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## The Siderian-Orosirian magmatism in the Archean Gavião Paleoplate, Brazil: U-Pb geochronology, geochemistry and tectonic implications

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# Accepted Manuscript

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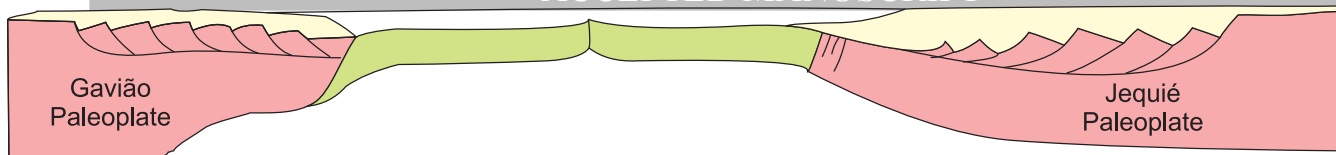
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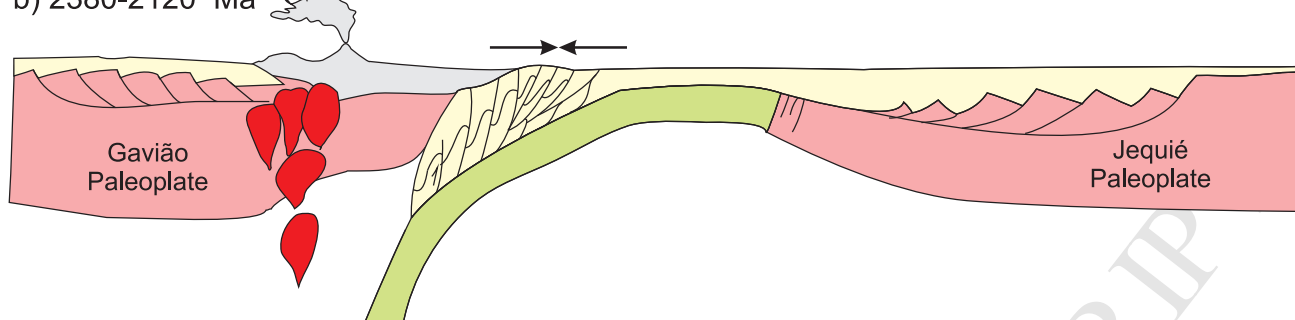


a) 2400 - 2330 (?) Ma

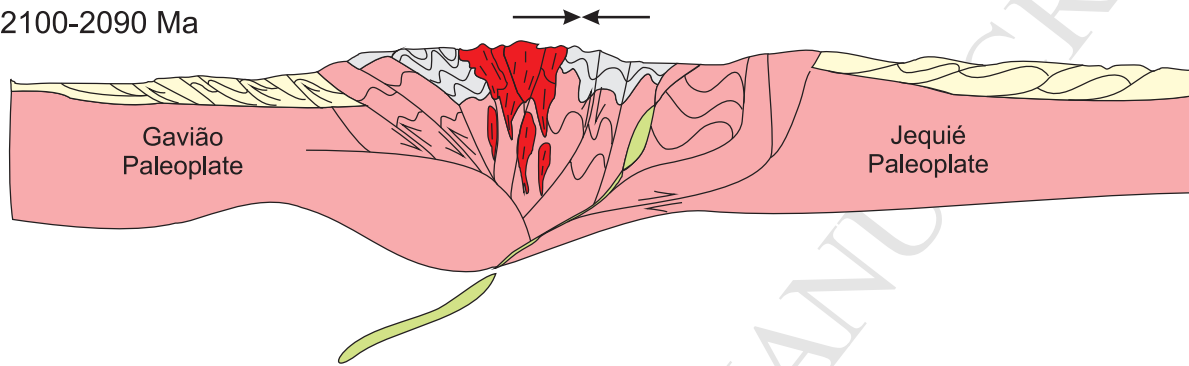
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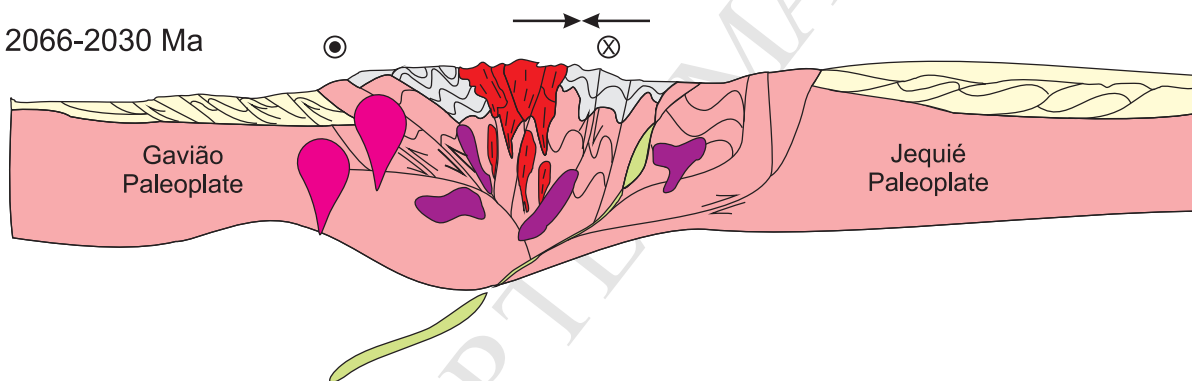
b) 2380-2120 Ma



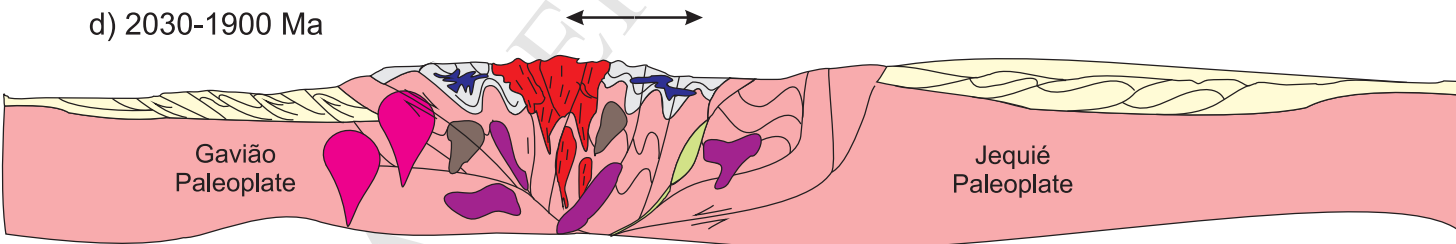
c) 2100-2090 Ma



d) 2066-2030 Ma



d) 2030-1900 Ma



Legend

- Calc-alkali, alkali-calcic to alkali granitoids (Grupo 2d)
- Alkali-calcic to alkali granitoids (Grupo 2c)
- Alkali-calcic to alkali granitoids (Grupo 2b)
- Alkali to alkali – calcic granitoids (Group 2a)
- Calcic to calc-alkalic, pre-collisional granitoids (Group 1)
- Metavolcanosedimentary rocks associated with Siderian-Riacian magmatic arc
- Syn to pre-collisional metasedimentary rocks
- Oceanic crust
- Archean orthogneisses

→← Regional shortening domain

↔ Regional stretching domain

⊗ ⊙ sinistral movement

↖↗ reverse movement

↗↖ normal movement

1 **The Siderian-Orosirian magmatism in the Archean Gavião Paleoplate, Brazil: U-Pb**  
2 **geochronology, geochemistry and tectonic implications**

3  
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28  
29 **Abstract**

30 The southern portion of the Gavião Paleoplate is composed by Archean orthogneisses,  
31 Archean-Paleoproterozoic metavolcano-sedimentary rocks and Siderian-Rhyacian-Orosirian  
32 granitoids. Petrographic, geochemical, U-Pb (Laser Ablation, ICPMS) and Sm-Nd data are



33 presented for five Paleoproterozoic granitoids that were recently mapped: Jussiape II, Lagoa  
34 das Almas, Humaitá, Belo Campo and Broco granitoids. These granitoids present U-Pb zircon  
1 34 (LA-ICPMS) ages of  $2,052 \pm 43$ ,  $2,114 \pm 24$ ,  $2,140 \pm 9$ ,  $2,049 \pm 23$  and  $2,038 \pm 8$  Ma,  
2 35 (LA-ICPMS) ages of  $2,052 \pm 43$ ,  $2,114 \pm 24$ ,  $2,140 \pm 9$ ,  $2,049 \pm 23$  and  $2,038 \pm 8$  Ma,  
3 436 respectively. In addition to these granitoids, another twenty-five ones were identified and  
5 637 studied by several authors, resulting in a total of twenty-nine plutons. Despite the previous  
7 838 petrography, geochemistry and geochronology studies that have been performed, no model  
9 39 had been proposed to explain the tectonic setting of this extensive granitogenesis. Integration  
10 40 Integration of the new data and the literature has been done and corresponds to the second  
11 40 part of the article. Based on U-Pb dating and geochemical data, Siderian-Rhyacian-Orosirian  
12 1341 granitoids of the southern Gavião Paleoplate were classified into five groups, or five suites: 1  
13 142 (2,324  $\pm$  6 to 2,091 $\pm$ 6.6 Ma), 2a (2,054 -6/+8 to 2,041 $\pm$ 23 Ma), 2b (2,066 $\pm$ 37 to 2,019 $\pm$ 32  
14 1743 Ma), 2c (2,058  $\pm$ 8 to 1,852 $\pm$ 50 Ma) and 2d (2,049 $\pm$ 12 to 1,929 $\pm$ 16 Ma). The granitoids of  
15 18 44 Group 1 present heterogeneous deformation, while the granitoids of groups 2a to 2d are  
16 19 44 generally not deformed. Usually the rocks are potassic, but sodic granitic rocks can be found  
17 20 45 in samples of groups 1, 2c and 2d. Several chemical classification parameters are presented  
18 21 45 and discussed herein, but it is noteworthy that the granitoids of Group 1 are mainly classified  
19 22 46 as calcic to calc-alkalic, while the rocks of the second group are mostly classified as alkalic  
20 23 46 ones. In the remaining groups, the samples vary between calc-alkalic and alkali-calcic. The  
21 24 47  $\epsilon_{Nd}$  values range between 4.0 and -15.4 and suggest an important and varied share of the  
22 25 47 continental crust in the formation of these rocks. The Humaitá granitoid probably presents the  
23 26 48 lowest contribution from the continental crust in its genesis. The rocks from Group 1 were  
24 27 49 generated as the product of an active continental margin arc situated eastwards from the  
25 28 49 southern portion of the Gavião Paleoplate. The spatial distribution between the granitoids of  
26 29 50 groups 1 and 2a suggests westwards subduction and led to a cordilleran model for the Western  
27 30 50 Bahia Magmatic Arc. Continental collision between the Gavião and Jequié paleoplates  
28 31 51 occurred around 2.09 Ga and was followed by the setting of late-collision granitoids of groups  
29 32 51 2a to 2d. The comparison between the tectonic model presented in this study and other  
30 33 52 existing models that explain the Siderian-Rhyacian-Orosirian granitogenesis of the Mineiro  
31 34 52 Belt and Mantiqueira Complex suggests a continuation of the Western Bahia Magmatic Arc  
32 35 53 and of the collisional orogen that followed, towards the south. The Western Bahia Magmatic  
33 36 53 Arc emplacement occurred before the Paleoproterozoic granitogenesis of the Serrinha (Bahia-  
34 37 54 Brazil) and Congo (Africa) paleoplates.

65 **Keywords:** granitoids, Siderian-Orosirian, Gavião Paleoplate, São Francisco Craton.

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## 1. Introduction

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### Figure 1

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The northern portion of the São Francisco Craton is instead composed of four tectonic units, denominated herein for the first time as the Gavião, Jequié, Serrinha, and Uauá paleoplates (Fig. 1). These paleoplates are composed of Archean nuclei (Bastos Leal et al. 1998, Santos Pinto et al. 1998, 2012, Cruz et al. 2012) and Siderian-Orosirian accretions (see synthesis in Silva et al. 2002a, Barbosa et al., 2012 and discussion of the present study). They were involved in Paleoproterozoic collisions that resulted in the Itabuna-Salvador-Curaçá orogen (Barbosa and Sabaté 2002, 2004) in the eastern part of the São Francisco Craton, with a metamorphic peak reaching the granulite facies ca. 2150-2050 Ma (Silva et al. 1997, 2002a, Barbosa and Sabaté, 2002, 2004; Peucat et al., 2011). As a consequence of its previous residence in Gondwana, the São Francisco Craton has an African counterpart (Fig. 1), which is represented by the Congo Craton (Alkmim and Martins Neto 2012). The counterpart of this orogen in the Congo Craton is the West Central African Belt (Trompette, 1994; Feybesse et al., 1998). Both crustal segments were connected until the Early Cretaceous, when West Gondwana started to split apart within the context of Pangaea breakup (Porada, 1989; Trompette, 1994; Ledru et al., 1994; Feybesse et al., 1998; Pedrosa Soares et al., 1992, 2001, Silva et al., 2008).

The Gavião Paleoplate was previously defined by Barbosa and Sabaté (2002, 2004) and Souza et al. (2003) as the Gavião Block. It consists of Archean tonalitic, granodioritic and granitic gneisses and migmatites exposed together with Archean metavolcanosedimentary sequences (Figs. 1 and 2). In the southern Gavião Paleoplate, these units are intruded by Siderian/Rhyacian (2.38 to 2.05 Ga) and Orosirian (2.05 to 1.80 Ga) granitoids as batholiths, dikes and stocks. This extensive granitogenesis in the southern region of the Gavião Paleoplate has been described in studies carried out by several authors, among which are Santos Pinto et al. (1998, 2012), Rosa (1999), Arcanjo et al. (2005), Leal et al. (2005), Guimarães et al. (2005), Loureiro et al. (2010) and Barbosa et al. (2012). However, despite the detailed petrography, geochemistry and geochronology studies that exist, none has integrated these data with the intention of elaborating an evolution model to explain the

98 tectonic setting of these granitoids. Geological mapping performed at a scale of 1:100,000 by  
99 Cruz et al. (2009, 2014a) revealed the existence of four new granitoids, denominated Lagoa  
100 das Almas, Humaitá, Belo Campo and Broco. Moreover, the Jussiape Granite was mapped in  
101 detail, at a scale of 1:25,000 (Cruz 2004), and divided into two groups: Jussiape I, that  
102 represents the body studied by Guimarães et al. (2005), with U-Pb age (zircon, LA-ICPMS) of  
103  $2,121 \pm 2.2$  (Table 1), and Jussiape II, investigated in the present study.

104 The present study first presents new petrographic, geochemical, U-Pb (LA-ICPMS)  
105 zircon ages and Nd isotope data results obtained for Jussiape II granitoid, as well as for the  
106 Lagoa das Almas, Humaitá, Belo Campo and Broco granitoids, which were recently mapped.  
107 These new data seek to contribute towards the already existing archive of the granitoids from  
108 the southern region of the Gavião Paleoplate. The new data are then integrated to those  
109 already available in the literature, aiming to individualize magmatic suites to interpret  
110 interpret the tectonic context of the setting of the granitoids of these suites in face of the plate  
111 tectonic model. In addition, we present a comparison of the crystallization ages of the  
112 Paleoproterozoic magmatism in the São Francisco Craton (southern Gavião and Serrinha  
113 paleoplates, Brazil), in the Mantiqueira Complex, and in the Mineiro Belt (Brazil), which is  
114 part of the Minas Accretionary Orogen (Teixeira et al., 2015), with the West Central African  
115 Belt (Africa). This comparison was performed as a first attempt to demonstrate the  
116 diachronism between the evolution of the accretionary phase and the collisional phase of these  
117 orogenic systems in the scenario of the Columbia Supercontinent.

## 118 119 **2. Geological setting of the Gavião Paleoplate**

120 Previous geochronological datasets obtained for the southern portion of the Gavião  
121 Paleoplate suggest that the formation of the Archean continental crust was related to at least  
122 three main plutonic events at 3.4-3.3 Ga, 3.2-3.1 Ga and 2.9-2.6 Ga (Cordani et al., 1985,  
123 1992; Martin et al., 1991, Marinho, 1991, Nutman and Cordani, 1993, Cunha et al., 1996,  
124 Santos Pinto, 1996, Santos Pinto et al., 1998, 2012; Bastos Leal, 1998, Peucat et al., 2002,  
125 Barbosa et al., 2012, Cruz et al., 2012). This paleoplate is composed of felsic gneisses,  
126 migmatites, amphibolites and granulites of Archean age, as well as remnants of  
127 metavolcanosedimentary sequences and greenstone belts (Cunha and Fróes, 1994, Cunha et  
128 al., 1994, Santos Pinto, 1996, Santos Pinto et al., 1998, 2012; Bastos Leal et al., 1998,  
129 Barbosa et al., 2012). The few available geochronological data of the  
130 metavolcanosedimentary sequence reveal a Meso- to Neoproterozoic age for the basal part of the

131 stratigraphic pile (Marinho, 1991; Marinho et al., 2008, Bastos Leal et al., 2003, Cruz et al.,  
132 2014a, Zincone and Oliveira, 2014) and Siderian to Rhyacian age for the top sequence  
133 (Rodrigues et al., 2012, Cruz et al., 2014a, Zincone and Oliveira, 2014). The upper sequence  
134 is composed of metagraywackes, meta-arkoses, metasandstones, quartzites, aluminous schists  
135 (metapelites), calcite/manganese-rich marbles and itabirites that are intercalated with mafic  
136 metavolcanic rocks. In the Caculé region (Fig. 2), Vitória (2014) identified meta-andesitic  
137 rocks intercalated with the metasedimentary rocks from the top of this sequence and a sample  
138 of metavolcanic rocks was dated at  $2,218 \pm 18$  Ma by Rodrigues et al. (2012).

139 Paleoproterozoic granitoids in the southern portion of the Gavião Paleoplate are  
140 represented by twenty-nine intrusive massifs (Fig. 2) which intrude Archean-Paleoproterozoic  
141 metavolcanosedimentary sequences and Archean gneissic-migmatitic terranes. These  
142 granitoids have varied forms, sizes and chemical characteristics (Bastos Leal, 1998, Bastos  
143 Leal et. al., 1998, Santos Pinto et al., 1998, Barbosa et al., 2012). The available zircon  
144 crystallization ages of these rocks range between  $1,852 \pm 50$  Ma and 2,380 Ma and are reported  
145 in table 1. The main objective of the present study was to understand the tectonic meaning of  
146 this extensive granitogenesis. The  $\epsilon_{Nd}(t)$  values vary between -4 and -15.4 (Tab. 1), which  
147 indicates an important crustal component in the genesis of these rocks.

148 Barbosa and Cruz (2011) reported the existence of migmatites with ages of 2.03 Ga in  
149 this portion of the Gavião Paleoplate. On the other hand, Medeiros (2013) obtained U-Pb  
150 (SHRIMP) ages of  $2,095 \pm 9$  Ma for the migmatization of the Archean crust in the western  
151 region of the Gavião Paleoplate, close to the village of Riacho de Santana (Fig. 2). In turn,  
152 Barbosa et al. (2013) dated older metamorphism in Archean rocks located in the same village,  
153 Riacho de Santana (Fig. 2), at  $2,250 \pm 2$  Ma.

154 The Gavião Paleoplate is covered by Statherian and Tonian metavolcanosedimentary  
155 rocks (Fig. 2) associated with the Paramirim Aulacogen (Pedrosa Soares et al., 2001).

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### 157 3. Analytical Procedures

158 In the present study, five granitoid bodies were investigated in terms of petrography,  
159 geochemistry and geochronology: Jussiape II, Lagoa das Almas, Humaitá, Belo Campo and  
160 Broco. The locations of the samples used for U-Pb zircon and Sm-Nd (whole rock) analyses  
161 are shown in figure 2, and the data are listed in tables 2 and 3.

162 Samples for isotope studies were crushed and milled using a jaw crusher and a ring  
163 mill apparatus to prepare bulk-rock powders. Zircon grains were separated from another

164 aliquot of bulk-rock powders using conventional heavy liquid and magnetic procedures at the  
165 Universidade Federal de Ouro Preto. U-Pb zircon ages were obtained by LA-ICPMS at the  
166 geochronological laboratories of the Universidade de Brasília (samples SCP-SJ01 and SCP-  
167 1351), Universidade do Rio Grande do Sul (Sample L-05) and the Université Blaise-Pascal  
168 (samples OPU 6356 and TB-05). Age calculation was carried out using the Isoplot-Ex  
169 spreadsheet (Ludwig, 2003). The Sm-Nd isotopic analyses of samples SCP-SJ-01 (Jussiapé II  
170 granite) and SCP-1351 (Belo Campo granodiorite) were performed at the Geochronology  
171 Laboratory of the Universidade de Brasília (Brazil). A detailed description of the analytical  
172 procedures for the Sm-Nd isotopes and U-Pb zircon dating performed at the Universidade de  
173 Brasília can be found elsewhere (Gioia and Pimentel, 2000, Buhn et al., 2009, Chemale Jr. et  
174 al., 2011). For samples OPU 6356/F-05 (Humaitá Granodiorite) and TB-05Nd (Broco  
175 granodiorite), the isotope compositions for whole rocks were determined using a Finnigan  
176 Mat 262 mass spectrometer at Géosciences Rennes (France). Total blanks for Sm and Nd  
177 contents were lower than 0.05 ng. Uncertainties were 0.2% for  $^{147}\text{Sm}/^{144}\text{Nd}$  ratios. Nd ratios  
178 were normalized to  $^{146}\text{Nd}/^{144}\text{Nd} = 0.7219$ . All analyses were adjusted for variations of  
179 instrumental bias due to periodic adjustment of collector positions as monitored by  
180 measurements of the La Jolla, AMES or JNd standards. Neodymium crustal residence ages  
181 ( $T_{\text{DM}}$ ) were calculated following the depleted mantle model of DePaolo (1981).  $\epsilon_{\text{Nd}(t)}$  values  
182 were calculated using as reference U-Pb zircon ages where available or estimated ages based  
183 on regional geology and coherent results from nearby samples.

184 Whole rock analyses of major and trace elements were carried out at SGS GEOSOL  
185 Laboratórios Ltda and are reported in tables 4 to 7. With the exception of FeO, the major  
186 elements analysis was performed through X-ray fluorescence using samples fused with  
187  $\text{Li}_2\text{B}_4\text{O}_7$ .  $\text{K}_2\text{O}$  and  $\text{Na}_2\text{O}$  were also analyzed by means of atomic absorption, after total  
188 dissolution with  $\text{HF} + \text{HClO}_4$ . FeO was determined through titration with potassium  
189 dichromate. Rb, Sr, Ba, Ga, Cs, Nb, Y, Zr, Hf, Ta, Th, U were determined by means of X-ray  
190 fluorescence, using the pressed powder technique. F was determined using the specific ion  
191 method. La, Ce, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Yb, Lu were analyzed through ICP-AES.  
192 The amount of  $\text{Fe}_2\text{O}_3$  of each sample was determined based on the formula  $\text{Fe}_2\text{O}_3 = \text{FeO}_t$   
193 (Total iron) -  $1,11\text{FeO}$ .

#### 194 195 **4 Results**

196 The mapping of five new granitoids in the southern region of the Gavião Paleoplate  
197 and the performance of petrography, geochronology and geochemical studies broadens the  
198 volume of data that exists for the Paleoproterozoic granitoids of the region.

#### 199 4.1 Petrography results

##### 200 Jussiape II granite

201 The Jussiape II granite, exposed ca. 50 km to the northeast of the Brumado (Fig. 2,  
202 number 14), occupies the core of the Abaíra-Jussiape anticlinal (Cruz 2004). This pluton  
203 crops out with ca. 25 km in length and maximum width of 12 km. Moreover, it is intrusive in  
204 the Rhyacian Jussiape I ( $2,121 \pm 2.2$ , Guimarães et al., 2005) and in the Archean Caraguataí  
205 syenitic suite ( $2,696 \pm 5$  Ma, Cruz et al., 2012). The rock types are hololeucocratic to  
206 leucocratic (Fig. 3a).

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#### 208 Figure 3

209 The rocks generally present syenogranitic composition (Fig. 4) and plot in the field of  
210 the aluminous granitoids found in the alkaline provinces of Lameyre and Bowden (1982).  
211 Xenoliths of amphibolites, meta-ultramafic rocks and metatexite migmatites are common. The  
212 two main facies are medium-grained phaneritic and medium-grained porphyritic, with  
213 recognizable isotropic and anisotropic bodies in both cases. The anisotropic and porphyritic  
214 bodies present magmatic flow foliation with oriented K-feldspar phenocrysts measuring 2 to 3  
215 cm in size. This foliation presents an orientation of  $262^\circ/76^\circ$  (dip direction). The matrix of the  
216 porphyritic facies is medium-grained phaneritic and isotropic and is mainly constituted of  
217 quartz, K-feldspar and plagioclase. In both facies, the accessory phases include zircon,  
218 titanite, apatite, allanite and pyrite. Although rare, magnetite and biotite are also present.  
219 Myrmekitic and poikilitic igneous microstructures were observed, the latter revealed by the  
220 presence of apatite and zircon inclusions in plagioclase and biotite; allanite, zircon, titanite,  
221 apatite, magnetite and pyrite inclusions in biotite; plagioclase inclusions in K-feldspar; and  
222 biotite inclusions in plagioclase. The crystallization sequence is most likely zircon, titanite,  
223 apatite, magnetite and pyrite, followed by biotite, K-feldspar, plagioclase and quartz  
224 crystallized at later phases.

#### 227 Figure 4



229 Lagoa das Almas granodiorite

230 This granitoid is located 5 km southwards from the village of Jacaraci (Fig. 2, number  
231 4). The massif is approximately ellipsoidal, with 15 km in width and 23 km in length. It  
232 intrudes an association of aluminous schists, quartzites and goudites. The rocks (Fig. 3b) are  
233 generally anisotropic, predominantly medium-grained phaneritic, hololeucocratic to  
234 leucocratic with predominant granodioritic composition (Fig. 4). In the Lameyre and Bowden  
235 (1982) diagram, this granitoid plots in the field of calc-alkaline-trondhjemitic rocks (low K),  
236 though two samples plot in the field of calc-alkaline-granodioritic rocks (medium K) and one  
237 other in the field of tholeiitic rocks. Accessory minerals are zircon, titanite, apatite, biotite and  
238 magnetite. Locally, a porphyritic facies is also observed with medium- to fine-grained  
239 phaneritic matrix and anisotropic fabric, predominantly constituted of quartz, K-feldspar and  
240 plagioclase. In this facies, the K-feldspar phenocrysts are with approximately 1-2 cm to 3 cm  
241 in size.

242 The presence of perthites suggests it could be a subsolvus granitoid. The order of  
243 crystallization is similar to that suggested for the Jussiape II granite. The rock has a solid state  
244 magmatic foliation marked by the stretching of quartz and feldspars as well as the preferred  
245 orientation of biotite. Magmatic flow can be observed in low deformation domains and in the  
246 meso- and micro-scale by the preferential orientation of K-feldspar.

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248 Humaitá granodiorite

249 This rock (Fig. 3c) occurs 15 km southwards from the village of Caetité (Fig. 2,  
250 number 5) with an approximately ellipsoidal shape, measuring 12 km in length by 6 km in  
251 width. This pluton also intrudes an association of quartzites, aluminous schists, itabirites and  
252 manganese-rich marbles. The rocks are gray, usually anisotropic, phaneritic, and medium-  
253 grained. The predominant composition is granodioritic (Fig. 4), but samples with modal  
254 tonalitic and monzogranitic compositions were also found. The samples analyzed plot in the  
255 field of the calc-alkaline-granodioritic (medium K) series, though four samples are in the  
256 trend of calc-alkaline-trondhjemitic rocks (low K), according to Lameyre and Bowden (1982).  
257 This granodiorite contains biotite, zircon, allanite and titanite as accessory minerals. Biotite  
258 can be found included in K-feldspar, which is in turn included in plagioclase, marking the  
259 poikilitic texture. Perthites were observed in the K-feldspars. Deformation in the solid state  
260 for this granitoid is heterogeneous, with a finely spaced foliation.

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## 262 Belo Campo granodiorite

263 This granitoid (Fig. 3d) is leucocratic, mainly composed of monzogranite (Fig. 4), and  
264 with accessory minerals such as biotite, zircon, apatite and titanite. This rock is found  
265 mylonitized in the vicinities of the village of Belo Campo (Fig. 2, number 29). In the domains  
266 with less ductile deformation intensity, relicts of igneous textures are found, such as: (i)  
267 porphyritic, with larger K-feldspar grains inserted in a finer matrix; and (ii) poikilitic, with  
268 biotite, zircon, titanite and apatite inclusions in K-feldspar and plagioclase

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## Broco granodiorite

270 This body, located 20 km northwards from the village of Caculé (Fig. 2, number 27),  
271 is the product of the partial melting of the surrounding biotite- and garnet-bearing metapelites  
272 (Palmeiras 2010). Cordierite is rarely found. The host rock is a stromatic metatexite  
273 migmatites (Sensu Sawyer, 2008) and the Broco granodiorite occurs as fine layers in these  
274 metatexite migmatites (Fig. 3e). The main body of the Broco granodiorite is a diatexite, in  
275 which nebulite and schlieren structures are found (Sensu Sawyer 2008). Biotite and garnet  
276 concentration domains forming restites were preserved in the melting. This rock is leucocratic  
277 to mesocratic, phaneritic and porphyritic, with plagioclase phenocrysts varying from medium-  
278 to coarse-grained. Mainly composed of granodiorite (Fig. 4), this rock is generally isotropic,  
279 but intense deformation domains are associated with Neoproterozoic shear zones.

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## 4.2 U-Pb geochronology

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295 Caraguataí pluton (Cruz et al., 2012). (3) A single core within grain Z14 was concordant at  $3,115$   
296  $\pm 25$  Ma (Fig. 5b) and interpreted as the witness of an older Archean basement recognized in the  
297 southern Gavião Block (Santos Pinto et al., 1998, 2012).

#### 298 299 Lagoa das Almas granite

300 The L-05 sample was collected in a quarry located 7 km southwestwards from Jacaraci  
301 (Fig. 2). The zircon grains are euhedral to subhedral and exhibit a fine oscillatory magmatic  
302 zoning (Fig. 5c, Tab. 2). Rounded inner cores were documented in some grains (Z8 in Fig. 5c). A  
303 set of 6 subconcordant to concordant analyses of the magmatic grain-type defined an upper  
304 intercept at  $2,114 \pm 24$  Ma with the lower intercept close to the origin (MSWD = 0.48). The 2.1  
305 Ga intercept corresponds to the crystallization age of the magmatic zircon crystals, whereas the  
306 lower one was interpreted as the result of an episodic lead loss during the Brasiliano orogeny.  
307 One zircon core yielded a concordant age at  $2,250 \pm 23$  Ma, suggesting the occurrence of an older  
308 Paleoproterozoic component in the granite.

#### 309 310 Humaitá granodiorite

311 Zircons grains from the Humaitá granodiorite are euhedral to subhedral, with cores  
312 surrounded by zoned overgrowths (Figs. 6a and b). A set of 11 overgrowths (out of 12, Tab. 2)  
313 defined an upper intercept age of  $2,140 \pm 9$  Ma (MSWD = 1.2), which was interpreted as the  
314 crystallization age of the granitoid (Fig. 6a). The cores provided a set of discordant and  
315 concordant points, with the latter ranging from 2.35 Ga (spot 1.1) to 2.8 Ga (spot 5.1). An older  
316 discordant grain was dated at ca 3.13 Ga (Fig. 6b, Tab. 2). These grains were interpreted as  
317 inherited from the basement intruded by the granite.

#### 318 319 Belo Campo granodiorite

320 Sample SCP-1351 was collected at the Tremedal-Belo Campo Highway (BA 265), 15 km  
321 eastwards from the village of Tremedal (Fig. 2). The zircons crystals are elongated and euhedral  
322 to subhedral. They often contain cores (Fig. 6c) that can be well developed and only surrounded  
323 by very fine overgrowths (Z13 and Z8, Fig. 6d).

324 Two groups of ages were obtained. Eleven analyses corresponding to some whole grains  
325 and the overgrowths, defined a chord with an upper intercept at  $2,049 \pm 23$  Ma (MSWD = 3.3,  
326 Fig. 6c). Despite the poor quality of this alignment, this age could be interpreted as the  
327 emplacement of the granite. The second set is composed of older ages related to the occurrence of

328 zircon cores, with  $^{207}\text{Pb}/^{206}\text{Pb}$  ages ranging from 2.69 Ga (Z13) to 3.13 Ga (Z6). Four of these  
 329 points (Fig. 6d) defined a mean  $^{207}\text{Pb}/^{206}\text{Pb}$  age of  $2,829 \pm 10$  Ma (MSWD = 1.0), whose  
 330 significance has not yet been understood. All zircon cores were interpreted as inherited and  
 331 indicate crustal contamination.

### 333 Broco granodiorite

334 Sample TB05 was collected 15 km northwards of Caculé (Fig. 2). These zircon crystals  
 335 are euhedral without any visible core. Most of the analyses are concordant and provide a  
 336  $^{207}\text{Pb}/^{206}\text{Pb}$  mean age of  $2,038 \pm 8$  Ma, which was interpreted as the crystallization age of the rock  
 337 (Fig. 6e, Tab. 2). The lack of inherited zircon grains in such a peraluminous granite is most likely  
 338 explained by a high rate of differentiation. This sample also contained large monazite crystals, as  
 339 frequently found in anatectic granites. The whole dataset of the monazite crystals provided a  
 340 mean  $^{207}\text{Pb}/^{206}\text{Pb}$  age of  $1,964 \pm 9$  Ma. This age is significantly younger than the zircon age, even  
 341 if it is in the same range of ca 2.0 Ga. Thus, it may have recorded cooling following partial  
 342 melting processes, or it could be related to late fluid flows.

### 4.3 Sm-Nd isotopic results

345 The Nd model age (Tab. 3) obtained for the Jussiape II granite sample is 3.21 Ga (with  
 346 a  $\text{DM}_0 = +10$ ). Epsilon value at 2.1 Ga was defined as -10.3, which suggests that the Jussiape  
 347 II granite was derived from the melting of the surrounding Archean basement, an  
 348 interpretation that is in agreement with the presence of inherited zircon grains in the granite.  
 349 Regarding the Humaitá granodiorite, the Sm-Nd model age obtained is ca 2.76 Ga (Tab. 3),  
 350 with an epsilon Nd value of -4.0 at 2.1 Ga. The model age obtained for sample SCP-1351  
 351 (Belo Campo granodiorite) is ca 3.28 Ga (Tab. 3), with epsilon Nd value of -15 at 2.03 Ga.  
 352 This result and the presence of inherited zircon grains are both indicative of a large crustal  
 353 reworking process in the genesis of this granitoid. In addition, regarding the Broco  
 354 granodiorite sample, the Nd model age obtained is ca 2.8 Ga (Tab. 3), with epsilon Nd value  
 355 of -6.3 at 2.1 Ga. A  $\epsilon_{\text{Nd}}$  evolution diagram for granitoid samples is shown in figure 7, in  
 356 which the isotopic growth lines for the five samples were plotted in the evolution field defined  
 357 for Archean gneisses of the Gavião Block by Santos-Pinto et al. (2012) and Barbosa et al.  
 358 (2013).

### 360 Figure 7

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## 362 4.4 Geochemistry

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363 New geochemical data are presented for the Jussiape II, Lagoa das Almas, Humaitá,  
364 and Broco granitoids (Tabs. 4 to 7).

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365 Less differentiated samples were found in the Jussiape II and Broco granitoids (Fig.  
366 8). Regarding the other four studied granitoids, a lower variation of SiO<sub>2</sub> was observed for all  
367 samples of the Humaitá granitoid and the majority are strongly differentiated, with SiO<sub>2</sub>  
368 contents higher than 70 wt.%. The aluminum is variable for the Lagoa das Almas and Jussiape  
369 II granitoids, but for the Humaitá and Broco granitoids this element varied varies little. In the  
370 Harker diagrams (Fig. 8), the contents of K<sub>2</sub>O and Rb increase with the growth of SiO<sub>2</sub> for all  
371 the studied granitoids except Broco. This behavior was also observed for Ga and Nb in the  
372 Lagoa das Almas granitoid and for Nb in the Jussiape II granitoid. There is a general decrease  
373 in the contents of other elements when there is an increase of SiO<sub>2</sub> (Fig. 8). The Humaitá  
374 granitoids display very low values of TiO<sub>2</sub> and Fe<sub>2</sub>O<sub>3</sub> in comparison to the other studied  
375 granitoids. Similar to what was interpreted by Teixeira et al. (2015), the low contents of these  
376 elements in the Humaitá granitoid may suggest that Ti- and Fe-rich minerals represent the  
377 refractory phases during the partial melting for the formation of the magma that generated  
378 these rocks. In this situation, Ti is largely retained in ilmenite, sphene, or rutile in the  
379 protolith.

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## 381 Figure 8

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383 Regarding the Fe-index, the samples from the Jussiape II and Humaitá granitoids are  
384 distributed both in the field of ferroan rocks, as well as in the field of magnesian rocks.  
385 However, the samples of the Lagoa das Almas and Broco granitoids are predominantly  
386 magnesian (Fig. 9a). Considering the MALI index (Fig. 9b), the Jussiape II samples plot in  
387 the field of alkali and alkali – calcic rocks, while the samples from the Lagoa das Almas  
388 granitoids are distributed broadly across the diagram. On the other hand, the samples from the  
389 Humaitá granitoids were plot in the field of calcic and calc-alkalic rocks, while the Broco  
390 granite samples plot in the calc-alkalic field.

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## 392 Figure 9

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394 The Jussiape II (A/CNK = 0.95 to 1.20), Lagoa das Almas (A/CNK = 1.0 to 1.20) and  
395 Broco (A/CNK = 1.03 to 1.31) granitoids present  $K_2O/Na_2O$  ratios higher than 1. The Humaitá  
396 granodiorite display most  $K_2O/Na_2O$  ratios lower than 1 and A/CNK varies from 0.99 to  
397 1.11(Fig. 9c). The normative corundum varies from 1.78 to 2.98, 2.21 to 4.2, 0.54 to 6.58 and  
398 3.37 to 7.14 for the Jussiape II, Lagoa das Almas, Humaitá and Broco granitoids, respectively.

399 The REE patterns (Fig. 10a-d) show fractionation of the LREEs in relation to the  
400 HREEs. The  $La/Yb_N$  ratios range between 21.9-51.9 and 10.04-98.02 for the Jussiape II and  
401 Lagoa das Almas granodiorites, respectively. For the Humaitá and Broco granitoids, this ratio  
402 varies between 9.78-32.59 and 9.71-77.70, respectively, reflecting less fractionation of the  
403 REEs of the Humaitá granodiorite when compared to the other granites of this study. A  
404 negative Eu anomaly is observed for all rocks, though it is less intense for the Humaitá and  
405 Broco granodiorites.

406 Spider diagrams (Fig. 10e-h) are marked by LILE (Rb, Th, Ba) enrichment in all the  
407 granitoids studied. The Lagoa das Almas and Humaitá granitoid samples, as well as some  
408 samples of the Jussiape II granitoid, yield negative Ta and Nb anomalies. HFSEs, particularly  
409 Zr, Tb, and Y, are depleted in these rocks.

411 Figure 10

412  
413 When compared to the classic calc-alkalic granitoids of Best (2003), some samples of  
414 the Jussiape II granite exhibit high contents of incompatible elements (Tab. 4), especially  
415 HFSEs, such as Ta (18 to 30 ppm). The concentration of Ba varies between 178 and 559 ppm  
416 and the total REEs between 227.35 and 1178.38 ppm. Some samples yield F contents >300  
417 ppm. The Lagoa das Almas and Humaitá granitoids, on the other hand, exhibit low contents  
418 of incompatible elements (Tabs. 5, 6), especially HFSEs such as Ta and Nb. Most of the  
419 samples of the Humaitá granitoid present content of less than 10 ppm of these elements.  
420 However, this granitoid presents a high content of LILE, such as Ba (951-1502 ppm).  
421 Regarding the Humaitá granitoid, most of the samples yield low F contents (<300 ppm), but  
422 considering the Lagoa das Almas granitoid some samples reached values higher than 1,300  
423 ppm.

424 The intraplate setting is delimited in the Pearce (1996) diagram (Figs. 9d, e). Some  
425 Jussiape II samples plot in the intraplate field, whereas other Jussiape II samples and the  
426 Broco and Lagoa das Almas granitoid samples plot in the field of post-collisional granites.

427 Most of the Humaitá granitoid samples plot in the magmatic arc field, which is corroborated  
428 by their chemical characteristics, such as being sodic and calcic to calc-alkalic with a  
429 relatively lower K. Although the Lagoa das Almas granodiorite samples in figure 9d plot in  
430 the field of anorogenic rocks, the trace elements pattern is similar to the magmatic arc granites  
431 of Pearce et al. (1984). The same is the case for some samples of the Humaitá granodiorite. In  
432 the diagrams of figures 9a and 9b, the samples of all the granitoids plot in the field of  
433 cordilleran granitoids of Frost et al., (2001). However, two samples of the Broco granitoids  
434 can be considered as belonging to the field of peraluminous leucogranites, since they present  
435 normative corundum greater than 1.

## 437 **5. Integration of the Petrography, Geochronology and Geochemical data of the** 438 **Paleoproterozoic Granitoids in the Southern Gavião Paleoplate**

439 This section presents the results of the integration of the new petrography,  
440 geochronology and geochemistry data reported in the present study for the Jussiape II, Lagoa  
441 das Almas, Humaitá, Belo Campo and Broco granitoids to the data of the Siderian, Rhyacian  
442 and Orosirian granitoids of the southern sector of the Gavião Paleoplate, which were  
443 compiled from the references presented in tables 1 and 8, as well as in Barbosa et al. (2012).  
444 The geochemical data gathered from the literature were integrated to the results reported in  
445 the present study when obtained by means of similar methodologies. To perform this  
446 integration, the initial step was to separate the granitoids with similar chemical signatures.  
447 Then, geochronology and petrography data were compared, individualizing distinct groups of  
448 granitoids. Finally, the spatial distribution of the identified groups was observed. The main  
449 objective was to identify distinct magmatic suites (Groups) and observe the tectonic meaning  
450 of each one.

451 Based on the geochronology data of table 1 and on the presence or not of  
452 deformational structures, the twenty nine granitoids of the southern sector of the Gavião  
453 Paleoplate were separated into two main groups (Figs. 2, 11 and Tab. 1): Group 1, or Bom  
454 Sucesso Suite, comprising plutons with variable intensities of solid state deformation and that  
455 are older than 2.09 Ga. This group is represented by the Veredinha, Ibitiara-Queimada Nova,  
456 Aracatu, Lagoa das Almas, Humaitá, Rio do Paulo and Jussiape I granitoids. Granodiorites  
457 predominate, but tonalitic and monzogranitic rocks, and quartz-monzodioritic and quartz-  
458 dioritic enclaves can also be found (Fig. 12). The rocks vary between leucocratic and  
459 mesocratic with biotite and amphibole. Zircon, apatite, allanite, magnetite and titanite are the

460 accessory phases; and (ii) Group 2 is younger than 2.09 Ga and comprises granitoids with  
461 little or no deformation. Based on petrography (Fig. 12) and geochemical data (Figs. 13 to 17  
462 and tab. 8), Group 2 was divided into four subgroups, or distinct magmatic suites: (i) Group  
463 2a, which comprises the Guanambi Suite, with U-Pb ages ranging from 2.06 to 2.04 Ga,  
464 composed of multiple intrusions of the Urandi-Guanambi batholiths and by the Boquira,  
465 Estreito, Cara Suja and Ceraíma massifs. This subgroup is composed of multiple intrusions of  
466 syenites and monzonites with subordinate granitic and mafic rocks (Fig. 12) (Rosa, 1999 and  
467 Teixeira, 2000), corresponding to an area of approximately 6,000 km<sup>2</sup>. According to Rosa  
468 (1999), these rocks vary from leuco- to mesocratic and present biotite or phlogopite, diopside,  
469 edenite, pargasite, or hornblende. The accessory mineralogy is represented by variable  
470 proportions of apatite, zircon, ilmenite, magnetite, titanite, allanite, monazite, fluorite,  
471 molybdenite and pyrite. The presence of normative quartz suggests that the majority of the  
472 rocks is silica-saturated, except for the foid-syenitic and foid-monzonitic terms; (ii) Group 2b,  
473 dated at 2.05-2.01 Ga (U-Pb), is composed of rocks of the Caculé, Jussiape II and Santa Isabel  
474 granitoids. This subgroup comprises, mainly, monzogranites and syenogranites with minor  
475 quartz-syenite and quartz-monzonite (Fig. 12) with hornblende e/or biotite. Leucocratic rocks  
476 and porphyritic facies predominate. Angular xenoliths of host orthogneisses are also found.  
477 Zircon, titanite, magnetite, monazite and apatite are accessory minerals. (iii) Group 2c  
478 presents U-Pb age varying between 2.05 and 1.8 Ga and is represented by the Iguatemi,  
479 Riacho das Pedras, Serra da Franga and Pé do Morro massifs. This subgroup presents  
480 syenogranites with subordinate monzogranites (Fig. 12). Biotite can be found in these rocks.  
481 The accessory mineralogy is composed of titanite, zircon, apatite, allanite and monazite; and  
482 (iv) Group 2d, with U-Pb ages ranging between 2.05 and 1.9 Ga (Fig. 11, tab. 1), presents  
483 rocks of the Umburanas, Mariana, Espírito Santo, Lagoa Grande-Lagoinha, Gameleira,  
484 Caetano-Aliança, Campo do Meio, Broco and Piripá granitoids. This subgroup corresponds to  
485 granodiorites and monzogranites (Fig. 12). The accessory mineralogy is composed of apatite,  
486 magnetite, ilmenite, allanite, biotite, muscovite, zircon and monazite. Garnet, tourmaline and  
487 cordierite were also found.

488 The rocks of groups 2c and 2d are spatially associated with the  
489 metavolcanosedimentary sequences of the Gavião Paleoplate. Stromatic migmatites generated  
490 from the partial melting of metasedimentary rocks are the host rocks of these granitoids.  
491 These granitoids are diatexites and may present nebulite and schlieren structures.



492 A superposition of ages occurs among groups 2a, 2b, 2c and 2d, in which group 2a  
493 presents the smallest age variation and group 2c presents the youngest granitoids (Tab. 1 and  
494 fig. 11).

495  
496 Figure 11

497  
498 With the exception of the granitoids of Group 1, that show deformational foliation  
499 and, in some cases, gneissic banding, these massifs are generally isotropic and magmatic flow  
500 is sometimes visible. In the field, the contacts between the granitoids of groups 1, 2a and 2b  
501 with Archean orthogneisses are abrupt. On the other hand, stromatic migmatites represent the  
502 host rocks of the granitoids of groups 2c and 2d. Transitional contacts between the granitoids  
503 of these groups and the migmatites are frequently observed. Thus, the granitoids of these two  
504 groups are better characterized as diatexites (Sensu Sawyer 2008).

505  
506 Figure 12

507  
508 The distribution of the petrography data for all the groups allows the distinction of  
509 magmatic differentiation trends by Lameyre and Bowden (1982) (Fig. 12), from rocks with a  
510 calc-alkaline-trondhjemitic (low K) trend (Group 1) to rocks with an alkaline and peralkaline  
511 trend (Group 2a). The granitoids of Group 2b were plotted in the calc-alkaline-granodioritic  
512 (medium K) field and the plutons of groups 2c and 2d were mainly plotted in the field of  
513 granitoids formed by crustal melting.

514 Table 8 presents a synthesis of the chemical data for the individualized groups through  
515 their means (M) and standard deviations (SD). The supplementary material of chemical data  
516 is presented in appendix 1 through 4. The rocks that are poorer in SiO<sub>2</sub> belong to groups 2a  
517 and 2b, while the other groups generally present contents of SiO<sub>2</sub> higher than 65%. Harker-  
518 like diagrams for major, compatible, LIL and HFS elements are shown in figures 13 and 14.  
519 All of the groups identified show a decrease in major elements content with the enrichment of  
520 SiO<sub>2</sub>, with the exception of K<sub>2</sub>O and Na<sub>2</sub>O, whose concentrations increase with the  
521 differentiation trend. This behavior suggests that the fractionation of calcic plagioclase,  
522 apatite, titanite, hornblende, biotite and magnetite controls TiO<sub>2</sub>, P<sub>2</sub>O<sub>5</sub>, CaO, MgO and FeO<sub>t</sub>  
523 contents. The values of P<sub>2</sub>O<sub>5</sub> can be explained by the presence of apatite in all groups.  
524 Regarding the trace elements (Fig. 14), the results show a progressive decrease of Sr, Ba, Zr,

525 La and Y, and an increase of Nd concentrations with the growth of SiO<sub>2</sub>, although a relative  
526 increase of Sr and Ba was observed in Group 1. The presence of allanite and zircon during the  
527 initial phases of crystallization can explain this behavior for all groups.

528  
529 Figure 13

530  
531 Figure 14

532  
533 When comparing the average concentration of major and trace elements for five  
534 individualized groups (Tab. 8), moderate values of Ba were observed for Group 1, moderate  
535 values of Sr, Ba, Zr and total REE were observed for Group 2a, while Group 2b presented  
536 high values of Th and total REE. The values of Rb for Group 2c were particularly noteworthy,  
537 with the highest values among all groups. In groups 1, 2b, 2c and 2d, rocks with A/CNK  
538 greater than 1 predominated, while in Group 2a, rocks with A/CNK lower than 1  
539 predominated. In general, the K<sub>2</sub>O/Na<sub>2</sub>O ratio is greater than 1 and Group 2a have the greatest  
540 values.

541 The rocks from all groups were predominantly potassic, although some samples  
542 plotted in the field of sodic rocks (Fig. 15a). Figure 15b shows that the rocks of Group 1 are  
543 predominantly subalkaline, while the rocks of groups 2a and 2b plot dominantly in the field of  
544 alkaline rocks. The remaining groups are distributed in both fields.

545  
546 Figure 15

547  
548 In the K<sub>2</sub>O–SiO<sub>2</sub> the granitoids of Group 1 plot mainly in the fields of medium- and  
549 low-K series, while the rocks of Group 2a, 2b and 2c plot mainly in the field of high-K series  
550 (Fig. 15c). Group 2d is distributed between the fields of high- and medium-K series. The  
551 granitoids of groups 1 and 2d plot in the ferroan and magnesian fields (Fig. 15d). The  
552 granitoids of Group 2a are predominantly magnesian, while the granitoids of groups 2b and 2c  
553 are predominantly ferroan. Regarding the MALI index (Fig. 15e), the granitoids of Group 1  
554 are predominantly calcic to calc-alkalic, while the rocks of Group 2a are mainly alkali-calcic  
555 to alkali. On the other hand, the granitoids of Group 2b plot mainly in the alkali-calcic field.  
556 Comparing the spatial distribution of the calc-alkalic to calcic and the alkali to alkali-calcic  
557 granitoids in figure 2, the intrusions of Group 1, which are calc-alkalic to calcic, occur to the



558 east, while the rocks of Group 2a, alkali to alkali-calcic, occur in the western sector of this  
 559 figure.

560 Chondrite-normalized REE patterns are presented in figure 16 (a-e). As a whole, the  
 561 groups show REE patterns characterized by: (i) highly fractionated light/heavy REE ratios  
 562 ( $La_N/Yb_N \geq 15$  up to 90, Fig. 16a to f) for groups 1, 2a, 2b and 2d and low fractionated  
 563 light/heavy REE ratios ( $La_N/Yb_N < 15$ , Fig. 16 a to f) for Group 2c and for most of the samples  
 564 of Group 2d; (ii) there is an increase of  $La_N/Yb_N$  with the increase of the sum of REE (Fig.  
 565 16f); and (iii) negative europium anomalies, though some positive anomalies are observed in  
 566 Group 2a (Figs. 16a to e and 16g). The samples of groups 1 and 2b show a flat HREE pattern.  
 567 Although the Eu anomaly is negative in all groups, in Group 2a it is more subtle, suggesting  
 568 less fractionation of feldspar in relation to the other groups. Regarding the sum of REE (Figs.  
 569 16f, g), most analyses of Group 1 are below 500 ppm, but some samples of this group present  
 570 values above 1,500 ppm. The highest values are generally those of Group 2a. Table 8 informs  
 571 average composition of the different groups of rocks. Although there is a REE similarity  
 572 pattern between groups 1 and 2b, the main distinction, besides age, is the greater enrichment  
 573 in LILE and HFSE of the granitoids of Group 2b in comparison to Group 1, as well as the  
 574 sum of REE (Tab. 8 and appendix 2, 3).

575  
 576 Figure 16

577  
 578 In the ORG-normalized diagrams (Fig. 17), the groups exhibit the following common  
 579 characteristics: (i) negative slopes from LILE to HFSE; (ii) negative spikes of Nb–Ta relative  
 580 to their neighboring elements, which is a characteristic of arc settings; and (iii) enrichment of  
 581 Th relative to Ba, of Rb relative to  $K_2O$  and of Ce relative to Nb. Rb is enriched relative to Ba  
 582 for groups 2c and 2d. For the remaining groups, Rb was either enriched or depleted relative to  
 583 Ba. For groups 1 and 2a the values of Cr reach 362 and 500 ppm, respectively (Appendix 2).  
 584 These values are much above those of the other groups.

585  
 586 Figure 17

587  
 588 Regarding the tectonic environment, the diagrams of figure 18a-e show a clear  
 589 association between the Siderian-Rhyacian-Orosirian granitoids of the southern sector of the  
 590 Gavião Paleoplate and magmatic arc and post-collisional environments. These results

591 corroborate those shown in figure 17. This figure shows that the curve of the volcanic arc  
592 granites of Chile by Pearce et al. (1984) adjusts to the data of all samples of the groups  
593 studied. Moreover, the post-collision granite curve by Pearce et al. (1984) also adjusts to the  
594 curve of the granitoids of groups 2c and 2d.

595  
596 Figure 18

## 597 598 **6. Discussion**

599 Amalgamation of four main paleoplates, Gavião, Serrinha, Jequié and Uauá, occurred  
600 in the NE sector of the São Francisco Craton during the Siderian to Orosirian. As described  
601 firstly by Barbosa and Sabaté (2002, 2004), the Gavião Paleoplate behaved as the foreland of  
602 the Itabuna-Salvador-Curaçá orogen. However, the neosome ages of  $2,250 \pm 2$  Ma,  $2,095 \pm 9$   
603 Ma and  $2,032 \pm 14$  Ma, obtained by Barbosa et al. (2013; zircon, LA-ICPMS), Medeiros  
604 (2013; zircon, LA-ICPMS and SHRIMP), and Barbosa and Cruz (2011; zircon, LA-ICPMS),  
605 respectively, suggest the existence of three migmatization events in the Gavião Paleoplate  
606 between the Rhyacian and the Orosirian. This interpretation takes into account the existence  
607 of granulites in this sector of the southern Gavião Paleoplate and the vergence located  
608 southeastwards of earlier deformations recorded in these rocks and associated with  
609 granulitization. These data provide clues regarding the effective participation of the Gavião  
610 Paleoplate in collisional processes of the four paleoplates that included continental margin  
611 reworking from the Itabuna-Salvador-Curaçá Belt to the West Central African Belt.

612 Geochronological and geochemical data of 28 granitoids available from the southern  
613 sector of the Gavião Paleoplate led to the identification of a group of rocks older than 2.09  
614 Ga, which were generally deformed, with crystallization ages varying between 2,380 and  
615  $2,113 \pm 11$  Ma (Group 1, present study), and another group younger than 2.09 Ga, which was  
616 not deformed, with crystallization ages varying between  $2,066 \pm 37$  and  $1,852 \pm 50$  Ma (Group  
617 2, present study). The model ages can be grouped as follows: 3.6 to 3.3 Ga for the Aracatu  
618 (Group 1), Iguatemi (Group 2c), Mariana (Group 2d) and Umburanas (Group 2d) massifs; 3.3  
619 to 3.1 Ga for the Jussiape II (Group 2b), Riacho das Pedras (Group 2c), Iguatemi (Group 2c)  
620 and Espírito Santo (Group 2d) massifs; 2.9 to 2.6 for the Humaitá (Group 1), Guanambi –  
621 Urandi Multiple Intrusions (Group 2a), Cara Suja (Group 2a), Ceraíma (Group 2a), Estreito  
622 (Group 2a) and Caculé (Group 2b) massifs (Tab. 1); and ca 2.6 to 2.4 Ga for the Caetano-  
623 Aliança, Lagoa Grande-Lagoinha and Gameleira massifs (Group 2d) (Tab. 1). The available

624 Nd isotopes with Archean model ages and negative values of epsilon (Tab. 1, Fig.19) all  
625 indicate the important participation of Archean crust in the formation of the granitoids of  
626 groups 1 and 2. The younger model ages would suggest mixing between an Archean crustal  
627 source and a possible juvenile source of ca 2.0 Ga.

628  
629 Figure 19

630  
631 Santos Pinto (1996) performed geochemical modeling of major elements and REE and  
632 proposed the melting of Archean crustal rocks as the source for the following granites:  
633 Aracatu (Group 1, partial melting product of 3.33 Ga Archean grey gneisses), Mariana (Group  
634 2c, partial melting product of Archean orthogneisses with a minimum age of 3.26 Ga) and  
635 Umburanas (Group 2d, partial melting product of Archean tonalites of the granite host rocks).  
636 Furthermore, in the Aracatu granite (Group 1), an inherited zircon core provided a slightly  
637 discordant  $^{207}\text{Pb}/^{206}\text{Pb}$  SHRIMP age of ca 3.25 Ga (Santos Pinto et al., 2012), which is  
638 considered as the minimum age for inheritance from an Archean gneissic source. In the  
639 Umburanas massif (Group 2c), inherited zircon grains were found with ages between 2.7 and  
640 3.1 Ga (Santos Pinto, 1996; Santos Pinto et al., 1998). Bastos Leal et al., (2000) also indicated  
641 an anatexis origin for the Archean gneissic-migmatitic rocks of the Gavião Paleoplate, with  
642 contamination of upper crust material from the Iguatemi (Group 2c) and Espírito Santo  
643 (Group 2d) massifs. The processes involving assimilation/crustal contamination may have  
644 been responsible for collecting these crystals from the host rocks.

645 The regional distribution of groups 1 and 2a (Fig. 2) shows the existence of calcic to  
646 calc-alkalic (sensu Frost et al., 2001) granitoids older than 2.09 Ga in Group 1, in the eastern  
647 sector of the southern region of the Gavião Paleoplate, and alkali to alkali-calcic, ultrapotassic  
648 to shoshonitic granitoids with ages between 2.05 to 2.04 in the western sector (Group 2a). The  
649 chemical characteristics of these rocks and their distribution indicate the existence of a  
650 Siderian-Rhyacian subduction zone situated in the eastern portion of the southern domain of  
651 the Gavião Paleoplate.

652 By integrating the chemical and geochronological data presented in this study with  
653 those published in the literature (see references in tables 1 and 8), as well as data associated  
654 with metamorphism and regional deformation obtained by Barbosa and Cruz (2011),  
655 Medeiros (2013) and Cruz et al. (2014a), it can be suggested that the Siderian-Rhyacian-  
656 Orosirian granitogenesis in the southern region of the Gavião Paleoplate possibly developed

657 through the following steps (Fig 20): (i) between 2.38 and 2.1 Ga the magmatic arc was  
658 installed on the eastern continental margin of the Gavião Paleoplate and a subduction zone  
659 also developed to the west, producing calcic to calc-alkalic granitic rocks of Group 1 with a  
660 maximum age obtained for the pre-collisional granitoids of 2.38 Ma (Aracatu granitoid). This  
661 body should represent the initial stage of formation of the Western Bahia Magmatic Arc, with  
662 intense participation of the continental crust; (ii) collision between the Gavião and Jequié  
663 paleoplates, metamorphism between 2.1 and 2.09 Ga with syn-collisional migmatization,  
664 recorded by Medeiros et al. (2011). This migmatization is associated with the formation of  
665 metatexites and diatexites, though plutons of this age have not yet been found. In case they  
666 have existed, they were possibly positioned in the uppermost areas of the crust, removed  
667 either by tectonic processes or by erosion. Currently, deeper crustal levels crop out and,  
668 perhaps due to this, larger bodies are not found; (iii) from 2.06 to 2.03 there was the  
669 crystallization of the alkali to alkali-calcic granitoids of Group 2a, which were late-collisional  
670 and ultrapotassic; anatexis associated with the melting of igneous continental crust and  
671 crystallization of the alkali-calcic to alkali granitoids of Group 2b; (iv) from 2.03 to 1.9 Ga  
672 there was a broad anatexis associated with the melting of igneous continental crust and  
673 metavolcanosedimentary rocks, as well as crystallization of the granitoids of groups 2c and  
674 2d. Continental collision of Archean terranes of the Gavião and Jequié paleoplates led to  
675 crustal thickening and reworking with the generation of Orosirian-Rhyacian granitoids in a  
676 subduction model far from the subduction zone, as described by the crustal derived magma of  
677 the Cordilleran-granite type. If this model is applied, the granitogenesis associated with the  
678 generation of granitoids in the southern region of the Gavião Paleoplate occurred during a  
679 prolonged oceanic crust subduction period and in a context of a long-lived  
680 convergence/collision of two Archean masses.

681  
682 Figure 20

683  
684 Mascarenhas (1979), Rosa et al. (1996) and Rosa (1999) had already suggested the  
685 presence of a Paleoproterozoic belt and a magmatic arc in the region between Guanambi and  
686 Caetité (Fig. 1) without, however, defining the polarity of the subduction zone. Mafic  
687 metavolcanic rocks with crystallization age of  $2,218 \pm 18$  Ma (Rodrigues et al., 2012)  
688 corroborate the interpretation of a Paleoproterozoic magmatic arc in this sector of the Gavião  
689 Paleoplate. Mafic to intermediate rocks with magmatic arc signature, which are intercalated

690 with metagraywackes with maximum age of 2.5 Ma have also been reported by Vitória  
691 (2014). Moreover, the existence of granulitic migmatites (Arcanjo et al., 2005; Barbosa et al.,  
692 2011, 2013) and related reworking of the Archean crust (Santos Pinto et al., 1998, 2012) may  
693 be a further argument for the existence of continental collisions in this sector of the Gavião  
694 Paleoplate. The metamorphism age of  $2,250 \pm 2$  Ma obtained in the region of Riacho de  
695 Santana (Fig. 2) by Barbosa et al. (2013) is probably related to early collisions between the  
696 Gavião Paleoplate and another paleoplate located northwestwards. This interpretation  
697 considers the existence of granulites in this sector of the southern Gavião Paleoplate and of  
698 the vergence located to the southeast of the earlier deformations recorded in these rocks,  
699 associated with granulitization. These ages that represent an older Rhyacian metamorphism in  
700 the Gavião Paleoplate are similar to those obtained by Ávila et al. (2008) for the first  
701 metamorphism event of the Mineiro Belt. A detailed geological study of the Gavião  
702 Paleoplate, especially stratigraphic and isotopic study of the metavolcanosedimentary  
703 sequences, can contribute to a better delimitation of the tectonic plates involved in this  
704 collisional scenario, as well as lead to a better understanding of the architecture of the  
705 orogenic system.

706 Some petrogenetic aspects can be discussed based on the chemical data of the major  
707 and trace elements found in granitoids of groups 1, 2b, 2c and 2d. As interpreted by Ávila et  
708 al. (2014), the positive correlation between  $K_2O$  and Ba (Fig. 13m) for the granitoids of  
709 groups 1, 2b, 2c and 2d may suggest crystallization control by biotite and K-feldspar for these  
710 granitoids, while the positive correlation between CaO and Sr (Fig. 13n) for all groups may  
711 suggest crystallization control by plagioclase and apatite. Moreover, the negative correlation  
712 between Zr and  $SiO_2$  in all groups (Fig. 14i) indicates that zircon was fractionated during the  
713 initial phase of the melt crystallization, as interpreted also by Ávila et al. (2014). The negative  
714 Eu anomaly of the diagrams in figure 16a-d suggests that plagioclase was also a residual  
715 phase. In all the individualized groups, the negative Nb anomalies of figure 17a-e could be  
716 explained by the presence of sphene, ilmenite, rutile or amphibole as residual minerals in the  
717 protolith (Ávila et al., 2014, Teixeira et al., 2015). The low content of this element reflects the  
718 absence of rutile and ilmenite, and the sparse presence of amphibole in the rocks of all groups.  
719 In turn, low Y values may suggest that garnet and xenotime were also residual phases in the  
720 source of the magmas that originated the granitoids of all groups.

721 Groups 1 and 2a have high values of Rb, Ba and Zr. Rb presents positive correlation  
722 with  $SiO_2$ , but Ba and Zr present negative correlation with this oxide (Fig. 14). This negative

723 correlation may be related to an originally enriched magmatic source (Martin et al., 2010),  
724 since there was no incompatible behavior for these two elements. These geochemical  
725 attributes associated with the arc signature of the rocks in Group 1, as well as the values of  $\epsilon_{Nd}$   
726 and the  $T_{DM}$  age of the Humaitá granodiorite (Table 3, Group 1) suggest that participation of  
727 Archean continental crust may have been a predominant factor in the formation of the  
728 granitoids of these groups. Alternatively, the participation of a metasomatized mantle wedge  
729 above a Paleoproterozoic subduction zone cannot be discarded. In a subduction environment,  
730 fluids derived from slab dehydration and/or slab-derived melts may enrich the mantle wedge  
731 in LILE (K, Rb, Sr, Ba), light REE and highly incompatible HFSE (Plank and Langmuir,  
732 1998, Martin et al., 2010; Rapp et al., 2010, Seixas et al., 2013). One hypothesis for mantle  
733 metasomatism participation for the granitoids in Group 2a was also suggested by Rosa (1999),  
734 considering the association of these rocks with the magmatic arc environment and the  
735 negative values of  $\square_{Nd}$  for these rocks.

736 Figure 21 compares the geochronological data of the granitoids of groups 1 and 2  
737 presented in this paper with those produced by Rios et al. (2008, 2009 and authors cited  
738 therein) for the Serrinha Paleoplate; by Silva et al. (2002b) and Ávila et al (2010, 2014 and  
739 authors cited therein), Seixas et al. (2012, 2013 and authors cited therein), Teixeira et al.  
740 (2015 and authors cited therein) and Nunes (2007) for the Mineiro Belt; by Silva et al.  
741 (2002b) and Noce et al. (2007) for the Mantiqueira Complex and by Thieblemont et al. (2009  
742 and authors cited therein) for the Eburnean granitoids of Gabon. The granitogenesis of the  
743 tectonic domains illustrated in figure 20 reflects a diachronic soft accretion/collision event  
744 (sensu Cordani et al., 2000, among others). In the Mineiro Belt and in the southern sector of  
745 the Gavião Paleoplate the earliest arc magmatism is marked by the granitoids of the Lagoa  
746 Dourada and Rio do Paulo/Aracatu suites, respectively, with Siderian ages. Granitogenesis  
747 between 2.23 and 2.13 Ga was identified in the Mineiro Belt by Ávila et al. (2010, 2014), but  
748 igneous representatives of this age have not yet been reported in the Western Bahia Magmatic  
749 Arc. A concordant age at  $2,250 \pm 23$  Ma was found in a zircon core of the Lagoa das Almas  
750 granitoid (Fig. 5c). In turn, ages between 2.13-2.10 were obtained for the granitoids of the  
751 Western Bahia Magmatic Arc (see references of table 1), as well as for the Mineiro Belt  
752 (Seixas et al., 2012, 2013 and authors cited therein), the Mantiqueira Complex (Noce et al.,  
753 2000, 2007 and authors cited therein) and the Serrinha Paleoplate (Rios et al., 2008, 2009 and  
754 authors cited therein).



Figure 21

When compared to the Western Bahia Magmatic Arc and the Mineiro Belt, the magmatic arcs of Serrinha (Bahia-Brazil), Mantiqueira (Minas Gerais-Brazil) and Gabon (Africa) belts began relatively later, from 2.20 to 2.10, 2.16 to 2.10 and 2.08 to 2.04 Ga, respectively (Fig. 21). Analysis of the age intervals for the pre, syn and late collisional granites in figure 21 suggests that the magmatic arcs formed during a diachronic accretionary process between the Siderian and Rhyacian. In all four tectonic systems of figure 21 there was continental collision and metamorphism followed by late-collisional granitogenesis. This late-collisional, younger granitogenesis is very pronounced in the Gavião Paleoplate and is represented by groups 2a, 2b, 2c and 2d. The Congo Paleoplate comprises the L'Ogooué Suite. In the Mineiro Belt, a representative of this magmatism is the Gentil granitoid (Nunes 2007), which presents crystallization age ( $2,066 \pm 10$  Ma) and REE signature similar to that of the granitoids of Group 2d of the present study.

According to Noce et al. (2007), the Rhyacian-Orosirian magmatism of the Mantiqueira Complex would be associated with magmatic arcs formed due to west-vergent subduction. The same subduction direction was interpreted by Ávila et al. (2010) for the Rhyacian Ritópolis Arc, in the Mineiro Belt, and in the present study for the accretionary period of the Western Bahia Magmatic Arc. The similarity of Rhyacian U-Pb ages and subduction vergence obtained from the granitoids of the southern portion of the Gavião Paleoplate suggests a hypothesis of continuity of the Western Bahia Magmatic Arc towards the Mineiro Belt and the Mantiqueira Complex (Fig. 22).

Figure 22

A comparison between the isotopic  $\epsilon_{Nd(2.2-2.0 Ga)}$  data of the Mineiro Belt granitoids and the Gavião Paleoplate is presented in figure 23. Based on Noce et al. (2000), regarding this isotopic parameter, two groups of granitoids were individualized. The granitoids of groups 1, 2a, 2b, 2c and 2d were plotted in Group A, as proposed by Noce et al. (2000). According to these authors, the samples of this group are characterized by an inherited crustal signature with a wider range of  $\epsilon_{Nd(2.2-2.0 Ga)}$  values. On the other hand, samples from Group B tend to have a narrow range of  $\epsilon_{Nd(2.2-2.0 Ga)}$  values, implying the presence of Rhyacian juvenile accretion. Granitoids of both groups were identified in the Mineiro Belt, particularly the

789 Maranhão tonalite with crystallization age of  $2,128 \pm 9.9$  Ma and values of  $\epsilon_{\text{Nd}}(2130 \text{ Ga})$  varying  
 790 from -1.0 to +0.9 (Seixas et al., 2013). This granitoid presents crystallization age near the  
 791 crystallization age of the Humaitá and Lagoa das Almas granitoids. Moreover, the REE  
 792 spectrum is similar to that of the granitoids of Group 1 (Fig. 16a). However, the values of  $\epsilon_{\text{Nd}}$   
 793 suggest a lower participation of the continental crust in the genesis of the Maranhão tonalite in  
 794 relation to the granitoids of Group 1. This variation suggests distinct sources for the regions  
 795 and different degrees of interaction between mantle-derived magmas and continental crust for  
 796 these granitoids. As suggested for the Humaitá Granitoid, one participation hypothesis for the  
 797 enriched mantle in the genesis of the precursor magma for the Maranhão Granitoid was  
 798 offered by Seixas et al. (2013).

800 Figure 23

## 802 6. Conclusions

803 Based on what was presented and discussed, we conclude the following:

804 (a) The U-Pb (zircon, LA-ICPMS) ages obtained for Jussiape II, Lagoa das Almas,  
 805 Humaitá, Belo Campo and Broco granitoids are  $2,052 \pm 43$ ,  $2,114 \pm 24$ ,  $2,140 \pm 9$ ,  $2,049 \pm 23$   
 806 and  $2,038 \pm 8$  Ma, respectively. The  $\epsilon_{\text{Nd}}$  values for these granitoids are, respectively, -10.3, -  
 807 15.4, -4.0 and -6.3. These values suggest variable proportions of involvement of the  
 808 continental crust in the formation of these rocks.

809 (b) Twenty-nine Siderian-Rhyacian-Orosirian granitoids were recognized in the  
 810 southern Gavião Paleoplate. The whole set of geochemical and geochronological data for  
 811 these granitoids allowed the individualization of five groups, or five magmatic suites. The  
 812 crystallization ages varied from 2,380 to  $2,091 \pm 6.6$  Ma,  $2,054 -6/+8$  to  $2,041 \pm 23$  Ma,  
 813  $2,066 \pm 37$  to  $2,019 \pm 32$  Ma,  $2,058 \pm 8$  to  $1,852 \pm 50$  Ma and  $2,049 \pm 12$  to  $1,929 \pm 16$  Ma for  
 814 groups 1, 2a, 2b, 2c and 2d suites, respectively. In general, the granitoids of Group 1  
 815 presented varied intensities of deformation, while the granitoids of the remaining groups were  
 816 generally not deformed. Additionally, the granitoids of groups 2c and 2d are associated with  
 817 domains of intense rock migmatization. For the granitoids of groups 2a and 2b, this  
 818 association are not clear.

819 (c) Group 1 includes mainly calcic to calc-alkalic rocks, with low to medium  
 820 potassium. The tectonic environment interpreted for the rocks of this group is a magmatic arc.  
 821 Group 2a is formed predominantly of alkali-calcic to alkali granitoids with ultrapotassic to



822 shoshonitic rocks. The rocks rocks plot in the field of the post-collisional granitoids, but the  
823 trace element signature, especially Nb and Ta, suggests association with a magmatic arc  
824 environment. An increase in alkalinity from the west to the east was observed when  
825 comparing the spatial distribution of the intrusions of groups 1 and 2a. This geochemical trend  
826 between the granitoids of groups 1 and 2a suggests a cordilleran environment with subduction  
827 to the west.

828 (d) The geochronological and geochemical data set may suggest the following model  
829 in the western portion of the paleoplate: (i) 2.38-2.12 Ga- a magmatic arc (Western Bahia  
830 Magmatic Arc) was installed, with the subduction zone dipping westward, producing calcic to  
831 calc-alkalic granitic Group 1; (ii) 2.1 and 2.09 Ga- syn-collisional migmatization; (iii) 2.06 to  
832 2.04- crystallization of alkali to alkali – calcic granitoids of Group 2a and of alkali – calcic to  
833 alkali granitoids of Group 2b; (iv) 2.04 to 1.8- large anatexis associated with the melting of  
834 continental crust and metavolcanosedimentary rocks and the crystallization of the granitoids  
835 of groups 2c and 2d.

836 (e)  $\epsilon_{Nd}$  (t) values are negative, varying between -4.0 and -15.4, for the individualized  
837 groups, which can be interpreted as a result of melting or reworking of the Archean  
838 continental crust. Considering the magmatic arc system, some contribution from a  
839 metasomatized mantle can be suggested for the formation of these rocks, particularly the  
840 Humaitá granitoid, presented in this study.

841 (f) Comparing the granitogenesis of the Western Bahia Magmatic Arc with the  
842 granitogenesis of the Mineiro Belt and the Mantiqueira Complex, we suggest that there might  
843 be a continuity of this Siderian-Rhyacian-Orosirian accretionary-collisional system towards  
844 the south. The earlier and pre-collision granitogenesis of the Serrinha (Bahia-Brazil) and  
845 Congo paleoplates are younger than those of the Western Bahia Magmatic Arc and the  
846 Mineiro Belt, suggesting diachronic evolution of these tectonic systems during the formation  
847 of the Columbia Supercontinent.

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## 1201 **Figures captions**

- 1202 Figure 1. Schematic geological map showing the limits, marginal fold belts and major  
 1203 structural units of the São Francisco Craton. Adapted from Alkmin et al. (1993). The grey  
 1204 rectangle indicates the study area.
- 1205 Figure 2. Location of the Gavião Paleoplate granitoids. Adapted from Barbosa et al. (2012).
- 1206 Figure 3. Field aspects of the studied granitoids. (a) Jussiape II granite, (b) Lagoa das Almas  
 1207 granodiorite, (c) Humaitá granodiorite, (d) Belo Campo granodiorite (e) Broco granodiorite.
- 1208 Figure 4. QAP modal diagram (after Strekeisen, 1967) for the Jussiape II, Lagoa das Almas,  
 1209 Humaitá, Belo Campo and Broco granitoids showing important fields of various granitoid  
 1210 series of the Lameyre and Bowden (1982).
- 1211 Figure 5. Zircon U-Pb concordia plot for the Jussiape II granite (Sample SCP SJ 01) (a, b) and  
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 1216 White circles correspond to the laser spot (size ~20  $\mu\text{m}$ ). Ellipses are reported at  $1\sigma$ . Zircon  
 1217 (e) and monazite (f) U-Pb concordia plot for the Broco granitoid (Sample TB-05). TL =  
 1218 transmitted light and BS = backscattered images. White circles correspond to the laser spot  
 1219 (size ~20  $\mu\text{m}$ ). Ellipses are reported at  $1\sigma$ .

1220 Figure 7. Epsilon Nd vs time diagram for the samples of the Jussiape II, Humaitá, Belo  
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 1222 Santos-Pinto et al. (2012) and Barbosa et al. (2013), as well as the granitoids of the Gavião  
 1223 Block (consult references in table 1), are reported. \*= Granitoids studies herein.

1224 Figure 8. Harker-like diagrams of major (wt.%) and trace elements (ppm) for Jussiape II,  
 1225 Lagoa das Almas, Humaitá, Belo Campo and Broco granitoids.

1226 Figure 9. Whole-rock, major and trace element geochemistry for Humaitá, Lagoa das Almas,  
 1227 Jussiape II and Broco granitoids. (a)  $\text{FeO}t/(\text{FeO}t+\text{MgO})$  (Fe-index) versus  $\text{SiO}_2$  diagram  
 1228 (Frost et al., 2001). (b)  $\text{Na}_2\text{O} + \text{K}_2\text{O}-\text{CaO}$  (MALI) versus  $\text{SiO}_2$  plot. (c) Diagram  
 1229  $[\text{Al}_2\text{O}_3/(\text{CaO} + \text{Na}_2\text{O} + \text{K}_2\text{O})]_{\text{mol}}$  versus  $[\text{Al}_2\text{O}_3/(\text{Na}_2\text{O} + \text{K}_2\text{O})]_{\text{mol}}$  (Maniar and Picolli,  
 1230 1989). (d, e) Tectonic discrimination diagrams according to Pearce (1996). WPG- Within  
 1231 plate granites, ORG- Ocean Ridge granites, VAG- Volcanic Arc granites, Syn-COLG- Syn-  
 1232 collision granites and Pos-COLG- Post-collision granites.

1233 Figure 10. (a-d) REE patterns for the studied granitoids normalized to chondrite values after  
 1234 Boynton (1984); (e-h) Spider diagrams normalized to ORG (ocean ridge Granites) values  
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1236 Figure 11. Crystallization ages for the granitoids of the southern region of the Gavião  
 1237 Paleoplate. Based on table 1.

1238 Figure 12. QAP modal diagram (after Streekeisen, 1967) for the granitoids of the southern  
 1239 region of the Gavião Paleoplate showing important fields of various granitoid series by  
 1240 Lameyre and Bowden (1982). Data for the granitoids: Aracatu (Santos Pinto 1996), Boquira  
 1241 (Arcanjo et al., 2005), Broco (this work), Caculé (Bastos Leal 1998, Cruz et al., 2009),  
 1242 Campo do Meio (Lopes 2002), Cara Suja (Rosa 1999, Paim 1998, 2014), Ceraíma (Rosa  
 1243 1999, Santos 1999, 2005), Espírito Santo (Bastos Leal 1998, Cruz et al., 2009), Estreito (Rosa  
 1244 1999, Leahy 1997), Guanambi (Rosa 1999), Humaitá (this study), Ibitirara (Guimarães et al.,  
 1245 2005), Iguatemi (Bastos Leal 1998), Jussiape I (Guimarães et al., 2005), Jussiape II (this  
 1246 study), Lagoa das Almas (this study), Mariana (Santos Pinto 1996), Pé do Morro and Piripá



1247 (Cruz Filho and Martins 2013), Ibitiara-Queimada Nova (Arcanjo et al., 2005), Rio do Paulo  
 1248 (Bastos Leal 1998), Santa Isabel (Cruz et al., 2014b), Serra da Franga (Santos Pinto 1996),  
 1249 Umburanas (Santos Pinto 1996, Martins et al., 2014), Veredinha (Arcanjo et al., 2005).

1250 Figure 13. (a-l) Harker-like diagrams of major elements (wt.%) for the granitoids of the  
 1251 southern region of the Gavião Paleoplate; (m)  $K_2O$  versus Ba; (n) Sr versus CaO for the  
 1252 groups of granitoids individualized in this article.

1253 Figure 14. Harker-like diagrams of trace elements (ppm) for the granitoids of the southern  
 1254 region of the Gavião Paleoplate.

1255 Figure 15. (a) Figure 15- discriminative diagrams for the samples of the individualized groups  
 1256 of granitoids in the present study. (a)  $K_2O$  versus  $Na_2O$  with the limit (full line) that separates  
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 1258 the fields with proportions between  $K_2O$  and  $Na_2O$ ; (b)  $K_2O$ - $Na_2O$  diagram, alkaline and  
 1259 subalkaline fields from Irvine and Baragar, (1971); (c)  $K_2O$ - $SiO_2$  diagram, high-, medium-  
 1260 and low-K series fields from Le Maitre (2002); (d)  $FeO_t/(FeO_t+MgO)$  versus  $SiO_2$  diagram  
 1261 (Frost et al., 2001); (e)  $Na_2O + K_2O$ -CaO (MALI) versus  $SiO_2$  plot (Frost et al., 2001).

1262 Figure 16. (a-e) REE patterns for the studied granitoids normalized to chondrite values after  
 1263 Boynton (1984). The yellow polygon shows the values for the Alto do Maranhão granitoid  
 1264 (see text for discussion); (e) and (f) total REE versus (La/Yb)<sub>N</sub> and Eu/Eu\* ratios,  
 1265 respectively.

1266 Figure 17. a-e) Spider diagrams normalized to ORG (Ocean Ridge Granites) values after  
 1267 Pearce et al. (1984) for the groups of granitoids individualized in this study. f) Spider  
 1268 diagrams normalized to ORG for some granitoids presented by Pearce et al., (1984).

1269 Figure 18- Tectonic discrimination diagrams according to (a) Harris et al. (1986), (b, c)  
 1270 Pearce et al. (1984), and (d-f) Müller and Groves (1993). WPG- Within plate granites, ORG-  
 1271 Ocean Ridge granites, VAG- Volcanic Arc granites, Syn-COLG- Syn-collision granites and  
 1272 Pos-COLG- Post-collision granites.

1273 Figure 19. Comparison of the  $\epsilon_{Nd}(t)$  data for the various granitoids of the southern region of  
 1274 the Gavião Paleoplate. See text for discussion.

1275 Figure 20. Schematic model of the tectonic environment for the formation of the granitoids of  
 1276 groups 1 and 2. a) 2.38 to 2.1: installation of a magmatic arc and a subduction zone to the  
 1277 west, producing the calcic to calc-alkalic granitic group 1; b) metamorphism between 2.1 and  
 1278 2.09 Ga with syn-collisional migmatization; c) 2.06 to 2.04: crystallization of alkali to alkali –  
 1279 calcic granitoids of Group 2a and of alkali – calcic to alkali granitoids of Group 2b; (d) 2.04

1280 to 1.8: large anatexis associated with the melting of continental crust and  
 1281 metavolcanosedimentary rocks and crystallization of the granitoids of groups 2c and 2d.  
 1282 Figure 21. Summary of the age of pre-collisional and post-collisional granitoids in the Gavião  
 1283 Paleoplate (Ar- Aracatu, H- Humaitá, I- Ibitiara, JI- Jussiape I, LA- Lagoa das Almas, RP-  
 1284 Rio do Paulo, V- Veredinha), Mineiro Belt (AM- Alto Maranhão, Br- Brumado, Ca-  
 1285 Cassiterita, G- Glória, Ge- Gentil, LD- Lagoa Doutorada, La- Lajedo, R- Ritópolis, S-  
 1286 Serrinha and Ti- Tiradentes), Mantiqueira Belt (D- Several granitoids from Noce et al.  
 1287 (2007), EC- Ewbank da Câmara, Pn1- Ponte Nova 1/inherited nuclei, Pn2- Ponte Nova 2,  
 1288 PRG-Piedade do Rio Grande, RPo-Rio Pomba), Serrinha Paleoplate (A-Arara, B-Barrocas,  
 1289 Ca- Cansação, C- Cipó, Ef- Efaceas, Eu- Euclides, It-Itareru, L- Lagoa dos Bois, N-  
 1290 Nordestina, Q- Quinjingue, Te-Teofilândia, T-trilhado) and eburnean granitoids of the Congo  
 1291 Paleoplate (LW- Lambaréné-Waka, O- L'Ogooué). Based on Silva et al. (2002b), Nunes  
 1292 (2007), Rios et al. (2008, 2009 and authors cited therein), Noce et al. (2007), Thieblemont et  
 1293 al. (2009 and authors cited therein) and the authors cited in table 1.

1294 Figure 22. Suggested outline for the continuity between the Western Bahia Magmatic Arc and  
 1295 the Mantiqueira and Mineiro arcs. GP- Gavião Paleoplate, JP- Jequié Paleoplate, SP- Serrinha  
 1296 Paleoplate.

1297 Figure 23. Comparison between the  $\square_{Nd}$  (t) data of the various granitoids in the southern  
 1298 region of the Gavião Paleoplate and the  $\square_{Nd}$  (t) data of the granitoids of the Mineiro Belt, of  
 1299 the Archean Basement of the São Francisco Craton and the Lavras mafic dike swarm of the  
 1300 Mineiro Belt. Groups A and B were obtained from Noce et al. (2000). See text for discussion.

### 1302 Table captions

1303 Table 1. Summary of the U-Pb ages (SHRIMP, TIMS and LA-ICPMS) in the Gavião  
 1304 Paleoplate and the corresponding Nd isotopes modified from Santos Pinto et al., (2012).  
 1305 Methodologies: (i) U-Pb: (1) SHRIMP, (2) TIMS evaporation, (3) TIMS (ID), (4) LA  
 1306 ICPMS, (5) EPMA. (ii) (6) Rb-Sr. References: (1) Sabaté et al (1990) (2) Santos Pinto (1996),  
 1307 (3) Santos Pinto et al. (1998), (4) Rosa (1999), (5) Bastos Leal et al. (2000), (6) Rosa et al.  
 1308 (2000), (7) Lopes (2002), (8) Arcanjo et al. (2005), (9) Guimarães et al. (2005), (10) Santos  
 1309 Pinto et al. (2012), (11) Campos (2013), (12) Medeiros (2013), (13) Cruz Filho and Martins  
 1310 (2013), Wosniak et al. (2013).

1311 Table 2. Summary of the LA-ICPMS U-Pb zircon results. Uncertainties are given at a 1  $\sigma$   
 1312 level. (-) parameter not analyzed. Coordinates in UTM (WGS 84 Datum).

- 1313 Table 3. Whole rock Sm-Nd results for the rock studied.
- 1314 Table 4. Whole rock chemical analysis for the Jussiape II granitoid. Oxides are in wt.% and  
 1315 trace elements in ppm. Detection limit for major elements was 0.01% and for trace elements:  
 1316 Rb (> 2 ppm), Sr (> 10 ppm), Ba (> 10 ppm), Ga (> 0.1 ppm), Cs (> 0.05 ppm), Nb (> 0.05  
 1317 ppm), Y (> 10 ppm), Zr (> 10 ppm), Hf (> 0.05 ppm), Ta (> 0.05 ppm), Th (> 0.1 ppm), U (>  
 1318 0.05 ppm), La (> 0.1 ppm), Ce (> 0.1 ppm), Nd (> 0.1 ppm), Sm (> 0.1 ppm), Eu (> 0.05  
 1319 ppm), Gd (> 0.05 ppm), Tb (> 0.05 ppm), Dy (> 0.05 ppm), Ho (> 0.05 ppm), Er (> 0.05  
 1320 ppm), Yb (> 0.1 ppm), Lu (> 0.05).
- 1321 Table 5. Whole rock chemical analysis for the Lagoa das Almas granitoid. Oxides are in wt.%  
 1322 and trace elements in ppm. 1. The detection limit for major and trace elements is the same of  
 1323 table 4.
- 1324 Table 6. Whole rock chemical analysis for the Humaitá granitoid. Oxides are in wt.% and  
 1325 trace elements in ppm. The detection limit for major and trace elements is the same of table 4.
- 1326 Table 7. Whole rock chemical analysis for the Broco granitoid. Oxides are in wt.% and trace  
 1327 elements in ppm. The detection limit for major and trace elements is the same of table 4.
- 1328 Table 8. Synthesis of the geochemical data for the granitoids of the southern Gavião  
 1329 Paleoplate elaborated from Appendix 1.

### 1331 Appendix captions

- 1332 Appendix 1– Geochemical data (Major elements) for the granitoids of the southern Gavião  
 1333 Paleoplate: Aracatu (Santos Pinto 1996), Boquira (Teixeira 2000), Broco (this study), Caculé  
 1334 (Bastos Leal 1998, Leal et al., 2005), Caetano-Aliança (Cuney et al., 1990), Campo do Meio  
 1335 (Lopes 2002), Cara Suja (Rosa 1999, Paim 1998, 2014), Ceraíma (Rosa 1999), Espírito Santo  
 1336 (Bastos Leal 1998, Leal et al., 2005), Estreito (Rosa 1999, Santos 2005), Gameleira granitoid  
 1337 (Petta 1979, Marinho 1991, Cuney et al., 1990), Guanambi-Urandi multiples intrusion (Rosa  
 1338 1999), Humaitá (this study), Ibitirara-Queimada Nova (Teixeira 2005), Iguatemi-Pé do Morro  
 1339 (Bastos Leal 1998, Leal et al., 2005, Teixeira 2014), Jussiape I (Teixeira 2005), Jussiape II  
 1340 (this study), Lagoa das Almas (this study), Lagoa Grande-Lagoinha (Conceição 1986, Cuney  
 1341 et al., 1990), Mariana (Santos Pinto 1996), Piripá (Teixeira 2014), Riacho das Pedras (Cuney  
 1342 et al., 1990, Marinho 1991), Rio do Paulo (Bastos Leal 1998, Leal et al., 2005, Teixeira  
 1343 2014), Santa Isabel (Cruz et al., 2014b), Serra da Franga (Santos Pinto 1996), Umburanas  
 1344 (Santos Pinto 1996, Teixeira 2014), Veredinha (Teixeira 2000) granitoids. NC- Normative  
 1345 corundum.

- 1346 Appendix 2– Geochemical data (Trace elements) for the granitoids of the southern Gavião  
1347 Paleoplate. 2. The data source is the same of Appendix 1.  
1348 Appendix 3– Geochemical data (Trace elements) for the granitoids of the southern Gavião  
1349 Paleoplate. The data source is the same of Appendix 1.  
1350 Appendix 4– Geochemical data for the granitoids of the southern Gavião Paleoplate based on  
1351 the data from appendices 1 through 3.

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Table 1.

Group	Granitoid	Sample	Rock type	Zircon age (Ma or Ga) $\pm 2 \delta$ (inherited)	Method	Monazite* age	Methodology	Nd TDM in Ga	$\epsilon(t)$ with $t =$ zircon age	Reference
1	Aracatu	ARA170	Isotropic granite	1999 $\pm$ 14 to 2262 $\pm$ 22	2			3.58	-12,19	2, 3
1	Aracatu	ARA81-4	Leucosome of an Archean trondhlemite	2.38 (to 2.93 Ga)	2			3.77	-12,95	2, 3
1	Humaitá		Granodiorite	2140 $\pm$ 9	4			2.76	- 4.0	This work
1	Ibitiara		Tonalite	2.091 $\pm$ 6.6	4					9
1	Ibitiara	IBI-01	Granodiorite	2.174 $\pm$ 17-15	4					11
1	Ibitiara	FPP-05	Granodiorite	2.174 $\pm$ 51						11
1	Lagoa das Almas	L-05	Granodiorite	2114 $\pm$ 24 (2250 $\pm$ 23 Ma)	4					This work
1	Rio do Paulo		Granite	2324 $\pm$ 6	4					13
1	Veredinha		Monzogranite and granodiorite	2113 $\pm$ 11	4					8
1	Jussiape I		Granite	2121 $\pm$ 2.2	4					9
2a	Boquira		Biotite monzogranite	2041 $\pm$ 23	4					8
2a	Cara Suja	974	Syenite	2053 $\pm$ 3	3			2.61	- 7.5	4
2a	Ceraíma	1188	Syenite	2050 $\pm$ 1	3			2.84	-9.5	4

2a	Ceraíma	1170	Syenite	2049 ± 2	2			2.85	-10.2	4
2a	Estreito	1226	Monzonite	2054 ± 3	3					4
2a	Estreito	1232	Syenite	2041 ± 2	2			2.69	-10.3	4
2a	Multiple intrusions	1141	Monzonite	2054 -6/+8	3			2.66	-8.23	4
2a	Multiple intrusions	1002	Syenite	2049 ± 1	2			2.77	-9.85	4
2b	Santa Isabel Granitoide (Diatexitic migmatites)	OPU 6355	Monzogranite	2066 ± 37 (3097 ± 24)	4					12
2b	Caculé	BRJC 234	Granite		2			2.77 (to t=2.0 Ga)	-8 (to t=2.0 Ga)	5
	Caculé	BRJC 237	Granite	2019±32 (1956±56 to 2070±72)						5
2b	Jussape II	SCP-SJ-01	Syenogranite	2052 ± 44	4			3.25	-10	This work
2c	Pé do Morro		Granite	1.968±35	4					13
2c	Iguatemi	RO-23	Granite	2.058±8	4					13
2c	Iguatemi	BR-JC-309	Granite					2.93(to t=2.0 Ga)	-8,9(to t=2.0 Ga)	5
2c	Iguatemi	BR-JC-304J	Granite					3.46(to t=2.0 Ga)	-13,4(to t=2.0 Ga)	5
2c	Mariana	MAR137	Isotropic pink	1852±50 to	2			3.45	-10	2,3



			granite	1944±14						
2c	Serra da Franga	SRF	Isotropic monzogranite	2039±22	2					2,3
2d	Riacho da Pedras		Monzogranite	1929 ±16	6			3.16	-6.2	1
2d	Broco	TB-05	Granodiorite	2038 ±8	4	1964±9 *	4	2.9	-6.3	This work
2d	Espírito Santo	BR01/02	Granite	1997 ±32 to	2					5
2d	Espírito Santo	BR01/06	Granite	2023 ±26						5
2d	Espírito Santo	BR01L	Granite					3.05 (to t=2.0 Ga)	-11,1 (to t=2.0 Ga)	5
		BR01S	Granite					3,09 (to t=2.0 Ga)	-12,0 (to t=2.0 Ga)	
2d	Umburana	ARN58-1	Isotrope anatic granite	(2570±20 to 2833±66)	2			3.30	-14	2,3
2d	Umburana	ARN60-1	Granodiorite to monzogranite	(2848±10 to 3103±8)	2			3.38	-14	2,3
2d	Umburana	UMB 164	Granodiorite to monzogranite	(3052±30 to 3130±14)	2			3.38	-15	2,3
2d	Umburana	UMB 165	Granodiorite to monzogranite	(2791±8 to 3006±18)	2	2002±26 to 2049±12	2	3.35	-15	10
2d	Umburana	UMB 165	Granodiorite to monzogranite			1962±13 to 2053±17	5			10
2d	Umburana	UMB 165	Granodiorite to monzogranite			1971±10 and 2.50	4			10
2d	Lagoinha-Lagoa		Granite	1974 ±36	6					1

	Grande- Lagoinha	GO9HC- BC						2.7	-4.9	1
	Lagoa Grande-	G58HC						2,6	-7.6	1
2d	Gameleira		Granite	1947 ±54	6			2.6	-8.8	1
2d	Caetano- Aliança		Granite	ND				2.4	-5.2	1
2d	Campo do Meio		Granite	2012±4	3					7
2d	Piripá		Granite	1.871±180	4					14
Undefined Group	Belo Campo		Granodiorite	2049 ± 23	4			3.28	-15.4	This work

Table 2

	U	Pb	Th	Isotopic ratios							Ages in Ma								
	ppm	ppm	ppm	Th/U	<sup>206</sup> Pb/ <sup>204</sup> Pb	<sup>207</sup> Pb/ <sup>206</sup> Pb	± 1l (%)	<sup>207</sup> Pb/ <sup>235</sup> U	± 1l (%)	<sup>206</sup> Pb/ <sup>238</sup> U	± 1l (%)	Rho	<sup>207</sup> Pb/ <sup>235</sup> U	± 1l	<sup>206</sup> Pb/ <sup>238</sup> U	± 1l	<sup>207</sup> Pb/ <sup>206</sup> Pb	± 1l	Conc (%)
<b>Jussiape Granite, sample SCP SJ01. Coordinate: 24 L 220332 / 8505202</b>																			
<b>LA-ICPMS analyses Brasilia / Brazil</b>																			
euhedral zircons ca 2.0 Ga																			
Z2	-	-	-	-	-	0,1199	6,7	5,091	5,5	0,3078	3,8	0,85	1835	45	1730	58	1955	114	88
Z5	-	-	-	0,32	19039	0,1176	6,3	2,956	8,9	0,1823	6,3	0,89	1396	67	1080	62	1920	112	56
Z7	-	-	-	0,27	27025	0,1331	10,2	6,986	8,4	0,3808	5,9	0,94	2110	72	2080	104	2139	169	97
Z8	-	-	-	0,20	100561	0,1190	14,8	3,706	12,3	0,2259	8,1	0,96	1573	94	1313	97	1941	244	68
Z9	-	-	-	0,02	6482	0,1216	7,7	4,929	6,3	0,2939	4,4	0,86	1807	52	1661	64	1980	130	84
Z10	-	-	-	-	25150	0,1229	10,0	4,337	8,2	0,2559	5,7	0,92	1700	65	1469	75	1999	167	73
Z11	-	-	-	0,18	593	0,1357	4,5	7,261	6,2	0,3881	4,4	0,79	2144	56	2114	78	2173	78	97
Z12	-	-	-	0,03	64775	0,1275	10,3	6,428	8,4	0,3658	5,9	0,93	2036	72	2010	101	2063	171	97
Z13	-	-	-	0,92	654	0,1336	8,8	4,226	7,4	0,2293	4,7	0,87	1679	59	1331	58	2146	147	62
Z15	-	-	-	0,02	16377	0,1309	4,3	8,959	6,0	0,4965	4,1	0,86	2334	54	2599	88	2110	75	123
Z16	-	-	-	0,04	210602	0,1272	4,7	7,415	6,6	0,4226	4,5	0,87	2163	59	2272	87	2060	84	110
Z17	-	-	-	0,31	7400	0,1269	7,2	5,815	6,0	0,3324	4,1	0,85	1949	50	1850	65	2055	122	90
Z19	-	-	-	0,02	25801	0,1234	5,8	6,427	8,2	0,3777	5,8	0,92	2036	72	2066	102	2006	104	103
Z20	-	-	-	0,01	129780	0,1255	3,9	6,507	5,4	0,3761	3,7	0,85	2047	48	2058	65	2036	69	101
cores and inherited zircons ca 2.7 & 3.1 Ga																			
Z1	-	-	-	-	-	0,1738	7,5	10,395	6,1	0,4337	4,3	0,88	2471	55	2322	83	2595	119	89
Z3	-	-	-	-	-	0,1594	9,7	8,701	7,9	0,3959	5,6	0,89	2307	70	2150	101	2449	155	88
Z4	-	-	-	-	-	0,1847	6,4	12,157	5,2	0,4773	3,7	0,89	2617	48	2515	77	2696	102	93
Z6	-	-	-	0,08	1267	0,1851	8,5	12,372	6,9	0,4848	4,9	0,92	2633	63	2548	102	2699	133	94
Z14	-	-	-	0,07	17954	0,2397	7,3	20,279	6,0	0,6135	4,1	0,86	3105	57	3084	101	3118	112	99
Z18	-	-	-	0,04	29032	0,1834	3,8	13,160	5,3	0,5205	3,6	0,84	2691	50	2701	80	2684	64	101
<b>Lagoa das Almas Granite, sample ( L-05). Coordinate: 23 L 777329 / 8351468</b>																			
<b>LA-ICPMS analyses Brasilia / Brazil</b>																			
Z1	723	248	23	0,03	-	0,1229	0,82	4,980	1,8	0,2939	1,62	0,89	1816	33	1661	27	1998	16	84
Z2	502	187	152	0,30	-	0,1321	0,85	7,009	2,4	0,3847	2,19	0,93	2113	50	2098	46	2127	18	99
Z3-1	535	159	57	0,11	-	0,1305	0,87	7,152	3,1	0,3974	2,98	0,96	2131	66	2157	64	2105	18	102
Z3-2	445	192	95	0,21	-	0,1328	0,79	7,535	2,3	0,4115	2,12	0,94	2177	49	2222	47	2136	17	104
Z4	598	220	555	0,93	-	0,1326	0,78	7,555	1,8	0,4132	1,64	0,90	2180	40	2230	37	2133	17	105
Z5	125	52	39	0,31	-	0,1322	1,58	7,249	2,1	0,3975	1,32	0,64	2142	44	2158	29	2128	34	101
Z6	258	110	28	0,11	-	0,1281	1,53	6,471	2,6	0,3664	2,16	0,82	2042	54	2012	43	2072	32	97
Z7	53	29	19	0,35	-	0,1434	1,73	8,143	2,5	0,4119	1,88	0,74	2247	57	2224	42	2268	39	98
Z8	591	238	82	0,14	-	0,1294	1,53	6,610	1,9	0,3706	1,15	0,60	2061	39	2032	23	2089	32	97
Z9	1324	301	341	0,26	-	0,1152	1,91	3,520	2,4	0,2216	1,38	0,59	1532	36	1290	18	1883	36	69
Z10	2708	398	199	0,07	-	0,0954	2,21	2,271	2,6	0,1727	1,43	0,54	1203	32	1027	15	1536	34	67

Table 2 ..cont.

<b>Humaíta Granodiorite, sample OPU 6356/F-05, Coordinate: 24L 773551/8416956</b>																				
<b>LA-ICPMS analyses Clermont Ferrand / France</b>																				
U	Pb	Th	Th/U	Isotopic ratios				Ages in Ma				Conc. (%)								
ppm	ppm	ppm		206Pb/204Pb	207Pb/206Pb	± 1	207Pb/235U	± 1	206Pb/238U	± 1 (%)	Rho	207Pb/235U	± 1	206Pb/238U	± 1	207Pb/206Pb	± 1	Conc. (%)		
<b>Humaíta granite, sample OPU 6356</b>																				
<b>Magmatic overgrowths</b>																				
Z2.1	1234	388	264	0,21	-	0,1342	0,00141	6,672	0,07523	0,3605	0,00392	0,96	1985	19	2069	10	2154	18,26	92	
Z2.1	1420	406	241	0,17	-	0,1339	0,00143	6,116	0,06968	0,3314	0,0036	0,95	1845	17	1993	10	2149	18,53	86	
Z5.2	1434	452	221	0,15	-	0,1379	0,00146	6,932	0,07817	0,3645	0,00395	0,96	2004	19	2103	10	2201	18,25	91	
Z7.1	2540	802	414	0,16	-	0,1326	0,00142	6,754	0,0766	0,3693	0,00399	0,95	2026	19	2080	10	2133	18,57	95	
Z8.1	2087	684	369	0,18	-	0,1331	0,00143	6,999	0,07973	0,3813	0,00412	0,95	2082	19	2111	10	2140	18,67	97	
Z9.1	1149	348	169	0,15	-	0,1334	0,00144	6,533	0,07458	0,3553	0,00384	0,95	1960	18	2050	10	2143	18,73	91	
Z10.1	2113	640	425	0,20	-	0,1347	0,00146	6,490	0,07419	0,3496	0,00377	0,94	1933	18	2045	10	2160	18,75	89	
Z12.1	1247	351	194	0,16	-	0,1341	0,00147	6,078	0,07032	0,3286	0,00355	0,93	1832	17	1987	10	2153	19,07	85	
Z12.2	1413	427	180	0,13	-	0,1336	0,00147	6,521	0,07538	0,3541	0,00382	0,93	1954	18	2049	10	2145	19,1	91	
Z13.2	3798	1124	1339	0,35	-	0,1335	0,00147	6,075	0,07025	0,3301	0,00355	0,93	1839	17	1987	10	2144	19,14	86	
Z16.1	910	242	160	0,18	-	0,1340	0,00153	5,698	0,06756	0,3084	0,00333	0,91	1733	16	1931	10	2151	19,74	81	
Z16.2	1227	379	233	0,19	-	0,1332	0,0015	6,607	0,07744	0,3597	0,00387	0,92	1981	18	2060	10	2141	19,51	93	
<b>inherited cores</b>																				
Z1.1	1131	450	360	0,32	-	0,1499	0,00157	9,107	0,10241	0,4407	0,00479	0,97	2354	21	2349	10	2345	17,82	100	
Z2.2	957	593	529	0,55	-	0,2473	0,00259	20,739	0,23281	0,6083	0,0066	0,97	3063	26	3127	11	3167	16,51	97	
Z3.1	1382	661	239	0,17	-	0,1923	0,00202	14,141	0,1588	0,5335	0,00578	0,96	2756	24	2759	11	2762	17,13	100	
Z4.1	327	137	78	0,24	-	0,2011	0,00213	12,285	0,13896	0,4431	0,00481	0,96	2365	21	2626	11	2835	17,19	83	
Z5.1	203	116	167	0,82	-	0,1994	0,00212	15,084	0,17073	0,5486	0,00595	0,96	2819	25	2821	11	2821	17,23	100	
Z6.1	1086	651	1818	1,67	-	0,1764	0,00187	11,959	0,13502	0,4918	0,00532	0,96	2579	23	2601	11	2619	17,56	98	
Z9.2	329	169	306	0,93	-	0,1745	0,00188	11,910	0,13585	0,4949	0,00535	0,95	2592	23	2597	11	2602	17,86	100	
Z11.1	281	137	164	0,58	-	0,1802	0,00195	12,408	0,14194	0,4995	0,00539	0,94	2612	23	2636	11	2654	17,86	98	
Z13.1	421	177	194	0,46	-	0,1779	0,002	10,810	0,12692	0,4407	0,00477	0,92	2354	21	2507	11	2633	18,53	89	
Z14.1	166	69	91	0,55	-	0,1768	0,00207	10,388	0,12634	0,4262	0,00465	0,90	2288	21	2470	11	2623	19,36	87	
Z15.1	540	297	527	0,98	-	0,1858	0,00207	13,374	0,15552	0,5219	0,00562	0,93	2707	24	2707	11	2706	18,23	100	
Z17.1	262	121	204	0,78	-	0,1876	0,00219	11,682	0,14145	0,4516	0,0049	0,90	2402	22	2579	11	2721	19,13	88	
<b>Belo Campo Granite-Gneiss, sample SCP 1351, Coordinate: 24L 252896/8339686</b>																				
<b>LA-ICPMS analyses Brasilia / Brazil</b>																				
<b>euhedral zircons ca 2.03 Ga</b>																				
Z1	-	-	-	0,43	-	19006	0,1235	0,7	5,840	2,0	0,3430	1,9	0,90	1952	18	1901	31	2007	13	95
Z2	-	-	-	0,15	-	61242	0,1269	0,5	6,328	1,8	0,3616	1,8	0,95	2022	16	1990	30	2056	10	97
Z3	-	-	-	0,13	-	56831	0,1228	0,5	5,330	1,6	0,3147	1,5	0,94	1874	14	1764	24	1998	9	88
Z9	-	-	-	0,17	-	141710	0,1239	0,6	6,196	1,3	0,3627	1,1	0,86	2004	11	1995	20	2013	10	99
Z10	-	-	-	0,16	-	208355	0,1245	0,5	6,298	1,1	0,3670	1,0	0,82	2018	10	2015	17	2021	9	100
Z11	-	-	-	0,06	-	84689	0,1137	0,6	3,961	1,4	0,2527	1,3	0,91	1626	12	1452	17	1859	10	78
Z12	-	-	-	0,17	-	76913	0,1259	0,6	6,077	1,9	0,3501	1,8	0,95	1987	16	1935	29	2041	10	95
Z16	-	-	-	0,11	-	3246	0,1284	0,6	6,281	1,8	0,3548	1,7	0,94	2016	16	1957	28	2076	10	94
Z17	-	-	-	0,18	-	366452	0,1253	0,6	6,286	1,6	0,3638	1,5	0,92	2017	14	2000	25	2033	10	98
Z18	-	-	-	0,09	-	60368	0,1253	0,6	6,447	1,5	0,3730	1,4	0,90	2039	13	2044	24	2034	10	100
Z20	-	-	-	0,10	-	243273	0,1257	0,5	6,417	1,6	0,3702	1,5	0,96	2035	14	2030	27	2039	9	100
<b>cores and inherited zircons ca 2.8 &amp; 3.0 Ga</b>																				
Z4	-	-	-	0,03	-	440969	0,1997	0,5	13,868	1,3	0,5037	1,2	0,87	2741	12	2630	25	2824	8	93
Z5	-	-	-	0,39	-	52813	0,1896	0,5	11,568	1,9	0,4425	1,8	0,96	2570	17	2362	35	2739	9	86
Z6	-	-	-	0,22	-	316783	0,2410	0,5	19,270	1,4	0,5799	1,3	0,92	3055	13	2948	30	3127	8	94
Z7	-	-	-	0,06	-	184582	0,2016	0,5	14,512	1,5	0,5221	1,4	0,94	2784	14	2708	30	2839	8	95
Z8	-	-	-	0,24	-	38707	0,2014	1,2	13,226	4,0	0,4762	3,9	0,95	2696	38	2511	80	2838	19	88
Z13	-	-	-	0,15	-	150199	0,1844	0,5	12,818	1,4	0,5040	1,3	0,92	2666	13	2631	28	2693	8	98
Z14	-	-	-	0,23	-	52196	0,2083	0,5	15,426	1,2	0,5371	1,1	0,86	2842	12	2771	25	2892	8	96
Z15	-	-	-	0,19	-	25678	0,2265	0,7	17,558	3,5	0,5623	3,4	0,97	2966	33	2876	79	3027	11	95
Z19	-	-	-	0,04	-	220844	0,1991	0,7	14,680	2,1	0,5348	2,0	0,91	2795	20	2762	44	2819	11	98



Table 2 ..cont.

Broco Granodiorite , sample TB-05, Coordinate: 24L 796533/8418388																			
LA-ICPMS analyses Clermont Ferrand / France																			
	U	Pb	Th	Th/U	Isotopic ratios					Ages in Ma					Conc (%)				
					206Pb/204Pb	207Pb/206Pb	± 1	207Pb/235U	± 1	206Pb/238U	± 1	Rho	207Pb/235U	± 1		206Pb/238U	± 1	207Pb/206Pb	± 1
	ppm	ppm	ppm																
<b>TB-05 zircons</b>																			
1,2	2590	188	327	0,13	-	0,1256	0,0013	6,434	0,078	0,3717	0,0022	0,96	2037	11	2037	21	2037	19	100
3,1	3166	223	517	0,16	-	0,1261	0,0014	6,237	0,076	0,3588	0,0021	0,96	2010	11	1976	20	2044	19	97
5,1	3838	274	209	0,05	-	0,1243	0,0013	6,328	0,077	0,3694	0,0022	0,96	2022	11	2026	20	2018	19	100
6,1	2738	199	146	0,05	-	0,1256	0,0014	6,443	0,079	0,3721	0,0022	0,95	2038	11	2039	21	2037	19	100
7,1	2766	207	495	0,18	-	0,1276	0,0014	6,613	0,081	0,3758	0,0022	0,96	2061	11	2057	21	2066	19	100
8,1	4746	348	262	0,06	-	0,1260	0,0014	6,485	0,080	0,3732	0,0022	0,95	2044	11	2045	21	2043	19	100
9,1	2221	165	65	0,03	-	0,1278	0,0014	6,579	0,081	0,3734	0,0022	0,95	2057	11	2045	21	2068	19	99
9,2	3787	276	219	0,06	-	0,1256	0,0014	6,448	0,079	0,3722	0,0022	0,95	2039	11	2040	20	2038	19	100
10,1	2633	189	141	0,05	-	0,1245	0,0014	6,341	0,078	0,3693	0,0022	0,95	2024	11	2026	20	2022	19	100
11,1	1814	129	47	0,03	-	0,1279	0,0014	6,273	0,078	0,3558	0,0021	0,94	2015	11	1962	20	2069	19	95
12,1	3033	218	196	0,06	-	0,1242	0,0014	6,351	0,079	0,3708	0,0022	0,94	2026	11	2033	20	2018	19	101
13,1	2351	174	174	0,07	-	0,1268	0,0014	6,538	0,081	0,3739	0,0022	0,94	2051	11	2048	21	2055	19	100
13,2	2386	176	202	0,08	-	0,1263	0,0014	6,491	0,081	0,3726	0,0022	0,94	2045	11	2042	20	2048	19	100
13,3	2322	171	106	0,05	-	0,1265	0,0014	6,497	0,082	0,3726	0,0022	0,93	2046	11	2042	20	2049	20	100
14,1	3249	232	247	0,08	-	0,1239	0,0014	6,289	0,079	0,3680	0,0022	0,93	2017	11	2020	20	2014	20	100
14,2	4282	304	261	0,06	-	0,1246	0,0014	6,254	0,079	0,3641	0,0021	0,93	2012	11	2002	20	2023	20	99
14,3	4036	287	310	0,08	-	0,1240	0,0014	6,270	0,079	0,3668	0,0021	0,92	2014	11	2014	20	2014	20	100
15,1	2898	208	459	0,16	-	0,1248	0,0014	6,324	0,081	0,3676	0,0022	0,92	2022	11	2018	20	2025	20	100
15,2	2940	213	483	0,16	-	0,1253	0,0014	6,367	0,081	0,3686	0,0022	0,92	2028	11	2023	20	2033	20	100
17,1	2907	210	449	0,15	-	0,1250	0,0015	6,349	0,082	0,3683	0,0022	0,91	2025	11	2022	20	2029	20	100
18,1	1777	118	84	0,05	-	0,1270	0,0015	5,862	0,076	0,3348	0,0020	0,90	1956	11	1862	19	2057	21	91
18,2	3405	201	135	0,04	-	0,1248	0,0015	5,196	0,068	0,3020	0,0018	0,90	1852	11	1701	17	2025	21	84
19,1	2014	143	121	0,06	-	0,1281	0,0015	6,249	0,082	0,3540	0,0021	0,89	2011	11	1953	20	2071	21	94
20,1	3171	227	417	0,13	-	0,1243	0,0015	6,287	0,083	0,3668	0,0021	0,89	2017	12	2014	20	2019	21	100
21,1	769	50	95	0,12	-	0,1270	0,0016	5,705	0,077	0,3257	0,0019	0,87	1932	12	1818	19	2057	22	88
<b>TB-05 monazite</b>																			
1,1	7006	9937	96117	14	-	0,1218	0,0014	6,263	0,081	0,3731	0,0047	0,97	2013	11	2044	22	1982	20	102
1,3	7492	11811	112949	15	-	0,1215	0,0014	6,164	0,080	0,3681	0,0046	0,96	1999	11	2020	22	1978	20	101
1,4	9938	9894	97040	10	-	0,1199	0,0013	5,914	0,077	0,3578	0,0045	0,96	1963	11	1972	21	1955	20	100
2,1	2840	11431	113651	40	-	0,1180	0,0013	5,761	0,076	0,3542	0,0045	0,95	1941	11	1955	21	1926	20	101
2,2	2891	11657	114963	40	-	0,1197	0,0014	5,855	0,078	0,3549	0,0045	0,95	1955	11	1958	21	1951	20	100
2,3	3464	8962	87825	25	-	0,1200	0,0014	5,767	0,076	0,3488	0,0044	0,95	1942	11	1929	21	1955	20	99
3,1	5562	9158	89168	16	-	0,1215	0,0014	6,085	0,081	0,3632	0,0046	0,95	1988	12	1998	22	1979	20	100
3,2	9296	8769	85613	9	-	0,1203	0,0014	5,932	0,079	0,3578	0,0045	0,95	1966	12	1972	21	1960	20	100
3,3	5411	7425	71352	13	-	0,1210	0,0014	6,173	0,082	0,3700	0,0047	0,94	2001	12	2030	22	1971	20	101
3,4	3005	12417	121625	40	-	0,1194	0,0014	5,856	0,079	0,3558	0,0045	0,93	1955	12	1962	21	1947	21	100
4,1	2226	8970	89126	40	-	0,1196	0,0014	5,950	0,081	0,3608	0,0046	0,93	1969	12	1986	22	1950	21	101
4,2	6342	8743	88638	14	-	0,1195	0,0014	5,944	0,080	0,3610	0,0045	0,94	1968	12	1987	21	1948	21	101
4,3	4108	9288	92166	22	-	0,1214	0,0014	6,079	0,082	0,3633	0,0046	0,93	1987	12	1998	22	1977	21	101
4,4	3370	9419	93367	28	-	0,1206	0,0014	6,018	0,082	0,3619	0,0046	0,93	1978	12	1991	22	1965	21	101
5,1	1149	1492	61126	53	-	0,1206	0,0014	5,732	0,078	0,3448	0,0043	0,93	1936	12	1910	21	1965	21	99
5,2	15860	9068	92461	6	-	0,1213	0,0014	5,790	0,079	0,3464	0,0044	0,92	1945	12	1917	21	1975	21	98
5,3	17085	9254	90190	5	-	0,1200	0,0014	5,740	0,078	0,3468	0,0044	0,92	1937	12	1920	21	1957	21	99
5,4	12930	8339	82463	6	-	0,1198	0,0014	5,829	0,080	0,3529	0,0044	0,91	1951	12	1948	21	1954	21	100
6,1	1659	7271	79511	48	-	0,1234	0,0015	5,928	0,084	0,3484	0,0044	0,89	1965	12	1927	21	2006	22	98
6,2	2238	9591	95701	43	-	0,1212	0,0015	6,044	0,085	0,3617	0,0046	0,89	1982	12	1990	22	1974	22	100
6,3	2185	9309	91674	42	-	0,1216	0,0015	6,035	0,086	0,3602	0,0046	0,89	1981	12	1983	22	1979	22	100
6,4	2430	9998	106174	44	-	0,1198	0,0015	5,659	0,082	0,3425	0,0043	0,88	1925	12	1899	21	1954	23	99

Table 3.

Sample	Rock	Sm(ppm)	Nd(ppm)	$^{147}\text{Sm}/^{144}\text{Nd}$	$^{143}\text{Nd}/^{144}\text{Nd}$	$\epsilon$ (t=Crystallization age)	$T_{\text{DM}}$ (Ga)	t (Crystallization age) (Ga)
SCP-SJ01	Jussiape II syenogranite	17,315	87,290	0,1199	0,511078	- 10,3	3,21	2052 ± 44
SCP-1351	Belo Campo granodiorite	5,621	35,630	0,0954	0,510507	- 15,4	3,28	2028 ± 14
OPU 6356 (F-05)	Humaitá granodiorite	1,705	9,702	0,1062	0,511193	- 4,0	2,76	2140±9
TB-05	Broco granodiorite	4,435	27,390	0,0960	0,510934	- 6,3	2,85	2038 ±8

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Table 4

ID	SCP-1449a1	SCP-1449a2	SCP- 1449c	SCP-2019.5J	SCP-SJ01	SCP-SJ-24b	SCP-1449b	SCP-2035b	SCP-2035c
General classification	Syenogranite	Syenogranite	Quartz-syenite	Quartz-syenite	Syenogranite	Syenogranite	Syenogranite	Syenogranite	Syenogranite
<b>SiO<sub>2</sub></b>	74,80	74,80	66,70	67,07	72,80	76,90	75,70	74,90	73,40
<b>TiO<sub>2</sub></b>	0,17	0,16	0,49	0,32	0,24	0,41	0,48	0,26	0,17
<b>Al<sub>2</sub>O<sub>3</sub></b>	13,00	13,20	18,50	18,02	13,70	11,90	11,70	12,90	13,60
<b>FeO</b>	0,87	0,79	3,19	3,18	1,03	1,73	4,56	4,36	0,88
<b>Fe<sub>2</sub>O<sub>3</sub></b>	1,38	1,42	1,43	0,70	1,72	1,87	2,23	2,44	2,50
<b>MnO</b>	0,02	0,02	0,04	0,02	0,02	0,04	0,03	0,03	0,03
<b>MgO</b>	0,24	0,24	0,49	0,24	0,44	0,38	0,33	0,31	0,24
<b>CaO</b>	1,03	1,10	3,36	1,76	1,16	0,80	0,95	1,14	1,22
<b>Na<sub>2</sub>O</b>	3,20	3,10	9,10	5,39	3,10	2,70	3,00	3,20	3,30
<b>K<sub>2</sub>O</b>	5,50	5,40	0,51	6,40	5,50	5,20	4,40	4,80	5,00
<b>P<sub>2</sub>O<sub>5</sub></b>	0,04	0,04	0,10	0,12	0,10	0,08	0,07	0,04	0,04
<b>LOI</b>	0,20	0,10	0,10	0,21	0,13	0,14	0,12	0,11	0,13
<b>Total</b>	99,58	99,58	100,82	100,25	98,91	100,42	99,01	100,13	99,63
<b>Ba</b>	178,00	199,00	860,00	359,80	233,00	559,00	966,00	730,00	721,00
<b>Cs</b>	35,00	33,00	83,00	10,40	45,00	35,00	< 0,05	< 0,05	< 0,05
<b>F</b>	275,00	295,00	279,00	110,00	527,00	489,00	415,00	729,00	514,00
<b>Ga</b>	18,00	21,00	22,00	16,50	20,00	12,00	21,00	19,00	19,00
<b>Hf</b>	2,00	11,10	3,20	2,10	4,30	4,40	4,30	5,20	1,40
<b>Nb</b>	18,00	15,00	15,00	16,00	12,00	12,00	59,00	24,00	29,00
<b>Rb</b>	56,00	55,00	40,00	33,40	78,00	138,00	194,00	282,00	292,00
<b>Sr</b>	62,00	57,00	82,00	137,10	109,00	118,00	8,00	21,00	24,00
<b>Ta</b>	18,00	20,00	30,00	23,80	22,00	18,00	12,00	12,00	14,00
<b>Th</b>	45,10	19,20	67,00	116,00	83,70	106,00	34,20	119,00	117,00
<b>U</b>	7,40	24,00	21,40	11,50	42,30	7,45	4,65	29,00	46,00
<b>Y</b>	22,50	22,30	58,40	44,40	40,50	112,00	41,40	70,00	146,00
<b>Zr</b>	9,00	9,30	9,20	9,10	8,55	9,55	599,00	232,00	197,00

<b>Ce</b>	113,00	225,00	347,00	308,80	201,00	479,00	287,00	176,00	306,00
<b>Dy</b>	5,06	5,07	14,10	8,21	9,08	25,50	10,00	6,18	17,00
<b>Er</b>	2,07	2,06	5,77	2,55	3,66	9,63	3,73	3,61	8,77
<b>Eu</b>	0,97	0,98	1,91	1,27	1,14	3,96	1,87	1,36	2,29
<b>Gd</b>	7,04	8,13	24,50	16,38	14,30	46,50	17,10	9,01	20,20
<b>Ho</b>	0,87	1,02	2,34	1,10	1,50	4,34	1,63	1,25	3,19
<b>La</b>	53,20	52,20	159,00	142,50	94,20	335,00	136,00	92,30	210,00
<b>Lu</b>	0,24	0,34	0,63	0,31	0,41	0,75	0,34	0,51	0,99
<b>Nd</b>	36,40	40,05	128,00	132,30	76,80	223,00	99,90	56,40	123,00
<b>Pr</b>	12,20	12,20	41,20	40,30	25,10	69,50	33,00	33,00	19,50
<b>Sm</b>	7,10	8,05	27,10	21,80	17,60	45,20	19,00	10,40	23,70
<b>Tb</b>	1,10	1,10	3,20	3,80	2,00	5,92	2,32	1,26	3,29
<b>Tm</b>	0,25	0,25	0,72	0,22	0,44	1,05	0,40	0,51	1,16
<b>Yb</b>	1,60	2,00	4,40	1,85	2,90	5,50	2,30	3,30	7,60

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<b>ID</b>	<b>SCP-SJ-24a</b>	<b>SCP-SJ-28</b>	<b>SCP-SJ-04</b>	<b>SCP-1858</b>	<b>SCP-1723</b>	<b>SCP-1726</b>	<b>SCP-1828</b>	<b>SCP-1822</b>
	Syenogranite	Syenogranite	Syenogranite	Syenogranite	Syenogranite	Syenogranite	Syenogranite	Syenogranite
<b>SiO<sub>2</sub></b>	72,80	76,20	73,80	72,20	73,00	74,00	74,20	75,30
<b>TiO<sub>2</sub></b>	0,41	0,41	0,16	0,22	0,16	0,26	0,15	0,11
<b>Al<sub>2</sub>O<sub>3</sub></b>	11,70	11,70	13,90	13,40	14,60	13,10	13,40	13,50
<b>FeO</b>	4,54	1,44	0,62	0,50	1,00	1,33	0,84	0,77
<b>Fe<sub>2</sub>O<sub>3</sub></b>	2,48	2,41	1,42	2,20	0,79	1,21	1,14	0,99
<b>MnO</b>	0,03	0,04	0,03	0,03	0,01	0,02	0,03	0,01
<b>MgO</b>	0,33	0,43	0,36	0,40	0,28	0,34	0,25	0,28
<b>CaO</b>	1,10	1,75	0,80	1,06	0,59	0,80	0,66	0,97
<b>Na<sub>2</sub>O</b>	2,80	3,20	3,40	3,00	3,60	3,10	3,40	3,70

<b>K<sub>2</sub>O</b>	4,40	2,90	5,20	5,50	6,00	6,00	5,50	5,00
<b>P<sub>2</sub>O<sub>5</sub></b>	0,07	0,07	0,09	0,09	0,09	0,12	0,03	0,04
<b>LOI</b>		0,02	0,21	0,44	0,24	0,39	0,37	0,17
<b>Total</b>	100,66	100,57	99,99	99,04	100,36	100,67	99,97	100,84
<b>Ba</b>	816,00	790,00	399,00	410,00	608,00	464,00	362,00	384,00
<b>Cs</b>	ND	ND	ND	ND	ND	ND	ND	ND
<b>F</b>	341,00	502,00	202,00	315,00	211,00	360,00	249,00	286,00
<b>Ga</b>	18,00	20,00	22,00	21,00	23,00	22,00	23,00	22,00
<b>Hf</b>	5,40	6,10	6,50	7,20	8,20	2,20	2,40	2,30
<b>Nb</b>	38,00	45,00	45,00	55,00	25,00	59,00	36,00	16,00
<b>Rb</b>	199,00	168,00	401,00	357,00	343,00	307,00	394,00	272,00
<b>Sr</b>		23,00	57,00	15,00	47,00	11,00	11,00	47,00
<b>Ta</b>	16,00	3,10	8,20	5,20	7,90	6,30	8,20	9,10
<b>Th</b>	97,00	28,00	52,10	80,00	58,70	75,40	52,60	45,40
<b>U</b>	16,00	27,00	19,40	31,90	25,00	21,10	14,40	5,66
<b>Y</b>	65,00	113,00	83,90	119,00	156,00	104,00	83,50	73,50
<b>Zr</b>	621,00	613,00	173,00	197,00	176,00	225,00	142,00	130,00
<b>Ce</b>	274,00	296,00	124,00	199,00	130,00	200,00	146,00	121,00
<b>Dy</b>	10,50	14,30	12,10	20,70	20,90	18,10	14,40	11,60
<b>Er</b>	3,84	7,31	7,01	11,80	14,60	9,64	8,21	7,09
<b>Eu</b>	1,49	2,23	0,75	0,95	1,19	1,09	0,85	0,71
<b>Gd</b>	17,80	19,50	12,20	18,70	17,50	21,70	14,10	10,80
<b>Ho</b>	1,71	2,84	2,44	4,16	4,79	3,62	2,78	2,39
<b>La</b>	130,00	165,00	64,60	93,90	73,80	87,20	84,60	57,80
<b>Lu</b>	0,37	0,78	0,99	1,56	2,16	0,95	1,21	0,96
<b>Nd</b>	99,80	117,00	51,90	77,30	55,10	77,30	61,60	44,70
<b>Pr</b>	44,30	31,00	16,90	25,30	17,00	24,00	19,70	14,80
<b>Sm</b>	19,10	22,60	13,00	19,70	13,80	20,10	15,10	11,30
<b>Tb</b>	2,44	2,88	2,16	3,45	3,28	3,38	2,48	1,98
<b>Tm</b>	0,44	0,85	0,94	1,67	2,22	1,22	1,21	0,99

<b>Yb</b>	2,50	5,30	6,60	11,00	14,40	6,70	8,50	7,10
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Table 5

<b>ID</b>	<b>L-45</b>	<b>L-46</b>	<b>L-50</b>	<b>L-52</b>	<b>L-52</b>	<b>L-59</b>	<b>L-05A</b>	<b>L-16A</b>	<b>L-22</b>	<b>L-40</b>	<b>L-44A</b>
<b>General classification</b>	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite
<b>SiO<sub>2</sub></b>	72,70	73,80	73,50	66,20	66,90	68,30	73,60	71,50	71,10	71,00	70,30
<b>TiO<sub>2</sub></b>	0,26	0,18	0,20	0,50	0,50	0,43	0,19	0,22	0,35	0,37	0,38
<b>Al<sub>2</sub>O<sub>3</sub></b>	14,20	14,00	14,10	16,10	16,30	15,50	14,50	15,40	14,50	14,60	14,60
<b>FeO</b>	1,77	1,57	2,21	2,69	2,87	2,99	0,38	0,89	0,99	0,94	0,27
<b>Fe<sub>2</sub>O<sub>3</sub></b>	2,83	2,17	2,72	4,85	4,51	3,91	1,64	1,29	2,14	2,13	2,63
<b>MnO</b>	0,04	0,03	0,03	0,05	0,05	0,04	0,03	0,02	0,05	0,04	0,06
<b>MgO</b>	0,45	0,38	0,41	1,46	1,47	1,01	0,60	0,49	0,96	0,91	0,61
<b>CaO</b>	1,27	1,29	1,53	2,44	2,44	2,81	0,50	0,53	1,54	0,99	1,89
<b>Na<sub>2</sub>O</b>	3,90	3,97	4,23	5,60	5,70	4,75	5,30	3,60	3,50	3,60	3,70
<b>K<sub>2</sub>O</b>	3,87	4,23	3,34	1,69	1,71	2,12	3,30	5,50	4,90	4,30	4,40
<b>P<sub>2</sub>O<sub>5</sub></b>	0,08	0,08	0,06	0,19	0,19	0,13	0,16	0,09	0,13	0,15	0,11
<b>LOI</b>	0,02	0,15	0,08	0,03	0,01	0,01	0,01	0,15	0,03	0,03	0,01
<b>Total</b>	101,39	101,85	102,41	101,80	102,65	102,00	100,21	99,68	100,19	99,06	98,96
<b>Ba</b>	732,00	862,00	600,00	659,00	625,00	1296,00	632,00	1039,00	1644,00	8,33	1685,00
<b>F</b>	610,00	384,00	1543,00	1425,00	424,00	502,00	147,00	197,00	397,00	443,00	1339,00
<b>Ga</b>	26,00	25,00	27,00	21,00	23,00	23,00	22,00	22,00	19,00	17,00	25,00
<b>Hf</b>	5,00	7,00	6,00	8,00	7,00	6,00	8,00	7,00	6,00	5,00	8,00
<b>Nb</b>	9,00	17,00	22,00	9,00	10,00	8,00	17,00	23,00	12,00	19,00	18,00
<b>Rb</b>	191,00	193,00	172,00	78,00	68,00	80,00	193,00	361,00	198,00	208,00	214,00
<b>Sr</b>	196,00	198,00	188,00	575,00	575,00	808,00	58,00	151,00	286,00	334,00	755,00
<b>Ta</b>	0,50	0,45	0,44	0,54	0,54	0,55	0,54	0,70	0,88	0,66	0,66
<b>Th</b>	15,00	5,00	14,00	22,00	22,00	22,00	13,60	29,40	51,30	29,90	93,50
<b>U</b>	3,20	3,20	3,14	4,23	4,23	5,20	2,94	8,72	2,88	6,67	5,60
<b>Y</b>	6,00	7,00	5,00	10,00	11,00	6,00	7,10	30,10	18,50	89,00	23,30
<b>Zr</b>	148,00	134,00	151,00	236,00	237,00	225,00	137,00	169,00	333,00	255,00	209,00
<b>Ce</b>	63,00	48,40	50,90	68,90	67,20	78,70	36,80	88,20	191,00	229,00	375,00
<b>Dy</b>	2,08	1,92	1,20	1,94	1,97	1,03	1,41	5,35	3,77	12,50	7,13
<b>Er</b>	0,76	0,70	0,31	0,96	0,91	0,38	0,56	3,07	1,66	6,44	1,86

<b>Eu</b>	0,45	0,31	0,35	0,89	0,91	0,76	0,45	0,83	1,34	3,31	6,00
<b>Gd</b>	2,98	2,63	2,37	2,76	2,43	1,71	2,60	5,71	8,04	18,20	18,30
<b>Ho</b>	0,27	0,27	0,15	0,36	0,29	0,14	0,22	1,06	0,64	2,40	0,96
<b>La</b>	35,60	27,00	27,90	39,80	39,60	49,40	19,10	43,20	101,00	149,00	189,00
<b>Lu</b>	0,07	0,05	0,05	0,06	0,07	0,19	<0,05	0,43	0,23	0,68	0,15
<b>Nd</b>	25,60	20,70	20,20	27,10	26,50	25,10	14,80	32,60	69,60	106,00	159,00
<b>Sm</b>	4,70	4,00	3,50	3,90	3,90	3,00	3,50	7,10	11,90	20,40	28,60
<b>Tb</b>	0,37	0,33	0,27	0,33	0,26	0,19	0,33	0,99	1,02	2,63	2,19
<b>Yb</b>	0,70	0,60	0,30	0,90	0,90	0,40	0,40	2,90	1,60	4,80	1,30



Table 6

<b>Sample</b>	<b>F-05</b>	<b>F-22</b>	<b>F-22A</b>	<b>F-22 B</b>	<b>F-22 C</b>	<b>F-20</b>	<b>G-4</b>	<b>G-13</b>
<b>General classification</b>	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite
<b>SiO<sub>2</sub></b>	72,5	71,7	70,8	72,3	72,6	73,5	71,6	70,2
<b>TiO<sub>2</sub></b>	0,11	0,11	0,11	0,12	0,12	0,03	0,09	0,11
<b>Al<sub>2</sub>O<sub>3</sub></b>	16,1	15,9	15,8	16,2	16,3	13,9	16,2	16,1
<b>FeO</b>	0,18	0,22	0,19	0,22	0,2	0,32	0,35	0,44
<b>Fe<sub>2</sub>O<sub>3</sub></b>	1,2	1,22	1,24	1,18	1,22	1,5	1,63	2,21
<b>MnO</b>	0,02	0,03	0,1	0,2	0,1	0,04	0,04	0,04
<b>MgO</b>	0,51	0,56	0,55	0,53	0,51	0	0,29	0,38
<b>CaO</b>	2,75	2,75	2,77	2,76	2,75	1,34	2,65	2,79
<b>Na<sub>2</sub>O</b>	4,2	4,2	4,2	4,2	4,1	3,53	4,74	4,68
<b>K<sub>2</sub>O</b>	3,2	2,4	2,8	2,5	3	4,89	3	3,17
<b>P<sub>2</sub>O<sub>5</sub></b>	0,02	< 0,01	< 0,01	< 0,01	< 0,01	0,074	0,028	0,045
<b>LOI</b>	0,02	0,2	0,13	0,02	0,01	0,08	< 0,01	< 0,01
<b>SiO<sub>2</sub></b>	100,81	99,29	98,69	100,23	100,91	99,204	100,618	100,165
<b>Ba</b>	1460	951	1290	1345	1090	1449	1095	1502
<b>F</b>	182	236	189	199	219	30	347	448
<b>Ga</b>	20	20	21	22	19	14	21	20
<b>Hf</b>	8	9	6	5	8	9	6	7
<b>Nb</b>	6	5	6	7	5	9	18	14
<b>Rb</b>	120	80	92	95	89	117	51	58
<b>Sr</b>	830	748	789	800	799	343	762	766
<b>Ta</b>	0,45	0,56	0,43	0,5	0,54	0,65	0,55	0,44
<b>Th</b>	22	2,2	3,2	6,4	12	4	3,4	3,5
<b>U</b>	8,5	4,8	4,9	5,9	8,5	4,5	4,5	4,6
<b>Y</b>	6,1	7,7	6,2	7,4	6,2	18	14	17
<b>Zr</b>	129	94	99	103	111	49	177	179

<b>Ce</b>	24,9	23,1	23,2	23,6	24,6	17,1	17,9	17,9
<b>Dy</b>	1,05	0,93	0,95	0,93	0,98	1,04	0,58	0,61
<b>Er</b>	0,5	0,51	0,5	0,52	0,5	0,74	0,32	0,3
<b>Eu</b>	0,36	0,41	0,41	0,38	0,4	0,4	0,35	0,31
<b>Gd</b>	1,48	1,44	1,44	1,47	1,46	1,05	0,99	1,1
<b>Ho</b>	0,19	0,19	0,2	0,18	0,19	0,23	0,12	0,11
<b>La</b>	14,6	17,2	15,4	16,8	14,5	14,5	10,2	12,6
<b>Lu</b>	0,06	0,05	0,06	0,06	0,07	0,15	0,05	0,05
<b>Nd</b>	9,5	8,7	8,7	9,2	8,8	6,8	6	7,6
<b>Pr</b>	3,15	2,92	2,88	2,87	2,89	2,13	1,85	2,16
<b>Sm</b>	1,8	1,9	1,9	1,9	1,9	1,2	1,1	1,3
<b>Tb</b>	0,22	0,2	0,21	0,2	0,2	0,16	0,11	0,12
<b>Tm</b>	0,07	0,07	0,07	0,08	0,07	0,14	0,05	0,05

Table 7

<b>ID</b>	<b>TB-01</b>	<b>TB-02</b>	<b>TB-03</b>	<b>TB-04</b>	<b>TB-05</b>	<b>TB-06</b>	<b>TB-07</b>
<b>General classification</b>	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite	Granodiorite
<b>SiO<sub>2</sub></b>	74,40	68,80	66,00	69,20	72,10	53,7	54,1
<b>TiO<sub>2</sub></b>	0,04	0,43	0,35	0,04	0,04	0,97	0,95
<b>Al<sub>2</sub>O<sub>3</sub></b>	14,50	15,50	16,40	16,50	15,50	15,7	15,7
<b>FeO</b>	0,78	3,05	2,36	3,10	0,79	10,85	11,21
<b>Fe<sub>2</sub>O<sub>3</sub></b>	1,31	4,08	7,20	4,20	2,24	16,6	16,6
<b>MnO</b>	0,02	0,04	0,15	0,02	0,01	0,28	0,27
<b>MgO</b>	0,24	1,06	2,01	1,08	0,25	4,28	4,22
<b>CaO</b>	1,54	2,67	1,94	2,55	1,66	1,82	1,86
<b>Na<sub>2</sub>O</b>	4,13	4,81	3,14	4,50	4,12	2,68	2,65
<b>K<sub>2</sub>O</b>	4,01	2,15	2,86	2,40	4,04	3,5	3,46
<b>P<sub>2</sub>O<sub>5</sub></b>	0,04	0,12	0,04	0,02	0,04	0,065	0,069
<b>LOI</b>	0,20	0,10	0,20	0,23	0,22	0,49	0,45
<b>Total</b>	100,43	99,76	100,29	100,74	100,22	100,09	100,33
<b>Ba</b>	195,00	1319,00	497,00	1322,00	212,00	463	427
<b>F</b>	112,00	480,00	368,00	487,00	112,00	945	934
<b>Ga</b>	25,00	21,00	22,00	22,00	22,00	19	20
<b>Hf</b>	6,10	3,40	6,40	6,40	6,40	7	7
<b>Nb</b>	19,00	6,00	20,00	6,00	22,00	23	30
<b>Rb</b>	128,00	78,00	81,00	77,00	144,00	127	132
<b>Sr</b>	131,00	704,00	208,00	704,00	132,00	140	156
<b>Ta</b>	12,00	13,00	10,00	12,00	12,00	9	9
<b>Th</b>	13,00	9,00	3,00	10,00	10,00	4	3
<b>U</b>	6,50	6,30	7,50	5,60	6,40	5	7
<b>Y</b>	29,00	<3	82,00	4,00	29,00	31	30
<b>Zr</b>	33,00	220,00	148,00	221,00	32,00	100	101
<b>Ce</b>	53,50	74,20	43,30	70,30	55,20	67,90	58,00
<b>Dy</b>	3,22	1,20	3,33	1,20	3,22	5,98	4,70
<b>Er</b>	2,00	0,42	2,20	0,44	2,00	2,96	2,52
<b>Eu</b>	0,49	0,76	0,50	0,65	0,50	1,53	1m38
<b>Gd</b>	3,22	1,78	3,24	1,55	3,33	6,10	4,85
<b>Ho</b>	0,64	0,19	0,66	0,20	0,55	1,28	1,02
<b>La</b>	37,00	46,10	31,70	46,30	38,00	43,40	36,10
<b>Lu</b>	0,08	0,05	0,06	0,07	0,09	0,64	0,46
<b>Nd</b>	17,50	22,80	14,40	23,10	18,30	31,10	25,80
<b>Pr</b>	5,63	7,39	4,51	7,41	5,93	8,68	7,13
<b>Sm</b>	3,10	2,90	2,90	3,10	3,20	6,20	4,70
<b>Tb</b>	0,44	0,18	1,1	0,12	0,55	1,18	0,89
<b>Tm</b>	0,32	0,07	0,8	0,44	0,08	0,63	0,50
<b>Yb</b>	2,1	0,4	2,2	2,10	2,20	2,90	2,50

Table 8

Data set/Group	G1		G2a		G2b		G2c		G2d	
Age U-Pb (Ma)	2324 ± 6 - 2.091±6.6		2054 -6/+8 - 2041 ±23		2066± 37 - 2019±32		2058 ±8 - 1852±50		2049±12 -1929 ±16	
K <sub>2</sub> O versus SiO <sub>2</sub>	Low-K . Medium-K. High-K		High-K		High-K		Medium-K. High-K		Medium-K. High-K	
Plag. Comp	Oligoclase (An 22-29%)		Oligoclase (An 20-30%)		Albite to oligoclase (An 06-30%)		oligoclase to albite (An 8-29%)		oligoclase to albite (An 8-28%)	
Element	M	SD	M	SD	M	SD	M	SD	M	SD
SiO <sub>2</sub>	70.77	3.30	61.67	5.79	69.30	6.26	74.76	1.68	72.30	2.57
TiO <sub>2</sub>	0.34	0.22	0.93	0.45	0.82	2.30	0.13	0.12	0.21	0.12
Al <sub>2</sub> O <sub>3</sub>	14.74	1.26	15.35	1.85	14.02	1.50	13.35	1.37	14.48	0.85
FeO	2.45	1.17	2.55	1.51	2.16	1.43	1.18	0.65	1.24	0.84
Fe <sub>2</sub> O <sub>3</sub>	2.16	2.10	3.08	1.15	3.45	2.79	2.00	0.97	2.26	1.40
MnO	0.06	0.03	0.12	0.04	0.05	0.04	0.04	0.04	0.04	0.03
MgO	0.69	0.44	2.15	1.51	0.91	1.19	0.22	0.16	0.60	0.54
CaO	2.12	1.08	3.32	1.44	1.87	1.51	0.93	0.41	1.34	0.72
Na <sub>2</sub> O	3.57	0.88	2.99	0.60	3.37	0.96	3.72	0.83	4.02	0.59
K <sub>2</sub> O	3.96	1.17	6.07	1.57	4.90	1.18	4.76	0.93	4.30	1.26
P <sub>2</sub> O <sub>5</sub>	0.14	0.09	0.43	0.28	0.19	0.27	0.06	0.05	0.11	0.10
Normative corundum	2.9	2.32	0.39	0.92	1.06	1.58	0.72	0.67	1.57	1.68
Rb	135.38	75.43	190.58	112.88	198.04	88.11	254.78	191.88	163.97	71.64
Sr	360.30	284.05	1018.48	925.25	316.86	446.10	94.97	102.48	266.08	241.86
Ba	1175.98	572.49	2418.18	4399.37	917.05	711.31	383.19	346.43	496.59	312.87
Ga	21.00	3.68	35.00	1.02	19.97	2.46	25.68	6.79	21.26	2.66
Cs	9.73	12.54	7.82	6.53	8.44	15.60	6.00	3.05	3.84	3.53
Nb	15.06	7.65	22.74	12.37	21.84	14.80	39.92	48.35	10.01	5.66
Y	30.29	21.93	34.14	36.96	49.69	39.12	82.43	50.98	19.23	23.82
Zr	259.03	192.39	490.66	264.77	293.22	241.86	181.20	136.37	166.04	98.81
Hf	13.14	12.11	12.12	5.45	7.44	4.36	5.87	3.03	6.42	2.74
Ta	4.21	6.98	5.07	0.35	5.21	7.17	4.98	7.23	4.33	4.23
Th	31.69	30.07	32.38	43.57	52.98	31.32	29.79	19.36	30.62	32.53

U	6.01	7.60	11.07	4.74	11.50	11.26	9.07	6.98	7.00	6.53
Cr										
F	426.46	313.57	0.26	0.22	353.76	152.50	NI	NI	311.80	188.40
La	84.28	95.16	168.18	93.47	139.69	93.10	65.39	57.23	65.35	74.69
Ce	143.62	150.86	346.31	179.32	256.93	154.68	111.53	95.00	100.96	100.97
Nd	56.91	55.43	134.28	65.85	94.51	56.12	44.92	37.06	37.98	38.65
Sm	9.11	7.77	18.82	8.90	16.04	8.85	9.60	7.13	6.03	5.86
Eu	1.45	1.20	3.65	1.47	2.12	1.99	0.71	0.53	0.74	0.46
Gd	6.30	5.65	10.88	5.18	12.15	7.54	9.37	8.01	4.00	3.85
Tb	0.84	0.74	NI	NI	2.86	1.13	2.19	0.87	1.13	1.00
Dy	4.38	3.92	6.30	2.90	8.28	5.81	11.44	9.07	2.44	1.81
Ho	0.79	0.73	1.12	0.55	1.52	1.16	2.91	1.84	0.47	0.36
Er	2.08	1.96	2.52	1.27	3.98	3.22	7.33	6.32	1.08	0.82
Yb	2.00	1.70	1.62	0.85	3.60	2.95	7.59	6.36	1.31	1.29
Lu	0.30	0.24	0.23	0.14	0.52	0.42	1.07	0.92	0.10	0.07
<b>REE total</b>	335.60	315.75	693.90	349.45	547.38	315.28	263.98	219.38	244.77	250.73
<b>Eu/Eu*</b>	0.62	0.22	0.82	0.46	0.44	0.30	0.32	0.13	0.57	0.25
<b>LaN/YbN</b>	33.90	30.91	80.08	43.78	40.05	18.28	5.42	4.12	42.44	33.48
<b>CeN/YbN</b>	21.57	16.34	63.72	34.23	28.70	11.15	3.61	2.63	28.40	22.94
<b>A/NK</b>	1.47	0.19	1.42	0.10	1.30	0.16	1.19	0.08	1.30	0.16
<b>A/CNK</b>	1.06	0.09	0.89	0.13	1.00	0.14	1.03	0.04	1.06	0.09
<b>K2O/Na2O</b>	1.23	0.58	2.32	2.05	1.61	0.60	1.38	0.49	1.13	0.53
<b>(Na+K) / Al</b>	0.54	0.07	0.49	0.06	0.48	0.06	0.44	0.03	0.48	0.06
<b>Mg/(Fe+Mg)</b>	0.36	0.13	0.58	0.14	0.30	0.13	0.17	0.12	0.28	0.12
<b>Fe/(Fe+Mg)</b>	0.64	0.13	0.42	0.14	0.70	0.13	32.72	0.12	0.72	0.12

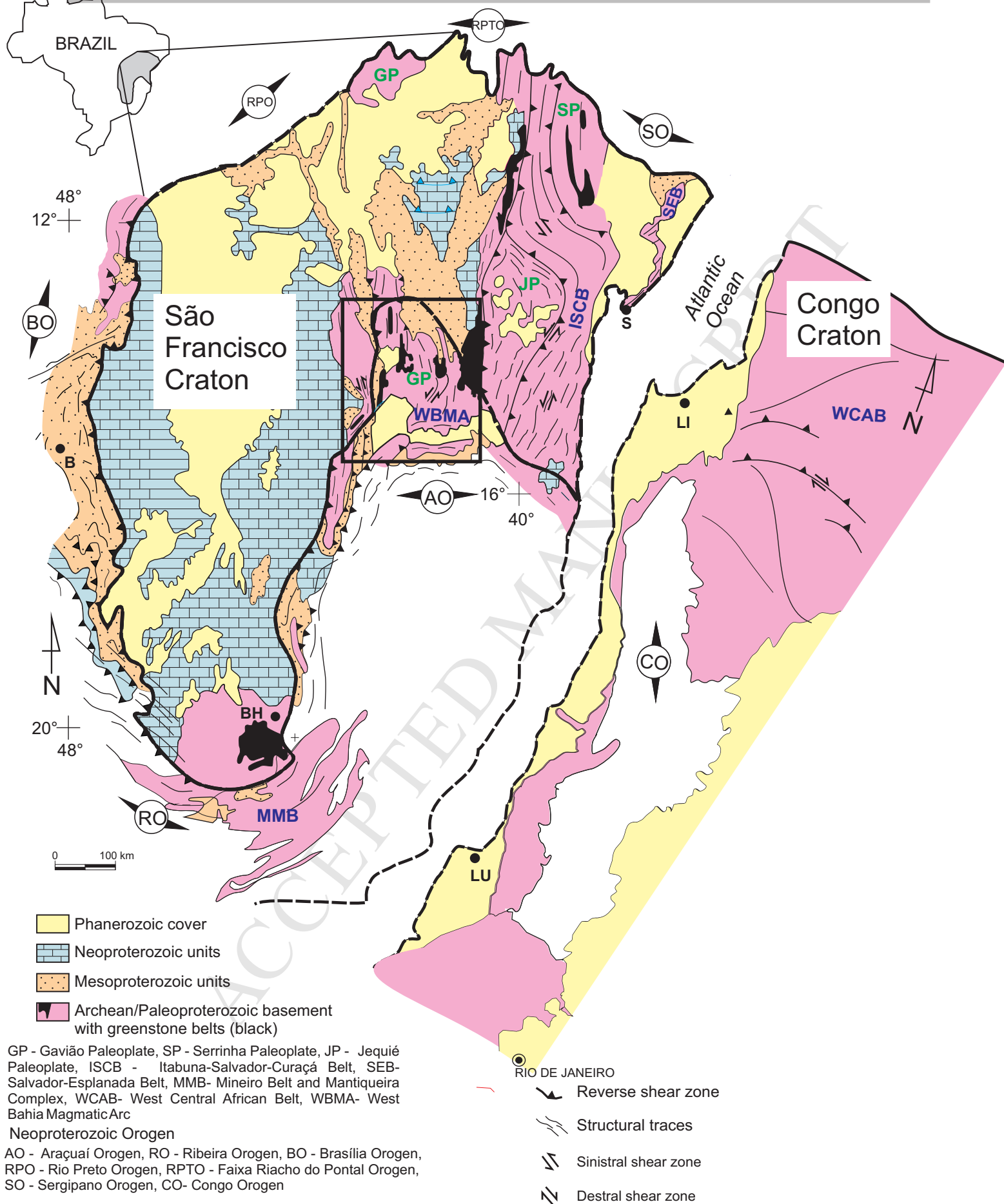
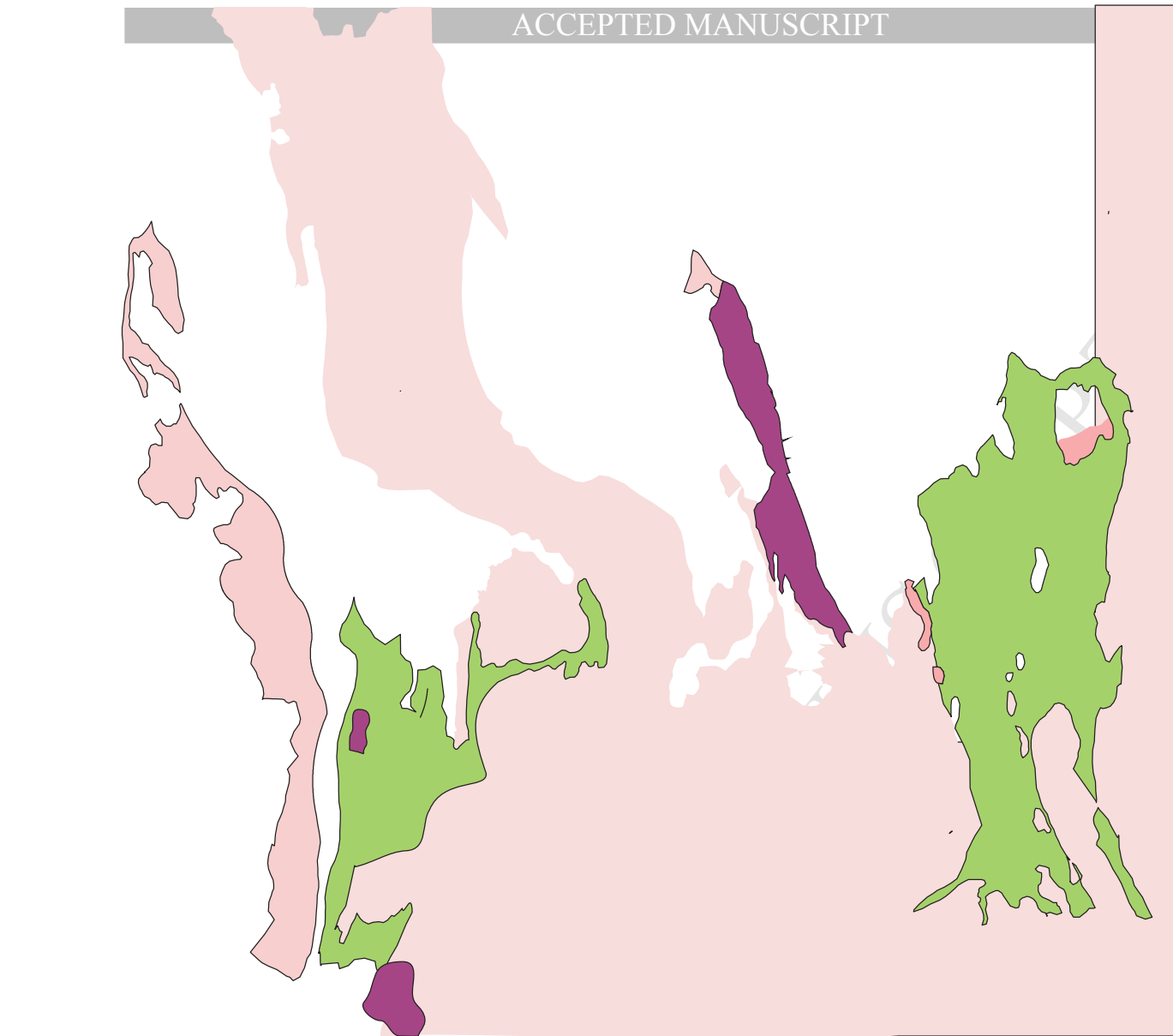


Figure 1





□ Staterian to Tonian metavolcanosedimentary sequences and Staterian Lagoa Real suite

### SIDERIAN-OROSIRIAN GRANITOIDS

#### Group 1

- 1 Veredinha
- 2 Ibitiara-Queimada Nova
- 3 Aracatu
- 4 Lagoa das Almas
- 5 Humaitá
- 6 Rio do Paulo
- 7 Jussiape I

#### Group 2a

- 8 Estreito
- 9 Ceraíma
- 10 Cara Suja
- 11 Guanambi-Urandi Multiple intrusion
- 12 Boquira Granitoid

#### Group 2b

- 13 Caculé
- 14 Jussiape II
- 15 Santa Isabel

#### Group 2c

- 16 Pé do Morro
- 17 Riacho das Pedras
- 18 Serra da Franga

#### Group 2d

- +20+ Umburanas
- +21+ Mariana
- +22+ Espírito Santo
- +23+ Lagoa Grande-Lagoinha
- +24+ Gameleira
- +25+ Caetano-Aliança
- +26+ Campo do Meio
- +27+ Broco
- +28+ Piripá

### ARCHEAN/PALEOPROTEROZOIC UNITS

□ TTGs, gneisses, mafic intrusions, migmatites and granulites

■ Metavolcanosedimentaries sequences

● Towns

JD-14  
\* Sample studied

— Paleoproterozoic Structural lineaments

Figure 2

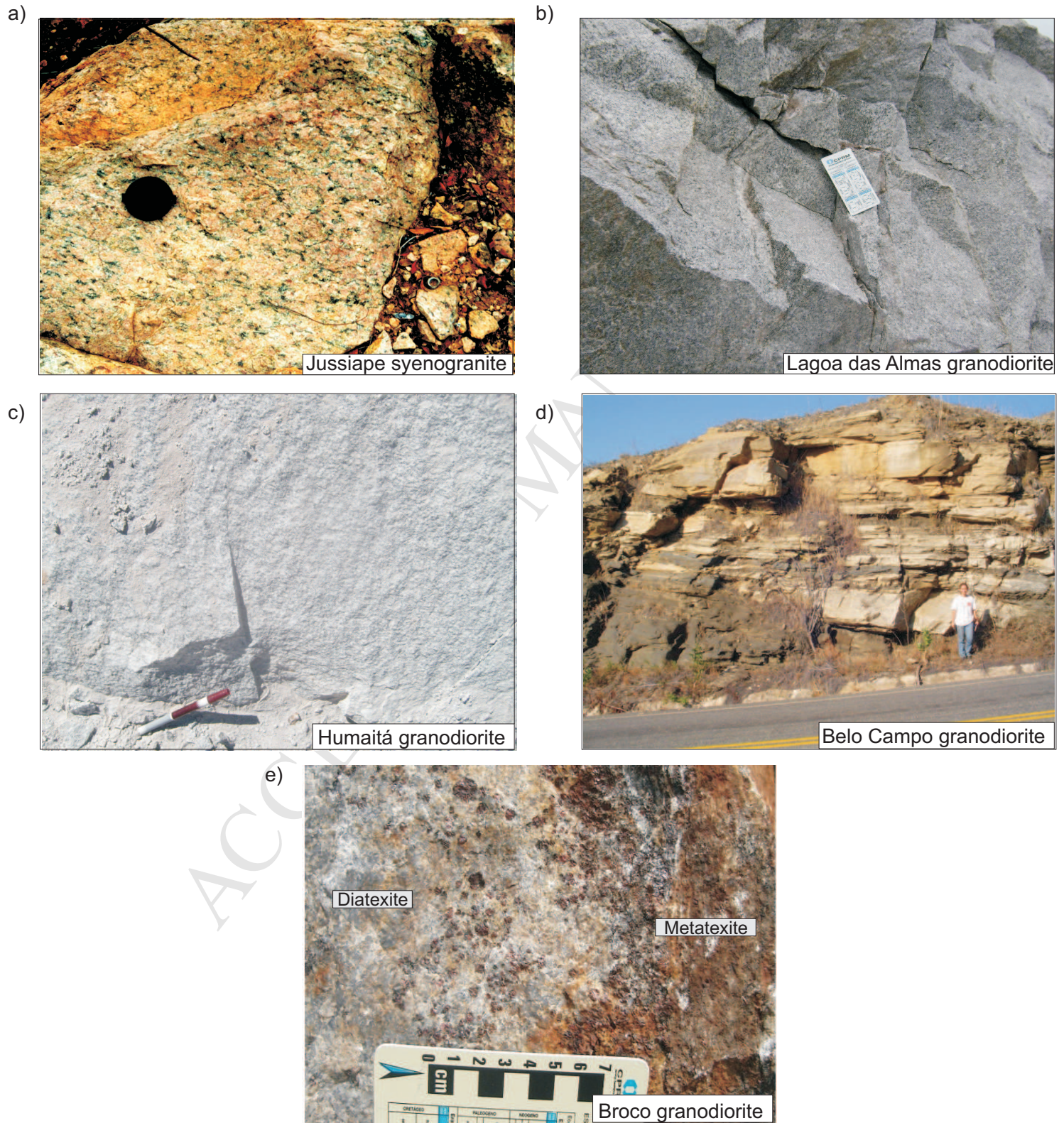


Figure 3

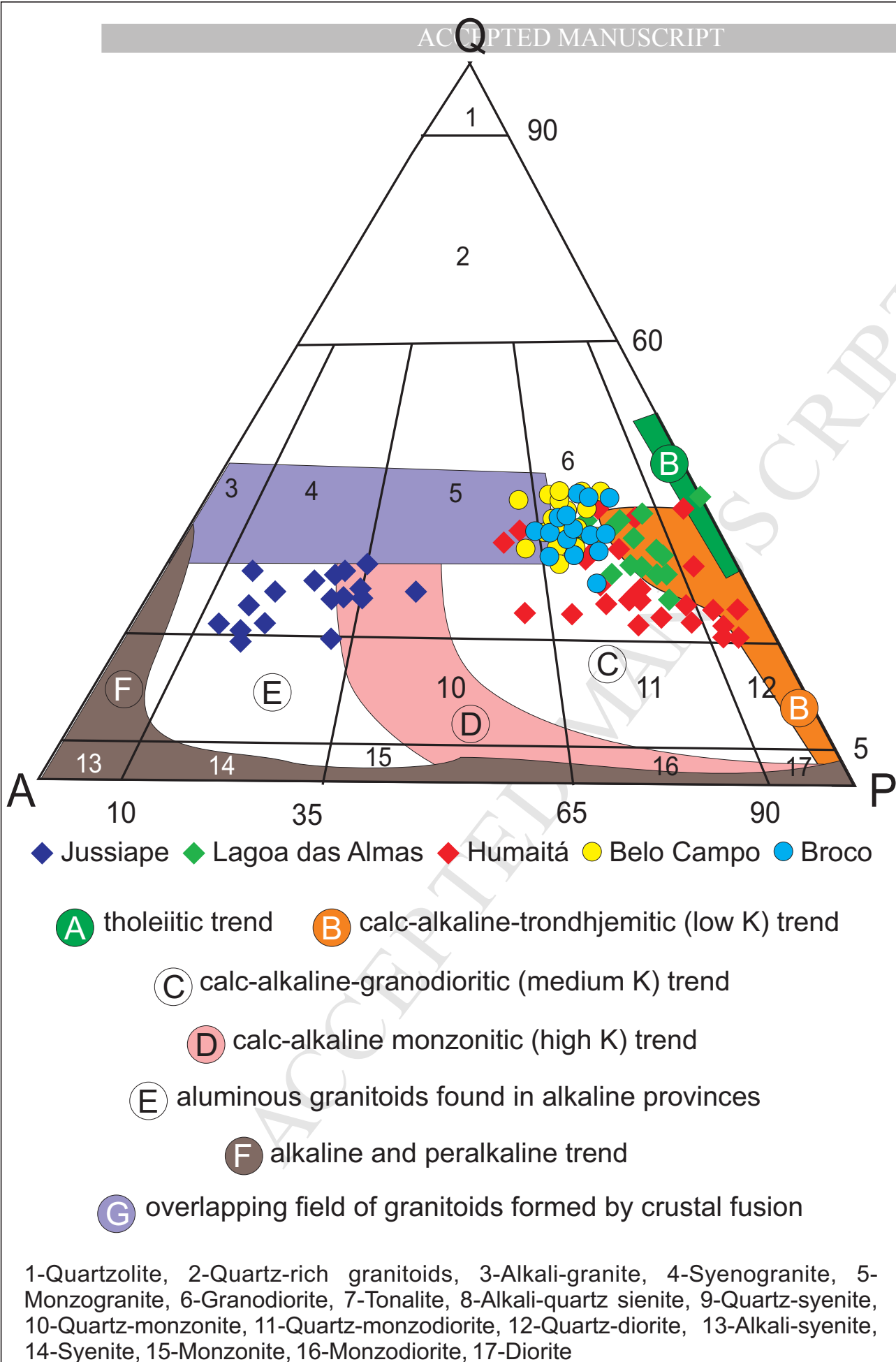


Figure 4



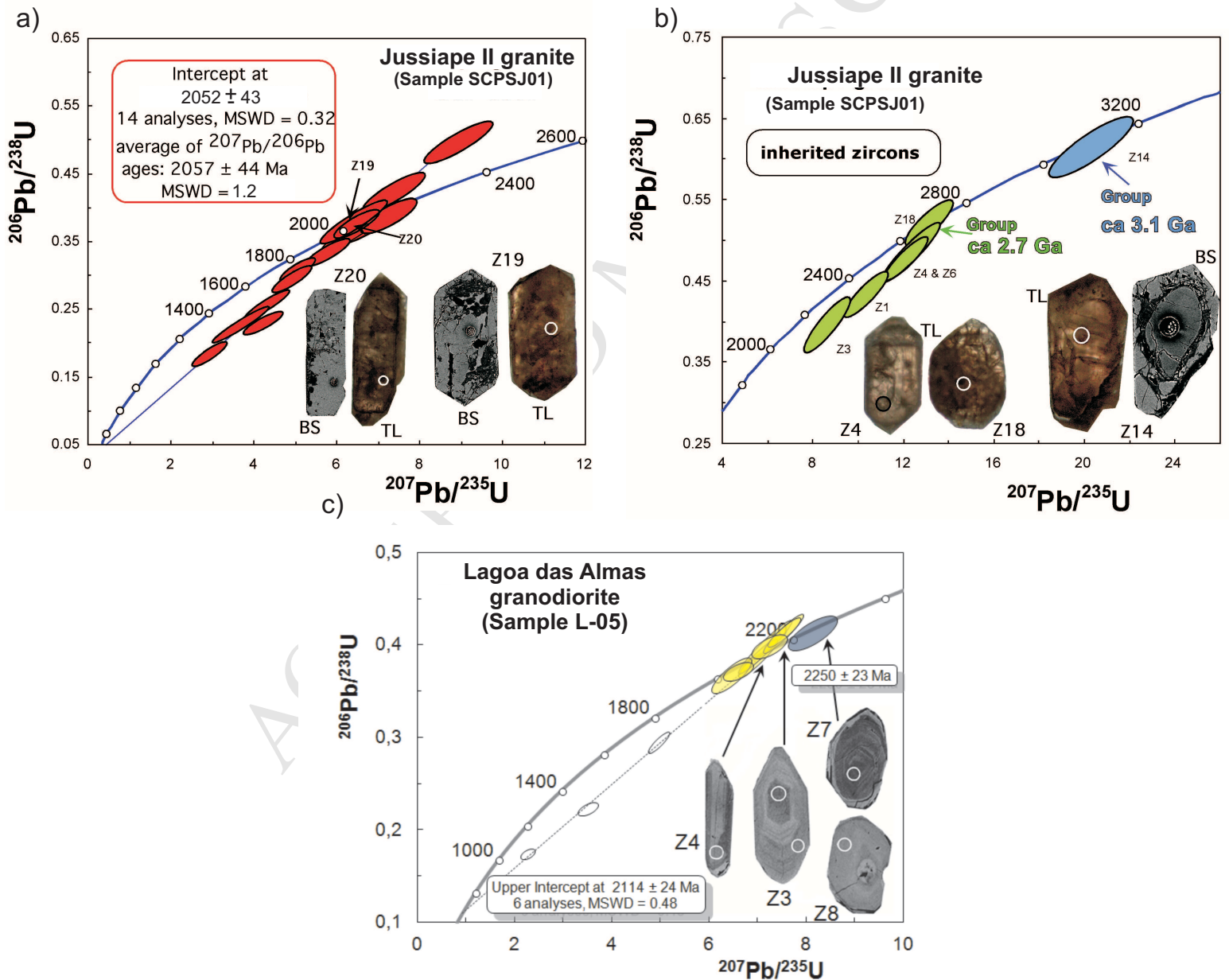


Figure 5

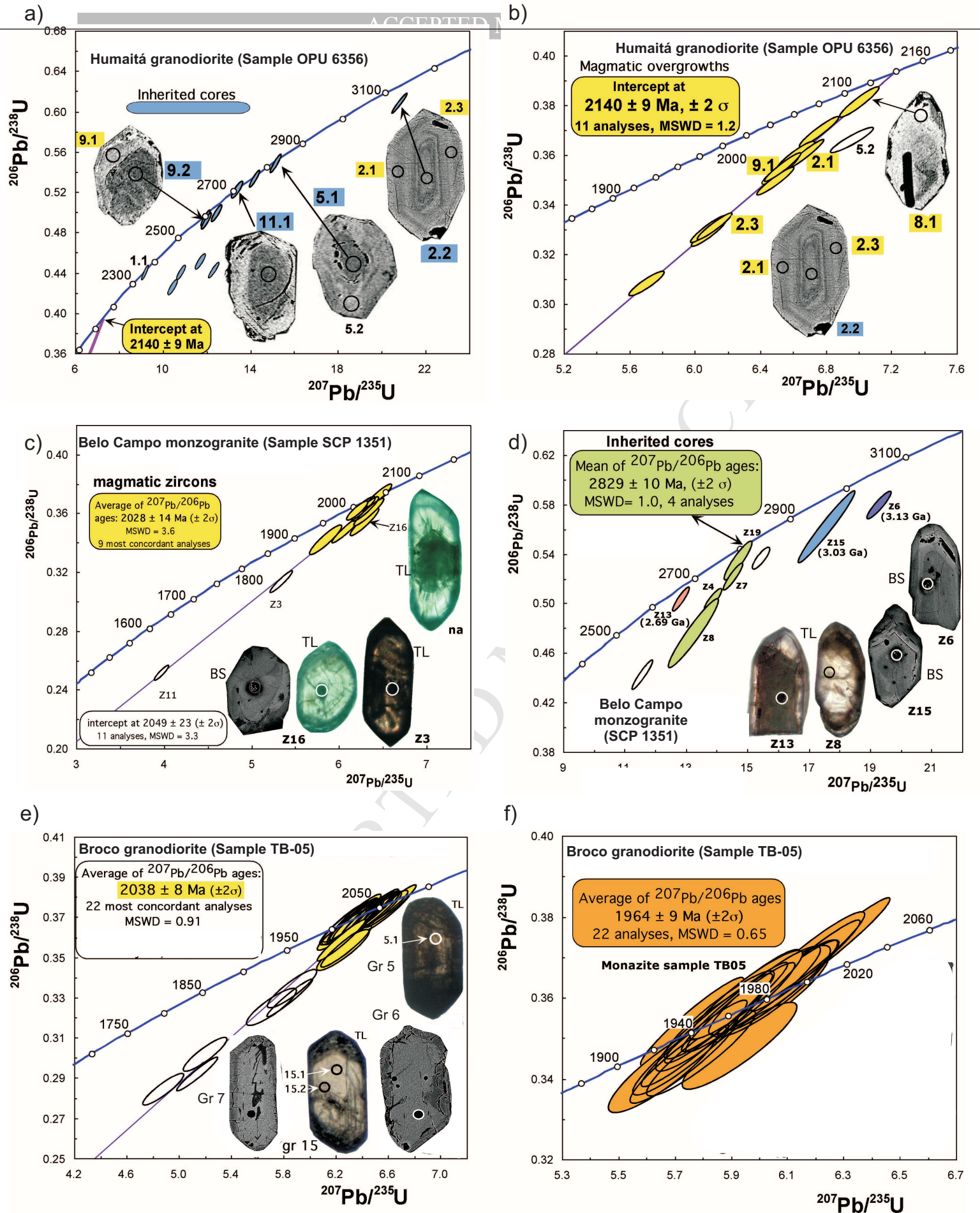
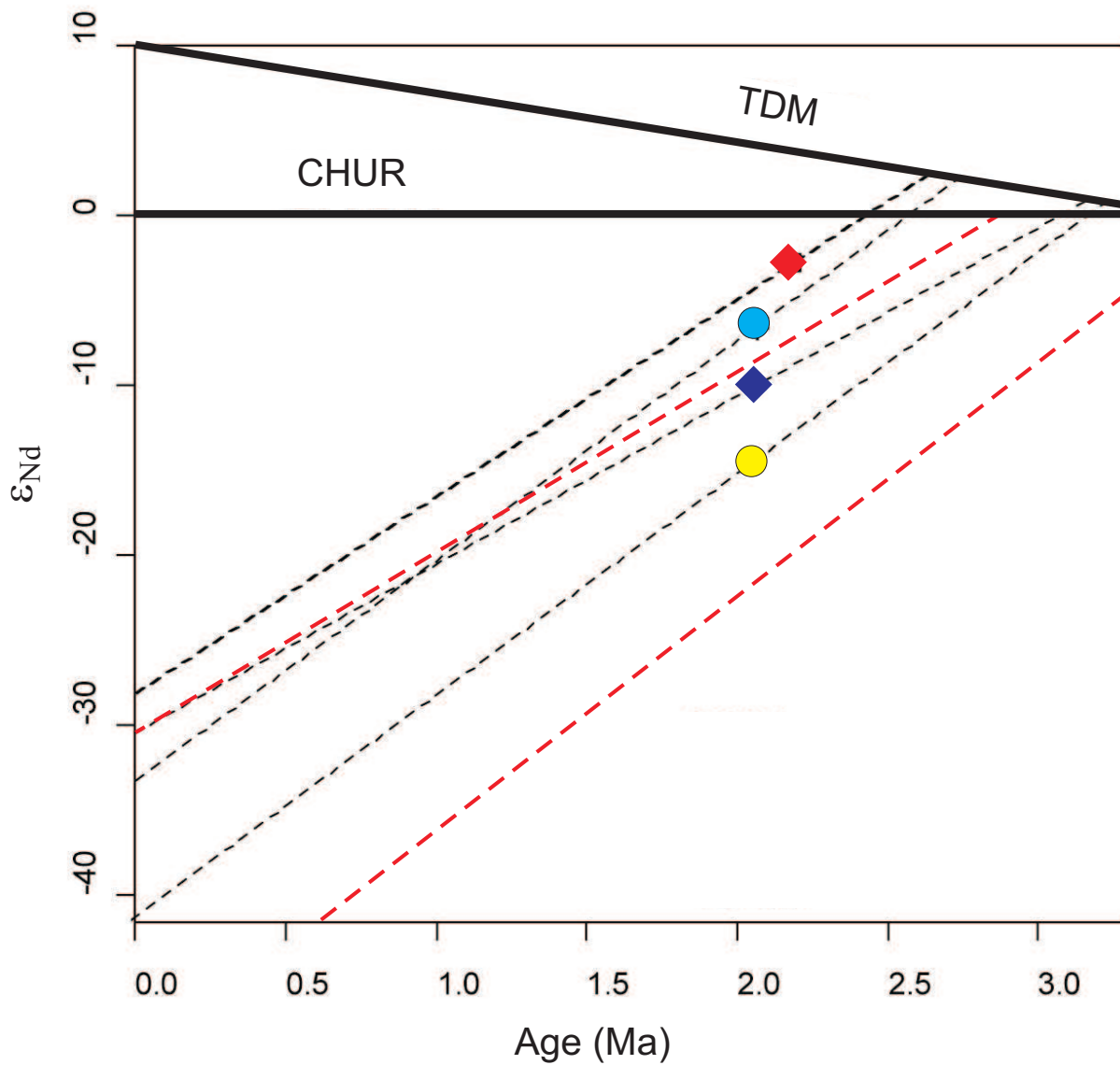


Figure 6



◆ Jussiape ◆ Humaitá ● Belo Campo ● Broco

Dated gneisses and felsic volcanics in the Gavião paleoplate (From: Santos Pinto et al. 2012 and Barbosa et al. 2013).

Figure 7



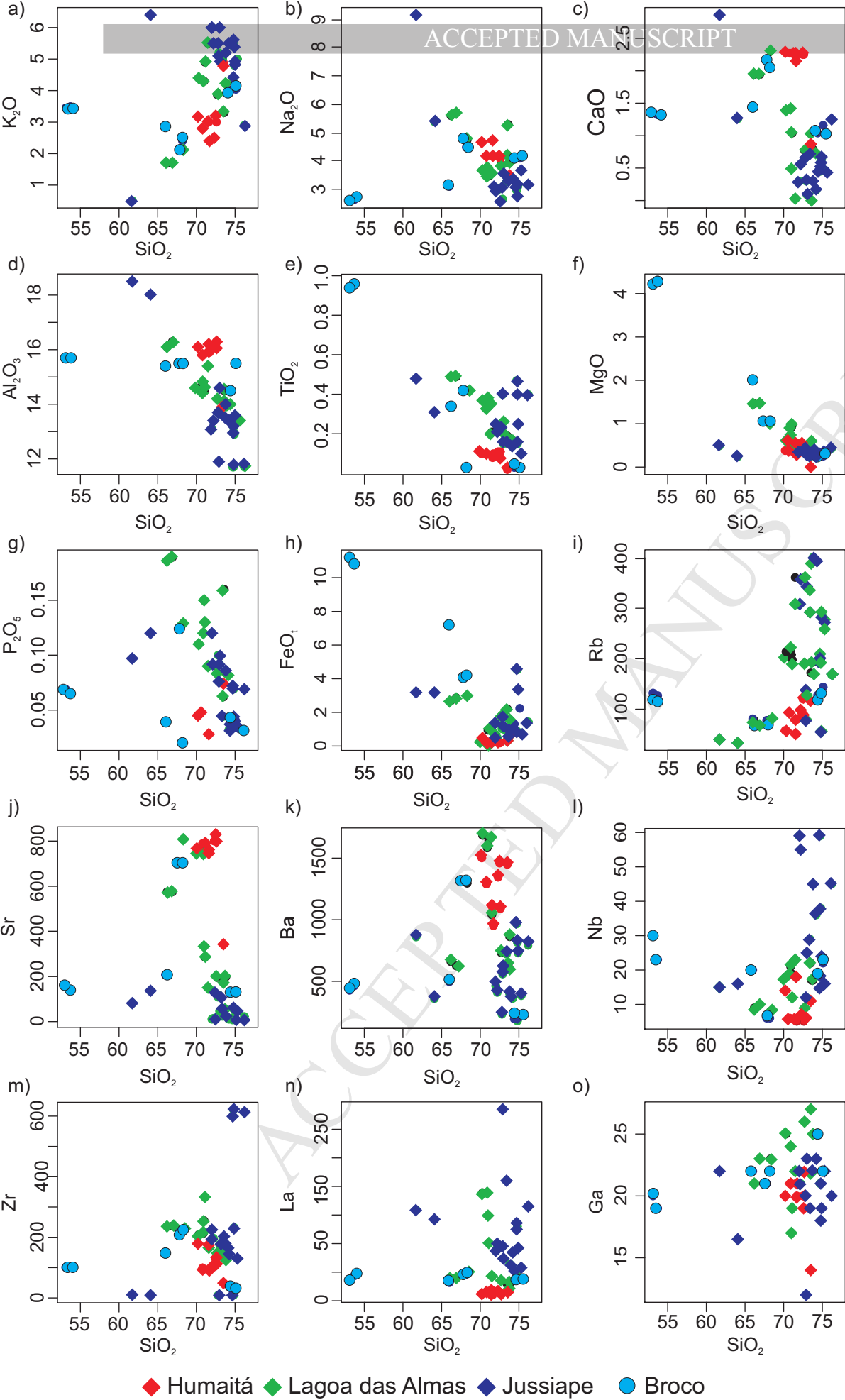


Figure 8

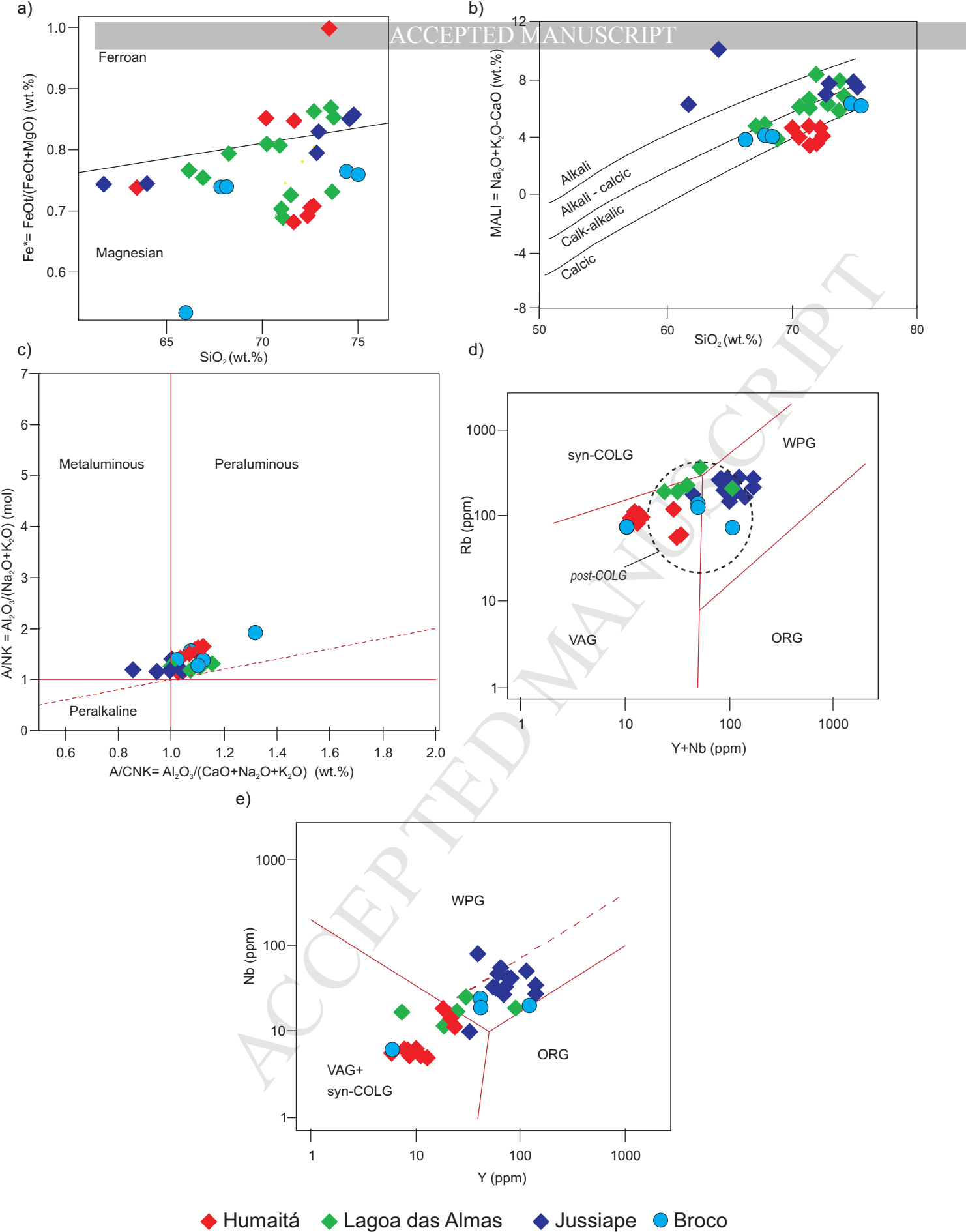


Figure 9

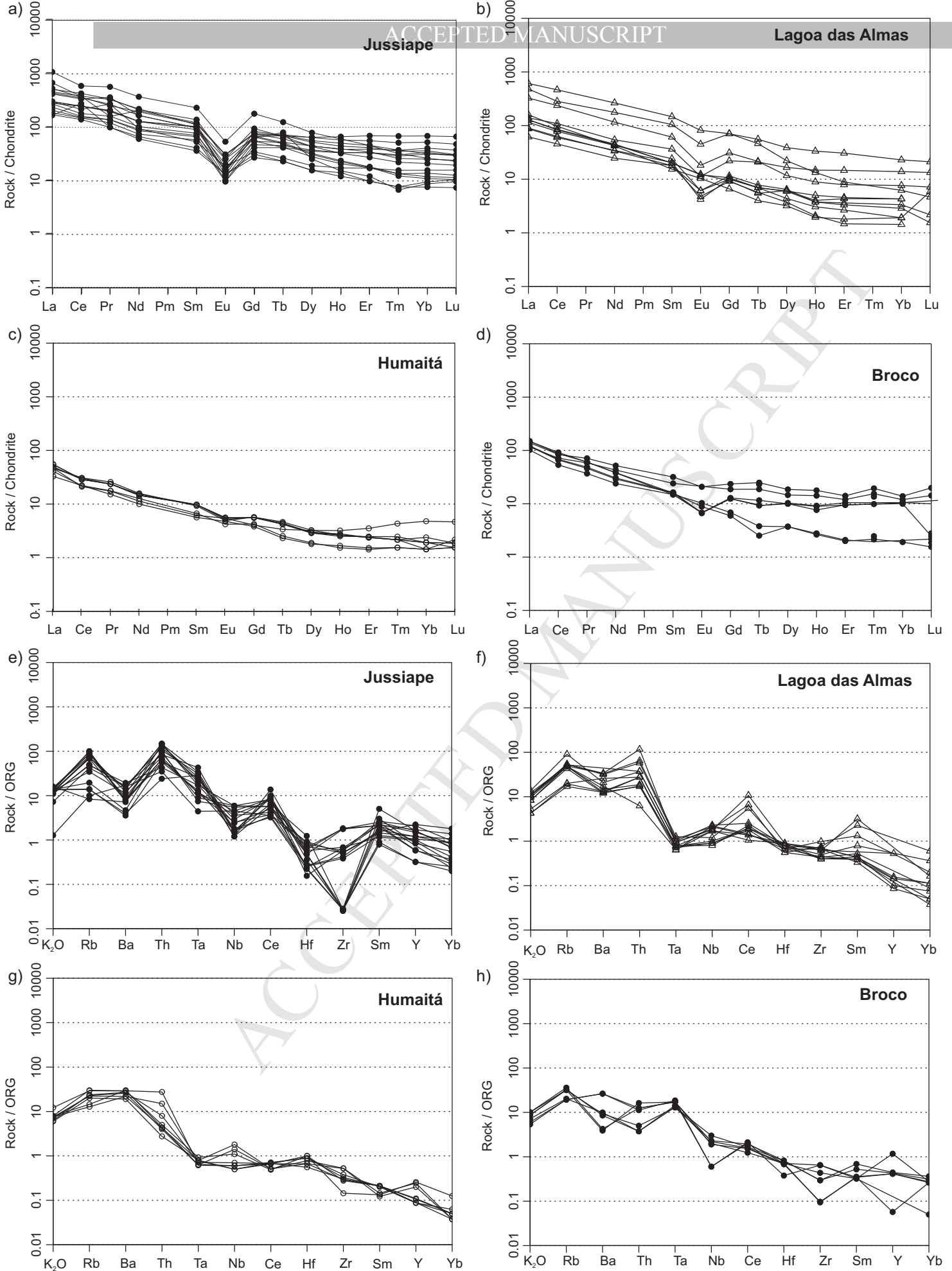


Figure 10

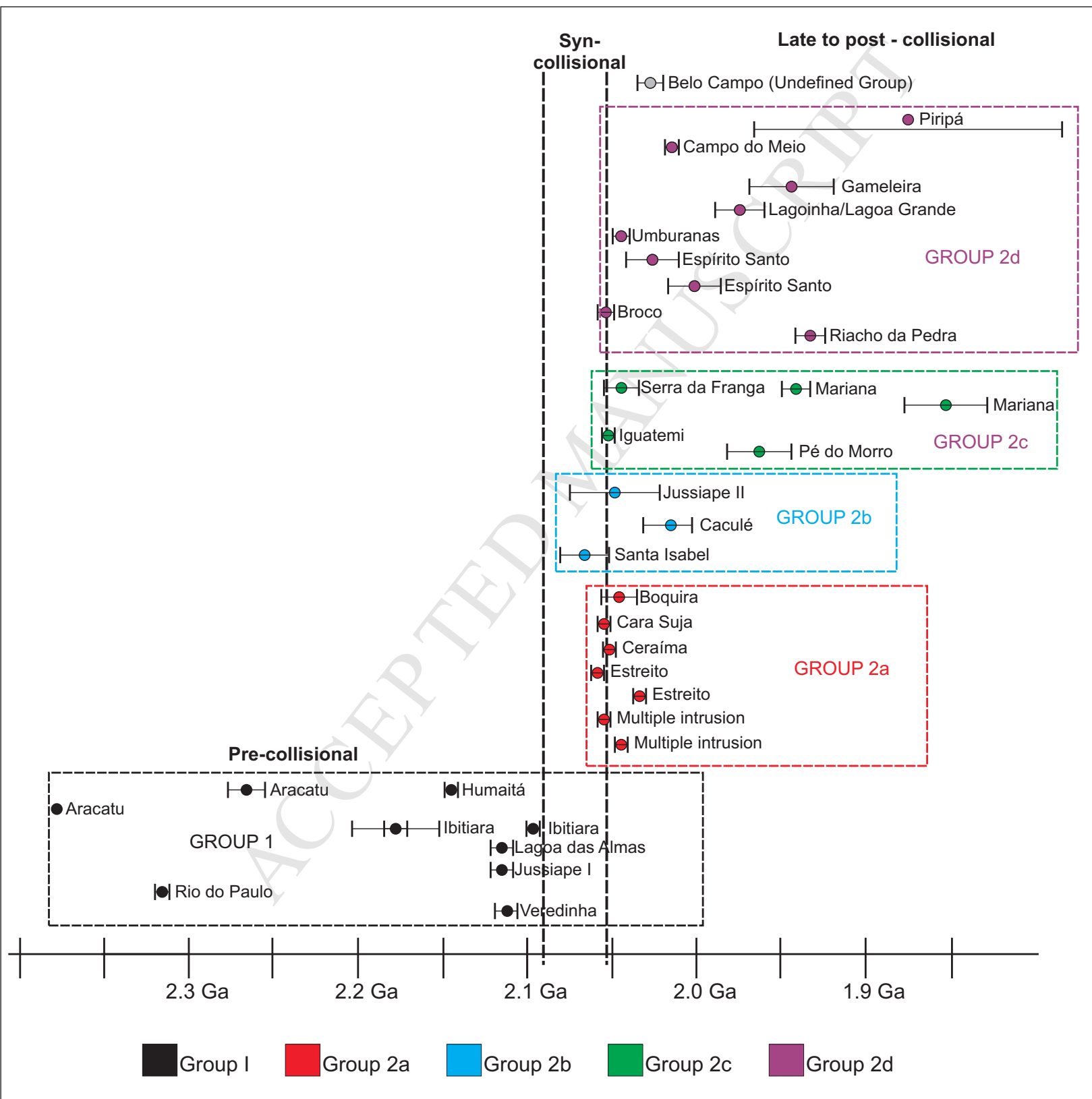
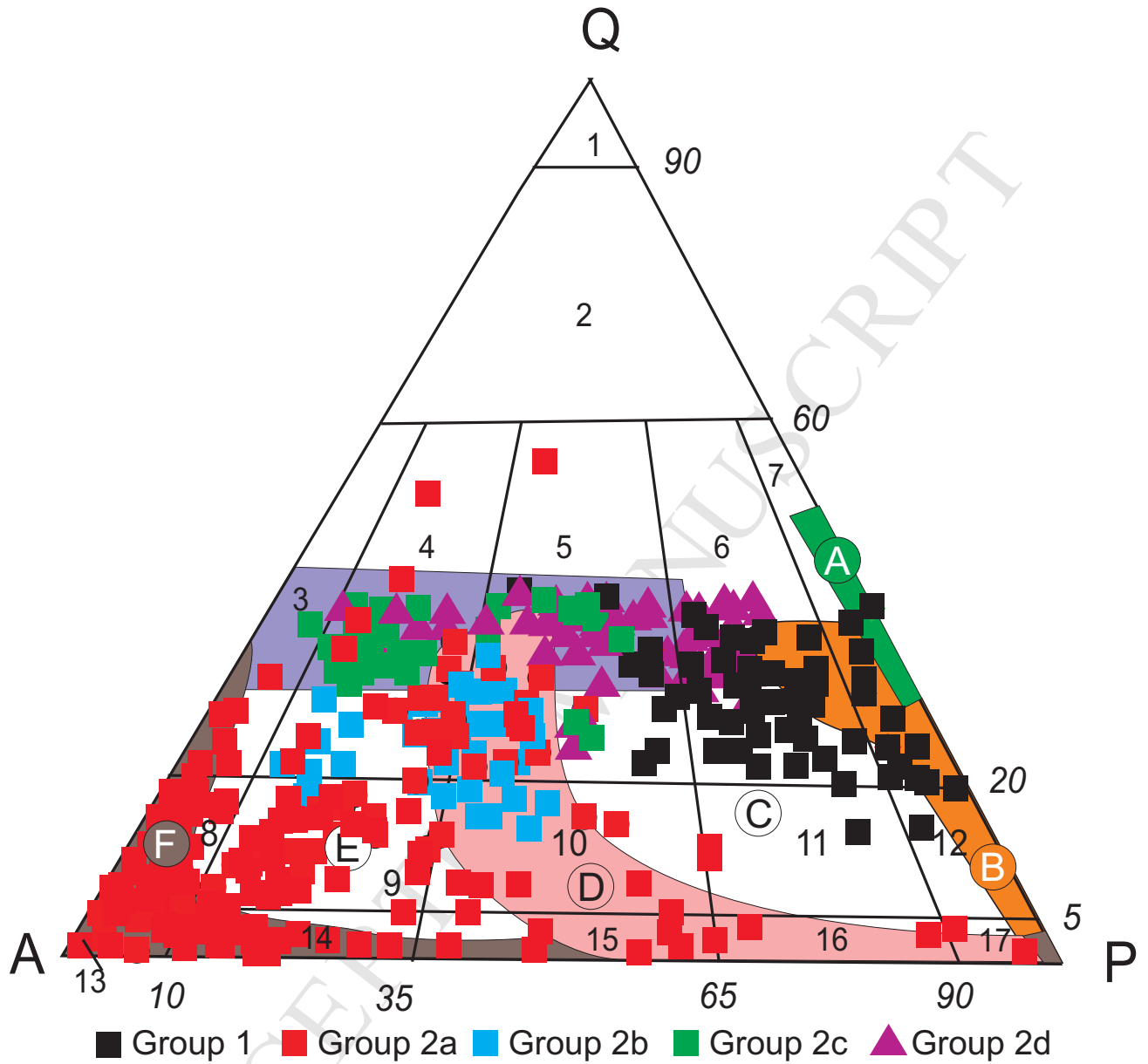


Figure 11



(A) tholeiitic trend    (B) calc-alkaline-trondhjemitic (low K) trend

(C) calc-alkaline-granodioritic (medium K) trend    (D) calc-alkaline monzonitic (high K) trend

(E) aluminous granitoids found in alkaline provinces    (F) alkaline and peralkaline trend

(G) overlapping field of granitoids formed by crustal fusion

1-Quartzolite, 2-Quartz-rich granitoids, 3-Alkali-granite, 4-Syenogranite, 5-Monzogranite, 6-Granodiorite, 7-Tonalite, 8-Alkali-quartz sienite, 9-Quartz-syenite, 10-Quartz-monzonite, 11-Quartz-monzodiorite, 12-Quartz-diorite, 13-Alkali-syenite, 14-Syenite, 15-Monzonite, 16-Monzodiorite, 17-Diorite

Figure 12

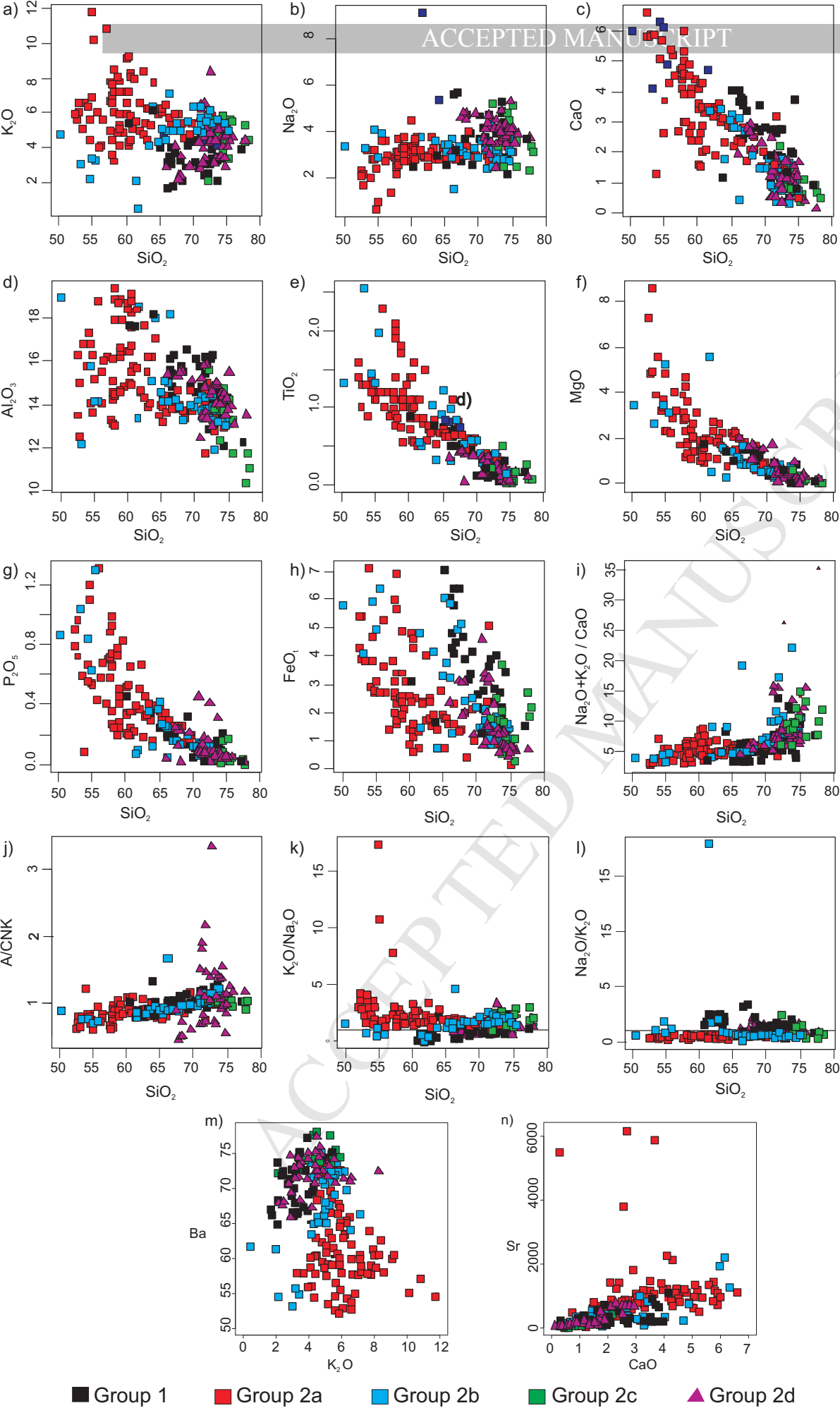


Figure 13



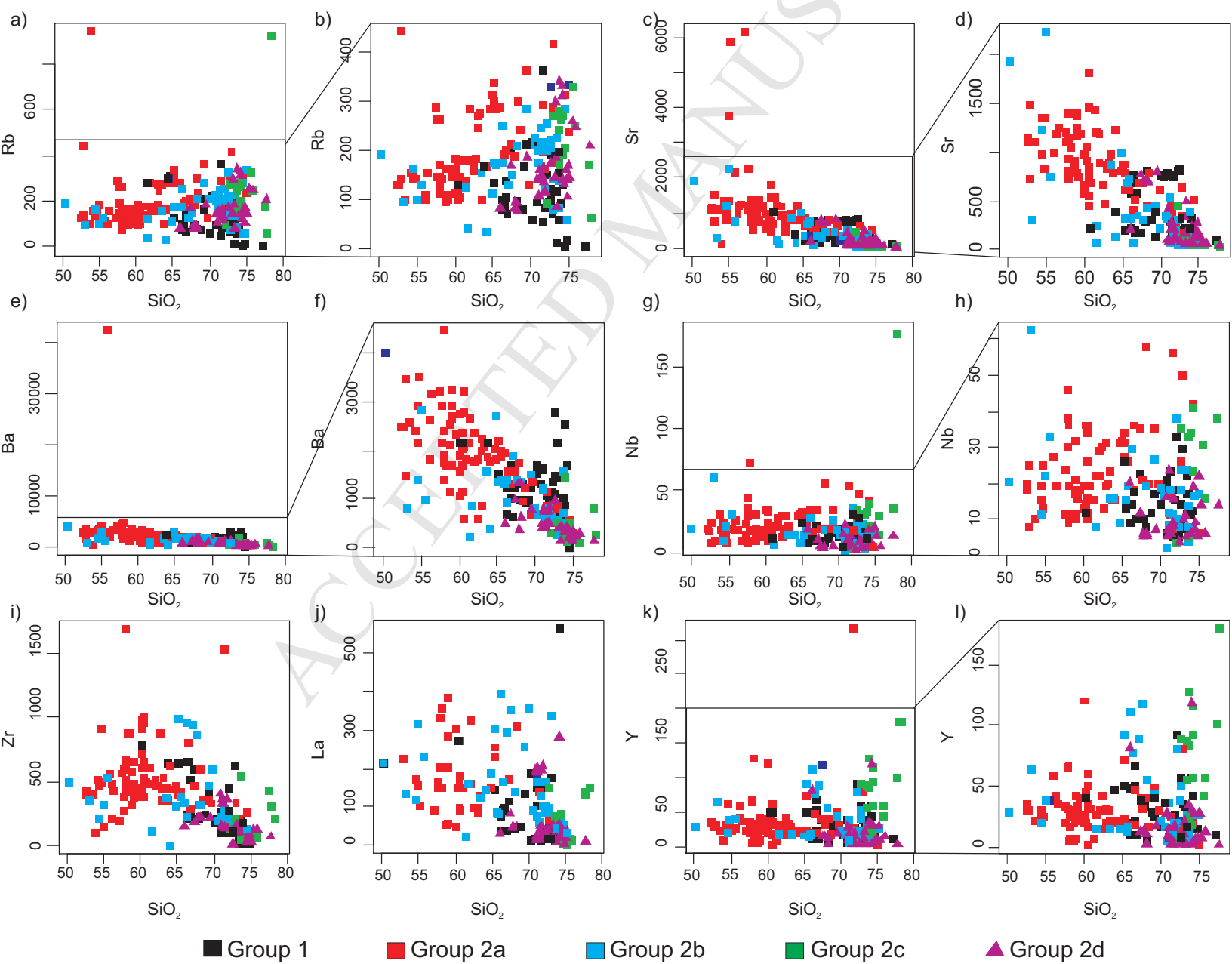


Figure 14

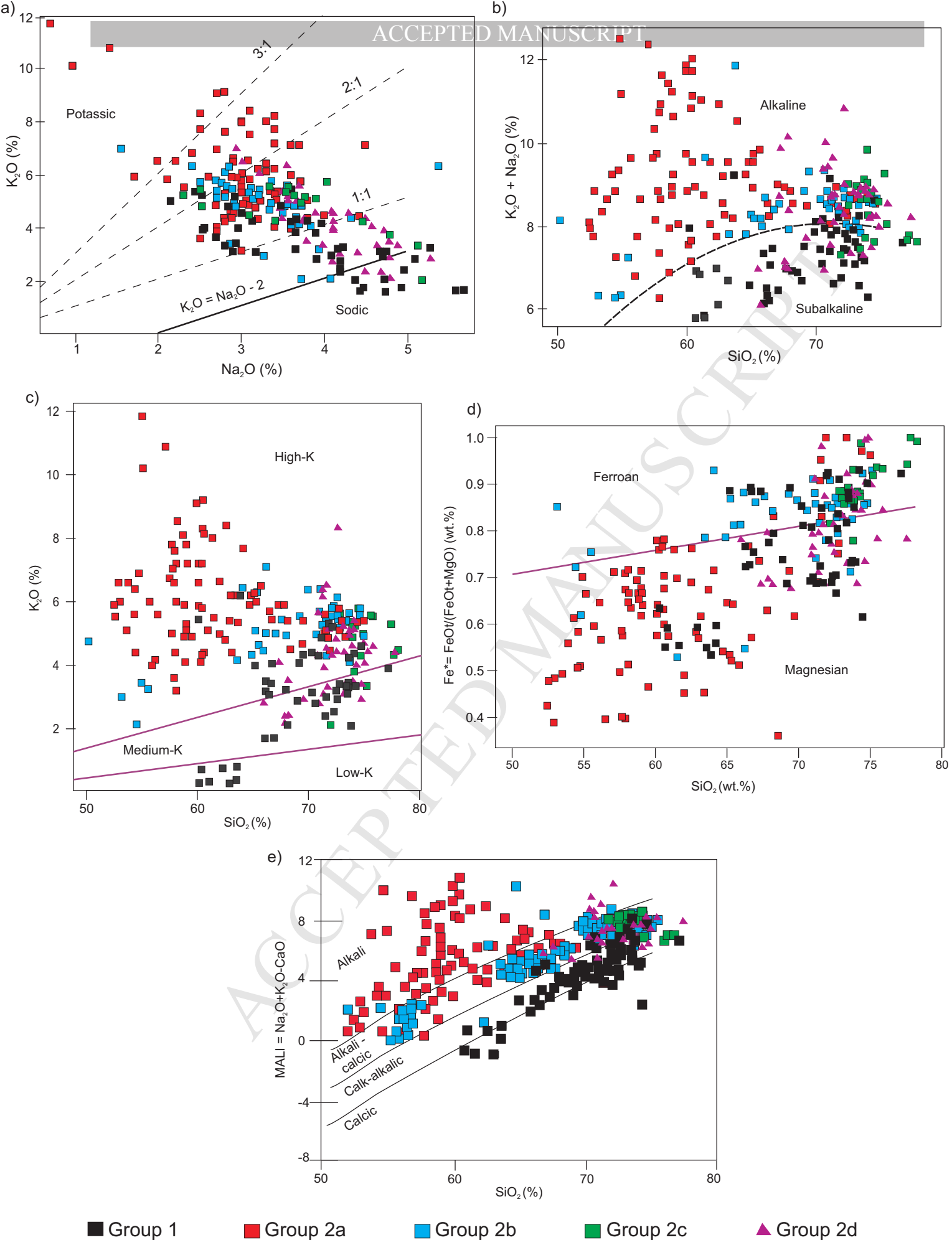


Figure 15

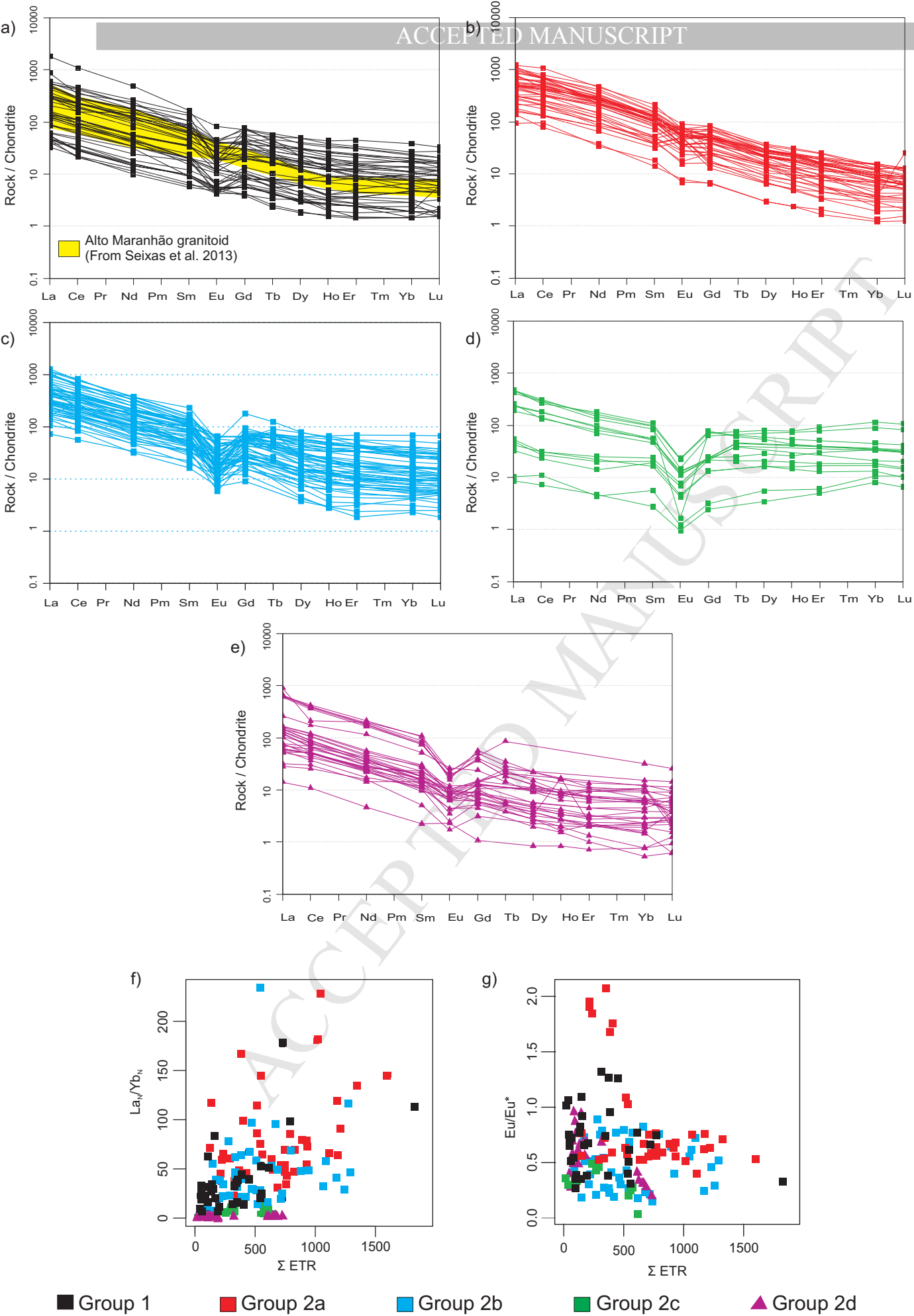


Figure 16

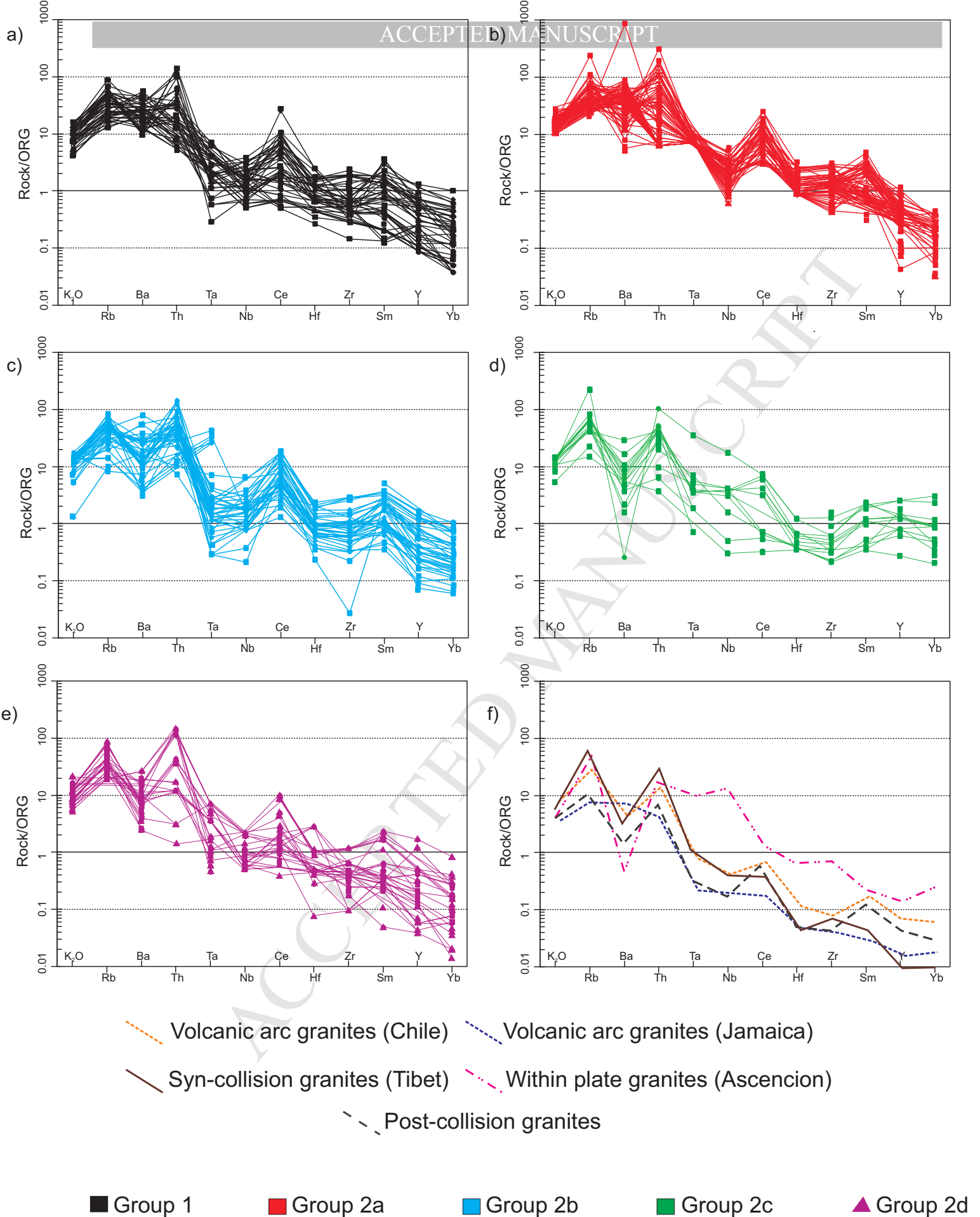


Figure 17

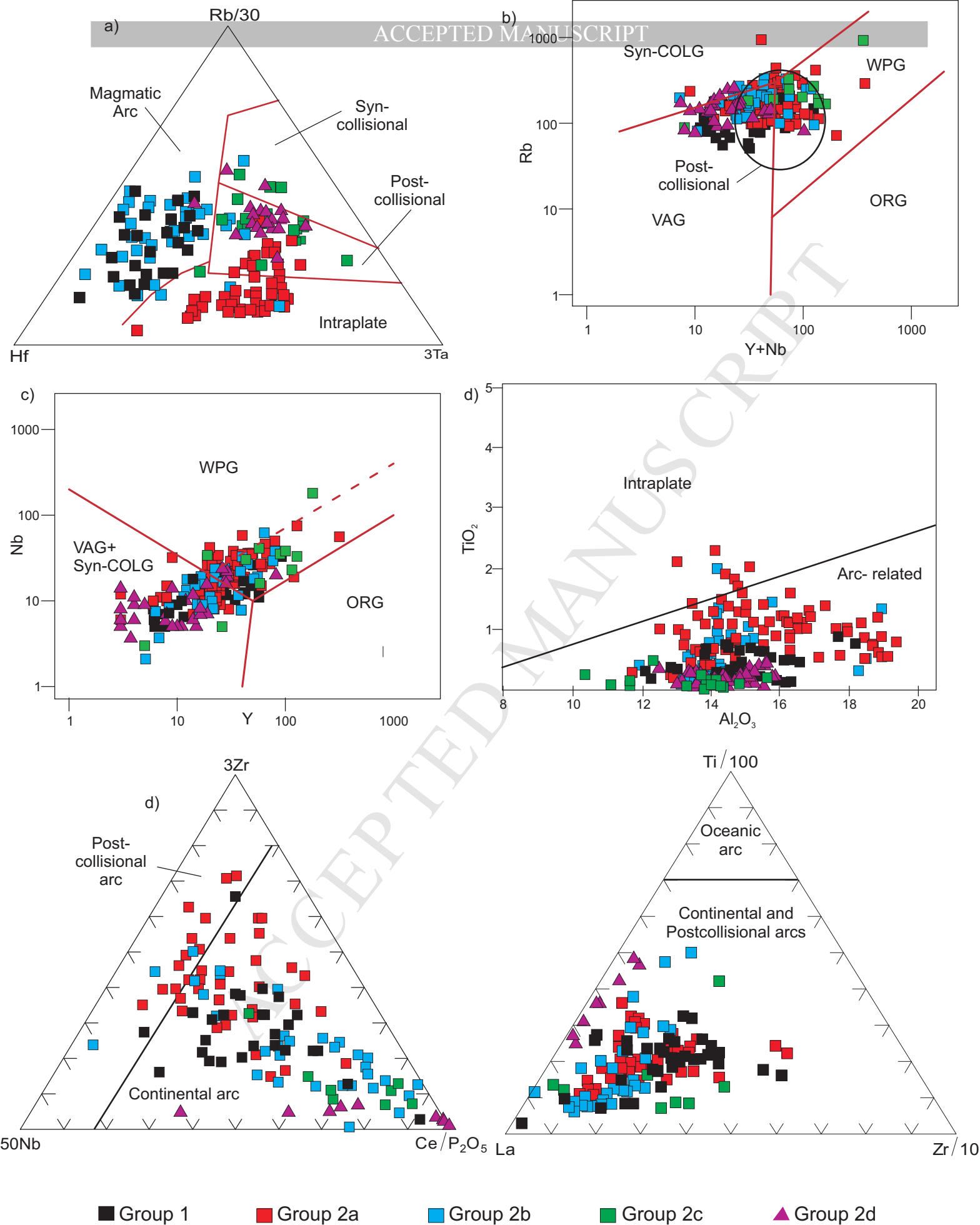


Figure 18

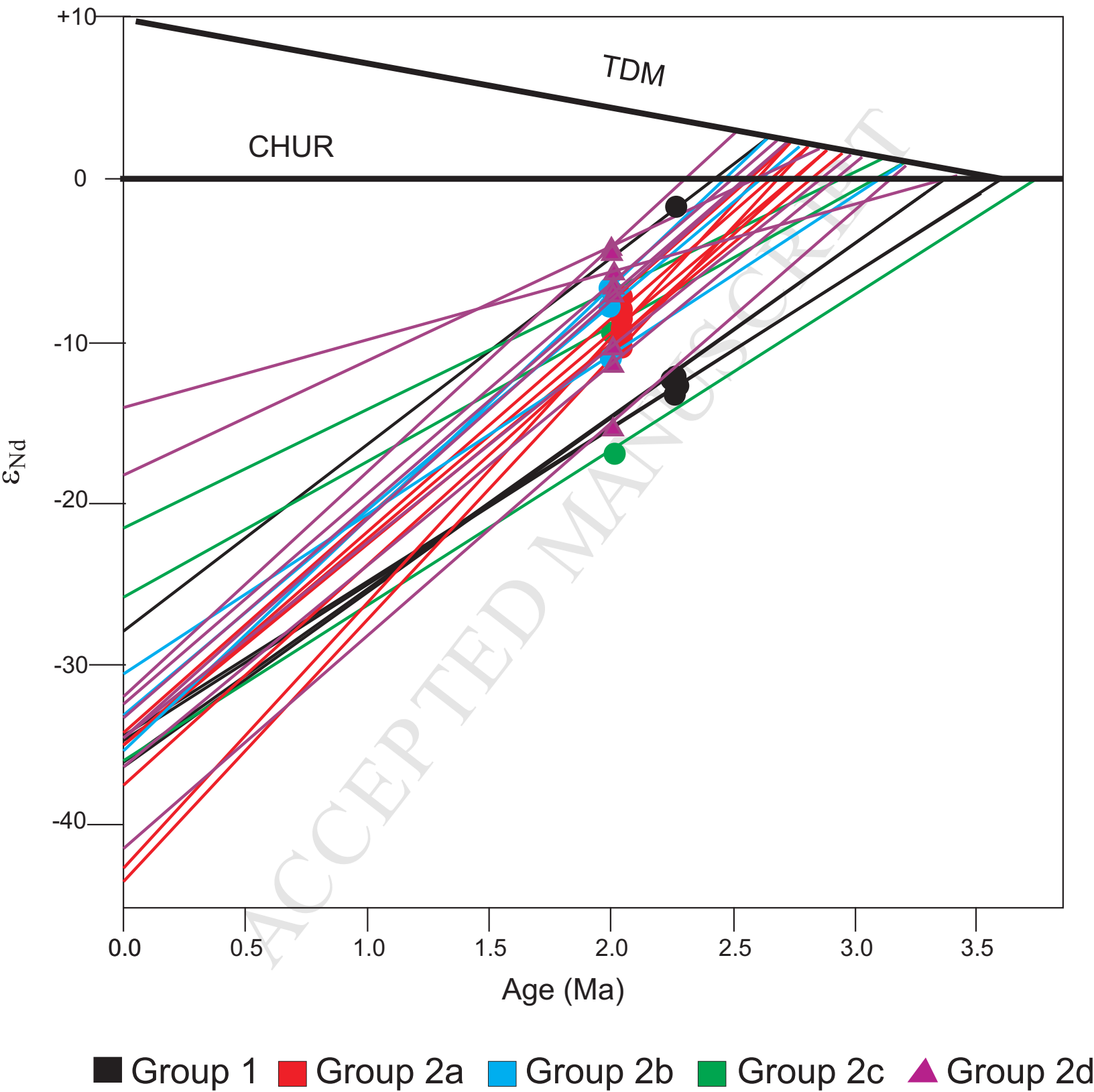
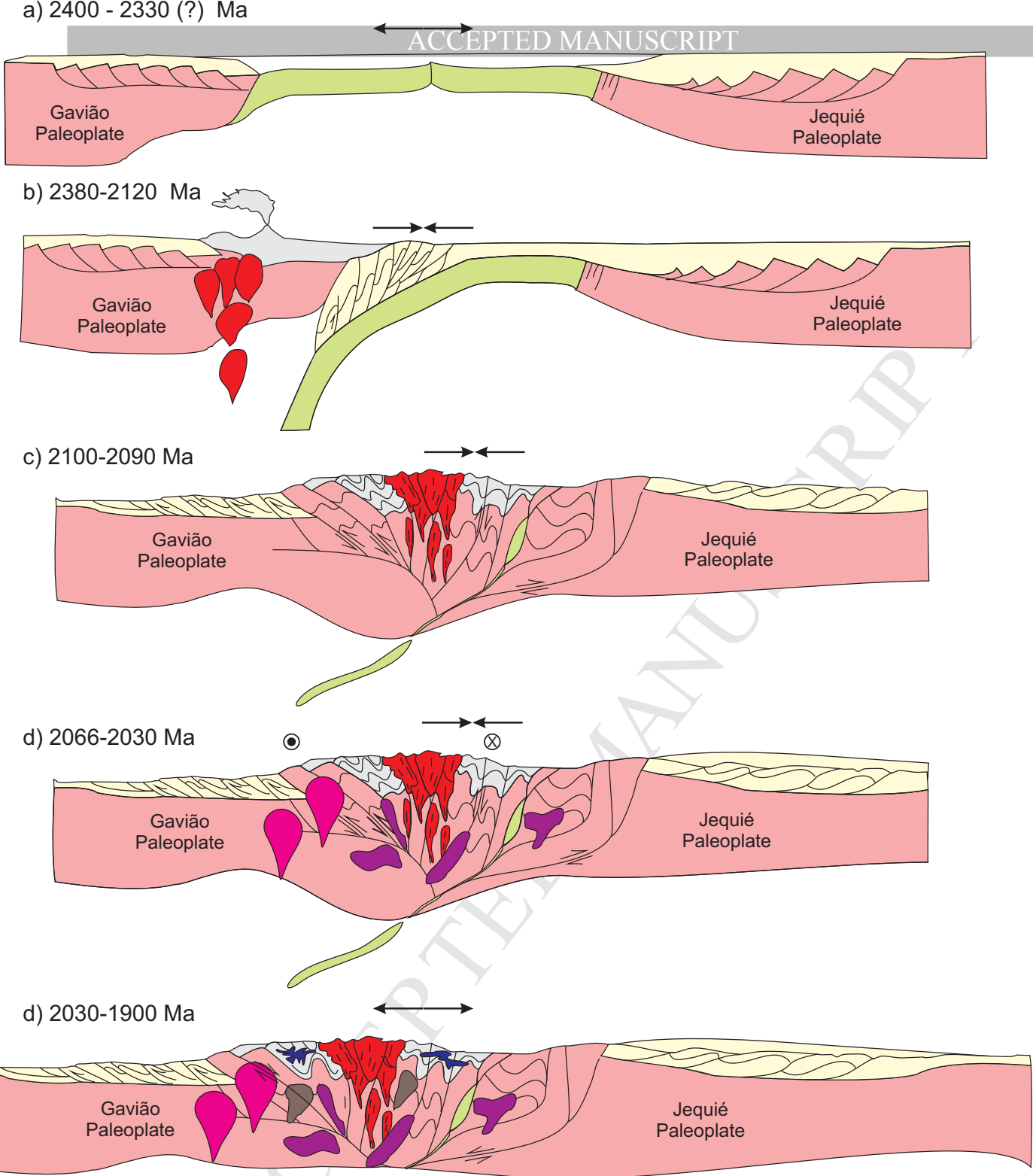


Figure 19





Legend

- Calk-alkali, alkali-calcic to alkali granitoids (Grupo 2d)
- Alkali-calcic to alkali granitoids(Grupo 2c)
- Alkali-calcic to alkali granitoids (Grupo 2b)
- Alkali to alkali – calcic granitoids (Group 2a)
- Calcic to calk-alkalic, pre-collisional granitoids (Group 1)
- Metavolcanosedimentary rocks associated with Siderian-Riacian magmatic arc
- Syn to pre-collisional metasedimentary rocks
- Oceanic crust
- Archean orthogneisses

- Regional shortening domain
- Regional stretching domain
- sinistral movement
- reverse movement
- normal movement

Figure 20

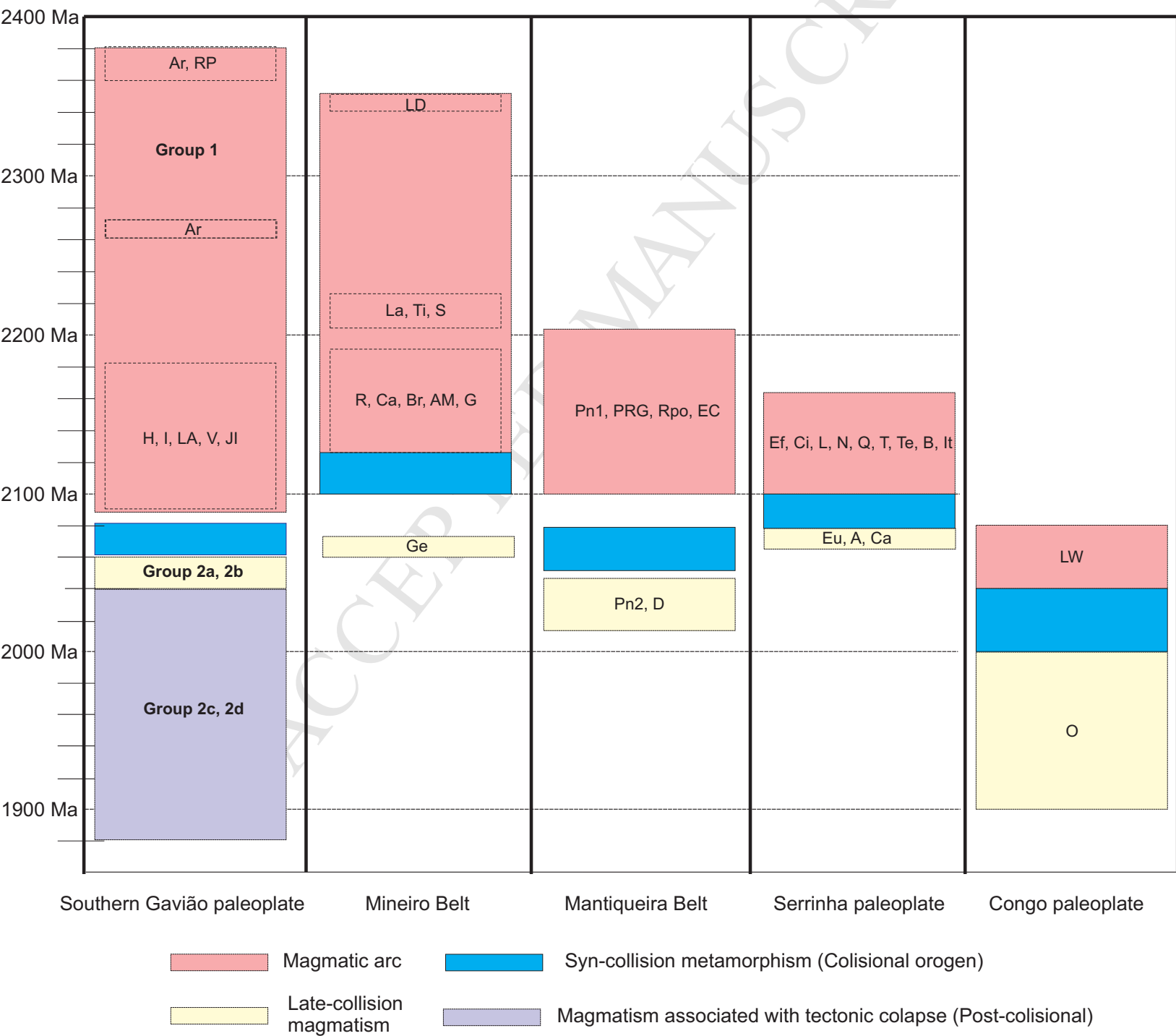


FIGURE 21

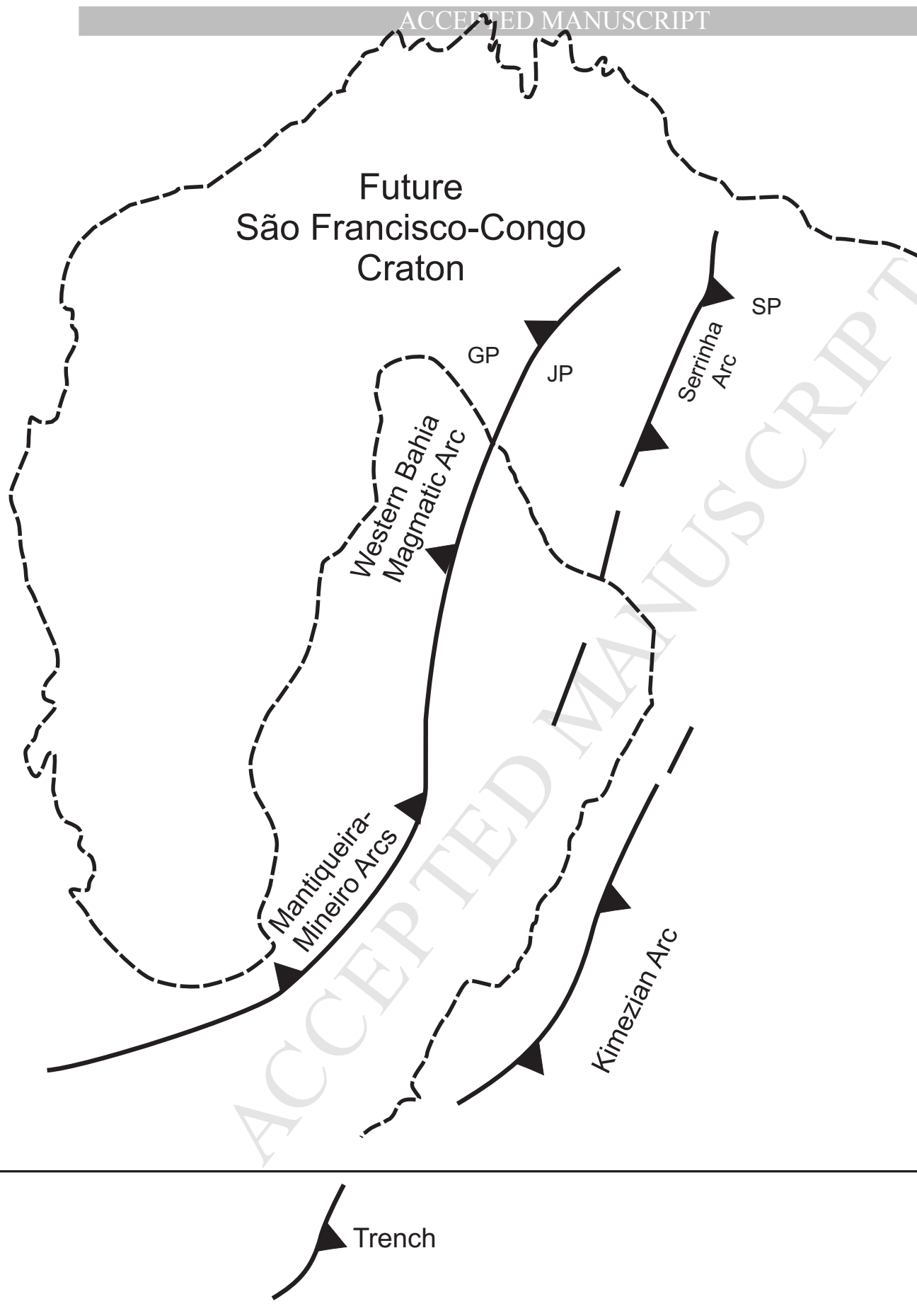
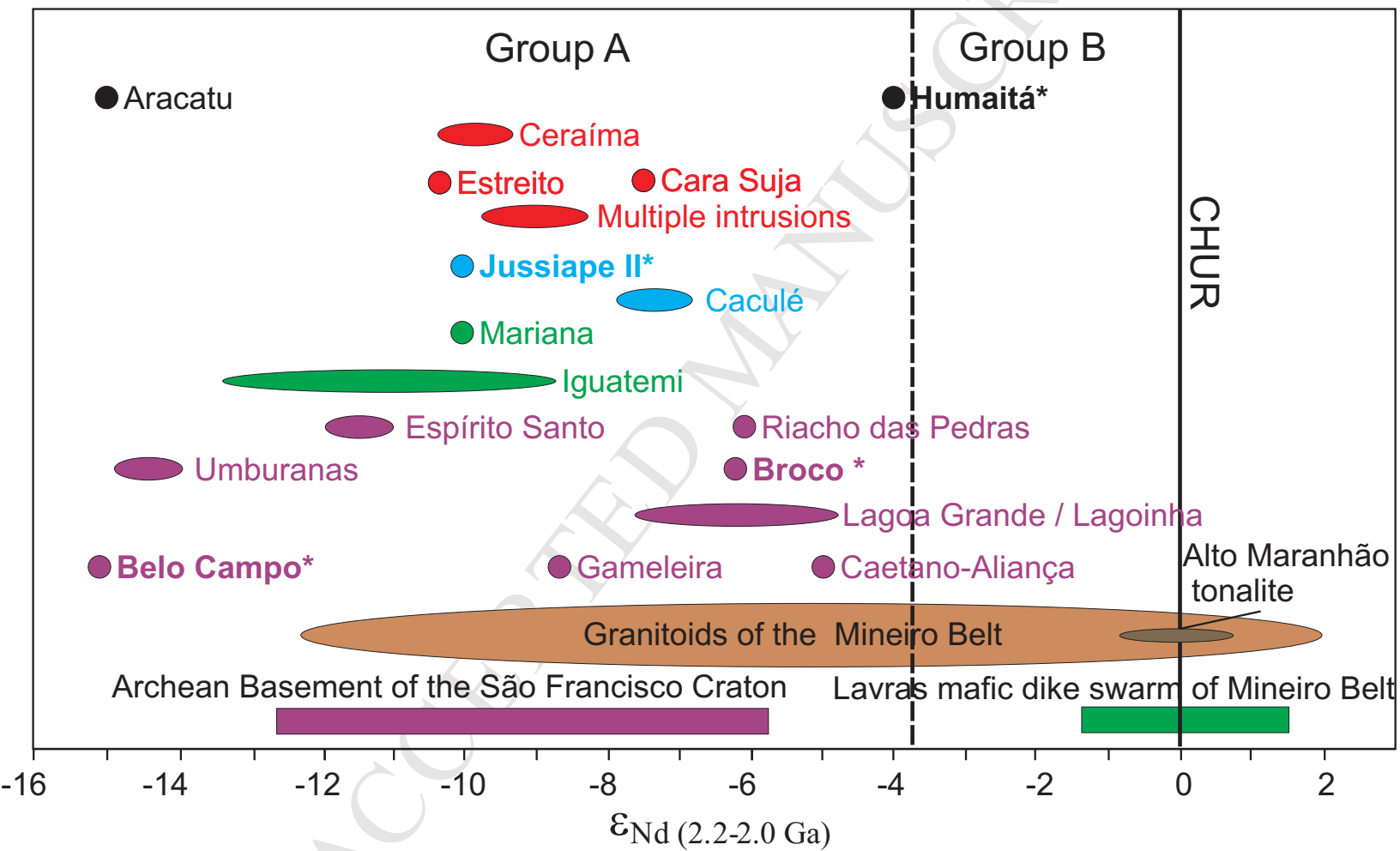


FIGURE 22



\* Granitoid studied

● Group 1 ● Group 2a ● Group 2b ● Group 2c ● Group 2d

# FIGURE 23

## Highlights

Twenty-nine Siderian-Rhyacian-Orosirian granitoids were recognized in the southern Gavião Paleoplate

In Gavião Paleoplate the age of Rhyacian-Orosirian magmatism ranges between  $1944 \pm 7$  and  $2140 \pm 9$  Ma.

Data suggest that some rocks were generated in subduction environment.