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„Mt. Etna: Petrologic studies of the eccentric cones Monte Spagnolo, Monte Rossi, Mounts de Fiore and the lava flow 2002/2003“

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2. ABSTRACT

Mt. Etna, located in Sicily, Italy, is Europe's most active volcano and its geodynamic setting and plumbing system have been in the centre of many extensive studies.

The 6 stages of eruptive activity from the past to the present are: (1) 'Tholeiitic Stage' between 600-320 ka ago, (2) 'Timpe Stage' 220-110 ka ago, (3) 'Ancient Alkaline Volcanism' 110-65 ka ago, (4) 'Ellittico Stage' 57-15 ka ago, (5) 'Mongibello Stage' from 15 ka ago until 1971 and (6) the 'post -1971 Stage' comprising the volcanic activity since 1971 (Casetta, Giacomoni, Ferlito, Bonadiman, & Coltorti, 2019). The lava propagating through the Etnean plumbing system generated a complex network of sills and dykes and is responsible for the formation of the summit craters and a plethora of eccentric cones that cover the flanks of the volcano.

We studied whole rock and mineral chemistry of the lavas from three eccentric cones (Monte Spagnolo, Mounts de Fiore and Monte Rossi) and the 2002/03 southern flank lava flow. All lavas are trachybasalts with trachytic texture and variable modal composition of olivine, clinopyroxene and plagioclase phenocrysts. The Monte Spagnolo whole rock composition has the most primitive lavas of all the sampled outcrops with Mg# between 55-57.5 and 10.7 wt% CaO, whereas the Monte Rossi lavas are the most evolved ones with a Mg# between 48.3 and 49.3 and a CaO content between 10.44 and 10.48 wt%. Mounts de Fiore and the 2002/03 lava flow are more evolved than the Monte Spagnolo lavas, as they have a Mg# of around 51 to 52. The corresponding CaO concentration is around 11.2 wt% and 10.62 wt% respectively.

Deviating from the trend of the corresponding whole rock composition, the most MgO- rich olivine (Fo=88.9 %) was found in the Monte Spagnolo lavas. Due to its low NiO content (0.17 - 0.2 wt%) and high CaO content (0.25 - 0.26 wt%) this olivine is apparently of magmatic origin. Considering that the olivine, which could be in equilibrium with these lavas, has Fo=82.2. It is evident that the olivine with Fo=88.9 points to magma mixing with high MgO- rich lavas. The most evolved lavas from Monte Rossi have the lowest Fo-content (Fo=67 - 75 %). In conclusion olivine and clinopyroxene with inverse zoning, a higher Mg# in the rims, than in the cores, indicate extensive magma mixing in all locations except for Monte Rossi. The Fo contents of olivine increases in the Monte Spagnolo basalts from about 75 to 76, from Mounts de Fiore from about 76.5 to 80, and from the 2002/03 lava flow from 70 to 76 %

Monte Spagnolo lavas, compared to the other studied eccentric cones, represent the most primitive magma formed at high temperatures (avg. 1170 °C) and the Monte Rossi lavas the most evolved magma formed at lower temperatures (avg. 1140 °C). In comparison, the lavas of Mounts de Fiore and of the 2002/2003 eruption show a mediate grade of evolvement and average formation temperatures (avg. 1160 °C).

2.1. KURZZUSAMMENFASSUNG

Der Ätna in Sizilien, Italien, ist der aktivste Vulkan Europas und seine geodynamischen Gegebenheiten und sein Fördersystem standen schon im Mittelpunkt vieler umfangreicher Studien.

Die 6 Stadien der eruptiven Aktivität von der Vergangenheit bis zur Gegenwart sind:

(1) "Tholeiitisches Stadium" vor 600-320 ka, (2) "Timpe-Stadium" vor 220-110 ka, (3) "Antiker Alkaline-Vulkanismus" vor 110-65 ka, (4) "Ellittico-Stadium" vor 57-15 ka, (5) "Mongibello-Stadium" von vor 15 ka bis 1971 und (6) das "Post-1971-Stadium", das die vulkanische Aktivität seit 1971 umfasst (Casetta, Giacomoni, Ferlito, Bonadiman, & Coltorti, 2019).

Die Lava, die sich durch das Ätna-Fördersystem ausbreitete, erzeugte ein komplexes Netzwerk von Gängen und Dykes und ist verantwortlich für die Bildung der Gipfelkrater und einer Vielzahl von exzentrischen Schlackekegeln, die die Flanken des Vulkans bedecken.

Wir untersuchten die Gesamtgesteins- und Mineralchemie der Laven von drei exzentrischen Schlackekegeln (Monte Spagnolo, Mounts de Fiore und Monte Rossi) und des Lavastroms der Südflanke von 2002/03. Alle Laven sind Trachybasalte mit trachytischer Textur und variabler modaler Zusammensetzung von Olivin-, Klinopyroxen- und Plagioklasphänokristallen. Die Gesamtgesteinszusammensetzung des Monte Spagnolo weist von allen beprobten Aufschlüssen die primitivsten Laven mit einer Mg# zwischen 55-57,5 und 10,7 Gew. % CaO auf, während die Laven des Monte Rossi die am weitesten entwickelten, sind mit einer Mg# zwischen 48,3 und 49,3 und einem CaO-Gehalt zwischen 10,44 und 10,48 Gew. %. Mounts de Fiore und der Lavastrom 2002/03 sind weiterentwickelt als die Monte Spagnolo-Laven, da sie eine Mg# von etwa 51 bis 52 aufweisen. Die entsprechende CaO-Konzentration liegt bei etwa 11,2 Gew. % bzw. 10,62 Gew. %.

Abweichend vom Trend der entsprechenden Gesamtgesteinszusammensetzung wurde der MgO-reichste Olivin (Fo=88,9%) in den Monte Spagnolo-Laven gefunden. Aufgrund des geringen NiO-Gehalts (0,17-0,2 Gew. %) und des hohen CaO-Gehalts (0,25-0,26 Gew. %) ist dieser Olivin offensichtlich magmatischen Ursprungs. Wenn man bedenkt, dass der Olivin, der mit diesen Laven im Gleichgewicht sein könnte, Fo=82,2 hat. Es ist offensichtlich, dass der Olivin mit Fo=88,9% auf eine Magmamischung mit hoch MgO-reichen Laven hinweist. Die an den weitesten entwickelten Laven vom Monte Rossi haben den niedrigsten Fo-Gehalt (Fo=67-75%).

Zusammenfassend lässt sich sagen, dass Olivin und Pyroxen mit inverser Zonierung, also einer höheren Mg# in den Rändern als in den Kernen, auf eine umfangreiche Magmamischung an allen Lokationen mit Ausnahme von Monte Rossi hinweisen. Die Fo-Gehalte der Olivine steigen in den Basalten Monte Spagnolos von ca. 75 auf 76, Mounts de Fiore von ca. 76,5 auf 80 und des 2002/03 Lavastroms von 70 auf 76 %.

Die Laven des Monte Spagnolo repräsentieren im Vergleich zu den anderen untersuchten exzentrischen Kegeln das primitivste Magma, das bei hohen Temperaturen (~1170 °C) gebildet wurde, und die Laven des Monte Rossi das am weitesten entwickelten Magma, das bei niedrigeren Temperaturen (~1140 °C) gebildet wurde. Im Vergleich dazu zeigen die Laven des Mounts de Fiore und der Eruption von 2002/2003 einen mittleren Grad der Entwicklung und durchschnittliche Bildungstemperaturen (~1160 °C).

3. INTRODUCTION

This work is based on petrographical, petrological and geochemical study of basalts of four eccentric volcanic cones on Mount Etna, Sicily. The aim of this study is to derive the origin and the history of the erupted magmas and identify possible different processes responsible for their ascension.

3.1. STRUCTURE OF THE EARTH

To understand the processes on the surface of the Earth, it is important to understand the general structure of the planet. The Earth has a radius of 6371 km and can be divided into three major sections: crust, mantle and core, with subgroups in each case (Figure 3-1)

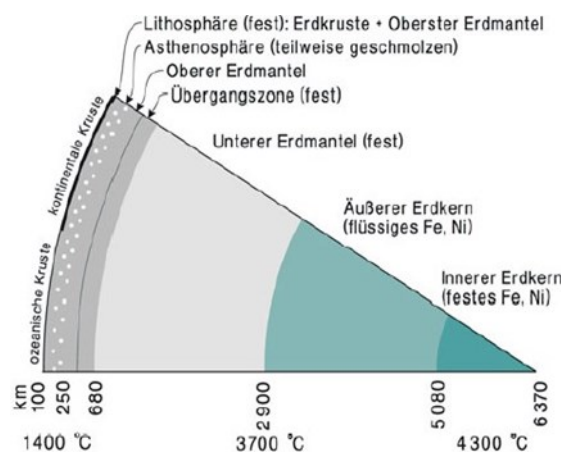


Figure 3-1: Structure of the Earth; from Okrusch & Matthes, 2009, after Ringwood 1979

The crust consists of an oceanic and a continental part, where the oceanic crust can reach a thickness of around 5-8 km, has an average density of $2.9 \text{ g} \cdot \text{cm}^{-3}$ and is primarily composed of mafic rocks like basalt.

The continental crust can reach a thickness from around 25 km in the extension area and up to 90 km underneath an orogen and is composed of a variety of sedimentary, metamorphic and igneous rocks, which results in a lower average density of $2.6 \text{ g} \cdot \text{cm}^{-3}$.

The border between the crust and the underlying mantle is the so called Mohorovičić discontinuity (MOHO), which marks a change in terms of chemical and mineralogical composition.

The mantle can be divided into an upper and a lower mantle, which can be distinguished through slightly different densities, due to a change in mineralogical and chemical composition.

The upper mantle ranges from the MOHO to a depth of around 410 km. The next approx. 250 km mark a transition zone between upper and lower mantle, where the different high-pressure modifications of certain minerals, like for example olivine, are formed.

The lower mantle continues into 2.900 km depth, where it is adjacent to the outer core. The upper and lower mantle together make up about 83% of the total volume of the Earth and 2/3 of Earth's mass.

The border between mantle and core is the so-called Gutenberg-discontinuity and marks the

transition of rigid mantle to liquid outer core. This transition is considered to be the source of the so-called mantle plumes, a fixed source of hot magma independent of crustal plate movement (Hawaii, Tenerife).

The outer core is characterized by a density gradient from $9.9 \text{ g}\cdot\text{cm}^{-3}$ to around $12.2 \text{ g}\cdot\text{cm}^{-3}$ at the last discontinuity along the border to the solid inner core in around 5.200 km depth. This increase in density is most likely due to metallic components and also non-metallic components like sulphur, silicon and oxygen in iron- and nickel-compounds. The inner core is the last section and reaches from 5.200 km to Earth's centre at a depth of 6.370 km. Analyses of the density ($12.6 - 13.0 \text{ g}\cdot\text{cm}^{-3}$) suggest that the composition of the inner core is most likely a mixture of 80% iron and 20% nickel (Okrusch & Matthes, 2014).

3.2. VOLCANISM

Volcanism is not only one of the most important drivers of geological processes on Earth, but also the source of a variety of geological products. Depending on the geotectonic setting, the type of volcanism can vary significantly (Figure 3-2).

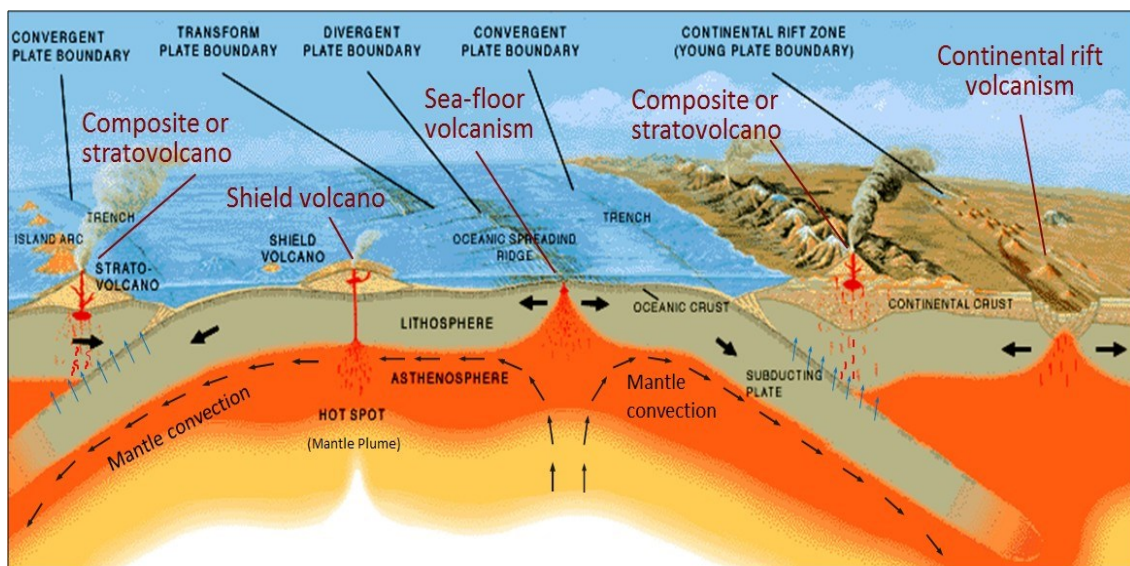


Figure 3-2: Different volcanic environments lead to different volcano types: Convergent plate boundary - Composite- or stratovolcano or Sea-floor volcanism in form of an island arc; Mantle plumes (Hot spot) - Shield volcano; Divergent plate boundary - Sea-floor volcanism in form of an island arc; Mantle plumes (Hot spot) - Shield volcano; Divergent plate boundary - Sea-floor volcanism; Continental rifting - Cinder cones (from <https://opentextbc.ca/geology/chapter/4-1-plate-tectonics-and-volcanism/>)

3.2.1. Convergent plate boundary

The collision of two oceanic plates due to plate-tectonic result in the subduction of one of the two plates. This subduction leads to a rise in temperature of the subduction plate and subsequently to a (partial) melting. The uprising of this (often water-rich) melted magma, mixed with material from the asthenosphere, leads to the formation of ocean island arcs. The exact composition of these andesitic basalts is dependent on the composition of the subducted and (partially) melted plate (Niu, 2005).

3.2.2. Divergent plate boundary

Two different main types of plate boundaries are recognized:

- Mid-Ocean ridge basalts
- Basalts resulting from continental rifting or lithospheric extension

Mid-Ocean ridges are the result of plate separation due to plate tectonics, which creates a gravitational "void". This "void" is filled by an uprising asthenospheric mantle material, and this subsequently leads to the formation of a new oceanic crust. The erupted material at mid-ocean ridges are usually low-K-basalts, consisting of mainly Mg-olivine, Ca-rich clinopyroxene, plagioclase and titanomagnetite (Niu, 2005).

Due to lithospheric extension, intra-plate features like rifts can occur (e.g., the East African rift system). These rifts are considered to be among the earliest stages of new oceanic basins. The magmas associated with these rifts often show enrichment in alkalis, volatiles and some other incompatible elements, due to 1.) the higher thickness of continental plates, compared to ocean plates and slow rate of extension compared to ocean ridges and 2.) the influence of continental plate composition on the uprising magma (Niu, 2005).

3.2.3. Hot spots/Mantle Plume

Hot spot volcanoes are mostly tectonic-independent, as their feeding system is considered to reach down to the core-mantle boundary. They usually form shield volcanoes, due to their more andesitic and low viscous magmas.

3.3. BASALTS

The igneous rocks can be divided into two groups: 1. intrusive and 2. extrusive rocks. Whereas the rocks of the first group solidify beneath the surface, the rocks of the second group solidify only on the earth's surface.

The most common intrusive rocks are granite, gabbro and diorite, which represent a large part of the different plates.

The second, and for this work more important, group consists of a wide range of different rock types, like Rhyolite, Andesite, Basalt or Komatiite, with basalts being the most common group.

Depending on the fineness of the texture and whether or not one can determine the volumetric amount of the mineral in the rock, different classification methods are used:

If the volume of the minerals can be determined: The QAPF-Diagram as proposed by Streckeisen (1978) (Figure 3-3).

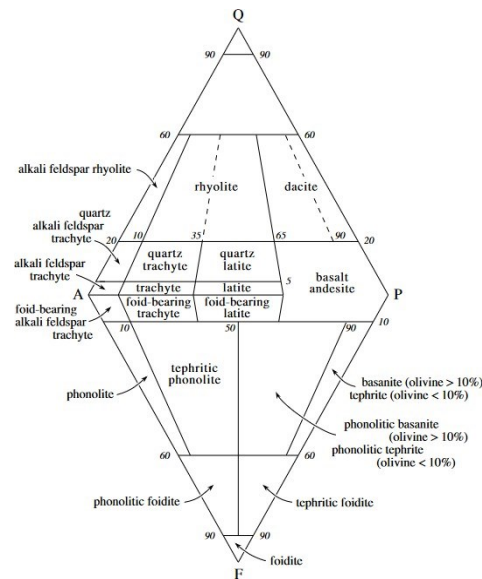


Figure 3-3: Classification after Streckisen (1978) dependent on the mode of the rocks, i.e., the amount of Quartz, Alkali feldspar, Plagioclase and Feldspathoids

After the determination of the major element composition, especially the SiO_2 , Na_2O and K_2O content, of the whole rock: The TAS-Diagram as proposed by (Maitre, 2002)(Figure 3-4).

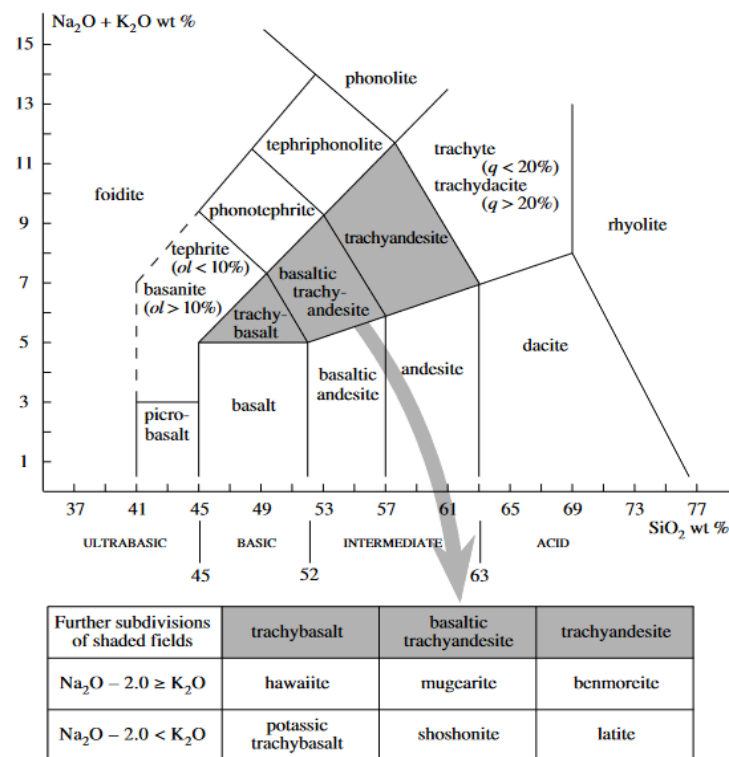


Figure 3-4: Classification after LeMaitre (2002) dependent on the SiO_2 and total alkaline ($\text{Na}_2\text{O} + \text{K}_2\text{O}$) content. The grey shaded areas can further be distinguished, depending on the total alkalis, into hawaiite, mugearite, benmoreite, potassic trachybasalt, shoshonite or latite

As already explained in the upper chapters, each geochemical assignment can also be assigned to a very specific environment, like plate boundaries, hot spots, etc..

4. GEOLOGY OF THE AREA

4.1. MOUNT ETNA - GENERAL INFORMATION

The 3340m high stratovolcano Mt. Etna is located on the eastern coast of the Italian island of Sicily and is one of the most monitored and investigated volcanoes in the world. The first activity, shown by submarine tholeiitic lavas as fissural eruptions, started 600ka ago. This phase was followed by continuous effusive and explosive eruptions of volatile rich alkaline products.

During the evolution of Mt. Etna 6 different stages were identified by Branca et al. (2011): (a) the "Tholeiitic Stage", was active between 600-320 ka ago, (b) the "Timpe Stage" between 220 and 110 ka ago, (c) the "Ancient Alkaline Volcanism" between 110 and 65 ka ago and (d) the "Ellittico Stage" between 57 and 15 ka ago (e) the "Mongibello Stage" from 15 ka ago until 1971 and (f) the "post-1971 Stage" active since 1971 (Casetta, Giacomoni, Ferlito, Bonadiman, & Coltorti, 2019). (Figure 4-1).

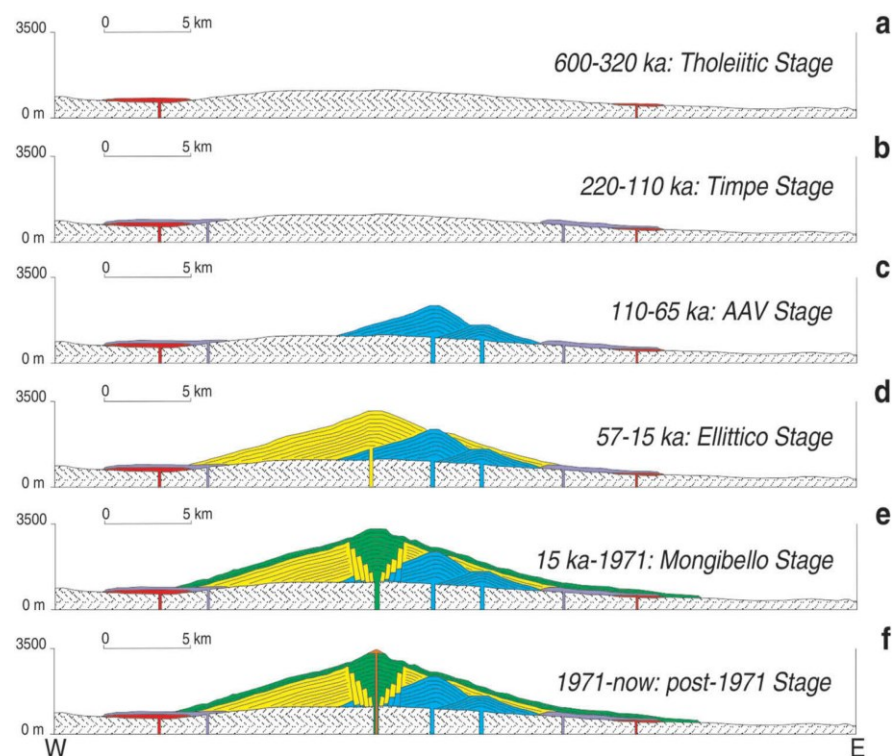


Figure 4-1: The evolutionary sequence of Mt. Etna along a W-E oriented geological sketch (after Casetta et al. 2019, who modified after Monaco et al. 2010; Branca et al. 2011).

(a) Tholeiitic Stage; (b) Timpe Stage; (c) Ancient Alkaline Volcanism (AAV) Stage; (d)

The first stage (a), the Tholeiitic Stage, consists mainly of submarine tholeiitic lavas in form of lava flows and pillow lava, with a basaltic composition. They consist of different phenocrysts, such as olivine (60 %), clinopyroxene (20 %), plagioclase (15 %) and Cr- spinel (5 %), with a mainly microcrystalline groundmass of plagioclase, clinopyroxene and apatite (Tanguy, Condomines, & Kieffer, 1997)

The (b) Timpe Stage consists of basalts to alkali rich basalts, which contain mainly

clinopyroxene phenocrysts and of other minerals such as olivine, plagioclase, titano-magnetite and rarely amphibole (Tanguy, Condomines, & Kieffer, 1997)

The products of the (c) Ancient Alkaline Volcanism (AAV) Stage are lava flows and dykes with a hawaiitic to benmoreitic composition. They are characterized by large labradoritic plagioclase, large clinopyroxene, olivine and titano-magnetite phenocrysts. The groundmass ranges from glassy to a microcrystalline fabric. The rare occurrence of kaersutitic to Mg-hastingsitic amphibole has also been recorded (Casetta, Giacomoni, Ferlito, Bonadiman, & Coltorti, 2019).

The most evolved products of Mt. Etna can be found in the lavas of the (d) Ellittico Stage with a composition ranging from hawaiitic to trachytic (Ferlito & Lanzafame 2010). The plagioclase phenocrysts of the least evolved lavas are andesinic to bytownitic and constitute up to 70 vol.% of the samples, followed by olivine with 15 vol.%, clinopyroxene with 11 vol.% and titano-magnetite with 4 vol.%. These phenocrysts are embedded into a glassy to microcrystalline matrix (Casetta, Giacomoni, Ferlito, Bonadiman, & Coltorti, 2019).

Generally, the lavas from the (e) Mongibello Stage are more primitive than the prior stage. Plagioclases have a labradoritic to bytownitic composition, and other minerals as clinopyroxene, plagioclase, olivine and titano-magnetite with decreasing abundance can be observed. Two locations investigated in this work originate from this stage, i.e., Monte Spagnolo (erupted between 15 - 3.9 ka (Corsaro & Métrich, 2016)) and Monte Rossi (erupted 1669, (Kahl, Viccaro, Ubide, Morgan, & Dingwell, 2017)). A more detailed description of these two locations is carried out in the chapters 3.2 (Monte Spagnolo) and 3.3 (Monte Rossi).

The remaining two locations investigated are part of the (f) post-1971 Stage, i.e., Mounts de Fiore (erupted 1974, (Corsaro R. A., et al., 2009)) and the 2002/03 lava flow (Andronico, et al., 2004). Due to its historic age, these products are already described in previous works (e.g., (Viccaro, Giacomoni, Ferlito, & Cristofolini, 2010); (Ferlito, Coltorti, Cristofolini, & Giacomoni, 2009); (Kahl, Chakraborty, Costa, & Pompilio, 2011); (Giacomoni, et al., 2012), 2014, 2016, 2018). The products are composed of plagioclase (50 - 55 vol.%), diopsidic to augitic clinopyroxene (30 - 35 vol.%), olivine (10-15 vol.%) and titano-magnetite (0 - 5 vol.%) phenocrysts, which are embedded in a glassy to microcrystalline groundmass (Casetta, Giacomoni, Ferlito, Bonadiman, & Coltorti, 2019).

The eccentric cones of Mount Etna are of special significance because they erupt not only in the higher regions of the volcano, but also close to the villages surrounding the mountain and are therefore a constant threat to the people living there. In the past eruptions of eccentric cones lead to sometimes devastating destructions of entire villages, like the eruption of Monte Rossi in the year 1669.

Therefore, this work attempts to shed some light on the most important questions behind the geological processes leading to the eruptions of eccentric cones on the Mt. Etna volcano.

4.2. MONTE SPAGNOLO

The eruption of Monte Spagnolo is the only non-historic eruption investigated in this work. It has been studied before (e.g.: (Kamenetsky, 1996); (Tanguy, Condomines, & Kieffer, 1997)), but there is only few information about its evolution. However, the most recent study puts the age of the eruption between 15.000 and 3930 ± 60 years (Branca, Geological map of Etna volcano, 1:50,000 scale, 2011)

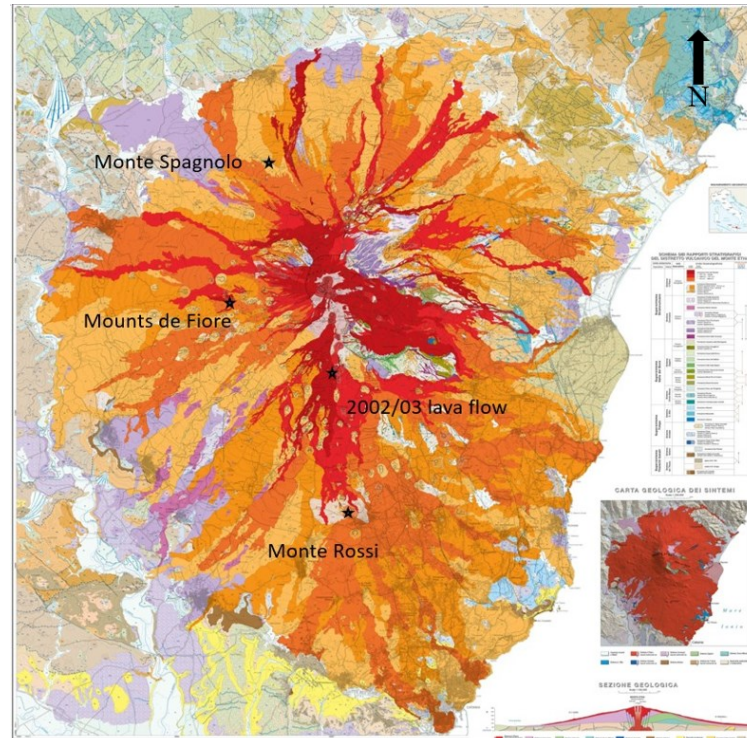


Figure 4-2: Geological map of Monte Etna with the positions of the sample sites, after Branca et al. (2011) - Monte Spagnolo in the NW corner

4.3. MONTE ROSSI

The eruption at Monte Rossi took place between March and July 1669 and is considered to be one of the most destructive eruptions of Mt. Etna in historic times, with a total output of $607 \pm 105 \times 10^6 \text{ m}^3$ (Branca, Beni, & Proietti, The large and destructive 1669 AD eruption at Etna volcano: reconstruction of the lava flow field evolution and effusion rate trend, 2013). A system of NNW-SSE-trending eruptive fissures opened at an altitude between 950 and 700 m a.s.l. (Branca, Beni, & Proietti, The large and destructive 1669 AD eruption at Etna volcano: reconstruction of the lava flow field evolution and effusion rate trend, 2013)

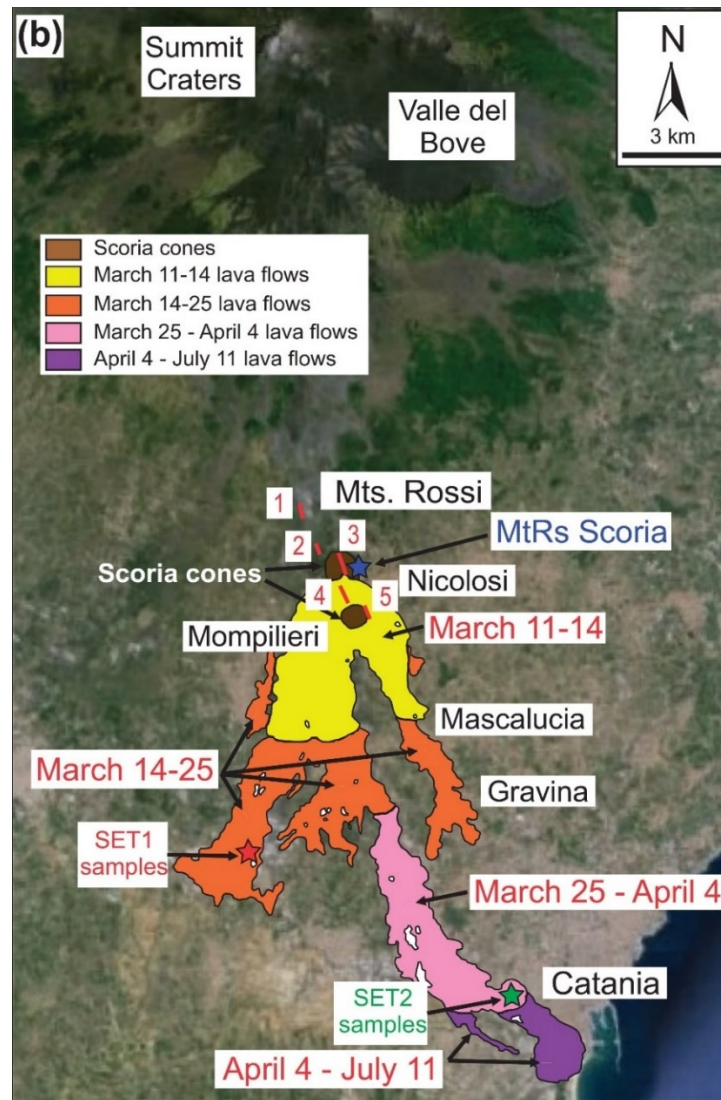


Figure 4-3: Position of 1669 Monte Rossi eruption (after Kahl et al., 2017)

The eruptive events were characterized by an opening of two segments with weak and short-lived explosive activity. This was followed by the opening of a third segment, which became the main vent of the Mt. Rossi eruptive phase. At first this vent produced an extensive ash fall due to explosive activity, followed by lava emission. In combination with two other segments the eruption lasted for 122 days (Kahl, Viccaro, Ubide, Morgan, & Dingwell, 2017) and covered an area of around 40 x 106 m² (Figure 4-3) (Branca, Beni, & Proietti, The large and destructive 1669 AD eruption at Etna volcano: reconstruction of the lava flow field evolution and effusion rate trend, 2013).

At the end of the eruptive activity the lava flow had a length of around 17 km (Branca, Beni, & Proietti, The large and destructive 1669 AD eruption at Etna volcano: reconstruction of the lava flow field evolution and effusion rate trend, 2013) and reached down to the shore of Catania. On its way down the southern flank, the lava flow (partly) destroyed several settlements and towns (Kahl, Viccaro, Ubide, Morgan, & Dingwell, 2017).

Corsaro et al. (1996) characterized the erupted lavas as porphyritic hawaiites consisting of different minerals, such as plagioclase, clinopyroxene, olivine and titano-magnetite in different quantities. The products of the Mt. Rossi eruption differ considerably in petrography, depending on the eruption date. The lavas erupted pre-March 20 (Set 1) are

described as more basic, with a higher bulk MgO (means 6.65 ± 0.38 wt%), in contrast to the post-March 20 lavas (Set 2), with a lower bulk MgO (means 5.01 ± 0.19 wt%).

4.4. MOUNTS DE FIORE

The eruption of the Mounts de Fiore can be divided into two major events in quick succession, with the first flank eruption occurring between January 30th and February 17th and the second between 11th and 29th of March. These eruptions were preceded by a prolonged period of increased seismic and strombolian activity. The eruptions took place on the western flank, in quite a low altitude between 1670 and 1650 m asl (Figure 4-4).

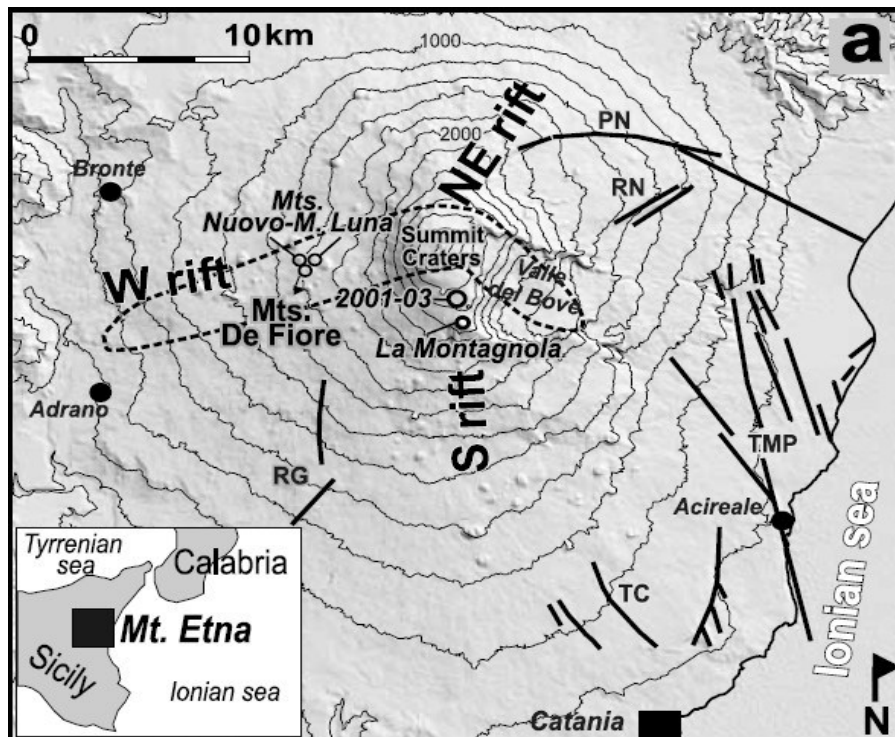


Figure 4-4: Position of the 1974 Mounts de Fiore eruptions (after Corsaro et al., 2008)

(Bottari & Lo, 1975) and (Tanguy, Condomines, & Kieffer, 1997) calculated the cumulative volume of the lava flows as $4.5 \times 10^6 \text{ m}^3$. Of those $2.4 \times 10^6 \text{ m}^3$ poured out during the first event and $2.1 \times 10^6 \text{ m}^3$ during the second. Corsaro et al. calculated a total volume of the erupted pyroclastites for the eruptions of $2.48 \times 10^6 \text{ m}^3$ for the first, and $0.74 \times 10^6 \text{ m}^3$ for the later event. As for the amount of additional deposit of coarse pyroclastites outside the cones, Bottari et al. (1975) calculated around $0.3 \times 10^6 \text{ m}^3$. This equals to a total output of pyroclastites of $3.52 \times 10^6 \text{ m}^3$.

4.5. 2002/03 LAVA FLOW

The most recent eruptive activity of Mt. Etna to be investigated in this work is the 2002/03 lava flow. The eruptive activity of this lava flow started on 26 October 2002 and continued with a continuous explosive activity and lava flow output until 28 January 2003. Eruptive fissures opened on the NE and the S flank of Mt. Etna (Figure 4-5), however the lava output was limited, after November 5th, 2002, to the southern flank. The eruptive activity produced a lava volume of around $8 \text{ to } 12 \times 10^6 \text{ m}^3$ and covered a total area of 5.06 km^2 (Andronico, et al., 2004).

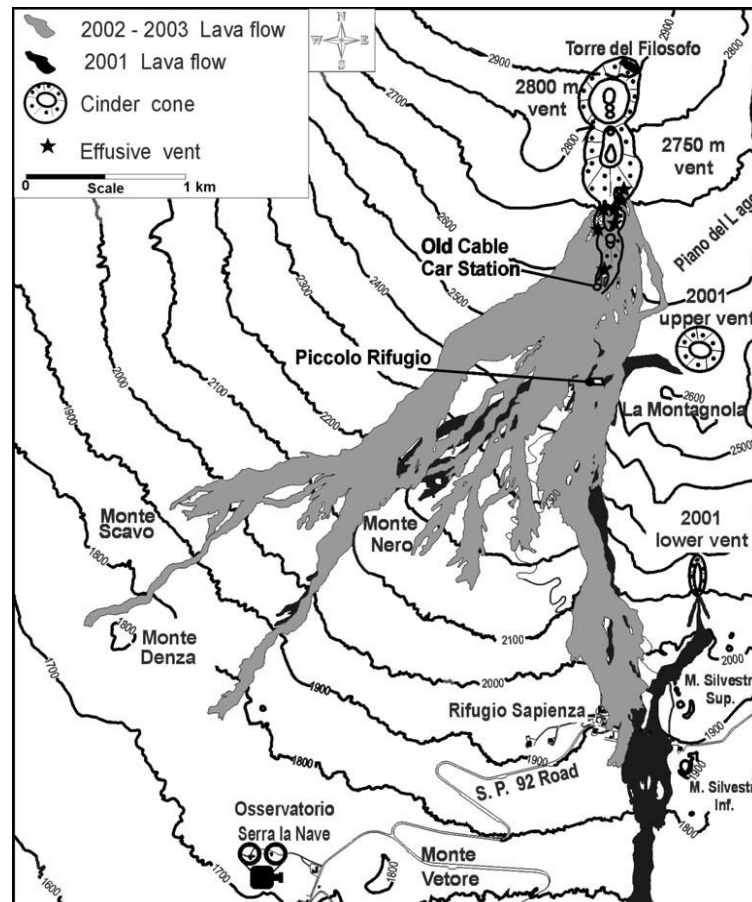


Figure 4-5: Position of the 2002/03 lava flow (after Adronico et al. 2004)

5. ANALYTICAL METHODS

5.1. SAMPLES

5.1.1. Sample collection and preparation

The samples were collected during a field week in September 2018. Four eccentric cones (Figure 4-2) and a total of 20 samples were selected for this work. The distribution of these samples according to their location is as follows:

- Monte Rossi - 18MR01 to 18MR03 - N 37°36.625', E 015°00.479'
- Monte Spagnolo - 18MS01 to 18MS04 - N 37°50.234', E 014°56.351'
- Monte Spagnolo - 18MS05 - N 37°50.117', E 014°56.642'
- Mounts de Fiore - 18MF01 to 18MF07 - N 37°44.255', E 014°55.418' (including 18MF03A and 18MF03B)
- Mounts de Fiore - 18MF09 - 18MF10 - N 37°44.627', E 014°55.328'
- 2002/03 lava flow - 18RS01 to 18RS02 - N 37°42.013', E 014°59.989'

The naming of the samples was done on site and is therefore the reason for the deviation of the name for the samples from the 2002/03 lava flow. They were collected right next to the Rifugio Sapienza and named after that, and not after the lava flow itself.

Of all 20 samples thin sections were made, analysed and described according to their petrographical, textural and mineralogical properties. Subsequently, the mineral chemistry of 11 thin sections were analysed with an electron microprobe. All thin sections were scanned and saved as TIF-files using a film scanner. These images were later used for orientation while examining the respective thin section under the microscope or with an electron microprobe.

In order to produce the thin sections, the samples were cut with a stone saw in small blocks with dimensions of around 25 mm x 35mm x 10 mm. One of the two larger surfaces was grinded using a diamond-grinding wheel MD-Plan, grit 220. In the next step, after the fine grinding of the surface via a MD-Plan grit 500 and 1200, the blocks were glued downwards on microscope slides (dimensions 28mm x 48mm x 1.5mm), using a 2-component epoxy resin adhesive (Araldite 2020). These microscope slides were beforehand finely ground with a grit 600, SiC.

As soon as the adhesive was hardened, the samples were cut plane-parallel on a precision stone saw to a thickness of about 150 µm. The final grinding to the standard thickness of 25 – 30 µm was done using a SiC slurry (1000 grit) on an automatic grinder (Logitech LP 50). The work was finished with a final mechanical polish (polishing agents: diamond 1 µm and 0.25 µm in kerosene oil).

Out of the remaining fragments of the samples a small part was taken and crushed with a jaw crusher until the average grain size was smaller than 5 mm. From each sample 200g of

the crushed fragments were grinded in an agate vibrating cup mill until the necessary grain size of <40µm for further analyses was achieved.

5.2. MICROSCOPIC EXAMINATION

Each thin section was analysed in respect of their mode, also known as porphyric index, and of their petrographic properties.

5.2.1. Mode - point-counting method

For the determination of the porphyric index with the so-called point-counting method, a microscope with a polarisation device was used. This microscope was equipped with a microstepper-device, which was connected to the PetrogLite software on a computer. With this software it is possible to examine the thin section evenly in a defined grid. With specific keys on the keyboard, which were defined beforehand, it is possible to control the microstepper as well as assign every step to a specific mineral.

The output, after finishing the examination of the thin section, is a list with the number of times each key, therefore each mineral, was pressed/determined. Besides the absolute numbers the output also includes a proportion of minerals normalised to 100%.

For each sample, the number of counting points was set at 1000.

5.3. PETROGRAPHY

The petrographic examinations of the thin sections were carried out using the polarisation microscope LEITZ LABORLUX 11POL S and the LEICA DM4500P. The latter one was also used in connection with a colour camera, Leica DMC 400, and the software Leica Application Suite V 4.9 to create photos of parts of the thin sections.

5.4. X-RAY FLUORESCENCE ANALYSIS

For the calculation of the major- and minor element (Si, Ti, Al, Fe, Mg, Mn, Ca, K and P) parts of the samples were grinded into fine powder and then further fused with lithium tetraborate/metaborate as flux in order to form a glass bead. These elements are usually present in amounts greater 0.1 wt% element oxides.

For the calculation of trace elements (As, Ba, Ce, Co, Cr, Cu, Ga, La, Mo, Nb, Nd, Ni, Pb, Rb, Sc, Sn, Sr, Ta, Th, U, V, Y, Zn, Zr), pressed powder pellets were created of the rock powder, which was mixed with a binding agent of polyvinyl alcohol. The trace elements are usually present in amounts of smaller than 1000 ppm.

The analyses were performed on a sequential X-Ray spectrometer PHILIPS PW2404, while using a super-sharp end-window tube with a Rh-anode and a programmable 4kW generator (60kV max., 125mA max. and with iso-Wattswitching). The corresponding software was version 5.1B(5.822.3) of the PANalytical "SuperQ".

5.5. TRACE-ELEMENT ANALYSIS VIA ICP-MS

Additional trace element analyses were conducted via ICP-MS (Inductively coupled plasma-mass spectrometry) coupled with a quadrupole mass spectrometer (*AGILENT 7000*) were conducted on following 9 samples:

The additional analysed elements (As, B, Ba, Be, Bi, Cd, Ce, Cs, Dy, Er, Eu, Gd, Hf, Ho, La, Li, Lu, Mn, Mo, Nd, P, Pb, Pr, Rb, Sb, Sc, Se, Sm, Ta, Tb, Th, Tl, Tm, U, V, W, Y, Yb) included mainly the Rare Earth Elements (REE), measured in ppm.

For control purposes, a blank sample and two standards with the designation BCR-2 and BHVO-2 were also analysed.

The analyses were conducted at the University Graz.

5.6. ELECTRON PROBE MICRO ANALYSIS

Using the department's own electron probe microanalyzer (EPMA), a CAMECA SXFive Field Emission, the minerals of the samples were analysed regarding their major- and minor-elements.

First, the thin sections were cut (see Chapter 5.1.1) and mechanically polished. The specimens used for further analysis were covered with a thin carbon layer to prevent electrostatic charging.

A first classification of the minerals was made using the built in EDX-apparatus. In the next step, the position of the point analyses and line scans was determined, mainly according to the visible texture of the individual crystal.

An acceleration voltage of 15 kV and a beam current of 20 nA was used for the analyses. The beam diameter was generally set to 1 µm and only for the analyses of glass or melt inclusions defocused to 5 µm. The change of the focus was necessary to avoid the escape of the alkali elements during the beam-sample interaction. The measuring time was set generally to 20 seconds at the peak-position and 10 seconds on the lateral substrate (but not for the alkalis). The Analyser crystals were PET (Pentaerythrol), LIF (Lithiumfluorid) and TAP (Thalliumphthakat).

6. RESULTS

6.1. PORPHYRIC INDEX - MODE

The porphyric index, also known as mode, of all thin sections was determined following the point-counting-method as described in paragraph 5.2.1. The results are given in Table 6-1.

In general, the matrix of all samples consists mainly of fine-grained plagioclase, clinopyroxene, olivine, opaque phases (mostly titanomagnetite) and glass. These minerals are also the main components (phenocrysts) of all samples.

The respective modes determined for the lava samples taken from the eccentric cones show significant variations, e.g., regarding the amount of vesicles and plagioclase phenocrysts. For example, the fraction of vesicles in the samples from Monte Rossi ranges from around 0-5 vol.% whereas in the samples from Mounts de Fiori the range is between 10-26 vol.%. And while the mode of the plagioclase phenocrysts in samples from Monte Spagnolo is below 0.1 vol.%, it is up to 44.8 vol.% in the samples from Monte Rossi

6.1.1. Monte Spagnolo

The olivine mode for the five thin sections ranges from 3.8 vol.% (sample 18MS05) to 6.7 vol.% (sample 18MS03) and the clinopyroxene mode from 7.1 vol.% (sample 18MS01) up to 10.1 vol.% (sample 18MS02). The plagioclase mode ranges from only 0.1 vol.% (samples 18MS04 & 18MS05) to 5.8 vol.% (sample 18MS01). The opaque phase is restricted to the matrix for sample 18MS05 but ranges up to 0.6 vol.% for samples 18MS01 and 18MS02.

The amount of vesicles ranges from 11.0 vol.% (sample 18MS02) to 20.1 vol.% (sample 18MS05). The matrix ranges from 63.7 vol.% (sample 18MS01) to 70.7 vol.% (18MS03) (Table 6-1).

6.1.2. Monte Rossi

Three samples were investigated and show the following variations in mineral content. The olivine fraction ranges from 5.9 vol.% (sample 18MR02) to 7.4 vol.% (sample 18MR03). The clinopyroxene mode ranges from 5.0 vol.% (sample 18MR01) to 12.2 vol.% (sample 18MR02). The plagioclase mode ranges from 33.9 vol.% (sample 18MR03) up to 44.8 vol.% (sample 18MR01). The mode of the opaque phase ranges from 1.9 vol.% (sample 18MR01) to 2.5 vol.% (18MR03).

The amount of the vesicles ranges from 0.5 vol.% (sample 18MR01) to 5.5. vol.% (sample 18MR03). The fraction of the matrix hardly varies. It makes up 40.3 vol.% of sample 18MR02, 41.3 vol.% of sample 18MR01 and 43.8 vol. of sample 18MR03 (Table 6-1).

6.1.3. Mounts de Fiore

A total of ten samples were collected from the eccentric cones of the Mounts de Fiore: 18MF01, 18MF02, 18MF03A, 18MF03B, 18MF04, 18MF05, 18MF06, 18MF07, 18MF09 and 18MF10.

The olivine mode ranges from 4.8 vol.% (sample 18MF09) to 9.9 vol.% (sample 18MF02) and the clinopyroxene mode ranges from 4.5 vol.% (sample 18MF07) to 13.2 vol.% (18MF09). The plagioclase mode of the Mounts de Fiore ranges from 0.4 vol.% (samples 18MF01 &

18MF05) to 1.7 vol.% (sample 18MF02). The opaque phases for sample 18MF01 are restricted to the matrix and have a mode ranging from 0.1 vol.% (samples 18MF03A, 18MF04 and 18MF05) to 0.8 vol.% (samples 18MF07 & 18MF09).

The amount of vesicles ranges from 10.3 vol.% (sample 18MF02) to 25.5 vol.% (18MF01). The matrix ranges from 57.2 vol.% (sample 18MF01) to 70.8 vol.% (sample 18MF04) (Table 6-1).

6.1.4. 2002/03 lava flow

The variations in the thin sections 18RS01 and 18RS02 of the 2002/03 lava flow, are mainly restricted to the matrix- and clinopyroxene-content.

The matrix ranges from 61.9 vol.% (sample 18RS01) to 67.3 vol.% (sample 18RS02) and the clinopyroxene mode ranges from 9.9 vol.% (sample 18RS02) to 16.9 vol.% (sample 18RS01). The plagioclase fraction shows only a minor variation from 7.2 vol.% (sample 18RS01) to 7.9 vol.% (sample 18RS02) and the olivine from 5.8 vol.% (sample 18RS01) to 6.8 vol.% (sample 18RS02). The opaque phases are restricted to the matrix for sample 18RS01) and at 0.7 vol.% for sample 18RS02.

The mode of the vesicles makes up 8.2 vol.% of sample 18RS01 and 7.4 vol.% of sample 18RS02 (Table 6-1).

Table 6-1: Porphyric index (mode) of the different fractions of all thin sections

Thin section	Pyroxene	Plagioclase	Olivine	Timag	Vesicles	Matrix
18MS01	7.1	5.8	5.8	0.6	17	63.7
18MS02	10.1	3.4	6.4	0.6	11	68.5
18MS03	7.3	1.9	6.7	0.2	13.2	70.7
18MS04	7.7	0.1	5	0.2	18.6	68.4
18MS05	8.2	0.1	3.8	/	20.1	67.8
18MR01	5	44.8	6.5	1.9	0.5	41.3
18MR02	12.2	35.5	7.4	2.1	2.5	40.3
18MR03	8.4	33.9	5.9	2.5	5.5	43.8
18MF01	7.7	0.4	9.2	/	25.5	57.2
18MF02	9.2	1.7	9.9	0.4	10.3	68.5
18MF03A	10	1.5	8.3	0.1	20	60.1
18MF03B	6.9	0.5	7.9	1.4	20.7	62.6
18MF04	7.6	1.1	8.3	0.1	12.1	70.8
18MF05	5.2	0.4	5.8	0.1	22.4	66.1
18MF06	7.3	0.7	6.8	0.3	21.5	63.4
18MF07	4.5	0.9	8.1	0.8	20.4	65.3
18MF09	13.2	0.7	4.8	0.5	23.1	57.7
18MF10	12.2	1.3	5.9	0.8	16.3	63.5
18RS01	16.9	7.2	5.8	/	8.2	61.9
18RS02	9.9	7.9	6.8	0.7	7.4	67.3

6.2. PETROGRAPHY

6.2.1. General remarks

The description of the general textural characteristics of the minerals is based on the description by Giacomoni et al. 2016 for the clinopyroxene and Giacomoni et al. 2014 for the plagioclase. These characterizations focus mainly on the texture and growth features of the crystals and only secondarily on their chemistry. The characterization of the olivine was based on the work of Kahl et al. 2015, 2017 and of the titanomagnetite on the work of Mollo et al. 2012.

6.2.2. Olivine

Under the microscope four types of olivine have been recognized:

- **Type 1** - optically homogeneous up to the outer rim
- **Type 2** - zoned crystals
- **Type 3** - special cases
 - * **Type 3.1** - patchy
 - * **Type 3.2** - skeletal texture

Olivine crystals of Type 1 texture have mostly sub-idiomorphic shapes and, occasionally, idiomorphic. The interference colours are homogeneous up to the very rim, indicating an insignificant zoning (Figure 6-1). This texture type can be found in every sample.

The matrix olivine has a very homogenous texture, its edges aren't always distinctive and sharp. It can contain inclusions, like melt-pockets or other minerals, like clinopyroxene or titanomagnetite.

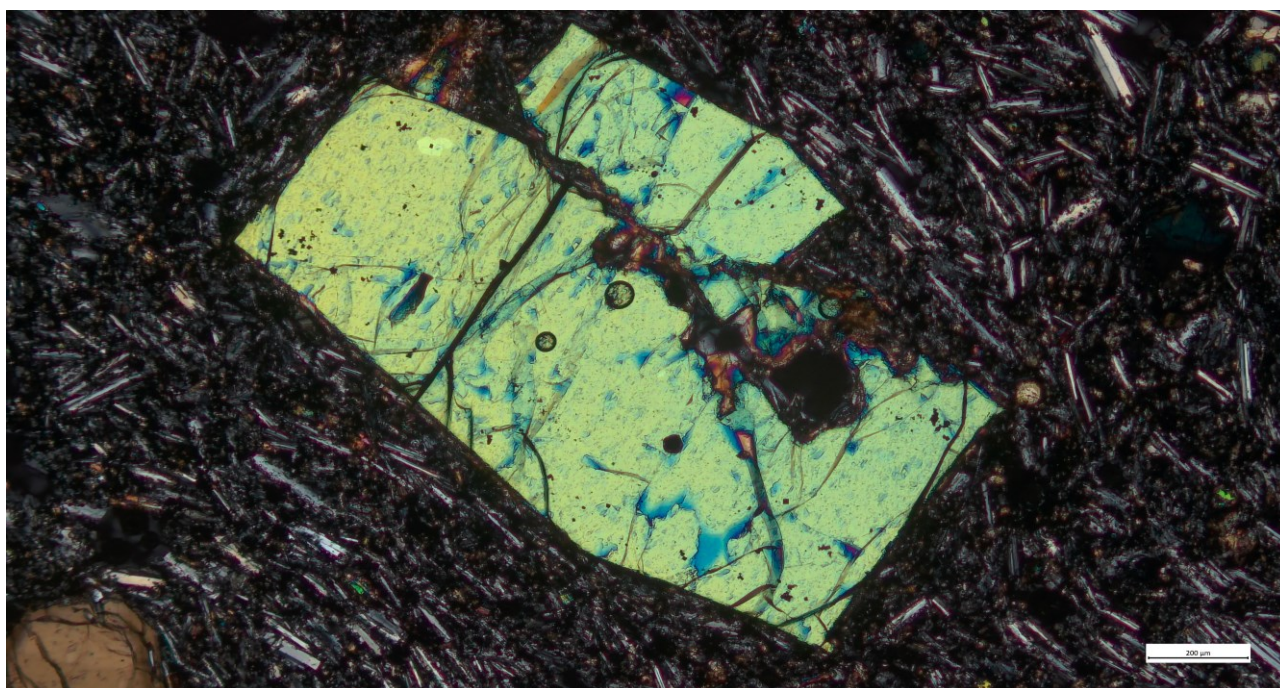


Figure 6-1: Olivine of Type 1 - normal zoning texture under crossed polarizers (18MS01)

The olivine of the second group, Type 2, has a wide homogeneous core and a prominent marginal zoning with different interference colours (Figure 6-2).

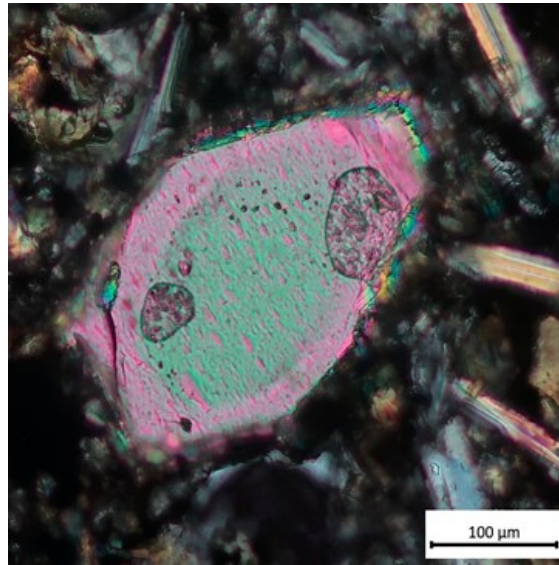


Figure 6-2: Olivine of Type 2 - inverse zoning texture under crossed polarizers (MF03B)

In many cases, Type 1 and Type 2 olivine can only be distinguished under the microprobe backscattered imaging, as the rim of the Type 2 zoned crystals has a much darker colour, than the rim of the Type 1 crystals. This colour difference is caused by element variations. A higher number of elements with a lower atomic number (Z) result in darker colours, whereas elements with a higher atomic number cause brighter colours (Figure 6-3).

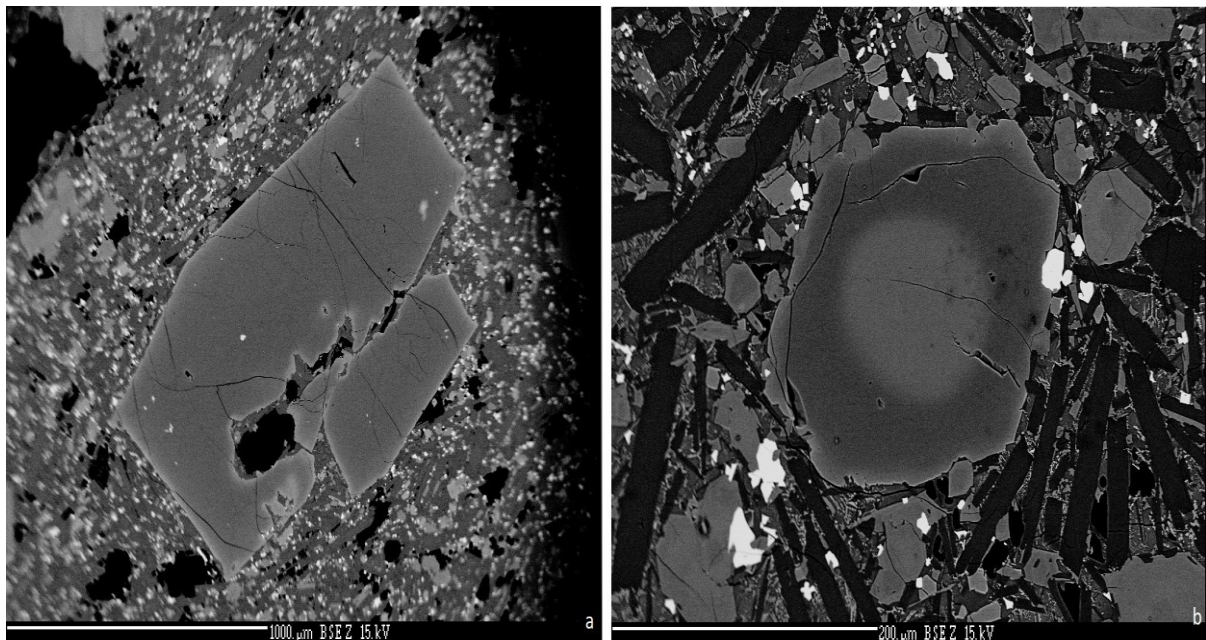


Figure 6-3: BSE-imaging of olivine with a) Type 1 (18MS01) and b) Type 2 texture (18MF01)

Type 2 occurs in the basalts of the Monte Spagnolo, Mounts de Fiore eccentric cones and the 2002/03 lava flow. Like the Type 1 olivine, the crystals vary in size and shape, but usually does not exceed the width of 500-600 μm. The core of such olivine is mostly rounded, and the outer rim is often sub-idiomorphic.

The third type comprises two special cases of rarely occurring olivine with a patchy (subtype 3.1) or skeletal (subtype 3.2) appearance.

Type 3.1 is characterized by a very heterogenic extinction under crossed polarizers, from which the patchy appearance follows. Melt pockets and inclusions of various minerals, such as clinopyroxene, plagioclase or titanomagnetite are well distributed all over the crystal (Figure 6-4). Such olivine was found in samples from Monte Spagnolo (18MS02), Mounts de Fiore (18MF01) and 2002/03 lava flow (18RS02), and its diameter varies from 0.4 to around 1 mm. The crystal texture varies from idiomorphic with sharp edges (e.g., sample 18MS02) to sub-idiomorphic with partly sharp edges (e.g., 18RS02) to allotriomorphic (e.g., sample 18MF01) with undefined edges. The patchy textured olivine of 18MS02 and 18MF01 is surrounded by many small clinopyroxene crystals and titanomagnetite (Figure 6-4).

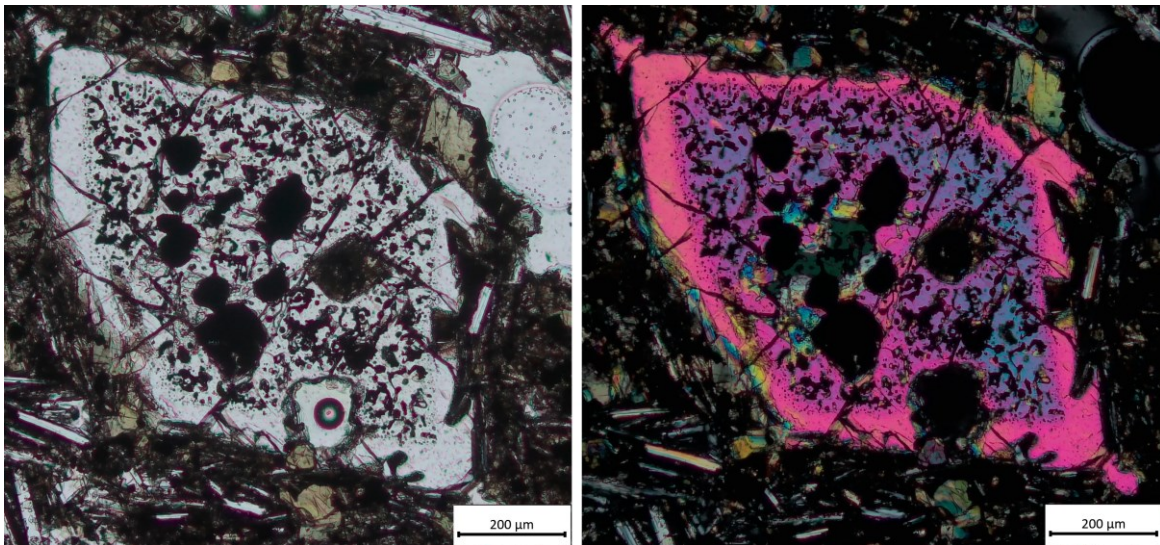


Figure 6-4: Olivine of Type 3.1 - patchy texture without (left) and with (right) crossed polarizers (18MF02)

The second subgroup of special cases, Type 3.2, comprises olivine crystals with a skeletal growth. It was mainly observed in the lavas from the eccentric cones of the Mounts de Fiore (Figure 6-5).

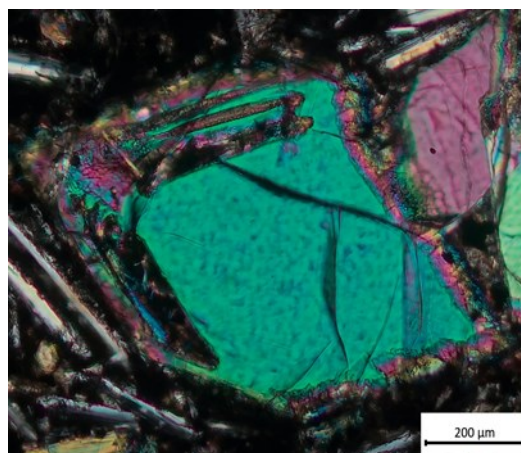


Figure 6-5: Olivine of Type 3.2 – skeletal texture under crossed polarizers (18MF02)

Type 3.2 is characterized by the skeletal continuous growing of an existing crystal. Figure 6-6

a-c) shows the skeletal growing of an idiomorphic olivine, which is developing from two crystal faces. At the final stage a narrow rim of ca. 25 μm is overgrowing the whole combined crystal.

In the first step they can look like arrowheads: They start from the corners, grow towards each other, until, at some point, they merge into one another and form a new continuous band. The result of this process is a newly grown rim. These three steps are depicted with BSE-images in Figure 6-6.

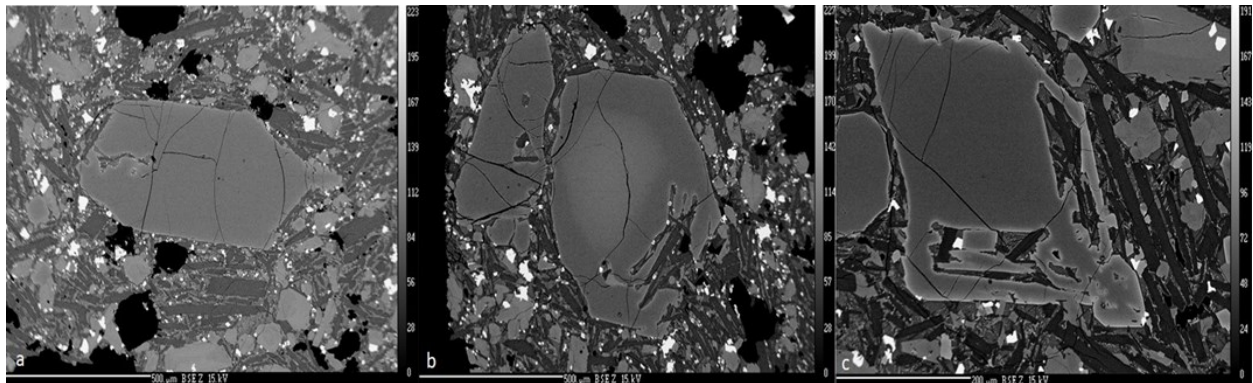


Figure 6-6: Olivine of Type 3.2 - skeletal texture; a) arrowhead appendix (18MF05_4) b) continuous growth (18MF03A_1) c) skeletal coalescence (18MF02_4)

6.2.3. Clinopyroxene

The clinopyroxene was classified mainly according to Giacomoni et al. 2016 in five different types. Additional to the 5 different types, distinguished by Giacomoni et al. 2016, a sixth texture type was found in the samples investigated in this work:

- **Type 1** - normal or oscillatory zoning
- **Type 2** - sharp compositional variations from core to rim
- **Type 3** - sieve textured core
- **Type 4** - reverse zoning
- **Type 5** - dusty texture rim with reverse zoning
- **Type 6** – hourglass zoning

Type 1 clinopyroxene has a euhedral shape with a homogeneous normal or oscillatory zoning. Normal zoning shows no trace of resorption or dissolution, and the oscillatory zoning shows a repetitive change in interference colours (Figure 6-7). This texture type was found in all locations and thin sections, as it is the texture type of many phenocrysts and of all matrix clinopyroxene grains.

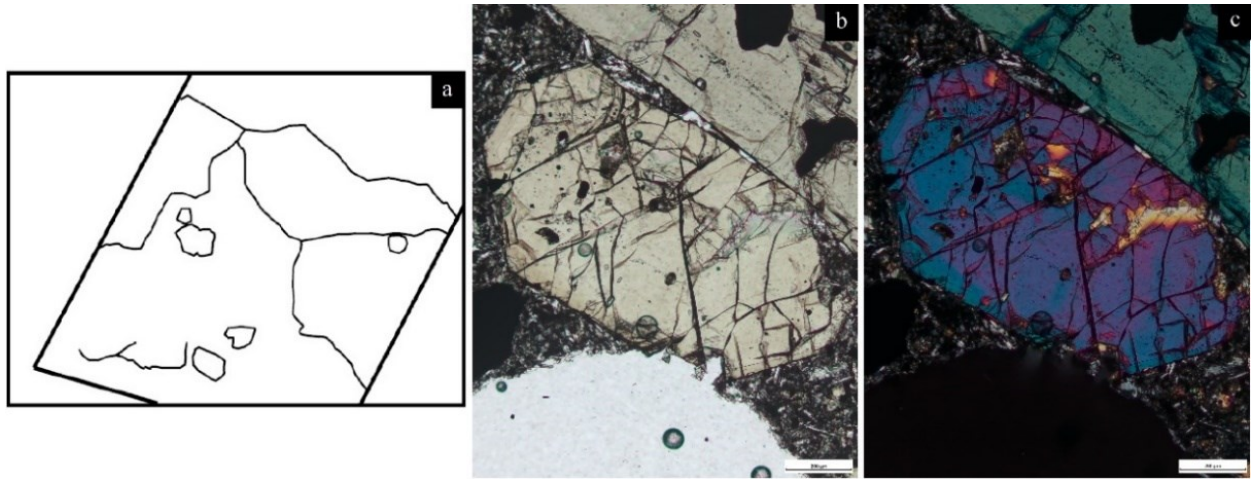


Figure 6-7: Type 1 clinopyroxene - normal zoning; a) drawing from the classification in Giacomoni et al. 2016; example from this study b) with and c) without crossed polarizers (18MR03)

Type 2 clinopyroxene has also a euhedral shape, but it differs from Type 1 by a clearly defined rim of darker interference colours (Figure 6-8). This texture type is restricted to one sample of Monte Spagnolo (sample 18MS01).

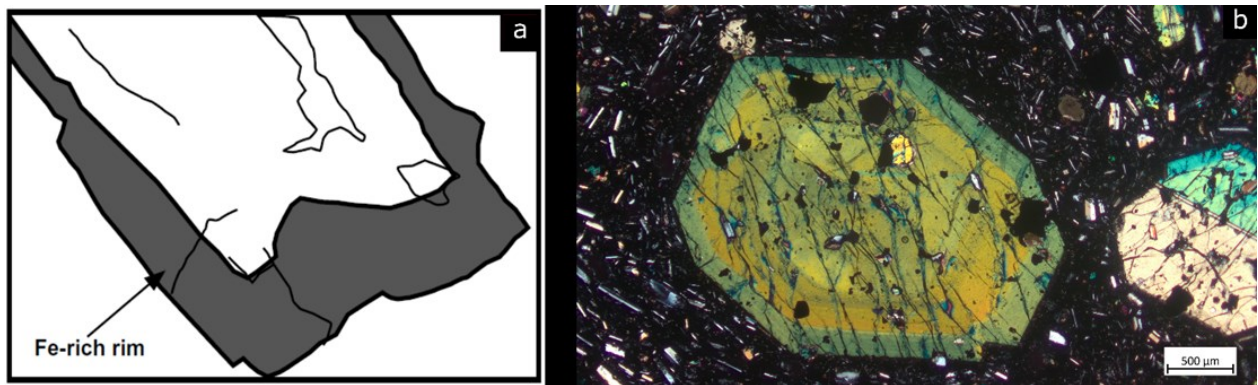


Figure 6-8: Clinopyroxene of Type 2 - sharp compositional variations from core to rim; a) drawing from the classification in Giacomoni et al. 2016; example from this study b) with crossed polarizers (18RS01)

Type 4 clinopyroxene shows an inverse zoning, which means, that the core shows darker interference colours under the optical microscope, due to a higher Fe-content, than the rim (Figure 6-9). This texture type was found in several samples of Monte Spagnolo, Mounts de Fiore and the 2002/03 lava flow.

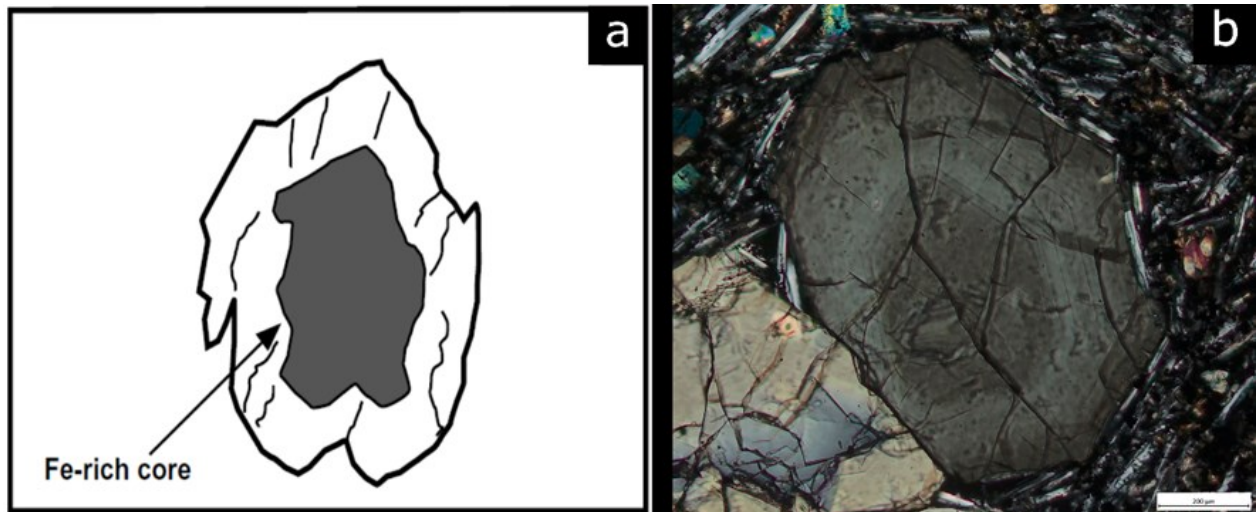


Figure 6-9: Clinopyroxene with Type 4 - reverse zoning; a) drawing from the classification in Giacomoni et al. 2016; example from this study b) with crossed polarizers (18MS03)

An additional texture type of clinopyroxene, which was not yet described in Giacomoni et al., 2016, was observed in samples of the Mounts de Fiore eccentric cones: hourglass zoning (Type 6). The clinopyroxene of this texture type consists of two zones, which appear as four sectors (two prism and two hourglass sectors) in an appropriately oriented thin section. Naturally, the shapes of the sectors depend on the actual habitus of the crystal and how the thin section cuts through (Figure 6-10).

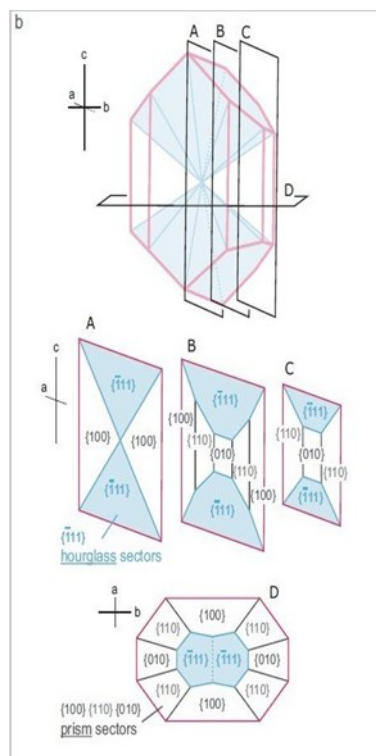


Figure 6-10: Possible sector shapes of an idealized clinopyroxene with "hourglass zoning", depending on the orientation of the thin section (from Ubide et al., 2019).

The main difference between the two sector pairs lies in the geochemistry, as the prism sectors have a higher content of Si and Mg and a lower content of Al, Ti, Fe and V. This leads to different interference colours for the two zones, where the hourglass sectors are generally

darker than the prism sectors (Figure 6-11 and Chapter 6.4.3.5). Type 6 clinopyroxene was observed in samples from Monte Rossi, Monte Spagnolo, Mounts de Fiore as well as in the samples of the 2002/03 lava flow.

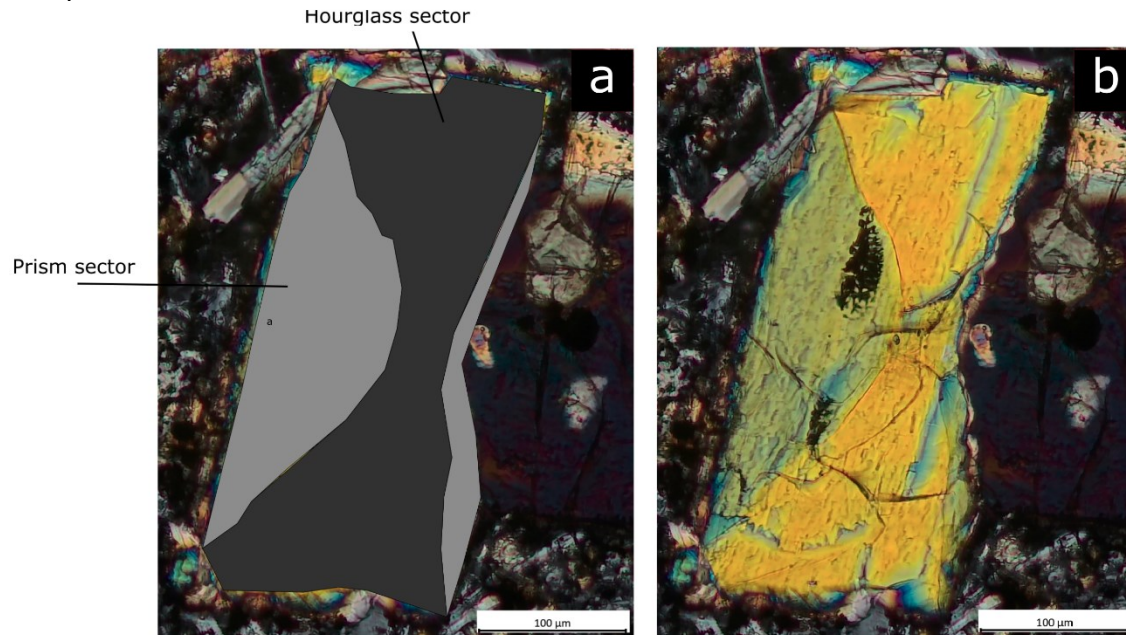


Figure 6-11: Clinopyroxene with Type 6 - hourglass zoning; a) schematic of the different sectors b) with crossed polarizers (18MS01)

6.2.4. Plagioclase

Plagioclase is distinguished according to the classification of Giacomoni et al. (2014) concerning the type of crystal-zoning (texture):

- The first group is simple zoned plagioclase. It consists of one zonation-type:

- * **Type a** - oscillatory zoning

The second group consists of plagioclase with complex zoning in the core. The complex zoning can occur as well as in the core as in the rim. This group is divided into four texture types:

- * **Type b** - clear rounded core

- * **Type c** - dusty core

- * **Type d** - patchy rounded core

- * **Type e** - sieved-textured core

Texture types b, c and d show an abrupt change of chemistry from core to rim, which can be seen in backscattered images and often also through an optical microscope. The transition from core to rim for Type e crystals is a more textural feature, as the sieved texture is characterized by partially recrystallized melt pockets randomly spread across the core.

The third group is plagioclase with complex zoning at the rims. It consists of two members:

- * **Type f** - dusty rim
- * **Type g** - rim with melt inclusion alignments

These two texture types show either a dusty rim (Type f) or melt inclusions in the rim (Type g). Crystals of both types have sieved-textured cores, which usually is (sub-)rounded in Type f plagioclase and rectangular in Type g plagioclase.

Type a – oscillatory zoned plagioclase is the most common texture type for the matrix plagioclase and for a large share of phenocrysts, i.e., all of the phenocrysts of Mounts de Fiore. This plagioclase has its euhedral habitus preserved, with core and rim showing oscillatory zoning (Figure 6-12).

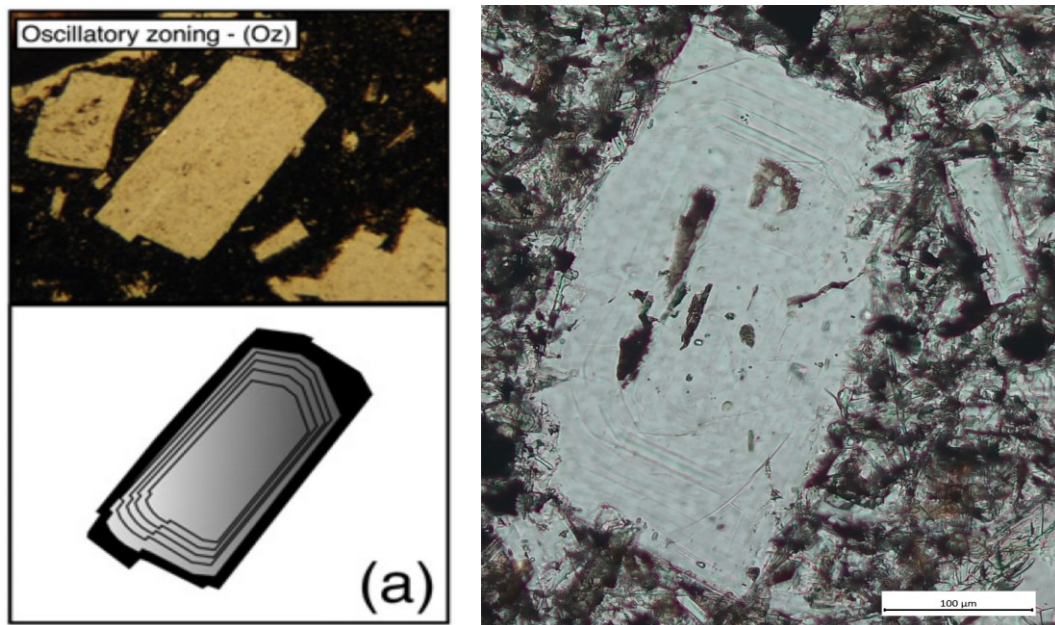


Figure 6-12: Plagioclase of Type a - oscillatory zoning; classification after Giacomoni 2014 (left) and an example from this study (right) (18MR01)

Plagioclase of Type b - clear rounded core is present in the matrix and as phenocryst, whereas the latter is restricted to a low share of phenocrysts in the samples of Monte Rossi (Figure 6-13).

This type shows an abrupt change in the geochemistry and interference colours between core and rim (see chapter 6.4.4.3).

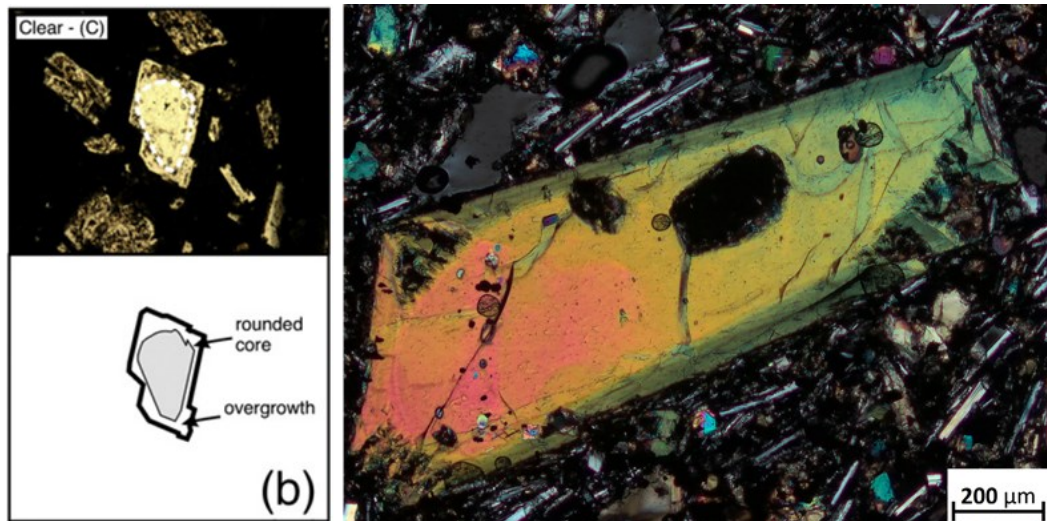


Figure 6-13: Plagioclase of Type b - clear rounded cores; classification after Giacomoni 2014 (left) and an example from this study (right) (18MF03B)

Plagioclase of Type c - dusty core is characterized by a core consisting of partially crystallized or glassy melt pockets. The core is (sub-)rounded and surrounded by a clear, sometimes rounded, rim (Figure 6-14).

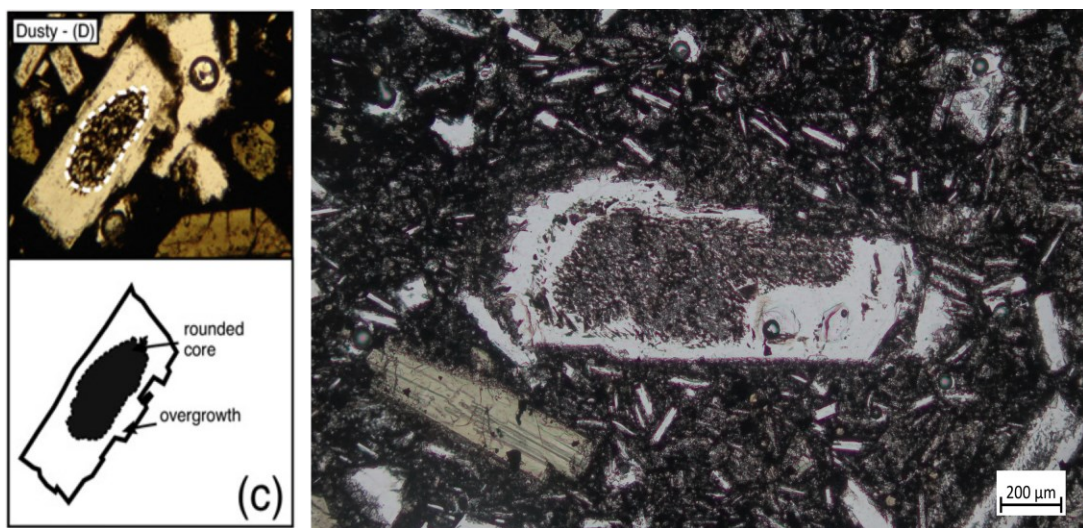


Figure 6-14: Plagioclase of Type c - dusty core; classification after Giacomoni 2014 (left) and an example from this study (right) (18RS02)

Plagioclase of type d - patchy rounded core has a complex juxtaposition of irregular arranged patches of An-rich and An-poor domains. This texture type is more frequent in the 2002/03 lava flow (Figure 6-15).

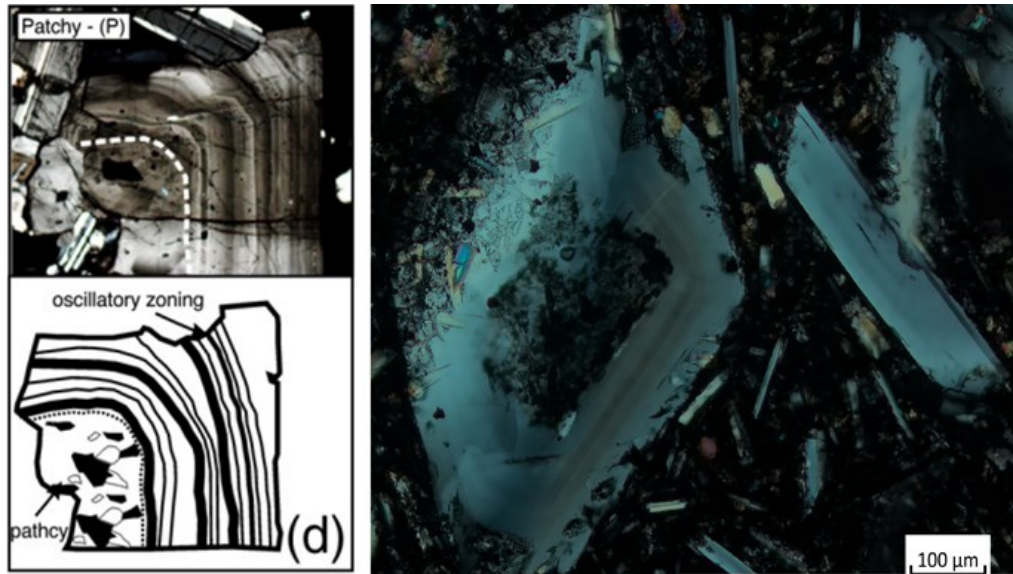


Figure 6-15: Plagioclase of Type d - patchy rounded core; classification after Giacomoni 2014 (left) and an example from this study (right) (18RS01)

Plagioclase of a type e – sieved textured core represents the most frequent phenocryst in the samples of Monte Rossi, Monte Spagnolo and the 2002/03 lava flow. It shows partially recrystallized melt pockets randomly spread across the core (Figure 6-16). Compared to Type c - dusty cores, no (sub-)rounded core area is distinguishable.

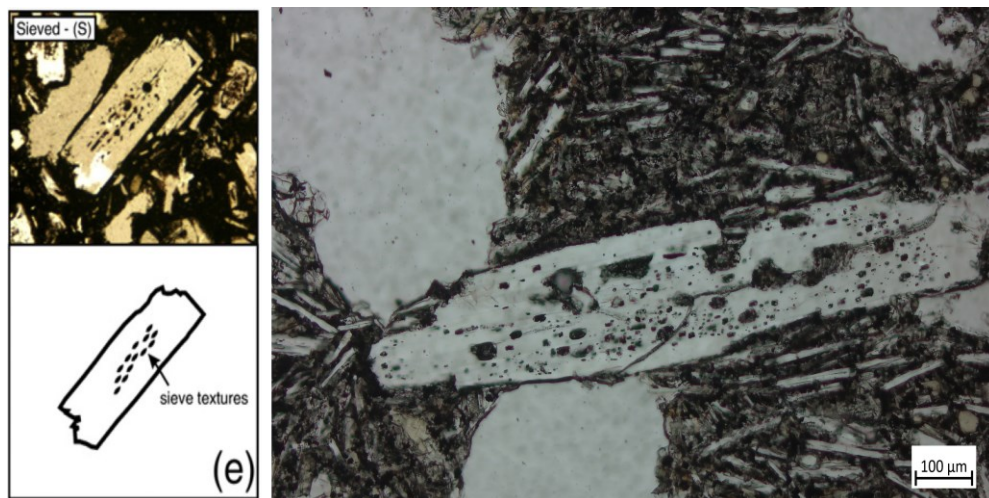


Figure 6-16: Plagioclase of type e - sieved-textured core; classification after Giacomoni 2014 (left) and an example from this study (right) (18MS03)

Plagioclase of texture type f - dusty rim is characterized by a complex zoning of the rim, i.e., a rounded dusty rim-zone, which is composed of isolated or interconnected, partially recrystallized melt pockets (Figure 6-17).

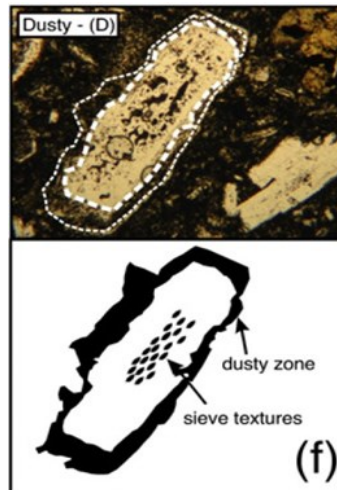


Figure 6-17: Plagioclase of type f - dusty rims; classification after Giacomoni 2014

Plagioclase of texture type g - rim with melt inclusion alignments is characterized by a rim of iso-oriented, only a few μm large melt inclusions (Figure 6-18). This texture is restricted to the samples of Monte Spagnolo.

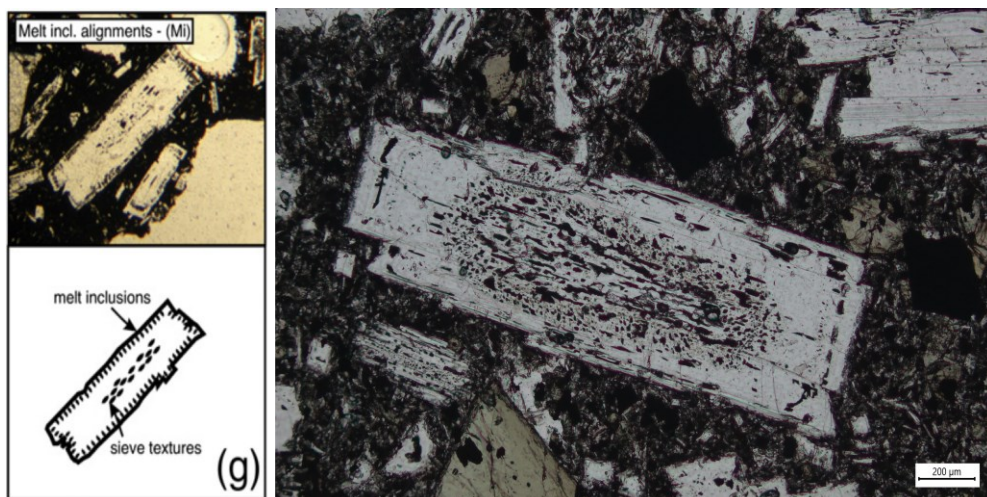


Figure 6-18: Plagioclase of type g - rim with melt inclusion alignments; classification after Giacomoni 2014 (left) and an example from this study (right) (18MR02)

6.2.5. Titanomagnetite

The titanomagnetite appears in different sizes as inclusion, phenocryst or part of the matrix. It is found in all samples and can vary in size from a few μm small matrix crystals to multiple 100 μm large phenocrysts (Figure 6-19). The shape of the phenocrysts is mostly sharp to sub-rounded, with a varying amount of sharp edges.

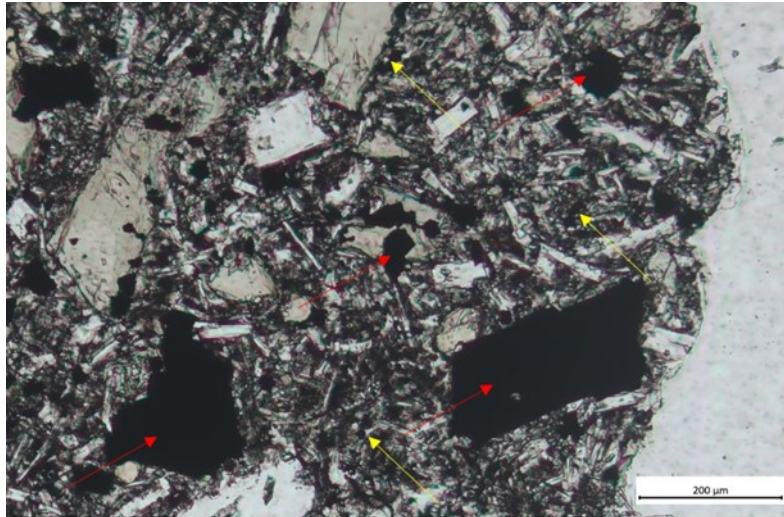


Figure 6-19: Titanomagnetite as part of the matrix (yellow arrows) and as phenocrysts (red arrows) (18MR03)

A special occurrence is the agglomeration of many drop-shaped titanomagnetites in a small area. (Figure 6-20)

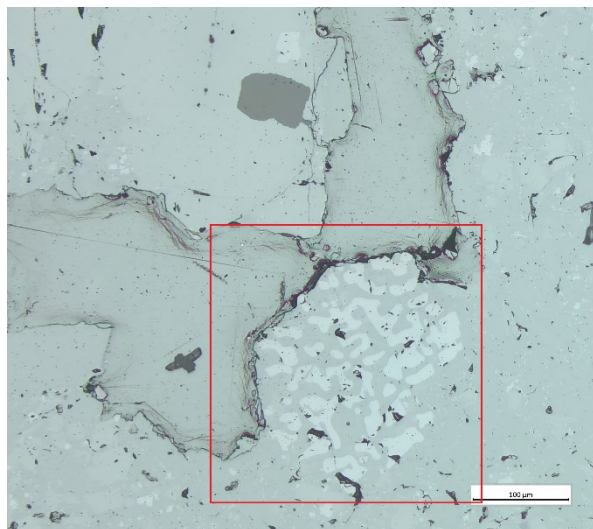


Figure 6-20: Reflected light microscopic image of a densely packed agglomeration of rounded titanomagnetite crystals (red box) (18RS01)

Titanomagnetite also commonly appears as an inclusion in other minerals, like olivine, clinopyroxene or plagioclase. The size of the titanomagnetite-inclusion can vary from a few µm up to several hundred µm (Figure 6-21)

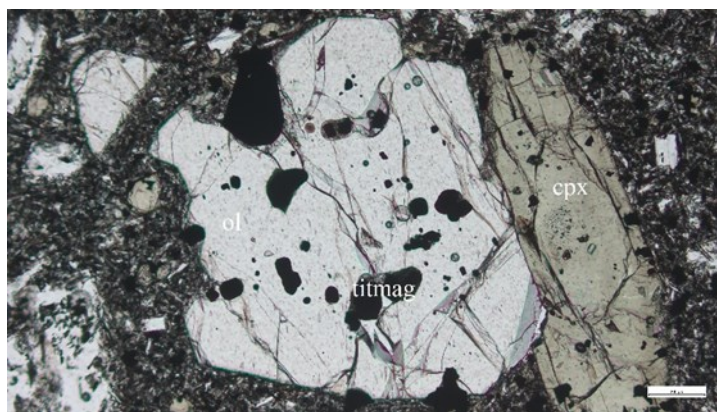


Figure 6-21: Inclusion of titanomagnetite (black spots) in olivine (left, white crystal) and clinopyroxene (right, beige crystal) (18MR03)

6.3. CHEMICAL ANALYSIS

6.3.1. Major elements - whole rock

The geochemical composition of all samples was determined for the major and trace elements using the X-ray fluorescence (XRF) spectrometer and an inductively coupled plasma mass spectrometer (ICP-MS) (see chapter 5). The results of the major and trace element analyses are shown in Table 6-2, Table 6-3, Table 6-4.

The major element distribution plotted on a TAS-diagram after LeMaitre et al. 1998 (Figure 6-22) shows a clear trachybasaltic composition for the samples of all locations, with a mediated SiO_2 content of 48.18 wt% and a mediated total alkali content of 5.51 wt%.

The basalts of Monte Spagnolo show the highest SiO_2 content with an average of 49.53 wt%, followed by Monte Rossi with 49.10 wt%, the 2002/03 lava flow with 48.24 wt% and Mounts de Fiore with 47.22 wt%.

The average total alkali content of all studied cones is very similar, ranging between 5.58 and 5.48 wt%.

However, there are differences among the alkalis. The mean K_2O content of Monte Spagnolo is 1.59 wt%, which is very similar to Monte Rossi, with an average of 1.55 wt%. In the 2002/03 lava flow and in the samples from Mounts de Fiore the K_2O content is higher with 2.03 and 1.95 wt%, respectively.

The Na_2O content of the Monte Spagnolo and Monte Rossi samples is very similar with 3.98 and 4.01 wt%, respectively. In the 2002/03 lava flow and Mounts de Fiore samples the Na_2O content is slightly lower with 3.55 and 3.50 wt%, respectively.

For the different locations the Mg# varies between 48.34 and 49.27 mol.% for Monte Rossi, 54.94 and 57.43 mol.% for Monte Spagnolo, 51.22 and 51.83 mol.% for Mounts de Fiore and 51.42 and 52.01 mol.% for the 2002/03 lava flow.

The sample 18MSO4 has the highest Mg# of 57.43 mol.% and the sample 18MR02 the lowest with 48.34 mol.% (Table 6-2, Table 6-3, Table 6-4).

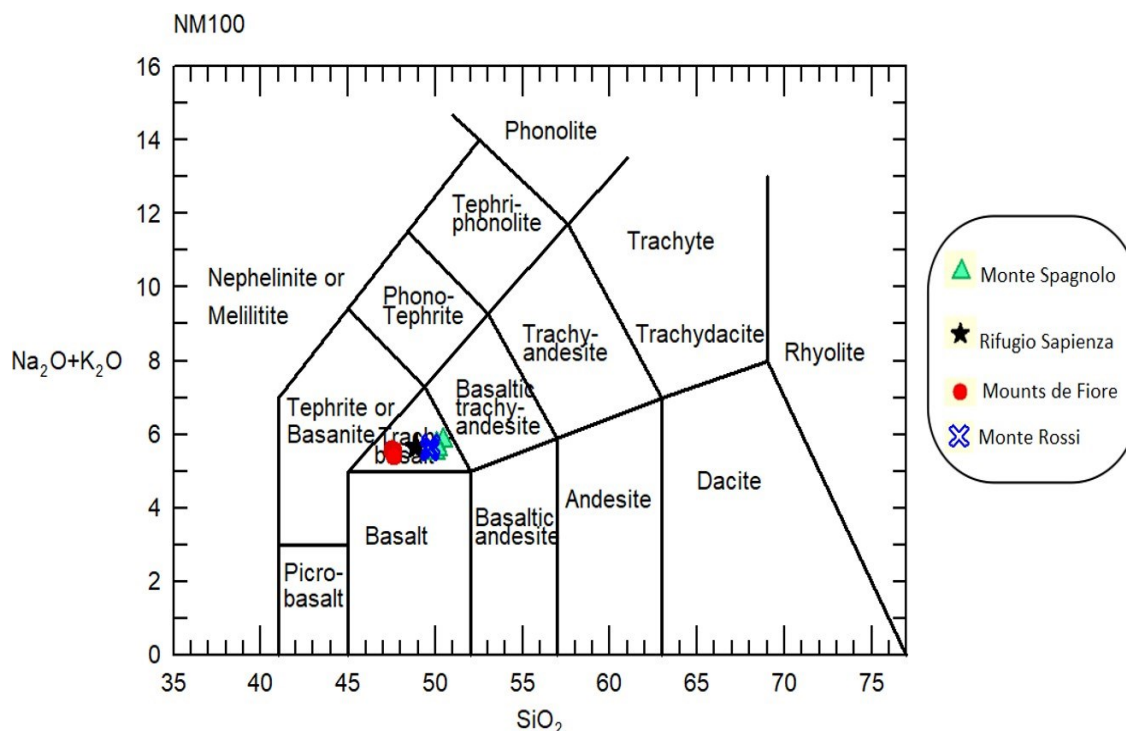


Figure 6-22: TAS-Diagram of the XRF-analysis showing a clear trachybasaltic composition for the samples of all locations; mineral content in wt% (Le Maitre et al., 1998)

Figure 6-23 depicts the whole rock element concentration (Al_2O_3 , TiO_2 , CaO , Na_2O and K_2O) plotted against the MgO content (see also Table 6-2, Table 6-3, Table 6-4.).

The MgO content is lowest for the samples of Monte Rossi, between 4.58 and 4.82 vol.%. For the other locations, the range of the MgO content is narrow, with the 2002/03 lava flow ranging from 5.91 to 5.94 vol.% and Mounts de Fiore from 6.23 to 6.50 vol.%. At Monte Spagnolo, the samples 18MS02 to 18MS05 all lie between 6.33 and 6.51 vol.%, whereas 18MS01 lies at 5.84 vol.%.

The highest Al_2O_3 concentrations were found in the samples of Monte Rossi with appr. 18 vol.%, whereas the other locations are more clustered together between 15.58 and 16.57 vol.% (Figure 6-23a).

The TiO_2 distribution allows a division into samples of higher and lower TiO_2 content. The former consists of the samples of the more recent erupted Mounts de Fiore (erupted 1974) and the 2002/03 lava flow, with a TiO_2 content between 1.69 and 1.78 vol.%. The latter, comprising Monte Spagnolo and Monte Rossi, is characterized by a lower TiO_2 content of 1.50 ± 0.2 vol.% (Figure 6-23b).

The CaO content in the samples of Monte Rossi, Mounts de Fiore and the 2002/03 lava flow shows only minor variations. For Monte Rossi the CaO content varies between 10.44 to 10.48 vol.%. The samples of Mounts de Fiore show CaO content stretching from 11.12 to 11.34 vol.%. The two samples of the 2002/03 lava flow lie very close together, with only minimal deviations of the CaO content between 10.62 and 10.63 vol.%.

The samples of Monte Spagnolo show a wider range of CaO content, with samples 18MS02 to 18MS05 ranging from 10.75 to 10.91 vol.%. Sample 18MS01, collected somewhat distant from the others, shows a low CaO content of only 10.31 vol.% (Figure 6-23c).

Figure 6-23d shows a wider Na_2O range within each location. The samples of Monte Spagnolo

are scattered over an area reaching from a Na₂O content of 3.81 up to 4.12 vol.%. Monte Rossi has a similar high Na₂O content between 3.97 and 4.07 vol.%.

The two more recent eruptions have a lower Na₂O content, the samples of Mounts de Fiore between 3.42 and 3.54 vol.% and the samples of the 2002/03 lava flow between 3.53 and 3.57 vol.%.

The K₂O content is clearly higher in the two most recent eruptions. The samples of Mounts de Fiore show a range from 1.92 to 1.99 vol.% and the 2002/03 lava flow from 2.03 to 2.04 vol.%. The samples of Monte Rossi have a K₂O content between 1.52 and 1.57 vol.% and the ones of Monte Spagnolo between 1.50 and 1.66 vol.% (Figure 6-23e).

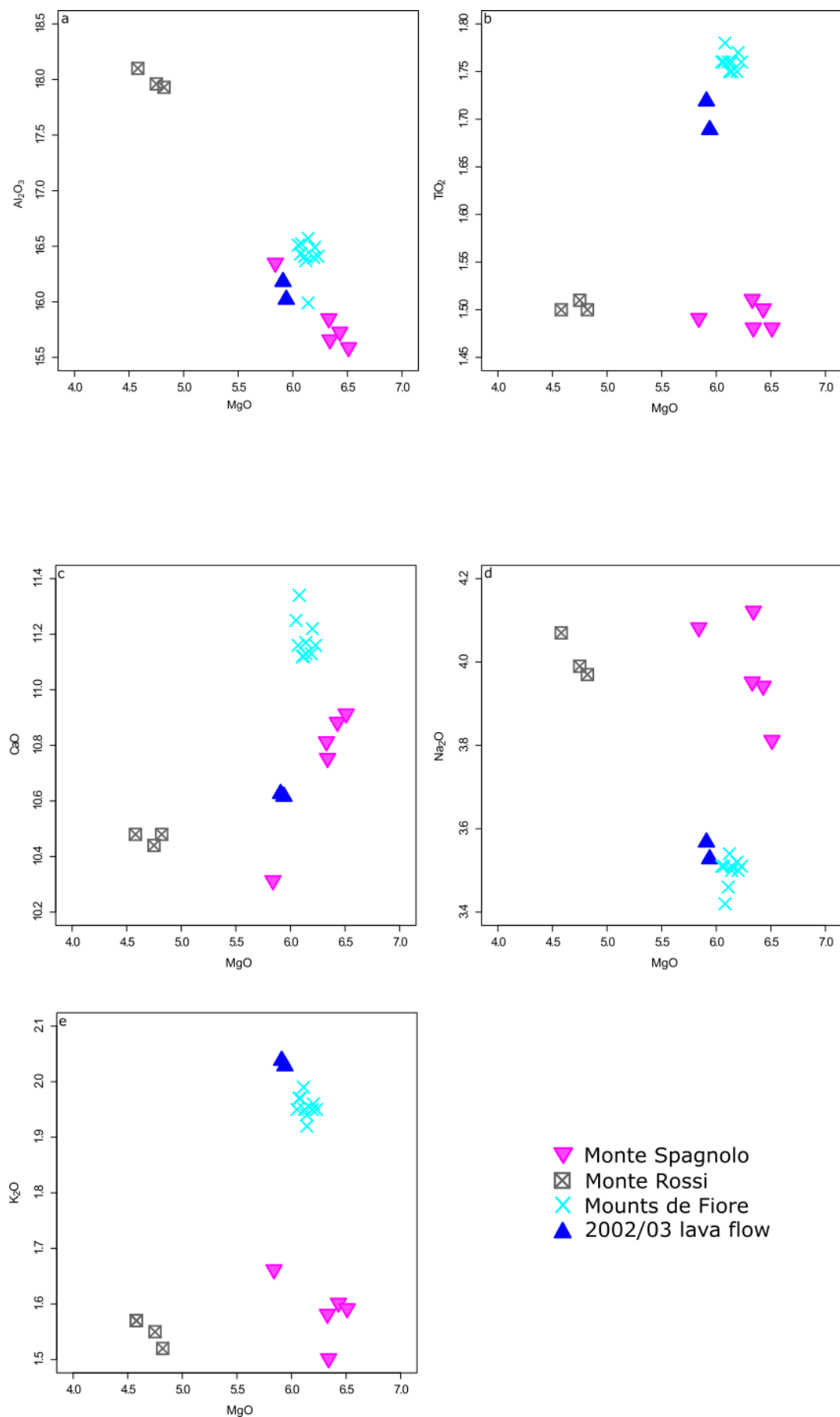


Figure 6-23: Major element concentration of whole rocks of Monte Spagnolo (pink triangle), Monte Rossi (box), Mounts de Fiore (cross) and the 2002/03 lava flow (blue triangle)

6.3.2. Trace elements - whole rock

Trace elements are the elements with a measured weight percent of $< 0.1\%$ in geochemical analyses. These elements can be crucial for the determination of different magmatic processes, like magma mixing and the differentiation between the mixing magmas.

They can be distinguished into compatible (e.g., Cr, Cu, Co or Ni) and incompatible elements. The latter group can be subdivided into two groups:

- 1.) Elements with a small ion-radius, but high valence, also known as High Field Strength Elements (HFSE). They contain the Rare Earth Elements (REE), like La, Ce, Pr, Nd, Sm, Eu^{3+} , Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, as well as Th, U, Pb^{4+} , Zr, Hf, Ti, Nb und Ta.
- 2.) Elements with a large ion-radius, but low valence, also known as Large Ion Lithophile Elements (LILE), like K, Rb, Cs, Ba, Pb^{2+} , Sr, Eu^{2+} .

The differentiation into compatible and incompatible elements is due to the likeliness to be incorporated into the crystal lattice during the fractional crystallization. The compatible elements are the first to be incorporated, whereas the incompatible elements tend to remain in the melt until the melt is (over-)saturated with them and they are forced to crystallize.

It is important to consider which mineral phase is investigated, e.g., the element Sc is incompatible in olivine, but compatible in clinopyroxene.

Therefore, the distribution of compatible and/or incompatible elements can offer an insight on the fractionated minerals and the history of the melt, respectively.

A total of 9 samples were analysed via ICP-MS, i.e., samples 18MF01, 18MF03A, 18MF04, 18MF06, 18MF09, 18MR02, 18MS01, 18MS02 and 18RS02 (Table 6-2, Table 6-3, Table 6-4) Figure 4.26 shows the multielemental patterns, normalized to the composition of a pyrolite as proposed by Sun and McDonough, 1989, of the analysed samples.

Within the individual locations, the samples vary only slightly from one another, but there are clear differences between the individual eccentric cones and lava flow.

The oldest two sampling sites, Monte Spagnolo and Monte Rossi, show the lowest enrichment in Cs, Rb and K, but the highest enrichment in Th, Nb and especially in U, compared with the other two, younger locations Mounts de Fiore and the 2002/03 lava flow. This leads to a higher normalized Rb/Th ratio for the post-1971 eruptions, Mounts de Fiore and the 2002/03 lava flow, between 812 and 919, compared to the pre-1971 eruption, with a ratio between 323 and 477.

Monte Spagnolo is, compared to the other sampling sites, the most depleted sampling site in the HREE (Dy, Yb, Lu) and Y. In contrary to the 2002/03 lava flow, which is the least depleted in the mentioned elements.

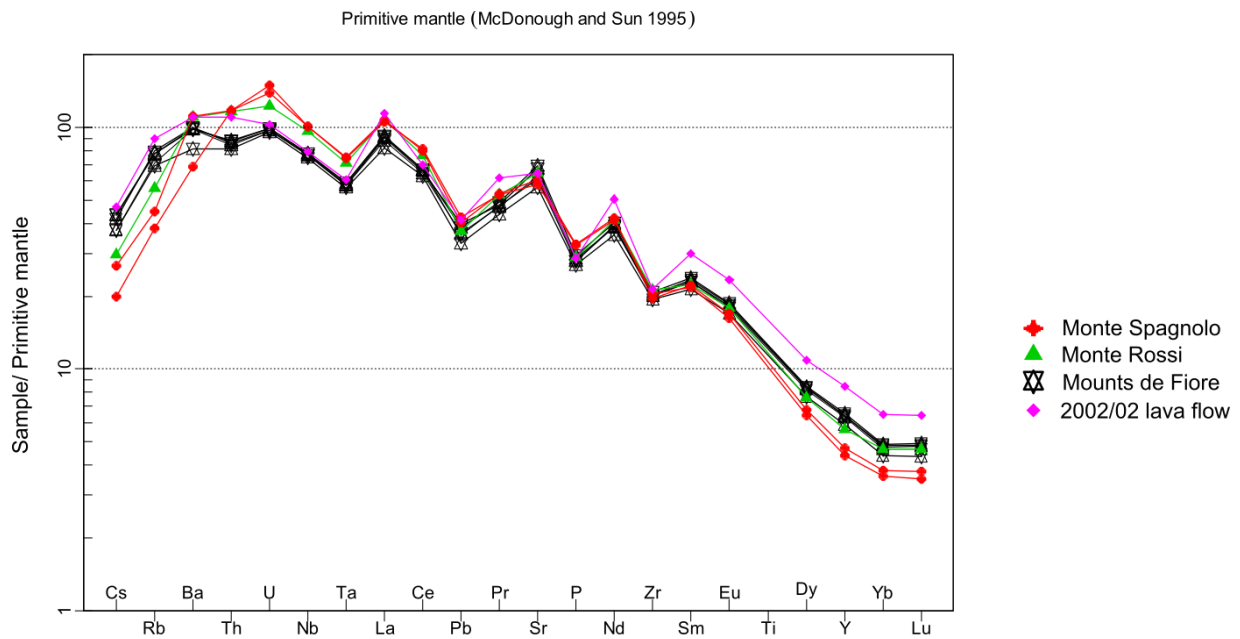


Figure 6-24: Primitive mantle normalized trace-element patterns for the four locations. Data for primitive mantle from Sun and McDonough (1995)

The results of the trace element analysis plotted against the REE composition of the primitive mantle (McDonough and Sun, 1995) offers a similar picture: a REE enrichment in the younger magmas, especially in the most recently erupted one, the 2002/03 lava flow. These magma shows an enrichment, compared to the other three sites, in all elements.

The convention to depict a possible enrichment or depletion of REE is via the normalized ratio of $(La/Yb)_N$.

The normalized La/Yb ratio can also be grouped into pre- and post-1971 eruptions, with extends of ~ 23 -30 and ~ 18 -19 respectively (Table 6-2, Table 6-3, Table 6-4). This means that the post-1971 eruptions are enriched in HREE compared to the pre-1971 eruptions.

The oldest erupted magma, the basalts of Monte Spagnolo, show a depletion in the HREE, whereas they show no large aberrations from the other samples in the LREE (Figure 6-25).

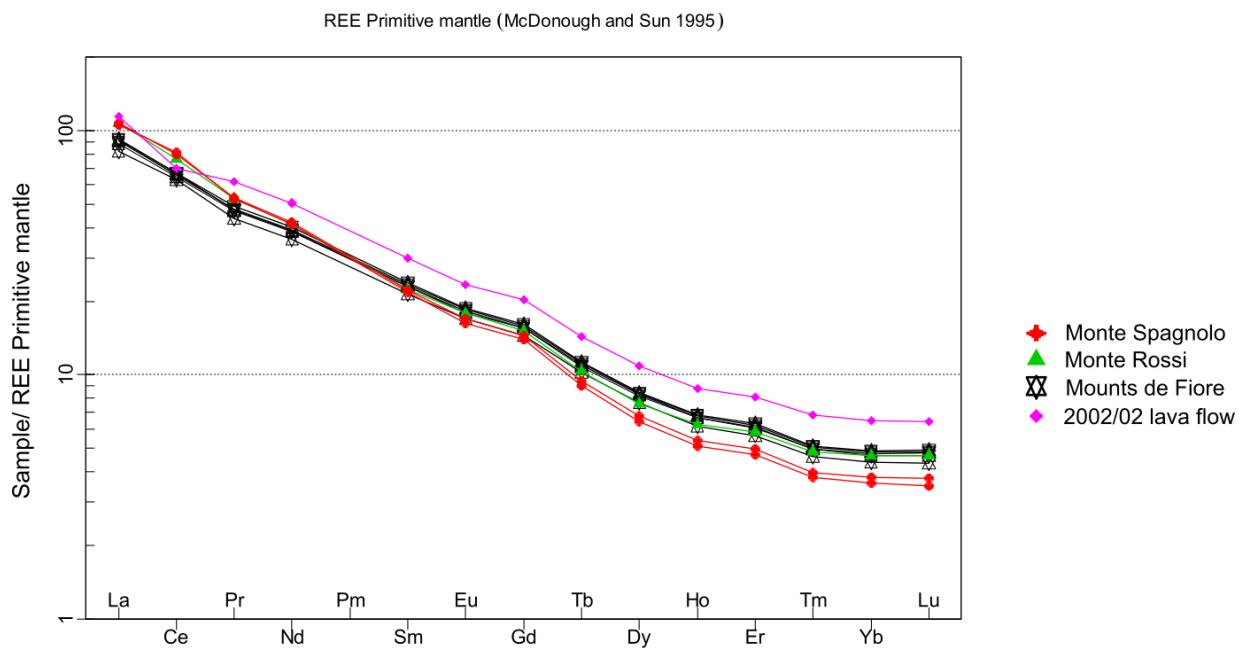


Figure 6-25: REE Primitive mantle normalized trace-element patterns for the four locations. Data for primitive mantle from McDonough and Sun (1995)

Table 6-2: Results of the XRF- (wt%) and ICP-MS analyses (ppm); Ratios at the bottom are normalized to primitive mantle (Sun & McDonough, 1995) (1/3)

Sample	18MS01	18MS02	18MS03	18MS04	18MS05	18MR01	18MR02
SiO2	49.84	49.31	49.55	49.31	49.65	49.11	49.16
TiO2	1.49	1.48	1.50	1.48	1.51	1.50	1.50
Al2O3	16.34	15.65	15.72	15.58	15.84	17.93	18.10
FeOt	8.53	8.56	8.60	8.60	8.60	8.84	8.72
MnO	0.15	0.15	0.15	0.15	0.15	0.16	0.16
MgO	5.84	6.34	6.43	6.51	6.33	4.82	4.58
CaO	10.31	10.75	10.88	10.91	10.81	10.48	10.48
Na2O	4.08	4.12	3.94	3.81	3.95	3.97	4.07
K2O	1.66	1.50	1.60	1.59	1.58	1.52	1.57
P2O5	0.62	0.63	0.64	0.62	0.64	0.51	0.52
Sum	98.86	98.49	99.01	98.58	99.06	98.85	98.88
Mg#	54.94	56.91	57.13	57.43	56.77	49.27	48.34
As	2.72		2.70				1.69
B	8.61		8.95				7.02
Ba	453		734				730
Be	1.73		1.66				1.59
Bi	0.014		0.030				0.014
Cd	0.107		0.110				0.109
Ce	136		134				128
Co	35.8	35.6	36.7	37.8	36.5	31.5	31.8
Cr	105.2	129.1	135.8	140.7	122.3	40.9	43.8
Cs	0.419		0.560				0.625
Cu	116	122	122	123	115	131	134
Dy	4.33		4.55				5.13
Er	2.05		2.16				2.56
Eu	2.49		2.62				2.74
Ga	20.0	20.2	19.6	19.4	19.1	21.4	21.3
Gd	7.59		7.84				8.22
Hf	4.70		4.56				4.81
Ho	0.756		0.799				0.928
La	68.6		69.5				69.8
Li	8.20		7.86				7.73
Lu	0.239		0.256				0.316
Mn	1317		1303				1404
Mo	3.75		4.09				3.20
Nb	59.5	59.8	61.1	60.3	61.4	54.7	56.3
Nd	51.6		52.4				51.6
Ni	35.5	40.6	43.1	45.0	42.4	19.0	17.6
P	2917		2951				2594
Pb	6.40		6.05				5.59
Pr	13.3		13.5				13.3
Rb	22.9		26.9				33.6
Sb	0.192		0.181				0.123
Sc	28.5		34.5				24.8
Se	0.139		0.182				0.101
Sm	8.85		9.03				9.07
Sn	9.10	7.10	7.60	6.70	7.40	5.40	9.20
Sr	1315	1309	1300	1291	1303	1291	1311
Ta	2.75		2.79				2.64
Tb	0.893		0.929				1.02
Th	9.37		9.37				9.32
Tl	0.017		0.081				0.025
Tm	0.257		0.269				0.328
U	2.99		2.78				2.46
V	276		280				295
W	10.181		8.20				2.41
Y	18.9		20.1				24.1
Yb	1.58		1.67				2.05
Zn	84.1	79.4	87.7	86.7	89.5	79.9	83.4
Zr	220	217	216	216	219	229	233
La/Yb	29.56		28.30				23.16
Rb/Th	323.34		380.34				477.18

Table 6-3: Results of the XRF- (wt%) and ICP-MS analyses (ppm); Ratios at the bottom are normalized to primitive mantle (Sun & McDonough, 1995) (2/3)

Sample	18MR03	18MF01	18MF02	18MF03A	18MF03B	18MF04	18MF05
SiO ₂	49.04	47.41	47.10	46.96	47.02	47.01	47.23
TiO ₂	1.51	1.76	1.76	1.75	1.75	1.76	1.75
Al ₂ O ₃	17.96	16.57	16.41	16.37	15.99	16.43	16.40
FeO _t	8.82	10.34	10.29	10.30	10.18	10.29	10.32
MnO	0.16	0.18	0.18	0.18	0.18	0.18	0.18
MgO	4.75	6.14	6.11	6.12	6.14	6.07	6.19
CaO	10.44	11.17	11.12	11.12	11.13	11.16	11.13
Na ₂ O	3.99	3.51	3.46	3.54	3.50	3.51	3.52
K ₂ O	1.55	1.92	1.99	1.95	1.94	1.97	1.95
P ₂ O ₅	0.52	0.50	0.50	0.50	0.50	0.50	0.50
Sum	98.75	99.51	98.91	98.78	98.34	98.88	99.17
Mg#	48.95	51.42	51.43	51.45	51.80	51.24	51.67
As		2.00			1.91	2.18	
B		9.54			8.99	8.94	
Ba		646			648	658	
Be		1.52			1.48	1.46	
Bi		0.032			0.025	0.039	
Cd		0.134			0.128	0.154	
Ce		112			108	111	
Co	31.3	41.6	41.9	42.0	42.0	41.3	42.1
Cr	38.0	36.4	39.1	41.7	40.9	36.5	39.7
Cs		0.916			0.788	0.880	
Cu	134	144	146	145	142	144	141
Dy		5.68			5.53	5.65	
Er		2.76			2.63	2.71	
Eu		2.88			2.76	2.84	
Ga	21.3	20.4	20.3	20.4	20.4	20.2	19.9
Gd		8.76			8.43	8.60	
Hf		4.95			4.76	4.81	
Ho		1.02			0.987	1.01	
La		60.0			57.1	58.5	
Li		7.65			6.97	7.11	
Lu		0.334			0.317	0.327	
Mn		1843			1706	1642	
Mo		2.72			2.68	2.60	
Nb	56.9	46.8	46.0	46.9	46.2	46.8	45.7
Nd		50.3			48.0	48.9	
Ni	17.9	25.5	26.9	25.4	26.4	25.1	24.3
P		2663			2579	2524	
Pb		5.79			5.48	5.97	
Pr		12.5			11.9	12.1	
Rb		46.7			42.6	47.8	
Sb		0.090			0.082	0.083	
Sc		53.1			46.0	47.6	
Se		0.192			0.171	0.153	
Sm		9.68			9.32	9.51	
Sn	6.80	9.30	5.80	3.70	7.00	7.90	9.40
Sr	1307	1269	1255	1275	1258	1275	1282
Ta		2.18			2.13	2.14	
Tb		1.12			1.07	1.10	
Th		7.07			6.77	6.89	
Tl		0.062			0.050	0.092	
Tm		0.347			0.336	0.343	
U		1.97			1.94	1.95	
V		415			401	394	
W		2.68			2.86	3.67	
Y		28.2			27.1	27.4	
Yb		2.15			2.05	2.13	
Zn	84.7	100.0	95.8	96.7	96.8	99.4	96.9
Zr	235	223	218	223	216	223	221
La/Yb		18.96			18.97	18.74	
Rb/Th		875.71			833.63	919.25	

Table 6-4: Results of the XRF- (wt%) and ICP-MS analyses (ppm); Ratios at the bottom are normalized to primitive mantle (Sun & McDonough, 1995) (3/3)

Sample	18MF06	18MF07	18MF09	18MF10	18RS01	18RS02
SiO ₂	47.45	47.31	47.34	47.43	48.07	48.41
TiO ₂	1.77	1.76	1.76	1.78	1.69	1.72
Al ₂ O ₃	16.49	16.41	16.51	16.52	16.03	16.19
FeO _t	10.34	10.32	10.27	10.29	9.78	9.84
MnO	0.18	0.18	0.18	0.18	0.17	0.17
MgO	6.20	6.23	6.05	6.08	5.94	5.91
CaO	11.22	11.16	11.25	11.34	10.62	10.63
Na ₂ O	3.50	3.51	3.51	3.42	3.53	3.57
K ₂ O	1.96	1.95	1.95	1.97	2.03	2.04
P ₂ O ₅	0.50	0.50	0.50	0.50	0.53	0.53
Sum	99.60	99.32	99.31	99.50	98.39	99.01
Mg#	51.67	51.83	51.22	51.28	52.01	51.70
As	1.96		1.75			2.23
B	8.79		8.72			9.77
Ba	655		538			725
Be	1.51		1.50			1.69
Bi	0.033		0.026			0.037
Cd	0.145		0.116			0.121
Ce	112		105			117
Co	41.0	42.7	43.1	44.0	40.6	38.6
Cr	42.1	41.2	37.2	42.3	45.8	42.1
Cs	0.908		0.791			0.985
Cu	141	145	139	149	139	143
Dy	5.59		5.17			7.30
Er	2.66		2.47			3.54
Eu	2.80		2.61			3.61
Ga	20.4	20.5	20.2	20.4	20.4	20.8
Gd	8.43		7.87			11.05
Hf	4.82		4.60			5.05
Ho	0.989		0.917			1.30
La	59.1		53.1			74.2
Li	6.98		6.25			9.50
Lu	0.325		0.294			0.437
Mn	1603		1516			1543
Mo	3.08		2.56			2.80
Nb	46.4	46.9	46.5	45.6	45.9	45.9
Nd	48.7		44.8			63.2
Ni	25.2	27.2	25.7	24.4	27.3	25.2
P	2521		2419			2586
Pb	5.40		4.96			6.20
Pr	12.0		11.1			15.7
Rb	46.9		41.6			54.0
Sb	0.087		0.080			0.098
Sc	35.9		35.6			43.6
Se	0.181		0.168			0.212
Sm	9.33		8.68			12.2
Sn	8.20	7.00	6.20	8.80	7.00	7.60
Sr	1270	1267	1264	1278	1155	1169
Ta	2.15		2.08			2.24
Tb	1.08		1.01			1.42
Th	7.00		6.49			8.80
Tl	0.067		0.062			0.066
Tm	0.338		0.315			0.463
U	1.98		1.91			2.05
V	392		384			353
W	4.45		4.99			4.13
Y	27.6		25.2			36.3
Yb	2.09		1.92			2.86
Zn	98.2	98.4	97.6	99.7	94.0	94.6
Zr	221	222	221	222	222	222
La/Yb	19.24		18.79			17.69
Rb/Th	886.87		848.55			812.02

6.4. MINERAL CHEMISTRY

6.4.1. General remarks

Out of the available 20 thin sections, 14 were analysed with an EPMA in order to determine the chemical composition of the different mineral phases (18RS01, 18RS02, 18MR01, 18MR02, 18MR03, 18MS01, 18MS02, 18MS05, 18MF01, 18MF02, 18MF03A, 18MF03B, 18MF05 and 18MF07). Point analyses as well as line scans were conducted in order to determine not only the inter- but also the intra-crystal variations in the chemical composition.

The position of the analyses was selected, mostly, depending on the texture of the mineral. The differences in composition between core and rim is especially important for olivine and clinopyroxene since typical chemical variations could provide useful information regarding the evolution of the studied lavas.

All in all, more than 2000 point-analyses were conducted on olivine, clinopyroxene, plagioclase and titanomagnetite, as well as on melt inclusions. The number of analyses in each thin section varies depending on the sizes and frequency of the different minerals.

6.4.2. Olivine

The following sections deal with the classification of olivine into the individual groups and subgroups. First in a general and then in a more detailed perspective.

6.4.2.1. General classification

The classification scheme for the zoning patterns of the olivine was employed by Kahl et al. (2015), with a distinction between normal (decreasing forsterite contents from core to rim) or inverse (increasing forsterite contents from core to rim) zoning pattern. In the samples of Mounts de Fiore a third type was also found, the so-called “patchy” zoning, but due to the low number of grains, and therefore analyses, they will not be regarded in the detailed classification. The patchy zoning is characterized by neither a normal nor inverse zoning, but with a “patchy” distribution of high-Mg# areas.

Most analyses (1158 out of 2278) were made on 168 different olivine crystals. 678 analyses can be assigned to normal zoned olivine (138 crystals) and 469 to inverse zoned olivine (30 crystals). The remaining 11 analyses were conducted on one olivine grain with “patchy” zoning pattern.

Table 6-5 shows the mean chemical compositions and mean Mg# of all olivine crystals for the different locations. The Mg#-dispersion, of all locations, separated into core and rim, is visualized in a boxplot in Figure 6-26.

The mean Mg#, the most distinctive parameter of the analyses, varies between 72.36 for Monte Rossi and 79.51 mol.% for Monte Spagnolo. The basalts of the 2002/03 lava flow and of Mounts de Fiore lie in between that range, with a mean Mg# of 74.48 and 78.73 mol.% respectively.

Table 6-5: The mean chemical composition of olivine for each sampling location in wt% and the mean Mg# in mol.%

Location	Monte Spagnolo		Monte Rossi		Mounts de Fiore		2002/03 lava flow	
Quantity n	321	1 σ	238	1 σ	399	1 σ	199	1 σ
SiO ₂	38.82	1.35	37.3	0.69	38.35	0.76	37.44	0.86
Al ₂ O ₃	0.04	0.14	0.03	0.03	0.03	0.01	0.03	0.02
Cr ₂ O ₃	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
FeO	18.78	5.67	24.78	3.21	19.72	2.58	23.02	3.77
MnO	0.37	0.17	0.49	0.10	0.36	0.10	0.48	0.15
NiO	0.10	0.05	0.04	0.02	0.06	0.03	0.05	0.03
MgO	41.42	4.83	36.57	2.91	41.08	2.38	37.92	3.28
CaO	0.31	0.05	0.33	0.05	0.29	0.06	0.29	0.05
Total	99.87	0.82	99.57	0.55	99.92	0.59	99.26	0.60
Mg#	79.51	6.91	72.36	4.37	78.73	3.21	74.48	4.73

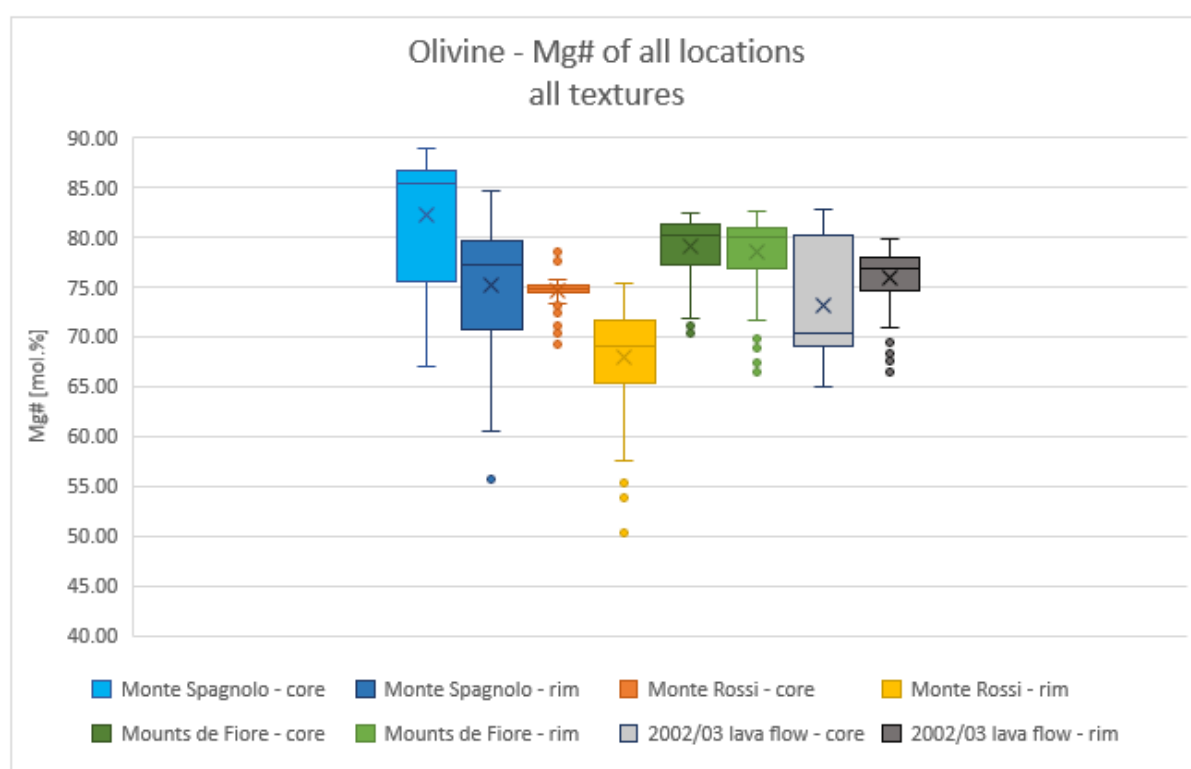


Figure 6-26: Distribution of the Mg# of olivine of the four investigated locations. Both textures summarized and divided into core and rim. (Supplementary Data 11.1)

- **Normal zoned olivine**

The normal zoned olivine can be found in every location. It is characterized by a decrease of MgO and a coupled increase of FeO (and thus a decreasing Mg#) from the core outwards to the rim (Figure 6-27).

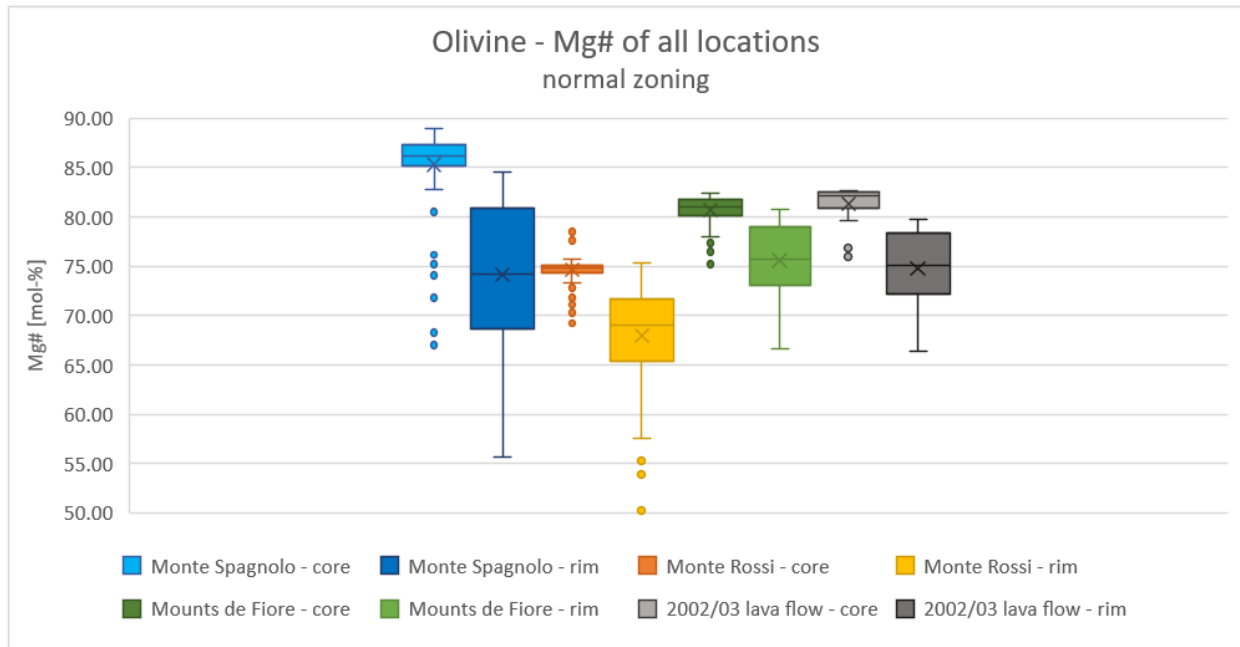


Figure 6-27: Distribution of the Mg# of normal zoned olivine of the four investigated locations, divided into core and rim. (Supplementary Data 11.1)

Table 6-6 shows the mean chemical compositions of normal zoned olivine for each sampling location, as well as the corresponding Mg#.

The difference in the mean Mg# between crystal core and rim varies from 85.30 to 74.11 mol.% at Monte Spagnolo, from 74.63 to 67.93 mol.% at Monte Rossi, from 80.66 to 75.57 mol.% at Mounts de Fiore and from 81.33 to 74.77 at the 2002/03 lava flow.

At Monte Spagnolo and Mounts de Fiore matrix-olivine was also analysed and these crystals have an even lower mean Mg#, with 64.54 mol.% (-10 mol.% compared to the rim) for Monte Spagnolo and 73.99 mol.% for Monte Rossi (-1.5 mol.%).

Table 6-6: The mean chemical composition of normal zoned olivine for each sampling location in wt% and the mean Mg# in mol.%

Texture	Normal zoned									
	Monte Spagnolo			Monte Rossi						
Sample Position	inclusion		matrix		core		rim		inclusion	
Quantity n	4	1 σ	5	1 σ	142	1 σ	52	1 σ	1	1 σ
SiO ₂	38.40	0.83	36.22	0.13	39.95	0.82	37.97	1.28	36.13	0.33
Al ₂ O ₃	0.03	0.01	0.06	0.04	0.04	0.11	0.09	0.28	0.03	0.01
Cr ₂ O ₃	0.02	0.01	<0.01	<0.01	0.03	0.01	<0.01	0.01	<0.01	<0.01
FeO	20.82	3.64	30.26	0.64	13.89	3.29	23.07	5.40	31.92	0.92
MnO	0.41	0.11	0.87	0.03	0.24	0.09	0.51	0.20	0.71	0.04
NiO	0.07	0.04	0.01	0.01	0.15	0.04	0.07	0.04	0.00	0.01
MgO	39.30	3.36	30.91	0.89	45.44	2.82	37.56	4.91	29.98	0.79
CaO	0.29	0.02	0.44	0.02	0.29	0.03	0.34	0.05	0.53	0.03
Total	99.36	0.80	98.85	0.89	100.03	0.79	99.66	0.94	99.37	0.50
Mg#	76.97	4.58	64.54	0.97	85.30	3.93	74.11	7.06	62.61	1.12
									158	79
									core	rim
									1 σ	1 σ
									36.67	0.76
									0.04	0.06
									<0.01	<0.01
									28.10	3.47
									0.59	0.11
									0.03	0.02
									33.57	3.16
									0.36	0.06
									99.40	0.60
									67.93	4.87

Sample Position	2002/03 lava flow									
	Mounts de Fiore			rim						
Quantity n	matrix		core		inclusion		core		rim	
	5	1 σ	135	1 σ	1	30	1 σ	9	1 σ	
SiO ₂	37.79	0.61	38.46	0.56	36.85	38.76	0.43	37.60	0.58	
Al ₂ O ₃	0.04	0.01	0.03	0.01	0.03	0.02	0.01	0.04	0.04	
Cr ₂ O ₃	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	
FeO	23.19	3.86	18.15	1.21	25.94	17.47	1.55	22.86	2.96	
MnO	0.48	0.14	0.30	0.04	0.62	0.29	0.05	0.49	0.14	
NiO	0.04	0.02	0.07	0.02	0.02	0.09	0.03	0.05	0.02	
MgO	37.33	3.85	42.50	1.11	35.11	42.74	1.28	38.18	2.86	
CaO	0.42	0.11	0.28	0.04	0.25	0.26	0.02	0.33	0.07	
Total	99.40	0.33	99.83	0.42	98.85	99.66	0.36	99.61	0.73	
Mg#	73.99	5.12	80.66	1.44	70.70	81.33	1.81	74.77	3.92	

In the next step of characterising normal zoned olivine, various chemical components were examined for possible correlations. Special attention was paid to the components NiO, MnO and CaO, as they are the most distinctive elements for the differentiation of various zoning types.

The Mg# is always taken as the basis, as it represents the most characteristic property, and the values are the averaged weights for the whole individual eccentric cone and lava flow respectively.

The first investigated component is NiO, which shows a similar behaviour as Mg#, as it also decreases from core to rim (Figure 6-28).

This decrease is for Monte Spagnolo from 0.15 to 0.07 wt%, for Monte Rossi from 0.04 to 0.03 wt%, for Mounts de Fiore from 0.07 to 0.04 wt% and for the 2002/03 lava flow from 0.09 to 0.05 wt% (Table 6-6)

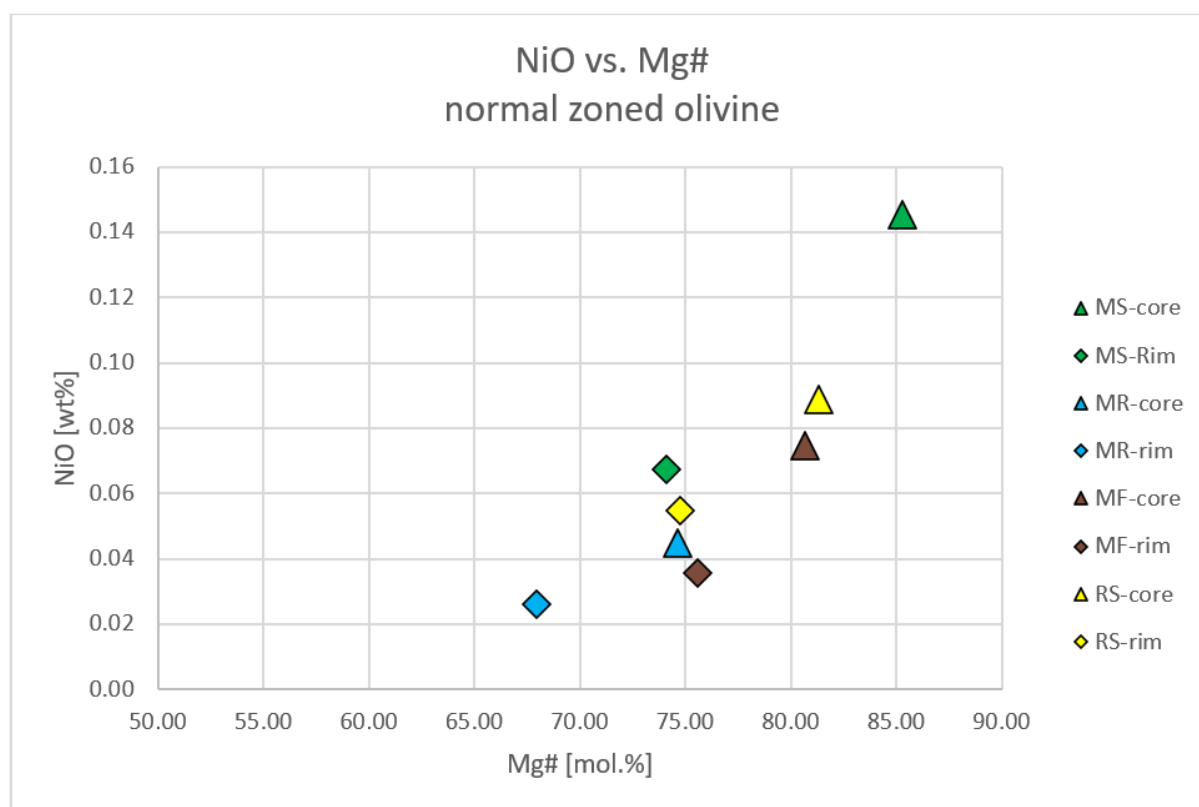


Figure 6-28: Mean NiO concentration of normal zoned olivine of the four investigated locations divided into core and rim against their Mg# (Supplementary Data 11.1)

The next component, MnO, shows exactly the opposite correlation, it increases from core to rim (Figure 6-29).

This increase is for the olivine of Monte Spagnolo from 0.24 to 0.51 wt.%, for Monte Rossi from 0.44 to 0.59 wt%, for Mounts de Fiore from 0.30 to 0.47 wt% and for the 2002/03 lava flow from 0.29 to 0.49 wt% (Table 6-6)

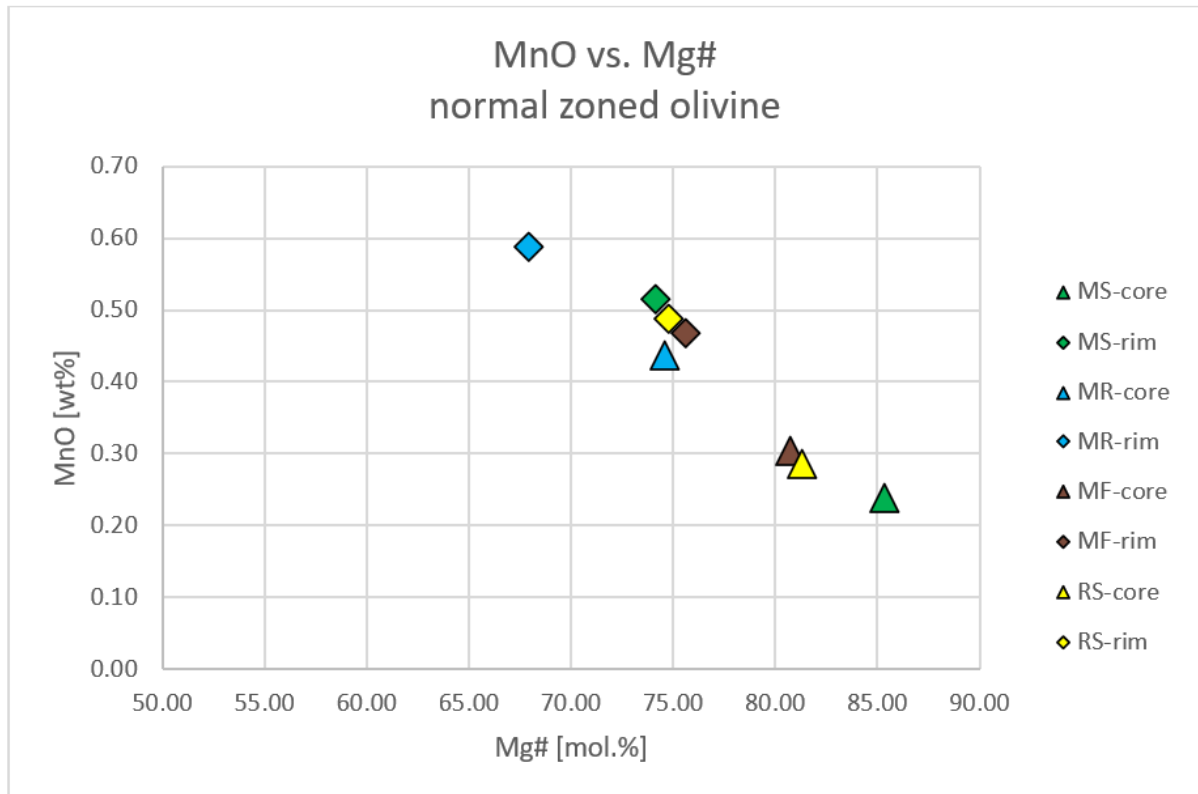


Figure 6-29: Mean MnO concentration of the normal zoned olivine of the four investigated locations divided into core and rim against their Mg# (Supplementary Data 11.1)

The last of the three most important components is CaO. It shows a similar correlation as MnO, with an increase from core to rim (Figure 6-30).

This increase is for Monte Spagnolo from 0.29 to 0.34 wt%, for Monte Rossi from 0.32 to 0.36 wt%, for Mounts de Fiore from 0.28 to 0.36 wt% and for the 2002/03 lava flow from 0.26 to 0.33 wt% (Table 6-5).

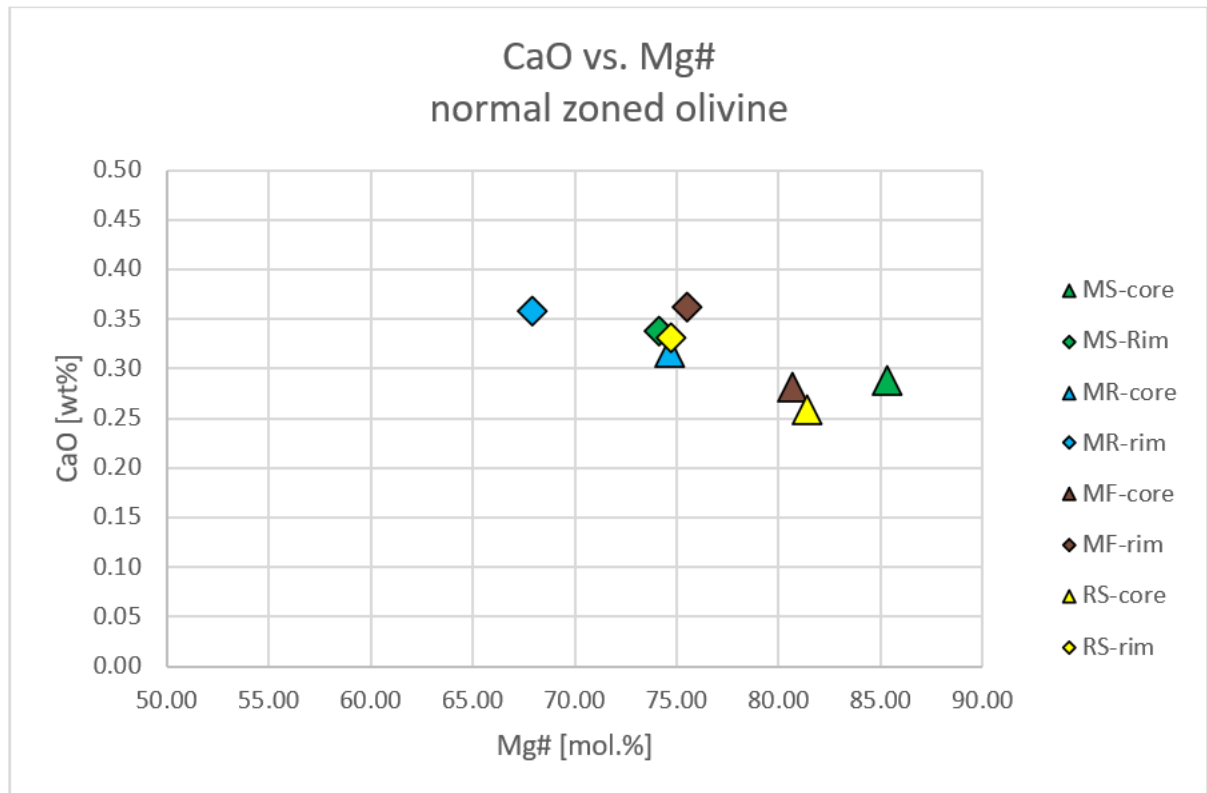


Figure 6-30: Mean CaO concentration of the normal zoned olivine of the four investigated locations divided into core and rim against their Mg# (Supplementary Data 11.1)

- **Inverse zoned olivine**

Inverse zoned olivine is found in the basalts of Monte Spagnolo, Mounts de Fiore and the 2002/03 lava flow, but not in the basalts of Monte Rossi.

Inverse zoning is characterized by lower Mg# in the core and higher Mg# in the rim (Figure 6-31).

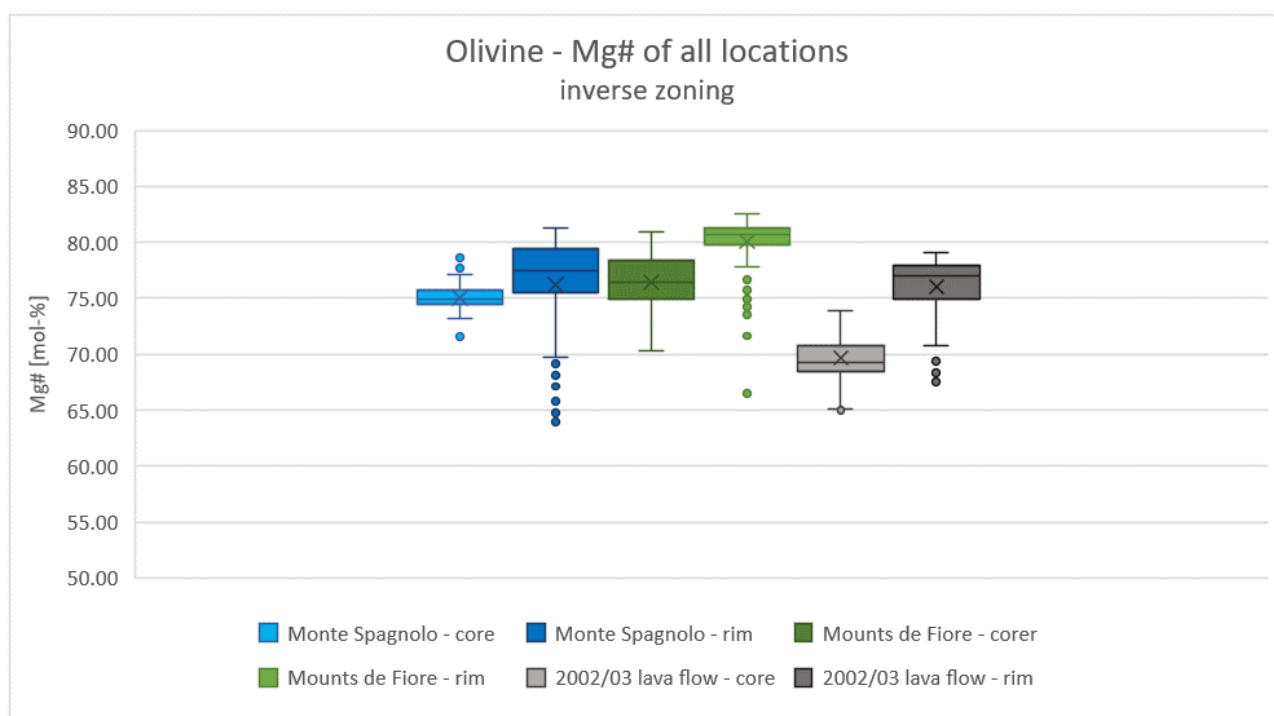


Figure 6-31: Distribution of the Mg# of inverse zoned olivine of Monte Spagnolo, Mounts de Fiore, and the 2002/03 lava flow, divided into core and rim. (Supplementary Data 11.1)

Table 6-7 shows the mean chemical compositions of normal zoned olivine for each sampling location, as well as the corresponding Mg#.

The average Mg# reaches in the core up to 76.44 for Mounts de Fiore, 75.05 for Monte Spagnolo and 69.66 mol.% for the 2002/03 lava flow.

In the rim the Mg# reaches for Mounts de Fiore to 80.08, for Monte Spagnolo to 76.24 and for the 2002/03 lava flow to 76.06 mol.%.

Table 6-7: The mean chemical composition of inverse zoned olivine for each sampling location in wt% and the mean Mg# in mol.%

Texture	Inverse zoned											
	Monte Spagnolo				Mounts de Fiore				2002/03 lava flow			
Sample Position	core		rim		core		rim		core		rim	
Quantity n	60	1 σ	58	1 σ	82	1 σ	110	1 σ	71	1 σ	88	1 σ
SiO ₂	37.83	0.58	38.08	0.79	38.17	0.65	38.78	0.64	36.69	0.34	37.59	0.63
Al ₂ O ₃	0.02	0.01	0.03	0.02	0.03	0.01	0.02	0.01	0.02	0.01	0.03	0.02
Cr ₂ O ₃	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
FeO	22.77	0.96	21.64	3.47	21.67	1.89	18.61	1.86	26.87	1.54	21.79	2.09
MnO	0.44	0.03	0.44	0.14	0.41	0.07	0.32	0.07	0.64	0.07	0.42	0.10
NiO	0.05	0.01	0.07	0.03	0.05	0.02	0.08	0.02	0.02	0.01	0.05	0.02
MgO	38.44	0.96	39.16	3.09	39.49	1.74	42.06	1.82	34.64	1.34	38.92	1.96
CaO	0.28	0.03	0.33	0.05	0.26	0.04	0.29	0.04	0.29	0.05	0.29	0.05
Total	99.87	0.76	99.79	0.71	100.10	0.59	100.18	0.64	99.21	0.49	99.12	0.66
Mg#	75.05	1.23	76.24	4.44	76.44	2.36	80.08	2.36	69.66	2.00	76.06	2.70

In the same way as the normal zoned olivine, the next step of characterising inverse zoned olivine, the same chemical components (NiO, MnO and CaO) were examined for possible correlations.

The first investigated component is NiO, which shows a similar behaviour as Mg#, as it also increases from core to rim (Figure 6-32).

This increase is for Monte Spagnolo from 0.05 to 0.07 wt%, for Mounts de Fiore from 0.05 to 0.08 wt% and for the 2002/03 lava flow from 0.02 to 0.05 wt% (Table 6-7)

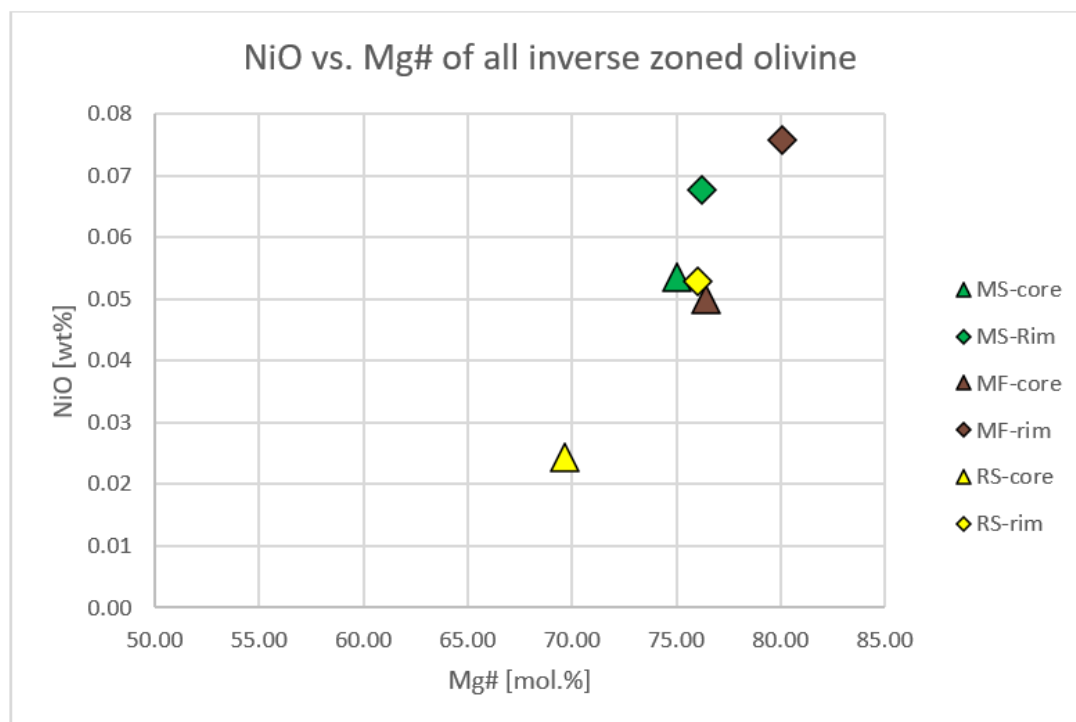


Figure 6-32: Mean NiO concentration of inverse zoned olivine of Monte Spagnolo, Mounts de Fiore, and the 2002/03 lava flow, divided into core and rim against their Mg# (Supplementary Data 11.1)

The next component, MnO, shows exactly the opposite correlation, it decreases from core to rim (Figure 6-33).

This decrease is for Mounts de Fiore from 0.41 to 0.32 wt% and for the 2002/03 lava flow from 0.64 to 0.42 wt% (Table 6-7)

But it is not visible for the olivine of Monte Spagnolo, as it remains constant at 0.44 wt% for the core and for the rim. A closer look on the distribution of the results at Monte Spagnolo allows us to see the same differences as in the other two locations: a decrease from core to rim (Figure 6-34)

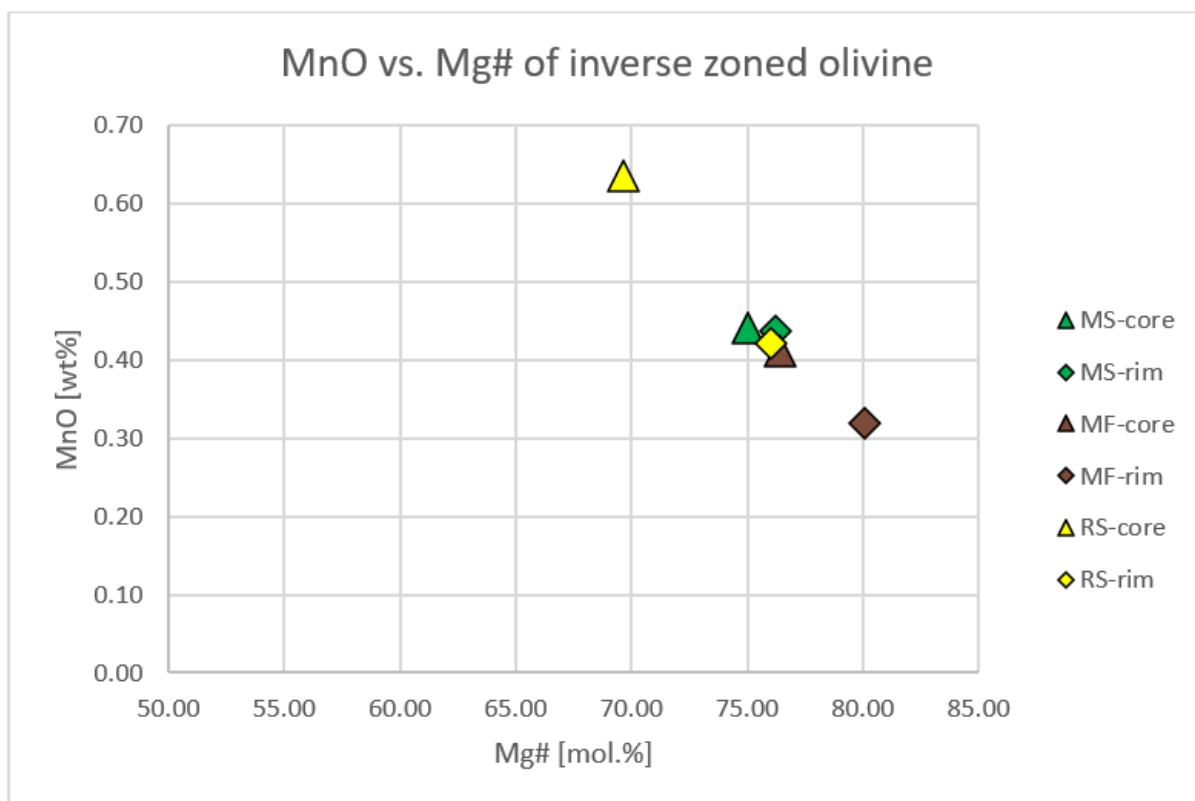


Figure 6-33: Mean MnO concentration of inverse zoned olivine of Monte Spagnolo, Mounts de Fiore, and the 2002/03 lava flow, divided into core and rim against their Mg# (Supplementary Data 11.1)

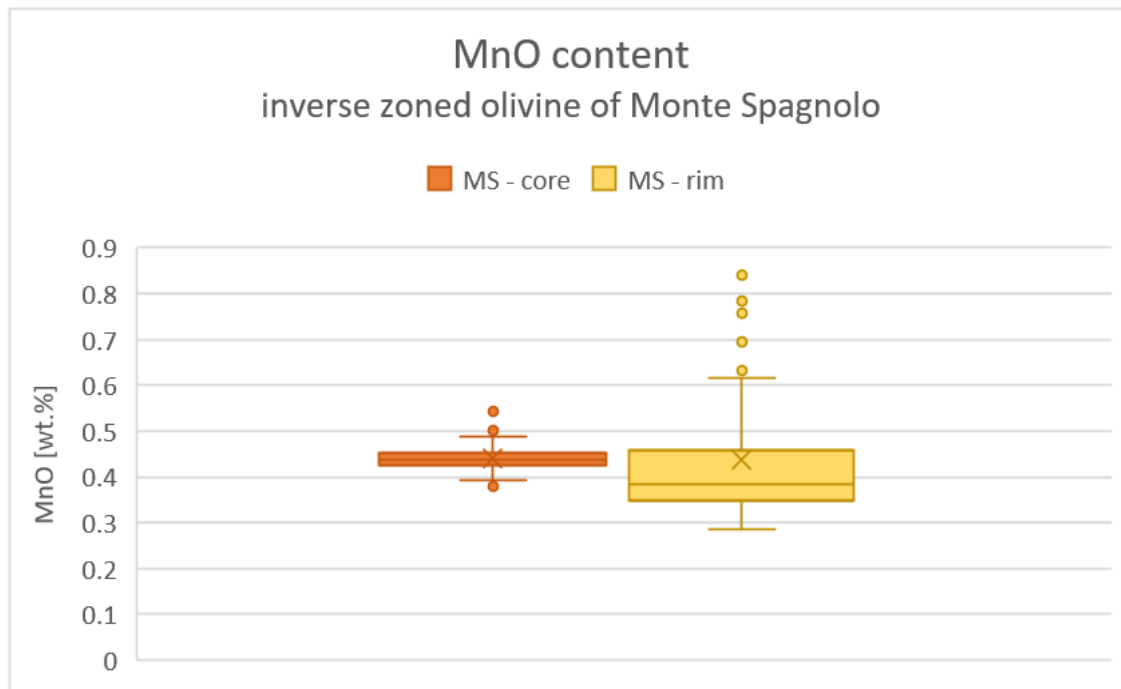


Figure 6-34: Distribution of the MnO content of inverse zoned olivine of Monte Spagnolo, divided into core and rim. (Supplementary Data 11.1)

The last of the three most important components is CaO. It shows a similar correlation as MnO, with a decrease from core to rim (Figure 6-35).

This decrease is for Monte Spagnolo from 0.28 to 0.33 wt% and for Mounts de Fiore from 0.26 to 0.29 wt%. The 2002/03 lava flow shows neither a decrease nor an increase, as it remains at ~ 0.29 wt% (Table 6-7).

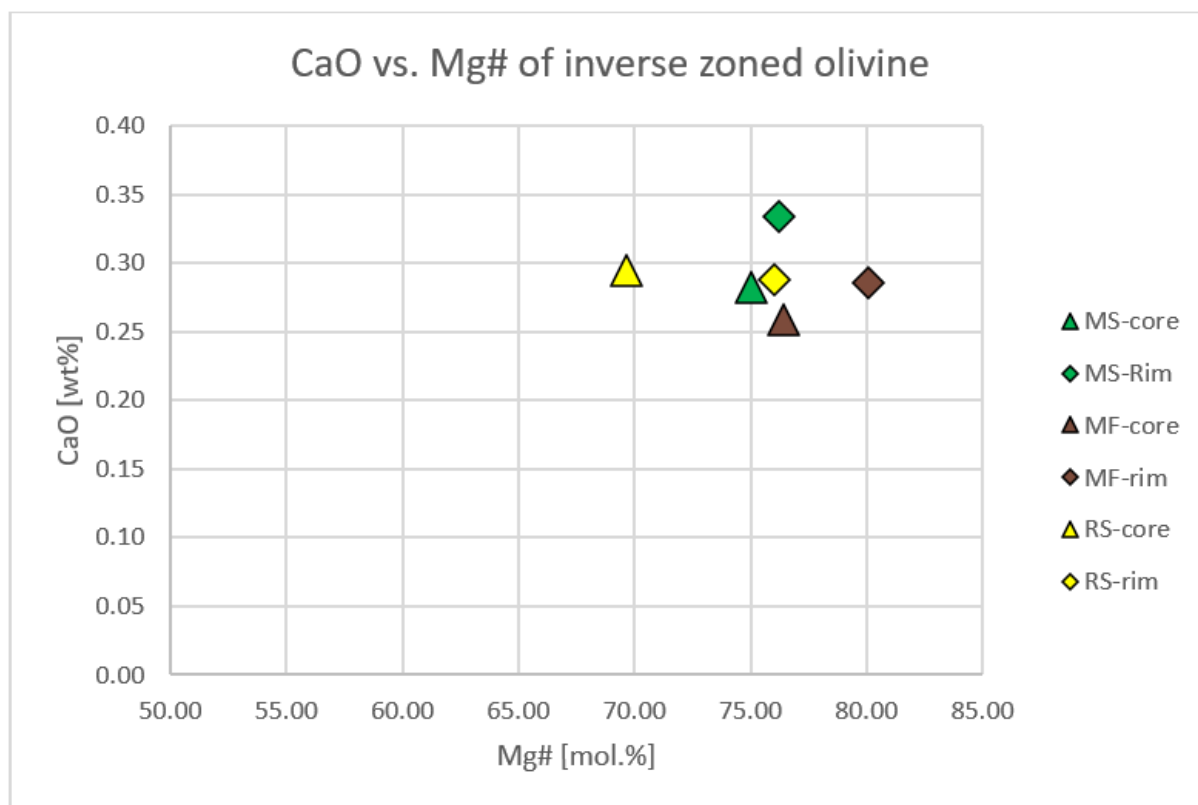


Figure 6-35: Mean CaO concentration of Monte Spagnolo, Mounts de Fiore, and the 2002/03 lava flow, divided into core and rim against their Mg# (Supplementary Data 11.1)

Even a closer look at the distribution of the results of the 2002/03 lava flow offers no additional insight (Figure 6-36)

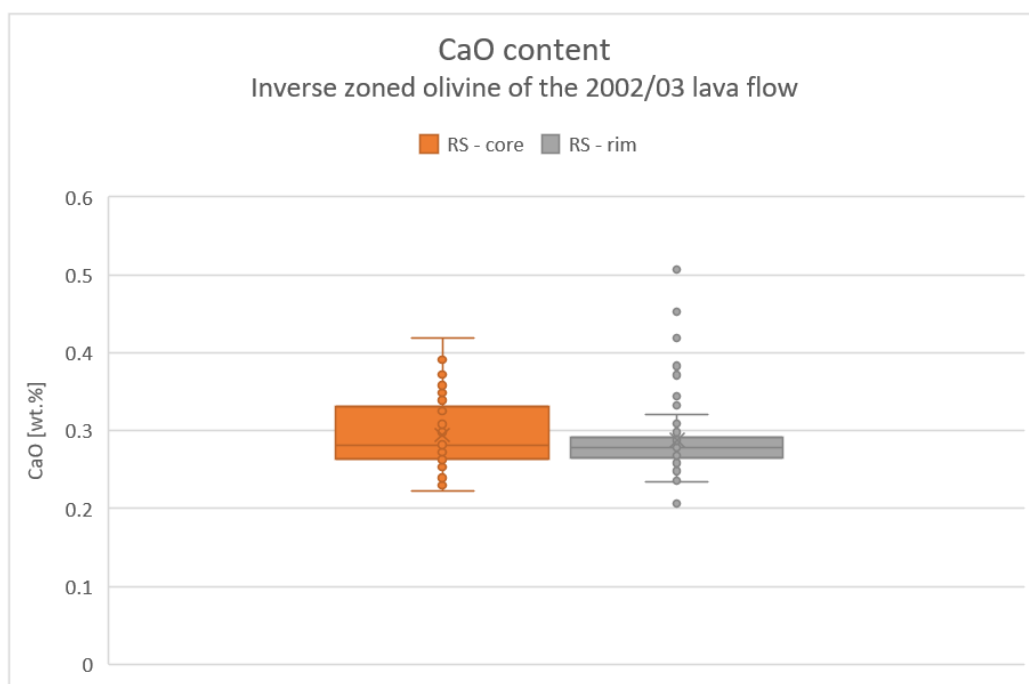


Figure 6-36: Distribution of the CaO content of inverse zoned olivine of the 2002/03 lava flow, divided into core and rim. (Supplementary Data 11.1)

6.4.2.2. Detailed classification

Quantitative elemental line scans from core to rim in each type of olivine zoning (normal- and inverse- zoned) could provide useful information about complex geochemical evolution of the studied lavas.

- **Normal zoned olivine**

The normal zoned olivine can be distinguished into two different subtypes:

- Subtype 1: Weak decrease of Mg# at the crystal rim
- Subtype 2: Strong decrease of Mg# at the crystal rim

Each subtype is characteristic for two of the locations. Olivine from Monte Spagnolo and Monte Rossi mainly show a weak decrease of Mg# at the rim (Sub-type 1), whereas olivine from Mounts the Fiore and the 200/03 lava flow show strong decrease of Mg# at the rim (Sub-type 2).

Subtype 1: Weak decrease of Mg# at the crystal rim

Both Mounts de Fiore and the 2002/03 lava flow are characterized by a core with a Mg# of around 81 mol.% and a rim of around 75 mol.% (Table 6-6).

Figure 6-37 shows the decrease of the Mg# from core to rim of a representative line scan on a subtype 1 olivine (Fig. 5-40 and Table 6-8).

The Mg# remains constant until the very edge of the crystal, where it drops from around 81 mol.% to 78 mol.% (Fig. 5.38).

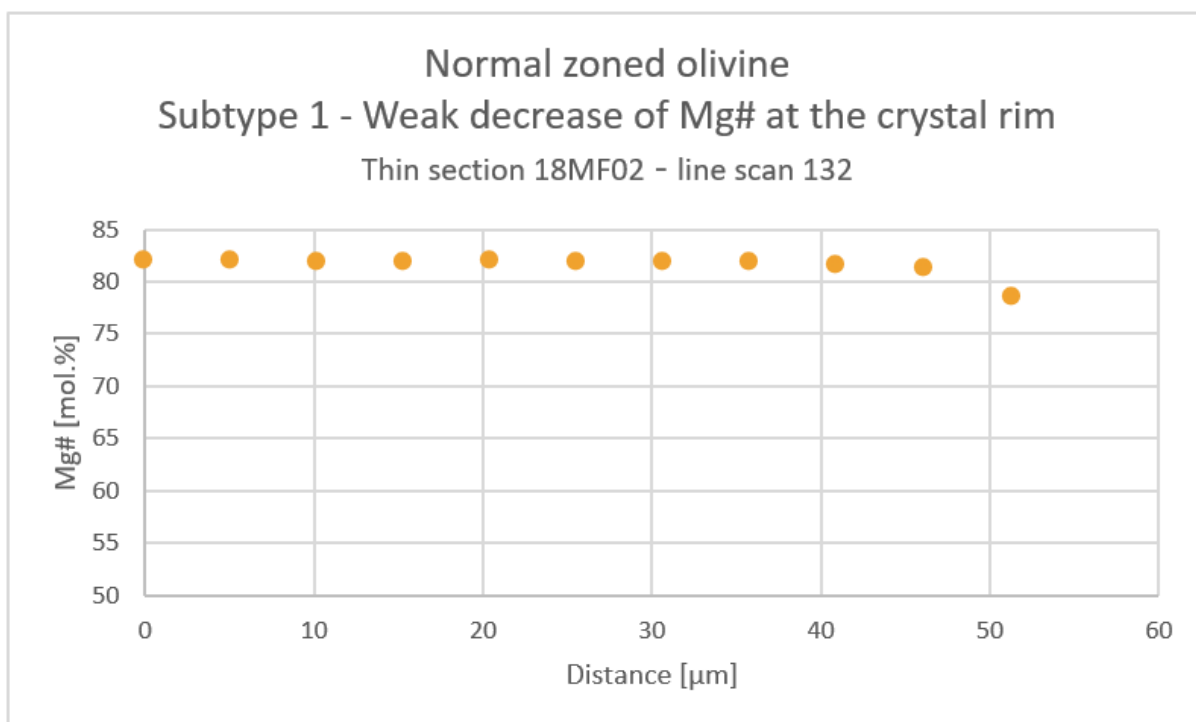


Figure 6-37: Representative Mg# profile of a normal zoned Subtype 1 olivine: Line scan 132, from core towards the rim, on thin section 18MF02 (Data see Table 6-8)

The NiO content follows the same trend as the Mg#. It stays more or less constant until the last few micrometres of the olivine, where it drops from 0.08 to 0.06 wt%. The CaO and MnO content is for most parts of the olivine roughly identical, with around 0.25 to 0.30 wt%. In contrast to Mg# and NiO, these components rise in the rim by appr. 0.01 – 0.05 wt% to 0.32 wt% (Figure 6-38).

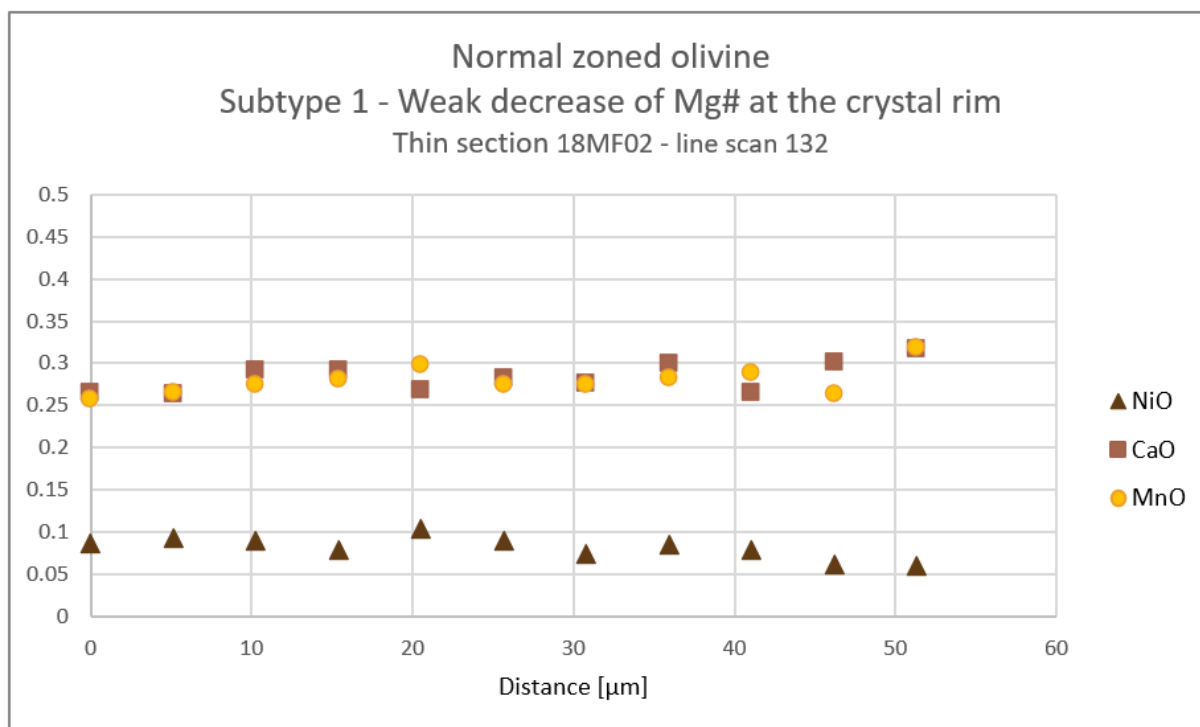


Figure 6-38: Representative profiles of the NiO, CaO and MnO content [wt%] on a normal zoned Subtype 1 olivine: Line scan 132, from core towards the rim, on thin section 18MF02 (Data see Table 6-8)

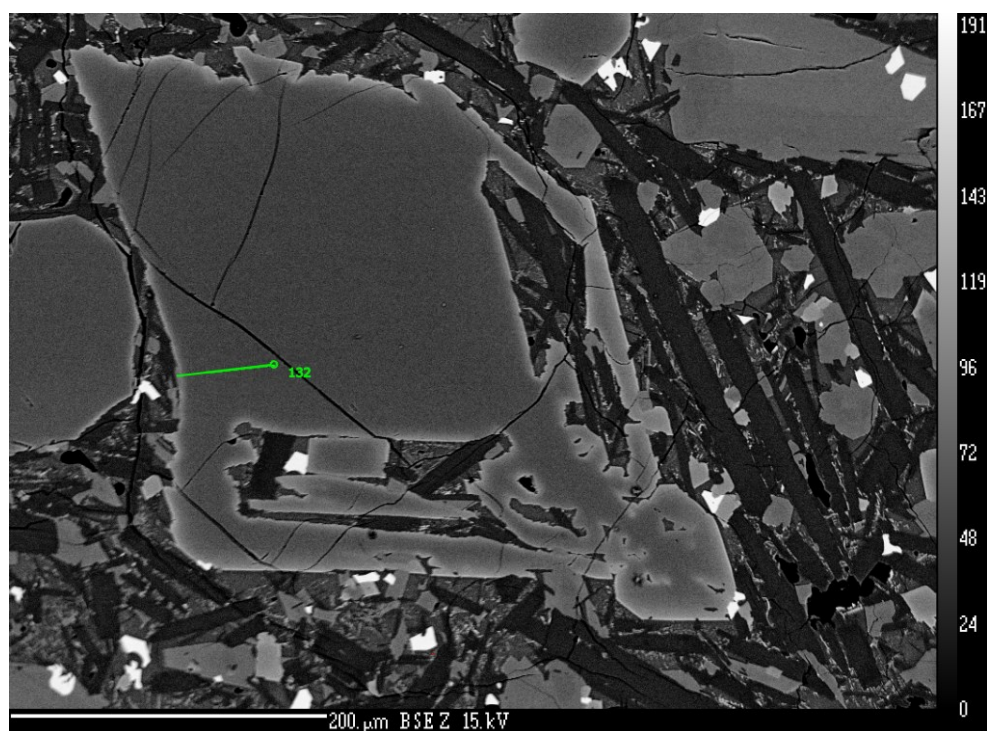


Figure 6-39: Position of the line scan 132 on the normal zoned Subtype 1 - olivine on thin section 18MF02

Table 6-8: Composition of line scan 132 on a normal zoned olivine of Mounts de Fiore (18MF02)

Distance (μ)	SiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO	MnO	NiO	MgO	CaO	Total	Mg#
0	38.34	0.02	0	16.99	0.26	0.09	43.39	0.27	99.36	82.0
5.13	38.39	0.03	0	17.08	0.27	0.09	43.64	0.26	99.78	82.0
10.26	38.32	0.03	0	17.20	0.27	0.09	43.33	0.29	99.56	81.8
15.39	38.39	0.02	0	17.29	0.28	0.08	43.67	0.29	100.05	81.8
20.52	38.48	0.03	0.02	17.33	0.30	0.10	43.81	0.27	100.38	81.8
25.65	38.44	0.03	0	17.39	0.27	0.09	43.77	0.28	100.30	81.8
30.78	38.33	0.03	0	17.24	0.27	0.07	43.19	0.28	99.44	81.7
35.91	38.30	0.02	0	17.35	0.28	0.09	43.31	0.30	99.66	81.7
41.04	38.44	0.03	0	17.36	0.29	0.08	42.88	0.27	99.38	81.5
46.17	38.42	0.04	<0.01	17.80	0.26	0.06	42.89	0.30	99.82	81.1
51.31	38.03	0.02	0	20.04	0.32	0.06	40.79	0.32	99.62	78.4

Subtype 2: Strong decrease of Mg# at the crystal rim

The second subtype of normal zoned olivine is characterized by a steep drop of the Mg# at the rim of the crystal. This subtype is mostly found in the basalts of Monte Spagnolo and Monte Rossi.

The average core Mg# in the Monte Spagnolo olivine is around 85 and in the rim 74 mol.%. For the olivine of Monte Rossi, the Mg# lies in the core at ~75 and in the rim at ~68 mol.% (Table 6-6).

Even though the difference in the average Mg# is around 10 mol.%, the patterns of the line scans is very similar for both locations. They are characterized by a wide core with a constant to slightly declining Mg# and a rim steep declining Mg#.

Line scan 109 of the thin section 18MR01 from Monte Rossi shows a core with a more or less constant Mg# around 75 mol.% and then a steep decline towards and inside the rim area to 63 mol.% (Figure 6-40). Line scan 84 of thin section 18MS01 from Monte Spagnolo shows an olivine crystal with a slightly declining Mg# from the core towards the rim from around 89 to 86 mol.% and then dropping rapidly in the rim area down to 73 mol.%. A BSE-image of the two olivine crystals is depicted in Figure 6-45 respectively.

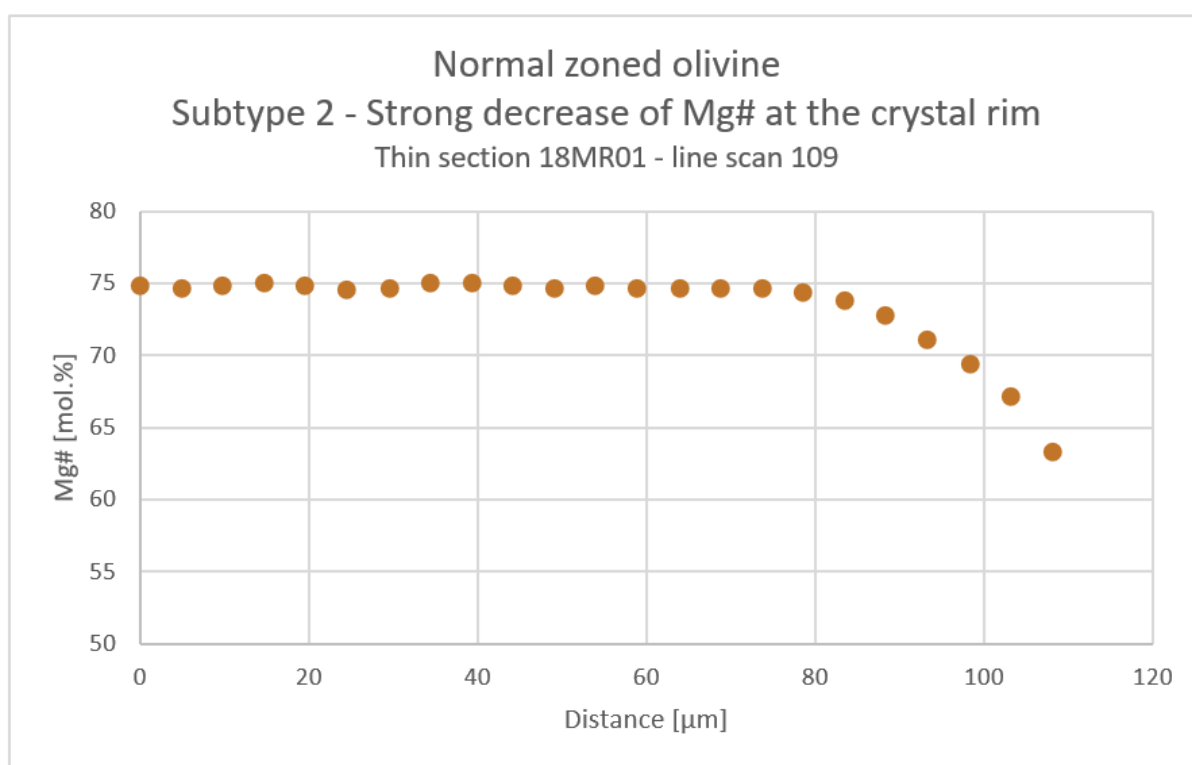


Figure 6-40: Representative Mg# profile of a normal zoned Subtype 2 olivine: Line scan 109, from core towards the rim, on thin section 18MR01 (Data see Table 6-10)

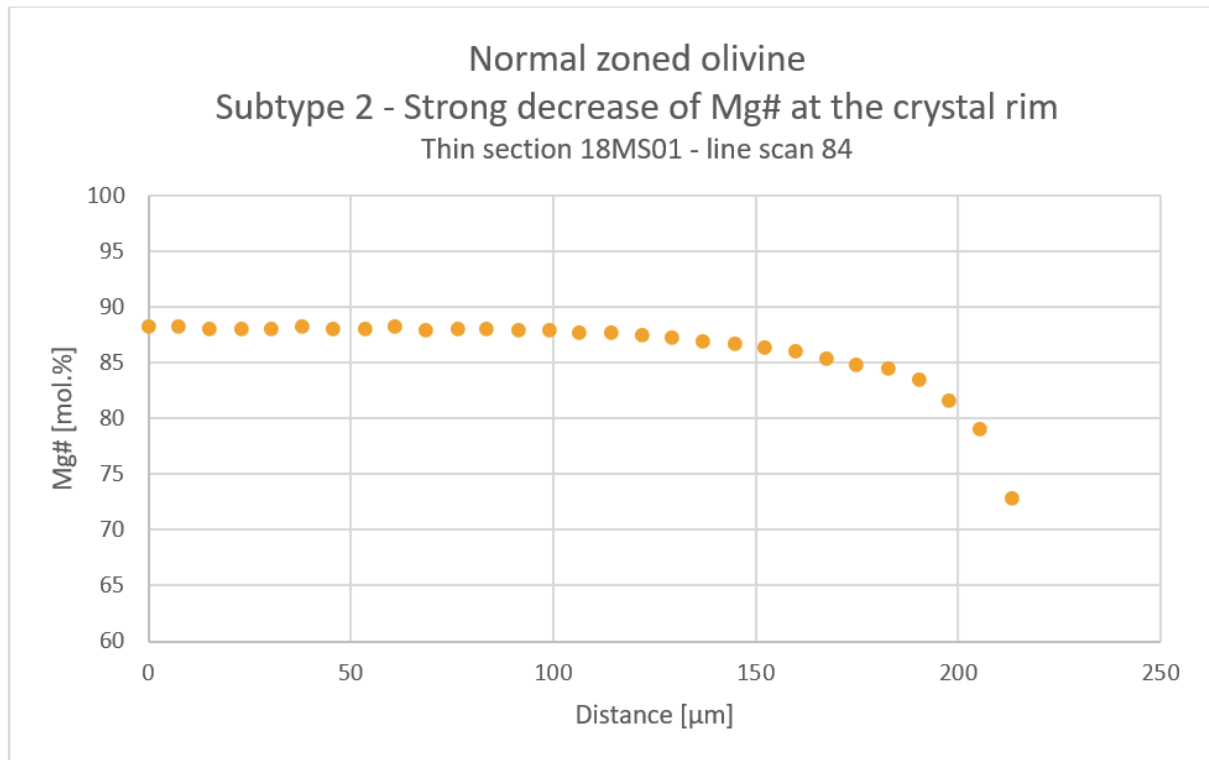


Figure 6-41: Representative Mg# profile of a normal zoned Subtype 2 olivine: Line scan 84, from core towards the rim, on thin section 18MS01 (Data see Table 6-9)

The differences in the concentrations of chemical components between the two locations is also visible in the oxides, like NiO, MnO and CaO. But again, the change in the concentrations from core to rim is similar.

The average NiO content for the samples from Monte Spagnolo is 0.16 wt% in the olivine cores and 0.10 wt% in the olivine rims. For the olivine of Monte Rossi, the average NiO concentration lies in the core at 0.04 and in the rim at 0.02 wt%. Therefore, in both locations there is a decline of NiO towards the crystal rim. This decline is not linear but, similar to the Mg#, shallow in the core and steep in the rim (Figure 6-42).

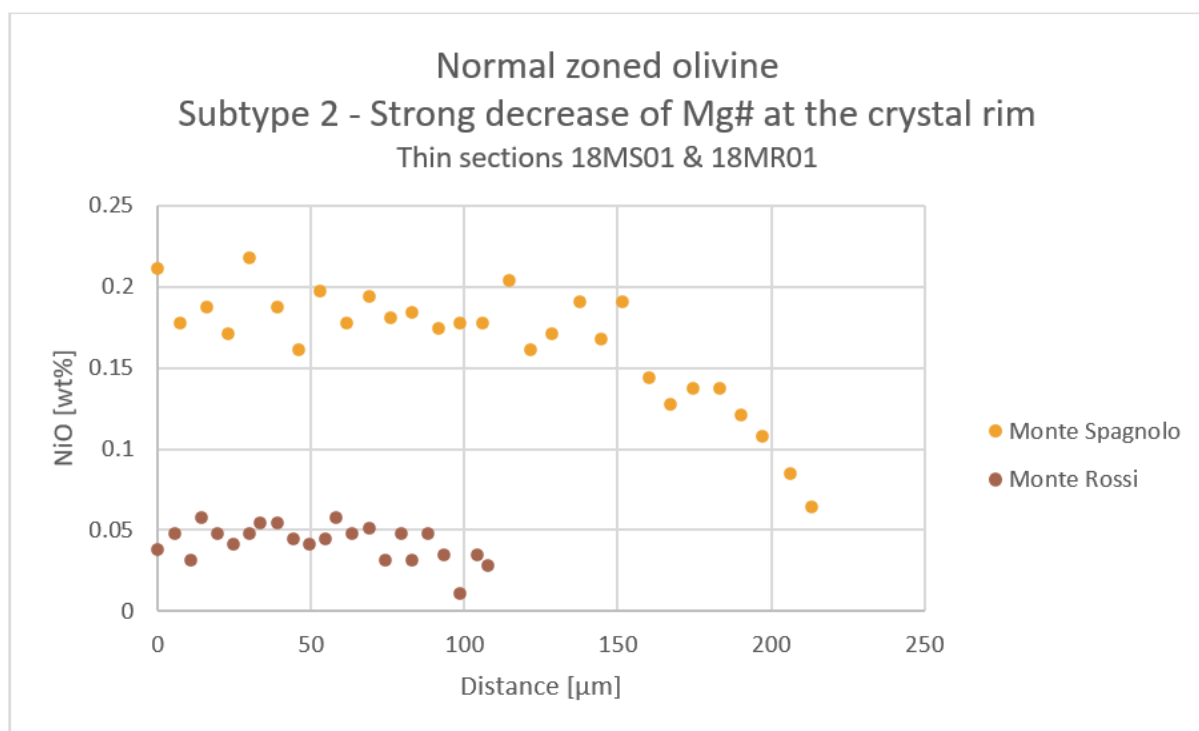


Figure 6-42: Representative profile of the NiO content [wt%] on two normal zoned Subtype 2 olivine, from core to rim: Line scan 84 on thin section 18MS01 and line scan 109 on thin section 18MR01 (Data see Table 6-9 and Table 6-10)

The MnO profiles in the two sampling locations, have similar patterns even though at slightly different concentration levels. For Monte Rossi, the MnO rises in the olivine from around 0.4 in the core up to 0.7 wt% in the rim. The line scan of Monte Spagnolo shows the same trend, but with a core concentration of around 0.2 wt% and a rise in the rim up to 0.6 wt% (Figure 6-43).

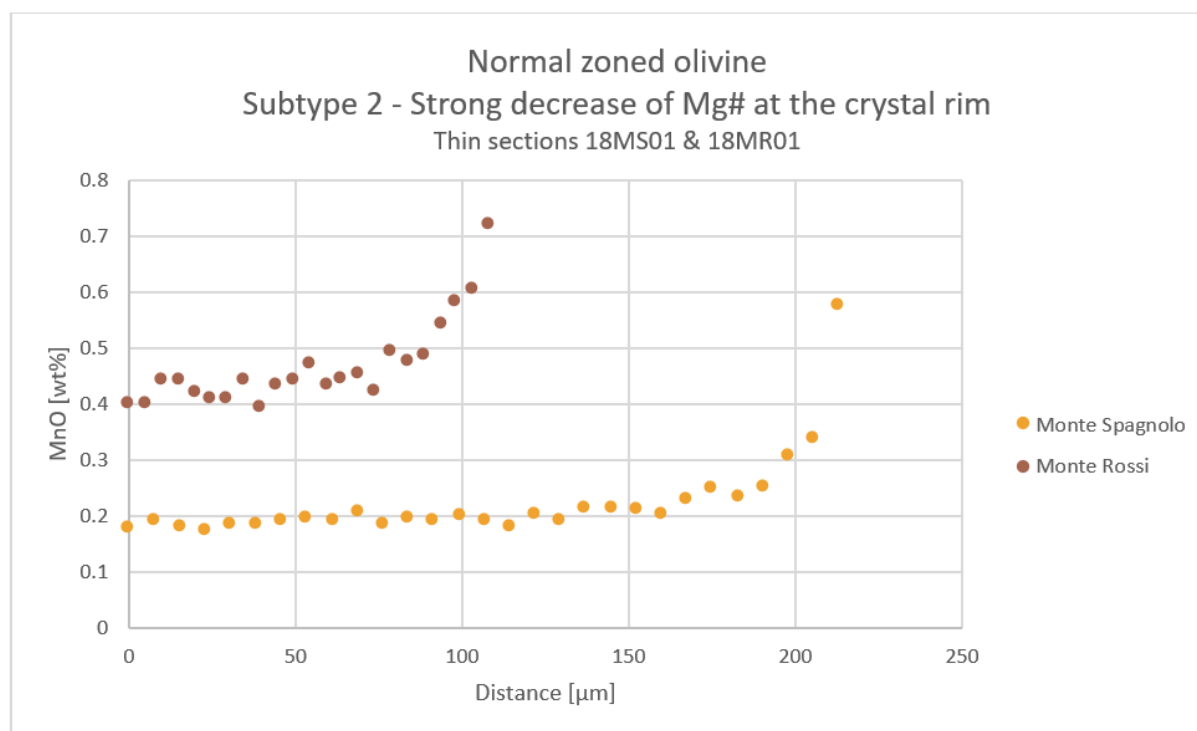


Figure 6-43: Representative profile of the MnO content [wt%] on two normal zoned Subtype 2 olivine, from core to rim: Line scan 84 on thin section 18MS01 and line scan 109 on thin section 18MR01 (Data see Table 6-9 and Table 6-10)

The differences in the CaO concentrations are not that significant for the two sampling locations, compared to MnO, NiO or the Mg#. Even though the analyses are quite noisy a trend of constant concentration in the core, with a rise in the rim can be seen only in the MF olivine. The CaO profile in the MS olivine does not show any significant zoning.

The CaO concentration for Monte Rossi is around 0.3 in the core and rises up to 0.40 wt% in the rim. At Monte Spagnolo the core concentration is around 0.28 to 0.32 and rises in the rim up to 0.40 wt% (Figure 6-44, Table 6-9 and Table 6-10).

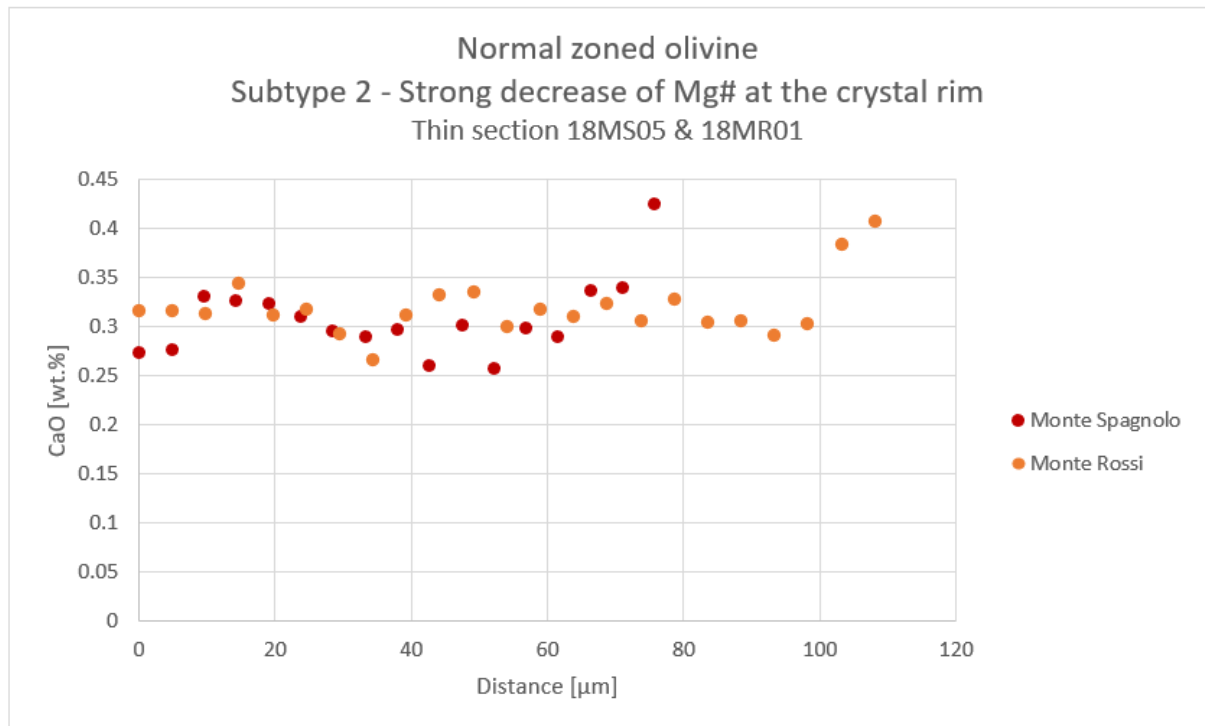


Figure 6-44: Representative profile of the CaO content [wt%] on two normal zoned Subtype 2 olivine, from core to rim: Line scan 36 on thin section 18MS05 and line scan 109 on thin section 18MR01 (Data see Table 6-9 and Table 6-10)

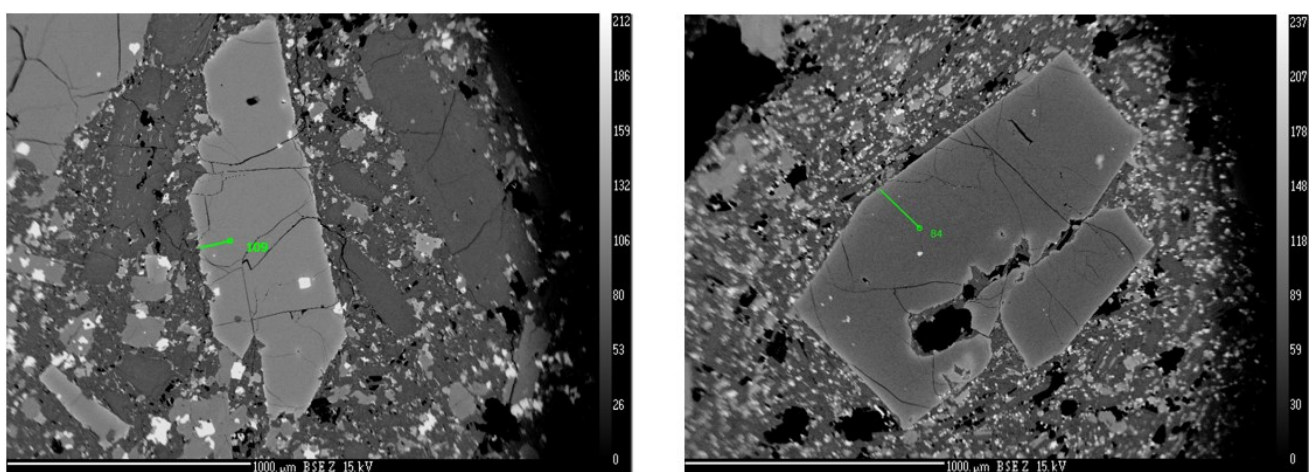


Figure 6-45: Position of the line scans on the normal zoned Subtype 2 olivine: Monte Rossi - 18MR01 (left) and Monte Spagnolo - 18MS01 (right)

Table 6-9: Composition of line scan 84 on a normal zoned olivine of Monte Spagnolo (18MS01)

Distance [μm]	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	Total	Mg#
0.00	40.82	0.03	0.03	11.22	0.18	0.21	47.14	0.26	99.91	88.22
7.61	40.89	0.01	0.05	11.13	0.19	0.18	47.33	0.27	100.08	88.34
15.22	40.97	0.02	0.04	11.25	0.18	0.19	46.94	0.25	99.84	88.15
22.82	40.65	0.04	0.03	11.31	0.18	0.17	46.83	0.23	99.44	88.07
30.43	40.75	<0.01	0.04	11.33	0.19	0.22	47.06	0.25	99.85	88.10
38.04	40.87	0.03	0.04	11.22	0.19	0.19	46.97	0.28	99.81	88.18
45.65	40.74	0.02	0.05	11.26	0.19	0.16	46.88	0.28	99.55	88.13
53.26	40.72	0.02	0.03	11.23	0.20	0.20	46.76	0.23	99.40	88.13
60.86	40.68	0.02	0.04	11.23	0.19	0.18	47.18	0.26	99.80	88.22
68.47	40.89	0.02	0.04	11.36	0.21	0.19	46.59	0.29	99.63	87.97
76.08	40.59	0.03	0.05	11.45	0.19	0.18	47.02	0.29	99.81	87.99
83.69	40.69	0.01	0.04	11.28	0.20	0.19	46.60	0.22	99.20	88.05
91.30	40.74	0.03	0.05	11.60	0.19	0.17	46.82	0.26	99.88	87.80
98.91	40.66	0.04	0.03	11.52	0.20	0.18	46.82	0.27	99.75	87.87
106.52	40.69	0.02	0.04	11.60	0.19	0.18	46.54	0.26	99.51	87.74
114.12	40.47	0.02	0.03	11.71	0.18	0.20	46.56	0.26	99.45	87.63
121.73	40.38	0.02	0.03	11.87	0.21	0.16	46.49	0.30	99.46	87.47
129.34	40.69	0.02	0.02	12.00	0.19	0.17	46.15	0.27	99.53	87.27
136.95	40.51	0.03	0.04	12.33	0.21	0.19	46.11	0.27	99.72	86.96
144.55	40.33	<0.01	0.03	12.37	0.22	0.17	45.67	0.26	99.07	86.81
152.16	40.27	0.03	0.03	12.82	0.21	0.19	45.67	0.27	99.49	86.39
159.77	40.33	0.01	0.02	13.18	0.21	0.15	45.40	0.25	99.55	85.99
167.38	40.10	0.04	0.03	13.64	0.23	0.13	44.88	0.27	99.35	85.43
174.99	39.91	<0.01	0.02	14.20	0.25	0.14	44.81	0.28	99.65	84.91
182.59	40.05	0.01	0.03	14.58	0.24	0.14	44.37	0.24	99.65	84.43
190.20	39.86	0.03	0.02	15.35	0.25	0.12	43.49	0.26	99.36	83.47
197.81	39.52	0.03	0.02	17.03	0.31	0.11	42.27	0.26	99.57	81.57
205.42	39.20	0.02	<0.01	19.07	0.34	0.09	40.34	0.26	99.31	79.03
213.03	37.92	0.03	<0.01	23.92	0.58	0.06	35.93	0.27	98.78	72.81

Table 6-10: Composition of line scan 109 on a normal zoned olivine of Monte Rossi (18MR01)

Distance [μm]	SiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO	MnO	NiO	MgO	CaO	Total	Mg#
0.00	37.99	0.02	<0.01	22.94	0.40	0.04	38.21	0.32	99.94	74.81
4.91	37.63	0.02	<0.01	22.84	0.40	0.05	37.90	0.32	99.19	74.73
9.83	37.78	0.02	0.01	22.93	0.44	0.03	38.37	0.31	99.93	74.89
14.74	37.73	0.01	<0.01	22.79	0.44	0.06	38.34	0.34	99.74	75.00
19.65	37.69	0.02	<0.01	22.94	0.42	0.05	38.39	0.31	99.85	74.89
24.56	37.82	0.03	0.02	23.07	0.41	0.04	37.97	0.32	99.70	74.58
29.48	37.80	0.02	<0.01	22.87	0.41	0.05	37.94	0.29	99.42	74.73
34.39	37.79	0.03	<0.01	22.68	0.44	0.05	38.10	0.27	99.38	74.97
39.30	37.80	0.03	<0.01	22.77	0.39	0.06	38.31	0.31	99.69	74.99
44.21	37.80	0.02	0.02	22.85	0.44	0.05	37.99	0.33	99.50	74.77
49.13	37.65	0.04	<0.01	23.05	0.44	0.04	38.16	0.34	99.74	74.69
54.04	37.84	0.02	<0.01	22.84	0.47	0.05	38.12	0.30	99.68	74.84
58.95	37.65	0.03	0.01	23.07	0.44	0.06	38.14	0.32	99.73	74.66
63.86	37.83	<0.01	<0.01	23.11	0.45	0.05	38.14	0.31	99.91	74.63
68.78	38.05	0.02	<0.01	23.04	0.45	0.05	38.23	0.32	100.19	74.74
73.69	37.63	0.04	<0.01	23.05	0.42	0.03	38.16	0.31	99.64	74.69
78.60	37.43	0.02	<0.01	23.29	0.50	0.05	37.98	0.33	99.61	74.41
83.51	37.90	0.04	<0.01	23.67	0.48	0.03	37.26	0.30	99.72	73.73
88.43	37.49	0.03	<0.01	24.56	0.49	0.05	36.65	0.31	99.60	72.68
93.34	37.05	0.04	0.01	25.76	0.54	0.04	35.50	0.29	99.25	71.07
98.25	36.90	0.02	<0.01	27.12	0.58	<0.01	34.56	0.30	99.51	69.43
103.16	36.65	0.01	<0.01	28.46	0.61	0.03	32.61	0.38	98.79	67.13
108.08	36.24	0.02	<0.01	31.80	0.72	0.03	30.64	0.41	99.91	63.20

- **Inverse zoned olivine**

Olivine with an inversed zoning is characterized, as already described in chapter 6.2.2 , by an increase of Mg# towards the rim. This increase is caused either by the marginal re-growth of existing olivine crystals or by diffusion. For both scenarios a MgO-source is needed, which makes the inverse zoning often a good indicator for the influx of fresh magma or magma mixing in general.

Whether crystal growth or diffusion is the determining process depends on the time span until the closure temperature is reached. Depending on the determining process the transition from the old crystal to the newly formed crystal rim can be:

- Subtype 1: Diffusion
 - 1.1. Diffusion with a sharp border
 - 1.2: Diffusion with an indistinct border
 - 1.3: Diffusion with a smooth transition
- Subtype 2: New Growth

Subtype 1.1 – Diffusion with a sharp border

Olivine from Monte Spagnolo mainly shows a sharp border between core and (re-grown) rim. This is also visible in the geochemical data and in the BSE-images (Figure 6-46).

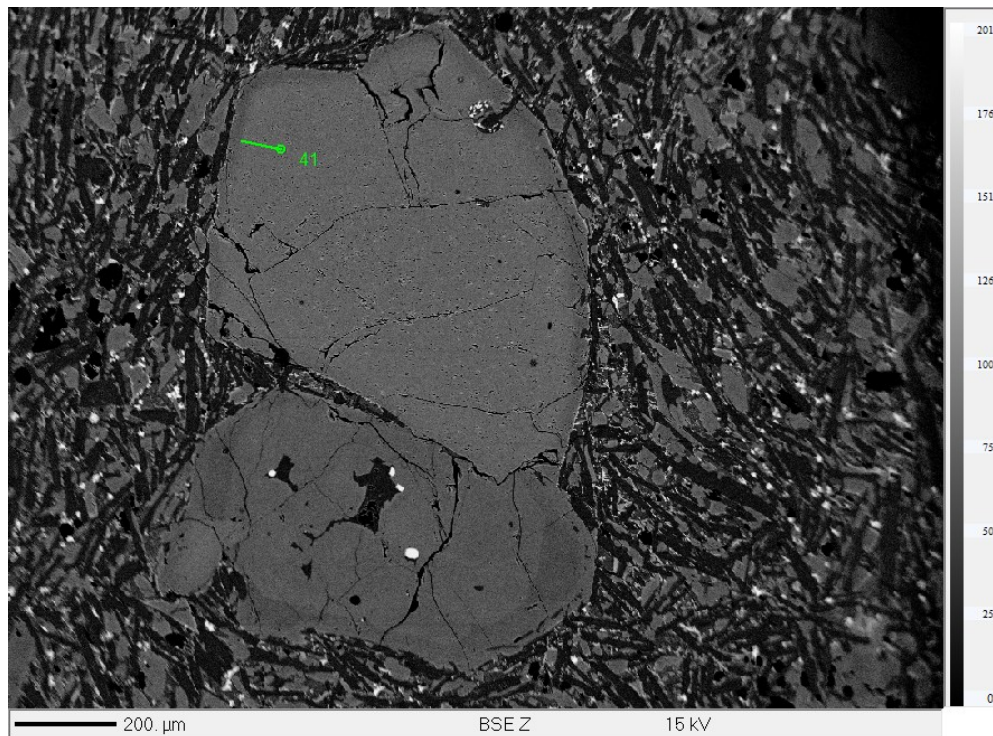


Figure 6-46: Position of the line scan 41 on the inverse zoned Subtype 1 olivine: Monte Spagnolo – 18MS05

As an example, line scan 41 of thin section 18MS05 was chosen. The Mg# concentration is decreasing from the core towards the rim (distance along the scan line appr. 0 – 40 μm), which is characteristic for a simple normal zoning. But then a rapid increase in the Mg# from 75 to almost 79 mol.% (appr. 40 – 65 μm) shows the diffusion with its surroundings. The Mg# of this rim then decreases again (distance along the scan line appr. 65 – 75 μm) to around 78 mol.% (Figure 6-47).

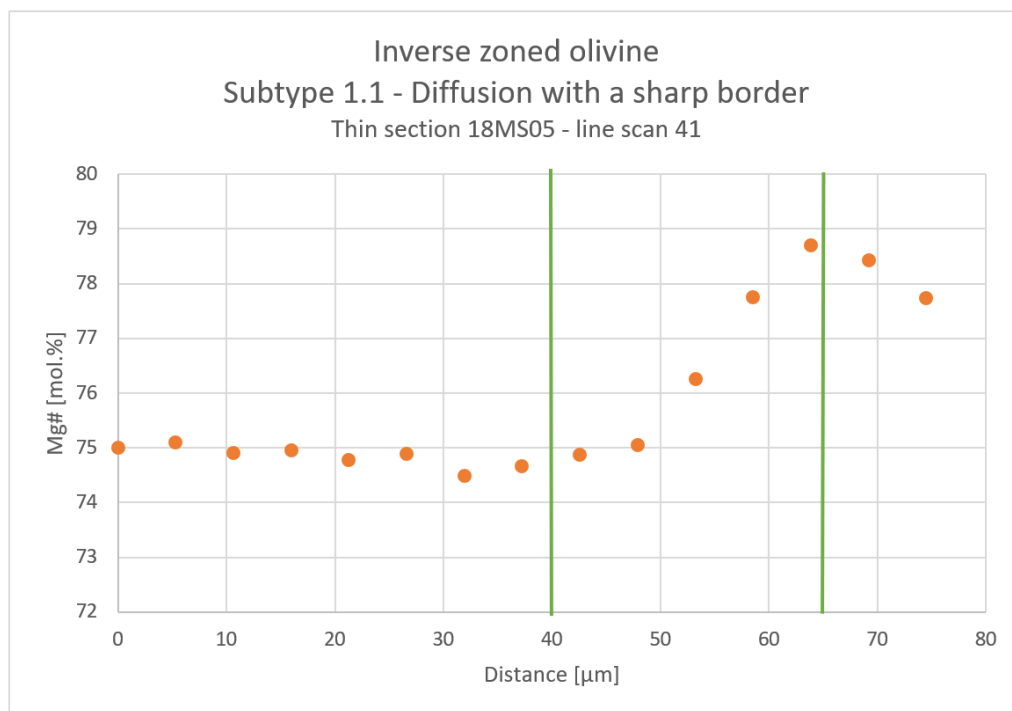


Figure 6-47: Representative Mg# profile of an inverse zoned Subtype 1.1 olivine: Line scan 41, from core towards the rim, on thin section 18MS05 (Data see Table 6-11)

The inverse zoning pattern can also be observed for the MnO and CaO concentrations. In the crystal core, distance from centre appr. 0 – 40 μm , the trend of the considered element concentrations is similar to “normal zoning” behaviour. Then, between 40 and 65 μm distance along the scan line, a rapid (even though not that significant as in the Mg#) change in the trend is observed. The MnO concentration shows, similar to the Mg#, yet another reversal in the trend between 65 and 75 μm and rises again according to a “normal zoning” behaviour. The CaO concentration shows, in this line scan, no change in the last 10 μm , but continues to rise (Figure 6-48).

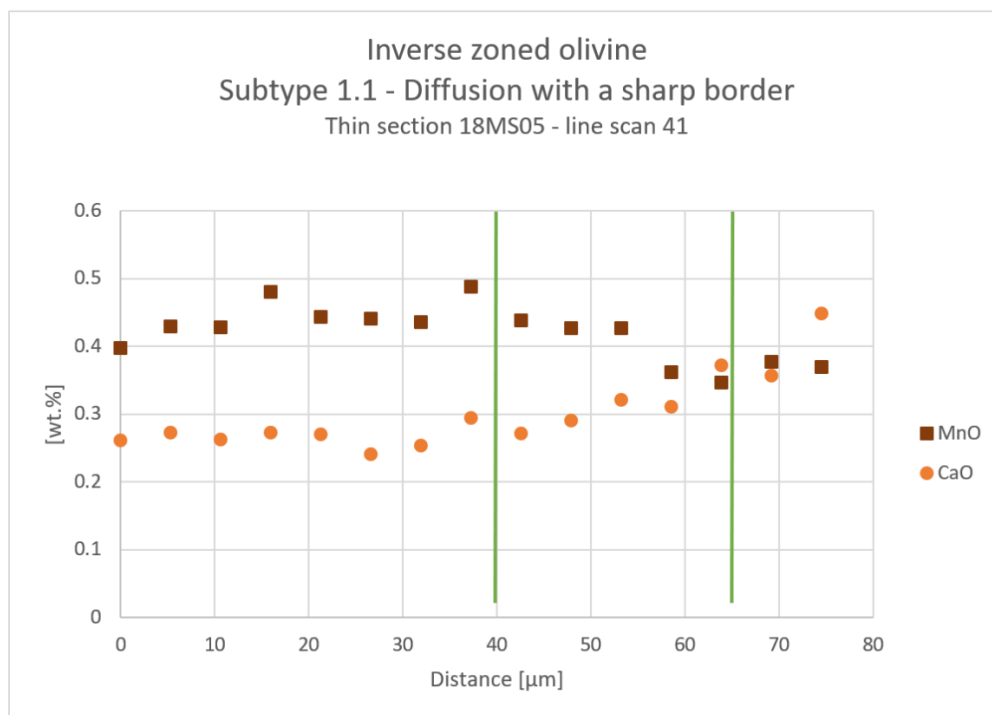


Figure 6-48: Representative profiles of the MnO and Cao content [wt%] on an inverse zoned Subtype 1.1 olivine: Line scan 41, from core towards the rim, on thin section 18MS05 (Data see Table 6-11)

Table 6-11: Composition of line scan 41 on an inverse zoned olivine of Monte Spagnolo (18MS05)

Distance [μm]	SiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO	MnO	NiO	MgO	CaO	Total	Mg#
0.00	38.09	0.02	0.01	23.03	0.40	0.05	38.76	0.26	100.61	75.00
5.32	38.03	0.03	<0.01	23.02	0.43	0.06	38.96	0.27	100.81	75.10
10.64	38.37	0.01	<0.01	23.05	0.43	0.04	38.60	0.26	100.80	74.90
15.97	38.45	0.02	<0.01	22.87	0.48	0.04	38.41	0.27	100.58	74.96
21.29	38.34	0.02	<0.01	23.24	0.44	0.03	38.66	0.27	101.03	74.78
26.61	38.28	0.02	0.01	23.01	0.44	0.07	38.51	0.24	100.62	74.90
31.93	38.66	0.02	<0.01	23.33	0.44	0.06	38.22	0.25	101.02	74.49
37.25	38.33	0.02	0.01	23.21	0.49	0.05	38.37	0.29	100.81	74.66
42.58	38.11	0.02	0.01	23.15	0.44	0.04	38.71	0.27	100.77	74.88
47.90	38.55	0.02	<0.01	22.87	0.43	0.06	38.59	0.29	100.82	75.05
53.22	38.32	0.03	<0.01	21.91	0.43	0.06	39.48	0.32	100.60	76.26
58.54	38.87	0.03	0.02	20.66	0.36	0.07	40.49	0.31	100.81	77.75
63.86	38.87	0.02	<0.01	19.86	0.35	0.08	41.17	0.37	100.74	78.70
69.19	38.79	0.03	0.02	20.05	0.38	0.06	40.88	0.36	100.63	78.42
74.51	38.98	0.03	0.01	20.58	0.37	0.06	40.31	0.45	100.81	77.73

Subtype 1.2 – Diffusion with an indistinct border

The olivine of the 2002/03 lava flow shows a relative slow increase in Mg# from 0 to appr. 12 μm line length and then a steep increase from 12 to appr. 32 μm . Between 32 and 45 μm a plateau of a constant Mg# of 78 mol.% was formed, which is followed, from 45 μm on, by a steady decline, down to 75 mol.% (Figure 6-49).

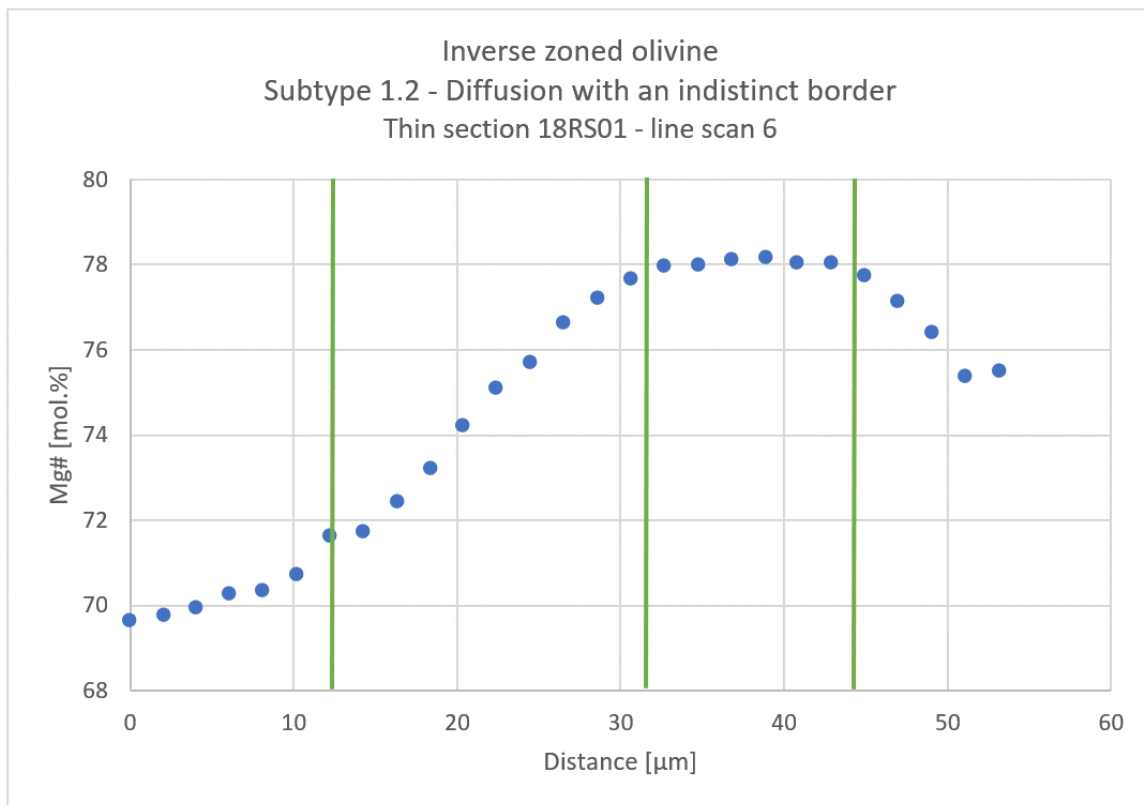


Figure 6-49: Representative Mg# course of an inverse zoned Subtype 1.2 olivine: Line scan 6, from core towards the rim, on thin section 18RS01 (Data see Table 6-12)

For MnO and CaO there is no change in the gradient of the concentration at the transition from segment one (0 – 12 μm) to segment two (12 – 32 μm) as shown for the Mg# concentration. For MnO there is a constant decrease from 0.7 to 0.4 wt%, while the CaO content stays appr. the same around 0.3 wt%. In segment three, the composition of both elements remains constant (= plateau). Segment four, from appr. 45 μm on, shows an increase for both CaO and MnO (Figure 6-50).

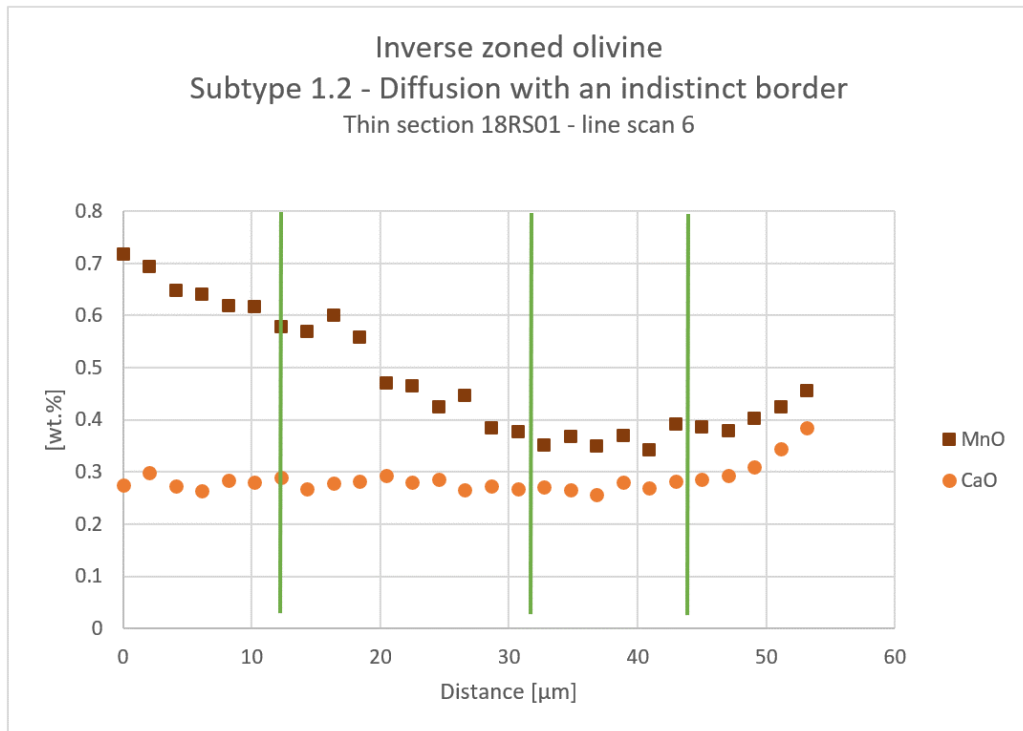


Figure 6-50: Representative course of the MnO and CaO content [wt%] on an inverse zoned Subtype 1.2 olivine: Line scan 6, from core towards the rim, on thin section 18RS01 (Data see Table 6-12)

The difference between inverse zoned olivine subtype 1.1 and 1.2 can also be seen in the BSE-images, where the rim appears mostly broader and brighter and with (sub-)rounded inner-edges (Figure 6-51).

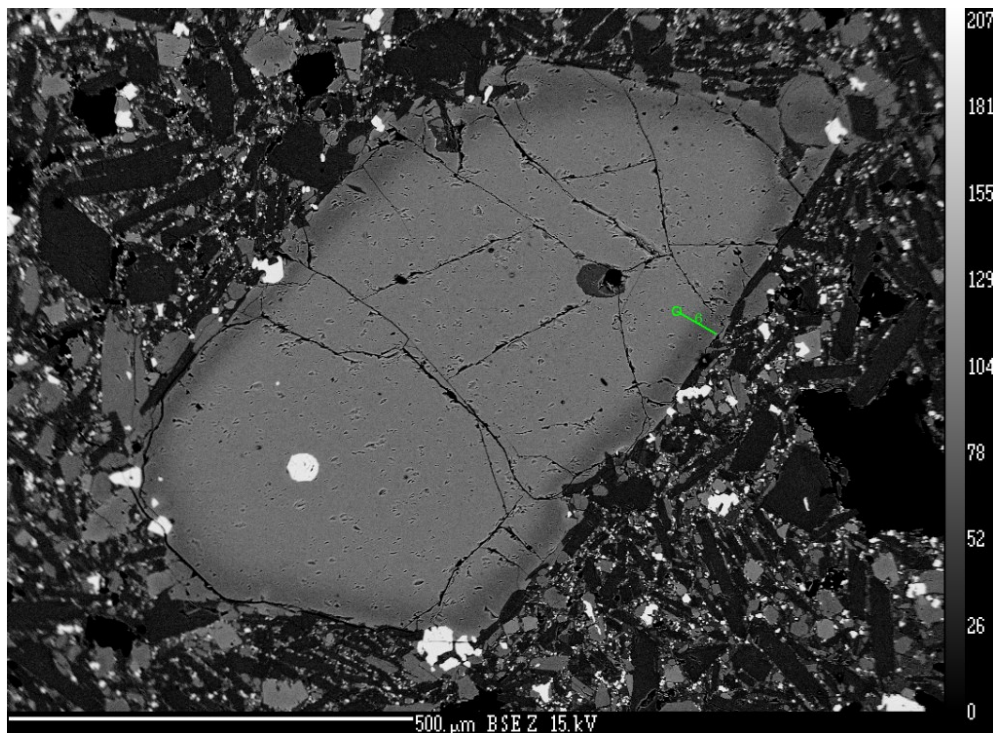


Figure 6-51: Position of the line scan 6 on the inverse zoned Subtype 1.2 olivine: 2002/03 lava flow – 18RS01

Table 6-12: Composition of line scan 6 on an inverse zoned olivine of the 2002/03 lava flow (18RS01)

Distance [μm]	SiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO	MnO	NiO	MgO	CaO	Total	Mg#
0.00	36.28	0.02	<0.01	27.03	0.72	0.02	34.79	0.28	99.17	69.64
2.05	36.22	0.02	<0.01	26.90	0.69	<0.01	34.86	0.30	99.02	69.79
4.09	36.13	0.02	<0.01	26.71	0.65	0.02	34.85	0.27	98.68	69.93
6.14	36.55	0.01	<0.01	26.83	0.64	0.03	35.59	0.26	99.94	70.28
8.18	36.43	0.02	<0.01	26.42	0.62	0.02	35.22	0.28	99.06	70.38
10.23	36.43	0.03	<0.01	25.97	0.62	<0.01	35.23	0.28	98.59	70.75
12.27	36.50	0.02	<0.01	25.52	0.58	<0.01	36.19	0.29	99.14	71.65
14.32	36.71	0.02	<0.01	25.41	0.57	0.02	36.21	0.27	99.23	71.75
16.36	36.63	0.01	<0.01	24.90	0.60	0.04	36.69	0.28	99.20	72.43
18.41	36.73	0.02	<0.01	24.09	0.56	0.02	37.02	0.28	98.74	73.26
20.45	36.93	0.02	<0.01	23.47	0.47	0.06	37.90	0.29	99.16	74.21
22.50	37.08	<0.01	<0.01	22.82	0.47	0.05	38.61	0.28	99.34	75.10
24.55	37.05	0.02	<0.01	22.43	0.42	0.07	39.23	0.29	99.54	75.72
26.59	37.27	0.03	<0.01	21.54	0.45	0.07	39.64	0.27	99.27	76.64
28.64	37.16	0.01	<0.01	21.18	0.39	0.06	40.31	0.27	99.39	77.24
30.68	37.49	0.02	<0.01	20.87	0.38	0.06	40.77	0.27	99.90	77.69
32.73	37.67	0.02	<0.01	20.43	0.35	0.08	40.58	0.27	99.44	77.98
34.77	37.30	0.03	<0.01	20.33	0.37	0.06	40.50	0.27	98.87	78.03
36.82	37.47	0.02	<0.01	20.18	0.35	0.05	40.43	0.26	98.80	78.13
38.86	37.53	0.02	<0.01	20.28	0.37	0.06	40.73	0.28	99.29	78.16
40.91	37.39	0.03	<0.01	20.37	0.34	0.07	40.67	0.27	99.16	78.06
42.95	37.39	0.03	<0.01	20.38	0.39	0.07	40.71	0.28	99.28	78.08
45.00	37.71	0.05	<0.01	20.73	0.39	0.03	40.63	0.29	99.85	77.75
47.04	37.13	0.03	<0.01	21.00	0.38	0.05	39.72	0.29	98.65	77.13
49.09	37.13	0.04	<0.01	21.72	0.40	0.03	39.53	0.31	99.20	76.44
51.14	36.46	0.09	<0.01	22.10	0.42	0.02	37.98	0.34	97.48	75.39
53.18	37.51	0.20	<0.01	22.62	0.46	0.03	39.13	0.38	100.38	75.52

- **Subtype 1.3 – Diffusion with a smooth transition**

The third subtype is found mostly in the olivine of Mounts de Fiore. Figure 6-52 shows a representative olivine in thin section 18MF03A (line scan 229).

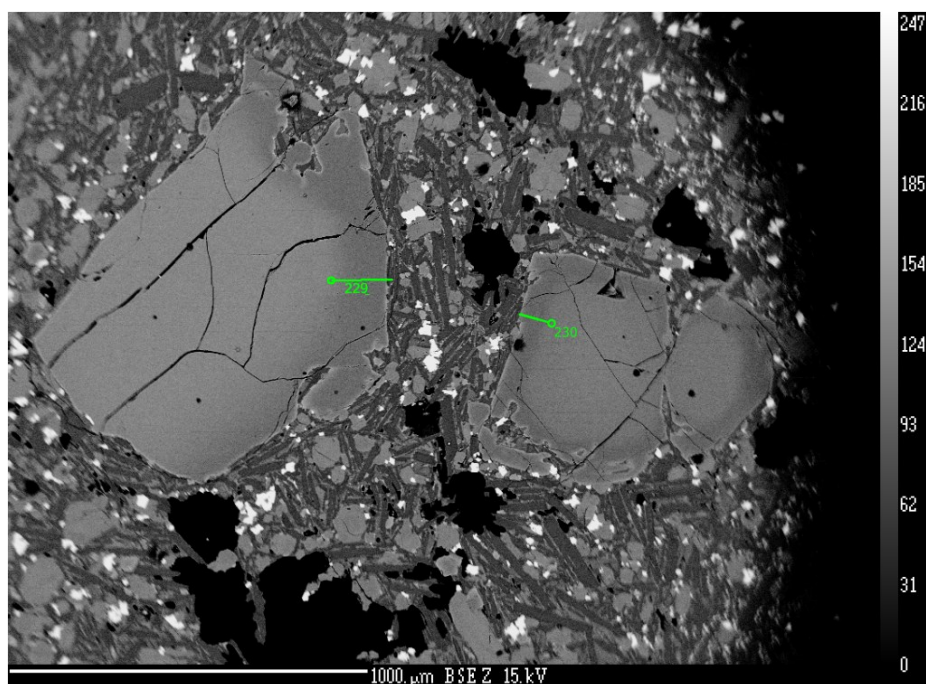


Figure 6-52: Position of the line scan 229 on the inverse zoned Subtype 3 olivine: Mounts de Fiore – 18MF03A

As shown in Figure 6-53 the Mg# increases steadily from the core to the rim, without the establishment of a plateau as in the olivine of subtype 2 (see above). There is, however, a flattening of the gradient between 100 and around 180 μm . Then, on the most outer rim, the Mg# drops rapidly.

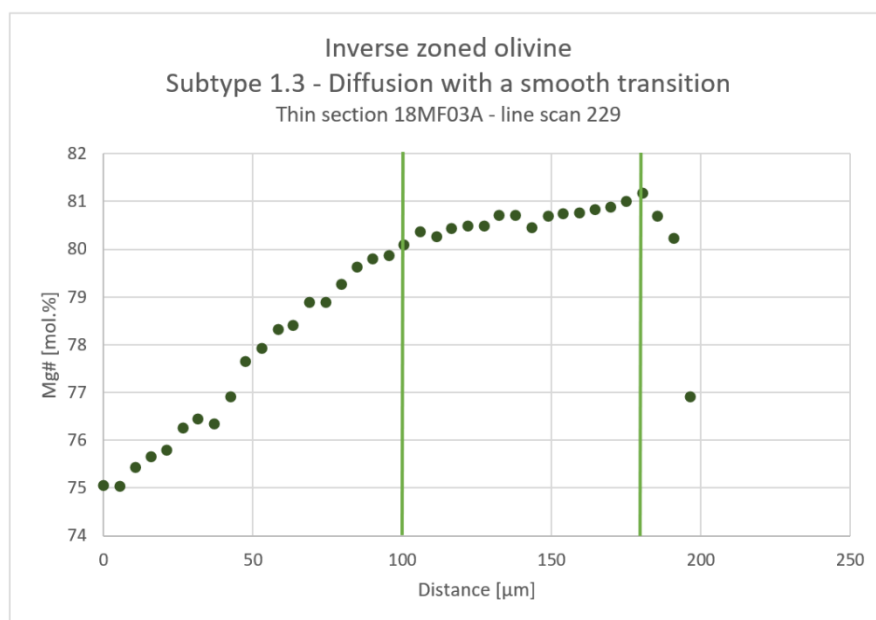


Figure 6-53: Representative Mg# course of an inverse zoned Subtype 1.3 olivine: Line scan 229, from core towards the rim, on thin section 18MF03A. The line scan is subdivided into three segments, which represent different stages of evolution: diffusion – slight flattening – drop (Data see Table 6-13)

The CaO and MnO concentrations for this olivine show quite noisy curves, but a trend is still distinguishable. Similar to the Mg#, there is a clear trend until around 100 μm (decrease of the MnO concentration and slight but steady increase of the CaO concentration (Figure 6-54).

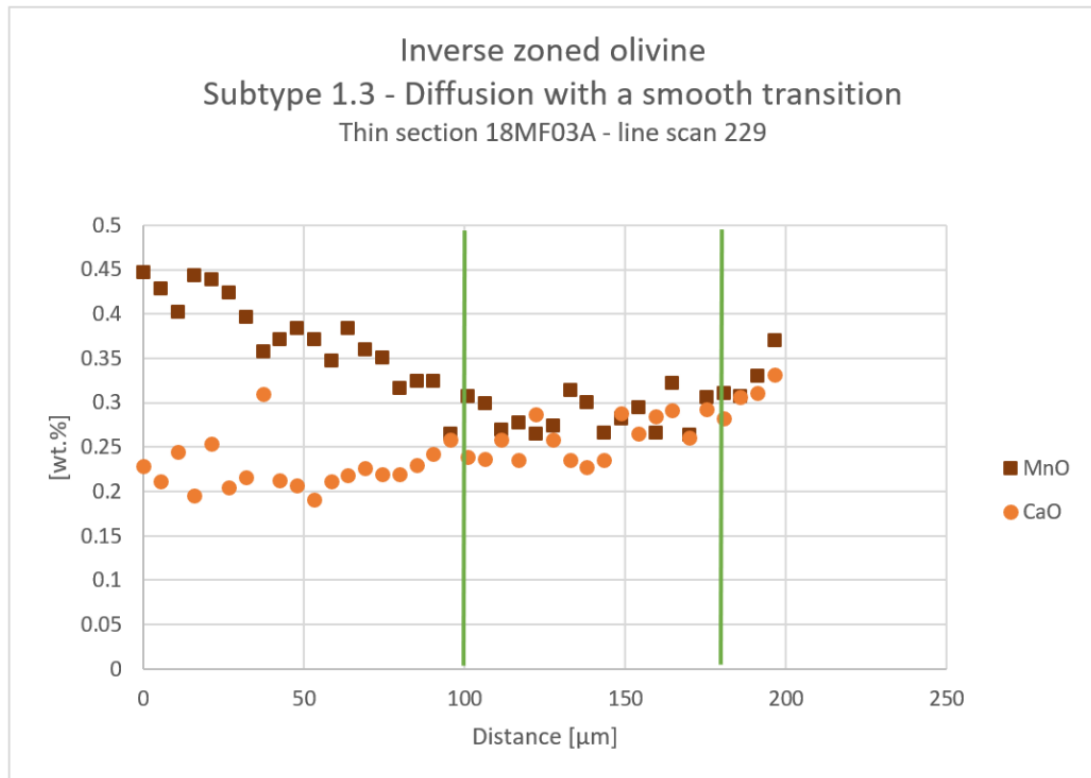


Figure 6-54: Representative profiles of the MnO and CaO content [wt%] on an inverse zoned Subtype 1.3 olivine: Line scan 229, from core towards to rim, on thin section 18MF03A. The line scan is subdivided into three segments, which represent different stages of evolution: diffusion – slight flattening – increase (Data see Table 6-13)

Table 6-13: Composition of line scan 229 on an inverse zoned olivine of Mounts de Fiore (18MF03A)

Distance [μm]	SiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO	MnO	NiO	MgO	CaO	Total	Mg#
0.00	38.27	0.12	<0.01	22.87	0.45	0.04	38.58	0.23	100.62	75.04
5.31	38.31	0.04	<0.01	22.84	0.43	0.05	38.44	0.21	100.34	75.00
10.62	38.35	0.04	<0.01	22.81	0.40	0.03	39.24	0.24	101.15	75.41
15.93	38.61	0.03	<0.01	22.52	0.44	0.04	39.25	0.20	101.11	75.65
21.24	38.56	0.03	<0.01	22.48	0.44	0.06	39.49	0.25	101.32	75.79
26.55	38.40	0.02	<0.01	22.11	0.42	0.06	39.81	0.20	101.07	76.25
31.86	38.30	0.03	<0.01	21.76	0.40	0.05	39.59	0.22	100.38	76.43
37.16	38.47	0.03	<0.01	21.96	0.36	0.07	39.73	0.31	100.94	76.33
42.47	38.71	0.04	<0.01	21.39	0.37	0.07	39.91	0.21	100.72	76.89
47.78	38.68	0.02	<0.01	20.76	0.38	0.05	40.40	0.21	100.51	77.62
53.09	39.08	0.02	<0.01	20.60	0.37	0.08	40.74	0.19	101.09	77.90
58.40	38.97	0.02	<0.01	20.20	0.35	0.07	40.94	0.21	100.78	78.32
63.71	39.05	0.03	<0.01	20.02	0.38	0.08	40.78	0.22	100.58	78.41
69.02	38.72	0.02	<0.01	19.72	0.36	0.08	41.28	0.23	100.43	78.87
74.33	39.11	<0.01	<0.01	19.81	0.35	0.05	41.48	0.22	101.05	78.87
79.64	38.99	0.01	<0.01	19.38	0.32	0.08	41.51	0.22	100.56	79.24
84.95	39.38	0.02	<0.01	19.07	0.32	0.06	41.78	0.23	100.90	79.61
90.26	39.20	0.02	<0.01	18.94	0.33	0.08	41.91	0.24	100.74	79.78
95.57	39.46	0.04	<0.01	18.78	0.27	0.10	41.73	0.26	100.66	79.85
100.88	39.38	0.02	<0.01	18.66	0.31	0.10	42.03	0.24	100.76	80.06
106.18	39.46	<0.01	0.01	18.53	0.30	0.08	42.51	0.24	101.16	80.35
111.49	39.30	<0.01	<0.01	18.50	0.27	0.09	42.18	0.26	100.60	80.25
116.80	39.47	0.01	0.01	18.35	0.28	0.10	42.26	0.24	100.73	80.41
122.11	39.45	0.02	<0.01	18.44	0.27	0.07	42.59	0.29	101.15	80.46
127.42	39.32	0.03	<0.01	18.44	0.27	0.10	42.60	0.26	101.05	80.46
132.73	39.58	0.02	<0.01	18.26	0.31	0.09	42.84	0.24	101.35	80.71
138.04	39.49	0.02	<0.01	18.17	0.30	0.08	42.64	0.23	100.95	80.71
143.35	39.49	0.02	<0.01	18.42	0.27	0.08	42.51	0.24	101.03	80.44
148.66	39.61	0.02	<0.01	18.14	0.28	0.08	42.49	0.29	100.95	80.68
153.97	39.50	0.03	0.01	18.10	0.29	0.08	42.54	0.27	100.84	80.73
159.28	39.45	0.01	<0.01	18.13	0.27	0.09	42.67	0.28	100.93	80.75
164.59	39.67	0.02	<0.01	17.99	0.32	0.08	42.52	0.29	100.91	80.82
169.90	39.51	0.03	<0.01	18.12	0.26	0.08	42.96	0.26	101.24	80.87
175.20	39.65	0.02	<0.01	17.90	0.31	0.07	42.74	0.29	100.98	80.97
180.51	39.56	0.02	<0.01	17.71	0.31	0.05	42.77	0.28	100.70	81.15
185.82	39.42	0.02	<0.01	18.13	0.31	0.06	42.42	0.31	100.70	80.66
191.13	39.13	0.02	<0.01	18.64	0.33	0.07	42.44	0.31	100.96	80.23
196.44	38.76	0.03	<0.01	21.25	0.37	0.06	39.67	0.33	100.51	76.89

Subtype 2 – New growth

Even though inverse zoning is found in 3 of the 4 investigated locations, the documentation of newly grown crystals turned out to be very difficult. The analysed crystals show only diffusion reactions, as explained above, but no re-growth features.

New growing crystals are characterized by a simultaneous increase in MgO and CaO, coupled with a decrease of FeO and MnO, in difference to diffusing crystals, where the CaO increase posterior to the other elements.

From a petrographic point of view, the presence of newly grown crystals is confirmed (see chapter 6.2.2), but not enough analyses of those crystals have been made to confirm it also geochemically. Therefore, a subsequent analysis of those crystals is necessary.

6.4.3. Clinopyroxene

6.4.3.1. General classification

The classification of the clinopyroxene in all studied eccentric cones follows the scheme based on textural criteria as described by Giacomoni et al. (2014) (see also chapter 6.2.3)

- **Type 1** - normal or oscillatory zoning
- **Type 2** - core-to-rim sharp compositional variations
- **Type 4** - reverse zoning
- **Type 6** - hourglass zoning

Of the 402 electron microprobe analyses made of clinopyroxene, 355 were made on 84 individual phenocrysts, 8 of clinopyroxene inclusions in 5 different crystals (olivine or plagioclase) and the remaining 39 of matrix crystals.

The majority of analysed crystals were Type 1 clinopyroxene, with 58 crystals and 225 analyses. The remaining 130 analyses are distributed among the other three texture types as follow: Type 2) 1 crystal (3 analyses); Type 4) 5 crystals (43 analyses) and Type 6) 20 crystals (84 analyses) (Supplementary table 0).

The clinopyroxene chemical composition was further used to estimate the temperature and pressure conditions applying the thermobarometer by Putirka et al. (2012), see Chapter 6.5.

The clinopyroxene has an average Mg# of up to 77.8 for Monte Spagnolo, 74.05 for Monte Rossi 71.29 for Mounts de Fiore and 75.1 mol.% for the 2002/03 lava flow.

The mean MgO content lies for Monte Spagnolo at 14.2, for Monte Rossi 13.27, for Mounts de Fiore at 12.37 and for the 2002/03 lava flow at 13.18 wt.%.

In terms of the CaO content, the four locations can be divided into two groups: group (a) consists of the samples from Monte Spagnolo and Monte Rossi with an average of CaO content of around 22.0 wt% and group (b) includes samples from Mounts de Fiore and the 2002/03 lava flow, with an average of CaO content of around 22.4 wt%.

The Na₂O concentration behaves similarly like the CaO content, where in the group (a) the average Na₂O is ~0.47 wt% and in the group (b) ~0.36 wt%.

The Al₂O₃ content for Monte Spagnolo lies at 4.57, for Monte Rossi at 4.89, for Mounts de Fiore at 7.19 and for the 2002/03 lava flow at 5.8 wt.%. This means, that the Al₂O₃ content is for Mounts de Fiore around 36% higher than for Monte Spagnolo (Supplementary table 0).

The clinopyroxene can be classified further into its mineralogical endmembers enstatite, wollastonite and ferrosilite. Each of the endmembers is defined by the major elements of the clinopyroxene.

- **Enstatite**, with the idealized formula $\text{Mg}_2[\text{Si}_2\text{O}_6]$ is a common magnesium silicate, which is part of the inosilicate group.
- **Wollastonite**, with the formula $\text{Ca}_2[\text{Si}_2\text{O}_6]$ is the calcium analogue and
- **Ferrosilite**, with the formula $\text{Fe}_2[\text{Si}_2\text{O}_6]$, the iron analogue of enstatite.

Therefore, the distribution of the endmembers is a simple way to represent the different chemical compositions.

Plotted into the conventional classification diagram (Morimoto 1988) of the International Mineralogical Association (IMA), the clinopyroxenes of Monte Rossi, Mounts de Fiore and the 2002/03 lava flow lie predominantly in the border region of the diopside and salite field (Figure 6-55 a-d, Supplementary Data 0).

The clinopyroxenes of Monte Spagnolo show the widest diversity, with the major part falling into the border region between the diopside and the salite field. There are some analyses, which fall into the augite field due to a more Mg-rich composition (Figure 6-55 a).

The clinopyroxene of Monte Rossi is more salitic, but some analyses still fall also partly in the diopside field Figure 6-55 b).

Both, Mounts de Fiore and 2002/2003 lava flow, plot mainly in the salite field (Figure 6-55 c, d).

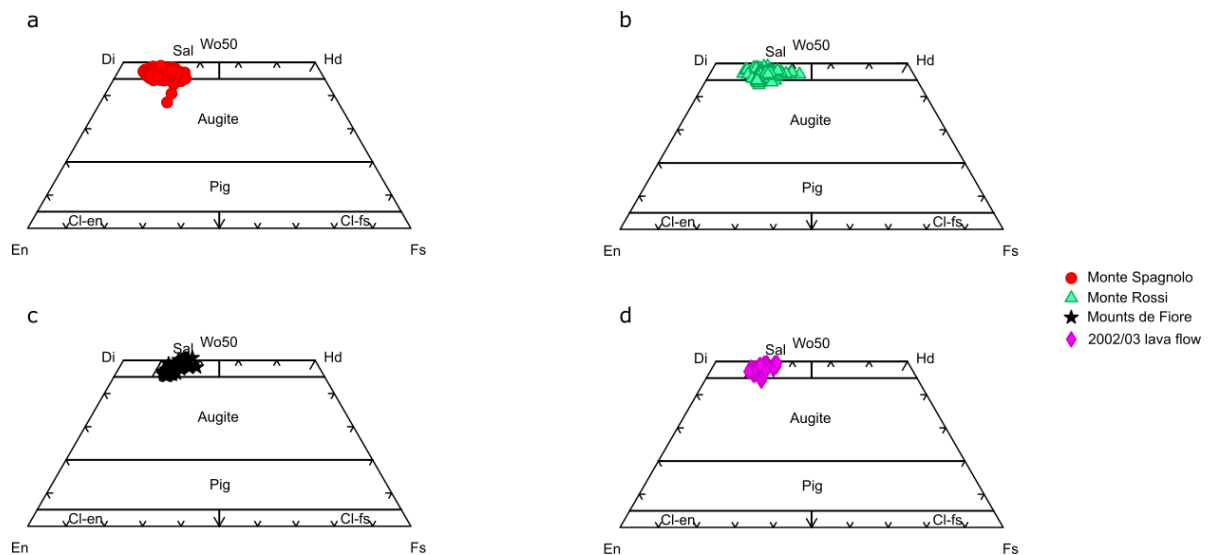


Figure 6-55: Composition of the clinopyroxene from the four investigated locations using the Morimoto (1988) diagram. a.) Monte Spagnolo, b.) Monte Rossi, c.) Mounts de Fiore and d.) 2002/03 lava flow. The abbreviations stand for **Di**opside, **Sal**ite, **Hd**edenbergite, **Fs**errosilite and **Wo**ollastonite (Supplementary Data 11.2).

6.4.3.2. Type 1 - normal zoning

The clinopyroxene of Type 1 is characterized primarily by a normal zoning, which means, that the core shows a higher temperature composition, than the rim and mainly stands for a progressive development of the surrounding melt composition during the growth of the crystal. Sometimes oscillatory zoning is also present, which represents a more diverse environment, where the composition of the surrounding melt varies. This can be either through melt influx, water content of the melt or due to surrounding crystals (Giacomoni et al., 2016).

All inclusions and matrix clinopyroxene, as well as the majority of phenocrysts, show the same Type 1 texture, but have different geochemical compositions:

The average Mg# of the phenocryst core is 78.83 for Monte Spagnolo, 75.41 for Monte Rossi, 71.63 for Mounts de Fiore and 76.38 mol.% for the 2002/03 lava flow. The average Mg# for the rim is at 73.75 for Monte Spagnolo, 72.40 for Monte Rossi, 70.04 for Mounts de Fiore and 70.82 mol.% for the 2002/03 lava flow.

The matrix clinopyroxene, which has an average Mg# of 75.83 for Monte Spagnolo, 71.50 for Monte Rossi, 69.53 for Mounts de Fiore and 75.29 mol.% for the 2002/03 lava flow.

Clinopyroxene inclusions show an average Mg# at Monte Spagnolo of 70.09, at Monte Rossi of 68.96 and at Mounts de Fiore of 74.19 mol.%. No inclusions were analysed of the samples of the 2002/03 lava flow.

Plotted into the Morimoto (1988) diagram the two pre-1971 eruptions, Monte Spagnolo and Monte Rossi plot in both, the diopside and the salite field, whereas the two post-1971 eruptions, Mounts de Fiore and the 2002/03 lava flow, plot entirely in the salite field. Some matrix analyses of Monte Spagnolo even plot in the augite field (Figure 6-56). This indicates an increase in the CaO composition between the pre- and post-1971 eruptions.

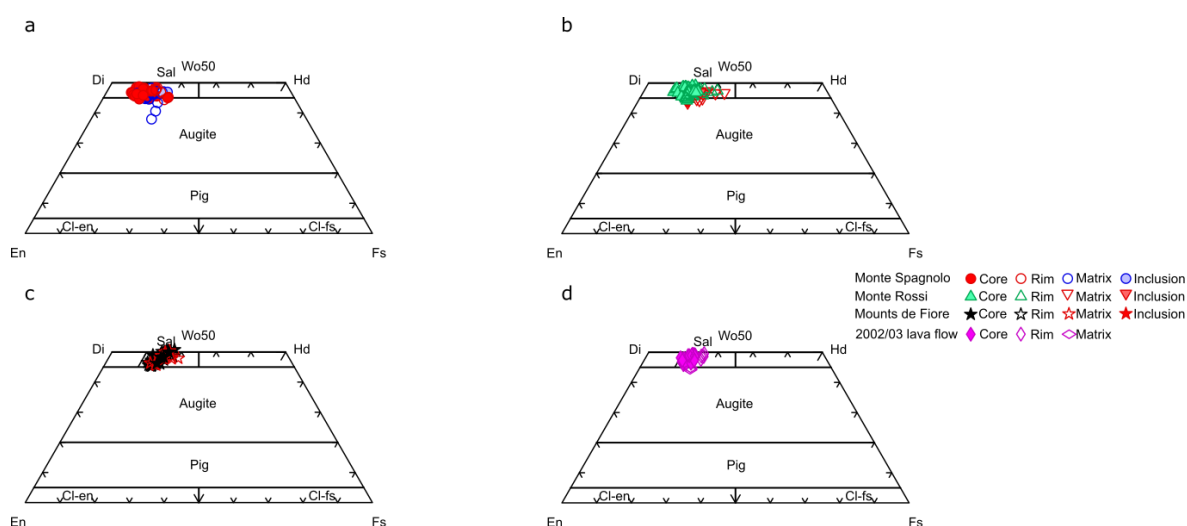


Figure 6-56: Composition of the Type 1 – normal zoned clinopyroxene from the four investigated locations using the Morimoto (1988) diagram. The abbreviations stand for **D**iopside, **S**alite, **H**edenbergite, **F**errosilite and **W**ollastonite (Supplementary Data 11.2)

The following section shows representative samples of Type 1 clinopyroxene for each sampling site (Figures Figure 6-57 to Figure 6-60). The composition of the depicted crystals is given in the tables below each figure (Table 6-14 to Table 6-17).

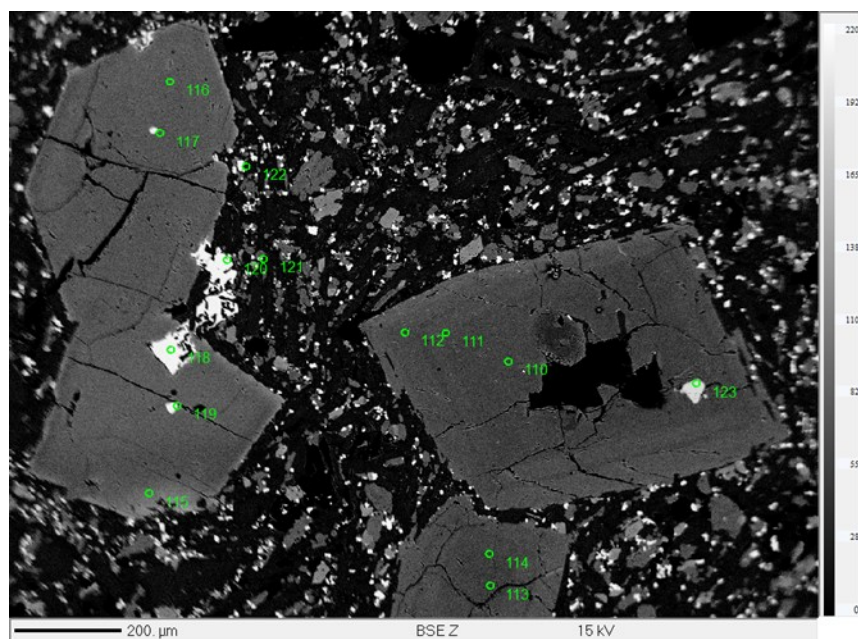


Figure 6-57: BSE image of a clinopyroxene with Type 1 - normal zoning from Monte Spagnolo (18MS01)

Table 6-14: The chemical composition of a Type 1 – oscillatory zoned clinopyroxene of Monte Spagnolo (18MS01) in wt% and the mean Mg# in mol.%

Texture	Type 1 - normal zoning		
Sample	Monte Spagnolo - 18MS01		
Position	Core	Core	Core
Analysis	111_1 .	112_1 .	113_1 .
SiO ₂	50.40	51.07	52.27
TiO ₂	0.89	0.86	0.49
Al ₂ O ₃	4.19	3.24	2.35
Cr ₂ O ₃	0.81	0.20	0.60
FeO	4.98	6.23	4.35
MnO	0.10	0.14	0.09
NiO	0.04	0.03	0.01
MgO	14.51	14.85	16.05
CaO	22.95	22.57	22.68
Na ₂ O	0.37	0.36	0.29
Total	99.23	99.54	99.18
Mg#	83.86	80.96	86.81
En	42.93	42.96	46.14
Fs	8.27	10.11	7.01
Wo	48.81	46.93	46.85

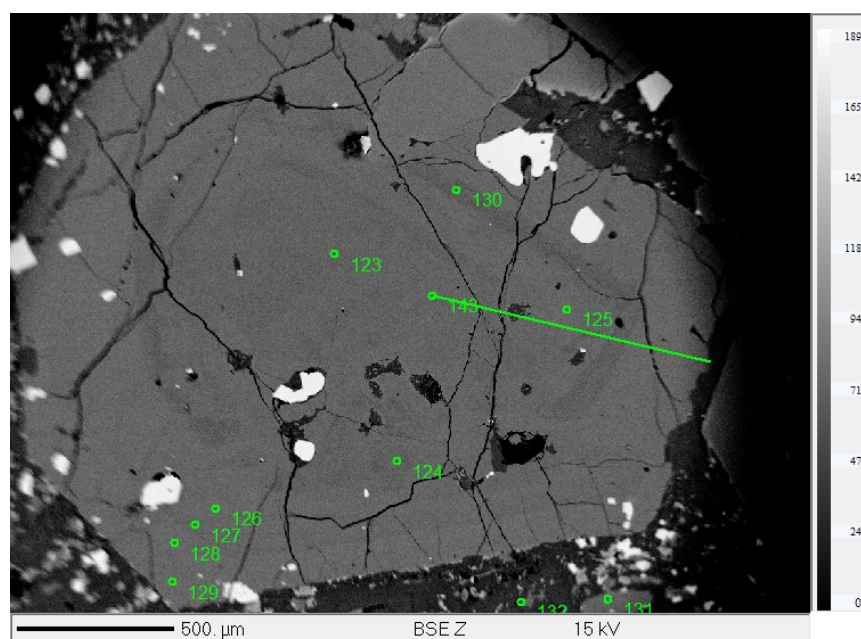


Figure 6-58: BSE image of a clinopyroxene with Type 1 - normal zoning from the Monte Rossi (18MR01)

Table 6-15: The chemical composition of a Type 1 – normal zoned clinopyroxene of Monte Rossi (18MR01) in wt% and the mean Mg# in mol.% (Data of line scan see Supplementary table 11.2)

Texture	Type 1 - normal zoning									
Sample	Monte Rossi - 18MR01									
Position	Core	Core	Core	Core	Core	Core	Core	Core	Rim	Rim
Analysis	123_1 .	124_1 .	125_1 .	126_1 .	127_1 .	128_1 .	129_1 .	130_1 .	131_1 .	132_1 .
SiO ₂	48.31	48.22	49.31	48.48	48.11	48.19	47.86	51.53	45.74	47.58
TiO ₂	1.39	1.23	1.28	1.55	1.51	1.70	1.89	0.63	2.48	1.84
Al ₂ O ₃	6.72	5.97	4.95	5.01	5.90	5.61	5.74	3.14	7.36	5.99
Cr ₂ O ₃	0.11	0.18	0.02	0.03	0.06	0.02	<0.01	0.31	<0.01	<0.01
FeO	6.80	7.28	8.05	8.29	7.98	8.47	8.55	5.29	9.16	8.35
MnO	0.14	0.14	0.18	0.17	0.15	0.18	0.22	0.11	0.21	0.19
NiO	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.01	<0.01	0.01
MgO	13.54	13.65	13.48	13.17	13.08	13.01	12.72	15.51	11.78	12.60
CaO	22.42	22.79	21.90	22.26	22.34	22.12	22.09	22.82	21.70	22.17
Na ₂ O	0.44	0.38	0.56	0.48	0.45	0.47	0.51	0.23	0.53	0.48
Total	99.89	99.85	99.72	99.44	99.57	99.76	99.60	99.56	98.98	99.24
Mg#	78.02	76.96	74.90	73.90	74.50	73.26	72.63	83.95	69.61	72.90
En	40.46	40.00	39.96	38.94	38.91	38.65	38.10	44.47	36.22	37.93
Fs	11.40	11.98	13.39	13.75	13.32	14.11	14.36	8.50	15.81	14.10
Wo	48.14	48.02	46.65	47.31	47.77	47.24	47.55	47.02	47.97	47.97

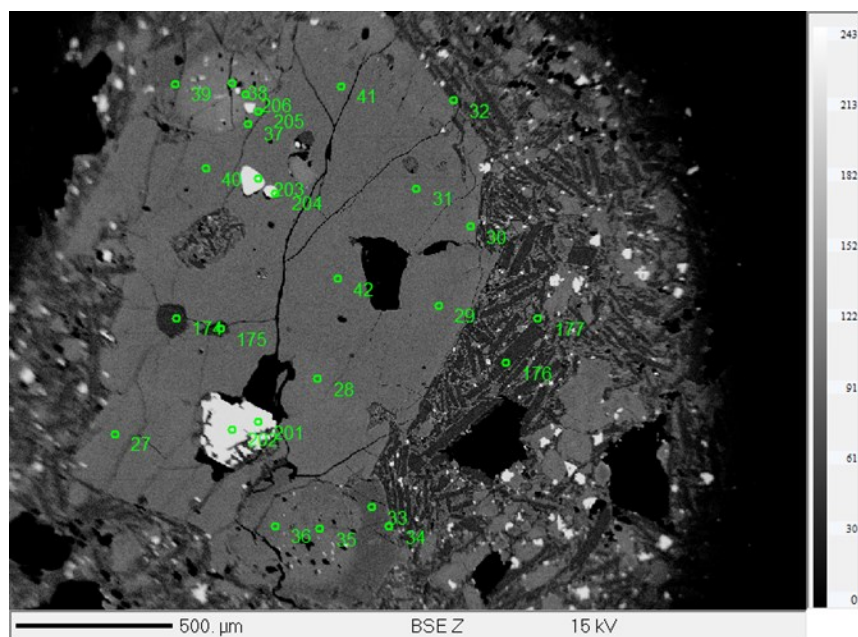


Figure 6-59: BSE image of a clinopyroxene with Type 1 - normal zoning from Mounts de Fiore (18MF01)

Table 6-16: The chemical composition of a Type 1 – normal zoned clinopyroxene of Mounts de Fiore (18MF01) in wt% and the mean Mg# in mol.%

Texture	Type 1 - normal zoning								
Sample	Mounts de Fiore - 18MF01								
Position	Core	Core	Core	Core	Core	Rim	Core	Core	Core
Analysis	27_1 .	28_1 .	29_1 .	30_1 .	31_1 .	32_1 .	40_1 .	41_1 .	42_1 .
SiO ₂	47.88	49.55	48.98	44.97	48.94	49.51	49.23	49.55	49.11
TiO ₂	1.36	1.45	1.40	2.27	1.40	1.37	1.34	1.29	1.29
Al ₂ O ₃	6.63	4.37	4.82	8.23	5.00	4.21	4.84	4.37	4.90
Cr ₂ O ₃	0.13	0.01	0.05	0.11	0.05	<0.01	0.03	0.04	0.10
FeO	7.31	9.22	7.88	8.37	7.75	8.20	7.65	7.65	7.59
MnO	0.13	0.27	0.18	0.09	0.19	0.21	0.21	0.18	0.14
NiO	0.03	0.02	0.02	<0.01	<0.01	0.01	<0.01	0.01	0.02
MgO	13.15	12.83	13.52	11.75	13.65	13.67	13.72	13.90	13.63
CaO	23.11	21.56	22.15	23.08	22.18	21.99	22.16	21.88	22.39
Na ₂ O	0.28	0.60	0.40	0.34	0.48	0.37	0.54	0.53	0.42
Total	100.01	99.87	99.40	99.22	99.64	99.55	99.71	99.39	99.58
Mg#	76.23	71.25	75.35	71.45	75.84	74.83	76.17	76.41	76.21
En	38.84	38.29	39.92	35.57	40.22	40.12	40.42	40.99	40.11
Fs	12.11	15.45	13.06	14.22	12.81	13.49	12.65	12.66	12.52
Wo	49.05	46.26	47.01	50.21	46.97	46.38	46.93	46.36	47.36

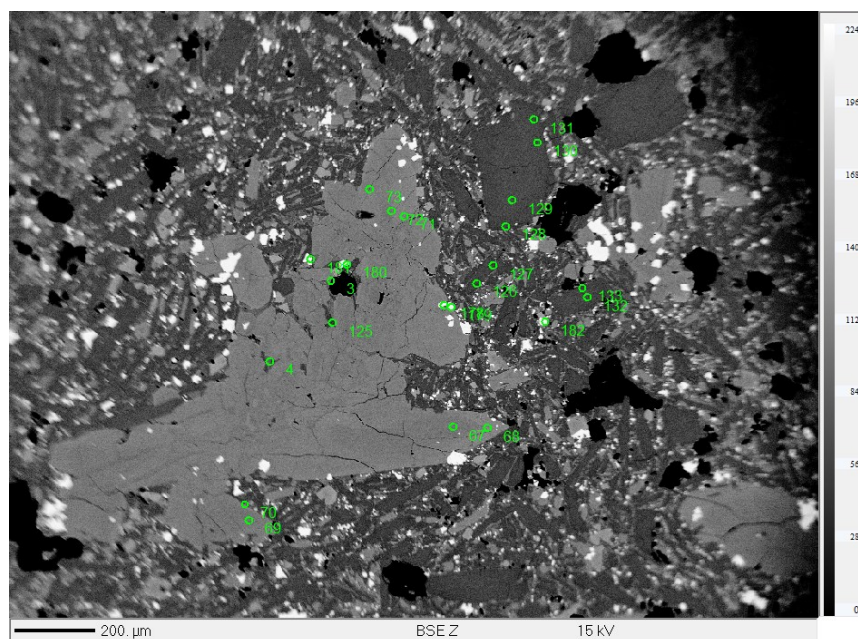


Figure 6-60: BSE image of a clinopyroxene with Type 1 - normal zoning from the 2002/03 lava flow (18RS02)

Table 6-17: The chemical composition of a Type 1 – normal zoned clinopyroxene of the 2002/03 lava flow (18RS02) in wt% and the mean Mg# in mol.%

Texture	Type 1 - normal zoning						
Sample	2002/03 lava flow - 18RS02						
Position	Rim	Core	Core	Core	Core	Core	Core
Analysis	67_1 .	68_1 .	69_1 .	70_1 .	71_1 .	72_1 .	73_1 .
SiO ₂	50.16	43.38	49.85	47.30	46.15	50.30	46.55
TiO ₂	1.06	3.01	1.10	1.67	2.07	0.97	1.94
Al ₂ O ₃	4.09	9.33	4.23	6.87	7.69	3.72	7.34
Cr ₂ O ₃	0.02	0.01	0.03	0.02	0.04	0.13	0.05
FeO	6.77	9.42	6.82	7.64	8.09	6.66	7.78
MnO	0.12	0.15	0.14	0.13	0.12	0.13	0.13
NiO	<0.01	<0.01	0.01	0.02	<0.01	<0.01	<0.01
MgO	14.28	11.32	14.10	12.71	12.46	14.47	12.47
CaO	23.16	21.94	23.04	23.14	22.92	22.81	22.82
Na ₂ O	0.29	0.39	0.28	0.34	0.32	0.23	0.34
Total	99.95	98.98	99.61	99.84	99.88	99.37	99.41
Mg#	78.99	68.18	78.66	74.78	73.31	79.48	74.08
En	41.12	34.97	40.88	37.81	37.23	41.82	37.53
Fs	10.94	16.32	11.09	12.75	13.55	10.80	13.13
Wo	47.94	48.71	48.02	49.44	49.22	47.39	49.34

6.4.3.3. Type 2 - core-to-rim sharp compositional variations

This type includes the smallest group of analyses of clinopyroxene with only 3 analyses on one crystal on sample 18MS01 of Monte Spagnolo (Figure 6-61). They are characterized by a sharp compositional change from core to rim. This decrease can be observed in the MgO content from around 17 to around 13 wt% and of CaO content from 23 to 22 wt%. In consequence the Mg# decreases from core to rim from 84 to 78 mol.% (Table 6-18).

Figure 6-61: BSE image of the clinopyroxene with a Type 2 - core-to-rim sharp compositional variations zoning at Monte Spagnolo (18MS01)

Plotted into a quadrilateral diagram (Morimoto 1988), the core can be classified as diopside and the rim as salite (Figure 6-62)

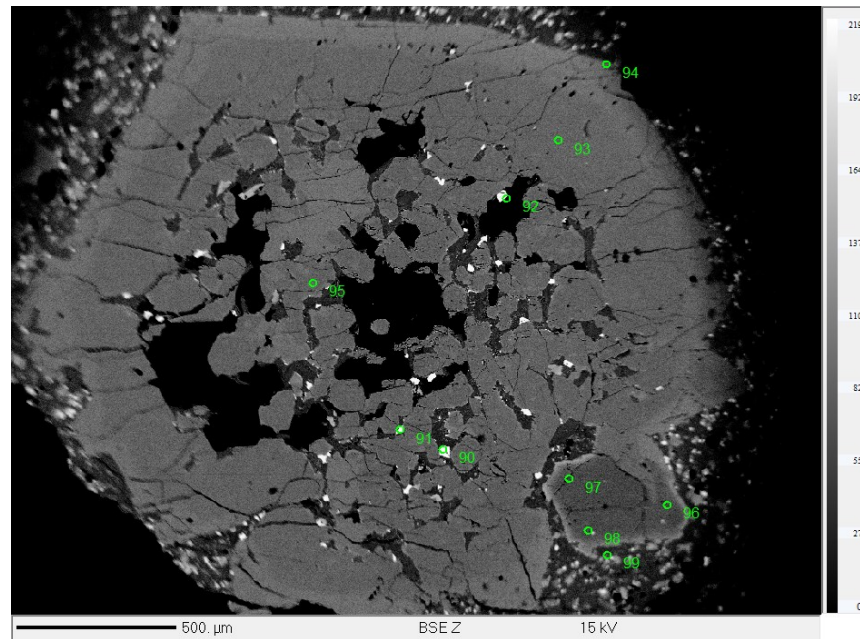


Figure 6-61: BSE image of the clinopyroxene with a Type 2 - core-to-rim sharp compositional variations zoning at Monte Spagnolo (18MS01)

Table 6-18: The chemical composition of the Type 2 - clinopyroxene with core-to-rim sharp compositional variations for Monte Spagnolo in wt% and the mean Mg# in mol.%

Texture	Type 2 - core-to-rim sharp compositional variations		
Sample	Monte Spagnolo - 18MS01		
Position	core	core	rim
Analysis	93_1 .	95_1 .	94_1 .
SiO ₂	52.07	52.42	47.62
TiO ₂	0.50	0.41	1.92
Al ₂ O ₃	2.95	2.52	5.43
Cr ₂ O ₃	1.01	0.68	0.01
FeO	4.02	4.01	8.88
MnO	0.10	0.12	0.17
NiO	0.01	0.02	0.03
MgO	15.81	16.22	12.47
CaO	23.02	23.09	21.64
Na ₂ O	0.38	0.38	0.51
Total	99.88	99.86	98.72
Mg#	87.51	87.83	71.46
En	45.68	46.26	37.78
Fs	6.52	6.41	15.09
Wo	47.80	47.33	47.13

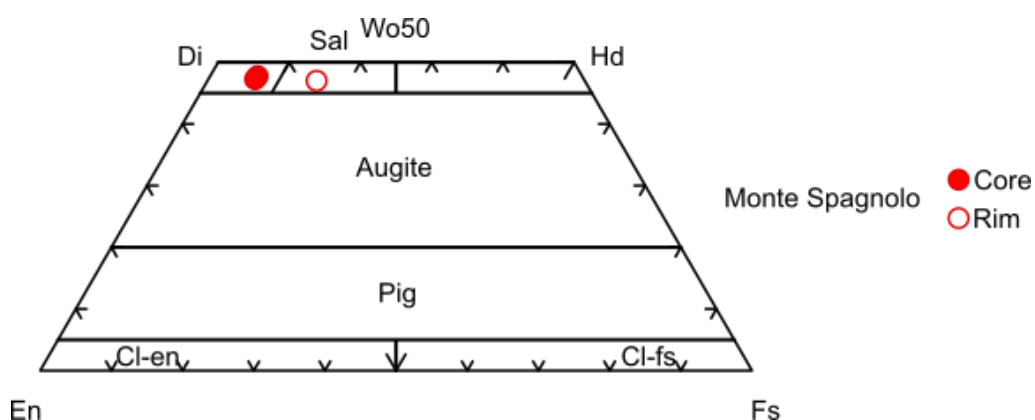


Figure 6-62: Composition of the Type 2 - clinopyroxene with core-to-rim sharp compositional variations from Monte Spagnolo using the Morimoto (1988) diagram. The abbreviations stand for **D**iopside, **S**alite, **H**edenbergite, **F**errosilite and **W**ollastonite (Supplementary Data 11.2).

6.4.3.4. Type 4 - reverse zoning

Reversed zoned clinopyroxene has, in contrary to the Type 2 clinopyroxene, a FeO-rich and therefore in the BSE images a darker core and a brighter, FeO-poor rim. This texture type was found at every location, except Monte Rossi, but measured only on samples of Monte Spagnolo and the 2002/03 lava flow.

The FeO content drops, from core to rim, at each investigated location about 2 wt%. From 8 to ~ 6 wt% at Monte Spagnolo and from 8.3 to 6.6 wt% at the 2002/03 lava flow.

Coupled with the decline of the FeO content the Mg# increases from core to rim. At Monte Spagnolo from 75 to around 80-83 mol and at the 2002/03 lava flow from 73 to 77 mol.%.

Independent of the location, Type 4 clinopyroxene shows the same trend of decreasing FeO and Al₂O₃ content and increasing MgO content and subsequently an increasing Mg#.

For example, the crystal found in the basalts of the 2002/03 lava flow, on thin section 18RS02 (Figure 6-65), shows a decrease of FeO from 8.34 to 6.62 wt% and of Al₂O₃ from 5.32 to 3.71 wt%. The initial value of the MgO increases from 12.73 to 14.58 wt%. The Mg# increases accordingly from 73.09 to 79.69 mol.% (Table 6-20 and Supplementary Data 11.2).

Plotted in the Morimoto (1988) diagram Monte Spagnolo plots slightly in the diopside field, whereas the 2002/03 lava flow plots entirely in the salite field. (Figure 6-63).

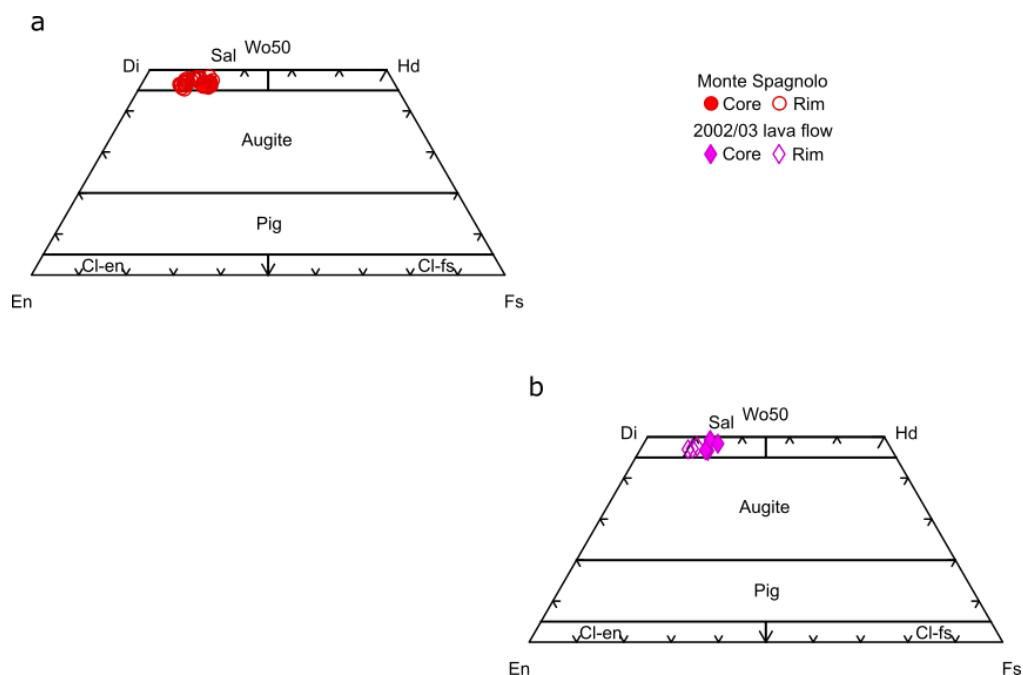


Figure 6-63: Composition of the Type 4 – reverse zoned clinopyroxene from a.) Monte Spagnolo and b.) 2002/03 lava flow, using the Morimoto (1988) diagram. The abbreviations stand for **D**iopside, **S**alite, **H**edenbergite, **F**errosilite and **W**ollastonite (Supplementary Data 11.2).

The following section shows representative samples of Type 4 clinopyroxene for both sampling sites (Figure 6-64 & Figure 6-65). The composition of the depicted crystals is given in the tables below each figure (Table 6-19Table 6-20).

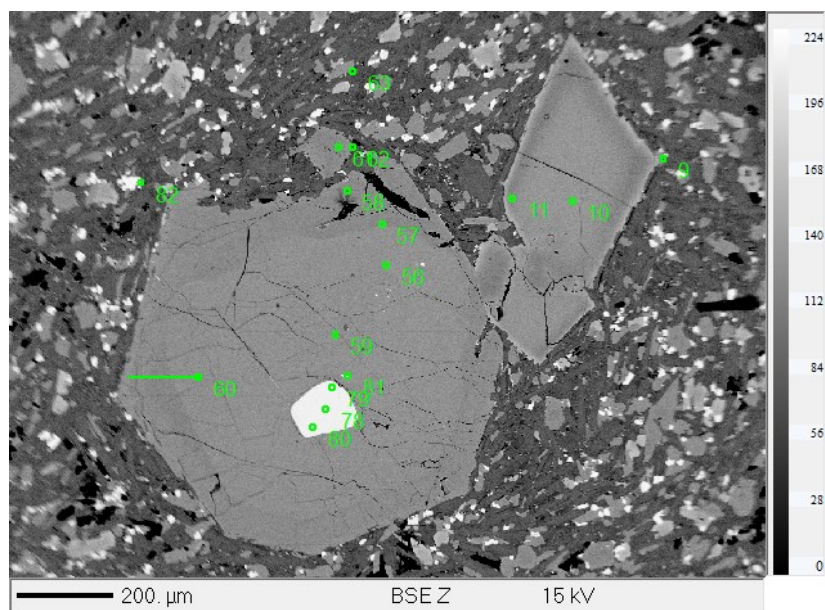


Figure 6-64: BSE image of a clinopyroxene with Type 4 - reverse zoning from Monte Spagnolo (18MS02)

Table 6-19: The chemical composition of a Type 4 – reversed zoned clinopyroxene of Monte Rossi (18MS02) in wt% and the mean Mg# in mol.% (Data of line scan see Supplementary Table 0)

Texture	Type 4 - reverse zoning			
Sample	Monte Spagnolo - 18MS02			
Position	Core	Rim	Rim	Core
Analysis	56 / 1 .	57 / 1 .	58 / 1 .	59 / 1 .
SiO ₂	48.91	49.07	48.49	48.59
TiO ₂	1.23	0.85	1.13	1.21
Al ₂ O ₃	3.92	4.35	5.13	4.26
Cr ₂ O ₃	0.05	0.51	0.34	0.03
FeO	8.43	5.49	6.16	8.56
MnO	0.20	0.11	0.13	0.20
NiO	<0.01	<0.01	<0.01	0.02
MgO	13.75	14.95	14.42	13.58
CaO	22.00	23.08	23.04	21.89
Na ₂ O	0.48	0.35	0.34	0.50
Total	98.96	98.77	99.17	98.83
Mg#	74.42	82.91	80.67	73.87
En	40.10	43.18	41.87	39.80
Fs	13.79	8.90	10.03	14.08
Wo	46.11	47.92	48.10	46.12

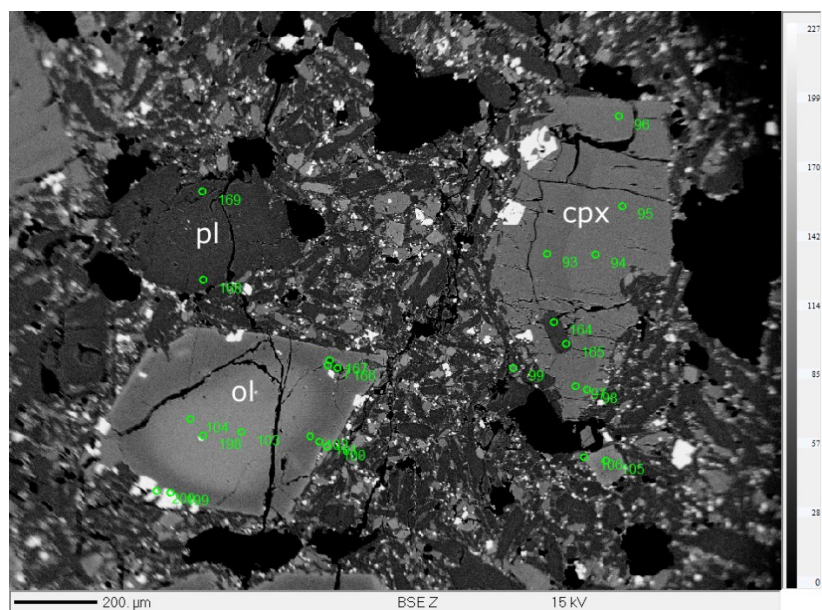


Figure 6-65: BSE image of a clinopyroxene with Type 4 - reverse zoning from the 2002/03/lava flow (18RS02)

Table 6-20: The chemical composition of a Type 4 - clinopyroxene with reverse zoning of the 2002/03 lava flow (18RS02) in wt% and the mean Mg# in mol.%

Texture	Type 4 - reverse zoning					
Sample	2002/03 lava flow - 18RS02					
Position	Rim	Core	Core	Core	Rim	Core
Analysis	93_1 .	94_1 .	95_1 .	96_1 .	97_1 .	98_1 .
SiO ₂	50.38	49.81	49.91	46.51	49.68	46.49
TiO ₂	0.92	1.18	1.25	1.92	1.09	2.25
Al ₂ O ₃	3.54	4.15	4.19	7.38	4.05	6.51
Cr ₂ O ₃	0.09	<0.01	<0.01	0.02	<0.01	<0.01
FeO	6.62	8.40	8.20	7.98	7.04	9.05
MnO	0.14	0.23	0.22	0.12	0.13	0.18
NiO	<0.01	0.02	0.01	<0.01	<0.01	<0.01
MgO	14.59	13.10	13.05	12.40	14.07	11.88
CaO	22.81	21.79	21.80	22.86	22.92	22.22
Na ₂ O	0.25	0.80	0.84	0.31	0.30	0.43
Total	99.34	99.49	99.48	99.50	99.28	99.01
Mg#	79.70	73.54	73.93	73.47	78.08	70.06
En	42.05	39.14	39.17	37.23	40.78	36.08
Fs	10.71	14.08	13.81	13.44	11.45	15.41
Wo	47.24	46.78	47.02	49.33	47.77	48.51

6.4.3.5. Type 6 - hourglass zoning

This texture Type is not part of the clinopyroxene classification of Giacomoni 2014, but nevertheless an important additional texture type found in all locations investigated in this work (see also chapter 6.2.3).

The classification of the clinopyroxene with hourglass zoning is based on the classification of Ubide et al. (2019) and references therein.

Two sector-pairs can be distinguished often already on the BSE image, due to the darker SiO_2 and MgO richer hourglass sectors and the Al_2O_3 and TiO_2 richer prism sectors (Figure 6-66). Depending on the cut of the crystal the texture is differently well developed, and the hourglass cut is accordingly recognisable.

The higher MgO content in the hourglass sector also results in a higher $\text{Mg\#}$, which is between 4 (Monte Spagnolo, Monte Rossi) and 7 wt% (Mounts de Fiore, 2002/02 lava flow) higher than in the prism sector (Table 6-22 and Supplementary Data 11.2).

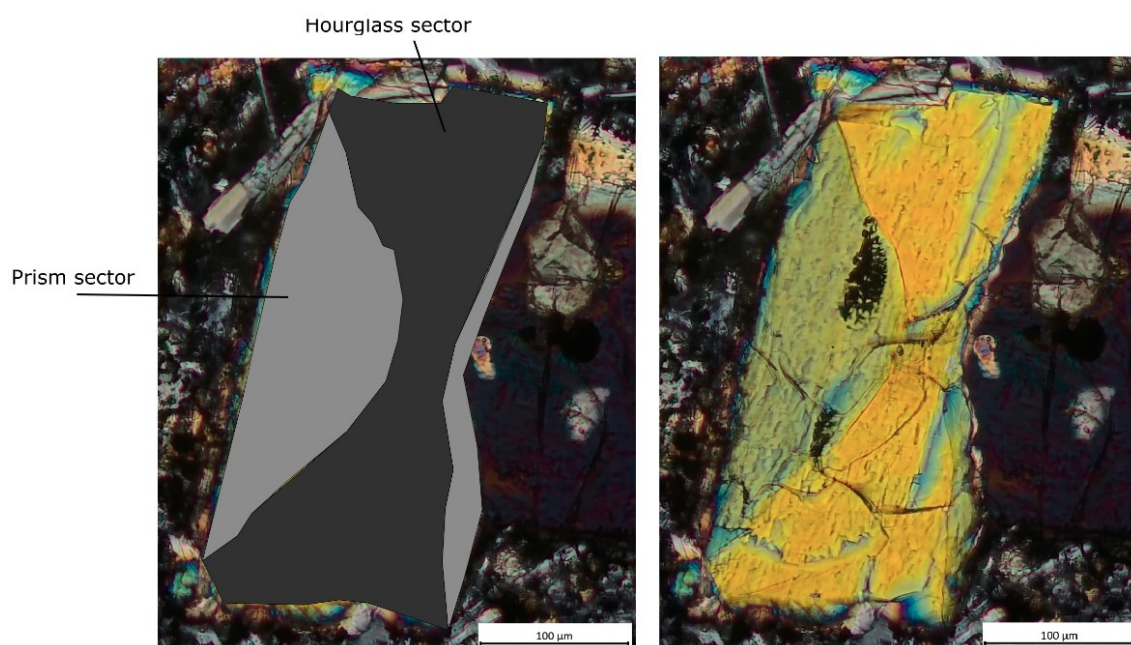


Figure 6-66: Clinopyroxene crystal with Type 6 – hourglass zoning on thin section 18MS01 (Monte Spagnolo)

Plotted in the Morimoto (1988) diagram, all analyses, except a few of Monte Spagnolo, fall entirely into the salite field. Those few analyses of Monte Spagnolo are in the diopside field, but very close to the salite field, due to the higher MgO content.

Generally, the prism sectors show a more hedenbergitic composition, thus a higher FeO content, than the hourglass sectors (Figure 6-67).

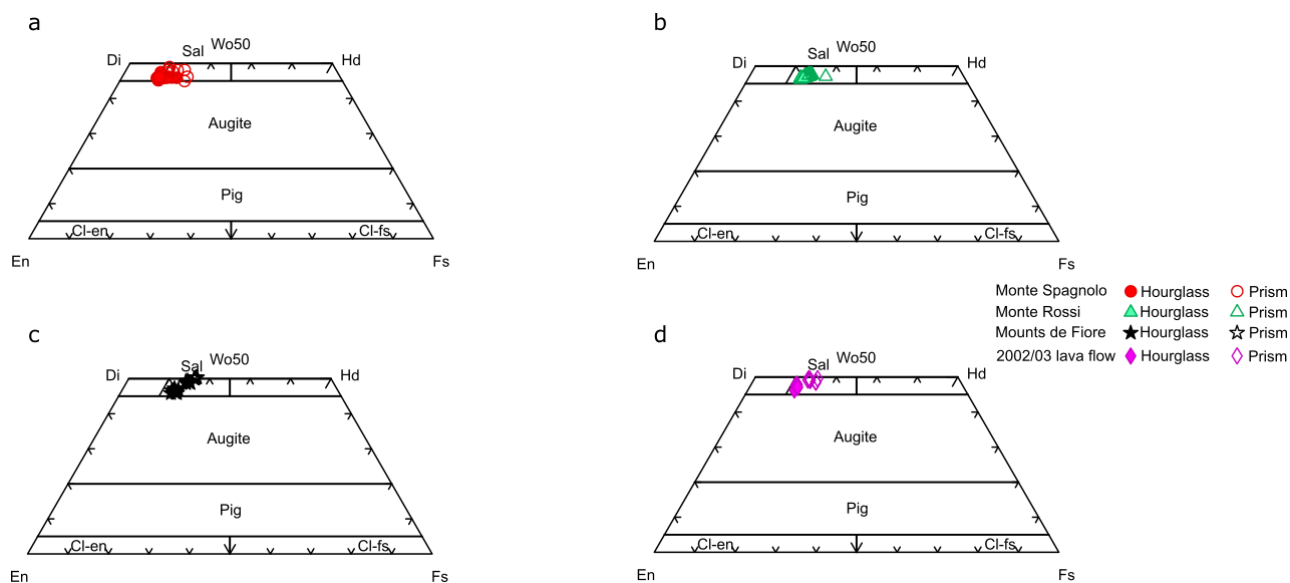


Figure 6-67: Composition of the Type 6 – hourglass zoned clinopyroxene from the four investigated locations, using the Morimoto (1988) diagram. a.) Monte Spagnolo, b.) Monte Rossi, c.) Mounts de Fiore and d.) 2002/03 lava flow. The abbreviations stand for **D**iopside, **S**alite, **H**edenbergite, **F**errosilite and **W**ollastonite (Supplementary Data 0).

The following section shows representative samples of Type 4 clinopyroxene for all sampling sites (Figure 6-68 to Figure 6-71). The composition of the depicted crystals is given in the tables below each figure (Table 6-21 to Table 6-24).

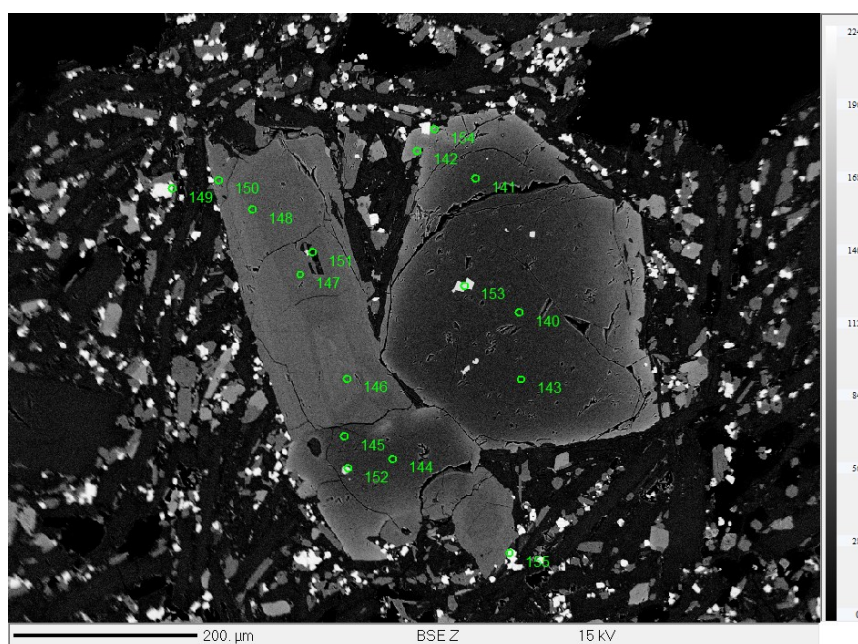


Figure 6-68: BSE image of a clinopyroxene with Type 6 - hourglass zoning from Monte Spagnolo (18MS01)

Table 6-21: The chemical composition of a Type 6 - clinopyroxene with hourglass zoning of Monte Spagnolo (18MS01) in wt% and the mean Mg# in mol.%

Texture	Type 6 - hourglass zoning		
Sample	Monte Spagnolo - 18MS01		
Position	Hourglass	Hourglass	Hourglass
Analysis	146_1 .	147_1 .	148_1 .
SiO ₂	50.50	50.19	45.84
TiO ₂	1.02	1.00	2.15
Al ₂ O ₃	3.11	4.11	7.75
Cr ₂ O ₃	<0.01	0.19	0.13
FeO	7.40	6.83	8.31
MnO	0.19	0.17	0.14
NiO	<0.01	0.04	0.01
MgO	14.36	14.59	12.29
CaO	22.03	22.12	21.99
Na ₂ O	0.45	0.34	0.42
Total	99.08	99.58	99.02
Mg#	77.58	79.19	72.49
En	41.81	42.51	37.51
Fs	12.08	11.17	14.24
Wo	46.11	46.32	48.25

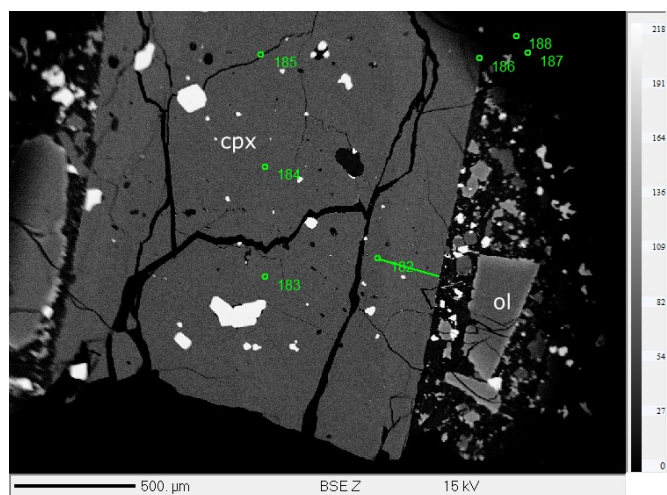


Figure 6-69: BSE image of a clinopyroxene with Type 6 - hourglass zoning from Monte Rossi (18MR01)

Table 6-22: The chemical composition of a Type 6 - clinopyroxene with hourglass zoning of Monte Rossi (18MR01) in wt% and the mean Mg# in mol.% (Data of line scan see Supplementary Table 0)

Texture	Table 6 - hourglass zoning			
	Monte Rossi - 18MR01			
Sample	Hourglass	Hourglass	Hourglass	Prism
Position	Hourglass	Hourglass	Hourglass	Prism
Analysis	183_1 .	184_1 .	185_1 .	186_1 .
SiO ₂	49.37	49.70	49.87	47.36
TiO ₂	4.15	4.24	4.09	5.95
Al ₂ O ₃	1.37	1.37	1.31	1.73
Cr ₂ O ₃	0.02	<0.01	<0.01	0.02
FeO	7.95	7.81	8.00	8.45
MnO	0.20	0.21	0.20	0.17
NiO	<0.01	<0.01	0.01	<0.01
MgO	13.47	13.49	13.59	12.72
CaO	21.91	21.77	21.98	21.92
Na ₂ O	0.56	0.55	0.54	0.46
Total	99.00	99.13	99.59	98.80
Mg#	75.12	75.49	75.18	72.85
En	39.15	40.00	40.25	38.30
Fs	13.57	13.25	13.07	14.27
Wo	47.28	46.75	46.68	47.43

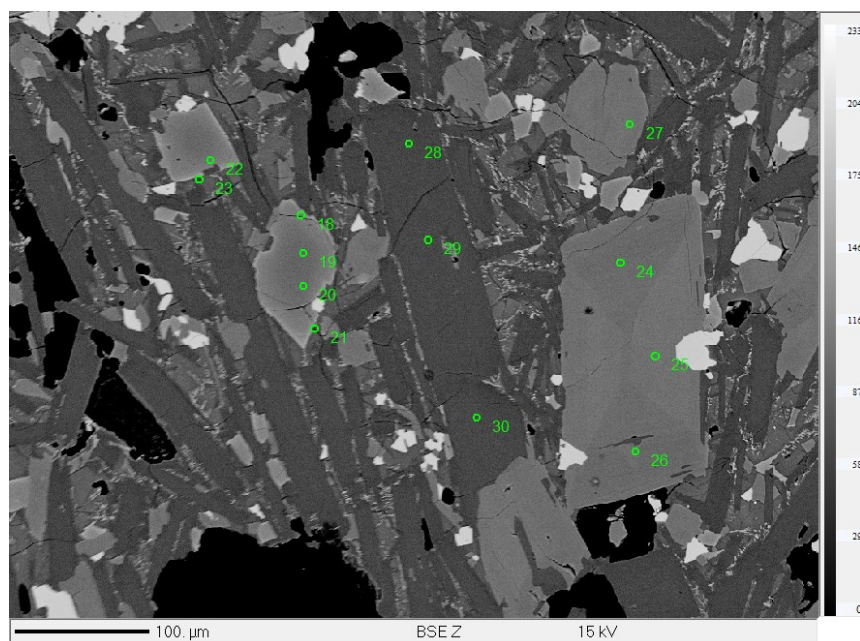


Figure 6-70: BSE image of a clinopyroxene with Type 6 - hourglass zoning from Mounts de Fiore (18MF03B)

Table 6-23: The chemical composition of a Type 6- hourglass zoned clinopyroxene Mounts de Fiore (18MF03B) in wt% and the mean Mg# in mol.%

Texture	Type 6 - hourglass zoning	
Sample	Mounts de Fiore - 18MF03B	
Position	Hourglass	Hourglass
Analysis	24_1.	26_1.
SiO ₂	47.63	48.79
TiO ₂	1.27	1.14
Al ₂ O ₃	5.19	4.06
Cr ₂ O ₃	0.01	<0.01
FeO	8.06	7.56
MnO	0.14	0.19
NiO	0.04	0.04
MgO	13.94	14.46
CaO	22.08	22.13
Na ₂ O	0.27	0.28
Total	98.62	98.64
Mg#	75.52	77.33
En	40.61	41.78
Fs	13.17	12.25
Wo	46.23	45.97

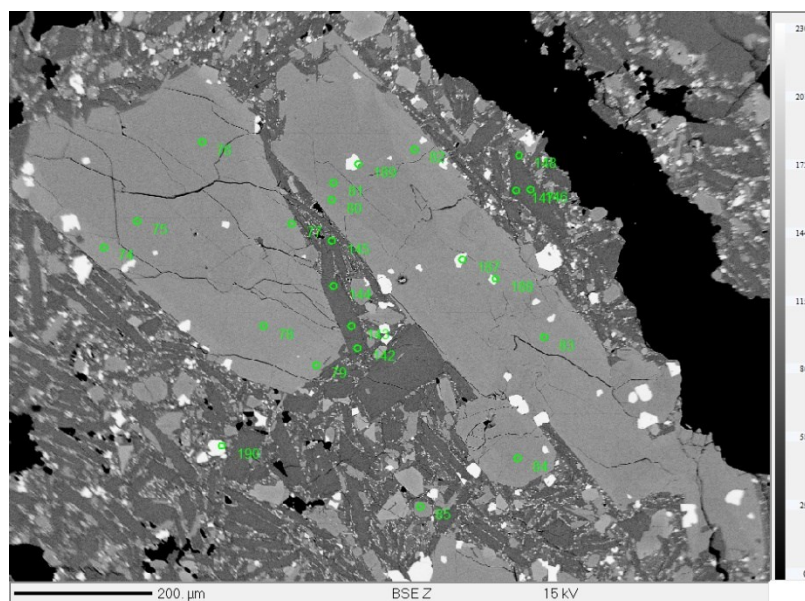


Figure 6-71: BSE image of a clinopyroxene with Type 6 - hourglass zoning from the 2002/03 lava flow (18RS02)

Table 6-24: The chemical composition of a Type 6- hourglass zoned clinopyroxene of the 2002/03 lava flow (18RS02) in wt% and the mean Mg# in mol.%

Texture	Type 6 - hourglass zoning					
Sample	2002/03 lava flow - 18RS02					
Position	Prism	Hourglass	Hourglass	Prism	Prism	Prism
Analysis	74_1 .	75_1 .	76_1 .	77_1 .	78_1 .	79_1 .
SiO ₂	46.30	49.66	49.61	44.52	46.28	46.18
TiO ₂	2.37	1.17	1.11	2.57	1.97	2.32
Al ₂ O ₃	7.07	4.51	4.52	9.10	7.45	7.24
Cr ₂ O ₃	<0.01	0.02	0.03	0.02	0.01	<0.01
FeO	9.06	6.95	6.79	8.95	8.02	9.06
MnO	0.18	0.13	0.13	0.13	0.12	0.18
NiO	0.02	<0.01	0.01	<0.01	<0.01	0.02
MgO	11.81	14.15	14.31	11.37	12.34	11.88
CaO	22.29	23.03	23.00	22.43	22.89	22.44
Na ₂ O	0.43	0.28	0.26	0.38	0.34	0.42
Total	99.52	99.88	99.76	99.45	99.44	99.75
Mg#	69.92	78.40	78.98	69.36	73.28	70.03
En	35.88	40.89	41.30	34.96	37.06	35.90
Fs	15.44	11.26	10.99	15.44	13.51	15.36
Wo	48.68	47.84	47.72	49.60	49.42	48.73

Position	Prism	Hourglass	Prism	Prism	Hourglass
Analysis	80_1 .	81_1 .	82_1 .	83_1 .	84_1 .
SiO ₂	46.70	49.53	46.20	46.06	49.67
TiO ₂	1.86	1.09	2.05	1.88	1.12
Al ₂ O ₃	7.21	4.49	7.66	7.25	4.31
Cr ₂ O ₃	0.05	0.03	0.05	0.04	<0.01
FeO	7.89	6.83	8.20	7.83	7.22
MnO	0.12	0.13	0.12	0.13	0.14
NiO	0.01	0.01	<0.01	0.02	<0.01
MgO	12.56	14.09	12.30	12.26	14.24
CaO	22.92	23.02	22.67	22.86	22.73
Na ₂ O	0.34	0.27	0.31	0.31	0.26
Total	99.67	99.49	99.56	98.65	99.71
Mg#	73.94	78.62	72.77	73.63	77.86
En	37.53	40.88	37.05	37.06	41.12
Fs	13.23	11.12	13.87	13.27	11.70
Wo	49.24	48.01	49.08	49.67	47.18

6.4.4. Plagioclase

6.4.4.1. General classification

The classification of plagioclase is based on the work of Giacomoni et al. (2014). Four of their seven (a-g) distinguished texture types were found in the studied thin sections:

- **Type a** - oscillatory zoning
- **Type b** - clear rounded core
- **Type e** - sieved-textured core
- **Type g** - rim with melt inclusion alignments

A total of 333 analyses were conducted on 69 individual phenocrysts and a number of matrix crystals. Depending on the size and availability of plagioclase phenocrysts, the number of analyses varies among the individual samples. For example, the plagioclase analyses in the Mounts de Fiore basalts are entirely limited either to the matrix or to inclusions. Therefore, no analyses of phenocrysts were performed.

The most frequently analysed texture type is the Type a - oscillatory zoning, with 51 analyses on 29 phenocrysts, 112 on matrix crystals and 10 inclusions.

The second most frequent texture with 137 analyses on 34 crystals, is the Type e, plagioclase with a sieved-textured core analysis.

The third most frequent texture type is Type b, plagioclase with a clear rounded core, 14 analyses on 8 crystals.

The least frequent texture type is Type g, plagioclase with aligned melt inclusions near the rim with 9 analyses on one crystal of Monte Spagnolo.

The presentation of plagioclase in its three endmembers allows a quick overview of the general geochemical composition. Each of these endmembers represents the predominance of a major element (Ca, Na or K).

- **Anorthite** – $\text{Ca}[\text{Al}_2\text{Si}_2\text{O}_8]$
- **Albite** – $\text{Na}[\text{AlSi}_3\text{O}_8]$
- **Orthoclase** - $\text{K}[\text{AlSi}_3\text{O}_8]$

This endmember distribution can best be visualized in a ternary diagram, where the mentioned endmembers functions as the endpoints of the triangle.

Generally, the composition of the plagioclase is mostly bytownitic, labradoritic or andesitic.

Whereby, the sampling locations can be divided into two groups: a) Monte Spagnolo and Monte Rossi (pre-1971 eruptions) and b) Mounts de Fiore and 2002/03 lava flow (post-1971 eruptions). Characteristic for group a) is a wider range of the endmember composition, as some analyses show even an anorthoclase composition. Whereas group b) is basically limited to the bytownite and labradorite field.

Some of the plagioclases fall into the miscibility gap and are referred to as ternary feldspar.

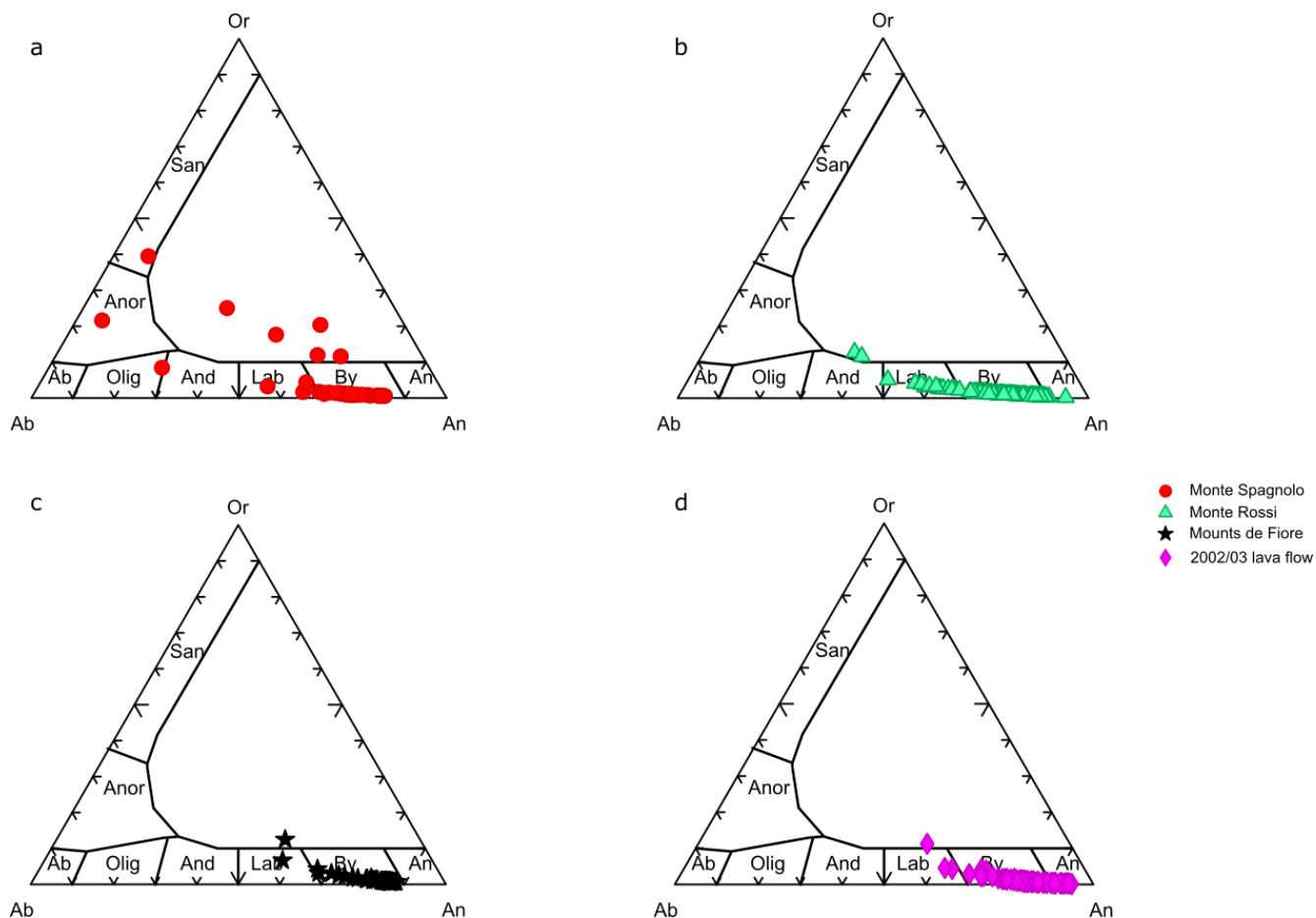


Figure 6-72: Ternary diagrams of the overall plagioclase composition. Each triangle contains all plagioclase analyses of the individual location. a.) Monte Spagnolo, b.) Monte Rossi, c.) Mounts de Fiore and d.) 2002/03 lava flow. The abbreviations stand for Albite, Anorthite and Orthoclase (Supplementary Data 11.3).

6.4.4.2. Type a - oscillatory zoning

Most of the analysed plagioclase with Type a - oscillatory zoning are, due to their abundance, matrix plagioclase (113 of 174).

The plagioclase of Type a is characterized primarily by an oscillatory zoning, which represents a more diverse environment, where the composition of the surrounding melt varies. This can be either through melt influx, water content of the melt or due to surrounding crystals.

Normal zoning, which is also quite frequently found., represents crystals with a core, that shows a higher temperature composition than the rim and mainly stands for a progressive development of the surrounding melt composition during the growth of the crystal.

In the basalts of Mounts de Fiore the plagioclase occurs only in the matrix and as inclusion. In the other sample sites plagioclase is also present in form of phenocrysts. The Al_2O_3 and the CaO content decreases in the order core>rim>matrix>inclusion, coupled with an increase of the SiO_2 , TiO_2 , FeO, Na_2O and K_2O content.

The MgO content increases in the samples of Monte Spagnolo in the same order from 0.10 to 0.25 wt% and at Mounts de Fiore between matrix and inclusions from 0.12 to 0.23 wt%. The samples of the 2002/03 lava flow and Monte Rossi show only marginal changes of the MgO content. The former shows an increase from core to inclusion from 0.10 to 0.11 wt% and the latter even a small decrease from 0.08 at the core to 0.07 wt% at the matrix plagioclase, with 0.09 wt% at the rim (Supplementary Data 0).

Plotted in a ternary plot the core and the rim of the Type 1 plagioclase is mostly of bytownitic and labradoritic composition. The matrix plagioclase and the plagioclase inclusions have a higher NaO content and fall therefore also in the andesine field. This is especially the case for Monte Spagnolo and Monte Rossi.

The other two sampling sites, Mounts de Fiore and the 2002/03 lava flow fall almost completely into the bytownitic field.

Five analyses of Monte Spagnolo and one analysis of Mounts de Fiore and the 2002/03 lava flow, respectively, fall into the miscibility gap and can be referred to as ternary feldspar (Figure 6-73).

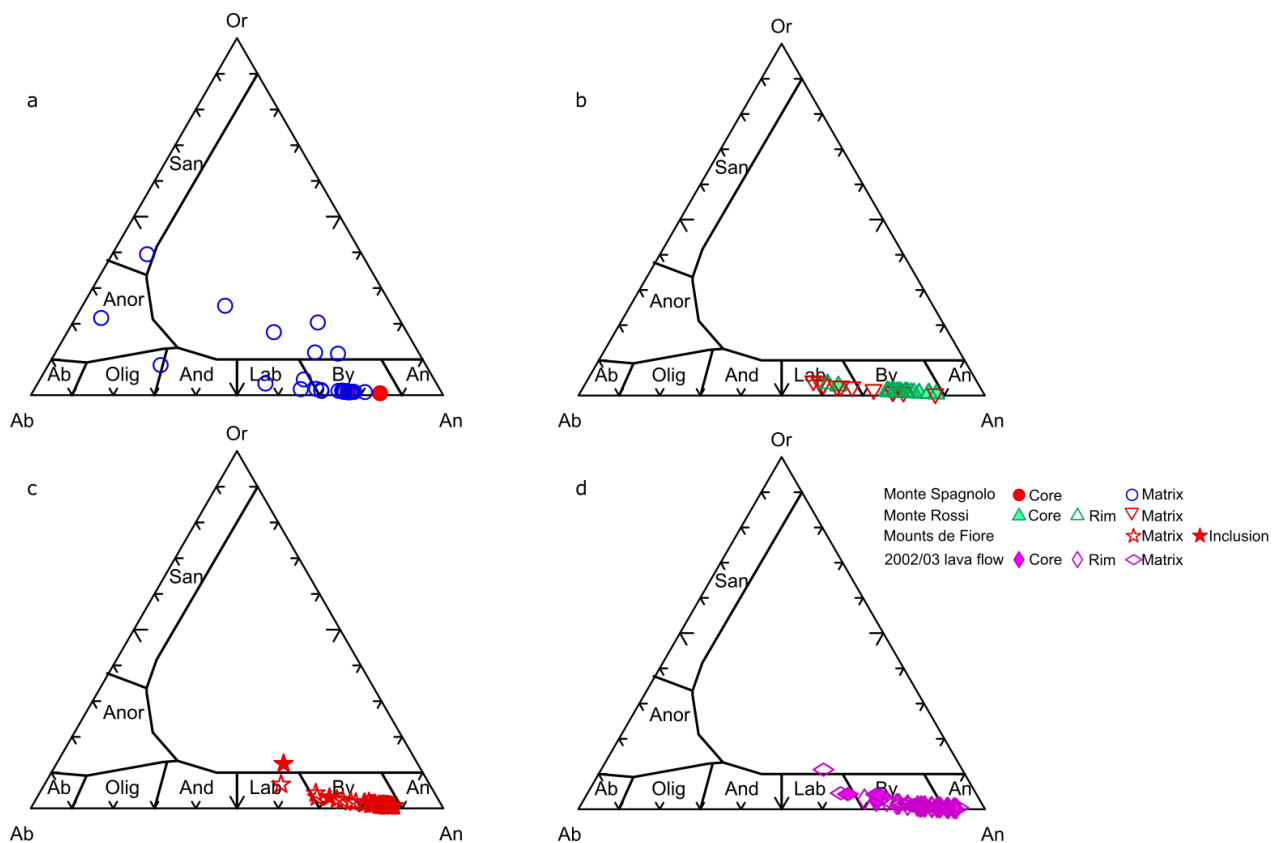


Figure 6-73: Ternary diagrams of the composition of Type a – oscillatory zoned plagioclase. The analyses are divided into core, rim, matrix, and inclusion. a.) Monte Spagnolo, b.) Monte Rossi, c.) Mounts de Fiore and d.) 2002/03 lava flow. The abbreviations stand for **Al**bite, **An**orthite and **Or**thoclase (Supplementary Data 11.3).

The following section shows representative samples of Type a plagioclase for all sampling sites (Figure 6-74Figure 6-77). The composition of the depicted crystals is given in the tables below each figure (Table 6-25Table 6-28).

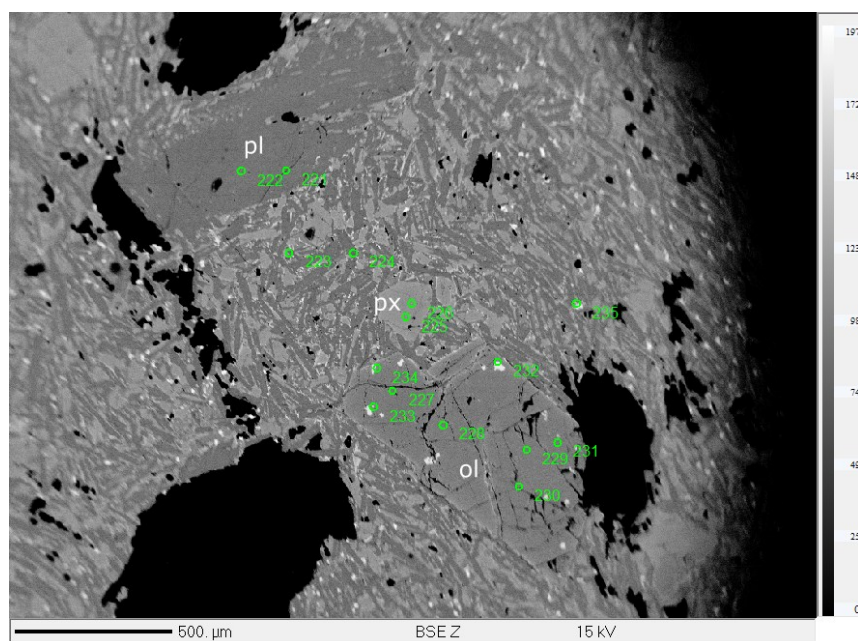


Figure 6-74: BSE image of a plagioclase with Type a – oscillatory zoning from Monte Spagnolo (18MS05)

Table 6-25: The chemical composition of a Type a- oscillatory zoned plagioclase of Monte Spagnolo (18MS05) in wt% and the mean Mg# in mol. %

Texture	Type a - oscillatory zoning		
Sample	Monte Spagnolo - 18MS05		
Position	Matrix	Matrix	Matrix
Analysis	264_1 .	265_1 .	266_1 .
SiO ₂	41.86	50.36	56.43
TiO ₂	0.98	1.31	0.52
Al ₂ O ₃	14.56	16.60	18.06
FeO	4.26	3.14	6.07
MgO	0.69	0.94	0.94
CaO	14.78	11.29	0.77
Na ₂ O	4.69	4.97	5.22
K ₂ O	4.19	3.60	6.00
Total	86.01	92.21	94.01
An	68.70	62.97	8.48
Ab	19.71	25.10	52.09
Or	11.59	11.94	39.43

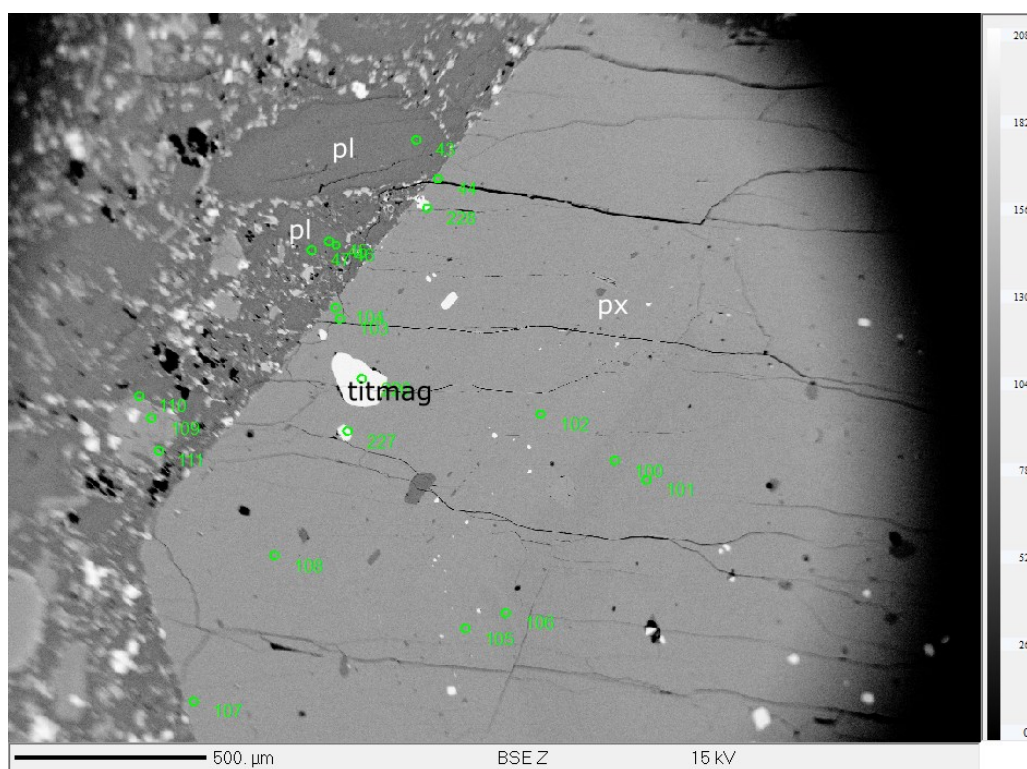


Figure 6-75: BSE image of a plagioclase with Type a – oscillatory zoning from Monte Rossi (18MR03)

Table 6-26: The chemical composition of a Type a- oscillatory zoned plagioclase of Monte Rossi (18MR03) in wt% and the mean Mg# in mol.%

Texture	Type a - oscillatory zoning	
Sample	Monte Rossi - 18MR03	
Position	Core	Rim
Analysis	45_1 .	46_1 .
SiO ₂	47.72	51.65
TiO ₂	0.05	0.08
Al ₂ O ₃	32.04	29.47
FeO	0.70	0.71
MgO	0.05	0.08
CaO	15.91	12.95
Na ₂ O	2.35	4.04
K ₂ O	0.13	0.29
Total	98.94	99.27
An	87.86	77.19
Ab	11.72	21.77
Or	0.42	1.04

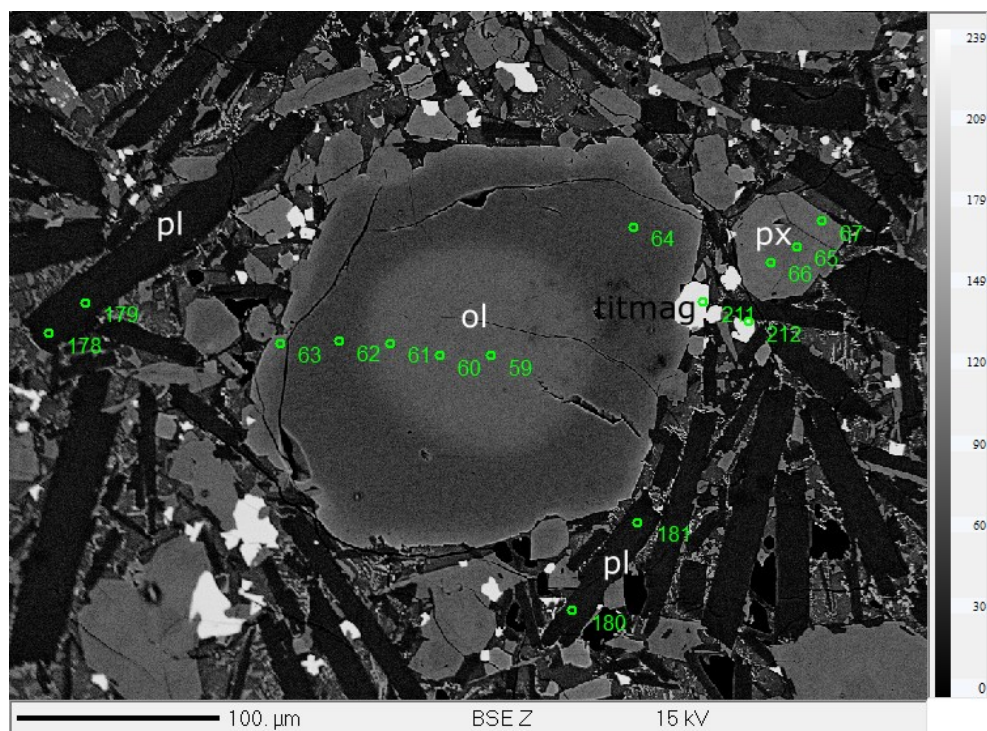


Figure 6-76: BSE image of a plagioclase with Type a – oscillatory zoning from Mounts de Fiore (18MF01)

Table 6-27: The chemical composition of a Type a- oscillatory zoned plagioclase of Mounts de Fiore (18MF01) in wt% and the mean Mg# in mol.%

Texture	Type a - oscillatory zoning			
Sample	Mounts de Fiore - 18MF01			
Position	Matrix	Matrix	Matrix	Matrix
Analysis	178_1 .	179_1 .	180_1 .	181_1 .
SiO ₂	53.90	49.62	50.19	48.87
TiO ₂	0.11	0.08	0.08	0.07
Al ₂ O ₃	27.68	30.99	30.68	31.20
FeO	0.97	0.98	1.06	1.10
MgO	0.11	0.13	0.10	0.11
CaO	10.54	14.81	14.35	15.01
Na ₂ O	5.00	2.89	3.29	2.77
K ₂ O	0.81	0.27	0.33	0.25
Total	99.12	99.76	100.08	99.36
An	67.81	84.21	81.90	84.99
Ab	29.09	14.89	16.97	14.17
Or	3.09	0.90	1.14	0.84

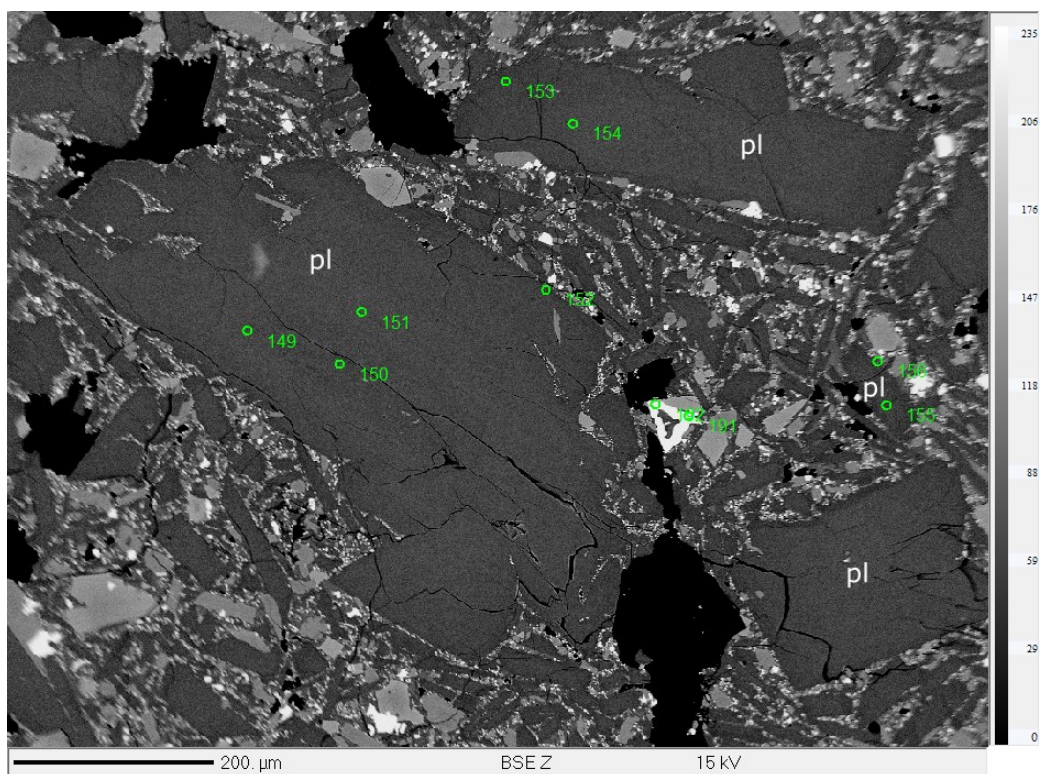


Figure 6-77: BSE image of a plagioclase with Type a – oscillatory zoning from the 2002/03 lava flow (18RS02)

Table 6-28: The chemical composition of a Type a- oscillatory zoned plagioclase of the 2002/03 lava flow (18RS02) in wt% and the mean Mg# in mol.%

Texture	Type a - oscillatory zoning						
Sample	2002/03 lava flow - 18RS02						
Position	Core	Core	Core	Rim	Core	Core	Matrix
Analysis	149_1 .	150_1 .	151_1 .	152_1 .	153_1 .	154_1 .	155_1 .
SiO ₂	48.13	49.05	46.80	51.63	53.10	49.03	50.31
TiO ₂	0.03	0.05	0.03	0.09	0.10	0.05	0.10
Al ₂ O ₃	32.17	31.19	32.98	29.65	28.34	31.13	30.06
FeO	0.70	0.72	0.65	0.84	0.77	0.79	0.98
MgO	0.09	0.11	0.08	0.10	0.11	0.12	0.09
CaO	16.07	15.06	17.08	13.36	11.72	15.07	13.82
Na ₂ O	2.33	2.87	1.85	3.87	4.59	2.83	3.43
K ₂ O	0.16	0.20	0.09	0.42	0.62	0.21	0.45
Total	99.69	99.25	99.57	99.95	99.35	99.23	99.23
An	87.95	84.73	90.82	78.08	72.14	84.87	80.40
Ab	11.54	14.59	8.91	20.45	25.59	14.41	18.03
Or	0.51	0.68	0.27	1.47	2.28	0.72	1.57

6.4.4.3. Type b - clear rounded core

Plagioclase with texture Type b - clear rounded core, has been found only in the basalts of Monte Rossi. The analyses can be grouped into a) core and rim analyses of phenocrysts and b) matrix plagioclase. A total of 14 analyses were conducted on Type b plagioclase.

A decrease of the Ca content from core to rim is visible in the ternary diagram, as the core analyses plot primarily in the bytownite-andesite boarder region and the rim and matrix analyses fall into also in the labradorite field (Figure 6-78, Table 6-29)

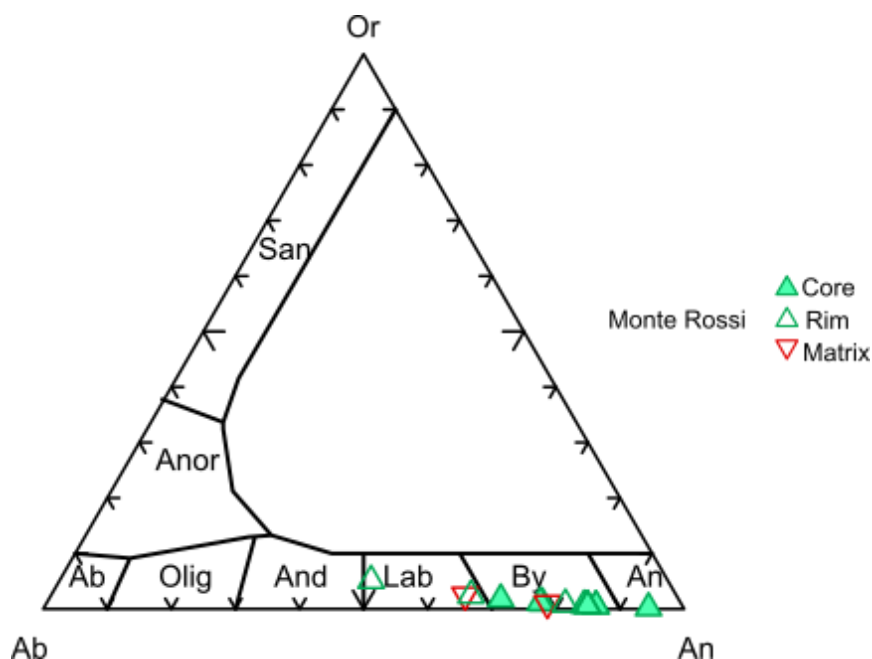


Figure 6-78: Ternary diagrams of the composition of Type b – plagioclase of Monte Rossi with a clear rounded core. The analyses are divided into core, rim, and matrix. The abbreviations stand for **Albite**, **Anorthite** and **Orthoclase** (Table 6-29).

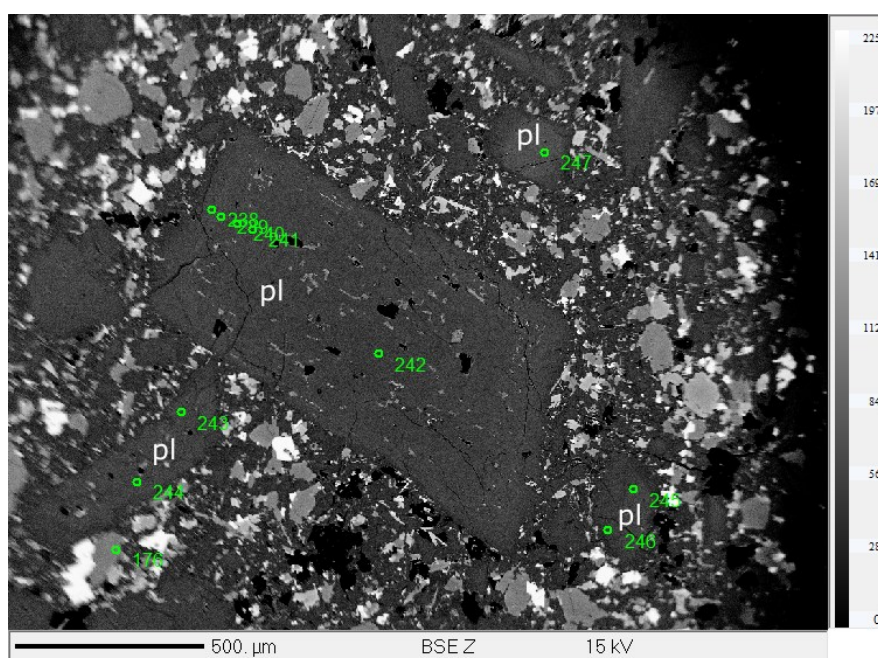


Figure 6-79: BSE image of a plagioclase with Type b – clear rounded core from 18MR01 (Monte Rossi)

Table 6-29: The chemical composition of the Type b – plagioclase with a clear rounded core of Monte Rossi (18MR01 & 18MR03) in wt% and the mean Mg# in mol.%

Texture	Type b - clear rounded core						
Sample	Monte Rossi - 18MR01 & 18MR03						
Position	Core	Core	Core	Core	Core	Core	Core
Analysis	223_1 .	224_1 .	245_1 .	246_1 .	247_1 .	17_1 .	43_1 .
SiO ₂	48.62	49.46	49.63	51.75	45.05	53.78	48.47
TiO ₂	0.05	0.05	0.05	0.09	0.02	0.10	0.05
Al ₂ O ₃	31.51	31.12	31.25	29.65	34.05	28.20	31.63
FeO	0.72	0.73	0.73	0.70	0.68	0.66	0.72
MgO	0.07	0.10	0.08	0.11	0.06	0.05	0.07
CaO	15.30	14.94	14.92	12.92	18.34	11.27	15.49
Na ₂ O	2.66	3.00	2.89	3.98	1.17	4.89	2.67
K ₂ O	0.16	0.19	0.17	0.30	0.05	0.46	0.16
Total	99.09	99.59	99.72	99.49	99.43	99.42	99.27
An	85.96	84.08	84.59	77.38	94.37	70.55	86.03
Ab	13.51	15.29	14.84	21.56	5.47	27.72	13.44
Or	0.53	0.63	0.57	1.06	0.17	1.73	0.53

Position	Matrix	Matrix	Core	Rim	Rim	Rim	Rim
Analysis	18_1 .	19_1 .	57_1 .	15_1 .	16_1 .	44_1 .	58_1 .
SiO ₂	55.43	51.57	52.00	48.94	50.38	55.10	59.37
TiO ₂	0.12	0.08	0.09	0.05	0.06	0.13	0.16
Al ₂ O ₃	27.12	29.64	29.46	31.44	30.39	27.07	24.65
FeO	0.71	0.80	0.78	0.76	0.67	0.80	0.48
MgO	0.06	0.08	0.10	0.11	0.09	0.10	0.02
CaO	10.01	13.34	12.98	15.01	14.11	10.08	6.70
Na ₂ O	5.64	3.93	4.08	2.88	3.49	5.44	7.05
K ₂ O	0.66	0.29	0.32	0.17	0.23	0.62	1.18
Total	99.73	99.72	99.81	99.38	99.42	99.36	99.61
An	64.58	78.18	77.01	84.69	81.08	65.56	48.62
Ab	32.90	20.82	21.87	14.73	18.13	32.03	46.28
Or	2.52	1.00	1.12	0.58	0.79	2.41	5.10

6.4.4.4. Type e - sieved texture

Plagioclase with a Type e texture is the most common and most frequent analysed phenocryst. They are found in the samples of Monte Spagnolo, Monte Rossi, and the 2002/03 lava flow. They are missing in the samples of Mounts de Fiore, where plagioclase is only present as part of the matrix.

This plagioclase is characterized by partially recrystallized melt pockets, which are randomly spread across the core, but not in the rim.

At Monte Spagnolo only one core was analysed and therefore a comparison within the location is not possible.

The plagioclase of Monte Rossi shows only minimal compositional variations of $\pm 1-2$ wt% between core and rim, for the major elements SiO_2 , Al_2O_3 or CaO and only $<0.01-0.5$ wt% for TiO_2 , FeO , MgO , Na_2O and K_2O .

At the 2002/03 lava flow the results show the same trend, but with broader ranges, as the major elements SiO_2 , Al_2O_3 or CaO are in the range of 4 - 5 wt% and TiO_2 , FeO , MgO , Na_2O and K_2O in the range of around 0.5 to 2 wt%.

A closer look at the different thin sections confirms the trend described above for the sample of the 2002/03 lava flow, as well as for Monte Rossi.

The most important thin sections to compare are 18RS02, of the 2002/03 lava flow and 18MR01 and 18MR03 of Monte Rossi, since those three are the ones with core analyses, as well as with rim analyses made on the same crystal.

The main differences between the locations are the CaO content, with 16.08 - 17.60 wt% at the core and 12.46 wt% at the rim of the 2002/03 lava flow compared to the 13.05-14.40 wt% at the core and the 12.00 - 14.07 wt% at the rim of Monte Rossi.

The one core of Monte Spagnolo is with an average of 13.76 wt% in the middle range of the samples from Monte Rossi.

The FeO content is except for the rim of 18RS02 in the range of 0.68 and 0.73 wt%. The rim of 18RS02 reaches an FeO content of up to 0.83 wt%.

The Na_2O and K_2O content, which varies from sample to sample with the same trend of a lower content in the core than in the rim.

For 18RS02 the Na_2O content increases from 2.32 to 4.15 wt% and the K_2O content from 0.17 to 0.51 wt%.

18MR01 and 18MR03 show a Na_2O increase of 3.22 to 3.39 wt% and a coupled increase of K_2O from 0.22 to 0.24 wt% and from 0.32 to 0.63 wt%.

For Monte Spagnolo the Na_2O content lies at 3.62 and The K_2O content at 0.23 wt%.

The ternary plots show that the core analyses are of a more CaO -rich bytownitic and even anorthitic (2002/03 lava flow) composition, whereas the rim is less anorthitic and shows at Monte Rossi even a labradoritic composition. Two analyses of Monte Rossi even show an anorthoclase composition (Figure 6-80).

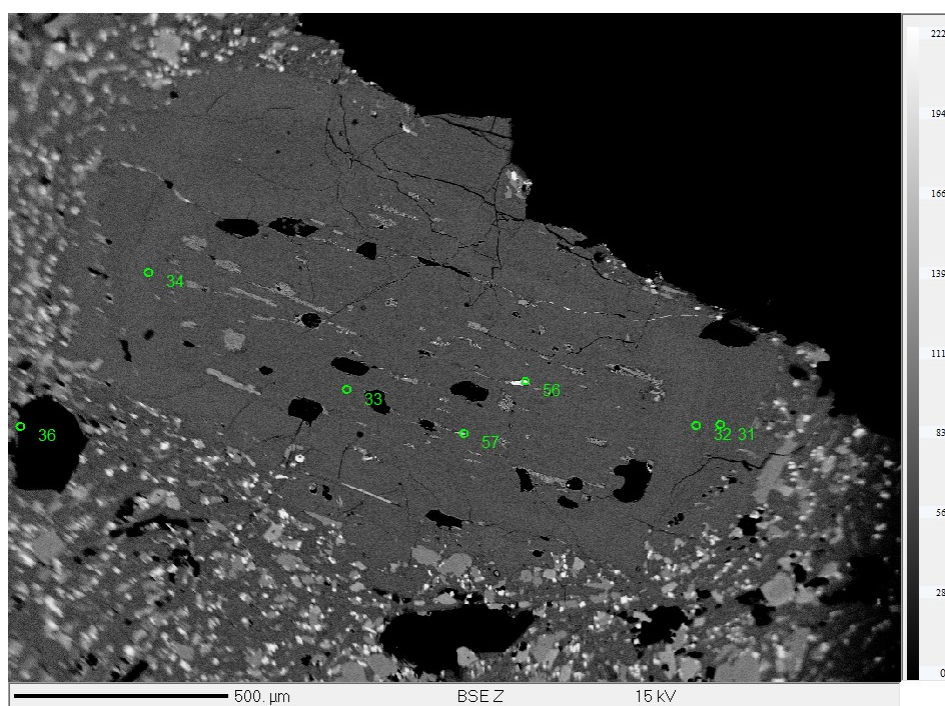


Figure 6-81: BSE image of a plagioclase with Type e – sieve texture from Monte Spagnolo (18MS01)

Table 6-30: The chemical composition of a Type e- sieved textured plagioclase of Monte Spagnolo (18MS01) in wt% and the mean Mg# in mol.%

Texture	Type e - sieved texture			
Sample	Monte Spagnolo - 18MS01			
Position	Core	Core	Core	Core
Analysis	31_1 .	32_1 .	33_1 .	34_1 .
SiO ₂	52.04	50.33	51.41	49.87
TiO ₂	0.08	0.05	0.01	0.04
Al ₂ O ₃	29.33	30.50	29.76	30.83
FeO	0.68	0.67	0.69	0.68
MgO	0.07	0.08	0.09	0.08
CaO	12.66	14.04	13.59	14.76
Na ₂ O	4.17	3.45	3.79	3.07
K ₂ O	0.28	0.20	0.27	0.18
Total	99.31	99.31	99.60	99.50
An	76.28	81.24	79.10	83.67
Ab	22.73	18.09	19.98	15.73
Or	0.99	0.67	0.92	0.59

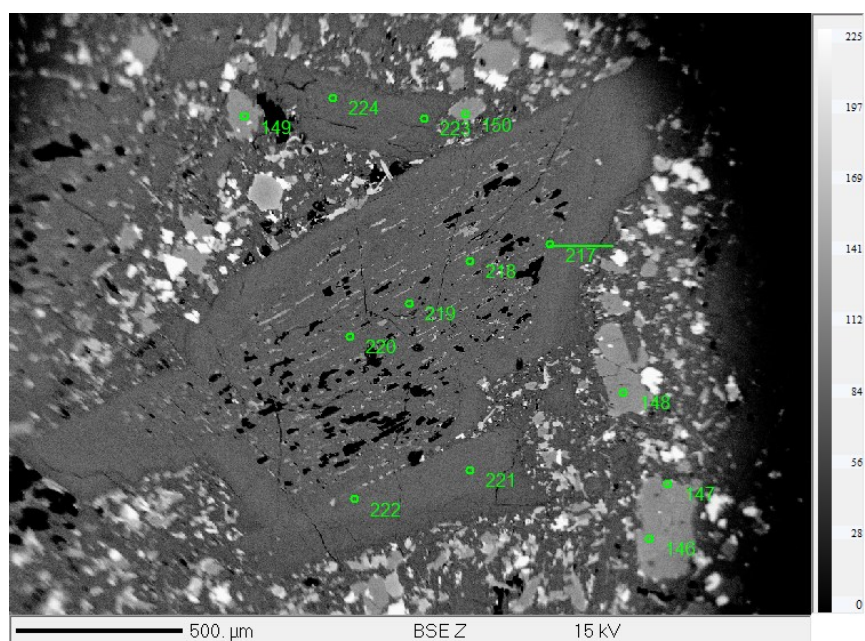


Figure 6-82: BSE image of a plagioclase with Type e – sieve texture from Monte Rossi (18MR01)

Table 6-31: The chemical composition of a Type e- sieved textured plagioclase of Monte Rossi (18MR01) in wt% and the mean Mg# in mol.% (Data of line scan see Supplementary Table 11.3)

Texture	Type e - sieved texture				
Sample	Monte Rossi - 18MR01				
Position	Core	Core	Core	Core	Core
Analysis	218_1 .	219_1 .	220_1 .	221_1 .	222_1 .
SiO ₂	49.59	48.40	49.99	47.06	47.24
TiO ₂	0.04	0.04	0.06	0.04	0.03
Al ₂ O ₃	30.98	31.69	30.73	32.38	32.50
FeO	0.72	0.74	0.73	0.67	0.73
MgO	0.08	0.07	0.11	0.06	0.05
CaO	14.88	15.71	14.52	16.38	16.52
Na ₂ O	2.97	2.55	3.25	2.18	2.11
K ₂ O	0.21	0.15	0.22	0.11	0.13
Total	99.46	99.34	99.59	98.87	99.32
An	84.12	86.76	82.54	88.97	89.26
Ab	15.17	12.76	16.71	10.69	10.33
Or	0.71	0.49	0.74	0.34	0.41

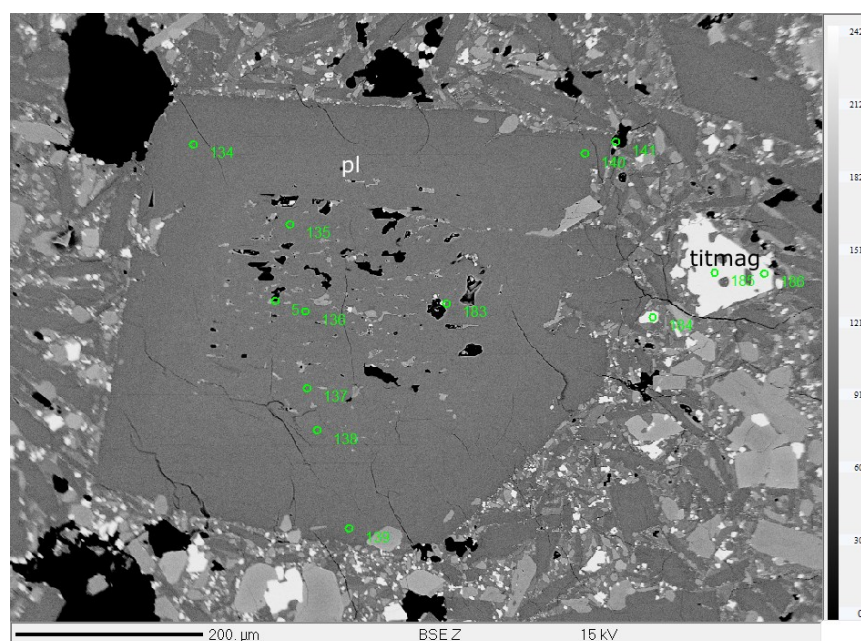


Figure 6-83: BSE image of a plagioclase with Type e – sieve texture from the 2002/03 lava flow (18RS02)

Table 6-32: The chemical composition of a Type e- sieved textured plagioclase of the 2002/03 lava flow (18RS02) in wt% and the mean Mg# in mol.%

Texture	Type e - sieved texture							
Sample	2002/03 lava flow - 18RS02							
Position	Core	Core	Core	Core	Core	Rim	Core	Rim
Analysis	134_1 .	135_1 .	136_1 .	137_1 .	138_1 .	139_1 .	140_1 .	141_1 .
SiO ₂	50.06	46.26	48.83	45.72	46.94	51.50	50.44	53.40
TiO ₂	0.07	0.03	0.05	0.04	0.04	0.09	0.08	0.10
Al ₂ O ₃	30.76	33.20	31.71	33.69	32.81	29.70	30.33	28.44
FeO	0.82	0.68	0.64	0.71	0.68	0.85	0.83	0.80
MgO	0.12	0.05	0.07	0.06	0.08	0.12	0.08	0.09
CaO	14.37	17.52	15.60	18.18	16.92	13.30	13.89	11.62
Na ₂ O	3.16	1.64	2.59	1.27	1.88	3.72	3.36	4.58
K ₂ O	0.25	0.11	0.16	0.09	0.11	0.38	0.28	0.64
Total	99.62	99.50	99.64	99.76	99.46	99.66	99.28	99.67
An	82.66	91.86	86.49	93.81	90.56	78.71	81.26	72.00
Ab	16.47	7.80	13.00	5.92	9.08	19.94	17.76	25.65
Or	0.87	0.34	0.51	0.27	0.36	1.35	0.98	2.35

6.4.4.5. Type g - rim with melt inclusion alignment

This plagioclase is characterized by a rim with melt inclusion alignment of iso-oriented μm -sized melt inclusions.

This texture type is only found in one sample of Monte Spagnolo. Geochemically, core and rim differ especially in CaO , SiO_2 and Na_2O content. As the first one increases from around 12 up to 14 wt.%, the SiO_2 decreases from ~52 to 49 wt.% and the Na_2O content from 4.5 to 3.0 wt.% (Table 6-33).

Both, core and rim, plot into the bytownite field, but the rim shows clearly a more anorthitic composition (Figure 6-84).

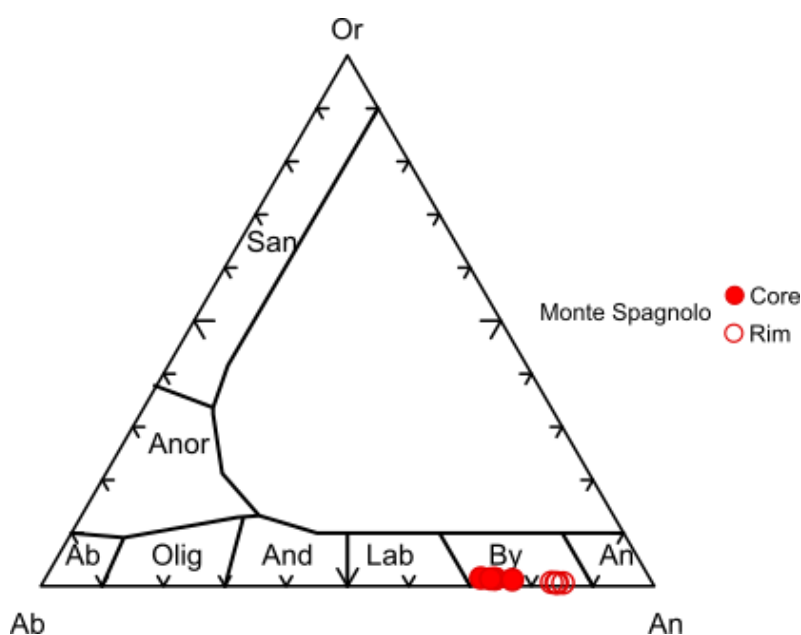


Figure 6-84: Ternary diagrams of the composition of Type g – plagioclase with a rim with aligned melt inclusions of Monte Spagnolo. The analyses are divided into core and rim. The abbreviations stand for **Al**bite, **An**orthite and **Or**thoclase (Table 6-33).

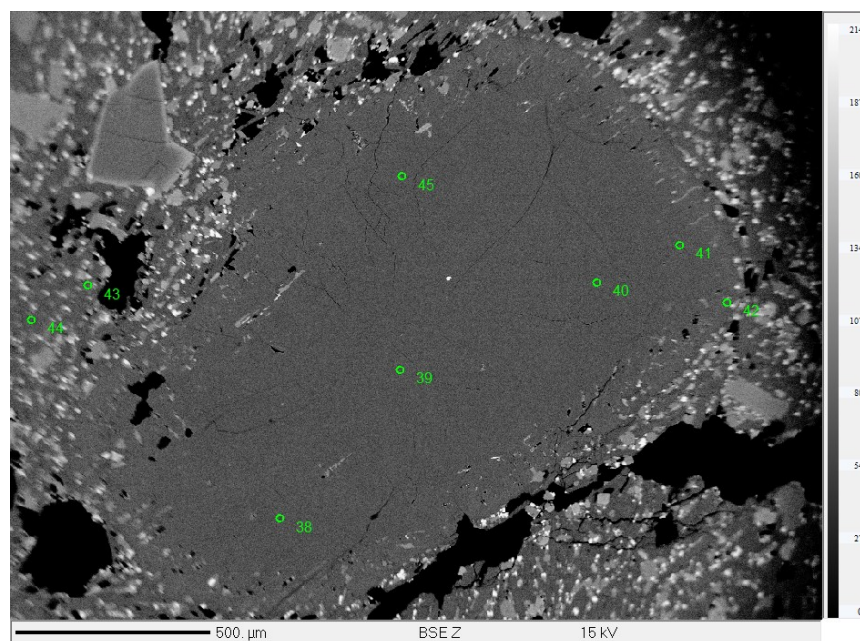


Figure 6-85: BSE image of a plagioclase with Type g – plagioclase with a rim with aligned melt inclusions from Monte Spagnolo (18MS01) Data see Table 6-33

Table 6-33: The chemical composition of the Type g - plagioclase with rims with melt inclusion alignments of Monte Spagnolo (18MS01) in wt% and the mean Mg# in mol.%

Texture	Type g - rims with melt inclusion alignments								
Sample	Monte Spagnolo - 18MS01								
Position	Core	Core	Core	Core	Core	Rim	Rim	Rim	Rim
Analysis	38_1 .	39_1 .	40_1 .	41_1 .	45_1 .	42_1 .	47_1 .	49_1 .	50_1 .
SiO ₂	53.09	52.82	53.97	51.87	53.44	49.85	48.70	48.97	48.90
TiO ₂	0.10	0.07	0.09	0.04	0.09	0.07	0.05	0.05	0.05
Al ₂ O ₃	28.66	28.81	28.19	29.19	28.55	30.73	31.49	31.16	31.19
FeO	0.63	0.61	0.64	0.70	0.66	0.79	0.74	0.71	0.72
MgO	0.07	0.09	0.12	0.06	0.09	0.06	0.05	0.07	0.07
CaO	11.92	12.03	11.24	12.61	11.69	14.56	15.02	14.68	14.72
Na ₂ O	4.52	4.59	4.82	4.11	4.63	3.18	2.85	3.04	3.00
K ₂ O	0.38	0.38	0.40	0.33	0.37	0.20	0.18	0.17	0.19
Total	99.37	99.39	99.46	98.92	99.52	99.43	99.08	98.85	98.83
An	73.41	73.31	70.98	76.29	72.62	82.93	84.84	83.70	83.90
Ab	25.20	25.30	27.51	22.52	26.00	16.38	14.56	15.70	15.46
Or	1.39	1.39	1.51	1.20	1.38	0.68	0.59	0.59	0.64

6.4.5. Titanomagnetite

Titanomagnetite occurs as: a) phenocryst, b) matrix-crystal and c) inclusion. In the samples investigated in this work, most of the analysed titanomagnetite (262 analyses) belong to the group c (183 analyses) and group b (56 analyses).

The low number of group a.) analyses is due to the generally smaller number of phenocrysts, compared to inclusions and matrix-crystals (see also Chapter 6.2.5).

The chromium number Cr# is, similar to the Mg#, an important value to compare the mineral composition of different samples. It is calculated as

$$\text{Cr\#} = (\text{Cr}_2\text{O}_3 / (\text{Cr}_2\text{O}_3 + \text{Al}_2\text{O}_3)) * 100).$$

The Cr# shows hardly any changes in the samples of the 2002/03 lava flow, regardless of the group or the position of the analysis and lies always around 0.16 mol.%. Only the titanomagnetite inclusion shows a Cr# of 0.27 mol.%.

The titanomagnetite of the other three locations shows a more diverse Cr#-range. At Mounts de Fiore it ranges from 0.2 in the matrix to 0.74 mol.% in the inclusion, at Monte Spagnolo from 0.17 in the matrix to 0.97 mol.% in the rim and at Monte Rossi it ranges from 0.09 in the matrix up to 0.61 in the matrix (Supplementary Data 11.4).

A special case are the samples of Monte Spagnolo, where, beside titanomagnetite, chromite was also found as an inclusion.

Chromite is characterized through a high Cr_2O_3 content of 30-40 wt% and a lower Al_2O_3 content of around 13 wt% (Supplementary Table 11.4). These inclusions of chromite were found mainly in olivine, but once also in a clinopyroxene (Figure 6-86).

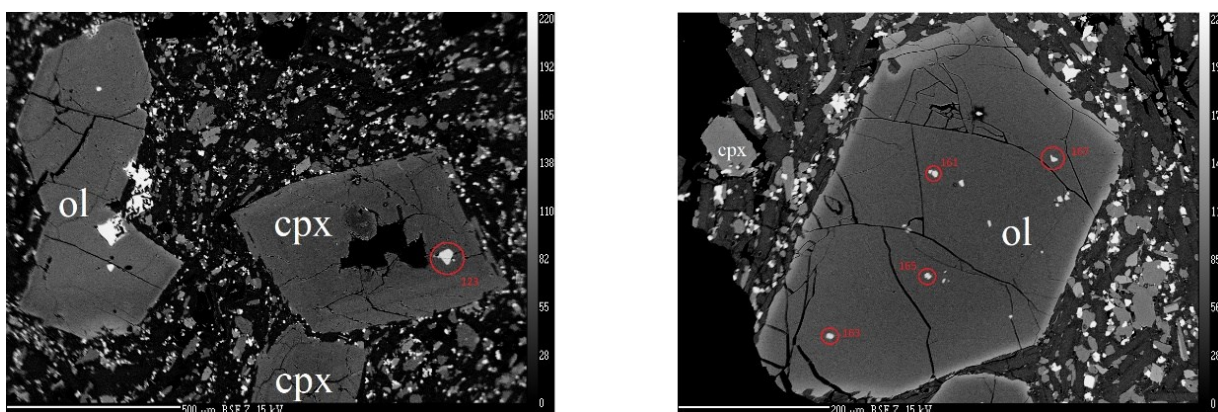


Figure 6-86: Inclusions of chromite in clinopyroxene (cpx) and olivine (ol) crystals (red circles)

The composition of the chromite inclusion in the clinopyroxene varies from the inclusion in olivine. The Cr_2O_3 content of the chromite in the clinopyroxene is about 7 wt% higher than of the chromite with an olivine host-mineral (Supplementary Data 11.4).

6.4.6. Melt inclusions

Melt inclusions can either be found in the matrix or trapped inside olivine, clinopyroxene or plagioclase crystals. A total of 56 analyses of melt inclusions were conducted for this work, distributed over all four locations: 16 on samples of Monte Rossi, 20 on samples of Monte Spagnolo, 21 on samples of Mounts de Fiore and the remaining 9 on samples of the 2002/03 lava flow.

Plotted into the TAS diagram, according to Le Maitre et al (1989), the melt inclusions can be categorized into two groups (Figure 6-87):

- The pre-1971 eruptions with a trachytic, basaltic composition (Monte Spagnolo & Monte Rossi)
- The post 1971 eruptions with a tephriphonolitic and phonolitic composition (Mounts de Fiore & the 2002/03 lava flow)

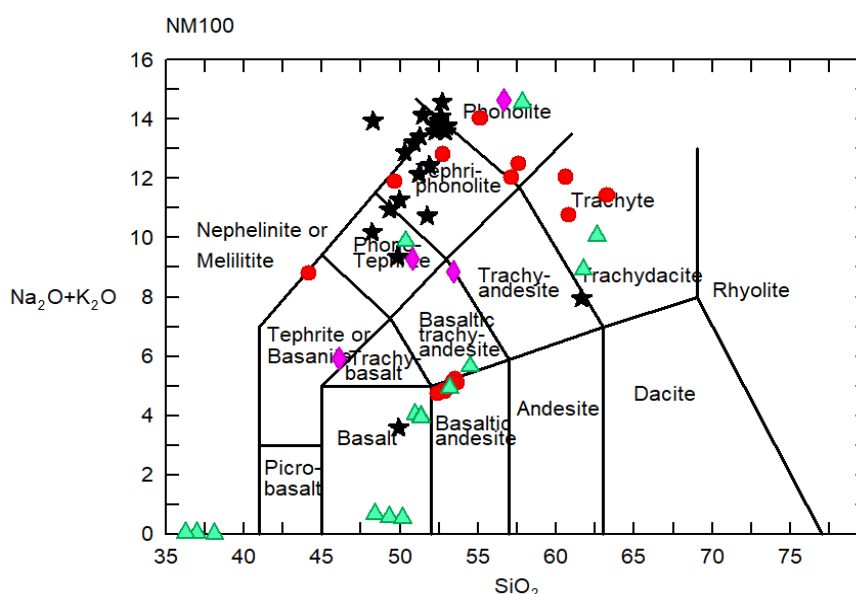


Figure 6-87: TAS-Diagram of the XRF-analysis showing a clear trachybasaltic composition for the samples of all locations; mineral content in wt% (Le Maitre et al., 1989). Monte Spagnolo – red circles, Monte Rossi – green triangles, Mounts de Fiore black stars and the 2002/03 lava flow – magenta diamonds.

The following tables (Table 6-34 & Table 6-35) depict the results of these analyses.

Table 6-34: The chemical composition of analysed melt inclusions (1/2)

Sample Point	18MS01_6 181_1.	18MS01_B1 1_1.	18MS01_B2 2_1.	18MS01_B2 3_1.	18MS01_B2 4_1.	18MS01_B3 5_1.	18MS01_B3 6_1.	18MS01_B5 7_1.	18MS01_B6 8_1.	18MS01_B7 9_1.
Incl. in	Olivine	Olivine	Clinopyroxene	Clinopyroxene	Clinopyroxene	Clinopyroxene	Clinopyroxene	Clinopyroxene	Clinopyroxene	Olivine
FeO	2.25	1.07	0.83	0.89	0.80	1.02	1.10	2.70	0.60	1.60
TiO2	1.08	0.12	0.13	0.10	0.09	0.07	0.04	0.80	0.41	1.38
Al2O3	21.88	28.55	27.95	28.31	28.37	28.93	0.07	22.37	20.29	22.76
MgO	0.28	0.13	0.08	0.09	0.08	0.08	0.32	0.34	0.22	0.27
CaO	1.35	12.09	11.56	11.45	11.52	12.20	53.01	0.26	2.12	2.80
SiO2	59.50	52.44	52.65	53.27	52.68	51.73	1.15	57.85	61.77	56.17
MnO	n.a.	n.a.	n.a.	n.a.	n.a.	<0.01	0.06	0.07	0.06	0.05
P2O5	n.a.	0.03	0.04	0.04	<0.01	<0.01	39.69	0.51	0.97	1.42
Na2O	4.77	4.43	4.68	4.68	4.68	4.37	0.03	4.46	4.87	6.09
K2O	7.05	0.36	0.46	0.39	0.39	0.30	0.11	5.79	6.30	5.72
Cl	n.a.	n.a.	n.a.	n.a.	n.a.	<0.01	1.24	0.59	0.31	0.41
Total	98.17	99.22	98.37	99.23	98.61	98.70	96.81	95.73	97.92	98.67
Mg#	17.99	17.83	14.03	14.81	14.36	12.38	34.36	18.12	39.99	23.13

Sample Point	18MR03_1 1_1.	18MR03_1 2_1.	18MR03_2 3_1.	18MR03_2 4_1.	18MR03_2 5_1.	18MR03_2 6_1.	18MR03_4 7_1.	18MR03_5 8_1.	18MR03_5 9_1.	18MR03_6 10_1.
Incl. in	Clinopyroxene	Olivine	Plagioclase	Plagioclase	Plagioclase	Plagioclase	Olivine	Clinopyroxene	Clinopyroxene	Clinopyroxene
FeO	10.19	31.33	0.89	0.78	1.18	1.61	43.10	1.18	0.79	8.86
TiO2	2.27	0.09	0.10	0.08	0.46	0.72	0.06	0.65	0.11	1.72
Al2O3	4.50	0.03	30.27	28.70	21.03	21.49	0.03	23.03	30.87	4.41
MgO	11.65	29.77	0.06	0.09	0.26	0.63	19.04	0.13	0.07	12.74
CaO	21.79	0.53	13.73	12.33	2.27	2.72	1.08	1.45	13.31	21.76
SiO2	48.06	36.69	51.05	53.25	61.27	59.88	33.61	56.94	51.85	48.92
MnO	0.23	0.71	n.a.	n.a.	0.07	0.08	1.13	0.08	<0.01	0.24
P2O5	n.a.	n.a.	n.a.	n.a.	1.46	1.21	n.a.	0.65	n.a.	n.a.
Na2O	0.63	0.02	3.79	4.49	5.44	4.22	0.09	7.44	3.75	0.54
K2O	0.03	0.02	0.25	0.46	4.39	4.44	0.02	6.88	0.26	0.02
Cl	n.a.	n.a.	n.a.	n.a.	0.27	0.25	n.a.	0.41	n.a.	n.a.
Total	99.35	99.19	100.14	100.17	98.10	97.25	98.16	98.85	101.04	99.24
Mg#	67.08	62.88	10.51	16.38	27.91	41.08	44.06	16.22	14.22	71.94

Sample Point	18MR03_6 11_1.	18MR03_6 12_1.	18MR03_7 13_1.	18MR03_7 14_1.	18MR03_7 15_1.	18MR03_7 16_1.
Incl. in	Clinopyroxene	Olivine	Plagioclase	Plagioclase	Olivine	Clinopyroxene
FeO	8.80	34.75	0.79	0.89	24.61	1.25
TiO2	1.54	0.03	0.07	0.11	0.03	0.24
Al2O3	3.85	0.06	30.01	27.86	0.03	30.50
MgO	12.80	26.36	0.10	0.08	35.82	0.85
CaO	21.71	0.62	13.65	10.91	0.37	0.12
SiO2	49.79	35.66	51.21	54.45	37.84	41.78
MnO	0.22	0.78	n.a.	n.a.	0.48	0.02
P2O5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Na2O	0.53	0.03	3.65	5.16	0.01	0.60
K2O	<0.01	<0.01	0.27	0.50	<0.01	7.59
Cl	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total	99.25	98.32	99.75	99.96	99.21	82.96
Mg#	72.17	57.49	18.81	13.63	72.18	54.80

Table 6-35: The chemical composition of analysed melt inclusions (2/2)

Sample Point	18MF01_1	18MF01_2	18MF01_2	18MF01_2	18MF01_2	18MF01_3	18MF01_5	18MF05_1	18MF05_1	18MF05_1	18MF05_1
	1 .	2 .	3 .	4 .	5 .	6 .	7 .	185 .	186 .	187 .	188 .
Incl. In	Olivine	Clinopyroxene	Pyroxene	Clinopyroxene	Olivine	Olivine	Olivine	Olivine	Olivine	Olivine	Olivine
FeO	8.60	9.06	2.39	7.64	6.04	9.91	8.98	5.70	4.67	4.92	5.17
TiO2	2.30	1.16	3.44	1.65	2.17	2.45	2.36	1.10	1.73	1.75	1.46
Al2O3	17.34	19.28	19.25	19.01	18.59	16.36	16.83	17.53	19.74	19.42	19.20
MgO	1.37	1.30	0.77	1.08	0.93	0.88	0.97	3.80	0.89	0.85	0.86
CaO	8.50	4.64	3.97	3.40	6.19	4.90	7.86	4.18	4.25	3.97	5.09
SiO2	48.64	51.13	60.96	50.89	50.95	49.46	49.41	51.27	52.05	51.97	52.20
MnO	0.19	0.24	0.03	0.24	0.15	0.30	0.26	0.17	0.13	0.13	0.15
P2O5	0.86	1.40	0.28	1.03	1.06	1.38	1.04	1.06	1.27	1.25	1.17
Na2O	6.16	6.40	4.89	7.54	7.39	6.93	6.25	7.11	6.82	7.21	7.07
K2O	4.62	4.20	2.98	6.43	5.94	5.73	4.90	6.22	6.70	7.17	6.32
Cl	0.28	0.38	0.24	0.39	0.30	0.57	0.43	n.a.	n.a.	n.a.	n.a.
Total	98.86	99.20	99.19	99.31	99.72	98.86	99.30	98.47	98.60	99.03	99.02
Mg#	22.13	20.32	36.36	20.20	21.55	13.71	16.18	54.34	25.39	23.49	22.82

Sample Point	18MF05_4	18MF05_4	18MF05_4	18MF05_5	18MF05_5	18MF05_5	18MF07_4	18MF07_4	18MF07_4	18MF07_5
	189 .	190 .	191 .	192 .	193 .	194 .	195 .	196 .	197 .	198 .
Incl. In	Olivine	Olivine	Olivine	Olivine	Olivine	Olivine	Olivine	Olivine	Olivine	Olivine
FeO	5.50	6.71	6.36	6.57	6.45	5.21	10.78	7.39	5.88	1.26
TiO2	1.38	1.43	1.89	1.96	2.05	2.03	1.47	2.31	2.02	0.10
Al2O3	19.38	17.92	16.23	17.39	19.18	18.71	14.36	16.96	18.76	30.73
MgO	1.09	1.29	4.37	0.93	0.94	1.73	10.15	1.34	0.87	0.12
CaO	4.11	4.22	10.27	5.59	5.49	6.14	3.29	6.23	4.43	14.18
SiO2	51.86	51.49	49.34	43.11	50.27	51.00	47.77	50.15	51.38	49.90
MnO	0.15	0.19	0.14	0.18	0.15	0.13	0.30	0.21	0.15	0.02
P2O5	1.20	1.18	1.11	1.09	1.23	1.08	0.85	1.45	1.27	0.05
Na2O	7.26	7.43	5.02	6.58	6.65	6.85	5.53	6.11	7.11	3.24
K2O	6.63	6.26	4.24	5.86	6.38	5.38	4.56	5.78	6.45	0.35
Cl	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total	98.90	98.59	99.20	89.59	99.15	98.58	99.35	98.37	98.68	99.96
Mg#	26.11	25.50	55.07	20.15	20.67	37.17	62.68	24.38	20.80	14.53

Sample Point	18RS02_1	18RS02_1	18RS02_2	18RS02_2	18RS02_6	18RS02B_01	18RS02B_01	18RS02B_01	18RS02B_01
	3 .	4 .	5 .	6 .	7 .	189 / 1 .	190 / 1 .	191 / 1 .	192 / 1 .
Incl. In	Clinopyroxene	Clinopyroxene	Plagioclase	Clinopyroxene	Olivine	Clinopyroxene	Clinopyroxene	Clinopyroxene	Clinopyroxene
FeO	6.49	9.22	13.48	2.10	8.95	14.49	7.93	8.91	3.85
TiO2	1.25	1.86	2.59	1.27	2.31	1.46	1.34	1.08	0.69
Al2O3	18.51	17.01	14.99	20.94	14.86	15.30	18.03	18.49	21.40
MgO	1.05	1.41	5.43	0.99	1.25	3.79	1.82	1.68	0.23
CaO	1.91	2.76	9.30	3.19	8.78	11.13	6.97	7.87	1.48
SiO2	54.47	52.21	44.35	56.88	48.80	44.40	51.10	48.39	54.60
MnO	0.18	0.24	0.35	0.11	0.19	n.a.	n.a.	n.a.	n.a.
P2O5	1.06	1.61	1.07	0.95	1.39	n.a.	n.a.	n.a.	n.a.
Na2O	7.14	6.80	6.15	6.69	5.36	4.15	5.80	6.29	8.08
K2O	6.72	5.88	2.68	5.65	6.34	1.55	2.68	2.55	6.01
Cl	0.35	0.44	0.29	0.24	0.76	n.a.	n.a.	n.a.	n.a.
Total	99.12	99.43	100.68	99.02	98.99	31.82	29.08	25.18	9.77
Mg#	22.41	21.38	41.77	45.76	19.98	96.27	95.68	95.26	96.36

Sample Point	18RS02_1	18RS02_1	18RS02_2	18RS02_2	18RS02_6	18RS02B_01	18RS02B_01	18RS02B_01	18RS02B_01
	3 .	4 .	5 .	6 .	7 .	189 / 1 .	190 / 1 .	191 / 1 .	192 / 1 .
Incl. In	Clinopyroxene	Clinopyroxene	Plagioclase	Clinopyroxene	Olivine	Clinopyroxene	Clinopyroxene	Clinopyroxene	Clinopyroxene
FeO	6.49	9.22	13.48	2.10	8.95	14.49	7.93	8.91	3.85
TiO2	1.25	1.86	2.59	1.27	2.31	1.46	1.34	1.08	0.69
Al2O3	18.51	17.01	14.99	20.94	14.86	15.30	18.03	18.49	21.40
MgO	1.05	1.41	5.43	0.99	1.25	3.79	1.82	1.68	0.23
CaO	1.91	2.76	9.30	3.19	8.78	11.13	6.97	7.87	1.48
SiO2	54.47	52.21	44.35	56.88	48.80	44.40	51.10	48.39	54.60
MnO	0.18	0.24	0.35	0.11	0.19	n.a.	n.a.	n.a.	n.a.
P2O5	1.06	1.61	1.07	0.95	1.39	n.a.	n.a.	n.a.	n.a.
Na2O	7.14	6.80	6.15	6.69	5.36	4.15	5.80	6.29	8.08
K2O	6.72	5.88	2.68	5.65	6.34	1.55	2.68	2.55	6.01
Cl	0.35	0.44	0.29	0.24	0.76	n.a.	n.a.	n.a.	n.a.
Total	99.12	99.43	100.68	99.02	98.99	31.82	29.08	25.18	9.77
Mg#	22.41	21.38	41.77	45.76	19.98	96.27	95.68	95.26	96.36

6.5. THERMOBAROMETRY

6.5.1. General remarks and calculations

In order to estimate the pressure and temperature conditions at the time of crystallisation, thermobarometric calculations must be carried out. For this purpose, the composition of the clinopyroxene and the equilibrated melt composition is needed, but as due to a lack of melt composition information, the composition of the whole rock can be used instead as a close approximation (Putirka et al., 2008).

The first step is to calculate the equilibrium constant $^{clinopyroxene-liq}Kd_{Fe-Mg}$ between the crystal core, outer mantle, rim and whole rock since a crystal-melt equilibrium is needed to calculate the PT conditions.

All calculations are based on the Putirka (2008), thermobarometer based on the jadeite–diopside/hedenbergite exchange reactions.

Putirka (2008) states that only clinopyroxenes with a $^{clinopyroxene-liq}Kd_{Fe-Mg}$ between 0.24 and 0.30, at $T > 1050$ °C are suitable for the PT calculations. Armienti et al. (2012) extended the acceptable $^{clinopyroxene-liq}Kd_{Fe-Mg}$ range to 0.20 to 0.36.

Out of the 402 clinopyroxene analyses 282 fit the $^{clinopyroxene-liq}Kd_{Fe-Mg}$ value of Armienti et al. (2012) and were therefore used for the subsequent calculations. The results of these calculations were categorized according to the mineralogical texture type, the place of origin and the position of the analysis within the selected crystals (Table 6-36).

Table 6-36: Results for the thermobarometric calculations after Putirka (2008) according to the texture type and the location. (Supplementary Data 11.2; Temperature rounded to the nearest ten)

Texture	Sample	Position	n	Temperature [°C]				Pressure [kbar]				Kd			
				Min	avg	1 σ	Max	Min	Avg	1 σ	Max	Min	Avg	1 σ	Max
Type 1 - normal zoning	Monte Spagnolo	core	11	1140	1170	10	1180	1.4	4.3	1.2	6.5	0.21	0.27	0.04	0.35
		rim	1	-	1160	-	-	-	2.8	-	-	-	0.21	-	-
		matrix	6	1160	1180	13	1200	3.2	5.1	1.6	7.4	0.24	0.32	0.04	0.35
	Monte Rossi	core	98	1110	1140	9	1160	1.0	4.4	1.0	6.5	0.20	0.29	0.03	0.35
		rim	13	1120	1130	9	1150	2.3	4.0	0.9	5.3	0.26	0.31	0.03	0.35
		matrix	11	1110	1130	11	1150	1.0	3.6	1.3	5.6	0.26	0.30	0.03	0.34
		inclusion	1	-	1160	-	-	-	7.2	-	-	-	0.35	-	-
	Mounts de Fiore	core	17	1140	1160	12	1180	2.7	4.8	1.7	8.0	0.29	0.31	0.01	0.33
		matrix	4	1150	1150	5	1160	3.5	4.2	0.6	4.9	0.30	0.33	0.03	0.36
		inclusion	1	-	1180	-	-	-	7.8	-	-	-	0.33	-	-
	2002/03 lava flow	core	19	1140	1160	12	1190	3.0	4.7	1.4	9.0	0.23	0.29	0.04	0.35
		rim	1	-	1160	-	-	-	5.3	-	-	-	0.35	-	-
		matrix	3	1150	1160	6	1160	3.7	4.5	0.7	5.4	0.28	0.32	0.03	0.34
Type 4 - reverse zoning	Monte Spagnolo	core	-	-	-	-	-	-	-	-	-	-	-	-	-
		rim	19	1140	1170	14	1180	0.5	4.0	1.6	5.6	0.21	0.26	0.04	0.33
	2002/03 lava flow	core	4	1160	1180	15	1200	4.7	8.4	2.2	10.1	0.33	0.34	<0.01	0.35
		rim	3	1140	1140	4	1150	3.3	3.6	0.4	4.3	0.22	0.25	0.02	0.27
	Monte Spagnolo	hourglass sector	12	1150	1160	7	1180	3.2	3.8	0.8	6.0	0.22	0.25	0.03	0.32
		prism sector	7	1170	1180	5	1180	4.1	4.9	0.7	5.9	0.29	0.31	0.02	0.35
Type 6 - hourglass zoning	Monte Rossi	hourglass sector	9	1140	1140	3	1150	4.2	5.3	0.5	5.7	0.27	0.28	<0.01	0.29
		prism sector	25	1140	1150	5	1160	4.3	5.4	0.6	6.4	0.30	0.32	0.02	0.35
	Mounts de Fiore	hourglass sector	9	1150	1150	4	1160	3.3	4.2	0.5	5.0	0.28	0.31	0.02	0.33
		prism sector	-	-	-	-	-	-	-	-	-	-	-	-	-
	2002/03 lava flow	hourglass sector	5	1140	1150	2	1150	2.9	3.6	0.3	4.0	0.26	0.26	<0.01	0.27
		prism sector	3	1160	1160	2	1160	4.7	5.0	0.2	5.2	0.34	0.35	<0.01	0.35

6.5.2. Monte Spagnolo

Out of the 102 analyses of clinopyroxene, 57 were within the acceptable range of *clinopyroxene-liq* Kd_{Fe-Mg} of 0.2. - 0.36 and were therefore used for the thermobarometric calculations (Figure 6-88).

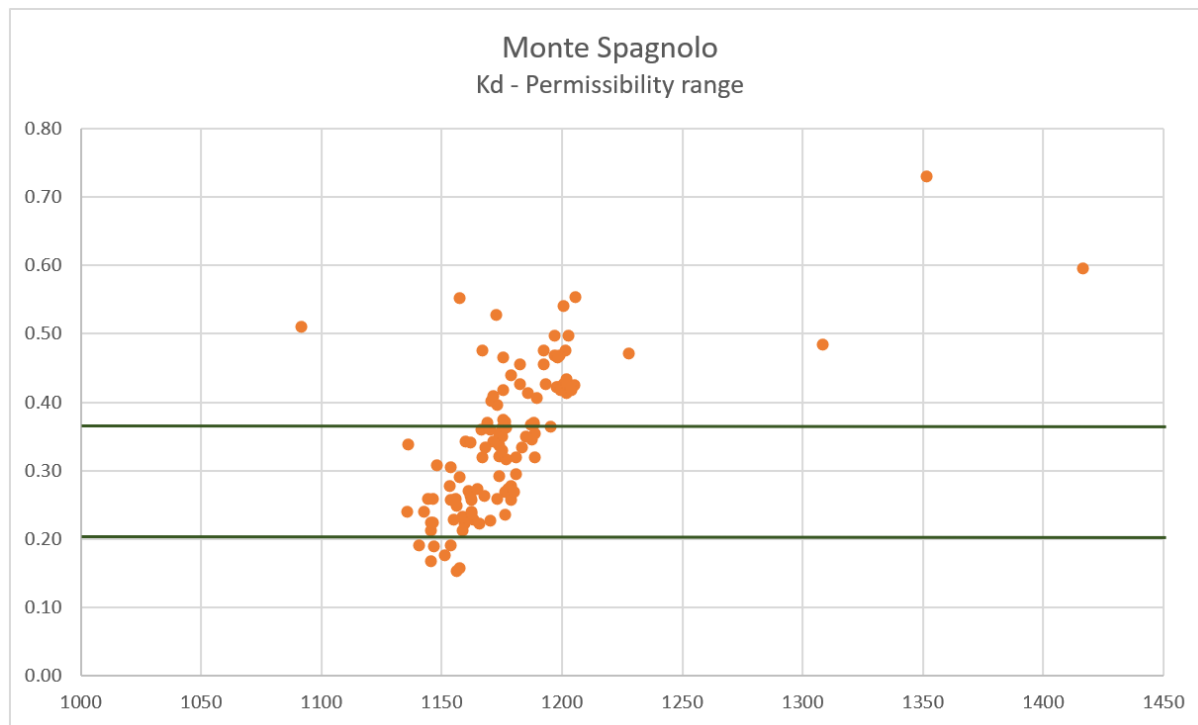


Figure 6-88: Results of the *clinopyroxene-liq* Kd_{Fe-Mg} determination after Putirka (2008) at Monte Spagnolo

Differentiated into the individual samples, the results show for Monte Spagnolo two different PT-trends, one for sample 18MS01 and one for the samples 18MS02 and 18MS05. On 18MS01 a total of 9 analyses were conducted, on 18MS02 32 analyses and on 18MS05 15 analyses (Table 6-36).

The first trend at 18MS01 is characterized by generally higher pressures, but medium temperatures, ranging from 3.2 to 6.5 kbar (avg. ~5 kbar) and 1150 to 1180 °C (avg. 1160 °C), respectively.

The second trend, with a wider range of temperatures, is shown by the analyses of 18MS02 and 18MS05. Whereas, 18MS02 has pressures ranging from 0.5 to 7.4 kbar (avg. 4.1 kbar) and temperatures between 1140 to 1200 °C (avg. 1160 °C) and 18MS05: pressures ranging from 2.7 to 5.6 kbar (avg. 4.0 kbar) and temperatures ranging from 1160 to 1180 °C (avg. 1170 °C) (Figure 6-89).

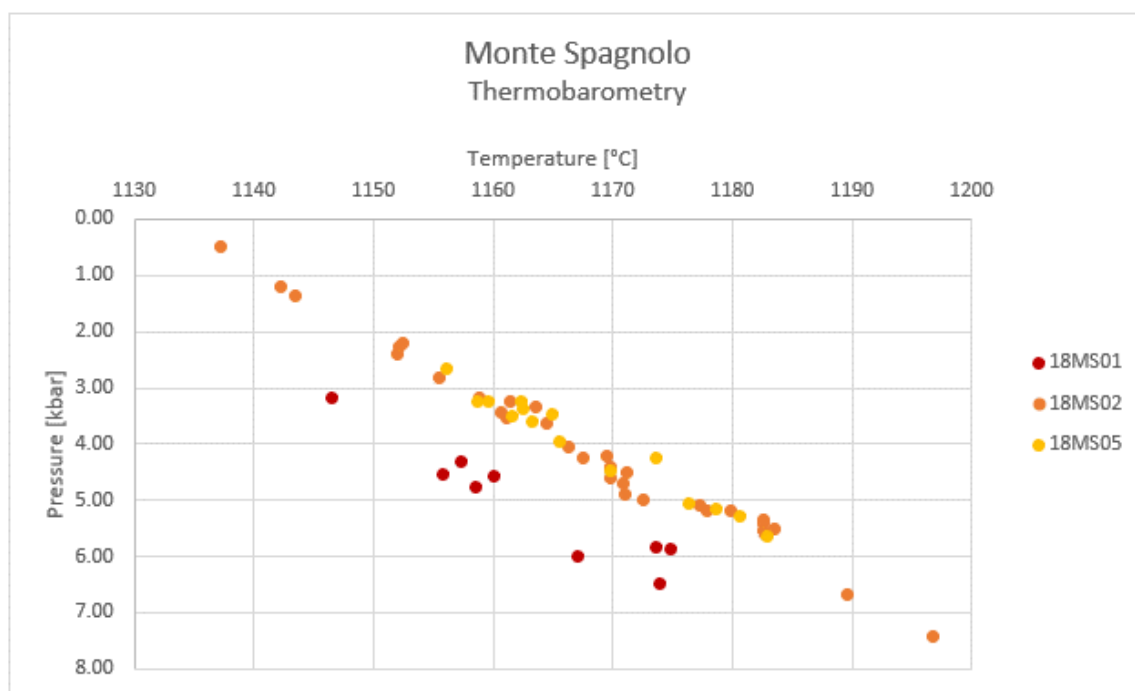


Figure 6-89: Results of the thermobarometric calculations at Monte Spagnolo divided into the thin section

To differentiate the results further, a distinction into the different texture types was made. In the samples of Monte Spagnolo three different texture types were found:

- **Type 1-** normal zoning (19 analyses)
- **Type 4-** reverse zoning (19 analyses)
- **Type 6 -** hourglass zoning (20 analyses)

For texture Type 1, the results yield, at the core, a temperature range between 1140 and 1180 °C and pressures between 1.4 and 6.5 kbar.

There was only one analysis conducted on rim and therefore no trend or range can be determined, this analysis has a temperature of 1160 °C and a pressure of 2.8 kbar.

The matrix temperatures range from 1160 to 1200 °C and pressures from 3.2 to 7.4 kbar.

Only rim-analyses were conducted on clinopyroxene with texture Type 4 – reverse zoning and they show a temperature range from 1140 to 1180 °C and a pressure range from 0.5 to 5.6 kbar.

For Type 6 - hourglass texture a distinction between the prism sectors (7 analyses) and hourglass sectors (13 analyses) yields minor differences in temperature and pressure.

As the temperature for the prism sectors ranges from 1170 to 1180 °C (avg. 1170 °C) and the pressure from 4.1 to 5.6 kbar (avg. 4.8 kbar).

The hourglass sectors on the contrary have a temperature range from 1160 to 1180 °C (avg. 1160 °C) and a pressure range from 3.2 to 5.0 kbar (avg. 3.6 kbar) (Figure 6-90; Supplementary Data 11.2).

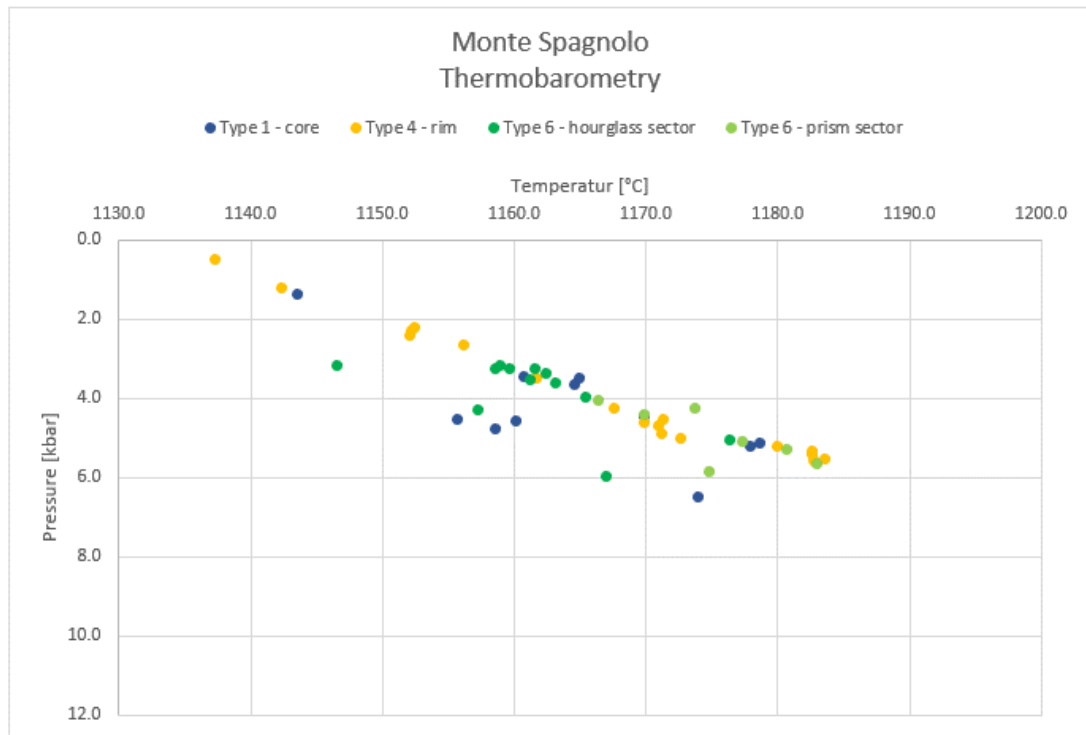


Figure 6-90: Results of the thermobarometric calculations for Monte Spagnolo divided into the texture types

6.5.3. Monte Rossi

At Monte Rossi 157 of the 189 clinopyroxene analyses fit in the range of a *clinopyroxene-liq* Kd_{Fe-Mg} of 0.20 - 0.36 (Figure 6-91) and therefore can be used for the determination of the P-T conditions.

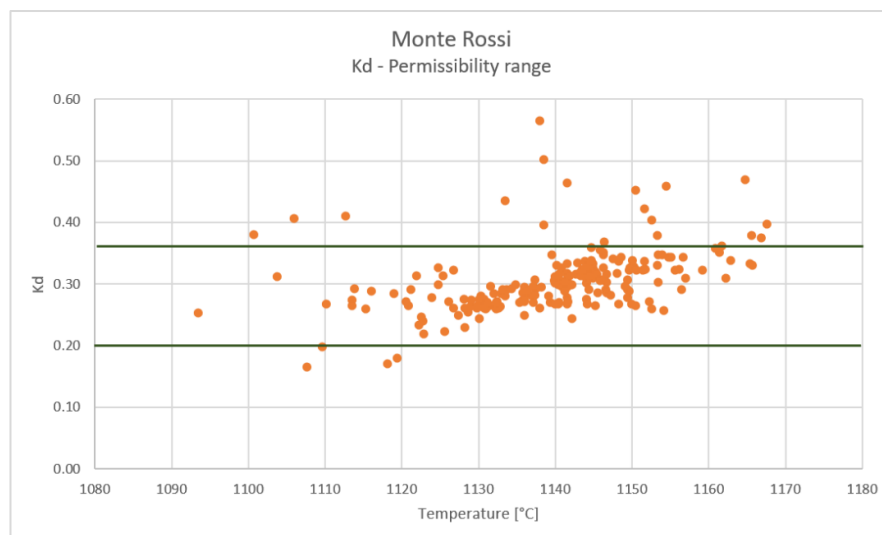


Figure 6-91: Results of the *clinopyroxene-liq* Kd_{Fe-Mg} determination after Putirka (2008) at Monte Rossi

The 157 analyses are distributed over the three thin sections of Monte Rossi, with 112 falling on 18MR01, 5 on 18MR02 and the remaining 40 on 18MR03.

The results of the temperature and pressure calculations show that all three samples plot along the same trend. The temperatures ranges are for 18MR01 between 1110 and 1160 °C, for 18MR02 between 1120 and 1140 °C and for 18MR03 between 1110 and 1150 °C (Figure 6-92).

The pressure ranges for 18MR01 between 1.0 and 7.2 kbar, for 18MR02 between 2.1 and 4.6 kbar and for 18MR03 between 1.0 and 5.5 kbar (Table 6-36).

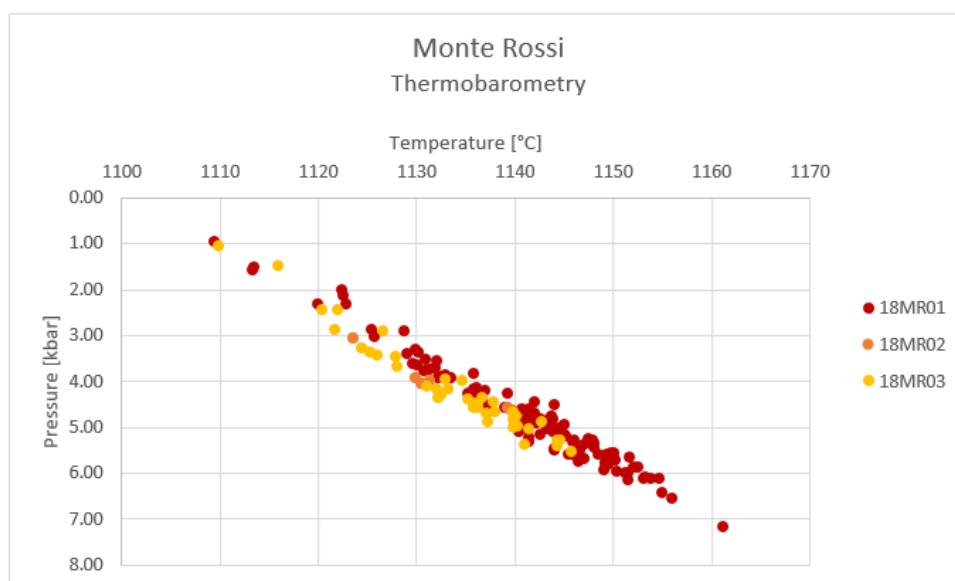


Figure 6-92: Results of the thermobarometric calculations for Monte Rossi according to the thin section

To differentiate the results further, a distinction into the different texture types is necessary. In the samples of Monte Spagnolo two different texture types were found:

- **Type 1** - normal zoning (123 analyses)
- **Type 6** - hourglass zoning (34 analyses)

A vast amount of the analyses of Type 1 clinopyroxene was made of the core area, with a total of 98 of 123 analyses. The remaining analyses were made either of the rim areas (13 analyses), of matrix clinopyroxene (11 analyses) or of an inclusion of a clinopyroxene in another mineral (1 analysis).

The trend for the core areas of the Type 1 – normal zoned clinopyroxene is, naturally like the general trend, linear. The temperature ranges from 1110 to 1160 °C and the pressure from 1.0 to 6.6 kbar. The range of the rim is narrower with temperatures between 1120 and 1150 °C and pressures between 2.3 and 4.4 kbar (Figure 6-93)

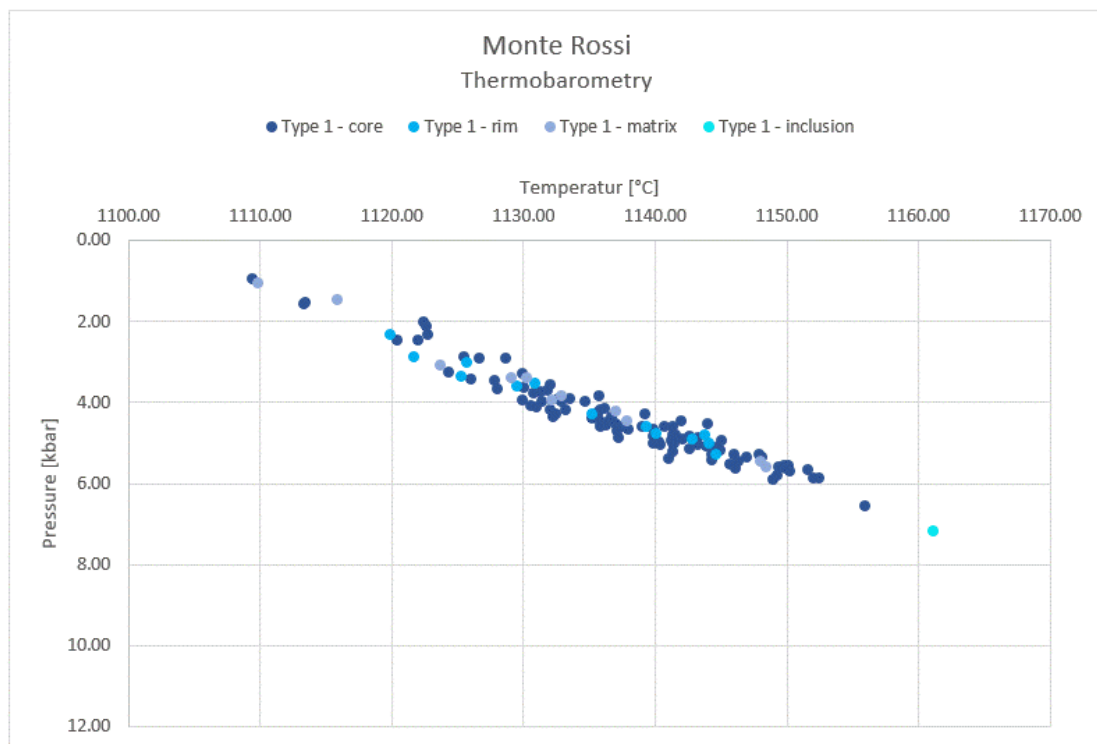


Figure 6-93: Results of the thermobarometric calculations of Type 1 -normal zoned clinopyroxene of Monte Rossi, divided into core, rim, matrix and inclusion

The matrix clinopyroxene shows very similar values, with temperatures between 1110 and 1148 °C and pressures between 1 and 5.6 kbar.

The only analysed clinopyroxene-inclusion shows the highest temperature of Monte Rossi with 1160 °C and a pressure of 7.1 kbar.

The second texture type of clinopyroxene found in the samples of Monte Rossi is Type 6 - hourglass zoning. The 34 analyses can be divided into the two sector pairs of hourglass zoned clinopyroxene, hourglass sector (9 analyses) and prism sector (25 analyses).

The results show a temperature range for the hourglass sectors from 1140 to 1150 °C and for prism sectors from 1140 to 1160 °C. The pressure values vary between

4.2 and 5.8 kbar for the hourglass sectors and between 4.2 and 6.5 kbar for the prism sectors (Table 6-36; Supplementary Data 11.2).

Figure 6-94 depicts clearly that the prism sectors represent higher temperature, but the hourglass sectors relatively higher pressures.



Figure 6-94: Results of the thermobarometric calculations of Type 6 – clinopyroxene with a hourglass texture of Monte Rossi, divided into hourglass and prism sector

6.5.4. Mounts de Fiore

At Mounts de Fiore 30 analyses fit in the range of a *clinopyroxene-liq* Kd_{Fe-Mg} of 0.20 - 0.36 (Figure 6-95) and therefore can be used for the determination of the P-T conditions.

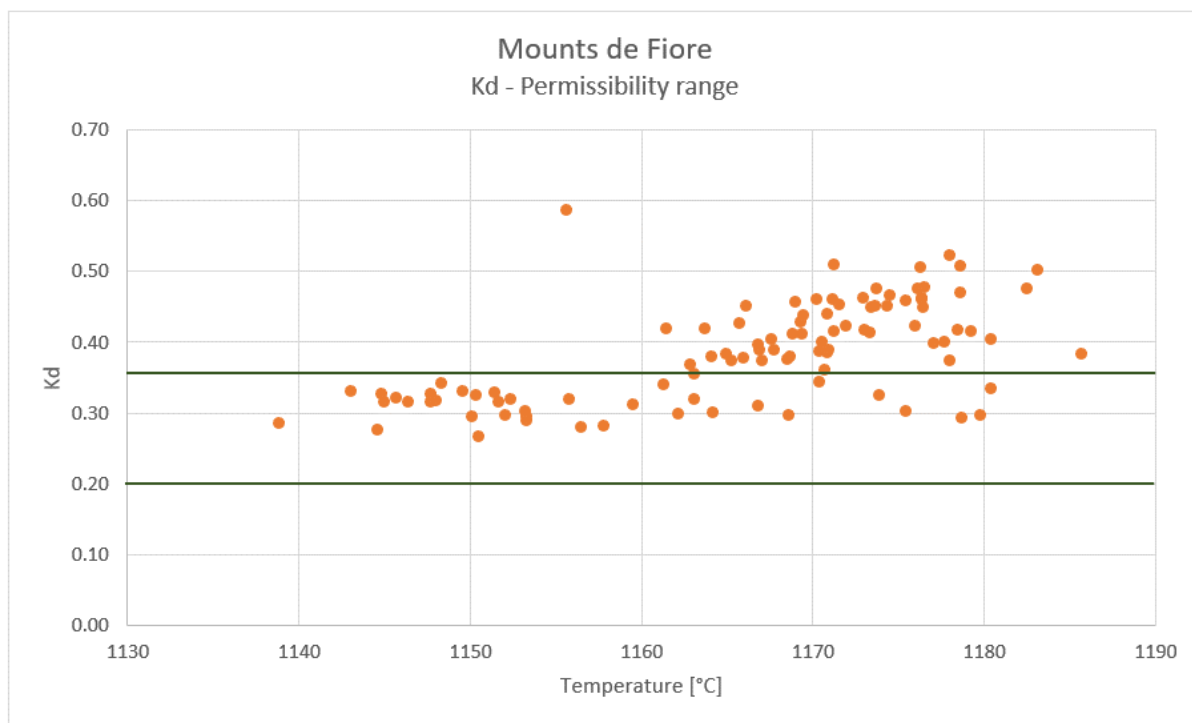


Figure 6-95: Results of the *clinopyroxene-liq* Kd_{Fe-Mg} determination after Putirka (2008) at Mounts de Fiore

The 187 analyses can be divided between the 6 investigated samples of Monte Rossi:

- **18MF01** (17analyses)
- **18MF02** (2 analyses)
- **18MF03A**(1 analyses)
- **18MF03B**(7 analyses)
- **18MF05** (3 analyses)

The results of the temperature and pressure calculations show that all samples plot along the same trend (Figure 6-96), with a total temperature range from 1140 to 1180 °C and a pressure range from 2.8 to 8.0 kbar (Table 6-36).

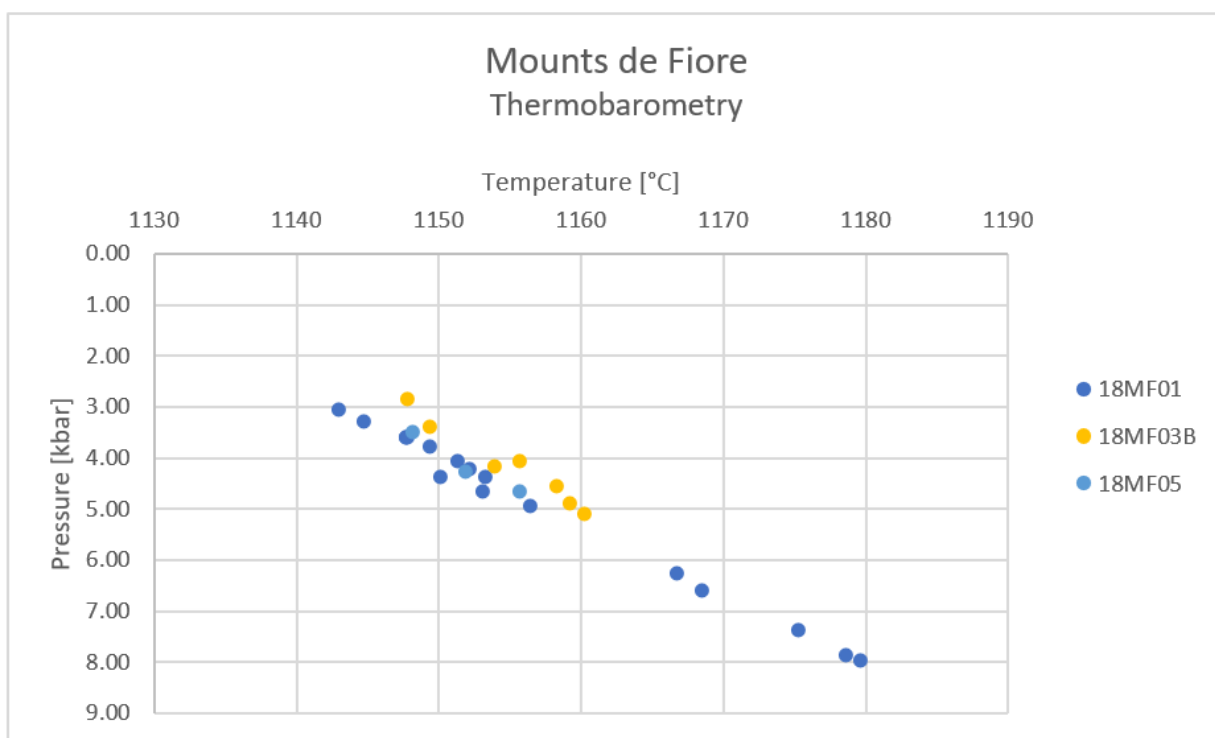


Figure 6-96: Results of the thermobarometric calculations for Mounts de Fiore according to the thin section

To differentiate the results further, a distinction into the different texture types is necessary. In the samples of Mounts de Fiore two different texture types were found:

- **Type 1** - normal zoning (21 analyses)
- **Type 6** - hourglass zoning (9 analyses)

Of the 54 analyses of Type 1 - normal zoned clinopyroxene 17 were conducted on the core areas of the crystals, 3 on matrix clinopyroxene and 1 on clinopyroxene inclusions. The temperature for the core areas varies from 1140 to 1180 °C, with an average temperature of 1160 °C and pressures vary from 2.7 to 8.0 kbar, with an average of 4.8 kbar.

The matrix clinopyroxene shows temperatures between 1150 and 1170 °C and pressures between 3.4 and 6.6 kbar and the two inclusions temperatures between 1170 and 1180 °C and pressures 7.1 and 7.9 kbar.

All 9 analyses of clinopyroxene with Type 6 - hourglass zoning were conducted on the hourglass sectors and their temperature varies from 1140 to 1160 °C, with an average of 1150 °C and pressures varying from 3.3 kbar and 5.0 kbar (Table 6-36; Supplementary Data 11.2).

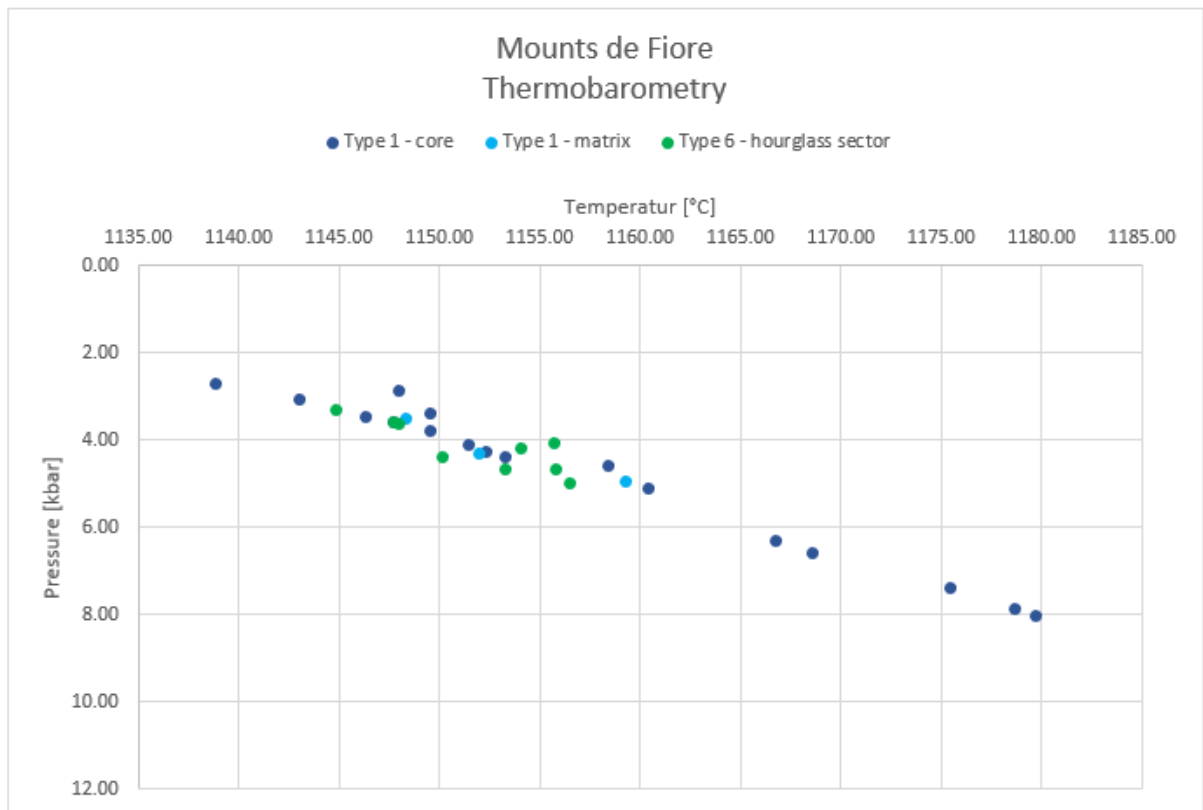


Figure 6-97: Results of the thermobarometric calculations for Monte Rossi divided into the different texture types and the specific position of the analyses

6.5.5. 2002/03 lava flow

A total of 38 analyses falls in the range of $^{clinopyroxene-liq}Kd_{Fe-Mg}$ of 0.20 - 0.36, with 5 analyses on 18RS01 and 33 analyses on 18RS02 (Figure 6-98).

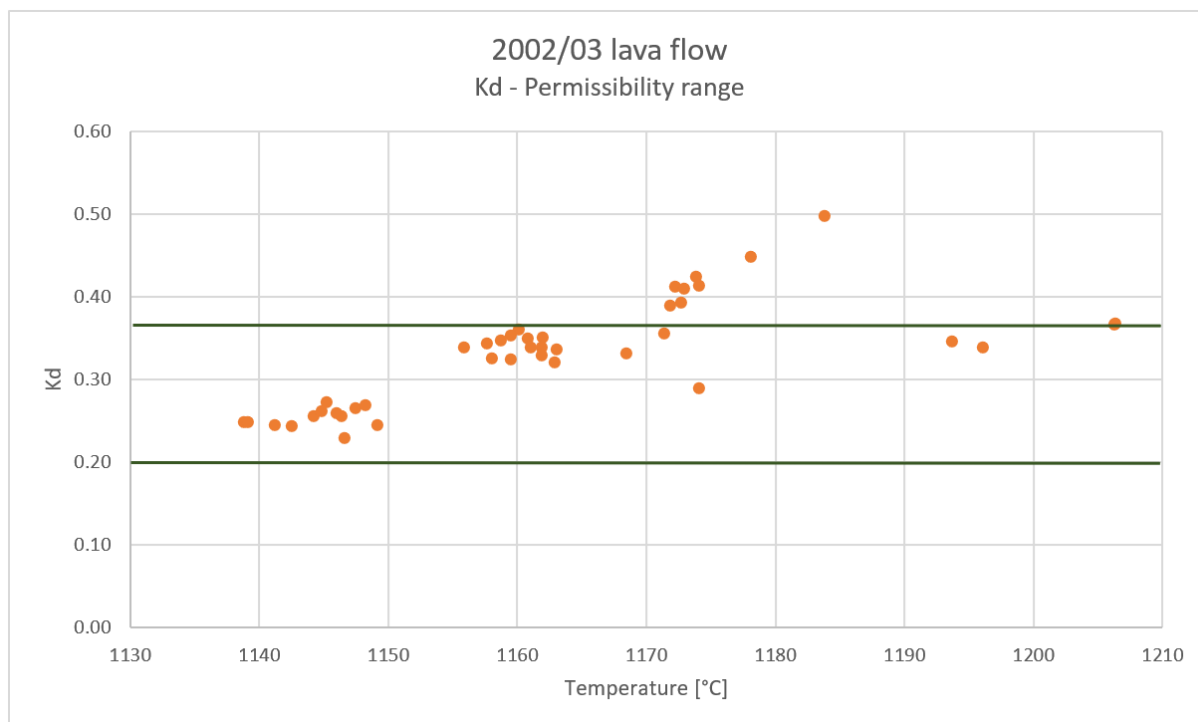


Figure 6-98: Results of the $^{clinopyroxene-liq}Kd_{Fe-Mg}$ determination after Putirka (2008) at the 2002/03 lava flow

The results show that both samples share the same PT-trend with a temperature range of 1140 to 1200 °C and a pressure range of 2.9 to 10.2 kbar. The five analyses of 18RS01 plot only in the lower temperature and pressure range with the maximum temperature of 1150 °C and maximum pressure of 4.4 kbar (Figure 6-99).

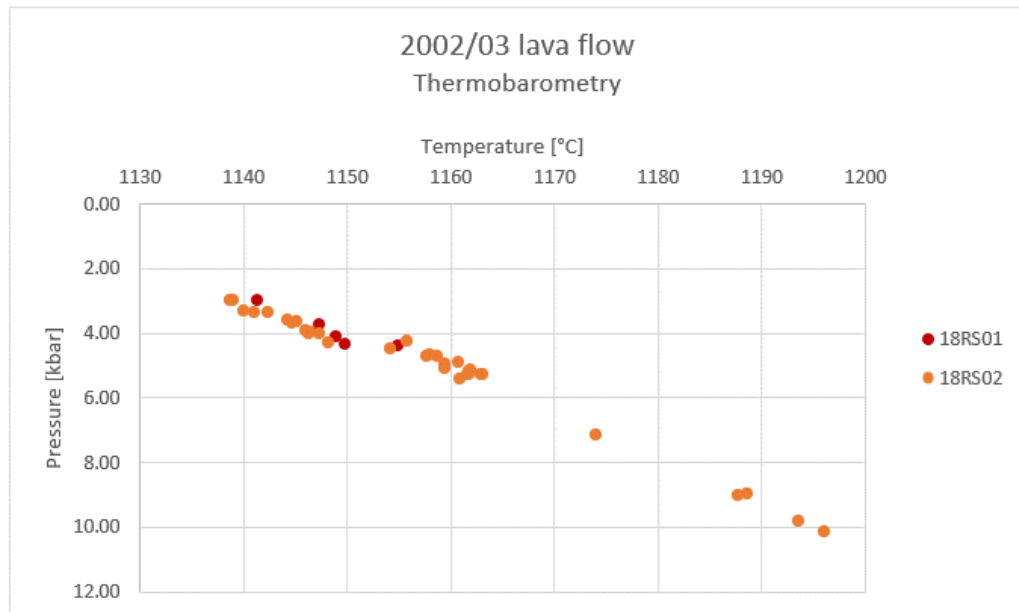


Figure 6-99: Results of the thermobarometric calculations at the 2002/03 lava flow according to the thin section. To differentiate the results further, a distinction into the different texture types is necessary. In the samples of the 2002/03 lava flow three different texture types were found:

- **Type 1** - normal zoning (25 analyses)
- **Type 4** - reverse zoning (7 analyses)
- **Type 6** - hourglass zoning (8 analyses)

Most of the analyses were conducted on clinopyroxene with a texture Type 1 - normal zoning. Their temperatures of the core areas (19 analyses) range from 1140 to 1190 °C and the pressure range from 2.9 to 9.0 kbar. The results of the two analyses of the rim area show a temperature range from 1160 °C to 1170 °C and a pressure range from 5.0 to 5.3 kbar. The matrix clinopyroxene was analysed three times and the results show a low temperature range from 1140 °C to 1160 °C and a pressure range from 3.7 to 5.4 kbar (Table 6-36).

Out of the 7 analyses of Type 4 - reverse zoned clinopyroxene, 4 were conducted on core areas and 3 on rim areas. The temperatures of these core areas range from 1160 to 1200 °C and the pressures range from 4.7 to 10.2 kbar. The rim areas show temperatures from 1140 to 1150 °C and pressures from 3.3 to 4.3 kbar.

The remaining 8 analyses were conducted on clinopyroxene with a texture Type 6 - hourglass zoning, whereas 5 analyses were conducted on the hourglass sectors and 3 on prism sectors. The hourglass sectors show a temperature range from 1140 to 1150 °C and pressures from 2.9 to 4.0 kbar and the prism sectors a temperature range from 1150 to 1160 °C and pressures from 4.7 to 5.2 kbar (Figure 6-100; Supplementary Data 11.2).

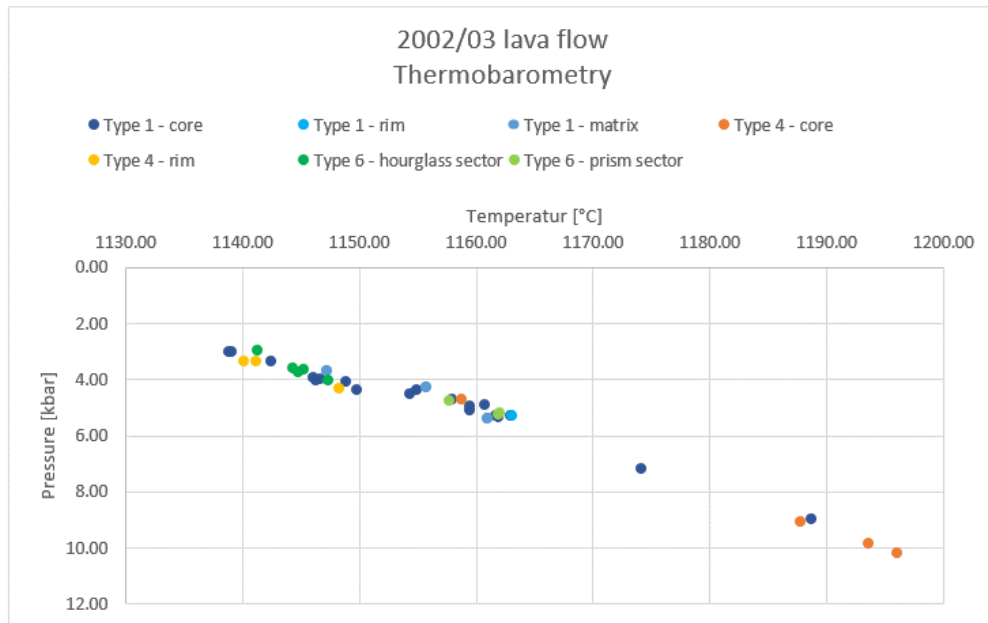


Figure 6-100: Results of the thermobarometric calculations for Monte Rossi divided into the different texture types and the specific position of the analyses

7. DISCUSSION

7.1. INTRODUCTORY REMARKS

In the following chapters, the main results are summarised and weighted. For this purpose, fact sheets were created for each location.

The following four chapters each contain a fact sheet and the discussion of the locally relevant results.

This is followed by a cross-location discussion of the results, including whole rock major and trace element contribution.

With regard to the fact sheets please note that there are some deviations in the total amount of analyses for some minerals compared to the data in the chapters above. This is due to the selection of only the statistically significant analyse-positions for mentioned fact sheets.

Table 7-1: Factsheet of the results of the geochemical composition of the basalts of Monte Spagnolo. Mg# & Cr# in mol-%, Temperature (rounded to the nearest ten) in [°C]; Pressure in [kbar]; microprobe analyses in [wt%]

Monte Spagnolo

		WR-Geochemistry				Trace elements				WR-Geochemistry													
		SiO2	Na2O	K2O	Mg#	La/Yb	Rb/Th			SiO2	Na2O	K2O	Mg#										
Monte Spagnolo	min	49.31	3.81	1.50	57.43	41.58	2.44	18MS04		49.31	3.81	1.59	57.43										
	avg	49.53	3.98	1.59	56.64	42.51	2.66	18MS05		49.65	3.95	1.58	56.77										
	1σ	0.20	0.11	0.05	0.88	0.93	0.22																
	max	49.84	4.12	1.66	57.43	43.43	2.87																
18MS01		49.84	4.08	1.66	54.94	43.43	2.44																
18MS02		49.31	4.12	1.50	56.91	-	-																
18MS03		49.55	3.94	1.60	57.13	41.58	2.87																
Olivine																							
		Type 1 - normal zoning										Type 2 - inverse zoning											
		Mg#		NiO		MnO		CaO				Mg#		NiO		MnO		CaO					
		core	rim	core	rim	core	rim	core	rim			core	rim	core	rim	core	rim	core	rim				
Monte Spagnolo n = 194	min	66.99	55.72	0.02	<0.01	0.13	0.22	0.22	0.25	Monte Spagnolo n = 118	min	71.57	63.97	0.03	<0.01	0.38	0.28	0.18	0.24				
	avg	85.30	74.11	0.15	0.07	0.24	0.51	0.29	0.34		avg	75.05	76.24	0.05	0.07	0.44	0.44	0.28	0.33				
	1σ	3.93	7.06	0.04	0.04	0.09	0.20	0.03	0.04		1σ	1.23	4.44	0.01	0.03	0.03	0.14	0.03	0.05				
	max	88.91	84.55	0.23	0.13	0.66	0.93	0.43	0.44		max	78.61	81.24	0.09	0.14	0.55	0.84	0.34	0.46				
18MS01 n = 89	min	74.10	66.32	0.05	<0.01	0.13	0.25	0.22	0.25	18MS01 n = 2	min	-	-	-	-	-	-	-	-				
	avg	85.99	73.36	0.16	0.06	0.22	0.56	0.28	0.32		avg	73.35	68.13	0.05	0.03	0.44	0.70	0.27	0.30				
	1σ	3.13	4.90	0.04	0.03	0.07	0.18	0.03	0.06		1σ	-	-	-	-	-	-	-	-				
	max	88.91	83.47	0.23	0.12	0.49	0.92	0.43	0.44		max	-	-	-	-	-	-	-	-				
18MS02 n = 64	min	66.99	55.72	0.02	0.02	0.17	0.22	0.24	0.28	18MS02 n = 75	min	71.57	63.97	0.03	<0.01	0.38	0.29	0.18	0.26				
	avg	83.85	71.74	0.13	0.07	0.27	0.56	0.30	0.35		avg	75.06	75.45	0.06	0.07	0.45	0.46	0.29	0.33				
	1σ	5.55	8.65	0.04	0.04	0.13	0.22	0.04	0.05		1σ	1.56	4.75	0.01	0.03	0.04	0.15	0.03	0.05				
	max	88.90	84.55	0.21	0.13	0.66	0.93	0.41	0.44		max	78.61	80.39	0.09	0.14	0.55	0.84	0.34	0.46				
18MS05 n = 41	min	83.49	77.77	0.10	0.06	0.17	0.25	0.26	0.29	18MS05 n = 41	min	74.49	75.20	0.03	0.03	0.38	0.28	0.23	0.24				
	avg	85.85	80.50	0.14	0.09	0.23	0.33	0.30	0.33		avg	75.12	78.56	0.05	0.07	0.43	0.36	0.27	0.34				
	1σ	1.20	1.88	0.02	0.02	0.03	0.05	0.03	0.04		1σ	0.38	1.83	0.01	0.02	0.02	0.04	0.02	0.05				
	max	88.40	83.43	0.20	0.13	0.28	0.41	0.40	0.43		max	76.10	81.24	0.08	0.12	0.49	0.43	0.30	0.45				
Pyroxene																							
		Type 1 - normal zoning										Type 2 - core-to-rim sharp compositional variations											
		Mg#		En		Fs		Wo				Mg#		En		Fs		Wo					
		core	rim	core	rim	core	rim	core	rim			core	rim	core	rim	core	rim	core	rim				
Monte Spagnolo n = 26	min	66.50	68.29	38.39	37.90	7.01	8.02	44.68	44.50	Monte Spagnolo n = 3	min	87.51	-	45.68	-	6.41	-	47.33	-				
	avg	78.91	73.75	42.51	39.86	10.59	13.80	46.90	46.34		avg	87.67	71.46	45.97	37.78	6.47	15.09	47.56	47.33				
	1σ	4.46	5.72	2.42	3.08	2.41	3.17	1.17	1.16		1σ	0.16	-	0.29	-	0.06	-	0.23	-				
	max	86.81	85.15	46.14	46.00	14.85	17.60	48.81	48.02		max	87.83	-	46.26	-	6.52	-	47.80	-				
18MS01 n = 12	min	72.66	-	38.39	-	7.01	-	44.86	-	18MS01 n = 3	min	87.51	-	45.68	-	6.41	-	47.33	-				
	avg	80.07	72.00	42.36	38.18	10.45	14.85	47.20	46.97		avg	87.67	71.46	45.97	37.78	6.47	15.09	47.56	47.33				
	1σ	5.19	-	2.59	-	2.83	-	1.14	-		1σ	0.16	-	0.29	-	0.06	-	0.23	-				
	max	86.81	-	46.14	-	14.85	-	48.81	-		max	87.83	-	46.26	-	6.52	-	47.80	-				
18MS02 n = 10	min	66.50	68.29	39.67	37.90	8.77	8.02	45.83	44.50	18MS02 n = 0	min	-	-	-	-	-	-	-	-				
	avg	76.16	74.00	42.32	40.28	11.00	13.54	46.68	40.40		avg	-	-	-	-	-	-	-	-				
	1σ	3.78	6.27	2.13	3.32	2.05	3.50	0.92	1.25		1σ	-	-	-	-	-	-	-	-				
	max	83.62	85.15	44.84	46.00	14.50	17.60	48.37	48.02		max	-	-	-	-	-	-	-	-				
18MS05 n = 4	min	76.29	-	40.21	-	8.71	-	44.68	-	18MS05 n = 0	min	-	-	-	-	-	-	-	-				
	avg	80.64	-	43.23	-	10.36	-	46.42	-		avg	-	-	-	-	-	-	-	-				
	1σ	2.77	-	2.20	-	1.37	-	1.34	-		1σ	-	-	-	-	-	-	-	-				
	max	83.99	-	45.67	-	12.50	-	48.07	-		max	-	-	-	-	-	-	-	-				
		Type 4 - reverse zoning										Type 6 - hourglass zoning											
		Mg#		En		Fs		Wo				Mg#		En		Fs		Wo					
		core	rim	core	rim	core	rim	core	rim			hourglass sector	prism sector	hourglass sector	prism sector	hourglass sector	prism sector	hourglass sector	prism sector				
Monte Spagnolo n = 35	min	72.85	72.66	39.09	38.10	12.54	7.87	45.88	45.39	Monte Spagnolo n = 22	min	61.80	70.43	41.81	37.51	8.53	10.15	45.29	45.17				
	avg	75.08	80.89	40.35	42.69	13.32	10.06	46.32	47.25		avg	80.73	76.85	44.54	40.61	9.38	11.77	46.08	47.62				
	1σ	1.07	3.61	0.49	2.37	0.61	1.81	0.22	0.87		1σ	1.98	3.27	1.18	1.57	1.07	1.86	0.53	1.16				
	max	76.43	85.27	40.86	45.55	14.57	14.34	46.82	48.52		max	84.22	80.32	45.55	42.88	12.08	15.60	47.56	49.03				
18MS01 n = 0	min	-	-	-	-	-	-	-	-	18MS01 n = 5	min	75.35	72.49	41.81	37.51	10.33	12.50	45.92	48.23				
	avg	-	-	-	-	-	-	-	-		avg	78.26	74.17	42.69	38.39	141.19	13.37	46.12	48.24				
	1σ	-	-	-	-	-	-	-	-		1σ	1.36	1.68	0.80	0.88	0.72	0.87	0.16	0.01				
	max	-	-	-	-	-	-	-	-		max	80.90	75.85	43.75	39.27	12.08	14.24	46.32	48.25				
18MS02 n = 31	min	72.85	72.66	39.09	38.10	12.73	7.87	46.11	45.39	18MS02 n = 7	min	61.80	79.45	44.79	40.82	8.75	10.15	45.29	46.03				
	avg	75.08	80.67	40.37	42.50	13.31	10.16	46.32	47.34		avg	79.15	79.95	45.16	41.76	8.94	10.48	45.90	47.76				
	1σ	1.01	3.72	0.51	2.41	0.55	1.87	0.14	0.86		1σ	0.28	0.37	0.25	0.85	0.20	0.44	0.37	1.26				
	max	76.19	85.27	40.86	45.55	14.57	14.34	46.52	48.52		max	83.76	80.32	45.46	42.88	9.26	11.09	46.26	49.03				
18MS05 n = 4	min	73.70	82.71	40.10	44.41	8.20	8.86	41.10	46.31	18MS05 n = 10	min	83.32	70.43	43.73	39.23	8.53	10.31	45.38	45.17				
	avg	75.06	83.09	40.25	44.57	8.85	9.07	41.40	46.36		avg	83.71	76.06	45.06	40.85	8.77	11.93	46.18	47.21				
	1σ	1.36	0.38	0.38	0.16	0.85	0.21	0.47	0.05		1σ	0.31	3.53	0.64	1.06	0.17	2.17	0.68	1.21				
	max	76.43	83.47	40.40	44.74	9.50	9.28	41.70	46.26		max	84.22	80.25	45.55	42.13	9.11	15.60	47.56	48.31				
Plagioclase																							
		Type a - oscillatory zoning								Type e - sieved-textured core								Type g - rim with melt inclusion alignments					
		An		Ab		Or				An		Ab		Or				An		Ab		Or	
		core	matrix	core	matrix	core	matrix			core	rim	core	rim	core	rim			core	rim	core	rim	core	rim
Monte Spagnolo n = 30	min	76.28	6.27	15.05	18.56	0.50	0.81	Monte Spagnolo n = 4	min	76.28	-	15.73	-	0.59	-	Monte Spagnolo n = 9	min	70.98	82.93	22.52	14.56	1.20	0.59
	avg	80.36	63.11	18.84	30.16	0.79	6.74		avg	80.07	-	19.13	-	0.79	-		avg	73.32	83.85	25.31	15.53	1.37	0.63
	1σ	4.08	20.24	3.79	13.16	0.29	9.71		1σ	2.72	-	2.57	-	0.16	-		1σ	1.72	0.68	1.62	0.65	0.10	0.04
	max	84.45	80.61	22.63	72.13	1.08	39.43		max	83.67	-	22.73	-	0.99	-		max	76.29	84.84	27.51	16.38	1.51	0.68
18MS01 n = 5	min	-	68.37	-	18.56	-	0.93	18MS01 n = 4	min	76.28	-	15.73	-	0.59	-	18MS01 n = 9	min	70.98	82.93	22.52	14.56	1.20	0.59
	avg	-	74.74	-	24.07	-	1.19		avg	80.07	-	19.13	-	0.79	-		avg	73.32	83.85	25.31	15.53	1.37	0.63
	1σ	-	3.91	-	3.61	-	0.30		1σ	2.72	-	2.57	-	0.16	-		1σ	1.72	0.68	1.62	0.65	0.10	0.04
	max	-	80.61	-	29.89	-	1.74		max	83.67	-	22.73	-	0.99	-		max	76.29	84.84	27.51	16.38	1.51	0.68
18MS02 n = 14	min	-	6.27	-	21.12	-	0.81	18MS02 n = 0															

7.2. MONTE SPAGNOLO

Monte Spagnolo is the oldest eccentric cone analysed in this work. It erupted sometime between 15.000 and 3930 $\pm$ 60 years ago due to a DDF eruption (Corsaro and Métrich, 2016; Kamenetsky et al., 1996).

The investigated basalts show a low porphyritic index (12-20 vol%) and are characterized by a fine-grained ground mass and phenocrysts of (in order of abundance) pyroxene, olivine, plagioclase and titanomagnetite. Some olivine also contain inclusions of Cr-spinel.

Monte Spagnolo was the subject of several previous works, i.a., by Kamenetsky et al., 1996, Tanguy et al., 1996 and Gennaro et al., 2019.

7.2.1. Whole-rock geochemistry

The whole rock chemistry shows a trachybasaltic composition, with an average SiO_2 content of 49.53 wt% and an average total alkali content of 5.57 wt%. The whole rock Mg# ranges from 54.94 to 57.43 mol.%, with an average of 56.64 mol.%.

Compared with literature data, the investigated samples of Monte Spagnolo show a similar trachy-basaltic composition, but with a slight enrichment in the total alkaline elements as well as in SiO_2 (Figure 7-1).

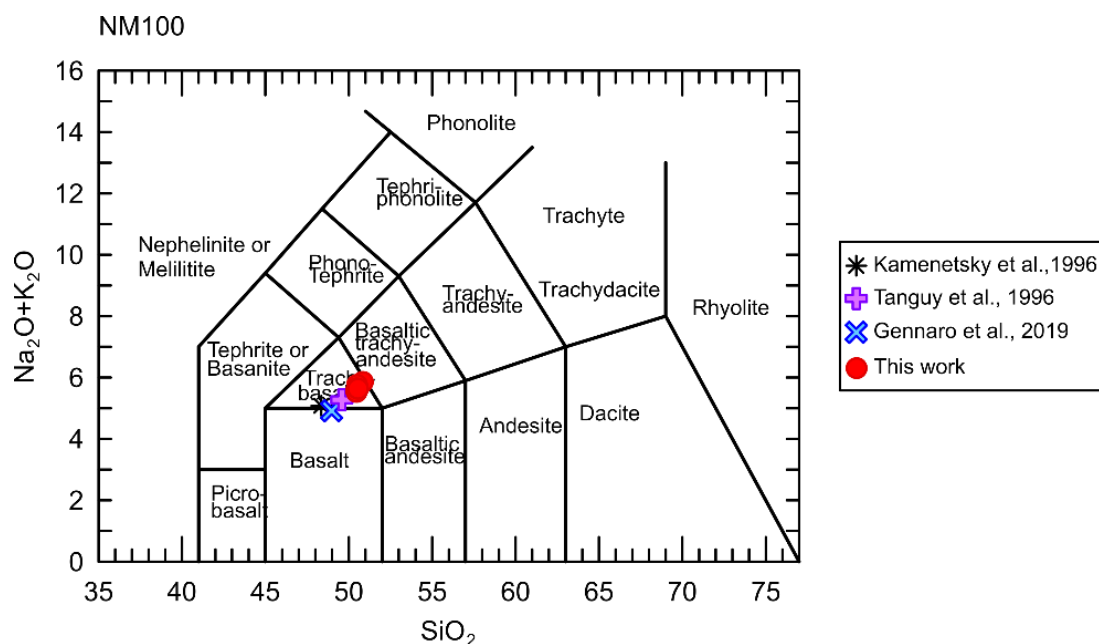


Figure 7-1: Whole rock composition of Monte Spagnolo (Table 6-2 - Table 6-4), compared with literature data (Kamenetsky et al.; 1996; Tanguy et al., 1996 and Gennaro et al., 2019)

7.2.2. Olivine

The olivine of Monte Spagnolo is characterized by normal and inverse zoned texture. The normal zoned olivine shows a high Mg# with an average of 85.30 in the core and 74.11 mol.% in the rim. The highest analysed Mg# is the core of a normal zoned crystal with 88.91 mol.%.

The inverse zoned olivine shows a Mg# with an average of 75.05 mol.%, in the core and

with an average of 76.24 mol.% in the rim, which is only slightly higher than in the core. The Mg# of the rim is wider spread as of the core, both in the inverse as in the normal zoned olivine (Figure 7-2).

The average NiO content decreases from 0.15 to 0.07 wt% from core to rim in the normal zoned olivine but increases from 0.05 to 0.07 wt% in the inverse zoned olivine.

Average MnO and CaO content on the other hand, show an increase between core and rim, in the normal zoned olivine, from 0.24 to 0.51 wt% and 0.29 and 0.34 wt%, respectively.

The inverse zoned olivine shows a constant average MnO content of 0.44 wt%, both in core and rim. The average CaO increases, from core to rim, in the inverse zoned olivine from 0.28 to 0.33 wt% (Table 7-1).

The results of these investigations are consistent with the data from literature, such as Tanguy et al., 1996 or Gennaro et al., 2019 or, who both put the Mg# of the olivine up to 82-88 mol-%. The latter also records the presence of inverse zoned olivine, but with a Mg# of up to 85 mol-% in the rim, which is significant higher, than in the investigated samples of this work.

The presence of inverse zoned olivine, without a normal zoned rim, **suggests the occurrence of magma mixing** right before the eruption.

The minor difference in the Mg# of the inverse zoned olivine indicates that the inflowing magma was more depleted than the primary magma, as it shows a lower MgO in the influx-related crystal growth.

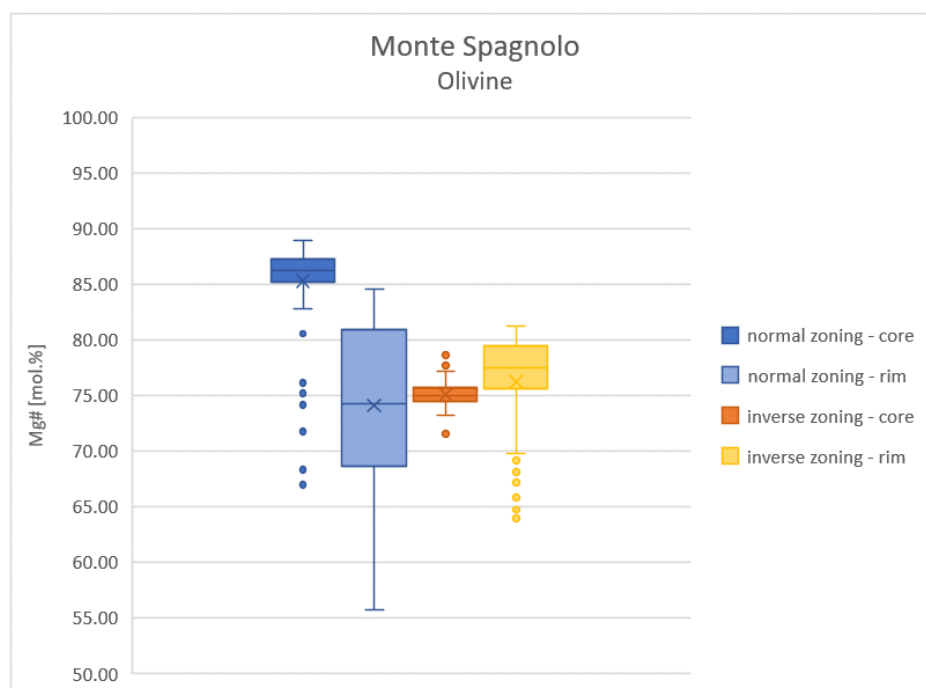


Figure 7-2: Distribution of the Mg# of normal and inverse zoned olivine of Monte Spagnolo, divided into core and rim. (Supplementary Data 11.1)

7.2.3. Clinopyroxene

All four different texture types were found in this location: Type 1 – normal zoning, Type 2 – core-to-rim sharp compositional variations, Type 4 – reverse zoning and Type 6 – hourglass zoning.

The distribution of the Mg# according to the individual texture type is depicted in a boxplot in Figure 7-4 and the endmember composition in Figure 7-5.

Clinopyroxene with a Type 1 texture was found in every thin section and has an average Mg# of 78.91 in the core and 73.75 mol.% in the rim.

Texture Type 2 was only found in the sample 18MS01. Only 3 analyses were conducted on this texture type, two of the core of the crystal and one of the rim. Because of this small number of analyses, these results are subject to statistical uncertainties. They show an average Mg# of 87.67 and 71.46 mol.% in the core and the rim, respectively.

Clinopyroxene with a Type 4 texture type were only found in the samples 18MS02 and 18MS05, but not in 18MS01. They show an increasing average Mg# from 75.08 in the core to 80.89 mol.% in the rim.

The average Mg# is, for clinopyroxene with Type 6 – hourglass texture, for the hourglass sector 80.73 and in the prism sector 76.85 mol.% (Table 7-1).

Plotted in the Morimoto (1988) classification diagram, the clinopyroxene of Monte Spagnolo shows an almost complete diopsidic and salitic composition. Only a few rim analyses of Type 1 clinopyroxene fall into the augite field.

The core of Type 1 and 2 texture falls mainly in the diopside field, whereas the rim has a (more) salitic composition. The Type 4 clinopyroxene shows, as expected, a more salitic composition of the core and a more diopsidic composition of the rim.

The prism sectors of the Type 6 clinopyroxene are of mainly salitic and the hourglass sectors of mainly diopsidic composition (Figure 7-3).

In general, the investigations confirm the literature, with clinopyroxene of diopsidic and salitic composition.

In difference to Gennaro et al., 2019, who sets the Fs content of the clinopyroxenes between 7-12 mol%, this work suggests a lower Fs content, between 2-8 mol%.

The presence of Type 4 – reverse zoned clinopyroxene is, similar to the inverse zoning of olivine, can be seen as **evidence for magma mixing!**

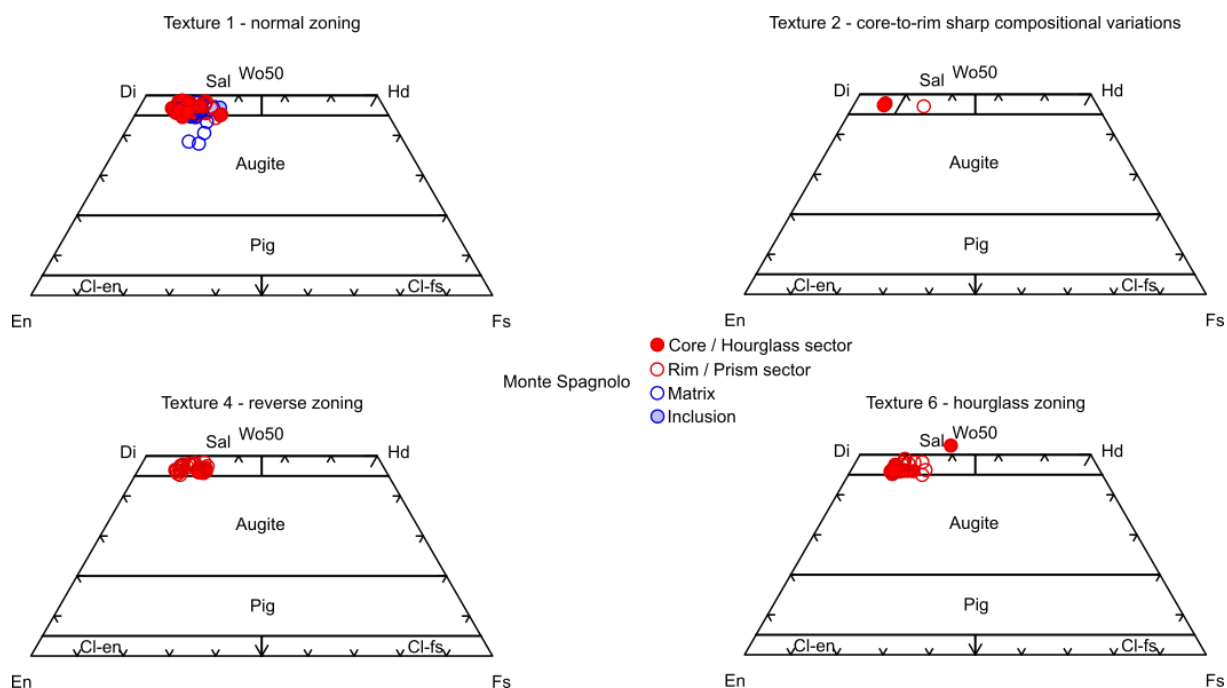


Figure 7-3: Composition of the clinopyroxene of Monte Spagnolo divided into the different texture types, using the Morimoto (1988) diagram. The abbreviations stand for **Di**opside, **Sal**ite, **Hd**edenbergite, **Fs**errosilite and **Wo**llastonite (Supplementary Data 11.2).

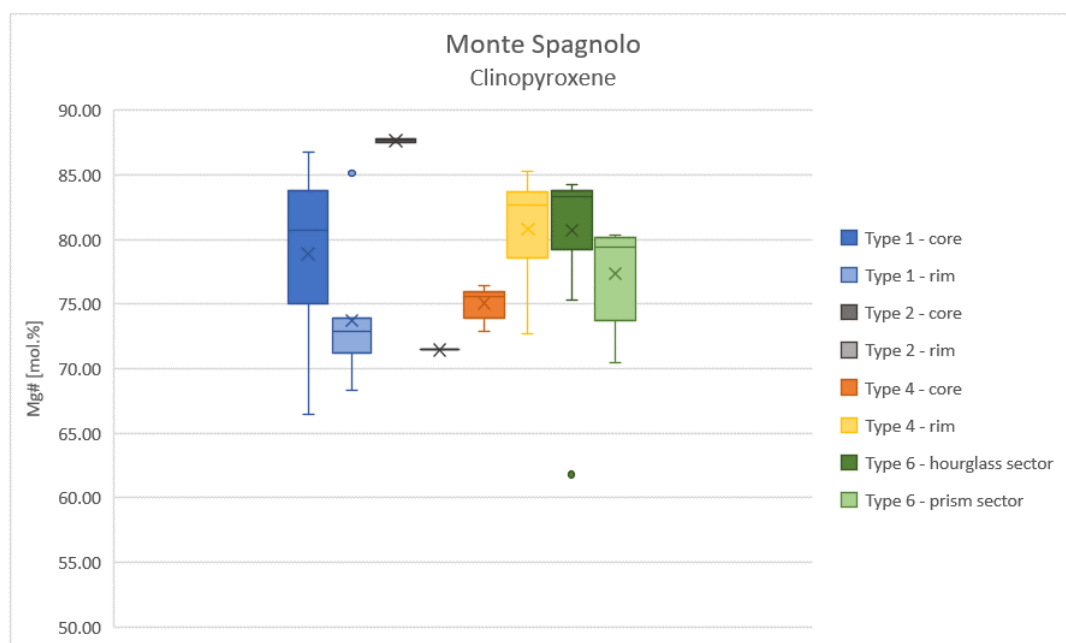


Figure 7-4: Distribution of the Mg# of the clinopyroxene of Monte Spagnolo, divided into the different texture types present, as well as into core, rim, hourglass- and prism sector (Supplementary Data 11.2).

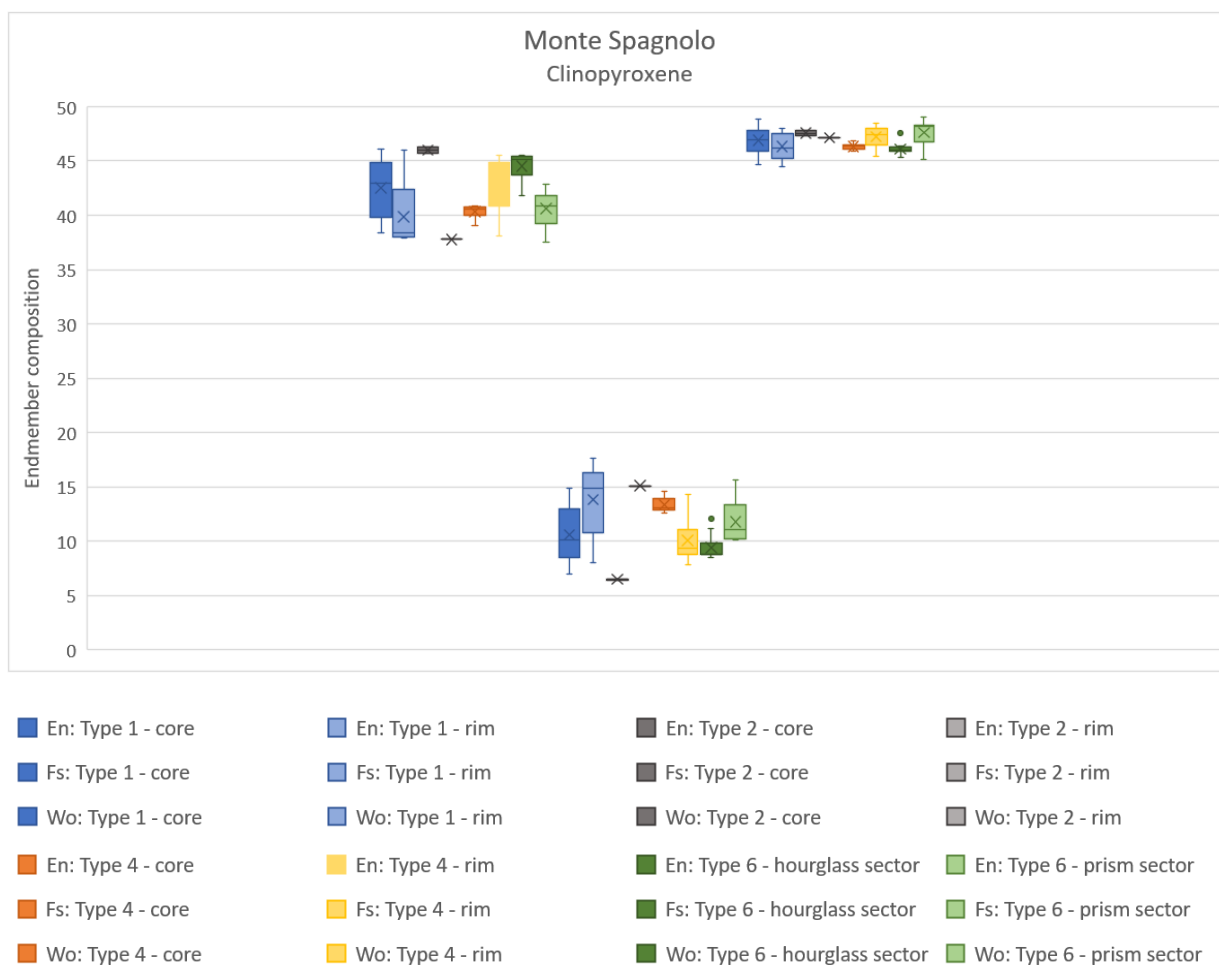


Figure 7-5: Distribution of the endmember composition (Enstatite, Ferrosilite and Wollastonite) of the clinopyroxene of Monte Spagnolo, divided into the different texture types present, as well as into core, rim, hourglass- and prism sector (Supplementary Data 11.2).

7.2.4. Plagioclase

Three different texture types were found in the samples of Monte Spagnolo: Type a – oscillatory zoning, Type e - sieved textured core and Type g – rim with melt inclusion alignments.

Plotted in ternary diagrams, the different texture types of plagioclases show in general a primarily bytownitic composition. Some matrix analyses of Type a seem to be even of anorthoclase or sanidine composition. Some of the plagioclases fall into the miscibility gap and can be considered as ternary feldspars.

The analyses of plagioclase of Type g show a clear distinction between core and rim, as the rim shows a clear An-rich composition (Figure 7-6).

Quite little is known about plagioclase from the literature, i.e., Tanguy et al., 1996 and Gennaro, 2019, but what is known agrees with the observations of this work, that the plagioclase has a labradoritic to anorthitic composition. The documented presence of ternary feldspars is also consistent.

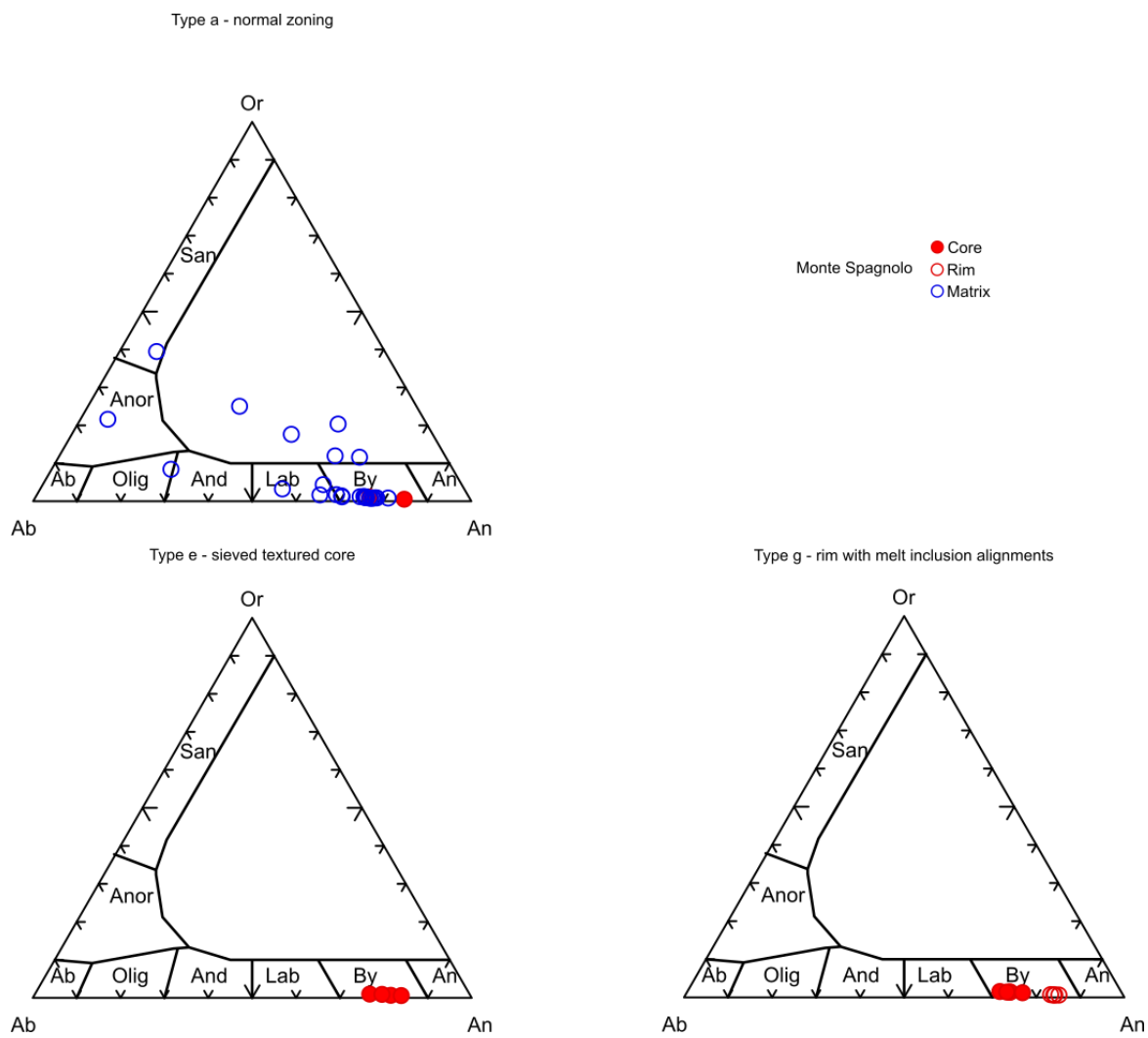


Figure 7-6: Composition of plagioclase of Monte Spagnolo divided into the different texture types in a ternary diagram. These results are further divided into core, rim, and matrix. The abbreviations stand for **Albite**, **Anorthite** and **Orthoclase**

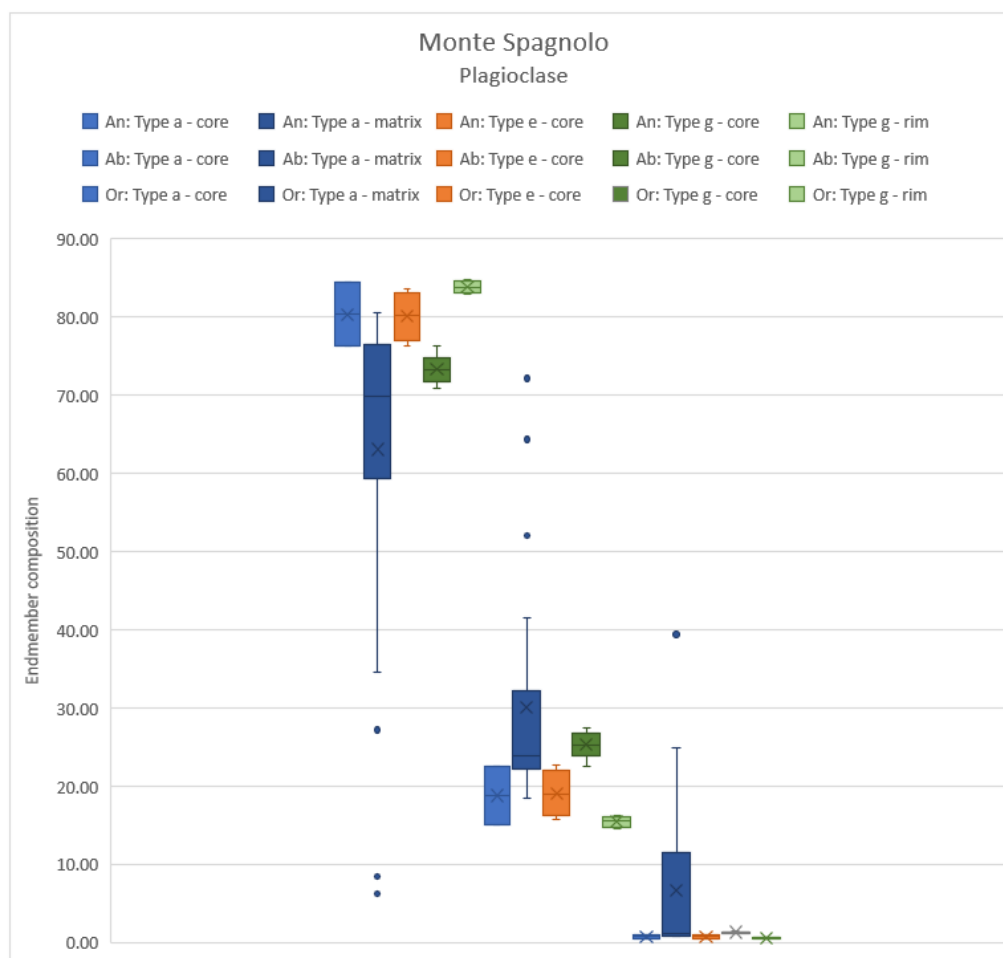


Figure 7-7: Distribution of the endmember composition (**Anorthite**, **Albite** and **Orthoclase**) of the plagioclase of Monte Spagnolo, divided into the different texture types present, as well as into core, rim, and matrix. (Supplementary Data 11.3)

7.2.5. Titanomagnetite

Titanomagnetite is present in form of phenocrysts, inclusions and as part of the matrix. Most of the analyses were conducted on inclusions of titanomagnetite in other minerals. These inclusions show an average Cr# of 0.45 mol.% and an average FeO and TiO content of 72.14 and 11.71 wt%.

The samples from Monte Spagnolo differ from the other study areas because inclusions of Cr spinels were found in them. These inclusions have an average Cr# of 46.21 mol.% and a FeO and TiO content of 31.60 and 1.49, respectively (Table 7-1 and Supplementary Data 11.4).

7.2.6. Thermobarometric calculations

The results for the temperature (rounded to the nearest ten) and pressure conditions of the magma during the formation of the crystals lie for Type 1 – normal zoned clinopyroxene in the core between 1140 and 1180 °C, with an average of 1160 °C. For this type only one rim-analysis was fitting for the thermobarometric calculations, and it

shows a temperature of 1160 °C.

The pressure ranges in the core between 1.4 and 6.5 kbar, with an average pressure of 4.3 kbar. The rim shows a pressure of 2.8 kbar.

From the analyses of the Type 4 textured clinopyroxene only the rim-analyses were suitable, and they resulted in a temperature range between 1140 and 1190 °C, with an average of 1167 °C.

Clinopyroxene with a Type 6 – hourglass zoning shows a temperature and pressure range between 1150 and 1180 °C (avg. 1160 °C) in the hourglass sector and between 1170 and 1180 °C (avg. 1180 °C) in the prism sector.

The pressure between 3.1 and 6.0 kbar (avg. 4.0) and between 4.0 and 5.6 kbar (avg. 5.0 kbar) in the hourglass and prism sector, respectively (Table 7-1).

None of the analyses of clinopyroxene with Type 2 texture were suitable for these calculations.

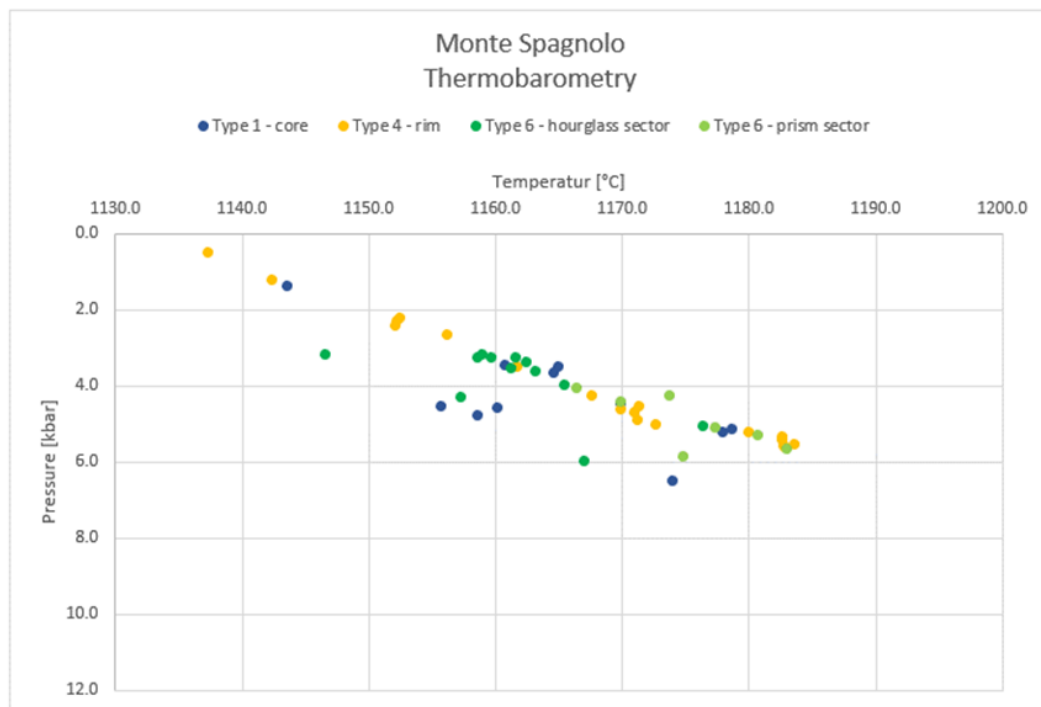


Figure 7-8: Results of the thermobarometric calculations at Monte Spagnolo divided into the texture types

Differentiated into the individual samples, the results show for Monte Spagnolo two different PT-trends, one for sample 18MS01 and one for the samples 18MS02 and 18MS05.

The trend of 18MS01 shows higher pressures to comparable temperatures than the other thin sections (Figure 7-9).

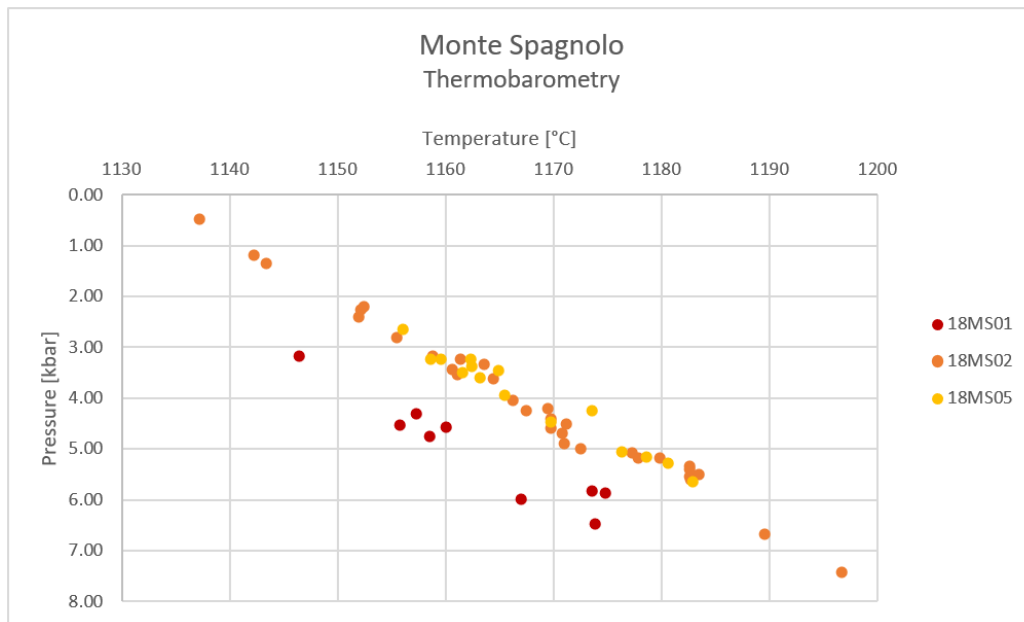


Figure 7-9: Results of the thermobarometric calculations at Monte Spagnolo divided into the thin sections (Supplementary Data 0)

Table 7-2: Factsheet of the results of the geochemical composition of the basalts of Monte Rossi. Mg# & Cr# in mol-%, Temperature (rounded to the nearest ten) in [°C]; Pressure in [kbar]; microprobe analyses in [wt%]

Monte Rossi

		WR-Geochemistry				Trace elements																	
		SiO2	Na2O	K2O	Mg#	La/Yb	Rb/Th																
Monte Rossi	min	49.04	3.97	1.52	48.34	-	-																
	avg	49.10	4.01	1.55	48.85	34.03	3.60																
	1σ	0.07	0.05	0.02	0.38	-	-																
	max	49.16	4.07	1.57	49.27	-	-																
18MR01		49.11	3.93	1.51	49.27	34.03	3.60																
18MR02		49.16	4.03	1.56	48.34	-	-																
18MR03		49.04	3.95	1.54	48.95	-	-																
Olivine																							
		Type 1 - normal zoning																					
		Mg#		NiO		MnO		CaO															
		core	rim	core	rim	core	rim	core	rim														
Monte Rossi n = 237	min	69.22	50.24	<0.01	<0.01	0.29	0.42	0.18	0.28														
	avg	74.63	67.93	0.04	0.03	0.44	0.59	0.32	0.36														
	1σ	1.12	4.87	0.01	0.02	0.04	0.11	0.03	0.06														
	max	78.64	75.28	0.09	0.09	0.59	1.00	0.40	0.58														
18MR01 n = 126	min	70.84	63.20	0.02	<0.01	0.35	0.44	0.27	0.28														
	avg	74.62	69.70	0.04	0.03	0.44	0.55	0.32	0.33														
	1σ	0.79	2.76	0.01	0.01	0.04	0.06	0.03	0.04														
	max	75.58	73.74	0.08	0.05	0.59	0.72	0.40	0.44														
18MR02 n = 56	min	69.22	55.32	<0.01	<0.01	0.29	0.42	0.18	0.28														
	avg	74.79	67.37	0.05	0.02	0.43	0.60	0.30	0.36														
	1σ	2.06	4.57	0.02	0.02	0.06	0.10	0.05	0.07														
	max	78.64	73.94	0.09	0.07	0.57	0.87	0.35	0.56														
18MR03 n = 55	min	72.83	50.24	<0.01	<0.01	0.39	0.44	0.26	0.32														
	avg	74.57	65.17	0.05	0.02	0.44	0.66	0.32	0.40														
	1σ	0.82	6.96	0.01	0.02	0.03	0.16	0.02	0.07														
	max	75.72	75.28	0.07	0.09	0.48	1.00	0.40	0.58														
Pyroxene																							
		Type 1 - normal zoning								Type 6 - hourglass zoning													
		Mg#		En		Fs		Wo				Mg#		En		Fs		Wo					
		core	rim	core	rim	core	rim	core	rim			hourglass sector	prism sector	hourglass sector	prism sector	hourglass sector	prism sector	hourglass sector	prism sector				
Monte Rossi n = 152	min	70.82	60.36	37.24	31.62	8.50	12.47	44.72	44.74	Monte Rossi n = 35	min	75.12	64.98	40.00	34.29	12.57	13.36	46.39	46.80				
	avg	75.46	72.03	39.98	38.39	13.00	14.88	47.01	46.73		avg	75.91	72.65	40.52	38.21	12.86	14.38	46.62	47.40				
	1σ	2.29	4.02	1.34	2.61	1.24	1.99	0.88	0.96		1σ	0.49	1.82	0.32	1.00	0.25	0.95	0.17	0.24				
	max	83.95	76.92	44.47	42.09	15.35	20.77	49.19	48.02		max	76.38	74.62	40.94	39.33	13.25	18.48	46.85	47.88				
18MR01 n = 98	min	70.82	67.51	37.24	35.09	8.50	12.47	44.72	44.74	18MR01 n = 35	min	75.12	64.98	40.00	34.29	12.57	13.36	46.39	46.80				
	avg	75.59	74.32	39.93	39.83	12.90	13.73	47.17	46.44		avg	75.91	72.65	40.52	38.21	12.86	14.38	46.62	47.40				
	1σ	2.68	2.74	1.47	2.13	1.45	1.24	0.88	1.04		1σ	0.49	1.82	0.32	1.00	0.25	0.95	0.17	0.24				
	max	83.95	76.92	44.47	42.09	15.35	16.89	48.78	48.02		max	76.38	74.62	40.94	39.33	13.25	18.48	46.85	47.88				
18MR02 n = 7	min	73.75	-	39.09	-	11.76	-	45.25	-	18MR02 n = 0	min	-	-	-	-	-	-	-	-				
	avg	76.06	70.65	40.76	37.20	12.82	15.45	46.42	47.35		avg	-	-	-	-	-	-	-	-				
	1σ	1.51	-	1.36	-	0.66	-	0.83	-		1σ	-	-	-	-	-	-	-	-				
	max	78.37	-	42.62	-	13.92	-	47.45	-		max	-	-	-	-	-	-	-	-				
18MR03 n = 45	min	72.39	60.36	37.94	31.62	11.07	14.53	45.25	45.59	18MR03 n = 0	min	-	-	-	-	-	-	-	-				
	avg	75.08	69.47	39.94	36.81	13.25	16.17	46.80	47.02		avg	-	-	-	-	-	-	-	-				
	1σ	1.24	3.84	0.94	2.23	0.67	1.98	0.82	0.77		1σ	-	-	-	-	-	-	-	-				
	max	78.48	73.26	41.52	39.86	14.96	20.77	49.19	48.01		max	-	-	-	-	-	-	-	-				
Plagioclase																							
		Type a - oscillatory zoning						Type b - clear rounded core						Type e - sieved-textured core									
		An		Ab		Or				An		Ab		Or				An		Ab		Or	
		core	rim	core	rim	core	rim			core	rim	core	rim	core	rim			core	rim	core	rim	core	rim
Monte Rossi n = 25	min	62.62	59.61	11.72	13.52	0.42	0.58	Monte Rossi n = 12	min	70.55	48.62	5.47	14.73	0.17	0.58	Monte Rossi n = 122	min	70.26	36.72	9.48	10.11	0.33	0.27
	avg	79.23	77.54	19.75	21.29	1.02	1.17		avg	82.50	69.99	16.71	27.79	0.79	2.22		avg	80.85	77.41	18.26	21.01	0.89	1.58
	1σ	5.90	6.37	5.41	5.68	0.52	0.71		1σ	6.81	14.28	6.37	12.49	0.46	1.81		1σ	5.15	11.07	4.81	8.74	0.36	2.55
	max	87.86	85.90	34.69	37.04	2.69	3.35		max	94.37	84.69	27.72	46.28	1.73	5.10		max	90.19	89.55	27.99	50.58	1.75	12.70
18MR01 n = 13	min	62.62	59.61	13.41	18.58	0.56	0.90	18MR01 n = 5	min	77.38	-	5.47	-	0.17	-	18MR01 n = 70	min	71.53	74.70	10.33	10.11	0.34	0.27
	avg	78.42	73.44	20.47	24.98	1.12	1.58		avg	85.28	-	14.13	-	0.59	-		avg	82.40	81.25	16.84	17.91	0.76	0.84
	1σ	6.67	8.16	6.09	7.14	0.60	1.03		1σ	5.43	-	5.15	-	0.29	-		1σ	4.59	4.73	4.31	4.42	0.29	0.32
	max	85.92	80.49	34.69	37.04	2.69	3.35		max	94.37	-	21.56	-	1.06	-		max	89.26	89.55	27.01	23.77	1.48	1.53
18MR02 n = 5	min	78.71	75.33	19.06	17.11	0.92	0.78	18MR02 n = 0	min	-	-	-	-	-	-	18MR02 n = 13	min	73.33	-	9.48	-	0.33	-
	avg	79.35	78.61	19.72	20.35	0.93	1.04		avg	-	-	-	-	-	-		avg	81.30	-	17.80	-	0.91	-
	1σ	0.65	2.77	0.66	2.56	0.01	0.22		1σ	-	-	-	-	-	-		1σ	5.40	-	5.02	-	0.40	-
	max	80.00	82.12	20.38	23.36	0.94	1.31		max	-	-	-	-	-	-		max	90.19	-	24.98	-	1.69	-
18MR03 n = 12	min	76.93	77.19	11.72	13.52	0.42	0.58	18MR03 n = 7	min	70.55	48.62	13.44	14.73	0.53	0.58	18MR03 n = 39	min	70.26	36.72	11.18	12.63	0.45	0.48
	avg	81.57	80.85	17.64	18.30	0.79	0.86		avg	77.86	69.99	21.01	27.79	1.13	2.22		avg	77.37	72.13	21.48	25.27	1.16	2.59
	1σ	4.61	3.28	4.34	3.09	0.28	0.19		1σ	6.35	14.28	5.86	12.49	0.49	1.81		1σ	4.39	14.56	4.08	11.10	0.32	3.67
	max	87.86	85.90	21.99	21.77	1.08	1.04		max	86.03	84.69	27.72	46.28	1.73	5.10		max	88.37	86.88	27.99	50.58	1.75	12.70
Titanomagnetite																							
		Phenocryst						Matrix						Inclusion									
		Cr#		FeO		TiO				Cr#	FeO	TiO			Cr#	FeO	TiO						
		core	rim	core	rim	core	rim																
Monte Rossi n = 12	min	0.21	0.06	69.09	69.31	11.26	11.33	Monte Rossi n = 4	min	0.07	69.67	17.51	Monte Rossi n = 64	min	0.04	63.82	9.37						
	avg	0.61	0.40	70.55	70.02	13.76	16.21		avg	0.09	69.95	18.45		avg	0.56	69.80	13.24						
	1σ	0.23	0.27	0.98	0.78	2.25	2.55		1σ	0.02	0.16	0.71		1σ	0.40	1.36	2.38						
	max	0.91	0.86	71.79	71.55	17.84	18.51		max	0.13	70.10	19.35		max	1.91	71.57	18.68						
18MR01 n = 10	min	0.21	0.06	69.61	69.31	11.26	11.33	18MR01 n = 2	min	0.07	69.99	18.89	18MR01 n = 32	min	0.05	63.82	9.37						
	avg	0.53	0.40	70.97	70.02	13.33	16.21		avg	0.08	70.01	19.12		avg	0.57	69.44	13.54						
	1σ	0.22	0.27	0.82	0.78	2.31	2.55		1σ	<0.01	0.02	0.23		1σ	0.47	1.52	2.58						
	max	0.83	0.86	71.79	71.55	17.84	18.51		max	0.08	70.04	19.35		max	1.91	71.55	18.68						
18MR02 n = 2	min	0.70	-	69.09	-	13.19	-	18MR02 n = 0	min	-	-	-	18MR02 n = 6	min	0.04	66.66	10.61						
	avg	0.80	-	69.50	-	14.85	-		avg	-	-	-		avg	0.52	69.45	12.79						
	1σ	0.11	-	0.41	-	1.65	-		1σ	-	-	-		1σ	0.29	1.60	1.80						
	max	0.91	-	69.91	-	16.50	-		max	-	-	-		max	0.88	71.39	16.25						
18MR03 n = 0	min	-	-	-	-	-	-	18MR03 n = 2	min	0.10	69.67	17.51	18MR03 n = 26	min	0.06	67.33	10.83						
	avg	-	-	-	-	-	-		avg	0.11	69.89	17.78		avg	0.55	70.31	12.97						
	1σ	-	-	-	-	-	-		1σ	0.02	0.21	0.28		1σ	0.31	0.83	2.17						
	max	-	-	-	-	-	-		max	0.13	7												

7.3. MONTE ROSSI

The eccentric cone of Monte Rossi erupted between March and July of 1669 and formed a lava flow with a total length of around 17km. For more details about this cone see chapter 3.3.

The investigated basalts show a medium porphyritic index (40-50 vol%) and are characterized by a fine-grained ground mass (matrix) and phenocrysts of (in order of abundance) plagioclase, olivine, pyroxene and titanomagnetite.

Monte Rossi has been the subject of extensive previous research, i.e., by Corsaro et al., 1996, Mulas et al., 2016 and Kahl et al., 2017.

Even though no direct evidence for magma mixing was found in the three investigated samples of Monte Rossi in course of this study, Magee et al., 2020, suggest a “cryptic” mixing of two, compositionally similar, magmas, as the trigger for the eruption of 1669. This “cryptic” mixing also explains the relatively high porphyritic index and the presence of large crystals (“megacrysts”), as the initial magma was only exposed to a magma with similar composition.

7.3.1. Whole-rock geochemistry

Monte Rossi shows a trachybasaltic composition with an average SiO_2 content of 49.10 wt%. The average total-alkali content is 5.56 wt%. The average Mg# is at 48.85 mol.% (Table 7-2).

There is a small deviation between the investigated samples and the compared literature data from Corsaro et al., 1996, Mulas et al., 2016 and Kahl et al., 2017, as they show a more basic and less alkaline composition (Figure 7-10)

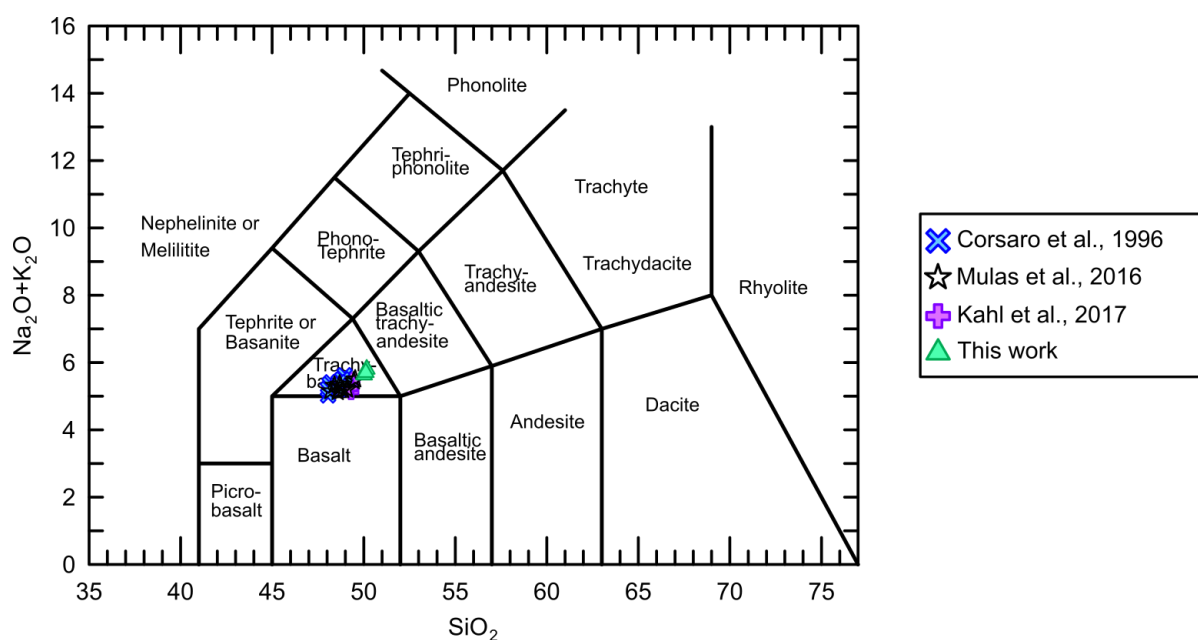


Figure 7-10: Whole rock composition of Monte Rossi (Table 6-2 - Table 6-4), compared with literature data (Corsaro et al., 1996; Mulas et al., 2016 and Kahl et al., 2017)

7.3.2. Olivine

In contrast to Kahl et al., 2017, who reported a small number of inverse zoned olivine, no inverse zoning was found in these samples, wherefore all olivine crystals are of Type 1 – normal zoning. The average Mg# is in the core 74.63 and 67.93 mol.% in the rim (Figure 7-11). This is consistent with the geochemical analyses of Kahl et al., 2017. The average NiO content is 0.04 in the core and 0.03 wt% in the rim. The average MnO and CaO content show both an increase from core to rim, with 0.44 to 0.59 and 0.32 to 0.36 wt%, respectively (Table 7-2).

The decreasing Mg# and NiO content, as well as the increasing MnO and CaO content suggests no radical changes in the magma and can therefore be seen as **no explicit evidence for magma mixing in olivine**.

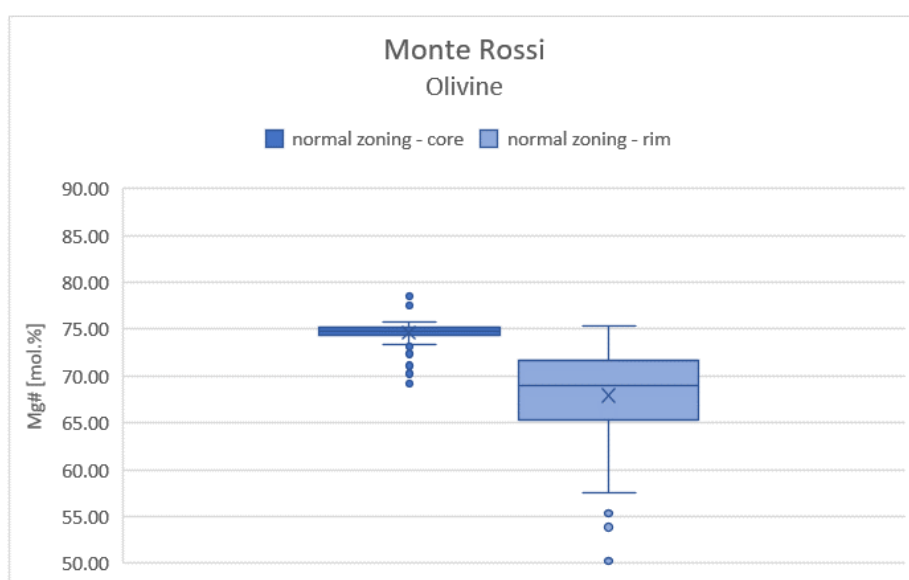


Figure 7-11: Distribution of the Mg# of normal zoned olivine of Monte Rossi, divided into core and rim (Supplementary Data 11.1)

7.3.3. Clinopyroxene

Two different texture types were found, Type 1 – normal zoning and Type 6 – hourglass zoning.

Clinopyroxene with a Type 1 texture was found in every thin section and has an average Mg# of 75.46 in the core and 72.03 mol.% in the rim.

Type 6 – hourglass zoning texture was only found in the thin section 18MR01. The average Mg# is in the hourglass sector 75.91 and in the prism sector 72.65 mol.%. In conclusion, the changes in the FeO to MgO ratio are relatively small. (Table 7-2).

Plotted in the composition diagram after Morimoto (1988), the clinopyroxene with a Type 1 normal zoning almost all fall into the salite field, with only a few core analyses in the border region to the diopside field. Generally, the rim and matrix analyses are of a more wollastonitic composition.

This is consistent with the work of Corsaro et al., 1996, and Kahl et al., 2017.

Both the hourglass and the prism sectors show a salitic composition in the clinopyroxene of Monte Rossi (Figure 7-12).

In the Type 1 clinopyroxene, the decrease in MgO content is visible in decreasing Mg# as well as in the decreasing enstatitic composition (Figure 7-13). Following this decrease, the ferrosilitic and wollastonitic composition increases (Figure 7-14). All these observations rather suggest no magma mixing, but a high-resolution investigation of clinopyroxene by Magee et al., 2020, identifies a “cryptic” mixing, where the intruding magma shows a very similar geochemical composition, as the most probable trigger.

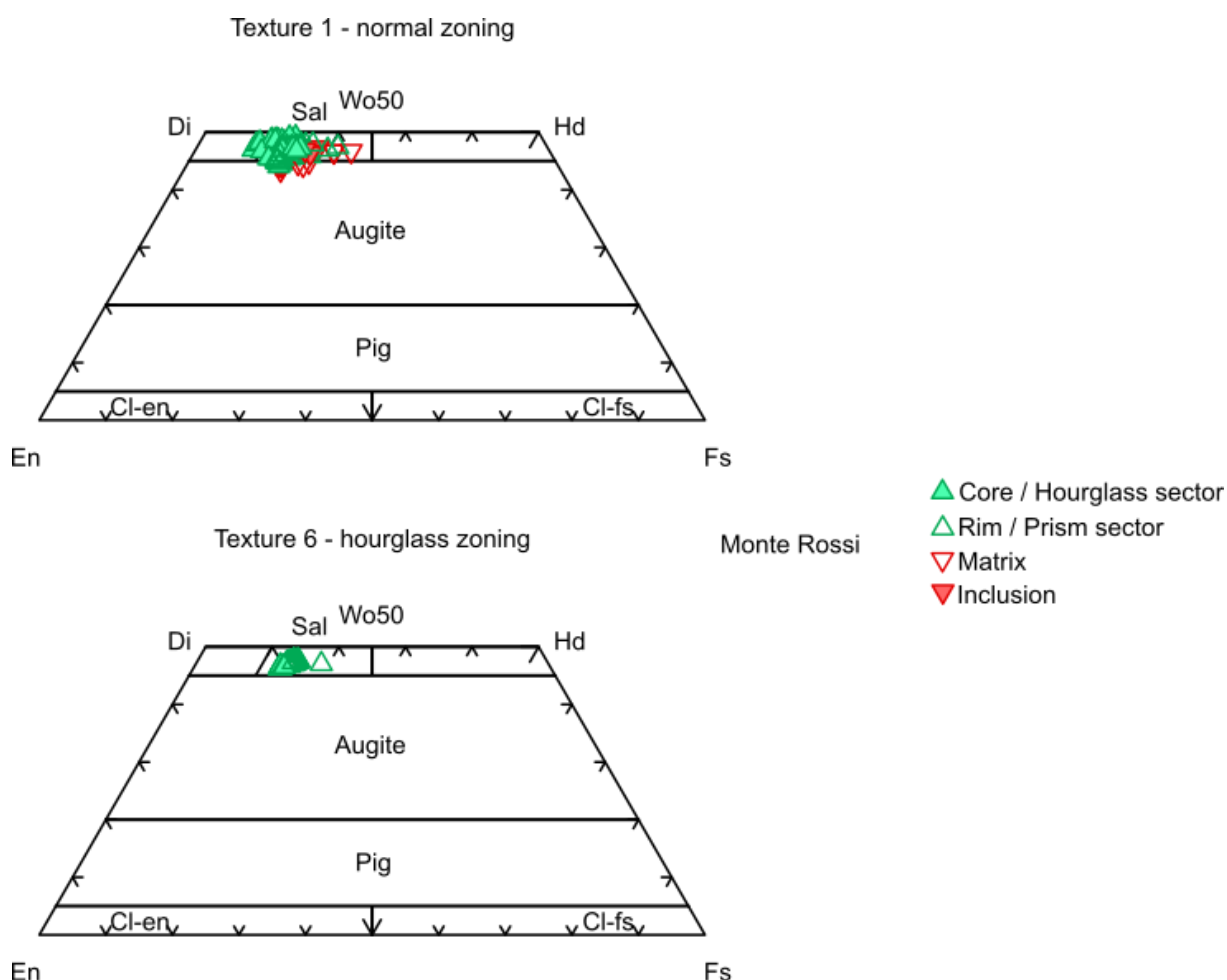


Figure 7-12: Composition of the clinopyroxene of Monte Rossi divided into the different texture types, using the Morimoto (1988) diagram. The abbreviations stand for **D**iopside, **S**alite, **H**edenbergite, **F**errosilite and **W**ollastonite

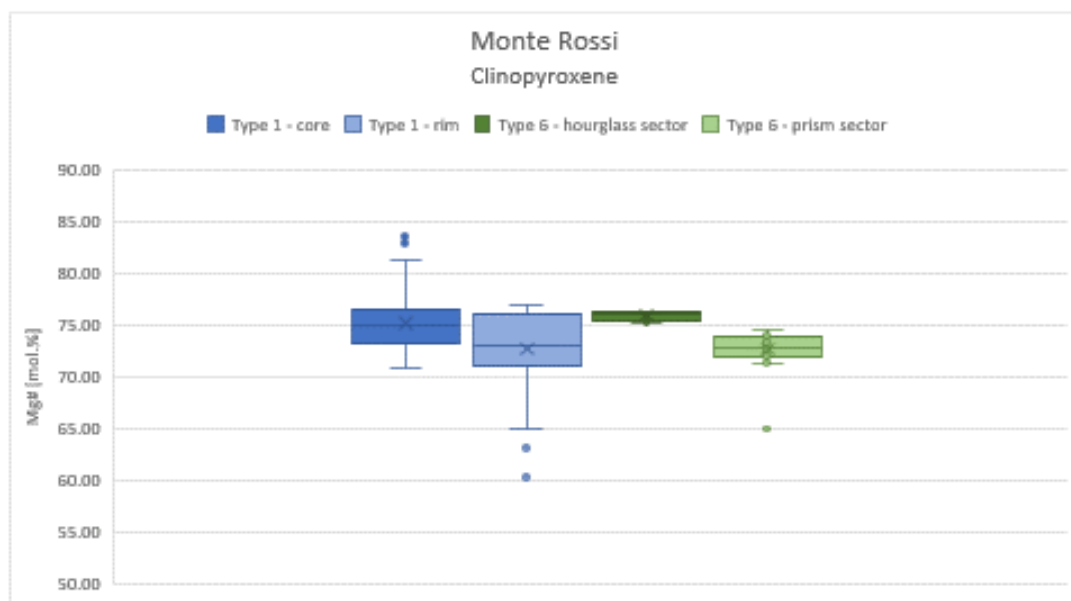


Figure 7-13: Distribution of the Mg# of the clinopyroxene of Monte Rossi, divided into the different texture types present, as well as into core, rim, hourglass- and prism sector (Supplementary Data 0)

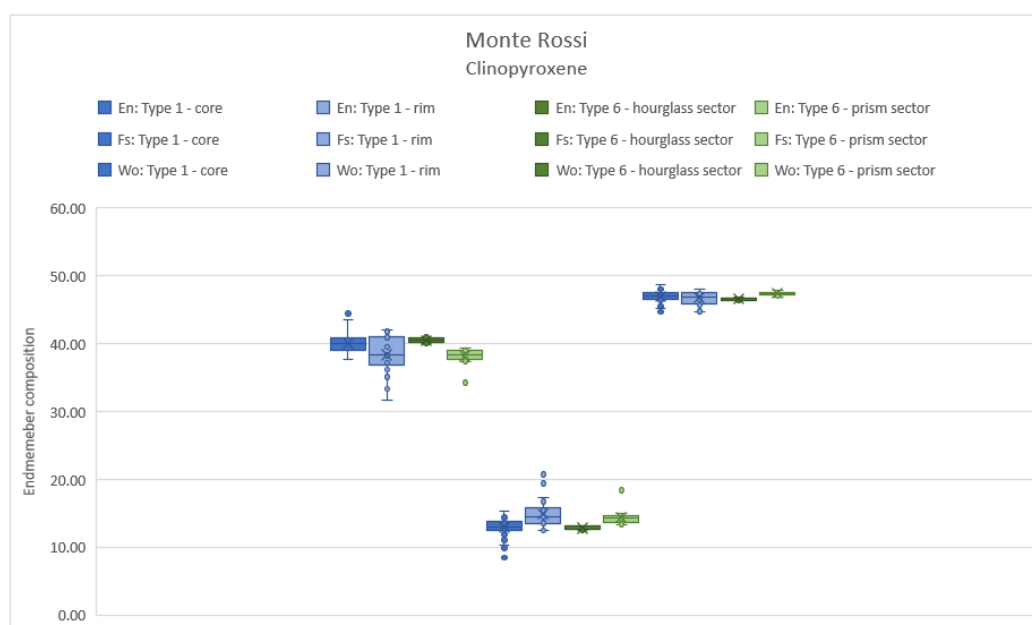


Figure 7-14: Distribution of the endmember composition (**En**statite, **Fs**errosilite and **Wo**llastonite) of the clinopyroxene of Monte Rossi, divided into the different texture types present, as well as into core, rim, hourglass- and prism sector (Supplementary Data 0)

7.3.4. Plagioclase

Three different texture types were found in the samples of Monte Rossi: Type a – oscillatory zoning, Type b – clear rounded core and Type e - sieved textured core. All three texture types show similar changes in the endmember composition between core and rim. They all show a decreasing anorthitic and an increasing albitic and orthoclase composition from core to rim (Figure 7-16).

Plagioclase with a Type a and Type e texture was also identified by Kahl et al., 2017, and

the analyses show a composition of An₅₆₋₈₅, which is consistent with the results of this work.

The analyses of the different texture types plotted into a ternary diagram show for core and rim of normal zoned plagioclase a predominantly bytownitic and for the matrix plagioclase a more labradoritic composition.

Type b plagioclase shows a similar distribution, as core analyses plot in the bytownite, whereas rim and matrix also fall into the labradorite field.

The plagioclase with a Type e texture shows a gradual transition from core to rim, from bytownite to labradorite. A few rim analyses even plot in the anorthoclase field (Figure 7-15).

The petrological and geochemical analyses of the plagioclase **also show no distinct signs for magma mixing.**

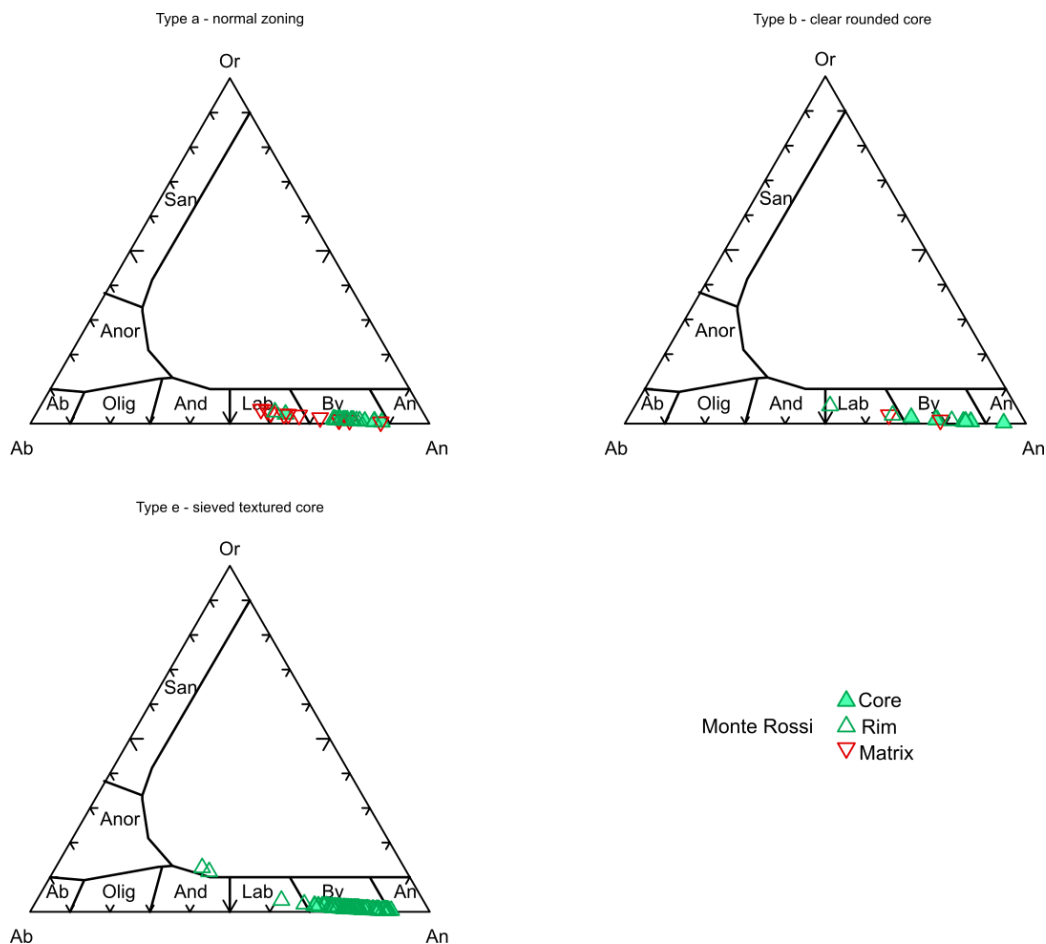


Figure 7-15: Composition of plagioclase of Monte Rossi divided into the different texture types in a ternary diagram. These results are further divided into core, rim, and matrix. The abbreviations stand for Albite, Anorthoclase and Orthoclase (Supplementary Data 11.3)

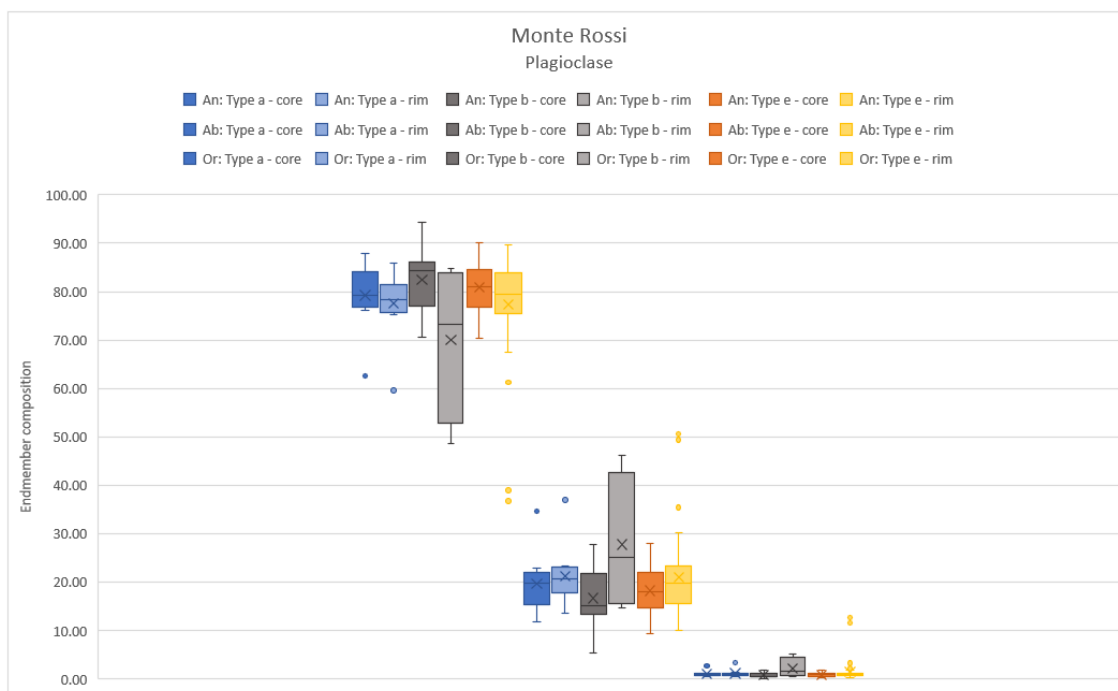


Figure 7-16: Distribution of the endmember composition (**A**northite, **A**lbite and **O**orthoclase) of the plagioclase of Monte Rossi, divided into the different texture types present, as well as into core, rim, and matrix. (Supplementary Data 11.3)

7.3.5. Titanomagnetite

Titanomagnetite is present in the form of phenocrysts, inclusions and as part of the matrix. The Cr# is highest in the cores of the phenocrysts, with an average of 0.61 mol.%. The inclusions have a similar average Cr# of 0.56 mol.%, whereas the matrix has only an average Cr# of 0.09 mol.% (Table 7-2).

The decrease of the Cr# from core (0.61 mol.%) to rim (0.40 mol.%) is a **possible indicator that no significant magma mixing occurred**.

7.3.6. Thermobarometric calculations

The results for the temperature (rounded to the nearest ten) and pressure conditions of the magma during the formation of the crystals lie for Type 1 – normal zoned clinopyroxene in the core between 1100 and 1160 °C, with an average of 1140 °C. In the rim the temperature ranges between 1110 and 1150 °C, with an average of 1130 °C. The pressure ranges in the core between 1.0 and 6.5 kbar, with an average pressure of 4.4 kbar. The rim shows a narrower range between 2.3 and 5.3 kbar, but with a similar average pressure of 4.0 kbar.

Clinopyroxene with a Type 6 – hourglass zoning shows an overall higher temperature and pressure range between 1140 and 1150 °C (avg. 1140 °C) in the hourglass sector and between 1140 and 1160 °C (avg. 1140 °C) in the prism sector.

The pressure is much higher in the Type 6 clinopyroxene with values between 4.2 and 5.7 kbar (avg. 5.3) and between 4.9 and 5.5 kbar (avg. 5.3 kbar) in the hourglass and prism sector, respectively (Table 7-2).

All results plot along one linear trend with the highest temperatures analysed in the hourglass zoned pyroxenes (Figure 7-17).

A comparison with the thermobarometric calculations by Magee et al., 2020, support our results, as they also show the mean crystallisation temperature at $\sim 1400^{\circ}\text{C}$ and pressure at ~ 4 kbar.

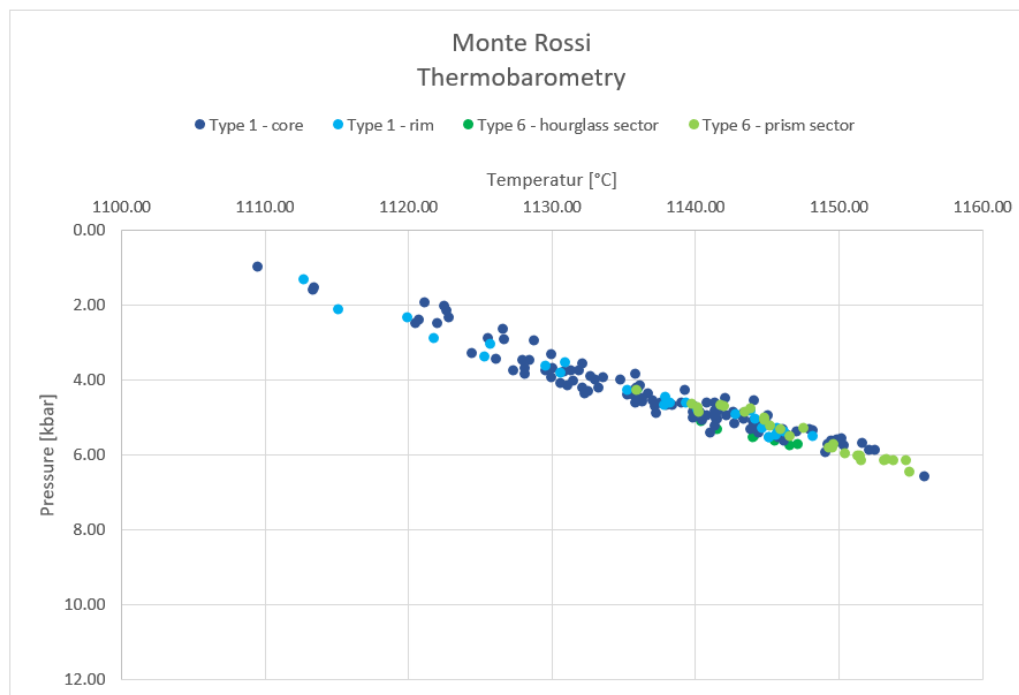


Figure 7-17: Results of the thermobarometric calculations for Monte Rossi divided into the texture types (Supplementary Data 11.2)

Table 7-3: Factsheet of the results of the geochemical composition of the basalts of Mounts de Fiore. Mg# & Cr# in mol-%, Temperature (rounded to the nearest ten) in [°C]; Pressure in [kbar]; microprobe analyses in [wt%]

Mounts de Fiore

		WR-Geochemistry				Trace elements				WR-Geochemistry				Trace elements	
		SiO2	Na2O	K2O	Mg#	La/Yb	Rb/Th			SiO2	Na2O	K2O	Mg#	La/Yb	Rb/Th
Mounts de Fiore	min	46.96	3.42	1.92	51.22	27.54	6.29	18MF04	47.01	3.51	1.97	51.24	27.54	6.94	
	avg	47.22	3.50	1.95	51.50	27.83	6.59	18MF05	47.23	3.52	1.95	51.67	-	-	
	1σ	0.18	0.03	0.02	0.21	0.26	0.23	18MF06	47.45	3.50	1.96	51.67	28.27	6.69	
	max	47.45	3.54	1.99	51.83	28.27	6.94	18MF07	47.31	3.51	1.95	51.83	-	-	
18MF01		47.41	3.51	1.92	51.42	27.85	6.61	18MF09	47.34	3.51	1.95	51.22	27.60	6.40	
18MF02		47.10	3.46	1.99	51.43	-	-	18MF10	47.43	3.42	1.97	51.28	-	-	
18MF03A		46.96	3.54	1.95	51.45	27.88	6.29								
18MF03B		47.02	3.50	1.94	51.80										

Olivine																			
		Type 1 - normal zoning										Type 2 - inverse zoning							
		Mg#		NiO		MnO		CaO				Mg#		NiO		MnO		CaO	
		core	rim	core	rim	core	rim	core	rim			core	rim	core	rim	core	rim	core	rim
Mounts de Fiore n = 196	min	75.22	66.68	0.03	<0.01	0.23	0.27	0.19	0.27	Mounts de Fiore n = 112	min	70.35	71.65	<0.01	0.03	0.26	0.24	0.19	0.22
	avg	80.66	75.57	0.07	0.04	0.30	0.47	0.28	0.36		avg	76.44	80.66	0.05	0.08	0.41	0.30	0.26	0.27
	1σ	1.44	3.47	0.02	0.02	0.04	0.12	0.04	0.06		1σ	2.36	1.46	0.02	0.02	0.07	0.04	0.04	0.03
	max	82.43	80.73	0.11	0.08	0.54	0.69	0.43	0.52		max	80.94	82.54	0.10	0.12	0.57	0.60	0.36	0.49
18MF01 n = 22	min	79.59	69.84	0.06	<0.01	0.28	0.33	0.25	0.33	18MF01 n = 26	min	71.86	71.65	0.02	0.03	0.39	0.27	0.19	0.25
	avg	80.81	73.57	0.08	0.02	0.30	0.49	0.28	0.42		avg	74.23	79.52	0.05	0.08	0.46	0.34	0.28	0.31
	1σ	0.67	3.68	0.02	0.02	0.02	0.10	0.03	0.07		1σ	1.53	2.60	0.01	0.02	0.03	0.08	0.05	0.06
	max	81.69	79.94	0.11	0.05	0.32	0.63	0.33	0.52		max	76.81	81.75	0.07	0.12	0.50	0.60	0.36	0.49
18MF02 n = 84	min	77.61	66.68	0.03	<0.01	0.24	0.32	0.21	0.29	18MF02 n = 21	min	70.35	75.75	<0.01	0.03	0.44	0.26	0.29	0.26
	avg	80.92	76.21	0.07	0.04	0.29	0.42	0.28	0.34		avg	73.21	79.94	0.02	0.06	0.49	0.32	0.33	0.29
	1σ	0.90	4.26	0.02	0.02	0.03	0.10	0.03	0.05		1σ	1.83	1.84	0.01	0.02	0.04	0.05	0.02	0.02
	max	82.43	79.96	0.11	0.06	0.39	0.64	0.36	0.47		max	75.86	81.39	0.04	0.11	0.55	0.42	0.35	0.32
18MF03A n = 26	min	79.19	74.85	0.06	0.03	0.24	0.27	0.23	0.30	18MF03A n = 129	min	72.92	79.24	0.01	0.05	0.26	0.24	0.19	0.22
	avg	81.47	78.75	0.08	0.05	0.29	0.38	0.28	0.32		avg	77.06	81.01	0.05	0.09	0.40	0.29	0.25	0.26
	1σ	1.06	2.07	0.02	0.02	0.03	0.09	0.04	0.02		1σ	1.85	0.85	0.02	0.01	0.07	0.03	0.03	0.02
	max	82.43	80.73	0.11	0.08	0.37	0.55	0.36	0.35		max	80.94	82.54	0.10	0.11	0.57	0.37	0.31	0.31
18MF03B n = 19	min	75.66	72.04	0.03	0.02	0.29	0.34	0.19	0.27	18MF03B n = 16	min	79.78	66.51	0.06	0.02	0.26	0.28	0.24	0.27
	avg	78.74	75.14	0.06	0.04	0.33	0.45	0.29	0.36		avg	80.18	78.56	0.06	0.06	0.28	0.36	0.27	0.32
	1σ	1.93	2.50	0.02	0.02	0.03	0.06	0.07	0.05		1σ	0.51	4.14	<0.01	0.02	0.02	0.11	0.03	0.06
	max	81.28	79.43	0.10	0.07	0.38	0.53	0.43	0.42		max	80.91	81.33	0.07	0.09	0.31	0.70	0.31	0.48
18MF05 n = 12	min	80.96	74.68	0.05	0.02	0.23	0.33	0.23	0.31	18MF05 n = 0	min	-	-	-	-	-	-	-	-
	avg	81.68	77.07	0.09	0.05	0.28	0.47	0.25	0.33		avg	-	-	-	-	-	-	-	-
	1σ	0.46	1.78	0.02	0.02	0.03	0.10	0.02	0.01		1σ	-	-	-	-	-	-	-	-
	max	82.20	79.81	0.11	0.06	0.33	0.64	0.28	0.35		max	-	-	-	-	-	-	-	-
18MF07 n = 33	min	75.22	72.31	0.03	<0.01	0.26	0.29	0.27	0.29	18MF07 n = 0	min	-	-	-	-	-	-	-	-
	avg	79.52	74.41	0.07	0.03	0.34	0.55	0.31	0.38		avg	-	-	-	-	-	-	-	-
	1σ	1.88	2.02	0.02	0.02	0.07	0.11	0.02	0.05		1σ	-	-	-	-	-	-	-	-
	max	81.45	79.49	0.11	0.05	0.54	0.69	0.35	0.46		max	-	-	-	-	-	-	-	-

Pyroxene																							
		Type 1 - normal zoning												Type 6 - hourglass zoning									
		Mg#			En			Fs			Wo					Mg#		En		Fs		Wo	
		core	rim	matrix	core	rim	matrix	core	rim	matrix	core	rim	matrix	Mounts de Fiore n = 23	min	hourglass sector	prism sector	hourglass sector	prism sector	hourglass sector	prism sector	hourglass sector	prism sector
Mounts de Fiore n = 73	min	64.22	66.67	61.82	31.69	33.37	32.09	12.11	13.49	12.65	45.39	46.38	45.79	Mounts de Fiore n = 23	min	74.33	66.66	39.46	33.01	12.15	14.33	45.97	49.39
	avg	72.03	69.84	70.19	37.65	35.70	36.83	14.31	15.38	15.59	48.04	48.92	47.58		avg	75.80	68.98	40.57	34.73	12.95	15.53	46.48	49.93
	1σ	3.53	2.60	4.67	2.87	2.21	3.10	1.33	1.03	2.27	1.74	1.37	1.46		1σ	1.03	1.95	0.61	1.36	0.57	0.85	0.43	0.42
	max	76.91	74.83	76.38	41.74	40.12	40.89	17.46	16.68	19.82	50.84	50.41	49.99		max	77.33	71.69	41.78	36.28	13.63	16.51	47.31	50.47
18MF01 n = 24	min	64.48	66.67	-	31.69	33.37	-	12.11	13.49	-	45.96	46.38	-	18MF01 n = 10	min	74.33	66.66	39.46	33.01	12.15	14.33	46.09	49.39
	avg	72.68	69.34	-	37.88	35.51	-	14.18	15.64	-	47.94	48.85	-		avg	75.73	69.25	40.39	34.54	12.95	15.41	46.65	49.86
	1σ	3.47	2.90	-	2.81	2.58	-	1.44	1.10	-	1.67	1.61	-		1σ	1.04	2.10	0.52	1.27	0.60	0.92	0.42	0.44
	max	76.41	74.83	-	40.99	40.12	-	17.46	16.68	-	50.84	50.41	-		max	77.19	71.69	41.12	36.28	13.63	16.51	47.31	50.47
18MF02 n = 2	min	-	-	-	-	-	-	-	-	-	-	-	-	18MF02 n = 0	min	-	-	-	-	-	-	-	-
	avg	76.91	71.74	-	41.74	36.58	-	12.53	14.41	-	45.73	49.01	-		avg	-	-	-	-	-	-	-	-
	1σ	-	-	-	-	-	-	-	-	-	-	-	-		1σ	-	-	-	-	-	-	-	-
	max	-	-	-	-	-	-	-	-	-	-	-	-		max	-	-	-	-	-	-	-	-
18MF03A n = 10	min	67.54	-	61.82	33.64	-	32.09	13.54	-	17.99	45.64	-	47.90	18MF03A n = 1	min	-	-	-	-	-	-	-	-
	avg	70.34	-	63.64	35.95	-	33.10	15.12	-	18.91	48.93	-	48.00		avg	-	67.90	-	33.80	-	15.98	-	50.21
	1σ	2.14	-	1.82	2.07	-	1.01	0.75	-	0.91	1.38	-	0.10		1σ	-	-	-	-	-	-	-	-
	max	75.10	-	65.46	40.83	-	34.10	16.17	-	19.82	50.19	-	48.09		max	-	-	-	-	-	-	-	-
18MF03B n = 9	min	64.22	-	-	33.69	-	12.80	-	-	-	45.39	-	-	18MF03B n = 3	min	75.52	-	40.61	-	12.25	-	45.97	-
	avg	71.81	70.41	73.04	38.61	35.79	39.60	13.83	15.04	14.61	47.56	49.17	45.79		avg	76.42	-	41.19	-	12.71	-	46.10	-
	1σ	4.18	-	-	2.96	-	-	1.06	-	-	1.97	-	-		1σ	0.91	-	0.58	-	0.46	-	0.13	-
	max	76.27	-	-	41.55	-	-	15.72	-	-	50.59	-	-		max	77.33	-	41.78	-	13.17	-	46.23	-
18MF05 n = 4	min	-	-	69.60	-	-	34.81	-	-	12.65	-	-	45.93	18MF05 n = 4	min	-	-	-	-	-	-	-	-
	avg	-	-	72.75	-	-	38.00	-	-	14.18	-	-	47.81		avg	74.99	-	40.35	-	13.46	-	46.19	-
	1σ	-	-	2.55	-	-	2.46	-	-	0.95	-	-											

7.4. MOUNTS DE FIORE

The Mounts de Fiore eccentric cone erupted in the first half of 1971 on the western flank of Mt. Etna. The sampling order was from the first sampling spot at the lava flow, up to the crater of Mounts de Fiore (Figure 6-18) For a more detailed description of this eccentric cone see chapter 4.4.

The investigated basalts show a low porphyritic index (11-21 vol%) and are characterized by a fine-grained glassy ground mass (matrix) and phenocrysts of (in order of abundance) olivine, pyroxene and an almost entire absence of plagioclase and titanomagnetite as phenocrysts.

The most comprehensive work on Mounts de Fiore was published by Corsaro et al., 2008, where the eruptions of Mounts de Fiore are classified as deep dike-fed (DDF) eruptions. These are characterized by dike-like intrusions, which are not fed by the central conduits, but from conduits, originating beneath the volcanic pile. These *deep dikes* bypass the central conduit and thus create the so-called eccentric cones.

7.4.1. Whole-rock geochemistry

The whole rock chemistry shows a trachybasaltic composition, with an average SiO_2 content of 47.22 wt% and an average total alkali content of 5.45 wt%. The whole rock Mg# ranges from 51.22 to 51.83 mol.%, with an average of 51.50 mol.% (Table 7-3). This composition is consistent with the analyses performed by Corsaro et al., 2008.

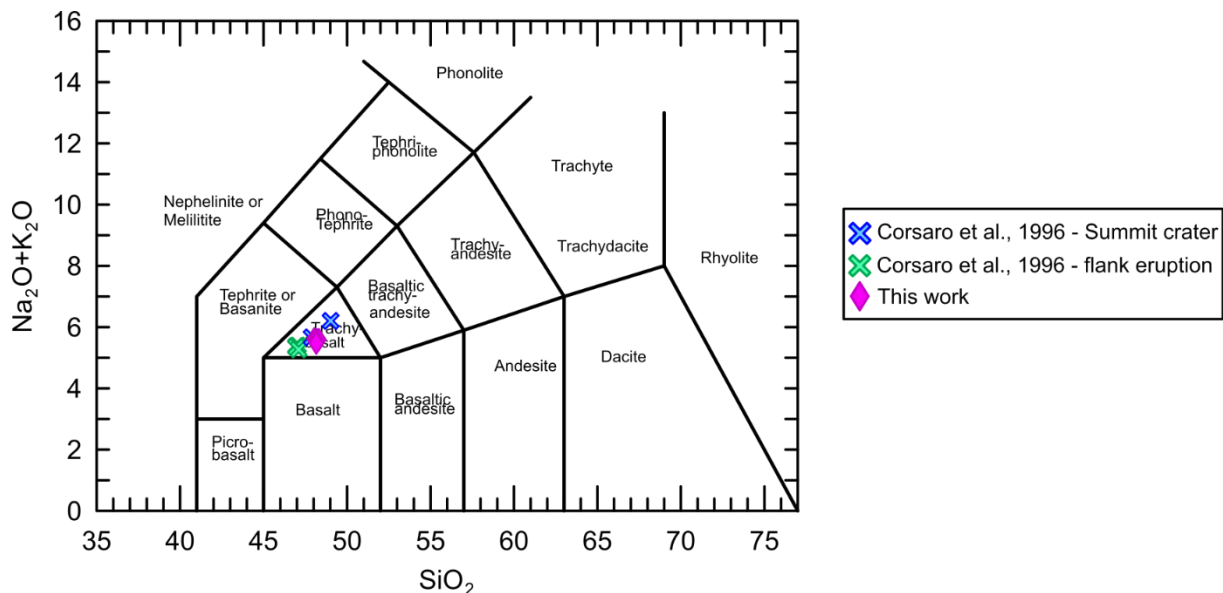


Figure 7-19: Whole rock composition of Mounts de Fiore (Table 6-2 - Table 6-4), compared with literature data (Corsaro et al., 2008)

7.4.2. Olivine

The olivine of Mounts de Fiore is characterized by a normal and also inverse zoned texture. The normal zoned olivine shows a Mg# with an average of 80.66 in the core and with an average of 75.57 mol.% in the rim.

The inverse zoned olivine shows a Mg# with an average of 76.44 mol.%, in the core and with an average of 80.66 mol.% in the rim.

The average NiO content decreases from 0.07 to 0.04 wt% from core to rim in the normal zoned olivine but increases from 0.05 to 0.08 wt% in the inverse zoned olivine.

Average MnO and CaO content on the other hand, show an increase between core and rim, in the normal zoned olivine, from 0.30 to 0.47 wt% and 0.28 and 0.36 wt%, respectively.

The inverse zoned olivine shows a decreasing average MnO content from 0.41 to 0.30 wt%. The average CaO increases slightly, from core to rim, in the inverse zoned olivine from 0.26 to 0.27 wt% (Table 7-3).

Corsaro et al., 2008, described only normal zoned, mostly heterogeneous olivine crystals, with a Mg# between 80 and 82 mol-% for the core and between 74 and 82 mol-% for the rims, which is consistent with our analyses.

The presence of inverse zoning is possibly **the result of magma mixing**.

The minor differences in the Mg# between the rim of the inverse zoned and the core of the normal zoned olivine indicate that the inflowing magma is only slightly different, in terms of composition and evolution, than the magma present.

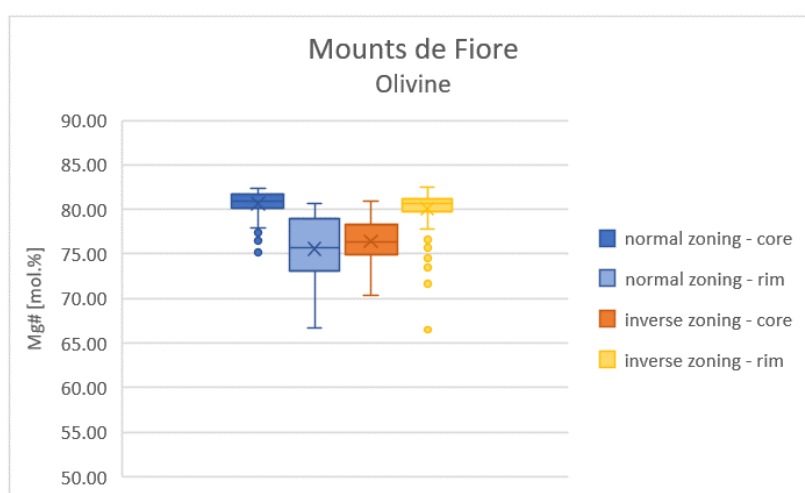


Figure 7-20: Distribution of the Mg# of normal and inverse zoned olivine of Mounts de Fiore, divided into core and rim (Supplementary Data 11.1)

7.4.3. Clinopyroxene

Three different texture types were found in this location: Type 1 – normal zoning, Type 4 – reverse zoning and Type 6 – hourglass zoning. The overall texture of these samples is very fine grained, with a high matrix content and a high amount of holes.

Clinopyroxene with a Type 1 texture was found in every thin section and has an average Mg# of 72.03 in the core and 69.84 mol.% in the rim (Figure 7-20).

The average Mg# is, for clinopyroxene with Type 6 – hourglass texture, for the hourglass sector 75.80 and in the prism sector 68.98 mol.%.

Corsaro et al., 2008, described, similar as this work, the presence of normal zoned and *sector zoned*, i.e., hourglass zoned clinopyroxene with a composition of Wo_{51-44} , En_{42-32} , Fs_{17-12} , which is consistent with this study. Similar to olivine, Corsaro et al., 2008, recorded no reverse zoning.

All analyses of Mounts de Fiore, independent of texture type or position, plot in the salite field of the Morimoto (1988) diagram (Figure 7-21).

There was Type 4, reverse zoned clinopyroxene present in the samples, but it was not analysed, but the presence alone be seen **as an indicator for magma mixing**.

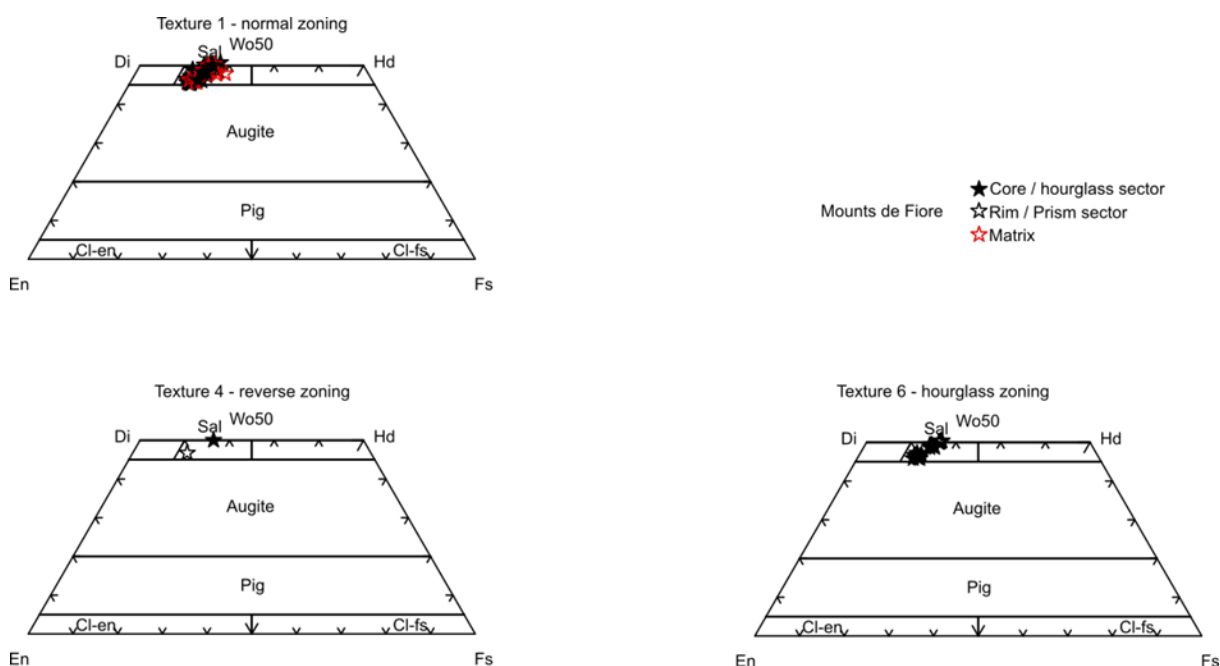


Figure 7-21: Composition of the clinopyroxene of Mounts de Fiore divided into the different texture types, using the Morimoto (1988) diagram. The abbreviations stand for **D**iopside, **S**alite, **H**edenbergite, **F**errosilite and **W**ollastonite (Supplementary Data 0)

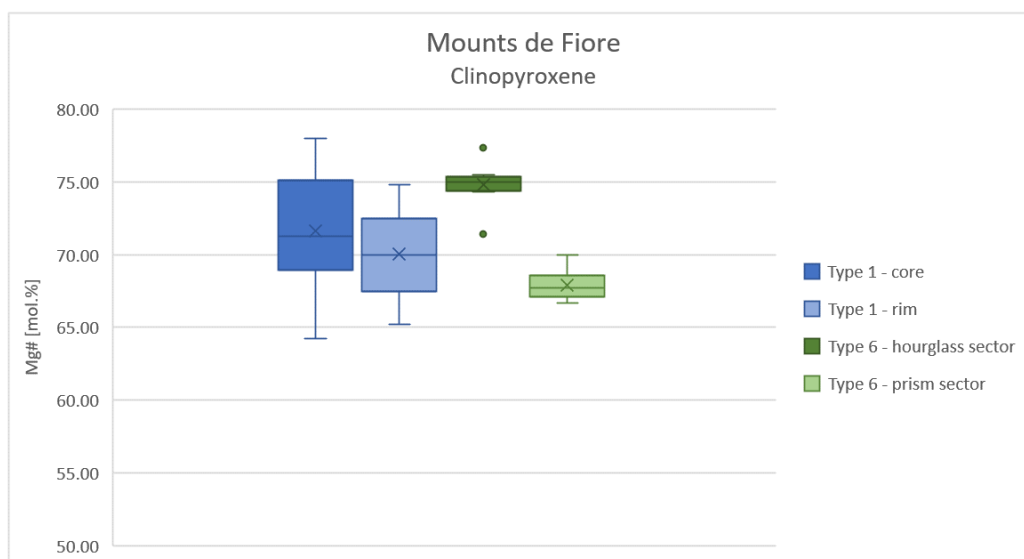


Figure 7-22: Distribution of the Mg# of the clinopyroxene of Mounts de Fiore, divided into the different texture types present, as well as into core, rim, hourglass- and prism sector (Supplementary Data 11.2).

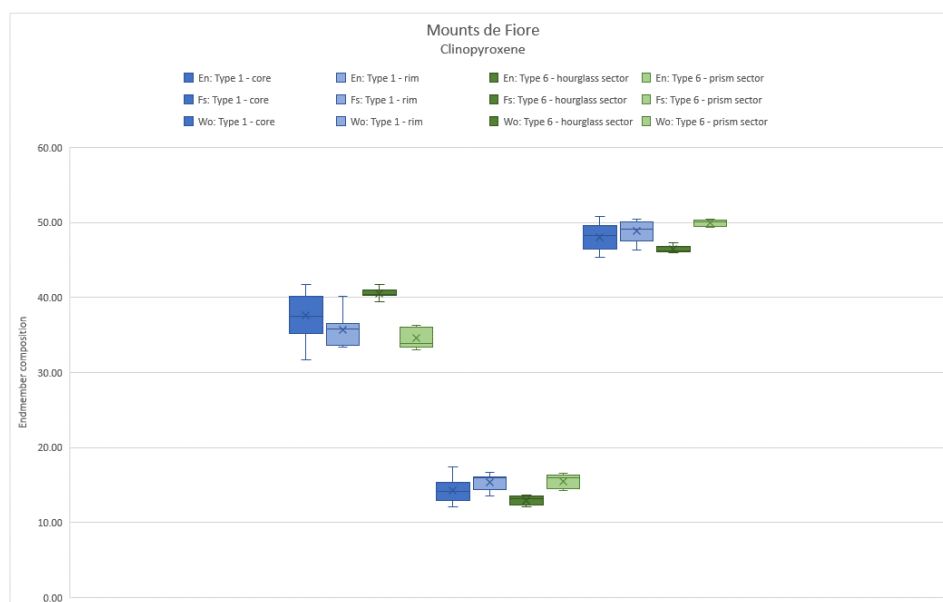


Figure 7-23: Distribution of the endmember composition (**En**statite, **Fs**errosilite and **Wo**llastonite) of the clinopyroxene of Mounts de Fiore, divided into the different texture types present, as well as into core, rim, hourglass- and prism sector (Supplementary Data 11.2).

7.4.4. Plagioclase

In the samples of Mounts de Fiore the plagioclase only occurs as microlites in the matrix and in the form of inclusion in other minerals and therefore only with a Type a - normal zoning texture. Due to this, a differentiation between core and rim is not possible.

Plotted into a ternary diagram, the geochemical analyses show for matrix plagioclase and for plagioclase inclusions a predominantly bytownitic composition (Figure 7-24).

This is also consistent with the literature, as Corsaro et al., 2008, recorded microlite plagioclase with An₈₀₋₇₀.

Mainly due to the low variety and low grain size, this plagioclase offers **no clear indication if magma mixing was present or not.**

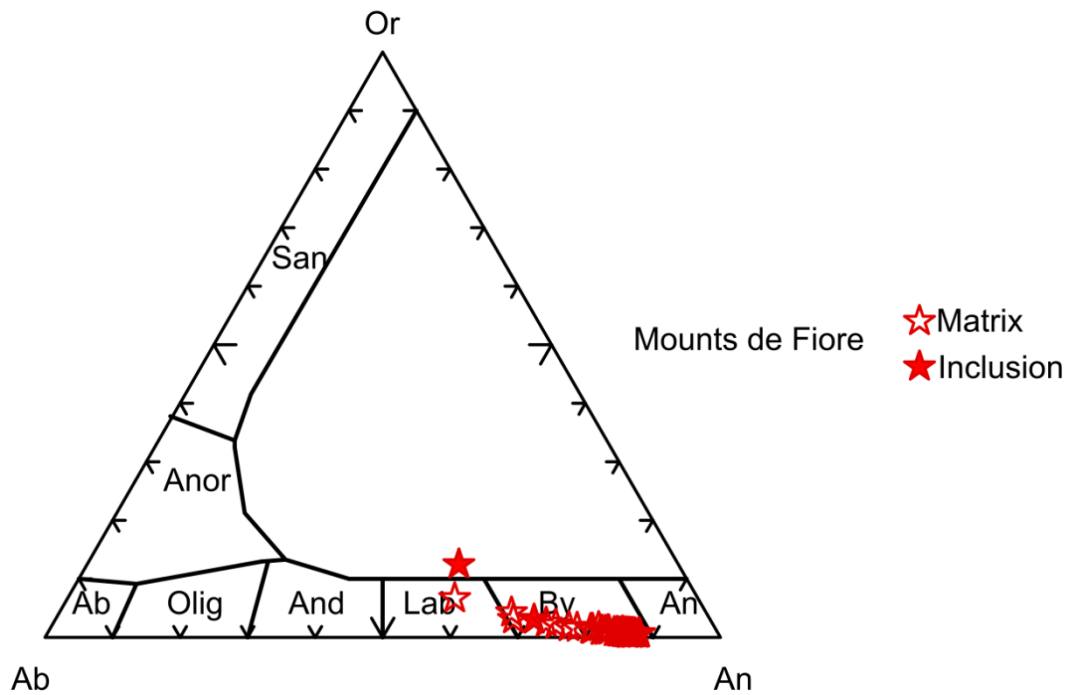


Figure 7-24: Composition of Type a – normal zoned plagioclase of Mounts de Fiore in a ternary diagram. These results are further divided into matrix and inclusion. The abbreviations stand for **Albite**, **Anorthite** and **Orthoclase** (Supplementary Data 11.3)

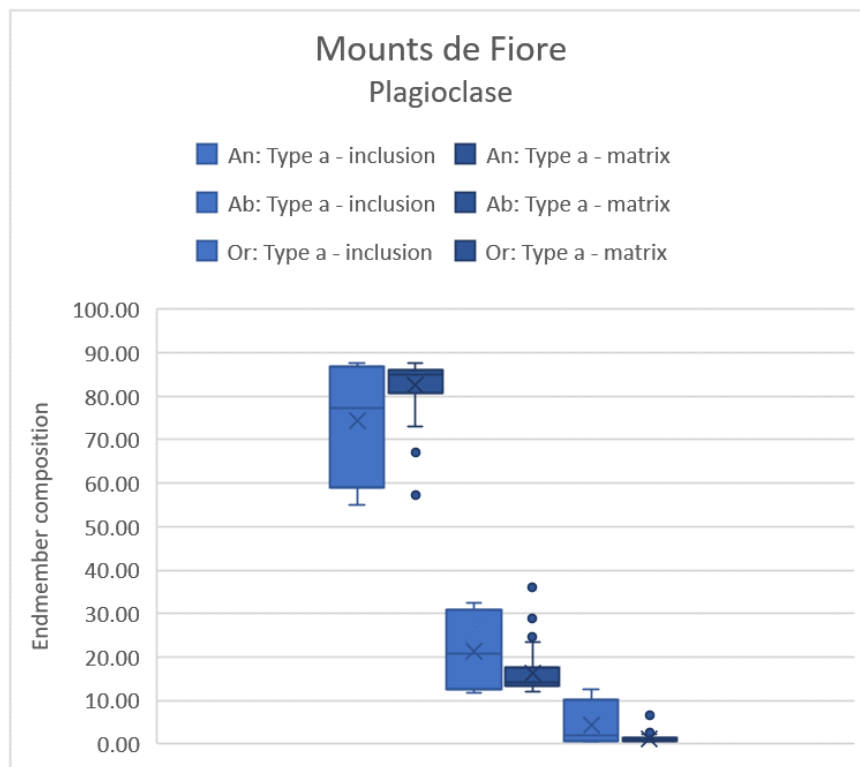


Figure 7-25: Distribution of the endmember composition (**Anorthite**, **Albite** and **Orthoclase**) of Type a – normal zoned plagioclase of Mounts de Fiore, divided into inclusion and matrix (Supplementary Data 11.3)

7.4.5. Titanomagnetite

Similar to the plagioclase, titanomagnetites is only present in the form of inclusions and as part of the matrix.

The matrix titanomagnetites show a Cr# range from 0.03 to 0.86 mol.%, with an average of 0.22 mol.%. The FeO content is at around 70 wt% with a deviation of ± 2 wt%. The TiO content ranges from 9.69 to 15.32 wt%, with an average of 11.91 wt%.

The titanomagnetite inclusions show a more diverse composition, with a Cr# ranging from 0.04 to 2.85 mol.% (avg. 0.74 mol.%). The FeO content ranges from 66.85 to 78.10 wt% (avg. 70.57 wt%) and the TiO content from 6.28 to 17.32 wt% (avg. 10.85 wt%) (Table 7-3).

7.4.6. Thermobarometric calculations

Less than half of all clinopyroxene analyses were suitable for the thermobarometric calculations: Only core analyses of Type 1 and only hourglass sector analyses for Type 6 clinopyroxene.

This leads to a possible statistical uncertainty within the single textures; however, a clear linear trend can be described for this study area.

The temperatures were rounded to the nearest ten.

The core of the Type 1 normal zoned clinopyroxene shows a temperature range from 1140 to 1180 °C (avg. 1160 °C) and a pressure range from 2.7 to 8.0 kbar (avg. 4.8 kbar).

The Type 6 hourglass zoned clinopyroxene shows a temperature range between 1150 and 1160 °C (avg. 1150 °C) and a pressure range between almost zero and 4.7 kbar (3.4 kbar) (Table 7-3).

The results show a clear linear trend from around 1180 to close to 1140 °C and from around 8 to about 2.5 kbar (Figure 7-26).

The stop slightly below 2 kbar suggests, that the magma rose so fast, that there was no time for the formation of new crystals.

The small cluster of analyses at high temperatures (~1175-1180°C) and high pressure (~7-8 kbar) might be an indicator for the *deep-dike magma* that mixed with the initial magma and thus triggered the eruption.

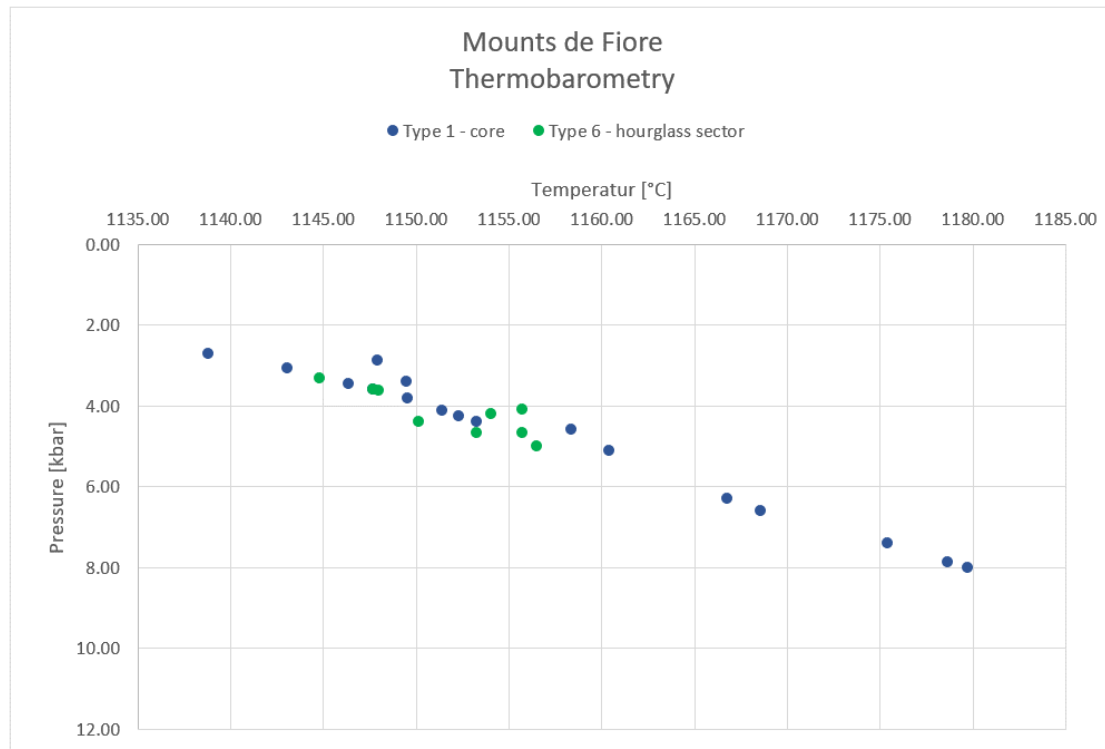


Figure 7-26: Results of the thermobarometric calculations at Mounts de Fiore divided into the texture types

Table 7-4: Factsheet of the results of the geochemical composition of the basalts of the 2002/03 lava flow. Mg# & Cr# in mol-%, Temperature (rounded to the nearest ten) in [°C]; Pressure in [kbar]; microprobe analyses in [wt%]

2002/03 lava flow

		WR-Geochemistry				Trace elements															
		SiO2	Na2O	K2O	Mg#	La/Yb	Rb/Th														
2002/03 lava flow	min	48.07	3.53	2.03	51.70	-	-														
	avg	48.24	3.55	2.03	51.85	25.99	6.13														
	1σ	0.17	0.02	<0.01	0.15	-	-														
	max	48.41	3.57	2.04	52.01	-	-														
18RS01		48.07	3.53	2.03	52.01	-	-														
18RS02		48.41	3.57	2.04	51.70	25.99	6.13														
Olivine																					
		Type 1 - normal zoning								Type 2 - inverse zoning											
		Mg#		NiO		MnO				CaO		Mg#		NiO		MnO		CaO			
		core	rim	core	rim	core	rim			core	rim	core	rim	core	rim	core	rim	core	rim		
2002/03 lava flow n = 39	min	76.01	66.38	<0.01	0.01	0.22	0.27	0.21	0.26	2002/03 lava flow n = 141	min	65.01	67.53	<0.01	<0.01	0.47	0.30	0.22	0.21		
	avg	81.33	74.77	0.09	0.05	0.29	0.49	0.26	0.33		avg	69.66	76.06	0.02	0.05	0.64	0.42	0.29	0.29		
	1σ	1.81	3.92	0.03	0.02	0.05	0.14	0.02	0.07		1σ	2.00	2.70	0.01	0.02	0.07	0.10	0.05	0.05		
	max	82.67	79.77	0.12	0.10	0.44	0.82	0.32	0.49		max	73.88	79.08	0.06	0.10	0.78	0.80	0.42	0.51		
18RS01 n = 12	min	76.68	71.63	0.03	0.01	0.24	0.39	0.21	0.28	18RS01 n = 51	min	69.04	68.43	<0.01	<0.01	0.50	0.31	0.24	0.26		
	avg	79.92	75.60	0.07	0.06	0.32	0.47	0.26	0.31		avg	70.73	75.97	0.02	0.05	0.62	0.43	0.27	0.29		
	1σ	2.25	2.57	0.03	0.03	0.07	0.05	0.03	0.05		1σ	1.58	2.47	0.02	0.02	0.07	0.10	0.02	0.04		
	max	82.60	78.92	0.12	0.10	0.44	0.54	0.32	0.40		max	73.86	78.61	0.06	0.10	0.72	0.80	0.31	0.45		
18RS02 n = 27	min	76.01	66.38	0.00	0.03	0.22	0.27	0.23	0.26	18RS02 n = 90	min	65.01	67.53	<0.01	<0.01	0.47	0.30	0.22	0.21		
	avg	81.76	73.73	0.09	0.05	0.28	0.51	0.26	0.36		avg	69.27	76.12	0.02	0.06	0.64	0.41	0.30	0.29		
	1σ	1.39	4.94	0.02	0.02	0.03	0.20	0.02	0.09		1σ	1.99	2.87	0.01	0.02	0.07	0.09	0.05	0.05		
	max	82.67	79.77	0.12	0.08	0.41	0.82	0.30	0.49		max	73.88	79.08	0.06	0.10	0.78	0.73	0.42	0.51		
Pyroxene																					
		Type 1 - normal zoning								Type 4 - reverse zoning											
		Mg#		En		Fs				Wo		Mg#		En		Fs		Wo			
		core	rim	core	rim	core	rim			core	rim	core	rim	core	rim	core	rim	core	rim		
2002/03 lava flow n = 27	min	72.97	68.18	37.21	34.97	9.93	13.70	46.12	48.71	2002/03 lava flow n = 8	min	70.06	78.08	36.08	40.78	13.44	9.90	46.78	47.07		
	avg	76.54	70.71	39.70	36.23	12.15	15.01	48.16	48.76		avg	73.09	79.69	38.22	41.95	14.06	10.69	47.72	47.36		
	1σ	2.55	2.53	1.88	1.26	1.20	1.31	1.03	0.05		1σ	1.55	1.31	1.34	0.92	0.71	0.63	1.02	0.30		
	max	80.81	73.24	42.26	37.49	13.89	16.32	49.44	48.81		max	74.44	81.29	39.49	43.03	15.41	11.45	49.33	47.77		
18RS01 n = 4	min	72.97	-	37.49	-	10.87	-	46.12	-	18RS01 n = 0	min	-	-	-	-	-	-	-	-		
	avg	76.46	-	40.06	-	12.30	-	47.63	-		avg	-	-	-	-	-	-	-	-		
	1σ	2.64	-	2.18	-	1.16	-	1.14	-		1σ	-	-	-	-	-	-	-	-		
	max	79.52	-	42.26	-	13.89	-	48.84	-		max	-	-	-	-	-	-	-	-		
18RS02 n = 18	min	73.14	68.18	37.21	34.97	9.93	13.70	46.39	48.71	18RS02 n = 8	min	70.06	78.08	36.08	40.78	13.44	9.90	46.78	47.07		
	avg	76.56	70.71	39.60	36.23	12.11	15.01	48.29	48.76		avg	73.09	79.69	38.22	41.95	14.06	10.69	47.72	47.36		
	1σ	2.53	2.53	1.78	1.26	1.21	1.31	0.96	0.05		1σ	1.55	1.31	1.34	0.92	0.71	0.63	1.02	0.30		
	max	80.81	73.24	41.82	37.49	13.68	16.32	49.44	48.81		max	74.44	81.29	39.49	43.03	15.41	11.45	49.33	47.77		
		Type 6 - hourglass zoning																			
		Mg#		En		Fs				Wo		Mg#		En		Fs		Wo			
		hourglass sector	prism sector	hourglass sector	prism sector	hourglass sector	prism sector			hourglass sector	prism sector	hourglass sector	prism sector	hourglass sector	prism sector	hourglass sector	prism sector				
2002/03 lava flow n = 13	min	77.86	69.36	40.88	34.96	10.99	13.23	46.42	48.68												
	avg	78.57	71.98	41.30	36.55	11.27	14.23	47.43	49.22												
	1σ	0.42	1.75	0.53	0.81	0.24	0.94	0.58	0.34												
	max	78.98	73.94	42.32	37.53	11.70	15.44	48.01	49.67												
18RS01 n = 2	min	-	-	-	-	-	-	-	-												
	avg	78.98	72.89	42.80	37.70	6.00	5.70	41.70	40.50												
	1σ	-	-	-	-	-	-	-	-												
	max	-	-	-	-	-	-	-	-												
18RS02 n = 11	min	77.86	69.36	40.88	34.96	10.99	13.23	47.18	48.68												
	avg	78.47	71.85	41.05	36.49	11.27	14.30	47.69	49.20												
	1σ	0.41	1.84	0.17	0.85	0.27	0.98	0.31	0.36												
	max	78.98	73.94	41.30	37.53	11.70	15.44	48.01	49.67												
Plagioclase																					
		Type a - oscillatory zoning									Type e - sieved-textured core										
		An			Ab					Or			An			Ab			Or		
		core	rim	matrix	core	rim	matrix			core	rim	matrix	core	rim	core	rim	core	rim	core	rim	
2002/03 lava flow n = 49	min	72.14	68.93	54.70	7.41	7.00	0.36	0.27	0.19	0.36	2002/03 lava flow n = 11	min	81.26	72.00	5.09	19.94	0.10	1.35			
	avg	86.35	83.21	80.96	12.93	15.77	1.56	0.71	1.02	1.56		avg	89.56	75.35	9.99	22.79	0.45	1.85			
	1σ	5.77	6.38	7.78	5.22	5.67	2.13	0.57	0.73	2.13		1σ	4.71	3.36	4.44	2.86	0.28	0.50			
	max	92.29	92.81	93.29	25.59	28.23	11.22	2.28	2.84	11.22		max	94.81	78.71	17.76	25.65	0.98	2.35			
18RS01 n = 5	min	-	-	83.10	-	-	0.51	-	-	0.51	18RS01 n = 3	min	90.44	-	5.09	-	0.10	-			
	avg	-	-	84.48	-	-	0.76	-	-	0.76		avg	93.14	-	6.63	-	0.23	-			
	1σ	-	-	1.77	-	-	0.14	-	-	0.14		1σ	1.93	-	1.84	-	0.10	-			
	max	-	-	87.62	-	-	0.91	-	-	0.91		max	94.81	-	9.22	-	0.34	-			
18RS02 n = 44	min	72.14	68.93	54.70	7.41	7.00	0.36	0.27	0.19	0.36	18RS02 n = 8	min	81.26	72.00	5.92	19.94	0.27	1.35			
	avg	86.35	83.21	80.08	12.93	15.77	1.76	0.71	1.02	1.76		avg	87.77	75.35	11.67	22.79	0.55	1.85			
	1σ	5.77	6.38	8.43	5.22	5.67	2.34	0.57	0.73	2.34		1σ	4.68	3.36	4.41	2.86	0.27	0.50			
	max	92.29	92.81	93.29	25.59	28.23	11.22	2.28	2.84	11.22		max	93.81	78.71	17.76	25.65	0.98	2.35			
Titanomagnetite																					
		Phenocryst						Matrix					Inclusion								
		Cr#		FeO				TiO		Cr#			FeO	TiO	Cr#	FeO	TiO				
		core	rim	core	rim	core	rim	core	rim	core			rim	core	rim	core	rim	core	rim		
2002/03 lava flow n = 6	min	0.06	0.05	69.73	69.76	13.82	13.20	2002/03 lava flow n = 8	min	0.05	69.45	9.59	2002/03 lava flow n = 32	min	0.02	58.42	6.38				
	avg	0.15	0.16	69.84	69.93	14.33	14.45		avg	0.16	70.24	14.04		avg	0.27	69.85	11.99				
	1σ	0.09	0.12	0.11	0.17	0.51	0.81		1σ	0.14	0.65	1.71		1σ	0.25	2.68	2.39				
	max	0.24	0.34	69.96	70.18	14.83	15.30		max	0.40	71.73	15.17		max	0.93	77.07	15.34				
18RS01 n = 0	min	-	-	-	-	-	-	18RS01 n = 0	min	-	-	-	18RS01 n = 8	min	0.02	58.42	8.86				
	avg	-	-	-	-	-	-		avg	-	-	-		avg	0.10	68.81	12.25				
	1σ	-	-	-	-	-	-		1σ	-	-	-		1σ	0.08	4.18	2.42				
	max	-	-	-	-	-	-		max	-	-	-		max	0.27	71.74	15.22				
18RS02 n = 6	min	0.06	0.05	69.73	69.76	13.82	13.20	18RS02 n = 8	min	0.05	69.45	9.59	18RS02 n = 24	min	0.03	67.06	6.38				
	avg	0.15	0.16	69.84	69.93	14.33	14.45		avg	0.16	70.24	14.04		avg	0.32	70.19	11.90				
	1σ	0.09	0.12	0.11	0.17	0.51	0.81		1σ	0.14	0.65	1.71		1σ	0.27	1.81	2.38				
	max	0.24	0.34	69.96	70.18	14.83	15.30		max	0.40	71.73	15.17		max	0.93	77.07	15.34				
Temperature and Pressure Conditions																					
		Type 1																			

7.5. 2002/03 LAVA FLOW

The eruptive activity of this lava flow started on 26 October 2002 and continued with a continuous explosive activity and lava flow output until 28 January 2003. Eruptive fissures opened on the NE and the S flank of Mt. Etna, however the lava output was limited, after November 5th, 2002, to the southern flank.

Due to its recent nature, this lava flow was already the subject of many previous works, i.a., Andronico et al., 2004; Clocchiatti et al., 2004; Ferlito et al., 2009; Giacomoni et al., 2012; etc..

This eruption is, similar to Mounts de Fiore considered as a deep-dike fed (DDF) eruption (see Corsaro et al., 2009; Giacomoni et al., 2012).

The two samples investigated have a porphyritic index (PI) between 25-30 vol.% and are characterized by a fine-grained glassy ground mass (matrix) and phenocrysts of (in order of abundance) plagioclase, pyroxene, olivine and an almost entire absence of titanomagnetite as phenocrysts.

7.5.1. Whole-rock geochemistry

The whole rock chemistry shows a trachybasaltic composition, with an average SiO_2 content of 48.24 and an average total alkali content of 5.58 wt%. The average whole rock Mg# is 51.85 mol.%, with an aberration of ± 0.15 mol.% (Table 7-3).

This composition is coherent with the data found in the literature.

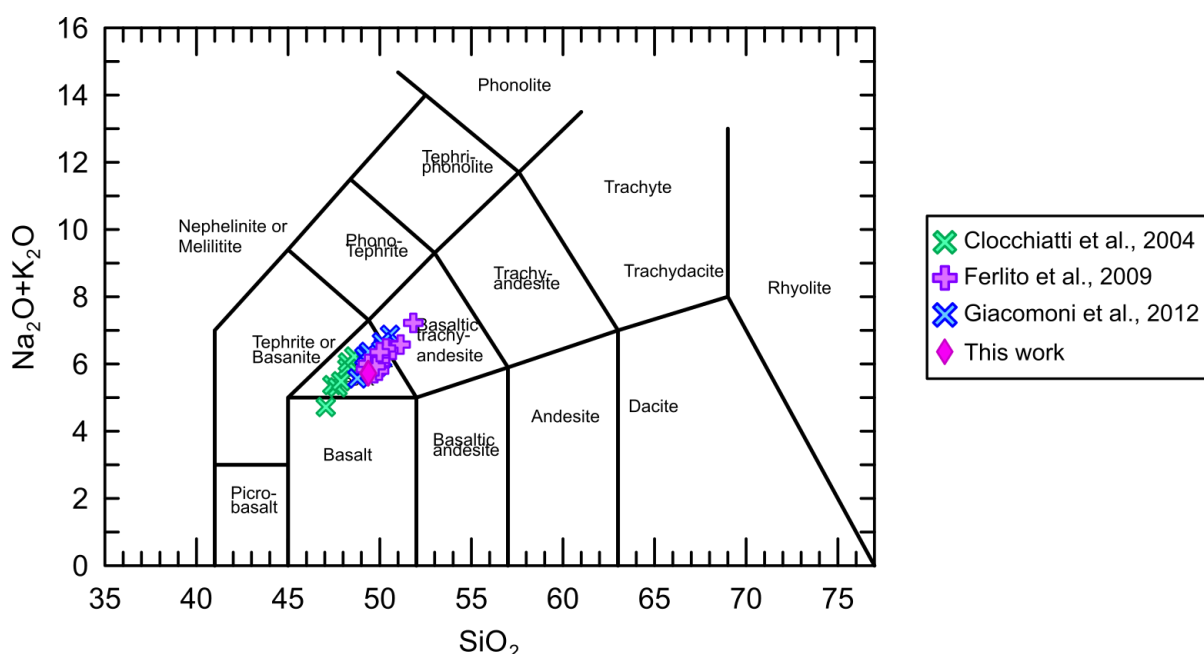


Figure 7-27: Whole rock composition of the 2002/03 lava flow (Table 6-2 - Table 6-4), compared with literature data (Clocchiatti et al., 2014; Ferlito et al., 2009 and Giacomoni et al., 2012)

7.5.2. Olivine

Both normal and inverse zoning is found in the two samples of the 2002/03 lava flow. The largest proportion of analyses of olivine was carried out on sample 18RS02, 141 compared to 39 on 18RS01.

The Mg# of normal zoned olivine decrease an average of 81.33 in the core to 74.77 mol.% in the rim. Whereas it increases from an average of 69.66 to 76.06 mol.% from core to rim (Figure 7-28).

The average NiO content decreases from 0.09 to 0.05 wt% from core to rim in the normal zoned olivine but increases from 0.02 to 0.05 wt% in the inverse zoned olivine.

Average MnO and CaO content on the other hand, show an increase between core and rim, in the normal zoned olivine, from 0.29 to 0.49 wt% and 0.26 and 0.33 wt%, respectively.

The inverse zoned olivine shows a decrease of MnO from 0.64 to 0.42 wt%. The average CaO is for both, core, and rim, in the inverse zoned olivine at 0.29 wt% (Table 7-3).

Ferlito et al., 2009 and Giacomoni et al., 2012, documented only normal zoned olivine with a Mg# between 75.5-79.9 and 78-75 mol-%, respectively, which is both slightly lower, than the olivine of this work.

The presence of inverse zoned olivine can be seen as an **indicator for magma mixing**

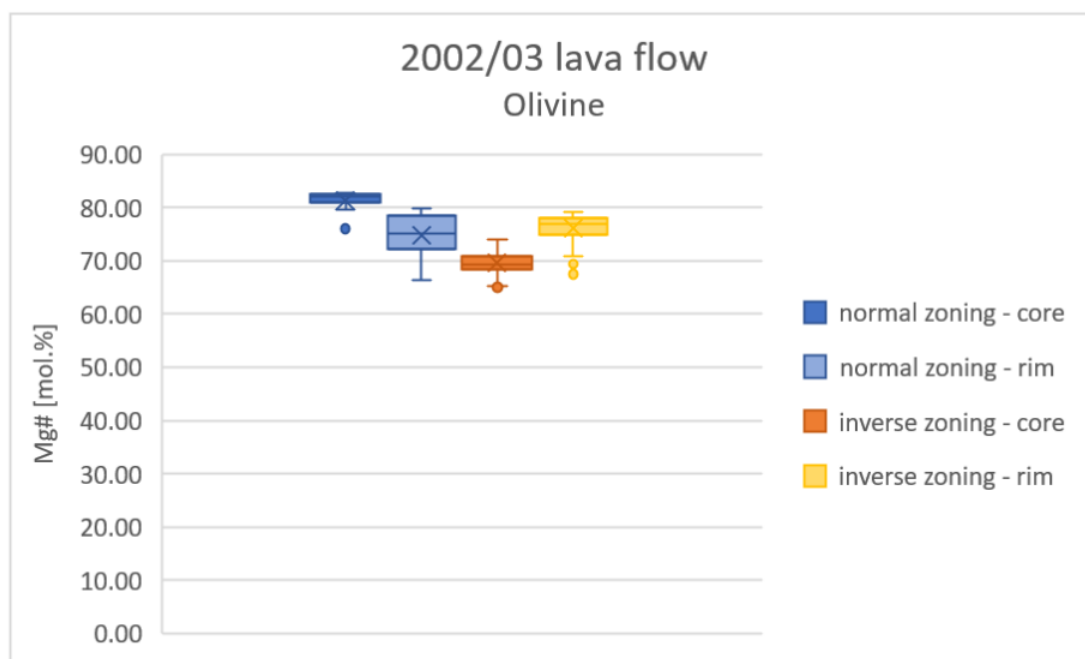


Figure 7-28: Distribution of the Mg# of normal and inverse zoned olivine of the 2002/03 lava flow, divided into core and rim (Supplementary Data 11.1).

7.5.3. Clinopyroxene

Three different texture types were found in this location: Type 1 – normal zoning, Type 4 – reverse zoning and Type 6 – hourglass zoning.

Clinopyroxene with a Type 1 texture was found in both thin sections and has an average Mg# of 76.54 in the core and 70.71 mol.% in the rim (Figure 7-30).

Clinopyroxene with a Type 4 texture type were only found in the sample 18RS02. It shows an increasing average Mg# from 73.09 in the core to 79.69 mol.% in the rim.

The average Mg# is, for clinopyroxene with Type 6 – hourglass texture, for the hourglass sector 78.57 and in the prism sector 71.98 mol.%.

All analyses of clinopyroxene of the 2002/03 lava flow fall into the salite field of the Morimoto (1988) classification diagram, independent of their texture type or position. But, for the normal zoned clinopyroxene, the core has a less ferrous composition than the rim. As the name of the texture type already suggests, the reverse zoned clinopyroxene show the exact opposite behaviour. There the core is more ferrous than the rim.

As for texture type 6, the hourglass sector shows a similar behaviour as the core of the normal zoned clinopyroxene, with a less ferrous composition, than the prism sector (Figure 7-29).

The analyses are largely consistent with the literature, with only minor deviations, e.g., Ferlito et al., 2009, describes the clinopyroxenes as diopsidic with an Al_2O_3 content between 2.7 – 5 wt.%, whereas this work shows an Al_2O_3 variety between 2.9 and 7.8 wt.%. The same is for SiO_2 or TiO_2 , as this study shows a broader range of composition, than the literature.

The presence of Type 4 – reverse zoned clinopyroxene is, similar to the inverse zoning of olivine, in combination with the alignment with literature data, **possible evidence for magma mixing!**

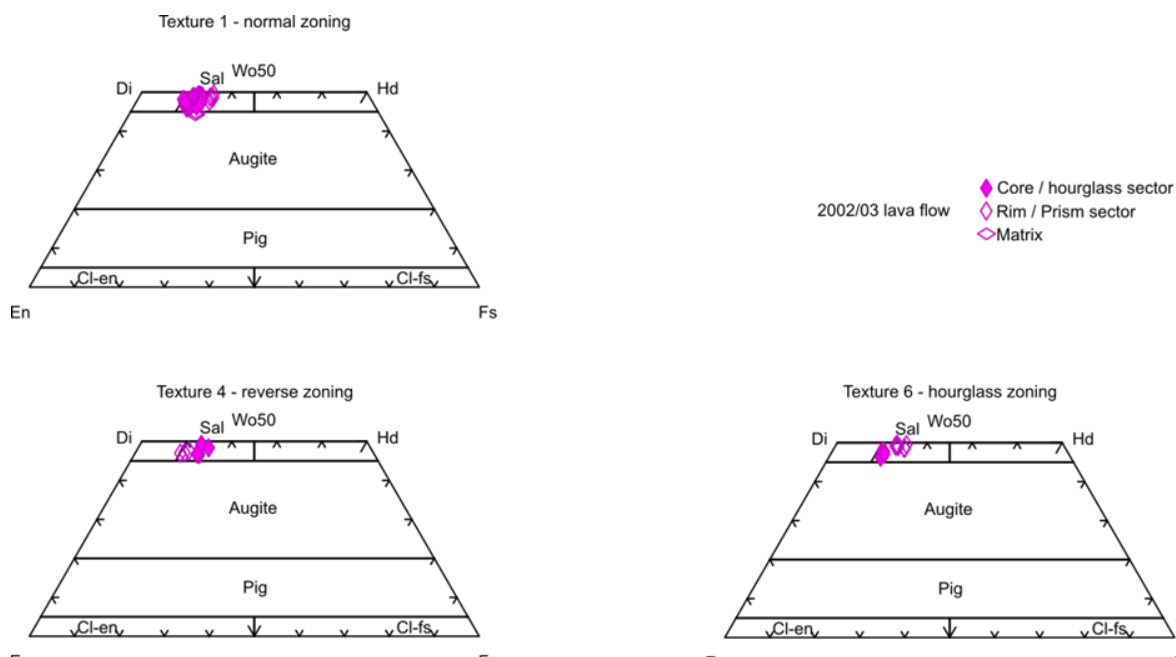


Figure 7-29: Composition of the clinopyroxene of the 2002/03 lava flow divided into the different texture types, using the Morimoto (1988) diagram. The abbreviations stand for **Di**opside, **Sal**ite, **Hd**enbergite, **Fs**errosilite and **Wo**llastonite (Supplementary Data 11.2)

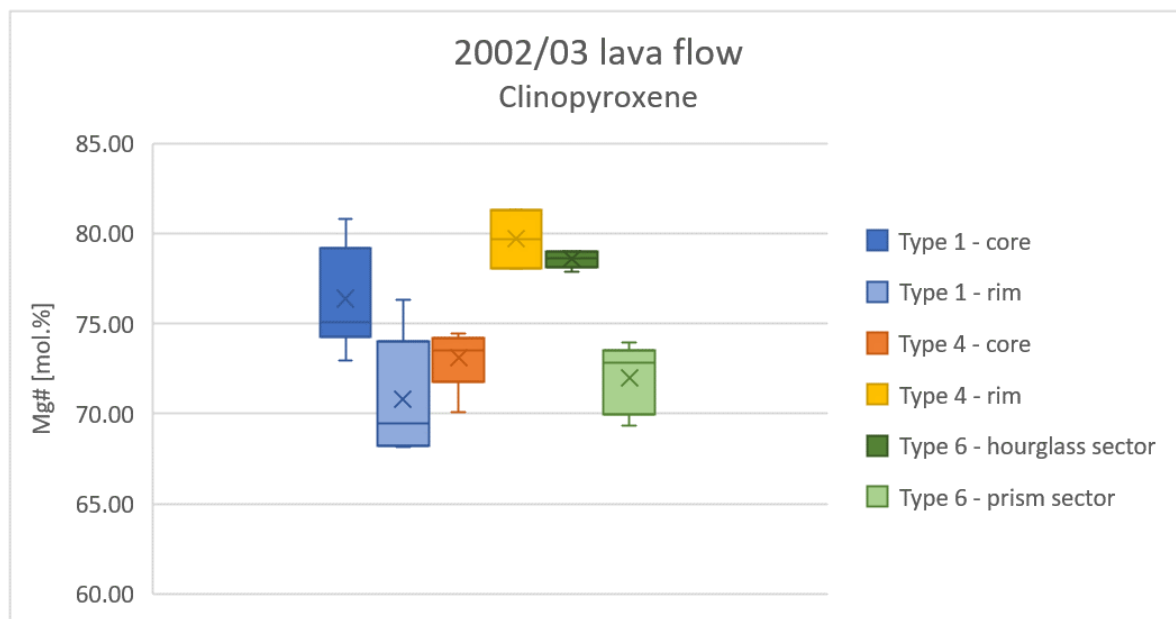


Figure 7-30: Distribution of the Mg# of the clinopyroxene of the 2002/03 lava flow, divided into the different texture types present, as well as into core and rim (Supplementary Data 11.2).

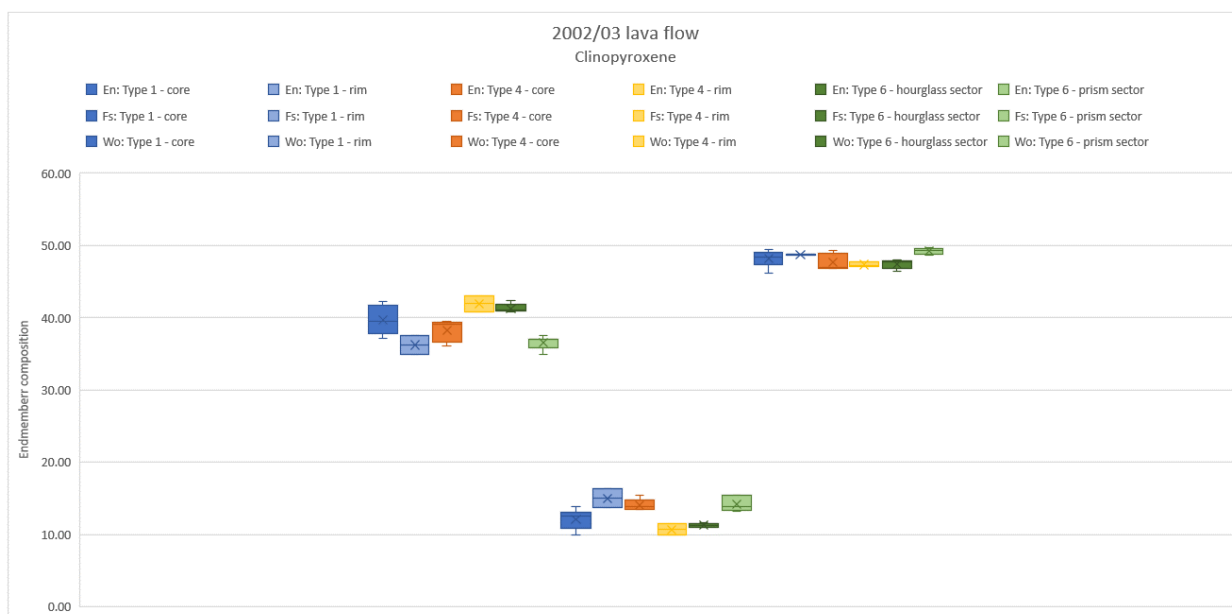


Figure 7-31: Distribution of the endmember composition (**En**statite, **Fs**errosilite and **Wo**llastonite) of the clinopyroxene of the 2002/03 lava flow, divided into the different texture types present, as well as into core, rim, hourglass- and prism sector (Supplementary Data 11.2)

7.5.4. Plagioclase

Two different texture types were found in the samples of Monte Spagnolo: Type a – oscillatory zoning and Type e - sieved textured core.

Plagioclase phenocrysts with a texture Type a were only analysed in sample 18RS02, whereas plagioclase with texture Type e were also analysed in sample 18RS01.

Both existing texture types show the same behaviour of a bytownite core and a labradorite rim. The matrix and inclusion analyses of the normal zoned plagioclase show additionally a labradoritic and a slight andesitic composition (Figure 7-32).

Consistent with the detailed previous study by Giacomoni et al., 2014, the main composition of the plagioclase is labradoritic and bytownitic.

A more detailed investigation of the individual plagioclase crystals, in terms of texture and composition, may offer hints if magma mixing occurred, but at this stage, there are no clear indicators.

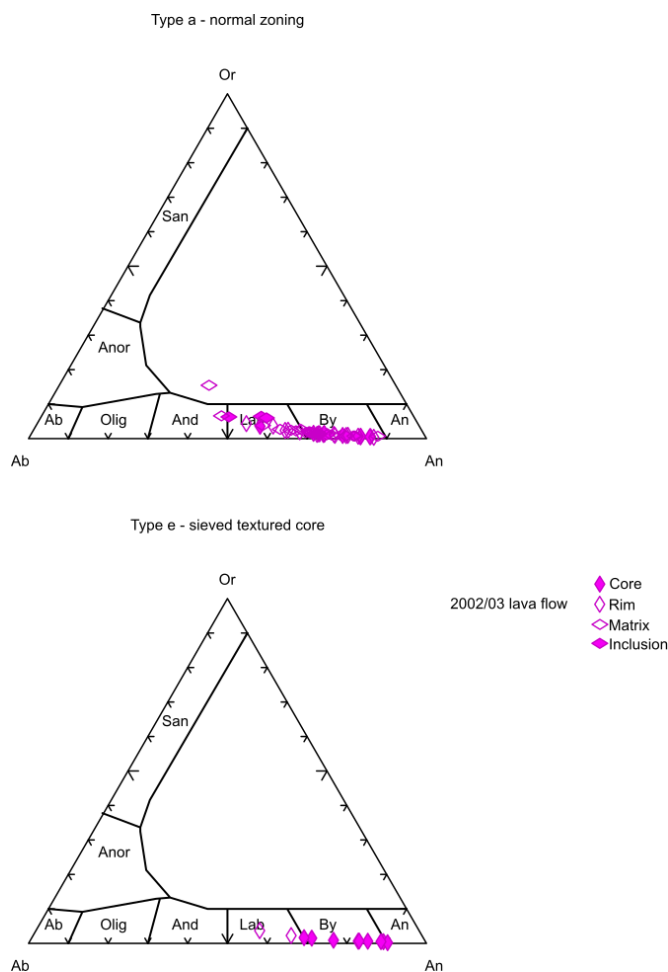


Figure 7-32: Composition of plagioclase of the 2002/03 lava flow divided into the different texture types in a ternary diagram. These results are further divided into core, rim, matrix, and inclusion. The abbreviations stand for **Albite**, **Anorthite** and **Orthoclase** (Supplementary Data 11.3)

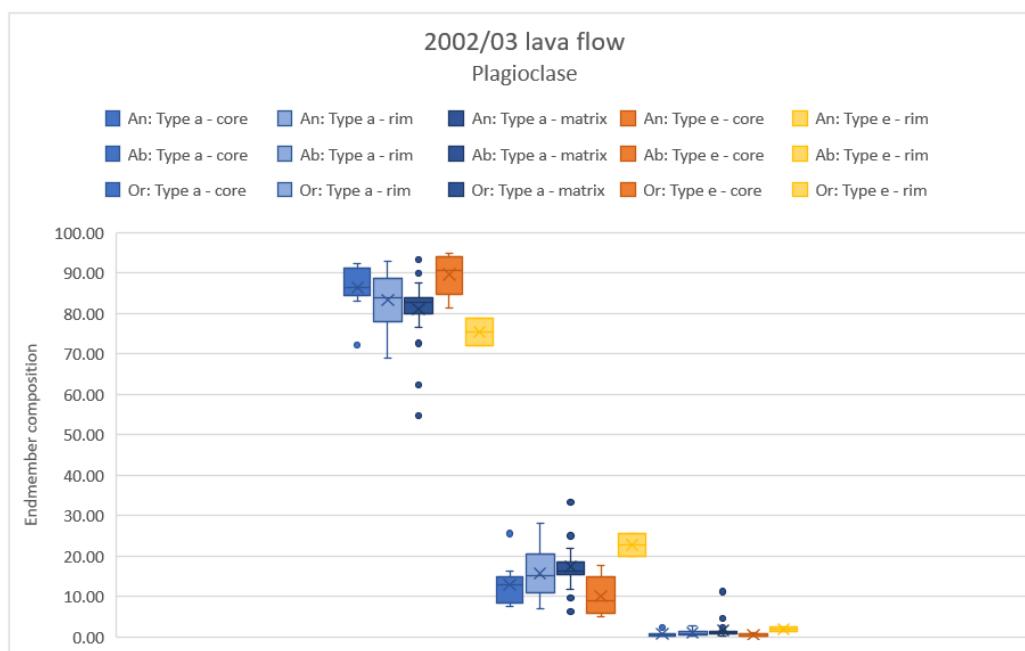


Figure 7-33: Distribution of the endmember composition (**Anorthite**, **Albite** and **Orthoclase**) of the plagioclase of the 2002/03 lava flow, divided into the different texture types present, as well as into core, rim, and matrix (Supplementary Data 11.3).

7.5.5. Titanomagnetite

Only the titanomagnetite inclusions in other crystals were analysed in sample 18RS01, whereas in sample 18RS02 analyses were also conducted in the titanomagnetite phenocrysts and the matrix titanomagnetites.

The analysis of the phenocrysts yields a Cr# range between 0.06 and 0.24 mol.% (avg. 0.15 mol.%) in the core and between 0.05 and 0.34 mol.% (avg. 0.16 mol.%) in the rim.

The average FeO and TiO content varies between core and rim from 69.84 to 69.93 wt% and from 14.33 to 14.45 wt%, respectively (Table 7-3).

The matrix titanomagnetites show a similar composition with a Cr# range from 0.05 to 0.40 mol.% (avg. 0.16 mol.%). The average FeO and TiO content lies at 70.24 and 14.04 wt%, respectively.

The titanomagnetite inclusions show a greater composition range with a Cr# between 0.02 and 0.93 mol.% (avg. 0.27 mol.%) and an average FeO and TiO content of 69.85 and 11.99 wt% respectively (Supplementary Data 11.4).

7.5.6. Thermobarometric calculations

Temperature (rounded to the nearest ten) and pressure conditions were calculated for all three clinopyroxene textures (Table 7-3).

For texture Type 1 the temperature ranges in the core from 1140 to 1190 °C (avg. 1156 °C) and the one rim analysis of 1160 °C. The pressure ranges in the core from 3.0 to 9.0 kbar (4.8 kbar) and lies in the rim at 5.3 kbar.

The reverse zoned clinopyroxene shows temperatures between 1160 and 1200 °C (avg. 1180 °C) in the core and between 1140 and 1150 °C (avg. 1140 °C) in the rim. The pressure ranges from 4.7 to 10.1 kbar (avg. 8.4) in the core and from 3.3 to 4.3 kbar (avg. 3.6 kbar) in the rim.

The 8 analyses of Type 6 hourglass zoned clinopyroxene show a narrower temperature range between 1140 and 1150 °C (avg. 1150 °C) and pressure values between 2.9 and 4.0 kbar (avg. 3.6 kbar) in the hourglass sector. The prism sector shows a temperature around 1160 °C and pressures between 4.7 and 5.2 kbar (avg. 5.0 kbar).

The results show a clear linear trend from temperatures and pressures of 1200 °C and 10 kbar, respectively, to almost 1140 °C and 3 kbar (Figure 7-34).

The abrupt stop slightly below 2 kbar suggests, that the magma rose so fast, that there was no time for the formation of new crystals.

The small cluster of analyses at high temperatures (~1185-1195°C) and high pressure (~9-10 kbar) might be an indicator for the *deep-dike magma* that mixed with the initial

magma and thus triggered the eruption.

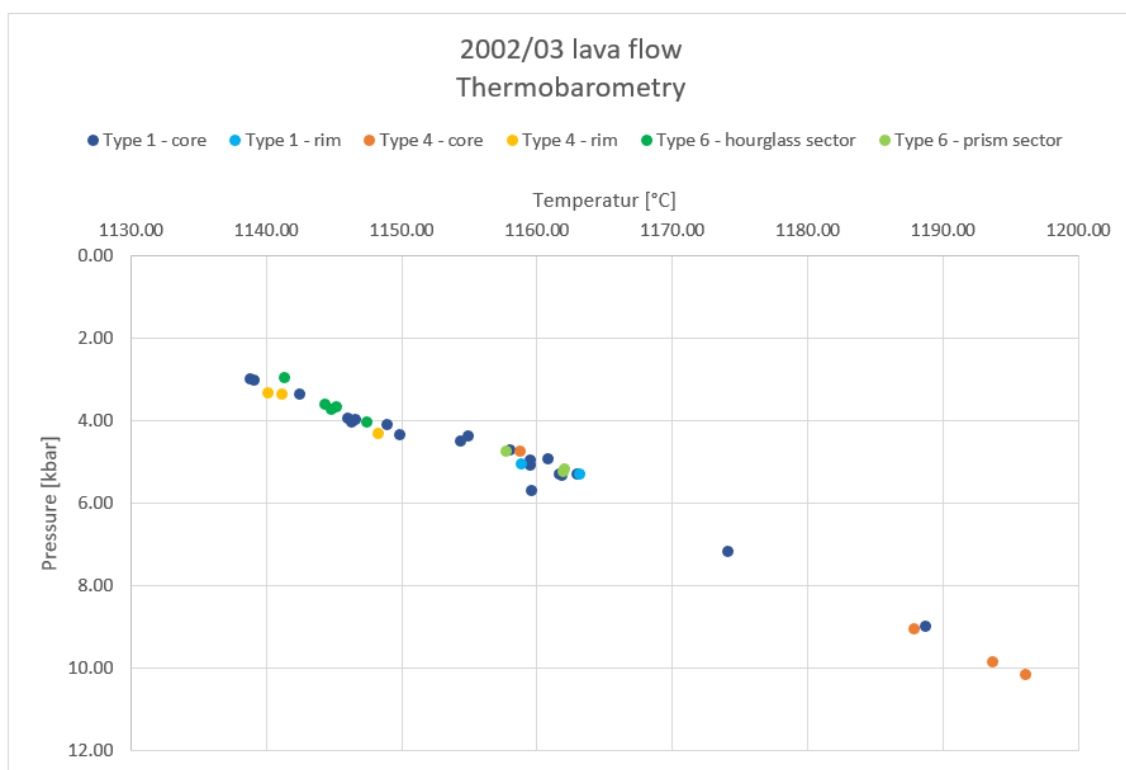


Figure 7-34: Results of the thermobarometric calculations at the 2002/03 lava flow, divided into the texture types (Supplementary Data 11.2).

7.6. COMPARATIVE ANALYSIS OF THE RESULTS

7.6.1. Whole-rock geochemistry

Etna has been a widespread research topic for many decades, which is why a large amount of literature is available. In the following chapter, the four locations studied here will be compared with each other in order to work out the various similarities and differences. Secondly, the results will be compared with the literature in order to classify them correctly.

The comparison of the four locations offers an insight into the complexity of Mount Etna. The samples are results of eruptive activity over a period of several thousands of years.

All erupted magmas can be classified according to Le Maitre et al., 1989, as trachybasalts with a SiO_2 content between 46.96 and 49.84 wt%. The highest SiO_2 content is in the oldest samples, i.e., the samples of Monte Spagnolo. The lowest is in the basalts of the second youngest, i.e., the samples of Mounts de Fiore (Figure 7-35).

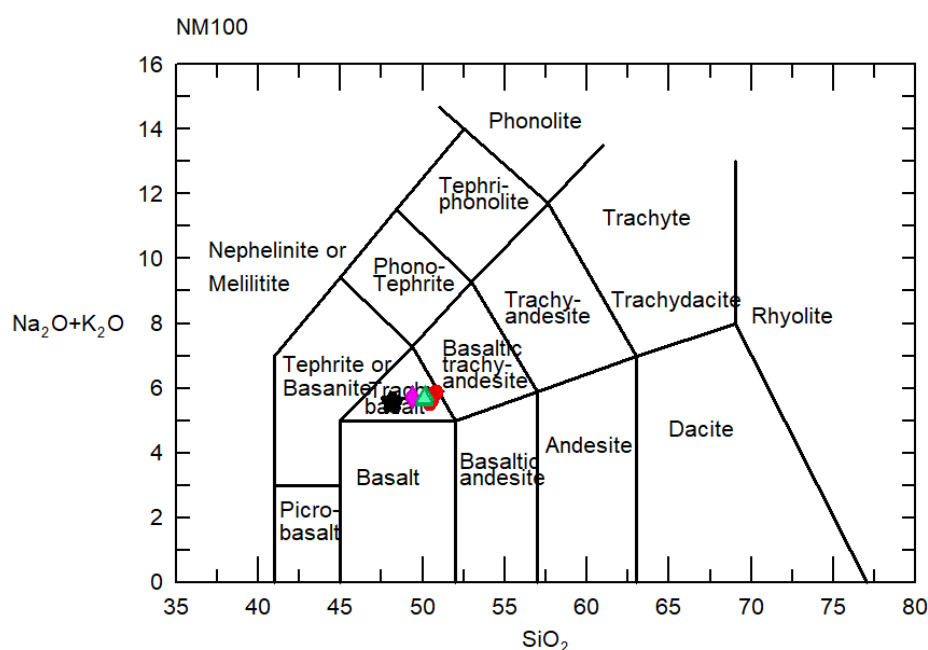


Figure 7-35: TAS-Diagram of the XRF-analysis showing a clear trachybasaltic composition for the samples of all locations; mineral content in wt% (Table 6-2 - Table 6-4)

The results show a significant change in the SiO_2 and total alkali content between the pre- (Monte Spagnolo & Monte Rossi) and the post 1971 (Mounts de Fiore & 2002/03 lava flow) eruptions. The pre-1971 eruptions are characterized by a higher SiO_2 and Na_2O content and a lower K_2O (Figure 7-36, Figure 7-37, Figure 7-38) (Corsaro et al. 2016, Armienti et al., 2007;2012).

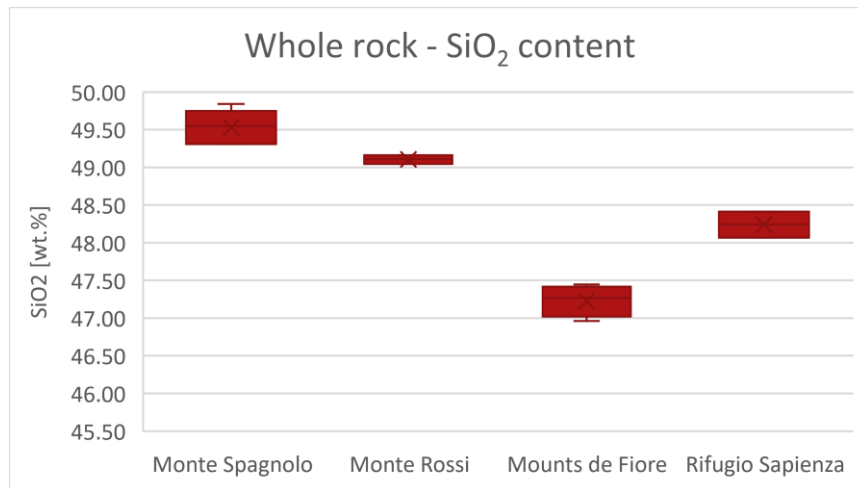


Figure 7-36: Distribution of the major element SiO₂ in the whole rock of the different locations: Pre-1971 (Monte Spagnolo, Monte Rossi) & Post-1971 (Mounts de Fiore & 2002/03 lava flow) (Supplementary Data 11.1)

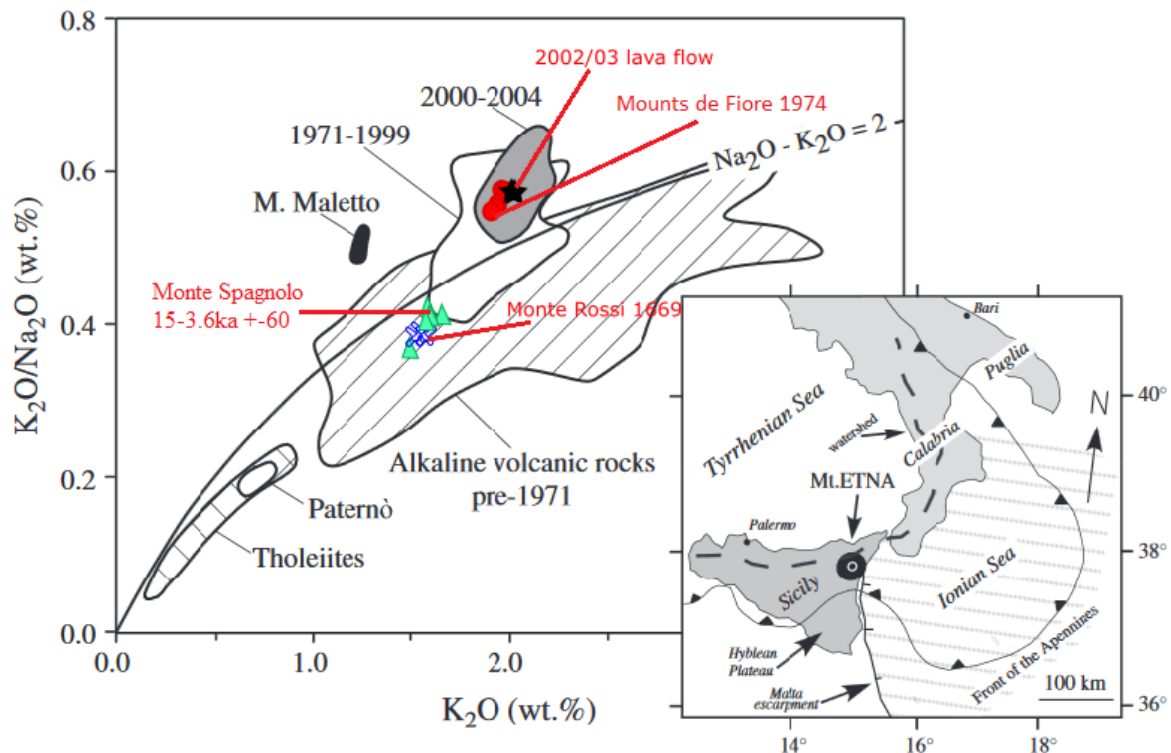


Figure 7-37: Total alkali (K₂O/Na₂O) ratio vs. K₂O after Armienti et al., 2012. Crossing from sodic to potassic field (Na₂O - K₂O = 2) of the two younger (post-1971) eruptions.

A total of 9 samples, analysed via ICP-MS, i.e., samples 18MF01, 18MF03A, 18MF04, 18MF06, 18MF09, 18MR02, 18MS01, 18MS02 and 18RS02 (Tables 4.28, 4.29 and 4.30), were compared with representative whole-rock analyses from the Ellitico and Mongibello stages. These representative analyses were taken from Casetta et al. (2019) (and references therein).

Figure 7-38 shows the multielemental patterns, normalized to the Primitive Mantle (Sun and McDonough, 1989) of the samples discussed in this work (in colour) compared to the representative data (in grey).

The figure shows a lower enrichment in Th and U for the studied samples, than for the data of Casetta et al. (2019).

The Rb and K-content is for the two post-1971 eruptions (Mounts de Fiore and the 2002/03 lava flow) enriched, whereas the Nb content is depleted, all compared to the pre-1971 samples.

The LREE & HREE show for all, except the 2002/03 lava flow, no major deviations from the representative data.

The data from the 2002/03 lava flow shows a slight enrichment in the elements Dy, Y, Yb and Lu.

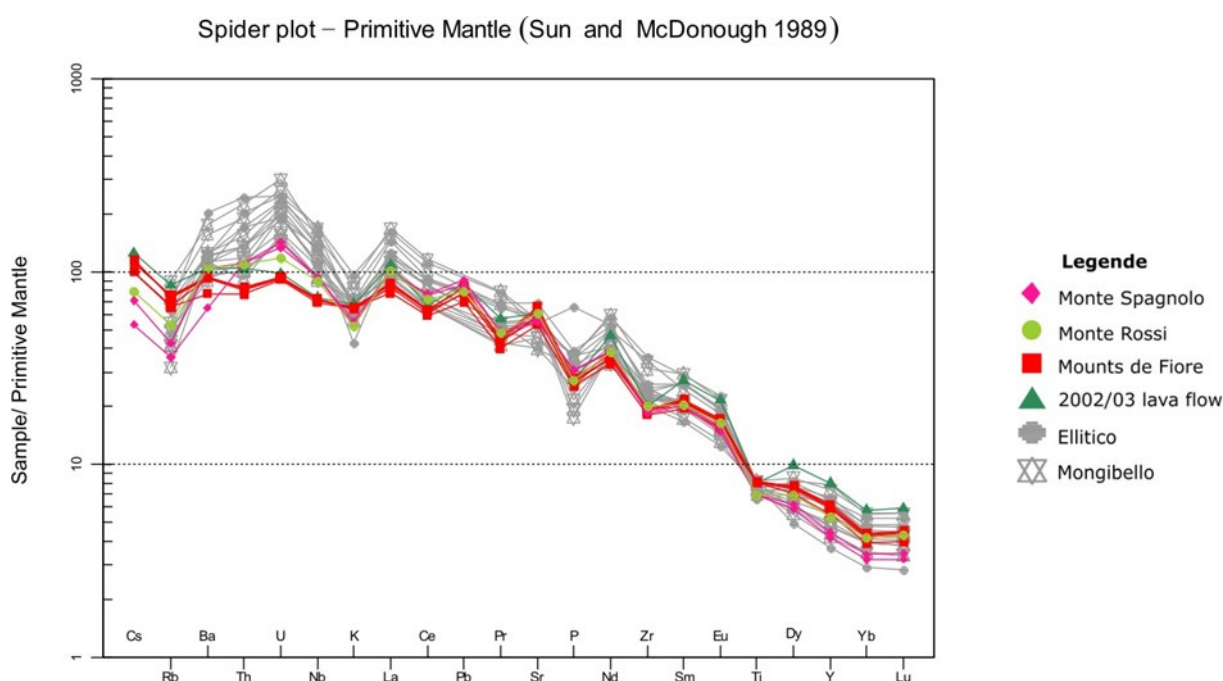


Figure 7-38: Primitive Mantle (Sun and McDonough (1989)) normalized incompatible element patterns for the studied samples of Monte Spagnolo (purple diamond), Monte Rossi (green circle), Mounts de Fiore (red box) and the 2002/03 lava flow (dark green triangle), compared to representative data from the Ellitico Stage (grey circle) and the Mongibello Stage (grey hexagon) (reference data from Casetta et al. (2012); this work Table 6-2 - Table 6-4).

The comparison of the trace elements from the studied samples with the representative data from Casetta et al. 2019 in regard of the REE patterns, shows, that the enrichment in HREE is for the younger products, especially for the 2002/03 lava flow higher, than for the older eruptions (Figure 7-39).

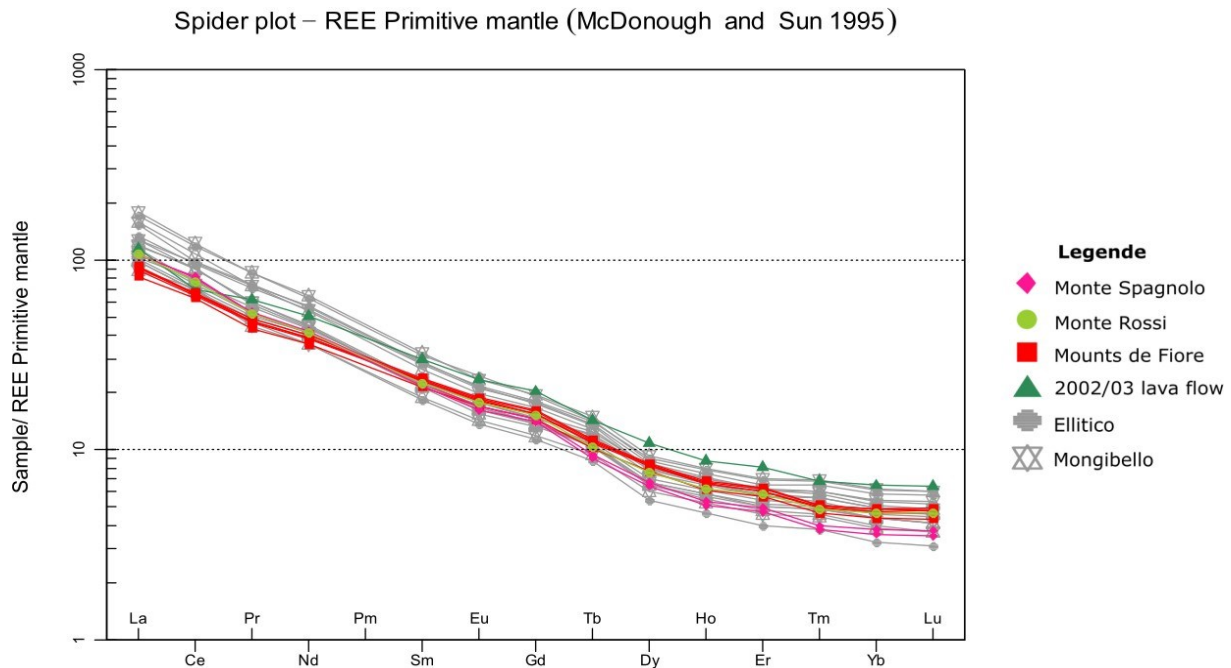


Figure 7-39: REE element patterns normalized to the Primitive Mantle (Sun and McDonough (1995)) for the studied samples of Monte Spagnolo (purple diamond), Monte Rossi (green circle), Mounts de Fiore (red box) and the 2002/03 lava flow (dark green triangle), compared to representative data from the Ellitico Stage (grey circle) and the Mongibello Stage (grey hexagon) (reference data from Casetta et al. (2012); this work Table 6-2 - Table 6-4).

7.6.2. Mineral geochemistry

The geochemical analysis of the minerals olivine, clinopyroxene, plagioclase and titanomagnetite show that there are many similarities between the different sampling sites, e.g., the occurrence of specific texture types in all thin sections (e.g., normal zoned olivine, clinopyroxene and plagioclase), but also some differences.

The most pressing difference is the complete absence of inverse zoning of olivine and clinopyroxene in the samples of Monte Rossi. This eruption is characterized by normal zoned olivine and clinopyroxene and by plagioclase with an oscillatory zoning. The geochemical analysis showed no clear evidence for reheating or the interaction with another hot magma. Magee et al., 2020, suggests that the trigger for the eruption of Monte Rossi was the recharge with a so-called “cryptic” magma, which has a similar composition and temperature as the initial magma and therefore induces no drastic changes in the composition of the minerals – therefore no inverse/reverse zoning. The trigger was not a drastic change in temperature, but most likely due to overpressure in the storage region.

The other three locations show more diversity, in terms of geochemistry and petrography.

E.g., clinopyroxene also exists with two additional texture types:

- Type 2 – clinopyroxene with a core-to-rim sharp compositional variation (Giacomoni, 2016; see also chapters 6.2.3 & 6.4.3.3; Monte Spagnolo) and

- Type 4 – reverse zoning (Giacomoni, 2016; see also chapters 6.2.3 & 6.4.3.4; Monte Spagnolo, Mounts de Fiore, 2002/03 lava flow).

Plagioclase is also more diverse in some of the other locations, such as

- Type g plagioclase with melt inclusion alignments in the rim (Giacomoni, 2014; see also chapters 6.2.4 & 6.4.4.5).

The oldest eruption, Monte Spagnolo (15.000-3.930 $\pm$ 60 years), is also, in geochemical terms, the most primitive one. This is best shown in the high MgO and NiO content. The core of the normal zoned olivine has an average Mg# of 85, with a maximum of up to almost 89 mol-% (see also Kamenetsky, 1996) and an average NiO content of 0.15, with a maximum of up to 0.23 wt%. Whereas the other locations show a lower average Mg# of around 80 mol-% (Mounts de Fiore & 2002/02 lava flow) (see also Corsaro et al., 2008) or even just around 75 mol-% (Monte Rossi) (see also Kahl et al. 2015; 2017) (Figure 7-40).

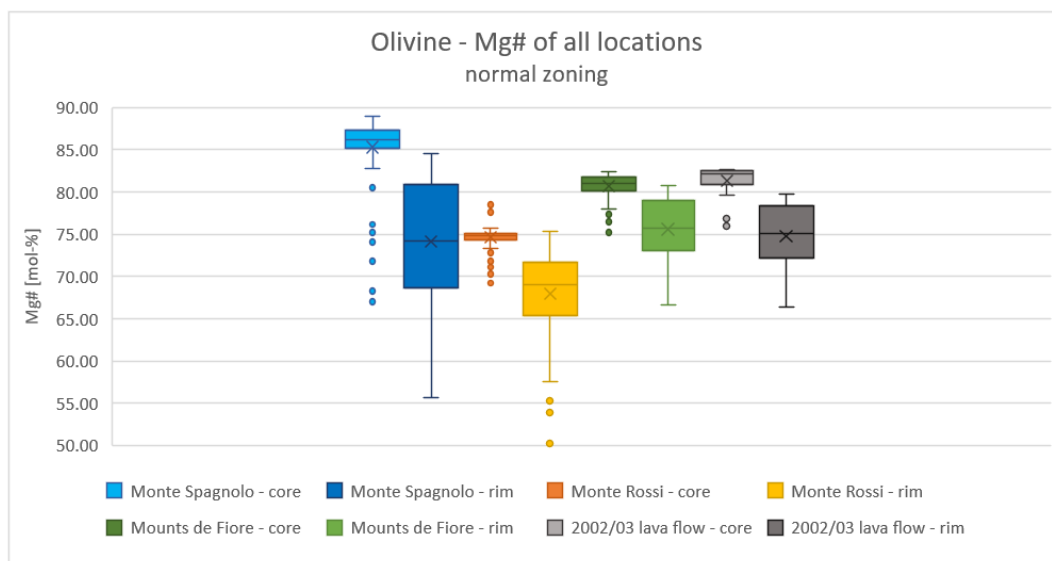


Figure 7-40: Distribution of the Mg# of normal zoned olivine of the four investigated locations, divided into core and rim.

The inverse zoned olivine is characterized by an Mg# increase from core to rim. This increase varies between the locations, as Monte Spagnolo shows an increase of the average Mg# from 75 to 76 mol-%, Mounts de Fiore from 76 to 80 mol-% and the 2002/03 lava flow from 70 to 76 mol-% (Figure 7-41).

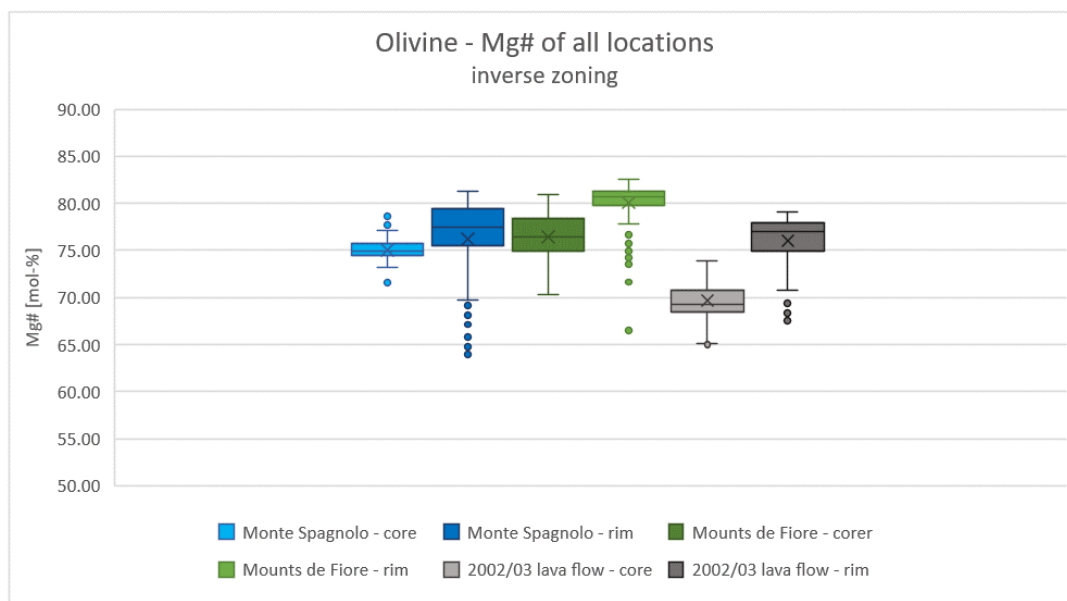


Figure 7-41: Distribution of the Mg# of inverse zoned olivine for three investigated locations, Monte Spagnolo, Mounts de Fiore, and the 2002/03 lava flow, divided into core and rim.

The composition of the clinopyroxene shows a switch from diopsidic-salitic composition towards pure salitic composition from oldest to youngest eruption. At Monte Spagnolo the clinopyroxene plots clearly in both fields (and even in the augite field), at Monte Rossi a small share of analyses plots right over the border of the two fields, whereas Mounts de Fiore and the 2002/03 lava flow are entirely salitic (Figure 7-42). See also chapters 6.4.3 and 7.2 - 7.5.

The proposed shift toward a more enstatitic composition, by Giacomoni et al. (2016), in the recent Mongibello phase (i.e., the 2002/03 lava flow) is not documented in this samples. On the contrary, the shift seems to be even more to a hedenbergitic/ferrosilitic composition.

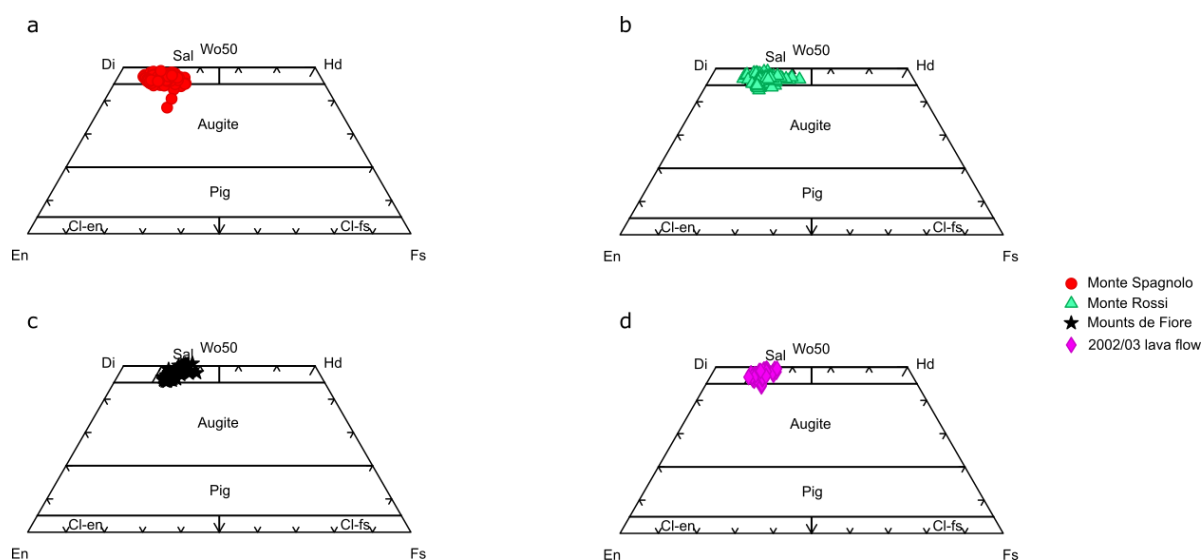


Figure 7-42: Composition of the clinopyroxene from the four investigated locations using the Morimoto (1988) diagram. a.) Monte Spagnolo, b.) Monte Rossi, c.) Mounts de Fiore and d.) 2002/03 lava flow. The abbreviations stand for **D**iopside, **S**alite, **H**edenbergite, **F**errosilite and **W**ollastonite (Supplementary Data 0)

The plagioclase shows a continuous trend from a labradoritic to a An-richer bytownitic,

composition. This change is, similar to the compositional change in the clinopyroxene, from the oldest eruption to the most recent one. Some analyses of Monte Spagnolo even fall into the anorthoclase or sanidine field, in contrast to the other three locations, which are almost completely restricted to the labradorite and bytownite fields (see also Giacomoni, 2014). Important to note, that the samples of Mounts de Fiore did not contain any plagioclase phenocrysts, but microcrysts in the matrix (see also Corsaro, 2008).

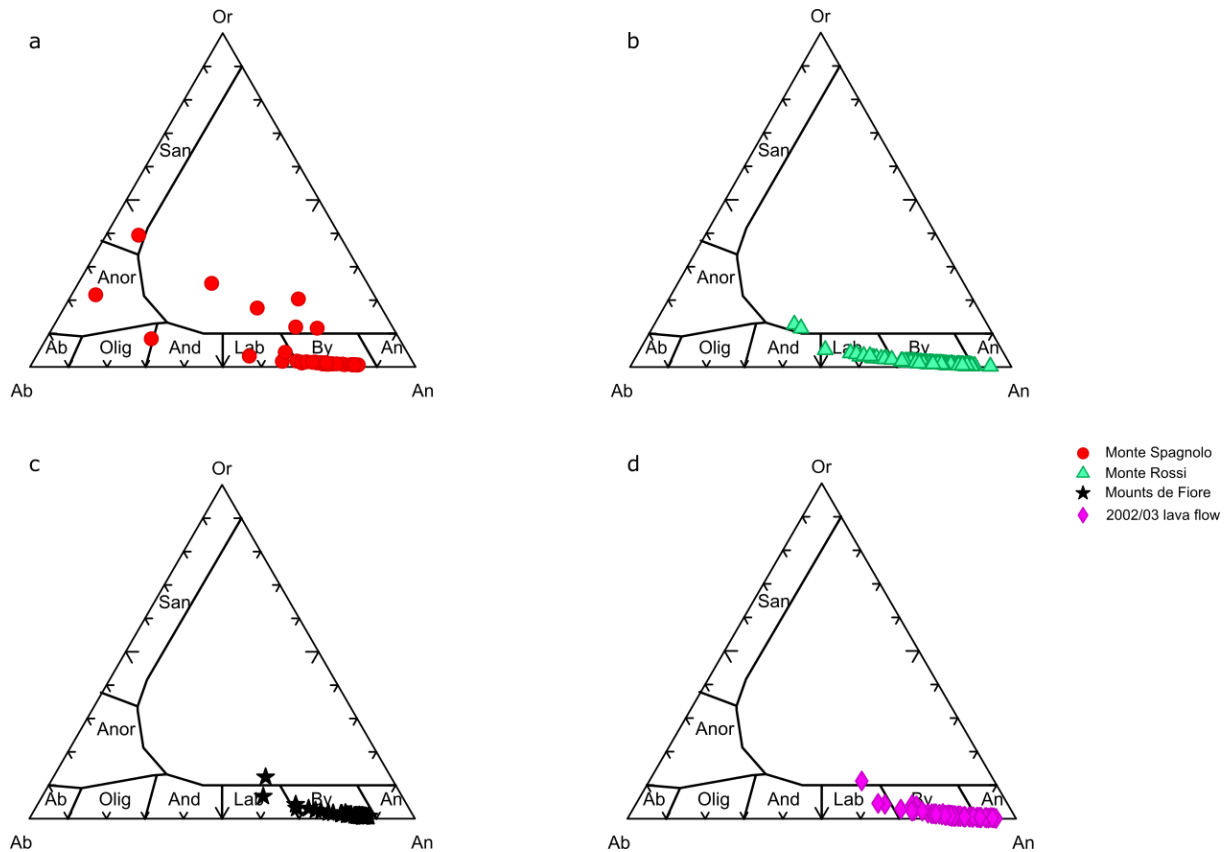


Figure 7-43: Ternary diagrams of the overall plagioclase composition. Each triangle contains all plagioclase analyses of the individual location. a.) Monte Spagnolo, b.) Monte Rossi, c.) Mounts de Fiore and d.) 2002/03 lava flow. The abbreviations stand for **Albite**, **Anorthite** and **Orthoclase** (Supplementary Data 11.3)

7.6.3. Thermobarometric calculations

The thermobarometric calculations showed that there is a linear trend from high temperatures and high pressures to low temperatures and low pressures (Figure 7-44). This suggests that crystallisation of minerals occurs until and during eruption.

The level of temperature or pressure differs for the different locations. As the oldest and the youngest eruption show the highest temperatures and pressures with ~1200 and ~10 kbar, respectively.

Monte Rossi, the only eruption with no apparent evidence in the minerals for magma mixing, shows the smallest temperature and pressure range, from 1160 to around 1110 °C at a pressure between 8 and 1 kbar.

The two most recent eruptions are again very similar, showing an overlapping temperature and pressure course, although the 2002/03 lava flow apparently initiated from much higher depths/temperatures, as Mounts de Fiore.

The lack of clinopyroxene with pressures below 2 kbar suggests, that the eruption occurred very fast and explosive (Andronico, 2004; Corsaro, 2008) with no time to form crystals on the last stage upwards.

The occurrence of small clusters at high temperatures (1190 – 1200 °C) and high pressures (~9-10 kbar for the 2002/02 lava flow, ~7-8 kbar for Monte Spagnolo) might be evidence for the source of the intruding magma, as it is quite a lot hotter and under higher pressure than most of the analyses.

Also, Monte Rossi, shows no such high temperatures or pressures, which can be interpreted as a sign for a “cryptic” mixing, with a magma of similar composition/temperature.

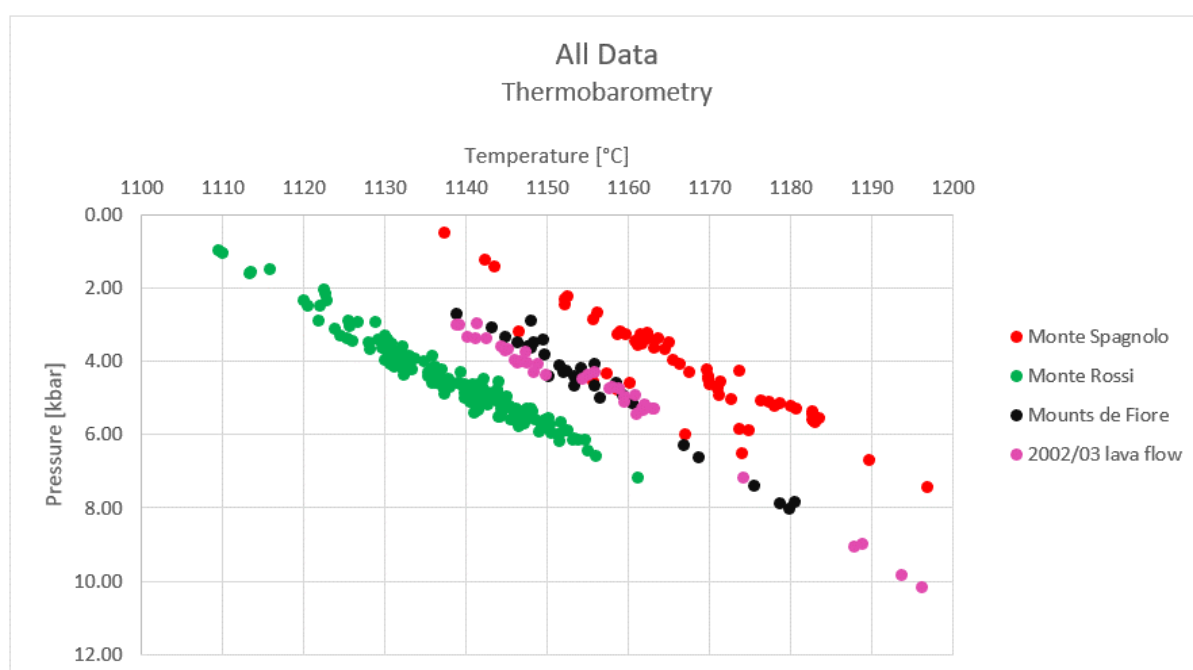


Figure 7-44: Results of the thermobarometric calculations the different investigated eruptions (Supplementary Data 11.20)

8. CONCLUSIO

Field mapping

A total of 20 samples were taken from three eccentric cones (Monte Spagnolo, Monte Rossi, and Mounts de Fiore) and one lava flow (2002/03 lava flow) during a fieldwork in September 2018.

Petrography

The main minerals found in those samples/thin sections are olivine, clinopyroxene, plagioclase and various opaque phases, which were mostly titanomagnetite, but also some spinel. Olivine, clinopyroxene and plagioclase were categorized according to their textural characteristics. For more details on this categorization see chapters 6.2.2 to 6.2.4. The distribution of certain textures across the locations was the first indicator that the provenance history is not the same for all. E.g., Monte Rossi is the only location that does not include inverse zoned olivine or clinopyroxene.

A new texture type of clinopyroxene, Type 6 – hourglass zoning, was introduced and described (chapter 6.2.3).

Geochemistry – Whole rock

All sites can be defined as trachy basalts based on their whole rock composition. The investigated data shows a clear enrichment in K₂O from the two older (Monte Spagnolo & Monte Rossi) to the two younger (Mounts de Fiore, 2002/03 lava flow) eruptions.

Compared with the literature, the trace element analysis shows no major deviations, except from the 2002/03 lava flow, which shows a slight enrichment in the elements Dy, Y, Yb and Lu (see chapter 6.3).

Geochemistry – Mineral chemistry

Out of the 20 samples, 11 were examined with a microprobe. The results of these analyses were used to further categorize and describe the different (texture) types of the individual minerals. In the end, possible evidence of magma mixing was found and identified in three of the four sampled locations (see chapter 6.4. and the following chapters).

Thermobarometry

Temperature and pressure conditions during the crystallization of clinopyroxene were calculated. All four locations show a linear trend, but at different temperature ranges: Monte Spagnolo (1140 – 1180 °C) and Monte Rossi (1110 – 1160 °C) with the *hottest* and the *coldest*, respectively.

Mounts de Fiore and the 2002/03 lava flow, overlap more or less completely and lie between the two older eruptions.

Monte Spagnolo and the 2002/03 lava flow show a *cluster* of very high temperature/pressure analyses (~1180-1200 °C / 8-10 kbar), which might be an

indicator for the source of the intruding magma.

A “cryptic” mixing is the most probable trigger for Monte Rossi, when very similar magma intruded into the magma body and raised the pressure in the chamber until an eruption was triggered.

Magma mixing

The detailed petrographical and geochemical analysis of a variety of samples from these 4 locations led to the assumption, that 1.) magma mixing is the major trigger for eruption and can occur with either hot intruding magma in great depths, or as “cryptic” mixing in shallower regions 2.) there is evidence of a deep (10 kbar) source of magma, which is most likely the trigger of at least two eruptions

Possible evidence for hot magma mixing (DDF) was found in:

- Monte Spagnolo
- 2002/03 lava flow
- Mounts de Fiore (most likely too)

Possible evidence for “cryptic” magma mixing was found in:

- Monte Rossi

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11. SUPPLEMENTARY TABLE

11.1. OLIVINE POINT ANALYSES

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Spagnolo	18MS01	129_1 .	37.59	0.02	<0.01	25.04	0.57	0.04	36.46	0.37	0.04	100.13	72.18
Monte Spagnolo	18MS01	130_1 .	37.91	0.03	<0.01	23.44	0.52	0.05	37.31	0.32	0.06	99.63	73.94
Monte Spagnolo	18MS01	132_1 .	36.36	0.06	<0.01	30.82	0.90	<0.01	31.86	0.44	0.09	100.52	64.82
Monte Spagnolo	18MS01	133_1 .	36.37	0.04	<0.01	29.13	0.82	0.02	31.87	0.42	0.06	98.72	66.10
Monte Spagnolo	18MS01	134_1 .	38.03	0.03	<0.01	23.44	0.49	0.05	37.68	0.28	0.03	100.04	74.13
Monte Spagnolo	18MS01	135_1 .	37.94	0.02	<0.01	23.58	0.49	0.06	37.85	0.29	0.02	100.26	74.10
Monte Spagnolo	18MS01	136_1 .	38.06	0.03	<0.01	23.08	0.47	0.05	37.80	0.31	0.01	99.80	74.49
Monte Spagnolo	18MS01	137_1 .	38.44	0.02	<0.01	21.88	0.41	0.06	39.15	0.30	0.03	100.30	76.13
Monte Spagnolo	18MS01	138_1 .	36.81	0.03	<0.01	27.05	0.74	0.02	33.54	0.37	0.04	98.60	68.85
Monte Spagnolo	18MS01	139_1 .	36.36	0.04	<0.01	27.92	0.84	<0.01	32.00	0.40	0.05	97.61	67.14
Monte Spagnolo	18MS01	140_1 .	37.22	0.03	<0.01	26.61	0.75	0.03	33.53	0.42	0.05	98.64	69.19
Monte Spagnolo	18MS01	141_1 .	36.29	0.03	<0.01	29.73	0.92	0.02	32.85	0.43	0.09	100.38	66.32
Monte Spagnolo	18MS01	142_1 .	37.71	0.03	<0.01	24.58	0.49	0.03	36.43	0.28	0.04	99.60	72.54
Monte Spagnolo	18MS01	147_1 .	39.30	0.02	0.02	17.16	0.33	0.11	43.25	0.26	0.02	100.47	81.80
Monte Spagnolo	18MS01	148_1 .	39.16	0.02	0.03	17.21	0.28	0.12	41.98	0.31	<0.01	99.12	81.30
Monte Spagnolo	18MS01	152_1 .	37.43	0.03	<0.01	24.35	0.55	0.02	35.54	0.30	0.02	98.26	72.24
Monte Spagnolo	18MS01	153_1 .	40.03	0.02	0.04	11.24	0.18	0.19	47.54	0.25	<0.01	99.49	88.29
Monte Spagnolo	18MS01	154_1 .	40.26	0.02	0.03	10.73	0.18	0.19	48.24	0.26	<0.01	99.91	88.91
Monte Spagnolo	18MS01	155_1 .	40.44	0.03	0.03	10.66	0.13	0.23	47.51	0.25	<0.01	99.28	88.82
Monte Spagnolo	18MS01	156_1 .	39.73	0.02	0.02	14.70	0.24	0.12	45.37	0.27	<0.01	100.47	84.62
Monte Spagnolo	18MS01	157_1 .	40.46	0.03	0.04	11.57	0.19	0.17	47.86	0.24	0.01	100.57	88.06
Monte Spagnolo	18MS01	158_1 .	40.11	0.01	0.03	12.10	0.21	0.17	46.56	0.27	<0.01	99.46	87.28
Monte Spagnolo	18MS01	159_1 .	38.61	0.02	<0.01	19.82	0.40	0.08	40.46	0.28	0.02	99.70	78.44
Monte Spagnolo	18MS01	160_1 .	39.93	0.03	0.02	14.59	0.24	0.14	44.71	0.27	0.02	99.95	84.52
Monte Spagnolo	18MS01	162_1 .	39.95	0.01	0.07	12.63	0.19	0.16	46.44	0.26	0.03	99.75	86.76
Monte Spagnolo	18MS01	164_1 .	39.57	0.02	0.06	13.55	0.20	0.15	45.73	0.27	0.01	99.57	85.75
Monte Spagnolo	18MS01	166_1 .	40.06	0.01	0.05	12.15	0.20	0.17	47.25	0.28	<0.01	100.18	87.39
Monte Spagnolo	18MS01	168_1 .	40.11	0.01	0.05	12.88	0.21	0.15	45.94	0.27	<0.01	99.64	86.41
Monte Spagnolo	18MS01	172_1 .	36.13	0.03	<0.01	30.92	0.87	0.02	29.88	0.48	0.07	98.41	63.27
Monte Spagnolo	18MS01	182_1 .	36.22	0.13	<0.01	30.21	0.89	<0.01	29.89	0.42	0.10	97.86	63.82
Monte Spagnolo	18MS01	183_1 .	36.03	0.04	<0.01	30.22	0.88	<0.01	31.07	0.43	0.06	98.75	64.70
Monte Spagnolo	18MS01	84_1 .	40.82	0.03	0.03	11.22	0.18	0.21	47.14	0.26	0.02	99.91	88.22
Monte Spagnolo	18MS01	84_2 .	40.89	0.01	0.05	11.13	0.19	0.18	47.33	0.27	0.02	100.08	88.34
Monte Spagnolo	18MS01	84_3 .	40.97	0.02	0.04	11.25	0.18	0.19	46.94	0.25	<0.01	99.84	88.15
Monte Spagnolo	18MS01	84_4 .	40.65	0.04	0.03	11.31	0.18	0.17	46.83	0.23	<0.01	99.44	88.07
Monte Spagnolo	18MS01	84_5 .	40.75	<0.01	0.04	11.33	0.19	0.22	47.06	0.25	<0.01	99.85	88.10
Monte Spagnolo	18MS01	84_6 .	40.87	0.03	0.04	11.22	0.19	0.19	46.97	0.28	0.02	99.81	88.18
Monte Spagnolo	18MS01	84_7 .	40.74	0.02	0.05	11.26	0.19	0.16	46.88	0.28	<0.01	99.55	88.13
Monte Spagnolo	18MS01	84_8 .	40.72	0.02	0.03	11.23	0.20	0.20	46.76	0.23	<0.01	99.40	88.13
Monte Spagnolo	18MS01	84_9 .	40.68	0.02	0.04	11.23	0.19	0.18	47.18	0.26	<0.01	99.80	88.22
Monte Spagnolo	18MS01	84_10 .	40.89	0.02	0.04	11.36	0.21	0.19	46.59	0.29	0.02	99.63	87.97
Monte Spagnolo	18MS01	84_11 .	40.59	0.03	0.05	11.45	0.19	0.18	47.02	0.29	0.02	99.81	87.99
Monte Spagnolo	18MS01	84_12 .	40.69	0.01	0.04	11.28	0.20	0.19	46.60	0.22	<0.01	99.20	88.05
Monte Spagnolo	18MS01	84_13 .	40.74	0.03	0.05	11.60	0.19	0.17	46.82	0.26	<0.01	99.88	87.80
Monte Spagnolo	18MS01	84_14 .	40.66	0.04	0.03	11.52	0.20	0.18	46.82	0.27	<0.01	99.75	87.87
Monte Spagnolo	18MS01	84_15 .	40.69	0.02	0.04	11.60	0.19	0.18	46.54	0.26	<0.01	99.51	87.74

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Spagnolo	18MS01	84_16 .	40.47	0.02	0.03	11.71	0.18	0.20	46.56	0.26	<0.01	99.45	87.63
Monte Spagnolo	18MS01	84_17 .	40.38	0.02	0.03	11.87	0.21	0.16	46.49	0.30	<0.01	99.46	87.47
Monte Spagnolo	18MS01	84_18 .	0.69	0.02	0.02	12.00	0.19	0.17	46.15	0.27	<0.01	99.53	87.27
Monte Spagnolo	18MS01	84_19 .	40.51	0.03	0.04	12.33	0.21	0.19	46.11	0.27	0.02	99.72	86.96
Monte Spagnolo	18MS01	84_20 .	40.33	<0.01	0.03	12.37	0.22	0.17	45.67	0.26	0.01	99.07	86.81
Monte Spagnolo	18MS01	84_21 .	40.27	0.03	0.03	12.82	0.21	0.19	45.67	0.27	<0.01	99.49	86.39
Monte Spagnolo	18MS01	84_22 .	40.33	0.01	0.02	13.18	0.21	0.15	45.40	0.25	<0.01	99.55	85.99
Monte Spagnolo	18MS01	84_23 .	40.10	0.04	0.03	13.64	0.23	0.13	44.88	0.27	0.02	99.35	85.43
Monte Spagnolo	18MS01	84_24 .	39.91	<0.01	0.02	14.20	0.25	0.14	44.81	0.28	0.02	99.65	84.91
Monte Spagnolo	18MS01	84_25 .	40.05	0.01	0.03	14.58	0.24	0.14	44.37	0.24	<0.01	99.65	84.43
Monte Spagnolo	18MS01	84_26 .	39.86	0.03	0.02	15.35	0.25	0.12	43.49	0.26	<0.01	99.36	83.47
Monte Spagnolo	18MS01	84_27 .	39.52	0.03	0.02	17.03	0.31	0.11	42.27	0.26	0.02	99.57	81.57
Monte Spagnolo	18MS01	84_28 .	39.20	0.02	<0.01	19.07	0.34	0.09	40.34	0.26	0.01	99.31	79.03
Monte Spagnolo	18MS01	84_29 .	37.92	0.03	<0.01	23.92	0.58	0.06	35.93	0.27	0.04	98.78	72.81
Monte Spagnolo	18MS01	85_1 .	40.71	0.01	0.03	11.66	0.18	0.17	46.62	0.28	0.02	99.69	87.69
Monte Spagnolo	18MS01	86_1 .	40.45	0.02	0.03	11.41	0.19	0.18	46.68	0.23	<0.01	99.21	87.94
Monte Spagnolo	18MS01	87_1 .	39.96	0.03	0.03	14.26	0.23	0.10	44.18	0.28	<0.01	99.09	84.67
Monte Spagnolo	18MS01	46_1 .	37.62	0.04	<0.01	25.83	0.66	0.04	34.39	0.34	0.05	98.98	70.36
Monte Spagnolo	18MS01	96_1 .	39.88	0.03	0.02	14.78	0.26	0.14	43.85	0.31	<0.01	99.29	84.10
Monte Spagnolo	18MS01	97_1 .	39.48	0.01	0.02	14.22	0.23	0.13	44.46	0.33	0.04	98.93	84.79
Monte Spagnolo	18MS01	105_1 .	37.43	0.03	<0.01	23.44	0.47	0.03	36.70	0.29	0.02	98.43	73.62
Monte Spagnolo	18MS01	106_1 .	38.29	0.03	<0.01	23.46	0.45	0.05	36.76	0.29	0.06	99.38	73.64
Monte Spagnolo	18MS01	107_1 .	38.96	0.03	<0.01	23.24	0.45	0.03	38.03	0.25	<0.01	101.00	74.47
Monte Spagnolo	18MS01	115_1 .	36.95	0.02	<0.01	27.77	0.70	0.03	33.30	0.30	0.03	99.08	68.13
Monte Spagnolo	18MS01	116_1 .	38.14	0.02	<0.01	23.62	0.44	0.05	36.47	0.27	0.01	99.04	73.35
Monte Spagnolo	18MS01	129_1 .	40.52	0.03	0.04	12.39	0.20	0.18	45.84	0.29	0.03	99.51	86.84
Monte Spagnolo	18MS01	130_1 .	40.29	0.01	0.04	12.02	0.21	0.18	46.17	0.28	0.02	99.21	87.25
Monte Spagnolo	18MS01	131_1 .	40.45	0.02	0.04	12.60	0.19	0.15	45.68	0.28	0.02	99.42	86.60
Monte Spagnolo	18MS01	132_1 .	37.08	0.02	<0.01	26.14	0.67	0.06	33.58	0.33	0.04	97.96	69.61
Monte Spagnolo	18MS01	133_1 .	37.39	<0.01	<0.01	25.48	0.62	0.05	34.73	0.32	0.03	98.63	70.84
Monte Spagnolo	18MS01	134_1 .	37.09	0.03	<0.01	27.08	0.68	0.04	33.14	0.35	0.04	98.47	68.57
Monte Spagnolo	18MS01	135_1 .	37.74	0.02	<0.01	23.43	0.52	0.06	36.59	0.30	0.02	98.72	73.57
Monte Spagnolo	18MS01	136_1 .	39.88	0.03	<0.01	12.73	0.21	0.16	45.80	0.25	<0.01	99.06	86.51
Monte Spagnolo	18MS01	137_1 .	40.22	0.03	0.03	13.13	0.22	0.16	44.80	0.31	0.02	98.92	85.88
Monte Spagnolo	18MS01	138_1 .	40.70	0.59	0.02	11.98	0.21	0.15	43.93	0.43	<0.01	98.08	86.73
Monte Spagnolo	18MS01	139_1 .	39.55	0.02	0.02	12.46	0.22	0.19	44.97	0.29	0.02	97.77	86.55
Monte Spagnolo	18MS01	139_2 .	40.36	0.02	0.03	12.44	0.20	0.18	45.99	0.26	0.03	99.50	86.83
Monte Spagnolo	18MS01	139_3 .	40.46	0.02	0.03	12.54	0.21	0.17	46.12	0.28	0.02	99.84	86.76
Monte Spagnolo	18MS01	139_4 .	40.49	0.03	0.03	12.61	0.21	0.16	45.77	0.28	<0.01	99.60	86.61
Monte Spagnolo	18MS01	139_5 .	40.41	0.03	0.03	12.80	0.22	0.17	45.81	0.25	0.02	99.74	86.45
Monte Spagnolo	18MS01	139_6 .	40.24	0.01	0.03	12.84	0.22	0.17	45.71	0.30	<0.01	99.52	86.39
Monte Spagnolo	18MS01	139_7 .	40.17	0.02	0.02	13.04	0.21	0.15	45.80	0.29	0.01	99.73	86.23
Monte Spagnolo	18MS01	139_8 .	40.23	0.02	0.03	13.37	0.22	0.14	45.50	0.26	<0.01	99.78	85.85
Monte Spagnolo	18MS01	139_9 .	40.10	0.03	0.02	13.61	0.22	0.20	45.35	0.27	<0.01	99.80	85.59
Monte Spagnolo	18MS01	139_10 .	39.91	0.02	0.02	13.84	0.24	0.16	44.76	0.28	0.02	99.28	85.22
Monte Spagnolo	18MS01	139_11 .	39.80	0.02	<0.01	14.71	0.25	0.16	44.43	0.30	<0.01	99.65	84.34
Monte Spagnolo	18MS01	139_12 .	39.74	0.03	0.01	16.42	0.30	0.12	42.71	0.27	<0.01	99.62	82.26

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Spagnolo	18MS01	139_13 .	38.60	0.02	<0.01	21.39	0.46	0.08	38.64	0.31	0.02	99.52	76.30
Monte Spagnolo	18MS01	140_1 .	40.23	0.02	0.03	12.66	0.21	0.19	45.84	0.31	<0.01	99.48	86.59
Monte Spagnolo	18MS01	141_1 .	40.13	0.02	0.02	14.53	0.25	0.12	44.22	0.29	<0.01	99.57	84.44
Monte Spagnolo	18MS01	142_1 .	37.47	0.02	<0.01	28.05	0.72	0.05	32.99	0.44	0.03	99.78	67.71
Monte Spagnolo	18MS01	143_1 .	40.53	0.01	0.03	12.89	0.21	0.13	46.11	0.29	0.01	100.22	86.44
Monte Spagnolo	18MS01	144_1 .	39.91	0.02	0.04	14.51	0.25	0.15	44.13	0.31	0.01	99.33	84.43
Monte Spagnolo	18MS01	145_1 .	39.92	0.02	0.02	15.27	0.28	0.10	43.58	0.32	0.02	99.56	83.57
Monte Spagnolo	18MS02	37_1 .	38.25	0.03	<0.01	22.36	0.43	0.07	39.17	0.29	0.02	100.63	75.75
Monte Spagnolo	18MS02	37_2 .	38.46	0.02	<0.01	21.97	0.45	0.06	39.07	0.25	0.03	100.33	76.02
Monte Spagnolo	18MS02	37_3 .	38.80	0.02	<0.01	21.44	0.40	0.06	39.53	0.30	0.01	100.56	76.67
Monte Spagnolo	18MS02	37_4 .	38.63	0.03	<0.01	21.17	0.41	0.07	40.01	0.28	<0.01	100.62	77.12
Monte Spagnolo	18MS02	37_5 .	38.34	0.03	<0.01	20.74	0.39	0.07	40.53	0.31	0.03	100.43	77.70
Monte Spagnolo	18MS02	37_6 .	38.81	0.02	0.02	20.30	0.38	0.09	40.93	0.29	<0.01	100.86	78.23
Monte Spagnolo	18MS02	37_7 .	38.89	0.01	0.02	19.37	0.33	0.09	41.52	0.33	0.01	100.58	79.26
Monte Spagnolo	18MS02	37_8 .	39.36	0.03	<0.01	18.58	0.31	0.09	42.24	0.30	0.01	100.93	80.20
Monte Spagnolo	18MS02	37_9 .	39.16	0.02	<0.01	18.43	0.29	0.07	42.37	0.29	0.02	100.66	80.39
Monte Spagnolo	18MS02	37_10 .	39.24	0.03	<0.01	18.74	0.32	0.09	42.14	0.31	0.01	100.89	80.04
Monte Spagnolo	18MS02	37_11 .	38.91	0.02	<0.01	19.26	0.35	0.10	41.78	0.29	0.02	100.73	79.45
Monte Spagnolo	18MS02	37_12 .	38.35	<0.01	0.03	22.33	0.43	0.06	38.95	0.27	0.02	100.45	75.67
Monte Spagnolo	18MS02	37_13 .	37.28	0.02	<0.01	27.61	0.61	0.04	34.67	0.32	0.04	100.58	69.12
Monte Spagnolo	18MS02	37_15 .	37.66	0.04	<0.01	26.43	0.62	0.06	34.94	0.37	0.05	100.17	70.21
Monte Spagnolo	18MS02	37_16 .	37.05	0.03	<0.01	28.91	0.69	0.03	33.12	0.39	0.07	100.29	67.13
Monte Spagnolo	18MS02	37_17 .	36.81	0.08	<0.01	30.45	0.78	0.02	31.35	0.44	0.12	100.09	64.73
Monte Spagnolo	18MS02	69_1 .	36.87	0.02	<0.01	25.24	0.54	0.04	35.64	0.31	0.01	98.68	71.57
Monte Spagnolo	18MS02	70_1 .	37.26	0.02	<0.01	23.02	0.41	0.04	38.19	0.28	<0.01	99.25	74.73
Monte Spagnolo	18MS02	72_1 .	37.45	0.02	<0.01	22.61	0.42	0.04	38.14	0.30	0.02	99.01	75.05
Monte Spagnolo	18MS02	73_1 .	37.06	0.02	<0.01	23.31	0.44	0.08	37.53	0.26	0.02	98.72	74.16
Monte Spagnolo	18MS02	73_2 .	37.01	0.03	<0.01	23.38	0.44	0.07	37.43	0.30	0.01	98.69	74.05
Monte Spagnolo	18MS02	73_3 .	36.95	0.01	<0.01	23.43	0.43	0.05	38.15	0.28	0.03	99.33	74.38
Monte Spagnolo	18MS02	73_4 .	36.98	0.02	<0.01	23.17	0.44	0.06	37.79	0.28	<0.01	98.75	74.41
Monte Spagnolo	18MS02	73_5 .	37.01	0.04	<0.01	23.33	0.42	0.05	37.84	0.28	0.02	98.98	74.31
Monte Spagnolo	18MS02	73_6 .	37.03	0.03	<0.01	23.09	0.44	0.04	37.90	0.30	<0.01	98.84	74.53
Monte Spagnolo	18MS02	73_7 .	36.93	0.01	0.01	23.01	0.44	0.03	38.03	0.30	0.03	98.80	74.66
Monte Spagnolo	18MS02	73_8 .	36.76	0.03	<0.01	23.15	0.46	0.06	38.04	0.30	0.03	98.84	74.55
Monte Spagnolo	18MS02	73_9 .	37.05	0.02	<0.01	22.90	0.44	0.05	38.54	0.28	<0.01	99.31	75.00
Monte Spagnolo	18MS02	73_10 .	37.25	0.03	0.01	22.45	0.43	0.05	38.38	0.27	<0.01	98.87	75.29
Monte Spagnolo	18MS02	73_11 .	37.23	0.03	<0.01	22.22	0.46	0.06	38.80	0.31	0.01	99.15	75.69
Monte Spagnolo	18MS02	73_12 .	37.32	0.02	<0.01	21.83	0.38	0.05	38.98	0.31	0.03	98.93	76.10
Monte Spagnolo	18MS02	73_13 .	37.49	0.04	0.02	21.31	0.36	0.07	39.28	0.30	0.02	98.88	76.67
Monte Spagnolo	18MS02	73_14 .	37.31	0.03	<0.01	20.57	0.36	0.07	39.91	0.32	0.02	98.60	77.57
Monte Spagnolo	18MS02	73_15 .	37.61	0.03	0.01	20.08	0.39	0.08	40.40	0.30	0.02	98.92	78.20
Monte Spagnolo	18MS02	73_16 .	37.60	0.03	<0.01	19.58	0.35	0.08	40.98	0.26	<0.01	98.88	78.86
Monte Spagnolo	18MS02	73_17 .	38.36	0.02	<0.01	18.69	0.31	0.10	41.56	0.30	0.01	99.37	79.86
Monte Spagnolo	18MS02	82_1 .	37.46	0.43	0.01	27.87	0.64	0.06	31.73	0.41	0.03	98.86	66.99
Monte Spagnolo	18MS02	83_1 .	37.90	0.11	<0.01	25.06	0.57	0.08	35.75	0.34	0.02	99.87	71.78
Monte Spagnolo	18MS02	85_1 .	39.57	0.01	0.03	13.78	0.25	0.13	46.00	0.26	<0.01	100.05	85.61
Monte Spagnolo	18MS02	86_1 .	39.71	<0.01	0.01	13.69	0.21	0.16	46.14	0.26	0.02	100.22	85.73

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Spagnolo	18MS02	87_1 .	38.76	0.04	0.04	18.16	0.33	0.10	42.16	0.32	0.01	99.92	80.54
Monte Spagnolo	18MS02	88_1 .	35.65	0.02	<0.01	33.53	0.89	0.04	28.73	0.42	0.09	99.37	60.43
Monte Spagnolo	18MS02	89_1 .	37.00	1.77	<0.01	35.71	0.93	0.02	25.21	0.39	0.05	101.33	55.72
Monte Spagnolo	18MS02	90_1 .	39.63	0.02	<0.01	13.97	0.19	0.09	46.23	0.30	<0.01	100.45	85.50
Monte Spagnolo	18MS02	91_1 .	39.86	0.01	0.03	12.86	0.22	0.15	46.86	0.30	<0.01	100.29	86.66
Monte Spagnolo	18MS02	92_1 .	40.13	<0.01	0.03	13.68	0.23	0.13	46.01	0.31	<0.01	100.53	85.71
Monte Spagnolo	18MS02	94_1 .	39.66	1.16	0.02	13.14	0.23	0.15	43.07	0.40	0.02	97.90	85.38
Monte Spagnolo	18MS02	95_1 .	38.27	0.02	<0.01	20.89	0.40	0.07	40.08	0.31	0.01	100.05	77.38
Monte Spagnolo	18MS02	106_1 .	37.19	0.02	<0.01	23.31	0.48	0.04	37.66	0.30	0.01	99.04	74.23
Monte Spagnolo	18MS02	107_1 .	37.24	0.03	<0.01	22.33	0.43	0.04	37.95	0.33	<0.01	98.38	75.18
Monte Spagnolo	18MS02	108_1 .	35.81	0.02	0.01	29.54	0.63	0.03	32.30	0.31	0.03	98.69	66.09
Monte Spagnolo	18MS02	110_1 .	35.77	0.03	0.03	28.49	0.64	0.06	33.57	0.36	0.09	99.05	67.74
Monte Spagnolo	18MS02	129_1 .	37.10	1.13	<0.01	31.02	0.80	0.03	30.03	0.42	0.05	100.78	63.31
Monte Spagnolo	18MS02	130_1 .	40.24	0.02	0.04	10.80	0.19	0.21	48.55	0.27	0.02	100.35	88.90
Monte Spagnolo	18MS02	131_1 .	40.34	0.01	0.03	11.18	0.19	0.20	48.72	0.27	<0.01	100.93	88.59
Monte Spagnolo	18MS02	132_1 .	40.05	0.03	0.03	12.76	0.20	0.13	46.90	0.28	<0.01	100.40	86.76
Monte Spagnolo	18MS02	133_1 .	39.80	0.03	0.03	13.20	0.21	0.12	46.46	0.29	<0.01	100.14	86.25
Monte Spagnolo	18MS02	38_1 .	40.57	0.03	0.03	12.02	0.19	0.19	48.21	0.27	0.01	101.53	87.73
Monte Spagnolo	18MS02	38_3 .	40.72	0.03	0.03	12.35	0.19	0.17	47.99	0.27	<0.01	101.77	87.38
Monte Spagnolo	18MS02	38_4 .	40.55	0.02	0.02	12.55	0.18	0.16	47.85	0.29	<0.01	101.64	87.18
Monte Spagnolo	18MS02	38_5 .	40.37	0.02	0.01	12.41	0.17	0.16	47.48	0.29	0.02	100.94	87.21
Monte Spagnolo	18MS02	38_6 .	40.26	0.02	0.02	13.19	0.24	0.14	46.89	0.27	0.01	101.06	86.37
Monte Spagnolo	18MS02	38_7 .	39.98	0.03	0.02	14.51	0.27	0.15	45.55	0.29	0.01	100.80	84.84
Monte Spagnolo	18MS02	38_8 .	39.75	0.02	0.02	17.10	0.31	0.13	43.44	0.28	<0.01	101.07	81.91
Monte Spagnolo	18MS02	38_9 .	38.04	0.03	<0.01	26.39	0.63	0.06	35.82	0.35	0.01	101.34	70.76
Monte Spagnolo	18MS02	149_1 .	39.85	0.25	0.02	16.36	0.31	0.10	43.98	0.38	0.03	101.29	82.74
Monte Spagnolo	18MS02	3_1 .	39.20	0.03	<0.01	19.93	0.50	0.05	41.09	0.18	0.02	101.01	78.61
Monte Spagnolo	18MS02	39_17 .	38.64	0.02	<0.01	21.74	0.53	0.02	39.17	0.36	0.03	100.53	76.26
Monte Spagnolo	18MS02	39_18 .	37.42	0.03	<0.01	26.00	0.65	0.02	35.55	0.43	0.02	100.12	70.90
Monte Spagnolo	18MS02	39_19 .	36.33	0.02	<0.01	31.11	0.84	0.05	30.98	0.46	0.05	99.84	63.97
Monte Spagnolo	18MS02	162_1 .	38.05	<0.01	<0.01	24.24	0.55	0.05	37.30	0.28	<0.01	100.52	73.28
Monte Spagnolo	18MS02	179_1 .	38.26	0.02	<0.01	19.03	0.38	0.11	41.28	0.31	0.02	99.42	79.45
Monte Spagnolo	18MS02	43_1 .	40.59	0.02	0.02	13.73	0.21	0.14	46.81	0.30	0.01	101.83	85.87
Monte Spagnolo	18MS02	43_2 .	40.45	0.02	0.03	13.59	0.24	0.12	46.76	0.28	0.01	101.51	85.98
Monte Spagnolo	18MS02	43_3 .	40.53	0.02	0.04	13.67	0.23	0.13	46.34	0.30	<0.01	101.26	85.80
Monte Spagnolo	18MS02	43_4 .	40.41	0.03	0.03	13.88	0.21	0.11	46.65	0.24	<0.01	101.57	85.70
Monte Spagnolo	18MS02	43_5 .	40.33	0.02	0.02	13.97	0.19	0.13	46.13	0.30	<0.01	101.09	85.48
Monte Spagnolo	18MS02	43_6 .	40.19	0.03	0.03	14.41	0.24	0.14	45.89	0.32	<0.01	101.26	85.02
Monte Spagnolo	18MS02	43_7 .	40.04	0.01	0.02	14.80	0.22	0.12	45.56	0.28	0.01	101.06	84.58
Monte Spagnolo	18MS02	43_8 .	39.84	0.02	0.01	15.70	0.26	0.11	45.04	0.33	<0.01	101.33	83.64
Monte Spagnolo	18MS02	43_9 .	39.26	0.02	0.01	17.18	0.33	0.09	43.81	0.30	<0.01	101.01	81.96
Monte Spagnolo	18MS02	43_10 .	39.08	0.02	<0.01	18.86	0.37	0.09	42.37	0.31	0.02	101.13	80.02
Monte Spagnolo	18MS02	166_1 .	39.80	0.01	0.02	13.28	0.23	0.14	46.47	0.27	<0.01	100.23	86.18
Monte Spagnolo	18MS02	167_1 .	39.67	0.03	0.03	13.73	0.24	0.13	46.11	0.30	0.02	100.25	85.69
Monte Spagnolo	18MS02	168_1 .	39.76	0.03	0.02	12.99	0.20	0.17	46.60	0.30	<0.01	100.08	86.47
Monte Spagnolo	18MS02	170_1 .	39.60	0.02	0.02	13.30	0.19	0.14	46.02	0.29	<0.01	99.60	86.05
Monte Spagnolo	18MS02	171_1 .	39.57	0.04	0.06	14.60	0.22	0.13	44.83	0.34	<0.01	99.81	84.55

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Spagnolo	18MS02	1 / 1 .	37.22	0.02	<0.01	23.17	0.45	0.07	37.57	0.25	<0.01	98.74	74.30
Monte Spagnolo	18MS02	2 / 1 .	37.57	0.03	<0.01	23.95	0.46	0.04	37.22	0.29	0.04	99.60	73.48
Monte Spagnolo	18MS02	3 / 1 .	37.31	0.03	<0.01	23.96	0.47	0.05	37.10	0.30	0.03	99.27	73.40
Monte Spagnolo	18MS02	4 / 1 .	37.46	0.03	<0.01	23.22	0.45	0.06	37.67	0.27	0.02	99.17	74.31
Monte Spagnolo	18MS02	5 / 1 .	38.35	0.02	<0.01	18.16	0.34	0.08	41.67	0.27	<0.01	98.90	80.36
Monte Spagnolo	18MS02	6 / 1 .	38.55	0.02	<0.01	18.33	0.33	0.07	41.50	0.30	0.02	99.13	80.14
Monte Spagnolo	18MS02	7 / 1 .	36.66	0.03	<0.01	27.23	0.65	0.07	33.43	0.39	0.03	98.49	68.64
Monte Spagnolo	18MS02	8 / 1 .	38.74	0.02	<0.01	18.38	0.34	0.11	41.53	0.31	0.01	99.45	80.11
Monte Spagnolo	18MS02	10 / 1 .	37.37	0.03	<0.01	23.99	0.49	0.03	37.49	0.27	0.03	99.70	73.59
Monte Spagnolo	18MS02	11 / 1 .	37.93	0.02	<0.01	19.85	0.39	0.14	40.40	0.32	0.02	99.06	78.39
Monte Spagnolo	18MS02	12 / 1 .	38.48	0.02	0.01	18.90	0.36	0.06	41.38	0.30	0.02	99.53	79.60
Monte Spagnolo	18MS02	13 / 1 .	38.21	0.02	<0.01	21.50	0.45	0.06	39.24	0.34	0.01	99.83	76.49
Monte Spagnolo	18MS02	14 / 1 .	38.50	0.02	0.01	18.94	0.34	0.11	41.09	0.31	<0.01	99.33	79.45
Monte Spagnolo	18MS02	15 / 1 .	36.69	0.03	<0.01	26.06	0.61	0.05	35.11	0.37	0.04	98.95	70.60
Monte Spagnolo	18MS02	16 / 1 .	35.92	0.03	<0.01	29.57	0.76	<0.01	31.97	0.40	0.06	98.72	65.84
Monte Spagnolo	18MS02	17 / 1 .	36.92	0.02	<0.01	26.76	0.63	0.05	34.64	0.42	0.03	99.47	69.77
Monte Spagnolo	18MS02	18 / 1 .	38.34	0.03	<0.01	19.87	0.37	0.07	40.04	0.33	<0.01	99.07	78.23
Monte Spagnolo	18MS02	19 / 1 .	38.15	0.02	<0.01	21.20	0.41	0.04	39.55	0.32	0.01	99.70	76.88
Monte Spagnolo	18MS02	19 / 2 .	37.96	0.02	<0.01	21.02	0.39	0.04	39.59	0.32	0.02	99.37	77.06
Monte Spagnolo	18MS02	19 / 3 .	38.27	0.03	<0.01	21.38	0.42	0.08	39.50	0.30	<0.01	99.98	76.71
Monte Spagnolo	18MS02	19 / 4 .	37.88	0.03	<0.01	21.62	0.42	0.09	39.11	0.32	0.05	99.53	76.33
Monte Spagnolo	18MS02	19 / 5 .	37.82	0.03	<0.01	21.68	0.41	0.06	38.96	0.34	0.04	99.34	76.21
Monte Spagnolo	18MS02	19 / 6 .	37.64	0.03	<0.01	22.17	0.45	0.06	38.76	0.33	0.04	99.47	75.71
Monte Spagnolo	18MS02	19 / 7 .	37.82	0.02	<0.01	22.00	0.46	0.06	38.73	0.34	0.01	99.43	75.84
Monte Spagnolo	18MS02	19 / 8 .	37.89	0.03	<0.01	22.01	0.44	0.04	38.36	0.32	0.05	99.15	75.65
Monte Spagnolo	18MS02	19 / 9 .	37.85	0.03	<0.01	21.55	0.44	0.04	38.84	0.34	0.05	99.15	76.27
Monte Spagnolo	18MS02	19 / 10 .	37.77	0.03	0.01	20.55	0.42	0.09	39.55	0.34	0.01	98.79	77.43
Monte Spagnolo	18MS02	19 / 11 .	38.02	0.03	<0.01	20.28	0.43	0.10	40.46	0.35	0.02	99.70	78.05
Monte Spagnolo	18MS02	19 / 12 .	37.97	0.02	<0.01	21.90	0.50	0.10	38.77	0.36	0.01	99.64	75.94
Monte Spagnolo	18MS02	19 / 13 .	36.81	0.20	<0.01	25.61	0.61	0.06	35.22	0.35	0.02	98.88	71.03
Monte Spagnolo	18MS02	20 / 1 .	37.17	0.04	<0.01	25.07	0.52	0.05	36.42	0.33	0.02	99.60	72.14
Monte Spagnolo	18MS02	21 / 1 .	37.48	0.03	<0.01	24.23	0.50	0.03	37.09	0.30	0.01	99.69	73.18
Monte Spagnolo	18MS02	22 / 1 .	37.96	0.02	<0.01	21.97	0.44	0.08	38.89	0.29	0.02	99.67	75.94
Monte Spagnolo	18MS02	24 / 1 .	38.11	0.02	0.01	20.56	0.38	0.06	40.44	0.30	<0.01	99.89	77.81
Monte Spagnolo	18MS02	26 / 1 .	39.52	0.02	0.03	12.15	0.21	0.16	47.10	0.28	0.01	99.47	87.36
Monte Spagnolo	18MS02	27 / 1 .	39.26	0.03	0.03	13.01	0.21	0.16	46.32	0.27	<0.01	99.29	86.39
Monte Spagnolo	18MS02	28 / 1 .	39.26	0.02	0.03	12.97	0.22	0.14	46.32	0.27	<0.01	99.24	86.42
Monte Spagnolo	18MS02	29 / 1 .	36.72	0.02	<0.01	26.10	0.59	0.02	35.18	0.34	0.05	99.03	70.61
Monte Spagnolo	18MS02	30 / 1 .	39.14	0.02	0.01	13.87	0.25	0.13	45.60	0.30	0.01	99.33	85.43
Monte Spagnolo	18MS02	31 / 1 .	35.82	0.02	<0.01	29.65	0.76	0.04	32.02	0.38	0.09	98.79	65.81
Monte Spagnolo	18MS02	32 / 1 .	39.23	0.02	0.02	13.00	0.22	0.15	46.51	0.26	0.04	99.45	86.45
Monte Spagnolo	18MS02	33 / 1 .	39.06	0.02	0.02	13.96	0.24	0.14	45.73	0.28	<0.01	99.46	85.38
Monte Spagnolo	18MS02	34 / 1 .	39.64	0.03	0.02	12.85	0.21	0.19	46.98	0.27	<0.01	100.20	86.70
Monte Spagnolo	18MS02	35 / 1 .	39.69	0.02	0.03	13.31	0.21	0.14	45.97	0.29	<0.01	99.64	86.03
Monte Spagnolo	18MS02	36 / 1 .	38.60	0.02	0.01	17.30	0.31	0.13	42.91	0.31	<0.01	99.59	81.56
Monte Spagnolo	18MS02	37 / 1 .	38.84	0.03	0.02	17.63	0.31	0.09	42.60	0.32	<0.01	99.84	81.16
Monte Spagnolo	18MS02	38 / 1 .	37.77	0.03	<0.01	21.89	0.47	0.09	39.03	0.34	0.02	99.67	76.07

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Spagnolo	18MS02	39 / 1 .	36.00	0.04	<0.01	28.47	0.66	0.02	32.98	0.39	0.02	98.57	67.37
Monte Spagnolo	18MS02	40 / 1 .	35.81	0.16	<0.01	31.88	0.83	0.05	29.48	0.42	<0.01	98.63	62.24
Monte Spagnolo	18MS02	41 / 1 .	36.28	0.02	<0.01	29.44	0.67	0.02	32.76	0.44	<0.01	99.62	66.49
Monte Spagnolo	18MS02	42 / 1 .	36.55	0.03	<0.01	27.94	0.63	0.04	33.79	0.40	0.06	99.45	68.31
Monte Spagnolo	18MS02	43 / 1 .	35.12	0.04	<0.01	32.58	0.84	0.02	29.31	0.42	0.04	98.37	61.59
Monte Spagnolo	18MS05	188_1 .	39.15	0.03	<0.01	17.70	0.31	0.11	42.58	0.30	0.01	100.22	81.09
Monte Spagnolo	18MS05	189_1 .	40.31	0.01	0.11	13.42	0.25	0.14	46.53	0.40	0.02	101.20	86.08
Monte Spagnolo	18MS05	190_1 .	40.43	0.02	0.02	13.50	0.25	0.12	46.42	0.31	0.01	101.08	85.97
Monte Spagnolo	18MS05	191_1 .	39.60	0.02	<0.01	18.17	0.30	0.10	42.38	0.31	0.01	100.91	80.61
Monte Spagnolo	18MS05	192_1 .	40.28	0.02	0.02	13.76	0.23	0.13	46.22	0.26	0.02	100.94	85.69
Monte Spagnolo	18MS05	192_2 .	40.41	0.02	0.03	13.79	0.26	0.13	46.07	0.29	<0.01	101.03	85.62
Monte Spagnolo	18MS05	192_3 .	40.30	0.02	0.02	14.07	0.23	0.13	46.11	0.30	0.01	101.20	85.38
Monte Spagnolo	18MS05	192_4 .	40.35	0.03	0.02	14.28	0.24	0.12	45.52	0.30	0.01	100.87	85.04
Monte Spagnolo	18MS05	192_5 .	40.27	0.02	0.02	14.99	0.24	0.13	45.22	0.33	<0.01	101.21	84.32
Monte Spagnolo	18MS05	192_6 .	40.14	0.02	0.03	15.67	0.28	0.13	44.46	0.26	<0.01	100.99	83.49
Monte Spagnolo	18MS05	192_7 .	39.54	0.02	0.03	16.57	0.29	0.11	43.66	0.30	0.01	100.55	82.44
Monte Spagnolo	18MS05	193_1 .	39.11	0.03	0.02	19.94	0.40	0.06	40.82	0.41	<0.01	100.78	78.49
Monte Spagnolo	18MS05	194_1 .	40.01	0.03	0.05	14.81	0.24	0.15	45.24	0.29	<0.01	100.80	84.49
Monte Spagnolo	18MS05	205_1 .	38.17	0.02	<0.01	23.17	0.45	0.06	38.16	0.27	0.02	100.31	74.59
Monte Spagnolo	18MS05	207_1 .	38.51	0.02	<0.01	23.03	0.46	0.03	38.72	0.29	<0.01	101.08	74.98
Monte Spagnolo	18MS05	208_1 .	38.37	<0.01	<0.01	23.05	0.42	0.04	38.68	0.28	0.02	100.86	74.95
Monte Spagnolo	18MS05	209_2 .	38.31	<0.01	<0.01	22.93	0.43	0.04	38.77	0.28	0.01	100.80	75.09
Monte Spagnolo	18MS05	209_4 .	38.78	<0.01	<0.01	21.60	0.41	0.06	39.71	0.34	<0.01	100.92	76.62
Monte Spagnolo	18MS05	209_5 .	38.92	0.04	<0.01	20.94	0.36	0.07	40.06	0.36	0.02	100.78	77.33
Monte Spagnolo	18MS05	227_1 .	40.27	0.01	0.06	12.96	0.22	0.13	46.43	0.27	<0.01	100.37	86.46
Monte Spagnolo	18MS05	228_1 .	40.62	0.02	0.03	13.39	0.19	0.13	46.89	0.30	0.02	101.58	86.19
Monte Spagnolo	18MS05	229_1 .	40.67	0.02	0.03	13.20	0.21	0.13	46.72	0.29	0.01	101.29	86.32
Monte Spagnolo	18MS05	231_1 .	40.40	0.03	0.03	13.20	0.22	0.15	46.78	0.28	<0.01	101.09	86.34
Monte Spagnolo	18MS05	238_1 .	39.50	0.03	0.01	15.40	0.28	0.10	44.83	0.31	0.02	100.49	83.84
Monte Spagnolo	18MS05	239_1 .	39.99	0.03	0.04	12.18	0.23	0.15	47.20	0.29	<0.01	100.10	87.36
Monte Spagnolo	18MS05	240_1 .	40.21	0.02	0.04	11.24	0.17	0.19	48.05	0.26	<0.01	100.18	88.40
Monte Spagnolo	18MS05	241_1 .	40.23	0.03	0.03	11.33	0.18	0.20	47.85	0.29	<0.01	100.16	88.27
Monte Spagnolo	18MS05	242_1 .	39.87	0.02	<0.01	12.80	0.20	0.14	46.64	0.31	<0.01	99.98	86.66
Monte Spagnolo	18MS05	243_1 .	40.10	0.03	0.03	11.49	0.18	0.16	47.97	0.29	<0.01	100.26	88.16
Monte Spagnolo	18MS05	252_1 .	38.92	0.02	<0.01	15.58	0.25	0.11	44.02	0.32	0.03	99.27	83.43
Monte Spagnolo	18MS05	253_1 .	37.71	0.02	<0.01	22.46	0.42	0.05	38.70	0.23	0.03	99.62	75.44
Monte Spagnolo	18MS05	254_1 .	37.81	0.02	<0.01	22.82	0.43	0.05	38.14	0.30	0.02	99.60	74.87
Monte Spagnolo	18MS05	255_1 .	37.51	0.03	<0.01	22.84	0.43	0.07	38.65	0.27	0.03	99.86	75.10
Monte Spagnolo	18MS05	257_1 .	37.93	0.02	<0.01	22.44	0.44	0.08	38.76	0.28	0.03	99.97	75.49
Monte Spagnolo	18MS05	257_2 .	37.98	0.04	<0.01	22.01	0.40	0.07	38.90	0.25	0.02	99.66	75.91
Monte Spagnolo	18MS05	257_3 .	38.29	0.03	<0.01	21.14	0.39	0.03	40.04	0.24	0.02	100.20	77.15
Monte Spagnolo	18MS05	257_4 .	38.78	0.03	<0.01	19.22	0.37	0.09	41.38	0.30	<0.01	100.19	79.33
Monte Spagnolo	18MS05	257_5 .	39.05	0.02	<0.01	17.61	0.29	0.09	42.74	0.32	0.01	100.16	81.23
Monte Spagnolo	18MS05	257_6 .	38.89	0.02	<0.01	17.52	0.28	0.12	42.56	0.31	0.02	99.73	81.24
Monte Spagnolo	18MS05	42_1 .	37.86	0.03	<0.01	22.72	0.43	0.05	38.66	0.28	0.01	100.06	75.20
Monte Spagnolo	18MS05	42_2 .	37.92	0.01	<0.01	22.58	0.43	0.06	38.95	0.26	0.02	100.25	75.46
Monte Spagnolo	18MS05	42_3 .	37.86	0.02	<0.01	22.34	0.39	0.05	38.55	0.24	0.03	99.48	75.46

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Spagnolo	18MS05	42_4 .	38.15	0.03	<0.01	22.49	0.38	0.06	38.92	0.26	0.03	100.33	75.52
Monte Spagnolo	18MS05	42_5 .	38.11	0.02	<0.01	22.08	0.43	0.03	39.44	0.29	0.02	100.45	76.10
Monte Spagnolo	18MS05	42_6 .	38.20	0.03	<0.01	20.87	0.42	0.04	39.87	0.25	0.03	99.70	77.30
Monte Spagnolo	18MS05	42_7 .	38.52	0.03	<0.01	19.36	0.38	0.05	41.47	0.32	0.03	100.17	79.25
Monte Spagnolo	18MS05	42_8 .	38.80	0.03	0.01	17.86	0.34	0.10	42.93	0.32	<0.01	100.40	81.07
Monte Spagnolo	18MS05	42_9 .	38.73	0.03	0.01	17.69	0.29	0.09	42.77	0.34	<0.01	99.96	81.17
Monte Spagnolo	18MS05	42_10 .	38.62	0.03	<0.01	18.83	0.38	0.08	41.60	0.34	0.03	99.91	79.75
Monte Spagnolo	18MS05	42_11 .	37.60	0.05	<0.01	22.31	0.36	0.08	37.94	0.44	0.03	98.83	75.20
Monte Spagnolo	18MS05	40 / 1 .	40.03	0.03	0.03	13.02	0.22	0.12	46.76	0.27	<0.01	100.49	86.49
Monte Spagnolo	18MS05	40 / 2 .	39.75	0.02	0.02	13.29	0.21	0.13	46.66	0.28	<0.01	100.40	86.22
Monte Spagnolo	18MS05	40 / 3 .	39.69	0.02	0.02	13.16	0.23	0.13	46.55	0.33	0.02	100.15	86.31
Monte Spagnolo	18MS05	40 / 4 .	39.72	0.02	0.02	13.35	0.18	0.13	46.42	0.33	0.02	100.18	86.11
Monte Spagnolo	18MS05	40 / 5 .	40.04	0.02	0.01	13.35	0.22	0.11	46.59	0.32	<0.01	100.68	86.15
Monte Spagnolo	18MS05	40 / 6 .	39.71	0.01	0.01	13.38	0.21	0.15	46.47	0.31	<0.01	100.25	86.09
Monte Spagnolo	18MS05	40 / 7 .	39.74	0.03	<0.01	13.63	0.19	0.12	46.44	0.30	0.01	100.47	85.87
Monte Spagnolo	18MS05	40 / 8 .	39.80	0.01	0.01	13.77	0.22	0.14	46.26	0.29	0.02	100.52	85.69
Monte Spagnolo	18MS05	40 / 9 .	39.80	0.03	0.01	14.18	0.25	0.11	45.98	0.30	0.01	100.67	85.25
Monte Spagnolo	18MS05	40 / 10 .	39.68	0.02	0.01	14.46	0.23	0.13	45.65	0.26	0.02	100.45	84.91
Monte Spagnolo	18MS05	40 / 11 .	39.74	<0.01	0.01	14.87	0.25	0.15	45.35	0.30	0.02	100.70	84.47
Monte Spagnolo	18MS05	40 / 12 .	39.53	0.02	<0.01	15.42	0.28	0.11	44.77	0.26	0.02	100.43	83.80
Monte Spagnolo	18MS05	40 / 13 .	39.37	0.02	0.03	16.46	0.28	0.13	43.88	0.30	0.03	100.50	82.62
Monte Spagnolo	18MS05	40 / 14 .	39.18	0.02	<0.01	17.65	0.31	0.10	42.20	0.29	<0.01	99.78	81.00
Monte Spagnolo	18MS05	40 / 15 .	38.85	0.03	<0.01	19.27	0.34	0.09	41.28	0.34	0.03	100.24	79.25
Monte Spagnolo	18MS05	40 / 16 .	38.27	0.03	<0.01	20.06	0.37	0.07	40.54	0.34	0.02	99.73	78.28
Monte Spagnolo	18MS05	40 / 17 .	39.22	0.16	<0.01	20.71	0.41	0.06	40.65	0.43	0.05	101.72	77.77
Monte Spagnolo	18MS05	41 / 1 .	38.09	0.02	<0.01	23.03	0.40	0.05	38.76	0.26	<0.01	100.61	75.00
Monte Spagnolo	18MS05	41 / 2 .	38.03	0.03	<0.01	23.02	0.43	0.06	38.96	0.27	0.01	100.81	75.10
Monte Spagnolo	18MS05	41 / 3 .	38.37	0.01	<0.01	23.05	0.43	0.04	38.60	0.26	<0.01	100.80	74.90
Monte Spagnolo	18MS05	41 / 4 .	38.45	0.02	<0.01	22.87	0.48	0.04	38.41	0.27	<0.01	100.58	74.96
Monte Spagnolo	18MS05	41 / 5 .	38.34	0.02	<0.01	23.24	0.44	0.03	38.66	0.27	0.02	101.03	74.78
Monte Spagnolo	18MS05	41 / 6 .	38.28	0.02	0.01	23.01	0.44	0.07	38.51	0.24	0.02	100.62	74.90
Monte Spagnolo	18MS05	41 / 7 .	38.66	0.02	<0.01	23.33	0.44	0.06	38.22	0.25	0.02	101.02	74.49
Monte Spagnolo	18MS05	41 / 8 .	38.33	0.02	0.01	23.21	0.49	0.05	38.37	0.29	0.02	100.81	74.66
Monte Spagnolo	18MS05	41 / 9 .	38.11	0.02	0.01	23.15	0.44	0.04	38.71	0.27	0.01	100.77	74.88
Monte Spagnolo	18MS05	41 / 10 .	38.55	0.02	<0.01	22.87	0.43	0.06	38.59	0.29	0.01	100.82	75.05
Monte Spagnolo	18MS05	41 / 11 .	38.32	0.03	<0.01	21.91	0.43	0.06	39.48	0.32	0.02	100.60	76.26
Monte Spagnolo	18MS05	41 / 12 .	38.87	0.03	0.02	20.66	0.36	0.07	40.49	0.31	<0.01	100.81	77.75
Monte Spagnolo	18MS05	41 / 13 .	38.87	0.02	<0.01	19.86	0.35	0.08	41.17	0.37	0.02	100.74	78.70
Monte Spagnolo	18MS05	41 / 14 .	38.79	0.03	0.02	20.05	0.38	0.06	40.88	0.36	0.04	100.63	78.42
Monte Spagnolo	18MS05	41 / 15 .	38.98	0.03	0.01	20.58	0.37	0.06	40.31	0.45	0.02	100.81	77.73
Monte Rossi	18MR01	137_1 .	36.89	0.03	<0.01	29.25	0.61	<0.01	32.40	0.35	0.03	99.59	66.38
Monte Rossi	18MR01	138_1 .	37.49	0.03	<0.01	26.27	0.57	0.02	34.73	0.30	0.04	99.47	70.21
Monte Rossi	18MR01	48_1 .	37.50	0.03	<0.01	23.13	0.42	0.03	37.96	0.33	0.02	99.45	74.52
Monte Rossi	18MR01	49_1 .	37.62	0.03	<0.01	23.02	0.42	0.05	37.92	0.29	0.04	99.38	74.60
Monte Rossi	18MR01	50_1 .	36.82	0.02	<0.01	27.08	0.56	0.03	34.81	0.31	<0.01	99.71	69.62
Monte Rossi	18MR01	51_1 .	36.85	0.02	<0.01	25.16	0.53	0.05	35.99	0.34	0.03	98.96	71.83
Monte Rossi	18MR01	52_1 .	37.28	0.02	<0.01	22.93	0.46	0.04	38.10	0.34	0.03	99.19	74.76

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Rossi	18MR01	53_1 .	38.36	0.02	<0.01	22.74	0.41	0.06	37.37	0.31	0.04	99.32	74.55
Monte Rossi	18MR01	54_1 .	37.39	0.02	<0.01	25.73	0.52	0.03	34.76	0.32	0.01	98.80	70.66
Monte Rossi	18MR01	55_1 .	37.22	0.04	<0.01	27.94	0.59	0.02	33.48	0.31	0.07	99.69	68.12
Monte Rossi	18MR01	1 / 1 .	35.47	0.02	0.02	28.56	0.60	0.04	33.02	0.35	0.03	98.13	67.33
Monte Rossi	18MR01	2 / 1 .	37.06	0.03	<0.01	22.38	0.41	0.07	38.41	0.30	0.02	98.68	75.37
Monte Rossi	18MR01	3 / 1 .	37.29	0.02	<0.01	22.52	0.42	0.05	38.36	0.27	0.01	98.95	75.23
Monte Rossi	18MR01	4 / 1 .	37.53	0.04	<0.01	22.39	0.42	0.06	38.44	0.33	0.02	99.25	75.37
Monte Rossi	18MR01	5 / 1 .	37.42	0.03	<0.01	22.24	0.38	0.04	38.35	0.29	0.02	98.79	75.45
Monte Rossi	18MR01	6 / 1 .	37.30	0.02	<0.01	22.30	0.39	0.05	38.70	0.30	0.02	99.10	75.57
Monte Rossi	18MR01	7 / 1 .	37.09	0.04	0.01	22.59	0.42	0.05	38.05	0.28	<0.01	98.53	75.02
Monte Rossi	18MR01	7 / 2 .	37.31	0.03	<0.01	22.86	0.39	0.05	38.46	0.34	0.02	99.46	74.99
Monte Rossi	18MR01	7 / 3 .	37.08	0.02	<0.01	23.86	0.44	0.02	37.32	0.31	0.03	99.09	73.60
Monte Rossi	18MR01	8 / 1 .	37.33	0.02	<0.01	22.20	0.41	0.03	38.55	0.30	0.01	98.86	75.58
Monte Rossi	18MR01	8 / 2 .	37.36	0.03	0.01	22.39	0.42	0.05	38.55	0.29	0.02	99.14	75.43
Monte Rossi	18MR01	8 / 3 .	37.04	0.03	<0.01	22.45	0.43	0.07	38.19	0.32	0.03	98.56	75.20
Monte Rossi	18MR01	8 / 4 .	37.47	0.03	<0.01	22.44	0.44	0.05	38.57	0.30	0.03	99.33	75.39
Monte Rossi	18MR01	8 / 5 .	37.63	0.05	0.01	22.44	0.41	0.06	38.46	0.31	0.03	99.41	75.34
Monte Rossi	18MR01	8 / 6 .	37.24	0.03	<0.01	22.49	0.40	0.05	38.56	0.32	0.02	99.12	75.35
Monte Rossi	18MR01	8 / 7 .	37.42	0.04	<0.01	22.68	0.44	0.04	38.65	0.29	0.04	99.61	75.23
Monte Rossi	18MR01	8 / 8 .	37.50	0.03	<0.01	22.52	0.43	0.03	38.41	0.34	0.02	99.29	75.25
Monte Rossi	18MR01	8 / 9 .	37.35	0.04	<0.01	22.56	0.40	0.05	38.13	0.33	0.02	98.87	75.08
Monte Rossi	18MR01	8 / 10 .	37.36	0.04	<0.01	22.54	0.42	0.08	38.59	0.33	0.03	99.40	75.33
Monte Rossi	18MR01	8 / 11 .	37.32	0.03	<0.01	22.40	0.42	0.06	38.70	0.28	0.03	99.24	75.49
Monte Rossi	18MR01	8 / 12 .	37.26	0.02	0.01	22.65	0.35	0.05	38.52	0.31	0.01	99.20	75.20
Monte Rossi	18MR01	8 / 13 .	37.28	0.04	<0.01	22.85	0.44	0.04	38.24	0.29	<0.01	99.21	74.90
Monte Rossi	18MR01	8 / 14 .	37.21	0.04	<0.01	23.26	0.45	0.05	37.64	0.30	0.02	98.99	74.26
Monte Rossi	18MR01	8 / 15 .	37.10	0.03	0.01	24.22	0.49	0.05	37.14	0.31	0.03	99.38	73.21
Monte Rossi	18MR01	8 / 16 .	36.83	0.04	<0.01	25.46	0.49	0.01	36.13	0.29	0.02	99.28	71.67
Monte Rossi	18MR01	8 / 17 .	36.56	0.03	<0.01	26.64	0.52	0.04	34.96	0.31	<0.01	99.07	70.05
Monte Rossi	18MR01	8 / 18 .	36.42	0.02	<0.01	27.88	0.62	0.02	33.81	0.34	0.03	99.17	68.37
Monte Rossi	18MR01	8 / 19 .	35.80	0.10	<0.01	30.45	0.66	0.02	31.73	0.40	0.03	99.21	65.01
Monte Rossi	18MR01	21 / 1 .	37.26	0.02	<0.01	22.76	0.42	0.02	38.64	0.29	0.03	99.47	75.16
Monte Rossi	18MR01	22 / 1 .	36.98	0.03	<0.01	22.71	0.45	0.05	38.19	0.33	<0.01	98.78	74.98
Monte Rossi	18MR01	23 / 1 .	37.17	0.02	<0.01	22.58	0.43	0.04	37.89	0.36	0.03	98.56	74.94
Monte Rossi	18MR01	24 / 1 .	36.62	0.01	<0.01	26.03	0.51	0.03	35.38	0.34	0.03	98.98	70.78
Monte Rossi	18MR01	25 / 1 .	37.14	0.04	<0.01	22.61	0.43	0.05	38.55	0.30	0.02	99.16	75.24
Monte Rossi	18MR01	36 / 1 .	37.34	0.04	<0.01	22.88	0.45	0.05	38.39	0.29	0.02	99.48	74.95
Monte Rossi	18MR01	37 / 1 .	37.46	0.05	<0.01	22.97	0.37	0.06	38.24	0.32	0.02	99.50	74.80
Monte Rossi	18MR01	38 / 1 .	37.32	0.02	<0.01	22.52	0.43	0.05	38.42	0.34	0.02	99.12	75.26
Monte Rossi	18MR01	39 / 1 .	37.58	0.04	<0.01	22.68	0.44	0.04	37.91	0.28	0.03	99.00	74.88
Monte Rossi	18MR01	40 / 1 .	37.30	0.02	<0.01	22.86	0.43	0.06	38.28	0.30	0.02	99.27	74.91
Monte Rossi	18MR01	41 / 1 .	37.35	0.02	<0.01	22.89	0.41	0.05	38.13	0.30	0.02	99.17	74.81
Monte Rossi	18MR01	41 / 2 .	37.29	0.04	<0.01	22.96	0.40	0.04	38.07	0.34	0.02	99.17	74.72
Monte Rossi	18MR01	41 / 3 .	37.22	0.02	<0.01	22.85	0.41	0.04	38.11	0.30	<0.01	98.97	74.83
Monte Rossi	18MR01	41 / 4 .	37.13	0.03	<0.01	22.94	0.42	0.03	38.23	0.33	<0.01	99.14	74.81
Monte Rossi	18MR01	41 / 5 .	37.18	0.03	<0.01	22.91	0.43	0.03	38.29	0.27	0.02	99.19	74.87
Monte Rossi	18MR01	41 / 6 .	37.28	0.04	<0.01	22.86	0.41	0.03	38.12	0.29	0.03	99.07	74.82

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Rossi	18MR01	41 / 7 .	37.42	0.03	<0.01	23.10	0.46	0.03	38.40	0.31	0.02	99.77	74.77
Monte Rossi	18MR01	41 / 8 .	37.70	0.04	<0.01	22.95	0.39	0.05	38.23	0.31	0.02	99.71	74.80
Monte Rossi	18MR01	41 / 9 .	37.16	0.02	0.01	23.07	0.44	0.04	38.04	0.30	0.02	99.12	74.62
Monte Rossi	18MR01	41 / 10 .	37.58	0.02	0.01	22.75	0.44	0.05	38.32	0.34	0.03	99.54	75.02
Monte Rossi	18MR01	41 / 11 .	37.50	0.04	<0.01	22.76	0.40	0.03	38.08	0.27	0.02	99.10	74.89
Monte Rossi	18MR01	41 / 12 .	37.46	0.02	0.02	22.78	0.46	0.05	38.33	0.31	0.02	99.46	75.00
Monte Rossi	18MR01	41 / 13 .	37.33	0.03	<0.01	22.71	0.41	0.05	38.49	0.31	0.01	99.35	75.13
Monte Rossi	18MR01	41 / 14 .	37.53	0.02	<0.01	23.15	0.43	0.04	37.79	0.29	0.03	99.29	74.42
Monte Rossi	18MR01	41 / 15 .	37.25	0.04	0.02	23.77	0.49	0.03	37.16	0.30	0.03	99.10	73.59
Monte Rossi	18MR01	41 / 16 .	36.59	0.02	<0.01	25.46	0.51	0.04	35.67	0.35	<0.01	98.63	71.41
Monte Rossi	18MR01	41 / 17 .	36.16	0.02	<0.01	27.49	0.55	0.03	33.61	0.36	0.05	98.29	68.55
Monte Rossi	18MR01	41 / 18 .	35.73	0.03	<0.01	30.59	0.59	0.02	31.44	0.44	0.05	98.89	64.69
Monte Rossi	18MR01	60 / 1 .	36.13	0.03	<0.01	31.92	0.71	<0.01	29.98	0.53	0.04	99.37	62.61
Monte Rossi	18MR01	73 / 1 .	37.07	0.03	<0.01	23.64	0.44	0.04	37.81	0.35	0.05	99.42	74.03
Monte Rossi	18MR01	74 / 1 .	36.86	0.05	<0.01	26.40	0.55	0.03	34.97	0.30	0.02	99.19	70.25
Monte Rossi	18MR01	75 / 1 .	37.28	0.02	<0.01	23.62	0.43	0.05	37.55	0.33	0.02	99.32	73.91
Monte Rossi	18MR01	76 / 1 .	37.29	0.03	<0.01	23.85	0.49	0.02	37.37	0.34	0.02	99.42	73.64
Monte Rossi	18MR01	77 / 1 .	37.21	0.02	0.02	25.65	0.52	0.04	35.99	0.35	0.07	99.88	71.44
Monte Rossi	18MR01	78 / 1 .	36.09	0.02	0.01	30.20	0.63	0.03	32.32	0.38	0.18	99.85	65.61
Monte Rossi	18MR01	79 / 1 .	36.36	0.03	<0.01	28.38	0.58	0.03	33.38	0.33	0.05	99.14	67.71
Monte Rossi	18MR01	80 / 1 .	37.33	0.03	<0.01	24.76	0.56	0.05	36.41	0.40	0.01	99.56	72.38
Monte Rossi	18MR01	81 / 1 .	36.96	0.04	<0.01	26.20	0.59	0.04	35.70	0.37	0.03	99.95	70.84
Monte Rossi	18MR01	82 / 1 .	37.19	0.03	<0.01	24.59	0.54	0.04	36.34	0.39	0.02	99.16	72.48
Monte Rossi	18MR01	83 / 1 .	36.83	0.01	<0.01	27.30	0.59	0.02	34.10	0.33	0.03	99.22	69.01
Monte Rossi	18MR01	84 / 2 .	37.29	0.02	<0.01	24.30	0.50	0.02	37.12	0.34	0.02	99.64	73.14
Monte Rossi	18MR01	84 / 3 .	37.31	0.04	<0.01	24.01	0.46	0.03	37.32	0.36	0.04	99.57	73.48
Monte Rossi	18MR01	84 / 4 .	37.35	0.03	<0.01	24.12	0.47	0.04	37.37	0.33	0.02	99.76	73.41
Monte Rossi	18MR01	84 / 5 .	37.51	0.03	<0.01	23.88	0.44	0.02	37.38	0.37	0.03	99.67	73.62
Monte Rossi	18MR01	84 / 6 .	37.36	0.03	<0.01	24.01	0.46	0.04	37.57	0.36	0.03	99.86	73.61
Monte Rossi	18MR01	84 / 7 .	37.63	0.02	<0.01	23.64	0.48	0.03	37.46	0.37	0.04	99.69	73.85
Monte Rossi	18MR01	84 / 8 .	37.64	0.02	<0.01	23.55	0.45	0.06	37.83	0.34	<0.01	99.88	74.11
Monte Rossi	18MR01	84 / 9 .	37.61	0.03	<0.01	23.64	0.48	0.05	37.81	0.36	0.01	100.01	74.03
Monte Rossi	18MR01	84 / 10 .	37.71	0.02	<0.01	23.24	0.46	0.04	37.77	0.34	0.03	99.62	74.34
Monte Rossi	18MR01	84 / 11 .	37.80	0.03	<0.01	23.39	0.47	0.04	37.96	0.39	0.02	100.10	74.31
Monte Rossi	18MR01	84 / 12 .	37.97	0.02	0.01	23.17	0.43	0.03	37.72	0.34	0.03	99.73	74.37
Monte Rossi	18MR01	84 / 13 .	38.02	0.03	<0.01	23.03	0.43	0.03	38.10	0.34	0.02	100.02	74.68
Monte Rossi	18MR01	84 / 14 .	37.68	0.03	<0.01	23.17	0.49	0.02	37.86	0.32	0.02	99.60	74.45
Monte Rossi	18MR01	84 / 15 .	37.78	0.03	<0.01	23.10	0.46	0.05	38.27	0.32	0.03	100.04	74.71
Monte Rossi	18MR01	84 / 16 .	37.79	0.03	<0.01	23.16	0.43	0.03	37.79	0.32	0.03	99.61	74.41
Monte Rossi	18MR01	84 / 17 .	38.00	0.03	<0.01	23.69	0.47	0.05	37.31	0.31	0.02	99.89	73.74
Monte Rossi	18MR01	84 / 18 .	37.46	0.02	<0.01	24.90	0.51	0.02	36.19	0.28	0.03	99.41	72.15
Monte Rossi	18MR01	84 / 19 .	37.25	0.03	<0.01	26.46	0.53	0.04	35.15	0.31	0.01	99.82	70.31
Monte Rossi	18MR01	84 / 20 .	36.66	0.02	<0.01	29.04	0.58	0.03	33.01	0.37	0.02	99.74	66.96
Monte Rossi	18MR01	102 / 1 .	37.97	0.03	<0.01	23.04	0.47	0.04	38.03	0.33	0.02	99.93	74.64
Monte Rossi	18MR01	103 / 1 .	37.63	0.02	<0.01	22.72	0.42	0.06	38.26	0.30	0.02	99.44	75.01
Monte Rossi	18MR01	104 / 1 .	37.65	0.03	<0.01	22.52	0.44	0.04	38.57	0.34	0.02	99.61	75.33
Monte Rossi	18MR01	105 / 1 .	37.29	0.03	<0.01	24.74	0.45	0.04	36.33	0.31	<0.01	99.19	72.36

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Rossi	18MR01	106 / 1 .	37.61	0.03	<0.01	23.84	0.45	0.06	37.23	0.29	0.02	99.53	73.57
Monte Rossi	18MR01	107 / 1 .	37.55	0.02	<0.01	23.31	0.44	0.04	37.91	0.31	0.04	99.63	74.36
Monte Rossi	18MR01	108 / 1 .	36.87	0.06	<0.01	26.85	0.58	0.04	35.04	0.32	0.07	99.83	69.94
Monte Rossi	18MR01	109 / 1 .	37.99	0.02	<0.01	22.94	0.40	0.04	38.21	0.32	0.01	99.94	74.81
Monte Rossi	18MR01	109 / 2 .	37.63	0.02	<0.01	22.84	0.40	0.05	37.90	0.32	0.02	99.19	74.73
Monte Rossi	18MR01	109 / 3 .	37.78	0.02	0.01	22.93	0.44	0.03	38.37	0.31	<0.01	99.93	74.89
Monte Rossi	18MR01	109 / 4 .	37.73	0.01	<0.01	22.79	0.44	0.06	38.34	0.34	0.02	99.74	75.00
Monte Rossi	18MR01	109 / 5 .	37.69	0.02	<0.01	22.94	0.42	0.05	38.39	0.31	0.01	99.85	74.89
Monte Rossi	18MR01	109 / 6 .	37.82	0.03	0.02	23.07	0.41	0.04	37.97	0.32	0.02	99.70	74.58
Monte Rossi	18MR01	109 / 7 .	37.80	0.02	<0.01	22.87	0.41	0.05	37.94	0.29	0.03	99.42	74.73
Monte Rossi	18MR01	109 / 8 .	37.79	0.03	<0.01	22.68	0.44	0.05	38.10	0.27	0.02	99.38	74.97
Monte Rossi	18MR01	109 / 9 .	37.80	0.03	<0.01	22.77	0.39	0.06	38.31	0.31	<0.01	99.69	74.99
Monte Rossi	18MR01	109 / 10 .	37.80	0.02	0.02	22.85	0.44	0.05	37.99	0.33	0.01	99.50	74.77
Monte Rossi	18MR01	109 / 11 .	37.65	0.04	<0.01	23.05	0.44	0.04	38.16	0.34	<0.01	99.74	74.69
Monte Rossi	18MR01	109 / 12 .	37.84	0.02	<0.01	22.84	0.47	0.05	38.12	0.30	0.01	99.68	74.84
Monte Rossi	18MR01	109 / 13 .	37.65	0.03	0.01	23.07	0.44	0.06	38.14	0.32	0.02	99.73	74.66
Monte Rossi	18MR01	109 / 14 .	37.83	<0.01	<0.01	23.11	0.45	0.05	38.14	0.31	<0.01	99.91	74.63
Monte Rossi	18MR01	109 / 15 .	38.05	0.02	<0.01	23.04	0.45	0.05	38.23	0.32	<0.01	100.19	74.74
Monte Rossi	18MR01	109 / 16 .	37.63	0.04	<0.01	23.05	0.42	0.03	38.16	0.31	<0.01	99.64	74.69
Monte Rossi	18MR01	109 / 17 .	37.43	0.02	<0.01	23.29	0.50	0.05	37.98	0.33	0.01	99.61	74.41
Monte Rossi	18MR01	109 / 18 .	37.90	0.04	<0.01	23.67	0.48	0.03	37.26	0.30	0.03	99.72	73.73
Monte Rossi	18MR01	109 / 19 .	37.49	0.03	<0.01	24.56	0.49	0.05	36.65	0.31	0.01	99.60	72.68
Monte Rossi	18MR01	109 / 20 .	37.05	0.04	0.01	25.76	0.54	0.04	35.50	0.29	0.01	99.25	71.07
Monte Rossi	18MR01	109 / 21 .	36.90	0.02	<0.01	27.12	0.58	<0.01	34.56	0.30	<0.01	99.51	69.43
Monte Rossi	18MR01	109 / 22 .	36.65	0.01	<0.01	28.46	0.61	0.03	32.61	0.38	0.01	98.79	67.13
Monte Rossi	18MR01	109 / 23 .	36.24	0.02	<0.01	31.80	0.72	0.03	30.64	0.41	0.02	99.91	63.20
Monte Rossi	18MR02	62_1 .	37.91	0.02	<0.01	23.12	0.41	0.05	38.52	0.34	0.01	100.39	74.82
Monte Rossi	18MR02	63_1 .	37.64	0.03	<0.01	22.95	0.44	0.07	38.59	0.33	<0.01	100.06	74.98
Monte Rossi	18MR02	64_1 .	38.03	0.02	<0.01	23.22	0.45	0.04	38.18	0.35	0.01	100.32	74.56
Monte Rossi	18MR02	65_1 .	37.99	0.04	0.01	22.69	0.43	0.08	38.74	0.34	0.01	100.32	75.27
Monte Rossi	18MR02	66_1 .	37.96	0.03	<0.01	22.91	0.40	0.03	38.66	0.31	0.02	100.34	75.05
Monte Rossi	18MR02	66_2 .	37.92	0.02	<0.01	22.93	0.39	0.03	38.91	0.31	0.01	100.55	75.15
Monte Rossi	18MR02	66_3 .	38.23	0.03	<0.01	22.89	0.41	0.05	38.78	0.33	0.02	100.73	75.12
Monte Rossi	18MR02	66_4 .	37.88	0.02	<0.01	23.00	0.42	0.02	38.79	0.32	0.01	100.47	75.04
Monte Rossi	18MR02	66_5 .	37.91	0.02	<0.01	23.52	0.41	0.05	38.30	0.31	0.01	100.55	74.37
Monte Rossi	18MR02	66_6 .	37.81	0.03	<0.01	24.20	0.45	0.03	37.18	0.32	0.03	100.06	73.25
Monte Rossi	18MR02	66_7 .	37.59	0.02	<0.01	25.33	0.50	0.05	36.49	0.31	0.02	100.31	71.98
Monte Rossi	18MR02	66_8 .	37.25	0.02	<0.01	26.33	0.58	0.01	35.48	0.32	0.01	100.02	70.61
Monte Rossi	18MR02	66_9 .	36.93	0.03	<0.01	27.44	0.53	<0.01	34.81	0.33	0.02	100.12	69.34
Monte Rossi	18MR02	66_10 .	36.49	0.03	<0.01	29.25	0.61	<0.01	32.82	0.38	0.03	99.62	66.67
Monte Rossi	18MR02	66_11 .	35.96	0.03	<0.01	31.11	0.70	<0.01	30.86	0.44	0.04	99.13	63.87
Monte Rossi	18MR02	70_1 .	37.27	0.04	<0.01	24.64	0.45	0.05	37.21	0.30	0.02	99.98	72.92
Monte Rossi	18MR02	71_1 .	36.46	0.03	<0.01	29.25	0.61	0.03	33.00	0.34	0.02	99.74	66.79
Monte Rossi	18MR02	72_1 .	37.12	0.03	<0.01	25.90	0.50	0.04	35.73	0.30	0.02	99.64	71.09
Monte Rossi	18MR02	72_2 .	36.75	0.02	<0.01	26.75	0.52	0.03	35.43	0.30	0.01	99.83	70.25
Monte Rossi	18MR02	72_3 .	37.12	0.03	<0.01	27.42	0.57	<0.01	34.60	0.30	0.02	100.07	69.22
Monte Rossi	18MR02	72_4 .	36.68	0.03	0.01	27.95	0.56	0.02	34.36	0.31	0.02	99.95	68.67

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Rossi	18MR02	72_5 .	36.36	0.02	<0.01	28.52	0.62	<0.01	33.79	0.35	0.03	99.69	67.87
Monte Rossi	18MR02	72_6 .	36.20	0.02	<0.01	29.59	0.63	<0.01	32.94	0.35	0.02	99.77	66.49
Monte Rossi	18MR02	72_7 .	35.96	0.03	<0.01	30.63	0.64	0.02	31.94	0.38	0.01	99.63	65.02
Monte Rossi	18MR02	72_8 .	35.76	0.02	<0.01	32.28	0.70	0.02	30.61	0.40	0.02	99.83	62.83
Monte Rossi	18MR02	72_9 .	35.20	0.01	<0.01	35.72	0.79	0.01	27.55	0.50	0.04	99.83	57.89
Monte Rossi	18MR02	74_1 .	38.30	0.03	<0.01	19.63	0.29	0.06	40.53	0.20	0.01	99.06	78.64
Monte Rossi	18MR02	75_1 .	37.87	0.03	<0.01	20.40	0.30	0.07	39.62	0.22	0.01	98.53	77.59
Monte Rossi	18MR02	76_1 .	38.33	0.02	<0.01	19.74	0.32	0.09	40.46	0.20	0.02	99.19	78.51
Monte Rossi	18MR02	77_1 .	37.88	0.03	<0.01	20.46	0.36	0.08	39.65	0.18	0.01	98.66	77.55
Monte Rossi	18MR02	78_1 .	37.48	0.02	<0.01	23.35	0.42	0.07	37.16	0.28	0.02	98.81	73.94
Monte Rossi	18MR02	78_2 .	37.56	0.02	<0.01	24.37	0.48	0.02	35.83	0.30	0.02	98.60	72.38
Monte Rossi	18MR02	78_3 .	36.76	0.03	<0.01	25.38	0.50	0.04	35.37	0.31	0.02	98.41	71.30
Monte Rossi	18MR02	78_4 .	36.78	0.02	<0.01	26.57	0.53	0.02	34.27	0.31	0.02	98.52	69.69
Monte Rossi	18MR02	78_5 .	36.61	0.03	<0.01	27.73	0.58	<0.01	33.40	0.32	0.02	98.73	68.22
Monte Rossi	18MR02	78_6 .	36.27	0.03	<0.01	28.80	0.64	0.04	32.12	0.38	0.03	98.31	66.54
Monte Rossi	18MR02	78_7 .	35.87	0.02	<0.01	31.29	0.66	0.01	29.69	0.39	0.03	97.96	62.84
Monte Rossi	18MR02	78_8 .	34.74	0.02	<0.01	36.39	0.87	0.02	25.27	0.44	0.05	97.81	55.32
Monte Rossi	18MR02	85_1 .	37.90	0.02	<0.01	22.86	0.40	0.04	38.73	0.34	0.02	100.34	75.13
Monte Rossi	18MR02	86_1 .	37.83	0.02	<0.01	23.01	0.44	0.05	38.67	0.32	0.03	100.38	74.98
Monte Rossi	18MR02	87_1 .	37.76	0.03	<0.01	22.83	0.42	0.01	38.55	0.34	0.02	99.97	75.07
Monte Rossi	18MR02	88_1 .	37.43	0.02	<0.01	22.88	0.43	0.03	38.72	0.32	0.02	99.85	75.10
Monte Rossi	18MR02	89_1 .	37.80	0.03	<0.01	22.79	0.45	0.05	38.61	0.32	0.02	100.07	75.12
Monte Rossi	18MR02	89_2 .	37.70	0.03	<0.01	22.91	0.43	0.04	38.50	0.33	0.02	99.97	74.97
Monte Rossi	18MR02	89_3 .	37.84	0.02	<0.01	22.88	0.47	0.09	38.55	0.32	0.02	100.21	75.02
Monte Rossi	18MR02	89_4 .	37.77	0.02	<0.01	23.25	0.45	0.04	38.28	0.32	0.02	100.16	74.59
Monte Rossi	18MR02	89_5 .	37.80	0.02	<0.01	23.96	0.45	<0.01	37.86	0.31	0.01	100.42	73.80
Monte Rossi	18MR02	89_6 .	37.26	0.03	<0.01	25.57	0.50	0.03	36.31	0.31	0.02	100.04	71.68
Monte Rossi	18MR02	89_7 .	36.73	0.02	<0.01	28.10	0.61	0.02	34.05	0.35	0.03	99.92	68.36
Monte Rossi	18MR02	89_8 .	36.84	0.29	<0.01	32.76	0.69	0.03	29.28	0.56	0.05	100.67	61.44
Monte Rossi	18MR02	109_1 .	35.95	0.02	<0.01	31.68	0.66	0.02	30.90	0.43	0.04	99.73	63.49
Monte Rossi	18MR02	110_1 .	36.48	0.02	<0.01	29.02	0.62	0.02	33.02	0.36	0.03	99.57	66.98
Monte Rossi	18MR02	111_1 .	37.48	0.02	<0.01	23.25	0.48	0.02	38.32	0.34	0.03	99.95	74.61
Monte Rossi	18MR02	112_1 .	37.48	0.03	<0.01	25.09	0.47	0.04	36.91	0.33	0.02	100.39	72.40
Monte Rossi	18MR02	116_1 .	37.68	0.03	<0.01	23.27	0.46	0.03	38.10	0.31	0.01	99.90	74.49
Monte Rossi	18MR02	117_1 .	36.13	0.03	<0.01	31.13	0.70	0.06	31.03	0.47	0.03	99.60	63.99
Monte Rossi	18MR03	1_1 .	36.99	0.02	<0.01	23.40	0.44	0.05	38.52	0.32	<0.01	99.79	74.58
Monte Rossi	18MR03	2_1 .	37.85	0.03	<0.01	23.12	0.41	0.07	38.73	0.32	<0.01	100.54	74.91
Monte Rossi	18MR03	3_1 .	37.97	0.03	<0.01	22.21	0.39	0.05	38.86	0.32	0.02	99.85	75.72
Monte Rossi	18MR03	4_1 .	37.43	0.02	<0.01	25.11	0.50	0.03	36.67	0.32	0.02	100.10	72.24
Monte Rossi	18MR03	4_2 .	37.04	0.03	<0.01	27.32	0.53	<0.01	34.42	0.36	0.03	99.74	69.20
Monte Rossi	18MR03	4_3 .	36.32	0.03	<0.01	29.67	0.67	0.02	32.30	0.38	0.04	99.45	66.00
Monte Rossi	18MR03	4_4 .	34.98	0.44	<0.01	37.47	0.96	<0.01	24.55	0.48	0.09	98.99	53.87
Monte Rossi	18MR03	9_1 .	37.36	0.02	<0.01	24.08	0.46	0.06	37.38	0.35	<0.01	99.73	73.45
Monte Rossi	18MR03	10_1 .	37.52	0.03	<0.01	24.40	0.46	0.06	37.63	0.30	0.02	100.42	73.33
Monte Rossi	18MR03	11_1 .	37.37	0.02	<0.01	24.09	0.48	<0.01	37.48	0.29	0.02	99.76	73.50
Monte Rossi	18MR03	12_1 .	37.46	0.04	<0.01	24.23	0.46	0.05	37.46	0.34	0.02	100.07	73.37
Monte Rossi	18MR03	19_1 .	37.85	0.02	<0.01	22.65	0.44	0.09	38.70	0.32	0.03	100.12	75.28

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Monte Rossi	18MR03	20_1 .	37.87	0.03	<0.01	22.83	0.47	0.06	38.63	0.29	0.02	100.20	75.10
Monte Rossi	18MR03	21_1 .	37.87	0.03	<0.01	22.92	0.42	0.05	38.96	0.31	<0.01	100.60	75.19
Monte Rossi	18MR03	22_1 .	37.75	0.02	<0.01	23.14	0.44	0.04	38.51	0.31	0.02	100.23	74.79
Monte Rossi	18MR03	23_1 .	37.66	0.03	<0.01	23.52	0.48	0.05	38.25	0.31	0.02	100.33	74.35
Monte Rossi	18MR03	24_1 .	37.96	0.02	<0.01	22.57	0.40	0.03	38.88	0.30	0.01	100.17	75.43
Monte Rossi	18MR03	25_1 .	37.94	0.04	<0.01	22.65	0.45	0.07	38.91	0.33	0.01	100.40	75.38
Monte Rossi	18MR03	26_1 .	37.72	0.02	<0.01	22.55	0.41	0.06	39.21	0.30	0.02	100.29	75.61
Monte Rossi	18MR03	26_2 .	38.00	0.03	<0.01	22.50	0.40	0.04	39.29	0.30	0.02	100.58	75.69
Monte Rossi	18MR03	26_3 .	38.00	0.03	<0.01	22.53	0.47	0.05	38.99	0.30	0.02	100.39	75.52
Monte Rossi	18MR03	26_4 .	37.96	0.03	<0.01	22.63	0.44	0.04	38.90	0.30	<0.01	100.30	75.39
Monte Rossi	18MR03	26_5 .	37.84	0.03	<0.01	22.50	0.45	0.02	38.71	0.33	0.01	99.90	75.41
Monte Rossi	18MR03	26_6 .	37.90	0.02	<0.01	22.55	0.41	0.04	38.89	0.31	0.01	100.16	75.46
Monte Rossi	18MR03	26_7 .	37.96	0.03	<0.01	22.62	0.42	0.05	38.83	0.32	0.02	100.26	75.36
Monte Rossi	18MR03	26_8 .	38.04	0.02	<0.01	22.80	0.47	0.07	38.90	0.31	0.02	100.63	75.26
Monte Rossi	18MR03	26_9 .	37.95	0.02	<0.01	22.65	0.40	0.05	38.59	0.32	0.02	100.02	75.23
Monte Rossi	18MR03	26_10 .	37.82	0.03	<0.01	23.26	0.43	0.04	38.67	0.31	0.02	100.58	74.77
Monte Rossi	18MR03	26_11 .	37.70	0.03	<0.01	23.33	0.47	0.05	38.09	0.31	0.02	100.00	74.43
Monte Rossi	18MR03	26_12 .	37.40	0.02	<0.01	24.62	0.53	0.02	37.31	0.33	0.04	100.30	72.98
Monte Rossi	18MR03	26_13 .	37.03	0.02	<0.01	26.87	0.56	0.02	34.90	0.36	0.03	99.80	69.84
Monte Rossi	18MR03	26_14 .	36.31	0.03	<0.01	29.97	0.66	<0.01	31.73	0.46	0.06	99.25	65.36
Monte Rossi	18MR03	45_1 .	37.78	0.02	<0.01	23.62	0.43	0.06	38.27	0.30	0.02	100.50	74.28
Monte Rossi	18MR03	46_1 .	37.64	0.03	<0.01	23.54	0.45	0.06	38.35	0.32	<0.01	100.41	74.39
Monte Rossi	18MR03	47_1 .	37.50	0.03	<0.01	24.51	0.47	0.03	36.85	0.40	0.03	99.82	72.83
Monte Rossi	18MR03	48_1 .	37.91	0.04	<0.01	23.00	0.44	0.03	38.34	0.34	0.03	100.13	74.83
Monte Rossi	18MR03	49_1 .	36.90	0.02	<0.01	27.27	0.55	0.02	34.38	0.36	0.05	99.57	69.21
Monte Rossi	18MR03	49_2 .	35.88	0.13	<0.01	31.74	0.76	0.02	30.50	0.45	0.08	99.57	63.14
Monte Rossi	18MR03	84_1 .	37.92	0.03	<0.01	24.53	0.52	0.05	36.29	0.33	0.02	99.69	72.51
Monte Rossi	18MR03	85_1 .	38.28	0.03	<0.01	22.99	0.43	0.05	37.50	0.29	0.02	99.59	74.41
Monte Rossi	18MR03	86_1 .	38.10	0.04	0.01	23.20	0.44	0.06	37.47	0.30	<0.01	99.63	74.22
Monte Rossi	18MR03	87_1 .	38.09	0.03	<0.01	23.18	0.45	0.03	37.41	0.26	<0.01	99.46	74.20
Monte Rossi	18MR03	112_1 .	37.80	0.03	0.01	24.08	0.48	0.02	36.23	0.37	0.04	99.08	72.84
Monte Rossi	18MR03	113_1 .	37.79	0.03	<0.01	24.05	0.47	0.04	36.78	0.33	0.04	99.55	73.16
Monte Rossi	18MR03	114_1 .	35.52	0.03	<0.01	35.15	0.78	0.01	26.74	0.43	0.06	98.73	57.55
Monte Rossi	18MR03	115_1 .	38.08	<0.01	<0.01	23.62	0.46	0.05	36.98	0.33	0.02	99.55	73.62
Monte Rossi	18MR03	116_1 .	35.91	0.03	<0.01	32.43	0.70	0.04	29.55	0.43	0.10	99.22	61.89
Monte Rossi	18MR03	117_1 .	34.28	0.03	<0.01	39.66	1.00	<0.01	22.46	0.58	0.09	98.15	50.24
Monte Rossi	18MR03	118_1 .	38.09	0.02	<0.01	23.32	0.47	0.03	36.93	0.35	0.05	99.26	73.84
Monte Rossi	18MR03	125_1 .	38.17	0.02	<0.01	22.61	0.44	0.06	38.16	0.31	0.02	99.79	75.06
Monte Rossi	18MR03	126_1 .	38.20	0.04	<0.01	22.92	0.43	0.04	37.92	0.32	0.03	99.90	74.68
Monte Rossi	18MR03	127_1 .	35.72	0.02	<0.01	33.57	0.75	0.01	28.47	0.45	0.03	99.02	60.19
Monte Rossi	18MR03	128_1 .	38.17	0.04	<0.01	23.14	0.46	0.03	37.43	0.31	0.05	99.66	74.25
Monte Rossi	18MR03	129_1 .	38.19	0.03	<0.01	22.94	0.45	0.04	37.69	0.30	<0.01	99.66	74.55
Monte Rossi	18MR03	130_1 .	36.20	0.02	<0.01	31.36	0.68	0.02	30.32	0.34	0.04	98.99	63.28
Mounts de Fiore	18MF01	1_1 .	39.39	0.03	<0.01	18.25	0.31	0.09	41.55	0.32	0.02	99.96	80.23
Mounts de Fiore	18MF01	2_1 .	37.45	0.05	<0.01	26.55	0.59	<0.01	34.49	0.47	0.08	99.75	69.84
Mounts de Fiore	18MF01	3_1 .	38.96	0.04	<0.01	20.04	0.36	0.04	40.14	0.34	<0.01	99.93	78.12
Mounts de Fiore	18MF01	4_1 .	38.49	0.03	<0.01	23.54	0.48	0.02	37.05	0.40	0.04	100.05	73.73

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Mounts de Fiore	18MF01	5_1 .	39.01	0.02	0.02	17.91	0.31	0.06	41.72	0.27	0.02	99.35	80.59
Mounts de Fiore	18MF01	6_1 .	39.74	0.01	<0.01	17.04	0.28	0.06	42.66	0.25	0.01	100.05	81.69
Mounts de Fiore	18MF01	7_1 .	39.60	0.02	<0.01	17.21	0.29	0.10	42.86	0.27	<0.01	100.35	81.62
Mounts de Fiore	18MF01	8_1 .	39.52	0.02	0.01	18.04	0.32	0.09	41.70	0.28	0.03	100.02	80.47
Mounts de Fiore	18MF01	9_1 .	39.72	0.02	<0.01	17.33	0.30	0.11	42.54	0.28	<0.01	100.29	81.40
Mounts de Fiore	18MF01	10_1 .	39.32	0.02	<0.01	18.58	0.33	0.05	41.54	0.33	<0.01	100.19	79.94
Mounts de Fiore	18MF01	11_1 .	39.63	0.02	<0.01	17.76	0.30	0.08	42.00	0.26	0.03	100.08	80.82
Mounts de Fiore	18MF01	12_1 .	37.74	0.04	0.01	24.79	0.53	<0.01	35.52	0.46	0.08	99.20	71.87
Mounts de Fiore	18MF01	13_1 .	37.30	0.05	<0.01	26.64	0.62	0.06	33.98	0.51	0.08	99.26	69.45
Mounts de Fiore	18MF01	14_1 .	36.96	0.07	0.01	27.35	0.65	0.02	33.25	0.56	0.07	99.00	68.43
Mounts de Fiore	18MF01	15_1 .	39.12	0.04	<0.01	18.82	0.32	0.06	41.16	0.33	0.02	99.91	79.59
Mounts de Fiore	18MF01	16_1 .	37.88	0.03	0.01	25.22	0.54	<0.01	35.64	0.52	0.02	99.91	71.58
Mounts de Fiore	18MF01	33_1 .	39.44	0.02	0.02	17.73	0.31	0.11	42.29	0.29	0.01	100.20	80.96
Mounts de Fiore	18MF01	34_1 .	39.25	0.02	<0.01	18.86	0.34	0.06	41.30	0.35	<0.01	100.20	79.61
Mounts de Fiore	18MF01	35_1 .	38.70	0.03	<0.01	21.21	0.39	0.06	39.42	0.30	0.02	100.13	76.81
Mounts de Fiore	18MF01	36_1 .	38.57	0.02	<0.01	21.77	0.42	0.06	39.20	0.35	<0.01	100.39	76.25
Mounts de Fiore	18MF01	37_1 .	38.49	0.02	0.01	22.75	0.45	0.07	37.87	0.36	0.01	100.00	74.80
Mounts de Fiore	18MF01	38_1 .	38.07	0.02	<0.01	23.93	0.50	0.06	37.01	0.30	<0.01	99.89	73.38
Mounts de Fiore	18MF01	39_1 .	39.24	0.02	<0.01	17.70	0.29	0.09	42.14	0.31	0.03	99.81	80.93
Mounts de Fiore	18MF01	43_1 .	38.13	0.02	<0.01	24.27	0.52	<0.01	36.50	0.21	0.02	99.70	72.84
Mounts de Fiore	18MF01	44_1 .	38.57	0.01	<0.01	21.31	0.39	0.03	39.21	0.31	<0.01	99.82	76.64
Mounts de Fiore	18MF01	45_1 .	39.02	<0.01	<0.01	20.23	0.38	0.03	39.89	0.29	0.02	99.88	77.85
Mounts de Fiore	18MF01	46_1 .	39.30	0.03	0.01	17.44	0.29	0.09	42.12	0.29	0.03	99.60	81.15
Mounts de Fiore	18MF01	47_1 .	39.64	0.01	<0.01	17.28	0.29	0.08	42.53	0.25	0.02	100.11	81.44
Mounts de Fiore	18MF01	48_1 .	38.08	0.03	<0.01	24.27	0.48	<0.01	36.74	0.29	<0.01	99.90	72.96
Mounts de Fiore	18MF01	49_1 .	38.21	0.01	<0.01	23.67	0.47	0.04	36.87	0.30	0.03	99.61	73.52
Mounts de Fiore	18MF01	50_1 .	39.36	0.01	0.01	17.20	0.30	0.11	42.17	0.27	0.03	99.48	81.38
Mounts de Fiore	18MF01	51_1 .	38.92	0.02	<0.01	20.22	0.38	0.06	40.22	0.29	<0.01	100.11	78.00
Mounts de Fiore	18MF01	52_1 .	38.41	0.03	<0.01	23.45	0.47	0.05	37.22	0.38	0.03	100.06	73.88
Mounts de Fiore	18MF01	53_1 .	38.37	0.03	<0.01	22.82	0.44	0.02	37.63	0.38	0.05	99.77	74.62
Mounts de Fiore	18MF01	59_1 .	38.40	0.02	<0.01	22.89	0.45	0.05	37.74	0.25	<0.01	99.81	74.61
Mounts de Fiore	18MF01	60_1 .	38.26	0.02	<0.01	22.93	0.47	0.04	37.73	0.27	<0.01	99.76	74.57
Mounts de Fiore	18MF01	61_1 .	38.54	0.03	<0.01	22.44	0.47	0.05	37.82	0.27	<0.01	99.62	75.02
Mounts de Fiore	18MF01	62_1 .	39.44	0.01	0.02	17.93	0.32	0.08	42.02	0.28	0.03	100.13	80.68
Mounts de Fiore	18MF01	63_1 .	38.06	0.04	<0.01	23.76	0.49	0.03	37.03	0.43	0.05	99.92	73.53
Mounts de Fiore	18MF01	64_1 .	39.37	0.05	0.01	18.05	0.32	0.08	41.54	0.31	0.02	99.74	80.40
Mounts de Fiore	18MF01	68_1 .	37.82	0.04	<0.01	25.18	0.50	0.04	36.07	0.26	0.02	99.92	71.86
Mounts de Fiore	18MF01	69_1 .	37.78	0.05	<0.01	24.93	0.46	0.03	36.38	0.28	0.03	99.93	72.23
Mounts de Fiore	18MF01	70_1 .	37.57	0.03	<0.01	25.05	0.48	0.03	35.95	0.29	<0.01	99.39	71.89
Mounts de Fiore	18MF01	71_1 .	39.43	0.03	<0.01	17.03	0.27	0.08	42.81	0.25	<0.01	99.89	81.75
Mounts de Fiore	18MF01	72_1 .	39.35	0.02	<0.01	18.35	0.32	0.12	41.74	0.28	0.02	100.22	80.22
Mounts de Fiore	18MF01	73_1 .	38.26	0.04	<0.01	22.93	0.50	0.05	37.57	0.31	0.02	99.70	74.50
Mounts de Fiore	18MF01	74_1 .	38.81	0.02	0.01	19.20	0.35	0.07	41.13	0.28	0.01	99.92	79.25
Mounts de Fiore	18MF01	75_1 .	39.26	0.04	0.02	18.31	0.30	0.08	41.68	0.32	0.03	100.06	80.23
Mounts de Fiore	18MF01	76_1 .	39.23	0.03	0.01	18.19	0.32	0.07	41.36	0.30	<0.01	99.53	80.21
Mounts de Fiore	18MF01	77_1 .	37.32	0.05	<0.01	25.98	0.63	<0.01	34.30	0.49	0.05	98.87	70.18
Mounts de Fiore	18MF01	78_1 .	39.19	0.02	0.01	18.26	0.31	0.03	41.48	0.30	<0.01	99.59	80.20

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Mounts de Fiore	18MF01	79_1 .	37.81	0.04	<0.01	24.61	0.60	0.05	34.90	0.49	0.05	98.55	71.65
Mounts de Fiore	18MF01	80_1 .	38.37	0.02	<0.01	22.90	0.49	0.02	37.80	0.19	0.02	99.81	74.64
Mounts de Fiore	18MF01	81_1 .	38.45	0.02	<0.01	22.94	0.50	0.04	37.94	0.22	<0.01	100.10	74.67
Mounts de Fiore	18MF01	82_1 .	39.19	0.01	<0.01	19.20	0.35	0.06	40.78	0.28	0.01	99.90	79.11
Mounts de Fiore	18MF01	83_1 .	38.28	0.04	<0.01	22.74	0.48	0.03	37.36	0.37	0.05	99.37	74.55
Mounts de Fiore	18MF01	91_1 .	39.49	0.03	0.02	17.16	0.28	0.10	42.80	0.26	0.02	100.16	81.64
Mounts de Fiore	18MF01	92_1 .	39.50	0.03	0.02	17.47	0.28	0.10	42.42	0.26	0.04	100.12	81.23
Mounts de Fiore	18MF01	93_1 .	37.71	0.04	<0.01	25.07	0.50	0.04	35.41	0.41	0.03	99.21	71.58
Mounts de Fiore	18MF02	78_1 .	38.84	0.04	0.01	18.37	0.31	0.07	42.39	0.29	0.01	100.34	80.44
Mounts de Fiore	18MF02	79_1 .	38.72	0.02	<0.01	16.81	0.26	0.09	43.98	0.21	0.02	100.14	82.34
Mounts de Fiore	18MF02	80_1 .	38.38	0.02	<0.01	17.47	0.29	0.08	43.25	0.26	0.02	99.78	81.52
Mounts de Fiore	18MF02	81_1 .	38.50	0.03	<0.01	17.14	0.26	0.09	43.55	0.26	0.02	99.85	81.92
Mounts de Fiore	18MF02	82_1 .	38.42	0.03	<0.01	18.40	0.29	0.06	42.27	0.32	0.02	99.80	80.37
Mounts de Fiore	18MF02	83_1 .	38.41	0.04	0.01	18.87	0.32	0.05	42.25	0.30	0.02	100.30	79.96
Mounts de Fiore	18MF02	84_1 .	37.89	0.03	0.01	19.24	0.37	0.05	41.63	0.37	0.05	99.67	79.41
Mounts de Fiore	18MF02	85_1 .	37.91	0.02	<0.01	21.23	0.42	0.04	39.55	0.33	0.04	99.54	76.86
Mounts de Fiore	18MF02	86_1 .	38.24	0.02	<0.01	18.14	0.29	0.07	42.61	0.30	0.03	99.73	80.72
Mounts de Fiore	18MF02	87_1 .	38.39	0.04	<0.01	17.76	0.31	0.05	43.25	0.27	0.02	100.08	81.28
Mounts de Fiore	18MF02	87_2 .	38.29	0.02	<0.01	17.99	0.27	0.07	43.29	0.26	<0.01	100.20	81.09
Mounts de Fiore	18MF02	87_3 .	38.55	0.02	<0.01	17.53	0.30	0.08	42.70	0.30	0.01	99.51	81.28
Mounts de Fiore	18MF02	87_4 .	38.68	0.02	<0.01	17.80	0.28	0.08	43.20	0.31	0.03	100.39	81.23
Mounts de Fiore	18MF02	87_5 .	38.19	0.02	0.01	18.10	0.29	0.07	42.89	0.29	0.03	99.89	80.86
Mounts de Fiore	18MF02	87_6 .	38.17	0.02	0.01	18.55	0.34	0.05	42.25	0.30	0.04	99.74	80.24
Mounts de Fiore	18MF02	87_7 .	37.61	0.02	<0.01	20.64	0.39	0.04	40.52	0.36	0.04	99.64	77.78
Mounts de Fiore	18MF02	94_1 .	36.56	0.03	<0.01	25.22	0.54	0.04	36.39	0.36	0.05	99.19	72.01
Mounts de Fiore	18MF02	95_1 .	38.04	0.02	<0.01	18.96	0.31	0.06	42.04	0.24	0.02	99.70	79.81
Mounts de Fiore	18MF02	96_1 .	37.98	0.02	<0.01	18.92	0.34	0.08	41.99	0.26	0.02	99.61	79.82
Mounts de Fiore	18MF02	97_1 .	38.05	0.05	<0.01	18.95	0.32	0.06	41.68	0.25	0.02	99.38	79.68
Mounts de Fiore	18MF02	98_1 .	38.34	0.04	<0.01	18.58	0.31	0.06	42.53	0.24	0.02	100.12	80.31
Mounts de Fiore	18MF02	98_2 .	37.95	0.02	<0.01	18.73	0.32	0.07	42.29	0.26	0.02	99.66	80.09
Mounts de Fiore	18MF02	98_3 .	38.32	0.02	<0.01	18.69	0.29	0.07	42.23	0.24	0.01	99.88	80.11
Mounts de Fiore	18MF02	98_4 .	38.31	0.04	<0.01	18.50	0.28	0.08	42.16	0.21	0.03	99.62	80.25
Mounts de Fiore	18MF02	98_5 .	38.30	0.02	<0.01	18.76	0.27	0.09	42.09	0.26	0.02	99.83	80.00
Mounts de Fiore	18MF02	98_6 .	38.29	0.03	<0.01	18.92	0.31	0.08	42.11	0.25	0.03	100.04	79.87
Mounts de Fiore	18MF02	98_7 .	37.84	0.03	<0.01	20.75	0.39	0.06	39.85	0.29	0.04	99.25	77.40
Mounts de Fiore	18MF02	99_1 .	38.24	0.02	<0.01	17.39	0.29	0.06	42.93	0.27	<0.01	99.21	81.48
Mounts de Fiore	18MF02	99_2 .	38.20	0.02	<0.01	17.44	0.27	0.09	43.21	0.29	0.02	99.55	81.54
Mounts de Fiore	18MF02	99_3 .	38.09	0.03	0.01	17.91	0.28	0.08	42.96	0.27	0.04	99.67	81.05
Mounts de Fiore	18MF02	99_4 .	38.11	0.04	0.03	17.81	0.30	0.06	42.59	0.29	0.02	99.28	81.00
Mounts de Fiore	18MF02	99_5 .	38.22	0.04	<0.01	18.26	0.30	0.06	42.57	0.32	0.02	99.79	80.60
Mounts de Fiore	18MF02	99_6 .	38.00	0.03	<0.01	18.71	0.36	0.05	42.06	0.28	0.03	99.53	80.03
Mounts de Fiore	18MF02	99_7 .	37.51	0.03	<0.01	21.27	0.38	0.04	39.82	0.32	0.02	99.38	76.94
Mounts de Fiore	18MF02	100_1 .	37.94	0.03	0.03	18.53	0.32	0.07	42.28	0.31	0.03	99.55	80.27
Mounts de Fiore	18MF02	101_1 .	38.38	0.02	<0.01	17.02	0.26	0.05	43.57	0.25	<0.01	99.57	82.02
Mounts de Fiore	18MF02	102_1 .	37.65	0.02	<0.01	19.19	0.35	0.06	41.67	0.29	0.03	99.28	79.47
Mounts de Fiore	18MF02	103_1 .	37.71	0.04	<0.01	20.06	0.37	0.06	40.51	0.37	0.03	99.15	78.26
Mounts de Fiore	18MF02	104_1 .	38.15	0.02	0.02	17.29	0.26	0.08	43.40	0.28	<0.01	99.50	81.73

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Mounts de Fiore	18MF02	105_1 .	38.28	0.03	<0.01	18.50	0.30	0.07	41.92	0.33	0.02	99.46	80.15
Mounts de Fiore	18MF02	107_1 .	37.83	0.03	<0.01	19.35	0.35	0.03	41.32	0.33	0.05	99.29	79.19
Mounts de Fiore	18MF02	108_1 .	38.29	0.03	0.01	18.22	0.29	0.08	42.50	0.34	0.01	99.77	80.61
Mounts de Fiore	18MF02	109_1 .	38.37	0.03	<0.01	17.66	0.30	0.07	42.89	0.27	0.02	99.62	81.23
Mounts de Fiore	18MF02	110_1 .	38.13	0.02	0.02	18.14	0.34	0.08	42.44	0.26	0.02	99.46	80.66
Mounts de Fiore	18MF02	111_1 .	38.60	0.04	<0.01	17.25	0.26	0.08	43.81	0.27	0.02	100.35	81.91
Mounts de Fiore	18MF02	119_1 .	38.22	0.03	<0.01	16.98	0.25	0.09	43.32	0.25	<0.01	99.16	81.97
Mounts de Fiore	18MF02	120_1 .	38.51	0.02	<0.01	16.73	0.24	0.11	43.70	0.25	<0.01	99.58	82.32
Mounts de Fiore	18MF02	121_1 .	38.43	0.03	<0.01	16.96	0.28	0.08	43.52	0.25	0.02	99.57	82.06
Mounts de Fiore	18MF02	122_1 .	38.77	0.01	<0.01	16.71	0.26	0.07	43.99	0.28	0.03	100.14	82.43
Mounts de Fiore	18MF02	123_1 .	38.58	0.01	0.01	16.90	0.28	0.08	43.99	0.26	<0.01	100.12	82.27
Mounts de Fiore	18MF02	125_1 .	37.75	0.04	0.01	19.47	0.38	0.06	41.36	0.31	0.02	99.41	79.11
Mounts de Fiore	18MF02	126_1 .	38.20	0.02	<0.01	18.05	0.25	0.06	42.84	0.30	0.02	99.75	80.88
Mounts de Fiore	18MF02	127_1 .	38.18	0.03	<0.01	18.69	0.33	0.06	41.93	0.36	0.02	99.61	79.99
Mounts de Fiore	18MF02	128_1 .	36.35	0.04	<0.01	28.69	0.64	<0.01	33.11	0.47	0.05	99.39	67.29
Mounts de Fiore	18MF02	129_1 .	36.15	0.03	<0.01	28.88	0.59	<0.01	32.43	0.42	0.04	98.56	66.68
Mounts de Fiore	18MF02	130_1 .	37.22	0.03	<0.01	22.26	0.48	<0.01	38.65	0.35	0.03	99.03	75.58
Mounts de Fiore	18MF02	131_1 .	38.07	0.03	0.03	18.58	0.27	0.05	41.97	0.31	0.04	99.36	80.11
Mounts de Fiore	18MF02	132_1 .	38.34	0.02	<0.01	16.99	0.26	0.09	43.39	0.27	0.01	99.36	81.99
Mounts de Fiore	18MF02	132_2 .	38.39	0.03	<0.01	17.08	0.27	0.09	43.64	0.26	<0.01	99.78	82.00
Mounts de Fiore	18MF02	132_3 .	38.32	0.03	<0.01	17.20	0.27	0.09	43.33	0.29	0.02	99.56	81.79
Mounts de Fiore	18MF02	132_4 .	38.39	0.02	<0.01	17.29	0.28	0.08	43.67	0.29	0.02	100.05	81.82
Mounts de Fiore	18MF02	132_5 .	38.48	0.03	0.02	17.33	0.30	0.10	43.81	0.27	0.02	100.38	81.84
Mounts de Fiore	18MF02	132_6 .	38.44	0.03	<0.01	17.39	0.27	0.09	43.77	0.28	<0.01	100.30	81.77
Mounts de Fiore	18MF02	132_7 .	38.33	0.03	<0.01	17.24	0.27	0.07	43.19	0.28	0.02	99.44	81.71
Mounts de Fiore	18MF02	132_8 .	38.30	0.02	<0.01	17.35	0.28	0.09	43.31	0.30	<0.01	99.66	81.65
Mounts de Fiore	18MF02	132_9 .	38.44	0.03	<0.01	17.36	0.29	0.08	42.88	0.27	0.02	99.38	81.49
Mounts de Fiore	18MF02	132_10 .	38.42	0.04	<0.01	17.80	0.26	0.06	42.89	0.30	0.02	99.82	81.11
Mounts de Fiore	18MF02	132_11 .	38.03	0.02	<0.01	20.04	0.32	0.06	40.79	0.32	0.02	99.62	78.39
Mounts de Fiore	18MF02	138_1 .	36.66	0.02	<0.01	24.18	0.50	<0.01	37.29	0.29	<0.01	98.95	73.33
Mounts de Fiore	18MF02	138_2 .	36.64	0.02	0.01	23.72	0.45	0.03	38.13	0.32	0.03	99.36	74.13
Mounts de Fiore	18MF02	138_3 .	36.80	0.02	<0.01	22.87	0.44	0.04	38.28	0.33	0.03	98.84	74.90
Mounts de Fiore	18MF02	138_4 .	37.02	0.03	<0.01	22.44	0.42	0.03	39.32	0.32	0.01	99.59	75.75
Mounts de Fiore	18MF02	138_5 .	37.35	0.02	<0.01	21.51	0.40	0.03	39.66	0.29	0.02	99.30	76.67
Mounts de Fiore	18MF02	138_6 .	37.38	0.02	<0.01	20.38	0.36	0.06	40.83	0.30	0.01	99.36	78.12
Mounts de Fiore	18MF02	138_7 .	37.78	0.02	<0.01	19.06	0.32	0.07	42.00	0.29	0.01	99.56	79.71
Mounts de Fiore	18MF02	138_8 .	37.86	0.02	0.01	18.14	0.26	0.07	42.91	0.28	0.02	99.57	80.83
Mounts de Fiore	18MF02	138_9 .	38.08	0.02	<0.01	17.81	0.32	0.06	43.14	0.26	<0.01	99.72	81.19
Mounts de Fiore	18MF02	138_10 .	37.46	0.02	<0.01	17.69	0.28	0.06	43.11	0.28	0.03	98.96	81.29
Mounts de Fiore	18MF02	138_11 .	37.85	0.01	<0.01	17.66	0.28	0.07	43.04	0.26	0.01	99.18	81.29
Mounts de Fiore	18MF02	138_12 .	38.05	0.02	0.01	17.76	0.28	0.07	43.04	0.28	<0.01	99.54	81.20
Mounts de Fiore	18MF02	138_13 .	37.81	0.02	<0.01	18.04	0.31	0.07	42.82	0.30	<0.01	99.39	80.88
Mounts de Fiore	18MF02	138_14 .	37.55	0.02	<0.01	20.43	0.35	0.06	40.24	0.29	0.02	98.97	77.83
Mounts de Fiore	18MF02	139_1 .	37.98	0.02	0.01	17.64	0.29	0.11	43.28	0.27	<0.01	99.61	81.39
Mounts de Fiore	18MF02	140_1 .	36.19	0.02	<0.01	26.49	0.54	0.03	35.26	0.35	0.03	98.92	70.35
Mounts de Fiore	18MF02	141_1 .	37.11	0.02	<0.01	22.28	0.45	0.03	39.28	0.35	0.04	99.59	75.86
Mounts de Fiore	18MF02	142_1 .	36.40	<0.01	<0.01	26.03	0.55	0.01	35.95	0.35	0.03	99.34	71.11

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Mounts de Fiore	18MF02	143_1.	36.87	0.03	0.01	24.62	0.48	0.03	36.99	0.35	0.03	99.41	72.81
Mounts de Fiore	18MF02	144_1.	38.21	0.02	<0.01	17.80	0.29	0.09	43.17	0.28	0.02	99.89	81.21
Mounts de Fiore	18MF02	145_1.	38.15	0.03	<0.01	19.03	0.32	0.05	41.90	0.32	0.07	99.90	79.69
Mounts de Fiore	18MF02	156_1.	38.31	0.02	<0.01	19.08	0.33	0.04	41.87	0.26	0.02	99.92	79.64
Mounts de Fiore	18MF02	156_2.	38.13	0.02	0.02	18.25	0.32	0.06	42.54	0.29	0.01	99.64	80.60
Mounts de Fiore	18MF02	156_3.	38.53	0.02	<0.01	17.73	0.31	0.08	42.91	0.26	0.01	99.84	81.19
Mounts de Fiore	18MF02	156_4.	38.59	0.03	0.01	17.85	0.30	0.10	43.31	0.26	0.02	100.48	81.22
Mounts de Fiore	18MF02	156_5.	38.64	0.03	<0.01	18.27	0.31	0.07	42.41	0.30	<0.01	100.02	80.54
Mounts de Fiore	18MF02	156_6.	38.67	0.03	<0.01	18.13	0.28	0.07	42.54	0.28	0.02	100.03	80.70
Mounts de Fiore	18MF02	156_7.	38.69	0.03	<0.01	17.90	0.32	0.07	42.69	0.32	0.03	100.05	80.95
Mounts de Fiore	18MF02	156_8.	38.82	0.03	0.02	18.25	0.34	0.08	42.60	0.29	0.02	100.45	80.62
Mounts de Fiore	18MF02	156_9.	38.52	0.03	0.02	18.53	0.31	0.07	42.23	0.32	0.03	100.06	80.25
Mounts de Fiore	18MF02	156_10.	38.56	0.04	<0.01	19.32	0.33	0.06	41.40	0.33	0.02	100.06	79.26
Mounts de Fiore	18MF02	156_11.	37.19	0.12	<0.01	27.52	0.56	0.03	34.16	0.40	0.02	100.03	68.87
Mounts de Fiore	18MF02	157_1.	38.63	0.02	<0.01	18.22	0.28	0.06	42.54	0.28	0.02	100.06	80.63
Mounts de Fiore	18MF02	158_1.	37.89	0.03	<0.01	20.81	0.39	0.03	40.46	0.23	<0.01	99.84	77.61
Mounts de Fiore	18MF02	159_1.	38.16	0.03	0.02	19.67	0.33	0.03	41.29	0.24	0.01	99.79	78.91
Mounts de Fiore	18MF02	160_1.	38.62	0.01	0.02	17.88	0.29	0.07	42.67	0.28	0.03	99.88	80.97
Mounts de Fiore	18MF02	161_1.	38.12	0.03	0.01	19.39	0.34	0.06	41.52	0.31	0.02	99.81	79.24
Mounts de Fiore	18MF03A	164_1.	37.97	0.04	<0.01	21.11	0.35	0.03	40.33	0.23	0.02	100.10	77.30
Mounts de Fiore	18MF03A	165_1.	37.22	0.03	<0.01	20.59	0.33	0.04	40.73	0.24	0.02	99.22	77.91
Mounts de Fiore	18MF03A	166_1.	38.93	<0.01	0.01	16.68	0.27	0.11	43.77	0.27	<0.01	100.04	82.39
Mounts de Fiore	18MF03A	167_1.	38.40	0.02	<0.01	16.83	0.26	0.10	43.98	0.25	0.01	99.86	82.32
Mounts de Fiore	18MF03A	168_1.	38.93	0.03	<0.01	16.79	0.24	0.11	43.98	0.23	0.02	100.31	82.36
Mounts de Fiore	18MF03A	169_1.	39.12	<0.01	<0.01	16.79	0.25	0.09	43.77	0.23	<0.01	100.30	82.29
Mounts de Fiore	18MF03A	170_1.	38.84	0.02	<0.01	17.40	0.28	0.06	43.81	0.28	<0.01	100.71	81.78
Mounts de Fiore	18MF03A	171_1.	38.68	0.02	0.02	16.62	0.29	0.09	43.37	0.27	0.02	99.39	82.31
Mounts de Fiore	18MF03A	172_1.	38.19	0.05	<0.01	18.68	0.36	0.08	42.19	0.30	0.02	99.87	80.10
Mounts de Fiore	18MF03A	173_1.	38.14	0.02	<0.01	19.85	0.30	0.07	41.40	0.22	<0.01	100.02	78.81
Mounts de Fiore	18MF03A	173_2.	38.27	0.02	<0.01	19.86	0.32	0.06	41.66	0.22	0.01	100.42	78.90
Mounts de Fiore	18MF03A	173_3.	38.30	0.02	<0.01	19.44	0.33	0.06	41.46	0.22	<0.01	99.87	79.18
Mounts de Fiore	18MF03A	173_4.	38.34	0.03	<0.01	19.54	0.30	0.06	42.03	0.22	<0.01	100.52	79.32
Mounts de Fiore	18MF03A	173_5.	38.52	0.02	<0.01	19.02	0.26	0.06	41.93	0.24	0.01	100.08	79.72
Mounts de Fiore	18MF03A	173_6.	38.35	0.02	0.01	18.93	0.27	0.04	41.99	0.22	0.02	99.85	79.82
Mounts de Fiore	18MF03A	173_7.	38.30	0.04	<0.01	18.64	0.27	0.09	42.24	0.23	<0.01	99.82	80.16
Mounts de Fiore	18MF03A	173_8.	38.48	0.03	<0.01	18.00	0.29	0.10	42.86	0.25	<0.01	100.02	80.94
Mounts de Fiore	18MF03A	173_9.	38.72	0.02	<0.01	17.58	0.27	0.11	43.44	0.25	0.02	100.40	81.50
Mounts de Fiore	18MF03A	173_10.	38.33	0.03	<0.01	17.14	0.25	0.11	43.68	0.26	0.02	99.82	81.96
Mounts de Fiore	18MF03A	173_11.	38.69	0.01	<0.01	16.95	0.28	0.10	43.62	0.22	0.02	99.91	82.10
Mounts de Fiore	18MF03A	173_12.	38.59	0.01	<0.01	16.80	0.25	0.10	43.84	0.24	<0.01	99.84	82.31
Mounts de Fiore	18MF03A	173_13.	38.65	<0.01	<0.01	16.88	0.24	0.10	43.48	0.26	0.02	99.63	82.12
Mounts de Fiore	18MF03A	173_14.	38.73	0.01	0.01	16.96	0.26	0.11	43.93	0.26	<0.01	100.31	82.20
Mounts de Fiore	18MF03A	173_15.	38.55	0.02	<0.01	16.95	0.27	0.09	43.91	0.24	0.02	100.06	82.20
Mounts de Fiore	18MF03A	173_16.	38.75	0.04	0.01	16.95	0.26	0.09	43.89	0.27	0.01	100.28	82.19
Mounts de Fiore	18MF03A	173_17.	38.55	0.02	<0.01	16.58	0.28	0.10	43.95	0.26	0.03	99.76	82.54
Mounts de Fiore	18MF03A	173_18.	38.74	0.03	<0.01	16.71	0.27	0.10	43.83	0.26	0.01	99.96	82.38
Mounts de Fiore	18MF03A	173_19.	38.74	0.02	<0.01	17.04	0.26	0.10	44.05	0.26	0.01	100.50	82.17

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Mounts de Fiore	18MF03A	173_20 .	38.86	0.02	<0.01	16.91	0.28	0.08	43.88	0.27	0.02	100.34	82.23
Mounts de Fiore	18MF03A	173_21 .	38.43	0.03	<0.01	17.16	0.23	0.10	43.26	0.30	<0.01	99.51	81.80
Mounts de Fiore	18MF03A	173_22 .	38.21	0.03	0.01	17.92	0.29	0.06	42.59	0.31	0.02	99.44	80.91
Mounts de Fiore	18MF03A	173_23 .	37.97	0.03	<0.01	19.97	0.46	0.06	40.12	0.31	0.01	98.96	78.17
Mounts de Fiore	18MF03A	182_1 .	38.32	0.04	<0.01	18.89	0.37	0.06	40.96	0.34	<0.01	98.99	79.45
Mounts de Fiore	18MF03A	183_1 .	38.41	0.03	0.02	18.58	0.32	0.06	42.12	0.32	0.04	99.90	80.17
Mounts de Fiore	18MF03A	184_1 .	37.89	0.04	<0.01	19.30	0.36	0.08	41.19	0.30	0.02	99.18	79.19
Mounts de Fiore	18MF03A	185_1 .	38.20	0.04	<0.01	18.80	0.31	0.06	42.10	0.34	0.02	99.87	79.97
Mounts de Fiore	18MF03A	192_1 .	38.15	0.03	<0.01	19.33	0.35	0.06	41.99	0.33	<0.01	100.27	79.47
Mounts de Fiore	18MF03A	193_1 .	38.83	<0.01	<0.01	17.10	0.30	0.09	43.72	0.23	<0.01	100.30	82.01
Mounts de Fiore	18MF03A	194_1 .	39.09	0.03	<0.01	16.96	0.28	0.07	43.82	0.26	0.01	100.53	82.16
Mounts de Fiore	18MF03A	195_1 .	38.85	0.03	0.01	16.91	0.25	0.09	43.94	0.27	<0.01	100.39	82.25
Mounts de Fiore	18MF03A	196_1 .	39.04	0.03	<0.01	16.78	0.26	0.10	43.71	0.28	<0.01	100.19	82.28
Mounts de Fiore	18MF03A	197_1 .	39.05	0.02	<0.01	16.94	0.31	0.11	43.69	0.25	<0.01	100.40	82.13
Mounts de Fiore	18MF03A	198_1 .	38.36	<0.01	<0.01	19.92	0.35	0.03	41.00	0.33	0.02	100.02	78.58
Mounts de Fiore	18MF03A	199_1 .	37.58	0.04	<0.01	22.91	0.55	0.03	38.25	0.35	0.04	99.76	74.85
Mounts de Fiore	18MF03A	206_1 .	38.97	0.03	<0.01	16.70	0.30	0.08	43.66	0.23	0.02	99.99	82.34
Mounts de Fiore	18MF03A	207_1 .	39.02	0.01	<0.01	16.74	0.26	0.10	43.93	0.27	0.02	100.37	82.38
Mounts de Fiore	18MF03A	208_1 .	38.61	0.02	0.01	18.03	0.29	0.08	42.90	0.27	0.03	100.24	80.92
Mounts de Fiore	18MF03A	209_1 .	38.59	0.03	0.03	18.06	0.27	0.04	42.44	0.30	<0.01	99.76	80.73
Mounts de Fiore	18MF03A	210_1 .	38.98	0.02	0.01	16.95	0.28	0.11	43.95	0.27	0.01	100.58	82.22
Mounts de Fiore	18MF03A	211_1 .	38.76	0.04	<0.01	18.52	0.30	0.07	42.23	0.36	0.01	100.30	80.26
Mounts de Fiore	18MF03A	212_1 .	39.05	0.02	0.01	16.71	0.27	0.10	43.97	0.24	0.02	100.39	82.43
Mounts de Fiore	18MF03A	213_1 .	38.89	0.02	<0.01	17.77	0.30	0.09	42.78	0.29	0.02	100.17	81.10
Mounts de Fiore	18MF03A	214_1 .	38.95	0.02	0.02	18.10	0.32	0.07	42.78	0.31	0.02	100.59	80.82
Mounts de Fiore	18MF03A	223_1 .	37.89	0.03	<0.01	24.00	0.42	0.03	37.45	0.24	<0.01	100.07	73.55
Mounts de Fiore	18MF03A	224_1 .	38.08	0.03	<0.01	24.33	0.45	0.01	37.51	0.24	0.03	100.68	73.32
Mounts de Fiore	18MF03A	225_1 .	39.14	0.02	<0.01	18.34	0.32	0.09	42.85	0.24	<0.01	101.02	80.64
Mounts de Fiore	18MF03A	226_1 .	39.50	0.02	0.01	18.57	0.33	0.08	42.75	0.29	<0.01	101.56	80.40
Mounts de Fiore	18MF03A	227_1 .	38.51	0.03	<0.01	21.70	0.44	0.08	39.81	0.28	<0.01	100.87	76.59
Mounts de Fiore	18MF03A	229_1 .	38.27	0.12	<0.01	22.87	0.45	0.04	38.58	0.23	0.05	100.62	75.04
Mounts de Fiore	18MF03A	229_2 .	38.31	0.04	<0.01	22.84	0.43	0.05	38.44	0.21	<0.01	100.34	75.00
Mounts de Fiore	18MF03A	229_3 .	38.35	0.04	<0.01	22.81	0.40	0.03	39.24	0.24	0.01	101.15	75.41
Mounts de Fiore	18MF03A	229_4 .	38.61	0.03	<0.01	22.52	0.44	0.04	39.25	0.20	<0.01	101.11	75.65
Mounts de Fiore	18MF03A	229_5 .	38.56	0.03	<0.01	22.48	0.44	0.06	39.49	0.25	<0.01	101.32	75.79
Mounts de Fiore	18MF03A	229_6 .	38.40	0.02	<0.01	22.11	0.42	0.06	39.81	0.20	0.03	101.07	76.25
Mounts de Fiore	18MF03A	229_7 .	38.30	0.03	<0.01	21.76	0.40	0.05	39.59	0.22	0.03	100.38	76.43
Mounts de Fiore	18MF03A	229_8 .	38.47	0.03	<0.01	21.96	0.36	0.07	39.73	0.31	0.01	100.94	76.33
Mounts de Fiore	18MF03A	229_9 .	38.71	0.04	<0.01	21.39	0.37	0.07	39.91	0.21	0.02	100.72	76.89
Mounts de Fiore	18MF03A	229_10 .	38.68	0.02	<0.01	20.76	0.38	0.05	40.40	0.21	0.01	100.51	77.62
Mounts de Fiore	18MF03A	229_11 .	39.08	0.02	<0.01	20.60	0.37	0.08	40.74	0.19	<0.01	101.09	77.90
Mounts de Fiore	18MF03A	229_12 .	38.97	0.02	<0.01	20.20	0.35	0.07	40.94	0.21	0.02	100.78	78.32
Mounts de Fiore	18MF03A	229_13 .	39.05	0.03	<0.01	20.02	0.38	0.08	40.78	0.22	0.01	100.58	78.41
Mounts de Fiore	18MF03A	229_14 .	38.72	0.02	<0.01	19.72	0.36	0.08	41.28	0.23	0.02	100.43	78.87
Mounts de Fiore	18MF03A	229_15 .	39.11	<0.01	<0.01	19.81	0.35	0.05	41.48	0.22	0.02	101.05	78.87
Mounts de Fiore	18MF03A	229_16 .	38.99	0.01	<0.01	19.38	0.32	0.08	41.51	0.22	0.03	100.56	79.24
Mounts de Fiore	18MF03A	229_17 .	39.38	0.02	<0.01	19.07	0.32	0.06	41.78	0.23	0.03	100.90	79.61

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Mounts de Fiore	18MF03A	229_18 .	39.20	0.02	<0.01	18.94	0.33	0.08	41.91	0.24	0.02	100.74	79.78
Mounts de Fiore	18MF03A	229_19 .	39.46	0.04	<0.01	18.78	0.27	0.10	41.73	0.26	<0.01	100.66	79.85
Mounts de Fiore	18MF03A	229_20 .	39.38	0.02	<0.01	18.66	0.31	0.10	42.03	0.24	0.02	100.76	80.06
Mounts de Fiore	18MF03A	229_21 .	39.46	<0.01	0.01	18.53	0.30	0.08	42.51	0.24	0.01	101.16	80.35
Mounts de Fiore	18MF03A	229_22 .	39.30	<0.01	<0.01	18.50	0.27	0.09	42.18	0.26	<0.01	100.60	80.25
Mounts de Fiore	18MF03A	229_23 .	39.47	0.01	0.01	18.35	0.28	0.10	42.26	0.24	<0.01	100.73	80.41
Mounts de Fiore	18MF03A	229_24 .	39.45	0.02	<0.01	18.44	0.27	0.07	42.59	0.29	<0.01	101.15	80.46
Mounts de Fiore	18MF03A	229_25 .	39.32	0.03	<0.01	18.44	0.27	0.10	42.60	0.26	0.03	101.05	80.46
Mounts de Fiore	18MF03A	229_26 .	39.58	0.02	<0.01	18.26	0.31	0.09	42.84	0.24	<0.01	101.35	80.71
Mounts de Fiore	18MF03A	229_27 .	39.49	0.02	<0.01	18.17	0.30	0.08	42.64	0.23	0.01	100.95	80.71
Mounts de Fiore	18MF03A	229_28 .	39.49	0.02	<0.01	18.42	0.27	0.08	42.51	0.24	<0.01	101.03	80.44
Mounts de Fiore	18MF03A	229_29 .	39.61	0.02	<0.01	18.14	0.28	0.08	42.49	0.29	0.02	100.95	80.68
Mounts de Fiore	18MF03A	229_30 .	39.50	0.03	0.01	18.10	0.29	0.08	42.54	0.27	0.01	100.84	80.73
Mounts de Fiore	18MF03A	229_31 .	39.45	0.01	<0.01	18.13	0.27	0.09	42.67	0.28	0.01	100.93	80.75
Mounts de Fiore	18MF03A	229_32 .	39.67	0.02	<0.01	17.99	0.32	0.08	42.52	0.29	0.01	100.91	80.82
Mounts de Fiore	18MF03A	229_33 .	39.51	0.03	<0.01	18.12	0.26	0.08	42.96	0.26	<0.01	101.24	80.87
Mounts de Fiore	18MF03A	229_34 .	39.65	0.02	<0.01	17.90	0.31	0.07	42.74	0.29	<0.01	100.98	80.97
Mounts de Fiore	18MF03A	229_35 .	39.56	0.02	<0.01	17.71	0.31	0.05	42.77	0.28	<0.01	100.70	81.15
Mounts de Fiore	18MF03A	229_36 .	39.42	0.02	<0.01	18.13	0.31	0.06	42.42	0.31	0.02	100.70	80.66
Mounts de Fiore	18MF03A	229_37 .	39.13	0.02	<0.01	18.64	0.33	0.07	42.44	0.31	0.01	100.96	80.23
Mounts de Fiore	18MF03A	229_38 .	38.76	0.03	<0.01	21.25	0.37	0.06	39.67	0.33	0.04	100.51	76.89
Mounts de Fiore	18MF03A	230_1 .	38.95	0.02	<0.01	20.90	0.38	0.07	40.47	0.26	0.02	101.07	77.54
Mounts de Fiore	18MF03A	230_2 .	38.78	0.02	<0.01	20.68	0.36	0.06	40.69	0.28	<0.01	100.90	77.81
Mounts de Fiore	18MF03A	230_3 .	38.75	0.03	<0.01	20.43	0.40	0.06	40.40	0.23	<0.01	100.31	77.90
Mounts de Fiore	18MF03A	230_4 .	38.81	0.04	<0.01	20.41	0.37	0.07	40.64	0.20	0.02	100.58	78.02
Mounts de Fiore	18MF03A	230_5 .	38.80	0.03	<0.01	20.25	0.40	0.05	41.17	0.25	0.02	101.00	78.37
Mounts de Fiore	18MF03A	230_6 .	38.75	0.02	<0.01	20.01	0.38	0.07	41.02	0.24	<0.01	100.50	78.52
Mounts de Fiore	18MF03A	230_7 .	39.22	0.03	0.01	19.69	0.34	0.07	41.35	0.23	0.02	100.99	78.91
Mounts de Fiore	18MF03A	230_8 .	39.28	0.01	<0.01	19.16	0.31	0.07	41.95	0.24	<0.01	101.04	79.60
Mounts de Fiore	18MF03A	230_9 .	39.22	0.02	<0.01	18.62	0.30	0.06	42.15	0.24	<0.01	100.61	80.14
Mounts de Fiore	18MF03A	230_10 .	39.17	0.02	<0.01	17.93	0.27	0.09	42.81	0.25	0.02	100.56	80.97
Mounts de Fiore	18MF03A	230_11 .	39.29	0.03	<0.01	17.63	0.26	0.08	43.24	0.28	0.02	100.85	81.38
Mounts de Fiore	18MF03A	230_12 .	39.47	0.01	<0.01	17.59	0.28	0.08	43.37	0.26	<0.01	101.08	81.46
Mounts de Fiore	18MF03A	230_13 .	39.49	0.03	<0.01	17.48	0.32	0.09	43.27	0.27	<0.01	100.96	81.53
Mounts de Fiore	18MF03A	230_14 .	39.46	0.02	<0.01	17.62	0.32	0.07	43.18	0.26	<0.01	100.94	81.37
Mounts de Fiore	18MF03A	230_15 .	39.38	0.02	0.02	17.73	0.32	0.08	42.93	0.28	0.02	100.80	81.19
Mounts de Fiore	18MF03A	230_16 .	39.34	0.03	<0.01	18.16	0.30	0.07	42.63	0.31	<0.01	100.85	80.71
Mounts de Fiore	18MF03A	230_17 .	38.94	0.02	<0.01	18.99	0.32	0.06	42.11	0.32	<0.01	100.77	79.81
Mounts de Fiore	18MF03A	230_18 .	38.42	0.03	<0.01	21.89	0.38	0.04	39.24	0.35	0.02	100.38	76.16
Mounts de Fiore	18MF03A	231_1 .	37.86	0.04	<0.01	24.24	0.41	0.05	37.37	0.22	0.01	100.21	73.32
Mounts de Fiore	18MF03A	239_1 .	38.81	0.02	0.01	17.37	0.27	0.09	42.62	0.28	0.02	99.49	81.39
Mounts de Fiore	18MF03A	240_1 .	37.78	0.04	<0.01	22.57	0.43	0.03	38.80	0.29	0.01	99.97	75.39
Mounts de Fiore	18MF03A	241_1 .	37.64	0.02	<0.01	23.02	0.50	0.01	38.62	0.26	0.02	100.12	74.94
Mounts de Fiore	18MF03A	242_1 .	38.93	0.02	<0.01	17.43	0.27	0.08	43.15	0.29	0.01	100.18	81.53
Mounts de Fiore	18MF03A	243_1 .	38.42	<0.01	<0.01	18.03	0.37	0.09	42.63	0.28	0.01	99.88	80.82
Mounts de Fiore	18MF03A	244_1 .	37.47	0.02	<0.01	23.86	0.57	0.05	37.62	0.26	0.01	99.87	73.76
Mounts de Fiore	18MF03A	245_1 .	37.25	0.02	<0.01	24.68	0.54	0.03	37.28	0.26	0.03	100.10	72.92

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Mounts de Fiore	18MF03A	246_1 .	38.67	0.01	<0.01	17.28	0.29	0.09	43.35	0.27	0.01	99.99	81.73
Mounts de Fiore	18MF03A	247_1 .	37.75	0.03	<0.01	22.78	0.51	0.03	38.32	0.26	0.01	99.70	74.99
Mounts de Fiore	18MF03A	247_2 .	37.60	0.03	<0.01	22.55	0.49	0.03	38.55	0.26	0.02	99.55	75.29
Mounts de Fiore	18MF03A	247_3 .	37.81	0.02	<0.01	22.87	0.49	0.03	38.54	0.27	0.02	100.06	75.02
Mounts de Fiore	18MF03A	247_4 .	37.47	0.02	<0.01	22.30	0.45	0.03	38.52	0.28	0.02	99.08	75.49
Mounts de Fiore	18MF03A	247_5 .	37.81	0.03	<0.01	22.18	0.51	0.03	38.71	0.28	0.02	99.56	75.68
Mounts de Fiore	18MF03A	247_6 .	37.69	0.02	<0.01	22.03	0.46	0.05	38.87	0.30	0.01	99.44	75.88
Mounts de Fiore	18MF03A	247_7 .	37.69	0.02	<0.01	21.87	0.45	0.04	39.16	0.27	0.02	99.53	76.15
Mounts de Fiore	18MF03A	247_8 .	37.90	0.03	<0.01	21.77	0.48	0.04	38.99	0.28	0.02	99.52	76.15
Mounts de Fiore	18MF03A	247_9 .	37.95	0.02	<0.01	21.58	0.45	0.04	39.21	0.30	0.01	99.59	76.41
Mounts de Fiore	18MF03A	247_10 .	38.16	0.02	<0.01	21.49	0.45	0.05	39.33	0.26	0.03	99.81	76.54
Mounts de Fiore	18MF03A	247_11 .	38.16	0.03	<0.01	21.16	0.41	0.03	39.86	0.29	<0.01	99.95	77.06
Mounts de Fiore	18MF03A	247_12 .	37.87	<0.01	<0.01	21.30	0.40	0.04	39.53	0.30	0.02	99.49	76.79
Mounts de Fiore	18MF03A	247_13 .	38.03	0.03	0.01	20.97	0.40	0.04	39.79	0.27	0.02	99.57	77.18
Mounts de Fiore	18MF03A	247_14 .	38.31	0.01	<0.01	20.70	0.38	0.06	40.29	0.26	0.02	100.03	77.63
Mounts de Fiore	18MF03A	247_15 .	38.46	0.02	0.02	20.46	0.44	0.05	40.50	0.25	0.02	100.21	77.92
Mounts de Fiore	18MF03A	247_16 .	38.46	0.01	<0.01	20.19	0.37	0.06	40.67	0.27	0.02	100.05	78.22
Mounts de Fiore	18MF03A	247_17 .	38.44	0.04	<0.01	19.94	0.41	0.07	40.72	0.23	0.04	99.90	78.45
Mounts de Fiore	18MF03A	247_18 .	38.60	<0.01	<0.01	19.62	0.38	0.07	41.03	0.25	0.02	99.98	78.85
Mounts de Fiore	18MF03A	247_19 .	38.31	0.02	<0.01	19.33	0.36	0.07	41.33	0.24	<0.01	99.67	79.22
Mounts de Fiore	18MF03A	247_20 .	38.65	0.03	<0.01	19.15	0.35	0.08	41.16	0.25	<0.01	99.67	79.30
Mounts de Fiore	18MF03A	247_21 .	38.37	0.01	<0.01	18.94	0.34	0.07	41.65	0.29	<0.01	99.68	79.67
Mounts de Fiore	18MF03A	247_22 .	38.66	0.02	<0.01	18.79	0.35	0.08	42.12	0.29	<0.01	100.33	79.99
Mounts de Fiore	18MF03A	247_23 .	38.58	0.02	<0.01	18.62	0.31	0.07	42.22	0.29	0.01	100.14	80.17
Mounts de Fiore	18MF03A	247_24 .	38.49	0.03	<0.01	18.09	0.33	0.07	42.19	0.30	<0.01	99.48	80.61
Mounts de Fiore	18MF03A	247_25 .	38.50	0.03	<0.01	17.93	0.31	0.09	42.33	0.28	0.02	99.50	80.80
Mounts de Fiore	18MF03A	247_26 .	38.71	0.01	<0.01	17.94	0.28	0.09	42.69	0.26	<0.01	99.99	80.92
Mounts de Fiore	18MF03A	247_27 .	38.66	0.02	<0.01	17.61	0.33	0.06	42.62	0.26	<0.01	99.57	81.18
Mounts de Fiore	18MF03A	247_28 .	38.67	0.02	<0.01	17.61	0.34	0.08	42.76	0.29	0.01	99.77	81.23
Mounts de Fiore	18MF03A	247_29 .	38.63	0.03	<0.01	17.74	0.27	0.09	42.34	0.31	0.01	99.43	80.97
Mounts de Fiore	18MF03A	247_30 .	38.41	0.04	<0.01	17.85	0.27	0.09	42.46	0.30	<0.01	99.44	80.92
Mounts de Fiore	18MF03A	247_31 .	38.48	0.03	<0.01	18.61	0.34	0.06	41.82	0.28	0.02	99.64	80.03
Mounts de Fiore	18MF03A	247_32 .	38.06	0.03	<0.01	19.72	0.50	0.04	40.62	0.35	0.01	99.33	78.59
Mounts de Fiore	18MF03B	1_1 .	38.97	0.03	<0.01	17.66	0.31	0.10	42.15	0.28	<0.01	99.53	80.96
Mounts de Fiore	18MF03B	2_1 .	39.20	0.03	<0.01	17.65	0.29	0.07	43.01	0.32	0.02	100.59	81.28
Mounts de Fiore	18MF03B	3_1 .	37.80	0.02	<0.01	23.40	0.47	0.03	37.24	0.34	0.04	99.36	73.94
Mounts de Fiore	18MF03B	4_1 .	38.03	0.05	<0.01	21.79	0.45	0.02	38.90	0.37	0.04	99.65	76.09
Mounts de Fiore	18MF03B	18_1 .	36.86	0.04	<0.01	24.96	0.53	0.02	36.07	0.42	0.04	98.96	72.04
Mounts de Fiore	18MF03B	19_1 .	38.49	0.04	<0.01	19.16	0.35	0.07	41.21	0.43	0.02	99.79	79.31
Mounts de Fiore	18MF03B	20_1 .	38.39	0.04	<0.01	20.25	0.38	0.03	40.28	0.37	0.05	99.79	78.00
Mounts de Fiore	18MF03B	22_1 .	37.41	0.03	<0.01	23.27	0.46	0.04	37.57	0.37	0.03	99.18	74.21
Mounts de Fiore	18MF03B	44_1 .	38.01	0.03	<0.01	21.39	0.34	0.06	40.03	0.22	0.02	100.08	76.94
Mounts de Fiore	18MF03B	45_1 .	37.73	0.03	<0.01	22.19	0.37	0.06	38.70	0.19	<0.01	99.29	75.66
Mounts de Fiore	18MF03B	46_1 .	37.65	0.03	<0.01	22.20	0.36	0.07	39.07	0.25	0.01	99.69	75.83
Mounts de Fiore	18MF03B	47_1 .	38.08	0.03	<0.01	21.21	0.35	0.07	39.88	0.22	0.02	99.84	77.02
Mounts de Fiore	18MF03B	48_1 .	38.27	0.03	<0.01	19.03	0.34	0.07	41.21	0.27	0.02	99.26	79.43
Mounts de Fiore	18MF03B	49_1 .	38.45	0.04	<0.01	18.46	0.31	0.06	41.92	0.29	0.02	99.56	80.19

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Mounts de Fiore	18MF03B	50_1 .	38.51	0.03	0.02	18.69	0.32	0.06	41.99	0.29	0.03	99.97	80.02
Mounts de Fiore	18MF03B	54_1 .	38.34	0.02	<0.01	18.75	0.29	0.08	41.34	0.26	<0.01	99.11	79.72
Mounts de Fiore	18MF03B	55_1 .	38.34	0.04	<0.01	19.15	0.35	0.05	41.07	0.38	0.03	99.41	79.26
Mounts de Fiore	18MF03B	56_1 .	38.75	0.03	<0.01	17.64	0.30	0.08	42.69	0.29	0.03	99.82	81.18
Mounts de Fiore	18MF03B	57_1 .	38.57	0.03	<0.01	17.87	0.26	0.06	42.47	0.31	<0.01	99.58	80.91
Mounts de Fiore	18MF03B	57_2 .	38.65	0.03	<0.01	17.73	0.30	0.07	42.69	0.30	0.01	99.78	81.10
Mounts de Fiore	18MF03B	57_3 .	38.43	0.02	0.01	17.72	0.30	0.07	42.89	0.27	0.02	99.73	81.19
Mounts de Fiore	18MF03B	57_4 .	38.21	0.03	<0.01	19.10	0.36	0.09	41.27	0.32	0.03	99.44	79.39
Mounts de Fiore	18MF03B	57_5 .	37.32	0.04	<0.01	23.32	0.42	0.04	37.67	0.36	0.03	99.20	74.22
Mounts de Fiore	18MF03B	59_1 .	38.27	0.01	<0.01	18.85	0.31	0.03	41.60	0.31	0.04	99.44	79.73
Mounts de Fiore	18MF03B	36 / 1 .	39.19	0.02	0.02	18.91	0.31	0.06	42.04	0.24	0.02	100.82	79.85
Mounts de Fiore	18MF03B	36 / 2 .	39.24	0.03	<0.01	19.07	0.27	0.07	42.22	0.26	0.03	101.20	79.78
Mounts de Fiore	18MF03B	36 / 3 .	39.43	0.03	<0.01	18.56	0.30	0.08	42.00	0.27	0.01	100.69	80.13
Mounts de Fiore	18MF03B	36 / 4 .	39.14	0.02	<0.01	18.70	0.31	0.07	42.61	0.29	0.03	101.17	80.25
Mounts de Fiore	18MF03B	36 / 5 .	39.21	0.02	<0.01	17.83	0.28	0.07	42.83	0.28	0.03	100.55	81.07
Mounts de Fiore	18MF03B	36 / 6 .	39.46	0.02	0.02	17.68	0.32	0.07	43.20	0.28	0.03	101.07	81.33
Mounts de Fiore	18MF03B	36 / 7 .	39.34	0.04	<0.01	17.80	0.32	0.09	43.13	0.29	0.02	101.03	81.20
Mounts de Fiore	18MF03B	36 / 8 .	39.13	0.02	0.02	17.96	0.30	0.07	42.44	0.31	0.03	100.29	80.81
Mounts de Fiore	18MF03B	36 / 9 .	39.03	0.02	0.02	19.38	0.36	0.04	41.34	0.32	0.02	100.54	79.18
Mounts de Fiore	18MF03B	36 / 10 .	38.10	0.03	<0.01	22.85	0.43	0.03	38.30	0.36	0.05	100.16	74.92
Mounts de Fiore	18MF03B	36 / 11 .	37.05	0.09	0.01	29.16	0.70	0.02	32.48	0.48	0.07	100.08	66.51
Mounts de Fiore	18MF05	93_1 .	38.87	0.03	0.01	16.94	0.27	0.10	43.63	0.24	0.02	100.11	82.11
Mounts de Fiore	18MF05	94_1 .	39.02	0.03	<0.01	17.36	0.27	0.11	42.88	0.26	0.01	99.94	81.49
Mounts de Fiore	18MF05	95_1 .	38.04	0.03	<0.01	21.09	0.47	0.04	39.64	0.34	0.04	99.68	77.02
Mounts de Fiore	18MF05	96_1 .	37.34	0.03	<0.01	23.01	0.64	0.06	38.08	0.34	0.02	99.55	74.68
Mounts de Fiore	18MF05	97_1 .	38.04	0.02	<0.01	20.21	0.44	0.06	40.40	0.34	0.04	99.55	78.09
Mounts de Fiore	18MF05	102_1 .	38.76	0.02	<0.01	17.25	0.30	0.09	43.55	0.25	<0.01	100.26	81.82
Mounts de Fiore	18MF05	103_1 .	38.52	0.02	<0.01	17.96	0.33	0.08	42.83	0.27	0.02	100.04	80.96
Mounts de Fiore	18MF05	104_1 .	37.76	0.02	<0.01	22.06	0.46	0.02	38.70	0.35	0.03	99.40	75.77
Mounts de Fiore	18MF05	118_1 .	38.35	0.01	<0.01	18.77	0.33	0.05	41.61	0.31	0.02	99.47	79.81
Mounts de Fiore	18MF05	119_1 .	38.82	0.02	0.02	16.93	0.23	0.11	43.33	0.23	0.01	99.71	82.02
Mounts de Fiore	18MF05	120_1 .	38.96	0.02	<0.01	16.74	0.27	0.11	43.36	0.24	<0.01	99.71	82.20
Mounts de Fiore	18MF05	121_1 .	38.41	0.02	<0.01	17.71	0.31	0.05	42.70	0.28	0.01	99.50	81.12
Mounts de Fiore	18MF07	136_1 .	38.28	0.03	<0.01	18.04	0.32	0.07	42.80	0.27	0.02	99.86	80.87
Mounts de Fiore	18MF07	137_1 .	37.06	0.03	<0.01	22.81	0.55	0.02	38.30	0.35	0.04	99.16	74.96
Mounts de Fiore	18MF07	138_1 .	38.25	0.03	<0.01	18.58	0.31	0.09	42.19	0.30	0.02	99.78	80.19
Mounts de Fiore	18MF07	139_1 .	36.69	0.05	<0.01	24.26	0.62	0.02	36.92	0.41	0.05	99.02	73.07
Mounts de Fiore	18MF07	141_1 .	37.02	0.03	<0.01	20.83	0.40	0.03	40.44	0.31	0.04	99.10	77.58
Mounts de Fiore	18MF07	142_1 .	36.32	0.02	<0.01	24.32	0.64	0.01	37.13	0.39	0.03	98.90	73.13
Mounts de Fiore	18MF07	143_1 .	37.26	0.03	<0.01	19.96	0.32	0.04	41.02	0.33	0.03	98.99	78.56
Mounts de Fiore	18MF07	144_1 .	36.29	0.04	<0.01	24.81	0.62	0.02	36.81	0.43	0.04	99.09	72.56
Mounts de Fiore	18MF07	149_1 .	36.47	0.03	<0.01	24.19	0.65	0.01	37.03	0.46	0.04	98.89	73.18
Mounts de Fiore	18MF07	150_1 .	37.29	0.02	<0.01	19.09	0.26	0.09	41.99	0.33	0.01	99.09	79.68
Mounts de Fiore	18MF07	151_1 .	37.34	0.03	<0.01	18.37	0.31	0.06	42.62	0.30	0.02	99.06	80.53
Mounts de Fiore	18MF07	152_1 .	36.69	0.03	<0.01	23.41	0.54	0.02	37.88	0.40	0.06	99.03	74.26
Mounts de Fiore	18MF07	157_1 .	37.07	0.02	0.01	20.34	0.34	0.05	40.37	0.34	0.02	98.58	77.97
Mounts de Fiore	18MF07	157_2 .	36.96	0.03	<0.01	21.00	0.42	0.04	40.32	0.34	0.02	99.16	77.39

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
Mounts de Fiore	18MF07	157_3 .	36.68	0.02	<0.01	21.69	0.44	0.04	39.50	0.33	0.03	98.73	76.45
Mounts de Fiore	18MF07	157_4 .	36.41	0.02	<0.01	22.78	0.54	0.03	38.80	0.35	0.02	98.95	75.22
Mounts de Fiore	18MF07	157_5 .	36.20	0.03	<0.01	23.61	0.54	0.05	38.04	0.34	0.02	98.84	74.17
Mounts de Fiore	18MF07	157_6 .	36.04	0.04	<0.01	24.02	0.60	<0.01	37.54	0.39	0.03	98.70	73.59
Mounts de Fiore	18MF07	157_7 .	35.82	0.03	<0.01	24.37	0.69	0.02	36.93	0.42	0.05	98.34	72.98
Mounts de Fiore	18MF07	158_1 .	35.78	0.02	<0.01	24.85	0.58	0.05	37.21	0.36	0.02	98.87	72.75
Mounts de Fiore	18MF07	159_1 .	37.53	0.02	0.01	18.26	0.28	0.07	42.60	0.30	0.02	99.11	80.61
Mounts de Fiore	18MF07	160_1 .	36.51	0.03	<0.01	22.95	0.51	0.03	38.31	0.40	0.04	98.79	74.85
Mounts de Fiore	18MF07	165_1 .	38.65	0.03	<0.01	17.52	0.27	0.09	43.18	0.29	0.02	100.05	81.45
Mounts de Fiore	18MF07	165_2 .	38.89	0.02	<0.01	17.62	0.33	0.08	43.22	0.28	0.02	100.48	81.39
Mounts de Fiore	18MF07	165_3 .	38.62	0.02	<0.01	17.78	0.28	0.11	42.92	0.28	0.01	100.03	81.14
Mounts de Fiore	18MF07	165_4 .	38.63	0.02	<0.01	17.83	0.30	0.09	42.85	0.29	0.01	100.03	81.08
Mounts de Fiore	18MF07	165_5 .	38.59	0.03	<0.01	17.88	0.28	0.09	42.82	0.29	0.01	100.00	81.02
Mounts de Fiore	18MF07	165_6 .	38.47	0.03	<0.01	18.36	0.30	0.06	42.90	0.28	0.02	100.43	80.64
Mounts de Fiore	18MF07	165_7 .	38.30	0.02	<0.01	19.29	0.29	0.05	41.94	0.29	0.01	100.20	79.49
Mounts de Fiore	18MF07	165_8 .	38.03	0.03	<0.01	20.37	0.35	0.05	41.30	0.30	0.03	100.47	78.33
Mounts de Fiore	18MF07	165_9 .	37.69	0.03	<0.01	21.39	0.47	0.03	39.45	0.32	0.03	99.41	76.68
Mounts de Fiore	18MF07	165_10 .	37.40	0.03	<0.01	23.36	0.54	0.05	37.91	0.37	0.02	99.69	74.32
Mounts de Fiore	18MF07	165_11 .	37.16	0.05	<0.01	24.95	0.67	0.02	36.54	0.44	0.04	99.90	72.31
2002/03 lava flow	18RS01	1_1 .	36.04	0.02	<0.01	27.55	0.70	0.03	34.46	0.31	0.02	99.12	69.04
2002/03 lava flow	18RS01	2_1 .	36.50	<0.01	<0.01	27.57	0.71	0.03	34.62	0.27	0.02	99.74	69.12
2002/03 lava flow	18RS01	3_1 .	36.63	0.05	<0.01	27.38	0.63	0.02	34.69	0.28	0.03	99.71	69.31
2002/03 lava flow	18RS01	4_1 .	36.63	0.02	<0.01	27.44	0.64	<0.01	34.63	0.28	0.02	99.68	69.23
2002/03 lava flow	18RS01	5_1 .	36.42	0.02	<0.01	27.48	0.69	<0.01	34.66	0.26	0.03	99.59	69.22
2002/03 lava flow	18RS01	6_1 .	36.28	0.02	<0.01	27.03	0.72	0.02	34.79	0.28	0.01	99.17	69.64
2002/03 lava flow	18RS01	6_2 .	36.22	0.02	<0.01	26.90	0.69	<0.01	34.86	0.30	0.02	99.02	69.79
2002/03 lava flow	18RS01	6_3 .	36.13	0.02	<0.01	26.71	0.65	0.02	34.85	0.27	0.02	98.68	69.93
2002/03 lava flow	18RS01	6_4 .	36.55	0.01	<0.01	26.83	0.64	0.03	35.59	0.26	0.02	99.94	70.28
2002/03 lava flow	18RS01	6_5 .	36.43	0.02	<0.01	26.42	0.62	0.02	35.22	0.28	0.02	99.06	70.38
2002/03 lava flow	18RS01	6_6 .	36.43	0.03	<0.01	25.97	0.62	<0.01	35.23	0.28	0.02	98.59	70.75
2002/03 lava flow	18RS01	6_7 .	36.50	0.02	<0.01	25.52	0.58	<0.01	36.19	0.29	0.02	99.14	71.65
2002/03 lava flow	18RS01	6_8 .	36.71	0.02	<0.01	25.41	0.57	0.02	36.21	0.27	0.02	99.23	71.75
2002/03 lava flow	18RS01	6_9 .	36.63	0.01	<0.01	24.90	0.60	0.04	36.69	0.28	0.02	99.20	72.43
2002/03 lava flow	18RS01	6_10 .	36.73	0.02	<0.01	24.09	0.56	0.02	37.02	0.28	0.01	98.74	73.26
2002/03 lava flow	18RS01	6_11 .	36.93	0.02	<0.01	23.47	0.47	0.06	37.90	0.29	0.01	99.16	74.21
2002/03 lava flow	18RS01	6_12 .	37.08	<0.01	<0.01	22.82	0.47	0.05	38.61	0.28	0.02	99.34	75.10
2002/03 lava flow	18RS01	6_13 .	37.05	0.02	<0.01	22.43	0.42	0.07	39.23	0.29	0.02	99.54	75.72
2002/03 lava flow	18RS01	6_14 .	37.27	0.03	<0.01	21.54	0.45	0.07	39.64	0.27	0.02	99.27	76.64
2002/03 lava flow	18RS01	6_15 .	37.16	0.01	<0.01	21.18	0.39	0.06	40.31	0.27	0.01	99.39	77.24
2002/03 lava flow	18RS01	6_16 .	37.49	0.02	<0.01	20.87	0.38	0.06	40.77	0.27	0.02	99.90	77.69
2002/03 lava flow	18RS01	6_17 .	37.67	0.02	<0.01	20.43	0.35	0.08	40.58	0.27	0.02	99.44	77.98
2002/03 lava flow	18RS01	6_18 .	37.30	0.03	<0.01	20.33	0.37	0.06	40.50	0.27	<0.01	98.87	78.03
2002/03 lava flow	18RS01	6_19 .	37.47	0.02	<0.01	20.18	0.35	0.05	40.43	0.26	0.02	98.80	78.13
2002/03 lava flow	18RS01	6_20 .	37.53	0.02	<0.01	20.28	0.37	0.06	40.73	0.28	0.02	99.29	78.16
2002/03 lava flow	18RS01	6_21 .	37.39	0.03	<0.01	20.37	0.34	0.07	40.67	0.27	0.02	99.16	78.06
2002/03 lava flow	18RS01	6_22 .	37.39	0.03	<0.01	20.38	0.39	0.07	40.71	0.28	0.02	99.28	78.08
2002/03 lava flow	18RS01	6_23 .	37.71	0.05	<0.01	20.73	0.39	0.03	40.63	0.29	0.03	99.85	77.75

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
2002/03 lava flow	18RS01	6_24 .	37.13	0.03	<0.01	21.00	0.38	0.05	39.72	0.29	0.03	98.65	77.13
2002/03 lava flow	18RS01	6_25 .	37.13	0.04	<0.01	21.72	0.40	0.03	39.53	0.31	0.03	99.20	76.44
2002/03 lava flow	18RS01	6_26 .	36.46	0.09	<0.01	22.10	0.42	0.02	37.98	0.34	0.04	97.48	75.39
2002/03 lava flow	18RS01	6_27 .	37.51	0.20	<0.01	22.62	0.46	0.03	39.13	0.38	0.05	100.38	75.52
2002/03 lava flow	18RS01	8_1 .	37.14	0.02	<0.01	21.48	0.41	0.03	39.62	0.32	0.03	99.08	76.68
2002/03 lava flow	18RS01	9_1 .	36.65	0.03	<0.01	25.41	0.54	0.01	35.99	0.40	0.03	99.07	71.63
2002/03 lava flow	18RS01	13_1 .	36.29	0.01	<0.01	27.55	0.67	0.02	34.46	0.29	0.02	99.33	69.04
2002/03 lava flow	18RS01	14_1 .	36.32	0.03	<0.01	25.96	0.63	0.05	36.01	0.28	0.02	99.29	71.20
2002/03 lava flow	18RS01	15_1 .	37.59	0.02	<0.01	20.62	0.36	0.06	40.73	0.28	0.02	99.71	77.88
2002/03 lava flow	18RS01	16_1 .	37.21	0.03	<0.01	21.34	0.40	0.03	40.03	0.31	0.03	99.39	76.98
2002/03 lava flow	18RS01	17_1 .	39.04	0.02	0.02	16.55	0.28	0.10	44.07	0.24	0.02	100.34	82.60
2002/03 lava flow	18RS01	18_1 .	39.09	0.01	<0.01	16.55	0.24	0.12	43.83	0.24	0.02	100.10	82.52
2002/03 lava flow	18RS01	19_1 .	38.63	0.02	<0.01	18.47	0.29	0.05	42.18	0.28	0.02	99.94	80.28
2002/03 lava flow	18RS01	19_2 .	38.41	0.01	0.01	19.03	0.30	0.06	41.68	0.27	0.02	99.80	79.61
2002/03 lava flow	18RS01	19_3 .	38.04	0.02	<0.01	19.70	0.39	0.10	41.37	0.28	0.03	99.92	78.92
2002/03 lava flow	18RS01	19_4 .	38.19	0.04	<0.01	20.47	0.46	0.05	40.22	0.31	0.04	99.82	77.79
2002/03 lava flow	18RS01	20_1 .	38.43	0.02	<0.01	18.03	0.25	0.10	42.98	0.25	<0.01	100.07	80.95
2002/03 lava flow	18RS01	21_1 .	37.36	0.03	0.01	22.69	0.48	0.07	38.33	0.28	0.03	99.30	75.07
2002/03 lava flow	18RS01	51_1 .	36.71	0.03	<0.01	27.77	0.80	<0.01	33.77	0.45	0.07	99.63	68.43
2002/03 lava flow	18RS01	53_1 .	36.87	0.03	<0.01	25.61	0.59	0.02	35.90	0.27	0.02	99.31	71.41
2002/03 lava flow	18RS01	54_1 .	37.08	0.03	<0.01	25.76	0.54	<0.01	36.07	0.25	0.02	99.77	71.40
2002/03 lava flow	18RS01	55_1 .	36.99	0.04	<0.01	24.91	0.55	0.06	36.80	0.26	0.03	99.64	72.48
2002/03 lava flow	18RS01	55_2 .	37.06	0.03	<0.01	24.84	0.53	0.04	36.88	0.25	0.02	99.65	72.58
2002/03 lava flow	18RS01	55_3 .	37.35	0.03	<0.01	24.47	0.52	0.02	37.31	0.26	0.02	99.98	73.11
2002/03 lava flow	18RS01	55_4 .	37.27	0.02	<0.01	24.36	0.50	0.06	37.45	0.27	0.02	99.96	73.27
2002/03 lava flow	18RS01	55_5 .	37.29	0.03	<0.01	23.84	0.53	0.03	37.79	0.24	0.01	99.77	73.86
2002/03 lava flow	18RS01	55_6 .	36.98	0.02	<0.01	22.92	0.44	0.03	37.34	0.28	0.02	98.04	74.38
2002/03 lava flow	18RS01	55_7 .	37.40	0.02	<0.01	23.08	0.48	0.06	38.26	0.27	0.02	99.62	74.72
2002/03 lava flow	18RS01	55_8 .	37.47	0.02	<0.01	22.30	0.48	0.05	39.06	0.28	0.02	99.68	75.74
2002/03 lava flow	18RS01	55_9 .	37.65	0.04	<0.01	21.89	0.46	0.06	39.39	0.26	0.03	99.79	76.24
2002/03 lava flow	18RS01	55_10 .	37.86	0.02	<0.01	21.24	0.40	0.04	39.81	0.28	0.01	99.68	76.96
2002/03 lava flow	18RS01	55_11 .	38.01	0.02	<0.01	20.92	0.38	0.06	40.38	0.28	0.02	100.08	77.48
2002/03 lava flow	18RS01	55_12 .	38.19	0.02	<0.01	20.51	0.37	0.07	40.68	0.27	0.01	100.12	77.95
2002/03 lava flow	18RS01	55_13 .	38.16	0.02	<0.01	19.99	0.34	0.08	40.84	0.26	<0.01	99.69	78.46
2002/03 lava flow	18RS01	55_14 .	38.28	0.02	<0.01	20.10	0.36	0.10	41.20	0.28	<0.01	100.36	78.51
2002/03 lava flow	18RS01	55_15 .	38.18	0.03	<0.01	19.94	0.33	0.08	41.10	0.28	0.02	99.97	78.61
2002/03 lava flow	18RS01	55_16 .	38.20	0.02	<0.01	20.10	0.31	0.07	40.92	0.27	0.01	99.91	78.40
2002/03 lava flow	18RS01	55_17 .	38.25	0.02	<0.01	20.52	0.33	0.07	40.59	0.28	0.02	100.08	77.90
2002/03 lava flow	18RS01	55_18 .	37.85	0.02	<0.01	21.41	0.37	0.04	39.52	0.27	0.01	99.50	76.69
2002/03 lava flow	18RS01	55_19 .	37.56	0.03	<0.01	23.30	0.42	0.05	37.98	0.29	0.01	99.66	74.40
2002/03 lava flow	18RS01	55_20 .	36.15	0.04	<0.01	24.83	0.54	0.04	35.12	0.34	0.03	97.11	71.60
2002/03 lava flow	18RS01	59_1 .	37.82	<0.01	<0.01	21.60	0.44	0.05	40.18	0.21	<0.01	100.31	76.83
2002/03 lava flow	18RS01	60_1 .	37.88	0.02	0.01	23.68	0.47	0.06	38.95	0.30	0.05	101.43	74.57
2002/03 lava flow	18RS02	100_1 .	37.31	0.03	<0.01	27.53	0.64	<0.01	33.40	0.33	0.02	99.29	68.38
2002/03 lava flow	18RS02	101_1 .	39.01	0.02	<0.01	20.04	0.35	0.07	39.85	0.24	0.05	99.61	78.00
2002/03 lava flow	18RS02	102_1 .	39.54	0.02	<0.01	19.14	0.33	0.05	40.27	0.24	0.01	99.62	78.95
2002/03 lava flow	18RS02	103_1 .	37.52	0.03	<0.01	28.27	0.70	0.02	33.25	0.29	0.03	100.15	67.71

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
2002/03 lava flow	18RS02	104_1 .	37.19	0.03	<0.01	27.47	0.69	0.05	33.68	0.29	0.05	99.44	68.60
2002/03 lava flow	18RS02	105_1 .	38.50	0.03	<0.01	21.72	0.41	<0.01	38.59	0.28	0.03	99.56	76.01
2002/03 lava flow	18RS02	106_1 .	36.73	0.03	<0.01	28.82	0.82	0.03	31.92	0.49	0.07	98.95	66.38
2002/03 lava flow	18RS02	113 / 1 .	36.71	0.02	<0.01	27.86	0.69	<0.01	33.78	0.28	0.04	99.38	68.37
2002/03 lava flow	18RS02	114 / 1 .	36.75	0.03	0.01	27.19	0.68	0.04	34.12	0.28	<0.01	99.11	69.11
2002/03 lava flow	18RS02	115 / 1 .	36.51	0.03	<0.01	27.33	0.63	0.02	34.41	0.27	0.02	99.22	69.18
2002/03 lava flow	18RS02	116 / 1 .	36.53	0.02	<0.01	27.11	0.66	0.01	34.21	0.31	<0.01	98.86	69.23
2002/03 lava flow	18RS02	117 / 1 .	36.51	0.03	<0.01	27.88	0.66	0.03	33.70	0.27	0.02	99.13	68.30
2002/03 lava flow	18RS02	118 / 1 .	36.85	0.03	0.02	25.94	0.62	0.02	35.11	0.25	0.02	98.85	70.70
2002/03 lava flow	18RS02	119 / 1 .	36.49	0.03	<0.01	27.74	0.73	<0.01	33.85	0.25	0.02	99.12	68.50
2002/03 lava flow	18RS02	119 / 2 .	36.30	0.03	<0.01	27.89	0.71	0.02	33.77	0.24	0.02	98.98	68.33
2002/03 lava flow	18RS02	119 / 3 .	36.43	0.02	<0.01	28.04	0.68	0.01	33.82	0.27	<0.01	99.30	68.25
2002/03 lava flow	18RS02	119 / 4 .	36.57	0.03	<0.01	27.93	0.69	0.02	33.93	0.24	0.01	99.45	68.41
2002/03 lava flow	18RS02	119 / 5 .	36.67	0.03	<0.01	27.78	0.70	0.05	33.88	0.26	0.03	99.39	68.50
2002/03 lava flow	18RS02	119 / 6 .	36.39	0.02	<0.01	27.63	0.71	0.03	33.80	0.26	0.03	98.88	68.56
2002/03 lava flow	18RS02	119 / 7 .	36.48	0.01	<0.01	27.75	0.68	0.04	34.19	0.28	0.01	99.45	68.72
2002/03 lava flow	18RS02	119 / 8 .	36.51	0.03	<0.01	27.28	0.70	0.02	34.50	0.27	0.02	99.34	69.28
2002/03 lava flow	18RS02	119 / 9 .	36.61	0.01	<0.01	26.99	0.75	0.02	34.15	0.24	0.03	98.81	69.28
2002/03 lava flow	18RS02	119 / 10 .	36.64	0.01	<0.01	26.70	0.69	0.03	34.61	0.26	0.03	98.96	69.80
2002/03 lava flow	18RS02	119 / 11 .	36.97	0.02	<0.01	26.30	0.66	<0.01	34.93	0.25	0.03	99.18	70.31
2002/03 lava flow	18RS02	119 / 12 .	36.90	0.03	<0.01	25.50	0.66	0.01	35.22	0.24	0.02	98.57	71.12
2002/03 lava flow	18RS02	119 / 13 .	37.11	0.02	<0.01	24.64	0.55	0.02	36.68	0.23	0.02	99.29	72.63
2002/03 lava flow	18RS02	119 / 14 .	37.29	0.03	0.02	23.57	0.55	0.04	37.40	0.26	0.01	99.19	73.88
2002/03 lava flow	18RS02	119 / 15 .	37.58	0.02	0.03	22.17	0.47	0.06	38.25	0.29	0.01	98.89	75.46
2002/03 lava flow	18RS02	119 / 16 .	37.74	<0.01	<0.01	21.13	0.42	0.06	39.48	0.30	0.02	99.16	76.91
2002/03 lava flow	18RS02	119 / 17 .	38.01	0.02	<0.01	20.38	0.37	0.06	39.69	0.28	0.02	98.82	77.64
2002/03 lava flow	18RS02	119 / 18 .	37.93	<0.01	<0.01	20.50	0.36	0.08	39.74	0.30	0.02	98.94	77.56
2002/03 lava flow	18RS02	119 / 19 .	37.71	0.04	<0.01	22.53	0.41	0.06	38.16	0.29	0.03	99.23	75.12
2002/03 lava flow	18RS02	119 / 20 .	36.53	0.02	<0.01	25.67	0.52	0.02	34.90	0.38	0.02	98.08	70.79
2002/03 lava flow	18RS02	119 / 21 .	36.25	0.05	<0.01	27.98	0.73	0.02	32.64	0.51	0.05	98.24	67.53
2002/03 lava flow	18RS02	137 / 1 .	39.20	0.02	0.01	16.87	0.28	0.09	43.30	0.24	0.01	100.02	82.07
2002/03 lava flow	18RS02	138 / 1 .	38.96	0.03	0.02	16.47	0.29	0.10	43.78	0.25	0.02	99.92	82.57
2002/03 lava flow	18RS02	139 / 1 .	38.96	0.03	0.02	16.51	0.26	0.10	43.17	0.24	0.02	99.31	82.34
2002/03 lava flow	18RS02	140 / 1 .	38.78	0.02	0.01	16.67	0.29	0.10	43.61	0.26	<0.01	99.76	82.34
2002/03 lava flow	18RS02	141 / 1 .	38.98	0.02	<0.01	16.44	0.27	0.12	43.64	0.26	0.02	99.75	82.56
2002/03 lava flow	18RS02	142 / 1 .	39.08	0.03	0.01	16.34	0.26	0.08	43.75	0.24	<0.01	99.84	82.67
2002/03 lava flow	18RS02	143 / 1 .	39.15	0.02	<0.01	16.44	0.26	0.10	43.74	0.23	0.02	99.95	82.59
2002/03 lava flow	18RS02	143 / 2 .	38.88	0.03	0.01	16.56	0.27	0.11	43.91	0.27	<0.01	100.05	82.54
2002/03 lava flow	18RS02	143 / 3 .	38.81	<0.01	0.01	16.65	0.27	0.12	43.53	0.25	0.01	99.67	82.33
2002/03 lava flow	18RS02	143 / 4 .	38.93	<0.01	0.01	16.45	0.26	0.11	43.32	0.25	0.03	99.37	82.44
2002/03 lava flow	18RS02	143 / 5 .	39.09	0.02	<0.01	16.55	0.22	0.10	43.35	0.26	0.01	99.59	82.36
2002/03 lava flow	18RS02	143 / 6 .	39.08	0.01	0.01	16.60	0.25	0.10	42.95	0.25	0.02	99.28	82.18
2002/03 lava flow	18RS02	143 / 7 .	39.01	0.03	0.01	16.81	0.25	0.11	43.21	0.29	<0.01	99.75	82.08
2002/03 lava flow	18RS02	143 / 8 .	38.89	0.02	<0.01	16.72	0.26	0.12	42.97	0.27	<0.01	99.28	82.08
2002/03 lava flow	18RS02	143 / 9 .	39.02	0.02	0.02	17.17	0.29	0.10	42.82	0.30	0.01	99.77	81.64
2002/03 lava flow	18RS02	143 / 10 .	38.73	<0.01	<0.01	17.79	0.31	0.09	42.39	0.28	<0.01	99.62	80.94
2002/03 lava flow	18RS02	143 / 11 .	38.43	0.02	<0.01	18.78	0.27	0.08	41.55	0.26	<0.01	99.41	79.77

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
2002/03 lava flow	18RS02	143 / 12 .	37.52	0.16	<0.01	24.48	0.53	0.07	36.49	0.37	0.02	99.68	72.65
2002/03 lava flow	18RS02	144 / 1 .	36.09	0.01	<0.01	29.92	0.68	0.02	32.12	0.34	0.02	99.20	65.68
2002/03 lava flow	18RS02	144 / 2 .	36.20	0.02	0.01	29.37	0.71	0.02	32.51	0.33	0.02	99.20	66.37
2002/03 lava flow	18RS02	144 / 3 .	36.44	0.03	<0.01	29.33	0.65	0.04	33.16	0.36	0.02	100.05	66.83
2002/03 lava flow	18RS02	144 / 4 .	36.55	0.02	<0.01	28.64	0.69	0.03	33.61	0.33	0.02	99.90	67.66
2002/03 lava flow	18RS02	144 / 6 .	36.55	0.02	<0.01	28.32	0.66	0.02	33.30	0.38	0.03	99.30	67.70
2002/03 lava flow	18RS02	144 / 7 .	36.96	0.02	0.01	28.02	0.68	<0.01	33.69	0.36	0.01	99.80	68.19
2002/03 lava flow	18RS02	144 / 8 .	36.21	0.03	<0.01	27.46	0.62	0.02	33.47	0.36	0.03	98.19	68.48
2002/03 lava flow	18RS02	144 / 9 .	36.69	0.01	0.01	27.66	0.65	<0.01	34.18	0.35	0.03	99.60	68.78
2002/03 lava flow	18RS02	144 / 10 .	36.92	<0.01	<0.01	27.28	0.67	0.06	34.09	0.34	0.02	99.38	69.02
2002/03 lava flow	18RS02	144 / 11 .	36.95	0.02	<0.01	26.97	0.61	0.03	34.21	0.37	0.02	99.18	69.34
2002/03 lava flow	18RS02	144 / 12 .	36.68	<0.01	<0.01	26.66	0.62	0.02	34.06	0.37	0.02	98.45	69.49
2002/03 lava flow	18RS02	144 / 13 .	36.64	0.03	<0.01	25.99	0.61	0.04	34.30	0.36	0.04	98.03	70.17
2002/03 lava flow	18RS02	144 / 14 .	36.90	0.02	<0.01	26.08	0.57	0.01	34.47	0.42	0.03	98.53	70.21
2002/03 lava flow	18RS02	144 / 15 .	36.56	0.03	<0.01	26.36	0.56	0.03	34.55	0.39	0.02	98.51	70.03
2002/03 lava flow	18RS02	144 / 16 .	36.43	0.05	<0.01	26.10	0.54	0.03	35.60	0.38	0.03	99.16	70.86
2002/03 lava flow	18RS02	144 / 17 .	36.42	0.01	<0.01	23.87	0.47	0.05	36.18	0.35	<0.01	97.37	72.98
2002/03 lava flow	18RS02	144 / 18 .	37.35	0.02	<0.01	22.25	0.44	0.05	37.55	0.32	<0.01	97.98	75.05
2002/03 lava flow	18RS02	144 / 19 .	37.80	0.03	0.01	21.42	0.36	0.08	39.42	0.26	<0.01	99.40	76.64
2002/03 lava flow	18RS02	144 / 20 .	38.36	0.02	0.02	20.29	0.34	0.06	40.24	0.29	0.01	99.63	77.95
2002/03 lava flow	18RS02	144 / 21 .	38.27	0.03	<0.01	20.18	0.34	0.07	40.10	0.24	0.02	99.26	77.99
2002/03 lava flow	18RS02	144 / 22 .	38.05	<0.01	<0.01	20.66	0.34	0.07	40.02	0.28	0.03	99.46	77.54
2002/03 lava flow	18RS02	144 / 23 .	38.11	0.01	<0.01	21.66	0.39	0.04	39.00	0.31	0.03	99.57	76.25
2002/03 lava flow	18RS02	144 / 24 .	37.19	0.03	<0.01	25.65	0.55	0.02	35.00	0.37	0.04	98.86	70.86
2002/03 lava flow	18RS02	145 / 1 .	36.50	0.02	<0.01	30.00	0.70	<0.01	32.09	0.37	<0.01	99.69	65.60
2002/03 lava flow	18RS02	146 / 1 .	36.34	0.03	0.01	30.31	0.78	0.02	31.77	0.33	0.01	99.62	65.14
2002/03 lava flow	18RS02	147 / 1 .	37.13	<0.01	<0.01	25.44	0.56	0.03	36.13	0.33	<0.01	99.63	71.68
2002/03 lava flow	18RS02	148 / 1 .	36.20	0.02	0.01	30.21	0.69	0.02	31.48	0.36	0.02	99.00	65.01
2002/03 lava flow	18RS02	149 / 1 .	38.98	0.03	0.02	16.53	0.26	0.10	43.33	0.25	0.02	99.52	82.38
2002/03 lava flow	18RS02	150 / 1 .	38.93	0.03	<0.01	16.42	0.28	0.12	43.32	0.24	0.02	99.38	82.47
2002/03 lava flow	18RS02	161 / 1 .	36.78	0.03	0.01	26.72	0.62	0.05	34.02	0.30	<0.01	98.57	69.41
2002/03 lava flow	18RS02	161 / 2 .	36.65	0.02	<0.01	26.93	0.61	0.03	34.56	0.29	0.04	99.14	69.58
2002/03 lava flow	18RS02	161 / 3 .	36.56	0.03	<0.01	26.61	0.65	<0.01	34.68	0.28	0.03	98.84	69.91
2002/03 lava flow	18RS02	161 / 4 .	36.83	0.02	<0.01	26.10	0.59	0.03	34.99	0.28	0.03	98.88	70.50
2002/03 lava flow	18RS02	161 / 5 .	36.89	0.01	<0.01	26.14	0.62	0.02	35.10	0.28	0.03	99.10	70.53
2002/03 lava flow	18RS02	161 / 6 .	37.21	0.02	<0.01	25.74	0.58	0.03	35.83	0.28	0.03	99.74	71.28
2002/03 lava flow	18RS02	161 / 7 .	37.34	0.04	0.01	24.89	0.58	0.03	35.84	0.30	0.02	99.06	71.96
2002/03 lava flow	18RS02	161 / 8 .	37.33	0.03	<0.01	24.58	0.54	0.04	36.78	0.32	0.02	99.67	72.73
2002/03 lava flow	18RS02	161 / 10 .	37.39	<0.01	<0.01	22.53	0.46	0.04	38.07	0.27	0.02	98.81	75.08
2002/03 lava flow	18RS02	161 / 11 .	38.74	0.02	0.02	21.62	0.43	0.08	40.03	0.26	0.02	101.22	76.75
2002/03 lava flow	18RS02	161 / 12 .	38.0	0.02	<0.01	20.8	0.39	0.08	39.4	0.28	0.03	98.95	77.2
2002/03 lava flow	18RS02	161 / 13 .	37.9	0.01	<0.01	20.2	0.39	0.10	40.4	0.29	0.01	99.38	78.1
2002/03 lava flow	18RS02	161 / 14 .	38.4	<0.01	<0.01	19.3	0.36	0.07	40.5	0.28	0.01	99.02	78.9
2002/03 lava flow	18RS02	161 / 16 .	38.0	0.03	<0.01	19.1	0.30	0.09	40.2	0.30	0.03	98.08	78.9
2002/03 lava flow	18RS02	161 / 17 .	38.4	0.02	<0.01	19.1	0.32	0.10	40.4	0.24	0.03	98.60	79.0
2002/03 lava flow	18RS02	161 / 18 .	38.2	0.03	<0.01	19.5	0.31	0.07	40.4	0.25	0.03	98.72	78.7
2002/03 lava flow	18RS02	161 / 19 .	38.2	0.02	<0.01	20.2	0.33	0.06	40.1	0.28	0.03	99.31	78.0
2002/03 lava flow	18RS02	161 / 20 .	38.1	0.03	<0.01	20.3	0.37	0.06	40.1	0.28	0.03	99.26	77.9

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Total	Mg#
2002/03 lava flow	18RS02	161 / 21 .	38.1	0.03	<0.01	20.6	0.39	0.05	39.4	0.26	0.05	98.91	77.3
2002/03 lava flow	18RS02	161 / 22 .	37.6	0.02	<0.01	23.0	0.42	0.01	37.5	0.29	0.04	98.85	74.4
2002/03 lava flow	18RS02	161 / 23 .	36.5	0.07	<0.01	26.7	0.68	0.02	34.0	0.42	0.06	98.40	69.4
2002/03 lava flow	18RS02	162 / 1 .	36.8	0.01	<0.01	27.7	0.64	0.02	33.5	0.30	0.02	99.10	68.3
2002/03 lava flow	18RS02	163 / 1 .	36.6	0.01	<0.01	27.8	0.68	0.02	33.8	0.28	0.04	99.31	68.4
2002/03 lava flow	18RS02	164 / 1 .	38.3	0.01	<0.01	19.3	0.36	0.09	40.9	0.26	<0.01	99.23	79.1
2002/03 lava flow	18RS02	165 / 1 .	38.2	0.02	<0.01	20.2	0.37	0.06	40.1	0.25	<0.01	99.24	78.0
2002/03 lava flow	18RS02	167 / 1 .	38.7	0.03	0.01	17.1	0.30	0.07	42.8	0.26	0.02	99.36	81.7
2002/03 lava flow	18RS02	168 / 1 .	38.5	0.02	<0.01	17.2	0.26	0.07	42.6	0.26	0.03	98.96	81.5
2002/03 lava flow	18RS02	169 / 1 .	38.2	0.03	<0.01	18.6	0.30	0.08	41.7	0.26	0.01	99.15	80.0
2002/03 lava flow	18RS02	170 / 1 .	38.8	0.03	<0.01	17.9	0.29	0.07	41.8	0.28	0.02	99.19	80.7
2002/03 lava flow	18RS02	171 / 1 .	37.6	0.03	<0.01	21.7	0.43	0.03	38.8	0.30	0.03	98.90	76.1
2002/03 lava flow	18RS02	180 / 1 .	37.0	0.02	<0.01	23.6	0.47	0.04	36.7	0.23	<0.01	98.05	73.5
2002/03 lava flow	18RS02	181 / 1 .	36.9	0.02	<0.01	23.3	0.51	0.05	37.0	0.23	0.01	97.97	73.9
2002/03 lava flow	18RS02	182 / 1 .	37.1	0.02	0.01	23.7	0.47	0.04	37.2	0.22	<0.01	98.70	73.7
2002/03 lava flow	18RS02	183 / 1 .	37.8	0.02	<0.01	20.0	0.34	0.04	40.1	0.27	0.02	98.55	78.1
2002/03 lava flow	18RS02	184 / 1 .	38.1	0.02	0.01	19.5	0.35	0.07	40.8	0.28	0.04	99.16	78.8
2002/03 lava flow	18RS02	188 / 1 .	37.2	0.02	<0.01	22.9	0.45	0.06	37.4	0.21	<0.01	98.23	74.5
2002/03 lava flow	18RS02	188 / 2 .	37.2	0.03	<0.01	22.6	0.47	0.03	37.9	0.21	0.02	98.39	75.0
2002/03 lava flow	18RS02	188 / 3 .	37.5	0.02	<0.01	22.2	0.42	0.04	38.1	0.23	0.03	98.60	75.4
2002/03 lava flow	18RS02	188 / 4 .	37.5	0.02	<0.01	21.6	0.40	0.03	38.7	0.24	0.01	98.46	76.1
2002/03 lava flow	18RS02	188 / 5 .	37.7	0.04	<0.01	21.3	0.38	0.08	39.4	0.28	0.03	99.15	76.7
2002/03 lava flow	18RS02	188 / 6 .	37.8	0.03	0.02	20.4	0.35	0.06	39.6	0.25	0.02	98.57	77.6
2002/03 lava flow	18RS02	188 / 7 .	37.8	0.02	<0.01	20.2	0.39	0.07	40.0	0.27	0.01	98.75	77.9
2002/03 lava flow	18RS02	188 / 8 .	38.1	0.01	<0.01	20.0	0.34	0.07	40.4	0.29	0.03	99.26	78.3
2002/03 lava flow	18RS02	188 / 9 .	37.8	0.02	<0.01	20.0	0.35	0.06	39.9	0.25	0.02	98.40	78.0
2002/03 lava flow	18RS02	188 / 10 .	38.0	0.02	<0.01	20.3	0.36	0.05	40.0	0.26	<0.01	99.06	77.8
2002/03 lava flow	18RS02	188 / 11 .	37.7	0.03	<0.01	21.2	0.34	0.03	39.0	0.29	0.02	98.61	76.7
2002/03 lava flow	18RS02	188 / 13 .	37.0	0.08	<0.01	25.4	0.55	0.01	34.9	0.37	0.04	98.40	71.1

11.2. CLINOPYROXENE POINT ANALYSES

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Na2O	Total	Mg#	En	Fs	Wo	T [°C]	P [kbar]	Kd
Monte Spagnolo	18MS01	125_1	51.09	3.24	0.23	6.45	0.14	0.03	15.32	22.38	0.86	0.28	100.02	80.9	43.7	10.3	45.9	1146.4	3.16	0.26
Monte Spagnolo	18MS01	126_1	46.92	6.95	0.54	7.38	0.15	<0.01	13.00	22.22	1.71	0.43	99.31	75.8	39.3	12.5	48.2	1174.8	5.86	0.35
Monte Spagnolo	18MS01	128_1	49.28	4.11	0.03	8.18	0.19	<0.01	14.67	21.81	1.23	0.36	99.89	76.2	42.0	13.1	44.9	1160.0	4.57	0.34
Monte Spagnolo	18MS01	131_1	47.63	5.26	0.02	8.87	0.20	<0.01	12.79	21.89	1.89	0.57	99.14	72.0	38.2	14.9	47.0	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	143_1	48.96	4.77	<0.01	8.83	0.20	<0.01	13.16	21.20	1.45	0.59	99.15	72.7	39.5	14.8	45.7	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	145_1	48.08	5.41	0.07	7.82	0.18	0.02	13.31	22.05	1.63	0.48	99.05	75.2	39.7	13.1	47.3	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	146_1	46.70	7.08	0.14	7.63	0.13	0.02	12.60	22.18	1.85	0.45	98.79	74.6	38.4	13.0	48.6	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	151_1	51.81	2.63	0.54	4.71	0.12	0.03	15.36	22.69	0.58	0.30	98.78	85.3	44.8	7.7	47.5	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	174_1	46.18	7.07	0.63	7.19	0.13	0.05	13.21	22.46	1.83	0.43	99.17	76.6	39.6	12.1	48.3	1173.6	5.83	0.34
Monte Spagnolo	18MS01	93_1	52.07	2.95	1.01	4.02	0.10	0.01	15.81	23.02	0.50	0.38	99.88	87.5	45.7	6.5	47.8	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	94_1	47.62	5.43	0.01	8.88	0.17	0.03	12.47	21.64	1.92	0.51	98.72	71.5	37.8	15.1	47.1	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	95_1	52.42	2.52	0.68	4.01	0.12	0.02	16.22	23.09	0.41	0.38	99.86	87.8	46.3	6.4	47.3	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	109_1	48.60	4.85	0.05	7.65	0.15	0.02	13.32	22.06	1.37	0.49	98.56	75.6	39.8	12.8	47.4	1173.9	6.48	0.35
Monte Spagnolo	18MS01	110_1	50.59	3.75	0.84	4.65	0.12	0.04	15.01	23.08	0.68	0.34	99.09	85.2	43.9	7.6	48.5	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	111_1	50.40	4.19	0.81	4.98	0.10	0.04	14.51	22.95	0.89	0.37	99.23	83.9	42.9	8.3	48.8	1158.5	4.74	0.21
Monte Spagnolo	18MS01	112_1	51.07	3.24	0.20	6.23	0.14	0.03	14.85	22.57	0.86	0.36	99.54	81.0	43.0	10.1	46.9	1155.7	4.54	0.26
Monte Spagnolo	18MS01	113_1	52.27	2.35	0.60	4.35	0.09	0.01	16.05	22.68	0.49	0.29	99.18	86.8	46.1	7.0	46.9	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	114_1	52.02	2.43	0.61	4.56	0.11	0.02	16.13	22.87	0.47	0.34	99.56	86.3	45.9	7.3	46.8	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	146_1	50.50	3.11	<0.01	7.40	0.19	<0.01	14.36	22.03	1.02	0.45	99.08	77.6	41.8	12.1	46.1	1167.0	5.96	0.32
Monte Spagnolo	18MS01	147_1	50.19	4.11	0.19	6.83	0.17	0.04	14.59	22.12	1.00	0.34	99.58	79.2	42.5	11.2	46.3	1157.2	4.29	0.29
Monte Spagnolo	18MS01	148_1	45.84	7.75	0.13	8.31	0.14	0.01	12.29	21.99	2.15	0.42	99.02	72.5	37.5	14.2	48.2	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	51_1	47.30	4.95	0.01	9.37	0.26	0.02	12.18	21.77	2.33	0.68	98.87	69.9	36.8	15.9	47.3	n.a.	n.a.	n.a.
Monte Spagnolo	18MS01	53_1	47.32	5.02	<0.01	9.29	0.21	<0.01	12.31	21.63	2.18	0.61	98.59	70.3	37.2	15.8	47.0	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	134_1	47.67	5.24	0.01	8.96	0.18	<0.01	13.04	21.61	2.04	0.62	99.37	72.2	38.8	15.0	46.2	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	136_1	48.14	4.35	<0.01	8.72	0.21	<0.01	13.38	21.51	1.82	0.61	98.74	73.2	39.7	14.5	45.8	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	169_1	47.16	5.75	0.05	8.63	0.18	<0.01	12.86	22.02	2.01	0.52	99.18	72.6	38.4	14.4	47.2	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	65_1	48.90	4.02	0.23	8.04	0.19	0.03	13.79	22.03	0.93	0.46	98.64	75.4	40.4	13.2	46.4	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	68_1	47.71	5.00	0.01	8.83	0.19	<0.01	13.29	21.91	1.47	0.45	98.88	72.8	39.1	14.6	46.3	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	98_1	46.34	5.05	0.11	10.69	0.18	0.02	12.92	21.10	2.20	0.53	99.19	68.3	37.9	17.6	44.5	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	120_1	50.92	3.16	0.27	5.75	0.11	0.03	15.93	22.78	0.72	0.28	99.94	83.2	44.8	9.1	46.1	1160.7	3.43	0.24
Monte Spagnolo	18MS02	137_1	50.82	2.96	0.26	5.50	0.11	0.02	15.92	22.65	0.67	0.29	99.21	83.8	45.1	8.7	46.1	1161.1	3.53	0.23
Monte Spagnolo	18MS02	138_1	47.98	5.51	0.62	6.20	0.12	0.02	14.19	22.90	1.28	0.37	99.18	80.3	41.6	10.2	48.2	1177.2	5.08	0.29
Monte Spagnolo	18MS02	139_1	50.79	3.03	0.29	5.76	0.15	0.03	15.87	22.01	0.81	0.27	99.01	83.1	45.5	9.3	45.3	1161.5	3.24	0.24
Monte Spagnolo	18MS02	276_1	47.97	5.51	0.04	8.17	0.15	<0.01	13.55	22.09	1.66	0.49	99.63	74.7	39.8	13.5	46.7	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	277_1	49.68	3.89	0.03	7.52	0.20	<0.01	14.50	21.71	1.20	0.55	99.29	77.5	42.3	12.3	45.5	1189.7	6.67	0.35
Monte Spagnolo	18MS02	278_1	49.80	3.47	<0.01	7.35	0.28	0.01	14.79	21.66	1.31	0.74	99.46	78.2	42.9	12.0	45.1	1163.6	3.33	0.33
Monte Spagnolo	18MS02	279_1	49.72	4.05	0.02	7.45	0.21	0.04	14.40	21.46	1.31	0.80	99.48	77.5	42.4	12.3	45.4	1196.7	7.42	0.34
Monte Spagnolo	18MS02	280_1	50.56	3.12	0.02	7.44	0.17	0.03	15.07	21.76	1.08	0.43	99.68	78.3	43.2	12.0	44.8	1169.5	4.21	0.33
Monte Spagnolo	18MS02	281_1	50.86	1.61	0.06	10.04	0.23	0.02	14.10	21.17	0.97	0.77	99.84	71.5	40.3	16.1	43.5	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	282_1	52.91	0.40	<0.01	10.70	0.36	<0.01	15.88	18.79	0.25	0.70	100.01	72.6	44.9	17.0	38.2	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	284_1	51.39	1.52	<0.01	10.67	0.29	0.04	15.04	20.14	0.72	0.54	100.39	71.5	42.4	16.9	40.8	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	285_1	51.03	2.66	0.03	8.15	0.25	0.02	14.84	21.83	0.94	0.53	100.27	76.4	42.3	13.0	44.7	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	287_1	48.17	5.50	0.04	8.09	0.15	0.02	13.77	22.04	1.55	0.49	99.85	75.2	40.3	13.3	46.4	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	173_1	48.55	5.49	0.60	6.07	0.12	0.02	14.25	23.02	1.05	0.38	99.56	80.7	41.7	10.0	48.4	1177.9	5.18	0.28
Monte Spagnolo	18MS02	177_1	51.22	2.66	0.42	5.05	0.12	0.02	16.26	22.61	0.58	0.32	99.27	85.2	46.0	8.0	46.0	1155.6	2.81	0.21
Monte Spagnolo	18MS02	56 / 1	49.91	3.92	0.05	8.43	0.20	<0.01	13.75	22.00	1.23	0.48	98.96	74.4	40.1	13.8	46.1	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	57 / 1	49.07	4.35	0.51	5.49	0.11	<0.01	14.95	23.08	0.85	0.35	98.77	82.9	43.2	8.9	47.9	1170.9	4.70	0.24
Monte Spagnolo	18MS02	58 / 1	48.49	5.13	0.34	6.16	0.13	<0.01	14.42	23.04	1.13	0.34	99.17	80.7	41.9	10.0	48.1	1171.2	4.52	0.28
Monte Spagnolo	18MS02	59 / 1	48.59	4.26	0.03	8.56	0.20	0.02	13.58	21.89	1.21	0.50	98.83	73.9	39.8	14.1	46.1	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	60 / 1	48.62	4.54	0.05	7.97	0.17	<0.01	13.99	22.02	1.29	0.56	99.23	75.8	40.8	13.0	46.2	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	60 / 3	48.73	4.58	0.04	8.02	0.18	<0.01	13.72	21.96	1.33	0.52	99.09	75.3	40.3	13.2	46.4	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	60 / 4	48.62	4.59	0.04	7.94	0.19	<0.01	13.85	22.00	1.30	0.56	99.09	75.7	40.6	13.1	46.3	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	60 / 5	48.56	4.57	0.05	7.73	0.17	<0.01	13.88	22.05	1.25	0.52	98.79	76.2	40.7	12.7	46.5	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	60 / 6	48.60	4.56	0.05	7.86	0.19	0.02	13.96	22.06	1.35	0.52	99.17	76.0	40.8	12.9	46.3	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	60 / 7	48.71	4.55	0.06	7.87	0.19	0.02	13.79	22.01	1.27	0.52	98.98	75.8	40.5	13.0	46.5	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	60 / 8	48.85	4.51	0.04	7.86	0.18	<0.01	13.99	22.04	1.26	0.56	99.25	76.0	40.9	12.9	46.3	n.a.	n.a.	n.a.
Monte Spagnolo	18MS02	60 / 9	50.04	3.63	0.46	5.49	0.13	<0.01	15.28	22.86	0.81	0.35	99.05	83.2	43.9	8.9	47.2	1169.9	4.61	0.24
Monte Spagnolo	18MS02	60 / 10	50.04	3.56	0.51	5.39	0.11	0.03	15.44	22.73	0.72	0.32	98.87	83.6	44.4	8.7	46.9	1167.5	4.25	0.23
Monte Spagnolo	18MS02	60 / 11	49.95	3.70	0.51	5.29	0.12	0.03	15.32	23.15	0.78	0.36	99.20	83.8	43.9	8.5	47.6	1171.1	4.88	0.23
Monte Spagnolo	18MS02	60 / 12	49.65	4.03	0.55	5.48	0.10	0.06	15.21	23.18	0.82	0.37	99.45	83.2	43.5	8.8	47.7	1172.6	4.99	0.24
Monte Spagnolo	18MS02	60 / 13	51.04	2.88	0.54	4.96	0.10	0.01	16.13	22.94	0.64	0.32	99.56	85.3	45.6	7.9	46.6	1152.0	2.41	0.21
Monte Spagnolo	18MS02	60 / 14	50.74	2.65	0.50	5.13	0.11	0.02	15.93	22.76										

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Na2O	Total	Mg#	En	Fs	Wo	T [°C]	P [kbar]	Kd
Monte Rossi	18MR01	147_1	47.14	6.26	<0.01	8.70	0.17	0.01	12.56	21.90	1.97	0.46	99.17	72.0	37.9	14.7	47.4	1143.7	4.74	0.34
Monte Rossi	18MR01	148_1	50.25	3.41	<0.01	8.24	0.25	0.01	14.12	21.63	1.24	0.39	99.54	75.3	41.2	13.5	45.3	1131.8	3.71	0.29
Monte Rossi	18MR01	149_1	49.97	3.54	<0.01	8.48	0.23	0.02	14.21	21.35	1.20	0.42	99.42	74.9	41.4	13.9	44.7	1136.1	4.14	0.29
Monte Rossi	18MR01	150_1	49.16	3.93	<0.01	9.10	0.25	0.02	12.76	21.55	1.63	0.54	98.98	71.4	38.3	15.3	46.4	1146.1	5.61	0.35
Monte Rossi	18MR01	151_1	49.28	3.43	<0.01	8.02	0.19	<0.01	14.27	22.09	1.10	0.40	98.79	76.0	41.2	13.0	45.8	1113.4	1.52	0.28
Monte Rossi	18MR01	163_1	49.35	3.32	<0.01	7.83	0.19	<0.01	14.34	22.09	1.04	0.38	98.56	76.5	41.4	12.7	45.9	1113.3	1.55	0.27
Monte Rossi	18MR01	166_1	48.86	5.07	<0.01	8.56	0.23	<0.01	12.84	21.51	1.51	0.63	99.20	72.8	38.8	14.5	46.7	1155.9	6.54	0.33
Monte Rossi	18MR01	167_1	49.60	3.97	<0.01	8.29	0.22	0.02	13.58	21.50	1.31	0.57	99.08	74.5	40.3	13.8	45.9	1149.0	5.91	0.30
Monte Rossi	18MR01	176_1	50.44	3.35	<0.01	8.03	0.19	<0.01	14.24	21.75	1.12	0.37	99.47	76.0	41.4	13.1	45.5	1129.0	3.39	0.28
Monte Rossi	18MR01	177_1	48.27	5.37	0.05	7.85	0.16	0.04	13.13	22.54	1.54	0.40	99.33	74.9	38.9	13.0	48.0	1133.5	3.90	0.29
Monte Rossi	18MR01	178_1	49.91	3.61	<0.01	8.16	0.22	0.02	13.50	21.96	1.20	0.51	99.10	74.7	39.9	13.5	46.6	1141.3	5.20	0.30
Monte Rossi	18MR01	179_1	47.92	5.80	0.02	8.41	0.18	0.01	12.86	22.06	1.74	0.45	99.44	73.2	38.5	14.1	47.4	1141.3	4.59	0.32
Monte Rossi	18MR01	180_1	50.49	3.56	0.02	7.80	0.21	0.02	14.07	21.95	1.17	0.45	99.73	76.3	41.1	12.8	46.1	1137.0	4.51	0.27
Monte Rossi	18MR01	181_1	48.28	5.44	0.04	8.32	0.18	<0.01	12.94	21.98	1.56	0.48	99.21	73.5	38.7	14.0	47.3	1143.1	4.92	0.32
Monte Rossi	18MR01	182_1	49.87	3.72	0.02	7.63	0.21	<0.01	13.85	21.84	1.25	0.48	98.84	76.4	40.9	12.7	46.4	1140.2	4.94	0.27
Monte Rossi	18MR01	182_2	50.08	3.64	0.02	7.85	0.21	<0.01	13.83	21.95	1.27	0.54	99.38	75.8	40.7	12.9	46.4	1143.9	5.50	0.28
Monte Rossi	18MR01	182_3	50.12	3.66	0.02	7.66	0.20	<0.01	13.88	21.88	1.24	0.53	99.21	76.4	40.9	12.7	46.4	1144.0	5.47	0.27
Monte Rossi	18MR01	182_4	50.15	3.61	<0.01	7.68	0.20	<0.01	13.87	22.11	1.24	0.50	99.36	76.3	40.7	12.6	46.6	1140.3	5.09	0.27
Monte Rossi	18MR01	182_5	49.71	3.60	0.01	7.58	0.21	<0.01	13.72	22.05	1.23	0.52	98.62	76.3	40.6	12.6	46.9	1141.4	5.30	0.27
Monte Rossi	18MR01	182_6	47.94	5.33	<0.01	8.44	0.20	0.01	12.72	21.80	1.83	0.55	98.83	72.9	38.4	14.3	47.3	1149.5	5.80	0.33
Monte Rossi	18MR01	182_7	46.74	6.41	<0.01	8.63	0.17	<0.01	12.27	21.63	2.20	0.58	98.64	71.7	37.6	14.8	47.6	1154.6	6.10	0.34
Monte Rossi	18MR01	182_8	47.35	6.08	0.03	8.79	0.18	<0.01	12.31	21.79	2.06	0.58	99.16	71.4	37.4	15.0	47.6	1153.7	6.12	0.35
Monte Rossi	18MR01	182_9	48.96	4.79	0.02	8.27	0.19	<0.01	13.06	21.66	1.60	0.56	99.06	73.8	39.3	13.9	46.8	1149.2	5.78	0.31
Monte Rossi	18MR01	182_10	47.77	5.62	0.02	8.59	0.18	<0.01	12.64	21.69	1.95	0.58	99.03	72.4	38.2	14.6	47.2	1153.0	6.12	0.33
Monte Rossi	18MR01	182_11	47.93	5.52	0.02	8.46	0.16	<0.01	12.63	21.72	1.87	0.54	98.85	72.7	38.3	14.4	47.3	1149.5	5.68	0.33
Monte Rossi	18MR01	182_12	47.20	5.84	0.01	8.64	0.18	0.02	12.26	21.78	2.04	0.61	98.58	71.7	37.4	14.8	47.8	1154.9	6.43	0.35
Monte Rossi	18MR01	182_13	47.70	5.61	0.02	8.25	0.19	<0.01	12.45	21.83	1.93	0.57	98.54	72.9	38.0	14.1	47.9	1151.2	5.99	0.32
Monte Rossi	18MR01	182_14	48.01	5.22	0.02	8.50	0.19	0.02	12.82	21.80	1.78	0.57	98.92	72.9	38.6	14.3	47.1	1150.4	5.95	0.32
Monte Rossi	18MR01	182_15	47.96	5.31	0.02	8.37	0.19	<0.01	12.61	21.89	1.77	0.59	98.67	72.9	38.2	14.2	47.6	1151.5	6.14	0.33
Monte Rossi	18MR01	182_16	47.40	5.98	0.01	8.75	0.18	0.02	12.24	21.76	2.09	0.58	99.02	71.4	37.3	15.0	47.7	1153.2	6.08	0.35
Monte Rossi	18MR01	182_17	47.53	5.70	0.02	8.67	0.19	<0.01	12.57	21.86	1.90	0.57	98.98	72.1	37.9	14.7	47.4	1151.4	5.98	0.34
Monte Rossi	18MR01	182_18	48.51	5.03	0.03	8.06	0.18	0.02	12.90	21.86	1.67	0.53	98.79	74.1	38.9	13.6	47.4	1146.5	5.48	0.31
Monte Rossi	18MR01	182_19	47.13	6.07	0.03	8.57	0.15	<0.01	12.54	21.90	1.82	0.48	98.68	72.3	37.9	14.5	47.6	1144.7	4.99	0.34
Monte Rossi	18MR01	182_20	47.76	5.66	0.03	8.30	0.16	<0.01	12.83	21.98	1.63	0.50	98.83	73.4	38.5	14.0	47.5	1145.2	5.18	0.32
Monte Rossi	18MR01	182_22	47.90	5.68	0.03	8.33	0.17	0.01	13.07	21.94	1.56	0.49	99.16	73.7	39.0	13.9	47.0	1144.7	5.05	0.31
Monte Rossi	18MR01	182_23	48.76	4.97	0.02	8.18	0.17	<0.01	13.02	22.02	1.48	0.45	99.07	73.9	38.9	13.7	47.3	1139.7	4.61	0.31
Monte Rossi	18MR01	182_24	48.90	4.62	0.02	8.00	0.17	0.01	13.19	22.12	1.42	0.42	98.87	74.6	39.3	13.4	47.3	1135.8	4.25	0.30
Monte Rossi	18MR01	182_25	48.80	4.73	0.03	8.15	0.17	0.01	13.20	22.17	1.46	0.47	99.20	74.3	39.2	13.6	47.3	1140.2	4.83	0.30
Monte Rossi	18MR01	182_26	48.85	4.73	0.02	8.08	0.17	<0.01	13.14	21.89	1.43	0.46	98.77	74.4	39.3	13.6	47.1	1140.1	4.69	0.30
Monte Rossi	18MR01	182_27	47.77	5.55	0.05	8.16	0.16	0.02	12.88	21.94	1.62	0.51	98.64	73.8	38.8	13.8	47.5	1145.8	5.30	0.31
Monte Rossi	18MR01	182_28	48.09	5.64	0.03	8.00	0.17	0.01	13.03	21.94	1.55	0.45	98.92	74.4	39.1	13.5	47.4	1141.9	4.69	0.30
Monte Rossi	18MR01	182_29	46.91	6.46	<0.01	8.68	0.18	0.02	12.39	21.97	1.91	0.50	99.02	71.8	37.5	14.7	47.8	1147.4	5.26	0.34
Monte Rossi	18MR01	182_30	47.29	5.56	0.02	10.63	0.28	<0.01	11.07	21.21	2.43	0.76	99.28	65.0	34.3	18.5	47.2	n.a.	n.a.	n.a.
Monte Rossi	18MR01	183_1	49.37	4.15	0.02	7.95	0.20	<0.01	13.47	21.91	1.37	0.56	99.00	75.1	40.0	13.2	46.8	1146.5	5.74	0.29
Monte Rossi	18MR01	184_1	49.70	4.24	<0.01	7.81	0.21	<0.01	13.49	21.77	1.37	0.55	99.13	75.5	40.2	13.1	46.7	1147.0	5.68	0.28
Monte Rossi	18MR01	185_1	49.87	4.09	<0.01	8.00	0.20	0.01	13.59	21.98	1.31	0.54	99.59	75.2	40.1	13.2	46.6	1145.4	5.58	0.29
Monte Rossi	18MR01	186_1	47.36	5.95	0.02	8.45	0.17	<0.01	12.72	21.92	1.73	0.46	98.80	72.8	38.3	14.3	47.4	1143.4	4.83	0.33
Monte Rossi	18MR01	187_1	50.08	3.59	<0.01	8.22	0.22	<0.01	14.05	21.68	1.17	0.40	99.37	75.3	41.0	13.5	45.5	1132.8	3.84	0.29
Monte Rossi	18MR01	188_1	50.25	3.33	0.02	8.40	0.23	0.01	14.53	21.42	1.18	0.36	99.74	75.5	41.9	13.6	44.4	1130.2	3.37	0.28
Monte Rossi	18MR01	9 / 1	47.73	5.12	0.05	8.28	0.17	0.03	13.49	21.99	1.34	0.52	98.73	74.4	39.7	13.7	46.6	n.a.	n.a.	n.a.
Monte Rossi	18MR01	11 / 1	47.83	5.26	0.05	7.83	0.16	<0.01	13.65	22.53	1.31	0.45	99.08	75.7	39.9	12.8	47.3	n.a.	n.a.	n.a.
Monte Rossi	18MR01	27 / 1	48.97	3.17	<0.01	8.18	0.22	0.02	14.78	21.91	1.21	0.41	98.89	76.3	42.1	13.1	44.8	n.a.	n.a.	n.a.
Monte Rossi	18MR01	61 / 1	45.78	6.09	0.02	10.01	0.23	<0.01	11.83	21.16	3.17	0.62	98.91	67.8	36.2	17.2	46.6	n.a.	n.a.	n.a.
Monte Rossi	18MR01	62 / 1	48.65	4.50	<0.01	8.21	0.19	<0.01	13.46	22.02	1.47	0.53	99.04	74.5	39.7	13.6	46.7	n.a.	n.a.	n.a.
Monte Rossi	18MR01	64 / 1	49.57	3.59	<0.01	7.58	0.21	<0.01	14.12	21.78	1.26	0.51	98.63	76.9	41.5	12.5	46.0	1137.5	4.60	0.26
Monte Rossi	18MR01	65 / 1	49.24	3.62	0.02	7.66	0.21	0.03	14.33	21.83	1.23	0.48	98.65	76.9	41.7	12.5	45.7	1125.6	3.01	0.26
Monte Rossi	18MR01	66 / 1	49.85	3.48	0.01	7.04	0.18	<0.01	14.77	21.81	1.02	0.50	98.65	78.9	42.9	11.5	45.6	1135.6	4.36	0.23
Monte Rossi	18MR01	67 / 1	47.74	4.99	0.01	7.77	0.17	<0.01	13.60	22.14	1.65	0.54	98.63	75.7	40.1	12.9	47.0	1142.6	5.15	0.28
Monte Rossi	18MR01	89 / 1	45.02	6.31	0.02	9.89	0.21	<0.01	11.53	21.96	3.02	0.60	98.58	67.5	35.1	16.9	48.0	n.a.	n.a.	n.a.
Monte Rossi	18MR01	91 / 1	49.99	3.36	<0.01	7.89	0.20	0.02	14.59	22.08	1.08	0.37	99.59	76.7	41.8	12.7	45.5	1119.8	2.32	0.27
Monte Rossi	18MR01	93 / 1	49.70	3.91	0.03	7.88	0.18	<0.01												

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Na2O	Total	Mg#	En	Fs	Wo	T [°C]	P [kbar]	Kd
Monte Rossi	18MR03	52_1	49.03	4.62	0.02	8.03	0.21	0.02	14.17	21.78	1.20	0.49	99.57	75.9	41.3	13.1	45.6	1141.4	5.02	0.27
Monte Rossi	18MR03	53_1	48.97	4.67	0.02	7.84	0.19	<0.01	14.08	21.87	1.33	0.48	99.44	76.2	41.2	12.9	46.0	1139.8	4.83	0.27
Monte Rossi	18MR03	54_1	47.95	5.15	0.03	7.96	0.15	<0.01	13.45	22.20	1.50	0.45	98.85	75.1	39.7	13.2	47.1	1136.2	4.47	0.29
Monte Rossi	18MR03	55_1	47.82	5.17	0.01	8.41	0.16	<0.01	13.15	22.05	1.67	0.48	98.94	73.6	39.0	14.0	47.0	1140.3	4.95	0.31
Monte Rossi	18MR03	56_1	48.18	5.32	0.04	7.98	0.18	<0.01	13.54	22.05	1.38	0.43	99.11	75.2	40.0	13.2	46.8	1136.6	4.34	0.29
Monte Rossi	18MR03	61_1	49.82	3.21	0.01	8.15	0.23	<0.01	14.66	21.61	1.15	0.37	99.22	76.2	42.2	13.1	44.7	1109.8	1.03	0.27
Monte Rossi	18MR03	79_1	47.32	5.92	0.01	8.55	0.17	<0.01	12.66	22.15	1.82	0.44	99.05	72.5	37.9	14.4	47.7	1137.8	4.44	0.33
Monte Rossi	18MR03	80_1	47.23	4.19	<0.01	11.88	0.33	<0.01	10.64	21.30	2.77	0.70	99.06	61.5	32.6	20.4	46.9	n.a.	n.a.	n.a.
Monte Rossi	18MR03	81_1	46.93	4.39	0.01	11.85	0.31	<0.01	10.54	21.12	2.95	0.76	98.90	61.3	32.6	20.5	46.9	n.a.	n.a.	n.a.
Monte Rossi	18MR03	89_1	49.05	4.49	0.02	8.25	0.19	0.02	13.16	21.95	1.45	0.49	99.05	74.0	39.2	13.8	47.0	1139.8	4.99	0.30
Monte Rossi	18MR03	90_1	49.96	4.07	0.03	7.80	0.19	<0.01	13.69	21.17	1.22	0.46	99.59	75.8	40.3	12.9	46.9	1135.8	4.58	0.28
Monte Rossi	18MR03	91_1	49.66	4.40	<0.01	7.75	0.18	0.02	13.78	22.10	1.21	0.44	99.55	76.0	40.5	12.8	46.7	1135.2	4.37	0.27
Monte Rossi	18MR03	92_1	50.81	2.52	<0.01	9.07	0.26	<0.01	13.35	21.68	1.18	0.47	99.33	72.4	39.2	15.0	45.8	1124.3	3.26	0.33
Monte Rossi	18MR03	93_1	48.42	5.25	0.04	8.32	0.17	<0.01	13.13	21.84	1.42	0.54	99.12	73.8	39.2	13.9	46.9	1145.7	5.51	0.31
Monte Rossi	18MR03	94_1	46.27	6.65	<0.01	8.92	0.18	0.02	12.18	22.08	2.17	0.51	99.00	70.9	36.9	15.1	48.0	n.a.	n.a.	n.a.
Monte Rossi	18MR03	95_1	45.81	5.66	<0.01	11.86	0.27	0.02	10.13	21.22	3.12	0.79	98.90	60.4	31.6	20.8	47.6	n.a.	n.a.	n.a.
Monte Rossi	18MR03	96_1	48.20	5.14	0.02	8.34	0.18	<0.01	13.03	22.44	1.54	0.47	99.34	73.6	38.5	13.8	47.7	1137.1	4.69	0.31
Monte Rossi	18MR03	97_1	49.80	3.67	0.02	8.04	0.20	<0.01	13.68	21.99	1.31	0.48	99.18	75.2	40.2	13.3	46.5	1137.2	4.87	0.28
Monte Rossi	18MR03	98_1	47.81	5.64	0.03	8.37	0.16	<0.01	12.82	22.17	1.71	0.52	99.24	73.2	38.3	14.0	47.6	1144.3	5.40	0.32
Monte Rossi	18MR03	99_1	48.53	4.04	<0.01	9.89	0.25	<0.01	12.02	21.61	1.84	0.58	98.77	68.4	36.3	16.8	46.9	n.a.	n.a.	n.a.
Monte Rossi	18MR03	100_1	48.67	5.95	0.15	6.67	0.12	0.01	13.65	22.83	1.08	0.31	99.42	78.5	40.4	11.1	48.5	1121.9	2.44	0.24
Monte Rossi	18MR03	101_1	49.29	5.46	0.03	7.46	0.13	<0.01	13.66	22.21	1.06	0.34	99.65	76.5	40.4	12.4	47.2	1126.6	2.89	0.26
Monte Rossi	18MR03	102_1	50.33	3.57	0.02	7.89	0.19	<0.01	13.92	22.43	1.14	0.45	99.93	75.9	40.4	12.8	46.8	1132.2	4.34	0.27
Monte Rossi	18MR03	103_1	50.52	3.62	<0.01	7.65	0.19	<0.01	14.05	22.27	1.09	0.39	99.78	76.6	40.9	12.5	46.6	1128.0	3.66	0.26
Monte Rossi	18MR03	104_1	50.81	2.74	<0.01	8.86	0.26	<0.01	13.53	21.84	1.19	0.53	99.76	73.1	39.6	14.5	45.9	1125.2	3.36	0.32
Monte Rossi	18MR03	105_1	49.62	3.92	<0.01	8.42	0.20	<0.01	13.34	22.08	1.29	0.53	99.41	73.8	39.3	13.9	46.8	1141.0	5.36	0.31
Monte Rossi	18MR03	106_1	46.58	7.39	0.27	7.62	0.13	<0.01	12.60	22.73	1.68	0.27	99.28	74.7	37.9	12.9	49.2	n.a.	n.a.	n.a.
Monte Rossi	18MR03	107_1	50.03	2.72	<0.01	10.46	0.32	0.02	12.40	21.70	1.48	0.53	99.71	67.9	36.6	17.3	46.1	n.a.	n.a.	n.a.
Monte Rossi	18MR03	108_1	50.10	3.78	0.04	7.62	0.18	0.01	13.95	22.31	1.16	0.44	99.57	76.6	40.7	12.5	46.8	1132.5	4.28	0.26
Monte Rossi	18MR03	109_1	47.34	5.98	<0.01	8.84	0.20	<0.01	12.53	22.00	1.77	0.51	99.15	71.6	37.6	14.9	47.5	1144.6	5.27	0.34
Monte Rossi	18MR03	110_1	47.40	5.68	<0.01	8.59	0.19	0.02	12.52	21.97	1.90	0.46	98.74	72.2	37.8	14.5	47.7	1140.1	4.76	0.33
Monte Rossi	18MR03	111_1	50.85	2.49	0.01	8.85	0.24	0.01	13.59	21.63	1.22	0.39	99.31	73.3	39.9	14.6	45.6	1121.7	2.87	0.32
Monte Rossi	18MR03	119_1	50.74	2.28	0.02	10.39	0.33	<0.01	13.15	21.22	1.26	0.43	99.85	69.3	38.4	17.0	44.6	n.a.	n.a.	n.a.
Monte Rossi	18MR03	120_1	46.85	6.02	0.02	9.94	0.23	0.03	11.87	21.36	2.46	0.58	99.35	68.0	36.2	17.0	46.8	n.a.	n.a.	n.a.
Monte Rossi	18MR03	121_1	50.15	3.31	<0.01	7.95	0.21	<0.01	14.06	22.04	1.09	0.37	99.20	75.9	40.9	13.0	46.1	1126.0	3.43	0.27
Monte Rossi	18MR03	122_1	50.44	3.32	0.01	8.16	0.22	0.02	14.22	21.70	1.09	0.38	99.55	75.7	41.3	13.3	45.4	1127.8	3.46	0.28
Monte Rossi	18MR03	123_1	50.34	3.44	<0.01	7.91	0.19	<0.01	14.13	22.02	1.14	0.43	99.62	76.1	41.1	12.9	46.0	1132.1	4.17	0.27
Monte Rossi	18MR03	124_1	48.78	4.63	0.02	8.17	0.21	0.01	13.44	22.14	1.43	0.45	99.26	74.6	39.6	13.5	46.9	1135.8	4.49	0.29
Monte Rossi	18MR03	131_1	48.04	5.39	0.02	7.96	0.17	<0.01	13.19	22.28	1.49	0.41	98.92	74.7	39.2	13.3	47.6	1132.9	3.96	0.29
Monte Rossi	18MR03	132_1	47.42	5.90	0.03	8.32	0.16	<0.01	12.84	22.08	1.70	0.46	98.89	73.3	38.5	14.0	47.5	1139.8	4.67	0.31
Monte Rossi	18MR03	133_1	46.24	6.70	<0.01	9.00	0.18	<0.01	12.21	22.05	2.07	0.50	98.93	70.7	36.9	15.3	47.9	n.a.	n.a.	n.a.
Monte Rossi	18MR03	134_1	46.08	5.54	<0.01	11.23	0.28	0.01	10.79	21.22	2.84	0.73	98.76	63.1	33.4	19.5	47.2	n.a.	n.a.	n.a.
Monte Rossi	18MR03	135_1	48.86	4.59	0.02	7.97	0.19	0.05	13.27	22.09	1.30	0.45	98.79	74.8	39.5	13.3	47.2	1136.2	4.56	0.29
Monte Rossi	18MR03	136_1	50.13	3.63	<0.01	7.83	0.19	<0.01	13.93	22.27	1.19	0.43	99.61	76.0	40.6	12.8	46.6	1131.0	4.11	0.27
Mounts de Fiore	18MF01	17_1	44.12	9.08	0.11	9.00	0.11	<0.01	11.19	22.83	2.69	0.35	99.48	68.9	34.3	15.5	50.3	n.a.	n.a.	n.a.
Mounts de Fiore	18MF01	18_1	43.57	9.75	0.02	9.28	0.13	0.01	10.93	22.53	2.94	0.34	99.51	67.7	33.8	16.1	50.1	n.a.	n.a.	n.a.
Mounts de Fiore	18MF01	19_1	48.65	5.06	0.08	8.27	0.16	<0.01	13.84	22.06	1.39	0.25	99.77	74.9	40.3	13.5	46.2	1147.9	3.61	0.32
Mounts de Fiore	18MF01	20_1	48.25	5.21	0.06	8.27	0.15	0.01	13.43	22.22	1.38	0.23	99.21	74.3	39.5	13.6	46.9	1144.8	3.31	0.33
Mounts de Fiore	18MF01	21_1	48.86	4.87	0.06	8.22	0.15	<0.01	13.82	21.93	1.31	0.24	99.46	75.0	40.4	13.5	46.1	1147.6	3.58	0.32
Mounts de Fiore	18MF01	22_1	42.94	10.09	0.03	9.44	0.13	<0.01	10.59	22.52	3.12	0.35	99.22	66.7	33.0	16.5	50.5	n.a.	n.a.	n.a.
Mounts de Fiore	18MF01	23_1	48.45	5.12	0.07	8.35	0.15	0.02	13.57	22.00	1.39	0.24	99.38	74.3	39.8	13.7	46.4	1147.7	3.57	0.33
Mounts de Fiore	18MF01	24_1	45.75	7.89	0.17	8.67	0.12	0.01	12.20	22.40	1.93	0.33	99.48	71.5	36.8	14.7	48.5	n.a.	n.a.	n.a.
Mounts de Fiore	18MF01	25_1	45.45	8.09	0.03	8.92	0.12	<0.01	11.99	22.70	1.93	0.35	99.57	70.6	36.0	15.0	49.0	n.a.	n.a.	n.a.
Mounts de Fiore	18MF01	26_1	41.62	10.88	0.04	9.88	0.11	0.03	10.06	22.46	3.56	0.37	99.02	64.5	31.7	17.5	50.8	n.a.	n.a.	n.a.
Mounts de Fiore	18MF01	27_1	47.88	6.63	0.13	7.31	0.13	0.03	13.15	23.11	1.36	0.28	100.01	76.2	38.8	12.1	49.1	1153.2	4.38	0.30
Mounts de Fiore	18MF01	28_1	49.55	4.37	<0.01	9.22	0.27	0.02	12.83	21.56	1.45	0.60	99.87	71.3	38.3	15.4	46.3	n.a.	n.a.	n.a.
Mounts de Fiore	18MF01	29_1	48.98	4.82	0.05	7.88	0.18	0.02	13.52	22.15	1.40	0.40	99.40	75.3	39.9	13.1	47.0	1166.8	6.28	0.31
Mounts de Fiore	18MF01	30_1	44.97	8.23	0.11	8.37	0.09	<0.01	11.75	23.08	2.27	0.34	99.22	71.4	35.6	14.2	50.2	n.a.	n.a.	n.a.
Mounts de Fiore	18MF01	31_1	48.94	5.00	0.05	7.75	0.19	<0.01	13.65	22.18	1.40	0.48	99.64	75.8	40.2	12.8	47.0	1175.4	7.38	0.30
Mounts de Fiore	18MF01	32_1	49.51	4.21	<0.01	8.20	0.21	0.01	13.67	21.99	1.37	0.37	99.55	74.8	40.1	13.5	46.4	n.a.	n.a.	n.a.
Mounts de Fiore	18MF01	40_1	49.23	4.84	0.03	7.65	0.21	<0.01	13.72	22.16	1.34	0.54	99.71	76.2	40.4	12.6	46.9	1179.7	7.	

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	MgO	CaO	TiO2	Na2O	Total	Mg#	En	Fs	Wo	T [°C]	P [kbar]	Kd
Mounts de Fiore	18MF02	115 1	47.78	4.59	0.18	7.81	0.15	0.02	14.60	22.25	1.31	0.26	98.95	76.9	41.7	12.5	45.7	1138.8	2.69	0.29
Mounts de Fiore	18MF03A	200 1	42.99	9.65	0.03	9.41	0.13	<0.01	10.99	22.80	2.83	0.34	99.17	67.5	33.6	16.2	50.2	n.a.	n.a.	n.a
Mounts de Fiore	18MF03A	201 1	44.04	8.66	0.09	8.92	0.12	<0.01	11.37	22.90	2.29	0.32	98.70	69.4	34.6	15.2	50.1	n.a.	n.a.	n.a
Mounts de Fiore	18MF03A	203 1	42.91	9.52	0.05	9.33	0.12	0.02	11.32	22.64	2.85	0.35	99.11	68.4	34.5	16.0	49.6	n.a.	n.a.	n.a
Mounts de Fiore	18MF03A	215 1	42.77	9.80	0.01	9.24	0.13	0.02	10.96	22.66	3.05	0.37	99.02	67.9	33.8	16.0	50.2	n.a.	n.a.	n.a
Mounts de Fiore	18MF03A	217 1	44.87	8.01	0.01	8.93	0.14	<0.01	11.88	22.63	2.38	0.38	99.26	70.3	35.8	15.1	49.1	n.a.	n.a.	n.a
Mounts de Fiore	18MF03A	218 1	44.40	8.24	0.15	8.63	0.11	0.01	12.02	22.52	2.28	0.32	98.69	71.3	36.4	14.7	49.0	n.a.	n.a.	n.a
Mounts de Fiore	18MF03A	232 1	44.69	8.06	0.05	8.99	0.14	<0.01	12.30	22.50	2.57	0.34	99.65	70.9	36.7	15.1	48.3	n.a.	n.a.	n.a
Mounts de Fiore	18MF03A	234 1	48.35	4.85	0.08	8.34	0.16	<0.01	14.11	21.94	1.33	0.24	99.40	75.1	40.8	13.5	45.6	1146.3	3.45	0.32
Mounts de Fiore	18MF03A	248 1	43.09	7.39	<0.01	11.47	0.23	0.01	10.42	21.73	3.60	0.66	98.61	61.8	32.1	19.8	48.1	n.a.	n.a.	n.a
Mounts de Fiore	18MF03A	249 1	44.77	6.82	0.01	10.40	0.22	0.03	11.05	21.60	3.22	0.52	98.74	65.5	34.1	18.0	47.9	n.a.	n.a.	n.a
Mounts de Fiore	18MF03A	250 1	43.26	9.23	0.14	8.91	0.11	<0.01	11.52	22.61	2.81	0.34	98.94	69.7	35.2	15.3	49.6	n.a.	n.a.	n.a
Mounts de Fiore	18MF03B	6 1	49.18	4.13	<0.01	8.00	0.21	<0.01	14.42	21.97	1.25	0.30	99.47	76.3	41.6	12.9	45.5	1158.3	4.56	0.30
Mounts de Fiore	18MF03B	7 1	44.09	8.30	<0.01	8.79	0.15	<0.01	11.73	22.42	2.63	0.38	98.50	70.4	35.8	15.0	49.2	n.a.	n.a.	n.a
Mounts de Fiore	18MF03B	8 1	47.97	4.98	0.05	7.88	0.16	<0.01	14.04	22.33	1.35	0.24	99.01	76.1	40.7	12.8	46.5	1149.5	3.38	0.30
Mounts de Fiore	18MF03B	9 1	42.86	9.54	0.02	9.10	0.13	0.04	10.95	22.87	3.00	0.34	98.85	68.2	33.7	15.7	50.6	n.a.	n.a.	n.a
Mounts de Fiore	18MF03B	10 1	44.82	8.05	0.02	8.33	0.14	<0.01	12.05	22.64	2.13	0.37	98.56	72.0	36.5	14.2	49.3	n.a.	n.a.	n.a
Mounts de Fiore	18MF03B	11 1	43.87	8.78	0.02	8.73	0.14	<0.01	11.76	22.57	2.48	0.35	98.69	70.6	35.8	14.9	49.3	n.a.	n.a.	n.a
Mounts de Fiore	18MF03B	12 1	47.75	5.20	0.10	8.36	0.16	0.04	14.28	21.94	1.39	0.22	99.43	75.3	41.1	13.5	45.4	1147.9	2.87	0.32
Mounts de Fiore	18MF03B	24 1	47.63	5.19	0.01	8.06	0.14	0.04	13.94	22.08	1.27	0.27	98.62	75.5	40.6	13.2	46.2	1155.7	4.06	0.31
Mounts de Fiore	18MF03B	26 1	48.79	4.06	<0.01	7.56	0.19	0.04	14.46	22.13	1.14	0.28	98.64	77.3	41.8	12.2	46.0	1154.0	4.17	0.28
Mounts de Fiore	18MF03B	34 1	49.73	3.33	<0.01	8.95	0.23	0.01	13.61	21.89	1.25	0.45	99.51	73.0	39.6	14.6	45.8	1159.3	4.91	0.36
Mounts de Fiore	18MF03B	63 1	49.14	3.77	<0.01	7.87	0.20	<0.01	14.12	22.18	1.28	0.41	98.99	64.2	41.0	12.8	46.2	1160.4	5.10	0.30
Mounts de Fiore	18MF05	105 1	47.35	5.24	0.02	8.24	0.15	<0.01	13.85	22.06	1.34	0.29	98.55	75.0	40.4	13.5	46.2	1155.7	4.65	0.32
Mounts de Fiore	18MF05	110 1	43.66	8.54	0.01	8.97	0.11	<0.01	11.53	23.03	2.52	0.30	98.68	69.6	34.8	15.2	50.0	n.a.	n.a.	n.a
Mounts de Fiore	18MF05	111 1	48.11	4.92	<0.01	7.74	0.16	<0.01	14.04	22.20	1.24	0.27	98.70	76.4	40.9	12.6	46.5	1152.0	4.28	0.30
Mounts de Fiore	18MF05	114 1	46.90	5.58	0.03	8.68	0.16	<0.01	13.64	21.87	1.50	0.23	98.60	73.7	39.8	14.2	45.9	1148.2	3.47	0.34
Mounts de Fiore	18MF05	115 1	44.41	8.05	<0.01	8.69	0.13	0.01	12.13	22.61	2.20	0.37	98.59	71.3	36.5	14.7	48.9	n.a.	n.a.	n.a
Mounts de Fiore	18MF07	168 1	43.75	8.63	0.09	9.19	0.13	<0.01	11.97	22.33	2.50	0.34	98.94	69.9	36.1	15.5	48.4	n.a.	n.a.	n.a
2002/03 lava flow	18RS01	11_1	48.59	4.45	<0.01	7.25	0.16	<0.01	14.34	22.60	1.22	0.26	98.88	77.9	41.4	11.7	46.9	1147.3	3.70	0.28
2002/03 lava flow	18RS01	22_1	46.83	6.55	0.02	7.75	0.13	<0.01	12.97	23.00	1.54	0.29	99.08	74.9	38.3	12.8	48.8	1154.8	4.34	0.33
2002/03 lava flow	18RS01	41_1	49.32	4.06	0.03	6.76	0.14	<0.01	14.73	22.80	1.00	0.28	99.12	79.5	42.2	10.9	46.9	1148.8	4.06	0.25
2002/03 lava flow	18RS01	42_1	50.41	2.91	0.01	7.24	0.32	0.02	14.77	22.43	0.70	0.41	99.20	78.4	42.3	11.6	46.1	1149.8	4.32	0.27
2002/03 lava flow	18RS01	48_1	44.97	7.85	0.03	8.35	0.13	0.04	12.64	22.81	2.17	0.32	99.32	73.0	37.5	13.9	48.6	n.a.	n.a.	n.a
2002/03 lava flow	18RS01	49_1	45.27	7.75	0.02	8.13	0.12	0.02	12.27	22.77	2.03	0.31	98.70	72.9	37.0	13.7	49.3	n.a.	n.a.	n.a
2002/03 lava flow	18RS01	50_1	49.50	3.97	<0.01	7.01	0.15	<0.01	14.77	22.54	1.04	0.23	99.19	79.0	42.3	11.3	46.4	1141.3	2.94	0.26
2002/03 lava flow	18RS02	67_1	50.16	4.09	0.02	6.77	0.12	<0.01	14.28	23.16	1.06	0.29	99.95	79.0	41.1	10.9	47.9	1146.3	4.02	0.26
2002/03 lava flow	18RS02	68_1	43.38	9.33	0.01	9.42	0.15	<0.01	11.32	21.94	3.01	0.39	98.98	68.2	35.0	16.3	48.7	n.a.	n.a.	n.a
2002/03 lava flow	18RS02	69_1	49.85	4.23	0.03	6.82	0.14	0.01	14.10	23.04	1.10	0.28	99.61	78.7	40.9	11.1	48.0	1146.0	3.92	0.26
2002/03 lava flow	18RS02	70_1	47.30	6.87	0.02	7.64	0.13	0.02	12.71	23.14	1.67	0.34	99.84	74.8	37.8	12.8	49.4	1159.5	5.07	0.32
2002/03 lava flow	18RS02	71_1	46.15	7.69	0.04	8.09	0.12	<0.01	12.46	22.92	2.07	0.32	99.88	73.3	37.2	13.6	49.2	1160.7	4.89	0.35
2002/03 lava flow	18RS02	72_1	50.30	3.72	0.13	6.66	0.13	<0.01	14.47	22.81	0.97	0.23	99.37	79.5	41.8	10.8	47.4	1138.8	2.97	0.25
2002/03 lava flow	18RS02	73_1	46.55	7.34	0.05	7.78	0.13	<0.01	12.47	22.82	1.94	0.34	99.41	74.1	37.5	13.1	49.3	1162.9	5.26	0.34
2002/03 lava flow	18RS02	74_1	46.30	7.07	<0.01	9.06	0.18	0.02	11.81	22.29	2.37	0.43	99.52	69.9	35.9	15.4	48.7	n.a.	n.a.	n.a
2002/03 lava flow	18RS02	75_1	49.66	4.51	0.02	6.95	0.13	<0.01	14.15	23.03	1.17	0.28	99.88	78.4	40.9	11.3	47.8	1147.3	4.00	0.27
2002/03 lava flow	18RS02	76_1	49.61	4.52	0.03	6.79	0.13	0.01	14.31	23.00	1.11	0.26	99.76	79.0	41.3	11.0	47.7	1144.2	3.57	0.26
2002/03 lava flow	18RS02	77_1	44.52	9.10	0.02	8.95	0.13	<0.01	11.37	22.43	2.57	0.38	99.45	69.4	35.0	15.4	49.6	n.a.	n.a.	n.a
2002/03 lava flow	18RS02	78_1	46.28	7.45	0.01	8.02	0.12	<0.01	12.34	22.89	1.97	0.34	99.44	73.3	37.1	13.5	49.4	1162.0	5.16	0.35
2002/03 lava flow	18RS02	79_1	46.18	7.24	<0.01	9.06	0.18	0.02	11.88	22.44	2.32	0.42	99.75	70.0	35.9	15.4	48.7	n.a.	n.a.	n.a
2002/03 lava flow	18RS02	80_1	46.70	7.21	0.05	7.89	0.12	0.01	12.56	22.92	1.86	0.34	99.67	73.9	37.5	13.2	49.2	1161.9	5.19	0.34
2002/03 lava flow	18RS02	81_1	49.53	4.49	0.03	6.83	0.13	0.01	14.09	23.02	1.09	0.27	99.49	78.6	40.9	11.1	48.0	1144.8	3.69	0.26
2002/03 lava flow	18RS02	82_1	46.20	7.66	0.05	8.20	0.12	<0.01	12.30	22.67	2.05	0.31	99.56	72.8	37.1	13.9	49.1	n.a.	n.a.	n.a
2002/03 lava flow	18RS02	83_1	46.06	7.25	0.04	7.83	0.13	0.02	12.26	22.86	1.88	0.31	98.65	73.6	37.1	13.3	49.7	1157.6	4.70	0.34
2002/03 lava flow	18RS02	84_1	49.67	4.31	<0.01	7.22	0.14	<0.01	14.24	22.73	1.12	0.26	99.71	77.9	41.1	11.7	47.2	1145.1	3.63	0.27
2002/03 lava flow	18RS02	85_1	49.34	4.16	<0.01	8.79	0.23	<0.01	14.02	21.02	1.37	0.29	99.23	74.0	41.2	14.5	44.4	1155.8	4.26	0.34
2002/03 lava flow	18RS02	86_1	49.72	4.33	0.17	6.51	0.12	0.01	14.43	22.95	1.01	0.25	99.50	79.8	41.7	10.6	47.7	1142.4	3.34	0.24
2002/03 lava flow	18RS02	87_1	50.60	3.86	<0.01	7.46	0.17	0.02	13.91	21.78	1.08	0.49	99.38	76.9	41.2	12.4	46.4	1174.1	7.16	0.29
2002/03 lava flow	18RS02	88_1	50.33	4.23	0.27	6.12	0.12	0.04	14.45	23.19	0.95	0.28	99.96	80.8	41.8	9.9	48.2	1146.5	3.96	0.23
2002/03 lava flow	18RS02	89_1	47.17	6.89	<0.01	7.75	0.12	<0.01	12.81	22.77	1.71	0.31	99.52	74.7	38.2	13.0	48.8	1158.0	4.68	0.33
2002/03 lava flow	18RS02	90_1	50.59	3.78	0.03	6.68	0.14	<0.01	14.48	22.89	1.02	0.24	99.86	79.4	41.7	10.8	47.4	1139.0	2.99	0.25
2002/03 lava flow	18RS02	91_1	47.28	6.81	<0.01	7.77	0.15	0												

11.3. PLAGIOCLASE POINT ANALYSES

Location	Sample	Point	SiO2	Al2O3	FeO	MgO	CaO	TiO2	Na2O	K2O	Total	Mg#	An	Ab	Or
Monte Spagnolo	18MS01	31_1 .	52.0	29.3	0.68	0.07	12.7	0.08	4.17	0.28	99.31	14.66	76.3	22.7	1.0
Monte Spagnolo	18MS01	32_1 .	50.3	30.5	0.67	0.08	14.0	0.05	3.45	0.20	99.31	16.74	81.2	18.1	0.7
Monte Spagnolo	18MS01	33_1 .	51.4	29.8	0.69	0.09	13.6	<0.01	3.79	0.27	99.60	19.07	79.1	20.0	0.9
Monte Spagnolo	18MS01	34_1 .	49.9	30.8	0.68	0.08	14.8	0.04	3.07	0.18	99.50	17.54	83.7	15.7	0.6
Monte Spagnolo	18MS01	35_1 .	51.8	29.0	0.96	0.11	12.4	0.07	4.25	0.31	98.89	17.05	75.5	23.4	1.1
Monte Spagnolo	18MS01	36_1 .	52.5	28.9	1.04	0.10	12.2	0.09	4.52	0.33	99.66	15.18	74.0	24.8	1.2
Monte Spagnolo	18MS01	38_1 .	53.1	28.7	0.63	0.07	11.9	0.10	4.52	0.38	99.37	17.39	73.4	25.2	1.4
Monte Spagnolo	18MS01	39_1 .	52.8	28.8	0.61	0.09	12.0	0.07	4.59	0.38	99.39	20.66	73.3	25.3	1.4
Monte Spagnolo	18MS01	40_1 .	54.0	28.2	0.64	0.12	11.2	0.09	4.82	0.40	99.46	24.63	71.0	27.5	1.5
Monte Spagnolo	18MS01	41_1 .	51.9	29.2	0.70	0.06	12.6	0.04	4.11	0.33	98.92	13.18	76.3	22.5	1.2
Monte Spagnolo	18MS01	45_1 .	53.4	28.6	0.66	0.09	11.7	0.09	4.63	0.37	99.52	19.56	72.6	26.0	1.4
Monte Spagnolo	18MS01	37_1 .	50.2	30.3	0.84	0.06	13.9	0.07	3.54	0.24	99.21	11.16	80.6	18.6	0.8
Monte Spagnolo	18MS01	43_1 .	52.5	28.9	1.06	0.13	12.3	0.10	4.29	0.30	99.64	18.32	75.2	23.7	1.1
Monte Spagnolo	18MS01	44_1 .	54.0	27.6	0.83	0.09	10.6	0.13	5.12	0.45	98.86	15.86	68.4	29.9	1.7
Monte Spagnolo	18MS01	42_1 .	49.8	30.7	0.79	0.06	14.6	0.07	3.18	0.20	99.43	11.55	82.9	16.4	0.7
Monte Spagnolo	18MS01	47_1 .	48.7	31.5	0.74	0.05	15.0	0.05	2.85	0.18	99.08	10.78	84.8	14.6	0.6
Monte Spagnolo	18MS01	49_1 .	49.0	31.2	0.71	0.07	14.7	0.05	3.04	0.17	98.85	14.99	83.7	15.7	0.6
Monte Spagnolo	18MS01	50_1 .	48.9	31.2	0.72	0.07	14.7	0.05	3.00	0.19	98.83	14.84	83.9	15.5	0.6
Monte Spagnolo	18MS02	143_1 .	55.4	25.4	0.45	0.02	0.9	0.12	11.58	5.27	99.17	7.75	6.3	72.1	21.6
Monte Spagnolo	18MS02	147_1 .	53.3	21.3	0.54	0.02	3.1	0.10	8.11	1.61	88.05	5.22	27.3	64.3	8.4
Monte Spagnolo	18MS02	44 / 1 .	54.1	28.1	0.95	0.06	11.0	0.11	5.05	0.31	99.71	10.73	69.9	28.9	1.2
Monte Spagnolo	18MS02	45 / 1 .	51.1	29.4	1.02	0.05	12.7	0.09	4.33	0.26	98.90	8.08	75.7	23.4	0.9
Monte Spagnolo	18MS02	46 / 1 .	51.8	29.3	1.06	0.05	12.8	0.09	4.20	0.23	99.44	8.00	76.5	22.7	0.8
Monte Spagnolo	18MS02	47 / 1 .	54.8	27.1	0.86	0.04	10.0	0.10	5.75	0.43	99.04	7.34	64.6	33.7	1.6
Monte Spagnolo	18MS02	48 / 1 .	50.9	29.3	1.08	0.08	12.9	0.12	4.09	0.23	98.72	11.59	77.0	22.2	0.8
Monte Spagnolo	18MS02	49 / 1 .	50.9	29.5	1.13	0.10	13.2	0.08	3.96	0.25	99.13	13.96	78.0	21.1	0.9
Monte Spagnolo	18MS02	50 / 1 .	50.8	29.3	1.14	0.09	12.9	0.08	4.05	0.24	98.62	11.82	77.2	22.0	0.8
Monte Spagnolo	18MS02	51 / 1 .	51.2	29.1	1.25	0.09	12.6	0.15	4.40	0.26	99.03	11.35	75.3	23.8	0.9
Monte Spagnolo	18MS02	52 / 1 .	57.0	25.4	0.72	0.02	7.8	0.12	6.50	0.77	98.34	4.97	55.3	41.5	3.2
Monte Spagnolo	18MS02	53 / 1 .	53.7	28.2	1.11	0.10	10.9	0.11	5.02	0.37	99.58	14.37	69.7	28.9	1.4
Monte Spagnolo	18MS02	54 / 1 .	50.9	29.9	1.14	0.12	12.9	0.11	3.93	0.25	99.28	15.62	77.7	21.4	0.9
Monte Spagnolo	18MS02	55 / 1 .	51.3	29.6	1.11	0.09	12.5	0.06	4.08	0.23	98.93	12.34	76.5	22.7	0.9
Monte Spagnolo	18MS05	221_1 .	49.2	31.8	0.65	0.10	14.8	0.07	2.92	0.15	99.70	21.23	84.4	15.0	0.5
Monte Spagnolo	18MS05	222_1 .	51.2	29.7	0.64	0.10	12.6	0.08	4.12	0.30	98.65	20.83	76.3	22.6	1.1
Monte Spagnolo	18MS05	204_1 .	53.3	18.1	6.60	0.67	4.3	1.69	5.54	5.22	95.42	15.27	34.6	40.4	25.0
Monte Spagnolo	18MS05	218_1 .	53.8	27.5	1.73	0.16	10.0	0.27	5.46	1.15	100.01	13.94	64.0	31.6	4.4
Monte Spagnolo	18MS05	223_1 .	52.4	29.3	1.09	0.12	12.3	0.12	4.33	0.35	100.09	16.02	74.9	23.9	1.3
Monte Spagnolo	18MS05	244_1 .	44.1	13.9	5.68	0.95	6.1	1.57	2.30	3.52	78.17	22.91	59.4	20.2	20.3
Monte Spagnolo	18MS05	246_1 .	46.8	16.6	6.64	1.10	8.4	1.55	5.94	4.93	91.91	22.79	50.1	32.2	17.6
Monte Spagnolo	18MS05	264_1 .	41.9	14.6	4.26	0.69	14.8	0.98	4.69	4.19	86.01	22.49	68.7	19.7	11.6
Monte Spagnolo	18MS05	265_1 .	50.4	16.6	3.14	0.94	11.3	1.31	4.97	3.60	92.21	34.78	63.0	25.1	11.9
Monte Spagnolo	18MS05	266_1 .	56.4	18.1	6.07	0.94	0.8	0.52	5.22	6.00	94.01	21.68	8.5	52.1	39.4
Monte Rossi	18MR01	223_1 .	48.6	31.5	0.72	0.07	15.3	0.05	2.66	0.16	99.09	15.28	86.0	13.5	0.5
Monte Rossi	18MR01	224_1 .	49.5	31.1	0.73	0.10	14.9	0.05	3.00	0.19	99.59	18.91	84.1	15.3	0.6
Monte Rossi	18MR01	245_1 .	49.6	31.2	0.73	0.08	14.9	0.05	2.89	0.17	99.72	15.39	84.6	14.8	0.6
Monte Rossi	18MR01	196_1 .	48.8	31.5	0.77	0.06	15.3	0.05	2.63	0.20	99.36	11.76	85.9	13.4	0.7

Location	Sample	Point	SiO2	Al2O3	FeO	MgO	CaO	TiO2	Na2O	K2O	Total	Mg#	An	Ab	Or
Monte Rossi	18MR01	197_1.	49.7	30.9	0.80	0.04	14.6	0.06	3.07	0.19	99.47	8.29	83.5	15.9	0.7
Monte Rossi	18MR01	198_1.	56.4	27.0	0.76	0.05	9.5	0.12	5.79	0.68	100.20	9.88	62.6	34.7	2.7
Monte Rossi	18MR01	229_1.	51.1	29.6	0.73	0.10	13.2	0.07	3.91	0.29	99.03	18.91	78.1	20.9	1.0
Monte Rossi	18MR01	230_1.	50.0	29.9	0.76	0.07	13.8	0.06	3.58	0.27	98.48	13.87	80.2	18.9	0.9
Monte Rossi	18MR01	231_1.	48.2	31.2	0.71	0.09	15.4	0.05	2.69	0.17	98.46	18.12	85.8	13.6	0.6
Monte Rossi	18MR01	85 / 1.	50.9	29.9	0.72	0.09	12.9	0.08	4.03	0.34	98.94	18.56	76.9	21.8	1.2
Monte Rossi	18MR01	86 / 1.	51.5	29.5	0.66	0.11	12.6	0.07	4.03	0.34	98.90	23.08	76.6	22.2	1.2
Monte Rossi	18MR01	100 / 1.	51.1	29.5	0.66	0.10	12.7	0.08	4.23	0.30	98.78	21.55	76.1	22.9	1.1
Monte Rossi	18MR01	199_1.	57.0	26.2	0.74	0.05	8.8	0.14	6.07	0.83	99.85	9.86	59.6	37.0	3.3
Monte Rossi	18MR01	50 / 1.	50.4	30.0	0.66	0.10	12.9	0.08	3.88	0.25	98.23	21.34	77.9	21.2	0.9
Monte Rossi	18MR01	51 / 1.	50.9	29.7	0.64	0.09	12.5	0.09	4.21	0.31	98.47	19.99	75.8	23.1	1.1
Monte Rossi	18MR01	99 / 1.	49.9	30.6	0.76	0.11	13.7	0.07	3.50	0.27	98.86	20.06	80.5	18.6	0.9
Monte Rossi	18MR01	211_1.	56.2	26.8	0.78	0.05	9.4	0.13	5.85	0.68	99.90	10.53	62.2	35.1	2.7
Monte Rossi	18MR01	190_1.	51.9	29.4	0.74	0.10	12.8	0.09	4.16	0.33	99.52	19.24	76.3	22.5	1.2
Monte Rossi	18MR01	191_1.	48.5	31.5	0.72	0.07	15.3	0.06	2.80	0.17	99.14	15.05	85.3	14.1	0.5
Monte Rossi	18MR01	194_1.	53.2	28.6	0.69	0.09	11.9	0.09	4.55	0.40	99.53	19.43	73.2	25.3	1.5
Monte Rossi	18MR01	195_1.	49.4	31.1	0.75	0.07	14.8	0.05	3.02	0.18	99.34	14.72	83.9	15.5	0.6
Monte Rossi	18MR01	201_1.	50.9	30.3	0.73	0.08	13.5	0.07	3.57	0.29	99.44	16.24	79.9	19.1	1.0
Monte Rossi	18MR01	204_1.	48.1	32.0	0.68	0.03	15.9	0.04	2.33	0.13	99.17	7.77	87.9	11.7	0.4
Monte Rossi	18MR01	205_1.	49.3	31.2	0.72	0.07	14.8	0.06	2.98	0.18	99.31	14.40	84.1	15.3	0.6
Monte Rossi	18MR01	206_1.	49.9	31.0	0.73	0.07	14.5	0.07	3.17	0.18	99.62	14.30	82.9	16.4	0.6
Monte Rossi	18MR01	207_1.	50.1	30.8	0.68	0.08	14.5	0.07	3.22	0.22	99.69	16.40	82.6	16.7	0.8
Monte Rossi	18MR01	209_1.	51.2	29.8	0.72	0.10	13.2	0.07	3.84	0.25	99.19	20.18	78.4	20.7	0.9
Monte Rossi	18MR01	210_1.	49.0	31.3	0.74	0.07	15.3	0.06	2.73	0.17	99.31	13.97	85.6	13.9	0.6
Monte Rossi	18MR01	216_1.	49.9	30.8	0.69	0.09	14.4	0.07	3.16	0.19	99.34	18.07	82.9	16.4	0.6
Monte Rossi	18MR01	217_1.	49.5	31.1	0.76	0.07	15.0	0.05	3.01	0.19	99.70	14.89	84.1	15.3	0.7
Monte Rossi	18MR01	217_2.	49.6	31.0	0.75	0.08	14.8	0.05	2.96	0.22	99.44	16.18	84.0	15.2	0.8
Monte Rossi	18MR01	217_3.	49.4	31.0	0.77	0.06	14.5	0.06	3.09	0.22	99.13	12.34	83.2	16.0	0.7
Monte Rossi	18MR01	217_4.	48.6	31.7	0.66	0.08	15.9	0.05	2.53	0.16	99.63	16.95	86.9	12.6	0.5
Monte Rossi	18MR01	217_5.	47.9	32.3	0.70	0.06	16.0	0.04	2.29	0.13	99.35	13.59	88.1	11.4	0.4
Monte Rossi	18MR01	217_6.	47.7	32.4	0.71	0.08	16.0	0.02	2.23	0.13	99.29	16.16	88.4	11.1	0.4
Monte Rossi	18MR01	217_7.	47.3	32.3	0.70	0.08	16.3	0.04	2.16	0.13	98.95	17.45	88.9	10.7	0.4
Monte Rossi	18MR01	217_8.	47.4	32.4	0.70	0.09	16.4	0.06	2.23	0.12	99.35	19.20	88.7	10.9	0.4
Monte Rossi	18MR01	218_1.	49.6	31.0	0.72	0.08	14.9	0.04	2.97	0.21	99.46	16.09	84.1	15.2	0.7
Monte Rossi	18MR01	219_1.	48.4	31.7	0.74	0.07	15.7	0.04	2.55	0.15	99.34	13.88	86.8	12.8	0.5
Monte Rossi	18MR01	220_1.	50.0	30.7	0.73	0.11	14.5	0.06	3.25	0.22	99.59	21.58	82.5	16.7	0.7
Monte Rossi	18MR01	221_1.	47.1	32.4	0.67	0.06	16.4	0.04	2.18	0.11	98.87	13.29	89.0	10.7	0.3
Monte Rossi	18MR01	222_1.	47.2	32.5	0.73	0.05	16.5	0.03	2.11	0.13	99.32	11.19	89.3	10.3	0.4
Monte Rossi	18MR01	225_1.	50.9	29.4	0.70	0.11	13.3	0.06	3.97	0.29	98.68	22.37	78.0	21.0	1.0
Monte Rossi	18MR01	226_1.	49.6	30.3	0.82	0.07	14.2	0.05	3.34	0.26	98.64	12.57	81.7	17.4	0.9
Monte Rossi	18MR01	233_1.	48.7	30.8	0.82	0.08	14.7	0.04	2.92	0.19	98.26	15.12	84.2	15.1	0.7
Monte Rossi	18MR01	234_1.	48.5	31.0	0.70	0.08	14.9	0.06	2.89	0.16	98.33	17.08	84.6	14.8	0.5
Monte Rossi	18MR01	235_1.	50.6	29.7	0.81	0.09	13.5	0.07	3.76	0.26	98.68	17.22	79.1	20.0	0.9
Monte Rossi	18MR01	236_1.	48.4	31.0	0.79	0.06	14.9	0.06	2.88	0.18	98.28	12.16	84.6	14.8	0.6
Monte Rossi	18MR01	238_1.	50.6	30.6	0.74	0.06	14.2	0.06	3.40	0.23	99.94	12.28	81.5	17.7	0.8
Monte Rossi	18MR01	239_1.	49.9	31.1	0.73	0.09	14.9	0.06	3.01	0.21	100.02	17.77	84.0	15.3	0.7
Monte Rossi	18MR01	240_1.	51.6	29.7	0.73	0.07	13.0	0.07	3.91	0.27	99.31	15.25	77.8	21.2	1.0

Location	Sample	Point	SiO2	Al2O3	FeO	MgO	CaO	TiO2	Na2O	K2O	Total	Mg#	An	Ab	Or
Monte Rossi	18MR01	241_1.	52.3	29.6	0.68	0.11	12.9	0.11	4.02	0.30	100.01	22.99	77.2	21.8	1.1
Monte Rossi	18MR01	242_1.	53.8	28.5	0.64	0.08	11.5	0.10	4.80	0.39	99.80	19.00	71.5	27.0	1.5
Monte Rossi	18MR01	243_1.	48.7	31.8	0.76	0.06	15.6	0.06	2.59	0.18	99.69	12.44	86.5	13.0	0.6
Monte Rossi	18MR01	244_1.	48.3	32.0	0.76	0.08	15.8	0.03	2.47	0.15	99.52	16.10	87.1	12.4	0.5
Monte Rossi	18MR01	246_1.	51.7	29.6	0.70	0.11	12.9	0.09	3.98	0.30	99.49	22.01	77.4	21.6	1.1
Monte Rossi	18MR01	247_1.	45.0	34.1	0.68	0.06	18.3	0.02	1.17	0.05	99.43	13.99	94.4	5.5	0.2
Monte Rossi	18MR01	13 / 1.	49.7	30.4	0.75	0.10	13.7	0.08	3.70	0.24	98.69	19.16	79.7	19.5	0.8
Monte Rossi	18MR01	48 / 1.	46.3	32.6	0.73	0.07	16.2	0.05	2.25	0.13	98.22	14.83	88.5	11.1	0.4
Monte Rossi	18MR01	49 / 1.	49.6	30.5	0.75	0.09	13.6	0.07	3.64	0.26	98.52	18.39	79.8	19.3	0.9
Monte Rossi	18MR01	52 / 1.	49.9	30.3	0.74	0.10	13.3	0.07	3.90	0.25	98.53	19.16	78.3	20.8	0.9
Monte Rossi	18MR01	54 / 1.	51.1	29.8	0.60	0.09	12.7	0.07	3.96	0.29	98.55	21.24	77.1	21.9	1.0
Monte Rossi	18MR01	55 / 1.	51.5	29.5	0.65	0.08	12.3	0.08	4.27	0.33	98.63	18.18	75.1	23.7	1.2
Monte Rossi	18MR01	56 / 1.	50.3	30.8	0.68	0.10	13.6	0.08	3.70	0.27	99.61	20.68	79.6	19.5	0.9
Monte Rossi	18MR01	58 / 1.	50.3	30.3	0.74	0.09	13.2	0.07	3.89	0.29	98.90	18.45	78.1	20.9	1.0
Monte Rossi	18MR01	59 / 1.	49.8	31.0	0.67	0.10	14.0	0.07	3.40	0.27	99.27	20.58	81.2	17.9	0.9
Monte Rossi	18MR01	101 / 1.	52.3	28.7	0.69	0.08	11.7	0.09	4.62	0.40	98.59	17.44	72.6	25.9	1.5
Monte Rossi	18MR01	189_1.	51.2	29.8	0.69	0.09	13.2	0.07	3.84	0.26	99.16	18.20	78.5	20.6	0.9
Monte Rossi	18MR01	192_1.	50.9	30.1	0.70	0.12	13.7	0.08	3.70	0.24	99.51	22.74	79.8	19.4	0.8
Monte Rossi	18MR01	193_1.	52.0	29.0	0.69	0.09	12.5	0.09	4.26	0.36	98.94	18.14	75.5	23.3	1.3
Monte Rossi	18MR01	200_1.	51.5	29.8	0.71	0.10	13.2	0.08	3.86	0.30	99.51	20.08	78.2	20.7	1.1
Monte Rossi	18MR01	202_1.	51.3	30.1	0.72	0.08	13.7	0.08	3.62	0.24	99.88	17.01	80.1	19.1	0.8
Monte Rossi	18MR01	203_1.	51.1	30.0	0.68	0.08	13.4	0.07	3.69	0.25	99.15	17.57	79.3	19.8	0.9
Monte Rossi	18MR01	212_1.	53.4	28.3	0.89	0.09	11.7	0.11	4.77	0.47	99.74	15.11	71.8	26.5	1.7
Monte Rossi	18MR01	213_1.	48.3	32.2	0.83	0.08	15.9	0.05	2.41	0.15	99.96	14.00	87.5	12.0	0.5
Monte Rossi	18MR01	214_1.	57.7	25.7	0.63	0.01	8.0	0.11	6.35	1.00	99.46	3.46	55.7	40.1	4.2
Monte Rossi	18MR01	237_1.	56.0	26.1	0.69	0.05	8.6	0.12	6.22	0.78	98.52	10.49	58.7	38.2	3.2
Monte Rossi	18MR01	208_1.	50.2	30.3	0.70	0.10	13.9	0.07	3.46	0.25	99.07	20.72	80.9	18.2	0.9
Monte Rossi	18MR01	215_1.	47.4	32.4	0.67	0.07	16.3	0.05	2.16	0.11	99.12	15.10	89.0	10.7	0.3
Monte Rossi	18MR01	217_9.	47.6	32.6	0.70	0.11	16.5	0.04	2.07	0.11	99.73	21.24	89.5	10.1	0.3
Monte Rossi	18MR01	217_10.	47.9	31.8	0.72	0.07	15.7	0.05	2.49	0.14	98.86	14.65	87.1	12.5	0.5
Monte Rossi	18MR01	217_11.	51.5	29.6	0.69	0.12	13.0	0.07	3.89	0.30	99.14	23.84	77.9	21.0	1.1
Monte Rossi	18MR01	217_12.	51.5	29.7	0.64	0.07	13.1	0.09	3.92	0.28	99.32	16.27	77.9	21.1	1.0
Monte Rossi	18MR01	217_14.	52.2	29.4	0.74	0.08	12.6	0.08	4.16	0.32	99.56	17.01	76.1	22.7	1.1
Monte Rossi	18MR01	227_1.	48.0	31.5	0.77	0.09	15.6	0.05	2.62	0.15	98.85	18.04	86.4	13.1	0.5
Monte Rossi	18MR01	228_1.	51.6	29.1	0.69	0.09	12.6	0.08	4.12	0.30	98.58	18.43	76.3	22.6	1.1
Monte Rossi	18MR01	232_1.	48.6	30.7	0.71	0.08	14.8	0.07	3.01	0.19	98.14	16.89	83.9	15.5	0.7
Monte Rossi	18MR01	12 / 1.	45.8	33.0	0.71	0.07	16.6	0.03	2.12	0.09	98.43	15.04	89.4	10.3	0.3
Monte Rossi	18MR01	14 / 1.	50.2	30.1	0.74	0.12	13.3	0.07	3.80	0.31	98.66	22.02	78.6	20.3	1.1
Monte Rossi	18MR01	53 / 1.	49.5	30.7	0.84	0.06	13.5	0.06	3.72	0.25	98.67	11.75	79.4	19.7	0.9
Monte Rossi	18MR01	57 / 1.	50.0	30.8	0.80	0.06	13.9	0.08	3.42	0.28	99.31	11.92	81.0	18.1	1.0
Monte Rossi	18MR01	87 / 1.	51.0	29.5	0.67	0.07	12.2	0.08	4.29	0.42	98.24	15.42	74.7	23.8	1.5
Monte Rossi	18MR01	88 / 1.	46.7	32.7	0.75	0.07	16.1	0.05	2.32	0.16	98.85	13.50	88.0	11.4	0.5
Monte Rossi	18MR02	73_1.	48.4	31.8	0.80	0.07	15.0	0.05	2.71	0.18	98.98	13.91	85.5	13.9	0.6
Monte Rossi	18MR02	94_1.	47.4	32.4	0.86	0.09	15.9	0.06	2.31	0.11	99.10	15.21	88.0	11.6	0.4
Monte Rossi	18MR02	98_1.	47.0	32.5	0.55	0.05	16.1	0.05	2.16	0.17	98.59	14.67	88.7	10.8	0.5
Monte Rossi	18MR02	99_1.	51.6	29.0	0.66	0.09	11.8	0.08	4.32	0.40	97.90	20.13	74.0	24.5	1.5
Monte Rossi	18MR02	100_1.	49.9	30.4	0.67	0.07	13.7	0.07	3.49	0.28	98.61	14.86	80.5	18.5	1.0

Location	Sample	Point	SiO2	Al2O3	FeO	MgO	CaO	TiO2	Na2O	K2O	Total	Mg#	An	Ab	Or
Monte Rossi	18MR02	101_1.	49.5	30.6	0.75	0.09	14.1	0.06	3.33	0.25	98.63	17.24	81.7	17.5	0.9
Monte Rossi	18MR02	102_1.	48.5	31.1	0.75	0.10	14.6	0.06	3.12	0.18	98.35	18.53	83.3	16.1	0.6
Monte Rossi	18MR02	103_1.	46.3	32.9	0.60	0.07	16.6	0.06	1.93	0.10	98.64	17.01	90.2	9.5	0.3
Monte Rossi	18MR02	104_1.	49.5	30.6	0.59	0.11	13.7	0.05	3.32	0.25	98.17	24.05	81.3	17.8	0.9
Monte Rossi	18MR02	105_1.	52.3	28.7	0.67	0.10	11.8	0.10	4.45	0.46	98.57	21.44	73.3	25.0	1.7
Monte Rossi	18MR02	106_1.	51.2	29.5	0.71	0.09	12.7	0.09	3.95	0.34	98.56	18.98	77.1	21.7	1.2
Monte Rossi	18MR02	107_1.	51.2	29.5	0.70	0.09	12.8	0.08	4.01	0.30	98.75	19.17	77.2	21.8	1.1
Monte Rossi	18MR02	108_1.	51.6	29.4	0.72	0.11	12.8	0.09	4.23	0.32	99.29	20.81	76.1	22.8	1.1
Monte Rossi	18MR02	82_1.	50.5	30.4	0.77	0.10	13.5	0.05	3.54	0.27	99.13	19.09	80.0	19.1	0.9
Monte Rossi	18MR02	93_1.	51.0	29.9	0.74	0.11	13.1	0.09	3.74	0.26	98.87	20.56	78.7	20.4	0.9
Monte Rossi	18MR02	83_1.	51.5	29.6	0.73	0.10	12.4	0.07	4.25	0.36	99.06	19.45	75.3	23.4	1.3
Monte Rossi	18MR02	120_1.	49.6	30.8	0.79	0.08	14.1	0.07	3.26	0.22	98.94	14.56	82.1	17.1	0.8
Monte Rossi	18MR02	121_1.	50.4	29.9	0.82	0.10	13.1	0.09	3.80	0.29	98.54	18.08	78.4	20.6	1.0
Monte Rossi	18MR03	17_1.	53.8	28.2	0.66	0.05	11.3	0.10	4.89	0.46	99.42	12.92	70.6	27.7	1.7
Monte Rossi	18MR03	43_1.	48.5	31.6	0.72	0.07	15.5	0.05	2.67	0.16	99.27	15.09	86.0	13.4	0.5
Monte Rossi	18MR03	18_1.	55.4	27.1	0.71	0.06	10.0	0.12	5.64	0.66	99.73	13.31	64.6	32.9	2.5
Monte Rossi	18MR03	19_1.	51.6	29.6	0.80	0.08	13.3	0.08	3.93	0.29	99.72	15.40	78.2	20.8	1.0
Monte Rossi	18MR03	18_1.	48.7	30.8	0.73	0.09	14.8	0.06	3.02	0.22	98.44	18.75	83.7	15.5	0.7
Monte Rossi	18MR03	29_1.	48.5	31.6	0.71	0.08	15.3	0.07	2.68	0.15	99.11	16.67	85.9	13.6	0.5
Monte Rossi	18MR03	1_1.	53.4	28.5	0.65	0.07	11.9	0.07	4.72	0.46	99.76	16.50	72.3	26.1	1.7
Monte Rossi	18MR03	2_1.	53.6	28.4	0.62	0.09	11.7	0.11	4.67	0.38	99.61	21.08	72.5	26.1	1.4
Monte Rossi	18MR03	3_1.	52.5	29.1	0.64	0.07	12.5	0.09	4.22	0.35	99.49	16.29	75.6	23.1	1.3
Monte Rossi	18MR03	4_1.	53.5	28.4	0.68	0.10	11.5	0.09	4.82	0.45	99.60	21.51	71.3	27.1	1.6
Monte Rossi	18MR03	5_1.	61.5	23.2	0.53	0.03	4.8	0.19	7.27	2.77	100.27	8.45	36.7	50.6	12.7
Monte Rossi	18MR03	6_1.	50.8	30.1	0.76	0.07	13.6	0.08	3.63	0.26	99.29	13.57	79.8	19.3	0.9
Monte Rossi	18MR03	7_1.	48.4	31.8	0.76	0.06	15.7	0.06	2.53	0.15	99.51	12.44	86.9	12.6	0.5
Monte Rossi	18MR03	8_1.	53.2	28.7	0.69	0.11	12.3	0.08	4.48	0.37	99.90	21.94	74.2	24.5	1.3
Monte Rossi	18MR03	13_1.	50.1	30.5	0.73	0.08	14.3	0.06	3.26	0.22	99.26	16.28	82.3	17.0	0.8
Monte Rossi	18MR03	14_1.	61.2	23.3	0.49	0.01	5.1	0.18	7.08	2.52	99.78	2.10	39.0	49.4	11.6
Monte Rossi	18MR03	57_1.	52.0	29.5	0.78	0.10	13.0	0.09	4.08	0.32	99.81	18.08	77.0	21.9	1.1
Monte Rossi	18MR03	22_1.	51.8	29.6	0.61	0.08	13.0	0.06	4.03	0.33	99.45	18.05	77.1	21.7	1.2
Monte Rossi	18MR03	23_1.	52.4	29.2	0.61	0.09	12.4	0.07	4.33	0.38	99.42	20.43	74.9	23.7	1.4
Monte Rossi	18MR03	24_1.	50.0	30.7	0.74	0.09	14.1	0.05	3.36	0.21	99.19	18.46	81.7	17.6	0.7
Monte Rossi	18MR03	26_1.	50.5	30.3	0.88	0.09	13.9	0.06	3.61	0.26	99.55	14.69	80.3	18.8	0.9
Monte Rossi	18MR03	27_1.	56.0	26.6	0.82	0.06	9.2	0.13	5.86	0.82	99.39	11.70	61.3	35.5	3.3
Monte Rossi	18MR03	28_1.	52.5	29.2	0.67	0.10	12.5	0.07	4.34	0.31	99.78	20.43	75.3	23.6	1.1
Monte Rossi	18MR03	29_1.	52.9	28.7	0.60	0.09	12.0	0.08	4.57	0.42	99.33	21.33	73.2	25.3	1.5
Monte Rossi	18MR03	30_1.	52.1	29.4	0.65	0.08	12.8	0.09	4.07	0.37	99.53	18.67	76.6	22.1	1.3
Monte Rossi	18MR03	31_1.	52.0	29.2	0.73	0.08	12.8	0.08	4.11	0.31	99.32	15.81	76.7	22.2	1.1
Monte Rossi	18MR03	32_1.	54.8	27.6	0.77	0.09	10.5	0.10	5.21	0.58	99.67	17.11	67.5	30.3	2.2
Monte Rossi	18MR03	33_1.	53.6	28.0	0.77	0.07	11.2	0.10	4.90	0.46	99.11	14.53	70.4	27.8	1.7
Monte Rossi	18MR03	34_1.	50.5	30.4	0.74	0.12	14.1	0.07	3.44	0.23	99.68	22.40	81.2	18.0	0.8
Monte Rossi	18MR03	35_1.	53.1	28.6	0.61	0.10	12.0	0.08	4.65	0.39	99.49	23.09	72.9	25.6	1.4
Monte Rossi	18MR03	36_1.	50.5	30.3	0.66	0.10	13.8	0.07	3.46	0.27	99.19	21.16	80.8	18.3	0.9
Monte Rossi	18MR03	37_1.	53.4	28.1	0.65	0.08	11.2	0.09	4.95	0.47	98.93	18.24	70.3	28.0	1.7
Monte Rossi	18MR03	38_1.	51.3	29.8	0.76	0.13	13.5	0.08	3.74	0.31	99.56	23.13	79.1	19.9	1.1
Monte Rossi	18MR03	39_1.	51.4	29.6	0.78	0.10	13.1	0.08	3.91	0.31	99.36	18.48	77.9	21.0	1.1

Location	Sample	Point	SiO2	Al2O3	FeO	MgO	CaO	TiO2	Na2O	K2O	Total	Mg#	An	Ab	Or
Monte Rossi	18MR03	40_1 .	52.4	29.2	0.67	0.08	12.5	0.07	4.23	0.34	99.45	18.51	75.6	23.2	1.2
Monte Rossi	18MR03	41_1 .	51.0	29.8	0.79	0.08	13.5	0.07	3.82	0.26	99.39	15.73	78.9	20.2	0.9
Monte Rossi	18MR03	15_1 .	48.9	31.4	0.76	0.11	15.0	0.05	2.88	0.17	99.38	20.82	84.7	14.7	0.6
Monte Rossi	18MR03	16_1 .	50.4	30.4	0.67	0.09	14.1	0.06	3.49	0.23	99.42	19.74	81.1	18.1	0.8
Monte Rossi	18MR03	11_1 .	51.1	29.9	0.94	0.12	13.7	0.08	3.71	0.27	99.80	18.01	79.5	19.6	0.9
Monte Rossi	18MR03	12_1 .	57.1	26.0	0.90	0.05	8.4	0.11	6.27	0.96	99.79	8.91	57.4	38.7	3.9
Monte Rossi	18MR03	48_1 .	52.3	29.0	0.59	0.07	12.5	0.07	4.20	0.38	99.10	17.78	75.7	23.0	1.4
Monte Rossi	18MR03	49_1 .	48.0	32.1	0.78	0.06	16.2	0.05	2.27	0.14	99.59	12.37	88.4	11.2	0.4
Monte Rossi	18MR03	50_1 .	50.1	30.4	0.82	0.08	14.3	0.08	3.34	0.27	99.44	15.57	81.8	17.3	0.9
Monte Rossi	18MR03	51_1 .	50.3	30.4	0.77	0.09	13.9	0.08	3.48	0.26	99.21	16.75	80.8	18.3	0.9
Monte Rossi	18MR03	53_1 .	52.3	28.9	0.74	0.11	12.4	0.08	4.32	0.32	99.21	21.32	75.2	23.7	1.2
Monte Rossi	18MR03	54_1 .	48.3	31.7	0.72	0.06	15.7	0.06	2.51	0.15	99.28	12.57	86.9	12.6	0.5
Monte Rossi	18MR03	55_1 .	52.1	29.3	0.69	0.10	12.9	0.09	4.10	0.30	99.55	20.36	76.9	22.1	1.1
Monte Rossi	18MR03	56_1 .	52.0	29.3	0.74	0.11	12.7	0.11	4.17	0.33	99.50	20.37	76.3	22.6	1.2
Monte Rossi	18MR03	44_1 .	55.1	27.1	0.80	0.10	10.1	0.13	5.44	0.62	99.36	17.84	65.6	32.0	2.4
Monte Rossi	18MR03	58_1 .	59.4	24.7	0.48	0.02	6.7	0.16	7.05	1.18	99.61	7.89	48.6	46.3	5.1
Monte Rossi	18MR03	21_1 .	54.8	27.6	0.90	0.05	10.2	0.14	5.38	0.63	99.67	9.12	66.1	31.4	2.4
Monte Rossi	18MR03	42_1 .	51.8	29.4	0.71	0.08	12.8	0.07	4.05	0.31	99.20	16.26	76.8	22.1	1.1
Monte Rossi	18MR03	59_1 .	51.8	29.3	0.93	0.10	12.8	0.10	4.08	0.33	99.39	16.63	76.7	22.2	1.2
Monte Rossi	18MR03	60_1 .	56.0	26.9	0.73	0.09	9.6	0.11	5.72	0.69	99.89	18.62	63.3	34.0	2.7
Monte Rossi	18MR03	30_1 .	51.4	29.5	0.69	0.09	12.8	0.08	4.03	0.30	98.78	18.57	76.9	22.0	1.1
Monte Rossi	18MR03	9_1 .	51.0	30.2	0.71	0.11	13.7	0.07	3.64	0.25	99.74	20.98	79.9	19.2	0.9
Monte Rossi	18MR03	45_1 .	47.7	32.0	0.70	0.05	15.9	0.05	2.35	0.13	98.94	11.65	87.9	11.7	0.4
Monte Rossi	18MR03	6_1 .	48.0	31.8	0.76	0.08	15.4	0.06	2.68	0.17	99.03	16.19	85.9	13.5	0.6
Monte Rossi	18MR03	7_1 .	49.8	30.6	0.80	0.11	13.9	0.08	3.36	0.23	98.77	20.25	81.4	17.8	0.8
Monte Rossi	18MR03	10_1 .	51.4	29.9	0.78	0.07	13.5	0.08	3.78	0.29	99.70	14.59	78.9	20.1	1.0
Monte Rossi	18MR03	46_1 .	51.7	29.5	0.71	0.08	12.9	0.08	4.04	0.29	99.27	16.46	77.2	21.8	1.0
Mounts de Fiore	18MF01	174_1 .	47.8	32.2	0.58	0.04	15.8	0.05	2.32	0.20	98.96	9.85	87.7	11.6	0.7
Mounts de Fiore	18MF01	175_1 .	49.4	31.4	0.60	0.05	14.8	0.05	2.99	0.26	99.53	13.90	83.8	15.3	0.9
Mounts de Fiore	18MF01	172_1 .	49.1	31.0	0.95	0.11	14.7	0.09	2.84	0.24	99.09	17.68	84.5	14.7	0.8
Mounts de Fiore	18MF01	173_1 .	54.2	27.1	1.15	0.09	10.4	0.22	4.92	1.11	99.14	11.84	67.0	28.8	4.2
Mounts de Fiore	18MF01	176_1 .	48.4	31.3	0.90	0.13	15.3	0.06	2.61	0.18	98.85	20.76	86.1	13.3	0.6
Mounts de Fiore	18MF01	177_1 .	52.5	29.0	0.96	0.12	12.2	0.11	4.22	0.59	99.63	18.27	74.6	23.3	2.2
Mounts de Fiore	18MF01	178_1 .	53.9	27.7	0.97	0.11	10.5	0.11	5.00	0.81	99.12	17.12	67.8	29.1	3.1
Mounts de Fiore	18MF01	179_1 .	49.6	31.0	0.98	0.13	14.8	0.08	2.89	0.27	99.76	19.34	84.2	14.9	0.9
Mounts de Fiore	18MF01	180_1 .	50.2	30.7	1.06	0.10	14.3	0.08	3.29	0.33	100.08	14.59	81.9	17.0	1.1
Mounts de Fiore	18MF01	181_1 .	48.9	31.2	1.10	0.11	15.0	0.07	2.77	0.25	99.36	15.68	85.0	14.2	0.8
Mounts de Fiore	18MF01	182_1 .	48.6	31.2	1.25	0.14	15.1	0.09	2.68	0.24	99.25	17.08	85.4	13.8	0.8
Mounts de Fiore	18MF01	183_1 .	48.5	31.3	1.19	0.15	15.2	0.06	2.64	0.22	99.28	18.67	85.8	13.5	0.7
Mounts de Fiore	18MF01	184_1 .	48.4	31.5	1.08	0.13	15.3	0.08	2.61	0.21	99.24	17.39	86.0	13.3	0.7
Mounts de Fiore	18MF01	185_1 .	48.4	31.7	0.84	0.13	15.8	0.07	2.52	0.20	99.61	21.81	86.8	12.6	0.6
Mounts de Fiore	18MF01	186_1 .	48.9	31.2	0.84	0.14	15.1	0.08	2.78	0.21	99.25	22.89	85.2	14.1	0.7
Mounts de Fiore	18MF01	187_1 .	51.5	29.4	1.03	0.09	13.0	0.10	3.75	0.45	99.32	13.82	78.0	20.4	1.6
Mounts de Fiore	18MF02	153_1 .	51.8	28.3	1.73	0.10	11.0	0.16	4.46	0.78	98.35	9.19	70.9	26.1	3.0
Mounts de Fiore	18MF02	112_1 .	46.7	31.9	0.90	0.11	15.5	0.05	2.64	0.21	98.12	18.50	86.1	13.2	0.7
Mounts de Fiore	18MF02	113_1 .	47.0	31.9	0.89	0.11	15.5	0.06	2.54	0.21	98.13	17.80	86.5	12.8	0.7
Mounts de Fiore	18MF02	154_1 .	47.6	31.7	0.93	0.14	15.1	0.06	2.69	0.20	98.45	21.13	85.6	13.7	0.7

Location	Sample	Point	SiO2	Al2O3	FeO	MgO	CaO	TiO2	Na2O	K2O	Total	Mg#	An	Ab	Or
Mounts de Fiore	18MF02	155_1 .	48.7	30.8	0.94	0.11	14.2	0.08	3.28	0.32	98.43	17.52	81.8	17.1	1.1
Mounts de Fiore	18MF03A	180_1 .	48.8	30.8	0.93	0.12	14.1	0.07	3.13	0.32	98.29	18.30	82.4	16.5	1.1
Mounts de Fiore	18MF03A	181_1 .	47.1	32.1	0.96	0.13	15.5	0.08	2.64	0.23	98.67	19.22	86.0	13.3	0.8
Mounts de Fiore	18MF03A	204_1 .	48.0	32.1	0.93	0.10	15.4	0.05	2.60	0.23	99.39	16.67	86.1	13.1	0.8
Mounts de Fiore	18MF03A	205_1 .	47.6	32.0	0.95	0.15	15.4	0.08	2.62	0.21	98.90	21.58	86.1	13.3	0.7
Mounts de Fiore	18MF03A	221_1 .	47.2	32.3	1.12	0.13	15.8	0.05	2.37	0.17	99.20	17.54	87.5	11.9	0.6
Mounts de Fiore	18MF03A	222_1 .	47.6	31.9	0.92	0.10	15.3	0.07	2.64	0.19	98.78	16.35	85.9	13.4	0.6
Mounts de Fiore	18MF03A	237_1 .	49.8	30.8	0.97	0.10	13.4	0.08	3.40	0.36	98.89	14.97	80.2	18.5	1.3
Mounts de Fiore	18MF03A	238_1 .	47.4	32.3	0.95	0.10	15.7	0.08	2.44	0.20	99.17	15.58	87.1	12.3	0.7
Mounts de Fiore	18MF03B	38_1 .	52.1	22.9	3.57	0.75	8.6	0.87	5.61	3.27	97.64	27.20	55.1	32.5	12.5
Mounts de Fiore	18MF03B	13_1 .	50.7	29.8	0.84	0.11	12.8	0.10	3.96	0.48	98.77	18.50	76.7	21.5	1.7
Mounts de Fiore	18MF03B	14_1 .	47.8	31.7	1.01	0.11	14.9	0.07	2.74	0.24	98.56	16.37	85.0	14.1	0.8
Mounts de Fiore	18MF03B	15_1 .	47.9	31.7	0.90	0.12	14.9	0.07	2.73	0.26	98.61	18.80	85.0	14.1	0.9
Mounts de Fiore	18MF03B	28_1 .	49.5	30.4	0.94	0.12	13.5	0.08	3.45	0.40	98.44	18.61	80.1	18.5	1.4
Mounts de Fiore	18MF03B	29_1 .	47.3	31.9	0.94	0.14	15.1	0.06	2.53	0.20	98.11	20.62	86.2	13.1	0.7
Mounts de Fiore	18MF03B	30_1 .	47.6	32.0	0.88	0.14	15.3	0.07	2.49	0.20	98.66	21.54	86.6	12.8	0.7
Mounts de Fiore	18MF03B	39_1 .	55.9	26.1	0.78	0.04	8.3	0.14	5.78	1.62	98.74	7.98	57.3	36.0	6.7
Mounts de Fiore	18MF03B	40_1 .	51.3	28.4	0.88	0.09	11.3	0.12	4.19	0.65	96.83	15.05	73.0	24.5	2.5
Mounts de Fiore	18MF03B	60_1 .	47.5	31.9	0.82	0.11	15.1	0.07	2.55	0.19	98.23	19.22	86.2	13.2	0.6
Mounts de Fiore	18MF03B	61_1 .	49.7	30.4	1.00	0.10	13.5	0.09	3.45	0.39	98.68	14.81	80.1	18.5	1.4
Mounts de Fiore	18MF03B	62_1 .	47.8	31.9	0.99	0.13	15.3	0.08	2.54	0.22	98.94	18.77	86.3	13.0	0.7
Mounts de Fiore	18MF05	98_1 .	47.6	31.9	0.92	0.14	15.4	0.07	2.46	0.22	98.75	21.78	86.7	12.5	0.7
Mounts de Fiore	18MF05	99_1 .	48.2	31.6	1.09	0.12	15.2	0.07	2.65	0.24	99.12	16.31	85.7	13.5	0.8
Mounts de Fiore	18MF05	107_1 .	49.8	30.2	1.08	0.11	13.6	0.11	3.42	0.37	98.69	15.73	80.4	18.3	1.3
Mounts de Fiore	18MF05	123_1 .	48.2	31.2	0.89	0.11	14.9	0.06	2.88	0.25	98.44	18.39	84.4	14.8	0.8
Mounts de Fiore	18MF05	135_1 .	42.2	28.6	0.99	0.12	13.9	0.10	2.98	0.34	89.25	17.47	82.8	16.0	1.2
Mounts de Fiore	18MF07	140_1 .	47.3	31.0	1.11	0.11	14.8	0.10	2.68	0.29	97.38	14.88	85.0	14.0	1.0
Mounts de Fiore	18MF07	148_1 .	48.0	30.8	0.98	0.13	14.2	0.07	3.02	0.34	97.58	19.34	82.9	15.9	1.2
Mounts de Fiore	18MF07	156_1 .	47.1	31.2	0.92	0.12	15.0	0.07	2.60	0.19	97.16	19.47	85.9	13.5	0.6
Mounts de Fiore	18MF07	163_1 .	48.7	29.9	1.39	0.07	13.6	0.13	3.19	0.49	97.58	8.40	81.1	17.2	1.7
Mounts de Fiore	18MF07	164_1 .	48.1	30.1	1.23	0.08	13.4	0.10	3.36	0.41	96.73	10.96	80.3	18.2	1.5
Mounts de Fiore	18MF07	166_1 .	47.9	32.0	0.86	0.11	15.4	0.05	2.52	0.18	99.01	18.61	86.6	12.8	0.6
Mounts de Fiore	18MF07	167_1 .	48.4	31.6	0.95	0.12	15.0	0.08	2.83	0.24	99.17	18.83	84.7	14.5	0.8
2002/03 lava flow	18RS01	34_1 .	46.4	33.0	0.69	0.08	16.8	0.04	1.90	0.11	98.99	17.04	90.4	9.2	0.3
2002/03 lava flow	18RS01	35_1 .	45.0	34.3	0.78	0.05	17.9	0.02	1.18	0.08	99.34	10.54	94.2	5.6	0.3
2002/03 lava flow	18RS01	36_1 .	44.9	34.3	0.71	0.05	18.0	0.02	1.07	0.03	99.13	10.82	94.8	5.1	0.1
2002/03 lava flow	18RS01	7_1 .	48.9	30.7	0.91	0.09	14.5	0.10	3.07	0.27	98.54	15.36	83.2	15.9	0.9
2002/03 lava flow	18RS01	26_1 .	49.3	31.1	0.86	0.13	14.4	0.08	3.04	0.25	99.24	21.81	83.2	15.9	0.9
2002/03 lava flow	18RS01	40_1 .	49.3	30.9	0.80	0.14	14.5	0.08	3.13	0.21	99.14	23.50	83.1	16.2	0.7
2002/03 lava flow	18RS01	52_1 .	47.6	32.1	0.78	0.09	15.8	0.07	2.37	0.15	98.93	17.10	87.6	11.9	0.5
2002/03 lava flow	18RS01	58_1 .	48.6	31.3	0.89	0.15	15.0	0.07	2.71	0.24	99.03	23.34	85.3	13.9	0.8
2002/03 lava flow	18RS02	129_1 .	46.2	33.2	0.71	0.07	17.7	0.03	1.57	0.09	99.56	15.12	92.3	7.4	0.3
2002/03 lava flow	18RS02	149_1 .	48.1	32.2	0.70	0.09	16.1	0.03	2.33	0.16	99.69	19.20	88.0	11.5	0.5
2002/03 lava flow	18RS02	150_1 .	49.1	31.2	0.72	0.11	15.1	0.05	2.87	0.20	99.25	20.87	84.7	14.6	0.7
2002/03 lava flow	18RS02	151_1 .	46.8	33.0	0.65	0.08	17.1	0.03	1.85	0.09	99.57	17.93	90.8	8.9	0.3
2002/03 lava flow	18RS02	153_1 .	53.1	28.3	0.77	0.11	11.7	0.10	4.59	0.62	99.35	19.66	72.1	25.6	2.3
2002/03 lava flow	18RS02	154_1 .	49.0	31.1	0.79	0.12	15.1	0.05	2.83	0.21	99.23	21.24	84.9	14.4	0.7

Location	Sample	Point	SiO2	Al2O3	FeO	MgO	CaO	TiO2	Na2O	K2O	Total	Mg#	An	Ab	Or
2002/03 lava flow	18RS02	157_1 .	49.4	31.2	0.81	0.11	15.0	0.06	2.81	0.26	99.62	19.63	84.8	14.4	0.9
2002/03 lava flow	18RS02	159_1 .	47.1	32.7	0.70	0.10	17.1	0.04	1.84	0.11	99.71	20.32	90.8	8.8	0.4
2002/03 lava flow	18RS02	162_1 .	49.6	30.7	0.84	0.11	14.3	0.07	3.09	0.25	98.99	19.35	83.0	16.2	0.9
2002/03 lava flow	18RS02	176/1 .	44.6	33.9	0.69	0.07	17.3	0.03	1.55	0.09	98.19	15.57	92.2	7.5	0.3
2002/03 lava flow	18RS02	125_1 .	55.4	26.6	0.82	0.07	9.7	0.15	5.31	1.09	99.18	13.92	64.1	31.6	4.3
2002/03 lava flow	18RS02	164_1 .	47.8	32.5	0.79	0.08	16.5	0.06	2.02	0.13	99.91	14.58	89.7	9.9	0.4
2002/03 lava flow	18RS02	165_1 .	47.8	32.2	0.80	0.08	16.2	0.07	2.24	0.13	99.52	14.95	88.5	11.0	0.4
2002/03 lava flow	18RS02	166_1 .	53.0	27.5	1.96	0.23	11.4	0.20	4.36	1.12	99.77	17.44	71.2	24.7	4.2
2002/03 lava flow	18RS02	167_1 .	52.9	28.3	1.36	0.13	11.7	0.12	4.23	1.04	99.78	14.30	72.5	23.7	3.8
2002/03 lava flow	18RS02	123/1 .	48.5	32.1	0.59	0.06	15.2	0.06	2.76	0.19	99.40		85.3	14.0	0.6
2002/03 lava flow	18RS02	134_1 .	50.1	30.8	0.82	0.12	14.4	0.07	3.16	0.25	99.62	21.02	82.7	16.5	0.9
2002/03 lava flow	18RS02	135_1 .	46.3	33.2	0.68	0.05	17.5	0.03	1.64	0.11	99.50	12.59	91.9	7.8	0.3
2002/03 lava flow	18RS02	136_1 .	48.8	31.7	0.64	0.07	15.6	0.05	2.59	0.16	99.64	17.24	86.5	13.0	0.5
2002/03 lava flow	18RS02	137_1 .	45.7	33.7	0.71	0.06	18.2	0.04	1.27	0.09	99.76	12.78	93.8	5.9	0.3
2002/03 lava flow	18RS02	138_1 .	46.9	32.8	0.68	0.08	16.9	0.04	1.88	0.11	99.46	17.84	90.6	9.1	0.4
2002/03 lava flow	18RS02	139_1 .	51.5	29.7	0.85	0.12	13.3	0.09	3.72	0.38	99.66	20.39	78.7	19.9	1.4
2002/03 lava flow	18RS02	140_1 .	50.4	30.3	0.83	0.08	13.9	0.08	3.36	0.28	99.28	14.15	81.3	17.8	1.0
2002/03 lava flow	18RS02	141_1 .	53.4	28.4	0.80	0.09	11.6	0.10	4.58	0.64	99.67	16.56	72.0	25.7	2.4
2002/03 lava flow	18RS02	126_1 .	49.9	30.5	0.92	0.13	14.6	0.09	3.22	0.28	99.70	20.13	82.6	16.5	0.9
2002/03 lava flow	18RS02	127_1 .	51.0	29.7	1.04	0.10	13.3	0.12	3.72	0.42	99.35	14.61	78.6	19.9	1.5
2002/03 lava flow	18RS02	142_1 .	50.0	30.6	0.88	0.11	14.5	0.07	3.15	0.30	99.57	17.86	82.7	16.3	1.0
2002/03 lava flow	18RS02	143_1 .	49.5	30.8	0.87	0.10	14.4	0.06	3.10	0.26	99.14	17.04	83.0	16.1	0.9
2002/03 lava flow	18RS02	144_1 .	49.9	30.6	0.94	0.11	14.3	0.09	3.22	0.29	99.45	17.27	82.2	16.8	1.0
2002/03 lava flow	18RS02	145_1 .	53.3	28.0	1.23	0.10	11.9	0.18	4.52	0.66	99.85	12.33	72.6	25.0	2.4
2002/03 lava flow	18RS02	146_1 .	50.1	30.4	0.89	0.15	14.0	0.08	3.30	0.29	99.15	23.47	81.6	17.4	1.0
2002/03 lava flow	18RS02	147_1 .	57.6	25.3	0.89	0.12	7.9	0.18	5.43	2.72	100.06	19.10	54.7	34.1	11.2
2002/03 lava flow	18RS02	148_1 .	51.7	29.5	0.88	0.08	12.8	0.10	4.04	0.47	99.56	14.20	76.5	21.9	1.7
2002/03 lava flow	18RS02	155_1 .	50.3	30.1	0.98	0.09	13.8	0.10	3.43	0.45	99.23	14.63	80.4	18.0	1.6
2002/03 lava flow	18RS02	156_1 .	56.1	26.2	0.96	0.07	9.4	0.14	5.57	1.16	99.60	11.63	62.2	33.2	4.5
2002/03 lava flow	18RS02	161_1 .	51.0	30.0	1.04	0.11	13.7	0.11	3.62	0.39	99.96	16.17	79.6	19.1	1.3
2002/03 lava flow	18RS02	124/1 .	49.2	30.7	0.95	0.13	14.1	0.09	3.19	0.34	98.72	19.99	82.0	16.8	1.2
2002/03 lava flow	18RS02	125/1 .	48.7	31.5	0.84	0.12	14.7	0.07	3.02	0.26	99.18	19.83	83.6	15.5	0.9
2002/03 lava flow	18RS02	135/1 .	47.8	31.8	0.88	0.15	15.3	0.06	2.60	0.17	98.79	23.26	86.1	13.3	0.6
2002/03 lava flow	18RS02	136/1 .	46.5	32.9	0.78	0.09	16.5	0.04	1.97	0.12	98.89	17.05	89.9	9.7	0.4
2002/03 lava flow	18RS02	151/1 .	48.3	31.3	0.77	0.12	14.6	0.06	2.97	0.24	98.29	21.11	83.8	15.4	0.8
2002/03 lava flow	18RS02	152/1 .	48.2	31.4	0.84	0.10	14.7	0.09	2.94	0.23	98.49	18.18	84.0	15.2	0.8
2002/03 lava flow	18RS02	153/1 .	44.5	34.2	0.80	0.10	17.7	0.05	1.33	0.11	98.70	17.52	93.3	6.4	0.4
2002/03 lava flow	18RS02	177/1 .	50.2	30.2	0.87	0.12	14.0	0.08	3.12	0.31	98.93	19.38	82.3	16.6	1.1
2002/03 lava flow	18RS02	128_1 .	51.3	29.6	0.78	0.10	13.0	0.07	3.89	0.41	99.15	18.24	77.5	21.0	1.4
2002/03 lava flow	18RS02	130_1 .	48.3	31.4	0.81	0.12	15.6	0.07	2.56	0.21	99.04	20.53	86.5	12.8	0.7
2002/03 lava flow	18RS02	131_1 .	49.8	30.8	0.85	0.14	14.8	0.10	2.99	0.24	99.70	22.69	83.9	15.3	0.8
2002/03 lava flow	18RS02	132_1 .	48.7	31.9	0.71	0.11	15.7	0.05	2.55	0.16	99.83	21.65	86.7	12.8	0.5
2002/03 lava flow	18RS02	133_1 .	52.7	28.8	0.86	0.11	12.4	0.10	4.22	0.63	99.81	18.18	74.7	23.0	2.3
2002/03 lava flow	18RS02	152_1 .	51.6	29.6	0.84	0.10	13.4	0.09	3.87	0.42	99.95	16.81	78.1	20.5	1.5
2002/03 lava flow	18RS02	158_1 .	53.9	27.9	0.83	0.06	10.8	0.13	4.89	0.75	99.32	10.63	68.9	28.2	2.8
2002/03 lava flow	18RS02	160_1 .	48.0	32.0	0.76	0.09	16.3	0.05	2.24	0.15	99.57	16.59	88.5	11.0	0.5
2002/03 lava flow	18RS02	163_1 .	51.1	30.0	0.90	0.12	13.9	0.09	3.52	0.34	99.95	19.39	80.4	18.5	1.2

Location	Sample	Point	SiO2	Al2O3	FeO	MgO	CaO	TiO2	Na2O	K2O	Total	Mg#	An	Ab	Or
2002/03 lava flow	18RS02	168_1.	49.2	30.9	0.93	0.12	14.7	0.07	2.94	0.24	99.12	18.19	84.0	15.2	0.8
2002/03 lava flow	18RS02	169_1.	49.7	30.8	0.73	0.10	14.7	0.05	3.05	0.21	99.38	19.50	83.7	15.6	0.7
2002/03 lava flow	18RS02	175/1.	46.0	33.3	0.73	0.10	16.8	0.03	1.89	0.12	98.90	18.80	90.4	9.2	0.4
2002/03 lava flow	18RS02	178/1.	46.5	32.7	0.76	0.07	16.2	0.05	2.16	0.16	98.61	13.76	88.8	10.7	0.5
2002/03 lava flow	18RS02	179/1.	44.4	33.7	0.70	0.07	17.5	0.03	1.46	0.06	97.92	15.97	92.8	7.0	0.2

11.4. TITANOMAGNETITE POINT ANALYSES

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	ZnO	MgO	CaO	TiO2	V2O3	Total	Cr#	Mg#
Monte Spagnolo	18MS01	149_1.	0.15	7.5	<0.01	74.6	0.37	0.02	0.08	3.2	0.18	6.6	<0.01	92.67	<0.01	7.0
Monte Spagnolo	18MS01	150_1.	0.14	6.2	0.03	76.8	0.39	<0.01	0.07	3.0	0.33	6.3	<0.01	93.16	0.03	6.4
Monte Spagnolo	18MS01	175_1.	0.09	5.5	1.33	70.7	0.35	0.05	0.05	5.2	0.07	11.7	<0.01	94.98	1.72	11.6
Monte Spagnolo	18MS01	176_1.	0.08	5.6	1.21	70.4	0.34	0.09	0.08	5.2	0.04	11.6	<0.01	94.58	1.57	11.5
Monte Spagnolo	18MS01	177_1.	0.13	1.4	0.08	73.7	0.33	<0.01	0.08	1.7	0.26	15.0	<0.01	92.61	0.11	3.9
Monte Spagnolo	18MS01	178_1.	0.11	1.6	0.13	70.0	0.53	0.04	0.12	2.1	0.22	17.0	<0.01	91.90	0.18	5.2
Monte Spagnolo	18MS01	161_1.	0.12	12.6	40.66	31.0	0.27	0.08	0.09	10.2	<0.01	1.3	<0.01	96.31	48.22	36.9
Monte Spagnolo	18MS01	163_1.	0.13	12.2	40.81	31.5	0.23	0.10	0.08	10.3	0.02	1.2	<0.01	96.53	48.32	36.8
Monte Spagnolo	18MS01	165_1.	0.12	13.2	40.77	29.7	0.26	0.11	0.09	10.6	0.02	1.2	<0.01	96.20	48.69	38.9
Monte Spagnolo	18MS01	167_1.	1.01	13.9	38.57	29.6	0.25	0.15	0.14	10.9	0.13	1.4	<0.01	96.10	47.01	39.8
Monte Spagnolo	18MS01	169_1.	0.16	1.5	0.11	69.0	0.57	<0.01	0.12	1.8	0.25	16.6	<0.01	90.18	0.16	4.5
Monte Spagnolo	18MS01	170_1.	0.09	1.8	0.12	69.9	0.50	0.04	0.11	2.1	0.16	18.4	<0.01	93.22	0.17	5.1
Monte Spagnolo	18MS01	88_1.	0.08	13.1	44.65	26.4	0.43	n.a.	0.08	11.3	0.03	1.1	0.10	97.26	53.08	43.3
Monte Spagnolo	18MS01	89_1.	0.05	13.9	40.11	29.6	0.41	n.a.	0.10	10.7	0.02	1.3	0.10	96.31	47.96	39.1
Monte Spagnolo	18MS01	90_1.	0.12	3.3	0.21	74.5	0.73	n.a.	0.20	2.6	0.11	18.0	0.47	100.26	0.27	5.8
Monte Spagnolo	18MS01	91_1.	0.13	2.2	0.27	69.0	0.56	n.a.	0.08	1.9	0.20	16.7	0.57	91.54	0.38	4.7
Monte Spagnolo	18MS01	92_1.	0.11	3.0	0.26	75.2	1.58	n.a.	0.26	5.8	0.13	3.7	0.58	90.59	0.33	12.0
Monte Spagnolo	18MS01	98_1.	0.11	14.3	28.59	39.7	0.41	n.a.	0.11	9.2	0.01	2.5	0.18	95.14	34.62	29.3
Monte Spagnolo	18MS01	99_1.	0.18	1.0	0.08	54.2	0.79	n.a.	0.08	2.1	0.22	33.8	0.45	93.03	0.15	6.6
Monte Spagnolo	18MS01	100_1.	0.10	6.2	0.60	70.0	0.43	n.a.	0.12	4.5	<0.01	11.9	0.49	94.39	0.79	10.2
Monte Spagnolo	18MS01	101_1.	0.11	4.8	0.74	68.5	0.59	n.a.	0.05	3.9	0.01	15.2	0.51	94.49	0.99	9.3
Monte Spagnolo	18MS01	102_1.	0.06	6.0	0.24	70.3	0.23	n.a.	0.06	5.0	0.02	11.9	0.53	94.36	0.31	11.3
Monte Spagnolo	18MS01	103_1.	0.11	6.4	0.21	70.5	0.39	n.a.	0.11	3.1	<0.01	13.2	0.53	94.54	0.27	7.2
Monte Spagnolo	18MS01	104_1.	0.10	5.5	0.31	70.3	0.39	n.a.	0.06	4.6	0.02	12.2	0.50	93.98	0.41	10.5
Monte Spagnolo	18MS01	117_1.	0.13	5.8	0.46	69.5	0.44	n.a.	0.04	3.3	0.04	6.3	0.52	86.61	0.61	7.8
Monte Spagnolo	18MS01	118_1.	0.08	6.0	1.24	72.2	0.21	n.a.	0.11	2.6	0.01	10.9	0.51	93.83	1.56	6.0
Monte Spagnolo	18MS01	119_1.	0.09	6.2	1.36	70.0	0.41	n.a.	0.11	4.0	<0.01	10.8	0.45	93.44	1.75	9.3
Monte Spagnolo	18MS01	120_1.	0.11	3.4	1.17	69.3	0.63	n.a.	0.10	3.0	0.07	12.6	0.56	90.88	1.59	7.1
Monte Spagnolo	18MS01	121_1.	0.12	0.8	0.06	65.4	0.82	n.a.	0.08	1.7	0.31	24.4	0.38	94.04	0.09	4.5
Monte Spagnolo	18MS01	122_1.	0.12	2.5	0.13	75.6	0.64	n.a.	0.15	2.7	0.21	8.8	0.48	91.43	0.16	6.0
Monte Spagnolo	18MS01	123_1.	0.04	12.9	45.53	26.1	0.46	n.a.	0.10	10.9	0.15	1.1	0.10	97.30	53.92	42.7
Monte Spagnolo	18MS01	124_1.	0.10	13.4	40.79	29.4	0.43	n.a.	0.10	10.0	0.01	1.3	0.10	95.60	48.81	37.8
Monte Spagnolo	18MS01	125_1.	0.05	13.3	41.30	29.2	0.43	n.a.	0.11	10.2	0.03	1.2	0.11	96.01	49.27	38.4
Monte Spagnolo	18MS01	126_1.	0.09	13.5	40.16	30.1	0.43	n.a.	0.15	9.7	<0.01	1.3	0.12	95.48	47.95	36.5
Monte Spagnolo	18MS01	127_1.	0.10	1.0	0.11	58.3	0.68	n.a.	0.13	2.1	0.19	23.9	0.51	87.01	0.19	6.1
Monte Spagnolo	18MS01	128_1.	0.15	2.1	0.08	49.2	0.66	n.a.	0.08	1.7	0.23	40.2	0.40	94.85	0.16	5.7
Monte Spagnolo	18MS01	149_1.	0.09	1.5	0.08	74.9	1.30	n.a.	0.10	2.2	0.20	14.3	0.49	95.12	0.10	5.1
Monte Spagnolo	18MS01	150_1.	1.30	2.1	0.04	58.9	0.66	n.a.	0.12	2.0	0.82	25.2	0.40	91.47	0.06	5.7
Monte Spagnolo	18MS01	151_1.	0.94	11.5	0.82	69.5	0.65	n.a.	0.09	4.3	0.80	1.3	0.31	90.20	1.00	9.9
Monte Spagnolo	18MS01	152_1.	0.07	13.6	36.08	35.1	0.45	n.a.	0.12	8.7	<0.01	1.6	0.15	95.83	42.56	30.6
Monte Spagnolo	18MS01	153_1.	0.08	12.3	41.84	29.8	0.46	n.a.	0.07	9.3	0.02	1.2	0.10	95.29	49.79	35.8
Monte Spagnolo	18MS01	154_1.	0.10	1.8	0.17	79.3	0.53	n.a.	0.09	1.5	0.10	6.8	0.60	90.93	0.21	3.2
Monte Spagnolo	18MS01	155_1.	0.37	2.2	0.04	81.5	0.22	n.a.	0.09	0.9	0.28	5.7	0.55	91.84	0.05	2.0
Monte Spagnolo	18MS01	54_1.	0.16	5.0	0.46	70.3	0.42	n.a.	0.01	4.3	0.31	11.4	0.45	92.78	0.61	9.8
Monte Spagnolo	18MS01	55_1.	0.13	1.8	0.08	73.6	0.54	n.a.	0.05	1.9	0.24	12.9	0.51	91.75	0.11	4.3
Monte Spagnolo	18MS01	56_1.	0.20	2.1	0.08	82.9	0.27	n.a.	0.02	0.8	0.22	4.2	1.20	91.89	0.09	1.6
Monte Spagnolo	18MS02	291_1.	0.10	13.5	40.32	28.6	0.44	0.08	0.08	10.9	0.02	1.2	0.13	95.36	48.94	40.5
Monte Spagnolo	18MS02	292_1.	0.09	13.3	42.12	27.0	0.42	0.12	0.13	11.4	<0.01	1.1	0.11	95.79	51.14	43.1
Monte Spagnolo	18MS02	293_1.	0.08	12.3	40.80	30.3	0.44	0.11	0.05	10.4	0.03	1.3	0.09	95.79	48.96	38.0
Monte Spagnolo	18MS02	6_1.	0.13	2.6	0.30	81.7	0.33	0.05	0.03	2.3	0.04	5.2	0.17	92.85	0.35	4.7
Monte Spagnolo	18MS02	7_1.	0.12	1.8	0.49	79.4	0.35	0.04	0.10	2.1	0.03	8.8	0.30	93.51	0.60	4.5
Monte Spagnolo	18MS02	8_1.	0.15	6.2	0.01	73.8	0.52	0.07	0.10	4.1	0.16	4.1	0.08	89.33	0.02	9.0
Monte Spagnolo	18MS02	9_1.	0.57	1.2	0.08	85.4	0.36	0.02	0.07	2.2	0.03	1.8	0.07	91.72	0.09	4.4
Monte Spagnolo	18MS02	72 / 1.	0.13	5.7	0.21	71.3	0.41	0.04	0.06	4.7	<0.01	12.4	<0.01	94.97	0.27	10.6
Monte Spagnolo	18MS02	73 / 1.	0.10	5.9	0.34	71.3	0.40	0.01	0.07	4.3	<0.01	11.3	<0.01	93.82	0.44	9.7
Monte Spagnolo	18MS02	74 / 1.	0.09	1.2	0.15	66.4	0.74	0.04	0.16	2.8	0.13	23.7	<0.01	95.30	0.22	6.9
Monte Spagnolo	18MS02	75 / 1.	0.16	1.9	0.04	66.3	0.91	0.01	0.13	1.1	0.17	20.8	<0.01	91.68	0.06	2.9
Monte Spagnolo	18MS02	78 / 1.	0.13	5.1	0.31	71.0	0.43	0.05	0.09	4.6	<0.01	13.4	<0.01	94.99	0.40	10.3
Monte Spagnolo	18MS02	79 / 1.	0.08	5.1	0.27	71.1	0.42	0.05	0.10	4.4	0.08	13.3	<0.01	94.97	0.36	10.0
Monte Spagnolo	18MS02	80 / 1.	0.08	5.2	0.29	70.6	0.43	0.03	0.02	4.7	0.05	13.5	<0.01	94.85	0.39	10.6
Monte Spagnolo	18MS02	82 / 1.	0.09	2.1	0.04	72.5	0.78	<0.01	0.11	1.4	0.13	17.6	<0.01	94.72	0.05	3.4
Monte Spagnolo	18MS02	83 / 1.	0.14	13.1	42.77	26.8	0.28	0.11	0.10	10.9	0.01	1.1	<0.01	95.31	51.76	42.1

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	ZnO	MgO	CaO	TiO2	V2O3	Total	Cr#	Mg#
Monte Spagnolo	18MS02	76 / 1 .	0.14	12.4	40.66	30.5	0.27	0.10	0.08	10.2	<0.01	1.2	<0.01	95.52	48.67	37.3
Monte Spagnolo	18MS02	77 / 1 .	0.10	1.6	0.05	72.5	0.88	0.01	0.12	1.1	0.11	17.9	<0.01	94.40	0.06	2.7
Monte Spagnolo	18MS05	28_1 .	0.10	9.5	27.92	45.2	0.42	0.05	0.12	7.3	0.10	2.7	0.16	93.63	33.79	22.4
Monte Spagnolo	18MS05	29_1 .	0.08	13.6	34.28	33.6	0.37	0.11	0.11	11.1	0.03	1.9	0.14	95.23	42.10	37.1
Monte Spagnolo	18MS05	30_1 .	1.13	14.4	32.15	33.8	0.37	0.09	0.08	11.2	0.13	1.9	0.15	95.49	40.02	37.2
Monte Spagnolo	18MS05	31_1 .	0.05	13.9	34.64	35.0	0.41	0.09	0.10	10.0	0.04	1.9	0.16	96.18	41.49	33.7
Monte Spagnolo	18MS05	32_1 .	0.04	13.8	33.98	34.4	0.40	0.12	0.09	11.1	0.03	2.0	0.13	96.13	41.32	36.5
Monte Spagnolo	18MS05	33_1 .	0.08	13.1	34.34	36.8	0.45	0.10	0.11	8.7	0.03	1.8	0.14	95.70	40.74	29.7
Monte Spagnolo	18MS05	34_1 .	0.06	12.7	43.18	26.6	0.42	0.09	0.08	12.0	0.01	1.2	0.14	96.43	52.39	44.7
Monte Spagnolo	18MS05	35_1 .	0.08	13.4	32.86	36.0	0.43	0.10	0.11	10.2	0.03	1.9	0.13	95.18	39.94	33.5
Monte Rossi	18MR01	20_1 .	0.06	4.1	1.47	71.5	0.52	n.a.	0.11	6.5	0.04	9.4	0.36	94.09	1.91	13.9
Monte Rossi	18MR01	21_1 .	0.08	3.8	1.36	71.1	0.59	n.a.	0.07	5.4	0.07	11.4	0.44	94.24	1.79	11.9
Monte Rossi	18MR01	22_1 .	0.11	6.0	0.62	70.6	0.39	n.a.	0.07	5.0	0.02	11.7	0.52	94.95	0.80	11.1
Monte Rossi	18MR01	23_1 .	0.11	6.2	0.78	71.1	0.44	n.a.	0.08	4.0	0.07	12.0	0.50	95.18	1.00	9.1
Monte Rossi	18MR01	24_1 .	0.11	3.9	0.24	69.6	0.61	n.a.	0.11	2.7	<0.01	17.8	0.69	95.87	0.33	6.5
Monte Rossi	18MR01	25_1 .	0.10	3.5	0.05	70.0	0.66	n.a.	0.15	2.3	0.13	18.1	0.69	95.75	0.07	5.6
Monte Rossi	18MR01	26_1 .	0.13	2.6	0.05	70.0	0.75	n.a.	0.13	1.5	0.04	19.3	0.59	95.16	0.07	3.6
Monte Rossi	18MR01	27_1 .	0.11	3.4	0.06	70.0	0.63	n.a.	0.08	2.1	0.05	18.9	0.67	95.90	0.08	5.0
Monte Rossi	18MR01	28_1 .	0.09	3.4	0.06	69.3	0.66	n.a.	0.10	2.2	0.25	18.2	0.62	94.88	0.09	5.4
Monte Rossi	18MR01	29_1 .	0.12	3.6	0.06	69.7	0.62	n.a.	0.13	2.4	0.16	18.1	0.64	95.55	0.08	5.8
Monte Rossi	18MR01	30_1 .	0.14	5.7	0.06	70.4	0.43	n.a.	0.10	4.7	0.19	12.2	0.51	94.36	0.07	10.6
Monte Rossi	18MR01	31_1 .	0.15	5.8	0.17	71.5	0.43	n.a.	0.07	3.8	<0.01	12.7	0.58	95.23	0.21	8.7
Monte Rossi	18MR01	32_1 .	0.08	4.8	0.17	69.8	0.54	n.a.	0.12	3.2	0.03	16.3	0.61	95.65	0.23	7.6
Monte Rossi	18MR01	33_1 .	0.12	6.0	0.30	71.0	0.38	n.a.	0.07	4.3	0.09	12.2	0.54	94.97	0.39	9.7
Monte Rossi	18MR01	34_1 .	0.12	6.2	0.30	69.7	0.39	n.a.	0.05	4.3	0.04	13.2	0.58	94.90	0.39	9.8
Monte Rossi	18MR01	35_1 .	0.10	6.6	0.27	68.8	0.38	n.a.	0.06	4.6	0.04	13.0	0.62	94.54	0.36	10.7
Monte Rossi	18MR01	36_1 .	0.08	6.3	0.49	71.8	0.40	n.a.	0.03	4.1	<0.01	11.3	0.48	94.92	0.62	9.2
Monte Rossi	18MR01	37_1 .	0.09	7.1	0.28	68.7	0.39	n.a.	0.05	4.4	0.07	11.7	0.59	93.31	0.36	10.2
Monte Rossi	18MR01	38_1 .	0.08	3.8	0.32	69.7	0.60	n.a.	0.10	2.5	0.03	17.9	0.69	95.72	0.43	5.9
Monte Rossi	18MR01	39_1 .	0.13	6.5	0.50	71.5	0.43	n.a.	0.10	4.0	<0.01	12.2	0.51	95.83	0.64	9.0
Monte Rossi	18MR01	40_1 .	0.12	6.5	0.31	70.3	0.38	n.a.	0.08	5.0	0.03	11.3	0.51	94.45	0.40	11.2
Monte Rossi	18MR01	41_1 .	0.10	5.6	0.20	69.1	0.45	n.a.	0.03	4.9	0.03	14.4	0.58	95.32	0.27	11.3
Monte Rossi	18MR01	42_1 .	0.07	5.4	0.24	69.6	0.45	n.a.	0.09	4.7	0.02	13.7	0.50	94.83	0.31	10.8
Monte Rossi	18MR01	43_1 .	0.12	3.3	0.06	70.1	0.66	n.a.	0.06	2.1	0.09	18.2	0.63	95.34	0.09	5.0
Monte Rossi	18MR01	15 / 1 .	0.06	6.9	0.64	69.1	0.35	0.05	0.06	5.3	0.02	11.6	0.45	94.45	0.84	11.9
Monte Rossi	18MR01	16 / 1 .	0.05	6.0	0.73	69.8	0.36	0.03	0.04	5.3	0.37	10.2	0.45	93.37	0.95	11.9
Monte Rossi	18MR01	17 / 1 .	0.09	4.2	0.32	69.3	0.57	<0.01	0.09	3.0	0.07	17.0	0.67	95.34	0.43	7.2
Monte Rossi	18MR01	18 / 1 .	0.08	6.5	0.62	70.9	0.37	0.04	0.08	4.1	0.03	11.7	0.48	94.97	0.80	9.4
Monte Rossi	18MR01	19 / 1 .	0.09	6.1	0.39	67.3	0.39	0.07	0.09	5.3	0.02	13.7	0.48	94.07	0.52	12.4
Monte Rossi	18MR01	20 / 1 .	0.10	6.3	0.68	71.5	0.39	0.07	0.03	4.1	0.02	11.3	0.48	95.02	0.86	9.2
Monte Rossi	18MR01	42 / 1 .	0.11	7.1	0.58	69.0	0.37	0.06	0.08	5.2	0.02	10.9	0.49	93.92	0.76	11.8
Monte Rossi	18MR01	43 / 1 .	0.85	9.9	0.53	63.8	0.43	0.10	0.05	3.5	0.10	14.5	0.49	94.33	0.71	8.9
Monte Rossi	18MR01	44 / 1 .	0.09	6.9	0.31	68.2	0.39	0.07	0.06	4.7	0.02	13.4	0.53	94.68	0.41	10.9
Monte Rossi	18MR01	45 / 1 .	0.08	6.3	0.64	70.5	0.44	0.03	0.07	3.9	0.01	12.7	0.48	95.09	0.83	9.0
Monte Rossi	18MR01	46 / 1 .	0.09	7.2	0.75	68.3	0.36	0.05	0.10	4.5	0.03	11.9	0.51	93.83	0.98	10.5
Monte Rossi	18MR01	47 / 1 .	0.09	4.4	1.08	71.3	0.43	0.02	0.04	4.5	0.14	11.3	0.51	93.83	1.40	10.2
Monte Rossi	18MR01	68 / 1 .	0.14	2.7	0.04	67.2	0.82	<0.01	0.14	2.0	0.33	18.7	0.39	92.36	0.05	5.0
Monte Rossi	18MR01	69 / 1 .	0.08	7.0	0.28	69.7	0.41	0.03	0.11	3.8	<0.01	12.5	0.53	94.46	0.36	8.9
Monte Rossi	18MR01	70 / 1 .	0.11	5.8	0.46	69.8	0.45	<0.01	0.04	3.4	0.10	13.5	0.59	94.29	0.60	8.1
Monte Rossi	18MR01	71 / 1 .	0.05	6.4	0.29	70.9	0.42	<0.01	0.07	4.1	0.04	12.4	0.53	95.19	0.37	9.3
Monte Rossi	18MR01	72 / 1 .	0.07	3.5	0.05	69.7	0.63	<0.01	0.12	2.3	0.03	18.5	0.65	95.62	0.06	5.5
Monte Rossi	18MR01	110 / 1 .	0.23	4.9	0.20	67.6	0.50	0.08	0.11	4.5	<0.01	15.4	0.59	94.12	0.27	10.6
Monte Rossi	18MR01	111 / 1 .	0.14	5.5	0.53	68.7	0.50	<0.01	0.09	4.1	0.03	15.5	0.56	95.54	0.70	9.6
Monte Rossi	18MR01	112 / 1 .	0.07	3.8	0.04	69.4	0.58	<0.01	0.10	2.9	0.17	17.6	0.69	95.28	0.05	7.0
Monte Rossi	18MR02	67_1 .	0.09	5.4	0.28	68.7	0.40	0.03	0.06	5.3	0.01	13.6	0.57	94.37	0.37	12.0
Monte Rossi	18MR02	68_1 .	0.13	8.6	0.57	66.7	0.38	0.03	0.06	4.6	0.05	12.8	0.66	94.65	0.75	11.0
Monte Rossi	18MR02	81_1 .	0.12	5.3	0.03	70.2	0.38	0.04	0.09	4.9	0.19	11.9	0.56	93.60	0.04	11.0
Monte Rossi	18MR02	90_1 .	0.11	4.5	0.52	68.8	0.54	0.03	0.07	3.7	<0.01	16.2	0.67	95.19	0.71	8.7
Monte Rossi	18MR02	91_1 .	0.11	6.3	0.29	71.0	0.37	0.04	0.08	5.0	0.01	10.6	0.54	94.32	0.37	11.2
Monte Rossi	18MR02	92_1 .	0.09	6.0	0.69	71.4	0.38	0.05	0.02	3.7	0.04	11.6	0.55	94.50	0.88	8.4
Monte Rossi	18MR02	118_1 .	0.07	4.2	0.67	69.1	0.53	0.02	0.11	3.7	0.02	16.5	0.66	95.59	0.91	8.6
Monte Rossi	18MR02	119_1 .	0.12	5.9	0.53	69.9	0.47	0.03	0.11	4.0	0.01	13.2	0.58	94.80	0.70	9.2
Monte Rossi	18MR03	5_1 .	0.11	4.3	0.70	69.2	0.54	0.02	0.06	3.2	0.04	16.4	0.67	95.26	0.94	7.6
Monte Rossi	18MR03	16_1 .	0.08	5.8	0.38	70.1	0.46	0.01	0.04	4.0	<0.01	13.8	0.57	95.33	0.50	9.3

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	ZnO	MgO	CaO	TiO2	V2O3	Total	Cr#	Mg#
Monte Rossi	18MR03	17_1.	0.09	5.6	0.30	69.5	0.41	0.06	0.08	5.0	0.02	13.3	0.58	94.87	0.39	11.5
Monte Rossi	18MR03	27_1.	0.10	5.6	0.33	70.7	0.39	0.02	0.03	4.9	<0.01	11.8	0.47	94.40	0.43	11.0
Monte Rossi	18MR03	28_1.	0.10	5.7	0.81	70.5	0.44	<0.01	0.06	3.8	<0.01	12.8	0.52	94.70	1.05	8.7
Monte Rossi	18MR03	57_1.	0.10	5.7	0.41	70.7	0.41	0.03	0.03	4.9	0.06	11.6	0.55	94.47	0.54	11.1
Monte Rossi	18MR03	58_1.	0.08	5.8	0.26	71.6	0.42	0.01	0.06	4.3	<0.01	11.5	0.56	94.57	0.34	9.7
Monte Rossi	18MR03	59_1.	0.16	6.1	0.42	71.1	0.42	0.05	0.08	4.7	0.07	11.1	0.51	94.63	0.54	10.5
Monte Rossi	18MR03	60_1.	0.13	6.3	0.44	70.8	0.42	0.04	0.07	4.5	0.09	11.1	0.51	94.34	0.56	10.2
Monte Rossi	18MR03	220_1.	0.08	6.5	0.63	70.6	0.37	n.a.	0.08	5.0	0.09	10.8	0.51	94.73	0.81	11.3
Monte Rossi	18MR03	221_1.	0.07	6.5	0.65	70.2	0.37	n.a.	0.10	5.0	0.06	10.9	0.48	94.31	0.84	11.3
Monte Rossi	18MR03	222_1.	0.11	4.3	0.29	70.1	0.56	n.a.	0.10	2.9	0.07	16.5	0.62	95.57	0.39	7.0
Monte Rossi	18MR03	223_1.	0.09	6.2	0.22	70.7	0.43	n.a.	0.03	4.0	0.16	11.9	0.50	94.28	0.29	9.2
Monte Rossi	18MR03	224_1.	0.05	5.8	0.05	71.2	0.42	n.a.	0.05	4.3	0.13	11.8	0.50	94.30	0.06	9.8
Monte Rossi	18MR03	225_1.	0.11	4.4	0.33	69.8	0.52	n.a.	0.11	3.0	<0.01	16.6	0.68	95.47	0.45	7.1
Monte Rossi	18MR03	226_1.	0.11	6.2	0.70	70.4	0.37	n.a.	0.08	5.0	0.02	11.5	0.52	94.93	0.91	11.2
Monte Rossi	18MR03	227_1.	0.10	6.4	0.77	70.4	0.39	n.a.	0.10	5.0	0.19	10.9	0.52	94.83	0.99	11.3
Monte Rossi	18MR03	228_1.	0.11	4.5	0.05	69.5	0.54	n.a.	0.12	3.2	0.18	16.3	0.64	95.16	0.07	7.6
Monte Rossi	18MR03	229_1.	0.19	4.4	0.28	67.3	0.47	n.a.	0.07	5.1	0.38	14.4	0.48	93.15	0.38	11.9
Monte Rossi	18MR03	230_1.	0.11	3.4	0.07	70.5	0.61	n.a.	0.08	2.3	0.13	17.8	0.68	95.63	0.09	5.4
Monte Rossi	18MR03	231_1.	0.11	6.0	0.58	69.9	0.40	n.a.	0.08	4.9	0.17	11.7	0.51	94.40	0.76	11.2
Monte Rossi	18MR03	232_1.	0.12	4.8	0.05	70.1	0.50	n.a.	0.10	3.3	0.14	15.6	0.64	95.30	0.06	7.8
Monte Rossi	18MR03	233_1.	0.09	6.2	0.80	71.2	0.41	n.a.	0.10	4.3	<0.01	11.2	0.46	94.77	1.02	9.8
Monte Rossi	18MR03	234_1.	0.08	6.3	0.76	71.0	0.39	n.a.	0.13	4.4	<0.01	11.0	0.50	94.59	0.98	10.0
Monte Rossi	18MR03	235_1.	0.12	6.2	0.52	71.2	0.41	n.a.	0.08	4.1	0.11	11.5	0.48	94.63	0.66	9.2
Monte Rossi	18MR03	236_1.	0.09	5.7	0.25	69.9	0.44	n.a.	0.10	4.4	0.24	13.2	0.54	94.88	0.33	10.2
Monte Rossi	18MR03	237_1.	0.16	3.6	0.10	69.7	0.59	n.a.	0.11	2.3	0.10	17.5	0.74	94.82	0.13	5.5
Monte Rossi	18MR03	238_1.	0.08	3.3	0.07	70.1	0.61	n.a.	0.10	2.1	0.10	18.1	0.72	95.28	0.10	5.2
Mounts de Fiore	18MF01	198_1.	0.06	7.0	0.51	69.4	0.36	n.a.	0.03	4.0	0.10	9.7	0.44	91.59	0.66	9.3
Mounts de Fiore	18MF01	199_1.	0.11	5.2	0.10	68.1	0.37	n.a.	0.10	4.0	0.12	11.3	0.57	89.97	0.14	9.4
Mounts de Fiore	18MF01	200_1.	0.08	6.4	0.13	68.1	0.33	n.a.	0.10	4.1	0.34	10.3	0.47	90.37	0.17	9.7
Mounts de Fiore	18MF01	201_1.	0.10	5.0	0.32	69.9	0.38	n.a.	0.07	5.7	0.04	13.2	0.57	95.28	0.43	12.8
Mounts de Fiore	18MF01	202_1.	0.09	4.7	0.31	68.2	0.37	n.a.	0.05	6.4	0.03	14.4	0.64	95.20	0.43	14.3
Mounts de Fiore	18MF01	203_1.	0.09	6.2	2.17	67.7	0.34	n.a.	0.04	6.9	0.06	10.1	0.42	94.06	2.85	15.3
Mounts de Fiore	18MF01	204_1.	0.05	6.1	2.14	68.2	0.35	n.a.	0.10	6.6	0.13	9.8	0.40	94.03	2.80	14.8
Mounts de Fiore	18MF01	205_1.	0.12	4.4	0.43	75.5	0.34	n.a.	0.07	4.5	0.07	7.8	0.39	93.65	0.53	9.6
Mounts de Fiore	18MF01	206_1.	0.13	4.4	0.03	78.1	0.37	n.a.	0.05	3.4	0.12	6.3	0.24	93.14	0.04	7.2
Mounts de Fiore	18MF01	207_1.	0.13	6.8	0.05	67.1	0.54	n.a.	0.05	3.9	0.50	11.6	0.55	91.20	0.07	9.4
Mounts de Fiore	18MF01	208_1.	0.07	7.1	0.46	71.2	0.32	n.a.	0.06	4.8	0.07	9.4	0.44	94.05	0.59	10.8
Mounts de Fiore	18MF01	209_1.	0.09	5.9	0.39	72.4	0.33	n.a.	0.09	4.8	0.04	9.3	0.39	93.78	0.50	10.6
Mounts de Fiore	18MF01	210_1.	0.11	7.9	0.54	69.7	0.40	n.a.	0.11	4.2	0.12	9.9	0.36	93.32	0.70	9.7
Mounts de Fiore	18MF01	211_1.	0.14	5.7	0.04	70.4	0.51	n.a.	0.07	4.1	0.07	12.4	0.54	93.99	0.06	9.4
Mounts de Fiore	18MF01	212_1.	0.14	5.1	0.04	70.0	0.54	n.a.	0.07	4.1	0.19	13.3	0.51	93.98	0.06	9.4
Mounts de Fiore	18MF02	117_1.	0.09	7.6	0.20	71.7	0.46	0.02	0.07	3.7	0.13	9.9	0.38	94.33	0.26	8.5
Mounts de Fiore	18MF02	118_1.	0.14	5.7	0.06	69.3	0.53	0.01	0.11	2.9	0.08	13.2	0.47	92.51	0.08	6.9
Mounts de Fiore	18MF02	146_1.	0.13	7.6	0.26	71.2	0.46	0.02	0.13	3.5	0.16	10.5	0.45	94.50	0.32	8.2
Mounts de Fiore	18MF02	147_1.	0.09	4.5	0.09	73.6	0.31	0.06	0.08	4.8	0.03	10.6	0.46	94.65	0.12	10.5
Mounts de Fiore	18MF02	148_1.	0.08	5.9	0.08	72.7	0.38	0.09	0.03	4.4	0.03	10.6	0.50	94.82	0.10	9.7
Mounts de Fiore	18MF02	149_1.	0.15	4.5	1.45	70.2	0.61	0.02	0.09	2.7	0.20	13.5	0.46	93.96	1.90	6.5
Mounts de Fiore	18MF02	162_1.	0.13	6.1	0.78	67.5	0.54	0.02	0.11	3.6	0.02	14.6	0.57	93.88	1.05	8.6
Mounts de Fiore	18MF02	163_1.	0.08	6.2	0.66	70.3	0.53	<0.01	0.10	3.4	0.11	13.0	0.60	94.98	0.86	7.9
Mounts de Fiore	18MF03A	186_1.	0.12	6.7	2.20	70.6	0.58	0.04	0.14	4.1	0.04	8.8	0.35	93.68	2.77	9.5
Mounts de Fiore	18MF03A	187_1.	0.11	5.0	0.06	72.2	0.65	<0.01	0.10	4.6	0.13	10.3	0.40	93.60	0.07	10.2
Mounts de Fiore	18MF03A	188_1.	0.09	5.6	0.46	71.7	0.55	<0.01	0.09	4.2	0.11	11.2	0.46	94.54	0.59	9.5
Mounts de Fiore	18MF03A	189_1.	0.10	7.0	0.40	71.2	0.49	0.01	0.10	4.9	0.16	8.9	0.38	93.58	0.51	10.9
Mounts de Fiore	18MF03A	190_1.	0.09	7.4	1.36	70.3	0.45	0.02	0.13	5.1	0.27	8.0	0.35	93.44	1.72	11.5
Mounts de Fiore	18MF03A	191_1.	0.24	3.2	0.05	68.8	0.79	0.02	0.11	2.4	0.10	17.3	0.56	93.60	0.08	5.9
Mounts de Fiore	18MF03A	219_1.	0.08	4.1	0.14	70.3	0.60	0.02	0.07	2.9	0.07	15.3	0.62	94.26	0.19	6.9
Mounts de Fiore	18MF03A	220_1.	0.09	5.5	0.22	69.9	0.53	<0.01	0.06	3.7	0.15	13.5	0.56	94.20	0.30	8.5
Mounts de Fiore	18MF03A	235_1.	0.08	6.6	0.06	70.3	0.48	0.02	0.09	4.1	0.08	12.2	0.48	94.48	0.08	9.4
Mounts de Fiore	18MF03A	236_1.	0.11	5.7	0.49	69.4	0.54	0.01	0.11	4.0	0.07	13.4	0.57	94.28	0.65	9.3
Mounts de Fiore	18MF03A	251_1.	0.14	5.3	0.39	73.0	0.44	0.05	0.05	4.4	0.01	9.1	0.35	93.18	0.49	9.6
Mounts de Fiore	18MF03A	252_1.	0.15	4.1	0.31	71.6	0.44	0.05	0.06	4.2	<0.01	12.0	0.46	93.39	0.40	9.6
Mounts de Fiore	18MF03A	253_1.	0.10	5.1	0.20	72.2	0.65	<0.01	0.08	4.4	0.10	10.7	0.38	93.87	0.26	9.9
Mounts de Fiore	18MF03B	16_1.	1.16	4.3	0.05	70.2	0.57	<0.01	0.12	2.6	0.34	14.9	0.52	94.71	0.07	6.2
Mounts de Fiore	18MF03B	51_1.	5.02	6.8	0.04	66.8	0.55	0.02	0.25	2.8	0.19	8.9	0.41	91.85	0.06	6.9

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	NiO	ZnO	MgO	CaO	TiO2	V2O3	Total	Cr#	Mg#
Mounts de Fiore	18MF03B	52_1.	0.61	7.2	0.14	68.7	0.35	0.06	0.02	5.8	0.03	11.6	0.40	94.79	0.19	13.0
Mounts de Fiore	18MF03B	53_1.	0.08	6.6	0.13	68.7	0.34	0.09	0.06	5.6	<0.01	13.1	0.41	95.13	0.17	12.6
Mounts de Fiore	18MF05	100_1.	0.12	4.9	0.37	71.8	0.54	<0.01	0.11	4.9	0.14	10.6	0.41	93.87	0.48	10.8
Mounts de Fiore	18MF05	108_1.	0.10	4.8	0.05	71.7	0.57	0.02	0.04	5.1	0.10	10.8	0.40	93.56	0.06	11.2
Mounts de Fiore	18MF05	109_1.	0.16	4.8	0.02	71.9	0.58	0.01	0.12	4.5	0.22	11.0	0.44	93.70	0.03	10.0
Mounts de Fiore	18MF05	116_1.	0.18	4.9	0.03	71.3	0.57	<0.01	0.09	5.0	0.33	10.6	0.39	93.51	0.04	11.2
Mounts de Fiore	18MF05	122_1.	0.09	4.8	0.19	72.0	0.57	0.04	0.08	4.7	0.09	10.6	0.39	93.63	0.24	10.5
Mounts de Fiore	18MF05	133_1.	0.13	5.0	0.16	70.5	0.48	0.02	0.11	4.6	0.14	11.2	0.47	92.87	0.22	10.4
Mounts de Fiore	18MF05	134_1.	0.11	4.6	0.09	71.3	0.48	0.02	0.12	4.4	0.10	11.6	0.53	93.29	0.12	9.8
Mounts de Fiore	18MF05	147_1.	0.13	4.8	0.04	71.5	0.58	<0.01	0.09	4.4	0.11	11.9	0.49	94.12	0.06	9.9
Mounts de Fiore	18MF05	155_1.	0.12	4.7	0.04	71.8	0.55	<0.01	0.08	4.5	0.04	11.9	0.49	94.15	0.05	10.0
Mounts de Fiore	18MF05	169_1.	0.12	4.8	0.04	70.6	0.53	0.04	0.02	4.4	0.23	12.4	0.47	93.62	0.05	10.0
2002/03 lava flow	18RS01	10_1.	0.16	3.5	0.02	67.0	0.62	<0.01	0.09	3.6	0.20	14.3	0.57	90.13	0.03	8.8
2002/03 lava flow	18RS01	12_1.	0.13	4.7	0.07	71.1	0.53	0.02	0.05	3.9	0.02	12.9	0.47	93.89	0.09	9.0
2002/03 lava flow	18RS01	31_1.	0.06	6.4	0.06	71.7	0.31	0.06	0.07	5.2	0.03	8.9	0.44	93.33	0.08	11.5
2002/03 lava flow	18RS01	32_1.	0.11	6.4	0.14	71.2	0.30	0.08	0.03	5.5	0.09	8.9	0.48	93.26	0.18	12.1
2002/03 lava flow	18RS01	33_1.	0.05	5.0	0.21	71.3	0.31	0.04	0.10	5.5	0.04	10.6	0.43	93.56	0.27	12.2
2002/03 lava flow	18RS01	37_1.	0.39	3.3	0.05	69.2	0.62	<0.01	0.08	3.5	0.40	15.2	0.44	93.19	0.07	8.2
2002/03 lava flow	18RS01	38_1.	0.14	3.3	0.01	70.6	0.58	0.02	0.07	3.3	0.23	15.1	0.47	93.80	0.02	7.7
2002/03 lava flow	18RS01	39_1.	8.49	8.4	0.03	58.4	0.44	<0.01	0.06	2.6	2.19	12.0	0.46	93.12	0.04	7.4
2002/03 lava flow	18RS02	178_1.	0.14	5.6	0.52	69.6	0.55	n.a.	0.09	3.9	0.30	11.4	0.45	92.54	0.69	9.1
2002/03 lava flow	18RS02	179_1.	0.12	4.3	0.27	69.4	0.60	n.a.	0.08	3.6	0.30	13.3	0.50	92.40	0.36	8.4
2002/03 lava flow	18RS02	180_1.	0.11	4.7	0.26	69.8	0.55	n.a.	0.10	3.6	0.22	13.3	0.52	93.21	0.35	8.5
2002/03 lava flow	18RS02	181_1.	0.13	3.6	0.03	69.6	0.59	n.a.	0.14	3.4	0.17	14.7	0.48	92.84	0.04	7.9
2002/03 lava flow	18RS02	182_1.	0.13	3.5	0.04	69.5	0.66	n.a.	0.10	3.5	0.10	14.8	0.55	92.83	0.05	8.2
2002/03 lava flow	18RS02	183_1.	0.28	3.7	0.03	72.5	0.48	n.a.	0.08	2.9	0.55	10.7	0.46	91.80	0.03	6.7
2002/03 lava flow	18RS02	184_1.	0.16	3.8	0.04	70.3	0.71	n.a.	0.11	3.8	0.13	14.4	0.50	93.98	0.05	8.9
2002/03 lava flow	18RS02	185_1.	0.10	4.7	0.18	70.0	0.65	n.a.	0.08	3.9	0.04	13.8	0.59	94.09	0.24	9.1
2002/03 lava flow	18RS02	186_1.	0.11	4.3	0.25	70.2	0.67	n.a.	0.07	3.9	0.05	14.3	0.59	94.43	0.34	9.1
2002/03 lava flow	18RS02	187_1.	0.13	7.4	0.55	69.9	0.28	n.a.	0.09	5.4	0.29	9.0	0.42	93.47	0.71	12.2
2002/03 lava flow	18RS02	188_1.	0.13	7.5	0.72	69.0	0.30	n.a.	0.05	5.5	0.51	8.8	0.40	92.86	0.93	12.4
2002/03 lava flow	18RS02	189_1.	0.13	7.6	0.20	70.3	0.32	n.a.	0.08	5.5	0.28	9.1	0.40	93.92	0.26	12.3
2002/03 lava flow	18RS02	190_1.	0.12	3.8	0.26	70.3	0.68	n.a.	0.10	3.7	0.11	15.2	0.59	94.74	0.35	8.5
2002/03 lava flow	18RS02	191_1.	0.13	4.0	0.04	70.0	0.68	n.a.	0.12	3.7	0.10	15.3	0.64	94.66	0.05	8.6
2002/03 lava flow	18RS02	192_1.	0.15	3.8	0.03	69.8	0.69	n.a.	0.07	3.3	0.16	15.0	0.53	93.48	0.05	7.7
2002/03 lava flow	18RS02	193_1.	0.16	3.7	0.04	69.7	0.64	n.a.	0.10	3.7	0.27	14.8	0.58	93.84	0.06	8.7
2002/03 lava flow	18RS02	194_1.	0.14	3.8	0.04	70.0	0.67	n.a.	0.06	3.8	0.18	15.0	0.56	94.28	0.05	8.7
2002/03 lava flow	18RS02	195_1.	0.09	7.2	0.05	71.7	0.35	n.a.	0.07	4.8	0.07	9.6	0.44	94.42	0.07	10.6
2002/03 lava flow	18RS02	196_1.	0.14	7.5	0.44	70.1	0.33	n.a.	0.10	5.5	0.44	9.0	0.43	93.98	0.56	12.4
2002/03 lava flow	18RS02	197_1.	0.08	7.6	0.07	70.8	0.49	n.a.	0.11	4.2	0.09	10.5	0.46	94.38	0.09	9.6
2002/03 lava flow	18RS02	198_1.	0.26	4.6	0.12	68.4	0.53	n.a.	0.13	4.0	0.02	15.0	0.39	93.43	0.17	9.5
2002/03 lava flow	18RS02	199_1.	0.15	5.8	0.32	69.2	0.62	n.a.	0.11	4.1	0.04	13.7	0.59	94.74	0.43	9.6
2002/03 lava flow	18RS02	200_1.	0.14	4.0	0.05	70.0	0.66	n.a.	0.07	3.9	0.10	14.7	0.63	94.38	0.07	9.1
2002/03 lava flow	18RS02	126/1.	0.13	3.7	0.03	69.7	0.67	<0.01	0.07	4.0	0.10	15.0	0.59	93.96	0.05	9.2
2002/03 lava flow	18RS02	127/1.	0.10	6.2	0.34	71.1	0.52	0.02	0.06	3.9	0.02	11.0	0.49	93.71	0.44	9.0
2002/03 lava flow	18RS02	128/1.	0.07	6.6	0.26	72.3	0.36	0.02	0.10	4.6	<0.01	10.0	0.44	94.71	0.33	10.1
2002/03 lava flow	18RS02	129/1.	0.11	3.8	0.04	70.5	0.68	0.02	0.11	3.8	0.17	14.2	0.53	93.98	0.05	8.7
2002/03 lava flow	18RS02	130/1.	0.09	6.1	0.16	69.8	0.60	<0.01	0.11	4.3	0.05	13.2	0.56	94.95	0.21	9.9
2002/03 lava flow	18RS02	131/1.	0.13	5.8	0.09	70.7	0.56	0.03	0.12	4.2	0.20	12.2	0.53	94.65	0.12	9.6
2002/03 lava flow	18RS02	154/1.	0.08	4.9	0.08	70.2	0.62	0.05	0.07	4.1	0.06	13.9	0.52	94.66	0.11	9.5
2002/03 lava flow	18RS02	155/1.	0.15	5.1	0.03	77.1	0.37	0.05	0.10	3.4	0.02	6.4	0.20	92.86	0.04	7.2
2002/03 lava flow	18RS02	156/1.	0.11	4.0	0.17	69.9	0.66	<0.01	0.08	4.0	0.14	14.7	0.60	94.44	0.23	9.4
2002/03 lava flow	18RS02	172/1.	0.10	5.2	0.30	69.8	0.67	0.03	0.06	3.7	0.03	14.4	0.62	94.79	0.40	8.6
2002/03 lava flow	18RS02	173/1.	0.07	5.5	0.27	69.4	0.62	0.04	0.12	4.3	<0.01	13.9	0.58	94.76	0.35	9.9
2002/03 lava flow	18RS02	174/1.	0.09	4.6	0.13	69.0	0.58	0.06	0.09	4.1	0.05	15.3	0.40	94.40	0.17	9.5
2002/03 lava flow	18RS02	185/1.	0.07	7.4	0.05	69.9	0.52	0.01	0.05	4.4	0.02	11.7	0.44	94.51	0.06	10.1
2002/03 lava flow	18RS02	186/1.	0.11	9.1	0.52	67.1	0.41	0.04	0.08	4.9	0.09	11.4	0.40	94.10	0.68	11.5
2002/03 lava flow	18RS02	187/1.	0.12	6.4	0.59	69.5	0.41	0.05	0.09	5.1	<0.01	11.7	0.46	94.45	0.78	11.5

11.5. MELT INCLUSION POINT ANALYSES

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	TiO2	Na2O	K2O	P2O5	Total	Mg#
Monte Spagnolo	18MS01	181_1 .	59.5	21.9	n.a.	2.25	0.02	0.28	1.35	1.08	4.77	7.05	n.a.	98.17	18.0
Monte Spagnolo	18MS01	1_1 .	52.4	28.6	n.a.	1.07	0.01	0.13	12.09	0.12	4.43	0.36	0.03	99.22	17.8
Monte Spagnolo	18MS01	2_1 .	52.7	27.9	n.a.	0.83	<0.01	0.08	11.56	0.13	4.68	0.46	0.04	98.37	14.0
Monte Spagnolo	18MS01	3_1 .	53.3	28.3	n.a.	0.89	0.01	0.09	11.45	0.10	4.68	0.39	0.04	99.23	14.8
Monte Spagnolo	18MS01	4_1 .	52.7	28.4	n.a.	0.80	<0.01	0.08	11.52	0.09	4.68	0.39	<0.01	98.61	14.4
Monte Spagnolo	18MS01	5_1 .	51.7	28.9	n.a.	1.02	<0.01	0.08	12.20	0.07	4.37	0.30	n.a.	98.70	12.4
Monte Spagnolo	18MS01	6_1 .	1.2	<0.01	n.a.	1.10	0.06	0.32	53.01	0.04	0.03	0.11	39.69	96.81	34.4
Monte Spagnolo	18MS01	7_1 .	57.9	22.4	n.a.	2.70	0.07	0.34	0.26	0.80	4.46	5.79	0.51	95.73	18.1
Monte Spagnolo	18MS01	8_1 .	61.8	20.3	n.a.	0.60	0.06	0.22	2.12	0.41	4.87	6.30	0.97	97.92	40.0
Monte Spagnolo	18MS01	9_1 .	56.2	22.8	n.a.	1.60	0.05	0.27	2.80	1.38	6.09	5.72	1.42	98.67	23.1
Monte Rossi	18MR03	1_1 .	48.1	4.5	<0.01	10.19	0.23	11.65	21.79	2.27	0.63	0.03	n.a.	99.35	67.1
Monte Rossi	18MR03	2_1 .	36.7	<0.01	<0.01	31.33	0.71	29.77	0.53	0.09	0.02	0.02	n.a.	99.19	62.9
Monte Rossi	18MR03	3_1 .	51.1	30.3	n.a.	0.89	n.a.	0.06	13.73	0.10	3.79	0.25	n.a.	100.14	10.5
Monte Rossi	18MR03	4_1 .	53.3	28.7	n.a.	0.78	n.a.	0.09	12.33	0.08	4.49	0.46	n.a.	100.17	16.4
Monte Rossi	18MR03	5_1 .	61.3	21.0	n.a.	1.18	0.07	0.26	2.27	0.46	5.44	4.39	1.46	98.10	27.9
Monte Rossi	18MR03	6_1 .	59.9	21.5	n.a.	1.61	0.08	0.63	2.72	0.72	4.22	4.44	1.21	97.25	41.1
Monte Rossi	18MR03	7_1 .	33.6	<0.01	<0.01	43.10	1.13	19.04	1.08	0.06	0.09	0.02	n.a.	98.16	44.1
Monte Rossi	18MR03	8_1 .	56.9	23.0	n.a.	1.18	0.08	0.13	1.45	0.65	7.44	6.88	0.65	98.85	16.2
Monte Rossi	18MR03	9_1 .	51.9	30.9	0.01	0.79	<0.01	0.07	13.31	0.11	3.75	0.26	n.a.	101.04	14.2
Monte Rossi	18MR03	10_1 .	48.9	4.4	0.01	8.86	0.24	12.74	21.76	1.72	0.54	0.02	n.a.	99.24	71.9
Monte Rossi	18MR03	11_1 .	49.8	3.8	<0.01	8.80	0.22	12.80	21.71	1.54	0.53	<0.01	n.a.	99.25	72.2
Monte Rossi	18MR03	12_1 .	35.7	<0.01	<0.01	34.75	0.78	26.36	0.62	0.03	0.03	<0.01	n.a.	98.32	57.5
Monte Rossi	18MR03	13_1 .	51.2	30.0	n.a.	0.79	n.a.	0.10	13.65	0.07	3.65	0.27	n.a.	99.75	18.8
Monte Rossi	18MR03	14_1 .	54.5	27.9	n.a.	0.89	n.a.	0.08	10.91	0.11	5.16	0.50	n.a.	99.96	13.6
Monte Rossi	18MR03	15_1 .	37.8	<0.01	<0.01	24.61	0.48	35.82	0.37	0.03	0.01	<0.01	n.a.	99.21	72.2
Monte Rossi	18MR03	16_1 .	41.8	30.5	n.a.	1.25	0.02	0.85	0.12	0.24	0.60	7.59	n.a.	82.96	54.8
Mounts de Fiore	18MF01	1_1 .	48.6	17.3	n.a.	8.60	0.19	1.37	8.50	2.30	6.16	4.62	0.86	98.86	22.1
Mounts de Fiore	18MF01	2_1 .	51.1	19.3	n.a.	9.06	0.24	1.30	4.64	1.16	6.40	4.20	1.40	99.20	20.3
Mounts de Fiore	18MF01	3_1 .	61.0	19.2	n.a.	2.39	0.03	0.77	3.97	3.44	4.89	2.98	0.28	99.19	36.4
Mounts de Fiore	18MF01	4_1 .	50.9	19.0	n.a.	7.64	0.24	1.08	3.40	1.65	7.54	6.43	1.03	99.31	20.2
Mounts de Fiore	18MF01	5_1 .	50.9	18.6	n.a.	6.04	0.15	0.93	6.19	2.17	7.39	5.94	1.06	99.72	21.6
Mounts de Fiore	18MF01	6_1 .	49.5	16.4	n.a.	9.91	0.30	0.88	4.90	2.45	6.93	5.73	1.38	98.86	13.7
Mounts de Fiore	18MF01	7_1 .	49.4	16.8	n.a.	8.98	0.26	0.97	7.86	2.36	6.25	4.90	1.04	99.30	16.2
Mounts de Fiore	18MF05	185_1 .	51.3	17.5	n.a.	5.70	0.17	3.80	4.18	1.10	7.11	6.22	1.06	98.47	54.3
Mounts de Fiore	18MF05	186_1 .	52.0	19.7	n.a.	4.67	0.13	0.89	4.25	1.73	6.82	6.70	1.27	98.60	25.4
Mounts de Fiore	18MF05	187_1 .	52.0	19.4	n.a.	4.92	0.13	0.85	3.97	1.75	7.21	7.17	1.25	99.03	23.5
Mounts de Fiore	18MF05	188_1 .	52.2	19.2	n.a.	5.17	0.15	0.86	5.09	1.46	7.07	6.32	1.17	99.02	22.8
Mounts de Fiore	18MF05	189_1 .	51.9	19.4	n.a.	5.50	0.15	1.09	4.11	1.38	7.26	6.63	1.20	98.90	26.1
Mounts de Fiore	18MF05	190_1 .	51.5	17.9	n.a.	6.71	0.19	1.29	4.22	1.43	7.43	6.26	1.18	98.59	25.5
Mounts de Fiore	18MF05	191_1 .	49.3	16.2	n.a.	6.36	0.14	4.37	10.27	1.89	5.02	4.24	1.11	99.20	55.1
Mounts de Fiore	18MF05	192_1 .	43.1	17.4	n.a.	6.57	0.18	0.93	5.59	1.96	6.58	5.86	1.09	89.59	20.2
Mounts de Fiore	18MF05	193_1 .	50.3	19.2	n.a.	6.45	0.15	0.94	5.49	2.05	6.65	6.38	1.23	99.15	20.7
Mounts de Fiore	18MF05	194_1 .	51.0	18.7	n.a.	5.21	0.13	1.73	6.14	2.03	6.85	5.38	1.08	98.58	37.2
Mounts de Fiore	18MF07	195_1 .	47.8	14.4	n.a.	10.78	0.30	10.15	3.29	1.47	5.53	4.56	0.85	99.35	62.7
Mounts de Fiore	18MF07	196_1 .	50.2	17.0	n.a.	7.39	0.21	1.34	6.23	2.31	6.11	5.78	1.45	98.37	24.4
Mounts de Fiore	18MF07	197_1 .	51.4	18.8	n.a.	5.88	0.15	0.87	4.43	2.02	7.11	6.45	1.27	98.68	20.8
Mounts de Fiore	18MF07	198_1 .	49.9	30.7	n.a.	1.26	0.02	0.12	14.18	0.10	3.24	0.35	0.05	99.96	14.5

Location	Sample	Point	SiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	TiO2	Na2O	K2O	P2O5	Total	Mg#
2002/03 lava flow	18RS02	3_1 .	54.5	18.5	n.a.	6.49	0.18	1.05	1.91	1.25	7.14	6.72	1.06	99.12	22.4
2002/03 lava flow	18RS02	4_1 .	52.2	17.0	n.a.	9.22	0.24	1.41	2.76	1.86	6.80	5.88	1.61	99.43	21.4
2002/03 lava flow	18RS02	5_1 .	44.3	15.0	n.a.	13.48	0.35	5.43	9.30	2.59	6.15	2.68	1.07	100.68	41.8
2002/03 lava flow	18RS02	6_1 .	56.9	20.9	n.a.	2.10	0.11	0.99	3.19	1.27	6.69	5.65	0.95	99.02	45.8
2002/03 lava flow	18RS02	7_1 .	48.8	14.9	n.a.	8.95	0.19	1.25	8.78	2.31	5.36	6.34	1.39	98.99	20.0
2002/03 lava flow	18RS02	189 / 1 .	44.4	15.3	n.a.	14.49	n.a.	3.79	11.13	1.46	4.15	1.55	n.a.	96.27	31.8
2002/03 lava flow	18RS02	190 / 1 .	51.1	18.0	n.a.	7.93	n.a.	1.82	6.97	1.34	5.80	2.68	n.a.	95.68	29.1
2002/03 lava flow	18RS02	191 / 1 .	48.4	18.5	n.a.	8.91	n.a.	1.68	7.87	1.08	6.29	2.55	n.a.	95.26	25.2
2002/03 lava flow	18RS02	192 / 1 .	54.6	21.4	n.a.	3.85	n.a.	0.23	1.48	0.69	8.08	6.01	n.a.	96.36	9.8

12. LITERATURVERZEICHNIS

- Andronico, D., Branca, S., Calvari, S., Burton, M., Caltabiano, T., Corsaro, R. A., . . . Spampinato, L. (July 2004). A multi-disciplinary study of the 2002/03 Etna eruption: insights into a complex plumbing system. *Bulletin of Volcanology*, 67, 314–330. doi:10.1007/s00445-004-0372-8
- Armienti, P., Perinelli, C., & Putirka, K. D. (December 2012). A New Model to Estimate Deep-level Magma Ascent Rates, with Applications to Mt. Etna (Sicily, Italy). *Journal of Petrology*, 54, 795–813. doi:10.1093/petrology/egs085
- Armienti, P., Tonarini, S., Innocenti, F., & D'Antonio, M. (2007). Mount Etna pyroxene as tracer of petrogenetic processes and dynamics of the feeding system. In *Cenozoic Volcanism in the Mediterranean Area*. Geological Society of America. doi:10.1130/2007.2418(13)
- Bottari, A., & Lo, G. (1975). L'eruzione etnea del Gennaio-Marzo 1974. (154).
- Branca, S. (December 2011). Geological map of Etna volcano, 1:50,000 scale. *Italian Journal of Geosciences*, 265–291. doi:10.3301/ijg.2011.15
- Branca, S., Beni, E. D., & Proietti, C. (February 2013). The large and destructive 1669 AD eruption at Etna volcano: reconstruction of the lava flow field evolution and effusion rate trend. *Bulletin of Volcanology*, 75. doi:10.1007/s00445-013-0694-5
- Branca, S., Coltelli, M., Beni, E. D., & Wijbrans, J. (January 2007). Geological evolution of Mount Etna volcano (Italy) from earliest products until the first central volcanism (between 500 and 100 ka ago) inferred from geochronological and stratigraphic data. *International Journal of Earth Sciences*, 97, 135–152. doi:10.1007/s00531-006-0152-0
- Carlino, M. F., Cavallaro, D., Coltelli, M., Cocchi, L., Zgur, F., & Patanè, D. (August 2019). Time and space scattered volcanism of Mt. Etna driven by strike-slip tectonics. *Scientific Reports*, 9. doi:10.1038/s41598-019-48550-1
- Casetta, F., Giacomoni, P. P., Ferlito, C., Bonadiman, C., & Coltorti, M. (May 2019). The evolution of the mantle source beneath Mt. Etna (Sicily, Italy): from the 600 ka tholeiites to the recent trachybasaltic magmas. *International Geology Review*, 62, 338–359. doi:10.1080/00206814.2019.1610979
- Corsaro, R. A., & Métrich, N. (May 2016). Chemical heterogeneity of Mt. Etna magmas in the last 15 ka. Inferences on their mantle sources. *Lithos*, 252–253, 123–134. doi:10.1016/j.lithos.2016.02.006
- Corsaro, R. A., Métrich, N., Allard, P., Andronico, D., Miraglia, L., & Fourmentraux, C. (July 2009). The 1974 flank eruption of Mount Etna: An archetype for deep dike-fed eruptions at basaltic volcanoes and a milestone in Etna's recent history. *Journal of Geophysical Research*, 114. doi:10.1029/2008jb006013
- Duboc, O., Robbe, A., Santner, J., Folegnani, G., Gallais, P., Lecanuet, C., . . . Wenzel, W. W. (April 2019). Silicon Availability from Chemically Diverse Fertilizers and Secondary Raw Materials. *Environmental Science & Technology*, 53, 5359–5368. doi:10.1021/acs.est.8b06597
- Ferlito, C., & Lanzafame, G. (October 2010). The role of supercritical fluids in the potassium enrichment of magmas at Mount Etna volcano (Italy). *Lithos*, 119, 642–650. doi:10.1016/j.lithos.2010.08.006
- Ferlito, C., Coltorti, M., Cristofolini, R., & Giacomoni, P. P. (September 2009). The contemporaneous emission of low-K and high-K trachybasalts and the role of the NE Rift during the 2002 eruptive event, Mt. Etna, Italy. *Bulletin of Volcanology*, 71, 575–587. doi:10.1007/s00445-008-0243-9
- Gennaro, E., Iacono-Marziano, G., Paonita, A., Rotolo, S. G., Martel, C., Rizzo, A. L., . . . Liotta, M. (January 2019). Melt inclusions track melt evolution and degassing of Etna magmas in the last 15 ka. *Lithos*, 324–325, 716–732. doi:10.1016/j.lithos.2018.11.023
- Giacomoni, P. P., Coltorti, M., Bryce, J. G., Fahnstock, M. F., & Guitreau, M. (March 2016). Mt. Etna plumbing system revealed by combined textural, compositional, and thermobarometric studies in clinopyroxenes. *Contributions to Mineralogy and Petrology*, 171. doi:10.1007/s00410-016-1247-7
- Giacomoni, P. P., Coltorti, M., Mollo, S., Ferlito, C., Braiato, M., & Scarlato, P. (January 2018). The 2011–2012 paroxysmal eruptions at Mt. Etna volcano: Insights on the vertically zoned

- plumbing system. *Journal of Volcanology and Geothermal Research*, 349, 370–391. doi:10.1016/j.jvolgeores.2017.11.023
- Giacomoni, P. P., Ferlito, C., Alesci, G., Coltorti, M., Monaco, C., Viccaro, M., & Cristofolini, R. (November 2012). A common feeding system of the NE and S rifts as revealed by the bilateral 2002/2003 eruptive event at Mt. Etna (Sicily, Italy). *Bulletin of Volcanology*, 74, 2415–2433. doi:10.1007/s00445-012-0672-3
- Giacomoni, P. P., Ferlito, C., Coltorti, M., Bonadiman, C., & Lanzafame, G. (November 2014). Plagioclase as archive of magma ascent dynamics on \textquotedblleftopen conduit\textquotedblright volcanoes: The 2001–2006 eruptive period at Mt. Etna. *Earth-Science Reviews*, 138, 371–393. doi:10.1016/j.earscirev.2014.06.009
- Kahl, M., Chakraborty, S., Costa, F., & Pompilio, M. (August 2011). Dynamic plumbing system beneath volcanoes revealed by kinetic modeling, and the connection to monitoring data: An example from Mt. Etna. *Earth and Planetary Science Letters*, 308, 11–22. doi:10.1016/j.epsl.2011.05.008
- Kahl, M., Chakraborty, S., Pompilio, M., & Costa, F. (October 2015). Constraints on the Nature and Evolution of the Magma Plumbing System of Mt. Etna Volcano (1991–2008) from a Combined Thermodynamic and Kinetic Modelling of the Compositional Record of Minerals. *Journal of Petrology*, 56, 2025–2068. doi:10.1093/petrology/egv063
- Kahl, M., Viccaro, M., Ubide, T., Morgan, D. J., & Dingwell, D. B. (March 2017). A Branched Magma Feeder System during the 1669 Eruption of Mt Etna: Evidence from a Time-integrated Study of Zoned Olivine Phenocryst Populations. *Journal of Petrology*, 58, 443–472. doi:10.1093/petrology/egx022
- Kamenetsky, V. (August 1996). Primitive magmatism of Mt. Etna: insights from mineralogy and melt inclusions. *Earth and Planetary Science Letters*, 142, 553–572. doi:10.1016/0012-821x(96)00115-x
- Magee, R., Ubide, T., & Kahl, M. (January 2020). The Lead-up to Mount Etna's Most Destructive Historic Eruption (1669). Cryptic Recharge Recorded in Clinopyroxene. *Journal of Petrology*, 61. doi:10.1093/petrology/egaa025
- Maitre, R. W. (2002). *Igneous rocks : a classification and glossary of terms : recommendations of the International Union of Geological Sciences, Subcommittee on the Systematics of Igneous Rocks*. Cambridge, U.K. New York: Cambridge University Press.
- Markl, G. (2015). *Minerale und Gesteine*. Springer Berlin Heidelberg. doi:10.1007/978-3-662-44628-7
- Mollo, S., Gaudio, P. D., Ventura, G., Iezzi, G., & Scarlato, P. (August 2010). Dependence of clinopyroxene composition on cooling rate in basaltic magmas: Implications for thermobarometry. *Lithos*, 118, 302–312. doi:10.1016/j.lithos.2010.05.006
- Mollo, S., Giacomoni, P. P., Andronico, D., & Scarlato, P. (June 2015). Clinopyroxene and titanomagnetite cation redistributions at Mt. Etna volcano (Sicily, Italy): Footprints of the final solidification history of lava fountains and lava flows. *Chemical Geology*, 406, 45–54. doi:10.1016/j.chemgeo.2015.04.017
- Mollo, S., Putirka, K., Iezzi, G., & Scarlato, P. (October 2012). The control of cooling rate on titanomagnetite composition: implications for a geospeedometry model applicable to alkaline rocks from Mt. Etna volcano. *Contributions to Mineralogy and Petrology*, 165, 457–475. doi:10.1007/s00410-012-0817-6
- Mollo, S., Putirka, K., Misiti, V., Soligo, M., & Scarlato, P. (August 2013). A new test for equilibrium based on clinopyroxene–melt pairs: Clues on the solidification temperatures of Etnan alkaline melts at post-eruptive conditions. *Chemical Geology*, 352, 92–100. doi:10.1016/j.chemgeo.2013.05.026
- Mulas, M., Cioni, R., Andronico, D., & Mundula, F. (December 2016). The explosive activity of the 1669 Monti Rossi eruption at Mt. Etna (Italy). *Journal of Volcanology and Geothermal Research*, 328, 115–133. doi:10.1016/j.jvolgeores.2016.10.012
- Niu, Y. (2005). Generation and evolution of basaltic magmas: some basic concepts and a new view on the origin of Mesozoic-Cenozoic basaltic volcanism in Eastern China. *Geological Journal of China Universities*, 11, 9–46.
- Okrusch, M., & Matthes, S. (2014). *Mineralogie*. Springer Berlin Heidelberg. doi:10.1007/978-3-642-34660-6

- Tanguy, J.-C., Condomines, M., & Kieffer, G. (February 1997). Evolution of the Mount Etna magma: Constraints on the present feeding system and eruptive mechanism. *Journal of Volcanology and Geothermal Research*, 75, 221–250. doi:10.1016/s0377-0273(96)00065-0
- Ubide, T., & Kamber, B. S. (January 2018). Volcanic crystals as time capsules of eruption history. *Nature Communications*, 9. doi:10.1038/s41467-017-02274-w
- Ubide, T., Mollo, S., Zhao, J.-x., Nazzari, M., & Scarlato, P. (April 2019). Sector-zoned clinopyroxene as a recorder of magma history, eruption triggers, and ascent rates. *Geochimica et Cosmochimica Acta*, 251, 265–283. doi:10.1016/j.gca.2019.02.021
- Viccaro, M., Barca, D., Bohrsen, W. A., D'Orlando, C., Giuffrida, M., Nicotra, E., & Pitcher, B. W. (April 2016). Crystal residence times from trace element zoning in plagioclase reveal changes in magma transfer dynamics at Mt. Etna during the last 400 years. *Lithos*, 248–251, 309–323. doi:10.1016/j.lithos.2016.02.004
- Viccaro, M., Giacomoni, P. P., Ferlito, C., & Cristofolini, R. (April 2010). Dynamics of magma supply at Mt. Etna volcano (Southern Italy) as revealed by textural and compositional features of plagioclase phenocrysts. *Lithos*, 116, 77–91. doi:10.1016/j.lithos.2009.12.012