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Introduction to the special issue on "Geoconservation" of the Journal of the Geological Survey of Brazil

Invited Editors

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1. Introduction

Since 1997, when the Brazilian Commission of Geological and Paleobiological Sites (SIGEP) was created, the subjects of Geodiversity, Geological Heritage, Geoconservation, Geotourism, and Geoparks - the so-called 5 Gs - have been gradually included in the national events and publications.

An increasingly expressive number of researchers and institutions have been working to study and promote this area, an effort that has led to the creation of a specific event, the Brazilian Symposium on Geological Heritage (BSGH), which the first edition took place in 2011, in the city of Rio de Janeiro.

Over the years, an intense exchange of knowledge, the development of methods, and the achievement of technical and scientific support through partnerships with researchers and international institutions, have gradually promoted the scientific maturity necessary for the advancement of this research area in Brazil. From almost exclusively descriptive works, aimed mainly at the dissemination of sites of geological interest, research at the national level has progressively included discussions and ideas that bring important scientific contributions to the development of methods and concepts focused on geodiversity, geological heritage, and geoconservation. Moreover, these advances have been accompanied by a growing concern with the insertion of

these themes in the scope of society, which reinforces the multidisciplinary character of geoconservation and the crucial role of geosciences in understanding the great current socio-environmental themes.

It is with pleasure that we present the Special Issue on Geoconservation of the Journal of the Geological Survey of Brazil, which brings relevant contributions from Brazilian researchers on topics ranging from data collection to geoscientific outreach. These papers were initially presented as abstracts at the V Brazilian Symposium on Geological Heritage, held in Crato, Ceará, from October 14 to 18, 2019.

2. Content of the Special Issue

The ten articles in this special volume cover numerous aspects of the topic of Geoconservation. Three of the papers are national in scope and deal with geoethics, mining heritage, and geoparks, while the other seven articles have a more local scope, being related to the assessment of geodiversity and geological heritage (three papers); geotourism and geoparks (two papers); and geodiversity and society (two papers). Those of more local importance are highlighted in Figure 1, being two in the state of São Paulo and one in the states of Mato Grosso, Paraná, Rio de Janeiro, Bahia, and Pernambuco. In the following paragraphs, these papers are briefly described.



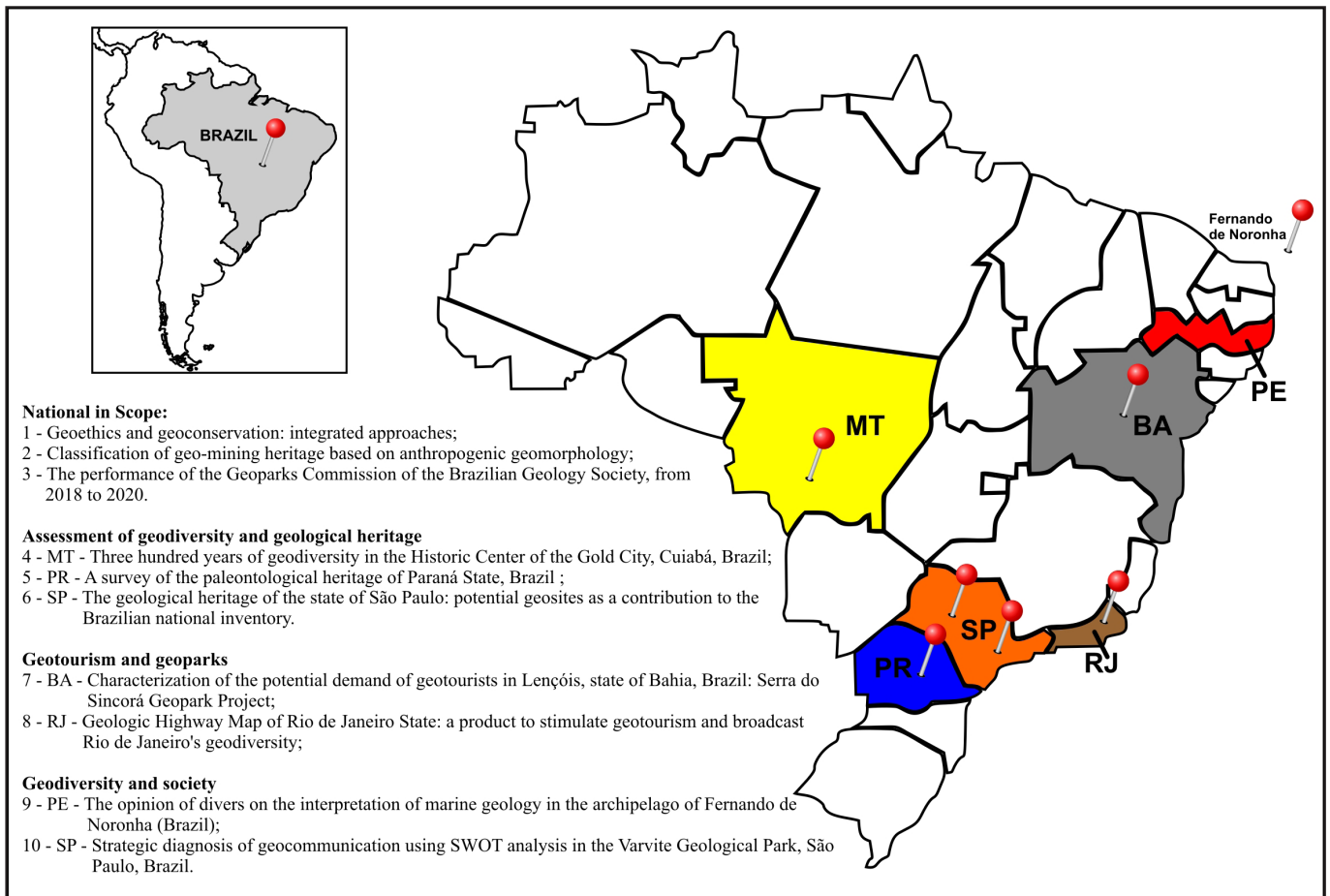


FIGURE 1. Location of the studied areas addressed by the articles included in this special issue

2.1. National in scope (geoethics, mining heritage and geoparks)

The paper “Geoethics and geoconservation: integrated approaches” by **Paulo de Tarso Amorim Castro, Kátia Leite Mansur, Úrsula Azevedo Ruchkys, and Rosely Aparecida Liguori Imbernon** (Castro et al. 2021a) presents a discussion on integrative approaches regarding two emerging fields of geosciences: geoconservation and geoethics. While the first is related to the conservation relevant elements of geodiversity and associated processes, the latter deals with the connection between humankind and the Earth system as a whole, aiming at both education and professional fields. Issues such as intensive rock sampling and the integrity of iconic rock exposures are discussed in the light of geoconservation and the role of geoscientists. The authors also argue on the importance of disseminating geoscientific information for society when dealing with both natural and human-induced disasters.

The paper “Classification of geo-mining heritage based on anthropogenic geomorphology” by **Paulo de Tarso Amorim Castro, Stênio Toledo Nascimento, and Suzana Fernandes de Paula** (Castro et al. 2021b) analyzes the geo-mining heritage based on concepts of anthropogenic geomorphology. A theoretical discussion is made about the relationship between the geological heritage and the mining heritage, including their differences and similarities, enabling the conception of mixed heritage, namely, geomining. Based on the discussion and analysis of case studies in several countries, including Brazil,

a geomining classification is proposed considering the intensity and extent of anthropic alterations on the geofoms: (a) Re-qualifiable local landscape; (b) Regional landscape intensely transformed through mining activities; and (c) Regional landscape exhumed by regional mining activities. This is an innovative approach based in the landscape concept, which incorporates elements of the natural and the anthropic.

The paper “The performance of the Geoparks Commission of the Brazilian Geology Society, from 2018 to 2020” by **Marilda Santos-Pinto, Marcos Antonio Leite do Nascimento, Caiubi Emanuel Souza Kuhn, Gilson Guimarães, and Antonio Dourado Rocha** (Santos-Pinto et al. 2021) discusses the processes involved in the conception and the creation of this commission within the most traditional Brazilian geological organization. Following careful documentary research on existing data, the text describes the role of the commission as a channel for information on geoparks in Brazil and the several actions that have been implemented regarding its regional branches, the aspiring and geopark projects, events, dissemination of information through a website, and its positioning on the creation of a National Geoparks Committee, which reinforce its contribution to the promotion of the theme.

2.2. Assessment of geodiversity and geological heritage

The paper “Three hundred years of geodiversity in the Historic Center of the Gold City, Cuiabá, Brazil” by **Ana**

Cláudia Dantas da Costa, Marcos Antonio Leite do Nascimento, Carlos Humberto da Silva, and Renato Blat Migliorini (Costa et al. 2021) presents descriptions about stone heritage and sites of geodiversity of the city of Cuiabá, which has its origin in gold mining. An inventory of the sites was made, as well as the characteristics and materials used in the monuments were described. The associated historical aspects were also highlighted. From this research, a geological heritage was identified by the association between an outcrop of the geological fault, that stands out in the landscape, and the place where the city's historic buildings are located. The authors point out that this site can be considered the first geosite described in the city.

The paper "A survey of the paleontological heritage of Paraná State, Brazil" by **Christopher Santos and Antonio Liccardo** (Santos and Liccardo 2021) emphasizes the paleofauna and paleoflora of the state of Paraná in the context of sedimentary outcrops from the sedimentary basins of Paraná, Bauru, and Curitiba, as well basement rocks. The survey was carried out with the aim of subsidizing the creation of a geoscience museum, using methods that involved bibliographic research, consultations with experts, visits to institutions, and final selection of samples. The results reflect the state-of-art of knowledge within the several State institutions, organized as an exhibition at the UEPG's Museum of Natural Sciences. Twenty-five geosites and ten museums in twenty municipalities were identified.

The paper "The geological heritage of the state of São Paulo: potential geosites as a contribution to the Brazilian national inventory" by **Lígia Maria de Almeida Leite Ribeiro, Maria da Glória Motta Garcia, and Karina Kawai Higa** (Ribeiro et al. 2021) emphasizes the inventory of the geological heritage of the state of São Paulo, with 137 geosites, being the first systematic inventory in Brazil. The study analyzed this inventory and propose criteria to indicate geosites to the national list of the geological heritage inventory, which is being carried out by the Geological Survey of Brazil. In this paper, 57 geosites were chosen and further analyzed according to the main thematic classification and general geological context. The geosites were also evaluated according to typology and statutory framework.

2.3. Geotourism and geoparks

The paper "Characterization of the potential demand of geotourists in Lençóis, state of Bahia, Brazil: Serra do Sincorá Geopark Project" by **Natália Augusta Rothmann Eschiletti** (Eschiletti 2021) seeks to understand consumer demands regarding geotourism and shows how essential it is to direct strategies in the elaboration of tourism products and planning of tourism supply. The definition of the tourist profile serves to segment the tourism market, contributing to promoting ecotourism as an economic segment in Brazil and in the world. The aim of the research was to analyze the demand for geotourists and contribute to the management and planning of geotourism in the territory of the Serra do Sincorá Geopark Project, Lençóis, Bahia.

The paper "Geologic Highway Map of Rio de Janeiro State: a product to stimulate geotourism and broadcast Rio de Janeiro's geodiversity" by **Raphael e Silva Girão, Thaís Lima Verde Monteiro, Natália Cota de Freitas, Roney Almeida dos Santos Chagas, Marcus Felipe Emerick Soares**

Cambra, Miguel Tupinambá, Rodrigo Costa Santos, Henrique Bruno, and Julio Cesar Horta de Almeida (Girão et al. 2021) brings a tool that has been commonly used abroad to promote geosciences to drivers along main highways. The authors use the rich and complex geodiversity of the state of Rio de Janeiro state to explore the potential of the several geotouristic resources that may be found along the highways. The product is presented as a pioneering initiative in Brazil and a way to disseminate geodiversity and promote geotourism.

2.4. Geodiversity and society

The paper "The opinion of divers on the interpretation of marine geology in the archipelago of Fernando de Noronha (Brazil)" by **Tatiane Ferrari do Vale, Rafael Altoe Albani, and Jasmine Cardozo Moreira** (Vale et al. 2021) shows that environmental interpretation seeks to reveal meanings to provoke personal connections between the public and the protected heritage. In the specific case of geological heritage, it determines and communicates the meaning of a geological and geomorphological phenomenon, event, or site. Fernando de Noronha is one of the best diving sites in Brazil and actions focused on marine geology aspects add even more value to the activity. Thus, this study sought to investigate divers' opinions concerning environmental interpretation and aspects of marine geology in the archipelago by means of a questionnaire.

The paper "Strategic diagnosis of geocommunication using SWOT analysis in the Varvite Geological Park, São Paulo, Brazil" by **Andrea Duarte Cañizares and Christine Laure Marie Bourotte** (Cañizares and Bourotte 2021) deals with the Varvito Geological Park as a geosite of the state of São Paulo and that is often used in formal education activities, highlighting its importance for the dissemination of knowledge in geosciences. This municipal park brings important geodiversity elements that represent the late Paleozoic glaciation in southeastern Brazil, such as sedimentary structures, dropstones, and ichnofossils. A SWOT analysis of the park itself was carried out involving various stakeholders. The results of the SWOT (strengths, weaknesses, opportunities, and threats) analysis pointed out a discontinuity in the existing communication actions and the lack of an integrated and strategic approach.

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