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Boreal Agrominerals Inc. (hereafter "**BAI**")

Technical Report

Geochemistry of the Spanish River Carbonatite Complex:

A study of the spatial distribution of different apatite types within the geological facies of the SRC

Client Number: 411155

Prepared by Christopher Caron, April 20,2020

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Boreal AGROMINERALS INC

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Executive Summary

This technical report relates to Boreal's development of the Spanish River Carbonatite Complex ("SRCC"). In 2019, Boreal Agrominerals Inc. ("BAI") partnered with the University of Western Ontario ("UWO") to carry out a geochemical study of the SRCC. A National Science and Engineering Research Council of Canada (NSERC) Engage grant was approved for this study in the amount of $25,000. Boreal made an in-kind contribution towards the study.

The goal of this research project was to determine the spatial distribution of different apatite types within the geological facies of the SRCC. To achieve this goal the following strategies were implemented:

1) facies mapping and sampling of outcrops exposed in trenches and quarries,

2) detailed logging and sampling of drill core,

3) cathodoluminescence (CL) microscopy and spectroscopy of apatite grains, and

4) electron microprobe analysis of apatite grains.

The results from these actions can be used by BAI to provide a more focused approach to their planned drilling program and the long-term development of the property.

This project culminated in an academic paper published by UWO. The Engage Project and academic paper focused on determining if apatite grains from different units of the SRC vary in composition. The results indicate that there are different types of apatite grains in terms of morphology (e.g. amorphous, euhedral) and overgrowths (none, one or multiple zones), but none of these are distinctive of specific units.

The report provides a clearer understanding of the facies and the apatite/biotite distribution in the SRC deposit which will assist Boreal in determining the most economic means of developing its deposit. In addition, the report provides further recommendations for:

- Drilling deeper holes that are inclined to the surface in order to better interpret the geometry of the complex,

- Investing in geochemical methods to determine and study plant-available nutrients in SRC,
- Supporting a detailed petrographic study of the number of apatite minerals in each sample unit and residuum with a focus on distinguishing different textural types.

This report is structured into several identified sections that are designed to capture, in an organized fashion, information necessary for the Ministry of Northern Development and Mines to evaluate the work and effort conducted by Boreal and expenditures associated therewith to further the Project. A short summary of each of the sections found in this report will be found below.

Section A. The Property

This section will summarize Boreal's property and the SRCC analyzed in the UWO Report, including the property's characteristics, location, proximity to nearby populations, and access.

Section B. Geochemical Analysis

This section includes an overall project timeline, the Engage Project proposal and supporting documentation, and the results of the Engage Project titled, *Geochemistry of the Spanish River Carbonatite Complex – An Engage Project done in partnership with Boreal Agrominerals by Patricia L. Corcoran, Laurisha Bynoe, and Carolyn M. Hill, February, 2020* (the "UWO Report").

Section C. Appendices

This section will include the geochemical analysis data from ALS Labs that was used by UWO for this report.

Section D. Invoices and Expense Summary

This section will include the invoices and expenses to be considered with the report.

Section A. The Property

Property Description and History

The Spanish River Carbonatite Complex is enveloped in a halo of fenitized granitic rocks. Carbonatite rocks with a high silicate mineral content occur along the periphery of the body. Lower silicate carbonatite occurs toward the core. The contact between fenitized wall rock and carbonatite appears to be over a maximum thickness of 300 metres. This observation is based on the trenching program and the Union Carbide drill hole. This area is referred to as the "Transition Zone" and is a complex, erratic assemblage of layered biotite sovite, fenite and mafic rocks. The transition zone appears to be a result of contact metamorphism and metasomatism. Discreet lenses bands and veins of high purity sovite have been located in this zone. The sovites in this area appear to have higher quantities of magnetite, vermiculite and apatite.

The second classification of the complex is referred to as the "**Outer Core**". This classification is used for the purpose of describing the trenching program and is adopted from a drill hole completed in 1968, by Union Carbide. The Outer Core is very similar to the transition zone with exception of a marked increase in sovite (calcite).

The third and last classification of the complex is the "**Inner Core**", comprised almost entirely of sovite.

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Property Location and Access

The SRCC straddles the common boundary of Venturi and Tofflemire townships just south of a sharp bend in the Spanish River known as the "*Elbow*". The property is cut by numerous, very well maintained, logging roads.

Access to the property is via the Fox Lake Lodge road, which turns southerly from highway 144 at Cartier. From Cartier it is 25 km to the property. All river and creek crossings have had culverts and bridges put in place to handle heavy logging trucks. Cartier is the closest community with approximately 250 inhabitants. Within the community limits is a rail spur owned by C.P.R. and Sudbury is approximately 60 km south of Cartier on highway 144. Total driving time from Sudbury to the Project is approximately 1½ hours.

General Geology of the Spanish River Carbonatite Complex

Regional Structural Geology
The SRCC lies within the Abitibi Subprovince of the Superior Province of the Canadian Shield. The complex occurs along a north-south striking fault zone along the west side of the Sudbury Basin. According to the 1987 O.G.S. Study 30 this fault system maybe a graben structure branching off the Ottawa-Bonnechere graben, a system hosting carbonatite-alkalic rock complexes in the Nipissing area. Air photos of the region also suggest the complex occurs at the point of intersection of a number of regional lineaments.

Carbonatite Complex Structure
Shearing and brecciation of the enveloping quartz monzonite is common. Fractures are commonly filled with mafic pyroxenes, amphiboles and calcite. There is evidence in the trenching and the Union Carbide drill hole that blocks of fenite have peeled off the walls and are incorporated into the complex. Banding of fenites and sovite is common.
Post faulting has not been encountered at this time. The heterogeneous mixture and lack of outcrop makes it very difficult at this time to suggest that post faulting has occurred.

Fenitized Quartz Monzonite
The host rock enclosing the Spanish River Complex is massive, medium grained pink quartz monzonite. In contact with the complex the quartz monzonite has been fenitized. The granitic rock becomes mottled pink and green-blue in colour. Sodic amphibole and pyroxene have replaced the quartz in the quartz monzonite.
The fenitized quartz monzonite is brecciated and intruded by dark green mafic veins. Carbonate is commonly associated with the veins and fracture fills. The closer to the intrusive the greater the number of mafic and calcite filled fractures and veins.

Spanish River Carbonatite Complex – Transition Zone
The transition zone is predominantly fenite but exhibits less brecciation and more banding. There is a marked increase of sovite veins, lenses and bands. The purity of the sovite in this zone varies from 45% $CaCO_3$ to nearly pure. The variations and types of accessory mineral found in the sovite is as follows:
- Vermiculite – 0 to 15%
- Biotite – 0 to 15%

• Magnetite – 0 to 5%
• Pyrrhotite – 0 to 5%
• Apatite – 0 to 5%

Overburden thickness overlying the transition zone varies from 0 to 15 metres. Bedrock exposed is highly oxidized and weathered. A seismic survey conducted in1975 over this area suggested depths of overburden were 50 to 90 feet and that bedrock was covered by a dense layer that came to surface.

Spanish River Carbonatite Complex - Outer Core

The actual contact between the transition zone and Outer Core is not well defined and is based on the degree of sovite verses fenite present and overburden thickness. Where there is a sharp increase in overburden would be the logical location for the contact between the complex and altered host rock. The approximate thickness of the Outer Core based on the above observations would be 200 metres. The Outer Core appears only to outcrop along the road where Vein No.3 is located. A vertical rotary percussion hole (TP-2) drilled, in 1975, in this vicinity encountered 15 feet of overburden. This is also in the vicinity of test pits, which exposed decomposed sovite very similar to TP-2.

In the O.G.S. Study, *"**Spanish River Carbonatite Complex**"* the Outer Core is described as the *Outer Phase*. The outer phase based on this report is comprised of syenite, pyroxenite, ijolite and biotite sovite. For the purpose of this report the description of the composition for the outer core is from the Union Carbide drill hole.

The Outer Core of the carbonatite-filled diatreme, is composed of biotite amphibole sovite with some phyrrhotite and minor chalcopyrite and gramphite. There is no appreciable magnetite between 1066'4" and 1339'. Between 1339'and 1495'coarse magnetite is present in both sovite and the gramphite. For the purpose of logging this core, 3 rock types are recognized, gramphite, sovite inclusions, which may be either sovite with a high proportion of inclusions, or gramphite, which has been carbonated. In either case, the dark minerals constitute up to 50% of the rock. The proportions of sovite, inclusions and gramphite in this section are: 22%, 32% and 46% respectively."

Figure 1

Property Location Map

Figure 2

Property Access Map

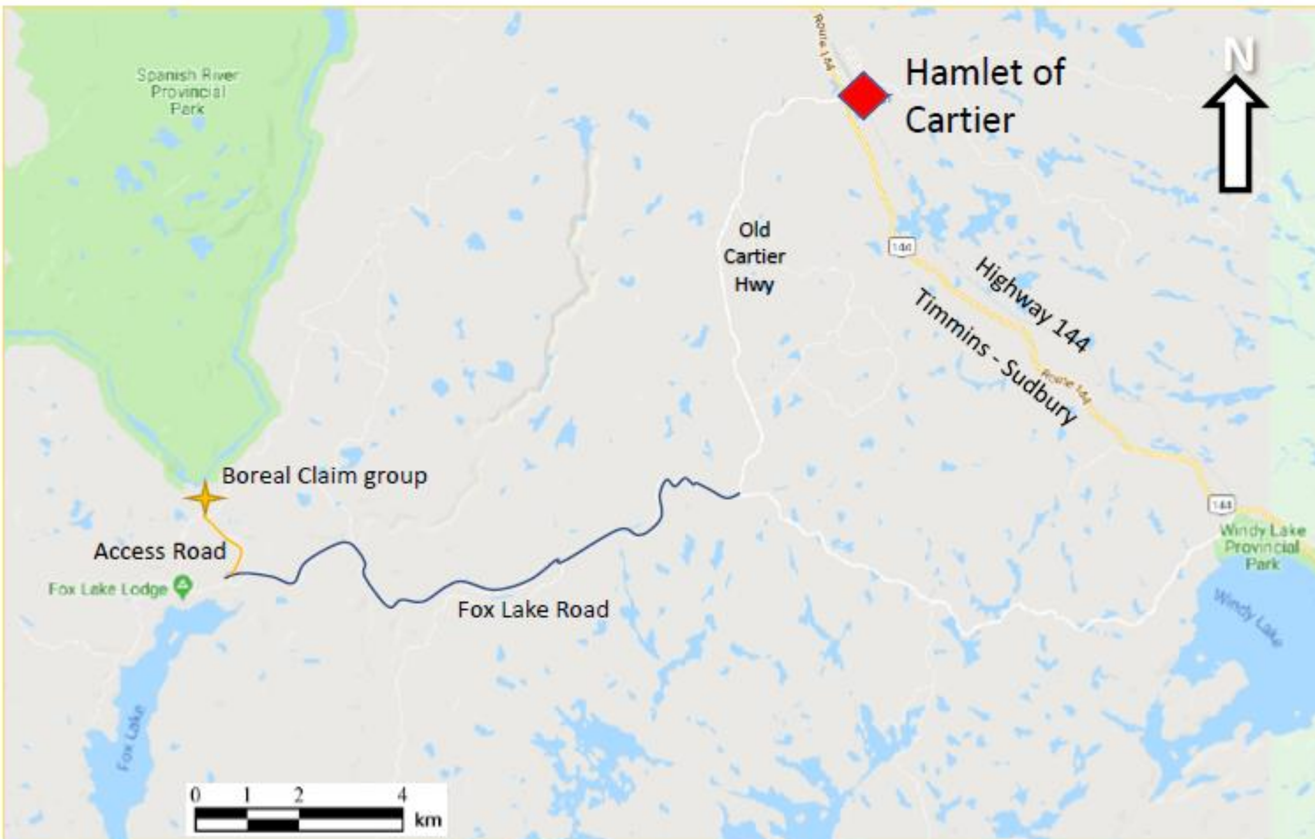
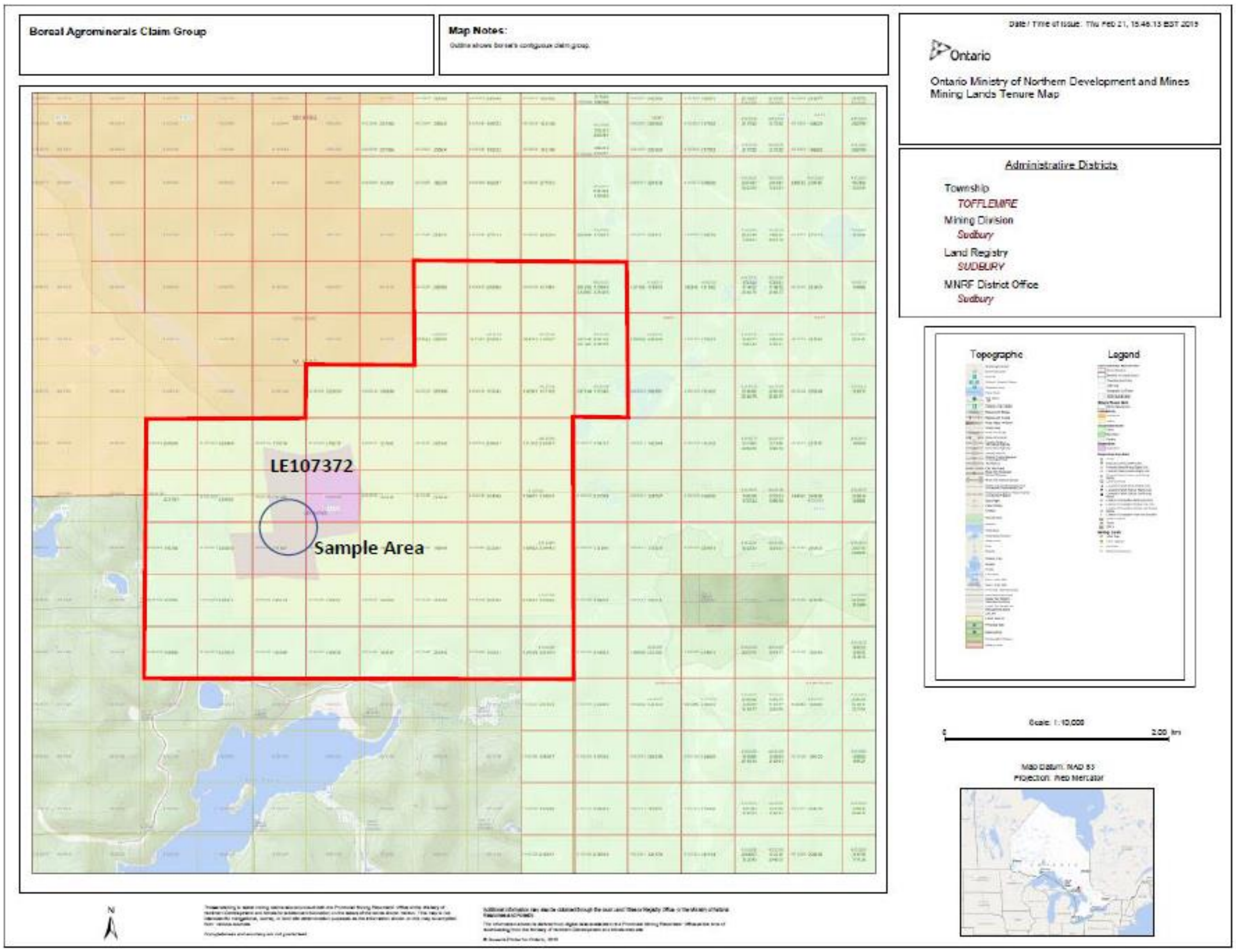


Figure 3

Boreal Claim Map



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Section B. The Project: Geochemical Analysis of the SRCC

Project Timeline

Management and supervision of the project was completed by Chris Caron on BAI's behalf.

Core drilling occurred towards the end of 2018.

Geochemical analysis of drill core samples for this research was provided by BAI. Supervised site access, access to drill cores, and the washing of outcrop to facilitate geological mapping was provided by BAI.

UWO personnel were involved in various stages of the project, including attending the site, selecting samples, mapping the outcrop, logging the drill core, etc. Their analysis was published in the UWO Report.

November-December, 2018 – Core drilling occurs to obtain core samples for geochemical analysis (Chris Caron – 30 hrs)
January-February, 2019 – Work with UWO and NSERC to establish scope of research and Engage grant conditions
January 10-15, 2019 – Sample preparation by Boreal for Geochem analysis (Chris Caron - 18 hrs)
January 30, 2019 – Boreal receives geochemical assay results from ALS laboratories (ALS invoice)
May 9, 2019 – Site visit completed by UWO and Boreal (Chris Caron - 10hrs)
June 6, and 7th, 2019 – UWO logs drill core at Boreal core shed assisted by Boreal (Chris Caron - 16hrs)
August 1, 2, and 3rd, 2019 – Boreal washes exposed outcrop for mapping by UWO (Chris Caron - 30 hrs) (Autowash invoice)
August 6, 7, and 8th, 2019 – UWO maps outcrop at deposit with Boreal assistance (Chris Caron - 30 hrs)
August 12, 2019 – Boreal / UWO consultation and data sharing (Chris Caron - 8 hrs)
January 30, 2020 – UWO presentation of results to Boreal
February 11, 2020 – UWO delivers completed UWO Report to Boreal
April 20, 2020 – Boreal prepares this technical report (Chris Caron - 8 hrs)

UWO – NSERC Engage Grant Research Proposal and Project Description, by Dr. Patricia Corcoran

OVERVIEW OF COMPANY SPECIFIC PROBLEM:

Boreal Agrominerals Inc. (BAI) is a private company that explores for, tests, develops and produces organic approved agromineral fertilizers and soil amendment products. Apatite and biotite are is the primary minerals containing inorganic phosphorus and potassium, which are is an essential nutrients for all life and play plays a crucial role in the viability of fertilizers for crop growth. BAI mines its fertilizer from the Spanish River Carbonatite Complex (SRC) approximately 55km northwest of Sudbury, Ontario. The SRC contains on average 9% apatite group minerals. The company wishes to target the purest and most reactive minerals that are superior for organic as well as conventional farming enterprises.

The work of BAI on the SRC presents an excellent example of sustainable agriculture in Canada as well as internationally. The company has been processing material quarried from the outer core of the SRC since 2009. Their quarried quantities have been limited due to the poor outcrop exposure of the SRC as a result of pine reforestation and the presence of overburden in excess of 30 m thick above the inner core region. To date, the relative distribution, types and internal textures of apatite group minerals within the different zones of the SRC remain poorly known. BAI lacks the personnel, expertise and facilities to undertake this type of detailed sample analysis. By utilizing the advanced scientific tools proposed in this research partnership we expect to help BAI to strategically target the rocks containing optimal apatite group minerals. BAI is committed to safe, environmental approaches, as indicated by their use of sustainable quarrying practices (e.g. no waste dumps, no water). The results from the proposed project will determine key target areas for quarrying, which will minimize the negative effects to surrounding flora and fauna. In addition, the reduction in quarry operating costs will increase efficiency, thus enabling BAI to be highly competitive in the organic agriculture marketplace.

RESEARCH PROJECT:

The overall goal of this proposed research project is to determine the spatial distribution of different apatite types within the geological facies of the SRC. This goal will be achieved by implementing specific action strategies, which include: 1) facies mapping and sampling of outcrops exposed in trenches and quarries, 2) detailed logging and sampling of drill core, 3) cathodoluminescence (CL) microscopy and spectroscopy of apatite grains, and 4) electron microprobe analysis of apatite grains. This knowledge can be used by BAI to provide a more focused approach to their planned drilling program now and in long term planning for development of the property.

This project is to be completed within six months, and will entail the following main work items:

1. Mapping and sampling of the SRC property (Month 2 or 3 depending on weather conditions), which will enable distinction of individual geological facies based on spatial distribution, textures and mineral content.
2. Logging of core recently drilled by BAI, and of legacy core housed at the Royal Ontario Museum (Month 1 and 2). Units identified in drill core will be related back to those facies recognized in the field.

3. CL microscopy of selected samples from each facies (Months 3-5). Apatite minerals are highly luminescent and allow for evaluation of zoning, inclusions, and defects in the mineral structure. CL spectroscopy will be used in order to determine the presence of certain rare earth elements (REE) incorporated into the apatite structures of different facies.
4. Electron microprobe analysis to determine the relative abundances of REE, P and additional elements of each sample (Months 4-6).
5. Documentation of the results of the mapping, CL and microprobe analyses (Months 5-6).

The project will enable clearer understanding of the facies and apatite distribution in the SRC, which will assist BAI in extracting fertilizer material with the greatest potential of reactivity. Through the expertise brought to the project by Dr. Corcoran and the state of the art facilities at Western University, this research partnership will enable BAI to grow and find success in a rapidly advancing marketplace.

RESEARCH COMPETENCE:
The PI for this project will be Dr. Patricia Corcoran. Dr. Corcoran is a Precambrian geologist and petrologist, who consistently uses a multi-disciplinary approach to geological problems. Fieldwork has been the mainstay of her research for the past 20 years, and microscopy plays a significant role in the majority of her projects. She has published numerous papers that use the microscopic and sub-microscopic characteristics of grains to make inferences concerning past Earth-forming processes. Dr. Corcoran's sample separation facility houses a cathodoluminescence spectrometer, and she is experienced in using the luminescence of specific minerals to determine trace element contents. Dr. Corcoran's knowledge, expertise and resources are thus ideally suited to the proposed research project.

CONTRIBUTION TO TECHNOLOGY TRANSFER:
Dr. Corcoran will manage the project overall and supervise the activities at Western University while CEO and Director John Pollesel, and Agricultural Advisor and former Director John Slack, will oversee activities at BAI. This project will be highly collaborative, with personnel from BAI and Western University communicating regularly (conference calls and email conversations as necessary). Formal project review meetings will occur monthly by video conference (Skype) with all the parties involved attending. Dr. Corcoran will hire recently graduated M.Sc. student Zhaoming Jiang to work with her on the project. Zhaoming Jiang and Dr. Corcoran will meet John Pollesel and John Slack at the SRC property at the start of the project. A report detailing the results and progress to date will be presented by Jiang at the halfway point. Dr. Corcoran and Jiang, will spend a day at BAI headquarters to present the results of the project and deliver the final written report to John Pollesel.

As the deliverables of this project are successfully completed, BAI and Dr. Corcoran will discuss further directions to take their partnership. Patentable intellectual property arising from this project will reside with and be owned by BAI.

BENEFITS TO CANADA:
The proposed project will have direct and immediate economic benefit to an established Canadian company, creating value and intellectual property that will remain in Canada, and further strengthening both the agricultural & mining operations in the region. This project will have indirect benefits to numerous other Canadian companies, as well as Canadian consumers, as the knowledge co-developed

with BAI will enable development of new organic approved agromineral fertilizers and soil amendment products. In doing so, significant contributions will be made to the training of highly qualified personnel, producing experienced researchers who can transfer analytical techniques from one major sector to another. This project also forms a basis for future collaborations between BAI and Western University, with additional benefits foreseen for years to come.

Studies have shown that traditional agricultural practices can cause serious damage to ecosystems, and that they have been carried out on a global scale, including in Canada. In contrast, sustainable agriculture involves farming that avoids disrupting ecosystems and in the process, creates a longer-term application than traditional methods.

Boreal Agrominerals Support Letter for NSERC Research Proposal

NSERC Ontario Office
250 - 2655 North Sheridan Way
Mississauga, Ontario L5K 2P8

Re: Engage Proposal with Dr. Patricia Corcoran (Associate Professor)

Dear NSERC Engage Review Committee -

On behalf of Boreal Agrominerals Inc. (BAI), I am writing this letter to confirm our very strong support for the above-referenced NSERC Engage project to be undertaken by Dr. Patricia Corcoran of the Department of Earth Sciences at The University of Western Ontario. Our company is interested in engaging Dr. Corcoran and her team to deploy cutting-edge research in order to further delineate and study our unique, rare agromineral deposit. BAI believes this research will greatly support the company in developing and marketing our organic product that will become increasingly important to the global agricultural industry as governments progress to restrict the use of chemical fertilizers and focus on remediating damaged soils.

By way of introduction, Boreal Agrominerals Inc. (BAI) is a private company that explores for, tests, develops, and produces organic approved agromineral fertilizers and soil amendment products. Apatite and biotite are primary minerals containing inorganic phosphorus and potassium, which are essential nutrients for all life and play a crucial role in the viability of fertilizers for crop growth. BAI mines its products from the Spanish River Carbonatite (SRC) Complex approximately 55 km northwest of Sudbury, Ontario. The SRC deposit contains on average, 12% apatite, 15% biotite, and 8% rare-earth group minerals. The company wishes to target the purest and most reactive minerals that are superior for organic as well as conventional farming enterprises.

While SRC product is proven to be extremely effective as an organic fertilizer and soil amendment product, it is not well known in the marketplace nor are the mechanisms well understood regarding which minerals within the deposit are effective in delivering these results. Dr. Corcoran's research team, using advanced scientific research tools, in conjunction with BAI researchers, will help explain the deposit and target those minerals suspected to be most important to promote the efficacy of the SRC product. With greater understanding of the deposit, BAI will better understand the rock structure and mineral location to determine key target areas for quarrying. This knowledge will improve the production efficiency and minimize the negative effects to the surrounding landscape, flora, and fauna. As the current marketplace is extremely competitive, this research will greatly support BAI's efforts.

Currently BAI is supplying SRC material to the North American market, primarily Ontario with few customers in the United States. The Company is also working with the government of Mexico and has been contracted to supply 100,000 tonnes of product to them during 2019. The potential to increase the volume of sales internationally is significant; BAI has established offices in China, India, South America (Peru) and Mexico. The market potential for this product is in the millions of tonnes per annum especially with the increasingly tight restrictions being placed on chemical fertilizers and harmful heavy metals in the soils. Sales of this magnitude could contribute millions of dollars to the Canadian economy annually in the form of export sales, employment, and taxes.

Additionally, BAI has recently discovered through research by one of its partners that the carbonatite material produced at the mines is very effective in reducing a plant's ability to absorb or consume heavy metals such as cadmium, aluminum, arsenic, and other dangerous metals. Dr. Corcoran's study will assist to further the understanding of the structure and mineralogy of the deposit and will greatly support BAI in marketing its product within Canada and internationally.

In the end, this NSERC project will assist BAI to provide significant tangible benefits to the company and Canada, financially (employment, taxes, export sales), while lessening any negative environmental impacts resulting from mining the deposit.

This project will further support carbonatite research currently being performed in China (Fujian University), Mexico (University of Chapingo and College of Post Graduates) and Peru (University of La Molina). Together, this combined research will further the understanding of the mechanisms that make the SRC deposit so unique and important to organic farming and soil remediation.

BAI is willing to commit resources and share in the research costs to delineate this deposit. The company has invested in exploration and will continue to explore and provide material to Dr. Corcoran's team to conduct its research. BAI's contribution will be in-kind through the supply of material and personnel time as follows:

Exploration drilling $38,920

Exploration management – Chris Caron 150 hours; $80/hr = $12,000

Consulting – Carbonatite expert – John Slack 220 hours; $100/hr = $22,000

Boreal Management – John Pollesel 24 hours; $0/hr = $0

It is estimated that the total cost to BAI will be in the order of $72,920.

The timing for this project is very good in light of increasing restrictions placed on the use of chemical fertilizers, heavy metals in food products (European union restrictions on Cadmium levels in chocolate, fruits etc.) and reclamation of damaged soils from mining and other sources. SRC has proven to be a viable alternative to chemical fertilizers and an effective soil amendment product. This project will provide more valuable information to promote SRC in becoming a more competitive alternative to existing products that can be damaging to the environment. It is BAI's desire to develop the intellectual property to propel the company to become a significant, environmentally friendly producer that will derive benefits for the company and the Canadian economy.

Yours truly,

John Pollesel, CEO

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Phone: (780) 719-7769

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UWO Research Paper – Geochemistry of the Spanish River Carbonatite Complex – An Engage Project done in partnership with Boreal Agrominerals

Geochemistry of the Spanish River Carbonatite Complex – An Engage Project done in partnership with Boreal Agrominerals

By Patricia L. Corcoran, Laurisha Bynoe, and Carolyn M. Hill

February, 2020

Western
UNIVERSITY · CANADA

1.0 Introduction

Carbonatites are defined as igneous rocks composed of at least 50% primary magmatic carbonate minerals, <20% SiO_2, and as having enrichments in the light rare earth elements (LREEs), Ba, P, Th and Sr (Nelson et al., 1988; Le Maitre, 2002). Less than 550 carbonatite occurrences have been identified globally, and they are diverse in terms of size, rock suite, and whether they are of an extrusive or intrusive origin (Woolley and Kjarsgaard, 2008). Extrusive carbonatites form from lava of very low viscosity and temperature, and are characterized by pyroclastic textures such as lapilli, bombs, and spatter (Woolley and Church, 2005). In contrast, intrusive carbonatites are characterized by extensive recrystallization and fenite aureoles.

The Spanish River Carbonatite Complex (SRC) is located in the Abitibi Subprovince of the Canadian Shield and is one of over 40 carbonatite complexes proximal to the Ontario-Quebec border (Figure 1). The SRC lies within a fault zone that is a possible splay of the Ottawa-Bonnechere graben system (Sage, 1987). Rubidium-strontium isotopic dating of the complex yielded a Neoarchean age for the complex of 1838 $\pm$ 95 Ma (Bell and Blenkinsop, 1980). The SRC belongs to the Nephelinite clan of carbonatites (Woolley and Kjarsgaard, 2008), which is generally regarded as representing the roots of nephelinitic volcanoes that have eroded away. Given the recrystallization textures and fentinization of the SRC, it is interpreted as an intrusive carbonatite.

According to Sage (1987), the SRC contains the following rock units, in increasing carbonate content: ijolite, pyroxenite, silico-carbonatite, and sovite. These rocks are locally associated with a cancrinite-nepheline syenite that is interpreted as a product of metasomatism, thermal alteration or rheomorphism of the host quartz monzonite.

The present report utilizes the terminology of Sage (1987) and of Chris Caron (Boreal Agrominerals):

Pyroxenite: an ultramafic rock containing > 90% Mg- and Fe-rich minerals; pyroxene is the main mafic mineral
Silicocarbonatite: a carbonate-rich igneous rock composed of 50% or more oxide and silicate minerals
Quartz-rich carbonatite: a carbonatitic rock that is characterized by a significant quartz content
Sovite: a carbonatitic rock composed of 50% or more calcite
Vermiculite: a poorly indurated layer rich in Al-Fe-Mg silicate clay minerals
Residuum: an up to 5 m thick layer of weathered material overlying the rocks of the SRC

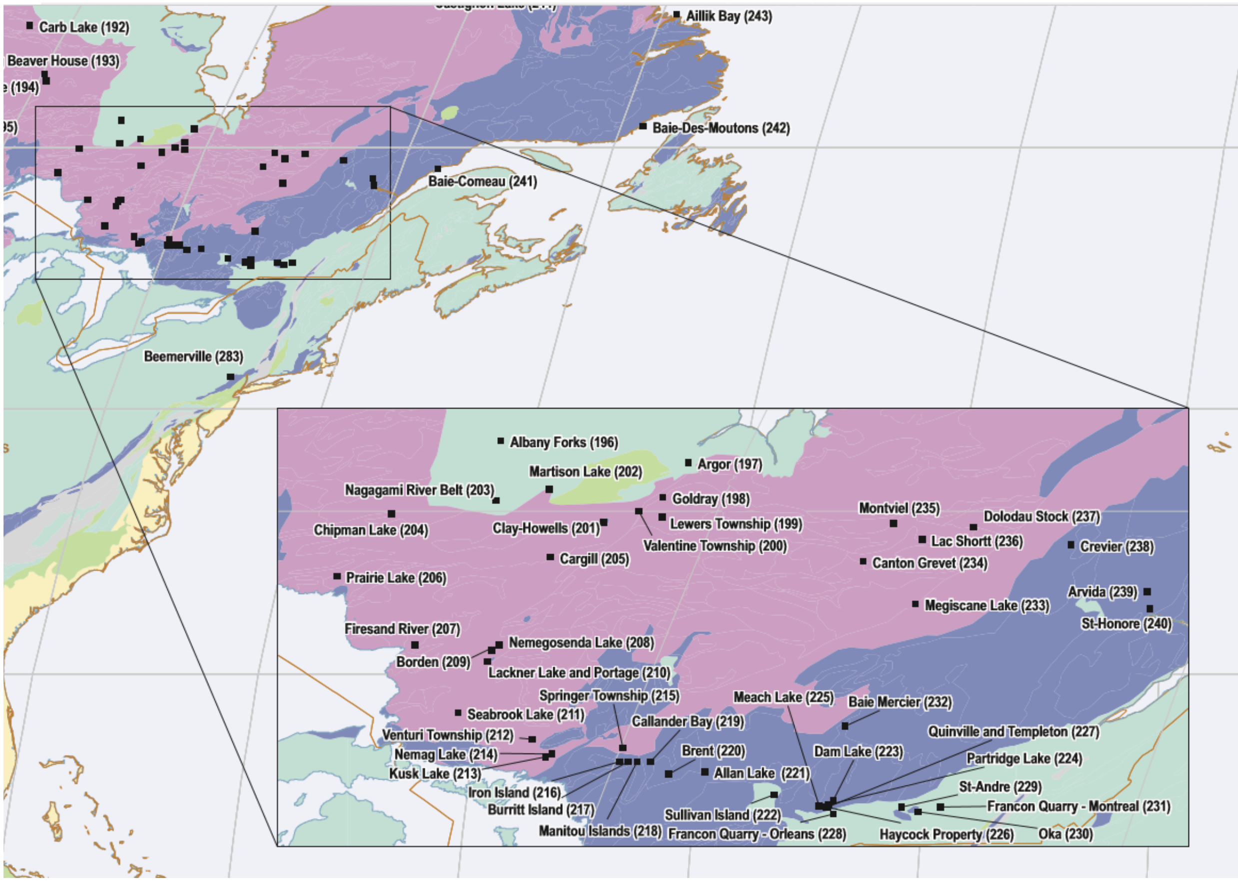


Figure 1: Location of the Spanish River Carbonatite Complex (Venturi Township -212) north of Lake Huron in Ontario, Canada. Note the locations of over 40 carbonatite-alkalic complexes in Ontario and Quebec. Map from Woolley and Kjarsgaard (2008).

Objective of the Study

Prior to the present investigation, the relative distribution, types and textures of apatite group minerals within the different units of the SRC remained poorly known. This project aimed to help Boreal Agrominerals (BAI) strategically target the rocks containing optimal apatite group minerals for mining of agromineral fertilizer. The main questions were: i) Do different rock units contain different varieties of apatite? ii) Does one variety form part of a unit that could be targeted for agromineral fertilizer extraction?

Apatite-group phosphates are typically abundant in carbonatites (Chakhmouradian et al., 2017). Apatite refers to a series of monoclinic and hexagonal phosphates with an idealized formula of $Ca_5(PO_4)_3(F,OH,Cl)$. Depending on the origin, the prefixes fluor-, hydroxyl- or chlor- are used to indicate the predominant anion. Apatite in carbonatite is mainly of the fluor- or Fe-rich hydroxyl type, and can be either primary or hydrothermal (replacement of primary apatite) (Chakhmouradian et al., 2017).

2.0 Methods, Results and Discussion

In order to address the main objective of the project, the methods employed included: 1) study of the exposed SRC in the BAI quarry as well as surveying the remainder of the property for additional rock outcrops, 2) logging of core recently drilled by BAI, and of legacy core at the Royal Ontario Museum, and 3) combined electron probe microanalysis (EPMA) and cathodoluminescence (CL) microscopy of apatite minerals from the different rock units identified in core. In addition, BAI provided major and trace element whole rock geochemical data for samples from the different rock units and these data are also considered in this report.

Field Observations

In the summer of 2019, BAI performed a site clearing program in their quarry to expose as much of the underlying rock as possible. Subsequently, Dr. Patricia Corcoran and Dr. Carolyn Hill visited the quarry in order to classify the different rock types at the current quarry site. Although the aim was to map the site in detail, this proved difficult due to the rapid discontinuity of units, their repeated intercalation, and their thickness, which in some areas was as thin as approximately 30 cm.

Figure 2 displays the characteristics of each unit identified in the field. Some rock types were exposed as lenses, veins or bands. The sovite, silicocarbonatite and pyroxenite lenses contain coarse crystals and are cut by carbonatitic veins (Figure 2f). The bands are irregular, discontinuous, contain finer crystals than the lenses, but are also cut by carbonatitic veins.

Figure 2 (following page): Rock units of the SRC. A) Residuum found on the BAI property, B) Pyroxenite with vermiculite in the quarry, C) Biotite-rich sovite in the quarry, D) Sovite in the quarry, E) Silicocarbonatite on the BAI property, F) Carbonatitic lenses, bands and veins in the pyroxenite unit in the quarry. Quartz-rich carbonatite was identified only in core.


A
Residuum
Pyroxenite
Vermiculite
C
Sovite
D
Sovite
F
Bands
Lenses
Vein
E
Silicocarbonatite

Core Logging and Sample Selection

The geographic locations of the six drill cores provided by BAI are indicated in Figure 3. In all six cores the residuum drilled in the top few metres was removed prior to logging. Core logging was done in 2019 by Dr. Carolyn Hill (Figures 4-9). BA0001 through to BA0005 were approximately 30 m deep, whereas BA0006 was the deepest hole drilled at 200 m.

Core BA0001 has a depth of 30.8 m. The residuum is intercalated with the silicocarbonatite down to a depth of 7 m. Within this pocket, there are abundant large flakes of biotite. Down depth, calcite mineralisation becomes much coarser and the residuum disappears at approximately 10 m (Figure 4). Pyroxenite makes up the final 3 m of the core.

Core BA0002 is 32.6 m deep. The residuum is limited to the first 2 m of the core. This core has a significant interval of sovite and a limited silicocarbonatite interval. Pyroxenite also occurs at <10 m from the surface. BA0002 contains a significant vermiculite interval at a depth of 10-15 m (Figure 5).

Core BA0003 is 30.5 m deep and contains a <1 m interval of pyroxenite at the top of the hole, followed down depth by alternating sovite and silicocarbonatite layers (Figure 6).

Core BA0004 is 31.5 m deep and contains a significant 3 m of residuum at the surface. This grades directly into a silicocarbonatite interval that carries through the rest of the core (Figure 7).

Core BA0005 is 32.95 m deep and is very similar to BA0003 and BA0004. Residuum is confined to the top few metres of the drill hole. Intercalated sovite and silicocarbonatite compose the entire core (Figure 8).

The longest of all the drill holes at 200.2 m is BA0006. A very thin layer of residuum is at the top of the drill hole. Lithological units are intercalated throughout the depth of BA0006 (Figure 9). One gabbro dyke was identified approximately midway through the core. In addition, fault zone gouge was identified at approximately 60 m depth.

Historic Core

In October 2019, logging of historic core drilled by Union Carbide was undertaken at the Royal Ontario Museum. The core is no longer representative of the 521 m originally drilled, with discontinuous pieces representing the remaining relics of sequential core (Figure 10). No data on core location, azimuth, dip and down hole variations were available.

Figure 3: Google Earth image displaying the locations of drill holes. The cores retrieved from these holes were sampled for EPMA and CL analyses.

The core samples, discontinuous down depth, range from 3-244 m. Overall, the major rock type is white-pink, sub-equigranular, coarse crystalline sovite and silicocarbonatite. From approximately 18-21 m there are veins of similar composition to the host rock with a thin quenched margin. The veins have a cockscomb texture mainly defined by chloritized biotite. At 66 m, there is a dark green aphanitic to fine crystalline pyroxenite with oxidized pyrrhotite. This is cut by a carbonate-rich and weakly magnetic dyke. At 149-152 m, there is a dark green aphanitic to fine crystalline ijolite with limited carbonate content in its groundmass. Carbonate veins ~3mm wide cross-cut this unit.

In summary, there is an increase in pyroxenite down depth in both the historic core and BA0006, the deepest of the recent cores. Pyroxenite initially occurs intercalated with carbonate-rich layers of silicocarbonatite or sovite and then progresses down depth to substantially thicker intervals. Because core BA0006 and the Union Carbide core were extracted from inclined holes, these may

Figure 4: BA0001

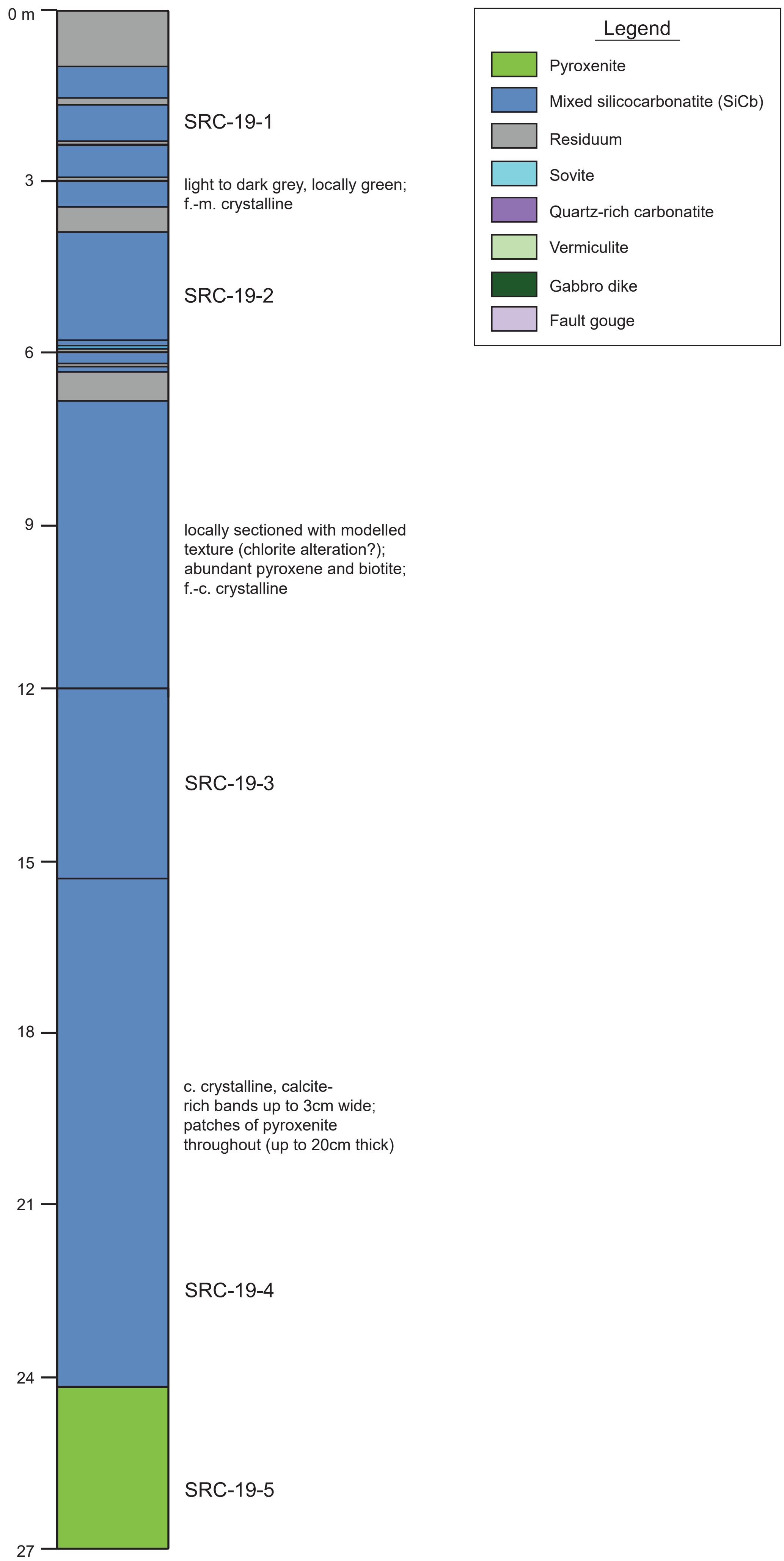


Figure 5: BA0002

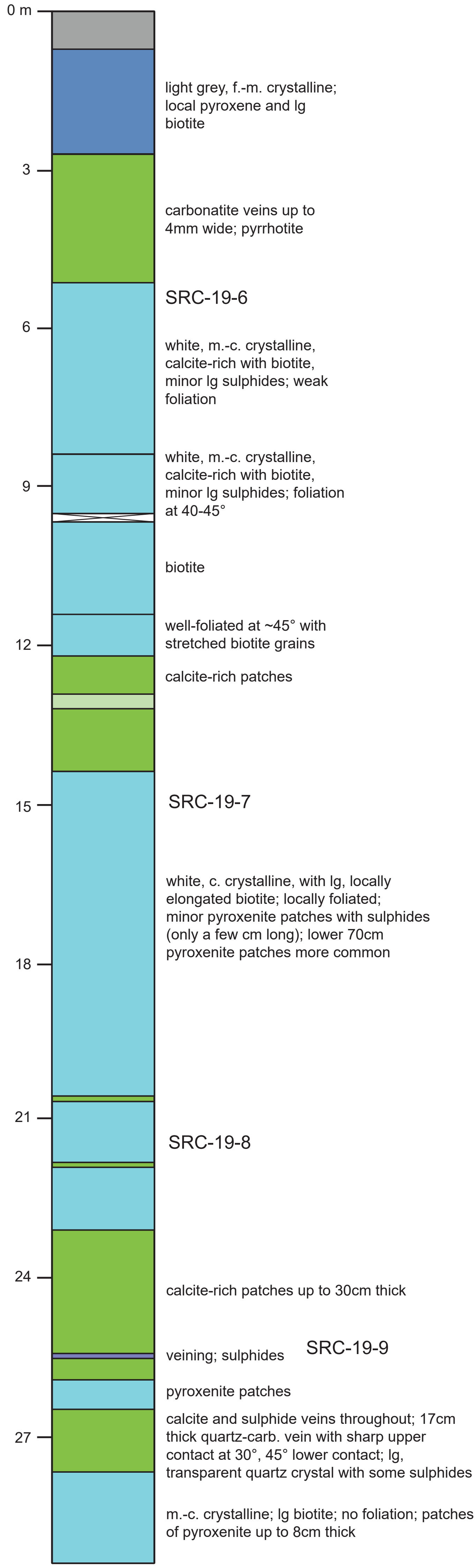


Figure 6: BA0003

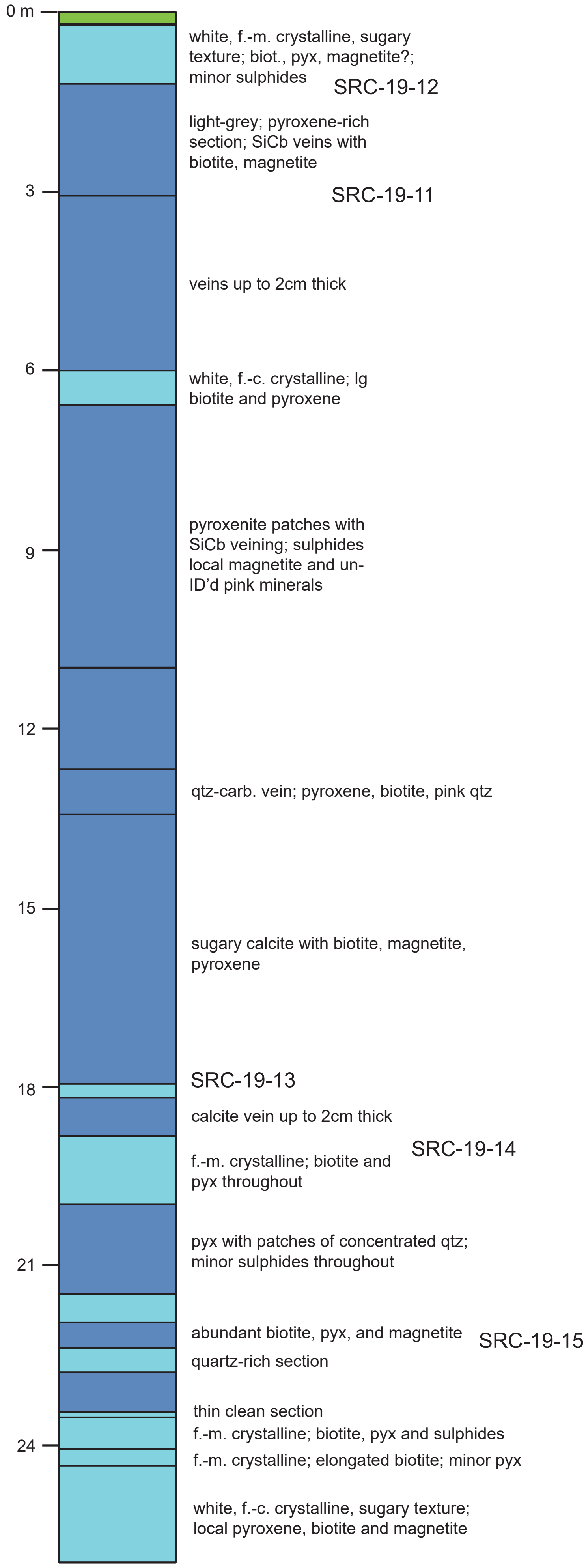


Figure 7: BA0004

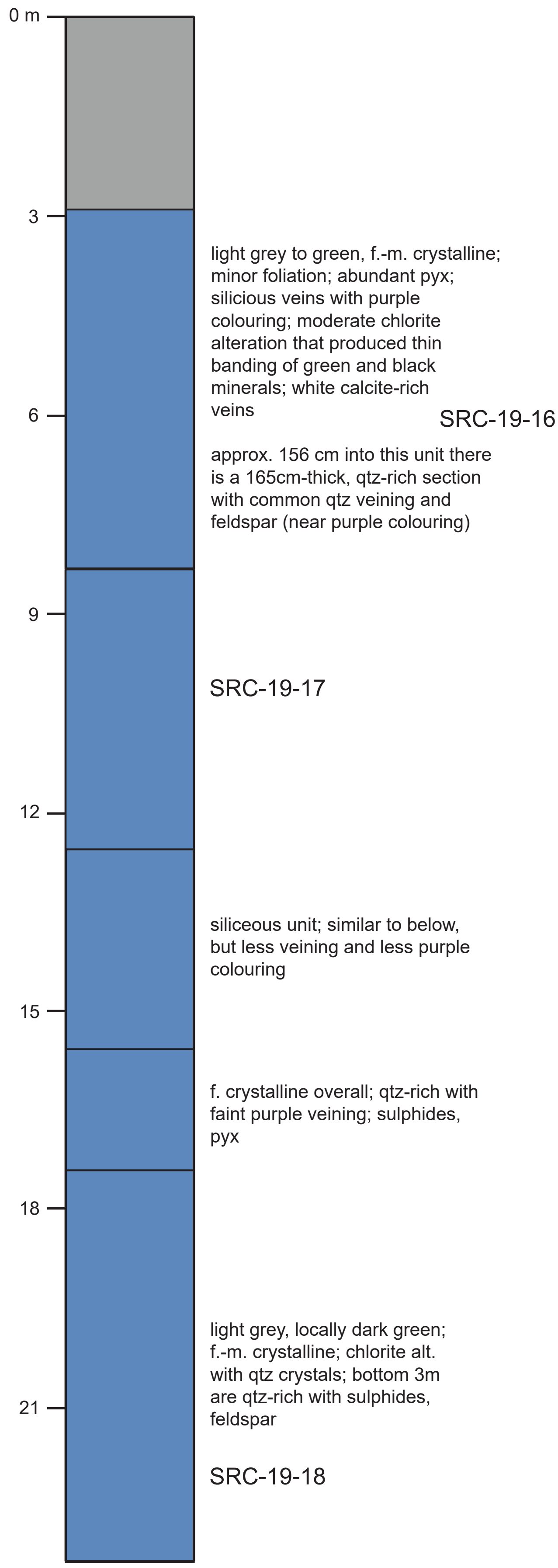


Figure 8: BA0005

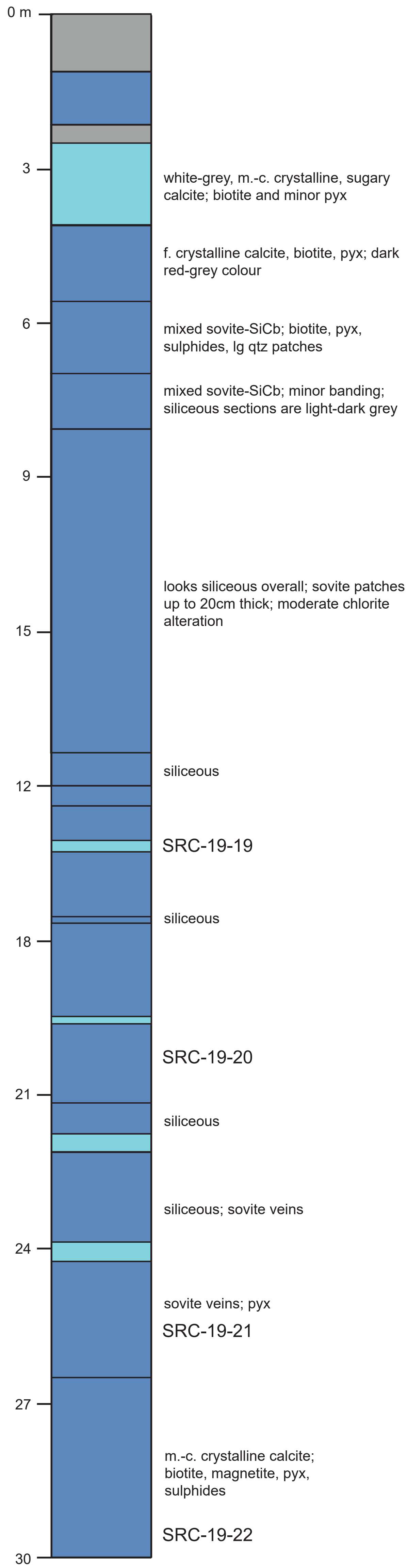


Figure 9: BA0006-1

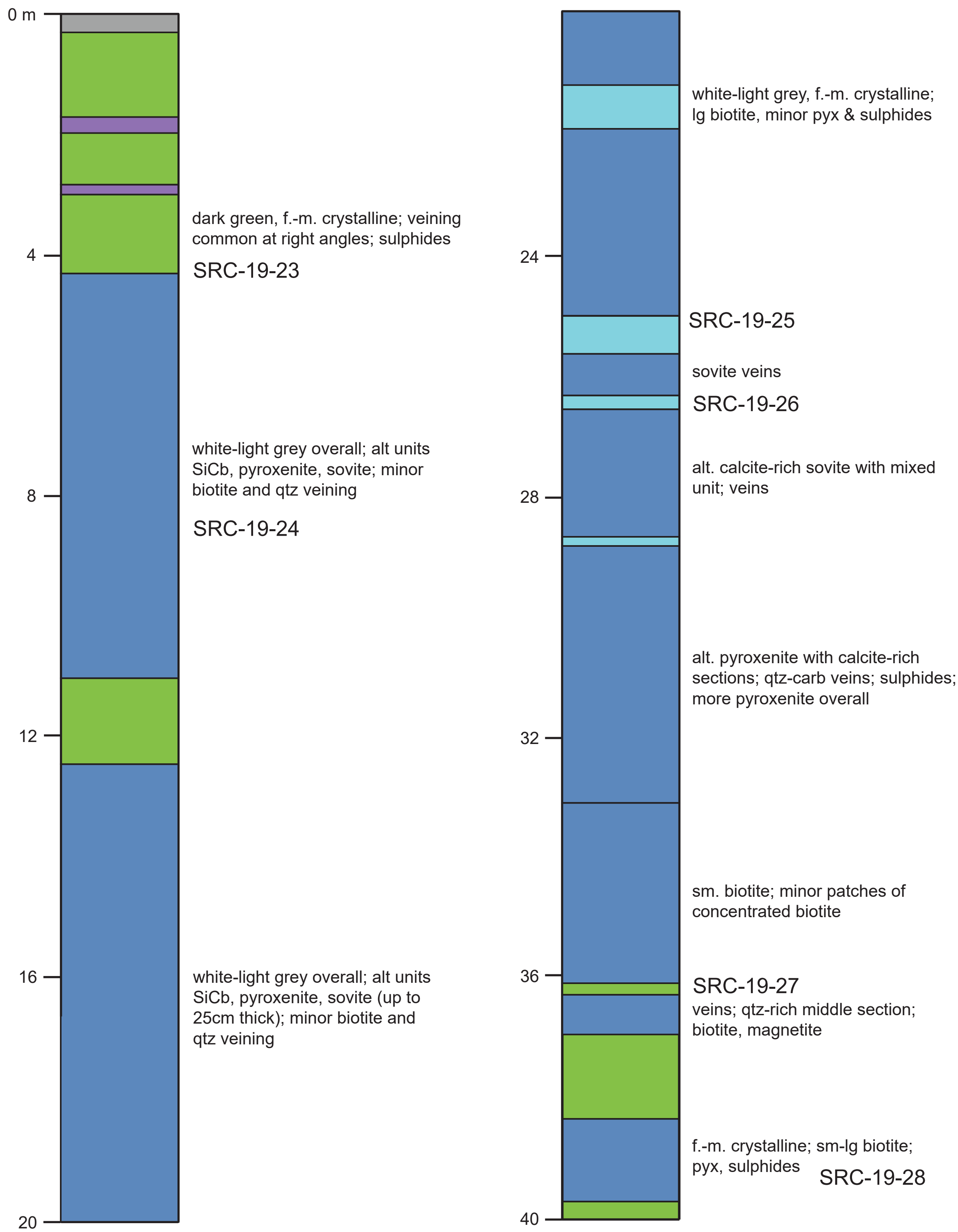


Figure 9: BA0006-2

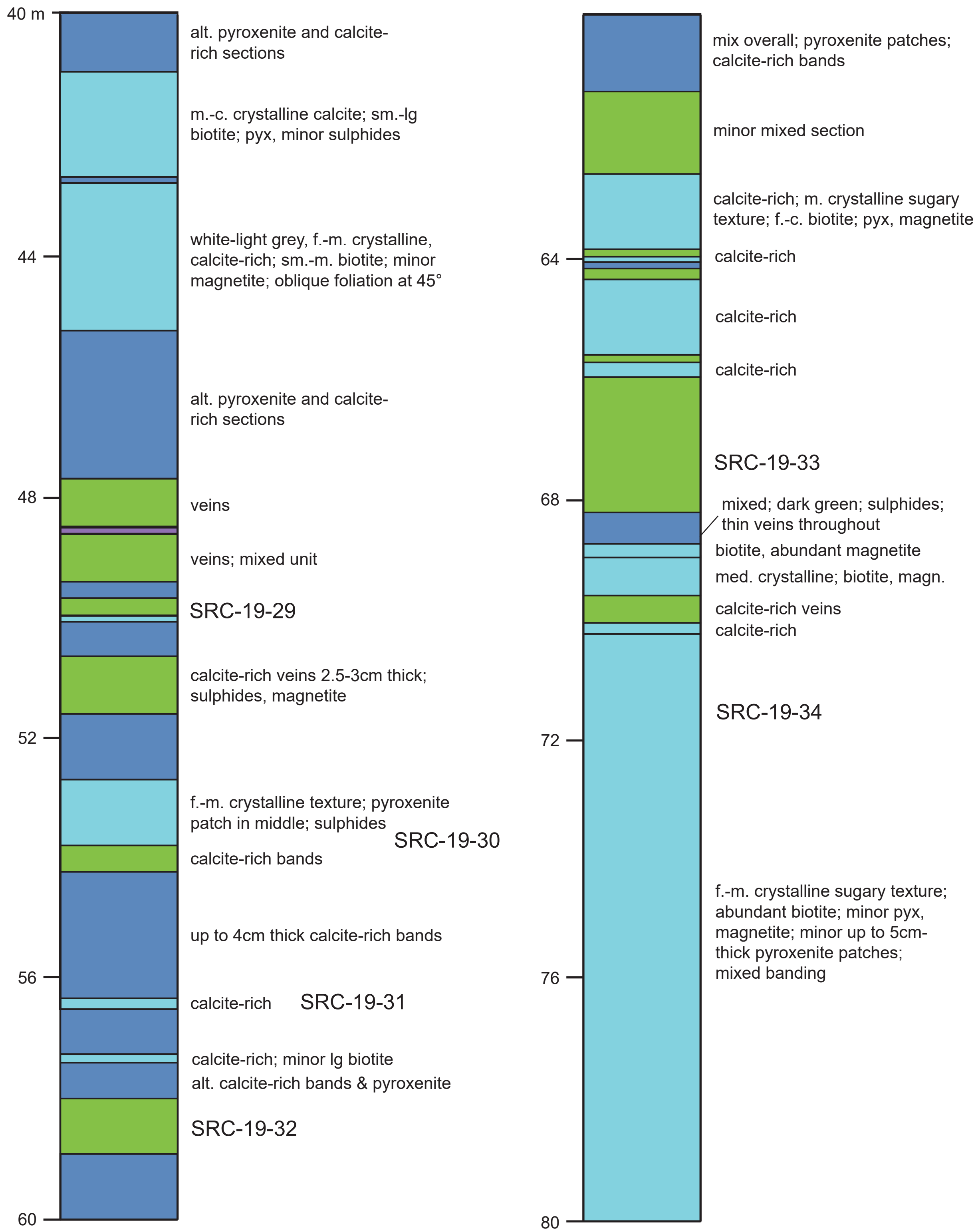


Figure 9: BA0006-3

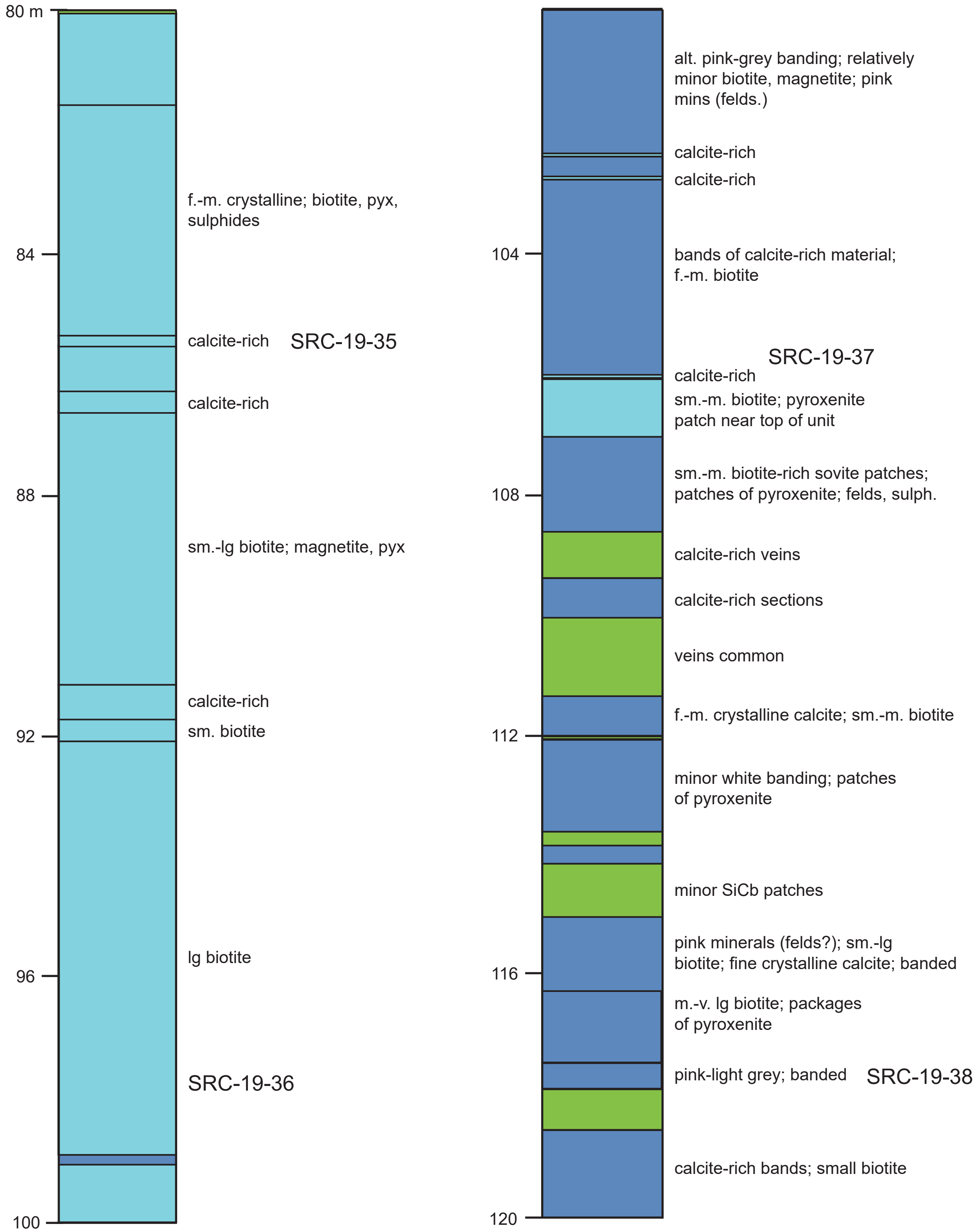


Figure 9: BA0006-4

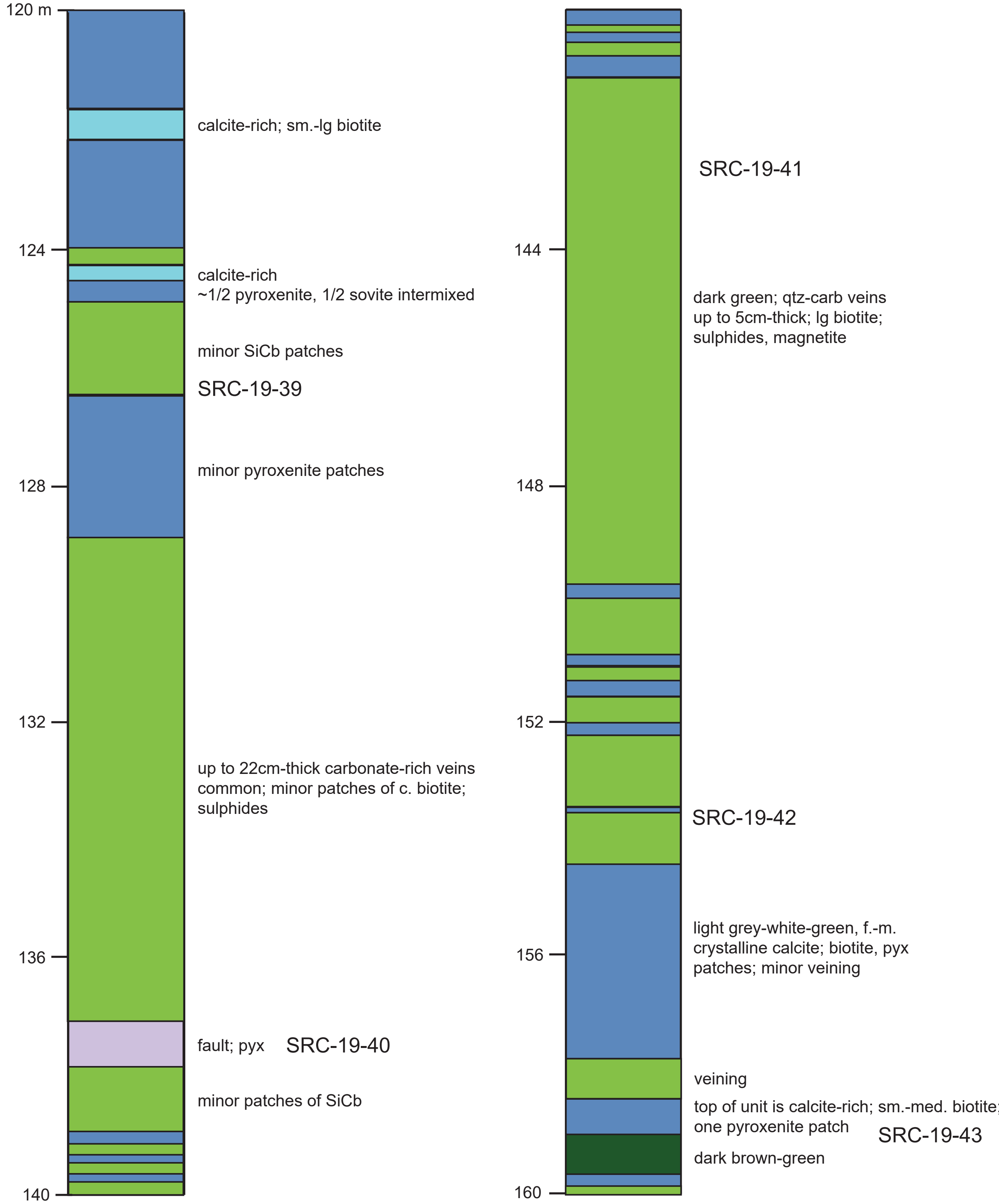
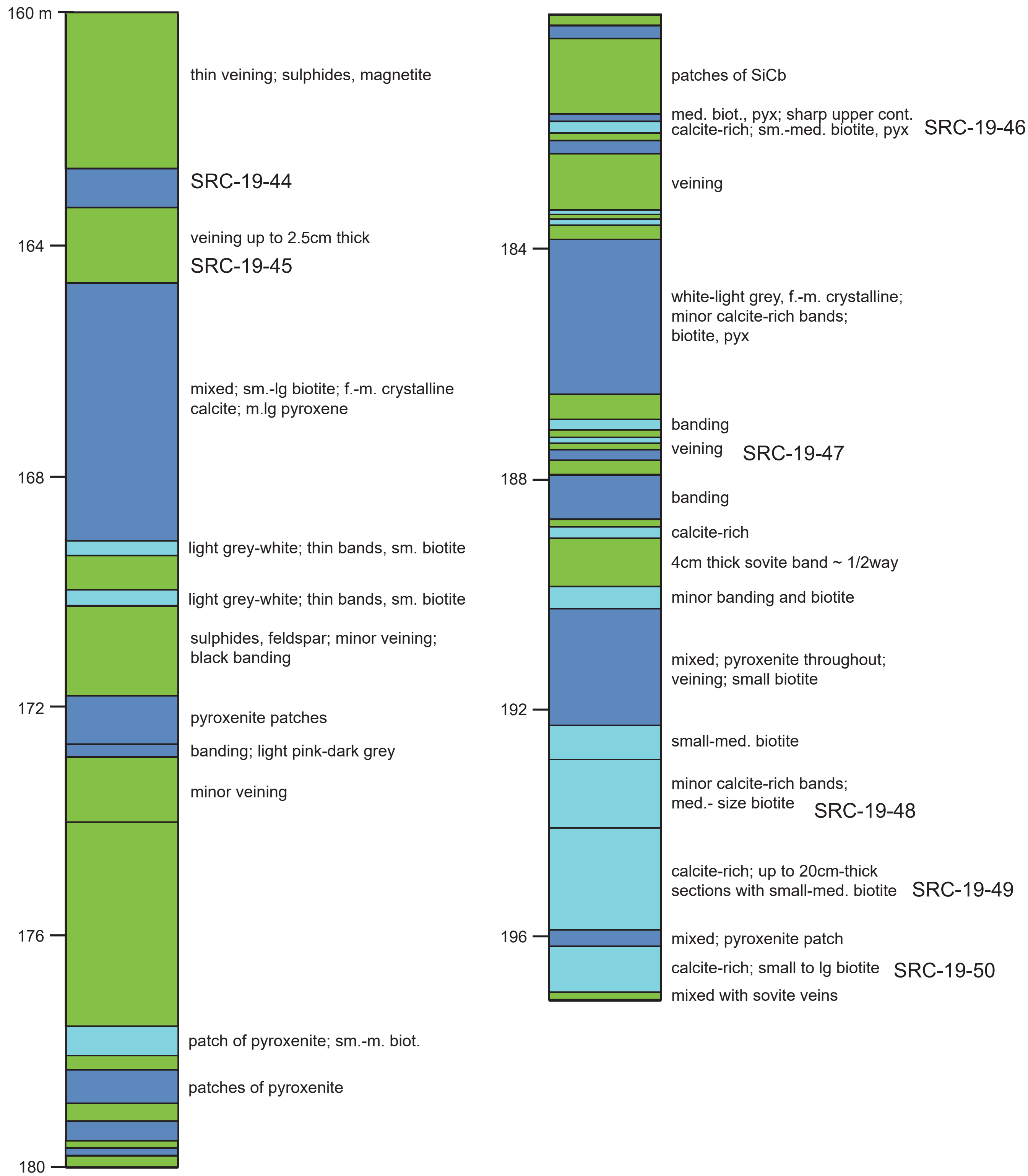


Figure 9: BA0006-5



best represent snapshots of the unknown geometry of the complex. Cores BA0001-5 were drilled vertically, and as the rocks are dipping vertically, it is difficult to interpret the geometry of the complex from them. ***We highly recommend that BAI drill deeper holes that are inclined to the present-day ground surface.*** Sulphides are sporadically preserved within all units; however, magnetite is confined to the pyroxenite intervals. Within all lithological units, calcite is the principal carbonate mineral.

Figure 10: Photos of the remnants remaining from the Union Carbide Core at the Royal Ontario Museum. The original intact core was studied in detail by Sage (1987).

<u>Apatite Imaging and Composition</u>

Fifty samples from the six recently drilled cores were made into polished sections for the project (Table 1). Each section was surveyed for apatite grains, which were easily identified. They ranged from prismatic and subhedral to interstitial and anhedral. The dominant morphology was anhedral. Multiple apatite grains were subjected to BSE and CL to identify zoning. The majority of the apatite grains showed no zoning, but those grains that did display zones were selected for EPMA analysis. Several spots were analysed across individual apatite grains (Supplementary Table 1) to determine whether there are any geochemical differences responsible for the zoning and to determine variations in apatite content across rock types.

Table 1: Samples selected for EPMA and CL analysis.

DDH	Depth Range	Sample ID	Lithology
BA0001	1-3m	SRC-19-1	SiCb
	5-6m	SRC-19-2	SiCb
	12-15m	SRC-19-3	SiCb
	23-25m	SRC-19-4	SiCb
	26-27m	SRC-19-5	Pyroxenite
BA0002	4-6m	SRC-19-6	Sovite
	12-15m	SRC-19-7	Sovite
	20-22m	SRC-19-8	Sovite
	25-26m	SRC-19-9	Pyroxenite
BA0003	-	SRC-19-10	-
	3-5m	SRC-19-11	SiCb
	1-2m	SRC-19-12	SiCb
	18-20m	SRC-19-13	Sovite
	20-22m	SRC-19-14	Sovite
	22-23m	SRC-19-15	SiCb
BA0004	6-7m	SRC-19-16	SiCb
	10-12m	SRC-19-17	SiCb
	23-25m	SRC-19-18	SiCb
BA0005	15-17m	SRC-19-19	Sovite
	20-22m	SRC-19-20	SiCb
	25-27m	SRC-19-21	SiCb
	29-30m	SRC-19-22	SiCb
BA0006	1-5m	SRC-19-23	Pyroxenite
	9-11m	SRC-19-24	SiCb
	-	SRC-19-25	Sovite
	-	SRC-19-26	Sovite
	-	SRC-19-27	Pyroxenite
	-	SRC-19-28	SiCb
	-	SRC-19-29	Sovite
	-	SRC-19-30	Sovite
	-	SRC-19-31	SiCb
	-	SRC-19-32	Pyroxenite
	-	SRC-19-33	Pyroxenite
	-	SRC-19-34	Pyroxenite
	-	SRC-19-35	Sovite
	86-88m	SRC-19-36	Sovite
	107-109m	SRC-19-37	SiCb
	116-118m	SRC-19-38	SiCb
	120-122m	SRC-19-39	Pyroxenite
	135-137m	SRC-19-40	Fault gouge
	140-143m	SRC-19-41	Pyroxenite
	152-154m	SRC-19-42	Pyroxenite
	157-159m	SRC-19-43	SiCb/Gabbro
	163-165m	SRC-19-44	SiCb
	168-170m	SRC-19-45	Pyroxenite
	180-183m	SRC-19-46	Sovite
	188-189m	SRC-19-47	SiCb
	190-193m	SRC-19-48	Sovite
	193-195m	SRC-19-49	Sovite
	195-197m	SRC-19-50	Sovite

The main elements in apatite minerals are Ca, P, and F. In the apatite grains analyzed, CaO mass% ranges from 50.77-55.58 in pyroxenite, 48.88-55.53 in silicocarbonatite, and 47.78-55.63 in sovite. The P_2O_5 mass% ranges from 39.78-43.01 in pyroxenite, 39.76-43.44 in silicocarbonatite, and 38.38-42.64 in sovite. The F mass% ranges from 2.78-5.83 in pyroxenite, 2.50-6.18 in silicocarbonatite, and 2.70-6.74 in sovite. These results indicate that there is great overlap in the abundances of the three elements and that: 1) no specific unit contains distinct apatite grains, and 2) the abundances of CaO, P_2O_5, and F does not vary significantly from cores to rims (Figure 11).

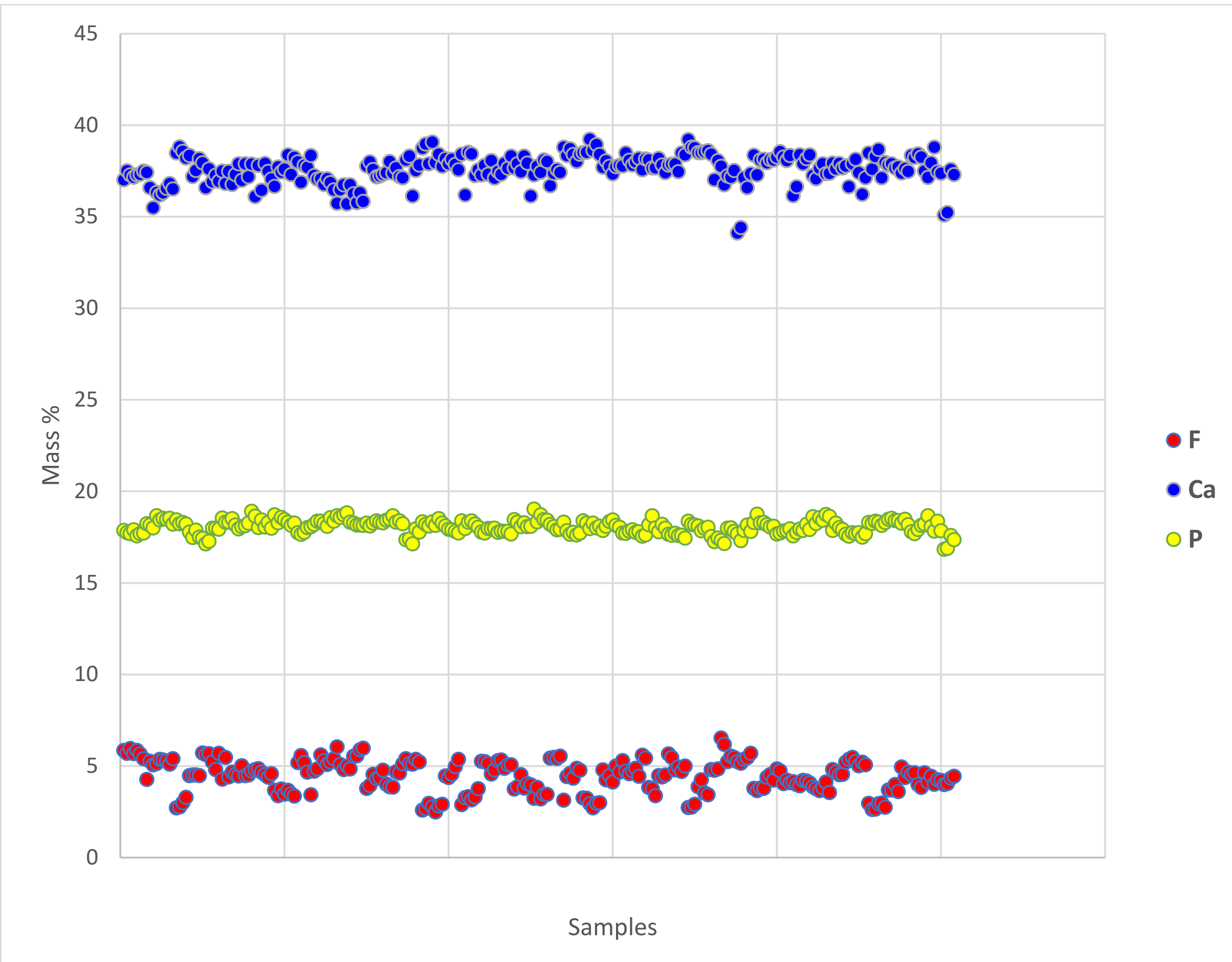


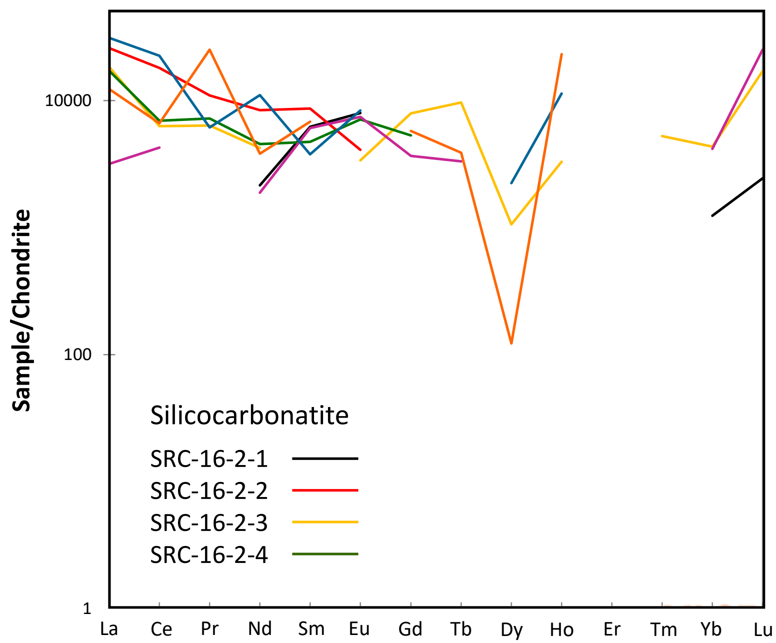
Figure 11: Graph showing the variance in the abundance of the major elements in apatite minerals of the SRC (CaO=C, P_2O_5=P, F).

Figures 12-23 display the REE contents of analyzed spots within representative apatite grains, as well as their BSE and CL images. Take note that some elements were below the level of detection and thus the lines in the REE plots are not all continuous. All grains display an enrichment in the LREEs, which is typical of carbonatite complexes. The La/Yb_n values for the apatite grains in sovite samples range from 0.83-54.28, with an average of 12.77. Grains in the silicocarbonatite produced La/Yb_n values between 0.16 and 13.58, with an average of 4.57. The La/Yb_n values for apatite in the pyroxenite samples range from 1.04-3.59, with an average of 1.99. These differences are also supported by the REE results of whole rock geochemistry (see next section), in that rock samples from the sovite contain higher LREE abundances than those of the silicocarbonatite and pyroxenite.

The grains displayed in Figures 12-23 all contain overgrowths, here referred to as zones. Although the zones did not show variations in major element geochemistry, there are differences in the REE contents of zones within individual grains. For example, apatite grain 2 from the sovite sample SRC-19-26 contains a zone (spot 1) that is bright in both BSE and CL imaging that has a La/Yb_n ratio of 39.18 as well as a small negative anomaly in Pr and Sm (Figure 19). In contrast, spot 3 on the same grain is dark in both BSE and CL imaging and has a La/Yb_n ratio of 8.89 and a positive Sm anomaly. In general, there are variations in LREE abundances between bright and dark zones overall. Zones that are: 1) dark in both BSE and CL imaging have La/Yb, ratios between 0.51 and 9.86 (ave. 3.20), 2) bright in both BSE and CL imaging have La/Yb_n ratios ranging from 2.36 to 39.18 (ave. 15.91), 3) dark in BSE and bright in CL have La/Yb_n ratios between 0.16 and 25.81 (ave. 5.55), and 4) bright in BSE and dark in CL imaging have La/Yb_n ratios from 6.90-54.28 (ave. 20.50). The zones that are bright in both BSE and CL imaging or are bright in BSE only are more enriched in the LREE. The dark, homogenous cores in the apatite grains (e.g. Figures 16, 19) could be considered primary apatite, whereas the bright zones are secondary, having formed from multiple and/or protracted growth episodes in the magma chamber and during later metasomatic overprinting. Understanding the number and nature of primary apatite alteration episodes in the SRC requires a detailed petrographic textural analysis.

Whole Rock Geochemistry

The SRC samples were plotted on a ternary diagram for carbonatite type (Figure 24). The results show that the sovite samples plot as a calcio-carbonatites whereas the samples from the other rock units are classified as ferro-carbonatites. The residuum overlying the rock units also has a ferro-carbonatite composition.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Pr
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Sm
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Gd
Tb
Dy
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Tm
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Lu
Silicocarbonatite
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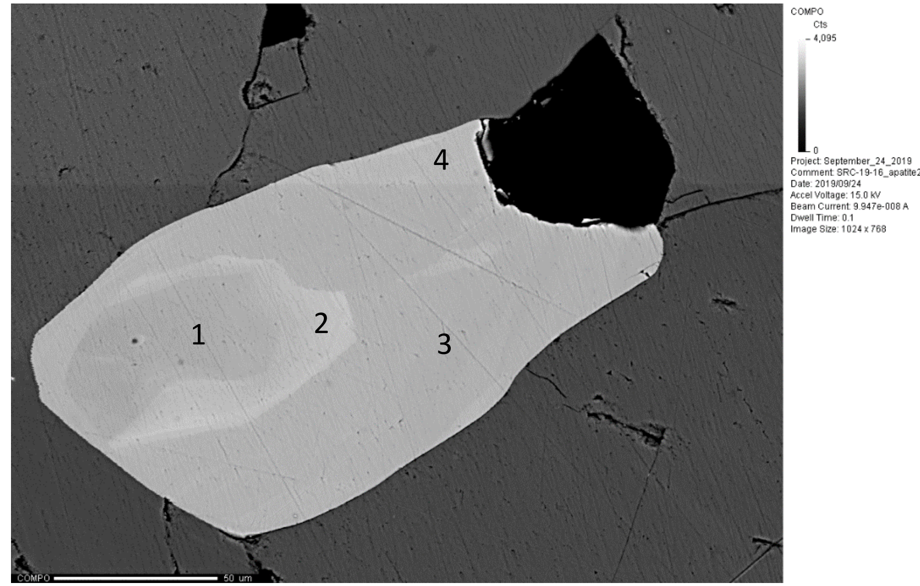
SRC-16-2-2
SRC-16-2-3
SRC-16-2-4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3
4
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Image Size: 1024 x 768

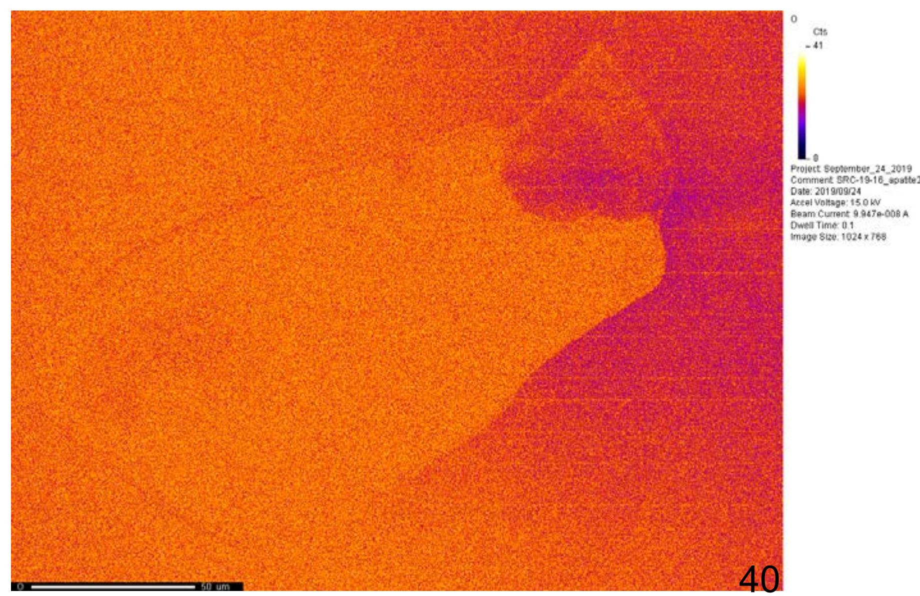
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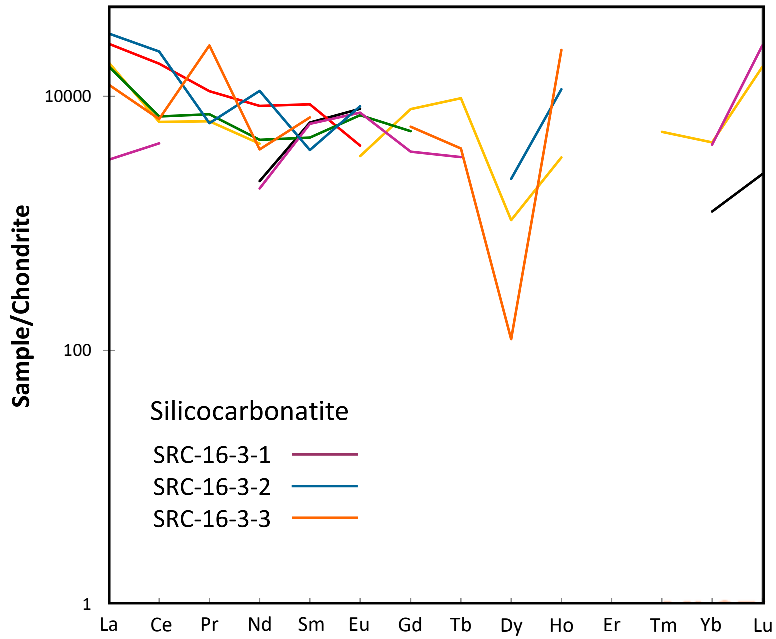
Image Size: 1024 x 768

Figure 12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Gd
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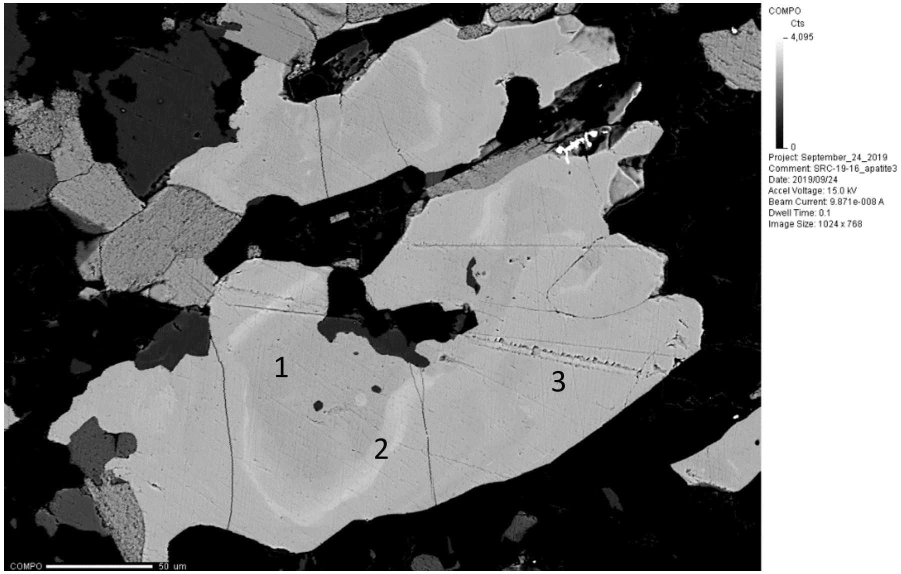
Tm
Yb
Lu
Silicocarbonatite
SRC-16-3-1
SRC-16-3-2
SRC-16-3-3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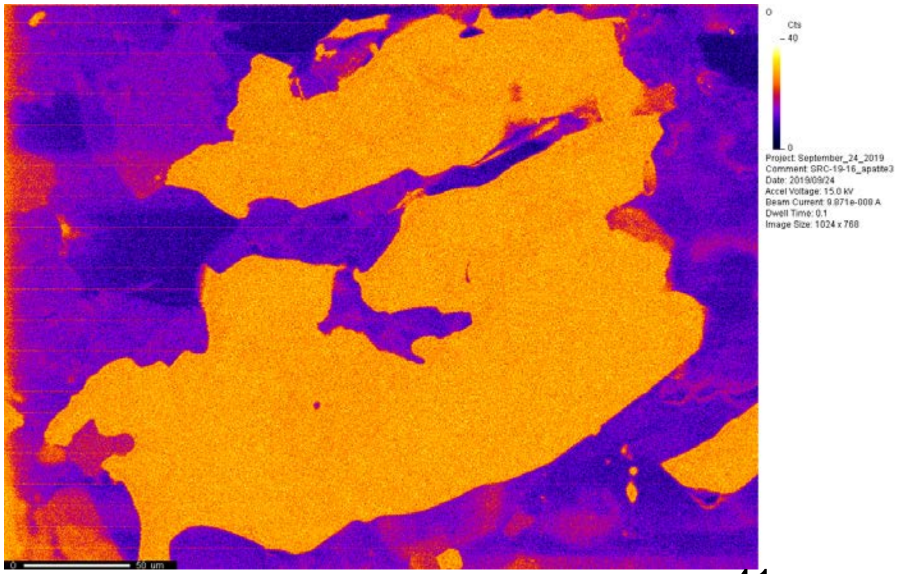
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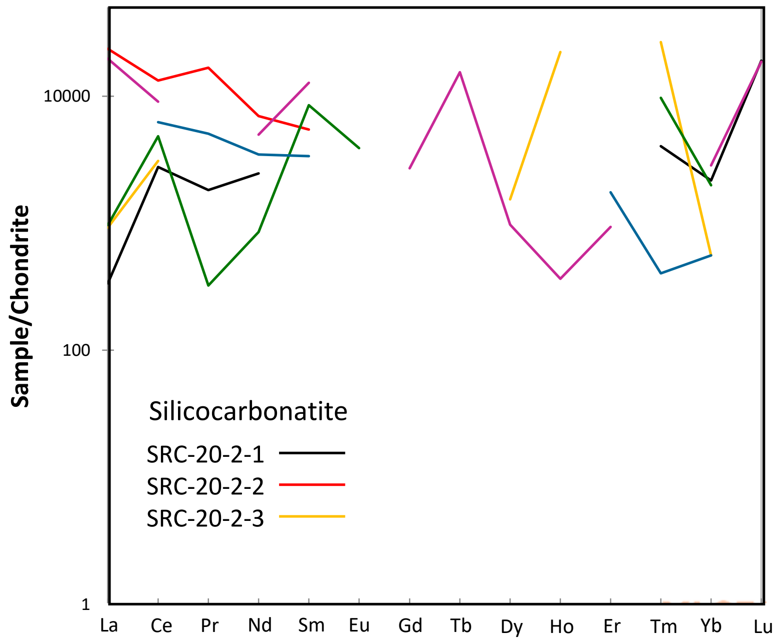
Figure 13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Yb
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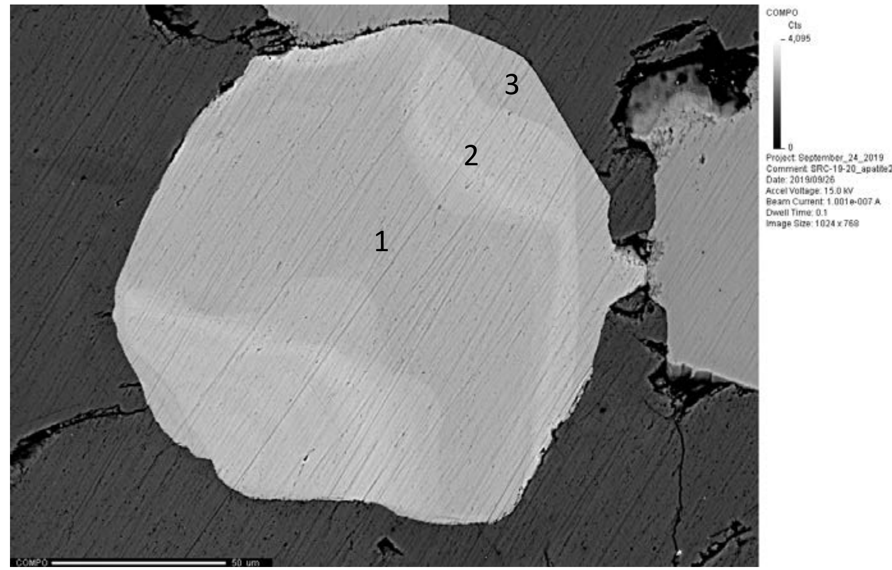
Silicocarbonatite
SRC-20-2-1
SRC-20-2-2
SRC-20-2-3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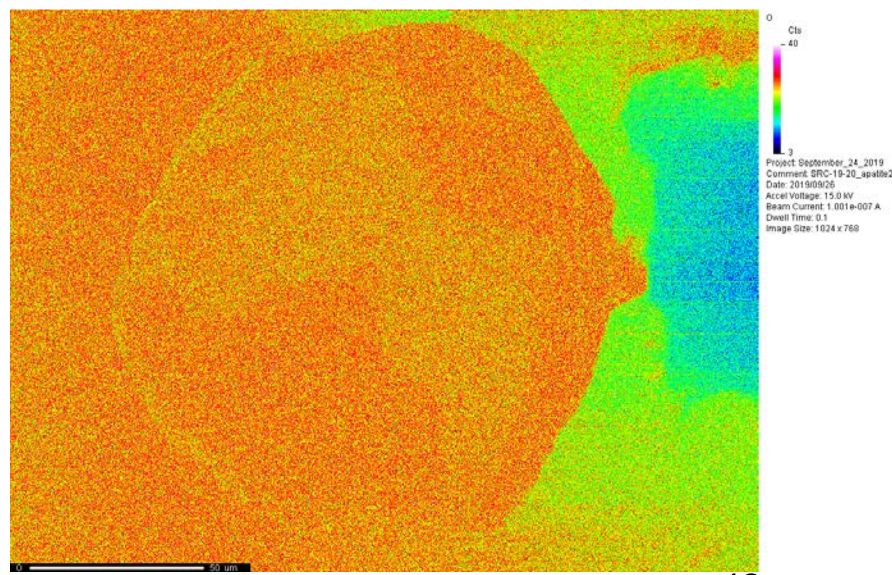
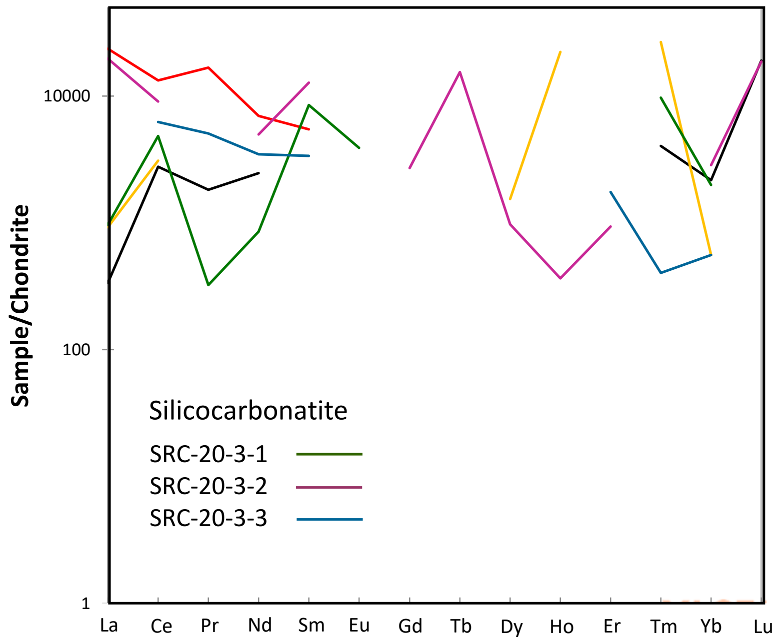


Figure 14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SRC-20-3-1
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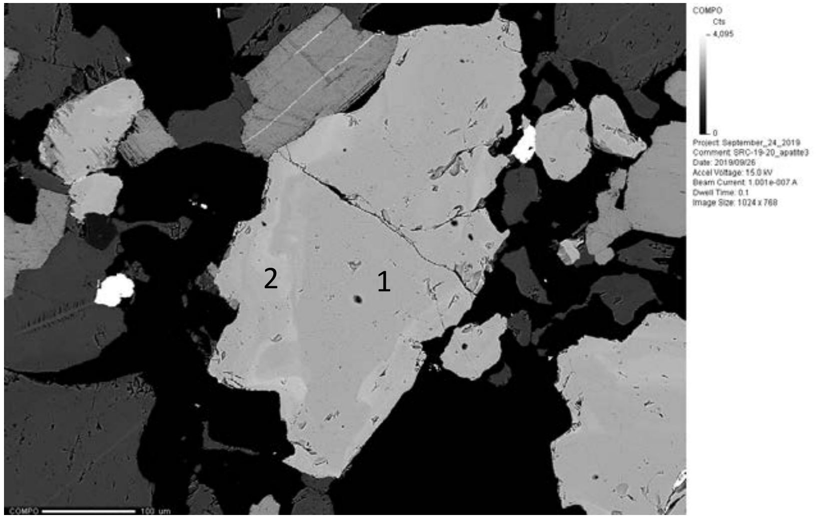
SRC-20-3-3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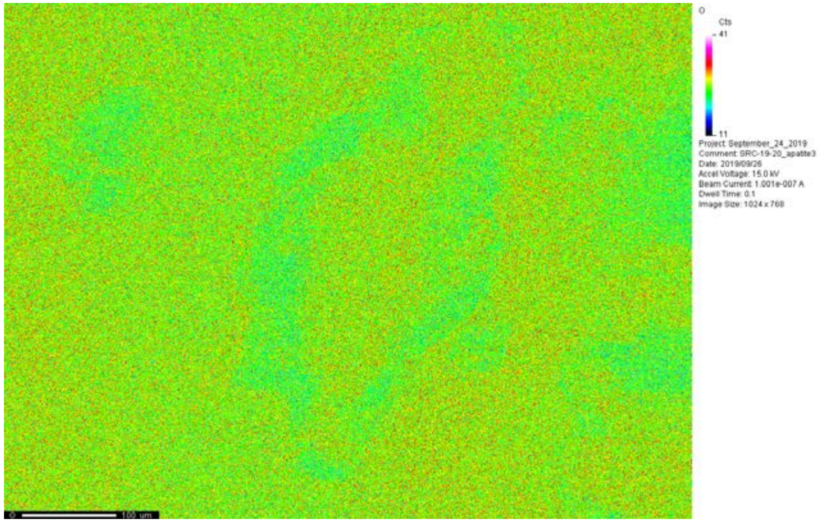
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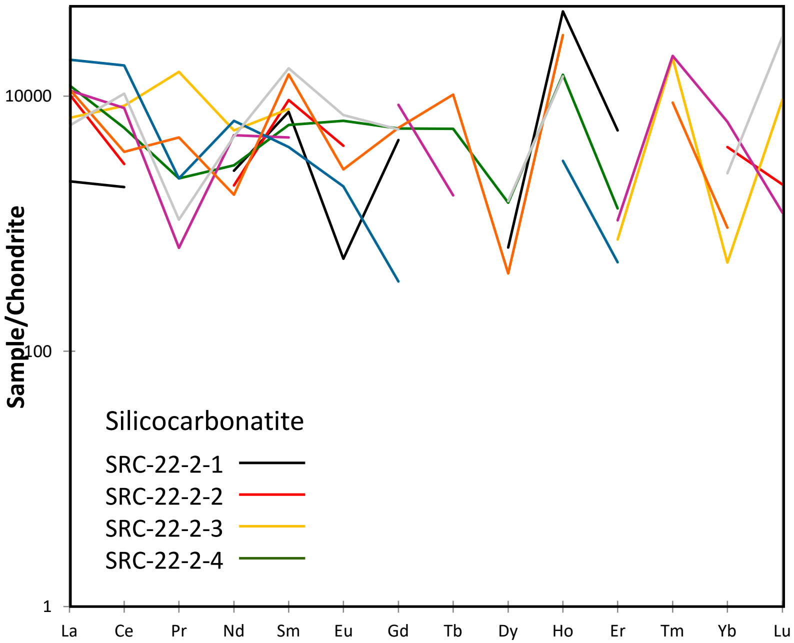
Image Size: 1024 x 768

Figure 15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Silicocarbonatite
SRC-22-2-1
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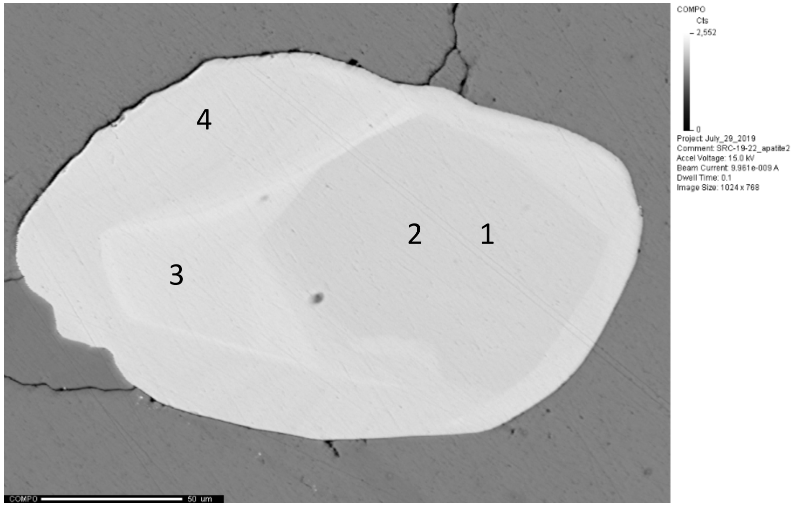
SRC-22-2-4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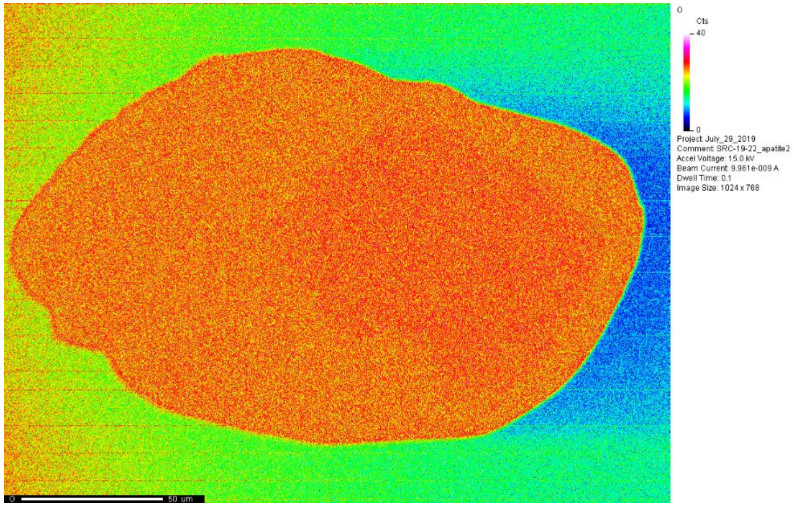
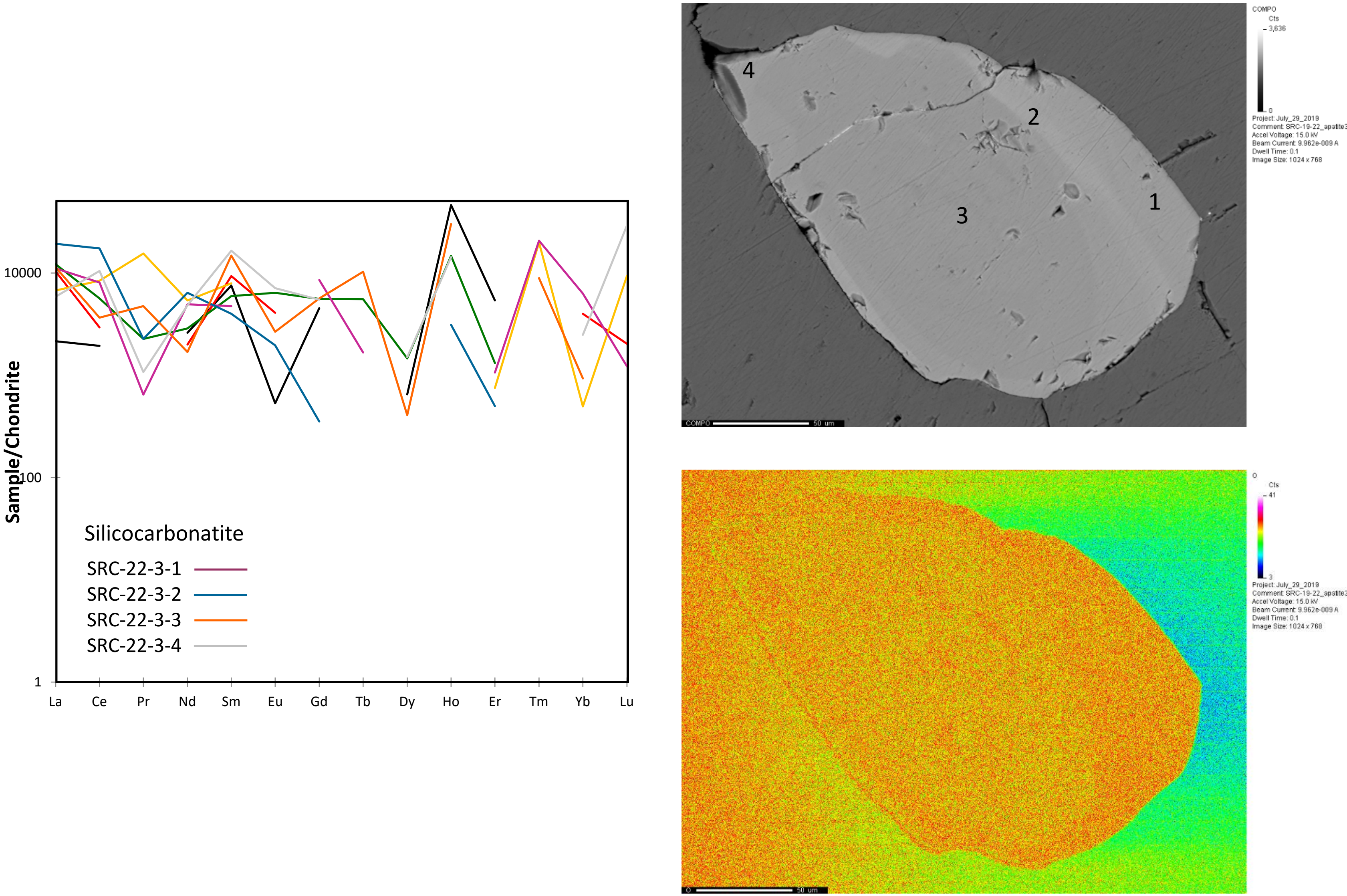


Figure 16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Project: July_29_2019
Comment: SRC-19-22_apatite3
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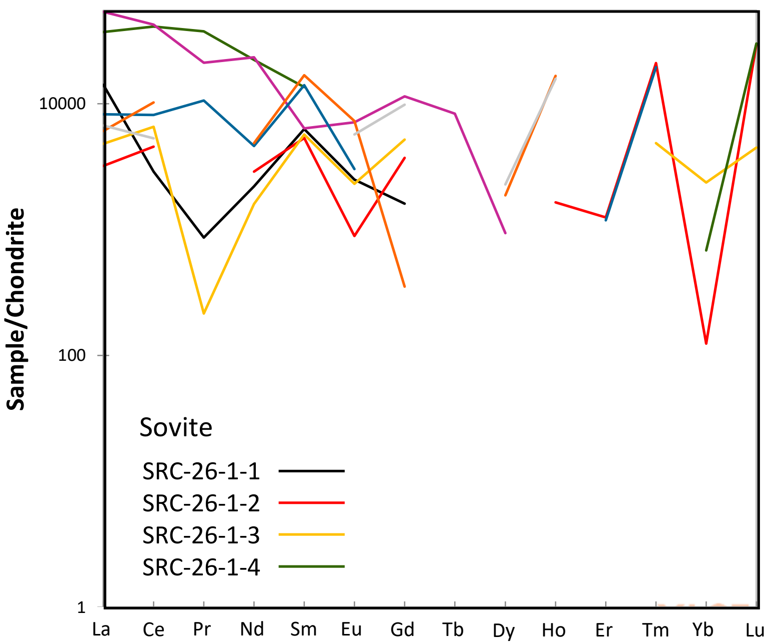
Figure 17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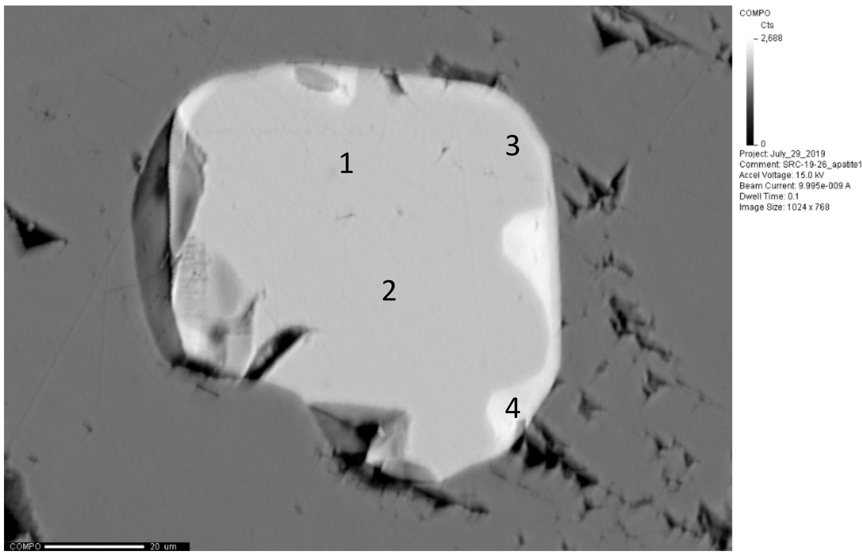
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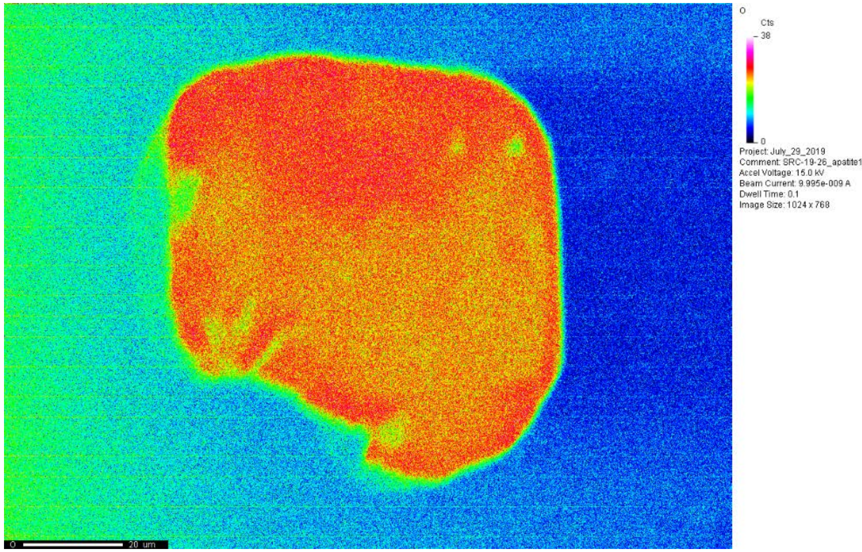
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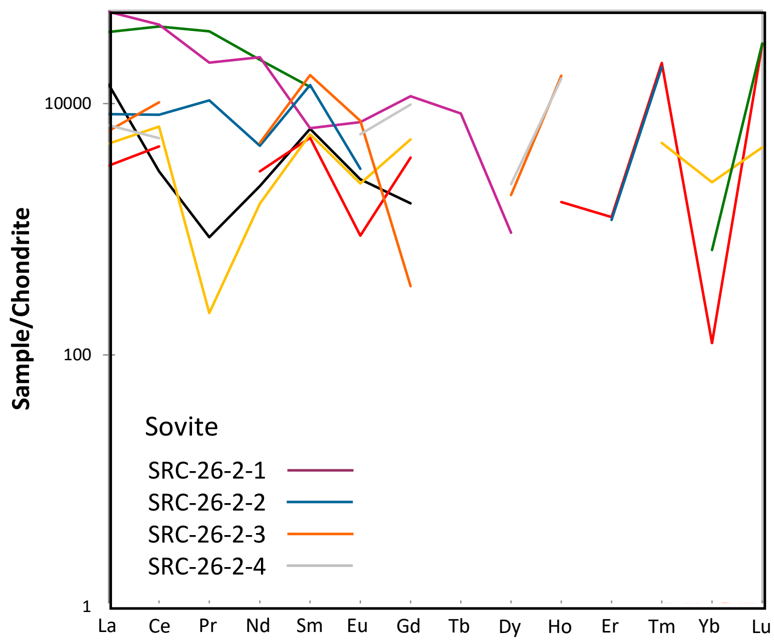
20 um

Figure 18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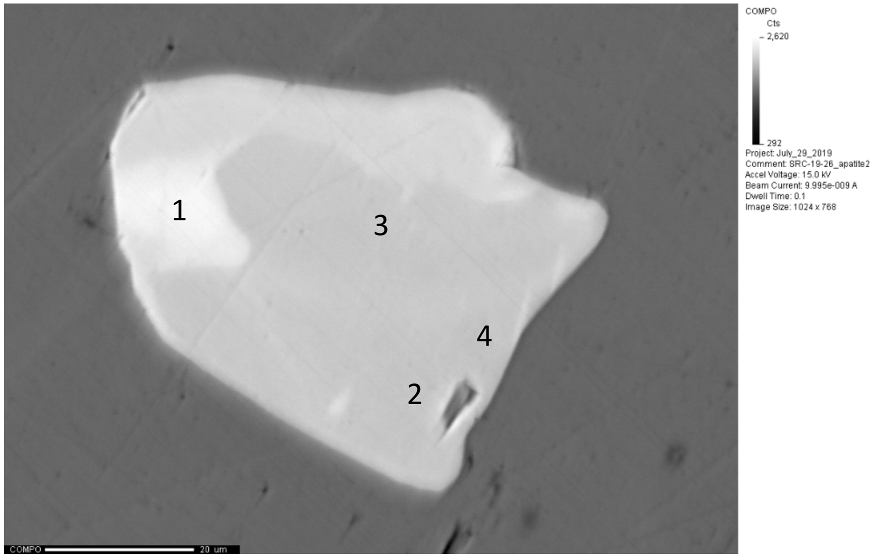
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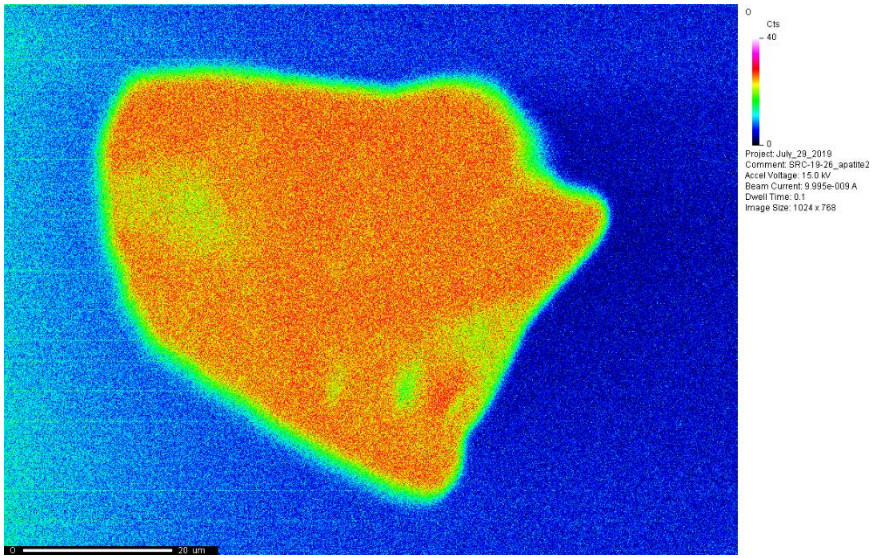
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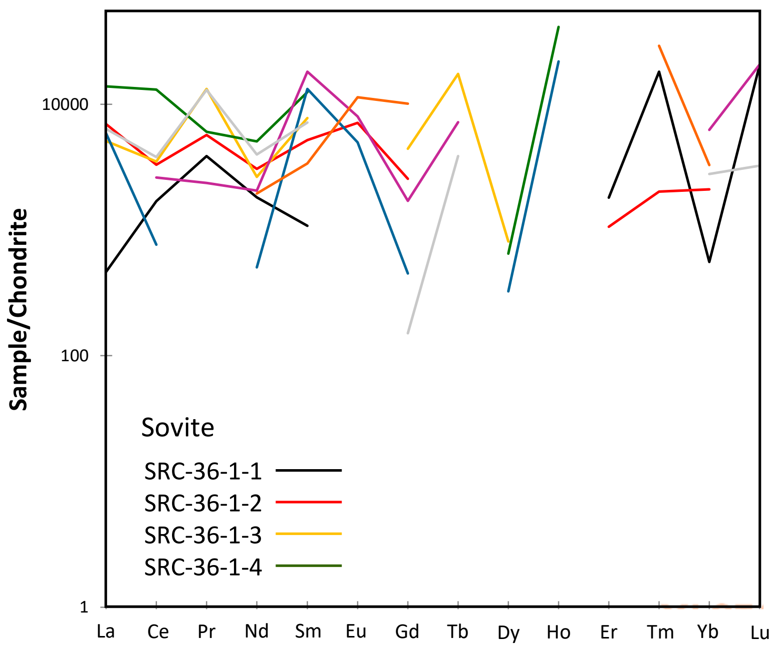
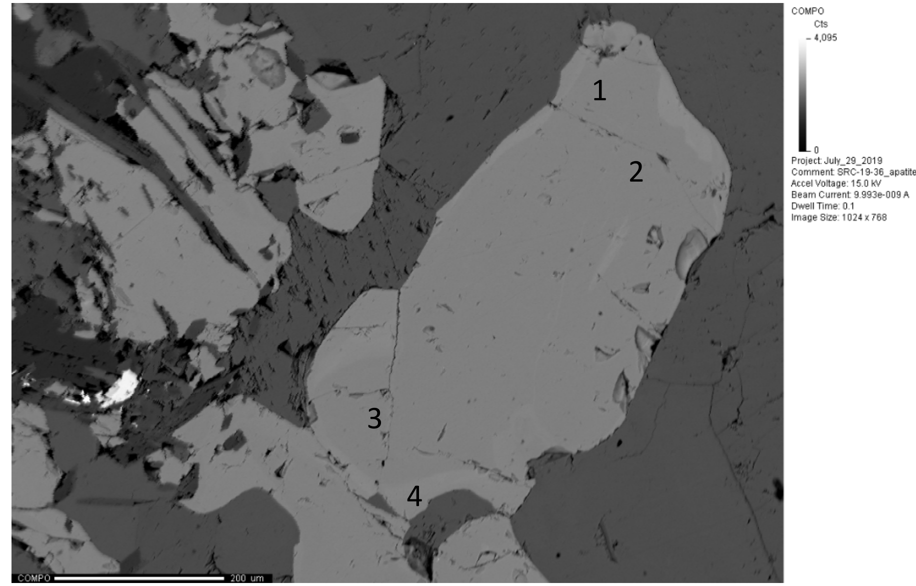
Project: July_29_2019
Comment: SRC-19-26_apatite2
Accel Voltage: 15.0 kV
Beam Current: 9.995e-009 A
Dwell Time: 0.1
Image Size: 1024 x 768

Figure 19


Sample/Chondrite
10000
100
1
La Ce Pr Nd Sm Eu Gd Tb Dy Ho Er Tm Yb Lu
Sovite
SRC-36-1-1
SRC-36-1-2
SRC-36-1-3
SRC-36-1-4


1
2
3
4
COMPO
Cts
4,095
0
Project: July_29_2019
Comment: SRC-19-36_apatite1
Accel Voltage: 15.0 kV
Beam Current: 9.993e-009 A
Dwell Time: 0.1
Image Size: 1024 x 768
200 um

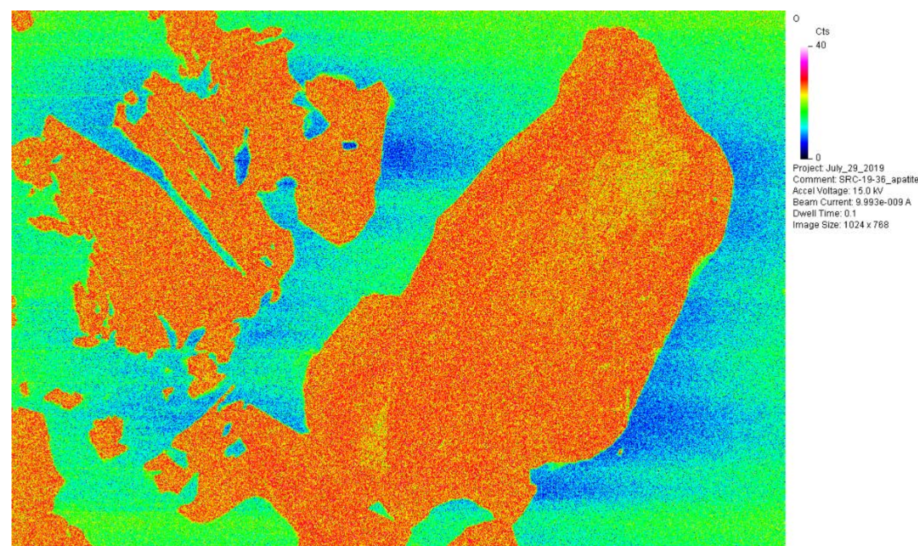
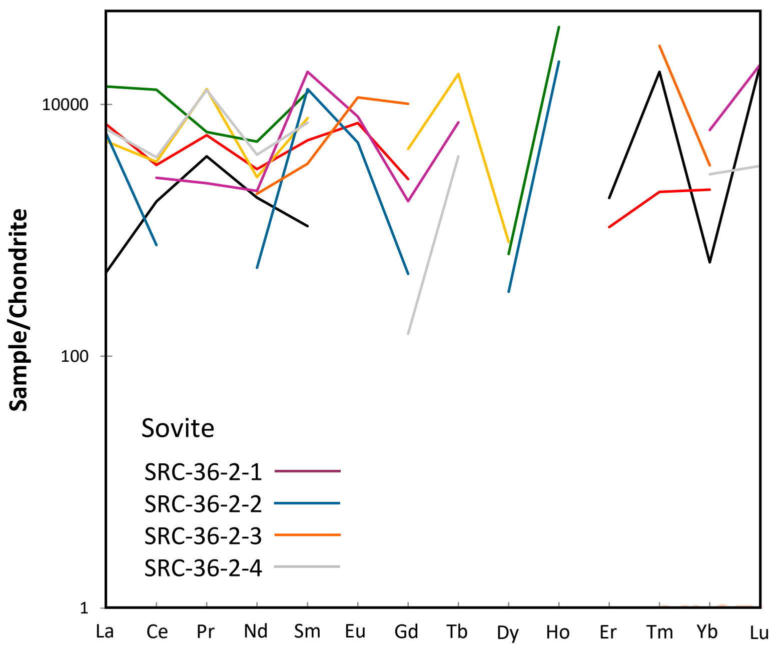
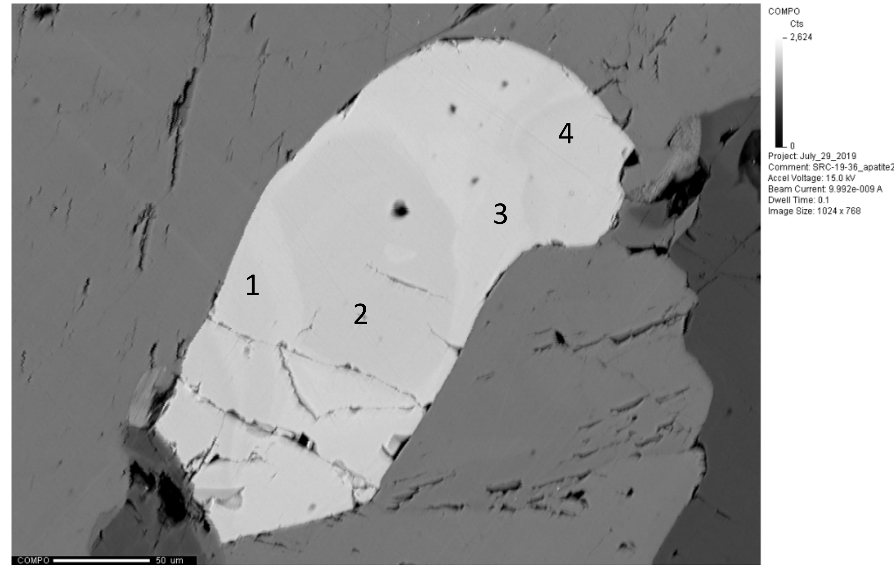

O
Cts
40
0
Project: July_29_2019
Comment: SRC-19-36_apatite1
Accel Voltage: 15.0 kV
Beam Current: 9.993e-009 A
Dwell Time: 0.1
Image Size: 1024 x 768
200 um

Figure 20


Sample/Chondrite
10000
100
1
La
Ce
Pr
Nd
Sm
Eu
Gd
Tb
Dy
Ho
Er
Tm
Yb
Lu
Sovite
SRC-36-2-1
SRC-36-2-2
SRC-36-2-3
SRC-36-2-4


1
2
3
4
COMPO
Cts
2,624
0
Project: July_29_2019
Comment: SRC-19-36_apatite2
Accel Voltage: 15.0 kV
Beam Current: 9.992e-009 A
Dwell Time: 0.1
Image Size: 1024 x 768
50 um

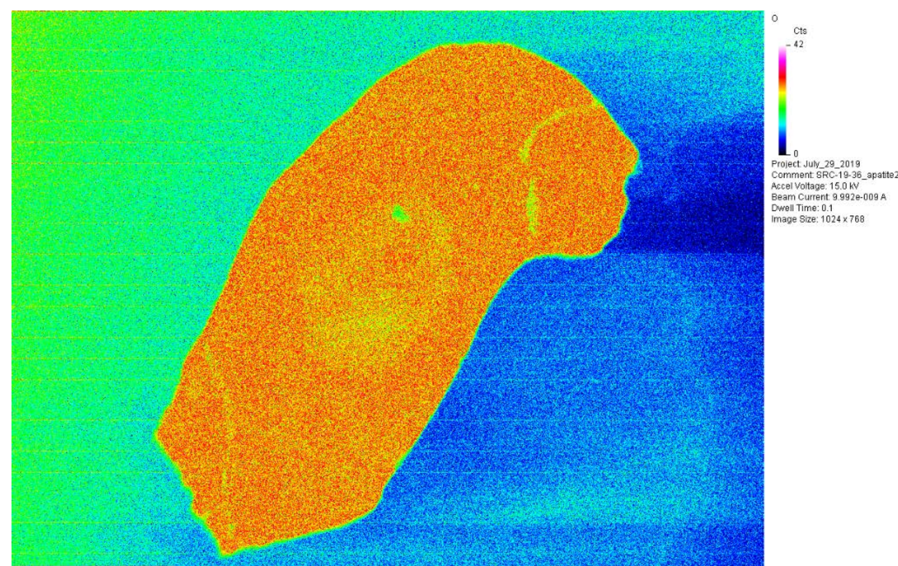
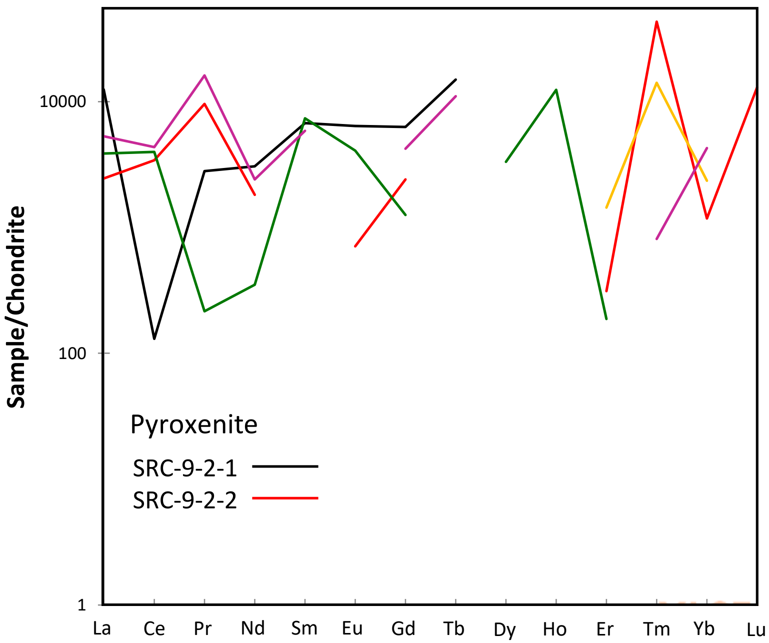
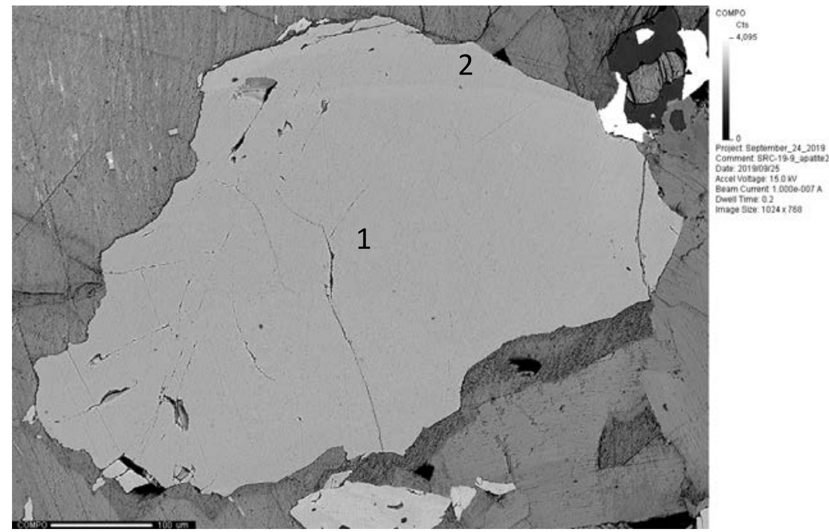

O
Cts
42
0
Project: July_29_2019
Comment: SRC-19-36_apatite2
Accel Voltage: 15.0 kV
Beam Current: 9.992e-009 A
Dwell Time: 0.1
Image Size: 1024 x 768
50 um

Figure 21


Sample/Chondrite
10000
100
1
La
Ce
Pr
Nd
Sm
Eu
Gd
Tb
Dy
Ho
Er
Tm
Yb
Lu
Pyroxenite
SRC-9-2-1
SRC-9-2-2


2
1

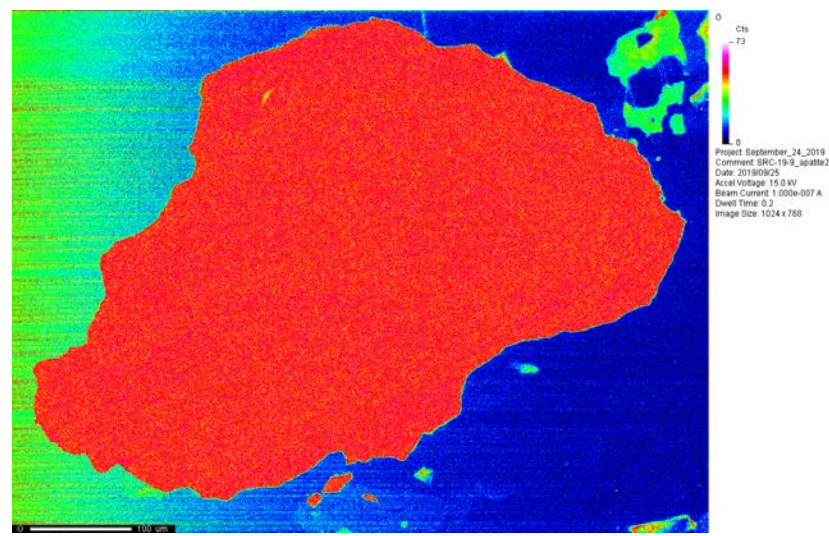
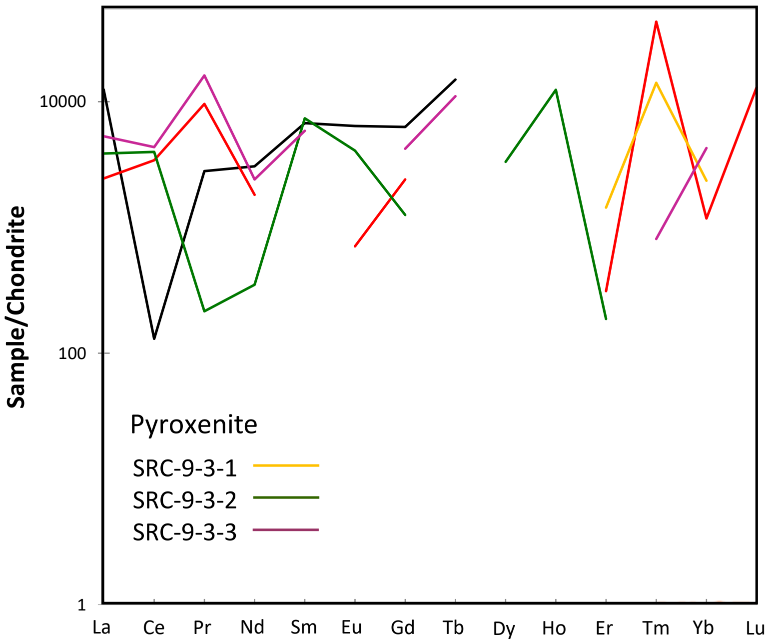
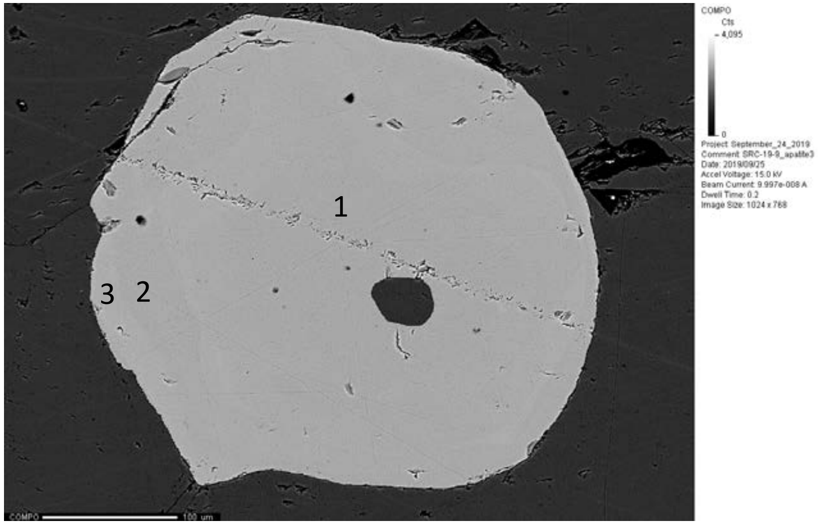


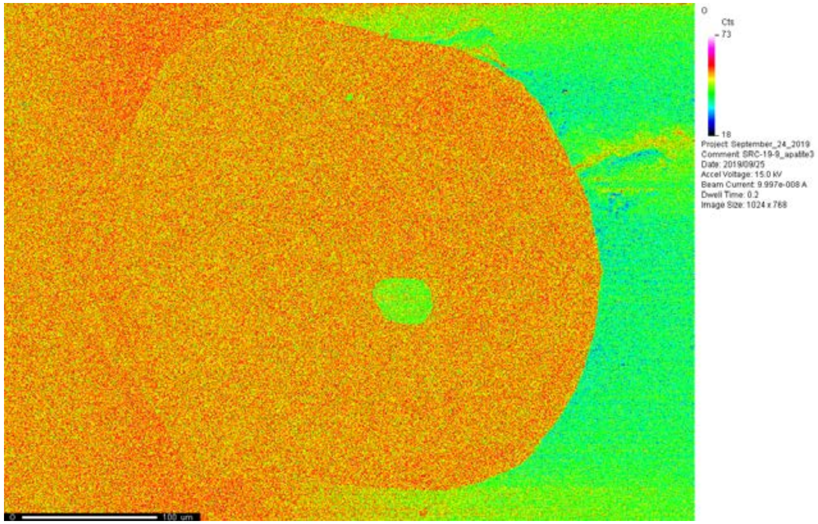
Figure 22



Sample/Chondrite
10000
100
1
La
Ce
Pr
Nd
Sm
Eu
Gd
Tb
Dy
Ho
Er
Tm
Yb
Lu
Pyroxenite
SRC-9-3-1
SRC-9-3-2
SRC-9-3-3



1
2
3
COMPO
Cts
4,095
0
Project: September_24_2019
Comment: SRC-19-9_apatite3
Date: 2019/09/25
Accel Voltage: 15.0 kV
Beam Current: 9.997e-008 A
Dwell Time: 0.2
Image Size: 1024 x 768



Cts
73
18
Project: September_24_2019
Comment: SRC-19-9_apatite3
Date: 2019/09/25
Accel Voltage: 15.0 kV
Beam Current: 9.997e-008 A
Dwell Time: 0.2
Image Size: 1024 x 768

Figure 23

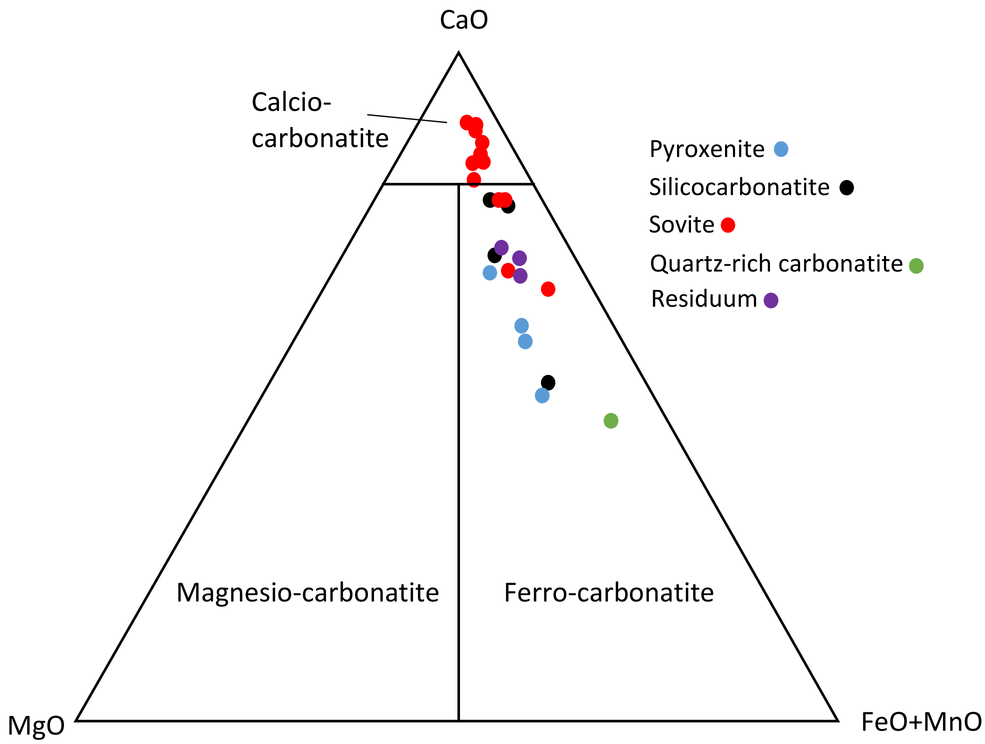
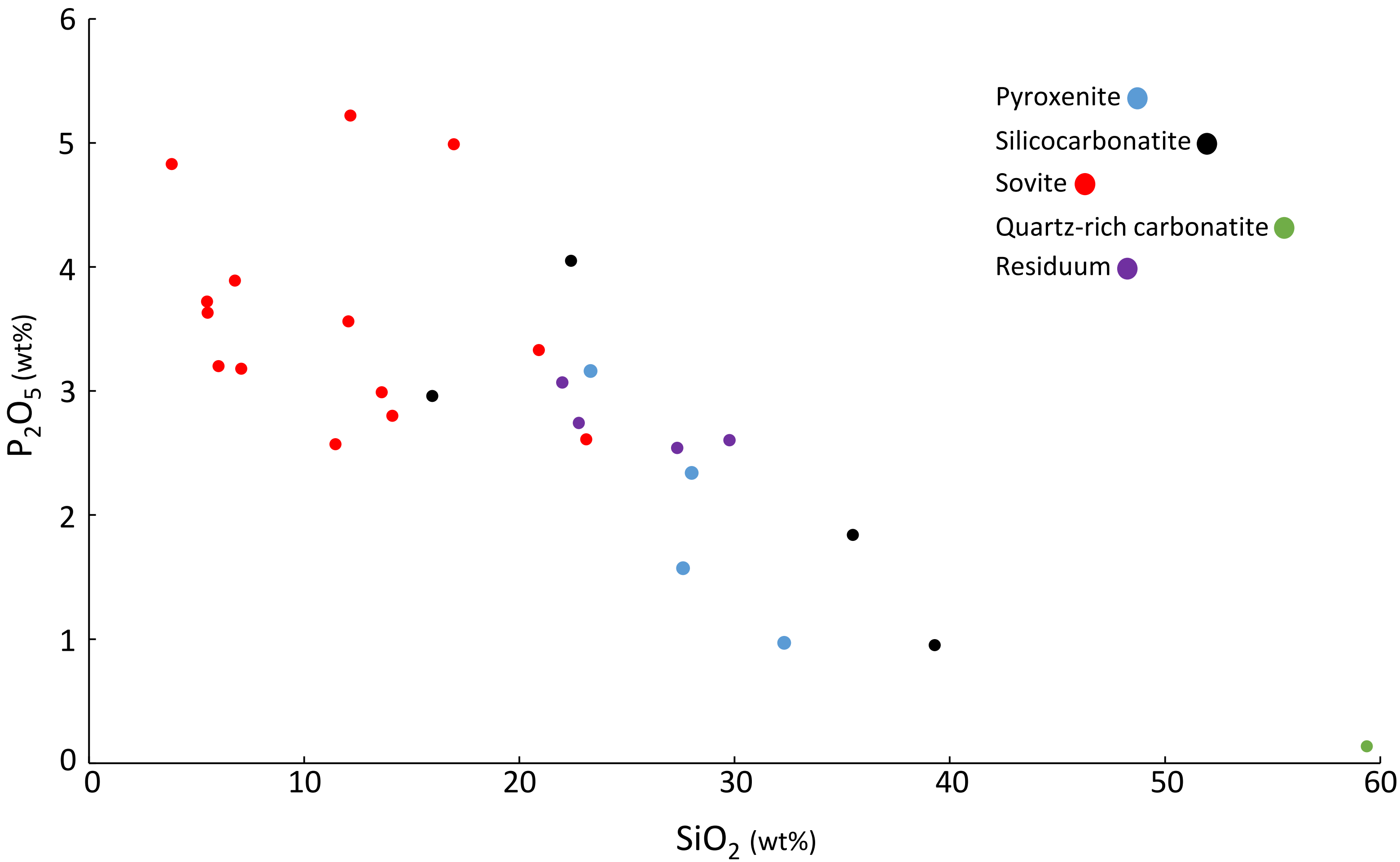


Figure 24: Ternary classification diagram for carbonatites with SRC samples plotted. Diagram after Woolley and Kempe (1989).

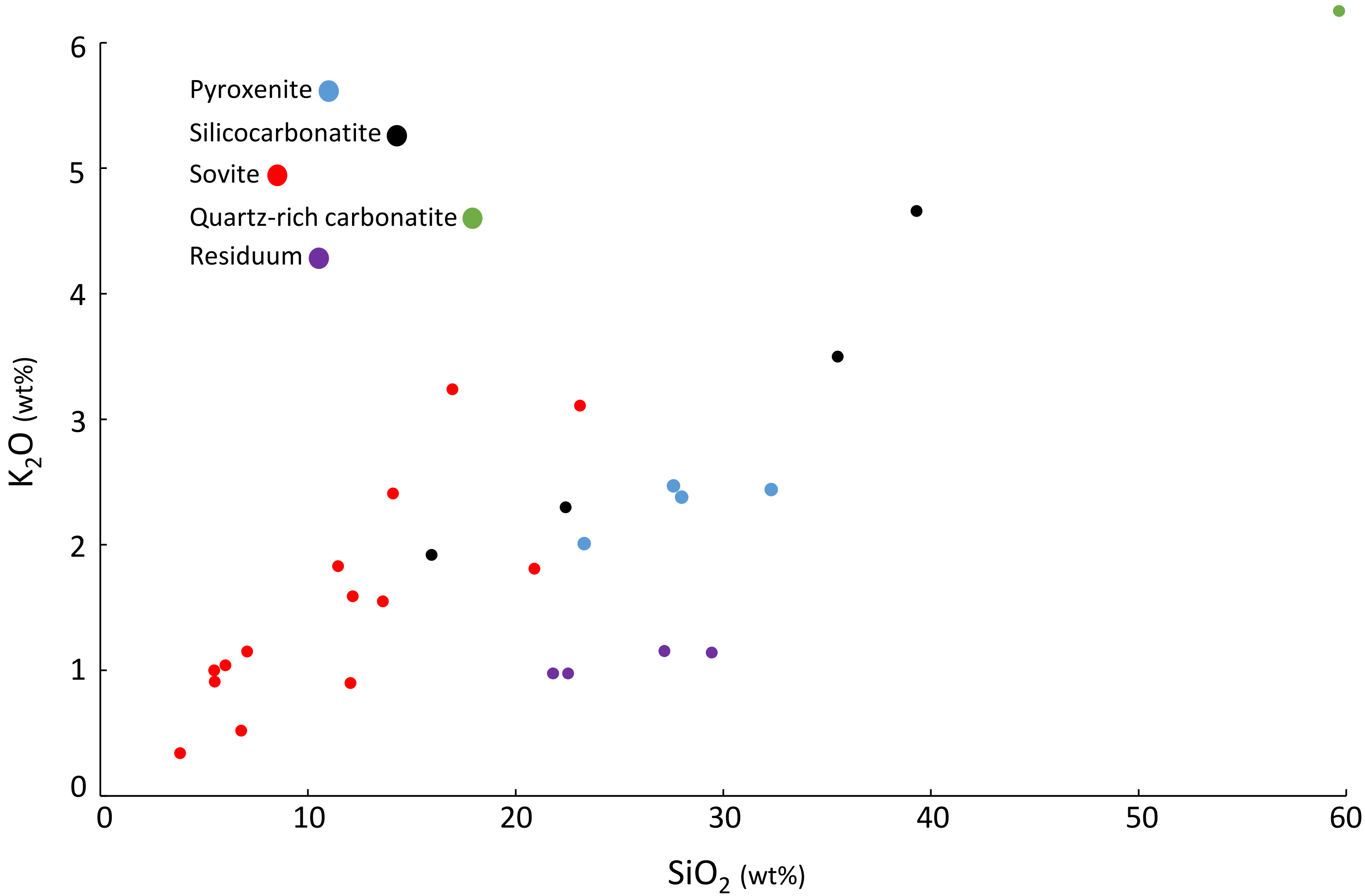
Plotting the results on a P_2O_5 vs SiO_2 diagram however, indicates that only the sovite samples are classified as true carbonatites with SiO_2 wt% <20 (Figure 25). This diagram also displays that with increasing P_2O_5, the percentage of SiO_2 decreases. The product currently used by BAI for agromineral fertilizer is the residuum, which plots where the composition of the silicocarbonatite, sovite and pyroxenite overlap. This may indicate that the residuum is an ideal mixed composition of the three rock types.

The second element important for plant growth is K. On the bivariate plot of K_2O vs SiO_2, the highest amounts of K_2O are in the quartz-rich carbonatite and silicocarbonatite, but the residuum contains relatively low K_2O, similar to the sovite (Figure 26). Although whole rock geochemical data indicates abundances of different elemental oxides in the rocks and overlying weathered horizon, it's important to note that not all of these are plant-available nutrients. In other words, the amount of a certain element taken up from the plant will differ from the amount that is bound in the minerals in the rock. ***We recommend that BAI invest in having the plant-available nutrients determined for SRC samples.*** The low values of K_20 and MnO in the residuum compared to the



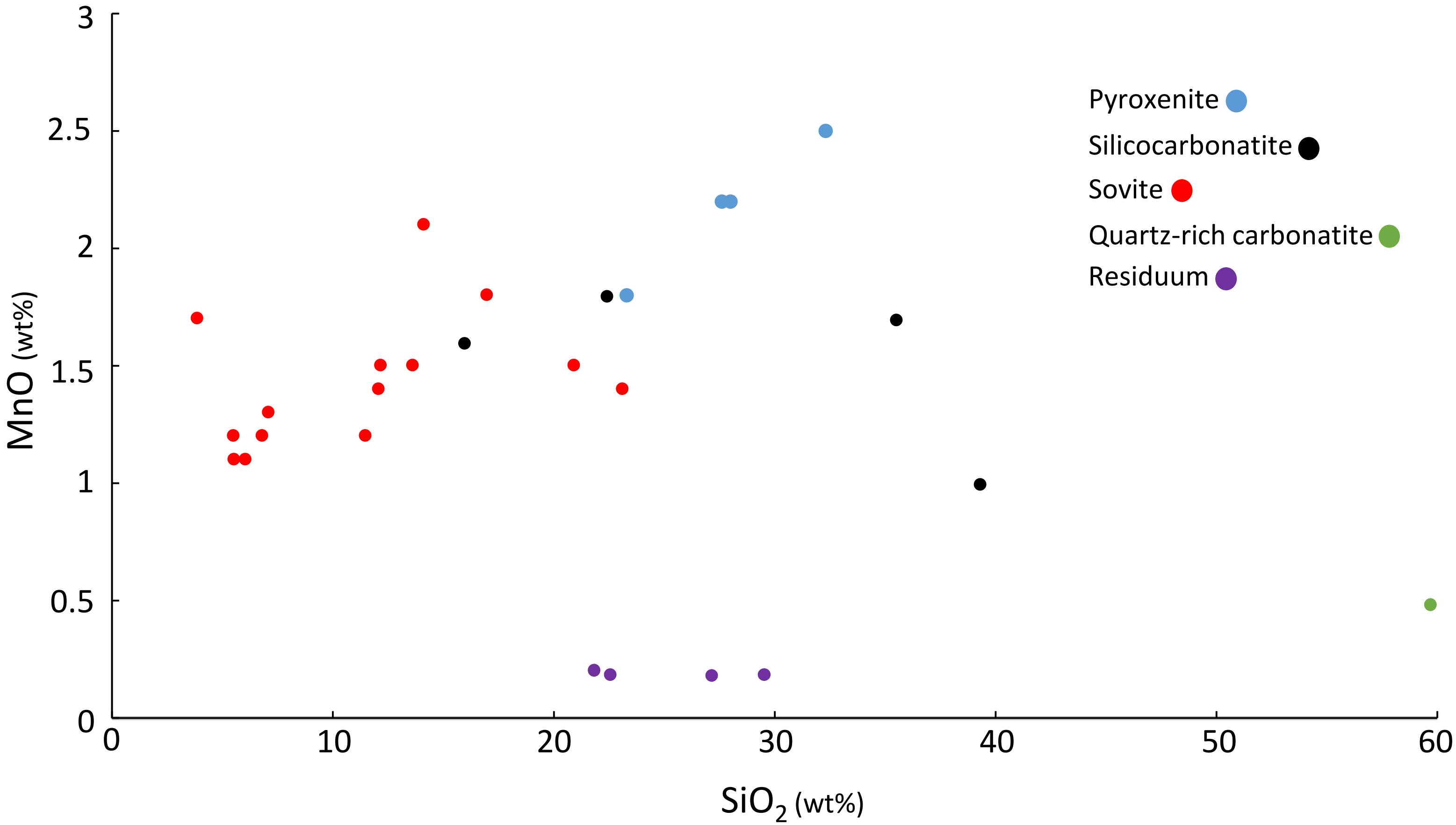
Pyroxenite
Silicocarbonatite
Sovite
Quartz-rich carbonatite
Residuum
P_2O_5 (wt%)
SiO_2 (wt%)
0
1
2
3
4
5
6
0
10
20
30
40
50
60

Figure 25



Pyroxenite
Silicocarbonatite
Sovite
Quartz-rich carbonatite
Residuum
K_2O (wt%)
SiO_2 (wt%)
0
1
2
3
4
5
6
0
10
20
30
40
50
60

Figure 26



3
2.5
2
1.5
1
0.5
0
MnO (wt%)
0
10
20
30
40
50
60
SiO2 (wt%)
Pyroxenite
Silicocarbonatite
Sovite
Quartz-rich carbonatite
Residuum

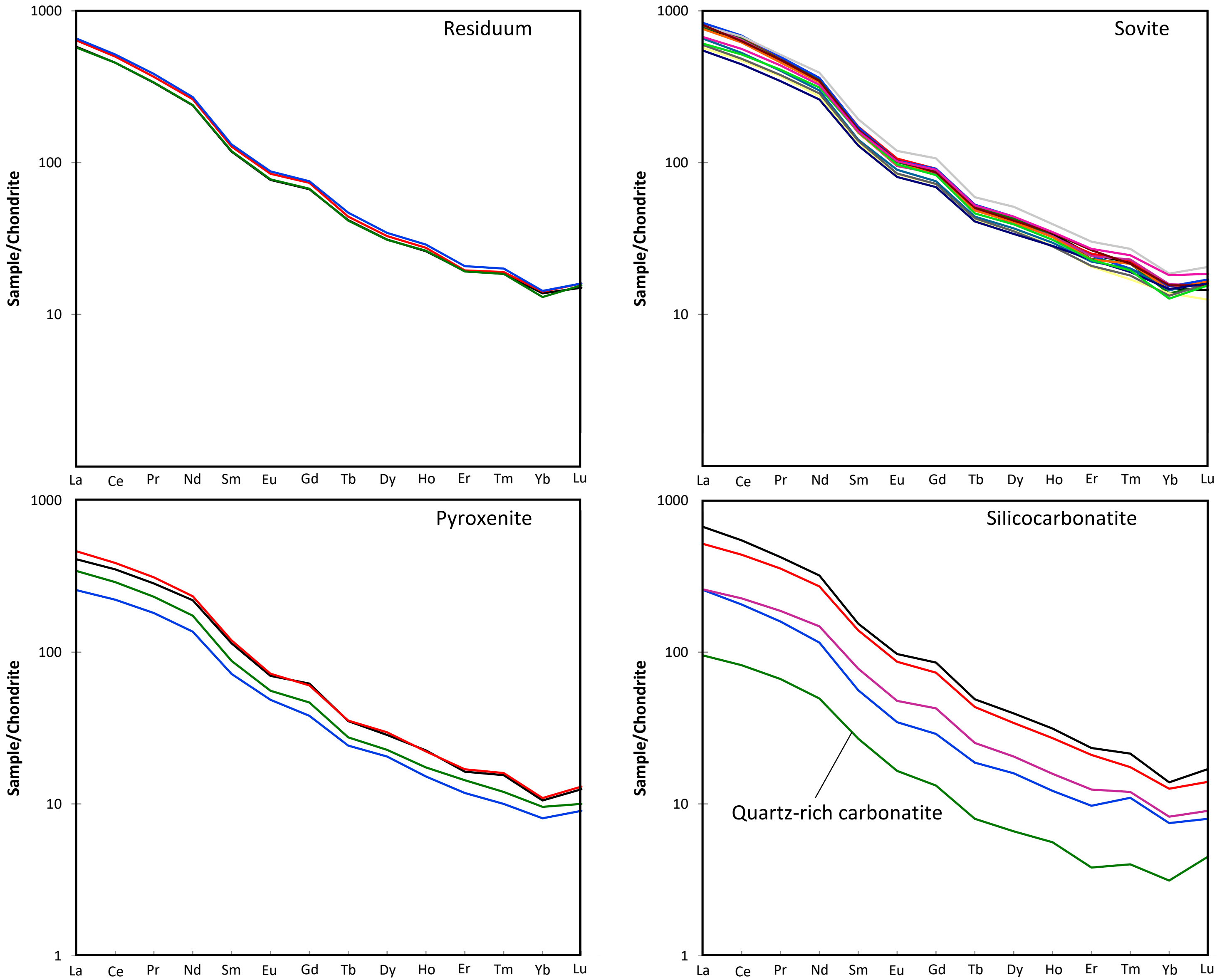
Figure 27

underlying rock units (Figures 26, 27) are consistent with mobilization of the large ion lithophile elements (LILE) in the weathered horizon, which is represented by the residuum. Although the relatively low abundances of K_2O and MnO indicate that there is more potassium and manganese in the rock units underlying the residuum, it may be possible that the amount of these elements available to the plants from the residuum is sufficient to produce an optimal agromineral fertilizer.

An analysis of the REEs in samples from the sovite, pyroxenite, silicocarbonatite and quartz-rich carbonatite shows that the patterns are identical, which indicates that they are petrogenetically realted (i.e. from the same magma source). Although the patterns are identical, the abundances differ with the sovite samples being more enriched in the REEs overall (Figure 28). Because apatite is a host for the REEs, specifically as a result of elemental substitutions that occur during their formation or later hydrothermal alteration (e.g. metasomatism), it can be inferred that the sovite is the rock unit within the SRC that contains the greatest number of apatite minerals. This can be easily determined through petrographic point counting of samples from all the SRC units, including the residdum. ***We therefore recommend that BAI support a detailed petrographic study of the number of apatite minerals in each unit, with a focus on distinguishing different textural types.***

3.0 Conclusions

The major objective of the Engage project was to determine if apatite grains from different units of the SRC vary in composition. The results indicate that there are different types of apatite grains in terms of morphology (e.g. amorphous, euhedral) and overgrowths (none, one or multiple zones), but none of these are distinctive of specific units. All types of apatite grains were identified in all units sampled. We did, however, distinguish geochemical differences between zones within individual grains, which indicates that primary magmatic apatite has been altered. In addition, we were able to clearly distinguish between different rock units based on the abundances of major oxides and REEs. It was also clear that the material currently used for agromineral fertilizer – the residuum, contains an amount of P_2O_5 that is consistent with homogenization of the pyroxenite, sovite and silicocarbonatite. The percentages of MnO and K_2O, (Mn and K both being essential for plant growth) in the residuum were very low compared to all other rock units, which indicates that either: 1) one or a combination of many of the other units could be mined for agromineral fertilizer when the residuum has all been removed, or 2) the low percentages are all that the plant



Residuum
Sovite
Pyroxenite
Silicocarbonatite
Quartz-rich carbonatite
Sample/Chondrite
1000
100
10
1
La
Ce
Pr
Nd
Sm
Eu
Gd
Tb
Dy
Ho
Er
Tm
Yb
Lu

Figure 28

requires for growth. The former hypothesis could be tested by grinding different combinations of the units and applying them to plants growing in a controlled environment. This could easily be done in the Biotron at the University of Western Ontario or at the Environmental Sciences Western Field Station. The latter hypothesis should be tested by analyzing for plant-available nutrients.

In preparation for EPMA, CL and BSE, we quickly examined the thin sections of the samples from different units, and in doing so, were able to distinguish between different grain textures. Because grain textures provide significant clues concerning the processes that have affected the apatite grains, we recommend that detailed petrography be conducted on the samples. Core logging and outcrop observation indicated that the units composing the SRC are highly intercalated and therefore, it is challenging to map out the geometry of the complex. Additional inclined drill cores would substantially help in this regard and possibly allow a model to be developed for the SRC.
In the coming months, we will analyze biotite grains using EPMA and BSE to determine if it is also a site for P_2O_5 in the complex.

References

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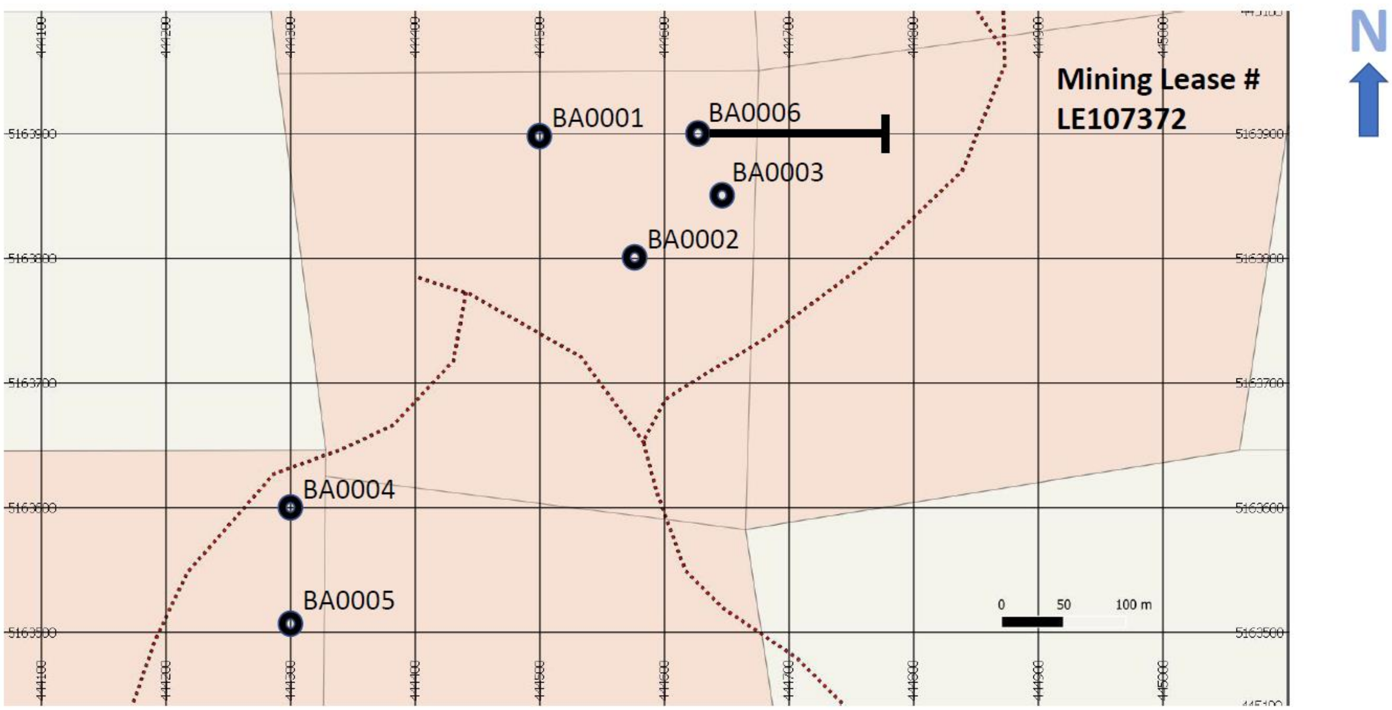
Woolley, A.R. and Kjarsgaard, B.A., 2008. Carbonatite occurrences of the world: Map and database. Geological Survey of Canada Open File 5796.

Section C. Geochemical Data

Table 1 - Drill Hole Location Summary

Proposed Hole #	BHID	Depth (m)	Azi	Dip	Section	Line	Easting	Northing	Elevation	Completion Date
P1	BA0001	30	0	-90	39	45	444505	5163899	348	11/02/2018
P2	BA0002	30	0	-90	38	46	444577	5163811	356	11/05/2018
P3	BA0003	30	0	-90	38.5	46.5	444657	5163849	345	11/06/2018
P4	BA0004	30	0	-90	36	43	444295	5163596	355	11/08/2018
P5	BA0005	30	0	-90	35	43	444297	5163515	362	11/13/2018
P6	BA0006	200	90	-45	39	46	444635	5163900	353	12/02/2018

Figure 4 – Drill Hole Location Map



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Finalized Date: 30- JAN- 2019
Account: BAISEMMT

CERTIFICATE SD19013441

Project: 2018 DD- BOREAL

This report is for 26 Drill Core samples submitted to our lab in Sudbury, ON, Canada on 18- JAN- 2019.

The following have access to data associated with this certificate:

CHRIS CARON	JOHN POLLESEL	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI- 21	Received Sample Weight
LOG- 22	Sample login - Rcd w/o BarCode
CRU- 31	Fine crushing - 70% <2mm
CRU- QC	Crushing QC Test
PUL- QC	Pulverizing QC Test
SPL- 21	Split sample - riffle splitter
PUL- 31	Pulverize split to 85% <75 um

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
ME- 4ACD81	Base Metals by 4- acid dig.	ICP- AES
PGM- ICP23	Pt, Pd, Au 30g FA ICP	ICP- AES
ME- ICP06	Whole Rock Package - ICP- AES	ICP- AES
OA- GRA05	Loss on Ignition at 1000C	WST- SEQ
ME- MS81	Lithium Borate Fusion ICP- MS	ICP- MS
TOT- ICP06	Total Calculation for ICP06	

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature:
Colin Ramshaw, Vancouver Laboratory Manager

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Finalized Date: 30-JAN-2019
Account: BAISEMMT

Project: 2018 DD-BOREAL

CERTIFICATE OF ANALYSIS SD19013441

Sample Description	Method / Analyte / Units / LOD	WEI-21 Recvd Wt. kg 0.02	ME-MS81 Ba ppm 0.5	ME-MS81 Ce ppm 0.1	ME-MS81 Cr ppm 10	ME-MS81 Cs ppm 0.01	ME-MS81 Dy ppm 0.05	ME-MS81 Er ppm 0.03	ME-MS81 Eu ppm 0.03	ME-MS81 Ga ppm 0.1	ME-MS81 Gd ppm 0.05	ME-MS81 Hf ppm 0.2	ME-MS81 Ho ppm 0.01	ME-MS81 La ppm 0.1	ME-MS81 Lu ppm 0.01	ME-MS81 Nb ppm 0.2
S895305		3.89	536	333	<10	0.90	9.88	3.75	5.85	12.6	17.15	4.0	1.57	161.0	0.34	65.2
S895306		5.22	380	215	10	0.95	7.12	2.61	4.20	15.2	12.45	8.4	1.13	98.4	0.25	214
S895307		2.03	506	44.5	110	0.27	2.18	1.05	1.16	20.3	2.56	1.9	0.38	21.4	0.14	4.7
S895308		4.89	369	397	<10	0.57	10.50	3.93	6.32	8.7	17.55	2.2	1.69	185.5	0.29	27.0
S895309		4.70	283	412	<10	0.27	10.55	4.02	6.37	6.6	18.20	4.7	1.62	193.5	0.33	26.0
S895310		1.42	308	419	<10	0.60	11.00	3.89	6.18	8.0	18.25	2.2	1.63	200.0	0.34	26.5
S895311		3.14	370	237	<10	1.18	7.41	2.71	4.33	14.1	12.10	8.7	1.11	111.0	0.26	129.5
S895312		4.37	334	399	<10	0.63	10.70	3.70	6.05	8.2	17.30	1.6	1.64	188.5	0.31	31.0
S895313		4.19	369	393	<10	0.70	9.95	3.88	5.70	9.1	16.95	1.9	1.64	192.0	0.31	60.0
S895314		4.31	357	322	<10	0.84	9.21	3.56	5.38	12.4	15.05	3.8	1.48	158.0	0.33	102.5
S895315		3.96	404	135.5	<10	1.30	5.14	1.89	2.92	18.3	7.62	9.9	0.76	61.6	0.18	183.0
S895316		3.79	408	176.5	<10	1.30	5.69	2.30	3.35	17.3	9.33	8.5	0.87	82.6	0.20	184.0
S895317		2.93	266	377	<10	0.53	10.10	3.67	5.79	8.8	17.30	4.3	1.61	182.5	0.33	49.8
S895318		1.81	555	414	<10	0.63	12.80	4.81	7.17	10.1	21.3	2.7	1.97	192.0	0.41	37.9
S895319		1.05	613	287	<10	1.60	8.87	3.29	5.03	19.8	14.40	3.7	1.42	137.0	0.25	94.6
S895320		1.40	676	268	<10	0.95	8.55	3.37	5.19	13.2	14.70	5.4	1.36	124.5	0.28	107.5
S895321		3.21	454	295	<10	0.74	8.82	3.33	5.08	15.4	14.45	8.9	1.40	143.0	0.32	55.7
S895322		2.64	514	385	<10	0.90	10.35	4.23	6.18	11.7	17.25	2.7	1.72	194.0	0.31	38.7
S895323		2.24	1235	126.0	<10	1.80	3.99	1.56	2.08	25.3	5.80	6.8	0.61	61.9	0.16	116.5
S895324		2.43	1205	50.2	<10	0.59	1.65	0.61	0.99	29.4	2.65	9.9	0.28	22.9	0.09	120.5
S895325		2.48	836	271	<10	1.31	8.48	3.66	4.83	16.6	13.80	2.8	1.41	131.5	0.32	63.5
S895326		1.57	735	138.0	<10	1.79	5.13	1.99	2.87	20.5	8.54	7.8	0.79	62.3	0.18	159.5
S895327		3.93	637	314	<10	1.61	9.81	3.64	5.84	15.9	16.55	3.3	1.55	146.0	0.31	76.9
S895328		4.46	223	342	<10	0.18	11.00	4.32	6.11	5.3	17.95	2.2	1.74	161.5	0.37	35.6
S895329		4.25	438	363	<10	0.82	10.10	3.99	6.12	12.5	17.65	5.3	1.59	171.0	0.29	61.8
S895330		1.70	579	283	<10	0.92	8.74	3.39	5.28	14.2	15.70	5.9	1.36	133.0	0.29	103.0

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Account: BAISEMMT

Project: 2018 DD- BOREAL

CERTIFICATE OF ANALYSIS SD19013441

Sample Description	Method / Analyte / Units / LOD	ME- MS81 Nd ppm 0.1	ME- MS81 Pr ppm 0.03	ME- MS81 Rb ppm 0.2	ME- MS81 Sm ppm 0.03	ME- MS81 Sn ppm 1	ME- MS81 Sr ppm 0.1	ME- MS81 Ta ppm 0.1	ME- MS81 Tb ppm 0.01	ME- MS81 Th ppm 0.05	ME- MS81 Tm ppm 0.01	ME- MS81 U ppm 0.05	ME- MS81 V ppm 5	ME- MS81 W ppm 1	ME- MS81 Y ppm 0.1	ME- MS81 Yb ppm 0.03
S895305		147.5	38.1	47.7	23.2	2	3450	6.7	1.96	5.59	0.43	0.61	182	<1	38.6	2.22
S895306		101.5	25.6	49.1	17.20	4	1730	23.4	1.41	6.90	0.31	1.10	385	<1	25.9	1.69
S895307		19.9	5.16	41.0	3.55	1	521	0.3	0.34	3.93	0.14	0.44	116	<1	9.5	0.87
S895308		164.5	42.9	24.6	25.6	1	3960	1.7	2.09	9.19	0.44	0.31	159	<1	40.0	2.35
S895309		166.5	44.5	14.0	25.9	2	3750	1.7	2.11	11.55	0.45	0.53	150	<1	40.5	2.44
S895310		166.5	44.7	24.1	25.7	1	4110	2.3	2.11	9.79	0.40	0.31	91	<1	40.2	2.44
S895311		107.5	28.1	51.1	17.95	3	2220	16.6	1.42	6.24	0.32	0.46	270	<1	27.0	1.75
S895312		160.5	42.8	29.0	24.7	1	4410	3.1	2.05	7.30	0.43	0.27	68	<1	40.7	2.20
S895313		158.0	42.4	30.8	23.8	1	4280	5.6	1.99	6.90	0.46	2.54	98	1	39.9	2.52
S895314		137.5	36.3	42.1	21.2	2	3580	10.3	1.76	5.40	0.40	4.37	156	<1	35.1	2.30
S895315		62.9	16.35	58.6	10.80	4	1225	18.3	0.97	4.25	0.20	0.42	472	<1	17.1	1.29
S895316		80.3	20.9	60.4	13.15	4	1775	22.6	1.10	4.36	0.24	0.49	353	<1	21.0	1.53
S895317		155.0	41.1	25.4	23.6	2	3720	5.7	1.93	7.25	0.43	0.38	163	<1	37.6	2.34
S895318		180.5	46.3	47.0	29.0	1	3520	2.1	2.37	4.80	0.54	0.42	193	<1	50.2	2.97
S895319		126.0	33.3	62.5	20.0	2	2940	7.5	1.68	7.10	0.34	1.75	308	<1	33.8	2.20
S895320		125.0	32.0	55.3	20.9	6	2660	14.4	1.74	8.24	0.35	1.52	189	1	31.6	2.02
S895321		131.5	34.0	36.5	20.9	2	2880	5.3	1.72	8.49	0.36	0.71	150	<1	33.4	2.12
S895322		159.0	42.8	50.1	24.7	1	3940	2.6	2.01	7.18	0.43	0.53	89	<1	41.1	2.48
S895323		53.3	14.35	66.7	8.44	2	1985	5.6	0.75	4.44	0.22	1.55	89	<1	15.3	1.20
S895324		22.8	5.99	68.0	4.04	3	461	9.0	0.32	3.87	0.08	2.97	144	1	6.0	0.50
S895325		120.0	31.0	74.9	19.40	1	3090	4.3	1.64	3.90	0.38	1.12	103	<1	34.5	2.35
S895326		68.2	16.90	87.9	11.70	4	1150	19.0	1.01	3.97	0.24	0.61	237	<1	18.9	1.32
S895327		143.5	36.9	86.8	23.9	3	2730	7.8	1.85	7.18	0.39	0.56	205	1	35.4	2.03
S895328		149.5	39.4	9.1	24.1	1	3780	5.0	2.09	8.24	0.49	0.41	124	<1	42.0	2.90
S895329		159.0	41.2	37.5	25.2	2	3620	5.0	2.04	8.39	0.43	0.55	185	<1	38.5	2.42
S895330		128.0	33.7	54.5	20.7	12	2750	9.7	1.75	6.39	0.40	0.79	233	2	32.6	2.18

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25-109 ORMONT DR N
YORK ON M9L 2Z1

Finalized Date: 30-JAN-2019
Account: BAISEMMT

Project: 2018 DD-BOREAL

CERTIFICATE OF ANALYSIS SD19013441

Sample Description	ME-MS81	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	ME-ICP06	OA-CRA05
Method / Analyte	Zr	SiO2	Al2O3	Fe2O3	CaO	MgO	Na2O	K2O	Cr2O3	TiO2	MnO	P2O5	SrO	BaO	LOI
Units	ppm	%	%	%	%	%	%	%	%	%	%	%	%	%	%
LOD	2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.002	0.01	0.01	0.01	0.01	0.01	0.01
S895305	269	15.95	4.45	7.71	36.3	3.09	1.92	1.92	<0.002	0.90	0.16	2.96	0.39	0.06	23.4
S895306	483	28.0	4.16	15.05	25.7	4.86	2.73	2.38	<0.002	2.09	0.22	2.34	0.20	0.04	10.85
S895307	68	57.4	17.75	6.23	7.39	4.49	3.08	1.68	0.015	0.52	0.07	0.16	0.06	0.05	2.66
S895308	153	5.48	1.26	6.92	47.7	1.81	0.30	1.00	<0.002	0.55	0.12	3.72	0.46	0.04	31.4
S895309	318	6.78	0.82	5.71	47.9	1.81	0.82	0.52	<0.002	0.42	0.12	3.89	0.44	0.03	31.3
S895310	155	5.51	1.20	4.69	48.6	1.75	0.33	0.91	<0.002	0.38	0.11	3.63	0.48	0.03	31.9
S895311	604	23.3	3.59	10.50	30.9	4.95	1.92	2.01	<0.002	1.14	0.18	3.16	0.26	0.04	16.55
S895312	119	6.02	1.36	3.93	49.6	1.80	0.29	1.04	<0.002	0.35	0.11	3.20	0.51	0.04	32.9
S895313	156	7.07	1.52	4.93	47.9	2.15	0.41	1.15	<0.002	0.42	0.13	3.18	0.50	0.04	31.1
S895314	282	13.60	2.96	6.66	40.8	3.14	1.44	1.55	<0.002	0.63	0.15	2.99	0.42	0.04	26.0
S895315	549	32.3	4.31	17.40	21.2	6.03	2.45	2.44	<0.002	2.37	0.25	0.97	0.14	0.04	8.14
S895316	491	27.6	4.15	14.05	26.2	5.47	2.17	2.47	<0.002	1.86	0.22	1.57	0.21	0.04	13.55
S895317	330	12.05	1.43	6.76	43.5	2.56	0.82	0.90	<0.002	0.51	0.14	3.56	0.43	0.03	26.1
S895318	135	12.15	2.59	8.91	39.7	2.76	0.83	1.59	<0.002	0.96	0.15	5.22	0.41	0.06	22.8
S895319	267	14.10	5.18	16.15	32.7	3.06	1.76	2.41	<0.002	1.71	0.21	2.80	0.34	0.07	21.4
S895320	272	22.4	5.38	9.66	31.4	4.53	2.33	2.30	<0.002	1.33	0.18	4.05	0.31	0.07	16.90
S895321	504	20.9	5.96	7.21	32.9	2.68	3.14	1.81	<0.002	0.67	0.15	3.33	0.34	0.05	19.65
S895322	156	11.45	3.79	6.16	41.5	2.55	1.27	1.83	<0.002	0.69	0.12	2.57	0.46	0.05	28.3
S895323	382	39.3	13.70	4.23	16.40	0.95	6.27	4.66	<0.002	0.38	0.10	0.95	0.23	0.13	12.15
S895324	477	59.9	15.95	4.24	3.65	0.61	6.73	6.30	<0.002	0.28	0.05	0.54	0.05	0.13	2.44
S895325	141	23.1	8.43	6.67	29.0	1.98	3.67	3.11	<0.002	0.78	0.14	2.61	0.36	0.09	19.60
S895326	356	35.5	12.05	11.65	14.50	3.48	6.67	3.50	<0.002	1.58	0.17	1.84	0.13	0.08	7.40
S895327	149	16.95	4.35	11.55	32.3	5.58	0.65	3.24	<0.002	1.51	0.18	4.99	0.32	0.07	17.75
S895328	179	3.84	0.36	6.55	49.3	3.07	0.14	0.34	<0.002	0.35	0.17	4.83	0.44	0.02	31.8
S895329	350	13.60	3.49	8.04	40.5	2.72	1.58	1.55	<0.002	0.71	0.15	3.80	0.42	0.05	24.5
S895330	301	20.9	5.15	10.85	32.0	3.69	2.38	2.22	<0.002	1.27	0.17	3.42	0.33	0.06	18.00

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25-109 ORMONT DR N
YORK ON M9L 2Z1

Finalized Date: 30-JAN-2019
Account: BAISEMMT

Project: 2018 DD-BOREAL

CERTIFICATE OF ANALYSIS SD19013441

Sample Description	Method	TOT-ICP06	ME-4ACD81	ME-4ACD81	ME-4ACD81	ME-4ACD81	ME-4ACD81	ME-4ACD81	ME-4ACD81	ME-4ACD81	ME-4ACD81	ME-4ACD81	ME-4ACD81	ME-4ACD81	PGM-ICP23	PGM-ICP23
	Analyte	Total	Ag	As	Cd	Co	Cu	Li	Mo	Ni	Pb	Sc	Tl	Zn	Au	Pt
	Units	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
	LOD	0.01	0.5	5	0.5	1	1	10	1	1	2	1	10	2	0.001	0.005
S895305		99.21	<0.5	<5	0.6	16	25	<10	1	2	4	2	<10	70		
S895306		98.62	<0.5	<5	0.5	30	117	10	1	12	<2	8	10	96	<0.001	<0.005
S895307		101.56	<0.5	<5	<0.5	24	25	10	1	23	7	12	10	53	<0.001	<0.005
S895308		100.76	<0.5	<5	<0.5	9	8	<10	1	3	<2	<1	<10	58		
S895309		100.56	<0.5	<5	<0.5	6	6	<10	<1	4	5	1	<10	44		
S895310		99.52	<0.5	<5	0.6	9	19	<10	<1	3	<2	<1	<10	42		
S895311		98.50	<0.5	<5	0.6	17	55	<10	1	3	2	3	10	89	<0.001	<0.005
S895312		101.15	<0.5	<5	<0.5	8	21	<10	<1	3	<2	<1	<10	39		
S895313		100.50	<0.5	<5	0.5	8	20	<10	<1	3	2	<1	<10	45		
S895314		100.38	<0.5	<5	0.6	12	26	<10	1	4	3	1	10	60		
S895315		98.04	<0.5	<5	0.8	25	77	10	1	2	<2	6	10	130	<0.001	<0.005
S895316		99.56	<0.5	<5	0.7	20	51	10	<1	4	2	5	<10	117		
S895317		98.79	<0.5	<5	0.6	15	55	<10	<1	8	2	1	<10	50		
S895318		98.13	<0.5	<5	0.5	22	37	<10	1	5	<2	1	<10	73		
S895319		101.89	<0.5	<5	0.5	16	7	10	1	2	2	<1	10	145		
S895320		100.84	<0.5	<5	0.5	20	42	<10	<1	3	2	3	<10	87		
S895321		98.79	<0.5	<5	0.5	9	13	<10	<1	1	5	2	<10	61		
S895322		100.74	<0.5	<5	<0.5	11	10	<10	<1	3	4	<1	<10	59		
S895323		99.45	<0.5	<5	<0.5	3	5	<10	1	<1	<2	<1	<10	41		
S895324		100.87	<0.5	<5	<0.5	1	1	<10	2	<1	3	1	<10	18		
S895325		99.54	<0.5	<5	<0.5	11	11	10	1	1	4	<1	<10	77		
S895326		98.55	<0.5	<5	<0.5	16	26	10	1	1	<2	2	<10	102		
S895327		99.44	<0.5	<5	<0.5	21	47	10	1	3	3	2	<10	108		
S895328		101.21	<0.5	<5	0.6	8	2	<10	1	2	4	2	<10	48		
S895329		101.11	<0.5	<5	<0.5	12	16	<10	1	3	4	2	<10	67		
S895330		100.44	<0.5	<5	<0.5	19	76	10	1	15	2	2	<10	83	<0.001	<0.005

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Finalized Date: 30- JAN- 2019
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Project: 2018 DD- BOREAL

CERTIFICATE OF ANALYSIS SD19013441

Sample Description	Method / Analyte / Units / LOD	PGM- ICP23 Pd ppm 0.001	CRU- QC Pass2mm % 0.01	PUL- QC Pass75um % 0.01
S895305			85.7	85.7
S895306		0.008		92.7
S895307		0.001		
S895308				
S895309				
S895310				
S895311		0.001		
S895312				
S895313				
S895314				
S895315		<0.001		
S895316				
S895317				
S895318				
S895319				
S895320				
S895321				
S895322				
S895323				
S895324				
S895325				
S895326				
S895327				
S895328				
S895329				
S895330		0.001		

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CERTIFICATE OF ANALYSIS SD19013441

CERTIFICATE COMMENTS

LABORATORY ADDRESSES

Processed at ALS Sudbury located at 1351- B Kelly Lake Road, Unit #1, Sudbury, ON, Canada.

Applies to Method:	CRU- 31	CRU- QC	LOG- 22	PUL- 31
	PUL- QC	SPL- 21	WEI- 21	

Processed at ALS Vancouver located at 2103 Dollarton Hwy, North Vancouver, BC, Canada.

Applies to Method:	ME- 4ACD81	ME- ICP06	ME- MS81	OA- GRA05
	PGM- ICP23	TOT- ICP06		

Specifications of Laboratory and Petrographic Instruments (SEM)

- The polished thin sections from core samples were initially surveyed for apatite grains at various magnifications using a Nikon Eclipse E600POL microscope equipped with a Nikon DXM1200 digital camera.

- Selected apatite grains were later imaged using backscattered electrons (BSE) and cathodoluminescence (CL) to identify any internal zoning using a JEOL JXA-8530F field-emission electron microprobe at the Earth and Planetary Materials Analysis Laboratory at Western University. Grains that displayed zoning were further analyzed for major elements and REE using the same microprobe; several spots were analyzed across individual apatite grains showing zoning. Probe conditions for apatite analyses were 15 kV accelerating voltage and ~10 nA (variable) current using wavelength-dispersive spectroscopy (WDS) detectors.

JXA-8530F Field Emission Electron Probe Microanalyzer

Specifications

Detectable element range WDS： (Be*) / B～U,EDS: B～U

Detectable X-ray range Detectable wavelength range with WDS : 0.087 to 9.3nm

Detectable energy range with EDS : 20keV

Number of spectrometers WDS: Up to 5 selectable, EDS: 1

Maximum specimen size 100 mm × 100 mm × 50 mm (H)

Accelerating voltage 1 to 30 kV (0.1 kV steps)

Probe current range 10-12 to 5×10-7 A

Probe current stability ± 0.3 % /h

Secondary electron image resolution 3 nm (W.D. 11 mm, 30 kV)

Minimum probe size 40 nm (10 kV, 1×10-8 A)

100 nm (10 kV, 1×10-7 A)

Scanning magnification × 40 to × 300,000 (W. D. 11 mm)

Scanning image resolution Maximum 5,120 × 3,840

Color display For EPMA analysis : LCD 1,280×1,024

For SEM operation and EDS analysis : LCD 1,280×1,024

Section D. Invoices, Expenses

Boreal AGROMINERALS INC

Expense Summary

Date	Description of Work	Vendor	Quantity	Units	Unit Rate	Total	Reference
Nov-Dec, 2018	Core Drilling Supervision	Chris Caron	30	hours	80	2400.00	Chris Caron Invoice #18010
Jan 10-15, 2019	Prep and sample drill core	Chris Caron	18	hours	80	1440.00	Chris Caron Invoice #19002
Jan 30, 2019	Geochemical Analysis	ALS	26	each	76.81	1997.06	ALS Invoice #4608564
May 9, 2019	UWO Site visit, supervision	Chris Caron	10	hours	80	800.00	Chris Caron Invoice #19002
June 6,7, 2019	Supervise/facilitate UWO core logging	Chris Caron	16	hours	80	1280.00	Chris Caron Invoice #19003
Aug 1-3, 2019	Wash outcrop for UWO mapping	Chris Caron	30	hours	80	2400.00	Chris Caron Invoice #19007
Aug 1-3, 2019	Wash outcrop for UWO mapping	Autowash	32.5	hours	100	3250.00	Autowash Invoice #940365
Aug 6-8, 2019	Supervise/facilitate UWO mapping at site	Chris Caron	30	hours	80	2400.00	Chris Caron Invoice #19007
Aug 12, 2019	Boreal/UWO consultaion, data exchange	Chris Caron	8	hours	80	640.00	Chris Caron Invoice #19007
April 20, 2020	Report writing	Chris Caron	8	hours	80	640.00	