METAMORPHIC EVOLUTION OF ANATECTIC METAPELITES FROM THE GABRIEL HIGH STRAIN ZONE, GRENVILLE PROVINCE

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by

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A thesis submitted to the

School of Graduate Studies

in partial fulfilment of the

requirements for the degree of

Master of Science

Department of Earth Sciences
Memorial University of Newfoundland

2005

St. John's Newfoundland

0-494-06692-X

Your file Votre référence
ISBN:
Our file Notre référence
ISBN:

Abstract

The Gabriel High Strain Zone, exposed in the Manicouagan Reservoir area, is part of the Allochthonous Belt of the eastern Grenville Province. It was metamorphosed under mid-*P* granulite facies conditions during the culmination of the Ottawan orogeny (ca. 1050 Ma). Anatectic metapelites from the Gabriel High Strain Zone are characterized by quartz-rich layers that also contain ferromagnesian minerals and, in some cases sillimanite, alternating with granitic layers which likely represent segregated leucosome.

Samples of the quartz-rich layers have been divided into three groups on the basis of the observed mineral assemblages which in turn are controlled by bulk composition. Group 1 has a moderate to high Alumina Index (0.35-0.66) and the highest X_{Mg} (0.51-0.77) and contains the assemblage quartz + garnet + biotite + sillimanite + cordierite ± K-feldspar ± plagioclase; group 2 has a moderate to high Alumina Index (0.22-0.60) and intermediate X_{Mg} (0.35-0.51) and consists of the mineral assemblage quartz + K-feldspar + garnet + biotite + sillimanite ± plagioclase; and finally, group 3 has a low Alumina Index (0.10-0.13) and low to intermediate X_{Mg} (0.23-0.39) and is comprised of the assemblage quartz + garnet + biotite + plagioclase + K-feldspar. These mineral assemblages provide complementary information that, if put together, allow the *P-T* field of the thermal peak to be tightly constrained.

Textural relationships and AFM topologies in the KFMASH system were used to determine the following sequence of reactions that affected these rocks with increasing temperature. Cores of garnet porphyroblasts in groups 1 and 2 rocks contain inclusions of sillimanite needles and are interpreted to have grown by subsolidus reactions in the sillimanite

stability field. The absence of muscovite and the coexistence of sillimanite porphyroblasts and K-feldspar in the matrix are indicative of the reaction: muscovite + albite + quartz → K-feldspar + sillimanite + liquid (R1) which marks the onset of dehydration melting in pelitic rocks. Clear rims of garnet porphyroblasts are consistent with a second phase of garnet growth by the continuous reaction: biotite + sillimanite + quartz → garnet + K-feldspar + liquid (RIIa). In addition, the coexistence of garnet and cordierite in group 1 rocks indicates that the subsequent discontinuous reaction: biotite + sillimanite + quartz → garnet + cordierite + liquid (R2) was crossed. In the rocks of groups 1 and 2 prograde biotite was eliminated by reactions R2 and RIIa, respectively, therefore it was not available for further dehydration melting by the reaction: biotite + garnet + quartz → orthopyroxene + cordierite + liquid (R3). In contrast, group 3 rocks retain peak biotite, therefore the absence of orthopyroxene in them indicates that the *P-T* conditions for reaction R3 were not reached. In all rocks, texturally late biotite and sillimanite aggregates developed at the expense of garnet and cordierite as a result of reactions RIIa and R2 having taken place in the reverse sense during cooling.

Garnet porphyroblasts experienced extensive chemical homogenization at high temperatures and only preserve, in the best cases, an incomplete record of their evolution. For instance, growth zoning in terms of grossular, which is preserved in the most Ca-rich samples, attests to a two stage garnet growth and variably developed rim zoning is consistent with retrograde resetting of the composition. Based upon textures, AFM topologies, garnet X_{Fe} isopleths and the KFMASH petrogenetic grid it is inferred that the thermal peak occurred between 6.2 kbar (between 820 to 870°C) and ~8.9 kbar (at 900°C) and that the *P-T* path was clockwise with little decompression between the prograde and retrograde parts of the path. Application of thermobarometry (garnet-biotite and GASP) was of limited use in these rocks because: (a) biotite is in most cases retrograde and in addition experienced extensive resetting of its composition during late cooling; and (b) it was difficult to identify plagioclase that was stable at the thermal peak. However, in group 1 and 2 rocks GASP isopleths are consistent with the *P-T* field determined with the petrogenetic grid. In addition, GASP isopleths that correspond to different stages of the metamorphic evolution cover a narrow range further supporting the interpretation that the *P-T* path did not involve significant decompression.

The metamorphic evolution of the sillimanite-bearing metapelites of the Gabriel High Strain Zone is consistent with a previously proposed tectonic model which suggests that this zone was part of the hangingwall of an extruded high-*P* unit known as the Manicouagan Imbricate Zone. The results of this study provide additional constraints to this model. For instance the examined rocks were metamorphosed at similar temperatures, but lower pressures than the Manicouagan Imbricate Zone and experienced a *P-T* path that is consistent with heating and cooling with little decompression in between. These observations indicate that a fast heat transfer from the hot extruding Manicouagan Imbricate Zone to the Gabriel High Strain Zone may have been responsible for the metamorphism of the latter.

Acknowledgements

There are many people who have in one way or another contributed to this thesis. Most importantly I would like to thank Dr. Aphrodite Indares for her guidance, encouragement and support (both emotional and financial) through these last three years. Words cannot express how grateful I truly am. I would also like to thank the School of Graduate Studies for their financial support. Especially Chet Jablonski for believing in me and allowing my funding to continue after my first semester.

Special thanks to all of the faculty, staff and graduate students in the Earth Sciences department for their assistance during the preparation of my thesis. I would especially like to thank Dr. Jim Wright and Dr. Ali Aksu; for convincing Graduate Studies to give me a chance to prove myself; Maggie Piranian and Michael Shaffer, the two best probe technicians in the world; and Gerri Starkes, Gerry Ford, Raymund Patzold and Joanne Samson, for all there support and help over the last three years.

Thank you to Sherri Furey and Danny Mulrooney for your help and suggestions, I appreciate it more than you both know. I am also indebt to my friends Paula, Goldie and Vanessa. For the last three years you have listened to me talk about my thesis and pretended to be understand what I was saying, for this I say thank you. Finally I would like to thank my family for their support and encouragement. Especially my mom, it was your courage and strength that helped me get through this.

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List of Abbreviations

The following list of abbreviations follow the convention of Kretz (1983):

Ab = Albite	**Alm** = Almandine
An = Anorthite	**Bt** = Biotite
Crd = Cordierite	**Grt** = Garnet
Grs = Grossular	**Kfs** =K-feldspar
Ky = Kyanite	**Ms** = Muscovite
Opx = Orthopyroxene	**Pl** = Plagioclase
Prp = Pyrope	**Sil** = Sillimanite
Sps = Spessartine	**Spl** = Spinel

The following are additional abbreviations that appear in the text:

AI = Alumina Index	**L** = Liquid

Chapter 1: Introduction

1.1 Aim

The purpose of this thesis is to elucidate the partial melting history and *P-T* evolution of anatectic metapelites from the Gabriel High Strain Zone (GHSZ), a mid-*P* granulite facies segment of the eastern Grenville Province that is exposed on the eastern shore of the Manicouagan Reservoir. This is done by means of detailed examination of textures and mineral compositions of selected samples. The data are interpreted in terms of *P-T* evolution with the aid of published petrogenetic grids and quantitative *P-T* conditions were determined by thermobarometry. This study provides new information on partial melting processes in "hot" units of the Grenville Province.

1.2 Geological Context

1.2.1 The Grenville Province

The Grenville Province extends along the eastern coast of North America from Labrador to Mexico (Hoffman, 1989). It consists of Archean to Mesoproterozoic units that were once part of the Laurentian margin. These units were subsequently deformed and metamorphosed at ~1200-1000 Ma during a continental collision with an unknown land mass; this event is known as the Grenvillian Orogenic cycle. The Grenvillian Orogenic cycle culminated with a major crustal thickening episode, the Ottawan orogeny (1080-1020 Ma; Rivers, 1997), which is largely responsible for the final tectonic configuration of the province.

The Grenville Province consists of three first order tectonic divisions: the Parautochthonous belt, the High-*P* belt, and the Allochthonous belt (*Figure 1.1*; Rivers *et al.*, 1989; Rivers *et al.*, 2002). The Parautochthonous belt is comprised of mainly Archean and Paleoproterozoic units that can be linked to the foreland of the orogen and have undergone Barrovian metamorphism during the late stages of the Grenvillian Orogenic cycle (Rivers *et al.*, 1989; Rivers *et al.*, 2002). The High-*P* belt consists of Mesoproterozoic units that were transformed to high-pressure granulites and eclogites (Indares and Rivers, 1995, Indares *et al.*, 2000; Rivers *et al.*, 2002) during the Ottawan orogeny and are of a continental affinity (Hynes *et al.*, 2000). The Allochthonous belt is comprised of Mesoproterozoic units that were transported from the southeast; although they are considered as part of the Laurentian margin, they do not have direct links with the foreland (Hynes *et al.*, 2000). The metamorphic grade in this belt ranges from amphibolite to granulite. Some units underwent high grade metamorphism during the Ottawan orogeny and thus represent "hot" Ottawan crust while other units were metamorphosed earlier in their history and during the Ottawan orogeny remained relatively cold.

Metapelitic rocks in the Grenville Province commonly display evidence of partial melting and contain the assemblage garnet - kyanite/sillimanite - K-feldspar - biotite - quartz. Based on the presence of biotite in the assemblage, these rocks have been traditionally interpreted as having undergone metamorphism under amphibolite facies conditions. However biotite may be of retrograde origin, formed at the expense of other ferromagnesian minerals during the release of fluid from the crystallizing melt (Spear *et al.*, 1999; Indares and

Dunning, 2001). If this is so then the extent of granulite facies metamorphism in some units of the Grenville Province may have been underestimated. This hypothesis is tested in an allochthonous unit, the GHSZ which contains anatectic metapelites.

1.2.2 Geology of the Manicouagan Reservoir Area

1.2.2.1 The Parautochthonous Belt and the High-*P* Belt

Located in the central part of the Grenville Province, the shores of the Manicouagan Reservoir reveal a complete section from the Parautochthonous belt through the High-*P* belt to the interior of the Allochthonous belt (*Figure 1.2*). The Parautochthonous belt is represented by the Gagnon terrane which is a *ca.* 1000 Ma fold-thrust and nappe belt comprised of Archean basement and a Paleoproterozoic continental margin sequence (Rivers *et al.*, 1989; Rivers *et al.*, 2002). This terrane displays a Barrovian metamorphic gradient that, increasing southwards, ranges from greenschist to upper amphibolite and locally ecologite facies (Rivers *et al.*, 1993; Indares and Rivers, 1995).

The High-*P* belt structurally overlies the Parautochthonous belt and is represented by the Manicouagan Imbricate Zone (MIZ). The MIZ consists of imbricated Mesoproterozoic units that have been divided into two separate terranes (*Figure 1.2*). The structurally lower Lelukuau terrane is comprised of an imbricated Labradorian (~1650 Ma) anorthosite-mangerite-charnockite-granite (AMGC) suite (Indares *et al.*, 2000). The overlying Tshenukutish terrane includes Pinwarian (~1467 Ma) diorite with rafts of supracrustal rocks, 1170 Ma metagabbro, tectonic silvers of anorthosite, and a 1020 Ma granite (Indares *et al.*, 1998; 2000). The MIZ has been metamorphosed under high P-T conditions (800-900°C and up to 1800 MPa) at ~ 1050-1030 Ma during the culmination of the Ottawan orogeny. During the same time period, mafic dykes (Thémines dykes) intruded major shear zones (Indares *et al.*, 1998).

1.2.2.2 The Allochthonous Belt

In the area of the Manicouagan Reservoir the Allochthonous belt consists of two units: the structurally lower Berthé terrane (BT), of which the GHSZ is a part, and the structurally higher Hart Jaune terrane (HJT). The Berthé terrane was originally defined by Hynes *et al.* (2000) as an assembly of two lithotectonic domains: the Gabriel and the Canyon domains. The Gabriel Domain, which has been subdivided into two complexes (see next section), consists of well layered migmatitic, quartzofeldspathic gneisses with concordant amphibolite sheets and granitoid rocks, as well as a large body of strongly recrystallized and deformed anorthosite (Hynes *et al.*, 2000). The Canyon Domain (which occurs south of the area shown in *Figure 1.2*) is made up of a granitoid complex that contains rafts of metapelites (Hynes *et al.*, 2000). Both were interpreted to have been metamorphosed under amphibolite facies conditions at 1011-990 Ma (Scott and Hynes, 1994). In addition, units of the BT are exposed structurally above the MIZ on a peninsula of the northeast reservoir (shown by arrow in *Figure 1.2*).

The HJT truncates the MIZ-BT boundary to the north and is separated from the BT to the south by a subvertical shear zone (*Figure 1.2*; Indares and Dunning, 2004). It consists of Mesoproterozoic mafic granulites (Gobeil, 1996a and b; Hynes *et al.*, 2000) which were metamorphosed at 1470 Ma (Scott and Hynes, 1994; Hynes *et al.*, 2000) and escaped Ottawan age deformation and metamorphism (Indares and Dunning, 2004) except for its base in which metamorphic ages of 989 Ma were determined (Scott and Hynes, 1994; Hynes *et al.*, 2000).

1.2.3 Geology of the Study Area: The Gabriel Domain and the Gabriel High Stain Zone

A recent study of the Gabriel Domain has led to a division of the domain into two main units: the Gabriel complex and the Banded complex (*Figure 1.2*; Indares and Dunning, 2004). Located in the northern portion of the Gabriel Domain the Gabriel complex consists of migmatized tonalitic gneiss with rafts of anatectic metapelites and boudinaged Fe-Ti gabbro sills. Preliminary *P-T* conditions calculated for these units range from 780-920°C and 950-1100 MPa, placing them in the mid-*P* field of the granulite facies (Indares and Dunning, 2004). Monazite dating in the anatectic metapelites gave ages of 1050-1040 Ma indicating that the high grade metamorphism took place during the Ottawan orogeny. The basal unit of the Gabriel complex, known as the Gabriel High Strain Zone (GHSZ; *Figures 1.2 and 1.3*), is exposed in the core of an antiform that outcrops in a small group of islands located near Relais Gabriel (*Figure 1.3*) and consists of tectonic layers of migmatite, anatectic metapelite and quartzite and tectonic lenses of eclogite. These units are crosscut by fine-grained mafic dykes (Indares and Dunning, 2004). The eclogite lenses have the same type of protolith and metamorphic assemblages as metagrabbros from the Lelukuau terrane and are considered to be dismembered components of this terrane. As for the mafic dykes, they are linked to the Thémines dykes that intrude the Lelukuau terrane. The GHSZ is truncated to the south by the Banded complex which is a unit of alternating mafic and granitic layers. Recent studies of units in the Banded complex have constrained *P-T* conditions to 800-830°C and 800-900 MPa and provided metamorphic ages of 971-996 Ma (ie. waning stages of the Grenvillian Orogenic cycle; Indares and Dunning, 2004).

1.3 Tectonic Interpretation

Structural, metamorphic and U-Pb data from the Manicouagan Reservoir area suggest that during the Ottawan orogeny the MIZ represented deep levels of thick, hot crust that were extruded to the northwest over a crustal scale ramp (Archean basement of the Gagnon terrane; Indares *et al.*, 1998; 2000). The GHSZ is interpreted to have been part of the hangingwall of the MIZ during the extrusion, as indicated by the presence of tectonic lenses of eclogite from the Lelukuau terrane within the GHSZ. At the time of the Ottawan orogeny the Gabriel complex was located at intermediate crustal levels that were metamorphosed under the same *T* but different *P* conditions than the MIZ. The high metamorphic temperatures in both the MIZ and the Gabriel complex are partly attributed to mantle-derived magma located at the base of the crust (Indares *et al.*, 2000; Indares and Dunning, 2004). This is inferred by the presence of the synmetamorphic dykes that are found in major shear zones within these units. The metamorphic evolution of the Banded complex of the BT is less well constrained. Finally, the HJT represents structurally higher and cooler levels that remained relatively rigid during the Ottawan orogeny.

Although it has different levels of exposure, the geology of the Manicouagan Reservoir area (see Section 1.2) is similar in geometry to that of the Himalaya-southern Tibet system (Indares and Dunning, 2004). The high grade gneisses of the Higher Himalaya sequence, which is interpreted to represent an extrusion front (Vannay and Graseman, 2001; Grujic *et al.*, 2002), is separated from gneissic domes in the hinterland by synforms exposing low grade rocks (e.g., Kangmar section, Lee *et al.*, 2000). This arrangement of units is similar to the configuration of the MIZ-Hart Jaune terrane-Gabriel complex (see Section 1.2). The Himalayan system has been modelled by Beaumont *et al.* (2001) and Jamieson *et al.* (2002) with channel flow of ductile crust underneath a plateau and surface denudation at the plateau rims as controlling factors. These models explain the asymmetric extrusion of ductile crust toward the foreland and the doming on the hinterland side, the latter being favoured by underthrusting of cold crust beneath the extrusion front. A difference between the Himalayan system and the Manicouagan Reservoir area is that in the Himalayas the development of high ductility is limited to the middle crust and is thought to be produced by radioactive decay, whereas in the Manicouagan Reservoir area the high metamorphic temperatures in both the MIZ and the Gabriel complex are partly attributed to mantle-derived magma located at the base of the crust (Indares *et al.*, 2000; Indares and Dunning, 2004). Finally steeper (and locally reversed) contacts between units overlying the MIZ are consistent with late crustal shortening in the Manicouagan Reservoir area during the waning stages of the Ottawan orogeny, a stage that as of yet has not occurred in the Himalayas (Indares and Dunning, 2004).

1.4 Anatectic Metapelites from the Manicouagan Reservoir Area

Anatectic metapelites that experienced partial melting during the Ottawan orogeny occur in the Tshenukutish terrane, in the Gagnon terrane immediately below the MIZ, and in the Gabriel Complex (*Figure 1.4*).

1.4.1 Anatectic Metapelites from the Tshenukuktish and Gagnon Terranes

Metapelites from the Tshenukutish terrane contain the assemblage Qtz-Ky+Kfs+Grt+Pl(±Bt) with biotite post-dating the thermal peak (Indares and Dunning, 2001). These rocks have reached *P-T* conditions in the range of ~14 to 16 kbar between ~850 to 875°C and they are interpreted to have experienced strong decompression during melt crystallization. This *P-T* path is consistent with extrusion over a crustal scale ramp. Monazite ages in most of these rocks range between 1040 and 1033 Ma and overlap with metamorphic ages that were obtained in mafic rocks throughout the MIZ (Indares *et al.*, 2000). However, younger monazite ages (1017-1019 Ma) are found at the highest structural levels. These younger ages are possibly due to resetting from the nearby Hart Jaune granite (Indares and Dunning, 2001).

Anatectic metapelites in the Gagnon terrane contain the assemblage Qtz-Ky+Kfs+Grt±Pl(±Bt)(±Ms) with both biotite and muscovite post-dating the metamorphic peak (Jordan, 2003). Partial melting of these rocks is interpreted to have occurred in the *P-T* range of ~11.4 to 14.5 kbar between ~750 to 780°C, with subsequent melt crystallization during cooling in the same *P* range (Jordan, 2003). Monazite ages constrain the partial melting event at 985±2 to 995±2 Ma (Jordan, in preparation) ie. during the waning stages of the Ottawan orogeny. Extrusion of the "hot" MIZ over the GT is consistent with the *P-T* path followed by these rocks and with their late metamorphism.

1.4.2 Anatectic Metapelites from the GHSZ

In contrast to the previously discussed rocks, anatectic metapelites in the GHSZ, which are the focus of this study, contain sillimanite instead of kyanite and display the assemblages Qtz-Sil+Kfs+Grt(±Pl)(±Bt) and Qtz-Sil+Grt+Crd(±Kfs)(±Pl)(±Bt). Their metamorphism was dated by monazite at 1053±2 Ma (Indares and Dunning, 2004). In the field, the metapelites display folded leucosome and meso/melanosome layers and pods (*Plate 1.1a*) that locally have a "rusty" appearance (*Plate 1.1b and 1.1c*). The clear separation between the leucosome and melanosome layers in the outcrop indicates that leucosome has been partly segregated from the host rock. The samples on which this study is based were collected by Dr. A. Indares during a field expedition in the summer of 2001.

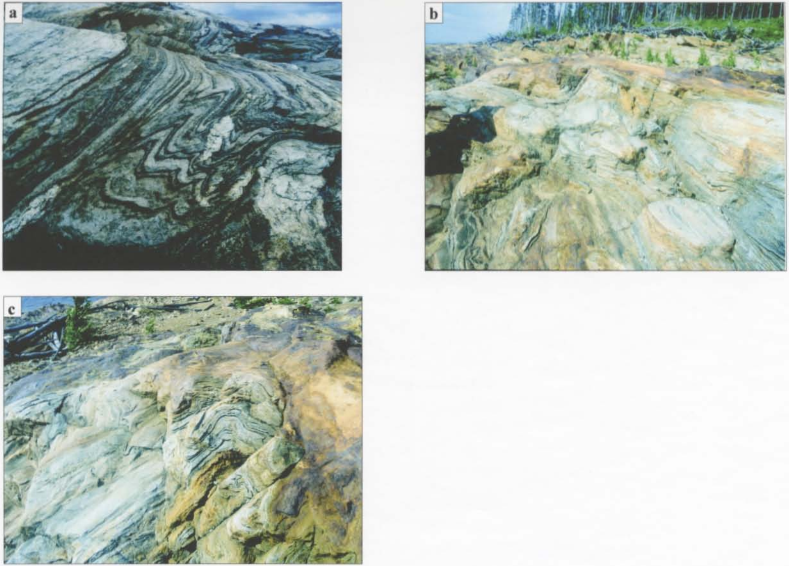


Plate 1.1: Outcrops of anatectic metapelites in the Gabriel area showing **a**) folded leucosomes and meso/melanosome layers; **b**) and **c**) "rusty" metapelites with interlayered leucosome.

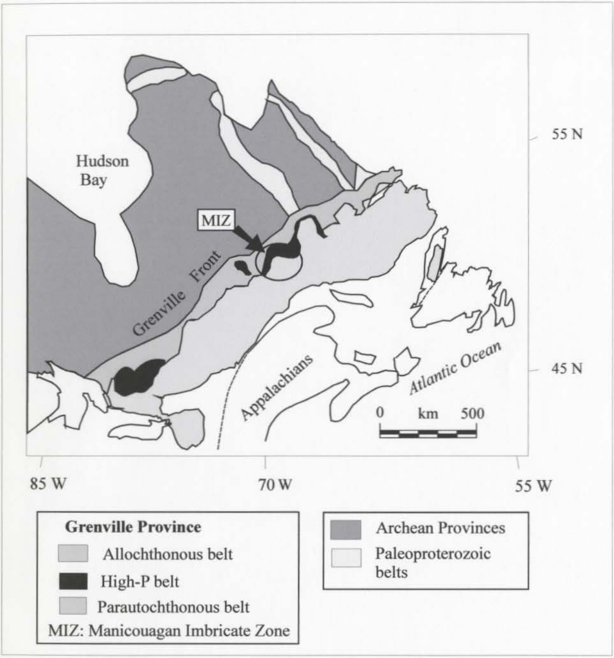


Figure 1.1: Simplified map of the eastern Canadian Shield showing the Grenville Province (modified after Rivers *et al.*, 1989; Rivers *et al.*, 2002). Circle shows the location of Figure 1.2.

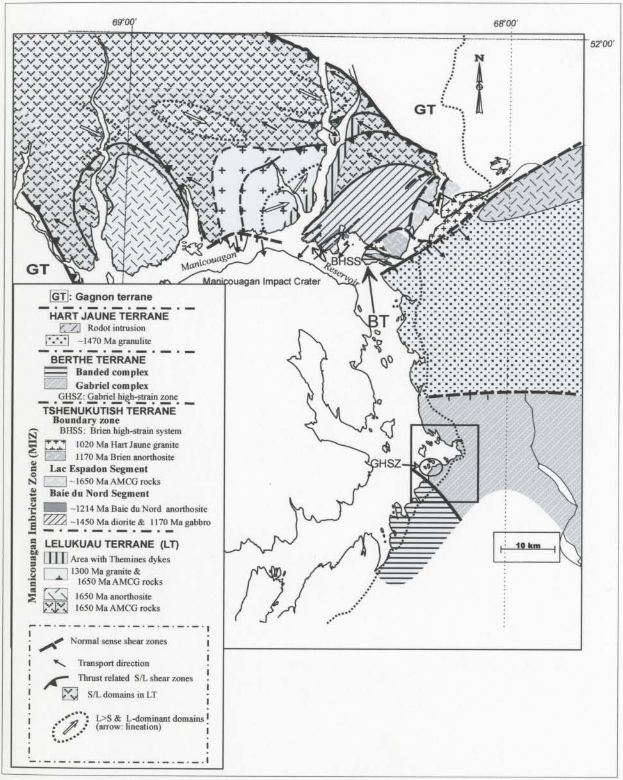


Figure 1.2: Simplified geological map of the Manicouagan Reservoir area (modified after Indares and Dunning, 2004). Box shows the location of Figure 1.3.

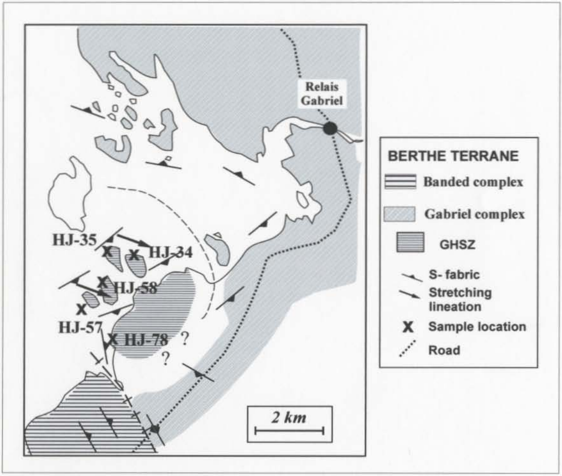


Figure 1.3: Blow-up of the Gabriel area from Figure 1.2. Map shows the location of the samples collected from the Gabriel High Strain Zone (GHSZ; modified after Indares and Dunning, 2004).

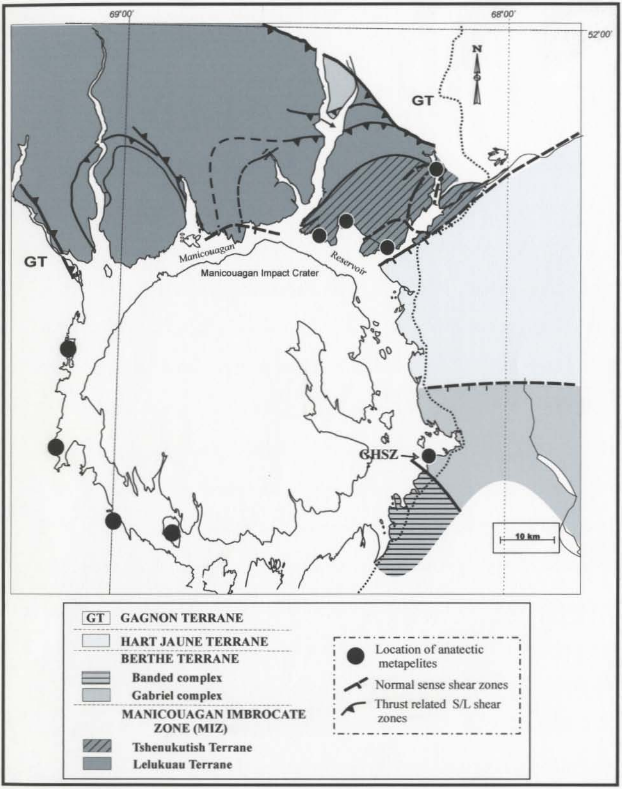


Figure 1.4: Map of the geology in the Manicouagan Reservoir area showing the locations of anatectic metapelites (modified after Indares and Dunning, 2004).

Chapter 2: Theoretical Background: Partial Melting of Anatectic Metapelites

2.1 Partial Melting Reactions of Metapelites

2.1.1 Introduction

Pelitic rocks subjected to high grade metamorphism experience partial melting under upper amphibolite and granulite facies conditions. The degree of partial melting mainly depends upon temperature, pressure and the presence or absence of a H_2O bearing fluid. In the presence of vapour, melting occurs at the lowest temperatures because H_2O dissolves preferentially in the melt (Holtz and Johannes, 1994). In vapour-free systems, partial melting occurs at higher temperatures by reactions involving dehydration of muscovite and biotite (vapour-absent melting; Spear *et al.*, 1999). The amount of free H_2O that is present in a rock depends on the pore space and is limited in deeply buried rocks. Thus when the "wet" melting temperature is reached only a small volume of melt is usually produced. In contrast, because pelitic rocks contain large amounts of muscovite and biotite, vapour-absent dehydration melting of micas is considered to be the main melt producing mechanism in these rocks. Partial melting of metapelitic rocks in the sillimanite stability field has been extensively investigated both experimentally (e.g. Huang and Wyllie 1973, 1974, 1975; Huang *et al.*, 1973; Le Breton and Thompson 1988; Vielzuef and Holloway, 1988; Gardien *et al.*, 1995; Carrington and Harley, 1995; Patiño Douce and Johnson, 1991) and by studying natural samples (Vernon and Collins, 1988; Spear and Parrish, 1996; Kriegsman and Hensen, 1998). As a result, the position of the various melting reactions in pelitic systems has been well constrained in P-T space (e.g. Thompson and Tracy, 1979; Thompson, 1982; Carrington and Harley, 1995; Spear *et al.*, 1999).

2.1.2 Relevant Systems

Partial melting of pelitic rocks is commonly described in the KFMASH system, for plagioclase-free metapelites, or the NaKFMASH system, which takes into account the albite (Ab) component of plagioclase. Relevant reactions are summarized in Spear *et al.* (1999) and their distribution in P-T space is illustrated in *Figures 2.1a* (KFMASH system) and *2.1b* (NaKFMASH system). Both grids are valid for rocks with excess quartz and emphasize vapour-absent reactions. Reactions are similar in the two systems, but they are located at lower temperatures (~ 40 to 60°C) in the NaKFMASH system. This is because albite gets preferentially incorporated into the melt and therefore it participates in all reactions as a reactant (Spear *et al.*, 1999). However it should be noted that the variance of the reactions does not change with the addition of the component albite, because there is also the addition of a new phase (plagioclase).

Plagioclase also contains Ca (anorthite component) that can be described in the CaNKFMASH system. In this system univariant NaKFMASH reactions become divariant because there is the addition of a new component but not a new phase. Anorthite does not dissolve readily in melt and stabilizes plagioclase at higher temperatures (Spear *et al*, 1999). Therefore, anorthite displaces the reactions to higher temperatures in P-T space with the amount of displacement depending upon the X_{An} of the plagioclase (ie. for plagioclase with

$An_{25\text{-}40}$ reactions are displaced by ~ 30°C to the right; Thompson and Tracey, 1979). Since plagioclase in metapelites is commonly poor in anorthite the NaKFMASH system can still be used to adequately describe plagioclase-bearing metapelites (Spear *et al*, 1999). However for metapelites with high-Ca plagioclase, the *P-T* location of the reactions in the KFMASH system may be more relevant since both anorthite in plagioclase and lack of plagioclase displace the reactions towards higher temperatures.

2.1.3 Dehydration Melting of Micas at Mid-*P* Conditions in the NaKFMASH System

The NaKFMASH grid of Spear *et al.* (1999) is divided by a network of univariant reactions into fields in which divariant reactions occur (*Figure 2.2*). At mid-*P* conditions (4 to 9 kbar) the three following vapor-absent discontinuous reactions occur in order of increasing temperature (from 700 to 900°C):

1) Muscovite + Albite + Quartz → Al_2SiO_5 + K-feldspar + Liquid (R1)

2) Biotite + Al_2SiO_5 + Quartz → Garnet + Cordierite + Liquid (R2)

3) Biotite + Garnet + Quartz → Orthopyroxene + Cordierite + Liquid (R3)

Between the univariant reactions, each divariant field is characterized by a specific AFM topology (*Figure 2.2*) that illustrates the relation between possible mineral assemblages in this field (*Table 2.1*) and bulk composition. Therefore, for a given rock, the specific continuous reaction that occurs in each field depends upon bulk composition. As an example, consider the divariant Field II between reactions R1 and R2 (*Figure 2.2*). In this field the mineral assemblage depends on the bulk X_{Mg}, with Grt + Bt + Sil stable in low X_{Mg} rocks and Crd +

Bt + Sil stable in high X_{Mg} rocks. Each assemblage is involved in a specific biotite dehydration reaction:

Biotite + Sillimanite ± Albite + Quartz → Garnet + K-feldspar + Liquid (RIIa)

and

Biotite + Sillimanite ± Albite + Quartz → Cordierite + K-feldspar + Liquid (RIIb),

respectively. In contrast, once the system crosses reaction R2 into Field III the divariant assemblages (and reactions) are mainly dependent on the Alumina Index (AI) of the rock (*Figure 2.2*). In rocks that have a high AI biotite is eliminated by R2 and thus biotite dehydration melting ends at this stage. These rocks, in Field III, now display the assemblage Grt + Crd + Sil which is involved in the continuous reaction:

Cordierite + K-feldspar ± Albite + Quartz → Garnet + Sillimanite + Liquid (RIIIa)

that produces only limited amounts of melt (Spear *et al.*, 1999). In contrast, rocks with low AI display the assemblage Grt + Crd + Bt that participates in the reaction:

Biotite + Cordierite ± Albite + Quartz → Garnet + K-feldspar + Liquid (RIIIb).

If biotite is in excess relative to cordierite then it is eliminated at higher temperatures by reaction R3 which produces orthopyroxene.

The starting temperatures and the widths of the continuous reactions involving dehydration melting of biotite, such as the ones described above, in *P-T* space are also controlled by the Ti and F contents of biotite (Spear, 1993; Carrington and Harley, 1995) both of which stabilize biotite to higher temperatures (Forbes and Flower, 1974; Manning and Pichavant, 1983).

2.2 Textures

2.2.1 Peak versus Retrograde Assemblages

Metamorphic rocks commonly preserve the mineral assemblage that was stable at the thermal peak. This is because with increasing temperature during prograde evolution, dehydration reactions are favoured and the H_2O released is incorporated into a fluid phase which leaves the rock. Therefore, during subsequent cooling retrograde rehydration reactions cannot take place unless fluid is reintroduced into the system. However, in anatectic rocks H_2O remains in the system because it is dissolved in the melt. Therefore during melt crystallization H_2O is released and used to produce retrograde hydrous phases, such as micas, at the expense of the peak assemblage. Thus the presence of micas in anatectic metapelites does not necessarily mean that they were stable at the *P-T* conditions of the metamorphic peak (*Spear el at.*, 1999). In this context mineral assemblages diagnostic of the thermal peak can be best preserved if part of the melt has been extracted. This can happen if a large amount of melt has been produced, but the percentage of melting required for melt extraction depends upon the viscosity, which in turn depends upon the *P-T* conditions (Clemens and Vielzeuf, 1987; Holtz and Johannes, 1994; Gardien *et al.*, 1995; Johannes and Holtz, 1996; Thompson, 1996). Melt extraction is also favoured by deformation (Sawyer, 1994).

Studies of anatectic metapelites have shown that in addition to the presence of leucosome, diagnostic mineral assemblages and reaction textures related to partial melting and subsequent melt crystallization can be variably preserved. A few examples of textures and their interpretation are given below:

1) The coexistence of sillimanite and K-feldspar indicates that reaction R1 (*Figure 2.2*) has taken place (Kohn *et al.*, 1997) and that the rock has entered the *P-T* domain of biotite dehydration melting. Common textures produced during subsequent melt crystallization are muscovite with relics of K-feldspar and/or sillimanite in its core and intergrowths of quartz and albitic plagioclase (myrmekite; Barker, 1990).

2) The presence of K-feldspar and/or garnet as rims around aluminum silicates (Indares and Dunning, 2001) provides good evidence of reaction RIIa (*Figure 2.2*). When the reaction reverses the result is the formation of aggregates of sillimanite, biotite and/or plagioclase around garnet (Barker, 1990).

3) The presence of cordierite surrounded by sillimanite, biotite and quartz or symplectites of these minerals is a common retrograde texture related to reaction R2 (Vernon and Collins, 1998; *Figure 2.2*).

2.3 Compositional Variations in Solid Solutions as a Result of Partial Melting and Melt Crystallization

In metapelites common minerals that form solid solutions are biotite, garnet, plagioclase and cordierite. During metamorphism the composition of a solid solution is dependent on the bulk composition and the *P-T* conditions of equilibrium. In addition, refractory minerals such as garnet and plagioclase may show zoning, whereas diffusion in biotite and cordierite is so efficient that these minerals are, in general, homogeneous. Finally, in some cases the composition of specific phases within a sample may depend on the textural and if the high-T event was short-lived. In contrast, diffusional homogenization may continue during early stages of cooling if grains are small and experience slow cooling.

Ca zoning, if preserved, is very informative about the growth history of garnet. As an example, garnet growing by reaction RIIa around a core previously formed by subsolidus reactions is more Ca-rich than the core. This is because during partial melting by reaction R1 Na is preferentially incorporated into the melt leaving behind Ca-rich plagioclase. If this plagioclase is subsequently involved in the garnet forming reaction RIIa the new garnet will be enriched in Ca because its grossular content is controlled by the GASP equilibrium: 3Anorthite = Grossular + 2Sillimanite + Quartz.

During retrograde metamorphism garnet rims tend to change their composition in response to the decreasing T (and P) conditions by reactions with adjacent matrix phases. This leads to a compositional gradient between the core and rim (retrograde zoning). If during cooling reaction RIIa takes place in reverse, garnet is partially resorbed and displays specific zoning trends in Mn and Ca. Mn shows an increase at the rim because in metapelites there are commonly no other Mn-bearing minerals. Therefore, during garnet consumption the Sps component remains in garnet. Grs may show a decrease at the rims if cooling is accompanied by strong decompression and the formation of new plagioclase at garnet rims or an increase if only the Alm and Pyp components break down. In addition, the Fe-Mg exchange between garnet and other ferromagnesian minerals during cooling leads to an increase of Fe relative to Mg that is usually restricted to the garnet rims because during cooling diffusion rates decrease exponentially (Spear, 1993).

Trace elements, due to their slow diffusion rate, may also preserve growth zoning in garnet (Hiroi and Ellis, 1994; Spear and Kohn, 1996; Pyle and Spear, 1999; Yang and Rivers, 2000). In some cases, trace elements may help to distinguish between garnet cores that grew by subsolidus reactions and rims that formed by reaction RIIa. This is particularly important

Trace elements, due to their slow diffusion rate, may also preserve growth zoning in garnet (Hiroi and Ellis, 1994; Spear and Kohn, 1996; Pyle and Spear, 1999; Yang and Rivers, 2000). In some cases, trace elements may help to distinguish between garnet cores that grew by subsolidus reactions and rims that formed by reaction RIIa. This is particularly important in garnets that have experienced diffusional homogenization of Ca. With subsolidus growth, in the presence of Y-rich phases such as monazite and xenotime, garnet cores will develop bell shaped outward decreases in Y (Pyle and Spear, 1999) and with continued growth in the presence of melt, will display flat Y profiles at the rims (Indares and Dunning, 2001). In the case of Cr, which is abundant in micas (Yang and Rivers, 2000), outward increases at the rims are consistent with garnet growth during the biotite dehydration melting reaction RIIa.

2.3.2 Biotite

Biotite grains are usually homogeneous because diffusion of elements in them is fast. However, differences in composition between grains may be observed in some cases and may provide information about the prograde versus retrograde origin of biotite in different textural settings. In anatectic metapelites biotite is continuously consumed once the rocks enter the *P-T* Field II. However, during subsequent melt crystallization new retrograde biotite forms (preferentially around ferromagnesian minerals such as garnet and cordierite) because H_2O is once again available for retrograde reactions (see Section 2.2.1). This biotite is more Fe-rich than the remaining peak biotite, if any (Spear and Florence 1992; Spear, 1993). Concurrently, as cooling continues, Fe-Mg exchange between biotite and garnet progressively lowers the X_{Fe} of biotite adjacent to garnet. Thus, if cooling is sufficiently fast biotite grains at different distances from garnet may display a characteristic compositional trend, with peak biotite away from the garnet having intermediate X_{Fe}, retrograde biotite having the highest X_{Fe} progressively decreasing toward garnet, and with minimum X_{Fe} in grains adjacent to garnet. Finally, Ti contents in biotite are directly related to temperature with higher Ti content being formed at higher temperatures than biotite with low Ti content (Spear and Florence, 1992).

2.3.3 Plagioclase

During prograde metamorphism in mid-*P* and *high-P* terranes plagioclase develops "normal" zoning with An-rich cores and Ab-rich rims because progressive growth of garnet depletes plagioclase of its An component. When melting begins the albite component of the plagioclase is partitioned into the melt while the remainder of the grain becomes An-rich. However, depending upon *P*, if garnet grows during melting (for example by reaction RIIa) then the anorthite component of the plagioclase is used by the GASP reaction to produce grossular in garnet.

During retrogression the new plagioclase crystallizing from the melt is generally Ab-rich with increasing Ab towards the rim ("normal" zoning). This is because the limited amount of An that dissolved in the melt tends to crystallize first. However plagioclase forming near garnet also incorporates Ca from the latter, especially if cooling is accompanied by decompression, and thus this plagioclase commonly displays "reverse" zoning, with rims adjacent to garnet enriched in anorthite. In summary, the composition and zoning of plagioclase depends on the relative timing of formation (i.e. prograde versus retrograde), the textural context (proximity to garnet) and the *P-T* conditions of metamorphism.

2.4 Geothermobarometry in Anatectic Metapelites

Geothermobarometry is the determination of the *P* and *T* at which a mineral assemblage achieved equilibrium by using thermodynamic relations between phase components linked by a pressure sensitive (barometer) or temperature sensitive (thermometer) reaction. In high-*T* metapelites the Grt-Bt Fe-Mg exchange thermometer and the GASP barometer (Grt + Pl + Al_2SiO_5 + Qtz) are most commonly used. In addition, if cordierite is present the Grt-Crd Fe-Mg exchange thermometer and the Crd + Grt + Sil + Qtz barometer can also be used.

As mentioned above, in order to perform thermobarometry the mineral assemblage must be in equilibrium. In metamorphic rocks large-scale equilibrium is most commonly achieved during peak-*T* conditions (that will be referred to as the metamorphic peak) because diffusion is most efficient at the highest temperatures. Subsequently, in anatectic metapelites significant textural changes may occur during melt crystallization (see Section 2.2.1). Under these conditions local equilibrium may be achieved between rims of adjacent minerals. Therefore, in the best case, two main types of *P-T* conditions can be calculated for anatectic metapelites: those of the thermal peak and those of melt crystallization. However, Fe-Mg contents at the rims of ferromagnesian minerals may be further reset by Fe-Mg exchange that stops at temperatures below those of net transfer reaction. Also, because complex zoning may occur in refractory minerals and because of the textural changes that occur during melt crystallization, it is important to interpret textures and zoning correctly in order to determine the appropriate textural setting and mineral composition to use for each type of *P-T* determination. In addition, biotite and plagioclase that are used for *T* and *P* determinations respectively may be entirely retrograde (see Section 2.3) thus making it impossible to calculate the conditions of the thermal peak. The following is a description of the types of mineral compositions to be used for *P-T* calculations in anatectic metapelites.

2.4.1 Garnet

If the cores of garnet are homogeneous then their composition represents the *P-T* conditions of the thermal peak or conditions at which homogenization stopped during the early stages of cooling (Spear, 1991). Retrograde conditions for melt crystallization may be represented by garnet rims adjacent to plagioclase and away from biotite. Usually rims adjacent to biotite continue to experience Fe-Mg exchange with the latter after the melt crystallizes. This composition cannot be used for *P* determinations because barometers are net transfer reactions that block at higher temperatures.

2.4.2 Biotite

Matrix biotite distant from garnet with intermediate $X_{Fe,}$ if a trend is present (see Section 2.3.2), and matrix grains with maximum $X_{Fe,}$ if a trend is absent, can be interpreted to represent the thermal peak. However, in the latter case, even if biotite was stable it is highly unlikely that the thermal peak composition is preserved unless biotite is abundant (infinite reservoir; Spear and Florence, 1992). Therefore, calculated temperatures using Grt-Bt thermometry should be considered minimum. Finally, clusters of biotite that do not touch garnet grains and display high X_{Fe} values may retain compositions obtained during melt crystallization and the composition of biotite adjacent to garnet (lowest X_{Fe}) represents the *T* at which Fe-Mg exchange ends.

An additional problem with biotite thermometry is the presence of Fe^{3+}. Since Fe^{3+} cannot be analyzed with the microprobe and, in the case of biotite, cannot be calculated by stoichiometry owing to the potential presence of vacancies, application of thermometry using total Fe as Fe^{2+} may give overestimated temperatures. This problem is minimized if the rock contains graphite because in this case coexisting biotite contains minimum amounts of Fe^{3+} (Guidotti and Dyar, 1991).

2.4.3 Plagioclase

If subsolidus plagioclase can be recognized, then the compositions of rims away from garnet and leucosome (to avoid possible effects of retrograde reequilibration) represent the compositions at the thermal peak. In the absence of such plagioclase, the core composition of a matrix grain that was likely produced during melt crystallization can be used to calculate an upper *P* limit for the thermal peak. This is because plagioclase crystallizing from melt during retrogression is usually more Ab-rich than peak plagioclase (see Section 2.3.3) and calculated pressures are directly related to the Ab content. Finally, the composition of An-rich rims adjacent to garnet commonly represent conditions of melt crystallization.

2.4.4 Cordierite

Cordierite is usually homogeneous with slight retrograde zoning at the rims. Therefore the composition of the core represents the thermal peak and that of the rims represents *P-T* conditions of retrograde exchange with garnet and/or biotite. However, when using cordierite for barometry it is important to determine if it contains H_2O or CO_2 because the location of barometric isopleths strongly depend upon the fluid composition (Martignole and Sisi, 1981; Harley *et al.*, 2002). A quick way to determine if cordierite is H_2O or CO_2 rich is to check its optic sign, a grain that is optically negative is H_2O rich and a grain that is optically positive is CO_2 rich.

2.4.5 Isopleths of X_{Fe} in Garnet

Spear *et al.* (1999) have proposed an alternative method for constraining *P-T* conditions by using X_{Fe} garnet isopleths (*Figure 2.3*). The locations of these isopleths have been calculated for the NaKFMASH system and their slopes depend on the divariant field in which the thermal peak occurred and on the divariant assemblage that was present in that field. For instance, in Field II (*Figure 2.3*) garnet X_{Fe} isopleths in the assemblage Grt-Bt-Sil-Kfs-L are steep and can provide good *T* constraints. In contrast, with the assemblage Grt-Sil-Crd-Kfs-L in Field III they are flat and therefore provide good *P* constraints. Indares and

Dunning (2001) and Jordan (2003) have shown that this method works well for rocks with moderate to high bulk X_{Mg}, but not for rocks with low bulk X_{Mg}.

Table 2.1: Mineral assemblages for the divariant fields of the KFMASH system (modified after Spear *et.al.*, 1999).

	Assemblage
Field I	Garnet + biotite + Al_2SiO_5 + muscovite + quartz (+ liquid)
Field II	Garnet + biotite + Al_2SiO_5 + K-feldspar + quartz (+ H_2O) Cordierite + biotite + Al_2SiO_5 + Kfeldspar + quartz (+ H_2O)
Field III	Garnet + biotite + Al_2SiO_5 + K-feldspar + quartz + liquid Cordierite + biotite + Al_2SiO_5 + Kfeldspar + quartz +liquid
Field IV	Garnet + cordierite + biotite + K-feldspar + quartz + liquid Garnet + cordierite + Al_2SiO_5 + K-feldspar + quartz + liquid Garnet + orthopyroxene + biotite + K-feldspar + quartz + liquid
Field V	Garnet + cordierite + orthopyroxene + K-feldspar + quartz + liquid Garnet + cordierite + Al_2SiO_5 + K-feldspar + quartz + liquid
Field VI	Garnet + orthopyroxene + cordierite + K-feldspar + quartz + liquid Garnet + spinel + cordierite + K-feldspar + quartz + liquid Spinel + cordierite + Al_2SiO_5 + K-feldspar + quartz + liquid
Field VII	Garnet + orthopyroxene + Al_2SiO_5 + K-feldspar + quartz + liquid

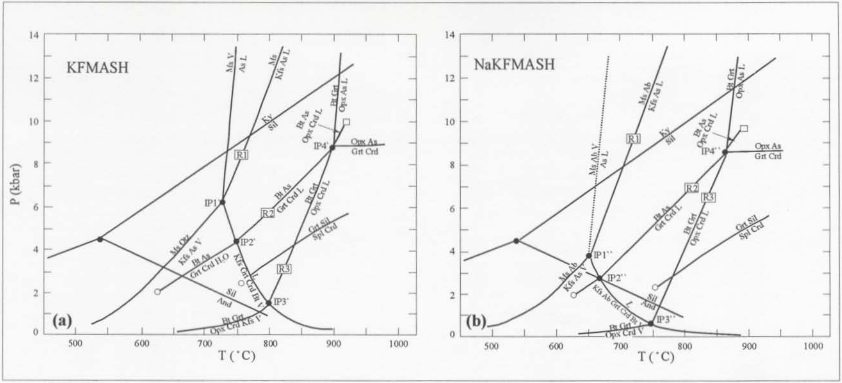
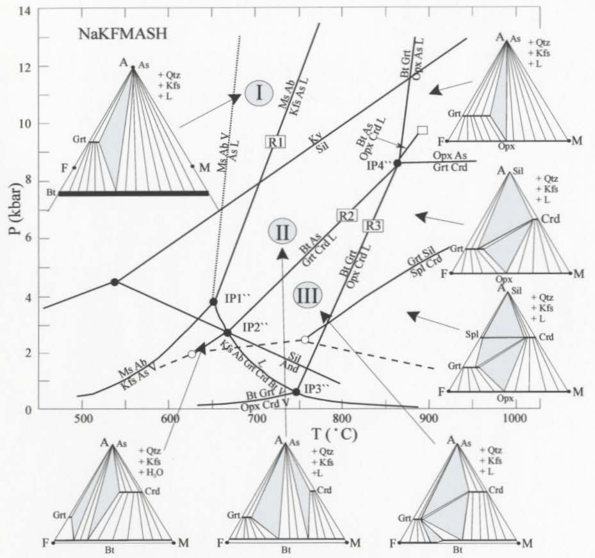


Figure 2.1: *P-T* diagram showing the locations of selected discontinuous reactions in the **(a)** KFMASH system and the **(b)** NaKFMASH system. The finely dotted line represents the pelite vapour-saturated melting reaction (modified after Spear *et al.*, 1999). IP1` to IP4` and IP1`` to IP4`` are invariant points in the system.



RIIa: Biotite + Sillimanite ± Albite + Quartz → Garnet + K-feldspar + Liquid
RIIb: Biotite + Sillimanite ± Albite + Quartz → Cordierite + K-feldspar + Liquid
RIIIa: Cordierite + K-feldspar + Quartz ± Albite → Garnet + Sillimanite + Liquid
RIIb: Biotite + Cordierite ± Albite + Quartz → Garnet + K-feldspar + Liquid

Figure 2.2: *P-T* diagram for the NaKFMASH showing the location of the divariant fields and their AFM topologies (mineral assemblages for each divariant field are listed in Table 2.1; modified after Spear *et al.*, 1999). Also shown are the continuous reactions for fields II and III.

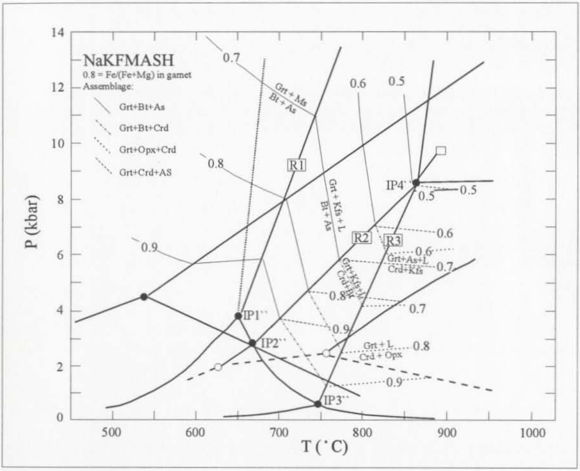


Figure 2.3: *P-T* diagram for the NaKFMASH system showing garnet X_{Fe} isopleths for selected divariant assemblages (modified after Spear *et al.*, 1999).

Chapter 3: Methodology and Analytical Techniques

3.1 Procedures

Nineteen polished thin sections of anatectic metapelites from the Gabriel High Strain Zone were subjected to a detailed investigation. The samples used for these thin sections were collected in layers that are relatively rich in garnet and appear to best preserve the peak metamorphic assemblage. The study was done following the approach outlined in the previous chapter and included:

a) detailed petrographic study of mineral assemblages and textures, and determination of the bulk compositions.

b) interpretation of the observations in terms of the reaction history and the *P-T* field of the metamorphic peak using the KFMASH and NaKFMASH grids of Spear *et al.* (1999) as well as the location of bulk compositions on AFM diagrams.

c) determination of mineral compositions and zoning to detect whether they preserve any record of the prograde and/or retrograde evolution and to select mineral compositions that can be used for thermobarometry.

d) application of thermobarometry and use of garnet X_{Fe} isopleths to further constrain the *P-T* conditions of the metamorphic peak and of melt crystallization, where possible.

3.2 Analytical Techniques

Chemical analyses of minerals and of thin section surfaces were done using a

CAMECA SX50 electron probe microanalyzer with three wavelength dispersive (WD) spectrometers and a Link energy dispersive (ED) spectrometer. The following types of analyses were performed all using a combination of SAMX computer software and in-house computer programs.

a) The bulk compositions of representative areas of thin sections were determined in terms of Fe, Mg, Ca, Mn, Si, Al, Na, K and Ti using an in-house program in ED mode with a beam current of 20 nA and a 15 kV accelerating voltage. For this type of analysis the stage was moved under the beam between specified limits (in-house program).

b) Quantitative analyses of garnet, biotite and cordierite were performed by ED method with a beam width of 1 micron, a beam current of 20 nA, a 15 kV accelerating voltage and a count time of 75 seconds.

i) Large and well preserved garnet grains were analysed in equally spaced points along one or two rim-core-rim perpendicular line traverses for the major elements Fe, Mg, Ca, Mn, Si, Al, Na, K, and Ti.

ii) Cordierite grains adjacent to garnet were analysed for Fe, Mg, Ca, Mn, Si, Al, Na, K, and Ti along transects perpendicular to the garnet grain.

iii) Biotite grains were small and thus only one point from the core of each grain was analyzed. Grains were selected along transects radiating from garnet and were analyzed for the elements Fe, Mg, Ca, Mn, Si, Al, Na, K, and Ti with most grains also being analysed for F, using the TAP WD spectrometer, and Cl, using the PET WD spectrometer, for count times of 50 and 20 seconds, respectively.

c) Plagioclase inclusions in garnet and matrix plagioclase (adjacent to and away from garnet) were analyzed for Ca, Na, K, Si, Al, and Fe along transects across the largest grains (and core and rim only in the case of small grains) with a beam width of 3 microns (to avoid the loss of Na), a beam current of 10 nA, a 15 kV accelerating voltage and a count time of 30 seconds.

d) X-ray maps of Fe, Mg and Ca in garnet were done to further constrain the zoning geometries of the grains that were chemically heterogeneous (see b). This was done using the SAMX HiMax Plus software and WD mode with an average pixel grid of 512 X 512, a beam current of 250 nA and a 15 kV accelerating voltage.

e) The trace elements Y, Cr and P were qualitatively analyzed in a number of typical garnets in order to detect zoning. WD analyses were done along the same rim-core-rim traverses as for the major element using the SAMX software Line and a beam current of 250 nA, a 15 kV accelerating voltage and a counting time of five seconds per point.

f) Backscattered electron images were acquired to identify minerals forming fine grained reaction textures using the SAMX software programs HiMax and MaxView.

3.3 Thermobarometric Methods

Thermobarometry was applied to selected mineral compositions using the computer program TWQ202 (based on TWQ, Berman 1991) that incorporates the solution models of Berman and Aranovich (1996) for ferromagnesian minerals and Fuhrman and Lindsley (1988) for plagioclase. Reactions used include the garnet-biotite (Almandine + Phlogophite = Pyrope + Annite) and garnet-cordierite (Almandine + Mg-cordierite = Pyrope + Fe-cordierite) exchange thermometers, and the GASP (Anorthite = Garnet + Al_2SiO_5 + Quartz) and garnet-cordierite-sillimanite-quartz barometers.

3.4 Presentation of the Data

Based on mineral assemblage the studied samples can be divided into three groups: Group 1- Qtz + Sil + Grt + Crd +Bt ± Kfs ± Pl, Group 2 - Qtz + Sil + Grt + Bt ± Kfs ± Pl, and Group 3 - Qtz + Grt + Bt +Kfs + Pl; which also have distinctive bulk compositions. Chapters 4 to 6 present the descriptions and interpretation of each group. In chapter 7 the results of this study are summarized and used to interpret the overall *P-T* history of these rocks. Finally, the rocks are compared to other anatectic metapelites from the Manicouagan Reservoir area and the tectonic implications of this study are discussed.

Chapter 4: Group 1 Garnet - Cordierite - Sillimanite Bearing Rocks

4.1 Introduction

The rocks of group 1 (samples HJ-57c_1, -57c_2, 57c_3, -57d, -35a, and -35d) consist of the assemblage quartz + garnet + biotite + sillimanite + cordierite ± K-feldspar ± plagioclase (*Table 4.1*). Chemically they are characterized by excess SiO_2 (78.88-85.37 wt%), low Al_2O_3 (9.51-11.32 wt%) and low CaO (up to 0.18 wt%) relative to the composition of "average" metapelites (Carmichael, 1989; *Table 4.2*). The samples can be divided into two subgroups in terms of X_{MgO} and $\sum$FeO + MgO (FM): samples HJ-57c_1 to -57d have high X_{MgO} (0.68-0.77) and low FM (~2-3%), whereas samples HJ-35a and -35d have lower X_{MgO} (0.51-0.57) and higher FM (~6-7.5%). Hand samples HJ-35a and -35d are finely laminated and relatively homogeneous whereas samples HJ-57c_1 to 57d contain coarse grained, millimetric scale quartz-rich domains alternating with finer grained domains.

4.1.1 Mineralogy and Texture

All samples are characterized by garnet porphyroblasts and large quartz ribbons (up to 7 mm in diameter; *Plate 4.1*) in a finer grained matrix (grain sizes up to 2 mm) of Qtz + Grt + Bt + Sil + Crd ± Kfs ± Pl. **Quartz**, which is the dominant mineral, has irregular boundaries and large grains are variably recrystallized with sub-grain development into fine grained aggregates. Large quartz grains have inclusions of biotite, sillimanite, plagioclase and monazite with some phases being present at sub-grain boundaries. **K-feldspar** (sections HJ-

$57c_1$, -57d, -35a, and -35d) and **plagioclase** (sections HJ-35a and -35d) occur as minor phases in the matrix and are mainly associated with garnet and biotite. K-feldspar displays fine lamella exsolutions and/or "wormy" exsolutions of plagioclase (*Plate 4.2*). Plagioclase (sample HJ-35a) also occurs as submillimetric grains located at the boundaries of K-feldspar, quartz and biotite (*Plate 4.3g*).

Three textural types of **garnet** have been distinguished: Grt 1 only occurs in the low X_{MgO}/high FM samples HJ-35a and -35d, and consists of porphyroblasts (3 to 7 mm in diameter) that contain abundant inclusions of sillimanite needles, quartz and biotite in their cores (*Plates 4.3a to e*). Grt 1 is elongated in sample HJ-35d (*Plates 4.3 a to d*) and more irregularly shaped with locally large sillimanite inclusions near rims in sample HJ-35a (*Plate 4.3e*). Grt 2 (samples HJ-$57c_1$, -57d, and -35a) consist of small grains (2 to 3 mm in diameter), with scarce inclusions of quartz, that are interstitial in quartz rich areas. Both Grt 1 and Grt 2 are partially corroded and replaced by sillimanite and biotite (Plates 4.3a, b, d, e and *f*). Grt 3 (samples HJ-$57c_1$, -$57c_2$, -$57c_3$, and -35a) consists of small xenomorphic grains (2 to 3 mm in diameter), with scarce quartz and sillimanite inclusions, associated with quartz and cordierite (*Plates 4.3g and h*). Garnet-cordierite contacts are corroded by small grains of biotite and sillimanite (*Plate 4.3g*).

Biotite, together with quartz ribbons roughly defines the foliation (*Plate 4.1*) and mainly occurs as small interstitial laths or as aggregates that corrode garnet (*Plates 4.3e*). In addition biotite replaces garnet and K-feldspar in samples HJ-35a and -35d and locally forms symplectites with **spinel**, quartz, and sillimanite (*Plates 4.4a* and b). Three textures of

sillimanite have been recognized: Sil 1 forms small submillimetric needles and is only found as inclusions in the cores of Grt 1 (*Plates 4.3c and d*). Sil 2 consist of large spongy porphyroblasts with inclusions of quartz and is most common in the high X_{MgO}/low FM samples (*Plate 4.5*). Finally Sil 3 consists of inclusion-free, smaller prisms that commonly form aggregates (all samples; *Plate 4.6*). These aggregates are oriented parallel to the foliation and are commonly associated with biotite but also form thin discontinuous layers between quartz-rich domains (*Plate 4.1*).

Two textures of **cordierite** are present in these rocks: Crd 1 is associated with biotite and sillimanite and occurs in the high X_{MgO}/low FM samples (*Plate 4.7a*); Crd 2 is associated with garnet + biotite ± sillimanite (all samples; *Plates 4.3g, h and 4.7b*). Both types are optically positive implying that cordierite is CO_2-rich (see Section 2.4.4). In all samples cordierite is variably altered to pinite. In samples HJ-57c_1 to 57d pinite forms "strings" that surround quartz, sillimanite, biotite and the remaining cordierite (*Plate 4.8*). In samples HJ-35a and -35d cordierite grains are larger and pinite alteration only occurs at the rims and along fractures (*Plates 4.3g and h*).

4.1.2 Interpretation

4.1.2.1 AFM Topologies

The presence of K-feldspar and sillimanite in samples HJ-57c_1, -35a and -35d indicates that the *T*-conditions for the dehydration melting of muscovite (reaction R1; *Figure 4.1*) were exceeded in the sillimanite stability field and that the rocks reached temperatures high enough for biotite dehydration melting to occur (Fields II and III; *Figure 4.1*). *Figure 4.1* also shows the plotting positions of phases and bulk compositions on AFM diagrams for these samples. The low X_{MgO}/high FM samples (HJ-35a and -35d) lie in the Sil+Grt+Bt triangle of Field II whereas the high X_{MgO}/low FM sample (HJ-57c_1) lies in the Sil+Crd+Bt triangle. In contrast, all samples lie in the Sil+Grt+Crd triangle of Field III, with the low X_{MgO}/high FM (and therefore low AI) samples close to the Grt corner. According to the AFM topologies the four phases: Bt + Sil + Grt + Crd cannot all be stable unless: a) the assemblage equilibrated at the *P-T* conditions of the univariant reaction R2; or b) the rocks reached *P-T* conditions of Field III where biotite was eliminated, because all bulk compositions lie within the Sil-Crd-Grt subtriangle and the biotite present is actually retrograde. Retrograde biotite in this context can be produced during melt crystallization first by reaction R2 in the reverse sense as the system moves from Field III to Field II, and subsequently by the reverse operation of the continuous reactions RIIa and/or RIIb in Field II (*Figure 4.1*). Based upon the AFM topologies, the high X_{MgO}/low FM samples are interpreted to have evolved during prograde metamorphism from a Sil-Bt-Crd assemblage in Field II to a Crd-Grt-Sil assemblage in Field III, whereas the low X_{MgO}/high FM samples evolved from a Grt-Bt-Sil assemblage to a Crd-Grt-Sil assemblage in Field III.

It is important to note is that the mineralogy of group 1 samples does not allow to constraint the upper *T* limit of metamorphism. Since these rocks are biotite-free in Field III, reaction R3 which produces orthopyroxene at the expense of Grt + Bt and marks the transition to Field IV, would not occur with increasing *T*. Therefore it is not possible to know if peak temperatures had reached Field IV (*Figure 4.1*).

4.1.2.2 Textural Settings of Garnet and Cordierite

The evolution proposed above is consistent with the textural settings of garnet and cordierite in the two types of samples. Crd 1 (i.e., cordierite isolated from garnet), which only occurs in the high X_{MgO}/low FM samples, is interpreted to represent early cordierite that was formed in Field II. Similarly, Grt 1 which only occurs in the low X_{MgO}/high FM samples is interpreted to have formed at temperatures below reaction R2. Distinction between cores with abundant Sil 1 inclusions and mostly clear rims that are occasionally xenomorphic and contain large Sil 2 inclusions (*Plate 4.3e*) suggests that Grt 1 may have grown in two stages. For instance the cores may have grown by subsolidus reactions at temperatures below R1 whereas the rims likely grew by the biotite dehydration melting reaction RIIa within Field II. In contrast, Crd 2 and Grt 2 and 3 (with Crd 2 and Grt 3 being always in contact) are likely products of reaction R2, which marks the transition to Field III, and affected all the samples.

4.1.2.3 Retrograde Textures

Corrosion of garnet - cordierite contacts and replacement by biotite and sillimanite is consistent with reaction R2 in the retrograde direction during melt crystallization. In addition, partial replacement of isolated garnet and cordierite by biotite and Sil 3 aggregates as well as the presence of biotite symplectites and Bt-Sil-Qtz intergrowths after Kfs, are consistent with further development of biotite during melt crystallization (within Field II by reactions RIIa and RIIb in the reverse sense). The presence of spinel symplectites associated with biotite grains that replace garnet in some samples may be indicative of locally high Zn contents in retrograde biotite because Zn stabilizes spinel at lower temperatures. The Bt + Qtz + Spl symplectite is a texture that develops as the rock cools and the zinc saturation limit is reached, at this point the Zn from biotite starts to be released and Zn-rich spinel forms (Dietvorst, 1980). In fact, qualitative ED spectrums of spinel in the studied samples have shown a notable Zn peak however not quantitative analysis were performed.

4.1.2.4 The Significance of the Different Sillimanite Generations

The aggregates of inclusion-free prisms of sillimanite (Sil 3), which are commonly associated with biotite, are interpreted to have been mainly produced by the retrograde reactions indicated above. However the large spongy grains of sillimanite (Sil 2) most likely represent prograde sillimanite produced by reaction R1 that was stable in Fields II and III. This is supported by the abundant inclusions of quartz, which occur due to the excess of SiO_2 during dehydration melting of muscovite, that is breaking down to form aluminum silicate and melt (reaction R1; *Figure 4.1*). Further evidence supporting this interpretation is the abundance of Sil 1 in the high X_{MgO}/low FM samples (which have the highest AI). Finally, Sil 1 needles, which only occur as inclusions in Grt 1, may represent an earlier generation of sillimanite produced by subsolidus reactions. It is therefore implied that group 1 rocks evolved for most of their *P-T* history in the sillimanite stability field.

4.1.2.5 Additional Considerations

Group 1 samples lack textural domains that can be clearly defined as leucosomes. This is consistent with field evidence of melt segregation in discrete layers. In addition, extensive recrystallization due to deformation may have strongly modified the texture of any remaining leucosome in the examined samples. In fact, the only textures that can be related to *in situ* leucosome are the retrograde replacement textures of garnet and cordierite by biotite and sillimanite. It should be noted that the K-feldspar free samples have the same textures as the K-feldspar bearing ones shown on the AFM diagrams. They also come from the same locations and are interpreted to have followed the same P-T evolution. Lack of K-feldspar in these rocks may be attributed to more advanced retrograde reactions that produced biotite and/or to more advanced melt escape.

Preservation of the peak metamorphic phases garnet and cordierite indicates that back reactions during melt crystallization were limited, which is consistent with melt extraction as discussed earlier. Another point that has to be examined is the scarcity of plagioclase, which occurs in trace amounts in samples HJ-35a and -35d only, where it is interpreted as a product of melt crystallization. Therefore, group 1 rocks are considered to be best represented by the KFMASH system (*Figure 4.1a*). However, it is possible that during their prograde evolution these rocks had some plagioclase, the albite component of which was dissolved in the melt and left the system during melt extraction. Therefore phase relations are also shown on the NaKFMASH system (*Figure 4.1b*) for comparison. As indicated in Section 2.1.2, reactions in the two systems are the same, but in the NaKFMASH system they are displaced towards lower temperatures.

4.2 Mineral Compositions

Garnet, cordierite, biotite and plagioclase were analysed in the low X_{MgO}/high FM samples HJ-35a and 35d which have the largest garnet grains. In addition, cordierite was analyzed in the high X_{MgO}/low FM sample HJ-57c_3.

4.2.1 Garnet

4.2.1.1 Mineral Composition

A total of seven garnet grains was analysed: five Grt 1 porphyroblasts (four from sample HJ-35d and one from HJ-35a; *Plates 4.4b to e*; see section 4.1.1) and two Grt 3 grains (sample HJ-35a; *Plates 4.4g and h*). Most selected grains display only scarce biotite replacement at their rims, so that retrograde resetting of the composition should be minimal. The exception is garnet A14 (sample HJ-35a) which is surrounded by sillimanite/biotite intergrowths (*Plate 4.4e*). This grain was selected because it is the only one that displays clear textural evidence of rim growth by reaction RIIa (see Section 4.1.2.2). Analyses were done along one or two approximately perpendicular rim-core-rim line traverses (*Figures 4.2 to 4.7*) and five grains (three Grt 1 and two Grt 2) were mapped for Ca, Fe and Mg (*Figures 4.3 to 4.7*). The compositions of the Grt 1 grains fall in the range $Alm_{46\text{-}55}$ $Prp_{35\text{-}45}$ $Grs_{3\text{-}6}$ $Sps_{4\text{-}5}$. Most garnets display relatively homogeneous cores whereas the outer ~100 microns of some rims are slightly zoned, with Prp decreasing and Alm increasing. Garnet A8 (sample

HJ-35d) constitutes an exception because it is divided into two homogeneous domains (subgrains?) separated by a low X_{Prp}/high X_{Alm} zone, and one of these domains is slightly richer in Grs than the other. This garnet also displays the stronger rim zoning on one side (A), whereas the Grs-poor domain shows a regular increase in Grs toward its rims (*Figure 4.3*). Finally garnet A14 (sample HJ-35a), which is the most corroded, is distinct in that it displays strong Prp decrease and Alm increase towards the rims (i.e., retrograde zoning; *Figure 4.5*). Grt 3 grains have the composition Alm_{53-63} Prp_{32-38} Sps_{3-4} Grs_{1-2} and are therefore poorer in Prp and Grs and richer in Alm than Grt 1 grains. Grt 3 grains are either relatively homogeneous or display a grain-scale decrease in Prp compensated by an increase in Alm towards the rims implying retrograde reactions with biotite. Minor variations in the zoning profiles are attributed to the presence of inclusions.

Concerning the trace elements, Cr, Y and P profiles are generally flat. The exceptions are Y zoning in garnet A8 of sample HJ-35d (*Figure 4.8a*), which is correlated with Ca zoning in garnet, and enrichment of P at some rims (*Figures 4.8b and c*).

4.2.1.2 Interpretation

The generally homogeneous cores of the two types of garnet indicate that they experienced diffusional homogenization at high temperatures. Diffusional homogenization also explains the lack of compositional variation between garnet cores with Sil 1 inclusions, that are interpreted to have grown by subsolidus reactions, and clear rims or rims with Sil 2 inclusions, such as those of garnet A14 (sample HJ-35a; *Plate 4.3e, Figure 4.5*) and are interpreted to have grown by reaction RIIa. The only exception is the relatively low Grs domain of Grt 1 A8 (sample HJ-35d; *Plate 4.4b, Figure 4.3*) which displays an outward Grs increase that may be interpreted as relict growth zoning. In fact, this zoning trend is consistent with the low-Grs domain having grown by subsolidus reactions followed by growth of the surrounding rims and the adjacent subgrain (*Figure 4.3*) by reaction RIIa (see Section 2.3.1).

Grt 1 porphyroblasts, which are interpreted to have started growing by subsolidus reactions and continued to grow across Field II in the presence of melt, are chemically distinct from Grt 3 grains, which grew by reaction R2 only, the former being systematically more rich in Prp and poorer in Alm than the latter. Alternatively differences in Alm and Prp between these two types of garnet may be attributed to the smaller grain size of Grt 3 which may have led to grain-scale Fe-Mg resetting and extensive retrograde resetting during cooling. The observed increase of Alm toward some garnet rims and the corresponding decrease in Prp is consistent with limited Fe-Mg exchange between garnet and biotite during cooling. These retrograde effects are minimal in most Grt 1 porphyroblasts which are several millimetres across and occur in areas poor in biotite and cordierite, with the exception of garnet A14 (sample HJ-35a) which displays the most corroded texture.

Y zoning in garnet A8 (sample HJ-35a) is consistent with the breakdown of an Y-rich phase, such as apatite or epidote, during garnet growth. P humps at the rims of garnets A9 (sample HJ-35d) and A1 (sample HJ-35a) may indicate the breakdown of a P-rich phase such as apatite during the growth of these rims.

4.2.2 Biotite

Biotite laths isolated in the matrix and in aggregates associated with garnet were analyzed along transects with increasing distance from garnet: three transects in sample HJ-35a, radiating from garnets A1 and A8, and two transects in sample HJ-35d, radiating from garnet A3 (*Figure 4.9*). X_{Fe} and X_{Ti} roughly increase with increasing distance from garnet, from 0.16 to 0.26 and 0.03 to 0.07, respectively. X_{Al}^{VI} (0.08 to 0.17) follows the opposite trend and the number of fluorine anions (0.17 to 0.24) remains constant or slightly decreases with increasing distance from garnet (*Figure 4.9*). The X_{Fe} trend is consistent with resetting of the biotite compositions during cooling by Fe-Mg exchange with garnet. In addition, the X_{Ti} trend indicates that biotite adjacent to garnet my have formed at lower temperatures during melt crystallization than matrix biotite (see Section 2.1.3).

4.2.3 Cordierite

Cordierite is Mg rich (X_{Mg} 0.86-0.95); X_{Mg} decreases with increasing distance from garnet and increases at rims adjacent to biotite. In addition the optically positive character of this Mg-rich cordierite is indicative of high CO_2 contents. In all samples cordierite is altered, to some degree, to pinite which is mainly composed of K, Si, Al, Mg, and Fe.

4.2.4 Plagioclase

Discrete plagioclase grains were only found in sample HJ-35a associated with K-feldspar, quartz and biotite close to garnet A1. These grains are Ab-rich and of homogeneous composition Ab_{76-77} An_{22-23}. The high Ab contents as well as the textural setting of this plagioclase suggest that it formed during melt crystallization. However, high Ab contents are also consistent with the high X_{Na2O} of these rocks (*Table 4.2*).

4.3 *P-T* Constraints

4.3.1 Limits Placed by the Petrogenetic Grid

The petrogenetic grid of Spear *et al.* (1999) for the KFMASH system, which best represents the group 1 rocks (see Section 4.1.2.5), can be used to obtain first-order *P-T* constraints for the thermal peak (*Figure 4.10*). Since the peak assemblage developed within Field III (see Section 4.1.2), reaction R2, which constitutes the lower-*T* boundary of that field, places a lower temperature limit for the thermal peak at ~750 to 900°C in the *P*-interval between ~4 to 9 kbar. However, the upper *T* limit is unconstrained because, although orthopyroxene relics are not observed, the rocks may have crossed into Field IV without developing any diagnostic texture (see Section 4.1.2). Finally, an upper *P* limit is set at 9 kbar by the invariant point IP4' above which cordierite is unstable (*Figure 4.10*).

Further *P-T* constraints can be placed by garnet X_{Fe} isopleths in Field III, the locations of which have been calculated by Spear *et al.* (1999). Two types of X_{Fe} isopleths, corresponding to different mineral assemblages, were used. Grt 1 isopleths correspond to the assemblage Grt - Sil - Bt - Ksp - L because this garnet is not associated with cordierite. In Field III these isopleths are steep with X_{Fe} increasing towards lower temperatures. Grt 2 isopleths correspond to the assemblage Grt - Crd - Sil - Ksp - L in which garnet and cordierite are texturally associated. These isopleths are flat, with X_{Fe} increasing towards lower *P* (see inset in *Figure 4.10a*).

The range of isopleths that corresponds to the compositions of the analyzed garnets in Fields III and IV is indicated by the shaded area in *Figure 4.10* and the exact locations of the isopleths in Field III are shown in the inset diagram. Note that the shaded area was extended to higher temperatures in Field IV because the upper *T* limit of metamorphism of these rock is unconstrained. The isopleths allow the definition in Fields III and IV of a *P*-interval between ~7 and 8.9 kbar, which is interpreted to represent the *P*-range of the thermal peak. This also limits the range of the minimum *T* discussed earlier between ~850 to 900°C.

4.3.2 Thermobarometry

Based upon the observed mineral assemblages, potential thermobarometers that may place additional *P-T* constraints are the Grt-Bt and Grt-Crd Fe-Mg exchange thermometers and the GASP and Grt-Crd-Sil-Qtz barometers (see *Tables 4.3 to 4.6* for analyses used in thermobarometric calculations). However, application of these methods to the rocks of group 1 is limited for the following reasons. The biotite is most likely retrograde therefore Bt-Grt temperatures in the best case would represent the final stages of melt crystallization. However, because these rocks do not contain graphite, calculated temperatures may also be overestimated. Grt 3 and Crd 2 pairs that can be used for Grt-Crd (Sil-Qtz) thermobarometry consist of small grains (less than 1 mm in diameter each) for which there is evidence of grain-scale resetting of composition during retrogression. Finally, plagioclase occurs as rare, small, Ab-rich grains associated with K-feldspar indicating that it may have formed during melt crystallization. Bearing these limitations in mind, the following thermobarometric calculations were performed.

(a) Grt-Bt temperatures were calculated using garnet core compositions that have the highest X_{Mg} in conjunction with distant biotite grains that show the highest X_{Fe} values. Given that biotite is likely retrograde, these temperatures can only be considered as lower limits for the thermal peak. In addition, Grt-Bt temperatures, which may provide some constraint on melt crystallization temperatures, were calculated using garnet rims not in contact with biotite and nearby biotite with higher X_{Fe} values than those in contact with garnet.

(b) A GASP isopleth was calculated using core compositions of a homogeneous Grt 2 grain and a submillimetric plagioclase grain located in the nearby matrix (sample HJ-35a). The garnet has experienced some resetting in terms of Fe and Mg because it displays retrograde zoning in terms of these elements, but the Ca content of its core could represent the thermal peak because Ca diffuses much more slowly than Fe and Mg (Spear, 1993). However, because the plagioclase may have formed during melt crystallization, in which case it may be more Ab-rich than plagioclase would be at the thermal peak (see Section 2.3.3), this GASP isopleth may only represent an upper P limit of the thermal peak. In addition, the rim of this garnet (away from biotite; see Section 2.4) and the same plagioclase were used to constrain the P of melt crystallization.

(c) Grt-Crd thermometry and barometry was performed using cores of Grt 3 grains and adjacent cordierite, to place lower P-T limits on the thermal peak, and rims of the same minerals to calculate retrograde conditions.

The *T*-ranges calculated with the Grt-Bt thermometer for the thermal peak and for the conditions of melt crystallization overlap and fall below those of Field II in the KFMASH system. Therefore these temperatures do not provide valuable constraints, neither for the thermal peak nor for the conditions of melt crystallization. In group 1 rocks biotite is scarce compared to Grt 1 porphyroblasts which, in addition, show only minimal retrograde zoning and it is expected that the composition of biotite would experience much more drastic resetting during retrogression than garnets (Spear, 1991). Consequently, the low temperatures calculated by Grt-Bt thermometry are interpreted to be the result of sample scale resetting of the biotite composition by Fe-Mg exchange with garnet during retrogression at temperatures below those of melt crystallization.

The GASP isopleth that represents the upper *P*-limit of the thermal peak, crosses the high *P* corner of Field III, at ~9 kbar, which is consistent with textural observation (see Section 4.3.1). The GASP isopleth that represents melt crystallization is located ~0.5 kbar lower, suggesting that decompression was not significant during cooling and melt crystallization (*Figure 4.10a*). Finally, the Grt-Crd thermometer gives temperatures below the *P*-*T* fields in which melt occurs consistent with evidence that Grt 3 and Crd 2 underwent major late resetting, in terms of their Fe and Mg contents. Therefore the significance of the Grt-Crd-Sil-Qtz isopleth cannot be evaluated.

Table 4.1: Mineral assemblages of group 1 samples.

Thin Sections:	Garnet	Biotite	Sillimanite	Cordierite	Plagioclase	K-Feldspar	Quartz
HJ-57c_1	X	X	X	X		X	X
HJ-57c_2	X	X	X	X			X
HJ-57c_3	X	X	X	X			X
HJ-57d	X	X	X	X		X	X
HJ-35a	X	X	X	X	X	X	X
HJ-35d	X	X	X	X	X	X	X

Table 4.2: Chemical compositions of group 1 samples. In addition, the chemical composition of a typical pelite (Carmichael, 1989) is shown for comparison. $X_{Na2O} = Na_2O/(Na_2O + CaO)$, $X_{MgO} = MgO/(MgO + FeO)$ and $FeO^* = FeO + Fe_2O_3$.

	Sample HJ-57c$_1$	Sample HJ-57c$_2$	Sample HJ-57c$_3$	Sample HJ-57d	Sample HJ-35a	Sample HJ-35d	Typical pelite
Wt%	High X_{Mg}/Low FM				Low X_{Mg}/High FM		
SiO_2	78.88	85.37	82.97	82.49	80.91	79.10	54.9
TiO_2	0.40	0.43	0.42	0.45	0.30	0.23	0.78
Al_2O_3	9.55	9.85	9.90	9.51	9.61	11.32	16.6
FeO*	0.88	0.65	0.62	1.08	4.37	3.86	9.7
MgO	1.19	1.20	1.15	1.30	3.24	2.44	3.4
MnO	0.03	0.03	0.02	0.04	0.15	0.30	--
CaO	0.00	0.00	0.00	0.00	0.09	0.18	0.72
Na_2O	0.11	0.40	0.33	0.12	0.22	0.11	1.3
K_2O	1.22	2.54	2.52	1.62	1.28	0.65	2.7
Total	92.26	100.47	97.93	96.61	100.17	98.19	90.10
Mole%							
SiO_2	89.44	89.06	88.93	89.23	83.81	84.35	
TiO_2	0.34	0.34	0.34	0.37	0.24	0.18	
Al_2O_3	6.38	6.06	6.25	6.06	5.87	7.11	
FeO	0.83	0.56	0.55	0.97	3.78	3.44	
MgO	2.01	1.86	1.84	2.09	5.01	3.88	
MnO	0.03	0.03	0.02	0.04	0.13	0.27	
CaO	0.00	0.00	0.00	0.00	0.10	0.21	
Na_2O	0.12	0.41	0.35	0.13	0.22	0.11	
K_2O	0.88	1.69	1.72	1.12	0.85	0.44	
X_{Na2O}	1.00	1.00	1.00	1.00	0.69	0.34	
X_{MgO}	0.71	0.77	0.77	0.68	0.57	0.53	

Table 4.3: Garnet compositions used for thermobarometry. Type P^{MC} and P^{P} compositions were used to calculate pressure conditions of melt crystallization and of the thermal peak, respectively. Types T^{MC} and T^{P} compositions were used to calculate temperature conditions of melt crystallization and of the thermal peak, respectively.

			Oxide percentage								Cations on a 12 (O) basis								Molar fraction				
Sample	Type	Analysis #	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
35a A1	T^{MC},P^{MC}	AB 1	9.97	21.54	38.60	0.69	0.00	1.45	26.10	98.36	1.16	1.98	3.01	0.06	0.00	0.10	1.70	8.00	0.56	0.38	0.02	0.03	0.59
	T^{P}	CD 12	10.01	21.64	38.77	0.74	0.00	1.44	26.15	98.75	1.16	1.98	3.01	0.06	0.00	0.09	1.70	8.00	0.56	0.38	0.02	0.03	0.59
	T^{P},P^{P}	AB 15	9.61	21.71	38.56	0.79	0.00	1.61	26.92	99.18	1.11	1.99	2.99	0.07	0.00	0.11	1.75	8.01	0.58	0.37	0.02	0.03	0.61
	T^{MC},P^{MC}	AB 25	9.06	21.80	38.68	0.86	0.00	1.59	27.26	99.24	1.05	2.00	3.01	0.07	0.00	0.10	1.77	8.00	0.59	0.35	0.02	0.03	0.63
35a A8	T^{MC},P^{MC}	CD 24	9.58	21.68	38.75	0.68	0.00	1.32	26.83	98.84	1.11	1.99	3.01	0.06	0.00	0.09	1.74	8.00	0.58	0.37	0.02	0.03	0.61
	T^{P},P^{P}	AB 14	9.60	21.78	38.92	0.75	0.00	1.27	27.21	99.65	1.11	1.98	3.01	0.06	0.00	0.09	1.80	8.00	0.58	0.37	0.02	0.03	0.61
35d A3	T^{MC}	CD 3	11.12	23.55	41.51	2.06	0.26	1.86	25.29	105.65	1.19	2.00	2.99	0.16	0.01	0.11	1.52	8.00	0.51	0.40	0.05	0.04	0.56
	T^{P}	AB 19	11.41	23.68	41.96	1.75	0.10	1.88	24.64	105.60	1.22	2.01	3.02	0.13	0.01	0.11	1.48	8.00	0.50	0.41	0.05	0.04	0.55
35d A10	T^{MC},P^{MC}	CD 40	11.53	23.83	40.61	1.77	0.14	2.15	23.02	103.06	1.26	2.06	2.98	0.14	0.01	0.13	1.41	7.99	0.48	0.43	0.05	0.05	0.53
	T^{P},P^{P}	CD 13	11.92	23.48	40.46	1.57	0.24	1.93	23.26	102.96	1.31	2.03	2.97	0.12	0.01	0.12	1.43	8.00	0.48	0.44	0.04	0.04	0.52

Table 4.4: Biotite compositions used for thermobarometry. Type T^{P} and T^{MC} compositions were used to calculate temperature conditions of the thermal peak and of melt crystallization, respectively. Note: Oxides less than 0.1% are not reported here.

		Oxide percentage								Cations on a 11 (O) basis								Anions		Molar fraction			
Sample	Type	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	FeO	Total	Na	Mg	Al	Si	K	Ti	Fe	Total	F	Cl	X_{Al}^{VI}	X_{Ti}^{VI}	X_{Fe}^{VI}	X_{Mg}^{VI}
35a A1	T^{MC}	0.57	17.87	19.08	38.87	9.60	2.00	8.96	96.95	0.08	1.90	1.61	2.78	0.88	0.11	0.54	7.89	0.22	0.00	0.13	0.04	0.18	0.65
	T^{P}	0.63	18.00	19.38	39.01	9.62	1.87	8.79	97.29	0.09	1.91	1.63	2.78	0.87	0.10	0.52	7.90	0.22	0.01	0.14	0.03	0.18	0.65
35d A3	T^{MC}	0.98	18.34	17.26	38.19	9.48	3.26	8.53	96.05	0.14	1.99	1.48	2.77	0.88	0.18	0.52	7.95	0.27	0.01	0.09	0.06	0.18	0.68
	T^{P}	1.42	19.78	18.12	39.46	9.62	3.35	8.52	100.26	0.19	2.05	1.49	2.74	0.85	0.17	0.50	8.00	0.30	0.00	0.08	0.06	0.17	0.70

Table 4.5: Cordierite compositions used for thermobarometry. Type P^{P} and P^{MC} compositions were used to calculate conditions of the thermal peak and of melt crystallization, respectively.

		Oxide percentage								Cations on a 18 (O) basis								Molar fractions	
Sample	Type	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Fe}	X_{Mg}
35a A1	P^{MC}	11.99	34.48	50.79	0.16	0.13	0.12	3.14	101.02	1.75	3.98	4.98	0.02	0.01	0.01	0.26	11.03	0.13	0.87
	P^{P}	11.80	34.35	50.95	0.20	0.20	0.09	3.25	101.06	1.72	3.97	4.99	0.02	0.01	0.01	0.27	11.02	0.13	0.87
35d A10	$P^{MC,P}$	12.28	34.61	50.86	0.18	0.12	0.09	2.23	100.81	1.73	3.99	4.98	0.02	0.01	0.01	0.18	11.04	0.09	0.91

Table 4.6: Plagioclase compositions used for thermobarometry. Type P^{MC} values were used to calculate pressure conditions of melt crystallization.

		Oxide percentage							Cations on a 8 (O) basis							Molar fraction		
Sample	Type	Na	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
35a A1	P^{MC}	8.84	24.19	61.10	0.09	4.85	0.05	101.11	0.77	1.28	2.73	0.00	0.23	0.00	5.01	0.23	0.76	0.00

Plate 4.1: General texture of sample HJ-35d: Quartz ribbons and garnet porphyroblasts with interstital biotite and sillimanite.

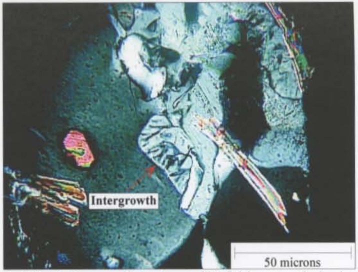


Plate 4.2: Intergrowth texture of K-feldspar and plagioclase (sample HJ-35a).

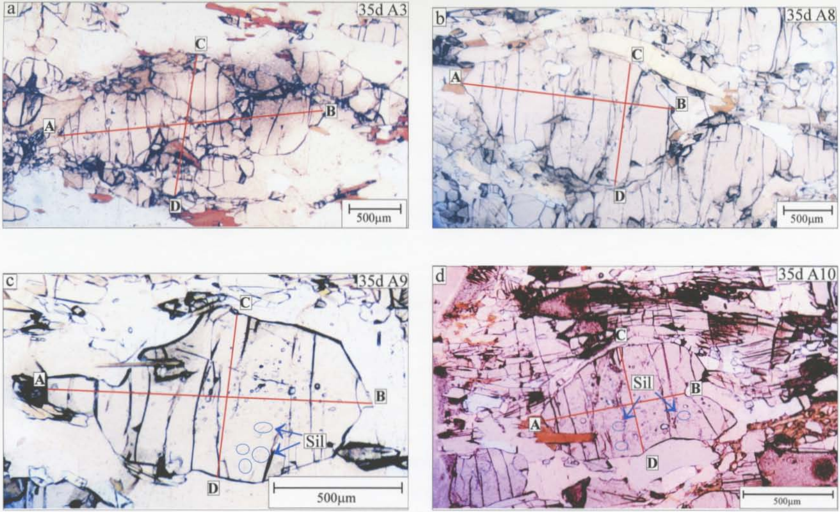


Plate 4.3: Textures of garnet: (**a**) to (**e**): Grt 1 porphyroblasts; (**f**) Grt 2; and (**g**) to (**h**) Grt 3. Red lines indicate the analyzed rim-core-rim transects. Top right labels indicate the sample number (ex. 35d stands for sample HJ-35d) followed by the garnet grain number.

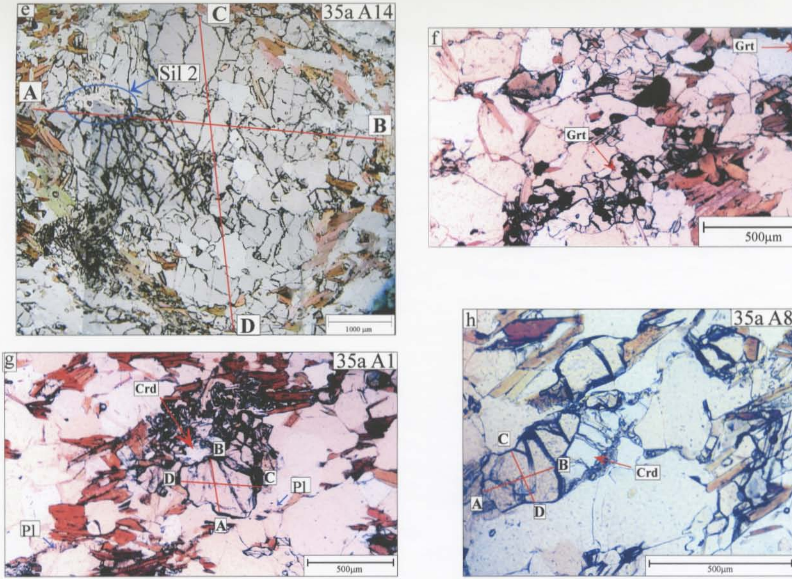


Plate 4.3 (continued).

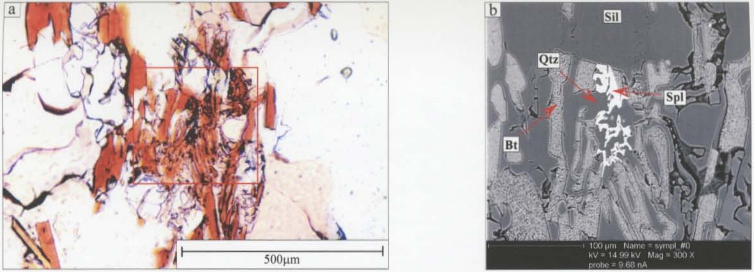


Plate 4.4: **(a)** Spinel + quartz symplectite associated with biotite (the square indicates the area shown in (b). **(b)** Enlarged backscatter image of symplectite (sample HJ-35a).

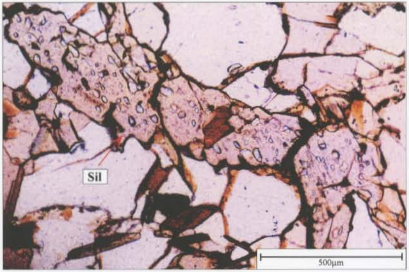


Plate 4.5: Sil 2 porphyroblast with inclusions of quartz (sample HJ-35d).

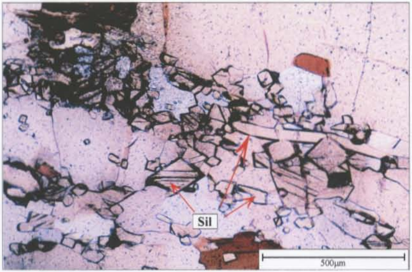


Plate 4.6: Sil 3 aggregates (sample HJ-35d).

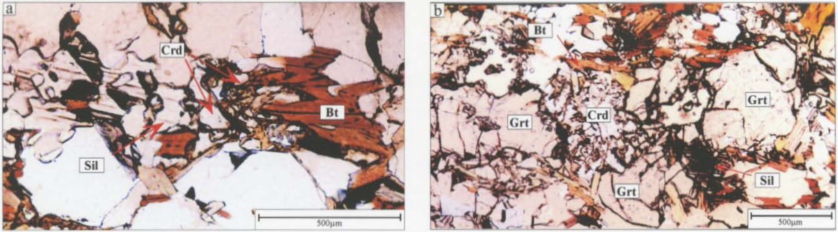


Plate 4.7: **(a)** cordierite associated with biotite and sillimanite (sample HJ-57d) and **(b)** cordierite associated with garnet + biotite + sillimanite (sample HJ-35a).

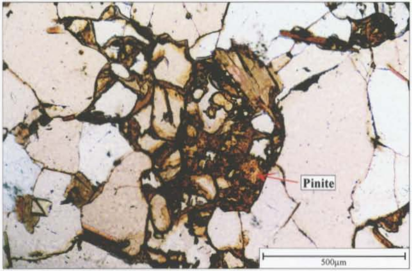
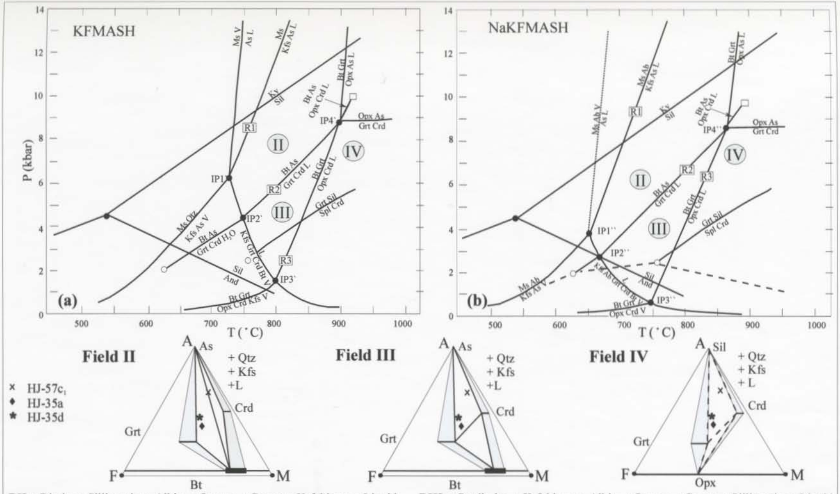


Plate 4.8: Pinite "strings" enclosing matrix minerals (sample HJ-57d).



RIIa: Biotite + Sillimanite ± Albite + Quartz → Garnet + K-feldspar + Liquid

RIIb: Biotite + Sillimanite ± Albite + Quartz → Cordierite + K-feldspar + Liquid

RIIIa: Cordierite + K-feldspar ± Albite + Quartz → Garnet + Sillimanite + Liquid

RIIIb: Biotite + Cordierite ± Albite + Quartz → Garnet + K-feldspar + Liquid

Figure 4.1: Petrogenetic grids for (**a**) the KFMASH system and (**b**) the NaKFMASH system with AFM diagrams for Fields II, III and IV that show the location of bulk compositions of K-feldspar bearing samples of group 1 (modified after Spear *et al.*, 1999). Mineral compositional bands correspond to the range of X_{Fe} of the analyzed garnet cores, biotite and cordierite (see Sections 4.2.1, 4.2.2 and 4.2.3, respectively). Also shown are the continuous reactions in Field II and III.

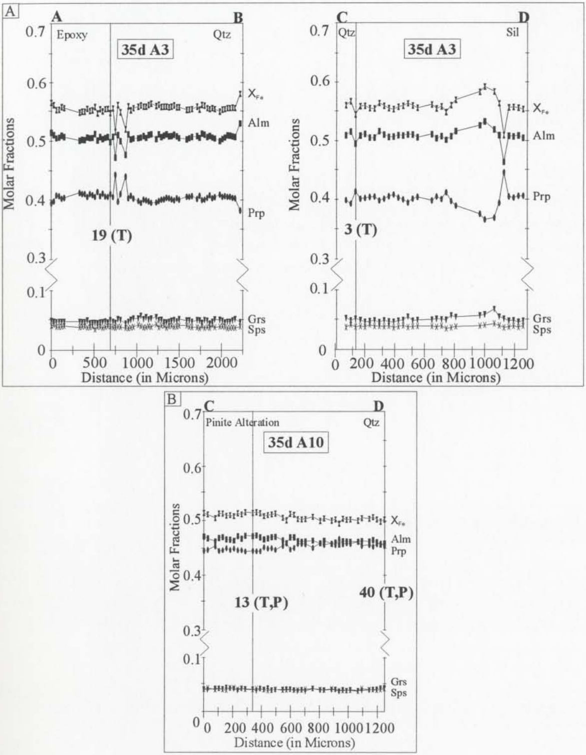


Figure 4.2: Garnet zoning profiles in terms of Alm, Prp, Grs and Sps for (**a**) Grt 1 A3 and (**b**) Grt 1 A10 (sample HJ-35d; see Plates 4.3a and d for the location of the traverses). Vertical lines indicate compositions used for thermobarometry (see Table 4.3).

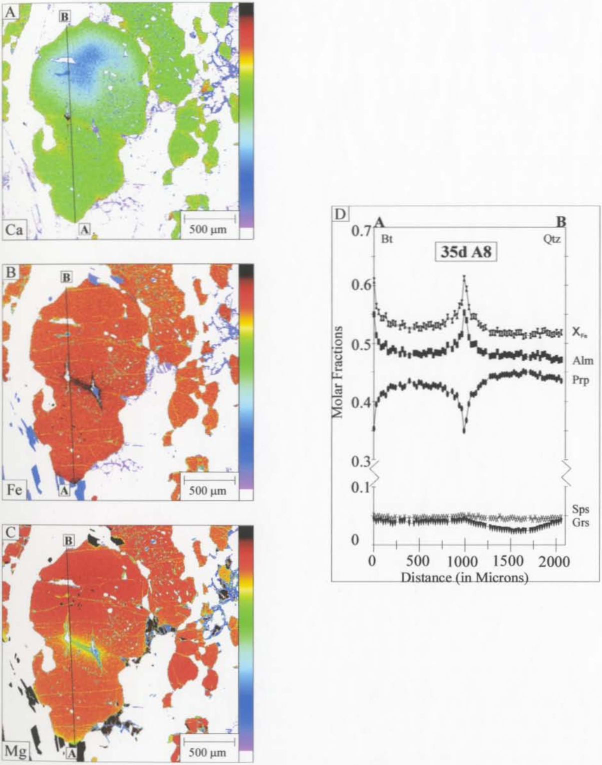


Figure 4.3: X-ray compositional maps and zoning profiles for Grt 1 A8 (sample HJ-35d). The color scale for the compositional maps indicates relative abundance of the element. A photo of this garnet is shown in Plate 4.3b.

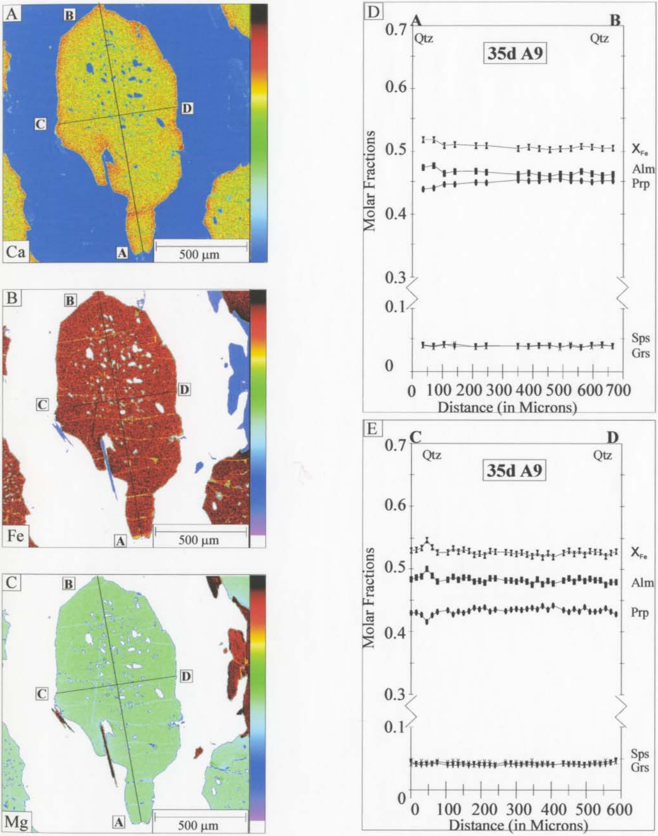


Figure 4.4: X-ray compositional maps and zoning profiles for Grt 1 A9 (sample HJ-35d). The color scale for the compositional maps indicates relative abundance of the element. A photo of this garnet is shown in Plate 4.3c.

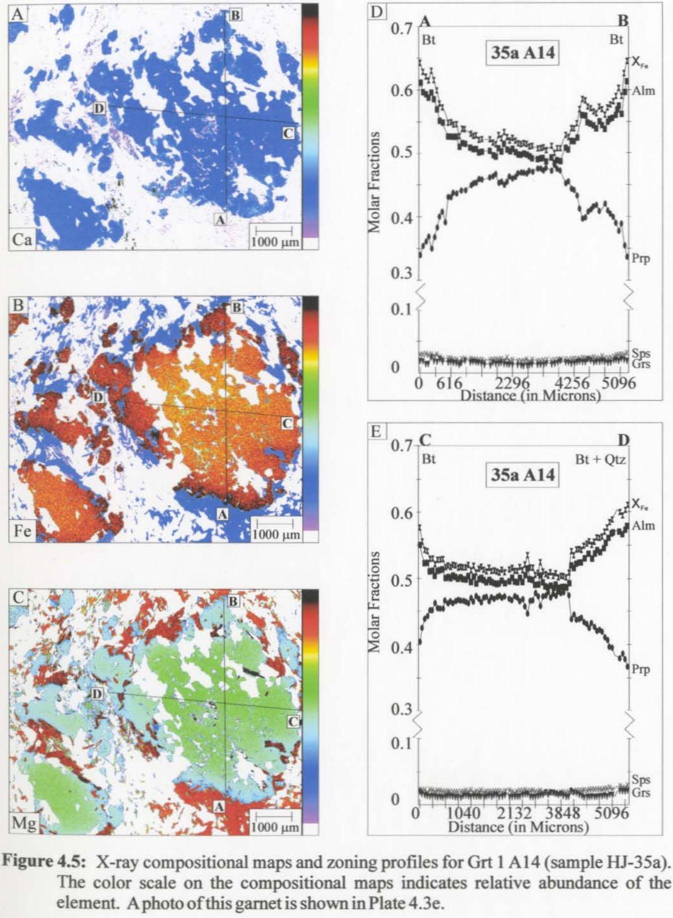


Figure 4.5: X-ray compositional maps and zoning profiles for Grt 1 A14 (sample HJ-35a). The color scale on the compositional maps indicates relative abundance of the element. A photo of this garnet is shown in Plate 4.3e.

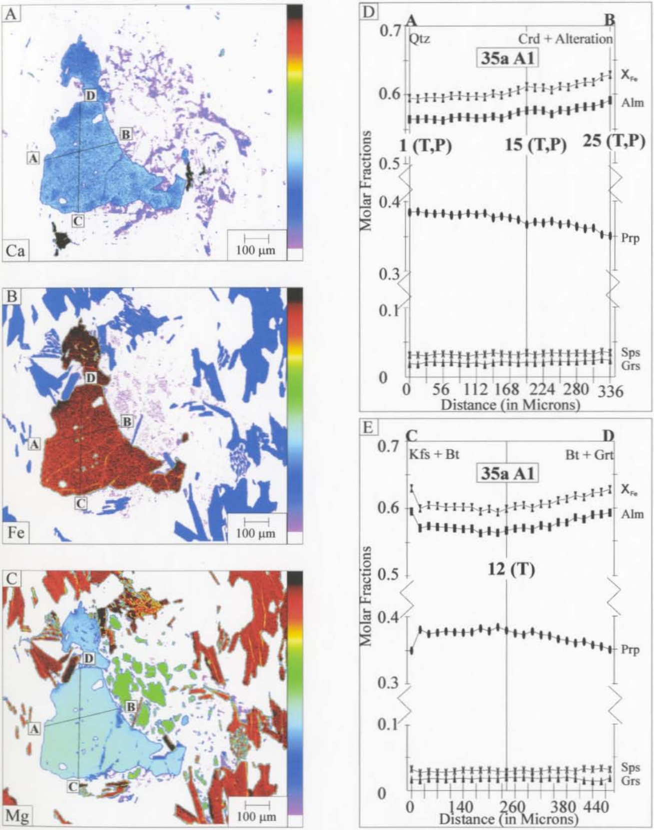


Figure 4.6: X-ray compositional maps and zoning profiles for Grt 3 A1 (sample HJ-35a). The color scale on the compositional maps indicates relative abundance of the element. Vertical lines indicate compositions used for thermobarometry (see Table 4.3). A photo of this garnet is shown in Plate 4.3g.

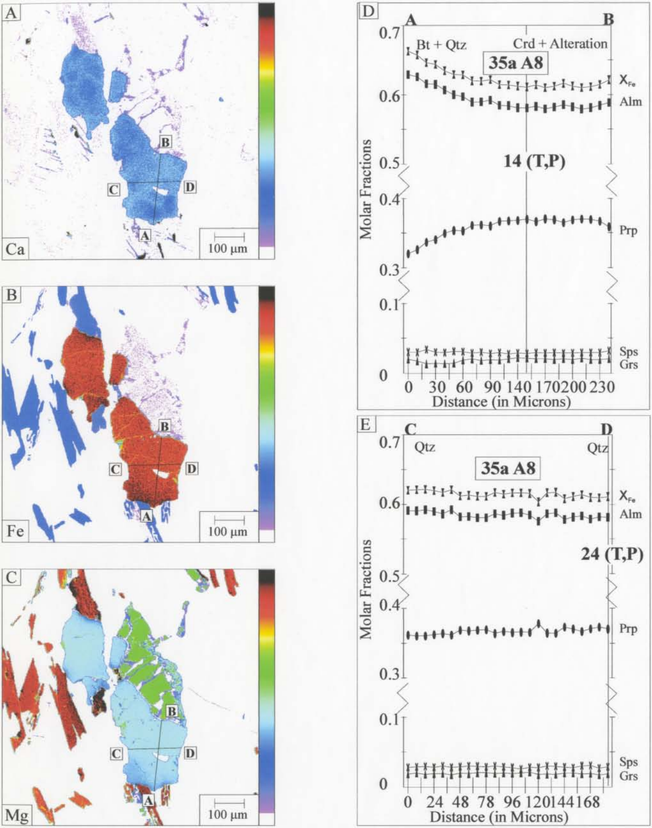


Figure 4.7: X-ray compositional maps and zoning profiles for Grt 3 A8 (sample HJ-35a). The color scale on compositional maps indicates relative abundance of the element. Vertical lines indicate compositions used for thermobarometry (see Table 4.3). A photo of this garnet is shown in Plate 4.3h.

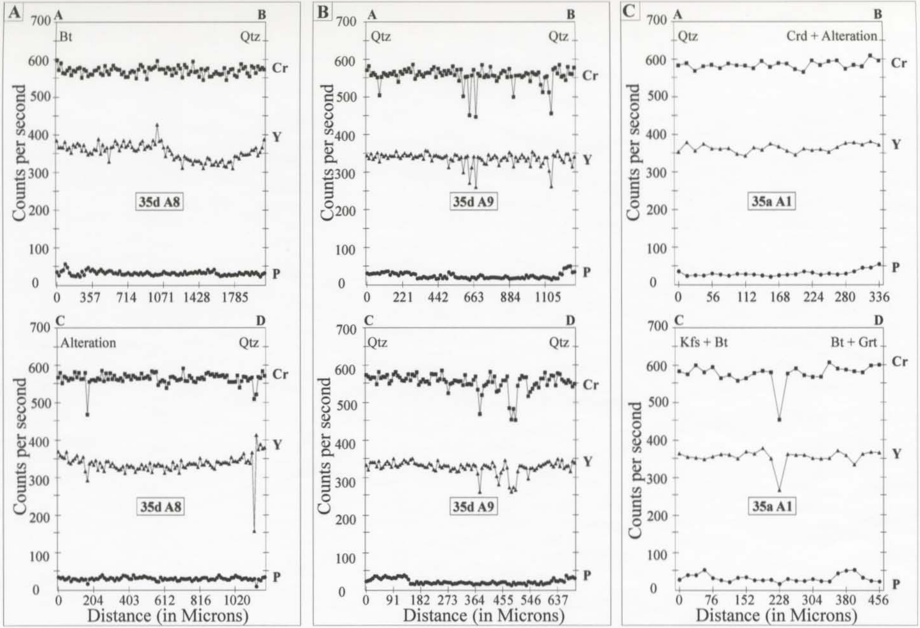


Figure 4.8: Trace element zoning profiles in terms of Cr, Y and P for garnets (**a**) Grt 1 A8 (sample HJ-35d), (**b**) Grt 1 A9 (sample HJ-35d) and (**c**) Grt 3 A1 (sample HJ-35a; see Plates 4.3b, 4.3c and 4.3g, respectively, for the locations of the traverses).

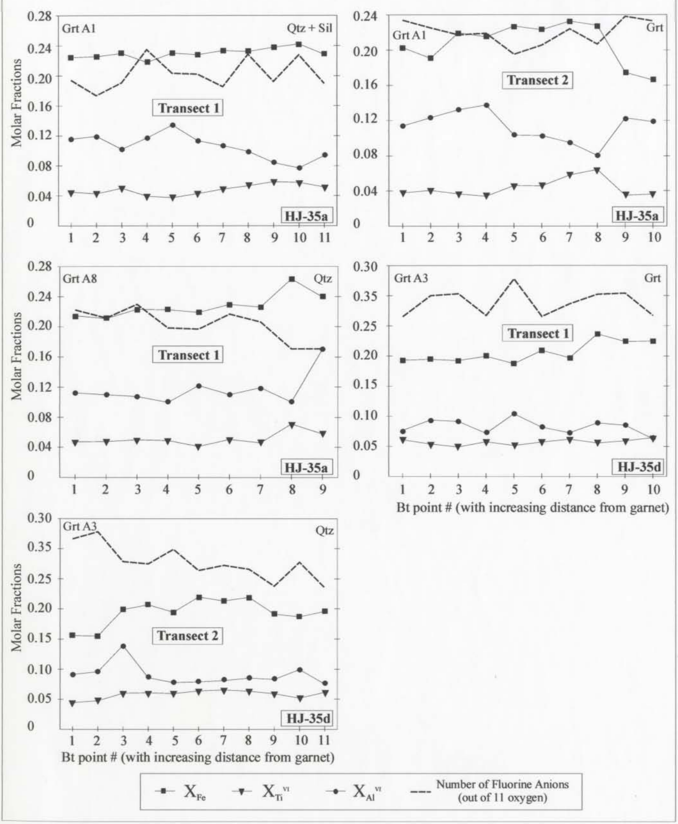


Figure 4.9: X_{Fe}, X_{Ti}, X_{Al}^{VI} and number of F anions in biotite with increasing distance from garnet A1 and A8 (sample HJ-35a) and A3 (sample HJ-35d).

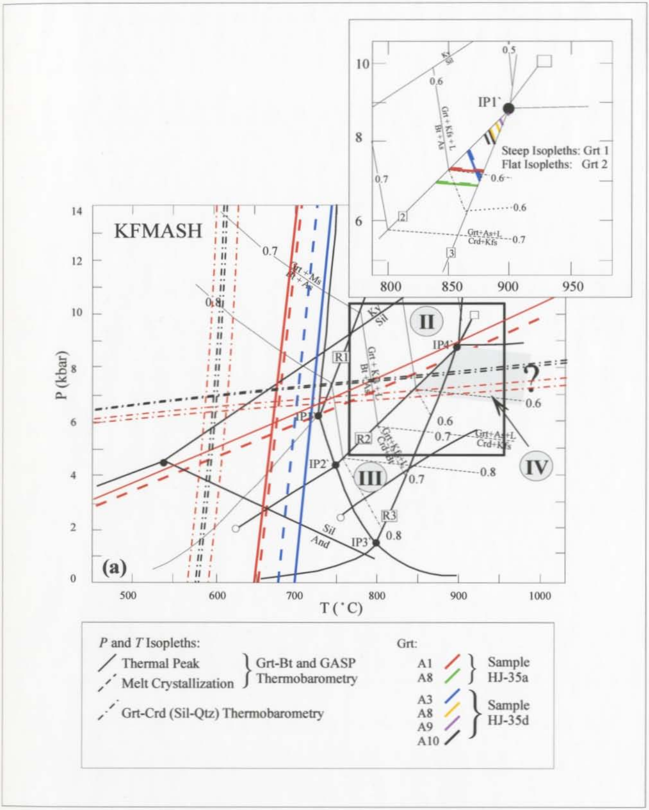


Figure 4.10: Petrogenetic grid for the KFMASH system with X_{Fe} isopleths (modified after Spear *et al.*, 1999). The shaded area represents the *P-T* field determined by the X_{Fe} of the analysed garnets (shown in inset), also shown are *P* and *T* isopleths calculated by thermobarometry.

Chapter 5: Group 2 Garnet - Biotite - Sillimanite Bearing Rocks

5.1 Introduction

The rocks of group 2 (samples HJ-35e_1, - 35e_2, -34b, -34c, -57b, and -58c) consist of the mineral assemblage quartz + K-feldspar + garnet + biotite + sillimanite ± plagioclase and in sample HJ-58c graphite (*Table 5.1*). Chemically most samples are characterized by excess SiO_2 (67.26-85.89 wt%), lower Al_2O_3 (7.55-14.26 wt%; samples HJ-35e_1,-34b, -34c, -57b, and -58c) and lower CaO (0.05-1.53 wt%) relative to the composition of "average" metapelite (Carmichael, 1989; *Table 5.2*). The exception is sample HJ-35e_2 which has high Al_2O_3 contents (20.4 wt%). X_{MgO} generally falls in the range 0.35 - 0.43, except for sample HJ-57b which has a high X_{MgO} of 0.51. Samples HJ-35e_1, -35e_2 and 34c consist of centimetre scale coarse grained quartzofeldspathic layers/pods alternating with homogeneous domains of finer grained felsic and mafic minerals. Samples HJ-34b, -57b and 58c are finely laminated and relatively homogeneous.

5.1.1 Mineralogy and Texture

Sample HJ-35e_2 is texturally different from the rest, therefore it will be described separately. This sample consists of quartzofeldspathic layers alternating with Sil-rich layers and pods (*Plate 5.1*). The quartzofeldspathic layers consist of ribbon quartz (up to 24 mm long) and K-feldspar (up to 5 mm in diameter). The Sil-rich layers consist of large (up to 8 mm in diameter) spongy sillimanite porphyroblasts partially or fully enclosing rounded to elongated garnet (up to 1 mm in diameter) and locally biotite (*Plate 5.2*). Garnet occurs both as inclusions in sillimanite and as fine grained aggregates at some rims of the Sil-rich layers (*Plate 5.1*). Garnet in aggregates is corroded by biotite and locally small sillimanite prisms.

All the other samples are characterized by garnet porphyroblasts (up to 9 mm in diameter) in a homogeneous finer grained matrix (grain size up to 4 mm) of quartz + biotite + garnet + sillimanite + K-feldspar ± plagioclase (*Plate 5.3*). **Quartz,** the dominant mineral in these samples, has irregular boundaries and is variably recrystallized. Large grains contain inclusions of biotite, sillimanite, K-feldspar (sample HJ-35e_1), garnet, plagioclase, graphite (sample HJ-58c) and monazite with some phases being present at sub-grain boundaries. **K-feldspar** is abundant in all samples and occurs as a matrix phase associated with garnet and biotite. In sample HJ-35e_1 K-feldspar also occurs with quartz in coarser, more felsic domains. K-feldspar commonly displays fine lamella exsolution and, in samples HJ-57b and -58c, exsolution blebs (*Plate 5.4*). **Plagioclase** is present only in samples HJ-35e_1, -57b and -58c. In sample HJ-35e_1 plagioclase is small (less than 1 mm in diameter) and associated with garnet, whereas in sample HJ-58c it mainly occurs as larger (up to 3 mm in diameter) grains in the matrix. In sample HJ-57b plagioclase occurs as highly fractured porphyroblasts (up to 3 mm in diameter; *Plate 5.5*), interstitial matrix grains (up to ½ mm in diameter; *Plate 5.6*), inclusions in garnet, small grains partially enclosed in K-feldspar (*Plate 5.7*) and locally with quartz forming myrmekite (*Plate 5.8*). All these types of plagioclase have high relief due to alteration along grain boundaries and fractures.

Garnet mainly consists of elongated porphyroblasts (up to 9 mm in diameter) with inclusions of sillimanite needles, biotite, quartz blebs and (in samples HJ-57b and -58c only) plagioclase (*Plate 5.9 a to l*). In addition, garnet is found as small grains (less than 1 mm in diameter) oriented parallel to the foliation and locally associated with biotite and sillimanite aggregates (*Plate 5.10*; samples HJ-34b, -34c, -58c and -57b) and, in sample HJ-35e_1, as trails of elongated grains enclosed in large quartz grains (*Plate 5.11*).

Biotite defines the foliation and occurs as small interstitial laths and as aggregates, both in the matrix and corroding garnet (*Plate 5.9e and f*). In samples HJ-35e_1, -34b and -34c biotite is corroded by **spinel**-quartz symplectites (*Plate 5.12a and b*) and biotite along with quartz and sillimanite locally form intergrowths that replace K-feldspar. **Sillimanite** occurs as three main types: Sil 1 consists of submillimetric needles that are found only as inclusions within the cores of garnet porphyroblasts; Sil 2 occurs as porphyroblasts with quartz inclusions in samples HJ-34b and -34c; and Sil 3 is comprised of small prisms (less than 1 mm in diameter) that form aggregates together with biotite in the matrix (*Plate 5.13*) and locally corrode garnet. In addition, small sillimanite prisms in sample HJ-58c are partially or fully enclosed in an alteration product that has a composition similar to the pinite in group 1 samples (see Section 4.1.1; *Plate 5.14*) and may indicate incipient cordierite development around sillimanite. The same feature as mentioned above is observed in a pyrite-rich layer of sample HJ-57b that is composed of sillimanite, quartz, biotite, garnet and pyrite (*Plate 5.15*).

5.1.2 Interpretation

5.1.2.1 AFM Topologies

The presence of K-feldspar and sillimanite indicates that the *T*-conditions for the dehydration melting of muscovite (reaction R1; *Figure 5.1*) were exceeded in the sillimanite stability field and the rocks reached temperatures at which biotite experiences dehydration melting. *Figure 5.1* also shows the distribution of the phases and bulk compositions on AFM diagrams for *P-T* Fields II and III. Samples can be divided into three types based on their alumina index (AI). Type 1 (sample HJ-35e_2) has the highest AI (0.60); type 2 (samples HJ-34b and -34c) have intermediate AI (0.36-0.37); and type 3 (samples HJ-35e_1, -58c and-57b) have the lowest AI (0.22-0.25). X_{MgO} values cluster between 0.35 and 0.39, with the exception of type 3 samples HJ-35e_1 and -58c which have higher X_{MgO} (0.43-0.51). In terms of the observed mineralogy all samples fall into the Sil-Grt-Bt triangle of Field II (*Figure 5.1*). However, the bulk compositions of type 1 and 2 samples fall into the Sil-Grt tie lines region and those of type 3 samples fall in the vicinity of the garnet compositional band. This AFM topology suggests that the group 2 samples evolved in Field II as follows: a) during prograde metamorphism they entered Field II with the Sil-Grt-Bt assemblage and started experiencing biotite dehydration melting by reaction RIIa; b) because with increasing temperature coexisting garnet and biotite become more Mg-rich (Carrington and Harley, 1995; Spear *et al.*, 1999) and therefore the Sil-Grt-Bt triangle swings to the right, and because the bulk compositions fall on the Sil-Grt side, at some temperature within Field II biotite was eliminated, and the bulk composition entered the two phase Sil-Grt tie lines region; c) finally, during retrogression the triangle swung back to the left (by reaction RIIa in the opposite direction) and retrograde biotite was formed. Elimination of biotite in Field II implies that these rocks would not develop any diagnostic assemblages if subjected to higher temperatures (ie. those of Field III) and cannot provide constraints on the upper *T* limit of the thermal peak. The exception is type 3 samples HJ-58c and -57b that display pinite rims around sillimanite indicating that reaction R2 was crossed and metamorphic temperatures reached those of Field III (Crd-Grt-Bt). These samples also have the highest X_{MgO} values, therefore they are the most likely to have preserved some prograde biotite which would be available for reaction upon crossing R2. However this reaction had a minimal effect on these samples because their bulk composition lies close to the Grt compositional band (*Figure 5.1*).

5.1.2.2 Prograde and Retrograde Textures

Garnet and sillimanite textures provide some constraints on their growth history. Some cores of garnet porphyroblasts have abundant inclusions of Sil 1 needles and clear rims, suggesting two stages of garnet growth. For instance, the cores may have grown by subsolidus reactions at temperatures below R1, whereas the clear rims may have developed by reaction RIIa (*Figure 5.1*). In addition small garnet grains such as the ones included in quartz (sample HJ-35e_1) and sillimanite (sample HJ-35e_2) may represent subsolidus garnet that did not evolve any further due to its isolation.

Sil 1 needles, which only occur as inclusions in garnet porphyroblasts, represent the earlier generation of sillimanite that was likely produced by subsolidus reactions. Sillimanite porphyroblasts enclosing garnet in type 1 sample HJ-35e_2, which has the highest AI, as well as Sil 2 porphyroblasts in type 2 samples (HJ-34b and -34c), which have intermediate AI, represent a second generation of sillimanite that was likely produced by reaction R1 which marks the onset of partial melting. The relatively small sillimanite prisms that are corroded by pinite in the high X_{MgO} type 3 samples probably belong to the same generation because they were present as reactants when reaction R2 occurred. Aggregates of Sil 3, which are commonly associated with biotite and corrode garnet in all samples, are interpreted to define a third generation that was produced by the melting reaction RIIa operating in the reverse sense. The presence of biotite symplectites and Bt-Sil-Qtz intergrowths after Kfs is consistent with retrograde development of biotite during melt crystallization (by the continuous reaction RIIa). Finally, the presence of spinel symplectites associated with biotite grains that replace garnet in some samples may be indicative of locally high Zn contents in retrograde biotite (see Section 4.1.2).

5.2 Mineral Compositions

Large garnet porphyroblasts and biotite were analyzed in type 2 and 3 samples. Plagioclase was only analyzed in type 3 samples HJ-57b and -58c in which this phase is most abundant.

5.2.1 Garnet

5.2.1.1 Mineral Composition

A total of twelve garnet porphyroblasts were analyzed: three from type 2 sample HJ-34b (*Plate 5.9a to c*), four from type 2 sample HJ-34c (*Plate 5.9d to g*), one from type 3 sample HJ-35e_1 (*Plate 5.9h*), two from type 3 sample HJ-58c (*Plate 5.9i and j*) and two from type 3 sample HJ-57b (*Plate 5.9k and l*). The selected grains only show scarce biotite replacement at their rims, so that retrograde resetting of their composition should be minimal. Analyses were done along one or two approximately perpendicular rim-core-rim line traverses (*Figures 5.2 to 5.6*) and three porphyroblasts (two from HJ-34c and one from HJ-57b) were mapped for Ca, Fe and Mg (*Figures 5.3, 5.4 and 5.6*). The compositions fall in the range $Alm_{52-74}Prp_{31-45}Sps_{1-3}Grs_{1-3}$ except for those from sample HJ-57b which are poorer in Alm and richer in Grs and Sps ($Alm_{48-55}Prp_{34-44}Grs_{5-9}Sps_{5-6}$). Most porphyroblasts are homogeneous in terms of Prp and Alm with the exception of the outer ~ 250 microns of some rims that display a slight Prp decrease and Alm increase (*Figures 5.2 to 5.6*). Grs zoning depends on the sample type: some garnets from type 2 samples display cores enriched in Grs relative to the rims (*Figures 5.2 to 5.4*); and garnets from type 3 samples, that have the highest bulk CaO (HJ-57b and -58c), have homogeneous cores surrounded by concentric inner rims enriched in Grs, which in turn show a decrease in Grs towards the outer rims (*Figures 5.5d and 5.6*). The remaining grains are relatively homogeneous in terms of Grs (*Figure 5.5a to c*). Minor variations in the zoning profiles are attributed to the presence of inclusions.

Qualitative trace element profiles were obtained for five garnet porphyroblasts: two form type 2 samples (*Figure 5.7*) and three from type 3 samples (*Figure 5.8*). Cr profiles are generally homogeneous except for some rims adjacent to biotite, in which Cr increases slightly (*Figures 5.7 and 5.8*). Y profiles are flat in type 3 samples and asymmetrically bell shaped in garnets of type 2 samples. P trends are generally flat in type 3 samples. In contrast rims with relatively low Y in garnets of type 2 samples display P enriched zones. Finally, P decreases slightly in most outer rims (*Figures 5.7 and 5.8*).

5.2.1.2 Interpretation

The generally homogeneous composition of garnet cores in terms of Alm, Prp and Sps is consistent with diffusional homogenization at high temperatures. The increase in Alm and decrease in Prp at some rims is consistent with limited Fe-Mg exchange between garnet and biotite during cooling. The Grs profiles are interpreted as follows: (i) the outward Grs decrease in garnet of type 2 samples represents relict growth zoning but it is not diagnostic of the reaction history; (ii) the lack of zoning in some garnets may be due to either growth with constant Grs content or homogenization of Grs at high temperatures; and (iii) the Grs enriched inner rims in garnets from type 3 samples HJ-57b and -58c represent a second phase of growth. These Grs peaks usually represent the onset of garnet growth by reaction RIIa (Indares and Dunning, 2001). However they have not been observed in the relatively CaO-poor samples of groups 1 and 2. Thus the most likely reason they developed (and were preserved) in the garnets of samples HJ-57b and -58c is the high bulk CaO (*Table 5.2*).

Increase of Cr at some garnet rims is consistent with growth by a biotite consuming reaction (ie. reaction RIIa). The bell-shaped profiles of Y (type 2 samples) may indicate growth of the Y-rich cores by subsolidus reactions in the presence of an Y-bearing phase, such as apatite or epidote. This is consistent with the presence of Sil 1 inclusions in these cores (see Section 5.1.2.2). In contrast, the flat Y profile of some rims may suggest growth in the presence of melt (ie. reaction RIIa).

5.2.2 Biotite

Biotite laths isolated in the matrix and in aggregates associated with garnet were analyzed along five transects with increasing distance from garnet: one from sample HJ-34b, one from sample HJ-34c, one from sample HJ-57b and two from sample HJ-58c (*Figure 5.9*). X_{Fe} (0.21 to 0.40) roughly increases with increasing distance from garnet where as X_{Al}^{VI} (0.03 to 0.08) and X_{Ti} (0.05 to 0.12) remain relatively consistent. Finally, the number of F anions (0.12-0.26; only analyzed in samples HJ-34b and -34c) roughly decreases with increasing distance from garnet (*Figure 5.9*). The X_{Fe} trend is consistent with resetting of biotite compositions during cooling by Fe-Mg exchange with garnet.

5.2.3 Plagioclase

Matrix plagioclase grains, located at varying distances from the garnet (5 from sample HJ-57b and 20 from sample HJ-58c), and plagioclase inclusions in garnet (5 from sample HJ-57b) were analysed. Plagioclase from sample HJ-57b is An-rich (matrix grains: Ab_{15-19} An_{81-85}; inclusions: Ab_{18-22} An_{77-82}) and is generally homogeneous, with An slightly decreasing at some rims (*Figure 5.10*). Plagioclase in sample HJ-58c is Ab-rich and relatively homogeneous ($Ab_{75-80}An_{18-23}$; *Figure 5.10*). Differences in plagioclase composition between the two samples can be attributed to differences in bulk X_{Na2O} (*Table 5.2*).

5.3 Thermobarometric *P-T* constraints

5.3.1 Constraints Provided by the Petrogenetic Grid

Petrogenetic grids for the KFMASH and NaKFMASH system can be used to obtain qualitative *P-T* constraints for the samples of group 2 (*Figure 5.11*). Sample HJ-58c contains Ab-rich plagioclase and can therefore be best represented on the NaKFMASH grid. In contrast, because An displaces the reactions towards higher temperatures sample HJ-57b, together with the rest of the samples which are plagioclase free, can be best represented by the KFMASH grid (see Section 2.1.2). However, because in the KFMASH system melting reactions are displaced to higher temperatures relative to the NaKFMASH system, the former system can give better constraints on the minimum conditions of the thermal peak for the group 2 samples and will be used for further interpretation.

As indicated earlier (see Section 5.1.2), most rocks display mineral assemblages typical of Field II, however the location of the bulk compositions in or near the Sil-Grt tie line region suggests that biotite was eliminated by reaction RIIa before crossing reaction R2. Therefore no diagnostic assemblage would be developed at higher temperatures (ie. those of Field III; see Section 5.1.2). The only evidence that group 2 samples crossed into the *P-T* conditions of Field III is the pinite rims around sillimanite in the high X_{MgO} samples (HJ-58c and -57b). Therefore the R2 reaction provides a lower-*T* limit for the metamorphic peak at ~810 to 900°C at a pressure of ~6.2 to 8.9 kbar in the KFMASH (*Figure 5.11*). For the reason indicated above the upper *T* limit of the thermal peak is unconstrained. However, an upper *P* limit can be set at 9 kbar by the invariant point IP4, above which cordierite is unstable (*Figure 5.11*), assuming that the alteration rims around sillimanite in samples HJ-57b and -58c represent pinitized cordierite.

Further constraints can be placed by the garnet X_{Fe} isopleths. The range of isopleths that corresponds to the composition of the analyzed garnets is indicated by the dark grey area in *Figures 5.11*. This area defines a *P* range of ~5.8 to 8.3 kbar within Field III.

5.3.2 Thermobarometry

Additional *P-T* constraints may be provided by thermobarometry. Potential thermobarometers for these samples are the garnet-biotite Fe-Mg exchange thermometer and the GASP barometer (see *Tables 5.3 to 5.5* for values used in *P-T* calculations). Temperatures were calculated for samples HJ-34b, -34c and -58c using garnet cores with the highest X_{Mg}, and biotite grains away from garnet that have the highest X_{Fe} (*Tables 5.3 and 5.4*). However biotite is likely retrograde therefore calculated temperatures in the best case would represent the conditions during melt crystallization.

GASP isopleths were calculated for samples HJ-57b and -58c which are the only ones that contain significant amounts of plagioclase. Mineral compositions selected for GASP barometry were those of garnet cores of homogeneous grains and rims that do not display retrograde zoning, in the case of grains that preserve growth zoning in terms of Grs. Since plagioclase is in general homogeneous, average compositions of matrix grains were used. Finally in sample HJ-57b a core inclusion of plagioclase in conjunction with a garnet composition at the boundary between the core and the Grs enriched rim, that is interpreted to have grown in Field II, was used to calculate a P limit for the crossing of reaction R1 into Field II.

The temperatures determined by Grt-Bt thermometry fall in the range of ~762 to 875°C and overlap with Fields II and III in the KFMASH system (*Figure 5.11*). The locations of the GASP isopleths appear to mainly depend upon the composition of the plagioclase used. The isopleths calculated with sample HJ-58c, which contains Ab-rich plagioclase, are located at pressures well above the invariant point IP4 and near the Sil-Ky boundary. In contrast the GASP isopleths calculated with sample HJ-57b, which contains An-rich plagioclase, define a band that crossed the upper corner of Field III. In both cases they are considered to represent upper P limits for the thermal peak. A possible explanation is that the matrix plagioclase in both samples formed during melt crystallization, within Field II (see Section 2.3.3). However, this is not consistent with the location of the GASP isopleths of sample HJ-58c because it would imply cooling with increasing P within Field II. Finally the GASP isopleth that was calculated using the garnet core and plagioclase inclusion gave a P-T condition for the prograde crossing of reaction R1 of ~697°C and 7.5 kbar.

5.3.3 Constraints on the *P-T* path

Additional constraints can be placed on the *P-T* path by the different textural types of sillimanite and the position of the GASP isopleths calculated for sample HJ-57b. The presence of Sil 1 inclusions in the cores of garnet porphyroblasts, large Sil 2 porphyroblasts (which are interpreted to represent the products of reaction R1) in the type 1 and 2 samples and late Sil 3 aggregates (which formed during melt crystallization) indicate that the rocks evolved for the most part of their *P-T* history in the sillimanite stability field. Finally the GASP isopleths calculated from sample HJ-57b that likely represent *P-T* conditions of melt crystallization form a narrow band into which the GASP isopleth that was calculated for the onset of muscovite dehydration melting (ie. crossing reaction R1) falls (*Figure 5.11*). This suggests that as the prograde path progressed through Field II the *P-T* path followed the slope of the isopleths and that during the early stages of retrogression there was no significant decrease in *P*.

Table 5.1: Mineral assemblages of group 2 samples. Parenthesis indicate retrograde minerals.

Thin Sections:	Garnet	Biotite	Sillimanite	Plagioclase	K-Feldspar	Quartz	Muscovite
HJ-35e$_1$	X	X	X	X	X	X	(X)
HJ-35e$_2$	X	X	X		X	X	
HJ-34b	X	X	X		X	X	
HJ-34c	X	X	X		X	X	
HJ-57b	X	X	X	X	X	X	
HJ-58c	X	X	X	X	X	X	

Table 5.2: Chemical compositions of group 2 samples. In addition, the chemical composition of a typical pelite (Carmicheal, 1989) is shown for comparison. Bolded results are an average of multiple analyses. $X_{Na2O} = Na_2O/(Na_2O + CaO)$, $X_{MgO} = MgO/(MgO + FeO)$ and $FeO^* = FeO + Fe_2O_3$.

	Sample HJ-35e$_1$	Sample HJ-35e$_2$	Sample HJ-34b	Sample HJ-34c	Sample HJ-57b	Sample HJ-58c	Typical pelite
Wt%							
SiO_2	**76.14**	**67.26**	79.27	85.89	71.78	71.44	54.9
TiO_2	**0.31**	**0.41**	0.35	0.32	0.58	0.60	0.78
Al_2O_3	**8.13**	**20.40**	10.31	7.55	12.41	14.26	16.6
FeO*	**8.43**	**4.53**	6.10	5.37	3.60	5.56	9.7
MgO	**3.46**	**1.60**	2.23	1.66	2.10	1.81	3.4
MnO	**0.48**	**0.44**	0.21	0.30	0.14	0.06	--
CaO	**0.16**	**0.07**	0.08	0.05	0.56	1.53	0.72
Na_2O	**0.26**	**0.50**	0.37	0.16	0.66	3.30	1.3
K_2O	**1.17**	**3.46**	2.08	0.58	6.27	2.40	2.7
Total	**98.54**	**98.67**	101.00	101.88	98.10	100.96	90.10
Mole%							
SiO_2	**79.71**	**75.67**	82.59	87.31	78.85	75.95	
TiO_2	**0.25**	**0.35**	0.27	0.24	0.48	0.48	
Al_2O_3	**5.15**	**13.52**	6.33	4.53	8.04	8.93	
FeO	**7.63**	**4.26**	5.31	4.56	3.30	4.94	
MgO	**5.58**	**2.68**	3.46	2.51	3.44	2.87	
MnO	**0.44**	**0.42**	0.19	0.26	0.13	0.06	
CaO	**0.19**	**0.08**	0.08	0.06	0.66	1.75	
Na_2O	**0.27**	**0.54**	0.37	0.15	0.70	3.41	
K_2O	**0.79**	**2.48**	1.38	0.38	4.39	1.63	
X_{Na2O}	**0.59**	**0.87**	0.82	0.33	0.52	0.66	
X_{MgO}	**0.43**	**0.39**	0.39	0.35	0.51	0.37	

Table 5.3: Garnet compositions used for Grt-Bt thermometry (type T) and GASP barometry (type P for the calculation of upper pressure limits of the thermal peak; and type R1 for the calculation of the pressure at which reaction R1 was crossed).

			Oxide percentage								Cations on a 12 (O) basis								Molar fraction				
Sample	Analysis #	Type	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
34b A7	EF 17	T	9.31	21.41	39.46	0.53	0.05	1.16	28.20	100.11	1.07	1.94	3.04	0.04	0.00	0.08	1.82	7.99	0.60	0.36	0.01	0.03	0.63
34c A3	AB 40	T	9.48	23.94	39.99	0.85	0.24	1.51	27.47	103.47	1.05	2.09	2.96	0.07	0.01	0.09	1.70	7.97	0.58	0.36	0.02	0.03	0.62
58c A1	AB 11	T, P	8.50	21.74	39.53	1.06	0.00	0.49	31.01	102.34	0.96	1.95	3.01	0.09	0.00	0.03	1.97	8.02	0.65	0.32	0.03	0.01	0.67
58c A2	CD 23	T	9.54	22.75	40.26	0.90	0.00	0.24	29.21	102.89	1.06	2.01	3.01	0.07	0.00	0.02	1.83	8.00	0.61	0.36	0.02	0.01	0.63
	AB 64	P	9.24	22.57	39.48	1.06	0.00	0.41	26.69	99.45	1.04	2.01	2.98	0.09	0.00	0.03	1.87	8.02	0.62	0.34	0.03	0.01	0.64
57b A1	AB 1	P	10.41	22.07	39.35	2.46	0.00	2.48	24.13	100.90	1.18	1.97	2.99	0.22	0.00	0.16	1.53	8.03	0.50	0.38	0.07	0.05	0.57
	AB 15	R1	10.83	22.29	39.64	2.09	0.04	2.28	24.20	101.33	1.22	1.98	2.99	0.17	0.00	0.15	1.53	8.02	0.50	0.40	0.06	0.05	0.56
57b A2	AB 24	P	11.05	22.38	39.76	2.01	0.04	2.52	23.95	101.72	1.24	1.98	2.98	0.16	0.00	0.16	1.50	8.03	0.49	0.40	0.05	0.05	0.55

Table 5.4: Biotite compositions used for the calculation of the peak temperatures (type T). Note: Mn values were less than 0.1% and are not reported here.

		Oxide percentage								Cations on a 11 (O) basis								Anions		Molar fraction			
Sample	Type	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	FeO	Total	Na	Mg	Al	Si	K	Ti	Fe	Total	F	Cl	X_{Al}^{VI}	X_{Ti}^{VI}	X_{Fe}^{VI}	X_{Mg}^{VI}
34b A7	T	0.85	14.61	17.41	37.70	9.43	4.51	11.60	96.11	0.12	1.60	1.51	2.77	0.88	0.25	0.71	7.84	0.00	0.00	0.10	0.09	0.25	0.56
34c A3	T	0.61	9.81	22.13	38.08	6.93	4.06	10.54	92.16	0.09	1.08	1.92	2.81	0.65	0.23	0.65	7.43	0.12	0.01	0.27	0.08	0.24	0.40
58c A1	T	0.00	11.43	17.53	36.51	9.59	5.13	13.87	94.00	0.06	1.28	1.55	2.74	0.92	0.29	0.87	7.71	–	–	0.11	0.11	0.32	0.47
58c A2	T	0.10	11.87	17.66	37.17	9.63	4.98	14.17	95.59	0.01	1.31	1.54	2.75	0.91	0.28	0.88	7.68	–	–	0.10	0.10	0.32	0.48

Table 5.5: Plagioclase compositions used for thermobarometry. Type P and R1 compositions were used to calculate upper pressure limits, and the pressure at which reaction R1 was crossed, respectively.

		Oxide percentage							Cations on a 8 (O) basis							Molar fraction		
Sample	Type	Na	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
58c A1	P	9.23	23.07	66.61	0.36	4.21	0.00	100.79	0.79	1.20	2.80	0.02	0.20	0.00	5.00	0.20	0.78	0.02
58c A2	P	9.29	23.37	63.82	0.12	4.59	0.13	101.38	0.79	1.20	2.79	0.01	0.21	0.00	5.01	0.21	0.78	0.01
57b A1	P	2.09	34.03	47.75	0.00	17.34	0.04	101.23	0.18	1.82	2.17	0.00	0.84	0.00	5.01	0.82	0.18	0.00
	R1	2.03	33.91	47.09	0.05	17.29	0.10	100.48	0.18	1.83	2.16	0.00	0.85	0.00	5.02	0.82	0.18	0.00
57b A2	P	2.01	33.53	47.15	0.04	16.99	0.20	99.93	0.18	1.82	2.17	0.00	0.84	0.01	5.01	0.82	0.18	0.00

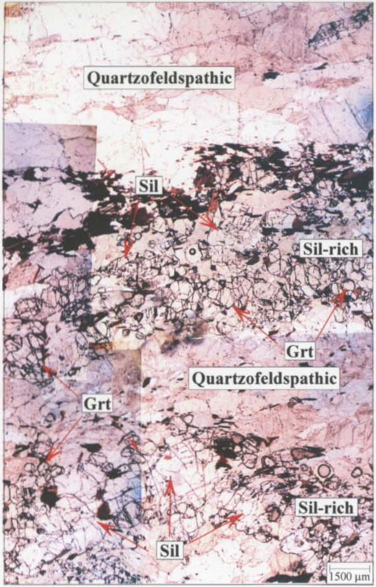


Plate 5.1: Alternating quartzofeldspathic and sillimanite-rich layers in sample HJ-35e$_2$.

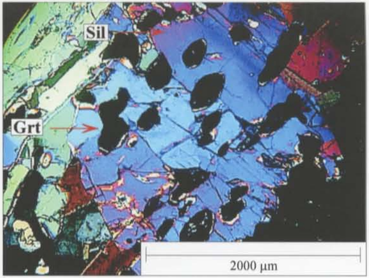


Plate 5.2: Rounded to elongated garnets enclosed in a sillimanite porphyroblast (sample HJ-35e$_2$). Note: the high birefringence of the sillimanite is due to the thickness of the thin section (<30 microns).

Plate 5.3: Typical general texture of group 2 samples (sample HJ-57b).

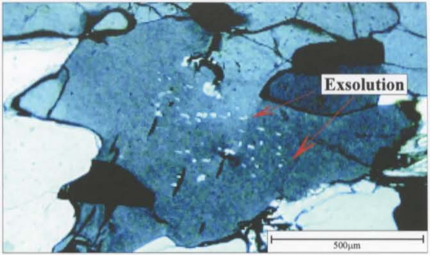


Plate 5.4: K-feldspar with exsolution bleds (sample HJ-57b).

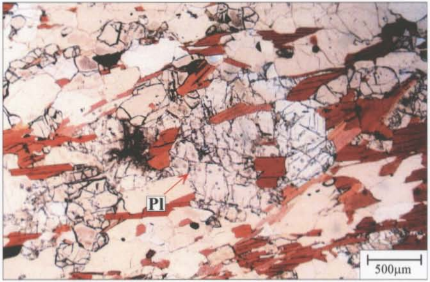


Plate 5.5: Plagioclase porphyroblast (sample HJ-57b).

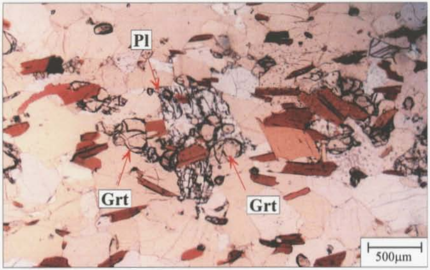


Plate 5.6: Interstitial plagioclase (sample HJ-57b).

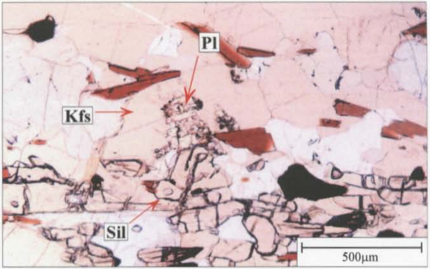


Plate 5.7: Plagioclase partially enclosed in K-feldspar (sample HJ-57b).

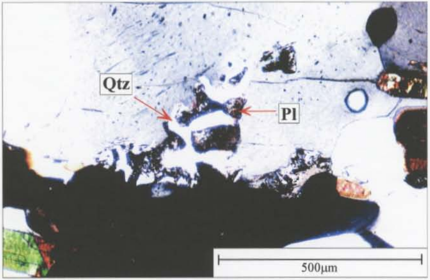


Plate 5.8: Mymerkite (sample HJ-57b).

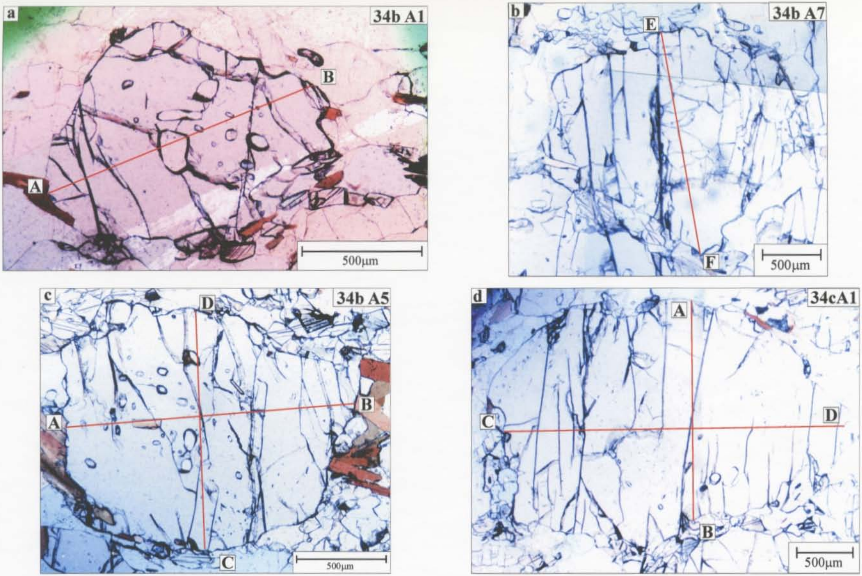


Plate 5.9: Garnet porphyroblasts: (**a**) to (**g**) are from type 2 samples; and (**h**) to (**l**) are from type 3 samples. Red lines indicate the analyzed rim-core-rim traverses. Top right labels indicate the sample number (ex. 34b stands for sample HJ-34b followed by the garnet grain number).

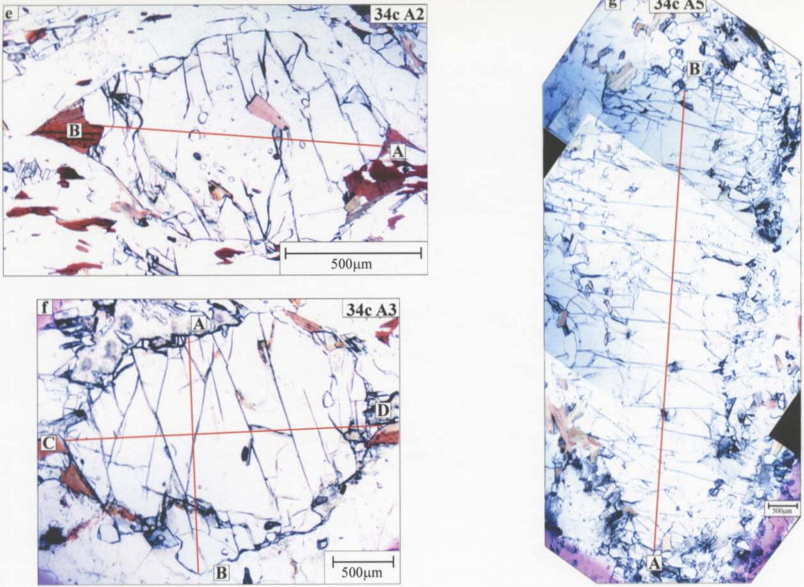


Plate 5.9 (continued):

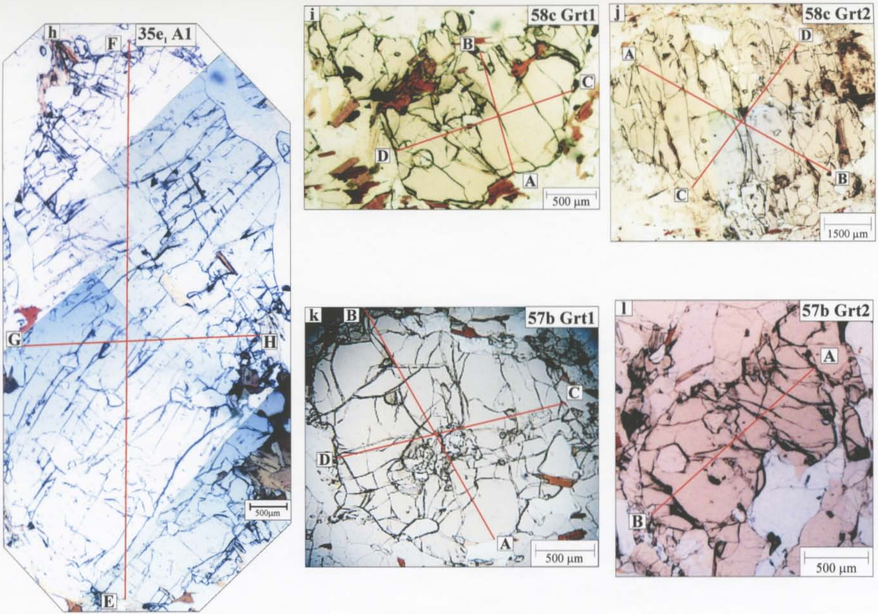


Plate 5.9 (continued):

Plate 5.10: Small garnet grains oriented parallel to the foliation (sample HJ-34b).

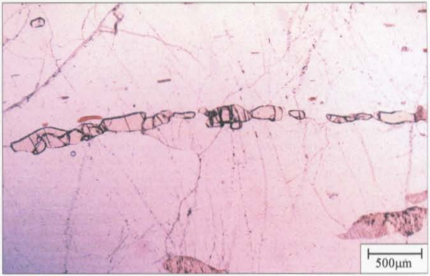
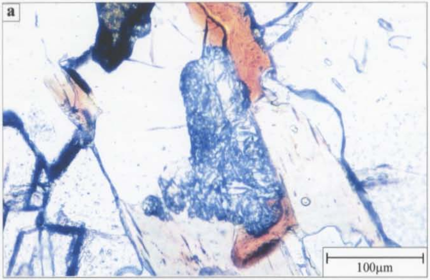


Plate 5.11: Trails of elongated garnet enclosed in quartz (sample HJ-35e$_1$).



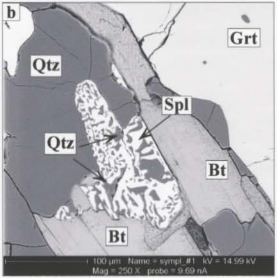


Plate 5.12: **(a)** Spl + Qtz symplectite associated with biotite. **(b)** Enlarged back scatter image of symplectite (sample HJ-34c).

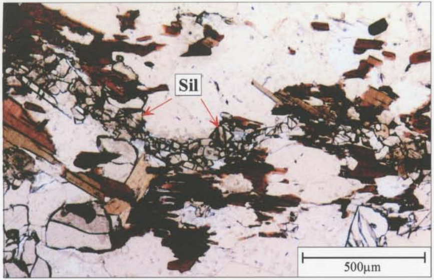


Plate 5.13: Sillimanite aggregates defining the foliation (sample HJ-58c).

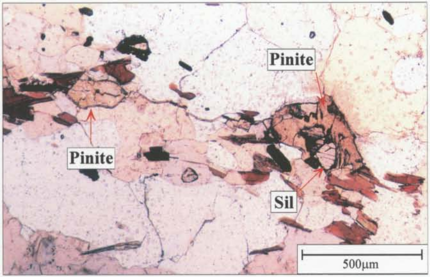


Plate 5.14: Sillimanite surrounded by pinite alteration (sample HJ-58c).

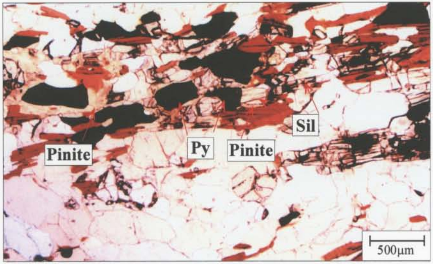


Plate 5.15: Pyrite-rich layer containing sillimanite surrounded by pinite (sample HJ-57b).

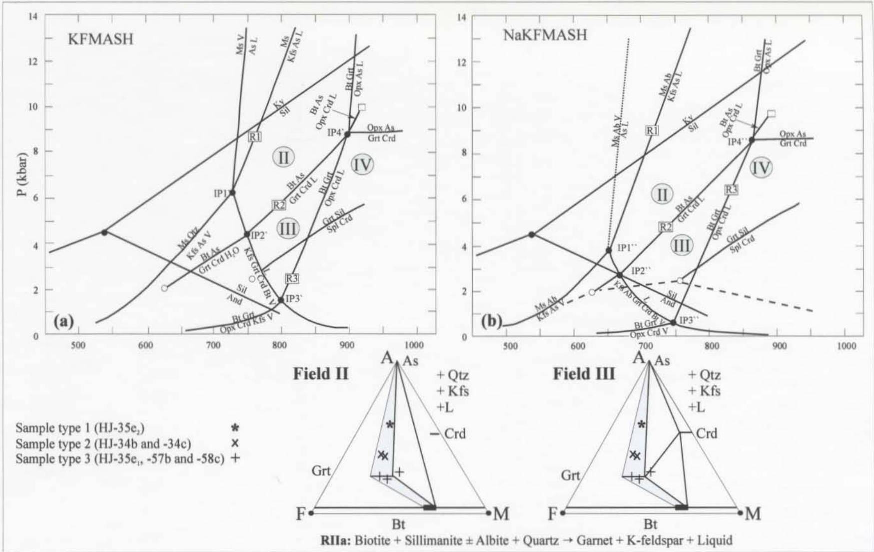


Figure 5.1: Petrogenetic grid for (**a**) the KFMASH system and (**b**) the NaKFMASH system with AFM diagrams for Fields II and III that show the location of bulk compositions of samples from group 2 (modified after Spear *et al.*, 1999). Mineral compositional bands correspond to the range of X_{Fe} of the analyzed garnet cores and biotite (see Sections 5.2.1 and 5.2.2, respectively). Also shown is the continuous reaction RIIa.

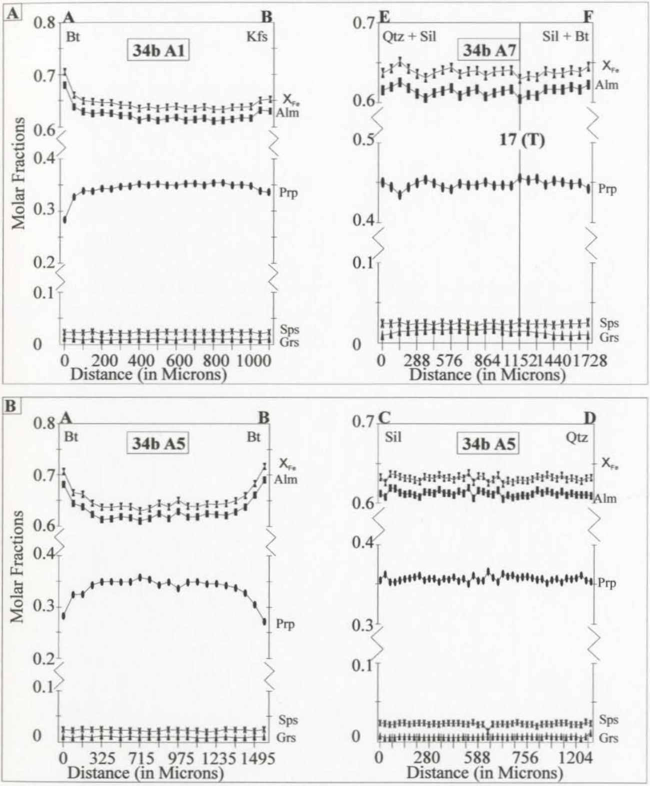


Figure 5.2: Garnet zoning profiles in terms of Alm, Prp, Grs and Sps for type 2 garnets (**a**) A3 and A7 (sample HJ-34b), (**b**) A5 (sample HJ-34b) and (**c**) A1 and A2 (sample HJ-34c; see Plates 5.9a to e for the locations of the traverses). The vertical line indicates an analysis used for thermometry (see Table 5.3).

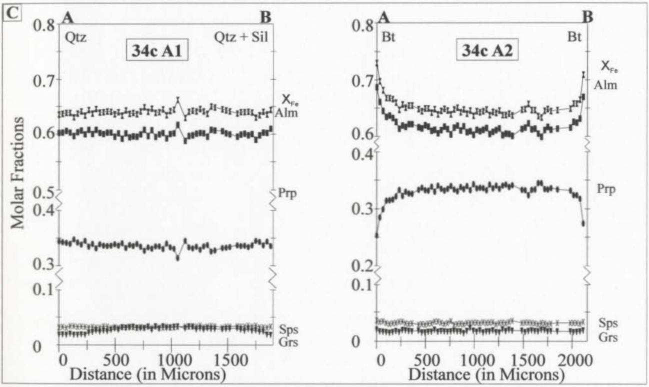


Figure 5.2 (continued):

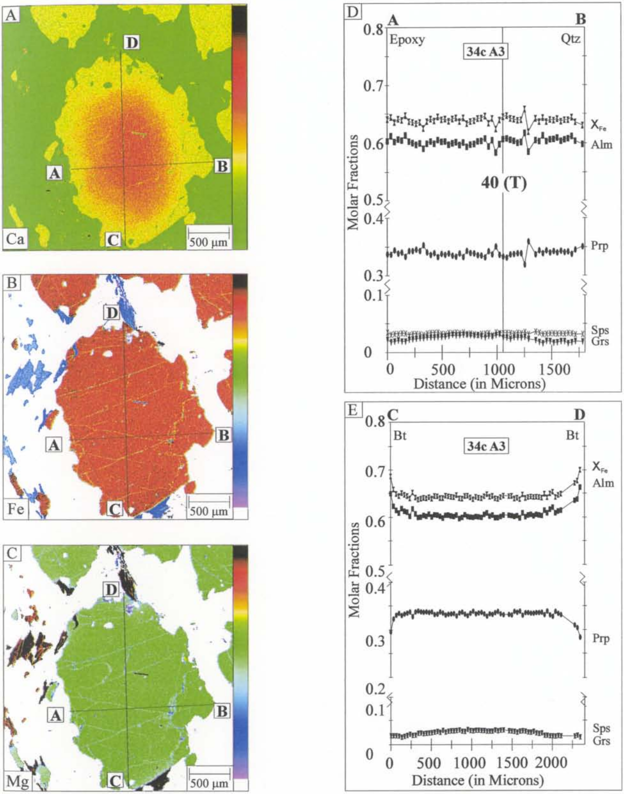


Figure 5.3: X-ray compositional maps and zoning profiles for sample type 2, garnet A3 (sample HJ-34c). The color scale on compositional maps indicates relative abundance of the element. The vertical line indicates an analysis used for thermometry (see Table 5.5). A photo of this garnet is shown in Plate 5.9f.

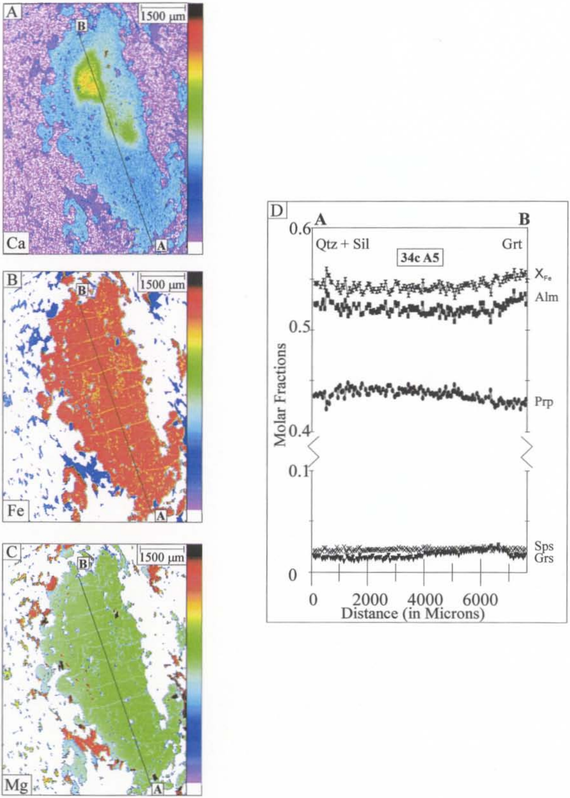


Figure 5.4: X-ray compositional maps and zoning profiles for sample type 2, garnet A5 (sample HJ-34c). The color scale on compositional maps indicates relative abundance of the element. A photo of this garnet is shown in Plate 5.9g.

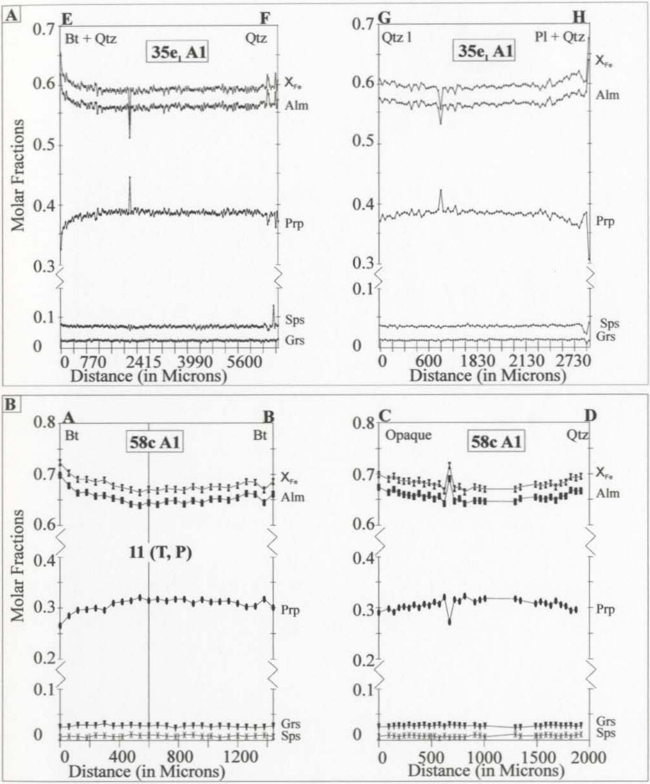
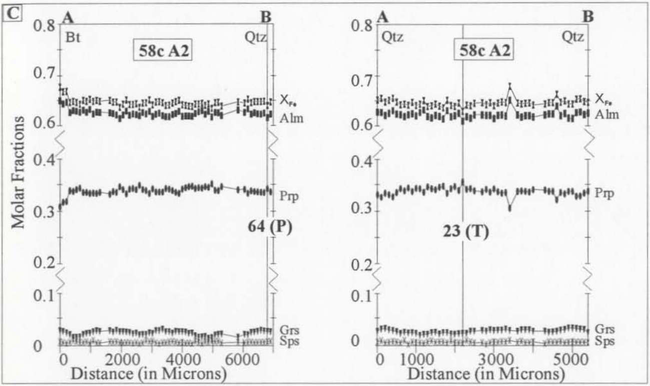


Figure 5.5: Garnet zoning profiles in terms of molar fractions of Alm, Prp, Grs and Sps for type 3 garnets (**a**) A1 (sample HJ-35e$_1$), (**b**) A1 (sample HJ-58c), (**c**) A2 (sample HJ-58c) and (**d**) A2 (sample HJ-57b; see Plates 5.9h to j and 5.9l, for the location of the traverses). Vertical lines indicate compositions used for thermobarometry (see Table 5.3).



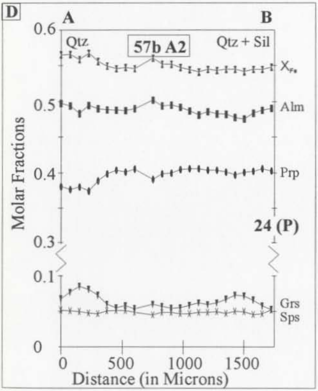


Figure 5.5 (continued):

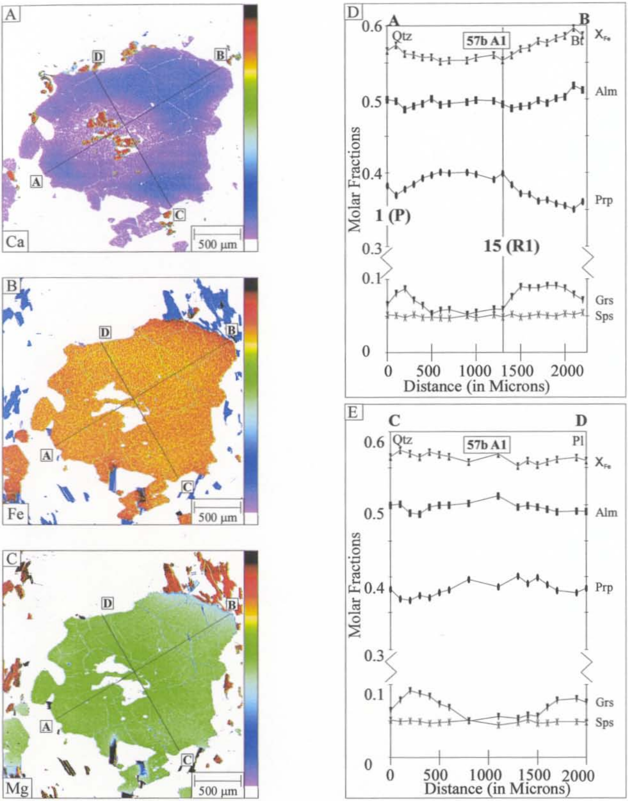


Figure 5.6: X-ray compositional maps and zoning profiles for garnet 57b A1. The color scale on the compositional maps indicates relative abundance of the element. Vertical lines indicate compositions used for thermobarometry (see Table 5.5). A photo of this garnet is shown in Plate 5.9k.

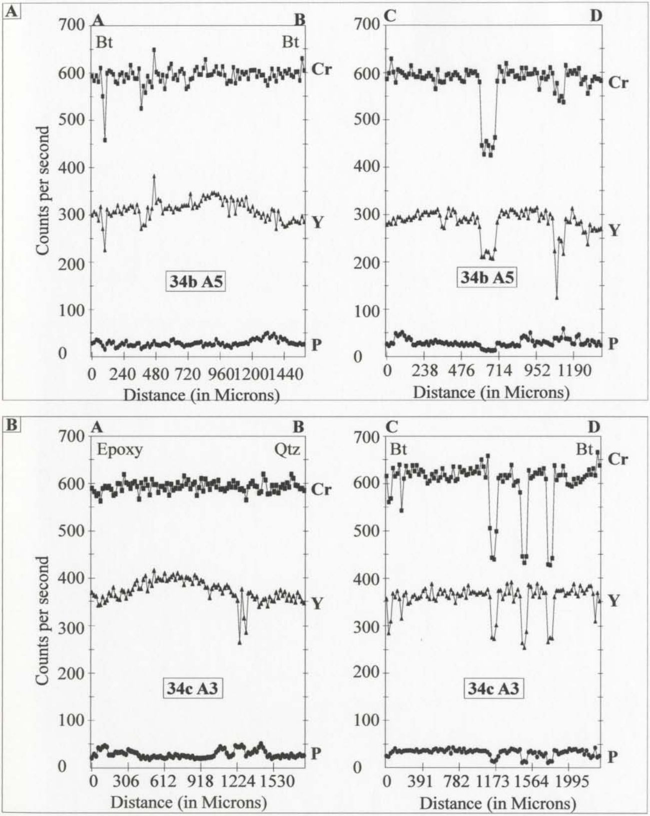


Figure 5.7: Qualitative trace element zoning profiles in terms of Cr, Y and P for sample type 2 garnets (**a**) A5 (sample HJ-34b) and (**b**) A3 (sample HJ-34c; see Plates 5.9c and f, respectively, for the locations of the transects).

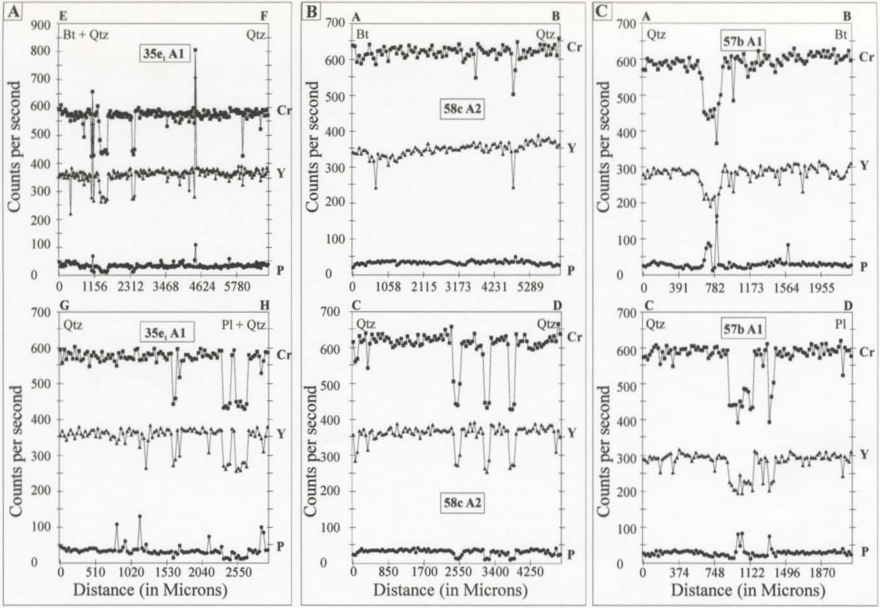


Figure 5.8: Qualitative trace element zoning profiles in terms of Cr, Y and P for sample type 3, garnets (**a**) A1 (sample HJ-35e$_1$), (**b**) A2 (sample HJ-58c) and (**c**) A1 (sample HJ-57b; see Plates 5.9h, j and k, respectively, for the locations of the traverses).

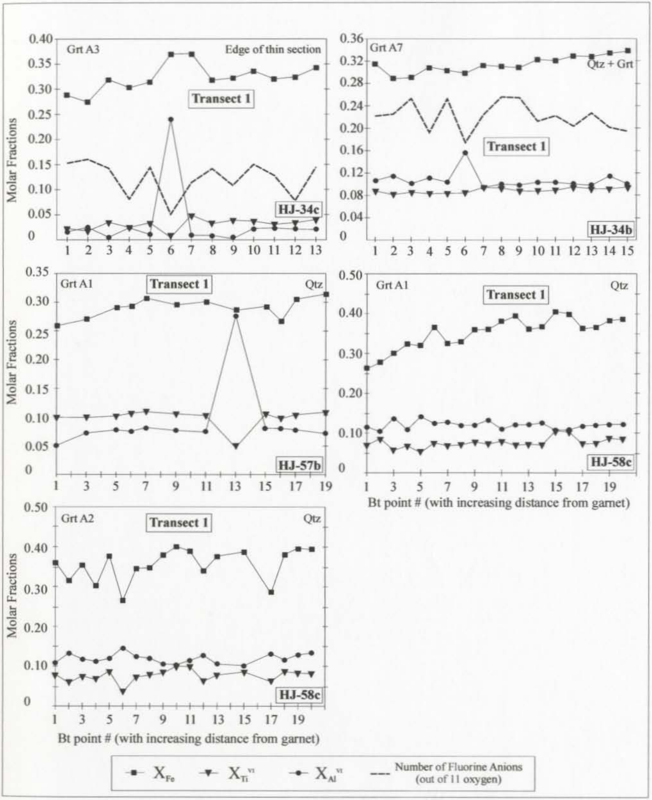


Figure 5.9: X_{Fe}, X_{Ti}, X_{Al}^{VI} and number of F anions in biotite with increasing distance from garnet for type 2 samples (HJ-34b and 34c) and type 3 samples (HJ-57b and 58c).

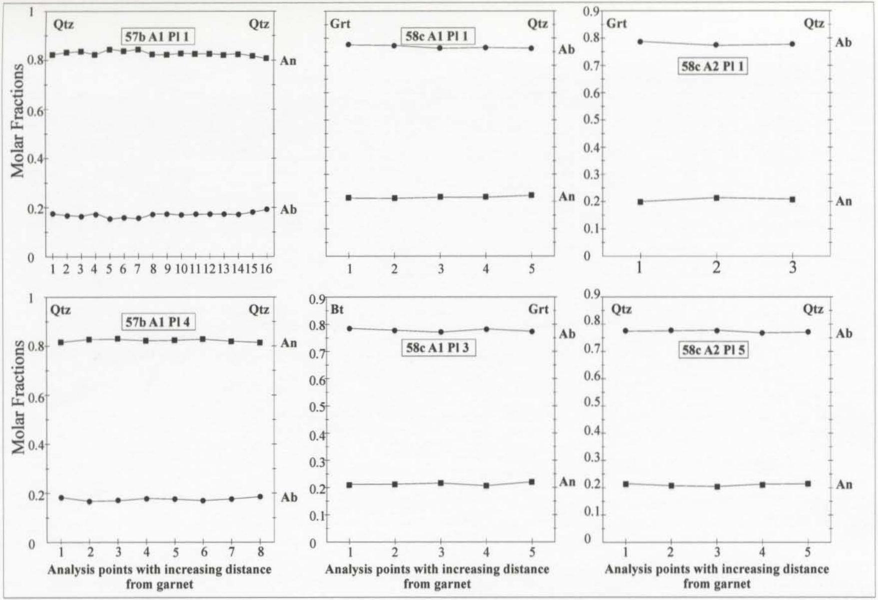


Figure 5.10: Representative plagioclase zoning profiles in terms of Ab and An from samples HJ-57b and -58c.

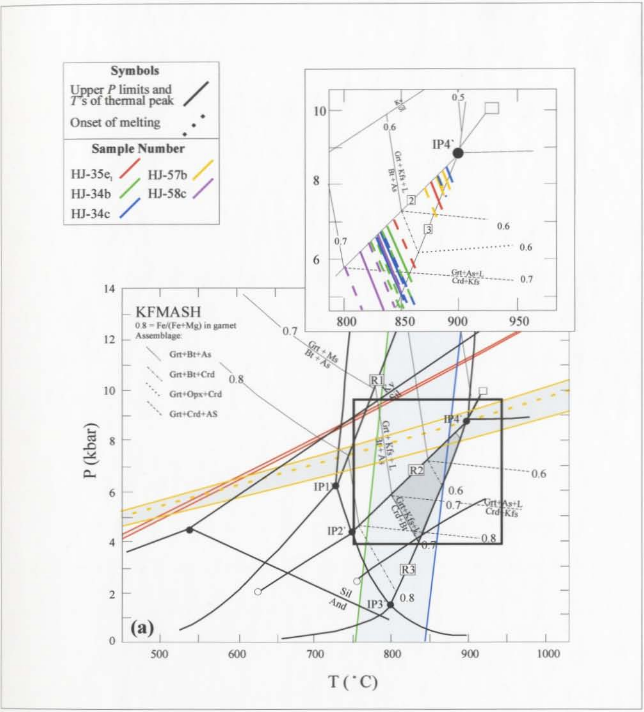


Figure 5.11: Petrogenetic grid for the KFMASH system with X_{Fe} isopleths (modified after Spear *et. al.*, 1999). The dark grey shaded area represents the *P-T* field of the thermal peak determined by the X_{Fe} isopleths (shown in inset). The light grey shaded area shows the *T*-range calculated by Grt-Bt thermometry and the intermediate grey shaded area represents the range of the calculated GASP isopleths.

Chapter 6: Group 3 Garnet - Biotite - Plagioclase Bearing Rocks

6.1 Introduction

The rocks of group 3 (samples HJ-57a_1, -57a_2, -74, -58a, and -58b) are composed of the mineral assemblage quartz + garnet + biotite + plagioclase + K-feldspar (*Table 6.1*). Chemically they are characterized by an excess of SiO_2 (62.63-78.06 wt%), high Na_2O (1.02-4.62 wt%) and CaO (1.20-4.63 wt%), and low K_2O (1.13-2.56 wt%) relative to the composition of "average" metapelites (Carmicheal, 1989, *Table 6.2*). X_{MgO} falls in the range of 0.32-0.39 in samples HJ-58b, -58a and -74 and 0.23 - 0.24 in samples HJ-57a_1 and -57a_2. Hand specimens are characterized by centimetre scale layers of coarse-grained mainly felsic minerals alternating with fine grained layers that are richer in ferromagnesian minerals.

6.1.1 Mineralogy and Texture

These samples are characterized by garnet porphyroblasts (up to 7 mm in diameter) and large quartz grains (up to 10 mm in diameter) in a finer grained matrix (grain sizes up to 2 mm) of quartz + biotite + plagioclase + garnet + K-feldspar (*Plate 6.1*). **Quartz** has irregular boundaries and is variably recrystallized. Large grains contain inclusions of biotite, garnet and feldspar with some phases being present on sub-grain boundaries. **Plagioclase** occurs in alternating plagioclase-rich and quartz-rich layers and has irregular grain boundaries. It locally forms myrmekite with quartz (samples HJ-57a_1, -57a_2, -74, and -58b; *Plate 6.2*), which partially rims clear plagioclase, and in some cases it partially surrounds garnet and separates it from quartz (sample HJ-57a_1 and -57a_2; *Plate 6.3*). **K-feldspar** is xenomorphic and contains plagioclase exsolutions (both blebs and lamellae) and is locally altered to sericite (samples HJ-58a and -74). In samples HJ-57a_1 and -57a_2 K-feldspar forms large (up to 3 mm in diameter) grains that are evenly distributed in the matrix. However, in samples HJ-58a, -58b and -74 K-feldspar is scarce and occurs as small grains (less than 2 mm in diameter), locally associated with garnet.

Garnet mainly occurs as up to 7 mm in diameter porphyroblasts (*Plate 6.4a to n*) most of which contain abundant inclusions of quartz, with subordinate biotite and plagioclase in their cores (*Plate 6.4c, d, e, f, I and j*). Some porphyroblasts are fractured with quartz, biotite and plagioclase filling the gap (*Plate 6.4m*). Grain boundaries are embayed and variably corroded by biotite (*Plate 6.4g, h, l, m and n*).

Biotite defines the foliation and occurs as small interstitial grains, in the matrix, or as aggregates that corrode garnet. In samples HJ-57a_1, -57a_2 and -74 biotite is locally altered to chlorite.

6.1.2 Interpretation

6.1.2.1 AFM Topologies

The only AFM phases that are present in the group 3 samples are garnet and biotite. This is consistent with the location of the bulk compositions within the Grt-Bt tie line region of the AFM diagrams for both Fields II and III (*Figure 6.1*). For Field II the Grt-Bt tie line region is located to the left of the Sil-Grt-Bt triangle which represents the first reaction of dehydration melting of biotite (RIIa) in pelitic rocks. However, it is possible that during earlier stages of the evolution of these rocks within Field II, reaction RIIa occurred to some extent (see Section 5.1.2.1). With increasing temperature within Field II, the Sil-Grt-Bt triangle swings to the right (*Figure 6.1c and d*). Therefore when the group 3 rocks entered Field II during prograde metamorphism the bulk compositions may have been within the Sil-Grt-Bt triangle (*Figure 6.1c*) and reaction RIIa would have proceeded until the total elimination of sillimanite leaving garnet and excess biotite as the only AFM phases. In any case this is the only group of samples in the study area that likely contain peak biotite (*Figure 6.1d*).

The bulk compositions of group 3 samples cannot record mineralogical evidence of the transition into Field III because reaction R2 which marks this transition requires sillimanite as a reactant and, as mentioned above, sillimanite is absent. However the AFM phases garnet and biotite that are present are also reactants in the subsequent discontinuous reaction R3 which produces orthopyroxene and cordierite (*Figure 6.1e*). The absence of these minerals indicates that the temperatures required for R3 were not exceeded. Therefore group 3 rocks are the only ones that allow the placement of an upper temperature limit on the thermal peak in the study area.

6.1.2.2 Interpretation of Textures

The only texture in these samples that is clearly related to partial melting is the myrmekite. However this cannot be linked to reaction RIIa because in that case upon melt crystallization by the same reaction in the opposite sense, retrograde sillimanite would form. In fact, the lack of retrograde sillimanite suggests that if reaction RIIa occurred according to the evolution proposed earlier the produced melt has to have escaped entirely. Small amounts of melt do not normally migrate and escape the system (Sawyer, 1994) unless deformation made melt escape possible.

Following the elimination of sillimanite in Field II an additional biotite dehydration reaction may occur. Biotite + plagioclase + quartz → garnet + K-feldspar + liquid (RIIa′) is a multivariant reaction for metagreywakes suggested by Vielzeuf and Schmidt (2001) that can produce limited amounts of melt in plagioclase-bearing rocks such as those in group 3. Several textures that are consistent with this reaction and that are present in group 3 samples include: a) the observed association between garnet and K-feldspar; b) the presence of myrmekite around garnet; and c) the partial replacement of garnet by biotite and fine grained plagioclase as a result of reaction RIIa′ in the reverse sense during melt crystallization. Also plagioclase + quartz + biotite which filled the fractures in some garnets may have formed by incipient melt moving along the fractures and forcing them to open as the melt crystallized by reaction RIIa′ in reverse. Finally, evidence of late, low-grade, hydration in samples HJ-57a_1, 57a_2 and -74 consists of replacement of biotite by muscovite and chlorite and K-feldspar by sericite.

6.2 Mineral Compositions

Garnet, biotite and plagioclase were analyzed in thin sections HJ-57a_1, -74, and -58b which have the largest garnet grains.

6.2.1 Garnet

6.2.1.1 Mineral Composition

Twelve garnet porphyroblasts were selected for quantitative analysis: four from sample HJ-57a_1 (*Plates 6.4a, b and d to f*), five from sample HJ-58b (*Plates 6.4g to k*) and three from sample HJ-74 (*Plates6.4 l to n*). The selected grains are characterized by only scarce biotite replacement at their rims so that retrograde resetting of the composition should be minimal. Each grain was analyzed along one or two perpendicular rim-core-rim traverses (*Plates 6.4a to n; Figures 6.2 to 6.6*) and three grains from sample HJ-74 were mapped for Ca, Fe and Mg (*Plates6.4 l to n; Figures 6.4 to 6.6*).

The composition of the garnets from samples HJ-74 and -58b fall in the range $Alm_{55-77}Prp_{15-26}Grs_{8-17}Sps_{2-9}$. Garnets of sample HJ-57a_1 are distinctly poorer in Grs (consistent with the lower bulk CaO content of this sample; *Table 6.2*) and fall in the compositional range $Alm_{73-82}Prp_{11-19}Grs_{4-5}Sps_{2-4}$. Most garnets display relatively homogeneous cores with respect to Alm and Prp ($Alm_{51-62}Prp_{15-26}Grs_{8-17}Sps_{2-9}$ for samples HJ-58b and -74 and $Alm_{73-77}Prp_{16-18}Grs_{4-6}Sps_{2-4}$ for samples HJ-57a_1), whereas the outer ~250 to 400 microns as well as the rims adjacent to the fractures are variably zoned with Prp decreasing and Alm increasing.

In terms of Grs, garnet displays a range of zoning trends, such as Grs-enriched domains in the core (sample HJ-57a_1), flat profiles, or gradual and asymmetric decrease in Grs towards the rims (sample HJ-58b), and discontinuous zones of high Grs between core and rim (sample HJ-74). The fractured garnet of sample HJ-74 is characterized by two relatively high Grs domains with Grs decreasing towards the rims and the fracture. In terms of Sps, garnets of sample HJ-57a_1 are homogeneous whereas in garnets of samples HJ-58b and -74 (in which Grs decreases at the rims; *Figures 6.3 to 6.6*) Sps increases in the outer ~250 microns. Minor variations in the zoning profiles can be attributed to the presence of inclusions.

Qualitative trace element profiles were obtained in three grains (A1 and A5a from sample HJ-57a_1 and A8 from sample HJ-74). Garnet A1 of sample HJ-57a_1 is characterized by flat Cr, Y and P profiles (*Figure 6.7a*). Whereas garnet A5a from the same sample displays a bell shaped profile in Y (*Figure 6.7b*). Finally, garnet A8 of sample HJ-74 displays increasing Cr and Y within ~400 microns of the rims (*Figure 6.7c*).

6.2.1.2 Interpretation

The generally homogeneous garnet cores in terms of Alm, Prp and Sps are consistent with diffusional homogenization of the Fe, Mg and Mn at high temperatures. Grs zoning in some cores is likely a growth feature that is variably preserved because of the slow diffusion rate of Ca and, in samples HJ-58b and -74, the high Grs content of the garnets. The observed increase in Alm toward most rims and the corresponding decrease in Prp is consistent with Fe-Mg exchange between garnet and biotite during cooling. The high Grs rings in samples HJ-57a_1 and -74 represent a second phase of growth and may be related to garnet production by reaction RIIa (see Section 2.3.1) or RIIa′. The decrease in Grs at some garnet rims and the general increase in Sps at most garnet rims is attributed to resorption of the grains and production of retrograde biotite, by reaction RIIa′ in reverse, during cooling.

Cr increase at some rims is consistent with growth by reactions involving breakdown of biotite, whereas Y increase at the same rims indicate the breakdown of a Y-rich phase, such as monazite, during garnet growth. Finally, the Y-enriched core of garnet A5a (sample HJ-57a_1) is consistent with growth by subsolidus reactions (Indares and Dunning, 2001).

6.2.2 Biotite

Biotite laths isolated in the matrix and in aggregates associated with garnet, were analysed along fourteen transects with increasing distance from garnet: four from HJ-57a_1; six from HJ-58b; and four from HJ-74 (*Figures 6.8, 6.9 and 6.10*). X_{Fe} and X_{Ti} range between 0.36 to 0.59 and 0.05 to 0.12, respectively, and display a slight increase with increasing distance from garnet. X_{Al}^{VI} (range: 0.05 to 0.17) and the number of fluorine anions (range: 0.09 to 0.32) slightly decrease with increasing distance from garnet. The X_{Fe} trend is consistent with biotite having been strongly reset by Fe-Mg exchange during the formation of retrograde biotite. In addition the X_{Ti} trend indicates that biotite adjacent to garnet may have formed at lower temperatures than in the matrix (see Section 2.1.3). This is consistent with textural and chemical zoning evidence of partial garnet replacement by biotite.

6.2.3 Plagioclase

Matrix plagioclase located at varying distances from the examined garnets (31 from sample HJ-57a_1, 15 from sample HJ-58b and 17 from sample HJ-74) and plagioclase inclusions in garnet (30 from HJ-57a_1, 27 from sample HJ-58b and 20 from sample HJ-74) were analysed and display a wide range of compositions and zoning trends. Matrix grains and inclusions in garnet from samples HJ-57a_1 and -74 are Ab-rich (HJ-57a_1: matrix $Ab_{77-88}An_{13-21}$; inclusions $Ab_{74-79}An_{19-24}$; HJ-74: matrix $Ab_{70-74}An_{26-30}$; inclusions $Ab_{67-74}An_{26-33}$). Matrix grains are generally homogeneous, with Ab increasing slightly at some rims (*Figure 6.11*). In contrast, plagioclase in sample HJ-58b is An-rich, inclusions in garnet are homogeneous ($Ab_{37-46}An_{53-63}$), whereas matrix plagioclase displays homogeneous cores ($Ab_{45-55}An_{45-56}$) and An-enriched rims ($Ab_{29-43}An_{57-70}$; *Figure 6.12*). In addition plagioclase around garnet A4 of this sample is homogeneous and very An-rich ($Ab_{14-19}An_{81-85}$). Differences in An and Ab contents of the analyzed plagioclase can be attributed to differences in the bulk X_{Na2O} (*Table 6.2*): samples with Ab-rich plagioclase (HJ-57a_1 and -74) have higher X_{Na2O} than sample HJ-58b which has An-rich plagioclase (*Table 6.2*). Finally, increase in the An content at some rims is related to the retrograde breakdown of garnet by reaction RIIa′ in reverse (see Section 6.1.2) and is consistent with decreasing Grs contents in resorbed garnet rims (see Section 6.2.1).

6.3 *P-T* Constraints

6.3.1 Constraints Provided by the Petrogenetic Grid

Petrogenetic grids can be used to place some constraints on the *P-T* conditions of metamorphism. This is the only group that likely retained peak biotite (see Section 6.1.2) and since orthopyroxene and cordierite are not present reaction R3 places an upper *T* limit for the thermal peak. The temperature at which R3 occurs in a given rock is inversely related to the Ab content of plagioclase. Therefore, the fact that samples with Ab-rich plagioclase did not experience R3 means that the maximum temperature was lower than that required for R3 to occur in these rocks. Since the Ab-rich plagioclase also contains some An, which displaces the melting reactions to higher temperatures relative to the pure NaKFMASH system, the upper *T* limit for the thermal peak should be placed between the R3 reactions of the KFMASH and NaKFMASH systems. The lack of sillimanite in these samples makes it impossible to use garnet X_{Fe} isopleths to constraint *P-T* conditions because these isopleths are determined for sillimanite bearing assemblages.

6.3.2 Thermobarometry

In contrast, because there is evidence that these samples contain peak biotite (see Section 6.1.2), garnet-biotite thermometry can be used with more confidence than in previous groups. However, sillimanite (a high pressure mineral in the GASP reaction) is absent, therefore the GASP barometer can be used only to provide upper *P* limits. *P-T* conditions were calculated for samples HJ-57a_1 and -58b using garnet grains which show the least amount of retrogression. *T* conditions of the thermal peak were calculated using garnet compositions with the highest X_{Mg} away from inclusion and resorbed rims (*Table 6.3*) and biotite grains with the highest X_{Fe} that were located away form garnet, in the matrix (*Table 6.4*).

Upper *P* limits for the thermal peak were calculated using garnet core compositions, in the case of garnets that were homogeneous in terms of Grs, and rim compositions from relatively flat portions of the Grs profiles, in the case of garnet with Grs-enriched cores (*Table 6.3*; *Figures 6.11 and 6.12*) in association with average core compositions from matrix plagioclase (*Table 6.5*). Finally, in sample HJ-57a_1 the compositions of garnet rims and adjacent plagioclase rims were used to calculate the upper *P* limits of retrograde breakdown of garnet to produce plagioclase (conditions of melt crystallization?).

T conditions fall into the range of ~748 to 935°C (between 4 and 9 kbar; *Figure 6.13a and b*). These temperatures lie in and above the range defined for Field III, in which the thermal peak is interpreted to have occurred. The overlap of calculated temperatures from these samples with the *T* range for Field III allows the conclusion that garnet cores and biotite compositions were not significantly affected by retrograde Fe-Mg resetting. Upper *P* limits, for both the thermal peak and the retrograde breakdown of garnet (melt crystallization?), lie above invariant point IP4 (which is the maximum *P* limit of Field III; *Figure 6.13a and b*) and therefore these isopleths provide no useful *P* constraints for this group.

Table 6.1: Mineral assemblages of group 3 samples. Parenthesis indicate retrograde minerals.

Thin Sections:	Garnet	Biotite	Plagioclase	K-feldspar	Quartz	(Chlorite)	(Muscovite)
HJ-57a_1	X	X	X	X	X	(X)	
HJ-57a_2	X	X	X	X	X	(X)	
HJ-74	X	X	X	X	X	(X)	(X)
HJ-58a	X	X	X	X	X		
HJ-58b	X	X	X	X	X		

Table 6.2: Chemical compositions of group 3 samples. In addition, the chemical composition of a typical pelite (Carmicheal, 1989) is shown for comparison. Bolded results are an average of multiple analysis. $X_{Na2O} = Na_2O/(Na_2O + CaO)$, $X_{MgO} = MgO/(MgO + FeO)$ and $FeO^* = FeO + Fe_2O_3$.

	Sample HJ-57a_1	Sample HJ-57a_2	Sample HJ-74	Sample HJ-58a	Sample HJ-58b	Typical pelite
Wt%						
SiO_2	**73.94**	78.06	**62.63**	**67.10**	**71.10**	54.9
TiO_2	**0.64**	0.40	**0.66**	**0.59**	**0.46**	0.78
Al_2O_3	**12.21**	11.02	**17.27**	**15.13**	**11.40**	16.6
FeO*	**5.51**	3.94	**6.28**	**6.90**	**7.05**	9.7
MgO	**0.93**	0.70	**2.29**	**2.39**	**1.83**	3.4
MnO	**0.18**	0.11	**0.20**	**0.57**	**0.47**	--
CaO	**1.63**	1.20	**3.06**	**4.63**	**3.66**	0.72
Na_2O	**3.43**	3.05	**4.62**	**2.25**	**1.02**	1.3
K_2O	**1.90**	2.56	**2.09**	**1.14**	**1.13**	2.7
Total	**100.37**	101.04	**99.10**	**100.70**	**98.12**	90.10
Mole%						
SiO_2	**78.86**	82.03	**68.64**	**71.33**	**76.61**	
TiO_2	**0.49**	0.32	**0.56**	**0.48**	**0.37**	
Al_2O_3	**7.68**	6.82	**11.17**	**9.46**	**7.24**	
FeO	**4.88**	3.46	**5.75**	**6.12**	**6.35**	
MgO	**1.22**	1.09	**3.75**	**3.82**	**2.93**	
MnO	**0.16**	0.10	**0.16**	**0.48**	**0.43**	
CaO	**1.87**	1.35	**3.59**	**5.25**	**4.23**	
Na_2O	**3.54**	3.11	**4.91**	**2.31**	**1.06**	
K_2O	**1.30**	1.72	**1.48**	**0.76**	**0.78**	
X_{Na2O}	**0.65**	0.70	**0.58**	**0.31**	**0.20**	
X_{MgO}	**0.23**	0.24	**0.39**	**0.38**	**0.32**	

Table 6.3: Garnet compositions used for Grt-Bt thermometry (type T) and GASP barometry (type P for the calculation of upper P limits of the thermal peak; and type R for the calculation of melt crystallization pressures).

			Oxide percentage								Cations on a 12 (O) basis								Molar fraction				
Sample	Analysis #	Type	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Pyp}	X_{Grs}	X_{Sps}	X_{Fe}
$57a_1$ A1	CD 31	T	4.35	22.44	39.03	2.05	0.31	1.45	34.91	104.55	0.49	2.01	2.97	0.17	0.02	0.09	2.22	7.98	0.75	0.17	0.06	0.03	0.82
$57a_1$ A2	AB 70	P	3.56	22.06	38.71	1.58	0.08	1.14	34.87	102.01	0.41	2.04	3.02	0.13	0.00	0.08	2.28	7.95	0.79	0.14	0.05	0.03	0.85
$57a_1$ A4	CD 1	R	4.58	22.52	39.26	1.91	0.28	1.44	33.77	103.76	0.52	2.03	3.00	0.16	0.02	0.09	2.15	7.97	0.74	0.19	0.05	0.03	0.81
	CD 13	P	4.85	22.31	39.13	1.70	0.19	1.46	34.19	104.61	0.55	2.01	2.99	0.14	0.01	0.09	2.18	7.97	0.74	0.19	0.05	0.03	0.80
$57a_1$ A5	GH 116	T	5.07	23.01	39.07	1.64	0.19	1.29	32.73	103.00	0.58	2.07	2.98	0.13	0.01	0.08	2.09	7.95	0.72	0.20	0.05	0.03	0.78
	GH 149	R	4.24	22.91	38.91	1.45	0.06	0.98	33.56	102.11	0.49	2.09	3.01	0.12	0.00	0.06	2.17	7.95	0.76	0.17	0.04	0.02	0.82
58b A1	AB 23	T, P	6.14	21.52	37.84	4.62	0.28	2.53	27.44	100.65	0.72	1.98	2.96	0.39	0.02	0.17	1.79	8.03	0.59	0.23	0.13	0.05	0.71
58b A2	CD 21	T	6.16	21.46	37.93	4.34	0.18	2.57	26.94	99.58	0.72	1.99	2.98	0.37	0.01	0.17	1.77	8.00	0.58	0.24	0.12	0.06	0.71
	AB 23	P	6.18	21.22	37.65	4.57	0.21	2.60	27.47	99.90	0.72	1.97	2.96	0.39	0.01	0.17	1.81	8.03	0.58	0.23	0.12	0.06	0.71
58b A3	CD 34	T, P	6.37	21.78	38.15	3.95	0.18	2.97	26.89	100.29	0.74	2.00	2.97	0.33	0.01	0.20	1.75	8.00	0.58	0.25	0.11	0.06	0.70
58b A4	CD 11	T, P	6.64	22.05	38.97	5.05	0.25	4.31	25.08	102.35	0.76	1.98	2.97	0.41	0.01	0.28	1.60	8.01	0.53	0.25	0.14	0.09	0.68
58b A5	AB 23	T, P	6.22	21.51	38.00	4.65	0.17	3.18	26.26	99.99	0.73	1.98	2.97	0.39	0.01	0.21	1.72	8.01	0.56	0.24	0.13	0.07	0.70

Table 6.4: Biotite compositions used for Grt-Bt thermometry. Note: Oxides less than 0.1% are not reported here.

		Oxide percentage								Cations on a 11 (O) basis								Anions		Molar Fractions			
Sample	Type	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	FeO	Total	Na	Mg	Al	Si	K	Ti	Fe	Total	F	Cl	X_{Al}^{VI}	X_{Ti}^{VI}	X_{Fe}^{VI}	X_{Mg}^{VI}
$57a_1$ A1	T	0.00	8.35	16.28	35.08	9.81	5.19	18.54	93.25	0.00	0.98	1.51	2.77	0.99	0.31	1.22	7.77	0.22	0.01	0.10	0.11	0.45	0.35
$57a_1$ A5	T	0.00	7.82	16.38	35.16	9.75	5.38	19.29	93.78	0.00	0.92	1.52	2.76	0.98	0.32	1.27	7.76	0.21	0.01	0.10	0.11	0.48	0.32
58b A1	T	0.00	10.15	16.33	35.91	9.36	4.08	16.24	92.04	0.00	1.18	1.50	2.81	0.93	0.24	1.06	7.72	0.15	0.01	0.11	0.09	0.38	0.42
58b A2	T	0.00	10.94	16.83	35.94	9.19	3.55	15.33	91.28	0.00	1.27	1.55	2.81	0.92	0.21	1.00	7.76	0.19	0.01	0.12	0.06	0.35	0.45
58b A3	T	0.00	8.81	18.30	35.68	9.72	3.82	17.46	93.79	0.00	1.01	1.66	2.75	0.95	0.22	1.12	7.71	0.12	0.01	0.17	0.07	0.41	0.37
58b A4	T	0.00	10.43	16.59	35.11	9.14	3.17	18.97	93.41	0.00	1.25	1.57	2.82	0.94	0.19	1.01	7.77	0.20	0.01	0.14	0.07	0.35	0.45
58b A5	T	0.00	8.39	18.98	34.50	9..34	3.50	16.08	90.78	0.00	0.99	1.77	2.73	0.94	0.21	1.06	7.70	0.13	0.01	0.18	0.08	0.39	0.36

Table 6.5: Plagioclase compositions used for GASP barometry. Type P and R: compositions used to calculate upper pressure limits for the thermal peak and for melt crystallization, respectively.

		Oxide percentage							Cations on a 8 (O) basis							Molar fraction		
Sample	Type	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
$57a_1$ A2	R	9.50	23.02	64.35	0.29	3.87	0.00	101.03	0.81	1.19	2.81	0.02	0.18	0.00	5.01	0.18	0.80	0.02
$57a_1$ A4	R	9.40	23.54	63.48	0.24	4.31	0.25	101.22	0.80	1.21	2.78	0.01	0.20	0.01	5.01	0.20	0.79	0.01
	P	9.49	23.26	63.59	0.29	4.14	0.02	100.79	0.81	1.20	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
$57a_1$ A5	R	10.22	22.06	65.83	0.09	2.45	0.34	100.99	0.86	1.13	2.87	0.00	0.11	0.01	4.98	0.12	0.88	0.00
58b A1	P	5.36	39.11	54.85	0.08	10.68	0.03	100.11	0.47	1.54	2.47	0.00	0.51	0.00	4.99	0.52	0.47	0.00
58b A2	P	4.27	31.09	52.58	0.03	12.62	0.02	100.61	0.37	1.65	2.37	0.00	0.61	0.01	5.00	0.62	0.38	0.00
58b A3	P	5.52	29.26	57.96	0.19	10.44	0.03	103.40	0.46	1.50	2.52	0.01	0.49	0.00	4.98	0.51	0.48	0.01
58b A4	P	2.11	34.31	47.94	0.05	16.42	0.11	100.94	0.19	1.83	2.18	0.00	0.80	0.00	5.00	0.81	0.19	0.00
58b A5	P	5.32	29.12	54.84	0.18	10.92	0.00	100.38	0.46	1.54	2.46	0.01	0.53	0.00	5.00	0.53	0.46	0.01

Plate 6.1: General texture of group 3 samples (sample HJ-58a).

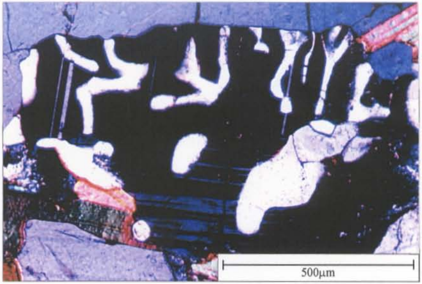


Plate 6.2: Myrmekite (sample HJ-74).

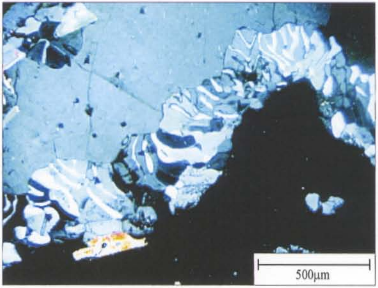


Plate 6.3: Myrmekite surrounding garnet (sample HJ-58b).

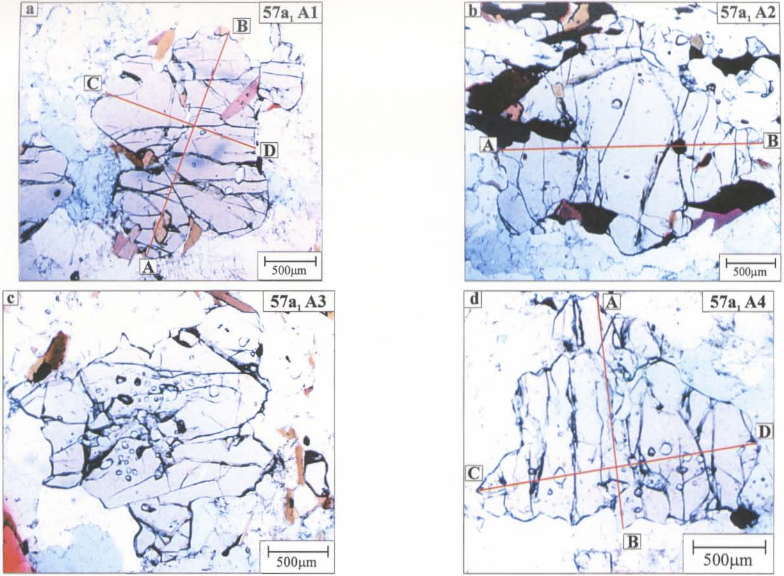


Plate 6.4: Garnet porphyroblasts: (**a**) to (**e**): sample HJ-57a$_1$; (**f**) to (**k**): sample HJ-58b; and (**l**) to (**n**): sample HJ-74. Red lines indicate the analyzed rim-core-rim traverses. Top right labels indicate the sample number (ex. 57a$_1$ stands for sample HJ-57a$_1$ followed by the garnet grain number)

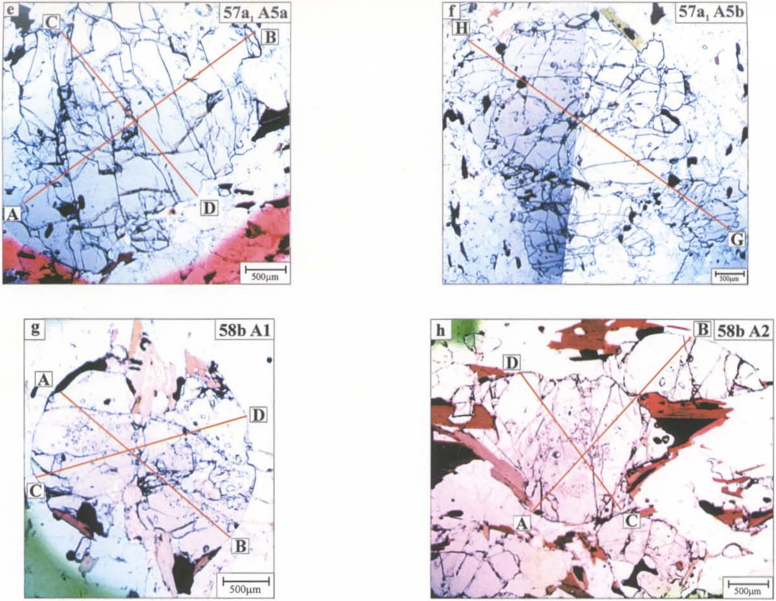


Plate 6.4 (continued):

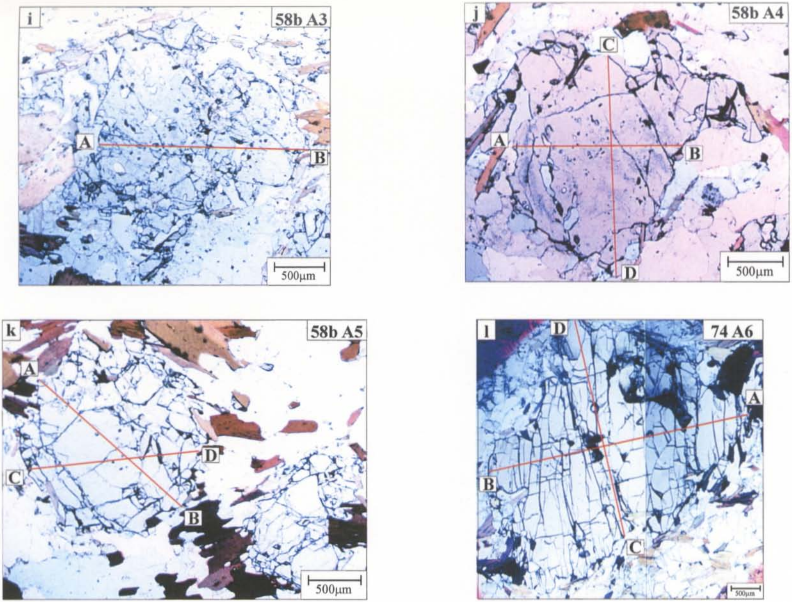
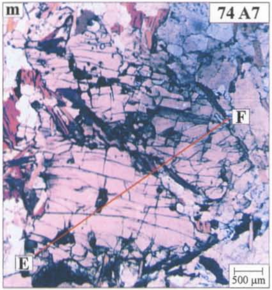


Plate 6.4 (continued):



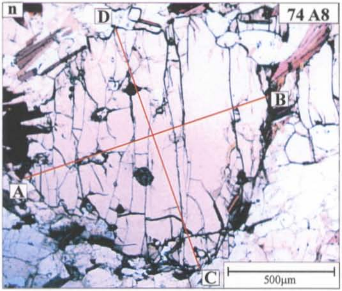


Plate 6.4 (continued):

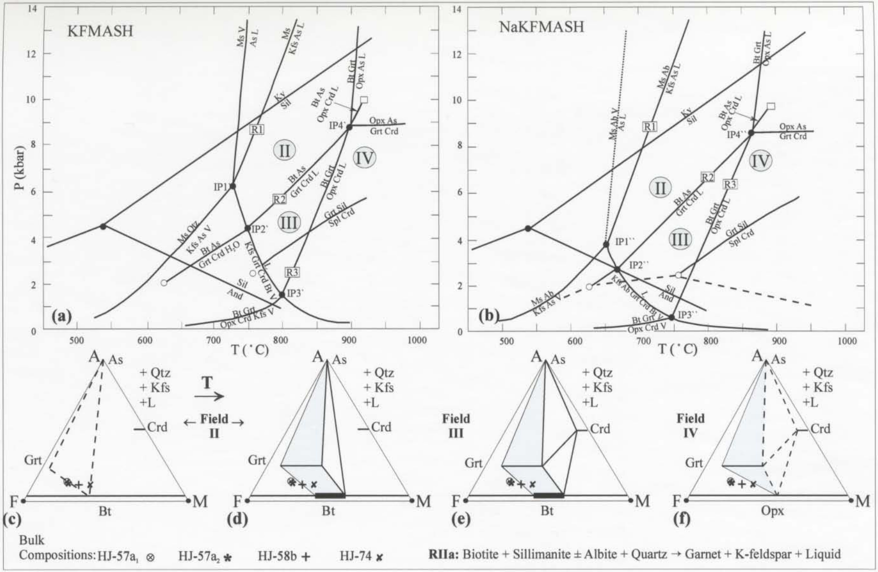


Figure 6.1: Petrogenetic grids for the (**a**) KFMASH and (**b**) NaKFMASH systems (modified after Spear *et al.*, 1999) with AFM diagrams for the group 3 samples. Compositional bands correspond to the range of X_{Fe} of the analyzed garnet cores and biotite (see Sections 6.2.1 and 6.2.2, respectively). Also shown is the continuous reaction RIIa.

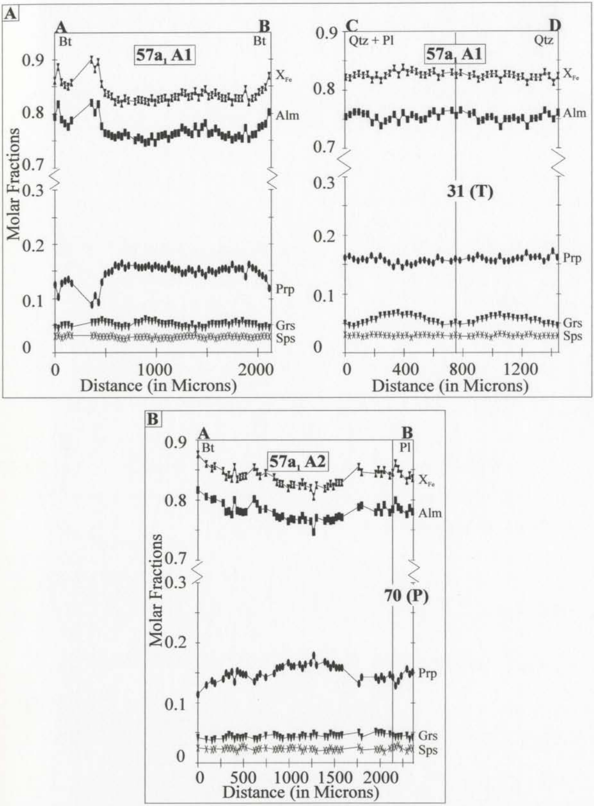


Figure 6.2: Garnet zoning profiles in terms of molar fractions of Alm, Prp, Grs and Sps for (**a**) A1, (**b**) A2, (**c**) A4 and (**d**) A5a and A5b (sample HJ-57a$_1$; see Plates 6.4a to f for the location of the traverses). Vertical lines indicate compositions used for thermobarometry (see Table 6.5).

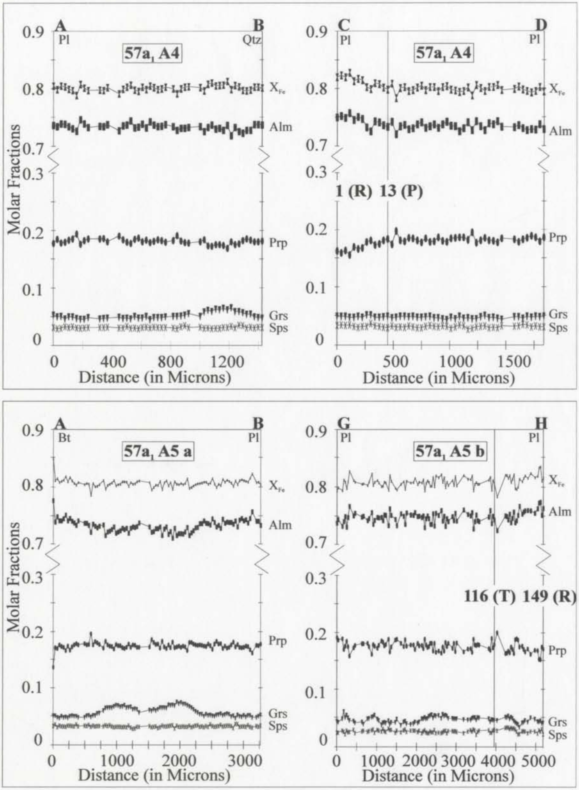


Figure 6.2 (continued):

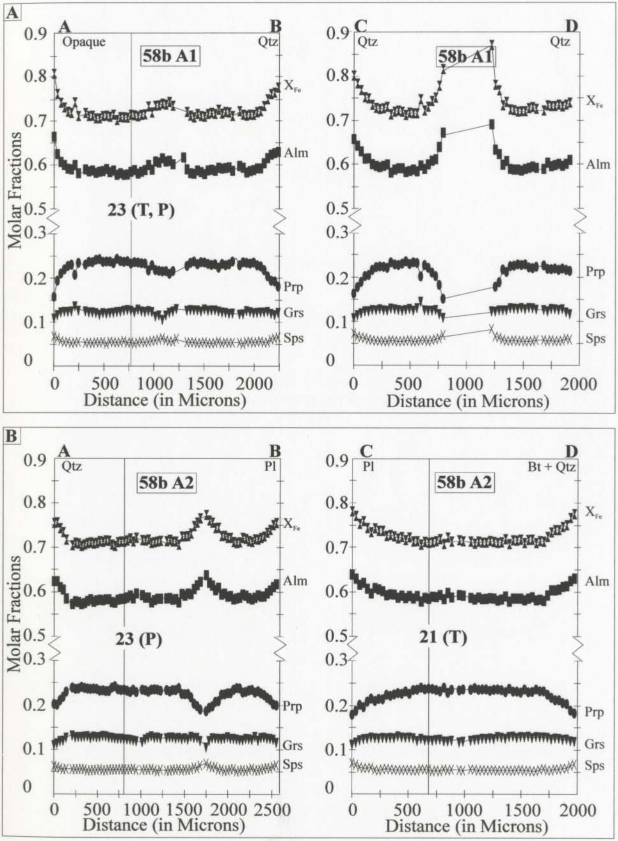
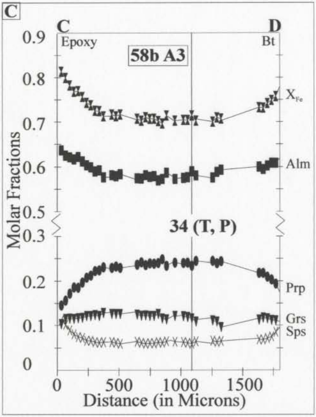


Figure 6.3: Garnet zoning profiles in terms of molar fractions of Alm, Prp, Grs and Sps for (**a**) A1, (**b**) A2, (**c**) A3 and (**d**) A4 (sample HJ-58b; see Plates 6.4g to k for the location of the traverses). Vertical lines indicate compositions used for thermobarometry (see Table 6.5).



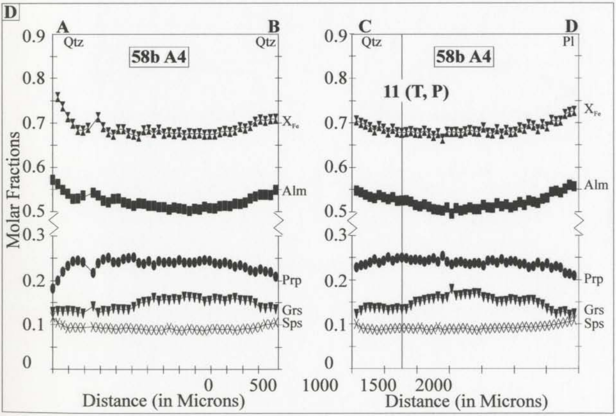


Figure 6.3 (continued):

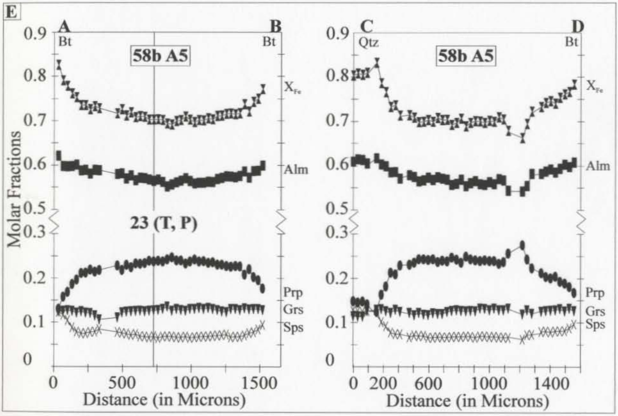


Figure 6.3 (continued):

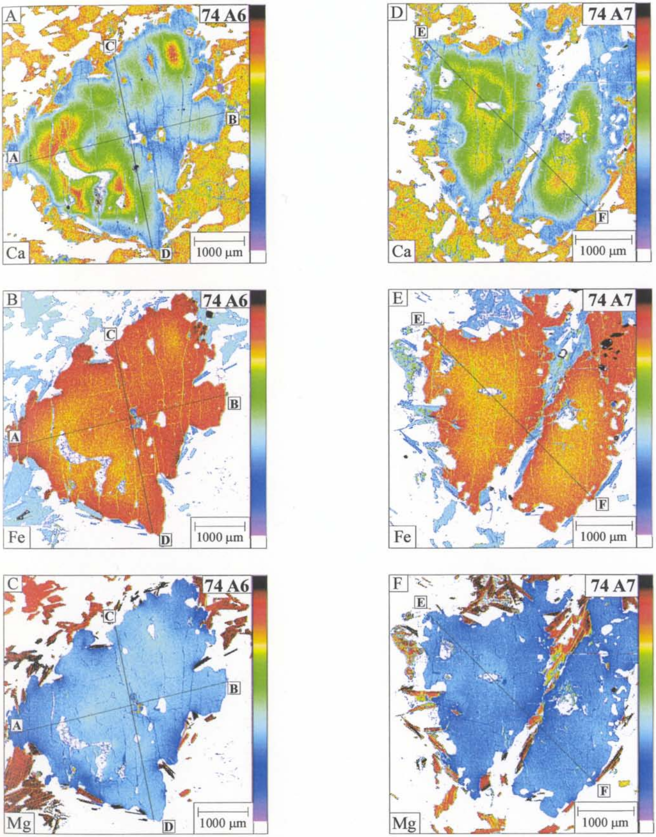


Figure 6.4: X-ray compositional maps and zoning profiles for garnets A6 and A7 (sample HJ-74). The color scale on the compositional maps indicates relative abundance of the element. Photos of these garnets are shown in Plates 6.4l and m.

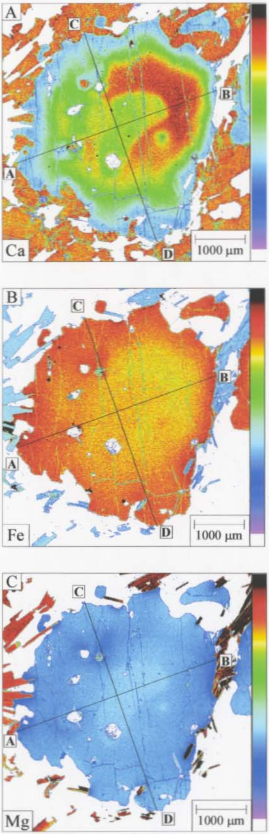


Figure 6.5: X-ray compositional maps and zoning profiles for garnet A8 (sample HJ-74). The color scale on the compositional maps indicates relative abundance of the element. A photo of this garnet is shown in Plate 6.4n.

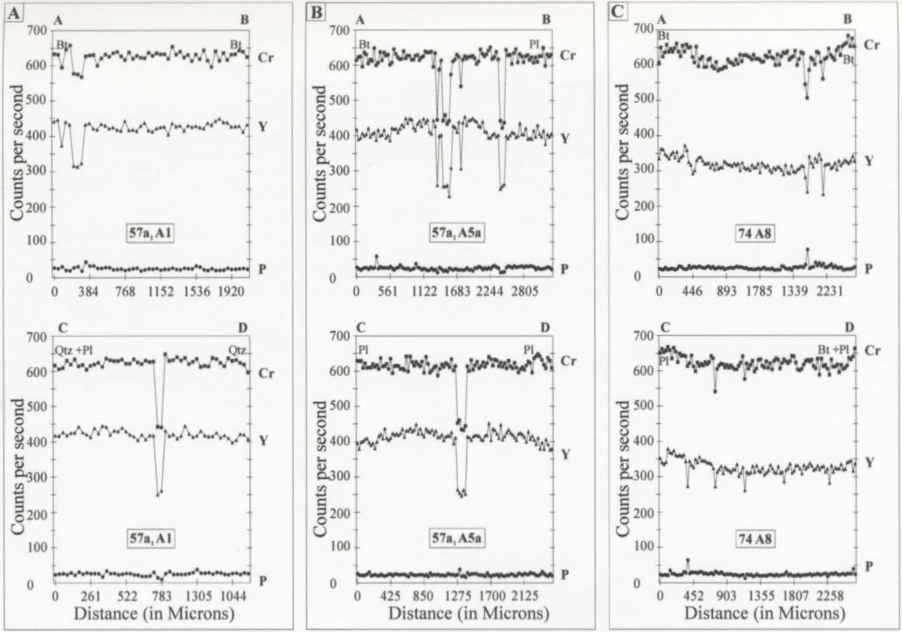


Figure 6.6: Qualitative trace element zoning profiles for garnets in terms of Cr, Y and P for (**a**) A1 (sample HJ-57a_1), (**b**) A5a (sample HJ-57a_1) and (**c**) A8 (sample HJ-74; see Plates 6.4a, e and n, respectively, for the locations of the traverses).

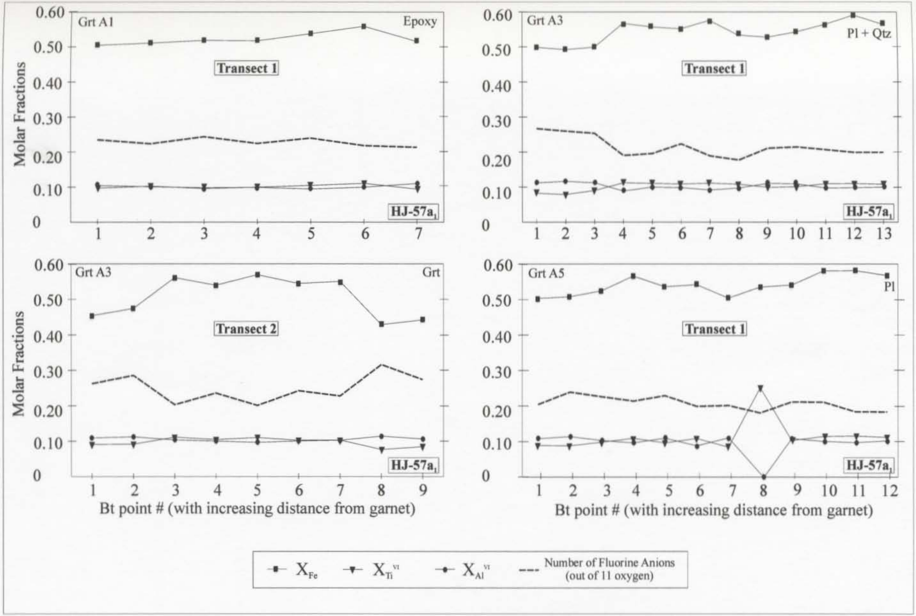


Figure 6.7: X_{Fe}, X_{Ti}, X_{Al}^{VI} and number of F anions in biotite with increasing distance from garnet A1, A3 and A5 (sample HJ-57$a_{1)}$.

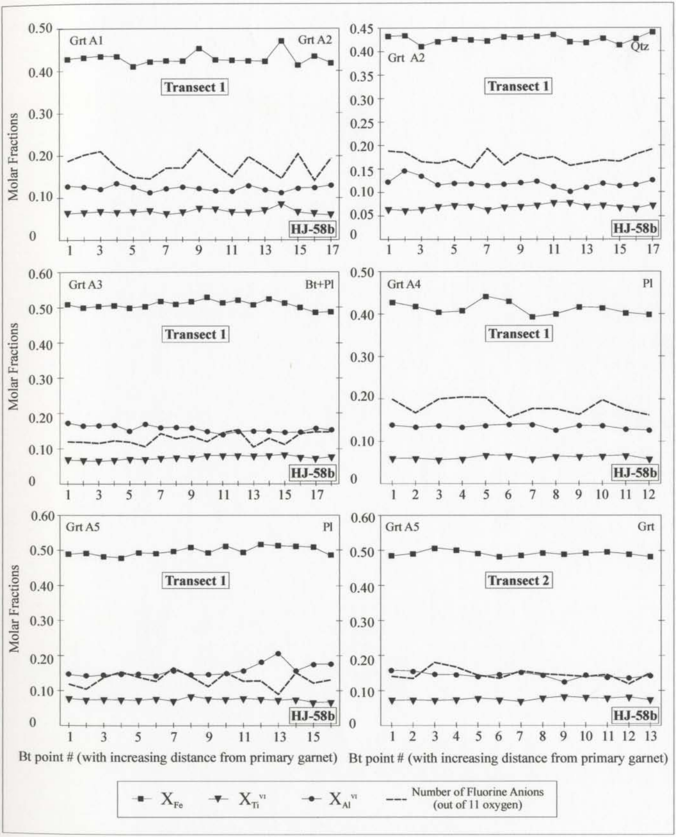


Figure 6.8: X_{Fe}, X_{Ti}, X_{Al}^{VI} and number of F anions in biotite with increasing distance from garnet for A1 to A5 (sample HJ-58b).

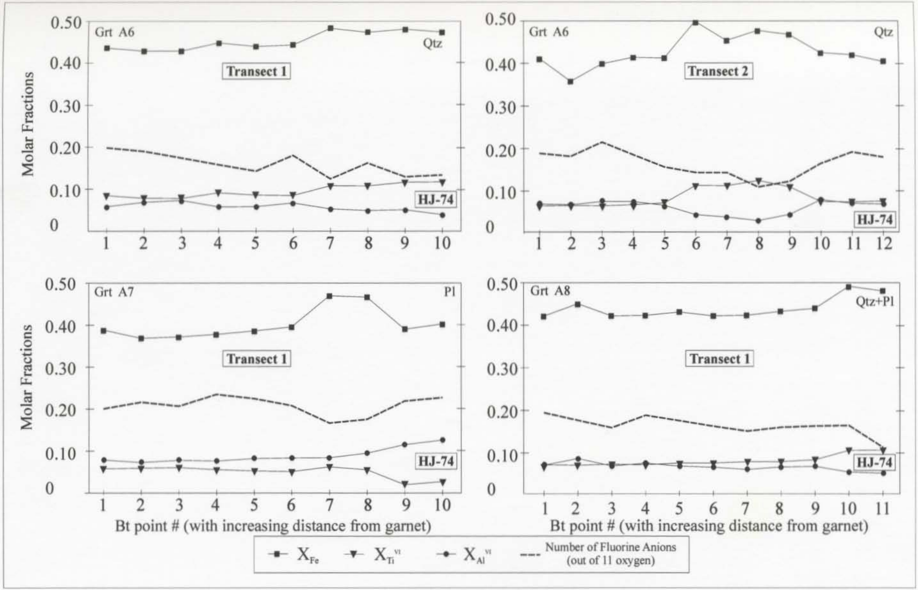


Figure 6.9: X_{Fe}, X_{Ti}, X_{Al}^{VI} and number of F anions in biotite with increasing distance from garnet A6, A7 and A8 (sample HJ-74).

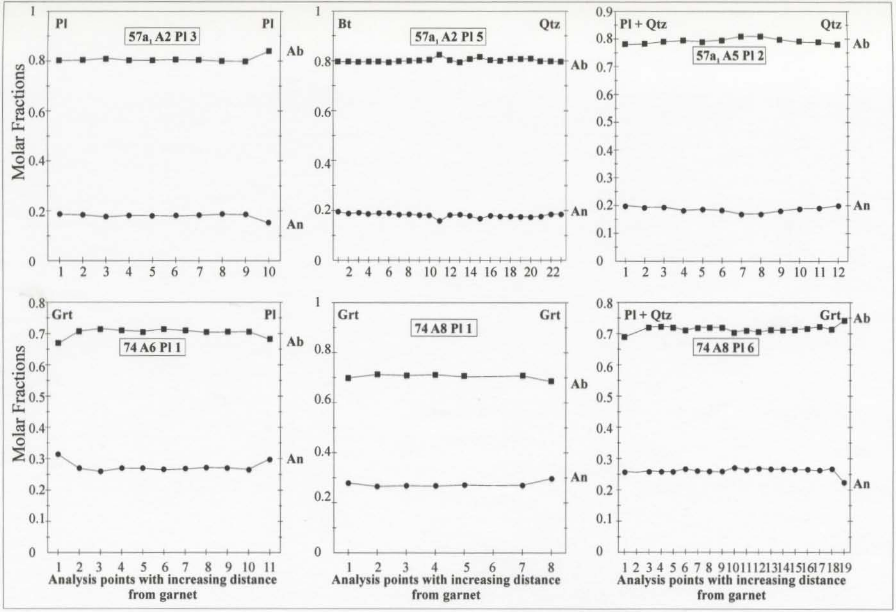


Figure 6.10: Representative plagioclase zoning profiles in terms of Ab and An (samples HJ-57a$_1$ and -74).

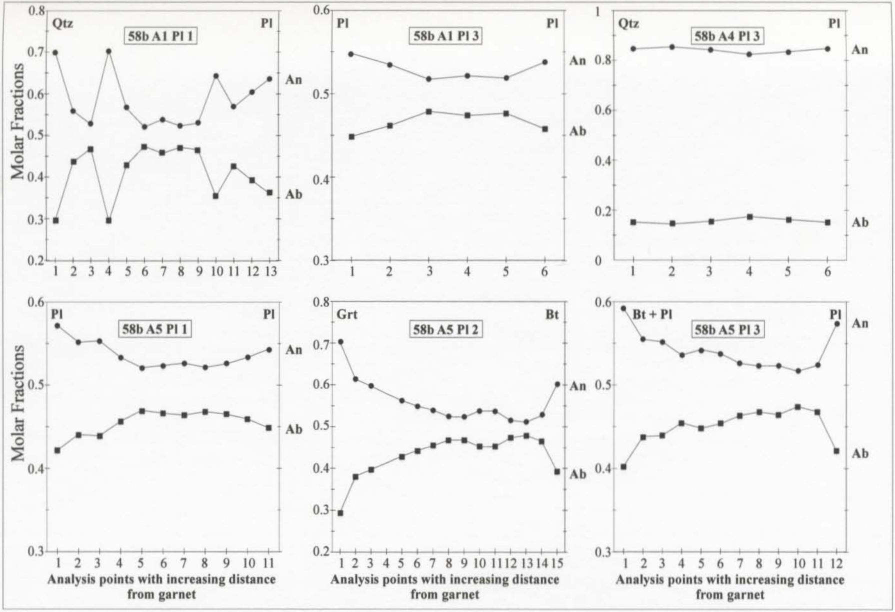


Figure 6.11: Representative plagioclase zoning profiles in terms of Ab and An (sample HJ-58b).

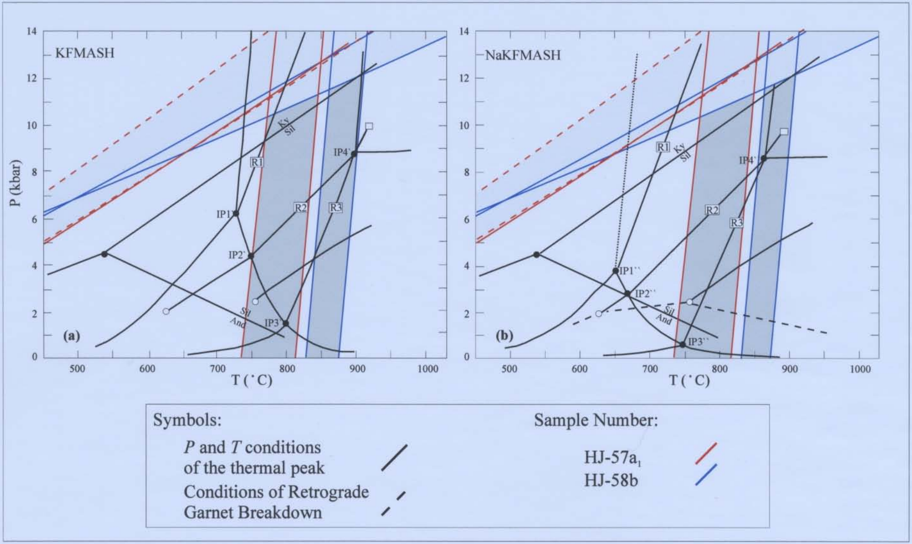


Figure 6.12: Petrogenetic grid of (**a**) the KFMASH and (**b**) the NaKFMASH system (modified after Spear *et al.*, 1999). Light grey shaded areas represent the calculated T ranges of the thermal peak and dark grey shaded areas represent the calculated range of GASP isopleths.

Chapter 7: Discussions and Conclusions

7.1 Partial Melting History of Anatectic Metapelites from the Gabriel High Strain Zone

7.1.1 Relationships Between Mineral Assemblages and Bulk Compositions

Anatectic metapelites from the GHSZ are characterized by quartz-rich layers that also contain sillimanite and ferromagnesian minerals such as garnet and cordierite, alternating with layers of granitic composition. These rocks are interpreted to have experienced partial melting in the sillimanite stability field, with the granitic layers representing melt segregation, probably aided by deformation.

The studied samples come from a small area (2 x 2 km; *Figure 1.3*) and therefore it is likely that they experienced the same *P-T* evolution. However, there is some variation in the observed mineral assemblages of the quartz-rich layers which is controlled by the bulk composition as shown by the AFM topologies (*Figure 7.1*) and therefore the samples have been divided into three groups. Group 1 has moderate to high AI (0.35-0.66) and the highest X_{Mg} (0.51-0.77) and contains the assemblage quartz + garnet + biotite + sillimanite + cordierite ± K-feldspar ± plagioclase; group 2 has moderate to high AI (0.22-0.60) and intermediate X_{Mg} (0.35-0.51) and consists of the mineral assemblage quartz + K-feldspar + garnet + biotite + sillimanite ± plagioclase; and finally, group 3 has low AI (0.10-0.13) and low to intermediate X_{Mg} (0.23-0.39) and is comprised of the assemblage quartz + garnet + biotite + plagioclase + K-feldspar. These mineral assemblages provide complementary information that, if put together, allows the *P-T* field of the thermal peak to be tightly constrain by using the petrogenetic grid of Spear *et al.* (1999) which accounts for partial melting reactions in pelitic rocks.

7.1.2 Interpretations of Textures, AFM Topologies and Garnet Zoning

7.1.2.1 AFM Topologies

The presence of K-feldspar together with sillimanite in groups 1 and 2 indicates that the *T*-conditions for the dehydration melting of muscovite (reaction R1; *Figure 7.1*) were exceeded in the sillimanite stability field and that the rocks reached temperatures high enough for biotite dehydration melting (ie. RIIa and RIIb) to occur (Fields II and III; *Figure 7.1*).

Group1 samples have four AFM phases (Bt-Sil-Grt-Crd) present and are interpreted to have reached *P-T* conditions of Field III, in the Grt-Sil-Crd triangle on the AFM diagram (biotite-free). The current presence of biotite is attributed to retrograde reactions that occurred during melt crystallization (ie. R2, RIIa and RIIb in reverse). Since biotite is needed as a reactant in R3, which marks the transition into Field IV, no diagnostic mineral assemblage would form at higher temperatures (ie. Field III) in these rocks. Therefore the mineral assemblage in group 1 rocks does not provide an upper *T* limit for the thermal peak.

Group 2 samples have three AFM phases present (Grt-Sil-Bt) but their bulk compositions lie in the Grt-Sil tie lines region. This AFM topology suggests a prograde *P-T* evolution in the Grt-Bt-Sil triangle of Field II via reaction RIIa, which led to a rotation of the three phase triangle to the right (*Figure 7.1*) until biotite was eliminated. Since biotite is needed as a reactant in R2, which marks the transition into Field III, no diagnostic mineral assemblages would form at higher temperatures (ie. Field III) in these rocks. As in group 1, the observed biotite in group 2 rocks is interpreted to be retrograde.

Group 3 samples have no sillimanite and their bulk compositions and lie in the Grt-Bt tie lines region of the AFM diagram. However, because of the rotation of the Grt-Bt-Sil triangle to the right with increasing T (see above), it is possible that upon entering Field II some sillimanite may have been present and thus reaction RIIa may have occurred to a limited extent. Finally, these rocks are also plagioclase-rich, and additional partial melting may have occurred by the multivariant reaction Bt + Pl + Qtz → Grt + Kfs + L (RIIa′; Vielzeuf and Schmidt, 2001). Since group 3 samples contain peak biotite and garnet, but not orthopyroxene and cordierite it is concluded that reaction R3 was not crossed (*Figure 7.1*). Therefore this is the only group that provides an upper T limit for the thermal peak of the GHSZ.

7.1.2.2 Prograde Textures and Garnet Zoning

All three groups contain garnet porphyroblasts (Grt 1) with inclusion rich cores and relatively inclusion-free rims. In groups 1 and 2 inclusions of sillimanite needles imply subsolidus garnet growth, as also suggested in groups 2 and 3 by Y enrichment in the cores. Inclusion-free rims are interpreted to represent a second phase of garnet growth in the presence of melt (ie. after crossing reaction R1) by reactions such as RIIa and R2. An increase in Cr at some garnet rims supports this interpretation because this zoning pattern is consistent with growth of garnet at the expense of biotite. In terms of major elements Fe, Mg and Mn garnet cores are homogenized, whereas Ca zoning is occasionally present and mainly occurs in garnets with the highest Grs content (groups 2 and 3). In these samples Grs zoning can be divided into two types that are both interpreted to represent relict growth zoning: 1) a bell shaped decrease towards the rims that is not particularly diagnostic of specific garnet-producing reactions; and 2) Grs-enriched domains and/or concentric rings between cores and rims that are consistent with a second phase of garnet growth by reaction R2 or RIIa. Groups 1 and 2 also contain large spongy sillimanite porphyroblasts (Sil 2), with inclusions of quartz, which are likely produced by reaction R1. The presence of Sil 2 as inclusions on some garnet rims provides additional evidence of a second phase of garnet growth in Field II.

In group 1 rocks, distinct generations of garnet and cordierite have been observed (see Section 4.1.2.2). Crd 1, which is isolated from garnet and only occurs in the high X_{MgO}/low FM samples (HJ-57c_1 to 57d), is interpreted to represent earlier cordierite that was formed in Field II (Grt-Bt-Sil triangle), in the absence of garnet (*Figure 7.1*). Similarly Grt 1, which only occurs in the low X_{MgO}/high FM samples (HJ-35d and -34a), is interpreted to have largely formed within the same field (Grt-Bt-Sil triangle) in the absence of cordierite. In contrast, Crd 2 and Grt 2 and 3 (with Crd 2 and Grt 3 being always in contact), that occur in all samples of group 1, are likely products of reaction R2 which marks the transition to Field III and affected all the bulk compositions. Group 2 samples with the highest X_{MgO}, which have a bulk composition close to the Grt-Bt-Sil triangle in the AFM diagram, also contain small amounts of pinite that attests to incipient formation and subsequent retrogression of cordierite as the rocks crossed reaction R2 into Field III (*Figure 7.1*).

7.1.2.3 Retrograde Textures

The studied samples also display a number of textures that are related to retrograde melt crystallization. In sillimanite-bearing samples (groups 1 and 2), garnet and cordierite rims variably replaced by biotite and sillimanite aggregates (Sil 3), as well as sillimanite aggregates associated with biotite in the matrix and Bt-Sil-Qtz intergrowths after K-feldspar, are consistent with melt crystallization by reactions such as R2, RIIa and RIIb in reverse. Garnets that display retrograde textures also show retrograde Fe-Mg zoning at the rims. In the same groups, spinel symplectites associated with biotite replacing garnet may be indicative of locally high Zn contents in retrograde biotite because Zn stabilizes spinel at lower temperatures. In group 3 retrograde evidence for melt crystallization is observed in the partial replacement of garnet by biotite and plagioclase, which is consistent with reaction RIIa′ in the reverse sense. Also, the plagioclase + quartz + biotite which fills the fractures in some garnets may have occurred by incipient melt moving along fractures and forcing them to open as the melt crystallized.

Preservation of peak metamorphic phases such as garnet and cordierite indicates that back reactions were limited during melt crystallization. This is consistent with melt segregation, as also suggested by field observations (see Section 1.4.2), and with the scarcity of K-feldspar and/or plagioclase in some of these rocks.

7.2 *P-T* Determinations

7.2.1 The *P-T* grid and Garnet X_{Fe} Isopleths

As mentioned above (see Section 7.1.2) the presence of cordierite in groups 1 and 2 and the lack of orthopyroxene, along with the fact that all samples came from the same area, indicates that these rocks achieved their thermal peak within Field III (*Figure 7.2*). Garnet X_{Fe} isopleths for core compositions (sillimanite-bearing samples; groups 1 and 2) were plotted in Field III of the KFMASH system to determine the *P-T* range for the thermal peak (*Figure 7.1*). The range for group 1 is ~7 to 8.9 kbar between ~845 to 900°C whereas the range from group 2 is lower at ~5.8 to 8.3 kbar between ~800 to 880°C. This difference appears to be related to the bulk X_{MgO} of the groups (*Figure 7.1*). Group 2 samples have low X_{MgO} (high X_{FeO}) which, as noted by Indares and Dunning (2001) and Jordan (2003), gives isopleths that are displaced towards lower *P-T* conditions and that are in some cases inconsistent with the observed mineralogy (see Section 2.4.5). The lack of sillimanite in group 3 samples makes it impossible to use this method because garnet X_{Fe} isopleths are calculated for Al_2SiO_5 bearing assemblages (Spear *et al.*, 1999).

7.2.2 Thermobarometry

The studied rocks contain mineral assemblages that can be used to calculate *P-T* conditions of metamorphism by Grt-Bt thermometry (all groups), GASP barometry (groups 1 and 2) and Grt-Crd-Sil-Qtz thermobarometry (group 1). However, the application of these thermobarometers in the studied rocks suffers serious limitations: 1) In groups 1 and 2 biotite is retrograde, therefore Grt-Bt thermometry can only give temperatures of melt crystallization or late Fe-Mg exchange. 2) Subsolidus plagioclase was not clearly recognized on the basis of textures and it is difficult to know which compositions can be used with garnet to determine GASP isopleths. 3) Most garnet cores are homogeneous in terms of Fe and Mg and it was impossible to estimate if diffusional homogenization in garnet continued during the early stages of cooling. 4) Finally, due to the small grain sizes of cordierite in group 1 samples the composition of this phase likely represents the conditions at which grain-scale diffusion stopped.

As a consequence of the above mentioned limitations the results of thermobarometry are rather scattered and do not provide tighter constraints to the *P-T* field determined for the thermal peak by using the petrogenetic grid. In all groups Grt-Bt thermometry was applied by using garnet cores and biotite away from garnet in order to determine temperatures that would be the closest to the thermal peak. However, temperatures calculated with group 1 rocks are lower than those of Field II (ie. within the melt absent domain of the petrogenetic grid; *Figure 7.2*). Therefore they probably represent late Fe-Mg exchange between garnet and biotite following the complete crystallization of melt. In contrast, the temperatures calculated for group 2 and 3 rocks span the width of Field III, in which the thermal peak occurred (*Figure 7.2*). In group 1, temperatures calculated by garnet-cordierite thermometry are lower than those of Field II, probably due to the small grain sizes that are prone to extensive retrograde resetting.

GASP isopleths were calculated in an attempt to constrain the thermal peak, using relevant garnet compositions (see Section 2.4) and matrix plagioclase. For each group GASP isopleths calculated for the peak form narrow bands in which lie the isopleths determined for both melt crystallization (using adjacent garnet and plagioclase rims; groups 1 and 3) and the beginning of melting (using plagioclase inclusions in garnet and garnet compositions interpreted to represent the crossing of R1; group 1; *Figure 7.2*). The relationships of the various isopleths in each group suggests that during the early stages of retrogression there was little decompression. For groups 1 and 2 the isopleths calculated for the peak transect Field III and cover a range that overlaps that of the X_{Fe} garnet isopleths. With respect to group 3, isopleths determined for the peak plot at pressures higher than Field III (*Figure 7.2*). This is expected as the group does not contain sillimanite, a phase in the GASP reaction, and therefore these isopleths can only be used to provide upper *P*-limits for the rocks.

7.2.3 Suggested *P-T* Path

Mineral assemblages, textures and GASP isopleths provide some constrains on the *P-T* path. As mentioned earlier three generations of sillimanite are present in group 1 and 2 samples. The earliest one (Sil 1), which only occur as inclusions in the cores of garnet porphyroblasts (Grt 1), are interpreted to have grown by subsolidus reactions. In contrast, Sil 2 porphyroblasts likely grew during the onset of melting by reaction R1 (*Figure 7.1*). Finally late Sil 3 aggregates replacing garnet and cordierite were produced by melt crystallization reactions during retrogression. These features indicate that the studied samples evolved for most of their *P-T* history within the sillimanite stability field. In addition, the overlap of GASP isopleths calculated for the onset of melting, the thermal peak and melt crystallization indicate that these samples mainly experienced heating with little change in pressure during their prograde evolution, and that subsequent cooling during retrogression also followed a shallow *P-T* gradient. Finally the lack of decompression textures in these rocks also supports the samples having experienced cooling with little change in pressure during the retrograde portion of the *P-T* path (*Figure 7.3*).

7.3 Comparison with Anatectic Metapelites from Other Locations in the Manicouagan Area

Anatectic metapelites also occur in other tectonic units of the Manicouagan Reservoir area (*Figure 1.4*). These are: the Gagnon terrane at the footwall of the Manicouagan Imbricate Zone (MIZ), and the Tshenukutish terrane which constitutes the upper structural level of the MIZ (see Section 1.2). These metapelites contain kyanite rather than of sillimanite and are characterized by distinctive *P-T* paths.

To the west of the Gabriel High Strain Zone (GHSZ) anatectic metapelites of the underlying Gagnon terrane are comprised of the assemblage Qtz + Ky + Kfs + Grt ± Pl (± Bt) (± Ms; Jordan, 2003). The presence of kyanite and K-feldspar in the absence of primary muscovite suggests that partial melting of these rocks occurred in the kyanite stability field as reaction R1 was crossed and biotite dehydration melting occurred by reaction RIIa. Further evidence supporting this reaction includes replacement of kyanite by K-feldspar and homogeneous garnet cores surrounded by Grs-rich zones which indicate a second phase of growth. Partial melting is estimated to have begun at ~11.4 - 14.5 kbar and ~750 - 780°C with melting continuing to higher temperatures in the biotite dehydration field (Jordan, 2003) along a moderate *P-T* gradient, followed by cooling at lower pressures, but still within the kyanite stability field (*Figure 7.3*).

To the north anatectic metapelites of the underlying Tshenukutish terrane contain the assemblage Qtz + Ky + Kfs + Grt + Pl (± Bt; Indares and Dunning, 2001). In these rocks the presence of kyanite and K-feldspar in the absence of muscovite again suggests that partial melting occurred in the kyanite stability field when reaction R1 was crossed. The presence of garnet, which are distinctly richer in Ca at the rims, indicates a second phase of growth by reaction RIIa. Retrograde evidence that melt crystallized completely in Field II, by reaction RIIa in reverse, is displayed by the lack of muscovite in these rocks and by biotite in the matrix corroding garnet. In these rocks dehydration melting of mica is estimated to have begun between ~14 to 16 kbar with biotite dehydration proceeding to temperatures in excess of ~850 to 875°C (Indares and Dunning, 2001). Cooling of these rocks is interpreted to have occurred together with a significant drop in *P*, but still within the kyanite stability field (*Figure 7.3*).

The high *P-T* conditions of metapelites from the Tshenukutish terrane are consistent with this unit having been extruded from deep and hot crustal levels (Indares *et al.*, 2000). While the *P-T* condition in the southern Gagnon terrane, near the tectonic contact with the MIZ, are still in the kyanite field but are lower than those of the Tshenukutish terrane. These conditions may have been achieved by burial during the tectonic transport of the MIZ over the Gagnon terrane. The *P-T* conditions for the GHSZ places metamorphism at similar temperatures but lower pressures than the Tshenukutish terrane (see Section 7.2). This is consistent with the GHSZ having been located at mid-crustal levels before being extruded with the MIZ as part of the hanging wall.

7.4 Tectonic Implications

As discussed in Section 1.3, the Gabriel high strain zone is interpreted to have been part of the hangingwall of the Manicouagan Imbricate Zone during its extrusion, as indicated by the presence of tectonic lenses of eclogites from the Lelukuau terrane within the GHSZ. Monazite dating of metapelites from the GHSZ gave ages of 1050-1040 Ma (Indares and Dunning, 2004) indicating that they were metamorphosed during the Ottawan orogeny, at the same time as the MIZ (see Section 1.2.2). Results of this study that provide additional constraints to this model are: 1) The examined rocks were metamorphosed at similar temperatures but lower pressures than the MIZ. 2) a *P-T* path that is consistent with heating and cooling with little decompression in between. These observations are compatible with a heat transfer from the hot extruding MIZ to the GHSZ which may have been responsible for the metamorphism of the latter.

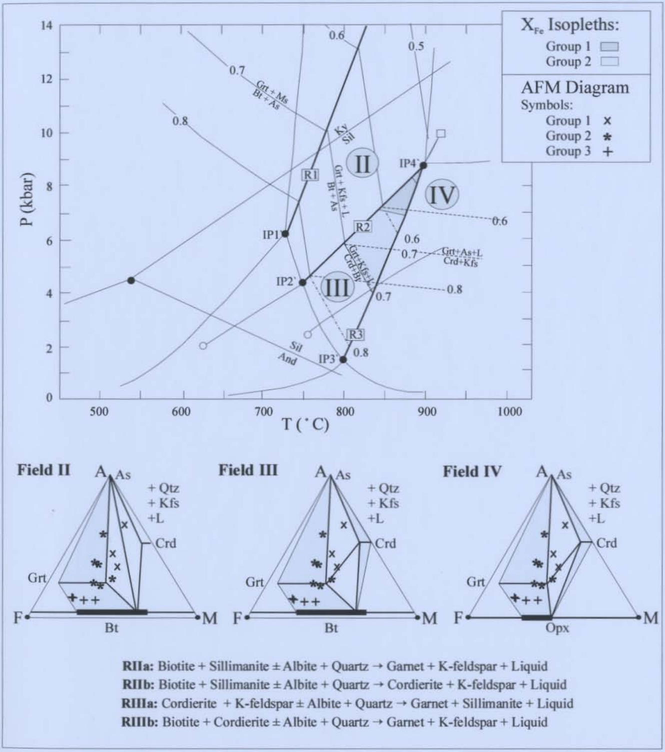


Figure 7.1: Petrogenetic grid of the KFMASH system showing garnet X_{Fe} isopleths for groups 1 and 2 and AFM diagrams for Fields II, III and IV that show the location of bulk compositions of samples from group 1 to 3 (modified after Spear *et al.*, 1999). The majority of samples are either plagioclase free or contain Ca-rich plagioclase therefore they are best represented in the KFMASH system (see Section 2.1.2).

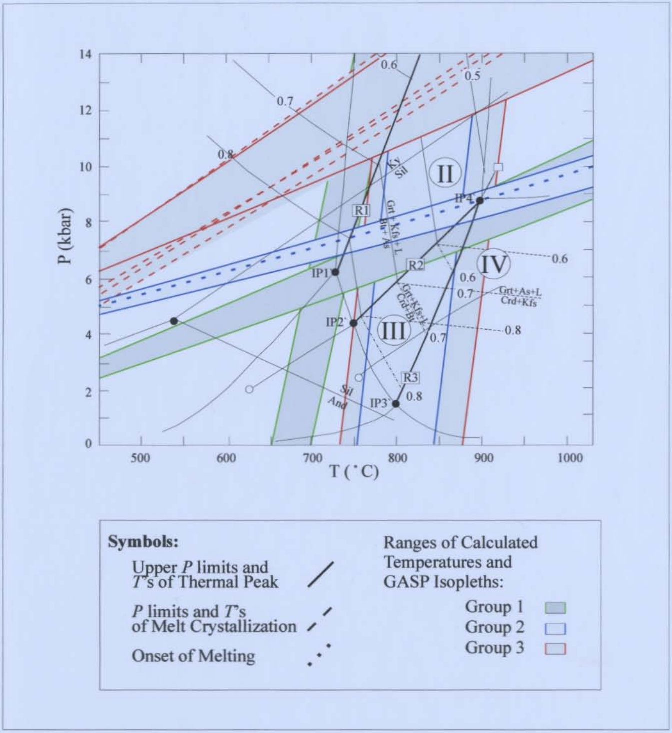


Figure 7.2: Petrogenetic grid of the KFMASH system (modified after Spear *et. al.*, 1999) showing the range of the calculated Grt-Bt temperatures and GASP isopleths for groups 1 to 3.

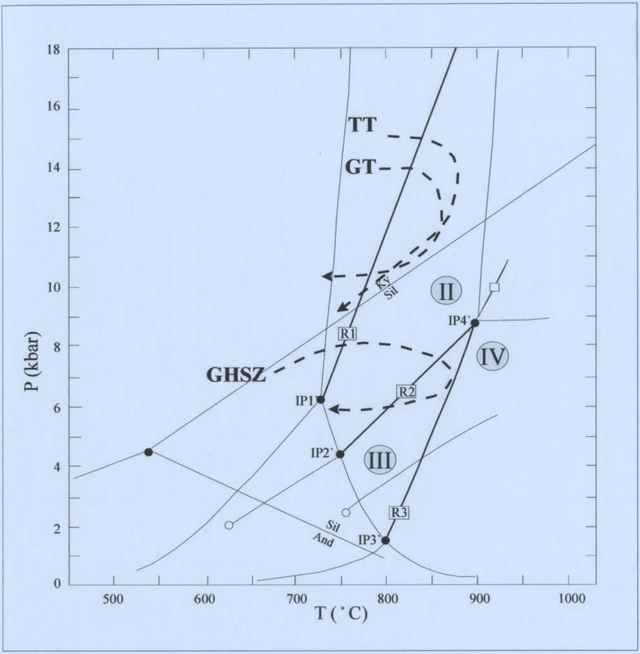


Figure 7.3: Petrogenetic grid of the KFMASH system showing the estimated P-T paths for the Gagnon terrane (GT), the Tshenukutish terrane (TT) and the Gabriel High Strain Zone (GHSZ; modified after Spear *et al.*, 1999).

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APPENDIX 1: GARNET ANALYSES*

(Only analyses with acceptable stoichiometry are included here.)

* Note: in all tables FeO = FeO + Fe_2O_3

Table 1.1: Composition of garnet A3 from sample HJ-35d (group 1) as analysed along traverse A-B (Plate 4.4a). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
2	30	10.78	23.31	40.88	1.83	0.19	2.02	24.65	103.67	1.18	2.02	3.00	0.14	0.01	0.13	1.51	7.98	0.51	0.40	0.05	0.04	0.56
3	60	11.15	24.05	41.11	1.80	0.24	1.89	24.62	104.85	1.20	2.05	2.97	0.14	0.01	0.12	1.49	7.99	0.51	0.41	0.05	0.04	0.55
5	120	10.97	23.58	41.17	1.82	0.17	1.90	24.73	104.35	1.19	2.02	3.00	0.14	0.01	0.12	1.51	7.98	0.51	0.40	0.05	0.04	0.56
6	150	11.09	23.79	41.39	1.83	0.20	1.97	24.83	105.10	1.19	2.03	2.99	0.14	0.01	0.12	1.50	7.99	0.51	0.40	0.05	0.04	0.56
16	450	10.88	23.22	40.50	1.68	0.18	1.80	23.90	102.17	1.20	2.03	3.00	0.13	0.01	0.11	1.48	7.97	0.51	0.41	0.05	0.04	0.55
17	480	11.11	23.67	41.36	1.74	0.13	1.89	24.48	104.38	1.20	2.03	3.00	0.14	0.01	0.12	1.49	7.98	0.51	0.41	0.05	0.04	0.55
18	510	11.03	23.87	41.68	1.75	0.13	1.67	24.83	104.96	1.19	2.03	3.01	0.14	0.01	0.10	1.50	7.97	0.51	0.41	0.05	0.03	0.56
19	540	11.41	23.68	41.96	1.75	0.10	1.88	24.64	105.42	1.22	2.01	3.02	0.13	0.01	0.11	1.48	7.98	0.50	0.41	0.05	0.04	0.55
20	570	10.90	23.32	40.72	1.75	0.15	1.86	24.22	102.91	1.20	2.03	3.00	0.14	0.01	0.12	1.49	7.98	0.51	0.41	0.05	0.04	0.55
21	600	11.38	23.93	41.75	1.83	0.13	1.81	24.87	105.71	1.22	2.02	3.00	0.14	0.01	0.11	1.49	7.99	0.50	0.41	0.05	0.04	0.55
22	630	11.33	23.70	41.62	1.87	0.20	1.92	25.13	105.76	1.21	2.01	2.99	0.14	0.01	0.12	1.51	7.99	0.51	0.41	0.05	0.04	0.55
23	660	10.93	23.50	41.17	1.76	0.09	1.90	24.33	103.67	1.19	2.03	3.01	0.14	0.00	0.12	1.49	7.97	0.51	0.41	0.05	0.04	0.56
25	720	11.04	23.60	41.71	1.82	0.10	1.83	24.64	104.75	1.19	2.01	3.02	0.14	0.01	0.11	1.49	7.97	0.51	0.41	0.05	0.04	0.56
29	810	11.20	23.66	41.50	1.91	0.18	1.86	24.34	104.64	1.21	2.02	3.00	0.15	0.01	0.11	1.47	7.98	0.50	0.41	0.05	0.04	0.55
31	900	11.00	23.94	41.82	1.83	0.13	1.76	24.88	105.36	1.18	2.03	3.01	0.14	0.01	0.11	1.50	7.97	0.51	0.40	0.05	0.04	0.56
36	1050	10.97	23.41	41.50	2.23	0.27	1.95	25.00	105.34	1.18	1.99	3.00	0.17	0.01	0.12	1.51	7.99	0.51	0.40	0.06	0.04	0.56
37	1080	11.07	23.98	41.79	2.00	0.15	1.84	25.03	105.86	1.18	2.03	3.00	0.15	0.01	0.11	1.50	7.98	0.51	0.40	0.05	0.04	0.56
38	1110	11.11	23.77	41.65	2.16	0.18	1.88	25.09	105.83	1.19	2.01	2.99	0.17	0.01	0.11	1.51	7.99	0.51	0.40	0.06	0.04	0.56
39	1140	10.89	23.76	41.50	1.97	0.15	1.93	24.92	105.11	1.17	2.02	3.00	0.15	0.01	0.12	1.51	7.98	0.51	0.40	0.05	0.04	0.56
40	1170	10.67	23.65	41.31	1.99	0.15	1.86	24.60	104.23	1.16	2.03	3.01	0.16	0.01	0.11	1.50	7.97	0.51	0.40	0.05	0.04	0.56
42	1230	11.02	23.77	41.27	2.16	0.32	2.15	24.98	105.67	1.18	2.02	2.97	0.17	0.02	0.13	1.51	8.00	0.50	0.40	0.06	0.04	0.56
43	1260	10.54	23.32	41.29	1.86	0.16	1.80	24.13	103.10	1.15	2.02	3.03	0.15	0.01	0.11	1.48	7.95	0.51	0.40	0.05	0.04	0.56
47	1380	10.98	23.43	41.13	1.82	0.21	1.93	24.67	104.18	1.19	2.01	3.00	0.14	0.01	0.12	1.50	7.98	0.51	0.40	0.05	0.04	0.56
48	1410	11.12	23.73	41.92	1.88	0.14	1.98	25.11	105.89	1.19	2.01	3.01	0.14	0.01	0.12	1.51	7.98	0.51	0.40	0.05	0.04	0.56
49	1440	10.86	23.74	41.48	1.90	0.28	1.85	24.77	104.89	1.17	2.02	3.00	0.15	0.02	0.11	1.50	7.97	0.51	0.40	0.05	0.04	0.56

50	1470	11.20	23.87	41.50	1.88	0.28	1.94	25.14	105.81	1.20	2.02	2.98	0.14	0.02	0.12	1.51	7.99	0.51	0.40	0.05	0.04	0.56
51	1500	11.20	23.74	41.16	2.03	0.30	2.05	25.16	105.65	1.20	2.02	2.97	0.16	0.02	0.13	1.52	8.01	0.51	0.40	0.05	0.04	0.56
54	1590	11.29	23.68	41.05	1.92	0.26	2.02	24.96	105.18	1.22	2.02	2.97	0.15	0.01	0.12	1.51	8.01	0.50	0.41	0.05	0.04	0.55
56	1650	11.19	23.88	41.93	1.83	0.12	1.85	24.85	105.64	1.20	2.02	3.01	0.14	0.01	0.11	1.49	7.98	0.51	0.41	0.05	0.04	0.55
59	1740	11.20	23.81	42.00	1.90	0.14	1.79	24.80	105.62	1.20	2.01	3.01	0.15	0.01	0.11	1.49	7.97	0.51	0.41	0.05	0.04	0.55
62	1830	11.03	23.76	41.55	1.88	0.26	1.88	24.67	105.03	1.19	2.02	3.00	0.15	0.01	0.12	1.49	7.97	0.51	0.40	0.05	0.04	0.56
63	1860	11.31	23.75	41.49	1.75	0.15	1.81	25.12	105.37	1.22	2.02	2.99	0.13	0.01	0.11	1.51	7.99	0.51	0.41	0.05	0.04	0.55
64	1890	11.05	23.67	41.60	1.84	0.08	2.03	24.75	105.02	1.19	2.02	3.01	0.14	0.00	0.12	1.50	7.98	0.51	0.40	0.05	0.04	0.56
65	1920	11.22	23.84	40.77	1.98	0.21	1.88	24.93	104.83	1.21	2.04	2.96	0.15	0.01	0.12	1.51	8.01	0.50	0.40	0.05	0.04	0.55
68	2010	11.21	23.84	41.28	1.89	0.20	1.97	24.82	105.21	1.21	2.03	2.98	0.15	0.01	0.12	1.50	7.99	0.50	0.41	0.05	0.04	0.55
69	2040	11.15	23.91	41.75	1.79	0.20	1.88	24.74	105.41	1.19	2.03	3.00	0.14	0.01	0.11	1.49	7.97	0.51	0.41	0.05	0.04	0.55
71	2100	11.06	23.98	41.90	1.81	0.10	1.79	24.75	105.38	1.19	2.03	3.01	0.14	0.01	0.11	1.49	7.97	0.51	0.41	0.05	0.04	0.56
73	2160	11.13	24.03	41.23	2.01	0.08	1.80	24.92	105.20	1.20	2.05	2.98	0.16	0.00	0.11	1.50	8.00	0.51	0.40	0.05	0.04	0.56
75	2220	10.39	23.11	40.27	1.79	0.26	1.88	25.64	103.34	1.15	2.01	2.98	0.14	0.01	0.12	1.59	8.00	0.53	0.38	0.05	0.04	0.58

✓ *~~Despite~~ for elevated oxide totals, ~~values are still considered~~ these analyses accurate relative to each other rather than accurate relative to standard garnet compositions.

~~ate due to~~ ~~stoichiometry or~~

and analyses of gt standards ~~during the same day~~ reproduced the standard

find a way to say that stoichiometries are good.

Table 1.2: Composition of garnet A3 from sample HJ-35d (group 1) as analysed along traverse C-D (Plate 4.4a). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
3	64	11.12	23.55	41.51	2.06	0.26	1.86	25.29	105.65	1.19	2.00	2.99	0.16	0.01	0.11	1.52	8.00	0.51	0.40	0.05	0.04	0.56
4	96	10.81	23.69	41.73	1.88	0.24	2.02	25.25	105.62	1.16	2.01	3.00	0.15	0.01	0.12	1.52	7.98	0.52	0.39	0.05	0.04	0.57
6	160	11.21	23.29	41.76	1.94	0.23	1.94	25.32	105.69	1.20	1.98	3.01	0.15	0.01	0.12	1.52	7.99	0.51	0.40	0.05	0.04	0.56
7	192	11.14	23.79	41.76	1.80	0.11	1.86	25.24	105.70	1.19	2.02	3.00	0.14	0.01	0.11	1.52	7.99	0.51	0.40	0.05	0.04	0.56
9	256	11.07	23.50	41.24	1.87	0.25	1.91	24.59	104.42	1.20	2.01	3.00	0.15	0.01	0.12	1.49	7.98	0.51	0.41	0.05	0.04	0.55
11	320	11.09	23.63	41.00	1.88	0.30	1.90	25.13	104.92	1.20	2.02	2.97	0.15	0.02	0.12	1.52	8.00	0.51	0.40	0.05	0.04	0.56
12	352	11.13	23.78	41.83	1.81	0.10	1.93	24.76	105.32	1.19	2.02	3.01	0.14	0.01	0.12	1.49	7.97	0.51	0.41	0.05	0.04	0.56
13	384	11.20	23.77	41.54	1.79	0.09	1.79	24.77	104.95	1.21	2.02	3.00	0.14	0.00	0.11	1.50	7.98	0.51	0.41	0.05	0.04	0.55
14	416	11.17	23.75	41.57	1.87	0.21	1.90	25.14	105.60	1.20	2.01	2.99	0.14	0.01	0.12	1.51	7.99	0.51	0.40	0.05	0.04	0.56
15	448	11.05	23.77	41.63	1.92	0.22	2.00	25.04	105.62	1.19	2.02	3.00	0.15	0.01	0.12	1.51	7.98	0.51	0.40	0.05	0.04	0.56
16	480	10.89	23.72	41.24	2.14	0.20	1.84	25.08	105.10	1.17	2.02	2.99	0.17	0.01	0.11	1.52	7.99	0.51	0.40	0.06	0.04	0.56
17	512	10.90	23.56	41.59	1.84	0.11	1.86	24.74	104.62	1.18	2.01	3.02	0.14	0.01	0.11	1.50	7.97	0.51	0.40	0.05	0.04	0.56
21	640	10.74	23.68	41.22	1.88	0.11	1.88	24.54	104.06	1.17	2.03	3.00	0.15	0.01	0.12	1.50	7.97	0.51	0.40	0.05	0.04	0.56
22	672	11.14	24.04	42.11	2.00	0.06	1.85	24.73	105.95	1.19	2.03	3.01	0.15	0.00	0.11	1.48	7.97	0.50	0.40	0.05	0.04	0.55
23	704	11.11	23.73	41.47	1.97	0.11	1.97	25.06	105.42	1.19	2.02	2.99	0.15	0.01	0.12	1.51	7.99	0.51	0.40	0.05	0.04	0.56
24	736	11.17	23.80	41.35	1.89	0.21	1.68	24.22	104.32	1.21	2.03	3.00	0.15	0.01	0.10	1.47	7.97	0.50	0.41	0.05	0.04	0.55
26	800	10.71	23.58	41.44	2.10	0.26	1.90	25.26	105.24	1.15	2.01	3.00	0.16	0.01	0.12	1.53	7.98	0.52	0.39	0.05	0.04	0.57
31	960	10.11	23.14	41.13	2.16	0.16	1.90	25.24	103.84	1.11	2.00	3.02	0.17	0.01	0.12	1.55	7.97	0.53	0.38	0.06	0.04	0.58
34	1056	10.03	22.80	40.32	2.57	0.11	2.09	25.12	103.04	1.11	2.00	2.99	0.20	0.01	0.13	1.56	8.00	0.52	0.37	0.07	0.04	0.58
37	1152	11.00	23.80	41.67	1.84	0.13	1.83	24.61	104.89	1.18	2.03	3.01	0.14	0.01	0.11	1.49	7.97	0.51	0.40	0.05	0.04	0.56
39	1216	11.18	23.55	41.35	1.78	0.16	1.84	24.95	104.81	1.21	2.01	3.00	0.14	0.01	0.11	1.51	7.99	0.51	0.41	0.05	0.04	0.56
40	1248	11.04	23.43	41.30	1.83	0.15	1.93	24.43	104.11	1.20	2.01	3.01	0.14	0.01	0.12	1.49	7.98	0.50	0.41	0.05	0.04	0.55

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.3: Composition of garnet A8 from sample HJ-35d (group 1) as analysed along traverse A-B (Plate 4.4b). Distance is in mircons from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	9.58	23.65	41.11	1.66	0.17	2.46	26.59	105.23	1.04	2.03	3.00	0.13	0.01	0.15	1.62	7.98	0.55	0.35	0.04	0.05	0.61
3	52	11.21	23.81	41.21	1.61	0.12	2.48	24.89	105.34	1.21	2.03	2.98	0.13	0.01	0.15	1.50	8.00	0.50	0.40	0.04	0.05	0.55
4	78	11.48	24.09	41.56	1.66	0.27	2.42	24.44	105.92	1.23	2.03	2.98	0.13	0.01	0.15	1.46	7.99	0.49	0.41	0.04	0.05	0.54
5	104	11.49	23.86	41.16	1.53	0.25	2.39	24.43	105.11	1.24	2.03	2.97	0.12	0.01	0.15	1.48	8.00	0.50	0.42	0.04	0.05	0.54
7	156	11.80	24.07	41.37	1.63	0.30	2.47	24.18	105.82	1.26	2.03	2.97	0.13	0.02	0.15	1.45	8.00	0.49	0.42	0.04	0.05	0.53
8	182	11.68	23.59	40.37	1.47	0.11	2.23	23.77	103.21	1.28	2.04	2.97	0.12	0.01	0.14	1.46	8.01	0.49	0.43	0.04	0.05	0.53
9	208	11.47	23.59	41.22	1.38	0.14	2.15	23.62	103.56	1.25	2.03	3.01	0.11	0.01	0.13	1.44	7.97	0.49	0.43	0.04	0.05	0.54
10	234	11.55	23.50	41.21	1.46	0.19	2.33	23.66	103.89	1.25	2.02	3.00	0.11	0.01	0.14	1.44	7.98	0.49	0.42	0.04	0.05	0.53
13	312	11.76	23.98	41.43	1.59	0.19	2.15	24.22	105.32	1.26	2.03	2.98	0.12	0.01	0.13	1.46	7.99	0.49	0.42	0.04	0.04	0.54
14	338	11.86	24.16	41.37	1.62	0.20	2.38	23.90	105.49	1.27	2.04	2.97	0.12	0.01	0.14	1.43	8.00	0.48	0.43	0.04	0.05	0.53
16	390	12.10	23.92	41.21	1.46	0.14	2.27	23.72	104.81	1.30	2.03	2.97	0.11	0.01	0.14	1.43	8.00	0.48	0.44	0.04	0.05	0.52
18	442	11.80	23.62	41.01	1.42	0.18	2.33	23.62	103.99	1.28	2.03	2.98	0.11	0.01	0.14	1.44	7.99	0.48	0.43	0.04	0.05	0.53
19	468	12.04	23.84	41.29	1.65	0.21	2.40	24.40	105.82	1.29	2.02	2.96	0.13	0.01	0.15	1.46	8.02	0.48	0.43	0.04	0.05	0.53
21	520	12.10	23.96	41.41	1.54	0.28	2.35	23.96	105.60	1.29	2.03	2.97	0.12	0.02	0.14	1.44	8.00	0.48	0.43	0.04	0.05	0.53
22	546	11.83	23.95	41.24	1.53	0.23	2.41	23.93	105.13	1.27	2.03	2.97	0.12	0.01	0.15	1.44	8.00	0.48	0.43	0.04	0.05	0.53
23	572	12.00	24.18	41.47	1.59	0.16	2.35	24.04	105.80	1.28	2.04	2.97	0.12	0.01	0.14	1.44	8.00	0.48	0.43	0.04	0.05	0.53
24	598	11.68	23.67	41.00	1.50	0.18	2.22	23.77	104.01	1.27	2.03	2.98	0.12	0.01	0.14	1.45	7.99	0.49	0.43	0.04	0.05	0.53
25	624	11.60	23.67	40.98	1.57	0.25	2.23	23.70	104.00	1.26	2.03	2.98	0.12	0.01	0.14	1.44	7.99	0.49	0.42	0.04	0.05	0.53
26	650	11.90	23.66	41.23	1.58	0.14	2.40	23.73	104.64	1.28	2.02	2.98	0.12	0.01	0.15	1.44	8.00	0.48	0.43	0.04	0.05	0.53
27	676	11.84	23.81	41.26	1.51	0.26	2.35	23.94	104.97	1.27	2.03	2.98	0.12	0.01	0.14	1.44	8.00	0.49	0.43	0.04	0.05	0.53
29	728	11.62	23.63	41.23	1.49	0.11	2.25	23.34	103.68	1.26	2.03	3.00	0.12	0.01	0.14	1.42	7.98	0.48	0.43	0.04	0.05	0.53
30	754	11.50	23.46	40.64	1.53	0.23	2.35	23.74	103.46	1.26	2.03	2.98	0.12	0.01	0.15	1.46	8.00	0.49	0.42	0.04	0.05	0.54
31	780	11.86	23.87	41.28	1.59	0.22	2.35	24.21	105.38	1.27	2.02	2.97	0.12	0.01	0.14	1.46	8.00	0.49	0.42	0.04	0.05	0.53
32	806	11.42	23.50	41.20	1.51	0.15	2.38	24.51	104.68	1.24	2.01	2.99	0.12	0.01	0.15	1.49	8.00	0.50	0.41	0.04	0.05	0.55
34	858	11.72	24.00	40.86	1.64	0.27	2.41	24.51	105.40	1.26	2.04	2.95	0.13	0.01	0.15	1.48	8.02	0.49	0.42	0.04	0.05	0.54

35	884	11.12	23.35	40.08	1.54	0.23	2.36	24.44	103.12	1.22	2.03	2.96	0.12	0.01	0.15	1.51	8.01	0.50	0.41	0.04	0.05	0.55
36	910	11.32	23.96	41.01	1.55	0.16	2.40	24.42	104.82	1.22	2.05	2.97	0.12	0.01	0.15	1.48	8.00	0.50	0.41	0.04	0.05	0.55
37	936	10.77	23.59	41.22	1.62	0.15	2.45	24.96	104.74	1.17	2.02	3.00	0.13	0.01	0.15	1.52	7.99	0.51	0.39	0.04	0.05	0.57
39	988	9.55	23.65	40.79	1.69	0.08	2.47	26.88	105.10	1.04	2.04	2.98	0.13	0.00	0.15	1.64	7.99	0.55	0.35	0.04	0.05	0.61
40	1014	10.04	23.84	40.90	1.62	0.20	2.32	26.26	105.17	1.09	2.05	2.98	0.13	0.01	0.14	1.60	7.99	0.54	0.37	0.04	0.05	0.59
42	1066	11.53	23.82	41.12	1.51	0.28	2.41	24.77	105.43	1.24	2.03	2.97	0.12	0.02	0.15	1.49	8.01	0.50	0.41	0.04	0.05	0.55
43	1092	11.56	24.05	41.06	1.48	0.25	2.48	24.93	105.81	1.24	2.04	2.95	0.11	0.01	0.15	1.50	8.01	0.50	0.41	0.04	0.05	0.55
44	1118	11.15	23.43	40.40	1.36	0.09	2.25	23.95	102.64	1.23	2.04	2.99	0.11	0.01	0.14	1.48	7.99	0.50	0.42	0.04	0.05	0.55
46	1170	11.96	23.76	40.98	1.38	0.25	2.35	24.22	104.89	1.29	2.03	2.96	0.11	0.01	0.14	1.47	8.01	0.49	0.43	0.04	0.05	0.53
47	1196	12.01	23.92	41.52	1.31	0.20	2.32	23.81	105.09	1.29	2.03	2.99	0.10	0.01	0.14	1.43	7.99	0.48	0.43	0.03	0.05	0.53
48	1222	11.96	23.77	40.91	1.26	0.26	2.28	23.91	104.35	1.29	2.03	2.97	0.10	0.01	0.14	1.45	8.00	0.49	0.43	0.03	0.05	0.53
51	1300	12.29	23.67	41.47	1.11	0.11	2.27	23.63	104.55	1.32	2.01	3.00	0.09	0.01	0.14	1.43	7.99	0.48	0.44	0.03	0.05	0.52
53	1352	12.20	24.03	41.46	1.06	0.18	2.18	23.93	105.04	1.31	2.04	2.98	0.08	0.01	0.13	1.44	7.99	0.49	0.44	0.03	0.04	0.52
54	1378	12.33	24.18	41.53	1.08	0.22	2.45	23.63	105.42	1.32	2.04	2.98	0.08	0.01	0.15	1.42	7.99	0.48	0.44	0.03	0.05	0.52
55	1404	12.32	23.96	41.33	1.03	0.16	2.28	23.53	104.60	1.32	2.04	2.98	0.08	0.01	0.14	1.42	7.99	0.48	0.45	0.03	0.05	0.52
56	1430	12.33	23.98	40.85	1.01	0.18	2.17	23.69	104.20	1.33	2.05	2.96	0.08	0.01	0.13	1.44	8.00	0.48	0.45	0.03	0.04	0.52
57	1456	12.46	23.81	41.13	1.03	0.27	2.25	23.82	104.76	1.34	2.03	2.97	0.08	0.01	0.14	1.44	8.00	0.48	0.45	0.03	0.05	0.52
58	1482	12.32	24.08	41.41	0.99	0.34	2.26	23.71	105.10	1.32	2.04	2.97	0.08	0.02	0.14	1.42	7.99	0.48	0.45	0.03	0.05	0.52
59	1508	12.33	23.88	41.22	0.93	0.26	2.33	23.59	104.54	1.33	2.03	2.98	0.07	0.01	0.14	1.43	7.99	0.48	0.45	0.02	0.05	0.52
60	1534	12.59	23.94	41.32	0.91	0.25	2.33	23.74	105.07	1.35	2.03	2.97	0.07	0.01	0.14	1.43	8.00	0.48	0.45	0.02	0.05	0.51
63	1612	12.31	23.64	41.52	0.90	0.13	2.12	23.73	104.35	1.33	2.01	3.00	0.07	0.01	0.13	1.43	7.98	0.48	0.45	0.02	0.04	0.52
64	1638	12.70	24.29	41.48	0.99	0.26	2.24	23.81	105.77	1.35	2.04	2.96	0.08	0.01	0.14	1.42	8.00	0.48	0.45	0.03	0.05	0.51
65	1664	12.65	23.92	41.40	0.96	0.19	2.28	23.87	105.28	1.35	2.02	2.97	0.07	0.01	0.14	1.43	8.01	0.48	0.45	0.02	0.05	0.51
67	1716	12.43	24.02	41.47	0.98	0.20	2.31	23.38	104.78	1.33	2.04	2.98	0.08	0.01	0.14	1.41	7.99	0.48	0.45	0.03	0.05	0.51
68	1742	12.36	23.92	41.44	0.99	0.21	2.13	23.56	104.60	1.33	2.03	2.99	0.08	0.01	0.13	1.42	7.99	0.48	0.45	0.03	0.04	0.52
69	1768	12.42	24.23	41.40	1.03	0.29	2.33	23.64	105.35	1.33	2.05	2.97	0.08	0.02	0.14	1.42	7.99	0.48	0.45	0.03	0.05	0.52
70	1794	12.39	23.90	41.73	1.10	0.05	2.17	24.09	105.42	1.32	2.02	2.99	0.08	0.00	0.13	1.44	8.00	0.48	0.44	0.03	0.04	0.52
71	1820	12.48	23.77	41.31	1.17	0.24	2.18	23.55	104.71	1.34	2.02	2.98	0.09	0.01	0.13	1.42	8.00	0.48	0.45	0.03	0.04	0.51
72	1846	12.39	24.08	41.50	1.21	0.22	2.33	24.11	105.85	1.32	2.03	2.97	0.09	0.01	0.14	1.44	8.01	0.48	0.44	0.03	0.05	0.52
73	1872	12.29	24.05	41.61	1.25	0.23	2.21	24.01	105.66	1.31	2.03	2.98	0.10	0.01	0.13	1.44	8.00	0.48	0.44	0.03	0.05	0.52
75	1924	12.24	23.74	41.04	1.32	0.34	2.20	23.43	104.32	1.32	2.03	2.97	0.10	0.02	0.14	1.42	8.00	0.48	0.44	0.03	0.05	0.52

77	1976	11.95	23.81	40.82	1.42	0.18	2.24	22.80	103.22	1.30	2.05	2.98	0.11	0.01	0.14	1.39	7.98	0.47	0.44	0.04	0.05	0.52
78	2002	12.22	23.97	41.64	1.52	0.22	2.30	23.63	105.50	1.30	2.02	2.98	0.12	0.01	0.14	1.42	7.99	0.48	0.44	0.04	0.05	0.52
79	2028	12.36	24.36	41.76	1.55	0.13	2.30	23.49	105.96	1.31	2.05	2.97	0.12	0.01	0.14	1.40	8.00	0.47	0.44	0.04	0.05	0.52
80	2054	11.97	23.91	41.45	1.61	0.21	2.35	23.10	104.60	1.29	2.03	2.99	0.12	0.01	0.14	1.39	7.98	0.47	0.44	0.04	0.05	0.52

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.4: Composition of garnet A9 from sample HJ-35d (group 1) as analysed along traverse A-B (Plate 4.4c). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	12.37	23.53	41.50	1.63	0.14	2.02	23.34	104.53	1.33	2.00	3.00	0.13	0.01	0.12	1.41	8.00	0.47	0.45	0.04	0.04	0.51
4	78	12.42	23.39	41.09	1.64	0.32	1.97	22.57	103.40	1.35	2.01	2.99	0.13	0.02	0.12	1.37	7.99	0.46	0.45	0.04	0.04	0.50
5	104	12.25	24.03	41.89	1.65	0.12	2.09	22.98	105.01	1.31	2.03	3.00	0.13	0.01	0.13	1.38	7.98	0.47	0.45	0.04	0.04	0.51
6	130	12.26	23.67	42.04	1.63	0.09	1.97	23.02	104.68	1.31	2.00	3.02	0.13	0.01	0.12	1.38	7.97	0.47	0.45	0.04	0.04	0.51
7	156	12.59	23.85	42.27	1.76	0.05	1.95	23.24	105.71	1.34	2.00	3.01	0.13	0.00	0.12	1.38	7.99	0.47	0.45	0.05	0.04	0.51
8	182	12.33	23.99	41.68	1.65	0.23	2.16	22.88	104.92	1.32	2.03	2.99	0.13	0.01	0.13	1.37	7.98	0.47	0.45	0.04	0.04	0.51
9	208	12.37	23.53	41.94	1.63	0.15	2.17	22.77	104.57	1.33	2.00	3.02	0.13	0.01	0.13	1.37	7.98	0.46	0.45	0.04	0.04	0.51
10	234	12.51	23.78	42.20	1.55	0.21	2.07	23.56	105.88	1.33	2.00	3.00	0.12	0.01	0.13	1.40	7.99	0.47	0.45	0.04	0.04	0.51
12	286	12.24	23.85	41.84	1.64	0.15	2.00	23.24	104.95	1.31	2.02	3.00	0.13	0.01	0.12	1.39	7.98	0.47	0.44	0.04	0.04	0.52
15	364	12.16	23.58	41.96	1.49	0.15	2.07	23.06	104.48	1.31	2.00	3.02	0.12	0.01	0.13	1.39	7.97	0.47	0.44	0.04	0.04	0.52
19	468	12.52	23.86	41.54	1.56	0.16	1.96	23.32	104.92	1.34	2.02	2.99	0.12	0.01	0.12	1.40	8.00	0.47	0.45	0.04	0.04	0.51
21	494	12.45	23.75	41.81	1.58	0.23	2.06	23.38	105.26	1.33	2.01	3.00	0.12	0.01	0.13	1.40	7.99	0.47	0.45	0.04	0.04	0.51
22	546	12.77	24.35	41.88	1.62	0.08	1.97	23.27	105.94	1.35	2.04	2.98	0.12	0.00	0.12	1.38	8.00	0.46	0.45	0.04	0.04	0.51
23	572	12.77	23.99	41.83	1.62	0.14	1.98	22.83	105.17	1.36	2.02	2.99	0.12	0.01	0.12	1.37	7.99	0.46	0.46	0.04	0.04	0.50
25	624	12.55	23.97	41.89	1.55	0.16	1.96	23.33	105.41	1.34	2.02	2.99	0.12	0.01	0.12	1.39	7.99	0.47	0.45	0.04	0.04	0.51
27	676	12.57	23.67	41.64	1.55	0.20	1.94	22.59	104.14	1.35	2.01	3.00	0.12	0.01	0.12	1.36	7.98	0.46	0.46	0.04	0.04	0.50
28	702	12.35	23.29	41.30	1.44	0.10	2.01	22.28	102.77	1.34	2.01	3.02	0.11	0.01	0.12	1.36	7.97	0.46	0.46	0.04	0.04	0.50
32	806	12.76	23.87	41.60	1.56	0.16	2.01	22.69	104.65	1.37	2.02	2.99	0.12	0.01	0.12	1.36	7.99	0.46	0.46	0.04	0.04	0.50
36	910	12.78	23.89	41.77	1.61	0.31	2.08	23.00	105.45	1.36	2.01	2.98	0.12	0.02	0.13	1.37	7.99	0.46	0.46	0.04	0.04	0.50
39	988	12.65	23.75	41.50	1.50	0.14	1.93	22.70	104.16	1.36	2.02	3.00	0.12	0.01	0.12	1.37	7.99	0.46	0.46	0.04	0.04	0.50
42	1066	12.79	23.94	41.18	1.50	0.18	1.85	22.81	104.25	1.38	2.04	2.97	0.12	0.01	0.11	1.38	8.00	0.46	0.46	0.04	0.04	0.50
43	1092	12.47	23.71	41.61	1.51	0.11	2.09	22.64	104.14	1.34	2.02	3.00	0.12	0.01	0.13	1.37	7.98	0.46	0.45	0.04	0.04	0.50
46	1170	12.76	24.03	41.82	1.62	0.17	2.05	23.35	105.81	1.36	2.02	2.98	0.12	0.01	0.12	1.39	8.00	0.46	0.45	0.04	0.04	0.51
49	1248	12.63	24.14	41.85	1.71	0.25	2.10	22.74	105.41	1.34	2.03	2.99	0.13	0.01	0.13	1.36	7.99	0.46	0.45	0.04	0.04	0.50

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.5: Composition of garnet A9 from sample HJ-35d (group 1) as analysed along traverse C-D (Plate 4.4c). Distance is in mircons from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
2	35	12.17	23.76	41.96	1.64	0.14	2.05	23.37	105.10	1.30	2.01	3.01	0.13	0.01	0.12	1.40	7.98	0.47	0.44	0.04	0.04	0.52
3	70	12.27	24.12	41.75	1.57	0.21	1.92	23.61	105.45	1.31	2.03	2.99	0.12	0.01	0.12	1.41	7.99	0.48	0.44	0.04	0.04	0.52
5	140	12.51	23.85	42.31	1.56	0.00	2.15	23.30	105.68	1.33	2.00	3.01	0.12	0.00	0.13	1.39	7.98	0.47	0.45	0.04	0.04	0.51
11	350	12.67	24.11	42.22	1.58	0.28	2.01	23.03	105.90	1.34	2.02	3.00	0.12	0.01	0.12	1.37	7.98	0.46	0.45	0.04	0.04	0.50
12	385	12.35	23.62	41.62	1.53	0.11	1.95	22.63	103.81	1.33	2.01	3.01	0.12	0.01	0.12	1.37	7.97	0.47	0.45	0.04	0.04	0.51
13	420	12.63	24.12	42.39	1.61	0.10	2.06	22.95	105.86	1.34	2.02	3.01	0.12	0.01	0.12	1.36	7.98	0.46	0.45	0.04	0.04	0.50
14	455	12.64	24.00	41.99	1.59	0.10	2.08	22.77	105.17	1.35	2.02	3.00	0.12	0.01	0.13	1.36	7.98	0.46	0.46	0.04	0.04	0.50
15	490	12.64	24.14	41.57	1.58	0.19	1.87	22.91	104.90	1.35	2.04	2.98	0.12	0.01	0.11	1.37	7.99	0.46	0.46	0.04	0.04	0.50
16	525	12.52	23.92	41.84	1.58	0.20	2.10	22.75	104.91	1.34	2.02	3.00	0.12	0.01	0.13	1.36	7.98	0.46	0.45	0.04	0.04	0.50
17	560	12.49	23.90	42.05	1.48	0.09	1.92	22.99	104.92	1.33	2.02	3.01	0.11	0.00	0.12	1.38	7.97	0.47	0.45	0.04	0.04	0.51
18	595	12.28	23.74	41.56	1.61	0.14	1.96	22.51	103.80	1.32	2.02	3.01	0.12	0.01	0.12	1.36	7.97	0.46	0.45	0.04	0.04	0.51
19	630	12.62	23.89	41.46	1.67	0.21	2.06	22.92	104.83	1.35	2.02	2.98	0.13	0.01	0.13	1.38	8.00	0.46	0.45	0.04	0.04	0.50
20	665	12.46	23.92	41.64	1.56	0.18	2.02	22.71	104.49	1.34	2.03	3.00	0.12	0.01	0.12	1.37	7.98	0.46	0.45	0.04	0.04	0.51

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.6: Composition of garnet A10 from sample HJ-35d (group 1) as analysed along traverse C-D (Plate 4.4d). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	11.91	23.93	41.36	1.72	0.13	2.04	23.87	104.97	1.28	2.03	2.98	0.13	0.01	0.12	1.44	8.00	0.48	0.43	0.04	0.04	0.53
2	15	11.90	24.15	41.09	1.60	0.28	2.01	23.97	105.00	1.28	2.05	2.96	0.12	0.02	0.12	1.44	8.00	0.49	0.43	0.04	0.04	0.53
3	30	11.77	23.72	40.96	1.53	0.31	2.19	24.01	104.49	1.27	2.03	2.97	0.12	0.02	0.13	1.46	8.00	0.49	0.43	0.04	0.05	0.53
5	60	11.67	23.96	41.37	1.58	0.25	2.04	23.88	104.75	1.26	2.04	2.99	0.12	0.01	0.12	1.44	7.98	0.49	0.43	0.04	0.04	0.53
9	120	11.48	23.47	40.93	1.48	0.10	2.15	23.33	102.94	1.26	2.03	3.00	0.12	0.01	0.13	1.43	7.98	0.49	0.43	0.04	0.05	0.53
10	135	11.94	24.00	41.46	1.51	0.17	2.22	23.76	105.06	1.28	2.04	2.98	0.12	0.01	0.14	1.43	7.99	0.48	0.43	0.04	0.05	0.53
11	150	12.06	24.28	41.31	1.61	0.20	2.09	24.33	105.87	1.29	2.05	2.96	0.12	0.01	0.13	1.46	8.01	0.49	0.43	0.04	0.04	0.53
12	165	11.96	24.10	41.24	1.49	0.20	2.07	23.92	104.98	1.28	2.05	2.97	0.12	0.01	0.13	1.44	8.00	0.49	0.43	0.04	0.04	0.53
13	180	11.92	23.48	40.46	1.57	0.24	1.93	23.26	102.86	1.31	2.03	2.97	0.12	0.01	0.12	1.43	8.00	0.48	0.44	0.04	0.04	0.52
14	195	11.87	23.71	41.12	1.50	0.20	2.08	23.36	103.83	1.29	2.03	2.99	0.12	0.01	0.13	1.42	7.98	0.48	0.44	0.04	0.04	0.52
15	210	12.10	23.86	40.92	1.49	0.17	2.14	23.50	104.18	1.31	2.04	2.97	0.12	0.01	0.13	1.43	8.00	0.48	0.44	0.04	0.04	0.52
16	225	11.83	24.95	41.36	1.49	0.28	2.11	23.67	105.69	1.26	2.10	2.95	0.11	0.02	0.13	1.41	7.98	0.49	0.43	0.04	0.04	0.53
17	240	12.13	24.26	41.42	1.48	0.15	2.01	24.10	105.56	1.30	2.05	2.97	0.11	0.01	0.12	1.44	8.00	0.49	0.44	0.04	0.04	0.53
19	270	12.17	24.07	41.32	1.60	0.26	2.20	24.14	105.77	1.30	2.03	2.96	0.12	0.01	0.13	1.45	8.01	0.48	0.43	0.04	0.04	0.53
20	285	12.01	23.89	40.84	1.63	0.17	1.99	23.72	104.24	1.30	2.04	2.96	0.13	0.01	0.12	1.44	8.00	0.48	0.43	0.04	0.04	0.53
21	300	11.89	23.38	40.71	1.51	0.23	2.10	23.30	103.11	1.30	2.02	2.98	0.12	0.01	0.13	1.43	7.99	0.48	0.44	0.04	0.04	0.52
22	315	11.92	23.90	40.63	1.54	0.28	2.06	23.60	103.92	1.29	2.05	2.96	0.12	0.02	0.13	1.44	8.00	0.48	0.43	0.04	0.04	0.53
23	330	11.93	23.82	41.12	1.57	0.16	2.04	23.36	103.99	1.29	2.04	2.98	0.12	0.01	0.13	1.42	7.99	0.48	0.44	0.04	0.04	0.52
24	345	12.14	24.10	41.26	1.56	0.19	2.25	23.46	104.95	1.30	2.04	2.97	0.12	0.01	0.14	1.41	8.00	0.48	0.44	0.04	0.05	0.52
25	360	12.02	23.89	41.49	1.52	0.17	2.01	23.75	104.85	1.29	2.03	2.99	0.12	0.01	0.12	1.43	7.99	0.48	0.44	0.04	0.04	0.53
26	375	12.28	23.94	41.18	1.57	0.11	2.09	23.58	104.76	1.32	2.04	2.97	0.12	0.01	0.13	1.42	8.01	0.48	0.44	0.04	0.04	0.52
27	390	11.89	23.97	41.22	1.55	0.21	2.06	23.42	104.32	1.28	2.04	2.98	0.12	0.01	0.13	1.42	7.98	0.48	0.44	0.04	0.04	0.52
28	405	12.22	23.57	41.23	1.54	0.07	2.00	23.53	104.16	1.32	2.01	2.99	0.12	0.00	0.12	1.43	8.00	0.48	0.44	0.04	0.04	0.52
30	435	12.00	24.20	41.15	1.63	0.29	2.03	23.71	105.02	1.29	2.05	2.96	0.13	0.02	0.12	1.43	8.00	0.48	0.43	0.04	0.04	0.53
21	450	11.99	23.84	41.40	1.58	0.20	2.09	24.03	105.13	1.29	2.02	2.98	0.12	0.01	0.13	1.45	8.00	0.48	0.43	0.04	0.04	0.53
32	465	12.22	24.04	41.12	1.60	0.19	2.09	23.96	105.22	1.31	2.04	2.96	0.12	0.01	0.13	1.44	8.01	0.48	0.44	0.04	0.04	0.52

33	480	11.82	24.02	41.59	1.57	0.16	1.96	23.66	104.77	1.27	2.04	3.00	0.12	0.01	0.12	1.42	7.98	0.49	0.43	0.04	0.04	0.53
34	495	11.96	23.61	40.77	1.52	0.10	1.91	23.35	103.23	1.30	2.04	2.98	0.12	0.01	0.12	1.43	7.99	0.48	0.44	0.04	0.04	0.52
35	510	11.86	24.10	41.37	1.55	0.14	2.05	23.69	104.76	1.27	2.05	2.98	0.12	0.01	0.13	1.43	7.99	0.48	0.43	0.04	0.04	0.53
36	525	12.07	23.83	41.38	1.63	0.21	2.16	23.99	105.27	1.29	2.02	2.98	0.13	0.01	0.13	1.44	8.00	0.48	0.43	0.04	0.04	0.53
37	540	12.12	23.97	41.48	1.59	0.17	2.11	24.03	105.48	1.30	2.03	2.98	0.12	0.01	0.13	1.44	8.00	0.48	0.43	0.04	0.04	0.53
38	555	12.15	24.08	40.88	1.60	0.22	2.26	23.52	104.69	1.31	2.05	2.95	0.12	0.01	0.14	1.42	8.01	0.48	0.44	0.04	0.05	0.52
39	570	12.12	24.16	41.50	1.71	0.30	2.22	23.94	105.95	1.29	2.03	2.97	0.13	0.02	0.13	1.43	8.00	0.48	0.43	0.04	0.04	0.53
40	585	11.53	23.83	40.61	1.77	0.14	2.15	23.02	103.06	1.26	2.06	2.98	0.14	0.01	0.13	1.41	7.99	0.48	0.43	0.05	0.05	0.53

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.7: Composition of garnet A1 from sample HJ-35a (group 1) as analysed along traverse A-B (Plate 4.4g). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	9.97	21.54	38.60	0.69	0.00	1.45	26.10	98.36	1.16	1.98	3.01	0.06	0.00	0.10	1.70	8.00	0.56	0.38	0.02	0.03	0.59
2	14	10.14	21.80	38.70	0.66	0.00	1.46	26.43	99.18	1.17	1.99	2.99	0.06	0.00	0.10	1.71	8.01	0.56	0.39	0.02	0.03	0.59
3	28	10.05	21.86	39.16	0.78	0.00	1.40	26.40	99.65	1.15	1.98	3.01	0.06	0.00	0.09	1.70	8.00	0.57	0.38	0.02	0.03	0.60
4	42	10.05	21.70	38.78	0.77	0.00	1.52	26.39	99.20	1.16	1.98	3.00	0.06	0.00	0.10	1.71	8.01	0.56	0.38	0.02	0.03	0.60
5	56	10.04	21.73	38.54	0.76	0.00	1.54	26.25	98.86	1.16	1.99	2.99	0.06	0.00	0.10	1.70	8.01	0.56	0.38	0.02	0.03	0.59
6	70	9.90	21.82	38.79	0.77	0.00	1.48	26.27	99.04	1.14	1.99	3.00	0.06	0.00	0.10	1.70	8.00	0.57	0.38	0.02	0.03	0.60
7	84	10.06	21.80	38.89	0.74	0.00	1.46	26.72	99.65	1.16	1.98	3.00	0.06	0.00	0.10	1.72	8.01	0.57	0.38	0.02	0.03	0.60
8	98	10.09	21.66	38.58	0.71	0.00	1.39	26.61	99.04	1.17	1.98	2.99	0.06	0.00	0.09	1.73	8.02	0.57	0.38	0.02	0.03	0.60
9	112	9.95	21.73	38.64	0.75	0.00	1.49	26.30	98.86	1.15	1.99	3.00	0.06	0.00	0.10	1.71	8.01	0.57	0.38	0.02	0.03	0.60
10	126	10.12	21.75	38.91	0.66	0.00	1.51	26.66	99.61	1.16	1.98	3.00	0.05	0.00	0.10	1.72	8.01	0.57	0.38	0.02	0.03	0.60
11	140	9.86	21.61	38.62	0.75	0.00	1.60	26.51	98.95	1.14	1.98	3.00	0.06	0.00	0.11	1.72	8.01	0.57	0.38	0.02	0.03	0.60
12	154	9.95	21.67	38.77	0.80	0.00	1.55	26.47	99.22	1.15	1.98	3.00	0.07	0.00	0.10	1.71	8.01	0.57	0.38	0.02	0.03	0.60
13	168	9.85	21.72	38.78	0.79	0.00	1.48	26.59	99.19	1.14	1.98	3.00	0.07	0.00	0.10	1.72	8.01	0.57	0.38	0.02	0.03	0.60
14	182	9.72	21.56	38.68	0.73	0.00	1.45	26.66	98.80	1.13	1.98	3.01	0.06	0.00	0.10	1.73	8.00	0.57	0.37	0.02	0.03	0.61
15	196	9.61	21.71	38.56	0.79	0.00	1.61	26.92	99.18	1.11	1.99	2.99	0.07	0.00	0.11	1.75	8.01	0.58	0.37	0.02	0.03	0.61
16	210	9.69	21.67	38.90	0.74	0.00	1.46	26.93	99.40	1.12	1.98	3.01	0.06	0.00	0.10	1.74	8.00	0.58	0.37	0.02	0.03	0.61
17	224	9.81	21.72	38.80	0.78	0.00	1.58	27.32	100.00	1.13	1.97	2.99	0.06	0.00	0.10	1.76	8.02	0.58	0.37	0.02	0.03	0.61
18	238	9.73	21.68	38.80	0.82	0.00	1.59	26.69	99.32	1.12	1.98	3.00	0.07	0.00	0.10	1.73	8.01	0.57	0.37	0.02	0.03	0.61
19	252	9.62	21.71	38.81	0.80	0.00	1.58	26.99	99.51	1.11	1.98	3.00	0.07	0.00	0.10	1.75	8.01	0.58	0.37	0.02	0.03	0.61
20	266	9.75	21.85	38.82	0.82	0.00	1.57	27.21	100.03	1.12	1.98	2.99	0.07	0.00	0.10	1.75	8.02	0.58	0.37	0.02	0.03	0.61
21	280	9.63	21.97	39.12	0.82	0.00	1.58	27.37	100.48	1.10	1.98	3.00	0.07	0.00	0.10	1.75	8.01	0.58	0.36	0.02	0.03	0.61
22	294	9.47	21.75	38.55	0.86	0.00	1.57	27.23	99.42	1.09	1.99	2.99	0.07	0.00	0.10	1.77	8.02	0.58	0.36	0.02	0.03	0.62
23	308	9.44	21.63	38.71	0.84	0.00	1.52	27.12	99.26	1.09	1.98	3.00	0.07	0.00	0.10	1.76	8.01	0.58	0.36	0.02	0.03	0.62
24	322	9.26	21.69	38.56	0.91	0.00	1.70	27.46	99.57	1.07	1.98	2.99	0.08	0.00	0.11	1.78	8.02	0.59	0.35	0.03	0.04	0.62
25	336	9.06	21.80	38.68	0.86	0.00	1.59	27.26	99.24	1.05	2.00	3.01	0.07	0.00	0.10	1.77	8.00	0.59	0.35	0.02	0.03	0.63

Table 1.8: Composition of garnet 35a from sample HJ-35a (group 1) as analysed along traverse C-D (Plate 4.4g). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	9.08	21.48	38.18	0.71	0.00	1.60	27.57	98.62	1.06	1.99	2.99	0.06	0.00	0.11	1.81	8.01	0.60	0.35	0.02	0.04	0.63
2	20	9.93	23.44	39.84	0.68	0.00	1.35	26.54	101.77	1.11	2.07	2.99	0.05	0.00	0.09	1.66	7.98	0.57	0.38	0.02	0.03	0.60
3	40	9.77	21.70	38.58	0.75	0.00	1.44	26.71	98.95	1.13	1.99	3.00	0.06	0.00	0.09	1.74	8.01	0.57	0.37	0.02	0.03	0.61
4	60	9.81	21.73	38.59	0.75	0.00	1.39	26.63	98.89	1.14	1.99	3.00	0.06	0.00	0.09	1.73	8.01	0.57	0.38	0.02	0.03	0.60
5	80	9.86	21.76	38.60	0.72	0.00	1.39	26.57	98.89	1.14	1.99	3.00	0.06	0.00	0.09	1.73	8.01	0.57	0.38	0.02	0.03	0.60
7	120	9.87	21.64	38.69	0.76	0.00	1.45	26.66	99.07	1.14	1.98	3.00	0.06	0.00	0.10	1.73	8.01	0.57	0.38	0.02	0.03	0.60
8	140	9.83	21.67	38.80	0.77	0.00	1.54	26.54	99.15	1.14	1.98	3.01	0.06	0.00	0.10	1.72	8.00	0.57	0.38	0.02	0.03	0.60
9	160	9.97	21.76	38.61	0.74	0.00	1.53	26.84	99.46	1.15	1.98	2.99	0.06	0.00	0.10	1.74	8.02	0.57	0.38	0.02	0.03	0.60
10	180	10.03	21.73	38.82	0.78	0.00	1.53	26.32	99.21	1.16	1.98	3.00	0.06	0.00	0.10	1.70	8.01	0.56	0.38	0.02	0.03	0.60
11	200	10.01	21.66	38.91	0.79	0.04	1.56	26.71	99.68	1.15	1.97	3.00	0.07	0.00	0.10	1.72	8.01	0.57	0.38	0.02	0.03	0.60
12	220	10.01	21.64	38.77	0.74	0.00	1.44	26.15	98.75	1.16	1.98	3.01	0.06	0.00	0.09	1.70	8.00	0.56	0.38	0.02	0.03	0.59
13	240	9.97	21.89	38.54	0.83	0.00	1.42	26.57	99.23	1.15	2.00	2.98	0.07	0.00	0.09	1.72	8.02	0.57	0.38	0.02	0.03	0.60
14	260	9.75	21.58	38.97	0.81	0.00	1.48	26.41	99.00	1.13	1.97	3.02	0.07	0.00	0.10	1.71	7.99	0.57	0.38	0.02	0.03	0.60
15	280	9.89	21.78	38.72	0.83	0.00	1.56	27.02	99.80	1.14	1.98	2.99	0.07	0.00	0.10	1.74	8.02	0.57	0.37	0.02	0.03	0.61
16	300	9.92	21.63	38.95	0.78	0.00	1.44	26.61	99.33	1.14	1.97	3.01	0.06	0.00	0.09	1.72	8.00	0.57	0.38	0.02	0.03	0.60
17	320	9.75	21.78	38.71	0.75	0.00	1.46	26.80	99.24	1.13	1.99	3.00	0.06	0.00	0.10	1.74	8.01	0.57	0.37	0.02	0.03	0.61
18	340	9.82	21.64	38.62	0.81	0.00	1.58	26.95	99.43	1.13	1.98	2.99	0.07	0.00	0.10	1.75	8.02	0.57	0.37	0.02	0.03	0.61
19	360	9.60	21.65	38.93	0.77	0.00	1.50	27.02	99.47	1.11	1.97	3.01	0.06	0.00	0.10	1.75	8.00	0.58	0.37	0.02	0.03	0.61
20	380	9.59	21.76	38.75	0.84	0.00	1.56	27.17	99.66	1.11	1.98	3.00	0.07	0.00	0.10	1.76	8.01	0.58	0.36	0.02	0.03	0.61
21	400	9.51	21.57	38.51	0.77	0.00	1.46	27.56	99.39	1.10	1.98	2.99	0.06	0.00	0.10	1.79	8.02	0.59	0.36	0.02	0.03	0.62
22	420	9.33	21.51	38.12	0.64	0.00	1.59	26.75	97.94	1.09	1.99	3.00	0.05	0.00	0.11	1.76	8.01	0.58	0.36	0.02	0.04	0.62
23	440	9.35	21.70	38.77	0.62	0.00	1.58	27.52	99.55	1.08	1.98	3.00	0.05	0.00	0.10	1.78	8.00	0.59	0.36	0.02	0.03	0.62
24	460	9.37	21.63	38.53	0.62	0.00	1.67	27.77	99.58	1.08	1.98	2.99	0.05	0.00	0.11	1.80	8.02	0.59	0.36	0.02	0.04	0.62
25	480	9.13	21.87	39.00	0.77	0.00	1.57	27.52	99.85	1.05	1.99	3.01	0.06	0.00	0.10	1.78	7.99	0.59	0.35	0.02	0.03	0.63

Table 1.9: Composition of garnet A8 from sample HJ-35a (group 1) as analysed along traverse A-B (Plate 4.4h). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	8.18	21.54	38.46	0.72	0.00	1.37	28.65	98.91	0.96	1.99	3.02	0.06	0.00	0.09	1.88	7.99	0.63	0.32	0.02	0.03	0.66
2	10	8.38	21.28	38.24	0.62	0.00	1.36	28.67	98.55	0.98	1.98	3.01	0.05	0.00	0.09	1.89	8.00	0.63	0.33	0.02	0.03	0.66
3	20	8.74	21.32	38.42	0.49	0.00	1.55	28.48	98.99	1.02	1.97	3.01	0.04	0.00	0.10	1.87	8.01	0.62	0.34	0.01	0.03	0.65
4	30	8.83	21.41	38.39	0.51	0.00	1.38	28.42	98.94	1.03	1.98	3.01	0.04	0.00	0.09	1.86	8.01	0.62	0.34	0.01	0.03	0.64
5	40	9.05	21.55	38.42	0.50	0.00	1.35	28.02	98.88	1.05	1.99	3.00	0.04	0.00	0.09	1.83	8.00	0.61	0.35	0.01	0.03	0.63
6	50	9.17	21.65	38.58	0.53	0.00	1.43	27.74	99.09	1.06	1.99	3.00	0.04	0.00	0.09	1.81	8.00	0.60	0.35	0.01	0.03	0.63
7	60	9.12	21.68	38.45	0.68	0.00	1.40	27.50	98.82	1.06	1.99	3.00	0.06	0.00	0.09	1.80	8.00	0.60	0.35	0.02	0.03	0.63
8	70	9.37	21.54	38.58	0.74	0.00	1.32	27.25	98.80	1.09	1.98	3.01	0.06	0.00	0.09	1.78	8.00	0.59	0.36	0.02	0.03	0.62
9	80	9.35	21.67	38.67	0.66	0.00	1.39	27.18	98.92	1.08	1.99	3.01	0.05	0.00	0.09	1.77	8.00	0.59	0.36	0.02	0.03	0.62
10	90	9.51	21.83	38.78	0.72	0.00	1.31	27.88	100.03	1.09	1.98	2.99	0.06	0.00	0.09	1.80	8.02	0.59	0.36	0.02	0.03	0.62
11	100	9.64	21.69	39.06	0.70	0.00	1.36	27.40	99.86	1.11	1.97	3.01	0.06	0.00	0.09	1.77	8.00	0.58	0.37	0.02	0.03	0.61
14	130	9.60	21.78	38.92	0.75	0.00	1.27	27.21	99.53	1.11	1.98	3.01	0.06	0.00	0.08	1.76	8.00	0.58	0.37	0.02	0.03	0.61
15	140	9.58	21.69	38.81	0.80	0.00	1.32	26.98	99.18	1.11	1.98	3.01	0.07	0.00	0.09	1.75	8.00	0.58	0.37	0.02	0.03	0.61
16	150	9.81	21.91	38.96	0.79	0.00	1.32	27.49	100.29	1.12	1.98	2.99	0.06	0.00	0.09	1.77	8.02	0.58	0.37	0.02	0.03	0.61
17	160	9.59	21.59	38.64	0.76	0.00	1.37	27.21	99.14	1.11	1.98	3.00	0.06	0.00	0.09	1.77	8.01	0.58	0.37	0.02	0.03	0.61
18	170	9.66	21.65	38.66	0.76	0.00	1.34	26.95	99.02	1.12	1.98	3.00	0.06	0.00	0.09	1.75	8.01	0.58	0.37	0.02	0.03	0.61
19	180	9.65	21.85	38.74	0.70	0.00	1.35	27.16	99.45	1.11	1.99	3.00	0.06	0.00	0.09	1.76	8.01	0.58	0.37	0.02	0.03	0.61
20	190	9.59	21.77	38.88	0.76	0.00	1.33	27.45	99.78	1.10	1.98	3.00	0.06	0.00	0.09	1.77	8.01	0.59	0.36	0.02	0.03	0.62
21	200	9.70	21.73	38.82	0.72	0.00	1.34	27.33	99.65	1.12	1.98	3.00	0.06	0.00	0.09	1.77	8.01	0.58	0.37	0.02	0.03	0.61
22	210	9.71	21.71	38.85	0.78	0.00	1.37	27.12	99.53	1.12	1.98	3.00	0.06	0.00	0.09	1.75	8.01	0.58	0.37	0.02	0.03	0.61
23	220	9.67	21.64	38.76	0.72	0.00	1.38	27.13	99.30	1.12	1.98	3.00	0.06	0.00	0.09	1.76	8.01	0.58	0.37	0.02	0.03	0.61
24	230	9.55	21.75	38.85	0.70	0.00	1.35	27.14	99.35	1.10	1.98	3.01	0.06	0.00	0.09	1.76	8.00	0.58	0.37	0.02	0.03	0.61
25	240	9.36	21.79	38.66	0.75	0.00	1.48	27.38	99.43	1.08	1.99	3.00	0.06	0.00	0.10	1.78	8.01	0.59	0.36	0.02	0.03	0.62

Table 1.10: Composition of garnet A8 from sample HJ-35a (group 1) as analysed along traverse C-D (Plate 4.4h). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	9.49	21.68	38.69	0.69	0.00	1.31	27.62	99.48	1.10	1.98	3.00	0.06	0.00	0.09	1.79	8.01	0.59	0.36	0.02	0.03	0.62
2	8	9.33	21.57	38.81	0.72	0.00	1.32	27.27	99.02	1.08	1.98	3.02	0.06	0.00	0.09	1.77	7.99	0.59	0.36	0.02	0.03	0.62
3	16	9.49	21.77	38.81	0.66	0.00	1.38	27.81	99.91	1.09	1.98	3.00	0.05	0.00	0.09	1.80	8.01	0.59	0.36	0.02	0.03	0.62
4	24	9.53	21.82	38.71	0.70	0.00	1.32	27.69	99.78	1.10	1.99	2.99	0.06	0.00	0.09	1.79	8.01	0.59	0.36	0.02	0.03	0.62
5	32	9.60	21.66	38.74	0.72	0.00	1.40	27.57	99.70	1.11	1.98	3.00	0.06	0.00	0.09	1.78	8.02	0.59	0.36	0.02	0.03	0.62
6	40	9.47	21.65	38.72	0.65	0.00	1.30	27.65	99.44	1.09	1.98	3.00	0.05	0.00	0.09	1.79	8.01	0.59	0.36	0.02	0.03	0.62
7	48	9.57	21.84	38.64	0.72	0.00	1.34	26.93	99.04	1.11	2.00	3.00	0.06	0.00	0.09	1.75	8.00	0.58	0.37	0.02	0.03	0.61
8	56	9.65	21.72	39.02	0.70	0.00	1.41	27.26	99.76	1.11	1.98	3.01	0.06	0.00	0.09	1.76	8.00	0.58	0.37	0.02	0.03	0.61
9	64	9.65	21.66	38.73	0.74	0.00	1.38	27.10	99.27	1.12	1.98	3.00	0.06	0.00	0.09	1.76	8.01	0.58	0.37	0.02	0.03	0.61
10	72	9.63	21.80	38.85	0.74	0.00	1.34	27.01	99.37	1.11	1.99	3.01	0.06	0.00	0.09	1.75	8.00	0.58	0.37	0.02	0.03	0.61
11	80	9.53	21.81	38.58	0.70	0.00	1.39	27.40	99.41	1.10	1.99	2.99	0.06	0.00	0.09	1.78	8.01	0.59	0.36	0.02	0.03	0.62
12	88	9.62	21.92	38.75	0.73	0.00	1.34	27.33	99.69	1.11	2.00	2.99	0.06	0.00	0.09	1.77	8.01	0.58	0.37	0.02	0.03	0.61
13	96	9.47	21.73	38.74	0.70	0.00	1.28	27.15	99.06	1.10	1.99	3.01	0.06	0.00	0.08	1.76	8.00	0.59	0.37	0.02	0.03	0.62
14	104	9.54	21.77	38.64	0.74	0.00	1.19	27.33	99.21	1.10	1.99	3.00	0.06	0.00	0.08	1.77	8.01	0.59	0.37	0.02	0.03	0.62
15	112	9.52	21.75	38.74	0.79	0.00	1.30	27.17	99.27	1.10	1.99	3.00	0.07	0.00	0.09	1.76	8.00	0.58	0.37	0.02	0.03	0.62
16	120	9.53	21.70	36.70	0.63	0.00	1.24	25.85	95.65	1.14	2.06	2.95	0.05	0.00	0.08	1.74	8.02	0.58	0.38	0.02	0.03	0.60
17	128	9.52	21.55	38.77	0.68	0.04	1.40	27.30	99.25	1.10	1.97	3.01	0.06	0.00	0.09	1.77	8.00	0.59	0.36	0.02	0.03	0.62
18	136	9.59	21.64	38.46	0.67	0.03	1.38	27.58	99.36	1.11	1.98	2.99	0.06	0.00	0.09	1.79	8.02	0.59	0.36	0.02	0.03	0.62
19	144	9.84	21.77	38.95	0.74	0.00	1.33	27.20	99.83	1.13	1.98	3.00	0.06	0.00	0.09	1.75	8.01	0.58	0.37	0.02	0.03	0.61
20	152	9.78	22.00	38.82	0.74	0.00	1.29	27.40	100.03	1.12	2.00	2.99	0.06	0.00	0.08	1.76	8.01	0.58	0.37	0.02	0.03	0.61
21	160	9.57	21.61	38.82	0.69	0.00	1.41	27.15	99.25	1.11	1.97	3.01	0.06	0.00	0.09	1.76	8.00	0.58	0.37	0.02	0.03	0.61
22	168	9.65	21.54	38.48	0.70	0.00	1.43	26.89	98.68	1.12	1.98	3.00	0.06	0.00	0.09	1.75	8.01	0.58	0.37	0.02	0.03	0.61
23	176	9.77	21.70	38.81	0.64	0.00	1.25	27.16	99.33	1.13	1.98	3.00	0.05	0.00	0.08	1.76	8.01	0.58	0.37	0.02	0.03	0.61
24	184	9.58	21.68	38.75	0.68	0.00	1.32	26.83	98.84	1.11	1.99	3.01	0.06	0.00	0.09	1.74	8.00	0.58	0.37	0.02	0.03	0.61

Table 1.11: Composition of garnet 35a A14 from sample HJ-35a (group 1) as analysed along traverse A-B (Plate 4.4e). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	8.65	21.41	39.33	0.67	0.00	1.31	27.70	99.07	1.00	1.96	3.06	0.06	0.00	0.09	1.80	7.96	0.61	0.34	0.02	0.03	0.64
2	56	9.16	21.63	39.68	0.68	0.00	1.36	27.56	100.06	1.05	1.96	3.05	0.06	0.00	0.09	1.77	7.97	0.60	0.35	0.02	0.03	0.63
3	112	9.16	21.45	39.41	0.50	0.00	1.34	26.78	98.62	1.06	1.96	3.06	0.04	0.00	0.09	1.74	7.96	0.59	0.36	0.01	0.03	0.62
4	168	9.47	21.31	39.60	0.54	0.00	1.28	26.94	99.13	1.09	1.94	3.06	0.04	0.00	0.08	1.74	7.97	0.59	0.37	0.01	0.03	0.61
5	224	9.05	21.30	39.22	0.96	0.00	1.30	27.53	99.36	1.05	1.95	3.04	0.08	0.00	0.09	1.79	7.99	0.60	0.35	0.03	0.03	0.63
6	280	9.57	21.75	39.98	0.69	0.00	1.23	27.20	100.42	1.09	1.96	3.05	0.06	0.00	0.08	1.74	7.97	0.59	0.37	0.02	0.03	0.61
7	336	9.86	21.46	39.74	0.68	0.00	1.33	26.23	99.29	1.13	1.95	3.06	0.06	0.00	0.09	1.69	7.97	0.57	0.38	0.02	0.03	0.60
8	392	10.45	21.64	39.83	0.81	0.00	1.11	25.58	99.43	1.19	1.95	3.05	0.07	0.00	0.07	1.64	7.97	0.55	0.40	0.02	0.02	0.58
9	448	10.64	22.00	40.25	0.68	0.00	1.04	25.43	100.04	1.20	1.97	3.05	0.06	0.00	0.07	1.61	7.96	0.55	0.41	0.02	0.02	0.57
11	560	11.15	21.64	40.07	0.61	0.00	1.05	24.15	98.67	1.27	1.95	3.07	0.05	0.00	0.07	1.55	7.96	0.53	0.43	0.02	0.02	0.55
12	616	11.39	21.96	40.16	0.66	0.00	1.06	24.75	99.99	1.29	1.96	3.04	0.05	0.00	0.07	1.57	7.98	0.53	0.43	0.02	0.02	0.55
13	672	11.45	21.76	40.31	0.59	0.00	0.95	24.47	99.53	1.30	1.95	3.06	0.05	0.00	0.06	1.55	7.97	0.53	0.44	0.02	0.02	0.55
14	728	11.48	21.96	40.47	0.60	0.03	0.96	24.56	100.08	1.29	1.95	3.06	0.05	0.00	0.06	1.55	7.97	0.53	0.44	0.02	0.02	0.55
15	784	12.01	22.92	40.81	0.52	0.00	0.83	23.83	100.93	1.33	2.01	3.04	0.04	0.00	0.05	1.48	7.96	0.51	0.46	0.01	0.02	0.53
18	952	11.56	21.78	40.13	0.64	0.00	1.02	24.07	99.19	1.31	1.95	3.05	0.05	0.00	0.07	1.53	7.97	0.52	0.44	0.02	0.02	0.54
19	1008	11.57	21.75	40.01	0.73	0.00	0.97	23.96	98.99	1.31	1.95	3.05	0.06	0.00	0.06	1.53	7.97	0.52	0.44	0.02	0.02	0.54
26	1400	11.74	21.83	40.09	0.65	0.00	1.04	23.67	99.02	1.33	1.96	3.05	0.05	0.00	0.07	1.51	7.97	0.51	0.45	0.02	0.02	0.53
27	1456	11.78	21.78	40.21	0.68	0.00	0.89	23.41	98.76	1.34	1.96	3.06	0.06	0.00	0.06	1.49	7.96	0.51	0.45	0.02	0.02	0.53
28	1512	11.97	22.13	40.52	0.68	0.00	0.96	23.86	100.12	1.34	1.96	3.05	0.06	0.00	0.06	1.50	7.97	0.51	0.45	0.02	0.02	0.53
29	1568	12.07	21.97	40.37	0.63	0.00	0.94	23.38	99.36	1.36	1.96	3.05	0.05	0.00	0.06	1.48	7.97	0.50	0.46	0.02	0.02	0.52
30	1624	12.00	21.67	40.30	0.58	0.00	0.96	23.34	98.84	1.36	1.94	3.07	0.05	0.00	0.06	1.48	7.96	0.50	0.46	0.02	0.02	0.52
31	1680	13.71	23.71	42.94	0.50	0.00	0.87	22.75	104.46	1.45	1.99	3.06	0.04	0.00	0.05	1.35	7.95	0.47	0.50	0.01	0.02	0.48
33	1792	12.05	21.96	40.44	0.48	0.00	0.96	23.40	99.29	1.36	1.96	3.06	0.04	0.00	0.06	1.48	7.96	0.50	0.46	0.01	0.02	0.52
34	1848	12.04	21.97	40.42	0.62	0.00	0.95	22.98	98.96	1.36	1.96	3.06	0.05	0.00	0.06	1.46	7.95	0.50	0.46	0.02	0.02	0.52
35	1904	12.31	22.17	40.90	0.57	0.00	1.00	23.22	100.17	1.37	1.96	3.06	0.05	0.00	0.06	1.45	7.96	0.50	0.47	0.02	0.02	0.51

37	2016	11.79	21.74	40.51	0.59	0.00	0.98	23.61	99.22	1.33	1.94	3.07	0.05	0.00	0.06	1.50	7.96	0.51	0.45	0.02	0.02	0.53
38	2072	12.12	22.06	40.21	0.64	0.00	1.03	23.80	99.87	1.36	1.96	3.04	0.05	0.00	0.07	1.50	7.98	0.50	0.46	0.02	0.02	0.52
39	2128	11.79	21.99	40.51	0.52	0.00	0.90	24.03	99.74	1.33	1.96	3.06	0.04	0.00	0.06	1.52	7.96	0.52	0.45	0.01	0.02	0.53
40	2184	11.88	21.91	40.22	0.54	0.00	1.08	23.47	99.11	1.35	1.96	3.05	0.04	0.00	0.07	1.49	7.96	0.51	0.46	0.01	0.02	0.53
41	2240	12.09	21.71	40.10	0.51	0.00	0.85	23.35	98.59	1.37	1.95	3.06	0.04	0.00	0.05	1.49	7.97	0.50	0.46	0.01	0.02	0.52
42	2296	12.05	22.06	40.46	0.48	0.00	0.95	23.64	99.63	1.36	1.96	3.05	0.04	0.00	0.06	1.49	7.96	0.51	0.46	0.01	0.02	0.52
43	2352	12.07	22.02	40.22	0.51	0.00	0.96	23.31	99.09	1.36	1.97	3.05	0.04	0.00	0.06	1.48	7.97	0.50	0.46	0.01	0.02	0.52
44	2408	12.37	21.85	40.33	0.46	0.00	0.89	23.52	99.41	1.39	1.95	3.05	0.04	0.00	0.06	1.49	7.98	0.50	0.47	0.01	0.02	0.52
45	2464	12.56	22.16	40.52	0.47	0.00	0.88	23.69	100.28	1.40	1.96	3.04	0.04	0.00	0.06	1.49	7.98	0.50	0.47	0.01	0.02	0.51
46	2520	12.27	22.00	40.18	0.43	0.00	0.92	23.33	99.13	1.39	1.97	3.05	0.04	0.00	0.06	1.48	7.97	0.50	0.47	0.01	0.02	0.52
47	2576	12.32	22.27	40.45	0.51	0.00	0.98	23.30	99.83	1.38	1.97	3.04	0.04	0.00	0.06	1.47	7.97	0.50	0.47	0.01	0.02	0.51
48	2632	12.51	22.06	40.00	0.51	0.00	0.84	23.28	99.21	1.41	1.97	3.03	0.04	0.00	0.05	1.48	7.98	0.49	0.47	0.01	0.02	0.51
49	2688	12.33	22.04	40.46	0.53	0.00	0.95	23.01	99.33	1.39	1.96	3.06	0.04	0.00	0.06	1.45	7.96	0.49	0.47	0.01	0.02	0.51
51	2800	12.48	21.83	40.48	0.54	0.00	0.86	22.92	99.11	1.41	1.95	3.06	0.04	0.00	0.06	1.45	7.96	0.49	0.48	0.01	0.02	0.51
52	2856	12.43	22.13	40.40	0.49	0.00	0.85	22.91	99.21	1.40	1.97	3.05	0.04	0.00	0.05	1.45	7.96	0.49	0.48	0.01	0.02	0.51
53	2912	12.36	22.16	40.50	0.49	0.00	0.92	22.89	99.33	1.39	1.97	3.06	0.04	0.00	0.06	1.44	7.96	0.49	0.47	0.01	0.02	0.51
57	3136	12.42	22.10	40.43	0.60	0.00	0.88	22.55	98.97	1.40	1.97	3.06	0.05	0.00	0.06	1.43	7.96	0.49	0.48	0.02	0.02	0.50
59	3248	12.40	22.03	40.32	0.52	0.00	0.87	23.14	99.27	1.40	1.96	3.05	0.04	0.00	0.06	1.46	7.97	0.49	0.47	0.01	0.02	0.51
60	3304	12.63	21.87	40.44	0.55	0.00	0.92	22.59	98.99	1.42	1.95	3.06	0.04	0.00	0.06	1.43	7.97	0.48	0.48	0.02	0.02	0.50
61	3360	12.50	22.04	40.48	0.64	0.00	0.88	22.98	99.51	1.40	1.96	3.05	0.05	0.00	0.06	1.45	7.97	0.49	0.47	0.02	0.02	0.51
64	3528	12.40	22.01	40.37	0.74	0.00	0.91	22.77	99.21	1.40	1.96	3.05	0.06	0.00	0.06	1.44	7.97	0.49	0.47	0.02	0.02	0.51
74	4088	11.96	21.86	40.46	0.65	0.00	0.97	23.95	99.86	1.35	1.95	3.05	0.05	0.00	0.06	1.51	7.97	0.51	0.45	0.02	0.02	0.53
75	4144	12.02	21.59	40.13	0.64	0.00	0.93	23.74	99.04	1.36	1.94	3.05	0.05	0.00	0.06	1.51	7.98	0.51	0.46	0.02	0.02	0.53
76	4200	11.55	22.08	40.21	0.55	0.00	0.96	24.05	99.40	1.31	1.97	3.05	0.04	0.00	0.06	1.53	7.96	0.52	0.44	0.02	0.02	0.54
77	4256	11.55	21.81	40.33	0.59	0.04	0.99	24.11	99.42	1.31	1.95	3.06	0.05	0.00	0.06	1.53	7.96	0.52	0.44	0.02	0.02	0.54
78	4312	11.29	21.80	40.13	0.65	0.00	1.00	24.33	99.20	1.28	1.96	3.06	0.05	0.00	0.06	1.55	7.96	0.53	0.43	0.02	0.02	0.55
79	4368	10.60	21.80	40.17	0.70	0.00	1.00	25.02	99.28	1.21	1.96	3.07	0.06	0.00	0.06	1.60	7.95	0.55	0.41	0.02	0.02	0.57
81	4480	10.24	21.80	40.07	0.64	0.00	1.06	25.78	99.59	1.17	1.96	3.06	0.05	0.00	0.07	1.65	7.96	0.56	0.40	0.02	0.02	0.59
85	4704	10.28	21.84	40.04	0.66	0.00	1.05	25.66	99.54	1.17	1.97	3.06	0.05	0.00	0.07	1.64	7.96	0.56	0.40	0.02	0.02	0.58
86	4760	10.66	21.76	40.19	0.82	0.00	1.00	25.45	99.87	1.21	1.95	3.06	0.07	0.00	0.06	1.62	7.97	0.55	0.41	0.02	0.02	0.57
87	4816	10.67	21.58	40.07	0.72	0.00	1.04	25.22	99.30	1.22	1.95	3.06	0.06	0.00	0.07	1.61	7.96	0.55	0.41	0.02	0.02	0.57

88	4872	10.65	21.59	39.93	0.59	0.00	1.08	24.73	98.57	1.22	1.96	3.07	0.05	0.00	0.07	1.59	7.95	0.54	0.42	0.02	0.02	0.57
89	4928	10.90	21.77	40.06	0.66	0.00	1.06	25.00	99.45	1.24	1.96	3.05	0.05	0.00	0.07	1.59	7.97	0.54	0.42	0.02	0.02	0.56
90	4984	10.59	21.62	39.86	0.65	0.00	1.02	25.33	99.07	1.21	1.95	3.06	0.05	0.00	0.07	1.62	7.97	0.55	0.41	0.02	0.02	0.57
91	5040	10.75	21.77	40.29	0.71	0.00	1.16	25.35	100.04	1.22	1.95	3.06	0.06	0.00	0.07	1.61	7.97	0.54	0.41	0.02	0.03	0.57
92	5096	10.97	21.85	40.05	0.63	0.00	1.03	24.88	99.42	1.25	1.96	3.05	0.05	0.00	0.07	1.59	7.97	0.54	0.42	0.02	0.02	0.56
93	5152	10.72	22.03	39.87	0.59	0.00	1.01	25.53	99.74	1.22	1.98	3.04	0.05	0.00	0.06	1.63	7.97	0.55	0.41	0.02	0.02	0.57
94	5208	10.52	21.86	40.14	0.62	0.00	1.04	25.60	99.78	1.19	1.96	3.06	0.05	0.00	0.07	1.63	7.96	0.55	0.41	0.02	0.02	0.58
95	5264	10.32	21.87	39.78	0.71	0.00	1.09	25.51	99.28	1.18	1.97	3.05	0.06	0.00	0.07	1.63	7.96	0.56	0.40	0.02	0.02	0.58
96	5320	10.07	21.54	39.92	0.75	0.00	1.24	25.82	99.34	1.15	1.95	3.06	0.06	0.00	0.08	1.66	7.96	0.56	0.39	0.02	0.03	0.59
97	5376	9.60	21.46	39.82	0.69	0.00	1.27	26.02	98.86	1.10	1.95	3.07	0.06	0.00	0.08	1.68	7.95	0.57	0.38	0.02	0.03	0.60
99	5488	9.13	21.61	39.94	0.75	0.00	1.27	27.45	100.15	1.04	1.95	3.06	0.06	0.00	0.08	1.76	7.96	0.60	0.35	0.02	0.03	0.63
100	5544	8.67	21.62	39.84	0.69	0.00	1.42	28.16	100.41	0.99	1.96	3.06	0.06	0.00	0.09	1.81	7.96	0.61	0.34	0.02	0.03	0.65

Table 1.12: Composition of garnet A14 from sample HJ-35a (group 1) as analysed along traverse C-D (Plate 4.4e). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	10.59	21.87	40.18	0.79	0.00	1.12	25.81	100.36	1.20	1.96	3.05	0.06	0.00	0.07	1.64	7.97	0.55	0.40	0.02	0.02	0.58
2	52	11.05	21.72	40.01	0.68	0.00	0.98	24.76	99.19	1.26	1.95	3.05	0.06	0.00	0.06	1.58	7.97	0.53	0.43	0.02	0.02	0.56
3	104	11.52	21.97	39.88	0.55	0.00	1.04	24.45	99.41	1.31	1.97	3.04	0.05	0.00	0.07	1.56	7.98	0.52	0.44	0.02	0.02	0.54
4	156	11.61	21.76	40.36	0.53	0.00	0.82	24.48	99.55	1.31	1.94	3.06	0.04	0.00	0.05	1.55	7.97	0.52	0.44	0.01	0.02	0.54
5	208	11.87	21.90	40.13	0.50	0.00	1.05	23.89	99.34	1.34	1.96	3.05	0.04	0.00	0.07	1.52	7.97	0.51	0.45	0.01	0.02	0.53
6	260	11.93	22.08	39.93	0.49	0.00	1.01	24.09	99.53	1.35	1.97	3.03	0.04	0.00	0.06	1.53	7.98	0.51	0.45	0.01	0.02	0.53
7	312	12.13	22.06	40.18	0.49	0.00	0.90	23.54	99.29	1.37	1.97	3.04	0.04	0.00	0.06	1.49	7.97	0.50	0.46	0.01	0.02	0.52
8	364	11.78	22.07	40.34	0.46	0.00	0.98	23.58	99.21	1.33	1.97	3.06	0.04	0.00	0.06	1.49	7.96	0.51	0.45	0.01	0.02	0.53
9	416	11.89	21.79	40.17	0.45	0.00	0.97	23.75	99.02	1.35	1.95	3.06	0.04	0.00	0.06	1.51	7.97	0.51	0.46	0.01	0.02	0.53
10	468	11.86	21.83	40.55	0.43	0.00	0.91	23.78	99.36	1.34	1.95	3.07	0.03	0.00	0.06	1.51	7.96	0.51	0.46	0.01	0.02	0.53
11	520	12.13	22.08	40.07	0.45	0.00	0.88	23.15	98.76	1.37	1.98	3.05	0.04	0.00	0.06	1.47	7.96	0.50	0.47	0.01	0.02	0.52
12	572	12.10	21.89	40.19	0.51	0.00	0.92	23.34	98.94	1.37	1.96	3.05	0.04	0.00	0.06	1.48	7.97	0.50	0.46	0.01	0.02	0.52
13	624	12.06	21.77	40.58	0.49	0.00	0.88	23.10	98.88	1.36	1.95	3.08	0.04	0.00	0.06	1.47	7.95	0.50	0.47	0.01	0.02	0.52
14	676	12.12	21.93	40.28	0.45	0.00	0.89	23.52	99.20	1.37	1.96	3.05	0.04	0.00	0.06	1.49	7.97	0.50	0.46	0.01	0.02	0.52
15	728	12.15	21.95	40.44	0.42	0.00	0.88	23.40	99.23	1.37	1.96	3.06	0.03	0.00	0.06	1.48	7.96	0.50	0.47	0.01	0.02	0.52
16	780	12.30	22.06	40.51	0.45	0.00	0.88	23.47	99.67	1.38	1.96	3.05	0.04	0.00	0.06	1.48	7.97	0.50	0.47	0.01	0.02	0.52
17	832	12.13	21.81	40.19	0.40	0.00	0.88	23.24	98.64	1.38	1.96	3.06	0.03	0.00	0.06	1.48	7.96	0.50	0.47	0.01	0.02	0.52
18	884	12.16	21.94	40.31	0.48	0.00	0.91	23.19	98.98	1.38	1.96	3.06	0.04	0.00	0.06	1.47	7.96	0.50	0.47	0.01	0.02	0.52
19	936	12.21	21.93	40.43	0.52	0.00	0.98	23.31	99.38	1.38	1.95	3.06	0.04	0.00	0.06	1.47	7.97	0.50	0.47	0.01	0.02	0.52
20	988	12.17	21.85	40.19	0.50	0.00	0.89	23.62	99.21	1.38	1.95	3.05	0.04	0.00	0.06	1.50	7.97	0.50	0.46	0.01	0.02	0.52
21	1040	12.44	22.03	40.25	0.48	0.00	1.02	23.27	99.49	1.40	1.96	3.04	0.04	0.00	0.07	1.47	7.98	0.49	0.47	0.01	0.02	0.51
22	1092	12.14	21.91	40.45	0.48	0.00	0.83	23.40	99.19	1.37	1.96	3.06	0.04	0.00	0.05	1.48	7.96	0.50	0.47	0.01	0.02	0.52
23	1144	12.28	21.81	40.37	0.47	0.00	0.91	22.73	98.57	1.39	1.95	3.07	0.04	0.00	0.06	1.44	7.96	0.49	0.47	0.01	0.02	0.51
24	1196	12.21	22.01	40.43	0.51	0.00	0.88	23.07	99.12	1.38	1.96	3.06	0.04	0.00	0.06	1.46	7.96	0.50	0.47	0.01	0.02	0.51
26	1300	12.17	21.76	40.16	0.49	0.00	0.98	23.32	98.89	1.38	1.95	3.05	0.04	0.00	0.06	1.48	7.97	0.50	0.47	0.01	0.02	0.52

27	1352	12.33	21.98	40.15	0.45	0.00	0.84	23.18	98.92	1.39	1.97	3.05	0.04	0.00	0.05	1.47	7.97	0.50	0.47	0.01	0.02	0.51
28	1404	12.36	21.98	40.10	0.47	0.00	0.91	23.03	98.84	1.40	1.97	3.05	0.04	0.00	0.06	1.46	7.97	0.49	0.47	0.01	0.02	0.51
29	1456	12.31	22.08	40.55	0.56	0.00	0.92	23.40	99.82	1.38	1.96	3.05	0.05	0.00	0.06	1.47	7.97	0.50	0.47	0.02	0.02	0.52
30	1508	12.34	21.87	40.19	0.49	0.00	0.90	23.03	98.81	1.40	1.96	3.05	0.04	0.00	0.06	1.46	7.97	0.49	0.47	0.01	0.02	0.51
31	1560	12.30	21.96	40.40	0.57	0.00	0.93	23.04	99.20	1.39	1.96	3.06	0.05	0.00	0.06	1.46	7.96	0.49	0.47	0.02	0.02	0.51
32	1612	12.36	22.08	40.28	0.55	0.04	0.92	22.98	99.21	1.39	1.97	3.05	0.04	0.00	0.06	1.45	7.97	0.49	0.47	0.02	0.02	0.51
33	1664	12.43	22.21	40.27	0.47	0.00	0.93	23.02	99.33	1.40	1.98	3.04	0.04	0.00	0.06	1.45	7.97	0.49	0.47	0.01	0.02	0.51
34	1716	12.25	22.06	40.51	0.47	0.00	0.86	23.07	99.21	1.38	1.96	3.06	0.04	0.00	0.05	1.46	7.96	0.50	0.47	0.01	0.02	0.51
35	1768	12.40	22.03	40.25	0.51	0.00	0.88	22.98	99.05	1.40	1.97	3.05	0.04	0.00	0.06	1.46	7.97	0.49	0.47	0.01	0.02	0.51
37	1872	12.34	22.03	40.18	0.45	0.00	1.01	23.22	99.24	1.39	1.97	3.04	0.04	0.00	0.06	1.47	7.97	0.50	0.47	0.01	0.02	0.51
38	1924	12.29	22.12	40.33	0.48	0.00	0.92	23.39	99.53	1.38	1.97	3.04	0.04	0.00	0.06	1.48	7.97	0.50	0.47	0.01	0.02	0.52
39	1976	12.26	21.90	40.35	0.46	0.00	0.79	22.84	98.61	1.39	1.96	3.07	0.04	0.00	0.05	1.45	7.95	0.50	0.47	0.01	0.02	0.51
40	2028	12.52	21.95	40.28	0.50	0.00	0.95	23.33	99.53	1.41	1.95	3.04	0.04	0.00	0.06	1.47	7.98	0.49	0.47	0.01	0.02	0.51
41	2080	12.14	21.81	40.23	0.48	0.00	0.98	23.23	98.87	1.38	1.95	3.06	0.04	0.00	0.06	1.48	7.97	0.50	0.47	0.01	0.02	0.52
42	2132	12.38	22.05	40.63	0.58	0.00	0.99	23.21	99.84	1.39	1.95	3.06	0.05	0.00	0.06	1.46	7.97	0.49	0.47	0.02	0.02	0.51
43	2184	12.03	21.95	40.67	0.63	0.00	1.02	23.37	99.66	1.35	1.95	3.07	0.05	0.00	0.06	1.47	7.96	0.50	0.46	0.02	0.02	0.52
44	2236	11.51	21.57	39.83	0.64	0.00	0.92	23.61	98.07	1.32	1.95	3.06	0.05	0.00	0.06	1.52	7.96	0.51	0.45	0.02	0.02	0.54
54	2756	12.28	22.20	40.49	0.48	0.00	0.96	23.41	99.82	1.38	1.97	3.05	0.04	0.00	0.06	1.47	7.97	0.50	0.47	0.01	0.02	0.52
55	2808	12.28	22.03	40.47	0.47	0.00	0.99	23.34	99.58	1.38	1.96	3.05	0.04	0.00	0.06	1.47	7.97	0.50	0.47	0.01	0.02	0.52
56	2860	12.54	22.00	40.54	0.46	0.00	0.93	22.90	99.36	1.41	1.96	3.06	0.04	0.00	0.06	1.44	7.96	0.49	0.48	0.01	0.02	0.51
58	2964	12.47	21.83	40.21	0.55	0.00	0.92	23.03	99.01	1.41	1.95	3.05	0.04	0.00	0.06	1.46	7.97	0.49	0.47	0.01	0.02	0.51
61	3120	12.25	21.67	39.84	0.57	0.00	0.83	22.74	97.89	1.40	1.96	3.05	0.05	0.00	0.05	1.46	7.97	0.49	0.47	0.02	0.02	0.51
62	3172	12.50	22.17	40.55	0.71	0.00	0.82	22.89	99.64	1.40	1.97	3.05	0.06	0.00	0.05	1.44	7.97	0.49	0.47	0.02	0.02	0.51
64	3276	12.68	21.96	40.39	0.56	0.00	0.86	22.90	99.35	1.43	1.95	3.05	0.05	0.00	0.06	1.45	7.97	0.49	0.48	0.02	0.02	0.50
65	3328	12.31	21.96	40.77	0.66	0.00	0.93	22.81	99.45	1.38	1.95	3.07	0.05	0.00	0.06	1.44	7.95	0.49	0.47	0.02	0.02	0.51
66	3380	12.65	21.97	40.61	0.69	0.00	0.83	22.87	99.62	1.42	1.95	3.06	0.06	0.00	0.05	1.44	7.97	0.49	0.48	0.02	0.02	0.50
67	3432	12.46	22.07	40.61	0.60	0.00	0.83	22.99	99.56	1.40	1.96	3.06	0.05	0.00	0.05	1.45	7.96	0.49	0.47	0.02	0.02	0.51
68	3484	12.60	21.79	40.23	0.59	0.00	0.84	22.62	98.66	1.43	1.95	3.06	0.05	0.00	0.05	1.44	7.97	0.48	0.48	0.02	0.02	0.50
69	3536	12.53	22.11	40.60	0.60	0.00	0.85	22.68	99.38	1.41	1.96	3.06	0.05	0.00	0.05	1.43	7.96	0.49	0.48	0.02	0.02	0.50
70	3588	12.60	22.05	40.52	0.51	0.00	0.89	22.80	99.36	1.42	1.96	3.06	0.04	0.00	0.06	1.44	7.97	0.49	0.48	0.01	0.02	0.50
71	3640	12.65	21.82	40.34	0.47	0.00	0.83	22.68	98.79	1.43	1.95	3.06	0.04	0.00	0.05	1.44	7.97	0.49	0.48	0.01	0.02	0.50

72	3692	12.44	21.95	40.24	0.49	0.00	0.88	23.00	99.00	1.41	1.96	3.05	0.04	0.00	0.06	1.46	7.97	0.49	0.47	0.01	0.02	0.51
75	3848	11.63	22.19	40.37	0.71	0.00	0.91	23.92	99.73	1.31	1.98	3.05	0.06	0.00	0.06	1.51	7.96	0.51	0.45	0.02	0.02	0.54
76	3900	11.38	21.90	40.41	0.65	0.00	0.99	24.17	99.51	1.29	1.96	3.06	0.05	0.00	0.06	1.53	7.96	0.52	0.44	0.02	0.02	0.54
78	4004	11.35	21.85	40.14	0.58	0.00	0.96	24.19	99.07	1.29	1.96	3.06	0.05	0.00	0.06	1.54	7.96	0.52	0.44	0.02	0.02	0.54
79	4056	11.48	21.64	40.52	0.50	0.00	0.95	24.29	99.38	1.30	1.94	3.08	0.04	0.00	0.06	1.54	7.96	0.52	0.44	0.01	0.02	0.54
80	4108	11.37	21.60	40.14	0.46	0.00	1.01	24.78	99.36	1.29	1.94	3.06	0.04	0.00	0.07	1.58	7.97	0.53	0.43	0.01	0.02	0.55
81	4160	11.25	21.75	39.77	0.47	0.00	0.99	24.81	99.05	1.28	1.96	3.04	0.04	0.00	0.06	1.59	7.98	0.53	0.43	0.01	0.02	0.55
82	4212	11.10	21.71	39.97	0.49	0.00	1.04	24.84	99.14	1.26	1.96	3.05	0.04	0.00	0.07	1.59	7.97	0.54	0.43	0.01	0.02	0.56
83	4264	11.34	21.93	40.00	0.49	0.00	1.04	24.71	99.51	1.29	1.97	3.04	0.04	0.00	0.07	1.57	7.97	0.53	0.43	0.01	0.02	0.55
84	4316	11.04	21.79	39.90	0.46	0.00	1.07	24.66	98.92	1.26	1.97	3.05	0.04	0.00	0.07	1.58	7.96	0.54	0.43	0.01	0.02	0.56
85	4368	11.02	21.87	39.93	0.49	0.00	1.09	25.23	99.62	1.25	1.96	3.04	0.04	0.00	0.07	1.61	7.98	0.54	0.42	0.01	0.02	0.56
86	4420	11.02	21.84	40.14	0.50	0.00	1.10	25.13	99.73	1.25	1.96	3.05	0.04	0.00	0.07	1.60	7.97	0.54	0.42	0.01	0.02	0.56
87	4472	11.03	22.03	39.83	0.48	0.03	1.05	25.35	99.80	1.25	1.98	3.03	0.04	0.00	0.07	1.61	7.98	0.54	0.42	0.01	0.02	0.56
89	4576	10.78	21.80	40.07	0.56	0.00	1.10	25.59	99.90	1.22	1.96	3.05	0.05	0.00	0.07	1.63	7.97	0.55	0.41	0.02	0.02	0.57
90	4628	10.46	21.58	39.71	0.45	0.00	1.11	25.41	98.73	1.20	1.96	3.06	0.04	0.00	0.07	1.64	7.96	0.56	0.41	0.01	0.02	0.58
91	4680	10.31	21.70	39.84	0.55	0.00	1.17	25.98	99.56	1.18	1.96	3.05	0.05	0.00	0.08	1.66	7.97	0.56	0.40	0.02	0.03	0.59
92	4732	10.24	21.77	39.74	0.54	0.00	1.07	26.19	99.55	1.17	1.97	3.04	0.04	0.00	0.07	1.68	7.97	0.57	0.39	0.02	0.02	0.59
93	4784	9.78	21.71	39.66	0.45	0.00	1.10	26.78	99.47	1.12	1.97	3.05	0.04	0.00	0.07	1.72	7.97	0.58	0.38	0.01	0.02	0.61
94	4836	8.65	21.39	39.86	0.75	0.00	1.26	28.04	99.95	0.99	1.94	3.07	0.06	0.00	0.08	1.81	7.96	0.61	0.34	0.02	0.03	0.65
97	4992	9.79	21.66	39.86	0.75	0.00	1.28	26.20	99.54	1.12	1.96	3.06	0.06	0.00	0.08	1.68	7.96	0.57	0.38	0.02	0.03	0.60
98	5044	9.94	21.66	39.61	0.77	0.00	1.18	26.07	99.23	1.14	1.96	3.05	0.06	0.00	0.08	1.68	7.97	0.57	0.39	0.02	0.03	0.60
99	5096	9.72	21.54	39.75	0.79	0.00	1.16	26.31	99.26	1.12	1.95	3.06	0.06	0.00	0.08	1.69	7.96	0.57	0.38	0.02	0.03	0.60
100	5148	9.43	21.68	39.63	0.85	0.00	1.32	26.45	99.37	1.08	1.97	3.05	0.07	0.00	0.09	1.70	7.96	0.58	0.37	0.02	0.03	0.61

Table 1.13: Composition of garnet A3 from sample HJ-34b (group 2) as analysed along traverse A-B (Plate 5.9a). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	7.34	21.12	39.46	0.44	0.12	1.08	31.35	100.91	0.85	1.93	3.06	0.04	0.01	0.07	2.03	7.97	0.68	0.28	0.01	0.02	0.71
2	50	8.63	21.35	39.44	0.40	0.00	1.07	29.97	100.85	0.99	1.94	3.04	0.03	0.00	0.07	1.93	8.00	0.64	0.33	0.01	0.02	0.66
3	100	8.84	21.30	39.49	0.32	0.05	1.04	29.25	100.30	1.02	1.94	3.05	0.03	0.00	0.07	1.89	7.98	0.63	0.34	0.01	0.02	0.65
4	150	8.77	21.41	39.63	0.39	0.00	1.13	28.90	100.23	1.01	1.94	3.05	0.03	0.00	0.07	1.86	7.97	0.63	0.34	0.01	0.02	0.65
5	200	8.88	21.56	39.64	0.32	0.04	0.91	28.92	100.26	1.02	1.95	3.05	0.03	0.00	0.06	1.86	7.97	0.63	0.34	0.01	0.02	0.65
6	250	8.79	21.21	39.13	0.30	0.05	1.04	28.64	99.17	1.02	1.95	3.05	0.03	0.00	0.07	1.87	7.98	0.63	0.34	0.01	0.02	0.65
7	300	9.23	21.49	39.68	0.35	0.06	1.02	29.48	101.31	1.05	1.93	3.03	0.03	0.00	0.07	1.88	8.00	0.62	0.35	0.01	0.02	0.64
8	350	8.93	20.97	39.00	0.33	0.00	0.97	28.45	98.66	1.04	1.93	3.05	0.03	0.00	0.06	1.86	7.98	0.62	0.35	0.01	0.02	0.64
9	400	9.18	21.23	39.18	0.37	0.03	1.12	28.49	99.61	1.06	1.94	3.04	0.03	0.00	0.07	1.85	7.99	0.61	0.35	0.01	0.02	0.64
10	450	9.21	21.37	39.69	0.40	0.08	1.00	29.00	100.75	1.05	1.93	3.04	0.03	0.00	0.07	1.86	7.99	0.62	0.35	0.01	0.02	0.64
13	600	9.35	21.63	39.77	0.43	0.06	1.12	29.00	101.36	1.06	1.94	3.03	0.04	0.00	0.07	1.85	7.99	0.61	0.35	0.01	0.02	0.64
14	650	9.00	21.12	39.01	0.34	0.05	1.12	28.27	98.89	1.05	1.94	3.04	0.03	0.00	0.07	1.84	7.98	0.62	0.35	0.01	0.02	0.64
15	700	8.91	21.07	39.42	0.30	0.00	1.07	28.12	98.89	1.03	1.93	3.07	0.03	0.00	0.07	1.83	7.96	0.62	0.35	0.01	0.02	0.64
16	750	9.19	21.41	39.39	0.41	0.06	1.10	28.46	100.01	1.06	1.95	3.04	0.03	0.00	0.07	1.84	7.99	0.61	0.35	0.01	0.02	0.63
17	800	9.08	21.28	39.19	0.34	0.00	1.06	28.16	99.11	1.05	1.95	3.05	0.03	0.00	0.07	1.83	7.98	0.61	0.35	0.01	0.02	0.64
18	850	8.99	20.87	39.08	0.36	0.04	1.06	28.26	98.66	1.05	1.92	3.06	0.03	0.00	0.07	1.85	7.98	0.62	0.35	0.01	0.02	0.64
19	900	9.17	21.03	39.35	0.41	0.00	1.06	28.22	99.24	1.06	1.93	3.06	0.03	0.00	0.07	1.83	7.98	0.61	0.35	0.01	0.02	0.63
20	950	9.21	21.06	39.07	0.37	0.00	1.04	28.38	99.12	1.07	1.93	3.04	0.03	0.00	0.07	1.85	7.99	0.61	0.35	0.01	0.02	0.63
21	1000	9.06	21.16	39.17	0.39	0.07	1.15	28.38	99.38	1.05	1.94	3.04	0.03	0.00	0.08	1.84	7.98	0.61	0.35	0.01	0.03	0.64
22	1050	9.01	21.03	39.09	0.34	0.05	1.03	28.30	98.84	1.05	1.93	3.05	0.03	0.00	0.07	1.85	7.98	0.62	0.35	0.01	0.02	0.64
23	1100	9.21	21.16	39.20	0.40	0.05	1.13	29.05	100.20	1.06	1.93	3.03	0.03	0.00	0.07	1.88	8.00	0.62	0.35	0.01	0.02	0.64
24	1150	8.62	20.90	38.54	0.31	0.05	0.93	28.65	98.00	1.01	1.94	3.04	0.03	0.00	0.06	1.89	7.98	0.63	0.34	0.01	0.02	0.65
25	1200	8.59	21.21	39.40	0.37	0.00	1.08	28.79	99.43	0.99	1.94	3.06	0.03	0.00	0.07	1.87	7.97	0.63	0.34	0.01	0.02	0.65

Table 1.14: Composition of garnet A7 from sample HJ-34b (group 2) as analysed along traverse E-F (Plate 5.9b). Distance is in microns from starting point E.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	9.21	21.32	39.96	0.35	0.05	1.12	28.83	100.85	1.05	1.92	3.06	0.03	0.00	0.07	1.84	7.98	0.62	0.35	0.01	0.02	0.64
2	72	8.93	20.98	39.37	0.41	0.05	1.10	28.62	99.46	1.03	1.92	3.06	0.03	0.00	0.07	1.86	7.98	0.62	0.34	0.01	0.02	0.64
3	144	8.51	20.47	37.88	0.51	0.10	1.14	28.34	96.96	1.02	1.93	3.03	0.04	0.01	0.08	1.90	8.00	0.63	0.33	0.01	0.03	0.65
4	216	9.06	21.22	39.85	0.54	0.06	1.05	28.98	100.76	1.04	1.92	3.06	0.04	0.00	0.07	1.86	7.98	0.62	0.34	0.01	0.02	0.64
5	288	9.38	21.35	39.57	0.57	0.07	1.12	29.22	101.27	1.07	1.92	3.03	0.05	0.00	0.07	1.87	8.01	0.61	0.35	0.02	0.02	0.64
6	360	9.31	21.21	39.46	0.58	0.00	1.15	28.40	100.10	1.07	1.93	3.04	0.05	0.00	0.07	1.83	7.99	0.61	0.35	0.02	0.02	0.63
7	432	9.13	21.27	39.55	0.61	0.06	1.01	28.52	100.16	1.05	1.93	3.05	0.05	0.00	0.07	1.84	7.98	0.61	0.35	0.02	0.02	0.64
8	504	9.05	21.32	39.56	0.58	0.06	1.16	28.79	100.52	1.04	1.93	3.04	0.05	0.00	0.08	1.85	7.99	0.61	0.34	0.02	0.03	0.64
9	576	8.86	20.94	39.10	0.62	0.06	1.04	28.56	99.18	1.03	1.92	3.05	0.05	0.00	0.07	1.86	7.99	0.62	0.34	0.02	0.02	0.64
10	648	9.14	21.07	39.52	0.62	0.08	1.16	28.40	99.98	1.05	1.92	3.05	0.05	0.00	0.08	1.83	7.99	0.61	0.35	0.02	0.03	0.64
11	720	9.10	21.09	39.40	0.58	0.05	1.07	28.72	100.01	1.05	1.92	3.04	0.05	0.00	0.07	1.86	7.99	0.61	0.35	0.02	0.02	0.64
12	792	9.00	21.02	39.54	0.56	0.00	0.97	28.52	99.62	1.04	1.92	3.06	0.05	0.00	0.06	1.85	7.98	0.62	0.35	0.02	0.02	0.64
13	864	9.16	21.09	39.52	0.61	0.05	1.13	28.26	99.82	1.05	1.92	3.05	0.05	0.00	0.07	1.83	7.98	0.61	0.35	0.02	0.02	0.63
14	936	9.05	21.09	39.38	0.63	0.07	1.13	28.49	99.83	1.04	1.92	3.05	0.05	0.00	0.07	1.84	7.99	0.61	0.35	0.02	0.02	0.64
15	1008	9.05	21.19	39.13	0.56	0.04	1.05	28.57	99.58	1.05	1.94	3.04	0.05	0.00	0.07	1.85	7.99	0.61	0.35	0.02	0.02	0.64
16	1080	8.91	21.09	39.34	0.50	0.08	1.06	28.30	99.28	1.03	1.93	3.06	0.04	0.00	0.07	1.84	7.97	0.62	0.35	0.01	0.02	0.64
17	1152	9.31	21.41	39.46	0.53	0.05	1.16	28.20	100.11	1.07	1.94	3.04	0.04	0.00	0.08	1.82	7.99	0.60	0.36	0.01	0.03	0.63
18	1224	9.23	21.02	39.19	0.52	0.06	1.06	28.40	99.48	1.07	1.92	3.04	0.04	0.00	0.07	1.84	7.99	0.61	0.35	0.01	0.02	0.63
19	1296	9.30	21.29	39.27	0.46	0.05	1.10	28.42	99.89	1.07	1.94	3.03	0.04	0.00	0.07	1.84	7.99	0.61	0.35	0.01	0.02	0.63
20	1368	9.00	21.11	39.46	0.42	0.06	1.11	28.46	99.62	1.04	1.93	3.06	0.03	0.00	0.07	1.84	7.98	0.62	0.35	0.01	0.02	0.64
21	1440	9.15	21.07	39.38	0.33	0.04	1.01	28.55	99.54	1.06	1.93	3.05	0.03	0.00	0.07	1.85	7.98	0.62	0.35	0.01	0.02	0.64
22	1512	9.09	21.09	39.58	0.34	0.04	1.06	28.47	99.68	1.05	1.92	3.06	0.03	0.00	0.07	1.84	7.97	0.62	0.35	0.01	0.02	0.64
23	1584	9.03	21.34	39.60	0.32	0.04	1.08	28.65	100.05	1.04	1.94	3.05	0.03	0.00	0.07	1.85	7.98	0.62	0.35	0.01	0.02	0.64
24	1656	9.14	21.18	39.57	0.37	0.06	1.10	28.72	100.15	1.05	1.92	3.05	0.03	0.00	0.07	1.85	7.98	0.62	0.35	0.01	0.02	0.64
25	1728	8.83	21.28	39.73	0.35	0.00	1.15	28.57	99.91	1.02	1.94	3.07	0.03	0.00	0.08	1.84	7.97	0.62	0.34	0.01	0.03	0.64

Table 1.15: Composition of garnet A5 from sample HJ-34b (group 2) as analysed along traverse A-B (Plate 5.9c). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	7.34	21.30	39.31	0.39	0.05	1.13	31.47	100.98	0.85	1.94	3.04	0.03	0.00	0.07	2.04	7.98	0.68	0.28	0.01	0.02	0.71
2	65	8.38	21.17	39.25	0.31	0.00	1.03	29.67	99.80	0.97	1.94	3.05	0.03	0.00	0.07	1.93	7.98	0.64	0.32	0.01	0.02	0.67
3	130	8.38	20.94	39.30	0.42	0.07	1.15	29.27	99.52	0.97	1.92	3.06	0.03	0.00	0.08	1.91	7.98	0.64	0.33	0.01	0.03	0.66
4	195	9.08	20.98	39.18	0.34	0.05	1.14	29.38	100.14	1.05	1.91	3.03	0.03	0.00	0.07	1.90	8.01	0.62	0.34	0.01	0.02	0.64
6	325	9.32	21.28	39.68	0.44	0.08	1.19	29.13	101.12	1.06	1.92	3.04	0.04	0.00	0.08	1.86	8.00	0.61	0.35	0.01	0.03	0.64
9	520	9.19	21.48	39.42	0.43	0.06	1.11	28.78	100.47	1.05	1.95	3.03	0.04	0.00	0.07	1.85	7.99	0.61	0.35	0.01	0.02	0.64
10	585	9.00	21.08	39.16	0.34	0.06	1.03	28.43	99.10	1.04	1.93	3.05	0.03	0.00	0.07	1.85	7.98	0.62	0.35	0.01	0.02	0.64
11	650	9.20	21.48	39.74	0.40	0.04	1.05	28.93	100.84	1.05	1.94	3.04	0.03	0.00	0.07	1.85	7.99	0.62	0.35	0.01	0.02	0.64
12	715	9.38	21.28	39.69	0.33	0.00	1.01	28.47	100.16	1.07	1.93	3.05	0.03	0.00	0.07	1.83	7.98	0.61	0.36	0.01	0.02	0.63
13	780	9.27	21.48	39.58	0.35	0.00	0.97	28.70	100.35	1.06	1.95	3.04	0.03	0.00	0.06	1.84	7.99	0.62	0.35	0.01	0.02	0.63
14	845	9.00	21.43	39.79	0.36	0.04	1.00	29.15	100.76	1.03	1.94	3.05	0.03	0.00	0.07	1.87	7.98	0.62	0.34	0.01	0.02	0.65
15	910	9.22	21.34	39.48	0.38	0.05	1.15	28.95	100.57	1.06	1.93	3.04	0.03	0.00	0.07	1.86	8.00	0.62	0.35	0.01	0.02	0.64
16	975	8.69	20.85	38.10	0.38	0.08	1.06	28.91	98.06	1.03	1.95	3.02	0.03	0.00	0.07	1.91	8.01	0.63	0.34	0.01	0.02	0.65
17	1040	9.11	21.09	39.48	0.38	0.07	1.04	28.75	99.92	1.05	1.92	3.05	0.03	0.00	0.07	1.86	7.98	0.62	0.35	0.01	0.02	0.64
18	1105	9.11	21.30	39.57	0.31	0.07	1.03	28.69	100.10	1.05	1.94	3.05	0.03	0.00	0.07	1.85	7.98	0.62	0.35	0.01	0.02	0.64
19	1170	9.05	21.22	39.35	0.32	0.00	0.94	29.14	100.02	1.04	1.93	3.04	0.03	0.00	0.06	1.88	7.99	0.62	0.35	0.01	0.02	0.64
20	1235	8.84	21.05	39.22	0.32	0.08	0.96	28.37	98.85	1.03	1.94	3.06	0.03	0.00	0.06	1.85	7.97	0.62	0.35	0.01	0.02	0.64
21	1300	8.91	21.46	39.54	0.39	0.04	1.16	28.81	100.30	1.02	1.95	3.04	0.03	0.00	0.08	1.86	7.98	0.62	0.34	0.01	0.03	0.64
22	1365	8.76	21.10	39.46	0.33	0.09	1.12	29.02	99.89	1.01	1.93	3.05	0.03	0.01	0.07	1.88	7.98	0.63	0.34	0.01	0.02	0.65
23	1430	8.68	20.93	39.49	0.34	0.04	1.14	30.04	100.66	1.00	1.90	3.05	0.03	0.00	0.07	1.94	8.00	0.64	0.33	0.01	0.02	0.66
24	1495	8.09	21.36	39.30	0.40	0.00	1.04	31.17	101.36	0.93	1.94	3.03	0.03	0.00	0.07	2.01	8.00	0.66	0.31	0.01	0.02	0.68
25	1560	6.94	20.85	38.78	0.39	0.10	1.14	31.31	99.50	0.81	1.93	3.05	0.03	0.01	0.08	2.06	7.98	0.69	0.27	0.01	0.03	0.72

Table 1.16: Composition of garnet A5 from sample HJ-34b (group 2) as analysed along traverse C-D (Plate 5.9c). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	9.33	21.51	38.73	0.29	0.00	1.13	28.64	99.63	1.08	1.97	3.01	0.02	0.00	0.07	1.86	8.01	0.61	0.36	0.01	0.02	0.63
2	28	9.63	21.63	38.75	0.21	0.00	1.11	28.72	100.04	1.11	1.97	3.00	0.02	0.00	0.07	1.86	8.02	0.61	0.36	0.01	0.02	0.63
3	56	9.26	21.70	38.58	0.22	0.00	1.03	28.94	99.72	1.07	1.98	2.99	0.02	0.00	0.07	1.88	8.01	0.62	0.35	0.01	0.02	0.64
4	84	9.18	21.43	38.06	0.22	0.00	1.04	28.63	98.54	1.07	1.98	2.99	0.02	0.00	0.07	1.88	8.02	0.62	0.35	0.01	0.02	0.64
5	112	9.35	21.47	38.50	0.26	0.00	1.13	28.77	99.48	1.09	1.97	3.00	0.02	0.00	0.07	1.87	8.02	0.61	0.36	0.01	0.02	0.63
6	140	9.41	21.58	38.56	0.26	0.00	1.14	28.69	99.64	1.09	1.98	2.99	0.02	0.00	0.08	1.86	8.02	0.61	0.36	0.01	0.02	0.63
7	168	9.44	21.51	38.34	0.26	0.00	1.07	28.75	99.36	1.10	1.98	2.99	0.02	0.00	0.07	1.87	8.02	0.61	0.36	0.01	0.02	0.63
8	196	9.43	21.64	38.67	0.24	0.00	1.10	28.50	99.57	1.09	1.98	3.00	0.02	0.00	0.07	1.85	8.01	0.61	0.36	0.01	0.02	0.63
9	224	9.32	21.49	38.49	0.24	0.00	1.11	27.93	98.58	1.09	1.98	3.01	0.02	0.00	0.07	1.83	8.00	0.61	0.36	0.01	0.02	0.63
10	252	9.38	21.45	38.37	0.23	0.00	1.13	28.87	99.44	1.09	1.97	2.99	0.02	0.00	0.07	1.88	8.02	0.61	0.36	0.01	0.02	0.63
11	280	9.34	21.50	38.64	0.24	0.00	1.03	28.54	99.28	1.08	1.97	3.01	0.02	0.00	0.07	1.86	8.01	0.61	0.36	0.01	0.02	0.63
12	308	9.45	21.75	38.76	0.24	0.00	1.10	28.83	100.12	1.09	1.98	2.99	0.02	0.00	0.07	1.86	8.02	0.61	0.36	0.01	0.02	0.63
14	364	9.36	21.61	38.40	0.25	0.00	1.06	29.13	99.82	1.08	1.98	2.98	0.02	0.00	0.07	1.89	8.03	0.62	0.35	0.01	0.02	0.64
15	392	9.43	21.73	38.67	0.22	0.00	1.10	28.80	99.95	1.09	1.98	2.99	0.02	0.00	0.07	1.86	8.02	0.61	0.36	0.01	0.02	0.63
16	420	9.38	21.67	38.57	0.23	0.00	1.13	28.73	99.72	1.08	1.98	2.99	0.02	0.00	0.07	1.86	8.02	0.61	0.36	0.01	0.02	0.63
17	448	9.36	21.48	38.24	0.23	0.00	1.11	28.31	98.72	1.09	1.98	2.99	0.02	0.00	0.07	1.85	8.01	0.61	0.36	0.01	0.02	0.63
18	476	9.33	21.65	38.40	0.23	0.00	1.12	28.85	99.57	1.08	1.98	2.99	0.02	0.00	0.07	1.88	8.02	0.61	0.35	0.01	0.02	0.63
19	504	9.37	21.60	38.69	0.25	0.00	1.07	28.59	99.57	1.08	1.98	3.00	0.02	0.00	0.07	1.86	8.01	0.61	0.36	0.01	0.02	0.63
20	532	9.21	21.59	38.50	0.25	0.00	1.05	28.96	99.56	1.07	1.98	3.00	0.02	0.00	0.07	1.88	8.02	0.62	0.35	0.01	0.02	0.64
21	560	9.44	21.66	38.68	0.25	0.00	1.17	28.19	99.39	1.09	1.98	3.00	0.02	0.00	0.08	1.83	8.01	0.61	0.36	0.01	0.03	0.63
22	588	9.27	21.74	38.58	0.25	0.00	1.02	28.66	99.51	1.07	1.99	3.00	0.02	0.00	0.07	1.86	8.01	0.62	0.35	0.01	0.02	0.63
23	616	9.35	21.46	38.33	0.27	0.00	1.06	28.84	99.30	1.09	1.97	2.99	0.02	0.00	0.07	1.88	8.02	0.61	0.36	0.01	0.02	0.63
25	672	9.46	21.44	38.71	0.25	0.00	1.08	28.67	99.61	1.09	1.96	3.01	0.02	0.00	0.07	1.86	8.01	0.61	0.36	0.01	0.02	0.63
27	728	9.18	21.23	37.67	0.27	0.00	1.04	28.53	97.93	1.08	1.98	2.98	0.02	0.00	0.07	1.89	8.03	0.62	0.35	0.01	0.02	0.64
28	756	9.55	21.57	38.61	0.26	0.00	1.09	28.31	99.39	1.11	1.97	3.00	0.02	0.00	0.07	1.84	8.01	0.61	0.36	0.01	0.02	0.62

29	784	9.51	21.52	38.58	0.25	0.00	1.06	28.67	99.58	1.10	1.97	3.00	0.02	0.00	0.07	1.86	8.02	0.61	0.36	0.01	0.02	0.63
30	812	9.55	21.65	38.62	0.25	0.00	1.12	28.54	99.73	1.10	1.98	2.99	0.02	0.00	0.07	1.85	8.02	0.61	0.36	0.01	0.02	0.63
31	840	9.43	21.78	38.60	0.28	0.00	1.18	28.54	99.81	1.09	1.99	2.99	0.02	0.00	0.08	1.85	8.02	0.61	0.36	0.01	0.03	0.63
32	868	9.48	21.66	38.52	0.26	0.00	1.08	28.63	99.63	1.10	1.98	2.99	0.02	0.00	0.07	1.86	8.02	0.61	0.36	0.01	0.02	0.63
33	896	9.50	21.53	38.52	0.30	0.00	1.05	28.61	99.51	1.10	1.97	2.99	0.03	0.00	0.07	1.86	8.02	0.61	0.36	0.01	0.02	0.63
34	924	9.42	21.76	38.63	0.27	0.00	1.06	28.63	99.78	1.09	1.99	2.99	0.02	0.00	0.07	1.86	8.01	0.61	0.36	0.01	0.02	0.63
35	952	9.32	21.70	38.53	0.26	0.00	0.94	28.73	99.48	1.08	1.99	2.99	0.02	0.00	0.06	1.87	8.01	0.62	0.36	0.01	0.02	0.63
36	980	9.41	21.74	38.63	0.24	0.00	1.07	28.78	99.89	1.09	1.98	2.99	0.02	0.00	0.07	1.86	8.02	0.61	0.36	0.01	0.02	0.63
37	1008	9.21	21.58	38.45	0.32	0.00	1.09	28.67	99.32	1.07	1.98	3.00	0.03	0.00	0.07	1.87	8.01	0.62	0.35	0.01	0.02	0.64
38	1036	9.38	21.70	38.43	0.28	0.00	1.06	28.82	99.68	1.09	1.99	2.98	0.02	0.00	0.07	1.87	8.02	0.61	0.36	0.01	0.02	0.63
40	1092	9.42	21.91	38.59	0.26	0.00	1.14	28.65	99.96	1.09	2.00	2.98	0.02	0.00	0.07	1.85	8.02	0.61	0.36	0.01	0.02	0.63
41	1120	9.33	21.53	38.65	0.28	0.00	1.15	28.94	99.87	1.08	1.97	3.00	0.02	0.00	0.08	1.88	8.02	0.61	0.35	0.01	0.02	0.64
42	1148	9.42	21.74	38.77	0.24	0.00	1.16	28.60	99.93	1.09	1.98	3.00	0.02	0.00	0.08	1.85	8.01	0.61	0.36	0.01	0.02	0.63
43	1176	9.45	21.74	38.71	0.28	0.00	1.06	28.90	100.15	1.09	1.98	2.99	0.02	0.00	0.07	1.87	8.02	0.61	0.36	0.01	0.02	0.63
44	1204	9.45	21.58	38.54	0.29	0.00	1.07	28.68	99.61	1.09	1.97	2.99	0.02	0.00	0.07	1.86	8.02	0.61	0.36	0.01	0.02	0.63
45	1232	9.43	21.65	38.43	0.19	0.00	1.02	28.37	99.09	1.10	1.99	3.00	0.02	0.00	0.07	1.85	8.01	0.61	0.36	0.01	0.02	0.63
47	1288	9.33	21.50	38.49	0.29	0.00	1.20	28.53	99.33	1.08	1.97	3.00	0.02	0.00	0.08	1.86	8.02	0.61	0.36	0.01	0.03	0.63
49	1344	9.44	21.73	38.49	0.46	0.00	1.13	28.93	100.17	1.09	1.98	2.98	0.04	0.00	0.07	1.87	8.03	0.61	0.35	0.01	0.02	0.63

Table 1.17: Composition of garnet A1 from sample HJ-34c (group 2) as analysed along traverse A-B (Plate 5.9d). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	XGrs	X_{Sps}	X_{Fe}
1	0	9.01	22.85	39.69	0.70	0.18	1.49	28.11	102.02	1.01	2.03	2.99	0.06	0.01	0.10	1.77	7.97	0.60	0.34	0.02	0.03	0.64
2	33	8.87	22.88	39.95	0.70	0.21	1.52	27.81	101.95	1.00	2.03	3.01	0.06	0.01	0.10	1.75	7.95	0.60	0.34	0.02	0.03	0.64
5	132	9.55	23.51	40.96	0.74	0.27	1.67	29.20	105.90	1.04	2.02	2.98	0.06	0.01	0.10	1.78	7.98	0.60	0.35	0.02	0.03	0.63
6	165	9.27	23.56	40.67	0.72	0.28	1.61	29.19	105.30	1.01	2.03	2.98	0.06	0.02	0.10	1.79	7.98	0.60	0.34	0.02	0.03	0.64
7	198	9.21	23.50	41.07	0.75	0.09	1.62	29.44	105.68	1.00	2.02	3.00	0.06	0.00	0.10	1.80	7.98	0.61	0.34	0.02	0.03	0.64
8	231	9.26	23.17	41.03	0.72	0.23	1.59	28.66	104.66	1.01	2.01	3.01	0.06	0.01	0.10	1.76	7.96	0.60	0.35	0.02	0.03	0.63
9	264	9.05	23.66	41.18	0.87	0.28	1.54	29.29	105.87	0.98	2.03	2.99	0.07	0.02	0.10	1.78	7.96	0.61	0.34	0.02	0.03	0.64
11	330	8.99	23.54	40.80	1.00	0.22	1.55	29.38	105.47	0.98	2.03	2.98	0.08	0.01	0.10	1.80	7.98	0.61	0.33	0.03	0.03	0.65
12	363	9.10	23.53	41.19	0.93	0.25	1.52	28.85	105.37	0.99	2.02	3.00	0.07	0.01	0.09	1.76	7.96	0.60	0.34	0.03	0.03	0.64
14	429	9.03	23.42	40.70	0.95	0.27	1.61	28.89	104.86	0.99	2.03	2.99	0.07	0.01	0.10	1.78	7.97	0.60	0.34	0.03	0.03	0.64
15	462	9.04	23.47	41.02	1.05	0.20	1.49	28.90	105.17	0.99	2.02	3.00	0.08	0.01	0.09	1.77	7.96	0.60	0.34	0.03	0.03	0.64
16	495	9.09	23.51	41.16	1.14	0.29	1.58	28.46	105.24	0.99	2.02	3.00	0.09	0.02	0.10	1.74	7.95	0.60	0.34	0.03	0.03	0.64
17	528	9.09	23.53	41.00	1.08	0.18	1.50	28.96	105.34	0.99	2.03	3.00	0.08	0.01	0.09	1.77	7.97	0.60	0.34	0.03	0.03	0.64
18	561	9.25	23.69	41.04	1.22	0.21	1.61	28.61	105.62	1.00	2.03	2.99	0.10	0.01	0.10	1.74	7.97	0.59	0.34	0.03	0.03	0.63
19	594	8.88	23.20	40.96	1.17	0.23	1.56	28.67	104.67	0.97	2.01	3.01	0.09	0.01	0.10	1.76	7.96	0.60	0.33	0.03	0.03	0.64
20	627	9.19	23.53	40.94	1.23	0.29	1.64	28.84	105.66	1.00	2.02	2.98	0.10	0.02	0.10	1.76	7.97	0.60	0.34	0.03	0.03	0.64
21	660	9.14	23.47	41.15	1.28	0.21	1.56	28.94	105.75	0.99	2.01	3.00	0.10	0.01	0.10	1.76	7.97	0.60	0.34	0.03	0.03	0.64
23	726	9.07	23.44	41.11	1.16	0.18	1.60	29.02	105.58	0.99	2.02	3.00	0.09	0.01	0.10	1.77	7.97	0.60	0.33	0.03	0.03	0.64
24	759	8.83	23.35	40.76	1.17	0.21	1.52	29.22	105.06	0.97	2.02	2.99	0.09	0.01	0.09	1.79	7.97	0.61	0.33	0.03	0.03	0.65
25	792	8.97	23.62	41.27	1.26	0.20	1.63	28.65	105.61	0.97	2.03	3.00	0.10	0.01	0.10	1.74	7.96	0.60	0.33	0.03	0.03	0.64
26	825	8.71	23.32	40.69	1.04	0.11	1.47	28.49	103.83	0.96	2.04	3.01	0.08	0.01	0.09	1.76	7.95	0.61	0.33	0.03	0.03	0.65
27	858	9.01	23.14	40.85	1.26	0.23	1.64	28.52	104.66	0.99	2.01	3.00	0.10	0.01	0.10	1.75	7.97	0.60	0.34	0.03	0.03	0.64
28	891	8.99	23.58	41.16	1.14	0.17	1.53	28.65	105.22	0.98	2.03	3.01	0.09	0.01	0.09	1.75	7.96	0.60	0.34	0.03	0.03	0.64
29	924	8.94	23.65	40.80	1.29	0.18	1.50	29.04	105.40	0.97	2.04	2.98	0.10	0.01	0.09	1.78	7.98	0.60	0.33	0.03	0.03	0.65
30	957	9.20	23.64	40.69	1.18	0.18	1.61	28.54	105.06	1.00	2.04	2.98	0.09	0.01	0.10	1.75	7.98	0.59	0.34	0.03	0.03	0.64

31	990	8.93	23.33	41.04	1.21	0.21	1.51	28.66	104.90	0.98	2.02	3.01	0.10	0.01	0.09	1.76	7.96	0.60	0.33	0.03	0.03	0.64
32	1023	8.87	23.18	40.52	1.26	0.20	1.51	28.75	104.29	0.98	2.02	3.00	0.10	0.01	0.09	1.78	7.98	0.60	0.33	0.03	0.03	0.65
34	1122	9.27	23.65	41.09	1.16	0.18	1.62	28.16	105.13	1.01	2.03	3.00	0.09	0.01	0.10	1.72	7.96	0.59	0.35	0.03	0.03	0.63
35	1155	9.07	23.47	41.22	1.29	0.27	1.63	28.93	105.88	0.98	2.01	3.00	0.10	0.02	0.10	1.76	7.97	0.60	0.33	0.03	0.03	0.64
36	1188	8.96	23.58	40.95	1.27	0.32	1.66	28.80	105.55	0.97	2.03	2.99	0.10	0.02	0.10	1.76	7.97	0.60	0.33	0.03	0.03	0.64
37	1221	8.57	22.45	39.29	1.04	0.10	1.53	27.45	100.43	0.98	2.03	3.01	0.09	0.01	0.10	1.76	7.96	0.60	0.33	0.03	0.03	0.64
39	1254	8.59	22.85	40.16	1.13	0.12	1.65	28.07	102.57	0.96	2.02	3.01	0.09	0.01	0.11	1.76	7.96	0.60	0.33	0.03	0.04	0.65
42	1353	8.61	23.25	40.72	1.08	0.20	1.64	28.61	104.11	0.95	2.03	3.01	0.09	0.01	0.10	1.77	7.95	0.61	0.33	0.03	0.04	0.65
44	1452	8.58	22.56	39.57	1.04	0.17	1.47	27.90	101.28	0.97	2.02	3.01	0.08	0.01	0.09	1.77	7.96	0.61	0.33	0.03	0.03	0.65
45	1485	8.79	22.99	40.27	1.10	0.17	1.57	28.33	103.22	0.98	2.02	3.00	0.09	0.01	0.10	1.77	7.97	0.60	0.33	0.03	0.03	0.64
46	1518	8.75	22.67	39.74	1.11	0.19	1.58	27.99	102.03	0.98	2.02	3.00	0.09	0.01	0.10	1.77	7.97	0.60	0.33	0.03	0.03	0.64
50	1584	8.96	22.79	39.76	1.13	0.32	1.62	28.20	102.79	1.00	2.01	2.98	0.09	0.02	0.10	1.77	7.98	0.60	0.34	0.03	0.03	0.64
51	1617	8.87	23.14	40.59	1.05	0.24	1.60	28.20	103.69	0.98	2.02	3.01	0.08	0.01	0.10	1.75	7.95	0.60	0.34	0.03	0.03	0.64
53	1683	9.07	23.35	40.89	1.13	0.26	1.73	28.93	105.36	0.99	2.01	2.99	0.09	0.01	0.11	1.77	7.97	0.60	0.33	0.03	0.04	0.64
54	1716	8.90	22.63	39.81	0.97	0.24	1.60	28.26	102.41	1.00	2.01	3.00	0.08	0.01	0.10	1.78	7.97	0.60	0.34	0.03	0.03	0.64
57	1815	8.80	22.47	39.77	0.92	0.29	1.52	28.09	101.86	0.99	2.00	3.01	0.07	0.02	0.10	1.78	7.96	0.60	0.34	0.03	0.03	0.64
58	1848	9.14	23.01	40.04	0.74	0.21	1.50	28.50	103.14	1.02	2.02	2.99	0.06	0.01	0.09	1.78	7.98	0.60	0.34	0.02	0.03	0.64
59	1881	8.79	23.06	40.14	0.69	0.22	1.56	28.46	102.93	0.98	2.03	3.00	0.05	0.01	0.10	1.78	7.96	0.61	0.34	0.02	0.03	0.64

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.18: Composition of garnet A2 from sample HJ-34c (group 2) as analysed along traverse A-B (Plate 5.9e). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	6.82	23.15	40.13	0.77	0.40	1.77	32.87	105.91	0.75	2.02	2.97	0.06	0.02	0.11	2.04	7.98	0.69	0.25	0.02	0.04	0.73
2	33	7.41	22.48	39.15	0.65	0.20	1.59	30.57	102.04	0.84	2.02	2.99	0.05	0.01	0.10	1.95	7.97	0.66	0.29	0.02	0.03	0.70
3	66	8.03	22.97	40.25	0.64	0.15	1.71	30.79	104.54	0.89	2.01	2.99	0.05	0.01	0.11	1.92	7.98	0.65	0.30	0.02	0.04	0.68
4	99	8.42	23.02	40.97	0.63	0.18	1.56	30.26	105.04	0.92	2.00	3.02	0.05	0.01	0.10	1.86	7.96	0.64	0.31	0.02	0.03	0.67
5	132	8.27	22.82	40.00	0.56	0.12	1.43	29.78	102.98	0.93	2.02	3.01	0.05	0.01	0.09	1.87	7.97	0.64	0.32	0.02	0.03	0.67
7	198	8.74	23.34	41.04	0.69	0.31	1.57	30.27	105.96	0.95	2.01	3.00	0.05	0.02	0.10	1.85	7.97	0.63	0.32	0.02	0.03	0.66
10	297	8.87	23.13	40.72	0.73	0.21	1.52	29.56	104.74	0.97	2.01	3.00	0.06	0.01	0.10	1.82	7.97	0.62	0.33	0.02	0.03	0.65
11	330	8.78	23.10	40.20	0.68	0.25	1.47	29.74	104.22	0.97	2.02	2.98	0.05	0.01	0.09	1.85	7.98	0.62	0.33	0.02	0.03	0.66
12	363	8.65	22.81	40.22	0.66	0.16	1.50	29.33	103.32	0.96	2.01	3.01	0.05	0.01	0.09	1.83	7.97	0.62	0.33	0.02	0.03	0.66
14	429	9.00	23.46	40.89	0.72	0.24	1.42	29.69	105.42	0.98	2.02	2.99	0.06	0.01	0.09	1.82	7.97	0.62	0.33	0.02	0.03	0.65
15	462	8.96	23.12	40.55	0.60	0.19	1.45	29.09	103.96	0.99	2.02	3.00	0.05	0.01	0.09	1.80	7.96	0.62	0.34	0.02	0.03	0.65
16	495	8.78	23.11	40.81	0.58	0.09	1.39	29.13	103.90	0.97	2.02	3.02	0.05	0.01	0.09	1.80	7.95	0.62	0.33	0.02	0.03	0.65
18	561	9.00	23.07	40.44	0.63	0.23	1.50	28.88	103.75	1.00	2.02	3.00	0.05	0.01	0.09	1.79	7.96	0.61	0.34	0.02	0.03	0.64
19	594	8.86	23.13	40.51	0.77	0.25	1.67	29.25	104.44	0.98	2.01	2.99	0.06	0.01	0.10	1.81	7.97	0.61	0.33	0.02	0.04	0.65
20	627	9.15	23.42	40.62	0.64	0.29	1.67	28.98	104.77	1.00	2.03	2.98	0.05	0.02	0.10	1.78	7.97	0.61	0.34	0.02	0.04	0.64
21	660	9.08	22.97	40.77	0.70	0.27	1.59	29.55	104.93	1.00	1.99	3.00	0.06	0.01	0.10	1.82	7.98	0.61	0.34	0.02	0.03	0.65
22	693	8.80	23.17	39.98	0.65	0.18	1.44	29.15	103.38	0.98	2.04	2.98	0.05	0.01	0.09	1.82	7.97	0.62	0.33	0.02	0.03	0.65
23	726	9.10	23.49	41.12	0.65	0.26	1.58	29.66	105.86	0.99	2.02	2.99	0.05	0.01	0.10	1.81	7.97	0.61	0.34	0.02	0.03	0.65
25	792	9.10	23.76	40.72	0.71	0.23	1.43	29.92	105.87	0.99	2.04	2.97	0.06	0.01	0.09	1.82	7.98	0.62	0.33	0.02	0.03	0.65
26	825	8.99	23.50	40.71	0.67	0.17	1.48	30.01	105.53	0.98	2.03	2.98	0.05	0.01	0.09	1.84	7.98	0.62	0.33	0.02	0.03	0.65
27	858	8.98	22.97	40.12	0.65	0.21	1.49	28.89	103.31	1.00	2.02	2.99	0.05	0.01	0.09	1.80	7.97	0.61	0.34	0.02	0.03	0.64
28	891	8.93	23.00	40.40	0.56	0.20	1.44	29.37	103.89	0.99	2.01	3.00	0.04	0.01	0.09	1.82	7.97	0.62	0.34	0.02	0.03	0.65
29	924	9.25	23.36	40.81	0.69	0.29	1.56	29.46	105.44	1.01	2.01	2.98	0.05	0.02	0.10	1.80	7.98	0.61	0.34	0.02	0.03	0.64
30	957	8.74	22.64	39.93	0.88	0.20	1.51	28.54	102.43	0.98	2.01	3.01	0.07	0.01	0.10	1.80	7.97	0.61	0.33	0.02	0.03	0.65
32	1023	8.86	22.64	40.18	0.63	0.23	1.54	28.78	102.87	0.99	2.00	3.01	0.05	0.01	0.10	1.80	7.96	0.61	0.34	0.02	0.03	0.65

33	1056	9.14	23.53	41.09	0.74	0.18	1.55	29.44	105.66	0.99	2.02	3.00	0.06	0.01	0.10	1.80	7.97	0.61	0.34	0.02	0.03	0.64
34	1089	8.68	22.35	39.00	0.58	0.20	1.54	28.14	100.48	0.99	2.02	2.99	0.05	0.01	0.10	1.81	7.97	0.61	0.34	0.02	0.03	0.65
35	1122	8.73	22.77	39.90	0.64	0.24	1.51	28.74	102.53	0.98	2.02	3.00	0.05	0.01	0.10	1.81	7.97	0.62	0.33	0.02	0.03	0.65
36	1155	9.08	22.80	40.06	0.67	0.25	1.55	28.55	102.96	1.01	2.01	3.00	0.05	0.01	0.10	1.79	7.97	0.61	0.34	0.02	0.03	0.64
37	1188	8.73	22.40	39.07	0.72	0.16	1.57	28.16	100.81	1.00	2.02	2.99	0.06	0.01	0.10	1.80	7.98	0.61	0.34	0.02	0.03	0.64
38	1221	9.07	22.95	40.33	0.60	0.17	1.42	29.01	103.55	1.01	2.01	3.00	0.05	0.01	0.09	1.80	7.97	0.61	0.34	0.02	0.03	0.64
39	1254	9.07	23.46	41.47	0.59	0.20	1.57	29.61	105.97	0.98	2.01	3.01	0.05	0.01	0.10	1.80	7.96	0.62	0.34	0.02	0.03	0.65
41	1320	9.25	23.68	41.00	0.70	0.21	1.52	29.12	105.48	1.01	2.04	2.99	0.05	0.01	0.09	1.78	7.97	0.61	0.34	0.02	0.03	0.64
43	1386	9.21	23.52	41.25	0.71	0.19	1.75	28.90	105.53	1.00	2.02	3.01	0.06	0.01	0.11	1.76	7.96	0.60	0.34	0.02	0.04	0.64
47	1518	8.99	23.49	41.34	0.61	0.13	1.59	29.63	105.78	0.98	2.02	3.01	0.05	0.01	0.10	1.81	7.96	0.62	0.33	0.02	0.03	0.65
48	1551	8.40	22.58	37.37	0.68	0.15	1.51	28.80	99.50	0.98	2.08	2.92	0.06	0.01	0.10	1.88	8.02	0.62	0.32	0.02	0.03	0.66
49	1584	8.86	22.91	40.16	0.73	0.18	1.54	29.00	103.39	0.99	2.02	3.00	0.06	0.01	0.10	1.81	7.97	0.61	0.33	0.02	0.03	0.65
50	1617	9.00	23.25	41.33	0.68	0.10	1.53	29.47	105.35	0.98	2.00	3.02	0.05	0.01	0.09	1.80	7.96	0.61	0.33	0.02	0.03	0.65
51	1650	9.19	23.02	40.54	0.67	0.14	1.41	28.69	103.66	1.02	2.01	3.01	0.05	0.01	0.09	1.78	7.97	0.61	0.35	0.02	0.03	0.64
52	1683	9.39	23.20	40.41	0.79	0.22	1.57	29.03	104.60	1.03	2.02	2.98	0.06	0.01	0.10	1.79	7.99	0.60	0.35	0.02	0.03	0.63
53	1716	8.79	22.97	39.70	0.75	0.24	1.48	28.61	102.54	0.98	2.04	2.98	0.06	0.01	0.09	1.80	7.97	0.61	0.34	0.02	0.03	0.65
54	1749	8.90	22.68	40.28	0.66	0.21	1.41	29.32	103.47	0.99	1.99	3.00	0.05	0.01	0.09	1.83	7.97	0.62	0.33	0.02	0.03	0.65
55	1782	8.92	22.87	39.55	0.68	0.18	1.48	28.89	102.58	1.00	2.03	2.98	0.05	0.01	0.09	1.82	7.99	0.61	0.34	0.02	0.03	0.65
61	1980	8.88	23.42	40.90	0.65	0.19	1.55	29.32	104.91	0.97	2.03	3.00	0.05	0.01	0.10	1.80	7.96	0.62	0.33	0.02	0.03	0.65
62	2013	8.69	23.01	40.57	0.61	0.25	1.54	29.92	104.59	0.96	2.00	3.00	0.05	0.01	0.10	1.85	7.97	0.63	0.32	0.02	0.03	0.66
63	2046	8.74	23.49	40.91	0.64	0.19	1.57	30.02	105.58	0.95	2.03	2.99	0.05	0.01	0.10	1.84	7.97	0.63	0.32	0.02	0.03	0.66
64	2079	8.36	22.96	40.79	0.66	0.12	1.47	29.65	104.02	0.92	2.01	3.03	0.05	0.01	0.09	1.84	7.95	0.63	0.32	0.02	0.03	0.67
65	2112	7.33	23.33	40.79	0.73	0.17	1.62	31.87	105.83	0.80	2.02	3.00	0.06	0.01	0.10	1.96	7.96	0.67	0.27	0.02	0.03	0.71

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.19: Composition of garnet A3 from sample HJ-34c (group 2) as analysed along traverse A-B (Plate 5.9f). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	9.04	23.19	40.63	0.85	0.17	1.68	28.81	104.38	0.99	2.02	3.00	0.07	0.01	0.11	1.78	7.97	0.60	0.34	0.02	0.04	0.64
2	33	9.14	23.08	40.66	0.70	0.21	1.52	29.61	104.93	1.00	2.00	2.99	0.06	0.01	0.09	1.82	7.98	0.61	0.34	0.02	0.03	0.65
3	66	9.35	23.54	40.97	0.75	0.26	1.58	29.15	105.60	1.02	2.02	2.99	0.06	0.01	0.10	1.78	7.97	0.60	0.34	0.02	0.03	0.64
4	99	9.25	23.44	40.98	0.83	0.22	1.58	29.54	105.83	1.01	2.01	2.99	0.06	0.01	0.10	1.80	7.98	0.61	0.34	0.02	0.03	0.64
5	132	9.18	23.43	40.86	0.75	0.20	1.63	29.04	105.08	1.00	2.02	2.99	0.06	0.01	0.10	1.78	7.97	0.60	0.34	0.02	0.03	0.64
8	231	9.03	22.86	40.08	0.86	0.21	1.52	28.13	102.69	1.01	2.02	3.00	0.07	0.01	0.10	1.76	7.96	0.60	0.34	0.02	0.03	0.64
9	264	9.35	23.45	41.09	0.91	0.21	1.55	28.78	105.33	1.02	2.02	3.00	0.07	0.01	0.10	1.76	7.97	0.60	0.35	0.02	0.03	0.63
12	363	9.10	23.05	40.02	1.00	0.23	1.57	28.49	103.46	1.01	2.02	2.98	0.08	0.01	0.10	1.78	7.98	0.60	0.34	0.03	0.03	0.64
14	429	8.68	22.32	38.99	0.95	0.23	1.55	27.33	100.06	1.00	2.02	3.00	0.08	0.01	0.10	1.76	7.97	0.60	0.34	0.03	0.03	0.64
15	462	8.86	23.13	40.44	1.01	0.15	1.65	28.75	103.99	0.98	2.02	3.00	0.08	0.01	0.10	1.78	7.97	0.61	0.33	0.03	0.04	0.65
17	528	8.80	22.56	39.71	1.02	0.16	1.49	28.10	101.84	0.99	2.01	3.00	0.08	0.01	0.10	1.78	7.97	0.60	0.34	0.03	0.03	0.64
18	561	9.15	23.28	40.54	1.10	0.22	1.66	28.70	104.63	1.00	2.02	2.99	0.09	0.01	0.10	1.77	7.98	0.60	0.34	0.03	0.03	0.64
19	594	9.07	23.40	40.75	1.18	0.26	1.62	28.97	105.25	0.99	2.02	2.98	0.09	0.01	0.10	1.77	7.98	0.60	0.33	0.03	0.03	0.64
20	627	9.07	23.51	40.95	1.12	0.27	1.70	29.20	105.83	0.99	2.02	2.98	0.09	0.02	0.10	1.78	7.98	0.60	0.33	0.03	0.04	0.64
21	660	9.12	23.26	40.63	1.15	0.25	1.62	28.60	104.61	1.00	2.02	2.99	0.09	0.01	0.10	1.76	7.97	0.60	0.34	0.03	0.03	0.64
24	759	9.13	23.14	40.68	1.13	0.13	1.57	28.62	104.40	1.00	2.01	3.00	0.09	0.01	0.10	1.77	7.97	0.60	0.34	0.03	0.03	0.64
25	792	8.89	22.83	39.97	1.08	0.22	1.50	27.98	102.47	0.99	2.02	3.00	0.09	0.01	0.10	1.76	7.97	0.60	0.34	0.03	0.03	0.64
26	825	9.02	23.09	40.85	1.12	0.21	1.47	28.85	104.62	0.99	2.00	3.01	0.09	0.01	0.09	1.78	7.97	0.60	0.34	0.03	0.03	0.64
27	858	8.85	22.87	40.23	1.05	0.07	1.54	28.39	103.00	0.99	2.01	3.01	0.08	0.00	0.10	1.77	7.97	0.60	0.34	0.03	0.03	0.64
28	891	8.86	23.01	40.50	0.99	0.13	1.58	28.91	103.98	0.98	2.01	3.00	0.08	0.01	0.10	1.79	7.97	0.61	0.33	0.03	0.03	0.65
29	924	9.26	23.45	40.86	1.10	0.20	1.63	28.62	105.12	1.01	2.02	2.99	0.09	0.01	0.10	1.75	7.98	0.59	0.34	0.03	0.03	0.63
32	1023	9.15	23.24	40.59	1.21	0.35	1.64	28.97	105.14	1.00	2.01	2.98	0.10	0.02	0.10	1.78	7.98	0.60	0.34	0.03	0.03	0.64
33	1056	8.60	22.48	39.36	0.93	0.09	1.56	27.90	100.91	0.98	2.02	3.00	0.08	0.01	0.10	1.78	7.97	0.61	0.33	0.03	0.03	0.65
34	1089	8.47	22.14	39.17	0.93	0.19	1.57	27.69	100.16	0.97	2.01	3.01	0.08	0.01	0.10	1.78	7.96	0.61	0.33	0.03	0.03	0.65
35	1122	8.96	23.04	40.40	0.87	0.20	1.59	28.68	103.74	0.99	2.02	3.00	0.07	0.01	0.10	1.78	7.97	0.61	0.34	0.02	0.03	0.64

36	1155	8.85	22.85	39.99	0.96	0.23	1.51	28.20	102.60	0.99	2.02	3.00	0.08	0.01	0.10	1.77	7.97	0.60	0.34	0.03	0.03	0.64
38	1221	9.04	22.92	40.18	0.96	0.30	1.57	28.62	103.60	1.00	2.01	2.99	0.08	0.02	0.10	1.78	7.97	0.60	0.34	0.03	0.03	0.64
39	1254	8.48	22.27	38.99	1.01	0.31	1.70	29.20	101.94	0.96	2.00	2.97	0.08	0.02	0.11	1.86	8.00	0.62	0.32	0.03	0.04	0.66
40	1287	9.48	23.94	39.99	0.85	0.24	1.51	27.47	103.47	1.05	2.09	2.96	0.07	0.01	0.09	1.70	7.97	0.58	0.36	0.02	0.03	0.62
42	1353	9.18	23.29	41.08	0.81	0.19	1.77	29.35	105.66	1.00	2.00	3.00	0.06	0.01	0.11	1.79	7.97	0.60	0.34	0.02	0.04	0.64
43	1386	9.10	23.46	40.96	0.67	0.16	1.63	28.42	104.40	1.00	2.03	3.01	0.05	0.01	0.10	1.75	7.95	0.60	0.34	0.02	0.04	0.64
44	1419	8.93	23.13	40.31	0.60	0.12	1.50	28.78	103.37	0.99	2.03	3.00	0.05	0.01	0.09	1.79	7.97	0.61	0.34	0.02	0.03	0.64
45	1452	9.10	23.08	40.43	0.76	0.21	1.53	28.44	103.57	1.01	2.02	3.00	0.06	0.01	0.10	1.77	7.96	0.60	0.34	0.02	0.03	0.64
46	1485	9.24	23.37	40.87	0.75	0.30	1.61	29.31	105.45	1.01	2.01	2.99	0.06	0.02	0.10	1.79	7.97	0.61	0.34	0.02	0.03	0.64
49	1584	9.37	23.52	41.09	0.74	0.21	1.62	29.32	105.88	1.02	2.02	2.99	0.06	0.01	0.10	1.78	7.98	0.60	0.34	0.02	0.03	0.64
50	1617	9.16	23.18	40.50	0.75	0.30	1.56	29.03	104.47	1.01	2.02	2.99	0.06	0.02	0.10	1.79	7.98	0.61	0.34	0.02	0.03	0.64
51	1650	8.61	22.20	39.49	0.57	0.13	1.51	27.28	99.79	0.99	2.01	3.04	0.05	0.01	0.10	1.75	7.94	0.61	0.34	0.02	0.03	0.64
52	1683	9.02	23.36	40.76	0.66	0.18	1.56	29.13	104.66	0.99	2.03	3.00	0.05	0.01	0.10	1.79	7.97	0.61	0.34	0.02	0.03	0.64
53	1716	9.31	23.51	40.49	0.74	0.22	1.50	29.00	104.76	1.02	2.04	2.98	0.06	0.01	0.09	1.78	7.98	0.60	0.35	0.02	0.03	0.64
55	1782	9.31	23.21	40.80	0.70	0.21	1.51	28.26	103.99	1.02	2.02	3.01	0.06	0.01	0.09	1.74	7.96	0.60	0.35	0.02	0.03	0.63

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.20: Composition of garnet A3 from sample HJ-34c (group 2) as analysed along traverse C-D (Plate 5.9f). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	7.51	21.96	38.47	0.67	0.35	1.52	29.38	99.85	0.87	2.01	2.99	0.06	0.02	0.10	1.91	7.96	0.65	0.30	0.02	0.03	0.69
2	34	8.36	22.56	39.12	0.69	0.25	1.53	28.80	101.32	0.95	2.03	2.98	0.06	0.01	0.10	1.84	7.97	0.62	0.32	0.02	0.03	0.66
5	136	8.74	23.06	39.99	0.59	0.25	1.59	29.14	103.35	0.97	2.03	2.99	0.05	0.01	0.10	1.82	7.97	0.62	0.33	0.02	0.03	0.65
9	272	8.81	23.22	40.68	0.74	0.19	1.57	29.56	104.76	0.97	2.02	3.00	0.06	0.01	0.10	1.82	7.97	0.62	0.33	0.02	0.03	0.65
10	306	8.92	22.82	39.88	0.75	0.16	1.55	28.60	102.69	1.00	2.02	2.99	0.06	0.01	0.10	1.80	7.98	0.61	0.34	0.02	0.03	0.64
12	374	9.11	23.14	40.48	0.92	0.32	1.69	28.84	104.50	1.00	2.01	2.99	0.07	0.02	0.11	1.78	7.97	0.60	0.34	0.02	0.04	0.64
15	476	9.10	23.37	41.23	0.92	0.10	1.47	29.23	105.44	0.99	2.01	3.01	0.07	0.01	0.09	1.79	7.97	0.61	0.34	0.02	0.03	0.64
16	510	9.00	23.03	40.83	0.93	0.20	1.64	28.52	104.14	0.99	2.00	3.02	0.07	0.01	0.10	1.76	7.96	0.60	0.34	0.03	0.04	0.64
18	578	8.58	21.97	39.31	1.00	0.21	1.52	27.78	100.36	0.98	1.99	3.02	0.08	0.01	0.10	1.78	7.96	0.61	0.33	0.03	0.03	0.64
19	612	8.95	22.98	40.56	0.96	0.21	1.53	28.47	103.67	0.99	2.01	3.01	0.08	0.01	0.10	1.77	7.96	0.60	0.34	0.03	0.03	0.64
20	646	9.09	23.55	40.62	1.14	0.28	1.67	28.91	105.26	0.99	2.03	2.98	0.09	0.02	0.10	1.77	7.98	0.60	0.34	0.03	0.04	0.64
21	680	8.82	22.93	40.46	0.99	0.25	1.74	28.67	103.86	0.98	2.01	3.00	0.08	0.01	0.11	1.78	7.97	0.60	0.33	0.03	0.04	0.65
23	748	8.76	22.91	40.17	1.05	0.14	1.55	28.20	102.79	0.98	2.02	3.01	0.08	0.01	0.10	1.77	7.96	0.60	0.33	0.03	0.03	0.64
24	782	8.96	22.98	41.04	1.09	0.13	1.61	28.77	104.58	0.98	1.99	3.02	0.09	0.01	0.10	1.77	7.96	0.60	0.33	0.03	0.03	0.64
25	816	8.73	22.85	40.09	1.11	0.20	1.61	28.57	103.16	0.97	2.01	3.00	0.09	0.01	0.10	1.79	7.97	0.61	0.33	0.03	0.03	0.65
26	850	8.94	23.05	40.36	1.15	0.28	1.67	28.35	103.79	0.99	2.02	2.99	0.09	0.02	0.10	1.76	7.97	0.60	0.34	0.03	0.04	0.64
27	884	9.08	22.70	40.89	1.07	0.24	1.59	28.78	104.34	1.00	1.98	3.02	0.08	0.01	0.10	1.78	7.97	0.60	0.34	0.03	0.03	0.64
28	918	9.03	23.46	41.17	1.06	0.17	1.55	29.29	105.72	0.98	2.02	3.00	0.08	0.01	0.10	1.79	7.97	0.61	0.33	0.03	0.03	0.65
30	986	8.90	23.04	40.53	1.10	0.23	1.58	28.46	103.85	0.98	2.01	3.00	0.09	0.01	0.10	1.76	7.96	0.60	0.34	0.03	0.03	0.64
32	1054	8.67	22.46	39.55	1.09	0.24	1.54	27.86	101.42	0.98	2.01	3.00	0.09	0.01	0.10	1.77	7.97	0.60	0.33	0.03	0.03	0.64
33	1088	9.04	23.17	40.32	1.14	0.21	1.54	28.86	104.29	1.00	2.02	2.98	0.09	0.01	0.10	1.79	7.98	0.60	0.34	0.03	0.03	0.64
35	1156	8.76	23.02	40.72	1.08	0.11	1.40	28.37	103.46	0.97	2.01	3.02	0.09	0.01	0.09	1.76	7.95	0.61	0.33	0.03	0.03	0.65
36	1190	8.79	23.18	40.90	1.05	0.20	1.57	29.04	104.74	0.96	2.01	3.01	0.08	0.01	0.10	1.79	7.96	0.61	0.33	0.03	0.03	0.65
38	1258	8.88	23.20	41.30	1.05	0.16	1.57	28.79	104.96	0.97	2.00	3.03	0.08	0.01	0.10	1.76	7.95	0.61	0.33	0.03	0.03	0.65
40	1326	8.76	22.66	39.30	1.04	0.20	1.47	27.62	101.05	0.99	2.03	2.99	0.09	0.01	0.09	1.76	7.97	0.60	0.34	0.03	0.03	0.64

41	1360	8.74	23.02	40.56	1.11	0.12	1.53	28.08	103.17	0.97	2.02	3.02	0.09	0.01	0.10	1.75	7.95	0.60	0.33	0.03	0.03	0.64
42	1394	9.01	23.33	41.18	1.16	0.23	1.52	29.31	105.75	0.98	2.00	3.00	0.09	0.01	0.09	1.79	7.97	0.61	0.33	0.03	0.03	0.65
44	1462	8.59	22.40	39.30	1.05	0.23	1.52	27.81	100.89	0.98	2.02	3.00	0.09	0.01	0.10	1.78	7.97	0.60	0.33	0.03	0.03	0.64
45	1496	8.81	22.99	40.39	1.05	0.24	1.68	28.60	103.75	0.98	2.01	3.00	0.08	0.01	0.11	1.78	7.97	0.60	0.33	0.03	0.04	0.65
46	1530	8.83	22.52	39.78	1.01	0.14	1.42	27.96	101.66	1.00	2.01	3.01	0.08	0.01	0.09	1.77	7.97	0.60	0.34	0.03	0.03	0.64
47	1564	9.03	23.07	40.55	0.96	0.24	1.54	28.87	104.27	1.00	2.01	3.00	0.08	0.01	0.10	1.78	7.97	0.60	0.34	0.03	0.03	0.64
48	1598	8.74	22.36	39.18	1.01	0.22	1.52	27.50	100.53	1.00	2.02	3.00	0.08	0.01	0.10	1.76	7.97	0.60	0.34	0.03	0.03	0.64
49	1632	8.70	22.98	40.07	1.06	0.14	1.43	28.61	103.00	0.97	2.03	3.00	0.09	0.01	0.09	1.79	7.97	0.61	0.33	0.03	0.03	0.65
50	1666	9.02	22.96	40.38	1.06	0.28	1.57	28.73	104.01	1.00	2.01	2.99	0.08	0.02	0.10	1.78	7.98	0.60	0.34	0.03	0.03	0.64
51	1700	9.07	23.10	40.50	1.00	0.17	1.52	29.09	104.45	1.00	2.01	2.99	0.08	0.01	0.10	1.80	7.98	0.61	0.34	0.03	0.03	0.64
52	1734	9.08	23.56	40.93	0.97	0.22	1.56	29.29	105.60	0.99	2.03	2.99	0.08	0.01	0.10	1.79	7.98	0.61	0.33	0.03	0.03	0.64
54	1802	9.10	23.43	40.76	0.94	0.21	1.52	29.27	105.22	0.99	2.02	2.99	0.07	0.01	0.09	1.79	7.98	0.61	0.34	0.03	0.03	0.64
55	1836	9.10	23.24	40.66	0.89	0.25	1.66	29.17	104.96	1.00	2.01	2.99	0.07	0.01	0.10	1.79	7.98	0.61	0.34	0.02	0.03	0.64
57	1904	8.80	23.24	40.86	0.74	0.12	1.54	29.10	104.40	0.97	2.02	3.01	0.06	0.01	0.10	1.79	7.96	0.62	0.33	0.02	0.03	0.65
58	1938	9.14	23.27	40.82	0.74	0.23	1.49	29.26	104.96	1.00	2.01	3.00	0.06	0.01	0.09	1.80	7.97	0.61	0.34	0.02	0.03	0.64
59	1972	8.70	23.06	40.77	0.67	0.15	1.55	28.90	103.80	0.96	2.02	3.02	0.05	0.01	0.10	1.79	7.95	0.62	0.33	0.02	0.03	0.65
60	2006	8.65	23.26	41.04	0.68	0.14	1.45	29.18	104.41	0.95	2.02	3.03	0.05	0.01	0.09	1.80	7.95	0.62	0.33	0.02	0.03	0.65
63	2108	8.84	22.98	40.17	0.69	0.23	1.59	29.23	103.74	0.98	2.02	2.99	0.06	0.01	0.10	1.82	7.97	0.62	0.33	0.02	0.03	0.65
68	2278	8.41	23.28	40.91	0.68	0.19	1.71	30.73	105.91	0.92	2.01	3.00	0.05	0.01	0.11	1.88	7.98	0.64	0.31	0.02	0.04	0.67
70	2346	7.49	23.00	40.02	0.59	0.18	1.67	31.17	104.13	0.84	2.03	2.99	0.05	0.01	0.11	1.95	7.97	0.66	0.28	0.02	0.04	0.70

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.21: Composition of garnet A5 from sample HJ-34c (group 2) as analysed along traverse A-B (Plate 5.9g). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
4	153	12.20	23.79	41.81	0.58	0.13	1.05	26.10	105.67	1.30	2.01	2.99	0.04	0.01	0.06	1.56	7.98	0.53	0.44	0.02	0.02	0.55
8	357	11.85	23.40	41.36	0.60	0.14	1.03	25.30	103.68	1.29	2.01	3.01	0.05	0.01	0.06	1.54	7.97	0.52	0.44	0.02	0.02	0.54
9	408	11.88	23.71	41.63	0.55	0.23	1.00	25.84	104.83	1.28	2.02	3.00	0.04	0.01	0.06	1.56	7.97	0.53	0.43	0.01	0.02	0.55
10	459	12.26	23.71	41.22	0.59	0.19	1.18	25.86	105.02	1.32	2.02	2.97	0.05	0.01	0.07	1.56	8.00	0.52	0.44	0.02	0.02	0.54
11	510	11.65	23.64	41.63	0.55	0.26	1.16	26.46	105.34	1.25	2.00	3.00	0.04	0.01	0.07	1.59	7.97	0.54	0.42	0.01	0.02	0.56
12	561	11.62	23.24	41.24	0.58	0.09	1.01	25.75	103.52	1.27	2.00	3.01	0.05	0.01	0.06	1.57	7.97	0.53	0.43	0.02	0.02	0.55
13	612	11.80	24.08	42.02	0.60	0.20	1.09	26.09	105.87	1.26	2.03	3.00	0.05	0.01	0.07	1.56	7.96	0.53	0.43	0.02	0.02	0.55
14	663	11.52	23.15	40.48	0.57	0.16	0.95	24.83	101.65	1.27	2.03	3.01	0.05	0.01	0.06	1.54	7.96	0.53	0.44	0.02	0.02	0.55
15	714	12.02	23.44	41.30	0.56	0.20	1.03	25.88	104.43	1.30	2.00	2.99	0.04	0.01	0.06	1.57	7.98	0.53	0.44	0.01	0.02	0.55
17	816	10.41	21.41	37.95	0.56	0.14	0.99	25.68	97.14	1.22	1.98	2.99	0.05	0.01	0.07	1.69	8.00	0.56	0.40	0.02	0.02	0.58
18	867	12.09	23.69	41.91	0.57	0.19	0.96	25.47	104.88	1.30	2.01	3.01	0.04	0.01	0.06	1.53	7.96	0.52	0.44	0.01	0.02	0.54
19	918	11.95	23.35	40.77	0.65	0.33	1.19	25.72	103.95	1.30	2.01	2.97	0.05	0.02	0.07	1.57	7.99	0.52	0.43	0.02	0.02	0.55
20	969	11.66	22.62	40.05	0.57	0.15	0.98	24.30	100.33	1.31	2.00	3.01	0.05	0.01	0.06	1.53	7.97	0.52	0.44	0.02	0.02	0.54
21	1020	12.40	24.02	41.88	0.59	0.21	1.13	25.58	105.82	1.32	2.02	2.99	0.05	0.01	0.07	1.53	7.98	0.52	0.45	0.02	0.02	0.54
24	1173	11.23	22.43	39.55	0.40	0.17	1.14	24.44	99.36	1.27	2.01	3.01	0.03	0.01	0.07	1.56	7.97	0.53	0.43	0.01	0.03	0.55
25	1224	12.06	23.73	41.00	0.48	0.25	1.01	25.37	103.91	1.31	2.03	2.98	0.04	0.01	0.06	1.54	7.97	0.52	0.44	0.01	0.02	0.54
28	1377	12.05	23.47	41.12	0.53	0.19	1.12	24.96	103.44	1.31	2.02	3.00	0.04	0.01	0.07	1.52	7.97	0.52	0.45	0.01	0.02	0.54
29	1428	11.84	23.42	40.98	0.48	0.16	0.97	24.69	102.53	1.30	2.03	3.01	0.04	0.01	0.06	1.52	7.96	0.52	0.45	0.01	0.02	0.54
31	1530	11.68	23.02	40.13	0.44	0.18	1.05	24.65	101.14	1.30	2.03	3.00	0.04	0.01	0.07	1.54	7.97	0.52	0.44	0.01	0.02	0.54
32	1581	12.11	23.61	40.80	0.52	0.22	1.04	25.36	103.67	1.32	2.03	2.97	0.04	0.01	0.06	1.55	7.98	0.52	0.44	0.01	0.02	0.54
33	1632	12.20	23.82	41.91	0.56	0.21	1.07	25.93	105.69	1.30	2.01	3.00	0.04	0.01	0.06	1.55	7.97	0.52	0.44	0.01	0.02	0.54
35	1734	12.18	23.71	41.62	0.66	0.29	1.19	25.21	104.86	1.31	2.01	3.00	0.05	0.02	0.07	1.52	7.97	0.51	0.44	0.02	0.02	0.54
36	1785	11.78	22.97	40.49	0.55	0.15	1.00	24.16	101.08	1.31	2.02	3.02	0.04	0.01	0.06	1.50	7.96	0.52	0.45	0.01	0.02	0.54
39	1938	12.08	23.89	41.55	0.58	0.07	1.03	25.46	104.66	1.30	2.03	3.00	0.05	0.00	0.06	1.54	7.97	0.52	0.44	0.02	0.02	0.54
40	1989	11.93	23.76	41.28	0.54	0.20	1.09	25.57	104.36	1.29	2.03	2.99	0.04	0.01	0.07	1.55	7.98	0.53	0.44	0.01	0.02	0.55

42	2091	11.62	22.85	40.13	0.56	0.20	1.06	24.27	100.69	1.30	2.02	3.01	0.05	0.01	0.07	1.52	7.97	0.52	0.44	0.02	0.02	0.54
43	2142	12.24	24.15	42.31	0.60	0.16	1.09	25.43	105.99	1.30	2.02	3.01	0.05	0.01	0.07	1.51	7.96	0.52	0.44	0.02	0.02	0.54
44	2193	12.03	23.68	41.13	0.62	0.21	1.06	25.22	103.95	1.30	2.03	2.99	0.05	0.01	0.07	1.53	7.97	0.52	0.44	0.02	0.02	0.54
46	2295	12.09	23.59	41.32	0.53	0.24	1.08	25.04	103.88	1.31	2.02	3.00	0.04	0.01	0.07	1.52	7.96	0.52	0.45	0.01	0.02	0.54
47	2346	11.97	23.70	41.61	0.57	0.25	1.09	25.16	104.34	1.29	2.02	3.01	0.04	0.01	0.07	1.52	7.96	0.52	0.44	0.02	0.02	0.54
48	2397	12.09	23.47	40.91	0.55	0.18	1.10	25.14	103.44	1.32	2.02	2.99	0.04	0.01	0.07	1.54	7.98	0.52	0.44	0.01	0.02	0.54
51	2550	12.12	23.68	41.17	0.50	0.17	1.08	25.41	104.12	1.31	2.02	2.99	0.04	0.01	0.07	1.54	7.98	0.52	0.44	0.01	0.02	0.54
52	2601	11.78	23.89	41.57	0.54	0.12	1.06	25.39	104.35	1.27	2.04	3.01	0.04	0.01	0.06	1.54	7.96	0.53	0.44	0.01	0.02	0.55
54	2703	12.09	23.53	41.38	0.57	0.17	1.08	24.96	103.79	1.31	2.01	3.01	0.04	0.01	0.07	1.52	7.97	0.52	0.45	0.02	0.02	0.54
55	2754	12.35	24.19	41.59	0.69	0.31	1.12	25.37	105.62	1.31	2.03	2.97	0.05	0.02	0.07	1.51	7.97	0.51	0.45	0.02	0.02	0.54
56	2805	12.31	23.92	42.12	0.46	0.17	1.11	25.63	105.72	1.31	2.01	3.01	0.04	0.01	0.07	1.53	7.97	0.52	0.45	0.01	0.02	0.54
57	2856	12.10	23.66	41.66	0.53	0.10	1.14	25.29	104.47	1.30	2.01	3.01	0.04	0.01	0.07	1.53	7.97	0.52	0.44	0.01	0.02	0.54
58	2907	11.79	23.46	40.83	0.56	0.18	1.08	25.05	102.95	1.29	2.03	2.99	0.04	0.01	0.07	1.54	7.97	0.52	0.44	0.02	0.02	0.54
62	3111	12.02	23.70	41.31	0.62	0.26	1.19	24.91	104.01	1.30	2.03	3.00	0.05	0.01	0.07	1.51	7.97	0.52	0.44	0.02	0.03	0.54
64	3213	11.85	23.46	40.69	0.55	0.14	1.11	24.79	102.61	1.30	2.03	2.99	0.04	0.01	0.07	1.52	7.97	0.52	0.44	0.01	0.02	0.54
66	3315	12.15	23.94	41.96	0.53	0.09	1.08	25.46	105.20	1.30	2.02	3.01	0.04	0.00	0.07	1.53	7.96	0.52	0.44	0.01	0.02	0.54
67	3366	12.00	23.61	41.83	0.57	0.16	1.17	25.31	104.66	1.29	2.01	3.02	0.04	0.01	0.07	1.53	7.96	0.52	0.44	0.01	0.02	0.54
68	3417	12.33	23.87	41.64	0.60	0.23	1.11	25.20	104.98	1.32	2.02	2.99	0.05	0.01	0.07	1.51	7.97	0.51	0.45	0.02	0.02	0.53
69	3468	12.15	23.93	41.73	0.51	0.13	1.08	25.74	105.28	1.30	2.02	3.00	0.04	0.01	0.07	1.55	7.98	0.52	0.44	0.01	0.02	0.54
70	3519	12.06	23.65	41.74	0.57	0.11	1.01	25.20	104.35	1.30	2.01	3.02	0.04	0.01	0.06	1.52	7.96	0.52	0.44	0.02	0.02	0.54
71	3570	12.00	23.90	41.86	0.58	0.24	1.09	25.52	105.19	1.28	2.02	3.00	0.04	0.01	0.07	1.53	7.96	0.52	0.44	0.02	0.02	0.54
72	3621	12.12	23.66	41.59	0.51	0.20	1.07	25.27	104.42	1.31	2.02	3.01	0.04	0.01	0.07	1.53	7.97	0.52	0.44	0.01	0.02	0.54
73	3672	12.14	23.92	41.87	0.56	0.15	1.16	25.63	105.43	1.30	2.02	3.00	0.04	0.01	0.07	1.54	7.97	0.52	0.44	0.01	0.02	0.54
74	3723	12.07	23.66	41.68	0.63	0.17	1.10	25.46	104.77	1.30	2.01	3.00	0.05	0.01	0.07	1.53	7.97	0.52	0.44	0.02	0.02	0.54
75	3774	11.96	23.83	41.56	0.60	0.14	1.11	25.34	104.54	1.29	2.03	3.00	0.05	0.01	0.07	1.53	7.97	0.52	0.44	0.02	0.02	0.54
76	3825	12.21	23.93	42.01	0.68	0.19	1.04	25.39	105.45	1.30	2.02	3.00	0.05	0.01	0.06	1.52	7.97	0.52	0.44	0.02	0.02	0.54
77	3876	12.21	23.73	41.76	0.64	0.23	1.09	25.25	104.91	1.31	2.01	3.00	0.05	0.01	0.07	1.52	7.97	0.52	0.44	0.02	0.02	0.54
78	3927	11.84	23.75	41.61	0.64	0.17	1.10	25.65	104.75	1.27	2.02	3.00	0.05	0.01	0.07	1.55	7.97	0.53	0.43	0.02	0.02	0.55
79	3978	12.17	23.77	41.58	0.72	0.23	1.19	25.42	105.08	1.30	2.01	2.99	0.06	0.01	0.07	1.53	7.98	0.52	0.44	0.02	0.02	0.54
80	4029	12.16	23.80	41.38	0.80	0.32	1.24	25.44	105.14	1.30	2.02	2.98	0.06	0.02	0.08	1.53	7.98	0.51	0.44	0.02	0.03	0.54
82	4131	12.18	24.19	41.97	0.72	0.28	1.14	25.37	105.83	1.29	2.03	2.99	0.06	0.01	0.07	1.51	7.97	0.52	0.44	0.02	0.02	0.54

83	4182	11.96	23.56	41.53	0.74	0.17	1.22	25.00	104.18	1.29	2.01	3.01	0.06	0.01	0.08	1.51	7.97	0.52	0.44	0.02	0.03	0.54
84	4233	12.02	24.13	42.20	0.73	0.17	1.10	25.42	105.78	1.28	2.03	3.01	0.06	0.01	0.07	1.52	7.96	0.52	0.44	0.02	0.02	0.54
85	4284	12.01	23.94	41.70	0.77	0.23	1.15	25.22	105.01	1.29	2.03	3.00	0.06	0.01	0.07	1.52	7.97	0.52	0.44	0.02	0.02	0.54
86	4335	11.86	23.55	41.64	0.76	0.14	1.07	25.27	104.30	1.28	2.01	3.01	0.06	0.01	0.07	1.53	7.96	0.52	0.44	0.02	0.02	0.54
87	4386	11.91	23.81	41.28	0.73	0.14	1.08	25.18	104.12	1.29	2.03	2.99	0.06	0.01	0.07	1.53	7.97	0.52	0.44	0.02	0.02	0.54
88	4437	11.69	23.41	40.98	0.67	0.19	1.11	24.75	102.81	1.28	2.02	3.01	0.05	0.01	0.07	1.52	7.96	0.52	0.44	0.02	0.02	0.54
89	4488	11.79	23.62	41.45	0.76	0.14	1.03	25.46	104.25	1.27	2.02	3.00	0.06	0.01	0.06	1.54	7.97	0.52	0.43	0.02	0.02	0.55
90	4539	12.21	24.07	41.83	0.80	0.19	1.16	25.27	105.53	1.30	2.03	2.99	0.06	0.01	0.07	1.51	7.97	0.51	0.44	0.02	0.02	0.54
91	4590	11.98	24.07	42.09	0.71	0.15	1.11	25.73	105.83	1.27	2.02	3.00	0.05	0.01	0.07	1.54	7.97	0.52	0.43	0.02	0.02	0.55
92	4641	12.07	23.91	42.04	0.79	0.19	1.09	25.51	105.60	1.29	2.01	3.00	0.06	0.01	0.07	1.52	7.97	0.52	0.44	0.02	0.02	0.54
93	4692	12.03	23.48	41.26	0.74	0.23	1.11	25.22	104.06	1.30	2.01	3.00	0.06	0.01	0.07	1.53	7.98	0.52	0.44	0.02	0.02	0.54
94	4743	12.28	23.73	41.46	0.77	0.21	1.15	25.21	104.82	1.32	2.01	2.99	0.06	0.01	0.07	1.52	7.98	0.51	0.44	0.02	0.02	0.54
97	4896	12.07	23.99	41.54	0.79	0.24	1.03	25.67	105.32	1.29	2.03	2.98	0.06	0.01	0.06	1.54	7.98	0.52	0.44	0.02	0.02	0.54
98	4947	12.01	23.66	41.58	0.74	0.31	1.16	25.47	104.92	1.29	2.01	3.00	0.06	0.02	0.07	1.53	7.97	0.52	0.44	0.02	0.02	0.54
99	4998	12.25	24.07	41.65	0.80	0.21	1.14	25.55	105.66	1.31	2.03	2.98	0.06	0.01	0.07	1.53	7.98	0.52	0.44	0.02	0.02	0.54
100	5049	12.20	24.04	41.59	0.76	0.25	1.16	24.74	104.75	1.31	2.04	2.99	0.06	0.01	0.07	1.49	7.96	0.51	0.45	0.02	0.02	0.53
101	5100	12.36	23.87	41.36	0.81	0.21	1.12	25.83	105.56	1.32	2.02	2.96	0.06	0.01	0.07	1.55	7.99	0.52	0.44	0.02	0.02	0.54
102	5151	12.10	24.08	41.60	0.79	0.20	1.09	25.59	105.43	1.29	2.03	2.98	0.06	0.01	0.07	1.53	7.98	0.52	0.44	0.02	0.02	0.54
103	5202	11.90	23.56	41.26	0.72	0.21	1.14	24.67	103.47	1.29	2.02	3.01	0.06	0.01	0.07	1.50	7.96	0.51	0.44	0.02	0.02	0.54
104	5253	11.98	23.96	42.07	0.69	0.12	1.10	25.45	105.38	1.28	2.02	3.01	0.05	0.01	0.07	1.52	7.96	0.52	0.44	0.02	0.02	0.54
106	5355	12.09	23.97	41.37	0.89	0.28	1.22	25.68	105.50	1.29	2.03	2.97	0.07	0.02	0.07	1.54	7.99	0.52	0.43	0.02	0.02	0.54
107	5406	11.81	23.52	41.15	0.80	0.22	1.14	25.27	103.90	1.28	2.02	2.99	0.06	0.01	0.07	1.54	7.97	0.52	0.43	0.02	0.02	0.55
108	5457	11.91	23.92	41.69	0.90	0.24	1.08	25.41	105.15	1.28	2.02	2.99	0.07	0.01	0.07	1.53	7.97	0.52	0.43	0.02	0.02	0.54
110	5559	12.02	23.67	41.34	0.92	0.27	1.17	25.62	105.02	1.29	2.01	2.98	0.07	0.01	0.07	1.54	7.98	0.52	0.43	0.02	0.02	0.54
111	5610	11.71	23.65	41.50	0.84	0.07	1.05	25.11	103.93	1.27	2.02	3.01	0.07	0.00	0.06	1.52	7.96	0.52	0.43	0.02	0.02	0.55
112	5661	11.63	23.44	40.98	0.83	0.19	1.04	25.03	103.14	1.27	2.02	3.00	0.07	0.01	0.06	1.53	7.97	0.52	0.43	0.02	0.02	0.55
113	5712	11.85	23.40	40.40	0.94	0.25	1.09	24.92	102.84	1.30	2.03	2.97	0.07	0.01	0.07	1.53	7.99	0.52	0.44	0.02	0.02	0.54
114	5763	11.46	23.02	40.81	0.92	0.20	1.04	24.52	101.98	1.26	2.01	3.02	0.07	0.01	0.07	1.52	7.96	0.52	0.43	0.03	0.02	0.55
115	5814	12.10	23.89	41.49	0.91	0.17	1.15	25.28	104.99	1.30	2.03	2.98	0.07	0.01	0.07	1.52	7.98	0.51	0.44	0.02	0.02	0.54
116	5865	12.01	23.78	40.97	0.94	0.18	1.10	25.34	104.33	1.30	2.03	2.97	0.07	0.01	0.07	1.54	7.99	0.52	0.44	0.02	0.02	0.54
117	5916	12.05	23.92	41.28	0.99	0.24	1.15	25.61	105.23	1.29	2.03	2.97	0.08	0.01	0.07	1.54	7.99	0.52	0.43	0.03	0.02	0.54

118	5967	11.88	23.83	41.54	0.83	0.17	1.01	25.89	105.16	1.27	2.02	2.99	0.06	0.01	0.06	1.56	7.98	0.53	0.43	0.02	0.02	0.55
119	6018	12.14	23.74	41.64	0.93	0.26	1.20	26.07	105.99	1.30	2.00	2.98	0.07	0.01	0.07	1.56	7.99	0.52	0.43	0.02	0.02	0.55
120	6069	11.64	23.52	41.59	0.84	0.19	0.99	25.44	104.21	1.26	2.01	3.01	0.07	0.01	0.06	1.54	7.96	0.53	0.43	0.02	0.02	0.55
121	6120	11.95	23.73	41.33	0.98	0.26	1.13	25.59	104.97	1.28	2.02	2.98	0.08	0.01	0.07	1.54	7.98	0.52	0.43	0.03	0.02	0.55
122	6171	11.78	23.69	41.18	0.89	0.27	1.10	25.01	103.92	1.28	2.03	2.99	0.07	0.01	0.07	1.52	7.97	0.52	0.43	0.02	0.02	0.54
123	6222	11.89	23.48	41.16	0.85	0.17	1.15	25.31	104.01	1.29	2.01	2.99	0.07	0.01	0.07	1.54	7.98	0.52	0.43	0.02	0.02	0.54
126	6375	11.86	23.65	41.01	1.04	0.38	1.08	25.56	104.59	1.28	2.02	2.97	0.08	0.02	0.07	1.55	7.98	0.52	0.43	0.03	0.02	0.55
127	6426	11.88	23.77	41.66	0.98	0.21	1.04	25.78	105.32	1.27	2.01	2.99	0.08	0.01	0.06	1.55	7.98	0.52	0.43	0.03	0.02	0.55
128	6477	11.29	22.96	40.40	0.85	0.10	1.17	24.93	101.70	1.25	2.01	3.01	0.07	0.01	0.07	1.55	7.97	0.53	0.43	0.02	0.03	0.55
129	6528	11.73	23.69	41.84	0.95	0.18	1.13	25.79	105.31	1.26	2.01	3.01	0.07	0.01	0.07	1.55	7.97	0.53	0.43	0.02	0.02	0.55
130	6579	11.55	23.45	41.68	0.89	0.15	1.11	25.29	104.13	1.25	2.00	3.02	0.07	0.01	0.07	1.53	7.95	0.53	0.43	0.02	0.02	0.55
133	6732	11.96	23.75	41.47	0.95	0.17	1.22	25.79	105.30	1.28	2.01	2.98	0.07	0.01	0.07	1.55	7.99	0.52	0.43	0.02	0.02	0.55
136	6885	11.48	23.52	41.37	0.88	0.12	1.12	25.55	104.03	1.24	2.02	3.01	0.07	0.01	0.07	1.55	7.97	0.53	0.42	0.02	0.02	0.56
137	6936	11.79	23.81	41.10	0.86	0.30	1.05	25.71	104.62	1.27	2.03	2.97	0.07	0.02	0.06	1.56	7.98	0.53	0.43	0.02	0.02	0.55
139	7038	11.62	23.61	41.52	0.62	0.22	1.07	25.60	104.27	1.26	2.02	3.01	0.05	0.01	0.07	1.55	7.96	0.53	0.43	0.02	0.02	0.55
141	7140	11.41	23.83	41.57	0.55	0.13	1.02	25.79	104.30	1.23	2.03	3.01	0.04	0.01	0.06	1.56	7.95	0.54	0.43	0.01	0.02	0.56
142	7191	11.98	23.84	41.40	0.59	0.34	1.17	26.13	105.46	1.28	2.02	2.98	0.05	0.02	0.07	1.57	7.98	0.53	0.43	0.02	0.02	0.55
145	7344	11.81	23.90	41.43	0.62	0.15	1.08	25.84	104.82	1.27	2.03	2.99	0.05	0.01	0.07	1.56	7.98	0.53	0.43	0.02	0.02	0.55
146	7395	11.58	23.56	41.57	0.65	0.22	1.19	26.09	104.86	1.25	2.01	3.00	0.05	0.01	0.07	1.58	7.97	0.54	0.42	0.02	0.02	0.56
148	7497	11.80	23.72	41.93	0.61	0.18	1.05	26.15	105.45	1.26	2.01	3.01	0.05	0.01	0.06	1.57	7.97	0.53	0.43	0.02	0.02	0.55
149	7548	11.67	24.00	41.77	0.60	0.12	1.07	26.13	105.35	1.25	2.03	3.00	0.05	0.01	0.07	1.57	7.97	0.54	0.43	0.02	0.02	0.56

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.22: Composition of garnet A1 from sample HJ-35e$_1$ (group 2) as analysed along traverse E-F (Plate 5.9h). Distance is in microns from starting point E.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	8.50	21.73	38.26	0.52	0.00	1.83	28.63	99.47	0.99	2.00	2.99	0.04	0.00	0.12	1.87	8.01	0.62	0.33	0.01	0.04	0.65
2	35	9.29	21.78	38.64	0.46	0.00	1.80	27.74	99.71	1.07	1.99	2.99	0.04	0.00	0.12	1.80	8.01	0.59	0.35	0.01	0.04	0.63
3	70	9.54	21.70	38.60	0.46	0.00	1.75	27.57	99.64	1.10	1.98	2.99	0.04	0.00	0.12	1.79	8.02	0.59	0.36	0.01	0.04	0.62
4	105	9.55	21.86	38.57	0.46	0.00	1.77	27.36	99.57	1.10	2.00	2.99	0.04	0.00	0.12	1.77	8.01	0.59	0.36	0.01	0.04	0.62
5	140	9.65	21.83	38.72	0.48	0.00	1.74	26.71	99.14	1.12	2.00	3.00	0.04	0.00	0.11	1.73	8.00	0.58	0.37	0.01	0.04	0.61
6	175	9.51	21.76	38.65	0.41	0.00	1.70	27.52	99.54	1.10	1.99	3.00	0.03	0.00	0.11	1.78	8.01	0.59	0.36	0.01	0.04	0.62
7	210	9.76	21.84	38.71	0.45	0.00	1.73	27.27	99.76	1.12	1.99	2.99	0.04	0.00	0.11	1.76	8.02	0.58	0.37	0.01	0.04	0.61
8	245	9.79	21.82	38.69	0.47	0.00	1.65	26.99	99.42	1.13	1.99	2.99	0.04	0.00	0.11	1.75	8.01	0.58	0.37	0.01	0.04	0.61
9	280	9.76	21.78	38.77	0.46	0.00	1.73	26.94	99.44	1.13	1.99	3.00	0.04	0.00	0.11	1.74	8.01	0.58	0.37	0.01	0.04	0.61
10	315	9.97	21.97	38.82	0.50	0.00	1.76	27.23	100.24	1.14	1.99	2.98	0.04	0.00	0.11	1.75	8.02	0.57	0.37	0.01	0.04	0.61
11	350	10.02	21.99	39.03	0.50	0.00	1.66	26.93	100.13	1.15	1.99	3.00	0.04	0.00	0.11	1.73	8.01	0.57	0.38	0.01	0.04	0.60
12	385	9.91	21.85	38.88	0.52	0.00	1.73	27.11	100.00	1.14	1.98	2.99	0.04	0.00	0.11	1.75	8.02	0.57	0.37	0.01	0.04	0.61
13	420	9.98	21.70	38.81	0.50	0.00	1.69	26.62	99.31	1.15	1.98	3.00	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
14	455	9.98	21.74	38.24	0.41	0.00	1.64	26.58	98.59	1.16	2.00	2.98	0.03	0.00	0.11	1.73	8.02	0.57	0.38	0.01	0.04	0.60
15	490	9.93	21.99	38.65	0.45	0.00	1.79	26.22	99.03	1.15	2.01	2.99	0.04	0.00	0.12	1.70	8.00	0.57	0.38	0.01	0.04	0.60
16	525	9.96	21.81	38.87	0.46	0.00	1.71	26.75	99.55	1.15	1.98	3.00	0.04	0.00	0.11	1.73	8.01	0.57	0.38	0.01	0.04	0.60
17	560	10.11	21.94	38.75	0.49	0.00	1.66	26.68	99.63	1.16	1.99	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
18	595	10.22	22.11	39.23	0.46	0.00	1.72	26.71	100.46	1.16	1.99	3.00	0.04	0.00	0.11	1.71	8.01	0.57	0.39	0.01	0.04	0.59
19	630	9.91	22.04	38.89	0.49	0.00	1.71	27.06	100.09	1.14	2.00	2.99	0.04	0.00	0.11	1.74	8.01	0.57	0.38	0.01	0.04	0.61
20	665	10.08	21.80	38.76	0.44	0.00	1.67	27.15	99.90	1.16	1.98	2.99	0.04	0.00	0.11	1.75	8.02	0.57	0.38	0.01	0.04	0.60
21	700	10.02	21.82	38.68	0.46	0.00	1.64	26.67	99.29	1.16	1.99	2.99	0.04	0.00	0.11	1.73	8.01	0.57	0.38	0.01	0.04	0.60
22	735	10.12	21.82	38.91	0.44	0.00	1.73	26.81	99.84	1.16	1.98	3.00	0.04	0.00	0.11	1.73	8.01	0.57	0.38	0.01	0.04	0.60
23	770	9.99	21.72	38.71	0.51	0.00	1.68	26.52	99.13	1.15	1.98	3.00	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
24	805	10.24	21.76	39.03	0.49	0.00	1.72	26.51	99.74	1.17	1.97	3.00	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.04	0.59
25	840	10.15	22.04	38.99	0.53	0.00	1.69	27.05	100.45	1.16	1.99	2.99	0.04	0.00	0.11	1.73	8.02	0.57	0.38	0.01	0.04	0.60

26	875	10.17	22.20	38.90	0.55	0.00	1.73	26.51	100.06	1.16	2.01	2.98	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
27	910	10.05	21.61	38.64	0.42	0.00	1.71	26.78	99.21	1.16	1.98	3.00	0.03	0.00	0.11	1.74	8.02	0.57	0.38	0.01	0.04	0.60
28	945	10.06	21.96	38.89	0.44	0.00	1.59	26.69	99.64	1.16	1.99	3.00	0.04	0.00	0.10	1.72	8.01	0.57	0.38	0.01	0.03	0.60
29	980	10.19	22.06	38.93	0.52	0.00	1.71	26.45	99.85	1.17	2.00	2.99	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
30	1015	10.19	21.96	39.11	0.51	0.00	1.74	26.36	99.88	1.17	1.99	3.00	0.04	0.00	0.11	1.69	8.00	0.56	0.39	0.01	0.04	0.59
31	1050	9.88	21.80	38.71	0.52	0.00	1.76	26.71	99.38	1.14	1.99	3.00	0.04	0.00	0.12	1.73	8.01	0.57	0.38	0.01	0.04	0.60
33	1120	9.92	21.93	38.83	0.51	0.00	1.72	26.69	99.61	1.14	1.99	3.00	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
34	1155	10.59	22.57	39.81	0.56	0.00	1.79	26.51	101.83	1.19	2.00	2.99	0.04	0.00	0.11	1.67	8.01	0.55	0.39	0.01	0.04	0.58
35	1190	10.12	21.79	38.64	0.48	0.00	1.69	26.37	99.10	1.17	1.99	2.99	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.04	0.59
37	1260	9.98	21.61	38.60	0.50	0.00	1.66	26.16	98.51	1.16	1.98	3.01	0.04	0.00	0.11	1.70	8.00	0.57	0.38	0.01	0.04	0.60
38	1295	10.12	21.89	38.61	0.50	0.00	1.74	26.44	99.31	1.17	2.00	2.99	0.04	0.00	0.11	1.71	8.02	0.56	0.38	0.01	0.04	0.59
39	1330	10.28	21.86	38.85	0.46	0.00	1.76	25.91	99.12	1.18	1.99	3.00	0.04	0.00	0.12	1.67	8.00	0.56	0.39	0.01	0.04	0.59
40	1365	10.19	21.81	38.80	0.48	0.00	1.63	26.17	99.06	1.17	1.99	3.00	0.04	0.00	0.11	1.69	8.00	0.56	0.39	0.01	0.04	0.59
41	1400	10.22	21.66	38.83	0.49	0.00	1.67	26.35	99.22	1.18	1.97	3.00	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
42	1435	10.32	21.76	38.90	0.51	0.00	1.72	26.49	99.69	1.18	1.98	3.00	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
43	1470	10.05	21.82	38.72	0.47	0.00	1.74	26.18	98.99	1.16	1.99	3.00	0.04	0.00	0.11	1.70	8.00	0.56	0.39	0.01	0.04	0.59
44	1505	10.28	22.04	38.81	0.53	0.00	1.70	26.53	99.89	1.18	2.00	2.98	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
45	1540	10.36	22.15	38.81	0.49	0.00	1.61	26.55	99.97	1.19	2.00	2.98	0.04	0.00	0.10	1.70	8.02	0.56	0.39	0.01	0.03	0.59
46	1575	10.16	21.86	39.00	0.43	0.00	1.76	26.47	99.68	1.17	1.98	3.00	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
47	1610	10.10	21.90	38.91	0.41	0.00	1.62	25.89	98.83	1.17	2.00	3.01	0.03	0.00	0.11	1.68	7.99	0.56	0.39	0.01	0.04	0.59
48	1645	10.20	21.84	38.61	0.45	0.00	1.69	26.50	99.30	1.18	1.99	2.99	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
49	1680	10.23	22.01	38.76	0.47	0.00	1.64	26.44	99.56	1.18	2.00	2.99	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
50	1715	10.24	21.83	38.92	0.50	0.00	1.56	26.45	99.51	1.18	1.98	3.00	0.04	0.00	0.10	1.71	8.01	0.56	0.39	0.01	0.03	0.59
51	1750	10.32	22.12	38.70	0.48	0.00	1.74	26.16	99.54	1.19	2.01	2.98	0.04	0.00	0.11	1.69	8.01	0.56	0.39	0.01	0.04	0.59
52	1785	10.21	22.03	38.89	0.50	0.00	1.62	26.41	99.66	1.17	2.00	2.99	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.03	0.59
53	1820	10.28	21.89	38.78	0.48	0.00	1.65	26.53	99.61	1.18	1.99	2.99	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
54	1855	10.42	22.07	38.92	0.40	0.00	1.70	26.45	99.95	1.19	2.00	2.99	0.03	0.00	0.11	1.70	8.02	0.56	0.39	0.01	0.04	0.59
56	1925	10.21	21.88	39.00	0.50	0.00	1.74	26.68	100.01	1.17	1.98	3.00	0.04	0.00	0.11	1.71	8.01	0.56	0.38	0.01	0.04	0.59
57	1960	10.32	21.88	38.80	0.49	0.00	1.69	26.18	99.36	1.19	1.99	2.99	0.04	0.00	0.11	1.69	8.01	0.56	0.39	0.01	0.04	0.59
58	1995	10.22	22.14	38.93	0.48	0.00	1.71	26.36	99.85	1.17	2.00	2.99	0.04	0.00	0.11	1.69	8.01	0.56	0.39	0.01	0.04	0.59
59	2030	10.31	21.86	38.80	0.44	0.00	1.63	26.45	99.48	1.18	1.99	2.99	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.04	0.59

60	2065	10.37	21.87	38.80	0.48	0.00	1.69	27.02	100.23	1.19	1.98	2.98	0.04	0.00	0.11	1.74	8.03	0.56	0.39	0.01	0.04	0.59
61	2100	10.19	21.78	38.71	0.44	0.00	1.60	26.00	98.71	1.18	1.99	3.00	0.04	0.00	0.11	1.69	8.00	0.56	0.39	0.01	0.03	0.59
62	2135	10.21	22.05	39.00	0.47	0.00	1.58	26.80	100.11	1.17	1.99	2.99	0.04	0.00	0.10	1.72	8.01	0.57	0.39	0.01	0.03	0.60
63	2170	10.25	21.92	39.08	0.45	0.00	1.77	26.58	100.04	1.17	1.98	3.00	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.04	0.59
65	2240	10.26	21.81	38.70	0.46	0.00	1.73	26.72	99.68	1.18	1.98	2.99	0.04	0.00	0.11	1.72	8.02	0.56	0.39	0.01	0.04	0.59
66	2275	10.43	21.93	38.84	0.52	0.00	1.58	26.86	100.17	1.19	1.98	2.98	0.04	0.00	0.10	1.72	8.03	0.56	0.39	0.01	0.03	0.59
67	2310	10.18	21.87	38.87	0.45	0.00	1.69	26.51	99.56	1.17	1.99	3.00	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.04	0.59
68	2345	10.45	21.85	38.88	0.49	0.00	1.64	26.35	99.65	1.20	1.98	2.99	0.04	0.00	0.11	1.70	8.02	0.56	0.39	0.01	0.04	0.59
69	2380	10.41	21.80	38.68	0.46	0.00	1.57	26.28	99.19	1.20	1.99	2.99	0.04	0.00	0.10	1.70	8.02	0.56	0.39	0.01	0.03	0.59
70	2415	10.35	21.95	38.65	0.42	0.00	1.61	26.76	99.73	1.19	1.99	2.98	0.03	0.00	0.10	1.72	8.02	0.57	0.39	0.01	0.03	0.59
71	2450	10.33	21.94	38.71	0.43	0.00	1.56	26.16	99.13	1.19	2.00	2.99	0.04	0.00	0.10	1.69	8.01	0.56	0.39	0.01	0.03	0.59
72	2485	10.12	21.80	39.10	0.47	0.00	1.62	26.56	99.67	1.16	1.98	3.01	0.04	0.00	0.11	1.71	8.00	0.57	0.39	0.01	0.03	0.60
73	2520	10.26	21.84	38.75	0.46	0.00	1.69	26.50	99.51	1.18	1.99	2.99	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
74	2555	10.35	21.97	38.75	0.45	0.00	1.63	26.43	99.58	1.19	1.99	2.99	0.04	0.00	0.11	1.70	8.02	0.56	0.39	0.01	0.04	0.59
75	2590	10.25	21.88	38.93	0.48	0.03	1.65	26.00	99.23	1.18	1.99	3.00	0.04	0.00	0.11	1.68	8.00	0.56	0.39	0.01	0.04	0.59
76	2625	10.19	21.81	38.78	0.45	0.00	1.53	26.36	99.12	1.17	1.99	3.00	0.04	0.00	0.10	1.71	8.01	0.57	0.39	0.01	0.03	0.59
77	2660	10.19	21.81	39.00	0.48	0.00	1.70	26.50	99.68	1.17	1.98	3.00	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.04	0.59
78	2695	10.37	22.01	39.03	0.51	0.00	1.69	26.48	100.09	1.18	1.99	2.99	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
79	2730	10.26	21.87	38.91	0.46	0.00	1.67	26.39	99.56	1.18	1.99	3.00	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
80	2765	10.28	21.97	39.25	0.53	0.00	1.64	26.19	99.87	1.17	1.99	3.01	0.04	0.00	0.11	1.68	8.00	0.56	0.39	0.01	0.04	0.59
81	2800	10.30	21.80	38.82	0.50	0.00	1.75	26.21	99.39	1.19	1.98	3.00	0.04	0.00	0.11	1.69	8.01	0.56	0.39	0.01	0.04	0.59
83	2870	10.04	21.88	38.84	0.52	0.00	1.79	26.29	99.36	1.16	1.99	3.00	0.04	0.00	0.12	1.70	8.00	0.56	0.38	0.01	0.04	0.60
84	2905	10.08	21.68	38.99	0.48	0.00	1.66	26.47	99.35	1.16	1.97	3.01	0.04	0.00	0.11	1.71	8.00	0.57	0.38	0.01	0.04	0.60
85	2940	10.30	22.08	39.22	0.42	0.00	1.68	26.50	100.20	1.17	1.99	3.00	0.03	0.00	0.11	1.70	8.00	0.56	0.39	0.01	0.04	0.59
86	2975	10.05	21.90	38.80	0.49	0.00	1.70	26.65	99.59	1.16	1.99	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
87	3010	10.19	21.91	38.92	0.51	0.00	1.70	26.44	99.67	1.17	1.99	3.00	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
88	3045	10.27	22.03	38.64	0.51	0.00	1.60	26.56	99.61	1.18	2.00	2.98	0.04	0.00	0.10	1.71	8.02	0.56	0.39	0.01	0.03	0.59
89	3080	10.29	21.87	38.94	0.46	0.00	1.69	26.49	99.74	1.18	1.98	3.00	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
90	3115	10.21	22.01	38.59	0.43	0.00	1.73	26.53	99.50	1.17	2.00	2.98	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
91	3150	10.28	22.04	38.87	0.45	0.00	1.59	26.53	99.77	1.18	2.00	2.99	0.04	0.00	0.10	1.71	8.01	0.56	0.39	0.01	0.03	0.59
92	3185	10.13	21.82	38.70	0.45	0.00	1.60	26.53	99.22	1.17	1.99	2.99	0.04	0.00	0.10	1.72	8.01	0.57	0.39	0.01	0.03	0.59

93	3220	10.18	21.67	38.68	0.45	0.00	1.68	26.44	99.10	1.18	1.98	3.00	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.04	0.59
94	3255	10.15	22.06	38.85	0.46	0.00	1.65	26.33	99.51	1.17	2.00	2.99	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
95	3290	10.44	22.21	39.26	0.46	0.00	1.80	26.21	100.38	1.19	2.00	3.00	0.04	0.00	0.12	1.67	8.01	0.55	0.39	0.01	0.04	0.58
96	3325	10.24	21.92	38.58	0.46	0.00	1.68	26.43	99.30	1.18	2.00	2.98	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
97	3360	10.19	22.18	39.07	0.44	0.00	1.66	26.64	100.19	1.16	2.00	2.99	0.04	0.00	0.11	1.71	8.01	0.57	0.39	0.01	0.04	0.59
98	3395	10.33	21.91	38.88	0.49	0.00	1.64	26.86	100.11	1.18	1.98	2.99	0.04	0.00	0.11	1.72	8.02	0.56	0.39	0.01	0.03	0.59
99	3430	10.44	22.01	38.86	0.44	0.00	1.75	26.41	99.91	1.19	1.99	2.99	0.04	0.00	0.11	1.70	8.02	0.56	0.39	0.01	0.04	0.59
100	3465	10.21	21.96	38.88	0.51	0.00	1.81	26.68	100.06	1.17	1.99	2.99	0.04	0.00	0.12	1.71	8.02	0.56	0.38	0.01	0.04	0.59
101	3500	10.18	21.91	38.81	0.49	0.00	1.59	26.56	99.53	1.17	1.99	2.99	0.04	0.00	0.10	1.71	8.01	0.57	0.39	0.01	0.03	0.59
102	3535	10.15	21.92	38.83	0.45	0.00	1.66	26.66	99.68	1.17	1.99	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
103	3570	10.13	21.65	38.65	0.45	0.00	1.71	26.54	99.12	1.17	1.98	3.00	0.04	0.00	0.11	1.72	8.01	0.57	0.39	0.01	0.04	0.60
104	3605	10.07	21.88	38.67	0.45	0.00	1.67	26.23	98.96	1.16	2.00	3.00	0.04	0.00	0.11	1.70	8.00	0.56	0.39	0.01	0.04	0.59
105	3640	10.05	21.75	38.72	0.43	0.00	1.57	26.46	98.99	1.16	1.99	3.00	0.04	0.00	0.10	1.72	8.00	0.57	0.39	0.01	0.03	0.60
106	3675	10.25	21.72	38.67	0.42	0.00	1.64	26.35	99.06	1.18	1.98	3.00	0.03	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.04	0.59
107	3710	10.36	22.10	39.12	0.50	0.00	1.67	27.02	100.77	1.18	1.99	2.98	0.04	0.00	0.11	1.72	8.02	0.57	0.39	0.01	0.04	0.59
108	3745	9.98	21.75	38.52	0.40	0.00	1.64	26.44	98.73	1.16	1.99	3.00	0.03	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
109	3780	10.14	22.12	38.94	0.46	0.00	1.65	26.49	99.80	1.16	2.00	2.99	0.04	0.00	0.11	1.70	8.01	0.57	0.39	0.01	0.04	0.59
110	3815	10.25	21.69	38.56	0.43	0.00	1.65	26.01	98.58	1.19	1.99	3.00	0.04	0.00	0.11	1.69	8.01	0.56	0.39	0.01	0.04	0.59
111	3850	10.18	21.89	38.99	0.49	0.00	1.70	26.16	99.40	1.17	1.99	3.01	0.04	0.00	0.11	1.69	8.00	0.56	0.39	0.01	0.04	0.59
112	3885	10.12	21.70	38.81	0.46	0.00	1.69	26.26	99.04	1.17	1.98	3.01	0.04	0.00	0.11	1.70	8.00	0.56	0.39	0.01	0.04	0.59
113	3920	10.12	21.84	38.74	0.44	0.00	1.68	26.11	98.93	1.17	1.99	3.00	0.04	0.00	0.11	1.69	8.00	0.56	0.39	0.01	0.04	0.59
114	3955	10.20	22.11	39.03	0.46	0.00	1.64	26.85	100.30	1.16	2.00	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
115	3990	10.23	21.98	38.77	0.43	0.00	1.61	26.48	99.50	1.18	2.00	2.99	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.03	0.59
116	4025	10.21	21.88	39.08	0.49	0.00	1.75	26.98	100.39	1.17	1.98	2.99	0.04	0.00	0.11	1.73	8.02	0.57	0.38	0.01	0.04	0.60
117	4060	10.23	22.04	38.79	0.47	0.00	1.70	26.59	99.81	1.17	2.00	2.98	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
118	4095	10.09	21.85	38.75	0.47	0.00	1.68	26.07	98.90	1.17	2.00	3.00	0.04	0.00	0.11	1.69	8.00	0.56	0.39	0.01	0.04	0.59
119	4130	10.29	22.01	38.92	0.51	0.00	1.56	26.53	99.82	1.18	1.99	2.99	0.04	0.00	0.10	1.71	8.01	0.56	0.39	0.01	0.03	0.59
120	4165	10.11	21.66	38.91	0.48	0.00	1.69	26.12	98.96	1.17	1.98	3.01	0.04	0.00	0.11	1.69	8.00	0.56	0.39	0.01	0.04	0.59
121	4200	10.14	21.83	38.92	0.46	0.00	1.78	26.06	99.19	1.17	1.99	3.01	0.04	0.00	0.12	1.68	8.00	0.56	0.39	0.01	0.04	0.59
122	4235	10.03	21.75	38.51	0.49	0.00	1.61	26.10	98.48	1.16	2.00	3.00	0.04	0.00	0.11	1.70	8.00	0.56	0.39	0.01	0.04	0.59
123	4270	10.90	22.95	40.37	0.46	0.00	1.50	26.60	102.78	1.21	2.01	3.00	0.04	0.00	0.09	1.65	8.00	0.55	0.40	0.01	0.03	0.58

124	4305	10.14	21.92	38.67	0.44	0.00	1.61	26.37	99.16	1.17	2.00	2.99	0.04	0.00	0.11	1.71	8.01	0.57	0.39	0.01	0.04	0.59
126	4375	10.29	22.00	38.84	0.47	0.00	1.61	26.50	99.70	1.18	2.00	2.99	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.03	0.59
127	4410	10.18	21.99	38.90	0.49	0.00	1.74	26.50	99.79	1.17	1.99	2.99	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.04	0.59
129	4480	10.26	22.00	38.92	0.47	0.00	1.60	26.62	99.87	1.17	1.99	2.99	0.04	0.00	0.10	1.71	8.01	0.56	0.39	0.01	0.03	0.59
130	4515	10.19	21.78	38.60	0.48	0.00	1.67	25.88	98.60	1.18	1.99	3.00	0.04	0.00	0.11	1.68	8.00	0.56	0.39	0.01	0.04	0.59
131	4550	10.12	21.74	38.45	0.46	0.00	1.55	26.68	99.00	1.17	1.99	2.99	0.04	0.00	0.10	1.73	8.02	0.57	0.38	0.01	0.03	0.60
132	4585	10.45	21.96	39.04	0.49	0.00	1.69	26.95	100.59	1.19	1.98	2.98	0.04	0.00	0.11	1.72	8.03	0.56	0.39	0.01	0.04	0.59
133	4620	10.20	21.78	38.75	0.39	0.00	1.72	26.57	99.41	1.17	1.98	2.99	0.03	0.00	0.11	1.72	8.01	0.57	0.39	0.01	0.04	0.59
134	4655	10.24	21.93	38.99	0.43	0.00	1.60	26.84	100.03	1.17	1.98	2.99	0.04	0.00	0.10	1.72	8.01	0.57	0.39	0.01	0.03	0.60
135	4690	10.19	21.75	38.38	0.48	0.00	1.67	26.50	98.98	1.18	1.99	2.98	0.04	0.00	0.11	1.72	8.02	0.56	0.39	0.01	0.04	0.59
136	4725	10.35	22.10	39.35	0.48	0.00	1.81	26.96	101.06	1.17	1.98	2.99	0.04	0.00	0.12	1.71	8.02	0.56	0.39	0.01	0.04	0.59
137	4760	10.29	21.87	38.72	0.47	0.00	1.77	26.87	99.99	1.18	1.98	2.98	0.04	0.00	0.12	1.73	8.03	0.56	0.39	0.01	0.04	0.59
138	4795	10.42	21.97	39.21	0.49	0.00	1.60	26.81	100.50	1.19	1.98	3.00	0.04	0.00	0.10	1.71	8.02	0.56	0.39	0.01	0.03	0.59
139	4830	10.15	21.92	38.49	0.46	0.00	1.67	26.53	99.21	1.17	2.00	2.98	0.04	0.00	0.11	1.72	8.02	0.57	0.39	0.01	0.04	0.59
140	4865	10.33	22.07	38.86	0.51	0.00	1.75	26.60	100.12	1.18	2.00	2.98	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
141	4900	10.16	22.10	38.87	0.47	0.00	1.64	26.80	100.04	1.16	2.00	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
142	4935	10.16	21.87	38.65	0.53	0.00	1.75	26.64	99.60	1.17	1.99	2.98	0.04	0.00	0.11	1.72	8.02	0.56	0.38	0.01	0.04	0.60
143	4970	10.00	21.78	38.46	0.45	0.00	1.73	26.26	98.69	1.16	2.00	2.99	0.04	0.00	0.11	1.71	8.01	0.57	0.38	0.01	0.04	0.60
144	5005	10.19	21.86	38.95	0.49	0.00	1.58	26.93	100.00	1.17	1.98	2.99	0.04	0.00	0.10	1.73	8.02	0.57	0.38	0.01	0.03	0.60
145	5040	11.14	23.13	40.86	0.47	0.00	1.67	26.21	103.48	1.22	2.01	3.01	0.04	0.00	0.10	1.61	7.99	0.54	0.41	0.01	0.03	0.57
146	5075	10.24	21.88	38.82	0.45	0.00	1.59	26.59	99.57	1.18	1.99	2.99	0.04	0.00	0.10	1.71	8.01	0.57	0.39	0.01	0.03	0.59
147	5110	9.97	21.72	38.76	0.45	0.00	1.61	26.67	99.18	1.15	1.98	3.00	0.04	0.00	0.11	1.73	8.01	0.57	0.38	0.01	0.04	0.60
149	5180	10.33	21.84	38.86	0.43	0.00	1.64	26.41	99.53	1.19	1.98	3.00	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
150	5215	10.01	21.92	38.91	0.46	0.00	1.71	26.27	99.27	1.15	2.00	3.00	0.04	0.00	0.11	1.70	8.00	0.57	0.38	0.01	0.04	0.60
151	5250	10.29	21.88	38.82	0.51	0.00	1.56	26.72	99.77	1.18	1.98	2.99	0.04	0.00	0.10	1.72	8.02	0.57	0.39	0.01	0.03	0.59
152	5285	10.41	21.91	38.76	0.47	0.00	1.63	26.32	99.50	1.20	1.99	2.99	0.04	0.00	0.11	1.70	8.02	0.56	0.39	0.01	0.04	0.59
153	5320	10.23	21.77	38.53	0.41	0.00	1.61	26.23	98.78	1.18	1.99	2.99	0.03	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.03	0.59
154	5355	10.17	21.81	38.57	0.49	0.00	1.69	26.64	99.38	1.17	1.99	2.98	0.04	0.00	0.11	1.72	8.02	0.57	0.38	0.01	0.04	0.60
155	5390	10.30	21.91	38.88	0.48	0.00	1.77	26.79	100.13	1.18	1.98	2.99	0.04	0.00	0.11	1.72	8.02	0.56	0.39	0.01	0.04	0.59
156	5425	10.22	21.82	38.67	0.44	0.00	1.68	26.62	99.46	1.18	1.99	2.99	0.04	0.00	0.11	1.72	8.02	0.57	0.39	0.01	0.04	0.59
157	5460	10.33	21.93	38.84	0.47	0.00	1.71	26.20	99.48	1.19	1.99	2.99	0.04	0.00	0.11	1.69	8.01	0.56	0.39	0.01	0.04	0.59

158	5495	10.15	21.82	38.84	0.44	0.00	1.56	26.60	99.40	1.17	1.99	3.00	0.04	0.00	0.10	1.72	8.01	0.57	0.39	0.01	0.03	0.60
159	5530	10.20	21.93	38.82	0.49	0.00	1.76	26.16	99.37	1.17	1.99	3.00	0.04	0.00	0.12	1.69	8.01	0.56	0.39	0.01	0.04	0.59
160	5565	10.06	21.84	38.65	0.46	0.00	1.62	26.53	99.16	1.16	1.99	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
161	5600	10.17	22.01	38.78	0.44	0.00	1.54	26.78	99.71	1.17	2.00	2.99	0.04	0.00	0.10	1.72	8.01	0.57	0.39	0.01	0.03	0.60
162	5635	10.21	22.03	39.08	0.48	0.00	1.64	26.33	99.77	1.17	1.99	3.00	0.04	0.00	0.11	1.69	8.00	0.56	0.39	0.01	0.04	0.59
163	5670	10.11	21.76	38.75	0.44	0.00	1.67	26.06	98.79	1.17	1.99	3.01	0.04	0.00	0.11	1.69	8.00	0.56	0.39	0.01	0.04	0.59
164	5705	10.17	21.77	38.64	0.45	0.00	1.65	26.39	99.07	1.17	1.99	2.99	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.04	0.59
165	5740	10.26	22.00	38.83	0.44	0.00	1.75	26.65	99.93	1.18	1.99	2.99	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
166	5775	10.26	21.76	38.72	0.44	0.00	1.62	26.37	99.17	1.18	1.98	3.00	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.04	0.59
167	5810	10.26	21.80	38.66	0.44	0.00	1.62	26.42	99.19	1.18	1.99	2.99	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.03	0.59
168	5845	10.12	21.95	38.83	0.49	0.00	1.66	26.64	99.68	1.16	1.99	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
169	5880	10.23	21.72	38.55	0.45	0.00	1.71	26.01	98.67	1.18	1.99	3.00	0.04	0.00	0.11	1.69	8.01	0.56	0.39	0.01	0.04	0.59
170	5915	10.23	21.93	38.92	0.43	0.00	1.58	26.68	99.78	1.17	1.99	2.99	0.04	0.00	0.10	1.72	8.01	0.57	0.39	0.01	0.03	0.59
171	5950	10.25	21.95	39.11	0.51	0.00	1.65	26.20	99.69	1.17	1.99	3.01	0.04	0.00	0.11	1.68	8.00	0.56	0.39	0.01	0.04	0.59
172	5985	10.09	21.90	38.68	0.49	0.00	1.60	26.39	99.14	1.16	2.00	2.99	0.04	0.00	0.10	1.71	8.01	0.57	0.39	0.01	0.03	0.59
173	6020	10.28	21.98	39.04	0.49	0.00	1.75	26.48	100.03	1.18	1.99	3.00	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
174	6055	9.97	21.86	38.48	0.49	0.00	1.71	26.35	98.86	1.15	2.00	2.99	0.04	0.00	0.11	1.71	8.01	0.57	0.38	0.01	0.04	0.60
175	6090	10.21	22.05	38.76	0.43	0.00	1.67	26.64	99.75	1.17	2.00	2.98	0.04	0.00	0.11	1.72	8.02	0.57	0.39	0.01	0.04	0.59
176	6125	10.45	22.22	39.12	0.48	0.00	1.69	26.77	100.72	1.19	2.00	2.98	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
177	6160	10.25	21.90	38.90	0.46	0.00	1.73	26.75	99.98	1.17	1.98	2.99	0.04	0.00	0.11	1.72	8.02	0.56	0.39	0.01	0.04	0.59
178	6195	10.32	21.84	38.92	0.49	0.00	1.63	26.37	99.56	1.18	1.98	3.00	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
179	6230	10.24	21.83	38.81	0.44	0.00	1.61	26.52	99.45	1.18	1.99	3.00	0.04	0.00	0.11	1.71	8.01	0.56	0.39	0.01	0.03	0.59
180	6265	10.29	22.03	38.81	0.48	0.00	1.61	26.86	100.08	1.18	1.99	2.98	0.04	0.00	0.10	1.73	8.02	0.57	0.39	0.01	0.03	0.59
182	6335	10.02	21.84	38.72	0.43	0.00	1.63	26.53	99.18	1.16	1.99	3.00	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
183	6370	10.10	21.72	38.63	0.46	0.00	1.63	26.95	99.49	1.16	1.98	2.99	0.04	0.00	0.11	1.74	8.02	0.57	0.38	0.01	0.04	0.60
184	6405	8.65	22.87	39.14	0.38	0.00	1.83	28.57	101.43	0.98	2.05	2.98	0.03	0.00	0.12	1.82	7.99	0.62	0.33	0.01	0.04	0.65
185	6440	10.14	21.91	38.88	0.49	0.00	1.80	26.46	99.68	1.16	1.99	2.99	0.04	0.00	0.12	1.70	8.01	0.56	0.38	0.01	0.04	0.59
186	6475	9.97	22.04	38.77	0.48	0.00	1.61	26.20	99.08	1.15	2.01	3.00	0.04	0.00	0.11	1.69	8.00	0.57	0.38	0.01	0.04	0.60
189	6580	10.06	21.94	38.80	0.48	0.00	1.71	26.68	99.67	1.16	1.99	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
190	6615	10.19	22.03	39.15	0.49	0.00	1.64	26.50	100.00	1.16	1.99	3.00	0.04	0.00	0.11	1.70	8.00	0.56	0.39	0.01	0.04	0.59
192	6685	10.07	22.09	38.77	0.44	0.00	1.73	26.60	99.71	1.16	2.01	2.99	0.04	0.00	0.11	1.71	8.01	0.57	0.38	0.01	0.04	0.60

193	6720	4.36	21.15	37.38	0.48	0.00	3.12	33.56	100.06	0.52	2.00	2.99	0.04	0.00	0.21	2.25	8.01	0.74	0.17	0.01	0.07	0.81
197	6860	10.02	21.84	38.86	0.47	0.00	1.54	26.28	99.01	1.16	1.99	3.01	0.04	0.00	0.10	1.70	8.00	0.57	0.39	0.01	0.03	0.60
199	6930	10.20	21.80	38.72	0.50	0.00	1.70	26.32	99.24	1.18	1.99	2.99	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59

Table 1.23: Composition of garnet A1 from sample HJ-35e_1 (group 2) as analysed along traverse G-H (Plate 5.9h). Distance is in microns from starting point G.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	9.68	21.89	38.73	0.51	0.00	1.73	26.72	99.27	1.12	2.00	3.00	0.04	0.00	0.11	1.73	8.00	0.58	0.37	0.01	0.04	0.61
2	30	10.04	22.21	39.65	0.46	0.00	1.70	26.68	100.74	1.14	1.99	3.02	0.04	0.00	0.11	1.70	7.99	0.57	0.38	0.01	0.04	0.60
3	60	9.78	21.89	38.64	0.51	0.00	1.69	26.74	99.25	1.13	2.00	2.99	0.04	0.00	0.11	1.73	8.01	0.57	0.37	0.01	0.04	0.61
4	90	9.88	21.71	38.67	0.43	0.00	1.59	26.60	98.87	1.14	1.99	3.00	0.04	0.00	0.10	1.73	8.00	0.57	0.38	0.01	0.03	0.60
5	120	9.97	21.79	38.82	0.47	0.00	1.75	26.58	99.39	1.15	1.99	3.00	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
6	150	9.85	21.81	38.60	0.47	0.00	1.69	26.79	99.21	1.14	1.99	2.99	0.04	0.00	0.11	1.74	8.01	0.57	0.38	0.01	0.04	0.60
7	180	9.98	21.91	38.68	0.44	0.00	1.75	27.12	99.87	1.15	1.99	2.98	0.04	0.00	0.11	1.75	8.02	0.57	0.38	0.01	0.04	0.60
8	210	10.15	21.85	38.84	0.45	0.00	1.51	26.61	99.41	1.17	1.99	3.00	0.04	0.00	0.10	1.72	8.01	0.57	0.39	0.01	0.03	0.60
9	240	10.08	21.94	39.01	0.48	0.00	1.75	26.80	100.06	1.15	1.99	3.00	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
10	270	10.10	21.85	38.75	0.45	0.00	1.64	26.63	99.41	1.16	1.99	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
11	300	10.17	21.77	38.93	0.44	0.00	1.65	26.57	99.54	1.17	1.98	3.00	0.04	0.00	0.11	1.71	8.01	0.57	0.39	0.01	0.04	0.59
12	330	10.14	21.84	38.71	0.43	0.00	1.72	26.55	99.39	1.17	1.99	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.39	0.01	0.04	0.59
13	360	10.10	21.82	38.70	0.45	0.00	1.68	26.87	99.62	1.16	1.99	2.99	0.04	0.00	0.11	1.74	8.02	0.57	0.38	0.01	0.04	0.60
14	390	10.30	21.81	38.78	0.48	0.00	1.73	26.24	99.35	1.19	1.99	2.99	0.04	0.00	0.11	1.69	8.01	0.56	0.39	0.01	0.04	0.59
15	420	10.06	22.02	38.84	0.47	0.00	1.65	26.74	99.78	1.15	2.00	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
16	450	10.11	22.00	38.78	0.45	0.00	1.59	26.88	99.81	1.16	2.00	2.99	0.04	0.00	0.10	1.73	8.02	0.57	0.38	0.01	0.03	0.60
17	480	10.29	21.89	38.66	0.46	0.00	1.69	26.44	99.43	1.18	1.99	2.99	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
18	510	9.98	21.75	38.96	0.47	0.00	1.70	26.86	99.73	1.15	1.98	3.00	0.04	0.00	0.11	1.73	8.01	0.57	0.38	0.01	0.04	0.60
19	540	10.07	21.84	38.65	0.46	0.00	1.67	26.78	99.47	1.16	1.99	2.99	0.04	0.00	0.11	1.73	8.02	0.57	0.38	0.01	0.04	0.60
20	570	10.11	21.92	38.84	0.44	0.00	1.69	26.17	99.16	1.16	2.00	3.00	0.04	0.00	0.11	1.69	8.00	0.56	0.39	0.01	0.04	0.59
21	600	10.27	21.94	38.83	0.45	0.00	1.61	26.68	99.79	1.18	1.99	2.99	0.04	0.00	0.10	1.72	8.02	0.57	0.39	0.01	0.03	0.59
22	630	10.20	21.84	38.70	0.50	0.00	1.76	26.66	99.67	1.17	1.99	2.99	0.04	0.00	0.12	1.72	8.02	0.56	0.38	0.01	0.04	0.59
23	660	10.15	21.75	38.72	0.44	0.00	1.68	26.61	99.35	1.17	1.98	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.39	0.01	0.04	0.60
24	690	10.25	21.67	38.64	0.42	0.00	1.58	26.82	99.37	1.18	1.98	2.99	0.03	0.00	0.10	1.74	8.02	0.57	0.39	0.01	0.03	0.59
25	720	10.18	21.94	38.70	0.48	0.00	1.66	25.99	98.95	1.17	2.00	3.00	0.04	0.00	0.11	1.68	8.00	0.56	0.39	0.01	0.04	0.59

27	780	10.11	21.84	38.61	0.45	0.00	1.65	26.20	98.87	1.17	2.00	3.00	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
28	810	10.17	21.97	39.13	0.46	0.00	1.69	26.47	99.89	1.16	1.99	3.00	0.04	0.00	0.11	1.70	8.00	0.56	0.39	0.01	0.04	0.59
29	840	10.38	21.88	39.02	0.50	0.00	1.64	26.24	99.67	1.19	1.98	3.00	0.04	0.00	0.11	1.69	8.01	0.56	0.39	0.01	0.04	0.59
30	870	10.18	22.05	38.76	0.45	0.00	1.65	26.54	99.63	1.17	2.00	2.99	0.04	0.00	0.11	1.71	8.01	0.57	0.39	0.01	0.04	0.59
31	900	10.24	21.88	38.76	0.46	0.00	1.66	26.53	99.53	1.18	1.99	2.99	0.04	0.00	0.11	1.71	8.02	0.56	0.39	0.01	0.04	0.59
32	930	10.47	21.85	38.82	0.47	0.00	1.64	26.16	99.42	1.20	1.99	2.99	0.04	0.00	0.11	1.69	8.01	0.56	0.40	0.01	0.04	0.58
33	960	10.19	21.87	38.66	0.48	0.04	1.76	26.94	99.92	1.17	1.99	2.98	0.04	0.00	0.11	1.74	8.03	0.57	0.38	0.01	0.04	0.60
34	990	10.11	21.96	38.72	0.51	0.00	1.65	26.64	99.60	1.16	2.00	2.99	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
39	1140	10.25	21.94	38.70	0.50	0.00	1.71	26.32	99.41	1.18	2.00	2.99	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
40	1170	10.16	21.80	38.89	0.52	0.00	1.70	26.40	99.47	1.17	1.98	3.00	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
41	1200	10.27	22.00	38.91	0.45	0.00	1.87	26.62	100.12	1.17	1.99	2.99	0.04	0.00	0.12	1.71	8.02	0.56	0.39	0.01	0.04	0.59
42	1230	10.37	22.09	38.69	0.47	0.00	1.70	26.72	100.03	1.19	2.00	2.97	0.04	0.00	0.11	1.72	8.03	0.56	0.39	0.01	0.04	0.59
43	1260	10.25	21.90	38.91	0.47	0.00	1.73	26.27	99.55	1.18	1.99	3.00	0.04	0.00	0.11	1.69	8.01	0.56	0.39	0.01	0.04	0.59
44	1290	10.15	21.80	38.95	0.40	0.00	1.63	26.51	99.44	1.17	1.98	3.00	0.03	0.00	0.11	1.71	8.00	0.57	0.39	0.01	0.04	0.59
45	1320	10.07	21.90	38.89	0.44	0.00	1.74	26.54	99.57	1.16	1.99	3.00	0.04	0.00	0.11	1.71	8.01	0.57	0.38	0.01	0.04	0.60
46	1350	10.05	21.55	39.29	0.49	0.00	1.67	26.13	99.17	1.16	1.96	3.03	0.04	0.00	0.11	1.69	7.99	0.56	0.39	0.01	0.04	0.59
47	1380	10.21	21.87	38.75	0.47	0.00	1.60	26.80	99.71	1.17	1.99	2.99	0.04	0.00	0.10	1.73	8.02	0.57	0.39	0.01	0.03	0.60
48	1410	10.13	21.97	38.68	0.42	0.00	1.73	26.77	99.69	1.16	2.00	2.98	0.03	0.00	0.11	1.73	8.02	0.57	0.38	0.01	0.04	0.60
49	1440	10.21	21.92	39.34	0.44	0.00	1.56	26.61	100.07	1.17	1.98	3.01	0.04	0.00	0.10	1.70	8.00	0.57	0.39	0.01	0.03	0.59
50	1470	10.11	21.90	38.80	0.53	0.00	1.72	26.49	99.54	1.16	1.99	2.99	0.04	0.00	0.11	1.71	8.01	0.56	0.38	0.01	0.04	0.60
51	1500	10.20	21.92	38.89	0.52	0.00	1.70	26.84	100.06	1.17	1.98	2.99	0.04	0.00	0.11	1.72	8.02	0.57	0.38	0.01	0.04	0.60
52	1530	9.96	21.86	38.90	0.49	0.00	1.63	26.12	98.96	1.15	1.99	3.01	0.04	0.00	0.11	1.69	7.99	0.57	0.38	0.01	0.04	0.60
60	1770	10.15	21.99	38.60	0.48	0.00	1.77	26.25	99.24	1.17	2.00	2.98	0.04	0.00	0.12	1.70	8.01	0.56	0.39	0.01	0.04	0.59
61	1800	10.13	21.94	38.65	0.48	0.00	1.64	26.42	99.25	1.17	2.00	2.99	0.04	0.00	0.11	1.71	8.01	0.57	0.39	0.01	0.04	0.59
62	1830	10.13	21.92	38.81	0.47	0.00	1.63	26.31	99.28	1.17	2.00	3.00	0.04	0.00	0.11	1.70	8.00	0.56	0.39	0.01	0.04	0.59
63	1860	10.07	21.94	38.87	0.45	0.00	1.68	26.52	99.53	1.16	1.99	3.00	0.04	0.00	0.11	1.71	8.01	0.57	0.38	0.01	0.04	0.60
64	1890	9.99	21.79	38.77	0.45	0.00	1.69	26.41	99.11	1.15	1.99	3.00	0.04	0.00	0.11	1.71	8.00	0.57	0.38	0.01	0.04	0.60
65	1920	10.11	21.79	38.77	0.50	0.00	1.62	26.58	99.36	1.16	1.98	3.00	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.03	0.60
66	1950	10.06	22.05	38.84	0.51	0.00	1.65	26.62	99.75	1.15	2.00	2.99	0.04	0.00	0.11	1.71	8.01	0.57	0.38	0.01	0.04	0.60
67	1980	10.03	21.77	38.70	0.48	0.00	1.58	26.83	99.39	1.16	1.98	2.99	0.04	0.00	0.10	1.74	8.01	0.57	0.38	0.01	0.03	0.60
68	2010	10.19	21.96	38.81	0.50	0.00	1.69	26.85	100.00	1.17	1.99	2.98	0.04	0.00	0.11	1.73	8.02	0.57	0.38	0.01	0.04	0.60

69	2040	10.13	21.91	38.88	0.50	0.05	1.67	26.60	99.74	1.16	1.99	2.99	0.04	0.00	0.11	1.71	8.01	0.57	0.38	0.01	0.04	0.60
70	2070	10.10	21.99	39.05	0.44	0.00	1.66	26.53	99.77	1.16	1.99	3.00	0.04	0.00	0.11	1.71	8.00	0.57	0.38	0.01	0.04	0.60
71	2100	10.01	21.76	38.83	0.51	0.00	1.69	26.64	99.45	1.15	1.98	3.00	0.04	0.00	0.11	1.72	8.01	0.57	0.38	0.01	0.04	0.60
72	2130	10.12	21.76	38.80	0.52	0.00	1.73	26.94	99.88	1.16	1.98	2.99	0.04	0.00	0.11	1.74	8.02	0.57	0.38	0.01	0.04	0.60
73	2160	10.08	21.95	39.08	0.49	0.00	1.63	26.59	99.81	1.15	1.99	3.00	0.04	0.00	0.11	1.71	8.00	0.57	0.38	0.01	0.04	0.60
74	2190	10.13	21.87	38.94	0.48	0.00	1.70	26.51	99.63	1.16	1.99	3.00	0.04	0.00	0.11	1.71	8.01	0.57	0.38	0.01	0.04	0.59
75	2220	9.97	21.77	38.74	0.45	0.00	1.76	26.69	99.38	1.15	1.98	3.00	0.04	0.00	0.12	1.73	8.01	0.57	0.38	0.01	0.04	0.60
76	2250	10.07	21.89	38.83	0.52	0.00	1.70	26.41	99.43	1.16	1.99	3.00	0.04	0.00	0.11	1.71	8.01	0.56	0.38	0.01	0.04	0.60
77	2280	10.11	21.93	38.94	0.50	0.00	1.70	26.56	99.74	1.16	1.99	3.00	0.04	0.00	0.11	1.71	8.01	0.57	0.38	0.01	0.04	0.60
78	2310	10.25	21.99	38.92	0.50	0.00	1.66	26.23	99.54	1.18	2.00	3.00	0.04	0.00	0.11	1.69	8.01	0.56	0.39	0.01	0.04	0.59
79	2340	10.15	21.87	38.87	0.49	0.00	1.76	26.71	99.86	1.17	1.98	2.99	0.04	0.00	0.11	1.72	8.02	0.57	0.38	0.01	0.04	0.60
80	2370	10.09	21.85	38.47	0.47	0.00	1.72	26.16	98.76	1.17	2.00	2.99	0.04	0.00	0.11	1.70	8.01	0.56	0.39	0.01	0.04	0.59
81	2400	10.06	21.73	38.87	0.51	0.00	1.63	27.03	99.83	1.16	1.97	3.00	0.04	0.00	0.11	1.74	8.02	0.57	0.38	0.01	0.03	0.60
82	2430	9.66	21.32	37.94	0.47	0.00	1.73	26.59	97.70	1.14	1.98	2.99	0.04	0.00	0.12	1.75	8.02	0.58	0.37	0.01	0.04	0.61
83	2460	10.08	21.89	38.83	0.48	0.00	1.80	26.43	99.51	1.16	1.99	3.00	0.04	0.00	0.12	1.71	8.01	0.56	0.38	0.01	0.04	0.60
84	2490	10.19	22.26	39.23	0.49	0.00	1.76	26.82	100.74	1.16	2.00	2.99	0.04	0.00	0.11	1.71	8.01	0.57	0.38	0.01	0.04	0.60
85	2520	9.90	22.08	38.78	0.45	0.00	1.67	26.59	99.46	1.14	2.01	2.99	0.04	0.00	0.11	1.72	8.00	0.57	0.38	0.01	0.04	0.60
86	2550	9.97	21.92	38.98	0.49	0.00	1.76	27.07	100.19	1.14	1.98	2.99	0.04	0.00	0.11	1.74	8.01	0.57	0.38	0.01	0.04	0.60
87	2580	9.86	21.91	38.73	0.48	0.00	1.66	26.68	99.33	1.14	2.00	3.00	0.04	0.00	0.11	1.73	8.01	0.57	0.38	0.01	0.04	0.60
88	2610	9.87	21.88	38.51	0.49	0.00	1.64	27.36	99.76	1.14	1.99	2.98	0.04	0.00	0.11	1.77	8.03	0.58	0.37	0.01	0.04	0.61
89	2640	9.80	21.69	38.63	0.44	0.00	1.75	27.48	99.80	1.13	1.98	2.99	0.04	0.00	0.11	1.78	8.02	0.58	0.37	0.01	0.04	0.61
90	2670	9.77	21.87	38.71	0.44	0.00	1.68	26.88	99.36	1.13	2.00	3.00	0.04	0.00	0.11	1.74	8.01	0.58	0.37	0.01	0.04	0.61
91	2700	9.56	21.82	38.63	0.51	0.00	1.72	27.23	99.46	1.10	1.99	2.99	0.04	0.00	0.11	1.76	8.01	0.58	0.37	0.01	0.04	0.62
92	2730	9.56	21.73	38.65	0.49	0.00	1.75	27.29	99.46	1.10	1.99	3.00	0.04	0.00	0.12	1.77	8.01	0.58	0.36	0.01	0.04	0.62
93	2760	9.53	21.82	38.50	0.49	0.00	1.81	27.05	99.21	1.10	2.00	2.99	0.04	0.00	0.12	1.76	8.01	0.58	0.37	0.01	0.04	0.61
94	2790	9.43	21.85	38.69	0.46	0.00	1.80	27.49	99.72	1.09	1.99	2.99	0.04	0.00	0.12	1.78	8.01	0.59	0.36	0.01	0.04	0.62
95	2820	9.74	21.90	38.98	0.52	0.00	1.71	27.28	100.12	1.12	1.99	3.00	0.04	0.00	0.11	1.75	8.01	0.58	0.37	0.01	0.04	0.61
98	2910	8.73	28.81	34.44	0.19	0.00	0.92	23.69	96.77	1.02	2.65	2.69	0.02	0.00	0.06	1.55	7.98	0.59	0.38	0.01	0.02	0.60
99	2940	7.93	21.39	38.44	0.43	0.00	1.90	29.40	99.48	0.93	1.97	3.01	0.04	0.00	0.13	1.93	8.00	0.64	0.31	0.01	0.04	0.68

Table 1.24: Composition of garnet A1 from sample HJ-58c (group 2) as analysed along traverse A-B (Plate 5.9i). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	7.06	21.86	39.56	0.97	0.07	0.33	33.00	102.85	0.80	1.97	3.02	0.08	0.00	0.02	2.11	8.00	0.70	0.27	0.03	0.01	0.72
2	60	7.46	21.75	39.09	0.98	0.14	0.38	31.58	101.38	0.86	1.98	3.02	0.08	0.01	0.02	2.04	8.00	0.68	0.29	0.03	0.01	0.70
3	120	7.94	21.90	39.39	1.13	0.00	0.37	31.74	102.47	0.90	1.97	3.00	0.09	0.00	0.02	2.02	8.01	0.67	0.30	0.03	0.01	0.69
4	180	7.75	21.75	39.06	1.09	0.00	0.26	30.90	100.81	0.89	1.98	3.02	0.09	0.00	0.02	2.00	8.00	0.67	0.30	0.03	0.01	0.69
5	240	7.98	21.86	39.18	1.10	0.04	0.49	31.12	101.78	0.91	1.98	3.00	0.09	0.00	0.03	2.00	8.01	0.66	0.30	0.03	0.01	0.69
6	300	7.94	22.34	40.15	1.23	0.06	0.48	31.44	103.64	0.89	1.98	3.02	0.10	0.00	0.03	1.98	8.00	0.66	0.30	0.03	0.01	0.69
7	360	8.39	21.94	39.71	1.05	0.15	0.34	31.53	103.11	0.95	1.96	3.01	0.09	0.01	0.02	2.00	8.02	0.65	0.31	0.03	0.01	0.68
8	420	8.26	22.12	39.91	1.05	0.06	0.36	30.55	102.31	0.93	1.98	3.03	0.09	0.00	0.02	1.94	7.99	0.65	0.31	0.03	0.01	0.67
10	540	8.57	22.23	39.44	1.07	0.00	0.45	30.41	102.18	0.97	1.99	3.00	0.09	0.00	0.03	1.93	8.01	0.64	0.32	0.03	0.01	0.67
11	600	8.50	21.74	39.53	1.06	0.00	0.49	31.01	102.34	0.96	1.95	3.01	0.09	0.00	0.03	1.97	8.02	0.65	0.32	0.03	0.01	0.67
12	660	8.50	22.00	39.83	1.09	0.12	0.51	30.60	102.65	0.96	1.96	3.02	0.09	0.01	0.03	1.94	8.01	0.64	0.32	0.03	0.01	0.67
13	720	8.39	22.07	39.44	1.06	0.00	0.41	30.80	102.16	0.95	1.98	3.00	0.09	0.00	0.03	1.96	8.01	0.65	0.31	0.03	0.01	0.67
14	780	8.53	22.62	40.23	0.91	0.00	0.37	31.05	103.73	0.95	1.99	3.01	0.07	0.00	0.02	1.94	7.99	0.65	0.32	0.02	0.01	0.67
15	840	8.50	22.00	39.90	1.05	0.07	0.52	30.64	102.69	0.96	1.96	3.02	0.09	0.00	0.03	1.94	8.00	0.64	0.32	0.03	0.01	0.67
16	900	8.16	21.89	39.49	1.05	0.08	0.54	30.47	101.68	0.93	1.97	3.02	0.09	0.00	0.03	1.95	8.00	0.65	0.31	0.03	0.01	0.68
17	960	8.30	21.77	39.36	1.06	0.00	0.40	30.12	101.01	0.95	1.97	3.02	0.09	0.00	0.03	1.94	7.99	0.65	0.32	0.03	0.01	0.67
18	1020	8.33	22.11	39.39	0.97	0.10	0.43	31.03	102.35	0.95	1.98	3.00	0.08	0.01	0.03	1.98	8.02	0.65	0.31	0.03	0.01	0.68
19	1080	8.48	22.56	39.83	1.06	0.00	0.27	31.56	103.75	0.95	2.00	2.99	0.09	0.00	0.02	1.98	8.03	0.65	0.31	0.03	0.01	0.68
23	1320	8.08	22.40	39.59	0.93	0.18	0.43	31.36	102.98	0.91	2.00	3.00	0.08	0.01	0.03	1.99	8.01	0.66	0.30	0.03	0.01	0.69
25	1440	7.80	21.84	39.01	1.03	0.00	0.35	30.49	100.51	0.90	1.99	3.02	0.09	0.00	0.02	1.97	7.99	0.66	0.30	0.03	0.01	0.69

Table 1.25: Composition of garnet A1 from sample HJ-58c (group 2) as analysed along traverse C-D (Plate 5.9i). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
3	96	7.90	21.68	39.69	0.99	0.03	0.49	31.33	102.10	0.90	1.95	3.03	0.08	0.00	0.03	2.00	8.00	0.66	0.30	0.03	0.01	0.69
5	192	8.19	22.27	39.82	1.09	0.10	0.33	32.15	103.95	0.92	1.97	2.99	0.09	0.01	0.02	2.02	8.02	0.66	0.30	0.03	0.01	0.69
6	240	8.08	22.10	39.41	1.02	0.03	0.46	31.40	102.50	0.92	1.98	3.00	0.08	0.00	0.03	2.00	8.01	0.66	0.30	0.03	0.01	0.69
7	288	7.95	21.89	39.26	1.11	0.00	0.49	31.07	101.77	0.91	1.98	3.01	0.09	0.00	0.03	1.99	8.00	0.66	0.30	0.03	0.01	0.69
8	336	8.20	21.98	39.59	1.03	0.10	0.47	31.30	102.66	0.93	1.97	3.01	0.08	0.01	0.03	1.99	8.01	0.66	0.31	0.03	0.01	0.68
9	384	7.92	22.46	39.52	1.06	0.05	0.39	31.09	102.50	0.90	2.01	3.00	0.09	0.00	0.03	1.97	8.00	0.66	0.30	0.03	0.01	0.69
10	432	8.37	22.18	39.77	1.14	0.07	0.40	31.73	103.65	0.94	1.97	3.00	0.09	0.00	0.03	2.00	8.02	0.65	0.31	0.03	0.01	0.68
11	480	8.13	22.10	39.60	1.02	0.08	0.39	31.30	102.62	0.92	1.98	3.01	0.08	0.00	0.03	1.99	8.01	0.66	0.31	0.03	0.01	0.68
12	528	8.24	22.07	39.98	1.05	0.00	0.41	30.70	102.44	0.93	1.97	3.03	0.09	0.00	0.03	1.95	7.99	0.65	0.31	0.03	0.01	0.68
13	576	8.31	22.27	40.22	1.15	0.00	0.25	31.62	103.82	0.93	1.97	3.02	0.09	0.00	0.02	1.99	8.01	0.66	0.31	0.03	0.01	0.68
16	720	8.50	22.30	39.93	1.10	0.02	0.34	31.01	103.21	0.95	1.98	3.01	0.09	0.00	0.02	1.95	8.00	0.65	0.32	0.03	0.01	0.67
17	768	8.25	21.86	39.23	1.05	0.00	0.30	30.63	101.33	0.94	1.98	3.01	0.09	0.00	0.02	1.97	8.02	0.65	0.31	0.03	0.01	0.68
18	816	8.74	22.37	39.89	1.06	0.02	0.29	30.93	103.30	0.98	1.99	3.00	0.09	0.00	0.02	1.95	8.02	0.64	0.32	0.03	0.01	0.67
21	960	8.44	22.06	39.77	0.98	0.03	0.45	30.84	102.57	0.95	1.97	3.01	0.08	0.00	0.03	1.95	8.00	0.65	0.32	0.03	0.01	0.67
22	1008	8.45	21.96	39.81	1.04	0.04	0.34	30.59	102.23	0.96	1.97	3.02	0.08	0.00	0.02	1.94	8.00	0.65	0.32	0.03	0.01	0.67
33	1488	8.25	21.97	39.43	1.03	0.00	0.44	31.20	102.32	0.94	1.97	3.00	0.08	0.00	0.03	1.99	8.01	0.65	0.31	0.03	0.01	0.68
34	1536	8.29	22.00	39.76	0.99	0.07	0.42	30.83	102.35	0.94	1.97	3.02	0.08	0.00	0.03	1.96	8.00	0.65	0.31	0.03	0.01	0.68
35	1584	8.07	22.07	39.84	1.08	0.00	0.51	30.28	101.84	0.92	1.98	3.03	0.09	0.00	0.03	1.93	7.98	0.65	0.31	0.03	0.01	0.68
36	1632	8.05	22.16	39.73	1.10	0.00	0.48	30.75	102.26	0.91	1.98	3.02	0.09	0.00	0.03	1.95	7.99	0.65	0.31	0.03	0.01	0.68
37	1680	8.42	22.39	39.65	1.12	0.00	0.39	31.03	102.99	0.95	1.99	2.99	0.09	0.00	0.03	1.96	8.01	0.65	0.31	0.03	0.01	0.67
38	1728	8.05	21.76	39.19	1.04	0.03	0.41	30.75	101.24	0.92	1.97	3.01	0.09	0.00	0.03	1.98	8.00	0.66	0.31	0.03	0.01	0.68
39	1776	8.14	21.87	39.87	1.06	0.00	0.54	31.36	102.84	0.92	1.95	3.02	0.09	0.00	0.03	1.99	8.00	0.66	0.30	0.03	0.01	0.68
40	1824	7.77	21.95	39.21	1.05	0.08	0.38	31.40	101.82	0.89	1.98	3.01	0.09	0.00	0.02	2.01	8.01	0.67	0.29	0.03	0.01	0.69
41	1872	7.97	22.01	40.37	1.01	0.00	0.48	31.89	103.73	0.89	1.95	3.03	0.08	0.00	0.03	2.00	7.99	0.67	0.30	0.03	0.01	0.69
42	1920	7.80	22.01	39.44	1.09	0.00	0.56	31.76	102.64	0.88	1.98	3.00	0.09	0.00	0.04	2.02	8.01	0.67	0.29	0.03	0.01	0.70

Table 1.26: Composition of garnet A2 from sample HJ-58c (group 2) as analysed along traverse A-B (Plate 5.9j). Distance is in mircons from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	8.16	21.98	39.02	1.09	0.00	0.41	30.74	101.40	0.93	1.99	3.00	0.09	0.00	0.03	1.97	8.01	0.65	0.31	0.03	0.01	0.68
2	108	8.47	22.50	40.10	1.05	0.08	0.34	30.71	103.26	0.95	1.99	3.01	0.08	0.00	0.02	1.93	8.00	0.65	0.32	0.03	0.01	0.67
3	216	8.34	22.21	39.79	0.94	0.04	0.24	30.28	101.83	0.95	1.99	3.03	0.08	0.00	0.02	1.93	7.99	0.65	0.32	0.03	0.01	0.67
4	324	9.20	22.48	40.21	0.83	0.18	0.37	30.29	103.55	1.03	1.98	3.01	0.07	0.01	0.02	1.90	8.01	0.63	0.34	0.02	0.01	0.65
5	432	9.15	22.44	39.94	0.63	0.00	0.51	30.46	103.12	1.02	1.99	3.00	0.05	0.00	0.03	1.91	8.01	0.63	0.34	0.02	0.01	0.65
6	540	8.94	21.95	39.17	0.61	0.04	0.39	29.44	100.54	1.02	1.99	3.01	0.05	0.00	0.03	1.89	8.00	0.63	0.34	0.02	0.01	0.65
7	648	9.37	22.11	39.77	0.65	0.00	0.34	30.47	102.71	1.05	1.97	3.00	0.05	0.00	0.02	1.92	8.02	0.63	0.35	0.02	0.01	0.65
8	756	8.81	21.48	38.57	0.81	0.09	0.34	29.56	99.66	1.02	1.97	3.00	0.07	0.01	0.02	1.93	8.02	0.63	0.34	0.02	0.01	0.65
9	864	9.07	22.17	40.08	0.90	0.08	0.40	30.19	102.89	1.02	1.97	3.02	0.07	0.00	0.03	1.90	8.00	0.63	0.34	0.02	0.01	0.65
10	972	8.88	22.42	40.14	0.93	0.02	0.24	30.05	102.67	1.00	1.99	3.02	0.07	0.00	0.02	1.89	8.00	0.64	0.33	0.03	0.01	0.65
11	1080	9.02	22.18	39.52	1.02	0.14	0.49	30.03	102.40	1.02	1.98	3.00	0.08	0.01	0.03	1.90	8.02	0.63	0.34	0.03	0.01	0.65
12	1188	8.99	22.55	40.47	1.10	0.16	0.27	30.16	103.69	1.00	1.99	3.02	0.09	0.01	0.02	1.88	8.01	0.63	0.33	0.03	0.01	0.65
13	1296	9.00	22.58	40.30	1.05	0.04	0.28	29.98	103.24	1.01	1.99	3.02	0.08	0.00	0.02	1.88	8.00	0.63	0.34	0.03	0.01	0.65
16	1620	8.95	22.34	39.52	1.11	0.11	0.39	30.05	102.48	1.01	1.99	2.99	0.09	0.01	0.03	1.90	8.02	0.63	0.33	0.03	0.01	0.65
17	1728	9.08	22.82	40.34	1.00	0.05	0.37	30.01	103.66	1.01	2.00	3.01	0.08	0.00	0.02	1.87	7.99	0.63	0.34	0.03	0.01	0.65
18	1836	9.13	22.39	39.79	1.15	0.00	0.41	30.16	103.02	1.02	1.98	2.99	0.09	0.00	0.03	1.90	8.02	0.62	0.34	0.03	0.01	0.65
19	1944	9.40	22.73	40.52	1.03	0.00	0.32	29.75	103.75	1.04	1.99	3.02	0.08	0.00	0.02	1.85	8.01	0.62	0.35	0.03	0.01	0.64
20	2052	9.22	22.34	40.17	1.02	0.01	0.27	29.97	103.00	1.03	1.98	3.02	0.08	0.00	0.02	1.88	8.01	0.62	0.34	0.03	0.01	0.65
21	2160	9.02	22.69	40.00	1.01	0.13	0.30	30.39	103.55	1.01	2.00	3.00	0.08	0.01	0.02	1.91	8.03	0.63	0.33	0.03	0.01	0.65
22	2268	9.22	22.08	40.04	0.98	0.03	0.30	29.89	102.54	1.04	1.96	3.02	0.08	0.00	0.02	1.89	8.01	0.62	0.34	0.03	0.01	0.65
23	2376	9.13	21.95	39.42	0.87	0.07	0.25	29.57	101.26	1.04	1.98	3.01	0.07	0.00	0.02	1.89	8.02	0.63	0.34	0.02	0.01	0.65
24	2484	9.13	22.42	40.14	0.93	0.00	0.33	29.71	102.65	1.02	1.99	3.02	0.07	0.00	0.02	1.87	7.99	0.63	0.34	0.02	0.01	0.65
25	2592	9.26	22.29	39.28	0.80	0.00	0.19	29.32	101.13	1.05	2.01	3.00	0.07	0.00	0.01	1.87	8.01	0.62	0.35	0.02	0.00	0.64
26	2700	9.17	22.22	39.73	0.84	0.00	0.29	30.02	102.26	1.04	1.98	3.01	0.07	0.00	0.02	1.90	8.02	0.63	0.34	0.02	0.01	0.65
27	2808	9.16	22.26	40.19	0.84	0.16	0.51	30.08	103.20	1.02	1.97	3.02	0.07	0.01	0.03	1.89	8.01	0.63	0.34	0.02	0.01	0.65

28	2916	8.81	21.75	38.33	0.93	0.00	0.39	29.64	99.85	1.02	1.99	2.98	0.08	0.00	0.03	1.93	8.02	0.63	0.33	0.03	0.01	0.65
29	3024	9.26	22.33	40.12	0.92	0.10	0.47	29.88	103.07	1.04	1.98	3.01	0.07	0.01	0.03	1.88	8.01	0.62	0.34	0.02	0.01	0.64
30	3132	9.13	22.35	39.71	1.12	0.00	0.31	30.19	102.80	1.03	1.99	3.00	0.09	0.00	0.02	1.91	8.03	0.63	0.34	0.03	0.01	0.65
31	3240	9.10	22.25	39.70	1.12	0.13	0.22	30.21	102.73	1.03	1.98	3.00	0.09	0.01	0.01	1.91	8.03	0.63	0.34	0.03	0.00	0.65
32	3348	9.00	22.29	39.92	1.21	0.00	0.30	29.61	102.34	1.01	1.99	3.02	0.10	0.00	0.02	1.87	8.01	0.62	0.34	0.03	0.01	0.65
33	3456	9.20	22.48	39.81	1.04	0.10	0.30	29.54	102.46	1.04	2.00	3.01	0.08	0.01	0.02	1.87	8.02	0.62	0.34	0.03	0.01	0.64
34	3564	9.25	22.22	39.93	1.03	0.03	0.38	29.81	102.66	1.04	1.97	3.01	0.08	0.00	0.02	1.88	8.01	0.62	0.34	0.03	0.01	0.64
36	3780	9.05	22.59	40.31	1.06	0.00	0.37	30.03	103.41	1.01	1.99	3.01	0.09	0.00	0.02	1.88	7.99	0.63	0.34	0.03	0.01	0.65
37	3888	8.97	22.23	39.68	1.03	0.00	0.29	30.14	102.33	1.01	1.99	3.01	0.08	0.00	0.02	1.91	8.02	0.63	0.33	0.03	0.01	0.65
38	3996	9.04	22.18	39.17	1.01	0.00	0.34	29.20	100.94	1.03	2.00	3.00	0.08	0.00	0.02	1.87	8.00	0.62	0.34	0.03	0.01	0.64
39	4104	9.12	22.04	39.23	0.99	0.00	0.23	29.25	100.87	1.04	1.99	3.01	0.08	0.00	0.02	1.88	8.01	0.62	0.35	0.03	0.01	0.64
40	4212	9.15	21.86	39.11	0.87	0.00	0.28	29.16	100.42	1.05	1.98	3.01	0.07	0.00	0.02	1.88	8.01	0.62	0.35	0.02	0.01	0.64
41	4320	9.33	22.07	39.66	0.93	0.00	0.20	29.62	101.81	1.06	1.98	3.01	0.08	0.00	0.01	1.88	8.01	0.62	0.35	0.03	0.00	0.64
42	4428	9.30	22.14	39.70	0.72	0.00	0.43	30.17	102.45	1.05	1.97	3.00	0.06	0.00	0.03	1.91	8.01	0.63	0.34	0.02	0.01	0.65
43	4536	9.34	22.49	39.90	0.62	0.02	0.35	30.34	103.05	1.05	1.99	3.00	0.05	0.00	0.02	1.91	8.01	0.63	0.35	0.02	0.01	0.65
44	4644	9.22	22.56	40.06	0.65	0.01	0.21	30.13	102.84	1.03	2.00	3.01	0.05	0.00	0.01	1.89	8.00	0.63	0.35	0.02	0.00	0.65
45	4752	9.38	22.41	40.31	0.67	0.08	0.41	30.09	103.35	1.05	1.98	3.01	0.05	0.00	0.03	1.88	8.00	0.63	0.35	0.02	0.01	0.64
46	4860	9.15	22.00	39.46	0.54	0.00	0.33	29.69	101.18	1.04	1.98	3.01	0.04	0.00	0.02	1.90	8.00	0.63	0.35	0.01	0.01	0.65
47	4968	9.38	21.97	39.01	0.60	0.00	0.46	29.39	100.81	1.07	1.99	2.99	0.05	0.00	0.03	1.89	8.01	0.62	0.35	0.02	0.01	0.64
48	5076	9.29	22.47	39.71	0.78	0.00	0.42	30.52	103.19	1.04	1.99	2.98	0.06	0.00	0.03	1.92	8.02	0.63	0.34	0.02	0.01	0.65
49	5184	8.99	21.94	39.72	0.81	0.03	0.43	29.60	101.53	1.02	1.97	3.02	0.07	0.00	0.03	1.88	7.99	0.63	0.34	0.02	0.01	0.65
50	5292	9.10	22.04	39.11	0.83	0.07	0.28	29.00	100.43	1.04	2.00	3.01	0.07	0.00	0.02	1.87	8.01	0.62	0.35	0.02	0.01	0.64
55	5832	9.12	22.32	39.55	0.63	0.08	0.34	30.12	102.15	1.03	1.99	3.00	0.05	0.00	0.02	1.91	8.01	0.63	0.34	0.02	0.01	0.65
57	6048	9.06	21.93	39.29	0.81	0.00	0.28	29.64	101.01	1.04	1.98	3.01	0.07	0.00	0.02	1.90	8.01	0.63	0.34	0.02	0.01	0.65
58	6156	8.77	21.97	38.68	0.79	0.00	0.32	29.71	100.25	1.01	2.00	2.99	0.07	0.00	0.02	1.92	8.01	0.64	0.33	0.02	0.01	0.66
59	6264	9.02	22.32	40.06	0.97	0.00	0.38	29.60	102.35	1.01	1.98	3.02	0.08	0.00	0.02	1.87	7.99	0.63	0.34	0.03	0.01	0.65
60	6372	8.90	22.10	39.60	0.98	0.01	0.30	29.49	101.38	1.01	1.99	3.02	0.08	0.00	0.02	1.88	8.00	0.63	0.34	0.03	0.01	0.65
61	6480	9.00	22.13	40.05	1.06	0.00	0.35	29.81	102.39	1.01	1.97	3.02	0.09	0.00	0.02	1.88	7.99	0.63	0.34	0.03	0.01	0.65
62	6588	8.95	22.51	39.73	1.13	0.02	0.32	29.64	102.29	1.01	2.01	3.01	0.09	0.00	0.02	1.88	8.01	0.63	0.34	0.03	0.01	0.65
63	6696	8.92	21.99	39.50	1.06	0.02	0.32	29.69	101.51	1.01	1.98	3.01	0.09	0.00	0.02	1.89	8.00	0.63	0.34	0.03	0.01	0.65
64	6804	9.24	22.57	39.48	1.06	0.00	0.41	29.69	102.45	1.04	2.01	2.98	0.09	0.00	0.03	1.87	8.02	0.62	0.34	0.03	0.01	0.64

65	6912	8.92	21.95	39.45	1.01	0.35	0.42	29.47	101.56	1.01	1.97	3.00	0.08	0.02	0.03	1.88	7.99	0.63	0.34	0.03	0.01	0.65

Table 1.27: Composition of garnet A2 from sample HJ-58c (group 2) as analysed along traverse C-D (Plate 5.9j). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	8.92	22.20	39.70	1.05	0.00	0.38	30.10	102.34	1.01	1.98	3.00	0.09	0.00	0.02	1.91	8.01	0.63	0.33	0.03	0.01	0.65
2	100	8.57	21.86	39.58	1.18	0.00	0.45	29.34	100.98	0.98	1.97	3.03	0.10	0.00	0.03	1.88	7.98	0.63	0.33	0.03	0.01	0.66
3	200	9.07	22.44	40.16	1.28	0.00	0.29	30.10	103.33	1.01	1.98	3.01	0.10	0.00	0.02	1.89	8.02	0.62	0.34	0.03	0.01	0.65
4	300	8.95	22.27	40.21	1.16	0.00	0.34	30.14	103.07	1.00	1.97	3.02	0.09	0.00	0.02	1.89	8.00	0.63	0.33	0.03	0.01	0.65
5	400	8.32	22.59	38.54	1.03	0.10	0.38	28.56	99.53	0.96	2.06	2.99	0.09	0.01	0.02	1.85	7.98	0.63	0.33	0.03	0.01	0.66
6	500	8.98	22.20	39.97	1.02	0.02	0.38	29.81	102.38	1.01	1.98	3.02	0.08	0.00	0.02	1.88	8.00	0.63	0.34	0.03	0.01	0.65
7	600	9.16	22.11	39.70	0.90	0.01	0.28	29.68	101.84	1.04	1.98	3.02	0.07	0.00	0.02	1.89	8.01	0.63	0.34	0.02	0.01	0.65
8	700	8.99	22.50	39.79	0.96	0.05	0.50	29.33	102.12	1.01	2.01	3.01	0.08	0.00	0.03	1.85	7.99	0.62	0.34	0.03	0.01	0.65
9	800	9.14	21.80	39.04	0.91	0.00	0.15	29.52	100.56	1.05	1.98	3.00	0.08	0.00	0.01	1.90	8.02	0.63	0.35	0.02	0.00	0.64
10	900	8.97	22.29	39.98	0.94	0.08	0.36	29.65	102.27	1.01	1.99	3.02	0.08	0.00	0.02	1.87	7.99	0.63	0.34	0.03	0.01	0.65
11	1000	9.27	22.39	39.88	0.91	0.00	0.30	29.85	102.61	1.04	1.99	3.01	0.07	0.00	0.02	1.88	8.02	0.62	0.35	0.02	0.01	0.64
12	1100	9.17	22.70	40.03	0.74	0.10	0.28	29.91	102.93	1.03	2.01	3.01	0.06	0.01	0.02	1.88	8.01	0.63	0.34	0.02	0.01	0.65
13	1200	8.89	21.89	39.81	0.82	0.03	0.23	29.79	101.46	1.01	1.97	3.04	0.07	0.00	0.02	1.90	8.00	0.63	0.34	0.02	0.01	0.65
14	1300	9.39	22.40	39.23	0.84	0.01	0.37	29.97	102.21	1.06	2.00	2.97	0.07	0.00	0.02	1.90	8.03	0.62	0.35	0.02	0.01	0.64
15	1400	9.29	22.20	39.61	0.96	0.03	0.48	29.77	102.34	1.05	1.98	3.00	0.08	0.00	0.03	1.88	8.02	0.62	0.34	0.03	0.01	0.64
16	1500	8.90	21.52	38.37	0.94	0.00	0.32	28.96	99.01	1.04	1.99	3.00	0.08	0.00	0.02	1.90	8.02	0.62	0.34	0.03	0.01	0.65
17	1600	9.37	22.47	40.01	0.86	0.03	0.36	29.97	103.07	1.05	1.99	3.00	0.07	0.00	0.02	1.88	8.01	0.62	0.35	0.02	0.01	0.64
18	1700	9.52	22.28	39.86	0.97	0.05	0.36	30.00	103.04	1.07	1.97	2.99	0.08	0.00	0.02	1.88	8.02	0.62	0.35	0.03	0.01	0.64
19	1800	8.86	21.97	39.60	0.93	0.14	0.27	29.79	101.57	1.01	1.98	3.02	0.08	0.01	0.02	1.90	8.01	0.63	0.34	0.03	0.01	0.65
20	1900	9.27	22.48	39.90	0.86	0.00	0.48	29.81	102.80	1.04	1.99	3.00	0.07	0.00	0.03	1.87	8.00	0.62	0.34	0.02	0.01	0.64
21	2000	9.33	22.53	40.00	0.82	0.00	0.28	29.78	102.74	1.05	2.00	3.01	0.07	0.00	0.02	1.87	8.01	0.62	0.35	0.02	0.01	0.64
22	2100	9.19	22.27	39.43	0.87	0.07	0.32	30.15	102.30	1.04	1.99	2.99	0.07	0.00	0.02	1.91	8.04	0.63	0.34	0.02	0.01	0.65
23	2200	9.54	22.75	40.26	0.90	0.00	0.24	29.21	102.89	1.06	2.01	3.01	0.07	0.00	0.02	1.83	8.00	0.61	0.36	0.02	0.01	0.63
24	2300	9.29	22.41	39.92	0.91	0.00	0.52	29.99	103.03	1.04	1.98	3.00	0.07	0.00	0.03	1.88	8.01	0.62	0.34	0.02	0.01	0.64
25	2400	9.30	22.44	39.63	1.07	0.00	0.38	29.81	102.63	1.04	1.99	2.99	0.09	0.00	0.02	1.88	8.02	0.62	0.34	0.03	0.01	0.64

26	2500	8.97	22.10	39.46	1.05	0.10	0.27	29.39	101.34	1.02	1.99	3.01	0.09	0.01	0.02	1.88	8.01	0.63	0.34	0.03	0.01	0.65
28	2700	9.06	22.36	39.11	1.11	0.00	0.30	29.84	101.76	1.03	2.01	2.98	0.09	0.00	0.02	1.90	8.03	0.63	0.34	0.03	0.01	0.65
29	2800	9.17	22.37	40.02	1.06	0.00	0.15	29.75	102.52	1.03	1.99	3.01	0.09	0.00	0.01	1.87	8.00	0.62	0.34	0.03	0.00	0.65
30	2900	9.05	22.41	39.76	1.16	0.00	0.32	29.87	102.57	1.02	1.99	3.00	0.09	0.00	0.02	1.88	8.01	0.62	0.34	0.03	0.01	0.65
31	3000	9.09	21.98	39.82	1.08	0.08	0.38	29.17	101.60	1.03	1.97	3.03	0.09	0.00	0.02	1.85	7.99	0.62	0.34	0.03	0.01	0.64
32	3100	9.00	22.25	39.54	1.12	0.02	0.33	29.61	101.88	1.02	1.99	3.00	0.09	0.00	0.02	1.88	8.00	0.62	0.34	0.03	0.01	0.65
33	3200	8.85	21.97	39.19	1.12	0.13	0.40	29.37	101.03	1.01	1.99	3.00	0.09	0.01	0.03	1.88	8.01	0.63	0.34	0.03	0.01	0.65
34	3300	8.86	22.23	39.36	1.19	0.08	0.37	29.23	101.32	1.01	2.00	3.00	0.10	0.00	0.02	1.87	8.00	0.62	0.34	0.03	0.01	0.65
37	3600	8.86	21.88	39.41	1.03	0.02	0.34	29.11	100.66	1.01	1.98	3.02	0.08	0.00	0.02	1.87	7.99	0.63	0.34	0.03	0.01	0.65
38	3700	9.11	22.30	39.26	1.15	0.00	0.42	29.69	101.93	1.03	2.00	2.98	0.09	0.00	0.03	1.89	8.02	0.62	0.34	0.03	0.01	0.65
39	3800	8.86	22.18	39.06	1.12	0.01	0.28	29.05	100.57	1.02	2.01	3.00	0.09	0.00	0.02	1.87	8.01	0.62	0.34	0.03	0.01	0.65
40	3900	9.04	22.26	39.34	1.16	0.17	0.32	29.74	102.02	1.03	2.00	2.99	0.10	0.01	0.02	1.89	8.04	0.62	0.34	0.03	0.01	0.65
41	4000	9.08	22.08	39.45	1.04	0.00	0.38	29.35	101.39	1.03	1.98	3.01	0.08	0.00	0.02	1.87	8.00	0.62	0.34	0.03	0.01	0.64
44	4300	9.06	22.04	39.04	1.05	0.00	0.20	29.54	100.93	1.04	1.99	3.00	0.09	0.00	0.01	1.90	8.02	0.63	0.34	0.03	0.00	0.65
45	4400	8.92	22.14	39.42	0.96	0.08	0.35	29.38	101.25	1.01	1.99	3.01	0.08	0.00	0.02	1.88	8.00	0.63	0.34	0.03	0.01	0.65
46	4500	8.84	22.26	39.11	0.97	0.00	0.34	29.15	100.68	1.01	2.01	3.00	0.08	0.00	0.02	1.87	7.99	0.63	0.34	0.03	0.01	0.65
47	4600	8.05	22.53	37.35	0.98	0.00	0.32	28.59	97.83	0.95	2.10	2.95	0.08	0.00	0.02	1.89	7.99	0.64	0.32	0.03	0.01	0.67
48	4700	9.04	22.08	39.40	1.13	0.01	0.41	29.86	101.94	1.02	1.98	3.00	0.09	0.00	0.03	1.90	8.02	0.62	0.34	0.03	0.01	0.65
49	4800	8.82	21.81	39.42	1.17	0.01	0.26	29.51	101.00	1.01	1.97	3.02	0.10	0.00	0.02	1.89	8.01	0.63	0.33	0.03	0.01	0.65
50	4900	9.04	22.23	39.52	1.29	0.08	0.35	29.45	101.95	1.02	1.99	3.00	0.10	0.00	0.02	1.87	8.01	0.62	0.34	0.03	0.01	0.65
51	5000	8.87	22.17	39.44	1.25	0.03	0.37	28.85	100.99	1.01	2.00	3.01	0.10	0.00	0.02	1.84	7.99	0.62	0.34	0.03	0.01	0.65
52	5100	8.74	22.31	39.23	1.25	0.03	0.35	29.71	101.61	0.99	2.00	2.99	0.10	0.00	0.02	1.89	8.01	0.63	0.33	0.03	0.01	0.66
53	5200	8.72	21.92	38.83	1.18	0.05	0.34	29.70	100.75	1.00	1.99	2.99	0.10	0.00	0.02	1.91	8.02	0.63	0.33	0.03	0.01	0.66
54	5300	9.05	22.13	39.59	1.18	0.00	0.34	30.10	102.39	1.02	1.97	3.00	0.10	0.00	0.02	1.91	8.02	0.63	0.34	0.03	0.01	0.65
55	5400	8.97	21.83	39.24	0.94	0.10	0.32	29.68	101.09	1.03	1.98	3.01	0.08	0.01	0.02	1.91	8.03	0.63	0.34	0.03	0.01	0.65

Table 1.28: Composition of garnet A1 from sample HJ-57b (group 2) as analysed along traverse A-B (Plate 5.9k). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
3	0	10.15	22.04	39.58	2.42	0.07	2.42	23.66	100.34	1.15	1.98	3.01	0.20	0.00	0.16	1.51	8.00	0.50	0.38	0.07	0.05	0.57
4	100	9.92	22.09	39.36	3.02	0.11	2.42	23.81	100.72	1.13	1.98	2.99	0.25	0.01	0.16	1.52	8.02	0.50	0.37	0.08	0.05	0.57
5	200	10.22	22.46	39.70	3.27	0.00	2.29	23.41	101.35	1.14	1.99	2.98	0.26	0.00	0.15	1.47	8.00	0.49	0.38	0.09	0.05	0.56
6	300	10.26	22.35	39.67	2.67	0.00	2.46	23.36	100.76	1.16	1.99	3.00	0.22	0.00	0.16	1.48	7.99	0.49	0.38	0.07	0.05	0.56
7	400	10.50	22.16	39.80	2.40	0.04	2.27	23.53	100.70	1.18	1.98	3.01	0.19	0.00	0.15	1.49	8.00	0.49	0.39	0.06	0.05	0.56
8	500	10.71	22.37	39.70	2.00	0.10	2.31	24.09	101.28	1.20	1.98	2.99	0.16	0.01	0.15	1.52	8.00	0.50	0.40	0.05	0.05	0.56
9	600	10.97	22.56	39.89	2.21	0.03	2.30	24.03	101.98	1.22	1.99	2.98	0.18	0.00	0.15	1.50	8.02	0.49	0.40	0.06	0.05	0.55
10	700	10.64	22.20	39.41	2.17	0.00	2.20	23.46	100.10	1.21	1.99	3.00	0.18	0.00	0.14	1.49	8.01	0.49	0.40	0.06	0.05	0.55
12	900	10.43	22.30	39.01	1.88	0.00	2.33	23.01	98.96	1.19	2.02	3.00	0.16	0.00	0.15	1.48	7.99	0.50	0.40	0.05	0.05	0.55
13	1000	10.83	22.29	39.64	2.09	0.04	2.28	24.20	101.37	1.22	1.98	2.99	0.17	0.00	0.15	1.53	8.03	0.50	0.40	0.06	0.05	0.56
15	1200	10.55	22.20	39.48	2.23	0.00	2.45	23.97	100.89	1.19	1.98	2.99	0.18	0.00	0.16	1.52	8.02	0.50	0.39	0.06	0.05	0.56
16	1300	10.83	22.61	40.26	2.22	0.14	2.32	23.86	102.24	1.20	1.99	3.00	0.18	0.01	0.15	1.49	8.01	0.49	0.40	0.06	0.05	0.55
17	1400	10.23	22.14	39.28	2.83	0.02	2.46	23.17	100.13	1.16	1.99	2.99	0.23	0.00	0.16	1.48	8.01	0.49	0.38	0.08	0.05	0.56
18	1500	10.17	22.57	39.59	3.40	0.00	2.34	23.87	101.94	1.14	2.00	2.97	0.27	0.00	0.15	1.50	8.03	0.49	0.37	0.09	0.05	0.57
19	1600	10.18	22.69	39.64	3.37	0.05	2.42	24.03	102.37	1.14	2.00	2.97	0.27	0.00	0.15	1.50	8.03	0.49	0.37	0.09	0.05	0.57
20	1700	9.68	22.44	39.54	3.28	0.03	2.45	23.78	101.21	1.09	2.00	2.99	0.27	0.00	0.16	1.50	8.01	0.50	0.36	0.09	0.05	0.58
21	1800	9.80	22.66	39.56	3.42	0.07	2.40	23.81	101.70	1.10	2.01	2.98	0.28	0.00	0.15	1.50	8.02	0.50	0.36	0.09	0.05	0.58
22	1900	9.61	22.25	39.58	3.40	0.00	2.35	23.95	101.14	1.09	1.99	3.00	0.28	0.00	0.15	1.52	8.01	0.50	0.36	0.09	0.05	0.58
23	2000	9.56	22.23	39.19	3.29	0.10	2.52	24.11	100.99	1.08	1.99	2.98	0.27	0.01	0.16	1.53	8.03	0.50	0.36	0.09	0.05	0.59
24	2100	9.23	22.33	39.19	2.91	0.00	2.40	24.33	100.39	1.05	2.01	2.99	0.24	0.00	0.16	1.55	8.00	0.52	0.35	0.08	0.05	0.60

Table 1.29: Composition of garnet A1 from sample HJ-57b (group 2) as analysed along traverse C-D (Plate 5.9k). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	10.41	22.07	39.35	2.46	0.00	2.48	24.13	100.90	1.18	1.97	2.99	0.20	0.00	0.16	1.53	8.03	0.50	0.38	0.07	0.05	0.57
2	100	9.88	22.19	39.63	2.94	0.00	2.35	23.83	100.83	1.12	1.98	3.00	0.24	0.00	0.15	1.51	8.00	0.50	0.37	0.08	0.05	0.57
3	200	9.95	22.31	39.11	3.47	0.11	2.43	23.49	100.87	1.13	2.00	2.97	0.28	0.01	0.16	1.49	8.04	0.49	0.37	0.09	0.05	0.57
4	300	10.00	21.96	39.22	3.28	0.03	2.33	23.12	99.94	1.14	1.97	2.99	0.27	0.00	0.15	1.48	8.00	0.49	0.38	0.09	0.05	0.56
5	400	9.93	22.38	39.04	3.14	0.00	2.21	23.65	100.35	1.13	2.01	2.97	0.26	0.00	0.14	1.51	8.02	0.50	0.37	0.08	0.05	0.57
6	500	10.17	22.06	39.94	2.76	0.06	2.29	23.87	101.15	1.15	1.96	3.02	0.22	0.00	0.15	1.51	8.01	0.50	0.38	0.07	0.05	0.57
7	600	10.29	22.32	39.66	2.59	0.01	2.33	23.94	101.13	1.16	1.99	3.00	0.21	0.00	0.15	1.51	8.01	0.50	0.38	0.07	0.05	0.57
9	800	10.35	22.30	40.95	1.82	0.01	2.35	23.31	101.09	1.16	1.97	3.07	0.15	0.00	0.15	1.46	7.95	0.50	0.40	0.05	0.05	0.56
12	1100	10.24	22.09	39.40	2.08	0.00	2.08	24.16	100.04	1.16	1.99	3.01	0.17	0.00	0.13	1.54	8.00	0.51	0.39	0.06	0.04	0.57
14	1300	10.58	22.21	39.18	1.98	0.09	2.23	23.32	99.59	1.21	2.00	2.99	0.16	0.01	0.14	1.49	8.00	0.50	0.40	0.05	0.05	0.55
15	1400	10.40	22.16	39.51	2.16	0.03	2.44	23.63	100.34	1.18	1.99	3.00	0.18	0.00	0.16	1.50	8.01	0.50	0.39	0.06	0.05	0.56
16	1500	10.80	22.31	39.55	2.14	0.00	2.24	23.92	100.96	1.22	1.99	2.99	0.17	0.00	0.14	1.51	8.02	0.50	0.40	0.06	0.05	0.55
17	1600	10.47	22.11	39.65	2.59	0.08	2.25	23.62	100.76	1.18	1.97	3.00	0.21	0.00	0.14	1.50	8.01	0.49	0.39	0.07	0.05	0.56
18	1700	10.29	22.55	39.80	2.96	0.05	2.34	23.55	101.54	1.15	2.00	2.99	0.24	0.00	0.15	1.48	8.01	0.49	0.38	0.08	0.05	0.56
20	1900	10.10	22.38	39.32	3.01	0.04	2.32	23.34	100.52	1.14	2.00	2.99	0.24	0.00	0.15	1.48	8.01	0.49	0.38	0.08	0.05	0.56
21	2000	10.32	22.58	39.50	2.84	0.00	2.31	23.46	101.01	1.16	2.01	2.98	0.23	0.00	0.15	1.48	8.00	0.49	0.38	0.08	0.05	0.56

Table 1.30: Composition of garnet A2 from sample HJ-57b (group 2) as analysed along traverse A-B (Plate 5.9l). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	10.38	22.38	39.69	2.56	0.07	2.48	24.12	101.69	1.16	1.98	2.98	0.21	0.00	0.16	1.52	8.01	0.50	0.38	0.07	0.05	0.57
2	75	10.17	22.11	39.47	2.88	0.00	2.41	23.71	100.75	1.15	1.98	2.99	0.23	0.00	0.15	1.50	8.02	0.49	0.38	0.08	0.05	0.57
3	150	10.28	22.23	39.42	3.19	0.03	2.36	23.25	100.75	1.16	1.99	2.99	0.26	0.00	0.15	1.47	8.02	0.48	0.38	0.09	0.05	0.56
4	225	10.09	22.23	39.65	3.02	0.00	2.26	23.67	100.93	1.14	1.98	3.00	0.25	0.00	0.14	1.50	8.01	0.50	0.38	0.08	0.05	0.57
5	300	10.42	22.47	39.23	2.71	0.00	2.19	23.33	100.34	1.18	2.01	2.98	0.22	0.00	0.14	1.48	8.01	0.49	0.39	0.07	0.05	0.56
6	375	10.66	22.32	39.29	2.23	0.08	2.39	23.24	100.21	1.21	2.00	2.99	0.18	0.00	0.15	1.48	8.02	0.49	0.40	0.06	0.05	0.55
7	450	11.01	22.34	39.93	2.08	0.00	2.46	23.65	101.47	1.23	1.97	2.99	0.17	0.00	0.16	1.48	8.00	0.49	0.41	0.05	0.05	0.55
8	525	10.81	22.47	39.49	2.17	0.00	2.43	23.36	100.74	1.22	2.00	2.99	0.18	0.00	0.16	1.48	8.01	0.49	0.40	0.06	0.05	0.55
9	600	11.04	22.59	39.93	2.04	0.13	2.34	23.73	101.80	1.23	1.99	2.98	0.16	0.01	0.15	1.48	8.00	0.49	0.41	0.05	0.05	0.55
11	750	10.46	22.53	40.53	2.22	0.00	2.13	23.89	101.76	1.16	1.98	3.03	0.18	0.00	0.13	1.49	7.98	0.50	0.39	0.06	0.05	0.56
12	825	10.58	22.53	40.00	2.09	0.01	2.26	23.31	100.78	1.19	2.00	3.01	0.17	0.00	0.14	1.47	7.99	0.49	0.40	0.06	0.05	0.55
13	900	10.76	22.58	39.81	2.04	0.07	2.31	23.69	101.25	1.20	2.00	2.99	0.16	0.00	0.15	1.49	7.99	0.50	0.40	0.05	0.05	0.55
14	975	10.83	22.42	39.82	2.04	0.07	2.20	23.42	100.79	1.22	1.99	3.00	0.16	0.00	0.14	1.48	8.00	0.49	0.41	0.05	0.05	0.55
15	1050	11.03	22.41	39.98	2.20	0.00	2.23	23.54	101.39	1.23	1.98	3.00	0.18	0.00	0.14	1.48	8.01	0.49	0.41	0.06	0.05	0.54
16	1125	10.97	22.23	39.76	2.33	0.00	2.32	23.13	100.75	1.23	1.98	3.00	0.19	0.00	0.15	1.46	8.01	0.48	0.41	0.06	0.05	0.54
17	1200	11.01	22.61	39.88	2.25	0.00	2.34	23.56	101.64	1.23	2.00	2.99	0.18	0.00	0.15	1.48	8.02	0.49	0.41	0.06	0.05	0.55
18	1275	10.94	22.13	40.11	2.33	0.07	2.36	23.25	101.19	1.23	1.96	3.02	0.19	0.00	0.15	1.46	8.01	0.48	0.41	0.06	0.05	0.54
19	1350	10.95	22.32	39.77	2.55	0.00	2.27	23.42	101.27	1.23	1.98	2.99	0.21	0.00	0.14	1.47	8.02	0.48	0.40	0.07	0.05	0.55
20	1425	10.74	22.51	39.14	2.74	0.03	2.40	22.99	100.54	1.21	2.01	2.97	0.22	0.00	0.15	1.46	8.03	0.48	0.40	0.07	0.05	0.55
21	1500	10.93	22.41	39.53	2.72	0.00	2.39	23.08	101.06	1.23	1.99	2.98	0.22	0.00	0.15	1.45	8.03	0.48	0.40	0.07	0.05	0.54
22	1575	10.69	22.22	39.12	2.44	0.07	2.14	22.86	99.53	1.22	2.00	2.99	0.20	0.00	0.14	1.46	8.01	0.48	0.40	0.07	0.05	0.55
23	1650	11.00	22.29	39.66	2.18	0.00	2.23	23.55	100.91	1.24	1.98	2.99	0.18	0.00	0.14	1.49	8.02	0.49	0.41	0.06	0.05	0.55
24	1725	11.05	22.38	39.76	2.01	0.04	2.52	23.95	101.72	1.24	1.98	2.98	0.16	0.00	0.16	1.50	8.03	0.49	0.40	0.05	0.05	0.55

Table 1.31: Composition of garnet A1 from sample HJ-57a$_1$ (group 3) as analysed along traverse A-B (Plate 6.5a). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	3.24	22.44	38.81	1.68	0.23	1.40	36.40	104.22	0.37	2.03	2.98	0.14	0.01	0.09	2.34	7.97	0.80	0.13	0.05	0.03	0.86
2	33	2.67	22.02	38.74	1.64	0.14	1.46	37.72	104.39	0.31	2.01	2.99	0.14	0.01	0.10	2.44	7.98	0.82	0.10	0.05	0.03	0.89
3	66	3.34	22.63	38.99	1.83	0.13	1.29	36.47	104.68	0.38	2.04	2.98	0.15	0.01	0.08	2.33	7.98	0.79	0.13	0.05	0.03	0.86
4	99	3.49	22.37	39.12	1.88	0.18	1.42	36.60	105.06	0.40	2.01	2.98	0.15	0.01	0.09	2.34	7.98	0.78	0.13	0.05	0.03	0.85
5	132	3.54	22.40	39.14	1.90	0.34	1.56	36.14	105.01	0.40	2.01	2.98	0.16	0.02	0.10	2.30	7.98	0.78	0.14	0.05	0.03	0.85
12	363	2.26	21.69	38.30	1.99	0.31	1.43	37.09	103.06	0.26	2.00	3.00	0.17	0.02	0.09	2.43	7.97	0.82	0.09	0.06	0.03	0.90
13	396	2.71	22.20	38.66	1.99	0.20	1.48	36.46	103.70	0.31	2.03	2.99	0.17	0.01	0.10	2.36	7.97	0.80	0.11	0.06	0.03	0.88
14	429	2.39	22.05	38.61	2.03	0.22	1.37	37.27	103.93	0.28	2.01	2.99	0.17	0.01	0.09	2.42	7.97	0.82	0.09	0.06	0.03	0.90
15	462	3.33	22.02	39.04	2.17	0.14	1.36	35.39	103.44	0.38	2.00	3.01	0.18	0.01	0.09	2.28	7.96	0.78	0.13	0.06	0.03	0.86
16	495	3.79	22.41	39.21	2.08	0.22	1.40	35.55	104.66	0.43	2.01	2.99	0.17	0.01	0.09	2.27	7.97	0.77	0.15	0.06	0.03	0.84
17	528	3.85	22.45	39.21	2.04	0.42	1.40	35.32	104.68	0.44	2.01	2.99	0.17	0.02	0.09	2.25	7.97	0.76	0.15	0.06	0.03	0.84
18	561	3.98	22.50	39.19	2.03	0.32	1.49	35.57	105.08	0.45	2.01	2.98	0.17	0.02	0.10	2.26	7.98	0.76	0.15	0.06	0.03	0.83
19	594	4.20	22.56	39.42	1.81	0.23	1.34	34.83	104.39	0.48	2.02	3.00	0.15	0.01	0.09	2.22	7.96	0.76	0.16	0.05	0.03	0.82
20	627	4.22	22.63	39.42	1.86	0.18	1.31	35.99	105.62	0.48	2.02	2.98	0.15	0.01	0.08	2.27	7.99	0.76	0.16	0.05	0.03	0.83
21	660	4.34	22.79	40.27	1.72	0.16	1.24	35.37	105.89	0.49	2.01	3.02	0.14	0.01	0.08	2.22	7.96	0.76	0.17	0.05	0.03	0.82
22	693	3.98	22.33	38.77	1.77	0.24	1.17	34.70	102.95	0.46	2.03	2.99	0.15	0.01	0.08	2.24	7.96	0.77	0.16	0.05	0.03	0.83
23	726	4.15	22.37	39.55	1.74	0.12	1.31	34.94	104.18	0.47	2.01	3.01	0.14	0.01	0.08	2.23	7.96	0.76	0.16	0.05	0.03	0.83
25	792	4.22	22.73	39.50	2.07	0.16	1.37	35.10	105.15	0.48	2.03	2.99	0.17	0.01	0.09	2.22	7.97	0.75	0.16	0.06	0.03	0.82
26	825	4.12	22.44	39.01	2.00	0.19	1.33	35.17	104.26	0.47	2.02	2.98	0.16	0.01	0.09	2.25	7.98	0.76	0.16	0.06	0.03	0.83
27	858	4.11	22.37	39.23	2.11	0.22	1.34	34.87	104.26	0.47	2.01	2.99	0.17	0.01	0.09	2.23	7.97	0.75	0.16	0.06	0.03	0.83
28	891	4.19	22.59	39.20	2.30	0.20	1.41	35.10	104.99	0.47	2.02	2.97	0.19	0.01	0.09	2.23	7.98	0.75	0.16	0.06	0.03	0.82
29	924	4.20	22.30	39.12	2.18	0.18	1.35	34.78	104.09	0.48	2.01	2.99	0.18	0.01	0.09	2.22	7.98	0.75	0.16	0.06	0.03	0.82
30	957	4.03	22.24	39.30	2.11	0.18	1.16	35.00	104.02	0.46	2.01	3.01	0.17	0.01	0.08	2.24	7.97	0.76	0.16	0.06	0.03	0.83
31	990	4.22	22.45	39.21	2.19	0.23	1.37	34.69	104.36	0.48	2.02	2.99	0.18	0.01	0.09	2.21	7.98	0.75	0.16	0.06	0.03	0.82
32	1023	4.02	22.19	39.01	1.95	0.17	1.21	34.35	102.90	0.46	2.02	3.01	0.16	0.01	0.08	2.22	7.96	0.76	0.16	0.06	0.03	0.83

33	1056	4.02	22.31	38.96	1.94	0.29	1.25	34.86	103.63	0.46	2.02	2.99	0.16	0.02	0.08	2.24	7.97	0.76	0.16	0.05	0.03	0.83
34	1089	4.02	22.50	38.97	1.91	0.18	1.30	35.18	104.05	0.46	2.03	2.98	0.16	0.01	0.08	2.25	7.98	0.76	0.16	0.05	0.03	0.83
35	1122	4.28	22.46	39.47	1.95	0.28	1.27	35.26	104.97	0.48	2.01	2.99	0.16	0.02	0.08	2.24	7.98	0.76	0.16	0.05	0.03	0.82
36	1155	4.00	22.22	39.00	1.95	0.17	1.21	34.85	103.40	0.46	2.02	3.00	0.16	0.01	0.08	2.24	7.97	0.76	0.16	0.05	0.03	0.83
37	1188	3.95	22.00	39.00	1.84	0.12	1.35	35.11	103.38	0.45	2.00	3.01	0.15	0.01	0.09	2.26	7.97	0.77	0.15	0.05	0.03	0.83
38	1221	4.04	22.59	39.15	1.82	0.21	1.35	35.66	104.81	0.46	2.03	2.98	0.15	0.01	0.09	2.27	7.98	0.77	0.15	0.05	0.03	0.83
39	1254	3.72	22.08	38.83	1.67	0.07	1.34	34.95	102.65	0.43	2.02	3.01	0.14	0.00	0.09	2.27	7.96	0.78	0.15	0.05	0.03	0.84
40	1287	3.82	22.58	39.13	1.77	0.20	1.41	35.40	104.33	0.43	2.03	2.99	0.15	0.01	0.09	2.26	7.97	0.77	0.15	0.05	0.03	0.84
41	1320	3.97	22.44	39.18	1.66	0.11	1.43	35.04	103.84	0.45	2.03	3.00	0.14	0.01	0.09	2.25	7.96	0.77	0.15	0.05	0.03	0.83
42	1353	4.00	22.95	39.33	1.95	0.29	1.45	35.82	105.77	0.45	2.04	2.97	0.16	0.02	0.09	2.26	7.98	0.76	0.15	0.05	0.03	0.83
43	1386	3.72	22.22	39.23	1.61	0.13	1.47	35.55	103.91	0.43	2.01	3.01	0.13	0.01	0.10	2.28	7.96	0.78	0.14	0.05	0.03	0.84
44	1419	4.07	22.61	39.30	1.81	0.20	1.37	35.68	105.04	0.46	2.02	2.98	0.15	0.01	0.09	2.26	7.98	0.77	0.16	0.05	0.03	0.83
45	1452	3.81	22.49	39.32	1.67	0.06	1.28	35.66	104.29	0.43	2.03	3.00	0.14	0.00	0.08	2.28	7.97	0.78	0.15	0.05	0.03	0.84
46	1485	3.63	22.08	38.84	1.66	0.12	1.20	35.54	103.08	0.42	2.02	3.01	0.14	0.01	0.08	2.30	7.97	0.78	0.14	0.05	0.03	0.85
47	1518	3.95	22.44	39.04	1.88	0.15	1.38	35.21	104.05	0.45	2.03	2.99	0.15	0.01	0.09	2.25	7.97	0.76	0.15	0.05	0.03	0.83
48	1551	3.90	22.45	39.14	1.94	0.22	1.36	35.38	104.39	0.44	2.02	2.99	0.16	0.01	0.09	2.26	7.97	0.77	0.15	0.05	0.03	0.84
50	1617	3.92	22.24	39.14	1.88	0.23	1.28	35.12	103.81	0.45	2.01	3.00	0.15	0.01	0.08	2.25	7.96	0.77	0.15	0.05	0.03	0.83
51	1650	4.08	22.25	38.94	1.96	0.26	1.41	35.55	104.44	0.46	2.00	2.98	0.16	0.02	0.09	2.27	7.99	0.76	0.16	0.05	0.03	0.83
52	1683	4.01	22.30	38.92	2.01	0.25	1.38	34.73	103.59	0.46	2.02	2.99	0.17	0.01	0.09	2.23	7.97	0.76	0.16	0.06	0.03	0.83
53	1716	3.96	22.15	39.49	1.85	0.21	1.48	35.10	104.24	0.45	1.99	3.02	0.15	0.01	0.10	2.24	7.96	0.76	0.15	0.05	0.03	0.83
54	1749	4.26	22.40	39.41	1.99	0.25	1.33	35.07	104.70	0.48	2.01	3.00	0.16	0.01	0.09	2.23	7.97	0.75	0.16	0.05	0.03	0.82
55	1782	3.97	22.20	38.90	2.05	0.23	1.43	34.64	103.41	0.46	2.01	3.00	0.17	0.01	0.09	2.23	7.97	0.76	0.15	0.06	0.03	0.83
56	1815	4.06	22.38	39.55	1.94	0.22	1.32	35.18	104.65	0.46	2.01	3.01	0.16	0.01	0.08	2.24	7.97	0.76	0.16	0.05	0.03	0.83
57	1848	4.04	22.46	39.21	2.13	0.20	1.41	34.95	104.40	0.46	2.02	2.99	0.17	0.01	0.09	2.23	7.97	0.75	0.16	0.06	0.03	0.83
59	1914	4.27	22.47	39.31	1.96	0.38	1.31	35.11	104.83	0.48	2.01	2.98	0.16	0.02	0.08	2.23	7.97	0.75	0.16	0.05	0.03	0.82
60	1947	4.04	21.79	38.40	1.90	0.18	1.25	34.91	102.46	0.47	2.00	2.99	0.16	0.01	0.08	2.27	7.98	0.76	0.16	0.05	0.03	0.83
61	1980	4.01	22.29	39.15	1.91	0.26	1.36	35.39	104.37	0.46	2.01	2.99	0.16	0.01	0.09	2.26	7.98	0.76	0.15	0.05	0.03	0.83
64	2079	3.52	22.00	38.60	1.74	0.17	1.42	35.64	103.11	0.41	2.01	3.00	0.14	0.01	0.09	2.31	7.97	0.78	0.14	0.05	0.03	0.85
65	2112	2.97	21.99	38.42	1.63	0.12	1.35	35.86	102.35	0.35	2.03	3.01	0.14	0.01	0.09	2.35	7.96	0.80	0.12	0.05	0.03	0.87

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.32: Composition of garnet A1 from sample HJ-57a$_1$ (group 3) as analysed along traverse C-D (Plate 6.5a). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	4.24	22.71	39.66	1.82	0.27	1.45	35.10	105.24	0.48	2.02	2.99	0.15	0.02	0.09	2.22	7.96	0.76	0.16	0.05	0.03	0.82
2	30	4.28	22.50	39.55	1.70	0.13	1.31	35.00	104.46	0.48	2.02	3.01	0.14	0.01	0.08	2.23	7.96	0.76	0.17	0.05	0.03	0.82
4	90	4.04	22.31	38.92	1.72	0.15	1.37	34.86	103.38	0.46	2.02	3.00	0.14	0.01	0.09	2.24	7.97	0.76	0.16	0.05	0.03	0.83
5	120	4.15	22.75	39.27	1.86	0.19	1.26	35.01	104.48	0.47	2.04	2.99	0.15	0.01	0.08	2.23	7.97	0.76	0.16	0.05	0.03	0.83
6	150	4.07	22.41	39.45	1.90	0.11	1.33	34.87	104.14	0.46	2.02	3.01	0.16	0.01	0.09	2.23	7.96	0.76	0.16	0.05	0.03	0.83
7	180	4.28	22.48	38.76	2.06	0.20	1.45	34.20	103.43	0.49	2.04	2.98	0.17	0.01	0.09	2.20	7.98	0.74	0.17	0.06	0.03	0.82
10	270	4.04	21.99	38.41	2.30	0.28	1.34	33.99	102.36	0.47	2.02	2.99	0.19	0.02	0.09	2.21	7.98	0.75	0.16	0.06	0.03	0.83
11	300	3.83	21.66	37.86	2.27	0.17	1.29	33.22	100.30	0.45	2.02	3.00	0.19	0.01	0.09	2.20	7.97	0.75	0.15	0.07	0.03	0.83
12	330	3.78	22.27	38.99	2.40	0.13	1.26	34.86	103.69	0.43	2.02	3.00	0.20	0.01	0.08	2.24	7.97	0.76	0.15	0.07	0.03	0.84
13	360	4.09	22.29	38.62	2.49	0.17	1.42	34.73	103.80	0.47	2.02	2.97	0.20	0.01	0.09	2.23	7.99	0.74	0.16	0.07	0.03	0.83
14	390	3.69	21.92	38.47	2.26	0.21	1.28	34.36	102.19	0.43	2.02	3.00	0.19	0.01	0.08	2.24	7.97	0.76	0.15	0.06	0.03	0.84
15	420	4.01	22.46	39.28	2.38	0.22	1.40	34.95	104.70	0.45	2.01	2.99	0.19	0.01	0.09	2.22	7.98	0.75	0.15	0.07	0.03	0.83
16	450	3.74	21.80	38.14	2.29	0.18	1.15	33.75	101.05	0.44	2.02	3.00	0.19	0.01	0.08	2.22	7.96	0.76	0.15	0.07	0.03	0.84
17	480	3.93	22.14	38.90	2.22	0.17	1.41	34.68	103.45	0.45	2.01	3.00	0.18	0.01	0.09	2.23	7.97	0.75	0.15	0.06	0.03	0.83
18	510	4.12	22.60	39.12	2.29	0.27	1.39	35.01	104.81	0.47	2.02	2.97	0.19	0.02	0.09	2.23	7.98	0.75	0.16	0.06	0.03	0.83
19	540	4.15	22.30	39.12	2.14	0.21	1.45	35.05	104.43	0.47	2.01	2.99	0.17	0.01	0.09	2.24	7.98	0.75	0.16	0.06	0.03	0.83
20	570	4.04	22.18	39.30	1.96	0.22	1.39	35.17	104.26	0.46	2.00	3.00	0.16	0.01	0.09	2.25	7.97	0.76	0.16	0.05	0.03	0.83
21	600	3.79	21.49	37.51	1.84	0.19	1.24	33.67	99.73	0.45	2.02	2.99	0.16	0.01	0.08	2.25	7.97	0.76	0.15	0.05	0.03	0.83
23	660	4.13	22.30	39.58	1.74	0.20	1.35	35.51	104.82	0.47	2.00	3.01	0.14	0.01	0.09	2.26	7.97	0.76	0.16	0.05	0.03	0.83
25	720	4.07	22.47	39.30	1.79	0.20	1.31	35.57	104.72	0.46	2.02	2.99	0.15	0.01	0.08	2.26	7.98	0.77	0.16	0.05	0.03	0.83
26	750	4.27	22.51	39.40	1.93	0.35	1.42	35.82	105.72	0.48	2.00	2.97	0.16	0.02	0.09	2.26	7.99	0.76	0.16	0.05	0.03	0.82
27	780	4.07	22.69	39.05	1.74	0.25	1.28	35.32	104.40	0.46	2.04	2.98	0.14	0.01	0.08	2.25	7.97	0.77	0.16	0.05	0.03	0.83
29	840	4.22	22.53	39.73	1.82	0.19	1.31	35.21	105.02	0.48	2.01	3.01	0.15	0.01	0.08	2.23	7.96	0.76	0.16	0.05	0.03	0.82
30	870	4.14	22.11	39.20	1.80	0.17	1.31	35.23	103.97	0.47	2.00	3.01	0.15	0.01	0.09	2.26	7.98	0.76	0.16	0.05	0.03	0.83
31	900	4.35	22.44	39.03	2.05	0.31	1.45	34.91	104.55	0.49	2.01	2.97	0.17	0.02	0.09	2.22	7.98	0.75	0.17	0.06	0.03	0.82
32	930	4.19	22.09	38.37	2.07	0.39	1.39	34.43	102.92	0.48	2.01	2.97	0.17	0.02	0.09	2.23	7.98	0.75	0.16	0.06	0.03	0.82

33	960	3.98	21.85	38.48	2.07	0.15	1.28	33.84	101.67	0.46	2.01	3.01	0.17	0.01	0.08	2.21	7.96	0.75	0.16	0.06	0.03	0.83
34	990	3.96	21.85	38.55	2.20	0.22	1.17	33.96	101.90	0.46	2.01	3.01	0.18	0.01	0.08	2.21	7.96	0.75	0.16	0.06	0.03	0.83
35	1020	3.92	21.67	38.13	2.20	0.21	1.37	33.53	101.03	0.46	2.01	3.00	0.19	0.01	0.09	2.21	7.97	0.75	0.16	0.06	0.03	0.83
36	1050	4.32	22.07	38.71	2.36	0.39	1.52	34.43	103.79	0.49	2.00	2.97	0.19	0.02	0.10	2.21	7.99	0.74	0.16	0.06	0.03	0.82
37	1080	4.06	22.31	38.93	2.20	0.25	1.46	34.73	103.94	0.46	2.02	2.98	0.18	0.01	0.09	2.23	7.98	0.75	0.16	0.06	0.03	0.83
38	1110	3.96	21.89	38.54	2.18	0.06	1.34	33.85	101.82	0.46	2.01	3.01	0.18	0.00	0.09	2.21	7.97	0.75	0.16	0.06	0.03	0.83
39	1140	4.07	22.34	38.82	2.15	0.24	1.26	34.39	103.26	0.47	2.03	2.99	0.18	0.01	0.08	2.21	7.97	0.75	0.16	0.06	0.03	0.83
40	1170	4.13	21.97	38.46	2.08	0.17	1.38	34.01	102.19	0.48	2.02	2.99	0.17	0.01	0.09	2.21	7.98	0.75	0.16	0.06	0.03	0.82
41	1200	4.14	22.25	38.83	2.09	0.18	1.24	34.44	103.17	0.48	2.02	2.99	0.17	0.01	0.08	2.22	7.97	0.75	0.16	0.06	0.03	0.82
43	1260	4.16	21.93	38.85	1.96	0.30	1.43	34.35	102.98	0.48	2.00	3.00	0.16	0.02	0.09	2.22	7.97	0.75	0.16	0.05	0.03	0.82
44	1290	4.20	22.33	39.29	2.01	0.28	1.29	34.48	103.89	0.48	2.01	3.00	0.16	0.02	0.08	2.20	7.96	0.75	0.16	0.06	0.03	0.82
45	1320	4.17	22.05	38.49	1.92	0.19	1.23	34.18	102.23	0.48	2.02	2.99	0.16	0.01	0.08	2.22	7.97	0.75	0.16	0.05	0.03	0.82
46	1350	3.83	21.50	38.07	1.68	0.07	1.26	33.48	99.88	0.45	2.01	3.03	0.14	0.00	0.08	2.23	7.95	0.77	0.16	0.05	0.03	0.83
47	1380	4.17	22.16	38.96	1.80	0.20	1.31	34.92	103.52	0.48	2.01	3.00	0.15	0.01	0.09	2.25	7.97	0.76	0.16	0.05	0.03	0.82
48	1410	4.50	22.28	39.23	1.76	0.25	1.29	34.80	104.12	0.51	2.00	2.99	0.14	0.01	0.08	2.22	7.97	0.75	0.17	0.05	0.03	0.81
49	1440	4.22	22.46	39.33	1.66	0.13	1.33	35.26	104.39	0.48	2.02	3.00	0.14	0.01	0.09	2.25	7.97	0.76	0.16	0.05	0.03	0.82
50	1470	4.70	22.86	39.15	1.89	0.40	1.55	34.62	105.17	0.53	2.03	2.95	0.15	0.02	0.10	2.18	7.97	0.74	0.18	0.05	0.03	0.81

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.33: Composition of garnet A2 from sample HJ-57a_1 (group 3) as analysed along traverse A-B (Plate 6.5b). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
6	155	3.33	21.77	37.74	1.27	0.08	0.97	34.57	99.74	0.40	2.05	3.01	0.11	0.00	0.07	2.31	7.95	0.80	0.14	0.04	0.02	0.85
12	341	3.59	22.37	38.60	1.62	0.06	1.06	34.38	101.68	0.42	2.06	3.01	0.14	0.00	0.07	2.25	7.95	0.78	0.15	0.05	0.02	0.84
13	372	3.85	22.55	39.36	1.60	0.07	1.14	35.09	103.65	0.44	2.04	3.02	0.13	0.00	0.07	2.25	7.95	0.78	0.15	0.05	0.03	0.84
15	434	3.82	22.07	38.10	1.50	0.08	0.84	34.62	101.03	0.45	2.05	3.00	0.13	0.00	0.06	2.28	7.96	0.78	0.15	0.04	0.02	0.84
16	465	3.68	21.65	38.35	1.43	0.08	1.12	34.21	100.52	0.43	2.02	3.03	0.12	0.00	0.08	2.26	7.95	0.78	0.15	0.04	0.03	0.84
23	682	3.66	22.33	38.48	1.44	0.00	1.05	34.37	101.33	0.43	2.06	3.02	0.12	0.00	0.07	2.25	7.95	0.78	0.15	0.04	0.02	0.84
25	744	3.52	22.27	38.59	1.57	0.08	1.09	34.50	101.61	0.41	2.05	3.02	0.13	0.00	0.07	2.26	7.95	0.79	0.14	0.05	0.03	0.85
28	837	3.68	22.11	38.54	1.61	0.00	1.02	34.20	101.16	0.43	2.04	3.02	0.14	0.00	0.07	2.24	7.95	0.78	0.15	0.05	0.02	0.84
29	868	3.95	21.74	38.56	1.59	0.13	1.01	34.52	101.50	0.46	2.01	3.02	0.13	0.01	0.07	2.26	7.96	0.77	0.16	0.05	0.02	0.83
30	899	3.93	21.92	38.36	1.48	0.13	1.10	33.84	100.77	0.46	2.03	3.02	0.13	0.01	0.07	2.23	7.95	0.77	0.16	0.04	0.03	0.83
35	1054	4.02	22.18	38.61	1.52	0.12	1.11	34.01	101.58	0.47	2.04	3.01	0.13	0.01	0.07	2.22	7.95	0.77	0.16	0.04	0.03	0.83
42	1271	4.60	22.60	39.02	1.76	0.19	1.07	34.13	103.37	0.52	2.04	2.99	0.14	0.01	0.07	2.18	7.95	0.75	0.18	0.05	0.02	0.81
46	1395	4.20	22.72	38.58	1.51	0.08	0.93	33.99	102.01	0.49	2.08	2.99	0.13	0.00	0.06	2.21	7.96	0.77	0.17	0.04	0.02	0.82
58	1767	3.30	22.02	37.75	1.77	0.15	1.18	35.00	101.17	0.39	2.05	2.98	0.15	0.01	0.08	2.31	7.97	0.79	0.13	0.05	0.03	0.86
64	1953	3.52	21.91	38.38	1.79	0.08	1.02	34.23	100.94	0.41	2.03	3.02	0.15	0.00	0.07	2.25	7.95	0.78	0.14	0.05	0.02	0.84
69	2108	3.67	22.22	38.85	1.68	0.12	1.09	34.67	102.31	0.43	2.04	3.02	0.14	0.01	0.07	2.25	7.95	0.78	0.15	0.05	0.02	0.84
70	2139	3.56	22.06	38.71	1.58	0.08	1.14	34.87	102.01	0.41	2.03	3.02	0.13	0.00	0.08	2.28	7.95	0.79	0.14	0.05	0.03	0.85
72	2201	3.45	22.51	39.30	1.55	0.14	1.33	35.51	103.78	0.39	2.04	3.02	0.13	0.01	0.09	2.28	7.95	0.79	0.14	0.04	0.03	0.85
75	2294	3.90	22.27	39.05	1.60	0.07	0.88	34.49	102.26	0.45	2.04	3.03	0.13	0.00	0.06	2.24	7.95	0.78	0.16	0.05	0.02	0.83
76	2325	3.68	22.39	38.95	1.36	0.09	1.10	34.86	102.43	0.43	2.05	3.02	0.11	0.01	0.07	2.26	7.95	0.79	0.15	0.04	0.03	0.84

Table 1.34: Composition of garnet A4 from sample HJ-57a_1 (group 3) as analysed along traverse A-B (Plate 6.5d). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	4.15	22.13	38.90	1.79	0.11	1.54	33.82	102.43	0.48	2.02	3.01	0.15	0.01	0.10	2.19	7.96	0.75	0.16	0.05	0.03	0.82
2	30	4.16	22.39	39.40	1.82	0.19	1.61	34.72	104.29	0.47	2.01	3.00	0.15	0.01	0.10	2.21	7.97	0.75	0.16	0.05	0.04	0.82
3	60	4.19	22.31	38.55	1.79	0.25	1.58	33.99	102.65	0.48	2.03	2.98	0.15	0.01	0.10	2.20	7.97	0.75	0.16	0.05	0.04	0.82
4	90	4.05	22.06	38.85	1.75	0.24	1.60	34.74	103.30	0.47	2.01	3.00	0.14	0.01	0.10	2.24	7.97	0.76	0.16	0.05	0.04	0.83
5	120	4.51	22.50	39.74	1.80	0.15	1.56	35.11	105.38	0.51	2.00	3.00	0.15	0.01	0.10	2.22	7.98	0.75	0.17	0.05	0.03	0.81
6	150	4.36	22.17	38.99	1.81	0.15	1.42	34.76	103.65	0.50	2.01	2.99	0.15	0.01	0.09	2.23	7.98	0.75	0.17	0.05	0.03	0.82
7	180	4.33	22.04	39.27	1.74	0.12	1.51	34.07	103.08	0.50	2.00	3.02	0.14	0.01	0.10	2.19	7.96	0.75	0.17	0.05	0.03	0.82
9	240	4.76	22.51	38.88	1.92	0.33	1.77	33.88	104.04	0.54	2.02	2.97	0.16	0.02	0.11	2.16	7.98	0.73	0.18	0.05	0.04	0.80
10	270	4.44	22.19	39.13	1.72	0.14	1.51	33.83	102.97	0.51	2.01	3.01	0.14	0.01	0.10	2.18	7.96	0.74	0.17	0.05	0.03	0.81
11	300	4.58	22.45	39.45	1.78	0.18	1.52	34.46	104.42	0.52	2.01	3.00	0.14	0.01	0.10	2.19	7.97	0.74	0.18	0.05	0.03	0.81
12	330	4.70	22.36	39.22	1.77	0.26	1.45	33.97	103.73	0.54	2.01	3.00	0.14	0.02	0.09	2.17	7.97	0.74	0.18	0.05	0.03	0.80
13	360	4.83	22.75	39.25	1.82	0.28	1.40	34.18	104.51	0.55	2.03	2.98	0.15	0.02	0.09	2.17	7.98	0.73	0.19	0.05	0.03	0.80
14	390	4.48	22.47	39.19	1.69	0.20	1.54	33.86	103.42	0.51	2.03	3.00	0.14	0.01	0.10	2.17	7.96	0.74	0.18	0.05	0.03	0.81
15	420	5.24	23.04	40.16	1.79	0.29	1.46	33.90	105.87	0.58	2.02	2.99	0.14	0.02	0.09	2.11	7.96	0.72	0.20	0.05	0.03	0.78
16	450	4.77	22.48	39.34	1.85	0.37	1.49	34.31	104.61	0.54	2.01	2.98	0.15	0.02	0.10	2.18	7.98	0.73	0.18	0.05	0.03	0.80
17	480	4.67	22.37	39.07	1.81	0.19	1.42	34.00	103.52	0.53	2.02	2.99	0.15	0.01	0.09	2.18	7.97	0.74	0.18	0.05	0.03	0.80
18	510	4.93	22.68	39.40	1.83	0.35	1.58	34.35	105.13	0.55	2.02	2.97	0.15	0.02	0.10	2.17	7.98	0.73	0.19	0.05	0.03	0.80
19	540	4.83	22.40	38.82	1.83	0.12	1.47	33.99	103.47	0.55	2.03	2.98	0.15	0.01	0.10	2.18	7.99	0.73	0.19	0.05	0.03	0.80
20	570	4.75	22.48	39.25	1.75	0.19	1.39	34.28	104.09	0.54	2.02	2.99	0.14	0.01	0.09	2.18	7.98	0.74	0.18	0.05	0.03	0.80
21	600	4.60	22.28	39.26	1.75	0.16	1.39	34.04	103.47	0.52	2.01	3.01	0.14	0.01	0.09	2.18	7.97	0.74	0.18	0.05	0.03	0.81
22	630	4.80	22.53	39.19	1.78	0.14	1.49	33.77	103.69	0.55	2.03	2.99	0.15	0.01	0.10	2.16	7.97	0.73	0.19	0.05	0.03	0.80
23	660	4.74	22.83	39.52	1.84	0.17	1.61	34.54	105.24	0.53	2.03	2.98	0.15	0.01	0.10	2.18	7.98	0.74	0.18	0.05	0.03	0.80
24	690	4.73	22.43	39.52	1.74	0.24	1.54	34.45	104.64	0.53	2.00	3.00	0.14	0.01	0.10	2.18	7.97	0.74	0.18	0.05	0.03	0.80
25	720	4.89	22.53	39.60	1.75	0.21	1.48	34.05	104.51	0.55	2.01	3.00	0.14	0.01	0.10	2.16	7.97	0.73	0.19	0.05	0.03	0.80
26	750	4.63	22.28	39.16	1.62	0.17	1.52	33.56	102.94	0.53	2.02	3.01	0.13	0.01	0.10	2.16	7.96	0.74	0.18	0.05	0.03	0.80
27	780	4.61	22.39	39.00	1.57	0.16	1.48	33.96	103.18	0.53	2.03	3.00	0.13	0.01	0.10	2.18	7.97	0.74	0.18	0.04	0.03	0.81

28	810	4.78	22.49	39.18	1.74	0.16	1.35	33.81	103.50	0.55	2.03	3.00	0.14	0.01	0.09	2.16	7.97	0.74	0.19	0.05	0.03	0.80
29	840	4.82	22.52	39.36	1.67	0.24	1.46	33.80	103.86	0.55	2.02	3.00	0.14	0.01	0.09	2.15	7.96	0.73	0.19	0.05	0.03	0.80
30	870	4.92	22.60	39.17	1.83	0.25	1.66	33.97	104.40	0.56	2.02	2.97	0.15	0.01	0.11	2.16	7.98	0.73	0.19	0.05	0.04	0.79
31	900	4.90	22.28	39.30	1.71	0.21	1.59	34.10	104.09	0.56	2.00	2.99	0.14	0.01	0.10	2.17	7.98	0.73	0.19	0.05	0.03	0.80
32	930	4.71	22.57	39.16	1.71	0.12	1.26	34.06	103.59	0.54	2.03	2.99	0.14	0.01	0.08	2.18	7.97	0.74	0.18	0.05	0.03	0.80
33	960	5.06	22.87	39.96	1.67	0.20	1.36	33.53	104.64	0.57	2.03	3.01	0.13	0.01	0.09	2.11	7.95	0.73	0.20	0.05	0.03	0.79
34	990	4.62	22.24	38.99	1.66	0.21	1.49	34.35	103.54	0.53	2.01	2.99	0.14	0.01	0.10	2.20	7.98	0.74	0.18	0.05	0.03	0.81
35	1020	4.73	22.52	39.27	1.79	0.25	1.51	34.03	104.11	0.54	2.02	2.99	0.15	0.01	0.10	2.17	7.97	0.74	0.18	0.05	0.03	0.80
36	1050	4.84	23.02	40.15	1.89	0.24	1.55	33.78	105.47	0.54	2.03	3.00	0.15	0.01	0.10	2.11	7.95	0.73	0.19	0.05	0.03	0.80
37	1080	4.57	22.05	38.56	1.68	0.18	1.34	33.16	101.54	0.53	2.02	3.00	0.14	0.01	0.09	2.16	7.96	0.74	0.18	0.05	0.03	0.80
38	1110	4.68	22.18	38.81	1.74	0.26	1.44	33.97	103.07	0.54	2.01	2.99	0.14	0.02	0.09	2.19	7.98	0.74	0.18	0.05	0.03	0.80
39	1140	4.52	22.30	39.14	1.66	0.09	1.37	33.54	102.63	0.52	2.03	3.02	0.14	0.01	0.09	2.16	7.95	0.74	0.18	0.05	0.03	0.81
40	1170	4.91	22.88	39.70	1.67	0.26	1.58	34.57	105.56	0.55	2.02	2.98	0.13	0.01	0.10	2.17	7.97	0.73	0.19	0.05	0.03	0.80
43	1260	4.72	22.07	39.17	1.79	0.23	1.49	33.63	103.10	0.54	2.00	3.01	0.15	0.01	0.10	2.16	7.97	0.73	0.18	0.05	0.03	0.80
44	1290	4.68	22.33	38.92	1.81	0.25	1.57	34.27	103.84	0.53	2.01	2.98	0.15	0.01	0.10	2.19	7.99	0.74	0.18	0.05	0.03	0.80
45	1320	4.75	22.45	38.78	1.70	0.34	1.67	33.68	103.37	0.54	2.03	2.97	0.14	0.02	0.11	2.16	7.97	0.73	0.18	0.05	0.04	0.80
46	1350	4.96	22.73	39.43	1.86	0.24	1.66	34.55	105.43	0.56	2.02	2.97	0.15	0.01	0.11	2.18	7.99	0.73	0.19	0.05	0.04	0.80
47	1380	4.98	22.53	39.41	1.78	0.30	1.49	34.19	104.69	0.56	2.01	2.98	0.14	0.02	0.10	2.17	7.98	0.73	0.19	0.05	0.03	0.79
48	1410	4.85	22.35	38.93	1.81	0.28	1.54	33.69	103.44	0.55	2.02	2.98	0.15	0.02	0.10	2.16	7.98	0.73	0.19	0.05	0.03	0.80
49	1440	4.66	22.20	39.31	1.77	0.24	1.46	33.96	103.61	0.53	2.00	3.01	0.14	0.01	0.09	2.17	7.96	0.74	0.18	0.05	0.03	0.80
50	1470	4.80	22.54	39.45	1.79	0.22	1.47	33.31	103.59	0.55	2.02	3.01	0.15	0.01	0.09	2.12	7.95	0.73	0.19	0.05	0.03	0.80

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.35: Composition of garnet A4 from sample HJ-57a_1 (group 3) as analysed along traverse C-D (Plate 6.5d). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	4.58	22.52	39.26	1.91	0.28	1.44	33.77	103.75	0.52	2.03	3.00	0.16	0.02	0.09	2.15	7.96	0.74	0.18	0.05	0.03	0.81
2	33	4.72	22.21	39.18	1.79	0.08	1.32	33.47	102.78	0.54	2.01	3.01	0.15	0.00	0.09	2.15	7.96	0.74	0.18	0.05	0.03	0.80
3	66	4.63	22.63	39.51	1.84	0.14	1.38	34.11	104.23	0.52	2.03	3.00	0.15	0.01	0.09	2.17	7.96	0.74	0.18	0.05	0.03	0.81
4	99	4.64	22.21	38.95	1.68	0.15	1.52	33.87	103.02	0.53	2.01	3.00	0.14	0.01	0.10	2.18	7.97	0.74	0.18	0.05	0.03	0.80
5	132	4.82	22.53	39.40	1.83	0.24	1.46	34.37	104.66	0.54	2.01	2.99	0.15	0.01	0.09	2.18	7.98	0.73	0.18	0.05	0.03	0.80
6	165	4.90	22.95	39.70	1.84	0.31	1.54	34.37	105.62	0.55	2.03	2.98	0.15	0.02	0.10	2.16	7.97	0.73	0.19	0.05	0.03	0.80
7	198	4.95	22.76	39.61	1.69	0.09	1.41	33.06	103.57	0.56	2.04	3.01	0.14	0.01	0.09	2.10	7.95	0.73	0.19	0.05	0.03	0.79
8	231	4.50	22.25	39.02	1.63	0.17	1.36	33.82	102.74	0.52	2.02	3.01	0.13	0.01	0.09	2.18	7.96	0.75	0.18	0.05	0.03	0.81
9	264	4.75	22.41	39.39	1.67	0.16	1.40	34.21	104.00	0.54	2.01	3.00	0.14	0.01	0.09	2.18	7.97	0.74	0.18	0.05	0.03	0.80
10	297	4.87	22.48	39.53	1.78	0.22	1.46	34.22	104.56	0.55	2.01	3.00	0.14	0.01	0.09	2.17	7.97	0.73	0.19	0.05	0.03	0.80
13	396	4.85	22.31	39.13	1.70	0.19	1.46	34.19	103.84	0.55	2.01	2.99	0.14	0.01	0.09	2.18	7.98	0.74	0.19	0.05	0.03	0.80
14	429	4.93	22.35	39.13	1.74	0.21	1.46	34.55	104.36	0.56	2.01	2.98	0.14	0.01	0.09	2.20	7.99	0.73	0.19	0.05	0.03	0.80
15	462	4.69	22.47	39.25	1.73	0.21	1.47	34.07	103.90	0.53	2.02	2.99	0.14	0.01	0.09	2.17	7.97	0.74	0.18	0.05	0.03	0.80
18	561	5.06	22.74	39.33	1.84	0.30	1.46	34.29	105.01	0.57	2.02	2.97	0.15	0.02	0.09	2.16	7.98	0.73	0.19	0.05	0.03	0.79
19	594	4.79	22.46	39.52	1.73	0.17	1.43	34.07	104.16	0.54	2.01	3.00	0.14	0.01	0.09	2.17	7.97	0.74	0.18	0.05	0.03	0.80
20	627	4.71	22.52	39.45	1.75	0.24	1.56	34.31	104.54	0.53	2.01	2.99	0.14	0.01	0.10	2.18	7.97	0.74	0.18	0.05	0.03	0.80
21	660	4.59	22.44	39.28	1.68	0.15	1.39	34.26	103.79	0.52	2.02	3.00	0.14	0.01	0.09	2.19	7.97	0.74	0.18	0.05	0.03	0.81
22	693	4.83	22.62	39.57	1.84	0.20	1.43	34.10	104.60	0.55	2.02	3.00	0.15	0.01	0.09	2.16	7.97	0.73	0.19	0.05	0.03	0.80
23	726	4.92	22.80	39.24	1.77	0.22	1.37	34.30	104.61	0.56	2.04	2.97	0.14	0.01	0.09	2.17	7.98	0.73	0.19	0.05	0.03	0.80
24	759	4.80	22.46	39.53	1.76	0.23	1.48	34.88	105.13	0.54	2.00	2.99	0.14	0.01	0.09	2.21	7.99	0.74	0.18	0.05	0.03	0.80
25	792	4.83	22.80	38.82	1.88	0.32	1.49	34.29	104.42	0.55	2.04	2.95	0.15	0.02	0.10	2.18	7.99	0.73	0.18	0.05	0.03	0.80
26	825	4.60	22.31	39.02	1.63	0.18	1.41	33.97	103.12	0.53	2.02	3.00	0.13	0.01	0.09	2.18	7.97	0.74	0.18	0.05	0.03	0.81
27	858	4.79	22.42	39.39	1.78	0.22	1.49	34.66	104.74	0.54	2.00	2.99	0.14	0.01	0.10	2.20	7.98	0.74	0.18	0.05	0.03	0.80
28	891	4.77	22.55	39.42	1.75	0.16	1.43	33.80	103.87	0.54	2.02	3.00	0.14	0.01	0.09	2.15	7.96	0.73	0.18	0.05	0.03	0.80
29	924	4.77	22.49	39.30	1.78	0.16	1.47	34.15	104.10	0.54	2.02	2.99	0.15	0.01	0.09	2.17	7.97	0.74	0.18	0.05	0.03	0.80
30	957	4.59	22.39	39.12	1.77	0.12	1.41	33.50	102.89	0.53	2.03	3.01	0.15	0.01	0.09	2.15	7.96	0.74	0.18	0.05	0.03	0.80

32	1023	4.78	22.35	39.04	1.85	0.23	1.43	34.18	103.85	0.54	2.01	2.98	0.15	0.01	0.09	2.18	7.98	0.74	0.18	0.05	0.03	0.80
33	1056	4.85	22.71	39.78	1.79	0.08	1.33	32.87	103.41	0.55	2.04	3.03	0.15	0.00	0.09	2.09	7.94	0.73	0.19	0.05	0.03	0.79
34	1089	4.76	22.72	39.38	1.89	0.17	1.53	34.03	104.48	0.54	2.03	2.99	0.15	0.01	0.10	2.16	7.98	0.73	0.18	0.05	0.03	0.80
35	1122	4.71	22.40	38.36	1.95	0.18	1.63	34.21	103.44	0.54	2.03	2.95	0.16	0.01	0.11	2.20	8.00	0.73	0.18	0.05	0.04	0.80
36	1155	4.65	22.29	39.14	2.02	0.17	1.44	33.95	103.66	0.53	2.01	2.99	0.17	0.01	0.09	2.17	7.98	0.73	0.18	0.06	0.03	0.80
39	1254	4.59	22.48	39.13	1.81	0.22	1.46	33.29	103.00	0.53	2.03	3.00	0.15	0.01	0.10	2.14	7.96	0.74	0.18	0.05	0.03	0.80
40	1287	4.87	22.57	39.33	2.15	0.23	1.42	34.15	104.72	0.55	2.01	2.98	0.17	0.01	0.09	2.16	7.99	0.73	0.18	0.06	0.03	0.80
41	1320	4.49	22.13	39.16	2.21	0.18	1.39	33.70	103.26	0.51	2.00	3.01	0.18	0.01	0.09	2.16	7.97	0.73	0.17	0.06	0.03	0.81
42	1353	4.47	22.19	39.03	2.15	0.18	1.36	34.02	103.40	0.51	2.01	3.00	0.18	0.01	0.09	2.18	7.98	0.74	0.17	0.06	0.03	0.81
43	1386	4.62	22.41	39.42	2.32	0.27	1.39	34.15	104.58	0.52	2.00	2.99	0.19	0.02	0.09	2.17	7.98	0.73	0.18	0.06	0.03	0.81
44	1419	4.60	22.47	39.09	2.26	0.31	1.38	34.07	104.18	0.52	2.02	2.98	0.18	0.02	0.09	2.17	7.98	0.73	0.18	0.06	0.03	0.81
45	1452	4.53	22.51	39.19	2.36	0.15	1.45	33.70	103.88	0.52	2.02	2.99	0.19	0.01	0.09	2.15	7.97	0.73	0.17	0.07	0.03	0.81
46	1485	4.36	22.21	38.58	2.23	0.12	1.43	33.83	102.77	0.50	2.02	2.98	0.18	0.01	0.09	2.19	7.98	0.74	0.17	0.06	0.03	0.81
47	1518	4.79	22.50	39.47	2.45	0.42	1.58	33.97	105.18	0.54	2.00	2.98	0.20	0.02	0.10	2.14	7.98	0.72	0.18	0.07	0.03	0.80
48	1551	4.53	22.35	39.09	2.13	0.13	1.42	33.67	103.32	0.52	2.02	3.00	0.17	0.01	0.09	2.16	7.97	0.73	0.18	0.06	0.03	0.81
49	1584	4.66	22.66	39.42	2.19	0.32	1.67	34.02	104.94	0.53	2.02	2.98	0.18	0.02	0.11	2.15	7.98	0.73	0.18	0.06	0.04	0.80
50	1617	4.81	22.58	39.25	2.11	0.33	1.65	33.79	104.51	0.54	2.02	2.98	0.17	0.02	0.11	2.14	7.98	0.72	0.18	0.06	0.04	0.80
51	1650	4.89	22.44	39.32	2.01	0.32	1.44	34.18	104.60	0.55	2.01	2.98	0.16	0.02	0.09	2.17	7.98	0.73	0.19	0.05	0.03	0.80
52	1683	4.87	22.65	39.26	2.03	0.31	1.52	34.33	104.97	0.55	2.02	2.97	0.16	0.02	0.10	2.17	7.99	0.73	0.18	0.06	0.03	0.80
53	1716	4.74	22.32	39.17	1.83	0.18	1.43	34.53	104.19	0.54	2.01	2.99	0.15	0.01	0.09	2.20	7.99	0.74	0.18	0.05	0.03	0.80
54	1749	4.62	22.47	39.08	1.73	0.21	1.44	33.57	103.12	0.53	2.03	3.00	0.14	0.01	0.09	2.15	7.96	0.74	0.18	0.05	0.03	0.80
55	1782	4.77	22.45	39.46	1.75	0.23	1.45	34.33	104.44	0.54	2.01	2.99	0.14	0.01	0.09	2.18	7.97	0.74	0.18	0.05	0.03	0.80

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.36: Composition of garnet A5a from sample HJ-57a$_1$ (group 3) as analysed along traverse A-B (Plate 6.5e). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total*	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	3.47	22.11	38.86	1.82	0.20	1.50	35.01	102.97	0.40	2.02	3.01	0.15	0.01	0.10	2.27	7.96	0.78	0.14	0.05	0.03	0.85
2	33	4.49	22.50	39.25	1.88	0.38	1.69	34.48	104.67	0.51	2.01	2.98	0.15	0.02	0.11	2.19	7.98	0.74	0.17	0.05	0.04	0.81
3	66	4.37	22.38	39.37	1.75	0.18	1.44	34.25	103.75	0.50	2.02	3.01	0.14	0.01	0.09	2.19	7.96	0.75	0.17	0.05	0.03	0.81
4	99	4.54	22.57	39.28	1.70	0.16	1.57	34.02	103.83	0.52	2.03	3.00	0.14	0.01	0.10	2.17	7.96	0.74	0.18	0.05	0.03	0.81
5	132	4.62	22.77	39.32	1.90	0.30	1.56	35.17	105.64	0.52	2.02	2.96	0.15	0.02	0.10	2.22	7.99	0.74	0.17	0.05	0.03	0.81
6	165	4.50	22.26	39.37	1.78	0.16	1.52	34.76	104.36	0.51	2.00	3.00	0.15	0.01	0.10	2.21	7.98	0.75	0.17	0.05	0.03	0.81
7	198	4.27	22.19	39.27	1.76	0.09	1.45	34.32	103.34	0.49	2.01	3.02	0.15	0.00	0.09	2.21	7.96	0.75	0.17	0.05	0.03	0.82
8	231	4.61	22.22	39.19	1.78	0.29	1.61	34.87	104.56	0.52	1.99	2.98	0.15	0.02	0.10	2.22	7.99	0.74	0.17	0.05	0.03	0.81
9	264	4.34	22.38	38.99	1.84	0.15	1.58	34.45	103.74	0.50	2.02	2.99	0.15	0.01	0.10	2.21	7.98	0.75	0.17	0.05	0.03	0.82
10	297	4.54	22.59	39.37	1.89	0.20	1.58	34.72	104.90	0.51	2.02	2.98	0.15	0.01	0.10	2.20	7.98	0.74	0.17	0.05	0.03	0.81
11	330	4.69	22.71	39.55	1.88	0.32	1.57	34.91	105.63	0.53	2.01	2.98	0.15	0.02	0.10	2.20	7.98	0.74	0.18	0.05	0.03	0.81
12	363	4.70	22.59	39.51	1.86	0.31	1.69	34.46	105.14	0.53	2.01	2.98	0.15	0.02	0.11	2.18	7.98	0.73	0.18	0.05	0.04	0.80
13	396	4.52	22.29	38.89	1.75	0.18	1.49	33.90	103.02	0.52	2.02	3.00	0.14	0.01	0.10	2.18	7.97	0.74	0.18	0.05	0.03	0.81
16	495	4.63	22.37	39.23	1.76	0.21	1.59	34.08	103.86	0.53	2.01	3.00	0.14	0.01	0.10	2.18	7.97	0.74	0.18	0.05	0.03	0.80
17	528	4.63	22.59	39.68	1.90	0.18	1.56	34.53	105.08	0.52	2.01	3.00	0.15	0.01	0.10	2.18	7.97	0.74	0.18	0.05	0.03	0.81
18	561	4.63	22.42	38.93	1.90	0.18	1.65	34.10	103.81	0.53	2.02	2.98	0.16	0.01	0.11	2.18	7.98	0.73	0.18	0.05	0.04	0.81
19	594	5.13	23.14	39.93	1.81	0.22	1.51	33.69	105.43	0.57	2.04	2.99	0.15	0.01	0.10	2.11	7.97	0.72	0.20	0.05	0.03	0.79
20	627	4.57	22.25	38.87	1.88	0.17	1.58	33.95	103.27	0.52	2.02	2.99	0.15	0.01	0.10	2.18	7.98	0.74	0.18	0.05	0.03	0.81
21	660	4.71	22.26	39.02	1.89	0.18	1.50	33.74	103.29	0.54	2.01	2.99	0.16	0.01	0.10	2.17	7.97	0.73	0.18	0.05	0.03	0.80
22	693	4.62	22.58	39.07	1.99	0.25	1.51	33.33	103.36	0.53	2.04	2.99	0.16	0.01	0.10	2.13	7.96	0.73	0.18	0.06	0.03	0.80
23	726	4.59	22.19	39.09	2.03	0.22	1.53	33.73	103.38	0.52	2.01	3.00	0.17	0.01	0.10	2.16	7.97	0.73	0.18	0.06	0.03	0.80
25	792	4.46	22.18	39.12	2.21	0.15	1.54	34.25	103.92	0.51	2.00	2.99	0.18	0.01	0.10	2.19	7.99	0.74	0.17	0.06	0.03	0.81
26	825	4.93	22.81	39.49	2.44	0.50	1.69	34.38	106.23	0.55	2.01	2.95	0.20	0.03	0.11	2.15	7.99	0.72	0.18	0.07	0.04	0.80
27	858	4.58	22.42	39.49	2.39	0.24	1.56	33.35	104.02	0.52	2.01	3.01	0.19	0.01	0.10	2.12	7.97	0.72	0.18	0.07	0.03	0.80
28	891	4.63	22.52	39.42	2.43	0.33	1.65	34.24	105.23	0.52	2.00	2.98	0.20	0.02	0.11	2.16	7.98	0.72	0.17	0.07	0.04	0.81
29	924	4.50	22.39	39.11	2.38	0.25	1.53	33.63	103.78	0.51	2.02	2.99	0.19	0.01	0.10	2.15	7.97	0.73	0.17	0.07	0.03	0.81

30	957	4.40	22.41	39.15	2.45	0.19	1.44	33.79	103.82	0.50	2.02	2.99	0.20	0.01	0.09	2.16	7.97	0.73	0.17	0.07	0.03	0.81
31	990	4.65	22.48	39.38	2.56	0.35	1.49	33.71	104.61	0.53	2.01	2.98	0.21	0.02	0.10	2.14	7.98	0.72	0.18	0.07	0.03	0.80
32	1023	4.56	22.50	39.46	2.52	0.23	1.49	33.49	104.26	0.52	2.01	3.00	0.21	0.01	0.10	2.13	7.97	0.72	0.18	0.07	0.03	0.80
33	1056	4.57	22.30	39.31	2.45	0.06	1.49	33.68	103.88	0.52	2.01	3.00	0.20	0.00	0.10	2.15	7.98	0.72	0.18	0.07	0.03	0.81
34	1089	4.46	22.27	39.50	2.47	0.11	1.44	33.78	104.04	0.51	2.00	3.01	0.20	0.01	0.09	2.15	7.97	0.73	0.17	0.07	0.03	0.81
35	1122	4.37	22.13	38.94	2.50	0.25	1.47	33.20	102.87	0.50	2.01	3.00	0.21	0.01	0.10	2.14	7.97	0.73	0.17	0.07	0.03	0.81
36	1155	4.43	22.21	38.90	2.37	0.11	1.43	33.34	102.78	0.51	2.02	3.00	0.20	0.01	0.09	2.15	7.97	0.73	0.17	0.07	0.03	0.81
37	1188	4.68	22.23	38.70	2.43	0.28	1.59	33.68	103.57	0.54	2.01	2.97	0.20	0.02	0.10	2.16	8.00	0.72	0.18	0.07	0.03	0.80
38	1221	4.44	22.24	39.20	2.40	0.10	1.42	33.37	103.16	0.51	2.01	3.01	0.20	0.01	0.09	2.14	7.97	0.73	0.17	0.07	0.03	0.81
39	1254	4.58	22.58	39.32	2.29	0.14	1.33	33.86	104.11	0.52	2.03	2.99	0.19	0.01	0.09	2.16	7.98	0.73	0.18	0.06	0.03	0.81
40	1287	4.55	22.46	39.40	2.31	0.24	1.35	33.67	103.96	0.52	2.02	3.00	0.19	0.01	0.09	2.14	7.96	0.73	0.18	0.06	0.03	0.81
41	1320	4.54	22.63	39.44	2.31	0.19	1.51	34.36	104.98	0.51	2.02	2.98	0.19	0.01	0.10	2.17	7.98	0.73	0.17	0.06	0.03	0.81
42	1353	4.36	22.35	39.22	2.03	0.17	1.43	33.30	102.85	0.50	2.03	3.02	0.17	0.01	0.09	2.14	7.95	0.74	0.17	0.06	0.03	0.81
47	1518	4.43	22.09	38.57	2.18	0.21	1.51	33.30	102.30	0.51	2.02	2.99	0.18	0.01	0.10	2.16	7.97	0.73	0.17	0.06	0.03	0.81
48	1551	4.88	23.27	40.00	2.21	0.11	1.46	33.75	105.68	0.54	2.05	2.99	0.18	0.01	0.09	2.11	7.97	0.72	0.19	0.06	0.03	0.80
49	1584	4.72	22.33	39.21	2.28	0.29	1.49	33.60	103.94	0.54	2.01	2.99	0.19	0.02	0.10	2.14	7.97	0.72	0.18	0.06	0.03	0.80
50	1617	4.61	22.38	39.12	2.21	0.13	1.52	33.71	103.66	0.52	2.02	2.99	0.18	0.01	0.10	2.16	7.98	0.73	0.18	0.06	0.03	0.80
51	1650	4.64	22.40	38.98	2.29	0.18	1.39	33.80	103.68	0.53	2.02	2.98	0.19	0.01	0.09	2.16	7.98	0.73	0.18	0.06	0.03	0.80
52	1683	4.43	22.35	39.35	2.37	0.11	1.44	33.73	103.78	0.50	2.01	3.01	0.19	0.01	0.09	2.15	7.97	0.73	0.17	0.07	0.03	0.81
53	1716	4.86	22.68	39.46	2.42	0.31	1.63	33.80	105.15	0.55	2.01	2.97	0.20	0.02	0.10	2.13	7.98	0.72	0.18	0.07	0.03	0.80
54	1749	4.50	22.51	39.08	2.38	0.08	1.52	33.76	103.84	0.51	2.03	2.99	0.20	0.00	0.10	2.16	7.98	0.73	0.17	0.07	0.03	0.81
55	1782	4.32	22.26	39.14	2.31	0.10	1.49	33.12	102.74	0.50	2.02	3.02	0.19	0.01	0.10	2.13	7.96	0.73	0.17	0.07	0.03	0.81
56	1815	4.65	22.55	39.47	2.61	0.19	1.56	33.71	104.74	0.52	2.01	2.99	0.21	0.01	0.10	2.13	7.98	0.72	0.18	0.07	0.03	0.80
57	1848	4.51	22.38	39.23	2.57	0.21	1.58	33.79	104.27	0.51	2.01	2.99	0.21	0.01	0.10	2.15	7.98	0.72	0.17	0.07	0.03	0.81
58	1881	4.79	22.61	39.11	2.62	0.25	1.65	33.49	104.52	0.54	2.02	2.97	0.21	0.01	0.11	2.13	7.99	0.71	0.18	0.07	0.04	0.80
59	1914	4.48	22.36	39.08	2.53	0.18	1.36	33.90	103.90	0.51	2.01	2.99	0.21	0.01	0.09	2.17	7.98	0.73	0.17	0.07	0.03	0.81
60	1947	4.55	22.53	39.23	2.77	0.35	1.59	33.53	104.55	0.52	2.01	2.98	0.23	0.02	0.10	2.13	7.98	0.72	0.17	0.08	0.03	0.81
61	1980	4.67	22.47	39.39	2.71	0.32	1.54	34.27	105.37	0.53	2.00	2.97	0.22	0.02	0.10	2.16	7.99	0.72	0.17	0.07	0.03	0.80
62	2013	4.47	22.07	39.31	2.71	0.26	1.48	33.27	103.56	0.51	1.99	3.01	0.22	0.01	0.10	2.13	7.97	0.72	0.17	0.08	0.03	0.81
63	2046	4.56	22.44	39.13	2.65	0.23	1.54	33.50	104.04	0.52	2.02	2.98	0.22	0.01	0.10	2.14	7.98	0.72	0.17	0.07	0.03	0.80
64	2079	4.52	22.30	39.65	2.63	0.18	1.48	33.61	104.36	0.51	2.00	3.01	0.21	0.01	0.10	2.13	7.97	0.72	0.17	0.07	0.03	0.81

65	2112	4.25	21.96	39.22	2.50	0.13	1.45	33.19	102.71	0.49	2.00	3.02	0.21	0.01	0.09	2.14	7.96	0.73	0.17	0.07	0.03	0.81
66	2145	4.80	22.44	39.51	2.53	0.35	1.61	33.83	105.06	0.54	2.00	2.98	0.20	0.02	0.10	2.14	7.98	0.72	0.18	0.07	0.03	0.80
67	2178	4.64	22.34	39.08	2.37	0.12	1.44	33.03	103.01	0.53	2.02	3.00	0.19	0.01	0.09	2.12	7.97	0.72	0.18	0.07	0.03	0.80
68	2211	4.67	22.56	39.34	2.30	0.21	1.54	33.84	104.47	0.53	2.02	2.99	0.19	0.01	0.10	2.15	7.98	0.72	0.18	0.06	0.03	0.80
69	2244	4.58	22.45	39.20	2.15	0.18	1.56	33.69	103.81	0.52	2.02	2.99	0.18	0.01	0.10	2.15	7.97	0.73	0.18	0.06	0.03	0.80
70	2277	4.59	22.54	39.23	2.09	0.24	1.63	33.99	104.32	0.52	2.02	2.98	0.17	0.01	0.11	2.16	7.98	0.73	0.18	0.06	0.04	0.81
71	2310	4.54	22.25	39.14	1.95	0.16	1.46	33.80	103.31	0.52	2.01	3.00	0.16	0.01	0.09	2.17	7.97	0.74	0.18	0.05	0.03	0.81
72	2343	4.62	22.40	39.40	1.99	0.27	1.52	34.51	104.72	0.52	2.00	2.99	0.16	0.02	0.10	2.19	7.98	0.74	0.18	0.05	0.03	0.81
73	2376	4.55	22.25	39.35	1.85	0.10	1.46	34.41	103.97	0.52	2.00	3.01	0.15	0.01	0.09	2.20	7.97	0.74	0.17	0.05	0.03	0.81
74	2409	4.50	22.33	38.88	1.97	0.22	1.53	34.00	103.42	0.51	2.02	2.98	0.16	0.01	0.10	2.18	7.98	0.74	0.17	0.05	0.03	0.81
75	2442	4.67	22.40	38.91	1.92	0.20	1.48	34.40	103.98	0.53	2.02	2.98	0.16	0.01	0.10	2.20	7.99	0.74	0.18	0.05	0.03	0.81
76	2475	4.56	22.26	39.32	1.93	0.27	1.67	34.04	104.05	0.52	2.00	3.00	0.16	0.02	0.11	2.17	7.97	0.73	0.18	0.05	0.04	0.81
77	2508	4.31	21.64	37.82	1.84	0.17	1.52	33.93	101.23	0.51	2.01	2.98	0.16	0.01	0.10	2.24	8.00	0.75	0.17	0.05	0.03	0.82
78	2541	4.56	22.25	38.97	1.82	0.18	1.46	33.74	102.97	0.52	2.02	3.00	0.15	0.01	0.10	2.17	7.97	0.74	0.18	0.05	0.03	0.81
79	2574	4.80	22.58	39.28	1.94	0.23	1.52	34.19	104.54	0.54	2.02	2.98	0.16	0.01	0.10	2.17	7.98	0.73	0.18	0.05	0.03	0.80
80	2607	4.69	22.78	39.69	1.98	0.27	1.58	34.57	105.55	0.53	2.02	2.98	0.16	0.02	0.10	2.17	7.98	0.73	0.18	0.05	0.03	0.81
81	2640	4.74	22.61	38.98	2.05	0.33	1.69	34.46	104.85	0.54	2.02	2.96	0.17	0.02	0.11	2.19	8.00	0.73	0.18	0.06	0.04	0.80
82	2673	4.34	22.33	39.07	1.86	0.15	1.48	33.87	103.10	0.50	2.02	3.00	0.15	0.01	0.10	2.18	7.96	0.74	0.17	0.05	0.03	0.81
83	2706	4.55	22.40	39.18	1.97	0.30	1.55	34.33	104.27	0.52	2.01	2.99	0.16	0.02	0.10	2.19	7.98	0.74	0.17	0.05	0.03	0.81
84	2739	4.46	22.48	39.37	2.01	0.28	1.58	34.46	104.65	0.51	2.01	2.99	0.16	0.02	0.10	2.19	7.97	0.74	0.17	0.06	0.03	0.81
85	2772	4.50	22.50	39.07	1.97	0.21	1.57	34.34	104.16	0.51	2.02	2.98	0.16	0.01	0.10	2.19	7.98	0.74	0.17	0.05	0.03	0.81
86	2805	4.59	22.39	39.43	1.82	0.22	1.56	34.25	104.26	0.52	2.01	3.00	0.15	0.01	0.10	2.18	7.97	0.74	0.18	0.05	0.03	0.81
87	2838	4.81	22.79	39.37	1.90	0.27	1.43	34.76	105.32	0.54	2.03	2.97	0.15	0.02	0.09	2.19	7.99	0.74	0.18	0.05	0.03	0.80
88	2871	4.57	22.32	39.36	1.74	0.20	1.73	34.92	104.84	0.52	2.00	2.99	0.14	0.01	0.11	2.22	7.99	0.74	0.17	0.05	0.04	0.81
89	2904	4.70	22.73	39.63	1.97	0.41	1.75	34.49	105.67	0.53	2.01	2.98	0.16	0.02	0.11	2.17	7.98	0.73	0.18	0.05	0.04	0.80
90	2937	4.49	22.27	39.28	1.86	0.21	1.49	34.51	104.12	0.51	2.00	3.00	0.15	0.01	0.10	2.20	7.98	0.74	0.17	0.05	0.03	0.81
91	2970	4.44	22.18	38.69	1.78	0.11	1.50	34.40	103.11	0.51	2.02	2.99	0.15	0.01	0.10	2.22	7.99	0.75	0.17	0.05	0.03	0.81
92	3003	4.48	22.39	39.22	1.89	0.29	1.53	34.43	104.24	0.51	2.01	2.99	0.15	0.02	0.10	2.19	7.97	0.74	0.17	0.05	0.03	0.81
93	3036	4.57	22.58	39.13	1.80	0.17	1.50	34.76	104.51	0.52	2.02	2.98	0.15	0.01	0.10	2.21	7.98	0.74	0.17	0.05	0.03	0.81
94	3069	4.54	22.70	39.40	1.90	0.32	1.62	34.29	104.76	0.51	2.03	2.98	0.15	0.02	0.10	2.17	7.97	0.74	0.17	0.05	0.04	0.81
95	3102	4.42	22.08	39.33	1.93	0.25	1.51	34.97	104.49	0.50	1.98	3.00	0.16	0.01	0.10	2.23	7.98	0.75	0.17	0.05	0.03	0.82

96	3135	4.19	22.41	38.89	1.76	0.11	1.40	34.74	103.50	0.48	2.03	2.99	0.14	0.01	0.09	2.23	7.98	0.76	0.16	0.05	0.03	0.82
98	3201	4.62	22.53	39.23	1.79	0.35	1.57	34.72	104.81	0.52	2.01	2.98	0.15	0.02	0.10	2.20	7.98	0.74	0.18	0.05	0.03	0.81
99	3234	4.58	22.39	39.53	1.86	0.13	1.51	34.59	104.59	0.52	2.00	3.00	0.15	0.01	0.10	2.20	7.97	0.74	0.18	0.05	0.03	0.81
100	3267	4.58	23.01	39.42	1.91	0.30	1.58	33.68	104.47	0.52	2.05	2.98	0.15	0.02	0.10	2.13	7.96	0.73	0.18	0.05	0.03	0.80

*Despite elevated oxide totals, values are still considered accurate relative to each other rather than accurate relative to standard garnet compositions.

Table 1.37: Composition of garnet 1 A5a from sample HJ-57a$_1$ (group 3) as analysed along traverse C-D (Plate 6.5e). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	4.51	20.97	37.55	1.22	0.00	1.48	33.88	99.62	0.54	1.98	3.01	0.10	0.00	0.10	2.27	8.00	0.75	0.18	0.03	0.03	0.81
3	66	4.54	20.84	37.23	1.29	0.00	1.63	33.94	99.48	0.54	1.98	2.99	0.11	0.00	0.11	2.28	8.02	0.75	0.18	0.04	0.04	0.81
4	99	4.65	20.99	37.46	1.24	0.00	1.47	33.50	99.32	0.56	1.99	3.01	0.11	0.00	0.10	2.25	8.00	0.75	0.18	0.04	0.03	0.80
6	165	4.67	20.92	37.33	1.31	0.00	1.52	34.06	99.80	0.56	1.98	2.99	0.11	0.00	0.10	2.28	8.02	0.75	0.18	0.04	0.03	0.80
7	198	4.65	20.89	37.50	1.29	0.00	1.51	33.88	99.72	0.56	1.97	3.00	0.11	0.00	0.10	2.27	8.01	0.75	0.18	0.04	0.03	0.80
8	231	4.60	20.80	37.60	1.27	0.00	1.54	33.94	99.76	0.55	1.96	3.01	0.11	0.00	0.10	2.27	8.01	0.75	0.18	0.04	0.03	0.81
9	264	4.51	20.95	37.45	1.44	0.00	1.58	33.83	99.76	0.54	1.98	3.00	0.12	0.00	0.11	2.27	8.01	0.75	0.18	0.04	0.04	0.81
10	297	4.62	20.80	37.50	1.42	0.00	1.58	33.85	99.78	0.55	1.96	3.00	0.12	0.00	0.11	2.27	8.02	0.74	0.18	0.04	0.04	0.80
11	330	4.73	20.89	37.74	1.46	0.00	1.51	33.27	99.59	0.56	1.97	3.02	0.13	0.00	0.10	2.22	8.00	0.74	0.19	0.04	0.03	0.80
12	363	4.50	20.80	37.22	1.50	0.00	1.44	33.45	98.92	0.54	1.98	3.00	0.13	0.00	0.10	2.26	8.01	0.75	0.18	0.04	0.03	0.81
13	396	4.62	21.06	37.87	1.63	0.00	1.54	33.74	100.47	0.55	1.97	3.01	0.14	0.00	0.10	2.24	8.01	0.74	0.18	0.05	0.03	0.80
14	429	4.36	20.38	36.94	1.63	0.00	1.52	33.17	97.99	0.53	1.96	3.01	0.14	0.00	0.11	2.26	8.01	0.74	0.17	0.05	0.03	0.81
15	462	4.55	20.88	37.10	1.61	0.00	1.52	33.28	98.95	0.55	1.99	2.99	0.14	0.00	0.10	2.25	8.01	0.74	0.18	0.05	0.03	0.80
16	495	4.61	20.83	37.47	1.71	0.00	1.35	33.66	99.64	0.55	1.97	3.00	0.15	0.00	0.09	2.26	8.01	0.74	0.18	0.05	0.03	0.80
17	528	4.58	20.79	37.45	1.82	0.00	1.50	33.56	99.71	0.55	1.96	3.00	0.16	0.00	0.10	2.25	8.02	0.74	0.18	0.05	0.03	0.80
18	561	4.58	20.76	37.25	1.82	0.00	1.57	33.21	99.19	0.55	1.97	3.00	0.16	0.00	0.11	2.24	8.02	0.73	0.18	0.05	0.04	0.80
19	594	4.59	20.89	37.78	1.93	0.00	1.45	33.53	100.16	0.55	1.96	3.01	0.16	0.00	0.10	2.23	8.01	0.73	0.18	0.05	0.03	0.80
20	627	4.48	20.88	37.66	1.98	0.00	1.45	33.71	100.15	0.53	1.96	3.00	0.17	0.00	0.10	2.25	8.02	0.74	0.17	0.06	0.03	0.81
21	660	4.67	20.74	37.41	1.99	0.00	1.40	33.56	99.77	0.56	1.96	3.00	0.17	0.00	0.09	2.25	8.02	0.73	0.18	0.06	0.03	0.80
22	693	4.50	20.76	37.40	1.95	0.00	1.47	33.21	99.29	0.54	1.97	3.01	0.17	0.00	0.10	2.23	8.01	0.73	0.18	0.06	0.03	0.81
23	726	4.50	21.08	37.53	1.93	0.00	1.38	33.82	100.24	0.53	1.98	2.99	0.16	0.00	0.09	2.25	8.02	0.74	0.18	0.05	0.03	0.81
24	759	4.53	20.87	37.58	2.03	0.00	1.44	33.54	99.99	0.54	1.96	3.00	0.17	0.00	0.10	2.24	8.02	0.73	0.18	0.06	0.03	0.81
25	792	4.54	20.92	37.71	2.02	0.00	1.53	33.82	100.54	0.54	1.96	3.00	0.17	0.00	0.10	2.25	8.02	0.73	0.18	0.06	0.03	0.81
26	825	4.57	20.76	37.43	1.99	0.00	1.42	33.29	99.46	0.55	1.96	3.00	0.17	0.00	0.10	2.23	8.01	0.73	0.18	0.06	0.03	0.80
27	858	4.61	21.06	37.78	1.98	0.00	1.48	33.80	100.70	0.54	1.97	3.00	0.17	0.00	0.10	2.24	8.02	0.73	0.18	0.06	0.03	0.80
28	891	4.59	20.95	37.71	1.91	0.00	1.59	33.71	100.46	0.54	1.96	3.00	0.16	0.00	0.11	2.24	8.02	0.73	0.18	0.05	0.03	0.80

29	924	4.63	21.02	37.52	1.84	0.00	1.39	33.54	99.94	0.55	1.98	3.00	0.16	0.00	0.09	2.24	8.02	0.74	0.18	0.05	0.03	0.80
30	957	4.65	20.71	37.61	1.80	0.00	1.46	33.30	99.54	0.56	1.96	3.01	0.15	0.00	0.10	2.23	8.01	0.73	0.18	0.05	0.03	0.80
31	990	4.60	20.68	37.54	1.76	0.00	1.37	33.47	99.41	0.55	1.96	3.01	0.15	0.00	0.09	2.25	8.01	0.74	0.18	0.05	0.03	0.80
32	1023	4.59	20.91	37.32	1.74	0.00	1.42	33.61	99.59	0.55	1.98	2.99	0.15	0.00	0.10	2.25	8.02	0.74	0.18	0.05	0.03	0.80
33	1056	4.50	21.00	37.42	1.79	0.00	1.55	33.42	99.70	0.54	1.98	3.00	0.15	0.00	0.11	2.24	8.01	0.74	0.18	0.05	0.03	0.81
34	1089	4.46	20.72	37.34	1.72	0.00	1.50	33.70	99.43	0.54	1.96	3.00	0.15	0.00	0.10	2.27	8.02	0.74	0.18	0.05	0.03	0.81
35	1122	4.53	20.77	37.42	1.70	0.00	1.42	33.89	99.72	0.54	1.96	3.00	0.15	0.00	0.10	2.27	8.02	0.74	0.18	0.05	0.03	0.81
36	1155	4.53	20.95	37.31	1.64	0.00	1.44	33.73	99.62	0.54	1.98	2.99	0.14	0.00	0.10	2.26	8.02	0.74	0.18	0.05	0.03	0.81
37	1188	4.61	21.14	37.94	1.62	0.00	1.52	33.82	100.64	0.54	1.97	3.01	0.14	0.00	0.10	2.24	8.01	0.74	0.18	0.05	0.03	0.80
38	1221	4.67	21.25	37.89	1.64	0.00	1.47	33.24	100.17	0.55	1.99	3.01	0.14	0.00	0.10	2.21	8.00	0.74	0.18	0.05	0.03	0.80
44	1419	4.64	20.71	37.58	1.59	0.00	1.36	33.39	99.27	0.56	1.96	3.02	0.14	0.00	0.09	2.24	8.00	0.74	0.18	0.05	0.03	0.80
45	1452	4.59	20.68	37.20	1.65	0.00	1.54	33.30	98.96	0.55	1.97	3.00	0.14	0.00	0.11	2.25	8.01	0.74	0.18	0.05	0.03	0.80
46	1485	4.50	20.82	37.45	1.65	0.00	1.48	33.70	99.59	0.54	1.97	3.00	0.14	0.00	0.10	2.26	8.01	0.74	0.18	0.05	0.03	0.81
47	1518	4.70	20.83	37.48	1.73	0.00	1.48	33.79	100.02	0.56	1.96	3.00	0.15	0.00	0.10	2.26	8.02	0.74	0.18	0.05	0.03	0.80
48	1551	4.61	21.03	37.68	1.82	0.00	1.52	33.56	100.23	0.55	1.97	3.00	0.16	0.00	0.10	2.23	8.01	0.74	0.18	0.05	0.03	0.80
49	1584	4.51	20.66	37.48	1.80	0.00	1.38	33.50	99.34	0.54	1.96	3.01	0.16	0.00	0.09	2.25	8.01	0.74	0.18	0.05	0.03	0.81
50	1617	4.59	20.68	37.58	1.76	0.00	1.55	33.21	99.36	0.55	1.96	3.02	0.15	0.00	0.11	2.23	8.01	0.73	0.18	0.05	0.03	0.80
51	1650	4.59	21.16	37.77	1.89	0.00	1.52	33.25	100.18	0.54	1.98	3.00	0.16	0.00	0.10	2.21	8.01	0.73	0.18	0.05	0.03	0.80
53	1716	4.60	20.77	37.53	2.03	0.00	1.43	33.43	99.78	0.55	1.96	3.00	0.17	0.00	0.10	2.24	8.02	0.73	0.18	0.06	0.03	0.80
54	1749	4.39	20.59	37.44	2.05	0.00	1.56	33.31	99.34	0.53	1.95	3.01	0.18	0.00	0.11	2.24	8.01	0.73	0.17	0.06	0.03	0.81
55	1782	4.38	20.88	37.45	2.11	0.00	1.57	33.41	99.78	0.52	1.97	3.00	0.18	0.00	0.11	2.24	8.02	0.73	0.17	0.06	0.03	0.81
57	1848	4.45	20.86	37.31	2.14	0.00	1.48	33.37	99.60	0.53	1.97	2.99	0.18	0.00	0.10	2.24	8.02	0.73	0.17	0.06	0.03	0.81
58	1881	4.39	20.64	37.38	2.14	0.00	1.44	33.13	99.12	0.53	1.96	3.01	0.19	0.00	0.10	2.23	8.01	0.73	0.17	0.06	0.03	0.81
59	1914	4.44	21.09	37.74	2.23	0.00	1.53	33.59	100.60	0.53	1.97	3.00	0.19	0.00	0.10	2.23	8.02	0.73	0.17	0.06	0.03	0.81
60	1947	4.40	20.88	37.57	2.21	0.00	1.47	33.46	99.99	0.52	1.97	3.00	0.19	0.00	0.10	2.24	8.02	0.73	0.17	0.06	0.03	0.81
61	1980	4.34	20.88	37.43	2.11	0.00	1.40	33.45	99.62	0.52	1.97	3.00	0.18	0.00	0.10	2.24	8.01	0.74	0.17	0.06	0.03	0.81
62	2013	4.47	20.97	37.57	2.24	0.00	1.60	33.47	100.32	0.53	1.97	2.99	0.19	0.00	0.11	2.23	8.02	0.73	0.17	0.06	0.04	0.81
63	2046	4.34	20.94	37.60	2.23	0.00	1.56	33.89	100.57	0.52	1.96	2.99	0.19	0.00	0.11	2.26	8.02	0.74	0.17	0.06	0.03	0.81
64	2079	4.35	20.82	37.63	2.19	0.00	1.46	33.55	100.00	0.52	1.96	3.01	0.19	0.00	0.10	2.24	8.01	0.74	0.17	0.06	0.03	0.81
65	2112	4.30	20.72	37.29	2.14	0.00	1.48	33.38	99.32	0.52	1.97	3.00	0.18	0.00	0.10	2.25	8.02	0.74	0.17	0.06	0.03	0.81
66	2145	4.25	20.83	37.48	2.10	0.00	1.50	33.48	99.64	0.51	1.97	3.01	0.18	0.00	0.10	2.25	8.01	0.74	0.17	0.06	0.03	0.82

67	2178	4.34	20.90	37.49	2.02	0.00	1.52	33.21	99.48	0.52	1.98	3.01	0.17	0.00	0.10	2.23	8.01	0.74	0.17	0.06	0.03	0.81
68	2211	4.46	21.06	38.12	1.91	0.00	1.51	34.63	101.68	0.52	1.95	3.00	0.16	0.00	0.10	2.28	8.02	0.74	0.17	0.05	0.03	0.81
69	2244	4.44	20.89	37.71	1.72	0.00	1.49	34.32	100.57	0.53	1.96	3.00	0.15	0.00	0.10	2.28	8.02	0.75	0.17	0.05	0.03	0.81
70	2277	4.42	20.87	37.45	1.66	0.00	1.50	34.10	100.00	0.53	1.97	3.00	0.14	0.00	0.10	2.28	8.02	0.75	0.17	0.05	0.03	0.81
71	2310	4.36	20.71	37.30	1.61	0.00	1.39	34.02	99.38	0.52	1.97	3.00	0.14	0.00	0.10	2.29	8.01	0.75	0.17	0.05	0.03	0.81
72	2343	4.18	20.65	37.36	1.51	0.00	1.35	34.27	99.31	0.50	1.96	3.01	0.13	0.00	0.09	2.31	8.01	0.76	0.17	0.04	0.03	0.82
73	2376	4.25	20.86	37.50	1.44	0.00	1.53	34.71	100.30	0.51	1.97	3.00	0.12	0.00	0.10	2.32	8.02	0.76	0.17	0.04	0.03	0.82
74	2409	4.17	21.01	37.54	1.30	0.00	1.56	34.99	100.57	0.50	1.98	3.00	0.11	0.00	0.11	2.33	8.02	0.77	0.16	0.04	0.03	0.82
75	2442	4.19	20.91	37.32	1.21	0.00	1.55	34.03	99.22	0.50	1.99	3.01	0.10	0.00	0.11	2.29	8.00	0.76	0.17	0.03	0.04	0.82

Table 1.38: Composition of garnet A5b from sample HJ-57a_1 (group 3) as analysed along traverse G-H (Plate 6.5f). Distance is in microns from starting point G.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	4.92	23.15	39.54	1.62	0.09	1.15	33.75	104.21	0.56	2.07	2.99	0.13	0.01	0.07	2.14	7.96	0.74	0.19	0.05	0.03	0.79
5	140	4.89	22.77	39.62	1.79	0.13	1.30	33.61	104.10	0.55	2.04	3.00	0.15	0.01	0.08	2.13	7.96	0.73	0.19	0.05	0.03	0.79
8	245	4.74	22.80	39.36	2.00	0.12	1.29	33.36	103.67	0.54	2.05	3.00	0.16	0.01	0.08	2.13	7.96	0.73	0.19	0.06	0.03	0.80
9	280	4.40	22.39	39.13	1.77	0.10	1.15	33.33	102.26	0.51	2.04	3.02	0.15	0.01	0.08	2.15	7.95	0.75	0.18	0.05	0.03	0.81
26	875	3.98	21.55	38.09	1.78	0.00	1.28	33.10	99.78	0.47	2.02	3.03	0.15	0.00	0.09	2.20	7.96	0.76	0.16	0.05	0.03	0.82
27	910	4.46	21.82	37.94	1.84	0.09	1.36	32.54	100.06	0.53	2.03	3.00	0.16	0.01	0.09	2.15	7.97	0.74	0.18	0.05	0.03	0.80
28	945	4.42	22.31	38.64	1.95	0.12	1.11	33.16	101.72	0.51	2.04	3.00	0.16	0.01	0.07	2.16	7.96	0.74	0.18	0.06	0.03	0.81
34	1155	4.61	22.62	39.11	1.49	0.08	1.40	33.22	102.53	0.53	2.05	3.01	0.12	0.00	0.09	2.14	7.95	0.74	0.18	0.04	0.03	0.80
36	1225	4.48	22.53	38.96	1.48	0.00	1.19	33.44	102.08	0.52	2.06	3.02	0.12	0.00	0.08	2.16	7.95	0.75	0.18	0.04	0.03	0.81
38	1295	4.85	23.02	39.39	1.63	0.08	1.46	33.56	104.00	0.55	2.06	2.99	0.13	0.00	0.09	2.13	7.96	0.73	0.19	0.05	0.03	0.80
44	1505	4.85	22.91	39.41	1.76	0.11	1.31	33.63	103.98	0.55	2.05	2.99	0.14	0.01	0.08	2.13	7.96	0.73	0.19	0.05	0.03	0.80
47	1610	4.51	22.65	38.69	1.31	0.08	1.14	33.34	101.73	0.52	2.07	3.00	0.11	0.00	0.08	2.16	7.95	0.75	0.18	0.04	0.03	0.81
50	1715	4.82	22.70	38.99	1.63	0.11	1.40	33.60	103.25	0.55	2.05	2.99	0.13	0.01	0.09	2.15	7.97	0.74	0.19	0.05	0.03	0.80
51	1750	4.40	22.25	38.86	1.43	0.12	1.16	33.53	101.76	0.51	2.04	3.02	0.12	0.01	0.08	2.18	7.95	0.76	0.18	0.04	0.03	0.81
56	1925	4.44	22.30	38.77	1.43	0.07	1.27	33.30	101.56	0.51	2.05	3.02	0.12	0.00	0.08	2.17	7.95	0.75	0.18	0.04	0.03	0.81
64	2205	4.80	22.81	38.78	1.83	0.07	1.33	32.99	102.61	0.55	2.07	2.99	0.15	0.00	0.09	2.12	7.97	0.73	0.19	0.05	0.03	0.79
66	2275	4.32	22.55	38.71	1.74	0.09	1.06	33.09	101.57	0.50	2.07	3.01	0.15	0.01	0.07	2.15	7.95	0.75	0.17	0.05	0.02	0.81
68	2345	4.62	22.43	39.09	1.96	0.12	1.23	33.26	102.71	0.53	2.03	3.01	0.16	0.01	0.08	2.14	7.96	0.74	0.18	0.06	0.03	0.80
71	2450	4.56	22.77	38.94	1.94	0.14	1.34	32.82	102.51	0.52	2.06	3.00	0.16	0.01	0.09	2.11	7.95	0.73	0.18	0.06	0.03	0.80
79	2730	4.65	22.58	39.00	1.97	0.09	1.29	33.08	102.66	0.53	2.05	3.00	0.16	0.00	0.08	2.13	7.96	0.73	0.18	0.06	0.03	0.80
80	2765	4.44	22.31	38.69	1.91	0.10	1.10	33.57	102.13	0.51	2.04	3.00	0.16	0.01	0.07	2.18	7.97	0.75	0.18	0.05	0.02	0.81
82	2905	4.33	22.58	38.51	1.74	0.11	1.23	33.35	101.84	0.50	2.07	2.99	0.14	0.01	0.08	2.17	7.96	0.75	0.17	0.05	0.03	0.81
87	3010	4.53	22.30	38.55	1.71	0.00	1.17	32.79	101.04	0.53	2.05	3.01	0.14	0.00	0.08	2.14	7.95	0.74	0.18	0.05	0.03	0.80
99	3430	4.78	22.48	38.92	1.83	0.10	1.38	32.83	102.32	0.55	2.04	3.00	0.15	0.01	0.09	2.12	7.96	0.73	0.19	0.05	0.03	0.79
103	3570	4.50	22.22	39.15	1.79	0.12	1.29	33.18	102.25	0.52	2.02	3.02	0.15	0.01	0.08	2.14	7.95	0.74	0.18	0.05	0.03	0.81
110	3815	4.29	22.46	38.77	1.72	0.05	1.30	33.14	101.73	0.50	2.06	3.01	0.14	0.00	0.09	2.15	7.95	0.75	0.17	0.05	0.03	0.81

112	3885	4.85	22.90	39.25	1.70	0.07	1.14	33.51	103.42	0.55	2.06	3.00	0.14	0.00	0.07	2.14	7.96	0.74	0.19	0.05	0.03	0.80
116	4025	5.07	23.01	39.07	1.64	0.19	1.29	32.73	103.00	0.58	2.07	2.98	0.13	0.01	0.08	2.09	7.95	0.72	0.20	0.05	0.03	0.78
122	4235	4.23	22.51	39.10	1.87	0.23	1.54	34.56	104.05	0.48	2.03	2.99	0.15	0.01	0.10	2.21	7.97	0.75	0.16	0.05	0.03	0.82
123	4270	4.22	22.29	38.56	1.86	0.23	1.56	34.36	103.09	0.49	2.03	2.98	0.15	0.01	0.10	2.22	7.98	0.75	0.16	0.05	0.03	0.82
124	4305	4.35	22.50	39.44	1.96	0.36	1.56	34.30	104.46	0.49	2.01	3.00	0.16	0.02	0.10	2.18	7.96	0.74	0.17	0.05	0.03	0.82
125	4340	4.20	22.42	39.24	1.76	0.23	1.43	34.23	103.52	0.48	2.02	3.01	0.14	0.01	0.09	2.19	7.95	0.75	0.16	0.05	0.03	0.82
126	4375	4.58	22.92	39.34	1.90	0.27	1.56	34.41	104.98	0.52	2.04	2.97	0.15	0.02	0.10	2.18	7.98	0.74	0.18	0.05	0.03	0.81
128	4445	4.18	22.29	39.19	1.64	0.22	1.48	34.42	103.42	0.48	2.02	3.01	0.14	0.01	0.10	2.21	7.96	0.76	0.16	0.05	0.03	0.82
129	4480	4.77	23.10	39.41	1.52	0.13	1.37	33.46	103.76	0.54	2.07	2.99	0.12	0.01	0.09	2.13	7.95	0.74	0.19	0.04	0.03	0.80
130	4515	4.81	22.45	39.52	1.45	0.06	1.24	33.53	103.05	0.55	2.03	3.03	0.12	0.00	0.08	2.15	7.95	0.74	0.19	0.04	0.03	0.80
143	4970	4.28	22.42	38.89	1.71	0.12	1.21	33.97	102.59	0.49	2.04	3.00	0.14	0.01	0.08	2.19	7.96	0.75	0.17	0.05	0.03	0.82
146	5075	3.80	22.16	38.43	1.52	0.09	1.28	34.04	101.31	0.44	2.05	3.01	0.13	0.01	0.08	2.23	7.95	0.77	0.15	0.04	0.03	0.83
149	5180	4.24	22.91	38.91	1.45	0.06	0.98	33.56	102.12	0.49	2.09	3.01	0.12	0.00	0.06	2.17	7.95	0.76	0.17	0.04	0.02	0.82

Table 1.39: Composition of garnet A1 from sample HJ-58b (group 3) as analysed along traverse A-B (Plate 6.5g). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	4.05	21.08	36.71	3.86	0.20	3.07	30.42	99.40	0.48	2.00	2.95	0.33	0.01	0.21	2.04	8.03	0.67	0.16	0.11	0.07	0.81
2	35	5.08	21.20	37.22	4.21	0.24	2.93	29.11	99.99	0.60	1.98	2.95	0.36	0.01	0.20	1.93	8.03	0.63	0.19	0.12	0.06	0.76
3	70	5.51	21.21	37.30	4.45	0.31	2.66	28.30	99.74	0.65	1.98	2.95	0.38	0.02	0.18	1.87	8.03	0.61	0.21	0.12	0.06	0.74
4	105	5.81	21.54	37.94	4.55	0.22	2.53	28.25	100.86	0.68	1.98	2.96	0.38	0.01	0.17	1.84	8.02	0.60	0.22	0.12	0.05	0.73
5	140	5.91	21.29	36.98	4.47	0.22	2.55	27.38	98.80	0.70	2.00	2.94	0.38	0.01	0.17	1.82	8.03	0.59	0.23	0.12	0.06	0.72
6	175	6.10	21.40	37.26	4.58	0.20	2.45	27.81	99.81	0.72	1.99	2.94	0.39	0.01	0.16	1.83	8.04	0.59	0.23	0.12	0.05	0.72
8	245	6.04	21.01	37.21	4.50	0.10	2.52	26.64	98.02	0.72	1.98	2.97	0.39	0.01	0.17	1.78	8.01	0.58	0.24	0.13	0.06	0.71
10	315	6.03	21.06	37.02	4.53	0.22	2.44	27.47	98.77	0.72	1.98	2.95	0.39	0.01	0.16	1.83	8.04	0.59	0.23	0.12	0.05	0.72
11	350	6.20	21.37	37.49	4.45	0.16	2.49	27.31	99.48	0.73	1.99	2.96	0.38	0.01	0.17	1.80	8.03	0.59	0.24	0.12	0.05	0.71
12	385	6.14	21.50	37.33	4.41	0.23	2.39	27.23	99.23	0.72	2.00	2.95	0.37	0.01	0.16	1.80	8.02	0.59	0.24	0.12	0.05	0.71
13	420	6.51	21.65	37.79	4.52	0.31	2.58	27.94	101.30	0.75	1.98	2.93	0.38	0.02	0.17	1.81	8.04	0.58	0.24	0.12	0.05	0.71
14	455	6.32	21.59	37.67	4.23	0.19	2.48	27.10	99.58	0.74	2.00	2.96	0.36	0.01	0.16	1.78	8.01	0.59	0.24	0.12	0.05	0.71
15	490	6.18	21.31	37.58	4.37	0.22	2.55	27.27	99.48	0.73	1.98	2.96	0.37	0.01	0.17	1.80	8.02	0.59	0.24	0.12	0.06	0.71
16	525	6.23	21.33	37.29	4.36	0.18	2.36	27.62	99.37	0.73	1.99	2.95	0.37	0.01	0.16	1.83	8.04	0.59	0.24	0.12	0.05	0.71
17	560	6.40	21.61	37.95	4.53	0.24	2.66	28.02	101.41	0.74	1.98	2.94	0.38	0.01	0.17	1.82	8.04	0.58	0.24	0.12	0.06	0.71
18	595	6.15	21.39	37.81	4.43	0.17	2.54	27.53	100.04	0.72	1.98	2.97	0.37	0.01	0.17	1.81	8.02	0.59	0.23	0.12	0.06	0.72
19	630	6.46	21.41	37.71	4.54	0.24	2.52	27.24	100.12	0.75	1.98	2.95	0.38	0.01	0.17	1.78	8.03	0.58	0.24	0.12	0.05	0.70
20	665	6.27	21.61	37.95	4.54	0.27	2.54	27.30	100.49	0.73	1.99	2.96	0.38	0.02	0.17	1.78	8.02	0.58	0.24	0.12	0.05	0.71
21	700	6.33	21.65	38.09	4.67	0.24	2.70	27.44	101.11	0.73	1.98	2.96	0.39	0.01	0.18	1.78	8.03	0.58	0.24	0.13	0.06	0.71
22	735	6.32	21.57	37.72	4.72	0.24	2.49	27.32	100.36	0.74	1.99	2.95	0.39	0.01	0.16	1.79	8.03	0.58	0.24	0.13	0.05	0.71
23	770	6.14	21.52	37.84	4.62	0.28	2.53	27.44	100.37	0.72	1.98	2.96	0.39	0.02	0.17	1.79	8.02	0.59	0.23	0.13	0.05	0.71
24	805	6.21	21.71	37.99	4.47	0.24	2.39	27.54	100.55	0.72	1.99	2.96	0.37	0.01	0.16	1.80	8.02	0.59	0.24	0.12	0.05	0.71
25	840	6.30	21.66	38.09	4.78	0.24	2.53	27.70	101.30	0.73	1.98	2.95	0.40	0.01	0.17	1.80	8.03	0.58	0.24	0.13	0.05	0.71
26	875	6.14	21.53	37.63	4.55	0.25	2.59	27.36	100.05	0.72	1.99	2.95	0.38	0.01	0.17	1.79	8.02	0.59	0.23	0.12	0.06	0.71
27	910	6.10	21.25	37.47	4.47	0.30	2.50	27.44	99.52	0.72	1.98	2.96	0.38	0.02	0.17	1.81	8.02	0.59	0.23	0.12	0.05	0.72
28	945	5.64	21.48	37.43	4.52	0.17	2.54	27.69	99.46	0.66	2.00	2.96	0.38	0.01	0.17	1.83	8.02	0.60	0.22	0.13	0.06	0.73

29	980	5.90	21.20	37.54	4.40	0.12	2.62	27.06	98.82	0.70	1.98	2.98	0.37	0.01	0.18	1.80	8.01	0.59	0.23	0.12	0.06	0.72
30	1015	5.76	21.73	38.11	4.14	0.21	2.73	28.54	101.22	0.67	1.99	2.96	0.34	0.01	0.18	1.86	8.01	0.61	0.22	0.11	0.06	0.74
31	1050	5.80	21.52	37.90	4.29	0.21	2.87	28.88	101.47	0.67	1.97	2.95	0.36	0.01	0.19	1.88	8.03	0.61	0.22	0.12	0.06	0.74
32	1085	5.74	21.47	37.77	3.88	0.28	2.98	29.15	101.27	0.67	1.97	2.95	0.32	0.02	0.20	1.90	8.03	0.62	0.22	0.10	0.06	0.74
33	1120	5.74	21.02	37.45	4.26	0.14	2.75	28.73	100.08	0.68	1.96	2.96	0.36	0.01	0.18	1.90	8.04	0.61	0.22	0.12	0.06	0.74
34	1155	5.39	20.96	37.53	4.35	0.22	2.59	27.90	98.94	0.64	1.97	2.99	0.37	0.01	0.17	1.86	8.01	0.61	0.21	0.12	0.06	0.74
35	1190	5.61	21.37	37.51	4.49	0.18	2.56	27.78	99.50	0.66	1.99	2.96	0.38	0.01	0.17	1.84	8.01	0.60	0.22	0.12	0.06	0.74
39	1330	6.06	21.85	38.70	4.66	0.18	2.54	27.96	101.93	0.69	1.98	2.98	0.38	0.01	0.17	1.80	8.01	0.59	0.23	0.13	0.05	0.72
40	1365	6.31	21.74	37.90	4.77	0.25	2.60	27.89	101.47	0.73	1.98	2.94	0.40	0.01	0.17	1.81	8.04	0.58	0.23	0.13	0.05	0.71
41	1400	6.34	22.37	39.21	4.69	0.20	2.55	27.51	102.86	0.72	2.00	2.98	0.38	0.01	0.16	1.75	8.00	0.58	0.24	0.13	0.05	0.71
42	1435	6.01	21.47	37.58	4.56	0.08	2.40	27.16	99.26	0.71	2.00	2.97	0.39	0.00	0.16	1.79	8.02	0.59	0.23	0.13	0.05	0.72
43	1470	6.33	21.73	38.24	4.64	0.20	2.51	27.90	101.57	0.73	1.98	2.96	0.38	0.01	0.16	1.80	8.03	0.59	0.24	0.12	0.05	0.71
46	1575	6.07	21.60	38.14	4.65	0.10	2.44	27.72	100.72	0.70	1.98	2.97	0.39	0.01	0.16	1.81	8.02	0.59	0.23	0.13	0.05	0.72
47	1610	6.05	21.24	37.64	4.60	0.13	2.46	27.30	99.42	0.71	1.98	2.97	0.39	0.01	0.16	1.80	8.02	0.59	0.23	0.13	0.05	0.72
48	1645	5.93	22.07	38.69	4.60	0.18	2.62	28.04	102.13	0.68	2.00	2.97	0.38	0.01	0.17	1.80	8.01	0.59	0.22	0.12	0.06	0.73
49	1680	6.09	21.47	37.41	4.45	0.16	2.42	27.58	99.58	0.72	2.00	2.95	0.38	0.01	0.16	1.82	8.03	0.59	0.23	0.12	0.05	0.72
50	1715	6.03	21.74	38.00	4.44	0.10	2.52	27.80	100.63	0.70	2.00	2.96	0.37	0.01	0.17	1.81	8.02	0.59	0.23	0.12	0.05	0.72
51	1750	6.14	21.44	37.68	4.39	0.10	2.47	28.12	100.33	0.72	1.98	2.95	0.37	0.01	0.16	1.84	8.03	0.60	0.23	0.12	0.05	0.72
52	1785	6.28	21.32	37.51	4.40	0.30	2.52	27.63	99.96	0.74	1.98	2.95	0.37	0.02	0.17	1.82	8.03	0.59	0.24	0.12	0.05	0.71
54	1855	6.00	21.43	37.60	4.27	0.16	2.49	27.90	99.85	0.70	1.99	2.96	0.36	0.01	0.17	1.84	8.02	0.60	0.23	0.12	0.05	0.72
55	1890	6.12	21.19	37.34	4.25	0.13	2.30	27.41	98.74	0.72	1.98	2.97	0.36	0.01	0.15	1.82	8.02	0.59	0.24	0.12	0.05	0.72
56	1925	6.18	21.60	37.57	4.59	0.11	2.57	27.40	100.02	0.72	2.00	2.95	0.39	0.01	0.17	1.80	8.03	0.58	0.24	0.13	0.06	0.71
57	1960	6.25	21.77	38.09	4.57	0.19	2.65	27.98	101.50	0.72	1.99	2.95	0.38	0.01	0.17	1.81	8.03	0.59	0.23	0.12	0.06	0.72
58	1995	6.20	21.37	37.26	4.42	0.25	2.51	27.63	99.65	0.73	1.99	2.94	0.37	0.02	0.17	1.82	8.04	0.59	0.24	0.12	0.05	0.71
59	2030	5.94	21.48	37.80	4.38	0.19	2.55	27.35	99.67	0.70	1.99	2.97	0.37	0.01	0.17	1.80	8.01	0.59	0.23	0.12	0.06	0.72
60	2065	6.05	21.49	37.66	4.53	0.30	2.66	28.14	100.85	0.70	1.98	2.94	0.38	0.02	0.18	1.84	8.03	0.59	0.23	0.12	0.06	0.72
61	2100	5.78	21.45	37.90	4.49	0.32	2.53	28.50	100.96	0.67	1.97	2.96	0.38	0.02	0.17	1.86	8.02	0.61	0.22	0.12	0.05	0.73
62	2135	5.31	21.21	37.61	4.45	0.23	2.49	28.45	99.75	0.63	1.98	2.97	0.38	0.01	0.17	1.88	8.02	0.62	0.21	0.12	0.05	0.75
63	2170	5.01	21.01	36.96	4.26	0.18	2.77	28.59	98.78	0.60	1.98	2.96	0.37	0.01	0.19	1.92	8.02	0.62	0.19	0.12	0.06	0.76
64	2205	4.95	20.87	36.93	4.16	0.25	2.87	28.69	98.71	0.59	1.97	2.96	0.36	0.01	0.19	1.92	8.02	0.63	0.19	0.12	0.06	0.76
65	2240	4.66	21.64	37.93	4.33	0.17	2.99	28.86	100.58	0.55	2.00	2.98	0.36	0.01	0.20	1.89	7.99	0.63	0.18	0.12	0.07	0.78

Table 1.40: Composition of garnet A1 from sample HJ-58b (group 3) as analysed along traverse C-D (Plate 6.5g). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	4.26	21.50	37.62	3.90	0.17	3.33	30.63	101.42	0.50	1.99	2.96	0.33	0.01	0.22	2.01	8.02	0.66	0.16	0.11	0.07	0.80
2	33	4.66	21.36	37.66	4.15	0.21	3.04	30.05	101.12	0.55	1.98	2.96	0.35	0.01	0.20	1.98	8.03	0.64	0.18	0.11	0.07	0.78
3	66	4.99	21.44	37.72	4.31	0.27	2.92	29.56	101.23	0.58	1.98	2.96	0.36	0.02	0.19	1.94	8.03	0.63	0.19	0.12	0.06	0.77
4	99	5.34	21.52	38.01	4.50	0.33	2.89	28.87	101.45	0.62	1.98	2.96	0.38	0.02	0.19	1.88	8.02	0.61	0.20	0.12	0.06	0.75
5	132	5.40	21.50	37.71	4.50	0.15	2.71	28.85	100.82	0.63	1.99	2.96	0.38	0.01	0.18	1.89	8.03	0.61	0.20	0.12	0.06	0.75
6	165	5.73	21.29	37.61	4.62	0.34	2.67	28.39	100.65	0.67	1.97	2.95	0.39	0.02	0.18	1.86	8.03	0.60	0.22	0.13	0.06	0.74
7	198	5.92	21.70	38.25	4.60	0.14	2.58	28.30	101.49	0.68	1.98	2.96	0.38	0.01	0.17	1.83	8.02	0.60	0.22	0.12	0.06	0.73
8	231	5.82	21.20	37.53	4.59	0.18	2.53	27.50	99.35	0.69	1.98	2.97	0.39	0.01	0.17	1.82	8.02	0.59	0.22	0.13	0.06	0.73
9	264	5.79	21.56	37.81	4.50	0.23	2.49	27.62	100.01	0.68	1.99	2.97	0.38	0.01	0.17	1.81	8.01	0.60	0.22	0.12	0.05	0.73
10	297	5.69	21.29	37.52	4.44	0.21	2.45	27.52	99.13	0.67	1.99	2.97	0.38	0.01	0.16	1.82	8.01	0.60	0.22	0.12	0.05	0.73
11	330	6.22	21.63	37.79	4.75	0.35	2.67	27.60	101.00	0.72	1.98	2.94	0.40	0.02	0.18	1.80	8.03	0.58	0.23	0.13	0.06	0.71
12	363	5.93	21.62	37.75	4.58	0.15	2.52	27.19	99.74	0.69	2.00	2.97	0.39	0.01	0.17	1.79	8.01	0.59	0.23	0.13	0.06	0.72
13	396	5.97	21.61	37.88	4.59	0.23	2.55	27.71	100.55	0.70	1.99	2.96	0.38	0.01	0.17	1.81	8.02	0.59	0.23	0.13	0.06	0.72
14	429	5.94	21.34	37.52	4.45	0.10	2.48	27.23	99.06	0.70	1.99	2.97	0.38	0.01	0.17	1.80	8.02	0.59	0.23	0.12	0.05	0.72
15	462	6.20	21.34	37.71	4.59	0.16	2.55	27.32	99.86	0.73	1.98	2.96	0.39	0.01	0.17	1.80	8.02	0.58	0.24	0.13	0.06	0.71
16	495	6.08	21.41	37.98	4.70	0.21	2.66	27.57	100.61	0.71	1.97	2.96	0.39	0.01	0.18	1.80	8.02	0.59	0.23	0.13	0.06	0.72
17	528	5.89	21.99	35.85	4.34	0.17	2.41	26.48	97.14	0.71	2.09	2.89	0.38	0.01	0.17	1.79	8.03	0.59	0.23	0.12	0.05	0.72
18	561	6.14	21.68	37.75	4.76	0.29	2.55	27.58	100.75	0.71	1.99	2.94	0.40	0.02	0.17	1.80	8.03	0.58	0.23	0.13	0.05	0.72
19	594	5.27	20.73	36.63	5.25	0.15	2.61	27.88	98.53	0.63	1.96	2.94	0.45	0.01	0.18	1.87	8.05	0.60	0.20	0.14	0.06	0.75
20	627	5.97	21.37	37.59	4.57	0.24	2.65	27.65	100.04	0.70	1.98	2.95	0.38	0.01	0.18	1.82	8.03	0.59	0.23	0.13	0.06	0.72
21	660	5.77	21.41	37.53	4.51	0.31	2.53	27.95	100.00	0.68	1.99	2.95	0.38	0.02	0.17	1.84	8.02	0.60	0.22	0.12	0.06	0.73
22	693	5.43	21.02	37.58	4.47	0.19	2.60	28.09	99.37	0.64	1.96	2.98	0.38	0.01	0.17	1.86	8.01	0.61	0.21	0.12	0.06	0.74
23	726	5.29	21.44	37.59	4.58	0.32	2.75	28.56	100.53	0.62	1.98	2.95	0.39	0.02	0.18	1.88	8.02	0.61	0.20	0.13	0.06	0.75
24	759	4.71	21.16	37.40	4.17	0.20	2.80	29.40	99.84	0.56	1.98	2.97	0.35	0.01	0.19	1.95	8.01	0.64	0.18	0.12	0.06	0.78
25	792	3.81	21.18	37.16	3.76	0.09	3.06	30.16	99.22	0.46	2.00	2.98	0.32	0.01	0.21	2.02	8.00	0.67	0.15	0.11	0.07	0.82
38	1221	2.62	20.32	35.80	4.34	0.31	3.73	31.40	98.52	0.32	1.97	2.94	0.38	0.02	0.26	2.16	8.04	0.69	0.10	0.12	0.08	0.87

39	1254	4.68	21.21	37.30	4.45	0.25	3.04	29.63	100.57	0.55	1.98	2.95	0.38	0.02	0.20	1.96	8.03	0.63	0.18	0.12	0.07	0.78
40	1287	4.90	21.23	36.96	4.53	0.19	2.90	28.89	99.59	0.58	1.99	2.94	0.39	0.01	0.20	1.92	8.04	0.62	0.19	0.13	0.06	0.77
41	1320	5.78	22.17	38.68	4.61	0.23	2.74	28.42	102.61	0.66	2.00	2.96	0.38	0.01	0.18	1.82	8.01	0.60	0.22	0.12	0.06	0.73
42	1353	5.50	21.23	37.36	4.51	0.15	2.55	28.15	99.46	0.65	1.98	2.96	0.38	0.01	0.17	1.87	8.03	0.61	0.21	0.12	0.06	0.74
43	1386	6.07	21.59	37.97	4.87	0.25	2.64	28.44	101.83	0.70	1.97	2.94	0.40	0.01	0.17	1.84	8.04	0.59	0.22	0.13	0.06	0.72
44	1419	5.98	21.35	37.87	4.74	0.30	2.65	27.81	100.72	0.70	1.97	2.96	0.40	0.02	0.18	1.82	8.03	0.59	0.23	0.13	0.06	0.72
45	1452	6.06	21.54	37.87	4.70	0.37	2.56	27.78	100.88	0.70	1.98	2.95	0.39	0.02	0.17	1.81	8.02	0.59	0.23	0.13	0.05	0.72
46	1485	6.03	21.70	37.77	4.79	0.22	2.61	27.70	100.82	0.70	1.99	2.95	0.40	0.01	0.17	1.81	8.03	0.59	0.23	0.13	0.06	0.72
47	1518	5.99	21.21	37.78	4.62	0.14	2.47	27.54	99.74	0.70	1.97	2.97	0.39	0.01	0.16	1.81	8.02	0.59	0.23	0.13	0.05	0.72
48	1551	5.80	21.30	37.87	4.73	0.14	2.55	27.55	99.94	0.68	1.97	2.98	0.40	0.01	0.17	1.81	8.02	0.59	0.22	0.13	0.06	0.73
49	1584	5.81	21.52	37.53	4.74	0.12	2.53	27.97	100.21	0.68	1.99	2.95	0.40	0.01	0.17	1.84	8.03	0.60	0.22	0.13	0.05	0.73
50	1617	5.84	21.34	37.40	4.60	0.22	2.65	27.62	99.67	0.69	1.99	2.95	0.39	0.01	0.18	1.82	8.03	0.59	0.22	0.13	0.06	0.73
52	1683	6.11	21.63	37.94	4.72	0.41	2.74	28.37	101.93	0.70	1.97	2.93	0.39	0.02	0.18	1.83	8.04	0.59	0.23	0.13	0.06	0.72
53	1716	5.72	21.23	37.55	4.44	0.25	2.51	28.13	99.83	0.67	1.97	2.96	0.38	0.01	0.17	1.86	8.02	0.60	0.22	0.12	0.05	0.73
54	1749	5.71	21.24	37.73	4.68	0.12	2.66	27.86	99.99	0.67	1.97	2.97	0.39	0.01	0.18	1.83	8.02	0.60	0.22	0.13	0.06	0.73
55	1782	5.71	21.21	37.51	4.62	0.23	2.52	27.80	99.59	0.67	1.98	2.96	0.39	0.01	0.17	1.84	8.02	0.60	0.22	0.13	0.05	0.73
56	1815	5.58	21.31	37.37	4.51	0.07	2.53	27.66	99.03	0.66	1.99	2.97	0.38	0.00	0.17	1.84	8.02	0.60	0.22	0.13	0.06	0.74
57	1848	5.77	21.25	37.66	4.66	0.22	2.62	28.01	100.19	0.68	1.97	2.96	0.39	0.01	0.17	1.84	8.03	0.60	0.22	0.13	0.06	0.73
58	1881	5.66	21.41	37.46	4.38	0.17	2.81	28.08	99.97	0.66	1.99	2.95	0.37	0.01	0.19	1.85	8.02	0.60	0.22	0.12	0.06	0.74
59	1914	5.60	21.32	37.55	4.22	0.21	2.70	28.42	100.02	0.66	1.98	2.96	0.36	0.01	0.18	1.87	8.02	0.61	0.21	0.12	0.06	0.74

Table 1.41: Composition of garnet A2 from sample HJ-58b (group 3) as analysed along traverse A-B (Plate 6.5h). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	5.30	21.60	37.72	4.00	0.13	2.92	29.11	100.78	0.62	2.00	2.96	0.34	0.01	0.19	1.91	8.02	0.62	0.20	0.11	0.06	0.75
2	35	5.20	21.21	37.38	4.10	0.18	2.77	28.82	99.67	0.62	1.98	2.97	0.35	0.01	0.19	1.91	8.02	0.62	0.20	0.11	0.06	0.76
3	70	5.46	21.26	37.92	4.28	0.16	2.66	28.16	99.89	0.64	1.97	2.99	0.36	0.01	0.18	1.86	8.00	0.61	0.21	0.12	0.06	0.74
4	105	5.71	21.52	37.39	4.36	0.09	2.54	28.21	99.83	0.67	2.00	2.95	0.37	0.01	0.17	1.86	8.03	0.61	0.22	0.12	0.06	0.73
5	140	6.18	21.70	38.19	4.74	0.28	2.69	27.95	101.73	0.71	1.98	2.95	0.39	0.02	0.18	1.81	8.03	0.59	0.23	0.13	0.06	0.72
7	210	6.38	21.63	37.90	4.87	0.18	2.63	27.22	100.80	0.74	1.98	2.95	0.41	0.01	0.17	1.77	8.03	0.57	0.24	0.13	0.06	0.71
8	245	6.26	21.59	37.75	4.72	0.26	2.61	27.35	100.55	0.73	1.99	2.95	0.39	0.02	0.17	1.79	8.03	0.58	0.24	0.13	0.06	0.71
9	280	6.28	21.62	37.55	4.72	0.22	2.64	27.24	100.26	0.73	1.99	2.94	0.40	0.01	0.18	1.78	8.03	0.58	0.24	0.13	0.06	0.71
10	315	6.61	21.90	37.99	4.92	0.58	2.77	28.01	102.79	0.75	1.97	2.90	0.40	0.03	0.18	1.79	8.04	0.57	0.24	0.13	0.06	0.70
11	350	6.31	21.56	37.62	4.76	0.31	2.62	27.13	100.32	0.74	1.99	2.94	0.40	0.02	0.17	1.77	8.03	0.58	0.24	0.13	0.06	0.71
12	385	6.25	21.64	37.78	4.77	0.31	2.46	27.26	100.46	0.73	1.99	2.95	0.40	0.02	0.16	1.78	8.03	0.58	0.24	0.13	0.05	0.71
13	420	6.13	21.26	37.66	4.54	0.14	2.46	26.97	99.17	0.72	1.98	2.98	0.38	0.01	0.16	1.78	8.02	0.58	0.24	0.13	0.05	0.71
14	455	6.24	21.26	37.55	4.71	0.23	2.53	27.07	99.58	0.73	1.97	2.96	0.40	0.01	0.17	1.78	8.03	0.58	0.24	0.13	0.05	0.71
15	490	6.10	21.29	37.57	4.59	0.18	2.48	26.75	98.95	0.72	1.99	2.97	0.39	0.01	0.17	1.77	8.01	0.58	0.24	0.13	0.05	0.71
16	525	6.12	21.43	37.53	4.70	0.17	2.61	27.32	99.89	0.72	1.99	2.95	0.40	0.01	0.17	1.80	8.03	0.58	0.23	0.13	0.06	0.71
17	560	6.15	21.51	37.56	4.78	0.19	2.48	27.25	99.93	0.72	1.99	2.95	0.40	0.01	0.17	1.79	8.03	0.58	0.23	0.13	0.05	0.71
18	595	6.06	21.50	37.78	4.74	0.10	2.50	27.23	99.92	0.71	1.99	2.96	0.40	0.01	0.17	1.79	8.02	0.58	0.23	0.13	0.05	0.72
19	630	6.12	21.35	37.38	4.69	0.19	2.59	27.40	99.73	0.72	1.98	2.95	0.40	0.01	0.17	1.81	8.04	0.58	0.23	0.13	0.06	0.72
20	665	6.35	21.37	37.71	4.67	0.25	2.58	27.22	100.15	0.74	1.97	2.95	0.39	0.02	0.17	1.78	8.03	0.58	0.24	0.13	0.06	0.71
21	700	6.47	21.69	37.69	4.67	0.24	2.62	27.37	100.74	0.75	1.99	2.94	0.39	0.01	0.17	1.78	8.04	0.58	0.24	0.13	0.06	0.70
22	735	6.25	21.28	37.60	4.59	0.20	2.61	27.55	100.08	0.73	1.97	2.95	0.39	0.01	0.17	1.81	8.04	0.58	0.24	0.12	0.06	0.71
23	770	6.18	21.22	37.65	4.57	0.21	2.60	27.47	99.92	0.72	1.97	2.96	0.39	0.01	0.17	1.81	8.03	0.58	0.23	0.12	0.06	0.71
24	805	6.21	21.39	37.74	4.51	0.22	2.63	27.52	100.21	0.73	1.98	2.96	0.38	0.01	0.17	1.80	8.03	0.59	0.24	0.12	0.06	0.71
25	840	6.00	21.28	36.94	4.42	0.22	2.50	26.98	98.34	0.71	2.00	2.95	0.38	0.01	0.17	1.80	8.03	0.59	0.23	0.12	0.06	0.72
26	875	5.99	21.29	37.41	4.43	0.15	2.58	27.55	99.41	0.71	1.98	2.96	0.38	0.01	0.17	1.82	8.03	0.59	0.23	0.12	0.06	0.72
27	910	6.17	21.38	37.24	4.43	0.23	2.68	27.47	99.60	0.73	1.99	2.94	0.37	0.01	0.18	1.81	8.04	0.59	0.23	0.12	0.06	0.71

28	945	6.02	21.27	37.79	4.34	0.12	2.54	27.92	100.00	0.71	1.97	2.97	0.37	0.01	0.17	1.84	8.02	0.60	0.23	0.12	0.06	0.72
30	1015	6.26	21.54	38.00	4.35	0.26	2.58	28.19	101.18	0.73	1.97	2.95	0.36	0.02	0.17	1.83	8.03	0.59	0.23	0.12	0.05	0.72
31	1050	6.13	21.36	37.59	4.49	0.29	2.61	27.50	99.97	0.72	1.98	2.95	0.38	0.02	0.17	1.81	8.03	0.59	0.23	0.12	0.06	0.72
32	1085	5.99	21.39	37.71	4.58	0.30	2.51	27.20	99.68	0.70	1.98	2.97	0.39	0.02	0.17	1.79	8.01	0.59	0.23	0.13	0.05	0.72
33	1120	6.33	21.75	38.28	4.88	0.39	2.76	27.74	102.13	0.73	1.97	2.94	0.40	0.02	0.18	1.78	8.03	0.58	0.23	0.13	0.06	0.71
34	1155	6.26	21.54	37.66	4.72	0.35	2.57	27.60	100.70	0.73	1.98	2.94	0.39	0.02	0.17	1.80	8.03	0.58	0.24	0.13	0.05	0.71
36	1225	6.12	21.23	37.56	4.58	0.15	2.58	27.43	99.66	0.72	1.97	2.96	0.39	0.01	0.17	1.81	8.03	0.59	0.23	0.13	0.06	0.72
38	1295	6.26	21.52	37.88	4.69	0.37	2.50	27.95	101.16	0.72	1.97	2.94	0.39	0.02	0.16	1.82	8.03	0.59	0.23	0.13	0.05	0.71
39	1330	6.16	21.76	37.98	4.74	0.15	2.50	27.88	101.16	0.71	1.99	2.95	0.39	0.01	0.16	1.81	8.03	0.59	0.23	0.13	0.05	0.72
40	1365	6.17	21.54	37.89	4.69	0.17	2.57	27.40	100.43	0.72	1.98	2.96	0.39	0.01	0.17	1.79	8.03	0.58	0.23	0.13	0.06	0.71
41	1400	6.22	21.76	38.26	4.64	0.13	2.58	27.68	101.28	0.72	1.99	2.96	0.39	0.01	0.17	1.79	8.02	0.58	0.23	0.13	0.06	0.71
42	1435	6.38	21.66	38.36	4.73	0.25	2.68	27.42	101.48	0.73	1.97	2.96	0.39	0.01	0.18	1.77	8.01	0.58	0.24	0.13	0.06	0.71
43	1470	5.90	21.52	37.59	4.51	0.19	2.49	27.80	100.00	0.69	1.99	2.96	0.38	0.01	0.17	1.83	8.02	0.60	0.23	0.12	0.05	0.73
44	1505	6.00	21.53	37.95	4.69	0.17	2.64	28.20	101.18	0.70	1.97	2.95	0.39	0.01	0.17	1.84	8.03	0.59	0.22	0.13	0.06	0.73
45	1540	5.89	21.45	37.71	4.48	0.23	2.52	27.80	100.08	0.69	1.99	2.96	0.38	0.01	0.17	1.83	8.02	0.60	0.23	0.12	0.05	0.73
46	1575	5.82	21.57	37.79	4.82	0.27	2.66	28.32	101.26	0.68	1.98	2.94	0.40	0.02	0.18	1.84	8.04	0.60	0.22	0.13	0.06	0.73
47	1610	5.31	21.37	37.64	4.61	0.26	2.81	28.19	100.19	0.62	1.98	2.96	0.39	0.02	0.19	1.86	8.01	0.61	0.20	0.13	0.06	0.75
48	1645	5.13	21.19	37.49	4.58	0.16	2.69	28.40	99.65	0.61	1.98	2.97	0.39	0.01	0.18	1.88	8.02	0.62	0.20	0.13	0.06	0.76
49	1680	5.03	21.75	37.72	4.40	0.17	3.01	29.28	101.35	0.59	2.00	2.95	0.37	0.01	0.20	1.91	8.03	0.62	0.19	0.12	0.06	0.77
51	1750	4.87	21.18	37.44	3.82	0.21	3.16	29.61	100.29	0.57	1.98	2.96	0.32	0.01	0.21	1.96	8.02	0.64	0.19	0.11	0.07	0.77
52	1785	5.11	21.39	37.99	4.37	0.18	2.97	29.04	101.04	0.60	1.97	2.97	0.37	0.01	0.20	1.90	8.02	0.62	0.19	0.12	0.06	0.76
53	1820	5.11	21.12	37.36	4.52	0.23	2.78	28.28	99.39	0.60	1.98	2.97	0.38	0.01	0.19	1.88	8.01	0.61	0.20	0.13	0.06	0.76
54	1855	5.48	21.27	37.55	4.60	0.21	2.85	28.43	100.40	0.64	1.97	2.95	0.39	0.01	0.19	1.87	8.03	0.61	0.21	0.13	0.06	0.74
55	1890	5.42	21.18	36.88	4.49	0.23	2.54	28.15	98.89	0.64	1.99	2.95	0.38	0.01	0.17	1.88	8.03	0.61	0.21	0.12	0.06	0.74
56	1925	5.86	21.28	37.14	4.51	0.17	2.60	27.71	99.26	0.69	1.99	2.95	0.38	0.01	0.17	1.84	8.04	0.59	0.22	0.12	0.06	0.73
57	1960	5.95	21.54	37.87	4.62	0.22	2.44	28.18	100.83	0.69	1.98	2.95	0.39	0.01	0.16	1.84	8.03	0.60	0.22	0.13	0.05	0.73
58	1995	5.97	21.51	37.74	4.71	0.19	2.49	27.67	100.29	0.70	1.99	2.96	0.40	0.01	0.17	1.81	8.02	0.59	0.23	0.13	0.05	0.72
59	2030	5.88	21.28	37.42	4.49	0.25	2.56	27.26	99.14	0.69	1.99	2.96	0.38	0.01	0.17	1.80	8.01	0.59	0.23	0.12	0.06	0.72
60	2065	6.10	21.63	37.82	4.50	0.16	2.60	27.02	99.82	0.71	2.00	2.97	0.38	0.01	0.17	1.77	8.01	0.58	0.23	0.12	0.06	0.71
61	2100	6.30	21.34	37.81	4.50	0.22	2.40	27.51	100.08	0.74	1.97	2.96	0.38	0.01	0.16	1.80	8.02	0.59	0.24	0.12	0.05	0.71
62	2135	6.26	21.47	38.04	4.44	0.21	2.45	27.59	100.45	0.73	1.97	2.97	0.37	0.01	0.16	1.80	8.02	0.59	0.24	0.12	0.05	0.71

63	2170	5.93	21.23	37.58	4.37	0.15	2.48	27.46	99.21	0.70	1.98	2.97	0.37	0.01	0.17	1.82	8.02	0.60	0.23	0.12	0.05	0.72
64	2205	6.06	21.41	37.83	4.56	0.31	2.43	27.72	100.32	0.71	1.98	2.96	0.38	0.02	0.16	1.82	8.02	0.59	0.23	0.12	0.05	0.72
65	2240	6.12	21.59	37.63	4.50	0.08	2.57	27.38	99.86	0.72	2.00	2.96	0.38	0.00	0.17	1.80	8.02	0.59	0.23	0.12	0.06	0.72
66	2275	6.32	21.70	38.31	4.59	0.30	2.78	27.98	101.97	0.73	1.97	2.95	0.38	0.02	0.18	1.80	8.03	0.58	0.24	0.12	0.06	0.71
67	2310	5.97	21.45	37.69	4.69	0.10	2.49	27.30	99.69	0.70	1.99	2.97	0.40	0.01	0.17	1.80	8.02	0.59	0.23	0.13	0.05	0.72
68	2345	6.11	21.63	37.51	4.41	0.10	2.52	27.81	100.09	0.72	2.00	2.95	0.37	0.01	0.17	1.83	8.03	0.59	0.23	0.12	0.05	0.72
69	2380	5.96	21.56	37.60	4.63	0.21	2.57	27.60	100.13	0.70	1.99	2.95	0.39	0.01	0.17	1.81	8.02	0.59	0.23	0.13	0.06	0.72
70	2415	5.91	21.56	37.40	4.70	0.25	2.69	27.82	100.33	0.69	2.00	2.94	0.40	0.01	0.18	1.83	8.04	0.59	0.22	0.13	0.06	0.73
71	2450	5.69	21.27	37.78	4.58	0.22	2.75	27.96	100.25	0.67	1.97	2.97	0.39	0.01	0.18	1.84	8.02	0.60	0.22	0.13	0.06	0.73
72	2485	5.56	21.27	37.36	4.53	0.16	2.69	28.15	99.72	0.65	1.98	2.95	0.38	0.01	0.18	1.86	8.03	0.60	0.21	0.12	0.06	0.74
73	2520	5.41	21.32	37.42	4.56	0.27	2.94	29.07	100.97	0.63	1.97	2.94	0.38	0.02	0.20	1.91	8.05	0.61	0.20	0.12	0.06	0.75
74	2555	5.19	21.17	37.30	4.20	0.20	2.99	28.59	99.64	0.61	1.98	2.96	0.36	0.01	0.20	1.90	8.02	0.62	0.20	0.12	0.07	0.76

Table 1.42: Composition of garnet A2 from sample HJ-58b (group 3) as analysed along traverse C-D (Plate 6.5h). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	4.63	21.49	37.46	4.02	0.17	3.22	29.49	100.46	0.54	2.00	2.96	0.34	0.01	0.22	1.95	8.02	0.64	0.18	0.11	0.07	0.78
2	34	4.82	21.30	37.30	4.17	0.21	2.99	28.91	99.71	0.57	1.99	2.96	0.35	0.01	0.20	1.92	8.02	0.63	0.19	0.12	0.07	0.77
3	68	5.14	21.62	37.87	4.31	0.23	2.74	27.97	99.88	0.60	2.01	2.98	0.36	0.01	0.18	1.84	7.99	0.62	0.20	0.12	0.06	0.75
4	102	5.09	21.48	37.75	4.47	0.21	2.68	28.67	100.35	0.60	1.99	2.97	0.38	0.01	0.18	1.89	8.01	0.62	0.20	0.12	0.06	0.76
5	136	5.42	21.29	37.45	4.52	0.11	2.68	28.10	99.56	0.64	1.99	2.97	0.38	0.01	0.18	1.86	8.02	0.61	0.21	0.13	0.06	0.74
6	170	5.82	21.99	37.68	4.79	0.22	2.87	28.70	102.05	0.67	2.01	2.92	0.40	0.01	0.19	1.86	8.05	0.60	0.22	0.13	0.06	0.73
7	204	5.50	21.62	37.80	4.58	0.18	2.53	28.38	100.59	0.64	2.00	2.96	0.38	0.01	0.17	1.86	8.02	0.61	0.21	0.13	0.05	0.74
8	238	5.64	21.45	37.47	4.58	0.17	2.47	28.29	100.08	0.66	1.99	2.95	0.39	0.01	0.16	1.86	8.03	0.61	0.22	0.13	0.05	0.74
9	272	5.57	21.52	37.64	4.60	0.17	2.59	27.88	99.97	0.65	2.00	2.96	0.39	0.01	0.17	1.84	8.02	0.60	0.21	0.13	0.06	0.74
10	306	5.98	21.46	37.75	4.70	0.26	2.69	28.19	101.04	0.70	1.97	2.95	0.39	0.02	0.18	1.84	8.04	0.59	0.22	0.13	0.06	0.73
11	340	5.74	21.48	37.86	4.58	0.17	2.55	27.43	99.81	0.67	1.99	2.98	0.39	0.01	0.17	1.80	8.01	0.59	0.22	0.13	0.06	0.73
12	374	5.92	21.69	37.81	4.61	0.18	2.55	27.85	100.62	0.69	2.00	2.95	0.39	0.01	0.17	1.82	8.02	0.59	0.23	0.13	0.06	0.73
13	408	6.11	21.79	37.89	4.86	0.23	2.60	28.09	101.57	0.71	1.99	2.94	0.40	0.01	0.17	1.82	8.04	0.59	0.23	0.13	0.05	0.72
14	442	5.94	21.41	38.00	4.66	0.17	2.49	27.68	100.35	0.69	1.97	2.97	0.39	0.01	0.16	1.81	8.02	0.59	0.23	0.13	0.05	0.72
15	476	6.21	21.85	38.36	4.72	0.27	2.57	27.95	101.91	0.71	1.98	2.95	0.39	0.02	0.17	1.80	8.02	0.59	0.23	0.13	0.05	0.72
16	510	5.97	21.54	38.06	4.70	0.15	2.55	27.77	100.74	0.69	1.98	2.97	0.39	0.01	0.17	1.81	8.02	0.59	0.23	0.13	0.05	0.72
17	544	6.20	21.66	38.13	4.62	0.22	2.47	27.52	100.83	0.72	1.99	2.96	0.39	0.01	0.16	1.79	8.02	0.59	0.24	0.13	0.05	0.71
18	578	6.22	21.85	39.53	4.39	0.07	2.47	27.71	102.25	0.71	1.97	3.02	0.36	0.00	0.16	1.77	7.98	0.59	0.24	0.12	0.05	0.71
19	612	6.50	21.57	38.04	4.68	0.33	2.72	27.90	101.74	0.75	1.96	2.94	0.39	0.02	0.18	1.80	8.04	0.58	0.24	0.12	0.06	0.71
20	646	6.14	21.58	37.80	4.39	0.15	2.55	27.19	99.81	0.72	2.00	2.97	0.37	0.01	0.17	1.78	8.01	0.59	0.24	0.12	0.06	0.71
21	680	6.16	21.46	37.93	4.34	0.18	2.57	26.94	99.58	0.72	1.99	2.98	0.37	0.01	0.17	1.77	8.00	0.58	0.24	0.12	0.06	0.71
22	714	6.41	21.75	38.42	4.55	0.18	2.47	28.32	102.10	0.74	1.97	2.96	0.37	0.01	0.16	1.82	8.03	0.59	0.24	0.12	0.05	0.71
23	748	6.23	21.51	37.81	4.50	0.22	2.51	27.75	100.53	0.73	1.98	2.95	0.38	0.01	0.17	1.81	8.03	0.59	0.24	0.12	0.05	0.71
24	782	6.09	21.44	38.01	4.50	0.11	2.38	27.78	100.31	0.71	1.98	2.97	0.38	0.01	0.16	1.82	8.02	0.59	0.23	0.12	0.05	0.72
25	816	6.47	21.79	38.11	4.46	0.20	2.65	28.01	101.69	0.75	1.98	2.94	0.37	0.01	0.17	1.81	8.04	0.58	0.24	0.12	0.06	0.71
26	850	5.94	21.27	37.61	4.30	0.12	2.46	27.61	99.30	0.70	1.98	2.97	0.36	0.01	0.17	1.83	8.02	0.60	0.23	0.12	0.05	0.72

27	884	6.22	21.73	37.77	4.42	0.17	2.58	27.62	100.52	0.72	2.00	2.95	0.37	0.01	0.17	1.80	8.03	0.59	0.24	0.12	0.06	0.71
29	952	6.16	21.75	37.99	4.27	0.08	2.54	27.81	100.61	0.72	2.00	2.96	0.36	0.00	0.17	1.81	8.02	0.59	0.23	0.12	0.06	0.72
30	986	6.21	21.65	38.21	4.34	0.17	2.45	27.68	100.70	0.72	1.98	2.97	0.36	0.01	0.16	1.80	8.01	0.59	0.24	0.12	0.05	0.71
32	1054	6.13	21.45	37.70	4.36	0.15	2.58	27.23	99.60	0.72	1.99	2.97	0.37	0.01	0.17	1.79	8.02	0.59	0.24	0.12	0.06	0.71
33	1088	6.44	21.88	38.25	4.57	0.24	2.62	27.92	101.90	0.74	1.99	2.95	0.38	0.01	0.17	1.80	8.03	0.58	0.24	0.12	0.06	0.71
34	1122	6.25	21.87	38.27	4.55	0.16	2.49	27.80	101.39	0.72	1.99	2.96	0.38	0.01	0.16	1.80	8.02	0.59	0.24	0.12	0.05	0.71
35	1156	6.29	21.62	38.25	4.63	0.13	2.55	27.66	101.13	0.73	1.98	2.97	0.38	0.01	0.17	1.79	8.02	0.58	0.24	0.13	0.05	0.71
36	1190	6.30	21.59	37.76	4.61	0.24	2.51	27.69	100.69	0.73	1.98	2.95	0.39	0.01	0.17	1.81	8.03	0.58	0.24	0.12	0.05	0.71
37	1224	6.24	21.88	38.52	4.69	0.29	2.53	27.91	102.05	0.71	1.98	2.96	0.39	0.02	0.16	1.79	8.02	0.59	0.23	0.13	0.05	0.72
38	1258	6.15	21.38	37.80	4.52	0.26	2.51	27.24	99.86	0.72	1.98	2.97	0.38	0.02	0.17	1.79	8.02	0.59	0.24	0.12	0.05	0.71
39	1292	6.34	21.89	37.91	4.80	0.25	2.50	27.70	101.39	0.73	2.00	2.94	0.40	0.01	0.16	1.79	8.03	0.58	0.24	0.13	0.05	0.71
40	1326	6.34	21.91	37.98	4.79	0.29	2.55	27.97	101.83	0.73	1.99	2.93	0.40	0.02	0.17	1.81	8.04	0.58	0.24	0.13	0.05	0.71
41	1360	6.07	21.38	38.02	4.58	0.17	2.51	27.68	100.41	0.71	1.97	2.97	0.38	0.01	0.17	1.81	8.02	0.59	0.23	0.13	0.05	0.72
42	1394	6.41	21.78	37.86	4.83	0.28	2.55	27.74	101.45	0.74	1.99	2.93	0.40	0.02	0.17	1.80	8.04	0.58	0.24	0.13	0.05	0.71
43	1428	6.22	21.80	38.06	4.86	0.20	2.50	28.02	101.67	0.72	1.99	2.94	0.40	0.01	0.16	1.81	8.04	0.59	0.23	0.13	0.05	0.72
44	1462	6.16	21.57	37.99	4.70	0.18	2.56	27.70	100.86	0.71	1.98	2.96	0.39	0.01	0.17	1.80	8.03	0.59	0.23	0.13	0.05	0.72
45	1496	6.17	21.72	37.74	4.82	0.28	2.62	28.01	101.36	0.71	1.99	2.93	0.40	0.02	0.17	1.82	8.04	0.59	0.23	0.13	0.06	0.72
46	1530	6.28	21.86	37.89	4.77	0.16	2.51	27.54	101.01	0.73	2.00	2.94	0.40	0.01	0.16	1.79	8.03	0.58	0.24	0.13	0.05	0.71
47	1564	6.14	22.03	38.04	4.83	0.28	2.52	27.77	101.61	0.71	2.01	2.94	0.40	0.02	0.17	1.79	8.03	0.59	0.23	0.13	0.05	0.72
48	1598	6.09	21.78	38.15	4.67	0.14	2.44	27.62	100.88	0.71	1.99	2.96	0.39	0.01	0.16	1.79	8.02	0.59	0.23	0.13	0.05	0.72
49	1632	6.28	21.63	38.07	4.78	0.24	2.45	27.53	100.98	0.73	1.98	2.96	0.40	0.01	0.16	1.79	8.02	0.58	0.24	0.13	0.05	0.71
50	1666	6.18	21.81	38.03	4.76	0.15	2.60	27.66	101.20	0.71	1.99	2.95	0.40	0.01	0.17	1.79	8.03	0.58	0.23	0.13	0.06	0.72
51	1700	6.21	21.70	38.27	4.78	0.30	2.72	27.57	101.54	0.72	1.98	2.96	0.40	0.02	0.18	1.78	8.02	0.58	0.23	0.13	0.06	0.71
52	1734	5.92	21.56	37.58	4.67	0.23	2.51	27.76	100.23	0.69	1.99	2.95	0.39	0.01	0.17	1.82	8.03	0.59	0.23	0.13	0.05	0.72
53	1768	5.68	21.82	38.09	4.50	0.19	2.46	28.03	100.77	0.66	2.00	2.97	0.38	0.01	0.16	1.83	8.01	0.60	0.22	0.12	0.05	0.73
54	1802	5.53	21.44	38.03	4.56	0.17	2.63	28.05	100.43	0.65	1.98	2.98	0.38	0.01	0.17	1.84	8.01	0.60	0.21	0.13	0.06	0.74
55	1836	5.54	21.44	37.58	4.54	0.19	2.57	28.14	100.00	0.65	1.99	2.96	0.38	0.01	0.17	1.85	8.02	0.61	0.21	0.13	0.06	0.74
56	1870	5.39	21.30	37.55	4.48	0.17	2.69	28.45	100.02	0.63	1.98	2.96	0.38	0.01	0.18	1.88	8.03	0.61	0.21	0.12	0.06	0.75
57	1904	5.31	21.44	37.39	4.49	0.24	2.71	28.50	100.08	0.62	1.99	2.95	0.38	0.01	0.18	1.88	8.03	0.61	0.20	0.12	0.06	0.75
58	1938	4.90	21.34	37.43	4.34	0.14	2.95	28.84	99.94	0.58	1.99	2.96	0.37	0.01	0.20	1.91	8.02	0.63	0.19	0.12	0.06	0.77
59	1972	4.69	21.52	37.58	4.23	0.29	3.07	28.85	100.23	0.55	2.00	2.97	0.36	0.02	0.21	1.90	8.00	0.63	0.18	0.12	0.07	0.78

Table 1.43: Composition of garnet A3 from sample HJ-58b (group 3) as analysed along traverse A-B (Plate 6.5i). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
2	34	3.73	21.12	37.14	3.70	0.14	5.07	29.07	99.97	0.44	1.99	2.97	0.32	0.01	0.34	1.94	8.02	0.64	0.15	0.10	0.11	0.81
3	68	4.03	21.26	37.42	4.14	0.20	4.64	28.73	100.41	0.48	1.99	2.97	0.35	0.01	0.31	1.91	8.01	0.63	0.16	0.12	0.10	0.80
4	102	4.42	21.43	37.56	4.15	0.28	4.05	28.46	100.35	0.52	2.00	2.97	0.35	0.02	0.27	1.88	8.01	0.62	0.17	0.12	0.09	0.78
5	136	4.93	21.77	38.48	4.26	0.22	3.78	29.15	102.59	0.57	1.98	2.97	0.35	0.01	0.25	1.88	8.01	0.62	0.19	0.12	0.08	0.77
6	170	4.74	21.12	37.20	4.16	0.04	3.38	28.36	99.01	0.57	1.99	2.97	0.36	0.00	0.23	1.90	8.01	0.62	0.19	0.12	0.08	0.77
7	204	5.16	21.41	37.72	4.30	0.07	3.34	28.61	100.59	0.60	1.98	2.97	0.36	0.00	0.22	1.88	8.02	0.61	0.20	0.12	0.07	0.76
8	238	5.43	21.45	37.89	4.42	0.24	3.05	28.11	100.61	0.63	1.98	2.97	0.37	0.01	0.20	1.84	8.01	0.60	0.21	0.12	0.07	0.74
9	272	5.50	21.35	37.36	4.40	0.29	3.04	27.69	99.63	0.65	1.99	2.96	0.37	0.02	0.20	1.83	8.02	0.60	0.21	0.12	0.07	0.74
10	306	5.82	21.65	37.93	4.50	0.18	2.92	27.49	100.49	0.68	1.99	2.96	0.38	0.01	0.19	1.80	8.01	0.59	0.22	0.12	0.06	0.73
11	340	5.97	21.67	38.06	4.50	0.16	2.90	28.13	101.41	0.69	1.98	2.95	0.37	0.01	0.19	1.83	8.03	0.59	0.22	0.12	0.06	0.73
12	374	6.19	21.67	37.92	4.79	0.34	2.99	27.54	101.44	0.72	1.98	2.94	0.40	0.02	0.20	1.79	8.04	0.58	0.23	0.13	0.06	0.71
14	442	6.07	21.50	38.04	4.65	0.30	2.94	27.45	100.95	0.70	1.97	2.96	0.39	0.02	0.19	1.79	8.02	0.58	0.23	0.13	0.06	0.72
15	476	6.10	21.20	37.63	4.60	0.24	2.85	27.06	99.67	0.72	1.97	2.97	0.39	0.01	0.19	1.78	8.03	0.58	0.23	0.13	0.06	0.71
16	510	6.07	21.34	37.71	4.64	0.17	2.77	27.43	100.14	0.71	1.97	2.96	0.39	0.01	0.18	1.80	8.03	0.58	0.23	0.13	0.06	0.72
20	646	6.25	21.57	38.07	4.60	0.38	2.98	27.10	100.96	0.72	1.97	2.96	0.38	0.02	0.20	1.76	8.02	0.57	0.24	0.12	0.06	0.71
21	680	6.47	21.84	38.34	4.55	0.23	2.92	27.35	101.69	0.74	1.98	2.96	0.38	0.01	0.19	1.76	8.03	0.57	0.24	0.12	0.06	0.70
22	714	6.09	21.33	37.48	4.43	0.14	2.68	26.74	98.90	0.72	1.99	2.97	0.38	0.01	0.18	1.77	8.01	0.58	0.24	0.12	0.06	0.71
23	748	6.27	21.61	38.37	4.44	0.24	2.80	26.98	100.72	0.73	1.98	2.98	0.37	0.01	0.18	1.75	8.00	0.58	0.24	0.12	0.06	0.71
24	782	6.40	22.14	38.90	4.52	0.20	2.85	27.66	102.67	0.73	1.99	2.97	0.37	0.01	0.18	1.76	8.01	0.58	0.24	0.12	0.06	0.71
26	850	6.61	21.86	38.01	4.29	0.31	2.87	27.13	101.08	0.76	2.00	2.94	0.36	0.02	0.19	1.76	8.02	0.57	0.25	0.12	0.06	0.70
29	952	6.40	21.84	38.38	4.50	0.38	2.98	27.13	101.60	0.74	1.98	2.96	0.37	0.02	0.19	1.75	8.01	0.57	0.24	0.12	0.06	0.70
31	1020	6.39	21.75	38.11	4.46	0.18	2.98	27.26	101.13	0.74	1.99	2.96	0.37	0.01	0.20	1.77	8.03	0.58	0.24	0.12	0.06	0.71
32	1054	6.43	21.67	38.20	4.42	0.29	2.90	27.38	101.30	0.74	1.98	2.96	0.37	0.02	0.19	1.77	8.02	0.58	0.24	0.12	0.06	0.70
33	1088	6.18	21.53	38.09	4.25	0.15	2.74	27.70	100.64	0.72	1.98	2.97	0.36	0.01	0.18	1.81	8.02	0.59	0.23	0.12	0.06	0.72
34	1122	6.37	21.78	38.15	3.95	0.18	2.97	26.89	100.29	0.74	2.00	2.97	0.33	0.01	0.20	1.75	8.00	0.58	0.25	0.11	0.06	0.70
38	1258	6.64	22.12	38.42	4.20	0.37	3.17	27.76	102.67	0.75	1.99	2.93	0.34	0.02	0.20	1.77	8.02	0.58	0.25	0.11	0.07	0.70

39	1292	6.06	20.97	36.72	3.83	0.20	2.82	26.52	97.13	0.73	2.00	2.96	0.33	0.01	0.19	1.79	8.02	0.59	0.24	0.11	0.06	0.71
40	1326	6.29	21.50	37.82	3.47	0.16	2.97	27.19	99.40	0.74	2.00	2.98	0.29	0.01	0.20	1.79	8.00	0.59	0.24	0.10	0.07	0.71
49	1632	5.54	21.48	37.73	3.99	0.10	3.07	27.15	99.07	0.65	2.00	2.99	0.34	0.01	0.21	1.80	7.99	0.60	0.22	0.11	0.07	0.73
50	1666	5.77	21.59	37.76	4.36	0.19	3.23	28.13	101.03	0.67	1.99	2.95	0.36	0.01	0.21	1.84	8.03	0.60	0.22	0.12	0.07	0.73
51	1700	5.52	21.63	37.96	4.26	0.29	3.34	28.34	101.33	0.64	1.99	2.96	0.36	0.02	0.22	1.85	8.02	0.60	0.21	0.12	0.07	0.74
52	1734	5.26	21.25	37.61	4.04	0.09	3.45	28.07	99.76	0.62	1.98	2.98	0.34	0.01	0.23	1.86	8.01	0.61	0.20	0.11	0.08	0.75
53	1768	5.07	21.51	37.72	4.06	0.21	3.93	28.35	100.87	0.59	1.99	2.96	0.34	0.01	0.26	1.86	8.02	0.61	0.19	0.11	0.09	0.76
54	1802	4.47	21.15	36.99	3.90	0.22	4.42	28.51	99.66	0.53	1.99	2.95	0.33	0.01	0.30	1.90	8.02	0.62	0.17	0.11	0.10	0.78
55	1836	4.14	21.33	37.27	3.72	0.23	4.86	29.28	100.82	0.49	1.99	2.95	0.32	0.01	0.33	1.94	8.03	0.63	0.16	0.10	0.11	0.80

Table 1.44: Composition of garnet A4 from sample HJ-58b (group 3) as analysed along traverse A-B (Plate 6.5j). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	4.77	21.47	37.37	4.73	0.25	5.38	26.72	100.69	0.56	1.99	2.94	0.40	0.01	0.36	1.76	8.03	0.57	0.18	0.13	0.12	0.76
2	32	5.28	21.65	38.04	4.83	0.18	4.90	26.47	101.34	0.61	1.99	2.96	0.40	0.01	0.32	1.72	8.02	0.56	0.20	0.13	0.11	0.74
3	64	5.81	21.59	38.04	4.80	0.17	4.65	25.87	100.94	0.67	1.98	2.96	0.40	0.01	0.31	1.69	8.02	0.55	0.22	0.13	0.10	0.71
4	96	6.21	21.83	37.82	4.91	0.28	4.34	25.70	101.09	0.72	2.00	2.94	0.41	0.02	0.29	1.67	8.03	0.54	0.23	0.13	0.09	0.70
5	128	6.64	22.27	38.62	4.99	0.25	4.54	25.70	103.01	0.75	2.00	2.94	0.41	0.01	0.29	1.63	8.03	0.53	0.24	0.13	0.09	0.68
6	160	6.39	21.07	37.16	4.68	0.38	4.33	24.59	98.59	0.76	1.97	2.95	0.40	0.02	0.29	1.63	8.03	0.53	0.25	0.13	0.09	0.68
7	192	6.47	21.67	37.95	4.71	0.20	4.46	25.62	101.09	0.75	1.98	2.95	0.39	0.01	0.29	1.66	8.04	0.54	0.24	0.13	0.09	0.69
11	320	6.64	21.85	38.16	4.94	0.20	4.39	25.10	101.28	0.77	1.99	2.95	0.41	0.01	0.29	1.62	8.03	0.53	0.25	0.13	0.09	0.68
14	416	6.38	21.43	37.98	4.98	0.23	4.25	24.93	100.19	0.74	1.97	2.97	0.42	0.01	0.28	1.63	8.02	0.53	0.24	0.14	0.09	0.69
15	448	6.65	21.56	37.91	5.04	0.18	4.41	24.88	100.63	0.77	1.98	2.95	0.42	0.01	0.29	1.62	8.04	0.52	0.25	0.14	0.09	0.68
16	480	6.82	22.01	38.47	5.10	0.23	4.51	25.08	102.22	0.78	1.98	2.94	0.42	0.01	0.29	1.61	8.03	0.52	0.25	0.14	0.09	0.67
17	512	6.71	21.19	37.09	5.20	0.24	4.27	24.30	98.99	0.79	1.97	2.93	0.44	0.01	0.29	1.61	8.05	0.51	0.25	0.14	0.09	0.67
18	544	6.39	21.61	37.73	5.49	0.28	4.31	24.61	100.41	0.74	1.99	2.94	0.46	0.02	0.28	1.60	8.03	0.52	0.24	0.15	0.09	0.68
19	576	6.21	21.26	37.00	5.53	0.17	4.17	24.15	98.51	0.74	1.99	2.94	0.47	0.01	0.28	1.61	8.04	0.52	0.24	0.15	0.09	0.69
20	608	6.38	21.23	37.34	5.56	0.19	4.07	23.92	98.70	0.75	1.98	2.96	0.47	0.01	0.27	1.58	8.03	0.51	0.24	0.15	0.09	0.68
21	640	6.15	21.27	37.50	5.89	0.22	4.08	23.94	99.04	0.72	1.98	2.96	0.50	0.01	0.27	1.58	8.02	0.51	0.24	0.16	0.09	0.69
22	672	6.49	21.55	37.77	5.73	0.18	4.16	24.15	100.04	0.76	1.98	2.95	0.48	0.01	0.28	1.58	8.03	0.51	0.24	0.16	0.09	0.68
24	736	6.66	21.83	38.80	5.97	0.29	4.57	24.71	102.84	0.76	1.96	2.95	0.49	0.02	0.29	1.57	8.04	0.51	0.24	0.16	0.09	0.68
25	768	6.40	21.74	37.98	5.88	0.25	4.22	24.18	100.63	0.74	1.99	2.95	0.49	0.01	0.28	1.57	8.03	0.51	0.24	0.16	0.09	0.68
26	800	6.69	22.16	38.86	5.94	0.17	4.23	24.54	102.59	0.76	1.99	2.96	0.48	0.01	0.27	1.56	8.03	0.51	0.25	0.16	0.09	0.67
27	832	6.51	21.76	38.06	6.18	0.22	4.18	24.35	101.26	0.75	1.98	2.94	0.51	0.01	0.27	1.57	8.04	0.51	0.24	0.16	0.09	0.68
28	864	6.59	21.91	39.04	6.23	0.24	4.44	24.47	102.92	0.75	1.96	2.96	0.51	0.01	0.29	1.55	8.03	0.50	0.24	0.16	0.09	0.68
29	896	6.60	22.30	39.18	6.15	0.20	4.33	24.70	103.47	0.74	1.98	2.96	0.50	0.01	0.28	1.56	8.03	0.51	0.24	0.16	0.09	0.68
30	928	6.44	21.82	38.23	5.89	0.23	4.13	23.74	100.46	0.74	1.99	2.96	0.49	0.01	0.27	1.54	8.01	0.51	0.24	0.16	0.09	0.67
31	960	6.57	21.65	37.98	5.69	0.16	4.09	24.27	100.41	0.76	1.98	2.95	0.47	0.01	0.27	1.58	8.03	0.51	0.25	0.15	0.09	0.67
32	992	6.54	21.51	37.92	5.76	0.12	4.25	24.15	100.22	0.76	1.98	2.96	0.48	0.01	0.28	1.57	8.04	0.51	0.25	0.16	0.09	0.67

33	1024	6.38	21.46	37.90	5.91	0.13	4.30	24.05	100.13	0.74	1.97	2.96	0.49	0.01	0.28	1.57	8.03	0.51	0.24	0.16	0.09	0.68
34	1056	6.36	21.41	38.12	5.86	0.27	4.24	24.42	100.68	0.74	1.96	2.96	0.49	0.02	0.28	1.59	8.03	0.51	0.24	0.16	0.09	0.68
35	1088	6.42	21.74	37.86	5.72	0.16	4.24	24.39	100.54	0.74	1.99	2.94	0.48	0.01	0.28	1.59	8.03	0.51	0.24	0.15	0.09	0.68
36	1120	6.39	21.59	37.81	5.90	0.23	4.33	24.60	100.86	0.74	1.98	2.94	0.49	0.01	0.28	1.60	8.04	0.51	0.24	0.16	0.09	0.68
37	1152	6.06	21.47	37.86	5.84	0.22	4.04	24.14	99.64	0.71	1.98	2.97	0.49	0.01	0.27	1.58	8.01	0.52	0.23	0.16	0.09	0.69
38	1184	6.07	21.17	36.91	5.64	0.27	4.09	23.84	97.99	0.72	1.99	2.95	0.48	0.02	0.28	1.59	8.03	0.52	0.24	0.16	0.09	0.69
39	1216	6.11	21.57	38.09	5.73	0.17	4.34	24.62	100.62	0.71	1.98	2.96	0.48	0.01	0.29	1.60	8.02	0.52	0.23	0.16	0.09	0.69
40	1248	5.97	21.74	38.13	5.77	0.17	4.29	25.25	101.32	0.69	1.98	2.95	0.48	0.01	0.28	1.64	8.03	0.53	0.22	0.16	0.09	0.70
41	1280	5.73	20.98	37.35	5.41	0.17	4.33	24.77	98.75	0.68	1.97	2.97	0.46	0.01	0.29	1.65	8.03	0.53	0.22	0.15	0.09	0.71
42	1312	5.91	21.37	37.51	5.10	0.15	4.42	25.20	99.66	0.69	1.98	2.96	0.43	0.01	0.29	1.66	8.03	0.54	0.23	0.14	0.10	0.71
43	1344	5.90	21.85	38.31	5.10	0.25	4.79	25.61	101.81	0.68	1.99	2.96	0.42	0.01	0.31	1.65	8.02	0.54	0.22	0.14	0.10	0.71
44	1376	5.72	21.08	36.73	5.09	0.29	4.65	24.93	98.49	0.68	1.99	2.94	0.44	0.02	0.31	1.67	8.04	0.54	0.22	0.14	0.10	0.71

Table 1.45: Composition of garnet A4 from sample HJ-58b (group 3) as analysed along traverse C-D (Plate 6.5j). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
2	35	6.05	21.71	38.15	4.56	0.25	4.70	25.90	101.32	0.70	1.98	2.96	0.38	0.01	0.31	1.68	8.02	0.55	0.23	0.12	0.10	0.71
4	105	6.11	21.48	37.58	4.97	0.22	4.12	25.02	99.48	0.72	1.99	2.96	0.42	0.01	0.27	1.65	8.02	0.54	0.23	0.14	0.09	0.70
5	140	6.26	21.25	37.26	5.01	0.29	4.12	24.91	99.09	0.74	1.98	2.95	0.42	0.02	0.28	1.65	8.03	0.53	0.24	0.14	0.09	0.69
6	175	6.48	21.60	38.18	4.96	0.23	4.06	24.90	100.40	0.75	1.98	2.97	0.41	0.01	0.27	1.62	8.01	0.53	0.25	0.14	0.09	0.68
7	210	6.13	21.36	37.68	4.91	0.11	3.93	24.70	98.81	0.72	1.99	2.98	0.42	0.01	0.26	1.63	8.01	0.54	0.24	0.14	0.09	0.69
8	245	6.36	21.50	38.00	4.93	0.22	4.11	24.92	100.04	0.74	1.98	2.97	0.41	0.01	0.27	1.63	8.02	0.53	0.24	0.14	0.09	0.69
9	280	6.74	21.67	38.09	4.92	0.21	4.22	25.35	101.20	0.78	1.98	2.95	0.41	0.01	0.28	1.64	8.04	0.53	0.25	0.13	0.09	0.68
10	315	6.41	21.43	37.88	4.90	0.13	4.21	25.12	100.08	0.75	1.98	2.96	0.41	0.01	0.28	1.64	8.03	0.53	0.24	0.13	0.09	0.69
11	350	6.64	22.05	38.97	5.05	0.25	4.31	25.08	102.35	0.76	1.98	2.97	0.41	0.01	0.28	1.60	8.01	0.53	0.25	0.14	0.09	0.68
12	385	6.59	21.46	37.94	4.90	0.21	4.26	24.74	100.10	0.77	1.98	2.96	0.41	0.01	0.28	1.62	8.03	0.53	0.25	0.13	0.09	0.68
13	420	6.60	21.73	38.05	4.96	0.23	4.27	24.98	100.81	0.76	1.99	2.95	0.41	0.01	0.28	1.62	8.03	0.53	0.25	0.13	0.09	0.68
14	455	6.45	21.53	37.75	5.20	0.20	4.22	24.60	99.95	0.75	1.99	2.95	0.44	0.01	0.28	1.61	8.03	0.52	0.24	0.14	0.09	0.68
15	490	6.55	21.50	37.68	5.57	0.13	4.19	24.52	100.14	0.76	1.98	2.94	0.47	0.01	0.28	1.60	8.04	0.52	0.25	0.15	0.09	0.68
16	525	6.45	21.63	37.87	5.55	0.22	4.30	24.09	100.09	0.75	1.99	2.95	0.46	0.01	0.28	1.57	8.03	0.51	0.24	0.15	0.09	0.68
17	560	6.46	21.66	38.10	5.76	0.26	4.16	24.74	101.14	0.75	1.98	2.95	0.48	0.02	0.27	1.60	8.04	0.52	0.24	0.15	0.09	0.68
18	595	6.59	21.41	38.08	5.86	0.28	4.16	24.59	100.96	0.76	1.96	2.95	0.49	0.02	0.27	1.59	8.04	0.51	0.24	0.16	0.09	0.68
19	630	6.67	21.69	38.29	5.88	0.15	4.16	24.25	101.09	0.77	1.97	2.96	0.49	0.01	0.27	1.57	8.03	0.51	0.25	0.16	0.09	0.67
20	665	6.32	21.60	37.97	5.92	0.15	4.33	23.65	99.95	0.73	1.99	2.96	0.50	0.01	0.29	1.54	8.02	0.50	0.24	0.16	0.09	0.68
21	700	6.80	22.09	38.69	5.84	0.24	4.08	24.01	101.75	0.78	1.99	2.96	0.48	0.01	0.26	1.54	8.02	0.50	0.25	0.16	0.09	0.66
22	735	6.37	21.43	37.99	5.91	0.20	4.16	24.12	100.18	0.74	1.97	2.96	0.49	0.01	0.27	1.57	8.03	0.51	0.24	0.16	0.09	0.68
24	805	6.30	21.62	37.95	6.03	0.22	4.09	23.90	100.11	0.73	1.99	2.96	0.50	0.01	0.27	1.56	8.02	0.51	0.24	0.16	0.09	0.68
25	840	6.35	21.56	38.10	6.08	0.23	4.24	23.69	100.24	0.74	1.98	2.96	0.51	0.01	0.28	1.54	8.02	0.50	0.24	0.17	0.09	0.68
26	875	6.11	21.23	37.70	6.02	0.12	4.15	23.28	98.61	0.72	1.98	2.98	0.51	0.01	0.28	1.54	8.01	0.51	0.24	0.17	0.09	0.68
27	910	6.29	21.58	38.17	6.20	0.21	4.14	24.34	100.93	0.73	1.97	2.96	0.51	0.01	0.27	1.58	8.03	0.51	0.24	0.17	0.09	0.68
28	945	6.36	21.73	37.75	6.32	0.18	4.13	24.17	100.64	0.74	1.99	2.94	0.53	0.01	0.27	1.57	8.04	0.51	0.24	0.17	0.09	0.68
29	980	6.32	21.44	37.75	6.27	0.11	4.07	24.00	99.97	0.74	1.98	2.95	0.53	0.01	0.27	1.57	8.04	0.51	0.24	0.17	0.09	0.68

30	1015	6.10	21.56	38.22	5.85	0.17	4.27	24.12	100.31	0.71	1.98	2.97	0.49	0.01	0.28	1.57	8.01	0.52	0.23	0.16	0.09	0.69
31	1050	6.46	21.46	38.16	5.89	0.19	4.15	24.21	100.53	0.75	1.97	2.97	0.49	0.01	0.27	1.57	8.03	0.51	0.24	0.16	0.09	0.68
32	1085	6.51	21.61	38.00	5.83	0.24	4.28	24.26	100.72	0.75	1.98	2.95	0.49	0.01	0.28	1.58	8.04	0.51	0.24	0.16	0.09	0.68
33	1120	6.24	21.40	37.74	5.49	0.24	4.22	24.24	99.58	0.73	1.98	2.96	0.46	0.01	0.28	1.59	8.02	0.52	0.24	0.15	0.09	0.69
34	1155	6.52	21.70	37.94	5.58	0.24	4.25	24.22	100.44	0.76	1.99	2.95	0.46	0.01	0.28	1.57	8.03	0.51	0.25	0.15	0.09	0.68
35	1190	6.27	21.50	37.60	5.56	0.20	4.30	24.21	99.64	0.73	1.99	2.95	0.47	0.01	0.29	1.59	8.03	0.52	0.24	0.15	0.09	0.68
36	1225	6.41	21.55	38.18	5.75	0.18	4.29	24.10	100.46	0.74	1.97	2.97	0.48	0.01	0.28	1.57	8.02	0.51	0.24	0.16	0.09	0.68
37	1260	6.52	21.63	38.24	5.82	0.35	4.31	24.76	101.64	0.75	1.96	2.95	0.48	0.02	0.28	1.60	8.04	0.51	0.24	0.15	0.09	0.68
38	1295	6.22	21.31	37.72	5.53	0.14	4.32	24.60	99.84	0.73	1.97	2.96	0.46	0.01	0.29	1.61	8.03	0.52	0.24	0.15	0.09	0.69
39	1330	6.29	21.74	37.95	5.67	0.16	4.48	24.50	100.78	0.73	1.99	2.95	0.47	0.01	0.29	1.59	8.04	0.52	0.24	0.15	0.10	0.69
40	1365	5.98	21.67	37.71	5.63	0.16	4.27	24.57	99.98	0.70	2.00	2.95	0.47	0.01	0.28	1.61	8.03	0.53	0.23	0.15	0.09	0.70
41	1400	6.18	21.66	38.21	5.77	0.26	4.41	25.00	101.50	0.71	1.97	2.95	0.48	0.02	0.29	1.62	8.03	0.52	0.23	0.15	0.09	0.69
42	1435	6.33	21.61	38.15	5.44	0.16	4.40	24.59	100.68	0.73	1.98	2.96	0.45	0.01	0.29	1.60	8.02	0.52	0.24	0.15	0.09	0.69
43	1470	6.14	21.56	37.96	5.37	0.31	4.51	25.23	101.09	0.71	1.97	2.95	0.45	0.02	0.30	1.64	8.03	0.53	0.23	0.14	0.10	0.70
44	1505	6.33	21.67	37.93	5.02	0.27	4.52	25.36	101.10	0.73	1.98	2.94	0.42	0.02	0.30	1.65	8.04	0.53	0.24	0.13	0.10	0.69
45	1540	5.91	21.49	37.94	4.70	0.28	4.51	25.33	100.16	0.69	1.98	2.97	0.39	0.02	0.30	1.66	8.01	0.55	0.23	0.13	0.10	0.71
46	1575	6.09	21.57	37.86	4.49	0.22	4.66	25.76	100.65	0.71	1.98	2.95	0.38	0.01	0.31	1.68	8.03	0.55	0.23	0.12	0.10	0.70
47	1610	6.07	21.56	37.93	4.71	0.33	4.78	25.86	101.24	0.70	1.97	2.95	0.39	0.02	0.31	1.68	8.03	0.54	0.23	0.13	0.10	0.71
48	1645	5.61	21.50	37.72	4.65	0.14	4.79	25.65	100.06	0.66	1.99	2.96	0.39	0.01	0.32	1.69	8.02	0.55	0.22	0.13	0.10	0.72
49	1680	5.52	21.33	37.43	4.35	0.18	4.78	25.83	99.42	0.65	1.99	2.96	0.37	0.01	0.32	1.71	8.02	0.56	0.21	0.12	0.11	0.72
50	1715	5.45	21.45	37.56	4.50	0.13	5.01	25.90	99.99	0.64	1.99	2.96	0.38	0.01	0.33	1.71	8.02	0.56	0.21	0.12	0.11	0.73

Table 1.46: Composition of garnet A5 from sample HJ-58b (group 3) as analysed along traverse A-B (Plate 6.5j). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
2	33	3.28	21.06	37.25	4.36	0.16	5.45	27.75	99.31	0.39	1.99	2.99	0.37	0.01	0.37	1.86	7.99	0.62	0.13	0.12	0.12	0.83
3	66	4.16	21.54	37.52	4.63	0.26	5.45	28.07	101.63	0.49	1.99	2.94	0.39	0.02	0.36	1.84	8.03	0.60	0.16	0.13	0.12	0.79
4	99	4.41	21.43	37.52	4.65	0.22	4.82	27.75	100.80	0.52	1.99	2.96	0.39	0.01	0.32	1.83	8.02	0.60	0.17	0.13	0.11	0.78
5	132	4.83	21.09	37.33	4.55	0.21	4.06	27.54	99.60	0.57	1.98	2.97	0.39	0.01	0.27	1.83	8.02	0.60	0.19	0.13	0.09	0.76
6	165	5.12	21.26	37.57	4.43	0.23	3.66	27.85	100.12	0.60	1.98	2.97	0.37	0.01	0.24	1.84	8.02	0.60	0.20	0.12	0.08	0.75
7	198	5.64	21.50	37.85	4.64	0.39	3.54	27.92	101.47	0.65	1.97	2.95	0.39	0.02	0.23	1.82	8.03	0.59	0.21	0.13	0.08	0.74
8	231	5.56	21.82	37.39	4.45	0.20	3.51	27.53	100.45	0.65	2.02	2.94	0.37	0.01	0.23	1.81	8.03	0.59	0.21	0.12	0.08	0.74
9	264	5.84	21.57	37.90	4.50	0.30	3.69	27.56	101.35	0.68	1.98	2.95	0.38	0.02	0.24	1.79	8.03	0.58	0.22	0.12	0.08	0.73
10	297	5.61	21.46	37.32	4.23	0.22	3.66	27.44	99.94	0.66	2.00	2.95	0.36	0.01	0.24	1.81	8.03	0.59	0.21	0.12	0.08	0.73
11	330	5.77	21.14	37.46	3.93	0.25	3.96	27.63	100.14	0.68	1.97	2.96	0.33	0.02	0.26	1.82	8.03	0.59	0.22	0.11	0.09	0.73
15	462	6.06	21.85	38.13	4.10	0.23	3.69	27.36	101.42	0.70	2.00	2.95	0.34	0.01	0.24	1.77	8.02	0.58	0.23	0.11	0.08	0.72
16	495	5.76	21.68	37.67	4.50	0.23	3.53	27.24	100.60	0.67	2.00	2.95	0.38	0.01	0.23	1.78	8.03	0.58	0.22	0.12	0.08	0.73
17	528	5.98	21.42	37.46	4.49	0.13	3.43	26.35	99.27	0.70	2.00	2.96	0.38	0.01	0.23	1.74	8.02	0.57	0.23	0.12	0.08	0.71
18	561	5.92	21.22	37.92	4.58	0.17	3.34	27.03	100.17	0.69	1.96	2.98	0.39	0.01	0.22	1.77	8.02	0.58	0.23	0.13	0.07	0.72
19	594	6.14	21.52	37.78	4.63	0.13	3.45	26.59	100.24	0.72	1.99	2.96	0.39	0.01	0.23	1.74	8.03	0.57	0.23	0.13	0.07	0.71
20	627	6.05	21.36	37.58	4.59	0.18	3.15	26.48	99.39	0.71	1.99	2.97	0.39	0.01	0.21	1.75	8.02	0.57	0.23	0.13	0.07	0.71
21	660	6.22	21.68	37.89	4.64	0.14	3.22	26.97	100.76	0.72	1.99	2.95	0.39	0.01	0.21	1.76	8.03	0.57	0.23	0.13	0.07	0.71
22	693	6.28	21.71	37.68	4.62	0.21	3.05	26.48	100.02	0.73	2.00	2.95	0.39	0.01	0.20	1.73	8.02	0.57	0.24	0.13	0.07	0.70
23	726	6.22	21.51	38.00	4.65	0.17	3.18	26.26	99.99	0.73	1.98	2.97	0.39	0.01	0.21	1.72	8.01	0.56	0.24	0.13	0.07	0.70
24	759	6.28	21.48	37.66	4.68	0.18	3.00	26.53	99.80	0.73	1.99	2.96	0.39	0.01	0.20	1.74	8.03	0.57	0.24	0.13	0.06	0.70
25	792	6.30	21.66	37.98	4.80	0.18	3.20	26.46	100.59	0.73	1.99	2.96	0.40	0.01	0.21	1.72	8.02	0.56	0.24	0.13	0.07	0.70
26	825	6.51	21.58	37.71	5.08	0.23	3.22	26.33	100.65	0.76	1.98	2.94	0.42	0.01	0.21	1.72	8.04	0.55	0.24	0.14	0.07	0.69
27	858	6.54	21.58	37.89	4.66	0.12	3.20	26.17	100.16	0.76	1.99	2.96	0.39	0.01	0.21	1.71	8.02	0.56	0.25	0.13	0.07	0.69
28	891	6.37	21.65	37.96	4.82	0.19	3.12	26.50	100.60	0.74	1.99	2.96	0.40	0.01	0.21	1.73	8.02	0.56	0.24	0.13	0.07	0.70
29	924	6.26	21.35	37.77	4.65	0.15	3.03	26.25	99.47	0.73	1.98	2.97	0.39	0.01	0.20	1.73	8.02	0.57	0.24	0.13	0.07	0.70
30	957	6.06	21.35	37.48	4.60	0.20	3.13	26.39	99.21	0.71	1.99	2.96	0.39	0.01	0.21	1.74	8.02	0.57	0.23	0.13	0.07	0.71

31	990	6.28	21.53	37.93	4.80	0.18	3.06	26.50	100.28	0.73	1.98	2.96	0.40	0.01	0.20	1.73	8.02	0.56	0.24	0.13	0.07	0.70
32	1023	6.44	21.50	37.88	4.85	0.25	3.14	26.46	100.52	0.75	1.98	2.95	0.40	0.01	0.21	1.73	8.03	0.56	0.24	0.13	0.07	0.70
33	1056	6.29	21.80	38.21	4.91	0.27	3.18	26.45	101.11	0.73	1.99	2.96	0.41	0.02	0.21	1.71	8.02	0.56	0.24	0.13	0.07	0.70
34	1089	6.38	21.80	38.20	4.88	0.42	3.24	26.71	101.63	0.73	1.98	2.95	0.40	0.02	0.21	1.72	8.02	0.56	0.24	0.13	0.07	0.70
35	1122	6.22	21.83	37.99	4.91	0.20	3.20	26.59	100.95	0.72	2.00	2.95	0.41	0.01	0.21	1.73	8.02	0.56	0.23	0.13	0.07	0.71
36	1155	6.22	21.65	38.12	4.79	0.24	3.24	26.33	100.59	0.72	1.98	2.97	0.40	0.01	0.21	1.71	8.01	0.56	0.24	0.13	0.07	0.70
37	1188	6.11	21.77	37.75	4.74	0.28	3.32	26.83	100.82	0.71	2.00	2.94	0.40	0.02	0.22	1.75	8.03	0.57	0.23	0.13	0.07	0.71
38	1221	6.10	21.48	37.88	4.61	0.13	3.34	26.87	100.40	0.71	1.98	2.96	0.39	0.01	0.22	1.76	8.03	0.57	0.23	0.13	0.07	0.71
39	1254	5.92	21.38	37.69	4.49	0.14	3.35	26.65	99.61	0.70	1.99	2.97	0.38	0.01	0.22	1.76	8.02	0.58	0.23	0.12	0.07	0.72
40	1287	5.98	21.52	37.47	4.82	0.18	3.13	27.00	100.11	0.70	1.99	2.94	0.41	0.01	0.21	1.77	8.03	0.57	0.23	0.13	0.07	0.72
41	1320	6.08	21.53	37.90	4.85	0.16	3.22	27.24	100.99	0.71	1.98	2.95	0.40	0.01	0.21	1.77	8.04	0.57	0.23	0.13	0.07	0.72
42	1353	6.03	21.36	37.58	4.74	0.19	3.16	27.25	100.31	0.70	1.98	2.95	0.40	0.01	0.21	1.79	8.04	0.58	0.23	0.13	0.07	0.72
43	1386	5.44	21.23	37.75	4.80	0.13	3.31	27.24	99.90	0.64	1.97	2.98	0.41	0.01	0.22	1.80	8.02	0.59	0.21	0.13	0.07	0.74
44	1419	5.83	21.42	37.89	4.78	0.19	3.57	26.89	100.56	0.68	1.97	2.96	0.40	0.01	0.24	1.76	8.02	0.57	0.22	0.13	0.08	0.72
45	1452	5.39	21.70	37.99	4.83	0.24	3.69	27.80	101.64	0.62	1.99	2.95	0.40	0.01	0.24	1.81	8.02	0.59	0.20	0.13	0.08	0.74
46	1485	5.16	21.55	37.81	4.79	0.35	3.93	27.55	101.15	0.60	1.98	2.95	0.40	0.02	0.26	1.80	8.02	0.59	0.20	0.13	0.09	0.75
47	1518	4.63	21.27	37.45	4.66	0.23	4.37	27.89	100.51	0.55	1.98	2.96	0.39	0.01	0.29	1.84	8.03	0.60	0.18	0.13	0.10	0.77
49	1584	3.89	21.23	37.06	4.41	0.26	5.55	28.22	100.62	0.46	1.99	2.94	0.38	0.02	0.37	1.87	8.03	0.61	0.15	0.12	0.12	0.80
50	1617	2.89	21.14	36.93	4.42	0.19	5.81	28.49	99.86	0.35	2.00	2.96	0.38	0.01	0.39	1.91	8.01	0.63	0.11	0.13	0.13	0.85

Table 1.47: Composition of garnet A5 from sample HJ-58b (group 3) as analysed along traverse C-D (Plate 6.5j). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
1	0	3.83	21.32	37.15	4.10	0.23	5.76	27.93	100.32	0.45	2.00	2.95	0.35	0.01	0.39	1.86	8.02	0.61	0.15	0.11	0.13	0.80
2	31	3.74	21.14	37.16	4.06	0.13	5.64	28.08	99.95	0.44	1.99	2.97	0.35	0.01	0.38	1.88	8.02	0.61	0.15	0.11	0.13	0.81
3	62	3.78	21.31	37.02	4.05	0.23	5.60	27.92	99.89	0.45	2.01	2.96	0.35	0.01	0.38	1.86	8.02	0.61	0.15	0.11	0.12	0.81
4	93	3.65	21.23	37.23	4.51	0.18	5.72	27.76	100.27	0.43	1.99	2.96	0.38	0.01	0.39	1.85	8.02	0.61	0.14	0.13	0.13	0.81
6	155	3.14	21.19	36.83	4.55	0.14	5.74	27.79	99.38	0.38	2.01	2.96	0.39	0.01	0.39	1.87	8.01	0.62	0.12	0.13	0.13	0.83
7	186	4.21	21.29	37.16	4.70	0.18	4.61	27.72	99.87	0.50	2.00	2.96	0.40	0.01	0.31	1.84	8.02	0.60	0.16	0.13	0.10	0.79
8	217	4.76	21.26	37.62	4.58	0.25	4.22	27.91	100.59	0.56	1.97	2.96	0.39	0.01	0.28	1.84	8.02	0.60	0.18	0.13	0.09	0.77
9	248	5.42	23.85	37.77	4.32	0.12	3.50	26.50	101.48	0.62	2.16	2.91	0.36	0.01	0.23	1.71	7.99	0.59	0.21	0.12	0.08	0.73
10	279	5.42	21.42	37.44	4.67	0.16	3.37	27.02	99.49	0.64	2.00	2.96	0.40	0.01	0.23	1.79	8.02	0.59	0.21	0.13	0.07	0.74
11	310	6.15	21.62	37.35	4.65	0.31	3.52	27.31	100.90	0.72	1.99	2.92	0.39	0.02	0.23	1.78	8.04	0.57	0.23	0.12	0.07	0.71
13	372	6.00	21.52	37.68	4.43	0.12	3.07	26.80	99.62	0.70	2.00	2.97	0.37	0.01	0.20	1.76	8.02	0.58	0.23	0.12	0.07	0.71
14	403	6.24	21.51	37.83	4.31	0.09	3.33	27.11	100.43	0.73	1.98	2.96	0.36	0.01	0.22	1.77	8.03	0.58	0.24	0.12	0.07	0.71
15	434	6.38	21.50	38.01	4.46	0.19	3.20	26.39	100.11	0.74	1.98	2.97	0.37	0.01	0.21	1.73	8.02	0.56	0.24	0.12	0.07	0.70
16	465	6.50	21.81	37.86	4.39	0.23	3.34	27.03	101.16	0.75	1.99	2.94	0.37	0.01	0.22	1.75	8.04	0.57	0.24	0.12	0.07	0.70
17	496	6.43	21.60	37.89	4.37	0.23	3.09	27.18	100.79	0.75	1.98	2.95	0.36	0.01	0.20	1.77	8.03	0.57	0.24	0.12	0.07	0.70
18	527	6.41	21.56	37.94	4.44	0.17	3.07	26.67	100.27	0.75	1.98	2.96	0.37	0.01	0.20	1.74	8.02	0.57	0.24	0.12	0.07	0.70
19	558	6.15	21.27	37.37	4.33	0.15	3.10	26.55	98.91	0.73	1.99	2.96	0.37	0.01	0.21	1.76	8.02	0.57	0.24	0.12	0.07	0.71
20	589	6.39	21.49	37.82	4.44	0.21	3.13	27.04	100.51	0.74	1.98	2.95	0.37	0.01	0.21	1.77	8.03	0.57	0.24	0.12	0.07	0.70
21	620	6.24	21.58	37.61	4.54	0.20	3.10	26.50	99.75	0.73	2.00	2.95	0.38	0.01	0.21	1.74	8.02	0.57	0.24	0.12	0.07	0.70
22	651	6.63	21.53	37.76	4.73	0.27	3.22	26.61	100.75	0.77	1.98	2.94	0.39	0.02	0.21	1.73	8.04	0.56	0.25	0.13	0.07	0.69
23	682	6.40	21.46	37.87	4.70	0.24	3.20	26.31	100.17	0.75	1.98	2.96	0.39	0.01	0.21	1.72	8.03	0.56	0.24	0.13	0.07	0.70
24	713	6.16	21.24	37.69	4.62	0.28	3.13	26.50	99.63	0.72	1.97	2.97	0.39	0.02	0.21	1.74	8.02	0.57	0.24	0.13	0.07	0.71
25	744	6.72	21.70	37.87	4.74	0.39	3.29	26.60	101.31	0.78	1.98	2.93	0.39	0.02	0.22	1.72	8.04	0.55	0.25	0.13	0.07	0.69
26	775	6.45	21.38	37.77	4.68	0.19	3.21	26.54	100.21	0.75	1.97	2.96	0.39	0.01	0.21	1.74	8.03	0.56	0.24	0.13	0.07	0.70
27	806	6.35	21.30	37.80	4.62	0.14	3.08	26.57	99.87	0.74	1.97	2.97	0.39	0.01	0.20	1.74	8.03	0.57	0.24	0.13	0.07	0.70
28	837	6.37	21.90	37.67	4.91	0.24	3.25	26.52	100.86	0.74	2.01	2.93	0.41	0.01	0.21	1.72	8.04	0.56	0.24	0.13	0.07	0.70

29	868	6.45	21.71	38.06	4.89	0.20	3.28	26.52	101.11	0.75	1.98	2.95	0.41	0.01	0.22	1.72	8.03	0.56	0.24	0.13	0.07	0.70
30	899	6.45	21.91	37.80	4.81	0.32	3.22	27.07	101.58	0.74	2.00	2.92	0.40	0.02	0.21	1.75	8.05	0.56	0.24	0.13	0.07	0.70
31	930	6.31	21.51	38.06	4.83	0.16	3.17	26.21	100.24	0.73	1.98	2.97	0.40	0.01	0.21	1.71	8.02	0.56	0.24	0.13	0.07	0.70
32	961	6.20	21.86	37.82	4.75	0.19	3.13	27.05	101.01	0.72	2.00	2.94	0.40	0.01	0.21	1.76	8.03	0.57	0.23	0.13	0.07	0.71
33	992	6.16	21.07	37.48	4.65	0.18	3.06	26.29	98.89	0.73	1.97	2.97	0.40	0.01	0.21	1.74	8.02	0.57	0.24	0.13	0.07	0.71
34	1023	6.98	22.75	39.21	5.01	0.35	3.18	26.38	103.86	0.78	2.01	2.94	0.40	0.02	0.20	1.65	8.00	0.54	0.26	0.13	0.07	0.68
38	1147	6.61	22.01	38.01	4.87	0.33	3.47	26.87	102.18	0.76	1.99	2.92	0.40	0.02	0.23	1.72	8.03	0.56	0.24	0.13	0.07	0.70
39	1178	5.88	21.33	37.50	4.43	0.18	3.39	27.30	100.02	0.69	1.98	2.95	0.37	0.01	0.23	1.80	8.03	0.58	0.22	0.12	0.07	0.72
41	1240	5.59	21.47	37.69	4.59	0.18	3.70	27.35	100.58	0.65	1.98	2.96	0.39	0.01	0.25	1.79	8.03	0.58	0.21	0.13	0.08	0.73
42	1271	5.39	21.61	37.48	4.69	0.28	3.80	27.72	100.96	0.63	1.99	2.93	0.39	0.02	0.25	1.82	8.04	0.59	0.20	0.13	0.08	0.74
43	1302	5.35	21.43	37.57	4.73	0.27	3.69	28.13	101.17	0.62	1.98	2.94	0.40	0.02	0.24	1.84	8.04	0.59	0.20	0.13	0.08	0.75
44	1333	5.44	21.54	37.82	4.76	0.14	3.78	27.73	101.21	0.63	1.98	2.95	0.40	0.01	0.25	1.81	8.03	0.59	0.20	0.13	0.08	0.74
45	1364	4.96	21.23	37.10	4.71	0.21	3.65	27.17	99.04	0.59	2.00	2.96	0.40	0.01	0.25	1.81	8.02	0.59	0.19	0.13	0.08	0.75
46	1395	4.98	21.40	37.15	4.63	0.16	3.79	28.35	100.46	0.59	1.99	2.94	0.39	0.01	0.25	1.87	8.04	0.60	0.19	0.13	0.08	0.76
47	1426	4.65	21.22	37.26	4.72	0.20	3.99	27.38	99.43	0.55	1.99	2.96	0.40	0.01	0.27	1.82	8.01	0.60	0.18	0.13	0.09	0.77
48	1457	4.37	21.10	37.29	4.61	0.16	4.43	28.19	100.16	0.52	1.98	2.96	0.39	0.01	0.30	1.87	8.03	0.61	0.17	0.13	0.10	0.78
49	1488	3.77	21.19	37.39	4.45	0.16	5.07	28.12	100.15	0.45	1.99	2.97	0.38	0.01	0.34	1.87	8.01	0.62	0.15	0.12	0.11	0.81
50	1519	3.26	20.97	37.01	4.43	0.16	5.89	28.06	99.79	0.39	1.98	2.97	0.38	0.01	0.40	1.88	8.02	0.62	0.13	0.12	0.13	0.83

Table 1.48: Composition of garnet A6 from sample HJ-74 (group 3) as analysed along traverse A-B (Plate 6.5l). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
2	30	5.34	22.38	39.42	3.32	0.14	1.31	30.41	102.32	0.61	2.02	3.02	0.27	0.01	0.08	1.95	7.96	0.67	0.21	0.09	0.03	0.76
7	180	5.80	22.90	39.13	3.26	0.12	1.47	30.28	102.95	0.66	2.05	2.97	0.27	0.01	0.09	1.92	7.96	0.65	0.22	0.09	0.03	0.75
10	270	5.73	22.56	39.16	3.53	0.11	1.39	28.60	101.09	0.66	2.05	3.01	0.29	0.01	0.09	1.84	7.95	0.64	0.23	0.10	0.03	0.74
13	360	5.45	22.48	39.36	4.18	0.08	1.25	28.49	101.27	0.62	2.04	3.03	0.34	0.00	0.08	1.83	7.95	0.64	0.22	0.12	0.03	0.75
22	630	5.44	21.35	36.32	4.52	0.09	0.89	27.39	96.00	0.66	2.05	2.96	0.39	0.01	0.06	1.87	8.00	0.63	0.22	0.13	0.02	0.74
24	690	6.07	23.12	40.16	5.80	0.08	1.05	26.65	102.93	0.68	2.05	3.01	0.47	0.00	0.07	1.67	7.95	0.58	0.24	0.16	0.02	0.71
26	750	6.18	23.07	40.17	5.87	0.10	0.94	26.91	103.25	0.69	2.04	3.01	0.47	0.01	0.06	1.69	7.96	0.58	0.24	0.16	0.02	0.71
45	1320	6.49	23.22	40.44	5.80	0.11	1.00	26.30	103.37	0.72	2.04	3.02	0.46	0.01	0.06	1.64	7.95	0.57	0.25	0.16	0.02	0.69
55	1620	7.18	23.51	40.48	3.39	0.15	1.10	28.22	104.04	0.79	2.06	3.00	0.27	0.01	0.07	1.75	7.95	0.61	0.28	0.09	0.02	0.69
63	1860	6.47	22.82	39.30	4.12	0.00	1.01	26.88	100.60	0.74	2.06	3.01	0.34	0.00	0.07	1.72	7.95	0.60	0.26	0.12	0.02	0.70
74	2190	6.55	23.33	39.71	4.17	0.05	0.94	27.29	102.04	0.74	2.08	3.00	0.34	0.00	0.06	1.73	7.95	0.60	0.26	0.12	0.02	0.70
77	2280	6.79	23.07	40.45	4.27	0.08	0.95	27.98	103.58	0.75	2.03	3.02	0.34	0.00	0.06	1.75	7.95	0.60	0.26	0.12	0.02	0.70
80	2370	6.82	23.12	39.74	3.82	0.05	1.08	27.53	102.17	0.77	2.06	3.00	0.31	0.00	0.07	1.74	7.95	0.60	0.27	0.11	0.02	0.69
86	2550	6.56	23.14	39.96	3.04	0.10	1.18	29.27	103.25	0.74	2.05	3.00	0.25	0.01	0.08	1.84	7.95	0.64	0.25	0.08	0.03	0.71
95	2820	6.81	23.45	40.43	3.15	0.15	1.22	28.99	104.19	0.75	2.05	3.01	0.25	0.01	0.08	1.80	7.95	0.62	0.26	0.09	0.03	0.70
113	3360	6.55	23.15	39.65	3.18	0.08	1.15	28.62	102.37	0.74	2.07	3.00	0.26	0.00	0.07	1.81	7.95	0.63	0.26	0.09	0.03	0.71
117	3480	6.22	23.23	39.63	3.34	0.08	1.23	28.55	102.28	0.70	2.08	3.01	0.27	0.00	0.08	1.81	7.95	0.63	0.25	0.09	0.03	0.72
119	3540	6.28	22.62	39.71	3.58	0.12	1.33	28.31	101.94	0.71	2.03	3.02	0.29	0.01	0.09	1.80	7.95	0.62	0.25	0.10	0.03	0.72
127	3780	6.40	23.24	39.62	3.59	0.06	1.09	28.20	102.20	0.72	2.08	3.00	0.29	0.00	0.07	1.79	7.95	0.62	0.25	0.10	0.02	0.71
131	3900	6.21	23.37	39.99	3.90	0.12	1.34	28.49	103.42	0.69	2.07	3.00	0.31	0.01	0.09	1.79	7.95	0.62	0.24	0.11	0.03	0.72
149	4440	6.54	23.11	39.88	2.88	0.14	1.43	28.83	102.81	0.74	2.05	3.01	0.23	0.01	0.09	1.82	7.95	0.63	0.26	0.08	0.03	0.71

Table 1.49: Composition of garnet A6 from sample HJ-74 (group 3) as analysed along traverse C-D (Plate 6.5l). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
39	1216	6.70	22.96	39.84	3.39	0.09	1.08	28.10	102.16	0.76	2.05	3.01	0.27	0.01	0.07	1.78	7.95	0.62	0.26	0.10	0.02	0.70
43	1344	6.61	22.75	39.58	2.79	0.08	0.97	28.98	101.76	0.75	2.04	3.02	0.23	0.00	0.06	1.85	7.95	0.64	0.26	0.08	0.02	0.71
53	1664	6.26	22.82	39.33	2.76	0.06	1.08	29.19	101.49	0.71	2.06	3.01	0.23	0.00	0.07	1.87	7.95	0.65	0.25	0.08	0.02	0.72
59	1856	5.91	22.72	38.05	2.72	0.07	1.11	28.50	99.07	0.69	2.10	2.99	0.23	0.00	0.07	1.87	7.95	0.65	0.24	0.08	0.03	0.73
66	2080	6.51	22.92	39.41	3.57	0.10	0.92	27.87	101.31	0.74	2.06	3.01	0.29	0.01	0.06	1.78	7.95	0.62	0.26	0.10	0.02	0.71
70	2208	6.67	23.06	39.83	3.68	0.07	0.95	27.80	102.07	0.75	2.06	3.01	0.30	0.00	0.06	1.76	7.95	0.61	0.26	0.10	0.02	0.70
73	2304	6.80	22.68	39.83	3.42	0.08	1.09	28.17	102.06	0.77	2.03	3.02	0.28	0.00	0.07	1.79	7.95	0.62	0.26	0.10	0.02	0.70
90	2848	5.92	22.49	39.63	3.99	0.00	1.06	28.67	101.76	0.67	2.03	3.03	0.33	0.00	0.07	1.83	7.95	0.63	0.23	0.11	0.02	0.73
97	3072	6.46	23.44	39.98	3.95	0.14	1.12	28.42	103.51	0.72	2.07	2.99	0.32	0.01	0.07	1.78	7.96	0.62	0.25	0.11	0.02	0.71
102	3232	6.09	22.94	39.35	3.56	0.09	1.29	28.02	101.34	0.69	2.07	3.01	0.29	0.00	0.08	1.79	7.95	0.63	0.24	0.10	0.03	0.72
114	3616	6.59	22.81	40.05	3.24	0.12	1.25	28.91	102.97	0.74	2.03	3.02	0.26	0.01	0.08	1.82	7.95	0.63	0.25	0.09	0.03	0.71
118	3744	6.31	22.63	39.66	2.87	0.07	1.11	29.20	101.85	0.72	2.03	3.02	0.23	0.00	0.07	1.86	7.95	0.65	0.25	0.08	0.02	0.72
120	3808	6.68	23.06	39.91	2.99	0.10	1.27	29.39	103.41	0.75	2.04	3.00	0.24	0.01	0.08	1.85	7.96	0.63	0.26	0.08	0.03	0.71

Table 1.50: Composition of garnet A7 from sample HJ-74 (group 3) as analysed along traverse E-F (Plate 6.5m). Distance is in microns from starting point E.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
8	245	6.23	23.03	39.92	3.67	0.10	1.30	28.63	102.90	0.70	2.05	3.01	0.30	0.01	0.08	1.81	7.95	0.63	0.24	0.10	0.03	0.72
10	315	5.90	23.13	39.74	3.91	0.18	1.31	28.51	102.68	0.67	2.06	3.01	0.32	0.01	0.08	1.80	7.95	0.63	0.23	0.11	0.03	0.73
35	1190	6.12	22.66	40.15	5.30	0.11	1.09	26.99	102.42	0.69	2.02	3.03	0.43	0.01	0.07	1.70	7.95	0.59	0.24	0.15	0.02	0.71
39	1330	6.54	23.47	40.20	4.87	0.17	1.13	27.21	103.60	0.73	2.06	3.00	0.39	0.01	0.07	1.70	7.95	0.59	0.25	0.13	0.02	0.70
41	1400	6.56	22.93	39.78	4.56	0.12	1.06	26.69	101.70	0.74	2.05	3.02	0.37	0.01	0.07	1.69	7.95	0.59	0.26	0.13	0.02	0.70
42	1435	6.76	23.29	40.36	4.54	0.07	1.08	27.65	103.75	0.75	2.04	3.01	0.36	0.00	0.07	1.72	7.96	0.59	0.26	0.12	0.02	0.70
58	1995	6.63	23.19	39.94	4.98	0.11	1.18	26.84	102.87	0.74	2.05	3.00	0.40	0.01	0.08	1.69	7.96	0.58	0.26	0.14	0.03	0.69
61	2100	6.13	22.87	39.62	4.60	0.11	1.07	27.65	102.03	0.69	2.05	3.01	0.37	0.01	0.07	1.76	7.95	0.61	0.24	0.13	0.02	0.72
63	2170	5.44	21.22	38.03	4.44	0.09	1.23	27.29	97.73	0.65	1.99	3.03	0.38	0.01	0.08	1.82	7.96	0.62	0.22	0.13	0.03	0.74
68	2345	5.03	21.40	37.37	3.76	0.10	1.32	28.84	97.83	0.60	2.02	3.00	0.32	0.01	0.09	1.93	7.98	0.66	0.20	0.11	0.03	0.76
74	2555	5.09	23.01	39.85	3.34	0.10	1.37	30.81	103.57	0.57	2.05	3.01	0.27	0.01	0.09	1.95	7.95	0.68	0.20	0.09	0.03	0.77
96	3325	6.00	22.99	39.54	5.28	0.08	1.08	27.16	102.14	0.68	2.06	3.00	0.43	0.00	0.07	1.72	7.96	0.59	0.23	0.15	0.02	0.72
104	3605	5.87	22.98	39.80	5.56	0.00	1.04	27.19	102.43	0.66	2.05	3.01	0.45	0.00	0.07	1.72	7.96	0.59	0.23	0.16	0.02	0.72
106	3675	5.84	22.91	39.35	5.04	0.07	1.01	26.91	101.12	0.67	2.07	3.01	0.41	0.00	0.07	1.72	7.95	0.60	0.23	0.14	0.02	0.72
114	3955	6.11	22.77	39.71	3.99	0.10	1.12	28.23	102.04	0.69	2.04	3.02	0.33	0.01	0.07	1.79	7.95	0.62	0.24	0.11	0.03	0.72
115	3990	6.25	23.06	39.39	3.75	0.06	1.21	28.02	101.75	0.71	2.07	3.00	0.31	0.00	0.08	1.78	7.95	0.62	0.25	0.11	0.03	0.72
118	4095	6.43	23.13	40.23	3.15	0.15	1.21	29.19	103.50	0.72	2.04	3.02	0.25	0.01	0.08	1.83	7.95	0.64	0.25	0.09	0.03	0.72

Table 1.51: Composition of garnet A8 from sample HJ-74 (group 3) as analysed along traverse A-B (Plate 6.5n). Distance is in microns from starting point A.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
7	210	5.30	22.80	39.54	3.02	0.08	1.58	30.92	103.23	0.60	2.04	3.00	0.25	0.00	0.10	1.96	7.96	0.67	0.21	0.08	0.03	0.77
12	385	5.66	22.58	39.48	3.77	0.07	1.28	29.45	102.27	0.64	2.03	3.01	0.31	0.00	0.08	1.88	7.96	0.65	0.22	0.11	0.03	0.74
13	420	5.39	22.72	39.45	3.77	0.07	1.32	29.30	102.02	0.61	2.05	3.02	0.31	0.00	0.09	1.87	7.95	0.65	0.21	0.11	0.03	0.75
24	805	5.69	22.90	39.58	4.97	0.14	1.22	27.56	102.06	0.65	2.05	3.01	0.40	0.01	0.08	1.75	7.95	0.61	0.22	0.14	0.03	0.73
29	980	5.91	22.86	39.97	4.83	0.11	1.12	28.14	102.93	0.66	2.03	3.02	0.39	0.01	0.07	1.78	7.96	0.61	0.23	0.13	0.02	0.73
34	1155	6.24	23.13	39.91	5.19	0.14	1.16	27.30	103.06	0.70	2.05	3.00	0.42	0.01	0.07	1.72	7.96	0.59	0.24	0.14	0.03	0.71
43	1470	6.55	23.17	39.65	4.84	0.24	1.00	26.71	102.16	0.74	2.06	3.00	0.39	0.01	0.06	1.69	7.95	0.59	0.26	0.14	0.02	0.70
48	1645	6.66	22.95	39.06	4.22	0.07	0.64	27.70	101.29	0.76	2.07	2.99	0.35	0.00	0.04	1.77	7.97	0.61	0.26	0.12	0.01	0.70
50	1715	6.59	23.03	39.81	5.03	0.11	1.21	26.88	102.66	0.74	2.04	3.00	0.41	0.01	0.08	1.69	7.96	0.58	0.25	0.14	0.03	0.70
58	1995	6.07	22.77	39.87	6.15	0.12	1.06	25.84	101.88	0.69	2.03	3.02	0.50	0.01	0.07	1.64	7.95	0.57	0.24	0.17	0.02	0.70
64	2205	4.89	18.62	32.62	4.92	0.15	0.82	23.01	85.02	0.67	2.01	2.99	0.48	0.01	0.06	1.76	7.99	0.59	0.22	0.16	0.02	0.73
65	2240	5.62	22.69	40.25	6.11	0.10	0.95	27.09	102.80	0.63	2.02	3.03	0.49	0.01	0.06	1.71	7.95	0.59	0.22	0.17	0.02	0.73
69	2380	5.39	22.55	39.55	5.47	0.09	1.19	27.46	101.69	0.61	2.03	3.02	0.45	0.01	0.08	1.75	7.95	0.61	0.21	0.15	0.03	0.74
72	2485	5.16	22.88	39.85	4.30	0.08	1.11	29.54	102.91	0.58	2.04	3.02	0.35	0.00	0.07	1.87	7.95	0.65	0.20	0.12	0.02	0.76
75	2590	4.40	22.46	39.16	3.24	0.08	1.38	31.53	102.25	0.50	2.04	3.02	0.27	0.00	0.09	2.03	7.95	0.70	0.17	0.09	0.03	0.80

Table 1.52: Composition of garnet A8 from sample HJ-74 (group 3) as analysed along traverse C-D (Plate 6.5n). Distance is in microns from starting point C.

		Oxide percentage								Cations on a 12 (O) basis								Molar Fraction				
#	Distance	MgO	Al_2O_3	SiO_2	CaO	TiO_2	MnO	FeO	Total	Mg	Al	Si	Ca	Ti	Mn	Fe	Total	X_{Alm}	X_{Prp}	X_{Grs}	X_{Sps}	X_{Fe}
2	35	6.09	23.39	39.82	2.88	0.11	1.53	29.28	103.10	0.68	2.08	3.00	0.23	0.01	0.10	1.85	7.95	0.65	0.24	0.08	0.03	0.73
8	245	5.92	22.81	39.65	2.77	0.08	1.29	29.37	101.88	0.67	2.05	3.03	0.23	0.00	0.08	1.87	7.95	0.66	0.24	0.08	0.03	0.74
9	280	6.25	22.84	40.05	3.08	0.00	1.28	29.44	102.93	0.70	2.03	3.02	0.25	0.00	0.08	1.86	7.95	0.64	0.24	0.09	0.03	0.73
11	350	5.74	22.86	39.64	3.21	0.10	1.40	29.77	102.72	0.65	2.05	3.01	0.26	0.01	0.09	1.89	7.95	0.65	0.22	0.09	0.03	0.74
18	595	5.78	22.83	39.76	4.15	0.06	1.27	28.43	102.28	0.65	2.04	3.02	0.34	0.00	0.08	1.81	7.95	0.63	0.23	0.12	0.03	0.73
27	910	6.10	22.81	39.68	5.19	0.06	1.08	27.55	102.47	0.69	2.04	3.00	0.42	0.00	0.07	1.74	7.97	0.60	0.24	0.14	0.02	0.72
34	1155	6.27	23.01	40.06	5.01	0.11	1.12	27.44	103.02	0.70	2.04	3.01	0.40	0.01	0.07	1.72	7.96	0.59	0.24	0.14	0.02	0.71
39	1330	6.43	23.23	39.81	4.62	0.12	1.04	27.08	102.34	0.72	2.07	3.00	0.37	0.01	0.07	1.71	7.95	0.60	0.25	0.13	0.02	0.70
43	1470	6.14	22.71	39.70	4.69	0.07	1.09	27.29	101.69	0.70	2.04	3.02	0.38	0.00	0.07	1.74	7.95	0.60	0.24	0.13	0.02	0.71
51	1750	5.94	22.71	39.85	5.37	0.11	1.24	26.97	102.19	0.67	2.03	3.02	0.44	0.01	0.08	1.71	7.95	0.59	0.23	0.15	0.03	0.72
52	1785	5.82	22.58	39.85	5.42	0.15	1.07	27.06	101.95	0.66	2.02	3.03	0.44	0.01	0.07	1.72	7.95	0.60	0.23	0.15	0.02	0.72
53	1820	6.04	22.56	40.09	5.62	0.13	0.92	27.12	102.47	0.68	2.01	3.03	0.46	0.01	0.06	1.71	7.95	0.59	0.23	0.16	0.02	0.72
59	2030	5.20	23.15	39.56	4.74	0.12	1.32	28.85	102.94	0.59	2.07	3.00	0.38	0.01	0.08	1.83	7.95	0.63	0.20	0.13	0.03	0.76
68	2345	5.48	22.64	39.11	3.35	0.08	1.15	29.28	101.10	0.63	2.06	3.02	0.28	0.00	0.08	1.89	7.95	0.66	0.22	0.10	0.03	0.75

APPENDIX 2: BIOTITE ANALYSES*

(Only analyses with acceptable stoichiometry are included here.)

* Note: in all tables FeO = FeO + Fe_2O_3

Table 2.1: Analysis of biotite associated with garnet A3 from sample HJ-35d (group 1). $T_{\#}$ represents the transect number and # represents the points analysed with increasing distance from garnet, with the first analysis being adjacent to garnet and the last analysis being furthest from garnet.

		Oxide percentage								Cations on a 11(O) basis									Anions		Molar Fractions		Proportion on the oct. site			
$T_{\#}$	#	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	MnO	FeO	Total	Mg	Al^{IV}	Al^{VI}	Si	K	Ti	Mn	Fe	Total	F	Cl	X_{Fe}	X_{Mg}	X_{Fe}^{VI}	X_{Mg}^{VI}	X_{Al}^{VI}	X_{Ti}^{VI}
T_1	1	19.88	18.36	39.99	9.84	3.46	0.17	8.49	101.18	2.03	1.26	0.22	2.74	0.86	0.18	0.01	0.49	7.79	0.27	0.01	0.19	0.81	0.17	0.70	0.08	0.06
	2	18.74	17.20	38.41	9.43	2.91	0.04	8.06	96.80	2.04	1.20	0.28	2.80	0.88	0.16	0.00	0.49	7.84	0.30	0.01	0.19	0.81	0.17	0.69	0.09	0.05
	3	19.57	17.82	39.05	9.37	2.73	0.10	8.31	99.96	2.08	1.22	0.27	2.78	0.85	0.15	0.01	0.49	7.84	0.30	0.00	0.19	0.81	0.17	0.69	0.09	0.05
	4	19.65	17.91	39.04	9.62	3.22	0.17	8.72	102.32	2.05	1.27	0.21	2.73	0.86	0.17	0.01	0.51	7.81	0.27	0.01	0.20	0.80	0.17	0.70	0.07	0.06
	5	18.61	17.43	38.38	9.43	2.76	0.06	7.64	99.31	2.03	1.19	0.31	2.81	0.88	0.15	0.00	0.47	7.84	0.33	0.00	0.19	0.81	0.16	0.69	0.10	0.05
	8	17.52	16.41	37.97	9.03	2.96	0.00	9.68	101.58	1.94	1.17	0.26	2.83	0.86	0.17	0.00	0.60	7.83	0.30	0.01	0.24	0.76	0.20	0.65	0.09	0.06
T_2	1	20.63	17.82	39.50	9.61	2.49	0.05	6.78	97.87	2.17	1.21	0.27	2.79	0.87	0.13	0.00	0.40	7.84	0.32	0.01	0.16	0.84	0.13	0.73	0.09	0.04
	2	20.08	17.67	39.05	9.45	2.62	0.07	6.57	97.51	2.14	1.21	0.28	2.79	0.86	0.14	0.00	0.39	7.82	0.33	0.00	0.16	0.84	0.13	0.72	0.10	0.05
	3	17.35	18.94	40.13	9.00	3.22	0.13	7.69	99.46	1.82	1.17	0.40	2.83	0.81	0.17	0.01	0.45	7.66	0.28	0.01	0.20	0.80	0.16	0.64	0.14	0.06
	4	18.34	17.26	38.19	9.48	3.26	0.07	8.53	99.13	1.99	1.23	0.25	2.77	0.88	0.18	0.00	0.52	7.81	0.27	0.01	0.21	0.79	0.18	0.68	0.09	0.06
	5	19.78	18.12	39.46	9.62	3.35	0.09	8.52	103.93	2.05	1.26	0.23	2.74	0.85	0.17	0.01	0.50	7.81	0.30	0.00	0.19	0.81	0.17	0.70	0.08	0.06
	6	18.43	17.51	38.74	9.71	3.49	0.11	9.24	103.23	1.96	1.24	0.23	2.76	0.88	0.19	0.01	0.55	7.81	0.26	0.01	0.22	0.78	0.19	0.67	0.08	0.06
	10	18.82	17.21	38.45	8.96	2.80	0.04	7.71	103.99	2.05	1.19	0.29	2.81	0.84	0.15	0.00	0.47	7.81	0.28	0.01	0.19	0.81	0.16	0.69	0.10	0.05

Table 2.2: Analysis of biotite associated with garnets from sample HJ-35a (group 1). $T_{\#}$ represents the transect number and # represents the points analysed with increasing distance from garnet, with the first analysis being adjacent to garnet and the last analysis being furthest from garnet.

			Oxide percentage								Cations on a 11(O) basis									Anions		Molar Fractions		Proportion on the oct. site			
Grt	$T_{\#}$	#	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	MnO	FeO	Total	Mg	Al^{IV}	Al^{VI}	Si	K	Ti	Mn	Fe	Total	F	Cl	X_{Fe}	X_{Mg}	X_{Fe}^{VI}	X_{Mg}^{VI}	X_{Al}^{VI}	X_{Ti}^{VI}
A1	T_1	1	18.51	19.95	39.73	9.75	2.52	0.15	9.53	101.14	1.89	1.28	0.34	2.72	0.85	0.13	0.01	0.55	7.77	0.19	0.01	0.22	0.78	0.19	0.65	0.12	0.04
		2	17.99	19.23	39.34	9.73	2.33	0.07	9.33	100.02	1.88	1.24	0.35	2.76	0.87	0.12	0.00	0.55	7.77	0.17	0.01	0.23	0.77	0.19	0.65	0.12	0.04
		4	18.24	18.80	39.00	9.65	2.16	0.07	9.06	100.97	1.93	1.23	0.34	2.77	0.87	0.12	0.00	0.54	7.80	0.23	0.01	0.22	0.78	0.18	0.66	0.12	0.04
		5	17.21	19.08	38.07	9.39	2.00	0.04	9.18	99.97	1.86	1.24	0.39	2.76	0.87	0.11	0.00	0.56	7.79	0.20	0.01	0.23	0.77	0.19	0.64	0.13	0.04
		7	17.61	18.23	38.50	9.57	2.63	0.08	9.56	103.18	1.89	1.23	0.31	2.77	0.88	0.14	0.01	0.57	7.80	0.19	0.01	0.23	0.77	0.20	0.65	0.11	0.05
A1	T_2	1	18.48	18.72	37.95	9.80	2.06	0.07	8.37	96.44	1.99	1.26	0.34	2.74	0.90	0.11	0.00	0.51	7.85	0.23	0.01	0.20	0.80	0.17	0.68	0.11	0.04
		2	18.95	19.76	39.36	9.76	2.26	0.13	7.96	100.19	1.97	1.26	0.36	2.74	0.87	0.12	0.01	0.46	7.78	0.23	0.01	0.19	0.81	0.16	0.68	0.12	0.04
		3	17.87	19.08	38.87	9.60	2.00	0.06	8.96	99.44	1.90	1.22	0.39	2.78	0.88	0.11	0.00	0.54	7.82	0.22	0.00	0.22	0.78	0.18	0.65	0.13	0.04
		4	18.00	19.38	39.01	9.62	1.87	0.04	8.79	100.70	1.91	1.22	0.40	2.78	0.87	0.10	0.00	0.52	7.81	0.22	0.01	0.22	0.78	0.18	0.65	0.14	0.04
A8	T_1	1	18.16	18.66	38.77	9.55	2.59	0.07	8.85	96.66	1.93	1.24	0.33	2.76	0.87	0.14	0.00	0.53	7.80	0.22	0.01	0.21	0.79	0.18	0.66	0.11	0.05
		2	18.44	19.13	38.70	9.65	2.62	0.10	8.78	97.41	1.94	1.27	0.32	2.73	0.87	0.14	0.01	0.52	7.79	0.21	0.01	0.21	0.79	0.18	0.66	0.11	0.05
		3	18.05	18.66	38.85	9.69	2.74	0.11	9.24	97.35	1.91	1.25	0.31	2.75	0.88	0.15	0.01	0.55	7.80	0.23	0.01	0.22	0.78	0.19	0.65	0.11	0.05
		4	18.86	19.83	39.93	10.04	2.77	0.28	9.62	101.35	1.90	1.30	0.29	2.70	0.87	0.14	0.02	0.55	7.76	0.20	0.01	0.22	0.78	0.19	0.66	0.10	0.05
		5	17.82	18.79	38.74	9.55	2.23	0.08	8.92	96.14	1.90	1.23	0.36	2.77	0.87	0.12	0.00	0.53	7.78	0.20	0.01	0.22	0.78	0.18	0.65	0.12	0.04
		6	17.98	19.24	38.71	9.61	2.78	0.11	9.55	97.99	1.89	1.28	0.32	2.72	0.86	0.15	0.01	0.56	7.79	0.22	0.01	0.23	0.77	0.19	0.65	0.11	0.05
		7	17.51	18.52	38.55	9.49	2.47	0.06	9.13	95.74	1.88	1.22	0.35	2.78	0.87	0.13	0.00	0.55	7.79	0.21	0.01	0.23	0.77	0.19	0.65	0.12	0.05
		8	16.01	17.44	37.74	9.42	3.69	0.04	10.20	94.54	1.76	1.22	0.29	2.78	0.88	0.20	0.00	0.63	7.76	0.17	0.01	0.26	0.74	0.22	0.61	0.10	0.07
		9	15.83	20.62	39.64	8.56	3.09	0.13	8.88	96.75	1.65	1.22	0.48	2.78	0.77	0.16	0.01	0.52	7.59	0.17	0.00	0.24	0.76	0.18	0.59	0.17	0.06

Table 2.3: Analysis of biotite associated with garnet A7 from sample HJ-34b (group 2) . # represents the points analysed with increasing distance from garnet, the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

	Oxide percentage								Cations on a 11(O) basis									Anions		Molar Fractions		Proportion on the oct. site			
#	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	MnO	FeO	Total	Mg	Al^{IV}	Al^{VI}	Si	K	Ti	Mn	Fe	Total	F	Cl	X_{Fe}	X_{Mg}	X_{Fe}^{VI}	X_{Mg}^{VI}	X_{Al}^{VI}	X_{Ti}^{VI}
2	14.86	17.64	37.95	8.63	4.19	0.04	10.74	94.05	1.63	1.20	0.33	2.80	0.81	0.23	0.00	0.66	7.67	0.23	0.01	0.29	0.71	0.23	0.57	0.12	0.08
3	15.02	17.71	37.39	9.43	4.41	0.13	10.95	95.03	1.65	1.25	0.29	2.75	0.88	0.24	0.01	0.67	7.75	0.25	0.01	0.29	0.71	0.24	0.58	0.10	0.09
7	14.35	17.30	37.51	9.58	4.79	0.06	11.65	95.24	1.58	1.24	0.27	2.76	0.90	0.27	0.00	0.72	7.73	0.22	0.01	0.31	0.69	0.25	0.56	0.09	0.09
8	14.37	17.25	37.92	9.61	4.74	0.07	11.51	95.46	1.57	1.21	0.28	2.79	0.90	0.26	0.00	0.71	7.73	0.26	0.01	0.31	0.69	0.25	0.56	0.10	0.09
9	14.61	17.41	37.70	9.43	4.51	0.05	11.60	95.31	1.60	1.23	0.28	2.77	0.88	0.25	0.00	0.71	7.73	0.25	0.00	0.31	0.69	0.25	0.56	0.10	0.09
10	14.61	18.19	38.89	9.72	4.60	0.09	12.41	98.51	1.55	1.23	0.29	2.77	0.88	0.25	0.01	0.74	7.71	0.21	0.00	0.32	0.68	0.26	0.55	0.10	0.09
11	13.99	17.45	37.18	9.50	4.48	0.10	11.76	94.45	1.55	1.24	0.29	2.76	0.90	0.25	0.01	0.73	7.73	0.22	0.01	0.32	0.68	0.26	0.55	0.10	0.09
12	13.73	17.50	37.21	9.67	4.78	0.05	12.01	94.95	1.52	1.25	0.28	2.75	0.91	0.27	0.00	0.74	7.72	0.20	0.01	0.33	0.67	0.27	0.54	0.10	0.09
14	13.50	18.05	37.38	9.54	4.62	0.04	12.05	95.19	1.48	1.25	0.32	2.75	0.90	0.26	0.00	0.74	7.70	0.20	0.01	0.33	0.67	0.27	0.53	0.11	0.09
15	13.66	17.77	37.48	9.41	4.80	0.08	12.39	95.59	1.49	1.25	0.28	2.75	0.88	0.26	0.00	0.76	7.68	0.19	0.00	0.34	0.66	0.27	0.53	0.10	0.09

Table 2.4: Analysis of biotite associated with garnet A3 from sample HJ-34c (group 2). # represents the points analysed with increasing distance from garnet, the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

	Oxide percentage								Cations on a 11(O) basis									Anions		Molar Fractions		Proportion on the oct. site			
#	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	MnO	FeO	Total	Mg	Al^{IV}	Al^{VI}	Si	K	Ti	Mn	Fe	Total	F	Cl	X_{Fe}	X_{Mg}	X_{Fe}^{VI}	X_{Mg}^{VI}	X_{Al}^{VI}	X_{Ti}^{VI}
1	14.25	16.82	37.81	8.92	4.96	0.07	11.42	94.25	1.57	1.20	0.26	2.80	0.84	0.28	0.00	0.71	7.66	0.20	0.01	0.31	0.69	0.25	0.56	0.09	0.10
2	14.52	17.28	37.83	9.05	4.79	0.05	11.07	94.58	1.59	1.22	0.28	2.78	0.85	0.27	0.00	0.68	7.67	0.21	0.01	0.30	0.70	0.24	0.56	0.10	0.09
3	13.58	16.78	37.40	9.43	5.42	0.06	12.21	94.89	1.50	1.23	0.24	2.77	0.89	0.30	0.00	0.76	7.69	0.19	0.01	0.34	0.66	0.27	0.54	0.08	0.11
4	14.08	17.97	38.20	9.60	5.13	0.06	11.94	96.98	1.51	1.25	0.28	2.75	0.88	0.28	0.00	0.72	7.67	0.14	0.01	0.32	0.68	0.26	0.54	0.10	0.10
5	13.47	16.79	36.95	9.41	5.32	0.06	11.90	93.92	1.50	1.23	0.25	2.77	0.90	0.30	0.00	0.75	7.70	0.20	0.01	0.33	0.67	0.27	0.54	0.09	0.11
6	9.81	22.13	38.08	6.93	4.06	0.06	10.54	91.61	1.08	1.19	0.73	2.81	0.65	0.23	0.00	0.65	7.34	0.12	0.01	0.38	0.62	0.24	0.40	0.27	0.08
7	12.43	17.29	37.13	9.64	5.94	0.08	13.39	95.90	1.37	1.26	0.24	2.74	0.91	0.33	0.01	0.83	7.67	0.17	0.01	0.38	0.62	0.30	0.49	0.09	0.12
8	13.62	17.09	37.14	9.56	5.33	0.05	12.20	94.99	1.50	1.25	0.24	2.75	0.90	0.30	0.00	0.76	7.71	0.19	0.01	0.33	0.67	0.27	0.54	0.09	0.11
9	13.66	17.13	37.84	9.71	5.64	0.06	12.42	96.46	1.48	1.24	0.23	2.76	0.90	0.31	0.00	0.76	7.68	0.17	0.01	0.34	0.66	0.27	0.53	0.08	0.11
10	12.76	17.07	36.74	9.48	5.38	0.08	12.18	93.68	1.43	1.24	0.27	2.76	0.91	0.30	0.00	0.77	7.68	0.20	0.01	0.35	0.65	0.28	0.52	0.10	0.11
11	13.24	17.35	36.97	9.65	5.20	0.06	11.96	94.43	1.47	1.25	0.28	2.75	0.92	0.29	0.00	0.74	7.70	0.18	0.01	0.34	0.66	0.27	0.53	0.10	0.10
12	13.40	17.74	37.85	9.70	5.42	0.06	12.28	96.44	1.45	1.25	0.27	2.75	0.90	0.30	0.00	0.75	7.66	0.14	0.01	0.34	0.66	0.27	0.53	0.10	0.11
13	12.31	16.58	35.78	9.30	5.35	0.08	12.02	91.42	1.42	1.24	0.27	2.76	0.91	0.31	0.01	0.78	7.69	0.20	0.01	0.35	0.65	0.28	0.51	0.10	0.11

Table 2.5: Analysis of biotite associated with garnets from sample HJ-58c (group 2). $T_{\#}$ represents the transect number and # represents the points analysed with increasing distance from garnet, with the first analysis being adjacent to garnet and the last analysis being furthest from garnet (N/A = element not analysed).

			Oxide percentage								Cations on a 11(O) basis									Anions		Molar Fractions		Proportion on the oct. site			
Grt	$T_{\#}$	#	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	MnO	FeO	Total	Mg	Al^{IV}	Al^{VI}	Si	K	Ti	Mn	Fe	Total	F	Cl	X_{Fe}	X_{Mg}	X_{Fe}^{VI}	X_{Mg}^{VI}	X_{Al}^{VI}	X_{Ti}^{VI}
A1	T_1	1	15.48	18.01	38.13	9.40	3.55	0.00	9.78	94.33	1.68	1.22	0.32	2.78	0.87	0.19	0.00	0.60	7.67	N/A	N/A	0.26	0.74	0.21	0.60	0.12	0.07
		2	14.99	17.78	38.39	9.65	4.38	0.00	10.25	95.33	1.61	1.23	0.29	2.77	0.89	0.24	0.00	0.62	7.65	N/A	N/A	0.28	0.72	0.22	0.59	0.10	0.09
		3	14.52	18.94	37.52	9.61	2.89	0.07	11.10	94.66	1.59	1.25	0.39	2.75	0.90	0.16	0.00	0.68	7.72	N/A	N/A	0.30	0.70	0.24	0.56	0.14	0.06
		4	14.23	17.92	37.19	9.44	3.44	0.07	12.14	94.44	1.57	1.25	0.31	2.75	0.89	0.19	0.00	0.75	7.71	N/A	N/A	0.32	0.68	0.27	0.56	0.11	0.07
		5	14.27	19.10	37.23	9.12	2.64	0.12	11.95	94.41	1.57	1.26	0.40	2.74	0.86	0.15	0.01	0.74	7.72	N/A	N/A	0.32	0.68	0.26	0.55	0.14	0.05
		6	12.71	18.04	37.23	9.47	3.77	0.15	13.17	94.55	1.41	1.23	0.35	2.77	0.90	0.21	0.01	0.82	7.69	N/A	N/A	0.37	0.63	0.29	0.51	0.12	0.08
		7	13.79	18.04	37.82	9.61	3.43	0.03	11.83	94.56	1.51	1.21	0.35	2.79	0.90	0.19	0.00	0.73	7.69	N/A	N/A	0.32	0.68	0.26	0.54	0.13	0.07
		8	13.96	18.16	37.93	9.72	3.58	0.00	12.19	95.53	1.52	1.23	0.34	2.77	0.91	0.20	0.00	0.75	7.70	N/A	N/A	0.33	0.67	0.27	0.54	0.12	0.07
		9	12.93	18.08	37.46	9.45	3.91	0.03	12.91	94.77	1.42	1.24	0.33	2.76	0.89	0.22	0.00	0.80	7.66	N/A	N/A	0.36	0.64	0.29	0.51	0.12	0.08
		11	12.62	17.77	37.29	9.64	3.98	0.10	13.77	95.16	1.39	1.24	0.31	2.76	0.91	0.22	0.01	0.85	7.68	N/A	N/A	0.38	0.62	0.31	0.50	0.11	0.08
		12	12.68	18.59	36.56	8.67	3.56	0.02	14.68	94.75	1.40	1.28	0.34	2.72	0.82	0.20	0.00	0.91	7.68	N/A	N/A	0.39	0.61	0.32	0.49	0.12	0.07
		14	12.94	18.32	37.25	9.60	3.55	0.00	13.30	94.93	1.43	1.25	0.35	2.75	0.91	0.20	0.00	0.82	7.70	N/A	N/A	0.37	0.63	0.29	0.51	0.13	0.07
		15	11.43	17.53	36.51	9.59	5.13	0.08	13.87	94.13	1.28	1.26	0.29	2.74	0.92	0.29	0.00	0.87	7.66	N/A	N/A	0.40	0.60	0.32	0.47	0.11	0.11
		16	11.70	17.63	37.08	9.53	5.05	0.00	13.90	94.84	1.30	1.25	0.30	2.75	0.90	0.28	0.00	0.86	7.64	N/A	N/A	0.40	0.60	0.32	0.47	0.11	0.10
		17	13.18	18.48	37.34	9.57	3.70	0.00	13.35	95.55	1.44	1.26	0.33	2.74	0.89	0.20	0.00	0.82	7.69	N/A	N/A	0.36	0.64	0.29	0.52	0.12	0.07
		19	12.13	18.08	36.89	9.58	4.27	0.00	13.40	94.34	1.35	1.25	0.34	2.75	0.91	0.24	0.00	0.84	7.67	N/A	N/A	0.38	0.62	0.30	0.49	0.12	0.09
		20	12.16	18.07	37.11	9.63	4.19	0.05	13.61	94.82	1.35	1.24	0.34	2.76	0.91	0.23	0.00	0.85	7.68	N/A	N/A	0.39	0.61	0.31	0.49	0.12	0.08
A2	T_1	1	13.15	18.11	37.20	9.69	4.02	0.03	13.26	95.46	1.44	1.27	0.30	2.73	0.91	0.22	0.00	0.81	7.69	N/A	N/A	0.36	0.64	0.29	0.52	0.11	0.08
		2	14.36	18.86	37.89	9.88	3.01	0.09	11.74	95.82	1.56	1.24	0.37	2.76	0.92	0.16	0.01	0.71	7.73	N/A	N/A	0.31	0.69	0.25	0.55	0.13	0.06
		3	13.17	18.16	37.27	9.52	3.82	0.07	13.00	95.02	1.45	1.25	0.33	2.75	0.90	0.21	0.00	0.80	7.70	N/A	N/A	0.36	0.64	0.29	0.52	0.12	0.08
		4	14.98	18.23	38.14	9.42	3.44	0.01	11.39	95.61	1.62	1.24	0.32	2.76	0.87	0.19	0.00	0.69	7.68	N/A	N/A	0.30	0.70	0.25	0.58	0.11	0.07
		5	12.35	18.00	37.40	9.42	4.39	0.00	13.46	94.98	1.36	1.24	0.33	2.76	0.89	0.24	0.00	0.83	7.65	N/A	N/A	0.38	0.62	0.30	0.49	0.12	0.09
		7	13.64	18.58	38.28	9.59	3.78	0.09	12.86	96.81	1.47	1.24	0.35	2.76	0.88	0.21	0.01	0.78	7.69	N/A	N/A	0.35	0.65	0.28	0.52	0.12	0.07
		9	12.73	17.95	36.76	9.28	4.15	0.00	13.83	94.70	1.41	1.27	0.30	2.73	0.88	0.23	0.00	0.86	7.67	N/A	N/A	0.38	0.62	0.31	0.50	0.11	0.08

A2	T_1	10	11.87	17.66	37.17	9.63	4.98	0.06	14.17	95.53	1.31	1.25	0.29	2.75	0.91	0.28	0.00	0.88	7.66	N/A	N/A	0.40	0.60	0.32	0.48	0.10	0.10
		11	11.99	17.87	37.67	9.69	4.92	0.08	13.60	95.81	1.31	1.23	0.31	2.77	0.91	0.27	0.01	0.84	7.65	N/A	N/A	0.39	0.61	0.31	0.48	0.11	0.10
		12	14.08	19.04	37.18	8.71	3.26	0.00	12.86	95.01	1.54	1.28	0.37	2.72	0.81	0.18	0.00	0.79	7.68	N/A	N/A	0.34	0.66	0.27	0.54	0.13	0.06
		13	12.98	17.74	37.84	9.46	3.97	0.10	13.99	96.07	1.41	1.23	0.29	2.77	0.88	0.22	0.01	0.86	7.67	N/A	N/A	0.38	0.62	0.31	0.51	0.11	0.08
		14	12.47	17.37	37.10	9.65	4.29	0.00	14.05	94.91	1.38	1.24	0.28	2.76	0.92	0.24	0.00	0.87	7.69	N/A	N/A	0.39	0.61	0.31	0.50	0.10	0.09
		15	14.97	18.57	38.27	9.58	3.18	0.02	10.55	95.14	1.62	1.22	0.37	2.78	0.89	0.17	0.00	0.64	7.70	N/A	N/A	0.28	0.72	0.23	0.58	0.13	0.06
		16	12.47	18.23	37.28	9.61	4.37	0.11	13.66	95.72	1.37	1.26	0.32	2.74	0.90	0.24	0.01	0.84	7.68	N/A	N/A	0.38	0.62	0.30	0.49	0.12	0.09
		17	11.83	18.54	36.70	9.20	4.10	0.03	13.86	94.27	1.31	1.27	0.36	2.73	0.87	0.23	0.00	0.86	7.64	N/A	N/A	0.40	0.60	0.31	0.48	0.13	0.08
		18	12.01	18.71	36.85	8.99	4.10	0.00	13.88	94.50	1.33	1.26	0.37	2.74	0.85	0.23	0.00	0.86	7.64	N/A	N/A	0.39	0.61	0.31	0.48	0.13	0.08

Table 2.6: Analysis of biotite associated with garnet A1 from sample HJ-57b (group 2). $T_{\#}$ represents the transect number and # represents the points analysed with increasing distance from garnet, with the first analysis being adjacent to garnet and the last analysis being furthest from garnet (N/A = element not analysed).

		Oxide percentage								Cations on a 11(O) basis									Anions		Molar Fractions		Proportion on the oct. site			
$T_{\#}$	#	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	MnO	FeO	Total	Mg	Al^{IV}	Al^{VI}	Si	K	Ti	Mn	Fe	Total	F	Cl	X_{Fe}	X_{Mg}	X_{Fe}^{VI}	X_{Mg}^{VI}	X_{Al}^{VI}	X_{Ti}^{VI}
T_1	1	16.10	16.35	37.55	10.25	4.99	0.04	10.09	95.38	1.75	1.26	0.15	2.74	0.95	0.27	0.00	0.62	7.74	N/A	N/A	0.26	0.74	0.22	0.63	0.05	0.10
	2	15.58	17.11	37.84	10.14	4.98	0.00	10.24	95.88	1.68	1.26	0.20	2.74	0.94	0.27	0.00	0.62	7.71	N/A	N/A	0.27	0.73	0.22	0.61	0.07	0.10
	3	14.96	17.25	37.70	10.17	5.07	0.02	10.74	95.92	1.62	1.27	0.21	2.73	0.94	0.28	0.00	0.65	7.70	N/A	N/A	0.29	0.71	0.24	0.59	0.08	0.10
	5	14.12	16.92	37.16	10.09	5.24	0.08	10.83	94.44	1.55	1.26	0.22	2.74	0.95	0.29	0.00	0.67	7.69	N/A	N/A	0.30	0.70	0.24	0.57	0.08	0.11
	6	14.81	17.33	37.28	10.07	5.22	0.00	10.82	95.54	1.61	1.28	0.21	2.72	0.94	0.29	0.00	0.66	7.70	N/A	N/A	0.29	0.71	0.24	0.58	0.08	0.10
	7	14.83	17.13	37.58	10.20	5.10	0.06	11.10	96.00	1.61	1.27	0.20	2.73	0.95	0.28	0.00	0.68	7.71	N/A	N/A	0.30	0.70	0.24	0.58	0.07	0.10
	9	14.81	17.10	37.82	10.14	5.21	0.00	10.72	95.70	1.61	1.25	0.22	2.75	0.94	0.29	0.00	0.65	7.70	N/A	N/A	0.29	0.71	0.24	0.58	0.08	0.10
	10	15.43	17.28	37.60	10.19	4.85	0.07	9.99	95.42	1.67	1.27	0.22	2.73	0.95	0.27	0.00	0.61	7.71	N/A	N/A	0.27	0.73	0.22	0.61	0.08	0.10
	11	14.33	16.97	36.95	10.22	5.06	0.01	10.92	94.46	1.58	1.27	0.21	2.73	0.96	0.28	0.00	0.68	7.71	N/A	N/A	0.30	0.70	0.25	0.58	0.08	0.10
	12	14.18	16.72	36.87	10.05	5.23	0.11	11.20	94.36	1.57	1.27	0.19	2.73	0.95	0.29	0.01	0.69	7.70	N/A	N/A	0.31	0.69	0.25	0.57	0.07	0.11
T_2	1	15.88	17.11	38.06	9.83	5.00	0.09	9.99	95.96	1.71	1.26	0.20	2.74	0.90	0.27	0.01	0.60	7.69	N/A	N/A	0.26	0.74	0.22	0.61	0.07	0.10
	2	16.12	17.09	37.67	10.16	4.97	0.05	10.29	96.35	1.73	1.28	0.17	2.72	0.93	0.27	0.00	0.62	7.73	N/A	N/A	0.26	0.74	0.22	0.62	0.06	0.10
	3	15.91	17.00	37.47	9.94	4.53	0.00	10.05	94.90	1.73	1.26	0.20	2.74	0.93	0.25	0.00	0.61	7.72	N/A	N/A	0.26	0.74	0.22	0.62	0.07	0.09
	4	15.80	16.92	37.54	10.00	4.63	0.10	10.13	95.13	1.72	1.26	0.19	2.74	0.93	0.25	0.01	0.62	7.72	N/A	N/A	0.26	0.74	0.22	0.62	0.07	0.09
	5	17.06	17.11	38.36	10.10	4.73	0.00	8.45	95.78	1.82	1.25	0.19	2.75	0.92	0.26	0.00	0.51	7.70	N/A	N/A	0.22	0.78	0.18	0.66	0.07	0.09
	6	15.47	16.86	37.07	10.13	4.95	0.12	10.73	95.34	1.69	1.29	0.17	2.71	0.95	0.27	0.01	0.66	7.74	N/A	N/A	0.28	0.72	0.24	0.61	0.06	0.10
	7	15.53	17.25	37.79	10.18	4.98	0.14	10.79	96.65	1.67	1.27	0.19	2.73	0.94	0.27	0.01	0.65	7.73	N/A	N/A	0.28	0.72	0.23	0.60	0.07	0.10
	8	15.33	16.81	37.47	10.14	4.74	0.00	10.16	94.64	1.68	1.25	0.20	2.75	0.95	0.26	0.00	0.62	7.72	N/A	N/A	0.27	0.73	0.23	0.61	0.07	0.09
	9	15.14	17.21	37.68	10.22	4.95	0.04	10.29	95.54	1.65	1.25	0.22	2.75	0.95	0.27	0.00	0.63	7.72	N/A	N/A	0.28	0.72	0.23	0.59	0.08	0.10
	10	15.50	17.32	37.60	9.98	4.77	0.10	10.90	96.18	1.67	1.28	0.20	2.72	0.92	0.26	0.01	0.66	7.72	N/A	N/A	0.28	0.72	0.24	0.60	0.07	0.09
	11	15.17	17.07	37.08	9.95	4.89	0.08	10.64	94.88	1.66	1.28	0.19	2.72	0.93	0.27	0.00	0.65	7.71	N/A	N/A	0.28	0.72	0.24	0.60	0.07	0.10
	12	17.02	17.34	38.13	9.32	4.61	0.10	9.66	96.18	1.82	1.27	0.19	2.73	0.85	0.25	0.01	0.58	7.69	N/A	N/A	0.24	0.76	0.20	0.64	0.07	0.09
	14	14.91	15.98	36.91	9.74	5.49	0.04	11.37	94.43	1.65	1.27	0.13	2.73	0.92	0.31	0.00	0.70	7.70	N/A	N/A	0.30	0.70	0.25	0.59	0.05	0.11
T_3	1	16.78	17.20	37.99	10.05	4.08	0.01	8.40	94.51	1.82	1.24	0.24	2.76	0.93	0.22	0.00	0.51	7.72	N/A	N/A	0.22	0.78	0.18	0.65	0.08	0.08

T_3	2	16.22	17.28	37.66	10.14	4.50	0.08	8.90	94.77	1.76	1.26	0.23	2.74	0.94	0.25	0.01	0.54	7.72	N/A	N/A	0.24	0.76	0.20	0.63	0.08	0.09
	4	15.26	17.45	37.78	10.25	4.93	0.10	10.62	96.38	1.64	1.27	0.21	2.73	0.94	0.27	0.01	0.64	7.71	N/A	N/A	0.28	0.72	0.23	0.59	0.08	0.10
	5	14.92	17.05	37.45	10.25	5.06	0.16	10.46	95.36	1.63	1.26	0.21	2.74	0.96	0.28	0.01	0.64	7.71	N/A	N/A	0.28	0.72	0.23	0.59	0.07	0.10
	6	15.16	17.11	37.15	9.77	5.00	0.12	10.53	94.85	1.66	1.28	0.20	2.72	0.91	0.28	0.01	0.65	7.70	N/A	N/A	0.28	0.72	0.23	0.60	0.07	0.10
	7	15.22	16.99	37.37	10.02	4.81	0.01	10.25	94.67	1.66	1.26	0.20	2.74	0.94	0.26	0.00	0.63	7.69	N/A	N/A	0.27	0.73	0.23	0.60	0.07	0.10
	8	15.41	16.93	37.36	10.01	4.74	0.00	10.39	94.84	1.68	1.27	0.19	2.73	0.93	0.26	0.00	0.64	7.71	N/A	N/A	0.27	0.73	0.23	0.61	0.07	0.09
	9	15.21	17.25	37.32	10.13	5.04	0.00	10.69	95.64	1.65	1.29	0.19	2.71	0.94	0.28	0.00	0.65	7.70	N/A	N/A	0.28	0.72	0.24	0.60	0.07	0.10
	11	14.98	16.95	37.49	9.91	5.12	0.00	10.97	95.26	1.63	1.27	0.19	2.73	0.92	0.28	0.00	0.67	7.68	N/A	N/A	0.29	0.71	0.24	0.59	0.07	0.10
	14	15.64	17.39	37.91	10.25	4.84	0.04	9.44	95.51	1.69	1.26	0.23	2.74	0.95	0.26	0.00	0.57	7.70	N/A	N/A	0.25	0.75	0.21	0.61	0.08	0.10
	15	15.63	17.22	37.64	10.31	4.91	0.01	10.09	95.80	1.69	1.27	0.20	2.73	0.95	0.27	0.00	0.61	7.72	N/A	N/A	0.27	0.73	0.22	0.61	0.07	0.10
T_4	1	16.02	16.49	37.44	9.93	5.01	0.08	9.57	94.54	1.75	1.26	0.17	2.74	0.93	0.28	0.01	0.59	7.72	N/A	N/A	0.25	0.75	0.21	0.63	0.06	0.10
	2	15.50	17.30	37.49	9.32	4.59	0.02	10.29	94.52	1.69	1.26	0.23	2.74	0.87	0.25	0.00	0.63	7.67	N/A	N/A	0.27	0.73	0.22	0.60	0.08	0.09
	3	15.36	17.04	37.53	10.02	4.83	0.04	10.38	95.22	1.67	1.26	0.20	2.74	0.93	0.27	0.00	0.63	7.71	N/A	N/A	0.27	0.73	0.23	0.60	0.07	0.10
	4	15.44	16.71	37.20	10.34	4.92	0.10	10.44	95.13	1.69	1.27	0.18	2.73	0.97	0.27	0.01	0.64	7.76	N/A	N/A	0.27	0.73	0.23	0.61	0.07	0.10
	5	15.04	17.01	37.64	10.11	4.96	0.10	10.79	95.65	1.63	1.26	0.20	2.74	0.94	0.27	0.01	0.66	7.71	N/A	N/A	0.29	0.71	0.24	0.59	0.07	0.10
	6	15.20	17.08	37.45	9.88	5.05	0.07	10.56	95.29	1.65	1.27	0.20	2.73	0.92	0.28	0.00	0.64	7.70	N/A	N/A	0.28	0.72	0.23	0.60	0.07	0.10
	7	14.87	17.12	37.42	9.98	5.00	0.06	10.77	95.21	1.62	1.27	0.21	2.73	0.93	0.27	0.00	0.66	7.69	N/A	N/A	0.29	0.71	0.24	0.59	0.08	0.10
	8	15.28	17.13	37.59	9.93	4.95	0.04	11.06	95.98	1.65	1.28	0.19	2.72	0.92	0.27	0.00	0.67	7.70	N/A	N/A	0.29	0.71	0.24	0.59	0.07	0.10
	9	15.29	17.08	37.54	9.98	4.87	0.00	10.73	95.43	1.66	1.27	0.20	2.73	0.93	0.27	0.00	0.65	7.71	N/A	N/A	0.28	0.72	0.23	0.60	0.07	0.10
	10	15.14	16.57	36.91	9.44	5.12	0.10	10.84	94.13	1.67	1.27	0.17	2.73	0.89	0.28	0.01	0.67	7.68	N/A	N/A	0.29	0.71	0.24	0.60	0.06	0.10
	11	15.13	16.77	37.38	9.95	4.90	0.03	10.51	94.67	1.65	1.26	0.19	2.74	0.93	0.27	0.00	0.64	7.70	N/A	N/A	0.28	0.72	0.23	0.60	0.07	0.10
	12	15.06	16.61	37.13	10.03	5.18	0.13	11.08	95.23	1.65	1.28	0.16	2.72	0.94	0.29	0.01	0.68	7.72	N/A	N/A	0.29	0.71	0.25	0.59	0.06	0.10
	13	15.32	16.89	37.92	9.89	5.14	0.19	11.19	96.55	1.65	1.26	0.17	2.74	0.91	0.28	0.01	0.68	7.70	N/A	N/A	0.29	0.71	0.24	0.59	0.06	0.10

Table 2.7: Analysis of biotite associated with garnets from sample HJ-57a_1 (group 3). $T_\#$ represents the transect number and # represents the points analysed with increasing distance from garnet, with the first analysis being adjacent to garnet and the last analysis being furthest from garnet.

			Oxide percentage								Cations on a 11(O) basis									Anions		Molar Fractions		Proportion on the oct. site			
Grt	$T_\#$	#	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	MnO	FeO	Total	Mg	Al^{IV}	Al^{VI}	Si	K	Ti	Mn	Fe	Total	F	Cl	X_{Fe}	X_{Mg}	X_{Fe}^{VI}	X_{Mg}^{VI}	X_{Al}^{VI}	X_{Ti}^{VI}
A1	T_1	1	9.95	17.43	35.69	9.82	4.79	0.09	17.78	95.55	1.13	1.27	0.30	2.73	0.96	0.28	0.01	1.14	7.80	0.23	0.02	0.50	0.50	0.40	0.40	0.10	0.10
		3	9.65	17.00	35.20	9.91	4.67	0.10	18.23	94.77	1.11	1.27	0.28	2.73	0.98	0.27	0.01	1.18	7.83	0.24	0.01	0.51	0.49	0.41	0.39	0.10	0.10
		4	9.62	17.08	35.37	9.96	4.85	0.07	18.08	95.03	1.11	1.27	0.28	2.73	0.98	0.28	0.00	1.17	7.82	0.22	0.02	0.51	0.49	0.41	0.39	0.10	0.10
A3	T_1	1	10.12	17.10	35.61	9.68	4.06	0.08	17.63	94.26	1.17	1.24	0.32	2.76	0.96	0.24	0.01	1.14	7.83	0.27	0.01	0.49	0.51	0.40	0.41	0.11	0.08
		3	9.95	17.16	35.66	9.61	4.41	0.05	17.36	94.21	1.15	1.24	0.32	2.76	0.95	0.26	0.00	1.12	7.79	0.25	0.01	0.49	0.51	0.39	0.40	0.11	0.09
		4	8.59	16.89	35.41	9.75	5.46	0.13	19.70	95.93	0.98	1.28	0.25	2.72	0.95	0.32	0.01	1.27	7.78	0.19	0.02	0.56	0.44	0.45	0.35	0.09	0.11
		5	8.59	16.89	35.37	9.63	5.32	0.08	18.89	94.78	0.99	1.26	0.28	2.74	0.95	0.31	0.01	1.22	7.76	0.20	0.01	0.55	0.45	0.44	0.35	0.10	0.11
		6	8.71	16.82	35.12	9.76	5.22	0.09	18.74	94.46	1.01	1.27	0.28	2.73	0.97	0.31	0.01	1.22	7.79	0.22	0.01	0.55	0.45	0.43	0.36	0.10	0.11
		8	9.30	17.50	36.07	10.09	5.33	0.11	18.63	97.02	1.04	1.28	0.27	2.72	0.97	0.30	0.01	1.17	7.77	0.18	0.01	0.53	0.47	0.42	0.37	0.10	0.11
		11	8.56	17.00	35.53	9.83	5.30	0.07	19.39	95.68	0.98	1.27	0.27	2.73	0.96	0.31	0.00	1.25	7.77	0.21	0.01	0.56	0.44	0.44	0.35	0.10	0.11
		13	8.40	16.79	35.14	9.66	5.17	0.09	19.07	94.31	0.98	1.26	0.28	2.74	0.96	0.30	0.01	1.24	7.77	0.20	0.01	0.56	0.44	0.44	0.35	0.10	0.11
	T_2	4	8.82	16.88	35.17	9.85	5.06	0.04	18.74	94.55	1.02	1.26	0.28	2.74	0.98	0.30	0.00	1.22	7.80	0.24	0.01	0.54	0.46	0.43	0.36	0.10	0.10
		6	8.78	16.83	35.19	9.79	4.96	0.09	19.01	94.65	1.02	1.26	0.29	2.74	0.97	0.29	0.01	1.24	7.81	0.24	0.02	0.55	0.45	0.44	0.36	0.10	0.10
		7	8.69	17.17	35.53	10.01	5.02	0.07	19.28	95.77	1.00	1.27	0.29	2.73	0.98	0.29	0.00	1.24	7.80	0.23	0.01	0.55	0.45	0.44	0.35	0.10	0.10
		9	11.32	17.20	36.32	10.17	4.22	0.07	16.25	95.55	1.28	1.24	0.30	2.76	0.99	0.24	0.00	1.03	7.85	0.27	0.01	0.45	0.55	0.36	0.45	0.11	0.08
A5	T_1	1	9.86	17.31	35.78	10.15	4.36	0.07	17.80	95.33	1.13	1.26	0.31	2.74	0.99	0.25	0.00	1.14	7.82	0.20	0.01	0.50	0.50	0.40	0.40	0.11	0.09
		3	9.59	17.60	36.32	10.30	4.89	0.14	18.86	97.71	1.08	1.27	0.29	2.73	0.99	0.28	0.01	1.19	7.83	0.23	0.01	0.52	0.48	0.42	0.38	0.10	0.10
		4	8.41	16.83	35.41	9.84	5.26	0.08	19.57	95.39	0.97	1.26	0.27	2.74	0.97	0.31	0.01	1.27	7.78	0.21	0.01	0.57	0.43	0.45	0.34	0.10	0.11
		5	8.98	17.03	35.32	9.97	4.63	0.08	18.49	94.50	1.04	1.25	0.31	2.75	0.99	0.27	0.01	1.20	7.82	0.23	0.01	0.54	0.46	0.43	0.37	0.11	0.10
		6	9.09	16.97	35.48	10.19	5.31	0.08	19.14	96.25	1.04	1.28	0.25	2.72	1.00	0.31	0.01	1.23	7.82	0.20	0.01	0.54	0.46	0.44	0.37	0.09	0.11
		7	10.04	17.62	36.23	10.01	4.20	0.11	18.21	96.41	1.13	1.26	0.31	2.74	0.97	0.24	0.01	1.15	7.81	0.20	0.01	0.50	0.50	0.41	0.40	0.11	0.08
		8	8.70	16.19	32.58	8.53	12.09	0.09	17.85	96.03	0.99	1.52	-0.06	2.48	0.83	0.69	0.01	1.14	7.59	0.18	0.01	0.54	0.46	0.41	0.36	0.00	0.25
		9	8.89	16.98	35.90	9.72	4.98	0.07	18.65	95.20	1.02	1.24	0.30	2.76	0.95	0.29	0.00	1.20	7.77	0.21	0.02	0.54	0.46	0.43	0.36	0.11	0.10
		11	7.88	16.65	34.90	9.59	5.47	0.07	19.47	94.02	0.92	1.27	0.27	2.73	0.96	0.32	0.00	1.28	7.75	0.18	0.01	0.58	0.42	0.46	0.33	0.10	0.12

A5	T_1	12	8.26	17.14	35.45	9.78	5.37	0.09	19.33	95.42	0.95	1.27	0.28	2.73	0.96	0.31	0.01	1.24	7.75	0.18	0.01	0.57	0.43	0.45	0.34	0.10	0.11

Table 2.8: Analysis of biotite associated with garnets from sample HJ-58b (group 3). $T_{\#}$ represents the transect number and # represents the points analysed with increasing distance from garnet, with the first analysis being adjacent to garnet and the last analysis being furthest from garnet.

			Oxide percentage								Cations on a 11(O) basis									Anions		Molar Fractions		Proportion on the oct. site			
Grt	$T_{\#}$	#	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	MnO	FeO	Total	Mg	Al^{IV}	Al^{VI}	Si	K	Ti	Mn	Fe	Total	F	Cl	X_{Fe}	X_{Mg}	X_{Fe}^{VI}	X_{Mg}^{VI}	X_{Al}^{VI}	X_{Ti}^{VI}
A1	T_1	6	12.06	17.87	36.56	9.49	3.33	0.10	15.11	94.51	1.36	1.24	0.36	2.76	0.92	0.19	0.01	0.96	7.78	0.15	0.01	0.41	0.59	0.33	0.48	0.12	0.07
		11	11.73	17.38	36.67	9.45	3.69	0.10	15.64	94.65	1.32	1.22	0.33	2.78	0.91	0.21	0.01	0.99	7.78	0.18	0.00	0.43	0.57	0.35	0.46	0.12	0.07
		12	12.10	17.94	35.92	8.74	3.34	0.07	16.04	94.16	1.37	1.27	0.33	2.73	0.85	0.19	0.00	1.02	7.76	0.15	0.01	0.43	0.57	0.35	0.47	0.11	0.07
A2	T_1	3	12.37	18.88	37.00	9.15	3.28	0.09	15.28	96.04	1.37	1.26	0.39	2.74	0.86	0.18	0.01	0.95	7.75	0.17	0.01	0.41	0.59	0.33	0.47	0.14	0.06
		5	11.71	17.64	36.53	9.46	3.67	0.08	15.45	94.54	1.32	1.23	0.34	2.77	0.91	0.21	0.00	0.98	7.77	0.17	0.01	0.43	0.57	0.34	0.46	0.12	0.07
		6	11.80	17.70	36.68	9.40	3.63	0.14	15.44	94.78	1.33	1.23	0.34	2.77	0.90	0.21	0.01	0.97	7.76	0.15	0.01	0.42	0.58	0.34	0.47	0.12	0.07
		9	11.73	17.32	36.54	9.26	3.50	0.08	15.65	94.09	1.33	1.21	0.34	2.79	0.90	0.20	0.01	1.00	7.78	0.18	0.00	0.43	0.57	0.35	0.46	0.12	0.07
		12	12.27	17.60	36.78	9.54	4.05	0.12	15.79	96.16	1.36	1.26	0.29	2.74	0.91	0.23	0.01	0.98	7.78	0.16	0.01	0.42	0.58	0.34	0.48	0.10	0.08
A3	T_1	4	9.28	19.30	35.75	9.63	3.25	0.13	16.96	94.28	1.06	1.27	0.47	2.73	0.94	0.19	0.01	1.08	7.74	0.12	0.01	0.51	0.49	0.39	0.38	0.17	0.07
		5	9.75	19.23	36.26	10.03	3.55	0.19	17.30	96.32	1.09	1.28	0.42	2.72	0.96	0.20	0.01	1.09	7.76	0.12	0.00	0.50	0.50	0.39	0.39	0.15	0.07
		7	9.03	18.74	35.85	9.90	3.45	0.17	17.27	94.41	1.03	1.25	0.44	2.75	0.97	0.20	0.01	1.11	7.76	0.14	0.01	0.52	0.48	0.40	0.37	0.16	0.07
		8	9.23	19.20	36.30	9.97	3.67	0.15	17.11	95.63	1.04	1.26	0.44	2.74	0.96	0.21	0.01	1.08	7.74	0.13	0.00	0.51	0.49	0.39	0.37	0.16	0.08
		11	9.45	18.69	35.94	9.78	3.95	0.18	17.64	95.62	1.07	1.28	0.39	2.72	0.95	0.23	0.01	1.12	7.76	0.14	0.01	0.51	0.49	0.40	0.38	0.14	0.08
		13	9.28	18.64	36.48	9.97	3.81	0.12	17.09	95.39	1.04	1.24	0.42	2.76	0.96	0.22	0.01	1.08	7.72	0.10	0.00	0.51	0.49	0.39	0.38	0.15	0.08
A4	T_1	2	11.74	17.96	36.39	9.63	3.01	0.12	15.21	94.06	1.33	1.23	0.38	2.77	0.93	0.17	0.01	0.97	7.79	0.17	0.00	0.42	0.58	0.34	0.47	0.13	0.06
		4	12.11	18.23	36.44	9.65	3.00	0.15	15.04	94.62	1.37	1.24	0.38	2.76	0.93	0.17	0.01	0.95	7.81	0.20	0.00	0.41	0.59	0.33	0.48	0.13	0.06
		7	12.24	18.28	36.65	9.50	2.97	0.11	14.34	94.08	1.38	1.23	0.40	2.77	0.92	0.17	0.01	0.91	7.78	0.18	0.00	0.40	0.60	0.32	0.48	0.14	0.06
		8	12.32	18.11	36.68	9.59	3.29	0.16	14.89	95.05	1.38	1.24	0.36	2.76	0.92	0.19	0.01	0.94	7.79	0.18	0.00	0.40	0.60	0.33	0.48	0.13	0.06
		11	12.15	18.01	36.70	9.48	3.39	0.12	14.86	94.71	1.37	1.23	0.37	2.77	0.91	0.19	0.01	0.94	7.78	0.17	0.01	0.41	0.59	0.33	0.48	0.13	0.07
A5	T_1	3	9.86	18.09	36.16	9.78	3.64	0.11	16.41	94.05	1.13	1.23	0.40	2.77	0.96	0.21	0.01	1.05	7.75	0.14	0.01	0.48	0.52	0.38	0.40	0.14	0.08
		8	9.14	18.17	36.18	9.85	4.06	0.16	16.92	94.48	1.04	1.24	0.40	2.76	0.96	0.23	0.01	1.08	7.73	0.14	0.01	0.51	0.49	0.39	0.38	0.15	0.08
		9	9.71	18.89	36.03	9.93	3.77	0.21	16.87	95.41	1.09	1.28	0.40	2.72	0.96	0.21	0.01	1.07	7.75	0.11	0.00	0.49	0.51	0.38	0.39	0.15	0.08
A5	T_2	9	10.19	18.47	36.48	10.09	4.16	0.26	17.32	96.96	1.13	1.28	0.35	2.72	0.96	0.23	0.02	1.08	7.77	0.14	0.01	0.49	0.51	0.39	0.41	0.12	0.08
		11	9.65	17.92	36.18	9.88	3.77	0.11	16.91	94.42	1.10	1.23	0.39	2.77	0.96	0.22	0.01	1.08	7.76	0.15	0.01	0.50	0.50	0.39	0.40	0.14	0.08

Table 2.9: Analysis of biotite associated with garnets from sample HJ-74 (group 3). $T_{\#}$ represents the transect number and # represents the points analysed with increasing distance from garnet, with the first analysis being adjacent to garnet and the last analysis being furthest from garnet.

			Oxide percentage								Cations on a 11(O) basis									Anions		Molar Fractions		Proportion on the oct. site			
Grt	$T_{\#}$	#	MgO	Al_2O_3	SiO_2	K_2O	TiO_2	MnO	FeO	Total	Mg	Al^{IV}	Al^{VI}	Si	K	Ti	Mn	Fe	Total	F	Cl	X_{Fe}	X_{Mg}	X_{Fe}^{VI}	X_{Mg}^{VI}	X_{Al}^{VI}	X_{Ti}^{VI}
A6	T_1	1	12.16	15.17	36.09	9.81	4.19	0.09	16.74	94.24	1.40	1.21	0.17	2.79	0.97	0.24	0.01	1.08	7.86	0.20	0.01	0.44	0.56	0.37	0.48	0.06	0.08
		2	12.43	15.53	37.18	10.06	3.95	0.06	16.63	95.84	1.40	1.19	0.20	2.81	0.97	0.22	0.00	1.05	7.85	0.19	0.01	0.43	0.57	0.37	0.49	0.07	0.08
		6	11.96	15.59	37.02	10.12	4.23	0.12	16.96	96.01	1.35	1.20	0.19	2.80	0.98	0.24	0.01	1.07	7.84	0.18	0.01	0.44	0.56	0.38	0.47	0.07	0.08
		8	10.95	15.06	36.13	9.96	5.25	0.13	17.56	95.03	1.25	1.22	0.14	2.78	0.98	0.30	0.01	1.13	7.81	0.16	0.01	0.47	0.53	0.40	0.44	0.05	0.11
		9	10.49	15.09	35.86	9.95	5.60	0.05	17.33	94.36	1.21	1.23	0.14	2.77	0.98	0.33	0.00	1.12	7.78	0.13	0.01	0.48	0.52	0.40	0.43	0.05	0.12
		10	11.37	15.89	36.89	10.20	5.95	0.15	18.29	98.73	1.25	1.27	0.11	2.73	0.96	0.33	0.01	1.13	7.79	0.13	0.02	0.47	0.53	0.40	0.44	0.04	0.12
	T_2	2	14.82	15.96	37.86	9.49	3.49	0.12	14.63	96.38	1.64	1.20	0.20	2.80	0.90	0.19	0.01	0.91	7.84	0.18	0.01	0.36	0.64	0.31	0.56	0.07	0.07
		7	12.12	16.15	37.24	10.14	5.81	0.15	17.88	99.49	1.32	1.28	0.11	2.72	0.94	0.32	0.01	1.09	7.79	0.14	0.01	0.45	0.55	0.38	0.46	0.04	0.11
		9	11.38	15.39	37.00	10.07	5.49	0.07	17.75	97.16	1.27	1.23	0.13	2.77	0.96	0.31	0.00	1.11	7.78	0.12	0.01	0.47	0.53	0.39	0.45	0.05	0.11
A7	T_1	2	14.11	15.50	36.90	9.89	3.01	0.08	14.73	94.22	1.61	1.18	0.21	2.82	0.96	0.17	0.01	0.94	7.90	0.22	0.01	0.37	0.63	0.32	0.55	0.07	0.06
		3	13.99	15.84	37.17	10.06	3.08	0.05	14.80	94.98	1.58	1.19	0.23	2.81	0.97	0.18	0.00	0.94	7.89	0.21	0.01	0.37	0.63	0.32	0.54	0.08	0.06
		8	11.42	16.23	36.12	9.61	2.76	0.07	17.85	94.07	1.32	1.20	0.28	2.80	0.95	0.16	0.00	1.16	7.86	0.18	0.01	0.47	0.53	0.40	0.45	0.09	0.06
A8	T_1	1	12.76	15.81	36.78	9.91	3.67	0.11	16.46	95.51	1.44	1.21	0.21	2.79	0.96	0.21	0.01	1.05	7.87	0.19	0.01	0.42	0.58	0.36	0.50	0.07	0.07
		6	12.70	15.70	36.87	9.92	3.87	0.09	16.42	95.56	1.43	1.21	0.19	2.79	0.96	0.22	0.01	1.04	7.85	0.16	0.01	0.42	0.58	0.36	0.50	0.07	0.08
		7	12.78	15.79	36.98	10.02	4.04	0.16	16.62	96.39	1.43	1.22	0.18	2.78	0.96	0.23	0.01	1.04	7.85	0.15	0.01	0.42	0.58	0.36	0.50	0.06	0.08
		11	10.77	15.06	36.34	9.95	5.20	0.10	17.63	95.04	1.23	1.21	0.15	2.79	0.97	0.30	0.01	1.13	7.79	0.11	0.02	0.48	0.52	0.40	0.44	0.05	0.11

APPENDIX 3: PLAGIOCLASE ANALYSES

(Only analyses with acceptable stoichiometry are included here.)

Table 3.1: Analysis of plagioclase associated with garnet A1 from sample HJ-58c (group 2). Type A grains are adjacent to garnet and type M grains are in the matrix; # represents the analysis number with increasing distance from garnet: the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	A	1	9.30	23.44	64.16	0.22	4.63	0.11	101.86	0.78	1.20	2.79	0.01	0.22	0.00	5.01	0.21	0.77	0.01
		2	9.03	23.00	62.87	0.27	4.47	0.20	99.83	0.78	1.20	2.79	0.02	0.21	0.01	5.01	0.21	0.77	0.02
		3	8.98	23.45	64.35	0.39	4.59	0.02	101.78	0.76	1.20	2.80	0.02	0.21	0.00	4.99	0.22	0.76	0.02
		4	8.84	23.46	63.12	0.33	4.51	0.08	100.34	0.76	1.22	2.78	0.02	0.21	0.00	5.00	0.22	0.77	0.02
		5	8.93	23.47	63.66	0.25	4.71	0.13	101.16	0.76	1.21	2.79	0.01	0.22	0.00	5.00	0.22	0.76	0.01
2	M	1	9.38	23.42	63.30	0.26	4.48	0.08	100.92	0.80	1.21	2.78	0.01	0.21	0.00	5.02	0.21	0.78	0.01
		2	9.07	23.22	64.09	0.29	4.48	0.21	101.36	0.77	1.20	2.80	0.02	0.21	0.01	5.00	0.21	0.77	0.02
		4	8.61	23.62	63.92	0.38	4.36	0.10	100.99	0.73	1.22	2.80	0.02	0.20	0.00	4.97	0.21	0.76	0.02
		5	9.18	23.28	62.92	0.23	4.57	0.16	100.34	0.79	1.21	2.78	0.01	0.22	0.01	5.02	0.21	0.77	0.01
3	M	1	9.43	23.51	64.43	0.05	4.61	0.07	102.13	0.79	1.20	2.79	0.00	0.21	0.00	5.01	0.21	0.79	0.00
		2	9.29	23.37	63.82	0.17	4.59	0.13	101.38	0.79	1.20	2.79	0.01	0.21	0.00	5.01	0.21	0.78	0.01
		3	8.79	22.28	60.84	0.22	4.47	0.14	96.73	0.78	1.20	2.79	0.01	0.22	0.01	5.01	0.22	0.77	0.01
		4	9.59	23.53	63.97	0.19	4.59	0.00	101.88	0.81	1.21	2.78	0.01	0.21	0.00	5.02	0.21	0.78	0.01
		5	9.03	23.87	64.34	0.09	4.67	0.11	102.12	0.76	1.22	2.79	0.01	0.22	0.00	4.99	0.22	0.77	0.01
4	M	1	9.21	23.46	63.44	0.14	4.49	0.12	100.86	0.78	1.21	2.79	0.01	0.21	0.00	5.01	0.21	0.78	0.01
		2	8.89	23.40	64.75	0.29	4.48	0.16	101.98	0.75	1.20	2.81	0.02	0.21	0.01	4.98	0.21	0.77	0.02
		4	9.26	23.15	64.07	0.23	4.58	0.07	101.37	0.78	1.19	2.80	0.01	0.21	0.00	5.01	0.21	0.78	0.01
5	M	1	8.90	22.48	61.75	0.17	4.32	0.02	97.63	0.78	1.20	2.80	0.01	0.21	0.00	5.00	0.21	0.78	0.01
		2	9.23	23.07	63.61	0.36	4.21	0.00	100.49	0.79	1.20	2.80	0.02	0.20	0.00	5.00	0.20	0.78	0.02
		4	9.45	23.76	65.46	0.29	4.57	0.07	103.60	0.78	1.20	2.80	0.02	0.21	0.00	5.01	0.21	0.78	0.02
6	A	1	8.59	23.84	62.74	0.20	5.37	0.26	100.99	0.73	1.24	2.76	0.01	0.25	0.01	5.00	0.25	0.74	0.01
		2	9.05	23.36	64.89	0.30	4.41	0.00	102.01	0.76	1.19	2.81	0.02	0.20	0.00	4.98	0.21	0.77	0.02
		3	9.15	23.00	63.44	0.36	4.76	0.06	100.78	0.78	1.19	2.79	0.02	0.22	0.00	5.01	0.22	0.76	0.02
		4	9.42	23.19	64.19	0.22	4.63	0.04	101.69	0.80	1.19	2.80	0.01	0.22	0.00	5.01	0.21	0.78	0.01

7	M	1	9.36	23.17	62.89	0.28	4.69	0.00	100.39	0.80	1.21	2.78	0.02	0.22	0.00	5.03	0.21	0.77	0.02
		2	9.45	23.04	63.69	0.36	4.40	0.00	100.95	0.80	1.19	2.80	0.02	0.21	0.00	5.02	0.20	0.78	0.02
		3	9.37	23.07	63.74	0.38	4.43	0.08	101.07	0.80	1.19	2.80	0.02	0.21	0.00	5.02	0.20	0.78	0.02
		4	9.17	23.07	63.60	0.30	4.55	0.03	100.72	0.78	1.20	2.80	0.02	0.21	0.00	5.01	0.21	0.77	0.02
8	M	1	9.09	23.02	63.11	0.13	4.47	0.04	99.86	0.78	1.20	2.80	0.01	0.21	0.00	5.00	0.21	0.78	0.01
		2	9.27	23.08	64.43	0.21	4.36	0.00	101.34	0.78	1.19	2.81	0.01	0.20	0.00	4.99	0.20	0.78	0.01
		3	9.23	23.33	64.18	0.28	4.38	0.00	101.40	0.78	1.20	2.80	0.02	0.20	0.00	5.00	0.20	0.78	0.02
		4	9.72	23.61	64.84	0.25	4.55	0.10	103.07	0.81	1.20	2.79	0.01	0.21	0.00	5.03	0.20	0.78	0.01
9	M	1	9.71	23.90	65.44	0.24	4.54	0.15	103.98	0.80	1.20	2.79	0.01	0.21	0.01	5.02	0.20	0.78	0.01
10	M	1	8.91	23.72	64.21	0.23	4.50	0.10	101.68	0.75	1.21	2.79	0.01	0.21	0.00	4.98	0.22	0.77	0.01
		2	9.53	23.68	65.01	0.35	4.58	0.00	103.15	0.79	1.20	2.79	0.02	0.21	0.00	5.01	0.21	0.78	0.02
		4	9.37	23.43	64.33	0.39	4.53	0.10	102.16	0.79	1.20	2.79	0.02	0.21	0.00	5.02	0.21	0.77	0.02
		5	9.24	23.08	63.57	0.29	4.48	0.00	100.67	0.79	1.20	2.80	0.02	0.21	0.00	5.01	0.21	0.78	0.02

Table 3.2: Analysis of plagioclase associated with garnet A2 from sample HJ-58c (group 2). Type A grains are adjacent to garnet and type M grains are in the matrix; # represents the analysis number with increasing distance from garnet: the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	A	1	9.47	23.08	64.13	0.23	4.36	0.00	101.27	0.80	1.19	2.80	0.01	0.20	0.00	5.01	0.20	0.79	0.01
		2	9.06	23.20	63.96	0.23	4.55	0.00	100.99	0.77	1.20	2.80	0.01	0.21	0.00	4.99	0.21	0.77	0.01
		3	9.22	23.13	64.15	0.26	4.50	0.00	101.25	0.78	1.19	2.80	0.01	0.21	0.00	5.00	0.21	0.78	0.01
2	M	1	9.07	23.33	63.49	0.24	4.82	0.11	101.06	0.77	1.21	2.79	0.01	0.23	0.00	5.01	0.22	0.76	0.01
		2	9.19	23.70	65.87	0.26	4.62	0.05	103.69	0.76	1.19	2.81	0.01	0.21	0.00	4.99	0.21	0.77	0.01
		3	8.55	22.72	62.85	0.22	4.60	0.00	98.93	0.74	1.20	2.81	0.01	0.22	0.00	4.97	0.23	0.76	0.01
		4	8.60	23.15	63.66	0.31	4.38	0.00	100.09	0.73	1.20	2.81	0.02	0.21	0.00	4.97	0.22	0.77	0.02
3	M	1	9.09	22.92	63.43	0.11	4.38	0.14	100.08	0.78	1.19	2.80	0.01	0.21	0.01	5.00	0.21	0.78	0.01
		2	9.17	23.26	62.89	0.24	4.70	0.09	100.34	0.79	1.21	2.78	0.01	0.22	0.00	5.02	0.22	0.77	0.01
		3	9.14	22.75	64.87	0.27	3.80	0.04	100.87	0.77	1.17	2.83	0.02	0.18	0.00	4.98	0.18	0.80	0.02
		4	9.22	23.58	64.21	0.28	4.58	0.00	101.87	0.78	1.21	2.79	0.02	0.21	0.00	5.00	0.21	0.77	0.02
4	M	1	9.15	23.99	63.63	0.19	4.61	0.06	101.63	0.77	1.23	2.77	0.01	0.22	0.00	5.01	0.22	0.77	0.01
		2	8.97	23.07	63.57	0.29	4.35	0.04	100.29	0.77	1.20	2.80	0.02	0.21	0.00	4.99	0.21	0.78	0.02
		3	9.67	23.43	64.89	0.32	4.62	0.11	103.04	0.81	1.19	2.79	0.02	0.21	0.00	5.03	0.21	0.78	0.02
		4	9.37	23.69	64.34	0.34	4.71	0.00	102.46	0.79	1.21	2.78	0.02	0.22	0.00	5.01	0.21	0.77	0.02
		5	9.44	23.84	65.04	0.27	4.76	0.00	103.36	0.78	1.20	2.79	0.02	0.22	0.00	5.01	0.21	0.77	0.01
5	M	1	9.30	23.93	64.25	0.26	4.79	0.05	102.57	0.78	1.22	2.78	0.01	0.22	0.00	5.01	0.22	0.77	0.01
		2	9.34	23.32	63.34	0.28	4.77	0.03	101.08	0.80	1.21	2.78	0.02	0.22	0.00	5.02	0.22	0.77	0.01
		3	9.23	23.65	64.67	0.37	4.48	0.23	102.62	0.77	1.20	2.79	0.02	0.21	0.01	5.01	0.21	0.77	0.02
		4	9.19	23.35	64.04	0.33	4.59	0.04	101.54	0.78	1.20	2.79	0.02	0.21	0.00	5.01	0.21	0.77	0.02
		5	9.09	23.32	63.52	0.18	4.74	0.01	100.87	0.77	1.21	2.79	0.01	0.22	0.00	5.00	0.22	0.77	0.01
6	M	1	8.87	24.07	63.32	0.18	4.91	0.22	101.57	0.75	1.24	2.77	0.01	0.23	0.01	5.00	0.23	0.76	0.01
		2	9.19	23.49	63.69	0.31	4.70	0.11	101.49	0.78	1.21	2.78	0.02	0.22	0.00	5.01	0.22	0.77	0.02
		3	9.04	23.39	63.96	0.35	4.56	0.08	101.38	0.77	1.20	2.79	0.02	0.21	0.00	5.00	0.21	0.77	0.02

		4	9.33	23.51	64.84	0.35	4.95	0.25	103.24	0.78	1.19	2.79	0.02	0.23	0.01	5.02	0.22	0.76	0.02
6	M	5	8.81	23.30	63.05	0.26	4.51	0.00	99.93	0.76	1.21	2.79	0.01	0.21	0.00	4.99	0.22	0.77	0.02
7	M	2	8.92	23.18	62.96	0.35	4.53	0.08	100.02	0.77	1.21	2.79	0.02	0.22	0.00	5.00	0.22	0.77	0.02
		3	8.61	23.13	62.44	0.28	4.72	0.02	99.20	0.74	1.22	2.79	0.02	0.23	0.00	4.99	0.23	0.75	0.02
		4	9.04	23.87	63.80	0.24	4.79	0.16	101.90	0.76	1.22	2.78	0.01	0.22	0.01	5.01	0.22	0.76	0.01
		5	9.03	23.89	64.58	0.30	4.98	0.17	102.95	0.75	1.21	2.78	0.02	0.23	0.01	5.00	0.23	0.75	0.02
8	M	1	9.19	23.34	64.15	0.31	4.47	0.10	101.57	0.78	1.20	2.80	0.02	0.21	0.00	5.00	0.21	0.77	0.02
		2	9.19	23.53	64.71	0.31	4.52	0.20	102.46	0.77	1.20	2.80	0.02	0.21	0.01	5.00	0.21	0.77	0.02
		4	8.94	23.11	63.40	0.34	4.64	0.00	100.43	0.76	1.20	2.79	0.02	0.22	0.00	5.00	0.22	0.76	0.02
9	M	1	9.11	23.16	63.79	0.21	4.61	0.04	100.92	0.78	1.20	2.80	0.01	0.22	0.00	5.00	0.22	0.77	0.01
		2	9.19	23.60	63.87	0.17	4.74	0.09	101.67	0.78	1.21	2.78	0.01	0.22	0.00	5.01	0.22	0.77	0.01
		3	9.34	23.47	64.78	0.20	4.44	0.14	102.36	0.78	1.20	2.80	0.01	0.21	0.00	5.00	0.21	0.78	0.01
10	M	1	9.27	23.44	63.91	0.17	4.60	0.04	101.43	0.78	1.21	2.79	0.01	0.22	0.00	5.01	0.21	0.78	0.01
		2	9.29	23.13	63.36	0.17	4.46	0.08	100.48	0.79	1.20	2.79	0.01	0.21	0.00	5.01	0.21	0.78	0.01
		3	9.18	23.30	63.94	0.20	4.40	0.00	101.02	0.78	1.20	2.80	0.01	0.21	0.00	5.00	0.21	0.78	0.01
		4	9.18	23.10	64.37	0.25	4.48	0.01	101.38	0.78	1.19	2.81	0.01	0.21	0.00	4.99	0.21	0.78	0.01
		5	9.53	22.74	62.90	0.17	4.41	0.09	99.85	0.82	1.19	2.79	0.01	0.21	0.00	5.03	0.20	0.79	0.01

Table 3.3: Analysis of plagioclase associated with garnet A1 from sample HJ-57b (group 2). Type A grains are adjacent to garnet, type M grains are in the matrix, and tpye I grains are inclusions in garnet. # represents the analysis number; in the case of type A and M grains the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	M	1	1.96	33.74	47.41	0.04	16.74	0.00	99.90	0.17	1.83	2.18	0.00	0.82	0.00	5.00	0.82	0.17	0.00
		2	1.92	34.06	47.46	0.01	17.28	0.00	100.72	0.17	1.83	2.16	0.00	0.84	0.00	5.01	0.83	0.17	0.00
		3	1.88	34.02	47.50	0.01	17.33	0.02	100.77	0.17	1.83	2.16	0.00	0.85	0.00	5.01	0.83	0.16	0.00
		4	2.04	34.26	47.22	0.03	17.22	0.03	100.80	0.18	1.84	2.15	0.00	0.84	0.00	5.02	0.82	0.18	0.00
		5	1.73	33.47	46.15	0.02	17.19	0.00	98.56	0.16	1.84	2.15	0.00	0.86	0.00	5.01	0.85	0.15	0.00
		6	1.83	33.69	47.12	0.08	17.40	0.01	100.14	0.16	1.82	2.16	0.00	0.86	0.00	5.01	0.84	0.16	0.00
		7	1.76	33.80	46.91	0.03	17.45	0.03	99.98	0.16	1.83	2.16	0.00	0.86	0.00	5.01	0.84	0.15	0.00
		8	2.00	34.13	47.25	0.08	17.17	0.00	100.63	0.18	1.84	2.16	0.00	0.84	0.00	5.02	0.82	0.17	0.00
		9	2.03	33.91	47.09	0.05	17.29	0.10	100.48	0.18	1.83	2.16	0.00	0.85	0.00	5.02	0.82	0.17	0.00
		10	1.95	34.12	47.86	0.05	17.28	0.04	101.29	0.17	1.82	2.17	0.00	0.84	0.00	5.01	0.83	0.17	0.00
		11	1.98	33.70	47.39	0.04	17.23	0.05	100.39	0.18	1.82	2.17	0.00	0.85	0.00	5.01	0.83	0.17	0.00
		12	1.98	33.60	47.46	0.02	17.04	0.06	100.16	0.18	1.82	2.18	0.00	0.84	0.00	5.01	0.83	0.17	0.00
		13	1.99	33.45	47.37	0.06	17.02	0.05	99.93	0.18	1.81	2.18	0.00	0.84	0.00	5.01	0.82	0.17	0.00
		14	1.93	33.27	47.67	0.04	16.84	0.08	99.84	0.17	1.80	2.19	0.00	0.83	0.00	5.00	0.83	0.17	0.00
		15	2.09	33.59	47.48	0.03	17.04	0.04	100.28	0.19	1.81	2.17	0.00	0.84	0.00	5.01	0.82	0.18	0.00
		16	2.21	33.59	47.61	0.04	16.88	0.04	100.38	0.20	1.81	2.18	0.00	0.83	0.00	5.02	0.81	0.19	0.00
2	M	1	2.13	33.49	47.38	0.02	17.13	0.06	100.20	0.19	1.81	2.17	0.00	0.84	0.00	5.02	0.82	0.18	0.00
		2	2.01	33.80	47.09	0.00	17.13	0.07	100.06	0.18	1.83	2.16	0.00	0.84	0.00	5.02	0.83	0.18	0.00
		3	2.01	33.15	47.23	0.14	16.61	0.02	99.15	0.18	1.81	2.19	0.01	0.82	0.00	5.01	0.81	0.18	0.01
		4	2.07	33.40	47.31	0.04	17.08	0.03	99.93	0.18	1.81	2.18	0.00	0.84	0.00	5.02	0.82	0.18	0.00
		5	1.97	33.61	46.95	0.06	16.88	0.00	99.47	0.18	1.83	2.17	0.00	0.84	0.00	5.01	0.82	0.17	0.00
		6	2.05	33.67	47.61	0.03	17.06	0.11	100.51	0.18	1.81	2.18	0.00	0.84	0.00	5.01	0.82	0.18	0.00
		7	2.01	33.30	47.06	0.01	16.94	0.10	99.42	0.18	1.81	2.18	0.00	0.84	0.00	5.01	0.82	0.18	0.00
		8	1.94	33.73	47.33	0.11	17.17	0.19	100.47	0.17	1.82	2.17	0.01	0.84	0.01	5.02	0.83	0.17	0.01

3	M	1	2.04	33.61	47.51	0.04	16.79	0.07	100.05	0.18	1.82	2.18	0.00	0.83	0.00	5.01	0.82	0.18	0.00
3	M	2	1.75	33.46	47.24	0.06	17.03	0.05	99.60	0.16	1.82	2.18	0.00	0.84	0.00	5.00	0.84	0.16	0.00
		3	2.08	33.65	47.73	0.05	17.09	0.01	100.60	0.18	1.81	2.18	0.00	0.84	0.00	5.01	0.82	0.18	0.00
4	M	1	2.11	33.81	47.62	0.01	16.99	0.07	100.62	0.19	1.82	2.17	0.00	0.83	0.00	5.01	0.82	0.18	0.00
		2	1.96	33.88	47.78	0.09	17.47	0.07	101.24	0.17	1.81	2.17	0.01	0.85	0.00	5.01	0.83	0.17	0.01
		3	1.96	33.59	47.87	0.04	17.33	0.00	100.79	0.17	1.80	2.18	0.00	0.85	0.00	5.01	0.83	0.17	0.00
		4	2.09	34.03	47.75	0.00	17.34	0.04	101.23	0.18	1.82	2.17	0.00	0.84	0.00	5.02	0.82	0.18	0.00
		5	2.02	33.43	47.47	0.01	17.14	0.05	100.12	0.18	1.81	2.18	0.00	0.84	0.00	5.01	0.82	0.18	0.00
		6	1.94	33.96	47.72	0.03	17.08	0.02	100.75	0.17	1.82	2.17	0.00	0.83	0.00	5.00	0.83	0.17	0.00
		7	2.00	33.69	47.68	0.06	16.82	0.08	100.33	0.18	1.82	2.18	0.00	0.82	0.00	5.01	0.82	0.18	0.00
		8	2.12	33.16	47.65	0.01	16.84	0.08	99.86	0.19	1.80	2.19	0.00	0.83	0.00	5.01	0.81	0.19	0.00
	I	1	2.09	33.60	47.34	0.02	16.93	0.05	100.03	0.19	1.82	2.17	0.00	0.83	0.00	5.01	0.82	0.18	0.00
		2	2.58	33.12	48.91	0.10	16.13	0.00	100.83	0.23	1.77	2.22	0.01	0.78	0.00	5.01	0.77	0.22	0.01
		3	2.20	34.10	47.93	0.02	17.21	0.21	101.67	0.19	1.82	2.17	0.00	0.83	0.01	5.02	0.81	0.19	0.00
		4	2.01	33.53	47.15	0.04	16.99	0.20	99.93	0.18	1.82	2.17	0.00	0.84	0.01	5.01	0.82	0.18	0.00
		5	2.19	33.98	47.71	0.07	17.05	0.00	101.00	0.19	1.82	2.17	0.00	0.83	0.00	5.02	0.81	0.19	0.00

Table 3.4: Analysis of plagioclase associated with garnet A1 from sample HJ-57a_1 (group 3). Type A grains are adjacent to garnet and type M grains are in the matrix; # represents the analysis number with increasing distance from garnet: the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	A	1	11.14	21.00	67.30	0.16	1.38	0.38	101.35	0.94	1.07	2.92	0.01	0.06	0.01	5.01	0.06	0.93	0.01
		2	9.65	23.19	64.43	0.30	4.00	0.03	101.59	0.81	1.19	2.81	0.02	0.19	0.00	5.01	0.18	0.80	0.02
		3	9.26	23.68	63.52	0.31	4.08	0.00	100.86	0.79	1.22	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		4	10.78	21.04	66.91	0.18	1.42	0.43	100.77	0.91	1.08	2.92	0.01	0.07	0.01	5.00	0.07	0.92	0.01
		5	9.55	23.47	64.10	0.28	3.89	0.01	101.31	0.81	1.21	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		6	9.16	23.55	63.96	0.33	4.06	0.04	101.10	0.78	1.21	2.80	0.02	0.19	0.00	4.99	0.19	0.79	0.02
		7	9.29	23.74	63.44	0.36	3.91	0.32	101.07	0.79	1.23	2.78	0.02	0.18	0.01	5.01	0.18	0.79	0.02
2	A	1	9.68	23.56	63.50	0.32	4.21	0.12	101.38	0.82	1.21	2.78	0.02	0.20	0.00	5.03	0.19	0.79	0.02
		3	9.55	23.36	64.01	0.32	3.73	0.00	100.98	0.81	1.21	2.80	0.02	0.18	0.00	5.01	0.17	0.81	0.02
		4	9.34	23.10	63.58	0.39	3.87	0.00	100.28	0.80	1.20	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		5	9.49	23.14	63.94	0.38	3.99	0.03	100.97	0.81	1.20	2.80	0.02	0.19	0.00	5.01	0.18	0.79	0.02
		6	9.33	23.33	63.92	0.33	3.62	0.06	100.58	0.79	1.21	2.81	0.02	0.17	0.00	5.00	0.17	0.81	0.02
		7	9.57	22.92	64.24	0.35	3.76	0.00	100.84	0.81	1.18	2.82	0.02	0.18	0.00	5.01	0.17	0.81	0.02
		8	9.39	23.21	63.61	0.43	3.75	0.00	100.39	0.80	1.20	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		9	9.43	23.34	63.79	0.35	4.01	0.00	100.93	0.80	1.21	2.80	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		10	9.55	23.09	64.47	0.41	3.69	0.00	101.20	0.81	1.19	2.81	0.02	0.17	0.00	5.01	0.17	0.81	0.02
		11	9.54	22.90	64.19	0.39	3.76	0.03	100.81	0.81	1.18	2.81	0.02	0.18	0.00	5.01	0.17	0.80	0.02
		12	9.43	23.12	64.47	0.41	3.73	0.00	101.17	0.80	1.19	2.82	0.02	0.17	0.00	5.00	0.18	0.80	0.02
		13	9.60	22.92	63.77	0.42	3.65	0.03	100.41	0.82	1.19	2.81	0.02	0.17	0.00	5.02	0.17	0.81	0.02
		14	9.49	23.15	64.07	0.35	3.49	0.00	100.56	0.81	1.20	2.81	0.02	0.16	0.00	5.00	0.17	0.81	0.02
		15	9.54	23.07	64.14	0.43	3.58	0.07	100.83	0.81	1.19	2.81	0.02	0.17	0.00	5.01	0.17	0.81	0.02
		16	9.42	23.17	64.12	0.43	3.77	0.00	100.90	0.80	1.20	2.81	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		17	9.59	22.88	64.63	0.41	3.72	0.00	101.22	0.81	1.18	2.82	0.02	0.17	0.00	5.01	0.17	0.80	0.02
		18	9.66	23.14	64.91	0.41	3.68	0.08	101.88	0.81	1.18	2.82	0.02	0.17	0.00	5.01	0.17	0.81	0.02

		19	9.51	23.26	64.35	0.43	3.76	0.01	101.30	0.80	1.20	2.81	0.02	0.18	0.00	5.01	0.17	0.80	0.02
2	A	20	9.44	23.02	64.50	0.41	3.76	0.00	101.12	0.80	1.19	2.82	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		21	9.43	22.76	64.60	0.40	3.70	0.04	100.93	0.80	1.17	2.83	0.02	0.17	0.00	5.00	0.17	0.80	0.02
		22	9.37	22.76	64.42	0.43	3.60	0.02	100.62	0.80	1.18	2.83	0.02	0.17	0.00	5.00	0.17	0.80	0.02
		23	9.56	23.24	64.59	0.37	3.80	0.10	101.66	0.81	1.19	2.81	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		24	9.63	23.37	64.60	0.40	3.67	0.00	101.67	0.81	1.20	2.81	0.02	0.17	0.00	5.01	0.17	0.81	0.02
		25	9.48	23.20	64.53	0.36	3.85	0.01	101.43	0.80	1.19	2.81	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		26	9.26	23.20	64.30	0.37	3.80	0.05	100.97	0.79	1.20	2.81	0.02	0.18	0.00	4.99	0.18	0.80	0.02
		27	9.59	23.15	64.24	0.30	3.90	0.02	101.21	0.81	1.19	2.81	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		28	9.61	23.48	64.12	0.31	3.97	0.04	101.53	0.81	1.21	2.79	0.02	0.19	0.00	5.02	0.18	0.80	0.02
		29	9.31	23.44	64.28	0.29	4.00	0.01	101.34	0.79	1.20	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
3	M	1	9.54	23.42	63.74	0.21	4.23	0.01	101.15	0.81	1.21	2.79	0.01	0.20	0.00	5.02	0.19	0.79	0.01
		2	9.56	23.08	64.20	0.28	3.89	0.00	101.01	0.81	1.19	2.81	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		3	9.45	23.10	64.29	0.33	3.82	0.05	101.04	0.80	1.19	2.81	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		4	9.36	23.22	64.36	0.35	3.90	0.00	101.18	0.79	1.19	2.81	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		5	9.54	23.54	64.21	0.33	3.81	0.03	101.45	0.81	1.21	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		6	9.58	22.90	64.21	0.34	3.83	0.00	100.86	0.81	1.18	2.81	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		7	9.38	23.32	64.59	0.37	3.70	0.01	101.37	0.79	1.20	2.81	0.02	0.17	0.00	4.99	0.18	0.80	0.02
		8	9.54	23.30	64.41	0.35	3.74	0.02	101.35	0.81	1.20	2.81	0.02	0.17	0.00	5.01	0.17	0.81	0.02
		9	9.45	23.16	64.88	0.35	3.63	0.05	101.51	0.80	1.19	2.82	0.02	0.17	0.00	4.99	0.17	0.81	0.02
		10	9.85	22.83	65.10	0.35	3.82	0.04	102.01	0.83	1.17	2.82	0.02	0.18	0.00	5.02	0.17	0.81	0.02
4	M	1	9.32	23.24	63.08	0.38	4.16	0.01	100.18	0.80	1.21	2.79	0.02	0.20	0.00	5.02	0.19	0.79	0.02
		2	9.43	22.89	63.58	0.41	4.02	0.04	100.37	0.81	1.19	2.80	0.02	0.19	0.00	5.02	0.19	0.79	0.02
		3	9.58	22.64	63.84	0.35	3.43	0.10	99.94	0.82	1.18	2.82	0.02	0.16	0.00	5.01	0.16	0.82	0.02
		4	9.42	23.32	63.49	0.34	3.92	0.08	100.56	0.80	1.21	2.79	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		5	9.51	23.44	63.48	0.35	4.05	0.04	100.87	0.81	1.21	2.79	0.02	0.19	0.00	5.02	0.19	0.79	0.02
		6	9.47	23.39	63.35	0.31	4.15	0.04	100.72	0.81	1.21	2.79	0.02	0.20	0.00	5.02	0.19	0.79	0.02
		7	9.17	23.35	64.05	0.35	3.84	0.02	100.78	0.78	1.21	2.81	0.02	0.18	0.00	4.99	0.18	0.80	0.02
		8	9.44	23.15	63.74	0.36	3.74	0.00	100.43	0.81	1.20	2.81	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		9	9.57	22.67	63.87	0.36	3.64	0.01	100.12	0.82	1.18	2.82	0.02	0.17	0.00	5.01	0.17	0.81	0.02
		10	9.36	23.08	64.14	0.40	3.86	0.01	100.85	0.80	1.19	2.81	0.02	0.18	0.00	5.00	0.18	0.80	0.02

		11	9.38	23.28	64.05	0.37	3.87	0.00	100.94	0.80	1.20	2.80	0.02	0.18	0.00	5.00	0.18	0.80	0.02
4	M	12	9.58	23.19	64.06	0.41	3.93	0.03	101.20	0.81	1.20	2.80	0.02	0.18	0.00	5.02	0.18	0.80	0.02
		13	9.34	23.45	64.07	0.42	3.99	0.00	101.26	0.79	1.21	2.80	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		14	9.41	23.40	63.90	0.42	3.84	0.00	100.98	0.80	1.21	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		15	9.41	23.42	64.00	0.43	3.97	0.04	101.26	0.80	1.21	2.80	0.02	0.19	0.00	5.01	0.18	0.79	0.02
		16	9.36	23.43	63.55	0.45	3.99	0.08	100.85	0.80	1.21	2.79	0.03	0.19	0.00	5.01	0.19	0.79	0.02
		17	9.46	23.60	63.96	0.35	4.11	0.00	101.47	0.80	1.21	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
5	M	1	9.37	23.91	63.85	0.30	4.14	0.00	101.57	0.79	1.23	2.78	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		2	9.39	23.25	63.38	0.36	4.03	0.00	100.40	0.80	1.21	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		3	9.21	23.38	63.97	0.36	3.98	0.00	100.91	0.78	1.21	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		4	9.59	23.21	63.84	0.36	4.07	0.05	101.12	0.81	1.20	2.80	0.02	0.19	0.00	5.02	0.19	0.79	0.02
		5	9.43	23.51	64.10	0.33	3.93	0.00	101.30	0.80	1.21	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		6	9.58	23.31	63.98	0.35	3.84	0.01	101.07	0.81	1.20	2.80	0.02	0.18	0.00	5.02	0.18	0.80	0.02
		7	9.49	23.25	64.06	0.40	4.00	0.01	101.21	0.80	1.20	2.80	0.02	0.19	0.00	5.01	0.18	0.79	0.02
		8	9.15	23.38	64.27	0.36	3.86	0.01	101.03	0.78	1.20	2.81	0.02	0.18	0.00	4.99	0.19	0.79	0.02
		9	9.29	23.02	63.88	0.36	3.91	0.00	100.45	0.79	1.19	2.81	0.02	0.18	0.00	5.00	0.18	0.79	0.02
		10	9.63	23.49	63.85	0.34	3.95	0.02	101.28	0.82	1.21	2.79	0.02	0.18	0.00	5.02	0.18	0.80	0.02
		11	9.58	23.40	64.41	0.38	3.87	0.00	101.64	0.81	1.20	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		12	9.27	23.43	64.68	0.36	3.91	0.03	101.68	0.78	1.20	2.81	0.02	0.18	0.00	4.99	0.19	0.79	0.02
		13	9.41	23.56	64.27	0.35	3.94	0.01	101.54	0.79	1.21	2.80	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		14	9.43	23.46	64.32	0.33	3.96	0.07	101.57	0.80	1.20	2.80	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		15	9.32	23.48	63.95	0.26	4.09	0.03	101.13	0.79	1.21	2.80	0.01	0.19	0.00	5.00	0.19	0.79	0.01
6	M	1	8.96	23.25	62.64	0.18	4.23	0.00	99.27	0.77	1.22	2.79	0.01	0.20	0.00	4.99	0.20	0.78	0.01
		2	9.39	23.70	64.24	0.21	4.28	0.06	101.89	0.79	1.21	2.79	0.01	0.20	0.00	5.00	0.20	0.79	0.01
		3	9.35	23.37	63.82	0.25	3.98	0.00	100.77	0.79	1.21	2.80	0.01	0.19	0.00	5.00	0.19	0.80	0.01
		4	9.29	23.39	64.66	0.27	4.06	0.00	101.66	0.78	1.20	2.81	0.01	0.19	0.00	4.99	0.19	0.79	0.02
		5	9.68	23.25	63.86	0.25	3.99	0.07	101.10	0.82	1.20	2.80	0.01	0.19	0.00	5.02	0.18	0.80	0.01
		6	9.30	23.40	64.64	0.27	4.00	0.00	101.61	0.78	1.20	2.81	0.01	0.19	0.00	4.99	0.19	0.80	0.01
		7	9.42	23.47	63.92	0.25	4.01	0.00	101.07	0.80	1.21	2.80	0.01	0.19	0.00	5.01	0.19	0.80	0.01
		8	9.37	23.58	63.89	0.23	4.02	0.00	101.09	0.79	1.22	2.79	0.01	0.19	0.00	5.00	0.19	0.80	0.01
		9	9.38	23.36	63.34	0.22	3.96	0.05	100.31	0.80	1.21	2.79	0.01	0.19	0.00	5.01	0.19	0.80	0.01

	10	9.36	22.43	64.39	0.13	3.51	0.04	99.86	0.80	1.17	2.84	0.01	0.17	0.00	4.98	0.17	0.82	0.01

Table 3.5: Analysis of plagioclase associated with garnet A2 from sample HJ-57a$_1$ (group 3). Type A grains are adjacent to garnet and type M grains are in the matrix; # represents the analysis number with increasing distance from garnet: the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	M	1	9.66	23.45	63.75	0.25	4.15	0.03	101.28	0.82	1.21	2.79	0.01	0.19	0.00	5.02	0.19	0.80	0.01
		2	9.28	23.46	64.15	0.31	3.91	0.04	101.16	0.79	1.21	2.80	0.02	0.18	0.00	5.00	0.19	0.80	0.02
		3	9.76	23.38	64.97	0.28	4.06	0.00	102.46	0.82	1.19	2.81	0.02	0.19	0.00	5.02	0.18	0.80	0.02
		4	9.38	23.41	64.15	0.28	4.08	0.00	101.29	0.79	1.20	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		5	9.42	23.64	64.49	0.32	4.03	0.00	101.90	0.79	1.21	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		6	9.46	23.55	64.62	0.28	4.03	0.00	101.95	0.80	1.20	2.80	0.02	0.19	0.00	5.00	0.19	0.80	0.02
		7	9.46	23.47	64.45	0.31	3.93	0.00	101.62	0.80	1.20	2.80	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		8	9.47	23.57	64.34	0.27	3.99	0.00	101.63	0.80	1.21	2.80	0.02	0.19	0.00	5.00	0.19	0.80	0.02
		9	9.56	23.66	64.50	0.29	4.12	0.00	102.13	0.80	1.21	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		10	9.33	23.50	63.79	0.26	4.36	0.02	101.25	0.79	1.21	2.79	0.01	0.20	0.00	5.01	0.20	0.78	0.01
2	M	1	9.64	23.64	63.79	0.26	4.07	0.00	101.40	0.82	1.22	2.79	0.01	0.19	0.00	5.02	0.19	0.80	0.01
		3	9.55	23.34	63.66	0.27	4.12	0.03	100.97	0.81	1.21	2.79	0.02	0.19	0.00	5.02	0.19	0.80	0.01
		4	9.81	23.69	64.30	0.22	4.01	0.01	102.03	0.82	1.21	2.79	0.01	0.19	0.00	5.02	0.18	0.81	0.01
		5	9.35	23.55	64.46	0.27	4.07	0.00	101.71	0.79	1.21	2.80	0.01	0.19	0.00	5.00	0.19	0.79	0.02
		6	9.45	23.49	64.44	0.25	3.87	0.10	101.61	0.80	1.20	2.80	0.01	0.18	0.00	5.00	0.18	0.80	0.01
		7	9.38	23.16	64.09	0.25	3.71	0.01	100.60	0.80	1.20	2.81	0.01	0.17	0.00	5.00	0.18	0.81	0.01
		8	9.40	23.41	65.05	0.26	4.02	0.03	102.16	0.79	1.19	2.81	0.01	0.19	0.00	4.99	0.19	0.80	0.01
		9	9.68	23.36	64.16	0.19	3.98	0.00	101.36	0.82	1.20	2.80	0.01	0.19	0.00	5.02	0.18	0.81	0.01
		10	9.64	22.84	64.96	0.13	3.27	0.00	100.85	0.82	1.18	2.84	0.01	0.15	0.00	4.99	0.16	0.84	0.01
3	A	1	9.43	23.46	63.47	0.22	3.96	0.42	100.96	0.80	1.21	2.78	0.01	0.19	0.01	5.01	0.19	0.80	0.01
		2	9.47	23.25	63.46	0.24	3.92	0.04	100.38	0.81	1.21	2.80	0.01	0.18	0.00	5.01	0.18	0.80	0.01
		3	9.53	22.83	63.86	0.25	3.74	0.00	100.21	0.81	1.19	2.81	0.01	0.18	0.00	5.01	0.18	0.81	0.01
		4	9.50	23.02	64.35	0.29	3.87	0.00	101.03	0.81	1.19	2.81	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		5	9.46	22.98	64.08	0.29	3.85	0.04	100.70	0.81	1.19	2.81	0.02	0.18	0.00	5.00	0.18	0.80	0.02

		6	9.59	23.42	64.33	0.29	3.85	0.03	101.51	0.81	1.20	2.80	0.02	0.18	0.00	5.01	0.18	0.81	0.02
3	A	7	9.40	22.92	63.00	0.27	3.84	0.02	99.46	0.81	1.20	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		8	9.63	23.52	63.14	0.27	4.06	0.00	100.61	0.82	1.22	2.78	0.02	0.19	0.00	5.03	0.19	0.80	0.01
		9	9.23	23.35	63.51	0.29	3.86	0.00	100.25	0.79	1.21	2.80	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		10	9.91	22.71	64.47	0.18	3.23	0.00	100.49	0.84	1.17	2.83	0.01	0.15	0.00	5.01	0.15	0.84	0.01
4	M	2	9.82	22.68	64.23	0.21	3.16	0.00	100.10	0.84	1.18	2.83	0.01	0.15	0.00	5.01	0.15	0.84	0.01
		3	9.48	23.35	63.52	0.21	3.70	0.03	100.29	0.81	1.21	2.80	0.01	0.17	0.00	5.01	0.18	0.81	0.01
		4	9.26	23.15	63.27	0.16	2.50	0.01	98.37	0.80	1.22	2.82	0.01	0.12	0.00	4.97	0.13	0.86	0.01
5	M	1	9.48	23.67	63.74	0.20	4.17	0.13	101.38	0.80	1.22	2.78	0.01	0.19	0.00	5.01	0.19	0.80	0.01
		2	9.22	23.67	64.11	0.31	3.94	0.03	101.27	0.78	1.22	2.80	0.02	0.18	0.00	4.99	0.19	0.79	0.02
		3	9.44	23.61	63.59	0.28	4.10	0.03	101.05	0.80	1.22	2.78	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		4	9.52	23.32	63.59	0.32	3.99	0.05	100.79	0.81	1.21	2.79	0.02	0.19	0.00	5.02	0.18	0.80	0.02
		5	9.55	23.78	63.55	0.33	4.07	0.01	101.29	0.81	1.23	2.78	0.02	0.19	0.00	5.02	0.19	0.79	0.02
		6	9.53	23.27	63.67	0.34	4.07	0.03	100.92	0.81	1.20	2.79	0.02	0.19	0.00	5.02	0.19	0.79	0.02
		7	9.30	23.41	63.63	0.35	3.85	0.05	100.58	0.79	1.21	2.80	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		8	9.64	23.17	64.02	0.28	4.03	0.03	101.17	0.82	1.19	2.80	0.02	0.19	0.00	5.02	0.18	0.80	0.02
		9	9.70	23.36	64.07	0.33	3.97	0.03	101.46	0.82	1.20	2.80	0.02	0.19	0.00	5.02	0.18	0.80	0.02
		10	9.75	22.91	63.77	0.30	4.02	0.02	100.75	0.83	1.19	2.80	0.02	0.19	0.00	5.03	0.18	0.80	0.02
		11	9.77	22.90	64.54	0.33	3.35	0.00	100.89	0.83	1.18	2.82	0.02	0.16	0.00	5.01	0.16	0.83	0.02
		12	9.55	23.38	63.98	0.31	3.90	0.00	101.12	0.81	1.21	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		13	9.23	22.66	62.71	0.39	3.87	0.06	98.91	0.80	1.19	2.80	0.02	0.19	0.00	5.01	0.18	0.79	0.02
		14	9.62	22.89	64.09	0.32	3.80	0.00	100.72	0.82	1.18	2.81	0.02	0.18	0.00	5.01	0.18	0.81	0.02
		15	9.60	23.11	64.56	0.35	3.56	0.00	101.18	0.81	1.19	2.82	0.02	0.17	0.00	5.00	0.17	0.81	0.02
		16	9.60	23.20	63.94	0.36	3.90	0.00	101.00	0.82	1.20	2.80	0.02	0.18	0.00	5.02	0.18	0.80	0.02
		17	9.41	23.31	64.57	0.35	3.74	0.00	101.39	0.79	1.20	2.81	0.02	0.17	0.00	5.00	0.18	0.80	0.02
		18	9.50	23.14	64.39	0.34	3.72	0.06	101.16	0.80	1.19	2.81	0.02	0.17	0.00	5.00	0.17	0.81	0.02
		19	9.54	23.67	64.45	0.32	3.75	0.00	101.74	0.80	1.21	2.80	0.02	0.17	0.00	5.01	0.18	0.81	0.02
		20	9.70	23.31	64.84	0.32	3.78	0.01	101.96	0.82	1.19	2.81	0.02	0.18	0.00	5.01	0.17	0.81	0.02
		21	9.66	22.86	63.02	0.45	3.88	0.06	99.94	0.83	1.20	2.80	0.03	0.18	0.00	5.03	0.18	0.80	0.02
		22	9.48	23.57	63.75	0.28	3.98	0.00	101.07	0.80	1.22	2.79	0.02	0.19	0.00	5.01	0.19	0.80	0.02
		23	9.48	23.21	63.00	0.33	4.01	0.02	100.05	0.81	1.21	2.79	0.02	0.19	0.00	5.02	0.19	0.80	0.02

Table 3.6: Analysis of plagioclase associated with garnet A3 from sample HJ-57a_1 (group 3). Type A grains are adjacent to garnet, type M grains are in the matrix, and type I grains are inclusions in garnet. # represents the analysis number; in the case of type A and M grains the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage						Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	A	1	9.44	23.64	63.08	0.25	4.14	0.06	100.60	0.81	1.23	2.78	0.01	0.20	0.00	5.02	0.19	0.79	0.01
		2	9.51	23.49	64.02	0.23	4.23	0.08	101.56	0.80	1.21	2.79	0.01	0.20	0.00	5.01	0.19	0.79	0.01
		3	9.40	23.33	63.58	0.27	4.04	0.00	100.62	0.80	1.21	2.79	0.02	0.19	0.00	5.01	0.19	0.80	0.02
		4	9.37	23.64	63.26	0.28	4.18	0.01	100.74	0.80	1.22	2.78	0.02	0.20	0.00	5.02	0.19	0.79	0.02
		5	9.47	23.45	63.32	0.27	4.12	0.00	100.63	0.81	1.22	2.79	0.02	0.19	0.00	5.02	0.19	0.79	0.01
		6	9.37	23.13	63.48	0.29	4.08	0.01	100.36	0.80	1.20	2.80	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		7	9.29	23.36	62.75	0.29	4.12	0.00	99.80	0.80	1.22	2.78	0.02	0.20	0.00	5.01	0.19	0.79	0.02
		8	9.29	23.43	63.57	0.24	4.07	0.00	100.61	0.79	1.21	2.79	0.01	0.19	0.00	5.00	0.19	0.79	0.01
		9	9.53	23.52	63.13	0.24	4.08	0.00	100.50	0.81	1.22	2.78	0.01	0.19	0.00	5.02	0.19	0.80	0.01
2	A	1	9.49	23.65	63.98	0.25	4.08	0.11	101.57	0.80	1.21	2.79	0.01	0.19	0.00	5.01	0.19	0.80	0.01
		2	9.42	23.59	64.49	0.25	4.15	0.10	102.00	0.79	1.21	2.80	0.01	0.19	0.00	5.00	0.19	0.79	0.01
		3	9.35	23.64	63.36	0.25	3.85	0.04	100.47	0.80	1.23	2.79	0.01	0.18	0.00	5.01	0.18	0.80	0.01
		4	9.36	23.52	63.86	0.24	4.10	0.02	101.08	0.79	1.21	2.79	0.01	0.19	0.00	5.00	0.19	0.79	0.01
		5	9.28	23.63	63.80	0.24	4.22	0.03	101.21	0.79	1.22	2.79	0.01	0.20	0.00	5.00	0.20	0.79	0.01
		6	9.36	23.49	63.43	0.27	4.14	0.00	100.69	0.80	1.22	2.79	0.02	0.20	0.00	5.01	0.19	0.79	0.01
		7	9.46	23.61	63.89	0.21	4.18	0.06	101.41	0.80	1.21	2.79	0.01	0.20	0.00	5.01	0.19	0.79	0.01
		8	9.45	23.90	63.87	0.20	4.21	0.04	101.68	0.80	1.23	2.78	0.01	0.20	0.00	5.01	0.20	0.79	0.01
		9	9.49	23.68	63.84	0.15	4.19	0.18	101.54	0.80	1.22	2.78	0.01	0.20	0.01	5.01	0.19	0.80	0.01
3	M	1	9.49	23.76	63.30	0.36	4.18	0.00	101.09	0.81	1.23	2.77	0.02	0.20	0.00	5.02	0.19	0.79	0.02
		2	9.39	23.29	63.74	0.28	4.07	0.03	100.81	0.80	1.20	2.80	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		3	9.23	23.23	63.23	0.31	4.17	0.00	100.17	0.79	1.21	2.79	0.02	0.20	0.00	5.01	0.20	0.79	0.02
		4	9.37	23.45	63.29	0.28	4.01	0.08	100.48	0.80	1.22	2.79	0.02	0.19	0.00	5.01	0.19	0.80	0.02
		5	9.43	23.65	63.36	0.19	4.19	0.02	100.84	0.80	1.22	2.78	0.01	0.20	0.00	5.01	0.20	0.79	0.01
		6	9.40	23.54	63.57	0.22	4.22	0.00	100.95	0.80	1.22	2.79	0.01	0.20	0.00	5.01	0.20	0.79	0.01

		7	9.23	23.04	62.65	0.20	4.07	0.08	99.27	0.80	1.21	2.79	0.01	0.19	0.00	5.01	0.19	0.80	0.01
3	M	8	9.47	23.56	63.30	0.16	4.01	0.01	100.52	0.81	1.22	2.78	0.01	0.19	0.00	5.01	0.19	0.80	0.01
4	M	1	9.21	23.58	62.29	0.18	4.31	0.05	99.61	0.79	1.24	2.77	0.01	0.21	0.00	5.01	0.20	0.79	0.01
		2	9.34	23.56	62.97	0.22	4.14	0.00	100.22	0.80	1.23	2.78	0.01	0.20	0.00	5.01	0.19	0.79	0.01
		3	9.62	23.47	63.65	0.20	3.99	0.00	100.94	0.82	1.21	2.79	0.01	0.19	0.00	5.02	0.18	0.80	0.01
		4	9.62	22.97	63.82	0.24	3.91	0.00	100.57	0.82	1.19	2.81	0.01	0.18	0.00	5.02	0.18	0.81	0.01
		5	9.62	23.11	64.19	0.22	3.78	0.00	100.92	0.82	1.19	2.81	0.01	0.18	0.00	5.01	0.18	0.81	0.01
		6	9.39	23.24	63.92	0.24	3.74	0.01	100.54	0.80	1.20	2.81	0.01	0.18	0.00	5.00	0.18	0.81	0.01
		7	9.30	23.44	63.82	0.23	3.86	0.00	100.65	0.79	1.21	2.80	0.01	0.18	0.00	5.00	0.18	0.80	0.01
		8	9.35	23.38	63.26	0.26	3.88	0.00	100.12	0.80	1.22	2.79	0.01	0.18	0.00	5.01	0.18	0.80	0.01
		9	9.33	23.47	63.45	0.27	4.15	0.06	100.74	0.80	1.21	2.79	0.02	0.20	0.00	5.01	0.19	0.79	0.02
		10	9.37	23.20	64.16	0.19	4.15	0.20	101.26	0.79	1.19	2.80	0.01	0.19	0.01	5.00	0.19	0.80	0.01
5	M	1	9.25	23.50	62.48	0.18	4.12	0.02	99.56	0.80	1.23	2.78	0.01	0.20	0.00	5.01	0.20	0.79	0.01
		2	9.35	23.48	63.26	0.28	4.29	0.04	100.69	0.80	1.22	2.78	0.02	0.20	0.00	5.01	0.20	0.79	0.02
		3	9.46	23.21	62.89	0.29	4.18	0.00	100.04	0.81	1.21	2.79	0.02	0.20	0.00	5.02	0.19	0.79	0.02
		5	9.55	23.14	63.59	0.31	3.89	0.00	100.48	0.82	1.20	2.80	0.02	0.18	0.00	5.02	0.18	0.80	0.02
		6	9.42	23.10	63.24	0.30	4.02	0.00	100.08	0.81	1.20	2.80	0.02	0.19	0.00	5.01	0.19	0.80	0.02
		6	9.42	23.62	63.84	0.30	4.07	0.06	101.32	0.80	1.22	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		7	9.34	23.55	64.02	0.28	4.09	0.04	101.32	0.79	1.21	2.79	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		8	9.30	22.48	62.54	0.31	3.82	0.06	98.51	0.81	1.19	2.81	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		9	9.32	23.10	64.36	0.31	3.92	0.02	101.04	0.79	1.19	2.81	0.02	0.18	0.00	5.00	0.19	0.80	0.02
		10	9.53	23.23	64.08	0.31	4.03	0.00	101.19	0.81	1.20	2.80	0.02	0.19	0.00	5.01	0.19	0.80	0.02
		11	9.27	23.53	64.30	0.31	4.17	0.00	101.59	0.78	1.21	2.80	0.02	0.19	0.00	5.00	0.20	0.79	0.02
		12	9.49	23.92	64.23	0.24	4.31	0.00	102.19	0.80	1.22	2.78	0.01	0.20	0.00	5.01	0.20	0.79	0.01
	I	2	9.13	23.21	64.67	0.23	4.01	0.48	101.73	0.77	1.19	2.81	0.01	0.19	0.02	4.98	0.19	0.79	0.01
		3	8.87	23.03	64.15	0.37	4.02	0.16	100.60	0.75	1.19	2.81	0.02	0.19	0.01	4.97	0.20	0.78	0.02
		4	8.86	23.33	64.41	0.37	4.07	0.43	101.48	0.75	1.20	2.80	0.02	0.19	0.01	4.97	0.20	0.78	0.02

Table 3.7: Analysis of plagioclase associated with garnet A4 from sample HJ-57a_1 (group 3). Type A grains are adjacent to garnet, type M grains are in the matrix, and type I grains are inclusions in garnet. # represents the analysis number; in the case of type A and M grains the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	A	1	9.40	23.54	63.48	0.24	4.31	0.25	101.22	0.80	1.21	2.78	0.01	0.20	0.01	5.02	0.20	0.79	0.01
		2	9.34	23.43	63.27	0.23	4.15	0.08	100.50	0.80	1.22	2.79	0.01	0.20	0.00	5.01	0.19	0.79	0.01
		3	9.66	23.28	63.06	0.21	4.19	0.08	100.47	0.83	1.21	2.78	0.01	0.20	0.00	5.03	0.19	0.80	0.01
		4	9.48	23.43	63.54	0.19	4.12	0.08	100.82	0.81	1.21	2.79	0.01	0.19	0.00	5.01	0.19	0.80	0.01
		5	9.33	23.62	63.39	0.15	4.22	0.31	101.01	0.79	1.22	2.78	0.01	0.20	0.01	5.01	0.20	0.79	0.01
2	M	1	9.27	23.55	63.56	0.32	4.22	0.53	101.45	0.79	1.21	2.78	0.02	0.20	0.02	5.01	0.20	0.78	0.02
		2	9.52	23.46	64.27	0.30	4.10	0.13	101.79	0.80	1.20	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		3	9.41	23.47	64.07	0.26	4.02	0.02	101.24	0.80	1.21	2.80	0.01	0.19	0.00	5.00	0.19	0.80	0.01
		4	9.31	23.71	63.86	0.21	4.18	0.05	101.30	0.79	1.22	2.79	0.01	0.20	0.00	5.00	0.20	0.79	0.01
3	M	1	9.13	23.63	63.84	0.30	4.13	0.06	101.09	0.77	1.22	2.79	0.02	0.19	0.00	4.99	0.20	0.79	0.02
		2	9.57	23.58	63.66	0.31	4.24	0.06	101.43	0.81	1.21	2.78	0.02	0.20	0.00	5.02	0.19	0.79	0.02
		3	9.47	23.10	62.92	0.29	4.15	0.08	100.02	0.81	1.21	2.79	0.02	0.20	0.00	5.02	0.19	0.79	0.02
		4	9.26	23.02	62.47	0.28	4.08	0.11	99.21	0.80	1.21	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		5	9.44	23.16	63.92	0.22	4.18	0.06	100.98	0.80	1.20	2.80	0.01	0.20	0.00	5.01	0.19	0.79	0.01
		6	9.31	23.41	63.89	0.24	4.27	0.02	101.15	0.79	1.21	2.79	0.01	0.20	0.00	5.00	0.20	0.79	0.01
		7	9.31	23.17	63.51	0.24	4.15	0.00	100.37	0.80	1.20	2.80	0.01	0.20	0.00	5.00	0.19	0.79	0.01
		8	9.16	23.33	64.08	0.23	4.17	0.00	100.97	0.78	1.20	2.80	0.01	0.20	0.00	4.99	0.20	0.79	0.01
		9	9.42	23.57	63.74	0.18	4.24	0.00	101.15	0.80	1.21	2.79	0.01	0.20	0.00	5.01	0.20	0.79	0.01
4	M	1	9.64	23.41	63.18	0.23	4.00	0.00	100.45	0.82	1.22	2.78	0.01	0.19	0.00	5.03	0.18	0.80	0.01
		2	9.61	23.08	64.41	0.22	4.07	0.00	101.38	0.81	1.19	2.81	0.01	0.19	0.00	5.01	0.19	0.80	0.01
		3	9.73	23.18	63.26	0.23	3.88	0.01	100.30	0.83	1.21	2.79	0.01	0.18	0.00	5.03	0.18	0.81	0.01
		4	9.38	22.93	62.91	0.23	3.98	0.00	99.44	0.81	1.20	2.80	0.01	0.19	0.00	5.01	0.19	0.80	0.01
		5	9.46	23.29	63.30	0.23	3.91	0.00	100.19	0.81	1.21	2.79	0.01	0.19	0.00	5.01	0.18	0.80	0.01
		6	9.68	23.43	64.03	0.24	4.02	0.00	101.40	0.82	1.21	2.79	0.01	0.19	0.00	5.02	0.18	0.80	0.01

		7	9.56	23.28	63.74	0.26	4.01	0.00	100.85	0.81	1.20	2.80	0.01	0.19	0.00	5.02	0.19	0.80	0.01
4	M	8	9.48	23.28	63.02	0.23	4.21	0.04	100.25	0.81	1.21	2.78	0.01	0.20	0.00	5.02	0.19	0.79	0.01
		9	9.32	23.54	63.11	0.20	4.27	0.04	100.48	0.80	1.22	2.78	0.01	0.20	0.00	5.01	0.20	0.79	0.01
5	M	1	9.28	23.30	63.28	0.22	4.24	0.00	100.32	0.79	1.21	2.79	0.01	0.20	0.00	5.01	0.20	0.79	0.01
		2	9.30	23.24	63.76	0.23	4.24	0.05	100.83	0.79	1.20	2.80	0.01	0.20	0.00	5.00	0.20	0.79	0.01
		3	9.30	23.32	63.16	0.28	4.13	0.10	100.29	0.80	1.21	2.79	0.02	0.20	0.00	5.01	0.19	0.79	0.02
		4	9.35	23.51	63.47	0.26	4.08	0.05	100.73	0.80	1.22	2.79	0.01	0.19	0.00	5.01	0.19	0.79	0.01
		5	9.50	23.57	64.24	0.29	4.05	0.00	101.65	0.80	1.21	2.79	0.02	0.19	0.00	5.01	0.19	0.80	0.02
		6	9.45	23.42	64.04	0.26	4.18	0.00	101.34	0.80	1.21	2.80	0.01	0.20	0.00	5.01	0.19	0.79	0.01
		7	9.49	23.26	63.59	0.29	4.14	0.02	100.78	0.81	1.20	2.79	0.02	0.19	0.00	5.02	0.19	0.79	0.02
		8	9.33	23.44	63.54	0.27	4.21	0.01	100.82	0.79	1.21	2.79	0.02	0.20	0.00	5.01	0.20	0.79	0.02
		9	9.59	23.63	63.72	0.24	4.23	0.06	101.47	0.81	1.22	2.78	0.01	0.20	0.00	5.02	0.19	0.79	0.01
		10	9.52	23.25	63.72	0.14	3.98	0.00	100.60	0.81	1.20	2.80	0.01	0.19	0.00	5.01	0.19	0.81	0.01
	I	1	8.48	22.76	62.60	0.36	4.29	0.31	98.80	0.74	1.20	2.80	0.02	0.21	0.01	4.97	0.21	0.76	0.02
		3	8.82	23.39	64.34	0.36	4.39	0.25	101.55	0.74	1.20	2.80	0.02	0.20	0.01	4.98	0.21	0.77	0.02
		4	8.73	23.14	63.79	0.16	4.35	0.39	100.56	0.74	1.20	2.80	0.01	0.20	0.01	4.97	0.21	0.78	0.01
		5	8.88	23.03	64.42	0.40	4.19	0.25	101.17	0.75	1.19	2.81	0.02	0.20	0.01	4.98	0.20	0.77	0.02

Table 3.8: Analysis of plagioclase associated with garnet A5 from sample HJ-57a_1 (group 3). Type A grains are adjacent to garnet, type M grains are in the matrix, and tpye I grains are inclusions in garnet. # represents the analysis number; in the case of type A and M grains the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	A	1	9.16	23.29	64.12	0.58	3.84	0.43	101.42	0.78	1.20	2.80	0.03	0.18	0.01	5.00	0.18	0.79	0.03
		2	9.33	23.84	64.21	0.33	4.16	0.00	101.87	0.79	1.22	2.79	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		4	9.32	23.60	64.31	0.36	4.32	0.01	101.91	0.78	1.21	2.79	0.02	0.20	0.00	5.01	0.20	0.78	0.02
		5	9.11	24.07	64.17	0.35	4.47	0.03	102.20	0.77	1.23	2.78	0.02	0.21	0.00	5.00	0.21	0.77	0.02
		6	9.36	23.69	64.13	0.32	4.15	0.03	101.67	0.79	1.21	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		7	9.07	23.52	63.66	0.29	4.31	0.12	100.97	0.77	1.21	2.79	0.02	0.20	0.00	5.00	0.20	0.78	0.02
		8	9.09	23.95	63.87	0.28	4.48	0.05	101.73	0.77	1.23	2.78	0.02	0.21	0.00	5.00	0.21	0.77	0.02
		9	10.22	22.06	65.83	0.09	2.45	0.34	100.99	0.86	1.13	2.87	0.00	0.11	0.01	4.99	0.12	0.88	0.00
2	M	2	9.29	23.84	64.29	0.37	4.32	0.03	102.13	0.78	1.22	2.79	0.02	0.20	0.00	5.01	0.20	0.78	0.02
		3	9.45	23.74	64.70	0.44	4.24	0.00	102.56	0.79	1.21	2.79	0.02	0.20	0.00	5.01	0.19	0.78	0.02
		4	9.20	23.52	64.50	0.27	4.10	0.00	101.59	0.78	1.20	2.80	0.01	0.19	0.00	4.99	0.19	0.79	0.02
		5	9.44	23.66	64.93	0.43	3.95	0.01	102.41	0.79	1.20	2.80	0.02	0.18	0.00	5.00	0.18	0.79	0.02
		6	9.39	23.68	64.03	0.41	4.01	0.02	101.55	0.79	1.22	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		7	9.58	23.21	64.38	0.39	3.98	0.06	101.60	0.81	1.19	2.80	0.02	0.19	0.00	5.01	0.18	0.80	0.02
		8	9.64	23.22	65.34	0.39	3.66	0.04	102.28	0.81	1.18	2.82	0.02	0.17	0.00	5.00	0.17	0.81	0.02
		9	9.29	22.71	63.43	0.34	3.54	0.01	99.32	0.80	1.19	2.82	0.02	0.17	0.00	5.00	0.17	0.81	0.02
		10	9.51	23.48	64.51	0.38	3.91	0.00	101.80	0.80	1.20	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		11	9.30	23.26	64.87	0.38	4.04	0.00	101.84	0.78	1.19	2.81	0.02	0.19	0.00	4.99	0.19	0.79	0.02
		12	9.46	23.63	65.04	0.41	4.14	0.04	102.72	0.79	1.20	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		13	9.39	23.87	64.50	0.36	4.35	0.06	102.54	0.79	1.21	2.79	0.02	0.20	0.00	5.01	0.20	0.78	0.02
3	M	1	9.11	23.86	64.11	0.38	4.24	0.00	101.69	0.77	1.22	2.79	0.02	0.20	0.00	5.00	0.20	0.78	0.02
		2	9.18	23.58	64.31	0.44	4.33	0.06	101.91	0.77	1.21	2.79	0.02	0.20	0.00	5.00	0.20	0.77	0.02
		3	9.38	23.27	64.59	0.39	4.01	0.00	101.65	0.79	1.19	2.81	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		4	9.50	23.32	63.99	0.43	3.87	0.01	101.11	0.81	1.20	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02

		5	9.49	23.38	64.59	0.43	3.98	0.02	101.90	0.80	1.20	2.80	0.02	0.19	0.00	5.01	0.18	0.79	0.02
3	M	6	9.15	23.47	63.99	0.41	3.90	0.01	100.93	0.78	1.21	2.80	0.02	0.18	0.00	4.99	0.19	0.79	0.02
		7	9.54	23.40	64.47	0.39	3.95	0.02	101.77	0.80	1.20	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		8	9.24	23.26	63.81	0.39	4.03	0.00	100.73	0.79	1.20	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		9	9.29	23.84	64.64	0.43	4.08	0.00	102.28	0.78	1.21	2.79	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		10	9.20	23.89	64.17	0.42	4.35	0.07	102.09	0.77	1.22	2.78	0.02	0.20	0.00	5.00	0.20	0.77	0.02
4	M	1	9.33	23.75	64.15	0.21	4.35	0.20	101.99	0.79	1.21	2.78	0.01	0.20	0.01	5.00	0.20	0.79	0.01
		2	9.32	23.56	63.82	0.26	4.23	0.05	101.24	0.79	1.21	2.79	0.01	0.20	0.00	5.01	0.20	0.79	0.01
		3	9.42	23.37	64.18	0.24	3.96	0.06	101.23	0.80	1.20	2.80	0.01	0.19	0.00	5.00	0.19	0.80	0.01
		4	9.19	23.54	63.20	0.41	3.86	0.21	100.42	0.79	1.22	2.78	0.02	0.18	0.01	5.00	0.18	0.79	0.02
		5	9.41	23.11	64.65	0.29	4.01	0.00	101.47	0.79	1.19	2.81	0.02	0.19	0.00	5.00	0.19	0.80	0.02
		6	9.52	23.34	63.37	0.29	3.87	0.02	100.41	0.81	1.21	2.79	0.02	0.18	0.00	5.02	0.18	0.80	0.02
		7	9.20	23.34	64.14	0.28	3.98	0.06	101.01	0.78	1.20	2.80	0.02	0.19	0.00	4.99	0.19	0.79	0.02
		8	9.70	23.31	63.79	0.30	3.96	0.01	101.06	0.82	1.20	2.79	0.02	0.19	0.00	5.02	0.18	0.80	0.02
		9	9.58	23.22	63.61	0.31	3.98	0.00	100.70	0.82	1.20	2.80	0.02	0.19	0.00	5.02	0.18	0.80	0.02
		10	9.44	23.70	63.79	0.28	4.25	0.00	101.47	0.80	1.22	2.78	0.02	0.20	0.00	5.01	0.20	0.79	0.02
		11	9.20	23.52	63.69	0.23	4.25	0.19	101.08	0.78	1.21	2.79	0.01	0.20	0.01	5.00	0.20	0.79	0.01
5	A	1	9.19	23.17	64.11	0.35	4.18	0.28	101.28	0.78	1.19	2.80	0.02	0.20	0.01	5.00	0.20	0.78	0.02
		2	9.42	23.36	64.46	0.39	3.90	0.03	101.55	0.80	1.20	2.81	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		3	9.24	23.20	64.27	0.39	3.88	0.00	100.98	0.78	1.20	2.81	0.02	0.18	0.00	4.99	0.18	0.79	0.02
		4	9.22	23.29	64.02	0.40	4.03	0.03	100.98	0.78	1.20	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		5	9.35	23.15	64.34	0.38	3.83	0.00	101.05	0.79	1.19	2.81	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		6	9.39	23.17	64.25	0.36	3.97	0.01	101.16	0.80	1.19	2.81	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		7	9.41	23.16	64.04	0.34	3.94	0.04	100.91	0.80	1.20	2.81	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		8	9.54	23.42	64.33	0.36	3.83	0.07	101.55	0.81	1.20	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		9	9.43	23.18	63.44	0.35	3.89	0.00	100.29	0.81	1.21	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		10	9.42	23.31	64.31	0.39	4.03	0.06	101.52	0.80	1.20	2.80	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		11	9.28	23.40	63.94	0.35	4.03	0.01	101.01	0.79	1.21	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		12	9.46	23.29	62.77	0.35	4.11	0.03	100.01	0.81	1.22	2.78	0.02	0.20	0.00	5.03	0.19	0.79	0.02
		13	9.23	23.55	63.38	0.38	4.24	0.07	100.86	0.79	1.22	2.78	0.02	0.20	0.00	5.01	0.20	0.78	0.02
		14	9.25	23.50	63.53	0.39	4.14	0.03	100.83	0.79	1.22	2.79	0.02	0.19	0.00	5.01	0.19	0.78	0.02

		15	9.44	23.56	63.48	0.35	4.26	0.00	101.08	0.80	1.22	2.78	0.02	0.20	0.00	5.02	0.20	0.79	0.02
6	A	1	9.30	23.74	63.86	0.40	4.26	0.22	101.78	0.79	1.22	2.78	0.02	0.20	0.01	5.01	0.20	0.78	0.02
		2	9.21	23.67	63.89	0.42	4.34	0.12	101.66	0.78	1.22	2.78	0.02	0.20	0.00	5.01	0.20	0.77	0.02
		3	9.32	23.52	64.44	0.40	4.18	0.01	101.87	0.78	1.20	2.80	0.02	0.19	0.00	5.00	0.19	0.78	0.02
		4	9.28	23.73	63.65	0.30	4.18	0.14	101.29	0.79	1.22	2.78	0.02	0.20	0.00	5.01	0.20	0.79	0.02
		5	9.61	23.49	64.00	0.27	4.20	0.06	101.62	0.81	1.21	2.79	0.01	0.20	0.00	5.02	0.19	0.79	0.01
		6	9.41	23.51	64.59	0.30	3.88	0.08	101.76	0.79	1.20	2.80	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		7	9.22	23.60	64.01	0.34	4.31	0.09	101.57	0.78	1.21	2.79	0.02	0.20	0.00	5.00	0.20	0.78	0.02
		8	9.47	23.71	64.13	0.30	4.18	0.13	101.92	0.80	1.21	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		9	9.78	22.75	64.96	0.25	3.38	0.02	101.14	0.83	1.17	2.83	0.01	0.16	0.00	5.00	0.16	0.83	0.01
7	A	1	9.26	23.74	64.49	0.38	3.97	0.07	101.91	0.78	1.21	2.80	0.02	0.18	0.00	5.00	0.19	0.79	0.02
		2	9.04	23.58	64.29	0.32	4.23	0.00	101.46	0.76	1.21	2.80	0.02	0.20	0.00	4.99	0.20	0.78	0.02
		3	9.18	23.86	64.44	0.35	4.28	0.03	102.14	0.77	1.22	2.79	0.02	0.20	0.00	5.00	0.20	0.78	0.02
		4	9.32	23.39	64.08	0.27	4.20	0.00	101.26	0.79	1.20	2.80	0.02	0.20	0.00	5.00	0.20	0.79	0.01
		5	9.17	23.66	63.94	0.39	4.17	0.07	101.41	0.78	1.22	2.79	0.02	0.19	0.00	5.00	0.20	0.78	0.02
		6	9.36	23.83	64.45	0.43	4.10	0.05	102.23	0.79	1.22	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
8	M	1	9.18	23.58	64.63	0.34	4.33	0.03	102.09	0.77	1.20	2.80	0.02	0.20	0.00	4.99	0.20	0.78	0.02
		2	9.09	23.66	64.50	0.34	4.23	0.02	101.85	0.76	1.21	2.80	0.02	0.20	0.00	4.99	0.20	0.78	0.02
		3	9.39	23.79	64.16	0.36	4.17	0.00	101.87	0.79	1.22	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		4	9.45	23.59	64.35	0.38	4.21	0.03	102.02	0.80	1.21	2.79	0.02	0.20	0.00	5.01	0.19	0.79	0.02
		5	9.37	23.70	64.18	0.34	4.05	0.05	101.68	0.79	1.21	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		6	9.22	23.64	64.62	0.39	4.00	0.00	101.87	0.77	1.21	2.80	0.02	0.19	0.00	4.99	0.19	0.79	0.02
		7	9.22	23.41	64.41	0.40	4.08	0.01	101.53	0.78	1.20	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		8	9.35	23.46	64.54	0.38	4.08	0.00	101.82	0.79	1.20	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		9	9.41	23.49	64.66	0.43	3.94	0.03	101.95	0.79	1.20	2.80	0.02	0.18	0.00	5.00	0.18	0.79	0.02
		10	9.34	23.15	64.21	0.41	3.99	0.00	101.09	0.79	1.19	2.81	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		11	9.32	23.24	64.17	0.39	4.00	0.01	101.13	0.79	1.20	2.81	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		12	9.00	23.31	64.19	0.39	3.95	0.00	100.83	0.76	1.20	2.81	0.02	0.19	0.00	4.98	0.19	0.79	0.02
		13	9.31	23.46	64.25	0.31	4.33	0.03	101.68	0.79	1.20	2.80	0.02	0.20	0.00	5.00	0.20	0.78	0.02
9	A	1	9.38	23.59	64.61	0.26	4.15	0.16	102.14	0.79	1.20	2.80	0.01	0.19	0.01	5.00	0.19	0.79	0.01
		2	9.39	23.60	64.16	0.29	4.02	0.05	101.51	0.79	1.21	2.79	0.02	0.19	0.00	5.00	0.19	0.80	0.02

		3	9.66	23.37	65.16	0.34	4.01	0.00	102.54	0.81	1.19	2.81	0.02	0.19	0.00	5.01	0.18	0.80	0.02
9	A	4	9.71	23.38	65.03	0.32	3.84	0.00	102.28	0.81	1.19	2.81	0.02	0.18	0.00	5.01	0.18	0.81	0.02
		5	9.50	22.91	64.79	0.36	3.78	0.00	101.34	0.80	1.18	2.82	0.02	0.18	0.00	5.00	0.18	0.80	0.02
		6	9.32	23.12	64.69	0.37	3.88	0.00	101.38	0.79	1.19	2.82	0.02	0.18	0.00	4.99	0.18	0.80	0.02
		7	9.53	23.35	64.98	0.32	3.78	0.00	101.96	0.80	1.19	2.81	0.02	0.18	0.00	5.00	0.18	0.81	0.02
		8	9.63	23.28	64.39	0.34	3.88	0.04	101.56	0.81	1.19	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		9	9.25	23.53	64.38	0.31	3.78	0.02	101.27	0.78	1.21	2.81	0.02	0.18	0.00	4.99	0.18	0.80	0.02
		10	9.51	23.44	64.69	0.33	3.97	0.00	101.95	0.80	1.20	2.80	0.02	0.18	0.00	5.01	0.18	0.80	0.02
		11	9.40	23.52	65.02	0.31	3.97	0.02	102.24	0.79	1.20	2.81	0.02	0.18	0.00	4.99	0.19	0.80	0.02
		12	9.52	23.14	64.37	0.29	3.81	0.05	101.18	0.81	1.19	2.81	0.02	0.18	0.00	5.00	0.18	0.81	0.02
		13	9.39	23.30	64.31	0.28	3.96	0.01	101.25	0.79	1.20	2.81	0.02	0.18	0.00	5.00	0.19	0.80	0.02
		14	9.53	23.66	64.94	0.24	4.01	0.00	102.37	0.80	1.20	2.80	0.01	0.19	0.00	5.00	0.19	0.80	0.01
		15	9.22	23.80	64.38	0.24	4.27	0.19	102.10	0.77	1.22	2.79	0.01	0.20	0.01	4.99	0.20	0.79	0.01
10	M	1	9.20	23.93	64.29	0.24	4.21	0.10	101.97	0.77	1.22	2.79	0.01	0.20	0.00	4.99	0.20	0.79	0.01
		2	9.37	23.44	63.52	0.30	4.04	0.03	100.69	0.80	1.21	2.79	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		3	9.38	23.86	63.89	0.28	4.12	0.06	101.58	0.79	1.22	2.78	0.02	0.19	0.00	5.01	0.19	0.79	0.02
		4	9.59	23.42	64.32	0.29	4.37	0.03	102.04	0.81	1.20	2.79	0.02	0.20	0.00	5.02	0.20	0.79	0.02
		5	9.24	22.91	63.36	0.30	4.08	0.00	99.88	0.79	1.20	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		6	9.34	23.11	63.77	0.30	3.93	0.00	100.45	0.80	1.20	2.81	0.02	0.19	0.00	5.00	0.19	0.80	0.02
		7	9.21	23.49	64.32	0.27	4.08	0.00	101.37	0.78	1.21	2.80	0.02	0.19	0.00	4.99	0.19	0.79	0.02
		8	9.33	23.42	63.88	0.31	4.11	0.00	101.04	0.79	1.21	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		9	9.31	23.33	64.22	0.31	4.02	0.02	101.20	0.79	1.20	2.80	0.02	0.19	0.00	5.00	0.19	0.79	0.02
		10	8.95	23.28	63.09	0.30	3.99	0.05	99.65	0.77	1.22	2.80	0.02	0.19	0.00	4.99	0.19	0.79	0.02
		11	9.60	23.21	64.37	0.16	3.60	0.04	100.98	0.81	1.20	2.81	0.01	0.17	0.00	5.00	0.17	0.82	0.01
	I	1	8.47	23.52	63.33	0.36	4.65	0.30	100.63	0.72	1.22	2.78	0.02	0.22	0.01	4.97	0.23	0.75	0.02
		2	8.43	22.88	61.85	0.38	4.68	0.41	98.64	0.73	1.21	2.78	0.02	0.23	0.01	4.99	0.23	0.75	0.02
		3	8.34	23.22	62.83	0.27	4.67	0.77	100.10	0.72	1.21	2.78	0.02	0.22	0.03	4.97	0.23	0.75	0.02
		5	9.03	23.53	63.32	0.32	4.40	0.53	101.13	0.77	1.22	2.78	0.02	0.21	0.02	5.00	0.21	0.77	0.02
		6	8.79	23.24	64.67	0.46	4.42	0.44	102.03	0.74	1.19	2.80	0.03	0.21	0.01	4.98	0.21	0.76	0.03
		7	8.65	23.26	63.52	0.12	4.71	0.86	101.12	0.73	1.20	2.78	0.01	0.22	0.03	4.97	0.23	0.76	0.01
		9	8.32	23.70	63.20	0.47	4.59	0.15	100.43	0.71	1.23	2.78	0.03	0.22	0.01	4.97	0.23	0.75	0.03

		10	8.42	23.82	63.72	0.45	4.86	0.30	101.57	0.71	1.22	2.78	0.03	0.23	0.01	4.97	0.24	0.74	0.03
	I	11	8.60	23.51	63.01	0.31	5.13	0.26	100.81	0.73	1.22	2.77	0.02	0.24	0.01	4.99	0.24	0.74	0.02
		12	8.87	23.46	65.19	0.26	4.68	0.40	102.87	0.74	1.19	2.80	0.01	0.22	0.01	4.97	0.22	0.76	0.01
		15	8.79	23.33	65.39	0.48	4.28	0.46	102.73	0.73	1.18	2.81	0.03	0.20	0.01	4.97	0.21	0.77	0.03
		16	8.78	23.14	64.35	0.36	4.22	0.35	101.22	0.74	1.19	2.81	0.02	0.20	0.01	4.97	0.21	0.77	0.02
		17	8.86	22.93	65.07	0.33	4.16	0.13	101.47	0.75	1.17	2.83	0.02	0.19	0.00	4.97	0.20	0.78	0.02
		18	9.08	23.05	64.79	0.24	4.15	0.18	101.49	0.77	1.18	2.82	0.01	0.19	0.01	4.98	0.20	0.79	0.01
		20	8.94	22.86	64.77	0.27	4.10	0.09	101.03	0.76	1.18	2.83	0.02	0.19	0.00	4.97	0.20	0.79	0.02
		26	8.56	23.56	64.65	0.48	4.56	0.48	102.30	0.72	1.20	2.80	0.03	0.21	0.02	4.97	0.22	0.75	0.03
		28	8.73	22.73	63.52	0.40	4.17	0.67	100.23	0.75	1.18	2.80	0.02	0.20	0.02	4.98	0.20	0.77	0.02
		29	8.77	23.19	64.67	0.29	4.32	0.36	101.59	0.74	1.19	2.81	0.02	0.20	0.01	4.97	0.21	0.77	0.02
		30	8.64	23.54	63.93	0.40	4.37	0.38	101.24	0.73	1.21	2.79	0.02	0.20	0.01	4.97	0.21	0.76	0.02
		31	8.69	23.49	63.20	0.36	4.50	0.92	101.15	0.74	1.21	2.77	0.02	0.21	0.03	4.99	0.22	0.76	0.02
		32	8.93	23.31	63.43	0.42	4.35	0.49	100.92	0.76	1.21	2.79	0.02	0.20	0.02	5.00	0.21	0.77	0.02
		33	8.43	23.58	63.53	0.36	4.73	0.15	100.78	0.72	1.22	2.79	0.02	0.22	0.01	4.97	0.23	0.75	0.02
		35	8.78	23.10	64.16	0.42	4.25	0.34	101.05	0.74	1.19	2.81	0.02	0.20	0.01	4.98	0.21	0.77	0.02

Table 3.9: Analysis of plagioclase associated with garnet A1 from sample HJ-58b (group 3). Type A grains are adjacent to garnet, type M grains are in the matrix, and tpye I grains are inclusions in garnet. # represents the analysis number; in the case of type A and M grains the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	M	1	3.36	32.36	51.40	0.06	14.39	0.02	101.58	0.29	1.71	2.30	0.00	0.69	0.00	4.99	0.70	0.30	0.00
		2	4.96	30.06	54.75	0.08	11.51	0.00	101.36	0.43	1.58	2.44	0.00	0.55	0.00	4.99	0.56	0.44	0.00
		3	5.29	29.21	55.60	0.09	10.77	0.00	100.97	0.46	1.53	2.48	0.01	0.51	0.00	4.99	0.53	0.47	0.01
		4	3.30	32.11	50.11	0.04	14.31	0.05	99.91	0.29	1.72	2.28	0.00	0.70	0.00	5.00	0.70	0.29	0.00
		5	4.89	29.84	54.78	0.10	11.65	0.00	101.25	0.42	1.57	2.44	0.01	0.56	0.00	4.99	0.57	0.43	0.01
		6	5.39	29.36	55.03	0.10	10.71	0.03	100.61	0.47	1.55	2.46	0.01	0.51	0.00	5.00	0.52	0.47	0.01
		7	5.27	29.32	54.53	0.08	11.24	0.02	100.46	0.46	1.55	2.45	0.00	0.54	0.00	5.01	0.54	0.46	0.00
		8	5.31	29.35	54.58	0.09	10.67	0.04	100.04	0.46	1.56	2.46	0.01	0.51	0.00	5.00	0.52	0.47	0.01
		9	5.35	29.50	54.72	0.09	11.02	0.00	100.68	0.46	1.56	2.45	0.00	0.53	0.00	5.01	0.53	0.47	0.00
		10	3.99	30.90	51.59	0.04	13.19	0.06	99.78	0.35	1.66	2.35	0.00	0.64	0.00	5.00	0.64	0.35	0.00
		11	4.87	29.54	53.37	0.09	11.71	0.09	99.67	0.43	1.58	2.42	0.01	0.57	0.00	5.01	0.57	0.43	0.00
		12	4.44	30.28	52.19	0.07	12.34	0.00	99.32	0.39	1.63	2.38	0.00	0.60	0.00	5.01	0.60	0.39	0.00
		13	4.08	30.49	51.82	0.06	13.03	0.09	99.58	0.36	1.64	2.36	0.00	0.64	0.00	5.00	0.64	0.36	0.00
2	A	1	5.46	28.73	53.54	0.07	10.65	0.02	98.47	0.49	1.55	2.45	0.00	0.52	0.00	5.02	0.52	0.48	0.00
		2	5.36	28.36	54.00	0.08	11.03	0.02	98.85	0.47	1.53	2.47	0.00	0.54	0.00	5.01	0.53	0.47	0.00
		3	5.43	28.69	54.10	0.07	10.64	0.06	99.00	0.48	1.54	2.46	0.00	0.52	0.00	5.01	0.52	0.48	0.00
		4	5.37	28.45	53.75	0.09	10.58	0.00	98.24	0.48	1.54	2.47	0.01	0.52	0.00	5.01	0.52	0.48	0.01
		5	5.51	28.22	54.21	0.09	10.46	0.00	98.49	0.49	1.52	2.48	0.01	0.51	0.00	5.01	0.51	0.49	0.01
		6	5.41	28.18	54.59	0.10	10.49	0.00	98.77	0.48	1.51	2.49	0.01	0.51	0.00	5.00	0.51	0.48	0.01
		7	5.51	28.69	54.36	0.08	10.86	0.09	99.58	0.48	1.53	2.46	0.00	0.53	0.00	5.01	0.52	0.48	0.00
		8	5.21	28.63	54.11	0.07	11.18	0.17	99.37	0.46	1.53	2.46	0.00	0.54	0.01	5.00	0.54	0.46	0.00
3	M	1	5.07	29.41	53.83	0.06	11.21	0.03	99.62	0.45	1.57	2.44	0.00	0.54	0.00	5.00	0.55	0.45	0.00
		2	5.23	29.43	54.43	0.07	10.97	0.07	100.20	0.46	1.56	2.45	0.00	0.53	0.00	5.00	0.53	0.46	0.00
		3	5.50	28.89	55.45	0.07	10.75	0.00	100.66	0.48	1.52	2.48	0.00	0.52	0.00	5.00	0.52	0.48	0.00

		4	5.36	29.11	54.85	0.08	10.68	0.03	100.12	0.47	1.54	2.47	0.00	0.51	0.00	5.00	0.52	0.47	0.00
3	M	5	5.61	29.07	55.17	0.09	11.05	0.00	100.98	0.49	1.53	2.46	0.01	0.53	0.00	5.02	0.52	0.48	0.00
		6	5.12	28.45	54.44	0.08	10.88	0.01	98.98	0.45	1.53	2.48	0.00	0.53	0.00	4.99	0.54	0.46	0.00
4	M	1	5.45	28.30	53.60	0.08	10.73	0.05	98.21	0.49	1.53	2.46	0.00	0.53	0.00	5.02	0.52	0.48	0.00
		2	5.62	28.38	54.84	0.06	10.43	0.05	99.38	0.49	1.52	2.48	0.00	0.51	0.00	5.01	0.50	0.49	0.00
		3	5.59	28.76	54.29	0.06	10.62	0.02	99.34	0.49	1.54	2.46	0.00	0.52	0.00	5.01	0.51	0.49	0.00
		4	4.90	29.78	53.55	0.04	11.68	0.05	100.00	0.43	1.59	2.42	0.00	0.57	0.00	5.00	0.57	0.43	0.00
	I	1	4.31	30.35	52.46	0.10	12.08	0.31	99.61	0.38	1.62	2.38	0.01	0.59	0.01	4.99	0.60	0.39	0.01
		2	5.13	30.28	55.57	0.17	11.74	0.07	102.95	0.44	1.57	2.44	0.01	0.55	0.00	5.00	0.55	0.44	0.01
		3	5.27	29.98	56.31	0.17	11.12	0.11	102.96	0.45	1.55	2.46	0.01	0.52	0.00	4.99	0.53	0.46	0.01
		4	4.92	29.89	54.63	0.15	11.49	0.08	101.16	0.43	1.57	2.44	0.01	0.55	0.00	4.99	0.56	0.43	0.01
		5	3.89	31.59	52.59	0.06	13.22	0.04	101.39	0.34	1.66	2.35	0.00	0.63	0.00	4.99	0.65	0.35	0.00
		6	4.11	30.57	53.34	0.05	12.17	0.01	100.26	0.36	1.62	2.40	0.00	0.59	0.00	4.97	0.62	0.38	0.00
		7	4.58	30.42	54.15	0.08	12.04	0.08	101.35	0.40	1.60	2.41	0.00	0.57	0.00	4.99	0.59	0.41	0.00
		8	4.60	30.65	54.61	0.08	12.24	0.09	102.27	0.39	1.60	2.41	0.00	0.58	0.00	4.99	0.59	0.40	0.00
		9	3.93	31.47	52.63	0.06	13.38	0.03	101.51	0.34	1.66	2.35	0.00	0.64	0.00	4.99	0.65	0.35	0.00
		10	4.13	31.31	53.18	0.05	13.01	0.14	101.81	0.36	1.64	2.37	0.00	0.62	0.00	4.99	0.63	0.36	0.00
		11	5.04	29.56	56.19	0.08	11.32	0.07	102.25	0.43	1.53	2.47	0.00	0.53	0.00	4.98	0.55	0.44	0.00
		12	5.06	29.41	56.06	0.09	11.24	0.01	101.87	0.43	1.53	2.48	0.00	0.53	0.00	4.98	0.55	0.45	0.01
		13	5.07	28.95	55.64	0.08	10.98	0.07	100.79	0.44	1.52	2.48	0.00	0.53	0.00	4.98	0.54	0.45	0.00
		14	4.90	29.74	54.29	0.06	11.95	0.12	101.06	0.42	1.57	2.43	0.00	0.57	0.00	5.00	0.57	0.42	0.00

Table 3.10: Analysis of plagioclase associated with garnet A2 from sample HJ-58b (group 3). Type A grains are adjacent to garnet, type M grains are in the matrix, and tpye I grains are inclusions in garnet. # represents the analysis number; in the case of type A and M grains the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	A	1	5.37	29.27	54.82	0.06	10.84	0.16	100.51	0.47	1.55	2.46	0.00	0.52	0.01	5.00	0.53	0.47	0.00
		2	4.18	31.14	52.37	0.05	12.80	0.04	100.57	0.36	1.65	2.36	0.00	0.62	0.00	5.00	0.63	0.37	0.00
		3	4.30	30.82	52.27	0.07	12.49	0.19	100.13	0.38	1.64	2.36	0.00	0.61	0.01	5.00	0.61	0.38	0.00
		4	3.87	31.51	52.30	0.09	12.81	0.31	100.90	0.34	1.67	2.35	0.01	0.62	0.01	4.98	0.64	0.35	0.01
2	M	1	4.27	30.53	53.06	0.07	12.46	0.06	100.45	0.37	1.62	2.39	0.00	0.60	0.00	4.99	0.61	0.38	0.00
		2	4.27	31.09	52.58	0.03	12.62	0.02	100.61	0.37	1.65	2.37	0.00	0.61	0.00	5.00	0.62	0.38	0.00
		3	4.24	31.28	52.70	0.08	12.74	0.11	101.15	0.37	1.65	2.36	0.00	0.61	0.00	5.00	0.62	0.37	0.00
		4	3.82	31.28	51.78	0.05	13.60	0.01	100.54	0.33	1.66	2.34	0.00	0.66	0.00	5.00	0.66	0.34	0.00
		5	3.36	32.44	50.12	0.07	14.43	0.03	100.44	0.30	1.73	2.27	0.00	0.70	0.00	5.01	0.70	0.30	0.00
		6	3.29	32.73	50.31	0.03	14.83	0.07	101.25	0.29	1.74	2.27	0.00	0.72	0.00	5.01	0.71	0.29	0.00
3	A	1	4.44	31.17	53.26	0.08	12.41	0.13	101.48	0.38	1.64	2.38	0.00	0.59	0.00	5.00	0.60	0.39	0.00
		2	4.21	30.55	53.52	0.08	12.61	0.10	101.06	0.37	1.61	2.39	0.00	0.60	0.00	4.98	0.62	0.37	0.00
		3	4.73	30.18	53.68	0.11	12.09	0.05	100.83	0.41	1.60	2.41	0.01	0.58	0.00	5.00	0.58	0.41	0.01
		4	5.18	29.30	55.24	0.14	11.08	0.00	100.93	0.45	1.54	2.47	0.01	0.53	0.00	4.99	0.54	0.45	0.01
		5	4.43	30.50	53.43	0.06	12.60	0.01	101.02	0.38	1.61	2.39	0.00	0.60	0.00	5.00	0.61	0.39	0.00
		6	4.45	30.47	53.74	0.08	12.24	0.03	101.01	0.39	1.61	2.40	0.00	0.59	0.00	4.99	0.60	0.40	0.00
	I	1	4.87	29.67	54.21	0.17	11.38	0.22	100.52	0.42	1.57	2.43	0.01	0.55	0.01	4.99	0.56	0.43	0.01
		2	4.92	29.77	53.86	0.19	11.76	0.29	100.80	0.43	1.58	2.42	0.01	0.57	0.01	5.01	0.56	0.43	0.01

Table 3.11: Analysis of plagioclase associated with garnet A3 from sample HJ-58b (group 3). Type A grains are adjacent to garnet, type M grains are in the matrix, type I grains are inclusions in garnet, and type Myr grains are from myrmekite adjacent to the garnet. # represents the analysis number; in the case of type A and M grains the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	M	2	1.24	19.22	66.45	15.25	0.00	0.05	102.21	0.11	1.02	2.99	0.88	0.00	0.00	4.99	0.00	0.11	0.89
		3	5.64	29.20	56.66	0.15	10.51	0.04	102.21	0.48	1.51	2.49	0.01	0.50	0.00	4.99	0.50	0.49	0.01
		4	5.43	29.41	56.30	0.13	10.43	0.01	101.71	0.47	1.53	2.49	0.01	0.49	0.00	4.98	0.51	0.48	0.01
		5	6.29	28.24	58.51	0.13	9.33	0.03	102.53	0.53	1.45	2.56	0.01	0.44	0.00	4.99	0.45	0.55	0.01
		6	5.35	29.53	56.57	0.16	10.67	0.10	102.38	0.46	1.53	2.48	0.01	0.50	0.00	4.98	0.52	0.47	0.01
		7	5.47	29.43	57.31	0.17	10.58	0.07	103.03	0.46	1.51	2.50	0.01	0.49	0.00	4.98	0.51	0.48	0.01
		8	5.65	29.07	57.69	0.20	10.58	0.00	103.19	0.48	1.49	2.51	0.01	0.49	0.00	4.99	0.50	0.49	0.01
		9	5.42	29.36	57.56	0.16	10.52	0.00	103.02	0.46	1.51	2.51	0.01	0.49	0.00	4.97	0.51	0.48	0.01
		10	5.33	29.13	57.21	0.11	10.43	0.08	102.30	0.45	1.51	2.51	0.01	0.49	0.00	4.97	0.52	0.48	0.01
		11	5.43	29.55	57.71	0.14	10.42	0.14	103.38	0.46	1.51	2.50	0.01	0.48	0.00	4.97	0.51	0.48	0.01
		12	5.33	29.66	57.55	0.11	10.65	0.01	103.30	0.45	1.52	2.50	0.01	0.50	0.00	4.97	0.52	0.47	0.01
2	M	1	5.47	29.54	57.40	0.17	10.53	0.02	103.14	0.46	1.52	2.50	0.01	0.49	0.00	4.98	0.51	0.48	0.01
		2	5.29	29.49	57.60	0.16	10.75	0.00	103.29	0.45	1.51	2.50	0.01	0.50	0.00	4.97	0.52	0.47	0.01
		3	5.28	29.91	57.12	0.16	10.91	0.00	103.38	0.44	1.53	2.48	0.01	0.51	0.00	4.98	0.53	0.46	0.01
		4	5.52	29.26	57.96	0.19	10.44	0.03	103.41	0.46	1.50	2.52	0.01	0.49	0.00	4.97	0.51	0.48	0.01
		5	5.85	28.83	58.38	0.20	9.86	0.02	103.14	0.49	1.48	2.54	0.01	0.46	0.00	4.98	0.48	0.51	0.01
		6	5.73	28.49	57.79	0.21	10.02	0.00	102.23	0.49	1.47	2.54	0.01	0.47	0.00	4.98	0.49	0.50	0.01
		7	5.65	29.15	57.94	0.13	10.33	0.00	103.20	0.48	1.49	2.52	0.01	0.48	0.00	4.98	0.50	0.49	0.01
		8	5.59	29.38	57.38	0.15	10.37	0.05	102.92	0.47	1.51	2.50	0.01	0.48	0.00	4.98	0.50	0.49	0.01
		9	5.75	29.09	56.56	0.15	10.29	0.01	101.85	0.49	1.51	2.50	0.01	0.49	0.00	5.00	0.49	0.50	0.01
		10	5.41	29.58	55.99	0.14	10.95	0.04	102.11	0.46	1.54	2.47	0.01	0.52	0.00	5.00	0.52	0.47	0.01
	I	1	5.10	28.86	55.17	0.17	10.76	0.04	100.09	0.44	1.53	2.48	0.01	0.52	0.00	4.98	0.53	0.46	0.01
		2	6.32	28.18	58.35	0.15	9.10	0.09	102.18	0.54	1.46	2.56	0.01	0.43	0.00	4.99	0.44	0.55	0.01

		3	4.85	29.86	55.90	0.13	11.44	0.13	102.31	0.41	1.55	2.46	0.01	0.54	0.00	4.97	0.56	0.43	0.01
	Myr	1	5.79	28.85	57.51	0.13	10.28	0.14	102.69	0.49	1.49	2.52	0.01	0.48	0.00	4.99	0.49	0.50	0.01
		2	5.52	28.41	56.06	0.11	10.71	0.02	100.83	0.48	1.49	2.50	0.01	0.51	0.00	4.99	0.51	0.48	0.01
		3	5.98	27.51	56.62	0.09	9.38	0.01	99.58	0.52	1.46	2.55	0.01	0.45	0.00	4.99	0.46	0.53	0.01
		4	6.61	27.25	58.30	0.14	8.85	0.03	101.17	0.57	1.42	2.58	0.01	0.42	0.00	5.00	0.42	0.57	0.01
		5	6.43	27.16	58.05	0.13	8.58	0.00	100.34	0.55	1.43	2.59	0.01	0.41	0.00	4.98	0.42	0.57	0.01
		6	6.22	27.23	57.05	0.10	9.05	0.14	99.79	0.54	1.44	2.56	0.01	0.44	0.00	4.99	0.44	0.55	0.01
		7	6.81	27.05	59.16	0.11	8.18	0.02	101.32	0.58	1.40	2.61	0.01	0.39	0.00	4.99	0.40	0.60	0.01
		8	5.48	28.89	55.77	0.10	10.71	0.08	101.03	0.47	1.52	2.48	0.01	0.51	0.00	5.00	0.52	0.48	0.01

Table 3.12: Analysis of plagioclase associated with garnet A4 from sample HJ-58b (group 3). Type A grains are adjacent to garnet and type M grains are in the matrix; # represents the analysis number with increasing distance from garnet: the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	M	1	1.94	35.23	48.51	0.05	17.01	0.09	102.82	0.17	1.85	2.16	0.00	0.81	0.00	5.00	0.83	0.17	0.00
		2	2.14	34.92	48.63	0.02	16.46	0.01	102.19	0.19	1.84	2.18	0.00	0.79	0.00	5.00	0.81	0.19	0.00
		3	2.04	34.74	48.49	0.05	16.76	0.00	102.07	0.18	1.84	2.18	0.00	0.81	0.00	5.00	0.82	0.18	0.00
		4	2.20	34.68	48.14	0.03	16.87	0.06	101.99	0.19	1.84	2.17	0.00	0.81	0.00	5.01	0.81	0.19	0.00
		5	2.13	34.23	48.91	0.04	16.42	0.01	101.73	0.19	1.81	2.20	0.00	0.79	0.00	4.99	0.81	0.19	0.00
		6	2.11	34.31	47.94	0.05	16.42	0.11	100.94	0.19	1.83	2.18	0.00	0.80	0.00	5.00	0.81	0.19	0.00
2	A	1	2.12	34.26	47.37	0.03	16.56	0.07	100.41	0.19	1.84	2.16	0.00	0.81	0.00	5.01	0.81	0.19	0.00
		2	2.09	34.67	47.69	0.05	16.87	0.00	101.37	0.18	1.85	2.16	0.00	0.82	0.00	5.01	0.82	0.18	0.00
		3	2.00	34.16	47.56	0.01	16.51	0.00	100.23	0.18	1.84	2.17	0.00	0.81	0.00	5.00	0.82	0.18	0.00
3	M	1	1.71	34.68	46.67	0.03	17.23	0.01	100.34	0.15	1.87	2.14	0.00	0.84	0.00	5.01	0.85	0.15	0.00
		2	1.65	34.98	46.82	0.02	17.62	0.03	101.13	0.15	1.87	2.13	0.00	0.86	0.00	5.01	0.85	0.14	0.00
		3	1.76	34.45	46.89	0.03	17.25	0.07	100.45	0.16	1.86	2.14	0.00	0.85	0.00	5.01	0.84	0.16	0.00
		4	1.94	34.13	47.19	0.01	16.56	0.05	99.88	0.17	1.85	2.16	0.00	0.81	0.00	5.00	0.82	0.17	0.00
		5	1.81	34.32	47.14	0.03	16.75	0.07	100.12	0.16	1.85	2.16	0.00	0.82	0.00	5.00	0.83	0.16	0.00
		6	1.67	34.63	46.94	0.01	16.87	0.02	100.13	0.15	1.87	2.15	0.00	0.83	0.00	4.99	0.85	0.15	0.00

Table 3.13: Analysis of plagioclase associated with garnet A5 from sample HJ-58b (group 3). Type A grains are adjacent to garnet, type M grains are in the matrix, and type I grains are inclusions in garnet. # represents the analysis number; in the case of type A and M grains the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	M	1	4.76	29.84	53.61	0.12	11.68	0.05	100.05	0.42	1.59	2.42	0.01	0.56	0.00	5.00	0.57	0.42	0.01
		2	5.08	29.70	53.58	0.14	11.50	0.00	100.00	0.44	1.58	2.42	0.01	0.56	0.00	5.01	0.55	0.44	0.01
		3	5.03	29.63	53.91	0.14	11.47	0.01	100.18	0.44	1.57	2.43	0.01	0.55	0.00	5.01	0.55	0.44	0.01
		4	5.15	29.17	54.72	0.17	10.89	0.00	100.11	0.45	1.55	2.46	0.01	0.53	0.00	4.99	0.53	0.46	0.01
		5	5.33	29.07	54.80	0.17	10.71	0.00	100.08	0.47	1.54	2.47	0.01	0.52	0.00	5.00	0.52	0.47	0.01
		6	5.24	29.15	54.85	0.17	10.66	0.03	100.10	0.46	1.55	2.47	0.01	0.51	0.00	4.99	0.52	0.47	0.01
		7	5.32	29.12	54.84	0.18	10.92	0.00	100.37	0.46	1.54	2.46	0.01	0.53	0.00	5.00	0.53	0.46	0.01
		8	5.45	28.97	54.51	0.19	10.98	0.00	100.10	0.48	1.54	2.46	0.01	0.53	0.00	5.02	0.52	0.47	0.01
		9	5.25	29.15	54.46	0.16	10.74	0.05	99.81	0.46	1.55	2.46	0.01	0.52	0.00	5.00	0.53	0.47	0.01
		10	5.24	29.41	54.61	0.13	11.00	0.05	100.44	0.46	1.56	2.45	0.01	0.53	0.00	5.00	0.53	0.46	0.01
		11	5.20	29.73	55.25	0.15	11.39	0.00	101.71	0.45	1.55	2.45	0.01	0.54	0.00	5.00	0.54	0.45	0.01
2	A	1	3.32	31.88	50.60	0.06	14.33	0.15	100.35	0.29	1.70	2.30	0.00	0.70	0.01	5.00	0.70	0.29	0.00
		2	4.29	30.80	53.11	0.10	12.48	0.04	100.82	0.37	1.63	2.38	0.01	0.60	0.00	4.99	0.61	0.38	0.01
		3	4.62	30.58	53.21	0.11	12.56	0.00	101.07	0.40	1.62	2.39	0.01	0.60	0.00	5.01	0.60	0.40	0.01
		4	3.87	31.36	52.28	0.09	13.59	0.04	101.23	0.34	1.66	2.34	0.01	0.65	0.00	5.00	0.66	0.34	0.01
		5	4.84	29.77	53.70	0.15	11.46	0.00	99.91	0.42	1.58	2.43	0.01	0.55	0.00	5.00	0.56	0.43	0.01
		6	5.04	29.54	54.47	0.14	11.30	0.03	100.53	0.44	1.56	2.44	0.01	0.54	0.00	5.00	0.55	0.44	0.01
		7	5.16	29.40	55.01	0.10	11.10	0.07	100.84	0.45	1.55	2.46	0.01	0.53	0.00	4.99	0.54	0.45	0.01
		8	5.38	28.86	55.47	0.14	10.90	0.00	100.75	0.47	1.52	2.48	0.01	0.52	0.00	5.00	0.52	0.47	0.01
		9	5.32	29.34	56.37	0.15	10.74	0.06	101.98	0.45	1.52	2.49	0.01	0.51	0.00	4.98	0.52	0.47	0.01
		10	5.06	29.16	56.16	0.18	10.88	0.00	101.43	0.43	1.52	2.49	0.01	0.52	0.00	4.97	0.54	0.45	0.01
		11	5.10	29.31	55.84	0.16	10.96	0.00	101.36	0.44	1.53	2.48	0.01	0.52	0.00	4.98	0.54	0.45	0.01
		12	5.44	28.94	56.99	0.19	10.71	0.00	102.27	0.46	1.50	2.51	0.01	0.50	0.00	4.98	0.52	0.47	0.01
		13	5.47	29.02	57.23	0.16	10.55	0.00	102.43	0.46	1.50	2.51	0.01	0.50	0.00	4.98	0.51	0.48	0.01

		14	5.29	29.30	56.48	0.13	10.85	0.00	102.05	0.45	1.52	2.49	0.01	0.51	0.00	4.98	0.53	0.47	0.01
2	A	15	4.39	30.47	54.16	0.09	12.22	0.07	101.39	0.38	1.60	2.41	0.00	0.58	0.00	4.98	0.60	0.39	0.01
3	M	1	4.69	30.68	54.87	0.09	12.48	0.00	102.81	0.40	1.59	2.41	0.01	0.59	0.00	4.99	0.59	0.40	0.01
		2	5.05	29.88	55.42	0.12	11.58	0.00	102.05	0.43	1.56	2.45	0.01	0.55	0.00	4.99	0.55	0.44	0.01
		3	4.97	29.86	56.13	0.15	11.30	0.03	102.44	0.42	1.55	2.47	0.01	0.53	0.00	4.98	0.55	0.44	0.01
		4	5.27	29.65	56.15	0.17	11.25	0.06	102.56	0.45	1.54	2.47	0.01	0.53	0.00	4.99	0.54	0.45	0.01
		5	5.00	29.13	55.29	0.16	10.96	0.01	100.56	0.43	1.54	2.47	0.01	0.53	0.00	4.98	0.54	0.45	0.01
		6	5.20	29.60	55.96	0.15	11.16	0.00	102.07	0.44	1.54	2.47	0.01	0.53	0.00	4.99	0.54	0.45	0.01
		7	5.22	29.18	56.14	0.18	10.73	0.00	101.46	0.45	1.52	2.49	0.01	0.51	0.00	4.98	0.53	0.46	0.01
		8	5.32	29.37	56.43	0.17	10.77	0.02	102.08	0.45	1.52	2.49	0.01	0.51	0.00	4.98	0.52	0.47	0.01
		9	5.29	29.33	56.42	0.21	10.78	0.00	102.04	0.45	1.52	2.49	0.01	0.51	0.00	4.98	0.52	0.46	0.01
		10	5.16	28.89	55.60	0.15	10.16	0.03	99.99	0.45	1.53	2.49	0.01	0.49	0.00	4.97	0.52	0.47	0.01
		11	5.33	29.55	55.87	0.15	10.78	0.02	101.69	0.46	1.54	2.47	0.01	0.51	0.00	4.99	0.52	0.47	0.01
		12	4.80	30.15	55.08	0.11	11.85	0.07	102.06	0.41	1.57	2.44	0.01	0.56	0.00	4.99	0.57	0.42	0.01
	I	1	4.14	30.96	52.30	0.07	12.67	0.10	100.24	0.36	1.65	2.36	0.00	0.61	0.00	4.99	0.63	0.37	0.00
		2	5.27	29.77	54.39	0.13	10.89	0.18	100.62	0.46	1.57	2.44	0.01	0.52	0.01	5.01	0.53	0.46	0.01
		3	5.02	30.00	54.40	0.12	11.27	0.04	100.86	0.44	1.58	2.43	0.01	0.54	0.00	5.00	0.55	0.44	0.01
		4	5.21	29.47	54.36	0.12	11.28	0.10	100.54	0.45	1.56	2.44	0.01	0.54	0.00	5.01	0.54	0.45	0.01
		5	5.08	29.56	54.33	0.12	11.25	0.22	100.55	0.44	1.56	2.44	0.01	0.54	0.01	5.00	0.55	0.45	0.01
		6	5.36	29.58	55.12	0.15	10.95	0.10	101.24	0.46	1.55	2.45	0.01	0.52	0.00	5.00	0.53	0.47	0.01
		7	5.18	29.56	54.97	0.12	11.16	0.09	101.08	0.45	1.55	2.45	0.01	0.53	0.00	5.00	0.54	0.45	0.01
		8	4.89	30.15	54.16	0.14	11.42	0.08	100.85	0.42	1.59	2.42	0.01	0.55	0.00	5.00	0.56	0.43	0.01

Table 3.14: Analysis of plagioclase associated with garnet A6 from sample HJ-74 (group 3). Type A grains are adjacent to garnet, type M grains are in the matrix, and type I grains are inclusions in garnet. # represents the analysis number; in the case of type A and M grains the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	A	1	7.49	25.56	61.48	0.33	6.37	0.06	101.29	0.64	1.32	2.69	0.02	0.30	0.00	4.97	0.31	0.67	0.02
		2	8.20	24.40	62.12	0.41	5.63	0.37	101.13	0.70	1.26	2.73	0.02	0.27	0.01	4.99	0.27	0.71	0.02
		3	8.54	24.96	62.82	0.45	5.60	0.02	102.40	0.72	1.28	2.73	0.03	0.26	0.00	5.01	0.26	0.72	0.03
		4	8.42	24.94	62.65	0.36	5.78	0.07	102.22	0.71	1.28	2.72	0.02	0.27	0.00	5.00	0.27	0.71	0.02
		5	8.17	24.88	62.04	0.42	5.62	0.06	101.19	0.69	1.29	2.72	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		6	8.36	24.55	62.73	0.39	5.60	0.10	101.74	0.71	1.26	2.74	0.02	0.26	0.00	4.99	0.26	0.71	0.02
		7	8.32	24.48	62.74	0.42	5.67	0.00	101.63	0.70	1.26	2.74	0.02	0.27	0.00	4.99	0.27	0.71	0.02
		8	8.23	24.36	61.77	0.44	5.75	0.02	100.58	0.71	1.27	2.73	0.02	0.27	0.00	5.00	0.27	0.70	0.02
		9	8.32	24.79	62.35	0.44	5.78	0.00	101.69	0.71	1.28	2.72	0.02	0.27	0.00	5.00	0.27	0.70	0.02
		10	8.32	24.65	62.19	0.50	5.67	0.05	101.37	0.71	1.27	2.73	0.03	0.27	0.00	5.00	0.27	0.71	0.03
		12	7.87	25.00	61.66	0.36	6.24	0.02	101.15	0.67	1.29	2.71	0.02	0.29	0.00	4.99	0.30	0.68	0.02
2	A	1	10.92	21.36	66.64	0.21	1.97	0.53	101.63	0.92	1.09	2.89	0.01	0.09	0.02	5.02	0.09	0.90	0.01
		4	8.42	24.34	62.77	0.76	4.62	0.40	101.32	0.72	1.26	2.75	0.04	0.22	0.01	4.99	0.22	0.73	0.04
		5	8.55	24.94	61.92	0.14	5.87	0.19	101.60	0.73	1.29	2.71	0.01	0.28	0.01	5.01	0.27	0.72	0.01
		7	8.20	24.82	61.49	0.25	5.90	0.03	100.69	0.70	1.29	2.71	0.01	0.28	0.00	5.00	0.28	0.71	0.01
		8	8.71	24.80	62.62	0.34	5.53	0.00	102.00	0.74	1.27	2.73	0.02	0.26	0.00	5.01	0.26	0.73	0.02
		9	8.28	24.61	62.03	0.30	5.62	0.02	100.86	0.71	1.28	2.73	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		10	7.86	23.65	58.82	0.30	4.57	3.34	98.54	0.69	1.27	2.67	0.02	0.22	0.11	4.99	0.24	0.74	0.02
		11	8.19	24.56	61.07	0.30	5.56	0.06	99.75	0.71	1.29	2.72	0.02	0.27	0.00	5.00	0.27	0.71	0.02
3	M	1	8.25	25.11	61.87	0.35	6.01	0.53	102.11	0.70	1.29	2.70	0.02	0.28	0.02	5.01	0.28	0.70	0.02
		2	8.13	24.82	62.47	0.35	5.71	0.05	101.54	0.69	1.28	2.73	0.02	0.27	0.00	4.98	0.27	0.71	0.02
		3	8.28	24.87	62.27	0.36	5.72	0.09	101.59	0.70	1.28	2.72	0.02	0.27	0.00	5.00	0.27	0.71	0.02
		4	8.12	24.87	62.50	0.40	5.64	0.04	101.56	0.69	1.28	2.73	0.02	0.26	0.00	4.98	0.27	0.71	0.02
		5	8.22	24.82	62.31	0.38	5.76	0.03	101.53	0.70	1.28	2.73	0.02	0.27	0.00	4.99	0.27	0.71	0.02

		6	8.30	24.85	62.43	0.36	5.67	0.02	101.63	0.70	1.28	2.73	0.02	0.27	0.00	5.00	0.27	0.71	0.02
3	M	7	8.31	24.87	62.64	0.38	5.74	0.09	102.03	0.70	1.28	2.73	0.02	0.27	0.00	5.00	0.27	0.71	0.02
		8	8.27	25.12	62.28	0.36	5.92	0.12	102.07	0.70	1.29	2.71	0.02	0.28	0.00	5.00	0.28	0.70	0.02
		9	8.36	24.45	62.00	0.32	5.82	0.07	101.02	0.71	1.27	2.73	0.02	0.27	0.00	5.00	0.27	0.71	0.02
		10	8.55	24.79	62.86	0.31	5.58	0.16	102.25	0.72	1.27	2.73	0.02	0.26	0.01	5.00	0.26	0.72	0.02
		11	8.31	25.46	62.10	0.24	5.99	0.26	102.36	0.70	1.30	2.70	0.01	0.28	0.01	5.00	0.28	0.71	0.01
	I	1	7.75	23.99	62.70	0.49	5.90	0.15	100.98	0.66	1.24	2.75	0.03	0.28	0.01	4.97	0.29	0.68	0.03
		2	7.75	24.13	61.51	0.39	5.67	0.16	99.60	0.67	1.27	2.74	0.02	0.27	0.01	4.97	0.28	0.70	0.02
		3	7.83	24.55	62.36	0.55	5.66	0.41	101.36	0.67	1.27	2.73	0.03	0.27	0.01	4.98	0.28	0.69	0.03
		4	7.78	24.13	61.10	0.79	5.97	0.38	100.15	0.67	1.27	2.72	0.04	0.28	0.01	5.00	0.28	0.67	0.04
		5	7.74	23.92	61.96	0.49	5.48	0.98	100.58	0.66	1.25	2.74	0.03	0.26	0.03	4.97	0.27	0.70	0.03
		6	7.92	24.48	62.12	0.41	5.85	0.26	101.04	0.67	1.27	2.73	0.02	0.28	0.01	4.98	0.28	0.69	0.02
		9	7.83	24.71	63.20	0.51	5.67	0.32	102.24	0.66	1.26	2.74	0.03	0.26	0.01	4.97	0.28	0.69	0.03
		11	7.93	24.19	62.10	0.55	5.73	0.24	100.73	0.68	1.26	2.74	0.03	0.27	0.01	4.98	0.28	0.69	0.03
		12	7.35	24.46	61.16	0.56	6.11	0.33	99.95	0.63	1.28	2.72	0.03	0.29	0.01	4.97	0.30	0.66	0.03
		13	5.94	25.14	58.86	1.31	8.02	0.25	99.53	0.52	1.33	2.65	0.08	0.39	0.01	4.97	0.39	0.53	0.08
		14	7.01	25.55	60.30	0.30	7.34	0.18	100.68	0.60	1.33	2.67	0.02	0.35	0.01	4.97	0.36	0.62	0.02
		16	8.23	23.95	62.23	0.18	5.41	0.50	100.51	0.70	1.25	2.75	0.01	0.26	0.02	4.98	0.26	0.73	0.01

Table 3.15: Analysis of plagioclase associated with garnet A7 from sample HJ-74 (group 3). Type A grains are adjacent to garnet, type M grains are in the matrix, and type I grains are inclusions in garnet. # represents the analysis number; in the case of type A and M grains the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	A	1	8.23	24.98	61.31	0.41	5.63	0.02	100.58	0.71	1.30	2.71	0.02	0.27	0.00	5.00	0.27	0.71	0.02
		2	8.47	24.62	62.24	0.43	5.67	0.01	101.43	0.72	1.27	2.73	0.02	0.27	0.00	5.01	0.26	0.71	0.02
		3	8.23	24.57	62.16	0.44	5.36	0.04	100.81	0.70	1.27	2.74	0.02	0.25	0.00	4.99	0.26	0.72	0.03
		4	8.39	24.60	62.14	0.44	5.47	0.00	101.04	0.72	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		5	8.50	24.44	62.29	0.42	5.64	0.05	101.34	0.72	1.26	2.73	0.02	0.27	0.00	5.01	0.26	0.71	0.02
		6	8.01	25.10	62.13	0.44	5.78	0.03	101.49	0.68	1.29	2.72	0.02	0.27	0.00	4.99	0.28	0.70	0.03
		7	8.22	24.38	62.03	0.47	5.55	0.02	100.67	0.70	1.27	2.74	0.03	0.26	0.00	5.00	0.26	0.71	0.03
		8	8.67	25.57	61.12	0.33	3.61	0.06	99.36	0.75	1.34	2.72	0.02	0.17	0.00	5.00	0.18	0.80	0.02
		9	8.18	24.56	62.03	0.44	5.71	0.01	100.93	0.70	1.27	2.73	0.02	0.27	0.00	5.00	0.27	0.70	0.03
		10	8.30	24.84	62.27	0.41	5.39	0.05	101.27	0.71	1.28	2.73	0.02	0.25	0.00	4.99	0.26	0.72	0.02
2	M	1	8.12	24.91	62.59	0.48	5.79	0.00	101.88	0.69	1.28	2.73	0.03	0.27	0.00	4.99	0.28	0.70	0.03
		2	8.35	24.82	62.45	0.48	5.45	0.06	101.62	0.71	1.28	2.73	0.03	0.26	0.00	5.00	0.26	0.71	0.03
		3	8.28	24.52	62.52	0.48	5.64	0.01	101.45	0.70	1.27	2.74	0.03	0.26	0.00	5.00	0.27	0.71	0.03
		4	8.15	24.79	62.45	0.43	5.58	0.05	101.45	0.69	1.28	2.73	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		5	8.07	24.58	62.42	0.47	5.70	0.00	101.24	0.69	1.27	2.74	0.03	0.27	0.00	4.99	0.27	0.70	0.03
		6	8.22	24.75	62.78	0.46	5.63	0.00	101.84	0.69	1.27	2.74	0.03	0.26	0.00	4.99	0.27	0.71	0.03
		7	8.31	24.46	62.47	0.40	5.53	0.04	101.21	0.71	1.26	2.74	0.02	0.26	0.00	4.99	0.26	0.71	0.02
		8	8.09	24.79	62.31	0.39	5.99	0.06	101.64	0.69	1.28	2.72	0.02	0.28	0.00	4.99	0.28	0.69	0.02
		9	8.16	24.92	62.16	0.42	5.91	0.02	101.60	0.69	1.28	2.72	0.02	0.28	0.00	5.00	0.28	0.70	0.02
		10	7.91	24.83	61.75	0.42	6.02	0.05	100.99	0.68	1.29	2.72	0.02	0.28	0.00	4.99	0.29	0.69	0.02
		11	8.24	24.88	62.49	0.45	5.58	0.00	101.64	0.70	1.28	2.73	0.03	0.26	0.00	4.99	0.27	0.71	0.03
		12	8.39	24.64	62.34	0.47	5.67	0.00	101.51	0.71	1.27	2.73	0.03	0.27	0.00	5.00	0.26	0.71	0.03
		13	8.09	24.59	62.20	0.52	5.70	0.05	101.15	0.69	1.27	2.73	0.03	0.27	0.00	4.99	0.27	0.70	0.03

		14	8.28	24.53	62.40	0.47	5.66	0.00	101.34	0.70	1.27	2.73	0.03	0.27	0.00	5.00	0.27	0.71	0.03
		15	8.25	24.84	62.16	0.45	5.50	0.00	101.20	0.70	1.28	2.73	0.03	0.26	0.00	5.00	0.26	0.71	0.03
3	A	1	8.28	25.05	62.06	0.18	5.64	0.16	101.37	0.70	1.29	2.72	0.01	0.26	0.01	4.99	0.27	0.72	0.01
		2	8.82	24.03	63.07	0.31	4.72	0.26	101.20	0.75	1.24	2.76	0.02	0.22	0.01	5.00	0.22	0.76	0.02
		3	8.43	25.14	62.40	0.26	5.62	0.07	101.92	0.71	1.29	2.72	0.01	0.26	0.00	5.00	0.27	0.72	0.01
		4	7.96	23.63	59.92	0.25	4.84	1.95	98.54	0.70	1.26	2.71	0.01	0.23	0.07	4.98	0.25	0.74	0.02
		5	8.42	24.72	62.74	0.27	5.28	0.05	101.48	0.71	1.27	2.74	0.02	0.25	0.00	4.99	0.25	0.73	0.02
		6	8.41	24.94	62.69	0.25	5.50	0.05	101.84	0.71	1.28	2.73	0.01	0.26	0.00	4.99	0.26	0.72	0.01
		7	8.36	25.07	62.50	0.27	5.79	0.09	102.07	0.71	1.29	2.72	0.01	0.27	0.00	5.00	0.27	0.71	0.01
		8	8.51	24.71	61.91	0.29	5.66	0.08	101.16	0.73	1.28	2.72	0.02	0.27	0.00	5.01	0.26	0.72	0.02
		9	8.64	24.83	62.65	0.23	5.74	0.08	102.17	0.73	1.27	2.72	0.01	0.27	0.00	5.01	0.27	0.72	0.01
		10	8.34	24.96	62.08	0.16	5.77	0.00	101.30	0.71	1.29	2.72	0.01	0.27	0.00	4.99	0.27	0.72	0.01
4	M	1	8.44	24.87	62.29	0.25	5.65	0.25	101.75	0.71	1.28	2.72	0.01	0.26	0.01	5.00	0.27	0.72	0.01
		3	8.47	24.99	62.43	0.28	5.69	0.06	101.91	0.72	1.28	2.72	0.02	0.27	0.00	5.00	0.27	0.72	0.02
		4	8.59	24.83	62.67	0.27	5.55	0.05	101.97	0.73	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.73	0.02
		5	8.18	24.74	62.71	0.30	5.61	0.11	101.66	0.69	1.27	2.74	0.02	0.26	0.00	4.98	0.27	0.71	0.02
		6	8.12	24.76	62.39	0.31	5.71	0.06	101.35	0.69	1.28	2.73	0.02	0.27	0.00	4.98	0.27	0.71	0.02
		7	8.22	25.17	62.76	0.24	5.85	0.00	102.24	0.69	1.29	2.72	0.01	0.27	0.00	4.99	0.28	0.71	0.01
		8	7.96	25.29	61.82	0.27	6.10	0.02	101.46	0.68	1.30	2.71	0.02	0.29	0.00	4.99	0.29	0.69	0.02
		9	8.30	24.43	62.48	0.37	5.67	0.04	101.30	0.71	1.26	2.74	0.02	0.27	0.00	4.99	0.27	0.71	0.02
		10	8.58	24.81	62.69	0.38	5.67	0.03	102.15	0.72	1.27	2.73	0.02	0.26	0.00	5.01	0.26	0.72	0.02
		11	8.40	24.62	62.42	0.35	5.46	0.00	101.25	0.71	1.27	2.74	0.02	0.26	0.00	5.00	0.26	0.72	0.02
5	M	1	8.53	24.58	62.46	0.21	5.62	0.03	101.43	0.72	1.27	2.73	0.01	0.26	0.00	5.00	0.26	0.72	0.01
		2	8.43	24.50	62.49	0.30	5.65	0.03	101.40	0.72	1.26	2.74	0.02	0.26	0.00	5.00	0.27	0.72	0.02
		3	8.41	24.60	62.40	0.35	5.55	0.01	101.31	0.71	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		4	8.23	24.63	62.08	0.39	5.54	0.06	100.93	0.70	1.28	2.73	0.02	0.26	0.00	4.99	0.26	0.71	0.02
		5	8.83	25.11	63.55	0.42	5.06	0.04	103.02	0.74	1.27	2.74	0.02	0.23	0.00	5.01	0.24	0.74	0.02
		6	8.61	24.66	62.58	0.40	5.52	0.02	101.79	0.73	1.27	2.73	0.02	0.26	0.00	5.01	0.26	0.72	0.02
		7	8.36	24.53	62.31	0.41	5.43	0.00	101.05	0.71	1.27	2.74	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		8	8.34	24.40	62.34	0.41	5.41	0.05	100.95	0.71	1.26	2.74	0.02	0.25	0.00	4.99	0.26	0.72	0.02
		9	8.37	24.37	62.19	0.39	5.52	0.00	100.85	0.71	1.26	2.74	0.02	0.26	0.00	5.00	0.26	0.72	0.02

		10	8.19	24.73	62.45	0.44	5.73	0.03	101.58	0.69	1.27	2.73	0.02	0.27	0.00	4.99	0.27	0.70	0.03
		11	8.28	24.77	62.31	0.39	5.69	0.02	101.47	0.70	1.28	2.73	0.02	0.27	0.00	5.00	0.27	0.71	0.02
5	M	12	8.22	24.85	62.15	0.43	5.68	0.05	101.39	0.70	1.28	2.72	0.02	0.27	0.00	5.00	0.27	0.71	0.02
		13	8.32	24.64	62.57	0.43	5.73	0.02	101.71	0.70	1.27	2.73	0.02	0.27	0.00	5.00	0.27	0.71	0.02
		14	8.21	24.67	61.85	0.44	5.77	0.04	100.98	0.70	1.28	2.72	0.02	0.27	0.00	5.00	0.27	0.70	0.02
		15	8.38	24.65	61.54	0.39	5.72	0.03	100.71	0.72	1.28	2.72	0.02	0.27	0.00	5.01	0.27	0.71	0.02
		16	8.15	25.06	62.23	0.37	5.71	0.00	101.51	0.69	1.29	2.72	0.02	0.27	0.00	4.99	0.27	0.71	0.02
6	M	1	8.07	24.55	62.10	0.36	5.68	0.13	100.88	0.69	1.27	2.73	0.02	0.27	0.00	4.98	0.27	0.71	0.02
		2	8.27	24.48	62.43	0.47	5.68	0.07	101.40	0.70	1.26	2.73	0.03	0.27	0.00	5.00	0.27	0.71	0.03
		3	8.22	24.50	61.68	0.44	5.55	0.02	100.41	0.70	1.28	2.73	0.02	0.26	0.00	5.00	0.27	0.71	0.03
		4	8.25	24.61	62.56	0.47	5.52	0.04	101.45	0.70	1.27	2.74	0.03	0.26	0.00	4.99	0.26	0.71	0.03
		5	8.23	24.60	62.11	0.46	5.54	0.04	100.97	0.70	1.27	2.73	0.03	0.26	0.00	4.99	0.26	0.71	0.03
		6	8.32	24.79	62.23	0.46	5.60	0.02	101.42	0.71	1.28	2.73	0.03	0.26	0.00	5.00	0.26	0.71	0.03
		7	8.37	25.02	62.16	0.46	5.42	0.00	101.43	0.71	1.29	2.72	0.03	0.25	0.00	5.00	0.26	0.72	0.03
		8	8.13	24.70	62.16	0.45	5.59	0.07	101.11	0.69	1.28	2.73	0.03	0.26	0.00	4.99	0.27	0.71	0.03
		9	8.30	24.53	61.93	0.43	5.49	0.00	100.68	0.71	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.71	0.02
		10	8.28	24.71	62.05	0.47	5.60	0.00	101.11	0.71	1.28	2.73	0.03	0.26	0.00	5.00	0.26	0.71	0.03
		11	7.98	25.15	58.57	0.46	4.72	1.65	98.54	0.70	1.34	2.65	0.03	0.23	0.06	5.01	0.24	0.73	0.03
		12	8.18	24.79	62.76	0.45	5.51	0.01	101.69	0.69	1.27	2.74	0.03	0.26	0.00	4.98	0.26	0.71	0.03
		13	8.19	24.52	62.29	0.45	5.59	0.00	101.05	0.70	1.27	2.74	0.03	0.26	0.00	4.99	0.27	0.71	0.03
		14	8.35	24.79	62.08	0.46	5.74	0.00	101.42	0.71	1.28	2.72	0.03	0.27	0.00	5.01	0.27	0.71	0.03
		15	8.11	24.59	62.74	0.48	5.53	0.04	101.49	0.69	1.27	2.74	0.03	0.26	0.00	4.98	0.27	0.71	0.03
		16	8.10	24.68	62.20	0.48	5.71	0.01	101.19	0.69	1.28	2.73	0.03	0.27	0.00	4.99	0.27	0.70	0.03
		17	8.27	24.59	62.41	0.43	5.65	0.00	101.36	0.70	1.27	2.73	0.02	0.27	0.00	4.99	0.27	0.71	0.02
		18	8.29	24.69	62.33	0.49	5.51	0.00	101.31	0.70	1.28	2.73	0.03	0.26	0.00	5.00	0.26	0.71	0.03
		19	8.38	24.71	62.65	0.41	5.48	0.00	101.62	0.71	1.27	2.74	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		20	8.14	24.41	62.45	0.40	5.59	0.00	100.99	0.69	1.26	2.74	0.02	0.26	0.00	4.98	0.27	0.71	0.02
7	M	1	8.19	24.70	61.83	0.57	5.86	0.00	101.14	0.70	1.28	2.72	0.03	0.28	0.00	5.01	0.27	0.69	0.03
		2	8.16	24.86	62.27	0.52	5.43	0.00	101.24	0.69	1.28	2.73	0.03	0.26	0.00	4.99	0.26	0.71	0.03
		3	8.35	24.48	62.79	0.48	5.28	0.04	101.42	0.71	1.26	2.75	0.03	0.25	0.00	4.99	0.25	0.72	0.03
		4	8.21	24.36	62.21	0.48	5.48	0.25	100.99	0.70	1.26	2.74	0.03	0.26	0.01	4.99	0.26	0.71	0.03

		5	7.94	23.81	60.40	0.40	4.73	2.59	99.88	0.69	1.26	2.70	0.02	0.23	0.09	4.98	0.24	0.73	0.02
		6	8.23	24.69	62.36	0.50	5.61	0.01	101.41	0.70	1.27	2.73	0.03	0.26	0.00	5.00	0.27	0.71	0.03
7	M	7	8.12	24.58	62.18	0.51	5.58	0.00	100.98	0.69	1.27	2.73	0.03	0.26	0.00	4.99	0.27	0.70	0.03
		8	8.35	24.92	62.80	0.46	5.49	0.04	102.07	0.70	1.28	2.73	0.03	0.26	0.00	4.99	0.26	0.71	0.03
		9	8.26	24.47	62.37	0.49	5.69	0.04	101.32	0.70	1.26	2.73	0.03	0.27	0.00	5.00	0.27	0.70	0.03
		10	8.26	24.53	62.47	0.51	5.55	0.00	101.31	0.70	1.27	2.74	0.03	0.26	0.00	4.99	0.26	0.71	0.03
		11	8.30	24.51	61.69	0.44	5.77	0.03	100.76	0.71	1.28	2.72	0.02	0.27	0.00	5.01	0.27	0.70	0.02
		12	0.54	18.92	64.17	15.42	0.03	0.04	99.13	0.05	1.04	2.98	0.91	0.00	0.00	4.98	0.00	0.05	0.95
		13	8.42	24.39	62.19	0.45	5.55	0.03	101.02	0.72	1.26	2.73	0.03	0.26	0.00	5.00	0.26	0.71	0.02
		14	8.16	24.40	62.66	0.44	5.36	0.03	101.05	0.69	1.26	2.75	0.02	0.25	0.00	4.98	0.26	0.71	0.03
		15	8.04	24.40	61.50	0.44	5.62	0.00	100.01	0.69	1.28	2.73	0.02	0.27	0.00	4.99	0.27	0.70	0.03
		16	8.35	24.48	62.04	0.47	5.57	0.03	100.95	0.71	1.27	2.73	0.03	0.26	0.00	5.00	0.26	0.71	0.03
		17	8.24	24.44	61.94	0.50	5.38	0.06	100.55	0.71	1.27	2.73	0.03	0.25	0.00	5.00	0.26	0.71	0.03
		18	8.13	24.78	61.17	0.38	5.85	0.28	100.60	0.70	1.29	2.71	0.02	0.28	0.01	5.00	0.28	0.70	0.02
	I	1	7.12	25.00	61.56	0.50	6.52	0.72	101.42	0.61	1.29	2.70	0.03	0.31	0.02	4.96	0.33	0.64	0.03
		3	7.72	24.93	63.01	0.34	5.94	0.34	102.28	0.65	1.27	2.73	0.02	0.28	0.01	4.96	0.29	0.69	0.02
		4	8.01	24.40	63.30	0.38	5.52	0.64	102.26	0.67	1.25	2.75	0.02	0.26	0.02	4.97	0.27	0.71	0.02
		5	7.83	24.34	63.39	0.47	5.55	0.41	101.98	0.66	1.25	2.75	0.03	0.26	0.01	4.96	0.27	0.70	0.03

Table 3.16: Analysis of plagioclase associated with garnet A8 from sample HJ-74 (group 3). Type A grains are adjacent to garnet, type M grains are in the matrix, and type I grains are inclusions in garnet. # represents the analysis number; in the case of type A and M grains the first analysis is adjacent to garnet and the last analysis is furthest from garnet.

			Oxide percentage							Cations on an 8 (O) basis							Molar Fractions		
Grain #	Type	#	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	FeO	Total	Na	Al	Si	K	Ca	Fe	Total	X_{An}	X_{Ab}	X_{Or}
1	A	1	8.10	24.70	61.93	0.39	5.84	0.25	101.20	0.69	1.28	2.72	0.02	0.28	0.01	4.99	0.28	0.70	0.02
		2	8.37	24.89	61.80	0.40	5.64	0.14	101.23	0.71	1.29	2.71	0.02	0.27	0.00	5.01	0.27	0.71	0.02
		3	8.13	24.98	62.25	0.39	5.58	0.08	101.41	0.69	1.29	2.72	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		4	8.23	24.79	62.24	0.38	5.57	0.04	101.25	0.70	1.28	2.73	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		5	8.15	24.80	62.36	0.44	5.70	0.06	101.52	0.69	1.28	2.73	0.02	0.27	0.00	4.99	0.27	0.70	0.03
		6	10.61	21.96	66.36	0.19	2.56	0.03	101.70	0.89	1.12	2.87	0.01	0.12	0.00	5.02	0.12	0.87	0.01
		7	8.20	24.94	62.70	0.40	5.67	0.09	102.00	0.69	1.28	2.73	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		8	7.76	24.91	61.50	0.33	6.09	0.59	101.17	0.66	1.29	2.70	0.02	0.29	0.02	4.98	0.30	0.68	0.02
2	M	1	8.26	25.62	62.18	0.27	6.30	0.05	102.67	0.69	1.31	2.69	0.01	0.29	0.00	5.00	0.29	0.69	0.01
		2	8.40	24.95	61.67	0.34	5.74	0.06	101.15	0.72	1.29	2.71	0.02	0.27	0.00	5.01	0.27	0.71	0.02
		3	8.33	24.85	62.39	0.27	5.92	0.03	101.78	0.70	1.28	2.72	0.02	0.28	0.00	5.00	0.28	0.71	0.02
		4	8.10	25.25	62.30	0.39	5.92	0.03	101.99	0.68	1.30	2.71	0.02	0.28	0.00	4.99	0.28	0.70	0.02
		5	8.13	24.76	61.91	0.36	5.95	0.09	101.20	0.69	1.28	2.72	0.02	0.28	0.00	5.00	0.28	0.70	0.02
		6	8.12	24.45	61.63	0.51	5.26	0.28	100.25	0.70	1.28	2.73	0.03	0.25	0.01	4.99	0.26	0.71	0.03
		7	8.41	25.04	61.87	0.31	5.67	0.08	101.37	0.71	1.29	2.71	0.02	0.27	0.00	5.01	0.27	0.72	0.02
		8	8.35	24.73	61.98	0.31	5.62	0.13	101.12	0.71	1.28	2.72	0.02	0.26	0.00	5.00	0.27	0.72	0.02
		10	8.10	23.66	61.12	0.33	5.53	0.01	98.76	0.71	1.25	2.75	0.02	0.27	0.00	4.99	0.27	0.71	0.02
		11	8.66	24.24	62.39	0.30	5.23	0.04	100.87	0.74	1.26	2.74	0.02	0.25	0.00	5.00	0.25	0.74	0.02
		12	8.43	24.68	62.58	0.32	5.67	0.04	101.71	0.71	1.27	2.73	0.02	0.27	0.00	5.00	0.27	0.72	0.02
		13	8.43	24.53	62.59	0.32	5.58	0.03	101.49	0.71	1.26	2.74	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		14	8.21	24.49	62.40	0.29	5.78	0.01	101.17	0.70	1.27	2.74	0.02	0.27	0.00	4.99	0.28	0.71	0.02
		15	8.07	25.09	61.64	0.25	6.13	0.02	101.20	0.69	1.30	2.71	0.01	0.29	0.00	4.99	0.29	0.69	0.01
3	M	1	8.10	25.39	61.63	0.32	6.08	0.24	101.75	0.69	1.31	2.69	0.02	0.28	0.01	5.00	0.29	0.69	0.02
		2	8.23	24.78	61.96	0.34	5.67	0.14	101.13	0.70	1.28	2.72	0.02	0.27	0.00	5.00	0.27	0.71	0.02

		3	8.36	24.67	62.32	0.36	5.89	0.06	101.66	0.71	1.27	2.72	0.02	0.28	0.00	5.00	0.27	0.71	0.02
3	M	4	8.61	24.57	62.38	0.38	5.50	0.01	101.45	0.73	1.27	2.73	0.02	0.26	0.00	5.01	0.26	0.72	0.02
		5	8.40	24.52	62.16	0.40	5.49	0.04	101.02	0.72	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		6	8.24	24.63	62.60	0.33	5.66	0.04	101.49	0.70	1.27	2.74	0.02	0.27	0.00	4.99	0.27	0.71	0.02
		7	8.32	24.47	62.65	0.38	5.52	0.00	101.35	0.71	1.26	2.74	0.02	0.26	0.00	4.99	0.26	0.72	0.02
		8	8.33	24.55	62.88	0.45	5.50	0.02	101.73	0.70	1.26	2.74	0.03	0.26	0.00	4.99	0.26	0.71	0.03
		10	8.25	24.88	62.62	0.44	5.66	0.04	101.89	0.70	1.28	2.73	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		11	8.28	24.56	62.30	0.40	5.58	0.00	101.11	0.70	1.27	2.73	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		12	8.25	24.79	62.28	0.40	5.39	0.02	101.12	0.70	1.28	2.73	0.02	0.25	0.00	4.99	0.26	0.72	0.02
		13	8.42	24.69	63.06	0.43	5.53	0.02	102.16	0.71	1.26	2.74	0.02	0.26	0.00	4.99	0.26	0.72	0.02
		14	8.42	24.80	62.58	0.36	5.54	0.09	101.80	0.71	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.72	0.02
4	M	1	7.91	25.61	61.38	0.26	6.34	0.23	101.74	0.67	1.32	2.68	0.01	0.30	0.01	4.99	0.30	0.68	0.01
		2	8.19	24.90	62.47	0.35	5.62	0.05	101.57	0.69	1.28	2.73	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		3	8.34	25.09	62.40	0.38	5.82	0.01	102.03	0.70	1.29	2.72	0.02	0.27	0.00	5.00	0.27	0.71	0.02
		4	8.20	24.91	62.51	0.40	5.70	0.05	101.77	0.69	1.28	2.73	0.02	0.27	0.00	4.99	0.27	0.71	0.02
		5	8.61	24.66	62.44	0.39	5.64	0.11	101.84	0.73	1.27	2.73	0.02	0.26	0.00	5.01	0.26	0.72	0.02
		6	8.28	24.58	62.03	0.35	5.66	0.07	100.97	0.71	1.27	2.73	0.02	0.27	0.00	5.00	0.27	0.71	0.02
		7	8.42	24.80	62.64	0.40	5.54	0.00	101.80	0.71	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		8	8.18	24.96	62.30	0.44	5.63	0.00	101.51	0.69	1.29	2.72	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		9	8.45	24.59	62.41	0.41	5.55	0.02	101.43	0.72	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		10	8.23	24.82	62.57	0.35	5.48	0.03	101.46	0.70	1.28	2.73	0.02	0.26	0.00	4.99	0.26	0.72	0.02
		11	8.29	24.45	62.39	0.38	5.51	0.11	101.11	0.71	1.26	2.74	0.02	0.26	0.00	4.99	0.26	0.72	0.02
		12	8.63	24.57	62.80	0.32	5.56	0.12	102.00	0.73	1.26	2.73	0.02	0.26	0.00	5.01	0.26	0.72	0.02
5	M	1	8.46	25.00	62.52	0.39	5.50	0.03	101.90	0.71	1.28	2.72	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		2	8.30	25.05	62.42	0.36	5.55	0.00	101.68	0.70	1.29	2.72	0.02	0.26	0.00	4.99	0.26	0.72	0.02
		3	8.25	24.67	62.54	0.41	5.38	0.01	101.25	0.70	1.27	2.74	0.02	0.25	0.00	4.99	0.26	0.72	0.02
		4	8.34	24.79	62.47	0.39	5.56	0.06	101.61	0.71	1.28	2.73	0.02	0.26	0.00	5.00	0.26	0.71	0.02
		5	8.47	24.64	62.58	0.33	5.71	0.01	101.73	0.72	1.27	2.73	0.02	0.27	0.00	5.00	0.27	0.72	0.02
		6	8.15	24.57	62.03	0.35	5.78	0.04	100.92	0.70	1.27	2.73	0.02	0.27	0.00	4.99	0.28	0.70	0.02
		7	8.36	24.73	62.39	0.34	5.75	0.02	101.60	0.71	1.27	2.73	0.02	0.27	0.00	5.00	0.27	0.71	0.02
		8	8.56	24.65	62.83	0.35	5.60	0.00	101.99	0.72	1.26	2.74	0.02	0.26	0.00	5.00	0.26	0.72	0.02

		9	8.20	24.37	61.69	0.12	5.49	0.06	99.94	0.70	1.27	2.74	0.01	0.26	0.00	4.98	0.27	0.72	0.01
5	M	10	8.48	24.60	62.32	0.29	5.47	0.03	101.20	0.72	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.73	0.02
		11	8.54	24.69	61.70	0.23	5.51	0.04	100.70	0.73	1.28	2.72	0.01	0.26	0.00	5.01	0.26	0.73	0.01
6	M	1	7.27	24.92	58.11	0.84	4.93	3.48	99.56	0.64	1.33	2.63	0.05	0.24	0.12	4.99	0.26	0.69	0.05
		2	8.72	23.11	63.07	1.23	2.57	0.97	99.67	0.75	1.21	2.80	0.07	0.12	0.03	4.99	0.13	0.80	0.07
		3	8.57	25.05	62.94	0.33	5.61	0.03	102.53	0.72	1.28	2.73	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		4	8.54	24.63	62.78	0.33	5.51	0.05	101.84	0.72	1.27	2.74	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		5	8.53	24.68	62.15	0.37	5.53	0.01	101.27	0.73	1.28	2.73	0.02	0.26	0.00	5.01	0.26	0.72	0.02
		6	8.23	24.35	62.15	0.40	5.60	0.01	100.74	0.70	1.26	2.74	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		7	8.58	24.75	61.94	0.35	5.59	0.01	101.22	0.73	1.28	2.72	0.02	0.26	0.00	5.01	0.26	0.72	0.02
		8	8.25	24.62	62.26	0.36	5.37	0.00	100.86	0.70	1.28	2.74	0.02	0.25	0.00	4.99	0.26	0.72	0.02
		9	8.41	24.50	62.01	0.39	5.43	0.07	100.80	0.72	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		10	8.15	24.57	62.29	0.41	5.68	0.04	101.14	0.69	1.27	2.73	0.02	0.27	0.00	4.99	0.27	0.71	0.02
		11	8.31	24.62	62.02	0.43	5.58	0.04	101.00	0.71	1.28	2.73	0.02	0.26	0.00	5.00	0.26	0.71	0.02
		12	8.23	24.55	62.36	0.45	5.69	0.00	101.28	0.70	1.27	2.73	0.03	0.27	0.00	4.99	0.27	0.71	0.03
		13	8.07	24.22	61.05	0.39	5.45	0.30	99.48	0.70	1.27	2.73	0.02	0.26	0.01	4.99	0.27	0.71	0.02
		14	8.22	24.80	62.04	0.38	5.58	0.04	101.06	0.70	1.28	2.72	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		15	8.39	24.66	62.62	0.41	5.61	0.04	101.73	0.71	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.71	0.02
		16	8.55	24.94	62.33	0.31	5.71	0.00	101.85	0.72	1.28	2.72	0.02	0.27	0.00	5.01	0.27	0.72	0.02
		17	8.23	24.30	61.56	0.30	5.36	0.01	99.75	0.71	1.27	2.74	0.02	0.26	0.00	4.99	0.26	0.72	0.02
		18	8.32	24.71	62.31	0.30	5.67	0.08	101.39	0.71	1.27	2.73	0.02	0.27	0.00	4.99	0.27	0.71	0.02
		19	8.47	24.36	62.12	0.60	4.60	0.62	100.77	0.72	1.27	2.74	0.03	0.22	0.02	5.00	0.22	0.74	0.03
7	M	1	9.18	23.44	64.05	0.30	4.08	0.07	101.13	0.78	1.21	2.80	0.02	0.19	0.00	4.99	0.19	0.79	0.02
		2	8.32	24.28	62.08	0.40	5.47	0.03	100.58	0.71	1.26	2.74	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		3	8.39	24.67	62.49	0.36	5.44	0.00	101.35	0.71	1.27	2.74	0.02	0.26	0.00	4.99	0.26	0.72	0.02
		4	8.43	24.54	62.30	0.40	5.52	0.02	101.20	0.72	1.27	2.73	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		5	8.18	24.54	62.16	0.40	5.57	0.00	100.85	0.70	1.27	2.73	0.02	0.26	0.00	4.99	0.27	0.71	0.02
		6	8.36	24.39	62.36	0.42	5.52	0.01	101.07	0.71	1.26	2.74	0.02	0.26	0.00	5.00	0.26	0.72	0.02
		7	8.26	24.69	62.32	0.37	5.47	0.02	101.13	0.70	1.28	2.73	0.02	0.26	0.00	4.99	0.26	0.72	0.02
		8	8.41	24.68	62.71	0.32	5.63	0.02	101.78	0.71	1.27	2.73	0.02	0.26	0.00	5.00	0.27	0.72	0.02
		9	8.20	24.55	62.58	0.38	5.61	0.00	101.32	0.70	1.27	2.74	0.02	0.26	0.00	4.99	0.27	0.71	0.02

	I	1	7.36	24.56	60.76	0.29	6.47	0.50	99.95	0.63	1.29	2.70	0.02	0.31	0.02	4.97	0.32	0.66	0.02
	I	3	7.96	24.82	62.89	0.03	6.06	0.41	102.17	0.67	1.27	2.73	0.00	0.28	0.01	4.97	0.30	0.70	0.00
		4	7.94	24.15	62.00	0.39	5.80	0.19	100.46	0.68	1.26	2.74	0.02	0.27	0.01	4.98	0.28	0.70	0.02
		6	6.88	25.59	59.50	0.40	7.35	0.63	100.34	0.59	1.34	2.65	0.02	0.35	0.02	4.98	0.36	0.61	0.02

APPENDIX 4: CORDIERITE ANALYSES*

(Only analyses with acceptable stoichiometry are included here.)

* Note: in all tables FeO = FeO + Fe_2O_3

Table 4.1: Cordierite analysis (group 1 samples).

			Oxide percentage										Cations on an 18 (O) basis										Molar Fractions	
Sample	Associated Garnet	Analysis number	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	TiO_2	MnO	FeO	Total	NaK	MgK	AlK	SiK	K K	CaK	TiK	MnK	FeK	Total	X_{Fe}	X_{Mg}
HJ-35a	A1	1	0.00	11.77	34.70	50.98	0.28	0.07	0.11	0.12	3.32	101.35	0.00	1.72	4.00	4.98	0.03	0.01	0.01	0.01	0.27	11.03	0.14	0.86
		2	0.00	11.99	34.48	50.79	0.22	0.16	0.13	0.12	3.14	101.02	0.00	1.75	3.98	4.98	0.03	0.02	0.01	0.01	0.26	11.03	0.13	0.87
		3	0.11	12.04	34.18	50.65	0.26	0.17	0.12	0.15	3.12	100.81	0.02	1.77	3.96	4.98	0.03	0.02	0.01	0.01	0.26	11.06	0.13	0.87
		4	0.00	11.80	34.35	50.95	0.22	0.20	0.20	0.09	3.25	101.06	0.00	1.72	3.97	4.99	0.03	0.02	0.01	0.01	0.27	11.02	0.13	0.87
		5	0.08	11.96	34.78	50.43	0.31	0.24	0.24	0.10	3.24	101.38	0.02	1.74	4.01	4.94	0.04	0.03	0.02	0.01	0.27	11.07	0.13	0.87
	A2	1	0.09	12.23	34.58	50.46	0.30	0.23	0.27	0.20	3.27	101.62	0.02	1.78	3.98	4.93	0.04	0.02	0.02	0.02	0.27	11.08	0.13	0.87
		2	0.00	11.69	34.24	49.93	0.33	0.18	0.18	0.14	3.30	99.98	0.00	1.73	4.01	4.96	0.04	0.02	0.01	0.01	0.27	11.05	0.14	0.86
		3	0.10	11.91	34.47	50.32	0.27	0.22	0.23	0.20	3.40	101.12	0.02	1.74	3.99	4.94	0.03	0.02	0.02	0.02	0.28	11.07	0.14	0.86
	A7	1	0.00	12.38	35.00	51.82	0.22	0.14	0.18	0.09	2.90	102.72	0.00	1.78	3.97	4.99	0.03	0.01	0.01	0.01	0.23	11.03	0.12	0.88
		2	0.00	12.21	34.39	50.19	0.25	0.22	0.19	0.10	2.92	100.48	0.00	1.79	4.00	4.95	0.03	0.02	0.01	0.01	0.24	11.06	0.12	0.88
		3	0.06	11.81	34.17	49.97	0.25	0.20	0.23	0.11	3.05	99.86	0.01	1.75	4.00	4.96	0.03	0.02	0.02	0.01	0.25	11.05	0.13	0.87
		4	0.13	12.11	34.73	50.49	0.26	0.22	0.23	0.11	3.26	101.53	0.02	1.76	4.00	4.94	0.03	0.02	0.02	0.01	0.27	11.07	0.13	0.87
		5	0.00	11.83	34.48	50.72	0.26	0.18	0.19	0.15	3.32	101.13	0.00	1.73	3.98	4.97	0.03	0.02	0.01	0.01	0.27	11.04	0.14	0.86
	A 11	6	0.00	11.76	34.56	50.51	0.21	0.18	0.18	0.15	3.25	100.79	0.00	1.72	4.00	4.97	0.03	0.02	0.01	0.01	0.27	11.03	0.13	0.87
		7	0.08	12.04	34.49	50.61	0.28	0.16	0.25	0.11	3.26	101.27	0.01	1.76	3.98	4.96	0.03	0.02	0.02	0.01	0.27	11.06	0.13	0.87
		8	0.00	11.69	34.65	51.41	0.28	0.15	0.11	0.09	3.04	101.42	0.00	1.70	3.98	5.01	0.03	0.02	0.01	0.01	0.25	11.01	0.13	0.87
HJ-35d	A10	1	0.51	12.01	33.42	49.09	0.00	0.01	0.00	0.15	2.20	97.24	0.10	1.82	3.99	4.98	0.00	0.00	0.00	0.01	0.19	11.07	0.09	0.91
		2	0.54	11.98	33.26	49.15	0.00	0.00	0.05	0.00	2.47	97.33	0.11	1.81	3.97	4.98	0.00	0.00	0.00	0.00	0.21	11.08	0.10	0.90
		3	0.68	12.09	33.24	49.08	0.00	0.03	0.04	0.00	2.46	97.53	0.13	1.83	3.97	4.97	0.00	0.00	0.00	0.00	0.21	11.11	0.10	0.90
		4	0.10	12.28	34.61	50.86	0.35	0.18	0.12	0.09	2.23	100.81	0.02	1.79	3.99	4.98	0.04	0.02	0.01	0.01	0.18	11.04	0.09	0.91
		5	0.06	12.17	34.66	50.52	0.29	0.22	0.18	0.15	2.45	100.70	0.01	1.78	4.01	4.96	0.04	0.02	0.01	0.01	0.20	11.05	0.10	0.90