

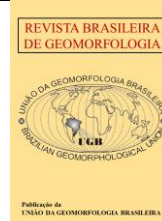


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Research Article

Petrographic Control on the Geomorphological Evolution of the Quixeramobim River Batholith, Northeastern Brazil

Controle Petrográfico na Evolução Geomorfológica do Batólito Rio Quixeramobim, Nordeste do Brasil

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Abstract: Petrographic control has a strong influence on the geomorphological evolution of granitic plutons in the Borborema Province (Northeast Brazil), which are made up of varied natures, shapes and dimensions. The Rio Quixeramobim Batholith, located in the Central Ceará Domain, is conditioned by the dextral shear zones of the NE direction, Quixeramobim and Senador Pompeu and is constituted by six distinct granite suites. This work aims to analyze the geomorphological aspects of the Rio Quixeramobim Batholith, based on petrographic (mineralogical and structural) analyses, correlating the morphologies with the different suites analyzed. The methodology consisted of analysis of geological and geomorphological data, field investigations, sample collection and analysis in a microscopy laboratory. Geomorphological features are strongly related to mineralogical and structural characteristics, associated with the degree of microfracturing of their constituent minerals. The data show that, in addition to mineralogical diversity, structural aspects such as the degree of microfracturing, porosity and texture are fundamental for the development of granitic macro and microforms. Furthermore, the NE-SW trending structural control is also fundamental in the geomorphological diversity, showing an aligned arrangement of inselbergs at the edges of the batholith, as a result of pre-defined structural patterns.

Keywords: Petrographic Analysis; Granitic Reliefs; Central Ceará Domain; Brazilian Semi-Arid Region.

Resumo: O controle petrográfico exerce forte influência na evolução geomorfológica de plútons graníticos da Província Borborema (Nordeste do Brasil), constituídos de natureza, formas e dimensões variadas. O Batólito Rio Quixeramobim, localizado no Domínio Ceará Central (Província Borborema), é condicionado pelas zonas de cisalhamento dextrais de sentido NE, Quixeramobim e Senador Pompeu e é constituído por seis suítes graníticas distintas. O presente trabalho visa analisar os aspectos geomorfológicos do Batólito Rio Quixeramobim a partir de análises petrográficas (mineralógicas e estruturais), correlacionando as morfologias com as diferentes suítes analisadas. A metodologia partiu da análise de dados geológicos,

geomorfológicos, averiguações em campo, coleta de amostras e análise em laboratório de microscopia. As feições geomorfológicas apresentam forte relação com as características mineralógicas e estruturais associadas ao grau de microfraturamento de seus minerais constituintes. Os dados mostram que, além da diversidade mineralógica, aspectos estruturais, como grau de microfraturamento, porosidade e textura, são fundamentais para o desenvolvimento e macro e microformas graníticas. Além disso, o controle estrutural de direção NE-SW também é fundamental na diversidade geomorfológica, mostrando uma disposição alinhada dos *inselbergs* nas bordas do batólito, como resultantes de padrões estruturais pré-definidos.

Palavras-chave: Análise Petrográfica; Relevos Graníticos; Domínio Ceará Central; Semiárido Brasileiro.

1. Introduction

The exhumation of granitic bodies in the northern sector of northeastern Brazil has revealed a wide diversity of landforms, whose genesis and evolution are attributed to the combined action of subsurface and surface processes (Twidale & Vidal Romaní, 2005; Maia & Nascimento, 2018). These processes are conditioned by Cretaceous and Cenozoic tectonic reactivations (Maia & Bezerra, 2014; Bastos et al., 2022), as well as by Cenozoic climatic oscillations (Corrêa et al., 2010), mineralogical predisposition (Vidal Romaní & Temiño, 2004; Maia & Nascimento, 2018), and the structural characteristics of the rocks (Goudie, 2016).

During the Miocene, the progressive aridification of a previously humid climate (Harris & Mix, 2002; Peulvast et al., 2008; Peulvast & Bétard, 2015), punctuated by short humid intervals identified since the Late Pleistocene (Behling et al., 2000; Wang et al., 2004), produced significant morphopedological and phytogeographical effects in the study area (Auler et al., 2004). These conditions account for the development of flattened hinterland surfaces (Sertaneja Surface), covered by shallow soils and deciduous vegetation (Caatinga).

Most granitic bodies of the Borborema Province (BP) (Almeida et al., 1977) are related to the Brasileiro Orogeny (Ferreira et al., 1995) and are interpreted as the result of extensional intrusions associated with regional tectonics (Neves, 2012). Their structural framework is characterised by shear zones (Vauchez et al., 1995), along which magma ascended through the crust, forming plutons (Castro et al., 2002).

Located in the central portion of Ceará State, the Central Ceará Domain (CCD)—the largest geotectonic unit in the northern sector of the Borborema Province, bounded by the Transbrasiliano Lineament (TL) and the Senador Pompeu Shear Zone (SPSZ)—exhibits a wide diversity of Neoproterozoic plutonic suites (Almeida, Parente & Arthaud, 2008). These suites were emplaced within Palaeoproterozoic and Meso–Neoproterozoic terrains, represented by the metasedimentary sequences of the Ceará Group (Crandall, 1910; Arthaud, 2007).

Among the granitic bodies of the CCD, the Rio Quixeramobim Batholith (RQB) stands out. Dated to the Neoproterozoic (~587 Ma) (Pinéo & Palheta, 2020), it intruded Precambrian country rocks (~2.05 Ga) of the Acopiara Complex and the metasedimentary rocks of the Ceará Group (Quixeramobim Unit) (~635 Ma). Magma ascent and emplacement were controlled by the Quixeramobim Shear Zone (QSZ) and the Senador Pompeu Shear Zone (SPSZ), both exhibiting dextral kinematics (Arthaud, 2007; Almeida, Parente & Arthaud, 2008). The batholith displays an elongated ellipsoidal geometry, with its major axis trending N40°E and extending for approximately 75 km, and a minor axis of about 20 km (Almeida & Ulbrich, 2003).

Cenozoic denudational processes were responsible for the exhumation and sculpting of the RQB relief, resulting in a widespread planation surface (Sertaneja Surface) (Ab'Sáber, 1969; Costa et al., 2020) that covers most of the batholith area. This surface is accompanied by residual landforms hosting granitic macroforms and microforms, whose evolution is associated with the geomorphological properties of the rocks (Penteado, 1974; Goudie, 2016), the geotectonic setting of the granitoids, and their textural, structural and weathering characteristics (Almeida & Ulbrich, 2001), under predominantly semi-arid climatic conditions.

In light of the above, this study aims to analyse the geomorphological aspects of the Rio Quixeramobim Batholith based on petrographic and structural analyses, correlating granitic macroforms and microforms with the different granitic suites that compose the batholith.

2. Study area

The study area is located in the central portion of Ceará State, predominantly within the municipality of Quixeramobim, extending into the municipalities of Quixadá, Banabuiú, Senador Pompeu and Mombaça. From a geotectonic perspective, the Rio Quixeramobim Batholith (RQB) is situated within the Central Ceará Domain (CCD) and comprises a poly-intrusive body covering approximately 1,600 km² of exposed area. The batholith trends NE–SW and is bounded by the Quixeramobim Shear Zone (QSZ) to the west and the Senador Pompeu Shear Zone (SPSZ) to the east (Figure 1).

From a geological standpoint, the RQB is subdivided into six distinct granitic suites based on texture, composition and degree of heterogeneity. These include: (i) the Muxuré Velho Suite (MVS), composed of mesocratic granodiorites and quartz diorites, occurring as enclaves, sheets and syn-plutonic dykes; (ii) the Muxuré Novo Suite (MNS), a medium-K calc-alkaline granitic series with porphyritic texture and K-feldspar megacrysts ranging from 1 to 6 cm; (iii) the Água Doce Suite (ADS), a low-K calc-alkaline granitic series, aphyric and medium-grained (~0.5 cm); (iv) the Serra Branca Suite (SBS), a medium-K calc-alkaline granitic series with porphyritic texture and K-feldspar megacrysts ranging from 6 to 20 cm; (v) the Uruquê Suite (URS), a high-K calc-alkaline granitic series, aphyric and fine-grained (~0.2 cm); and (vi) the Boa Fé Suite (BFS), a medium-K granitic series with porphyritic texture and K-feldspar megacrysts ranging from 1 to 3 cm (Torquato et al., 1989; Almeida, Parente & Arthaud, 2008) (Figure 1).

The batholith is located within the Brazilian semi-arid region, characterised by mean annual temperatures exceeding 29 °C and rainfall concentrated between January and June, with an average annual precipitation of approximately 700 mm yr⁻¹ (IPECE, 2012). These climatic conditions result in high annual evapotranspiration rates and a predominantly negative water balance throughout most of the year (Zanella, 2007). The drainage network is composed mainly of intermittent streams, forming open valleys and predominantly dendritic drainage patterns. Locally, drainage is structurally controlled by brittle deformation features, particularly along the lower and middle courses of the Quixeramobim and Banabuiú rivers, respectively (Almeida, 1995).

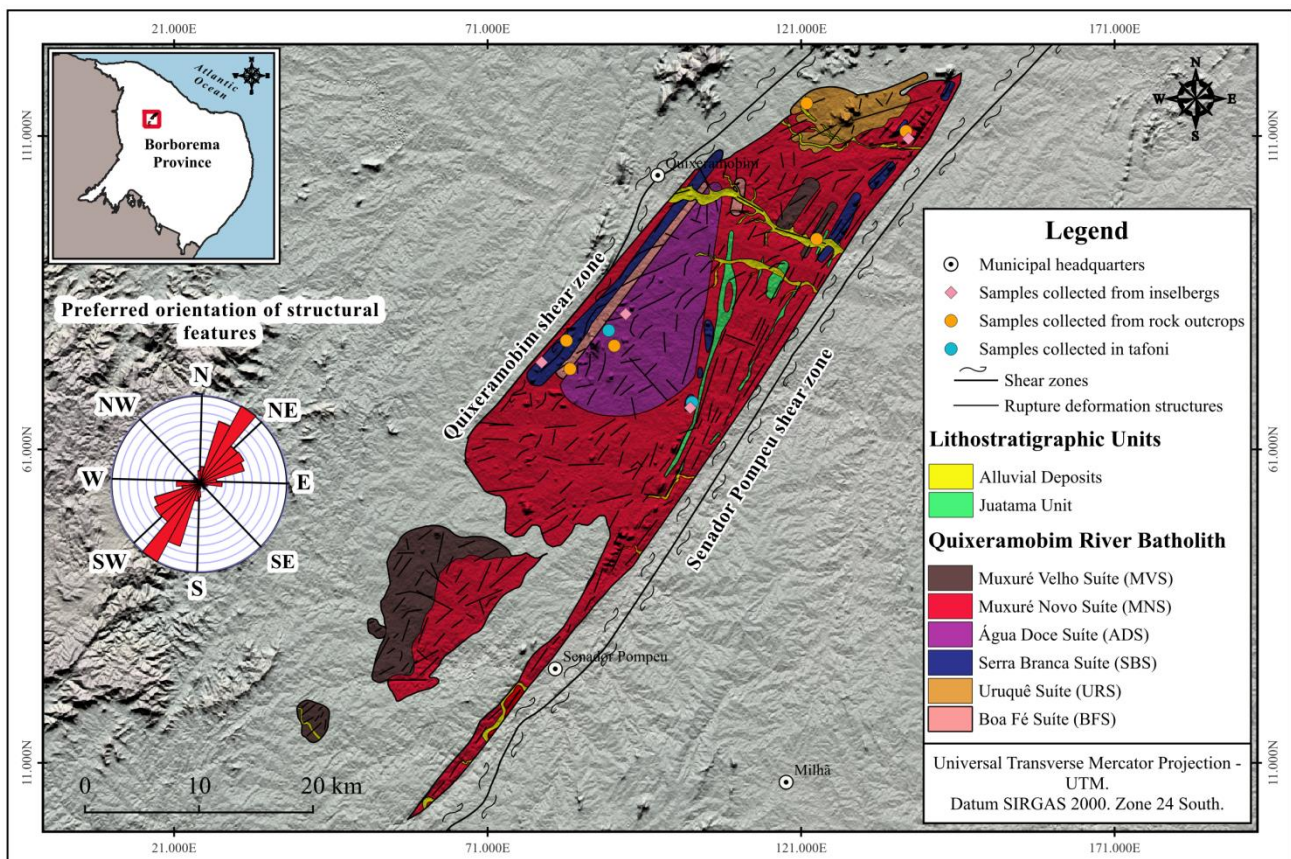


Figure 1. Location and geology map of the RQB, NE Brazil. Source: prepared by the authors (2025) from SRTM data and geological data based on the works of Almeida (1995) and Almeida, Parente and Arthaud (2008).

3. Materials and Methods

The methodological procedures adopted in this study initially focused on a comprehensive bibliographic review addressing the geological framework of the Borborema Province, with particular emphasis on the Rio Quixeramobim Batholith (RQB), as well as on the genesis and evolution of granitic landforms in the northern sector of northeastern Brazil.

Subsequently, fieldwork was carried out with the objective of identifying and characterising different geomorphological landforms and features at a detailed scale, in addition to establishing associations between granitic landforms and the distinct intrusive suites that compose the RQB and its surroundings. During this stage, photographic records were obtained using both a digital camera and a drone (Mavic 3 Mini). Rock samples were collected according to the spatial distribution of the different suites, inselbergs (with and without tafoni), and rock pavements (lajedos), for subsequent petrographic laboratory analyses (Figure 2).

Cartographic products were developed in a GIS environment using QGIS 3.28.4 Firenze software, provided by the Open Source Geospatial Foundation (OSGeo). Vector files (.shp) and Shuttle Radar Topography Mission (SRTM) data were employed, with all datasets projected in the UTM coordinate system and referenced to the SIRGAS 2000 datum. Geological mapping information was obtained from the Quixeramobim (SB.24-V-D-III), Mombaça (SB.24-V-D-V) and Senador Pompeu (SB.24-V-D-VI) geological sheets, all at a scale of 1:100,000 (Almeida, Parente & Arthaud, 2008; Naletto & Araújo, 2018; Palheta, 2017), made available by the Geological Survey of Brazil (SGB/CPRM).

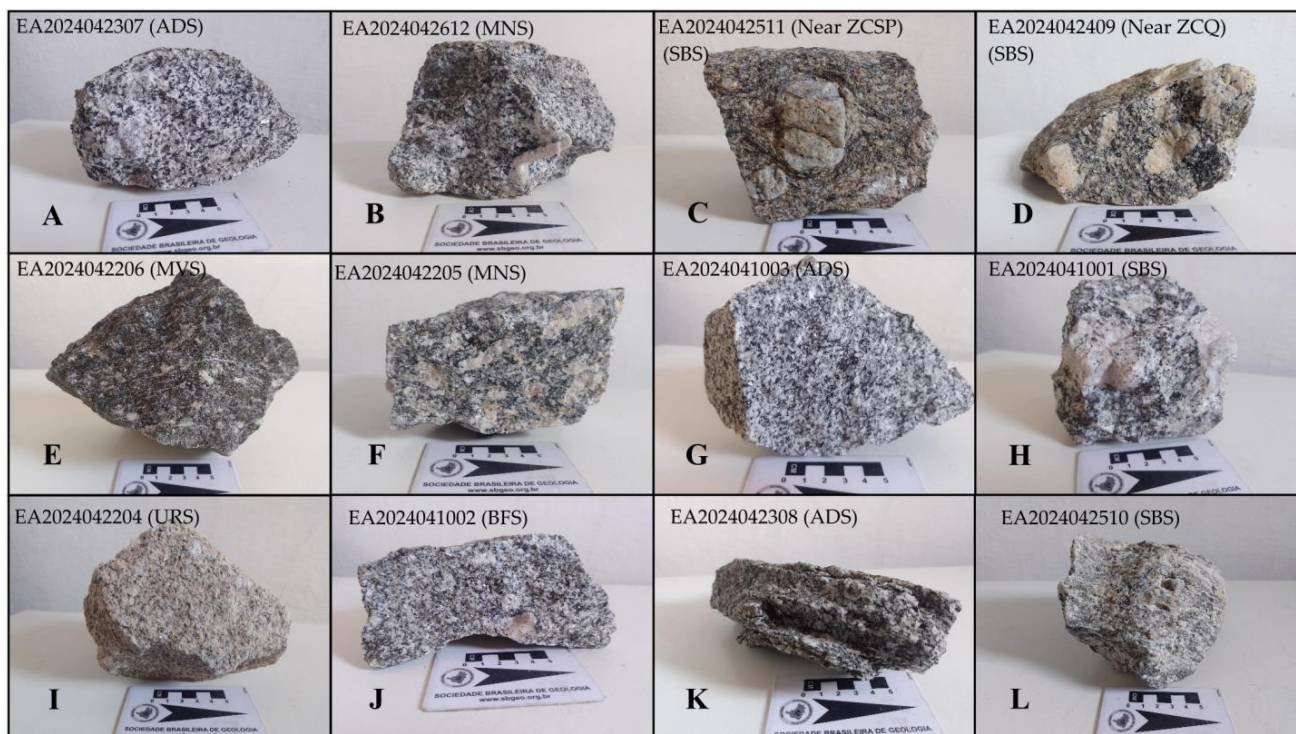


Figure 2. Rock samples collected in the granitoid suites of RQB. Legend: (A, B, C, D) samples collected in domed inselbergs; (E, F, G, H, I, J) samples collected in rock slabs; (K, L) samples collected in tafoni. Source: Authors (2025).

Brittle deformation structures and structural lineaments were derived from the interpretation of a Digital Elevation Model (DEM), specifically the Forest and Buildings Removed Copernicus DEM (FABDEM) v1-2, with a spatial resolution of approximately 30 m (Neal & Hawker, 2023), using ArcGIS software. Rose diagrams were generated in QGIS 3.28.4 Firenze using the *Line Direction Histogram* plugin, which indicates the preferential orientations of deformation structures within the RQB. The vectorisation of brittle structures aimed to establish correlations between structural control and its influence on landform development and drainage network configuration within the batholith.

Petrographic analyses were conducted at the Microscopy Laboratory of the Department of Geology, Federal University of Ceará (UFC). A total of twelve rock samples were collected: one sample from each granitic suite, totalling six samples from the Sertaneja Surface; four samples from domical inselbergs, including one sample from the Água Doce Suite (Salva Vida inselberg), one from the Muxuré Novo Suite (Pedra do Reduto inselberg), and two from the Serra Branca Suite, representing both structural belts within the batholith—one from the Pão de Açúcar inselberg (western belt, near the QSZ) and one from the Canhotinho Farm inselberg (eastern belt, near the SPSZ); and two samples from tafoni, collected from the Água Doce Suite (Serra do Meio inselberg) and the Serra Branca Suite (Canhotinho inselberg) (Figure 1).

In the laboratory, the samples were mounted on glass slides and cut to a thickness of approximately 0.03 mm, following standard petrographic preparation procedures (Gazzi, 1966; Dickinson, 1970). Mineralogical composition was determined by modal point-counting, following the parameters described by Davis and Reynolds (1996). The degree of microfracturing was quantified using the Linear Crack Density index (LCD, cracks mm^{-1}) and classified as low (<1.3), moderate (1.3–2.5), or high (>2.5), following a methodology similar to that proposed by Sousa et al. (2005).

The petrographic analyses aimed to obtain mineralogical and structural information in order to correlate these characteristics with the respective geomorphological properties of the granitoids from each suite and their spatial expression throughout the Rio Quixeramobim Batholith.

4. Results

4.1 Granitic Landforms of the Rio Quixeramobim Batholith

The morphological diversity of the RQB is due to the influences of lithostructural aspects associated with magma intrusions from each suite and the structural framework, related to Cretaceous and Cenozoic tectonic reactivations (Bezerra; Vita Finzi, 2000; Matos, 2000), as well as Cenozoic denudational action, marked by the predominance of regional semi-aridity since the Miocene (Harris; Mix, 2002; Peulvast et al., 2008; Bétard, 2012).

4.1.1 Macroformas graníticas do RQB

Based on the hierarchy parameters established by Bastos et al. (2022), the macroforms of the RQB were divided into *inselgebirge* (Figure 3), inselbergs (Figures 4 and 5), and *lajedos* (rocky pavements) or granitic outcrops.

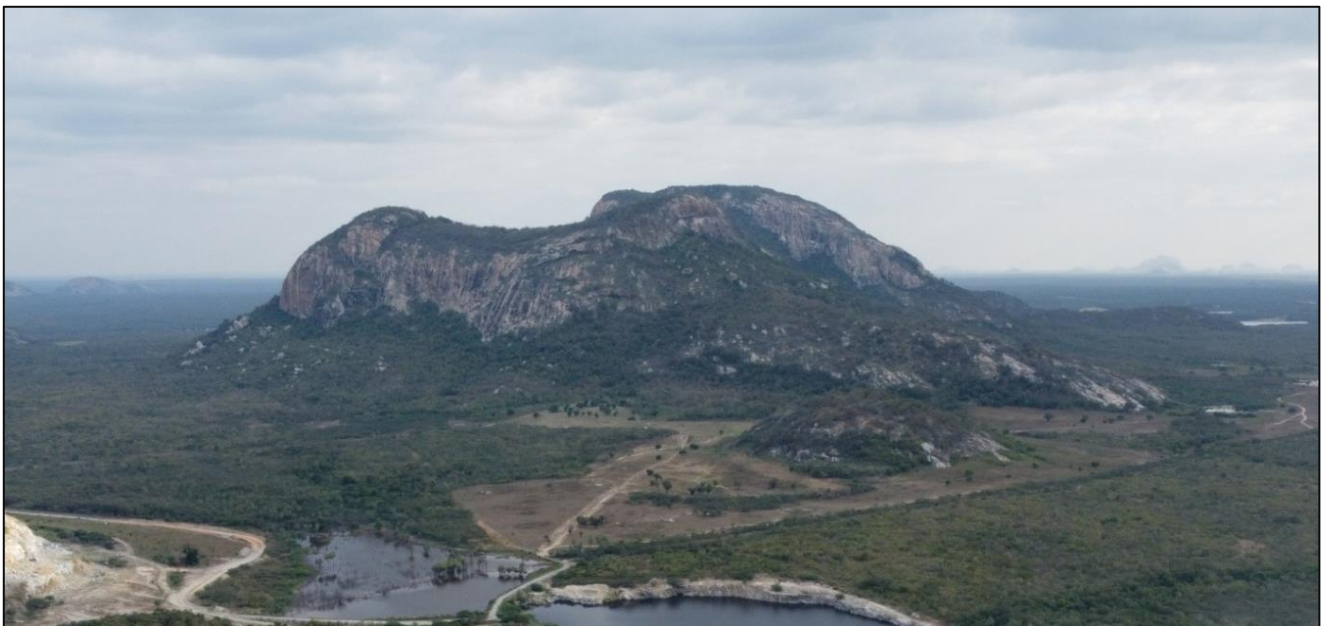


Figure 3. Inselgebirge “Serra da Baleia”, in the district of Uruquê (SU). Source: Authors' collection (2025).

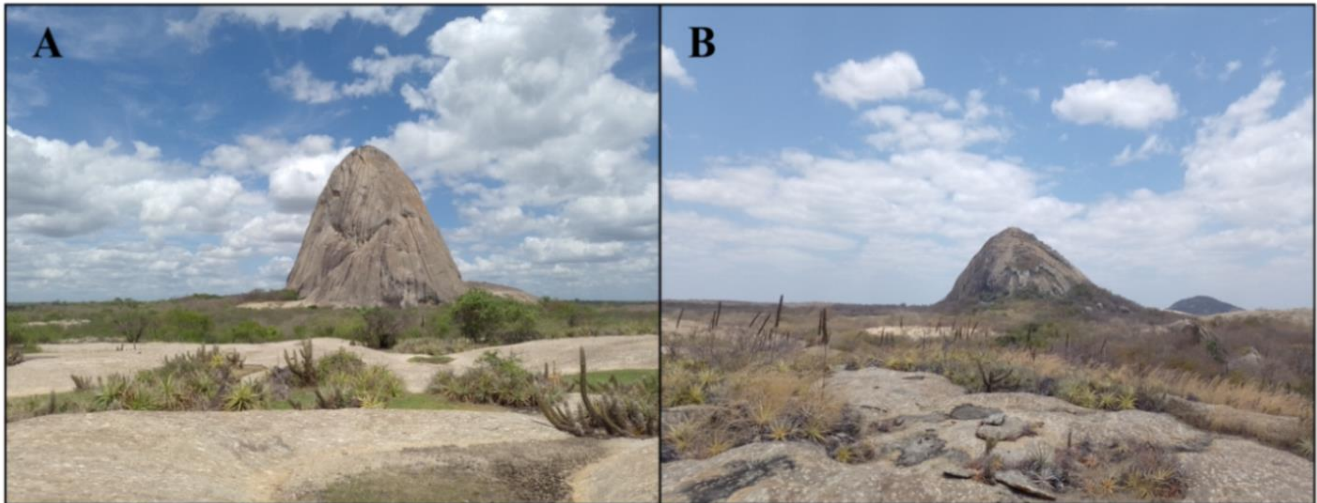


Figure 4. Conical inselbergs (SSB). (A) Sugarloaf Mountain, at Vista Alegre Farm, near the ZCQ (SSB. See Figure 1); (B) Serra Aguda, at Holanda Farm, near the ZCSP (SSB). Source: Authors' collection (2025).

For Twidale, Vidal Romaní, and Centeno (1996) and Twidale and Vidal Romaní (2005), the development of dome-shaped macroforms (e.g., bornhardt) is associated with regional strike-slip and shearing tectonic movements. The bornhardts of the RQB present steep escarpments (Figure 5), without the development of dissolution forms (e.g., tafoni, karren, gnammas).

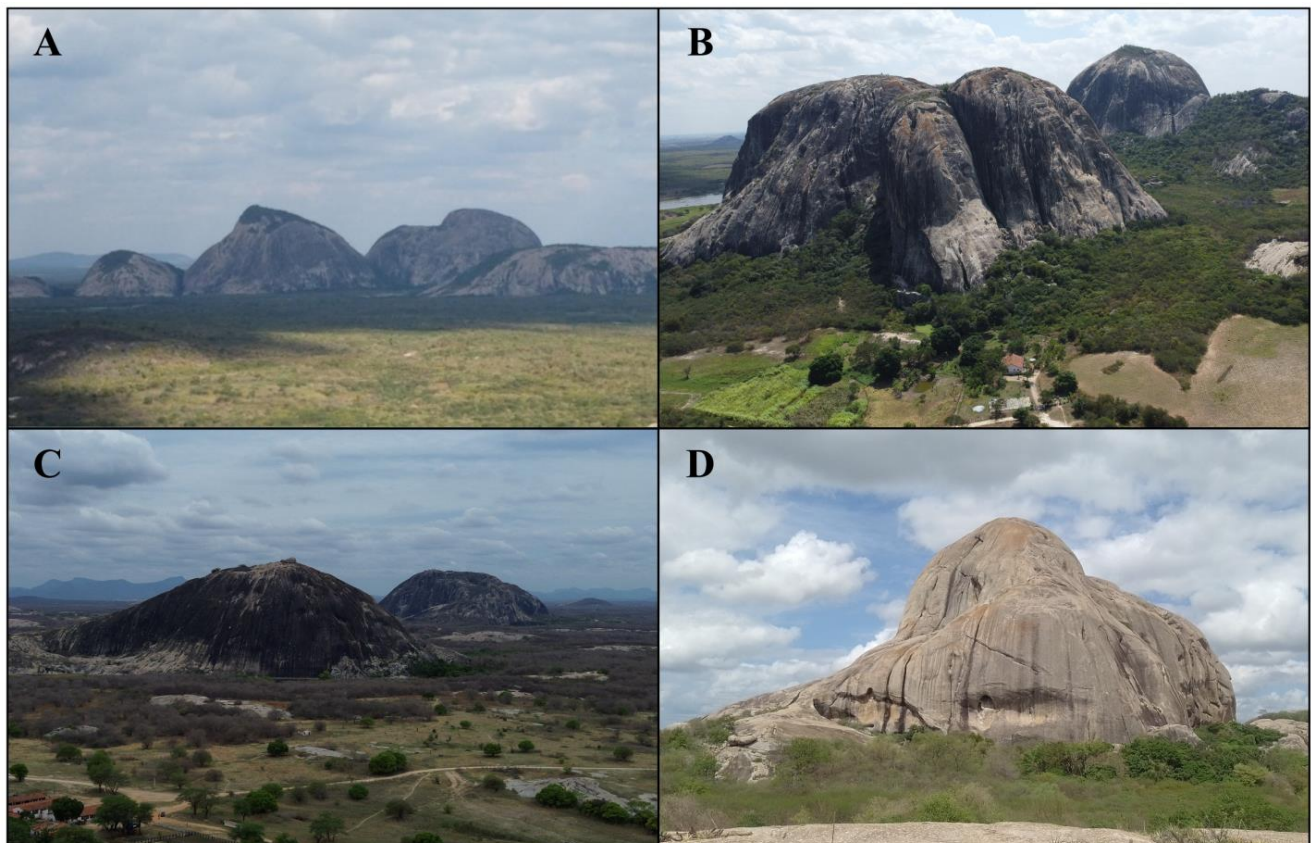


Figure 5. Domic inselbergs identified in the RQB study area. (A) At Fazenda Reduto, near ZCSP, north of the batholith (SMN); (B) In the Encantado District, Quixeramobim/CE, near ZCSP, south of the batholith (SMN); (C) At Fazenda Guarany, near ZCQ (SAD); (D) In the locality of Vista Alegre, near ZCQ, south of the batholith (SSB). Source: Authors' collection (2025).

4.1.2 Microforms related to granitic blocks

Boulders in the RQB are located at the base of the “Salva Vida” and “Serra do Meio” inselbergs (Figure 6). Conversely, the occurrence of block fields (*caos de blocos*) is arranged on the slopes (Figure 6B), forming talus ramps at the base of these same inselbergs, both in the SAD. These granitic blocks have cuboid to spherical shapes (Figures 6A and 6C).

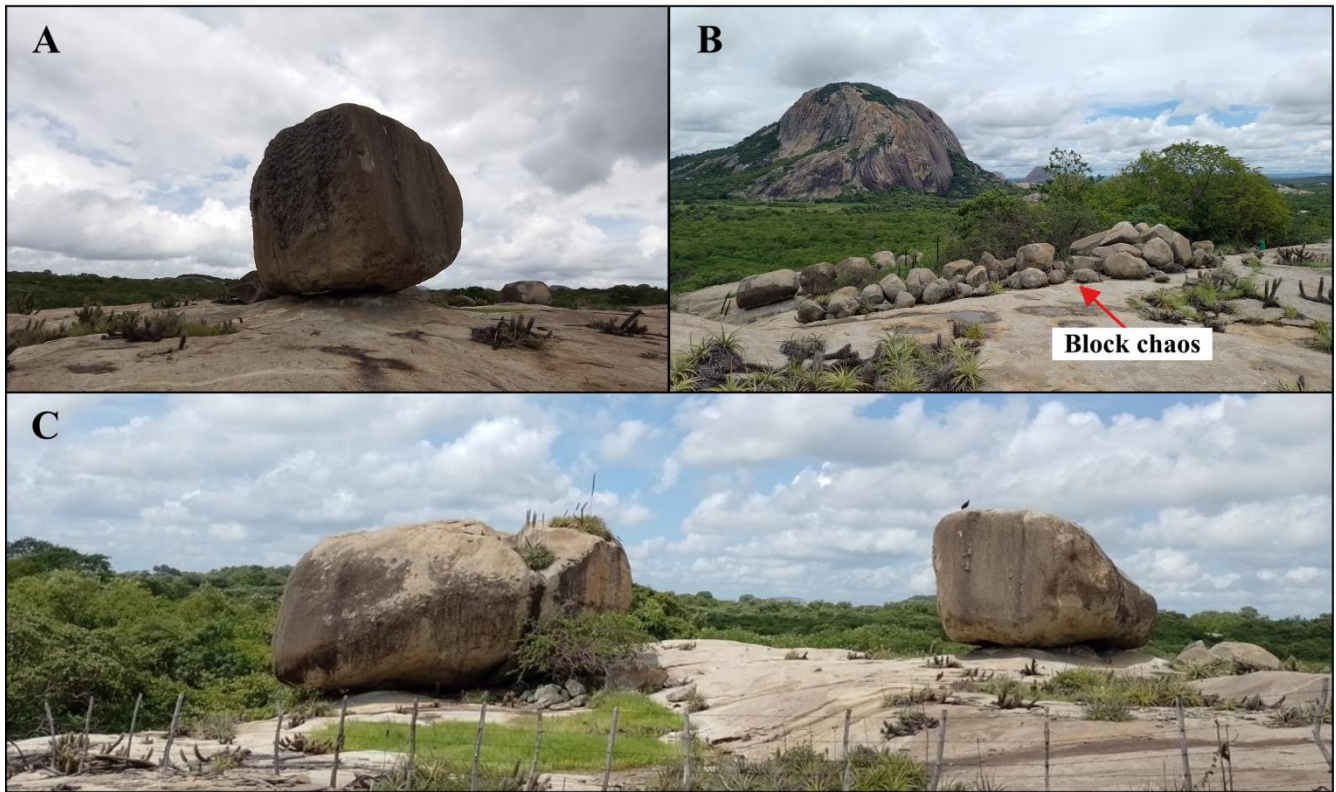


Figure 6. Microforms associated with granitic blocks identified in the SAD. (A and C) Granitic boulders on outcrop (SAD); (B) Block chaos (SAD). Source: Authors' collection (2025).

The castle koppie identified in the locality of Pedras Grandes, municipality of Senador Pompeu, in the SMN granite, south of the RQB (Figure 7C), reflects a spaced orthogonal jointing pattern. It also documents that saprolite exhumation occurred in the pre-exfoliation phase, presenting irregularly superimposed blocks that are more angular and less rounded.



Figure 7. Microforms identified in RQB. (A) Tor on the “Salva Vida” inselberg (SAD); (B) Tor on the Belo Norte Farm (SMN); (C) Castle koppies (SMN); (D) Pedestal Rock on the “Serra do Meio” inselberg (SAD). Source: Authors' collection (2025) and Alves (2012).

Other microforms developed in the SAD, specifically in the “Serra do Meio” inselberg, are plinths (Figure 8). These granitic structures are related to pedestal rocks and result from water dripping from saprolitic landforms (e.g., boulders), presenting low protrusions and flat tops that rise a few centimeters above the adjacent rock surface, usually topped by boulders that act as an “umbrella,” protecting against precipitation (Twidale; Vidal Romaní, 1994, 2005).

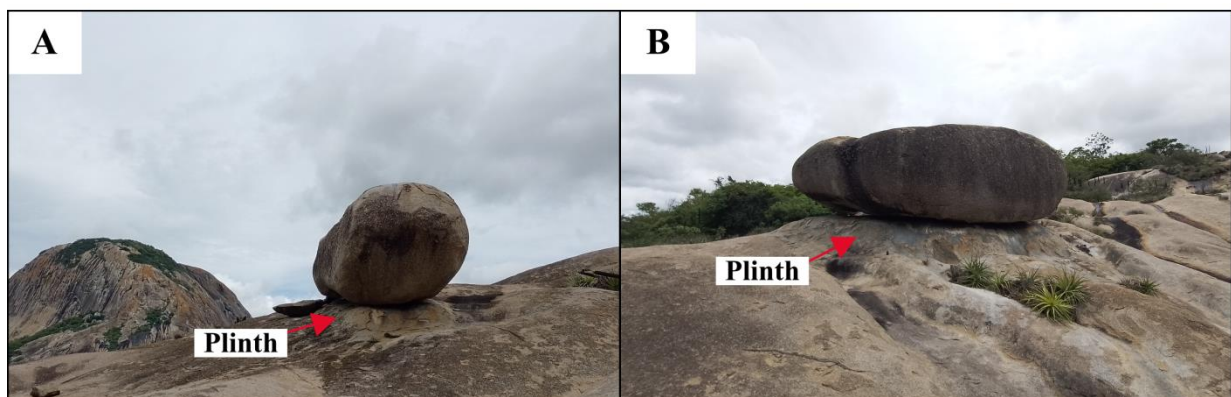


Figure 8. Plinths identified in the SAD. (A and B) Plinths developed under bouldering on the inselberg “Serra do Meio”. Source: Authors' collection (2025).

4.1.3. Microforms related to dissolution features

In the RQB area, tafoni are found on boulders and inselbergs (Figure 9), developing along planes of weakness and through chemical corrosion of the rock mass, as evidenced by Vidal Romaní and Twidale (1999) and Ward (2006). Basal tafoni, identified in the granitic rocks of the SAD and SSB, are characterized as concave features that

expand at the base and consume the interior of the boulder due to its greater susceptibility to chemical corrosion and granular disintegration. The basal tafoni in this area occur in boulders located on the crest of dome-shaped inselbergs (Figure 9A). The long period of stability of these boulders allowed for a prolonged process of tafone formation (*tafonização*) and the consequent development of larger cavities. Nevertheless, it is important to highlight that a granitic arch (Figure 9C) was identified in the “Salva Vida” inselberg (SAD).

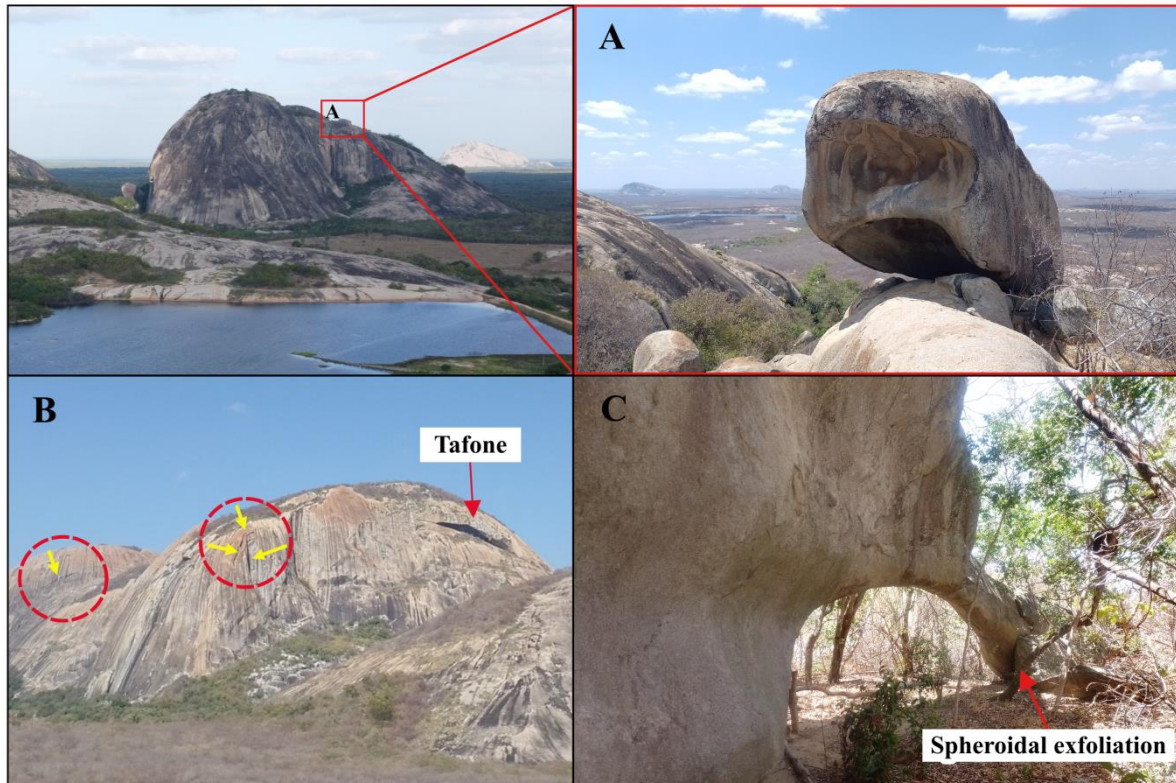


Figure 9. (A) Basal tafoni in a tor on the “Salva Vida” inselberg (SAD); (B) Domicic inselberg “Pedra do Reduto” with tafone and north-facing face (SMN); (C) Granitic arch on the “Salva Vida” inselberg. Note the dashed red circles with yellow arrows, indicating multidirectional fracturing. Source: Authors’ collection (2025).

The tafoni located on the granitic escarpments of the RQBinselbergs are mainly associated with dissolution processes along discontinuity surfaces; for example, the tafone located in the “Pedra do Reduto” inselberg (SMN) (Figure 9B) and in the Guarany (SAD), Serrote dos Mocós, and Canhotinho (SSB) inselbergs (Figure 10). These exhibit a more elongated shape, demonstrating a strong relationship between fractures, exfoliation, and surface inclination, associated with the direction of veins and mafic enclaves, along with block collapse, generating negative cavities in the escarpments.

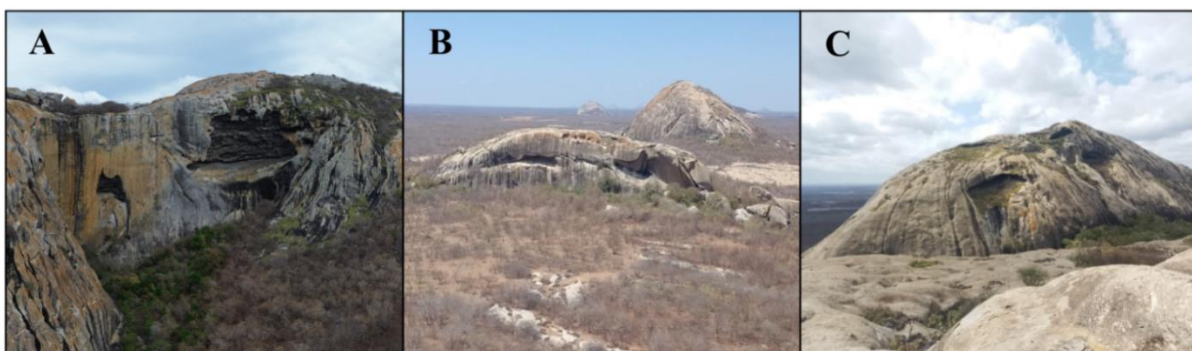


Figure 10. Tafoni on granite escarpments in RQB. (A) Guarany Inselberg (SAD); (B) Serrote dos Mocós Inselberg (SSB); (C) Canhotinho Inselberg (SSB). Source: Authors’ collection (2025).

The tafoni identified in the RQB show a primary axis of development coinciding with the direction of the batholith's deformation planes and veins (See Figure 1). Given this, evolution occurred through discontinuity surfaces, with block collapse and cavity expansion evolving via the alteration of mafic minerals. According to Maia et al. (2022), this evolution can be associated with different stages, such as the formation of pressure-release fractures and weathering along fractures, originating dissolution features in the pre-collapse phase.

The Canhotinho inselberg (SSB) presents a cavity ≈ 80 m long by ≈ 50 m high (Figure 11), producing a rain-shadow/shaded environment within the cavity. This promotes greater moisture retention, causing an increased detachment of altered materials that fall from the ceiling due to gravity, with varied grain sizes, accumulating on the tafone floor (Figure 11B, yellow dashed rectangle). Honeycombs were identified in the tafoni of the Canhotinho (SSB) and Guarany (SAD) inselbergs, as well as in a basal tafone (Figure 12) in the Serra do Meio inselberg (SAD).

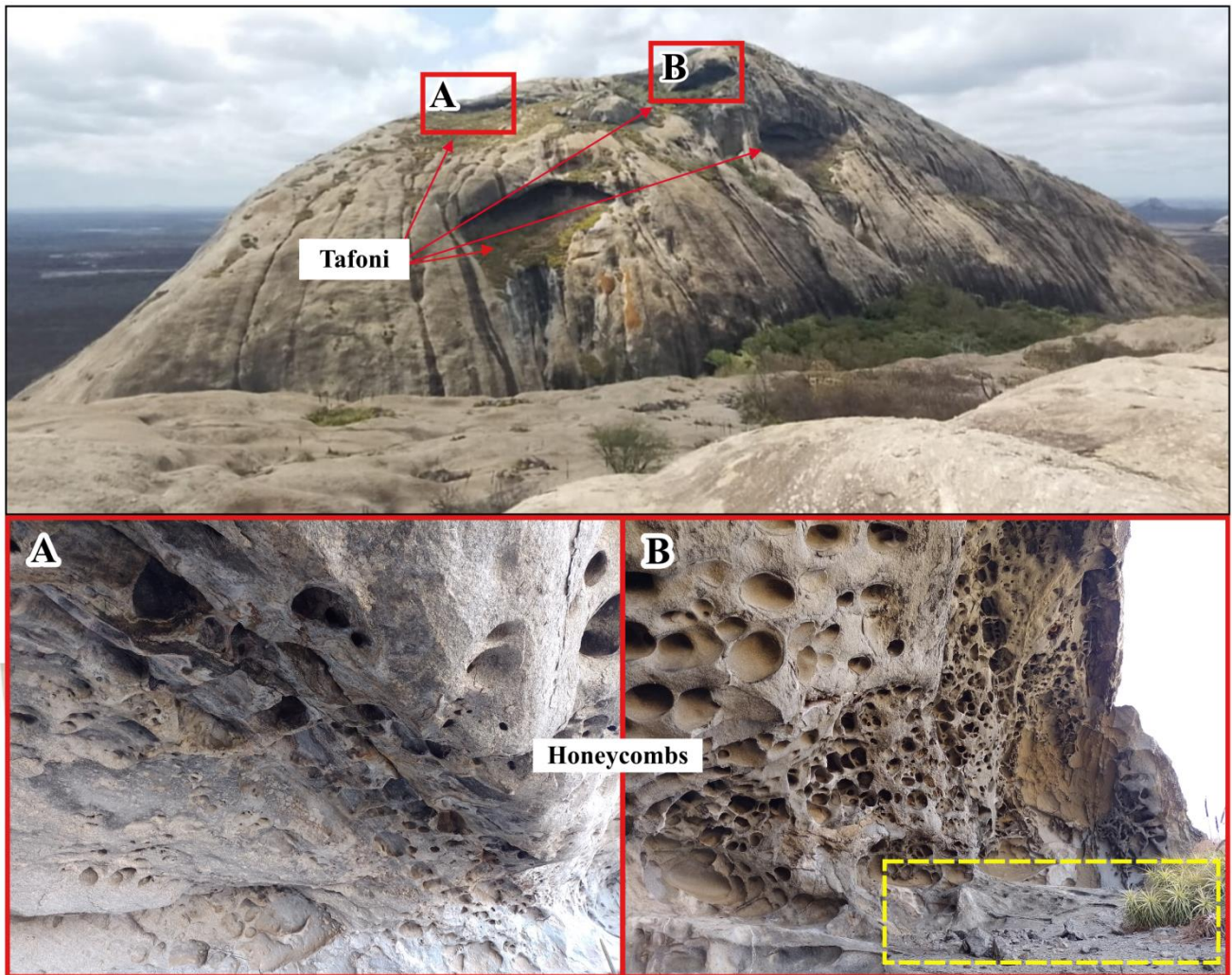


Figure 11. Honeycombs developed on the inselberg “Canhotinho”, next to the ZCSP (SSB). Source: Authors’ collection (2025).

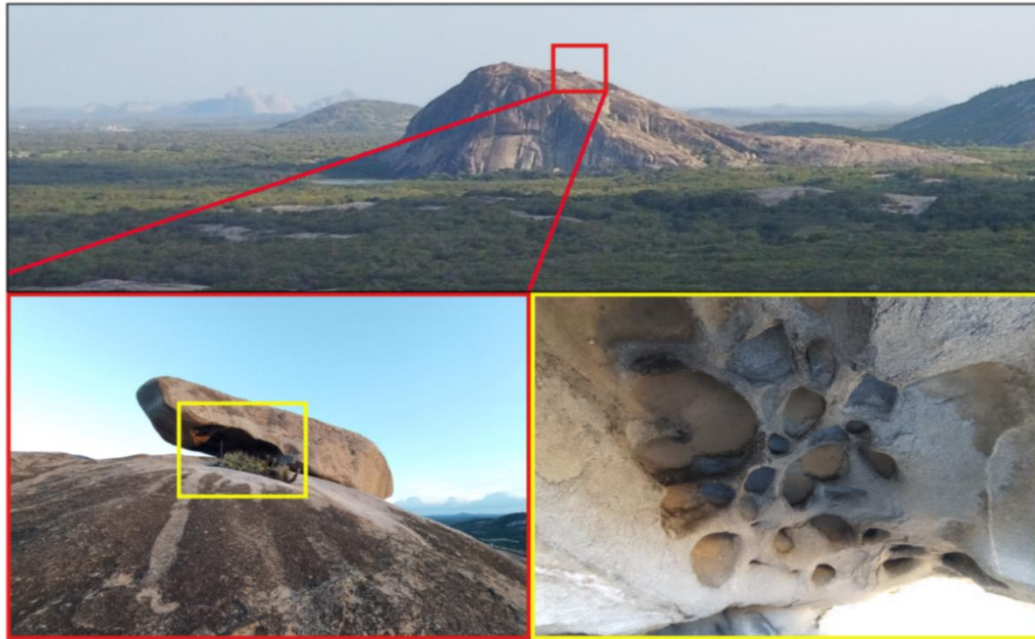


Figure 12. Honeycombs developed in basal tafone on the inselberg “Serra do Meio” (SAD). Source: Authors' collection (2025).

Honeycombs are dissolution microfeatures associated with cavernous weathering that cause the disintegration of the rock mass, producing alveoli. This involves the development of closely spaced cavities separated by thin, intricate walls, creating a surface resembling honeycombs (Twidale; Vidal Romani, 2005; Migón, 2006a).

Karren are parallel erosion grooves marked on inclined and vertical rock surfaces, varying in size, depth, width, and sinuosity (Migón, 2006a; Maia; Nascimento, 2018). Within the RQB, they occur associated with the slopes of inselbergs located in the SSB and SAD (Figure 13).



Figure 13. Erosion grooves developed in the granitoids of the RQB. (A) karrens developed on the “Pão de Açúcar” inselberg (SSB); (B) karrens developed on the “Salva Vida” inselberg (SAD). Source: Authors' collection (2025).

In the RQB, dissolution basins (gnammas) are spatially distributed and found in greater numbers in the MN, AD, and SB suites (Canhotinho and Pão de Açúcar inselbergs) (Figure 14) and the SU suite. Dissolution basins consist of small closed depressions with varied shapes and dimensions, which can be circular, elliptical, or irregular, with diameters ranging from decimetric to metric scales (Campbell, 1997), and may or may not present a spillway (Cordeiro et al., 2023).



Figure 14. Gnammas located in the RQB area. (A) Armchair pit type gnamma, approximately 8 m wide by approximately 5 m deep, on the Canhotinho inselberg (SSB); (B) Pit type gnammas, approximately 2 m deep by 1.5 m in diameter (SSB). Source: Authors' collection (2025).

Flared slopes are features that emerge as a basal zone of inclination or concavity (Migón, 2006a), associated with subsurface weathering (Twidale, 1982) and facilitated by the existence of horizontal fractures (Lima et al., 2019). Within the RQB, these features occur punctually in inselbergs with steep escarpments (Figure 15A) in the SMN and in a rock dome in the exhumation phase (Figure 15B) in the SU.

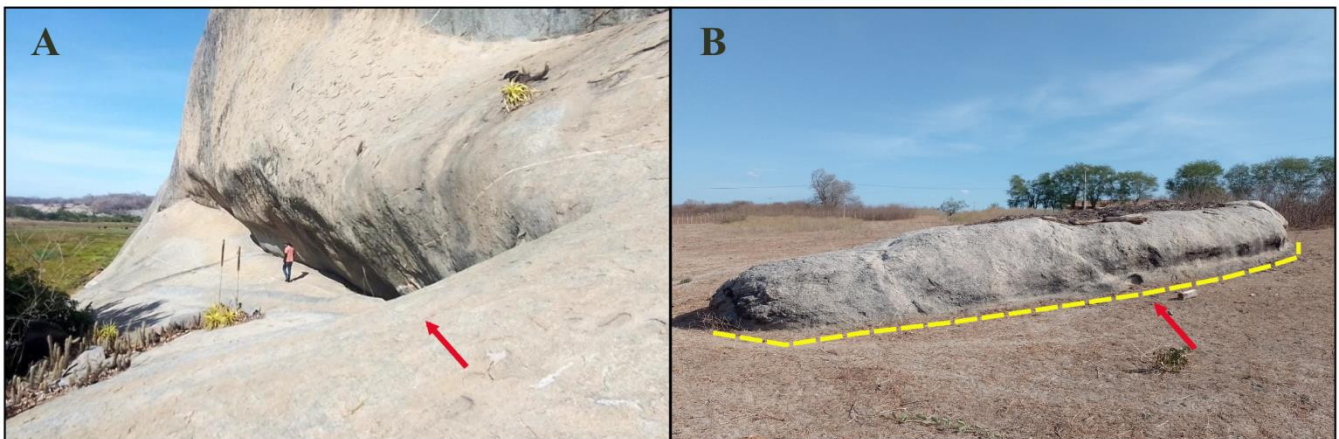


Figure 15. Flared slopes identified in the RQB. (A) On the steep slope of the inselberg “Lagoa do Fofô”, in the district of Encantado (SMN); (B) In a rocky dome in the exhumation phase at the Cachoeira farm, district of Uruquê (SU). Source: Authors' collection (2025).

4.1.4 Microforms related to fracturing

In the RQB area, microforms related to fracturing, such as split rocks (Figure 16A), are associated with the MV, AD, BF, and SB suites. This block-splitting process can occur regardless of the mineralogical composition, structure, or texture of the granitoid rocks (Twidale; Vidal Romani, 2005). Some boulders are subjected to a variety of surface processes that can compromise their strength, culminating in their division (Campbell; Twidale, 1995; Twidale; Vidal Romani, 2005).

Polygonal cracking was identified in boulders within the SAD rocks (Figure 16B), occurring as a function of the grain size and arrangement of mafic minerals in this suite. These fracturing microforms are superficial weathering cracks (Bigarella; Becker; Santos, 2009), with shallow fissures related to the structure of the rock mass (Williams; Robinson, 1989; Twidale, 1982), presenting orthogonal cracking patterns with variable geometry (Williams; Robinson, 1989).

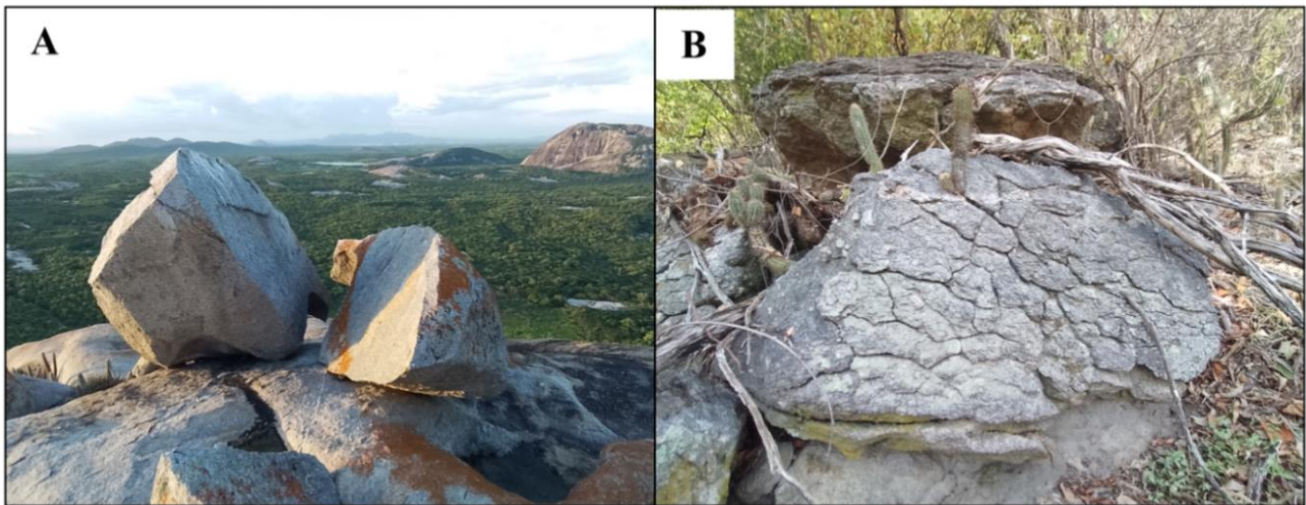


Figure 16. Microforms of fracturing identified in RQB. (A) Split rock identified on the inselberg “Serra do Meio” (SAD); (B) Polygonal cracking developed in boulder (SAD). Source: Authors' collection (2025).

In Figure 17, it is possible to observe the spatialization of the macro and microforms developed over the granitoid rocks of the RQB.

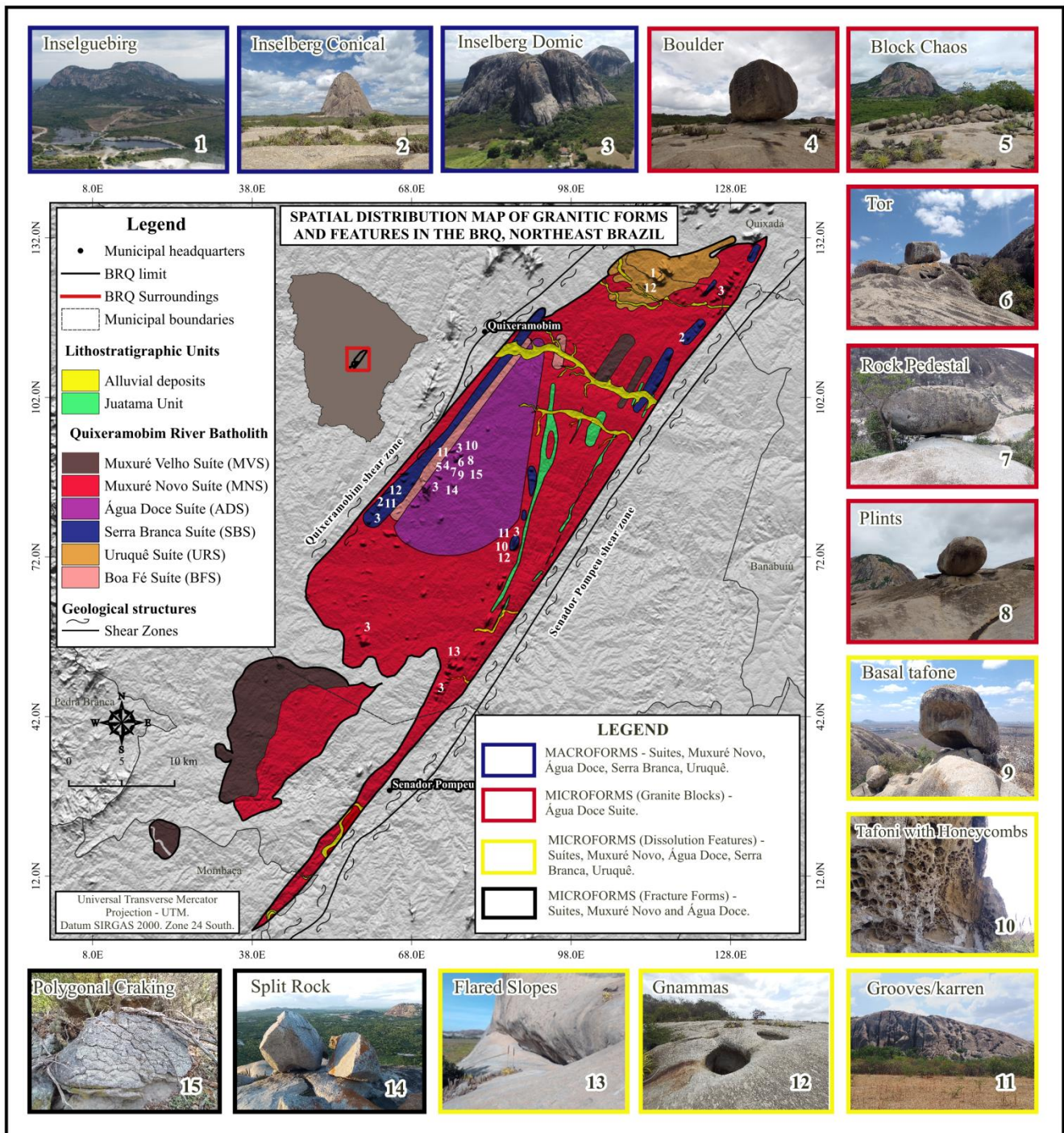


Figure 17. Spatialization of geomorphological forms and features in the RQB. Source: Prepared by the authors (2025).

4.2 Petrographic Parameters

The collected rocks present massive structures and inequigranular granoblastic texture, with the exception of the SU, which presents a granoblastic texture, and the SMV, with a granolepidoblastic texture. Petrographic analyses (Table 1) and structural characteristics (Table 2) are presented to support the understanding of the genesis and evolution of the macro and microforms of the RQB relief.

Table 1. Petrographic characteristics (mineralogy) of the granite suites of the RQB. Legend: (Suites) **MV** – Muxuré Velho; **MN** – Muxuré Novo; **AD** – Água Doce; **SB** – Serra Branca; **SU** – Uruquê; **BF** – Boa Fé; (Mineralogy) **Qtz** – Quartz; **Pl** – Plagioclase; **Kfs** – K-feldspar; **Bt** – Biotite; **Ep** – Epidote; **Zrc** – Zircon; **Ttn** – Titanite; **Apt** – Apatite; **Czo** – Clinozoisite; **Hbl** – Hornblende; **Cht** – Chlorite; **Ser** – Sericite; **Aln** – Alanite; **Ms** – Muscovite. Source: Prepared by the authors (2025).

N°	Sample	Suite	Relief	Mineralogy													
				Qtz	Pl	Kfs	Bt	Ep	Zrc	Ttn	Apt	Czo	Hbl	Cht	Ser	Aln	Ms
01	EA2024042206	MV	Lajedo	17%	42%	-	24%	6%	-	2%	<1%	-	8%	-	-	-	-
02	EA2024042205	MN	Lajedo	36%	42%	-	11%	1%	-	-	1,5%	-	6%	<1%	1,5%	-	-
03	EA2024042612		Inselberg	26%	38%	14%	16%	2%	<1%	<1%	<1%	-	3%	-	-	-	-
04	EA2024041003	AD	Lajedo	17%	59%	-	15%	2%	<1%	<1%	<1%	1%	4%	-	-	-	-
05	EA2024042307		Inselberg	23%	55%	-	10%	3%	-	1%	<1%	<1%	7%	-	-	-	-
06	EA2024042308		Tafoni	22%	56%	-	12%	4%	-	-	1%	<1%	4%	-	<1%	-	-
07	EA202404001	SB	Lajedo	17%	58%	4%	16%	3%	-	-	1%	-	-	-	-	-	-
08	EA2024042409		Inselberg	21%	39%	4%	16%	4%	<1%	2%	<1%	-	1%	-	-	-	-
09	EA2024042511		Inselberg	11%	68%	-	12%	1%	<1%	<1%	<1%	-	7%	-	-	-	-
10	EA2024042510		Tafone	16%	70%	5%	7%	1%	-	-	<1%	-	-	-	-	-	-
11	EA2024042204	UQ	Lajedo	31%	39%	16%	9%	-	<1%	-	-	-	-	-	<1%	-	4%
12	EA2024041002	BF	Lajedo	24%	27%	17%	13%	4%	<1%	-	-	-	-	-	<1%	<1%	-

Table 2. Structural characteristics of the granite suites of RQB. Legend: (S/P) No filling; (Suites) **MV** – Muxuré Velho; **MN** – Muxuré Novo; **AD** – Água Doce; **SB** – Serra Branca; **UQ** – Uruquê; **BF** – Boa Fé. Source: Prepared by the authors (2025).

N°	Sample	Suite	Relief	Degree of Fracture		Degree of Fracture	Fracture Filling	Maximum Fracture Opening (mm)	Degree of Change	Quantities of Myrmekites
				(mm)						
				Intergrain	Intragrain					
01	EA2024042206	MV	Lajedo	0,14	0,71	Incipient	S/P	0,02	Low	-
02	EA2024042205	MN	Lajedo	0,28	1,14	Incipient	S/P	0,02	Incipient	3%
03	EA2024042612		Inselberg	1,42	1,13	Moderate	S/P or iron oxide	0,80	Low	2%
04	EA2024041003	AD	Lajedo	0,42	0,52	Incipient	S/P or sericite	0,02	Low	<1%
05	EA2024042307		Inselberg	1,15	2,14	High	S/P or sericite	0,70	Moderate	2%
06	EA2024042308		Tafoni	0,16	0,71	Incipient	S/P	0,12	Moderate	-
07	EA202404001		Lajedo	1,28	2,28	Moderate	S/P	0,20	Incipient	<1%
08	EA2024042409	SB	Inselberg	2,04	3,31	High	S/P	0,43	Moderate	3%
09	EA2024042511		Inselberg	0,85	1,57	Moderate	S/P	0,06	Moderate	2%
10	EA2024042510		Tafone	0,57	2	Incipient	S/P or sericite	0,04	Low	<1%
11	EA2024042204	UQ	Lajedo	1,2	1,05	Incipient	S/P or iron oxide	0,03	Incipient	<1%
12	EA2024041002	BF	Lajedo	0,42	1,14	Moderate	S/P	0,10	Moderate	<1%

4.2.1 Muxuré Velho Suite (SMV) – Granodiorites

The rocks feature a mineralogy composed of quartz (17%), plagioclase (42%), biotite (24%), amphibole (8%), epidote (6%), titanite (2%), and apatite (<1%). Generally, a low degree of alteration is observed, with more altered grains found between biotite and amphibole, the latter undergoing the process of epidotization. The SMV granitoids present varied granulation, ranging from plagioclase porphyroclasts of dimensions >3.7 mm to quartz grains of 0.08 mm. Furthermore, they are sparsely microfractured, presenting intergrain fractures of 0.14 mm and intragrain fractures of 0.71 mm, with apertures of 0.02 mm. These fractures primarily affect plagioclase grains, showing low connectivity and pervasiveness without the development of cavities. When associated with grains of a higher degree of alteration, the fractures are filled with sericite; myrmekites are present at the edges of both large and small grains, indicating a deformational process generating recrystallization.

4.2.2 Muxuré Novo Suite (SMN) – Granodiorites

The SMN granitoids present a mineralogy composed of quartz (36%), plagioclase (42%), amphibole (6%), biotite (11%), apatite (1.5%), zircon (<1%), epidote (1%), hornblende (6%), chlorite (<1%), and sericite (1.5%). In the sample collected from the *lajedo* (rocky pavement), epidote, chlorite, and sericite result from mineral alteration. In addition to the granoblastic texture, myrmekitic structures can be observed, and the grains composing the rock present medium granulation, between 0.54 mm and 2.46 mm; the largest crystals are plagioclase, while the smallest are biotite and zircon.

Regarding the degree of alteration, it is overall incipient; however, biotite grains can reach moderate alteration with partial chloritization and sericitization. Concerning the degree of microfracturing, it possesses a small number of intergrain microfractures (0.28 mm) and intragrain microfractures (1.14 mm), with the intragrain type predominating. The predominant intergrain microfractures vary from 0.42 mm to 0.67 mm, with larger crystals showing longer fracture extensions. In minerals such as plagioclase, biotite, and amphibole, cleavage lines act as zones of weakness and/or starting points for fracture development.

The granitoid of the "Pedra do Reduto" dome-shaped inselberg, located at Fazenda Reduto, presents a variable mineralogy consisting of quartz (26%), K-feldspar (14%), plagioclase (38%), biotite (16%), amphibole (3%), apatite (3%), epidote (2%), titanite (<1%), chlorite, and zircon (<1%). This granitoid is coarse-grained with crystals ≥ 2 mm, with plagioclase grains being the largest. In general, it shows a moderate degree of alteration, with traces of relicts and a medium microfracturing pattern, unfilled, of intergrain (1.42 mm) and intragrain (1.13 mm) types, which are associated with the increase in the secondary porosity of the rock.

4.2.3 Freshwater Suite (SAD) – Diorites

The SAD granitoids, which constitute the *lajedos* (rocky pavements), present a mineralogy with contents of quartz (17%), plagioclase (59%), biotite (15%), amphibole (4%), apatite (<1%), zircon (<1%), titanite (<1%), allanite (<1%), epidote (2%), and clinozoisite (1%). The largest and most abundant crystals are plagioclase. Generally, the granitoid presents an incipient degree of alteration; however, biotite and plagioclase can reach a moderate level of alteration.

The granitoids of the "Salva Vida" inselberg are coarse-grained, with plagioclase, amphibole, and biotite as the largest minerals. They also exhibit a high degree of microfracturing with high connectivity and no infilling. In regions with a higher intersection of fractures and/or a greater amount of mafic minerals, it is possible to identify cavities that can reach apertures of 0.70 mm. The mineralogy consists of quartz (23%), plagioclase (55%), biotite (10%), amphibole (7%), apatite (<1%), titanite (1%), epidote (3%), and clinozoisite (<1%). Regarding the degree of alteration, it is highly altered.

The sample collected from a tafone in the "Serra do Meio" inselberg presents contents of quartz (22%), plagioclase (56%), biotite (12%), amphibole (4%), apatite (1%), epidote (4%), clinozoisite (<1%), titanite (<1%), and sericite (<1%), with a moderate degree of microfracturing, low connectivity, and no infilling. The longest fractures affect the plagioclase grains. In the thin section, it is possible to observe a large number of "voids" resulting from the disintegration of the rock. Regarding the degree of alteration, the most altered minerals are biotite, amphibole, and plagioclase.

4.2.4 Serra Branca Suite (SSB) – Monzogranites

The SSB granitoid consists of quartz (17%), K-feldspar (4%), plagioclase (58%), biotite (16%), epidote (3%), titanite (<1%), and apatite (<1%). This granitoid presents varied grain sizes (0.10 mm to 9.4 mm), with plagioclase grains being the largest, and a moderate degree of microfracturing. Intergrain microfractures are 1.28 mm and intragrain are 2.28 mm, unfilled; the intragrain fractures show extensions up to 3.40 mm and apertures of 0.74 mm. Generally, the rock has moderate alteration, where the largest grains are associated with K-feldspar, amphibole, and titanite.

The granitoid of the “Canhotinho” inselberg consists of quartz (11%), plagioclase (68%), biotite (12%), amphibole (7%), epidote (1%), titanite (<1%), apatite (<1%), and zircon (<1%). Granulation ranges from fine (0.04 mm to 0.25 mm) to coarse (0.40 mm to 2.18 mm). The degree of alteration is moderate, with plagioclase grains making up the bulk of the rock and showing low alteration. However, titanite and biotite grains exhibit advanced alteration, releasing iron oxide into the microfractures. This granitoid presents a moderate degree of microfracturing, with unfilled intergrain (0.85 mm) and intragrain (1.57 mm) microfractures and a maximum fracture aperture of 0.06 mm.

The granitoid of the “Pão de Açúcar” inselberg presents a mineralogy with quartz (21%), plagioclase (39%), K-feldspar (4%), biotite (16%), epidote (4%), titanite (1%), hornblende (1%), apatite (<1%), and zircon (<1%), with granulation ranging from 6.90 mm to 0.04 mm, with plagioclase being the largest. This rock presents a high degree of alteration, observed by the partial argillization of plagioclase and feldspar grains and the chloritization of biotite. The degree of microfracturing is high, with intergrain fractures of 2.04 mm, showing low connectivity and no infilling, and intragrain fractures of 3.31 mm with apertures up to 0.43 mm. The mineral with the highest degree of fracturing is amphibole, followed by quartz and plagioclase grains.

The sample collected from the tafone of the “Canhotinho” inselberg presents mineralogical contents of quartz (16%), plagioclase (70%), K-feldspar (5%), biotite (7%), epidote (1%), titanite (<1%), and apatite (<1%). This granitoid shows incipient microfracturing of the intergrain type (0.57 mm), open and unfilled, and intragrain type (2 mm), filled with sericite, as well as a low degree of alteration.

4.2.5 UruquêSuite (SU) – Granodiorites

The SU granitoid consists of quartz (31%), plagioclase (39%), K-feldspar (16%), muscovite (4%), biotite (9%), sericite (<1%), and zircon (<1%). The sample shows an incipient degree of microfracturing, with quartz and plagioclase being the most fractured minerals. The microfractures are primarily intergrain (1.2 mm) and intragrain (1.05 mm), both with low connectivity, no infilling, and apertures of 0.10 mm.

4.2.6 Boa Fé Suite (SBF) – Granodiorites

The SBF granitoid presents mineralogical contents of quartz (24%), plagioclase (27%), K-feldspar (17%), biotite (13%), amphibole (8%), allanite (<1%), epidote (4%), apatite (<1%), sericite (<1%), and zircon (<1%), with a moderate degree of alteration and intergrain (0.42 mm) and intragrain (1.14 mm) microfractures, with a maximum aperture of 0.10 mm.

5. Discussion

The RQB is the result of the interaction of magmas with relatively contrasting compositions (Almeida; Ulbrich, 2001), with transport and emplacement controlled by tectonics originating from NE-SW extensional fractures, associated with the sinistral movement of the ZCSP (Almeida, 1995). The reversal of ZCSP movements, resulting from the change in the collision regime during the Brasiliano Cycle to dextral movement, provided a strong late transpressional component, dragging the host rocks against the RQB and, subsequently, the RQB against the host rocks, belatedly activating the ZCQ with dextral movement (Caby; Arthaud, 1986; Arthaud et al., 1988; Almeida; Ulbrich, 1996). Consequently, the two shear zones, Senador Pompeu and Quixeramobim, both dextral strike-slip zones, began to condition and rotate the RQB in the dextral direction, determining its elongated ellipsoidal geometric shape (Almeida, 1995).

In general, the intrusion of the RQB granitoids results from the tangential syn-phase associated with crustal thickening during the Brasiliano Cycle along the ZCSP, followed by the intrusions of syn-transcurrent granites associated with transcurrent tectonics, controlled by the ZCQ and ZCSP (Almeida; Parente; Arthaud, 2008).

It is noteworthy that the most significant post-Brasiliano morphotectonic processes occurring in the DCC (Ceará Central Domain) can be described as the Neocomian-Barremian intracontinental rifting (Brito Neves, 1975; Cabby et al., 1991), which was responsible for the uplift of mountainous volumes, subsequently subjected to intense denudational processes during the syn-rift phase (Claudino-Sales; Peulvast, 2007), and the uplift that occurred from the Upper Cretaceous to the Oligocene (70.1 – 36.5 Ma) (Cavalcante, 2006).

Regarding structural aspects, the control exerted by Brasiliano deformations is clearly evidenced by the Quixeramobim and Senador Pompeu shear zones, characterized by dextral movement, which conditions the geomorphological macroforms and microforms in the RQB.

The orientation (NE-SW) and density of lineaments (Figure 1) were responsible for the individualization of the RQB inselbergs, conditioned by denudational processes, as well as the leveling of the most fractured sectors more susceptible to chemical weathering. Chemical weathering patterns, as well as the morphologies of granitic relief, are determined by the density of brittle deformation planes (Twidale, 1993; Maia; Bezerra, 2014).

In addition to the aforementioned structural factors, it should be noted that regional morphogenesis has a strong relationship with the climatic aridity that began to predominate during the Miocene (Harris; Mix, 2002; Peulvast et al., 2008; Peulvast; Bétard, 2015), justifying an evolution driven by the predominance of physical weathering, limited pedogenesis, and fluvial intermittency.

As a result of these processes, the morphology of the RQB is configured as a surface lowered by denudational cycles, with gently undulating topography, interspersed with *lajedos* and aligned inselbergs, mainly in the SMN and SSB, arranged alongside the ZCSP and ZCQ, respectively.

The exposure of residual macroforms (e.g., inselbergs, bornhardts) in the RQB varies in dimension, height, density, and alignment, demonstrating clear structural control over their distribution and density, with elevations reaching ≈530 m. The density of deformation planes and the variability in the mineralogical constitution of the RQB suites are relevant elements in the configuration and maintenance of residual landforms, with brittle deformation structures oriented predominantly NE-SW, exhibiting a behavior similar to that observed by Almeida et al. (2023) in the relief patterns of the Bannach batholith in the southeastern Amazonian Craton.

The main inselbergs of the RQB are associated with the monzogranites of the SSB (Canhotinho and Pão de Açúcar), granodiorites of the SMN (Pedra do Reduto), and diorites of the SAD (Salva Vida). Their spatial distribution borders the ZCSP in the NE and SE sectors of the batholith and near the ZCQ in the W sector of the batholith. Regarding the morphostructural aspects of the RQB, when compared to petrographic and structural analyses, it is possible to identify that samples collected from the inselbergs exhibit a higher degree of microfracturing, evidencing their long period of exposure to weathering agents.

Regarding the maintenance of the "Serra da Baleia" *inselgebirge* (Figure 3), it is sustained by granodiorites from the SU, which present fine granulation (0.02 cm) and inequigranular (porphyritic) texture, standing out on the *sertaneja* surface as a topographic prominence due to the low density of discontinuity surfaces (e.g., fractures) and the enrichment of felsic minerals such as quartz, plagioclase, and K-feldspar, representing 86% of its mineralogical composition, to the detriment of mafic constituents like biotite (9%) and micaceous minerals like muscovite (4%).

On the other hand, conical inselbergs with steep slopes (Figures 4A and 4B) occur associated with the SSB at the borders of the RQB. These inselbergs are rich in felsic minerals, representing 64% of their mineralogical composition, compared to mafic minerals like biotite (16%), which grants them greater physical cohesion against physicochemical weathering.

In these sectors of the SSB, the highest density of lineaments coincides with the greatest spacing between inselbergs. This suggests more intense denudational action in densely fractured sectors, as argued by Maia et al. (2022). Furthermore, the SSB features the highest number of diabase dikes (Almeida, 1995), justifying the formation of inselberg escarpments through differential erosion.

Denudational processes that caused the exhumation of the RQB allowed for the development of dome-shaped inselbergs (bornhardts), sustained by the SMN granitoids (Figures 5A and 5B), which consist predominantly of felsic minerals (78%) rather than mafic constituents such as biotite (16%). The abundance of minerals resistant to alteration, such as quartz and feldspar, favors the mechanical and chemical resistance of these granites. Like the

SMN, the SAD and SSB also show enrichment in felsic minerals (Figures 5C and 5D), with a mineralogy primarily composed of quartz and plagioclase, having biotite as the main mafic constituent.

The spatial organization of inselbergs in the RQB points decisively toward structural control. In addition to petrographic aspects, the higher number of inselbergs present in the RQB, especially at its borders, reflects the compressive stress provided by the movement of the Quixeramobim and Senador Pompeu shear zones (Figure 17), associated with mineralogical characteristics and lower density of brittle deformation structures (fractures), predominantly oriented NE-SW, as argued by Twidale (2007) and Migón (2006b). The density and orientation of deformation surfaces determine the efficiency of mechanical weathering and water infiltration through spatial variations in rock mass resistance, even within lithologically uniform domains.

In the RQB, specifically associated with the SBF granites located between the SB and AD suites, extensive *lajedos* occur, presenting felsic mineralogical characteristics (68%) with intergrain (0.42 mm) and intragrain (1.14 mm) microfracturing. The felsic composition helps justify the low solubility, while its microstructural characteristics (degree of microfracturing) indicate a more recent exposure compared to the inselbergs.

Regarding the role of mineralogical composition in maintaining the RQB forms, field observations showed that the inselbergs of the SB and MN suites contain large amounts of K-feldspar phenocrysts. In many cases, these phenocrysts occur stacked with small interstitial spaces, interpreted as resulting from gravitational accumulation and low-energy magmatic flow (Almeida, 1995). This stacking of K-feldspar is noticeable in both inselbergs and some outcrops, justifying the maintenance of small domes of K-feldspar clusters due to their higher resistance to weathering processes.

In addition to petrographic results, some lithological controls on the relief were identified in the field. Some escarpments are attributed to the intrusion of diabase dikes dated to the Middle Jurassic (175-160 Ma) (Sial, 1976; Palheta, 2017), predominantly oriented ENE-WSW, resulting from fissural magmatism that affected Northeast Brazil, associated with the breakup of Gondwana and the opening of the Atlantic (Almeida et al., 1988; Almeida; Parente; Arthaud, 2008).

As for the microforms associated with granitic blocks, boulders occur in the SAD, related to its faciological constitution (78% felsic mineral) and petrographic control (low density of microfracturing). The semi-rounded behavior of the boulders indicates a limited regolithization phase, which lacked the capacity for subsurface rounding of the blocks. It is noted that the arrangement of the boulders follows a preferential direction (NE-SW), and their occurrence is limited to the center of the batholith, in regions less influenced by the Quixeramobim and Senador Pompeu shear zones.

The tors identified on the SAD inselberg (Figure 7A) and SMN (Figure 6B) consist of granites with 78% felsic minerals and moderate to incipient microfracturing density. The occurrence of angular tor-like features is related to pressure-release jointing processes which, once exhumed, expose the structural framework resulting from fracturing (Maia; Nascimento, 2018).

Pedestal rock and plinth features identified at the base of the "Serra do Meio" inselberg in the SAD (Figure 7D) are associated with felsic lithology with incipient microfracturing. This type of feature is also related to the control exerted by granite fracturing, where exposed blocks serve as shelter for the contact surfaces with sound rock, justifying the lower alteration of this sheltered sector and a slight topographic prominence at their contact. The exhumation of these boulders is due to differential subsurface weathering (Crickmay, 1935; Twidale; Vidal Romaní, 2005).

The development of dissolution features in granites is generally associated with mafic minerals (Maia; Nascimento, 2018; Santos et al., 2024). Petrographic samples from the SSB tafone showed a significant reduction in mafic minerals, likely associated with chemical weathering followed by granular disintegration, leaving predominantly felsic minerals. In the SAD tafone, however, mafic minerals remain, but strong granular disintegration is observed. Regarding microstructural behavior, tafone samples exhibit the lowest degrees of microfracturing, which must be associated with granular disintegration that preferentially preserves less fractured minerals.

Analyzing the low degree of microfracturing and the higher quantity of pores in tafone samples, it is possible to infer that the rock mass remains saturated for longer due to its lower internal pressure, making it more susceptible to water flow within the inselberg body harboring the tafone. This structural behavior increases moisture and, consequently, chemical weathering. The absence of tafoni in the conical inselbergs of the SSB near

the ZCQ is associated with the high degree of microfracturing (intergrain 2.04 mm and intragrain 3.31 mm) of the inselberg, where, unlike near the ZCSP, the microfracturing rate reaches a pore-pressure level so low that it does not favor moisture accumulation, but rather surface runoff. It is important to highlight that this context favoring higher surface runoff, while limiting tafone genesis, may promote greater karren development.

The SSB inselbergs in the belt alongside the ZCSP present the largest tafoni, with the highest occurrences of honeycombs in the RQB. The genesis and evolution of tafoni, as well as honeycombs in the RQB, may be associated with structural characteristics and the mineralogical properties of the granitoid rocks, as the evolution of these features is related to the migration of moisture zones associated with the rock's microstructural characteristics. Thus, as evidenced by Delvigne (1998), regions of higher pore-pressure favor water migration, while regions of lower pore-pressure favor greater water accumulation and concentration, leading to a higher persistence of local weathering actions, which may start with dissolution and proceed to mineral detachment processes.

The granitic arch identified in the "Salva Vida" inselberg (SAD) is ≈ 20 m long and ≈ 5 m high, oriented NE-SW, developed due to structural control associated with felsic mineral veins and sub-horizontal fractures that condition differential erosion, as seen in the Alagoinha/PE batholith, as well as in the Spitzkoppe mountains in northern Namibia and Yosemite and Joshua Tree National Parks in the United States (Mariano; Guimarães; Correia, 2012).

The karren identified in the RQB appear in the MN, SB, and AD suites (Figure 13), associated with faciological variations of the granite, as well as the presence of structural discontinuities such as fractures, veins, and the presence of mafic enclaves, in agreement with observations by Maia et al. (2015) and Santos et al. (2024) in the Quixadá/CE batholith. The largest karren identified, both in width and depth, are developed in the SSB rocks near the ZCQ. Given the predominantly felsic mineralogical composition of the SSB, it is believed that the origin of these karren is likely associated with biotitic mafic enclaves oriented in the same direction as the grooves (NE-SW).

Dissolution basins (gnammas) occur preferentially in the SSB (Figure 14), with dimensions reaching ≈ 6 m in length and tens of centimeters in depth. Petrographic analyses of the SSB indicate about 20% mafic minerals, which may serve as a starting point for the evolution of these forms, corroborating the work of Santos et al. (2024). However, it should also be considered that the topographic horizontalization of *lajedos* and dome tops justifies longer periods of water accumulation and, consequently, vegetation, providing greater superficial chemical action and enhancing the development of these forms. Indeed, extensive and deep pit-type gnammas are found in the flatter sectors, while deep karren develop on steeper slopes, a behavior similar to that observed by Cordeiro et al. (2023) in the Chaval/CE batholith.

The greater number of microfractures and mafic minerals in inselbergs compared to *lajedos* coincides with the genesis and evolution of dissolution features such as gnammas and karren. In the RQB area, the largest gnammas are present in the "Canhotinho" and "Pão de Açúcar" inselbergs, both with the porphyritic texture of the SSB. Grooves (*caneluras*) are most expressive in the "Salva Vida" (SAD) and "Pão de Açúcar" (SSB) inselbergs.

The SU presents a higher concentration of gnammas developed on *lajedos*, appearing clustered, shallow, with an area of ≈ 2 m², and in the process of coalescence. According to petrographic analyses, this suite is the only one featuring muscovite (4%) in its mineralogical composition, which, along with biotite (9%), influences the development of dissolution features, in addition to the topographic smoothing of the *lajedos* that allows for longer water accumulation.

The SBF shows the most limited gnamma development due to its high concentration of mafic minerals, which leads to more homogeneous denudation of the body, not favoring the formation of circular depressions. On the other hand, the SAD gnammas show flat-bottomed morphological patterns with smooth edges, such as armchair pits and cauldron or pit types.

The identified flared slopes (Figure 15) are associated with higher moisture at a certain topographic level of the inselberg slopes, justified by topographic smoothing associated with structures that break rock homogeneity, such as dikes and veins. Thus, the hypothesis of a post-Miocene epigenetic paleolevel is unlikely to justify the genesis of these flared slopes.

Split rocks found in the RQB, in the MN, AD, and SB suites, are not very expressive. However, the division of the boulder is related as a response to the distribution of stress from the weight of the rock mass itself, which in many cases rests on small topographic prominence (pedestal rocks or plinths) scattered across the *lajedos*. Stress is released along pre-existing fractures that open and cause the boulder to split into two parts (Migón, 2006a).

As for polygonal cracking, these are found in the SAD, exhibiting orthogonal and irregular planes, related to the texture of the rock mass, demonstrating that the SAD rocks are more susceptible to the development of these features.

6. Conclusions

The present work sought to contribute to the understanding of geomorphological features developed in granitic structures in Northeast Brazil, based on the relationship between petrographic data and their geomorphological reflections, highlighting not only the mineralogical composition but also the microstructural aspects.

In the origin of the RQB, the transport and emplacement of magmas occurred through tectonic controls associated with the movement of the Quixeramobim and Senador Pompeu shear zones. Consequently, the tectonic reflections of the origin of this granite were also considered in explaining the geomorphological diversity of the area.

Given the above, the role of brittle and ductile deformations with a preferential NE-SW direction, genetically associated with Precambrian shear zones, influenced the structural lineaments present in the RQB, especially in the inselbergs of the SMN and SSB.

The deformation structures were responsible for conditioning the dissection of areas susceptible to weathering; as a consequence, these areas were more heavily denuded. The density of the deformation planes (fractures) is associated with the conditioning of the RQB by the Quixeramobim and Senador Pompeu shear zones. In view of this, a clear structural control can be observed, both in the alignment of the dome-shaped inselbergs (bornhardts), mainly in the SMN and SSB, and in the dissolution features, such as gnammas, karren, and tafoni, which are oriented in the NE-SW direction.

The expressive variety of geomorphological forms and features constitutes a record of processes associated with the genesis of the batholith, along with its mineralogical and structural variety, which allowed for the differential action of weathering and erosion processes on the rocks.

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