18	0.21	0.17	0.20	0.28	
P2O5	< 0.01	0.02	0.02	0.04	0.04	0.02	0.04	0.06	0.03	0.02	0.03	0.01	0.02	0.05	
LOI	1.96	2.77	2.88	2.98	2.94	4.92	5.54	5.80	5.66	4.62	4.41	1.77	2.45	2.72	
Total	99.20	97.52	98.03	98.44	97.81	98.50	97.72	96.39	99.53	98.38	97.11	98.47	98.88	100.00	
(ppm)															
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Be	33	22	32	209	49	17	49	33	17	26	30	25	22	34	
V	< 5	< 5	< 5	< 5	10	< 5	< 5	7	< 5	< 5	6	< 5	< 5	< 5	
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
Co	24	23	20	< 1	< 1	< 1	12	4	6	7	13	< 1	17	17	
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
Cu	< 10	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	
Ga	52	51	52	61	56	51	58	61	67	67	48	51	49	51	
Ge	4	3	3	3	5	4	3	4	5	3	3	3	3	3	
As	< 5	< 5	< 5	5	< 5	< 5	< 5	6	5	< 5	8	< 5	< 5	< 5	
Rb	261	259	310	277	234	284	292	299	298	252	229	252	227	221	
Sr	48	52	42	79	90	83	111	178	130	163	154	52	74	90	
Y	259	246	259	743	657	294	494	738	518	391	380	231	237	317	
Zr	2644	2260	945	3153	3728	2649	2974	8651	6355	4490	8525	1671	1750	2294	
Nb	452	494	346	837	830	415	702	780	614	708	574	380	448	393	
Mo	< 2	< 2	4	< 2	3	< 2	< 2	< 2	7	< 2	< 2	3	< 2	< 2	
Ag			7.6												
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Sn	54	49	41	53	125	22	29	67	188	40	44	26	25	22	
Sb	< 0.5	0.6	< 0.5	0.7	1.5	0.8	1	1.2	1.2	0.9	0.9	0.5	0.6	0.5	
Cs	0.7	0.7	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	
Ba	41	35	31	43	46	49	40	55	52	58	64	38	37	43	
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	
La	453	520	351	531	423	330	344	603	474	349	380	228	316	706	
Ce	737	814	588	976	735	557	607	1140	822	626	684	404	540	1290	
Pr	84.7	89.4	69	108	88.8	63.7	71.3	126	98.5	73.3	83.4	46.4	61.2	130	
Nd	286	306	239	376	302	220	253	444	345	251	297	156	202	412	
Sm	51.4	50.9	46	80.3	59.8	40.6	51.3	85.2	67.6	48.6	58.3	31.2	36.7	62.3	
Eu	3.25	2.98	2.82	5.45	3.97	2.7	3.52	5.69	4.85	3.17	3.92	2.11	2.42	3.73	
Gd	48.8	47.3	42.2	86.5	62.5	40	52.4	88.9	68.2	49.3	55.1	30.8	34	55.4	
Tb	8.5	7.6	7.3	17.4	13.3	7.1	10.9	17.7	12.9	9.5	9.8	6.2	6.5	9.3	
Dy	47.6	42.9	42.9	114	94.9	47.3	79.1	121	84.4	61.6	59.2	39.1	40.6	55.4	
Ho	9	8.1	8.5	24.3	21.6	10.1	17.6	26.3	18	13.5	12.4	7.8	8.4	11.1	
Er	24.3	23.3	24.5	74	66	31	52.9	80.7	57.1	41.6	41.3	22.4	25.4	34.2	
Tm	3.32	3.39	3.53	11.2	9.84	4.7	7.72	12.5	9.51	6.55	7.11	3.2	3.74	5.04	
Yb	19.4	20.6	20.4	69.6	58.8	28.7	44.7	76.3	62.8	42.2	49.2	19	23.4	33	
Lu	2.73	3.02	2.72	9.68	8.17	3.99	6	10.6	9.03	6.11	7.32	2.66	3.3	4.65	
Hf	64.3	57	22.8	71.5	83.8	62.6	73.2	212	152	113	203	38.5	40.8	52.5	
Ta	35.6	37	21.6	56.3	52.3	30.9	48.3	56.2	41.2	58.1	42.7	25.4	34.4	24.4	
W	263	263	216	6	4	2	227	51	66	72	170	3	187	184	
Tl	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.5	0.4	0.4	0.2	0.2	0.2	0.2	
Pb	73	40	13	12	12	8	10	18	15	19	26	17	20	14	
Th	34	31.1	46.1	144	58.2	40.4	51.1	99.9	97.1	46.9	52.9	39.8	43.1	63.5	
U	13.7	14.5	11.8	32.5	29.8	24.2	24.4	40.5	33.1	20.4	20.2	11.2	16.1	13.6	
Zn	440	270	200	170	220	210	250	210	300	230	150	210	200	200	

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Syenite											
Sample No.	11783	11784	11785	11786	11787	11788	11789	11790	11791	11792	11793	11795	11796
from	92.0	92.6	93.0	94.0	95.0	96.0	97.2	98.0	99.0	100.0	101.0	102.0	103.0
to	92.6	93.0	94.0	95.0	96.0	97.2	98.0	99.0	100.0	101.0	102.0	103.0	104.0
(wt%)													
SiO ₂	65.35	55.04	60.60	49.10	52.37	49.74	65.88	65.45	64.75	65.45	64.65	64.51	62.15
Al ₂ O ₃	12.66	13.03	13.55	14.14	13.02	11.79	13.22	13.54	13.14	13.34	12.82	13.30	14.01
Fe ₂ O ₃ (T)	7.41	8.27	5.25	4.63	4.40	5.94	5.05	5.39	5.90	5.64	5.81	4.92	4.76
MnO	0.09	0.09	0.10	0.32	0.26	0.22	0.14	0.15	0.16	0.16	0.15	0.14	0.15
MgO	0.04	0.09	0.05	0.06	0.05	0.08	0.03	0.02	0.02	0.02	0.02	0.02	0.04
CaO	3.85	9.59	6.10	14.31	12.23	15.03	1.80	1.43	1.76	1.67	3.43	2.13	2.32
Na ₂ O	3.90	2.85	3.89	4.06	3.75	2.76	4.67	5.42	5.41	5.29	4.80	4.69	4.77
K ₂ O	4.35	5.05	5.17	5.42	5.22	5.64	4.67	4.76	4.82	4.87	4.36	4.81	5.09
TiO ₂	0.28	0.22	0.27	0.21	0.20	0.19	0.26	0.24	0.29	0.25	0.27	0.23	0.25
P ₂ O ₅	0.02	0.03	0.03	0.02	0.03	0.04	0.02	0.03	0.03	0.02	0.02	0.03	0.02
LOI	2.54	3.35	3.19	6.50	5.87	5.92	2.89	1.81	1.31	1.52	2.77	2.63	3.60
Total	100.50	97.61	98.19	98.76	97.41	97.36	98.63	98.26	97.61	98.22	99.09	97.40	97.15
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	18	22	16	17	13	43	22	19	17	16	21	16	19
V	< 5	7	6	7	6	6	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	18	7	8	3	7	10	20	22	< 1	< 1	< 1	< 1	18
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	20	40	10	30	20	10	10	< 10	< 10
Ga	46	48	50	55	50	47	48	50	50	51	51	53	59
Ge	3	3	3	3	3	3	3	4	4	4	4	3	3
As	< 5	< 5	< 5	< 5	< 5	15	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	193	229	248	262	243	249	220	223	235	250	230	255	271
Sr	101	117	96	355	184	155	42	54	77	89	93	64	32
Y	270	270	259	547	266	452	345	344	313	290	234	274	412
Zr	1887	2173	1925	2073	1784	1685	1470	1958	1530	2118	1935	2334	3482
Nb	379	408	451	422	449	347	341	330	330	348	379	374	460
Mo	< 2	< 2	< 2	3	< 2	3	6	4	12	8	3	< 2	3
Ag													
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	31	42	45	41	27	38	23	23	24	26	23	19	29
Sb	0.7	0.6	0.6	< 0.5	0.5	0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	< 0.5	< 0.5	< 0.5	0.6	< 0.5	0.7	< 0.5	< 0.5	0.9	1.2	1.2	0.6	< 0.5
Ba	46	66	57	73	64	70	42	49	70	78	75	48	55
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.5	< 0.4	< 0.4	1.4	< 0.4	< 0.4
La	505	256	336	420	341	341	402	499	443	509	477	472	632
Ce	889	428	570	767	578	578	649	774	690	785	759	750	1090
Pr	91.4	48.4	63.5	77.4	64.6	66.6	72.1	85.7	76.2	86.9	87.1	87.5	116
Nd	305	163	211	265	218	230	238	284	251	292	302	306	394
Sm	50.8	30.4	38.5	52.7	39.9	43.6	41.7	47.1	41.8	47.7	51.5	54.5	72.8
Eu	3.44	2.1	2.35	3.27	2.55	3.04	2.87	3.24	2.83	3.29	3.27	3.48	4.84
Gd	44.2	31.1	35.6	56.6	37.7	46.8	41	44.6	38.6	42.5	45.9	48.1	67.2
Tb	7.5	6.4	7	11.4	7.2	10.5	8.4	8.8	7.5	7.8	7.5	8	12.2
Dy	45.9	42.1	45.1	83.4	45.8	71	54.7	57.3	50	48.1	41.5	46.5	73.6
Ho	9.1	8.5	8.9	18.5	9.3	14.8	11.5	12	10.6	9.8	7.6	8.8	14.4
Er	26.8	25.1	25.5	47.5	27	42.6	35	36.6	32.6	29.4	20.7	26.1	42.1
Tm	4.02	3.79	3.64	6.56	3.99	5.85	5.24	5.65	4.89	4.4	2.88	3.9	6.13
Yb	26.1	23	22	33.9	24.6	34.3	31.8	34.3	29.4	27.3	18.9	25.4	37.6
Lu	3.77	3.26	3.21	4.14	3.34	4.44	4.38	4.67	4.07	3.79	2.85	3.53	5.2
Hf	44.1	51.5	46.9	41.7	41.6	39.4	33	44.2	36	50.4	44	51.3	81.9
Ta	24.8	28.5	29.2	31.5	32.7	23.3	21	18.9	20.9	22.1	22.4	26.1	29.6
W	224	97	101	36	75	117	216	221	4	2	2	1	196
Tl	0.2	0.2	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3
Pb	11	13	29	16	12	14	22	48	41	55	97	32	15
Th	47.8	39.2	48.1	57.5	34.9	54.9	78.2	70.2	49.2	57.3	28.7	26.4	66.8
U	15.4	15.6	14.8	16.6	15.3	14.1	13.6	13	12.9	13.2	11.6	13.5	19.3
Zn	180	360	250	160	270	270	300	430	380	390	380	280	240

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Syenite											
Sample No.	11797	11798	11799	11800	11801	11802	11803	11804	11805	11806	11807	11808	11809
from	104.0	105.0	106.0	107.0	108.0	109.0	110.0	111.0	112.0	113.0	114.0	115.0	116.0
to	105.0	106.0	107.0	108.0	109.0	110.0	111.0	112.0	113.0	114.0	115.0	116.0	117.0
(wt%)													
SiO ₂	65.44	64.34	65.02	64.94	63.93	65.97	65.16	64.20	64.78	62.78	63.86	62.38	64.33
Al ₂ O ₃	13.31	13.32	13.38	13.56	13.12	13.22	13.54	13.26	13.14	12.03	12.88	12.59	12.93
Fe ₂ O ₃ (T)	6.42	6.18	6.03	5.50	6.23	5.89	5.09	6.33	5.31	6.71	6.77	7.13	6.35
MnO	0.16	0.15	0.17	0.17	0.18	0.17	0.14	0.19	0.15	0.20	0.20	0.21	0.18
MgO	0.02	0.02	0.03	0.02	0.03	0.01	0.03	0.03	0.05	0.03	0.03	0.04	0.05
CaO	1.25	1.77	1.95	1.78	2.07	1.60	2.64	2.21	2.50	3.15	2.46	3.13	2.99
Na ₂ O	5.12	5.14	5.27	5.01	5.01	5.45	4.82	5.09	4.40	4.35	4.82	4.40	4.33
K ₂ O	4.81	4.70	4.99	4.65	4.77	4.75	4.93	4.56	4.63	4.11	4.54	4.41	4.54
TiO ₂	0.25	0.24	0.28	0.22	0.24	0.25	0.21	0.30	0.21	0.27	0.26	0.34	0.28
P ₂ O ₅	0.04	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.03	0.03	0.04	0.03	0.01
LOI	1.57	1.68	1.67	2.33	1.93	1.18	2.75	2.58	3.37	3.68	2.48	3.01	3.59
Total	98.41	97.59	98.80	98.22	97.52	98.53	99.33	98.78	98.57	97.34	98.34	97.67	99.57
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	16	16	15	15	15	14	13	16	16	21	17	22	20
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	23	18	21	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	10	50	10	< 10	< 10	< 10	10	< 10	10
Ga	52	51	48	50	49	50	50	49	52	50	48	50	47
Ge	4	4	4	4	4	4	3	4	4	4	4	4	3
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	245	238	248	240	248	248	252	218	239	213	226	199	197
Sr	39	65	69	67	79	76	87	96	83	130	90	89	80
Y	259	254	233	205	223	189	180	235	299	428	327	317	356
Zr	2232	1749	2279	1264	2588	2213	1870	1602	2074	2481	2008	1592	2247
Nb	362	308	341	276	322	397	349	306	389	422	323	320	421
Mo	3	2	3	4	5	3	2	7	2	10	4	7	6
Ag													
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	23	25	31	21	23	23	19	17	24	39	27	19	22
Sb	< 0.5	< 0.5	< 0.5	< 0.5	0.6	< 0.5	< 0.5	< 0.5	< 0.5	0.6	< 0.5	< 0.5	0.5
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5	0.7	< 0.5	< 0.5	< 0.5	< 0.5
Ba	44	45	46	46	44	37	38	47	50	50	43	43	46
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
La	503	467	397	365	316	320	286	519	467	531	398	592	471
Ce	794	738	633	572	528	517	472	837	750	864	650	1060	767
Pr	88.5	83.8	70.8	65.1	59.3	58.9	53.5	93.5	84.8	103	72.9	110	85.6
Nd	297	287	240	223	206	202	184	312	289	364	249	373	291
Sm	51.5	50.7	42.8	38.6	37.4	36.6	33.7	48.7	49.8	69.6	46.5	60.7	50.7
Eu	3.58	3.31	2.89	2.5	2.47	2.41	2.13	2.85	3.26	4.79	3.06	3.57	3.35
Gd	46.6	45.7	38.4	34.4	32.7	32.7	30.5	40.2	45.5	63.2	43.1	50.9	44.7
Tb	7.9	7.8	6.7	6.2	6.2	5.6	5.3	6.7	8.2	11.6	8.7	9.2	8.5
Dy	46.2	45.2	39.7	35.9	39.4	33.6	30.1	39.1	50.4	70.5	54.8	56.3	52.4
Ho	9.1	8.7	7.8	7	7.9	6.4	5.8	7.4	10.1	13.8	11	10.9	10.8
Er	27	24.6	23.8	20.6	24.7	18.5	16.5	21.4	29.8	40.7	33.4	31.7	33.7
Tm	4.01	3.62	3.74	2.94	4	2.92	2.49	3.2	4.48	5.89	5.06	4.68	5.39
Yb	25.6	23.8	24.5	18.3	27.3	19.3	15.9	20.5	28	35.2	32.6	30	34.3
Lu	3.72	3.46	3.53	2.62	3.94	2.94	2.44	3.05	3.95	4.91	4.54	4.16	4.85
Hf	49.1	42.1	50.8	28.9	58.8	49	42.4	34.5	48.3	62.7	45.5	34.8	48
Ta	24.3	20.1	22.9	18.3	20.9	26.7	22.8	18	24.8	27.1	18.2	18.1	23.6
W	245	189	225	5	2	1	2	2	1	5	1	1	1
Tl	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.2
Pb	43	46	54	28	53	84	38	38	33	52	63	43	42
Th	67.2	36.3	43.6	33.5	58.4	20.6	97.5	52.6	47.2	56.6	68.5	60.7	53.3
U	16.5	12.8	14.1	9.4	13.2	12.4	15.4	9.8	13.7	15.2	12.6	14.5	16.6
Zn	390	330	380	290	450	380	270	380	290	430	470	430	370

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Syenite											
Sample No.	11810	11811	11812	11813	11814	11815	11816	11817	11818	11819	11820	11821	11822
from	117.0	118.0	119.0	120.0	121.0	122.0	123.0	124.0	125.0	126.0	127.0	128.0	129.0
to	118.0	119.0	120.0	121.0	122.0	123.0	124.0	125.0	126.0	127.0	128.0	129.0	129.6
(wt%)													
SiO ₂	66.02	65.21	65.78	65.37	65.50	65.09	65.83	65.32	65.14	64.53	65.92	61.68	66.21
Al ₂ O ₃	13.30	13.01	12.86	12.97	13.49	13.12	12.85	13.51	13.49	13.06	13.31	12.47	13.10
Fe ₂ O ₃ (T)	5.88	5.99	5.70	6.59	5.37	5.90	6.47	5.41	5.88	6.76	6.50	9.48	6.78
MnO	0.15	0.16	0.14	0.16	0.15	0.15	0.16	0.14	0.14	0.16	0.16	0.23	0.18
MgO	0.02	0.02	0.02	0.02	0.02	< 0.01	0.02	0.02	0.02	0.01	0.02	0.03	0.02
CaO	1.44	1.63	1.63	1.31	1.37	1.44	1.07	1.55	1.24	1.04	1.15	1.61	1.10
Na ₂ O	5.20	5.02	5.18	5.33	5.19	5.38	5.81	5.28	5.76	5.97	5.72	6.19	5.73
K ₂ O	5.04	4.84	4.75	4.86	4.96	4.87	4.77	4.89	5.07	4.77	4.90	4.69	4.63
TiO ₂	0.19	0.21	0.19	0.23	0.20	0.19	0.23	0.18	0.22	0.24	0.23	0.36	0.28
P ₂ O ₅	0.03	0.02	0.04	0.03	0.01	0.03	0.01	0.01	0.02	0.02	0.02	0.05	0.02
LOI	1.90	2.22	1.72	1.72	1.81	1.76	0.80	1.29	1.04	0.79	0.87	0.79	0.87
Total	99.17	98.31	98.00	98.58	98.06	97.94	98.01	97.60	98.03	97.35	98.80	97.58	98.93
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	13	14	14	13	13	19	15	15	14	14	14	15	15
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	20	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Ga	49	48	53	52	51	53	51	55	57	54	54	48	48
Ge	4	4	4	5	4	4	5	4	5	5	5	6	4
As	< 5	< 5	< 5	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	279	272	269	274	264	272	270	279	286	276	279	239	214
Sr	50	47	58	53	52	50	34	49	34	32	33	31	35
Y	244	290	317	369	353	372	355	404	369	436	355	264	221
Zr	1345	1820	1595	2262	1767	2392	2186	2585	1978	2149	2187	1276	1495
Nb	280	319	411	379	329	394	355	397	399	432	435	237	301
Mo	4	3	2	2	< 2	< 2	< 2	< 2	3	2	4	4	11
Ag													
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	21	26	31	38	31	43	37	30	32	36	35	18	16
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	38	42	39	40	41	39	38	71	37	37	37	34	39
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	1.1	< 0.4	< 0.4	< 0.4
La	320	267	348	330	302	326	275	350	341	383	349	528	497
Ce	493	440	592	578	522	572	495	621	604	676	616	932	819
Pr	54.2	50.5	68	67.7	62.4	68.7	60.8	75.7	74.3	80	74.2	113	91.8
Nd	182	178	241	243	225	249	226	274	266	288	275	412	304
Sm	33.6	35.7	44.6	48.7	46.8	50.4	47.6	57.3	54.3	59.2	56	70.4	49.4
Eu	2.21	2.34	2.83	3.2	3.08	3.32	3.08	3.79	3.6	3.91	3.58	4.1	2.81
Gd	31	34.1	41.5	47.5	44.6	48.6	45.4	55.1	52.6	56.7	51.7	57.1	40.1
Tb	6.2	6.9	7.9	9.1	8.6	9.3	9	10.1	9.7	11.1	9.6	8.9	6.5
Dy	38.8	44	49.4	57.2	54.7	58	55.9	62.4	58.4	68	57.1	49.2	38.4
Ho	8.1	9	10.1	11.6	11.1	11.6	11.1	12.4	11.7	13.4	11.2	9.1	7.5
Er	24.5	27.2	30.1	35.7	32.9	35.3	33.5	37	34.1	38.8	32.5	25.4	22.2
Tm	3.67	4.11	4.4	5.52	4.96	5.47	4.84	5.52	4.77	5.52	4.71	3.46	3.36
Yb	23.6	25.8	26.7	35.3	30.9	33.2	29.9	32.7	27.8	32.7	27.9	22.2	20.9
Lu	3.45	3.79	3.71	5.01	4.21	4.52	4.22	4.36	3.86	4.36	3.86	3.35	3.16
Hf	30.5	40.1	35.8	51	40.1	54.9	48.7	55.8	44	45.9	49.1	27.2	32.1
Ta	17.1	19.6	23.9	22.9	21.4	24.1	22.3	24.5	24.6	25.4	26	13.3	18.4
W	< 1	< 1	< 1	< 1	< 1	< 1	1	1	< 1	1	< 1	1	< 1
Tl	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2
Pb	46	41	43	55	51	57	53	48	52	81	62	44	56
Th	46	49.1	78.7	67.1	83.8	52.9	55.4	84.8	61.9	71.9	60	31.5	33.9
U	11.5	11.6	13.6	12.1	14.6	12.7	13.9	18.4	15.1	14.8	14.9	9.8	13.1
Zn	420	430	390	460	400	430	490	450	500	570	540	520	440

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology	Pegmatite			Syenite								
Sample No.	11823	11824	11825	11826	11827	11828	11829	11830	11831	11832	11833	11835
from	129.6	130.0	131.0	132.0	133.2	134.0	135.0	136.0	137.0	138.0	139.0	140.0
to	130.0	131.0	132.0	133.2	134.0	135.0	136.0	137.0	138.0	139.0	140.0	140.5
(wt%)												
SiO ₂	63.68	67.52	69.47	63.19	66.31	66.46	65.15	66.04	65.84	65.34	61.96	63.77
Al ₂ O ₃	12.44	11.41	11.19	12.97	12.76	12.66	13.17	13.30	13.26	13.19	11.78	11.94
Fe ₂ O ₃ (T)	7.88	5.56	6.08	5.46	6.51	6.71	6.21	5.98	5.80	5.94	8.73	9.24
MnO	0.23	0.17	0.17	0.18	0.16	0.17	0.14	0.16	0.14	0.15	0.23	0.24
MgO	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.05
CaO	2.59	2.07	1.43	3.79	2.95	2.00	1.76	1.65	1.39	1.39	2.35	2.26
Na ₂ O	5.43	3.75	3.99	5.05	5.19	5.20	5.00	5.27	5.58	5.44	5.93	5.83
K ₂ O	4.48	5.11	4.66	4.35	4.02	4.49	4.79	4.82	4.69	4.92	4.43	4.49
TiO ₂	0.29	0.22	0.18	0.27	0.25	0.24	0.20	0.21	0.20	0.19	0.32	0.38
P ₂ O ₅	0.04	0.04	0.04	0.03	0.04	0.03	0.03	0.02	0.05	0.02	< 0.01	0.04
LOI	2.04	2.45	1.93	2.96	2.33	1.51	1.35	1.35	0.93	1.41	1.82	1.34
Total	99.11	98.32	99.16	98.27	100.50	99.48	97.83	98.83	97.89	98.00	97.59	99.58
(ppm)												
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1
Be	18	13	18	15	15	16	15	13	14	14	13	13
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	30	< 20	20	< 20	20	< 20	20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	10	20	40	30	20	20	20	20	10	< 10	< 10	< 10
Ga	47	47	49	51	49	54	51	49	49	50	50	46
Ge	5	4	4	4	4	4	4	4	4	4	5	5
As	< 5	8	5	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	216	268	260	235	222	248	281	288	264	273	237	196
Sr	81	89	68	75	139	70	49	42	33	52	114	81
Y	208	491	385	196	231	350	265	191	227	284	305	173
Zr	2037	2036	1922	1519	1115	2151	2268	1307	1951	1143	1564	1350
Nb	228	316	563	298	309	471	311	272	272	300	328	260
Mo	7	4	< 2	18	3	3	< 2	3	< 2	2	< 2	5
Ag												
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	19	32	38	16	24	30	36	30	30	21	24	11
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	< 0.5	< 0.5	< 0.5	0.6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	40	50	40	49	34	41	41	37	39	42	41	43
Bi	< 0.4	< 0.4	0.6	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.5	< 0.4
La	416	570	330	550	357	469	369	295	331	313	483	650
Ce	740	1000	620	907	585	822	626	512	587	561	816	1030
Pr	85.4	116	72.5	99.2	62.5	94.8	70.2	57.8	67.6	64.4	93.4	111
Nd	302	419	264	340	219	338	256	208	244	232	330	364
Sm	51.7	76.5	54.3	53	38.7	65.4	48.9	40	46.5	45.6	58.4	50.1
Eu	2.99	4.25	3.14	2.97	2.38	3.59	3.08	2.34	2.64	2.59	3.35	2.67
Gd	40.7	64.1	50.3	42.1	35.6	59.4	43.4	35.1	40.6	41.8	48.8	37.2
Tb	6.4	11.2	9.6	6.4	6.2	10.1	7.4	5.8	6.7	7.4	8	5
Dy	37	71.9	60.1	36.4	37.5	59	42.6	32.9	38.2	45.5	48.4	28.9
Ho	7.1	14.6	12	6.9	7.6	10.9	8.2	6.2	7	8.8	9.4	5.6
Er	20.6	45.2	33.7	19.7	21.9	30.9	24.3	17.3	19.6	25.3	27.6	17
Tm	3.15	6.26	4.56	2.95	3.16	4.48	3.8	2.48	2.69	3.48	3.93	2.68
Yb	20.8	32.9	24.1	18.8	19	26.9	25.1	15.7	16.2	19.4	24.8	18.9
Lu	3.16	4.15	3.09	2.9	2.71	3.77	3.54	2.31	2.28	2.64	3.65	3.07
Hf	43.9	44.1	43.8	33.9	25.3	46.5	50.4	30.3	44.2	27.3	35	30.4
Ta	13.2	19.7	29.5	17.4	16.9	28.2	19.3	17.2	17.8	19	20.4	14.5
W	< 1	< 1	3	< 1	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tl	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1
Pb	42	44	40	37	30	29	49	39	39	74	99	53
Th	25.5	63.1	25.8	29.6	40.1	71.4	43.7	29.8	32.9	40.3	33.2	25.3
U	10.6	14.4	13.1	11.7	9.5	18.7	12.2	8.4	12.1	10.4	11.1	9.4
Zn	460	340	370	290	320	400	430	410	380	420	650	480

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology									Pegmatite			
Sample No.	11836	11837	11838	11839	11840	11841	11842	11843	11844	11845	11846	11847
from	140.5	141.2	142.0	143.0	143.4	144.0	144.8	146.0	147.0	148.0	149.0	150.0
to	141.2	142.0	143.0	143.4	144.0	144.8	146.0	147.0	148.0	149.0	150.0	151.0
(wt%)												
SiO ₂	60.42	64.52	64.12	64.52	65.97	65.96	66.09	67.20	69.23	69.39	67.81	73.24
Al ₂ O ₃	11.70	13.13	13.75	10.93	11.02	11.83	11.13	11.30	11.60	11.11	10.35	9.36
Fe ₂ O ₃ (T)	11.50	7.03	5.80	8.66	8.42	6.79	6.84	8.00	6.14	6.89	7.49	5.32
MnO	0.31	0.18	0.17	0.23	0.22	0.18	0.18	0.20	0.16	0.18	0.21	0.16
MgO	0.07	0.03	0.02	0.02	0.04	0.02	0.02	0.03	0.02	0.02	0.02	0.02
CaO	2.88	1.74	2.06	2.26	2.08	1.90	1.98	1.59	1.47	1.52	1.55	1.07
Na ₂ O	5.78	5.70	5.76	5.59	5.51	5.62	4.85	5.37	5.02	5.34	4.98	3.97
K ₂ O	4.14	4.72	4.57	3.84	3.76	4.01	4.48	4.15	4.34	4.13	3.91	3.80
TiO ₂	0.48	0.28	0.23	0.32	0.25	0.19	0.21	0.21	0.17	0.22	0.21	0.12
P ₂ O ₅	0.06	0.04	0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	0.03	< 0.01	0.03	0.03
LOI	1.33	1.09	2.02	1.64	1.41	1.34	2.02	0.95	1.34	0.83	0.99	0.82
Total	98.68	98.45	98.51	98.01	98.68	97.83	97.80	99.02	99.51	99.63	97.54	97.88
(ppm)												
Sc	2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	14	14	15	16	13	14	14	14	14	14	12	12
V	< 5	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	80	< 10
Ga	46	50	55	44	47	54	54	55	54	56	55	48
Ge	6	4	4	5	5	4	5	4	4	4	5	3
As	< 5	< 5	< 5	< 5	< 5	< 5	5	< 5	< 5	< 5	6	< 5
Rb	164	254	276	205	216	244	295	259	277	265	236	252
Sr	66	40	86	104	88	76	106	86	78	79	76	76
Y	220	204	385	411	329	395	449	520	478	464	643	351
Zr	1202	1302	1837	3279	2363	2135	2340	4342	3002	2132	1105	1645
Nb	244	241	357	496	429	406	500	551	441	880	653	532
Mo	14	4	< 2	< 2	< 2	< 2	2	< 2	< 2	3	17	< 2
Ag												
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	11	21	25	46	43	39	48	38	51	51	47	29
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.6	0.5	< 0.5	0.6
Ba	41	39	41	54	42	42	44	43	43	41	34	40
Bi	< 0.4	< 0.4	0.5	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.6	0.4
La	655	368	387	271	259	284	324	281	300	344	578	332
Ce	1130	622	686	539	501	563	673	578	598	696	1100	649
Pr	130	70.3	79.7	66.9	61	70.6	78.2	74.3	76.7	86.2	141	80.9
Nd	459	254	291	263	234	281	301	294	301	328	550	310
Sm	69	44.4	58.6	56.7	50.4	63.8	69.1	68	71.9	72.8	119	67.8
Eu	3.68	2.89	3.5	3.49	3.05	3.83	4.34	4.26	4.4	4.63	6.94	3.81
Gd	49.4	37.2	52.9	52.1	46.9	58.3	70	65.2	69.6	66	104	59.4
Tb	7	5.9	9.5	9	8.1	10	10.5	12.1	12.4	11.5	18.3	10.5
Dy	38.6	33.6	56	54.6	46.3	57.5	63.1	75.6	72.7	68.4	107	62.7
Ho	7.1	6.3	11.1	11.3	9.1	10.5	12	15.5	13.9	13.3	20.2	11.8
Er	20.6	17.7	32.4	34.9	27	30	34.8	48.2	38.3	38.7	55.2	33.4
Tm	3.04	2.62	4.66	5.51	4.23	4.68	5.14	7.88	5.46	6.08	7.05	4.66
Yb	20.2	16.6	28	35.6	28.4	30.3	32.2	51	33.3	39.1	36.4	26.5
Lu	3.32	2.53	3.86	5.22	4.18	4.26	4.2	7.11	4.58	5.27	4.24	3.53
Hf	25.2	30.2	42.4	66.9	55.1	53.1	50.7	99.3	70.1	51.2	22.8	35.9
Ta	11.9	14	21.3	35.1	28.6	25.9	32.6	37.2	25.1	61.4	42.2	34.6
W	< 1	< 1	< 1	< 1	< 1	< 1	2	< 1	< 1	< 1	< 1	< 1
Tl	< 0.1	0.2	0.2	0.1	0.1	0.1	0.3	0.2	0.1	0.2	0.1	0.1
Pb	51	45	103	54	46	39	52	35	48	54	90	80
Th	23.8	22.8	54.7	42.3	29.5	46.3	45.6	57.5	64.2	60.3	78.5	57
U	10.6	8.9	15	15.4	12.9	15.5	16.6	22.8	16.8	24.4	20.4	18.8
Zn	580	420	550	630	560	620	660	650	620	750	750	610

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Pegmatite									
Sample No.	11848	11849	11850	11851	11852	11853	11854	11855	11856	11857	11858
from	151.0	152.0	153.0	154.0	155.0	156.0	157.0	158.0	159.0	160.0	161.0
to	152.0	153.0	154.0	155.0	156.0	157.0	158.0	159.0	160.0	161.0	162.0
(wt%)											
SiO ₂	70.56	71.66	72.51	71.74	71.62	70.05	71.90	71.14	71.76	70.19	71.11
Al ₂ O ₃	9.45	9.72	8.71	8.46	8.99	9.11	10.20	10.21	10.38	9.91	10.02
Fe ₂ O ₃ (T)	5.56	5.46	6.06	7.40	6.95	5.87	4.55	5.33	5.50	5.72	6.64
MnO	0.17	0.18	0.19	0.20	0.21	0.17	0.13	0.13	0.13	0.15	0.15
MgO	0.01	0.02	0.02	0.03	0.01	0.01	0.02	0.02	0.02	0.01	0.01
CaO	1.80	2.09	1.42	1.64	1.48	1.75	1.27	1.07	0.82	1.33	0.97
Na ₂ O	3.58	3.58	4.09	3.33	3.59	2.75	3.29	4.42	4.57	4.50	4.80
K ₂ O	4.21	3.62	3.20	4.01	4.27	4.63	5.09	4.05	4.17	3.93	3.91
TiO ₂	0.11	0.17	0.13	0.15	0.15	0.17	0.10	0.13	0.16	0.14	0.17
P ₂ O ₅	< 0.01	0.04	0.03	0.05	0.08	0.08	0.04	0.03	0.04	0.04	< 0.01
LOI	1.95	2.38	0.96	1.03	1.31	1.26	0.86	0.64	0.57	0.92	0.75
Total	97.41	98.91	97.31	98.05	98.68	95.85	97.45	97.18	98.13	96.84	98.53
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	11	12	11	10	11	13	12	15	19	16	17
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	20	20	20	30	30	30	20	< 10
Ga	47	50	49	45	46	49	52	53	49	49	49
Ge	3	3	3	4	4	4	3	3	3	3	4
As	6	5	< 5	< 5	< 5	7	< 5	9	11	7	8
Rb	271	233	217	276	291	351	355	272	262	247	245
Sr	119	117	76	94	85	102	87	61	41	85	51
Y	266	383	404	506	495	601	588	324	329	372	353
Zr	1981	2071	6072	5629	2513	13940	14150	3601	4396	5468	5201
Nb	517	658	632	443	647	915	761	559	555	533	424
Mo	< 2	< 2	< 2	< 2	8	< 2	< 2	4	3	< 2	2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	37	35	46	48	50	60	42	48	42	40	41
Sb	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	< 0.5	< 0.5	0.7	0.7	< 0.5	0.8	0.8	0.8	1	0.7	1.6
Ba	45	44	78	65	41	64	86	50	60	99	65
Bi	0.4	< 0.4	< 0.4	0.6	0.7	0.8	0.5	0.4	0.4	0.5	0.5
La	231	364	316	407	557	569	417	286	276	391	353
Ce	445	697	592	768	1100	1130	795	544	524	719	631
Pr	53.2	82.3	71.3	98.1	123	122	99.9	64.8	63.6	87.2	76.4
Nd	198	305	270	378	449	441	390	238	242	318	294
Sm	43	63	55.8	86	94.5	90.1	87.9	50.4	52.6	65.1	59
Eu	2.61	3.3	3.45	5.74	5.52	6.49	7.54	3.27	3.47	4.09	3.53
Gd	39.4	56	52.3	82.7	86.6	89.9	84.5	48.4	51.2	59.8	53.9
Tb	7.5	10.4	10.1	15.8	15.8	17.1	15.8	9.4	9.5	10.7	9.6
Dy	47.7	66.2	65.7	95.1	93.3	108	96.8	58.4	57.9	65.7	59.1
Ho	9.7	13.4	14.5	18.3	17.2	21.9	19.8	11.7	11.5	13.3	12
Er	29.1	38.7	46.1	52.2	45.6	64.5	60.4	33.5	33.4	39.2	37.9
Tm	4.29	5.55	7.44	7.63	5.62	9.83	9.65	5.05	5.03	6.06	5.97
Yb	25.8	31.7	50.7	49.1	30.6	66.2	66.4	31.4	32.3	38.9	39.3
Lu	3.61	4.21	7.47	6.9	4.06	10.1	10.1	4.64	4.75	5.78	5.85
Hf	44.3	44	140	144	58.8	355	328	88.4	106	131	128
Ta	34.3	49	47.1	28	39.7	62.4	55.5	37.8	36.6	34.8	33.2
W	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tl	0.2	0.1	0.1	0.2	0.2	0.3	0.2	0.5	0.6	0.3	0.4
Pb	73	57	80	110	118	138	94	86	81	93	56
Th	68.8	69.5	36.8	88.6	102	92.4	53.8	54.2	65.8	59.2	44.9
U	20	21.2	24.3	21.8	24.7	36.9	31	19.4	23	22.1	18.9
Zn	380	340	600	630	730	560	380	440	510	590	420

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology	Granite							Granite						
Sample No.	11859	11860	11861	11862	11863	11864	11865	11866	11867	11868	11869	11870	11871	
from	162.0	163.0	164.0	165.0	166.0	166.4	167.0	168.0	169.0	170.0	171.0	172.0	173.0	
to	163.0	164.0	165.0	166.0	166.4	167.0	168.0	169.0	170.0	171.0	172.0	173.0	174.0	
(wt%)														
SiO2	71.90	71.51	71.87	72.16	65.61	72.62	72.20	71.97	71.71	72.34	72.12	74.16	73.73	
Al2O3	10.61	10.55	11.61	11.31	13.50	10.69	10.50	11.08	11.13	11.14	10.44	10.08	8.54	
Fe2O3(T)	7.23	6.05	3.40	4.59	5.56	5.60	5.48	4.99	4.82	5.06	5.18	5.35	6.21	
MnO	0.15	0.12	0.08	0.13	0.15	0.14	0.12	0.11	0.11	0.12	0.12	0.13	0.14	
MgO	0.02	0.03	0.02	0.02	0.02	0.02	< 0.01	0.02	0.01	0.01	0.01	0.02	< 0.01	
CaO	0.83	0.56	0.91	0.40	1.44	0.26	0.22	0.29	0.28	0.55	0.20	0.44	0.23	
Na2O	6.78	4.71	3.49	3.63	5.82	4.05	4.37	4.52	3.99	3.96	4.32	3.91	3.85	
K2O	1.39	3.61	5.61	5.35	5.15	5.05	4.58	4.78	4.92	4.83	4.30	4.48	3.92	
TiO2	0.12	0.12	0.08	0.17	0.25	0.21	0.11	0.08	0.14	0.09	0.12	0.15	0.14	
P2O5	0.04	< 0.01	0.01	< 0.01	0.06	0.02	0.02	0.02	0.01	< 0.01	< 0.01	< 0.01	< 0.01	
LOI	0.85	1.12	1.18	1.37	0.64	0.94	0.50	0.52	1.01	1.06	0.52	0.63	0.41	
Total	99.91	98.36	98.25	99.11	98.18	99.59	98.11	98.39	98.15	99.18	97.32	99.36	97.18	
(ppm)														
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Be	13	18	24	27	27	26	18	17	19	15	15	29	20	
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	
Ga	60	59	63	62	52	58	61	64	61	65	60	62	50	
Ge	4	4	3	4	4	4	4	4	4	4	4	4	4	
As	< 5	7	6	28	< 5	8	< 5	7	5	10	7	7	6	
Rb	92	287	477	453	282	411	384	399	410	435	375	431	350	
Sr	33	44	49	33	66	30	27	38	31	34	22	27	24	
Y	153	135	391	308	355	338	304	315	324	339	283	278	308	
Zr	1344	516	4479	1785	2906	2357	1829	2407	2636	3132	3152	2240	3908	
Nb	139	353	399	364	521	322	240	312	268	299	309	311	488	
Mo	< 2	< 2	< 2	< 2	3	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	
Ag		3.6												
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Sn	16	13	26	27	39	28	33	20	26	25	25	35	25	
Sb	< 0.5	< 0.5	1.6	0.6	< 0.5	< 0.5	< 0.5	0.9	0.9	1.3	1.1	< 0.5	1.2	
Cs	< 0.5	0.6	0.9	0.9	0.9	0.7	0.7	0.8	0.8	1	0.9	0.9	0.9	
Ba	18	19	27	25	67	24	22	24	24	28	24	24	29	
Bi	< 0.4	0.5	0.8	0.7	< 0.4	0.5	0.5	< 0.4	< 0.4	0.5	1	0.4	0.7	
La	375	623	603	633	406	688	693	735	687	656	689	755	693	
Ce	586	1110	1090	1140	691	1230	1250	1230	1150	1090	1140	1230	1170	
Pr	68.2	122	120	126	74	137	138	141	132	127	131	147	132	
Nd	256	470	451	477	250	527	536	539	508	484	503	559	506	
Sm	42.3	76.1	79.9	82.2	49.1	90.6	93.1	88.4	84.6	79.5	84	93.2	81.8	
Eu	2.21	3.83	4.57	4.48	3.15	4.79	4.97	4.91	4.48	4.32	4.43	4.97	4.47	
Gd	35.5	58.2	68.9	65.2	46.3	73.9	75.2	78.3	72.3	71.2	71.2	75.3	70	
Tb	4.9	6.4	10.9	9.5	9.1	10.2	10.2	10.1	10	9.7	9.2	9.7	9.1	
Dy	25.8	29.1	66.7	53.7	57.8	56.7	53.8	53.9	56.1	53.9	50.1	51	52.1	
Ho	4.7	4.6	13.6	10.5	12	11	9.5	10	10.7	10.6	9.9	9.4	10.5	
Er	12.8	12.3	42.4	30.6	35.6	32	24.8	28.4	31.9	33.2	31.6	25.9	33.6	
Tm	1.81	1.61	6.75	4.72	5.6	4.84	3.28	4.2	4.83	5.34	5.14	3.71	5.59	
Yb	11.9	10.3	43.4	29.2	34.9	32.1	19.1	24.9	30	33.9	33.8	23.4	37.5	
Lu	1.78	1.48	6.03	4.11	4.9	4.61	2.5	3.46	3.96	4.85	4.71	3.39	5.39	
Hf	33.5	12.7	106	40.8	69.1	54	45.6	53.1	56.5	63.4	74	53.3	89.3	
Ta	8.6	30.4	30.5	26.3	35.9	24.5	15.7	24.7	24.5	24.9	26.4	24	41.2	
W	< 1	< 1	< 1	< 1	< 1	2	< 1	< 1	< 1	< 1	< 1	1	< 1	
Tl	< 0.1	0.2	0.5	0.4	0.3	0.4	0.3	0.7	0.6	0.6	0.5	0.5	0.5	
Pb	23	37	34	29	81	42	34	29	31	40	51	91	40	
Th	17.8	20.9	66.7	50.6	65.1	44	45.9	33.7	39.4	36.8	33.2	42.7	30.6	
U	5.5	11.9	17.3	12	19.9	11.1	13.7	12.7	12.8	15.1	13.5	12.8	17.2	
Zn	400	410	340	580	500	600	510	430	450	450	430	500	510	

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Granite											
Sample No.	11872	11873	11875	11876	11877	11878	11879	11880	11881	11882	11883	11884	11885
from	174.0	175.0	176.0	177.0	178.0	179.0	215.0	216.0	217.0	218.0	219.0	220.0	221.0
to	175.0	176.0	177.0	178.0	179.0	180.0	216.0	217.0	218.0	219.0	220.0	221.0	222.0
(wt%)													
SiO ₂	75.19	77.92	77.17	77.98	79.27	77.81	72.49	73.77	74.21	72.31	72.95	71.80	71.77
Al ₂ O ₃	7.07	7.25	6.58	6.73	5.99	6.16	9.65	9.34	9.65	9.40	10.07	10.18	10.30
Fe ₂ O ₃ (T)	6.96	6.00	6.33	6.52	6.56	6.32	5.61	5.61	6.17	6.25	5.39	5.46	5.60
MnO	0.16	0.14	0.15	0.15	0.15	0.15	0.13	0.13	0.15	0.14	0.13	0.12	0.14
MgO	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	0.01	< 0.01	0.01	0.02	0.02	0.01	0.01
CaO	0.23	0.33	0.25	0.31	0.25	0.25	0.75	0.61	0.53	0.65	1.05	1.57	1.36
Na ₂ O	3.71	3.55	3.36	3.56	3.13	3.25	4.09	3.96	4.43	4.02	3.96	4.22	4.14
K ₂ O	3.25	3.20	2.82	3.02	2.76	2.85	4.08	3.84	3.80	3.93	4.02	4.16	4.35
TiO ₂	0.15	0.18	0.11	0.16	0.16	0.12	0.10	0.11	0.11	0.11	0.09	0.09	0.10
P ₂ O ₅	0.01	0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	0.40	0.48	0.61	0.36	0.31	0.28	0.62	0.77	0.67	0.81	1.06	0.76	1.00
Total	97.14	99.06	97.38	98.79	98.61	97.20	97.56	98.13	99.72	97.63	98.75	98.40	98.77
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	11	25	13	22	15	33	15	20	13	22	20	24	21
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Ga	39	45	40	40	36	36	47	50	50	49	53	54	52
Ge	4	4	4	4	4	4	3	3	3	3	3	3	3
As	7	16	< 5	< 5	< 5	6	< 5	6	< 5	< 5	< 5	5	9
Rb	267	287	250	261	262	240	262	268	255	271	278	278	286
Sr	20	21	23	22	17	17	27	24	21	29	52	146	140
Y	349	296	291	342	280	294	166	206	157	194	261	210	263
Zr	3030	2961	3468	2100	2641	3007	2394	1990	2086	2196	2089	1871	2377
Nb	297	336	354	359	391	292	258	314	249	344	330	272	328
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag													
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	27	26	23	23	26	25	25	18	23	28	22	28	23
Sb	0.8	0.9	1	0.8	0.9	1	0.7	0.8	0.6	0.8	1.1	0.9	1.2
Cs	0.8	0.8	0.7	0.7	0.8	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.6
Ba	25	25	26	24	20	22	29	26	26	27	26	34	33
Bi	0.5	0.5	0.7	0.5	0.4	0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
La	681	729	670	628	580	572	124	128	143	118	130	121	148
Ce	1120	1200	1130	1060	964	964	265	271	301	261	283	260	307
Pr	132	138	133	122	111	113	31.9	31.7	36.1	31.7	34	31.8	37.3
Nd	493	525	504	464	422	428	122	117	138	119	127	121	141
Sm	84.1	86	83.4	80	70.3	74.6	26.8	27	30	28.5	30.6	28.8	33.3
Eu	4.65	4.5	4.6	4.52	3.85	4.06	1.7	1.74	1.87	1.91	1.98	1.91	2.06
Gd	73.4	71.3	70.8	72.6	58.5	63.4	26.8	27.7	27.8	28.5	32.5	29.8	33.9
Tb	10.1	9.3	9.2	10.8	8.3	8.9	4.5	5.2	4.3	5.3	6.3	5.6	6.3
Dy	58.6	51.7	50.2	61.1	48.7	49.6	25.8	33	24.7	32.4	39.1	33.8	39.4
Ho	11.6	10	10	11.6	9.9	9.6	5.2	6.9	4.9	6.2	8	6.4	8.2
Er	37	30.8	31.2	32.9	31.2	28.6	15.4	22.3	14.7	18	23.8	18.2	24.9
Tm	6.01	4.84	5.01	4.79	5.13	4.34	2.67	3.7	2.4	2.89	3.74	2.62	4.08
Yb	37.2	31.7	31.7	29.3	33.4	26.9	16.8	24.4	15.4	17.7	22.8	14.9	25
Lu	5.2	4.45	4.74	3.98	4.86	3.64	2.42	3.49	2.25	2.51	3.06	1.96	3.6
Hf	68.3	69.3	80.4	47.6	59.2	65.9	53.9	42.7	48	49.7	44.8	43.7	50.1
Ta	24.6	28.3	28.8	28.6	30.4	23.7	21.3	28.6	20.1	26.6	28	20.4	25.2
W	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tl	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4
Pb	50	58	52	51	43	44	41	21	23	29	67	81	47
Th	36.1	36.4	31.1	51.7	37.6	44.4	23.1	26.1	17.8	32.8	38.8	36.6	34.6
U	13.9	13.8	15.1	15.5	14.8	14.8	10.5	12.2	9.3	13.3	15.3	11	12.6
Zn	510	480	510	540	560	560	410	430	440	480	440	490	450

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Granite											
Sample No.	11886	11887	11888	11889	11890	11891	11892	11893	11894	11895	11896	11897	11898
from	222.0	223.0	224.0	225.0	226.0	227.0	228.0	229.0	230.0	231.0	232.0	233.0	234.0
to	223.0	224.0	225.0	226.0	227.0	228.0	229.0	230.0	231.0	232.0	233.0	234.0	235.0
(wt%)													
SiO ₂	72.29	72.19	64.88	70.91	72.52	71.33	71.22	71.77	72.32	73.08	69.36	71.49	72.28
Al ₂ O ₃	9.68	9.89	8.86	9.60	9.61	10.33	10.14	10.08	10.31	9.96	10.60	9.70	9.96
Fe ₂ O ₃ (T)	6.05	6.15	5.42	5.97	5.45	5.42	5.25	4.95	5.23	5.47	4.95	6.13	6.06
MnO	0.15	0.15	0.29	0.18	0.14	0.16	0.14	0.13	0.13	0.13	0.16	0.14	0.15
MgO	0.02	0.01	0.03	0.01	< 0.01	0.02	0.02	0.02	< 0.01	0.01	0.01	0.02	< 0.01
CaO	1.80	0.90	8.70	2.12	0.89	1.89	1.68	2.05	0.90	0.65	2.63	0.70	0.38
Na ₂ O	4.29	4.29	3.29	4.25	4.25	4.30	4.05	3.99	4.80	4.42	4.68	4.36	4.46
K ₂ O	3.97	4.05	3.78	4.13	4.02	4.28	4.31	4.25	3.89	4.08	3.91	4.19	4.13
TiO ₂	0.13	0.11	0.10	0.12	0.10	0.11	0.11	0.14	0.10	0.11	0.11	0.12	0.12
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	0.90	0.71	2.37	0.99	0.64	1.01	1.19	1.11	0.60	0.55	1.08	0.78	0.63
Total	99.27	98.46	97.71	98.28	97.63	98.83	98.12	98.49	98.30	98.45	97.50	97.64	98.19
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	19	22	26	52	33	39	29	24	26	25	37	19	19
V	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	30	< 20	20	< 20	30
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Ga	51	53	44	51	51	55	54	54	54	51	56	50	51
Ge	3	4	3	4	3	3	3	3	3	3	3	4	4
As	8	6	6	12	9	9	5	8	< 5	< 5	< 5	< 5	< 5
Rb	274	292	235	266	264	285	284	283	261	256	253	263	267
Sr	171	46	1705	196	48	164	95	126	71	29	201	29	27
Y	282	265	255	326	319	313	335	309	262	224	315	256	302
Zr	2407	2187	1728	1594	2342	2451	2413	2893	1927	2421	2619	3234	4649
Nb	283	336	307	328	353	371	371	385	346	296	344	336	511
Mo	< 2	< 2	< 2	< 2	< 2	2	< 2	5	3	< 2	3	< 2	2
Ag													
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	30	29	26	27	26	27	35	39	38	32	32	25	28
Sb	1.2	0.8	1.5	1	0.9	1.4	0.8	1.4	0.8	1.2	1.4	1.1	1.9
Cs	0.6	0.7	0.8	0.6	0.6	0.6	0.6	0.7	1	0.6	0.6	0.8	0.7
Ba	44	27	114	106	29	37	38	42	33	27	59	74	40
Bi	< 0.4	< 0.4	0.5	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
La	160	152	125	144	171	182	157	221	151	128	180	154	208
Ce	330	326	264	317	364	383	336	456	328	275	374	327	440
Pr	40.2	39.7	32.2	38.4	43.2	46.2	40.4	56.5	39	33	46.3	38.8	51.5
Nd	153	146	121	147	166	174	153	215	148	123	174	149	190
Sm	33.8	35	29.6	36.9	38.1	40.1	39.4	49.5	37.1	29.8	41.4	34.4	41.2
Eu	2.17	2.26	2.1	2.53	2.35	2.49	2.56	3.02	2.5	2.11	2.97	2.37	2.56
Gd	34.3	36.2	30.4	39.4	37.9	41.8	40.7	48.7	40.9	31	42.2	34.4	39.4
Tb	6.5	7.3	5.9	8.4	7.7	8	8.6	9.1	8.1	6.1	8	6.5	7.1
Dy	41.9	45.5	37.9	55.1	51.3	50.9	54.1	54.7	48.6	38.7	51.6	40.3	46.5
Ho	8.9	9.2	7.7	11.2	10.8	10.9	11	10.7	9	7.9	10.4	8.3	10.5
Er	28	26.5	24	33.2	34.3	35.4	33	30.6	23.7	24.8	31.2	26.4	33.4
Tm	4.64	4.13	3.69	5.24	5.56	5.73	5.1	4.91	3.32	4.16	4.91	4.47	5.44
Yb	29.7	24.2	22.2	30.8	33.7	37.2	31.2	30	18.4	26.2	29.1	29.2	37.5
Lu	4.07	3.32	2.82	3.89	4.53	5.2	4.13	4.21	2.36	3.69	3.83	4.2	5.76
Hf	53.9	52.9	37.4	35.9	51	54.1	53.2	66.6	43.6	54	61.4	72.5	99.1
Ta	21.7	24.1	18.8	22	25.6	28	28.5	30	27.9	24.8	28.5	26.9	44
W	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tl	0.3	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Pb	39	52	89	65	42	94	61	26	66	43	158	24	30
Th	37.1	50.9	35.4	59.4	41	61.3	63.4	47.3	60.6	41.8	42.6	35.4	46.7
U	13.2	14.2	10.7	13.8	14.9	16.1	15.8	16.8	15.1	14.6	19.7	14.8	20.2
Zn	490	520	390	510	450	480	490	470	490	460	470	480	460

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Granite											
Sample No.	11899	11900	11901	11902	11903	11904	11905	11906	11907	11908	11909	11910	11911
from	235.0	236.0	237.0	238.0	239.0	240.0	241.0	242.0	243.0	244.0	245.0	246.0	247.0
to	236.0	237.0	238.0	239.0	240.0	241.0	242.0	243.0	244.0	245.0	246.0	247.0	248.0
(wt%)													
SiO ₂	71.20	73.41	72.29	63.36	68.01	69.89	69.96	55.85	66.96	70.85	70.41	70.27	70.88
Al ₂ O ₃	10.94	9.62	10.58	9.49	10.48	9.33	10.93	7.70	9.22	10.97	11.26	11.68	10.01
Fe ₂ O ₃ (T)	5.26	6.85	5.18	5.86	4.71	5.94	4.84	5.56	5.80	3.30	3.92	4.94	5.24
MnO	0.13	0.17	0.13	0.25	0.17	0.22	0.14	0.31	0.28	0.15	0.13	0.14	0.15
MgO	0.01	0.02	0.02	0.02	< 0.01	< 0.01	< 0.01	0.07	0.04	0.03	0.04	0.03	0.03
CaO	0.36	0.97	0.50	8.43	3.68	3.21	1.43	12.34	5.47	2.95	2.32	1.92	1.90
Na ₂ O	4.86	4.48	4.55	3.97	3.83	3.54	4.32	2.30	3.40	3.65	3.80	4.19	3.74
K ₂ O	4.13	4.11	4.30	3.93	4.38	4.06	4.46	3.28	3.86	4.57	4.65	4.83	4.34
TiO ₂	0.10	0.14	0.11	0.11	0.12	0.15	0.13	0.07	0.16	0.09	0.11	0.15	0.13
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	0.54	0.69	0.66	1.74	1.99	1.57	1.29	11.66	4.60	2.94	2.23	1.79	1.79
Total	97.54	100.50	98.30	97.14	97.38	97.92	97.51	99.14	99.82	99.51	98.87	99.95	98.20
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	21	16	22	43	38	17	16	52	15	19	26	18	23
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	100	< 10	100	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Ga	58	49	58	50	55	52	59	42	50	54	61	65	56
Ge	4	3	4	3	3	4	3	2	3	2	3	3	3
As	10	< 5	6	18	12	11	15	91	9	< 5	5	8	8
Rb	272	276	304	259	312	302	331	224	264	299	348	360	322
Sr	30	75	43	899	417	209	72	260	150	83	96	75	54
Y	427	370	431	409	291	250	321	297	227	365	302	349	296
Zr	3653	1899	2246	2362	2909	3639	3930	1938	1693	1569	4264	3065	2642
Nb	426	357	395	333	407	410	458	304	353	366	479	481	539
Mo	< 2	8	5	11	< 2	< 2	< 2	7	2	5	< 2	4	< 2
Ag													
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	29	39	26	28	27	36	32	18	60	29	30	36	39
Sb	1.7	< 0.5	0.9	< 0.5	0.8	0.7	0.9	1.1	1.1	0.7	0.8	1.1	1.3
Cs	0.8	0.6	0.7	0.6	0.8	1	1.1	0.6	0.8	2.5	1	1.1	0.8
Ba	39	35	42	90	42	32	30	42	36	55	36	43	38
Bi	0.5	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
La	356	250	253	149	109	156	199	108	179	179	156	290	196
Ce	711	526	544	321	257	333	428	228	400	401	350	619	433
Pr	86.4	63.8	67.1	39	32.7	40	51.1	27.3	51	48.8	41.9	77.2	52.9
Nd	333	240	266	146	126	151	192	104	200	193	160	305	199
Sm	73.3	61	66.7	37.8	34.4	36.2	43.5	27.5	49.8	49.6	37.3	69.5	47.6
Eu	4.62	3.87	4.16	2.91	2.63	1.75	2.47	1.49	2.65	2.47	2.31	3.95	2.74
Gd	67.3	57.3	62.9	39.5	32.8	33	41.1	28.9	45.2	49.8	34.4	61.3	44
Tb	11.5	10.4	12	8.3	6.9	6.4	8.1	6.4	7.6	9.6	6.8	10.1	8.5
Dy	70.4	60.7	74.4	56.5	46.6	40.9	52.8	45.8	43.8	60.3	47.9	62.5	54.5
Ho	14.8	11.7	14.7	12.7	9.9	9	11.3	10.2	8	12.5	10.8	12.5	11.2
Er	41.9	33.4	43.2	43.1	32.1	30.6	36.7	33.8	21.8	38	37	38.9	36.2
Tm	6.15	4.5	6.1	6.64	4.92	5.12	5.7	5.19	2.94	5.33	6.05	5.87	5.45
Yb	39.8	25.2	33.2	39.2	30.3	34	35.3	29.4	17	29	38.7	36.3	32.3
Lu	5.6	3.23	4.37	5.15	4.23	4.91	4.98	3.97	2.32	3.66	5.43	5.1	4.49
Hf	76.8	44.5	49.2	56.8	64.7	90.2	94.9	43.3	41.9	35.7	101	72.6	64.9
Ta	35	23.4	28.9	24.2	30.3	33.8	38	21.1	22.5	22.4	39.9	36.3	40.1
W	< 1	1	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1	< 1	1	< 1
Tl	0.4	0.3	< 0.1	0.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	< 0.1	< 0.1	< 0.1
Pb	65	80	32	766	134	27	25	46	257	41	34	75	60
Th	66.6	59.2	73.1	55	88.6	21.9	32.9	28.9	77.5	93.2	30.3	88.7	42.8
U	20.5	14.9	17.4	16.9	17.2	15.5	18.8	17	13.9	16.9	20.8	19.1	19.3
Zn	460	608	460	520	380	460	400	300	530	252	320	400	440

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Granite											
Sample No.	11912	11913	11915	11916	11917	11918	11919	11920	11921	11922	11923	11924	11925
from	248.0	249.0	250.0	251.0	252.0	253.0	254.0	255.0	256.0	257.0	258.0	259.0	260.0
to	249.0	250.0	251.0	252.0	253.0	254.0	255.0	256.0	257.0	258.0	259.0	260.0	260.5
(wt%)													
SiO ₂	69.90	71.17	72.41	72.89	72.69	74.07	74.69	74.31	74.46	72.39	74.19	72.36	69.82
Al ₂ O ₃	10.31	11.31	10.40	9.64	10.25	10.36	9.92	9.82	9.68	10.98	10.27	9.64	8.66
Fe ₂ O ₃ (T)	5.46	4.50	4.40	4.96	4.75	4.11	4.63	4.62	4.43	4.53	4.61	5.00	5.30
MnO	0.16	0.12	0.11	0.12	0.12	0.10	0.11	0.11	0.10	0.10	0.11	0.13	0.15
MgO	0.02	< 0.01	< 0.01	0.01	< 0.01	0.01	0.02	< 0.01	0.01	0.02	0.02	0.05	0.09
CaO	1.85	1.00	0.82	1.08	1.27	0.95	1.01	0.70	0.76	0.71	0.66	1.57	3.61
Na ₂ O	3.97	4.22	4.19	4.10	4.15	4.13	4.02	4.05	3.98	4.15	3.78	3.01	2.33
K ₂ O	4.39	4.77	4.40	4.11	4.33	4.44	4.27	4.06	4.04	4.54	4.74	4.39	3.58
TiO ₂	0.16	0.13	0.17	0.12	0.17	0.11	0.14	0.09	0.09	0.09	0.12	0.11	0.11
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	1.59	1.15	0.75	0.79	0.95	0.80	0.80	0.56	0.71	1.12	0.92	2.11	3.42
Total	97.81	98.41	97.67	97.82	98.68	99.08	99.62	98.33	98.28	98.64	99.39	98.37	97.08
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	38	34	29	22	22	25	23	20	24	33	24	13	15
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	30	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	20	< 10	10	< 10	< 10
Ga	55	64	57	52	55	58	53	53	53	58	51	51	49
Ge	4	3	3	3	3	3	3	3	3	3	3	3	3
As	7	9	5	< 5	< 5	< 5	< 5	< 5	< 5	6	< 5	9	11
Rb	306	366	317	288	313	329	309	307	294	331	313	314	265
Sr	77	67	50	65	64	51	50	49	62	54	54	64	103
Y	357	418	227	203	243	219	330	317	296	271	247	305	389
Zr	2057	2992	2572	6686	4618	4186	2379	2148	847	2559	2561	2110	4898
Nb	448	585	397	264	417	337	463	358	348	417	455	388	457
Mo	4	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag									11.4				
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	36	34	40	38	36	32	32	29	42	31	29	26	27
Sb	0.9	0.9	0.7	0.8	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.7	1.7
Cs	0.7	0.9	0.6	0.6	0.6	0.7	0.7	0.6	0.5	0.8	0.7	0.9	0.8
Ba	47	39	36	26	31	29	28	28	23	26	27	32	42
Bi	< 0.4	< 0.4	< 0.4	< 0.4	0.6	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
La	284	226	154	228	221	184	180	184	144	98.2	137	128	252
Ce	594	479	331	465	443	393	387	398	335	224	287	274	521
Pr	74.5	57.8	39	56.9	52.6	47.1	46.5	48.3	40.7	25.4	31.6	31.5	62.3
Nd	287	222	144	218	193	180	172	182	155	88.1	108	118	232
Sm	67	54.2	35	48.1	40.6	41.1	40.8	43.1	45.5	23.4	25.4	30.9	51.2
Eu	3.89	3.32	2.36	2.73	2.43	2.48	2.43	2.77	3.06	1.51	1.54	2.06	2.88
Gd	58.6	52.4	33	41.4	35.1	36.4	38.4	42.6	47.3	23.8	24.5	32.7	47
Tb	10.2	10.6	6.6	6.6	6.2	6.6	8	8.4	9.7	5.9	5.3	7.4	8.8
Dy	62.8	69.9	43	38.6	41.5	41.2	54.8	55.1	64.5	43.5	38.2	51.4	59.6
Ho	12.6	14.8	8.6	7.3	9.1	8.4	12.2	11.9	12.5	10	9	11.1	13.6
Er	39.4	48.9	27.6	21.9	32	27	42.1	39.8	34.7	35.7	32.2	36.2	47.5
Tm	6.17	7.66	4.26	3.14	5.23	4.18	6.71	6.05	4.54	6.13	5.33	5.52	7.8
Yb	37.3	45.6	25.9	18.5	33.3	26.2	42	38	23.6	37.9	33.2	32.8	48.9
Lu	5.07	6.1	3.59	2.52	4.84	3.69	5.78	5.04	2.85	5.34	4.74	4.43	6.82
Hf	44.6	66.1	61.6	163	112	101	52	46.5	20.8	56.8	55.7	44.4	116
Ta	30	40.2	34.3	32.9	40	30.2	33.6	23.1	22.1	29.2	34.5	24.4	36.1
W	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2	< 1	3	< 1	1	< 1
Tl	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	< 0.1	< 0.1
Pb	157	87	63	57	36	73	124	79	84	58	48	42	35
Th	43.2	66.5	48.6	33.8	24.4	42.6	42.1	39.2	95.2	37.1	41.9	66.2	47.6
U	16.4	22.6	16.9	22.6	23.2	16.9	16.9	17.1	17.3	16.2	17.9	14.3	22.3
Zn	450	430	400	390	380	360	380	370	400	350	366	360	430

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology		Granite											
Sample No.	11926	11927	11928	11929	11930	11931	11932	11933	11934	11935	11936	11937	11938
from	260.5	261.0	262.0	263.0	263.4	264.0	265.0	266.0	267.0	268.0	269.0	270.0	271.0
to	261.0	262.0	263.0	263.4	264.0	265.0	266.0	267.0	268.0	269.0	270.0	271.0	272.0
(wt%)													
SiO ₂	71.14	70.13	67.55	68.98	70.97	71.37	72.06	71.89	71.98	71.90	72.71	72.39	70.31
Al ₂ O ₃	10.23	10.30	9.62	10.62	11.78	10.86	10.51	10.51	10.65	10.81	10.39	10.05	9.71
Fe ₂ O ₃ (T)	4.78	4.65	4.74	4.07	4.11	4.72	5.03	4.94	4.63	4.77	4.85	4.99	5.76
MnO	0.11	0.14	0.16	0.16	0.11	0.13	0.13	0.14	0.12	0.14	0.12	0.13	0.15
MgO	0.06	0.03	0.07	0.07	0.03	0.04	0.02	0.02	0.02	0.02	0.02	0.05	0.06
CaO	3.04	2.59	5.67	4.37	1.88	1.45	0.60	0.76	0.70	0.62	0.43	1.51	3.09
Na ₂ O	3.74	3.59	3.08	3.54	4.74	3.65	4.37	4.32	5.21	3.96	4.47	3.52	2.86
K ₂ O	3.55	4.27	3.61	3.81	3.18	4.71	4.32	4.38	3.00	4.74	4.01	3.55	3.81
TiO ₂	0.12	0.13	0.17	0.17	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.13	0.12
P ₂ O ₅	< 0.01	< 0.01	0.02	< 0.01	< 0.01	0.02	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	2.11	2.06	2.72	2.34	1.88	1.84	0.87	1.08	0.91	1.22	0.74	1.91	3.15
Total	98.89	97.91	97.42	98.12	98.82	98.95	98.08	98.20	97.37	98.32	97.87	98.23	99.03
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	14	41	99	57	21	21	30	28	20	18	16	16	15
V	< 5	< 5	< 5	6	6	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	10	10	< 10	< 10	< 10	< 10	< 10	< 10	10	< 10	< 10	< 10
Ga	53	54	50	49	61	53	51	52	60	56	53	54	50
Ge	2	3	2	1	2	3	3	4	3	4	3	3	3
As	7	< 5	8	< 5	7	9	8	6	9	104	10	9	19
Rb	250	302	246	255	231	344	298	311	219	334	279	259	266
Sr	104	162	201	133	94	59	30	43	39	40	23	55	54
Y	184	189	276	187	314	392	232	291	229	317	228	246	305
Zr	1260	1769	3655	1513	4382	4822	4391	2566	2747	3325	1200	1764	1855
Nb	269	355	710	829	637	676	470	552	380	534	436	442	339
Mo	5	7	6	< 2	< 2	< 2	< 2	4	< 2	4	< 2	< 2	4
Ag													
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	25	31	37	32	36	44	42	36	31	31	28	27	31
Sb	0.6	< 0.5	1	1.1	1.7	1.4	0.7	0.6	< 0.5	1.2	0.5	0.6	0.5
Cs	0.6	0.6	0.5	0.6	0.7	1	0.7	0.9	0.6	1	0.9	0.9	0.9
Ba	28	31	41	36	31	41	43	41	34	47	30	34	32
Bi	< 0.4	0.4	0.5	0.4	0.4	< 0.4	< 0.4	< 0.4	0.4	0.5	< 0.4	< 0.4	< 0.4
La	141	194	201	132	235	188	207	183	271	362	228	231	281
Ce	290	409	412	286	466	369	419	373	536	701	454	469	567
Pr	34.8	49.1	46.2	30.9	53.1	39.7	46.8	41.8	60.9	80.7	51.8	53.6	66.2
Nd	135	186	166	101	197	136	169	151	229	300	194	197	258
Sm	30.8	41	35.7	20.5	42.6	32.7	38.6	36	47.9	63.5	40.4	44.6	60.3
Eu	1.94	2.29	2.43	1.24	2.53	2.2	2.34	2.25	2.85	3.71	2.32	2.59	3.63
Gd	28.6	36.7	33.4	19.5	41.4	33.9	34	34.3	42.1	51.8	34.1	39.9	55.6
Tb	4.9	5.8	6.6	3.9	7.6	8.4	6.3	7.1	6.7	8.5	6.1	6.9	9.8
Dy	30.4	34.2	44.9	28.9	51.6	61	40	46.9	40.3	53.3	38.5	42.3	57.2
Ho	6.2	6.7	9.8	6.8	11.7	14	7.9	10.2	7.8	10.9	7.8	8.4	10.5
Er	19.9	21	33.4	24.2	40.9	46.8	24.7	32.5	24.5	35.1	23.5	26.2	30
Tm	3.09	3.13	5.47	4.04	6.65	7.34	3.73	5.01	3.71	5.54	3.47	3.89	4.14
Yb	19.2	19.5	34.1	23.9	40.4	43.1	22	29	21.3	33.2	20.1	23	22.9
Lu	2.72	2.79	4.67	3.44	6	5.65	3.08	3.85	2.88	4.47	2.73	3.15	2.99
Hf	28.1	40.8	81.4	35.3	104	108	98.6	54.2	57.2	71	25.7	38.6	40.2
Ta	18.9	25.6	57.6	63.1	51	53.1	39.6	39.5	30.8	39.1	30.3	29.9	20.4
W	< 1	< 1	2	2	1	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tl	< 0.1	< 0.1	< 0.1	0.4	0.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pb	23	46	58	62	41	92	54	66	45	58	78	40	29
Th	18.1	29.6	29	35.1	28.4	69.1	38.6	45.2	54.1	47.9	39.8	37.2	39.7
U	9.1	12.9	25.3	17.9	20.4	31.2	22.4	20.1	16.2	19.4	13.4	13.9	10.8
Zn	420	410	380	267	385	530	530	530	440	450	450	510	650

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology									Pegmatite			
Sample No.	11939	11940	11941	11942	11943	11944	11945	11946	11947	11948	11949	11950
from	272.0	273.0	274.0	275.0	276.0	277.0	278.0	279.0	280.0	281.0	282.0	283.0
to	273.0	274.0	275.0	276.0	277.0	278.0	279.0	280.0	281.0	282.0	283.0	284.0
(wt%)												
SiO ₂	71.26	70.09	72.22	71.10	72.36	71.42	71.13	70.71	72.60	70.80	71.23	73.07
Al ₂ O ₃	10.05	10.35	10.84	10.87	10.36	10.84	11.03	11.10	11.01	11.16	11.60	11.15
Fe ₂ O ₃ (T)	4.49	4.80	4.77	4.60	4.66	4.79	5.02	5.15	5.26	5.06	4.51	5.43
MnO	0.12	0.15	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.10	0.13
MgO	0.05	0.05	0.03	0.05	0.03	0.02	0.02	0.02	0.02	0.01	0.02	0.02
CaO	2.49	1.93	0.63	1.33	0.83	0.58	0.45	0.38	0.41	0.62	0.53	0.39
Na ₂ O	3.01	3.05	3.84	3.81	3.70	4.15	4.70	4.86	4.90	4.75	4.98	4.91
K ₂ O	3.97	4.16	4.38	3.99	3.91	4.27	4.33	4.45	4.53	4.13	4.17	4.43
TiO ₂	0.12	0.14	0.12	0.14	0.12	0.16	0.15	0.17	0.14	0.15	0.17	0.17
P ₂ O ₅	< 0.01	0.02	< 0.01	< 0.01	0.02	0.01	< 0.01	0.01	0.02	0.01	0.02	< 0.01
LOI	2.76	2.62	1.36	1.74	1.60	1.45	0.80	0.60	0.48	0.68	0.69	0.44
Total	98.31	97.37	98.33	97.74	97.72	97.81	97.74	97.60	99.49	97.50	98.02	100.10
(ppm)												
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	18	40	28	27	24	22	33	26	27	30	29	20
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	10	< 10	< 10	< 10	< 10	< 10
Ga	51	51	55	54	44	48	49	46	49	56	61	49
Ge	3	3	4	3	3	4	3	3	4	4	4	4
As	12	8	8	10	9	10	12	8	17	18	27	10
Rb	286	292	316	283	231	255	287	252	259	270	274	256
Sr	43	42	28	29	27	25	24	17	15	23	30	18
Y	334	446	294	316	272	289	299	246	305	379	400	270
Zr	1456	1668	1172	1852	1165	1232	1146	952	997	3928	3431	2039
Nb	391	404	389	353	317	352	293	304	323	295	344	279
Mo	3	< 2	< 2	3	< 2	2	3	7	5	2	2	4
Ag								9.7	10.1			
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	42	38	46	35	30	32	31	26	28	22	25	25
Sb	< 0.5	< 0.5	0.6	0.7	< 0.5	0.7	< 0.5	0.8	0.8	< 0.5	0.8	< 0.5
Cs	0.8	0.7	0.8	0.8	0.6	0.7	0.6	0.7	0.7	0.8	0.8	0.6
Ba	30	28	28	31	22	27	25	22	52	31	55	59
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.4	< 0.4	0.5	1	0.6	< 0.4
La	313	292	362	304	251	312	260	255	275	327	532	313
Ce	629	588	728	615	499	634	528	519	565	649	1010	600
Pr	73.5	68.4	85.2	72.2	56.7	73.6	62.3	59.2	65.9	76.1	120	69.3
Nd	279	262	309	273	213	285	241	223	249	290	469	260
Sm	67.9	64.2	71.1	64.7	48.4	64.8	55.1	48.5	56.7	63.7	95.8	56.7
Eu	4.28	4.16	4.26	3.96	2.94	4	3.39	3.11	3.57	3.82	5.59	3.16
Gd	63	63.8	60	58.1	46.5	57.4	52.4	43.7	53.5	60.3	84.9	51.3
Tb	11.1	12.4	10.5	10.3	7.6	9.3	8.8	7.2	8.7	9.5	12.5	7.8
Dy	63.6	78.8	60.3	59.3	45.5	53.4	52.5	42.3	52.1	59.5	71.8	46.6
Ho	11.7	15.8	11	11.1	8.6	10	10.3	8.3	10	12.3	14.1	8.9
Er	32.3	47.7	30.5	32.5	24.3	27.6	30.4	23.1	26.8	40.4	43.8	26.9
Tm	4.11	6.78	4.04	4.47	3.28	4.15	4.31	3.71	4.13	6.26	6.73	3.98
Yb	22.6	38.2	22.2	25.3	18.8	23.5	24.4	21.2	22.6	39.1	42.5	24.7
Lu	2.94	4.9	2.89	3.31	2.41	3.19	3.32	3.05	2.91	5.69	6.14	3.5
Hf	31.9	34.6	25.6	39.7	20.4	26.1	22.2	20.6	20.5	83.3	72.4	39.9
Ta	23.5	26	24.9	24.1	19.9	22.8	19.6	22.5	19.9	24.4	31.7	19.2
W	< 1	< 1	< 1	< 1	< 1	1	< 1	1	< 1	2	< 1	< 1
Tl	< 0.1	< 0.1	< 0.1	< 0.1	0.3	0.4	0.4	0.5	0.4	0.4	0.5	0.5
Pb	35	39	89	56	54	92	54	51	51	47	65	89
Th	92.9	127	61.9	78.8	54	63.8	52	46.1	48.4	36.4	50	40.5
U	12.2	14.8	12.8	17.1	12.3	12.3	10	9.6	14.3	11.4	13.8	12.3
Zn	540	440	460	440	391	390	408	390	430	386	374	431

Major and trace element data of representative Khaldzan Burgedei complex

Appendix 1

Lithology	Granite					Granite				
Sample No.	11951	11952	11953	11955	11956	11957	11958	11959	11960	11961
from	284.0	285.0	286.0	287.0	288.0	289.0	290.0	291.0	292.0	293.0
to	285.0	286.0	287.0	288.0	289.0	290.0	291.0	292.0	293.0	293.4
(wt%)										
SiO ₂	71.34	71.65	71.29	71.92	72.86	72.82	72.06	72.42	72.29	71.51
Al ₂ O ₃	10.50	10.52	11.05	10.85	10.78	10.71	10.63	10.85	11.85	10.73
Fe ₂ O ₃ (T)	5.05	5.32	5.07	5.22	5.39	5.16	5.20	4.92	5.31	5.47
MnO	0.13	0.13	0.14	0.12	0.13	0.12	0.12	0.12	0.13	0.13
MgO	0.39	0.01	0.02	0.02	0.02	0.02	0.01	0.03	0.01	0.02
CaO	1.47	0.42	0.89	0.37	0.38	0.31	0.33	0.38	0.43	0.39
Na ₂ O	4.70	4.74	4.71	4.76	4.94	4.72	4.89	4.54	5.13	5.06
K ₂ O	4.10	4.27	4.19	4.23	4.34	4.12	4.30	4.35	4.49	4.35
TiO ₂	0.15	0.15	0.15	0.17	0.16	0.17	0.17	0.16	0.17	0.17
P ₂ O ₅	0.04	0.02	0.02	0.02	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	0.38	0.54	0.94	0.35	0.37	0.39	0.38	0.30	0.42	0.66
Total	98.24	97.77	98.48	98.02	99.39	98.55	98.10	98.07	100.20	98.50
(ppm)										
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	26	23	33	25	27	20	20	36	97	70
V	5	< 5	< 5	< 5	< 5	< 5	< 5	5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	250	20	20	< 10	< 10	< 10	< 10	30	< 10	< 10
Ga	47	45	49	46	46	49	47	50	50	46
Ge	3	4	4	3	4	4	4	4	3	4
As	16	12	10	9	17	6	12	18	12	20
Rb	246	227	254	248	224	255	237	276	258	224
Sr	215	17	23	13	16	15	15	28	22	18
Y	211	237	268	223	285	248	271	293	599	409
Zr	2100	1457	1062	2617	2757	2202	2377	2393	1260	1300
Nb	269	351	235	333	276	274	347	331	315	287
Mo	4	5	4	5	5	3	4	2	5	5
Ag										
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	20	21	24	22	23	25	27	31	27	26
Sb	0.9	0.9	0.6	0.6	0.8	0.7	0.9	0.7	< 0.5	0.9
Cs	0.7	0.6	0.6	1.1	1.3	1.7	2.5	2.2	4.2	2.2
Ba	80	43	227	37	119	113	68	71	269	159
Bi	6	< 0.4	0.7	< 0.4	< 0.4	< 0.4	< 0.4	1.1	< 0.4	1.7
La	204	209	248	172	207	210	266	295	178	200
Ce	412	414	494	347	419	419	526	595	351	398
Pr	47.4	46	58	40.9	48.7	48.6	60	68.2	40.2	45.9
Nd	178	170	223	150	188	184	230	247	147	179
Sm	38.3	38.8	49.6	33.2	43	41.2	49.9	53.3	36.6	47.3
Eu	2.41	2.58	3.06	2.11	2.87	2.46	3.18	3.19	2.69	3.39
Gd	34.3	38	46.7	31.2	42	38	45.2	48.8	55.8	52.5
Tb	5.9	6.7	7.9	5.8	7.5	6.7	7.6	8.8	13.5	10.6
Dy	35.7	40.4	46.1	36.8	46.8	41.2	46.1	54.7	95.2	65.5
Ho	7.1	7.9	9	7.7	9.3	8.4	9.1	10.9	19.6	12.7
Er	22.3	21.9	26.6	23.8	27	26.3	26.3	34.4	52.7	33.7
Tm	3.43	3.57	3.76	3.74	4.32	3.89	3.92	4.92	6.47	4.67
Yb	20.7	20.9	21.7	23.4	26.4	23.8	24.9	30.8	33.4	27.4
Lu	2.94	2.87	3.08	3.39	3.78	3.52	3.46	4.18	4.13	3.72
Hf	41.9	34.3	21	51.9	60.3	45.2	55.5	51.6	26.1	27.8
Ta	21.1	25.8	15.4	28.2	21.5	21.8	25.4	26.1	18.5	17.9
W	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1
Tl	0.7	0.4	0.4	1.2	0.9	0.9	0.8	0.7	0.6	0.7
Pb	105	71	73	54	40	44	64	167	84	49
Th	35.7	45.8	40.9	40.1	48.9	41.2	46.3	54.6	42.6	54.8
U	14.1	11.5	10.4	15.7	15.5	15.1	15.8	17.3	10.7	9.3
Zn	383	410	393	364	390	391	410	395	460	400

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology		Syenite										
Sample	11962	11963	11964	11965	11966	11967	11968	11969	11970	11971	11972	11973
from	140.0	141.0	142.0	143.0	144.0	145.0	146.0	147.0	148.0	149.0	150.0	151.0
to	141.0	142.0	143.0	144.0	145.0	146.0	147.0	148.0	149.0	150.0	151.0	152.0
(wt%)												
SiO ₂	61.54	64.57	64.63	62.45	61.61	61.42	66.04	65.68	64.85	65.3	65.4	66.37
Al ₂ O ₃	13.22	12.66	13.76	13.55	13.17	14.51	13.83	14.07	14.09	14.4	14.05	13.6
Fe ₂ O ₃ (T)	4.16	4.88	7.33	8.93	9.51	8.52	5.58	6.86	5.96	6.42	5.93	4.4
MnO	0.166	0.152	0.082	0.093	0.076	0.085	0.065	0.054	0.063	0.064	0.06	0.063
MgO	0.14	0.16	0.21	0.24	0.27	0.23	0.12	0.13	0.1	0.11	0.1	0.08
CaO	5.09	5.64	2.26	2.66	2.41	2.5	2.42	1.92	2.32	1.89	2.03	2.15
Na ₂ O	3.88	3.37	3.71	3.3	2.5	3.18	3.73	3.67	3.97	4.04	4	3.86
K ₂ O	5.08	4.37	4.95	4.82	5.2	5.45	5.28	5.14	5.2	5.09	4.98	5.28
TiO ₂	0.292	0.247	0.231	0.358	0.182	0.195	0.216	0.21	0.179	0.201	0.196	0.183
P ₂ O ₅	0.07	0.05	0.04	0.06	0.02	0.03	0.03	< 0.01	0.02	0.03	0.03	0.02
LOI	4.7	4.55	2.57	2.91	2.76	2.81	2.24	1.94	2.16	1.99	2.03	2.13
Total	98.34	100.6	99.76	99.39	97.72	98.93	99.54	99.7	98.91	99.53	98.82	98.13
(ppm)												
Sc	3	2	1	2	< 1	1	< 1	< 1	< 1	< 1	< 1	< 1
Be	13	17	18	10	7	9	19	11	11	14	14	21
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	6	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	1	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	100	115	140	180	180	160	87.5	132	110	107	130	110
Ga	34	35	40	37	37	42	42	48	40	46	42	42
Ge	3	3	3	5	4	4	3	3	3	3	3	4
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	130	125	125	114	132	146	161	164	145	168	151	186
Sr	77	60	33	29	24	28	28	22	31	25	23	30
Zr	2326	1640	1322	1176	1236	1576	2090	1843	1542	1917	1795	4010
Nb	258	208	173	138	114	186	229	236	184	198	218	234
Mo	11	5	4	4	2	3	< 2	3	4	3	4	3
Ag												
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	15	13	12	9	6	13	21	19	16	18	19	18
Sb	1	0.7	0.7	0.7	0.7	0.7	0.6	< 0.5	0.7	0.6	0.9	1.1
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	243	161	181	173	153	157	137	129	120	109	112	113
Hf	49.8	32.2	25.5	23.5	23.2	35.1	38.8	33.3	29.1	35.1	35.3	92.1
Ta	18.2	16.3	11.4	8.5	8.7	14.7	17.2	16.1	13.9	13.4	14.6	19.9
W	4	2	2	2	1	2	3	3	2	2	2	2
Tl	0.4	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.3
Pb	8	7	5	14	< 5	< 5	5	< 5	6	7	6	9
Th	28.9	27.8	23.9	18.7	21.6	30.5	28.4	23.2	19.4	25	25.7	30.6
U	10	8.8	6.8	4.5	4.6	7.5	8.8	9.1	6.7	7.5	8.4	12.3
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.4
Y	175	178	146	136	113	174	188	159	140	166	188	238
La	165	139	181	125	112	145	162	189	150	175	170	271
Ce	331	282	353	265	232	292	323	366	297	348	341	556
Pr	37.4	32.9	39.9	32.4	27.7	34.1	37.1	41.5	34.5	39.8	39.8	65.8
Nd	137	126	150	130	107	132	143	153	131	153	151	251
Sm	28.7	27.6	28.8	27.9	22.2	29	31.1	32.2	27.7	31.7	32.7	54.5
Eu	3.08	2.53	2.67	2.58	1.99	2.36	2.38	2.32	2.12	2.11	2.39	3.36
Gd	26.5	25.9	25	24	19.8	25.8	28.7	30.3	23.9	28.6	29.9	46.9
Tb	4.6	4.5	4	3.7	3	4.5	5	5	3.8	4.6	5.1	7
Dy	28.5	29.3	23.4	21.6	18.6	28.1	31.8	30.7	22.4	27	30.6	38.8
Ho	5.9	6.1	4.8	4.5	3.7	5.8	6.5	6.1	4.3	5.4	6.2	7.7
Er	18	19	14.1	13.1	11.2	17.4	20.4	18.6	12.9	17.4	18	22.6
Tm	2.95	2.93	2.23	2.11	1.87	2.68	3.08	2.79	2.06	2.63	2.73	3.65
Yb	19	17.7	14.4	13.7	11.8	17.4	19.1	17.3	13.4	16.3	17.5	23.8
Lu	2.79	2.57	2.17	2	1.68	2.48	2.76	2.58	2.01	2.41	2.54	3.49
TREE	985.42	896.03	991.47	803.59	687.54	912.62	1003.92	1056.39	867.09	1019.95	1037.46	1593.6

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology		Syenite									
Sample	11974	11975	11976	11977	11978	11979	11980	11981	11982	11983	11984
from	152.0	153.0	154.0	155.0	156.0	157.0	158.0	159.0	160.0	161.0	161.6
to	153.0	154.0	155.0	156.0	157.0	158.0	159.0	160.0	161.0	161.6	162.0
(wt%)											
SiO ₂	65.92	64.01	65.22	64.77	64.69	65.15	66.53	66.17	65.14	63.48	66.59
Al ₂ O ₃	14.84	14.29	14.61	14.27	14.97	14.29	14.84	13.92	15.11	14.13	13.41
Fe ₂ O ₃ (T)	4.51	4.49	4.58	4.02	3.12	3.55	3.5	3.6	3.36	4.59	5.01
MnO	0.08	0.096	0.056	0.1	0.08	0.075	0.068	0.073	0.055	0.094	0.082
MgO	0.07	0.06	0.06	0.05	0.03	0.03	0.03	0.03	0.02	0.05	0.07
CaO	2.38	2.99	1.95	2.72	3.34	2.56	2.32	2.64	2.09	3.21	3.13
Na ₂ O	4.57	4.46	4.62	4.4	5.16	4.79	4.72	4.73	5.13	4.36	3.38
K ₂ O	5.38	5.04	5.26	5.25	5.37	5.06	5.63	5.16	5.56	5.31	5.55
TiO ₂	0.161	0.205	0.151	0.186	0.207	0.178	0.144	0.148	0.137	0.13	0.184
P ₂ O ₅	0.02	0.04	0.03	0.03	0.02	0.07	0.02	0.03	0.02	0.02	0.03
LOI	2.33	2.91	1.97	2.87	2.81	2.29	2.11	2.34	1.84	2.87	3.46
Total	100.3	98.59	98.5	98.66	99.79	98.03	99.94	98.85	98.46	98.23	100.9
(ppm)											
Sc	< 1	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1	< 1
Be	17	18	24	20	18	23	28	32	19	19	16
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	10	< 10	10	20	< 10	30	< 10	< 10	< 10
Zn	100	86.1	110	120	70	77.2	90	100	60	63.9	97.4
Ga	44	48	44	43	43	49	43	47	43	46	45
Ge	3	3	3	3	3	3	3	3	3	3	3
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	159	182	175	164	161	196	176	172	158	169	171
Sr	34	43	31	43	49	49	43	49	37	49	28
Zr	1729	2159	2034	1741	1683	3104	2145	3161	1280	1460	1952
Nb	212	248	301	205	183	378	235	367	210	187	185
Mo	5	7	6	5	6	2	4	4	5	4	2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	17	21	23	16	12	22	20	30	14	20	11
Sb	1	0.7	1.1	0.9	0.9	0.8	0.8	0.9	0.9	0.6	< 0.5
Cs	0.5	< 0.5	< 0.5	0.6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	98	95	93	78	79	81	97	95	104	102	112
Hf	33.4	41.3	46.1	35.8	29.4	63.3	42.4	71.8	28.1	29.7	34.2
Ta	14.2	18.1	21.9	13.8	12.3	30.5	17.3	26.6	14.6	13.4	12.9
W	2	2	2	2	2	2	2	3	2	2	< 1
Tl	0.3	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.2	0.2
Pb	8	13	10	8	15	15	9	11	8	6	< 5
Th	26.2	33.9	34.4	26.1	24.7	27.3	42.1	60.2	25.7	22.7	21.8
U	7.3	10.5	11.9	6.9	7.9	16.1	9	13.7	7	7.1	6.8
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	158	206	203	176	176	226	323	384	167	162	173
La	125	183	169	150	226	209	222	172	132	107	163
Ce	255	379	351	305	458	395	454	352	267	222	340
Pr	29.4	44	40.4	35.7	52.4	43.7	52.9	41	31.1	25.6	39.5
Nd	112	169	152	138	198	155	204	153	117	100	152
Sm	25.2	37.3	34.6	29.9	40.3	33.3	44.5	39.3	26	24.3	33.6
Eu	1.94	2.59	2.76	2.18	2.65	2.29	3.17	3.2	2	1.71	2.28
Gd	23.5	34.6	31.4	28	35	31.3	42.7	41.7	25.5	24.3	32.6
Tb	4.1	6	5.8	4.9	5.3	5.7	7.7	8.4	4.4	4.5	5.3
Dy	25.4	36.4	35.6	29.6	29.7	36.4	48.3	56.3	27.2	28.1	31.6
Ho	5.2	7.3	7.1	6	5.7	7.4	9.8	11.7	5.4	5.6	6.3
Er	15.5	22.8	21.2	17.7	16.8	23.3	28	34.4	15.9	17.6	18.8
Tm	2.44	3.46	3.29	2.69	2.64	3.67	4.25	5.21	2.42	2.58	2.74
Yb	16	21.5	20.9	17	16.7	22.5	26.1	32.2	15.3	15.6	17
Lu	2.33	3.07	2.92	2.42	2.43	3.21	3.52	4.37	2.15	2.2	2.49
TREE	801.01	1156.02	1080.97	945.09	1267.62	1197.77	1473.94	1338.78	840.37	743.09	1020.21

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology		Syenite										
Sample	11985	11986	11987	11988	11989	11990	11991	11992	11993	11995	11996	11997
from	162.0	163.0	164.0	165.0	166.0	167.0	168.0	169.0	170.0	171.0	172.0	173.0
to	163.0	164.0	165.0	166.0	167.0	168.0	169.0	170.0	171.0	172.0	173.0	173.8
(wt%)												
SiO ₂	65.45	66.07	63.26	64.85	66.74	65.21	65.81	67.79	65.16	65.23	66.73	65.03
Al ₂ O ₃	14.35	14.3	13.75	14.4	14.69	14.49	14.71	14.19	14.95	13.94	15.45	14.89
Fe ₂ O ₃ (T)	4.59	3.68	7.41	6.16	4.66	4.69	5.07	3.94	3.19	5.83	2.34	2.5
MnO	0.056	0.056	0.086	0.06	0.047	0.057	0.058	0.068	0.052	0.065	0.075	0.052
MgO	0.06	0.05	0.1	0.08	0.07	0.05	0.07	0.05	0.04	0.09	0.02	0.03
CaO	1.97	2.1	2.41	1.37	1.79	1.76	1.96	2.44	2.09	2.56	2.54	3.14
Na ₂ O	3.9	4.03	3.13	3.77	4.06	4.35	4.17	4.02	4.77	3.53	5.3	4.79
K ₂ O	5.79	5.56	5.55	5.58	5.56	5.36	5.42	5.46	5.74	5.3	5.35	5.38
TiO ₂	0.172	0.149	0.156	0.136	0.163	0.174	0.174	0.201	0.133	0.132	0.138	0.133
P ₂ O ₅	0.02	< 0.01	< 0.01	< 0.01	0.03	0.01	0.03	0.03	< 0.01	< 0.01	0.01	< 0.01
LOI	2.13	1.89	2.38	1.66	1.57	1.7	1.79	1.97	1.74	2.22	2.15	2.23
Total	98.49	97.9	98.23	98.06	99.38	97.85	99.26	100.2	97.87	98.92	100.1	98.15
(ppm)												
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	14	13	11	9	10	12	13	14	18	20	29	17
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	30	< 10
Zn	90	73.2	140	110	88	79.8	92.4	75.8	70	110	50	50
Ga	45	46	46	45	48	48	49	46	44	45	49	45
Ge	3	3	3	3	3	3	3	3	2	3	2	2
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	162	177	172	174	182	180	181	174	179	181	197	191
Sr	24	28	28	26	21	31	25	30	28	30	39	31
Zr	1501	1737	1588	1309	1309	1500	1605	1719	1373	1535	1404	1331
Nb	178	175	191	159	158	186	191	174	171	225	263	204
Mo	3	< 2	2	< 2	< 2	3	< 2	2	< 2	< 2	12	7
Ag												
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	15	11	12	11	11	16	15	11	11	13	19	13
Sb	0.7	< 0.5	0.7	0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.7	0.8	0.6	0.6
Cs	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba	110	108	121	119	105	88	99	109	102	114	92	96
Hf	30.9	34	35.1	28.2	27.6	31.8	32.3	35.1	30.7	33.7	32.9	30.4
Ta	12.1	14.5	14.8	12.4	12.1	12.9	13.2	12.2	12.4	15.7	18	14
W	2	< 1	1	< 1	< 1	1	1	< 1	2	4	2	2
Tl	0.3	0.3	0.5	0.4	0.4	0.2	0.2	0.2	0.3	0.3	0.3	0.3
Pb	< 5	< 5	< 5	< 5	< 5	6	5	< 5	< 5	< 5	9	< 5
Th	24	23.5	24.3	19.4	19.9	22.6	26.1	25.6	19.5	25.1	42.2	21.9
U	5.8	8.3	7.6	6.8	6.6	7.1	7	6.9	6.5	8.2	7.8	6.6
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	168	174	186	144	144	148	253	174	190	196	201	174
La	131	130	134	133	173	209	205	205	149	137	158	136
Ce	280	281	286	282	358	427	411	431	323	287	328	276
Pr	33.5	33.7	34.6	34.1	42.3	50.7	48.6	51.5	39.4	34.9	38.8	32.6
Nd	132	130	132	133	162	197	185	199	153	132	146	123
Sm	30.2	30.8	30.8	29.8	35.1	40.5	40.1	41.4	34.7	30.4	33.3	27.6
Eu	2.36	2.24	2.07	2.07	2.5	2.87	2.74	2.76	2.36	2.13	2.38	2
Gd	27.4	29.2	29.2	26.2	30.1	33.7	36.1	35.2	30.7	28.5	30	25
Tb	4.8	5	5.2	4.4	4.8	5.3	6.3	5.7	5.2	5	5.5	4.4
Dy	28.4	30.4	32.6	26.4	27.8	30	39.3	32.6	32.5	30.8	34.1	27.4
Ho	5.6	6	6.5	5.2	5.4	5.6	8.2	6.2	6.4	6.2	7	5.4
Er	16.1	18.2	19.1	15.3	16.1	16.4	26.9	18.8	19.5	18.9	21.2	16.6
Tm	2.49	2.74	2.91	2.31	2.39	2.34	4.18	2.78	2.92	2.83	3.14	2.51
Yb	16.1	16.4	17	14.1	14.8	14.1	24.8	16.8	17.3	16.7	19.5	15.8
Lu	2.28	2.38	2.38	2.02	2.21	2.05	3.35	2.38	2.34	2.28	2.74	2.17
TREE	880.23	892.06	920.36	853.9	1020.5	1184.56	1294.57	1225.12	1008.32	930.64	1030.66	870.48

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology		Syenite									
Sample	11998	11999	12000	12001	12002	12003	12004	12005	12006	12007	12008
from	173.8	174.7	175.0	176.0	177.0	177.8	179.0	179.4	180.0	181.0	182.0
to	174.7	175.0	176.0	177.0	177.8	179.0	179.4	180.0	181.0	182.0	183.0
(wt%)											
SiO ₂	58.78	66.06	65.59	64.08	58.87	65.27	66.09	65.56	65.19	64.96	65.61
Al ₂ O ₃	14.81	15.24	14.99	14.32	14.32	14.26	14.45	13.87	13.39	14.14	14.62
Fe ₂ O ₃ (T)	7.78	4.77	3.34	4.67	10.57	4.76	3.2	3.7	4.46	5.05	4.14
MnO	0.063	0.059	0.105	0.114	0.078	0.069	0.059	0.082	0.111	0.082	0.073
MgO	0.14	0.07	0.03	0.06	0.21	0.08	0.06	0.05	0.07	0.08	0.06
CaO	3.83	2.09	2.68	2.91	3.2	2.56	2.54	2.53	3.19	2.31	2.31
Na ₂ O	2.85	4.3	4.97	4.43	2.33	3.82	4.35	4.23	3.86	3.98	4.41
K ₂ O	6.19	6.13	5.24	4.97	5.97	5.65	5.46	5.28	5.15	5.29	5.27
TiO ₂	0.16	0.135	0.151	0.207	0.196	0.188	0.188	0.174	0.169	0.172	0.162
P ₂ O ₅	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.01	0.01	0.03	0.02
LOI	3.03	2.08	2.57	2.89	3.1	2.53	2.35	2.55	3.09	2.46	2.43
Total	97.65	100.9	99.65	98.66	98.84	99.18	98.76	98.03	98.69	98.56	99.11
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	11	15	16	19	16	13	15	14	14	16	17
V	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	10	< 10	< 10	< 10	< 10	< 10	10	< 10	< 10
Zn	158	90	60	80	200	110	80	80	90	100	79.1
Ga	50	48	48	46	50	50	50	48	47	48	49
Ge	4	2	2	2	4	3	3	3	3	3	3
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	205	197	181	174	198	203	201	190	182	190	183
Sr	27	30	43	46	29	44	33	42	59	36	38
Zr	1617	1285	1510	1841	2051	1599	1578	1651	2068	1416	1854
Nb	223	241	200	243	252	231	243	259	252	209	196
Mo	< 2	3	6	4	< 2	2	< 2	3	< 2	2	4
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	10	14	13	18	28	10	12	15	16	14	14
Sb	< 0.5	0.5	0.7	0.6	0.8	0.8	0.6	0.7	0.7	0.5	< 0.5
Cs	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5
Ba	155	118	97	88	133	111	104	88	87	85	87
Hf	36.9	30	32	36.6	46.2	33.6	32.4	34.3	46.4	30.8	38.6
Ta	18	18	13.3	16.6	18.4	15.5	16.2	17	18.4	13.7	14.7
W	1	2	1	2	2	1	2	2	1	1	1
Tl	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2
Pb	< 5	< 5	14	18	< 5	6	< 5	5	6	5	6
Th	27.7	24.3	18.7	26.1	34.5	26.6	30.1	30.3	29.9	29	25.6
U	10.3	9.3	6.9	8.2	10	7.8	7.9	8.2	9	7	7.5
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	212	170	148	189	212	214	216	195	199	179	182
La	175	164	129	200	181	191	204	173	204	176	194
Ce	354	317	258	392	352	373	409	344	400	353	389
Pr	40.6	36.2	29.2	45	40.4	42.8	48	40.4	46.5	41.7	45.1
Nd	155	134	108	171	150	159	179	151	176	158	168
Sm	34.3	29.4	23.3	35.8	33	35	39.9	33.3	37.8	34.6	36.3
Eu	2.49	2.03	1.67	2.25	2.34	2.31	2.5	2.17	2.51	2.21	2.31
Gd	31.3	26.4	20.6	31.2	31.3	32.6	36.2	31.5	34.9	31.3	30.9
Tb	5.6	4.5	3.7	5.3	5.8	5.9	6.3	5.4	5.9	5.4	5.2
Dy	34.7	28.1	23.7	32.1	37.1	37.2	38.5	33.2	36.2	33.1	30.6
Ho	7	5.7	4.9	6.3	7.5	7.4	7.7	6.9	7.4	6.8	6.3
Er	22.1	17.2	14.7	19.4	22.9	22.6	23.1	20.5	22.3	19.9	19.4
Tm	3.23	2.59	2.25	2.95	3.41	3.4	3.42	3.11	3.35	2.95	2.91
Yb	19.4	15.7	13.6	18.6	20.6	21.2	20.9	19.6	20.4	17.9	17.9
Lu	2.75	2.22	1.9	2.76	2.94	2.98	3.02	2.76	2.95	2.56	2.59
TREE	1099.47	955.04	782.52	1153.66	1102.29	1150.39	1237.54	1061.84	1199.21	1064.42	1132.51

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology		Syenite									
Sample	12009	12010	12011	12012	12013	12014	12015	12016	12017	12018	12019
from	183.0	184.0	185.0	186.0	187.0	188.0	189.0	190.0	191.0	191.5	192.0
to	184.0	185.0	186.0	187.0	188.0	189.0	190.0	191.0	191.5	192.0	193.0
(wt%)											
SiO ₂	62.88	65.33	66.08	61.06	59.28	63.25	64.38	63.73	65.75	65.29	66.53
Al ₂ O ₃	13.95	14.65	13.87	15.54	15.5	15.63	16.08	15.6	13.43	15.08	14.82
Fe ₂ O ₃ (T)	6.46	3.23	3.57	5.86	6.27	3.8	4.34	4.33	4.28	3.7	3.53
MnO	0.092	0.056	0.071	0.076	0.087	0.07	0.055	0.075	0.116	0.091	0.07
MgO	0.08	0.04	0.06	0.14	0.15	0.08	0.1	0.09	0.07	0.04	0.02
CaO	2.56	2.28	2.83	3.12	3.27	2.03	1.61	2.52	3.57	2.07	1.74
Na ₂ O	3.73	5.02	4.23	3.65	3.37	4.62	4.68	4.46	4.05	5.2	5.29
K ₂ O	5.19	5.32	5.2	6.44	6.58	6.12	5.99	6.12	5.12	5.4	5.28
TiO ₂	0.172	0.108	0.148	0.178	0.162	0.193	0.179	0.147	0.12	0.137	0.127
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01
LOI	2.71	2.03	2.44	2.78	3.12	2.1	1.91	2.43	3.39	2.02	1.63
Total	97.83	98.07	98.51	98.85	97.8	97.9	99.32	99.51	99.9	99.03	99.03
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	18	20	17	18	14	14	14	16	15	18	18
V	5	< 5	< 5	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	120	70	80	130	140	80	90	100	110	100	130
Ga	48	49	45	53	54	53	55	54	46	52	50
Ge	3	2	3	3	4	3	3	3	3	2	2
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	179	186	171	207	212	196	204	196	164	173	172
Sr	44	30	34	33	29	29	25	43	80	48	40
Zr	1631	1435	1843	1728	1678	1681	1815	2096	1331	1429	1885
Nb	219	226	248	291	239	215	263	284	223	222	268
Mo	3	3	< 2	< 2	< 2	< 2	< 2	< 2	< 2	8	13
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	18	18	25	17	9	10	13	14	20	13	17
Sb	0.6	0.5	0.6	0.7	0.6	0.6	0.6	0.8	0.7	0.6	0.9
Cs	0.5	< 0.5	< 0.5	0.9	1.1	0.6	0.7	< 0.5	< 0.5	0.7	0.6
Ba	89	91	99	142	132	99	101	94	74	80	78
Hf	33.7	30.4	43.4	40.4	38.2	38.6	41.1	49.6	32.6	32.5	45.8
Ta	15.5	15	17.3	21.1	19.5	16.2	18.7	20.8	15.5	15.6	18.5
W	1	3	2	1	1	1	< 1	1	< 1	1	1
Tl	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3
Pb	14	< 5	< 5	< 5	< 5	< 5	< 5	6	9	9	12
Th	34.6	28.5	33.4	31.2	27.4	27.7	26.3	30.4	23.6	23.7	25.6
U	7.2	7.5	8.3	9.3	8.8	7.3	9	10.8	8	7.9	8.7
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	207	176	195	240	199	172	180	239	156	197	176
La	175	159	166	185	178	222	157	187	132	183	150
Ce	348	311	327	361	352	432	311	360	255	358	289
Pr	40.1	35.7	38.1	41.1	40.4	50.3	35.6	40.8	28.8	42	33.4
Nd	153	132	143	154	151	189	133	151	108	158	123
Sm	33.8	29.5	30.7	33.9	32.9	39.1	28.5	33.3	23.5	33.1	27.4
Eu	2.18	2.05	2.21	2.34	2.29	2.55	1.85	2.22	1.62	2.1	2.12
Gd	31.2	27.5	28.9	32	30.2	34.3	25.7	31.2	22.2	30.9	26.1
Tb	5.7	4.8	5.2	6	5.4	5.3	4.5	5.8	4.1	5.3	4.7
Dy	35.3	30.2	32.4	39.3	34.7	31.6	29	38.2	25.8	33.5	30.3
Ho	7.2	6	6.7	8.2	6.9	6.1	6.1	8.1	5.3	6.8	6.1
Er	21.8	18.1	21.1	24.8	21.3	18.5	19.9	25.2	16.2	20.6	18.7
Tm	3.26	2.74	3.18	3.69	3.14	2.84	3.15	3.84	2.51	3.03	2.84
Yb	20.3	16.7	19.3	22.4	19	17.4	20.4	23.5	15.2	18.1	17.5
Lu	2.83	2.32	2.74	3.07	2.72	2.57	2.92	3.15	2.09	2.45	2.41
TREE	1086.67	953.61	1021.53	1156.8	1078.95	1225.56	958.62	1152.31	798.32	1093.88	909.57

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology		Syenite									
Sample	12020	12021	12022	12023	12024	12025	12026	12027	12028	12029	12030
from	193.0	194.0	195.0	210.0	211.0	212.0	213.0	214.0	215.0	215.4	216.0
to	194.0	195.0	196.0	211.0	212.0	213.0	214.0	215.0	215.4	216.0	217.2
(wt%)											
SiO ₂	61.83	61.65	66.61	64.08	60.86	62.08	63.25	64.71	63.16	42.52	44.63
Al ₂ O ₃	14.47	12.92	15	14.03	13.18	13.33	14.29	14.18	14.09	15.83	16.38
Fe ₂ O ₃ (T)	5.52	5.07	3.72	4.28	5.54	4.96	5.62	4.31	4.01	11.88	11.83
MnO	0.074	0.107	0.122	0.107	0.164	0.127	0.136	0.138	0.1	0.212	0.178
MgO	0.13	0.09	0.03	0.09	0.15	0.12	0.13	0.1	0.1	3.7	4.42
CaO	3.8	5.68	2.08	2.85	3.8	3.47	2.82	3.6	2.79	7.43	6.47
Na ₂ O	4.04	4.17	5.29	4.46	3.97	3.8	3.87	4.39	4.96	3.06	3.58
K ₂ O	5.41	4.63	5.06	4.76	4.76	4.91	5.42	4.94	4.08	1.87	2.61
TiO ₂	0.156	0.137	0.148	0.116	0.173	0.139	0.136	0.145	0.164	2.424	2.504
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	0.02	0.01	< 0.01	0.03	< 0.01	0.45	0.44
LOI	2.96	3.13	1.91	3.43	5.45	4.8	4.31	4.01	4.38	10.82	5.72
Total	98.4	97.57	99.97	98.2	98.06	97.73	99.98	100.5	97.85	100.2	98.75
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	13	14
Be	14	19	23	21	22	27	21	22	25	9	4
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	163	177
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	32	34
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	20	30
Cu	< 10	20	< 10	< 10	10	10	< 10	< 10	< 10	20	20
Zn	110	150	180	90	150	160	130	114	270	200	170
Ga	48	45	50	47	44	46	51	49	48	23	21
Ge	3	3	3	2	2	2	3	3	2	2	1
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	6	12	6
Rb	157	144	165	161	158	173	189	168	117	59	87
Sr	47	86	53	43	62	83	76	79	70	504	916
Zr	1822	1916	1730	1765	1680	3037	1250	1715	2104	447	222
Nb	213	252	295	225	253	334	253	241	241	33	20
Mo	4	4	7	3	16	5	< 2	< 2	3	2	< 2
Ag										3.5	1.7
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	12	15	19	14	17	16	13	14	15	2	1
Sb	< 0.5	1	0.8	0.6	0.8	0.8	0.6	< 0.5	0.9	0.7	0.7
Cs	< 0.5	0.7	0.8	0.6	1.1	1.1	1.2	0.9	1.1	4.6	7.3
Ba	90	92	97	65	94	75	72	64	111	227	523
Hf	41	44.7	40	38.3	37.6	74.2	27.9	36.6	46.2	9.7	4.1
Ta	17.2	17.7	20.1	17	17	25.2	17.4	18.4	17.3	2.3	1.2
W	< 1	1	2	2	3	2	1	< 1	1	1	< 1
Tl	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.1	0.2	0.2	0.3
Pb	8	11	23	6	10	8	5	8	22	49	25
Th	30.8	41.7	55.4	26.1	33.3	34.5	31.6	28.1	26.7	2	0.9
U	9.1	9.3	9.6	9.3	9.1	14.7	8.3	9.5	11.5	1.4	0.5
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	203	249	267	158	194	226	192	194	187	34	19
La	195	193	182	183	178	175	207	190	200	27.7	19
Ce	389	377	359	379	367	350	407	377	402	59.4	41.5
Pr	44.4	42.7	40.4	44.4	42.4	40.2	45.4	43.7	45.8	7.33	5.35
Nd	167	159	152	169	162	147	168	163	172	31.2	23.3
Sm	36.3	35.6	34.9	36.7	36.2	33.1	36.9	35.6	36.8	7.2	5.6
Eu	2.44	2.43	2.39	2.51	2.28	2.35	2.42	2.28	2.46	2	1.94
Gd	32.5	33.5	33.8	31.1	32.7	30.7	32.9	31.4	32.6	7	5
Tb	5.7	6.3	6.6	5.2	5.7	6	5.6	5.5	5.7	1.2	0.7
Dy	35.1	41.5	43.5	30.4	35.8	39.2	35	32.5	34.5	6.9	3.9
Ho	7.1	8.4	9.1	5.9	7.4	8.2	6.9	6.6	6.9	1.3	0.7
Er	22.4	25.8	28.5	17.2	21.9	24.9	20.6	20.3	20.5	3.5	1.9
Tm	3.23	3.89	4.27	2.62	3.29	3.62	3.06	2.93	2.99	0.49	0.27
Yb	19.7	23.6	25.8	15.7	20	21.4	19.1	18	18.4	3	1.7
Lu	2.86	3.23	3.44	2.23	2.82	3.02	2.65	2.51	2.6	0.41	0.23
TREE	1165.73	1204.95	1192.7	1082.96	1111.49	1110.69	1184.53	1125.32	1170.25	192.63	130.09

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology		Syenite									
Sample	12031	12032	12033	12035	12036	12037	12038	12039	12040	12041	12042
from	217.2	218.0	219.0	220.0	221.0	222.0	223.0	224.0	225.0	226.0	227.0
to	218.0	219.0	220.0	221.0	222.0	223.0	224.0	225.0	226.0	227.0	228.0
(wt%)											
SiO ₂	65.91	65.59	65.92	66.24	66.16	65.5	65.71	65.33	66.68	66.87	64.58
Al ₂ O ₃	14.05	14.52	14.13	14.79	14.44	14.42	14.4	14.35	14.54	14.72	14.02
Fe ₂ O ₃ (T)	4.8	4.4	4.62	4.27	4.95	4.95	4.68	4.39	5.47	4.87	5.48
MnO	0.166	0.138	0.168	0.129	0.162	0.164	0.157	0.13	0.166	0.146	0.167
MgO	0.06	0.04	0.04	0.03	0.04	0.03	0.02	0.03	0.03	0.02	0.02
CaO	1.99	1.65	2.36	1.31	1.31	1.41	1.17	1.38	1.57	1.29	1.29
Na ₂ O	5.3	5.28	5.2	5.41	5.52	5.88	5.74	5.52	5.85	5.8	5.85
K ₂ O	4.64	5.13	5.11	5.18	5.04	5.09	4.92	5	5.04	5.2	4.99
TiO ₂	0.191	0.144	0.149	0.131	0.163	0.175	0.168	0.146	0.209	0.171	0.207
P ₂ O ₅	0.02	0.03	0.02	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	0.02	0.02
LOI	2.98	2.67	3.2	1.96	2.19	1.59	1.18	1.57	1.2	1.33	1.55
Total	100.1	99.6	100.9	99.46	99.99	99.21	98.16	97.86	100.8	100.4	98.18
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	19	20	21	22	21	19	18	20	20	23	20
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	280	234	230	250	280	240	260	280	310	260	270
Ga	46	50	46	47	47	46	47	48	48	44	45
Ge	3	3	3	2	3	3	3	3	3	3	3
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	140	173	177	184	177	170	172	188	182	179	176
Sr	94	70	63	43	43	56	39	43	46	52	53
Zr	2076	1683	1652	1951	2149	1698	1559	1578	1842	1521	1665
Nb	275	237	227	268	283	232	229	250	263	244	227
Mo	3	5	2	4	5	6	6	5	4	3	4
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	15	16	14	17	16	17	15	18	19	17	19
Sb	0.9	< 0.5	0.7	0.8	0.6	0.6	0.6	0.6	0.7	< 0.5	< 0.5
Cs	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.5	< 0.5	0.5
Ba	92	66	59	56	52	59	55	56	60	59	55
Hf	42.4	36.6	35.9	43.8	50.1	37.7	34.9	37	39.5	31.1	35.4
Ta	19.1	17.7	16.5	19.6	20.5	17.2	16.4	17.9	16.7	18.2	15
W	1	2	2	2	2	< 1	2	2	1	2	1
Tl	0.5	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.2	0.3
Pb	42	49	28	33	29	43	46	46	50	45	39
Th	25.1	40.4	31.5	38	45.7	35	25	29.3	27.5	24.6	25.6
U	10.1	8.7	8.1	9.6	9.9	8.7	8.9	9.1	8.8	8.6	7.6
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	186	217	226	201	208	197	179	179	209	217	225
La	189	203	163	175	182	184	173	174	172	157	205
Ce	389	397	320	340	368	367	344	346	356	325	419
Pr	44.7	44.9	36.2	38.6	42.5	42.8	39.9	40.1	42.1	39.3	50.4
Nd	168	168	135	143	160	160	153	152	162	150	191
Sm	36.5	35.9	29.5	30.9	34.3	34.1	32	32.9	36.2	33.6	42.8
Eu	2.46	2.43	2.09	2.15	2.49	2.3	2.21	2.27	2.41	2.27	2.9
Gd	32.8	32.9	29.2	29.7	31.8	32.1	30.4	30.3	33.9	32.6	40.3
Tb	5.6	5.7	5.3	5.1	5.5	5.3	5.1	5.2	5.9	5.9	6.6
Dy	33.8	36.3	33.8	32.2	34.6	33.6	30.9	31.3	35.8	35.8	39.6
Ho	6.6	7.2	7.1	6.6	7.1	6.8	6.2	6.3	7.3	7.1	7.7
Er	19.7	22.7	22.4	19.7	22.5	21.1	19.1	19.2	21.8	21.5	23.8
Tm	2.85	3.25	3.3	2.91	3.37	3.2	2.85	2.81	3.26	3.15	3.45
Yb	17.9	19.4	20.3	18.3	20.8	20.2	17.6	17.4	19.7	19.1	20.8
Lu	2.54	2.73	2.86	2.5	3.01	2.86	2.46	2.48	2.88	2.72	3
TREE	1137.45	1198.41	1036.05	1047.66	1125.97	1112.36	1037.72	1041.26	1110.25	1052.04	1281.35

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology		Syenite									
Sample	12043	12044	12045	12046	12047	12048	12049	12050	12051	12052	12053
from	228.0	229.0	230.0	231.0	232.0	233.0	234.0	235.0	236.0	237.0	238.0
to	229.0	230.0	231.0	232.0	233.0	234.0	235.0	236.0	237.0	238.0	239.0
(wt%)											
SiO ₂	65.22	66.27	66.36	65.36	66.3	65.75	67.14	66.68	64.85	65.2	64.86
Al ₂ O ₃	14	14.16	14.81	13.64	14.38	14.27	14.47	14.77	14.36	13.98	13.73
Fe ₂ O ₃ (T)	5.27	4.87	4.8	6.05	5.29	5.06	5.49	4.93	5.08	5.08	5.38
MnO	0.169	0.162	0.157	0.195	0.175	0.151	0.148	0.137	0.144	0.165	0.114
MgO	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.05	0.05
CaO	1.23	1.31	1.16	1.26	1.07	1.06	1.02	1.18	1.41	1.76	1.62
Na ₂ O	5.9	5.76	6.11	6.17	6.27	6.15	6.4	6.21	5.83	5.58	5.33
K ₂ O	4.99	5.03	5.09	4.85	4.99	4.88	5.06	4.93	4.81	4.73	4.75
TiO ₂	0.191	0.169	0.17	0.234	0.204	0.187	0.203	0.185	0.202	0.214	0.182
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	0.02	0.02	< 0.01	0.02	0.02	0.02	0.02
LOI	0.94	1.47	0.94	0.67	0.62	0.72	0.64	0.92	1.19	2.22	2.2
Total	97.92	99.21	99.63	98.46	99.36	98.28	100.6	99.98	97.93	98.99	98.24
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	22	26	24	20	21	23	22	27	25	25	25
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	10	< 10
Zn	310	290	300	350	340	362	310	342	345	320	220
Ga	45	47	48	46	48	49	46	51	49	50	47
Ge	3	3	3	3	3	4	3	3	4	3	3
As	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Rb	184	193	189	171	167	179	178	197	193	197	191
Sr	61	62	53	48	41	37	38	40	36	57	38
Zr	1854	1873	1707	1813	1396	1502	1894	2354	1549	1477	2245
Nb	263	294	251	226	200	226	235	291	250	241	228
Mo	3	2	4	4	4	4	3	3	4	3	4
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	18	22	16	16	13	18	15	19	18	19	16
Sb	0.6	0.6	< 0.5	< 0.5	< 0.5	< 0.5	0.6	< 0.5	< 0.5	0.7	0.8
Cs	< 0.5	< 0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.6	0.5	< 0.5
Ba	51	49	52	68	68	64	60	64	54	52	55
Hf	41.3	40.8	36.4	37.9	28.8	32.1	40.1	50.7	33.6	31	50.3
Ta	17.3	19.6	17.2	14.2	12.7	15.1	15.4	21	16.9	15.9	15.8
W	1	1	1	< 1	< 1	< 1	< 1	< 1	< 1	2	< 1
Tl	0.3	0.3	0.3	0.2	0.3	0.1	0.2	0.1	0.1	0.3	0.2
Pb	40	63	48	49	57	55	43	46	47	31	14
Th	36.4	30.7	33.8	27.5	23.8	37.5	25.4	27.6	35.2	47.7	31.8
U	8.3	10	8.7	7.9	8.1	7.7	8.7	11.8	10.3	9.7	12.1
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Y	206	209	209	220	205	230	205	251	257	291	236
La	179	168	175	194	224	200	190	237	203	201	194
Ce	369	347	361	413	461	422	410	514	430	430	416
Pr	43.9	41.1	43.5	50	54.7	49.8	48.9	60.3	50.8	50.6	49.8
Nd	171	155	166	199	208	194	187	234	196	198	191
Sm	38.8	36.3	38.7	44.7	45.6	44.4	41.9	51.9	44.2	45.5	42.8
Eu	2.71	2.65	2.64	3.01	2.95	3.01	2.92	3.38	2.94	2.97	2.83
Gd	37	36	36.7	42.1	40.5	39.1	39	45.2	40.2	42	38.3
Tb	6.1	5.8	6.2	6.9	6.6	6.9	6.2	7.7	7.3	7.9	6.4
Dy	37.3	35.3	37.3	41.1	38.4	41.3	37.1	46	45	49.6	39.5
Ho	7.3	7	7.4	7.9	7.5	8.1	7.2	9.2	8.7	10.1	8.1
Er	21.5	21.6	22.3	23.8	21.6	24.7	21.7	27.5	25.3	32.4	25.5
Tm	3.22	3.29	3.37	3.62	3.03	3.59	3.34	3.99	3.7	5.04	3.82
Yb	19.7	19.9	19.7	21.5	18.1	21.4	19.9	23.5	22	29.6	23
Lu	2.85	2.91	2.79	3.08	2.59	3.06	2.98	3.35	3.03	4.01	3.34
TREE	1145.38	1090.85	1131.6	1273.71	1339.57	1291.36	1223.14	1518.02	1339.17	1399.72	1280.39

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology		Syenite									
Sample	12054	12055	12056	12057	12058	12059	12060	12061	12062	12063	12064
from	239.0	240.0	241.0	242.0	243.2	243.8	245.0	245.8	247.0	248.0	249.0
to	240.0	241.0	242.0	243.2	243.8	245.0	245.8	247.0	248.0	249.0	250.0
(wt%)											
SiO ₂	65.95	67.69	65.95	65.09	68.52	66.48	65.64	65.81	67.46	64.86	64.6
Al ₂ O ₃	14.82	14.51	14.83	14.57	12.6	8.14	10.5	14.65	15.12	13.91	13.88
Fe ₂ O ₃ (T)	3.71	4.52	5.22	5.19	4.47	9.91	8.28	5.07	4.13	5.3	5.52
MnO	0.092	0.118	0.134	0.132	0.125	0.29	0.237	0.131	0.129	0.171	0.183
MgO	0.03	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.02	0.02	0.03
CaO	0.93	0.89	0.99	1.38	1.63	1.99	2.41	2.08	1.17	1.42	1.46
Na ₂ O	5.56	6.05	6.01	5.31	5.77	4.04	4.85	5.14	6.07	6.04	5.94
K ₂ O	5.07	5.13	4.99	4.93	3.33	3.48	3.25	4.88	5.07	4.81	4.69
TiO ₂	0.119	0.162	0.209	0.181	0.134	0.298	0.26	0.189	0.138	0.2	0.207
P ₂ O ₅	0.02	< 0.01	0.04	0.03	0.01	0.02	0.03	< 0.01	< 0.01	0.04	0.03
LOI	1.62	1.2	1.12	2.52	2.41	2.38	2.22	2.2	1.42	1.25	1.29
Total	97.91	100.3	99.51	99.37	99.03	97.06	97.71	100.2	100.7	98.02	97.82
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	22	15	14	13	11	11	15	25	25	25	23
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	10	20	10	10	< 10	< 10	< 10	10	< 10	< 10	< 10
Zn	240	250	300	283	280	892	525	170	220	315	310
Ga	51	48	50	50	56	46	54	50	47	49	49
Ge	3	3	4	3	3	6	6	3	3	4	4
As	< 5	< 5	< 5	< 5	< 5	< 5	7	< 5	< 5	< 5	< 5
Rb	205	169	173	229	176	174	156	218	210	188	189
Sr	32	31	29	33	48	81	95	49	52	56	51
Zr	972	1193	1313	1459	1025	3778	7406	1728	1966	2314	2121
Nb	152	185	187	260	266	556	718	298	329	291	293
Mo	3	6	5	< 2	< 2	< 2	13	< 2	4	3	4
Ag	8.3										
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	13	12	13	16	17	40	45	21	23	28	25
Sb	0.6	0.6	< 0.5	< 0.5	0.8	1.2	1.6	1.3	0.9	< 0.5	1
Cs	0.6	0.6	0.6	< 0.5	< 0.5	< 0.5	4	1.9	0.5	< 0.5	< 0.5
Ba	55	56	61	51	34	60	201	174	57	55	51
Hf	21.3	25.5	27.8	33.6	23.9	86.6	168	39.1	46.4	49.8	43.9
Ta	10.6	11.9	12	19.6	19.3	47.9	53	20.2	24.1	20.7	19.2
W	< 1	< 1	< 1	1	1	2	4	2	1	2	1
Tl	0.3	0.2	< 0.1	0.1	0.2	< 0.1	< 0.1	0.3	0.4	0.1	0.3
Pb	16	16	24	15	12	45	37	11	28	46	46
Th	37.8	22.2	21.5	25.7	21.2	41.1	478	42.3	32.5	36.3	38.8
U	7.1	6.5	5.7	8.2	8.9	20.1	33.4	10.8	13.1	10.7	9.4
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.6	0.5	< 0.4	< 0.4	< 0.4	< 0.4
Y	165	145	138	140	178	387	621	207	218	227	246
La	187	256	336	222	162	296	570	167	139	228	278
Ce	397	512	620	392	313	586	1080	340	283	444	538
Pr	47.2	58.5	66.8	41.5	35.5	66	120	39.1	31.9	50.6	59.7
Nd	181	222	240	147	136	243	443	147	118	189	214
Sm	38.5	42.5	40.2	27.5	31.9	57.7	101	32.5	27	40.2	42.9
Eu	2.44	2.59	2.48	1.91	1.92	3.47	6.26	2.42	1.99	2.71	2.82
Gd	33.8	34	31.2	23.9	30.4	54.5	94.3	30.4	28.1	36.1	40
Tb	5.3	5	4.6	4	5.2	10.2	16.8	5.5	5.4	6.3	6.7
Dy	32	28.5	26.6	24.2	31	65.1	102	35.5	35.1	39.3	42.4
Ho	6.1	5.4	5.1	4.9	6	13.8	21.5	7.4	7.4	7.9	8.5
Er	18.3	16.1	15.9	15.2	17.2	47.4	72.2	23.8	23.6	24.5	26.1
Tm	2.63	2.39	2.41	2.38	2.52	7.96	11.8	3.64	3.57	3.6	3.89
Yb	15.8	14.1	15.5	14.6	15.1	52.5	74.9	22.8	22.2	22	23.9
Lu	2.22	2.15	2.33	2.14	2.15	7.61	10.9	3.23	3.08	3.15	3.31
TREE	1134.29	1346.23	1547.12	1063.23	967.89	1898.24	3345.66	1067.29	947.34	1324.36	1536.22

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology	Syenite										Granite
Sample	12065	12066	12067	12068	12069	12070	12071	12072	12073	12075	12076
from	250.0	251.0	252.0	252.3	252.8	254.0	268.0	269.0	269.6	270.0	271.0
to	251.0	252.0	252.3	252.8	254.0	255.0	269.0	269.6	270.0	271.0	272.0
(wt%)											
SiO ₂	65.8	65.09	64.74	45.36	64.89	66.78	65.61	65.58	65.25	66.35	70.23
Al ₂ O ₃	14.65	14.4	14.74	12.74	14.08	14.24	13.18	13.87	9.34	8.05	10.5
Fe ₂ O ₃ (T)	5.14	4.01	3.25	19.63	4.55	4.01	5.76	5.19	7.11	10.1	5.21
MnO	0.168	0.147	0.111	0.363	0.163	0.14	0.162	0.176	0.391	0.394	0.161
MgO	0.05	0.07	0.09	1.58	0.06	0.03	0.04	0.05	0.05	0.05	0.04
CaO	1.43	2.52	2.38	1.11	1.74	1.26	1.6	1.62	3.17	2.73	1.44
Na ₂ O	5.8	5.33	5.31	3.21	5.5	5.64	4.65	4.71	3.01	2.85	2.61
K ₂ O	4.87	4.88	4.84	2.86	4.81	4.85	4.83	5.2	3.91	3.05	5.53
TiO ₂	0.188	0.168	0.145	1.82	0.172	0.123	0.186	0.195	0.271	0.261	0.15
P ₂ O ₅	0.02	0.03	< 0.01	0.3	0.05	0.02	0.03	< 0.01	< 0.01	< 0.01	< 0.01
LOI	1.68	2.82	2.84	11.64	2.36	1.65	2.33	2.7	4.65	5.01	2.29
Total	99.8	99.47	98.46	100.6	98.39	98.73	98.38	99.28	97.15	98.86	98.18
(ppm)											
Sc	< 1	< 1	< 1	9	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	25	29	28	18	28	29	17	25	43	61	47
V	< 5	< 5	5	108	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	40	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	300	269	330	620	300	279	401	390	700	922	490
Ga	48	48	45	26	46	50	48	52	53	49	52
Ge	3	3	2	4	3	3	3	3	4	5	3
As	< 5	< 5	< 5	< 5	< 5	< 5	8	< 5	7	9	6
Rb	195	193	192	166	193	201	224	318	244	196	375
Sr	48	71	52	58	56	47	49	41	102	107	56
Zr	2039	2084	1927	407	1546	1963	1575	1554	6313	2252	2669
Nb	272	254	229	108	242	284	222	353	679	570	396
Mo	3	< 2	2	7	3	3	3	< 2	< 2	< 2	3
Ag				3.1							
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	24	23	20	9	20	15	16	21	40	50	31
Sb	0.8	< 0.5	0.7	0.8	0.7	< 0.5	< 0.5	1.1	1.7	1	< 0.5
Cs	0.5	< 0.5	< 0.5	4.8	0.5	0.5	0.5	0.6	< 0.5	< 0.5	0.5
Ba	50	44	45	77	47	46	51	40	46	35	50
Hf	43.7	45.5	42.4	7.9	34	43.1	33.7	33.3	159	50.9	61.2
Ta	18	19	19.2	4.3	15.4	20.7	13.1	21.1	53.5	43.3	29.9
W	1	< 1	< 1	2	1	1	1	2	2	3	1
Tl	0.3	0.1	0.3	0.3	0.3	0.2	0.2	0.4	0.3	< 0.1	0.7
Pb	48	36	17	27	40	50	39	28	68	110	103
Th	52.4	33.2	34.2	10.3	40.2	35.7	29.5	66	35.5	63.1	57.4
U	10	9.6	9.5	4.1	7.8	10.9	7.6	10.9	23.5	20.3	16.7
Bi	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.7	0.5
Y	241	214	253	65	218	231	171	342	373	437	409
La	174	185	154	38.4	143	161	209	179	304	369	227
Ce	339	352	311	80.1	286	324	390	373	686	777	480
Pr	38.5	40.1	36.3	9.83	33.3	36.4	43.6	43.9	84.2	92.9	57.9
Nd	147	148	138	39.3	125	135	164	171	336	358	221
Sm	31.7	32.4	31.2	9.6	29.1	31.2	33.3	44.2	75.5	83.9	56.3
Eu	2.3	2.37	2.35	1.22	2.21	2.25	2.16	2.88	11.1	4.31	3.58
Gd	31	29.3	30.7	9.9	28.9	29.3	28.1	47.9	70.1	76.9	58.2
Tb	5.5	5.2	6.1	1.8	5.5	5.5	4.8	9.7	10.8	13.1	11.1
Dy	35.9	33.1	40.2	10.9	35	35.9	29	61.3	65.4	77.9	68.2
Ho	7.5	6.8	8.5	2.3	7.4	7.6	5.9	11.8	13.3	15.1	13.8
Er	24.3	21.2	26	6.7	22.8	25.7	18.5	32.5	44.4	44.5	42.5
Tm	3.62	3.18	3.84	0.93	3.4	4.01	2.84	4.12	7.46	6.39	6.23
Yb	23	19.1	23.2	5.5	20.5	25.1	17.9	21.4	49.8	37.3	36.6
Lu	3.18	2.69	3.12	0.78	2.86	3.47	2.63	2.92	7.47	5.19	4.97
TREE	1107.5	1094.44	1067.51	282.26	962.97	1057.43	1122.73	1347.62	2138.53	2398.49	1696.38

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology		Granite					Pegmatite	Granite				
Sample	12077	12078	12079	12080	12081		12082	12083	12084	12085	12086	12087
from	272.0	273.0	274.0	275.0	276.0		277.0	278.0	279.0	280.0	281.0	282.0
to	273.0	274.0	275.0	276.0	277.0		278.0	279.0	280.0	281.0	282.0	283.0
(wt%)												
SiO ₂	72.05	70.88	68.6	70.09	69.05		68.6	69.95	73.79	71.38	69.91	70.35
Al ₂ O ₃	10.73	10.22	8.5	8.6	9.61		10.27	10.39	8.87	9.03	9.68	8.41
Fe ₂ O ₃ (T)	4.9	5.85	8.3	7.21	6.67		5.45	4.7	4.76	7.32	5.17	6.11
MnO	0.128	0.167	0.264	0.169	0.16		0.197	0.136	0.132	0.189	0.15	0.189
MgO	0.04	0.05	0.06	0.04	0.02		0.02	0.02	0.01	0.06	0.04	0.03
CaO	1.4	1.81	2.6	1.11	1.39		1.54	0.75	1	2.45	3.71	2.83
Na ₂ O	3.07	2.8	2.85	3.85	4.33		5.41	3.94	3.69	2.42	3.37	2.53
K ₂ O	4.82	5.38	3.67	2.96	3.83		2.15	5.08	3.96	4.25	3.61	4.25
TiO ₂	0.131	0.159	0.204	0.175	0.196		0.139	0.203	0.106	0.143	0.104	0.215
P ₂ O ₅	< 0.01	< 0.01	0.01	0.02	0.01		0.01	0.02	0.01	0.02	0.02	0.02
LOI	1.94	2.26	3.15	2.02	1.63		2.07	1.17	1.37	2.94	2.9	3.03
Total	99.2	99.58	98.22	96.25	96.91		95.85	96.36	97.7	100.2	98.66	97.98
(ppm)												
Sc	< 1	< 1	< 1	< 1	< 1		< 1	< 1	< 1	< 1	< 1	< 1
Be	50	24	36	103	283		115	54	16	19	26	48
V	< 5	< 5	< 5	< 5	< 5		< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20		< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1		< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20		< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	20		10	< 10	< 10	< 10	< 10	< 10
Zn	530	470	830	810	840		1120	570	410	670	500	530
Ga	62	55	51	56	60		67	60	46	48	52	46
Ge	3	3	4	5	4		4	4	3	3	3	4
As	6	5	8	16	17		9	9	6	8	6	12
Rb	350	368	250	220	269		163	392	275	283	246	263
Sr	50	52	87	87	117		91	106	115	93	182	126
Zr	9378	1798	4138	9690	6126		12560	6877	3033	2318	1475	9300
Nb	753	530	751	951	792			853	547	553	504	660
Mo	< 2	< 2	< 2	< 2	< 2		< 2	< 2	< 2	< 2	< 2	< 2
Ag												
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	47	53	58	59	52		64	55	32	40	35	64
Sb	1	< 0.5	< 0.5	< 0.5	< 0.5		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	1.2
Cs	0.5	0.6	0.5	0.7	0.5		0.5	0.8	0.6	0.5	< 0.5	< 0.5
Ba	78	42	52	72	59		94	65	37	38	31	111
Hf	227	43.5	99.6	241	146		315	173	73.1	52.9	35.6	219
Ta	58.3	37.8	55.7	68.7	56.8		81	69.9	42.4	36.7	34.1	50.4
W	2	< 1	< 1	< 1	< 1		< 1	< 1	< 1	< 1	< 1	< 1
Tl	0.6	0.5	0.4	0.3	0.3		0.2	0.5	0.4	0.4	0.4	0.4
Pb	68	61	156	96	145		97	105	54	61	57	85
Th	104	78.3	67.9	166	155		101	130	51	124	79.2	112
U	31	16.6	26.3	40.1	33.9		42.5	32.9	19.3	21.2	17.5	28.3
Bi	0.5	0.5	0.8	0.7	0.5		0.7	0.8	< 0.4	< 0.4	0.5	0.6
Y	634	262	442	918	769		772	1092	468	469	422	824
La	259	253	283	676	416		505	440	276	318	269	369
Ce	563	514	608	1370	890		1060	905	578	645	559	766
Pr	68	59.8	73.5	169	108		126	109	70.3	75.4	67	94.7
Nd	254	228	275	652	403		480	405	269	282	248	366
Sm	64.6	51.5	65.5	149	96.1		106	98.9	67.1	67.5	59.1	88.7
Eu	4.33	2.86	4.05	8.9	6.01		6.15	6.48	4.13	4.28	3.82	5.96
Gd	68.1	46	62.5	137	94.1		95.2	109	68.1	64.5	57	92.2
Tb	14.4	7.6	11.5	24.3	18.5		17.1	24.4	12.7	12.2	10.8	18.5
Dy	98.6	45.4	72	152	122		115	181	78.7	75.3	69.8	126
Ho	22.4	9	15.2	31	25.5		25.7	42.2	15.8	14.6	14.5	27.9
Er	78.4	28.7	49.6	99.6	82.4		91.7	140	46.8	43.8	45.2	97.8
Tm	12.9	4.34	7.65	14.9	12.3		15.3	20.4	6.41	5.77	6.31	15.5
Yb	80.4	25.5	46.4	88.1	71.5		95.3	104	35	30	33.6	95.8
Lu	11.5	3.63	6.59	11.8	9.43		13.5	13	4.57	3.86	4.04	13.7
TREE	2233.63	1541.33	2022.49	4501.6	3123.84		3523.95	3690.38	2000.61	2111.21	1869.17	3001.76

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-12)

Appendix 1

Lithology Pegmatite		Granite					
Sample	12088	12089	12090	12091	12092	12093	12094
from	283.0	284.0	285.0	286.0	287.1	288.0	289.0
to	284.0	285.0	286.0	287.1	288.0	289.0	290.0
(wt%)							
SiO ₂	68.3	69.98	68.33	69.91	66.99	65.17	67.05
Al ₂ O ₃	8.28	9.5	9.26	9.09	8.96	10.13	11.02
Fe ₂ O ₃ (T)	6	6.26	5.79	6.04	6.13	5.81	5.23
MnO	0.219	0.191	0.224	0.297	0.262	0.241	0.203
MgO	0.06	0.1	0.04	0.03	0.11	0.14	0.12
CaO	2.98	2.87	3.82	3.03	3.45	3.56	3.1
Na ₂ O	2.18	3.15	3.25	3.29	2.58	3.47	3.92
K ₂ O	4.24	3.64	3.85	3.9	4.29	3.63	3.58
TiO ₂	0.182	0.154	0.245	0.194	0.192	0.105	0.066
P ₂ O ₅	< 0.01	< 0.01	0.04	0.01	0.02	< 0.01	< 0.01
LOI	3.9	3.51	3.11	3.13	4.91	5.07	4.15
Total	96.35	99.35	97.96	98.91	97.88	97.35	98.43
(ppm)							
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	29	36	36	16	22	29	22
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	590	620	650	560	300	280	230
Ga	47	52	51	50	48	56	57
Ge	3	3	4	3	3	2	2
As	8	< 5	8	< 5	< 5	< 5	< 5
Rb	278	238	250	258	270	255	223
Sr	124	98	160	153	123	111	85
Zr	10870	1616	6429	3990	2453	2470	661
Nb	861	491	912	865	647	358	232
Mo	3	139	91	< 2	2	< 2	< 2
Ag							5.3
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	59	44	53	46	36	26	14
Sb	1	< 0.5	1.5	< 0.5	< 0.5	< 0.5	< 0.5
Cs	0.5	0.5	0.6	0.5	< 0.5	< 0.5	< 0.5
Ba	76	41	72	64	41	36	26
Hf	274	41.1	139	102	61.5	66.6	15.1
Ta	73.5	35	70.7	67.3	53.5	27.3	15.4
W	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tl	0.4	0.4	0.4	0.4	0.4	0.3	0.4
Pb	69	49	100	78	27	24	14
Th	68.5	51.5	254	51.4	102	62.7	28
U	33.2	21.5	47.3	25.4	22.8	11.9	9
Bi	0.4	0.6	1.2	0.6	< 0.4	< 0.4	< 0.4
Y	608	381	1067	390	355	216	231
La	373	170	383	261	260	196	209
Ce	769	370	778	550	540	401	410
Pr	92.6	45.5	92.8	65.8	63.3	48.2	49.1
Nd	348	176	346	242	232	182	192
Sm	74	46.4	86.5	57.6	56.1	43.2	42.6
Eu	11.1	2.77	5.88	3.23	3.1	2.36	2.2
Gd	68.6	49.3	99.5	55.1	55.7	41.2	38.1
Tb	12.7	10.2	23.4	10.5	10.5	7.1	6.7
Dy	89.5	65.3	173	70.1	66	43	42.2
Ho	21.3	13.6	40.3	15.4	14.2	8.6	8.2
Er	82.4	41.9	134	50.7	46.2	27	23
Tm	14.5	5.87	19.8	7.51	7.01	4.07	3.02
Yb	94.1	30.6	114	44	41.6	23.3	15.1
Lu	13.9	3.83	15	6.17	5.74	3.22	1.92
TREE	2672.7	1412.27	3378.18	1829.11	1756.45	1246.25	1274.14

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite										
Sample	12115	12116	12117	12118	12119	12120	12121	12122	12123	12124	12125
from	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00
to	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
(wt%)											
SiO ₂	70.88	72.37	70.22	71.13	72.8	72.32	68.09	70.32	64.55	63.86	71.07
Al ₂ O ₃	9.22	9.1	9.34	10.15	10.38	10.35	10.41	9.59	10.47	10.05	10.02
Fe ₂ O ₃ (T)	6.72	5.87	6.73	7.67	6.19	5.27	9.42	5.95	12.71	12.69	6.33
MnO	0.18	0.127	0.239	0.17	0.205	0.106	0.152	0.148	0.195	0.21	0.142
MgO	0.01	0.02	0.03	0.06	0.03	0.02	0.07	0.02	0.12	0.09	0.03
CaO	1.49	1.8	1.99	0.82	0.88	0.81	0.69	1.46	0.72	0.92	1.18
Na ₂ O	4.04	3.65	4.07	3.59	3.94	4.33	3.02	3.32	3.3	2.69	3.68
K ₂ O	3.73	3.6	2.09	2.09	3.03	2.5	3	3.43	2.16	3.19	3.58
TiO ₂	0.286	0.132	0.15	0.129	0.135	0.162	0.178	0.232	0.192	0.17	0.134
P ₂ O ₅	0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	0.01	0.02	0.01	0.01	0.02
LOI	1.16	1.48	2.07	2.2	1.56	1.17	2.39	2.09	3.24	3.18	1.9
Total	97.73	98.16	96.94	98.03	99.15	97.06	97.43	96.56	97.67	97.08	98.07
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	50	43	82	95	79	39	58	100	61	36	56
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	10	< 10	< 10	< 10	< 10	< 10	< 10	20	< 10	< 10
Zn	970	807	790	532	700	400	440	880	490	550	640
Ga	61	62	62	67	65	65	68	63	68	68	65
Ge	5	5	5	6	4	4	4	4	5	5	4
As	12	11	13	18	17	7	8	9	10	9	11
Rb	530	501	275	217	389	331	391	481	251	381	467
Sr	100	89	90	58	67	48	49	56	54	66	61
Zr	2393	7159	6625	9885	3507	3899	4205	5656	7878	6048	6438
Nb		789	967	634		875	820	776	936		782
Mo	< 2	< 2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	67	57	60	65	62	68	86	98	71	69	65
Sb	< 0.5	2.4	2.2	3.2	1.3	2.5	2.7	4.3	4.9	3.7	3
Cs	0.7	0.6	0.6	0.7	0.8	< 0.5	1.6	0.6	2	1.7	0.7
Ba	32	24	28	35	26	20	25	25	34	40	41
Hf	58.5	169	165	238	82.2	93.2	106	142	197	146	161
Ta	106	61.6	77	44.1	78.5	68.6	58	53.2	68.3	86	54.8
W	< 1	< 1	< 1	3	< 1	2	< 1	2	1	2	< 1
Tl	0.3	0.3	0.2	0.4	0.3	0.3	0.3	0.3	0.3	0.5	0.4
Pb	229	82	82	44	73	80	74	151	60	54	94
Th	134	82.1	71.1	107	122	108	154	106	104	124	129
U	0.7	0.8	0.7	0.7	0.4	0.9	0.7	0.9	0.5	0.6	0.5
Bi	29.8	28.1	32.5	34.6	28.5	23.6	27.7	32.2	33.3	40.2	28.8
Y	597	584	605	755	582	470	607	820	812	774	659
La	961	670	846	762	621	723	821	636	825	991	665
Ce	1830	1270	1610	1440	1180	1370	1540	1210	1590	1880	1270
Pr	214	151	192	168	139	160	186	144	189	221	154
Nd	799	563	714	644	528	595	703	560	708	828	586
Sm	156	112	140	128	110	121	142	123	146	168	121
Eu	8.54	6.34	7.78	7.52	6.35	6.32	7.91	7.93	9.02	9.5	7.24
Gd	134	99.5	119	119	101	104	124	122	136	149	108
Tb	20.5	15.9	17.6	19.7	16.7	15.4	19.6	22.5	22.6	23.1	17.8
Dy	114	95.9	104	123	99.5	87	110	142	136	133	111
Ho	21.3	20	20.9	26.4	19.2	16.1	20.7	28.9	27.6	25.5	23.1
Er	62.3	66.4	68.3	88.6	57.6	48.2	61.2	90	87.6	77.4	74.8
Tm	8.53	10.1	10.4	13.8	8	7	8.49	13.1	13.2	11	11.3
Yb	45.9	61.9	64	86	44.6	39.7	48.7	72.9	76.3	63.9	65.7
Lu	5.98	8.77	8.84	12.5	5.84	5.58	6.59	9.67	10.7	8.78	8.99
TREE	4978.05	3734.81	4527.82	4393.52	3518.79	3768.3	4406.19	4002	4789.02	5363.18	3882.93

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite											
Sample	12126	12127	12128	12129	12130	12131	12132	12133	12134	12135	12136	12137
from	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00	25.00	26.00
to	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00	25.00	26.00	27.00
(wt%)												
SiO ₂	71.53	70.65	44.33	52.97	62.82	24.17	26.58	47.46	69.17	64.02	69.3	65.9
Al ₂ O ₃	9.8	10.21	11.57	10.68	10.83	16.2	15.58	10.54	9.69	10.11	10.26	9.37
Fe ₂ O ₃ (T)	4.56	7.26	22.87	21.39	11.81	37.52	38.4	25.15	6.65	11.42	6.68	7.13
MnO	0.141	0.1	0.187	0.118	0.067	0.159	0.25	0.181	0.1	0.167	0.088	0.138
MgO	0.03	0.05	0.42	0.28	0.15	0.83	0.37	0.23	0.08	0.04	0.02	0.03
CaO	1.08	1.23	1.02	0.35	0.91	0.37	0.21	0.4	1.5	1.7	1.5	5.14
Na ₂ O	2.8	3.65	2.84	2.91	4.04	0.21	0.23	2.72	3.4	3.58	4.09	3.26
K ₂ O	4.49	2.41	4.92	3.82	2.39	4.9	5.49	3.5	3.71	3.05	2.91	2.44
TiO ₂	0.166	0.119	0.29	0.203	0.181	0.2	0.279	0.202	0.176	0.335	0.187	0.149
P ₂ O ₅	< 0.01	< 0.01	0.02	0.01	0.01	0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	2.06	2.38	7.41	5.47	3.31	11.87	8.94	6.27	2.26	3.38	2.03	3.51
Total	96.66	98.07	95.88	98.17	96.53	96.45	96.31	96.67	96.73	97.81	97.07	97.07
(ppm)												
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	52	26	119	118	89	116	82	45	45	50	44	89
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	30	< 20	< 20	30
Co	< 1	< 1	1	1	< 1	2	2	1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	720	340	550	370	310	626	548	390	530	580	820	470
Ga	62	60	72	68	67	124	109	67	61	60	71	62
Ge	4	4	6	4	4	6	5	5	4	4	4	4
As	12	28	44	19	14	17	18	26	23	31	18	18
Rb	604	262	360	271	244	550	518	257	497	300	395	299
Sr	64	53	49	34	58	53	47	56	120	57	103	63
Zr	5491	9988	7605	7231	8145	7763	8085	8111	5424	7598	7194	5166
Nb	734	679	1010	772					915	728		863
Mo	< 2	< 2	2	< 2	< 2	< 2	< 2	< 2	2	< 2	< 2	2
Ag												
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	62	60	80	129	78	108	96	110	64	90	79	76
Sb	2.5	4.5	3.9	4.2	5.9	5.4	6.7	8.1	5.5	6.5	6	3.7
Cs	0.8	1	0.9	1	1.1	7.2	6.1	1.6	0.8	0.6	0.6	0.6
Ba	33	36	84	72	43	53	101	114	30	36	26	29
Hf	142	240	194	180	201	198	200	201	135	186	181	131
Ta	51.7	49.5	59.9	53.3	95	56.7	58	92.6	70.8	53.6	80.3	61
W	< 1	3	7	3	4	3	5	7	< 1	4	4	4
Tl	0.4	0.4	1.4	1.1	0.5	1.1	1.5	1.1	0.4	0.4	0.3	0.2
Pb	97	61	60	23	37	24	29	30	105	63	87	60
Th	82.8	83.4	110	119	111	185	131	143	114	73.3	125	153
U	0.7	0.7	< 0.4	< 0.4	0.5	< 0.4	< 0.4	< 0.4	0.9	1	0.9	0.8
Bi	24.4	36.6	46.3	33.2	44.4	36.3	41.4	49.2	33.8	36.8	37.4	29.9
Y	551	716	1033	843	795	1060	1153	1092	614	714	687	641
La	751	680	1140	836	744	1450	987	984	724	814	804	871
Ce	1410	1290	2210	1600	1400	2660	1850	1870	1390	1500	1520	1640
Pr	170	154	270	196	168	317	219	223	164	178	181	192
Nd	643	592	1060	759	636	1170	841	841	628	681	668	730
Sm	129	118	226	164	138	239	184	188	130	132	135	148
Eu	7.16	7.32	13.8	10.4	8.42	13.9	12.2	11.9	7.48	7.56	7.45	8.83
Gd	113	106	208	148	129	212	189	178	116	115	118	128
Tb	17.1	17	32.2	23.5	22.1	35.7	35.2	32.3	19	17.7	19.4	19.8
Dy	102	110	174	138	134	199	212	196	112	108	121	114
Ho	20	24.5	33.6	28.5	27.5	36.1	40.4	37.9	22.1	23.4	24.6	22.1
Er	63.3	85.1	104	91.5	90.1	101	120	117	68.3	81.8	81.5	67.2
Tm	9.5	13.1	15.4	13.7	13.9	13.1	16.6	16.6	9.98	12.7	12.6	9.62
Yb	56.1	80	88.7	79.5	80.5	72.4	93.7	99	57.7	76.7	74.4	55.7
Lu	7.83	11.3	12	10.6	11.2	9.74	12.5	13.7	7.82	10.4	10.3	7.47
TREE	4049.99	4004.32	6620.7	4941.7	4397.72	7588.94	5965.6	5900.4	4070.38	4472.26	4464.25	4654.72

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology										Granite		Pegmatite	Granite
Sample	12138	12139	12140	12141	12142	12143	12144	12145	12146	12147	12148		
from	27.00	28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00	37.00		
to	28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00	37.00	38.00		
(wt%)													
SiO ₂	72.22	71.94	69.1	60.26	51.33	58.27	70.88	36.62	24.46	25.46	29.77		
Al ₂ O ₃	9.4	11.07	10.41	11.61	12.46	11.97	11.09	15.77	15.96	15.66	13.78		
Fe ₂ O ₃ (T)	7.55	4.88	7.34	14.71	21.57	13.7	5.46	29.77	38.71	36.43	33.99		
MnO	0.108	0.079	0.217	0.086	0.111	0.435	0.085	0.214	0.408	0.53	0.606		
MgO	0.03	0.02	0.04	0.03	0.08	0.07	0.03	0.26	0.4	0.39	0.33		
CaO	1.11	0.72	0.72	0.82	0.46	0.77	1.04	0.3	0.23	0.3	2.15		
Na ₂ O	2.76	4.76	1.03	3.54	3.93	3.75	3.7	2.35	0.45	0.51	2.28		
K ₂ O	2.09	1.84	3.53	4.08	3.1	2.32	4.15	4.09	4.51	4.75	3.14		
TiO ₂	0.185	0.214	0.217	0.144	0.258	0.155	0.14	0.206	0.199	0.33	0.223		
P ₂ O ₅	0.01	0.01	< 0.01	0.03	0.01	< 0.01	< 0.01	0.02	0.01	0.02	0.01		
LOI	2.93	1.92	4.01	3.8	6.1	4.99	1.78	8.41	10.83	11.37	11.15		
Total	98.4	97.44	96.61	99.12	99.41	96.44	98.38	98.01	96.17	95.74	97.43		
(ppm)													
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2	1		
Be	69	66	64	34	58	136	138	254	20	26	22		
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5	5	< 5		
Cr	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20		
Co	< 1	< 1	< 1	< 1	1	< 1	< 1	2	3	3	2		
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20		
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10		
Zn	360	335	432	408	510	407	370	510	589	530	520		
Ga	61	72	64	69	81	72	70	99	101	103	85		
Ge	4	4	6	4	5	4	4	5	5	6	5		
As	25	23	22	25	26	25	22	33	25	18	21		
Rb	241	235	448	335	214	281	516	402	456	455	301		
Sr	47	61	90	37	48	63	71	49	34	49	82		
Zr	7478	6662	6528	7711	5777	7624	4353	8403	7300	10180	9505		
Nb	608	856	722	593	963	732	841	963	698		746		
Mo	< 2	< 2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2		
Ag													
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		
Sn	74	67	57	73	97	62	88	86	97	127	104		
Sb	4.4	4.4	3.5	3.5	4.7	3.3	3.3	4.2	3.8	5.2	4.5		
Cs	0.7	0.6	1.7	0.6	0.9	1.3	1.1	4.3	5.3	5.3	3.7		
Ba	29	20	53	83	115	49	28	64	107	200	140		
Hf	172	142	126	171	143	176	103	206	181	232	234		
Ta	46.1	81.4	58.3	47.8	76.7	60.9	66	67.6	36.7	64.4	49		
W	8	9	8	7	11	11	8	10	7	8	9		
Tl	0.4	0.2	0.4	0.8	1	0.4	0.4	1	1.2	1.2	0.9		
Pb	61	50	61	21	22	53	48	40	19	25	36		
Th	92.3	137	131	114	141	111	102	119	121	167	132		
U	0.7	0.9	0.7	0.6	0.5	0.6	0.8	0.4	< 0.4	0.4	0.4		
Bi	33.7	37.2	38.5	32.3	37.7	39.8	26.5	39.6	36.8	47.1	46.4		
Y	753	796	781	773	811	933	577	1097	1115	1289	1109		
La	764	827	858	792	944	910	839	996	1260	1660	1210		
Ce	1430	1560	1610	1490	1780	1700	1580	1840	2290	3010	2180		
Pr	166	180	184	171	203	194	184	212	257	333	248		
Nd	631	687	705	664	772	745	714	803	967	1250	943		
Sm	134	149	145	132	155	146	142	163	187	224	172		
Eu	7.7	8.66	8.34	7.51	9.96	8.67	8.25	10.2	12	14.1	10.5		
Gd	119	139	128	114	143	132	123	152	168	188	141		
Tb	19.4	22.2	20.7	18.8	22.9	21.9	18.8	25.8	26.8	29.1	22		
Dy	126	135	134	119	136	142	108	159	165	184	151		
Ho	27	28.1	28.2	25.2	26.8	30.4	20.2	33.8	33.7	38.6	34.9		
Er	93.9	89.3	90.5	83.2	81.9	98.2	58.2	111	107	126	125		
Tm	15	13	12.7	12.4	11.8	14.5	8.34	16.5	15.9	18.9	20		
Yb	93.7	77.1	77.1	76.2	68.4	88.7	45.6	98.9	94	115	119		
Lu	12.8	10.7	10.6	10.4	9.59	12.4	5.96	14	13.4	16.4	17		
TREE	4392.5	4722.06	4793.14	4488.71	5175.35	5176.77	4432.35	5732.2	6711.8	8496.1	6502.4		

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite										
Sample	12149	12150	12151	12152	12153	12155	12156	12157	12158	12159	12160
from	38.00	39.00	40.00	41.40	42.60	43.80	45.00	46.00	47.00	48.00	49.00
to	39.00	40.00	40.40	42.60	43.80	45.00	46.00	47.00	48.00	49.00	50.00
(wt%)											
SiO ₂	51.88	68.3	42.7	68.83	70.84	70.49	72.52	70.71	72.24	70.26	73.17
Al ₂ O ₃	12.75	10.3	9.02	9.85	9.79	9.55	9.84	8.69	10	9.95	9.8
Fe ₂ O ₃ (T)	17.33	8.68	13.87	5.44	5.69	5.9	6.14	6.05	6.69	6.42	6.66
MnO	0.354	0.234	0.462	0.16	0.145	0.156	0.139	0.161	0.189	0.15	0.144
MgO	0.11	0.06	0.19	0.06	0.02	0.02	0.02	< 0.01	0.03	0.02	0.02
CaO	1.7	1.85	12.54	2.82	1.69	0.56	0.35	0.59	0.3	0.21	0.22
Na ₂ O	5.96	4.73	4.86	3.8	4.49	4.86	4.76	3.93	5.56	5.63	5.14
K ₂ O	1.13	1.59	0.2	3.11	4.09	4.48	4.45	5.02	3.72	3.64	3.98
TiO ₂	0.154	0.143	0.149	0.142	0.143	0.147	0.19	0.143	0.191	0.242	0.185
P ₂ O ₅	0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	0.01
LOI	5.32	3.26	12.66	3.13	1.58	0.97	0.85	1.11	0.92	0.88	0.72
Total	96.7	99.16	96.64	97.36	98.48	97.14	99.28	96.41	99.83	97.39	100
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	700	95	43	92	29	54	43	26	62	44	45
V	< 5	< 5	5	< 5	< 5	< 5	< 5	< 5	< 5	5	< 5
Cr	< 20	< 20	< 20	30	< 20	< 20	20	< 20	20	< 20	20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	90	< 10	< 10	< 10	100
Zn	340	270	390	450	710	700	739	591	909	759	754
Ga	76	70	46	68	64	66	62	51	66	68	62
Ge	6	4	4	3	5	5	5	4	5	5	5
As	58	22	24	15	26	20	21	25	23	17	16
Rb	104	159	17	349	451	517	514	557	436	448	486
Sr	66	76	468	102	203	134	72	145	48	38	38
Zr	4719	3611	9692	5653	5178	5249	4186	7652	4476	5026	3399
Nb		958	826	821	802	610	628	432	487	598	822
Mo	< 2	< 2	2	11	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	74	72	60	58	49	57	49	42	81	54	47
Sb	3.4	2.6	2.9	2.9	1.9	2.5	< 0.5	1	1.9	1.2	< 0.5
Cs	1.2	1.2	0.5	1	2	3	2.6	2	1.6	4.1	5.4
Ba	88	139	82	54	41	58	41	63	48	38	23
Hf	108	87.3	229	139	119	125	96	164	98.5	106	82.4
Ta	78.2	79.8	66.3	68.2	68.2	51.5	43.9	42.5	39	51.7	66.8
W	11	7	9	7	2	1	< 1	< 1	< 1	< 1	< 1
Tl	0.3	0.3	< 0.1	0.3	0.8	1	0.8	0.7	0.6	0.5	0.5
Pb	61	59	41	30	101	95	98	58	141	97	112
Th	136	132	108	86.8	94	80.8	85.9	53	103	78.8	89.7
U	0.5	< 0.4	< 0.4	< 0.4	0.8	0.6	0.5	0.9	0.6	0.6	0.8
Bi	29.5	28.2	42.3	27.8	29.1	22.1	18.9	20.4	23.5	21.6	20.1
Y	693	605	980	525	504	541	564	560	537	576	539
La	1030	915	796	810	878	925	1060	918	925	795	1070
Ce	1890	1700	1490	1490	1590	1660	1680	1620	1660	1440	1710
Pr	219	197	169	171	180	187	209	186	190	167	211
Nd	819	740	640	646	683	713	758	712	712	632	770
Sm	164	152	132	123	129	135	140	135	135	122	146
Eu	9.79	9.32	8.28	6.58	6.87	7.14	7.44	6.92	6.91	6.52	7.64
Gd	141	137	124	105	105	113	116	112	112	107	121
Tb	21	21.5	22.1	16.2	15.2	16.8	17	16.5	16.6	16.5	17.5
Dy	120	123	150	98.4	91.2	99.8	98.6	97.2	97.7	102	95.4
Ho	22.2	22.4	33.1	19.3	18.5	19.2	18.9	18.9	18.6	20.3	17.8
Er	66.7	65.4	113	60.1	59.2	59.2	55.4	57.1	55.6	61.7	51.6
Tm	9.61	9.26	17.7	9.01	8.96	8.79	7.86	8.48	7.98	9.12	6.99
Yb	54.8	50.8	103	53.3	51.4	49.7	47	49.7	48.7	56	40.4
Lu	7.55	6.74	14.6	7.44	7.03	6.93	6.39	7.08	6.68	7.76	5.39
TREE	5267.65	4754.42	4792.78	4140.33	4327.36	4541.56	4785.59	4504.88	4529.77	4118.9	4809.72

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite										
Sample	12161	12162	12163	12164	12165	12166	12167	12168	12169	12170	12171
from	50.00	51.00	52.00	53.00	54.00	55.00	56.00	57.00	58.00	59.00	60.00
to	51.00	52.00	53.00	54.00	55.00	56.00	57.00	58.00	59.00	60.00	61.00
(wt%)											
SiO ₂	71.57	70.48	70.67	70.27	71.14	71.77	71.2	70.76	69.5	69.99	69.96
Al ₂ O ₃	9.44	9.83	9.97	9.78	9.87	9.7	9.66	9.43	9.54	9.6	9.84
Fe ₂ O ₃ (T)	6.54	6.7	6.39	6.79	6.88	6.51	7.25	7.47	7.33	7.34	6.8
MnO	0.164	0.171	0.149	0.16	0.174	0.166	0.184	0.188	0.178	0.182	0.166
MgO	0.01	0.01	0.02	< 0.01	0.02	0.02	0.01	0.02	0.02	0.02	0.02
CaO	0.19	0.19	0.24	0.24	0.19	0.17	0.18	0.26	0.2	0.31	0.16
Na ₂ O	5.1	5.27	5.14	5.34	5.19	5.18	5.29	5.26	5.41	5.22	5.49
K ₂ O	4.01	4.17	4.33	3.93	4.02	3.91	3.8	3.85	3.65	4.08	3.58
TiO ₂	0.147	0.205	0.249	0.159	0.19	0.135	0.176	0.194	0.16	0.201	0.133
P ₂ O ₅	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01
LOI	0.75	0.81	0.75	0.86	0.7	0.78	0.66	0.88	0.82	0.93	1
Total	97.91	97.82	97.9	97.52	98.37	98.34	98.4	98.31	96.8	97.84	97.16
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	53	50	53	24	81	46	48	38	44	34	36
V	< 5	< 5	< 5	< 5	< 5	6	< 5	< 5	5	< 5	< 5
Cr	< 20	30	< 20	20	< 20	20	< 20	20	< 20	20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	760	755	756	746	744	666	786	791	773	725	707
Ga	63	62	63	61	61	59	65	60	61	60	61
Ge	5	5	5	5	5	5	6	5	5	5	4
As	12	21	42	13	17	11	23	12	25	12	24
Rb	493	501	517	475	501	473	476	456	416	472	423
Sr	37	37	40	43	38	38	33	56	59	38	32
Zr	4422	4887	3489	6384	4915	6463	3771	6572	5048	5680	7509
Nb	527	594	705	502	622	481	660	492	459	515	472
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	62	50	49	44	59	46	59	66	49	52	48
Sb	1.1	1.1	1.8	0.9	2	1.3	2	2	1.6	1.2	1.8
Cs	2.3	1.2	3.4	1.6	1.2	1.9	1.7	1.1	1.2	1.8	1.7
Ba	24	22	31	23	22	22	43	22	16	24	23
Hf	104	102	77.1	131	117	129	89.7	150	109	130	146
Ta	39.2	54	62.5	43.5	50.9	43.7	51.2	41.4	38.5	44.3	44.3
W	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tl	0.5	0.7	0.7	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Pb	89	92	115	80	100	83	108	87	102	81	86
Th	82.1	59	67.1	75.3	84.7	48.2	68.1	66.9	82.5	67.2	70.1
U	0.7	0.8	0.8	1	0.7	0.5	0.7	0.7	0.5	0.6	0.6
Bi	19.5	26	23.2	23.8	23.2	23.4	20.2	24	20.8	20.4	25.8
Y	495	549	492	581	552	482	501	552	545	498	590
La	860	795	852	803	808	694	906	736	734	803	699
Ce	1560	1440	1550	1440	1470	1270	1660	1320	1350	1460	1280
Pr	179	167	183	168	169	148	188	156	158	169	147
Nd	679	641	691	641	647	560	713	607	605	647	554
Sm	127	123	133	120	124	106	136	120	117	125	106
Eu	6.6	6.56	7.04	6.29	6.66	5.56	7.29	6.32	6.31	6.72	5.69
Gd	105	108	113	105	111	88.4	117	99.4	105	108	92.9
Tb	15.2	17.1	15.9	15.4	16.8	13.6	17	15.4	16.2	15.5	15.2
Dy	91.6	99.3	91.7	94.4	101	83.6	98.4	95.6	97.5	91.5	95.8
Ho	18.2	20	17.1	19.8	19.7	17.1	18.6	19.7	19.3	17.6	20.4
Er	55.5	60.2	52.1	64	59	55.1	54.5	63.4	60.4	55.9	69.7
Tm	7.93	8.65	7.69	9.55	8.58	8.48	7.36	9.95	9.1	8.48	11
Yb	46.7	47.8	46.1	57.5	50.2	54.3	42.4	59.8	53.4	50.7	68.9
Lu	6.32	6.82	6.51	8.12	7.13	7.99	5.85	8.44	7.22	7.27	9.93
TREE	4253.05	4089.43	4258.14	4133.06	4150.07	3594.13	4472.4	3869.01	3883.43	4063.67	3765.52

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite										
Sample	12172	12173	12174	12175	12176	12177	12178	12179	12180	12181	12182
from	61.00	62.00	63.00	64.00	65.00	66.00	67.00	68.00	69.00	70.00	71.00
to	62.00	63.00	64.00	65.00	66.00	67.00	68.00	69.00	70.00	71.00	72.00
(wt%)											
SiO ₂	70.92	70.42	70.83	71.87	70.71	71.46	73.12	72.72	73.03	73.56	73.12
Al ₂ O ₃	9.59	9.6	9.28	9.65	9.06	9.18	9.41	9.04	8.61	8.51	9.31
Fe ₂ O ₃ (T)	7.69	7.15	7.21	7.11	7.57	7.87	7.19	6.42	6.16	6.12	6.17
MnO	0.216	0.174	0.209	0.196	0.199	0.22	0.178	0.147	0.158	0.151	0.167
MgO	< 0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.03	0.02	0.02	0.03
CaO	0.3	0.25	0.18	0.22	0.21	0.22	0.19	0.21	0.18	0.18	0.18
Na ₂ O	5.22	4.89	4.67	4.65	4.73	4.91	4.66	4.32	4.23	4.09	4.23
K ₂ O	3.88	4.1	4.16	4.3	4.01	3.96	4.39	4.34	4.2	4.11	4.41
TiO ₂	0.226	0.238	0.225	0.208	0.152	0.181	0.185	0.145	0.13	0.167	0.275
P ₂ O ₅	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.24
LOI	0.83	0.72	0.74	0.74	0.68	0.83	0.64	0.75	0.64	0.78	0.64
Total	98.86	97.58	97.52	98.97	97.33	98.84	99.98	98.12	97.35	97.7	98.76
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	46	36	41	29	17	25	48	26	31	25	43
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	20	< 20	20	< 20	< 20	< 20	20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	760	681	730	734	782	799	740	659	650	660	700
Ga	61	57	59	61	59	59	59	54	55	55	61
Ge	5	5	5	5	5	5	5	5	4	4	6
As	18	14	18	20	13	15	13	14	15	13	13
Rb	462	473	516	529	498	474	513	530	515	495	517
Sr	40	34	26	28	31	31	29	27	24	26	27
Zr	5093	4078	4272	3591	4648	5241	2947	5848	3998	3994	2649
Nb	595	431	652	525	515	473	560	463	395	524	710
Mo	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	56	46	54	58	55	50	53	45	46	42	52
Sb	1.3	1	1.2	1.6	1	0.8	1.3	1.8	1.2	1.1	1.3
Cs	1.5	1.4	1.4	1.6	1.5	1.1	1.2	1.2	1.1	1	1.1
Ba	67	19	78	63	51	65	31	24	28	17	34
Hf	104	78	106	81.3	107	121	71.5	128	95.6	97.4	63.2
Ta	55.3	36.9	53.9	44.1	43.7	41	42.5	40.9	30.8	44.4	57
W	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tl	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8
Pb	92	90	79	87	80	116	88	66	77	69	99
Th	83	57.4	52.6	69.1	75.4	79.4	97.3	69.9	61	56.2	82.2
U	0.8	0.7	0.6	0.8	0.8	12.1	0.7	0.6	0.6	0.5	0.6
Bi	25.6	18.9	23.5	21.1	21.5	22.6	19	20.3	18.3	18.8	21.1
Y	517	576	482	526	455	486	421	476	442	405	385
La	916	780	911	879	844	873	976	791	781	780	901
Ce	1640	1390	1650	1550	1500	1560	1720	1380	1400	1390	1660
Pr	189	163	194	181	175	179	199	161	166	161	188
Nd	721	630	730	686	661	694	769	633	641	613	711
Sm	133	122	133	119	120	133	139	118	118	114	130
Eu	6.87	6.55	7.03	6.29	6.18	6.9	7.2	6.11	6.23	5.97	6.7
Gd	109	104	111	101	98.3	111	114	95.6	97	93.6	99.6
Tb	15.5	16.2	15.5	14.5	13.6	15.4	15.4	13.2	13.5	12.9	13.8
Dy	92.4	99.7	92	89.9	80.9	90	88	77.5	80.5	76.6	73.2
Ho	18.8	20.3	18	18.1	16.3	17.9	16.2	16.1	16.2	15	13.5
Er	60.6	62.2	57	57.1	51	56.2	48.4	51.7	51.1	47.7	39.6
Tm	9.2	8.81	7.93	8.15	7.48	8.26	6.82	7.86	7.38	7.11	5.65
Yb	53.2	50.9	45.1	47.6	43	51.2	37.8	47.9	42.8	42.9	32.5
Lu	7.34	7.03	6.4	6.39	6.12	7.16	5.1	6.95	5.99	6.13	4.44
TREE	4488.91	4036.69	4459.96	4290.03	4077.88	4289.02	4562.92	3881.92	3868.7	3770.91	4263.99

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite										
Sample	12183	12184	12185	12186	12187	12188	12189	12190	12191	12192	12193
from	72.00	73.00	74.00	75.00	76.00	77.00	78.00	79.00	80.00	81.00	82.00
to	73.00	74.00	75.00	76.00	77.00	78.00	79.00	80.00	81.00	82.00	83.00
(wt%)											
SiO ₂	70.37	73.54	72.39	72.78	73.29	73.09	74.62	73.97	74.7	73.81	73.19
Al ₂ O ₃	8.68	9.64	8.59	8.9	9.44	9.56	9.47	9.84	9.66	9.46	9.89
Fe ₂ O ₃ (T)	7.26	6.02	6.34	6.2	5.06	5.42	5.85	5.12	4.96	5.36	4.83
MnO	0.195	0.154	0.157	0.152	0.123	0.132	0.142	0.121	0.123	0.136	0.119
MgO	0.03	0.02	0.03	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02
CaO	0.21	0.17	0.19	0.16	0.38	0.13	0.18	0.17	0.17	0.15	0.16
Na ₂ O	4.37	4.36	4.35	4.29	3.83	4.29	4.44	4.22	4.2	4.26	4.29
K ₂ O	4.18	4.8	3.83	4.08	4.93	4.11	4.37	4.74	4.57	4.33	4.58
TiO ₂	0.229	0.162	0.127	0.155	0.121	0.152	0.108	0.108	0.135	0.157	0.115
P ₂ O ₅	0.22	< 0.01	0.16	0.16	0.15	< 0.01	0.1	0.1	0.09	0.09	0.07
LOI	0.96	0.71	0.79	0.64	0.76	0.57	0.72	0.58	0.63	0.53	0.71
Total	96.72	99.58	96.96	97.54	98.11	97.47	100	98.98	99.27	98.28	97.98
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	38	55	36	18	22	27	40	52	43	60	48
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	< 20	30	< 20	30	< 20	30	< 20	30	< 20	30
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	90	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	770	705	650	640	490	640	650	580	540	640	540
Ga	56	59	51	54	51	61	59	62	57	62	60
Ge	6	4	4	5	4	5	5	4	4	5	5
As	24	23	12	13	11	12	12	14	9	16	16
Rb	477	564	414	457	550	509	489	535	493	483	499
Sr	40	33	32	27	60	25	38	29	27	25	34
Zr	5849	3568	3610	3730	5186	3671	4498	3332	3972	2022	3843
Nb	580	667	520	500	519	450	475	461	435	547	482
Mo	< 2	< 2	3	< 2	2	< 2	3	< 2	3	< 2	2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	49	40	37	41	37	50	38	41	38	50	34
Sb	1.2	< 0.5	1.3	1.4	1.2	1.5	1.1	1	0.7	1.2	0.6
Cs	1.1	1	0.8	1	1.2	1.1	1.1	1.2	1.1	1	1
Ba	34	23	14	22	25	16	17	17	18	23	15
Hf	126	81.7	85.7	85.9	130	90.1	95.5	75.6	80.5	46.9	84.7
Ta	47.5	52.3	40.9	38.2	46.3	30.8	37.4	37.8	39.2	44.9	40.4
W	< 1	< 1	1	6	1	< 1	< 1	< 1	< 1	< 1	< 1
Tl	0.9	0.6	0.6	0.5	0.7	0.6	0.6	0.7	0.6	0.6	0.7
Pb	92	88	60	74	63	80	84	68	66	86	63
Th	101	62.5	52.1	66.8	64.1	61.5	61.6	48.8	51.6	66.3	58.8
U	0.8	0.6	0.5	0.5	0.9	0.6	0.7	0.7	0.6	0.7	0.5
Bi	29.9	26.4	22.5	21.8	23.2	18.1	25.1	20.1	20.5	18.3	18.8
Y	439	455	452	467	469	404	479	397	452	450	401
La	915	816	716	734	675	725	861	703	702	860	893
Ce	1670	1430	1270	1320	1210	1300	1550	1290	1270	1550	1590
Pr	184	164	145	151	139	148	176	146	145	176	178
Nd	699	604	558	581	543	564	670	559	553	667	684
Sm	127	114	103	109	98.2	105	123	104	101	125	123
Eu	6.76	6.35	5.63	5.99	5.26	5.72	6.56	5.45	5.46	6.64	6.38
Gd	99.7	101	95.9	96.2	86.4	84.8	96.7	83.3	83.4	100	95.6
Tb	14.6	14.8	14.1	14.5	12.9	13.4	14.8	12.9	13.6	15.6	13.9
Dy	81	79.1	79	84.1	79.7	77.1	86	73.7	80.2	86.9	78.4
Ho	15.9	14.5	15.1	15.9	16.4	14.7	16.5	13.8	15.2	15.9	14.7
Er	49.7	42.6	43.6	45.5	51	42.3	50.8	42.1	46.2	44.7	44
Tm	7.52	5.89	6.37	6.42	7.54	6	7.52	6.11	6.96	6.19	6.48
Yb	49	36.5	39.7	35.9	44.3	34	46	36.1	40.3	33.8	38.8
Lu	7.04	5.1	5.8	5.07	6.24	4.75	6.56	4.9	5.51	4.37	5.38
TREE	4365.22	3888.84	3549.2	3671.58	3443.94	3528.77	4190.44	3477.36	3519.83	4142.1	4172.64

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite										
Sample	12195	12196	12197	12198	12199	12200	12201	12202	12203	12204	12205
from	83.00	84.00	85.00	86.00	87.00	88.00	89.00	215.00	216.00	217.00	218.00
to	84.00	85.00	86.00	87.00	88.00	89.00	90.00	216.00	217.00	218.00	219.00
(wt%)											
SiO ₂	73.83	73.86	71.65	68.78	69.47	70.7	71.78	73.39	72.06	69.44	71.29
Al ₂ O ₃	9.93	9.93	9.63	8.49	9.22	10.7	10.8	10.88	11.47	10.18	10.2
Fe ₂ O ₃ (T)	4.73	5.11	6.07	10.43	7.99	6.27	5.54	4.1	4.62	4.73	4.75
MnO	0.116	0.121	0.148	0.26	0.19	0.155	0.133	0.098	0.133	0.115	0.157
MgO	0.03	0.03	0.03	0.02	0.02	0.03	0.02	0.03	0.02	0.04	0.04
CaO	0.23	0.18	0.18	0.2	0.17	0.21	0.22	0.63	0.39	3.51	1.74
Na ₂ O	4.02	4.38	4.35	5.27	4.38	4.89	4.78	3.82	4.25	2.57	2.82
K ₂ O	4.76	4.76	4.64	3.74	4.98	4.63	4.53	4.62	4.76	4.37	3.78
TiO ₂	0.121	0.16	0.22	0.175	0.196	0.129	0.117	0.094	0.126	0.139	0.139
P ₂ O ₅	< 0.01	0.04	0.06	< 0.01	0.07	0.06	0.04	0.04	0.04	< 0.01	< 0.01
LOI	0.75	0.77	0.72	0.64	0.63	0.67	0.72	0.94	1.01	2.92	2.92
Total	98.51	99.34	97.69	98	97.32	98.44	98.69	98.64	98.88	98.01	97.85
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	35	53	53	26	35	48	47	37	44	14	33
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	30	< 20	20	< 20	20	< 20	30	< 20	30	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	570	620	620	850	720	710	600	440	420	520	550
Ga	63	62	58	57	57	70	68	59	61	54	51
Ge	5	4	5	6	6	6	5	3	3	3	3
As	16	9	23	11	23	30	16	6	9	8	11
Rb	517	524	501	403	506	493	486	322	322	309	273
Sr	36	37	33	34	36	65	75	60	43	360	102
Zr	3715	4291	3505	3267	2508	2741	3318	1309	2703	3214	6164
Nb	497	558	433	352	344	495	466	409	329	349	366
Mo	< 2	3	< 2	< 2	< 2	< 2	< 2	3	< 2	3	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	40	49	44	36	31	43	48	47	38	35	31
Sb	0.9	1.4	1.2	0.9	0.6	0.8	0.8	< 0.5	0.7	0.9	0.9
Cs	1	1.1	1.1	1	1	1	0.9	0.7	0.8	0.9	0.6
Ba	14	17	23	40	20	17	16	29	26	47	35
Hf	91.2	103	80.5	79	51.5	58.5	75.6	29.6	65.1	79	162
Ta	38.3	42	35.5	28.2	26.9	36.2	37.9	29.1	25.6	25.7	28.8
W	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2	1
Tl	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.5	0.5	0.5	0.4
Pb	67	60	70	51	90	94	78	171	59	56	121
Th	58.9	62.2	51.6	47.7	67.7	66.2	79	80.5	50.4	27	26.6
U	0.6	0.6	0.5	< 0.4	0.7	0.7	0.6	< 0.4	< 0.4	< 0.4	0.8
Bi	19.2	22.1	17.9	16.3	15.7	18.6	24.3	13.7	12.9	13	24.3
Y	409	451	458	323	411	466	472	346	263	237	252
La	896	734	810	905	989	1160	974	286	207	230	364
Ce	1610	1330	1440	1570	1760	2040	1710	597	428	464	722
Pr	183	150	164	176	198	230	193	70.6	50.4	54.1	83.9
Nd	700	579	629	670	763	888	739	270	195	212	314
Sm	125	109	108	110	133	158	139	64.2	45	48.6	60.7
Eu	6.82	5.84	5.52	5.58	7.18	8.42	7.99	4.05	2.79	2.9	3.43
Gd	97.7	82.5	80.2	83.1	105	119	115	56.9	39	41.2	46
Tb	14.3	12.4	12.6	11.3	14.4	16.4	15.9	10.8	7.4	6.7	7.4
Dy	82	74.6	78.5	60.5	73.8	87.5	84.7	65.6	46.8	40.4	45
Ho	15.8	15	15.7	11	12.8	16.3	15.8	12.3	9.3	8.3	9.6
Er	46.2	47.2	47.4	33.8	34.5	45.7	46.7	32.8	27.8	25.5	31.7
Tm	6.83	7.28	7.09	5.31	4.91	6.34	6.65	4.21	4.16	4.14	5.29
Yb	39.9	43.9	41.5	34.2	29.6	34.7	37.6	21.1	24.7	25	33.3
Lu	5.49	6.13	5.61	4.85	4.15	4.52	5.08	2.6	3.42	3.7	4.95
TREE	4238.04	3647.85	3903.12	4003.64	4540.34	5280.88	4562.42	1844.16	1353.77	1403.54	1983.27

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite										
Sample	12206	12207	12208	12209	12210	12211	12212	12213	12214	12215	12216
from	219.00	220.00	221.00	222.00	223.00	224.00	225.00	226.10	226.40	227.00	228.00
to	220.00	221.00	222.00	223.00	224.00	225.00	226.10	226.40	227.00	228.00	229.00
(wt%)											
SiO ₂	71.35	73.16	72.06	72.6	73.57	70.58	71.48	70.59	71.77	70.33	72.6
Al ₂ O ₃	10.53	10.52	11.21	10.31	11.37	11.28	11.23	8.28	10.49	10.62	11
Fe ₂ O ₃ (T)	5.24	4.97	4.87	5.06	4.49	4.53	5.06	6.75	5.74	5.34	4.91
MnO	0.128	0.131	0.13	0.134	0.106	0.113	0.128	0.204	0.174	0.137	0.133
MgO	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
CaO	0.53	0.89	0.43	0.67	0.4	0.46	0.5	0.61	0.53	0.41	0.35
Na ₂ O	4.69	4.27	4.67	3.39	5.16	5	4.98	1.22	4.41	4.58	4.86
K ₂ O	4.27	3.61	4.15	4.54	4.38	4.65	4.32	5.9	3.3	4.25	4.2
TiO ₂	0.125	0.153	0.14	0.139	0.145	0.165	0.144	0.708	0.243	0.176	0.143
P ₂ O ₅	< 0.01	0.01	0.04	0.04	0.04	0.03	0.03	0.03	< 0.01	0.03	0.03
LOI	0.69	1.8	1.38	1.89	0.62	0.78	0.83	2.76	1.91	1.33	1.17
Total	97.56	99.53	99.09	98.8	100.3	97.62	98.72	97.07	98.59	97.22	99.41
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	24	15	22	16	19	20	19	22	16	21	21
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	30	< 20	30	< 20	30	< 20	30	< 20	30	< 20	30
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	10	< 10	10	< 10	< 10	< 10
Zn	470	490	430	430	400	440	520	660	540	480	450
Ga	54	52	54	50	54	52	52	45	55	54	54
Ge	4	3	4	3	4	3	4	5	4	4	4
As	16	13	11	8	9	15	12	20	14	9	< 5
Rb	300	260	285	314	304	315	310	430	235	300	294
Sr	37	83	47	67	38	47	59	70	36	27	26
Zr	4492	2959	7373	8168	1950	3740	2272	6571	4460	3541	875
Nb	437	432	317	394	338	290	388		584	453	341
Mo	4	< 2	9	< 2	6	3	5	< 2	4	< 2	4
Ag											8.7
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	50	23	30	29	34	29	37	48	29	32	43
Sb	1.9	< 0.5	0.8	0.9	< 0.5	< 0.5	< 0.5	2.6	2.1	1.5	1.2
Cs	0.7	0.7	0.7	0.8	0.6	0.7	0.7	0.9	0.5	0.7	0.6
Ba	100	41	48	42	215	178	157	119	52	45	185
Hf	108	66.9	179	206	43.8	75.9	46.9	172	98.2	88.6	16.2
Ta	35.3	34.9	26.4	31.3	27.1	27.7	31.2	313	45.6	35.7	23.1
W	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	< 1	< 1	< 1
Tl	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.3	0.4	0.4
Pb	39	72	36	49	84	80	60	236	64	57	51
Th	45.5	34.8	38.3	33.8	56.6	57.7	55.1	117	71.9	82	63.2
U	< 0.4	0.4	1.1	< 0.4	< 0.4	< 0.4	0.4	1.8	0.5	< 0.4	< 0.4
Bi	16.6	15.5	14.2	15	14.1	20.6	18.9	60.7	19.2	16	11.3
Y	395	297	352	391	271	371	279	422	495	493	340
La	351	273	401	298	308	265	239	442	491	326	267
Ce	701	546	781	596	615	541	496	997	995	679	551
Pr	82.1	62.2	91.1	69.2	72	63.9	57.7	96.7	116	79.5	64.1
Nd	313	228	350	267	271	249	219	288	442	303	246
Sm	63	47.5	73.3	60.9	57.7	60	51.8	53.1	94.1	73.5	58.7
Eu	3.83	2.9	4.22	3.99	3.53	3.86	3.18	3.38	5.56	4.75	3.89
Gd	53.5	44	59.7	60.8	48.6	55.1	43.1	47.2	77.7	71.6	53.1
Tb	9.6	8	9.8	10.6	8.4	10.3	7.8	10	14	14.2	9.8
Dy	65	52	60	64.7	49.2	63.7	47.2	69.2	86.4	87.6	59.3
Ho	13.3	10.5	12.3	13.2	9.2	12.4	9.2	16.3	17.7	16.8	11.4
Er	37.7	31.6	40.3	40.8	26.3	37.4	28.1	70.8	55.3	47.8	31.7
Tm	5.04	4.78	6.56	6.49	3.79	5.38	4.25	17.3	8.37	6.74	4
Yb	25.9	28.3	41.6	40.7	21.4	30.5	23.9	128	50.6	37.4	21.7
Lu	3.52	4	6.16	6.09	2.82	4.02	3.2	18.1	7.11	5.15	2.82
TREE	2122.49	1639.78	2289.04	1929.47	1767.94	1772.56	1512.43	2679.08	2955.84	2246.04	1724.51

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite		Pegmatite				Granite				
Sample	12217	12218	12219	12220	12221	12222	12223	12224	12225	12226	12227
from	229.00	229.70	230.00	231.00	232.00	233.00	233.40	234.00	235.00	236.00	237.00
to	229.70	230.00	231.00	232.00	233.00	233.40	234.00	235.00	236.00	237.00	238.00
(wt%)											
SiO2	72.71	73.76	72.59	67.19	55.07	72.37	69.01	66.91	72.87	71.32	71.27
Al2O3	10.9	10.22	9.27	8.92	4.73	9.5	10.3	9.91	11.32	10.74	11.1
Fe2O3(T)	5.08	5.41	3.71	7.03	4.63	3.19	4.59	5.38	4.89	5.07	4.91
MnO	0.139	0.145	0.088	0.258	0.119	0.083	0.111	0.273	0.116	0.135	0.132
MgO	0.02	0.01	0.02	0.02	0.04	0.01	0.02	0.04	0.01	0.02	0.02
CaO	0.25	0.33	2.57	2.98	15.96	2.12	3.76	4.82	0.45	0.48	0.33
Na2O	4.59	4.48	2.46	1.84	0.43	2.66	3.77	3.72	5.21	4.7	4.78
K2O	4.15	4.49	5.31	5.96	3.12	4.09	3.1	4.14	4.76	4.39	4.45
TiO2	0.154	0.169	0.161	0.341	1.072	0.146	0.152	0.196	0.143	0.168	0.161
P2O5	< 0.01	0.03	0.03	0.04	0.04	< 0.01	0.02	0.02	0.03	0.01	0.02
LOI	0.99	1.07	1.96	3.3	4.6	1.96	2.78	3.44	0.53	0.58	0.57
Total	98.97	100.1	98.16	97.87	89.8	96.14	97.6	98.84	100.3	97.63	97.73
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	18	23	32	16	23	15	12	37	33	25	15
V	< 5	< 5	6	5	6	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	30	< 20	30	< 20	40	< 20	30	< 20	30	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	20	< 10	< 10	< 10	10	< 10	< 10	< 10	10	10	10
Zn	510	620	480	840	350	430	490	600	510	570	580
Ga	58	58	58	60	39	55	58	47	55	53	56
Ge	4	5	5	6	6	3	3	3	4	4	4
As	6	8	14	17	67	19	9	19	11	13	9
Rb	298	296	350	407	193	284	200	252	309	316	317
Sr	37	99	409	386	2085	154	286	531	274	142	92
Zr	1407	1752	12780	10050	35760	14460	6409	3602	1481	8007	2946
Nb	352	573				822	913	595	512	566	635
Mo	5	4	< 2	3	< 2	3	< 2	5	< 2	4	< 2
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	46	39	50	72	194	60	46	60	51	52	55
Sb	2	0.9	1.7	2.1	5.9	2.1	1.4	1	0.9	1.6	1.1
Cs	0.6	0.8	0.8	0.8	1	0.6	0.5	0.6	0.7	0.8	0.8
Ba	93	170	803	563	1010	341	312	116	154	195	226
Hf	31	30	281	258	796	364	148	78.6	29.3	188	63.7
Ta	23.2	47.3	217	97.8	1010	67.8	71	42.4	26.9	37.6	36.4
W	< 1	< 1	1	< 1	8	< 1	2	< 1	1	1	1
Tl	0.4	0.3	0.4	0.4	0.3	0.4	0.3	0.6	0.7	0.7	0.7
Pb	65	88	199	87	176	38	43	83	143	124	118
Th	49	54.7	121	108	198	50.9	76.8	72.8	104	114	102
U	< 0.4	4	1.4	2.3	1.3	1.8	0.4	0.5	0.5	0.5	0.4
Bi	13.5	19.5	59.2	29.5	203	30.1	30.3	30.7	20.2	35.3	22.7
Y	303	431	706	486	2264	364	380	456	577	595	535
La	524	790	1010	1200	1240	276	460	254	278	345	322
Ce	995	1480	2030	2300	3000	556	902	521	592	720	665
Pr	115	168	223	260	288	60.9	101	60.1	69.2	83.3	74.1
Nd	436	634	798	933	805	214	363	227	275	327	271
Sm	87	120	150	167	149	42.9	69.2	53.9	75.2	80.4	62
Eu	4.85	6.67	8.26	7.9	8.91	2.65	3.99	3.62	4.9	5.29	4.06
Gd	65.7	94.1	120	109	131	34.7	50.3	47.5	78.5	85.5	63.9
Tb	10.3	13.8	19.8	16.4	35.5	7.5	8.8	9.9	15.3	16.3	13.7
Dy	57.2	75.5	123	90.7	305	58.6	59.7	67.7	96.3	105	93.3
Ho	10.6	14.1	25.6	18.2	82.6	15.4	14.7	14.8	19.1	21.7	19
Er	30.3	41.3	82.6	60.5	331	62.8	61.2	49.7	54.3	64.8	55.5
Tm	4.12	6.1	13	9.92	60	11.9	12.5	8.02	7.1	9.06	7.82
Yb	23.6	36.5	79.6	64.3	388	76.1	83	48.6	37.1	52.3	42.2
Lu	3.11	4.72	11.1	9.79	55.3	10.9	11	6.3	4.61	6.95	5.45
TREE	2669.78	3915.79	5399.96	5732.71	9143.31	1794.35	2580.39	1828.14	2183.61	2517.6	2234.03

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite										
Sample	12228	12229	12230	12231	12232	12233	12235	12236	12237	12238	12239
from	238.00	239.00	240.00	241.00	242.00	243.00	244.00	300.00	301.00	302.00	303.00
to	239.00	240.00	241.00	242.00	243.00	244.00	245.00	301.00	302.00	303.00	304.00
(wt%)											
SiO ₂	71.6	70.71	71.57	71.27	70.24	72.95	72.18	71.47	73.44	72.23	72.84
Al ₂ O ₃	10.72	11.37	10.53	11.07	11.05	10.85	11.33	11.39	10.64	10.66	11.8
Fe ₂ O ₃ (T)	4.88	5.42	4.65	5	4.98	5.51	4.78	5	4.81	5.53	4.82
MnO	0.127	0.15	0.128	0.137	0.144	0.145	0.124	0.13	0.121	0.14	0.123
MgO	0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.01
CaO	0.53	0.58	0.31	0.34	0.34	0.35	0.3	0.39	0.33	0.36	0.32
Na ₂ O	4.68	4.8	3.91	4.6	4.06	5.12	5.1	5.14	5	5.05	5.29
K ₂ O	4.42	4.58	4.27	4.52	4.21	4.55	4.47	4.48	4.18	4.44	4.59
TiO ₂	0.146	0.177	0.152	0.201	0.172	0.189	0.172	0.147	0.16	0.238	0.148
P ₂ O ₅	< 0.01	< 0.01	0.02	0.03	< 0.01	0.02	< 0.01	0.01	< 0.01	0.01	< 0.01
LOI	0.73	1.19	1.74	1.19	1.9	0.64	0.48	0.53	0.44	0.52	0.52
Total	97.86	98.99	97.3	98.38	97.11	100.3	98.95	98.71	99.15	99.19	100.5
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	12	14	11	14	11	23	22	106	341	29	23
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	30	< 20	30	< 20	30	< 20	20	< 20	30	< 20	20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	10	10	20	40	< 10	10	< 10	< 10	< 10	< 10	< 10
Zn	540	590	470	600	560	540	480	410	440	460	390
Ga	55	61	53	58	53	49	55	55	49	52	52
Ge	3	4	3	4	3	4	3	3	3	4	3
As	25	9	12	11	8	20	8	9	10	15	17
Rb	318	331	306	314	285	288	316	299	308	292	288
Sr	108	125	40	48	35	66	69	80	52	59	44
Zr	1473	2248	3677	2847	3657	1723	2524	2603	1918	1486	1318
Nb	531	578	677	634	536	515	594	430	400	474	382
Mo	4	< 2	3	< 2	4	2	4	10	10	15	14
Ag											
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	42	52	40	53	46	39	34	41	36	33	29
Sb	1	1.2	1.9	1	1.2	0.7	0.7	0.9	0.9	1.2	0.9
Cs	0.7	0.9	0.6	0.7	0.6	1.9	3.6	3.7	11.3	2.2	1.4
Ba	68	49	55	67	38	51	45	38	37	46	33
Hf	34.5	48.9	90.9	61.8	77.8	36.8	59.5	54.9	42.3	34.9	28.3
Ta	28.3	36	41.3	44	33.2	30	36.7	33.2	25.1	29.3	22.6
W	1	1	2	2	2	1	< 1	2	< 1	1	< 1
Tl	0.6	0.6	0.6	0.6	0.6	1	1.1	0.6	0.7	0.6	0.5
Pb	132	165	122	138	101	117	79	91	116	84	111
Th	55.5	46.4	53.4	49.3	50.2	69.6	58.6	38.2	47.7	35.9	81.2
U	< 0.4	< 0.4	< 0.4	0.4	< 0.4	0.5	< 0.4	< 0.4	0.5	< 0.4	< 0.4
Bi	15.6	23.8	25.2	18	21.1	18.5	18.3	17.5	13.6	13.5	13
Y	419	283	307	282	282	472	319	384	259	518	254
La	231	219	307	276	226	223	272	203	221	310	233
Ce	480	455	636	549	459	466	566	397	436	596	462
Pr	52.9	53.6	69.9	63.7	51.4	53.5	63.7	45.9	48.4	64.3	50.9
Nd	195	193	254	230	188	198	240	171	184	238	192
Sm	47.6	43.9	53.4	46.9	41.9	50.6	52.9	38.6	39.2	52.1	40.2
Eu	3.16	2.63	3.23	2.77	2.64	3.42	3.22	2.55	2.46	3.44	2.58
Gd	51.4	39.2	48	42.4	39.3	54.4	47.7	41.9	37.3	57.1	38.1
Tb	10.9	7.7	8.7	8.1	7.4	11	8.5	8.9	6.7	12	6.8
Dy	74.5	49.5	56.1	50.4	49	71.9	53.6	62.1	44	83.9	42.3
Ho	14.7	10	11.3	9.9	9.7	13.9	10.8	13.7	8.8	17.8	8.3
Er	43.1	31.2	34.3	29.2	29.7	38.9	32.1	42.3	26.9	52.4	23.7
Tm	5.81	4.7	4.96	4.14	4.52	4.99	4.6	5.88	4.13	6.92	3.28
Yb	31.9	29.1	29.2	23.6	27.9	26.9	26.5	32.7	26	38.3	18.4
Lu	4.09	3.99	3.98	3.25	3.76	3.54	3.65	4.22	3.56	5.11	2.52
TREE	1665.06	1425.52	1827.07	1621.36	1422.22	1692.05	1704.27	1453.75	1347.45	2055.37	1378.08

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite						Pegmatite	Granite			
Sample	12240	12241	12242	12243	12244	12245	12246	12247	12248	12249	12250
from	304.00	305.00	306.00	307.00	308.00	309.00	310.00	310.80	312.00	313.00	314.00
to	305.00	306.00	307.00	308.00	309.00	310.00	310.80	312.00	313.00	314.00	315.00
(wt%)											
SiO ₂	71.42	71.04	71.6	72.51	73.01	71.93	67.4	71.93	70.66	70.45	71.63
Al ₂ O ₃	10.71	11.27	11.33	11.38	11.95	12.06	6.14	11.71	11.06	11.98	10.66
Fe ₂ O ₃ (T)	5.24	4.92	4.7	4.95	4.57	4.38	5.06	4.7	5.26	4.82	5.23
MnO	0.133	0.12	0.115	0.125	0.114	0.111	0.141	0.128	0.137	0.122	0.131
MgO	0.02	< 0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.02	0.01	0.01
CaO	0.48	1.77	0.26	0.28	0.26	0.24	0.44	0.31	0.32	0.31	0.35
Na ₂ O	4.98	5.23	5.14	5.16	5.54	5.4	5.77	5.43	5.37	5.53	5.14
K ₂ O	4.33	4.47	4.56	4.5	4.85	4.44	3.68	4.35	4.34	4.46	4.3
TiO ₂	0.152	0.128	0.127	0.144	0.141	0.133	0.588	0.178	0.165	0.142	0.167
P ₂ O ₅	0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	0.55	0.8	0.44	0.38	0.37	0.21	2.91	0.15	0.2	0.18	0.22
Total	98.03	99.76	98.29	99.47	100.8	98.92	92.14	98.9	97.53	98.02	97.84
(ppm)											
Sc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Be	26	51	17	17	18	17	29	18	22	17	60
V	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cr	< 20	20	< 20	20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Co	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zn	440	400	400	410	380	360	440	450	430	420	440
Ga	51	50	54	52	53	54	36	56	48	54	52
Ge	3	3	3	3	3	3	3	3	3	3	4
As	14	45	13	16	9	10	14	12	27	9	20
Rb	288	275	300	295	297	283	239	290	261	295	295
Sr	83	441	31	23	21	17	1236	59	45	37	37
Zr	1470	1275	1265	1508	868	757	41920	2135	1763	1977	2733
Nb	362	321	370	327	356	382	2050	590	390	365	438
Mo	13	22	30	17	13	9	< 2	5	3	8	11
Ag					14.7	13.4					
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	31	31	18	27	13	9	117	38	24	27	33
Sb	1.2	1.3	1.2	1.2	0.9	1	1.5	1.7	1.4	1.3	1.4
Cs	1.4	0.9	1.1	1.2	1.4	1.4	3.1	1.7	1.5	1.2	3.7
Ba	43	77	32	35	32	29	245	63	39	42	55
Hf	32.3	27.3	30.1	34.2	17.6	16.9	1050	49.4	36.7	43.3	71.4
Ta	21	17.4	18.6	19.6	22	23.9	150	34.5	22.2	22.3	29.5
W	< 1	< 1	< 1	< 1	< 1	< 1	2	< 1	< 1	< 1	1
Tl	0.5	0.5	0.5	0.5	0.6	0.5	0.8	0.6	0.5	0.5	0.6
Pb	117	117	117	49	33	97	83	122	37	21	102
Th	27.8	30.8	44.2	22.8	35.8	20.7	147	27.1	45.9	37	50.2
U	< 0.4	0.5	< 0.4	< 0.4	< 0.4	< 0.4	1.8	< 0.4	< 0.4	< 0.4	< 0.4
Bi	12.1	11.4	11.6	10.3	9.4	8.7	53.1	14.8	11.4	11.2	14.1
Y	265	249	282	211	252	188	906	296	273	239	277
La	251	249	289	177	192	185	381	224	223	240	306
Ce	480	484	567	351	371	370	757	465	442	465	581
Pr	51.8	53.4	61.5	38.9	40	41.4	73.1	50.7	49.3	51	64.4
Nd	190	198	232	146	148	154	229	187	185	188	241
Sm	39.5	41.5	50.1	33	32.8	32.3	42.3	42.3	40.3	39.9	50.7
Eu	2.52	2.56	3.24	2.13	2.2	2.03	2.8	2.68	2.46	2.37	3.17
Gd	38.7	37.3	48.2	31.7	32.5	30.2	46.9	42.4	37.1	37.1	47
Tb	7.1	6.6	8.6	5.7	6.1	5.2	12.5	8.1	6.5	6.3	7.9
Dy	45.6	40.2	51.2	35.7	39.5	31.8	121	54.6	42.1	40.5	50.1
Ho	9.1	7.7	10	7.1	8	6.4	36.5	11	8.6	8.2	10.2
Er	27.3	22.3	29.1	22.2	24.6	19.2	157	33	26.4	24.9	32.3
Tm	3.88	3.2	4.09	3.68	3.47	2.88	31.8	4.55	3.79	3.68	5.06
Yb	22.7	18.5	24.1	23.2	19.5	16.6	228	26.4	21.7	21	31.5
Lu	3.05	2.54	3.29	3.31	2.61	2.35	36.3	3.65	3.01	2.9	4.47
TREE	1437.25	1415.8	1663.42	1091.62	1174.28	1087.36	3061.2	1451.38	1364.26	1369.85	1711.8

Major and trace element data of representative Khaldzan Burgedei complex (BTDDH-15)

Appendix 1

Lithology	Granite				
Sample	12251	12252	12253	12254	12255
from	315.00	316.00	317.00	318.00	319.00
to	316.00	317.00	318.00	319.00	320.00
(wt%)					
SiO ₂	72.2	71.24	72.58	70.25	70.69
Al ₂ O ₃	10.64	10.72	11.02	11.37	10.74
Fe ₂ O ₃ (T)	5.07	5.27	4.96	5.37	6.27
MnO	0.125	0.132	0.123	0.14	0.158
MgO	0.02	0.02	0.02	0.03	0.01
CaO	0.37	0.37	0.35	0.58	0.39
Na ₂ O	5.24	5.16	5.17	5.15	5.27
K ₂ O	4.45	4.38	4.48	4.33	4.29
TiO ₂	0.156	0.155	0.148	0.193	0.195
P ₂ O ₅	0.02	< 0.01	0.01	0.01	< 0.01
LOI	0.28	0.23	0.21	0.28	0.1
Total	98.57	97.7	99.08	97.69	98.12
(ppm)					
Sc	< 1	< 1	< 1	< 1	< 1
Be	29	97	34	54	22
V	< 5	< 5	< 5	< 5	< 5
Cr	20	< 20	< 20	< 20	20
Co	< 1	< 1	< 1	< 1	< 1
Ni	< 20	< 20	< 20	< 20	< 20
Cu	< 10	< 10	< 10	< 10	< 10
Zn	420	450	390	390	500
Ga	50	53	51	51	51
Ge	3	4	3	3	4
As	11	29	39	27	38
Rb	276	302	278	269	284
Sr	47	30	24	39	20
Zr	3891	2932	2668	2410	1470
Nb	359	392	298	324	364
Mo	14	17	11	9	13
Ag					
In	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sn	30	33	27	24	25
Sb	1.2	1.1	0.9	0.9	0.9
Cs	1.6	4.6	1.5	2.4	1.9
Ba	70	53	48	137	32
Hf	88.7	73.8	57.1	57.4	33.1
Ta	25.9	24.5	19.5	20.5	21.6
W	< 1	< 1	1	< 1	< 1
Tl	0.5	0.6	0.5	0.6	0.7
Pb	24	69	25	52	69
Th	40.9	46.2	47.7	31	47.7
U	0.9	0.7	< 0.4	< 0.4	0.4
Bi	15.6	14.4	12.6	11.8	10.3
Y	266	265	311	223	311
La	361	323	296	258	303
Ce	656	611	569	499	574
Pr	69	68.1	63	55.6	63.9
Nd	247	257	238	208	245
Sm	47.3	52.1	50.1	43.8	52.6
Eu	2.85	3.04	3.07	3.02	3.29
Gd	42.1	45.9	47.3	38.9	50.4
Tb	6.8	7.4	7.8	6.4	8.6
Dy	42	45.1	49	39.5	55.5
Ho	8.5	9.2	10	7.9	11.1
Er	26.7	27.9	30.1	24.5	33.3
Tm	4.32	4.3	4.57	3.8	4.78
Yb	27.1	26.4	26.4	23.3	28.3
Lu	3.84	3.79	3.69	3.3	4.04
TREE	1810.51	1749.23	1709.03	1438.02	1748.81

Appendix 2

EPMA analysis of amphibole

Point No.	KAT-1 (core)	KAT-1 (Late)	6412-17	6410-116	Katophorite	Richterite	Arfvedsonite	763	Quartz syenite							
									199	199	199	199	199	199	199	199
									P5.1-1c	P5.1-2c	P5.1-3c	P5.1-1r	P5.1-2r	P5.1-3r	P5.2-1c	P5.2-2c
SiO₂	43.90	48.50	51.63	48.80	48.04	56.74	48.99	56.32	46.01	50.53	50.69	50.65	50.96	50.51	48.78	49.44
TiO₂	2.43	1.05	0.00	1.10	2.09	0.28	0.77	1.10	0.50	0.87	0.52	0.60	0.71	0.98	1.41	1.42
Al₂O₃	9.82	6.31	7.39	5.65	3.86	0.71	1.66	0.29	0.20	0.36	0.19	0.19	0.24	0.49	1.83	1.80
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	7.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	16.50	15.10	7.55	12.50	25.58	0.87	26.56	4.99	30.56	32.89	33.09	33.75	32.48	33.17	34.28	34.58
MnO	0.60	0.56	0.17	0.78	1.11	0.07	0.94	0.12	1.98	2.15	2.06	1.84	1.94	1.77	1.08	1.03
MgO	11.20	13.30	18.09	15.00	6.42	21.95	0.45	20.26	0.11	0.12	0.13	0.10	0.11	0.11	0.10	0.10
CaO	11.50	11.60	12.32	11.30	8.08	6.15	0.93	5.98	7.28	0.20	0.21	0.13	0.13	0.63	0.83	0.58
Na₂O	1.45	0.83	0.61	1.19	4.18	5.15	6.94	6.10	7.98	8.92	8.93	8.99	8.73	8.86	8.43	8.51
K₂O	0.52	0.49	0.00	0.48	1.34	1.80	3.67	1.87	2.12	2.45	2.39	2.39	2.36	2.42	1.41	1.31
TOTAL	97.92	97.74	97.76	96.80	100.79	93.78	98.43	97.03	96.75	98.49	98.22	98.64	97.65	98.94	98.19	98.80
Numbers of ions on the basis of 23O																
Si	6.50	7.08	7.20	7.12	7.30	8.04	8.23	7.96	7.72	8.02	8.07	8.03	8.10	8.00	7.75	7.79
Al	1.50	0.92	0.80	0.88	0.70	-0.04	-0.23	0.04	0.28	-0.02	-0.07	-0.03	-0.10	0.00	0.25	0.21
Al	0.22	0.17	0.42	0.10	-0.01	0.16	0.56	0.01	-0.24	0.09	0.10	0.06	0.15	0.09	0.09	0.13
Fe³⁺	0.41	0.40	0.38	0.37	-0.06	0.25	0.34	-0.01	-0.12	0.62	0.64	0.71	0.69	0.54	0.67	0.65
Ti	0.27	0.12	0.00	0.12	0.24	0.03	0.10	0.12	0.06	0.10	0.06	0.07	0.08	0.12	0.17	0.17
Fe²⁺	1.63	1.43	0.44	1.15	3.31	-0.15	3.39	0.60	4.41	3.75	3.76	3.76	3.63	3.85	3.88	3.91
Mn	0.08	0.07	0.02	0.10	0.14	0.01	0.13	0.01	0.28	0.29	0.28	0.25	0.26	0.24	0.15	0.14
Mg	2.47	2.89	3.76	3.26	1.45	4.55	0.11	4.27	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.02
Ca	1.83	1.81	1.84	1.77	1.31	0.93	0.17	0.91	1.31	0.03	0.04	0.02	0.02	0.11	0.14	0.10
Na	0.42	0.23	0.16	0.34	1.23	1.41	2.26	1.67	2.59	2.75	2.76	2.76	2.69	2.72	2.60	2.60
K	0.10	0.09	0.00	0.09	0.26	0.33	0.79	0.34	0.45	0.50	0.49	0.48	0.48	0.49	0.29	0.26

Point No.	Quartz syenite																	
	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199
	P5.2-3c	P5.2-1r	P5.2-2r	P5.2-3r	P4.1-1	P4.1-2	P4.1-3	P4.1-1r	P4.1-2r	P4.1-3r	P4.2-1c	P4.2-2c	P4.2-3c	P3.1-1c	P3.1-2c	P3.1-3c	P3.1-1r	P3.1-2r
SiO₂	49.13	48.85	46.64	48.87	42.40	46.25	45.84	47.89	47.75	47.40	64.17	67.83	68.57	50.78	50.31	50.67	50.12	49.87
TiO₂	1.54	1.69	1.53	1.66	1.78	1.87	1.96	1.97	1.94	2.10	0.00	0.02	0.00	0.99	0.97	1.01	0.91	0.89
Al₂O₃	1.85	1.81	1.63	1.88	2.12	2.27	2.43	2.34	2.38	2.52	18.19	19.14	19.23	0.55	0.57	0.58	0.82	0.77
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	35.01	34.62	32.76	34.02	31.26	33.22	33.82	34.56	34.56	33.88	0.14	0.19	0.41	34.96	34.80	35.23	34.83	34.50
MnO	0.97	1.16	1.09	1.09	0.96	1.03	0.95	1.04	0.98	1.14	0.01	0.02	0.00	1.18	1.23	1.09	1.21	1.11
MgO	0.10	0.10	0.10	0.08	0.23	0.25	0.24	0.25	0.26	0.25	0.00	0.00	0.00	0.02	0.03	0.02	0.04	0.02
CaO	0.40	0.62	4.06	0.49	9.99	4.08	4.43	0.72	0.77	1.73	0.00	0.02	0.00	1.00	1.18	0.76	0.77	0.75
Na₂O	8.84	9.11	9.25	8.91	8.04	8.34	8.65	8.93	8.76	8.36	0.27	10.18	11.91	7.58	7.69	8.06	8.83	8.76
K₂O	1.43	1.49	1.45	1.60	1.32	1.33	1.37	1.48	1.44	1.37	16.51	2.38	0.14	1.50	1.49	1.52	1.80	1.80
TOTAL	99.32	99.45	98.53	98.63	98.11	98.65	99.69	99.19	98.84	98.76	99.33	99.79	100.26	98.58	98.27	98.92	99.34	98.48
Numbers of ions on the basis of 23O																		
Si	7.71	7.67	7.52	7.73	7.12	7.43	7.33	7.53	7.53	7.51	9.58	8.87	8.87	8.00	7.99	7.99	7.90	7.93
Al	0.29	0.33	0.48	0.27	0.88	0.57	0.67	0.47	0.47	0.49	-1.58	-0.87	-0.87	0.00	0.01	0.01	0.10	0.07
Al	0.05	0.00	-0.17	0.08	-0.46	-0.14	-0.21	-0.04	-0.03	-0.02	4.78	3.82	3.80	0.10	0.10	0.10	0.05	0.07
Fe³⁺	0.80	0.81	0.45	0.70	-0.29	0.48	0.47	0.91	0.89	0.69	-5.18	-1.35	-1.36	0.71	0.58	0.62	0.69	0.64
Ti	0.18	0.20	0.19	0.20	0.22	0.23	0.24	0.23	0.23	0.25	0.00	0.00	0.00	0.12	0.12	0.12	0.11	0.11
Fe²⁺	3.79	3.74	3.97	3.79	4.68	3.98	4.05	3.64	3.67	3.80	5.20	1.38	1.40	3.90	4.04	4.03	3.90	3.94
Mn	0.13	0.15	0.15	0.15	0.14	0.14	0.13	0.14	0.13	0.15	0.00	0.00	0.00	0.16	0.17	0.15	0.16	0.15
Mg	0.02	0.02	0.02	0.02	0.06	0.06	0.06	0.06	0.06	0.06	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00
Ca	0.07	0.10	0.70	0.08	1.80	0.70	0.76	0.12	0.13	0.29	0.00	0.00	0.00	0.17	0.20	0.13	0.13	0.13
Na	2.69	2.77	2.89	2.73	2.62	2.60	2.68	2.72	2.68	2.57	0.08	2.58	2.98	2.32	2.37	2.46	2.70	2.70
K	0.29	0.30	0.30	0.32	0.28	0.27	0.28	0.30	0.29	0.28	3.14	0.40	0.02	0.30	0.30	0.30	0.36	0.37

Point No.	Quartz syenite																	
	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199
	P3.1-3r	P3.2-1c	P3.2-1c	P3.2-2c	P3.2-1r	P3.2-2r	P3.2-3r	P2.1-1c	P2.1-2c	P2.1-3c	P2.1-1r	P2.1-2r	P2.1-3r	P2.1-1c	P2.1-2c	P2.1-3c	P2.1-1r	P2.1-2r
SiO₂	49.97	48.60	47.64	50.02	49.77	50.08	49.90	43.46	49.07	50.43	49.40	48.97	49.28	48.71	48.63	48.66	49.59	49.45
TiO₂	0.92	0.81	0.83	0.86	1.05	1.02	1.03	1.04	1.12	1.10	1.32	1.28	1.31	1.31	1.22	1.28	1.14	1.13
Al₂O₃	1.03	0.83	0.85	0.97	0.94	0.88	0.93	1.12	1.29	1.04	1.58	1.44	1.46	1.66	1.52	1.48	1.29	1.34
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	35.50	33.03	32.37	34.21	33.94	34.75	34.23	30.28	33.87	34.12	34.84	35.14	34.52	35.09	34.34	33.93	35.01	35.34
MnO	1.29	0.94	1.07	1.19	1.18	1.07	1.22	1.04	1.06	0.86	1.15	1.33	1.13	1.26	1.12	1.37	1.04	1.27
MgO	0.05	0.03	0.00	0.00	0.02	0.04	0.04	0.04	0.00	0.03	0.09	0.07	0.08	0.05	0.04	0.07	0.07	0.07
CaO	0.72	3.45	4.25	0.99	0.94	1.11	1.02	9.85	2.27	0.84	0.98	1.61	0.57	1.47	2.17	2.26	1.10	0.94
Na₂O	8.67	8.73	8.51	9.18	9.09	8.66	9.00	7.84	8.31	7.96	8.46	8.07	8.19	8.81	8.65	8.43	7.71	8.53
K₂O	1.62	1.73	1.66	1.75	1.56	1.49	1.58	1.29	1.45	1.55	1.52	1.35	1.60	1.37	1.37	1.34	1.30	1.36
TOTAL	99.76	98.13	97.21	99.18	98.51	99.10	98.99	95.96	98.46	97.98	99.34	99.29	98.16	99.73	99.08	98.87	98.24	99.43
Numbers of ions on the basis of 23O																		
Si	7.83	7.85	7.80	7.90	7.90	7.91	7.89	7.44	7.84	8.01	7.77	7.73	7.83	7.66	7.72	7.74	7.89	7.77
Al	0.17	0.15	0.20	0.10	0.10	0.09	0.11	0.56	0.16	-0.01	0.23	0.27	0.17	0.34	0.28	0.26	0.11	0.23
Al	0.02	0.01	-0.03	0.08	0.08	0.08	0.06	-0.34	0.08	0.20	0.06	0.00	0.11	-0.04	0.00	0.01	0.13	0.02
Fe³⁺	0.80	0.26	0.17	0.62	0.57	0.57	0.60	-0.45	0.39	0.50	0.68	0.68	0.66	0.80	0.59	0.52	0.54	0.78
Ti	0.11	0.10	0.10	0.10	0.13	0.12	0.12	0.13	0.13	0.13	0.16	0.15	0.16	0.15	0.15	0.15	0.14	0.13
Fe²⁺	3.85	4.20	4.26	3.90	3.93	4.02	3.93	4.78	4.13	4.03	3.90	3.96	3.93	3.81	3.97	3.99	4.12	3.87
Mn	0.17	0.13	0.15	0.16	0.16	0.14	0.16	0.15	0.14	0.12	0.15	0.18	0.15	0.17	0.15	0.18	0.14	0.17
Mg	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02
Ca	0.12	0.60	0.75	0.17	0.16	0.19	0.17	1.81	0.39	0.14	0.16	0.27	0.10	0.25	0.37	0.39	0.19	0.16
Na	2.63	2.73	2.70	2.81	2.80	2.65	2.76	2.60	2.57	2.45	2.58	2.47	2.52	2.68	2.66	2.60	2.38	2.60
K	0.32	0.36	0.35	0.35	0.32	0.30	0.32	0.28	0.29	0.31	0.31	0.27	0.32	0.27	0.28	0.27	0.26	0.27

Estimation of the Proportion of Ferric Iron in the EPMA Analysis of Amphibole. Leake et al., 1997,

Appendix 2

Point No.	Quartz syenite							Granite									
	199	199	199	199	199	199	199	271	271	271	271	271	271	271	271	271	271
	P2.1-3r	P1.1-1c	P1.1-2c	P1.1-3c	P1.1-1r	P1.1-2r	P1.1-3r	P1.1-1c	P1.1-2c	P1.1-3c	P1.1-1r	P1.1-2r	P1.1-3r	P2.1-1c	P2.1-2c	P2.1-3c	P2.1-1r
SiO₂	49.67	51.09	51.30	50.90	50.60	50.63	50.77	50.51	50.73	50.56	50.17	50.33	50.46	50.51	50.76	50.41	51.22
TiO₂	1.15	0.87	0.50	0.40	1.32	1.31	1.34	0.42	0.46	0.41	0.42	0.42	0.45	0.40	0.40	0.41	0.87
Al₂O₃	1.37	0.30	0.17	0.17	0.26	0.23	0.24	0.39	0.39	0.38	0.38	0.39	0.39	0.38	0.40	0.41	0.24
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	35.20	32.39	33.22	32.64	33.32	33.52	33.38	33.91	33.89	33.70	33.02	32.91	33.23	33.57	32.77	32.77	31.57
MnO	1.17	1.77	1.79	2.09	1.23	1.25	1.21	0.79	0.71	0.78	0.84	0.99	0.77	0.75	0.86	0.79	1.01
MgO	0.07	0.12	0.14	0.13	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.01
CaO	1.16	0.12	0.12	0.11	0.37	0.31	0.30	0.18	0.17	0.17	0.17	0.12	0.14	0.14	0.18	0.18	0.04
Na₂O	8.17	8.19	8.23	8.78	8.75	8.34	8.79	9.15	9.25	9.14	8.19	8.49	8.33	8.43	8.24	8.37	8.62
K₂O	1.26	2.31	2.26	2.19	1.73	1.66	1.71	1.27	1.30	1.32	1.35	1.35	1.33	1.36	1.22	1.26	1.67
TOTAL	99.23	97.15	97.73	97.41	97.57	97.27	97.76	96.62	96.93	96.46	94.54	95.00	95.11	95.57	94.84	94.66	95.27
Numbers of ions on the basis of 23O																	
Si	7.82	8.11	8.10	8.10	8.07	8.06	8.07	8.09	8.10	8.10	8.11	8.12	8.11	8.10	8.14	8.13	8.19
Al	0.18	-0.11	-0.10	-0.10	-0.07	-0.06	-0.07	-0.09	-0.10	-0.10	-0.11	-0.12	-0.11	-0.10	-0.14	-0.13	-0.19
Al	0.08	0.16	0.13	0.13	0.12	0.11	0.12	0.16	0.17	0.17	0.19	0.19	0.19	0.18	0.22	0.21	0.24
Fe³⁺	0.63	0.83	0.95	0.80	0.53	0.70	0.56	0.76	0.74	0.78	1.05	0.99	1.03	1.00	1.12	1.03	0.93
Ti	0.14	0.10	0.06	0.05	0.16	0.16	0.16	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10
Fe²⁺	4.00	3.46	3.43	3.54	3.91	3.76	3.88	3.78	3.78	3.74	3.41	3.45	3.44	3.50	3.28	3.39	3.29
Mn	0.16	0.24	0.24	0.28	0.17	0.17	0.16	0.11	0.10	0.11	0.12	0.14	0.10	0.10	0.12	0.11	0.14
Mg	0.02	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.20	0.02	0.02	0.02	0.06	0.05	0.05	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.01
Na	2.50	2.52	2.52	2.71	2.71	2.58	2.71	2.84	2.86	2.84	2.57	2.65	2.60	2.62	2.56	2.62	2.67
K	0.25	0.47	0.45	0.44	0.35	0.34	0.35	0.26	0.27	0.27	0.28	0.28	0.27	0.28	0.25	0.26	0.34

Point No.	Granite																	
	271 P2.1-2r	271 P2.1-3r	271 P2.1-1c	271 P2.2-2c	271 P2.2-3c	271 P2.2-1r	271 P2.2-2r	271 P2.2-3r	271 P3.1-1c	271 P3.1-2c	271 P3.1-3c	271 P3.1-1r	271 P3.1-2r	271 P3.1-3r	271 P4.1-1c	271 P4.1-2c	271 P4.1-3c	271 P4.1-1r
SiO₂	51.23	50.70	50.21	50.37	50.21	50.86	50.75	50.57	50.28	49.98	50.22	50.65	50.63	50.02	50.19	50.32	50.70	50.69
TiO₂	0.86	0.80	0.46	0.44	0.43	0.50	0.49	0.52	0.53	0.50	0.51	0.35	0.40	0.39	0.42	0.43	0.38	0.34
Al₂O₃	0.25	0.24	0.44	0.47	0.43	0.25	0.24	0.27	0.48	0.43	0.41	0.34	0.40	0.34	0.38	0.39	0.38	0.12
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	31.57	31.14	33.84	32.92	32.60	31.36	31.35	31.41	33.15	33.45	33.36	32.11	32.57	32.46	33.29	32.67	33.33	31.53
MnO	1.03	1.05	0.74	0.82	0.74	1.28	1.10	1.26	0.73	0.82	0.72	1.00	0.90	0.94	0.82	0.71	0.78	1.35
MgO	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.02
CaO	0.05	0.04	0.18	0.17	0.15	0.05	0.06	0.04	0.17	0.14	0.15	0.06	0.10	0.09	0.14	0.14	0.15	0.09
Na₂O	8.74	8.43	8.90	8.65	8.02	8.13	8.45	8.06	8.38	9.05	8.54	8.26	9.06	8.93	9.02	8.99	8.88	8.44
K₂O	1.69	1.64	1.21	1.24	1.33	1.71	1.71	1.73	1.07	1.11	1.15	1.68	1.35	1.31	1.11	1.06	1.07	1.91
TOTAL	95.42	94.04	95.98	95.08	93.93	94.14	94.15	93.85	94.81	95.50	95.07	94.47	95.41	94.48	95.38	94.70	95.65	94.52
Numbers of ions on the basis of 23O																		
Si	8.19	8.20	8.08	8.12	8.13	8.19	8.20	8.18	8.11	8.08	8.10	8.17	8.14	8.13	8.10	8.14	8.12	8.19
Al	-0.19	-0.20	-0.08	-0.12	-0.13	-0.19	-0.20	-0.18	-0.11	-0.08	-0.10	-0.17	-0.14	-0.13	-0.10	-0.14	-0.12	-0.19
Al	0.24	0.24	0.16	0.21	0.22	0.24	0.24	0.23	0.20	0.17	0.18	0.23	0.22	0.20	0.18	0.21	0.19	0.21
Fe³⁺	0.89	0.98	0.81	0.92	1.12	1.14	1.03	1.13	1.00	0.78	0.95	1.09	0.86	0.88	0.85	0.90	0.95	1.03
Ti	0.10	0.10	0.06	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.04	0.05	0.05	0.05	0.05	0.05	0.04
Fe²⁺	3.33	3.23	3.74	3.51	3.30	3.09	3.20	3.12	3.46	3.74	3.55	3.24	3.53	3.54	3.65	3.52	3.51	3.23
Mn	0.14	0.14	0.10	0.11	0.10	0.17	0.15	0.17	0.10	0.11	0.10	0.14	0.12	0.13	0.11	0.10	0.11	0.18
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Ca	0.01	0.01	0.03	0.03	0.03	0.01	0.01	0.01	0.03	0.02	0.03	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Na	2.71	2.64	2.78	2.70	2.52	2.54	2.65	2.53	2.62	2.84	2.67	2.58	2.83	2.81	2.82	2.82	2.76	2.64
K	0.34	0.34	0.25	0.25	0.27	0.35	0.35	0.36	0.22	0.23	0.24	0.34	0.28	0.27	0.23	0.22	0.22	0.39

Point No.	Granite																	
	271	271	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185
	P4.1-2r	P4.1-3r	P1.1-1c	P1.1-2c	P1.1-3c	P1.1-1r	P1.1-2r	P1.1-3r	P2.1-1c	P2.1-2c	P2.1-3c	P2.1-1r	P2.1-2r	P2.1-3r	P2.1-1c	P2.1-2c	P2.1-3c	P2.2-1r
SiO₂	50.87	50.94	49.30	49.65	49.09	49.70	49.89	50.16	49.02	49.46	48.28	50.51	50.62	50.67	49.31	49.65	50.27	50.44
TiO₂	0.33	0.39	0.76	0.76	0.77	0.60	0.61	0.45	0.66	0.68	0.63	0.58	0.64	0.67	0.92	0.67	0.70	0.63
Al₂O₃	0.15	0.36	0.92	0.89	0.97	0.30	0.28	0.16	0.66	0.66	0.65	0.31	0.28	0.26	0.67	0.67	0.76	0.26
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	31.06	31.89	33.20	34.36	33.62	31.82	31.40	32.29	33.41	33.62	32.76	32.29	32.14	31.72	33.42	33.19	33.45	32.71
MnO	1.29	1.25	0.93	0.91	0.84	0.95	0.94	0.98	0.78	0.80	0.94	0.91	0.91	1.11	0.77	0.82	0.74	1.02
MgO	0.01	0.00	0.04	0.03	0.05	0.01	0.01	0.02	0.03	0.02	0.03	0.00	0.00	0.00	0.06	0.01	0.04	0.01
CaO	0.11	0.12	0.77	0.67	0.71	0.16	0.14	0.14	0.96	0.44	2.14	0.20	0.16	0.11	1.44	0.48	0.40	0.16
Na₂O	8.20	8.39	7.54	7.05	7.40	8.53	8.49	7.93	8.38	7.86	8.19	8.65	8.52	8.05	6.51	7.86	7.67	8.38
K₂O	1.93	1.42	0.97	0.86	0.96	1.33	1.42	1.77	1.15	1.05	0.98	1.37	1.44	1.47	0.85	1.07	1.03	1.43
TOTAL	93.94	94.76	94.44	95.16	94.42	93.39	93.18	93.89	95.03	94.58	94.62	94.84	94.71	94.16	93.96	94.43	95.05	95.05
Numbers of ions on the basis of 23O																		
Si	8.22	8.17	8.03	7.99	8.00	8.15	8.17	8.15	8.04	8.04	8.01	8.15	8.16	8.17	8.03	8.06	8.07	8.13
Al	-0.22	-0.17	-0.03	0.01	0.00	-0.15	-0.17	-0.15	-0.04	-0.04	-0.01	-0.15	-0.16	-0.17	-0.03	-0.06	-0.07	-0.13
Al	0.25	0.24	0.20	0.16	0.19	0.20	0.22	0.18	0.16	0.17	0.14	0.21	0.21	0.22	0.16	0.19	0.21	0.18
Fe³⁺	1.13	1.09	0.82	1.03	0.84	0.92	0.94	1.12	0.52	0.91	0.29	0.91	0.96	1.11	0.95	0.92	1.03	0.97
Ti	0.04	0.05	0.09	0.09	0.09	0.07	0.08	0.06	0.08	0.08	0.08	0.07	0.08	0.08	0.11	0.08	0.08	0.08
Fe²⁺	3.07	3.19	3.70	3.59	3.74	3.44	3.36	3.27	4.06	3.66	4.26	3.45	3.37	3.17	3.60	3.59	3.46	3.43
Mn	0.18	0.17	0.13	0.12	0.12	0.13	0.13	0.13	0.11	0.11	0.13	0.12	0.12	0.15	0.11	0.11	0.10	0.14
Mg	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.01	0.00
Ca	0.02	0.02	0.13	0.11	0.12	0.03	0.02	0.02	0.17	0.08	0.38	0.03	0.03	0.02	0.25	0.08	0.07	0.03
Na	2.57	2.61	2.38	2.20	2.34	2.71	2.70	2.50	2.66	2.48	2.63	2.71	2.66	2.52	2.06	2.48	2.39	2.62
K	0.40	0.29	0.20	0.18	0.20	0.28	0.30	0.37	0.24	0.22	0.21	0.28	0.30	0.30	0.18	0.22	0.21	0.29

Point No.	Granite																	
	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185	185
	P2.2-2r	P2.2-3r	P3.1-1c	P3.1-2c	P3.1-3c	P3.1-1r	P3.1-2r	P3.1-3r	P3.2-1c	P3.2-2c	P3.2-3c	P3.2-1r	P3.2-2r	P3.2-3r	P4.1-1c	P4.1-2c	P4.1-3c	P4.1-1r
SiO₂	49.83	49.98	49.99	49.18	49.63	49.86	50.29	50.36	50.79	50.29	50.99	50.53	51.06	50.53	51.57	51.31	51.08	51.07
TiO₂	0.30	0.22	0.85	0.78	0.86	0.02	0.28	0.40	0.62	0.55	0.54	0.26	0.32	0.06	0.50	0.96	0.92	0.11
Al₂O₃	0.51	0.63	0.98	1.03	0.96	0.93	0.52	0.48	0.19	0.19	0.25	0.41	0.23	0.54	0.28	0.62	0.71	0.73
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	34.91	35.25	33.22	32.46	33.12	36.33	34.00	33.48	31.70	31.66	32.72	33.12	32.42	36.13	31.77	33.12	33.34	37.00
MnO	0.70	0.51	0.80	0.81	0.87	0.44	0.74	0.96	1.03	1.07	1.04	0.92	1.30	0.39	1.65	1.10	1.14	0.55
MgO	0.09	0.08	0.06	0.09	0.08	0.04	0.04	0.04	0.01	0.02	0.03	0.18	0.03	0.15	0.06	0.00	0.04	0.07
CaO	0.76	1.43	0.37	0.43	0.41	2.92	1.03	1.21	0.11	0.10	0.42	0.41	0.29	1.67	0.14	0.19	0.26	2.38
Na₂O	6.22	6.03	7.44	8.10	8.28	4.80	6.69	6.85	8.22	8.31	7.21	6.94	7.51	5.27	7.48	9.09	8.78	5.87
K₂O	0.68	0.43	1.04	1.08	1.06	0.08	0.68	1.02	1.63	1.54	1.43	1.04	1.46	0.07	1.54	1.85	1.62	0.09
TOTAL	94.02	94.55	94.81	93.95	95.29	95.41	94.28	94.82	94.29	93.71	94.64	93.83	94.62	94.80	94.99	98.25	97.88	97.89
Numbers of ions on the basis of 23O																		
Si	8.02	8.02	8.04	8.05	8.03	7.97	8.07	8.09	8.19	8.17	8.14	8.11	8.16	8.03	8.17	8.10	8.07	7.97
Al	-0.02	-0.02	-0.04	-0.05	-0.03	0.03	-0.07	-0.09	-0.19	-0.17	-0.14	-0.11	-0.16	-0.03	-0.17	-0.10	-0.07	0.03
Al	0.12	0.13	0.23	0.25	0.22	0.14	0.17	0.18	0.22	0.21	0.19	0.18	0.20	0.13	0.22	0.21	0.21	0.11
Fe³⁺	1.51	1.39	0.99	0.72	0.68	1.24	1.34	1.15	1.08	1.05	1.32	1.47	1.34	1.55	1.37	0.55	0.63	1.21
Ti	0.04	0.03	0.10	0.10	0.10	0.00	0.03	0.05	0.07	0.07	0.07	0.03	0.04	0.01	0.06	0.11	0.11	0.01
Fe²⁺	3.19	3.33	3.48	3.72	3.80	3.61	3.22	3.34	3.19	3.25	3.05	2.97	3.00	3.25	2.85	3.82	3.77	3.62
Mn	0.10	0.07	0.11	0.11	0.12	0.06	0.10	0.13	0.14	0.15	0.14	0.13	0.18	0.05	0.22	0.15	0.15	0.07
Mg	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.01	0.04	0.01	0.04	0.01	0.00	0.01	0.02
Ca	0.13	0.25	0.06	0.07	0.07	0.50	0.18	0.21	0.02	0.02	0.07	0.07	0.05	0.28	0.02	0.03	0.04	0.40
Na	1.94	1.88	2.32	2.57	2.60	1.49	2.08	2.13	2.57	2.62	2.23	2.16	2.33	1.63	2.30	2.78	2.69	1.78
K	0.14	0.09	0.21	0.22	0.22	0.02	0.14	0.21	0.33	0.32	0.29	0.21	0.30	0.01	0.31	0.37	0.33	0.02

Estimation of the Proportion of Ferric Iron in the EPMA Analysis of Amphibole. Leake et al., 1997,

Appendix 2

Point No.								Syenite									
	185	185	185	185	185	185	185	168	168	168	168	168	168	168	168	168	168
	P4.1-2r	P4.2-1c	P4.2-2c	P4.2-3c	P4.2-1r	P4.2-2r	P4.2-3r	P4.1-1c	P4.1-2c	P4.1-3c	P4.1-1r	P4.1-2r	P4.1-3r	P4.2-1c	P4.2-2c	P4.2-3c	P4.2-1r
SiO₂	50.92	50.93	46.92	50.54	51.39	51.51	51.15	48.94	48.98	49.05	49.61	49.64	49.48	48.86	48.90	48.84	49.42
TiO₂	0.22	0.76	0.74	0.78	0.26	0.69	0.84	1.26	1.33	1.30	1.25	1.20	1.30	1.27	1.31	1.34	1.32
Al₂O₃	0.80	0.66	0.53	0.65	0.43	0.24	0.23	1.09	1.09	1.08	0.93	0.96	0.92	1.13	1.09	1.12	0.90
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	36.54	34.38	32.10	34.26	35.91	33.68	32.27	34.33	34.40	34.27	33.90	34.47	34.17	33.75	33.85	33.97	34.29
MnO	0.66	0.91	0.80	0.94	0.53	1.02	1.07	1.08	1.13	1.16	1.20	1.11	1.22	1.19	1.24	1.26	1.33
MgO	0.05	0.03	0.05	0.03	0.03	0.01	0.01	0.39	0.43	0.38	0.30	0.28	0.30	0.35	0.38	0.34	0.25
CaO	2.65	0.64	6.09	0.79	2.07	0.27	0.35	4.92	4.96	4.95	3.84	4.04	4.07	4.64	4.67	4.66	4.09
Na₂O	5.66	8.86	8.10	8.91	6.38	8.75	8.72	5.58	5.83	5.59	5.32	5.45	5.47	5.64	5.72	5.73	5.78
K₂O	0.51	1.46	1.36	1.51	0.64	1.94	2.19	1.27	1.29	1.29	1.42	1.48	1.53	1.31	1.32	1.27	1.50
TOTAL	98.00	98.64	96.69	98.42	97.64	98.11	96.83	98.86	99.43	99.06	97.75	98.62	98.46	98.14	98.49	98.54	98.88
Numbers of ions on the																	
Si	7.98	8.04	7.80	8.02	8.04	8.12	8.16	7.83	7.81	7.84	7.96	7.92	7.91	7.86	7.85	7.84	7.89
Al	0.02	-0.04	0.20	-0.02	-0.04	-0.12	-0.16	0.17	0.19	0.16	0.04	0.08	0.09	0.14	0.15	0.16	0.11
Al	0.12	0.17	-0.10	0.14	0.12	0.16	0.20	0.04	0.02	0.04	0.13	0.10	0.09	0.08	0.06	0.05	0.06
Fe³⁺	1.07	0.52	-0.10	0.49	1.16	0.77	0.67	0.09	0.06	0.08	0.22	0.21	0.18	0.08	0.07	0.09	0.15
Ti	0.03	0.09	0.09	0.09	0.03	0.08	0.10	0.15	0.16	0.16	0.15	0.14	0.16	0.15	0.16	0.16	0.16
Fe²⁺	3.72	4.02	4.56	4.05	3.54	3.66	3.63	4.50	4.53	4.50	4.32	4.39	4.39	4.47	4.47	4.47	4.43
Mn	0.09	0.12	0.11	0.13	0.07	0.14	0.14	0.15	0.15	0.16	0.16	0.15	0.16	0.16	0.17	0.17	0.18
Mg	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.09	0.10	0.09	0.07	0.07	0.07	0.08	0.09	0.08	0.06
Ca	0.44	0.11	1.08	0.13	0.35	0.05	0.06	0.84	0.85	0.85	0.66	0.69	0.70	0.80	0.80	0.80	0.70
Na	1.72	2.71	2.61	2.74	1.94	2.67	2.70	1.73	1.80	1.73	1.65	1.69	1.70	1.76	1.78	1.78	1.79
K	0.10	0.29	0.29	0.31	0.13	0.39	0.45	0.26	0.26	0.26	0.29	0.30	0.31	0.27	0.27	0.26	0.31

Point No.	Syenite																	
	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168
	P4.2-2r	P4.2-3r	P5.1-1c	P5.1-2c	P5.1-3c	P5.1-1r	P5.1-2r	P5.1-3r	P6.1-1c	P6.1-2c	P6.1-3c	P6.1-1r	P6.1-2r	P6.1-3r	P6.1-1c	P6.2-1c	P6.2-3c	P6.2-1r
SiO₂	49.13	49.32	49.80	49.55	49.83	50.60	50.78	50.83	48.84	49.08	49.30	49.78	49.99	49.90	49.31	49.22	49.36	49.28
TiO₂	1.28	1.27	0.97	0.96	0.89	0.37	0.35	0.38	1.31	1.27	1.25	1.07	1.17	1.04	1.08	1.07	1.03	0.77
Al₂O₃	0.94	0.93	0.72	0.71	0.67	0.53	0.55	0.54	1.15	1.07	1.07	0.73	0.74	0.75	1.05	1.03	0.99	1.31
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	33.98	34.30	34.23	34.39	34.10	35.70	35.48	35.73	34.59	34.46	34.81	34.29	34.27	33.90	34.48	34.25	34.61	34.40
MnO	1.22	1.28	1.18	1.20	1.23	1.02	1.11	0.92	1.18	1.12	1.11	1.16	1.12	1.18	0.82	0.93	0.88	1.02
MgO	0.26	0.28	0.32	0.35	0.36	0.30	0.29	0.32	0.43	0.39	0.42	0.39	0.42	0.48	0.58	0.51	0.55	0.26
CaO	4.11	4.02	3.63	3.65	3.48	2.16	2.09	2.01	4.69	4.58	4.71	4.03	4.09	4.01	4.52	4.31	4.26	3.63
Na₂O	5.62	5.40	5.99	6.03	5.95	6.78	6.85	6.83	5.79	5.81	5.70	5.80	5.65	5.73	5.89	5.68	5.65	6.17
K₂O	1.48	1.48	1.68	1.66	1.71	1.14	1.20	1.09	1.43	1.42	1.42	1.59	1.65	1.58	1.31	1.31	1.30	1.40
TOTAL	98.06	98.29	98.56	98.51	98.26	98.60	98.72	98.65	99.43	99.25	99.78	98.87	99.10	98.57	99.08	98.31	98.66	98.24
	basis of 23O																	Numbers of i
Si	7.90	7.90	7.97	7.94	7.98	7.98	7.99	7.99	7.80	7.83	7.82	7.94	7.95	7.97	7.86	7.89	7.88	7.90
Al	0.10	0.10	0.03	0.06	0.02	0.02	0.01	0.01	0.20	0.17	0.18	0.06	0.05	0.03	0.14	0.11	0.12	0.10
Al	0.08	0.08	0.11	0.08	0.10	0.08	0.09	0.09	0.01	0.03	0.02	0.08	0.09	0.11	0.06	0.08	0.06	0.15
Fe³⁺	0.15	0.23	0.15	0.18	0.24	0.75	0.77	0.82	0.08	0.11	0.14	0.14	0.13	0.13	0.12	0.17	0.22	0.20
Ti	0.15	0.15	0.12	0.12	0.11	0.04	0.04	0.05	0.16	0.15	0.15	0.13	0.14	0.13	0.13	0.13	0.12	0.09
Fe²⁺	4.43	4.37	4.43	4.43	4.33	3.95	3.90	3.88	4.54	4.49	4.48	4.44	4.42	4.40	4.47	4.42	4.40	4.42
Mn	0.17	0.17	0.16	0.16	0.17	0.14	0.15	0.12	0.16	0.15	0.15	0.16	0.15	0.16	0.11	0.13	0.12	0.14
Mg	0.06	0.07	0.08	0.08	0.09	0.07	0.07	0.07	0.10	0.09	0.10	0.09	0.10	0.11	0.14	0.12	0.13	0.06
Ca	0.71	0.69	0.62	0.63	0.60	0.36	0.35	0.34	0.80	0.78	0.80	0.69	0.70	0.69	0.77	0.74	0.73	0.62
Na	1.75	1.68	1.86	1.87	1.85	2.07	2.09	2.08	1.79	1.80	1.75	1.79	1.74	1.77	1.82	1.76	1.75	1.92
K	0.30	0.30	0.34	0.34	0.35	0.23	0.24	0.22	0.29	0.29	0.29	0.32	0.33	0.32	0.27	0.27	0.26	0.29

Point No.	Syenite																	
	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168
	P6.2-2r	P6.2-3r	P6.3-1c	P6.3-2c	P6.3-3c	P3.1-1r	P3.1-2r	P3.1-3r	P2.1-1c	P2.1-2c	P2.1-3c	P2.1-1r	P2.1-2r	P2.1-3r	P1.1-1c	P1.1-2c	P1.1-3c	P1.1-1r
SiO₂	49.26	49.13	49.18	49.38	49.33	49.85	49.54	49.58	48.85	49.07	49.15	49.28	49.36	49.24	50.47	49.95	51.00	49.96
TiO₂	0.90	0.83	1.28	0.61	1.26	1.24	1.25	1.23	1.15	1.27	1.24	1.22	1.27	1.24	0.90	1.06	1.01	1.10
Al₂O₃	1.41	1.39	1.17	1.00	1.19	0.96	1.01	0.99	1.03	1.08	1.02	1.00	1.04	1.04	0.70	0.76	0.65	0.74
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	34.29	34.27	33.91	35.25	33.75	33.65	34.19	34.38	34.48	34.24	34.68	34.39	34.68	34.53	35.07	33.82	34.66	33.98
MnO	1.13	1.10	1.15	1.14	1.18	1.28	1.18	1.30	1.19	1.05	1.30	1.24	1.23	1.28	1.12	1.21	0.86	1.18
MgO	0.27	0.26	0.48	0.46	0.47	0.32	0.31	0.31	0.34	0.32	0.30	0.33	0.29	0.35	0.36	0.32	0.33	0.28
CaO	3.87	3.82	4.64	3.70	4.67	4.09	4.08	4.14	4.81	4.73	4.82	4.45	4.40	4.50	3.09	3.93	2.25	3.81
Na₂O	6.25	6.06	5.36	5.87	5.79	5.72	5.71	6.01	5.73	5.54	5.43	5.26	5.30	5.46	5.95	5.86	6.14	5.59
K₂O	1.45	1.45	1.37	1.46	1.43	1.54	1.49	1.52	1.26	1.29	1.32	1.54	1.49	1.50	1.35	1.61	0.99	1.52
TOTAL	98.84	98.32	98.54	98.88	99.07	98.64	98.76	99.47	98.84	98.59	99.27	98.74	99.04	99.17	99.01	98.51	97.89	98.16
ons on the basis of 23O																		Nu
Si	7.87	7.88	7.86	7.87	7.87	7.96	7.91	7.88	7.83	7.86	7.84	7.87	7.86	7.85	7.96	7.99	8.01	7.98
Al	0.13	0.12	0.14	0.13	0.13	0.04	0.09	0.12	0.17	0.14	0.16	0.13	0.14	0.15	0.04	0.01	-0.01	0.02
Al	0.13	0.14	0.08	0.06	0.09	0.14	0.10	0.07	0.03	0.07	0.03	0.06	0.06	0.04	0.09	0.13	0.13	0.13
Fe³⁺	0.14	0.18	0.14	0.34	0.04	0.08	0.15	0.12	0.11	0.10	0.15	0.19	0.22	0.18	0.47	0.10	0.83	0.23
Ti	0.11	0.10	0.15	0.07	0.15	0.15	0.15	0.15	0.14	0.15	0.15	0.15	0.15	0.15	0.11	0.13	0.12	0.13
Fe²⁺	4.44	4.42	4.39	4.36	4.46	4.41	4.41	4.45	4.52	4.49	4.47	4.40	4.40	4.42	4.15	4.43	3.72	4.31
Mn	0.15	0.15	0.16	0.15	0.16	0.17	0.16	0.17	0.16	0.14	0.18	0.17	0.17	0.17	0.15	0.16	0.11	0.16
Mg	0.06	0.06	0.11	0.11	0.11	0.08	0.07	0.07	0.08	0.08	0.07	0.08	0.07	0.08	0.08	0.08	0.08	0.07
Ca	0.66	0.66	0.80	0.63	0.80	0.70	0.70	0.70	0.83	0.81	0.82	0.76	0.75	0.77	0.52	0.67	0.38	0.65
Na	1.93	1.88	1.66	1.82	1.79	1.77	1.77	1.85	1.78	1.72	1.68	1.63	1.64	1.69	1.82	1.82	1.87	1.73
K	0.30	0.30	0.28	0.30	0.29	0.31	0.30	0.31	0.26	0.26	0.27	0.31	0.30	0.30	0.27	0.33	0.20	0.31

Point No.	Syenite															
	168	168	175	175	175	175	175	175	175	175	175	175	175	175	175	175
	P1.1-2r	P1.1-3r	P3a.1-1c	P3a.1-2c	P3a.1-3c	P3a.1-1r	P3a.1-2r	Pa3.1-3r	P3b.1-1	P3b.1-2c	P3b.1-3c	P3b.1-1r	P3b.1-2r	P3b.1-3r	P2.1-1c	P2.1-2c
SiO₂	49.93	49.94	47.45	47.01	49.06	50.31	50.20	50.44	50.95	51.46	51.41	51.19	51.20	51.34	43.17	31.14
TiO₂	1.07	1.00	1.36	1.36	1.39	0.95	0.93	0.87	1.39	1.43	1.42	1.41	1.48	1.49	1.77	1.35
Al₂O₃	0.74	0.75	1.84	1.85	2.13	0.79	0.72	0.62	0.24	0.21	0.22	0.20	0.20	0.20	2.15	1.53
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	33.21	33.51	31.33	30.96	33.32	32.60	33.31	32.63	32.02	32.30	31.79	31.90	31.84	32.06	30.40	22.33
MnO	1.28	1.43	1.28	1.22	1.21	1.31	1.27	1.22	1.45	1.53	1.42	1.36	1.37	1.51	0.99	0.74
MgO	0.28	0.24	0.11	0.14	0.11	0.03	0.01	0.03	0.00	0.03	0.01	0.01	0.00	0.00	0.23	0.17
CaO	3.87	3.81	3.31	4.04	1.55	1.77	1.93	1.71	0.44	0.48	0.43	0.45	0.46	0.45	9.03	27.33
Na₂O	5.52	5.62	8.22	8.11	8.58	8.55	8.55	8.69	8.92	9.03	9.05	9.22	9.08	9.21	7.48	5.26
K₂O	1.57	1.52	1.50	1.46	1.54	1.55	1.53	1.68	2.01	2.03	2.05	2.03	2.02	2.05	1.28	1.00
TOTAL	97.51	97.90	96.39	96.14	98.92	97.90	98.44	97.91	97.41	98.50	97.79	97.81	97.64	98.35	96.50	90.86
Numbers of ions on the basis of 23O																
Si	8.01	8.00	7.77	7.74	7.75	8.06	8.01	8.08	8.13	8.12	8.15	8.14	8.14	8.13	7.28	6.42
Al	-0.01	0.00	0.23	0.26	0.25	-0.06	-0.01	-0.08	-0.13	-0.12	-0.15	-0.14	-0.14	-0.13	0.72	1.58
Al	0.15	0.14	0.12	0.10	0.15	0.21	0.14	0.20	0.17	0.16	0.19	0.18	0.18	0.17	-0.29	-1.20
Fe³⁺	0.24	0.24	0.14	0.04	0.48	0.17	0.26	0.17	0.45	0.43	0.45	0.37	0.40	0.36	-0.28	-4.17
Ti	0.13	0.12	0.17	0.17	0.16	0.11	0.11	0.11	0.17	0.17	0.17	0.17	0.18	0.18	0.22	0.21
Fe²⁺	4.21	4.25	4.15	4.23	3.93	4.20	4.18	4.20	3.82	3.83	3.76	3.87	3.83	3.89	4.57	8.02
Mn	0.17	0.19	0.18	0.17	0.16	0.18	0.17	0.17	0.20	0.20	0.19	0.18	0.18	0.20	0.14	0.13
Mg	0.07	0.06	0.03	0.03	0.03	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.06	0.05
Ca	0.66	0.65	0.58	0.71	0.26	0.30	0.33	0.29	0.07	0.08	0.07	0.08	0.08	0.08	1.63	6.04
Na	1.72	1.75	2.61	2.59	2.63	2.66	2.64	2.70	2.76	2.76	2.78	2.84	2.80	2.83	2.45	2.10
K	0.32	0.31	0.31	0.31	0.31	0.32	0.31	0.34	0.41	0.41	0.41	0.41	0.41	0.41	0.28	0.26

Estimation of the Proportion of Ferric Iron in the EPMA Analysis of Amphibole. Leake et al., 1997,

Appendix 2

Point No.	Syenite																242
	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	
	P2.1-3c	P2.1-1r	P2.1-2r	P4.1-1c	P4.1-2c	P4.1-3c	P4.1-1r	P4.1-2r	P4.1-3r	P1.1-1c	P1.1-2c	P1.1-3c	P1.1-1r	P1.1-2r	P1.1-3r	P1.1-4r	P3.1-1c
SiO₂	39.09	38.04	48.07	50.66	50.75	51.04	50.72	50.74	51.06	48.12	47.41	47.78	40.27	50.05	49.53	49.64	49.21
TiO₂	1.64	1.58	1.96	1.11	1.05	1.10	0.95	0.94	0.83	1.68	1.55	1.56	0.71	0.64	0.91	0.84	0.27
Al₂O₃	1.87	1.39	1.89	0.31	0.30	0.33	0.41	0.43	0.43	2.24	2.15	2.27	0.78	0.95	0.89	0.87	1.08
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	27.92	26.57	33.29	33.63	32.72	32.87	32.29	33.04	32.64	33.06	32.79	33.14	27.28	33.65	34.03	33.50	35.46
MnO	0.90	0.86	1.10	1.22	1.31	1.18	1.48	1.39	1.31	1.20	1.26	1.12	1.09	1.26	1.52	1.41	1.45
MgO	0.18	0.15	0.19	0.01	0.01	0.00	0.00	0.00	0.00	0.12	0.13	0.12	0.05	0.07	0.07	0.09	0.34
CaO	14.95	17.69	2.42	0.89	0.91	0.98	1.09	1.11	1.14	2.47	3.50	2.73	14.70	0.87	2.06	2.06	4.97
Na₂O	6.65	6.52	8.01	8.95	9.01	8.96	8.99	8.95	9.06	8.15	8.26	8.16	7.05	8.65	8.33	8.41	5.31
K₂O	1.21	1.22	1.45	1.75	1.76	1.76	1.68	1.54	1.63	1.35	1.30	1.32	1.46	2.27	1.43	1.40	1.10
TOTAL	94.47	94.02	98.39	98.53	97.81	98.22	97.60	98.14	98.09	98.38	98.37	98.19	93.42	98.41	98.77	98.24	99.18
Numbers of ions on the basis of 23O																	
Si	7.01	6.99	7.68	8.05	8.10	8.11	8.11	8.08	8.12	7.68	7.61	7.65	7.32	7.96	7.88	7.93	7.85
Al	0.99	1.01	0.32	-0.05	-0.10	-0.11	-0.11	-0.08	-0.12	0.32	0.39	0.35	0.68	0.04	0.12	0.07	0.15
Al	-0.60	-0.71	0.04	0.11	0.16	0.17	0.19	0.17	0.20	0.10	0.01	0.08	-0.51	0.14	0.05	0.10	0.05
Fe³⁺	-1.18	-1.84	0.37	0.39	0.36	0.35	0.32	0.34	0.35	0.37	0.35	0.40	-1.39	0.57	0.48	0.38	0.29
Ti	0.22	0.22	0.24	0.13	0.13	0.13	0.11	0.11	0.10	0.20	0.19	0.19	0.10	0.08	0.11	0.10	0.03
Fe²⁺	5.37	5.93	4.07	4.08	4.01	4.01	4.00	4.07	3.99	4.04	4.05	4.04	5.53	3.91	4.05	4.09	4.44
Mn	0.14	0.13	0.15	0.16	0.18	0.16	0.20	0.19	0.18	0.16	0.17	0.15	0.17	0.17	0.20	0.19	0.20
Mg	0.05	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.01	0.02	0.02	0.02	0.08
Ca	2.87	3.48	0.41	0.15	0.16	0.17	0.19	0.19	0.19	0.42	0.60	0.47	2.86	0.15	0.35	0.35	0.85
Na	2.31	2.33	2.48	2.76	2.79	2.76	2.79	2.77	2.79	2.52	2.57	2.53	2.48	2.67	2.57	2.61	1.64
K	0.28	0.29	0.30	0.36	0.36	0.36	0.34	0.31	0.33	0.27	0.27	0.27	0.34	0.46	0.29	0.29	0.22

Point No.	Metasomatized quartz syenite																	
	242 P3.1-2c	242 P3.1-3c	242 P3.1-1r	242 P3.1-2r	242 P3.1-3r	242 P2.1-1c	242 P2.1-2c	242 P2.1-3c	242 P2.1-1r	242 P2.1-2r	242 P2.1-3r	242 P1.1-1c	242 P1.1-2c	242 P1.1-3c	242 P1.1-1r	242 P1.1-2r	242 P1.1-3r	242 P4.1-1c
SiO₂	49.12	48.90	48.75	48.26	48.48	48.90	48.52	48.74	49.30	49.09	49.05	46.45	46.83	46.91	47.83	48.01	47.94	48.71
TiO₂	0.29	0.29	0.59	0.66	0.55	0.68	0.64	0.65	0.69	0.65	0.72	1.94	2.00	2.03	1.26	1.32	1.34	0.96
Al₂O₃	1.14	1.22	1.44	1.49	1.43	1.33	1.35	1.37	0.80	0.91	0.80	2.22	2.19	2.24	1.72	1.84	1.78	1.31
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	34.95	34.90	35.21	34.89	35.10	34.97	34.80	35.09	34.35	34.73	34.69	34.87	34.64	34.79	34.39	34.29	34.44	34.54
MnO	1.53	1.62	1.64	1.68	1.49	1.43	1.53	1.42	1.68	1.54	1.47	1.11	1.03	1.07	1.20	1.22	1.19	1.64
MgO	0.35	0.30	0.26	0.29	0.28	0.16	0.15	0.15	0.17	0.19	0.15	0.20	0.22	0.20	0.20	0.17	0.20	0.18
CaO	5.01	5.05	5.24	5.24	5.34	5.08	5.06	5.11	3.96	4.09	3.81	5.86	5.89	5.83	5.19	5.38	5.53	5.21
Na₂O	5.17	5.10	4.96	5.04	4.96	5.04	5.08	5.20	5.84	5.72	5.77	4.87	4.93	5.14	5.24	5.28	4.94	5.37
K₂O	1.08	1.08	1.16	1.17	1.13	0.90	0.95	0.97	1.27	1.31	1.31	1.18	1.17	1.15	1.10	1.15	1.12	1.18
TOTAL	98.64	98.48	99.26	98.71	98.80	98.50	98.08	98.70	98.06	98.23	97.76	98.71	98.89	99.39	98.12	98.65	98.47	99.09
Numbers of ions on the basis of 23O																		
Si	7.86	7.84	7.78	7.76	7.77	7.83	7.81	7.81	7.94	7.90	7.92	7.55	7.57	7.56	7.72	7.71	7.71	7.80
Al	0.14	0.16	0.22	0.24	0.23	0.17	0.19	0.19	0.06	0.10	0.08	0.45	0.43	0.44	0.28	0.29	0.29	0.20
Al	0.08	0.07	0.05	0.04	0.04	0.08	0.07	0.07	0.09	0.07	0.07	-0.02	-0.01	-0.02	0.05	0.06	0.04	0.04
Fe³⁺	0.28	0.30	0.27	0.22	0.25	0.28	0.28	0.26	0.23	0.26	0.28	-0.13	-0.08	-0.11	0.17	0.11	0.16	0.15
Ti	0.04	0.03	0.07	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.09	0.24	0.24	0.25	0.15	0.16	0.16	0.12
Fe²⁺	4.39	4.38	4.42	4.47	4.46	4.41	4.41	4.44	4.40	4.41	4.40	4.87	4.76	4.80	4.47	4.49	4.47	4.47
Mn	0.21	0.22	0.22	0.23	0.20	0.19	0.21	0.19	0.23	0.21	0.20	0.15	0.14	0.15	0.16	0.17	0.16	0.22
Mg	0.08	0.07	0.06	0.07	0.07	0.04	0.04	0.04	0.04	0.05	0.04	0.05	0.05	0.05	0.05	0.04	0.05	0.04
Ca	0.86	0.87	0.90	0.90	0.92	0.87	0.87	0.88	0.68	0.71	0.66	1.02	1.02	1.01	0.90	0.93	0.95	0.89
Na	1.60	1.58	1.53	1.57	1.54	1.56	1.59	1.61	1.82	1.78	1.81	1.53	1.54	1.61	1.64	1.64	1.54	1.67
K	0.22	0.22	0.24	0.24	0.23	0.18	0.19	0.20	0.26	0.27	0.27	0.24	0.24	0.24	0.23	0.23	0.23	0.24

Estimation of the Proportion of Ferric Iron in the EPMA Analysis of Amphibole. Leake et al., 1997,

Appendix 2

Point No.	Metasomatized quartz syenite										
	242	242	242	242	242	242	242	242	242	242	242
	P4.1-2c	P4.1-3c	P4.1-1r	P4.1-2r	P4.1-3r	P5.1-1c	P5.1-2c	P5.1-3c	P5.1-1r	P5.1-2r	P5.1-3r
SiO₂	48.82	48.39	51.03	51.14	50.90	48.33	48.70	47.38	47.60	47.84	48.75
TiO₂	1.03	1.11	0.47	0.51	0.52	1.49	1.46	1.76	1.53	1.32	1.08
Al₂O₃	1.22	1.35	0.44	0.39	0.41	1.56	1.26	2.07	1.99	1.77	1.43
Fe₂O₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	34.60	34.00	36.01	35.26	36.11	34.13	34.30	34.41	34.44	34.32	34.49
MnO	1.58	1.55	1.56	1.61	1.50	1.20	1.16	1.07	1.33	1.19	1.31
MgO	0.18	0.15	0.06	0.07	0.09	0.20	0.22	0.17	0.16	0.16	0.17
CaO	5.29	5.03	3.54	3.38	3.63	5.30	5.08	5.54	5.25	5.02	4.82
Na₂O	5.02	5.32	5.38	5.56	5.26	4.89	5.19	4.92	5.22	5.40	5.46
K₂O	1.13	1.21	0.81	0.82	0.73	1.17	1.30	1.30	1.20	1.22	1.20
TOTAL	98.88	98.10	99.32	98.76	99.14	98.28	98.65	98.65	98.70	98.24	98.72
Numbers of ions on the basis of 23O											
Si	7.81	7.81	7.98	8.01	7.97	7.77	7.81	7.63	7.65	7.72	7.81
Al	0.19	0.19	0.02	-0.01	0.03	0.23	0.19	0.37	0.35	0.28	0.19
Al	0.04	0.07	0.06	0.08	0.04	0.06	0.05	0.02	0.03	0.05	0.08
Fe³⁺	0.19	0.13	0.80	0.83	0.80	0.14	0.11	0.11	0.16	0.15	0.16
Ti	0.12	0.13	0.06	0.06	0.06	0.18	0.18	0.21	0.18	0.16	0.13
Fe²⁺	4.44	4.46	3.91	3.79	3.93	4.44	4.49	4.53	4.47	4.48	4.46
Mn	0.21	0.21	0.21	0.21	0.20	0.16	0.16	0.15	0.18	0.16	0.18
Mg	0.04	0.04	0.01	0.02	0.02	0.05	0.05	0.04	0.04	0.04	0.04
Ca	0.91	0.87	0.59	0.57	0.61	0.91	0.87	0.96	0.90	0.87	0.83
Na	1.56	1.66	1.63	1.69	1.60	1.52	1.61	1.54	1.63	1.69	1.70
K	0.23	0.25	0.16	0.16	0.15	0.24	0.27	0.27	0.24	0.25	0.24

Appendix 3

EPMA analysis of pyroxene

Point No.	Reference			Granite												
	1	Aegirin (14)	Webmineral	199	199	199	199	199	199	199	199	199	199	199	199	199
				P5.1-1r	P5.1-2r	P5.1-1c	P5.1-2c	P5.2-1c	P5.2-2c	P5.2-3c	P5.2-1r	P5.2-2r	P3.1-1c	P3.1-2c	P3.1-3c	P3.1-1r
SiO₂	54.54	51.64	52.02	53.22	52.62	52.96	53.22	53.25	53.31	52.43	52.74	52.83	52.11	51.24	52.74	52.52
TiO₂	0.23	0.40	0.00	1.42	1.85	2.31	2.29	1.65	1.63	2.15	1.39	1.35	1.70	1.83	1.67	1.59
Al₂O₃	8.89	1.05	0.00	0.20	0.25	0.11	0.07	0.24	0.24	0.23	0.27	0.27	0.29	0.64	0.26	0.26
FeO	9.25	32.98	34.56	29.45	29.36	28.65	28.92	30.05	30.20	29.44	29.93	29.87	29.89	29.41	29.51	29.83
MnO	0.03	0.26	0.00	0.27	0.37	0.68	0.77	0.30	0.28	0.37	0.20	0.24	0.21	0.27	0.40	0.33
MgO	6.48	0.38	0.00	0.00	0.00	0.01	0.01	0.01	0.03	0.01	0.00	0.00	0.01	0.03	0.00	0.00
CaO	12.38	0.60	0.00	0.04	0.03	0.13	0.11	0.22	0.22	0.25	0.19	0.22	0.26	0.38	0.28	0.32
Na₂O	7.20	12.21	13.42	14.55	14.85	14.85	14.47	14.36	14.51	14.48	14.46	14.33	14.59	13.97	14.58	14.66
K₂O	0.06	0.06	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.00	0.01	0.01	0.00	0.00	0.01
TOTAL	99.06	99.58	100.00	99.16	99.38	99.69	99.85	100.08	100.42	99.38	99.18	99.12	99.08	97.77	99.45	99.53
Numbers of ions on the basis of 60																
Si	1.98	1.95	1.95	1.98	1.95	1.96	1.97	1.97	1.96	1.95	1.96	1.97	1.94	1.94	1.96	1.94
Al	0.38	0.05	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01
Fe3+	0.15	0.93	1.08	1.01	1.06	1.02	0.97	0.99	1.01	1.02	1.03	1.01	1.07	1.02	1.03	1.06
Ti	0.01	0.01	0.00	0.04	0.05	0.06	0.06	0.05	0.04	0.06	0.04	0.04	0.05	0.05	0.05	0.04
Fe2+	0.13	0.11	0.00	-0.09	-0.15	-0.13	-0.07	-0.06	-0.08	-0.10	-0.10	-0.08	-0.14	-0.08	-0.12	-0.14
Mn	0.00	0.01	0.00	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Mg	0.35	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.48	0.02	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
Na	0.51	0.89	0.97	1.05	1.07	1.06	1.04	1.03	1.03	1.04	1.04	1.03	1.05	1.02	1.05	1.05
K	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Point No.	Granite																
	199 P3.1-2r	199 P3.1-3r	199 P2.1-1c	199 P2.1-2c	199 P2.1-3c	199 P2.1-1r	199 P2.1-2r	199 P2.1-3r	199 P2.2-1c	199 P2.2-2c	199 P2.2-3c	199 P1.1-1c	199 P1.1-2c	199 P1.1-3c	199 P1.1-1r	199 P1.1-2r	199 P1.1-3r
SiO₂	52.77	52.60	53.04	53.15	52.94	53.34	52.97	53.19	52.90	52.94	53.25	53.11	53.01	52.33	53.51	53.34	52.94
TiO₂	1.68	1.69	1.21	1.76	2.10	1.48	1.32	1.25	0.88	0.50	0.67	0.54	0.57	0.65	0.45	0.57	0.80
Al₂O₃	0.25	0.26	0.25	0.24	0.24	0.23	0.27	0.26	0.25	0.22	0.22	0.17	0.20	0.17	0.15	0.20	0.26
FeO	29.35	29.43	29.99	29.35	28.76	29.80	29.76	29.68	30.62	30.93	30.76	30.69	30.76	30.52	30.76	30.76	30.37
MnO	0.30	0.28	0.23	0.27	0.34	0.23	0.29	0.26	0.06	0.07	0.04	0.15	0.21	0.23	0.18	0.36	0.17
MgO	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.01	0.06	0.05	0.05	0.11	0.07	0.05	0.13	0.09	0.04
CaO	0.26	0.31	0.22	0.27	0.31	0.15	0.19	0.17	0.05	0.05	0.07	0.12	0.05	0.50	0.07	0.04	0.04
Na₂O	14.33	14.37	14.48	14.21	14.07	14.37	14.47	14.34	14.63	14.66	14.23	13.94	14.14	13.95	14.29	14.12	14.10
K₂O	0.00	0.01	0.01	0.01	0.00	0.04	0.03	0.03	0.00	0.01	0.00	0.02	0.00	0.01	0.00	0.00	0.01
TOTAL	98.95	98.97	99.42	99.24	98.76	99.68	99.28	99.18	99.52	99.42	99.28	98.87	99.02	98.46	99.54	99.48	98.71
Numbers of																	
Si	1.97	1.96	1.97	1.98	1.98	1.98	1.97	1.98	1.96	1.96	1.98	1.99	1.98	1.97	1.98	1.98	1.98
Al	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Fe3+	0.99	1.01	1.03	0.96	0.93	0.99	1.02	1.00	1.07	1.10	1.02	1.00	1.02	1.04	1.03	1.01	1.00
Ti	0.05	0.05	0.03	0.05	0.06	0.04	0.04	0.04	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.02
Fe2+	-0.08	-0.09	-0.10	-0.04	-0.02	-0.06	-0.10	-0.07	-0.12	-0.14	-0.06	-0.04	-0.06	-0.08	-0.07	-0.05	-0.05
Mn	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Ca	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Na	1.04	1.04	1.04	1.03	1.02	1.03	1.04	1.03	1.05	1.05	1.03	1.01	1.02	1.02	1.03	1.02	1.02
K	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Point No.	Granite																
	199	199	199	199	199	199	271	271	271	271	271	271	271	271	271	271	271
	P1.2-1c	P1.2-2c	P1.2-3c	P1.2-1r	P1.2-2r	P1.2-3r	P1.1-1c	P1.1-2c	P1.1-3c	P1.1-1r	P1.1-2r	P1.1-3r	P2.1-1r	P2.1-2r	P2.1-3r	P2.1-1c	P2.1-2c
SiO₂	53.08	51.37	51.30	52.86	53.11	53.07	53.01	52.48	50.93	52.70	52.51	52.45	52.50	52.38	52.32	52.13	51.88
TiO₂	0.52	1.07	1.06	1.73	0.41	2.40	0.48	0.47	0.47	0.49	0.51	0.60	0.41	0.39	0.55	0.44	0.45
Al₂O₃	0.28	0.27	0.32	0.25	0.21	0.26	0.31	0.40	0.39	0.25	0.24	0.24	0.20	0.18	0.55	0.23	0.20
FeO	30.81	33.79	33.22	29.23	30.67	28.61	30.25	30.35	29.41	31.08	30.15	29.96	30.80	30.50	30.01	30.15	29.85
MnO	0.00	1.15	1.37	0.22	0.16	0.28	0.40	0.06	0.12	0.00	0.00	0.05	0.05	0.03	0.00	0.24	0.24
MgO	0.08	0.10	0.07	0.01	0.06	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.07	0.57	0.60	0.19	0.05	0.24	0.01	0.01	0.02	0.00	0.00	0.01	0.03	0.01	0.01	0.02	0.01
Na₂O	14.12	8.62	8.98	13.85	13.66	13.68	13.80	13.87	13.52	13.68	13.63	13.70	13.26	13.38	13.30	13.54	13.51
K₂O	0.01	1.58	1.58	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.00
TOTAL	98.98	98.56	98.49	98.34	98.39	98.58	98.27	97.65	94.89	98.20	97.13	97.05	97.26	96.87	96.78	96.74	96.14
Numbers of																	
Si	1.98	2.03	2.02	1.99	2.00	2.00	2.00	1.99	1.98	1.99	2.00	2.00	2.01	2.01	2.01	2.00	2.00
Al	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
Fe3+	1.02	0.60	0.65	0.92	0.96	0.85	0.97	1.00	1.01	0.98	0.96	0.97	0.94	0.95	0.92	0.98	0.98
Ti	0.01	0.03	0.03	0.05	0.01	0.07	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01
Fe2+	-0.06	0.51	0.45	0.00	0.01	0.05	-0.02	-0.04	-0.05	0.00	0.00	-0.01	0.05	0.03	0.04	-0.01	-0.01
Mn	0.00	0.04	0.05	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Mg	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.00	0.02	0.03	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na	1.02	0.66	0.69	1.01	1.00	1.00	1.01	1.02	1.02	1.00	1.01	1.01	0.98	0.99	0.99	1.01	1.01
K	0.00	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Point No.	Granite															
	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271	271
	P2.1-3c	P2.2-1c	P2.2-2c	P2.2-2c	P2.2-1r	P2.2-2r	P2.2-3r	P4.1-1r	P4.1-2r	P4.1-3r	P4.2-1c	P4.2-2c	P4.2-3c	P4.3-1c	P4.3-2c	P4.3-3c
SiO₂	51.97	52.01	52.41	52.07	52.27	52.19	51.94	52.81	52.20	51.49	51.65	51.76	51.63	51.13	51.34	51.68
TiO₂	0.39	0.46	0.49	0.60	0.44	0.37	0.44	0.57	0.58	0.54	0.30	0.31	0.31	0.52	0.58	0.61
Al₂O₃	0.27	0.32	0.32	0.42	0.32	0.29	0.33	0.27	0.24	0.22	0.15	0.15	0.11	0.26	0.27	0.25
FeO	30.28	30.16	30.21	29.70	30.05	29.88	29.97	30.40	29.72	29.77	29.57	29.70	29.89	29.07	29.18	29.36
MnO	0.35	0.14	0.18	0.16	0.02	0.11	0.02	0.17	0.17	0.20	0.44	0.42	0.50	0.32	0.14	0.29
MgO	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.00
CaO	0.02	0.04	0.06	0.10	0.00	0.02	0.00	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.01	0.02
Na₂O	13.74	13.87	13.67	13.60	13.31	13.41	13.27	14.51	13.38	13.25	13.27	13.30	13.33	13.60	13.50	13.44
K₂O	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00
TOTAL	97.04	97.01	97.36	96.65	96.42	96.33	96.07	98.76	96.35	95.50	95.39	95.69	95.79	94.91	95.05	95.65
Numbers of																
Si	1.98	1.98	1.99	1.99	2.01	2.01	2.01	1.97	2.01	2.00	2.01	2.01	2.00	1.99	2.00	2.00
Al	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
Fe³⁺	1.02	1.02	0.98	0.97	0.93	0.95	0.94	1.07	0.93	0.95	0.96	0.96	0.98	1.00	0.98	0.96
Ti	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02
Fe²⁺	-0.05	-0.06	-0.02	-0.02	0.04	0.01	0.03	-0.12	0.02	0.01	0.00	0.00	-0.01	-0.06	-0.03	-0.01
Mn	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.00	0.01
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na	1.02	1.02	1.01	1.01	0.99	1.00	0.99	1.05	1.00	1.00	1.00	1.00	1.00	1.03	1.02	1.01
K	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Point No.	Quartz syenite															
	185 P4.1-1c	185 P4.1-2c	185 P4.1-3c	168 P5.1-1c	168 P5.1-2c	168 P6.1-1c	168 P6.1-2c	168 P6.1-3c	168 P3.1-1c	168 P3.1-2c	168 P3.1-3c	168 P3.1-1r	168 P3.1-2r	168 P3.1-3r	168 P2.1-1c	168 P2.1-2c
SiO₂	29.40	52.37	48.18	51.47	51.62	50.61	50.68	50.66	50.50	50.40	46.97	48.34	50.45	49.22	50.94	50.86
TiO₂	23.28	0.30	4.51	0.35	0.26	0.07	0.06	0.02	0.30	0.28	0.25	0.25	0.30	0.22	0.22	0.21
Al₂O₃	1.10	0.32	0.55	0.17	0.19	0.16	0.17	0.15	0.19	0.20	0.18	0.19	0.20	0.18	0.15	0.15
FeO	5.00	22.22	20.23	29.10	29.26	27.83	28.39	28.28	28.65	28.13	26.75	27.36	28.71	27.97	27.93	27.56
MnO	0.00	1.67	1.08	0.73	0.57	1.19	1.03	1.12	1.10	0.96	0.70	1.09	0.95	0.95	0.93	0.92
MgO	0.00	0.02	0.04	0.08	0.10	0.46	0.43	0.42	0.23	0.27	0.24	0.19	0.18	0.19	0.06	0.07
CaO	21.37	15.81	20.25	9.34	9.32	15.60	15.52	15.38	14.09	13.95	15.50	13.71	13.38	13.84	10.69	10.72
Na₂O	0.00	0.11	0.08	8.54	8.65	4.63	4.60	4.63	5.62	5.50	7.12	5.42	5.78	5.35	7.28	7.11
K₂O	0.01	0.04	0.12	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
TOTAL	80.16	92.85	95.11	99.79	99.99	100.53	100.89	100.64	100.70	99.70	97.70	96.55	99.95	97.96	98.24	97.61
Numbers of																
Si	1.56	2.32	2.09	1.99	1.99	1.99	1.99	2.00	1.98	1.99	1.86	1.97	1.99	1.98	2.02	2.03
Al	0.07	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Fe³⁺	-1.05	-0.67	-0.49	0.64	0.65	0.35	0.35	0.35	0.45	0.41	0.81	0.46	0.44	0.43	0.51	0.48
Ti	0.93	0.01	0.15	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Fe²⁺	1.27	1.49	1.23	0.30	0.30	0.56	0.58	0.58	0.49	0.52	0.08	0.47	0.51	0.51	0.42	0.44
Mn	0.00	0.06	0.04	0.02	0.02	0.04	0.03	0.04	0.04	0.03	0.02	0.04	0.03	0.03	0.03	0.03
Mg	0.00	0.00	0.00	0.00	0.01	0.03	0.02	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.00
Ca	1.22	0.75	0.94	0.39	0.38	0.66	0.65	0.65	0.59	0.59	0.66	0.60	0.56	0.60	0.45	0.46
Na	0.00	0.01	0.01	0.64	0.65	0.35	0.35	0.35	0.43	0.42	0.55	0.43	0.44	0.42	0.56	0.55
K	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Point No.	Quartz syenite				Metasomatized quartz syenite											
	168	168	168	168	175	175	175	175	175	175	175	175	175	242	242	242
	P2.1-3c	P2.1-1r	P2.1-2r	P2.1-3r	P3.1-1c	P3.1-2c	P3.1-3c	P4.1-1c	P4.1-2c	P4.1-3c	P2.1-1c	P2.1-2c	P2.1-3c	P2.1-1c	P2.1-2c	P2.1-3c
SiO₂	51.43	51.08	50.78	51.12	50.46	50.62	50.51	53.19	53.15	53.45	50.90	50.96	51.04	49.43	49.00	49.09
TiO₂	0.27	0.32	0.33	0.31	0.95	0.95	0.97	1.03	1.04	1.03	1.12	1.22	1.13	0.30	0.38	0.35
Al₂O₃	0.17	0.18	0.18	0.20	0.74	0.76	0.78	0.49	0.49	0.51	0.42	0.30	0.33	0.27	0.30	0.34
FeO	28.26	28.09	27.99	27.81	33.28	33.65	33.05	28.89	29.17	29.12	32.21	32.39	32.72	27.71	27.93	28.09
MnO	0.91	0.96	0.89	0.92	1.34	1.21	1.30	0.32	0.27	0.25	1.87	1.82	1.76	1.21	1.29	1.24
MgO	0.07	0.07	0.08	0.07	0.03	0.04	0.05	0.00	0.00	0.01	0.10	0.07	0.05	0.62	0.68	0.70
CaO	10.30	9.96	9.99	9.84	1.85	1.43	1.74	0.14	0.17	0.17	0.98	0.94	0.93	17.74	19.56	19.27
Na₂O	7.71	7.70	7.82	7.90	8.26	8.38	8.37	14.59	14.74	14.66	9.02	8.83	8.95	1.44	1.39	1.46
K₂O	0.00	0.00	0.00	0.00	1.60	1.77	1.61	0.00	0.00	0.00	1.94	1.94	1.91	0.01	0.01	0.01
TOTAL	99.13	98.35	98.11	98.24	98.56	98.84	98.39	98.66	99.03	99.20	98.56	98.46	98.81	98.72	100.56	100.56
Numbers of																
Si	2.01	2.01	2.00	2.01	2.00	1.99	2.00	1.98	1.97	1.98	2.00	2.01	2.00	2.04	1.98	1.99
Al	0.01	0.01	0.01	0.01	0.03	0.04	0.04	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.02
Fe³⁺	0.54	0.54	0.56	0.55	0.63	0.65	0.63	1.01	1.04	1.01	0.70	0.67	0.69	0.00	0.10	0.10
Ti	0.01	0.01	0.01	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.01	0.01	0.01
Fe²⁺	0.38	0.39	0.36	0.36	0.47	0.46	0.46	-0.11	-0.13	-0.11	0.35	0.39	0.38	0.95	0.84	0.85
Mn	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.01	0.01	0.01	0.06	0.06	0.06	0.04	0.04	0.04
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.04	0.04
Ca	0.43	0.42	0.42	0.41	0.08	0.06	0.07	0.01	0.01	0.01	0.04	0.04	0.04	0.78	0.85	0.84
Na	0.58	0.59	0.60	0.60	0.63	0.64	0.64	1.05	1.06	1.05	0.69	0.67	0.68	0.12	0.11	0.11
K	0.00	0.00	0.00	0.00	0.08	0.09	0.08	0.00	0.00	0.00	0.10	0.10	0.10	0.00	0.00	0.00

Point No.	Metasomatized quartz syenite								
	242	242	242	242	242	242	242	242	242
	P2.2-1c	P2.2-2c	P2.2-3c	P4.1-1c	P4.1-2c	P4.1-3c	P5.1-1c	P5.1-2c	P5.1-3c
SiO₂	48.60	48.93	48.71	44.87	44.75	44.60	49.18	42.19	49.21
TiO₂	0.35	0.31	0.32	0.03	0.05	0.04	0.24	8.55	0.25
Al₂O₃	0.52	0.50	0.47	4.54	4.55	4.47	0.45	1.66	0.30
FeO	28.54	28.82	28.78	36.76	37.32	36.91	27.57	22.19	28.11
MnO	1.28	1.18	1.18	2.11	2.12	2.25	1.23	0.85	1.15
MgO	0.52	0.50	0.51	0.29	0.27	0.27	0.46	0.95	0.46
CaO	19.78	19.76	19.80	0.23	0.26	0.26	18.97	18.56	17.95
Na₂O	0.75	0.76	0.79	0.14	0.14	0.24	1.93	1.14	2.18
K₂O	0.00	0.00	0.00	1.55	1.56	1.74	0.00	0.11	0.03
TOTAL	100.37	100.77	100.55	90.54	91.03	90.77	100.02	96.23	99.63
Numbers of									
Si	1.99	1.99	1.99	2.09	2.08	2.07	1.99	1.80	2.00
Al	0.02	0.02	0.02	0.25	0.25	0.24	0.02	0.08	0.01
Fe3+	0.04	0.03	0.05	-0.33	-0.31	-0.27	0.13	-0.14	0.14
Ti	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.27	0.01
Fe2+	0.94	0.95	0.93	1.77	1.75	1.71	0.80	0.94	0.81
Mn	0.04	0.04	0.04	0.08	0.08	0.09	0.04	0.03	0.04
Mg	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.06	0.03
Ca	0.87	0.86	0.87	0.01	0.01	0.01	0.82	0.85	0.78
Na	0.06	0.06	0.06	0.01	0.01	0.02	0.15	0.09	0.17
K	0.00	0.00	0.00	0.09	0.09	0.10	0.00	0.01	0.00

Appendix 4

EPMA analysis of quartz

List of trace element analysis of Khaldzan Burgedei complex quartz (EPMA by ppm)

Appendix 4

Sample name	Depth	Com.	Si	Ti	K	Al	Fe	Ca	Ti-Q (Wark and Watsom, 2006) $T(^{\circ}\text{C}) = -3765 / (\text{Log}(X_{\text{Ti}}) - 5.69) - 273$	Com.	T(^{\circ}\text{C}) average
1948-23			1162.19	51		99	3	0	672.4	reference	
Quartz syenite											
256-1-1	40.2 rim 4		472540	48	50	0	8	0	666.1	rim	659.42
256-1-2	40.2 rim 3		469759	42	17	0	0	0	652.7		
256-1-3	40.2 core 2		469740	12	75	0	0	0	543.5	core	604.80
256-1-4	40.2 core 1		469847	48	25	0	8	0	666.1		
256-4-1	40.2 rim 4		462448	12	17	0	31	0	543.5	rim	590.61
256-4-2	40.2 rim 3		466963	36	0	0	0	7	637.7		
256-4-3	40.2 core 2		457325	30	8	0	0	14	620.6	core	636.67
256-4-4	40.2 core 1		461546	42	8	0	8	21	652.7		
256-5-1	40.2 rim 4		459779	30	8	5	8	21	620.6	rim	636.67
256-5-2	40.2 rim 3		462560	42	42	48	47	7	652.7		
256-5-3	40.2 core 2		462784	66	8	0	0	0	699.7	core	676.19
256-5-4	40.2 core 1		468412	42	25	0	0	0	652.7		
256-6-1	40.2 core 1		464827	36	17	0	0	0	637.7		
256-6-2	40.2 core 2		465645	54	0	0	0	7	678.2	core	651.23
256-6-3	40.2 core 3		463677	36	83	0	16	29	637.7		
256-6-4	40.2 rim 4		466402	48	25	0	16	0	666.1	rim	604.80
256-6-5	40.2 rim 5		467725	12	0	0	47	0	543.5		
Metasomatized quartz syenite											
265-1-1	99.5 rim		465799	36	50	228	16	14	637.7	rim	645.22
265-1-2	99.5 core		470591	42	0	0	31	14	652.7		
265-1-3	99.5 rim		468389	42	0	0	54	0	652.7	core	652.72
265-2-1	99.5 rim		469216	30	0	0	16	0	620.6	rim	637.73
265-2-2	99.5 core		470988	36	8	0	0	7	637.7		
265-2-3	99.5 core		473288	36	0	0	16	0	637.7	core	582.05
265-2-4	99.5 rim		468973	12	17	0	31	43	543.5		
265-4-1	99.5 rim		468889	30	0	0	16	14	620.6	rim	620.61
265-4-2	99.5 core		469216	48	8	0	31	7	666.1	core	666.11
Pegmatite											
258-1-1	59.7 core		473274	54	0	53	0	0	678.2	core	665.48
258-1-2	59.7 core		475873	42	33	0	31	0	652.7		
258-1-3	59.7 rim		475354	6	17	0	0	0	493.5	rim	493.46
258-2-1	59.7 rim		465790	48	17	0	117	0	666.1		
258-2-2	59.7 rim		473026	30	0	5	23	21	620.6	rim	646.48
258-2-3	59.7 rim		471834	42	0	0	54	7	652.7		
258-2-4	59.7 core		473213	48	8	873	0	7	666.1	core	643.36
258-2-5	59.7 core		472236	30	0	1556	23	14	620.6		
258-3-1	59.7 rim		465495	42	58	1709	2153	14	652.7	rim	665.48
258-3-2	59.7 rim		466318	54	17	0	544	7	678.2		
258-3-3	59.7 core		471264	18	0	0	62	0	575.9	core	621.01
258-3-4	59.7 core		434729	48	6093	26002	101	79	666.1		
259-6-1	60.5 rim		461013	24	8	1572	0	400	600.5	rim	639.38
259-6-2	60.5 rim		460910	54	8	64	0	79	678.2		
259-6-3	60.5 core		434336	54	108	1302	0	214	678.2	core	649.43
259-6-4	60.5 core		457423	30	91	905	0	36	620.6		
259-1-1	60.5 core		463126	12	8	1503	8	0	543.5	core	582.05
259-1-2	60.5 core		469712	30	25	0	0	0	620.6		
259-1-3	60.5 rim		466585	42	17	0	0	29	652.7	rim	645.22
259-1-4	60.5 rim		464360	36	8	0	23	43	637.7		
259-4-1	60.5 core		458718	42	0	566	0	57	652.7	core	652.72
259-4-2	60.5 core		463981	42	17	1265	31	43	652.7		
259-4-3	60.5 rim		457965	36	141	1551	8	29	637.7	rim	606.82
259-4-4	60.5 rim		467482	18	17	0	0	36	575.9		
Fractionated granite											
270-1-1	175.2 core 1		466650	18	0	0	0	0	575.9		
270-1-2	175.2 core 2		468931	42	8	0	0	0	652.7	core	614.32
270-1-3	175.2 core 3		468557	0	0	0	0	0			
270-1-4	175.2 rim		470506	12	0	0	0	0	543.5	rim	543.49
270-3-1	175.2 rim		471423	18	0	0	8	14	575.9	rim	575.91
270-3-2	175.2 core		471147	72	58	0	54	0	709.3		
270-3-3	175.2 core		471058	18	0	0	0	0	575.9	core	642.58

List of trace element analysis of Khaldzan Burgedei complex quartz (EPMA by ppm)

Appendix 4

Sample name	Depth	Com.	Si	Ti	K	Al	Fe	Ca	Ti-Q (Wark and Watsom, 2006) T(°C)=-3765/(Log(XTi)-5.69)-273	Com.	T(°C) average
270-3-4	175.2 rim		470824	18	0	0	8	14	575.9		
270-4-1	175.2 rim		472110	24	8	0	0	14	600.5	rim	600.52
270-4-2	175.2 core		471222	42	8	0	0	7	652.7		
270-4-3	175.2 core		468366	18	0	0	0	0	575.9	core	645.96
270-4-4	175.2 core		465042	72	0	0	16	0	709.3		
270-5-1	175.2 core		466346	36	8	0	39	0	637.7	core	645.22
270-5-3	175.2 core		467903	42	8	0	0	7	652.7		
270-5-4	175.2 rim		467220	48	0	0	0	7	666.1	rim	621.01
270-5-5	175.2 rim		465136	18	0	0	0	21	575.9		
270-6-1	175.2 rim		468959	48	17	0	23	0	666.1	rim	621.01
270-6-2	175.2 core		469927	54	0	0	0	0	678.2		
270-6-3	175.2 core		467594	30	25	0	0	0	620.6	core	649.43
270-6-4	175.2 rim		466061	18	33	0	0	0	575.9		
Granite											
272-1-1	216.5 rim		463738	24	8	0	0	0	600.5	rim	633.32
272-1-2	216.5 rim		465804	48	0	0	23	0	666.1		
272-1-3	216.5 core		464836	48	0	0	0	7	666.1		
272-1-4	216.5 core		470548	24	17	0	31	0	600.5	core	622.38
272-1-5	216.5 core		469025	24	8	0	0	0	600.5		
272-2-1	216.5 rim		467964	42	17	0	0	0	652.7	rim	645.22
272-2-2	216.5 core		466519	18	0	0	0	29	575.9		
272-2-3	216.5 core		466155	42	8	0	0	36	652.7	core	614.32
272-2-4	216.5 rim		468211	36	8	0	8	29	637.7		
272-3-1	216.5 rim		462494	36	33	0	0	0	637.7	rim	663.55
272-3-2	216.5 rim		466580	60	17	0	0	7	689.4		
272-3-3	216.5 core		469006	60	8	0	16	0	689.4		
272-3-4	216.5 core		468267	72	0	0	16	0	709.3	core	673.08
272-3-5	216.5 core		465276	30	8	0	0	0	620.6		
272-4-1	216.5 core		468375	24	25	0	0	0	600.5		
272-4-2	216.5 core		473334	42	8	0	23	0	652.7	core	609.72
272-4-3	216.5 core		473648	18	8	0	0	14	575.9		
272-5-1	216.5 core		466533	36	58	0	39	21	637.7		
272-5-2	216.5 core		469389	54	0	0	23	0	678.2	core	600.74
272-5-3	216.5 core		469805	12	8	0	0	7	543.5		
272-5-4	216.5 core		472773	12	0	0	0	0	543.5		
272-6-1	216.5 core		467688	102	8	0	0	14	749.6		
272-6-2	216.5 core		469576	18	0	0	8	14	575.9	core	642.01
272-6-3	216.5 core		469819	24	0	0	0	0	600.5		
272-6-4	216.5 rim		468375	0	8	0	39	7		rim	
276-1-1	290.4 rim		472297	30	33	0	39	0	620.6	core	629.17
276-1-2	290.4 core		471698	30	25	0	0	0	620.6		
276-1-3	290.4 core		472470	36	42	0	0	0	637.7		
276-1-4	290.4 rim		474054	54	17	0	31	7	678.2	core	624.92
276-1-5	290.4 rim		473049	18	50	0	0	7	575.9		
276-2-1	290.4 core		474587	66	8	0	0	7	699.7		
276-2-2	290.4 core		473096	30	0	0	31	0	620.6	core	652.67
276-2-3	290.4 core		474592	36	8	0	39	0	637.7		
276-2-4	290.4 rim		472890	24	0	0	8	0	600.5	rim	600.52
276-2-5	290.4 rim		474966	24	0	0	31	7	600.5		
276-3-1	290.4 core		473923	54	25	0	8	14	678.2		
276-3-2	290.4 core		473727	24	8	0	0	0	600.5		
276-3-3	290.4 core		472044	42	0	0	39	14	652.7	core	634.54
276-3-4	290.4 core		471726	30	0	0	0	0	620.6		
276-3-5	290.4 core		471427	30	8	0	23	0	620.6		
276-4-1	290.4 core		469057	60	25	0	0	0	689.4		
276-4-2	290.4 core		471516	48	8	0	0	0	666.1	core	663.59
276-4-3	290.4 core		473344	54	0	0	0	0	678.2		
276-4-4	290.4 core		469483	30	17	0	0	0	620.6		
276-4-5	290.4 rim		472278	18	0	0	23	0	575.9	rim	575.91
276-5-1	290.4 rim		472367	18	8	0	0	0	575.9	core	657.99
276-5-2	290.4 core		469688	54	25	0	31	29	678.2		
276-5-3	290.4 core		472797	36	0	0	0	7	637.7	rim	662.76
276-5-4	290.4 rim		472016	102	50	16	62	43	749.6		

Appendix 5

EPMA analysis of zircon

Sam.num	Type-1										Type-2			
	255-P2			255-P11							258-P7-1			
	1	2	3	1	2	3	4	5	6		1	2	3	4
Comment	core	rim	core	core	rim	core	rim	core	core		core	rim	core	core
SiO ₂	31.65	27.01	32.44	32.69	32.64	32.88	32.41	33.26	32.66		32.47	32.78	32.91	32.68
ZrO ₂	56.97	52.45	59.40	60.46	60.34	59.84	60.88	60.00	60.37		58.42	57.76	59.39	57.26
HfO ₂	1.03	1.00	1.11	1.23	1.24	1.40	1.28	1.28	1.27		1.08	1.02	0.88	1.05
Al ₂ O ₃	0.02	0.45	0.06	0.16	0.20	0.20	0.18	0.26	0.14		0.17	0.25	0.27	0.32
CaO	0.01	1.04	0.02	0.03	0.05	0.04	0.03	0.04	0.03		0.02	0.02	0.11	0.04
Na ₂ O														
TiO ₂	0.08	0.09	0.11	0.12	0.13	0.10	0.09	0.09	0.10		0.19	0.21	0.35	0.26
Y ₂ O ₃	3.62	2.65	1.01	0.54	0.47	0.39	0.22	0.21	0.44		2.07	1.86	1.28	1.59
Nb ₂ O ₅	0.16	0.99	0.14	0.14	0.14	0.14	0.16	0.15	0.22		0.27	0.23	0.16	0.15
Ce ₂ O ₃	0.14	0.46	0.70	0.19	0.09	0.07	0.00	0.10	0.16		0.93	1.22	0.16	1.06
Nd ₂ O ₃	0.29	0.11	0.26	bdl	bdl	bdl	bdl	bdl	bdl		0.90	0.47	bdl	0.61
Gd ₂ O ₃	0.27	0.07	0.04	0.01	0.01	0.02	0.01	0.00	0.00		0.23	0.15	0.13	0.25
Dy ₂ O ₃	0.48	0.40	0.26	0.27	0.12	0.24	0.01	0.28	0.29		0.30	0.35	0.37	0.33
Ho ₂ O ₃	bdl	0.10	bdl	0.03	0.08	0.05	bdl	bdl	bdl		bdl	bdl	0.16	0.02
Er ₂ O ₃	0.59	0.79	0.35	0.45	0.26	0.25	0.17	0.16	0.37		0.22	0.21	0.15	0.21
Yb ₂ O ₃	1.28	2.14	1.55	1.12	1.11	0.90	0.60	0.63	1.21		0.40	0.48	0.15	0.32
UO ₂	0.24	0.36	0.20	0.06	0.14	0.11	0.06	bdl	0.12		0.14	0.16	0.07	0.08
ThO ₂	0.74	bdl	0.28	0.01	0.05	0.01	bdl	0.03	bdl		bdl	bdl	0.02	0.08
FeO	1.03	2.19	0.28	0.41	1.12	0.55	2.20	0.63	0.47		0.17	0.31	0.44	0.25
P ₂ O ₅	0.14	0.13	0.05	0.06	0.07	0.06	0.10	0.04	0.07		0.01	0.03	0.09	0.03
SnO ₂	0.14	bdl	0.20	bdl	0.11	bdl	bdl	0.11	0.03		0.16	0.32	0.52	0.38
Total	98.87	92.43	98.45	97.95	98.34	97.25	98.39	97.26	97.95		98.15	97.83	97.61	96.98
Σ(LREE ₂ O ₃)	0.43	0.56	0.96	0.19	0.09	0.07	0.00	0.10	0.16		1.83	1.69	0.16	1.67
Σ(HREE ₂ O ₃)	6.24	6.15	3.21	2.41	2.03	1.86	1.02	1.28	2.31		3.23	3.05	2.23	2.73
Structural formulae based on 4 oxygen atoms														
Si	1.006	0.938	1.022	1.025	1.020	1.033	1.011	1.039	1.024		1.023	1.031	1.027	1.035
Zr	0.883	0.888	0.913	0.924	0.920	0.917	0.926	0.914	0.923		0.897	0.886	0.904	0.884
Hf	0.009	0.010	0.010	0.011	0.011	0.013	0.011	0.011	0.011		0.010	0.009	0.008	0.010
Al	0.001	0.018	0.002	0.006	0.007	0.007	0.007	0.010	0.005		0.006	0.009	0.010	0.012
Ca	-	0.039	0.001	0.001	0.002	0.001	0.001	0.001	0.001		0.001	0.001	0.004	0.002
Na														
Ti	0.002	0.002	0.003	0.003	0.003	0.002	0.002	0.002	0.002		0.005	0.005	0.008	0.006
Y	0.061	0.049	0.017	0.009	0.008	0.007	0.004	0.004	0.007		0.035	0.031	0.021	0.027
Nb	0.002	0.016	0.002	0.002	0.002	0.002	0.002	0.002	0.003		0.004	0.003	0.002	0.002
Ce	0.002	0.006	0.008	0.002	0.001	0.001	-	0.001	0.002		0.011	0.014	0.002	0.012
Nd	0.003	0.001	0.003	-	-	-	-	-	-		0.010	0.005	-	0.007
Gd	0.003	0.001	0.001	-	-	-	-	-	-		0.002	0.002	0.001	0.003
Dy	0.005	0.004	0.003	0.003	0.001	0.002	-	0.003	0.003		0.003	0.004	0.004	0.003
Ho	-	0.001	-	-	0.001	0.001	-	-	-		-	-	0.002	-
Er	0.006	0.009	0.004	0.004	0.003	0.003	0.002	0.002	0.004		0.002	0.002	0.001	0.002
Yb	0.012	0.023	0.015	0.011	0.011	0.009	0.006	0.006	0.012		0.004	0.005	0.001	0.003
U	0.002	0.003	0.001	-	0.001	0.001	-	-	0.001		0.001	0.001	0.001	0.001
Th	0.005	-	0.002	-	-	-	-	-	-		-	-	-	0.001
Fe	0.027	0.064	0.007	0.011	0.029	0.014	0.058	0.017	0.012		0.004	0.008	0.012	0.007
P	0.004	0.004	0.001	0.002	0.002	0.002	0.003	0.001	0.002		0.000	0.001	0.002	0.001
Sn	0.002	-	0.003	-	0.001	-	-	0.001	-		0.002	0.004	0.007	0.005
Total	2.035	2.075	2.016	2.014	2.022	2.014	2.033	2.014	2.014		2.020	2.021	2.017	2.021
Σ(LREE)	0.005	0.007	0.011	0.002	0.001	0.001	0.000	0.001	0.002		0.021	0.019	0.002	0.019
Σ(HREE)	0.087	0.087	0.039	0.027	0.023	0.021	0.011	0.014	0.026		0.046	0.043	0.031	0.038

Sam.num	Type-2												
	261-P25-2						261-P25-2						
	1	2	3	4	5	6	7	8	9	10	11	12	1
Comment	core	core	rim	rim	rim	core	rim	rim	rim	core	rim	rim	core
SiO ₂	32.44	32.25	25.64	23.21	32.28	32.57	25.27	22.13	31.25	32.40	21.84	33.49	31.45
ZrO ₂	57.31	57.82	46.48	40.95	58.31	58.33	46.41	40.07	57.59	58.12	39.52	58.40	56.27
HfO ₂	0.93	0.94	0.73	0.65	1.01	0.87	0.63	0.72	1.04	0.79	0.67	1.20	1.02
Al ₂ O ₃	0.11	0.09	0.29	0.46	0.11	0.02	0.34	0.35	0.11	0.03	0.49	0.17	0.02
CaO	bdl	bdl	1.19	1.88	0.01	0.03	1.09	2.06	0.18	0.02	1.48	0.06	0.09
Na ₂ O													
TiO ₂	0.09	0.10	0.22	0.21	0.13	0.12	0.19	0.28	0.18	0.05	0.13	0.10	0.06
Y ₂ O ₃	2.96	3.19	5.59	7.07	2.57	3.02	5.90	6.50	2.91	3.08	7.25	2.09	4.44
Nb ₂ O ₅	0.34	0.31	2.74	4.07	0.21	0.27	2.89	4.43	0.53	0.39	3.76	0.12	0.18
Ce ₂ O ₃	0.63	0.47	0.28	0.13	0.10	0.30	0.20	0.14	0.14	0.47	0.14	0.37	0.13
Nd ₂ O ₃	0.22	0.22	0.08	0.10	0.15	0.29	0.19	0.10	0.14	0.36	0.03	0.07	0.12
Gd ₂ O ₃	0.26	0.20	0.20	0.31	0.23	0.22	0.26	0.26	0.27	0.14	0.36	0.16	0.32
Dy ₂ O ₃	0.47	0.44	0.94	1.21	0.53	0.43	0.96	1.13	0.71	0.44	1.31	0.31	0.83
Ho ₂ O ₃	bdl	0.01	0.20	0.19	0.22	0.01	0.12	0.10	0.18	0.05	0.18	0.06	0.01
Er ₂ O ₃	0.53	0.51	0.92	1.11	0.50	0.51	0.98	1.18	0.68	0.49	1.22	0.38	0.70
Yb ₂ O ₃	0.78	0.88	1.12	1.16	0.58	0.88	1.17	1.19	0.70	0.89	1.13	0.53	1.23
UO ₂	0.18	0.20	0.15	0.11	0.14	0.28	0.05	0.01	0.22	0.39	0.08	0.10	0.12
ThO ₂	0.04	0.11	1.40	2.08	0.89	0.88	1.45	2.05	1.21	0.34	2.77	0.39	0.06
FeO	0.14	0.09	2.73	4.04	0.28	0.07	2.37	3.30	0.56	0.06	4.30	0.23	0.16
P ₂ O ₅	0.08	0.09	0.30	0.30	0.13	0.12	0.33	0.36	0.13	0.09	0.38	0.07	0.15
SnO ₂	bdl	bdl	bdl	bdl	0.04	0.06	bdl	0.13	0.12	bdl	0.14	bdl	0.06
Total	97.50	97.92	91.20	89.21	98.41	99.26	90.80	86.48	98.84	98.62	87.17	98.31	97.40
Σ(LREE ₂ O ₃)	0.85	0.69	0.36	0.22	0.25	0.60	0.39	0.24	0.28	0.82	0.16	0.44	0.25
Σ(HREE ₂ O ₃)	4.99	5.23	8.97	11.04	4.63	5.06	9.38	10.37	5.45	5.10	11.46	3.54	7.52
Structural formulae based on 4 oxygen atoms													
Si	1.028	1.021	0.915	0.867	1.018	1.021	0.907	0.853	0.995	1.021	0.847	1.043	1.011
Zr	0.886	0.893	0.809	0.746	0.897	0.891	0.813	0.754	0.894	0.893	0.747	0.887	0.882
Hf	0.008	0.009	0.008	0.007	0.009	0.008	0.007	0.008	0.010	0.007	0.007	0.011	0.009
Al	0.004	0.003	0.012	0.020	0.004	0.001	0.014	0.016	0.004	0.001	0.022	0.006	0.001
Ca	-	-	0.046	0.075	-	0.001	0.042	0.085	0.006	0.001	0.062	0.002	0.003
Na													
Ti	0.002	0.002	0.006	0.006	0.003	0.003	0.005	0.008	0.004	0.001	0.004	0.002	0.002
Y	0.050	0.054	0.106	0.141	0.043	0.050	0.113	0.134	0.049	0.052	0.150	0.035	0.076
Nb	0.005	0.004	0.044	0.069	0.003	0.004	0.047	0.077	0.008	0.006	0.066	0.002	0.003
Ce	0.007	0.005	0.004	0.002	0.001	0.004	0.003	0.002	0.002	0.005	0.002	0.004	0.002
Nd	0.003	0.003	0.001	0.001	0.002	0.003	0.003	0.001	0.002	0.004	-	0.001	0.001
Gd	0.003	0.002	0.002	0.004	0.002	0.002	0.003	0.003	0.003	0.002	0.005	0.002	0.003
Dy	0.005	0.004	0.011	0.015	0.005	0.004	0.011	0.014	0.007	0.005	0.016	0.003	0.009
Ho	-	-	0.002	0.002	0.002	-	0.001	0.001	0.002	0.001	0.002	0.001	0.000
Er	0.005	0.005	0.010	0.013	0.005	0.005	0.011	0.014	0.007	0.005	0.015	0.004	0.007
Yb	0.008	0.009	0.012	0.013	0.006	0.008	0.013	0.014	0.007	0.009	0.013	0.005	0.012
U	0.001	0.001	0.001	0.001	0.001	0.002	0.000	0.000	0.002	0.003	0.001	0.001	0.001
Th	-	0.001	0.011	0.018	0.006	0.006	0.012	0.018	0.009	0.003	0.024	0.003	-
Fe	0.004	0.002	0.082	0.126	0.008	0.002	0.071	0.106	0.015	0.002	0.139	0.006	0.004
P	0.002	0.003	0.009	0.009	0.004	0.003	0.010	0.012	0.003	0.003	0.012	0.002	0.004
Sn	-	-	-	-	0.001	0.001	-	0.002	0.002	-	0.002	-	0.001
Total	2.021	2.021	2.091	2.134	2.020	2.019	2.085	2.123	2.028	2.020	2.137	2.018	2.030
Σ(LREE)	0.010	0.008	0.005	0.003	0.003	0.007	0.005	0.003	0.003	0.009	0.002	0.005	0.003
Σ(HREE)	0.070	0.074	0.144	0.187	0.064	0.070	0.152	0.181	0.075	0.072	0.201	0.049	0.107

Sam.num	Type-2												
	264-P20-1					264-P22_2							
Comment	2 rim	3 core	5 core	6 core	7 core	8 rim	9 core	10 rim	1 core	2 core	3 core	4 core	5 rim
SiO ₂	31.44	31.78	31.51	31.63	31.74	31.79	31.73	32.38	27.04	27.26	31.62	27.21	30.52
ZrO ₂	55.37	55.70	55.53	55.93	56.00	55.22	56.16	56.53	49.29	51.16	56.79	50.99	55.69
HfO ₂	0.88	0.97	0.94	0.94	0.95	0.96	0.96	1.05	0.88	0.90	1.02	0.93	1.18
Al ₂ O ₃	bdl	0.14	0.14	0.31	0.03	bdl	0.04	0.16	0.59	0.31	bdl	0.33	0.29
CaO	0.08	0.09	0.06	0.08	0.08	0.12	0.12	0.15	0.75	0.90	0.12	0.77	0.65
Na ₂ O													
TiO ₂	0.05	0.10	0.08	0.07	0.05	0.07	0.07	0.10	0.08	0.11	0.06	0.08	0.04
Y ₂ O ₃	4.62	3.70	3.73	4.17	4.76	4.73	4.24	3.65	5.44	5.04	3.62	4.79	3.71
Nb ₂ O ₅	0.15	0.07	0.08	0.07	0.13	0.09	0.07	0.11	1.43	2.15	0.33	1.81	0.33
Ce ₂ O ₃	0.10	0.13	0.13	0.10	0.13	0.14	0.14	0.15	0.17	0.25	0.12	0.20	0.87
Nd ₂ O ₃	0.15	0.13	0.10	0.13	0.17	0.11	0.19	0.14	0.15	0.15	0.13	0.12	0.32
Gd ₂ O ₃	0.45	0.25	0.26	0.25	0.37	0.44	0.39	0.25	0.28	0.33	0.19	0.27	0.34
Dy ₂ O ₃	0.85	0.62	0.61	0.60	0.77	0.78	0.72	0.52	1.05	1.01	0.58	0.93	0.67
Ho ₂ O ₃	0.16	0.15	0.07	0.01	0.19	0.11	0.14	0.14	0.03	0.14	bdl	0.13	0.12
Er ₂ O ₃	0.68	0.76	0.56	0.70	0.65	0.72	0.69	0.61	0.98	0.94	0.77	0.75	0.53
Yb ₂ O ₃	1.22	1.41	1.19	1.37	1.22	1.28	1.26	1.44	1.85	1.81	2.13	1.89	1.04
UO ₂	0.19	0.12	0.18	0.06	0.20	0.20	0.17	0.19	0.31	0.38	0.48	0.33	0.00
ThO ₂	0.15	bdl	bdl	0.08	0.11	0.04	0.03	0.11	0.40	0.38	0.40	0.32	1.03
FeO	0.09	0.42	1.94	0.55	0.23	0.05	0.10	0.32	1.51	1.81	0.39	1.70	1.63
P ₂ O ₅	0.18	0.23	0.16	0.25	0.17	0.23	0.17	0.15	0.38	0.33	0.21	0.20	0.24
SnO ₂	0.12	0.13	0.12	0.04	0.06	bdl	bdl	0.09	0.11	bdl	bdl	bdl	bdl
Total	96.91	96.88	97.39	97.31	98.00	97.05	97.37	98.24	92.72	95.36	98.94	93.75	99.20
Σ(LREE ₂ O ₃)	0.25	0.26	0.23	0.23	0.30	0.25	0.33	0.29	0.32	0.41	0.24	0.32	1.19
Σ(HREE ₂ O ₃)	7.97	6.88	6.43	7.10	7.96	8.04	7.43	6.60	9.64	9.27	7.29	8.75	6.42
Structural formulae based on 4 oxygen atoms													
Si	1.016	1.020	1.010	1.012	1.014	1.022	1.017	1.024	0.939	0.925	1.006	0.936	0.978
Zr	0.872	0.872	0.868	0.872	0.872	0.866	0.878	0.872	0.835	0.847	0.881	0.856	0.870
Hf	0.008	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.009	0.009	0.009	0.009	0.011
Al	-	0.005	0.005	0.012	0.001	-	0.001	0.006	0.024	0.012	-	0.013	0.011
Ca	0.003	0.003	0.002	0.003	0.003	0.004	0.004	0.005	0.028	0.033	0.004	0.029	0.022
Na													
Ti	0.001	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.001	0.002	0.001
Y	0.079	0.063	0.064	0.071	0.081	0.081	0.072	0.062	0.101	0.091	0.061	0.088	0.063
Nb	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.002	0.022	0.033	0.005	0.028	0.005
Ce	0.001	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.002	0.003	0.001	0.003	0.010
Nd	0.002	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.001	0.002	0.004
Gd	0.005	0.003	0.003	0.003	0.004	0.005	0.004	0.003	0.003	0.004	0.002	0.003	0.004
Dy	0.009	0.006	0.006	0.006	0.008	0.008	0.007	0.005	0.012	0.011	0.006	0.010	0.007
Ho	0.002	0.002	0.001	-	0.002	0.001	0.001	0.001	-	0.002	-	0.001	0.001
Er	0.007	0.008	0.006	0.007	0.007	0.007	0.007	0.006	0.011	0.010	0.008	0.008	0.005
Yb	0.012	0.014	0.012	0.013	0.012	0.013	0.012	0.014	0.020	0.019	0.021	0.020	0.010
U	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.002	0.003	0.003	0.003	-
Th	0.001	-	-	0.001	0.001	-	-	0.001	0.003	0.003	0.003	0.003	0.008
Fe	0.003	0.011	0.052	0.015	0.006	0.001	0.003	0.009	0.044	0.051	0.010	0.049	0.044
P	0.005	0.006	0.004	0.007	0.005	0.006	0.005	0.004	0.011	0.010	0.006	0.006	0.006
Sn	0.002	0.002	0.002	0.000	0.001	-	-	0.001	0.002	-	-	-	-
Total	2.030	2.031	2.050	2.035	2.032	2.030	2.029	2.031	2.071	2.070	2.030	2.067	2.059
Σ(LREE)	0.003	0.003	0.003	0.003	0.004	0.003	0.004	0.003	0.004	0.005	0.003	0.004	0.014
Σ(HREE)	0.114	0.095	0.091	0.100	0.113	0.114	0.105	0.091	0.146	0.136	0.098	0.130	0.091

EPMA analysis. Zircon in the Khaldzan Burgedei complex

Appendix 5

Sam.num	Type-2												
	266-P5-1					266-P3-1				266-P3-2		270-P8-2	
	2	3	4	5	6	1	2	3	4	1	2	1	2
Comment	core	core	rim	core	rim	core	rim	core	rim	core	rim	core	rim
SiO ₂	31.95	32.02	18.72	32.44	20.30	32.00	31.98	32.42	31.12	32.68	31.71	30.72	30.61
ZrO ₂	58.22	58.32	30.71	58.99	36.09	59.24	59.97	60.22	57.78	59.95	57.52	56.00	57.02
HfO ₂	1.13	1.26	0.65	1.19	0.78	1.13	1.18	1.24	1.07	1.20	1.17	1.00	1.06
Al ₂ O ₃	0.19	0.21	0.42	0.29	0.41	0.17	0.11	0.16	bdl	0.12	0.03	0.01	0.02
CaO	0.04	0.05	2.51	0.07	2.41	0.10	0.03	0.05	0.02	0.04	0.01	0.02	bdl
Na ₂ O													
TiO ₂	0.08	0.05	0.13	0.06	0.08	0.08	0.05	0.10	0.07	0.12	0.04	0.07	0.10
Y ₂ O ₃	0.73	0.79	4.66	0.57	5.06	0.66	1.35	0.56	3.37	0.42	3.45	5.13	4.65
Nb ₂ O ₅	0.17	0.27	4.54	0.27	2.40	0.21	0.23	0.28	0.36	0.19	0.36	0.62	0.79
Ce ₂ O ₃	0.24	0.22	0.17	0.15	0.20	0.20	0.45	0.30	0.04	0.22	0.06	0.01	0.00
Nd ₂ O ₃	bdl	bdl	0.07	bdl	0.04	bdl	0.26	bdl	0.05	bdl	0.12	0.12	0.17
Gd ₂ O ₃	0.01	0.04	0.20	0.03	0.25	0.02	0.07	0.02	0.30	0.04	0.22	0.65	0.50
Dy ₂ O ₃	0.25	0.22	1.11	0.18	1.17	0.11	0.22	0.10	0.70	0.19	0.71	0.60	0.59
Ho ₂ O ₃	bdl	bdl	0.20	0.12	0.28	0.03	0.05	0.00	0.04	0.07	0.05	0.04	0.05
Er ₂ O ₃	0.48	0.48	1.39	0.22	1.31	0.28	0.27	0.22	0.86	0.15	0.82	0.39	0.59
Yb ₂ O ₃	1.76	1.62	1.62	1.07	1.61	0.91	0.80	0.80	1.23	0.79	1.31	0.62	0.81
UO ₂	0.36	0.41	0.24	0.07	0.07	0.15	0.07	0.03	0.09	0.21	0.09	0.11	0.10
ThO ₂	0.33	0.27	7.79	0.41	7.84	0.13	1.27	0.06	0.35	bdl	0.27	0.12	bdl
FeO	0.43	0.44	3.20	0.85	6.10	1.27	0.32	0.32	0.18	0.33	0.17	0.09	0.10
P ₂ O ₅	0.07	0.09	0.58	0.05	0.53	0.16	0.06	0.06	0.19	0.07	0.20	0.12	0.13
SnO ₂	0.14	0.14	0.04	0.22	bdl	0.25	bdl	0.22	0.02	0.25	0.15	bdl	0.12
Total	96.59	96.89	78.94	97.25	86.90	97.09	98.73	97.15	97.81	97.03	98.44	96.42	97.38
Σ(LREE ₂ O ₃)	0.24	0.22	0.24	0.15	0.24	0.20	0.71	0.30	0.08	0.22	0.18	0.13	0.17
Σ(HREE ₂ O ₃)	3.23	3.16	9.17	2.18	9.67	2.00	2.75	1.69	6.50	1.66	6.55	7.42	7.18
Structural formulae based on 4 oxygen atoms													
Si	1.024	1.023	0.831	1.025	0.824	1.015	1.009	1.023	0.998	1.030	1.008	0.998	0.987
Zr	0.910	0.908	0.665	0.909	0.715	0.916	0.923	0.926	0.904	0.922	0.892	0.887	0.897
Hf	0.010	0.012	0.008	0.011	0.009	0.010	0.011	0.011	0.010	0.011	0.011	0.009	0.010
Al	0.007	0.008	0.022	0.011	0.020	0.006	0.004	0.006	-	0.005	0.001	-	0.001
Ca	0.002	0.002	0.119	0.003	0.105	0.003	0.001	0.002	0.001	0.001	-	0.001	-
Na													
Ti	0.002	0.001	0.004	0.001	0.002	0.002	0.001	0.002	0.002	0.003	0.001	0.002	0.003
Y	0.013	0.013	0.110	0.010	0.109	0.011	0.023	0.009	0.058	0.007	0.058	0.089	0.080
Nb	0.003	0.004	0.091	0.004	0.044	0.003	0.003	0.004	0.005	0.003	0.005	0.009	0.012
Ce	0.003	0.003	0.003	0.002	0.003	0.002	0.005	0.004	0.001	0.003	0.001	-	-
Nd	-	-	0.001	-	0.001	-	0.003	-	0.001	-	0.001	0.001	0.002
Gd	-	-	0.003	-	0.003	-	0.001	-	0.003	-	0.002	0.007	0.005
Dy	0.003	0.002	0.016	0.002	0.015	0.001	0.002	0.001	0.007	0.002	0.007	0.006	0.006
Ho	-	-	0.003	0.001	0.004	-	0.001	-	0.000	0.001	0.001	-	0.001
Er	0.005	0.005	0.019	0.002	0.017	0.003	0.003	0.002	0.009	0.001	0.008	0.004	0.006
Yb	0.017	0.016	0.022	0.010	0.020	0.009	0.008	0.008	0.012	0.008	0.013	0.006	0.008
U	0.003	0.003	0.002	0.001	0.001	0.001	0.001	-	0.001	0.001	0.001	0.001	0.001
Th	0.002	0.002	0.079	0.003	0.072	0.001	0.009	-	0.003	-	0.002	0.001	-
Fe	0.012	0.012	0.119	0.023	0.207	0.034	0.009	0.009	0.005	0.009	0.005	0.002	0.003
P	0.002	0.002	0.022	0.001	0.018	0.004	0.002	0.002	0.005	0.002	0.005	0.003	0.004
Sn	0.002	0.002	0.001	0.003	-	0.003	-	0.003	0.000	0.003	0.002	-	0.002
Total	2.017	2.017	2.141	2.021	2.188	2.025	2.016	2.012	2.023	2.010	2.023	2.027	2.025
Σ(LREE)	0.003	0.003	0.004	0.002	0.004	0.002	0.008	0.004	0.001	0.003	0.002	0.001	0.002
Σ(HREE)	0.037	0.036	0.173	0.025	0.168	0.024	0.036	0.020	0.089	0.019	0.089	0.112	0.106

EPMA analysis. Zircon in the Khaldzan Burgedei complex

Appendix 5

Sam.num ;	270-P1-1			272-P5		Type-1		272-P4-2		Type-3	
	3	1	2	1c	2c1	1	6	1	2	265-15-1	
Comment	rim	rim	core	core	core	core	rim	core	rim	a	b
										core	rim
SiO ₂	30.82	31.43	30.48	32.72	32.85	32.30	31.64	31.69	32.41	33.20	30.29
ZrO ₂	57.20	58.82	56.02	60.01	59.72	59.01	58.35	57.97	59.05	61.93	58.77
HfO ₂	1.16	0.97	1.17	1.34	1.30	1.44	1.45	1.26	1.29	3.12	3.08
Al ₂ O ₃	0.05	0.17	0.09	0.16	0.17	0.16	0.22	0.25	0.27	0.29	0.27
CaO	0.01	0.04	0.03	0.08	0.08	0.07	0.09	0.14	0.18	0.23	0.27
Na ₂ O										0.19	0.09
TiO ₂	0.13	0.28	0.03	0.47	0.44	0.48	0.34	0.27	0.33		
Y ₂ O ₃	4.37	2.39	4.12	0.07	0.00	0.20	0.23	1.68	0.67	0.90	0.84
Nb ₂ O ₅	0.86	0.79	0.33	0.21	0.25	0.26	0.25	0.41	0.35		
Ce ₂ O ₃	0.07	0.19	0.05	0.09	0.11	0.11	0.34	0.42	0.44		
Nd ₂ O ₃	0.17	0.14	0.03	0.00	0.00	0.00	0.10	0.05	0.01		
Gd ₂ O ₃	0.51	0.22	0.42	0.02	0.02	0.07	0.08	0.04	0.05		
Dy ₂ O ₃	0.52	0.28	0.66	0.24	0.22	0.29	0.20	0.23	0.20		
Ho ₂ O ₃	0.15	0.07	0.19	0.01	0.04	0.04	0.00	0.07	bdl		
Er ₂ O ₃	0.52	0.29	0.51	0.05	0.06	0.06	0.04	0.20	0.11		
Yb ₂ O ₃	0.75	0.38	0.51	0.03	0.03	0.07	0.02	0.17	0.12		
UO ₂	0.06	0.13	0.09	0.08	0.05	0.16	0.01	0.00	0.09		
ThO ₂	bdl	0.02	0.19	0.02	0.00	0.06	bdl	0.14	0.19		
FeO	0.08	0.17	0.88	0.50	0.50	0.48	0.48	0.38	0.54	bdl	bdl
P ₂ O ₅	0.15	0.12	0.83	0.04	0.03	0.05	0.03	0.17	0.12		
SnO ₂	0.14	0.17	0.02	0.82	0.84	0.78	0.63	0.65	0.65		
Total	97.72	97.09	96.60	96.95	96.71	96.11	94.49	96.19	97.08	99.87	93.60
Σ(LREE ₂ O ₃)	0.24	0.33	0.07	0.09	0.11	0.11	0.44	0.46	0.45		
Σ(HREE ₂ O ₃)	6.81	3.64	6.40	0.42	0.37	0.74	0.56	2.39	1.16		
Structural formulae based on 4 oxygen atoms											
Si	0.989	1.000	0.984	1.027	1.031	1.025	1.022	1.012	1.020	1.020	1.000
Zr	0.895	0.913	0.882	0.918	0.914	0.913	0.919	0.903	0.906	0.955	0.975
Hf	0.011	0.009	0.011	0.012	0.012	0.013	0.013	0.012	0.012		
Al	0.002	0.006	0.002	0.006	0.006	0.006	0.009	0.009	0.010	0.011	0.010
Ca	-	0.001	0.001	0.003	0.003	0.003	0.003	0.005	0.006	0.007	0.010
Na										0.011	0.006
Ti	0.003	0.007	0.001	0.011	0.010	0.011	0.008	0.007	0.008		
Y	0.075	0.041	0.072	0.001	-	0.003	0.004	0.029	0.011	0.015	0.015
Nb	0.012	0.011	0.005	0.003	0.004	0.004	0.004	0.006	0.005		
Ce	0.001	0.002	0.001	0.001	0.001	0.001	0.004	0.005	0.005		
Nd	0.002	0.002	-	-	-	-	0.001	0.001	-		
Gd	0.005	0.002	0.005	-	-	0.001	0.001	-	0.001		
Dy	0.005	0.003	0.007	0.002	0.002	0.003	0.002	0.002	0.002		
Ho	0.002	0.001	0.002	-	-	-	-	0.001	-		
Er	0.005	0.003	0.005	0.000	-	0.001	-	0.002	0.001		
Yb	0.007	0.004	0.005	-	-	0.001	-	0.002	0.001		
U	0.000	0.001	0.001	-	-	0.001	-	-	0.001		
Th	-	-	0.001	-	-	-	-	0.001	0.001		
Fe	0.002	0.005	0.024	0.013	0.013	0.013	0.013	0.010	0.014	-	-
P	0.004	0.003	0.023	0.001	0.001	0.001	0.001	0.005	0.003		
Sn	0.002	0.002	-	0.010	0.011	0.010	0.008	0.008	0.008		
Total	2.023	2.015	2.030	2.010	2.010	2.011	2.012	2.018	2.016	2.019	2.015
Σ(LREE)	0.003	0.004	0.001	0.001	0.001	0.001	0.005	0.005	0.005		
Σ(HREE)	0.100	0.053	0.095	0.004	0.002	0.008	0.007	0.035	0.016		

Appendix 6

Fluid inclusions analysis data

Microthermometry data of fluid inclusions in quartz and fluorite

Appendix 6

Sample number	Type	mineral	Ice Freezing T (°C)	Ice Melting T (°C)	Homogenization T (°C)	Salinity (wt.% NaCl eq)
Inclusions from quartz-fluorite vein						
OP19	4.1-1	L-V fluorite	-70.2	-13.6	128.8	18.2
	4.1-2	L-V fluorite	-52.8	-4.6	198.2	7.9
	4.1-3	L-V fluorite	-40.3	-3.7	160.2	6.4
	4.1-3a	L-V fluorite	-44.0	-2.7	168.9	4.8
	4.3	L-V fluorite	-35.6	-7.6	285.3	11.9
	4.3-1	L-V fluorite	-40.9	-3.8	197.7	6.7
	4.2-1	L-V fluorite	-43.0	-6.9	236.9	11.1
	4.2-2	L-V fluorite	-39.9	-6.0	232.1	9.9
OP17a	1	L-V quartz	-43.3	-0.1	236.9	
	2	L-V quartz	-41.1	-4.8	273.6	8.1
	2.1	L-V quartz	-45.8	-5.6	244.6	9.3
	2.2	L-V quartz	-41.0	-3.8	234.1	6.6
	3.1	L-V quartz	-38.5	-3.7	235.5	6.4
	3.2	L-V quartz	-42.7	-4.1	245.2	7.2
	3.3	L-V quartz	-39.0	-3.9	315.3	6.9
259	1a	L-V-S fluorite	-56.6	-0.1		
	1b	L-V-S fluorite	-55.7	-14.0	220.9	18.6
	1.1-1	L-V-S fluorite	-72.8	-19.0	162.8	22.2
	1.1-2	L-V-S fluorite	-67.8	-15.9	188.6	20.1
	1.2-1	L-V-S fluorite	-66.6	-23.8	185.6	25.2
	1.2-2	L-V-S fluorite	-44.0	-22.5	169.3	24.4
	1.2-3	L-V-S fluorite	-62.4	-21.4	200.8	23.8
	1.3-1	L-V-S fluorite	-62.4	-23.2	218.2	24.8
	1.3-2	L-V-S fluorite	-69.1	-21.8	311.2	24.0
	2.1-1	L-V-S fluorite	-61.1	-21.4	216.2	23.8
	2.1-2	L-V-S fluorite	-60.1	-11.4	243.4	16.1
	2.2-1	L-V-S fluorite	-56.6	-24.3	197.6	25.5
	2.2-2	L-V-S fluorite	-58.6	-8.2	312.3	12.7
	2.2-3	L-V-S fluorite	-71.1	-23.1	239.1	24.8
	2.3-1	L-V-S fluorite	-57.1	-20.8	207.0	23.4
	2.3-2	L-V-S fluorite	-67.5	-19.2	209.0	22.4
	2.3-3	L-V-S fluorite	-75.6	-19.3	202.5	22.4
	2.3-4	L-V-S fluorite	-57.0	-22.4	284.6	24.3
	2.3-5	L-V-S fluorite	-55.0	-21.4	206.7	23.8
	6.1-1	L-V-S fluorite	-73.0	-16.1	147.9	20.1
	6.1-2	L-V-S fluorite	-68.6	-12.3	154.4	17.0
	6.2a	L-V-S fluorite	-45.3	-11.3	148.1	16.1
	6.2b	L-V-S fluorite	-48.1	-12.2	166.5	16.9
	6.2c	L-V-S fluorite	-45.7	-12.3	156.1	17.0
Inclusions from pegmatite vein						
259	6.2-1	L-V quartz	-61.8	-14.0	129.8	18.6
	6.2-2	L-V quartz	-51.1	-18.9	150.4	22.2
	7.1a	L-V quartz	-65.0	-23.8	120.7	25.2
	7.1b	L-V quartz	-62.3	-21.6	118.4	23.9
	7.1c	L-V quartz	-68.1	-21.0	8.7	23.5
	7.1-1	L-V quartz	-75.2	-21.5	96.1	23.8
	7.2a	L-V quartz	-70.2	-0.1	8.7	

Microthermometry data of fluid inclusions in quartz and fluorite

Appendix 6

	7.2b	L-V	quartz	-72.6	-16.6	105.5	20.5
	7.2-1	L-V	quartz	-64.7	-19.5	130.0	22.6
	7.2-2	L-V	quartz	-60.1	-16.4	105.6	20.4
258	1.1	L-V	quartz	-82.1	-22.6	126.6	24.5
	1.2	L-V	quartz	-80.7	-21.3	124.3	23.7
	2	L-V	quartz	-74.5	-22.5	150.9	24.4
	3.1	L-V	quartz	-82.6	-23.7	158.5	25.1
	3.2	L-V	quartz	-87.3	-22.6	172.6	24.5
	4.1	L-V	quartz	-75.9	-17.1	115.0	20.9
	4.2	L-V	quartz	-76.6	-22.6	121.8	24.5
	5.1	L-V	quartz	-89.5	-24.6	146.9	25.6
	5.2	L-V	quartz	-79.0	-21.6	138.8	23.9