



**UNIVERSIDADE FEDERAL DE MINAS GERAIS
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PROGRAMA DE PÓS-GRADUAÇÃO EM GEOLOGIA**



Evolução do Batólito Itaporé e rochas encaixantes, Orógeno Araçuaí (MG): geoquímica, geocronologia e petrogênese

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Evolução do Batólito Itaporé e rochas encaixantes, Orógeno Araçuaí (MG): geoquímica, geocronologia e petrogênese.

Dissertação apresentada ao programa de Pós-graduação em Geologia do Instituto de Geociências da Universidade Federal de Minas Gerais como requisito para obtenção do título de mestre em Geologia

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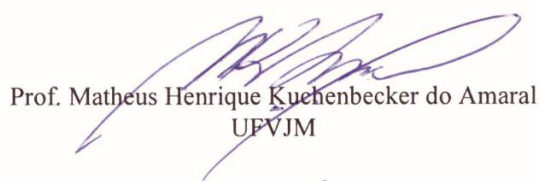
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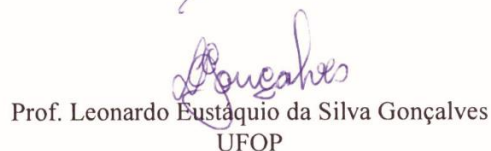
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“The truth is out there”
(The X-files)

RESUMO

O Orógeno Araçuaí (SE do Brasil) é marcado por um longo período de atividade magmática, englobando desde a fase pré-colisional (ca.630 Ma) a pós-colisional (ca.480 Ma). Na porção norte deste orógeno é notável a grande quantidade de intrusões relacionadas as fases orogênicas tardi- a pós-colisionais. O Batólito Itaporé (IB) situado na região de Coronel Murta-Itinga é considerado o mais importante representante da Supersuíte G4 (ca.530-500 Ma) atribuído ao magmatismo pós-colisional do Orógeno Araçuaí. O IB pode ser dividido em três litotipos principais, biotita granito, leucogranito a duas micas e granito pegmatoide. Sua porção ocidental é dominado por biotita monzogranitos, ao passo que a oriental consiste em leucogranitos a duas micas (sienogranitos a monzogranitos) que localmente apresentam contato gradacional com corpos pegmatoides subordinados. Idades inéditas U-Pb (ICP-MS) obtidas em apatita, monazita e zircão das rochas de IB revelaram uma longa e complexa história evolutiva de 540 a 474 Ma, englobando cristalização magmática, atividade deutérica e metamorfismo térmico. Datação em zircão proveu idades de *emplacement* em torno de 540 Ma para os biotita granitos. Assinaturas geoquímicas do biotita granito e do leucogranito a duas micas refletem processos petrogenéticos e fontes de magma distintas. Por outro lado, evidências constatadas na petrografia, química mineral e idades U-Pb em monazita revelam uma fase evolutiva comum de percolação de fluidos, entre 522 Ma e 527 Ma, relacionada ao escape de fluidos e voláteis durante a alteração deutérica do leucogranito a duas micas. Finalmente, o período evolutivo mais jovem (508 – 474 Ma) registrado por idades de monazite, apatita e zircão dos granitos a biotita e a duas micas, se relaciona a estabilização final do Orógeno Araçuaí durante suas fases pós-colisionais mais avançadas. Ainda focando na evolução geodinâmica do Orógeno Araçuaí, outro objeto desse estudo foram as rochas encaixantes que incluem grauvacas, pelitos e ortoconglomerados da Formação Salinas, metamorfisados desde a zona da biotita fácies xisto verde até a zona da sillimanita da fácies anfibolito. Com base em assinaturas litoquímicas foram feitas aproximações sobre as possíveis áreas fontes e ambiência tectônica que contribuíram para o preenchimento da Bacia Salinas. Os dados litoquímicos indicam intemperismo químico restrito nas fontes de sedimentos e proveniência de áreas-fonte relativamente próximas. Nota-se uma boa correlação entre as composições litoquímicas e mineralógicas, em relação às variações de quantidade de minerais metamórficos típicos de frações pelítica (micas, granada e outros silicatos peraluminosos) e psamítica (feldspatos, quartzo). A proveniência dos protolitos sedimentares está, claramente, relacionada com fontes em arcos magmáticos e margem continental ativa, sugerindo como fonte principal o Arco Rio Doce no contexto geotectônico do Orógeno Araçuaí.

ABSTRACT

The Araçuaí orogen (SE Brazil) records a long period of magmatic activity from the earliest pre-collisional (ca. 630 Ma) to the latest post-collisional (ca. 480 Ma) intrusions. The Itaporé batholith, located in the Coronel Murta - Itinga region (southeast Brazil), includes a number of granitic bodies that has been ascribed to the post-collisional G4 supersuite (ca. 530-500 Ma). According to field and analytical data, this batholith has been subdivided into three main granitic facies: i) biotite granite (Qtz + Kfs + Pl + Bt + Ap + Zrn ± Ms ± Mnz ± Ttn ± Aln), ii) two-mica leucogranite (Qtz + Kfs + Pl + Ms + Bt ± Grt + Zrn + Mnz + Ap ± Tur), and iii) pegmatoid granite (Kfs + Qz + Pl + Ms ± Bt ± Ap ± Tur ± Grt ± Brl). The western part of the batholith is dominated by biotite monzogranite while the eastern part consists of leucogranites (syenogranites to monzogranites) locally presenting gradational contacts with pegmatoid granite. U-Pb (ICP-MS) ages obtained from apatite, monazite and zircon reveal a long and complex evolution history from 540 Ma to 474 Ma, encompassing magmatic crystallization, deuteritic activity and thermal metamorphism. Dating on zircon yielded emplacement ages around 538 Ma for biotite granites. Geochemical signatures suggest two different petrogenetic processes and magma sources for the biotite and two-mica granites. On the other hand, similar evidence provided by petrographic, mineral chemistry and U-Pb monazite investigations reveal a common stage of fluid interaction between 522 Ma and 527 Ma, which are associated with volatile-rich fluids escape during deuteritic alteration of the two-mica leucogranites. The fluid evolution after magma solidification promoted element mobility under subsolidus conditions and postpone its thermal lifetime. Finally, the youngest evolution period (508 - 474 Ma) marked by monazite, apatite and zircon ages from both biotite and two-mica granites can be related to the final stabilization of the Araçuaí orogen, during the late post-collisional stage, involving fluid percolation probably related to crustal thinning and asthenospheric upwelling. Still focusing on the geodynamic evolution of the Araçuaí orogen, another object of this study are the country rocks of the Itaporé batholith that include graywackes, pelites and orthoconglomerates of the Salinas Formation, metamorphosed on the greenschist (biotite zone) to amphibolite facies (sillimanite zone). Based on lithochemical signatures we made approaches about the source areas and geotectonic settings that possibly contributed to fill the Salinas basin. The lithochemistry suggest limited chemical weathering on the sediment sources and deposition relatively close to the provenance areas. The samples show good correlations between the lithochemical and mineralogical compositions, in respect to the variable amounts of metamorphic minerals typical of pelitic (micas, garnet and other peraluminous silicates) and psammitic (feldspars, quartz) fractions. The provenance of sedimentary protoliths are clearly related to continental magmatic arc and active continental margin environments, suggesting a main provenance from the Rio Doce magmatic arc.

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1. Introdução

Nesta dissertação é apresentado um estudo detalhado dos processos magmáticos e tardi-magmáticos que atuaram nos granitos do Batólito Itaporé, através da integração de técnicas de datação de zircão, apatita e monazita, análise textural, litoquímica de elementos maiores e traços e química mineral. O Batólito Itaporé integra o vasto volume de rochas plutônicas contidas no Orógeno Araçuai, dentre aquelas pertencentes a supersuíte pós-colisional G4 representa o corpo granítico mais extenso, aproximadamente 520 Km². Nele estão contidas rochas graníticas ediacaranas a cambrianas posicionadas em um domínio totalmente ensialico.

Embora tal batólito tenha sido objeto de estudo de diversos autores (Correia Neves *et al.*, 1982; Monteiro, 1986; Pedrosa-Soares *et al.*, 1987; Paes *et al.* 2017), questões como a idade de cristalização de suas rochas graníticas, a natureza do metassomatismo e sua duração, são até então desconhecidas ou pouco compreendidas. A distinção dos episódios evolutivos desses granitos pode ainda trazer implicações diretas na compreensão do Orógeno Araçuai.

A integração de dados geocronológicos U-Pb em zircão, monazita e apatita podem ser utilizados para acessar a evolução temporal dos processos magmáticos a tardi-magmáticos, devido sua estabilidade química e temperaturas de fechamento altas a moderadas (e.g. Milloning *et al.*, 2013). Entende-se que o crescimento do zircão em rochas não metamorfisadas ocorre durante a cristalização do *melt*. A monazita é um geocronômetro robusto com alta temperatura de fechamento para Pb (>900°C, Chernik *et al.*, 2004; Gardes *et al.*, 2006), entretanto se recristaliza facilmente com a presença de fluidos, tornando-se especialmente útil na datação de episódios dessa natureza (Williams *et al.*, 2011). A apatita é um termocronômetro de média temperatura tendo em vista a temperatura de fechamento do seu sistema U-Pb (450-550°C, Cherniak *et al.*, 1991).

Neste trabalho as idades fornecidas por esses minerais separam claramente os processos de magmatismo, metassomatismo e resfriamento. Novas relações obtidas em campo, assinaturas litoquímicas combinadas, idades U-Pb e química mineral forneceram evidências de que determinados corpos graníticos não são produto do mesmo processo pretrogenético e fonte mantélica, conforme sugerido anteriormente por Paes *et al.* (2017).

Outro enfoque desse trabalho diz respeito as unidades metassedimentares da Formação Salinas, nas quais se alojam os corpos graníticos. Quais seriam as principais áreas fontes desses metassedimentos? Qual a ambiência tectônica dessas rochas?

Desta forma os trabalhos apresentados se articulam nesta dissertação com finalidade a **caracterização e compreensão do significado geotectônico os granitos do Batólito Itaporé e rochas metassedimentares entre os municípios de Turmalina e Salinas.**

1.1 Localização e acessos

As rochas estudadas ocorrem na região de Coronel Murta, nordeste de Minas Gerais. O acesso à região, a partir de Belo Horizonte, se dá pelas rodovias BR-135, BR-259 e BR-367 (Figura 1).

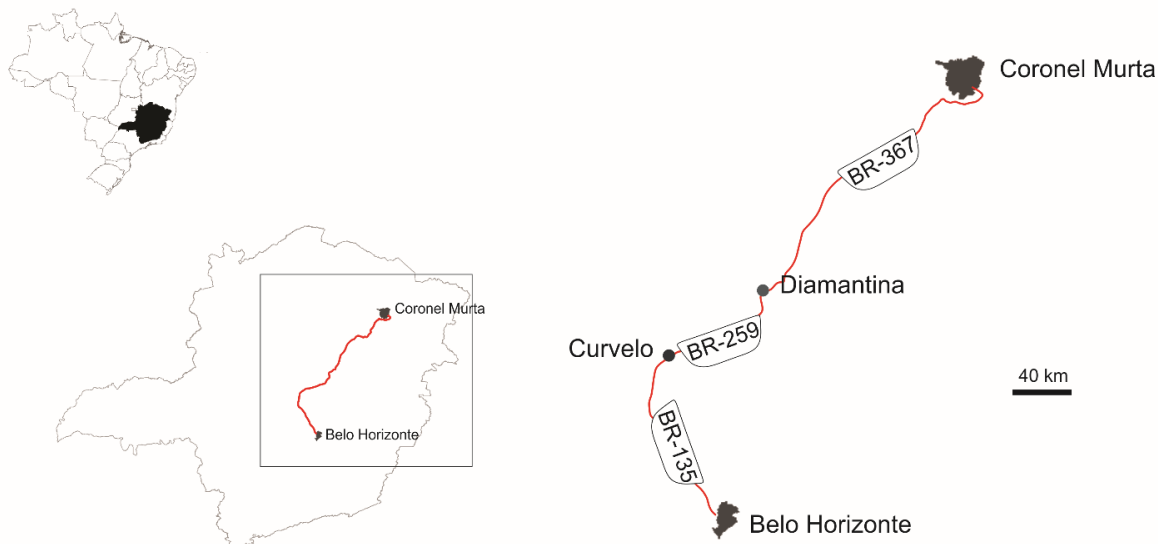


Figura 1: Localização e vias de acesso à região de Coronel Murta.

1.2 Objetivo

Através de estudos sistemáticos sobre as rochas graníticas do Batólito Itaporé e encaixantes, ao longo de seções geológicas, junto a análises petrográficas, química de rocha total, química mineral e termobarometria, visou-se alcançar os seguintes objetivos:

- Caracterização das feições de campo que sugiram processos ígneos importantes na geração dos tipos de granito presentes no interior do batólito, como por exemplo, relação de corte, variações texturais, composicionais e estruturais.
- Compreensão da relação das diferentes rochas graníticas frente a evolução magmática do batólito; por meio de análises petrográficas, química de rocha total, química mineral e termobarometria;
- Determinação das possíveis fontes dos protólitos envolvidos na produção das rochas graníticas inseridas no batólito, através de geoquímica e química mineral;
- Determinação das idades dos estágios evolutivos que aferam as rochas do Batólito Itaporé, a partir da datação das fases acessórias (zircão, monazita e apatita);
- Identificação da proveniência dos protólitos sedimentares dominantes na sedimentação da Bacia Salinas, bem como a identificação das potenciais áreas fontes relacionadas, no contexto geotectônico do Orogênio Araçuaí, por meio de dados geoquímicos.

1.3 Estrutura da Dissertação

A dissertação encontra-se estruturada na forma de quatro capítulos:

- Capítulo 1 (Introdução): neste capítulo é apresentada uma introdução ao tema desta pesquisa, a localização da área de estudo e principais objetivos.
- Capítulo 2 (Artigo 1): “*Lithochemical signature from metasedimentary rocks of the Ediacaran Salinas Formation, Araçuaí orogen, Southeast Brazil.*”

Este capítulo versa sobre a proveniência e ambiência tectônica da Formação Salinas baseado em dados litoquímicos. Seu resumo foi apresentado no 48º Congresso Brasileiro de Geologia realizado em Porto Alegre, Rio Grande do Sul. A íntegra do artigo foi submetida no dia 05 de janeiro de 2018 para a revista *Brazilian Journal of Geology*.

- Capítulo 3 (Artigo 2): “*Evolution of the Itaporé batholith, Ediacaran-Cambrian Araçuaí orogen, southeastern Brazil: Geochemical, geochronological constrain, petrogenesis and fluid interactions.*”

Neste capítulo é abordado o principal tema desenvolvido durante o mestrado: **os granitos dos arredores do município de Coronel Murta**, no qual são apresentados e discutidos dados de campo, petrográficos, litoquímicos, de química mineral e geocronológicos do Batólito Itaporé. Resumos preliminares desse estudo foram apresentados no 48º Congresso Brasileiro de Geologia (Porto Alegre, RS) e no *Primer Simposio de Tectónica Sudamerica* (Chile, Santiago) em 2016.

- Capítulo 4 (Conclusões): neste capítulo são articulados os dois temas abordados com intuito de sumarizar as principais implicações tectônicas e regionais dos resultados na evolução do Orógeno Araçuaí, bem como as conclusões obtidas.

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CAPÍTULO 2

Lithochemical signature from metasedimentary rocks of the Ediacaran Salinas Formation, Araçuaí orogen, Southeast Brazil

Assinatura litoquímica de rochas metassedimentares da Formação Salinas (Ediacarano), Orógeno Araçuaí, Sudeste do Brasil

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ABSTRACT: The Salinas Formation occurs in a large region of the northern Araçuaí orogen, southeastern Brazil. It includes greywacky sandstones, pelites and ortho-conglomerates, metamorphosed from the biotite zone of the greenschist facies to the sillimanite zone of the amphibolite facies. The Salinas Formation lies unconformably on top of the Macaúbas Group and hosts post-collisional granitic intrusions dated around 500 – 540 Ma. This study presents lithochemical data for low-grade rocks preserved from the regional deformation, found in the type-area of the Salinas Formation, and compares them with those from the deformed and more metamorphic rocks of the same unit. The lithochemical data indicate limited chemical weathering on the sediment sources and deposition relatively close to the provenance areas. The samples show good correlations between the lithochemical and mineralogical compositions, in respect to the variable amounts of metamorphic minerals typical of pelitic (micas, garnet and other peraluminous silicates) and psammitic (feldspars, quartz) fractions. The provenance of sedimentary protoliths are related to continental magmatic arc and active continental margin environments, suggesting a main provenance from the Rio Doce magmatic arc.

Keywords: lithochemistry, sediment provenance, volcanic contribution, Salinas Formation, Araçuaí orogen

RESUMO: A Formação Salinas, que ocorre em ampla área do Orógeno Araçuaí, inclui arenitos grauvaquianos, pelitos e ortoconglomerados, metamorfisados desde a zona da biotita da fácies xisto verde até a zona da sillimanita da fácies anfibolito. Esta formação repousa em discordância sobre unidades diversas do Grupo Macaúbas e é intrudida por granitos pós-colisionais datados em *ca.* 500 – 540 Ma. Este estudo apresenta dados litoquímicos das rochas indeformadas de mais baixo grau metamórfico da Formação salinas e os compara com aqueles das rochas deformadas e de mais alto metamorfismo da mesma unidade. Os dados litoquímicos indicam intemperismo químico restrito nas fontes de sedimentos e proveniência de áreas-fonte relativamente próximas. Nota-se uma boa correlação entre as composições litoquímicas e mineralógicas, em relação às variações de quantidade de minerais metamórficos típicos de frações pelítica (micas, granada e outros silicatos peraluminosos) e psamítica (feldspatos, quartzo). A proveniência dos protolitos sedimentares está, claramente, relacionada com fontes em arcos magmáticos e margem continental passiva, sugerindo como fonte principal o Arco Rio Doce no contexto geotectônico do Orógeno Araçuaí.

Palavras-chave: litoquímica; proveniência sedimentar; contribuição vulcânica; Formação Salinas; Orógeno Araçuaí

1. INTRODUCTION

Although processes like weathering, diagenesis and metamorphism may considerably change the composition of sedimentary materials from sediment sources to metamorphic rocks exposures, there are useful lithochemical approaches to investigate genetic attributes and tectonic environments of metasedimentary rocks (Bathia 1983; Bathia and Crook 1986; Rosen 1992; McLennan *et al.* 1993; Slack and Höy, 2000; Augustsson and Bahlburg 2008). The lithochemical investigation can be especially effective if combined with petrographic and isotopic studies on preserved rocks and their modified equivalents.

In the semi-arid Jequitinhonha Valley (Fig. 1), the Salinas Formation (northern Araçuaí orogen) provides a number of good exposures of non-weathered metasedimentary rocks. They vary from very low-grade metasiliclastic rocks (sandstone, pelite) preserved from the regional orogenic deformation to their deformed equivalents found up to the sillimanite zone of the amphibolite facies (Pedrosa-Soares 1995; Pedrosa-Soares *et al.* 1996, 2001, 2008; Lima *et al.*, 2002; Santos *et al.*, 2009; Peixoto *et al.*, 2017).

We present a detailed lithochemical investigation on 45 samples from the Salinas Formation, being 14 analysis from very low-grade metagraywackes preserved from orogenic deformation,

collected in the type-area of the Salinas Formation (cf. Lima et al., 2002), and 31 samples of deformed and more metamorphic lithotypes from outcrops located along the Minas Novas corridor (Fig. 1). This investigation was assisted by detailed field and petrographic studies on the analyzed lithotypes. The results disclose correlations between non-deformed and deformed lithotypes of the Salinas basin, and reinforce the useful application of the lithochemical approach to study similar rocks in other orogenic belts.

2. GEOLOGICAL SETTING

The Salinas Formation is one of the most extensive units of the northern Araçuaí orogen, occurring in large areas of the Jequitinhonha river valley (Fig. 1). Regionally, the Salinas Formation covers distinct units of the Macaúbas Group (e.g., the Chapada Acauã and Ribeirão da Folha formations), outlining a regional unconformity, and hosts late orogenic granitic intrusions dated from ca. 540 Ma to ca. 500 Ma (Fig. 1).

The studies on the metasedimentary rocks currently ascribed to the Salinas Formation started in the early 20th century when they were correlated to the Macaúbas Formation (Moraes 1932). Some decades later, those rocks were included in a distinct stratigraphic unit, the Salinas Group, considered as a more metamorphic unit intruded by granites and pegmatites that would correspond to the post-diamictite formations of the Macaúbas Group (Pedrosa-Soares et al., 1984; Karfunkel et al., 1985). Due to its apparent fit with the regional lithofacies distribution from the proximal to distal Macaúbas Group, the Salinas Formation was formerly defined as the more distal and youngest unit of the Macaúbas Group (Pedrosa-Soares et al. 1990a,b; 1992). These authors subdivided it into two units: i) an exclusively sedimentary unit located in the proximal (western) part of the Salinas Formation; and ii) a more distal (eastern) metavolcanic-sedimentary succession with oceanic sediments and mafic volcanic rocks, hosting tectonic slabs of ophiolitic rocks, the Ribeirão da Folha facies or member (Pedrosa-Soares et al. 1992, 1998, 2001).

In the second half of the 1990's decade, the construction of the BR-251 highway, linking the Salinas city to Rio-Bahia (BR-116) highway, exposed extensive and high roadcuts showing outstanding sections of the Salinas Formation completely preserved from weathering and, locally, from the orogenic deformation (Pedrosa-Soares and Oliveira, 1997). Those new outcrops allow to the detailed studies presented by Lima et al. (2002), defining the main lithofacies of the Salinas Formation and presenting the first U-Pb geochronological data on detrital zircon grains. According to Lima et al. (2002), the Salinas Formation in the type-area includes laminated, banded, graded, convolute, brecciated or massive graywackes, cross-bedded sandstones, metapelites (mica schists and quartz-

mica schists), clast-supported conglomerates and calc-silicate rocks, metamorphosed from the biotite to the garnet zones of the greenschist facies. The youngest detrital zircon grains suggest a maximum sedimentation age around 568 Ma, imposing a redefinition of the Salinas Formation as a stratigraphic unit younger than the Macaúbas Group (Lima et al., 2002). Santos et al. (2009) presented detailed tectonic studies on the northern Salinas Formation, showing its progressive deformation from completely non-deformed to tightly folded and transposed zones, and suggesting a model of flysch-type basin evolved in the collisional stage of the Araçuaí orogen. The detailed metamorphic studies presented by Peixoto et al. (2017) demonstrate a double metamorphic regime along the Salinas synclinorium, with a Barrovian-type event related to the collisional tectonics and a Buchan-type event related to the plutonic igneous activity associated with the gravitational collapse of the Araçuaí orogen. Mineral assemblages of the Salinas metapelites indicate maximum metamorphic conditions around 640 °C at 5.5 kbar, with no evidence of partial melting (Peixoto et al., 2017).

To the south of the Salinas synclinorium, the homonymous formation continues to occur along the Minas Novas corridor (Pedrosa-Soares et al., 1993; Pedrosa-Soares, 1995; Alkmim et al., 2006, 2007), a double-verging transpressive structure extending from Turmalina – Minas Novas to Coronel Murta – Araçuaí regions (Fig. 1).

Contrasting to the well-preserved rocks found in the type-area of the Salinas Formation (e.g., outcrops SP-4 and SP-5, Fig. 1), no rock exposure free from the regional deformation was yet found in the Minas Novas corridor. Therefore, the Salinas lithotypes in the Minas Novas corridor are tightly folded quartz-biotite schists, quartzose metagraywackes (or “impure quartzites”), carbonatic schists, muscovite schists, calc-silicate rocks and rare clast-supported metaconglomerate lenses, frequently showing tectonically transposed layering (Pedrosa-Soares 1995). From SW to NE along the Minas Novas corridor, the Salinas Formation displays an intermediate to low pressure regional metamorphism, including the biotite, garnet, staurolite, andalusite, cordierite and sillimanite zones in Al-rich schists (Pedrosa-Soares et al., 1993, 1996).

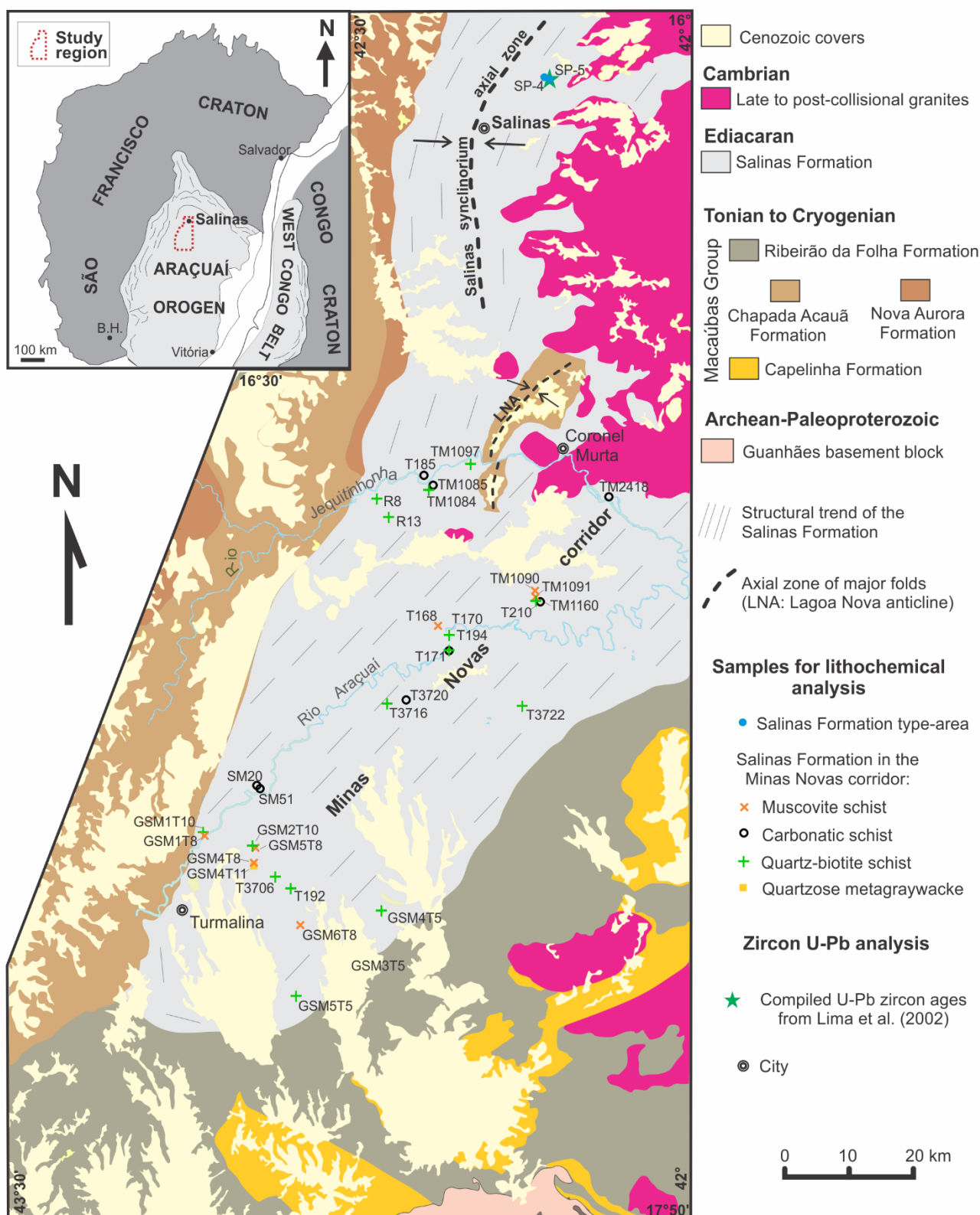


Figure 1: Location of the study region in the Araçuaí orogen shown within a paleotectonic fit including the African counterpart, and a simplified geological map of the main occurrence region of the Salinas Formation (modified from Pedrosa-Soares and Oliveira 1997; Pedrosa-Soares 1997a, b; Oliveira *et al.* 1997; Pedrosa-Soares and Grossi-Sad 1997; Baars *et al.* 1997; Guimarães and Grossi-Sad 1997).

3. ANALYTICAL METHODS

Besides conventional field and petrographic studies, this paper presents analytical data from petrological-quality lithochemical methods applied on clastic metasedimentary rocks.

3.1 Lithochemical analysis

The selected representative samples are free of weathering and hydrothermal alteration, with no veins and fractures filled by secondary minerals. The samples were firstly cleaned and prepared using conventional methods (crushing and milling) in the laboratories of the CPMTC Research Centre, Universidade Federal de Minas Gerais, and Department of Geology, Universidade Federal de Ouro Preto. Major oxides and trace elements including rare-earth elements (REE) were determined by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) on 14 whole-rock samples of low-grade (biotite zone) metagraywackes from the type-area of the Salinas Formation (outcrops SP-04 and SP-05, Fig. 1). Analysis were performed by the ACTLABS, Canada. Determination of FeO and Fe₂O₃ was done by colorimetric and volumetric methods at the CPMTC-UFMG.

Thirty-one whole-rock analysis (major and trace elements) of clastic metasedimentary rocks of the Salinas Formation collected in the Minas Novas corridor, were compiled from Pedrosa-Soares (1984; 1995, including samples from Grossi-Sad and Motta, 1991). These rocks include quartz-biotite schist, muscovite schist, carbonatic schist and quartzose metagraywacke, displaying regional metamorphism from the garnet to the staurolite zones (Fig. 1). Those 31 samples were analyzed in the GEOSOL Laboratory by Atomic Absorption Spectrometry, X-Ray Fluorescence Spectrometry, Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), and colorimetric and volumetric methods.

Whole rock classification diagrams and molar element ratios were obtained using the software GCDkit 2.3 (Janousek *et al.* 2006).

4. RESULTS AND INTERPRETATIONS

We synthesizes the field, petrographic and lithochemical studies, comparing the results from the samples collected in the type-area of the Salinas Formation, located in the surroundings of the homonymous town, with the samples collected along the Minas Novas corridor (Fig. 1).

4.1 Petrography

The best well-preserved exposures of the Salinas Formation are located in the homonymous city and surroundings (Fig. 1). In this region, known as Salinas type-area, occur metagraywackes,

metaconglomerates, metasandstones and metapelites. Although metamorphosed in the greenschist facies, those rocks can be found completely preserved from the orogenic deformation (Lima et al., 2002), but also showing the progressive deformation related to the collisional stage of the Araçuaí orogen (Santos et al., 2009; Peixoto et al., 2017). The rocks preserved from the orogenic deformation, includes successions of massive to graded metagraywackes, banded to laminated metagraywackes, convolute metagraywackes, and cataclastic to brecciated metagraywackes, showing outstanding sedimentary structures and striking evidence of syn-sedimentary tectonic activity (Fig. 2).

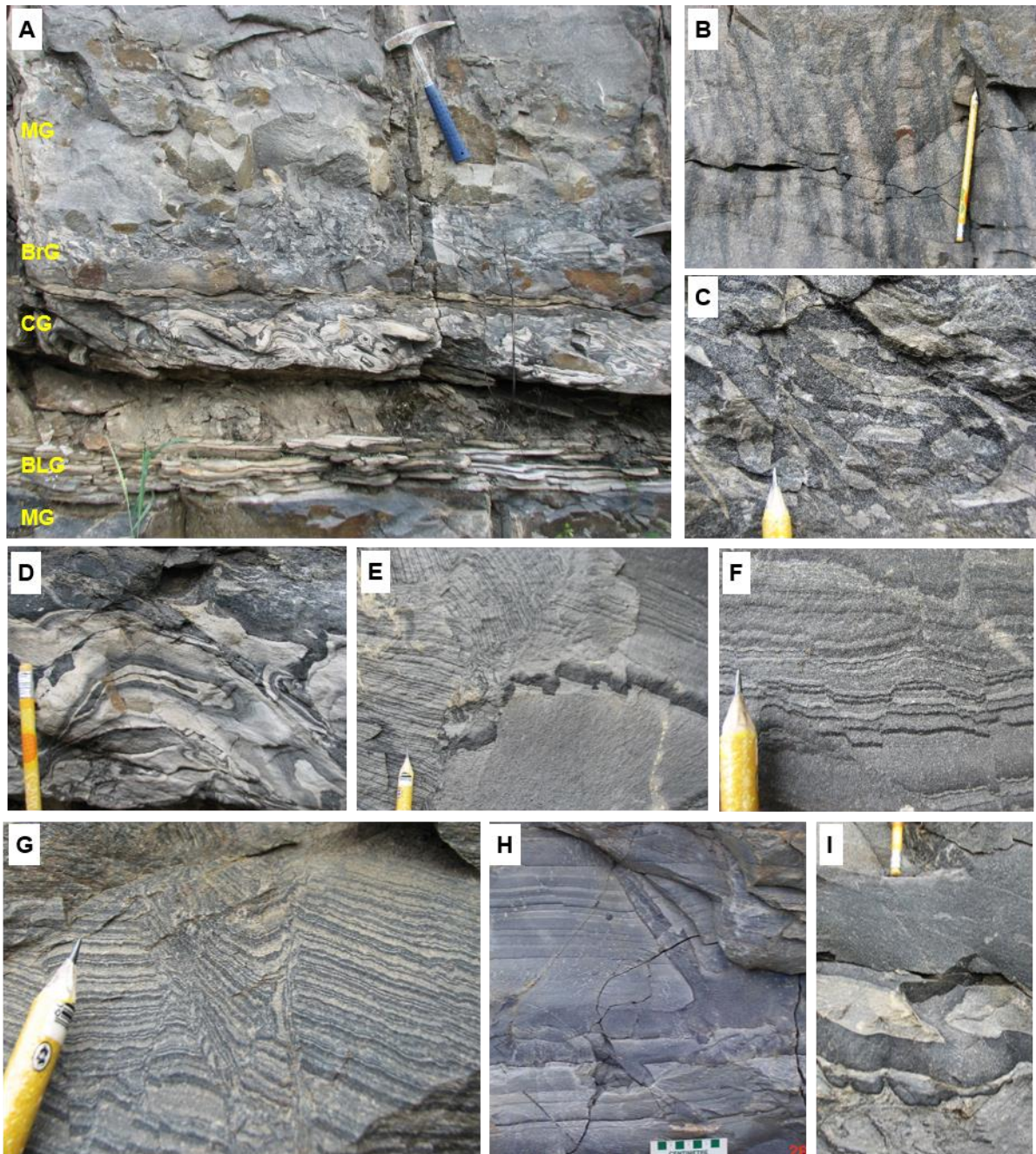


Figure 2. The Salinas Formation in outcrops without orogenic deformation but metamorphosed in the biotite zone of the greenschist facies, showing the main lithotypes and sedimentary features, found in the type-area of the formation (UTM: 801065 - 8222433; BR-251 highway roadcuts, 24 km to the east from the junction with MG-404 road): A, succession of banded to laminated graywacke (BLG), convolute graywacke (CG) and brecciated graywacke (BrG), between massive graywacke (MG) layers; B, water eescape structure marked by biotite-rich (i.e., mud-rich) darker upright flames in massive graywacke; C, detail of brecciated graywacke; D, detail of convolute graywacke; E, cataclastic laminated

graywacke filling space in a syn-sedimentary extensional (growth) fault cutting massive graywacke; F, syn-sedimentary (growth) micro-faults and graben-horst micro-pattern in laminated to banded graywacke with coarsening-up grading done by the gradual decreasing of biotite content from the base (darker) to top (lighter); G, syn-sedimentary fault with drag micro-folds in laminated graywacke; H, water escape structures along syn-sedimentary faults, cutting across coarsening-up graded, banded to laminated graywackes; I, flame structures outlined by biotite-rich (i.e., mud rich) bands, covered by massive graywacke.

The massive metagraywackes are generally medium- to fine-grained light gray rocks, showing a granoblastic to grano-lepidoblastic texture with low recrystallization. They consist of variable contents of quartz, biotite, plagioclase, white mica (sericite to muscovite), calcite, K-feldspar and lithic fragments. Tourmaline, garnet, apatite, zircon, titanite and opaque minerals are accessories. Despite the low-grade metamorphic recrystallization, most of those components represent clastic contribution. The gradual variation in the biotite amount, representing the mud fraction, reveal the graded bedding, besides the textural gradation done by the quartz-feldspar-rich matrix (Fig. 1). Coarsening-up graded bedding is a common feature in those metagraywackes. The banded to laminated metagraywackes consist of alternating bands and laminae relatively rich in biotite with those of graded to massive metagraywackes (Fig. 1). The biotite-rich bands and laminae vary in composition from pelite-rich metagraywacke to metapelite, represented by biotite-rich metasandstone and quartz-mica schist to mica schist. Although in distinct amounts, they present almost the same minerals found in the massive to graded metagraywackes and tend to be very poor to free in carbonate. The pelitic schists mark the regional metamorphism and can reach the garnet zone in the Salinas type-area.

To the top of the Salinas Formation, a general coarsening-up succession (Santos et al., 2009), occur metric to decametric lenses of polymictic clast-supported conglomerates (Fig. 3). The scarce matrix is of greywacky composition, similar to the metagraywacke layers hosting the orthoconglomerate lenses (Fig. 3A). They generally show strongly stretched and rotated clasts along the regional ductile foliation, including pebbles and cobbles of volcanic and subvolcanic rocks together with clasts of quartz, quartzite, gneiss, granite and carbonate rock. Most clasts of volcanic rocks vary in composition from andesite to rhyolite, being generally porphyritic with feldspar phenocrysts immersed in fine-grained matrix (Fig. 3B to 3D). The Salinas metaconglomerate lenses are sparsely found from the type-area to the Minas Novas corridor, where they mostly occur in the Araçuaí River banks and surroundings. They roughly follow the axial zone of the Salinas synclinorium and continue along the central zone of the Minas Novas corridor.

From the type-area, located in the axial zone of the Salinas synclinorium, to the south and east the Salinas Formation tends to become more metamorphic and deformed by the orogenic events that formed the Araçuaí orogen. This is the case of the rocks found in the Minas Novas corridor, from Coronel Murta to Turmalina (Fig. 1). In this region, the Salinas Formation comprises successions of

quartz-mica schist rich in biotite, muscovite schist, carbonatic schist and quartzose metagraywacke, with lenses of calc-silicate rocks and clast-supported conglomerates (Fig. 1 and 4). These rocks show at least the regional penetrative foliation and a prominent mineral lineation (Fig. 4). Generally, they are tightly folded and may show the sedimentary layering transposed along fold hinges (Fig. 4C). The alternating bands and laminae with variably amounts of quartz, biotite and feldspars resemble the banded to laminated metagraywackes of the type-area and, locally, there is evidence of graded bedding and water escape structures, despite the regional deformation. Besides metamorphic minerals (e.g., staurolite, cordierite) not found in the type-area, the mineralogical compositions of the psammitic to pelitic rocks along the Minas Novas corridor are similar to the non-deformed and weakly deformed lithotypes of the Salinas Formation.

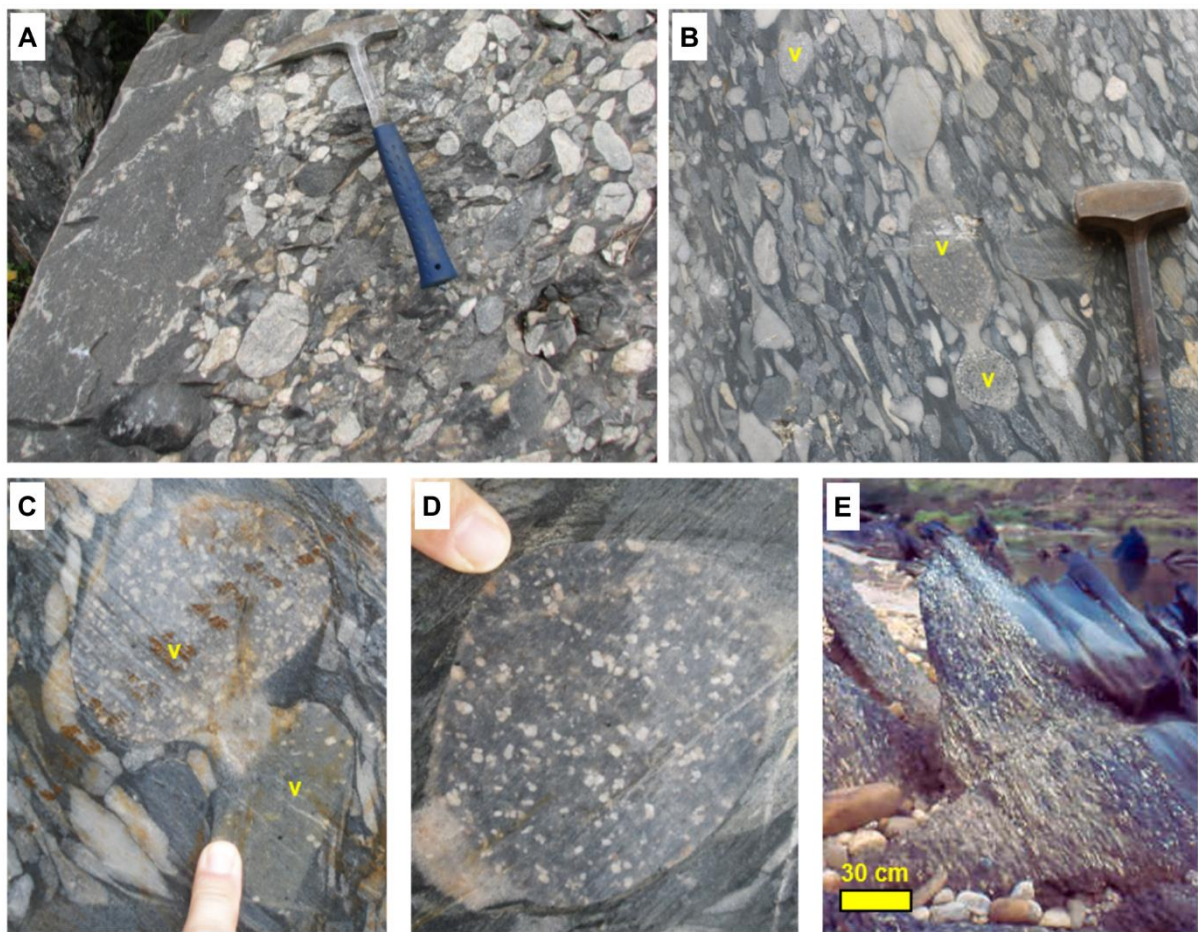


Figure 3. Clast-supported metaconglomerate lenses of the Salinas Formation: A, outcrop in a quarry for dimension stone, showing the contact of a conglomerate lens and massive graywacke (UTM: 789473 – 8220347; road MG-404, 12 km to the north of the road junction with the BR-251 highway); B, detail of the same metaconglomerate, showing stretched and rotate clasts (v, volcanic rocks); C, porphyritic volcanic rocks (v) of intermediate to felsic composition; D, pebble of porphyritic dacite; E, lens of clast-supported metaconglomerate intercalated with quartz-mica schist in the Minas Novas corridor (left margin of Araçuaí River in front of the mouth of the Fanado River).

These psammitic to pelitic rocks (i.e, the quartzose metagraywacke, carbonatic schist, quartz-biotite schist and muscovite schist) are essentially composed of variably contents of quartz, biotite, muscovite and plagioclase. Calcite, K-feldspar, garnet, apatite, zircon, titanite, tourmaline, monazite and opaque minerals are accessory phases. The carbonatic schist is a rock rich in quartz and biotite, with significant amount of calcite (readily reacting with diluted HCL). The muscovite schist is poor in Fe-rich minerals, probably reflecting a non-oxidizing environment during the sedimentation. Therefore, the banded to laminated packages composed of quartzose metagraywacke, carbonatic schist and quartz-mica schists correspond to the successions of massive to graded, banded to laminated metagraywackes with intercalations of more pelitic terms.

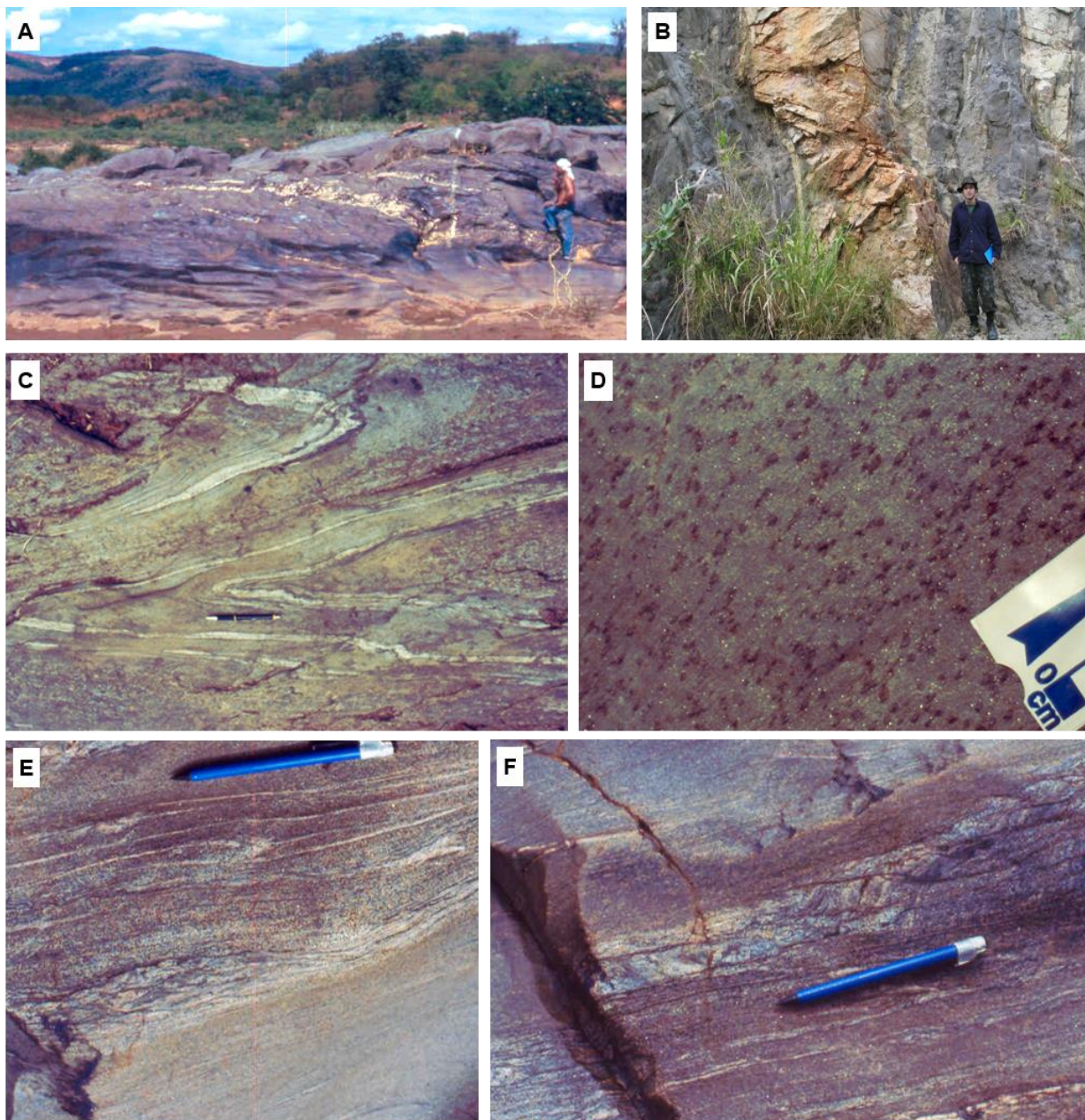


Figure 4. Outcrops of deformed and metamorphosed rocks of the Salinas Formation in the Minas Novas corridor: A, despite the rock composition, outcrops may be dark gray to black owing to coats rich in manganese oxide (the so-called

desert varnish); in this case, quartz veins locally rich in gold cut quartz-mica schist and metagraywacke (Pedrosa-Soares and Leonardos, 1996); B, quartz-mica schist hosting pegmatite veins (close to Coronel Murta); C, folded banded quartz-mica schist with concordant quartz veins (close to Virgem da Lapa); D, muscovite schist with biotite and garnet porphyroblasts (close to Minas Novas); E, banded to laminated metagraywacke; F, carbonatic schist (dark grey upper part), quartzose metagraywacke (light gray middle part) and laminated metagraywacke (lower part). The outcrops A, E and F are located in the Funil area, Araçuaí River banks, south of Virgem da Lapa.

Regionally, the field and petrographic features of the main lithofacies associations indicate that the Salinas Formation mostly comprises a turbiditic deep-sea sand-mud sequence, deposited in a basin episodically affected by syn-sedimentary tectonic activity, characterizing a flysch-type orogenic basin, as already suggested by other authors (Lima et al, 2002; Santos et al, 2009; Peixoto et al., 2015).

4.2 Lithochemistry

The analytical results of major and trace elements for the metagraywackes of the Salinas Formation are listed in Table 1 (major oxide elements) and Table 2 (trace elements). Firstly, we present an approach of the potential influences of sedimentary processes on the lithochemical data. After that, we evaluate the data in terms of protolith and depositional environment interpretations.

Data evaluation and protolith interpretation

The chemical composition of sediments is a complex system influenced by the petrological evolution of the source rocks, as well as sedimentary maturation, weathering and diagenesis. Although diagenesis can promote significant changes in the chemical composition of siliciclastic sediments, lithochemical data from sedimentary and metasedimentary rocks may be yet useful to interpret their origin. Even if clastic fractions (e.g., feldspars and lithoclasts) are selectively dissolved or replaced by authigenic minerals during diagenesis (Morton and Hallsworth, 1999) the overall lithochemical signature can be preserved, since fluid migration carries no significant amount of chemical components. Erosion and transport of weathered rocks may produce chemical differentiation, but not chemical changes, through the selection of transported sediments (Nesbitt and Young, 1984). Despite the distinct intensities of those processes, the weathering is the main compositional changer on the siliciclastic rocks (Nesbitt, 2003). According to Nesbitt and Young (1984), the weathering degree of the source rock can be measured by the chemical index of alteration ($CIA = [Al_2O_3 / (Al_2O_3 + CaO^* + Na_2O + K_2O)] \times 100$). The SiO_2/Al_2O_3 ratio can be useful to indicate the degree of sediment maturity, reflecting the increase of the quartz fraction in relation to clay fraction

during transport and recycling of sediments (Roser and Korsch, 1999). The K_2O/Na_2O ratio indicates the proportion of potassic phases (e.g., K-feldspar, common micas, illite) in relation to plagioclase, and the MgO/CaO ratio can retrieve the relative contribution of iron-magnesian minerals and plagioclase in carbonate-free rocks (Pedrosa-Soares 1995, and references therein).

The individual CIA values for the Salinas samples are low to intermediate, between 46.62 and 69.22 (Fig. 5), with a general average of 57.85 which is very close to the average CIA (= 50) for the non-weathered upper crust (Taylor and McLennan, 1985). The distinct lithotypes of the Salinas Formation show the following CIA averages: metagraywackes of the type-area, 54.03; carbonatic schists, 54.00; quartzose metagraywackes, 51.89; quartz-biotite schist, 61.90; and muscovite schist, 63.52. The general CIA average for the samples from the Minas Novas corridor is 58.69, a little bit greater than the average for the type-area (54.03). In terms of lithotype correlations, the CIA values of the metagraywackes from the type-area (54.03) and carbonatic schists (54.00) are virtually equal, and a little bit higher than the CIA (51.89) of the quartzose metagraywackes, indicating a solid correlation between these lithotypes rich in immature sand fraction. However, the bigger the mica content the greater the CIA value, as shown by the quartz mica schists (average CIA = 61.90) and muscovite schists (average CIA = 63.52), indicating increasing of clay fraction and, consequently, more weathered sources.

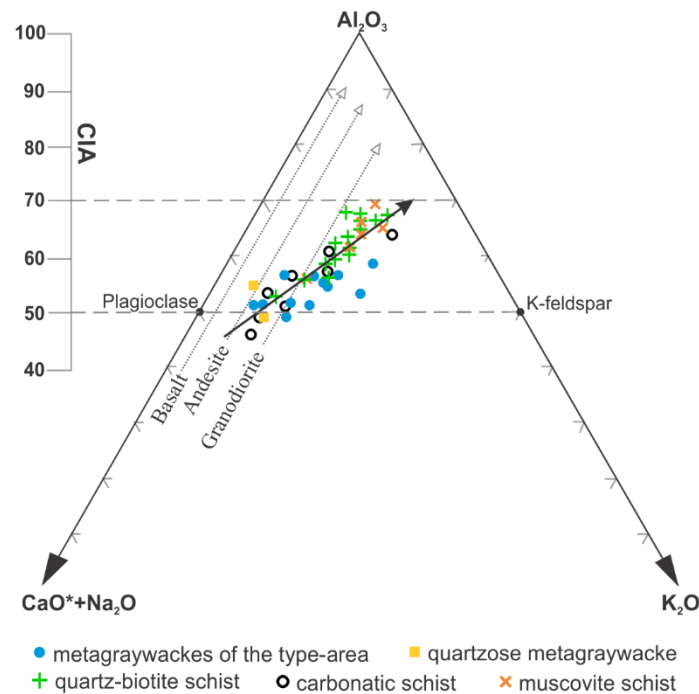


Figure 5: Al_2O_3 -(CaO^*+Na_2O)- K_2O (in molar proportion) diagram for the Salinas samples, together with the chemical index of alteration (CIA) scale. The black arrow shows the compositional trend done by the studied samples. The light grey dotted arrows show weathering trends of some common igneous rocks.

The diagram Al_2O_3 -($\text{CaO}^* + \text{Na}_2\text{O}$)- K_2O (Fig. 5) confirms the feebly weathered nature for the sedimentary protoliths, showing a moderate tendency toward the Al_2O_3 vertex (which corresponds to the maximum CIA). The Salinas samples outline a well-defined trend with relatively low CIA values close to the plagioclase corner and increasing Al_2O_3 , K_2O and CIA values (Fig. 5). The lower segment of this trend, with CIA from 46 to 60, includes the metagraywackes of the type-area and most of their deformed equivalents (the carbonatic schists and quartzose metagraywackes). The upper segment of the trend (CIA from 60 to 70) mainly includes the quartz-biotite schists and muscovite schists, reflecting the more pelitic (Al_2O_3 - and K-rich) fractions presented in these rocks. This trend suggests sediment sources originally rich in intermediate to felsic igneous rocks. The upper part of the trend can reflect clay-rich fractions directly eroded and transported from more weathered sources and/or the conversion of feldspars into clay during diagenetic processes. In turn, metagraywackes from the type-area, carbonatic schists and quartzose metagraywackes retain detrital compositions relatively poor in clay fraction, as also suggested by the presence of lithic fragments, as well as abundant quartz and plagioclase, instead of micas and other peraluminous silicates.

The Salinas rocks have a $\text{SiO}_2/\text{Al}_2\text{O}_3$ average ratio of 4.6, ranging from 2.3 to 7.9, reflecting a high degree of immaturity, which is typical of deposition close to the source (cf. Zhang, 2004), although can be also related to quick transport and/or cold climate conditions. The index of sediment maturity ($\text{SiO}_2/\text{Al}_2\text{O}_3$) can be compared with the relative contributions of K-rich components versus plagioclase ($\text{K}_2\text{O}/\text{Na}_2\text{O}$) and iron-magnesium minerals versus plagioclase (MgO/CaO), using the triangular diagram proposed by Pedrosa-Soares (1995).

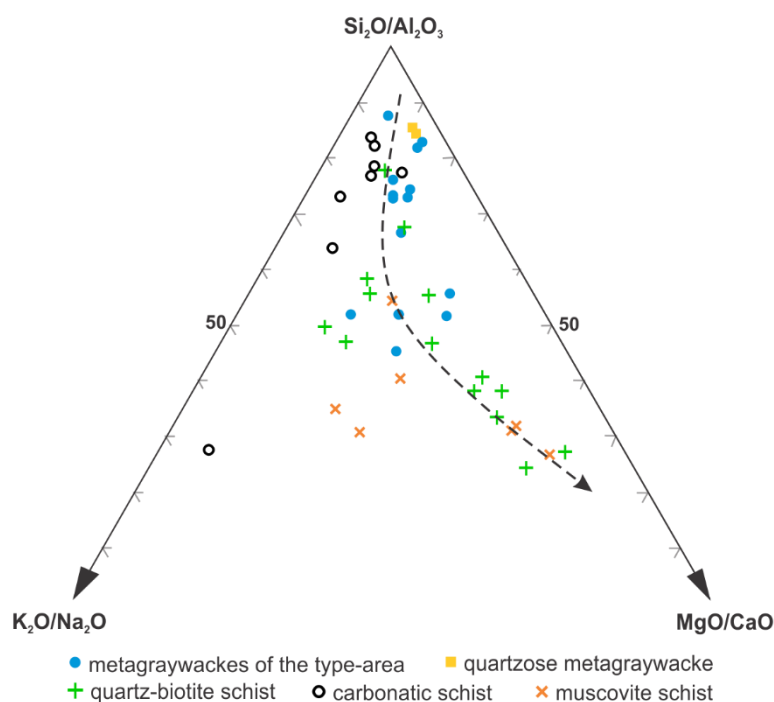


Figure 6: Chemical compositions of rocks of the Salinas Formation plotted in the $\text{SiO}_2/\text{Al}_2\text{O}_3 - \text{K}_2\text{O}/\text{Na}_2\text{O} - \text{MgO}/\text{CaO}$ diagram of Pedrosa-Soares (1995). The dashed black arrow outlines the curved trend shown the sample set.

Besides the correlation of metagraywackes from the type-area with carbonatic schists and quartzose metagraywackes, mostly of them plotting closer the $\text{SiO}_2/\text{Al}_2\text{O}_3$ vertex in relation to the quartz-biotite schists and muscovite schists, the sample set outlines a curved trend from the more mature rocks toward the MgO/CaO vertex (Fig. 6). This suggests that detrital plagioclase and iron-magnesium minerals were important contributions even in the pelitic protoliths and the K-rich contribution was mainly related to mica and/or clay fractions than detrital K-feldspar. The CaO component can be mainly ascribed to detrital plagioclase, even in the carbonatic schists and metagraywackes, as they plot far from the MgO/CaO vertex and tend to have a relatively narrow range of $\text{K}_2\text{O}/\text{Na}_2\text{O}$ ratios.

As expected from the field and petrographic studies, diagrams for lithological classification (Pettijohn *et al.* 1972; Herron, 1988) based on major element contents show that the studied rocks plot mostly in the graywacke and litho-arenite fields (Fig. 7). The Salinas metagraywackes show compositions with 47-78% SiO_2 , 9.8-20.4% Al_2O_3 and 8.1-21.7% FeO_t . As expected, the higher contents of silica correspond to relatively quartz-rich and biotite-poor rocks, mostly the massive metagraywackes and quartzose metagraywackes, but also to some quartz-biotite schists and carbonatic schists. The higher contents of Al_2O_3 and FeO_t correlate with increasing modal values of biotite and other peraluminous Fe-rich silicates (e.g., garnet and staurolite), reflecting the importance of the pelitic (mostly clay) contribution. TiO_2 , Al_2O_3 , MgO , P_2O_5 , K_2O , FeO_t and MnO are negatively correlated with SiO_2 , reflecting the decrease of silica with increasing of matrix proportion together with increasing of the maturity index of the studied metasedimentary rocks (Fig. 8). In contrast, Na_2O exhibit a positive correlation with SiO_2 (Fig. 4), and the higher Na_2O values correspond to samples of metagraywackes from the Salinas type-area and quartzose metagraywackes found in the Minas Novas corridor, which are generally the lithotypes richer in plagioclase. As the plagioclase found in those lithotypes are generally andesine to oligoclase, the lithochemical signature also points to sources rich in intermediate to felsic granitic rocks.

The large compositional spreading of major elements in relation to the upper continental crust average (Taylor and McLennan 1985) suggests a great variability in sediment maturity, involving a wide spectrum of mixtures from distinct contributions, possibly also reflecting distinct sources.

Table 1: Major element (wt%) compositions of clastic metasedimentary rocks from the Salinas Formation.

Sample	Lithofacies	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	FeOt	MnO	MgO	CaO	Na ₂ O	K ₂ O	P ₂ O ₅	LOI	log(SiO ₂)	log(Na ₂ O)	log(FeOt)	CIA	Al ₂ O ₃	CaO*+Na ₂ O	K ₂ O	SiO ₂	K ₂ O	MgO	SiO ₂	K ₂ O +	TiO ₂ +	Al ₂ O ₃	FeOt +	Al ₂ O ₃	Disc.	Disc.
															Al ₂ O ₃	K ₂ O	K ₂ O	(molar)	(molar)	(molar)	Al ₂ O ₃	Na ₂ O	CaO	20	Na ₂ O	FeOt+MgO	(CaO+Na ₂ O)	MgO	SiO ₂	function 1	function 2	
SM51*	Carb.schist	46.9	1.00	20.4	3.3	5.1	8.07	0.1	3.3	4.9	1.3	6.9	0.19	6.19	0.36	-0.72	0.07	63.46	0.2	0.04	0.07	2.3	5.31	0.67	2.35	8.2	12.37	3.29	11.37	0.43	0.53	-51.25
T171C*	Carb.schist	58.7	0.79	14.9	1.6	4.8	6.24	0.29	3.5	6.4	1.6	2.7	0.14	4.28	0.60	-0.23	0.36	46.62	0.15	0.14	0.03	3.94	1.69	0.55	2.94	4.3	10.53	1.86	9.74	0.25	0.26	-45.66
T3720*	Carb.schist	65.2	0.92	12.9	1.6	2.8	4.24	0.55	3.7	4.4	2.9	1.9	0.29	2.57	0.70	0.18	0.35	52.66	0.13	0.09	0.02	5.05	0.66	0.84	3.26	4.8	8.86	1.77	7.94	0.2	0.34	-38.76
SM20*	Carb.schist	66.7	0.73	11.1	0.72	3.4	4.04	0.09	1.8	4.9	2.8	2.3	0.2	5.12	0.78	0.09	0.25	48.68	0.11	0.09	0.02	6.01	0.82	0.37	3.34	5.1	6.58	1.44	5.85	0.17	1.29	-44.06
TM1085*	Carb.schist	68.3	0.81	13.1	1.00	3.32	4.22	0.11	1.6	3.00	2.8	2.5	0.18	1.73	0.72	0.05	0.23	52.36	0.13	0.09	0.03	5.21	0.89	0.53	3.42	5.3	6.63	2.26	5.82	0.19	0.45	-44.57
TM1160*	Carb.schist	68.6	0.74	12.00	1.5	2.89	4.24	0.11	1.6	3.8	2.7	2.2	0.17	1.92	0.76	0.09	0.28	51.58	0.12	0.09	0.02	5.72	0.81	0.42	3.43	4.9	6.58	1.85	5.84	0.17	0.29	-44.07
T185*	Carb.schist	69.8	0.64	13.00	0.48	2.9	3.33	0.09	1.8	3.1	2.3	2.4	0.17	3.12	0.73	-0.02	0.14	56.12	0.13	0.07	0.03	5.37	1.04	0.58	3.49	4.7	5.77	2.41	5.13	0.19	0.27	-44.32
TM2418*	Carb.schist	72.1	0.56	11.4	1.5	2.16	3.51	0.13	1.5	3.2	1.4	2.6	0.15	1.14	0.80	-0.27	0.13	60.57	0.11	0.05	0.03	6.32	1.86	0.47	3.61	4	5.57	2.48	5.01	0.16	-1.14	-44.63
SP4A	Type-area mg.	70.54	0.66	12.73	0.98	4.24	5.12	0.23	1.12	1.25	3.74	3.22	0.2	0.93	0.74	0.07	0.25	52.05	0.12	0.08	0.03	5.54	0.86	0.90	3.53	6.96	7.48	2.55	6.82	0.18	0.71	-46.88
SP4B	Type-area mg.	65.12	0.75	15.93	0.94	4.41	5.26	0.1	2.19	0.85	3.73	4.67	0.2	0.86	0.61	-0.10	0.10	55.93	0.16	0.07	0.05	4.09	1.25	2.58	3.26	8.4	8.78	3.48	8.03	0.24	1.35	-48.07
SP4C	Type-area mg.	62.39	0.79	16.81	1.26	4.48	5.61	0.14	2.73	1.52	3.15	5.18	0.19	0.8	0.57	-0.22	0.11	55.69	0.16	0.08	0.05	3.71	1.64	1.80	3.12	8.33	10.21	3.60	9.42	0.27	0.95	-48.56
SP4D	Type-area mg.	76.81	0.49	11.93	1.10	1.73	2.72	0.12	0.7	0.67	3.7	1.55	0.13	0.91	0.81	0.38	0.29	57.38	0.12	0.07	0.02	6.44	0.42	1.04	3.84	5.25	4.22	2.73	3.73	0.16	-0.30	-43.04
SP4E	Type-area mg.	70.01	0.59	14.66	1.10	2.83	3.82	0.08	1.55	0.58	3.5	3.99	0.18	1.00	0.68	-0.06	0.03	57.21	0.14	0.07	0.04	4.78	1.14	2.67	3.5	7.49	6.39	3.59	5.8	0.21	0.53	-46.56
SP4F	Type-area mg.	74.43	0.59	12.08	1.56	2.20	3.60	0.07	0.77	0.57	3.43	3.27	0.14	0.8	0.79	0.02	0.09	54.49	0.12	0.06	0.03	6.16	0.95	1.35	3.72	6.7	5.37	3.02	4.78	0.16	-0.35	-45.97
SP4G	Type-area mg.	70.47	0.52	14.51	0.45	3.03	3.00	0.13	1.22	0.92	3.64	4.09	0.16	0.66	0.69	-0.05	-0.03	54.86	0.14	0.07	0.04	4.86	1.12	1.33	3.52	7.73	5.56	3.18	5.04	0.21	0.61	-47.59
SP4H	Type-area mg.	72.26	0.48	12.77	0.73	3.34	4.00	0.2	1.05	0.87	4.25	3.3	0.14	0.33	0.75	0.11	0.13	51.52	0.13	0.08	0.04	5.66	0.78	1.21	3.61	7.55	5.98	2.49	5.5	0.18	0.61	-46.84
SP4I	Type-area mg.	63.82	0.8	16.71	1.08	4.50	5.57	0.11	2.39	1.01	2.41	5.39	0.21	1.17	0.58	-0.35	0.05	59.36	0.16	0.05	0.06	3.82	2.24	2.37	3.19	7.8	9.28	4.89	8.48	0.26	0.48	-49.10
SP4J	Type-area mg.	73.8	0.5	11.74	0.31	3.73	4.01	0.27	0.8	1.89	3.68	1.8	0.13	1.03	0.80	0.31	0.39	50.91	0.12	0.09	0.02	6.29	0.49	0.42	3.69	5.48	5.76	2.11	5.26	0.16	0.22	-45.50
SP5A	Type-area mg.	65.46	0.56	15.5	0.05	3.53	3.57	0.15	1.68	2.04	4.57	3.61	0.13	1.2	0.63	0.10	0.04	50.8	0.15	0.11	0.04	4.22	0.79	0.82	3.27	8.18	6.22	2.34	5.66	0.24	1.69	-46.51
SP5B	Type-area mg.	64.91	0.66	14.74	1.09	4.68	5.66	0.13	2.36	1.56	2.3	5.9	0.22	0.96	0.64	-0.41	0.03	53.52	0.14	0.06	0.06	4.4	2.57	1.51	3.25	8.2	9.32	3.82	8.66	0.23	0.61	-50.42
SP5C	Type-area mg.	72.34	0.39	14.11	-	-	2.96	0.05	1.00	1.21	5.68	1.47	0.16	0.65	0.71	0.59	0.35	52.07	0.14	0.11	0.02	5.13	0.26	0.83	3.62	7.15	4.68	2.05	4.29	0.20	-	-
SP5D	Type-area mg.	66.15	0.56	15.66	-	-	3.94	0.09	1.67	2.07	4.66	3.68	0.17	1.14	0.63	0.10	0.08	50.65	0.15	0.11	0.04	4.22	0.79	0.81	3.31	8.34	6.61	2.33	6.05	0.24	-	-
GSM1T8**	Musc.schist	59.3	0.74	19.00	5.4	2.1	6.95	0.26	3.00	1.00	1.3	5.2	0.15	1.78	0.49	-0.60	0.13	66.79	0.19	0.04	0.06	3.12	4.00	3.00	2.97	6.5	10.7	8.26	9.96	0.32	-2.51	-46.03
GSM4T8**	Musc.schist	63.8	0.92	16.6	4.7	2.4	6.63	0.11	2.8	0.43	1.9	3.8	0.19	1.95	0.58	-0.30	0.24	67.91	0.16	0.04	0.04	3.84	2.00	6.51	3.19	5.7	10.35	7.12	9.43	0.26	-1.56	-43.68
GSM5T8**	Musc.schist	64.7	0.93	16.6	3.9	2.8	6.31	0.18	2.6	0.4	2.00	3.7	0.19	1.56	0.59	-0.27	0.23	67.9	0.16	0.04	0.04	3.9	1.85	6.50	3.24	5.7	9.84	6.92	8.91	0.26	-1.49	-44.03
GSM6T8**	Musc.schist	65.0	0.8	16.4	4.5	2.2	6.25	0.1	2.6	0.29	1.9	3.5	0.16	1.85	0.6	-0.27	0.25	69.22	0.16	0.03	0.04	3.96	1.84	8.97	3.25	5.4	9.65	7.49	8.85	0.25	-1.73	-43.63
T171B*	Musc.schist	57.3	0.89	18.6	4.6	3.5	7.64	0.1	3.8	1.6	2.3	5.00	0.15	1.96	0.49	-0.34	0.18	60.85	0.18	0.06	0.05	3.08	2.17	2.38	2.87	7.3	12.33	4.77	11.44	0.32	-0.62	-46.52
T168*	Musc.schist	58.1	0.81	18.8	4.2	3.5	6.81	0.26	3.8	1.8	1.4	5.1	0.15	1.9	0.49	-0.56	0.13	54.99	0.18	0.05	0.05	3.09	3.64	2.11	2.91	6.5	11.42	5.88	10.61	0.32	-1.57	-46.73
TM1091*	Musc.schist	58.9	0.89	17.4	4.2	3.03	6.98	0.59	3.3	2.3	2.9	4.1	0.2	0.81	0.53	-0.15	0.23	56.86	0.17	0.09	0.04	3.39	1.41	1.43	2.95	7	11.17	3.35	10.28	0.3	-1.30	-43.38
GSM3T11**	Quartzose mg.	77.8	0.65	9.8	0.82	2.5	3.24	0.09	1.3	1.3	3.2	1.3	0.21	0.79	0.9	0.39	0.40	52.57	0.1	0.07	0.01	7.94	0.41	1.00	3.89	4.5	5.19	2.18	4.54	0.13	0.27	-42.13
GSM4T11**	Quartzose mg.	77.8	0.62	9.8	1.2	2.2	3.28	0.06	1.1	1.00	3.7	1.5	0.21	0.43	0.9	0.39	0.34	51.22	0.1	0.08	0.02	7.94	0.41	1.10	3.89	5.2	5	2.09	4.38	0.13	0.49	-42.33
GSM2T10**	Qtz-bt schist	70.3	0.76	13.5	2.9	2.7	5.31	0.13	1.1	1.6	2.9	2.4	0.19	1.07	0.72	0.08	0.34	57	0.13	0.07	0.03	5.21	0.83	0.69	3.52	5.3	7.17	3.00	6.41	0.19	-0.48	-44.64
GSM4T5**	Qtz-bt schist	63.3	1.1	16.4	2.1	4.9	6.79	0.16	2.8	0.63	2.2	4.1	0.17	1.83	0.59	-0.27	0.22	64.45	0.16	0.05	0.04	3.86	1.86	4.44	3.17	6.3	10.69	5.80	9.59	0.26	-0.56	-46.37
GSM5T5**	Qtz-bt schist	65.1	0.89	16.1	1.4	5.00	6.26	0.11	2.7	0.53	2.2	3.3	0.17	2.06	0.61	-0.18	0.28	66.81	0.16	0.04	0.04	4.04	1.50	5.09	3.26	5.5	9.85	5.90	8.96	0.25	-0.08	-45.83
R13*	Qtz-bt schist	58.7	0.78	18.3	2.2	5.00	6.76	0.35	3.2	2.4	2.00	4.6	0.15	2.04	0.51	-0.36	0.17	61.29	0.18	0.06	0.05	3.21	2.30	1.33	2.94	6.6	10.74	4.16	9.96	0.31	-0.53	-48.07
TM1084*	Qtz-bt schist	60.00	0.83	17.7	1.9	5.05	5.77	0.37	2.6	2.3	2.8	4.4	0.18	0.83	0.53	-0.20	0.12	56.94	0.17	0.08	0.05	3.39	1.57	1.13	3	7.2	9.2	3.47	8.37	0.3	0.09	-48.01
T3721*	Qtz-bt schist	61.5	0.79	16.6	1.3	4.6	6.78	0.41	3.5	3.5	3.4	2.7	0.25	1.13	0.57	0.10	0.40	54.06	0.16	0.11	0.03	3.7	0.79	1.00	3.08	6.1	11.07	2.41	10.28	0.27	1.37	-43.71
T192A*	Qtz-bt schist	61.9	0.92	17.8	2.2	4.8	6.9	0.14	2.9	0.57	2.2	3.9	0.16	2.15	0.54	-0.25	0.25	67.1	0.17	0.04	0.04	3.48	1.77	5.09	3.1	6.1	10.72	6.43	9.8	0.29	-0.36	-46.39
T210*	Qtz-bt schist	62.0	0.86	16.9	3.00	4.2	6.25	0.15	3.6	1.4	2.3	3.7	0.17	1.5	0.56	-0.21	0.23	62.42	0.17	0.06	0.04	3.67	1.61	2.57	3.1	6	10.71	4.57	9.85	0.27	-0	

Table 2: Trace element (in ppm) compositions of clastic metasedimentary rocks from the Salinas Formation.

Sample	Lithofacies	La	Ce	Nd	Sm	Eu	Gd	Dy	Ho	Er	Yb	Lu	U	Th	Zr	Sc	Co	Eu/Eu*	Zr/10	Ti/Zr	La/Sc
SM51*	Carb.schist	44.11	97.23	42.94	8.37	1.53	6.01	4.91	1	2.33	2.02	0.28	-	13	290	22	-	0.05	29	16.5	2.01
T171C*	Carb.schist	27.15	61.52	28.79	5.98	1.1	4.71	5.26	1.19	3.18	2.95	0.4	-	-	-	-	-	0.07	-	-	-
T3720*	Carb.schist	50.68	110.5	54.08	10.63	1.91	8.46	8.89	1.87	5.35	4.84	0.63	-	13	370	19	-	0.04	37	14.06	2.67
SM20*	Carb.schist	34.97	76.69	36.42	7.36	1.18	5.55	5.6	1.25	3.26	3.19	0.43	-	15	390	15	-	0.05	39	16.81	2.33
TM1085*	Carb.schist	43.1	83.1	37.6	7.1	1.4	6.3	4.4	0.93	2.3	1.9	0.25	-	-	430	-	-	0.05	43	13.74	-
TM1160*	Carb.schist	30.3	50.4	27	5.3	0.98	5.1	3.9	0.83	2.1	1.9	0.25	-	-	400	-	-	0.07	40	16.17	-
T185*	Carb.schist	30.8	65.93	30.85	6.09	1.2	4.51	4.54	0.99	2.67	2.54	0.33	-	14	280	17	-	0.06	28	26.71	1.81
TM2418*	Carb.schist	43.1	82	37.4	7.2	1.3	6.3	4.1	0.86	2.1	1.9	0.26	-	-	460	-	-	0.05	46	18.58	-
SP4A	Type-area mg.	84.5	161.53	60.53	10.33	16.92	7.95	6.59	1.27	3.76	3.64	0.54	4.45	27.29	522.3	9	35.16	0.04	52	13.95	9.39
SP4B	Type-area mg.	41.43	88.04	36.66	74.23	1.32	63.1	5.99	1.2	3.6	3.23	0.49	3.45	19.86	192.51	13	24.35	0.05	19	32.97	3.19
SP4C	Type-area mg.	60.55	105.99	47.14	8.43	1.54	6.77	5.61	1.08	3.23	3.01	0.44	2.18	20.77	180.48	15	23.89	0.05	18	33.4	4.04
SP4D	Type-area mg.	43.95	80.63	32.74	5.59	1.11	4.24	3.75	0.71	2.07	2.03	0.31	3.27	15.83	267.23	7	28.60	0.07	27	36.55	6.28
SP4E	Type-area mg.	50	87.13	38.82	6.95	1.36	5.92	5.2	0.99	2.93	2.77	0.39	2.25	16.96	249.31	9	19.38	0.06	25	32.48	5.56
SP4F	Type-area mg.	71.9	136.02	50.79	8.4	1.43	6.68	5.66	1.1	3.1	2.91	0.44	3.00	23.49	393.36	8	44.81	0.05	39	20.73	8.99
SP4G	Type-area mg.	49.02	95.62	37.38	6.52	1.28	5.06	4.75	0.9	2.77	2.55	0.38	2.46	14.63	223.26	8	25.14	0.06	22	40.99	6.13
SP4H	Type-area mg.	38.94	77.25	30.45	5.54	1.13	4.47	4.0	0.79	2.3	2.13	0.31	2.10	13.20	189.2	8	18.38	0.07	19	52.92	4.87
SP4I	Type-area mg.	44.3	92.37	38.68	7.39	1.41	6.21	6.18	1.21	3.64	3.3	0.51	3.44	21.12	179.05	15	25.49	0.05	18	33.37	2.95
SP4J	Type-area mg.	56.56	107.6	39.91	6.79	1.2	5.21	4.49	0.87	2.61	2.53	0.38	3.18	18.78	320.99	7	35.94	0.06	32	29.88	8.08
SP5A	Type-area mg.	41.73	84.27	36.77	7.08	1.37	5.78	5.31	1.06	3.15	2.91	0.44	2.20	18.65	242.77	11	35.82	0.06	24	34.95	3.79
SP5B	Type-area mg.	37.82	77.98	32.94	6.66	1.41	5.56	5.03	1.02	3.09	2.9	0.44	3.13	15.6	203.59	13	26.11	0.06	20	35.4	2.91
SP5C	Type-area mg.	20.27	27.43	17.94	3.9	0.67	3.44	4.18	0.91	3.14	3.29	0.53	4.72	17.04	200.32	8	21.26	0.1	20	61.11	2.53
SP5D	Type-area mg.	42.74	86.8	37.57	7.22	1.4	6.06	5.51	1.08	3.2	2.96	0.44	2.25	18.99	243.47	11	44.10	0.05	24	34.98	3.89
GSM1T8**	Musc.schist	42.61	93.21	40.4	7.68	1.41	6.17	6.2	1.25	3.4	3.21	0.39	-	-	-	-	53	0.05	-	-	-
GSM4T8**	Musc.schist	11.63	24.05	9.795	1.97	0.50	2.14	3.13	0.69	2.17	2.63	0.37	-	-	-	-	13	0.20	-	-	-
GSM5T8**	Musc.schist	38.36	83.94	35.89	6.71	1.23	5.1	5.14	1.05	2.96	3.26	0.41	-	-	-	-	13	0.06	-	-	-
GSM6T8**	Musc.schist	32.43	71.29	31.29	5.94	1.13	4.62	4.8	1	2.89	2.96	0.37	-	-	-	-	20	0.07	-	-	-
T171B*	Musc.schist	56.93	86.46	55.55	10.27	1.77	7.06	5.34	1.08	2.47	1.8	0.23	-	7	200	23	-	0.04		32.78	2.48
T168*	Musc.schist	26.81	61.37	26.66	5.4	0.99	3.85	3.75	0.83	2.26	2.42	0.34	-	12	200	22	-	0.07	20	29.54	1.22
TM1091*	Musc.schist	22.1	59.1	21.7	4.5	0.88	4.3	3.8	0.84	2.4	2.6	0.35	-	-	310	-	-	0.09	31	17.35	
GSM3T11**	Quartzose mg.	24.99	60.18	28.61	5.28	1.01	3.73	3.84	0.79	2.2	2.15	0.26	-	-	-	-	7	0.07	-	-	-
GSM4T11**	Quartzose mg.	22.07	45.34	20.41	5.15	0.9	4.58	4.1	0.82	2.17	2.52	0.36	-	-	-	-	-	0.08	-	-	-
GSM2T10**	Qtz-bt schist	35.69	79.9	34.69	6.46	1.09	4.72	4.16	0.84	2.29	2.53	0.32	-	-	-	-	9	0.06	-	-	-
GSM4T5**	Qtz-bt schist	42.14	92.28	40.43	8.03	1.41	6.29	6.74	1.39	3.97	4.04	0.54	-	-	-	-	18	0.05	-	-	-
GSM5T5**	Qtz-bt schist	29.65	68.12	33.03	6.24	1.19	4.6	4.89	0.99	2.72	2.66	0.34	-	-	-	-	36	0.06	-	-	-
R13*	Qtz-bt schist	29.03	68.5	32.01	6.37	1.22	4.6	4.29	0.88	2.31	2.32	0.34	-	13	200	18	-	0.06	20	31.49	1.61
TM1084*	Qtz-bt schist	43.6	92.3	40.6	8	1.5	6.5	4.2	0.84	2.1	2.2	0.3	-	-	500	-	-	0.05	50	8.7	
T3721*	Qtz-bt schist	32.69	78.9	34.35	6.57	1.22	4.9	5.16	1.06	3.06	3.13	0.42	-	-	-	-	-	0.06	-	-	-
T192A*	Qtz-bt schist	30.67	67.25	31.08	6.37	1.25	4.8	4.75	0.98	2.67	2.81	0.39	-	11	230	19	-	0.06	23	26.68	1.61
T210*	Qtz-bt schist	35.8	71.05	33.21	6.88	1.24	5.16	5.19	1.21	2.98	3.13	0.43	-	18	210	18	-	0.06	21	27.46	1.99
T170C*	Qtz-bt schist	44.96	89.69	43.06	8.33	1.56	6.17	6.54	1.4	3.51	3.01	0.37	-	-	-	-	-	0.05	-	-	-
T3706*	Qtz-bt schist	25.13	52.38	24.62	4.91	1.05	3.66	4.29	0.90	2.72	2.89	0.39	-	13	240	22	-	0.08	24	21.68	1.14
R8B*	Qtz-bt schist	34.99	71.9	33.13	6.23	1.18	4.46	4.08	0.84	2.16	1.88	0.23	-	13	220	17	-	0.06	22	25.3	2.06
T3722*	Qtz-bt schist	40.65	76.31	38.36	7.71	1.48	5.58	5.017	0.98	2.74	2.61	0.35	-	8	230	21	-	0.05	23	24.2	1.94
T3716*	Qtz-bt schist	29.11	63.85	28.05	5.1	0.97	3.52	2.96	0.54	1.65	1.89	0.28	-	7	170	20	-	0.08	17	28.15	1.46
UCC		30	64	26	4.5	0.88	3.8	3.5	0.8	2.3	2.2	0.32	2.8	10.7	190	13.6	17	0.09	19	0.09	2.21

(*) Grossi Sad and Motta (1991), (**) Pedrosa-Soares (1984, 1995), and UCC (Upper continental crust average, Taylor e McLennan, 1985). Abbreviations: Carb.schist, Carbonatic schist; Type-area mg., Type-area metagraywacke; Musc. schist, Muscovite schist; Quartzose mg., Quartzose metagraywacke; Qtz-bt schist, Quartz-biotite schist.

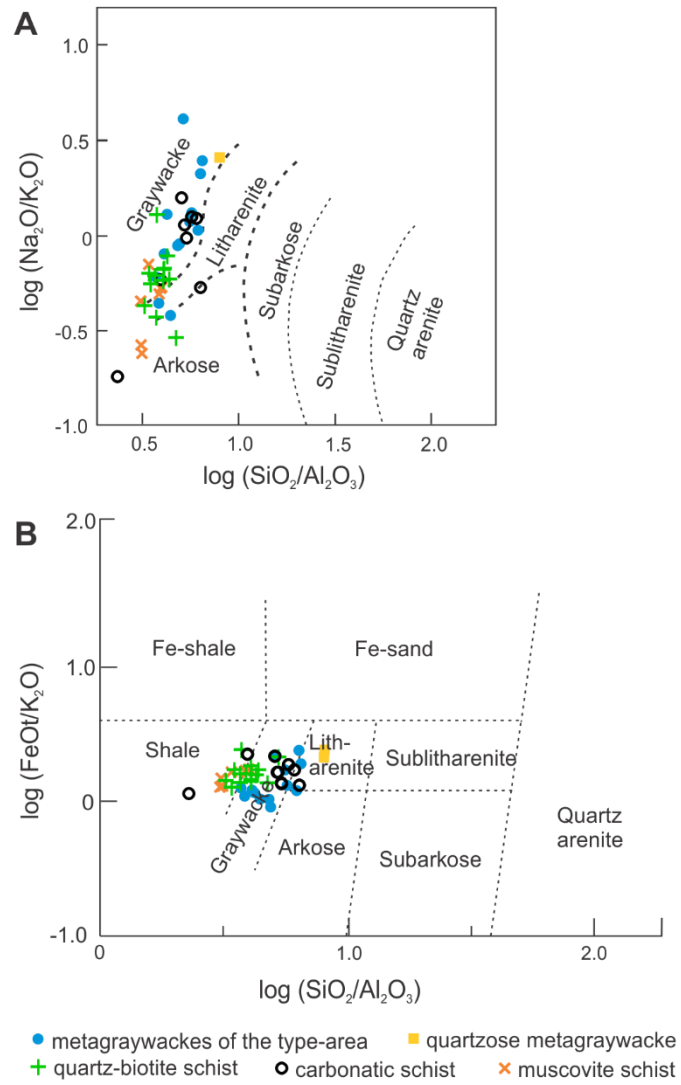


Figure 7: Chemical classification diagrams for rocks from the Salinas Formation: (a) $\log (\text{Na}_2\text{O}/\text{K}_2\text{O})$ versus $\log (\text{SiO}_2/\text{Al}_2\text{O}_3)$ of Pettijohn *et al.* (1972); (b) $\log (\text{FeOt}/\text{K}_2\text{O})$ versus $\log (\text{SiO}_2/\text{Al}_2\text{O}_3)$ of Herron (1988).

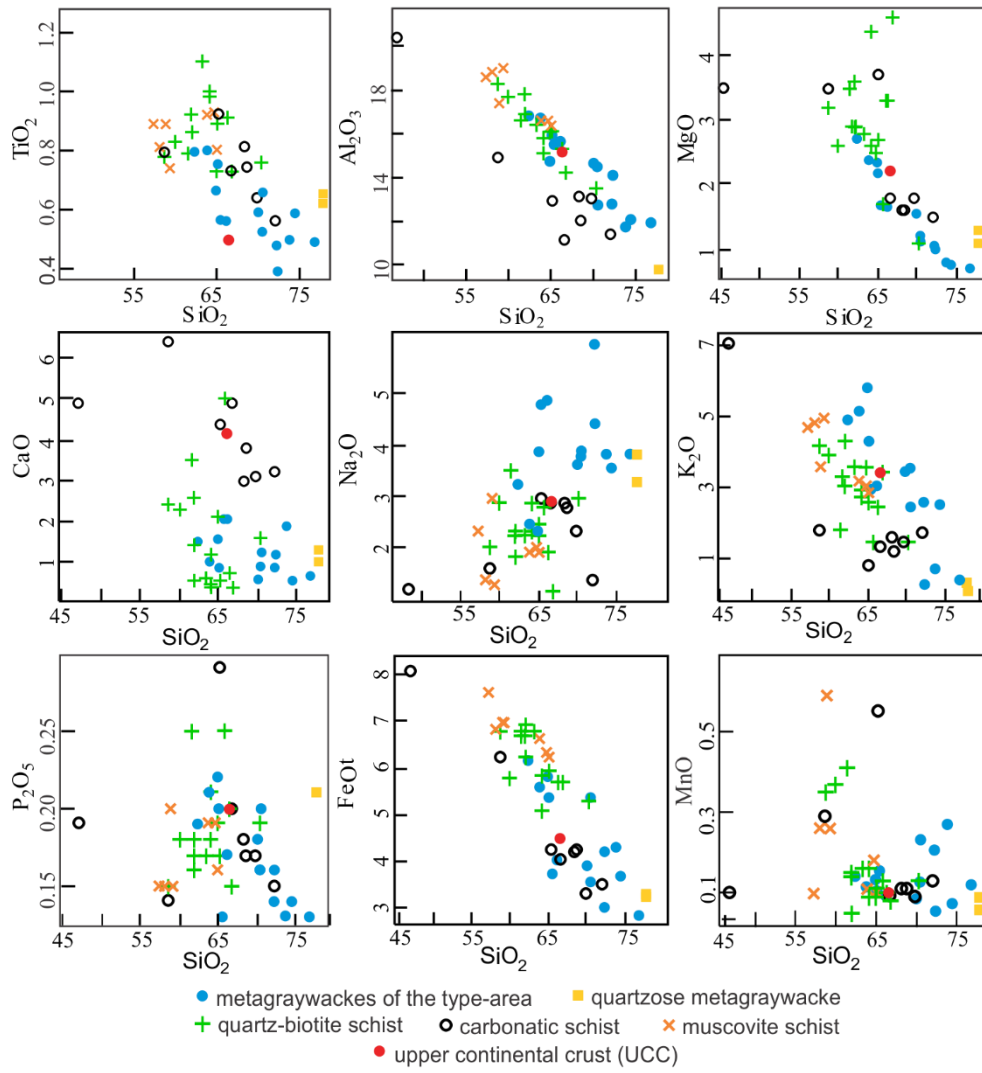


Figure 8: Bivariant diagrams of SiO_2 versus (a) TiO_2 , (b) Al_2O_3 , (c) MgO , (d) CaO , (e) Na_2O , (f) K_2O , (g) P_2O_5 , (h) FeO ; and (i) MnO . Upper continental crust (UCC) values are from Taylor and McLennan (1985).

Provenance and tectonic environment

The low metamorphic grade conditions experienced by the Salinas metagraywackes, mostly verified in the Salinas type-area (Fig. 1 and 2), suggest that metamorphism have not strongly affected these rocks. Furthermore, the high chemical immaturity (i.e., low $\text{SiO}_2/\text{Al}_2\text{O}_3$) and limited weathering of the source rocks (i.e., low CIA) allow us to analyze the provenance of these rocks using the petrographic and lithochemical features. The main sources for the Salinas sediments can be inferred from the relative abundance of their grains in thin section, where the high proportion of quartz and plagioclase in the metagraywackes may indicate granitic sources.

However, chemical modifications due to high mobility of some major elements even in low-grade conditions can occur. Therefore, trace elements such as La, Sc, Th, Ti, Zr and Co are considered

reliable indicators of tectonic environments (Bathia, 1983; Bathia and Crook 1986), and combined with major elements are used to identify tectonic environments,

The rare earth element (REE) distribution patterns (Fig. 9) show some overall enrichment in REE contents, specially of the light REE (LREE), and intermediate to weakly negative Eu anomalies ($\text{Eu}/\text{Eu}^* = 0.04 - 0.20$), with the average continental crust (UCC) curve roughly at a midpoint within the compositional range for the Salinas Formation. The range of negative Eu anomalies ($\text{Eu}/\text{Eu}^* = 0.04-0.20$) overlaps the UCC corresponding value ($\text{Eu}/\text{Eu}^* = 0.09$), suggesting contribution from predominantly felsic protoliths.

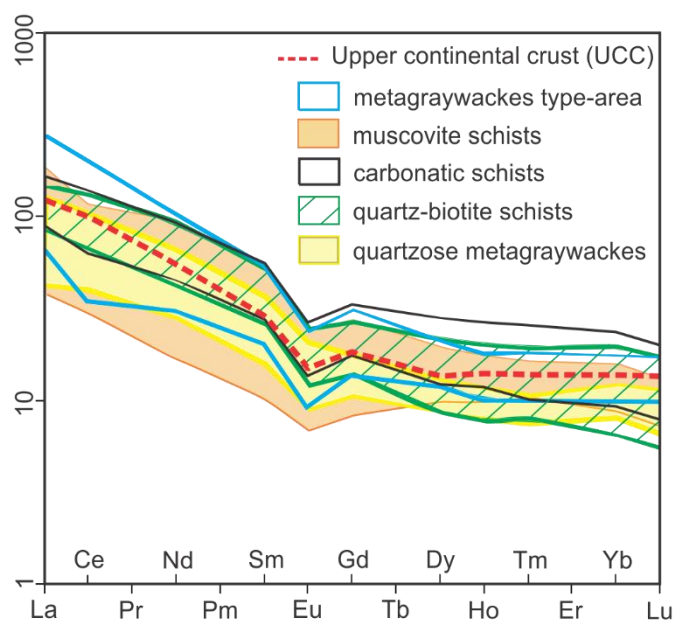


Figure 9: Chondrite-normalized REE patterns for the Salinas metagraywackes. Chondrite values from Boynton (1984), UCC values from Taylor e McLennan (1985).

Although these features are not conclusive, the general REE pattern tends to be close to those of mature active margins with continental magmatic arcs (Bathia 1983, Taylor and McLennan 1985, Sun et al. 2017).

Despite some scattered distributions, discriminant diagrams for tectonic environments (Fig. 10 and 11) show that the Salinas rocks plot mainly in the fields of continental magmatic arc, active continental margin and oceanic island arc, but virtually never in the passive margin field. Together, the major and trace element signatures indicate provenance of protoliths from magmatic arcs and active continental margins, which can be, indeed, of any age older than the regional metamorphism shown by the Salinas rocks (i.e., older than ca. 570 Ma, cf. Peixoto et al., 2017). In the regional scenario of the Araçuaí orogen, a candidate to provide sediment sources located in continental magmatic arc is the Ediacaran Rio Doce arc (Gonçalves et al., 2016; Tedeschi et al. 2016) and the Rhyacian-Orosirian Mantiqueira arc (Noce et al., 2007), and related active margins. Sources in island

arcs can be found in the juvenile basement of the Rio Doce arc, like the Rhyacian-Orosirian Juiz de Fora and Pocrane magmatic arcs (Noce et al., 2007; Heilbron et al., 2010; Novo, 2013), but also in the southern basement of the São Francisco craton (Ávila et al., 2010; Teixeira et al., 2015). Although far from the studied region, other possible sources in island arc setting are the juvenile magmatic arcs Serra da Prata and Rio Negro of the Ribeira belt (Tupinambá et al., 2012).

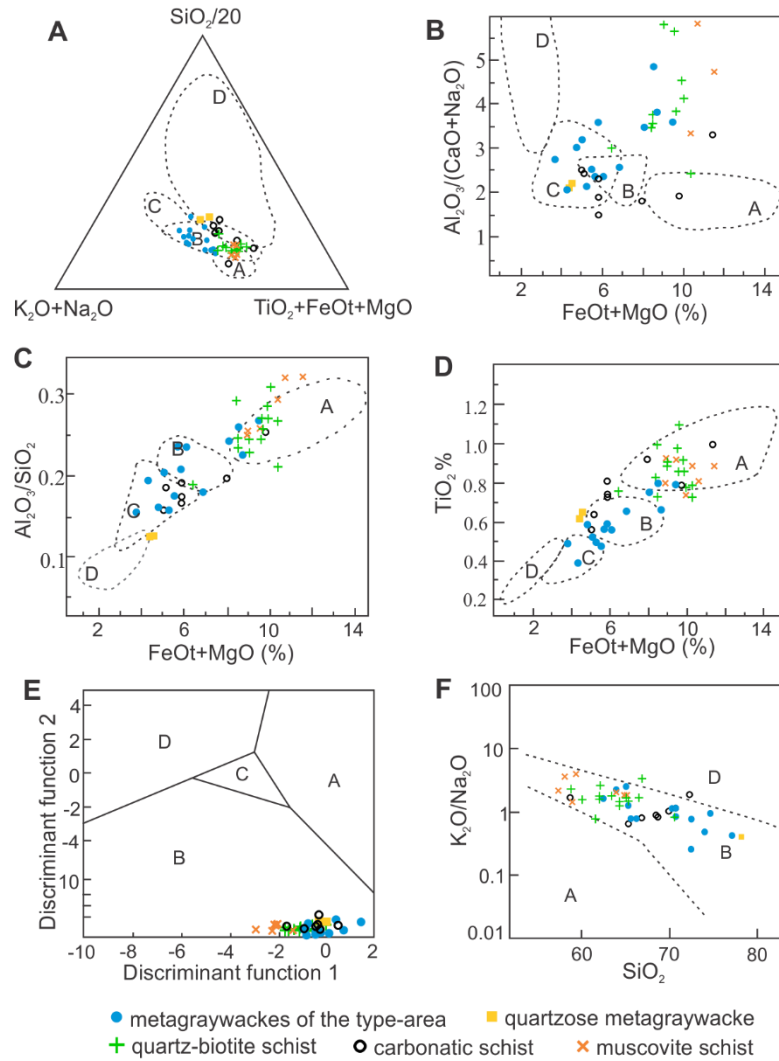


Figure 10: Major element diagrams for provenance discrimination of protoliths of Salinas rocks: (a) Ternary diagram $K_2O+Na_2O - SiO_2/20 - TiO_2+FeOt+MgO$ of Kroonenberg (1994); (b) $Al_2O_3/(CaO+Na_2O)$ versus $FeOt+MgO$ of Bathia (1983); (c) Al_2O_3/SiO_2 versus $FeOt+MgO$ of Bathia (1983); (d) TiO_2 versus $FeOt+MgO$ of Bathia (1983); (e) Discriminant function diagram from Bathia (1983), Discriminant Function 2 = $(-0.421 \times SiO_2\%) + (1.988 \times TiO_2\%) + (-0.526 \times Al_2O_3\%) + (-0.551 \times Fe_2O_3\%) + (-1.610 \times FeO\%) + (2.720 \times MnO\%) + (0.881 \times MgO) + (-0.907 \times CaO\%) + (-0.117 \times Na_2O\%) + (-1.840 \times K_2O\%) + (7.244 \times P_2O_5\%)$ versus Discriminant Function 1 = $(-0.0447 \times SiO_2\%) + (-0.972 \times TiO_2\%) + (0.008 \times Al_2O_3\%) + (-0.267 \times Fe_2O_3\%) + (0.208 \times FeO\%) + (-3.082 \times MnO\%) + (0.140 \times MgO\%) + (0.1958 \times CaO\%) + (0.719 \times Na_2O\%) + (-0.032 \times K_2O\%) + (7.510 \times P_2O_5\%)$; (f) K_2O/Na_2O of Roser and Korsch (1986). Fields: A, oceanic island arc; B, continental magmatic arc; C, active continental margin; D, passive continental margin.

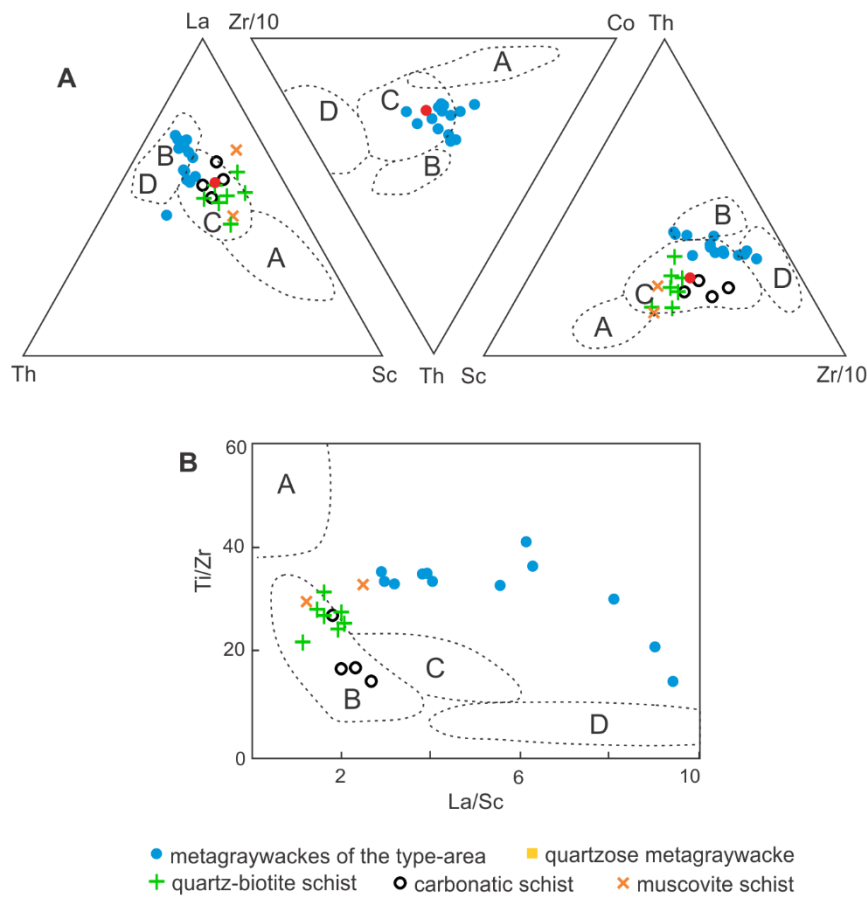


Figure 11: Trace element diagrams for provenance discrimination of protoliths of Salinas rocks: Bathia e Crook (1986): (a) Th-La-Sc, Zr/10-Th-Co and Sc-Th-Zr/10 ternary diagrams; (b) Ti/Zr versus La/Sc. Fields: A, oceanic island arc; B, continental magmatic arc; C, active continental margin; D, passive continental margin.

5. CONCLUSION

The presented lithochemical data from Salinas rocks show: i) low chemical index of alteration ($CIA = 46.62$ to 69.22), and low SiO_2/Al_2O_3 ratio (2.3 - 7.9), indicating limited weathering on the sediment source rocks and deposition relatively close to the source areas (considering wet climate conditions); ii) graywacke protoliths of the Salinas rocks derived from mixed sources; and iii) continental magmatic arc, active continental margin and island arcs were the most important geotectonic settings for the sources that contributed to fill the Salinas basin.

The available detrital zircon ages suggest that collisional granites of the Araçuaí orogen also provided sediments to the Salinas basin, as detrital grains as young as ca. 560 Ma were found in the graywackes (Lima et al., 2002; Pedrosa-Soares et al., 2011).

In the scenario of the geodynamic evolution of the Araçuaí orogen, the filling of the Salinas basin seems to have started with pre-collisional flysch-type sediments (Santos et al., 2009; Peixoto et al.,

2015), but it would have continued during the collisional stage, involving deep-sea turbiditic environments to shallow marine and fluvial environments (Fig. 12).

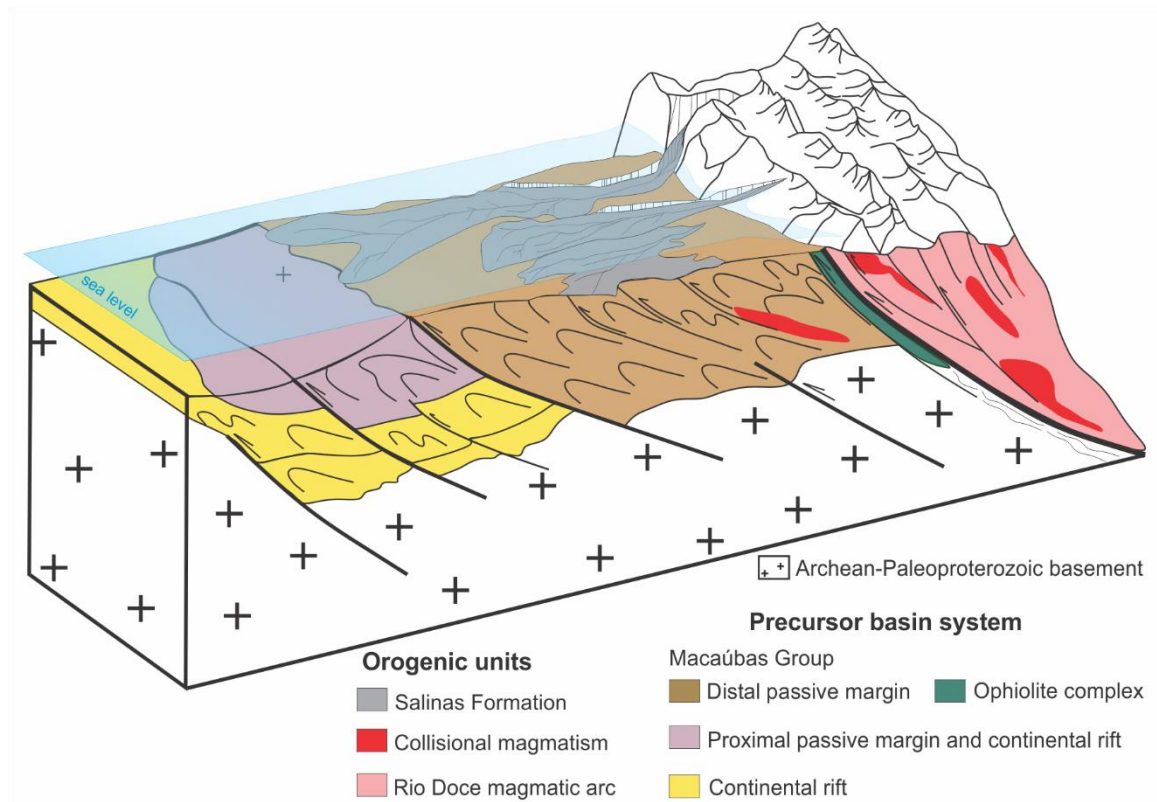


Figure 12: Tectonic model illustrating the syn-orogenic deposition in the Salinas basin.

6. ACKNOWLEDGEMENTS

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CAPÍTULO 3

Evolution of the Itaporé batholith, Ediacaran-Cambrian Araçuaí orogen, SE Brazil: Geochemistry, geochronology, petrogenesis and fluid interactions

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Abstract: The Araçuaí orogen (SE Brazil) records a long period of magmatic activity from the earliest pre-collisional (ca. 630 Ma) to the latest post-collisional (ca. 480 Ma) intrusions. The Itaporé batholith, located in the Coronel Murta - Itinga region (southeast Brazil), includes a number of granitic bodies that has been ascribed to the post-collisional G4 supersuite (ca. 530-500 Ma). According to field and analytical data, this batholith has been subdivided into three main granitic facies: i) biotite granite (Qtz + Kfs + Pl + Bt + Ap + Zrn ± Ms ± Mnz ± Ttn ± Aln), ii) two-mica leucogranite (Qtz + Kfs + Pl + Ms + Bt ± Grt + Zrn + Mnz + Ap ± Tur), and iii) pegmatoid granite (Kfs + Qz + Pl + Ms ± Bt ± Ap ± Tur ± Grt ± Brl). The western part of the batholith is dominated by biotite monzogranite while the eastern part consists of leucogranites (syenogranites to monzogranites) locally presenting gradational contacts with pegmatoid granite. U-Pb (ICP-MS) ages obtained from apatite, monazite and zircon reveal a long and complex evolution history from 540 Ma to 474 Ma, encompassing magmatic crystallization, deuteritic activity and thermal metamorphism. Dating on zircon yielded emplacement ages around 538 Ma for biotite granites. Geochemical signatures suggest

two different petrogenetic processes and magma sources for the biotite and two-mica granites. On the other hand, similar evidence provided by petrographic, mineral chemistry and U-Pb monazite investigations reveal a common stage of fluid interaction between 522 Ma and 527 Ma, which are associated with volatile-rich fluids escape during deuteritic alteration of the two-mica leucogranites. The fluid evolution after magma solidification promoted element mobility under subsolidus conditions and postpone its thermal lifetime. Finally, the youngest evolution period (508 - 474 Ma) marked by monazite, apatite and zircon ages from both biotite and two-mica granites can be related to the final stabilization of the Araçuaí orogen, during the late post-collisional stage, involving fluid percolation probably related to crustal thinning and asthenospheric upwelling.

Keywords: Apatite, monazite and zircon dating; deuteritic alteration; thermal events; Araçuaí orogen

Introduction

Understanding the origin and genesis of granites continues to be a challenging task, especially for the more evolved ones. The complicating factor is the tendency of mineralogical and chemical features converge as granites become more felsic and compositions approach those of low-temperature melts (Chappell and White, 2001).

Granitic rocks have been classified in genetic groups named I-, S-, M-, A- and C-types based on mineralogical and geochemical features (see a synthesis in Barbarin 1990 for summary). The terms I- and S-types refer to the magma source, being I-type granites derived from igneous sources and S-type granites from partial melting of metasedimentary rocks (Chappell and White, 1974, 2001). Among the I-type granites, the subdivision into high- and low-temperature can provide important implications for how those rocks are involved in crustal growth and evolution. High- and low-temperature I-type granites imply in inputs of juvenile magmas to the crust or recycling of older crustal igneous rocks, respectively. The S-type granites are apparently always crystallize at relatively low temperature origin (Chappell and White, 2001).

Following compressional orogenic stresses and crustal thickening, processes of gravitational collapse provide decompression and abundant partial melting within evolved orogens. For this reason, late- and post-collisional stages are exceptional periods for granitic production and crustal reworking, as has been described in many orogenic systems, such as the Lachlan fold belt (Chappell and White, 1974), Caledonian (Pitcher, 1983) and Hercynian (Förster et al., 1999) belts, and the Araçuaí orogen (Pedrosa-Soares et al. 2001, 2011; Gradim et al., 2014; De Campos et al., 2016).

In long-lived orogenic systems, the build-up of granitic batholiths is generally a result of the amalgamation of multiple magma injections from distinct magmatic chambers and sources, forming complex systems of incestuous plutons (e.g., Pitcher, 1983). Under this circumstances, the igneous

textures might continue to change (Glazner et al. 2004) because of grain coalescence and overgrowth caused by thermal cycling (Johnson and Glazner, 2010). Evidences of mineral replacement and geochronological studies may also provide valuable insights on processes that affected these plutons.

The Itaporé batholith (Pedrosa-Soares, 1997) covers an area over 520 km², and contains plutons mostly composed of two-mica granites and biotite granites, emplaced from the late-collisional to post-collisional stages of the Araçuaí orogen (Pedrosa-Soares et al., 2011). There are very few previous detailed studies on the Itaporé batholith (Pedrosa-Soares et al., 1987; Monteiro, 1990). They described the main granite varieties (biotite granite, two-mica granite and pegmatoid granite) forming plutons of the westernmost part of the batholith, and suggested a petrological model co-genetically linking them from igneous to deuteritic metasomatic processes within the same single plutons (Pedrosa-Soares et al., 1987). Although the Itaporé batholith has been generally classified in the S-type group owing to the large predominance of two-mica granites (Pedrosa-Soares et al., 2001, 2011), recent lithochemical studies suggest an I-type (Caledonian) origin for some plutons exclusively composed of biotite granite (Paes et al., 2017).

Our interest in a detailed analytical study on the Itaporé batholith arose from the field investigation on the intricate relations between biotite granites and two-mica granites in the Coronel Murta area (Fig. 1). This contribution presents a detailed approach on the petrogenesis and evolution of those granites, based on petrography, lithochemical, mineral chemistry and U-Pb geochronological data. Special attention is given to the complex petrographic features and related chemical attributes because of their close association with fluid-rock interactions from igneous to relatively low temperature deuteritic processes, which provide key elements to understand the late geodynamic evolution of this long-lived orogenic system. Our results from the U-Pb (ICP-MS) geochronology on zircon, monazite and apatite are the first to constrain the evolution stages of the Itaporé batholith, from magma emplacement, deuteritic alteration to the latest thermal metamorphism.

1. Geotectonic and regional settings

The Araçuaí orogen of southeastern Brazil together with its counterpart located in southwestern Africa make up an orogenic system edged by the São Francisco-Congo craton (Fig.1). This singular confined orogen developed within an embayment shaped in the São Francisco-Congo paleocontinent, which hosted an end-branch (a gulf) of the Adamastor Ocean in Late Neoproterozoic time (Pedrosa-Soares et al. 2001, 2008, 2011; Alkmim et al. 2006). In the Cretaceous, the Araçuaí - West Congo orogenic system was broken apart by the opening of South Atlantic Ocean, and the Araçuaí orogen inherited a huge amount of orogenic igneous rocks, including the Rio Doce magmatic arc and collisional to post-collisional granites (Pedrosa-Soares et al., 2011; Gradim et al., 2014; De

Campos et al., 2016; Richter et al., 2016; Gonçalves et al., 2016, 2018; Tedeschi et al., 2016; Melo et al., 2017a,b).

Regionally, those orogenic igneous rocks have been grouped in five supersuites (Pedrosa-Soares et al., 2011), namely: G1 (Rio Doce magmatic arc, ca. 630–585 Ma), G2 (collisional granites, ca. 585–545 Ma), G3 (late collisional to post-collisional granites, ca. 545–530 Ma), G4 (post-collisional granites, ca. 530–495 Ma), and G5 (post-collisional granites and mafic intrusions, ca. 525–480 Ma). Recent detailed studies on those suites can be found in Cavalcante et al. (2013), Gonçalves et al. (2014, 2016, 2018), Gradim et al. (2014), De Campos et al. (2016), Peixoto et al. (2015), Richter et al. (2016), Tedeschi et al. (2016), and Melo et al. (2017a,b).

The post-collisional granites are extensively exposed across the eastern Araçuaí orogen (southeastern Brazil, Fig.1), in particular the G4 supersuite. It represents an important S-type magmatism, including mainly two-mica, high-K alkaline, slightly metaluminous to peraluminous granites free of the regional solid-state deformation, which has been related to the gravitational collapse of Araçuaí Orogen (Pedrosa-Soares et al., 2011).

The Itaporé batholith (Pedrosa-Soares, 1997), cropping out over an area around 520 km², is the largest granitic body ascribed to the post-collisional G4 supersuite. Besides, the Itaporé batholith has a great economic relevance because the pegmatites producing gemstones, industrial minerals and most of the lithium ore yet found in Brazil, as well as many dimension stone quarries (Pedrosa-Soares et al., 2011; Paes et al., 2017). Systematic geological mapping in 1:100,000 scale covers the whole Itaporé batholith (Pedrosa-Soares, 1997; Pedrosa-Soares and Oliveira, 1997; Heineck et al., 2008; Paes et al., 2008; Knauer et al., 2011), and the first studies on their granites and pegmatites were presented by Sá (1977), Correia-Neves et al. (1982, 1986), Pedrosa-Soares (1984), Monteiro (1986), Siga-Junior (1986), Pedrosa-Soares and Siga-Junior (1987), Pedrosa-Soares et al. (1987, 1990, 2011) and Monteiro (1990).

The Itaporé plutons firstly studied in detail were understood as zoned bodies, consisting of biotite granite roots and cores, grading into two-mica and muscovite-garnet leucogranites towards the top zones and upper borders, which were capped by pegmatoid cupolas (Pedrosa-Soares, 1984; Monteiro, 1986). Based in petrographic, lithochemical and fluid inclusion studies, the origin of two-mica and muscovite-garnet leucogranites was explained by a pervasive and intense deuteritic auto-metasomatism related to ascending H₂O-rich fluids, established during the late magmatic to pneumatolytic stages, with the pegmatoid cupolas representing granitic melt residues emplaced during the thermal contraction of a cooling pluton (Pedrosa-Soares et al. 1987; Monteiro, 1990).

The first isotopic data from Itaporé granites of the study region were obtained by whole-rock Rb-Sr and K-Ar on mica analysis. Rb-Sr isochronic ages of 540 ± 10 Ma ($^{87}\text{Sr}/^{86}\text{Sr}_{(i)} = 0,7125 \pm 0.0007$) and 525 ± 30 Ma ($^{87}\text{Sr}/^{86}\text{Sr}_{(i)} = 0,71213 \pm 0.0002$) were interpreted as magmatic

crystallization ages, with the initial Sr ratios together with mineralogical and lithochemical signatures suggesting S-type magmas (Siga-Junior, 1986; Pedrosa-Soares and Siga-Junior, 1987). The biotite and muscovite K-Ar ages around 498-475 Ma were interpreted as the late cooling stages of plutons (Siga-Junior, 1986).

Recently, Paes et al. (2017) assumed that some granite types found in IB may not have originated from the same source. Then, biotite granite was included in the G5 supersuite as an I-type granite derived from deeper crustal levels by partial melting or mantellic magmatism. On the other hand, the two-mica granite and muscovite-garnet granite phases remained as G4 granites and so interpreted as formed by melting of metasedimentary rocks in shallower levels. The data and interpretations presented by Paes et al. (2017) corroborate the previous interpretations on the two-mica and muscovite-garnet granites, considering them as S-type granites formed in shallower crustal levels (cf. Pedrosa-Soares et al., 2011).

The study area region is located in the northeastern segment of the Minas Novas corridor, a NE-trending double-verging structure that records a transpressional phase related to the regional deformation and metamorphism (Fig. 1). This collisional phase was followed by a transtensional deformation, associated with late extensional structures and thermal metamorphism coeval with the emplacement of Itaporé intrusions (Pedrosa-Soares et al., 1993, 1996, 2011; Alkmim et al. 2006; Peixoto et al., 2017).

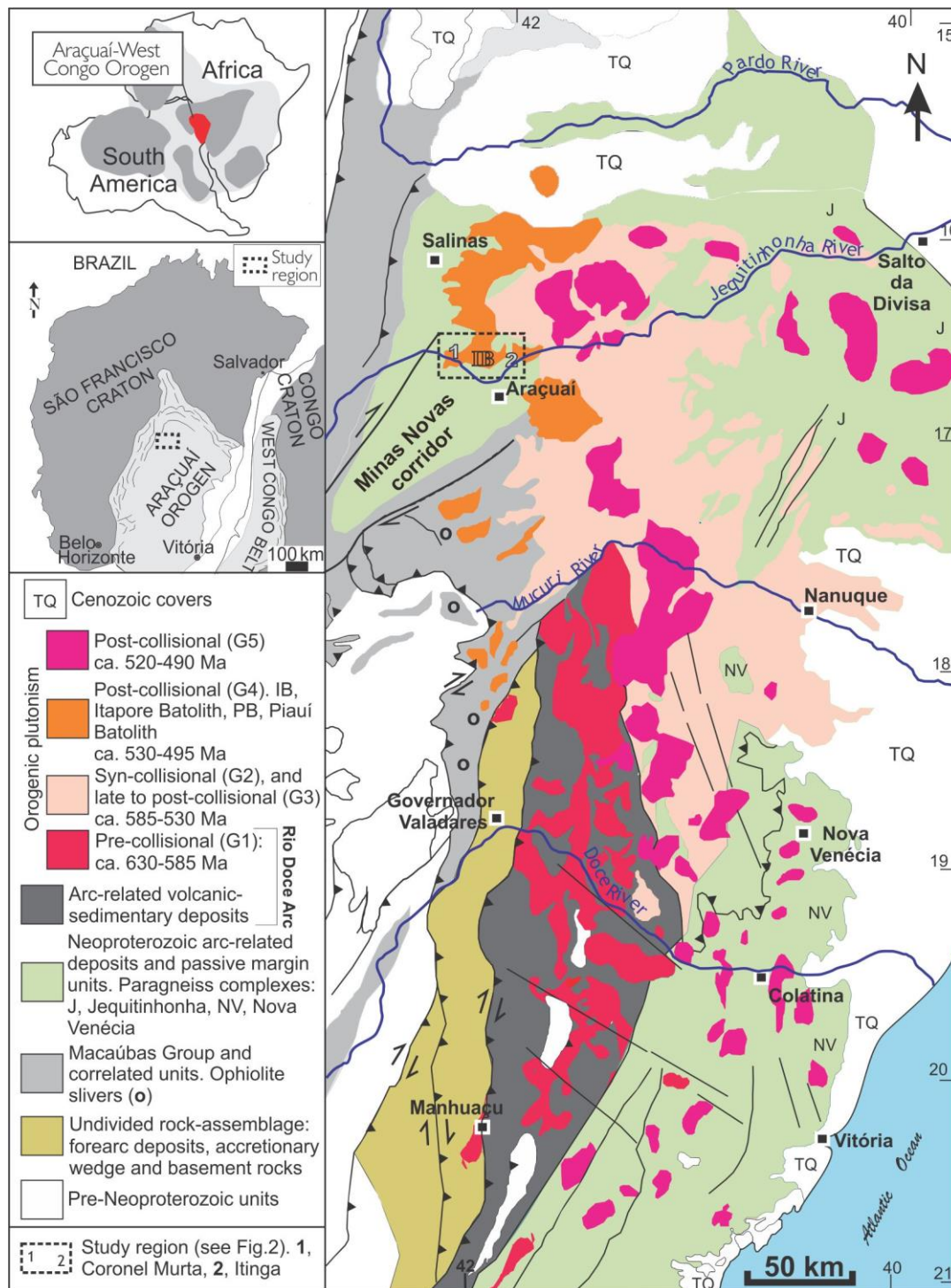


Figure 1: Simplified geological map highlighting the main components of the Araçuaí orogen, and its paleotectonic setting (modified from Pedrosa-Soares et al. 2011).

2. Geologic setting

The studied part of the Itapora batolith (IB) is an elongated body, extending for about 47 km in the W-E direction from the surroundings of Coronel Murta to the west of Itinga (Fig. 2). This portion of the batolith is an almost continuous mass of granitic rocks with the large predominance of two-

mica leucogranites in its eastern segment (more than 80% in area), and a minor but homogenous sector composed of biotite granite in the western tip (Fig. 2).

2.1. Host Rocks

Granitic bodies of the Itaporé batholith cut the regional structures of the country rocks which structural trend shows clear sudden adjustments around the intrusion borders. The country rocks are mainly quartz-mica schists with sparse lenses of calc-silicate rocks of the Salinas Formation (Fig. 2). The contacts between the Itaporé granitic bodies and their host rocks metasediments of Salinas Formation are sharp with granitic and pegmatitic apophysis and veins cutting across them. There are country-rock roof pendants lying on granite bodies and xenolith-rich zones within granites near their contacts.

In the northeast border of the batholith, the contact with G3 rocks is intrusive whereas the G3 granite is cut by pegmatite of IB without ever IB rocks being intruded by G3 lithotypes.

The metamorphic assemblage vary from west to east. In the Coronel Murta region metamorphic rocks comprise garnet, sillimanite and staurolite, while in the eastern, nearby Itinga occur garnet, sillimanite, andalusite and cordierite. These assemblages record the occurrence of two different metamorphic events generated under low-pressure metamorphism. The oldest event is described as a syn-collisional Barrovian metamorphism that affected the country rocks before the emplacement of Itaporé batholith, whereas the most recent occurred during the extensional collapse of the orogen and promoted ascent of the geotherms through post-collisional granite plutonism (see e.g. Costa, 1989, Pedrosa-Soares et al. 1996, Peixoto et al. 2017).

Evidences of metasomatism produced by fluids derived from the igneous bodies and thermal metamorphism are verified by abundance of muscovite, fibrous sillimanite and coarse-grained texture on the host rocks. Tungsten ore occurring at the contact zones as scheelite and wolframite-bearing quartz veins was reported by Monteiro et al. (1990).

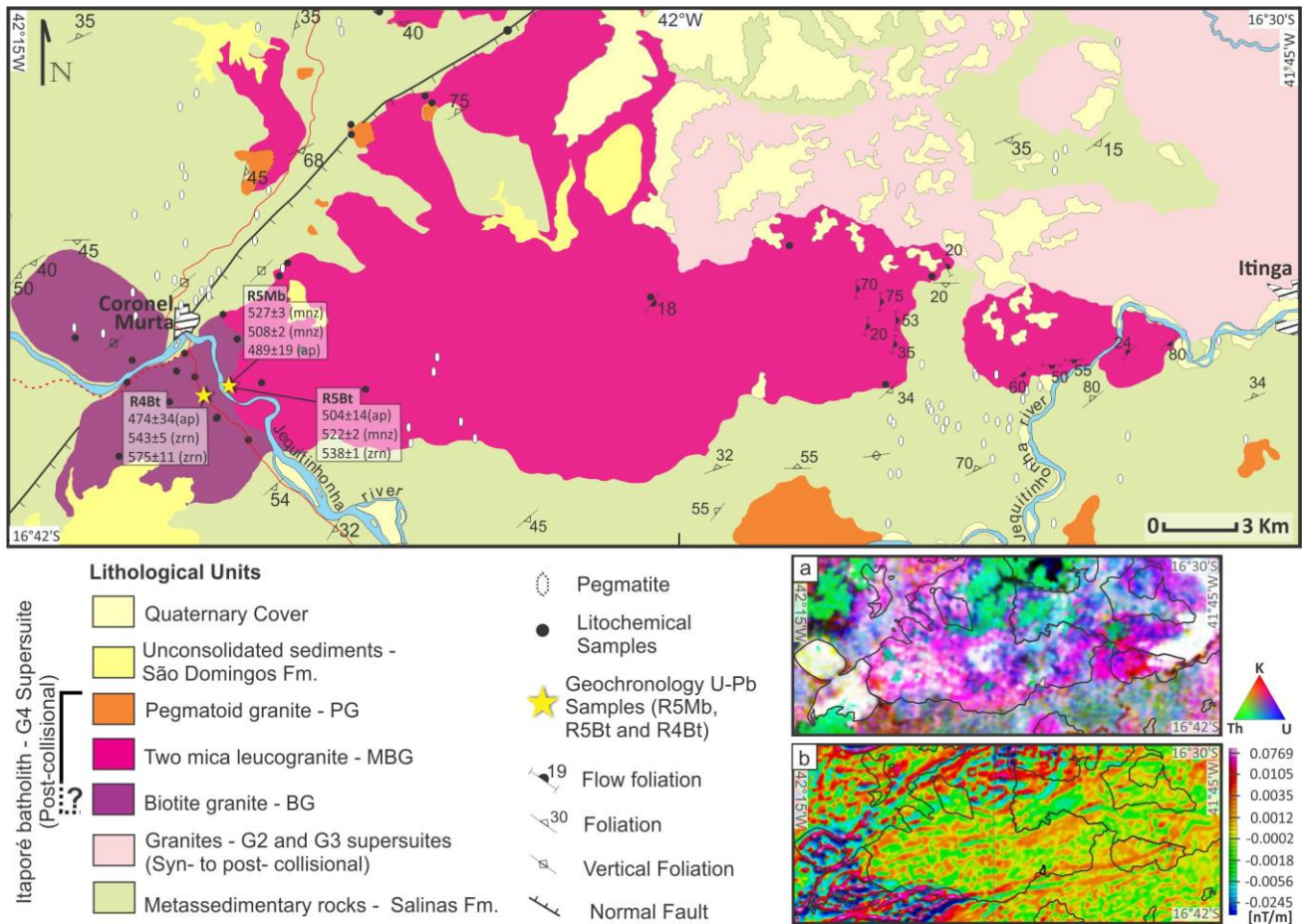


Figure 2: Geologic map of the studied region, made after compilation, detailed field mapping and modification of the geologic maps of Pedrosa-Soares (1997), Paes et al. (2008), Paes et al. (2017). Geophysical images from Paes et al. (2017) together with the lithological contours: (a) Ternary gamma-ray spectrometer map; (b) First vertical derivative magnetic map.

2.2 The rocks of the Itaporé batholith

Petrographic studies were carried out on ninety thin sections, including the seventy-one thin sections previously studied by Correia-Neves et al. (1982), Pedrosa-Soares (1984), Monteiro (1986) and Paes et al. (2010). Three representative groups of granitic rocks can be identified under the extensive area of the IB: (a) Biotite granite (BG); (b) Two-mica leucogranite and muscovite-rich granites (MBG); (c) Pegmatoid granite (PG). Furthermore, a large number of pegmatites occurs in the study region (Pedrosa-Soares 1984, Correia-Neves et al. 1986). Mineral modal proportions based on thin sections are presented in Table 1. The major minerals in all facies are quartz, sodium-plagioclase and K-feldspar. The modal contents indicate that granites are largely dominant by monzogranites. Figure 3 presents the macroscopic features of representative rocks from each granitic type observed along the IB.

Table 1

Mineral modal proportion in % vol.

	Qz	Kfl	Pl	Ms	Bt	Others
Biotite granite (BG)	16.5 - 33.2	16 - 41.7	24 - 54.4	0 - 0.8	5 - 12.5	ttn (<0.4); ap (<3)
Two-mica granite (MBG)	18.1 - 47.2	14.6 - 53.3	14.6 - 53.3	1 - 11.8	0.2 - 10.3	gr (<1.3); tur (<1.3); ap (<0.4)
Pegmatoid granite (PG)	36	44.5	9.9	3.1	0.4	tur (6.5)

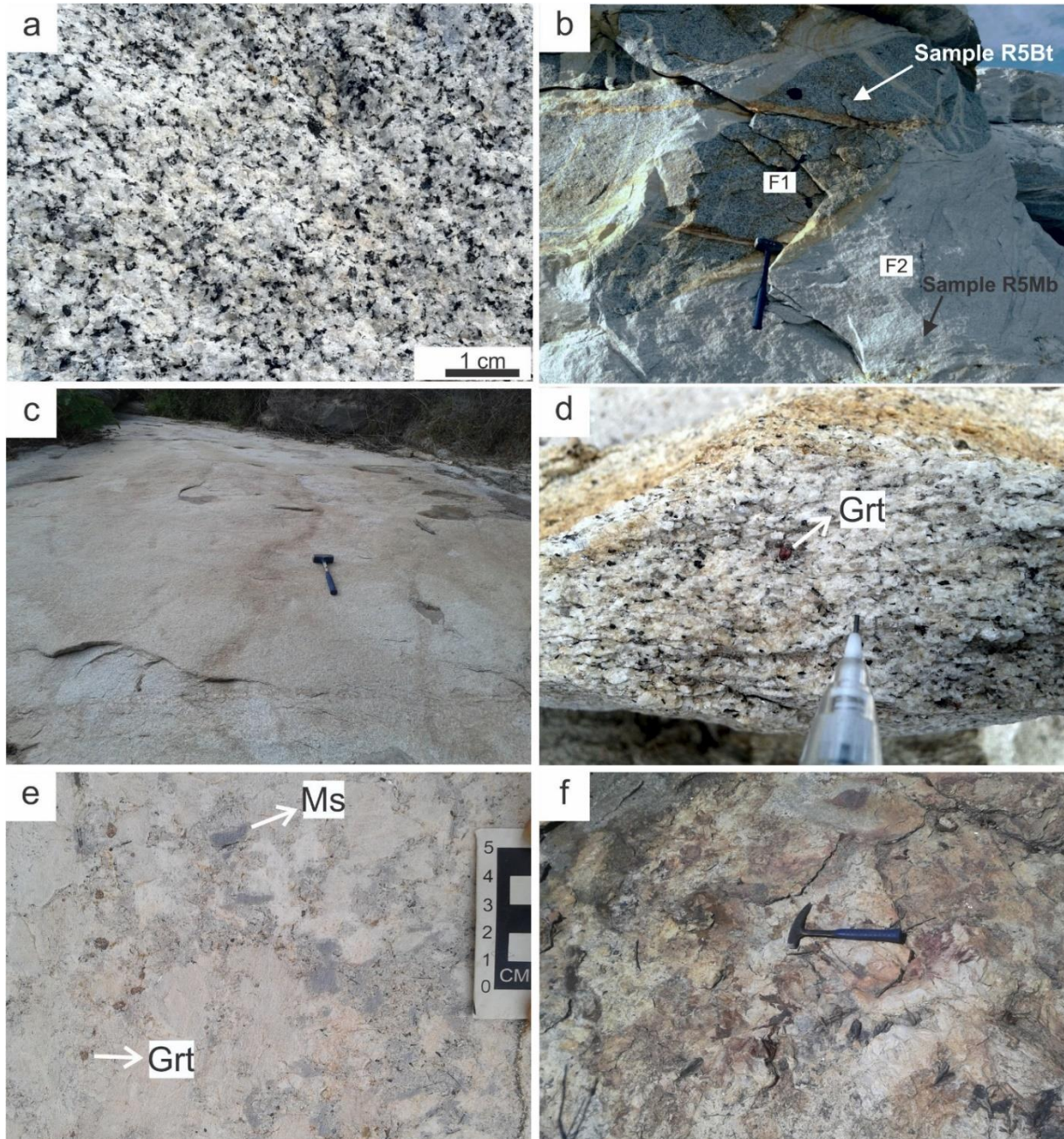


Figure 3: Macroscopic features of IB rocks from BG (a, b), MBG (b-d), PG (e) and pegmatite (f). (a) Isotropic medium coarse-grained granite. (b) BG type crosscut by MBG veins (c) Homogeneous and isotropic fine coarse-grained two-mica leucogranite (MBG). (d) Isotropic medium coarse-grained two-mica leucogranite with garnet. (e) Typical appearance of pegmatoid granite (PG); (f) pegmatite.

The biotite granite (BG) is a light grey color fine- to coarse-grained with biotite >> muscovite as the main characteristic. Textures varies from equigranular to sub-porphyritic with hypidiomorphic orthoclase that is most common in the central and internal parts of the plutons. The magmatic mineral assemblage is Qtz + Kfs + Pl + Bt with Ap + Zrn ± Ms ± Mnz ± Ttn ± Aln as accessories (abbreviations according with Siivola and Schmid, 2007). Rutile, ilmenite, hematite and pyrite are rare, and only observed in some thin sections. Even though the BG is more mafic when compared to others IB granitic facies, both micas are encounter on the majority of the accessory amounts. Igneous autholiths are scarce and only observed in the inward of BG pluton, whereas xenoliths, aplite and pegmatite veins are usual, especially in the outer pluton zones.

Detailed petrographic investigation has revealed several evidences of metasomatism (Fig.4). They are represented by partially muscovitization of biotite, plagioclase and k-feldspar (Fig.4a,b,c,d,e). In biotite the mineral-replacement process is associated with appearance of chlorite and a clay mass rich in iron oxide, as well as rutile (Fig.4a,b,c). This is interpreted to represent the reaction of $Bt \rightarrow Rt + Ms + Fe \text{ oxide}$, where Fe oxide is assumed to be transported away (Fig.4c). Albite is noticeably in oligoclase-albite replacement (Fig.4f,g). Deanorthitization (loss of calcium in plagioclase) associated with sericitization of plagioclase (Fig.4g). Allantite crystals appear altered with highly metamitic texture (Fig.4h).

The pluton tend to display a balloon-like shape. The foliation of the country rocks trough the contact are conformed showing centripetal, and moderate to vertical dip angles (40-90°). At the outcrop scale, biotite granite seems to be isotropic, but evidences of solid-state deformation is observed in thin section by localized undulose extinction in quartz and plagioclase, as well as small-scale brittle fractures (Fig.4i).

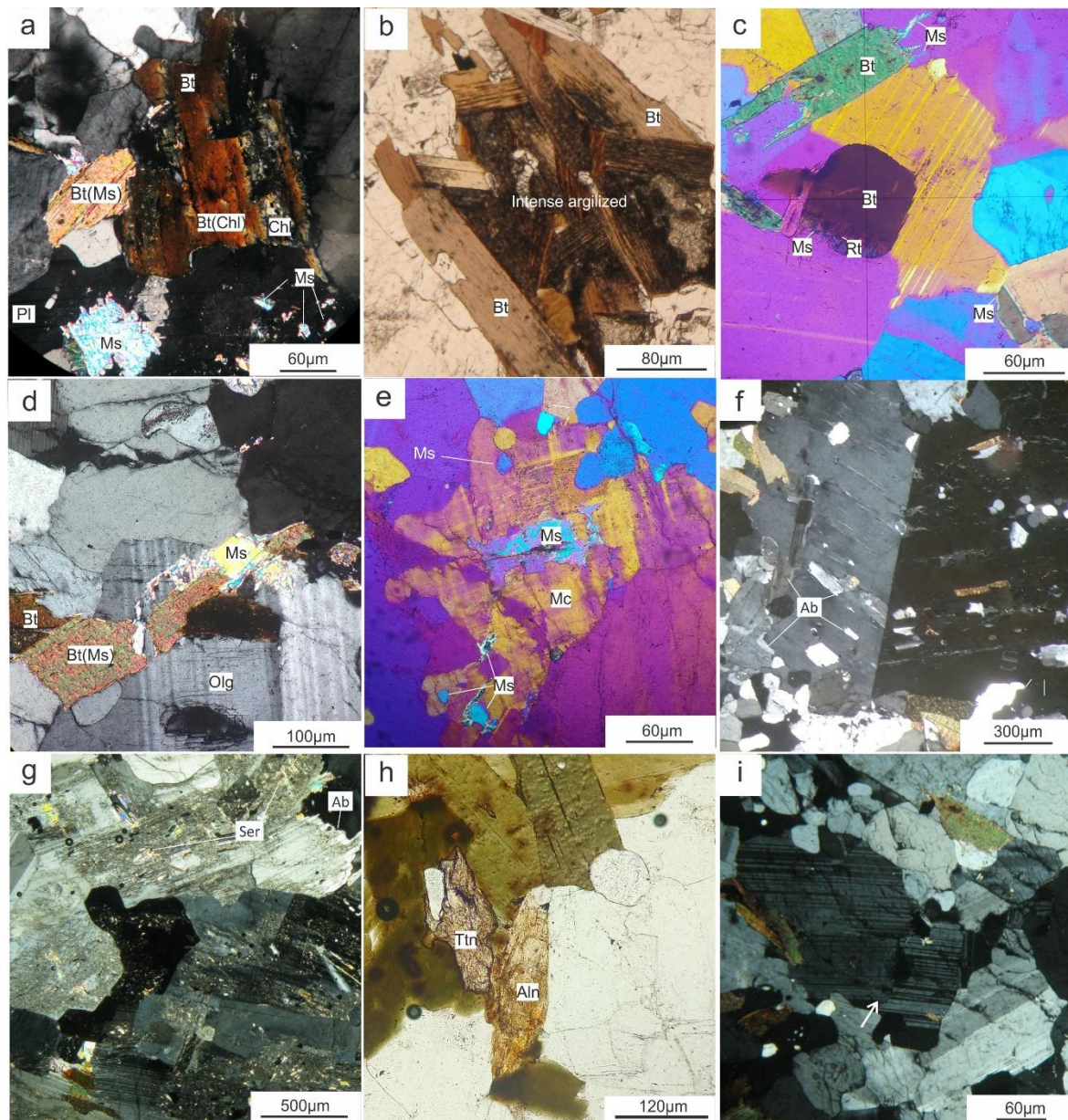


Figura 4: Microscopic features and textures of BG: (a) Biotite replaced by chlorite in pseudomorphic form and adjacent muscovite replacing oligoclase and biotite, note that the boundary of muscovite with primary minerals is rugged and unflattened. (b) Locally biotite may appear strongly argilized, the alteration occurs easier along cleavage. (c) Tiny growth of secondary metasomatic muscovite at the biotite border and rutile inclusions in sagenitic altered biotite. (d) Secondary muscovite formed between two biotite grains, the adjacent biotite grains are also altered showing high interference color and rugged appearance. (e) Newly fine muscovite chaotically formed at the expense of K-feldspar (f) Orthoclase containing plagioclase inclusions that exhibit clear replacive albite rims. (g) Intense sericitization and clear albite rim in oligoclase grains. (h) Titanite together with zoned metamitic allanite crystal (i) Plagioclase crystals showing brittle fractures and patchy undulose extinction. Note the new grain boundary (arrow) associated with dislocation of the twin orientation.

Two-mica leucogranite (MBG) comprises muscovite-biotite syenogranite to monzogranite with muscovite>biotite. MBG is widely dominated by two-mica leucogranite phase, but in outer zone of

the intrusion muscovite fine-grained rich massifs take place. Those are represented by muscovite-tourmaline, albite-tourmaline granite (TG) and albite-garnet granite could be also occur associated with pegmatoid granite. Qtz + Kfs + Pl + Ms + Bt are the magmatic assemblage minerals, and Grt + Zrn + Mnz + Ap ± Tur as accessories.

It is interesting to note that evidences of replacement minerals in MBG are similar, but even more usual if compared with BG. Deuteric alteration was recorded by sericitization of plagioclase and microcline, muscovitization and chloritization of biotite, as well as albitization of plagioclase (Fig.5). Advanced degree of replacement is represented by strongly blurred and sericitized feldspars (Fig. 5a,b). This occurs preferentially into plagioclase grains, and barely in k-feldspar as shown in Fig.5c. Altered albite has polysynthetic twinning partially erased and cloudy appearance, presumably caused by the distribution of impurities and high microporosity (Fig.5d,e). Biotite is commonly transformed to muscovite, and minor to pseudomorphic chlorite (Fig.5f,g,h). The contact between feldspar grains frequently has a welded appearance, suggesting incremental growth framework after the magmatic fabric was formed (Fig.5i).

New field observations revealed several MBG apophysis cutting BG granite, and enclaves of the BG immersed in MBG along the contact (Figure 3b). These features indicate BG finished solidification before intrusion of MBG.

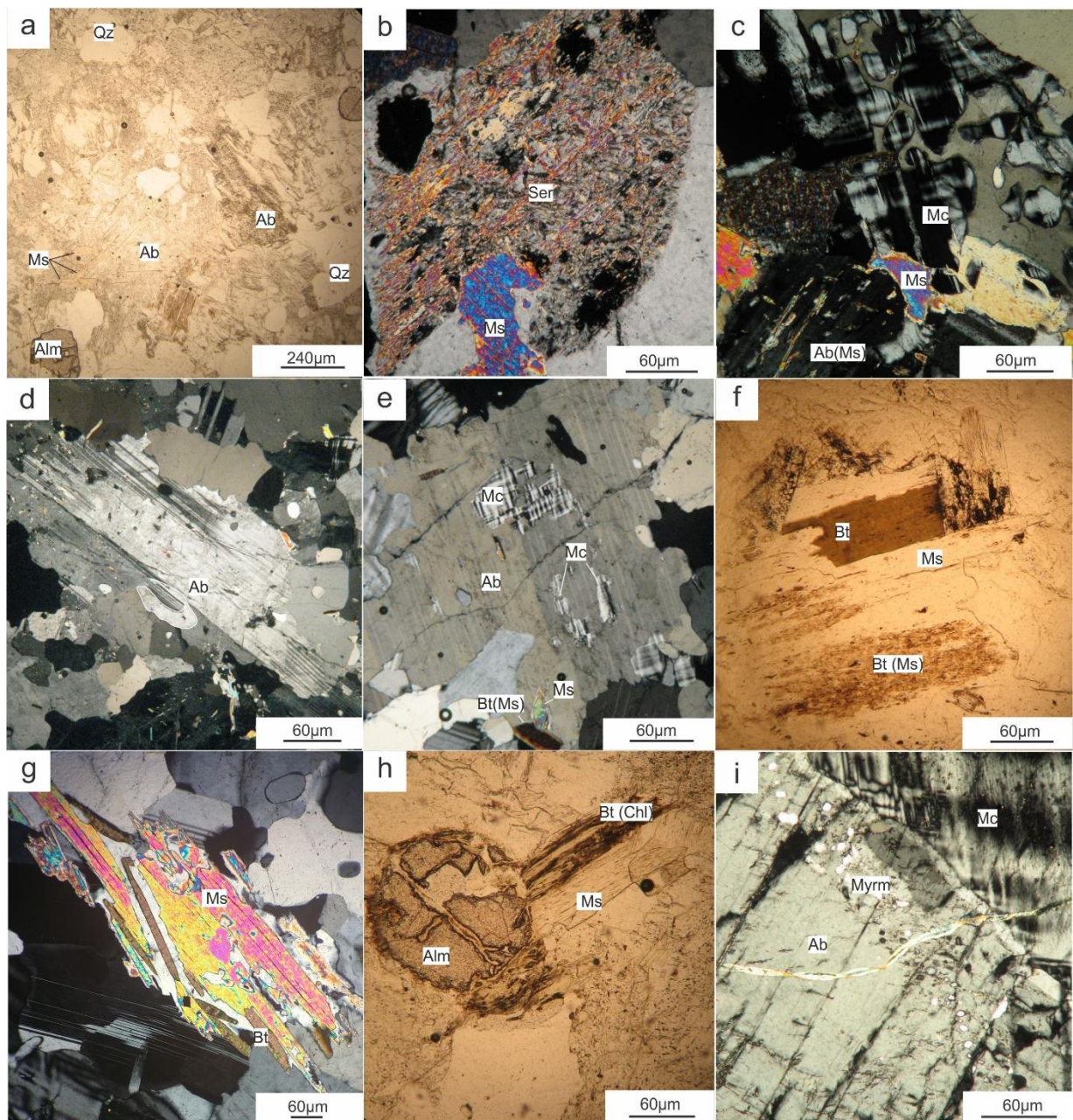


Figure 5: Microscopic features and textures of MBG. (a) Altered MBG shows feldspars grains highly sericitized. (b) Unrecognized feldspar is completely replaced by albite and sericite. (c) Muscovitization in albite and less strongly in microcline. (d) Polysynthetic twinning is destroyed owing to extreme albitization. (e) Altered albite has cloudy appearance along its boundaries. (f) Biotite appears muscovitized, and pale washed biotite remains. (g) Secondary muscovite may replace biotite and contiguous feldspar grains are also affected. (h) Altered biotite replaced by secondary muscovite and chlorite, while primary almandine survives. (i) Myrmekite appears together with coalescent grain-boundary of K-feldspar and plagioclase.

PG (pegmatoid granite) consists typically with cream-colored granites with greatly heterogeneous texture. Crystal size varies considerably from medium until coarse-pegmatitic grain size. The assemblage comprises $Kfs \pm Qz \pm Pl \pm Ms \pm Bt$ and $Ap \pm Tur \pm Grt \pm Brl$ as accessory minerals. Poikilitic perthitic K-feldspar phenocrysts can reach 25 cm of diameter. MBG and PG occur

associated and exhibit gradational contacts. Pegmatite and aplite veins are often observed and their compositions are analogues to PG content.

The pegmatites are centimetric to kilometeric with simple or complex textural and mineralogical zoning are common. They are hosted in schists and in all granitic facies. The assemblage comprises Kfs $\pm$ Qz $\pm$ Pl $\pm$ Ms $\pm$ Bt $\pm$ Tur $\pm$ Grt $\pm$ Brl, with the occasional presence of lithium minerals (lepidolite, amblygonite, petalite and spodumene).

2.3 Geophysical signatures

In the Figures 2a and 2b is explicit the relative contrast of the geophysical signatures between the BG intrusion and those of two-mica and pegmatoid granitic bodies. The ternary gamma-ray spectrometer map (Fig.2a) indicates heterogeneous composition in terms of K, Th, U, and general dominance of potassium (pinkish colors) in the MBG and PG bodies, while BG surface is marked by white zones that indicates the high concentration of these three radioactive elements. The first vertical derivative magnetic map (Fig.2b) emphasize the higher values for BG when compared with MBG and PG rocks. Very severe concentric elliptical anomalies are seen in the center and border of BG intrusion (Fig.2b). Magnetic lineaments also highlight the dominant NE-SW foliation printed on the Salinas Formation rocks within the Minas Novas corridor, as well as the external contact with the intrusions.

3.0. Whole-rock compositions

Major and trace elements data from 67 rock samples including new (16) and compiled data (51) from Monteiro (1986), Pedrosa-Soares et al. (1987) and Paes et al. (2010, 2017). The results of whole-rock chemistry are reported in Supplementary Data (Table 1) and the analytical methods are described in Supplementary Material.

3.1. Major elements

The Itaporé granites are evolved SiO₂-granites, on the K₂O + Na₂O vs. SiO₂ classification diagram (Middlemost, 1994) they plot exclusively in the granite field (Fig. 6a), and their SiO₂ content varies from 68.1 to 76.9%. These granites are also moderated enriched in total alkalis with values ranging from 5.7 to 10.4% (average=8.71%), the content of K₂O is mostly greater than Na₂O, with K₂O/ Na₂O values of 0.5-2.6 (average=1.19).

BG rocks are poorly metaluminous to peraluminous, with ASI (molar ratio of (Al₂O₃/[CaO+Na₂O+K₂O])); Shand, 1927) values ranging from 0.86 to 1.18. The calculated ASI for MBG and TG samples are distributed in a large range from 0.95 and 1.45, revealing mostly a

peraluminous character (Fig. 6b). On the $K_2O + Na_2O - CaO$ vs. SiO_2 diagram (Frost et al. 2001), rocks of BG are classified as calc-alkalic and alkali-calcic, whereas the remnants types plot mostly between the calc-alkalic to alkalic fields, proving to be slightly more alkaline (Fig. 6c). BG type has higher CaO/Na_2O values (0.24-0.44; average = 0.37) than those calculated for MBG (0.04-0.32; average = 0.18) and TG ($CaO/Na_2O = 0.12-0.4$) granites.

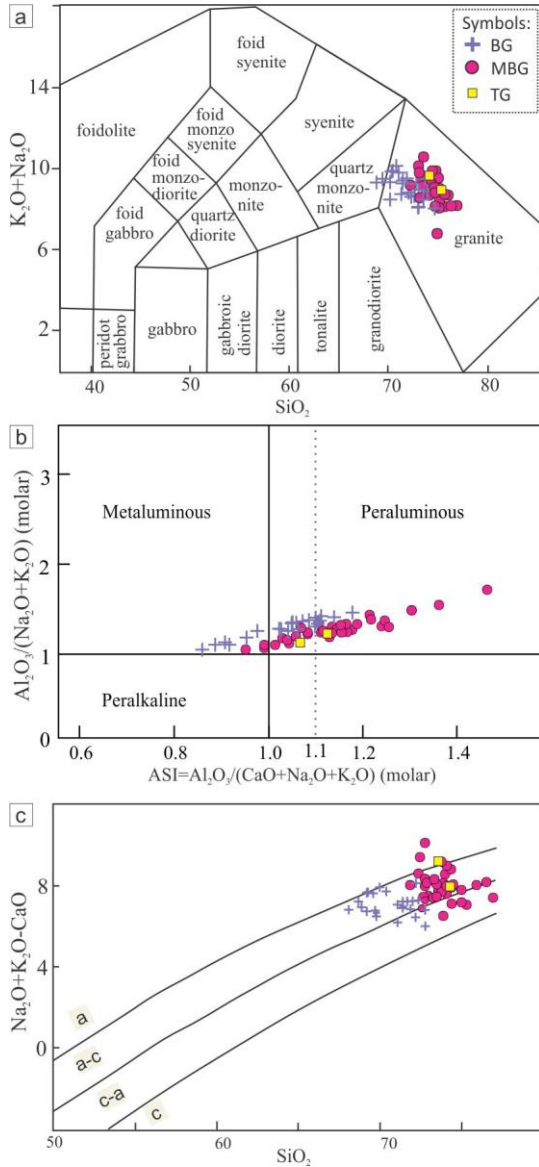


Figure 6: Chemical classification diagrams for the studied granites of Itapore batholith: (a) $K_2O + Na_2O$ vs SiO_2 (Middlemost, 1994); (b) Alumina saturation index (ASI) diagram. Boundary $ASI=1$ from Shand (1927), $ASI = 1.1$ from Chappell and White (1992). (c) $K_2O + Na_2O - CaO$ vs. SiO_2 diagram of (Frost et al. 2001). Abbreviations: a, alkalic; a-c, alkali-calcic; c-a, calc-alkalic; c, calcic.

3.2. Trace elements and REE

IB granites have medium to high abundance of rare-earth elements (REE, 168-696 ppm). BG type shows a relative increase of REE with respect to MBG rocks ($\Sigma\text{REE}=319\text{-}696$ and $168\text{-}378$ ppm, respectively). All BG samples display negative Eu anomalies ($\text{Eu}/\text{Eu}^*=0.24 - 0.94$), in contrast to the MBG samples that may contain positive and negative anomalies ($\text{Eu}/\text{Eu}^*=0.24 - 1.35$).

The diagram of chondrite-normalized REE (Fig. 7a) reveals two distinct fractionated patterns. The REE distribution of BG is much more regular if compared with the MBG, showing higher $\text{La}/\text{Yb}_N=60.78$. MBG exhibit typically flat chondrite-normalized REE patterns and somewhat enriched light REE distribution patterns, with $\text{La}/\text{Yb}_N=10.76$.

Primitive mantle-normalized spidergrams plots show different features for the two studied groups (Fig. 7b). BG distribution is enriched in LILE (large-ion lithophile elements) and relative depleted in high field strength elements (HSFE). MBG spectrums are systematically lower when compared with BG. They display negative Ba, Sr, Nb and Zr anomalies, but enrichment of Rb, Th, U and Cs. Pronounced Nd and Ti negative anomalies occur in all granite plots, and P negative anomalies are exclusive of BG.

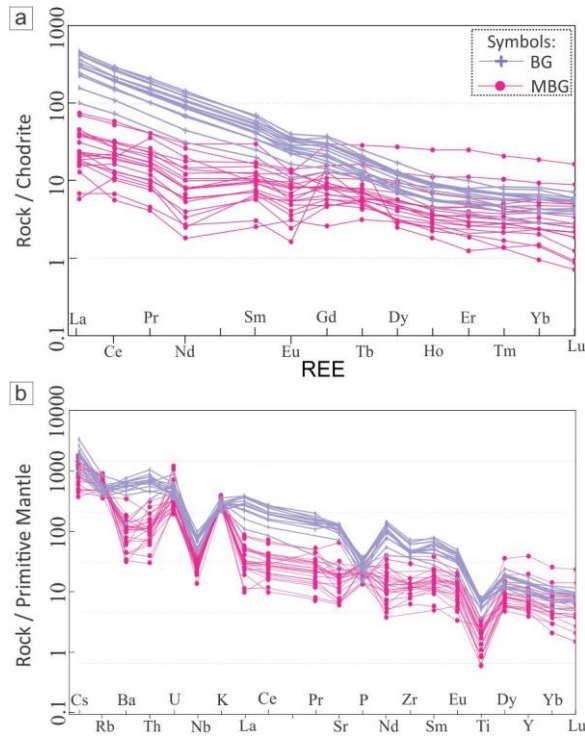


Figure 7: Trace and rare earth element (REE) element data of granitic facies of the Itapore batholith. (a) Chondrite-normalized (Boynton, 1984). REE patterns of BG and MBG. (b) Primitive mantle-normalized plots (Sun and McDonough, 1989).

4.0. Mineral Chemistry

The chemical composition of biotite, muscovite, plagioclase, alkali-feldspar and garnet phase is reported in Supplementary data (Table 2); the analytical methodology is reported in Supplementary material.

4.1. Biotite granite (BG)

Representative k-feldspar compositions vary X_{Or} between 0.88 and 0.97; those of plagioclase of X_{an} 0.06 and 0.10. Plagioclase is essentially oligoclase ($X_{ab} = 0.82-0.86$), which rarely shows an abrupt chemical change from $X_{ab} = 0.83$ to $X_{ab} = 0.96$ at the grain-boundary. The last X_{ab} composition is similar to those of albite in the MBG rocks.

The muscovite analyzed are euhedral with clean terminations, following textural criteria established by Miller et al.(1981) it is assumed to be primary. Chemically, the muscovite can be characterized by high Ti (0.06 - 0.11) and Mg (0.21-0.24) contents, as well as low F (0.16 - 0.20) and Al^{VI} (3.46 - 3.48).

The biotite can be subdivided into Al-Mg rich and Al-Fe rich annite, their average structural formula are $K_{0.96}(Mg_{1.22}, Fe_{1.17}, Al^{VI}_{0.19}, Ti_{0.16})[Al^{IV}_{1.11}, Si_{2.89}, O_{10}](OH_{1.65}, F_{0.34})$ and $K_{0.95}(Fe_{1.30}, Mg_{0.90}, Al^{VI}_{0.29}, Ti_{0.20})[Al^{IV}_{1.12}, Si_{2.89}, O_{10}](OH_{1.66}, F_{0.33})$, respectively. Furthermore, another biotite group enriched in siderophyllite-eastonite contents ($Fe^{2+}/(Fe^{2+}+Mg) = 0.64-0.66$) can be expressed by the structural average formula $K_{0.96}(Fe_{1.34}, Al^{VI}_{0.61}, Mg_{0.55}, Ti_{0.09})[Al^{IV}_{1.20}, Si_{2.80}, O_{10}](OH_{1.73}, F_{0.22})$. This latter is assumed to be secondary owing to textural and chemical evidences.

The apatite is fluorapatite ($F = 5.02\%$ to 5.57%). The occurrence of titanite, allanite, monazite, and the presence of the two opaque minerals, pyrite and hematite were confirmed by electron-microprobe data points.

5.2. Two-mica leucogranite (MBG)

The k-feldspars have X_{Or} compositions between 0.76 and 0.99; those of plagioclase of X_{an} 0.002 and 0.09. Phenocrysts of plagioclase is composed nearly solely of albite, with a composition of $X_{ab}=0.91-0.97$. X_{ab} contents is usually higher at plagioclase borders, as exemplified by $X_{ab}=0.91$, $X_{an}=0.09$ (core) and $X_{ab}=0.96$, $X_{an}=0.04$ (rim).

Biotite is a siderophyllite-eastonite solid-solution, characterized by high $Fe^{2+}/(Fe^{2+}+Mg)$ content varying from 0.61 to 0.82.

Only secondary muscovite occur considering textural and petrographic evidences. Chemical features of muscovite involve high $\#Al^{IV}$ (3.88 - 3.47) and $\#F$ (0.18 - 0.36) values. Additionally, the contents of $\#Ti$ (01 - 0.04) and $\#Mg$ (0.11 - 0.20) are significant lower than that quantified for muscovite of BG rocks.

The garnet is largely solid of almandine ($X_{\text{Alm}}=0.58-0.74$) and spessatine ($X_{\text{Spss}}=0.21-0.37$), which comprises 93-97% of the total composition. Pyrope and grossular constitute the remainder. Individual crystals contain chemical zoning that is characterized by the increasing of Mn-content ($X_{\text{Spss}}=0.33-0.37$) and decrease of Fe and Mg-content ($X_{\text{Alm}}=0.62-0.58$, $X_{\text{Py}}=0.04-0.03$) from the core for the border.

Apatite is fluorapatite ($F = 4.08\%$ to 4.74%). The systematic EMPA analysis indicate the presence of tourmaline, gahnite (Zn-oxide), as well as monazite and zircon.

5.0. Geochronology U-Pb

Three representative rock samples (R5Mb, R5Bt and R4Bt) of IB were collected at southern of Coronel Murta for U-Pb (LA-ICP-MS) geochronological studies (Fig. 2). Sample R5Mb corresponds to a two-mica leucogranite and, R4Bt and R5Bt are biotite granite, being R5Bt an enclave surrounded by MBG (Fig. 3b).

The combination of U-Pb dating on zircon, monazite and apatite crystals were performed to constrain the evolution stages of IB. Zircon dating were carried out with the aim to access magmatic intrusions ages and monazite ages to determine the fluid interactions episodes. In addition, apatite ages were accomplished to establish the late cooling stage after the thermal metamorphism during orogenic collapse. The results of all U-Pb analysis are reported in Supplementary data (Table 3) and the analytical methods are described in Supplementary material. The Concordia diagram were producing using Isoplot/Ex (Ludwig, 2003). Errors are reported at the 2-sigma.

5.1. LA-ICP-MS zircon geochronology

Sample R4Bt – Biotite granite

The zircons include euhedral to subhedral, elongate- and short-prismatic, limpid to lightly yellow grains. Their lengths vary between 80 and 200 μm and their length/width ratios range from 2:1 to 5:1, with an average of 3:1. CL (cathodoluminescence) images reveal that zircon grains comprise well developed oscillatory zoning to unzoned internal structures (Fig.8a-c).

Six zircons, with analysis located mostly in the outer oscillatory zoning (Fig.8a) gave a Concordia age of $538 \pm 2 \text{ Ma}$ ($\text{MSWD}=0.119$, Th/U values of 0.1-0.6), which is interpreted to be the magmatic crystallization age of BG (Fig.9a). This age essentially overlaps the Cambrian-Ediacaran boundary ($541 \pm 1 \text{ Ma}$, IUGS stratigraphic chart 2107, <http://www.stratigraphy.org/index.php/ics-chart-timescale>).

The other group of zircon grains investigated is characterized by low luminescence and weakly zoned internal structures, especially in the outer domains (Fig.8b). Six zircon analyses mainly

located in rim domains, yielded a younger Concordia age of 504 ± 4 Ma, MSWD=2.1, and Th/U ratios varying from 0.14 to 0.23 (Fig.9a).

Cryogenian (n=1) and ediacaran (n=2) inheritance zircon ages were verified in short-prismatic grains, usually with subhedral terminations (Fig.8c). One grain produced a Mesoproterozoic inheritance zircon age.

Sample R5Bt – Biotite granite (enclave)

Zircon grains are prismatic, euhedral and pyramidal, lightly yellow, and with 80 to 250 μ m of diameter. Their length/width ratios vary between 3:1 and 4:1, with an average of 3:1. Most zircons exhibit well developed growth zoning in CL images (Fig. 8d). The four spots analyzed generated a Concordia age of 539 ± 6 (MSWD=0.82) (Fig.10b). Zircon grains present very high common U (196-8705 ppm), and variable Th/U ratio values between 0.01 and 6.59.

Sample R5Mb – Two-mica leucogranite

Zircon grains are prismatic, euhedral to subhedral, lightly yellow to brownish, and diameter of 70 to 320 μ m. Their length/width ratios vary between 1:1 and 4:1, with an average of 3:1. In CL images the grains appear mostly darker, displaying “spongy” surfaces and heterogeneous patchy pattern typical of hydrothermalized zircons (Corfu et al. 2003, Fig. 8e). U-Pb zircon dating was unable owing to the poor condition of the grains.

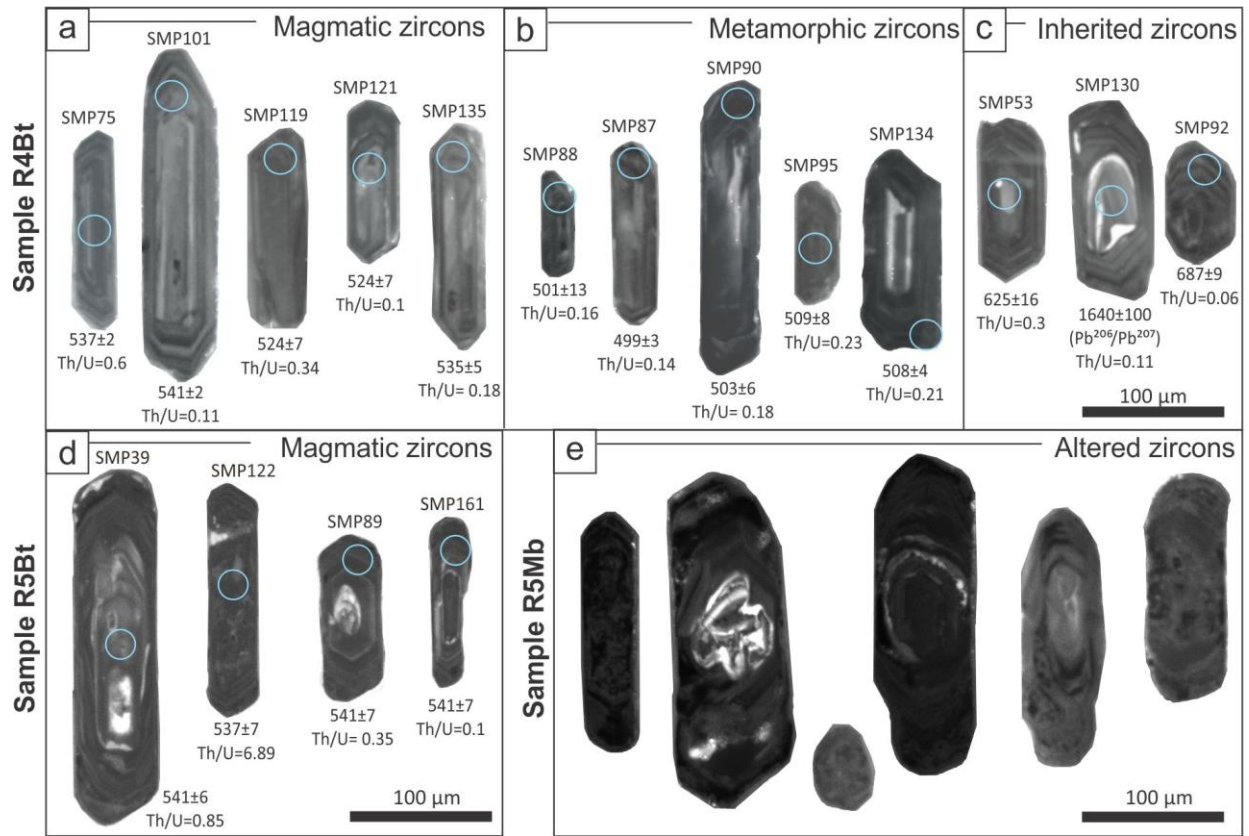


Figure 8: Cathodoluminescence (CL) images for representative zircon grains. a-c Samples R4Bt and R5Bt (enclave) from Itaporé batholith biotite granite (Fig.2) and R5Mb from IB two-mica leucogranite. Inherited and metamorphic zircons in sample R4Bt are also present. U–Pb ages are all mentioned as $^{238}\text{U}/^{206}\text{Pb}$ ages, unless referred otherwise.

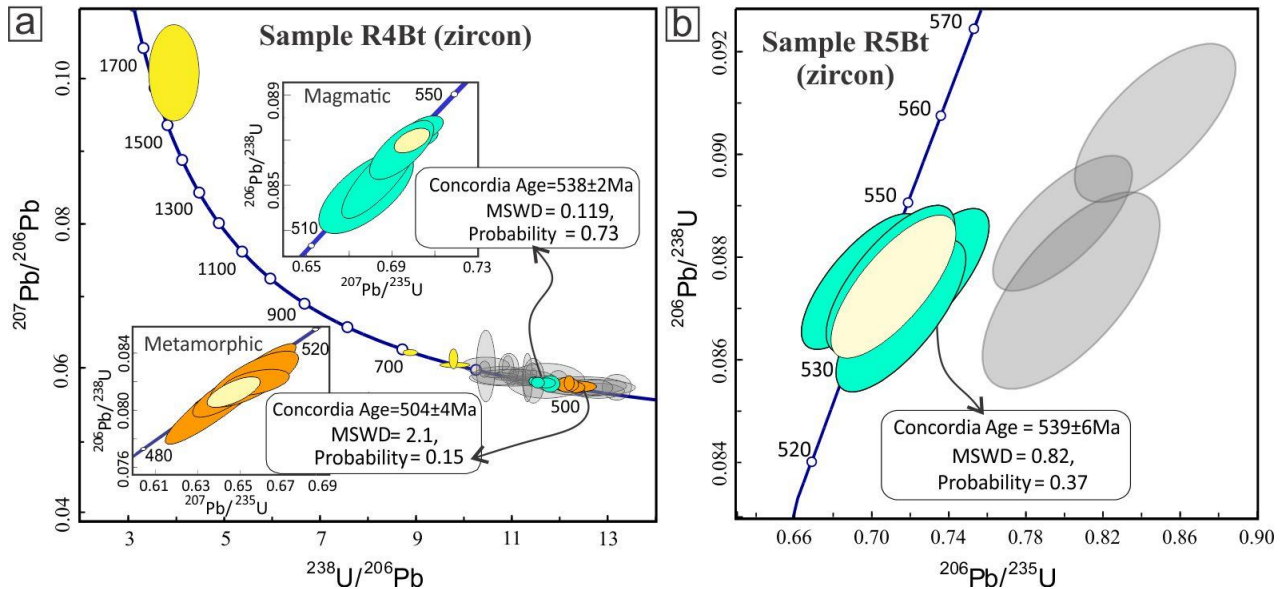


Figure 9: U-Pb LA-ICP-MS zircon dating for the BG rocks of the Itaporé batholith. (a) Tera-Wasserburg plot of sample R4Bt (Biotite granite) analysis. *Insets* show the two Concordia ages obtained 538 ± 2 Ma and 504 ± 4 Ma. Inherited zircon ages are also shown (yellow color); (b) Concordia diagram of sample R5Bt (Biotite granite enclave).

5.2. LA-ICP-MS monazite geochronology

Sample R5Bt - Facies 1 (enclave)

Monazite includes euhedral to subhedral, elongated, subrounded to oval-shaped, lightly yellow grains of 50-320 μm of diameter. BSE imaging displays any sign of zoned internal structures.

U-Pb data also at least one interaction fluid episode imprinted in monazite crystals. Twelve spots show a concordant $\text{Pb}^{206}\text{Pb}/\text{U}^{238}$ age of $522 \pm 2\text{Ma}$ (MSWD=0.052) and Th/U values from 13 to 67 (Fig.10a).

Sample R5Mb- Facies 2

The monazite crystals are euhedral to subhedral, elongated, subrounded to oval-shaped, lightly yellow, and are 80-300 μm in diameter. BSE imaging shows unzoned internal structure and very rarely weakly zoned grains.

The U-Pb data show at least two episodes of fluid percolation, eleven spots displayed an older mean $\text{Pb}^{207}/\text{U}^{235}$ age of $527 \pm 3\text{ Ma}$ (MSWD= 1.2), and Th/U values between 2 and 22 (Fig.10b). The younger $\text{Pb}^{207}/\text{U}^{235}$ age of $508 \pm 2\text{ Ma}$ (MSWD= 1.4) is yielded by twenty spots, with Th/U ranging from 0.05 to 16 (Fig.10c).

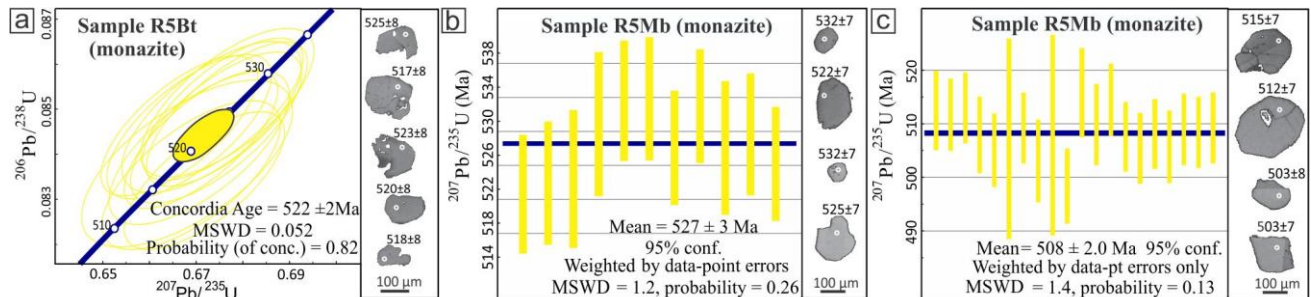


Figure 10: Diagrams of monazite ages and representative BSE images: (a) Concordia $^{206}\text{Pb}/^{238}\text{U}$ age from sample R5Bt. (BG enclave). (b) Older mean $^{207}\text{Pb}/^{235}\text{U}$ age of R5Mb (MBG). (c) Younger mean $^{207}\text{Pb}/^{235}\text{U}$ age of R5Mb (MBG).

5.3. LA-ICP-MS apatite geochronology

Sample R4Bt – Biotite granite (BG)

Apatites include elongated-prismatic, euhedral to subhedral, limpid grains, between 150 and 250 μm of diameter. Occurrence of biotite inclusions is very common. BSE imaging shows unzoned internal structures for the most grains and a few crystals exhibit a fine brighter rim.

The lower intercept age of 474 ± 34 Ma (MSWD= 1.1) was acquired from seventy-two apatite grains, and Th/U ratio of 1.1-3.6 (Fig.11a). This age probably correspond to the late cooling stage of the intrusion.

Sample R5Bt – Biotite granite (enclave)

Apatite crystals are elongated-prismatic, transparent, and of 150-300 μm of diameter. Some grains exhibit inclusions of biotite. Crystals show unzoned internal structures in BSE images.

Twenty-two spot analyses on apatite display a lower intercept age of 469 ± 43 Ma (MSWD=4.8, Th/U=0.06-0.44), which have been interpreted as the last cooling stage of IB (Fig.11b).

Sample R5Mb – Two-mica leucogranite

Apatites are prismatic, subhedral to euhedral, limpid, elongated crystals, with lengths from 120 to 250 μm . BSE imaging revealed that all grains are unzoned. A discordant age of 487 ± 18 Ma (MSWD=2.3, Th/U= 0.01-0.12) was obtained for thirty-nine spots, and was interpreted to be the last cooling age for this granite (Fig.11c).

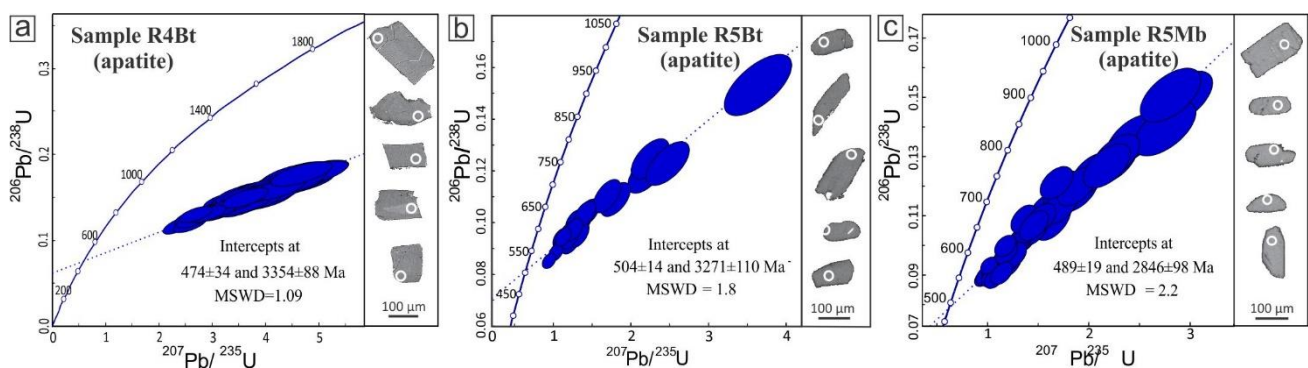


Figure 11: Concordia diagrams obtained from apatites and their representative BSE images. (a) Sample R4Bt (Biotite granite). (b) R5Bt (Biotite granite enclave). (c) R5Mb (Two-mica leucogranite).

6. P-T conditions

Estimation of magma temperature and emplacement depths were employed to constrain the crystallization conditions of BG and MBG, and then simulate their thermal evolutions. Magma temperatures values were derived from zircon saturation thermometry of Watson and Harrison (1983), a simple and robust method used in peraluminous and metaluminous rocks, either inheritance-rich or poor. Additionally, valuation of crystallization pressures (or emplacement depths) were determined by a numerical method of Yang (2017) that has been successfully applied to granitic systems. The two feldspar geobarometer was not used considering that extensive exsolution of alkali feldspar and alteration of plagioclase undoubtedly have been resetting under subsolidus temperature. The results obtained from BG vary between 850-786° C, with M values of 1.33-1.52 (calibration

range used for geothermometer) and pressures ranging from 4.0 and 2.3 (average=3.0 kbar). For MBG samples were calculated lower P-T values, magma temperature of 753 - 627° C (M = 1.19-1.39), crystallization pressures ranging from 3.1 to 1.7 kbar and average of 2.3 kbar (Table 2). Magma temperature of five samples of MBG could not be calculated because they have Zr values below the detection limit (<10 ppm). We draw attention to the pattern of Zr variation, generally Zr decrease with increasing of SiO₂ and as might be expected the temperature also decrease.

Table 2

Summary of magma temperature and crystallization pressure calculated for the IB rocks

Sample	Lithotype	T (° C)	M values	P (Kbar)	Sample	Lithotype	T (° C)	M values	P (Kbar)
CG49C	BG	786	1.35	2.36	CH398	MBG	627	1.29	3.08
CG25A	BG	791	1.36	2.53	VP020A	MBG	645	1.26	2.37
CG45B	BG	792	1.4	3.63	CH415	MBG	655	1.29	2.66
CG43	BG	794	1.38	3.91	LS092	MBG	674	1.27	2.11
CG67	BG	795	1.43	3.49	LS011	MBG	685	1.28	1.79
CG49B	BG	796	1.37	2.31	LS064	MBG	686	1.24	1.68
L2023	BG	798	1.42	3.04	LS059	MBG	687	1.25	1.83
R5Bt	BG	800	1.33	2.35	VP019	MBG	689	1.26	2.38
LS026	BG	801	1.46	3.33	LS054	MBG	689	1.26	1.84
R4Bt	BG	825	1.42	4	CH383	MBG	710	1.22	2.51
VP017	BG	826	1.52	2.97	R5Mb	MBG	(-)	(-)	1.67
CG63	BG	850	1.36	2.54	CG49A	MBG	(-)	(-)	1.65
Range	BG	850-786	1.33-1.52	1.61-4	Range	MBG	710-627	1.19-1.39	1.7-3.1

Magma temperature were calculated using zircon saturation thermometry of Watson and Harrison (1983) and crystallization pressure have been estimated according to Yang (2017) geobarometer.

7.0. Discussion: genesis and evolution of the Itaporé batholith

7.1. Petrogenesis of the granitic magmas

The two main facies of the Itaporé batholith present significant differences verified in petrography and lithochemistry strongly contradict the idea of a genetic relation.

BG rocks are mostly peraluminous to weakly metaluminous, alkali-calcic to calc-alkalic, with monzogranitic composition. The high CaO/Na₂O values (>0.24) and low Al₂O₃/TiO₂ (<88) ratios are distinctive features of BG which are consistent with a source plagioclase-rich and clay poor, and a relative hotter melt (Sylvester, 1998, Fig. 12). The REE chondrite-normalized patterns show higher LREE than HREE, which indicate highly fractionated process or fractionated source (Fig.7a). The relative increase of LILE with respect to HFSE also suggest that fractionated differentiation have taken place during the evolution of these rocks (Fig.7b). La and Ce enrichment demonstrate that allanite fractionation played a relevant role in magma evolution. In addition, the conspicuous presence of allanite and titanite strongly indicates a metaigneous source.

In turn, MBG and TG include peraluminous, alkalic to alkali-calcic monzo- to sienogranites. The low $\text{CaO}/\text{Na}_2\text{O}$ (<0.33) and high $\text{Al}_2\text{O}_3/\text{TiO}_2$ (>75) ratios indicate that were derived from a cooler melt originated from a clay rich source (Sylvester, 1998, Fig. 12). Chondrite-normalized REE patterns tend to be flat and somewhat enriched in LREE (Fig.7a). Very low LILE contents are observed, such as Ba, Sr, La and Ce reflect their poor fractionated differentiation character or an unfractionated source (Fig.7b). Negative Nd anomalies observed in the REE chondrite-normalized patterns and primitive normalized spider diagrams may demonstrate continental involvement in magma processes. All lithotypes contain highly aluminous phases, such as muscovite and garnet, as with expected for peraluminous granites. Additionally, the occasional occurrence of tourmaline suggests the presence of boron in the source, which is consistent with a metapelitic one.

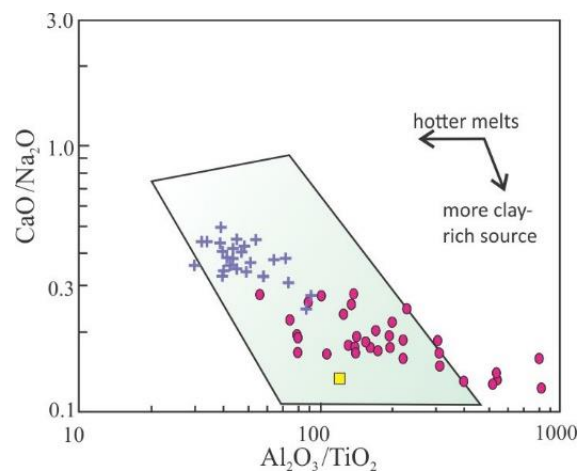


Figure 12: The diagram of $\text{Al}_2\text{O}_3/\text{TiO}_2$ vs. $\text{CaO}/\text{Na}_2\text{O}$ referenced by Sylvester (1998). See symbols in Fig.6.

7.2. Late- and post- magmatic stages

Taking into account many evidences of reactions involving changes in primary mineral phases and magmatic textures perceived mainly in two-mica leucogranite (MBG) and minor in biotite granite rocks (BG) is possible assume that both groups dealt with fluid interaction after complete crystallization (liquid + crystals). The most direct explanation for these adjustments described in Section 2, such as albitization, sericitization and muscovitization is an interaction between solidified phase and alkali-rich acidic fluids.

In biotite granite, the degree of alteration is incipient and conspicuous, particularly associated with two-mica leucogranite occurrence. Syderophyllite, for example was only described in BG nearby MBG veins. These findings lead us to consider that metasomatic adjustments were caused mostly by fluids released from MBG pluton. Metasomatism had the capacity to preferentially transport Mg, Ti and F from biotites and to enrich them in Fe and OH. Such modifications imprinted into the BG biotites a peraluminous character similar to those shown by MBG biotites (Fig.13a,b).

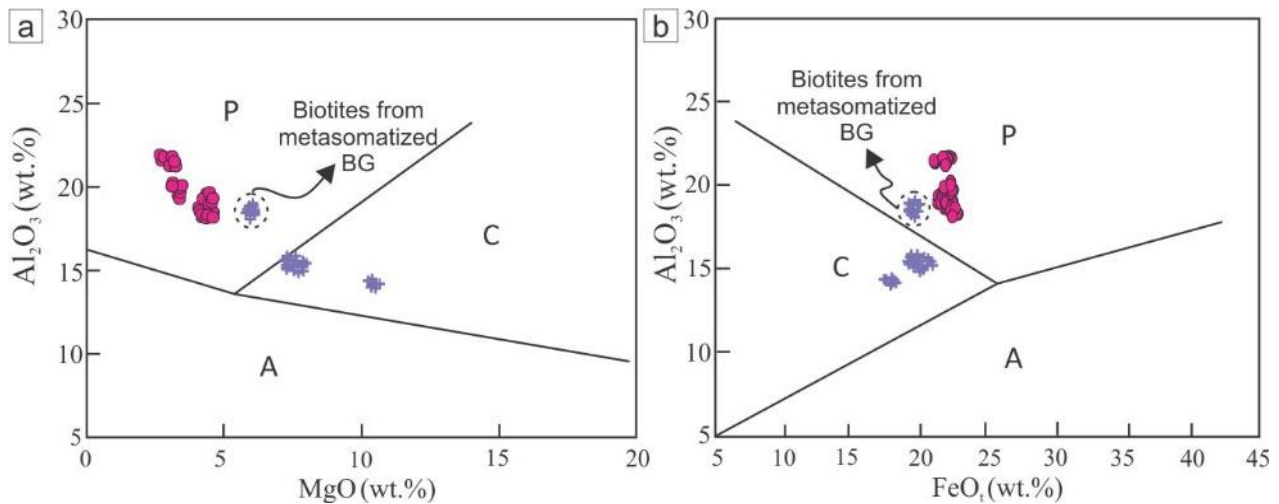


Figure 13: Biotite discriminant diagrams from Abdel-Rahman (1994): (a) Al_2O_3 vs. MgO , (b) Al_2O_3 vs. FeO_1 . Fields: A, biotite in anorogenic alkaline suites; P, biotite in peraluminous; C, biotite in metaluminous calc-alkaline granite suites granites. See symbols in Fig. 6.

The several evidences of mineral replacement observed in MBG and TG granites are interpreted as resulting of interaction between residual magmatic fluids under sub-solidus conditions after complete crystallization (Pedrosa-Soares, 1987, Monteiro, 1990). Fluid inclusion microthermometry data from Monteiro (1990) demonstrates that hydrothermal fluids were trapped into MBG rocks between 450°C and 300°C, assuming pressures around 2kbar. This high homogenization temperature is consistent with the solidus temperature of late-stage granitic melts (450-500°C, eg. Manning, 1981; London, 1987; Rong and Wang, 2016). Therefore, most probably the fluid activity started during the late stage of crystallization close to or under subsolidus conditions, as shown by fluid inclusion that record temperatures as low as 300°C.

Because fractional crystallization of a granitic melt is an important process in concentrating incompatible elements and volatiles, with fractionation the intensity of subsequent sub-solidus hydrothermal alteration substantially increase. The lowering of K/Cs and Mg/Li ratios have been previously well documented to be exceptional indicators of magmatic fractional crystallization. Particularly, very low values of Li/Mg ratio (<10) are useful markers to identification of parental fertile granites of Li-Cs-Ta enriched (LCT) pegmatites (Selway et al. 2005).

The plot of K/Cs versus Mg/Li (Fig.14a) shows gradually decrease linear trend through the rocks of IB. Thus, the degree of fractionation, rare element content and volatile content increase. Once the tourmaline granite rocks are found through the outer zone of the MBG intrusion, the path of hydrothermal fluids seems to have occurred from the innermost to the outermost zones of the pluton. In agreement, the economic LCT pegmatites related to those granites typically occur as external dikes emplaced into the country rocks.

Increasing fractionation also results in Na-rich compositions implying in extensive albitization of the granitic rocks (Fig.14b). The activity of the alkalic volatile-rich residual melt has triggered a significant element mobility. The early-formed minerals were replaced through pseudomorphism accompanied by the loss of MgO, TiO₂ and CaO. The grain coalescence at feldspars boundaries (Fig.5i) and overgrowth in garnet suggest that crystals underwent the effects of the repetition in the metasomatic influx process, during very slow temperature decline.

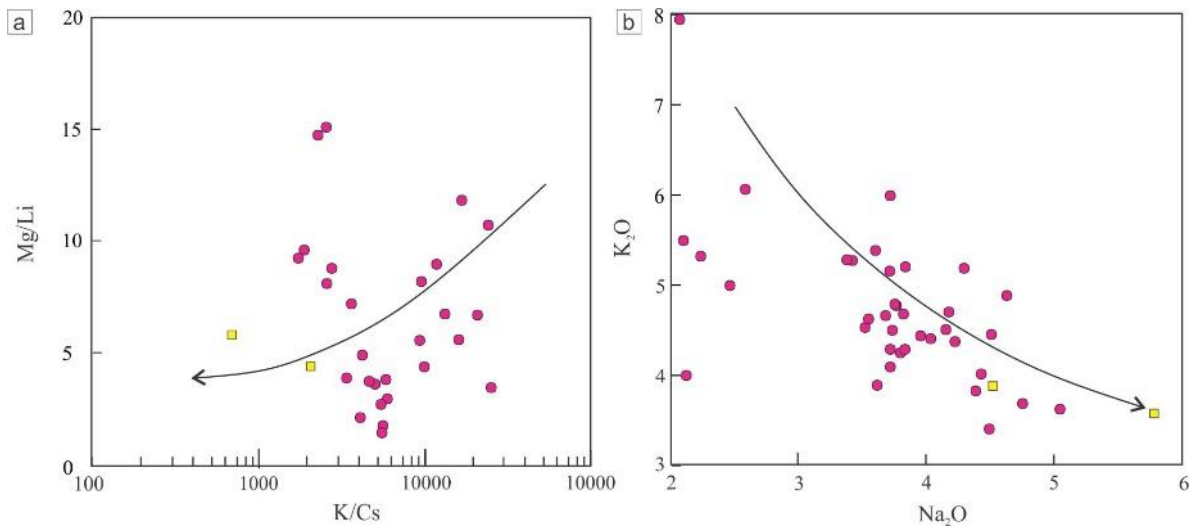


Figure 14: (a) Mg/Li versus K/Cs, (b) K₂O versus Na₂O. The arrows represent the general fractionation trend from two-mica leucogranite to muscovite-albite leucogranite.

7.3. Geochronological constraints

The geochronological data reported in Section 5 reveal a long and complex evolutionary for the studied granites that lasted over 40 Ma (Fig. 14). U-Pb zircon dating provide crystallization ages of 539 ± 6 Ma and 538 ± 2 Ma for biotite granite. These new data are unexpected considering previous studies that included BG in the post-collisional G4 Supersuite, which report younger magmatic ages between 530 and 500 Ma (Pedrosa-Soares et al. 2011). They support that BG emplacement occurred during the late-collisional stage of the Araçuaí Orogen. Inherited zircon grains described above yielded mostly Ediacaran ages between 625 Ma and 687 Ma, which may correlate with the metasedimentary host rocks or previous magmatic episodes, Salinas Formation (younger ages c. 599 - 568 Ma; Lima et al., 2002).

Although the attempt to obtain the MBG magmatic age was not successful, the irregular textures of many zircon grains reflect alteration by hydrothermal fluids.

Geochronology on monazite has uncovered two episodes involving fluid percolation that have affected the Itaporé batholith. The monazite ages 522 ± 2 Ma (R5Bt) and 527 ± 3 Ma (R5Mb) are interpreted as a product of late-stage magmatic reactions promoted by deuteric solutions of MBG that

metasomatically interacted with BG rocks. The youngest period is marked by monazite at 508 ± 2 Ma (R5Mb) and are also aligned with zircon age of 504 ± 4 Ma (R5Bt). These ages strongly suggest that those rocks were affected by the G5 re-heating episode, promoting resetting of the mineral isotopic systems, even far from the surface traces of intrusive contacts. In this particular case, zircon and monazite resetting could be facilitated by the fact that these plutons are emplaced within a major crustal structure, the Minas Novas corridor, that may accomplished an important as conducted channeling high-temperature fluids from below.

Subsequently, the late cooling stage of the Araçuaí orogen that succeeded the last heat supply are represented by the apatite ages, 474 ± 34 Ma (R4Bt), 489 ± 19 Ma (R5Mb) and 504 ± 14 Ma (R5Bt). Such interpretation are in accordance with experimental studies (eg. Cherniak et al. 1991) that determined medium closure temperatures ($450 - 550^{\circ}\text{C}$) for the apatite U-Pb system.

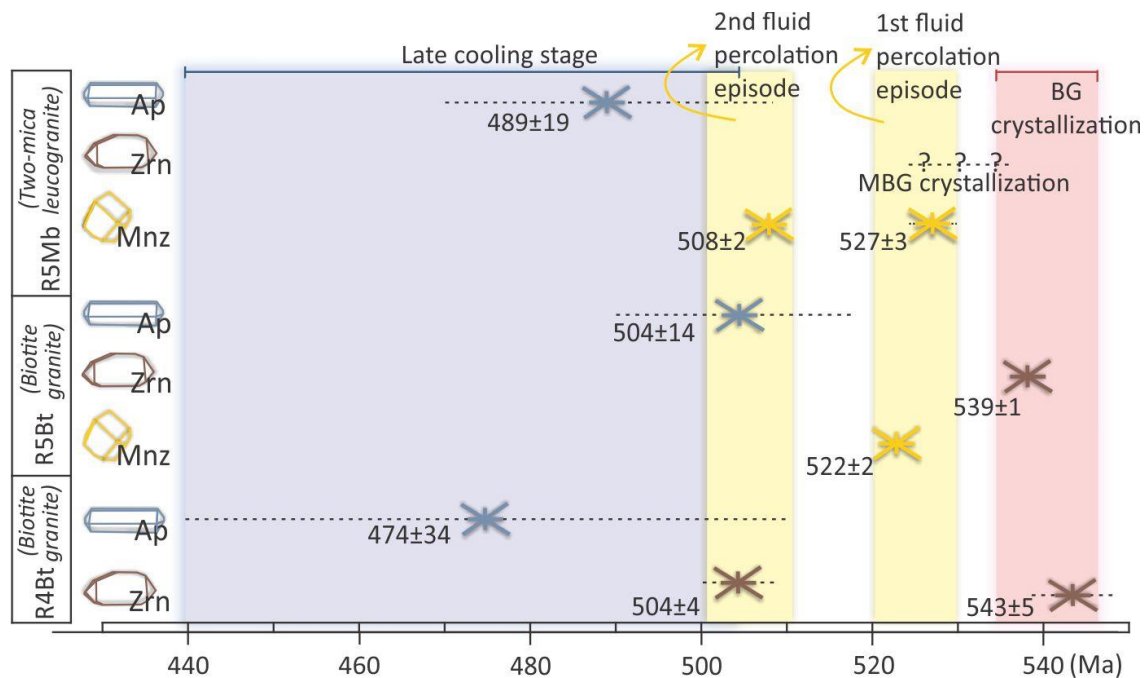


Figure 15: Schematic diagram constraining the timing of evolution stages encountered for the Itaporé batholith. Dashed lines represent the U-Pb errors.

8.0. Conclusions

1. Considering new field evidences, petrographic observations, geophysical signatures and geochemical approaches reported here, BG and MBG were probably delivered from two different sources, metaigneous and metasedimentary, respectively. This implies that the original stratigraphic term, Itaporé batholith is not suitable to designate these plutons. Therefore, BG granite is reassigned as Frade pluton, whereas the MBG and PG assemblages remain representing the Itaporé batholith.

2. The BG intrusion was emplaced in the latest Ediacaran or earliest Cambrian time; U-Pb zircon dating yielded two crystallization ages of 539 ± 6 Ma and 538 ± 2 Ma. Postdating the peak of regional metamorphism and emplaced into extensional structures, the BG may have resulted from anatexis caused by the decompression of an overthickened crust during the late-orogenic stage of the Araçuaí Orogen.

3. From primitive to the most fractionated, two-micas leucogranite (MBG), tourmaline granite (TG), pegmatoid granite (PG) and pegmatites seem to be part of a single fertile granite intrusion. The petrographic observations and geochemical data suggest that it may have formed by very slow and complex crystallization of a highly evolved magma. Overgrowth of later-stage muscovite and albitized plagioclase are evidences for progressive accumulation of fluids in the residual melt due to crystallization of anhydrous minerals, such as quartz and plagioclase.

3. Although the MBG intrusion age still unknown, the age of 527 ± 3 Ma obtained from monazites possibly is consistent with the period of hydrothermal fluid activity during late-crystallization stages. This age overlaps the 522 ± 2 Ma age yielded from monazites of the BG, indicating a significant interaction between exsolved vapors and aqueous fluids from MBG mass and the BG solidified system. In agreement, textural evidences as secondary siderophyllyte and muscovite also reinforce the idea of metasomatic adjustments.

4. A reduced number of zircon and monazites register the last meaningful regional heat supply of Araçuaí orogeny, which affected the BG rocks at *ca.* 504 Ma. Subsequently, the progressive cooling took place from 504 Ma until 474 Ma.

5. Crystallization ages obtained from BG also constrains the minimum age for the Salinas Formation host rocks around 540 Ma.

Acknowledgments

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CAPÍTULO 4

CONCLUSÕES

Através da combinação das observações de campo, investigação petrográfica, geoquímica de rocha total, química mineral, geotermobarometria, idades U-Pb em zircão, apatita e monazita obtidos no presente trabalho, juntamente ao grande acervo de dados compilados apresentados é possível sustentar diversas conclusões sobre a gênese, idade e evolução das unidades estudadas. Esse conjunto de dados traz ainda implicações diretas na evolução do Orógeno Araçuai.

Sobre as rochas metassedimentares da Formação Salinas:

- i) Os baixos valores de CIA (*chemical index of alteration*, 46.62 - 69.22), e baixas razões $\text{SiO}_2/\text{Al}_2\text{O}_3$ (2.3 -7.9), sugerem intemperismo limitado das rochas fontes e deposição relativamente próxima as áreas fontes, respectivamente.
- ii) Os protólitos das grauvacas da Fm. Salinas foram derivados de fontes mistas;
- iii) Arco magmático continental, margem continental ativa e arco de ilha foram os principais ambientes geotectônicos das rochas fontes que contribuíram na sedimentação da Bacia Salinas.

Sobre as rochas graníticas contidas entre os municípios de Coronel Murta e Itinga:

- iv) Considerando novas evidências de campo, observações petrográficas, assinaturas geofísicas e tratamento geoquímico reportados, biotita granito e leucogranito a duas micas foram provavelmente derivados de duas fontes diferentes, metaígneia e metassedimentares, respectivamente. Isso implica que o termo estratigráfico original, o batólito não é adequado para designar estes plutons. Portanto, o biotita granito é reatribuído como plutônio Frade, enquanto o leucogranito a duas micas e granito pegmatoide continuam a representar fácies pertencentes ao Batólito Itaporé.
- v) O *emplacement* do biotita granito ocorreu no fim do período Ediacano ou no início do Cambriano. Datações U-Pb e, zircão forneceram idades em torno de 539 Ma. Consideravelmente mais jovens que o pico metamórfico regional e encaixado ao longo de estruturas extensionais, o biotita granito pode ser produto da anatexia causada pela descompressão de uma crosta superespessada durante o estágio tardi-orogênico do Orógeno Araçuai.
- vi) Do mais primitivo para o mais fracionado o leucogranito a duas micas, turmalina granite e granite pegmatoide parecem ser parte de uma única intrusão fértil. As observações petrográficas e dados litoquímicos sugerem que tenham se formado de uma cristalização lenta e complexa a partir de uma magma altamente evoluído. O sobrecrecimento de muscovitas tardias e a presença de cristais de plagioclásio albitizados são evidências da acumulação progressiva dos fluídos no *melt* residual dada a cristalização de fases anidras, como quartzo e plagioclásio.

- vii) Embora a idade de cristalização do granito a duas micas permaneça desconhecida, a idade de 527 ± 3 Ma obtidas em monazita é consistente com o período da atividade hidrotermal ocorrida durante os estágios tardios da cristalização. Essa idade se sobrepõe a de 522 ± 2 Ma fornecida por monazitas do enclave de biotite granito, sugerindo uma significativa interação entre os fluidos aquosos do granito a duas micas com o biotite granito previamente cristalizado. A presença de siderofilita e muscovita secundária contatadas no biotite granito reforçam a hipótese de ajustes metassomáticos.
- viii) Um número reduzido de zircões e monazitas registra o último pico térmico regional significativo da orogenia Araçuaí, que afetou a intrusão de biotite granito em torno de 504 Ma. Subsequentemente, o resfriamento progressivo se deu entre 504 Ma e 474 Ma.
- ix) As idades de cristalização obtidas de BG também restringem a idade mínima para as rochas encaixantes da Formação de Salinas em torno de 539 Ma.

Appendix

Appendix A. Supplementary Material – Analytical Methodology

Whole Rock

Whole rock lithochemical analyses were conducted on samples, taking into account the rock diversity of the IB. Sample powders were analyzed by SGS-GEOSOL laboratory in Brazil. Major element content was determined by X-ray fluorescence (XRF). Most trace elements were measured by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) except for Ba, Sr, Zn, Zr, V that were analyzed by (ICP-OES) Inductively Coupled Plasma Optical Emission Spectrometry. (i) samples were fused with a lithium tetraborate flux to determine major elements by X-Ray fluorescence; (ii) in order to analyze trace elements and REE by ICP-OES, the samples were fused with lithium metaborate, and decomposed using multiacid solution (HCl, HNO₃, HF and HClO₄) for trace elements and (iii) fluorine-specific ion. Detection limits are 0.01% for oxides and 0.1 ppm for most trace elements.

EPMA - Mineral chemistry

The chemical composition of biotite, muscovite, plagioclase, alkali-feldspar, garnet, apatite, titanite, ilmenite phases in granitic phases were carried out with a JEOL Superprobe JXA8230 electron-microprobe mineral analyzer. The analyses were performed under an accelerating voltage of 15 kV, a sample current of 20 nA and a beam diameter of 10 µm. Quartz (Si), calcium fluorite (F), anorthoclase (Na), olivine (Mg), corundum (Al), magnetite (Fe), fluor-apatite (Ca and P), rutile (Ti), manganese dioxide and ilmenite (Mn), microcline (K), chromite (Cr), barite (Ba), scapolite (Cl) and strontianite (Sr) were used as standards. Counting times on the peak/background were 10/15 for Si, Na, Mg, Al, Fe, Ca, Ti, Mn, K, Cl, P and 30/15 s for Cr, Ba, F and Sr. Background intensities were collected at higher and lower energies relative to the corresponding K α and L α lines. Element maps were recorded using scanning mode at an acceleration voltage of 15kV and a probe current of 20nA. The step size of 1 µm was used in X and Y directions.

LA-ICP-MS U-Pb geochronology

About 2 to 5 kg of each rock samples were prepared for analyses by means of standard crushing techniques and heavy mineral separation. Apatite, monazite and zircon were then hand-picked, mounted in epoxy resin and ground down to expose their centers. Prior to isotope analyses, to obtain information about their internal structure and identify mineral inclusions all grains were investigated using a backscattered electron (BSE) images, and cathodoluminescence (CL) imaging was applied to zircon grains by the means of a JEOL- JSM-6510 scanning electron microscope housed at the Microanalysis Laboratory, Universidade Federal de Ouro Preto (UFOP), Brazil.

The isotope analyses were carried out by LA-ICP-MS on four subsequent days at the Isotope Laboratory, Universidade Federal de Ouro Preto. No analytical spot was performed on grain areas with inclusions, fractures and/or metamict features.

Zircon and apatite

U-Pb zircon (R5Bt sample) and apatite (R4Bt, R5Bt and R5Mb samples) dating were performed using the laser ablation-multicollector inductively coupled plasma mass spectrometry (LA-MC-ICP-MS, Neptune Thermo Scientific) equipment at Isotope Laboratory of the Universidade Federal de Ouro Preto, Brazil. The standard and sample grains were ablated in a small volume sample cell.

Apatite isotopic data were acquired using a spots size of 30 μm . The analytical procedure occurred in repeated cycles of three analyses of primary standard Madagascar (Thomson et al. 2012) and 10 analyses from the mount.

In zircon dating a spot size of 20 μm was adopted. Two standard zircons were employed, Plesovice (Sláma et al., 2008) and Blue Berry (Santos et al., 2017), each one were analyzed twice every 10 analyses.

The standard and sample grains were ablated in a small volume sample cell. Integration times for U/Pb age determinations were 15 ms for ^{206}Pb , 40 ms for ^{207}Pb , and 10 ms for ^{208}Pb , ^{204}Pb , ^{232}Th and ^{238}U . The respective isotopic ratios were displayed in time-resolved mode. The first 5-10s of each analysis was discarded, and from the remainder of each analysis the integration window was chosen so as to maximize its concordance (Jackson et al., 2004). The data were not corrected for common Pb because of an interference of ^{204}Hg on ^{204}Pb . Instead, ^{204}Pb was measured so as to exclude analyses with abnormal concentrations of common Pb. Initial data reduction was using the Excel sheet (Chemale Jr. et al. 2012) to calculate the relevant isotopic ratios ($^{207}\text{Pb}/^{206}\text{Pb}$, $^{208}\text{Pb}/^{206}\text{Pb}$, $^{208}\text{Pb}/^{232}\text{Th}$, $^{206}\text{Pb}/^{238}\text{U}$ and $^{207}\text{Pb}/^{235}\text{U}$). ^{235}U was calculated from ^{238}U counts via the natural abundance ratio $^{235}\text{U} = ^{238}\text{U}/137.88$ (Jackson et al., 2004). Errors propagated by the software assume a 1% uncertainty on the age of the standard. The 1% uncertainty in the standard is propagated in quadrature into the uncertainty on each spot age. The U-Pb data were plotted on Concordia diagrams via the software Isoplot (Ludwig, 2003).

U-Pb zircon dating for one sample (R5Bt) were carried out using a Thermo-Finnigan Element 2 sector field ICP-MS coupled to a CETAC UV laser with a Helix ablation cell. Data were acquired in peak jumping mode during 20 s background measurement followed by 20 s sample ablation. Data were corrected for background signal, common Pb, laser-induced elemental fractionation, instrumental mass discrimination, and time-dependent elemental fractionation of Pb/U using a MS Excel spreadsheet program (Gerdes and Zeh, 2006). The common-Pb correction was based on the Pb composition model (Stacey and Kramers, 1975). Laser-induced elemental fractionation and instrumental mass discrimination were corrected by normalization to the reference zircon GJ-1 (Jackson et al., 2004). Blue Berry zircon (Santos et al., 2017) was adopted as a secondary standard.

Monazite

Monazite grains from R5Mb and R5Bt samples were dated in the Isotope Geochemistry Laboratory at the Universidade Federal de Ouro Preto using a Thermo-Finnigan Element 2, single collector sector field (SF) ICP-MS, coupled to a CETAC UV Nd: YAG 213 nm laser with a Helix ablation cell. Prior to analysis monazite grains were imaged in BSE (backscattered electron) mode using a scanning electron microscope JEOL- JSM-6510 housed at the Microanalysis Laboratory, Universidade Federal de Ouro Preto. Instrumental and acquisition parameters, spot size had 15 μm . Raw data were processed offline using an Excel® spreadsheet, following Gerdes and Zeh (2006, 2009). The Itambé monazite (Dumond *et al.* 2008, Gasquet *et al.* 2010) was used as primary reference material. All reported uncertainties (2σ) are propagated by quadratic addition of the external

reproducibility (2 s.d.) obtained from the reference material Itambé monazite during the analytical session and the within-run precision of each analysis. The analytical runs involved repeated analysis cycles of the Itambé monazite (Dumond *et al.* 2008, Gasquet *et al.* 2010), used as the primary standard, USGS 44069 monazite (Aleinikoff *et al.*, 2006), used as a control/secondary standard, and 10 analyses of monazite from the mount. Integration times for U/Pb age calculations were 15 ms for ^{206}Pb , 40 ms for ^{207}Pb , and 10 ms for ^{208}Pb , ^{204}Pb , ^{232}Th and ^{238}U . LA-ICP-MS acquisitions consisted of a 60 second measurement of the gas blank, followed by 40 seconds of measurement of U, Th and Pb signals during ablation. Laser ablations were carried out at a frequency of 4 Hz and an energy density of $\sim 4.5\text{-}5\text{ J/cm}^2$, and produced 20 nm diameter wide pits.

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Lithochemical Data

Major element oxides in wt.%																			
Sample	Author	Petrology	SiO ₂	TiO ₂	Al ₂ O ₃	FeOt	MnO	MgO	CaO	Na ₂ O	K ₂ O	P ₂ O ₅	LOI	Sum	K ₂ O+Na ₂ O	Al ₂ O ₃ / (Na ₂ O+K ₂ O)	ASI	Na ₂ O+K ₂ O -CaO	CaO/ Na ₂ O
																(%mol)	(%mol)		
1014	Pedrosa Soares et al.1987	Bt- granite (BG)	68.1	0.48	15.4	2.47	0.06	0.96	1.9	4.4	4.7	0.26	0.85	99.57	9.1	1.25	0.98	7.2	0.43
203	Pedrosa Soares et al.1987	Bt- granite (BG)	68.7	0.5	15.1	2.52	0.06	0.73	1.7	4.8	4.5	0.21	0.59	99.41	9.3	1.18	0.95	7.6	0.35
LS024A	Paes et al.2017	Bt- granite (BG)	68.9	0.38	15.5	2.60	0.06	0.79	1.65	4.32	4.65	0.23	0.46	99.54	8.97	1.28	1.02	7.32	0.38
2926	Monteiro 1986	Bt- granite (BG)	69.2	0.21	15.6	2.14	0.04	0.72	1.32	4.3	4.8	0.01	0.85	99.19	9.1	1.27	1.06	7.78	0.31
VP017	Paes et al.2017	Bt- granite (BG)	69.2	0.4	15.6	2.68	0.05	0.7	1.79	4.26	4.65	0.25	0.51	100.01	8.91	1.3	1.02	7.12	0.42
1547	Pedrosa Soares et al.1987	Bt- granite (BG)	69.3	0.37	14.6	1.98	0.04	0.58	1.8	4.4	5.2	0.16	0.96	99.39	9.6	1.13	0.9	7.8	0.41
193	Pedrosa Soares et al.1987	Bt- granite (BG)	69.6	0.34	14.4	2.16	0.06	0.63	1.7	4.7	5	0.21	0.84	99.64	9.7	1.1	0.89	8	0.36
2916	Monteiro 1986	Bt- granite (BG)	69.7	0.23	16.6	2.07	0.03	0.55	1.55	4.1	4.2	0.19	0.57	99.79	8.3	1.47	1.18	6.75	0.37
R4bt	This study	Bt- granite (BG)	69.8	0.36	15.6	2.2	0.05	0.7	1.71	4.24	4.1	0.20	0.48	99.43	8.34	1.37	1.07	6.63	0.4
LS026	Paes et al.2017	Bt- granite (BG)	69.8	0.44	15	2.76	0.05	0.8	1.74	4	4.2	0.28	0.48	99.47	8.2	1.35	1.05	6.46	0.43
249	Pedrosa Soares et al.1987	Bt- granite (BG)	70	0.35	14	2.07	0.05	0.63	1.6	4.8	5.1	0.21	0.55	99.36	9.9	1.04	0.86	8.3	0.33
194	Pedrosa Soares et al.1987	Bt- granite (BG)	70.4	0.36	14.4	1.9	0.07	0.55	1.5	4.6	5	0.19	0.62	99.59	9.6	1.11	0.92	8.1	0.33
2996	Monteiro 1986	Bt- granite (BG)	71.1	0.24	15.5	1.81	0.04	0.55	1.56	4.2	4.4	0.23	0.64	100.26	8.6	1.33	1.07	7.04	0.37
CG25A	This study	Bt- granite (BG)	71.1	0.34	15.6	2	0.06	0.68	1.62	4.72	3.06	0.22	0.35	99.75	7.78	1.41	1.11	6.16	0.34
2980A	Monteiro 1986	Bt- granite (BG)	71.4	0.2	14.9	1.53	0.03	0.37	1.21	4	4.4	0.19	0.78	99.01	8.4	1.31	1.1	7.19	0.3
CG43	This study	Bt- granite (BG)	71.4	0.34	16.3	1.81	0.04	0.56	1.69	4.19	4.45	0.16	0.27	101.21	8.64	1.39	1.1	6.95	0.4
CG45B	This study	Bt- granite (BG)	71.4	0.35	16	2.04	0.05	0.64	1.74	3.98	4.63	0.195	0.32	101.35	8.61	1.38	1.09	6.87	0.44
CG63	This study	Bt- granite (BG)	71.7	0.39	15.2	1.92	0.07	0.6	1.5	3.05	5.65	0.1	0.34	100.53	8.7	1.37	1.1	7.2	0.49
CG67	This study	Bt- granite (BG)	71.9	0.32	15.6	1.82	0.06	0.76	1.72	4.19	4.35	0.23	0.42	101.36	8.54	1.34	1.06	6.82	0.41
2922A	Monteiro 1986	Bt- granite (BG)	72	0.17	15.7	1.5	0.04	0.29	1.28	4.7	3.8	0.15	0.39	100.01	8.5	1.33	1.11	7.22	0.27
RSBt	This study	Bt- granite (BG)	72.2	0.32	15.9	1.98	0.06	0.61	1.54	4.6	3.35	0.23	0.48	101.27	7.95	1.42	1.14	6.41	0.33
LS024B	This study	Bt- granite (BG)	72.2	0.17	15	1.19	0.03	0.25	1.1	4.54	4.66	0.14	0.54	99.82	9.2	1.2	1.03	8.1	0.24
LS023	This study	Bt- granite (BG)	72.4	0.25	14.7	1.91	0.05	0.45	1.35	4.2	4.38	0.15	0.39	100.22	8.58	1.26	1.04	7.23	0.32
CG49B	This study	Bt- granite (BG)	72.8	0.35	15.3	1.79	0.03	0.51	1.52	4.06	4.24	0.17	0.32	101.09	8.3	1.36	1.09	6.78	0.37
VP004J	Paes et al.2017	Bt- granite (BG)	72.8	0.27	14.5	1.93	0.04	0.37	1.77	4	3.75	0.09	0.44	99.96	7.75	1.36	1.05	5.98	0.44
Major element oxides in wt.%																			

Sample	Author	Petrology	SiO ₂	TiO ₂	Al ₂ O ₃	FeOt	MnO	MgO	CaO	Na ₂ O	K ₂ O	P ₂ O ₅	LOI	Sum	K ₂ O+Na ₂ O	Al ₂ O ₃ / (Na ₂ O+K ₂ O) (%mol)	ASI (%mol)	Na ₂ O+K ₂ O -CaO	CaO/ Na ₂ O
CG49C	This study	Bt- granite (BG)	73.1	0.3	15.5	1.76	0.05	0.53	1.43	3.99	4.45	0.2	0.42	101.73	8.44	1.36	1.11	7.01	0.36
CH383	Paes et al.2010	Ms-Bt leucogranite (MBG)	71.9	0.12	16.14	0.9	0.01	0.21	0.98	3.01	6.06	0.18	0.8	100.37	9.07	1.4	1.21	8.09	0.33
3051	Monteiro 1986	Ms-Bt leucogranite (MBG)	72.4	0.09	14.1	0.66	0.01	1.5	0.7	3.9	5.4	0.09	0.66	99.54	9.3	1.15	1.04	8.6	0.18
1274	Pedrosa Soares et al.1987	Ms-Bt leucogranite (MBG)	72.5	0.18	14.5	0.77	0.02	0.3	0.68	4	6	0.27	0.29	99.53	10	1.11	1.01	9.32	0.17
LS050	Paes et al.2017	Ms-Bt leucogranite (MBG)	72.6	0.17	15.1	1.55	0.03	0.18	1.36	4.58	3.84	0.09	0.78	99.58	8.42	1.29	1.07	7.06	0.3
LS059	Paes et al.2017	Ms-Bt leucogranite (MBG)	72.7	0.09	14.8	1.54	0.02	0.13	0.83	3.83	4.55	0.21	0.55	99.25	8.38	1.32	1.16	7.55	0.22
VP047	Paes et al.2017	Ms-Bt leucogranite (MBG)	72.8	0.11	15.2	1.18	0.02	0.14	0.81	4	5.17	0.13	0.34	99.9	9.17	1.25	1.11	8.36	0.20
1411	Pedrosa Soares et al.1987	Ms-Bt leucogranite (MBG)	72.8	0.11	14.1	0.70	0.06	0.22	0.46	2.5	7.9	0.21	0.47	99.55	10.4	1.11	1.04	9.94	0.18
1953	Pedrosa Soares et al.1987	Ms-Bt leucogranite (MBG)	72.8	0.12	14.7	0.73	0.04	0.26	0.96	3.7	5.3	0.12	0.8	99.6	9	1.24	1.08	8.04	0.26
2993	Monteiro 1986	Ms-Bt leucogranite (MBG)	72.8	0.2	15	1.31	0.03	0.37	1	4.1	4.3	0.16	1.08	100.4	8.4	1.32	1.13	7.4	0.24
2923	Monteiro 1986	Ms-Bt leucogranite (MBG)	72.9	0.18	14.4	0.70	0.04	0.22	0.91	4.4	4.7	0.14	1.2	99.83	9.1	1.17	1.03	8.19	0.21
LS078	Paes et al.2017	Ms-Bt leucogranite (MBG)	73	0.08	15	1.2	0.02	0.1	0.73	4.07	4.27	0.15	0.9	98.75	8.34	1.33	1.18	7.61	0.18
LS064	Paes et al.2017	Ms-Bt leucogranite (MBG)	73.3	0.07	14.8	1.27	0.02	0.07	0.78	4	4.3	0.18	0.79	98.93	8.3	1.32	1.17	7.52	0.2
CH415	Paes et al.2010	Ms-Bt leucogranite (MBG)	73.36	0.04	14.74	0.59	0.02	0.07	0.54	4.38	4.51	0.17	1.9	100.32	8.89	1.22	1.13	8.35	0.12
VP019	Paes et al.2017	Ms-Bt leucogranite (MBG)	73.5	0.09	15.1	1.12	0.02	0.07	0.7	4.04	4.78	0.14	1	100.57	8.82	1.28	1.15	8.12	0.17
2918	Monteiro 1986	Ms-Bt leucogranite (MBG)	73.5	0.01	14.9	0.59	0.01	0.08	0.53	4	4.1	0.07	1.2	98.99	8.1	1.35	1.24	7.57	0.13
LS055	Paes et al.2017	Ms-Bt leucogranite (MBG)	73.6	0.05	14.7	1.26	0.03	0.07	0.65	3.85	4.63	0.14	0.48	99.45	8.48	1.3	1.17	7.83	0.17
1224	Pedrosa Soares et al.1987	Ms-Bt leucogranite (MBG)	73.8	0.12	14.2	0.56	0.02	0.17	0.61	4.8	4.9	0.16	0.16	99.50	9.7	1.08	0.99	9.09	0.13
1268	Pedrosa Soares et al.1987	Ms-Bt leucogranite (MBG)	73.8	0.14	14.7	0.58	0.03	0.22	0.82	4.9	3.7	0.09	0.31	99.29	8.6	1.22	1.08	7.78	0.17
LS018	Paes et al.2017	Ms-Bt leucogranite (MBG)	73.9	0.07	15.3	0.95	0.01	0.1	1.08	3.91	3.89	0.22	0.54	99.97	7.8	1.44	1.21	6.72	0.28
LS029	Paes et al.2017	Ms-Bt leucogranite (MBG)	73.9	0.05	14.8	1.15	0.02	0.07	0.65	4.44	4.38	0.13	0.61	100.20	8.82	1.23	1.12	8.17	0.15
LS030	Paes et al.2017	Ms-Bt leucogranite (MBG)	73.7	0.1	15	1.2	0.02	0.11	0.77	4.03	4.8	0.13	0.84	100.7	8.83	1.27	1.13	8.06	0.19
1418	Pedrosa Soares et al.1987	Ms-Bt leucogranite (MBG)	74.0	0.1	13.6	0.62	0.04	0.15	0.74	4.1	5.2	0.1	0.89	99.54	9.3	1.1	0.99	8.56	0.18
2917	Monteiro 1986	Ms-Bt leucogranite (MBG)	74.0	0.26	14.8	0.99	0.05	1.2	0.84	2.6	4	0.09	0.71	99.54	6.6	1.72	1.46	5.76	0.32
LS054	Paes et al.2017	Ms-Bt leucogranite (MBG)	74.1	0.08	14.9	1.25	0.03	0.07	0.82	4.01	4.51	0.18	0.71	100.66	8.52	1.3	1.15	7.7	0.20
VP020A	Paes et al.2017	Ms-Bt leucogranite (MBG)	74.1	0.03	15	0.98	0.04	0.07	0.58	4.62	4.02	0.09	0.82	100.35	8.64	1.26	1.15	8.06	0.13
1408	Pedrosa Soares et al.1987	Ms-Bt leucogranite (MBG)	74.1	0.1	13.7	0.56	0.01	0.17	0.76	4.5	5.2	0.1	0.81	100.01	9.7	1.05	0.95	8.94	0.17
CH398	Paes et al.2010	Ms-Bt leucogranite (MBG)	74.38	0.12	14.94	0.73	0.02	0.07	0.38	4.69	4.47	0.17	0.5	100.46	9.16	1.19	1.13	8.78	0.08

	Author	Petrology	SiO ₂	TiO ₂	Al ₂ O ₃	FeOt	MnO	MgO	CaO	Na ₂ O	K ₂ O	P ₂ O ₅	LOI	Sum	K ₂ O+Na ₂ O	Al ₂ O ₃ / (Na ₂ O+K ₂ O)	ASI	Na ₂ O+K ₂ O -CaO	CaO/ Na ₂ O
																(%mol)	(%mol)		
CG70A	This study	Ms-Bt leucogranite (MBG)	74.4	0.12	15.8	0.49	0.05	0.15	0.78	2.7	5.33	0.2	0.91	100.93	8.03	1.55	1.36	7.25	0.29
VP020B	Paes et al.2017	Ms-Bt leucogranite (MBG)	74.4	0.02	14.7	1.03	0.01	0.07	0.82	5.16	3.64	0.09	0.5	100.9	8.8	1.18	1.06	7.98	0.16
LS092	Paes et al.2017	Ms-Bt leucogranite (MBG)	74.5	0.07	14.8	1.23	0.02	0.07	0.65	4.09	4.68	0.12	0.96	100.8	8.77	1.25	1.14	8.12	0.16
LS011	Paes et al.2017	Ms-Bt leucogranite (MBG)	75	0.05	14.5	1.03	0.04	0.07	0.77	3.97	4.66	0.11	0.59	100.99	8.63	1.25	1.12	7.86	0.19
200	Pedrosa Soares et al.1987	Ms-Bt leucogranite (MBG)	75	0.16	12.9	1.08	0.08	0.25	0.58	2.9	5	0.19	0.13	98.27	7.9	1.27	1.15	7.32	0.2
CG116	This study	Ms-Bt leucogranite (MBG)	75.3	0.15	15	1.03	0.02	0.32	0.8	2.51	5.5	0.22	0.94	101.79	8.01	1.49	1.3	7.21	0.32
R5Mb	This study	Ms-Bt leucogranite (MBG)	75.9	0.03	14.9	0.4	0.05	<0.1	0.57	4.21	4.44	0.08	0.39	100.97	8.65	1.27	1.17	8.08	0.14
CG49A	This study	Ms-Bt leucogranite (MBG)	76.5	0.02	15	0.47	0.08	<0.1	0.49	4.28	4.42	0.08	0.5	101.84	8.7	1.27	1.18	8.21	0.11
CG79	This study	Ms-Bt leucogranite (MBG)	76.9	0.03	14.4	0.37	0.03	<0.1	0.56	4.68	3.4	0.17	0.4	100.94	8.08	1.27	1.16	7.52	0.12
3057	Monteiro 1986	Ms granodiorite (MBG)	74		15.3	0.16		0.03	2.9	3.8	1.9	0.14	1.56	99.79	5.7	1.24	1.19	2.8	0.76
1913	Pedrosa Soares et al.1987	Turmaline leugranite (MBG)	73.6	0.1	14.8	0.45	0.03	0.06	0.25	5.8	3.6	0.47	1.12	100.28	9.4	1.84	1.13	9.15	0.04
1976	Pedrosa Soares et al.1987	Turmaline leugranite (MBG)	74.3	0.1	14.8	0.47	0.04	0.14	0.58	4.7	3.9	0.11	0.87	100.01	8.6	1.1	1.07	8.02	0.12
1914	Pedrosa Soares et al.1987	Pegmatoid (PG)	72.6	0.1	14.9	0.60	0.02	0.16	0.25	2.7	7	0.37	1.12	99.82	9.7	1.24	1.14	9.45	0.09

Trace elements in ppm																										
Sample	Author	Petrology	Ba	Be	Ce	Co	Cs	Cu	Dy	Er	Eu	F	Ga	Gd	Hf	Ho	La	Li	Lu	Nb	Nd	Ni	Pr	Rb	Sm	Sn
LS024A	Paes et al.2010	Bt- granite (BG)	2749	8.2	211.8	4.3	5.89	5	4.23	1.64	2.67	763	24.1	7.78	6.22	0.67	130.4	134	0.17	19.22	74.2	9		153.4	11.4	4.5
VP017	Paes et al.2017	Bt- granite (BG)	2781	6.9	238.9	4	10.66	7	5.46	2.08	2.97	735	25.8	9.73	6.64	0.83	142.6	457	0.19	22.12	79.7	10		169.7	13.7	4.8
R4bt	This study	Bt- granite (BG)	2796		223.4	49.2	16.16	9	3.99	1.53	2.55		24.9	7.94	7.2	0.63	132.8		0.18	20.16	74.1	13	22.36	213.3	11.5	6.1
LS026	Paes et al.2017	Bt- granite (BG)	1787	6.2	155.2	4.1	4.45	8	2.84	1.25	1.85	738	22.1	5.21	5.11	0.49	92.3	101	0.14	13.75	51.1	7		127.3	8	4.4
CG25A	This study	Bt- granite (BG)	2147		176.7	55.2	12.32	<5	4.03	1.61	2.11		27.8	7.5	5.27	0.64	101		0.19	22.27	62.4	8	18.14	215.4	10.3	8.5
CG43	This study	Bt- granite (BG)	2314		158.9	67.6	5.11	7	2.55	1.01	1.97		25.1	5.61	5.22	0.41	92.9		0.13	11.96	53.7	12	16.08	138.2	7.9	3.2
CG45B	This study	Bt- granite (BG)	2434		121.1	74.6	6.05	8	2.48	1.03	1.81		25.6	4.61	5	0.39	71.1		0.13	13.12	41.6	12	12.37	143.1	6.7	3.7
CG63	This study	Bt- granite (BG)	3217		235.2	62.4	10.6	<5	4.23	1.42	2.47		27.5	9.17	8.06	0.65	142.7		0.17	22.67	86.4	14	25.67	172.5	13.1	17.7
CG67	This study	Bt- granite (BG)	2566		176.5	81	8.27	<5	3.93	1.61	2.38		26	7.7	5.38	0.63	112.5		0.18	18.24	65.6	18	19.31	175.5	10.6	3
R5Bt	This study	Bt- granite (BG)	2550		161.7	61	21.33	6	3.79	1.53	2.34		27.5	6.88	5.6	0.61	92.9		0.18	18.89	56.7	9	16.58	330.2	9.5	10.2
LS024B	Paes et al.2017	Bt- granite (BG)	1469	8.9	87.8	1.4	10.06	<5	2.3	1.02	1.21	416	22.8	3.68	3.6	0.42	49.1	91	0.12	13.04	26.8	<5		178.2	4.9	3.4
LS023	Paes et al.2017	Bt- granite (BG)	2069	14.6	127.4	3	11.46	<5	2.51	1.14	1.63	670	24.3	4.26	5.08	0.39	75.9	234	0.14	21.2	40.3	8		177.8	6.6	5.4
CG49B	This study	Bt- granite (BG)	1822		159.2	44.4	12.64	<5	2.27	0.81	1.66		25.6	5.42	5.14	0.32	94.6		0.09	10.48	53.8	9	16.32	184.4	8.3	7
VP004J	Paes et al.2017	Bt- granite (BG)	404	5.8	59.8	2.7	5.7	<5	3	1.69	0.8	437	23.7	3.38	4.03	0.59	31.2	93	0.23	28.6	18.7	5		193.7	3.9	3.6
CG49C	This study	Bt- granite (BG)	2345		161.5	81.1	11.12	5	3.35	1.35	2.03		28	6.39	4.95	0.53	91.8		0.17	18.26	55.8	8	16.55	228.3	9.1	9.5
CH383	Paes et al.2010	Ms-Bt leucogranite (MBG)	381.4	2	24.9		2	0.3	4.09	2.34	1.02		29.1	4.01	2	0.8	12.3	365	0.29	5.9	10.8	0.4	2.86	184.6	3.3	3
LS050	Paes et al.2017	Ms-Bt leucogranite (MBG)	1269	4.9	46.8	2.1	2.7	<5	0.99	0.39	0.95	450	25.3	2.14	3.46	0.18	23.1	121	<0.05	6.89	15.8	6	4.95	117.6	3.2	1.3
LS059	Paes et al.2017	Ms-Bt leucogranite (MBG)	344	2.6	22.9	1.2	1.56	<5	2.31	0.95	0.62	178	29.4	2.66	1.37	0.37	13.2	73	0.09	6.48	7.2	<5	2.64	173.2	2.4	2.9
VP047	Paes et al.2017	Ms-Bt leucogranite (MBG)	431	5.4	25.9	1.3	4.51	<5	1.55	0.61	0.92	232	29.4	2.4	1.36	0.23	13	103	0.06	4.61	8.4	7	3.1	213.5	2.4	3.5
LS078	Paes et al.2017	Ms-Bt leucogranite (MBG)	347	9	18	0.6	5.97	<5	1.45	0.63	0.6	281	28.9	2.12	1.41	0.27	6.3	204	0.08	5.51	6	<5	2.13	222.2	2	6.4
LS064	Paes et al.2017	Ms-Bt leucogranite (MBG)	308	4	16.1	1	2.23	<5	1.56	0.71	0.5	233	29.2	3.38	1.38	0.26	5.8	75	0.08	7.04	12	<5	4.32	164.2	1.8	2.9
CH415	Paes et al.2010	Ms-Bt leucogranite (MBG)	180.9	43	10.7	0.6	8.1	1.2	1.01	0.44	0.36		26	1.23	1.2	0.2	5.4	113	0.04	5.4	3.6	0.2	1.21	298.8	1.4	9
VP019	Paes et al.2017	Ms-Bt leucogranite (MBG)	298	12	21.5	0.8	9.43	<5	1.58	0.62	0.62	488	34.7	2	1.45	0.26	14.1	86	0.07	4.89	6.4	<5	2.39	287	2.1	9.1
LS055	Paes et al.2017	Ms-Bt leucogranite (MBG)	222	12	9.9	0.6	7.71	7	1.66	0.96	0.4	245	28.6	1.68	1.42	0.33	5.8	117	0.14	6.08	2	<5	1.1	224.8	1.2	7
LS018	Paes et al.2017	Ms-Bt leucogranite (MBG)	167	3.9	15.1	<0.5	1.93	<5	2.79	1.26	0.65	245	31	2.81	1.94	0.5	7.2	51	0.16	5.81	4.7	<5	1.83	127.3	2.3	3.6
LS029	Paes et al.2017	Ms-Bt leucogranite (MBG)	269	10.2	13.2	<0.5	3.88	<5	1.02	0.42	0.4	164	28.8	1.5	1.44	0.16	4.8	76	<0.05	7.23	3.2	<5	1.47	199.9	1.5	6.7
LS030	Paes et al.2017	Ms-Bt leucogranite (MBG)	363	6.9	18.4	1	3.03	<5	1.31	0.55	0.71	308	29.6	1.73	1.41	0.23	9.6	98	0.06	4.33	4.9	<5	2.1	233.3	1.9	5.3
LS044	Paes et al.2017	Ms-Bt leucogranite (MBG)	515	2.9	14.3	0.7	2.1	<5	2.43	1.38	0.81	108	26.1	2.38	1.12	0.5	6.3	63	0.15	4.19	4	<5	1.67	164.3	1.7	2.3
LS054	Paes et al.2017	Ms-Bt leucogranite (MBG)	363	6.4	15.8	0.7	3.77	<5	1.83	0.77	0.59	348	29.4	2.19	1.3	0.3	6.7	96	0.09	5.19	4.7	<5	1.82	210.8	1.9	4.1
VP020A	Paes et al.2017	Ms-Bt leucogranite (MBG)	69	12.3	8.8	<0.5	6.08	<5	1.15	0.55	0.26	338	33.6	1.28	0.91	0.21	1.8	296	0.09	5.02	1.5	<5	1.01	299.5	1.3	8.6
CH398	Paes et al.2010	Ms-Bt leucogranite (MBG)	107.9	6	5.5	<5	6.4	1.2	0.81	0.26	0.12		25.8	4.01	1.2	0.13	2.1	110	0.03	9.9	1.6	0.1	0.55	338.4	0.6	51
CG70A	This study	Ms-Bt leucogranite (MBG)	497		42.9	60.6	3.79	<5	8.85	5.25	0.94		34.1	7.69	0.81	1.78	21.6		0.53	8.08	18.1	6	4.98	186.5	5.8	4.1
VP020B	Paes et al.2017	Ms-Bt leucogranite (MBG)	600	14.5	15.3	<0.5	5.42	<5	1.04	0.54	0.63	37	20.6	1.45	1.18	0.2	7.4	238	0.06	2.64	3.8	<5	1.67	250.2	1.4	2.6
LS092	Paes et al.2017	Ms-Bt leucogranite (MBG)	296	5.7	17	0.6	7.12	<5	2.24	1.07	0.46	238	28.7	2.11	1.2	0.41	7.2	156	0.15	4.94	4.7	<5	1.9	201	1.8	4.6
LS011	Paes et al.2017	Ms-Bt leucogranite (MBG)	145	8.7	25.3	<0.5	9.44	<5	1.74	0.84	0.4	414	31.2	2.39	1.59	0.32	11.7	201	0.12	9.36	7.5	<5	2.77	282.1	2.5	9.9

Sample	Author	Petrology	Ba	Be	Ce	Co	Cs	Cu	Dy	Er	Eu	F	Ga	Gd	Hf	Ho	La	Li	Lu	Nb	Nd	Ni	Pr	Rb	Sm	Sn
CG49A	This study	Ms-Bt leucogranite (MBG)	101		8.3	84.3	5.59	<5	1.81	0.95	0.18		35.6	1.21	1.37	0.31	5.3		0.16	7.74	2.4	6	0.93	333.2	1.1	15.3
CG79	This study	Ms-Bt leucogranite (MBG)	75		4.6	70	10.14	<5	0.95	0.5	0.23		22.5	0.68	1.22	0.18	4.1		0.07	6.84	1.1	6	0.51	250.7	0.5	9.6

Trace elements in ppm

Sample	Author	Petrology	Sr	Ta	Tb	Th	Tl	Tm	U	Y	Yb	Zn	Zr	(Eu/Eu*) _N	(La/Yb) _N
LS024A	Paes et al.2010	Bt- granite (BG)	1102.6	1.24	0.92	41.1	0.8	0.22	3.94	19.17	1.3		255.4	0.87	67.63
VP017	Paes et al.2017	Bt- granite (BG)	1133.4	1.33	1.19	47	0.8	0.25	4.46	23.44	1.6		275.8	0.79	60.09
R4bt	This study	Bt- granite (BG)	1220	1.38	0.97	41.6	1.1	0.22	5.91	16.38	1.2	14	252	0.82	74.61
LS026	Paes et al.2017	Bt- granite (BG)	927	0.75	0.63	27.2	0.6	0.15	5.16	13.27	0.9		199.6	0.88	69.14
CG25A	This study	Bt- granite (BG)	946	1.81	0.88	33	0.9	0.22	4.82	17.44	1.4	37	164	0.73	48.64
CG43	This study	Bt- granite (BG)	1145	0.56	0.63	29.9	<0.5	0.13	5.04	11.02	0.8	<5	172	0.9	78.29
CG45B	This study	Bt- granite (BG)	1192	0.6	0.55	21	<0.5	0.15	6.42	10.81	0.9	15	172	1	53.26
CG63	This study	Bt- granite (BG)	793	1.98	1	57.6	<0.5	0.19	7.6	16.69	1.2	<5	311	0.69	80.17
CG67	This study	Bt- granite (BG)	1202	0.94	0.9	35.6	<0.5	0.21	5.6	17.95	1.2	<5	182	0.81	63.21
R5Bt	This study	Bt- granite (BG)	1060	1.55	0.83	31.6	1.5	0.21	11.66	16.63	1.3	38	177	0.88	48.18
LS024B	Paes et al.2017	Bt- granite (BG)	586.1	0.73	0.49	22.2	0.7	0.13	4.23	11.74	0.8		132.8	0.87	41.38
LS023	Paes et al.2017	Bt- granite (BG)	957.9	2.07	0.53	37.4	0.9	0.15	7.35	12.15	0.9		187.7	0.94	56.86
CG49B	This study	Bt- granite (BG)	768	0.34	0.58	34.6	0.6	0.1	4.45	8.88	0.6	6	175	0.76	106.3
VP004J	Paes et al.2017	Bt- granite (BG)	174.7	3.67	0.51	14.7	0.5	0.27	7.41	17.58	1.7		139.6	0.67	12.37
CG49C	This study	Bt- granite (BG)	1017	1.37	0.75	31	0.9	0.18	8.86	14.72	1.2	13	153	0.81	51.58

Trace elements in ppm

Sample	Author	Petrology	Sr	Ta	Tb	Th	Tl	Tm	U	Y	Yb	Zn	Zr	(Eu/Eu*) _N	(La/Yb) _N
CH383	Paes et al.2010	Ms-Bt leucogranite (MBG)	130.9	0.5	0.77	7.9		0.34	4.4	26.9	1.95	17	53.5	0.86	4.25
LS050	Paes et al.2017	Ms-Bt leucogranite (MBG)	511.7	0.79	0.24	7.9	<0.5	<0.05	3.57	4.85	0.2		106.9	1.11	77.87
LS059	Paes et al.2017	Ms-Bt leucogranite (MBG)	105.9	0.05	0.44	4	<0.5	0.13	9.62	11.19	0.9		40.4	0.75	9.89
VP047	Paes et al.2017	Ms-Bt leucogranite (MBG)	154.3	0.09	0.33	6.1	0.9	0.09	3.11	7.17	0.5		41.8	1.17	17.53
LS078	Paes et al.2017	Ms-Bt leucogranite (MBG)	116	1.5	0.34	4.4	1.2	0.09	2.61	7.32	0.6		35.1	0.89	7.08
LS064	Paes et al.2017	Ms-Bt leucogranite (MBG)	102	0.33	0.29	4	0.5	0.1	4.01	8.04	0.6		39.3	0.62	6.52
CH415	Paes et al.2010	Ms-Bt leucogranite (MBG)	64.1	1.4	0.25	2.3		0.07	4.3	6	0.43	22	26	0.84	8.47

Sample	Author	Petrology	Sr	Ta	Tb	Th	Tl	Tm	U	Y	Yb	Zn	Zr	(Eu/Eu*) _N	(La/Yb) _N
VP019	Paes et al.2017	Ms-Bt leucogranite (MBG)	100.5	0.18	0.32	5.4	1.1	0.09	2.64	7.26	0.5		41.5	0.93	19.01
LS055	Paes et al.2017	Ms-Bt leucogranite (MBG)	77.4	0.42	0.29	2.3	0.6	0.13	2.08	10.04	0.9		36.7	0.86	4.34
LS018	Paes et al.2017	Ms-Bt leucogranite (MBG)	112.8	0.62	0.49	3.8	0.7	0.18	2.71	14.17	1.1		53.8	0.78	4.41
LS029	Paes et al.2017	Ms-Bt leucogranite (MBG)	102.2	0.68	0.23	4.1	0.7	<0.05	3.67	5.19	0.3		36.3	0.82	10.79
LS030	Paes et al.2017	Ms-Bt leucogranite (MBG)	124	0.1	0.27	3.9	0.9	0.08	2.23	6.76	0.5		41.9	1.2	12.94
LS044	Paes et al.2017	Ms-Bt leucogranite (MBG)	152	0.07	0.42	3.1	0.6	0.18	2.5	13.99	1.1		35	1.23	3.86
LS054	Paes et al.2017	Ms-Bt leucogranite (MBG)	117.6	0.19	0.36	3.3	0.6	0.11	6.01	8.69	0.6		41.4	0.88	7.53
VP020A	Paes et al.2017	Ms-Bt leucogranite (MBG)	40.8	0.33	0.21	3	1.1	0.09	16.59	6.33	0.6		21.7	0.62	2.02
CH398	Paes et al.2010	Ms-Bt leucogranite (MBG)	34.2	1.7	0.77	1.1		<0.05	2.2	4	0.31	18	16.8	0.24	4.57
CG70A	This study	Ms-Bt leucogranite (MBG)	115	0.14	1.36	13.7	<0.5	0.67	4.74	60.29	3.9	<5	<10	0.43	3.73
VP020B	Paes et al.2017	Ms-Bt leucogranite (MBG)	222.2	0.41	0.2	3.9	1	0.06	6.18	5.53	0.4		36.2	1.35	12.47
LS092	Paes et al.2017	Ms-Bt leucogranite (MBG)	84.9	0.36	0.38	4	0.8	0.15	5.08	11.77	1		33.8	0.72	4.85
LS011	Paes et al.2017	Ms-Bt leucogranite (MBG)	54.6	0.71	0.34	10.6	0.9	0.12	3.34	9.18	0.8		40	0.5	9.86
CG116	This study	Ms-Bt leucogranite (MBG)	95	0.16	0.56	5.6	<0.5	0.14	1.94	13.59	0.8	<5	<10	0.72	10.53
R5Mb	This study	Ms-Bt leucogranite (MBG)	36	0.26	0.26	1.9	0.8	0.1	6.39	7.89	0.7	<5	<10	0.64	7.13
CG49A	This study	Ms-Bt leucogranite (MBG)	33	0.39	0.27	2.2	0.8	0.16	14.51	10.46	1.2	<5	<10	0.48	2.98
CG79	This study	Ms-Bt leucogranite (MBG)	31	0.51	0.15	0.8	<0.5	0.07	2.54	5.38	0.5	<5	<10	1.21	5.53

Mineral Chemistry Data

Results of complete electron microprobe analyses from Two-mica leucogranite of the Itaporé batholith

K-feldspar

	SiO2	TiO2	Al2O3	FeO	MgO	CaO	MnO	BaO	Na2O	K2O	Total
CG-49a_campo6_02_Feldsp-1	64,817	0,000	18,592	0,000	0,017	0,016	0,000	0,078	0,973	15,616	100,11
CG-49a_campo6_02_Feldsp-2	64,766	0,006	18,204	0,040	0,009	0,009	0,000	0,117	0,900	15,684	99,74
CG-49a_campo6_02_Feldsp-3	64,763	0,000	18,341	0,000	0,000	0,043	0,005	0,094	10,070	15,334	108,65
CG-79_campo2_02-k-feldsp-3	65,016	0,015	18,650	0,002	0,000	0,020	0,037	0,054	0,831	15,775	100,40
CG-79_campo2_02-k-feldsp-4	64,816	0,000	18,499	0,000	0,031	0,035	0,015	0,047	0,605	16,105	100,15
CG-79_campo2_02-k-feldsp-8	65,337	0,001	18,590	0,020	0,000	0,008	0,000	0,058	0,854	15,490	100,36
CG-79_campo2_02-k-feldsp-9	65,084	0,000	18,592	0,035	0,000	0,018	0,000	0,040	1,080	15,596	100,45
CG-79_campo2_02-k-feldsp-10	65,051	0,000	18,601	0,000	0,017	0,020	0,000	0,047	0,555	16,026	100,32
CG-79_campo2_02-k-feldsp-11	65,179	0,000	18,920	0,000	0,007	0,245	0,056	0,092	2,490	13,145	100,13
CG-79_campo2_02-k-feldsp-13	64,993	0,000	18,475	0,024	0,000	0,017	0,000	0,022	0,790	15,639	99,96
CG-79_campo4_01_Feldsp-1	65,382	0,000	18,350	0,000	0,000	0,069	0,000	0,036	0,444	16,257	100,54
CG-79_campo4_01_Feldsp-2	65,022	0,000	18,768	0,011	0,009	0,036	0,026	0,047	0,787	16,006	100,71
CG-79_campo4_01_Feldsp-3	65,332	0,000	18,546	0,006	0,017	0,037	0,038	0,035	0,508	16,325	100,84
CG-96_campo5_01_Feldsp-1	64,309	0,038	18,277	0,000	0,005	0,030	0,037	0,009	0,867	15,554	99,13
CG-96_campo5_01_Feldsp-2	64,316	0,000	18,075	0,031	0,000	0,011	0,000	0,004	0,533	16,250	99,22
CG-96_campo5_01_Feldsp-3	63,915	0,007	18,374	0,007	0,004	0,009	0,000	0,015	0,321	16,574	99,23
R5MB_campo4_01_Feldsp-1	64,546	0,004	18,305	0,032	0,016	0,069	0,019	0,018	0,846	15,572	99,43
R5MB_campo4_01_Feldsp-2	65,058	0,000	18,418	0,015	0,000	0,038	0,000	0,041	1,319	15,131	100,02
R5MB_campo4_01_Feldsp-3	65,311	0,044	18,579	0,025	0,012	0,021	0,000	0,013	0,785	15,973	100,76
R5MB_campo4_01_Feldsp-4	64,657	0,000	18,361	0,018	0,025	0,026	0,000	0,023	0,743	15,741	99,59
R5MB_campo5_01_feldsp-6	65,145	0,003	18,378	0,062	0,000	0,041	0,015	0,054	0,832	15,847	100,38
R5MB_campo5_01_feldsp-7	64,213	0,000	18,392	0,028	0,001	0,018	0,015	0,021	0,669	15,965	99,32
R5MB_campo5_01_feldsp-8	64,785	0,019	18,303	0,012	0,008	0,054	0,000	0,008	0,869	15,885	99,94
R5MB_campo5_01_feldsp-9	64,893	0,035	18,233	0,035	0,015	0,053	0,015	0,023	0,853	16,007	100,16
R5MB_campo5_01_feldsp-10	64,759	0,028	18,404	0,036	0,011	0,020	0,000	0,028	0,266	16,679	100,23
R5MB_campo5_01_feldsp-11	63,001	0,010	18,406	0,046	0,000	0,075	0,000	0,026	0,807	15,775	98,15
R5MB_campo7_01_Feldsp-10	64,582	0,000	18,392	0,037	0,007	0,027	0,022	0,023	0,708	15,852	99,65
R5MB_campo7_01_Feldsp-11	64,397	0,000	18,305	0,000	0,000	0,000	0,000	0,033	0,893	15,451	99,08
R5MB_campo7_01_Feldsp-12	64,464	0,034	18,418	0,015	0,008	0,043	0,041	0,059	0,474	15,950	99,51
R5MB_campo7_01_Feldsp-13	64,447	0,000	18,409	0,030	0,000	0,022	0,000	0,037	0,887	15,748	99,58
R5MB_campo7_01_Feldsp-14	64,474	0,000	18,502	0,015	0,000	0,041	0,000	0,015	0,705	15,826	99,58
R5MB_campo7_01_Feldsp-15	64,254	0,000	18,519	0,000	0,000	0,031	0,000	0,049	0,273	16,336	99,46

Plagioclase

	SiO2	TiO2	Al2O3	FeO	MgO	CaO	MnO	BaO	Na2O	K2O	Total
CG-49a_campo1_01-Feldsp-1	66,328	0,031	20,772	0,022	0,022	1,601	0,011	0,000	10,428	0,167	99,38
	SiO2	TiO2	Al2O3	FeO	MgO	CaO	MnO	BaO	Na2O	K2O	Total
CG-49a_campo1_01-Feldsp-4	66,306	0,035	20,604	0,000	0,000	1,575	0,000	0,000	10,383	0,283	99,19
CG-49a_campo1_01-Feldsp-5	66,116	0,000	20,586	0,000	0,000	1,567	0,018	0,009	10,352	0,238	98,89
CG-49a_campo2_01_Feldsp-1	66,599	0,000	20,515	0,070	0,000	1,547	0,045	0,000	10,425	0,218	99,42
CG-49a_campo2_01_Feldsp-2	66,622	0,000	20,848	0,018	0,000	1,533	0,006	0,000	10,589	0,131	99,76
CG-49a_campo2_01_Feldsp-3	66,569	0,000	20,728	0,011	0,000	1,547	0,007	0,000	10,521	0,185	99,57
CG-49a_campo2_01_Feldsp-4	66,534	0,002	20,646	0,008	0,000	1,603	0,036	0,013	10,545	0,158	99,55
CG-49a_campo2_01_Feldsp-5	65,744	0,003	20,522	0,003	0,003	1,865	0,014	0,000	10,254	0,176	98,58
CG-49a_campo2_01_Feldsp-6	66,089	0,000	20,744	0,000	0,000	1,638	0,044	0,000	10,487	0,216	99,22
CG-49a_campo2_01_Feldsp-7	66,800	0,000	20,794	0,000	0,000	1,663	0,000	0,005	10,508	0,193	99,98
CG-49a_campo2_01_Feldsp-8	65,766	0,032	20,411	0,000	0,020	1,752	0,007	0,013	10,415	0,178	98,59
CG-49a_campo4_01_Feldsp-2	66,910	0,000	20,500	0,000	0,000	1,348	0,000	0,012	10,634	0,220	99,62
CG-49a_campo4_01_Feldsp-3	66,833	0,006	20,552	0,017	0,000	1,395	0,017	0,000	10,530	0,204	99,57
CG-49a_campo4_01_Feldsp-4	66,430	0,000	20,648	0,045	0,018	1,579	0,027	0,000	10,532	0,227	99,51
CG-49a_campo4_01_Feldsp-5	66,337	0,000	20,565	0,009	0,000	1,684	0,000	0,000	10,426	0,191	99,21
CG-49a_campo5_01_Feldsp-1	66,352	0,018	20,662	0,000	0,024	1,371	0,004	0,004	10,842	0,188	99,47
CG-49a_campo5_01_Feldsp-2	66,157	0,000	20,540	0,060	0,004	1,838	0,000	0,008	10,476	0,218	99,30
CG-49a_campo5_01_Feldsp-3	67,206	0,033	20,080	0,000	0,000	1,001	0,000	0,000	10,972	0,123	99,42
CG-49a_campo5_01_Feldsp-4	66,147	0,000	20,533	0,001	0,000	1,687	0,005	0,000	10,550	0,184	99,11
CG-49a_campo5_01_Feldsp-5	66,705	0,000	20,767	0,009	0,000	1,684	0,001	0,000	10,500	0,234	99,90
CG-49a_campo5_02_Feldsp-1	66,718	0,002	20,645	0,023	0,000	1,494	0,000	0,007	10,559	0,148	99,62
CG-49a_campo5_02_Feldsp-2	66,610	0,020	20,536	0,000	0,000	1,422	0,000	0,000	10,766	0,202	99,56
CG-49a_campo5_02_Feldsp-3	66,839	0,008	20,671	0,008	0,001	1,487	0,000	0,000	10,420	0,199	99,64
CG-49a_campo5_02_Feldsp-4	66,216	0,023	20,768	0,037	0,000	1,827	0,008	0,000	10,483	0,158	99,53
CG-49a_campo5_02_Feldsp-5	66,458	0,013	20,580	0,031	0,000	1,645	0,000	0,000	10,570	0,146	99,46
CG-49a_campo6_01_Feldsp-1	66,547	0,011	20,904	0,018	0,000	1,736	0,002	0,000	10,470	0,211	99,90
CG-49a_campo6_01_Feldsp-2	66,790	0,008	20,622	0,014	0,000	1,688	0,000	0,000	10,483	0,168	99,81
CG-49a_campo6_01_Feldsp-3	66,302	0,015	20,448	0,010	0,000	1,438	0,034	0,000	10,642	0,189	99,09
CG-49a_campo6_01_Feldsp-4	67,019	0,000	20,410	0,008	0,000	1,353	0,008	0,012	10,559	0,256	99,63
CG-49a_campo6_01_Feldsp-5	66,988	0,000	20,573	0,085	0,000	1,511	0,089	0,002	10,606	0,144	100,00
CG-49a_campo7_01_Feldsp-1	67,655	0,000	19,814	0,000	0,009	0,649	0,000	0,016	11,214	0,134	99,49
CG-49a_campo7_01_Feldsp-2	66,573	0,019	20,369	0,003	0,009	1,522	0,000	0,010	10,669	0,125	99,31
CG-49a_campo7_01_Feldsp-3	66,400	0,032	20,597	0,000	0,000	1,579	0,020	0,000	10,625	0,125	99,38
CG-49a_campo7_01_Feldsp-4	66,590	0,000	20,907	0,000	0,001	1,749	0,000	0,000	10,329	0,217	99,79
CG-49a_campo7_01_Feldsp-5	66,379	0,000	20,882	0,034	0,000	1,738	0,002	0,000	10,594	0,240	99,87
CG-49a_campo7_01_Feldsp-6	66,584	0,016	20,618	0,000	0,000	1,628	0,000	0,000	10,614	0,143	99,61
CG-49a_campo7_01_Feldsp-7	66,294	0,000	20,722	0,004	0,000	1,721	0,025	0,000	10,369	0,201	99,34
CG-79_campo1_01-Feldsp-1	66,630	0,006	20,745	0,000	0,000	1,404	0,000	0,000	10,646	0,152	99,58
CG-79_campo1_01-Feldsp-2	67,403	0,000	20,614	0,000	0,000	1,295	0,056	0,000	10,737	0,165	100,27
CG-79_campo1_01-Feldsp-3	66,791	0,006	20,665	0,000	0,015	1,389	0,000	0,017	10,783	0,126	99,79
CG-79_campo1_01-Feldsp-4	66,600	0,000	20,663	0,017	0,000	1,281	0,022	0,000	10,848	0,134	99,57
CG-79_campo1_01-Feldsp-5	67,314	0,000	20,527	0,000	0,000	1,289	0,018	0,000	10,657	0,118	99,92
CG-79_campo2_02-k-feldsp-1	66,737	0,010	20,861	0,000	0,027	1,529	0,000	0,000	10,558	0,195	99,92
CG-79_campo2_02-k-feldsp-2	67,450	0,005	20,695	0,000	0,000	1,425	0,000	0,010	10,670	0,093	100,35

	SiO2	TiO2	Al2O3	FeO	MgO	CaO	MnO	BaO	Na2O	K2O	Total
CG-79_campo2_02-k-feldsp-5	66,958	0,003	20,360	0,007	0,015	0,984	0,000	0,000	10,867	0,093	99,29
CG-79_campo2_02-k-feldsp-6	67,990	0,000	20,541	0,000	0,000	1,145	0,007	0,000	10,978	0,067	100,73
CG-79_campo2_02-k-feldsp-7	67,523	0,015	20,830	0,007	0,000	1,352	0,000	0,001	10,798	0,096	100,62
CG-79_campo2_02-k-feldsp-14	67,315	0,000	20,644	0,000	0,002	1,380	0,000	0,000	10,785	0,110	100,24
CG-79_campo3_01_Feldsp-1	67,073	0,010	20,634	0,000	0,006	1,237	0,008	0,000	10,923	0,122	100,01
CG-79_campo3_01_Feldsp-2	66,987	0,000	20,335	0,004	0,020	1,089	0,056	0,000	10,817	0,167	99,48
CG-79_campo3_01_Feldsp-3	67,453	0,053	20,635	0,015	0,007	1,225	0,000	0,009	10,702	0,127	100,23
CG-79_campo3_01_Feldsp-4	67,529	0,017	20,607	0,026	0,008	1,300	0,000	0,000	10,938	0,124	100,55
CG-79_campo3_01_Feldsp-5	67,433	0,001	20,519	0,011	0,005	1,099	0,000	0,000	11,015	0,163	100,25
CG-79_campo4_01_Feldsp-4	67,392	0,000	20,528	0,000	0,004	1,289	0,000	0,006	10,954	0,071	100,24
CG-79_campo4_01_Feldsp-5	66,972	0,029	20,266	0,000	0,019	0,765	0,000	0,000	11,250	0,082	99,38
CG-79_campo4_01_Feldsp-6	67,704	0,000	20,454	0,000	0,000	1,274	0,003	0,000	11,005	0,139	100,58
CG-79_campo4_01_Feldsp-7	67,488	0,001	20,366	0,000	0,005	0,958	0,004	0,000	11,014	0,148	99,98
CG-96_campo2_02_Plag-1	66,567	0,000	19,655	0,016	0,005	1,040	0,000	0,000	10,732	0,198	98,21
CG-96_campo2_02_Plag-2	66,393	0,027	19,766	0,000	0,000	1,147	0,041	0,019	10,715	0,202	98,31
CG-96_campo2_02_Plag-3	66,436	0,003	19,723	0,009	0,000	0,930	0,000	0,006	10,644	0,147	97,90
CG-96_campo2_02_Plag-4	66,619	0,005	19,571	0,000	0,008	0,797	0,000	0,000	10,586	0,201	97,79
CG-96_campo2_02_Plag-1	68,541	0,000	20,581	0,000	0,000	1,142	0,000	0,000	6,062	0,177	96,50
CG-96_campo2_02_Plag-2	66,476	0,000	20,095	0,001	0,000	1,072	0,000	0,000	9,780	0,173	97,60
CG-96_campo2_02_Plag-3	67,122	0,003	20,124	0,000	0,029	0,902	0,000	0,000	10,066	0,160	98,41
CG-96_campo2_02_Plag-4	66,994	0,017	20,067	0,000	0,000	0,795	0,000	0,000	9,964	0,215	98,05
CG-96_campo6_02_Plag-1	67,423	0,016	19,214	0,000	0,000	0,100	0,000	0,004	11,202	0,161	98,12
CG-96_campo6_02_Plag-2	66,663	0,000	19,972	0,000	0,024	0,854	0,030	0,003	10,769	0,238	98,55
CG-96_campo6_02_Plag-3	67,126	0,000	19,627	0,000	0,008	0,661	0,000	0,009	10,905	0,128	98,46
CG-96_campo6_02_Plag-4	65,492	0,036	20,077	0,000	0,013	0,892	0,026	0,003	10,319	0,245	97,10
CG-96_campo8_01_Plag-1	66,965	0,000	20,026	0,000	0,000	0,833	0,037	0,003	10,621	0,201	98,69
CG-96_campo8_01_Plag-2	67,088	0,008	19,971	0,000	0,000	0,771	0,141	0,000	10,729	0,211	98,92
CG-96_campo8_01_Plag-3	67,087	0,000	19,904	0,000	0,000	0,868	0,000	0,005	10,657	0,177	98,70
CG-96_campo8_01_Plag-4	67,016	0,038	20,105	0,000	0,000	0,900	0,004	0,000	10,608	0,113	98,78
R5MB_campo2_02_Feldsp-1	66,187	0,021	20,620	0,015	0,000	1,569	0,000	0,005	10,466	0,293	99,18
R5MB_campo2_02_Feldsp-2	65,759	0,014	20,669	0,041	0,005	1,652	0,015	0,000	10,327	0,194	98,68
R5MB_campo2_02_Feldsp-3	66,023	0,019	20,635	0,000	0,000	1,437	0,000	0,000	10,537	0,177	98,83
R5MB_campo2_02_Feldsp-4	66,763	0,003	20,434	0,001	0,000	1,469	0,041	0,009	10,648	0,173	99,54
R5MB_campo2_02_Feldsp-5	66,503	0,000	20,514	0,034	0,002	1,530	0,008	0,000	10,511	0,185	99,29
R5MB_campo2_02_Feldsp-6	65,934	0,003	20,546	0,000	0,019	1,466	0,003	0,009	10,310	0,151	98,44
R5MB_campo5_01_feldsp-1	67,007	0,008	19,858	0,033	0,000	0,654	0,000	0,014	11,223	0,117	98,96
R5MB_campo5_01_feldsp-2	66,539	0,000	20,594	0,033	0,000	1,501	0,026	0,000	10,616	0,219	99,53
R5MB_campo5_01_feldsp-3	66,872	0,007	20,526	0,000	0,008	1,422	0,000	0,024	10,728	0,235	99,82
R5MB_campo5_01_feldsp-4	66,632	0,050	20,496	0,033	0,000	1,497	0,000	0,006	10,523	0,204	99,44
R5MB_campo5_01_feldsp-5	66,797	0,000	20,758	0,000	0,004	1,565	0,004	0,000	10,524	0,210	99,86
R5MB_campo6_01_Feldsp-1	67,959	0,000	19,529	0,026	0,009	0,387	0,000	0,000	11,349	0,123	99,38
R5MB_campo6_01_Feldsp-2	68,101	0,000	19,661	0,018	0,000	0,255	0,052	0,004	11,265	0,071	99,43
R5MB_campo6_01_Feldsp-3	67,508	0,000	20,147	0,018	0,028	0,213	0,000	0,000	11,210	0,073	99,20
R5MB_campo6_01_Feldsp-4	67,471	0,008	19,795	0,025	0,022	0,492	0,019	0,000	11,306	0,069	99,21
R5MB_campo6_01_Feldsp-5	65,511	0,000	20,530	0,046	0,000	1,002	0,000	0,000	10,407	0,087	97,58

	SiO2	TiO2	Al2O3	FeO	MgO	CaO	MnO	BaO	Na2O	K2O	Total
R5MB_campo6_01_Feldsp-6	63,043	0,015	25,347	0,079	0,088	0,199	0,000	0,029	10,406	0,110	99,32
R5MB_campo6_01_Feldsp-7	68,055	0,012	19,645	0,027	0,011	0,227	0,000	0,013	11,369	0,060	99,44
R5MB_campo7_01_Feldsp-2	66,279	0,000	20,525	0,000	0,001	1,510	0,000	0,002	10,474	0,239	99,03
R5MB_campo7_01_Feldsp-4	65,997	0,000	20,763	0,009	0,000	1,682	0,000	0,000	10,433	0,236	99,12
R5MB_campo7_01_Feldsp-5	66,008	0,000	20,686	0,037	0,002	1,641	0,000	0,000	10,505	0,218	99,10
R5MB_campo7_01_Feldsp-6	66,024	0,007	20,629	0,023	0,006	1,620	0,000	0,010	10,416	0,199	98,94
R5MB_campo7_01_Feldsp-7	66,538	0,000	20,798	0,000	0,000	1,564	0,000	0,000	10,514	0,148	99,56
R5MB_campo7_01_Feldsp-8	65,738	0,000	20,459	0,002	0,000	1,624	0,082	0,007	10,464	0,224	98,60
R5MB_campo7_01_Feldsp-9	66,887	0,000	20,680	0,000	0,000	1,410	0,000	0,006	10,630	0,202	99,82

Biotite

Sample	SiO2	TiO2	Al2O3	FeO	MnO	MgO	ZnO	CaO	Na2O	K2O	F	Cl	Total
CG49acampo101Bt1	35,36	2,222	18,821	21,784	0,59	4,343	0,176	0,045	0,205	9,529	1,115	0,017	93,73
CG49acampo101Bt2	34,954	2,067	18,808	22,09	0,692	4,386	0,226	0,059	0,059	9,502	1,104	0,007	93,49
CG49acampo101Bt3	35,136	2,021	18,668	21,608	0,65	4,373	0,259	0,085	0,108	9,483	0,926	0,013	92,94
CG49acampo101Bt4	35,308	1,989	18,685	21,97	0,632	4,549	0,238	0,054	0,134	9,509	1,045	0,023	93,69
CG49acampo101Bt5	35,006	2,011	19,113	21,406	0,626	4,462	0,167	0,052	0,125	9,495	1,024	0,021	93,07
CG49acampo201Bt2	35,294	1,777	19,293	21,585	0,601	4,25	0,219	0,046	0,049	9,736	1,123	0,018	93,51
CG49acampo201Bt3	35,101	1,714	18,966	21,224	0,576	4,412	0,208	0,034	0,062	9,568	1,094	0,026	92,52
CG49acampo201Bt4	35,151	1,65	19,068	21,308	0,552	4,397	0,164	0,037	0,058	9,615	1,161	0,023	92,70
CG49acampo201Bt5	35,015	1,909	18,994	21,216	0,601	4,307	0,247	0,033	0,12	9,54	1,09	0,027	92,64
CG49acampo201Bt7	34,982	1,944	19,24	21,735	0,569	4,457	0,179	0,056	0,073	9,527	1,071	0,017	93,44
CG49acampo201Bt8	35,368	1,967	19,273	21,867	0,603	4,536	0,154	0,057	0,093	9,668	1,146	0,012	94,26
CG49acampo402Bt8	35,23	2,216	18,756	21,93	0,69	4,056	0,136	0,039	0,066	9,653	0,974	0,022	93,36
CG49acampo402Bt9	34,891	2,264	18,602	21,802	0,67	4,148	0,166	0,014	0,065	9,595	1,082	0,017	92,86
CG49acampo402Bt10	45,52	0,429	32,522	2,912	0,033	0,951	0,051	0,011	0,323	11,065	0,469	0	94,09
CG49acampo402Bt11	45,118	0,396	32,194	3,129	0,042	0,985	0,03	0,028	0,315	10,953	0,41	0,011	93,44
CG49acampo402Bt12	45,652	0,419	32,737	2,935	0,087	0,944	0,034	0,008	0,32	11,062	0,467	0,004	94,48
CG49acampo402Bt15	35,099	2,119	18,284	22,499	0,662	4,224	0,174	0	0,045	9,614	1,072	0,016	93,35
CG49acampo402Bt16	35,12	2,171	18,308	22,456	0,644	4,24	0,19	0,009	0,054	9,544	1,048	0,019	93,40
CG49acampo402Bt17	34,887	2,125	18,377	22,098	0,662	4,289	0,189	0,025	0,037	9,605	1,063	0,015	92,92
CG49acampo501Bt1	35,669	1,912	19,282	21,722	0,571	4,601	0,229	0,028	0,064	9,683	1,168	0,008	94,46
CG49acampo501Bt2	35,596	1,965	19,249	21,832	0,563	4,413	0,227	0,023	0,042	9,647	1,041	0,009	94,17
CG49acampo501Bt3	35,882	1,952	19,488	21,454	0,525	4,487	0,163	0,286	0,057	9,619	1,148	0,01	94,62
CG49acampo501Bt4	35,902	1,951	19,387	21,249	0,698	4,489	0,141	0,031	0,08	9,87	1,281	0,016	94,55
CG49acampo501Bt5	35,239	1,982	18,994	21,394	0,598	4,53	0,175	0,138	0,038	9,478	1,095	0,019	93,21
CG49acampo502Bt1	35,349	1,826	19,041	22,179	0,666	4,335	0,174	0,074	0,104	9,616	1,082	0,019	94,01
CG49acampo502Bt2	35,135	1,758	18,946	21,697	0,574	4,516	0,21	0,814	0,129	9,483	1,176	0,018	93,97
CG49acampo502Bt3	34,639	1,798	18,544	22,15	0,688	4,353	0,19	0,038	0,121	9,541	1,13	0,025	92,74
CG49acampo601Bt1	35,361	1,887	19,428	21,504	0,606	4,362	0,175	0,015	0,091	9,645	1,113	0,017	93,73
CG49acampo601Bt2	35,364	1,766	19,425	21,49	0,593	4,416	0,204	0,024	0,161	9,7	1,119	0,031	93,82
CG49acampo601Bt3	35,602	1,798	19,617	21,683	0,646	4,44	0,185	0,016	0,144	9,823	1,158	0,028	94,65
CG49acampo601Bt4	35,409	1,941	19,552	21,643	0,626	4,379	0,165	0,031	0,111	9,571	1,131	0,02	94,10
CG49acampo601Bt5	35,673	1,927	19,526	21,802	0,615	4,51	0,184	0,019	0,112	9,705	1,169	0,024	94,77
CG49acampo602Bt1	35,298	2,077	18,975	21,736	0,561	4,527	0,188	0,015	0,104	9,673	1,126	0,061	93,86
CG49acampo602Bt2	35,371	2,18	18,892	22,19	0,607	4,499	0,173	0,002	0,135	9,65	1,003	0,031	94,30

Sample	SiO2	TiO2	Al2O3	FeO	MnO	MgO	ZnO	CaO	Na2O	K2O	F	Cl	Total
CG49acampo602Bt3	35,195	2,12	18,663	22,081	0,615	4,483	0,229	0,017	0,105	9,734	1,06	0,037	93,88
CG49acampo602Bt4	34,997	2,206	18,225	22,141	0,607	4,602	0,199	0,023	0,128	9,597	1,176	0,043	93,47
CG49acampo602Bt5	35,137	2,343	18,454	22,005	0,644	4,629	0,176	0,018	0,103	9,629	1,042	0,039	93,82
CG49acampo602Bt7	34,92	2,272	18,135	22,137	0,613	4,343	0,185	0,057	0,127	9,254	0,99	0,041	92,65
CG-79_campo4_02_Bt-1	35,674	1,509	21,696	22,095	0,621	2,773	0,164	0,026	0,074	9,578	1,806	0,018	95,27
CG-79_campo4_02_Bt-2	35,301	1,528	21,742	21,95	0,538	2,696	0,233	0,064	0,058	9,53	1,713	0,011	94,66
CG-79_campo4_02_Bt-3	35,669	1,517	21,707	21,821	0,644	2,735	0,186	0,007	0,054	9,681	1,616	0,017	94,97
CG-79_campo4_02_Bt-4	35,278	1,402	21,735	21,76	0,575	2,67	0,24	0,05	0,086	9,426	1,709	0,003	94,21
CG-79_campo4_02_Bt-5	35,757	1,431	21,6	21,856	0,611	2,719	0,241	0,045	0,083	9,528	1,64	0,003	94,86
CG-79_campo5_01_Bt-1	35,554	1,366	21,427	21,062	0,462	3,182	0,222	0,101	0,096	9,559	1,732	0,009	94,04
CG-79_campo5_01_Bt-2	35,695	1,421	21,469	21,018	0,517	3,227	0,237	0,079	0,067	9,449	1,726	0,005	94,20
CG-79_campo5_01_Bt-3	35,678	1,31	21,534	20,991	0,586	3,195	0,179	0,092	0,074	9,473	1,798	0,009	94,17
CG-79_campo5_01_Bt-4	35,476	1,466	21,556	21,562	0,545	3,094	0,184	0,098	0,09	9,559	1,67	0,011	94,61
CG-79_campo5_01_Bt-5	35,098	1,353	21,346	21,772	0,461	3,061	0,215	0,126	0,07	9,51	1,485	0,012	93,88
CG-79_campo5_01_Bt-6	35,424	1,47	21,719	21,522	0,495	3,119	0,254	0,1	0,083	9,608	1,569	0,007	94,71
CG-79_campo5_01_Bt-7	34,579	1,42	21,246	21,708	0,502	3,257	0,199	0,094	0,086	9,455	1,51	0,022	93,45
R5MB_campo7_01_Bt-1	35,017	1,791	19,538	22,007	0,574	3,386	0,297	0,05	0,081	9,413	1,077	0,005	92,78
R5MB_campo7_01_Bt-2	34,787	1,846	19,973	22,035	0,559	3,322	0,307	0,073	0,081	9,556	1	0,01	93,13
R5MB_campo7_01_Bt-3	35,233	1,845	19,924	21,972	0,584	3,452	0,266	0,047	0,086	9,486	1,237	0,009	93,62
R5MB_campo7_01_Bt-4	34,98	1,806	19,753	22,207	0,638	3,43	0,289	0,034	0,038	9,627	1,069	0,011	93,43
R5MB_campo7_01_Bt-5	35,227	1,747	20,043	22,011	0,653	3,47	0,243	0,062	0,085	9,478	1,222	0,014	93,74
R5MB_campo7_01_Bt-6	34,69	1,819	19,621	22,082	0,595	3,312	0,249	0,035	0,067	9,457	1,106	0,012	92,58
R5MB_campo7_01_Bt-7	34,875	1,802	19,757	22,139	0,544	3,363	0,262	0,053	0,071	9,46	1,125	0,014	92,99
R5MB_campo7_01_Bt-8	35,048	1,736	19,922	21,611	0,613	3,401	0,307	0,029	0,033	9,546	1,107	0,013	92,90
R5MB_campo8_01_Bt-1	35,306	1,394	20,247	22,038	0,567	3,126	0,32	0,052	0,03	9,33	1,094	0,015	93,05
R5MB_campo8_01_Bt-7	34,92	1,514	20,049	22,036	0,526	3,1	0,298	0,047	0,017	9,51	1,272	0,015	92,77

Muscovite

Sample	SiO2	TiO2	Al2O3	FeO	MnO	MgO	ZnO*	CaO	Na2O	K2O	F	Cl	Total
CG-79_campo1_01-Ms-1	45,371	0,247	34,115	2,011	0,037	0,795	0,006	0,171	0,496	10,847	0,738	0,017	94,820
CG-79_campo1_01-Ms-2	44,317	0,233	32,642	2,074	0,056	0,755	0,018	0,144	0,38	10,513	0,738	0,051	91,894
CG-79_campo1_01-Ms-3	44,943	0,222	33,456	2,218	0,026	0,745	0,032	0,087	0,348	10,923	0,76	0,007	93,719
CG-79_campo1_01-Ms-5	45,723	0,226	33,489	2,075	0,108	0,741	0,011	0,173	0,466	10,745	0,7	0,012	94,417
CG-79_campo1_01-Ms-6	45,445	0,212	34,511	1,986	0,089	0,703	0,037	0,147	0,57	10,669	0,652	0,004	94,973
CG-79_campo1_01-Ms-7	45,459	0,216	34,179	1,944	0,022	0,723	0,016	0,152	0,404	10,797	0,846	0,007	94,722
CG-79_campo1_01-Ms-8	45,708	0,246	34,131	2,044	0,041	0,714	0,008	0,04	0,446	10,888	0,609	0	94,822
CG-79_campo1_01-Ms-9	45,063	0,198	33,888	1,943	0,049	0,713	0,046	0,035	0,48	10,634	0,685	0,006	93,718
CG-79_campo1_01-Ms-10	41,153	0,159	30,604	1,807	0,004	0,639	0,015	0,074	0,452	9,605	0,623	0,088	85,152
CG-79_campo1_01-Ms-11	45,627	0,205	34,307	2,006	0,052	0,739	0,007	0,04	0,525	10,764	0,713	0	94,943
CG-79_campo2_01-Ms-1	45,413	0,267	34,338	2,042	0,056	0,773	0,037	0,066	0,459	10,73	0,759	0,004	94,917
CG-79_campo2_01-Ms-2	45,893	0,253	33,599	1,996	0	0,842	0,088	0,068	0,509	10,973	0,769	0,002	94,946
CG-79_campo2_01-Ms-3	46,259	0,239	33,88	2,127	0,059	0,855	0,036	0,06	0,471	10,794	0,685	0,002	95,416
CG-79_campo2_01-Ms-4	45,76	0,413	34,297	2,024	0,093	0,777	0,054	0,051	0,568	10,653	0,717	0,007	95,378
CG-79_campo2_01-Ms-5	46,096	0,237	34	2,205	0	0,823	0,044	0,059	0,448	11,011	0,752	0,009	95,635
CG-79_campo2_01-Ms-6	45,828	0,202	33,526	2,208	0,052	0,873	0	0,056	0,509	10,569	0,709	0,003	94,496
CG-79_campo2_01-Ms-7	45,9	0,22	34,054	2,23	0,078	0,746	0,06	0,043	0,406	11,076	0,661	0,005	95,427
CG-79_campo4_02_Ms-1	45,53	0,294	34,235	2,111	0,022	0,733	0,035	0,064	0,517	10,993	0,781	0,004	95,276

Sample	SiO2	TiO2	Al2O3	FeO	MnO	MgO	ZnO*	CaO	Na2O	K2O	F	Cl	Total
CG-79_campo4_02_Ms-2	45,78	0,234	34,212	2,108	0,015	0,796	0,051	0,004	0,554	10,811	0,696	0,01	95,219
CG-79_campo4_02_Ms-3	45,734	0,256	34,301	2,105	0,052	0,817	0	0,041	0,61	10,719	0,792	0	95,382
CG-79_campo4_02_Ms-4	46,136	0,212	33,734	2,097	0,007	0,862	0,009	0,033	0,489	10,784	0,802	0,003	95,151
CG-79_campo4_02_Ms-5	45,472	0,181	34,512	1,956	0	0,715	0,046	0,033	0,675	10,656	0,677	0,033	94,898
CG-96_campo2_02_Ms-1	45,401	0,099	32,895	1,989	0,059	0,684	0,011	0	0,546	10,368		0,002	92,054
CG-96_campo2_02_Ms-2	45,726	0,168	32,832	2,054	0	0,69	0,037	0,025	0,454	10,49		0,013	92,520
CG-96_campo2_02_Ms-1	48,755	0,163	35,37	2,028	0	0,717	0,027	0,012	0,272	6,584		0,004	93,931
CG-96_campo2_02_Ms-2	48,434	0,16	35,079	2,265	0,015	0,756	0	0,014	0,204	6,623		0,006	93,555
CG-96_campo2_02_Ms-3	47,876	0,166	34,661	2,148	0,052	0,662	0,04	0,56	0,283	6,461		0,009	92,920
CG-96_campo2_02_Ms-4	48,023	0,175	35,518	2,013	0	0,669	0,055	0,005	0,282	6,894		0,012	93,658
CG-96_campo3_01_mica-3	45,741	0,125	33,397	2,006	0,033	0,696	0	0,023	0,547	10,344		0,005	92,926
CG-96_campo3_01_mica-4	45,997	0,169	33,579	1,9	0,059	0,679	0,055	0,045	0,541	10,086		0,006	93,126
CG-96_campo3_01_mica-5	45,489	0,133	33,459	1,983	0,049	0,676	0,027	0,025	0,558	10,108		0,003	92,509
CG-96_campo3_01_Mica-8	45,924	0,135	34,09	1,959	0,008	0,618	0,011	0,019	0,487	10,167		0,009	93,425
CG-96_campo3_01_Mica-9	46,151	0,174	33,818	2,024	0	0,759	0,06	0,039	0,512	10,256		0,004	93,801
CG-96_campo3_01_Mica-10	45,956	0,151	33,147	2,057	0,059	0,72	0,001	0	0,485	10,322		0,002	92,900
CG-96_campo3_01_Mica-11	45,709	0,119	33,68	1,974	0	0,75	0,038	0,033	0,452	10,107		0,009	92,870
CG-96_campo8_01_Mica-1	45,607	0,155	33,834	1,827	0,041	0,623	0	0	0,572	10,246		0,005	92,918
CG-96_campo8_01_Mica-2	45,691	0,17	33,597	1,885	0,052	0,644	0	0,023	0,555	10,126		0,007	92,765
CG-96_campo8_01_Mica-3	45,51	0,12	33,416	2,059	0,045	0,619	0,033	0	0,51	10,534		0,011	92,870
CG-96_campo8_01_Mica-4	45,034	0,176	33,169	2,003	0	0,646	0,018	0,011	0,515	10,409		0,008	92,002
CG-96_campo8_01_Mica-5	45,019	0,166	34,173	1,934	0	0,533	0,054	0,01	0,564	10,272		0,001	92,736
CG-96_campo8_01_Mica-6	45,229	0,171	33,986	1,861	0	0,679	0,004	0	0,569	10,383		0	92,892
CG-96_campo8_01_Mica-7	45,662	0,144	34,004	1,846	0,03	0,59	0,007	0,013	0,561	10,429		0,001	93,287
CG-96_campo8_01_Mica-8	45,33	0,168	33,855	1,827	0,022	0,694	0,031	0,027	0,566	10,368		0,001	92,896
CG-96_campo3_01_mica-1	44,723	0,144	33,559	2,102	0	0,619		0,082	0,495	10,599		0,013	92,333
CG-96_campo3_01_mica-2	45,555	0,096	33,222	2,023	0,022	0,701		0,016	0,557	10,53		0,005	92,726
CG-96_campo3_01_mica-3	45,362	0,208	33,757	1,926	0,045	0,62		0,019	0,563	10,524		0,011	93,033
CG-96_campo3_01_Mica-8	44,868	0,158	33,609	1,885	0,071	0,634		0,032	0,519	10,443		0,013	92,229
CG-96_campo3_01_Mica-9	45,717	0,099	33,271	1,951	0,004	0,733		0,02	0,484	10,671		0,002	92,952
CG-96_campo3_01_Mica-10	45,955	0,131	33,405	2,159	0,111	0,708		0,038	0,467	10,541		0,007	93,520
CG-96_campo3_01_Mica-11	44,844	0,191	33,638	1,85	0,048	0,636		0,062	0,513	10,524		0,012	92,315
CG-96_campo8_01_Mica-1	45,642	0,226	34,122	1,838	0,041	0,658		0,018	0,569	10,482		0,004	93,599
CG-96_campo8_01_Mica-2	45,573	0,183	33,769	1,87	0	0,589		0,004	0,548	10,543		0,011	93,088
CG-96_campo8_01_Mica-3	45,525	0,144	33,549	1,974	0,003	0,62		0,026	0,488	10,781		0,005	93,114
CG-96_campo8_01_Mica-4	45,575	0,094	33,642	2,058	0,056	0,681		0,018	0,484	10,553		0	93,161
CG-96_campo8_01_Mica-5	45,22	0,18	34,122	1,857	0,033	0,585		0,008	0,592	10,559		0,003	93,158
CG-96_campo8_01_Mica-6	45,365	0,176	33,615	1,864	0	0,606		0,013	0,546	10,524		0,004	92,712
CG-96_campo8_01_Mica-7	45,336	0,192	33,715	1,902	0,011	0,618		0,016	0,51	10,475		0,01	92,783
CG-96_campo8_01_Mica-8	45,515	0,158	33,628	1,988	0,041	0,581		0,022	0,479	10,559		0,001	92,972
CG-96_campo8_01_Mica-9	44,774	0,137	33,967	1,84	0,007	0,571		0,02	0,512	10,543		0,006	92,376
R5MB_campo1_01_Ms-1	45,511	0,339	33,641	2,295	0,018	0,67	0	0,039	0,433	10,781	0,516	0,012	94,199
R5MB_campo1_01_Ms-2	45,773	0,326	33,429	2,361	0,015	0,775	0,012	0,007	0,442	10,85	0,494	0,004	94,434
R5MB_campo1_01_Ms-3	45,602	0,266	32,718	2,435	0	0,884	0,032	0,039	0,431	10,84	0,678	0,003	93,877
R5MB_campo1_01_Ms-4	45,566	0,312	33,022	2,42	0,075	0,838	0,015	0,036	0,397	10,848	0,705	0,007	94,190
R5MB_campo1_01_Ms-5	45,271	0,351	32,855	2,509	0,049	0,825	0	0,019	0,46	10,648	0,469	0,007	93,408
R5MB_campo4_01_Ms-1	45,393	0,176	32,554	3,174	0,141	0,925	0,043	0,048	0,38	10,771	0,65	0,019	94,218

Sample	SiO2	TiO2	Al2O3	FeO	MnO	MgO	ZnO*	CaO	Na2O	K2O	F	Cl	Total
R5MB_campo4_01_Ms-2	44,739	0,208	32,727	3,241	0,018	0,893	0,098	0,065	0,392	10,834	0,654	0,018	93,832
R5MB_campo4_01_Ms-3	45,376	0,164	32,877	2,96	0,096	0,899	0,044	0,054	0,416	10,717	0,603	0,021	94,170
R5MB_campo4_01_Ms-4	45,181	0,222	32,522	3,16	0	0,904	0,046	0,033	0,394	10,673	0,61	0,023	93,710
R5MB_campo4_01_Ms-5	46	0,205	33,187	2,94	0,067	0,902	0,022	0,027	0,436	10,757	0,547	0,007	95,042
R5MB_campo4_01_Ms-6	45,259	0,285	32,75	3,128	0,041	0,972	0,07	0,048	0,402	10,875	0,62	0,025	94,417
R5MB_campo4_01_Ms-7	45,511	0,249	32,734	2,808	0,025	0,879	0,056	0,049	0,371	10,642	0,408	0,011	93,689
R5MB_campo4_01_Ms-8	45,781	0,209	33,084	2,815	0,056	0,857	0,049	0,052	0,447	10,673	0,647	0,012	94,628
R5MB_campo8_02_Mica-1	45,327	0,364	33,154	2,318	0,018	0,817	0,032	0,074	0,437	10,751	0,641	0,019	93,896
R5MB_campo8_02_Mica-4	45,532	0,343	33,259	2,409	0	0,793	0,042	0,064	0,351	10,821	0,59	0,016	94,163
R5MB_campo8_02_Mica-5	45,672	0,39	33,343	2,382	0,067	0,808	0,021	0,041	0,376	10,772	0,556	0,009	94,382
R5MB_campo8_02_Mica-6	46,017	0,385	33,518	2,429	0,052	0,786	0,008	0,037	0,371	10,903	0,518	0,01	94,978
R5MB_campo8_02_Mica-7	45,241	0,414	33,486	2,352	0,045	0,722	0,04	0,038	0,395	10,995	0,546	0,002	94,222

Garnet

Sample	data point	SiO2	Al2O3	MgO	CaO	MnO	FeO	Total	Py	Al	Sp	Gr
CG49a	rim85	36,527	20,637	0,750	0,465	15,731	26,773	100,883	3,071	58,951	36,609	1,369
CG49a	rim86	36,281	20,433	0,909	1,009	14,220	27,370	100,222	3,751	59,900	33,355	2,994
CG49a	core87	36,223	20,320	0,939	0,646	13,820	27,979	99,927	3,954	61,015	33,075	1,956
CG49a	core88	36,630	20,558	0,949	0,522	13,927	27,859	100,445	3,956	61,478	33,001	1,565
CG49a	core89	36,428	20,350	0,847	0,638	13,617	27,849	99,729	3,580	61,764	32,716	1,939
CG49a	core90	36,746	20,485	0,854	0,839	14,156	27,734	100,814	3,501	61,040	32,986	2,473
CG49a	rim92	36,451	20,417	0,810	0,983	14,805	26,828	100,294	3,320	59,297	34,487	2,897
CG49a	rim93	36,484	20,577	0,665	0,528	16,051	26,106	100,411	2,718	58,442	37,289	1,552
CG96	c1-Grt-1	36,325	19,913	0,821	0,232	10,986	31,296	99,573	3,310	70,847	25,171	0,672
CG96	c1-Grt-2	36,218	19,911	0,844	0,409	10,198	31,467	99,047	3,430	71,817	23,557	1,195
CG96	c1-Grt-3	36,173	19,800	0,837	0,230	11,010	31,260	99,310	3,373	70,742	25,218	0,666
CG96	c1-Grt-4	36,189	19,827	0,656	0,220	12,541	30,476	99,909	2,618	68,303	28,448	0,631
CG96	c1-Grt-5	36,252	19,981	0,752	0,556	11,925	30,645	100,111	2,991	68,457	26,962	1,590
CG96	c1-Grt-6	36,169	19,711	0,708	0,284	11,791	30,924	99,587	2,834	69,520	26,829	0,817
CG96	c2_Grt-16	36,042	19,909	0,801	0,223	10,730	31,593	99,298	3,230	71,534	24,590	0,646
CG96	c3_Grt-1	36,431	20,092	0,911	0,215	9,974	32,359	99,982	3,658	72,960	22,761	0,621
CG96	c3_Grt-2	36,497	20,018	0,930	0,286	10,022	32,735	100,488	3,688	72,905	22,591	0,816
CG96	c3_Grt-3	36,263	20,082	0,870	0,258	10,196	32,312	99,981	3,481	72,593	23,184	0,742
CG96	c3_Grt-6	36,276	19,952	0,617	0,500	13,741	29,081	100,167	2,456	65,018	31,094	1,431
CG96	c3_Grt-7	35,847	19,850	0,774	0,316	11,152	31,548	99,487	3,089	70,707	25,297	0,907
CG96	c3_Grt-8	36,202	19,974	0,829	0,289	10,606	31,589	99,489	3,342	71,517	24,303	0,838
CG96	c4_Grt-1	35,736	19,714	0,878	0,358	11,033	30,831	98,550	3,552	70,039	25,368	1,041
CG96	c4_Grt-2	36,266	20,003	0,927	0,389	10,353	31,901	99,839	3,707	71,642	23,532	1,118
CG96	c4_Grt-3	35,680	19,648	0,912	0,513	10,623	31,963	99,339	3,609	71,036	23,895	1,460
CG96	c4_Grt-4	35,982	19,693	0,912	0,289	10,009	31,882	98,767	3,690	72,449	23,020	0,841
CG96	c4_Grt-5	36,242	19,833	0,846	0,586	10,754	31,152	99,413	3,401	70,331	24,573	1,694
CG96	c4_Grt-6	36,025	19,954	0,863	0,467	10,539	31,427	99,275	3,475	71,056	24,117	1,352

Sample	data point	SiO2	Al2O3	MgO	CaO	MnO	FeO	Total	Py	Al	Sp	Gr
CG96	c4_Grt-7	36,646	20,138	0,981	0,576	9,904	31,885	100,130	3,935	71,824	22,580	1,661
CG96	c4_Grt-8	36,299	19,871	0,948	0,196	10,673	32,141	100,128	3,761	71,611	24,068	0,559
CG96	c5_Grt-1	36,174	19,910	0,670	0,222	12,028	30,813	99,817	2,683	69,299	27,379	0,639
CG96	c5_Grt-2	36,430	19,874	0,917	0,351	10,544	31,453	99,569	3,694	71,149	24,140	1,017
CG96	c5_Grt-3	36,378	20,254	0,774	0,373	11,307	31,264	100,350	3,093	70,155	25,680	1,072
CG96	c5_Grt-4	36,371	20,048	0,768	0,705	11,436	30,708	100,036	3,070	68,925	25,980	2,026
CG96	c5_Grt-5	36,228	19,955	0,919	0,411	11,078	31,629	100,220	3,636	70,280	24,914	1,169
CG96	c5_Grt-6	36,155	20,031	0,948	0,358	10,161	31,643	99,296	3,830	71,796	23,334	1,040
CG96	c5_Grt-7	36,163	19,862	0,890	0,269	10,586	31,257	99,027	3,610	71,199	24,406	0,785
CG96	c6_Grt-1	36,349	19,990	0,890	0,263	11,088	31,033	99,613	3,588	70,247	25,403	0,762
CG96	c6_Grt-2	36,267	19,936	0,862	0,480	10,710	31,756	100,011	3,431	70,970	24,226	1,373
CG96	c6_Grt-3	36,278	19,833	0,885	0,301	11,189	31,477	99,963	3,521	70,319	25,299	0,861
CG96	c6_Grt-4	36,144	19,920	0,903	0,433	11,135	31,568	100,103	3,573	70,151	25,044	1,232
CG96	c6_Grt-5	36,270	19,700	0,782	0,722	10,963	30,493	98,930	3,172	69,451	25,272	2,105
CG96	c6_Grt-6	36,294	19,645	0,852	0,288	11,038	31,518	99,635	3,404	70,707	25,063	0,827
CG96	c6_Grt-7	36,252	19,950	0,842	0,445	11,003	31,260	99,752	3,372	70,302	25,045	1,281
CG96	c6_Grt-8	36,207	19,676	0,842	0,229	11,015	31,021	98,990	3,411	70,563	25,359	0,667
CG96	c7_Grt-1	36,325	19,743	0,717	0,263	11,200	30,857	99,105	2,915	70,440	25,877	0,769
CG96	c7_Grt-2	35,862	19,868	0,783	0,577	12,246	30,606	99,942	3,089	67,812	27,462	1,637
CG96	c7_Grt-10	36,179	20,100	0,574	0,529	13,838	29,294	100,514	2,271	65,099	31,124	1,505
CG96	c7_Grt-11	36,116	19,987	0,871	0,227	11,363	31,606	100,170	3,451	70,316	25,587	0,647
R5Mb	c1_Grt-1	36,303	20,592	0,709	0,772	10,685	31,684	100,745	2,821	70,803	24,167	2,209
R5Mb	c1_Grt-2	36,348	20,512	0,712	0,735	9,986	32,254	100,547	2,845	72,367	22,677	2,111
R5Mb	c1_Grt-3	36,365	20,326	0,812	0,587	9,985	32,690	100,765	3,214	72,655	22,461	1,670
R5Mb	c1_Grt-4	36,766	20,522	0,798	0,586	10,124	32,529	101,325	3,162	72,372	22,797	1,669
R5Mb	c1_Grt-5	36,570	20,422	0,801	0,826	10,036	32,293	100,948	3,174	71,867	22,605	2,354
R5Mb	c1_Grt-6	36,202	20,380	0,691	0,565	11,248	31,154	100,240	2,766	70,021	25,587	1,626
R5Mb	c1_Grt-7	36,277	20,447	0,688	0,563	11,540	31,527	101,042	2,713	69,823	25,867	1,596
R5Mb	c1_Grt-8	36,342	20,385	0,844	0,660	9,977	32,252	100,460	3,362	72,155	22,592	1,890
R5Mb	c1_Grt-9	36,483	20,648	0,805	0,826	9,796	32,022	100,580	3,227	72,076	22,317	2,380
R5Mb	c1_Grt-10	36,469	20,484	0,757	0,904	10,082	31,722	100,418	3,034	71,395	22,966	2,605
R5Mb	c1_Grt-11	36,033	20,468	0,748	0,600	11,023	31,761	100,633	2,959	70,552	24,783	1,706
R5Mb	c1_Grt-12	36,342	20,304	0,656	0,584	11,781	30,912	100,579	2,610	69,074	26,644	1,671
R5Mb	c1_Grt-13	35,516	20,247	0,596	0,506	12,511	30,469	99,845	2,367	67,949	28,239	1,445
R5Mb	c2_Grt-1	36,079	20,500	0,757	0,537	11,764	31,098	100,735	2,993	69,045	26,436	1,526
R5Mb	c2_Grt-2	36,265	20,432	0,819	0,747	10,538	32,014	100,815	3,234	70,993	23,652	2,121
R5Mb	c2_Grt-3	36,522	20,295	0,841	0,758	9,894	31,824	100,134	3,380	71,828	22,602	2,190
R5Mb	c2_Grt-4	36,241	20,369	0,889	0,619	9,907	32,372	100,397	3,536	72,300	22,395	1,770
R5Mb	c2_Grt-5	36,229	20,356	0,844	0,541	10,037	32,357	100,364	3,361	72,369	22,721	1,549
R5Mb	c2_Grt-6	36,192	20,368	0,829	0,642	10,200	32,085	100,316	3,302	71,768	23,092	1,839

Sample	data point	SiO2	Al2O3	MgO	CaO	MnO	FeO	Total	Py	Al	Sp	Gr
R5Mb	c2_Grt-7	36,411	20,509	0,711	0,858	11,192	31,586	101,267	2,796	69,760	25,018	2,426
R5Mb	c3_Grt-1	36,481	20,583	0,543	0,495	13,802	30,059	101,963	2,119	65,877	30,615	1,389
R5Mb	c3_Grt-3	36,503	20,719	0,811	0,943	10,230	32,099	101,305	3,202	71,166	22,956	2,677
R5Mb	c3_Grt-4	36,281	20,377	0,913	0,620	9,597	32,817	100,605	3,617	73,008	21,609	1,766
R5Mb	c3_Grt-5	36,512	20,422	0,809	0,702	9,315	32,798	100,558	3,233	73,595	21,155	2,017
R5Mb	c3_Grt-6	36,457	20,594	0,871	1,020	9,546	32,506	100,994	3,445	72,196	21,459	2,900
R5Mb	c3_Grt-7	36,508	20,387	0,817	0,834	10,331	31,979	100,856	3,236	71,131	23,258	2,375
R5Mb	c3_Grt-8	36,251	20,525	0,740	0,617	11,433	31,267	100,833	2,932	69,565	25,745	1,758
R5Mb	c4_Grt-1	36,080	20,630	0,568	0,568	13,622	29,389	100,857	2,252	65,433	30,696	1,619
R5Mb	c4_Grt-2	36,227	20,524	0,746	0,614	11,590	31,346	101,047	2,940	69,363	25,958	1,740
R5Mb	c4_Grt-3	36,105	20,317	0,759	0,825	10,656	31,830	100,492	3,002	70,697	23,955	2,346
R5Mb	c4_Grt-4	36,703	20,371	0,771	0,829	10,266	31,963	100,903	3,065	71,365	23,199	2,370
R5Mb	c4_Grt-5	36,286	20,418	0,739	0,829	10,392	31,626	100,290	2,956	71,036	23,625	2,384
R5Mb	c4_Grt-6	35,750	19,954	0,745	0,658	11,447	31,011	99,565	2,964	69,274	25,881	1,882
R5Mb	c6_Grt-1	36,417	20,489	0,628	0,482	12,867	30,274	101,157	2,483	67,227	28,919	1,370
R5Mb	c6_Grt-2	36,571	20,630	0,756	0,526	11,556	31,178	101,217	2,999	69,448	26,053	1,500
R5Mb	c6_Grt-3	36,159	20,491	0,741	0,671	10,831	31,899	100,792	2,930	70,824	24,339	1,907
R5Mb	c6_Grt-4	36,506	20,408	0,782	0,642	11,334	31,785	101,457	3,063	69,902	25,228	1,808
R5Mb	c6_Grt-5	36,377	20,398	0,783	0,654	11,276	31,560	101,048	3,085	69,816	25,247	1,852
R5Mb	c6_Grt-6	36,534	20,600	0,841	0,804	10,636	31,847	101,262	3,318	70,553	23,848	2,280
R5Mb	c6_Grt-7	36,394	20,515	0,802	0,817	10,355	32,131	101,014	3,168	71,266	23,246	2,320
R5Mb	c6_Grt-8	36,731	20,622	0,797	0,810	10,699	31,400	101,059	3,176	70,270	24,233	2,321
R5Mb	c6_Grt-9	36,180	20,463	0,799	0,644	11,245	31,627	100,958	3,144	69,885	25,149	1,822
R5Mb	c6_Grt-10	35,814	20,402	0,719	0,568	11,471	31,405	100,379	2,844	69,754	25,787	1,615
R5Mb	c7_Grt-1	36,267	20,579	0,651	0,544	12,566	30,749	101,356	2,558	67,844	28,061	1,537
R5Mb	c7_Grt-2	36,188	20,667	0,673	0,585	12,041	30,993	101,147	2,656	68,679	27,006	1,660
R5Mb	c7_Grt-3	36,410	20,655	0,712	0,622	11,835	30,857	101,091	2,824	68,724	26,678	1,774
R5Mb	c7_Grt-4	36,097	20,394	0,691	0,591	11,513	31,545	100,831	2,723	69,813	25,789	1,675
R5Mb	c7_Grt-5	36,036	20,418	0,721	0,550	11,555	31,351	100,631	2,851	69,616	25,969	1,564
R5Mb	c7_Grt-6	36,105	20,405	0,650	0,601	11,857	31,018	100,636	2,575	69,012	26,701	1,712
R5Mb	c8_Grt-1	36,325	20,611	0,633	0,528	11,942	30,759	100,798	2,525	68,891	27,071	1,514
R5Mb	c8_Grt-2	36,399	20,429	0,754	0,574	11,383	31,939	101,478	2,949	70,138	25,300	1,614
R5Mb	c8_Grt-3	36,492	20,377	0,822	0,626	10,332	32,016	100,665	3,272	71,563	23,374	1,791
R5Mb	c8_Grt-4	36,384	20,522	0,806	0,623	9,802	32,345	100,482	3,225	72,687	22,295	1,792
R5Mb	c8_Grt-5	36,421	20,526	0,857	0,502	10,028	32,261	100,595	3,423	72,368	22,767	1,442
R5Mb	c8_Grt-6	36,440	20,793	0,793	0,615	10,682	32,151	101,474	3,127	71,190	23,939	1,743
R5Mb	c8_Grt-7	36,745	20,522	0,700	0,616	11,145	31,331	101,059	2,792	70,176	25,265	1,766

Apatite

Sample	Na2O	F	SiO2	Al2O3	MgO	ZnO	FeO	Cl	Cr2O3	P2O5	CaO	TiO2	K2O	MnO	Total
R5MG_01-Ap-1	0,126	4,399	0,04	0,008	0	0,055	0,168	0,008	0,02	40,035	55,937	0	0,01	0,747	99,7
R5MG_01-Ap-2	0,115	4,74	0,019	0,049	0	0	0,196	0,012	0,015	41,473	54,841	0,008	0,02	0,555	100,048
Sample	Na2O	F	SiO2	Al2O3	MgO	ZnO	FeO	Cl	Cr2O3	P2O5	CaO	TiO2	K2O	MnO	Total
R5MG_01-Ap-4	0,235	4,354	0,008	0,021	0	0,069	0,276	0,018	0	41,038	53,493	0,003	0,05	0,935	98,66
R5MG_01-Ap-5	0,16	4,083	0,001	0,034	0	0,12	0,176	0,01	0	41,013	54,818	0	0,02	0,571	99,285
R5MG_01-Ap-6	0,216	4,569	0,053	0,026	0	0,029	0,155	0,012	0,012	41,169	54,173	0	0,02	0,877	99,382

Results of complete electron microprobe analyses from Biotite granite of the Itaporé batholith**K-feldspar grains**

Sample	SiO2	TiO2	Al2O3	FeO	MgO	CaO	MnO	BaO*	Na2O	K2O	Total
CG-67_campo2_03_Feldsp-5	63,755	0,000	18,125	0,031	0,011	0,026	0,045	0,711	0,743	15,389	98,84
CG-67_campo2_03_Feldsp-6	63,287	0,000	17,931	0,071	0,000	0,035	0,000	0,758	0,799	15,214	98,10
CG-67_campo2_03_Feldsp-7	63,262	0,000	18,243	0,008	0,000	0,004	0,075	1,017	0,807	15,284	98,70
CG-67_campo5_01_Feldsp-5	63,489	0,000	17,917	0,040	0,000	0,061	0,056	0,817	0,659	15,723	98,76
CG-67_campo5_01_Feldsp-6	63,918	0,000	18,442	0,039	0,000	0,013	0,000	0,819	0,953	15,010	99,19
CG-67_campo5_01_Feldsp-7	62,625	0,000	17,658	0,060	0,002	0,040	0,000	0,852	0,892	15,010	97,14
CG-67_campo5_02_Feldsp-13	63,172	0,000	18,352	0,031	0,000	0,014	0,000	1,038	0,236	16,257	99,10
CG-67_campo5_02_Feldsp-14	63,164	0,000	18,209	0,005	0,022	0,015	0,026	0,968	0,496	16,101	99,02
R4bt_campo3_01_Feldsp-4	64,169	0,000	18,796	0,011	0,005	0,016	0,000	1,057	0,806	15,148	100,01
R4bt_campo3_01_Feldsp-5	63,963	0,000	18,632	0,000	0,000	0,032	0,000	1,178	0,944	15,112	99,86
R4bt_campo3_01_Feldsp-6	63,592	0,000	18,613	0,020	0,000	0,000	0,000	1,124	1,078	14,945	99,39
R4bt_campo3_01_Feldsp-7	63,896	0,000	18,442	0,047	0,008	0,013	0,000	1,151	0,926	14,814	99,30
R4bt_campo3_01_Feldsp-8	63,588	0,000	18,880	0,029	0,000	0,020	0,041	1,106	0,939	15,020	99,62
R4bt_campo3_01_Feldsp-9	64,134	0,000	18,611	0,000	0,000	0,002	0,018	1,110	0,926	15,090	99,89
R4bt_campo3_01_Feldsp-10	63,962	0,000	18,545	0,026	0,000	0,017	0,000	1,108	0,827	15,139	99,62
R4bt_campo6_01_Feldsp-1	63,743	0,000	18,642	0,028	0,000	0,027	0,000	1,103	0,928	14,783	99,25
R4bt_campo6_01_Feldsp-2	63,904	0,000	18,463	0,005	0,000	0,026	0,015	1,034	0,996	14,906	99,35
R4bt_campo6_01_Feldsp-3	63,815	0,000	18,528	0,042	0,019	0,029	0,000	1,011	0,992	14,935	99,37
R4bt_campo6_01_Feldsp-4	63,799	0,000	18,560	0,027	0,000	0,012	0,030	1,125	0,918	14,993	99,46
R4bt_campo6_01_Feldsp-5	63,592	0,000	18,712	0,000	0,000	0,015	0,000	1,104	0,702	15,394	99,52
R4bt_campo6_01_Feldsp-6	63,817	0,000	18,539	0,050	0,000	0,018	0,000	1,078	0,891	14,948	99,34
R4bt_campo6_02_Feldsp-1	63,569	0,000	18,568	0,042	0,004	0,021	0,000	1,133	0,931	14,819	99,09
R4bt_campo6_02_Feldsp-2	63,700	0,000	18,587	0,000	0,011	0,037	0,026	1,177	1,040	14,858	99,44
R4bt_campo6_02_Feldsp-3	63,251	0,000	18,767	0,022	0,008	0,032	0,000	1,372	0,897	14,787	99,17
R4bt_campo6_02_Feldsp-4	63,507	0,000	18,550	0,025	0,000	0,028	0,000	1,398	0,946	14,914	99,37
R4bt_campo6_02_Feldsp-5	63,599	0,000	18,536	0,000	0,000	0,000	0,030	1,220	0,896	15,158	99,44
R4bt_campo6_02_Feldsp-6	64,218	0,000	18,508	0,025	0,007	0,037	0,000	1,156	0,816	15,167	99,93

Plagioclase grains

Sample	SiO2	TiO2	Al2O3	FeO	MgO	CaO	MnO	BaO*	Na2O	K2O	Total
CG-67_campo2_01_Feldsp-1	66,968	0,022	19,577	0,064	0,000	0,728	0,004	0,000	10,878	0,130	98,24
CG-67_campo2_01_Feldsp-2	66,761	0,024	19,577	0,056	0,000	0,764	0,000	0,016	10,901	0,105	98,10
CG-67_campo2_01_Feldsp-4	63,597	0,008	22,059	0,031	0,000	3,528	0,067	0,044	9,230	0,127	98,56

Sample	SiO2	TiO2	Al2O3	FeO	MgO	CaO	MnO	BaO*	Na2O	K2O	Total
CG-67_campo2_01_Feldsp-6	63,149	0,000	22,002	0,046	0,000	3,653	0,004	0,000	9,059	0,194	97,91
CG-67_campo2_01_Feldsp-7	63,467	0,004	22,025	0,068	0,012	3,400	0,071	0,017	9,228	0,156	98,29
CG-67_campo2_03_Feldsp-1	63,842	0,006	21,875	0,077	0,000	3,433	0,030	0,000	9,300	0,135	98,56
CG-67_campo2_03_Feldsp-2	62,986	0,050	21,885	0,054	0,010	3,320	0,011	0,005	9,169	0,167	97,49
CG-67_campo2_03_Feldsp-3	63,574	0,022	21,890	0,078	0,000	3,331	0,000	0,019	9,335	0,143	98,25
CG-67_campo2_03_Feldsp-4	63,352	0,000	21,671	0,057	0,000	3,407	0,000	0,006	9,235	0,144	97,73
CG-67_campo5_01_Feldsp-1	63,778	0,000	21,995	0,119	0,000	3,368	0,000	0,014	9,332	0,127	98,61
CG-67_campo5_01_Feldsp-2	63,707	0,006	21,678	0,006	0,000	3,322	0,000	0,020	9,425	0,109	98,16
CG-67_campo5_01_Feldsp-3	62,965	0,000	21,600	0,010	0,014	3,332	0,000	0,009	9,263	0,135	97,19
CG-67_campo5_01_Feldsp-4	63,954	0,000	21,782	0,000	0,000	3,362	0,011	0,007	9,488	0,121	98,60
CG-67_campo5_02_Feldsp-8	63,679	0,018	22,054	0,053	0,003	3,467	0,034	0,010	9,476	0,138	98,79
CG-67_campo5_02_Feldsp-9	63,535	0,000	21,860	0,026	0,014	3,478	0,000	0,000	9,379	0,166	98,29
CG-67_campo5_02_Feldsp-10	63,553	0,016	21,788	0,075	0,000	3,522	0,019	0,017	9,255	0,145	98,25
CG-67_campo5_02_Feldsp-11	63,574	0,000	21,991	0,065	0,000	3,341	0,000	0,021	9,378	0,194	98,37
CG-67_campo5_02_Feldsp-12	63,430	0,000	21,872	0,035	0,000	3,395	0,030	0,000	9,545	0,206	98,31
R4bt_campo1_03_Feldsp-1	64,415	0,000	22,198	0,043	0,000	3,194	0,053	0,011	9,539	0,225	99,45
R4bt_campo1_03_Feldsp-2	64,196	0,001	22,163	0,027	0,000	3,278	0,015	0,019	9,595	0,240	99,29
R4bt_campo1_03_Feldsp-3	64,312	0,000	22,287	0,070	0,000	3,136	0,000	0,022	9,600	0,234	99,43
R4bt_campo1_03_Feldsp-4	64,311	0,005	22,214	0,046	0,000	3,242	0,000	0,005	9,640	0,231	99,46
R4bt_campo1_03_Feldsp-5	63,626	0,031	22,316	0,063	0,000	3,675	0,000	0,020	9,369	0,286	99,10
R4bt_campo1_03_Feldsp-6	64,303	0,026	21,909	0,022	0,000	3,156	0,019	0,018	9,642	0,148	99,10
R4bt_campo1_03_Feldsp-7	64,032	0,000	22,036	0,038	0,007	2,973	0,000	0,006	9,692	0,247	98,78
R4bt_campo4_01_Feldsp-1	64,298	0,000	21,974	0,010	0,000	3,147	0,004	0,018	9,632	0,204	99,08
R4bt_campo4_01_Feldsp-2	64,439	0,006	22,030	0,064	0,000	3,185	0,004	0,005	9,622	0,213	99,36
R4bt_campo4_01_Feldsp-3	63,978	0,020	21,926	0,007	0,000	3,196	0,052	0,013	9,541	0,206	98,73
R4bt_campo4_01_Feldsp-4	64,125	0,000	22,047	0,073	0,000	3,232	0,015	0,026	9,553	0,222	99,07
R4bt_campo4_01_Feldsp-5	64,216	0,019	22,309	0,031	0,019	3,272	0,071	0,027	9,519	0,181	99,48
R4bt_campo4_01_Feldsp-6	64,670	0,000	21,540	0,010	0,000	2,935	0,004	0,008	9,666	0,303	98,83
R4bt_campo4_01_Feldsp-7	64,455	0,000	21,654	0,032	0,000	3,166	0,000	0,014	9,615	0,262	98,94
R4bt_campo5_01_Feldsp-1	64,273	0,027	22,027	0,074	0,000	3,265	0,000	0,000	9,534	0,239	99,20
R4bt_campo5_01_Feldsp-2	64,075	0,000	22,173	0,027	0,010	3,198	0,000	0,007	9,557	0,288	99,05
R4bt_campo5_01_Feldsp-3	64,307	0,000	22,226	0,013	0,008	3,304	0,000	0,028	9,404	0,285	99,29
R4bt_campo5_01_Feldsp-4	64,166	0,015	22,010	0,043	0,000	3,275	0,000	0,010	9,646	0,254	99,17
R4bt_campo5_01_Feldsp-5	62,904	0,003	22,663	0,045	0,000	3,154	0,000	0,004	9,309	0,280	98,08
R4bt_campo5_01_Feldsp-6	64,270	0,000	22,069	0,021	0,000	2,989	0,037	0,028	9,487	0,199	98,90
R4bt_campo7_01_Feldsp-1	64,248	0,000	22,074	0,051	0,000	3,300	0,000	0,004	9,620	0,175	99,30
R4bt_campo7_01_Feldsp-2	64,080	0,017	21,878	0,055	0,000	3,171	0,004	0,022	9,754	0,142	98,98
R4bt_campo7_01_Feldsp-3	64,198	0,021	22,066	0,000	0,000	3,190	0,038	0,019	9,793	0,118	99,33
R4bt_campo7_01_Feldsp-4	63,819	0,011	22,434	0,032	0,000	3,561	0,015	0,007	9,450	0,185	99,33
R4bt_campo7_01_Feldsp-5	63,322	0,042	22,394	0,050	0,000	3,574	0,000	0,026	9,279	0,166	98,69
R4bt_campo7_01_Feldsp-6	63,984	0,000	22,315	0,057	0,000	3,530	0,038	0,025	9,192	0,187	99,14
R4bt_campo7_01_Feldsp-7	64,098	0,034	22,467	0,000	0,000	3,601	0,000	0,013	9,561	0,177	99,77

Sample	SiO2	TiO2	Al2O3	FeO	MgO	CaO	MnO	BaO*	Na2O	K2O	Total
R5bt_campo1_Feldsp-2	63,779	0,000	22,204	0,008	0,000	3,700	0,000	0,037	9,147	0,342	98,88
R5bt_campo1_Feldsp-3	64,253	0,000	21,892	0,000	0,005	3,441	0,053	0,004	9,221	0,248	98,87
R5bt_campo1_Feldsp-4	63,955	0,006	21,995	0,000	0,000	3,508	0,000	0,013	9,265	0,251	98,74
R5bt_campo1_Feldsp-6	64,245	0,000	22,118	0,000	0,022	3,401	0,030	0,019	9,424	0,217	99,26
R5bt_campo2_Feldsp-1	64,658	0,000	21,270	0,002	0,011	2,722	0,022	0,007	9,752	0,181	98,44
R5bt_campo2_Feldsp-2	64,294	0,020	21,556	0,003	0,001	2,908	0,018	0,021	9,543	0,230	98,36
R5bt_campo2_Feldsp-3	64,568	0,016	21,252	0,008	0,000	2,481	0,007	0,026	9,875	0,152	98,23
R5bt_campo2_Feldsp-4	64,638	0,031	21,060	0,013	0,000	2,681	0,000	0,009	9,672	0,252	98,10
R5bt_campo5-Feldsp-2	64,346	0,014	21,438	0,001	0,017	2,772	0,000	0,000	9,614	0,218	98,20
R5bt_campo5-Feldsp-3	64,380	0,001	21,329	0,000	0,005	2,902	0,000	0,019	9,570	0,209	98,21
R5bt_campo5-Feldsp-4	64,191	0,000	21,390	0,000	0,000	2,893	0,008	0,021	9,634	0,173	98,14
R5bt_campo5-Feldsp-5	64,805	0,000	21,255	0,002	0,000	2,648	0,000	0,003	9,670	0,174	98,38
R5bt_campo5-Feldsp-6	64,742	0,020	21,084	0,001	0,000	2,737	0,018	0,031	9,655	0,217	98,29

Biotite

Sample	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	F	Cl	Total
CG-67_campo1_01_Bt-2	36,918	2,62	14,19	0,703	18,105	0,029	10,366	0,03	0,107	9,572	1,411	0,02	96,76
CG-67_campo1_01_Bt-3	37,214	2,55	14,225	0,721	18,141	0,024	10,632	0,103	0,079	9,672	1,357	0,003	97,49
CG-67_campo1_01_Bt-4	36,796	2,534	14,073	0,743	18,191	0,027	10,369	0,067	0,084	9,664	1,348	0,02	96,63
CG-67_campo1_01_Bt-5	36,863	2,547	14,158	0,761	18,272	0,019	10,485	0,058	0,078	9,497	1,285	0,011	96,86
CG-67_campo1_01_Bt-6	36,435	2,659	14,059	0,677	17,894	0,027	10,362	0,051	0,05	9,564	1,304	0	95,84
CG-67_campo1_01_Bt-8	37,214	2,587	14,403	0,739	17,884	0,013	10,373	0,06	0,077	9,658	1,307	0,021	97,19
CG-67_campo1_01_Bt-9	36,846	2,483	14,284	0,659	17,535	0,025	10,349	0,013	0,038	9,612	1,35	0,007	95,92
CG-67_campo2_01_Bt-1	36,828	3,181	14,356	0,685	17,351	0,016	10,231	0,058	0,067	9,785	1,605	0	96,67
CG-67_campo2_01_Bt-2	37,179	2,952	14,127	0,64	17,763	0,02	10,494	0,04	0,03	9,664	1,532	0,019	97,04
CG-67_campo2_01_Bt-3	36,797	2,643	14,032	0,746	17,778	0,019	10,508	0,025	0,044	9,795	1,538	0	96,47
CG-67_campo2_01_Bt-4	36,928	2,99	14,119	0,717	17,922	0,017	10,514	0,057	0,056	9,75	1,48	0,008	97,16
R4bt_campo1_01_bt-3	37,025	3,545	15,228	0,033	20,128	0,467	7,628	0,061	0,065	9,625	1,452	0,011	97,93
R4bt_campo1_01_bt-4	36,901	3,503	15,185	0,007	19,868	0,46	7,709	0,034	0,065	9,483	1,407	0,008	97,29
R4bt_campo1_01_bt-6	37,006	3,594	15,742	0,026	19,808	0,482	7,239	0,044	0,073	9,575	1,36	0,012	97,70
R4bt_campo1_01_bt-7	36,844	3,618	15,268	0,043	20,323	0,521	7,416	0,076	0,039	9,44	1,464	0,005	97,66
R4bt_campo1_01_bt-8	36,824	3,652	15,626	0	20,216	0,492	7,357	0,03	0,076	9,65	1,266	0,003	97,98
R4bt_campo1_01_bt-9	37,232	3,426	15,814	0,03	19,794	0,529	7,58	0,011	0,067	9,77	1,371	0,012	98,37
R4bt_campo1_01_bt-10	36,82	3,477	15,793	0	19,338	0,435	7,256	0,114	0,035	9,841	1,413	0,01	97,13
R4bt_campo1_03_Bt-6	36,711	3,584	15,211	0,029	20,329	0,565	7,481	0,039	0,056	9,524	1,469	0,004	97,55
R4bt_campo1_03_Bt-7	36,441	3,195	15,445	0	19,914	0,481	7,206	0,067	0,034	9,555	1,413	0,016	96,40
R4bt_campo3_01_Bt-1	36,389	3,706	15,26	0	20,891	0,58	7,286	0,03	0,058	9,474	1,345	0,009	97,77
R4bt_campo3_01_Bt-2	36,928	3,819	15,344	0,019	20,431	0,5	7,526	0,039	0,026	9,608	1,259	0,004	98,36
R4bt_campo3_01_Bt-3	37,17	3,763	15,138	0,028	19,925	0,526	7,284	0,079	0,076	9,48	1,376	0,007	97,57
R4bt_campo3_01_Bt-4	36,872	3,495	15,608	0,012	19,735	0,551	7,522	0,027	0,05	9,701	1,429	0,005	97,64
R4bt_campo3_01_Bt-5	36,812	3,599	15,287	0,027	19,925	0,533	7,481	0,018	0,057	9,548	1,364	0,002	97,31

Sample	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	F	Cl	Total
R4bt_campo3_01_Bt-6	36,917	3,517	15,208	0,034	20,433	0,557	7,323	0,123	0,03	9,32	1,386	0,002	97,60
R4bt_campo3_01_Bt-7	36,849	3,739	15,199	0	20,18	0,54	7,401	0,034	0,072	9,649	1,479	0,006	97,77
R4bt_campo3_01_Bt-8	36,883	3,17	15,388	0	19,957	0,536	7,757	0,023	0,068	9,563	1,487	0,008	97,38
R4bt_campo5_01_Bt-2	36,872	3,643	15,016	0,02	20,255	0,416	7,529	0,023	0,056	9,425	1,559	0,011	97,29
R4bt_campo5_01_Bt-3	37,101	3,458	15,219	0	20,108	0,435	7,771	0,029	0,045	9,579	1,42	0,013	97,83
R4bt_campo5_01_Bt-4	36,733	3,262	15,173	0,006	20,408	0,529	7,869	0,021	0,05	9,691	1,524	0,009	97,85
R4bt_campo5_01_Bt-5	36,69	3,154	15,238	0	19,898	0,347	7,96	0,001	0,05	9,315	1,586	0,004	96,71
R4bt_campo5_01_Bt-6	36,922	3,352	15,007	0,006	19,992	0,497	7,88	0,031	0,023	9,511	1,426	0,009	97,28
R4bt_campo5_01_Bt-7	37,035	3,33	14,89	0	20,045	0,618	7,689	0,003	0,019	9,548	1,511	0,012	97,23
R4bt_campo5_01_Bt-8	36,83	3,133	15,097	0,009	20,113	0,46	7,587	0,024	0,074	9,458	1,567	0,005	96,87
R4bt_campo5_01_Bt-9	37,068	2,095	15,532	0,023	20,593	0,474	7,865	0,126	0,036	9,029	1,284	0,008	96,95
R4bt_campo5_01_Bt-10	36,967	2,798	15,391	0,006	20,804	0,423	7,558	0,029	0,051	9,462	1,562	0,003	97,58
R4bt_campo6_02_Bt-5	36,852	3,86	15,379	0,02	19,211	0,45	7,465	0,085	0,05	9,534	1,476	0,013	97,01
R4bt_campo6_02_Bt-6	36,98	4,036	15,367	0,017	19,424	0,517	7,37	0,077	0,038	9,66	1,353	0,014	97,56
R4bt_campo6_02_Bt-7	36,751	3,756	15,598	0,025	19,251	0,52	7,203	0,055	0,065	9,452	1,3	0,018	96,76
R4bt_campo6_02_Bt-8	36,603	3,926	15,234	0	19,568	0,509	7,253	0,05	0,032	9,469	1,219	0,005	96,69
R4bt_campo6_02_Bt-9	36,511	4,142	15,189	0,022	19,563	0,531	7,282	0,056	0,063	9,401	1,334	0,013	96,83
R4bt_campo6_02_Bt-10	36,813	3,96	15,331	0,013	19,039	0,502	7,277	0,042	0,053	9,671	1,269	0,013	96,74
R4bt_campo7_01_Bt-8	37,026	3,569	15,256	0,005	20,122	0,492	7,86	0,047	0,056	9,328	1,34	0,011	97,82
R4bt_campo7_01_Bt-9	36,814	3,137	15,397	0	19,959	0,511	7,959	0,067	0,066	9,309	1,561	0,008	97,36
R4bt_campo7_01_Bt-10	37,042	3,27	15,417	0,023	19,768	0,463	7,764	0,11	0,031	9,559	1,533	0,005	97,55
R4bt_campo7_01_Bt-11	36,744	3,29	15,287	0	19,637	0,496	7,691	0,084	0,04	9,639	1,302	0,013	97,02
R4bt_campo7_01_Bt-12	37,177	3,484	15,278	0,002	19,764	0,522	7,858	0,065	0,075	9,682	1,523	0,007	98,03
R4bt_campo7_01_Bt-13	37,257	3,581	15,497	0	19,794	0,457	7,619	0,097	0,042	9,734	1,502	0,007	98,21
R4bt_campo7_01_Bt-14	37,133	3,605	15,596	0,009	19,699	0,457	7,635	0,075	0,053	9,612	1,548	0,01	98,00
R4bt_campo7_01_Bt-15	37,103	3,523	15,425	0	19,11	0,476	7,64	0,069	0,07	9,424	1,453	0,011	97,01
R5bt_campo1_Bt-1	35,921	3,056	18,662	0,012	19,743	0,563	5,901	0,019	0,127	9,527	1,104	0,005	97,50
R5bt_campo1_Bt-2	35,704	3,128	18,695	0,008	19,846	0,581	5,839	0,036	0,063	9,517	1,078	0,008	97,38
R5bt_campo1_Bt-3	35,901	2,996	18,715	0,009	19,865	0,53	5,998	0,031	0,048	9,587	1,101	0,004	97,66
R5bt_campo1_Bt-4	36,021	3,162	18,641	0	19,706	0,694	5,92	0	0,089	9,732	1,065	0,007	97,95
R5bt_campo1_Bt-5	35,589	3,149	18,497	0	19,64	0,588	5,81	0,057	0,165	9,511	1,037	0,008	96,95
R5bt_campo1_Bt-6	35,442	3,029	18,488	0,051	19,573	0,471	5,97	0,062	0,101	9,468	1,079	0,009	96,59
R5bt_campo1_Bt-7	36,219	3,124	18,863	0	20,018	0,606	6,083	0,028	0,132	9,613	1,259	0,003	98,72
R5bt_campo1_Bt-8	35,601	2,95	18,597	0,013	19,357	0,559	5,817	0,047	0,162	9,664	1,14	0,032	96,73
R5bt_campo1_Bt-9	35,89	3,153	18,706	0,014	19,753	0,49	5,911	0,062	0,123	9,427	1,136	0,003	97,51
R5bt_campo1_Bt-10	35,493	3,116	18,644	0,019	19,623	0,537	5,997	0,068	0,118	9,534	1,14	0	97,10
R5bt_campo1_Bt-11	35,438	3,067	18,569	0,003	19,773	0,609	5,791	0,083	0,092	9,406	1,135	0,001	96,77
R5bt_campo1_Bt-12	35,334	3,209	18,487	0,012	19,447	0,478	5,767	0,044	0,092	9,54	1,163	0,008	96,34
R5bt_campo1_Bt-13	35,747	3,032	18,636	0,03	19,243	0,533	5,838	0,056	0,068	9,621	1,112	0,01	96,76
R5bt_campo1_Bt-14	35,65	3,094	18,755	0	19,292	0,533	6,004	0,036	0,108	9,61	1,062	0,002	97,04
R5bt_campo1_Bt-15	35,549	3,103	18,802	0	19,46	0,574	5,932	0,067	0,117	9,54	1,118	0,002	97,10

Sample	SiO2	TiO2	Al2O3	Cr2O3	FeO	MnO	MgO	CaO	Na2O	K2O	F	Cl	Total
R5bt_campo1_Bt-16	35,702	3,076	18,594	0,026	19,219	0,504	5,931	0,038	0,076	9,653	1,091	0,002	96,77
R5bt_campo2_Bt-1	35,614	3,111	18,694	0,002	19,407	0,512	6,03	0,019	0,081	9,625	1,189	0,006	97,03
R5bt_campo2_Bt-2	35,602	3,103	18,459	0	19,677	0,519	6,028	0,021	0,129	9,724	1,16	0,009	97,19
R5bt_campo2_Bt-4	35,485	3,088	18,6	0	19,623	0,442	5,977	0,031	0,108	9,707	1,113	0,009	96,98
R5bt_campo2_Bt-5	35,54	2,928	18,746	0	19,808	0,42	5,868	0,001	0,086	9,751	1,178	0,011	97,08
R5bt_campo2_Bt-6	35,683	3,115	19,008	0	19,654	0,541	6,037	0,008	0,086	9,573	1,167	0,006	97,66
R5bt_campo2_Bt-7	35,854	2,975	18,844	0	19,53	0,464	5,919	0,036	0,081	9,394	1,169	0,009	97,04
R5bt_campo4_Bt-1	35,395	3,037	18,841	0,013	19,176	0,621	6,033	0,046	0,114	9,668	1,162	0,009	96,87
R5bt_campo4_Bt-2	35,164	3,076	18,467	0	19,08	0,543	5,97	0,013	0,121	9,61	1,137	0,019	95,93
R5bt_campo4_Bt-3	35,217	2,998	18,391	0,037	19,207	0,599	5,949	0,026	0,137	9,621	1,118	0,019	96,07
R5bt_campo4_Bt-4	35,321	3,086	18,442	0	19,084	0,471	6,067	0,021	0,146	9,611	1,113	0,021	96,15
R5bt_campo4_Bt-5	35,342	3,135	18,697	0,009	19,249	0,558	5,9	0,034	0,158	9,546	1,201	0,015	96,54
R5bt_campo4_Bt-6	35,449	3,115	18,283	0,011	19,29	0,551	5,989	0,059	0,109	9,428	1,249	0,014	96,19
R5bt_campo4_Bt-7	35,439	3,078	18,378	0	19,535	0,579	5,977	0,041	0,095	9,568	1,131	0,012	96,59
R5bt_campo4_Bt-8	35,66	3,368	18,746	0,009	19,261	0,444	5,964	0,04	0,117	9,584	0,992	0,014	97,11
R5bt_campo4_Bt-9	35,668	3,281	18,444	0,015	19,512	0,415	6,026	0,022	0,129	9,599	1,074	0,009	97,03
R5bt_campo4_Bt-10	35,538	3,06	18,242	0	19,311	0,579	5,987	0,013	0,111	9,525	1,185	0,024	96,27
R5bt_campo4_Bt-11	35,773	3,227	18,424	0,024	19,536	0,401	6,062	0,017	0,109	9,45	1,1	0,018	96,95
R5bt_campo4_Bt-12	35,64	3,051	18,288	0,001	19,524	0,531	6,116	0,015	0,165	9,466	1,168	0,017	96,72
R5bt_campo4_Bt-13	35,638	3,155	18,398	0	19,665	0,542	6,048	0,027	0,119	9,458	1,085	0,008	96,96
R5bt_campo4_Bt-14	35,129	3,101	18,108	0,033	19,613	0,534	5,935	0,027	0,144	9,467	1,109	0,013	95,96
R5bt_campo5-bT-2	35,77	3,188	18,394	0,028	19,92	0,564	5,978	0,028	0,195	9,482	1,24	0,006	97,49
R5bt_campo5-bT-3	35,453	3,189	18,533	0,001	19,563	0,546	6,034	0,064	0,187	9,486	1,104	0,01	96,97
R5bt_campo5-bT-4	35,819	3,112	18,278	0,025	19,317	0,517	5,921	0,024	0,138	9,485	1,145	0,019	96,55
R5bt_campo5-bT-5	35,75	3,17	18,544	0,007	19,208	0,557	6,114	0	0,114	9,687	1,192	0,013	97,09
R5bt_campo5-bT-6	35,764	3,041	18,528	0,026	19,509	0,521	6,099	0,023	0,129	9,504	1,09	0,017	97,07
R5bt_campo5-bT-7	35,826	3,048	18,595	0	19,684	0,5	6,049	0,016	0,117	9,653	1,086	0,009	97,42
R5bt_campo5-bT-8	35,511	3,067	18,343	0	19,511	0,576	6,09	0,008	0,107	9,61	1,163	0,018	96,74

Muscovite

Sample	SiO2	TiO2	Al2O3	FeO	MnO	MgO	CaO	Na2O	K2O	F	Cl	Total
R5bt_campo4_Ms-1	45,18	0,893	32,066	1,841	0,015	1,141	0,014	0,484	10,653	0,384	0,023	92,638
R5bt_campo4_Ms-2	45,254	1,103	32,273	1,747	0,052	1,09	0	0,468	10,654	0,403	0,011	93,039
R5bt_campo4_Ms-3	45,325	0,842	32,497	1,657	0,048	1,034	0,053	0,524	10,688	0,392	0,016	93,059
R5bt_campo4_Ms-4	45,246	0,989	32,554	1,692	0,041	1,067	0,02	0,509	10,725	0,383	0,019	93,216
R5bt_campo4_Ms-5	44,518	1,068	32,248	1,617	0,063	0,943	0,013	0,561	10,609	0,461	0,011	92,056
R5bt_campo4_Ms-6	44,938	0,626	32,384	1,592	0,049	1,004	0,028	0,532	10,687	0,503	0,014	92,310
R5bt_campo4_Ms-7	45,345	0,604	32,748	1,641	0,004	1,082	0,036	0,493	10,691	0,398	0,012	93,005
R5bt_campo5-Ms-2	44,442	0,773	32,004	1,768	0,019	1,118	0,023	0,556	10,807	0,397	0,015	91,879

Sample	SiO2	TiO2	Al2O3	FeO	MnO	MgO	CaO	Na2O	K2O	F	Cl	Total
R5bt_campo5-Ms-4	45,168	1,021	32,464	1,871	0,03	1,076	0,039	0,501	10,75	0,357	0,016	93,250

Apatite

Sample	Na2O	F	SiO2	Al2O3	MgO	ZnO	FeO	Cl	P2O5	TiO2	CaO	K2O	MnO	Total
R4bt_campo1_01_Ap-1	0.059	5.020	0.112	0.008	0.000	0.000	0.031	0.007	40.100	0.002	53.981	0.016	0.102	97.322
R4bt_campo1_01_Ap-2	0.013	5.566	0.226	0.033	0.000	0.000	0.042	0.000	40.347	0.051	54.129	0.000	0.173	98.236
R4bt_campo1_02_Ap-2	0.004	5.302	0.160	0.030	0.000	0.043	0.007	0.001	40.090	0.000	54.264	0.000	0.045	97.714
R4bt_campo5_01_Ap-1	0.055	5.521	0.239	0.000	0.000	0.000	0.151	0.000	39.898	0.035	53.977	0.000	0.135	97.686
R4bt_campo5_01_Ap-2	0.037	5.490	0.257	0.020	0.000	0.027	0.062	0.001	39.845	0.025	53.723	0.000	0.079	97.254
R4bt_campo5_01_Ap-3	0.040	5.401	0.198	0.019	0.000	0.024	0.054	0.002	40.339	0.016	53.778	0.004	0.207	97.808
R4bt_campo5_01_Ap-4	0.041	5.350	0.192	0.014	0.000	0.042	0.031	0.000	39.915	0.018	53.737	0.014	0.135	97.236

Geochronological Data

LA-ICP-MS zircon U-Pb analytical results from sample R5Bt

All zircons

Grain	²⁰⁷ Pb	²⁰⁶ Pb	$\frac{^{206}\text{Pb}}{^{204}\text{Pb}}$	U	Th	$\frac{\text{Th}}{\text{U}}$	$\frac{^{207}\text{Pb}^*}{^{206}\text{Pb}^*}$	2s	$\frac{^{208}\text{Pb}}{^{232}\text{Th}}$	2s	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	2s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	2s	Rho	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}^*}$	2s	$\frac{^{206}\text{Pb}^*}{^{238}\text{U}}$	2s	$\frac{^{207}\text{Pb}^*}{^{235}\text{U}}$	2s	Disc. (%)
SMP039	101279	5827	0,0000	1200,90	1019,02	0,85	0,057530	1,11	0,025780	2,02	0,694388	3,66	0,087540	1,23	0,74	512	24	541	6	535	7	-1
SMP081	385617	25198	1890,9589	4514,11	984,17	0,22	0,065346	1,19	0,052870	2,19	0,798907	3,70	0,088670	1,22	0,72	785	25	548	6	596	8	8
SMP089	248626	15397	0,0000	2948,71	1021,98	0,35	0,061930	1,15	0,036710	2,62	0,727325	3,77	0,087520	1,35	0,76	672	25	541	7	567	8	5
SMP122	309879	18490	1975,1812	3702,68	25520,23	6,89	0,059668	1,23	0,021990	2,00	0,714679	3,86	0,086870	1,39	0,75	592	27	537	7	548	8	2
SMP161	138434	8132	0,0000	1440,25	141,40	0,10	0,058740	1,26	0,040590	4,04	0,709317	3,84	0,087580	1,35	0,73	557	27	541	7	544	8	1
SMP151	192971	12873	698,0823	2292,83	3351,73	1,46	0,066709	2,01	0,028720	4,39	0,803525	4,69	0,087360	1,79	0,67	829	42	540	9	599	12	10
SMP014	185995	12607	1084,6150	2130,21	1675,56	0,79	0,067779	1,47	0,029760	2,82	0,846976	4,03	0,090630	1,39	0,69	862	30	559	7	623	9	10

Zircon Corcordia age 539 ± 6 Ma

Grain	²⁰⁷ Pb	²⁰⁶ Pb	$\frac{^{206}\text{Pb}}{^{204}\text{Pb}}$	U	Th	$\frac{\text{Th}}{\text{U}}$	$\frac{^{207}\text{Pb}^*}{^{206}\text{Pb}^*}$	2s	$\frac{^{208}\text{Pb}}{^{232}\text{Th}}$	2s	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	2s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	2s	Rho	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}^*}$	2s	$\frac{^{206}\text{Pb}^*}{^{238}\text{U}}$	2s	$\frac{^{207}\text{Pb}^*}{^{235}\text{U}}$	2s	Disc. (%)
SMP039	101279	5827	0,0000	1200,90	1019,02	0,85	0,057530	1,11	0,025780	2,02	0,694388	3,66	0,087540	1,23	0,74	512	24	541	6	535	7	-1
SMP089	248626	15397	0,0000	2948,71	1021,98	0,35	0,061930	1,15	0,036710	2,62	0,727325	3,77	0,087520	1,35	0,76	672	25	541	7	567	8	5
SMP122	309879	18490	1975,1812	3702,68	25520,23	6,89	0,059668	1,23	0,021990	2,00	0,714679	3,86	0,086870	1,39	0,75	592	27	537	7	548	8	2
SMP161	138434	8132	0,0000	1440,25	141,40	0,10	0,058740	1,26	0,040590	4,04	0,709317	3,84	0,087580	1,35	0,73	557	27	541	7	544	8	1

LA-ICP-MS zircon U-Pb analytical results from sample R4Bt

All zircons

Grain	²⁰⁷ Pb ^a	Pb ^b	U ^b	Th	$\frac{\text{Th}}{\text{U}}$	²⁰⁶ Pb ^c	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	±2σ	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	±2σ	Rho	$\frac{^{207}\text{Pb}^d}{^{206}\text{Pb}}$	±2σ	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	±2σ	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	±2σ	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}}$	±2s	Disc
	(cps)	(ppm)	(ppm)	(ppm)	U	(%)	²³⁵ U	(Ma)	²³⁸ U	(Ma)		²⁰⁶ Pb	(%)	²³⁸ U	(Ma)	²³⁵ U	(Ma)	²⁰⁶ Pb	(Ma)	(%)
SMP 51	53443	109	5805	924	0,16	0,57	0,651561	2,50	0,081874	2,28	0,91	0,057717	1,0	507	11	509	10	519	22	2
SMP 52	52626	126	5956	1700	0,29	0,68	0,690305	1,24	0,086095	0,35	0,28	0,058152	1,2	532	2	533	5	535	26	1
SMP 53	31684	79	3126	948	0,30	0,00	0,851273	2,68	0,101878	2,64	0,98	0,060602	0,5	625	16	625	13	625	11	0
SMP 54	45664	84	3973	473	0,12	1,91	0,759109	2,51	0,091520	0,85	0,34	0,060157	2,4	565	5	573	11	609	51	7
SMP 55	78325	141	6888	2502	0,36	2,03	0,601014	3,14	0,075738	1,92	0,61	0,057553	2,5	471	9	478	12	513	55	8
SMP 57	37470	86	4115	656	0,16	1,14	0,754394	5,16	0,092540	4,85	0,94	0,059124	1,8	571	27	571	23	572	38	0
SMP 58	36617	79	3792	515	0,14	0,51	0,686956	1,38	0,085452	0,49	0,36	0,058305	1,3	529	3	531	6	541	28	2
SMP 59	42409	96	3993	1466	0,37	0,78	0,798580	4,17	0,095581	3,88	0,93	0,060596	1,5	588	22	596	19	625	33	6
SMP 60	40544	91	4527	682	0,15	0,02	0,713413	2,23	0,088490	2,19	0,98	0,058472	0,4	547	11	547	9	547	9	0
SMP 61	34688	66	3293	653	0,20	1,41	0,673685	2,27	0,083486	1,35	0,60	0,058525	1,8	517	7	523	9	549	40	6
SMP 62	18525	45	2121	621	0,29	0,45	0,700981	0,96	0,087094	0,38	0,40	0,058374	0,9	538	2	539	4	544	19	1
SMP 67	19273	47	2002	778	0,39	0,08	0,731655	1,90	0,090292	1,84	0,97	0,058770	0,5	557	10	558	8	559	10	0
SMP 68	32326	70	3413	594	0,17	0,33	0,712979	1,62	0,087883	1,41	0,87	0,058839	0,8	543	7	547	7	561	17	3
SMP 69	29486	65	3008	1154	0,38	0,83	0,614501	3,82	0,078073	3,51	0,92	0,057085	1,5	485	16	486	15	495	33	2

	²⁰⁷ Pb ^a	Pb ^b	U ^b	Th	Th ^b	²⁰⁶ Pbc ^c	²⁰⁷ Pb	±2σ	²⁰⁶ Pb	±2σ		²⁰⁷ Pb ^d	±2σ	²⁰⁶ Pb	±2σ	²⁰⁷ Pb	±2σ	²⁰⁷ Pb	±2s	Disc
Grain	(cps)	(ppm)	(ppm)	(ppm)	U	(%)	²³⁵ U	(Ma)	²³⁸ U	(Ma)	Rho	²⁰⁶ Pb	(%)	²³⁸ U	(Ma)	²³⁵ U	(Ma)	²⁰⁶ Pb	(Ma)	(%)
SMP 75	20529	56	2194	1308	0,60	0,18	0,698838	0,63	0,086925	0,33	0,53	0,058308	0,5	537	2	538	3	541	12	1
SMP 76	17147	35	1589	495	0,31	0,00	0,714089	1,14	0,087277	0,48	0,42	0,059340	1,0	539	2	547	5	580	23	7
SMP 78	57564	128	6129	1169	0,19	0,20	0,703543	1,38	0,087132	1,18	0,86	0,058561	0,7	539	6	541	6	551	15	2
SMP 86	69217	138	6576	1196	0,18	0,52	0,725334	1,99	0,089415	1,50	0,75	0,058834	1,3	552	8	554	9	561	29	2
SMP 87	37092	71	3796	528	0,14	0,74	0,640267	1,32	0,080566	0,69	0,53	0,057638	1,1	499	3	502	5	516	25	3
SMP 88	46557	88	4706	770	0,16	0,00	0,642497	2,85	0,080856	2,63	0,92	0,057631	1,1	501	13	504	11	516	24	3
SMP 89	33071	54	3024	222	0,07	0,88	0,626949	6,31	0,079083	6,09	0,96	0,057497	1,7	491	29	494	25	511	36	4
SMP 90	51910	108	5402	948	0,18	0,65	0,643493	1,63	0,081081	1,28	0,78	0,057560	1,0	503	6	504	7	513	22	2
SMP 92	34300	81	3370	206	0,06	0,07	0,966426	1,53	0,112442	1,43	0,93	0,062336	0,5	687	9	687	8	686	12	0
SMP 95	45786	90	4517	1024	0,23	0,67	0,656397	2,11	0,082205	1,57	0,74	0,057912	1,4	509	8	512	9	526	31	3
SMP 100	51510	112	5297	803	0,15	0,00	0,759786	2,03	0,093104	1,98	0,97	0,059186	0,5	574	11	574	9	574	10	0
SMP 101	20043	40	1988	227	0,11	0,23	0,704481	0,86	0,087513	0,44	0,52	0,058384	0,7	541	2	541	4	544	16	1
SMP 102	47496	93	4552	1073	0,24	0,81	0,737054	1,65	0,090267	1,15	0,70	0,059220	1,2	557	6	561	7	575	26	3
SMP 103	52153	110	5391	800	0,15	0,48	0,738574	1,74	0,090658	0,54	0,31	0,059086	1,7	559	3	562	8	570	36	2
SMP 104	47642	81	3910	604	0,15	1,52	0,716151	4,69	0,088289	0,78	0,17	0,058830	4,6	545	4	548	20	561	101	3
SMP 105	41250	81	4226	493	0,12	0,19	0,697202	3,10	0,086801	3,06	0,99	0,058255	0,5	537	16	537	13	539	12	1
SMP 106	44476	102	4798	1031	0,21	0,00	0,734438	2,98	0,090616	2,95	0,99	0,058783	0,4	559	16	559	13	559	10	0
SMP 107	57426	134	6204	1224	0,20	0,05	0,758183	2,52	0,092917	2,48	0,98	0,059180	0,4	573	14	573	11	574	10	0
SMP 108	73029	148	6355	1820	0,29	2,58	0,687367	6,65	0,085324	5,71	0,86	0,058427	3,4	528	29	531	28	546	74	3
SMP 109	52809	103	4522	489	0,11	1,43	0,866960	1,99	0,102239	0,80	0,40	0,061501	1,8	628	5	634	9	657	39	4
SMP 116	52984	112	5493	1957	0,36	1,04	0,620809	2,75	0,078344	2,29	0,83	0,057471	1,5	486	11	490	11	510	34	5
SMP 117	40666	83	3379	1836	0,54	1,82	0,757741	3,21	0,091387	1,59	0,50	0,060136	2,8	564	9	573	14	608	60	7
SMP 118	53123	100	4458	1388	0,31	1,49	0,714706	2,50	0,087475	1,09	0,44	0,059257	2,2	541	6	548	11	577	49	6
SMP 119	49673	111	5149	1725	0,34	0,00	0,677859	2,14	0,084691	1,42	0,66	0,058050	1,6	524	7	525	9	532	35	1
SMP 121	47239	92	4783	481	0,10	0,59	0,684033	1,68	0,085339	1,39	0,82	0,058134	1,0	528	7	529	7	535	21	1
SMP 122	43445	84	3990	726	0,18	1,03	0,737139	6,84	0,090882	6,65	0,97	0,058826	1,6	561	36	561	30	561	35	0
SMP 123	67418	117	5235	776	0,15	5,82	0,797463	6,85	0,095626	1,52	0,22	0,060483	6,7	589	9	595	31	621	144	5
SMP 124	53824	120	5337	1028	0,19	0,55	0,792953	1,76	0,095836	0,89	0,51	0,060009	1,5	590	5	593	8	604	33	2
SMP 134	81036	143	7216	1514	0,21	0,97	0,657422	1,57	0,081960	0,74	0,47	0,058176	1,4	508	4	513	6	536	30	5
SMP 135	46448	100	4987	884	0,18	0,61	0,694386	1,41	0,086575	1,00	0,71	0,058171	1,0	535	5	535	6	536	22	0
SMP 136	30626	62	2924	760	0,26	3,05	0,703866	4,63	0,087310	1,66	0,36	0,058469	4,3	540	9	541	20	547	95	1
SMP 130	87017	34	563	63	0,11	12,04	3,530945	12,10	0,253866	10,83	0,90	0,100875	5,4	1458	143	1534	101	1640	100	11

Zircon Corcordia age 539 ± 25 Ma

	²⁰⁷ Pb ^a	Pb ^b	U ^b	Th	Th ^b	²⁰⁶ Pb ^c	²⁰⁷ Pb	±2σ	²⁰⁶ Pb	±2σ		²⁰⁷ Pb ^d	±2σ	²⁰⁶ Pb	±2σ	²⁰⁷ Pb	±2σ	²⁰⁷ Pb	±2s	Disc
Grain	(cps)	(ppm)	(ppm)	(ppm)	U	(%)	²³⁵ U	(Ma)	²³⁸ U	(Ma)	Rho	²⁰⁶ Pb	(%)	²³⁸ U	(Ma)	²³⁵ U	(Ma)	²⁰⁶ Pb	(Ma)	(%)
SMP 62	18525	45	2121	621	0,29	0,45	0,700981	0,96	0,087094	0,38	0,40	0,058374	0,9	538	2	539	4	544	19	1
SMP 75	20529	56	2194	1308	0,60	0,18	0,698838	0,63	0,086925	0,33	0,53	0,058308	0,5	537	2	538	3	541	12	1
SMP 101	20043	40	1988	227	0,11	0,23	0,704481	0,86	0,087513	0,44	0,52	0,058384	0,7	541	2	541	4	544	16	1
SMP 119	49673	111	5149	1725	0,34	0,00	0,677859	2,14	0,084691	1,42	0,66	0,058050	1,6	524	7	525	9	532	35	1
SMP 121	47239	92	4783	481	0,10	0,59	0,684033	1,68	0,085339	1,39	0,82	0,058134	1,0	528	7	529	7	535	21	1
SMP 135	46448	100	4987	884	0,18	0,61	0,694386	1,41	0,086575	1,00	0,71	0,058171	1,0	535	5	535	6	536	22	0

Zircon Corcordia age 504 ± 4 Ma

	²⁰⁷ Pb ^a	Pb ^b	U ^b	Th	Th ^b	²⁰⁶ Pb ^c	²⁰⁷ Pb	±2σ	²⁰⁶ Pb	±2σ		²⁰⁷ Pb ^d	±2σ	²⁰⁶ Pb	±2σ	²⁰⁷ Pb	±2σ	²⁰⁷ Pb	±2s	Disc
Grain	(cps)	(ppm)	(ppm)	(ppm)	U	(%)	²³⁵ U	(Ma)	²³⁸ U	(Ma)	Rho	²⁰⁶ Pb	(%)	²³⁸ U	(Ma)	²³⁵ U	(Ma)	²⁰⁶ Pb	(Ma)	(%)
SMP 51	53443	109	5805	924	0,16	0,57	0,651561	2,50	0,081874	2,28	0,91	0,057717	1,0	507	11	509	10	519	22	2
SMP 87	37092	71	3796	528	0,14	0,74	0,640267	1,32	0,080566	0,69	0,53	0,057638	1,1	499	3	502	5	516	25	3
SMP 88	46557	88	4706	770	0,16	0,00	0,642497	2,85	0,080856	2,63	0,92	0,057631	1,1	501	13	504	11	516	24	3
SMP 90	51910	108	5402	948	0,18	0,65	0,643493	1,63	0,081081	1,28	0,78	0,057560	1,0	503	6	504	7	513	22	2
SMP 95	45786	90	4517	1024	0,23	0,67	0,656397	2,11	0,082205	1,57	0,74	0,057912	1,4	509	8	512	9	526	31	3
SMP 134	81036	143	7216	1514	0,21	0,97	0,657422	1,57	0,081960	0,74	0,47	0,058176	1,4	508	4	513	6	536	30	5

Inherited zircons

	²⁰⁷ Pb ^a	Pb ^b	U ^b	Th	Th ^b	²⁰⁶ Pb ^c	²⁰⁷ Pb	±2σ	²⁰⁶ Pb	±2σ		²⁰⁷ Pb ^d	±2σ	²⁰⁶ Pb	±2σ	²⁰⁷ Pb	±2σ	²⁰⁷ Pb	±2s	Disc
Grain	(cps)	(ppm)	(ppm)	(ppm)	U	(%)	²³⁵ U	(Ma)	²³⁸ U	(Ma)	Rho	²⁰⁶ Pb	(%)	²³⁸ U	(Ma)	²³⁵ U	(Ma)	²⁰⁶ Pb	(Ma)	(%)
SMP 53	31684	79	3126	948	0,30	0,00	0,851273	2,68	0,101878	2,64	0,98	0,060602	0,5	625	16	625	13	625	11	0
SMP 92	34300	81	3370	206	0,06	0,07	0,966426	1,53	0,112442	1,43	0,93	0,062336	0,5	687	9	687	8	686	12	0
SMP 109	52809	103	4522	489	0,11	1,43	0,866960	1,99	0,102239	0,80	0,40	0,061501	1,8	628	5	634	9	657	39	4
SMP 130	87017	34	563	63	0,11	12,04	3,530945	12,10	0,253866	10,83	0,90	0,100875	5,4	1458	143	1534	101	1640	100	11

LA-ICP-MS monazite U-Pb analytical results from sample R5Bt

All monazites

	uncorrected ratios				204 corrected ratios								204 corrected ages												
	²⁰⁷ Pb	²⁰⁶ Pb	²⁰⁶ Pb	U	Th	^{207*} Pb	2s	²⁰⁶ Pb	2s	^{207*} Pb	2s	²⁰⁸ Pb	2s	^{207*} Pb	2s	²⁰⁶ Pb	2s	^{207*} Pb	2s	Conc	²⁰⁷ Pb	2s	²⁰⁶ Pb	2s	Rho
			²⁰⁴ Pb	(ppm)	U	^{206*} Pb		²³⁸ U		²³⁵ U		²³² Th		²⁰⁶ Pb		²³⁸ U		²³⁵ U		(%)	²³⁵ U		²³⁸ U		
S.07	41553	2428,36	0	235,73	57,19	0,05844	1,49	0,08337	1,46	0,671771	2,09	0,02	1,29	546	32,53	516	7,264	522	8,55	99	0,67	2,09	0,08337	1,46	0,70
S.14	97131	5620	0	541,66	25,03	0,05786	1,43	0,08481	1,51	0,6765919	2,08	0,02	1,39	524	31,46	525	7,614	525	8,57	100	0,68	2,08	0,08481	1,51	0,72
S.15	98047	5612,21	0	544,01	25,04	0,05724	1,48	0,08524	1,57	0,6727355	2,16	0,03	1,43	501	32,70	528	7,964	522	8,87	101	0,67	2,16	0,08524	1,57	0,73
S.16	146005	8294,54	0	800,43	19,98	0,05681	1,14	0,08627	1,37	0,6757497	1,78	0,03	1,35	484	25,26	533	7,01	524	7,33	102	0,68	1,78	0,08627	1,37	0,77

	²⁰⁷ Pb	²⁰⁶ Pb	$\frac{^{206}\text{Pb}}{^{204}\text{Pb}}$	U (ppm)	$\frac{\text{Th}}{\text{U}}$	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}}$	2s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	2s	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	2s	$\frac{^{208}\text{Pb}}{^{232}\text{Th}}$	2s	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}}$	2s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	2s	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	2s	Conc (%)	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	2s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	2s	Rho
S.29	150276	7519,81	0	863,06	19,20	0,05004	1,36	0,08235	1,46	0,5681751	1,99	0,02	1,4	197	31,58	510	7,15	457	7,36	112	0,57	1,99	0,08235	1,46	0,73
S.35	61259	3396,81	0	359,68	54,42	0,05545	2,42	0,08055	2,01	0,6158407	3,14	0,02	1,46	430	53,86	499	9,67	487	12,24	102	0,62	3,14	0,08055	2,01	0,64
S.37	110681	6402,9	0	622,58	22,57	0,05785	1,71	0,08408	1,62	0,6706522	2,35	0,02	1,3	524	37,53	520	8,09	521	9,64	100	0,67	2,35	0,08408	1,62	0,69
S.39	188241	10872,8	0	1056,59	13,30	0,05776	1,39	0,08426	1,45	0,6710423	2	0,02	1,38	521	30,39	522	7,263	521	8,20	100	0,67	2,00	0,08426	1,45	0,72
S.42	63175	3623,09	0	353,43	47,14	0,05735	1,53	0,08454	1,51	0,6684931	2,16	0,02	1,4	505	33,76	523	7,61	520	8,81	101	0,67	2,16	0,08454	1,51	0,70
S.43	91454	5269,58	0	510,36	28,23	0,05762	1,72	0,08475	1,58	0,6733087	2,33	0,02	1,37	515	37,74	524	7,97	523	9,59	100	0,67	2,33	0,08475	1,58	0,68
S.44	97717	5653,91	0	546,80	30,23	0,05786	1,56	0,08452	1,59	0,6742783	2,22	0,02	1,36	524	34,11	523	7,97	523	9,12	100	0,67	2,22	0,08452	1,59	0,71
S.49	31870	1844	0	180,00	66,54	0,05786	2,13	0,08374	1,77	0,6680557	2,76	0,02	1,36	524	46,62	518	8,87	520	11,31	100	0,67	2,76	0,08374	1,77	0,64
S.51	102775	7525,19	0	558,51	26,85	0,07322	2,31	0,08703	2,00	0,8786178	3,05	0,03	1,5	1020	46,73	538	10,32	640	14,61	84	0,88	3,05	0,08703	2,00	0,65
S.52	53310	3097,84	0	301,99	50,45	0,05811	1,72	0,08349	1,58	0,6689391	2,34	0,02	1,32	534	37,68	517	7,86	520	9,56	99	0,67	2,34	0,08349	1,58	0,68
S.53	120626	9870,83	0	645,29	24,11	0,08183	1,33	0,08841	1,45	0,9975053	1,97	0,02	1,37	1241	26,10	546	7,59	703	10,02	78	1	1,97	0,08841	1,45	0,74
S.54	90353	5213,37	0	502,38	29,28	0,0577	1,61	0,08506	1,55	0,6767098	2,24	0,03	1,36	518	35,38	526	7,849	525	9,21	100	0,68	2,24	0,08506	1,55	0,69
S.55	223578	12902,7	0	1245,19	12,82	0,05771	1,46	0,08492	1,48	0,6757131	2,08	0,02	1,38	519	31,95	525	7,499	524	8,55	100	0,68	2,08	0,08492	1,48	0,71
S.81	97816	5528,56	0	435,16	35,05	0,05652	1,29	0,08906	1,50	0,6940426	1,98	0,03	1,39	473	28,58	550	7,94	535	8,28	103	0,69	1,98	0,08906	1,50	0,76
S.83	115886	6430,51	0	514,45	26,79	0,05549	1,41	0,08925	1,57	0,6828483	2,11	0,03	1,46	432	31,32	551	8,29	528	8,72	104	0,68	2,11	0,08925	1,57	0,74
S.85	103852	5864,52	0	465,14	30,32	0,05647	1,40	0,08846	1,56	0,688757	2,1	0,03	1,39	471	30,961	546	8,18	532	8,71	103	0,69	2,10	0,08846	1,56	0,74
S.87	111205	6196,34	0	490,92	24,99	0,05572	1,24	0,08975	1,49	0,68952	1,94	0,03	1,36	441	27,547	554	7,93	533	8,07	104	0,69	1,94	0,08975	1,49	0,77
S.88	116540	6626,46	0	533,24	26,70	0,05686	1,30	0,08659	1,52	0,6788532	2	0,03	1,41	486	28,728	535	7,836	526	8,26	102	0,68	2,00	0,08659	1,52	0,76
S.89	116599	6536,54	0	518,19	27,21	0,05606	1,20	0,08915	1,46	0,6890896	1,89	0,03	1,38	455	26,524	551	7,70	532	7,84	103	0,69	1,89	0,08915	1,46	0,77
S.95	97790	5543,72	0	439,23	27,32	0,05669	1,15	0,08821	1,43	0,6894862	1,83	0,03	1,38	479	25,338	545	7,47	532	7,62	102	0,69	1,83	0,08821	1,43	0,78
S.96	73296	4222,58	0	337,79	35,27	0,05761	1,56	0,08597	1,65	0,6828826	2,27	0,03	1,41	515	34,31	532	8,43	529	9,41	101	0,68	2,27	0,08597	1,65	0,73
S.97	84673	4745,07	0	380,66	37,84	0,05604	1,52	0,08813	1,63	0,6809625	2,23	0,03	1,4	454	33,67	545	8,54	527	9,21	103	0,68	2,23	0,08813	1,63	0,73

Monazite Corcordia age 522 ± 2 Ma

	uncorrected ratios			204 corrected ratios										204 corrected ages												
	²⁰⁷ Pb	²⁰⁶ Pb	²⁰⁶ Pb ²⁰⁴ Pb	U (ppm)	Th U	^{207*} Pb ^{206*} Pb	2s	²⁰⁶ Pb ²³⁸ U	2s	^{207*} Pb ²³⁵ U	2s	²⁰⁸ Pb ²³² Th	2s	^{207*} Pb ²⁰⁶ Pb	2s	²⁰⁶ Pb ²³⁸ U	2s	^{207*} Pb ²³⁵ U	2s	Conc (%)	²⁰⁷ Pb ²³⁵ U	2s	²⁰⁶ Pb ²³⁸ U	2s	Rho	
S.07	41553	2428,36	0	235,73	57,19	0,05844	1,49	0,08337	1,46	0,671771	2,09	0,02	1,29	546	32,53	516	7,264	522	8,55	99	0,67	2,09	0,08337	1,46	0,70	
S.14	97131	5620	0	541,66	25,03	0,05786	1,43	0,08481	1,51	0,6765919	2,08	0,02	1,39	524	31,46	525	7,614	525	8,57	100	0,68	2,08	0,08481	1,51	0,72	
S.27	90519	5174,07	0	506,28	30,55	0,05716	1,45	0,08456	1,47	0,666436	2,06	0,02	1,31	498	31,99	523	7,37	519	8,41	101	0,67	2,06	0,08456	1,47	0,71	
S.29	150276	7519,81	0	863,06	19,20	0,05004	1,36	0,08235	1,46	0,5681751	1,99	0,02	1,4	197	31,58	510	7,15	457	7,36	112	0,57	1,99	0,08235	1,46	0,73	
S.35	61259	3396,81	0	359,68	54,42	0,05545	2,42	0,08055	2,01	0,6158407	3,14	0,02	1,46	430	53,86	499	9,67	487	12,24	102	0,62	3,14	0,08055	2,01	0,64	
S.37	110681	6402,9	0	622,58	22,57	0,05785	1,71	0,08408	1,62	0,6706522	2,35	0,02	1,3	524	37,53	520	8,09	521	9,64	100	0,67	2,35	0,08408	1,62	0,69	
S.39	188241	10872,8	0	1056,59	13,30	0,05776	1,39	0,08426	1,45	0,6710423	2	0,02	1,38	521	30,39	522	7,263	521	8,20	100	0,67	2,00	0,08426	1,45	0,72	

	²⁰⁷ Pb	²⁰⁶ Pb	$\frac{^{206}\text{Pb}}{^{204}\text{Pb}}$	U (ppm)	$\frac{\text{Th}}{\text{U}}$	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}}$	2s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	2s	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	2s	$\frac{^{208}\text{Pb}}{^{232}\text{Th}}$	2s	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}}$	2s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	2s	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	2s	Conc (%)	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	2s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	2s	Rho
S.42	63175	3623,09	0	353,43	47,14	0,05735	1,53	0,08454	1,51	0,6684931	2,16	0,02	1,4	505	33,76	523	7,61	520	8,81	101	0,67	2,16	0,08454	1,51	0,70
S.43	91454	5269,58	0	510,36	28,23	0,05762	1,72	0,08475	1,58	0,6733087	2,33	0,02	1,37	515	37,74	524	7,97	523	9,59	100	0,67	2,33	0,08475	1,58	0,68
S.44	97717	5653,91	0	546,80	30,23	0,05786	1,56	0,08452	1,59	0,6742783	2,22	0,02	1,36	524	34,11	523	7,97	523	9,12	100	0,67	2,22	0,08452	1,59	0,71
S.49	31870	1844	0	180,00	66,54	0,05786	2,13	0,08374	1,77	0,6680557	2,76	0,02	1,36	524	46,62	518	8,87	520	11,31	100	0,67	2,76	0,08374	1,77	0,64
S.52	53310	3097,84	0	301,99	50,45	0,05811	1,72	0,08349	1,58	0,6689391	2,34	0,02	1,32	534	37,68	517	7,86	520	9,56	99	0,67	2,34	0,08349	1,58	0,68
S.54	90353	5213,37	0	502,38	29,28	0,0577	1,61	0,08506	1,55	0,6767098	2,24	0,03	1,36	518	35,38	526	7,849	525	9,21	100	0,68	2,24	0,08506	1,55	0,69
S.55	223578	12902,7	0	1245,19	12,82	0,05771	1,46	0,08492	1,48	0,6757131	2,08	0,02	1,38	519	31,95	525	7,499	524	8,55	100	0,68	2,08	0,08492	1,48	0,71

LA-ICP-MS monazite U-Pb analytical results from sample R5MB

All monazites

UNCORRECTED RATIOS

204 corrected ratios

204 corrected ages

	²⁰⁷ Pb	²⁰⁶ Pb	$\frac{^{206}\text{Pb}}{^{204}\text{Pb}}$	U (ppm)	$\frac{\text{Th}}{\text{U}}$	$\frac{^{208}\text{Pb}}{^{232}\text{Th}}$	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}}$	2s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	2s	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	2s	$\frac{^{208}\text{Pb}}{^{232}\text{Th}}$	2s	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}}$	2s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	2s	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	2s	Conc (%)	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	2s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	2s	Rho
17	388855	21836	2728	1732	10,54	0,0254	0,0561539	1,04	0,08896	1,35	0,6887732	1,70	0,025	1,34	458	23,11	549	7,09	532	7,07	103	0,689	1,70	0,08896	1,35	0,79
18	1065362	60875	0	4955	3,47	0,02563	0,05714	1,00	0,08518	1,39	0,6710875	1,71	0,026	1,40	497	21,98	527	7,01	521	6,98	101	0,671	1,71	0,08518	1,39	0,81
19	1089643	71873	0	4812	2,64	0,02677	0,06596	1,05	0,08971	1,34	0,8158734	1,70	0,027	1,34	805	21,90	554	7,10	606	7,78	91	0,816	1,70	0,08971	1,34	0,79
25	139484	7948	0	645	21,55	0,02493	0,05698	1,09	0,08569	1,40	0,6732151	1,77	0,025	1,36	491	24,00	530	7,13	523	7,27	101	0,673	1,77	0,08569	1,4	0,79
30	733395	41371	1025	3353	4,74	0,02505	0,05641	1,35	0,08666	1,45	0,6740254	1,98	0,025	1,36	468	29,99	536	7,46	523	8,15	102	0,674	1,98	0,08666	1,45	0,73
34	312654	17339	0	1345	13,65	0,02636	0,0554569	3,77	0,09211	2,57	0,7043103	4,56	0,026	1,37	431	83,91	568	13,97	541	19,30	105	0,704	4,56	0,09211	2,57	0,56
40	789526	44058	2255	3478	4,56	0,02592	0,0558026	1,06	0,08995	1,34	0,6920805	1,71	0,026	1,31	444	23,57	555	7,13	534	7,12	104	0,692	1,71	0,08995	1,34	0,78
42	344107	18368	0	1507	8,28	0,026	0,05338	1,11	0,09049	1,35	0,6660095	1,74	0,026	1,31	345	25,01	558	7,22	518	7,10	108	0,666	1,74	0,09049	1,35	0,77
44	301420	16888	1001	1347	16,00	0,02505	0,0560273	1,42	0,08864	1,49	0,6847482	2,05	0,025	1,36	453	31,49	547	7,81	530	8,51	103	0,685	2,05	0,08864	1,49	0,72
45	1072765	59973	125	4726	3,31	0,02574	0,0559055	1,29	0,08994	1,42	0,6932794	1,92	0,026	1,32	449	28,73	555	7,57	535	8,02	104	0,693	1,92	0,08994	1,42	0,74
48	323354	18072	0	1432	16,53	0,02539	0,05589	1,04	0,08945	1,36	0,6893118	1,71	0,025	1,34	448	23,06	552	7,22	532	7,13	104	0,689	1,71	0,08945	1,36	0,8
55	323317	18090	0	1433	14,50	0,02523	0,05595	1,04	0,08941	1,41	0,6897433	1,75	0,025	1,35	450	23,02	552	7,46	533	7,28	104	0,69	1,75	0,08941	1,41	0,81
56	693960	39112	0	3142	4,73	0,02516	0,05636	0,96	0,08752	1,33	0,6801106	1,64	0,025	1,35	467	21,22	541	6,88	527	6,74	103	0,68	1,64	0,08752	1,33	0,81
59	1152543	81867	723	5191	1,40	0,02904	0,0710317	1,45	0,08796	1,55	0,8614671	2,12	0,029	1,31	958	29,57	543	8,10	631	10,02	86	0,861	2,12	0,08796	1,55	0,73
61	1253589	70214	0	5573	2,24	0,0256	0,05601	0,96	0,08912	1,30	0,6882434	1,62	0,026	1,33	453	21,40	550	6,87	532	6,73	103	0,688	1,62	0,08912	1,3	0,8
62	1109334	62598	1169	5028	1,96	0,0252	0,0564285	1,29	0,08741	1,41	0,6800811	1,91	0,025	1,35	469	28,56	540	7,30	527	7,88	103	0,68	1,91	0,08741	1,41	0,74
63	427984	24160	0	1933	10,58	0,02501	0,05645	1,05	0,08772	1,39	0,6827534	1,74	0,025	1,36	470	23,13	542	7,23	528	7,19	103	0,683	1,74	0,08772	1,39	0,8
68	587107	41826	932	2320	1,54	0,03338	0,0712402	1,32	0,10028	1,46	0,9850103	1,96	0,033	1,38	964	26,85	616	8,58	696	9,95	88	0,985	1,96	0,10028	1,46	0,74

	²⁰⁷ Pb	²⁰⁶ Pb	²⁰⁶ Pb	U	Th	²⁰⁸ Pb	²⁰⁷ *Pb	2s	²⁰⁶ Pb	2s	²⁰⁷ *Pb	2s	²⁰⁸ Pb	2s	²⁰⁷ *Pb	2s	²⁰⁶ Pb	2s	²⁰⁷ *Pb	2s	Conc	²⁰⁷ Pb	2s	²⁰⁶ Pb	2s	Rho
			²⁰⁴ Pb	(ppm)	U	²³² Th	²⁰⁶ *Pb		²³⁸ U		²³⁵ U		²³² Th		²⁰⁶ Pb		²³⁸ U		²³⁵ U		(%)	²³⁵ U		²³⁸ U		
72	355146	18180	0	1633	12,10	0,02486	0,05119	1,04	0,08616	1,39	0,6081239	1,74	0,025	1,37	249	23,83	533	7,13	482	6,69	110	0,608	1,74	0,08616	1,39	0,8
74	1110621	74345	0	5042	3,17	0,02555	0,06694	1,05	0,08727	1,35	0,8054748	1,71	0,026	1,33	836	21,79	539	7,00	600	7,77	90	0,805	1,71	0,08727	1,35	0,79
43	238415	13257	1967	1036	15,22	0,0259	0,0556029	1,24	0,09118	1,39	0,6990338	1,86	0,026	1,31	436	27,56	563	7,51	538	7,82	105	0,699	1,86	0,09118	1,39	0,75
58	1136814	64470	5426	5203	2,49	0,02511	0,0567116	1,00	0,08657	1,30	0,6769248	1,64	0,025	1,27	480	22,16	535	6,67	525	6,75	102	0,677	1,64	0,08657	1,3	0,79
11	284879	15282	5733	1272	15,44	0,02482	0,0536445	1,13	0,08876	1,4	0,656514	1,84	0,025	1,37	356	25,57	548	7,60	512	7,42	107	0,657	1,84	0,08876	1,45	0,79
14	1138580	61221	0	5104	2,24	0,02535	0,05377	1,02	0,08838	1,3	0,6552323	1,67	0,025	1,341	361	23,07	546	6,87	512	6,71	107	0,655	1,66	0,08838	1,31	0,79
15	1044766	56073	5002	4660	3,04	0,02523	0,0536708	0,99	0,08883	1,3	0,6573534	1,64	0,025	1,348	357	22,35	549	6,90	513	6,64	107	0,657	1,64	0,08883	1,31	0,8
16	299459	16273	0	1369	16,17	0,02479	0,05434	1,09	0,08664	1,4	0,6491415	1,78	0,025	1,372	385	24,39	536	7,24	508	7,13	105	0,649	1,78	0,08664	1,41	0,79
24	935436	50804	0	4307	3,03	0,02502	0,05431	1,07	0,08606	1,35	0,6444399	1,72	0,025	1,359	384	24,00	532	6,89	505	6,87	105	0,644	1,72	0,08606	1,35	0,78
26	1045788	56675	0	4779	0,03	0,02881	0,0541938	3,82	0,08671	2,64	0,6479186	4,65	0,029	2,985	379	85,96	536	13,61	507	18,73	106	0,648	4,65	0,08671	2,64	0,57
27	945383	51145	0	4291	0,04	0,03278	0,0541	1,00	0,0873	1,31	0,6511976	1,64	0,033	2,502	375	22,46	540	6,76	509	6,60	106	0,651	1,64	0,0873	1,31	0,79
28	303138	16383	1189	1396	10,46	0,02476	0,0540462	1,31	0,08604	1,43	0,6411607	1,94	0,025	1,292	373	29,47	532	7,29	503	7,71	106	0,641	1,94	0,08604	1,43	0,74
29	730515	39416	0	3317	4,88	0,02439	0,0539564	3,85	0,08727	2,66	0,6492457	4,68	0,024	1,312	369	86,83	539	13,78	508	18,90	106	0,649	4,68	0,08727	2,66	0,57
32	367485	19640	9967	1621	13,80	0,02495	0,0534436	1,42	0,08983	1,49	0,6619402	2,06	0,025	1,363	348	32,20	555	7,91	516	8,36	108	0,662	2,06	0,08983	1,49	0,72
46	329577	17818	1374	1492	14,06	0,02489	0,0540628	1,24	0,0875	1,42	0,6522404	1,89	0,025	1,366	374	27,88	541	7,38	510	7,59	106	0,652	1,89	0,0875	1,42	0,75
47	339279	18210	5114	1508	12,41	0,02527	0,0536714	1,01	0,08915	1,33	0,6597292	1,67	0,025	1,345	357	22,74	551	7,02	514	6,75	107	0,66	1,67	0,08915	1,33	0,8
54	863693	46635	26184	3928	3,55	0,02598	0,0539944	0,96	0,08711	1,31	0,6485119	1,63	0,026	1,309	371	21,71	538	6,76	508	6,51	106	0,649	1,63	0,08711	1,31	0,81
57	924741	50221	4565	4253	3,01	0,02582	0,0543077	0,98	0,08614	1,33	0,645011	1,65	0,026	1,317	384	22,07	533	6,81	505	6,61	105	0,645	1,65	0,08614	1,33	0,8
60	951431	51558	0	4337	2,84	0,02445	0,05419	1,00	0,08691	1,29	0,6493669	1,63	0,024	1,309	379	22,41	537	6,65	508	6,53	106	0,649	1,63	0,08691	1,29	0,79
71	289472	15591	0	1319	13,50	0,02495	0,05386	1,02	0,08692	1,36	0,6454868	1,7	0,025	1,363	365	23,02	537	7,00	506	6,79	106	0,645	1,70	0,08692	1,36	0,8
73	300929	16262	0	1365	13,08	0,02471	0,05404	1,00	0,08734	1,33	0,6507734	1,66	0,025	1,295	373	22,50	540	6,88	509	6,67	106	0,651	1,66	0,08734	1,33	0,8
75	258139	13983	0	1175	11,44	0,02522	0,05417	0,98	0,08701	1,33	0,6498742	1,65	0,025	1,348	378	22,01	538	6,88	508	6,64	106	0,65	1,65	0,08701	1,33	0,81
76	291528	15772	0	1328	12,83	0,02489	0,0541	0,98	0,08695	1,33	0,6485868	1,66	0,025	1,366	375	22,05	537	6,88	508	6,63	106	0,649	1,66	0,08695	1,33	0,81
41	478685	26864	0	2118	9,05	0,025	0,05612	1,03	0,08956	1,38	0,6929997	1,73	0,025	1,36	457	22,93	552	7,34	535	7,21	103	0,693	1,73	0,08956	1,38	0,8

Mean age 527 ± 3 Ma

UNCORRECTED RATIOS

204 corrected ratios

204 corrected ages

	²⁰⁷ Pb	²⁰⁶ Pb	²⁰⁶ Pb	U	Th	²⁰⁸ Pb	^{207*} Pb	2s	²⁰⁶ Pb	2s	^{207*} Pb	2s	²⁰⁸ Pb	2s	^{207*} Pb	2s	²⁰⁶ Pb	2s	^{207*} Pb	2s	Conc	²⁰⁷ Pb	2s	²⁰⁶ Pb	2s	Rho
			²⁰⁴ Pb	(ppm)	U	²³² Th	^{206*} Pb		²³⁸ U		²³⁵ U		²³² Th		²⁰⁶ Pb		²³⁸ U		²³⁵ U		(%)	²³⁵ U		²³⁸ U		
18	1065362	60875	0	4955	3,47	0,02563	0,05714	1,00	0,08518	1,39	0,6710875	1,71	0,026	1,40	497	21,98	527	7,01	521	6,98	101	0,671	1,71	0,08518	1,39	0,81
19	1089643	71873	0	4812	2,64	0,02677	0,06596	1,05	0,08971	1,34	0,8158734	1,70	0,027	1,34	805	21,90	554	7,10	606	7,78	91	0,816	1,70	0,08971	1,34	0,79
25	139484	7948	0	645	21,55	0,02493	0,05698	1,09	0,08569	1,40	0,6732151	1,77	0,025	1,36	491	24,00	530	7,13	523	7,27	101	0,673	1,77	0,08569	1,4	0,79
30	733395	41371	1025	3353	4,74	0,02505	0,05641	1,35	0,08666	1,45	0,6740254	1,98	0,025	1,36	468	29,99	536	7,46	523	8,15	102	0,674	1,98	0,08666	1,45	0,73
34	312654	17339	0	1345	13,65	0,02636	0,0554569	3,77	0,09211	2,57	0,7043103	4,56	0,026	1,37	431	83,91	568	13,97	541	19,30	105	0,704	4,56	0,09211	2,57	0,56
40	789526	44058	2255	3478	4,56	0,02592	0,0558026	1,06	0,08995	1,34	0,6920805	1,71	0,026	1,31	444	23,57	555	7,13	534	7,12	104	0,692	1,71	0,08995	1,34	0,78
42	344107	18368	0	1507	8,28	0,026	0,05338	1,11	0,09049	1,35	0,6660095	1,74	0,026	1,31	345	25,01	558	7,22	518	7,10	108	0,666	1,74	0,09049	1,35	0,77
44	301420	16888	1001	1347	16,00	0,02505	0,0560273	1,42	0,08864	1,49	0,6847482	2,05	0,025	1,36	453	31,49	547	7,81	530	8,51	103	0,685	2,05	0,08864	1,49	0,72
45	1072765	59973	125	4726	3,31	0,02574	0,0559055	1,29	0,08994	1,42	0,6932794	1,92	0,026	1,32	449	28,73	555	7,57	535	8,02	104	0,693	1,92	0,08994	1,42	0,74
48	323354	18072	0	1432	16,53	0,02539	0,05589	1,04	0,08945	1,36	0,6893118	1,71	0,025	1,34	448	23,06	552	7,22	532	7,13	104	0,689	1,71	0,08945	1,36	0,8
55	323317	18090	0	1433	14,50	0,02523	0,05595	1,04	0,08941	1,41	0,6897433	1,75	0,025	1,35	450	23,02	552	7,46	533	7,28	104	0,69	1,75	0,08941	1,41	0,81
56	693960	39112	0	3142	4,73	0,02516	0,05636	0,96	0,08752	1,33	0,6801106	1,64	0,025	1,35	467	21,22	541	6,88	527	6,74	103	0,68	1,64	0,08752	1,33	0,81
59	1152543	81867	723	5191	1,40	0,02904	0,0710317	1,45	0,08796	1,55	0,8614671	2,12	0,029	1,31	958	29,57	543	8,10	631	10,02	86	0,861	2,12	0,08796	1,55	0,73
61	1253589	70214	0	5573	2,24	0,0256	0,05601	0,96	0,08912	1,30	0,6882434	1,62	0,026	1,33	453	21,40	550	6,87	532	6,73	103	0,688	1,62	0,08912	1,3	0,8
62	1109334	62598	1169	5028	1,96	0,0252	0,0564285	1,29	0,08741	1,41	0,6800811	1,91	0,025	1,35	469	28,56	540	7,30	527	7,88	103	0,68	1,91	0,08741	1,41	0,74
63	427984	24160	0	1933	10,58	0,02501	0,05645	1,05	0,08772	1,39	0,6827534	1,74	0,025	1,36	470	23,13	542	7,23	528	7,19	103	0,683	1,74	0,08772	1,39	0,8
68	587107	41826	932	2320	1,54	0,03338	0,0712402	1,32	0,10028	1,46	0,9850103	1,96	0,033	1,38	964	26,85	616	8,58	696	9,95	88	0,985	1,96	0,10028	1,46	0,74
69	1171704	77509	1003	5399	3,05	0,02621	0,0661504	1,28	0,08599	1,53	0,7842986	2,00	0,026	1,37	811	26,75	532	7,82	588	8,94	90	0,784	2,00	0,08599	1,53	0,77
70	891686	66446	506	3884	3,86	0,02698	0,0745167	1,75	0,09096	1,79	0,9345563	2,50	0,027	1,33	1055	35,15	561	9,62	670	12,33	84	0,935	2,50	0,09096	1,79	0,72
72	355146	18180	0	1633	12,10	0,02486	0,05119	1,04	0,08616	1,39	0,6081239	1,74	0,025	1,37	249	23,83	533	7,13	482	6,69	110	0,608	1,74	0,08616	1,39	0,8
74	1110621	74345	0	5042	3,17	0,02555	0,06694	1,05	0,08727	1,35	0,8054748	1,71	0,026	1,33	836	21,79	539	7,00	600	7,77	90	0,805	1,71	0,08727	1,35	0,79
43	238415	13257	1967	1036	15,22	0,0259	0,0556029	1,24	0,09118	1,39	0,6990338	1,86	0,026	1,31	436	27,56	563	7,51	538	7,82	105	0,699	1,86	0,09118	1,39	0,75
58	1136814	64470	5426	5203	2,49	0,02511	0,0567116	1,00	0,08657	1,30	0,6769248	1,64	0,025	1,27	480	22,16	535	6,67	525	6,75	102	0,677	1,64	0,08657	1,3	0,79

LA-ICP-MS monazite U-Pb analytical results from sample R5MB

All monazites

UNCORRECTED RATIOS

	UNCORRECTED RATIOS										204 corrected ratios								204 corrected ages								Rho
	²⁰⁷ Pb	²⁰⁶ Pb	²⁰⁶ Pb	U	Th	²⁰⁸ Pb	^{207*} Pb	2s	²⁰⁶ Pb	2s	^{207*} Pb	2s	²⁰⁸ Pb	2s	^{207*} Pb	2s	²⁰⁶ Pb	2s	^{207*} Pb	2s	Conc	²⁰⁷ Pb	2s	²⁰⁶ Pb	2s		
			²⁰⁴ Pb	(ppm)	U	²³² Th	^{206*} Pb		²³⁸ U		²³⁵ U		²³² Th		²⁰⁶ Pb		²³⁸ U		²³⁵ U		(%)	²³⁵ U		²³⁸ U			
14	1138580	61221	0	5104	2,24	0,02535	0,05377	1,02	0,08838	1,3	0,6552323	1,67	0,025	1,341	361	23,07	546	6,87	512	6,71	107	0,655	1,66	0,08838	1,31	0,79	
15	1044766	56073	5002	4660	3,04	0,02523	0,0536708	0,99	0,08883	1,3	0,6573534	1,64	0,025	1,348	357	22,35	549	6,90	513	6,64	107	0,657	1,64	0,08883	1,31	0,8	
16	299459	16273	0	1369	16,17	0,02479	0,05434	1,09	0,08664	1,4	0,6491415	1,78	0,025	1,372	385	24,39	536	7,24	508	7,13	105	0,649	1,78	0,08664	1,41	0,79	
24	935436	50804	0	4307	3,03	0,02502	0,05431	1,07	0,08606	1,35	0,6444399	1,72	0,025	1,359	384	24,00	532	6,89	505	6,87	105	0,644	1,72	0,08606	1,35	0,78	
26	1045788	56675	0	4779	0,03	0,02881	0,0541938	3,82	0,08671	2,64	0,6479186	4,65	0,029	2,985	379	85,96	536	13,61	507	18,73	106	0,648	4,65	0,08671	2,64	0,57	
27	945383	51145	0	4291	0,04	0,03278	0,0541	1,00	0,0873	1,31	0,6511976	1,64	0,033	2,502	375	22,46	540	6,76	509	6,60	106	0,651	1,64	0,0873	1,31	0,79	
28	303138	16383	1189	1396	10,46	0,02476	0,0540462	1,31	0,08604	1,43	0,6411607	1,94	0,025	1,292	373	29,47	532	7,29	503	7,71	106	0,641	1,94	0,08604	1,43	0,74	
29	730515	39416	0	3317	4,88	0,02439	0,0539564	3,85	0,08727	2,66	0,6492457	4,68	0,024	1,312	369	86,83	539	13,78	508	18,90	106	0,649	4,68	0,08727	2,66	0,57	
32	367485	19640	9967	1621	13,80	0,02495	0,0534436	1,42	0,08983	1,49	0,6619402	2,06	0,025	1,363	348	32,20	555	7,91	516	8,36	108	0,662	2,06	0,08983	1,49	0,72	
46	329577	17818	1374	1492	14,06	0,02489	0,0540628	1,24	0,0875	1,42	0,6522404	1,89	0,025	1,366	374	27,88	541	7,38	510	7,59	106	0,652	1,89	0,0875	1,42	0,75	
47	339279	18210	5114	1508	12,41	0,02527	0,0536714	1,01	0,08915	1,33	0,6597292	1,67	0,025	1,345	357	22,74	551	7,02	514	6,75	107	0,66	1,67	0,08915	1,33	0,8	
54	863693	46635	26184	3928	3,55	0,02598	0,0539944	0,96	0,08711	1,31	0,6485119	1,63	0,026	1,309	371	21,71	538	6,76	508	6,51	106	0,649	1,63	0,08711	1,31	0,81	
57	924741	50221	4565	4253	3,01	0,02582	0,0543077	0,98	0,08614	1,33	0,645011	1,65	0,026	1,317	384	22,07	533	6,81	505	6,61	105	0,645	1,65	0,08614	1,33	0,8	
60	951431	51558	0	4337	2,84	0,02445	0,05419	1,00	0,08691	1,29	0,6493669	1,63	0,024	1,309	379	22,41	537	6,65	508	6,53	106	0,649	1,63	0,08691	1,29	0,79	
71	289472	15591	0	1319	13,50	0,02495	0,05386	1,02	0,08692	1,36	0,6454868	1,7	0,025	1,363	365	23,02	537	7,00	506	6,79	106	0,645	1,70	0,08692	1,36	0,8	
73	300929	16262	0	1365	13,08	0,02471	0,05404	1,00	0,08734	1,33	0,6507734	1,66	0,025	1,295	373	22,50	540	6,88	509	6,67	106	0,651	1,66	0,08734	1,33	0,8	
75	258139	13983	0	1175	11,44	0,02522	0,05417	0,98	0,08701	1,33	0,6498742	1,65	0,025	1,348	378	22,01	538	6,88	508	6,64	106	0,65	1,65	0,08701	1,33	0,81	
76	291528	15772	0	1328	12,83	0,02489	0,0541	0,98	0,08695	1,33	0,6485868	1,66	0,025	1,366	375	22,05	537	6,88	508	6,63	106	0,649	1,66	0,08695	1,33	0,81	
41	478685	26864	0	2118	9,05	0,025	0,05612	1,03	0,08956	1,38	0,6929997	1,73	0,025	1,36	457	22,93	552	7,34	535	7,21	103	0,693	1,73	0,08956	1,38	0,8	

LA-ICP-MS apatite U-Pb analytical results from sample R4Bt

All apatites

grain	²⁰⁷ Pba (cps)	Ub (ppm)	Pbb (ppm)	Thb U	²⁰⁶ Pbcc (%)	²⁰⁶ Pbd ²³⁸ U	±2s (%)	²⁰⁷ Pbd ²³⁵ U	±2s (%)	²⁰⁷ Pbd ²⁰⁶ Pb	±2s (%)	rhoe	²⁰⁶ Pb ²³⁸ U	±2s (Ma)	²⁰⁷ Pb ²³⁵ U	±2s (Ma)	²⁰⁷ Pb ²⁰⁶ Pb	±2s (Ma)	disc (%)
Grain: 23	30631	14	9	1,65	57,6	0,1173	6,88	2,3778	10,03	0,1470	7,3	0,69	715	46,71	1236	74,37	2311	125,40	31
Grain: 24	25798	8	8	2,07	63,3	0,1791	6,44	4,9682	9,87	0,2012	7,5	0,65	1062	63,36	1814	87,05	2836	121,97	37
Grain: 25	28501	13	9	1,15	58,6	0,1300	6,43	2,7647	9,77	0,1542	7,4	0,66	788	47,86	1346	75,59	2394	125,14	33
Grain: 26	35790	10	10	2,43	65,6	0,1482	6,76	4,0433	10,06	0,1979	7,4	0,67	891	56,48	1643	85,36	2809	121,75	32
Grain: 27	27949	10	8	2,72	62,8	0,1494	6,36	3,7277	9,78	0,1810	7,4	0,65	898	53,50	1577	81,46	2662	123,07	34

grain	²⁰⁷ Pba (cps)	Ub (ppm)	Pbb (ppm)	Thb U	²⁰⁶ Pbcc (%)	²⁰⁶ Pbd ²³⁸ U	±2s (%)	²⁰⁷ Pbd ²³⁵ U	±2s (%)	²⁰⁷ Pbd ²⁰⁶ Pb	±2s (%)	rhoe	²⁰⁶ Pb ²³⁸ U	±2s (Ma)	²⁰⁷ Pb ²³⁵ U	±2s (Ma)	²⁰⁷ Pb ²⁰⁶ Pb	±2s (Ma)	disc (%)
Grain: 30	31662	12	10	2,63	61,8	0,1506	6,26	3,7264	9,69	0,1794	7,4	0,65	904	53,06	1577	80,73	2648	122,78	34
Grain: 31	32412	15	9	1,06	59,2	0,1220	6,08	2,6039	9,54	0,1548	7,3	0,64	742	42,76	1302	72,50	2400	124,92	31
Grain: 32	28252	11	9	2,55	61,8	0,1464	6,56	3,5347	9,90	0,1752	7,4	0,66	881	54,20	1535	81,51	2607	123,46	34
Grain: 34	31501	11	10	2,28	62,0	0,1568	6,38	3,8933	9,78	0,1801	7,4	0,65	939	55,93	1612	82,29	2654	123,08	35
Grain: 35	24576	8	10	2,91	63,5	0,2006	6,47	5,2041	9,87	0,1882	7,5	0,66	1179	70,05	1853	87,74	2726	122,76	43
Grain: 36	21756	9	7	1,94	62,3	0,1329	6,39	3,1162	9,78	0,1700	7,4	0,65	805	48,54	1437	78,07	2558	123,78	31
Grain: 37	18969	9	6	2,03	61,3	0,1180	6,50	2,5826	9,83	0,1587	7,4	0,66	719	44,41	1296	74,65	2442	124,87	29
Grain: 44	28522	16	9	1,82	57,5	0,1265	5,90	2,6123	9,43	0,1498	7,4	0,63	768	42,82	1304	71,71	2344	125,84	33
Grain: 51	27633	9	8	3,57	64,3	0,1577	6,93	4,2252	10,19	0,1944	7,5	0,68	944	61,16	1679	87,27	2779	122,30	34
Grain: 61	31644	14	10	2,25	58,4	0,1452	5,93	3,2108	9,47	0,1604	7,4	0,63	874	48,64	1460	76,10	2460	124,78	36
Grain: 63	30085	10	9	2,08	63,3	0,1471	6,57	3,7323	9,92	0,1840	7,4	0,66	885	54,56	1578	82,71	2689	122,81	33
Grain: 65	24687	10	8	1,76	61,9	0,1773	6,26	4,6292	9,75	0,1894	7,5	0,64	1052	61,06	1755	84,91	2737	123,10	38
Grain: 71	39432	16	12	2,81	59,6	0,1246	6,85	2,6546	10,08	0,1545	7,4	0,68	757	49,12	1316	77,21	2396	125,78	32
Grain: 75	21694	8	7	2,72	62,1	0,1538	6,41	3,8062	9,82	0,1795	7,4	0,65	922	55,28	1594	82,22	2648	123,54	35
Grain: 82	28569	11	9	2,52	62,1	0,1753	6,70	4,6009	10,03	0,1903	7,5	0,67	1041	64,76	1749	87,32	2745	122,73	38
Grain: 83	28079	10	9	2,56	63,1	0,1634	6,56	4,2850	9,93	0,1902	7,5	0,66	976	59,67	1690	85,23	2744	122,58	36
Grain: 86	37486	26	16	2,81	48,7	0,2110	5,36	4,4998	9,32	0,1546	7,6	0,58	1234	60,49	1731	80,52	2398	129,63	51
Grain: 89	28129	11	9	2,99	61,5	0,1503	6,22	3,6304	9,68	0,1752	7,4	0,64	903	52,63	1556	80,15	2608	123,53	35
Grain: 103	32571	14	11	2,58	59,2	0,1553	6,01	3,6292	9,54	0,1695	7,4	0,63	931	52,33	1556	78,92	2552	124,00	36
Grain: 104	27396	9	8	2,94	63,1	0,1532	6,93	3,9451	10,18	0,1868	7,5	0,68	919	59,66	1623	86,02	2714	122,96	34
Grain: 106	27848	8	8	2,36	65,0	0,1680	6,65	4,7230	10,01	0,2039	7,5	0,66	1001	61,93	1771	87,56	2858	121,82	35
Grain: 107	35864	10	11	2,78	64,2	0,1559	6,48	4,1166	9,87	0,1915	7,4	0,66	934	56,60	1658	83,98	2755	122,18	34
Grain: 111	32555	14	10	1,55	59,1	0,1361	9,58	3,0879	12,11	0,1645	7,4	0,79	823	74,41	1430	97,43	2503	124,74	33
Grain: 121	6652	52	53	37,65	4,9	0,0959	1,71	0,8136	4,26	0,0615	3,9	0,40	590	9,66	604	19,60	658	83,68	90
Grain: 123	7194	55	57	38,04	4,7	0,0952	1,64	0,8062	4,07	0,0614	3,7	0,40	586	9,19	600	18,63	654	80,01	90
Grain: 126	18465	7	5	1,09	63,6	0,1425	6,69	3,6696	9,99	0,1868	7,4	0,67	859	53,99	1565	83,04	2714	122,42	32
Grain: 136	30584	9	9	2,70	64,3	0,1649	6,55	4,5681	9,93	0,2009	7,5	0,66	984	60,09	1743	86,31	2833	121,75	35
Grain: 138	29209	10	9	2,72	63,2	0,1754	6,85	4,8792	10,13	0,2017	7,5	0,68	1042	66,21	1799	89,16	2840	121,68	37
Grain: 140	33243	13	10	1,33	60,3	0,1747	6,70	4,4293	10,05	0,1839	7,5	0,67	1038	64,53	1718	86,83	2688	123,77	39
Grain: 148	20243	9	8	2,26	63,8	0,1636	6,61	4,1772	9,98	0,1852	7,5	0,66	977	60,23	1670	85,21	2700	123,35	36
Grain: 150	22938	11	9	2,17	63,0	0,1501	6,45	3,6477	9,84	0,1762	7,4	0,66	902	54,52	1560	81,64	2618	123,69	34
Grain: 151	20117	12	8	2,40	61,2	0,1463	6,58	3,3548	9,91	0,1663	7,4	0,66	880	54,34	1494	80,63	2521	124,51	35
Grain: 152	19837	11	8	2,18	61,7	0,1509	6,36	3,5326	9,77	0,1698	7,4	0,65	906	53,97	1535	80,46	2555	124,29	35
Grain: 153	18764	9	7	1,92	61,9	0,1371	6,48	3,1646	9,83	0,1674	7,4	0,66	828	50,57	1449	78,83	2531	124,05	33
Grain: 154	20266	10	8	2,54	62,6	0,1538	6,44	3,7419	9,83	0,1765	7,4	0,66	922	55,56	1580	81,96	2620	123,50	35
Grain: 147	21280	10	9	2,57	63,4	0,1539	6,53	3,8204	9,90	0,1800	7,4	0,66	923	56,41	1597	82,99	2653	123,44	35
Grain: 148	20243	9	8	2,26	63,8	0,1636	6,61	4,1772	9,98	0,1852	7,5	0,66	977	60,23	1670	85,21	2700	123,35	36
Grain: 150	22938	11	9	2,17	63,0	0,1501	6,45	3,6477	9,84	0,1762	7,4	0,66	902	54,52	1560	81,64	2618	123,69	34
Grain: 151	20117	12	8	2,40	61,2	0,1463	6,58	3,3548	9,91	0,1663	7,4	0,66	880	54,34	1494	80,63	2521	124,51	35
Grain: 152	19837	11	8	2,18	61,7	0,1509	6,36	3,5326	9,77	0,1698	7,4	0,65	906	53,97	1535	80,46	2555	124,29	35
Grain: 153	18764	9	7	1,92	61,9	0,1371	6,48	3,1646	9,83	0,1674	7,4	0,66	828	50,57	1449	78,83	2531	124,05	33
Grain: 154	20266	10	8	2,54	62,6	0,1538	6,44	3,7419	9,83	0,1765	7,4	0,66	922	55,56	1580	81,96	2620	123,50	35
Grain: 155	20210	12	9	1,77	58,8	0,1827	6,27	4,2660	9,76	0,1693	7,5	0,64	1082	62,77	1687	83,67	2551	125,34	42

grain	²⁰⁷ Pba (cps)	Ub (ppm)	Pbb (ppm)	<u>Thb</u> U	²⁰⁶ Pbcc (%)	²⁰⁶ Pbd ²³⁸ U	±2s (%)	²⁰⁷ Pbd ²³⁵ U	±2s (%)	²⁰⁷ Pbd ²⁰⁶ Pb	±2s (%)	rhoe	²⁰⁶ Pb ²³⁸ U	±2s (Ma)	²⁰⁷ Pb ²³⁵ U	±2s (Ma)	²⁰⁷ Pb ²⁰⁶ Pb	±2s (Ma)	disc (%)
Grain: 163	20942	9	8	3,48	64,0	0,1397	7,58	3,5828	10,63	0,1859	7,5	0,71	843	60,16	1546	88,14	2707	123,14	31
Grain: 164	23438	12	10	2,45	62,6	0,1777	6,84	4,9358	10,11	0,2015	7,4	0,68	1054	66,82	1808	89,12	2838	121,35	37
Grain: 165	20312	9	8	2,50	64,3	0,1495	6,68	3,9603	10,01	0,1921	7,4	0,67	898	56,28	1626	84,55	2760	122,30	33
Grain: 166	26153	18	11	1,84	57,9	0,1524	5,93	3,4693	9,44	0,1651	7,3	0,63	914	50,78	1520	77,31	2509	123,56	36
Grain: 167	20436	10	8	2,55	62,5	0,1552	6,92	3,9996	10,14	0,1869	7,4	0,68	930	60,23	1634	85,93	2715	122,24	34
Grain: 168	20548	11	9	2,65	62,1	0,1684	6,39	4,4179	9,82	0,1902	7,5	0,65	1003	59,67	1716	84,73	2744	122,56	37
Grain: 169	22311	10	9	1,98	63,1	0,1587	7,27	4,2290	10,40	0,1933	7,4	0,70	950	64,56	1680	89,22	2770	121,95	34
Grain: 170	21940	13	10	2,82	59,5	0,1554	6,97	3,7122	10,15	0,1732	7,4	0,69	931	60,73	1574	84,63	2589	123,13	36
Grain: 175	23675	11	10	2,93	62,5	0,1546	6,44	4,0287	9,82	0,1890	7,4	0,66	926	55,78	1640	83,22	2734	122,14	34
Grain: 177	20393	12	8	1,56	59,6	0,1524	6,15	3,5808	9,63	0,1704	7,4	0,64	914	52,66	1545	79,45	2562	123,91	36
Grain: 179	17592	9	7	2,62	62,2	0,1593	6,38	4,1826	9,79	0,1904	7,4	0,65	953	56,76	1671	83,56	2745	122,08	35
Grain: 180	18979	11	8	1,95	61,7	0,1544	6,35	3,8533	9,77	0,1810	7,4	0,65	926	55,00	1604	82,00	2662	123,04	35
Grain: 181	35316	26	23	2,10	51,4	0,2030	5,43	4,6398	9,09	0,1658	7,3	0,60	1191	59,36	1756	78,97	2515	122,60	47
Grain: 182	23270	11	9	1,37	63,3	0,1670	7,41	4,5667	10,49	0,1983	7,4	0,71	995	68,72	1743	91,39	2813	121,37	35
Grain: 184	19548	8	7	1,57	64,6	0,1528	6,72	4,1351	10,04	0,1963	7,5	0,67	917	57,70	1661	85,57	2795	121,97	33
Grain: 189	21685	10	9	2,69	64,2	0,1448	6,63	3,8310	9,97	0,1919	7,4	0,67	872	54,33	1599	83,63	2758	122,23	32
Grain: 190	21184	12	9	2,50	61,3	0,1412	6,33	3,4019	9,73	0,1748	7,4	0,65	851	50,68	1505	79,40	2604	123,19	33
Grain: 192	19034	10	8	2,53	63,3	0,1432	7,67	3,6696	10,69	0,1859	7,4	0,72	863	62,26	1565	89,06	2706	122,70	32
Grain: 193	22577	13	9	2,12	60,8	0,1421	6,27	3,4043	9,69	0,1737	7,4	0,65	857	50,52	1505	79,04	2594	123,15	33
Grain: 194	18508	10	8	1,87	62,2	0,1562	6,40	4,0067	9,81	0,1860	7,4	0,65	936	55,99	1636	83,01	2707	122,67	35
Grain: 197	17894	10	7	1,77	60,6	0,1354	6,36	3,1373	9,74	0,1680	7,4	0,65	819	49,06	1442	77,88	2538	123,70	32
Grain: 198	22302	10	9	2,28	63,1	0,1590	6,52	4,2276	9,90	0,1928	7,4	0,66	951	57,92	1679	84,71	2766	122,21	34
Grain: 199	19036	10	8	2,50	61,1	0,1490	6,35	3,6273	9,77	0,1766	7,4	0,65	895	53,25	1556	80,86	2621	123,47	34
Grain: 200	23174	9	9	2,95	64,1	0,1765	6,65	4,6745	9,98	0,1921	7,4	0,67	1048	64,59	1763	87,08	2760	122,17	38
Grain: 191	19193	12	8	1,90	59,9	0,1299	6,18	2,9226	9,62	0,1632	7,4	0,64	787	45,95	1388	75,54	2489	124,33	32
Grain: 178	18950	13	8	2,32	57,2	0,1294	5,87	2,6965	9,39	0,1511	7,3	0,63	785	43,54	1327	72,03	2358	125,06	33

Intercept age of 474 ± 34 Ma

grain	²⁰⁷ Pba (cps)	Ub (ppm)	Pbb (ppm)	<u>Thb</u> U	²⁰⁶ Pbcc (%)	²⁰⁶ Pbd ²³⁸ U	±2s (%)	²⁰⁷ Pbd ²³⁵ U	±2s (%)	²⁰⁷ Pbd ²⁰⁶ Pb	±2s (%)	rhoe	²⁰⁶ Pb ²³⁸ U	±2s (Ma)	²⁰⁷ Pb ²³⁵ U	±2s (Ma)	²⁰⁷ Pb ²⁰⁶ Pb	±2s (Ma)	disc (%)
Grain: 23	30631	14	9	1,65	57,6	0,1173	6,88	2,3778	10,03	0,1470	7,3	0,69	715	46,71	1236	74,37	2311	125,40	31
Grain: 24	25798	8	8	2,07	63,3	0,1791	6,44	4,9682	9,87	0,2012	7,5	0,65	1062	63,36	1814	87,05	2836	121,97	37
Grain: 25	28501	13	9	1,15	58,6	0,1300	6,43	2,7647	9,77	0,1542	7,4	0,66	788	47,86	1346	75,59	2394	125,14	33
Grain: 26	35790	10	10	2,43	65,6	0,1482	6,76	4,0433	10,06	0,1979	7,4	0,67	891	56,48	1643	85,36	2809	121,75	32
Grain: 27	27949	10	8	2,72	62,8	0,1494	6,36	3,7277	9,78	0,1810	7,4	0,65	898	53,50	1577	81,46	2662	123,07	34
Grain: 28	30247	11	9	2,55	63,0	0,1556	6,67	3,9487	10,00	0,1841	7,4	0,67	932	58,16	1624	84,44	2690	123,11	35
Grain: 29	26080	11	8	2,08	60,4	0,1322	6,54	2,9640	9,84	0,1627	7,4	0,66	800	49,38	1398	77,63	2483	124,11	32
Grain: 30	31662	12	10	2,63	61,8	0,1506	6,26	3,7264	9,69	0,1794	7,4	0,65	904	53,06	1577	80,73	2648	122,78	34
Grain: 31	32412	15	9	1,06	59,2	0,1220	6,08	2,6039	9,54	0,1548	7,3	0,64	742	42,76	1302	72,50	2400	124,92	31
Grain: 32	28252	11	9	2,55	61,8	0,1464	6,56	3,5347	9,90	0,1752	7,4	0,66	881	54,20	1535	81,51	2607	123,46	34
Grain: 34	31501	11	10	2,28	62,0	0,1568	6,38	3,8933	9,78	0,1801	7,4	0,65	939	55,93	1612	82,29	2654	123,08	35
Grain: 36	21756	9	7	1,94	62,3	0,1329	6,39	3,1162	9,78	0,1700	7,4	0,65	805	48,54	1437	78,07	2558	123,78	31
grain	²⁰⁷ Pba (cps)	Ub (ppm)	Pbb (ppm)	<u>Thb</u> U	²⁰⁶ Pbcc (%)	²⁰⁶ Pbd ²³⁸ U	±2s (%)	²⁰⁷ Pbd ²³⁵ U	±2s (%)	²⁰⁷ Pbd ²⁰⁶ Pb	±2s (%)	rhoe	²⁰⁶ Pb ²³⁸ U	±2s (Ma)	²⁰⁷ Pb ²³⁵ U	±2s (Ma)	²⁰⁷ Pb ²⁰⁶ Pb	±2s (Ma)	disc (%)

	(cps)	(ppm)	(ppm)	U	(%)	²³⁸ U	(%)	²³⁵ U	(%)	²⁰⁶ Pb	(%)		²³⁸ U	(Ma)	²³⁵ U	(Ma)	²⁰⁶ Pb	(Ma)	(%)
Grain: 37	18969	9	6	2,03	61,3	0,1180	6,50	2,5826	9,83	0,1587	7,4	0,66	719	44,41	1296	74,65	2442	124,87	29
Grain: 44	28522	16	9	1,82	57,5	0,1265	5,90	2,6123	9,43	0,1498	7,4	0,63	768	42,82	1304	71,71	2344	125,84	33
Grain: 51	27633	9	8	3,57	64,3	0,1577	6,93	4,2252	10,19	0,1944	7,5	0,68	944	61,16	1679	87,27	2779	122,30	34
Grain: 61	31644	14	10	2,25	58,4	0,1452	5,93	3,2108	9,47	0,1604	7,4	0,63	874	48,64	1460	76,10	2460	124,78	36
Grain: 63	30085	10	9	2,08	63,3	0,1471	6,57	3,7323	9,92	0,1840	7,4	0,66	885	54,56	1578	82,71	2689	122,81	33
Grain: 65	24687	10	8	1,76	61,9	0,1773	6,26	4,6292	9,75	0,1894	7,5	0,64	1052	61,06	1755	84,91	2737	123,10	38
Grain: 71	39432	16	12	2,81	59,6	0,1246	6,85	2,6546	10,08	0,1545	7,4	0,68	757	49,12	1316	77,21	2396	125,78	32
Grain: 75	21694	8	7	2,72	62,1	0,1538	6,41	3,8062	9,82	0,1795	7,4	0,65	922	55,28	1594	82,22	2648	123,54	35
Grain: 82	28569	11	9	2,52	62,1	0,1753	6,70	4,6009	10,03	0,1903	7,5	0,67	1041	64,76	1749	87,32	2745	122,73	38
Grain: 83	28079	10	9	2,56	63,1	0,1634	6,56	4,2850	9,93	0,1902	7,5	0,66	976	59,67	1690	85,23	2744	122,58	36
Grain: 89	28129	11	9	2,99	61,5	0,1503	6,22	3,6304	9,68	0,1752	7,4	0,64	903	52,63	1556	80,15	2608	123,53	35
Grain: 103	32571	14	11	2,58	59,2	0,1553	6,01	3,6292	9,54	0,1695	7,4	0,63	931	52,33	1556	78,92	2552	124,00	36
Grain: 104	27396	9	8	2,94	63,1	0,1532	6,93	3,9451	10,18	0,1868	7,5	0,68	919	59,66	1623	86,02	2714	122,96	34
Grain: 106	27848	8	8	2,36	65,0	0,1680	6,65	4,7230	10,01	0,2039	7,5	0,66	1001	61,93	1771	87,56	2858	121,82	35
Grain: 107	35864	10	11	2,78	64,2	0,1559	6,48	4,1166	9,87	0,1915	7,4	0,66	934	56,60	1658	83,98	2755	122,18	34
Grain: 111	32555	14	10	1,55	59,1	0,1361	9,58	3,0879	12,11	0,1645	7,4	0,79	823	74,41	1430	97,43	2503	124,74	33
Grain: 126	18465	7	5	1,09	63,6	0,1425	6,69	3,6696	9,99	0,1868	7,4	0,67	859	53,99	1565	83,04	2714	122,42	32
Grain: 136	30584	9	9	2,70	64,3	0,1649	6,55	4,5681	9,93	0,2009	7,5	0,66	984	60,09	1743	86,31	2833	121,75	35
Grain: 138	29209	10	9	2,72	63,2	0,1754	6,85	4,8792	10,13	0,2017	7,5	0,68	1042	66,21	1799	89,16	2840	121,68	37
Grain: 140	33243	13	10	1,33	60,3	0,1747	6,70	4,4293	10,05	0,1839	7,5	0,67	1038	64,53	1718	86,83	2688	123,77	39
Grain: 148	20243	9	8	2,26	63,8	0,1636	6,61	4,1772	9,98	0,1852	7,5	0,66	977	60,23	1670	85,21	2700	123,35	36
Grain: 150	22938	11	9	2,17	63,0	0,1501	6,45	3,6477	9,84	0,1762	7,4	0,66	902	54,52	1560	81,64	2618	123,69	34
Grain: 151	20117	12	8	2,40	61,2	0,1463	6,58	3,3548	9,91	0,1663	7,4	0,66	880	54,34	1494	80,63	2521	124,51	35
Grain: 152	19837	11	8	2,18	61,7	0,1509	6,36	3,5326	9,77	0,1698	7,4	0,65	906	53,97	1535	80,46	2555	124,29	35
Grain: 153	18764	9	7	1,92	61,9	0,1371	6,48	3,1646	9,83	0,1674	7,4	0,66	828	50,57	1449	78,83	2531	124,05	33
Grain: 154	20266	10	8	2,54	62,6	0,1538	6,44	3,7419	9,83	0,1765	7,4	0,66	922	55,56	1580	81,96	2620	123,50	35
Grain: 147	21280	10	9	2,57	63,4	0,1539	6,53	3,8204	9,90	0,1800	7,4	0,66	923	56,41	1597	82,99	2653	123,44	35
Grain: 148	20243	9	8	2,26	63,8	0,1636	6,61	4,1772	9,98	0,1852	7,5	0,66	977	60,23	1670	85,21	2700	123,35	36
Grain: 150	22938	11	9	2,17	63,0	0,1501	6,45	3,6477	9,84	0,1762	7,4	0,66	902	54,52	1560	81,64	2618	123,69	34
Grain: 151	20117	12	8	2,40	61,2	0,1463	6,58	3,3548	9,91	0,1663	7,4	0,66	880	54,34	1494	80,63	2521	124,51	35
Grain: 152	19837	11	8	2,18	61,7	0,1509	6,36	3,5326	9,77	0,1698	7,4	0,65	906	53,97	1535	80,46	2555	124,29	35
Grain: 153	18764	9	7	1,92	61,9	0,1371	6,48	3,1646	9,83	0,1674	7,4	0,66	828	50,57	1449	78,83	2531	124,05	33
Grain: 154	20266	10	8	2,54	62,6	0,1538	6,44	3,7419	9,83	0,1765	7,4	0,66	922	55,56	1580	81,96	2620	123,50	35
Grain: 156	20454	10	8	2,86	62,7	0,1494	6,56	3,5863	9,91	0,1741	7,4	0,66	898	55,17	1547	81,90	2597	123,90	35
Grain: 162	24867	13	10	2,05	61,0	0,1659	6,32	4,1814	9,76	0,1828	7,4	0,65	989	58,24	1670	83,30	2679	123,02	37
Grain: 163	20942	9	8	3,48	64,0	0,1397	7,58	3,5828	10,63	0,1859	7,5	0,71	843	60,16	1546	88,14	2707	123,14	31
Grain: 164	23438	12	10	2,45	62,6	0,1777	6,84	4,9358	10,11	0,2015	7,4	0,68	1054	66,82	1808	89,12	2838	121,35	37
Grain: 165	20312	9	8	2,50	64,3	0,1495	6,68	3,9603	10,01	0,1921	7,4	0,67	898	56,28	1626	84,55	2760	122,30	33
Grain: 166	26153	18	11	1,84	57,9	0,1524	5,93	3,4693	9,44	0,1651	7,3	0,63	914	50,78	1520	77,31	2509	123,56	36
Grain: 167	20436	10	8	2,55	62,5	0,1552	6,92	3,9996	10,14	0,1869	7,4	0,68	930	60,23	1634	85,93	2715	122,24	34
grain	²⁰⁷ Pba	Ub	Pbb	Thb	²⁰⁶ Pbcc	²⁰⁶ Pbd	±2s	²⁰⁷ Pbd	±2s	²⁰⁷ Pbd	±2s	rhoe	²⁰⁶ Pb	±2s	²⁰⁷ Pb	±2s	²⁰⁷ Pb	±2s	disc

	(cps)	(ppm)	(ppm)	U	(%)	²³⁸ U	(%)	²³⁵ U	(%)	²⁰⁶ Pb	(%)		²³⁸ U	(Ma)	²³⁵ U	(Ma)	²⁰⁶ Pb	(Ma)	(%)
Grain: 168	20548	11	9	2,65	62,1	0,1684	6,39	4,4179	9,82	0,1902	7,5	0,65	1003	59,67	1716	84,73	2744	122,56	37
Grain: 169	22311	10	9	1,98	63,1	0,1587	7,27	4,2290	10,40	0,1933	7,4	0,70	950	64,56	1680	89,22	2770	121,95	34
Grain: 170	21940	13	10	2,82	59,5	0,1554	6,97	3,7122	10,15	0,1732	7,4	0,69	931	60,73	1574	84,63	2589	123,13	36
Grain: 175	23675	11	10	2,93	62,5	0,1546	6,44	4,0287	9,82	0,1890	7,4	0,66	926	55,78	1640	83,22	2734	122,14	34
Grain: 177	20393	12	8	1,56	59,6	0,1524	6,15	3,5808	9,63	0,1704	7,4	0,64	914	52,66	1545	79,45	2562	123,91	36
Grain: 179	17592	9	7	2,62	62,2	0,1593	6,38	4,1826	9,79	0,1904	7,4	0,65	953	56,76	1671	83,56	2745	122,08	35
Grain: 180	18979	11	8	1,95	61,7	0,1544	6,35	3,8533	9,77	0,1810	7,4	0,65	926	55,00	1604	82,00	2662	123,04	35
Grain: 182	23270	11	9	1,37	63,3	0,1670	7,41	4,5667	10,49	0,1983	7,4	0,71	995	68,72	1743	91,39	2813	121,37	35
Grain: 184	19548	8	7	1,57	64,6	0,1528	6,72	4,1351	10,04	0,1963	7,5	0,67	917	57,70	1661	85,57	2795	121,97	33
Grain: 189	21685	10	9	2,69	64,2	0,1448	6,63	3,8310	9,97	0,1919	7,4	0,67	872	54,33	1599	83,63	2758	122,23	32
Grain: 190	21184	12	9	2,50	61,3	0,1412	6,33	3,4019	9,73	0,1748	7,4	0,65	851	50,68	1505	79,40	2604	123,19	33
Grain: 192	19034	10	8	2,53	63,3	0,1432	7,67	3,6696	10,69	0,1859	7,4	0,72	863	62,26	1565	89,06	2706	122,70	32
Grain: 193	22577	13	9	2,12	60,8	0,1421	6,27	3,4043	9,69	0,1737	7,4	0,65	857	50,52	1505	79,04	2594	123,15	33
Grain: 194	18508	10	8	1,87	62,2	0,1562	6,40	4,0067	9,81	0,1860	7,4	0,65	936	55,99	1636	83,01	2707	122,67	35
Grain: 197	17894	10	7	1,77	60,6	0,1354	6,36	3,1373	9,74	0,1680	7,4	0,65	819	49,06	1442	77,88	2538	123,70	32
Grain: 198	22302	10	9	2,28	63,1	0,1590	6,52	4,2276	9,90	0,1928	7,4	0,66	951	57,92	1679	84,71	2766	122,21	34
Grain: 199	19036	10	8	2,50	61,1	0,1490	6,35	3,6273	9,77	0,1766	7,4	0,65	895	53,25	1556	80,86	2621	123,47	34
Grain: 200	23174	9	9	2,95	64,1	0,1765	6,65	4,6745	9,98	0,1921	7,4	0,67	1048	64,59	1763	87,08	2760	122,17	38
Grain: 191	19193	12	8	1,90	59,9	0,1299	6,18	2,9226	9,62	0,1632	7,4	0,64	787	45,95	1388	75,54	2489	124,33	32
Grain: 178	18950	13	8	2,32	57,2	0,1294	5,87	2,6965	9,39	0,1511	7,3	0,63	785	43,54	1327	72,03	2358	125,06	33

LA-ICP-MS apatite U-Pb analytical results from sample R5Bt

All apatites grain	²⁰⁷ Pba (cps)	Ub (ppm)	Pbb (ppm)	Thb U	²⁰⁶ Pbcc (%)	²⁰⁶ Pbd ²³⁸ U	±2s (%)	²⁰⁷ Pbd ²³⁵ U	±2s (%)	²⁰⁷ Pbd ²⁰⁶ Pb	±2s (%)	rhoe	²⁰⁶ Pb ²³⁸ U	±2s (Ma)	²⁰⁷ Pb ²³⁵ U	±2s (Ma)	²⁰⁷ Pb ²⁰⁶ Pb	±2s (Ma)	disc (%)
SMP 18	25710	13	10	0,07	62,0	0,1534	6,33	3,6343	9,76	0,1719	7,43	0,65	920	54,49	1557	81	2576	124,07	36
SMP 10	35753	84	18	0,44	34,0	0,0939	3,46	1,0953	7,72	0,0846	6,90	0,45	579	19,16	751	42	1306	133,98	44
SMP 11	72538	136	31	0,29	42,4	0,0808	4,83	1,0450	8,53	0,0938	7,03	0,57	501	23,33	726	45	1504	132,92	33
SMP 13	30631	69	15	0,21	35,2	0,0917	3,55	1,0979	7,79	0,0868	6,94	0,46	566	19,24	752	42	1357	133,76	42
SMP 14	29456	60	14	0,27	36,9	0,0922	3,75	1,1310	7,92	0,0890	6,97	0,47	568	20,46	768	44	1404	133,60	41
SMP 15	27956	48	12	0,19	40,7	0,0813	4,20	1,0282	8,22	0,0918	7,07	0,51	504	20,36	718	43	1462	134,39	34
SMP 17	24873	58	12	0,19	34,5	0,0885	3,49	1,0305	7,74	0,0844	6,90	0,45	547	18,35	719	41	1302	134,07	42
SMP 20	22410	20	9	0,14	52,5	0,1193	5,34	2,1975	9,00	0,1336	7,25	0,59	726	36,77	1180	65	2146	126,63	34
SMP 21	28292	70	14	0,24	32,7	0,0938	3,32	1,1399	7,62	0,0881	6,86	0,44	578	18,39	772	42	1385	131,78	42
SMP 22	30337	59	14	0,20	37,7	0,0922	3,81	1,2133	7,97	0,0955	7,01	0,48	568	20,76	807	45	1537	131,80	37

All apatites	²⁰⁷ Pba	Ub	Pbb	Thb	²⁰⁶ Pbcc	²⁰⁶ Pbd	±2s	²⁰⁷ Pbd	±2s	²⁰⁷ Pbd	±2s	rhoe	²⁰⁶ Pb	±2s	²⁰⁷ Pb	±2s	²⁰⁷ Pb	±2s	disc
grain	(cps)	(ppm)	(ppm)	U	(%)	²³⁸ U	(%)	²³⁵ U	(%)	²⁰⁶ Pb	(%)		²³⁸ U	(Ma)	²³⁵ U	(Ma)	²⁰⁶ Pb	(Ma)	(%)
SMP 29	23789	24	10	0,13	51,1	0,1247	5,16	2,2446	8,90	0,1305	7,26	0,58	758	37,00	1195	65	2105	127,36	36
SMP 30	26104	30	12	0,14	48,4	0,1414	4,95	2,4715	8,86	0,1268	7,35	0,56	853	39,65	1264	66	2053	129,81	42
SMP 31	29274	63	14	0,19	35,1	0,0942	3,54	1,1888	7,77	0,0915	6,92	0,46	580	19,68	795	44	1457	131,51	40
SMP 32	28669	80	15	0,25	31,04	0,0886	3,15	1,0310	7,53	0,0844	6,84	0,42	547	16,54	719	40	1302	132,80	42
SMP 34	28389	21	11	0,06	55,9	0,1230	5,66	2,4699	9,25	0,1457	7,32	0,61	748	40,05	1263	69	2296	125,78	33
SMP 35	28609	63	13	0,24	35,3	0,0866	3,62	1,0958	7,81	0,0917	6,93	0,46	536	18,62	751	42	1462	131,63	37
SMP 36	29681	33	12	0,07	48,7	0,1090	4,92	1,7988	8,72	0,1197	7,20	0,56	667	31,26	1045	59	1952	128,62	34
SMP 44	28909	71	15	0,17	33,5	0,0963	3,41	1,1935	7,68	0,0899	6,88	0,44	593	19,33	798	43	1423	131,50	42
SMP 45	30870	99	17	0,16	28,2	0,0853	2,86	0,9413	7,38	0,0801	6,81	0,39	527	14,49	674	37	1199	134,22	44
SMP 46	35337	46	15	0,16	44,7	0,1103	4,81	1,6848	8,62	0,1108	7,16	0,56	675	30,90	1003	56	1812	130,01	37
SMP 47	45109	90	21	0,24	37,7	0,1004	3,97	1,3600	7,94	0,0982	6,87	0,50	617	23,42	872	48	1590	128,38	39
SMP 48	32005	55	14	0,17	41,0	0,0954	4,30	1,3258	8,26	0,1007	7,05	0,52	588	24,19	857	49	1638	130,92	36
SMP 49	26640	54	12	0,18	36,9	0,0941	3,77	1,2076	8,01	0,0931	7,08	0,47	580	20,90	804	46	1490	133,95	39
SMP 50	29227	54	14	0,21	38,7	0,1034	4,04	1,4020	8,13	0,0983	7,05	0,50	634	24,43	890	49	1592	131,76	40
SMP 51	33052	69	16	0,13	36,6	0,0973	3,70	1,2590	7,93	0,0938	7,01	0,47	599	21,16	827	46	1505	132,51	40
SMP 52	31926	66	19	0,20	35,1	0,1501	3,65	2,1598	8,06	0,1044	7,18	0,45	902	30,76	1168	58	1703	132,27	53
SMP 53	30450	81	16	0,20	31,0	0,0945	3,14	1,1211	7,49	0,0861	6,80	0,42	582	17,48	763	41	1340	131,39	43
Intercept age of 504± 14 Ma																			
grain	²⁰⁷ Pba	Ub	Pbb	Thb	²⁰⁶ Pbcc	²⁰⁶ Pbd	±2s	²⁰⁷ Pbd	±2s	²⁰⁷ Pbd	±2s	rhoe	²⁰⁶ Pb	±2s	²⁰⁷ Pb	±2s	²⁰⁷ Pb	±2s	disc
	(cps)	(ppm)	(ppm)	U	(%)	²³⁸ U	(%)	²³⁵ U	(%)	²⁰⁶ Pb	(%)		²³⁸ U	(Ma)	²³⁵ U	(Ma)	²⁰⁶ Pb	(Ma)	(%)
SMP 18	25710	13	10	0,07	62,0	0,1534	6,33	3,6343	9,76	0,1719	7,43	0,65	920	54,49	1557	81	2576	124,07	36
SMP 10	35753	84	18	0,44	34,0	0,0939	3,46	1,0953	7,72	0,0846	6,90	0,45	579	19,16	751	42	1306	133,98	44
SMP 11	72538	136	31	0,29	42,4	0,0808	4,83	1,0450	8,53	0,0938	7,03	0,57	501	23,33	726	45	1504	132,92	33
SMP 13	30631	69	15	0,21	35,2	0,0917	3,55	1,0979	7,79	0,0868	6,94	0,46	566	19,24	752	42	1357	133,76	42
SMP 14	29456	60	14	0,27	36,9	0,0922	3,75	1,1310	7,92	0,0890	6,97	0,47	568	20,46	768	44	1404	133,60	41

grain	²⁰⁷ Pba	Ub	Pbb	Thb	²⁰⁶ Pbcc	²⁰⁶ Pbd	±2s	²⁰⁷ Pbd	±2s	²⁰⁷ Pbd	±2s	rhoe	²⁰⁶ Pb	±2s	²⁰⁷ Pb	±2s	²⁰⁷ Pb	±2s	disc
	(cps)	(ppm)	(ppm)	U	(%)	²³⁸ U	(%)	²³⁵ U	(%)	²⁰⁶ Pb	(%)		²³⁸ U	(Ma)	²³⁵ U	(Ma)	²⁰⁶ Pb	(Ma)	(%)
SMP 20	22410	20	9	0,14	52,5	0,1193	5,34	2,1975	9,00	0,1336	7,25	0,59	726	36,77	1180	65	2146	126,63	34
SMP 21	28292	70	14	0,24	32,7	0,0938	3,32	1,1399	7,62	0,0881	6,86	0,44	578	18,39	772	42	1385	131,78	42
SMP 22	30337	59	14	0,20	37,7	0,0922	3,81	1,2133	7,97	0,0955	7,01	0,48	568	20,76	807	45	1537	131,80	37
SMP 27	26593	56	13	0,20	36,3	0,1005	3,66	1,2767	7,88	0,0921	6,98	0,46	617	21,57	835	46	1470	132,43	42
SMP 28	28781	53	13	0,22	38,8	0,1042	3,93	1,4445	8,05	0,1006	7,03	0,49	639	23,92	908	50	1634	130,60	39
SMP 29	23789	24	10	0,13	51,1	0,1247	5,16	2,2446	8,90	0,1305	7,26	0,58	758	37,00	1195	65	2105	127,36	36
SMP 30	26104	30	12	0,14	48,4	0,1414	4,95	2,4715	8,86	0,1268	7,35	0,56	853	39,65	1264	66	2053	129,81	42
SMP 31	29274	63	14	0,19	35,1	0,0942	3,54	1,1888	7,77	0,0915	6,92	0,46	580	19,68	795	44	1457	131,51	40
SMP 32	28669	80	15	0,25	31,04	0,0886	3,15	1,0310	7,53	0,0844	6,84	0,42	547	16,54	719	40	1302	132,80	42
SMP 34	28389	21	11	0,06	55,9	0,1230	5,66	2,4699	9,25	0,1457	7,32	0,61	748	40,05	1263	69	2296	125,78	33
SMP 35	28609	63	13	0,24	35,3	0,0866	3,62	1,0958	7,81	0,0917	6,93	0,46	536	18,62	751	42	1462	131,63	37
SMP 36	29681	33	12	0,07	48,7	0,1090	4,92	1,7988	8,72	0,1197	7,20	0,56	667	31,26	1045	59	1952	128,62	34
SMP 44	28909	71	15	0,17	33,5	0,0963	3,41	1,1935	7,68	0,0899	6,88	0,44	593	19,33	798	43	1423	131,50	42
SMP 45	30870	99	17	0,16	28,2	0,0853	2,86	0,9413	7,38	0,0801	6,81	0,39	527	14,49	674	37	1199	134,22	44
SMP 46	35337	46	15	0,16	44,7	0,1103	4,81	1,6848	8,62	0,1108	7,16	0,56	675	30,90	1003	56	1812	130,01	37
SMP 47	45109	90	21	0,24	37,7	0,1004	3,97	1,3600	7,94	0,0982	6,87	0,50	617	23,42	872	48	1590	128,38	39
SMP 48	32005	55	14	0,17	41,0	0,0954	4,30	1,3258	8,26	0,1007	7,05	0,52	588	24,19	857	49	1638	130,92	36
SMP 49	26640	54	12	0,18	36,9	0,0941	3,77	1,2076	8,01	0,0931	7,08	0,47	580	20,90	804	46	1490	133,95	39
SMP 50	29227	54	14	0,21	38,7	0,1034	4,04	1,4020	8,13	0,0983	7,05	0,50	634	24,43	890	49	1592	131,76	40
SMP 51	33052	69	16	0,13	36,6	0,0973	3,70	1,2590	7,93	0,0938	7,01	0,47	599	21,16	827	46	1505	132,51	40
SMP 53	30450	81	16	0,20	31,0	0,0945	3,14	1,1211	7,49	0,0861	6,80	0,42	582	17,48	763	41	1340	131,39	43

LA-ICP-MS apatite U-Pb analytical results from sample R5Mb

All apatites

grain	²⁰⁷ Pb ^a (cps)	U ^b (ppm)	Pb ^b (ppm)	Th ^b U	²⁰⁶ Pb ^c (%)	²⁰⁶ Pb ^d ²³⁸ U	±2s (%)	²⁰⁷ Pb ^d ²³⁵ U	±2s (%)	²⁰⁷ Pb ^d ²⁰⁶ Pb	±2s (%)	rhoe	²⁰⁶ Pb ^e ²³⁸ U	±2s (Ma)	²⁰⁷ Pb ^e ²³⁵ U	±2s (Ma)	²⁰⁷ Pb ^f ²⁰⁶ Pb	±2s (Ma)	disc (%)
SMP 99	23944	89	14	0,02	24,3	0,0889	2,47	0,9475	6,99	0,0773	6,54	0,35	549	13,01	677	35,15	1129	130,32	49
SMP 98	22714	28	10	0,03	45,8	0,1185	4,85	1,8952	8,67	0,1160	7,19	0,56	722	33,17	1079	59,35	1896	129,36	38
SMP 97	30979	54	14	0,11	38,8	0,1122	3,92	1,5660	8,07	0,1012	7,06	0,49	686	25,54	957	51,30	1646	130,91	42
SMP 96	33303	28	14	0,04	51,1	0,1496	5,14	2,9028	8,92	0,1407	7,28	0,58	899	43,29	1383	69,67	2236	126,01	40
SMP 88	32682	99	16	0,12	28,4	0,0799	2,87	0,8725	7,39	0,0792	6,81	0,39	496	13,73	637	35,60	1177	134,76	42
SMP 87	24565	24	10	0,02	48,8	0,1360	5,05	2,4235	8,82	0,1292	7,24	0,57	822	39,06	1250	65,47	2087	127,26	39
SMP 86	29341	60	13	0,01	35,5	0,0949	3,58	1,1363	7,80	0,0869	6,93	0,46	584	20,04	771	43,01	1357	133,51	43
SMP 84	26679	54	12	0,03	35,8	0,0957	3,72	1,1548	7,88	0,0875	6,94	0,47	589	21,01	780	43,81	1371	133,61	43
SMP 83	29045	80	14	0,02	29,4	0,0900	2,97	0,9699	7,38	0,0782	6,76	0,40	555	15,80	688	37,59	1152	134,20	48
SMP 82	29341	36	12	0,05	45,2	0,1126	4,94	1,6653	8,67	0,1073	7,12	0,57	688	32,30	995	56,54	1753	130,36	39
SMP 81	22287	25	9	0,03	47,4	0,1083	4,83	1,6461	8,65	0,1103	7,18	0,56	663	30,49	988	56,17	1804	130,51	37
SMP 80	27360	67	13	0,12	32,0	0,0920	3,23	1,0339	7,56	0,0815	6,83	0,43	567	17,53	721	39,76	1235	134,01	46
SMP 79	25904	41	11	0,09	40,2	0,0940	4,06	1,2151	8,15	0,0937	7,06	0,50	579	22,55	808	46,44	1503	133,51	39
SMP 78	31383	49	13	0,01	40,6	0,1026	4,09	1,3551	8,16	0,0958	7,06	0,50	630	24,57	870	48,83	1544	132,74	41
SMP 142	23116	41	11	0,03	38,9	0,1051	3,97	1,4482	8,07	0,0999	7,02	0,49	644	24,40	909	49,66	1622	130,69	40
SMP 141	26645	56	13	0,09	35,3	0,1025	3,59	1,3303	7,75	0,0941	6,87	0,46	629	21,54	859	45,94	1510	129,68	42
SMP 140	25855	40	12	0,02	41,0	0,1193	4,15	1,7306	8,22	0,1052	7,09	0,51	726	28,60	1020	54,30	1718	130,27	42
SMP 139	18451	14	7	0,02	52,9	0,1396	5,40	2,7473	9,09	0,1427	7,32	0,59	842	42,77	1341	70,05	2260	126,27	37
SMP 138	23319	38	11	0,12	40,6	0,1187	4,10	1,7235	8,20	0,1054	7,10	0,50	723	28,10	1017	54,12	1721	130,53	42
SMP 137	22652	63	11	0,05	30,4	0,0895	3,11	1,0296	7,53	0,0835	6,86	0,41	552	16,48	719	39,55	1280	133,66	43
SMP 136	23358	28	10	0,00	45,6	0,1244	4,62	2,0269	8,54	0,1182	7,19	0,54	756	33,04	1125	59,81	1928	128,71	39
SMP 135	27621	66	13	0,05	32,5	0,0891	3,30	1,0666	7,60	0,0868	6,85	0,43	550	17,41	737	40,64	1356	132,08	41
SMP 125	26061	50	12	0,02	36,6	0,1057	3,73	1,4054	7,95	0,0965	7,02	0,47	647	23,04	891	48,29	1557	131,68	42
SMP 124	21982	21	9	0,01	48,7	0,1509	4,93	2,8020	8,77	0,1347	7,25	0,56	906	41,81	1356	67,86	2160	126,56	42
SMP 123	27501	98	16	0,05	24,6	0,0933	2,48	1,0139	6,96	0,0788	6,50	0,36	575	13,69	711	36,20	1167	128,73	49
SMP 122	21236	40	10	0,04	36,8	0,0967	3,72	1,2629	7,89	0,0947	6,95	0,47	595	21,18	829	45,69	1522	131,05	39
SMP 122	21236	40	10	0,04	36,8	0,0967	3,72	1,2629	7,89	0,0947	6,95	0,47	595	21,18	829	45,69	1522	131,05	39

grain	²⁰⁷ Pb ^a (cps)	Ub (ppm)	Pbb (ppm)	Thb U	²⁰⁶ Pb _{cc} (%)	²⁰⁶ Pb _d ²³⁸ U	±2s (%)	²⁰⁷ Pb _d ²³⁵ U	±2s (%)	²⁰⁷ Pb _d ²⁰⁶ Pb	±2s (%)	rhoe	²⁰⁶ Pb ²³⁸ U	±2s (Ma)	²⁰⁷ Pb ²³⁵ U	±2s (Ma)	²⁰⁷ Pb ²⁰⁶ Pb	±2s (Ma)	disc (%)
SMP 120	26200	71	12	0,02	30,1	0,0800	3,86	0,9913	7,83	0,0899	6,81	0,49	496	18,45	699	40,35	1423	130,10	35
SMP 119	25651	35	11	0,02	43,3	0,1134	4,37	1,7137	8,35	0,1096	7,12	0,52	693	28,73	1014	55,02	1792	129,67	39
SMP 118	24875	168	43	3,37	7,7	0,0993	14,79	0,9829	15,64	0,0718	5,08	0,95	611	86,76	695	81,94	979	103,48	62
SMP 117	29082	73	15	0,04	31,7	0,0978	3,22	1,1822	7,54	0,0877	6,82	0,43	602	18,51	792	42,37	1375	131,22	44
SMP 116	37679	87	18	0,15	33,8	0,0907	3,43	1,1357	7,70	0,0908	6,90	0,45	560	18,42	770	42,48	1443	131,43	39
SMP 115	23950	39	12	0,03	34,0	0,1340	5,28	1,6979	8,76	0,0919	6,99	0,60	811	40,36	1008	57,60	1465	132,85	55
SMP 107	25148	32	11	0,04	44,0	0,1200	4,45	1,8801	8,41	0,1136	7,14	0,53	731	30,79	1074	57,36	1858	129,04	39
SMP 106	25784	51	13	0,06	36,5	0,1213	3,72	1,6755	7,94	0,1002	7,02	0,47	738	25,98	999	51,81	1627	130,53	45
SMP 105	30469	30	13	0,15	48,1	0,1301	4,84	2,2606	8,69	0,1261	7,21	0,56	788	36,02	1200	63,08	2044	127,49	39
SMP 104	26546	28	11	0,05	47,7	0,1271	4,81	2,1755	8,67	0,1242	7,21	0,55	771	35,06	1173	62,17	2017	127,86	38
SMP 103	25705	55	13	0,05	34,3	0,1091	3,57	1,3559	7,76	0,0901	6,89	0,46	667	22,66	870	46,38	1429	131,52	47
SMP 102	27635	48	13	0,10	38,9	0,1091	3,92	1,5226	8,04	0,1012	7,01	0,49	667	24,89	940	50,48	1647	130,10	41
SMP 101	32665	59	15	0,03	38,0	0,1068	3,87	1,4561	8,01	0,0989	7,02	0,48	654	24,13	912	49,42	1604	130,84	41
SMP 100	25203	70	13	0,05	29,5	0,0999	2,99	1,1720	7,40	0,0851	6,77	0,40	614	17,54	788	41,40	1317	131,31	47

Intercept age of 489 ± 19 Ma

grain	²⁰⁷ Pb ^a (cps)	Ub (ppm)	Pbb (ppm)	Thb U	²⁰⁶ Pb _{cc} (%)	²⁰⁶ Pb _d ²³⁸ U	±2s (%)	²⁰⁷ Pb _d ²³⁵ U	±2s (%)	²⁰⁷ Pb _d ²⁰⁶ Pb	±2s (%)	rhoe	²⁰⁶ Pb ²³⁸ U	±2s (Ma)	²⁰⁷ Pb ²³⁵ U	±2s (Ma)	²⁰⁷ Pb ²⁰⁶ Pb	±2s (Ma)	disc (%)
SMP 99	23944	89	14	0,02	24,3	0,0889	2,47	0,9475	6,99	0,0773	6,54	0,35	549	13,01	677	35,15	1129	130,32	49
SMP 98	22714	28	10	0,03	45,8	0,1185	4,85	1,8952	8,67	0,1160	7,19	0,56	722	33,17	1079	59,35	1896	129,36	38
SMP 97	30979	54	14	0,11	38,8	0,1122	3,92	1,5660	8,07	0,1012	7,06	0,49	686	25,54	957	51,30	1646	130,91	42
SMP 96	33303	28	14	0,04	51,1	0,1496	5,14	2,9028	8,92	0,1407	7,28	0,58	899	43,29	1383	69,67	2236	126,01	40
SMP 87	24565	24	10	0,02	48,8	0,1360	5,05	2,4235	8,82	0,1292	7,24	0,57	822	39,06	1250	65,47	2087	127,26	39
SMP 86	29341	60	13	0,01	35,5	0,0949	3,58	1,1363	7,80	0,0869	6,93	0,46	584	20,04	771	43,01	1357	133,51	43
SMP 84	26679	54	12	0,03	35,8	0,0957	3,72	1,1548	7,88	0,0875	6,94	0,47	589	21,01	780	43,81	1371	133,61	43
SMP 83	29045	80	14	0,02	29,4	0,0900	2,97	0,9699	7,38	0,0782	6,76	0,40	555	15,80	688	37,59	1152	134,20	48
SMP 82	29341	36	12	0,05	45,2	0,1126	4,94	1,6653	8,67	0,1073	7,12	0,57	688	32,30	995	56,54	1753	130,36	39
SMP 81	22287	25	9	0,03	47,4	0,1083	4,83	1,6461	8,65	0,1103	7,18	0,56	663	30,49	988	56,17	1804	130,51	37
SMP 80	27360	67	13	0,12	32,0	0,0920	3,23	1,0339	7,56	0,0815	6,83	0,43	567	17,53	721	39,76	1235	134,01	46

grain	²⁰⁷ Pba	Ub	Pbb	Thb	²⁰⁶ Pbcc	²⁰⁶ Pbd	±2s	²⁰⁷ Pbd	±2s	²⁰⁷ Pbd	±2s	rhoe	²⁰⁶ Pb	±2s	²⁰⁷ Pb	±2s	²⁰⁷ Pb	±2s	disc
	(cps)	(ppm)	(ppm)	U	(%)	²³⁸ U	(%)	²³⁵ U	(%)	²⁰⁶ Pb	(%)		²³⁸ U	(Ma)	²³⁵ U	(Ma)	²⁰⁶ Pb	(Ma)	(%)
SMP 142	23116	41	11	0,03	38,9	0,1051	3,97	1,4482	8,07	0,0999	7,02	0,49	644	24,40	909	49,66	1622	130,69	40
SMP 141	26645	56	13	0,09	35,3	0,1025	3,59	1,3303	7,75	0,0941	6,87	0,46	629	21,54	859	45,94	1510	129,68	42
SMP 140	25855	40	12	0,02	41,0	0,1193	4,15	1,7306	8,22	0,1052	7,09	0,51	726	28,60	1020	54,30	1718	130,27	42
SMP 139	18451	14	7	0,02	52,9	0,1396	5,40	2,7473	9,09	0,1427	7,32	0,59	842	42,77	1341	70,05	2260	126,27	37
SMP 138	23319	38	11	0,12	40,6	0,1187	4,10	1,7235	8,20	0,1054	7,10	0,50	723	28,10	1017	54,12	1721	130,53	42
SMP 137	22652	63	11	0,05	30,4	0,0895	3,11	1,0296	7,53	0,0835	6,86	0,41	552	16,48	719	39,55	1280	133,66	43
SMP 136	23358	28	10	0,00	45,6	0,1244	4,62	2,0269	8,54	0,1182	7,19	0,54	756	33,04	1125	59,81	1928	128,71	39
SMP 135	27621	66	13	0,05	32,5	0,0891	3,30	1,0666	7,60	0,0868	6,85	0,43	550	17,41	737	40,64	1356	132,08	41
SMP 125	26061	50	12	0,02	36,6	0,1057	3,73	1,4054	7,95	0,0965	7,02	0,47	647	23,04	891	48,29	1557	131,68	42
SMP 124	21982	21	9	0,01	48,7	0,1509	4,93	2,8020	8,77	0,1347	7,25	0,56	906	41,81	1356	67,86	2160	126,56	42
SMP 123	27501	98	16	0,05	24,6	0,0933	2,48	1,0139	6,96	0,0788	6,50	0,36	575	13,69	711	36,20	1167	128,73	49
SMP 122	21236	40	10	0,04	36,8	0,0967	3,72	1,2629	7,89	0,0947	6,95	0,47	595	21,18	829	45,69	1522	131,05	39
SMP 122	21236	40	10	0,04	36,8	0,0967	3,72	1,2629	7,89	0,0947	6,95	0,47	595	21,18	829	45,69	1522	131,05	39
SMP 122	21236	40	10	0,04	36,8	0,0967	3,72	1,2626	7,88	0,0947	6,95	0,47	595	21,18	829	45,69	1522	131,06	39
SMP 121	32233	32	13	0,11	48,6	0,1286	4,90	2,2391	8,72	0,1263	7,21	0,56	780	36,07	1193	63,12	2047	127,44	38
SMP 119	25651	35	11	0,02	43,3	0,1134	4,37	1,7137	8,35	0,1096	7,12	0,52	693	28,73	1014	55,02	1792	129,67	39
SMP 117	29082	73	15	0,04	31,7	0,0978	3,22	1,1822	7,54	0,0877	6,82	0,43	602	18,51	792	42,37	1375	131,22	44
SMP 116	37679	87	18	0,15	33,8	0,0907	3,43	1,1357	7,70	0,0908	6,90	0,45	560	18,42	770	42,48	1443	131,43	39
SMP 107	25148	32	11	0,04	44,0	0,1200	4,45	1,8801	8,41	0,1136	7,14	0,53	731	30,79	1074	57,36	1858	129,04	39
SMP 106	25784	51	13	0,06	36,5	0,1213	3,72	1,6755	7,94	0,1002	7,02	0,47	738	25,98	999	51,81	1627	130,53	45
SMP 105	30469	30	13	0,15	48,1	0,1301	4,84	2,2606	8,69	0,1261	7,21	0,56	788	36,02	1200	63,08	2044	127,49	39
SMP 104	26546	28	11	0,05	47,7	0,1271	4,81	2,1755	8,67	0,1242	7,21	0,55	771	35,06	1173	62,17	2017	127,86	38
SMP 103	25705	55	13	0,05	34,3	0,1091	3,57	1,3559	7,76	0,0901	6,89	0,46	667	22,66	870	46,38	1429	131,52	47
SMP 102	27635	48	13	0,10	38,9	0,1091	3,92	1,5226	8,04	0,1012	7,01	0,49	667	24,89	940	50,48	1647	130,10	41
SMP 101	32665	59	15	0,03	38,0	0,1068	3,87	1,4561	8,01	0,0989	7,02	0,48	654	24,13	912	49,42	1604	130,84	41
SMP 100	25203	70	13	0,05	29,5	0,0999	2,99	1,1720	7,40	0,0851	6,77	0,40	614	17,54	788	41,40	1317	131,31	47

