








## Short Communication on “Updated geological map of the Borborema Province, northeastern Brazil”

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### Abstract

The Borborema Province (BP), Northeast Brazil, represents one of the main structural provinces of Brazil, and underwent numerous studies, including projects conducted by the Geological Survey of Brazil - SGB/CPRM, especially focusing on systematic geological mapping. As a result, a large part of the BP is covered by geological mapping at the scale 1:100,000 and, however, did not have an appropriate integrated map that represents the current level of knowledge of this geological object. The project Geology and Mineral Potential of the Borborema Province was conducted by the SGB with the objective of making available products to leverage the geological knowledge of the BP. In 2021 it was made available the regional geological integration map, besides the respective vector data, which represents the state-of-the-art of the geological knowledge in the province, also containing information about mineral resources and geochronological data. This short communication presents information about the making of the Geological Map of Borborema Province, at the scale of 1:500,000 (Appendix 1).

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## 1. Introduction

The Borborema Province (BP) is situated in the Northeast portion of Brazil (Figure 1), and represents one of the four provinces of the Brazilian Atlantic Shield (Borborema, São Francisco, Mantiqueira and Tocantins), partially covered by Phanerozoic provinces (Almeida 1981) and covers an area of about 440,370 km<sup>2</sup> (Figure 1). The province is bounded to the west by the Parnaíba Basin, to the south by the São Francisco Craton, and by the Continental Margin Province to the east and Equatorial Province to the north. The BP is compartmentalized as a mosaic of allochthonous/exotic terrains (Santos 1995) and divided into major domains: Médio Coreaú, Ceará Central, Jaguaribeano, Rio Piranhas-Seridó, São José de Campestre, Zona Transversal, Pernambuco-Alagoas, Sergipano and Riacho do Pontal (Delgado et al. 2003).

Despite the significant volume of data, both regional and systematic mapping in the BP area, some questions about

the geological knowledge remained open, which were the basis for the proposal of the Geology and Mineral Potential of Borborema Province project by the Geological Survey of Brazil - SGB/CPRM. One of the main objectives of the project is the consistency and integration of data and information generated by previous geological mappings of the SGB/CPRM, added to those produced by other institutions, especially through academic research. From this initiative, the Geological Map of the Borborema Province (scale 1:500,000) was produced, which allows a global and integrated view of the geology and mineral resources of this province.

## 2. Main stages of development of the geological map

Bibliographic review: The first stage of the work involved a bibliographic review, and a study of previous geological maps, a product of systematic geological mapping or of regional integration. We used mainly the information available in the



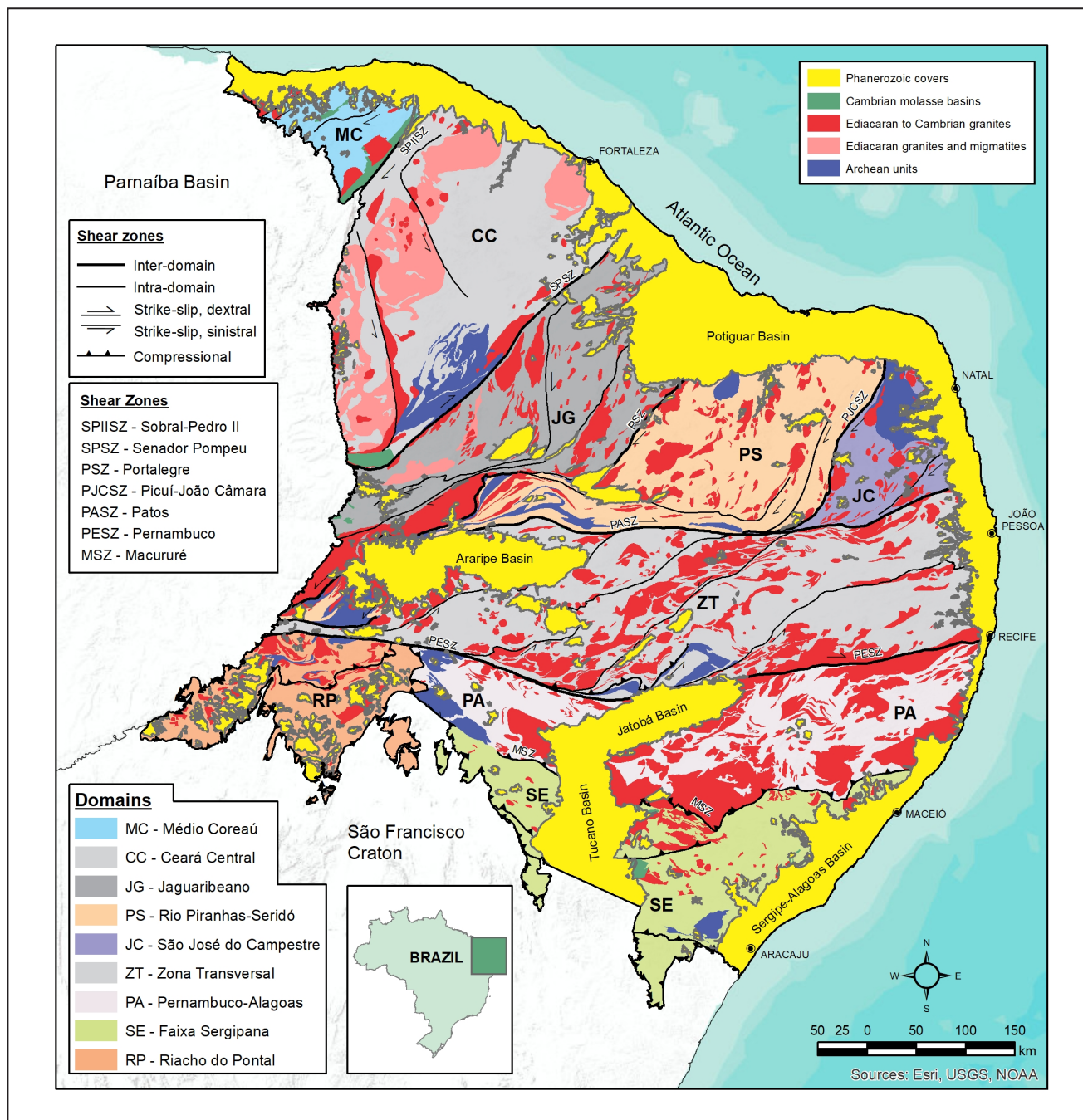


FIGURE 1. Tectonic subdivision of the Borborema Province according to Delgado et al. (2003) (adapted from Medeiros et al. 2021, with updates from Santos et al. 2023).

SGB-CPRM database (GeoSGB) to generate a preliminary framework for the product (Figure 2). The data from nineteen 1:100,000 scale maps, thirteen 1:250,000 scale maps, one 1:350,000 scale map, and one 1:1,000,000 scale map were used (references in Appendix 2). After the spatialization of these data, the existence of areas without geological information was verified, which were initially filled in with clippings from the 1:1,000,000 scale geological map of Brazil, and later refined with information from journal articles and theses/dissertations (e.g. Medeiros 2004), added to new data and field information obtained in the project.

Harmonization of the vectors of the geological-structural base: The vectors surveyed in the previous step were integrated for the BP limit, and the correction of geological

incongruences along the limits of the cartographic sheets was carried out, using as support airborne geophysical data and remote sensing images. The harmonization of contacts and limits of lithostratigraphic units was carried out, so that there was no overlapping of information, and in the places where the overlapping occurred, the criterion used was the most recent publication (Figure 3).

Re-evaluation and redefinition of lithostratigraphic units: A careful review of the lithostratigraphic units was carried out, taking into account pre-existing information, focusing on geological maps published by SGB-CPRM, as well as journal articles and theses/dissertations. The lithostratigraphic units were reviewed within each domain of the province, in their lithological content, geochronology, tectonic significance,

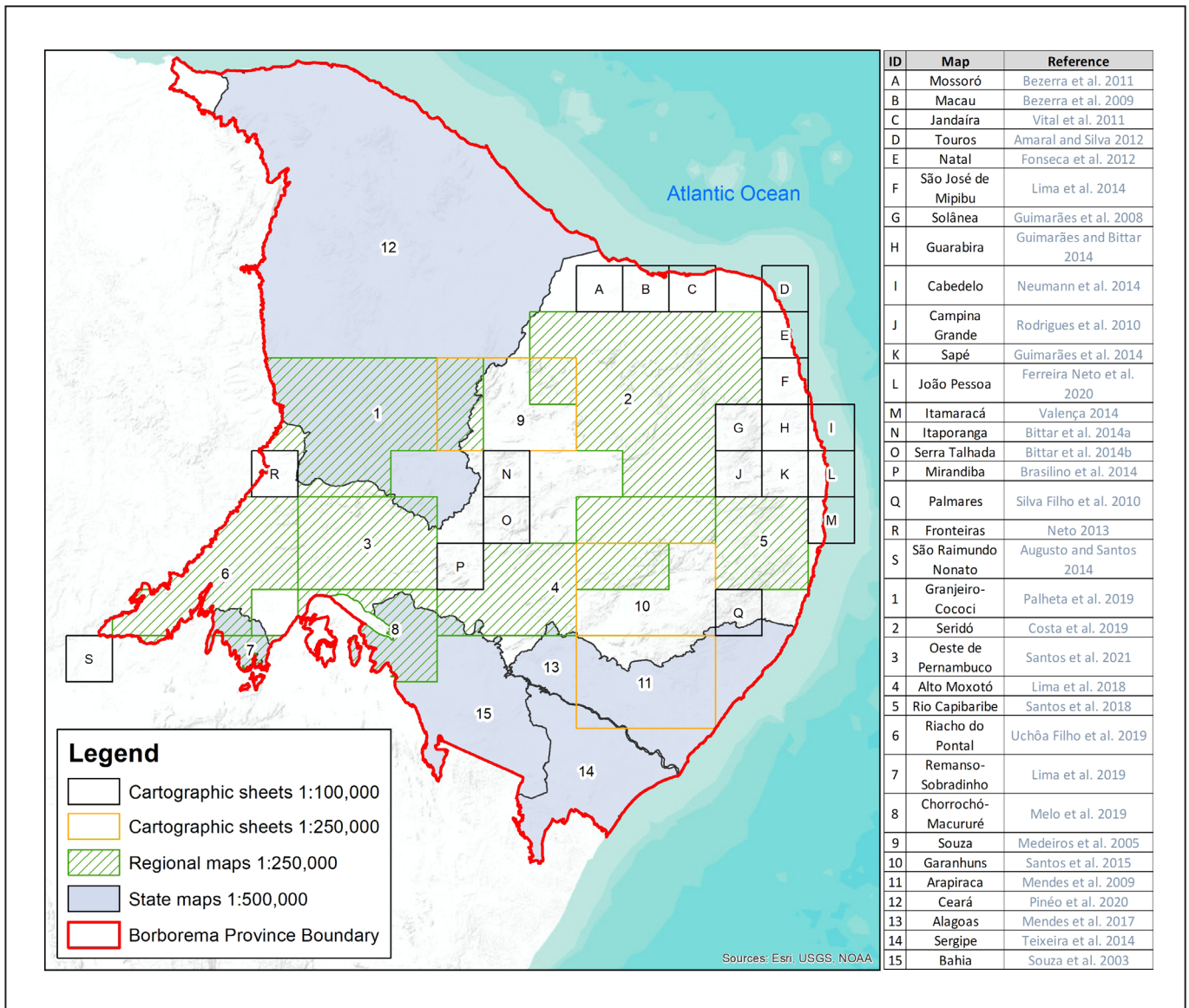


FIGURE 2. Location of previous geological maps available in the Borborema Province, and respective scales (References in Appendix 2).

designation and stratigraphic hierarchy, to which acronyms were assigned. The main challenge in this step was in relation to the Brasiliano granitogenesis, well mapped in BP, where the more than 700 syn- to late-orogenic plutons were grouped in nine associations of units according to similar physical-chemical characteristics. This procedure was necessary to make it possible to visualize all the units within the scale of the map, as well as to simplify the legend that has a lot of information.

Field surveys: To fill the information gaps in the areas where there were only geological maps at the millionth scale, field steps were carried out with focus on the crystalline rocks of the Jaguaribeian, Rio Piranhas-Seridó and Zona Transversal domains, and on the Inland Sedimentary Basins of the Northeast, located in the Zona Transversal Domain of BP.

Adaptation of the geological basis to the presentation scale: The vectors were uniformed in ArcGIS environment in order to extract the difference in scales of the surveyed products, where all the polygons with area less than 6.25 km<sup>2</sup> were simplified and made compatible with the presentation

scale of the map, 1:500,000. The product contains 3126 polygons, representing 326 lithostratigraphic units, and also the location of the 98 main mineral occurrences of the BP, and 315 points of geochronological dating in the U-Pb method.

Finalization: Due to the particular characteristics and the superlative dimensions of the map (200 x 105 mm), it was necessary to elaborate a layout from scratch, since it did not fit in any of the models used as standard for the SGB-CPRM maps. The layout has five inserts (Tectonic Compartmentation, Location Map, Reduced-to-pole Magnetic Anomaly map, and Ternary map of gamma ray spectrometry), two legends (Tectonostratigraphic Relationships and Lithostratigraphic Units), geological and cartographic conventions, location of the main cartographic products used, as well as the Technical Note and Author credits.

### 3. Products and results

The Geological Map of Borborema Province presents the predominance of Precambrian lithotypes, with contribution

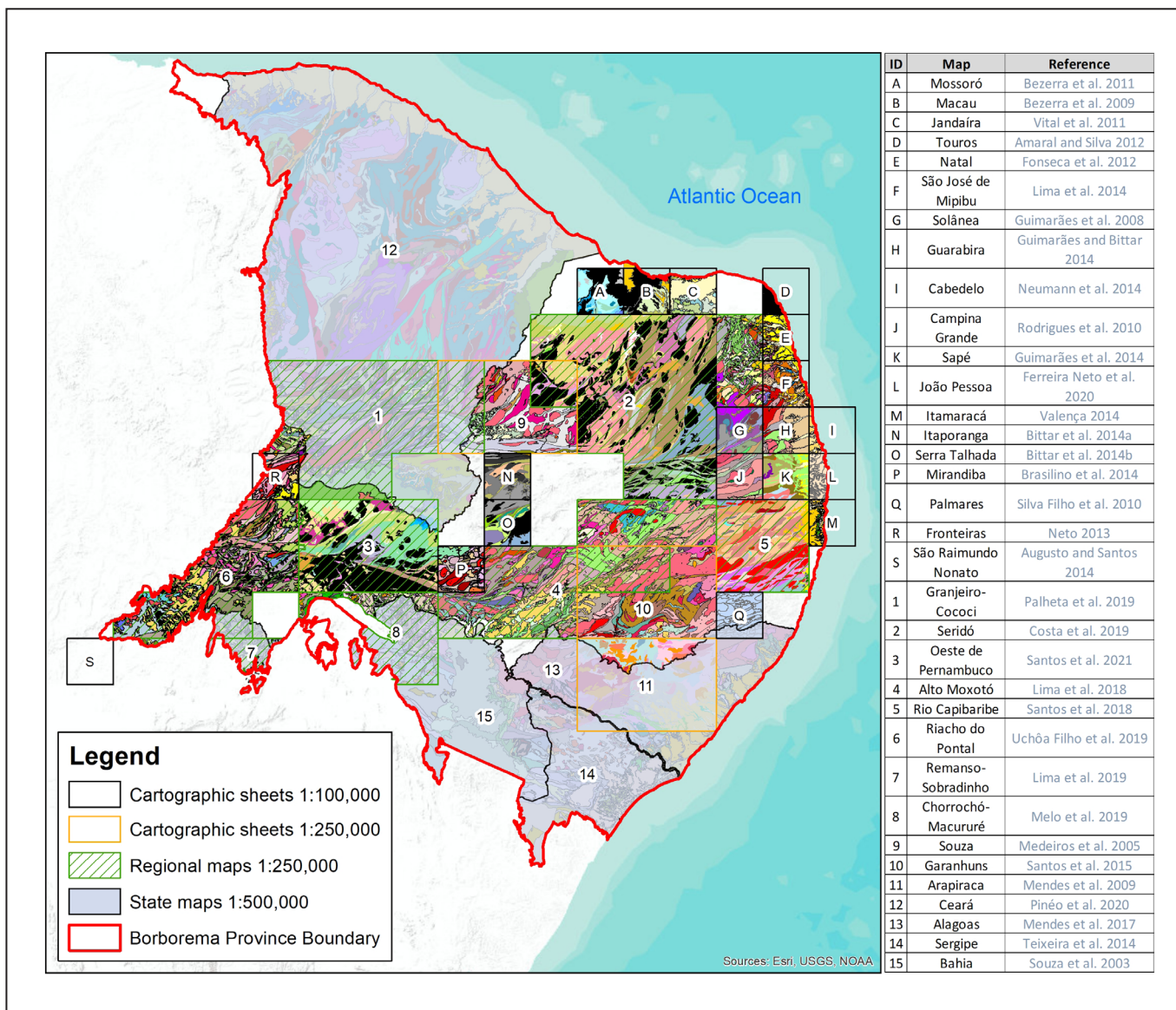


FIGURE 3. Overlapping of the geological maps used for the production of the Geological Map of Borborema Province (References in Appendix 2).

of Phanerozoic rocks from sedimentary basins, and brings relevant contributions with regard to the redefinition of important lithostratigraphic units, the updating of tectonic limits of the BP, besides presenting in an integrated way geological, mineral resources and geochronological data.

Based on new field data obtained from the SGB-CPRM Chorrochó-Macururé Project (Melo et al. 2019), the southern tectonic boundary of the BP was updated to encompass orthoderived Archean rocks, previously understood to belong to the São Francisco Craton, which were incorporated into the Entremontes Complex, contained in the BP.

The internal compartmentalization of the BP was also revised, based on the integrated geophysical maps (Oliveira and Santos 2020; Correa et al. 2020a, 2020b), which allowed the western boundary of the Transverse Zone Domain and the scope of its subdomains to be reassessed (further discussion in Santos et al. 2023).

This is the first geological map that contemplates the Borborema Province as a whole, therefore it is an unprecedented product, complete, easy to read, presented in the printing scale of 1:1.000.000, but with vector

files compatible with the 1:500.000 scale. The printout file in pdf, and the vector files of lithology, structures, hydrography, mineral occurrences, U-Pb geochronology and planimetric features, are available for free download at GeoSGB, SGB-CPRM’s corporate database, through the link <https://geosgb.cprm.gov.br/downloads/#> (folder Províncias Minerais e Domínios Geológicos), and at RIGEO-Repositório Institucional de Geociências, at <https://rigeo.cprm.gov.br/handle/doc/22508>.

It is expected that this new map will play an important role in the development of the geoscientific knowledge of the Borborema Province, being used by several agents of the public and private sectors, for example, in the regional evaluation of mineral potentialities, in planning and territorial management, and in geoscientific teaching and research activities, at undergraduate and graduate levels.

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### Authorship credits

Author	A	B	C	D	E	F
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JSS						
VCM						

**A** - Study design/Conceptualization **B** - Investigation/Data acquisition  
**C** - Data Interpretation/ Validation **D** - Writing  
**E** - Review/Editing **F** - Supervision/Project administration

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