Age, composition and thermal history of lower crustal xenoliths from the Artemisia, Ekati and Munn Lake kimberlites of the Slave Craton

by

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Abstract

In this study we present data from three lower crustal xenoliths suites collected in a northeast to southwest transect across the Slave craton. The samples are from the Artemisia kimberlite, located near the Coronation diamond district of the northwestern Slave (Nunavut), the Ekati kimberlite from the central Slave (NWT) and the Munn Lake kimberlite of the southeastern Slave (NWT). Samples from the Artemisia Suite have a range of bulk composition but the majority are granitic to semi-pelitic in composition and comprise Garnet + Plagioclase + Quartz + Rutile ± K-feldspar ± Biotite and significant amounts of retrograde hydrous minerals that likely pseudomorph orthopyroxene. As well, there are accessory grains of zircon and monazite. The garnet in these samples is characterized by relatively low grossular contents. In contrast to the Artemisia xenoliths, the Ekati and Munn Lake samples are garnet-bearing mafic granulites with a primary mineralogy of Garnet + Clinopyroxene + Plagioclase ±Quartz ± Orthopyroxene ± Amphibole ± Rutile ± Ilmenite. Metamorphic conditions of the lower crust as indicated by mineral equilibria are in the 9-12 kbar range of pressures with temperatures of at least 750-800°C. In the northern Slave, Neoarchean metamorphic events are recorded at 2624±11 Ma and 2520 Ma and Paleoproterozoic metamorphic events are recorded at 2415 Ma, 2150 Ma, and 2050 Ma and weakly at 2010 Ma. The ages observed in the Artemisia suite may be showing events not seen on the surface and there is a possible correlation with rocks of the Hottah terrane or mafic dike swarms that affected the Slave craton between 2200 and 2000 Ma. Still younger Paleoproterozoic ages of 1826-1868 Ma may be related to the Wopmay orogen. The Artemisia, Ekati and Munn Lake xenolith suites investigated in this study illustrates the complexity of unravelling the history of the lower crust.

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°C- Degrees Celsius
Bt- Biotite
BSE- Back Scattered Electron
Ca- Calcium
Cpx- Clinopyroxene
cm- centimeter
Crd- Cordierite
EDS- Energy dispersive spectroscopy
EPMA- Electron Probe Microanalyser
Fe- Iron
Ga- Billion
Grt- Garnet
Ilm- Ilmenite
kbars- kilobars
km- kilometre
kV- kilovolts
Ma- Million
Mg- Magnesium
mm- millimetre
Mn Manganese
nA- nanoamps
Nd- Neodynium
Nm- nanometre
Opx- Orthopyroxene
P- Pressure
Pb- Lead
Pl- Plagiooclase
PPL- Plane polarized light
Qtz- Quartz
Rt- Rutile
Si- Silicon
Sill- Sillimanite
T- Temperature
Ti- Titanite
Tl- Thallium
U- Uranium
µm- micrometre
WDS- Wavelength dispersive spectroscopy
XP- Cross polarized

1.1. Introduction

Lower crustal xenoliths play an important role in the study of crust-formation processes, particularly in Archean terrains where the lower crust is the interface between the crust and the cool lithospheric mantle keel underlying Archean cratons. The continental crust can be divided into three subgroups; the upper, middle and lower crust. Exposures of upper and middle crustal rocks are generally available for geological sampling and as such have been geochemically well studied. In contrast, the lower crust has been sparsely studied due to limitations in sample availability. An understanding of all subgroups of the continental crust is important as it allows for insight into continental crust composition, formation, and geochemical inventories (Heier, 1973; Rudnick and Gao, 2003).

Knowledge of the lower crust comes from studies of a limited number of high-pressure (P > 8-9 kbar) granulite terrains, from geophysical studies and from lower crustal xenoliths that are carried to the surface in volcanic conduits. (Rudnick and Gao, 2003). Ideally, information derived from uplifted terrains, geophysics and xenoliths would be integrated to provide a holistic picture of the nature and composition of the lower crust.

Previous studies have shown that lower crustal samples are dominantly composed of granulite-facies rocks and that there is a lithological sampling discrepancy between xenoliths and surface outcrops. Specifically, xenolith samples indicate a predominantly mafic lower crust whereas surface outcrop samples in high-grade metamorphic terranes indicate a predominantly felsic- to intermediate-composition lower crust (Rudnick and Fountain, 1995). This raises the questions of whether the bulk composition of the lower crust is mafic or felsic, as well as the subsequent implications this has on estimates for bulk composition of the continental crust. In particular, the composition of the lower crust must be constrained in order to obtain an accurate estimate of bulk continental crust composition.

In Canada, extensive research has been conducted in the Slave craton due to the availability of xenoliths from diamondiferous kimberlite pipes found throughout the region. U-Pb geochronology on zircon grains from lower crustal granulite xenolith samples from the southern and central region of the Slave has shown that granulite-facies metamorphism in the lower crust continued beyond metamorphism that is observed in the upper and middle crust (Davis et al., 2003a). Some of the younger metamorphic ages appear to be due to Proterozoic mafic magmatism that is manifested in the upper crust as mafic dike swarms (Davis, 1997). Davis et al. (2003b) also note that it is difficult to reconcile latest Neoarchean to Proterozoic granulite-facies metamorphism in the lower crust with the preservation of a diamond-bearing and cool lithospheric mantle keel, part of which is inferred to have formed in the Mesoarchean. Studies of lower crustal xenoliths can help to constrain the timing of the development of the lithospheric mantle and diamond-formation processes.

It should be noted that the northern part of the Slave craton has only been sparsely studied and so it is unclear whether observations made on lower crustal samples from the central and southern parts of the craton (Davis et al., 2003a) extend northward. The present study will compare lower crustal xenoliths from the northern Slave to those in the central and southern region and will provide an opportunity to gain insight into the age, composition and thermal history of a broader cross-section of the craton.

1.2. Regional Setting

The Slave craton (Figure 1) is an Archean block of crust bounded by Proterozoic orogens and faults that are associated with the 2.0 – 1.8 Ga amalgamation of Laurentia (Hoffman, 1988). To the west, the craton is bounded by the Wopmay Orogen which is composed of rocks of the Great Bear Magmatic arc, the Hottah terrane and the Coronation Supergroup sediments. To the east and south it is separated from the Queen Maud Block and the Rae and Hearne cratons by the Talston-Thelon Magmatic zones (Hoffman, 1988; 1999).

The Wopmay Orogen comprises rocks of the Coronation Supergroup that were thrust eastward onto the Slave craton during the 1.9-1.8 Ga Calderian Orogeny (Hildebrand et al., 2010). The Coronation Supergroup is divided into three groups, representing a rift to passive margin to foredeep succession. The rift facies assemblage is characterized by the coarse grained clastics of the Melville Group. The passive margin sequence is characterized by the shallow-

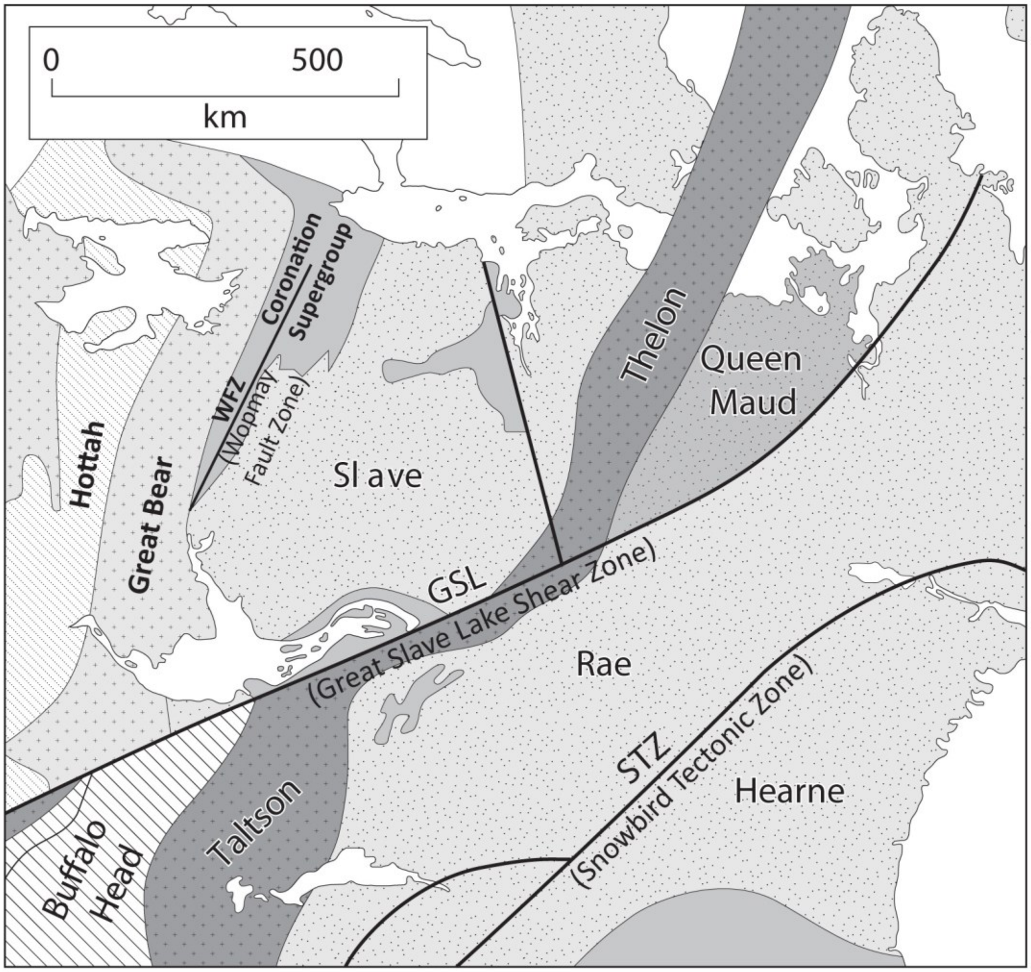

Figure 1: Basement domains geology of the western Canadian Shield (modified after Chacko et al., 2000).

marine sequence of the sliciclastic Odjick Formation and the carbonate platforms of the Rocknest Formation, which comprise the Epworth Group (Hoffman, 1973). The Recluse Group is a foredeep collision assemblage that marks terminal drowning of the Epworth Group (Hoffman et al., 2011; Hildebrand et al., 2010).

The Hottah terrane, is proposed to be an exotic island arc that accreted onto the Slave craton during the 1.9-1.8 Ga Calderian Orogeny (Hildebrand et al., 2010; Cook, 2011). It is dominated by amphibolite-facies sedimentary and intermediate volcanic rocks deposited on 2.0-2.4 Ga basement (Cook, 2011; Bowring and Podesk, 1989).

The collision between the Slave and Hottah has been dated at 1882 ± 4Ma (Bowring and Grotzinger, 1992). The Proterozoic Wopmay fault (Figure 2) is characterized by a 10 km wide zone of mylonite (Hoffman, 1988) and is a possible suture between the exotic Hottah terrane and Slave craton as there is no Pb or Nd isotopic evidence for Archean rocks farther east (Bowring and Podosek, 1989).

The area between the exposed Slave craton and the Wopmay fault (Figure 1) was originally mapped as part of the internal zone of the Wopmay orogen and the Coronation margin rocks (St-Onge et al., 1987) However, recent mapping and U-Pb dating by Jackson et al. (2013) indicate that a significant portion of this area is also made up of granitic rocks with Neoarchean ages (~

2580-2590 Ma), smaller amounts of Meso- to Paleoarchean basement rocks (~ 2950-3300 Ma) and small amounts of Yellowknife Supergroup rocks (which may include some Burwash Formation rocks). Some of these rocks have been reworked during the Wopmay orogen (~ 1880 Ma) and there may also be some reworking earlier in the Paleoproterozoic (one poorly defined lower intercept age in the Jackson et al study is ~ 2180 Ma).

The Great Bear Magmatic Zone is a 1.87-1.84 Ga Proterozoic continental arc dominated by calc-alkaline volcanics (Hildebrand et al., 2010) and magmatism associated with subduction beneath the Slave. Evidence for this subduction can be seen in the Morel Sills, a syncollisional suite of gabbroic intrusives (Hildebrand et al., 1987) that reflect extension during emplacement and are interpreted to be the result of the 'failed' subduction (Hildebrand and Bowring, 1999; Hildebrand et al., 2010).

Broadly, the Slave craton can be described by various 2.7 Ga greenstone supracrustal sequences, major orogenesis at 2.6 Ga and final cratonization occurring at 2.55 Ga (Bleeker and Hall, 2007). The craton itself is divided into two distinct geological terrains, an older terrain in the west that has surface exposure of older Mesoarchean- to Hadean-age (>2.9Ga) basement and an isotopically young Neoarchean terrain in the east. The older basement rocks are known as the Central Slave Basement Complex (Bleeker et al., 1999). This complex is made up of ancient sialic basement that has grown during multiple crustal growth events from 4.0 to 2.8 Ga (Bleeker and Hall, 2007). The Central

Slave Basement Complex also contains the Earth's oldest rocks, the 4.03 Ga Acasta Gneiss (Bowring et al., 1989; Bowring and Williams, 1999).

The Central Slave Basement Complex is unconformably overlain by supracrustal rocks of the Yellowknife Supergroup, which in turn consists of the Central Slave Cover Group the Kam Group, the Banting Group and the Duncan Lake Group (Bleeker et al., 1999). The Central Slave Cover Group consists of 2.9-2.8 Ga fuchsitic quartzite, banded iron formation and mafic and felsic volcanic rocks; the 2.73-2.70 Ga Kam Group mainly consists of tholeiitic mafic volcanic rocks; the 2.69-2.66 Ga Banting Group comprises calc-alkaline mafic, intermediate and felsic volcanic rocks and volcaniclastic sediments; the Duncan Lake Group includes 2.68-2.66 Ga turbiditic greywackes of the Burwash Basin and the northern Contwoyto terrain (Bleeker et al., 1999; Bleeker and Hall, 2007). The supracrustal rocks were followed by 2.64-2.58 Ga intrusion of various granitoid suites with a peak "granite bloom" between 2.595 – 2.585 Ga (Davis et al., 1994). The granite bloom was followed by slow cooling of the lower crust and final cratonization. During this final cratonization, fluids and melts were transported upward and the lower crust was mechanically coupled to the craton (Bleeker and Hall, 2007).

At ~1270 Ma the entire craton was partially uplifted and intruded by mafic magmas during the Mackenzie large igneous event (LeCheminant and Heaman, 1989). This massive, short-lived event, which is thought to be the product of a mantle plume centered on Victoria Island, generated the Mackenzie dike swarm, the Muskox layered intrusion and the Coppermine River flood basalts (LeCheminant and Heaman, 1989). Various other large igneous events, including the Coronation sill related to ~720 Ma Franklin event have been documented in the craton (Shellnut et al., 2004). Davis (1997) documented some occurrences of zircon and rutile growth in lower crustal xenoliths synchronous with the Mackenzie event.

From the Cambrian to the Eocene, the Slave craton was then host to sporadic kimberlitic magmatism. Broadly, the craton can be geographically divided into four kimberlitic age domains (as described by Heaman et al., 2003): Siluro-Ordovician in the southwest, Cambrian in the southeast, Cretaceous and Eocence in the central region and a mixed domain of Jurassic and Permian in the north. Our window to the lower crust comes from xenoliths entrained within and brought to the surface by these kimberlite magmas.

1.2.1. Samples Suites: Artemisia, Munn Lake, Ekati

The lower crustal xenoliths for this study represent a northwest to southeast transect across the Slave craton, with samples obtained from the Artemisia, Ekati and Munn Lake kimberlites (Figure 2). The northern Artemisia kimberlite emplacement age has not been determined, but the nearby Anuru kimberlite has been dated to ~613 ± 6 Ma (Masun et al., 2004), and this age likely applies to Artemisia as well. The Ekati kimberlite samples are from the Eocene age central Lac de Gras field, which has an emplacement of ~47.5-53.9

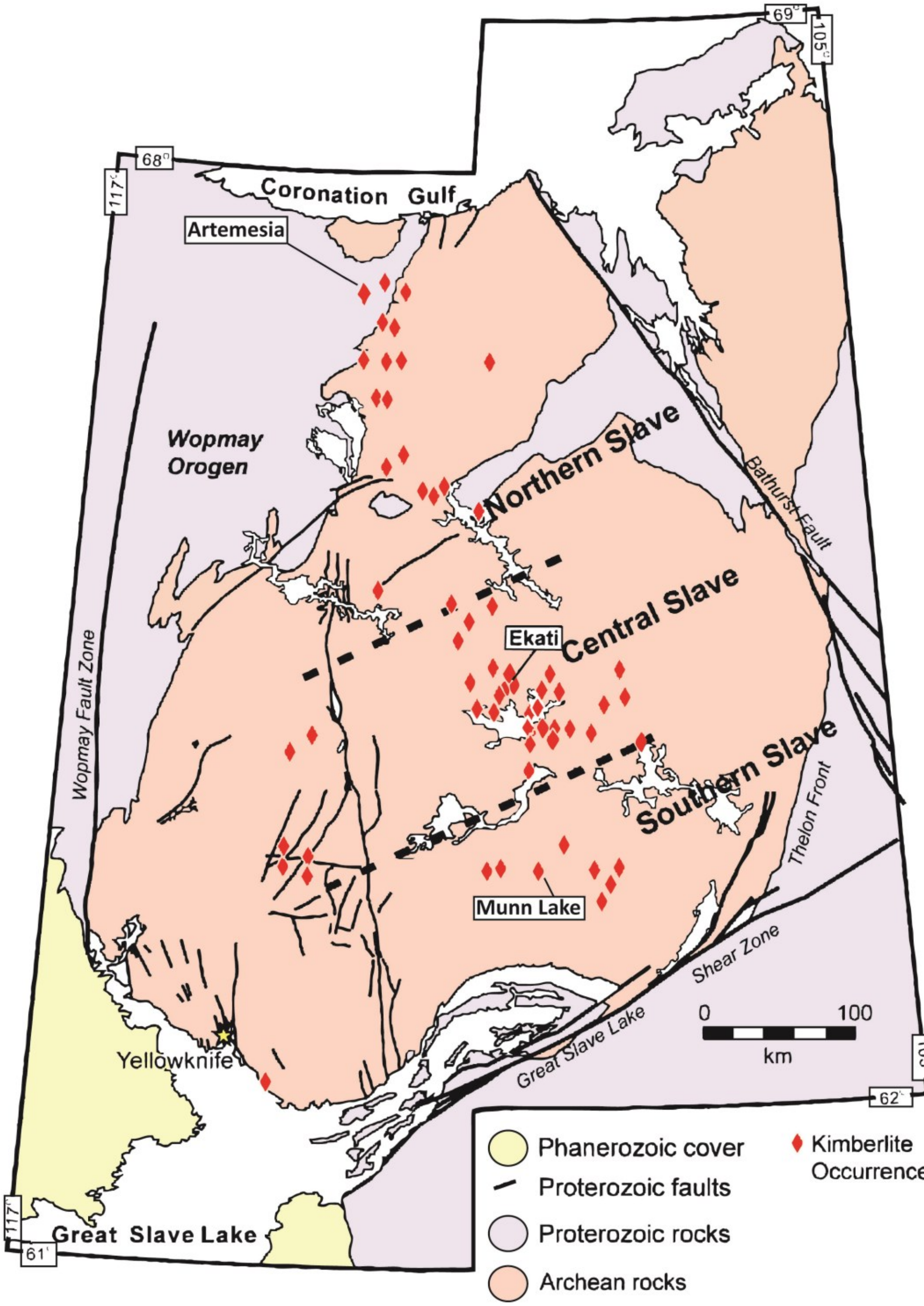

Figure 2: Location of sample xenolith suites in a northwest-southeast transect across the Slave Craton. Artemisia, Ekati and Munn Lake, respectively. Modified from Bleeker and Hall (2007).

Ma (Heaman et al., 2003). The Munn Lake kimberlite has not been dated but is from the southeastern Slave domain that is characterized by Cambrian kimberlite magmatism (Heaman et al., 2003).

In July of 2009, a joint field operation between the University of Alberta, the Geological Survey of Canada and Stornoway Diamonds Corporation was conducted in the Coronation Diamond District (as defined by Grütter et al., 1999) located in the northern portion of the Slave Province, Canada. The fieldwork was overseen by Drs. J. Armstrong (Stornoway) and B. Kjarsgaard (GSC). From this fieldwork, crustal xenoliths were hand collected at surface from the Artemisia kimberlite pipe, a vent like body ~ 3 ha in size (Ward and Clements, 2002), which intrudes into rocks of the Coronation Supergroup (Figure 3). Samples from the Munn and Ekati kimberlites were obtained from drill core and were donated for this study by Southern Era Resources (Munn Lake), Dr. D.G. Pearson of the University of Alberta (Ekati) and Dr. B. Kjarsgaard of the Geological Survey of Canada (Ekati).

1.3. Petrography

Crustal xenoliths from the Artemisia kimberlite have a range of bulk compositions. On the basis of petrographic observations, these can be divided into two distinct suites. Xenoliths from the first suite range in size from ~5 to 30 cm and have a mafic composition with a primary mineral assemblage of orthopyroxene-clinopyroxene-plagioclase. Texturally and mineralogically, this

Figure 3: Artemisia kimberlite (~ 60 meters across) intruding into carbonate rocks of the Rocknest Fm of the passive margin Epworth Group (Coronation Supergroup). Boundary of Artemisia intrusion defined by dashed lines.

suite is virtually identical to gabbroic Coronation sills related to the 720 Ma Franklin event (Figure 4). The majority of the samples collected at Artemisia were from this suite and likely represent Franklin age sills, but could also be derived from plutonic bodies related to some other mafic igneous event. Regardless of the specific igneous event, it was determined that this suite did not represent a sampling of the lower crust and therefore no further analysis was done on these samples for this study.

Most samples from the second suite of Artemisia xenoliths contain garnet, quartz and plagioclase ± K-feldspar and are heavily altered. These alteration zones around the garnet and plagioclase are likely composed of retrograde hydrous minerals that are possibly replacing primary pyroxene (Figure 5). Exploratory qualitative energy dispersive spectroscopy (EDS) on the alteration zones found them to have high concentrations of Mg, Fe and Si, consistent with this interpretation. The EDS technique is described in detail in section 1.4.2. The garnets from this suite are typically found as smaller grains clustering together separated from clusters of plagioclase by fine-grained alteration zones. Granoblastic texture is developed in some of the plagioclase-rich zones. Multiple accessory grains of large rutile are present in some of the samples, as well as minor zircon and monazite. Retrograde reaction around garnet grains is common. Minerals range in size from 0.25-3 mm across and are sub-anhedral. One sample from this second suite of xenoliths (Art-3) is somewhat less altered and is mineralogically distinct from the others (Figure 4e-f). In addition to garnet and plagioclase, this xenolith contains cordierite, biotite

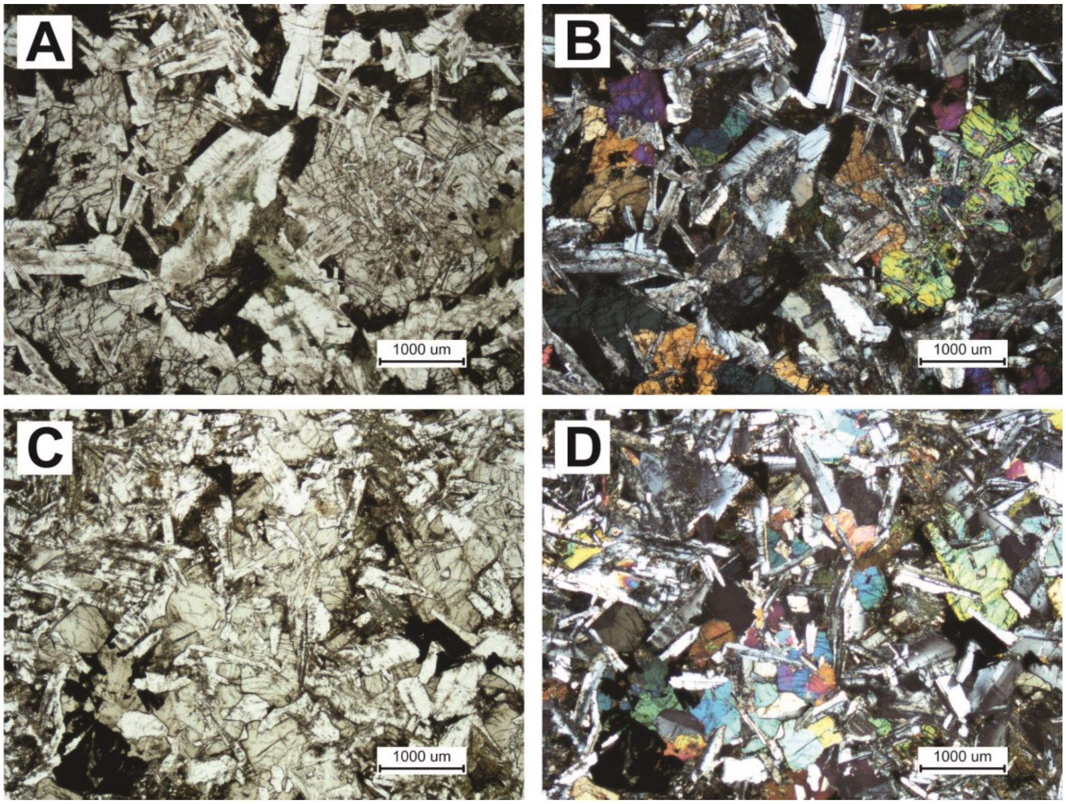

Figure 4: Petrology of Artemisia suite 1 xenoliths (Art-C) compared to Coronation sills (CM) samples. Note the similarity in mineralogy (Opx + Cpx + Pl) and textures. CM samples were collected ~ 300km northwest from the Artemisia kimberlite in Kugluktuk, NT. (A) Art-C-8 PPL (B) Art-C-8 XP (C) CM-1 PPL (D) CM-1 XP

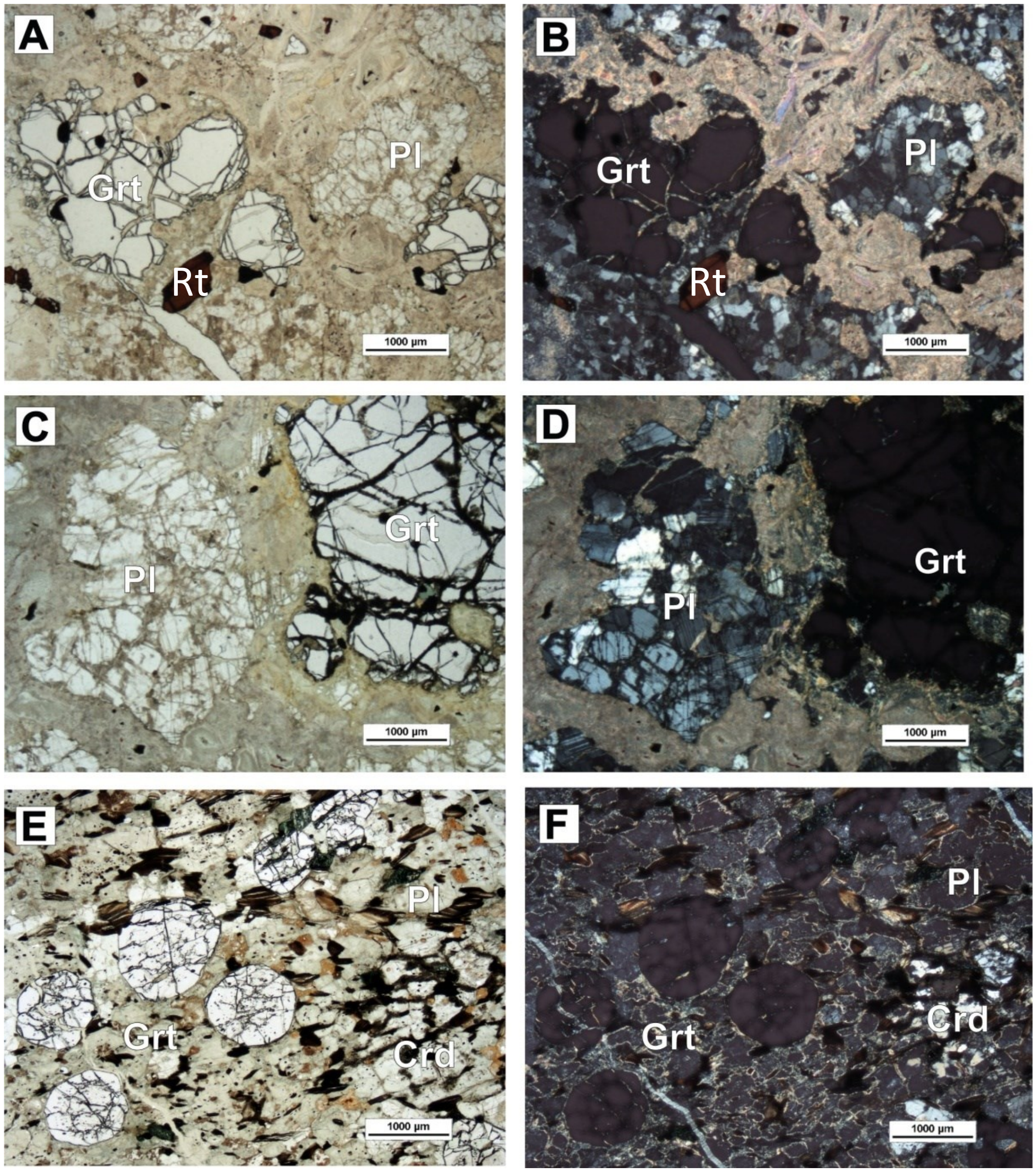

Figure 5: Petrology of Artemisia xenoliths (a) Art-4 PPL (b) Art-4 XP (c) Art-22 PPL (d) Art-22 XP (e) Art-3 PPL (f) Art-3 XP. In (a-d), note the varying degree of secondary alteration psuedomorphing what was likely orthopyroxene. See text for discussion.

and minor sillimanite. The garnets in this sample are euhedral and have no discernible reaction rims.

The garnet-bearing nature of the second suite of Artemisia samples suggests that these xenoliths were derived from the middle or lower crust, and as such, they were selected for further analysis. Geothermobarometric techniques were used to constrain the pressure- temperature (P-T) conditions of metamorphism and U-Pb geochronologic techniques were applied to zircon- and monazite-bearing samples to attempt to constrain the timing of metamorphism and/or protolith formation (described in section 1.4 and 1.5).

In contrast to the Artemisia xenoliths, which are felsic or intermediate in composition, the Ekati and Munn Lake xenolith suites are equigranular, garnet-bearing mafic granulites with sharp grain boundaries and significantly less retrograde alteration. Minor alteration along some grain boundaries is likely due to interaction with kimberlitic melt during emplacement. Granoblastic texture is developed in xenoliths from both suites. The Munn Lake xenoliths dominantly comprise garnet-plagioclase-clinopyroxene ± orthopyroxene ± rutile ± ilmenite (Figure 6). The Ekati xenoliths have a similar mineral assemblage with some samples also containing hornblende and one sample that is quartz bearing (Figure 7). The mineralogy of both suites is similar to other lower crustal xenoliths described elsewhere in the Slave craton (Davis et al., 2003a; Krauss et al, 2007). As with the Artemisia samples, geothermobaromic techniques were used to constrain P-T conditions (Section 1.4). However, as no accessory

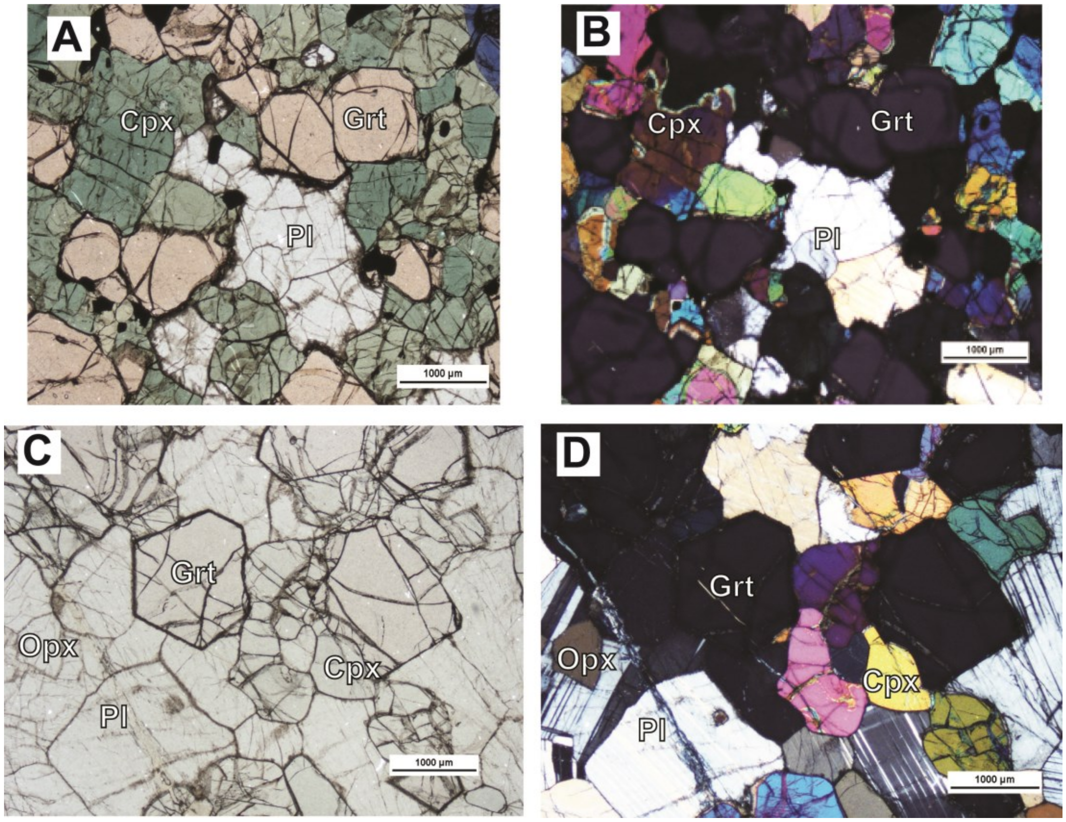

Figure 6: Petrology of Munn Lake (a) MUNN 51311 PPL (b) MUNN 51311 XP (c) MUNN 51313 PPL (d) MUNN 51313 XP. See text for discussion.

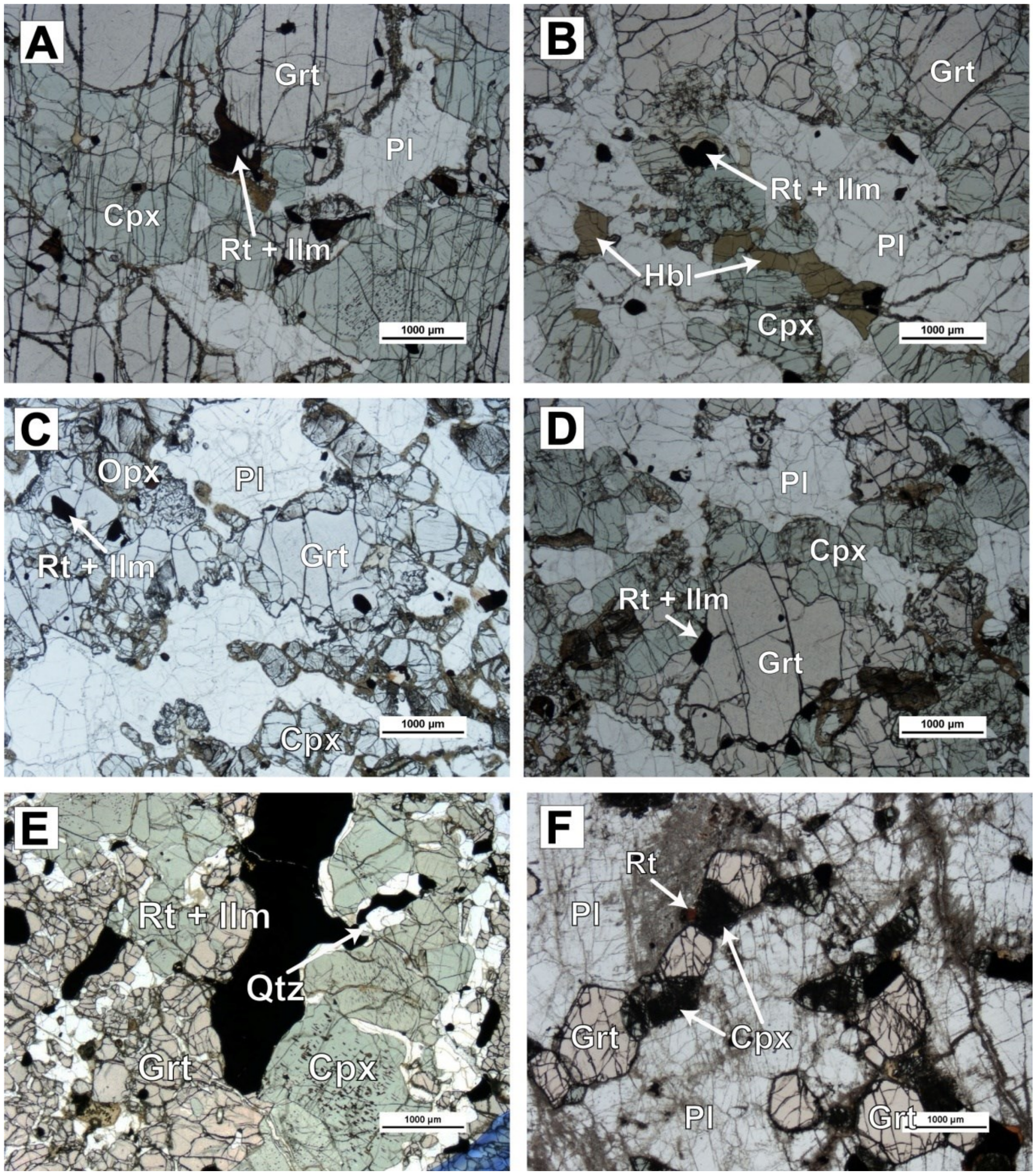

Figure 7: Representative petrology of lower crustal samples collected from the Ekati kimberlites (a) EKT-9B (b) EKT-9D (c) EKT-11A (d) EKT- 11B (e) EKT-12 (f) BD-184. See text for discussion.

minerals suitable for U-Pb dating were identified in thin sections of the Ekati or Munn xenoliths, geochronological data was not obtained for these suites. Full hand sample and thin section description of samples is provided in Appendix A.

1.4. Geothermobarometry

1.4.1. Methodology

To understand the deep crust of the Slave Craton, it is important to quantify the P-T conditions of metamorphism and in particular the paleodepths from which the crustal xenoliths were derived. In this study, granulite-grade conditions in the Ekati and Munn samples can be inferred by the presence of the Grt – Cpx – Pl ± Opx assemblages. In the Artemisia suite, although some xenoliths have been subjected to significant alteration, granulite-facies conditions can still be inferred for most of these xenoliths based on the presence of garnet, plagioclase, large rutile grains and the abundant retrograde hydrous minerals that likely replace primary pyroxene. The metamorphic grade of the one unique xenolith from Artemisia ((Grt-Crd-Bt-Sill-Pl-Qtz) assemblage) is less immediately apparent but could be as low as mid-amphibolite grade.

It should be noted that amphibolite- to granulite-grade conditions represents a wide range of pressures and temperatures. By using geothermobaromic techniques, a more precise quantitative estimate of the P-T conditions experienced by the middle and lower crust can be revealed.

Based on the mineralogy of samples, Fe-Mg exchange reactions were used to determine temperatures and net-transfer reactions were used to determine pressures. However, it must be noted that temperatures and pressures that are derived by geothermobaromic analysis are not always representative of peak P-T conditions. In particular, Fe-Mg exchange reactions are sensitive to resetting because the closure temperatures of Fe-Mg diffusion between garnet and pyroxene or garnet and biotite may be below the peak temperatures of granulite-facies metamorphism (e.g., Frost and Chacko, 1989; Pattison et al., 2003). Therefore, the calculated Fe-Mg exchange temperatures must be regarded as minimum estimates of peak temperature. Similarly, many lower crustal samples analyzed in this study are quartz absent, but we may still use a quartz-present barometer to derive a pressure estimate. For reactions where quartz is on the high-pressure side of the reaction boundary, the estimate will be a maximum (Mukhopadhyay et al., 1992) and conversely for samples where quartz is on the low-pressure side of the reactions, the pressure estimate will be a minimum.

Temperature conditions were calculated using the Grt-Opx [1], Grt-Cpx [2], Grt-Crd [3] or Grt-Bt [4] Fe-Mg exchange geothermometers and for one sample, the titanium-in-biotite geothermometer. Pressure conditions were calculated using the Grt-Pl-Opx-Qtz [5], Grt-Pl-Cpx-Qtz [6], Grt-Sill-Qtz-Pl (GASP) [7], Grt-Rt-Il-Pl-Qtz (GRIPS) [8], Crd-Grt-Sill-Qtz [9] or Grt-Cpx-Pl-Rt-Ilm [10] geobarometers.

[1] Grt-Opx

$$2Mg_3Al_2Si_3O_{12} + 3Fe_2Si_2O_6 = 2Fe_3Al_2Si_3O_{12} + 3Mg_2Si_2O_6$$

Pyrope Ferrosillite Almandine Enstatite

[2] Grt-Cpx

$$Mg_3Al_2Si_3O_{12} + 3FeCaSi_2O_6 = Fe_3Al_2Si_3O_{12} + 3MgCaSi_2O_6$$

Pyrope Hedenbergite Almandine Diopside

[3] Grt-Crd

$$2Fe_3Al_2Si_3O_{12} + 3Mg_2Al_4Si_5O_{18} = 2Mg_3Al_2Si_3O_{12} + 3Fe_2Al_4Si_5O_{18}$$

Almandine Cordierite Pyrope Fe-Cordierite

[4] Grt-Bt

$$Fe_3Al_2Si_3O_{12} + KMg_3AlSi_3O_{10}(OH)_2 = Mg_3Al_2Si_3O_{12} + KFe_3AlSi_3O_{10}(OH)_2$$

Almandine Phlogopite Pyrope Annite

[5] Grt-Pl-Opx-Qtz

$$Ca_3Al_2Si_3O_{12} + 2\ Mg_3Al_2Si_3O_{12} + 3SiO_2 = 3CaAl_2Si_2O_8 + 3Mg_2Si_2O_6$$

Grossular Pyrope Quartz Anorthite Enstatite

[6] Grt-Pl-Cpx-Qtz

$$2\ Ca_3Al_2Si_3O_{12} + Mg_3Al_2Si_3O_{12} + 3SiO_2 = 3MgCaSi_2O_6 + 3CaAl_2Si_2O_8$$

Grossular Pyrope Quartz Diopside Anorthite

[7] GASP

$$3CaAl_2Si_2O_8 = Ca_3Al_2Si_3O_{12} + 2Al_2SiO_5 + SiO_2$$

Anorthite Grossular Sillimanite Quartz

[8] GRIPS

$$Ca_3Al_2Si_3O_{12} + 2Fe_3Al_2Si_3O_{12} + 6TiO_2 = 6FeTiO_3 + 3CaAl_2Si_2O_8 + 3SiO_2$$

Grossular Almandine Rutile Ilmentite Anorthite Quartz

[9] Mg-Crd-Grt-Sil-Qtz

$$3Mg_2Al_4Si_5O_{18} = 2\ Mg_3Al_2Si_3O_{12} + 4Al_2SiO_5 + 5SiO_2$$

Mg-Crd Pyrope Sillimanite Quartz

[10] Grt-Cpx-Pl-Rt-Ilm

$$Ca_3Al_2Si_3O_{12}+2FeCaSi_2O_6+Mg_3Al_2Si_3O_{12}+2TiO_2=2FeTiO_3+3MgCaSi_2O_6+2CaAl_2Si_2O_8$$

Grossular Hedenbergite Pyrope Rutile Ilmenite Diopside Anorthite

For one Artemisia sample (Art-13a) where there was likely extensive down-temperature re-equilibration of the garnet-biotite Fe-Mg exchange geothermometer, a more accurate temperature estimate was obtained using the Ti-in-biotite geothermometer of Henry et al. (2005). This geothermometer is based on the empirical observation that the Ti content of biotite increases with increasing metamorphic grade and was calibrated on metapelites from New England that contained a Ti-saturating phase (ilmenite an/or rutile) equilibrated at 4-6 kbar pressure. Henry et al. (2005) derived the following expression relating temperature and the Ti content of biotite.

[11] $T = ([\ln(Ti) - a - c(X_{Mg})^3]/b)^{0.333}$

Where a,b and c are parameters with the values of -2.3594, $4.6482x10^{-9}$ and -1.7283 respectively, Ti is the atomic proportion of titanium in a biotite analysis normalized to 22 oxygens, and X_{mg} is Mg/(Mg+Fe).

This Artemisia xenolith likely equilibrated at higher pressure conditions than those used to calibrate the Ti-in-biotite geothermometer and the effect of pressure on the geothermometer is not fully understood. However, experimental studies suggest that increasing pressure decreases the Ti content of biotite (Henry et. al, 2005). As such, application of the Henry et al., (2005) calibration of the geothermometer to the high-pressure Artemisia rocks can be taken as providing a minimum estimate of the temperature experienced by the rocks.

And although the Ti-in-biotite geothermometer is calibrated based on pelitic rocks, semi-pelitic granulites from Ponmudi and Kalanjar, India (Nair and Chacko, 2002) show similar temperature results with both independent estimates (Ponmudi: T = 780 °C, Kalanjar: T = 769 °C) given by Chacko et al. (1996) and with the Ti-in-biotite geothermometer (Ponmudi: T = 747 °C, Kalanjar: T = 778°C). It can therefore be assumed that the Ti-in-biotite geothermometer will give reasonable results for the semi-pelitic Artemisia xenolith.

1.4.2. Analytical Technique

Prior to analysis, preliminary mineral identification was made in petrographic thin sections and samples were checked for any obvious textural evidence of disequilibrium. In selected samples, three to four grains of each mineral phase were targeted for analysis per sample. Qualitative energy dispersive spectroscopy (EDS) was used to confirm identification of mineral phases in petrographic thin section. Once the identification of the target mineral was confirmed, the chemical compositions of mineral grains were determined using wavelength dispersive spectroscopy (WDS) on the JEOL 8900 Electron Probe Microanalyser (EPMA) at the University of Alberta. The EPMA was operated with an accelerating voltage of 15 kV, a probe current of 15 nA and a beam diameter of 3-4 µm. Natural minerals were used for standardization (Table 1) and are from the collections of the University of Alberta and the Smithsonian Institution (Jarosewich et al., 1980). ZAF corrections were applied to the data in converting X-ray counts to elemental concentration. Only analyses with analytical totals between 98.5 and 101.5 weight percent were deemed acceptable for use in geothermobarometric calculations for anhydrous phases. In terms of stoichiometry, analyses were only accepted if cation totals were 8.00 ± 0.05 for garnet, 4.00±0.05 for pyroxenes, and 5.00±0.05 for feldspars.

Core to rim transects where made across the grains in order to determine if there was significant intra-grain compositional zoning that may affect P-T estimates. Depending on the size of the target mineral, 5-20 analysis points were selected for each grain.

Table 1: Standards conditions for mineral phases analyzed using EMPA

Element	Garnet	Plagioclase	Pyroxene	Cordierite	Rutile/Ilmenite	Biotite/Hornblende
Ti	rutile	rutile	rutile	rutile	rutile	rutile
Na	albite	albite	albite	albite	-	albite
Ca	diopside	anorthite	diopside	diopside	diopside	diopside
Si	GoreGrtCB1	orthoclase	orthoclase	diopside	diopside	diopside
Fe	fayalite_CB1	fayalite_CB1	fayalite_CB1	fayalite_CB1	hematite	Fayalite_CB1
Cr	chromite	chromite	chromite	chromite	chromite	chromite
Mg	pyrope	pyrope/diopside	pyrope	pyrope	chromite	FrankSmith_CB1
K	orthoclase	orthoclase	orthoclase	orthoclase	-	microcline
Al	GoreGrtCB1	plagioclase	GoreGrtCB1	kyanite	pyrope	Gore_CB1
Mn	willemite	willemite	willemite	willemite	Mn2O3	willemite
V	-	-	-	-	V_metal	-
Ni	-	-	-	-	Ni_metal	-
Nb	-	-	-	-	Nb_Metal	-
F	-	-	-	-	-	apatite
Cl	-	-	-	-	-	tugtupite

Minor changes in Mn, Ca and Fe/(Fe + Mg) were detected around the rims of some analysed grains (Figure 8). Only core analyses from these zoned grains were used for further P-T estimates. Results from each transverse were then averaged to provide a representative composition for each mineral phase. Appendix B contains a summary of all analyses made for the Artemisia, Munn Lake and Ekati suites prior to averaging. The averaged mineral compositions were then used with an updated version of the Berman (1988; 1991) internally consistent thermodynamic dataset and the winTWQ 2.3 (Berman, 2007) software to calculate the position of various equilibria in P-T space.

By calculating all equilibria with an internally consistent thermodynamic dataset, a visual test can be used to see if the samples analyzed are representative of equilibrium conditions. More specifically, if the thermodynamic data are accurate and all the minerals involved in the calculated reactions are in thermodynamic equilibrium then, in principle, all equilibria should intersect at a single point or a narrow region of P-T space (Berman, 1991). If the thermobarometers used did not intersect in the same region of P-T space, samples were re-examined to see if the mineral assemblage was in fact representative of equilibrium conditions or if there may be a variation in the closure-temperatures of equilibrium used. Using this software, samples with suspect textural relationships can be examined in P-T space to verify that the mineral assemblage is representative of equilibrium.

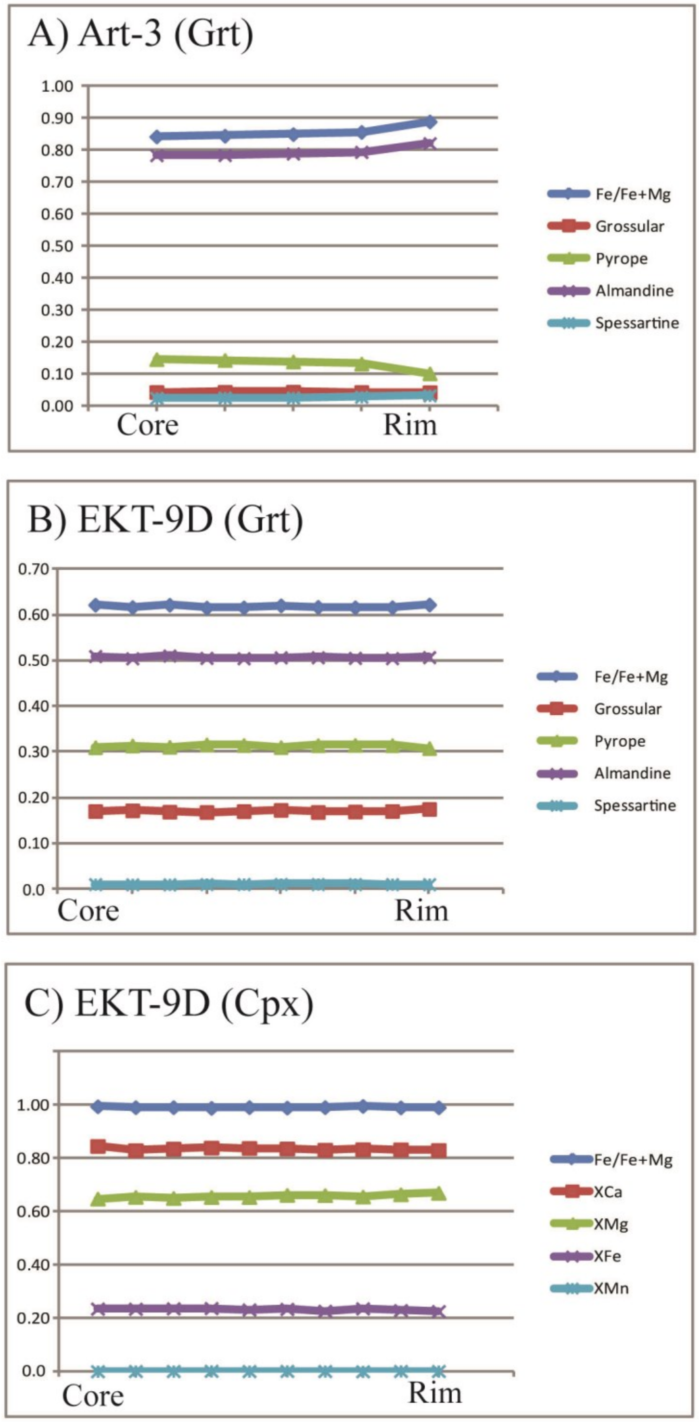

Figure 8: Mineral zoning profiles of selected core to rim transverses. Analysis that had minor changes in Mn, Ca, and Fe/(Fe + Mg) (Art-3) had the outlier points excluded from P-T determinations.

1.4.3. Results

As described in Section 1, based on geographic location, the xenoliths were divided into three suites (Artemisia, Ekati and Munn Lake). Thin section photomicrographs of Artemisia, Munn Lake and Ekati xenoliths are shown in Figures 5, 6 and 7. Average mineral composition for each element targeted are summarized in Table 2, 3 and 4.

Figure 9 shows garnet compositions of all xenolith suites plotted on a ternary Pyrope (Mg)-Grossular (Ca)-Almandine + Spessartine (Fe + Mn) diagram. Note the generally tight clustering of garnet compositions for each suite and the relatively higher grossular content of garnet in the Ekati and Munn Lake xenoliths compared to Artemisia xenoliths. Their distinctly lower grossular contents indicate that the garnet in both suites Artemisia xenoliths did not coexist with the high-calcium mineral, Cpx, which in turn suggests that the protolith of the Artemisia samples was likely granitic or semi-pelitic rather than mafic as in the Ekati and Munn Lake xenoliths. The garnet in the cordierite-bearing Artemisia xenolith, Art-3, is also characterized by low grossular content but has a distinctly higher Fe/(Fe+Mg) than the other Artemisia samples. Garnet in the one orthopyroxene-bearing Munn Lake xenolith has a significantly lower Fe/(Fe+Mg) than other xenoliths in this suite.

All of the xenoliths from the Ekati and Munn Lake suites and samples Art-3 and Art-13 from the Artemisia suite have mineral assemblages suitable for

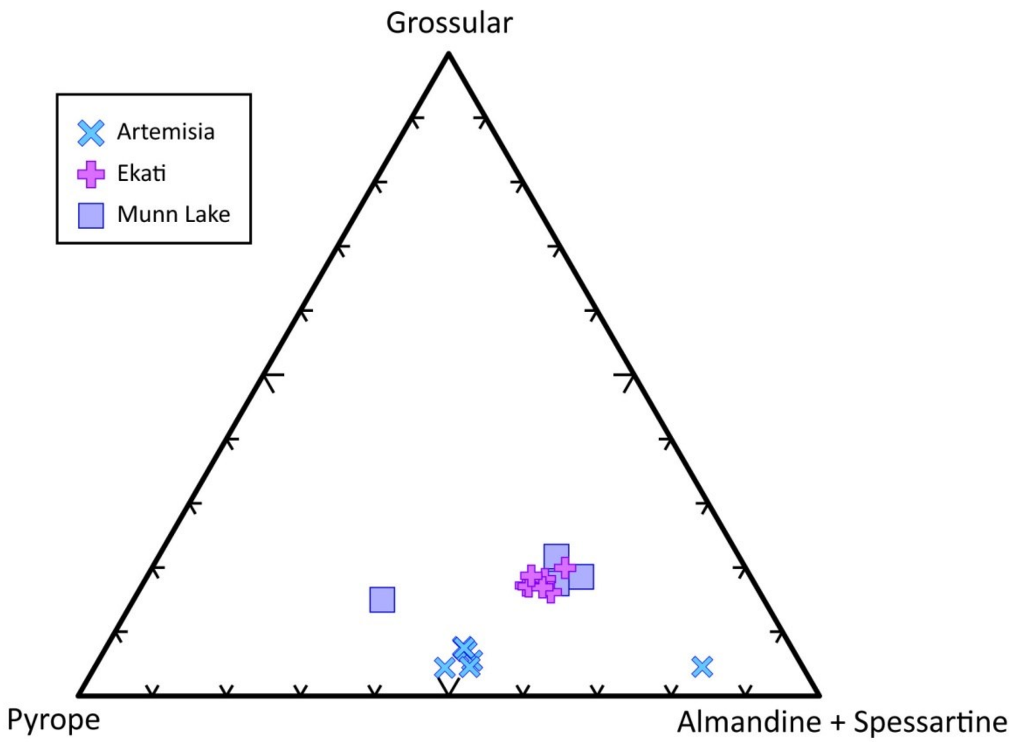

Figure 9: Garnet ternary of Pyrope (Mg), Grossular (Ca) and Almandine + Spessartine (Fe + Mn) endmembers. Note the relatively poor Grossular component of the Artemisia suite compared to the more mafic Ekati and Munn Lake suites.

Table 2: Average composition of Artemisia samples. Averages are based on analysis of 3-4 grains per sample.

Garnet

	Art-3	Art-4	Art-8	Art-9	Art-10	Art-11	Art-12	Art-13a
	n=15	n=15	n=15	n=38	n=40	n=44	n=14	n=53
SiO_2	37.69	39.97	39.70	39.71	39.73	39.77	40.41	40.01
TiO_2	0.02	0.04	0.03	0.02	0.03	0.03	0.02	0.03
Al_2O_3	21.64	22.83	22.94	23.05	22.80	22.78	23.14	22.66
Cr_2O_3	0.04	0.11	0.10	0.07	0.09	0.10	0.07	0.10
FeO	35.25	22.75	23.72	23.50	22.86	22.51	22.51	22.59
MnO	1.26	0.31	0.30	0.30	0.32	0.32	0.27	0.32
MgO	3.39	11.83	11.78	11.86	11.72	11.78	13.06	11.80
CaO	1.57	2.78	2.04	1.65	2.58	2.82	1.65	2.76
Na_2O	0.11	0.06	0.06	0.02	0.02	0.03	0.04	0.04
K_2O	0.05	0.03	0.01	0.00	0.00	0.01	0.01	0.01
Total	101.03	100.72	100.68	100.19	100.16	100.13	101.18	100.31
Si	2.992	2.989	2.977	2.985	2.988	2.989	2.990	3.001
Ti	0.001	0.002	0.002	0.001	0.002	0.002	0.001	0.002
Al	2.025	2.012	2.028	2.042	2.021	2.018	2.018	2.003
Cr	0.003	0.007	0.006	0.004	0.006	0.006	0.004	0.006
Fe	2.341	1.423	1.487	1.477	1.438	1.415	1.393	1.417
Mn	0.085	0.020	0.019	0.019	0.020	0.020	0.017	0.020
Mg	0.401	1.319	1.316	1.329	1.313	1.320	1.441	1.319
Ca	0.134	0.223	0.164	0.133	0.208	0.227	0.131	0.222
Na	0.017	0.009	0.009	0.003	0.004	0.004	0.006	0.006
K	0.005	0.003	0.001	0.000	0.000	0.001	0.001	0.001
Total	8.003	8.006	8.009	7.993	7.999	8.000	8.001	7.996
Grossular	0.045	0.075	0.055	0.045	0.070	0.076	0.044	0.074
Pyrope	0.135	0.442	0.441	0.449	0.441	0.443	0.483	0.443
Almandine	0.791	0.477	0.498	0.499	0.483	0.474	0.467	0.476
Spessartine	0.029	0.007	0.006	0.006	0.007	0.007	0.006	0.007
Fe/Fe+Mg	0.854	0.519	0.531	0.526	0.523	0.517	0.492	0.518

Table 2: Average chemical compositions of Artemisia samples continued…

Plagioclase

	Art-3	Art-4	Art-11	Art-13a
	n=19	n=15	n=20	n=19
SiO_2	58.25	61.85	61.04	61.62
TiO_2	0.01	0.01	0.01	0.01
Al_2O_3	26.67	24.68	24.58	24.77
Cr_2O_3	0.01	0.00	0.01	0.01
FeO	0.13	0.04	0.02	0.01
MnO	0.01	0.02	0.01	0.01
MgO	0.20	0.05	0.01	0.01
CaO	8.17	5.65	5.50	5.62
Na_2O	6.80	8.09	8.08	8.08
K_2O	0.21	0.54	0.31	0.34
Total	100.46	100.93	99.58	100.50
Si	2.595	2.723	2.720	2.721
Ti	0.000	0.001	0.000	0.000
Al	1.400	1.281	1.291	1.289
Cr	0.000	0.000	0.000	0.000
Fe	0.005	0.002	0.001	0.001
Mn	0.001	0.001	0.000	0.000
Mg	0.014	0.003	0.001	0.001
Ca	0.390	0.267	0.263	0.266
Na	0.587	0.690	0.699	0.692
K	0.012	0.030	0.018	0.019
Total	5.004	4.997	4.992	4.990
An	0.394	0.271	0.268	0.272
Ab	0.594	0.699	0.713	0.708
Or	0.012	0.030	0.018	0.019

Cordierite

	Art-3
	n=10
SiO_2	48.95
TiO_2	0.00
Al_2O_3	33.26
Cr_2O_3	0.01
FeO	8.60
MnO	0.08
MgO	7.44
CaO	0.03
Na_2O	0.35
K_2O	0.12
Total	98.85
Si	5.020
Ti	0.000
Al	4.021
Cr	0.001
Fe	0.738
Mn	0.008
Mg	1.137
Ca	0.003
Na	0.070
K	0.016
Total	11.012
Fe(X)	0.394

Table 2: Average chemical compositions of Artemisia samples continued…

Rutile

	Art-4	Art-11	Art-13a
	n=14	n=15	n=15
SiO2	0.04	0.04	0.06
TiO2	98.26	99.13	99.37
Al2O3	0.11	0.07	0.05
Cr2O3	0.21	0.22	0.24
Nb2O5	0.11	0.15	0.13
V2O3	0.66	0.55	0.56
FeO	0.45	0.12	0.12
MnO	0.02	0.01	0.02
MgO	0.02	0.02	0.02
CaO	0.01	0.01	0.01
Total	99.88	100.32	100.58
Si	0.001	0.001	0.001
Ti	0.988	0.990	0.990
Al	0.002	0.001	0.001
Cr	0.002	0.002	0.003
Nb	0.001	0.001	0.001
V	0.007	0.006	0.006
Fe	0.005	0.001	0.001
Mn	0.000	0.000	0.000
Mg	0.000	0.000	0.000
Ca	0.000	0.000	0.000
Total	1.005	1.003	1.003

Biotite

	Art-3	Art 13a
	n=6	n=20
SiO2	35.11	39.19
TiO2	2.04	4.21
Al2O3	19.25	13.58
Cr2O3	0.37	ND
FeO	19.02	5.01
MnO	0.04	0.13
MgO	9.64	20.81
CaO	0.02	0.00
BaO	ND	0.52
Na2O	0.40	0.10
K2O	8.95	10.13
F	0.17	ND
Cl	0.05	0.10
Total	94.99	93.79
Si	2.678	2.858
Ti	0.117	0.231
Al	1.731	1.167
Cr	0.023	0.000
Fe	1.214	0.306
Mn	0.003	0.001
Mg	1.096	2.262
Ca	0.002	0.000
Ba	ND	0.015
Na	0.059	0.015
K	0.871	0.942
F	0.040	0.000
Cl	0.006	0.013
Total	7.839	7.797

Table 3: Average compositions of Ekati samples. Averages are based on analysis of 3-4 grains per sample.

Garnet

	EKT-9B	EKT-9D	EKT-11A	EKT-11B	EKT-12	BD-184	Point-Lk-1
	n=25	n=28	n=32	n=31	n=12	n=16	n=18
SiO2	38.22	38.02	37.88	37.71	37.92	38.67	38.03
TiO2	0.04	0.09	0.11	0.05	0.07	0.12	0.09
Al2O3	21.71	21.75	22.00	21.77	20.94	21.87	21.50
Cr2O3	0.03	0.10	0.15	0.05	0.01	0.01	0.06
FeO	24.67	24.08	23.95	24.84	26.07	24.31	26.08
MnO	0.45	0.49	0.57	0.70	0.53	0.45	0.49
MgO	7.39	8.25	8.08	7.65	6.52	8.02	7.67
CaO	6.55	6.37	6.24	6.21	7.42	6.99	6.00
Na2O	0.08	0.03	0.03	0.02	0.02	0.03	0.03
K2O	0.04	0.00	0.00	0.00	0.00	0.01	0.00
Total	99.19	99.19	99.03	99.00	99.51	100.48	99.96
Si	2.977	2.953	2.946	2.948	2.976	2.967	2.956
Ti	0.002	0.005	0.006	0.003	0.004	0.007	0.005
Al	1.993	1.992	2.017	2.006	1.937	1.978	1.969
Cr	0.002	0.006	0.009	0.003	0.001	0.001	0.003
Fe	1.607	1.565	1.558	1.624	1.710	1.560	1.695
Mn	0.030	0.032	0.038	0.047	0.035	0.029	0.032
Mg	0.858	0.955	0.937	0.892	0.762	0.918	0.889
Ca	0.547	0.530	0.520	0.520	0.624	0.575	0.499
Na	0.012	0.005	0.004	0.004	0.003	0.004	0.005
K	0.004	0.000	0.000	0.000	0.000	0.001	0.000
Total	8.031	8.045	8.036	8.047	8.047	8.039	8.055
Grossular	0.180	0.172	0.170	0.169	0.199	0.187	0.160
Pyrope	0.282	0.310	0.307	0.289	0.243	0.298	0.285
Almandine	0.529	0.508	0.510	0.527	0.546	0.506	0.544
Spessartine	0.010	0.011	0.012	0.015	0.011	0.010	0.010
Fe/Fe+Mg	0.652	0.621	0.625	0.646	0.692	0.630	0.656

Table 3: Average compositions of Ekati samples continued…
Plagioclase

	EKT-9B	EKT-9D	EKT-11A	EKT-11B	EKT-12	BD-184	Point-Lk-1
	n=14	n=22	n=23	n=29	n=15	n=15	n=19
SiO_2	58.86	57.41	55.64	58.95	59.43	58.28	64.10
TiO_2	0.01	0.01	0.02	0.03	0.01	0.01	0.02
Al_2O_3	25.94	26.74	27.96	25.85	25.69	27.00	22.92
Cr_2O_3	0.01	0.01	0.01	0.01	0.00	0.01	0.01
FeO	0.04	0.02	0.01	0.03	0.03	0.03	0.04
MnO	0.01	0.01	0.01	0.01	0.01	0.01	0.01
MgO	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CaO	7.28	8.20	9.67	7.12	7.01	8.48	3.73
Na_2O	6.75	6.33	5.56	7.06	7.31	6.46	8.73
K_2O	0.45	0.39	0.35	0.27	0.31	0.33	0.86
Total	99.36	99.14	99.24	99.33	99.79	100.63	100.43
Si	2.637	2.586	2.515	2.642	2.651	2.588	2.812
Ti	0.000	0.000	0.001	0.001	0.000	0.000	0.001
Al	1.370	1.420	1.490	1.365	1.351	1.413	1.185
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fe	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Mn	0.001	0.000	0.000	0.000	0.000	0.001	0.000
Mg	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Ca	0.350	0.396	0.469	0.342	0.335	0.404	0.176
Na	0.587	0.553	0.488	0.613	0.632	0.556	0.742
K	0.026	0.023	0.020	0.015	0.018	0.019	0.048
Total	4.971	4.980	4.983	4.981	4.989	4.983	4.966
An	0.364	0.407	0.480	0.352	0.340	0.413	0.182
Ab	0.610	0.569	0.500	0.632	0.642	0.568	0.768
Or	0.027	0.023	0.021	0.016	0.018	0.019	0.050

Table 3: Average compositions of Ekati samples continued…

Clinopyroxene

	EKT-9B	EKT-9D	EKT-11A	EKT-11B	EKT-12	BD-184	Point-Lk-1
	n=14	n=22	n=11	n=19	n=6	n=18	n=17
SiO_2	51.40	51.32	52.05	51.85	50.17	49.02	51.12
TiO_2	0.43	0.43	0.46	0.33	0.34	0.67	0.43
Al_2O_3	4.29	4.70	3.45	3.74	3.67	4.78	4.72
Cr_2O_3	0.02	0.06	0.07	0.03	0.03	0.02	0.04
FeO	7.89	7.52	7.19	7.96	9.25	9.50	8.99
MnO	0.05	0.06	0.09	0.09	0.07	0.08	0.07
MgO	12.16	12.31	13.43	12.52	12.00	12.34	11.63
CaO	21.12	21.34	21.33	21.27	21.16	21.39	19.12
Na_2O	1.42	1.39	1.07	1.38	1.49	0.90	2.38
K_2O	0.04	0.00	0.00	0.01	0.00	0.01	0.00
Total	98.82	99.13	99.14	99.20	98.17	98.71	98.49
Si	1.896	1.882	1.914	1.911	1.887	1.829	1.893
Ti	0.012	0.012	0.013	0.009	0.010	0.019	0.012
Al	0.254	0.276	0.203	0.221	0.221	0.286	0.280
Cr	0.001	0.002	0.002	0.001	0.001	0.001	0.001
Fe	0.243	0.231	0.221	0.245	0.291	0.297	0.278
Mn	0.001	0.002	0.003	0.003	0.002	0.003	0.002
Mg	0.669	0.673	0.736	0.688	0.673	0.687	0.642
Ca	0.835	0.839	0.840	0.840	0.853	0.855	0.759
Na	0.102	0.099	0.076	0.099	0.108	0.065	0.171
K	0.002	0.000	0.000	0.001	0.000	0.000	0.000
AlM1	0.178	0.188	0.140	0.160	0.165	0.176	0.225
XMg	0.733	0.745	0.769	0.737	0.698	0.698	0.698
XFe	0.267	0.255	0.231	0.263	0.302	0.302	0.302
MgM1	0.594	0.595	0.650	0.612	0.576	0.562	0.531
FeM1	0.216	0.204	0.195	0.218	0.249	0.243	0.230
AlM1	0.178	0.188	0.140	0.160	0.165	0.176	0.225
TiM1	0.012	0.012	0.013	0.009	0.010	0.019	0.012
CaM2	0.835	0.839	0.840	0.840	0.853	0.855	0.759
MgM2	0.046	0.046	0.064	0.045	0.026	0.054	0.048
FeM2	0.017	0.016	0.019	0.016	0.011	0.023	0.021
NaM2	0.102	0.099	0.076	0.099	0.108	0.065	0.171

Orthopyroxene

	EKT-11A
	n=39
SiO_2	52.63
TiO_2	0.18
Al_2O_3	1.43
Cr_2O_3	0.04
FeO	21.16
MnO	0.17
MgO	23.03
CaO	0.76
Na_2O	0.04
K_2O	0.00
Total	99.44
Si	1.949
Ti	0.005
Al	0.085
Cr	0.001
Fe	0.655
Mn	0.005
Mg	1.271
Ca	0.030
Na	0.003
K	0.000
XMg	0.636
XFe	0.328
XAl	0.021

Table 3: Average compositions of Ekati samples continued…

Ilmenite

	EKT-9D	EKT-11B	EKT-9B	Point-Lk-1
	n=35	n=39	n=33	n=11
SiO_2	0.05	0.06	0.10	0.03
TiO_2	47.06	49.24	49.46	46.14
Al_2O_3	0.09	0.10	0.23	0.11
Nb_2O_5	0.01	0.01	0.00	0.01
Cr_2O_3	0.18	0.07	0.06	0.18
V_2O_3	0.27	0.39	0.59	0.64
FeO	50.09	48.06	47.40	50.68
MnO	0.11	0.18	0.18	0.10
MgO	1.64	1.99	1.96	1.76
Total	99.50	100.12	100.03	99.77
Si	0.001	0.002	0.003	0.001
Ti	0.881	0.916	0.921	0.861
Al	0.003	0.003	0.007	0.003
Nb	0.000	0.000	0.000	0.000
Cr	0.004	0.001	0.001	0.004
V	0.005	0.008	0.012	0.013
Fe3+	0.224	0.154	0.134	0.257
Fe2+	0.819	0.840	0.847	0.795
Mn	0.002	0.004	0.004	0.002
Mg	0.061	0.073	0.072	0.651
Total	2.000	2.000	2.000	2.000

Rutile

	EKT-9D	EKT-11B	EKT-9B	Point-Lk-1
	n=30	n=40	n=35	n=9
SiO_2	0.04	0.08	0.05	0.04
TiO_2	98.54	98.86	98.81	98.67
Al_2O_3	0.15	0.17	0.19	0.25
Nb_2O_5	0.06	0.18	0.05	0.10
Cr_2O_3	0.13	0.06	0.05	0.05
V_2O_3	0.25	0.36	0.47	0.42
FeO	0.89	0.30	0.23	0.78
MnO	0.01	0.01	0.01	0.01
MgO	0.03	0.02	0.02	0.07
NiO	0.00	0.01	0.00	0.01
CaO	0.07	0.02	0.02	0.03
Total	100.16	100.06	99.89	100.43
Si	0.001	0.001	0.001	0.000
Ti	0.988	0.990	0.991	0.987
Al	0.002	0.003	0.003	0.004
Nb	0.000	0.001	0.000	0.000
Cr	0.001	0.001	0.000	0.001
V	0.003	0.004	0.005	0.004
Fe	0.010	0.003	0.003	0.009
Mn	0.000	0.000	0.000	0.000
Mg	0.001	0.000	0.000	0.000
Ni	0.000	0.000	0.000	0.001
Ca	0.001	0.000	0.000	0.000
Total	1.007	1.004	1.004	1.007

Table 3: Average compositions of Ekati samples continued…

Hornblende

	EKT-9D
	n=4
SiO2	40.96
TiO2	2.24
Al2O3	13.70
Cr2O3	0.05
FeO	12.38
MnO	0.02
MgO	11.67
CaO	11.49
Na2O	1.71
K2O	2.45
F	0.70
Cl	0.22
Total	97.25
Si	2.947
Ti	0.121
Al	1.162
Cr	0.003
Fe	0.745
Mn	0.001
Mg	1.252
Ca	0.886
Na	0.239
K	0.225
F	0.157
Cl	0.027
Total	7.764

Table 4: Average composition of Munn Lake samples. Averages are based on analysis of 3-4 grains per sample.

Garnet

	MN51311	MN51312	MN51313	MN51314
	n=60	n=44	n=45	n=43
SiO2	38.54	38.82	40.88	38.78
TiO2	0.09	0.23	0.05	0.09
Al2O3	21.71	21.79	23.17	21.87
Cr2O3	0.05	0.06	0.10	0.10
FeO	26.95	25.55	15.97	24.77
MnO	0.54	0.57	0.39	0.59
MgO	6.02	7.01	14.08	6.45
CaO	6.78	6.40	5.69	8.01
Na2O	0.02	0.02	0.02	0.02
K2O	0.00	0.00	0.00	0.00
Total	100.71	100.45	100.36	100.67
Si	2.990	2.992	2.996	2.985
Ti	0.005	0.014	0.003	0.005
Al	1.974	1.976	2.001	1.984
Cr	0.003	0.004	0.006	0.006
Fe	1.747	1.646	0.979	1.594
Mn	0.036	0.037	0.024	0.038
Mg	0.697	0.805	1.539	0.740
Ca	0.562	0.528	0.447	0.660
Na	0.004	0.003	0.003	0.003
K	0.000	0.000	0.000	0.000
Total	8.018	8.006	7.999	8.017
Grossular	0.185	0.175	0.150	0.218
Pyrope	0.229	0.267	0.515	0.244
Almandine	0.574	0.546	0.328	0.526
Spessartine	0.012	0.012	0.008	0.013
Fe/Fe+Mg	0.715	0.671	0.389	0.683

Table 4: Average composition of Munn Lake samples. Averages are based on analysis of 3-4 grains per sample.

Plagioclase

	MN51311	MN51312	MN51313	MN51314
	n=41	n=33	n=40	n=20
SiO_2	59.80	59.62	55.90	58.37
TiO_2	0.02	0.01	0.01	0.01
Al_2O_3	25.57	24.95	28.04	26.44
Cr_2O_3	0.01	0.01	0.01	0.01
FeO	0.05	0.05	0.04	0.04
MnO	0.01	0.02	0.01	0.02
MgO	0.12	0.21	0.11	0.06
CaO	6.92	6.40	10.07	8.05
Na_2O	7.24	7.20	5.49	6.59
K_2O	0.36	0.61	0.17	0.18
Total	100.12	99.09	99.85	99.75
Si	2.661	2.679	2.515	2.612
Ti	0.001	0.001	0.000	0.000
Al	1.341	1.322	1.487	1.395
Cr	0.000	0.000	0.000	0.000
Fe	0.002	0.002	0.002	0.001
Mn	0.000	0.001	0.000	0.001
Mg	0.008	0.016	0.007	0.004
Ca	0.330	0.307	0.485	0.386
Na	0.625	0.626	0.479	0.571
K	0.020	0.037	0.010	0.010
Total	4.990	4.990	4.986	4.981
An	0.338	0.317	0.498	0.399
Ab	0.641	0.645	0.491	0.591
Or	0.021	0.038	0.010	0.011

Table 4: Average compositions of Munn Lake samples continued…

Clinopyroxene

	MN51311	MN51312	MN51313	MN51314
	n=41	n=40	n=39	n=17
SiO2	51.85	52.06	52.22	51.02
TiO2	0.30	0.31	0.31	0.59
Al2O3	3.55	3.88	5.46	5.22
Cr2O3	0.03	0.04	0.11	0.06
FeO	9.24	8.48	3.75	8.51
MnO	0.05	0.06	0.05	0.06
MgO	11.58	12.08	13.81	11.58
CaO	21.14	20.90	22.44	21.04
Na2O	1.41	1.50	1.00	1.48
K2O	0.00	0.00	0.00	0.08
Total	99.15	99.32	99.17	99.64
Si	1.923	1.946	1.916	1.904
Ti	0.008	0.009	0.009	0.017
Al	0.211	0.171	0.236	0.230
Cr	0.001	0.001	0.003	0.002
Fe	0.287	0.265	0.115	0.266
Mn	0.002	0.002	0.002	0.002
Mg	0.640	0.673	0.755	0.644
Ca	0.840	0.837	0.882	0.842
Na	0.101	0.108	0.071	0.107
K	0.000	0.000	0.000	0.004
Total	4.013	4.013	3.991	4.017
AlM1	0.156	0.140	0.154	0.168
XMg	0.691	0.717	0.868	0.708
XFe	0.309	0.283	0.132	0.292
MgM1	0.577	0.610	0.724	0.576
FeM1	0.258	0.240	0.110	0.237
AlM1	0.156	0.140	0.154	0.168
TiM1	0.008	0.009	0.009	0.017
CaM2	0.840	0.837	0.883	0.842
MgM2	0.039	0.039	0.040	0.036
FeM2	0.018	0.015	0.006	0.015
NaM2	0.101	0.108	0.071	0.107

Orthopyroxene

	MN51313
	n=29
SiO2	54.35
TiO2	0.04
Al2O3	4.18
Cr2O3	0.07
FeO	11.60
MnO	0.09
MgO	28.90
CaO	0.32
Na2O	0.03
K2O	0.00
Total	99.59
Si	1.924
Ti	0.001
Al	0.175
Cr	0.002
Fe	0.343
Mn	0.003
Mg	1.525
Ca	0.012
Na	0.002
K	0.000
XMg	0.763
XFe	0.172
XAl	0.044

Table 4. Average compositions of Munn Lake samples continued…

Ilmenite

	MN51312
	n=6
SiO_2	0.05
TiO_2	49.18
Al_2O_3	0.18
Cr_2O_3	0.21
Nb_2O_5	0.01
V_2O_3	0.48
FeO	47.00
MnO	0.25
MgO	2.15
NiO	0.29
Total	99.80
Si	0.001
Ti	0.916
Al	0.005
Cr	0.004
Nb	0.000
V	0.010
Fe3+	0.146
Fe2+	0.827
Mn	0.005
Ni	0.006
Mg	0.079
Total	2.000

Rutile

	MN51312
	n=7
SiO_2	0.05
TiO_2	98.84
Al_2O_3	0.05
Cr_2O_3	0.19
Nb_2O_5	0.19
V_2O_3	0.34
FeO	0.58
MnO	0.02
NiO	0.20
MgO	0.03
CaO	0.05
Total	100.52
Si	0.001
Ti	0.988
Al	0.001
Cr	0.002
Nb	0.001
V	0.004
Fe	0.006
Mn	0.000
Ni	0.002
Mg	0.001
Ca	0.001
Total	1.006

calculation of both pressure- and temperature-sensitive equilibria. In contrast, only pressure-sensitive GRIPS [8] and GASP [7] equilibria can be calculated for the remaining strongly altered, rutile-bearing Artemisia xenoliths. These two equilibria assume the presence of ilmenite and sillimanite, respectively, but these minerals are not in fact currently present in the xenoliths and may not have been present at peak metamorphic conditions. Nevertheless, even if these minerals were not part of the stable mineral assemblage, the calculated position of the GRIPS [8] and GASP [7] equilibria still provide robust lower and upper pressure bounds, respectively, for the altered Artemisia xenoliths. Graphical results of geothermobarometric calculations are presented in Figure 10.

Artemisia

Art-3

The P-T conditions of equilibrium for this sample were determined with the Grt-Crd [3] and Grt-Bt [4] thermometers and the GASP [7] and Crd-Grt-Sill-Qtz [9] barometers. Figure 10a illustrates a graph of the results with P-T estimates of ~3.5-4.5 kbars and 600-650 °C.

Pressure and temperature estimates for this sample indicate a mid-amphibolite grade.

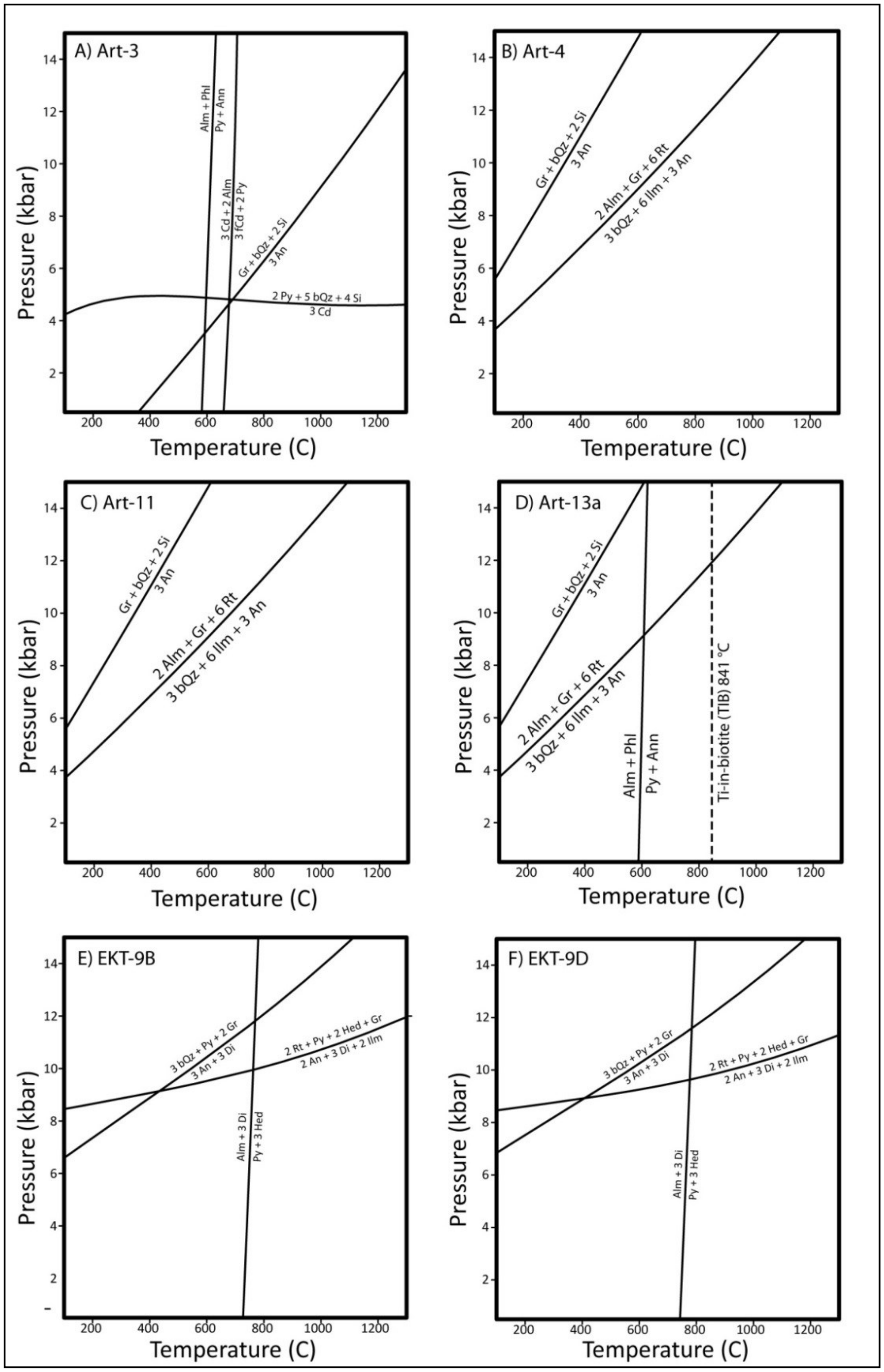

Figure 10: P-T graphs of geothermobaromic conditions for xenoliths from Artemisia (Art-3, Art-4, Art-11, Art-13a), Ekati (EKT-9D, EKT-9D, EKT-11A, EKT-11B, EKT-12, BD-184, Point-Lk-1) and Munn Lake (MN51311, MN51312, MN5313, MN51314) . See text for discussion.

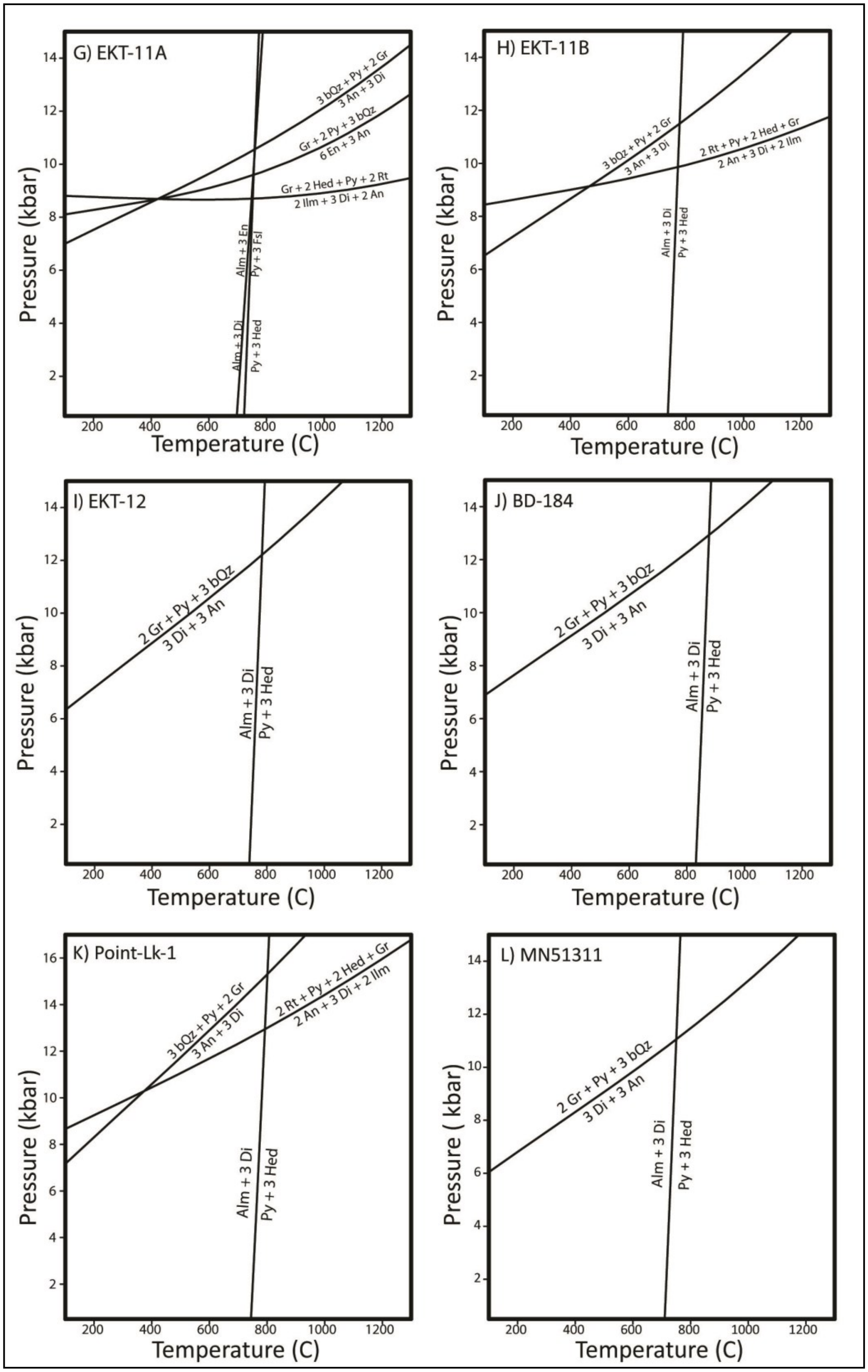

Figure 10 continued….

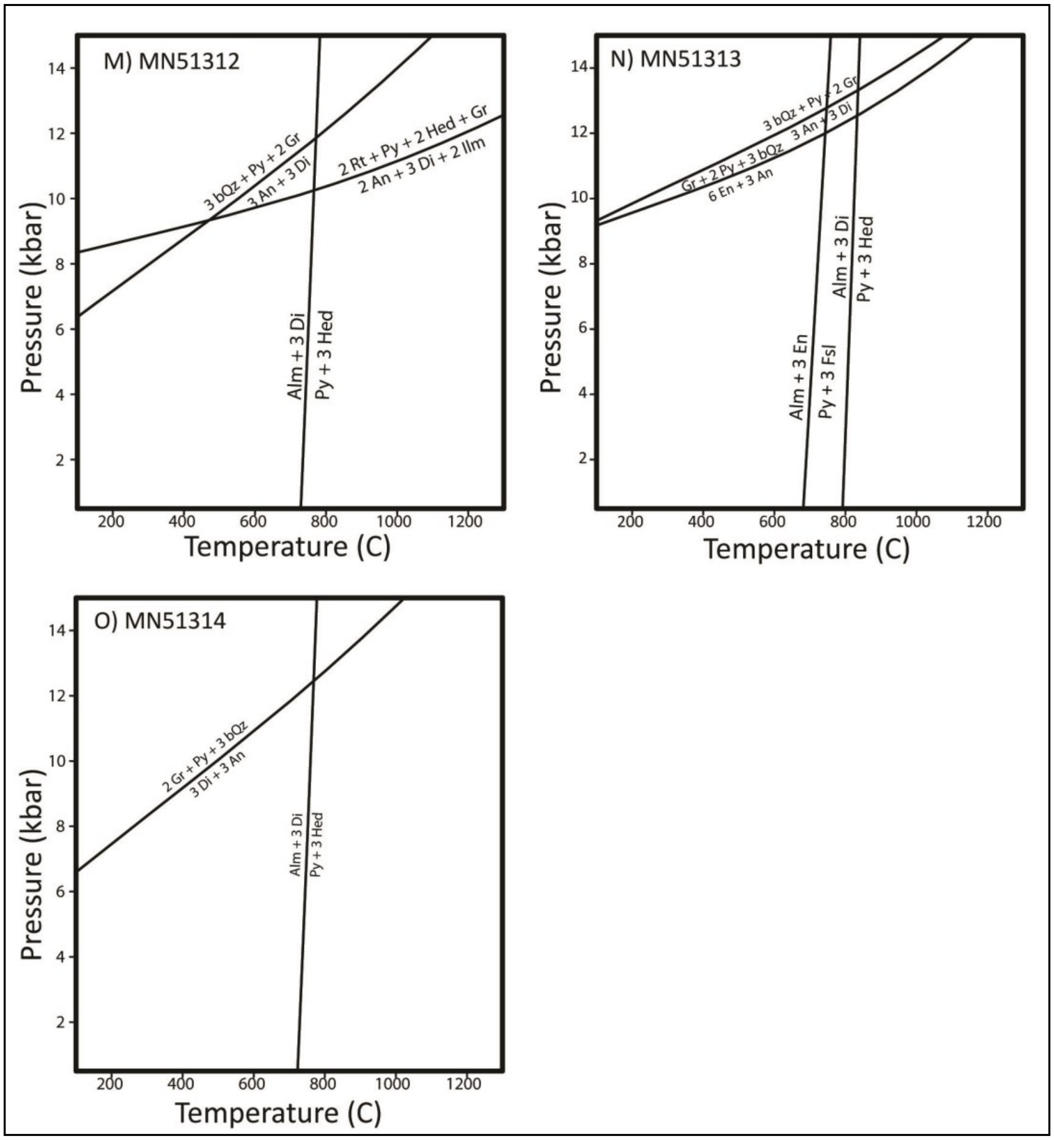

Figure 10 continued….

Art 13a

The P-T conditions of equilibrium for this sample were determined with the GRIPS [8] and GASP [7] barometers and the Grt-Bt [4] thermometer. In calculating these equilibria, we assumed that a($FeTiO_3$ in ilmenite) =1 and a(Al_2SiO_5 in sillimanite) =1. Given that these activities must be less than one (i.e., ilmenite and sillimanite are not present in the samples) then the positions of the GRIPS and GASP reactions shown in Figure 10d represent lower and upper bounds, respectively, on the actual pressure experienced by the sample.

Because the biotite analyzed in the sample were located adjacent to and as inclusions in garnet grains there was likely extensive down-temperature re-equilibration of the garnet-biotite Fe-Mg exchange geothermometer. For a more accurate temperature estimate the Ti-in-biotite (TIB) geothermometer [11] of Henry et al. (2005) was also used.

Figure 10d illustrates a graph of the results showing the Ti-in-biotite (TIB) temperature of 841 °C (dashed line) which intersects the GRIPS equilibrium at a pressure of 11.5 kbars. This temperature estimate, which is much higher than the ~600 °C estimate provided by the Grt-Bt [4] thermometer is likely a better indication of the peak temperature experienced by sample Art-13a.

Art-4 and Art-11

The GRIPS [8] and GASP [7] barometers were used to obtain pressure estimates for these samples. As with the Art-13, if we assume the presence of ilmenite and sillimanite in pure endmember compositions, the GRIPS equilibrium provides a minimum pressure estimate and the GASP equilibrium provides a maximum pressure estimate.

Figure 10b,c illustrates a graph of the results, and although there is no T estimate for Art-4 and Art-11, we can safely assume that these samples were metamorphosed to temperatures of at least 600°C and much more likely to temperatures in excess of 700 or even 800°C. This corresponds to pressures of at least 8.5 kbar and up to >10 kbars suggesting a likely deep crust origin.

Ekati

EKT-9B, EKT-9D, and EKT-11B

The P-T conditions of equilibrium for these samples were determined with the Grt-Cpx [2] thermometer and the Grt-Pl-Cpx-Qtz [6] and Grt-Rt-Pl-Ilm [10] barometers. Figure 10e,f,h illustrates a graph of the P-T estimates of 8 -11.5 kbars and 750-775 °C.

As the Grt-Cpx thermometer is sensitive to resetting, the temperature it yields must be regarded as a minimum estimate of peak temperatures. The results give a wide range of pressure estimates. As there is no quartz in the samples, the Grt-Cpx-Pl-Qtz barometer yields only a maximum pressure estimate of ~11 kbar. It may be that the true pressure is closer to the lower estimate of 8 kbar given by the quartz-absent Grt-Rt-Pl-Cpx-Ilm barometer, although it must be noted that this barometer requires the establishment of equilibrium between six rather than just four phases like the Grt-Cpx-Pl-Qtz barometer.

EKT-11A

The P-T conditions of equilibrium for this sample were determined with the Grt-Cpx [2] and Grt-Opx [1] thermometers and the Grt-Pl-Cpx-Qtz [6], Grt-Pl-Opx-Qtz [5] and Grt-Rt-Pl-Ilm [10] barometers. Figure 10g illustrates a graph of results with P-T estimates of 8.5-10.5 kbars and 775-800 °C.

Both the Grt-Cpx [2] and the Grt-Opx [1] thermometers plot roughly along the same path in P-T space, suggesting that the 775-800 °C estimate is either suggestive of the peak temperature of metamorphism or that the thermometers have similar closure temperatures and re-equilibrated to approximately the same degree. The pressure estimate for Grt-Cpx-Pl-Qtz [6] barometer is a pressure maximum, as there is no quartz present in the sample, and it is likely that the true pressure is closer to the lower estimate of 8.5 kbars given by the quartz absent Grt-Rt-Pl-Ilm [10] barometer.

EKT-12 and BD-184

The P-T conditions of equilibrium for these samples were determined with the Grt-Cpx [2] thermometer and the Grt-Pl-Cpx-Qtz [6] barometer. Figure 10i,j illustrates a graph of results with P-T estimates of 12 kbars and 800 °C.

As with previous samples, the temperature estimate is a minimum. Although only one barometer was available for samples EKT-12 and BD-184, these samples are quartz bearing, and as such, the calculated pressure from the Grt-Pl-Cpx-Qtz [6] barometer can be interpreted as being representative of the true pressure of equilibrium (Mukhopadhyay et al., 1992).

Point-Lk-1

The P-T conditions of equilibrium for this sample were determined with the Grt-Cpx [2] thermometer and the Grt-Pl-Cpx-Qtz [6] and Grt-Rt-Pl-Ilm [10] barometers. Figure 10k illustrates a graph of results with P-T estimates of 12.5-15 kbars and 775-800 °C.

The temperature estimate is a minimum, and as with other samples from the suite, a wider range of pressures are observed. The true pressure is likely closer to the lower estimate of 12.5 kbars given by the quartz absent Grt-Rt-Pl-Ilm [10] barometer (Mukhopadhyay et al., 1992). Overall, this sample is less altered than the sample BD-184, but is still recording the highest pressures observed within the suite. Sample BD-184 and Point-Lk-1are from kimberlitic pipes in the Ekati field that are sampling deep levels of the lower crust.

Munn Lake

<u>*MN51311 and MN51314*</u>

The P-T conditions of equilibrium for these samples were determined with the Grt-Cpx [2] thermometer and the Grt-Pl-Cpx-Qtz [6] barometer. Figure 10l,o illustrates a graph of results with P-T estimates of 10.5 kbars and 775 °C for Munn 51311 and 12 kbars and 775 °C for Munn 51314..

Although analysis for these sample only provides one point in P-T space, these samples have similar geothermobaromic conditions to the xenoliths analysed from the Ekati suite and there is no textural evidence to suggest that this estimate is not representative of the equilibrium assemblage.

<u>*MN51312*</u>

P-T conditions of equilibrium for this sample were determined with the Grt-Cpx [2] thermometer and the Grt-Pl-Cpx-Qtz [6] and Grt-Rt-Pl-Ilm [10] barometers. Figure 10m illustrates a graph of results with P-T estimates of 9.5-11.5 kbars and 775-800 °C.

The Grt-Cpx thermometer provides a temperature minimum and the barometer estimates a wide range of possible pressure. The true pressure is likely closer to the lower estimate of 9.5 kbars provided by the Grt-Rt-Pl-Ilm barometer, as there is no quartz present in MN51312 (Mukhopadhyay et al., 1992).

MN51313

The P-T conditions of equilibrium for this sample were determined with the Grt-Cpx [2] and Grt-Opx [1] thermometers and the Grt-Pl-Cpx-Qtz [6] and Grt-Pl-Opx-Qtz [5] barometers. Figure 10n illustrates a graph of results with P-T estimates of 11.5-12.5 kbars and 750-850 °C.

The Grt-Cpx [2] and Grt-Opx [1] thermometers are slightly offset from each other, which suggest the sample may not be representative of the peak metamorphic conditions. The closure temperature of the thermometers may not be the same and some degree of Fe-Mg resetting is possible between the grains. Overall, there is still a relatively small window of P-T defined for this sample.

1.5. U-Pb Geochronology

1.5.1. Methodology

U-Pb Geochronology is a powerful tool that helps to unravel the complex history of rocks (Krogh, 1993). Zircon and monazite are chosen for analysis because they are robust minerals that are less susceptible to isotopic resetting by later metamorphic events (Heaman and Parrish, 1991). If the accessory mineral has remained closed to U and Pb exchange with the surrounding rock since initial crystallization, the two independent U-Pb clocks should read the same crystallization age according to the following equations:

[12] $^{206}Pb^{*}={}^{238}U(e^{\lambda 238 t}-1)$

[13] $^{207}Pb^{*}={}^{235}U(e^{\lambda 235 t}-1)$

where $^{206}Pb^{*}$ and $^{207}Pb^{*}$ are the amount of radiogenic Pb produced after crystallization of the accessory mineral and λ_{238} and λ_{235} are the decay constants for ^{238}U and ^{235}U, respectively. Even in cases where the accessory mineral has been partially open to U or Pb, information on the original age of crystallization can commonly be recovered using the concordia plot of Wetherill (1956).

Due to the limited abundance of xenolithic material available, the U-Pb laser ablation ICP-MS method was used for isotopic analysis. This technique has the advantage of *in situ* collection of geochronological data at a high spatial resolution. Backscatter electron (BSE) imaging of grains can reveal internal structure within the grains, the degree of radiation damage and the number of phases of grain growth (e.g., inherited cores vs. magmatic growth zones). This information allows the best part of grains to be targeted for analysis and the possibility of documenting multiple age events within a single grain (Krogh 1993; Hanchar and Rudnick, 1995). Previous geochronological studies of xenoliths from the central and southern Slave craton have shown a complex history in timing of crustal growth (Davis et al., 2003a, Krauss et al., 2007).

1.5.2 Analytical Techniques

Based on initial petrographic inspection of thin sections, 4 of the Artemisia suite samples (Art-1a, Art-3, Art-4, Art-6) were deemed suitable for U-Pb *in situ* dating. From these samples, a total of 9 zircon grains and 6 monazite grains were of a suitable size (>30 μm) for analysis. Multiple spots were analyzed on each of the grains selected. The selected monazite and zircon grains were found predominantly in zones of heavy alteration or as inclusions within garnet grains.

Prior to geochronological analysis, backscatter electron (BSE) images were obtained using a JEOL 8900 microprobe located in the Department of Earth and Atmospheric Sciences, University of Alberta. These BSE images allow the hidden internal structure of the grains to be revealed and optimal analysis targets within grains could be selected.

Analyses for U-Pb dating were made *in situ* using the Laser NuPlasma Multi-Collector ICP Mass Spectrometer located in the Radiogenic Isotope Facility in the Department of Earth and Atmospheric Sciences, University of Alberta. The Nd:YAG UP 213nm laser system used allows for *in situ* analysis and simultaneous collection of ion signals ^{203}Tl through ^{238}U. Analytical techniques are described in detail in Simonetti et al. (2005; 2006).

A beam diameter of 30 μm was used for zircon analyses and 12 μm for monazite analyses. Data collection consisted of one-second integrations carried out for 30 seconds. Analyses that displayed a noticeable change in radiogenic

Pb counts over the 30 second analytical cycle were omitted prior to final age calculations. $^{207}Pb/^{206}Pb$ and $^{206}Pb/^{238}U$ normalization factors for zircon analyses in each analytical session were determined using an in-house 1830 ± 2 Ma zircon standard LH94-15 (Ashton et al., 1999). Standardization of monazite analyses was done using an in-house 2843.7 ± 6.5 Ma Western Australia monazite standard (Simonetti et al., 2006). A common Pb correction was not applied to these data.

Concordia plots and weighted mean ages were determined using Isoplot Version 3.0 (Ludwig, 2003). All error ellipses and ages discussed are reported at the 2 sigma level of uncertainty.

1.5.3. Results

U-Pb analytical data is summarized in Table 5 and 6, for zircon and monazite, respectively. Concordia plots, probabilty density plots and BSE images for each sample can be found in Figure 11 through Figure 23. The BSE images show the location of analysis targets within the grains and the corresponding $^{207}Pb/^{206}Pb$ ages for each location. Textural descriptions of zircons are based on Corfu et al.'s (2003) atlas of zircon textures.

Art-3

Sample Art-3 is mineralogically similar to metagreywacke samples of the Burwash formation of the Slave craton and geothermobarometry presented in

Table 5 *in situ* LA-MC-ICP-MS of zircons in rocks collected from the Artemisia kimberlite.

										Modal Ages (Ma)						%
Sample Analysis	^{206}Pb (cps)	^{204}Pb (cps)	^{207}Pb/^{206}Pb	±2 σ	^{207}Pb/^{235}U	±2 σ	^{206}Pb/^{238}U	±2 σ	ρ	^{207}Pb/^{206}Pb	±2 σ	^{207}Pb/^{235}U	±2 σ	^{206}Pb/^{238}U	±2 σ	discordance
ART6-1ZA	72726	3	0.17438	0.00220	11.79338	0.61568	0.49051	0.02485	0.97	2600	21	2588	48	2573	107	1.3
ART6-1ZB	94574	2	0.17197	0.00188	11.75834	0.65436	0.49589	0.02706	0.98	2577	18	2585	51	2596	116	-0.9
ART6-1ZC	68209	5	0.16280	0.00269	10.05996	0.43048	0.44816	0.01770	0.92	2485	28	2440	39	2387	78	4.7
ART6-1ZD	82899	6	0.15819	0.00197	9.62311	0.53768	0.44119	0.02403	0.98	2436	21	2399	50	2356	107	3.9
ART6-2ZA	120848	12	0.12580	0.00148	5.97853	0.24635	0.34468	0.01362	0.96	2040	21	1973	35	1909	65	7.4
ART6-2ZB	130058	16	0.12723	0.00182	6.53043	0.41417	0.37227	0.02300	0.97	2060	25	2050	54	2040	107	1.1
ART6-2ZC	44765	6	0.12639	0.00292	5.99381	0.41951	0.34394	0.02273	0.94	2048	41	1975	59	1906	108	8
ART6-2ZD	98375	6	0.13394	0.00155	6.94244	0.51707	0.37594	0.02766	0.99	2150	20	2104	64	2057	128	5
ART6-2ZE	47686	7	0.12354	0.00146	5.78842	0.30104	0.33982	0.01721	0.97	2008	21	1945	44	1886	82	7
ART1A-1-1A	151493	30	0.10601	0.00110	4.54150	0.21396	0.31072	0.01428	0.98	1732	19	1739	38	1744	70	-0.8
ART1A-1-1B	208191	31	0.16650	0.00220	10.54587	0.49671	0.45938	0.02077	0.96	2523	22	2484	43	2437	91	4.1
ART1A-1-1C	144079	20	0.11269	0.00128	5.08244	0.21299	0.32711	0.01320	0.96	1843	20	1833	35	1824	64	1.2
ART1A-2A	392436	5	0.16638	0.00181	11.30654	0.51915	0.49288	0.02198	0.97	2522	18	2549	42	2583	94	-3
ART1A-2B	235414	18	0.16614	0.00218	10.84961	0.65633	0.47364	0.02797	0.98	2519	22	2510	55	2499	121	0.9
ART1A-4A	130563	2	0.15473	0.00170	8.89877	0.49361	0.41711	0.02268	0.98	2399	19	2328	49	2247	102	7.5
ART1A-4B	591082	22	0.15744	0.00387	9.62596	0.71350	0.44343	0.03101	0.94	2428	42	2400	66	2366	137	3.1
ART1A-4C	229973	5	0.16149	0.00209	10.41970	0.51097	0.46795	0.02214	0.97	2471	22	2473	44	2475	96	-0.2
ART1A-4D	401591	26	0.14690	0.00216	8.74223	0.40041	0.43161	0.01872	0.95	2310	25	2311	41	2313	84	-0.1
ART1A-4E	133525	18	0.15979	0.00178	10.00823	0.51689	0.45427	0.02291	0.98	2453	19	2436	47	2414	101	1.9
ART1A-4F	948277	44	0.15553	0.00167	9.27912	0.57131	0.43269	0.02623	0.99	2408	18	2366	55	2318	117	4.4
ART1A-4G	453297	24	0.15496	0.00163	9.02884	0.43090	0.42258	0.01967	0.98	2401	18	2341	43	2272	89	6.4
ART1A-5A	1034199	35	0.16276	0.00173	10.19323	0.50162	0.45422	0.02183	0.98	2485	18	2452	45	2414	96	3.4
ART1A-6A	333205	24	0.17155	0.00177	11.11701	0.55603	0.47000	0.02300	0.98	2573	17	2533	46	2484	100	4.2
ART1A-6B	186459	21	0.16636	0.00173	11.32630	0.59482	0.49378	0.02542	0.98	2521	17	2550	48	2587	109	-3.2
ART4-1A	967805	55	0.17753	0.00187	11.58976	0.74991	0.47348	0.03023	0.99	2630	17	2572	59	2499	131	6
ART4-1B	1069999	52	0.16993	0.00183	10.91120	0.80626	0.46569	0.03404	0.99	2557	18	2516	67	2465	148	4.3
ART4-1C	89255	42	0.16723	0.00185	10.50538	0.60101	0.45561	0.02557	0.98	2530	19	2480	52	2420	112	5.2
ART4-1D	73122	39	0.16135	0.00194	9.82099	0.48857	0.44146	0.02131	0.97	2470	20	2418	45	2357	95	5.4

Table 5 continued…

ART4-1E	87565	43	0.17256	0.00196	10.89673	0.71731	0.45798	0.02969	0.99	2583	19	2514	59	2431	130	7.1
ART4-1F	65167	50	0.16731	0.00199	10.91175	0.53455	0.47301	0.02248	0.97	2531	20	2516	45	2497	98	1.6
ART4-1G	75246	37	0.16754	0.00186	10.45103	0.72705	0.45242	0.03107	0.99	2533	19	2476	63	2406	136	6
ART4-2A	97350	47	0.16701	0.00208	10.88838	0.56580	0.47285	0.02385	0.97	2528	21	2514	47	2496	104	1.5
ART4-2B	350949	45	0.15961	0.00165	9.98661	0.49602	0.45378	0.02204	0.98	2452	18	2434	45	2412	97	1.9
ART4-2C	600620	56	0.15554	0.00170	9.26068	0.57562	0.43182	0.02642	0.98	2408	19	2364	55	2314	118	4.6
ART4-2D	80575	42	0.16426	0.00227	10.49988	0.56387	0.46361	0.02406	0.97	2500	23	2480	49	2455	105	2.1

Table 6 *in situ* LA-MC-ICP-MS of monazite grains in rocks collected from the Artemisia kimberlite.

										Modal Ages (Ma)						
Sample Analysis	**^{206}Pb (cps)**	**^{204}Pb (cps)**	**$^{207}Pb/^{206}Pb$**	**±2 σ**	**$^{207}Pb/^{235}U$**	**±2 σ**	**$^{206}Pb/^{238}U$**	**±2 σ**	**ρ**	**$^{207}Pb/^{206}Pb$**	**±2 σ**	**$^{207}Pb/^{235}U$**	**±2 σ**	**$^{206}Pb/^{238}U$**	**±2 σ**	**% discordance**
ART3-2A	270274	31	0.17726	0.00370	11.05808	0.91217	0.45244	0.03610	0.97	2627	35	2528	74	2406	158	10.1
ART3-2B	496249	63	0.17819	0.00368	11.33211	0.95565	0.46125	0.03771	0.97	2636	34	2551	76	2445	164	8.7
ART3-2C	339398	24	0.17636	0.00366	11.09015	0.91664	0.45608	0.03649	0.97	2619	35	2531	74	2422	160	9
ART3-1A	467362	18	0.17763	0.00375	11.12999	0.91265	0.45445	0.03601	0.97	2631	35	2534	74	2415	158	9.8
ART3-1B	531824	21	0.17721	0.00366	11.07232	0.92683	0.45315	0.03676	0.97	2627	34	2529	75	2409	161	9.9
ART3-1C	410935	8	0.17677	0.00368	10.61059	0.95147	0.43535	0.03797	0.97	2623	35	2490	80	2330	168	13.3
ART3-1D	358692	10	0.17759	0.00371	11.12577	0.90439	0.45438	0.03569	0.97	2630	35	2534	73	2415	156	9.8
ART3-3A	957157	42	0.17608	0.00366	10.37608	1.03364	0.42738	0.04164	0.98	2616	35	2469	88	2294	185	14.6
ART3-4A	1045521	42	0.17572	0.00367	11.46501	1.05184	0.47321	0.04227	0.97	2613	35	2562	82	2498	182	5.3
ART3-4B	443550	15	0.17533	0.00362	11.29876	1.02007	0.46737	0.04108	0.97	2609	34	2548	81	2472	178	6.3
ART6-3A	94431	1	0.13135	0.00300	7.39133	0.71302	0.40812	0.03825	0.97	2116	40	2160	83	2206	173	-5
ART6-3B	72864	0	0.13336	0.00337	6.14574	0.53621	0.33423	0.02791	0.96	2143	44	1997	73	1859	133	15.2
ART6-3C	65221	0	0.12161	0.00403	5.58852	0.62465	0.33329	0.03558	0.96	1980	59	1914	92	1854	170	7.3
ART6-3D	70606	1	0.13088	0.00366	6.01328	0.57870	0.33322	0.03068	0.96	2110	49	1978	81	1854	147	13.9
ART6-3E	76906	0	0.13360	0.00363	6.32744	0.55687	0.34349	0.02875	0.95	2146	47	2022	74	1903	137	13
ART1A-2MA	21409	4	0.11164	0.00292	4.30663	0.36199	0.27979	0.02235	0.95	1826	47	1695	67	1590	112	14.6
ART1A-2MB	20099	3	0.11425	0.00310	4.77648	0.45742	0.30321	0.02785	0.96	1868	49	1781	77	1707	136	9.8

section 1.4 indicates a mid-amphibolite grade for the sample

A total of 10 analyses were made on four monazite grains. The grains are ~50μm in diameter and are subhedral with rounded edges and lack any distinct zoning patterns (Figure 11). Moderate irregular fracturing was visible in three of the grains. The rounded nature of the grains suggests that their growth may be related to metamorphism of the sample (Parrish, 1990).

The data generally cluster on the concordia plot (Fig. 12a) but are somewhat (5-15%) discordant. The discordance may be real (i.e., these monazites may have undergone Pb loss) or may be an artifact of an inaccurate U/Pb normalization factor, which can cause the data to slide up or down along a line that runs from the origin through the data points. Fortunately, the $^{207}Pb/^{206}Pb$ ages are unaffected by the U/Pb normalization factor.

9 analyses yield a weighted mean age of $^{207}Pb/^{206}Pb$ age of 2624 ± 11 Ma (MSWD = 0.23) (Figure 12b). I interpret this age to record the timing of metamorphism of the sample.

Art-1a

Sample Art-1a is dominated by a high degree of alteration with clusters of preserved zones of garnet and plagioclase affected by moderate degrees of

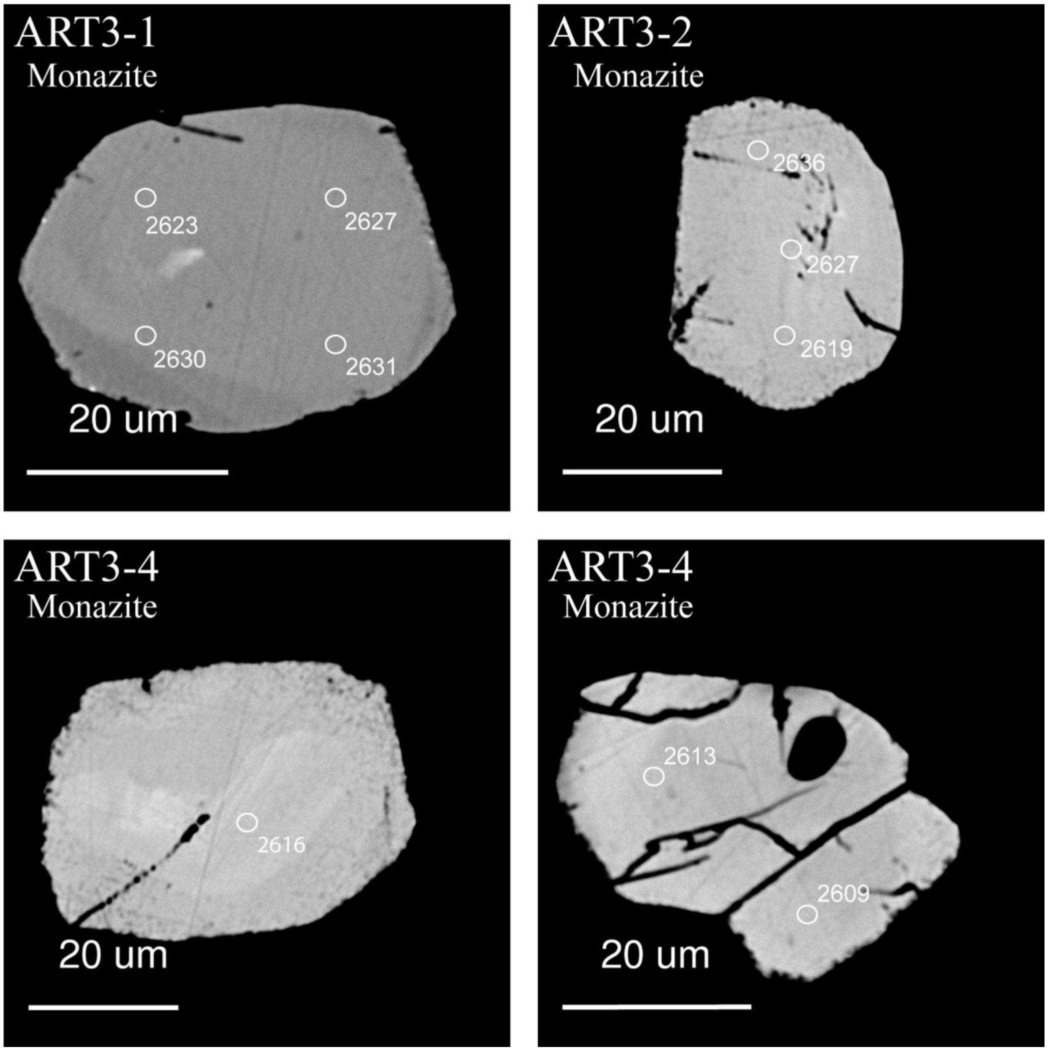

Figure 11: $^{207}Pb/^{206}Pb$ ages analysis locations shown on BSE image of monazite grains from sample Art-3. Grains lack and distinct zoning patterns and are subhedral with rounded edges. Moderate irregular fracturing is visible.

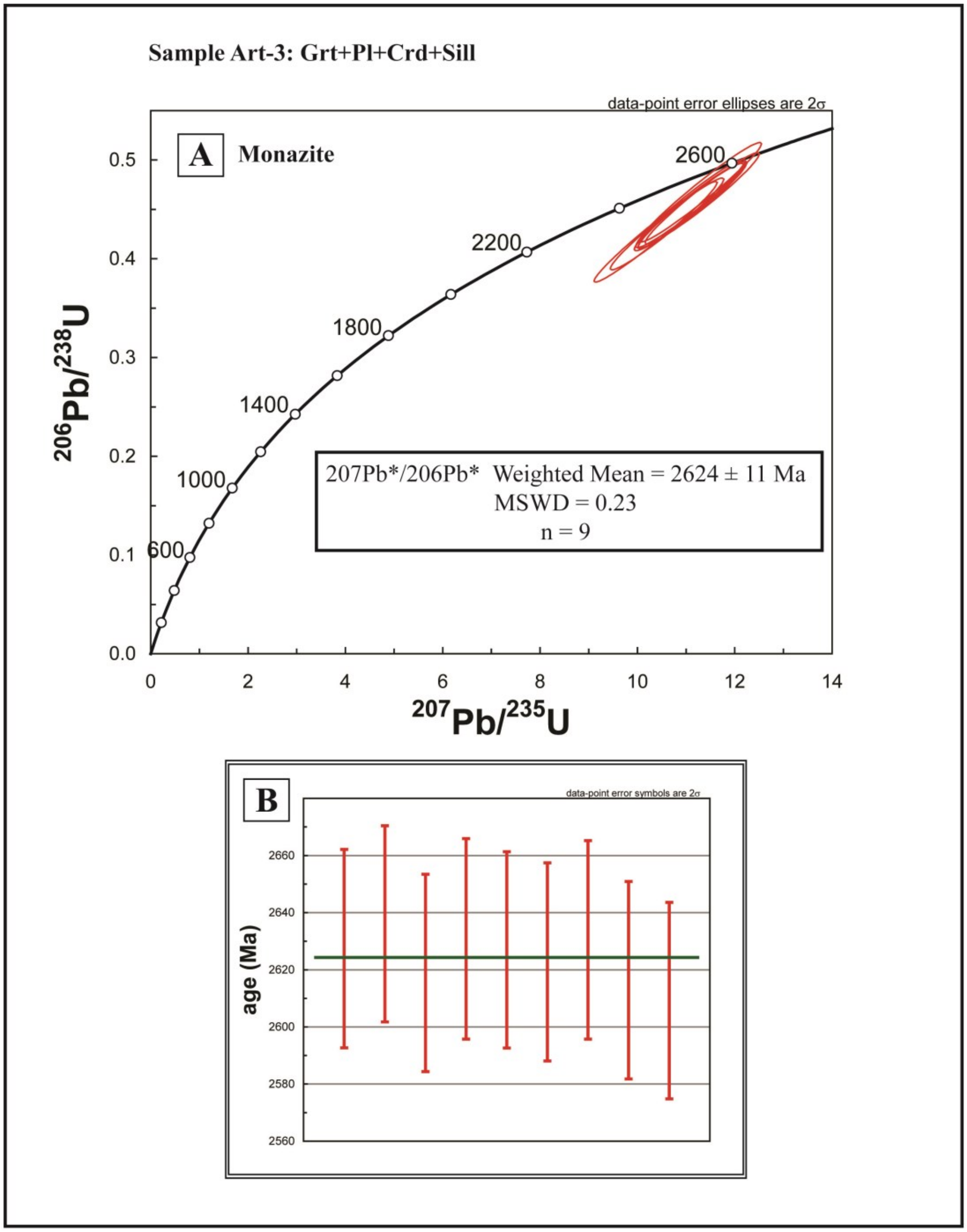

Figure 12: Sample Art-3 geochronology summary (a) Concordia plot of Monazite ages. (b) $^{207}Pb/^{206}Pb$ weighted mean of 2624 ± 11 Ma

chloritization and seriticization. The grains analyzed for their U-Pb isotopic composition were found predominantly within zones of fine-grained alteration.

From this sample, a total of 17 analyses were obtained from 1 grain of monazite and 5 grains of zircon. All of the zircons have a diameter of > 50 μm, with one grain having a diameter of > 100 μm. The monazite grain is elongate with a maximum diameter of ~ 50 μm and a minimum diameter of ~30 μm. The zircons are subhedral in shape, with all but one of the grains displaying moderate amounts of penetrative radial and concentric fracturing. The monazite grain showed no discernable internal structure in BSE images (Figure 13b), whereas the zircon grains showed varying degrees of recrystallization with the most strongly affected grain being ART1a-4 (Figure 13f). The unfractured zircon grain (Figure 13d) is unique in that it is only partially resorbed, with the BSE image showing a strong distinction between a weakly recrystallized core and metamorphic overgrowth rim.

The zircons analyzed can be separated into two general age ranges on a concordia diagram (Figure 14a). The first group of ages are from the weakly recrystallized grains (Figure 13) and define a spread of $^{207}Pb/^{206}Pb$ ages from 2573 ± 17 Ma to 2310 ± 25 Ma, with each analysis having a range of discordance from -0.8% - 6.4%. Generally, this data array can be attributed to variable Pb loss from Neoarchean zircons during one or more post-2.3 Ga thermal events. Alternatively, the data array may reflect several separate episodes of zircon growth as the crust cooled.

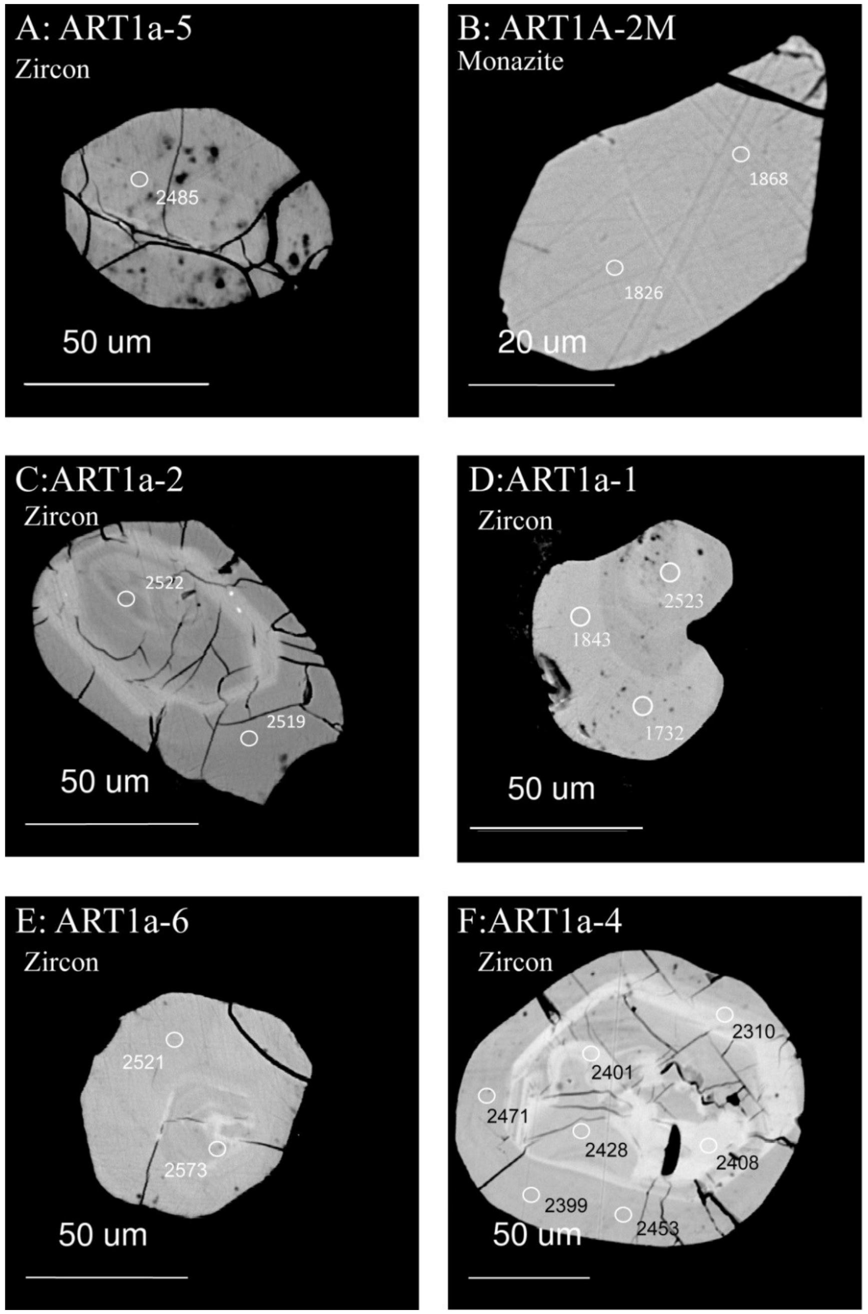

Figure 13: $^{207}Pb/^{206}Pb$ ages analysis locations shown on BSE images of zircon and monazite grains from sample Art-1a. Radial and concentric fracturing is visible in some of the zircon grains (a,c,e,f). The monazite grain displays no internal structure (b). Art-1a-1 displays a core rim zonation (d). Art1a-4 is most affected by recrystallization (f). See text for discussion.

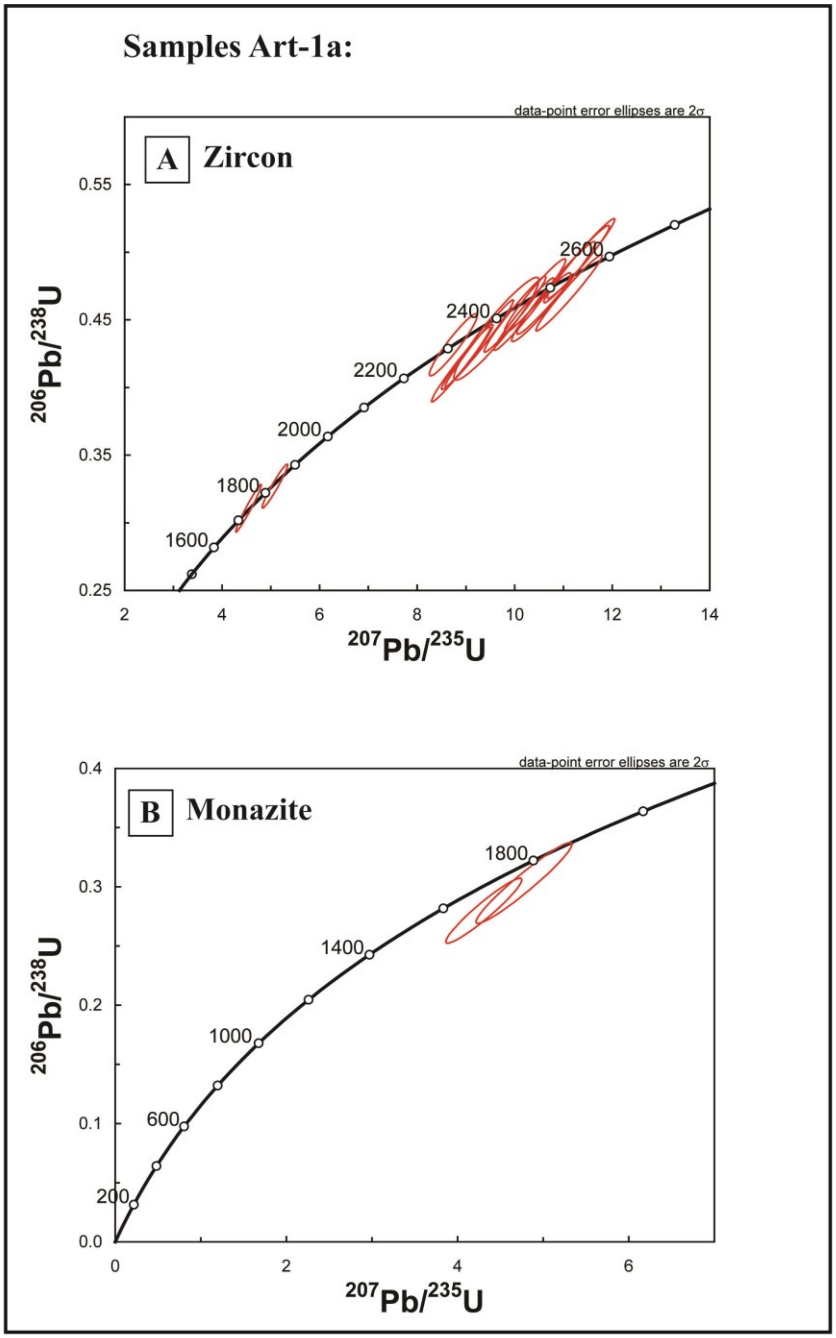

Figure 14: Sample Art-1a geochronology summary (a) Concordia plot showing zircon ages, with two general age groupings visible (b) Concordia plot showing monazite ages. See text for discussion.

Within this older age range, two main age peaks are visible on a probability density plot (Figure 15a,b). The main older peak is ~ 2520 Ma and the secondary one between about 2400-2430 Ma. Interestingly, all of the analyses recording the ~2415 Ma peak come from ART1a-4 (Figure 13f), the grain most affected by recrystallization. For the most part, based on the higher ^{206}Pb counts for this grain, the brighter parts in the BSE image likely have a higher U content. These high U parts of the grain may have undergone greater radiation damage and been more susceptible to recrystallization during the ~2415 Ma event.

There is also a third smaller age peak (~2460-80 Ma) (Figure 15c) between the two main peaks whose significance is not clear. A third 'event' may have produced this or it may be due to an analytical spot that incorporates material from both of the two larger age domains yielding a meaningless mixed age.

The second zircon age grouping comes from the previously mentioned zircon (Figure 13d) that showed a strong zonation between core and rim growth. Three analyses were made on this grain, one from the core and two from the rim. The core had a ^{207}Pb*/^{206}Pb Archean age of 2523 ± 22 Ma, which is consistent with the range recorded in the first age grouping from this sample. The outer edge of the grain record significantly younger Proterozoic ^{207}Pb/^{206}Pb ages of 1843 ± 20 Ma and 1732 ± 19 Ma. This is interpreted as an older core age related

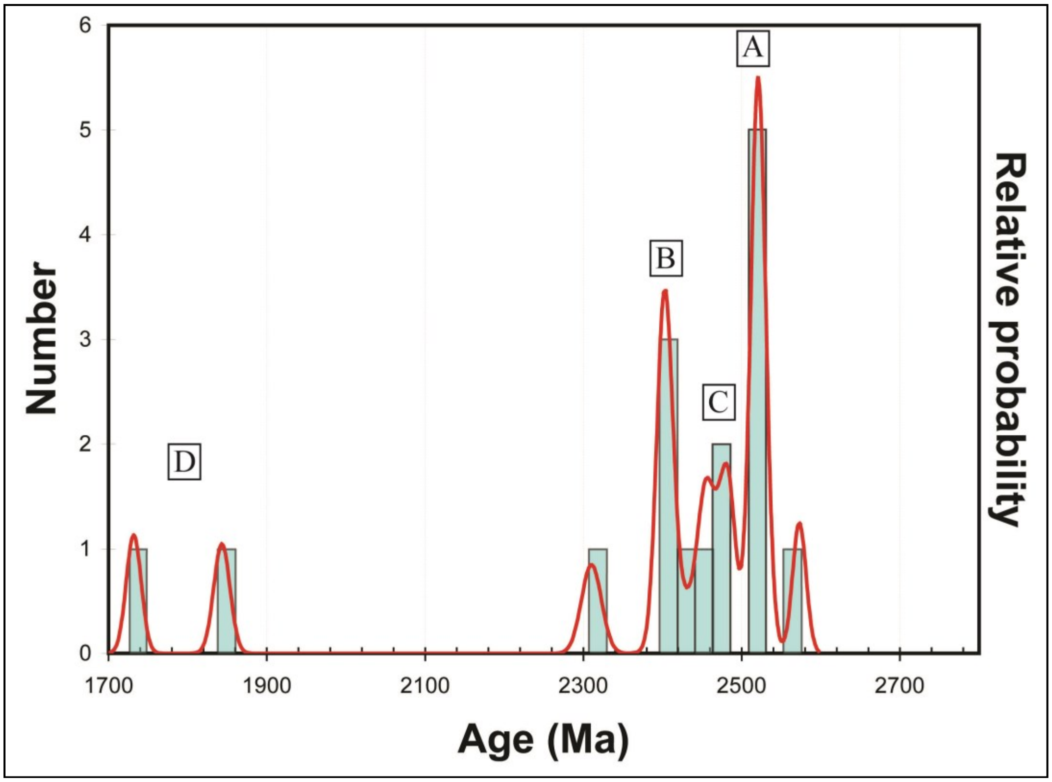

Figure 15: Probability Density Plot of $^{207}Pb/^{206}Pb$ ages from sample Art-1a zircons. (a) oldest age peak of ~2520 Ma (b) ~2415 Ma age peak (c) Possible age peak at ~ 2460-2480 Ma (d) Proterozoic ages from metamorphic overgrowth (grain ART1a-1). See text for Discussion.

to final cratonization in the Slave (Davis et al., 2003a) followed by development of an overgrowth during a younger metamorphic event.

Only two analyses of monazite were obtained for sample Art-1a and these show a higher degree of discordance compared to the zircon analyses. Both of these $^{207}Pb/^{206}Pb$ ages (1826 ± 47 Ma and 1868 ± 49 Ma) fall within the range of the Proterozoic zircon ages (Figure 15d).

Art-4

Sample Art-4 is characterized by a moderate degree of alteration with preserved zones of garnet and plagioclase. Two zircon grains were identified in thin section and 11 analyses were obtained on these grains. The zircon grains are subhedral with rounded edges, have diameters of 75 and 150 μm and are found within the alteration zone. In the BSE image, the largest grain shows a distinct core and rim and has pronounced radial fractures that penetrate from the core rim boundary to the edge of the grain (Figure 16a). The smaller grain has a patchy central zoning pattern with a small abundance of irregular fractures. (Figure 16b).

The ages obtained have a range of discordance from 1.5 to 7.1 % and define a spread of $^{207}Pb^*/^{206}Pb^*$ ages from 2630 ± 17 Ma to 2408 ± 19 Ma (Figure 17). On a probability density plot (Figure 18), one main age peak from the dataset is visible and it is similar to the 2520 Ma age peak from the Art-1a

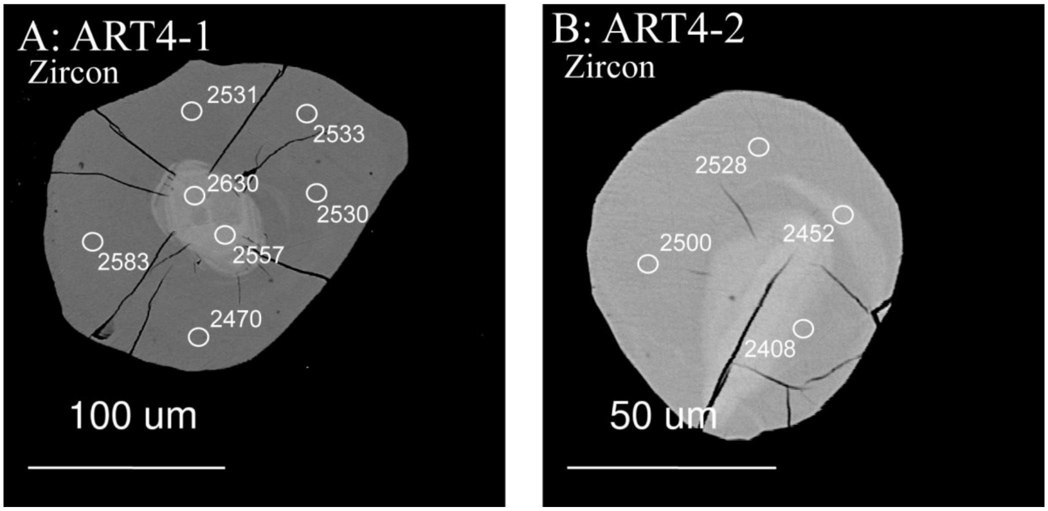

Figure 16: $^{207}Pb/^{206}Pb$ ages analysis locations shown on zircon BSE images from sample Art4-1. Radial fractures are visible propagating from core to rim in ART4-1 (a). ART4-2 (b) has a patchy central zoning and a small abundance of irregular fractures.

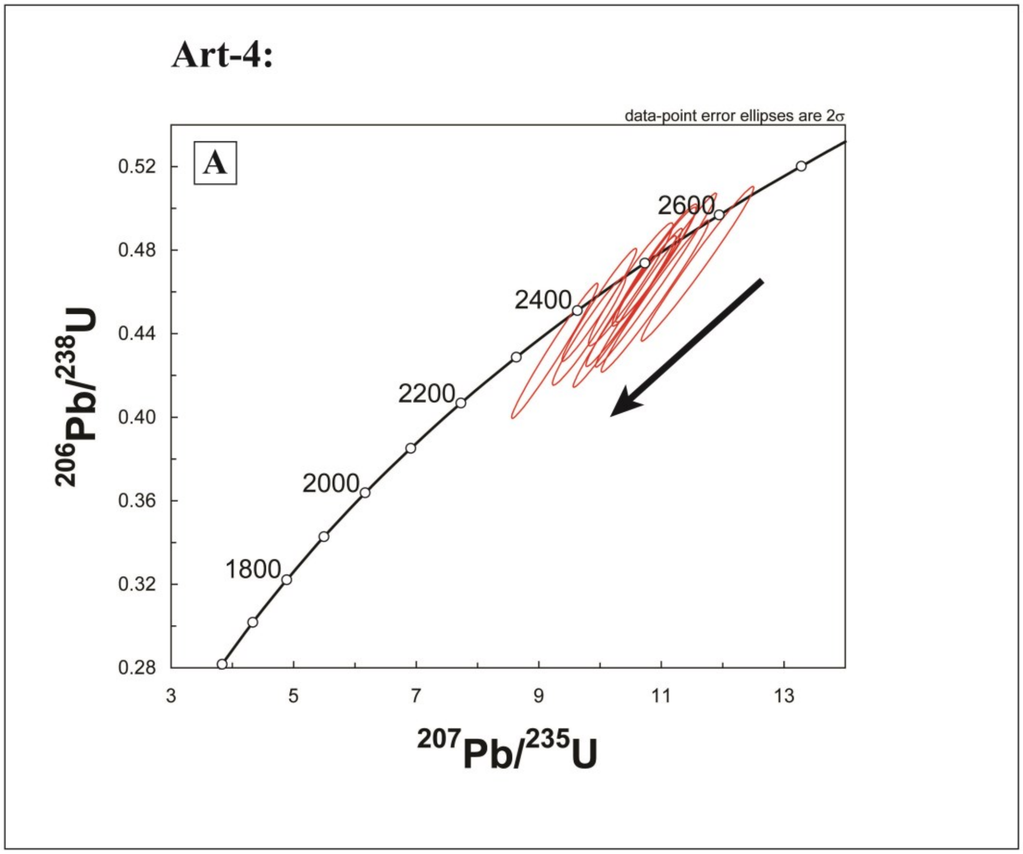

Figure 17: Sample Art-4 geochronology summary (a) Concordia plot showing spread of $^{207}Pb^*/^{206}Pb^*$ ages from 2630 ± 17 Ma to 2408 ± 19 Ma. See text for discussion

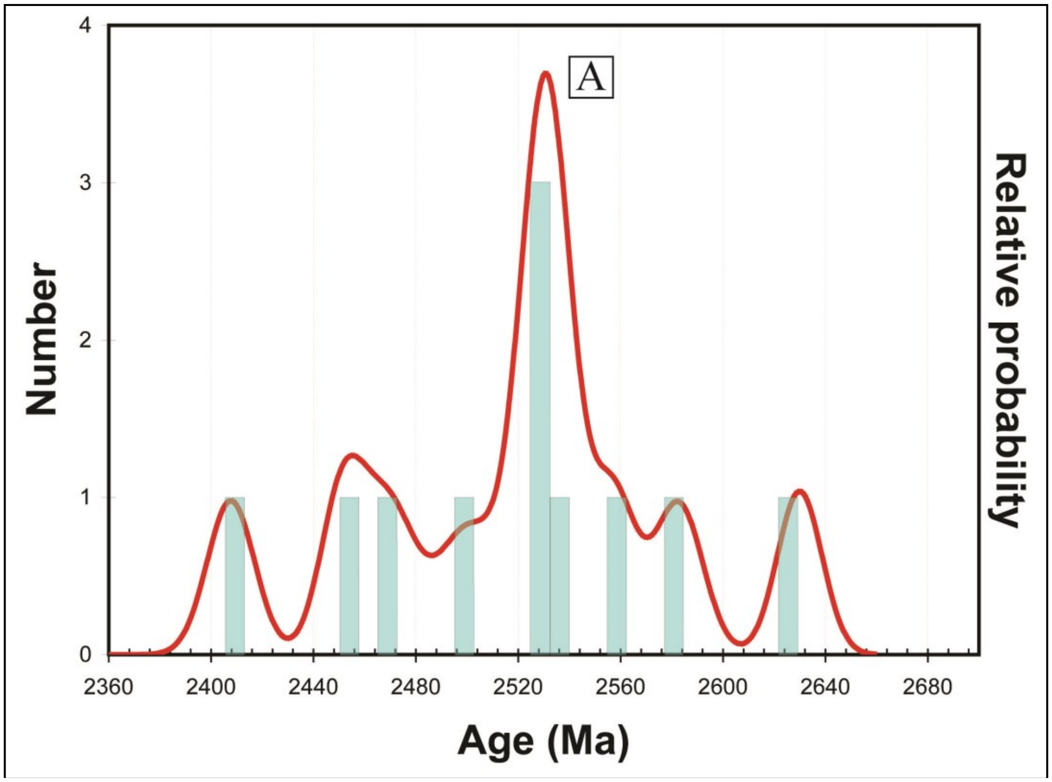

Figure 18: Probability Density Plot of $^{207}Pb/^{206}Pb$ ages from sample Art-4 zircons. (a) One main age peak is visible at ~ 2520 Ma. See text for discussion.

sample. The 2630 Ma age from Art4-1 (Figure 16a) was taken from the core of the grain and possibly reflects the age of the protolith.

Art-6

Of the Artemisia samples available for U-Pb dating, sample Art-6 was the most highly altered with some preserved zones of garnet and plagioclase. From this sample, one monazite and two zircons were analyzed for a total of 14 analyses. The grains were found in the zone of alteration or sharing grain boundaries with garnet grains. The zircons are subhedral with rounded edges. One of them shows a patchy central area with no internal structure visible in the rest of the grain (Figure 19a). The BSE image of the second zircon shows a suggestion of a core rim zonation that is not developed all of the way around the grain (Figure 19b). The monazite grain is subhedral with rounded edges and shows no internal structure (Figure 19c), suggesting it is metamorphic in origin (Parrish, 1990). The location of the monazite and one zircon grain sharing boundaries with garnet (Figure 20) suggest that it is unlikely they were xenocrystic grains derived from local country rock and transported into sample via the kimberlite.

As shown on a concordia diagram, the monazite yields Paleoproterozoic ages and the zircons both Archean and Paleoproterozoic ages (Figure 21a,b). The BSE image of one zircon shows no visible internal structure (Figure 19a) and contained two distinct Archean age clusters when plotted on a probability density

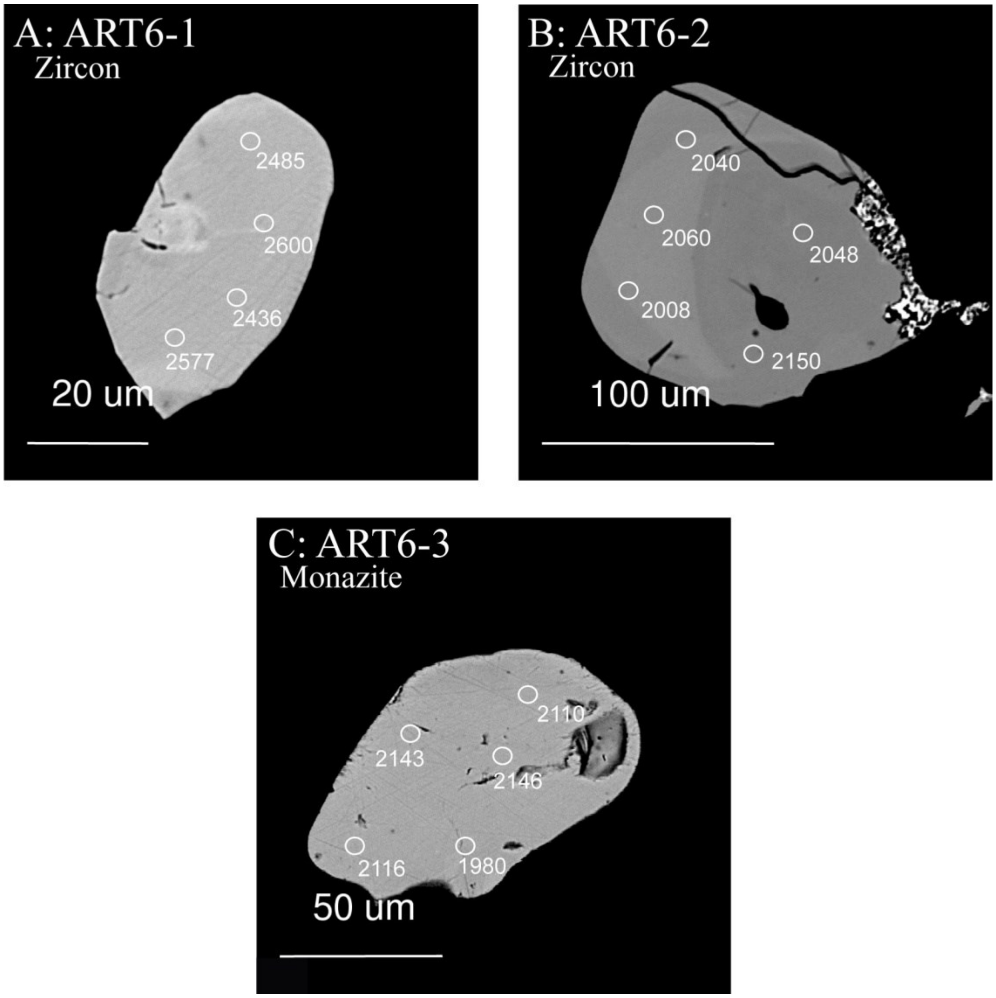

Figure 19: $^{207}Pb/^{206}Pb$ age spot locations BSE image of zircon and monazite grains from Sample Art-6.

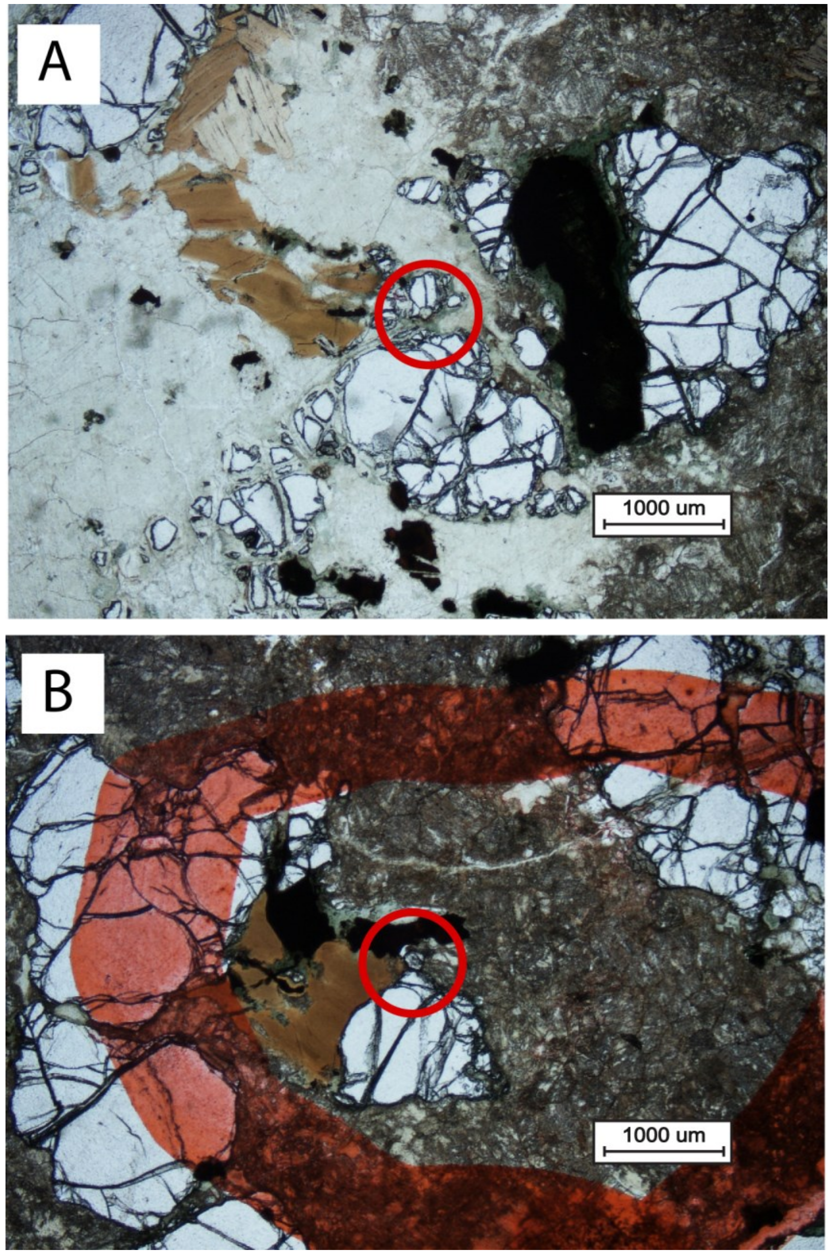

Figure 20: PPL photomicrograph of sample Art-6. (a) Monazite and (b) zircon grains share boundaries with garnet grains. See text for discussion

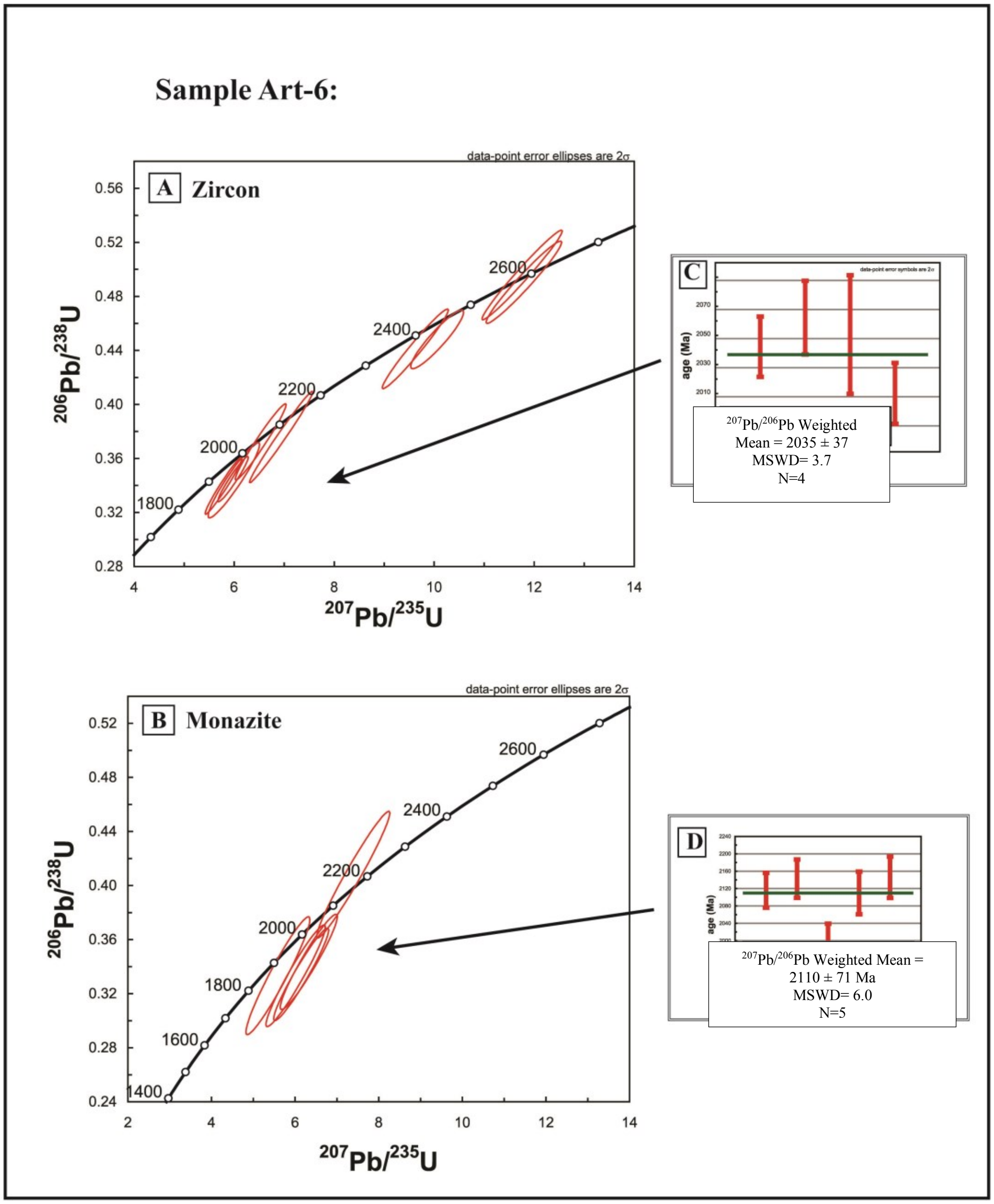

Figure 21: Sample Art-6 geochronology summary (a) Concordia plot showing Archean and Proterozoic age groupings from the zircon grains. (b) Concordia plot showing Proterozoic cluster of monazite ages (c) $^{207}Pb/^{206}Pb$ weighted mean age of 2035 ± 37 Ma for youngest zircons (d) $^{207}Pb/^{206}Pb$ weighted mean age of 2110 ± 71 Ma for monazite. See text for discussion.

diagram (Figure 22a,b). These ages fall in to the spread of ages found in sample Art-1a and Art-4 that suggest either Pb loss or continuous growth.

The zircon that had a suggestion of core rim zonation (Figure 19b) has ages that plot in a cluster on a concordia diagram (Figure 21a). The $^{207}Pb/^{206}Pb$ Weighted Mean age for this cluster is 2035 ± 37 Ma (MSWD 3.7) (Figure 21c). When analyzed in more detail on a probability density diagram, two ages groupings are visible in this group of younger zircon ages. One is between 2000 and 2060 Ma and the other is a single analysis at 2150 Ma (Figure 22c,d). The monazite grain ages plotted in a similar pattern to this zircon on a concordia diagram (Figure 21). The monazite ages from this cluster have a $^{207}Pb/^{206}Pb$ weighted mean age of 2110 ± 71 Ma (MSWD 6.0) (Figure 21d). On a probability density diagram, multiple age peaks are visible between 2110-2150 Ma and there is one age peak at 1980 Ma (Figure 22e,f). The Paleoproterozoic ages obtained from the zircon and monazite are within error of each other and the combined zircon and monazite data set suggest at least two main age peaks at ~2150 Ma and ~2050 Ma (Figure 23a,b), with the possibility of a third age peak at ~2010 Ma (Figure 23c).

1.6. Discussion

Based on composition, geochronology and geothermobarometry there are both similarities and differences between lower crustal xenoliths found in the northern Slave craton and those found in the central and southern Slave craton.

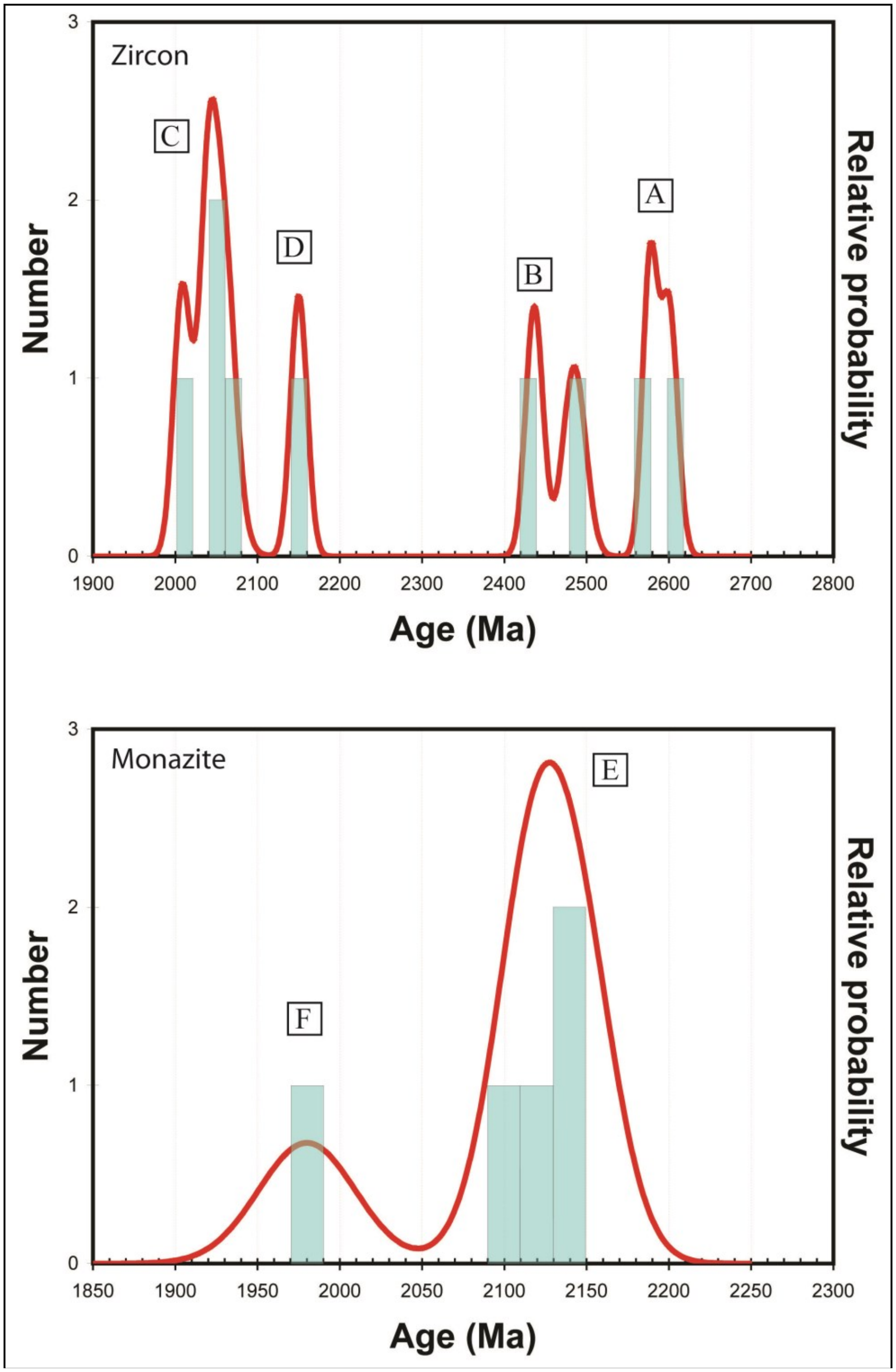

Figure 22: Probability Density Plot of $^{207}Pb/^{206}Pb$ ages from sample Art-6 zircons and monazites. Two distinct Archean age peaks are visible in the zircon dataset (a,b). Zircon Paleoproterozoic age peaks between 2000 and 2060 Ma (c) and a single analysis age peak at 2150 Ma (d). Multiple monazite age peaks between 2110-2150 Ma (e) and a single analysis age peak at 1980 Ma (f).

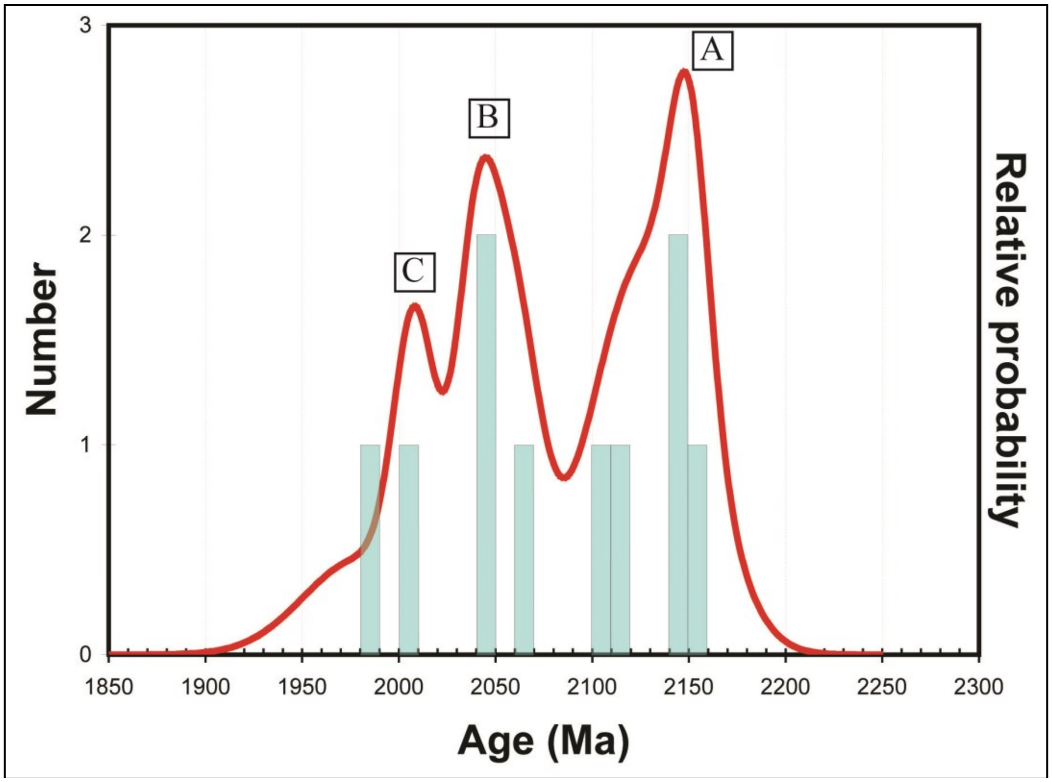

Figure 23: Probability Density Plot of combined zircon and monazite $^{207}Pb/^{206}Pb$ ages from sample Art-6. Two main peaks visible at ~2150 Ma (a) and ~2050 Ma (b) with the suggestion of a possible third age peak at ~2010 Ma (c). See text for discussion.

Previous studies (Davis et al., 2003a, Krauss et al., 2007) have shown that lower crustal xenoliths from the central and southern Slave are dominated by mafic granulites characterized by temperatures of 650-800 °C and pressures of 9-11 kbars (Davis et al., 2003a). This study indicates that metamorphic conditions as indicated by mineral equilibria for xenoliths from the northern, southern and central Slave are in the 9-12 kbar range of pressures with temperatures of at least 750-800°C.

The granitic or semi-pelitic protolith composition of the Artemisia xenoliths, as indicated by the lower grossular content of garnets and much higher quartz content in these samples, suggests that the composition of the lower crust in the northern Slave craton may be different than in the central and southern Slave craton. Alternatively, it is possible that the Artemisia xenoliths investigated in the present study are not representative of the northern Slave craton lower crust as a whole. Indeed, a much larger number of lower crustal xenoliths have been examined from central and southern Slave craton localities, both in the present and previous studies (Davis et al. 2003a; Krauss et al. 2007). My study suggests that although there is a dominance of mafic composition in the deep crust, as seen in the Ekati and Munn suites, felsic to intermediate compositions may also be present in significant quantities.

Previous geophysics studies in other cratons (e.g. China) have shown an intermediate composition of the lower crust in some regions (Gao et al., 1998) supporting that the composition of the lower crust is not constant worldwide. The northern Slave is one area where the lower crust may have originally been more felsic in composition. Alternatively, through the process of lithospheric delamination, significantly overthickened crust (thickness >55-60 km) in which the lower crust was originally mafic in composition may 'delaminate' from the rest of the lithosphere and sink into the asthenosphere below, effectively removing the mafic lower crust. This process can also trigger a flare-up of magmatic activity as hot asthenosphere rises up to take the place of the delaminated lithosphere and heats up the now felsic to intermediate base of the crust (Kay and Kay, 1993). The assumption that the lower crust entirely consists of mafic compositions may lead to a bias in estimates for bulk composition of continental crust.

As suggested by the mineralogy of the samples, geothermobarometry of the Artemisia samples confirmed that the majority of the xenoliths have a deep crustal origin. Zircon and monazite growth in these lower crustal xenoliths is complex and polyphase and can be connected to metamorphic events. For example, zircon may be formed by prograde mineral reactions involving breakdown of the relatively high Zr minerals such as hornblende or garnet to lower Zr minerals such as pyroxene (Fraser et al., 1997).

The Grt-Crd-Bt-Sil-Pl-Qtz assemblage of sample Art-3 was metamorphosed to 3.5-4.5 kbars and 600-650 °C and records a monazite U-Pb age of 2624±11 Ma. This age is slightly younger than the 2.67-2.65 Ga depositional age of the Burwash Fm (Bleeker and Hall, 2007), and corresponds to an early metamorphic event (M1) that took place in the Slave craton at 2630-2620

Ma (Bleeker and Hall, 2007). The 2624±11 Ma age, in combination with the lithological similarity of this sample to metagreywackes of the Burwash Fm, suggests that even though it intruded west of the surface exposures of the Slave craton, the Artemisia kimberlite sampled Slave craton rocks as it rose through the crustal column. The unique mid-amphibolite grade of this sample compared to the granulite grade of the remainder of the xenolith suite suggests that the Artemisia kimberlite was sampling rocks from different depths in the crustal column.

Previous studies have shown that Neoarchean ages observed in the granulite xenoliths of the central and southern Slave craton cluster into at least four intervals: 2.64–2.61, 2.59 – 2.58, 2.56–2.55 and ca. 2.51 Ga (Davis et al., 2003a). The intervals 2.64–2.61 and 2.59–2.58 Ga are significant and can be directly correlated with events recorded in the surface geology (Davis et al., 2003a). Neoarchean zircon growth recorded in the xenoliths at 2.64-2.61 Ga may be related to generation of Defeat suite magma, which was emplaced in the mid-crust at that time. Zircon growth at 2.59-2.58 Ma corresponds to K-feldspar megacrystic biotite granite and peraluminous two-mica granites (Breemen et al., 1992) found throughout the craton.

The zircons of the Artemisia xenoliths have a peak in $^{207}Pb/^{206}Pb$ ages at about 2520 Ma, which is close in age to the youngest population of Neoarchean ages observed by Davis et al., 2003a. However, the Artemisia zircon data also show an extended tail to younger ages, with a subordinate age peak at about 2420 Ma (Figure 24). These observations suggest that post-2.5 Ga thermal events may

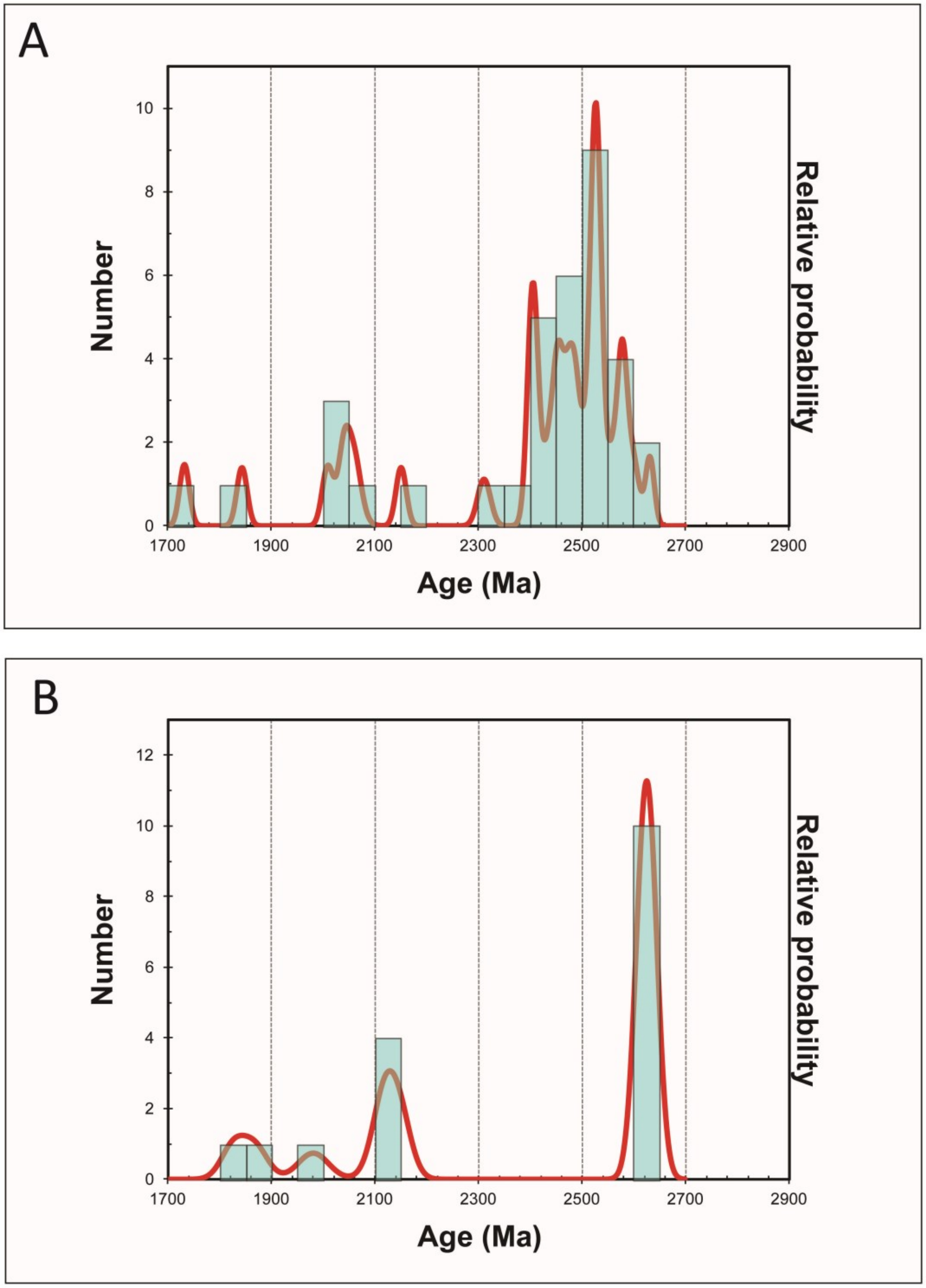

Figure 24: Probability Density Plot of combined zircon (a) and monazite (b) $^{207}Pb/^{206}Pb$ ages for all Artemisia samples. Zircon ages show a main age peak at 2520 Ma with an extended tail to younger ages, with a subordinate age peak at about 2420 Ma

have been more widespread in the lower crust of the northern part of the Slave craton than in the central and southern parts.

In interpreting these results, we acknowledge that in some instances the age peaks discussed are defined by 2 or at most 3 analyses, which makes them less convincing. The age peak at ca. 2520 seems well established in multiple samples in the combined dataset of Figure 24. Thus, that peak probably represents a real event. The remaining peaks between 2400 and 2520 may or may not represent geological events. It is important to also note that the smearing of age distributions visible in the concordia plots of Art-1a, 4 and 6 may also be generated by the Archean-aged zircons undergoing a partial Pb loss during a Paleoproterozoic (ca. 2.2-1.8 Ga) metamorphic/thermal event.

In addition to the 2520 and 2420 Ma age peaks, the Artemisia zircon data also record a broad range of younger ages from ~2300-1700 Ma. Most of the younger ages are from sample Art- 6, which records 2150, 2050, 2010 Ma ages in both a zircon and a monazite grain in the sample. The fact that both zircon and monazite record these ages in this sample suggests that an event or events may have taken place in this time period. These ages are unique and are not easily resolvable with ages found in the Slave craton. As stated previously, it is possible that this xenolith represents a sample that is exotic to the rocks of the Slave, that there is a signature of lower crustal events observed in the crustal column that is not represented in surface or that the zircons and monazite were transported into the sample by the kimberlite and are derived from local country rocks. As the zircon and monazite shared grain boundaries with garnet grains (Figure 20) , it is unlikely the zircon and monazite were derived from local country rock (e.g., detrital grains in the Paleoproterozoic metagreywacke) via transport by the kimberlite.

It is possible that these ages are related to mafic dike swarms that intruded the craton between 2200 and 2000 Ma (Ernst and Buchan, 2001), possibly related to the breakup of Sclavia (Bleeker, 2003). It is also possible that these ages are related to rocks of the Hottah terrane. There is Nd isotope evidence for 2.0-2.4 Ga crust in basement rocks of the Hottah terrane (Bowring and Podesek, 1989). The Hottah terrane was initially thought to be the remnant of an arc developed of the edge of the Slave craton (Hildebrand et al., 1987, Hildebrand and Roots, 1985) or to be exotic to the craton (Hildebrand, 1981; Hoffman, 1980). Lu-Hf systematics on eclogites obtained from the Diavik mine in the central Slave indicated a protolith that formed at ~2.1 Ga (Schmidberger et al., 2007), supporting Paleoproterozoic subduction of oceanic lithosphere along the present-day western margin of the craton. Current work is revealing that the exact relationship between the two crustal blocks is more complex and the Hottah terrane may not be as exotic as once thought. Recent mapping and U-Pb dating in the previously named Wopmay internal zone by Jackson et al. (2013) indicate that a significant portion of this area is also made up of granitic rocks with Neoarchean ages (ca. 2580-2590 Ma), smaller amounts of Meso- to Paleoarchean basement rocks (ca. 2950-3300 Ma) and small amounts of

Yellowknife Supergroup rocks (which may include some Burwash Formation rocks).

Figure 25 illustrates a theorized crustal column for the Artemisia kimberlite location. Sample Art-3 plots at a depth of ~16km and as previously discussed, the lithology and the 2624 ± 11 Ma age recorded by this sample strongly correlates with rocks of the Slave craton. Geothermobarometry quantitatively showed a deep crustal origin of at least 35km for sample Art-4. Based on the mineralogical and textural similarities between samples Art-4 and samples Art-1a and Art-6, we can also assume a deep crustal origin for these samples. U-Pb ages observed in samples Art-1a, Art-4 and Art 6 may be recording signature of Hottah terrane deep in the lower crust. As the Artemisia kimberlite is more or less along strike to where Jackson et al., (2013) did their mapping it may be suggested that the Hottah terrane continues northeast in the crust to the Artemisia kimberlite location. Although the exact relationship between the Hottah and Slave crustal blocks is still under discussion, the samples from Artemisia investigated in the present study support the idea that there are early Paleoproterozoic ages recorded in subsurface rocks that are not clearly exposed and reconcilable with rocks at surface in the northern Slave craton or the northeastern Wopmay orogen.

Still younger Paleoproterozoic ages of 1843± 20, 1826 ± 47 and 1868 ± 49 Ma recorded in a zircon overgrowth and a monazite grain in sample Art-1a suggest some reactivation of the tectonic system at this time. These ages are in fact only slightly younger than the proposed Hottah-Slave collision date of 1882

± 4. (Bowring and Grotzinger, 1992) Recent work has suggested that the assignment of Calderian metamorphism to this time may be slightly too old (Jackson et al., 2013). As such, it seems likely that the 1826-1868 Ma ages recorded in Artemisia samples is related to the Hottah-Slave collision.

Although abundant material was collected from the Artemisia kimberlite that was texturally similar to rocks related to mafic large igneous events (Figure 4), no geochronological evidence was found in the present study that corresponded to major events observed in the Slave, such as the ~1270 Ma Mackenzie large igneous event (LeCheminant and Heaman, 1989) or the ~720 Ma Franklin igneous events (Shellnut et al., 2004). Large igneous provinces represent substantial additions of magma to cratonal lithosphere that can occur long after craton stabilization (Heaman and Pearson, 2010). Given this fact and the proximity of the Artemisia kimberlite to the various proposed plume heads, it is curious that there is no evidence for the dike swarm recorded in the Artemisia lower crustal xenoliths. Other lower crustal xenolith studies from the Slave craton have shown that the Mackenzie event is recorded in the U-Pb systematics of rutile and some zircon (Davis, 1997). Thus, it is possible that further geochronological work on rutile in Artemisia samples may provide evidence of younger large igneous events.

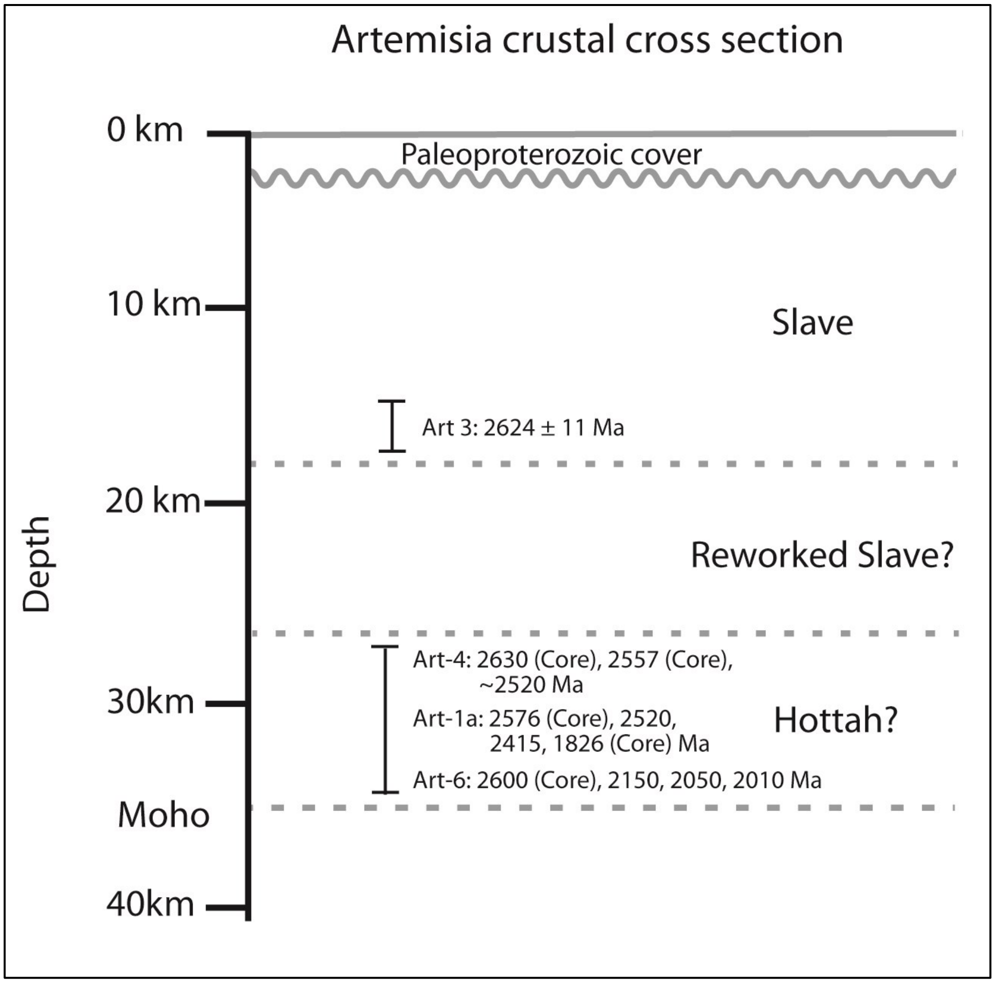

Figure 25: Cross section of the crust below the Artemisia kimberlite highlighting depths and representative ages of Artemisia crustal xenoliths. Depths are based on Geothermobarometry discussed in section 1.4. Although no quantitative P-T conditions were available for Art-1a and Art-6, they are qualitatively similar to Art-4 both mineralogically and texturally, and as such, deep crustal depths are assumed. Unless location of analysis in grain is stated, ages plotted are peaks from probability density plots discussed in section 1.5. Depth of Moho based on work done by Cook et al., 1998. See text for discussion.

1.7. Conclusions

- Overall, the Artemisia, Ekati and Munn Lake xenolith suites investigated in this study illustrates the complexity of unravelling the history of the lower crust.

- In the Slave craton, mafic lithologies dominate the lower crust but are not exclusive. Specifically, all the xenoliths investigated in the present study from the central (Ekati) and southern (Munn) Slave craton were mafic in composition, which is similar to the findings of previous xenoliths studies in those parts of the craton (Davis et al., 2003; Krauss et al., 2007). The Artemisia lower crustal xenoliths of the northern Slave craton, however, have a felsic to intermediate composition.

- Geothermobarometry and petrography of most of the Artemisia samples and all of the Ekati and Munn Lake samples is consistent with granulite-facies metamorphism and supports a deep crustal origin for these samples. Metamorphic conditions of the lower crust as indicated by mineral equilibria are in the 9-12 kbar range of pressures with temperatures of at least 750-800°C. One Artemisia xenolith recorded pressure-temperature conditions of ~4.5 kbar and 650°C indicating that, unlike the other Artemisia samples, it was derived from the middle rather than the lower crust.
- Geochronological study of the mid-crustal Artemisia xenolith yielded a monazite age of 2624 ± 11 Ma, which is similar to ages reported for M1

metamorphism of Burwash formation meta-turbidites from the Slave craton.

- U-Pb dating of zircon in the lower crustal Artemisia xenoliths yielded a few Neoarchean (2.63-2.56 Ga) ages in zircon cores. These may represent the ages of the xenolith protoliths or detrital ages. Several Artemisia lower crustal xenoliths also record a peak in zircon ages at ~2520 Ma, which is similar to some metamorphic ages reported by previous workers for lower crustal xenoliths from the central Slave craton (Davis et al., 2003). The Artemisia xenoliths, however, yielded an array of younger $^{207}Pb/^{206}Pb$ ages between ~2520 and 2050 Ma. These younger ages, which are not recorded in the other Slave craton xenolith suites, may represent multiple episodes of zircon growth in the northern Slave lower crust during that time interval or variable Pb loss from Neoarchean zircons during one or more post-2.3 Ga thermal events.

- Geochronology from the Artemisia samples supports previous observations from the central and southern Slave craton that metamorphism appears to continue in the lower crust beyond what is seen on the surface.

- Ages observed in the Artemisia Suite xenoliths may be showing events not seen on the surface and there is a possible correlation with rocks of the Hottah terrane or mafic dike swarms that affected the Slave craton between 2200 and 2000 Ma.

- In the northern Slave, Neoarchean and earliest Paleoproterozoic metamorphic events are recorded at 2624±11 Ma, 2520Ma and possibly also 2415 Ma, 2150 Ma, 2050 Ma and weakly at 2010 Ma.
- Paleoproterozoic ages of 1843± 20, 1826 ± 47 and 1868 ± 49 Ma may be evidence of the Slave-Hottah collision recorded in the lower crust.
- Although abundant material similar to rocks of large mafic igneous events were sampled from the Artemisia kimberlite, these events are not recorded in the zircon and monazite histories of the lower crustal samples.

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APPENDIX A: Petrographical Descriptions

Sample List:

Art-1a	Hand Sample and Thin Section
Art-3	Hand Sample and Thin Section
Art-4	Hand Sample and Thin Section
Art-6	Hand Sample and Thin Section
Art-8	Hand Sample and Thin Section
Art-9	Hand Sample and Thin Section
Art-10	Hand Sample and Thin Section
Art-11	Hand Sample and Thin Section
Art-12	Hand Sample and Thin Section
Art-13a	Hand Sample and Thin Section
Art-C (1-10)	Hand Sample and Thin Sections
EKT-9B	Hand Sample and Thin Section
EKT-9D	Hand Sample and Thin Section
EKT-11A	Thin Section
EKT-11B	Thin Section
EKT-12	Thin Section
BD-184	Hand Sample and Thin Section
Pt-Lk-1	Hand Sample and Thin Section
MN 51311	Thin Section
MN 51312	Thin Section
MN 51313	Thin Section
MN 51314	Thin Section
CM-1	Hand Sample and Thin Section

Artemisia Kimberlite, NU

The Artemisia samples were collected from the Artemisia kimberlite pipe which intrudes into rocks of the Coronation Supergroup (Figure 2). The kimberlite erupted in the sloped edge of a hill and intruded into rocks of the Rocknest FM of the Coronation Supergroup. The kimberlite itself was highly altered and samples were able to be collected by hand at surface. Based on initial appearance the samples were divided into the Art and Art-C sample suites. Xenoliths from the Art suite are described individually and xenoltihs from the Art-C suite are described as a group.

Art-1a

Hand sample: Art-1a is ~ 5cm in width and appears to be a small fragment of a larger xenolith. The massive groundmass is weathered to a grayish-green colour with garnet grains visible with a hand lense.

Thin section: moderate plagioclase (~0.5mm) is present in separated clusters from the garnet. The Garnet grains are 0.5 to 1cm across with minor fracturing. There is minor chlorite alteration along fractures and grain boundaries. The sample has been affected by heavy alteration. Zircon and rutile are present as accessory minerals and are found predominantly in the alteration zones.

Art-3

Hand sample: xenolith is ~ 10 cm in diameter and is a massive rounded sample with a dark green groundmass. Small garnet grains are visible with a hand lense.

Thin section: Sample is composed of garnet (1-2mm), cordierite (1-2mm), plagioclase (0.5-1.5mm) and biotite (0.5-1mm), with accessory sillimanite (0.5mm), monazite (~0.1mm) and rutile (<0.5mm). This sample is less altered than the other samples from this suite (Figure 5). Mineral grains have well formed euhedral grain boundaries. Sillimanite is present in minor abundance and is found as small grains throughout that sample. There is a suggestion of weakly developed foliation in Biotite grains. Sample has been affected by minor retrograde chloritization.

Art-4

Hand sample: xenolith is ~ 10 cm in diameter and is a massive rounded sample with a dark green groundmass. Small garnet grains are visible with a hand lense.

Thin section: Garnet grains are subhedral, fractured and ~1mm across. Clusters of plagioclase grains (<0.5mm) are separated from the garnets by large zones of heavy alteration. There is a moderate abundance of large (~0.5mm), strongly coloured rutile grains. Weak granoblastic texture is developed in plagioclase zones.

Art-6

Hand sample: ~5cm in diameter with gray/green weathering. Garnet is the only mineral visible with a hand lense.

Thin section: Fractured subhedral garnets ranging in size from 1-3 mm, with small remnants of plagioclase (<0.5mm) preserved within an altered groundmass. Alteration dominated by chlorite with minor component of biotite. The only well preserved mineral is garnet.

Art-8

Hand sample: ~10cm in diameter with gray/green weathering. Garnet is the only mineral identified in hand sample.

Thin section: garnet grains are ~1-1.5mm across and are rounded, sub-euhedral and highly fractured. Groundmass is highly altered. There is chloritization along fractures and around garnet rims. Small (<0.5mm) remnants of kspar can be identified by weakly preserved exosolution texture in ppl. There is a minor abundance of rutile in present in the groundmass and as inclusion in garnet.

Art-9

Hand sample: ~5cm in diameter with gray/green weathering. Garnet is the only mineral indentified in hand sample.

Thin section: garnet is ~0.5-1 cm in diameter and is subhedral and highly fractured. The sample has been affected by pervasive alteration and the only other mineral preserved is minor rutile (0.5-1mm).

Art-10

Hand sample: ~5cm in diameter with gray/green weathering. Garnet is the only mineral indentified in hand sample.

Thin section: Garnets and rutile are the only well preserved minerals in this sample. The remainder of the groundmass has been affected by pervasive alteration. The garnets are anhedral, highly fractured grains that are ~ 0.5-2mm in diameter. Rutile is present as small (<0.5mm) inclusions in the garnet and groundmass. Garnet rims have been affected by minor chloritization.

Art-11

Hand sample: ~5cm in diameter with gray/green weathering. Garnet is the only mineral indentified in hand sample.

Thin section: garnet grains are ~1mm across and are subhedral with a minor abundance of fracturing. Plagioclase grains are ~0.5mm across and are well preserved and display a weak granoblastic texture. A minor abundance of small strongly coloured rutile and small (<0.5mm) rounded quartz grains are identifiable. Sample is affected minor alteration along grain boundaries.

Art-12

Hand sample: ~5cm in diameter with gray/green weathering. Garnet is the only mineral indentified in hand sample.

Thin section: garnet grains are ~0.5-1mm in diameter and are well rounded, anhedral grains with minor fractures. Plagioclase, kspar and minor quartz comprise the remainder of the sample and are <0.5mm in diameter. Minor granoblastic texture is developed. The sample is affected by moderate alteration and secondary grains of biotite (~0.5mm) are visible in alteration zones.

Art-13a

Hand Sample: ~5cm in diameter with gray/green weathering. Garnet is the only mineral indentified in hand sample.

Thin section: Grt, ~0.5mm Qtz Pl, Rutile, Biotite. Biotite occurs as small inclusion inside of the garnet grains. Moderate development of Granoblastic texture and moderate alteration of groundmass

Art-C Group (1-10)

Hand samples: Xenoliths range in size from 5-30 cm in diameter and are well rounded massive sphere shaped samples. Plagioclase is visible in hand sample.

Thin sections: Plagioclase laths are 1mm in length, display simple twins and form an interlocking texture. Orthopyroxene and clinopyroxene range from 0.5-1mm and are subhedral to anhedral. Moderate alteration is present along grain boundaries and in some xenoliths mineral grains have been affected by minor retrograde chloritization.

Ekati Kimberlite Field, NWT

Samples EKT-9B, EKT-9D, EKT-11A, EKT-11B and EKT-12 were provided by Dr.Graham Pearson of the University of Alberta and samples BD-184 and Point-Lk-1 were provided by Dr. B. Kjarsgaard of the Geological Survey of Canada.

EKT-9B

Hand sample: sample is ~3cm in diameter and was removed from core. Garnet, clinopyroxene and plagioclase are visible with a hand lense.

Thin section: sample is composed of garnet (~1-2mm), clinopyroxene (~1-1.5mm), plagioclase (~0.5-1mm) and minor rutile (<0.5mm) and ilmenite(<0.5mm). Grains range in shape from subhedral to euhedral. The garnet grains are significantly larger than the other minerals (~2mm in diameter). There are well defined grain boundaries with minimal alteration and moderate granoblastic texture is developed. Rutile and ilmenite occur as inclusions within the garnet, clinopyroxene and plagioclase. There are abundant inclusions observable within the clinopyroxene.

EKT-9D

Hand sample: sample is ~3cm in diameter and 0.5cm in width. Garnet, clinopyroxene and plagioclase are visible with a hand lense.

Thin section: sample is composed of garnet (~1-2mm), clinopyroxene (~0.5-1.5mm), plagioclase (~1-1.5mm), hornblende (0.5-1mm) and minor rutile and ilmenite. Grains range in shape from subhedral to euhedral. The garnet grains are significantly larger than the other minerals. There are well defined grain boundaries with minimal alteration. The hornblende is found adjacent to the clinopyroxene and its presence is indicative of a slightly higher hydrous content in this xenolith. Minor alteration along grain boundaries is present and a moderate granoblastic texture is developed.

EKT-11A

Hand sample: None available

Thin section: Sample is composed of garnet (~1mm), clinopyroxene (~0.5mm), plagioclase (1-2mm), orthopyroxene(0.5mm) and minor rutile(<0.5mm) and ilmenite(0.5mm) (Figure 2-2(c)). The subhedral plagioclase and garnets grains are larger than the euhedral clinopyroxene and orthopyroxene. The garnets are irregularly shaped and disseminated throughout the sample. Moderate granoblastic texture is developed. There is some isolated alteration due to secondary biotite throughout the sample and some minimal alteration observed along grain boundaries. A second generation occurs in symplectic intergrowths with quartz in spatial association with pyroxene grains. It's possible that this later garnet formed by isobaric cooling.

EKT-11B

Hand sample: None available

Thins section: Sample EKT-11B is composed of garnet, clinopyroxene, plagioclase, rutile and ilmenite, with large irregular shaped garnets (Figure 2-2(d)). On average, the clinopyroxene has a smaller grain size than the garnets and is segregated into clusters. There is some alteration of the clinopyroxene, but care was taken during analysis to avoid the obviously altered grains. Moderate granoblastic texture is developed. The majority of the grain boundaries are unaltered, though there is some minor alteration along cracks. Based on this textural evidence, the sample is expected to represent an equilibrium assemblage.

EKT-12

Hand sample: None available

Thin section: Sample is composed of garnet (~0.5-1mm), clinopyroxene (~1-2 mm), plagioclase (~0.5 mm) and minor quartz (<0.5mm) and rutile (0.5mm) (Figure 2-2(e)). Compared to the other samples in this suite, there is a lower abundance of plagioclase. Garnets are small and disseminated throughout the sample, while the clinopyroxene is larger and inclusion rich. There is symplectic growth observed between quartz and clinopyroxene. Quartz is also present in larger grains away from the symplectic growth. There is minor alteration along cracks and grains boundaries, but there is no textural evidence to suggest disequilibrium in the sample.

BD-184

Hand sample: Sample was removed from kimberlitic core and is ~10cm in diameter. Sample was greenish gray in hand sample and appeared to have been affected by secondary alteration. Garnet grains were visible with a hand sample.

Thin section: Sample is composed of garnet (~0.5mm), clinopyroxene (0.5mm), plagioclase (1-2mm) and minor rutile (<0.5mm) and quartz (<0.5mm). The garnet, clinopyroxene and orthopyroxene are euhedral and define a weak granoblastic texture. Moderate amounts of clinopyroxene and some larger sections of plagioclase grains have been affected by varying degrees of alteration.

<u>Point-Lk-1</u>

Hand sample: The xenolith was removed from kimberlitic core and is subrounded and ~ 10cm in diameter. The sample is a pale green colour and small (~1mm) garnet and clinopyroxene grains are visible with a hand lense.

Thin section: Sample is composed of garnet (~1mm), clinopyroxene (~1mm), plagioclase (~1mm) and minor rutile (<0.5mm) and ilmenite (<0.5mm). The garnet and clinopyroxene are euhedral and define a moderately developed granoblastic texture. The rutile and ilmenite occur as minor inclusions within the garnet and clinopyroxene. There is limited alteration along fractures and grain boundaries.

Munn Lake Kimberlite, NWT

Samples provided by Dr. Thomas Chacko of the University of Alberta. No hand samples were available for the samples.

<u>MN51311</u>

Thin section: sample is composed of garnet, clinopyroxene, plagioclase and minor rutile. Garnet, clinopyroxene and plagioclase are ~1-2mm in diameter. This sample is equigranular, with euhedral mineral grains displaying a well developed granoblastic texture. Grain boundaries have been affected by little alteration.

<u>MN51312</u>

Thin section: Sample is composed of garnet, clinopyroxene, plagioclase and minor rutile and ilmenite. Garnet, clinopyroxene and plagioclase are ~1-2mm in diameter. This sample is moderately equigranular, with a range of grain shapes from subhedral to euhedral. There is a small degree of variation in the grain size of the clinopyroxene, as well as varying degrees of minor alteration to some of the grains.

MN51313

Thin section: Sample is composed of garnet, clinopyroxene, plagioclase and orthopyroxene with a grain size of ~1-2mm. The grains define a granoblastic texture and are roughly equigranular. The majority of the grains are inclusion free and euhedral in shape. The garnets are slightly larger than the clinopyroxene and there is almost no alteration is observed along grain boundaries or cracks.

MN51314

Thin section: Sample is composed of garnet, clinopyroxene, plagioclase and rutile. The grains are 1-2mm in diameter. The sample is defined by euhedral grains with minimal mineral inclusions and minor development of a granoblastic texture. There is little alteration along grain boundaries and cracks.

Kugluktuk, NWT (Coronation Gabbroic sills)

Two samples were collected in Kugluktuk, NWT for the purpose of comparison to the Art-C sample suite.

CM-1, CM-2

Hand sample: samples are both ~ 15cm in length and ~5cm in with and are characteristic of fine grained basalt.

Thin section: Plagioclase laths are 1mm in length, display simple twins and form an interlocking texture. Orthopyroxene and Clinopyroxene range from 0.5-1mm and are subhedral to euhedral. The mineral grain boundaries are well preserved and the samples have been affected by only minor secondary alteration.

APPENDIX B: EMPA Analytical Data

Table B-1 EMPA summary

Artemisia

Garnet:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Total
Art-3	37.59	0.01	21.64	0.03	34.59	1.11	3.62	1.51	0.20	0.14	100.43
	37.56	0.03	21.58	0.00	34.83	1.16	3.58	1.55	0.25	0.05	100.59
	37.64	0.01	21.64	0.06	35.29	1.16	3.49	1.57	0.04	0.02	100.91
	37.77	0.00	21.71	0.00	35.40	1.28	3.32	1.52	0.03	0.00	101.02
	37.78	0.03	21.69	0.00	34.81	1.26	3.63	1.85	0.11	0.01	101.16
	37.47	0.03	21.75	0.04	34.71	1.18	3.74	1.81	0.11	0.08	100.91
	37.41	0.02	21.58	0.04	35.15	1.20	3.69	1.75	0.05	0.00	100.88
	37.76	0.00	21.67	0.02	35.35	1.25	3.45	1.53	0.04	0.00	101.04
	37.99	0.05	21.59	0.11	34.96	1.35	3.58	1.49	0.11	0.05	101.26
	37.78	0.03	21.79	0.00	34.98	1.35	3.48	1.57	0.15	0.12	101.23
	37.80	0.00	21.73	0.07	35.05	1.30	3.54	1.53	0.10	0.06	101.17
	37.99	0.05	21.79	0.14	35.28	1.28	3.41	1.51	0.11	0.06	101.62
Art-4	40.13	0.05	23.06	0.09	22.89	0.32	12.11	2.68	0.07	0.04	101.43
	40.00	0.05	22.68	0.11	22.85	0.32	11.99	2.59	0.06	0.01	100.65
	39.86	0.08	22.81	0.13	23.02	0.31	11.73	2.76	0.04	0.01	100.76
	39.98	0.05	22.91	0.12	22.80	0.31	11.79	2.87	0.07	0.02	100.91
	39.98	0.02	22.78	0.07	22.86	0.32	11.65	3.25	0.07	0.02	101.01
	40.03	0.03	22.86	0.11	22.98	0.29	12.17	2.10	0.02	0.01	100.59
	39.72	0.00	22.91	0.12	22.79	0.34	12.11	2.14	0.12	0.07	100.32
	39.75	0.03	22.84	0.11	22.84	0.30	12.20	2.24	0.05	0.07	100.43
	39.92	0.04	23.03	0.13	22.66	0.33	12.10	2.54	0.06	0.01	100.83
	40.30	0.05	22.97	0.14	22.81	0.31	11.68	3.25	0.04	0.01	101.54
	39.99	0.07	22.72	0.08	22.72	0.28	11.62	3.03	0.01	0.01	100.51
	39.81	0.05	22.85	0.07	22.83	0.31	11.75	2.93	0.03	0.03	100.65
	39.98	0.02	22.84	0.09	22.61	0.30	11.55	3.04	0.02	0.00	100.45
	39.99	0.02	22.69	0.16	22.50	0.27	11.66	3.09	0.04	0.01	100.44
	40.05	0.01	22.49	0.14	22.16	0.34	11.36	3.22	0.27	0.20	100.23
Art-8	39.56	0.02	22.99	0.09	23.76	0.26	11.71	1.82	0.07	0.02	100.30
	39.72	0.01	22.76	0.11	23.98	0.28	11.81	1.93	0.03	0.01	100.64

	39.72	0.03	23.05	0.13	23.71	0.30	11.87	1.98	0.05	0.00	100.82
	39.74	0.04	22.82	0.14	23.28	0.29	11.75	2.18	0.04	0.01	100.28
	39.84	0.03	22.67	0.09	23.11	0.33	11.49	2.28	0.05	0.00	99.88
	39.90	0.04	22.95	0.08	23.80	0.29	11.89	1.90	0.05	0.01	100.92
	40.18	0.01	23.09	0.08	23.89	0.30	11.95	1.89	0.01	0.00	101.40
	40.00	0.05	23.18	0.10	23.98	0.32	11.78	1.95	0.07	0.02	101.44
	39.81	0.05	22.87	0.04	23.76	0.30	11.84	2.09	0.06	0.00	100.80
	39.63	0.05	22.54	0.10	23.50	0.28	11.62	2.26	0.18	0.03	100.19
	39.74	0.00	22.81	0.09	23.93	0.30	11.81	1.95	0.05	0.02	100.70
	39.54	0.01	23.27	0.11	23.71	0.30	11.84	1.98	0.10	0.02	100.88
	39.35	0.02	23.02	0.11	23.82	0.28	11.79	2.03	0.05	0.02	100.49
	39.35	0.01	22.94	0.08	23.75	0.30	11.88	2.07	0.05	0.01	100.46
	39.47	0.04	23.20	0.14	23.75	0.33	11.62	2.32	0.04	0.02	100.93
Art-9	39.78	0.03	23.01	0.02	23.40	0.30	11.82	1.75	0.05	0.00	100.17
	39.97	0.00	22.83	0.05	23.55	0.30	11.83	1.73	0.03	0.02	100.29
	39.99	0.00	22.87	0.10	23.70	0.26	11.82	1.77	0.01	0.00	100.53
	40.17	0.02	22.82	0.08	23.71	0.29	11.77	1.76	0.03	0.00	100.64
	39.92	0.02	22.99	0.10	23.66	0.32	11.99	1.69	0.01	0.00	100.69
	39.87	0.02	22.88	0.07	23.87	0.30	11.91	1.71	0.00	0.00	100.63
	40.07	0.02	23.02	0.04	23.84	0.26	11.90	1.70	0.02	0.00	100.86
	39.99	0.03	22.78	0.09	23.50	0.33	12.04	1.72	0.00	0.00	100.48
	39.95	0.00	23.09	0.06	23.83	0.31	11.95	1.67	0.00	0.00	100.87
	39.85	0.00	23.03	0.02	23.87	0.30	12.08	1.71	0.01	0.00	100.87
	39.71	0.03	22.74	0.05	23.49	0.34	11.84	1.67	0.01	0.00	99.87
	39.80	0.00	22.64	0.06	23.61	0.29	11.88	1.69	0.04	0.02	100.03
	39.86	0.00	22.85	0.08	23.39	0.30	11.92	1.75	0.04	0.00	100.18
	39.76	0.03	22.94	0.02	23.49	0.29	11.76	1.71	0.03	0.01	100.02
	39.76	0.00	22.78	0.09	23.68	0.30	12.00	1.79	0.03	0.01	100.43
	39.84	0.02	22.89	0.07	23.81	0.30	12.04	1.48	0.00	0.00	100.45
	39.83	0.01	22.91	0.03	23.79	0.27	12.02	1.42	0.02	0.01	100.30
	39.65	0.04	22.86	0.07	23.78	0.30	11.91	1.44	0.00	0.00	100.06
	39.31	0.01	22.81	0.07	23.48	0.26	11.94	1.50	0.03	0.00	99.41
	39.58	0.02	22.89	0.10	23.46	0.31	12.06	1.57	0.00	0.00	99.97
	39.61	0.02	22.91	0.07	23.72	0.30	12.10	1.55	0.03	0.00	100.29
	39.53	0.02	22.86	0.10	23.36	0.32	11.97	1.59	0.02	0.00	99.77
	39.47	0.04	22.85	0.02	23.41	0.31	12.06	1.66	0.00	0.02	99.84
	39.53	0.00	23.02	0.05	23.53	0.28	11.94	1.66	0.00	0.00	100.01

	39.61	0.04	22.74	0.03	23.37	0.32	11.69	1.73	0.05	0.00	99.56
	39.65	0.04	22.72	0.08	23.37	0.31	11.97	1.77	0.03	0.01	99.94
	39.51	0.02	22.81	0.07	23.47	0.29	11.89	1.73	0.00	0.00	99.79
	39.72	0.01	22.79	0.09	23.55	0.28	11.94	1.58	0.04	0.01	100.00
	39.61	0.06	22.75	0.00	23.68	0.31	11.93	1.58	0.00	0.00	99.92
	39.68	0.01	22.78	0.15	23.68	0.32	12.00	1.52	0.03	0.01	100.16
	39.79	0.00	22.88	0.07	23.60	0.35	12.01	1.51	0.00	0.00	100.21
	39.57	0.03	22.99	0.08	23.37	0.25	11.95	1.60	0.04	0.00	99.88
	39.76	0.05	23.04	0.05	23.83	0.27	11.91	1.62	0.04	0.01	100.58
	39.52	0.07	22.84	0.11	23.37	0.32	11.87	1.64	0.00	0.01	99.75
	39.80	0.00	23.10	0.09	23.49	0.28	12.01	1.71	0.05	0.00	100.52
	39.58	0.00	22.78	0.14	23.60	0.32	11.84	1.64	0.03	0.00	99.94
	39.64	0.00	22.86	0.08	23.80	0.30	11.88	1.75	0.01	0.00	100.31
	39.02	0.06	29.67	0.10	19.60	0.24	9.50	1.51	0.04	0.00	99.73
	39.59	0.00	23.06	0.06	23.69	0.30	11.69	1.95	0.02	0.00	100.35
Art-10	39.48	0.05	22.95	0.11	23.22	0.32	11.75	2.25	0.00	0.02	100.15
	39.66	0.03	22.89	0.07	23.07	0.30	11.96	2.16	0.03	0.00	100.16
	39.65	0.03	22.88	0.07	23.32	0.31	11.92	2.12	0.05	0.00	100.35
	39.55	0.00	22.68	0.06	23.20	0.32	11.87	2.10	0.00	0.01	99.78
	39.52	0.03	22.72	0.13	23.15	0.30	11.76	2.03	0.02	0.01	99.66
	39.61	0.00	22.86	0.11	23.12	0.34	11.97	2.10	0.00	0.00	100.10
	39.61	0.04	22.80	0.09	23.14	0.35	11.83	2.02	0.03	0.02	99.93
	39.66	0.01	22.66	0.05	22.90	0.31	11.92	2.11	0.01	0.00	99.62
	39.65	0.02	23.00	0.11	23.12	0.31	12.01	2.08	0.04	0.01	100.33
	39.72	0.00	22.77	0.12	23.24	0.36	11.89	2.14	0.02	0.00	100.27
	39.49	0.03	22.95	0.08	23.00	0.33	11.77	2.21	0.00	0.00	99.86
	39.66	0.00	22.79	0.08	22.92	0.34	11.70	2.54	0.04	0.01	100.07
	39.62	0.01	22.88	0.10	22.71	0.30	11.68	2.77	0.02	0.00	100.11
	39.66	0.03	22.80	0.09	22.86	0.32	11.75	2.70	0.02	0.00	100.22
	39.88	0.04	22.88	0.06	22.73	0.32	11.63	2.82	0.04	0.00	100.39
	39.61	0.02	22.65	0.09	22.69	0.35	11.67	2.82	0.03	0.01	99.93
	39.91	0.06	22.68	0.14	22.60	0.29	11.60	2.79	0.03	0.00	100.12
	39.73	0.05	22.93	0.14	22.83	0.32	11.50	2.77	0.03	0.00	100.30
	39.60	0.03	22.54	0.07	22.63	0.34	11.45	2.85	0.03	0.00	99.54
	39.24	0.03	22.74	0.12	22.54	0.30	11.39	2.79	0.04	0.00	99.19
	39.74	0.04	22.72	0.07	22.86	0.30	11.56	2.84	0.04	0.01	100.18
	39.87	0.03	22.67	0.02	23.04	0.33	11.61	2.92	0.01	0.00	100.48

	39.78	0.02	22.72	0.12	22.73	0.34	11.65	2.88	0.04	0.00	100.29
	39.67	0.04	22.89	0.07	22.95	0.29	11.34	3.00	0.04	0.00	100.28
	39.84	0.03	22.79	0.07	22.70	0.31	11.59	3.05	0.00	0.00	100.36
	39.95	0.02	22.68	0.10	22.77	0.28	11.41	3.05	0.04	0.00	100.28
	39.98	0.02	22.55	0.12	22.84	0.31	11.67	3.12	0.03	0.00	100.64
	40.02	0.04	22.90	0.10	23.04	0.34	11.89	2.41	0.03	0.00	100.76
	39.95	0.00	22.77	0.13	22.63	0.29	11.92	2.51	0.05	0.01	100.26
	39.87	0.00	22.80	0.15	22.79	0.32	11.86	2.41	0.02	0.01	100.24
	39.85	0.00	22.72	0.06	22.70	0.32	11.95	2.48	0.01	0.00	100.08
	39.77	0.04	22.90	0.08	22.76	0.32	11.79	2.40	0.03	0.00	100.08
	39.76	0.03	22.84	0.11	22.77	0.38	11.84	2.48	0.05	0.01	100.27
	39.86	0.01	22.84	0.07	22.80	0.31	11.90	2.48	0.04	0.00	100.30
	39.89	0.07	22.78	0.11	22.67	0.33	11.70	2.48	0.02	0.00	100.04
	39.74	0.09	22.89	0.07	22.76	0.28	11.82	2.67	0.01	0.01	100.34
	39.72	0.08	22.95	0.12	22.75	0.27	11.73	2.64	0.00	0.00	100.25
	39.83	0.04	22.93	0.14	22.74	0.34	11.67	2.79	0.02	0.00	100.50
	39.85	0.06	22.83	0.11	22.80	0.31	11.54	2.93	0.03	0.01	100.47
	39.75	0.07	22.92	0.06	22.84	0.30	11.52	2.99	0.03	0.01	100.49
	39.70	0.00	22.83	0.08	22.56	0.28	11.46	3.01	0.01	0.00	99.93
Art-11	40.03	0.06	22.75	0.08	22.61	0.28	11.48	3.19	0.04	0.02	100.52
	39.94	0.02	22.75	0.15	22.29	0.33	11.54	3.18	0.04	0.01	100.25
	39.80	0.03	22.81	0.03	22.33	0.33	11.59	3.20	0.01	0.00	100.12
	39.93	0.06	22.55	0.14	22.53	0.33	11.63	3.14	0.08	0.01	100.39
	40.22	0.04	22.94	0.09	22.61	0.31	11.77	3.16	0.03	0.00	101.15
	39.60	0.05	22.63	0.13	22.41	0.36	11.81	3.20	0.02	0.01	100.22
	39.97	0.04	22.86	0.06	22.66	0.32	11.59	3.21	0.02	0.02	100.75
	39.89	0.01	22.85	0.15	22.44	0.31	11.73	3.15	0.00	0.00	100.52
	39.90	0.04	22.86	0.12	22.35	0.30	11.72	3.19	0.03	0.01	100.52
	39.84	0.04	22.88	0.09	22.61	0.34	11.67	3.15	0.03	0.00	100.65
	39.77	0.01	22.69	0.07	22.37	0.28	11.60	3.24	0.05	0.02	100.09
	39.62	0.02	22.73	0.06	22.56	0.32	11.86	3.10	0.04	0.00	100.31
	39.83	0.06	22.93	0.02	22.25	0.31	11.54	3.18	0.04	0.01	100.15
	40.01	0.05	22.83	0.07	22.45	0.34	11.62	3.19	0.06	0.00	100.63
	39.92	0.05	22.95	0.09	22.33	0.32	11.52	3.24	0.03	0.00	100.45
	39.98	0.04	22.87	0.12	22.69	0.34	12.08	2.23	0.03	0.01	100.39
	39.93	0.03	22.78	0.11	22.70	0.34	12.18	2.22	0.01	0.01	100.30
	40.12	0.04	23.06	0.15	22.89	0.32	12.16	2.20	0.04	0.02	101.00

	40.05	0.05	22.91	0.10	22.73	0.31	12.16	2.26	0.02	0.00	100.56
	39.76	0.05	22.92	0.12	22.83	0.32	12.17	2.24	0.03	0.01	100.44
	39.46	0.00	22.90	0.13	22.65	0.29	12.05	2.25	0.02	0.01	99.76
	39.59	0.03	22.92	0.12	22.72	0.35	12.08	2.34	0.04	0.01	100.20
	39.61	0.00	22.76	0.14	22.59	0.32	12.17	2.36	0.01	0.00	99.96
	39.70	0.00	22.77	0.15	22.76	0.35	12.08	2.41	0.00	0.01	100.21
	39.86	0.03	23.01	0.07	22.43	0.34	11.98	2.46	0.05	0.01	100.25
	39.64	0.00	22.80	0.10	22.62	0.30	12.02	2.57	0.03	0.01	100.09
	39.94	0.04	22.71	0.07	22.53	0.31	11.79	2.75	0.01	0.00	100.13
	39.65	0.03	22.66	0.04	22.12	0.31	11.82	2.76	0.01	0.01	99.40
	39.93	0.03	22.83	0.07	22.34	0.31	11.81	2.85	0.05	0.00	100.21
	39.75	0.00	22.71	0.07	22.56	0.34	11.55	3.05	0.03	0.03	100.10
	39.64	0.03	22.79	0.08	22.73	0.32	11.79	2.59	0.01	0.00	99.98
	39.68	0.00	22.76	0.08	22.79	0.32	11.78	2.73	0.00	0.01	100.15
	39.58	0.04	22.74	0.09	22.49	0.30	11.76	2.68	0.01	0.00	99.68
	39.77	0.00	22.81	0.13	22.52	0.34	11.90	2.67	0.02	0.02	100.18
	39.69	0.01	22.65	0.11	22.34	0.27	11.59	2.62	0.00	0.01	99.28
	39.26	0.07	22.63	0.05	22.24	0.27	11.84	2.60	0.04	0.01	99.01
	39.16	0.03	22.45	0.10	22.37	0.34	11.70	2.69	0.04	0.00	98.88
	39.44	0.00	22.68	0.15	22.38	0.35	11.85	2.71	0.02	0.00	99.58
	40.03	0.06	22.95	0.10	22.66	0.28	11.77	2.81	0.02	0.01	100.68
	39.77	0.03	22.90	0.12	22.66	0.32	11.63	2.93	0.03	0.00	100.38
	39.71	0.03	22.73	0.04	22.14	0.29	11.59	3.02	0.00	0.00	99.54
	39.56	0.02	22.32	0.09	22.21	0.32	11.57	2.97	0.00	0.00	99.05
	39.26	0.02	22.60	0.04	22.44	0.32	11.54	2.99	0.02	0.01	99.24
	40.01	0.05	22.74	0.12	22.57	0.32	11.55	3.06	0.05	0.02	100.49
	39.73	0.03	22.62	0.16	22.24	0.32	11.60	3.31	0.04	0.00	100.06
Art-12	40.48	0.05	23.20	0.10	22.60	0.26	13.21	1.59	0.01	0.00	101.50
	40.52	0.01	22.95	0.09	22.68	0.26	13.01	1.60	0.05	0.02	101.19
	40.31	0.00	22.97	0.05	22.46	0.26	13.17	1.60	0.06	0.00	100.87
	40.46	0.00	22.95	0.08	22.50	0.27	13.15	1.63	0.04	0.00	101.09
	40.58	0.03	23.06	0.10	22.39	0.26	13.12	1.65	0.05	0.00	101.24
	40.26	0.02	23.18	0.07	22.25	0.29	13.15	1.68	0.04	0.03	100.97
	40.37	0.05	23.11	0.00	22.40	0.28	13.17	1.70	0.00	0.00	101.07
	40.15	0.02	23.40	0.10	22.30	0.31	13.12	1.69	0.04	0.03	101.14
	40.38	0.02	23.12	0.03	22.41	0.24	13.16	1.73	0.02	0.02	101.12
	40.42	0.00	23.38	0.10	22.23	0.23	12.95	1.77	0.05	0.04	101.16

	40.46	0.00	23.19	0.09	22.52	0.28	13.08	1.65	0.08	0.02	101.37
	40.52	0.03	23.16	0.06	22.54	0.28	12.97	1.60	0.06	0.02	101.25
	40.43	0.04	23.07	0.03	22.69	0.30	12.92	1.57	0.03	0.00	101.09
	40.39	0.00	23.19	0.09	23.11	0.29	12.67	1.67	0.01	0.01	101.43
Art-13	40.05	0.03	22.66	0.10	22.52	0.34	11.62	2.99	0.04	0.00	100.34
	40.06	0.05	22.47	0.13	22.68	0.34	11.64	2.93	0.04	0.01	100.34
	39.66	0.00	22.37	0.08	22.42	0.33	11.50	2.99	0.18	0.01	99.53
	39.77	0.03	22.58	0.18	22.30	0.34	11.53	3.03	0.07	0.01	99.84
	40.12	0.01	22.54	0.14	22.51	0.31	11.80	3.01	0.02	0.01	100.47
	40.03	0.03	22.57	0.17	22.59	0.32	11.56	3.01	0.04	0.03	100.35
	40.10	0.02	22.68	0.09	22.51	0.32	11.61	3.06	0.05	0.02	100.46
	40.05	0.03	22.69	0.11	22.58	0.29	11.66	3.06	0.03	0.01	100.51
	40.06	0.00	22.51	0.10	22.45	0.26	11.59	3.10	0.03	0.01	100.11
	39.92	0.06	22.85	0.11	22.37	0.32	11.42	3.13	0.01	0.02	100.20
	39.85	0.05	22.55	0.07	22.41	0.36	11.55	3.10	0.05	0.00	99.99
	39.93	0.04	22.67	0.02	22.65	0.31	11.43	3.14	0.04	0.00	100.23
	39.83	0.03	22.67	0.09	22.39	0.30	11.40	3.21	0.04	0.03	99.99
	39.86	0.03	22.54	0.10	22.25	0.32	11.72	3.15	0.04	0.00	100.02
	39.90	0.07	22.50	0.07	22.53	0.34	11.61	3.12	0.03	0.00	100.18
	40.00	0.02	22.45	0.13	22.19	0.33	11.61	3.08	0.02	0.00	99.82
	39.76	0.03	22.35	0.12	22.28	0.30	11.53	3.08	0.01	0.00	99.45
	40.02	0.03	22.61	0.07	22.44	0.34	11.63	3.13	0.03	0.01	100.31
	39.71	0.06	22.56	0.09	22.19	0.33	11.48	3.07	0.04	0.00	99.52
	39.79	0.00	22.46	0.09	22.42	0.31	11.59	3.15	0.03	0.00	99.85
	40.13	0.06	22.44	0.04	22.31	0.29	11.58	3.19	0.00	0.00	100.04
	39.89	0.07	22.56	0.05	22.47	0.34	11.62	3.14	0.04	0.00	100.18
	40.32	0.02	22.55	0.06	22.44	0.30	11.65	3.10	0.04	0.01	100.48
	39.96	0.04	22.46	0.13	22.36	0.31	11.58	3.17	0.03	0.00	100.02
	40.00	0.02	22.60	0.09	22.58	0.32	11.44	3.18	0.02	0.02	100.27
	39.90	0.02	22.50	0.05	22.39	0.33	11.56	3.21	0.00	0.00	99.96
	39.83	0.02	22.46	0.11	22.22	0.33	11.45	3.19	0.02	0.00	99.63
	40.01	0.02	22.77	0.10	22.44	0.26	11.85	2.72	0.05	0.02	100.23
	40.10	0.01	22.71	0.13	22.69	0.28	11.89	2.68	0.03	0.02	100.53
	40.02	0.01	22.90	0.06	22.78	0.32	11.68	2.69	0.05	0.01	100.52
	40.09	0.06	22.82	0.14	22.79	0.31	11.68	2.79	0.08	0.01	100.76
	40.14	0.04	22.82	0.11	22.78	0.34	11.85	2.71	0.02	0.00	100.82
	40.06	0.04	22.84	0.10	22.69	0.33	11.82	2.75	0.03	0.01	100.69

	40.12	0.04	22.86	0.14	22.66	0.34	11.90	2.78	0.01	0.00	100.86
	39.94	0.05	22.89	0.10	22.69	0.30	11.91	2.82	0.03	0.00	100.72
	39.98	0.04	22.91	0.05	22.70	0.34	11.83	2.86	0.05	0.00	100.77
	40.02	0.05	22.92	0.09	22.49	0.33	11.65	2.92	0.03	0.00	100.49
	40.06	0.06	22.93	0.17	22.63	0.26	12.01	2.92	0.04	0.00	101.09
	39.73	0.04	22.95	0.12	22.64	0.32	11.86	3.01	0.05	0.00	100.71
	39.98	0.00	22.82	0.14	22.43	0.31	11.69	3.03	0.03	0.00	100.42
	40.07	0.04	22.81	0.13	22.57	0.31	11.72	3.27	0.00	0.01	100.93

Placioclase:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Total
Art-3	58.61	0.00	26.66	0.00	0.06	0.00	0.00	8.21	6.89	0.10	100.53
	58.77	0.00	26.83	0.03	0.06	0.05	0.00	8.19	6.99	0.09	100.99
	58.22	0.04	26.84	0.06	0.11	0.00	0.02	8.42	6.94	0.14	100.78
	57.85	0.00	26.71	0.00	0.20	0.01	0.03	8.35	6.66	0.31	100.12
	58.21	0.00	26.51	0.02	0.01	0.02	0.01	8.13	6.92	0.07	99.89
	58.23	0.01	26.98	0.02	0.03	0.02	0.07	7.89	6.76	0.54	100.55
	58.30	0.00	26.95	0.00	0.00	0.03	0.01	8.53	6.80	0.07	100.69
	57.72	0.00	26.84	0.00	0.02	0.01	0.01	8.71	6.82	0.11	100.24
	57.27	0.02	26.59	0.00	0.12	0.01	0.03	8.45	6.70	0.09	99.27
	58.29	0.00	26.63	0.01	0.04	0.03	0.04	7.40	6.00	1.58	100.01
	55.73	0.03	24.92	0.00	1.21	0.00	3.53	7.07	5.93	0.13	98.54
	58.42	0.00	26.45	0.03	0.01	0.01	0.02	8.06	7.10	0.08	100.17
	58.60	0.02	26.68	0.00	0.05	0.01	0.00	8.26	6.87	0.11	100.59
	58.17	0.04	27.09	0.01	0.19	0.03	0.00	8.76	6.69	0.11	101.08
	58.88	0.01	26.73	0.00	0.07	0.00	0.02	8.16	6.98	0.11	100.96
	58.81	0.01	26.67	0.00	0.04	0.05	0.03	8.13	7.14	0.11	100.99
	58.87	0.02	26.72	0.00	0.05	0.00	0.01	7.99	7.05	0.10	100.80
	59.14	0.00	26.82	0.04	0.04	0.01	0.01	8.12	7.11	0.09	101.38
	58.61	0.03	27.14	0.03	0.10	0.00	0.03	8.36	6.91	0.06	101.26
Art-4	61.78	0.01	24.83	0.00	0.14	0.06	0.16	4.77	6.93	2.69	101.37
	61.87	0.00	24.77	0.00	0.01	0.02	0.00	5.77	8.21	0.23	100.89
	61.46	0.02	24.99	0.00	0.00	0.03	0.02	5.90	8.12	0.23	100.77
	61.84	0.03	24.84	0.01	0.02	0.02	0.02	5.90	8.29	0.26	101.21
	61.24	0.01	24.73	0.00	0.20	0.02	0.32	5.80	7.95	0.25	100.52
	61.74	0.03	24.71	0.00	0.00	0.00	0.02	6.03	8.10	0.23	100.86
	61.67	0.00	24.96	0.00	0.01	0.00	0.01	5.81	8.25	0.26	100.97

	61.79	0.04	24.45	0.00	0.04	0.03	0.01	5.11	7.14	2.09	100.68
	61.97	0.01	24.75	0.00	0.02	0.03	0.01	5.85	8.28	0.23	101.15
	61.96	0.00	24.74	0.01	0.04	0.00	0.04	5.90	8.18	0.23	101.10
	61.95	0.00	24.60	0.01	0.03	0.02	0.00	5.75	8.30	0.29	100.96
	62.09	0.03	24.40	0.01	0.03	0.00	0.01	5.58	8.36	0.25	100.77
	62.29	0.01	24.56	0.00	0.00	0.03	0.02	5.63	8.51	0.23	101.28
	62.11	0.00	24.57	0.00	0.04	0.00	0.03	5.49	8.26	0.27	100.77
	62.03	0.03	24.37	0.00	0.02	0.00	0.03	5.47	8.44	0.32	100.71
Art-11	60.18	0.03	24.63	0.00	0.02	0.00	0.00	5.54	8.04	0.33	98.76
	60.59	0.02	24.44	0.02	0.03	0.01	0.01	5.36	8.28	0.32	99.07
	60.36	0.00	24.40	0.00	0.00	0.01	0.00	5.48	8.03	0.32	98.60
	60.56	0.00	24.38	0.02	0.01	0.00	0.03	5.47	8.09	0.33	98.88
	60.78	0.03	24.42	0.02	0.03	0.00	0.02	5.43	8.00	0.32	99.04
	61.21	0.00	24.39	0.01	0.00	0.01	0.03	5.47	8.05	0.33	99.49
	61.12	0.02	24.77	0.00	0.02	0.01	0.00	5.52	8.02	0.33	99.80
	60.43	0.01	24.52	0.03	0.00	0.00	0.01	5.81	7.94	0.32	99.04
	60.78	0.02	24.71	0.00	0.05	0.00	0.01	5.58	8.15	0.33	99.63
	61.08	0.01	24.73	0.00	0.03	0.00	0.01	5.50	8.05	0.33	99.74
	61.11	0.01	24.76	0.04	0.04	0.01	0.02	5.41	8.25	0.30	99.93
	61.51	0.00	24.52	0.00	0.04	0.02	0.00	5.46	8.23	0.28	100.07
	61.38	0.00	24.54	0.00	0.00	0.01	0.02	5.52	7.97	0.29	99.73
	61.49	0.01	24.73	0.03	0.00	0.01	0.01	5.43	8.21	0.34	100.26
	61.34	0.00	24.49	0.00	0.00	0.00	0.00	5.45	8.12	0.34	99.74
	61.53	0.00	24.60	0.00	0.00	0.01	0.00	5.55	7.96	0.28	99.92
	61.40	0.00	24.59	0.00	0.01	0.00	0.02	5.41	8.01	0.27	99.72
	61.16	0.01	24.45	0.06	0.03	0.01	0.00	5.46	8.18	0.31	99.67
	61.38	0.00	24.63	0.00	0.00	0.02	0.00	5.52	7.98	0.28	99.80
	61.47	0.03	24.98	0.00	0.04	0.00	0.03	5.68	8.13	0.27	100.63
Art-13a	61.64	0.03	24.75	0.00	0.00	0.00	0.01	5.59	8.06	0.36	100.43
	61.54	0.04	24.87	0.01	0.02	0.02	0.02	5.62	8.15	0.32	100.61
	61.82	0.00	24.64	0.00	0.03	0.01	0.02	5.56	8.20	0.31	100.58
	61.82	0.00	24.94	0.00	0.01	0.01	0.00	5.73	8.16	0.32	100.99
	61.73	0.04	24.87	0.01	0.04	0.00	0.01	5.67	8.11	0.36	100.84
	61.73	0.00	24.91	0.00	0.02	0.01	0.02	5.66	8.18	0.29	100.82
	61.46	0.00	24.57	0.03	0.02	0.01	0.00	5.53	7.95	0.35	99.91
	61.81	0.00	24.69	0.04	0.00	0.00	0.01	5.58	7.92	0.31	100.36
	61.26	0.00	24.84	0.00	0.01	0.01	0.02	5.70	7.96	0.30	100.11

	61.93	0.02	24.87	0.00	0.01	0.00	0.02	5.76	8.18	0.35	101.13
	61.65	0.00	24.64	0.00	0.03	0.00	0.01	5.57	8.11	0.36	100.36
	61.33	0.01	24.71	0.00	0.00	0.01	0.01	5.63	8.05	0.35	100.11
	61.78	0.02	25.02	0.00	0.00	0.00	0.02	5.65	8.25	0.36	101.08
	61.22	0.01	24.54	0.04	0.01	0.05	0.03	5.65	7.97	0.39	99.91
	61.07	0.00	24.57	0.00	0.03	0.01	0.01	5.58	7.95	0.36	99.59
	61.90	0.00	24.70	0.00	0.00	0.01	0.01	5.41	8.03	0.36	100.44
	61.73	0.02	24.83	0.04	0.02	0.01	0.02	5.60	8.19	0.35	100.81
	61.57	0.02	24.86	0.00	0.00	0.00	0.01	5.66	8.08	0.36	100.57
	61.84	0.01	24.89	0.00	0.02	0.01	0.01	5.71	8.10	0.35	100.93

Rutile:

	SiO2	TiO2	Al2O3	Cr2O3	Nb2O5	V2O3	FeO	MnO	MgO	CaO	Total
Art-4	0.04	99.43	0.11	0.20	0.11	0.51	0.21	0.00	0.02	0.01	100.63
	0.04	99.83	0.11	0.13	0.10	0.52	0.11	0.03	0.00	0.00	100.87
	0.03	98.97	0.10	0.14	0.15	0.56	0.14	0.01	0.01	0.00	100.11
	0.11	94.45	0.07	0.20	0.00	0.61	4.07	0.05	0.04	0.01	99.61
	0.02	99.25	0.04	0.12	0.08	0.51	0.22	0.00	0.01	0.02	100.28
	0.04	99.04	0.08	0.27	0.09	0.57	0.12	0.05	0.01	0.02	100.28
	0.03	98.58	0.06	0.29	0.13	0.47	0.12	0.02	0.02	0.00	99.72
	0.04	98.81	0.06	0.29	0.12	0.55	0.13	0.01	0.03	0.01	100.03
	0.04	97.81	0.08	0.30	0.11	1.09	0.16	0.00	0.06	0.02	99.66
	0.01	97.65	0.10	0.26	0.16	1.13	0.09	0.00	0.03	0.00	99.42
	0.04	98.17	0.06	0.32	0.12	1.00	0.10	0.02	0.01	0.02	99.84
	0.05	98.41	0.08	0.14	0.11	0.59	0.15	0.04	0.04	0.01	99.61
	0.02	97.94	0.10	0.12	0.11	0.59	0.14	0.01	0.00	0.00	99.03
	0.06	97.35	0.44	0.17	0.12	0.51	0.48	0.00	0.06	0.01	99.19
Art-11	0.04	99.13	0.07	0.24	0.09	0.52	0.10	0.00	0.02	0.01	100.21
	0.07	98.59	0.07	0.24	0.13	0.50	0.10	0.00	0.05	0.01	99.73
	0.05	98.76	0.07	0.22	0.23	0.52	0.11	0.01	0.01	0.01	99.98
	0.06	98.84	0.04	0.22	0.17	0.52	0.15	0.00	0.00	0.02	100.02
	0.02	98.92	0.07	0.22	0.17	0.50	0.10	0.01	0.03	0.01	100.05
	0.05	99.14	0.06	0.24	0.14	0.47	0.11	0.05	0.01	0.00	100.26
	0.06	99.28	0.07	0.18	0.22	0.52	0.14	0.00	0.02	0.02	100.51
	0.03	99.30	0.10	0.11	0.10	0.56	0.16	0.01	0.01	0.00	100.38
	0.05	99.23	0.08	0.18	0.15	0.53	0.21	0.01	0.01	0.02	100.46
	0.06	98.52	0.07	0.24	0.11	0.70	0.15	0.02	0.00	0.00	99.86

	0.06	98.84	0.08	0.23	0.17	0.65	0.12	0.01	0.01	0.04	100.22
	0.03	98.47	0.05	0.27	0.18	0.66	0.10	0.03	0.01	0.02	99.82
	0.05	100.01	0.04	0.23	0.15	0.52	0.10	0.00	0.01	0.00	101.12
	0.05	99.80	0.04	0.23	0.20	0.56	0.13	0.05	0.04	0.00	101.08
	0.01	100.11	0.08	0.22	0.09	0.48	0.09	0.01	0.03	0.00	101.13
Art-13a	0.05	99.57	0.03	0.22	0.16	0.46	0.14	0.03	0.02	0.01	100.67
	0.04	99.30	0.02	0.22	0.12	0.54	0.09	0.02	0.02	0.02	100.38
	0.06	99.42	0.05	0.19	0.09	0.49	0.14	0.00	0.00	0.01	100.46
	0.03	99.52	0.06	0.27	0.13	0.57	0.08	0.01	0.02	0.00	100.69
	0.06	99.52	0.03	0.26	0.09	0.57	0.09	0.02	0.01	0.02	100.66
	0.07	99.42	0.07	0.29	0.17	0.57	0.09	0.03	0.02	0.01	100.72
	0.05	99.21	0.07	0.26	0.17	0.60	0.45	0.02	0.05	0.01	100.88
	0.03	99.83	0.10	0.25	0.13	0.67	0.07	0.04	0.01	0.01	101.14
	0.06	99.22	0.08	0.21	0.09	0.66	0.12	0.03	0.02	0.01	100.50
	0.21	98.85	0.05	0.27	0.11	0.51	0.08	0.00	0.01	0.01	100.09
	0.04	99.85	0.02	0.28	0.16	0.57	0.12	0.05	0.03	0.00	101.13
	0.05	99.96	0.03	0.26	0.22	0.49	0.08	0.03	0.03	0.02	101.18
	0.04	99.08	0.02	0.20	0.09	0.57	0.08	0.02	0.01	0.00	100.11
	0.04	99.06	0.03	0.26	0.14	0.52	0.11	0.02	0.04	0.02	100.24
	0.04	98.75	0.03	0.22	0.13	0.53	0.11	0.02	0.03	0.01	99.88

Biotite:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	F	Cl	Total
Art-3	35.07	2.16	19.34	0.42	19.31	0.05	9.14	0.04	0.38	9.05	0.13	0.07	95.07
	35.20	2.12	19.14	0.44	19.16	0.04	9.32	0.01	0.37	9.08	0.14	0.05	94.99
	35.39	1.88	19.80	0.33	18.51	0.05	10.16	0.01	0.43	8.83	0.21	0.04	95.53
	35.42	1.94	19.56	0.27	18.48	0.01	10.11	0.00	0.40	8.99	0.17	0.04	95.31
	34.59	2.06	18.80	0.42	19.40	0.05	9.53	0.03	0.47	8.75	0.17	0.05	94.24
	35.01	2.10	18.88	0.37	19.27	0.06	9.58	0.02	0.37	9.03	0.17	0.03	94.80

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	BaO	Na2O	K2O	Cl	O=Cl	Total
Art-13a	39.65	3.66	13.75	0.11	4.66	0.02	21.13	0.00	0.08	0.13	10.24	0.28	0.06	93.63
	40.33	4.60	13.82	0.10	5.12	0.00	21.00	0.00	0.09	0.14	10.32	0.26	0.06	95.73
	40.19	3.72	14.04	0.11	4.64	0.01	20.99	0.00	0.09	0.11	10.24	0.26	0.06	94.34
	38.39	4.17	13.50	0.16	6.98	0.01	19.21	0.00	0.68	0.07	10.01	0.06	0.01	93.22
	39.12	4.17	13.59	0.14	6.94	0.02	19.48	0.00	0.46	0.06	10.10	0.07	0.02	94.11
	39.08	3.62	13.57	0.18	6.57	0.02	19.66	0.00	0.34	0.08	10.24	0.07	0.02	93.41
	38.90	4.12	13.46	0.13	6.90	0.01	19.45	0.00	0.60	0.06	10.14	0.08	0.02	93.82

	38.94	5.46	13.75	0.12	4.76	0.01	20.26	0.00	1.00	0.16	9.78	0.10	0.02	94.32
	39.15	5.22	13.96	0.12	4.72	0.01	21.05	0.00	0.94	0.15	9.91	0.10	0.02	95.28
	38.35	5.91	13.85	0.13	5.02	0.00	20.28	0.01	1.00	0.29	9.78	0.13	0.03	94.71
	38.79	5.63	14.02	0.13	4.94	0.01	19.76	0.00	1.04	0.26	9.69	0.10	0.02	94.34
	37.80	4.81	13.67	0.11	4.73	0.02	20.19	0.01	1.06	0.23	9.66	0.12	0.03	92.36
	39.56	2.91	12.92	0.08	3.85	0.02	22.70	0.00	0.33	0.04	10.28	0.06	0.01	92.72
	39.57	2.95	13.09	0.09	3.76	0.01	22.25	0.00	0.28	0.03	10.29	0.04	0.01	92.32
	39.49	3.82	13.32	0.09	4.53	0.01	21.63	0.00	0.33	0.05	10.29	0.05	0.01	93.59
	39.02	4.29	13.19	0.08	4.65	0.00	21.09	0.00	0.39	0.03	10.25	0.05	0.01	93.03
	39.34	3.93	13.42	0.09	4.49	0.02	21.08	0.00	0.43	0.04	10.28	0.06	0.01	93.16
	39.05	3.95	13.54	0.10	4.66	0.01	21.69	0.00	0.50	0.08	10.36	0.05	0.01	93.96
	39.64	3.66	13.71	0.10	4.17	0.01	21.61	0.00	0.43	0.05	10.42	0.06	0.01	93.84
	39.55	3.58	13.55	0.09	4.20	0.00	21.74	0.00	0.35	0.05	10.33	0.06	0.01	93.49

Cordierite:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Total
Art-3	49.01	0.00	33.13	0.00	8.66	0.10	7.38	0.04	0.35	0.15	98.81
	48.98	0.01	33.48	0.04	8.69	0.10	7.39	0.02	0.31	0.10	99.10
	48.69	0.00	33.04	0.00	8.58	0.05	7.37	0.02	0.34	0.07	98.15
	48.70	0.02	32.90	0.01	8.67	0.10	7.38	0.00	0.32	0.05	98.16
	48.74	0.00	33.03	0.01	8.27	0.10	7.57	0.04	0.49	0.14	98.39
	49.04	0.00	33.20	0.00	8.80	0.08	7.38	0.01	0.32	0.11	98.95
	49.01	0.00	33.49	0.00	8.68	0.09	7.47	0.03	0.34	0.18	99.28
	49.26	0.01	33.39	0.01	8.64	0.07	7.53	0.04	0.31	0.16	99.42
	48.98	0.00	33.32	0.00	8.54	0.07	7.43	0.05	0.35	0.16	98.89
	49.07	0.00	33.65	0.00	8.51	0.10	7.51	0.03	0.38	0.12	99.37

Ekati

Garnet:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Total
EKT-9B	38.40	0.10	21.83	0.04	24.73	0.43	7.33	6.54	0.13	0.05	99.58
	38.09	0.03	21.70	0.04	24.91	0.49	7.29	6.68	0.10	0.03	99.35
	38.32	0.04	21.77	0.02	24.67	0.42	7.23	6.46	0.02	0.05	98.99
	38.13	0.03	21.64	0.08	24.85	0.46	7.26	6.54	0.08	0.05	99.12
	38.24	0.01	21.78	0.01	24.61	0.45	7.41	6.50	0.09	0.06	99.16
	38.29	0.05	21.60	0.07	25.00	0.44	7.23	6.59	0.10	0.08	99.43
	38.11	0.05	21.52	0.06	24.66	0.49	7.19	6.78	0.15	0.05	99.05

	38.19	0.07	21.40	0.03	24.62	0.45	7.31	6.34	0.22	0.10	98.73
	38.07	0.05	21.59	0.02	24.64	0.45	7.40	6.42	0.10	0.03	98.75
	38.41	0.02	21.74	0.01	25.08	0.44	7.45	6.47	0.03	0.03	99.68
	38.45	0.03	21.67	0.00	24.97	0.46	7.27	6.41	0.05	0.04	99.34
	38.08	0.02	21.65	0.02	24.98	0.43	7.24	6.51	0.08	0.03	99.05
	38.22	0.09	21.53	0.01	24.77	0.42	7.23	6.42	0.10	0.05	98.83
	38.27	0.05	21.59	0.04	24.90	0.45	7.13	6.52	0.03	0.02	98.99
	38.14	0.06	21.42	0.00	24.61	0.43	7.18	6.64	0.10	0.04	98.62
	38.18	0.01	21.71	0.01	24.53	0.46	7.51	6.51	0.10	0.03	99.04
	38.58	0.00	21.80	0.04	24.33	0.48	7.53	6.46	0.04	0.04	99.30
	38.60	0.08	21.93	0.03	24.75	0.45	7.61	6.46	0.06	0.00	99.97
	38.37	0.05	22.01	0.01	24.44	0.49	7.70	6.43	0.04	0.01	99.54
	38.19	0.05	21.77	0.03	24.65	0.43	7.59	6.58	0.03	0.03	99.34
	37.95	0.05	21.96	0.00	24.55	0.42	7.58	6.69	0.01	0.00	99.21
	38.07	0.03	21.74	0.06	24.37	0.45	7.49	6.59	0.10	0.02	98.92
	37.91	0.00	21.97	0.03	24.42	0.45	7.68	6.74	0.12	0.04	99.34
	38.14	0.03	21.81	0.01	24.18	0.45	7.55	6.94	0.08	0.04	99.20
EKT-9D	38.22	0.07	21.76	0.09	24.13	0.49	8.23	6.29	0.02	0.01	99.31
	38.14	0.08	21.84	0.06	24.02	0.47	8.38	6.39	0.00	0.01	99.39
	38.43	0.12	21.74	0.12	24.21	0.47	8.26	6.25	0.04	0.00	99.63
	38.07	0.11	21.78	0.12	24.12	0.50	8.46	6.26	0.00	0.00	99.43
	38.16	0.14	21.87	0.14	24.08	0.49	8.43	6.34	0.00	0.00	99.66
	37.79	0.12	21.66	0.11	24.06	0.50	8.26	6.40	0.06	0.02	98.97
	37.74	0.08	21.77	0.09	23.92	0.49	8.32	6.20	0.07	0.00	98.68
	37.72	0.14	21.82	0.10	24.16	0.50	8.45	6.31	0.04	0.00	99.22
	37.72	0.10	21.93	0.12	24.20	0.49	8.45	6.38	0.05	0.00	99.43
	37.96	0.13	21.92	0.06	24.04	0.48	8.19	6.47	0.06	0.00	99.29
	37.98	0.01	21.71	0.04	23.99	0.51	8.67	6.24	0.06	0.01	99.21
	38.16	0.07	21.58	0.11	24.10	0.47	8.43	6.32	0.05	0.02	99.31
	37.92	0.09	21.71	0.17	24.09	0.51	8.45	6.32	0.09	0.00	99.36
	38.15	0.11	21.82	0.08	23.90	0.48	8.47	6.27	0.03	0.00	99.32
	37.96	0.07	21.81	0.10	24.01	0.48	8.34	6.25	0.01	0.00	99.02
	38.11	0.12	21.74	0.14	23.78	0.48	8.41	6.24	0.00	0.01	99.04
	38.12	0.14	21.70	0.12	23.92	0.47	8.47	6.34	0.05	0.01	99.34
	38.18	0.12	21.66	0.07	23.82	0.45	8.16	6.44	0.04	0.00	98.93
	38.20	0.12	21.69	0.08	23.89	0.52	8.22	6.50	0.01	0.01	99.24
	38.36	0.09	21.57	0.11	23.80	0.43	8.10	6.87	0.00	0.00	99.32

	38.07	0.10	21.67	0.11	24.37	0.56	8.09	6.36	0.04	0.00	99.37
	38.04	0.08	21.93	0.12	24.31	0.47	8.08	6.28	0.06	0.00	99.38
	37.86	0.06	21.66	0.11	24.27	0.52	8.01	6.30	0.05	0.00	98.85
	38.06	0.09	21.82	0.11	24.39	0.50	8.00	6.31	0.06	0.00	99.32
	37.78	0.05	21.52	0.09	24.27	0.48	7.98	6.34	0.04	0.00	98.54
	37.86	0.04	21.84	0.10	24.37	0.52	7.96	6.29	0.01	0.00	99.00
	37.95	0.08	21.89	0.06	24.28	0.56	7.96	6.46	0.04	0.01	99.27
	37.75	0.04	21.68	0.12	23.84	0.47	7.71	6.92	0.00	0.00	98.54
EKT-11A	37.69	0.10	22.01	0.14	23.75	0.60	8.01	6.20	0.00	0.00	98.50
	37.86	0.07	22.00	0.19	24.03	0.60	7.98	6.11	0.00	0.00	98.84
	37.64	0.04	22.03	0.21	24.18	0.58	7.88	6.13	0.07	0.02	98.78
	37.50	0.10	21.92	0.14	24.09	0.55	8.01	6.23	0.01	0.01	98.55
	37.72	0.09	22.00	0.18	24.21	0.56	7.92	6.15	0.05	0.00	98.87
	37.78	0.03	22.15	0.12	24.22	0.55	7.77	6.27	0.01	0.00	98.89
	37.72	0.10	21.99	0.15	23.81	0.60	8.25	6.24	0.10	0.01	98.97
	37.79	0.04	22.06	0.17	23.64	0.55	8.31	6.05	0.00	0.00	98.60
	37.73	0.04	21.86	0.22	24.01	0.55	8.18	6.20	0.02	0.00	98.81
	37.68	0.07	22.09	0.14	23.79	0.60	8.24	6.18	0.02	0.00	98.82
	37.58	0.48	21.96	0.17	23.63	0.60	8.26	6.31	0.05	0.00	99.03
	37.43	0.08	22.13	0.18	24.02	0.56	8.29	6.30	0.07	0.00	99.05
	37.82	0.08	22.04	0.16	23.89	0.60	8.13	6.32	0.00	0.00	99.05
	37.88	0.10	22.07	0.08	23.53	0.56	8.29	6.25	0.05	0.00	98.79
	38.27	0.04	22.25	0.08	23.86	0.54	8.14	6.35	0.04	0.00	99.58
	38.22	0.00	22.06	0.18	24.24	0.57	7.76	6.30	0.00	0.00	99.33
	38.17	0.11	22.01	0.18	24.22	0.62	7.92	6.32	0.02	0.00	99.58
	38.12	0.04	22.01	0.19	24.11	0.55	7.89	6.25	0.00	0.00	99.16
	38.26	0.06	22.12	0.17	23.98	0.57	7.91	6.10	0.07	0.00	99.23
	38.11	0.05	21.93	0.20	24.17	0.60	7.91	6.31	0.03	0.00	99.30
	37.86	0.08	21.85	0.19	24.01	0.63	7.92	6.31	0.03	0.01	98.89
	38.18	0.05	21.88	0.16	24.14	0.56	8.01	6.22	0.01	0.00	99.21
	38.08	0.06	21.91	0.11	23.99	0.59	7.87	6.27	0.00	0.01	98.87
	38.12	0.08	21.79	0.10	24.01	0.63	8.08	6.36	0.00	0.00	99.15
	37.89	0.04	21.89	0.06	24.33	0.56	7.97	6.13	0.00	0.00	98.88
	37.93	0.07	22.03	0.21	23.83	0.56	8.20	6.19	0.06	0.00	99.08
	38.27	0.15	22.05	0.16	23.95	0.50	8.15	6.31	0.07	0.00	99.60
	37.94	0.72	22.08	0.13	23.80	0.55	8.27	6.10	0.00	0.01	99.61
	37.90	0.14	22.08	0.14	23.78	0.57	8.13	6.34	0.04	0.01	99.13

	37.82	0.17	21.91	0.17	24.08	0.56	8.32	6.32	0.00	0.03	99.38
	37.55	0.14	21.98	0.10	23.66	0.57	8.31	6.35	0.05	0.01	98.71
	37.74	0.08	21.97	0.11	23.61	0.55	8.21	6.35	0.01	0.01	98.63
EKT-11B	37.87	0.04	21.77	0.09	24.97	0.70	7.64	6.20	0.07	0.00	99.36
	37.87	0.01	21.64	0.02	25.02	0.68	7.53	6.20	0.02	0.00	98.97
	37.70	0.01	21.85	0.03	25.08	0.73	7.47	6.21	0.05	0.01	99.14
	37.68	0.06	21.74	0.05	24.86	0.69	7.63	6.19	0.03	0.00	98.92
	37.53	0.04	21.80	0.08	24.72	0.71	7.58	6.17	0.03	0.00	98.65
	37.65	0.00	21.66	0.08	24.94	0.66	7.63	6.16	0.06	0.00	98.84
	37.65	0.05	21.74	0.09	24.67	0.70	7.56	6.21	0.03	0.00	98.71
	37.43	0.06	21.56	0.00	24.90	0.73	7.58	6.25	0.00	0.00	98.51
	37.80	0.06	21.63	0.00	25.00	0.71	7.50	6.21	0.00	0.01	98.92
	38.16	0.07	21.70	0.00	24.85	0.69	7.58	6.31	0.02	0.02	99.40
	38.01	0.03	21.92	0.05	25.10	0.64	7.58	6.14	0.02	0.00	99.48
	37.96	0.02	21.68	0.05	24.99	0.67	7.46	6.16	0.02	0.00	99.00
	38.12	0.07	21.97	0.00	25.13	0.69	7.62	6.22	0.05	0.02	99.89
	37.75	0.04	21.92	0.04	25.44	0.73	7.43	6.01	0.00	0.00	99.34
	37.62	0.03	21.98	0.00	25.09	0.71	7.66	6.00	0.00	0.00	99.09
	37.65	0.01	22.00	0.00	25.00	0.70	7.78	6.02	0.02	0.00	99.18
	37.24	0.08	21.83	0.03	25.05	0.71	7.61	6.11	0.00	0.00	98.67
	37.47	0.03	21.60	0.00	25.03	0.71	7.50	6.24	0.03	0.00	98.62
	37.48	0.08	21.76	0.05	24.90	0.73	7.51	6.21	0.01	0.00	98.73
	37.31	0.06	21.65	0.01	24.94	0.69	7.61	6.37	0.02	0.00	98.67
	37.63	0.02	21.67	0.05	25.06	0.74	7.55	6.25	0.05	0.01	99.02
	37.48	0.05	21.68	0.06	24.92	0.69	7.49	6.33	0.05	0.02	98.76
	37.73	0.11	21.78	0.06	24.86	0.72	7.45	6.35	0.01	0.01	99.09
	37.75	0.05	21.90	0.09	24.47	0.69	8.01	6.14	0.06	0.00	99.16
	37.79	0.07	21.75	0.15	24.38	0.70	7.84	6.29	0.02	0.00	98.98
	37.75	0.07	21.63	0.07	24.40	0.72	7.91	6.23	0.00	0.01	98.80
	38.07	0.00	21.66	0.07	24.62	0.71	7.95	6.30	0.00	0.00	99.37
	37.73	0.08	21.89	0.07	24.38	0.69	7.91	6.30	0.00	0.01	99.05
	37.99	0.08	21.71	0.07	24.30	0.74	7.93	6.23	0.00	0.00	99.06
	37.58	0.04	21.84	0.12	24.39	0.74	7.89	6.18	0.04	0.00	98.83
	37.54	0.00	21.82	0.07	24.55	0.74	7.80	6.36	0.04	0.00	98.90
BD-184	38.67	0.12	21.72	0.00	24.27	0.42	7.88	7.11	0.02	0.00	100.21
	38.71	0.15	21.79	0.06	24.64	0.49	7.88	7.11	0.01	0.00	100.83
	38.77	0.09	21.90	0.01	24.34	0.44	7.88	7.03	0.00	0.00	100.45

	38.92	0.12	22.21	0.00	24.14	0.46	8.05	7.16	0.02	0.00	101.08
	38.85	0.10	22.12	0.00	24.44	0.47	8.03	6.97	0.00	0.01	101.00
	38.67	0.10	21.95	0.02	24.40	0.45	7.99	6.96	0.04	0.00	100.58
	38.63	0.14	21.85	0.00	24.21	0.53	8.12	6.92	0.06	0.01	100.45
	38.51	0.15	21.80	0.00	24.51	0.47	7.96	6.94	0.06	0.01	100.41
	38.28	0.09	21.67	0.01	24.43	0.41	7.98	7.02	0.02	0.02	99.92
	38.57	0.11	21.83	0.00	24.53	0.46	8.04	6.95	0.02	0.01	100.51
	38.68	0.12	22.02	0.04	24.23	0.42	8.15	6.92	0.02	0.02	100.61
	38.62	0.14	21.79	0.00	24.12	0.40	8.20	6.99	0.02	0.01	100.29
	38.89	0.12	21.79	0.00	24.19	0.42	8.12	6.94	0.03	0.01	100.51
	38.51	0.14	21.79	0.00	24.13	0.44	8.06	6.87	0.06	0.00	100.00
	38.84	0.09	21.89	0.03	24.09	0.48	8.04	6.95	0.05	0.00	100.46
	38.65	0.14	21.79	0.03	24.23	0.47	8.01	7.03	0.03	0.00	100.37
PT-LK1	38.81	0.02	21.70	0.05	26.49	0.46	7.82	6.02	0.04	0.00	101.41
	38.71	0.04	21.63	0.10	26.45	0.49	7.66	5.97	0.03	0.01	101.08
	38.71	0.06	21.70	0.06	26.06	0.51	7.69	6.07	0.04	0.01	100.91
	32.66	0.07	18.14	0.08	25.68	0.52	7.48	5.85	0.03	0.00	90.51
	38.65	0.05	21.72	0.01	25.90	0.52	7.54	6.35	0.05	0.00	100.80
	37.56	0.19	21.36	0.04	26.04	0.53	8.04	5.93	0.06	0.00	99.75
	37.86	0.19	21.54	0.06	25.96	0.47	7.63	5.88	0.06	0.00	99.64
	39.21	0.20	22.27	0.07	26.23	0.53	7.24	5.96	0.03	0.00	101.74
	38.08	0.16	21.69	0.03	26.16	0.45	7.67	5.98	0.03	0.02	100.26
	37.79	0.17	21.73	0.06	26.26	0.46	7.64	5.91	0.00	0.00	100.03
	38.19	0.15	21.70	0.04	26.29	0.47	7.69	6.10	0.05	0.00	100.68
	38.01	0.16	21.76	0.09	26.62	0.51	7.67	6.04	0.06	0.02	100.94
	38.10	0.11	21.59	0.00	26.38	0.51	7.37	6.17	0.02	0.00	100.24
	38.63	0.00	21.50	0.05	26.04	0.48	7.78	5.99	0.01	0.00	100.48
	38.67	0.04	21.81	0.06	26.00	0.49	7.87	5.83	0.05	0.00	100.81
	38.50	0.03	21.60	0.07	25.77	0.49	7.77	5.97	0.00	0.00	100.20
	38.14	0.02	21.55	0.08	25.63	0.52	7.96	5.91	0.02	0.00	99.84
	38.27	0.02	21.94	0.05	25.54	0.47	7.61	6.02	0.05	0.01	99.99

Plagioclase:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Total
EKT-9B	58.60	0.00	26.63	0.00	0.02	0.00	0.00	7.90	6.45	0.38	99.97
	58.95	0.01	26.48	0.00	0.05	0.00	0.02	7.74	6.52	0.42	100.17
	58.92	0.00	26.09	0.00	0.01	0.01	0.01	7.49	6.63	0.47	99.63

	58.74	0.04	25.62	0.00	0.02	0.01	0.01	6.92	6.95	0.55	98.85
	59.77	0.02	25.16	0.01	0.05	0.00	0.03	6.45	7.17	0.55	99.21
	57.83	0.01	26.42	0.00	0.02	0.06	0.00	7.81	6.36	0.41	98.92
	57.76	0.00	26.24	0.01	0.02	0.02	0.01	7.95	6.40	0.36	98.76
	57.73	0.00	26.16	0.04	0.04	0.01	0.01	7.72	6.62	0.38	98.71
	58.94	0.01	26.04	0.00	0.05	0.05	0.00	7.18	6.62	0.39	99.28
	60.29	0.00	25.04	0.01	0.08	0.00	0.00	6.24	7.23	0.56	99.45
	59.19	0.05	25.79	0.00	0.04	0.01	0.01	7.18	6.78	0.40	99.46
	58.56	0.02	26.05	0.00	0.05	0.01	0.02	7.39	6.81	0.53	99.42
	59.02	0.00	25.93	0.03	0.03	0.01	0.02	7.29	6.79	0.42	99.55
	59.72	0.00	25.54	0.02	0.03	0.00	0.00	6.69	7.23	0.44	99.66
EKT-9D	58.94	0.01	26.42	0.02	0.02	0.01	0.04	7.40	6.79	0.39	100.02
	58.83	0.03	25.74	0.00	0.11	0.00	0.05	6.89	6.21	1.32	99.17
	58.81	0.00	26.35	0.00	0.02	0.00	0.00	7.57	6.57	0.36	99.68
	58.55	0.02	26.37	0.02	0.00	0.00	0.02	7.63	6.79	0.41	99.79
	58.62	0.00	26.42	0.00	0.02	0.00	0.01	7.66	6.64	0.36	99.72
	58.10	0.00	26.23	0.05	0.03	0.01	0.01	7.68	6.68	0.38	99.15
	58.22	0.01	26.06	0.00	0.01	0.00	0.02	7.57	6.58	0.36	98.82
	58.39	0.00	25.91	0.01	0.03	0.02	0.01	7.43	6.73	0.38	98.90
	58.92	0.00	25.64	0.00	0.07	0.01	0.02	7.04	7.01	0.44	99.15
	57.96	0.01	26.27	0.00	0.00	0.01	0.01	7.59	6.63	0.40	98.87
	57.55	0.00	26.31	0.00	0.02	0.03	0.00	7.76	6.62	0.35	98.64
	57.62	0.01	26.53	0.00	0.03	0.00	0.01	7.72	6.74	0.37	99.03
	58.00	0.02	25.91	0.01	0.00	0.01	0.02	7.48	6.81	0.35	98.60
	56.25	0.02	27.49	0.04	0.03	0.02	0.00	9.14	5.88	0.29	99.15
	56.21	0.03	27.67	0.00	0.00	0.01	0.03	9.22	5.69	0.34	99.19
	56.05	0.00	27.78	0.00	0.03	0.01	0.01	9.08	5.86	0.33	99.16
	56.24	0.01	27.77	0.01	0.04	0.02	0.01	9.33	5.83	0.32	99.57
	55.75	0.00	27.29	0.00	0.02	0.00	0.00	9.24	5.86	0.29	98.45
	55.66	0.00	27.58	0.00	0.04	0.03	0.01	9.24	5.85	0.29	98.68
	56.21	0.00	27.65	0.03	0.00	0.00	0.00	9.40	5.99	0.33	99.61
	56.07	0.00	27.39	0.00	0.02	0.01	0.01	9.23	5.79	0.33	98.84
	56.14	0.00	27.57	0.01	0.03	0.00	0.00	9.07	5.72	0.30	98.84
EKT-11A	55.86	0.01	28.28	0.01	0.02	0.02	0.02	10.11	5.38	0.33	100.02
	55.55	0.02	28.21	0.00	0.01	0.02	0.01	9.90	5.44	0.32	99.48
	55.51	0.02	28.30	0.03	0.00	0.01	0.01	10.01	5.40	0.35	99.65
	55.71	0.03	28.35	0.00	0.00	0.02	0.00	9.96	5.50	0.34	99.91

	55.91	0.00	28.09	0.01	0.00	0.01	0.01	9.72	5.66	0.33	99.75
	55.99	0.01	28.18	0.03	0.00	0.02	0.00	9.66	5.62	0.34	99.84
	56.35	0.01	27.79	0.00	0.00	0.01	0.01	9.37	5.85	0.34	99.72
	56.95	0.06	27.36	0.01	0.04	0.00	0.00	8.94	5.96	0.41	99.72
	55.63	0.02	28.39	0.01	0.03	0.00	0.00	10.13	5.32	0.30	99.82
	55.35	0.02	28.36	0.00	0.04	0.00	0.00	10.08	5.40	0.33	99.59
	55.53	0.05	28.29	0.01	0.00	0.01	0.00	10.09	5.43	0.32	99.72
	55.30	0.02	28.29	0.00	0.03	0.00	0.00	9.96	5.29	0.33	99.22
	55.16	0.00	28.10	0.00	0.00	0.00	0.02	9.84	5.33	0.33	98.79
	55.32	0.04	27.86	0.00	0.00	0.01	0.02	9.92	5.32	0.33	98.82
	55.39	0.00	28.01	0.00	0.00	0.01	0.02	9.53	5.53	0.31	98.80
	55.87	0.00	27.40	0.02	0.00	0.01	0.02	9.22	5.79	0.37	98.70
	56.00	0.02	27.34	0.00	0.02	0.03	0.00	8.93	5.76	0.34	98.45
	56.33	0.00	27.06	0.00	0.00	0.00	0.00	8.84	6.03	0.36	98.64
	55.24	0.00	27.88	0.00	0.02	0.00	0.00	9.61	5.71	0.34	98.79
	55.12	0.01	28.10	0.00	0.01	0.01	0.00	9.81	5.55	0.41	99.01
	55.22	0.01	27.83	0.00	0.02	0.02	0.00	9.61	5.55	0.37	98.61
	55.03	0.04	27.80	0.00	0.01	0.01	0.02	9.71	5.37	0.48	98.46
	55.40	0.06	27.80	0.00	0.01	0.02	0.02	9.54	5.78	0.34	98.98
EKT-11B	59.92	0.00	25.16	0.02	0.07	0.00	0.01	6.29	7.48	0.30	99.25
	59.60	0.02	25.32	0.00	0.04	0.01	0.00	6.46	7.58	0.23	99.26
	59.81	0.03	25.07	0.00	0.03	0.00	0.01	6.50	7.24	0.26	98.94
	59.94	0.00	25.23	0.00	0.03	0.01	0.00	6.46	7.31	0.28	99.26
	59.62	0.00	25.41	0.00	0.00	0.00	0.00	6.71	7.41	0.32	99.46
	59.17	0.64	25.03	0.03	0.00	0.00	0.00	6.59	7.39	0.26	99.10
	59.62	0.02	25.51	0.06	0.02	0.00	0.01	6.70	7.32	0.30	99.56
	59.62	0.02	25.42	0.00	0.07	0.02	0.01	6.67	7.32	0.27	99.41
	59.16	0.01	25.61	0.02	0.02	0.02	0.00	6.86	7.15	0.33	99.19
	58.77	0.03	25.76	0.00	0.00	0.00	0.02	7.06	6.91	0.25	98.80
	58.98	0.03	25.95	0.00	0.02	0.01	0.02	7.32	7.07	0.25	99.65
	58.95	0.01	25.96	0.00	0.03	0.00	0.01	7.13	7.03	0.25	99.37
	58.91	0.04	25.94	0.00	0.04	0.01	0.02	7.25	7.13	0.25	99.60
	58.89	0.00	25.65	0.01	0.01	0.00	0.01	7.07	6.99	0.28	98.91
	59.00	0.00	25.83	0.00	0.02	0.00	0.01	7.11	7.07	0.26	99.31
	59.01	0.04	25.73	0.00	0.02	0.00	0.00	6.98	7.20	0.25	99.23
	59.58	0.00	25.83	0.00	0.02	0.01	0.00	6.90	7.05	0.30	99.68
	59.57	0.03	25.71	0.00	0.05	0.01	0.02	6.74	7.21	0.30	99.62

	59.76	0.02	25.24	0.01	0.02	0.02	0.02	6.56	7.36	0.32	99.32
	58.42	0.00	26.56	0.02	0.03	0.00	0.01	7.91	6.79	0.24	99.98
	58.22	0.01	26.55	0.00	0.03	0.04	0.01	7.76	6.72	0.25	99.58
	57.95	0.00	26.42	0.00	0.02	0.00	0.01	7.85	6.72	0.27	99.24
	58.03	0.00	26.58	0.03	0.03	0.00	0.01	7.62	6.70	0.23	99.24
	58.25	0.01	26.39	0.00	0.03	0.02	0.00	7.75	6.65	0.27	99.37
	57.86	0.00	26.29	0.00	0.02	0.00	0.00	7.70	6.70	0.24	98.81
	58.34	0.01	26.34	0.00	0.03	0.01	0.01	7.64	6.87	0.25	99.50
	58.23	0.02	26.33	0.00	0.03	0.02	0.00	7.74	6.73	0.26	99.35
	58.33	0.00	26.31	0.03	0.01	0.02	0.02	7.55	6.83	0.26	99.37
	58.02	0.02	26.45	0.00	0.01	0.03	0.01	7.63	6.79	0.28	99.23
EKT-12	59.35	0.01	25.64	0.00	0.04	0.02	0.00	7.07	7.33	0.27	99.73
	59.45	0.00	25.74	0.00	0.00	0.00	0.02	7.11	7.36	0.30	99.98
	59.23	0.00	25.61	0.00	0.00	0.00	0.02	7.04	7.18	0.27	99.35
	59.14	0.02	25.93	0.00	0.02	0.00	0.01	7.19	7.44	0.29	100.04
	58.78	0.00	25.57	0.00	0.04	0.01	0.01	7.11	7.22	0.26	99.01
	58.94	0.00	25.74	0.02	0.04	0.01	0.00	7.08	7.15	0.33	99.30
	59.37	0.04	25.88	0.00	0.01	0.00	0.02	7.03	7.18	0.32	99.84
	59.15	0.01	25.80	0.00	0.05	0.01	0.01	7.15	7.13	0.37	99.67
	58.93	0.00	25.65	0.00	0.01	0.00	0.00	7.21	7.43	0.30	99.54
	59.14	0.00	25.89	0.00	0.01	0.02	0.02	7.21	7.28	0.32	99.89
	59.95	0.00	25.47	0.00	0.01	0.03	0.02	6.65	7.38	0.33	99.82
	59.71	0.01	25.46	0.00	0.01	0.03	0.00	6.74	7.39	0.31	99.66
	59.94	0.00	25.52	0.00	0.04	0.00	0.00	6.76	7.42	0.31	99.98
	59.97	0.02	25.77	0.00	0.03	0.01	0.01	6.88	7.40	0.33	100.41
	60.43	0.03	25.64	0.00	0.08	0.00	0.00	6.90	7.31	0.34	100.72
BD-184	58.02	0.03	26.94	0.00	0.01	0.03	0.00	8.46	6.54	0.31	100.33
	58.29	0.06	27.05	0.00	0.04	0.01	0.01	8.47	6.26	0.34	100.53
	58.04	0.00	26.94	0.00	0.05	0.03	0.04	8.41	6.45	0.34	100.30
	58.29	0.00	26.92	0.00	0.02	0.00	0.00	8.41	6.48	0.37	100.49
	58.05	0.04	27.05	0.00	0.07	0.04	0.01	8.65	6.27	0.33	100.50
	57.92	0.02	26.92	0.00	0.03	0.00	0.01	8.51	6.24	0.32	99.96
	58.16	0.01	26.98	0.00	0.01	0.00	0.00	8.75	6.41	0.32	100.63
	58.42	0.00	27.21	0.04	0.04	0.03	0.02	8.45	6.44	0.29	100.92
	58.13	0.03	27.16	0.00	0.02	0.02	0.02	8.55	6.58	0.29	100.79
	58.58	0.00	27.15	0.00	0.03	0.00	0.01	8.44	6.65	0.30	101.17
	58.67	0.00	26.90	0.00	0.03	0.00	0.01	8.46	6.52	0.36	100.94

	58.40	0.00	26.95	0.01	0.03	0.03	0.02	8.36	6.42	0.39	100.59
	58.60	0.00	26.90	0.00	0.06	0.00	0.02	8.46	6.49	0.34	100.88
	58.58	0.00	26.99	0.00	0.02	0.03	0.00	8.27	6.56	0.39	100.84
	58.03	0.03	26.93	0.03	0.06	0.00	0.01	8.62	6.53	0.33	100.58
PT-LK1	64.22	0.00	22.83	0.02	0.02	0.04	0.01	3.65	9.20	0.39	100.39
	63.96	0.03	22.91	0.00	0.03	0.00	0.01	3.75	8.93	0.46	100.08
	63.93	0.02	22.58	0.00	0.00	0.00	0.00	3.57	8.92	0.54	99.57
	64.97	0.00	22.59	0.01	0.16	0.02	0.01	3.30	9.47	0.36	100.88
	63.94	0.00	22.87	0.04	0.03	0.00	0.02	3.77	9.00	0.45	100.11
	64.06	0.04	22.90	0.02	0.04	0.03	0.00	3.82	9.13	0.43	100.45
	63.99	0.00	23.14	0.00	0.06	0.00	0.02	3.75	8.93	0.41	100.31
	64.52	0.02	22.98	0.00	0.04	0.03	0.01	3.73	9.03	0.46	100.81
	64.42	0.00	22.68	0.02	0.03	0.02	0.00	3.54	9.06	0.44	100.21
	63.33	0.03	22.98	0.04	0.01	0.01	0.00	3.83	8.89	0.42	99.53
	64.67	0.05	21.27	0.00	0.17	0.04	0.07	1.94	4.39	8.18	100.77
	64.14	0.00	23.11	0.00	0.03	0.01	0.01	3.89	9.16	0.41	100.75
	63.49	0.02	23.20	0.00	0.01	0.02	0.01	4.10	8.73	0.39	99.96
	64.28	0.04	23.51	0.02	0.01	0.01	0.00	4.23	8.78	0.44	101.30
	63.40	0.04	23.15	0.00	0.01	0.00	0.01	4.06	8.88	0.68	100.23
	63.89	0.02	23.36	0.00	0.00	0.00	0.00	4.08	8.73	0.61	100.69
	64.19	0.02	23.16	0.03	0.00	0.01	0.02	4.07	8.90	0.48	100.86
	64.43	0.00	23.14	0.00	0.01	0.00	0.00	3.94	8.78	0.41	100.72
	64.07	0.02	23.15	0.00	0.03	0.02	0.01	3.95	8.88	0.44	100.58

Clinopyroxene:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Total
EKT-9B	51.09	0.40	4.57	0.01	8.07	0.09	11.85	21.19	1.41	0.04	98.70
	51.20	0.48	4.49	0.00	7.92	0.03	11.72	21.11	1.50	0.08	98.51
	51.33	0.33	4.44	0.02	7.98	0.03	12.04	21.23	1.37	0.07	98.82
	51.76	0.37	3.98	0.04	7.79	0.05	12.22	21.10	1.37	0.05	98.72
	52.14	0.27	3.50	0.00	7.15	0.06	12.92	21.53	1.33	0.02	98.92
	50.87	0.54	4.59	0.01	8.13	0.06	11.96	21.11	1.47	0.03	98.75
	50.79	0.54	4.50	0.00	7.97	0.07	11.97	21.15	1.42	0.03	98.44
	50.59	0.54	4.72	0.07	8.18	0.03	12.04	21.17	1.36	0.03	98.72
	51.89	0.53	4.37	0.07	7.98	0.04	12.14	20.96	1.31	0.01	99.29
	51.53	0.40	4.38	0.04	7.67	0.05	12.32	21.55	1.46	0.03	99.42
	51.28	0.48	4.34	0.02	8.23	0.02	11.78	20.84	1.49	0.03	98.51

	51.63	0.45	4.34	0.02	7.94	0.04	12.17	20.93	1.54	0.04	99.10
	51.54	0.42	4.27	0.03	7.96	0.04	12.48	20.74	1.45	0.07	98.99
	51.92	0.29	3.60	0.01	7.50	0.08	12.62	21.06	1.47	0.03	98.57
EKT-9D	50.96	0.44	5.16	0.05	7.69	0.04	11.86	21.54	1.39	0.00	99.13
	51.08	0.51	5.28	0.14	7.71	0.06	12.04	21.24	1.44	0.00	99.50
	51.40	0.42	5.04	0.09	7.76	0.06	11.95	21.36	1.33	0.01	99.41
	51.30	0.38	5.11	0.00	7.79	0.09	12.02	21.48	1.38	0.00	99.54
	51.21	0.42	5.10	0.01	7.59	0.06	11.98	21.37	1.40	0.00	99.13
	50.73	0.41	4.97	0.10	7.61	0.08	12.04	21.16	1.38	0.02	98.48
	51.15	0.33	4.94	0.08	7.40	0.06	12.06	21.09	1.45	0.00	98.54
	50.80	0.92	4.80	0.04	7.68	0.03	11.94	21.12	1.40	0.00	98.72
	51.88	0.28	4.73	0.05	7.54	0.07	12.22	21.32	1.44	0.00	99.52
	51.57	0.37	4.76	0.11	7.40	0.07	12.29	21.21	1.54	0.00	99.33
	51.96	0.36	4.10	0.00	7.28	0.04	12.70	21.51	1.28	0.00	99.23
	51.28	0.43	4.51	0.09	7.44	0.04	12.49	21.34	1.47	0.00	99.09
	50.61	0.49	4.92	0.06	7.60	0.06	12.16	21.25	1.44	0.00	98.59
	50.82	0.48	4.80	0.00	7.71	0.05	12.36	21.22	1.33	0.00	98.78
	50.91	0.58	5.03	0.07	7.50	0.02	12.10	21.35	1.40	0.00	98.96
	51.09	0.43	4.67	0.03	7.75	0.06	12.33	21.28	1.34	0.01	98.99
	51.81	0.29	3.99	0.07	7.46	0.07	12.78	21.37	1.37	0.00	99.21
	51.45	0.45	4.46	0.06	7.36	0.08	12.62	21.42	1.37	0.00	99.27
	51.46	0.41	4.36	0.07	7.34	0.05	12.70	21.49	1.37	0.00	99.25
	51.66	0.46	4.41	0.11	7.34	0.07	12.71	21.34	1.38	0.00	99.48
	51.80	0.39	4.30	0.07	7.29	0.06	12.71	21.46	1.51	0.01	99.60
	52.00	0.31	4.02	0.04	7.11	0.05	12.83	21.50	1.25	0.00	99.12
EKT-11A	51.77	0.50	3.62	0.08	7.02	0.07	13.24	21.41	1.13	0.00	98.82
	51.74	0.43	3.53	0.04	7.41	0.06	13.32	21.02	1.08	0.00	98.63
	52.31	0.50	3.64	0.11	7.23	0.14	13.23	21.59	1.01	0.00	99.76
	52.22	0.54	3.59	0.06	7.89	0.09	13.40	20.88	0.99	0.02	99.65
	52.18	0.43	3.47	0.09	7.38	0.10	13.25	21.47	1.06	0.00	99.44
	52.25	0.48	3.60	0.09	6.96	0.09	13.27	21.76	1.14	0.00	99.63
	51.87	0.49	3.48	0.10	7.50	0.08	13.35	20.83	1.06	0.00	98.77
	52.01	0.46	3.48	0.06	7.14	0.10	13.55	21.55	1.08	0.02	99.45
	51.83	0.49	3.42	0.07	7.21	0.11	13.65	21.06	1.04	0.01	98.87
	52.09	0.45	3.22	0.08	6.98	0.06	13.60	21.41	1.02	0.00	98.90
	52.25	0.25	2.89	0.05	6.37	0.07	13.94	21.66	1.12	0.00	98.60
EKT-11B	51.95	0.33	3.99	0.05	7.58	0.09	12.63	21.51	1.40	0.02	99.54

	52.53	0.32	3.81	0.05	7.70	0.06	12.62	21.56	1.48	0.00	100.14
	52.76	0.28	3.80	0.08	7.56	0.08	12.24	21.44	1.42	0.00	99.66
	52.97	0.15	3.00	0.07	5.57	0.05	13.45	22.73	1.07	0.14	99.20
	51.57	0.36	3.96	0.05	8.35	0.07	12.28	21.00	1.39	0.00	99.02
	51.98	0.39	4.02	0.02	8.36	0.08	12.18	21.39	1.43	0.02	99.84
	52.17	0.43	3.96	0.07	8.28	0.11	12.28	21.67	1.45	0.00	100.42
	52.37	0.38	3.94	0.03	8.19	0.13	11.96	21.50	1.38	0.00	99.88
	51.79	0.37	3.80	0.03	8.16	0.06	11.71	21.72	1.33	0.00	98.97
	51.20	0.34	3.93	0.00	8.27	0.13	12.65	20.86	1.35	0.00	98.72
	51.20	0.32	3.75	0.03	8.60	0.09	12.59	20.57	1.38	0.01	98.53
	51.30	0.38	3.84	0.00	8.28	0.10	12.49	20.93	1.37	0.01	98.68
	51.30	0.36	3.85	0.05	8.26	0.07	12.69	20.80	1.33	0.00	98.70
	51.31	0.36	3.86	0.02	8.07	0.09	12.46	21.07	1.47	0.00	98.71
	51.43	0.37	3.78	0.00	8.35	0.13	12.51	20.85	1.43	0.00	98.84
	51.82	0.35	3.73	0.06	7.87	0.07	12.56	21.34	1.33	0.03	99.15
	51.47	0.32	3.56	0.00	8.18	0.09	12.84	20.96	1.43	0.00	98.85
	51.82	0.34	3.37	0.04	8.02	0.07	12.70	20.93	1.44	0.00	98.72
	52.28	0.24	3.12	0.02	7.63	0.07	13.12	21.25	1.44	0.00	99.17
EKT-12	50.00	0.37	3.83	0.06	9.50	0.10	11.85	20.99	1.60	0.01	98.29
	50.57	0.29	3.37	0.03	9.28	0.05	12.13	21.05	1.46	0.01	98.23
	51.00	0.21	2.82	0.04	8.60	0.05	12.80	21.39	1.29	0.00	98.21
	49.76	0.41	4.09	0.00	9.36	0.06	11.81	21.09	1.48	0.00	98.05
	49.94	0.40	4.00	0.02	9.38	0.09	11.74	21.07	1.55	0.00	98.17
	49.75	0.35	3.92	0.04	9.39	0.06	11.70	21.34	1.54	0.00	98.10
BD-184	48.49	0.65	4.99	0.03	11.49	0.11	12.60	19.76	0.97	0.00	99.08
	48.29	0.67	4.87	0.05	12.21	0.12	12.67	18.53	0.83	0.00	98.23
	48.30	0.65	4.90	0.01	11.69	0.08	12.45	19.41	0.87	0.00	98.36
	48.41	0.70	5.13	0.03	9.26	0.10	11.75	22.20	0.95	0.00	98.54
	48.61	0.64	4.94	0.00	9.10	0.10	11.94	22.24	0.91	0.02	98.50
	48.79	0.61	4.82	0.04	10.75	0.10	12.65	20.67	0.90	0.00	99.33
	48.81	0.62	4.68	0.02	9.25	0.10	12.16	22.09	0.96	0.00	98.68
	48.78	0.76	5.26	0.05	9.43	0.05	11.98	21.85	1.01	0.00	99.16
	49.18	0.71	5.11	0.00	9.94	0.05	12.09	21.14	0.93	0.01	99.17
	49.09	0.74	5.07	0.02	9.50	0.10	12.06	21.27	0.97	0.00	98.81
	49.28	0.69	4.84	0.00	8.82	0.06	12.10	22.13	0.96	0.00	98.87
	49.80	0.59	4.22	0.00	8.70	0.08	12.76	21.73	0.79	0.01	98.68
	49.60	0.72	4.49	0.01	8.50	0.05	12.47	22.17	0.84	0.01	98.85

	49.19	0.64	4.56	0.02	8.60	0.08	12.49	22.16	0.81	0.00	98.56
	49.19	0.66	4.76	0.01	8.68	0.08	12.37	21.91	0.84	0.00	98.49
	49.42	0.63	4.70	0.04	8.58	0.08	12.28	21.95	0.86	0.00	98.54
	49.48	0.67	4.35	0.02	8.41	0.08	12.63	21.93	0.98	0.03	98.57
	49.57	0.71	4.40	0.00	8.15	0.05	12.69	21.97	0.86	0.01	98.42
PT-LK1	51.04	0.39	4.80	0.04	8.76	0.07	11.43	19.43	2.44	0.00	98.41
	51.10	0.28	4.88	0.08	8.86	0.07	11.42	19.57	2.37	0.01	98.63
	50.87	0.30	4.71	0.06	9.53	0.09	12.03	18.59	2.30	0.01	98.47
	51.32	0.30	4.57	0.02	10.31	0.08	12.16	17.55	2.14	0.00	98.47
	51.43	0.31	4.69	0.07	8.93	0.06	11.61	19.02	2.46	0.00	98.57
	51.28	0.40	4.57	0.05	9.01	0.08	11.85	18.93	2.40	0.00	98.57
	51.45	0.29	4.32	0.02	8.44	0.03	11.74	19.28	2.44	0.00	98.00
	50.78	0.40	5.18	0.07	8.76	0.05	11.53	19.57	2.23	0.00	98.55
	50.70	0.34	5.08	0.07	8.95	0.08	11.32	19.38	2.33	0.01	98.25
	50.98	0.49	4.96	0.02	9.01	0.04	11.34	19.44	2.28	0.00	98.55
	51.09	0.49	4.84	0.02	8.95	0.09	11.59	19.40	2.42	0.00	98.88
	50.91	0.46	4.78	0.00	8.94	0.08	11.44	19.25	2.40	0.01	98.27
	51.36	0.40	4.84	0.03	8.37	0.08	11.55	19.25	2.59	0.01	98.49
	50.67	1.32	4.33	0.08	9.31	0.05	11.76	18.77	2.22	0.00	98.51
	51.08	0.43	4.69	0.03	9.40	0.06	11.57	18.90	2.33	0.01	98.50
	51.21	0.36	4.53	0.05	8.92	0.08	11.50	19.34	2.45	0.00	98.44
	51.70	0.33	4.45	0.07	8.37	0.06	11.90	19.30	2.58	0.02	98.77

Orthopyroxene:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Total
EKT-11A	53.01	0.03	1.28	0.07	21.55	0.18	23.12	0.46	0.02	0.00	99.71
	52.04	1.98	1.20	0.01	20.23	0.18	22.13	1.79	0.07	0.01	99.64
	53.27	0.09	1.48	0.02	19.89	0.18	22.07	3.18	0.13	0.00	100.29
	53.06	0.06	1.36	0.05	21.36	0.19	22.72	1.03	0.04	0.00	99.87
	53.00	0.04	1.43	0.01	21.52	0.15	22.91	0.47	0.06	0.00	99.58
	52.54	1.02	1.29	0.07	21.83	0.15	22.77	0.46	0.05	0.00	100.16
	52.81	0.03	1.43	0.04	21.61	0.17	22.57	0.85	0.00	0.00	99.50
	52.50	0.04	1.49	0.05	21.61	0.20	22.79	0.49	0.01	0.00	99.17
	52.97	0.00	1.56	0.00	21.57	0.20	22.73	0.77	0.02	0.00	99.82
	52.69	0.08	1.55	0.06	21.73	0.17	23.13	0.45	0.00	0.00	99.84
	52.64	0.32	1.44	0.00	21.40	0.19	22.87	0.77	0.05	0.00	99.68
	51.67	1.12	1.27	0.00	21.52	0.12	22.72	0.51	0.01	0.02	98.96

	52.38	0.06	1.42	0.03	21.77	0.16	22.99	0.46	0.04	0.00	99.31
	52.82	0.01	1.53	0.02	20.65	0.16	22.36	1.78	0.10	0.00	99.43
	52.46	0.07	1.46	0.13	21.65	0.19	22.86	0.41	0.04	0.00	99.26
	52.05	0.08	1.41	0.03	21.87	0.18	23.15	0.46	0.02	0.00	99.25
	52.41	0.01	1.47	0.07	21.63	0.18	22.84	0.41	0.01	0.00	99.02
	52.40	0.05	1.52	0.01	21.59	0.15	22.86	0.42	0.01	0.01	99.00
	52.44	0.04	1.49	0.03	20.97	0.17	22.87	1.16	0.07	0.00	99.24
	52.70	0.03	1.54	0.11	21.00	0.19	22.72	1.20	0.04	0.00	99.53
	52.25	0.02	1.53	0.09	20.70	0.17	23.14	1.04	0.06	0.00	99.02
	52.13	0.04	1.41	0.05	21.16	0.15	23.33	0.45	0.01	0.00	98.73
	52.45	0.05	1.47	0.08	20.08	0.18	22.58	1.95	0.14	0.02	98.98
	52.69	0.03	1.47	0.00	21.14	0.18	23.24	0.56	0.05	0.01	99.38
	52.98	0.05	1.52	0.06	21.00	0.18	23.37	0.52	0.00	0.01	99.69
	52.33	0.04	1.60	0.04	21.25	0.14	23.61	0.41	0.06	0.01	99.47
	52.49	0.04	1.62	0.05	21.04	0.17	23.15	0.58	0.02	0.00	99.15
	52.45	0.05	1.69	0.03	20.92	0.13	22.98	0.63	0.02	0.00	98.89
	52.55	0.87	1.49	0.07	20.81	0.15	23.05	0.47	0.03	0.00	99.49
	53.01	0.03	1.39	0.05	21.05	0.13	23.09	0.74	0.01	0.00	99.50
	53.01	0.40	1.25	0.02	21.04	0.19	23.36	0.60	0.01	0.00	99.87
	52.94	0.03	1.34	0.05	20.88	0.16	23.29	0.75	0.01	0.01	99.46
	52.76	0.05	1.43	0.05	20.93	0.17	23.35	0.41	0.01	0.00	99.14
	52.44	0.06	1.45	0.08	21.35	0.18	23.61	0.41	0.07	0.00	99.64
	52.95	0.05	1.28	0.03	20.99	0.17	23.47	0.76	0.02	0.00	99.72
	52.75	0.02	1.43	0.06	21.22	0.16	23.52	0.45	0.09	0.01	99.71
	52.63	0.04	1.23	0.04	21.14	0.20	23.52	0.45	0.03	0.00	99.28
	52.71	0.07	1.33	0.03	20.89	0.19	23.71	0.44	0.05	0.00	99.41
	53.01	0.03	1.23	0.01	20.89	0.17	23.78	0.44	0.00	0.00	99.56

Ilmenite:

	SiO2	TiO2	Al2O3	Cr2O3	Nb2O5	V2O3	FeO	MnO	NiO	MgO	CaO	Total
EKT-9B	0.03	48.80	0.27	0.10	0.00	0.58	47.45	0.26	0.01	2.18	0.03	99.71
	1.21	47.10	0.58	0.08	0.00	0.51	45.90	0.25	0.04	3.17	0.09	98.93
	0.12	48.59	0.21	0.03	0.00	0.58	47.68	0.23	0.03	2.13	0.00	99.61
	0.07	48.52	0.14	0.04	0.00	0.62	47.90	0.23	0.03	2.09	0.01	99.65
	0.04	48.43	0.17	0.08	0.00	0.59	47.84	0.22	0.02	2.01	0.02	99.41
	0.06	48.61	0.16	0.05	0.03	0.59	47.88	0.22	0.04	2.10	0.02	99.75
	0.07	48.42	0.19	0.05	0.02	0.60	47.88	0.21	0.04	2.01	0.03	99.51

	0.07	48.55	0.17	0.05	0.00	0.54	47.68	0.22	0.05	2.04	0.01	99.37
	0.04	48.23	0.21	0.06	0.00	0.60	47.85	0.24	0.03	2.00	0.02	99.27
	0.06	48.15	0.23	0.07	0.00	0.61	47.93	0.23	0.03	1.99	0.03	99.31
	0.06	48.73	0.25	0.05	0.00	0.57	47.96	0.22	0.03	2.00	0.02	99.87
	0.07	48.78	0.27	0.02	0.02	0.56	47.97	0.22	0.04	1.99	0.02	99.96
	0.05	48.76	0.33	0.05	0.00	0.58	47.67	0.21	0.02	1.99	0.03	99.69
	0.10	48.43	0.43	0.02	0.00	0.63	47.45	0.19	0.05	1.95	0.06	99.30
	0.08	48.95	0.44	0.07	0.00	0.65	47.64	0.20	0.03	1.87	0.05	99.98
	0.06	48.05	0.07	0.06	0.03	0.43	49.02	0.10	0.02	1.98	0.01	99.84
	0.07	48.01	0.06	0.05	0.00	0.47	49.06	0.11	0.02	1.94	0.01	99.79
	0.07	47.97	0.06	0.05	0.00	0.42	48.79	0.10	0.01	1.95	0.01	99.42
	0.06	48.21	0.08	0.06	0.00	0.42	48.66	0.10	0.01	1.85	0.02	99.45
	0.05	48.45	0.06	0.03	0.00	0.46	48.94	0.12	0.02	1.95	0.00	100.07
	0.04	47.24	0.09	0.08	0.00	0.57	49.89	0.11	0.01	1.86	0.02	99.90
	0.09	47.86	0.10	0.05	0.00	0.45	48.73	0.12	0.01	1.92	0.00	99.34
	0.05	48.56	0.25	0.03	0.00	0.43	48.33	0.13	0.00	1.99	0.01	99.79
	0.06	53.07	0.26	0.07	0.00	0.54	44.20	0.17	0.01	2.36	0.01	100.75
	0.06	52.09	0.30	0.08	0.00	0.71	45.92	0.16	0.01	1.70	0.03	101.06
	0.04	51.91	0.30	0.10	0.00	0.70	46.04	0.15	0.01	1.62	0.02	100.89
	0.09	52.23	0.29	0.11	0.00	0.72	45.83	0.19	0.02	1.67	0.03	101.17
	0.06	52.21	0.29	0.09	0.00	0.74	45.79	0.21	0.02	1.75	0.01	101.17
	0.05	52.11	0.29	0.11	0.00	0.70	46.10	0.19	0.02	1.71	0.04	101.31
	0.06	51.89	0.28	0.13	0.00	0.68	46.03	0.18	0.02	1.68	0.02	100.96
	0.05	51.91	0.26	0.08	0.00	0.68	46.23	0.18	0.00	1.68	0.02	101.09
	0.05	51.64	0.25	0.07	0.00	0.74	45.91	0.21	0.02	1.79	0.03	100.71
	0.07	51.84	0.27	0.08	0.01	0.67	46.07	0.19	0.01	1.73	0.05	100.98
EKT-9D	0.03	46.76	0.08	0.21	0.00	0.28	50.81	0.10	0.00	1.51	0.01	99.79
	0.03	44.94	0.05	0.24	0.00	0.39	52.09	0.11	0.04	1.34	0.01	99.25
	0.05	46.56	0.04	0.17	0.02	0.27	50.90	0.12	0.08	1.44	0.01	99.68
	0.03	46.88	0.09	0.22	0.05	0.25	50.62	0.13	0.06	1.38	0.01	99.70
	0.05	45.43	0.08	0.29	0.01	0.32	51.80	0.10	0.05	1.27	0.01	99.40
	0.05	45.50	0.07	0.27	0.02	0.35	51.64	0.11	0.03	1.25	0.03	99.30
	0.04	46.27	0.10	0.19	0.02	0.28	50.92	0.11	0.06	1.32	0.03	99.35
	0.03	46.34	0.11	0.18	0.00	0.30	50.75	0.10	0.02	1.30	0.02	99.14
	0.03	45.62	0.23	0.22	0.03	0.34	51.10	0.10	0.00	1.30	0.06	99.03
	0.09	45.68	0.32	0.20	0.06	0.27	50.57	0.11	0.05	1.26	0.15	98.75
	0.06	47.31	0.10	0.13	0.00	0.34	48.64	0.13	0.00	2.37	0.03	99.10

	0.05	49.35	0.06	0.08	0.04	0.23	47.34	0.13	0.05	2.56	0.02	99.91
	0.05	49.22	0.04	0.08	0.00	0.26	47.24	0.16	0.06	2.51	0.01	99.63
	0.06	47.48	0.07	0.14	0.00	0.37	48.74	0.11	0.05	2.32	0.01	99.35
	0.04	48.85	0.06	0.12	0.04	0.25	47.74	0.12	0.05	2.41	0.03	99.71
	0.05	48.29	0.08	0.12	0.01	0.29	48.06	0.12	0.06	2.38	0.03	99.47
	0.07	48.71	0.07	0.09	0.01	0.22	47.64	0.15	0.08	2.41	0.05	99.48
	0.04	48.47	0.09	0.12	0.00	0.25	47.90	0.17	0.04	2.33	0.08	99.48
	0.09	48.34	0.10	0.10	0.00	0.28	47.35	0.13	0.03	2.23	0.26	98.91
	0.04	46.98	0.06	0.18	0.00	0.23	51.20	0.11	0.03	1.16	0.00	99.98
	0.07	46.87	0.08	0.19	0.00	0.24	51.28	0.10	0.02	1.19	0.01	100.05
	0.05	46.92	0.06	0.21	0.00	0.23	51.16	0.10	0.05	1.18	0.00	99.95
	0.03	46.68	0.07	0.18	0.01	0.25	50.94	0.12	0.04	1.20	0.02	99.53
	0.05	47.02	0.08	0.16	0.02	0.25	50.82	0.11	0.02	1.27	0.00	99.78
	0.05	46.88	0.05	0.20	0.02	0.25	51.26	0.10	0.02	1.22	0.02	100.05
	0.06	46.58	0.10	0.21	0.04	0.27	51.43	0.11	0.03	1.21	0.00	100.03
	0.06	46.97	0.09	0.23	0.02	0.25	50.85	0.11	0.05	1.26	0.00	99.88
	0.04	47.18	0.08	0.17	0.00	0.21	50.79	0.09	0.06	1.26	0.00	99.88
	0.04	46.49	0.09	0.20	0.00	0.27	50.80	0.09	0.07	1.36	0.02	99.43
	0.04	46.73	0.08	0.20	0.00	0.27	50.70	0.09	0.01	1.44	0.01	99.56
	0.06	47.02	0.06	0.21	0.00	0.21	50.30	0.10	0.04	1.56	0.01	99.56
	0.05	47.04	0.08	0.18	0.00	0.24	50.16	0.10	0.05	1.73	0.02	99.64
	0.05	47.52	0.10	0.15	0.02	0.21	49.42	0.12	0.05	2.09	0.07	99.81
EKT-11B	0.04	48.97	0.07	0.07	0.00	0.28	48.46	0.17	0.02	1.94	0.00	100.00
	0.06	48.24	0.06	0.07	0.00	0.32	48.78	0.17	0.01	2.04	0.01	99.76
	0.02	48.10	0.10	0.03	0.00	0.29	49.37	0.16	0.02	1.96	0.01	100.06
	0.05	47.84	0.07	0.08	0.00	0.37	49.43	0.12	0.02	2.01	0.00	99.99
	0.04	48.16	0.08	0.07	0.00	0.34	49.17	0.17	0.01	2.08	0.02	100.13
	0.05	47.20	0.09	0.10	0.00	0.34	49.86	0.18	0.02	2.09	0.01	99.94
	0.05	46.93	0.12	0.08	0.06	0.45	49.70	0.16	0.01	2.02	0.01	99.61
	0.03	47.52	0.20	0.07	0.00	0.32	48.60	0.19	0.02	2.23	0.03	99.20
	0.03	48.70	0.27	0.07	0.01	0.35	47.00	0.22	0.01	2.34	0.03	99.03
	0.07	49.55	0.34	0.05	0.00	0.32	47.11	0.22	0.00	2.37	0.03	100.06
	0.06	50.65	0.13	0.08	0.02	0.47	47.05	0.20	0.01	1.92	0.01	100.58
	0.05	50.76	0.12	0.04	0.00	0.48	47.35	0.23	0.02	1.88	0.01	100.92
	0.03	50.51	0.09	0.06	0.00	0.50	47.18	0.22	0.00	1.95	0.01	100.54
	0.04	50.43	0.15	0.08	0.00	0.47	47.14	0.22	0.00	1.83	0.00	100.35
	0.04	50.90	0.08	0.09	0.00	0.43	47.34	0.18	0.00	1.93	0.00	100.99

	0.05	50.65	0.07	0.09	0.00	0.44	47.29	0.19	0.00	1.85	0.02	100.65
	0.05	50.77	0.16	0.08	0.00	0.45	47.00	0.19	0.00	1.78	0.02	100.49
	0.03	50.74	0.07	0.09	0.00	0.48	47.19	0.17	0.00	1.90	0.00	100.67
	0.05	50.73	0.06	0.07	0.05	0.45	47.21	0.17	0.02	1.86	0.00	100.67
	0.04	50.65	0.07	0.06	0.00	0.47	47.21	0.20	0.00	1.86	0.00	100.57
	0.06	50.85	0.05	0.08	0.00	0.43	47.00	0.19	0.01	1.87	0.02	100.56
	0.06	50.81	0.04	0.06	0.00	0.45	47.00	0.18	0.03	1.80	0.01	100.41
	0.03	50.80	0.08	0.09	0.00	0.40	46.96	0.19	0.01	1.87	0.00	100.43
	0.04	50.68	0.14	0.11	0.00	0.41	46.82	0.17	0.00	1.78	0.00	100.16
	0.03	50.91	0.25	0.10	0.00	0.42	46.75	0.18	0.01	1.84	0.00	100.49
	0.05	49.21	0.05	0.05	0.00	0.38	48.61	0.12	0.01	1.83	0.02	100.33
	0.06	49.59	0.05	0.05	0.00	0.36	48.41	0.15	0.00	1.94	0.00	100.59
	0.07	46.67	0.06	0.09	0.00	0.37	51.02	0.15	0.00	1.94	0.00	100.36
	0.06	48.79	0.07	0.03	0.00	0.37	48.20	0.14	0.02	1.91	0.01	99.59
	0.05	43.60	0.09	0.10	0.04	0.44	52.36	0.16	0.00	1.92	0.02	98.80
	0.01	47.41	0.06	0.07	0.00	0.36	49.26	0.16	0.00	1.94	0.00	99.28
	0.05	49.08	0.05	0.02	0.00	0.37	48.25	0.15	0.01	1.92	0.00	99.89
	0.05	49.37	0.05	0.04	0.03	0.33	48.25	0.15	0.01	1.96	0.01	100.24
	0.41	49.11	0.16	0.03	0.00	0.34	47.57	0.16	0.00	2.19	0.01	99.98
	0.07	49.94	0.08	0.05	0.07	0.35	47.60	0.18	0.05	2.20	0.01	100.60
	0.03	49.45	0.06	0.04	0.00	0.35	47.92	0.20	0.00	2.14	0.02	100.22
	0.06	49.00	0.06	0.07	0.00	0.37	47.56	0.17	0.00	2.23	0.02	99.55
	0.08	48.56	0.10	0.03	0.00	0.38	47.72	0.24	0.00	2.30	0.02	99.42
	0.05	48.51	0.16	0.07	0.00	0.42	47.81	0.24	0.00	2.33	0.02	99.60
PT-LK-1	0.01	46.84	0.09	0.13	0.00	0.53	50.11	0.11	0.00	1.90	0.01	99.72
	0.00	46.94	0.08	0.14	0.06	0.58	50.09	0.11	0.00	1.96	0.00	99.96
	0.00	46.91	0.09	0.15	0.01	0.53	49.73	0.12	0.00	2.00	0.02	99.56
	0.04	45.32	0.07	0.20	0.00	0.70	51.04	0.15	0.36	1.94	0.02	99.84
	0.04	47.48	0.06	0.16	0.00	0.51	49.36	0.07	0.53	2.11	0.01	100.33
	0.05	48.76	0.13	0.18	0.00	0.73	49.23	0.11	0.04	1.35	0.01	100.58
	0.05	46.40	0.09	0.17	0.00	0.90	50.48	0.08	0.01	1.10	0.01	99.27
	0.03	46.67	0.22	0.27	0.00	0.94	50.21	0.07	0.13	1.31	0.01	99.85
	0.06	42.58	0.10	0.23	0.00	0.66	53.72	0.07	0.06	1.61	0.01	99.08
	0.04	43.23	0.08	0.20	0.00	0.62	52.95	0.07	0.14	1.75	0.02	99.10
	0.02	46.45	0.21	0.13	0.00	0.35	50.55	0.13	0.00	2.31	0.02	100.16

Rutile:

	SiO2	TiO2	Al2O3	Cr2O3	Nb2O5	V2O3	FeO	MnO	NiO	MgO	CaO	Total
EKT-9B	0.04	98.74	0.19	0.03	0.09	0.46	0.20	0.00	0.03	0.01	0.01	99.80
	0.04	99.36	0.19	0.02	0.04	0.46	0.19	0.00	0.02	0.02	0.00	100.34
	0.07	98.14	0.20	0.04	0.02	0.46	0.25	0.00	0.00	0.02	0.00	99.20
	0.04	98.63	0.21	0.04	0.04	0.41	0.19	0.00	0.00	0.02	0.00	99.59
	0.04	98.70	0.22	0.05	0.05	0.47	0.20	0.00	0.00	0.01	0.02	99.75
	0.05	98.64	0.21	0.08	0.06	0.46	0.16	0.01	0.00	0.02	0.00	99.69
	0.04	98.83	0.20	0.07	0.00	0.47	0.20	0.00	0.00	0.03	0.00	99.83
	0.03	98.85	0.22	0.04	0.01	0.46	0.22	0.00	0.00	0.01	0.01	99.85
	0.06	98.52	0.22	0.06	0.06	0.46	0.21	0.03	0.00	0.02	0.01	99.64
	0.05	98.77	0.20	0.06	0.03	0.47	0.19	0.00	0.00	0.01	0.00	99.77
	0.03	98.46	0.20	0.05	0.06	0.44	0.20	0.01	0.02	0.00	0.00	99.48
	0.05	98.58	0.22	0.03	0.02	0.44	0.21	0.02	0.00	0.01	0.00	99.57
	0.05	98.80	0.18	0.04	0.00	0.48	0.18	0.00	0.00	0.02	0.00	99.76
	0.05	98.95	0.21	0.07	0.04	0.46	0.20	0.02	0.00	0.00	0.02	100.02
	0.07	98.33	0.18	0.06	0.00	0.45	0.23	0.02	0.00	0.03	0.12	99.50
	0.02	98.90	0.20	0.05	0.09	0.37	0.24	0.01	0.00	0.02	0.02	99.92
	0.04	98.64	0.22	0.04	0.06	0.33	0.23	0.00	0.01	0.00	0.01	99.57
	0.05	98.33	0.21	0.07	0.04	0.32	0.23	0.00	0.02	0.02	0.01	99.30
	0.03	98.77	0.20	0.03	0.11	0.39	0.26	0.01	0.02	0.03	0.01	99.85
	0.05	98.30	0.18	0.05	0.07	0.36	0.30	0.00	0.00	0.03	0.02	99.37
	0.03	98.79	0.16	0.04	0.10	0.31	0.38	0.03	0.00	0.01	0.02	99.86
	0.04	98.75	0.16	0.04	0.08	0.34	0.42	0.01	0.00	0.02	0.02	99.86
	0.05	98.69	0.16	0.03	0.08	0.30	0.60	0.00	0.01	0.02	0.03	99.96
	0.04	98.77	0.13	0.05	0.19	0.33	0.31	0.01	0.02	0.02	0.04	99.90
	0.04	99.28	0.12	0.01	0.12	0.32	0.31	0.00	0.00	0.01	0.04	100.25
	0.04	99.20	0.17	0.07	0.01	0.62	0.13	0.01	0.00	0.03	0.00	100.28
	0.03	99.36	0.17	0.04	0.02	0.59	0.13	0.01	0.00	0.02	0.01	100.38
	0.03	99.32	0.18	0.03	0.00	0.60	0.14	0.00	0.01	0.04	0.01	100.38
	0.05	99.10	0.19	0.07	0.04	0.61	0.13	0.00	0.00	0.02	0.01	100.21
	0.04	98.93	0.19	0.08	0.00	0.67	0.16	0.00	0.00	0.01	0.01	100.10
	0.05	99.03	0.22	0.07	0.02	0.61	0.14	0.01	0.00	0.00	0.01	100.15
	0.07	99.04	0.21	0.05	0.00	0.60	0.17	0.02	0.00	0.03	0.02	100.20
	0.04	99.14	0.21	0.05	0.05	0.56	0.18	0.02	0.01	0.03	0.02	100.30
	0.06	98.96	0.21	0.04	0.00	0.64	0.21	0.02	0.00	0.02	0.03	100.19
	0.08	98.86	0.20	0.02	0.00	0.62	0.36	0.01	0.00	0.00	0.06	100.21
EKT-9D	0.05	99.51	0.12	0.16	0.12	0.19	0.17	0.02	0.00	0.02	0.02	100.38

	0.05	99.59	0.16	0.19	0.07	0.23	0.31	0.01	0.00	0.03	0.00	100.63
	0.03	96.53	0.15	0.14	0.07	0.23	2.98	0.00	0.00	0.18	0.01	100.32
	0.03	99.38	0.16	0.14	0.06	0.21	0.12	0.00	0.00	0.03	0.01	100.13
	0.06	99.33	0.17	0.14	0.08	0.19	0.12	0.00	0.00	0.01	0.03	100.13
	0.03	99.31	0.18	0.18	0.03	0.25	0.12	0.00	0.00	0.00	0.03	100.13
	0.06	99.34	0.19	0.13	0.13	0.20	0.12	0.02	0.01	0.03	0.02	100.24
	0.05	99.50	0.18	0.16	0.08	0.23	0.10	0.02	0.00	0.02	0.04	100.37
	0.02	99.67	0.18	0.17	0.07	0.15	0.11	0.01	0.00	0.04	0.04	100.46
	0.05	99.48	0.17	0.20	0.10	0.18	0.10	0.02	0.00	0.01	0.06	100.38
	0.05	98.97	0.09	0.13	0.08	0.21	0.27	0.01	0.00	0.00	0.04	99.84
	0.05	98.91	0.09	0.08	0.08	0.22	0.34	0.01	0.00	0.00	0.03	99.80
	0.05	96.32	0.09	0.09	0.05	0.19	2.62	0.01	0.00	0.04	0.03	99.49
	0.05	96.11	0.10	0.10	0.05	0.20	3.11	0.00	0.00	0.06	0.04	99.83
	0.04	97.61	0.14	0.09	0.03	0.17	1.52	0.02	0.00	0.05	0.08	99.73
	0.04	98.71	0.12	0.11	0.03	0.23	0.25	0.00	0.00	0.02	0.11	99.63
	0.04	95.65	0.14	0.08	0.05	0.22	3.24	0.01	0.00	0.09	0.14	99.65
	0.05	97.66	0.17	0.09	0.04	0.21	1.13	0.00	0.01	0.03	0.19	99.56
	0.03	98.95	0.15	0.13	0.08	0.23	0.28	0.02	0.00	0.01	0.27	100.14
	0.04	98.86	0.16	0.13	0.05	0.22	0.32	0.01	0.00	0.02	0.41	100.21
	0.03	99.41	0.14	0.13	0.06	0.35	0.40	0.00	0.00	0.00	0.01	100.52
	0.05	99.47	0.12	0.10	0.02	0.37	0.24	0.00	0.00	0.01	0.02	100.40
	0.05	98.71	0.16	0.14	0.03	0.39	0.88	0.00	0.01	0.03	0.02	100.41
	0.07	99.46	0.16	0.14	0.00	0.31	0.26	0.01	0.00	0.03	0.02	100.44
	0.04	99.17	0.18	0.10	0.04	0.34	0.27	0.00	0.00	0.01	0.02	100.16
	0.03	97.11	0.20	0.11	0.05	0.35	2.72	0.00	0.02	0.04	0.03	100.64
	0.04	98.11	0.18	0.14	0.05	0.34	1.62	0.01	0.00	0.03	0.03	100.54
	0.06	97.33	0.19	0.09	0.05	0.33	2.02	0.01	0.00	0.06	0.05	100.20
	0.03	98.85	0.16	0.15	0.05	0.36	0.60	0.00	0.00	0.02	0.10	100.33
	0.04	99.08	0.17	0.07	0.03	0.31	0.27	0.02	0.00	0.00	0.20	100.18
EKT-11B	0.06	98.61	0.21	0.09	0.20	0.26	0.33	0.02	0.00	0.02	0.02	99.82
	0.06	98.48	0.49	0.06	0.31	0.26	0.36	0.02	0.00	0.01	0.01	100.05
	0.03	98.79	0.19	0.04	0.17	0.27	0.34	0.01	0.00	0.02	0.00	99.86
	0.06	98.16	0.21	0.04	0.28	0.25	0.33	0.03	0.01	0.00	0.00	99.38
	0.04	98.26	0.23	0.04	0.19	0.30	0.37	0.01	0.02	0.01	0.00	99.47
	0.05	98.30	0.25	0.06	0.22	0.27	0.36	0.00	0.03	0.00	0.01	99.54
	0.05	98.25	0.22	0.09	0.16	0.26	0.38	0.02	0.02	0.02	0.01	99.47
	0.05	98.55	0.24	0.07	0.21	0.30	0.40	0.01	0.01	0.01	0.01	99.84

	0.05	98.55	0.23	0.09	0.23	0.25	0.48	0.00	0.00	0.00	0.04	99.92
	0.05	98.04	0.23	0.02	0.23	0.25	0.78	0.01	0.01	0.02	0.09	99.73
	0.06	98.86	0.19	0.07	0.08	0.42	0.23	0.00	0.00	0.03	0.01	99.95
	0.02	98.93	0.14	0.05	0.18	0.38	0.23	0.00	0.01	0.01	0.00	99.96
	0.04	98.72	0.12	0.08	0.11	0.37	0.21	0.00	0.01	0.02	0.00	99.67
	0.03	99.01	0.14	0.07	0.13	0.40	0.21	0.00	0.00	0.00	0.03	100.02
	0.05	99.01	0.14	0.12	0.09	0.44	0.27	0.03	0.01	0.01	0.00	100.15
	0.04	98.61	0.15	0.09	0.05	0.42	0.22	0.00	0.01	0.00	0.02	99.60
	0.04	98.67	0.16	0.06	0.08	0.44	0.21	0.02	0.03	0.01	0.01	99.72
	0.06	98.63	0.15	0.11	0.13	0.41	0.23	0.01	0.00	0.01	0.02	99.74
	0.03	98.73	0.13	0.11	0.13	0.40	0.24	0.01	0.02	0.01	0.01	99.80
	0.05	98.57	0.12	0.07	0.02	0.38	0.23	0.00	0.00	0.03	0.01	99.48
	0.06	98.77	0.12	0.07	0.07	0.41	0.24	0.01	0.00	0.02	0.01	99.75
	0.06	98.72	0.12	0.10	0.12	0.40	0.23	0.03	0.00	0.01	0.01	99.80
	0.03	98.47	0.12	0.09	0.08	0.42	0.25	0.01	0.00	0.02	0.01	99.50
	0.05	98.57	0.10	0.09	0.08	0.40	0.30	0.02	0.00	0.01	0.02	99.64
	0.04	99.11	0.10	0.07	0.05	0.34	0.39	0.01	0.00	0.01	0.04	100.17
	0.03	99.67	0.17	0.06	0.28	0.36	0.18	0.01	0.00	0.02	0.02	100.80
	0.05	99.62	0.14	0.00	0.27	0.41	0.19	0.02	0.00	0.02	0.01	100.73
	0.04	99.87	0.13	0.04	0.22	0.37	0.20	0.01	0.00	0.02	0.02	100.92
	0.04	99.58	0.12	0.04	0.27	0.39	0.22	0.00	0.00	0.01	0.03	100.70
	0.03	99.10	0.13	0.02	0.24	0.38	0.19	0.02	0.01	0.03	0.03	100.16
	0.05	99.00	0.11	0.03	0.15	0.34	0.37	0.01	0.00	0.01	0.01	100.07
	0.05	99.75	0.12	0.02	0.19	0.33	0.16	0.00	0.01	0.02	0.02	100.67
	0.03	99.59	0.14	0.06	0.22	0.41	0.16	0.02	0.00	0.02	0.01	100.67
	0.05	99.80	0.10	0.04	0.29	0.41	0.16	0.01	0.01	0.01	0.00	100.89
	0.03	99.70	0.15	0.02	0.23	0.39	0.14	0.00	0.01	0.01	0.01	100.69
	0.05	99.61	0.11	0.04	0.24	0.38	0.28	0.02	0.00	0.03	0.01	100.74
	0.02	100.06	0.10	0.03	0.18	0.38	0.21	0.00	0.00	0.00	0.00	101.00
	0.04	99.63	0.09	0.05	0.22	0.37	0.22	0.00	0.00	0.03	0.01	100.65
	0.06	99.72	0.07	0.03	0.28	0.34	0.23	0.01	0.01	0.01	0.02	100.78
	1.61	94.33	0.57	0.08	0.31	0.35	1.12	0.04	0.00	0.41	0.05	98.87
PT-LK-1	0.04	98.51	0.28	0.07	0.00	0.32	0.85	0.01	0.36	0.02	0.01	100.47
	0.06	98.27	0.42	0.10	0.02	0.37	1.32	0.02	0.00	0.03	0.02	100.63
	0.03	98.90	0.32	0.16	0.03	0.38	0.64	0.00	0.00	0.01	0.22	100.68
	0.04	98.16	0.31	0.14	0.04	0.42	0.72	0.00	0.00	0.00	0.01	99.84
	0.02	98.63	0.09	0.10	0.06	0.53	0.68	0.02	0.29	0.00	0.02	100.44

	0.04	98.23	0.18	0.07	0.01	0.48	0.62	0.03	0.00	0.00	0.00	99.66
	0.02	98.16	0.17	0.09	0.05	0.54	0.77	0.02	0.02	0.03	0.00	99.85
	0.06	99.58	0.17	0.05	0.17	0.41	0.76	0.02	0.00	0.02	0.02	101.24
	0.03	99.61	0.28	0.10	0.08	0.33	0.70	0.00	0.00	0.00	0.00	101.11

Hornblende:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	F	Cl	Total
EKT-9D	40.98	2.25	13.70	0.06	12.41	0.04	11.63	11.51	1.73	2.49	0.71	0.20	97.35
	41.08	2.07	13.66	0.05	12.29	0.00	11.87	11.48	1.74	2.35	0.75	0.22	97.20
	40.90	2.35	13.72	0.00	12.36	0.02	11.56	11.43	1.67	2.49	0.66	0.23	97.06
	40.90	2.28	13.74	0.09	12.46	0.02	11.63	11.53	1.71	2.47	0.68	0.24	97.41

Munn Lake

Garnet:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Total
MN51311	38.73	0.14	21.49	0.00	27.54	0.55	5.86	6.60	0.00	0.00	100.92
	38.54	0.08	21.72	0.07	27.51	0.52	5.83	6.54	0.00	0.00	100.82
	38.85	0.09	21.60	0.01	27.42	0.58	6.00	6.56	0.05	0.01	101.17
	38.44	0.16	21.61	0.04	27.62	0.53	5.84	6.53	0.01	0.00	100.78
	38.40	0.14	21.65	0.03	27.51	0.58	5.84	6.62	0.03	0.00	100.79
	38.88	0.11	21.58	0.06	27.31	0.53	5.87	6.63	0.00	0.00	100.98
	38.38	0.10	21.66	0.08	27.04	0.55	5.90	6.42	0.02	0.00	100.14
	38.34	0.08	21.67	0.04	27.04	0.60	5.78	6.47	0.02	0.00	100.04
	38.51	0.11	21.52	0.06	27.38	0.55	5.88	6.63	0.07	0.00	100.72
	38.61	0.09	21.52	0.07	27.30	0.57	5.85	6.82	0.00	0.00	100.83
	38.54	0.12	21.62	0.06	27.06	0.56	5.88	6.69	0.07	0.00	100.59
	38.70	0.11	21.39	0.07	27.37	0.53	5.83	6.80	0.05	0.00	100.84
	38.63	0.09	21.66	0.02	27.24	0.55	5.82	6.94	0.00	0.00	100.94
	38.58	0.05	21.59	0.03	27.11	0.51	5.58	7.30	0.03	0.00	100.78
	38.08	0.04	21.55	0.01	26.05	0.47	5.83	7.75	0.02	0.06	99.86
	38.57	0.02	21.56	0.08	26.82	0.53	5.63	7.57	0.01	0.00	100.79
	38.54	0.06	21.48	0.08	27.08	0.56	5.76	7.21	0.04	0.00	100.79
	38.92	0.04	21.52	0.03	26.86	0.55	5.85	7.02	0.01	0.00	100.79
	39.14	0.08	21.57	0.04	26.88	0.56	5.83	7.23	0.02	0.01	101.36
	38.61	0.03	21.66	0.00	27.04	0.51	5.78	7.18	0.01	0.01	100.82
	38.63	0.02	21.46	0.03	27.01	0.54	5.71	7.19	0.00	0.00	100.58
	38.79	0.04	21.57	0.02	26.91	0.53	5.99	7.38	0.02	0.02	101.25

	38.58	0.02	21.75	0.01	26.87	0.55	5.70	7.35	0.02	0.01	100.85
	38.66	0.05	21.75	0.07	26.96	0.50	5.67	7.45	0.05	0.00	101.16
	38.59	0.05	21.59	0.03	26.83	0.53	5.63	7.64	0.05	0.00	100.93
	38.79	0.00	21.49	0.06	26.41	0.54	5.59	7.68	0.05	0.01	100.61
	38.83	0.02	21.67	0.01	26.46	0.52	5.45	7.90	0.03	0.00	100.88
	38.48	0.10	21.68	0.03	27.05	0.55	6.40	6.39	0.02	0.00	100.71
	38.40	0.04	21.63	0.07	27.10	0.57	6.36	6.44	0.04	0.00	100.65
	38.81	0.03	21.93	0.06	26.80	0.56	6.38	6.43	0.05	0.00	101.03
	38.91	0.11	21.86	0.10	26.94	0.54	6.49	6.35	0.02	0.00	101.32
	38.20	0.08	21.51	0.03	26.72	0.53	6.17	6.37	0.00	0.00	99.60
	38.39	0.09	21.70	0.07	26.96	0.55	6.43	6.46	0.02	0.01	100.68
	38.67	0.10	21.57	0.05	27.10	0.54	6.40	6.46	0.00	0.00	100.88
	38.69	0.11	21.60	0.07	26.83	0.58	6.38	6.40	0.04	0.01	100.71
	38.69	0.14	21.62	0.03	27.20	0.55	6.27	6.51	0.02	0.00	101.03
	38.53	0.09	21.52	0.06	27.15	0.53	6.31	6.46	0.03	0.00	100.67
	38.86	0.11	21.47	0.10	26.91	0.55	6.25	6.52	0.04	0.00	100.79
	38.94	0.10	21.56	0.02	26.98	0.52	6.30	6.47	0.01	0.00	100.90
	38.38	0.12	21.70	0.05	27.03	0.54	6.25	6.64	0.03	0.00	100.74
	38.72	0.08	21.44	0.05	26.49	0.49	6.15	6.90	0.04	0.00	100.36
	38.97	0.13	21.86	0.06	27.02	0.54	6.33	6.43	0.05	0.00	101.39
	38.70	0.14	21.60	0.06	26.86	0.53	6.32	6.48	0.03	0.00	100.72
	38.70	0.11	21.55	0.06	26.90	0.58	6.32	6.44	0.02	0.00	100.68
	38.63	0.11	21.78	0.04	27.14	0.58	6.45	6.45	0.01	0.00	101.18
	38.77	0.11	21.63	0.04	27.03	0.58	6.36	6.48	0.04	0.00	101.03
	37.68	0.13	22.93	0.02	26.09	0.48	5.85	6.31	0.03	0.02	99.53
	38.58	0.11	21.61	0.03	27.07	0.60	6.26	6.49	0.02	0.01	100.78
	38.79	0.12	21.68	0.06	26.79	0.61	6.32	6.52	0.01	0.00	100.90
	38.51	0.11	21.69	0.06	27.01	0.53	6.27	6.53	0.00	0.01	100.73
	38.74	0.13	21.77	0.06	27.15	0.54	6.38	6.52	0.03	0.00	101.32
	38.92	0.14	21.66	0.03	27.00	0.58	6.26	6.61	0.03	0.00	101.24
	38.63	0.11	21.68	0.02	26.85	0.53	6.31	6.59	0.00	0.00	100.73
	38.55	0.12	21.55	0.09	26.67	0.55	6.14	6.68	0.03	0.00	100.39
	38.72	0.10	21.39	0.03	26.91	0.53	6.09	6.76	0.00	0.00	100.55
	38.76	0.09	21.61	0.05	26.82	0.52	6.02	6.99	0.03	0.00	100.88
MN51312	39.27	0.20	21.85	0.04	25.34	0.59	7.31	6.32	0.03	0.00	100.93
	39.39	0.15	22.01	0.07	25.55	0.56	7.20	6.27	0.01	0.00	101.21
	39.07	0.15	21.88	0.06	25.50	0.49	7.24	6.39	0.03	0.00	100.80

38.97	0.20	21.79	0.09	25.51	0.53	7.28	6.26	0.05	0.01	100.68
39.00	0.15	21.85	0.13	25.72	0.54	7.22	6.25	0.00	0.00	100.86
39.23	0.14	21.75	0.05	25.47	0.53	7.27	6.37	0.03	0.00	100.82
38.71	0.11	21.79	0.05	25.52	0.56	7.23	6.28	0.05	0.00	100.29
39.07	0.10	21.78	0.05	25.53	0.56	7.14	6.34	0.05	0.00	100.62
38.77	0.13	21.76	0.00	25.68	0.58	7.17	6.39	0.01	0.00	100.48
38.99	0.14	21.81	0.07	25.53	0.54	7.05	6.33	0.00	0.01	100.47
39.10	0.15	21.80	0.05	25.49	0.54	7.04	6.44	0.04	0.00	100.64
38.91	0.15	21.74	0.04	25.73	0.56	7.06	6.39	0.05	0.01	100.64
38.76	0.14	21.65	0.02	25.62	0.52	7.01	6.53	0.03	0.01	100.29
38.89	0.11	21.80	0.03	25.27	0.58	6.97	6.53	0.03	0.00	100.22
38.58	0.13	21.62	0.07	25.62	0.52	6.89	6.42	0.00	0.00	99.83
38.77	0.08	21.79	0.01	25.50	0.61	7.12	6.16	0.00	0.01	100.05
39.07	0.04	21.82	0.09	25.91	0.63	7.12	6.20	0.02	0.00	100.90
38.97	0.03	21.78	0.13	25.70	0.63	7.07	6.32	0.01	0.00	100.63
39.27	0.06	21.96	0.06	25.90	0.62	6.97	6.24	0.01	0.01	101.10
39.01	0.07	21.81	0.08	25.78	0.60	7.13	6.31	0.00	0.00	100.79
38.91	0.07	21.68	0.08	25.89	0.59	7.01	6.39	0.03	0.00	100.66
39.01	0.06	21.85	0.07	25.36	0.57	6.81	6.24	0.03	0.00	99.98
38.90	0.02	21.91	0.09	25.77	0.56	6.91	6.24	0.03	0.01	100.44
38.98	0.05	21.83	0.06	25.91	0.56	7.10	6.38	0.02	0.02	100.90
38.86	0.02	21.83	0.05	25.80	0.56	6.99	6.29	0.00	0.00	100.40
38.79	0.05	21.77	0.08	25.73	0.59	7.00	6.46	0.02	0.00	100.48
38.89	0.01	21.81	0.09	25.55	0.51	7.04	6.57	0.00	0.01	100.48
39.14	0.02	21.01	0.05	24.41	0.53	7.47	6.49	0.00	0.01	99.13
38.99	0.03	21.88	0.09	25.11	0.52	6.86	7.09	0.00	0.01	100.58
38.82	0.04	21.78	0.05	25.99	0.58	6.89	6.45	0.00	0.01	100.60
38.62	0.02	21.82	0.04	25.88	0.61	6.84	6.42	0.00	0.00	100.25
38.82	0.01	21.71	0.04	25.69	0.55	6.80	6.41	0.00	0.00	100.04
38.75	0.03	21.84	0.09	25.72	0.56	6.90	6.29	0.04	0.00	100.21
38.73	0.00	21.82	0.06	25.79	0.60	7.14	6.31	0.02	0.01	100.48
39.87	0.04	22.54	0.11	25.65	0.57	6.73	6.39	0.03	0.01	101.93
38.51	0.04	21.74	0.05	25.77	0.59	6.85	6.24	0.04	0.01	99.83
38.82	0.01	21.81	0.07	25.82	0.61	6.92	6.39	0.01	0.01	100.46
35.97	6.98	20.36	0.04	23.94	0.54	6.45	5.98	0.02	0.00	100.28
38.67	0.04	22.01	0.03	25.36	0.59	7.05	6.35	0.01	0.00	100.11
38.91	0.21	21.89	0.02	25.67	0.63	6.77	6.51	0.05	0.00	100.65

	38.81	0.07	22.16	0.02	25.62	0.64	6.92	6.60	0.00	0.01	100.85
	38.83	0.01	21.77	0.10	25.57	0.61	6.86	6.57	0.02	0.00	100.33
	38.89	0.05	21.92	0.04	25.67	0.61	6.92	6.87	0.02	0.01	101.01
	38.64	0.06	21.44	0.10	25.05	0.55	7.02	7.14	0.04	0.00	100.03
MN51313	40.68	0.05	23.03	0.13	15.81	0.38	14.27	5.68	0.03	0.00	100.06
	40.94	0.05	23.25	0.13	15.88	0.36	14.34	5.63	0.03	0.00	100.59
	40.45	0.07	22.79	0.17	15.69	0.38	14.01	5.62	0.00	0.01	99.19
	40.97	0.03	23.21	0.15	15.89	0.38	14.05	5.59	0.02	0.00	100.28
	40.97	0.01	23.23	0.11	15.84	0.39	14.25	5.65	0.02	0.00	100.46
	40.88	0.05	23.38	0.14	16.05	0.33	14.22	5.73	0.01	0.00	100.78
	41.14	0.06	23.02	0.13	15.90	0.42	14.12	5.74	0.03	0.00	100.56
	40.91	0.04	23.13	0.15	15.96	0.36	14.11	5.82	0.03	0.01	100.51
	41.04	0.09	23.29	0.11	15.89	0.44	14.10	5.65	0.00	0.00	100.61
	41.01	0.01	22.99	0.05	15.98	0.41	14.10	5.85	0.00	0.00	100.40
	41.11	0.06	23.18	0.10	15.80	0.40	14.05	5.89	0.02	0.00	100.60
	40.93	0.04	23.36	0.05	15.80	0.37	14.14	5.86	0.04	0.00	100.57
	41.16	0.05	23.15	0.03	15.73	0.42	14.10	5.84	0.02	0.01	100.51
	40.98	0.04	23.36	0.00	15.72	0.38	13.96	5.97	0.02	0.01	100.42
	41.00	0.00	23.31	0.01	15.57	0.37	13.83	5.98	0.01	0.00	100.09
	40.83	0.07	23.31	0.14	16.23	0.42	14.03	5.63	0.03	0.00	100.68
	40.89	0.04	23.08	0.13	16.36	0.37	14.09	5.67	0.02	0.00	100.66
	40.91	0.08	23.15	0.15	16.19	0.38	14.09	5.58	0.03	0.00	100.55
	41.06	0.06	23.12	0.15	16.17	0.40	13.99	5.62	0.04	0.01	100.61
	40.87	0.08	23.06	0.14	16.13	0.39	14.14	5.66	0.02	0.00	100.48
	41.03	0.02	23.23	0.12	16.23	0.38	14.12	5.53	0.02	0.01	100.68
	40.93	0.04	23.13	0.14	16.26	0.38	14.06	5.61	0.04	0.02	100.61
	40.39	0.07	22.92	0.10	16.36	0.41	13.97	5.64	0.02	0.00	99.89
	41.06	0.03	23.20	0.07	16.12	0.43	13.94	5.59	0.00	0.00	100.44
	41.11	0.02	23.08	0.09	16.16	0.41	14.07	5.60	0.03	0.00	100.57
	40.89	0.05	23.19	0.13	16.25	0.34	14.04	5.62	0.03	0.01	100.54
	41.02	0.07	23.19	0.10	16.13	0.41	14.03	5.66	0.02	0.02	100.65
	40.77	0.06	23.20	0.07	16.09	0.34	13.95	5.72	0.00	0.00	100.18
	41.23	0.07	23.15	0.09	16.16	0.38	14.01	5.68	0.00	0.00	100.77
	40.97	0.04	23.22	0.00	16.00	0.39	13.85	5.89	0.03	0.00	100.40
	41.00	0.05	23.18	0.10	16.03	0.38	14.10	5.55	0.02	0.00	100.42
	40.77	0.06	23.04	0.09	15.96	0.39	14.31	5.67	0.03	0.03	100.36
	40.76	0.01	23.13	0.10	15.90	0.37	14.11	5.71	0.05	0.01	100.16

	40.94	0.04	23.40	0.06	15.84	0.40	14.17	5.61	0.05	0.00	100.49
	40.93	0.06	23.42	0.05	15.88	0.40	14.11	5.66	0.01	0.00	100.51
	40.82	0.02	23.19	0.17	15.92	0.37	14.16	5.72	0.02	0.00	100.40
	40.88	0.03	23.30	0.13	15.83	0.40	14.17	5.66	0.03	0.00	100.42
	40.83	0.02	23.18	0.11	15.88	0.41	14.09	5.69	0.04	0.00	100.26
	40.84	0.05	23.31	0.16	15.94	0.41	14.19	5.72	0.05	0.00	100.67
	40.89	0.05	23.11	0.10	15.90	0.42	13.99	5.70	0.03	0.02	100.19
	40.91	0.03	23.21	0.09	15.89	0.32	14.13	5.71	0.05	0.00	100.35
	40.97	0.06	23.15	0.10	16.08	0.40	14.19	5.74	0.01	0.00	100.69
	40.38	0.10	23.03	0.15	15.82	0.39	13.94	5.59	0.02	0.00	99.42
	40.09	0.04	23.03	0.10	15.77	0.41	14.02	5.59	0.03	0.01	99.08
	40.41	0.05	22.94	0.10	15.81	0.39	13.89	5.69	0.03	0.02	99.32
MN51314	38.54	0.08	21.74	0.12	24.67	0.59	6.44	7.81	0.00	0.00	99.98
	38.30	0.09	21.74	0.07	24.43	0.63	6.39	7.74	0.06	0.00	99.44
	38.55	0.09	21.68	0.13	24.73	0.51	6.43	7.83	0.04	0.00	99.99
	38.91	0.11	21.89	0.07	24.82	0.57	6.55	7.96	0.02	0.00	100.89
	38.90	0.10	21.79	0.10	24.76	0.58	6.61	7.90	0.00	0.00	100.72
	38.88	0.08	21.99	0.13	24.89	0.54	6.58	8.04	0.02	0.00	101.14
	38.79	0.07	21.65	0.07	24.67	0.63	6.40	8.00	0.02	0.02	100.32
	38.86	0.09	21.91	0.11	24.88	0.57	6.39	8.02	0.04	0.00	100.87
	38.95	0.08	21.92	0.10	24.92	0.59	6.36	8.15	0.00	0.00	101.07
	39.13	0.11	21.82	0.10	24.82	0.62	6.34	8.22	0.03	0.00	101.18
	39.03	0.07	22.02	0.15	24.57	0.58	6.23	8.25	0.02	0.01	100.92
	38.36	0.11	21.62	0.10	24.45	0.60	6.19	8.47	0.05	0.01	99.96
	38.67	0.10	21.75	0.08	24.17	0.54	6.08	8.62	0.01	0.00	100.00
	38.72	0.03	21.79	0.05	24.40	0.54	5.98	9.04	0.01	0.00	100.57
	38.77	0.11	21.86	0.14	24.76	0.56	6.55	8.13	0.00	0.00	100.86
	38.83	0.12	21.82	0.11	24.92	0.56	6.36	8.05	0.00	0.01	100.77
	38.84	0.14	21.73	0.08	24.79	0.61	6.39	8.16	0.03	0.00	100.76
	39.12	0.06	21.88	0.11	24.80	0.58	6.43	8.04	0.00	0.00	101.01
	38.77	0.08	21.92	0.10	24.81	0.61	6.41	8.14	0.02	0.03	100.88
	38.83	0.08	21.75	0.05	24.83	0.56	6.40	8.11	0.00	0.02	100.63
	38.73	0.11	21.99	0.08	24.92	0.57	6.41	8.18	0.06	0.00	101.05
	38.85	0.12	21.93	0.10	24.90	0.56	6.32	8.25	0.02	0.02	101.08
	38.96	0.10	21.92	0.08	24.75	0.60	6.46	8.14	0.03	0.01	101.04
	38.70	0.10	21.91	0.10	24.60	0.56	6.33	8.24	0.03	0.00	100.58
	38.84	0.04	21.84	0.05	24.75	0.62	6.41	8.24	0.03	0.00	100.82

	38.91	0.04	21.98	0.05	24.55	0.59	6.23	8.45	0.03	0.01	100.83
	38.68	0.08	22.01	0.14	24.49	0.52	6.19	8.70	0.01	0.00	100.82
	39.08	0.08	21.85	0.09	24.52	0.58	6.14	8.84	0.04	0.00	101.20
	38.58	0.13	21.80	0.12	25.13	0.66	6.74	7.32	0.03	0.00	100.50
	38.97	0.05	21.98	0.08	25.36	0.58	6.74	7.49	0.04	0.01	101.29
	38.98	0.13	21.92	0.12	24.80	0.63	6.76	7.46	0.03	0.01	100.81
	38.92	0.07	21.96	0.12	25.18	0.64	6.81	7.48	0.03	0.01	101.22
	38.74	0.08	22.39	0.08	25.02	0.62	6.70	7.50	0.04	0.00	101.16
	38.90	0.13	22.00	0.12	25.00	0.58	6.64	7.55	0.03	0.00	100.96
	38.81	0.11	21.87	0.09	25.28	0.62	6.68	7.55	0.00	0.00	101.00
	38.99	0.11	21.88	0.07	24.96	0.61	6.64	7.63	0.04	0.00	100.93
	38.61	0.09	21.93	0.16	24.94	0.58	6.62	7.68	0.02	0.00	100.63
	38.65	0.06	21.82	0.10	24.84	0.62	6.61	7.60	0.02	0.00	100.31
	38.68	0.07	21.69	0.12	24.65	0.58	6.56	7.70	0.03	0.00	100.07
	38.56	0.13	21.95	0.06	24.50	0.64	6.47	7.86	0.02	0.02	100.21
	38.57	0.07	21.98	0.10	24.68	0.59	6.55	7.75	0.01	0.00	100.28
	38.49	0.11	21.63	0.13	24.58	0.57	6.25	7.97	0.03	0.00	99.76
	38.59	0.12	21.71	0.09	24.51	0.60	6.50	8.10	0.04	0.00	100.26

Plagioclase:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Total
MN51311	60.44	0.01	25.26	0.01	0.03	0.00	0.02	6.69	7.49	0.35	100.30
	60.58	0.00	25.51	0.00	0.02	0.00	0.02	6.67	7.47	0.35	100.63
	60.57	0.02	25.29	0.00	0.06	0.03	0.00	6.74	7.58	0.34	100.63
	60.33	0.01	25.27	0.00	0.00	0.00	0.01	6.64	7.51	0.31	100.07
	60.53	0.02	25.37	0.00	0.04	0.00	0.01	6.72	7.52	0.34	100.54
	60.74	0.00	25.50	0.00	0.02	0.00	0.01	6.51	7.53	0.37	100.67
	60.66	0.02	25.44	0.04	0.05	0.03	0.02	6.56	7.48	0.39	100.69
	60.72	0.00	25.24	0.00	0.03	0.03	0.03	6.52	7.62	0.36	100.54
	58.53	0.01	24.33	0.00	0.37	0.07	2.71	5.81	6.77	0.61	99.20
	60.57	0.00	25.12	0.00	0.08	0.03	0.24	6.28	7.69	0.37	100.37
	61.42	0.02	24.93	0.01	0.10	0.05	0.03	6.15	7.81	0.40	100.92
	61.00	0.01	24.81	0.04	0.12	0.00	0.01	6.08	7.91	0.36	100.33
	59.70	0.04	25.88	0.01	0.06	0.03	0.01	7.22	7.24	0.35	100.53
	59.03	0.02	25.54	0.02	0.04	0.03	0.01	7.15	7.22	0.30	99.36
	58.87	0.01	25.50	0.00	0.03	0.00	0.01	7.18	7.08	0.33	99.01
	59.16	0.00	25.68	0.00	0.00	0.03	0.00	7.11	7.09	0.33	99.40

	59.70	0.01	25.76	0.03	0.01	0.02	0.01	7.21	7.15	0.35	100.25
	59.72	0.02	25.72	0.00	0.00	0.02	0.01	7.11	7.13	0.34	100.06
	59.26	0.38	25.88	0.00	0.09	0.00	0.02	7.20	7.15	0.32	100.28
	59.07	0.03	25.60	0.00	0.03	0.03	0.01	7.08	7.11	0.33	99.27
	59.06	0.00	25.61	0.00	0.03	0.00	0.02	7.05	7.03	0.31	99.10
	59.10	0.01	25.72	0.03	0.02	0.00	0.01	7.28	7.20	0.34	99.71
	59.44	0.00	25.60	0.03	0.02	0.00	0.01	7.17	7.27	0.32	99.86
	59.33	0.04	25.74	0.06	0.04	0.02	0.01	7.12	7.18	0.33	99.86
	59.56	0.00	25.58	0.00	0.05	0.01	0.03	6.98	7.25	0.36	99.81
	58.98	0.00	25.24	0.01	0.06	0.00	0.00	7.03	7.25	0.34	98.90
	59.75	0.00	25.49	0.03	0.04	0.00	0.02	7.04	7.20	0.36	99.93
	59.77	0.00	25.94	0.00	0.02	0.00	0.01	7.25	7.07	0.34	100.40
	60.04	0.01	26.02	0.00	0.05	0.02	0.01	7.15	7.16	0.33	100.78
	59.65	0.01	26.02	0.00	0.01	0.02	0.01	7.18	6.99	0.50	100.39
	59.51	0.00	26.02	0.00	0.03	0.03	0.02	7.22	7.22	0.32	100.37
	59.97	0.00	26.17	0.07	0.04	0.01	0.00	7.32	7.15	0.33	101.04
	58.13	0.00	25.39	0.00	0.33	0.00	1.72	6.56	6.48	0.70	99.32
	59.75	0.00	25.75	0.00	0.04	0.00	0.00	7.35	7.07	0.30	100.26
	59.73	0.00	25.74	0.01	0.01	0.00	0.02	7.12	6.98	0.32	99.93
	59.77	0.00	26.00	0.00	0.03	0.00	0.01	7.23	7.18	0.33	100.55
	60.12	0.00	25.92	0.02	0.04	0.01	0.00	7.12	7.19	0.32	100.74
	59.77	0.00	25.88	0.00	0.06	0.00	0.01	7.14	7.06	0.32	100.23
	59.80	0.00	25.82	0.05	0.04	0.01	0.01	6.87	7.18	0.35	100.14
	60.04	0.00	25.59	0.03	0.05	0.00	0.01	6.98	7.15	0.36	100.20
	60.11	0.00	25.58	0.01	0.06	0.01	0.02	6.95	7.15	0.34	100.22
MN51312	60.07	0.03	24.87	0.04	0.04	0.00	0.00	6.48	7.51	0.35	99.40
	59.97	0.03	24.78	0.00	0.06	0.02	0.20	6.46	7.47	0.34	99.31
	60.12	0.00	24.89	0.01	0.03	0.02	0.00	6.54	7.43	0.40	99.43
	59.50	0.04	24.80	0.02	0.04	0.00	0.01	6.57	7.36	0.34	98.67
	59.70	0.01	24.90	0.01	0.01	0.01	0.01	6.62	7.22	0.35	98.82
	60.16	0.02	24.96	0.00	0.04	0.04	0.02	6.42	7.46	0.35	99.45
	59.96	0.00	24.90	0.00	0.03	0.03	0.01	6.60	7.31	0.37	99.20
	59.98	0.00	24.64	0.00	0.04	0.00	0.01	6.48	7.42	0.34	98.90
	59.97	0.04	24.88	0.01	0.03	0.01	0.02	6.49	7.39	0.35	99.19
	59.80	0.00	25.01	0.03	0.01	0.02	0.00	6.54	7.54	0.36	99.33
	59.72	0.03	24.96	0.02	0.01	0.02	0.02	6.67	7.30	0.34	99.09
	59.83	0.00	24.95	0.00	0.05	0.01	0.00	6.55	7.20	0.33	98.91

	60.10	0.00	25.08	0.00	0.02	0.02	0.01	6.64	7.27	0.35	99.49
	59.45	0.04	24.96	0.00	0.05	0.00	0.02	6.56	7.30	0.40	98.77
	59.40	0.03	24.76	0.03	0.00	0.01	0.00	6.60	7.31	0.37	98.52
	59.57	0.02	24.83	0.04	0.04	0.02	0.03	6.47	7.41	0.51	98.95
	59.89	0.00	25.04	0.01	0.03	0.02	0.03	6.46	7.36	0.37	99.21
	60.15	0.01	25.19	0.04	0.04	0.04	0.05	6.56	7.45	0.40	99.93
	60.29	0.03	25.26	0.01	0.04	0.02	0.08	6.64	7.43	0.34	100.13
	59.71	0.00	24.84	0.03	0.02	0.00	0.19	6.39	7.16	0.65	98.99
	59.44	0.03	24.96	0.00	0.06	0.01	0.01	6.40	7.36	0.37	98.64
	59.55	0.00	24.79	0.01	0.05	0.00	0.03	6.47	7.44	0.44	98.78
	60.42	0.00	25.23	0.00	0.04	0.01	0.09	6.46	7.27	0.63	100.16
	60.04	0.02	25.46	0.02	0.04	0.00	0.05	6.67	7.39	0.40	100.08
	60.02	0.02	25.12	0.00	0.00	0.02	0.03	6.67	7.45	0.39	99.72
	59.94	0.00	25.45	0.00	0.07	0.02	0.00	6.71	7.42	0.40	100.01
	60.17	0.00	25.26	0.01	0.03	0.01	0.01	6.64	7.46	0.37	99.94
	60.03	0.01	25.32	0.02	0.06	0.00	0.02	6.79	7.47	0.40	100.11
	59.95	0.01	25.36	0.00	0.02	0.00	0.01	6.65	7.49	0.37	99.86
	59.45	0.00	24.93	0.00	0.00	0.01	0.05	6.58	7.51	0.51	99.04
	59.89	0.01	25.27	0.01	0.04	0.01	0.01	6.55	7.40	0.49	99.68
	59.63	0.04	25.25	0.00	0.01	0.00	0.05	6.60	7.47	0.38	99.43
	59.76	0.00	25.05	0.00	0.03	0.01	0.00	6.57	7.45	0.40	99.26
MN51313	55.76	0.00	28.13	0.02	0.03	0.00	0.00	10.31	5.48	0.10	99.82
	56.16	0.00	28.26	0.01	0.01	0.03	0.03	10.17	5.64	0.11	100.41
	55.80	0.02	28.20	0.00	0.04	0.00	0.34	10.20	5.58	0.11	100.29
	55.72	0.01	28.03	0.03	0.02	0.02	0.01	10.27	5.38	0.10	99.57
	56.30	0.01	28.38	0.00	0.03	0.00	0.02	10.34	5.54	0.09	100.71
	56.14	0.00	28.26	0.04	0.03	0.01	0.02	10.29	5.51	0.08	100.39
	56.19	0.00	28.41	0.00	0.02	0.01	0.03	10.17	5.79	0.11	100.72
	56.25	0.00	28.15	0.03	0.03	0.00	0.01	10.24	5.63	0.12	100.45
	55.25	0.00	27.66	0.01	0.04	0.00	0.00	10.10	5.43	0.09	98.57
	55.66	0.01	28.10	0.02	0.04	0.00	0.00	10.19	5.50	0.11	99.62
	55.92	0.03	27.92	0.00	0.02	0.05	0.01	10.05	5.57	0.10	99.67
	56.05	0.00	28.06	0.00	0.02	0.00	0.01	10.02	5.59	0.11	99.86
	56.35	0.02	27.99	0.03	0.03	0.01	0.02	9.97	5.70	0.12	100.24
	55.93	0.02	28.31	0.00	0.02	0.00	0.00	10.47	5.33	0.12	100.19
	56.05	0.02	28.27	0.00	0.00	0.00	0.00	10.34	5.57	0.12	100.37
	55.93	0.00	28.18	0.02	0.01	0.01	0.01	10.20	5.48	0.10	99.93

	56.19	0.00	28.25	0.00	0.02	0.03	0.01	10.11	5.44	0.11	100.15
	56.01	0.00	28.07	0.04	0.00	0.00	0.02	10.17	5.65	0.09	100.03
	55.94	0.00	28.37	0.00	0.00	0.04	0.01	10.32	5.46	0.10	100.24
	56.20	0.00	28.44	0.00	0.02	0.00	0.02	10.25	5.55	0.08	100.56
	56.12	0.02	28.35	0.01	0.00	0.02	0.01	10.38	5.48	0.10	100.50
	56.17	0.02	28.38	0.02	0.03	0.00	0.01	10.29	5.37	0.09	100.38
	55.45	0.00	28.11	0.03	0.06	0.03	0.39	10.18	5.37	0.09	99.69
	55.66	0.00	28.47	0.00	0.02	0.01	0.01	10.18	5.51	0.10	99.95
	55.83	0.01	28.26	0.00	0.01	0.01	0.01	10.30	5.40	0.10	99.92
	55.74	0.00	28.10	0.02	0.03	0.01	0.01	10.14	5.49	0.23	99.76
	56.14	0.00	28.02	0.00	0.02	0.00	0.00	9.90	5.58	0.35	100.02
	56.16	0.01	27.91	0.04	0.10	0.00	0.01	9.89	5.62	0.09	99.82
	55.73	0.00	28.11	0.03	0.02	0.00	0.00	10.06	5.45	0.10	99.50
	55.75	0.02	27.51	0.01	0.03	0.01	0.22	9.61	5.37	0.66	99.19
	55.97	0.01	27.92	0.01	0.00	0.02	0.01	10.18	5.52	0.09	99.73
	55.84	0.00	27.98	0.00	0.04	0.00	0.02	10.06	5.47	0.08	99.47
	55.65	0.01	28.04	0.00	0.00	0.00	0.01	10.12	5.42	0.11	99.36
	56.01	0.02	27.85	0.00	0.02	0.00	0.00	10.24	5.63	0.09	99.87
	55.73	0.00	27.83	0.00	0.04	0.02	0.01	10.02	5.51	0.09	99.25
	56.10	0.00	27.93	0.00	0.00	0.01	0.02	10.06	5.57	0.10	99.78
	55.69	0.00	27.38	0.01	0.08	0.00	0.15	9.27	5.18	0.88	98.63
	55.89	0.00	28.04	0.01	0.08	0.01	0.18	9.78	5.12	0.51	99.62
	56.12	0.00	27.92	0.00	0.07	0.02	0.14	9.72	5.65	0.22	99.85
	54.64	0.00	26.09	0.03	0.64	0.00	2.61	8.30	4.96	0.74	98.01
MN51314	57.54	0.00	26.13	0.02	0.10	0.04	1.04	7.90	6.39	0.17	99.31
	58.70	0.00	26.62	0.00	0.04	0.03	0.00	8.22	6.73	0.20	100.54
	58.32	0.01	26.66	0.03	0.02	0.03	0.01	8.14	6.52	0.20	99.94
	58.23	0.01	26.57	0.00	0.04	0.00	0.02	7.98	6.61	0.21	99.68
	58.42	0.03	26.46	0.00	0.03	0.03	0.00	7.96	6.87	0.19	99.98
	58.39	0.02	26.48	0.05	0.03	0.04	0.02	8.03	6.56	0.20	99.81
	58.40	0.00	26.34	0.00	0.03	0.03	0.01	7.75	6.58	0.17	99.31
	58.56	0.00	26.23	0.00	0.03	0.02	0.00	7.93	6.53	0.19	99.50
	58.70	0.05	26.31	0.03	0.04	0.02	0.02	7.87	6.64	0.19	99.87
	59.01	0.02	26.22	0.04	0.03	0.01	0.01	7.85	6.76	0.18	100.12
	58.72	0.00	26.01	0.01	0.01	0.00	0.02	7.65	6.83	0.18	99.41
	58.95	0.02	25.83	0.00	0.03	0.00	0.01	7.52	6.86	0.20	99.41
	58.98	0.00	25.79	0.00	0.07	0.00	0.02	7.40	7.06	0.18	99.51

	59.18	0.00	25.68	0.00	0.03	0.01	0.02	7.28	6.99	0.21	99.39
	58.37	0.00	27.11	0.06	0.02	0.00	0.01	8.63	6.32	0.14	100.66
	57.86	0.01	26.89	0.01	0.04	0.03	0.01	8.60	6.32	0.18	99.94
	57.98	0.01	26.90	0.00	0.02	0.00	0.02	8.54	6.43	0.16	100.04
	57.69	0.00	26.91	0.00	0.00	0.01	0.00	8.48	6.26	0.15	99.50
	57.83	0.00	26.88	0.00	0.06	0.04	0.02	8.64	6.29	0.20	99.94
	57.45	0.00	26.75	0.00	0.05	0.00	0.03	8.56	6.18	0.16	99.19

Clinopyroxene:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Total
MN51311	51.42	0.36	3.71	0.04	9.38	0.06	11.35	21.21	1.52	0.00	99.04
	51.81	0.37	3.62	0.00	9.48	0.04	11.50	21.13	1.43	0.00	99.38
	51.86	0.29	3.54	0.07	9.35	0.05	11.59	21.29	1.46	0.00	99.51
	52.02	0.31	3.38	0.02	9.23	0.06	11.73	21.42	1.40	0.00	99.56
	52.20	0.25	3.44	0.01	8.88	0.04	12.01	21.46	1.39	0.02	99.70
	52.19	0.23	3.19	0.01	8.98	0.03	12.00	21.22	1.41	0.00	99.28
	51.95	0.29	3.49	0.03	9.48	0.04	11.68	21.29	1.39	0.01	99.65
	51.77	0.27	3.46	0.03	9.53	0.06	11.58	20.95	1.39	0.00	99.04
	51.73	0.30	3.55	0.05	9.41	0.08	11.41	21.04	1.42	0.00	98.98
	51.76	0.32	3.48	0.05	9.31	0.08	11.56	20.95	1.37	0.00	98.87
	52.01	0.26	3.45	0.00	9.35	0.05	11.65	21.12	1.39	0.00	99.28
	52.22	0.25	3.37	0.03	9.11	0.04	11.79	21.20	1.37	0.00	99.39
	51.95	0.30	3.64	0.09	9.46	0.04	11.72	20.71	1.38	0.01	99.29
	51.75	0.27	3.50	0.00	9.08	0.09	11.46	21.18	1.40	0.00	98.73
	51.82	0.24	3.41	0.03	8.96	0.03	11.95	21.12	1.41	0.01	98.97
	52.27	0.29	3.51	0.03	9.31	0.05	11.73	21.12	1.43	0.00	99.75
	51.67	0.32	3.64	0.00	9.52	0.07	11.44	21.19	1.52	0.00	99.37
	51.52	0.32	3.74	0.03	9.46	0.05	11.39	20.90	1.46	0.00	98.87
	51.59	0.31	3.66	0.05	9.47	0.07	11.45	20.85	1.47	0.00	98.91
	51.67	0.35	3.72	0.02	9.48	0.06	11.32	20.96	1.43	0.00	99.01
	51.52	0.37	3.78	0.03	9.57	0.07	11.40	21.12	1.40	0.00	99.25
	51.58	0.35	3.77	0.01	9.45	0.03	11.42	21.14	1.36	0.00	99.10
	51.77	0.32	3.63	0.01	9.30	0.05	11.42	21.04	1.38	0.00	98.91
	51.66	0.32	3.65	0.02	9.36	0.05	11.50	21.12	1.43	0.00	99.11
	51.50	0.32	3.57	0.00	9.17	0.07	11.47	21.20	1.44	0.00	98.75
	52.01	0.28	3.54	0.02	8.91	0.02	11.58	21.38	1.29	0.01	99.04
	51.93	0.26	3.31	0.05	8.80	0.10	11.83	21.45	1.35	0.00	99.08

	51.83	0.28	3.74	0.03	9.76	0.02	11.44	20.75	1.31	0.00	99.15
	51.79	0.24	3.59	0.00	9.10	0.03	11.80	20.90	1.38	0.01	98.84
	51.81	0.28	3.69	0.02	9.31	0.02	11.46	21.16	1.45	0.01	99.21
	51.92	0.34	3.62	0.07	9.20	0.07	11.60	21.28	1.39	0.00	99.49
	51.70	0.36	3.62	0.05	9.34	0.05	11.51	21.13	1.38	0.01	99.14
	51.90	0.33	3.60	0.08	9.20	0.06	11.47	21.13	1.46	0.00	99.23
	51.96	0.29	3.62	0.07	9.15	0.07	11.55	21.16	1.42	0.00	99.28
	52.13	0.27	3.49	0.00	9.26	0.06	11.60	21.10	1.46	0.00	99.38
	52.06	0.27	3.50	0.02	9.05	0.08	11.45	21.06	1.40	0.00	98.88
	51.77	0.31	3.49	0.05	9.02	0.06	11.56	21.25	1.48	0.01	98.98
	52.06	0.31	3.54	0.00	9.12	0.05	11.50	21.27	1.40	0.00	99.26
	51.88	0.27	3.40	0.02	9.01	0.04	11.56	21.30	1.34	0.01	98.82
	51.92	0.28	3.47	0.05	8.89	0.05	11.57	21.16	1.35	0.02	98.74
	52.04	0.23	3.34	0.05	8.63	0.04	11.89	21.29	1.41	0.00	98.92
MN51312	52.00	0.27	4.20	0.01	8.71	0.04	11.63	20.86	1.53	0.01	99.25
	51.83	0.30	4.14	0.02	9.46	0.01	11.86	20.09	1.51	0.00	99.22
	52.00	0.29	4.19	0.05	8.72	0.08	11.72	20.84	1.62	0.01	99.52
	52.18	0.22	4.00	0.01	8.53	0.07	11.93	20.86	1.69	0.00	99.47
	51.57	0.33	4.17	0.04	9.23	0.03	11.83	20.38	1.53	0.00	99.10
	51.62	0.31	4.34	0.10	8.50	0.06	11.72	20.90	1.62	0.01	99.18
	51.55	0.33	4.27	0.09	8.56	0.09	11.64	20.66	1.61	0.01	98.81
	51.19	0.37	4.15	0.06	9.23	0.05	11.69	20.44	1.54	0.03	98.75
	51.81	0.36	4.21	0.08	8.58	0.06	11.69	20.83	1.55	0.02	99.18
	51.65	0.40	4.21	0.00	8.67	0.04	11.66	20.72	1.59	0.01	98.95
	51.46	0.36	4.24	0.03	8.82	0.04	11.76	20.67	1.55	0.01	98.93
	51.82	0.35	4.27	0.06	8.44	0.03	11.63	20.65	1.55	0.00	98.80
	51.92	0.33	4.22	0.09	8.38	0.05	11.72	20.73	1.56	0.00	98.99
	52.08	0.27	3.84	0.06	8.35	0.07	12.24	21.07	1.45	0.00	99.44
	52.05	0.25	3.89	0.00	8.15	0.06	12.05	21.01	1.53	0.00	99.00
	51.71	0.29	3.88	0.05	8.36	0.10	12.13	21.13	1.36	0.00	99.00
	51.99	0.31	3.83	0.02	8.44	0.08	12.11	20.90	1.44	0.00	99.12
	52.02	0.31	3.95	0.04	8.40	0.06	12.25	20.89	1.54	0.00	99.46
	51.91	0.33	3.85	0.03	8.33	0.06	12.03	21.10	1.44	0.00	99.08
	52.63	0.25	3.88	0.00	8.43	0.06	12.16	21.10	1.48	0.01	99.98
	52.22	0.28	3.81	0.01	8.19	0.05	12.20	21.35	1.42	0.00	99.53
	52.30	0.43	3.92	0.05	8.12	0.07	13.72	19.58	1.70	0.00	99.89
	52.21	0.27	3.69	0.01	8.34	0.06	12.08	21.25	1.47	0.01	99.40

	52.54	0.23	3.67	0.04	8.11	0.08	12.35	21.46	1.49	0.00	99.98
	52.78	0.31	3.45	0.08	8.04	0.09	12.46	21.33	1.46	0.01	99.99
	52.72	0.28	3.48	0.02	7.74	0.04	12.60	21.26	1.49	0.00	99.64
	52.96	0.25	3.07	0.02	7.24	0.03	12.91	21.27	1.42	0.00	99.17
	51.76	0.35	3.94	0.00	8.58	0.07	11.87	20.83	1.39	0.00	98.79
	51.65	0.37	3.97	0.04	8.53	0.06	11.86	20.99	1.48	0.00	98.95
	52.00	0.35	3.93	0.05	8.56	0.06	12.06	21.01	1.39	0.01	99.43
	51.95	0.30	3.91	0.01	8.52	0.10	12.08	20.98	1.46	0.00	99.31
	52.03	0.28	3.83	0.06	8.77	0.07	12.14	20.92	1.46	0.00	99.56
	52.96	0.34	3.80	0.03	9.03	0.05	12.29	21.33	1.35	0.00	101.19
	52.19	0.38	3.84	0.05	8.61	0.10	11.86	20.95	1.45	0.00	99.43
	52.10	0.29	3.78	0.08	8.46	0.04	12.09	20.94	1.51	0.00	99.29
	51.81	0.32	3.63	0.02	9.06	0.06	12.23	20.41	1.40	0.01	98.93
	52.02	0.31	3.56	0.02	8.44	0.06	12.04	21.05	1.50	0.00	98.99
	52.38	0.32	3.48	0.11	8.39	0.05	12.18	21.07	1.39	0.00	99.37
	52.21	0.24	3.43	0.02	8.22	0.05	12.39	21.07	1.49	0.02	99.13
	52.65	0.29	3.30	0.00	8.04	0.09	12.46	21.23	1.44	0.01	99.51
MN51313	52.07	0.36	5.39	0.11	4.42	0.06	13.95	21.63	0.89	0.01	98.89
	51.84	0.35	5.49	0.14	3.72	0.04	13.36	22.82	1.03	0.01	98.80
	51.80	0.31	5.81	0.11	3.97	0.06	13.11	22.42	1.06	0.00	98.65
	51.62	0.33	5.72	0.08	4.43	0.07	13.82	21.60	1.00	0.00	98.67
	52.15	0.29	5.49	0.15	3.73	0.04	13.43	22.49	1.02	0.00	98.80
	52.49	0.27	5.01	0.10	3.51	0.05	13.85	22.50	1.03	0.01	98.81
	52.95	0.30	4.52	0.11	3.36	0.05	13.83	22.71	1.02	0.02	98.86
	52.13	0.28	5.36	0.14	3.66	0.05	13.69	22.56	0.94	0.00	98.81
	52.27	0.31	5.26	0.11	3.68	0.03	13.66	22.59	0.96	0.00	98.86
	52.13	0.29	4.95	0.12	3.53	0.09	13.84	22.73	0.99	0.00	98.65
	52.37	0.31	5.82	0.07	3.67	0.03	13.69	22.15	1.07	0.01	99.19
	52.53	0.32	5.90	0.10	3.60	0.03	13.51	22.72	1.09	0.00	99.80
	52.49	0.31	5.78	0.12	3.68	0.05	13.53	22.81	1.15	0.00	99.92
	52.27	0.36	5.80	0.13	3.67	0.06	13.71	22.37	0.98	0.00	99.35
	52.45	0.39	5.68	0.13	4.69	0.05	14.74	20.60	0.89	0.01	99.62
	52.38	0.33	5.72	0.05	3.68	0.04	13.78	22.59	0.99	0.00	99.57
	52.37	0.37	5.68	0.12	3.61	0.03	13.60	22.73	1.04	0.00	99.55
	51.93	0.34	5.47	0.08	4.22	0.06	14.35	21.40	0.93	0.01	98.77
	52.44	0.33	5.62	0.15	3.66	0.07	13.97	22.52	1.05	0.00	99.81
	52.50	0.29	5.40	0.13	3.51	0.09	13.63	22.74	1.02	0.01	99.32

	52.57	0.28	5.31	0.11	3.59	0.03	13.91	22.47	0.92	0.00	99.17
	52.31	0.29	5.10	0.13	4.13	0.04	14.50	21.69	0.95	0.00	99.13
	52.54	0.32	5.06	0.07	3.41	0.04	13.87	22.80	1.06	0.00	99.18
	52.84	0.26	4.76	0.18	3.49	0.07	14.12	22.93	1.00	0.00	99.65
	53.12	0.27	4.39	0.21	3.32	0.05	14.37	22.80	0.92	0.01	99.45
	51.89	0.29	6.15	0.11	3.88	0.03	13.21	22.32	1.09	0.01	98.97
	51.91	0.31	6.14	0.09	3.91	0.06	13.29	22.63	1.03	0.00	99.37
	51.76	0.33	6.08	0.14	3.96	0.06	13.26	22.59	1.00	0.00	99.16
	51.68	0.31	5.99	0.14	3.98	0.07	13.36	22.32	0.99	0.00	98.85
	51.64	0.31	5.88	0.14	3.89	0.07	13.42	22.66	1.11	0.00	99.12
	52.06	0.34	5.86	0.11	3.97	0.05	13.60	22.80	1.01	0.00	99.80
	51.61	0.31	5.88	0.12	3.74	0.05	13.49	22.46	0.95	0.00	98.61
	51.72	0.30	5.73	0.14	3.88	0.04	13.64	22.27	1.08	0.00	98.80
	51.95	0.30	5.74	0.07	3.69	0.05	13.60	22.62	1.01	0.02	99.04
	52.20	0.32	5.49	0.09	3.84	0.07	13.85	22.21	0.97	0.02	99.05
	52.10	0.28	5.59	0.12	3.58	0.06	14.95	22.85	1.14	0.00	100.66
	52.23	0.33	5.19	0.10	3.52	0.04	14.19	22.62	0.89	0.02	99.12
	52.31	0.30	4.79	0.16	3.44	0.04	14.09	22.56	0.93	0.01	98.64
	52.85	0.27	4.10	0.03	3.16	0.06	14.70	22.97	0.88	0.02	99.03
MN51314	50.39	0.70	5.59	0.09	8.86	0.06	11.17	20.96	1.42	0.08	99.31
	50.50	0.71	5.62	0.07	9.14	0.06	11.29	21.24	1.41	0.10	100.16
	50.61	0.71	5.51	0.07	8.97	0.06	11.26	20.88	1.48	0.10	99.64
	50.43	0.74	5.53	0.02	8.89	0.06	11.23	20.79	1.54	0.13	99.36
	50.98	0.69	5.61	0.06	8.91	0.04	11.27	20.98	1.45	0.00	99.98
	50.94	0.68	5.47	0.08	8.87	0.05	11.39	21.14	1.53	0.05	100.20
	51.04	0.63	5.33	0.10	8.53	0.03	11.42	21.15	1.50	0.06	99.77
	51.33	0.54	5.08	0.10	8.23	0.07	11.75	21.12	1.54	0.03	99.80
	51.58	0.43	4.65	0.10	7.71	0.06	12.27	21.51	1.49	0.05	99.85
	52.04	0.29	3.98	0.03	8.05	0.06	12.31	21.07	1.48	0.07	99.38
	52.07	0.40	4.59	0.11	8.01	0.07	12.39	20.85	1.43	0.01	99.93
	50.45	0.61	5.43	0.06	8.43	0.02	11.28	20.64	1.50	0.25	98.67
	50.68	0.67	5.46	0.01	8.67	0.10	11.34	20.91	1.42	0.06	99.31
	50.80	0.68	5.39	0.07	8.67	0.06	11.35	21.16	1.43	0.03	99.64
	50.88	0.61	5.38	0.06	8.69	0.06	11.39	21.02	1.46	0.08	99.60
	51.14	0.57	5.16	0.03	8.20	0.06	11.79	21.14	1.53	0.09	99.71
	51.41	0.42	4.90	0.00	7.86	0.04	11.94	21.18	1.60	0.20	99.53

Orthopyroxene:

	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	Total
MN51313	54.39	0.05	4.25	0.11	11.28	0.10	28.59	0.22	0.02	0.01	99.01
	53.85	0.01	4.43	0.07	11.79	0.08	28.51	0.26	0.01	0.00	98.99
	53.94	0.05	4.43	0.05	11.86	0.12	28.75	0.24	0.00	0.00	99.43
	53.90	0.06	4.42	0.07	11.83	0.10	28.87	0.23	0.00	0.00	99.48
	53.98	0.02	4.37	0.03	11.84	0.07	28.45	0.26	0.00	0.01	99.02
	53.99	0.06	4.47	0.08	11.87	0.12	28.67	0.23	0.05	0.00	99.53
	53.91	0.08	4.43	0.10	11.85	0.11	28.56	0.24	0.03	0.00	99.30
	54.12	0.03	4.36	0.11	11.93	0.09	28.80	0.24	0.00	0.00	99.69
	54.06	0.04	4.16	0.09	11.76	0.08	28.67	0.24	0.03	0.00	99.13
	54.63	0.04	4.37	0.02	11.64	0.09	28.32	0.86	0.06	0.00	100.04
	54.35	0.03	4.17	0.13	12.02	0.11	29.03	0.25	0.03	0.00	100.11
	54.23	0.04	4.08	0.04	11.91	0.09	28.93	0.25	0.01	0.02	99.59
	54.42	0.06	4.09	0.10	11.77	0.10	28.59	0.25	0.00	0.00	99.36
	54.52	0.03	4.08	0.04	11.94	0.07	28.86	0.24	0.07	0.00	99.85
	54.05	0.01	3.95	0.10	11.82	0.11	28.70	0.30	0.02	0.01	99.08
	54.46	0.02	3.90	0.13	11.95	0.10	28.64	0.23	0.03	0.00	99.46
	54.67	0.04	4.17	0.07	11.54	0.09	29.51	0.19	0.01	0.00	100.29
	54.64	0.00	4.20	0.06	11.50	0.10	29.26	0.22	0.00	0.00	99.98
	54.43	0.06	4.21	0.07	11.20	0.10	28.95	0.58	0.07	0.02	99.69
	54.62	0.04	4.17	0.07	11.06	0.07	29.05	0.76	0.09	0.00	99.93
	54.37	0.06	4.19	0.03	11.11	0.12	28.57	1.14	0.10	0.01	99.68
	54.69	0.04	4.17	0.02	11.45	0.07	29.30	0.24	0.02	0.00	100.00
	54.23	0.05	4.10	0.10	11.40	0.10	29.48	0.25	0.02	0.00	99.73
	54.48	0.03	4.12	0.05	11.45	0.09	29.11	0.22	0.03	0.00	99.59
	54.75	0.06	4.10	0.07	11.38	0.08	29.35	0.23	0.03	0.00	100.03
	54.55	0.04	4.00	0.05	11.24	0.08	29.12	0.26	0.05	0.01	99.40
	54.85	0.05	4.10	0.09	11.37	0.11	29.35	0.21	0.02	0.01	100.16
	54.45	0.01	3.89	0.09	11.21	0.11	29.12	0.25	0.02	0.00	99.14
	54.64	0.03	3.97	0.00	11.40	0.08	29.12	0.21	0.01	0.01	99.48

Rutile:

	SiO2	TiO2	Al2O3	Cr2O3	Nb2O5	V2O3	FeO	MnO	NiO	MgO	CaO	Total
MN51311	0.04	98.49	0.05	0.20	0.41	0.22	0.52	0.03	0.66	0.04	0.01	100.68
	0.03	98.94	0.03	0.15	0.33	0.18	1.00	0.01	0.72	0.05	0.13	101.57
	0.07	99.15	0.05	0.22	0.05	0.48	0.08	0.00	0.00	0.03	0.03	100.16

	0.08	98.50	0.06	0.29	0.03	0.53	0.42	0.01	0.00	0.01	0.00	99.93
	0.07	99.14	0.04	0.29	0.02	0.48	0.06	0.01	0.00	0.00	0.02	100.12
	0.05	99.17	0.03	0.12	0.22	0.22	0.14	0.01	0.00	0.02	0.08	100.06
	0.03	98.51	0.07	0.08	0.24	0.24	1.83	0.05	0.00	0.05	0.07	101.16

Ilmenite:

	SiO2	TiO2	Al2O3	Cr2O3	Nb2O5	V2O3	FeO	MnO	NiO	MgO	CaO	Total
MN51311	0.07	48.36	0.10	0.15	0.01	0.32	48.09	0.25	0.24	1.89	0.03	99.50
	0.06	48.36	0.07	0.18	0.08	0.35	47.97	0.21	0.68	2.00	0.03	99.98
	0.06	50.69	0.34	0.36	0.00	0.82	44.70	0.31	0.55	2.64	0.03	100.51
	0.07	49.49	0.35	0.41	0.00	0.77	44.92	0.31	0.25	2.51	0.05	99.12
	0.01	49.31	0.14	0.11	0.00	0.32	48.27	0.19	0.00	1.88	0.02	100.24
	0.06	48.87	0.12	0.06	0.00	0.30	48.05	0.22	0.00	2.00	0.02	99.70