

## PRELIMINARY STUDY IN SERRA DA CAPIVARA NATIONAL PARK (PIAUI, BRAZIL): INTEGRATING GEOLOGICAL AND ARCHAEOLOGICAL HERITAGE IN A WORLD HERITAGE SITE

### *ESTUDIO PRELIMINAR DEL PARQUE NACIONAL SERRA DA CAPIVARA (PIAUI, BRAZIL): INTEGRACIÓN DEL PATRIMONIO GEOLÓGICO Y ARQUEOLÓGICO EN UN LUGAR PATRIMONIO DE LA HUMANIDAD*

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**Abstract:** In 2006 the Geological Survey of Brazil (CPRM) launched Project Geoparks, whose goal is to identify and disseminate potential areas for geoparks in the country. The project Serra da Capivara Geopark, in the Brazilian state of Piauí, was published by CPRM in 2011 and encompasses the area of the Serra da Capivara National Park, which has important archaeological content, (and which also motivated their inclusion in the UNESCO's World Heritage List) and the nearest cities. The area comprises portions of three Brazilian structural provinces (Parnaíba, Borborema and São Francisco) and has rich geodiversity, which must be conserved and may bring much-needed economic benefits to the region through geotourism. The project presented here and currently underway aims to: select sites where geodiversity can be correlated with the local archaeology, defining geodiversity sites with potential tourism value; quantify and organize them hierarchically, and finally, propose management strategies and promotion of these sites in order to boost geotourism and facilitate the establishment of a geopark in the region.

**Key Words:** geoconservation, geoheritage, inventory, Serra da Capivara, sites of geodiversity.

**Resumen:** En el año 2006, el Servicio Geológico de Brasil (CPRM) puso en marcha el Proyecto Geoparque, cuyo objetivo principal es identificar y difundir las áreas brasileñas con potencial para convertirse en geoparque. El proyecto "Geoparque da Serra Capivara", en el estado brasileño de Piauí, fue publicado por la CPRM en 2011 y comprende el área del Parque Nacional da Serra da Capivara (cuyo importante contenido arqueológico motivó su inserción en la lista del Lugares de Patrimonio Mundial UNESCO) y las ciudades más cercanas. Esta área está ubicada en tres provincias estructurales brasileñas (Parnaíba, Borborema y São Francisco) y presenta una rica geodiversidad, que debe mantenerse protegida y que podría traer beneficios a una región que actualmente se encuentra en una situación de desventaja económica. El objetivo principal de este proyecto, actualmente a en curso, es seleccionar lugares donde la geodiversidad se pueda correlacionar con la arqueología de la zona, configurando sitios de geodiversidad de valor turístico; cuantificar dichos lugares, organizarlos jerárquicamente y finalmente, proponer estrategias de gestión y mejora, fomentar el geoturismo y facilitar el establecimiento de un Geoparque en la región.

**Palabras clave:** geoconservación, geodiversidad, inventario, patrimonio geológico, Serra da Capivara,

## INTRODUCTION

The Serra da Capivara National Park comprises an area of 129,140 ha in the southeastern region of the state of Piauí and is a symbol of the beginning of the human occupation in Brazil, thousands of years ago. It has a substantial archaeological record in the form of artifacts and tools, as well as evidence of the presence of humans, such as fires and cave paintings. It was created in 1979 to protect this extensive archaeological heritage, whose carbon-14 dating reaches 60,000 years in the past (Toca do Boqueirão, at the Pedra Furada Site, according to Barros *et al.*, 2011) and lays the basis for the hypothesis that the first South America human settlements were established by groups that crossed the Atlantic Ocean from Africa.

The Foundation and Museum of the American Man (FUMDHAM - non-profit organization established in 1986), in partnership with the Ministries of the Environment and Culture, are in charge of the management of the museum and the heritage preservation. The management plan contains policies on social inclusion and environmental protection actions, along with projects on education and professional training for the community and the development of sustainable tourism. The park was included in the UNESCO World Heritage List in 1991, because it preserves about 1223 archaeological and palaeontological sites with rupestrian paintings and carvings and 292 sites registered as villages, cemeteries, temporary camps and lithic and ceramics workshops (Fig.1).



Figure 1. Examples of geodiversity and archaeology in Serra da Capivara National Park. Above, "Pedra Furada" (left) and "Baixão das Andorinhas" (right). Below, fishtail-shaped quartz arrowhead (approximately 4 cm wide and 8,000 years old) and the rock paintings that have become the symbol of the park.

It is clear, however, that the site receives a yearly number of visitors which is below the expected, despite its considerable tourist appeal. Its location, economically disadvantaged and far from the nearest main cities; the lack of a receptive tourist infrastructure (especially regarding hotels) and the difficulty to reach the place due to the lack of bus services from the main urban centers towards São Raimundo Nonato, (the city where FUMDHAM and the principal entrance to the park are located and where there is an airport, but still under construction) are challenges responsible for keeping the annual visitors numbers low, especially if compared to other UNESCO World Heritage sites (Niède Guidon, 2013, oral communication).

## Geological setting

From a geological perspective, the park is located in the region where three main tectonic provinces (as defined by Almeida *et al.*, 1977, 1981) meet. These are the Borborema, the Parnaíba and the São Francisco Tectonic-Structural Provinces (Geological Survey of Brazil, CPRM, 2009; Barros *et al.*, 2011), comprising the edge of the Parnaíba Sedimentary Basin and the Riacho do Pontal Fold Belt. The geodiversity of the park is remarkable, since these three tectonic domains endow the area with a broad range of rock types and examples of geological processes: the sedimentary packages of the basin; the Archaean and Proterozoic crystalline basement rocks, prior to the amalgamation of Gondwana; the metamorphic rocks of the Fold Belt, showing the Brazilian Cycle orogeny and finally, all the geomorphological processes that have shaped the current relief of the area, forming canyons, cuestas, caves and grottoes.

## Project Serra da Capivara Geopark

In 2006, the Geological Survey of Brazil - CPRM launched the Project Geoparks of Brazil with the partnership of public and private organizations, especially universities. Its aims are to detect, identify, describe, assess and publicize the areas in the country that may potentially become geoparks (CPRM, <http://www.cprm.gov.br>, web consulted on January 17, 2015). Some years later, in 2011, the same governmental institution published the first 17 proposals of geoparks in Brazil and, among them, the project for a geopark in Serra da Capivara (Fig.2).

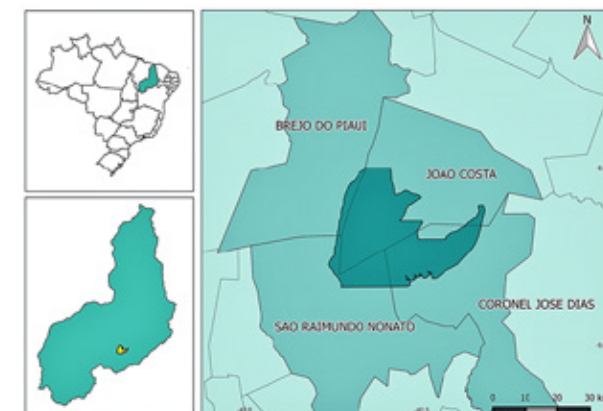


Figure 2. Localization of the Serra da Capivara National Park and the neighboring cities that may benefit economically from geotourism.

The area proposed for this geopark encompasses the National Park and the nearest adjacent cities (São Raimundo Nonato, Coronel José Dias, João Costa and João Vermelho), so as to promote the significant geodiversity of the region. The geological setting of the park and its neighboring area are interesting enough to be a major - still ignored - contribution, not only as a background to the archaeological heritage, but also for its own intrinsic value.

The inventory of geosites made for this geopark project, however, did not follow a defined framework, nor was strictly guided by scientific interest, since its purpose was to identify sites of geological interest without overlooking the intense archaeological appeal of the park. The sites were selected after extensive literature and field research and then its geological aspects were thoroughly described. Thirty-eight sites were chosen to compose the final list, many of which near or encompassing caves that had already been considered archaeological sites (due to the presence of rock paintings or fire remnants, for example). Therefore, most of the sites are places where excellent structure for tourists has been implemented.

It is important to point out that, as these sites have not been selected under a strict scientific-value view, some of them should not be considered geosites *stricto sensu*, but geodiversity sites: "geodiversity elements that do not have a particular scientific value but which are still important resources for education, tourism, or cultural identity of the communities" (Brilha, 2015).

### Objectives of this project

In order to establish a geopark, the tripod that supports the definition of such a land management tool must never be neglected: a geopark is based on geoconservation, education and social development. Since most of the proposed geosites are within the boundaries of the Serra da Capivara National Park, which is one of the categories among Brazilian protected areas, where both economic activities and regular housing are not allowed, the activities of a geopark in that place become quite restricted.

Within this perspective, this project intends to: i) revisit the inventory issued by the Geological Survey of Brazil, modifying and adapting it, when necessary, in order to point out geoheritage that may be correlated with archaeological heritage; ii) determine the tourist value of the geodiversity sites (Brilha, 2015), within the park as well as in the surrounding areas, and which may be used to boost geotourism, promoting the social development of the local communities; iii) quantify the vulnerability of both geosites and geodiversity sites, so that they may be hierarchized, thus enabling a management plan and, finally, iv) suggest a management plan for these sites in order to conserve and protect the local geodiversity. It is also an objective of this research to provide tools of environmental interpretation, so that its implementation is facilitated, making the establishment of a geopark feasible in the short and medium term.

It is expected that not only will Serra da Capivara benefit from the implementation of strategies of geoconservation, but also that it will stand great chances to thrive under initiatives to nurture geotourism. The latter seems mandatory, especially when considering the region's HDI (Human Development Index): it is the lowest in the country, due to its semi-arid climate, which frequently causes long periods of drought, making it difficult to maintain subsistence activities such as agriculture and the region's usual small-scale livestock farming (poultry and goats). Therefore, geotourism may be a potential alternative to substantially improve the living conditions of the population.

Nevertheless, strengthening the social development of this place is as important as valuing its geodiversity, in order to ensure that this comprehensive geological record present in the Serra da Capivara rocks is conserved.

### CONCLUSION

The project of a geopark in an area that encompasses part of the Serra da Capivara National Park (PNSC) and some of its neighboring cities, in the state of Piauí, Brazil, was published by the Geological Survey of Brazil, CPRM, in 2011. The project contained an inventory of 38 geosites that had been selected without a previous framework to guide and justify them, thus causing the list to be repetitive in geological elements and not representative of the local geodiversity.

The national park, UNESCO's World Heritage site since 1991, is widely known for its archaeological content. However, the area proposed for the geopark, partly located within the boundaries of PNSC, presented an issue towards the establishment of such an endeavor: it is a protected zone where both any type of economic activity and habitation are not allowed. From one perspective, this prohibition may help support geoconservation, one of the three objectives of a geopark; from another, it may hinder education and geotourism, the other two activities that compose a geopark's aim tripod.

This PhD project will attempt to adequate the inventory of geoheritage and of sites of geodiversity of tourist value in Serra da Capivara as well as suggest strategies of management and interpretation of its geodiversity, in order to facilitate geotourism in the place and the establishment of a geopark in the future.

The southeastern Piauí, where Serra da Capivara is located, is known for its low Human Development Index. It has long droughts periodically and the soil is not favorable to agriculture. Establishing the means for other economic activities, such as geotourism, seems to be an interesting alternative to help social development and better the lives of the people who live around the park.

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### REFERENCES

- Almeida, R.E.M. 1967. Origem e Evolução da Plataforma Brasileira. Rio de Janeiro, *Boletim do Departamento Nacional de Produção Mineral*, 241, 96 pp.
- Almeida, F.F.M., Hasui, Y; Brito Neves, B. B.; Fuck, R.A. 1981. Brazilian structural provinces: an introduction. *Earth Science Review*, 17, 1–29.
- Barros, J.S., Ferreira, R. V., Guidon, N., Silva, A.J. de C.L.P. 2011. Geoparque Serra da Capivara: proposta. In: Schobbenhaus, C. and Silva, C.R. (Org.). 2012. *Geoparques do Brasil: propostas*. CPRM, Brasília, 745 p.
- Brilha, J. 2015. Inventory and quantitative assessment of geosites and geodiversity sites: a review. *Geoheritage*. <http://dx.doi.org/10.1007/s12371-014-0139-3>.
- CPRM. 2009. Projeto Borda Sudeste da Bacia Sedimentar do Parnaíba. Teresina: Serviço Geológico do Brasil.