GEOPARK AND GEOTOURISM IN CHAPADA DIAMANTINA (NORTH-EASTERN BRAZIL): STRATEGIES AND PERSPECTIVES

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1. Geological settings

The Chapada Diamantina region comprises a group of mountains, plateaus and karst reliefs located in the center of Bahia State, north-eastern Brazil, occupying an area of around 65.000 km^2, in the middle of the São Francisco craton (Fig. 1). This region is constituted by low-grade metamorphosed volcanic and sedimentary siliciclastic and carbonate rocks from the Proterozoic Eon.

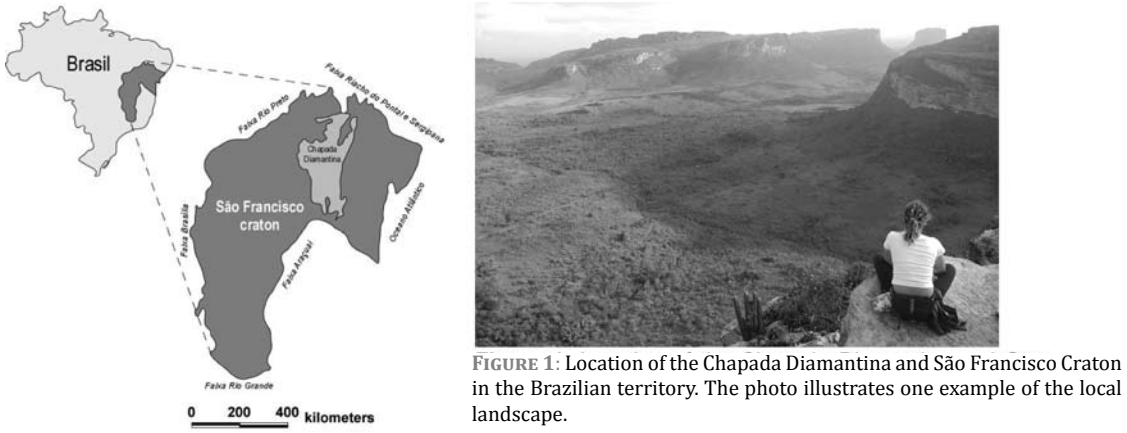

Figure 1: Location of the Chapada Diamantina and São Francisco Craton in the Brazilian territory. The photo illustrates one example of the local landscape.

These rocks are stratigraphically divided into four groups as follows: Rio dos Remedios Group (Paleoproterozoic), Paraguaçu and Chapada Diamantina Groups (Mesoproterozoic) and the Una Group (Neoproterozoic). The Rio dos Remédios and Paraguaçu groups were deposited inside an aborted rift valley and the Chapada Diamantina Group, as a sag basin. The set is shaped as a "bovine head" basin and exhibits nowadays an average thickness of more than 1.000 m. According to Dominguez (1993) the deposition of these rocks started 1,7 Ga. ago and lasted for around 700 million years (Pedreira, 1997).

The region has high hydrological and hydrogeological relevance, as the main rivers of the Bahia State start on these mountains and plateaus, which drives it to be considered as a natural reservoir. This situation reinforces its importance for conservation practices as we could say that the protection of that landscape and its geological heritage is also the protection of the water resources that feeds the main cities of the Bahia State, which includes around 13 million people.

2. Geoconservation in Chapada Diamantina: present situation and future perspectives

The Geological Survey of Brazil is proposing the creation of four geoparks in the region of Chapada Diamantina, which are supposed to integrate the UNESCO´s Global Geopark Network. Presently, 33 geosites were identified under the scope of an ongoing PhD's thesis project, carried out by the first author of this resume, which will contribute to support the creation of these geoparks. This inventory is evaluating the interests associated to each geosite, their potential uses, influence and the situation in respect to the nature conservation and protected areas.

Nowadays, there is already a network of 12 protected areas in the region, focused on the conservation of the biodiversity, but also considering some aspects or elements of geodiversity in their creation acts. Most of these protected areas are not fully operational and they cannot ensure the conservation of the geosites included inside their borders. There are also some private initiatives to protect localities that are object of intensive visitation (more than 10.000 visitors per year), which most of the time, can guarantee the protection of some geosites.

Preliminary considerations show that the set of protected areas occupies around 4000 km^2 of Chapada Diamantina´s territory, which corresponds to 6% of the total area estimated for the region. It was also detected that 50% of the inventoried places are located inside protected areas and around 10% of the inventoried geosites are protected and used by private initiatives, namely local population that owns the land and control the visitors' access to geosites.

The creation of geoparks in Chapada Diamantina would be a good strategy to protect geosites, to establish geotourism initiatives in the region and to publicize Earth Sciences in the country. Nevertheless, an important debate concerning the management structure of these geoparks, facing the huge geographical dimension of the area and difficulties related with municipality management, must be taken into account. The creation of an association of existing NGO´s and administrative institutions could be a good starting point to manage these geoparks.

3. Evaluation of the local geological heritage, geosites and geotourism

During the 18th and 19th centuries, the mining of gold and diamonds was the main economic activity at Chapada Diamantina. With the depletion of reserves, most of the population migrated away. Nowadays, tourism and an intensive farming raised the local economy, converting the region in one of the major nature tourism destinations of South America. Although the main tourist attractions are represented by geosites (waterfalls, caves and canyons), most of the tourists do not have the perception of their scientific or didactic relevance, as Earth Sciences are not a very popular topic in Brazil.

Considering that the geological heritage is already the main touristic attractiveness of Chapada Diamantina, which brings most of the tourists to the region, one could say that the present tourism activity in the region could be considered as geotourism. Nevertheless, there is a lack of interpretative information available to visitors and no coordination to ensure geosites management. The strategy to implement and handle the geotourism at Chapada Diamantina should integrate the guidelines to protect the geological heritage and the production of interpretative materials about the geosites, aiming to raise the visitors' awareness about the evolution of the regional landscape and Earth history.

Preliminary results of the ongoing inventory shows that the main interests related with geosites are geomorphological, tectonic and hydrological ones. Tourism is their main potential use, followed by the scientific use. In terms of its influence, field observations shows that 3 geosites are considered of international relevance and 4 of them are considered of national interest; the remaining geosites are considered of regional or local relevance.

The ensemble of geosites inventoried until now is representative of the regional geodiversity. Geosites are related with rocks that crop out in the region, their geomorphological features and with the ancient mining activity from the 19th century. These geosites reinforce the didactic value of Chapada Diamantina associated with sedimentary paleoenvironments, including marine, fluvio-deltaic, glacial and desert deposition and also geomorphological processes related with the landscape evolution, including karstic systems. Furthermore, the Chapada Diamantina's geological heritage is related with the mining history from the Brazilian colonial period, including the mining of gold and diamonds.

Many of the geosites are already used by the ongoing touristic activity, due to their aesthetical appeal and some of them, that are located at the eastern border of Chapada Diamantina, are visited by more than 10.000 persons per year, based on the information collected in the field. As an example, Fig. 2 presents a scheme of the Cachoeira da Fumaça waterfall that is 400 m high and located inside the Chapada Diamantina National Park being one of its main touristic attractions, visited by 16.000 people in the year of 2008, from different parts of the world, according to the local guides association that controls the access to the geosite.

Taking into account that tourism is already an important economical activity in the region, the production of interpretative material of the local geological heritage, followed by the creation of geotouristic routes and the reinforcement of the ancient local mining culture would drive the geotourism as an economical alternative to some cities of Chapada Diamantina, turning this activity as the basis for the sustainable development of the region.

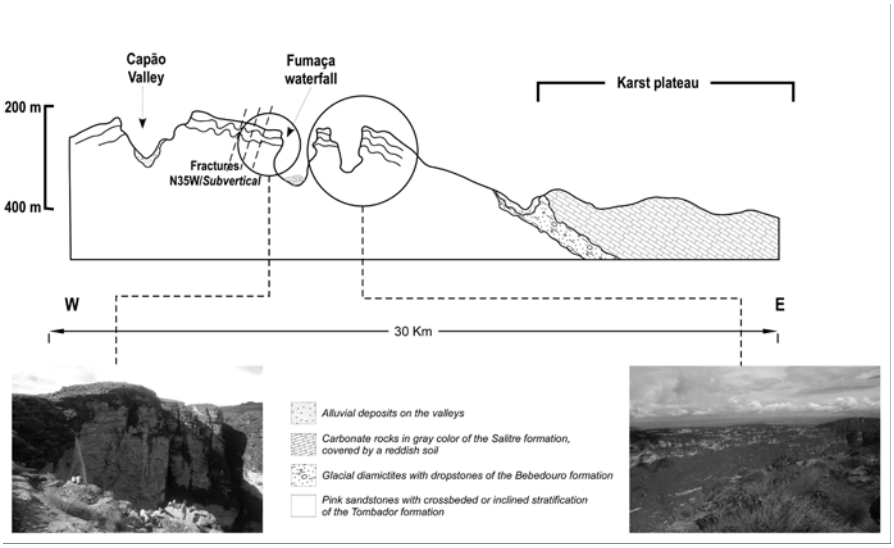

Figure 2: Scheme of Cachoeira da Fumaça waterfall and its geological context. The geosite is located within the Chapada Diamantina National Park and is one of its main touristic attractions.

4. Geoconservation and geotourism in Chapada Diamantina: strategies and perspectives

According to the UNESCO´s definition (UNESCO, 2009), a Geopark is a territory containing a number of geoheritage sites of particular importance, rarity or aesthetic appeal. These sites are part of an integrated concept of protection, education and sustainable development through geotourism. A geoconservation plan for Chapada Diamantina must ensure the conservation of its geological heritage and the definition of the main geosites that can be interpreted and publicized. It is necessary to define routes and sets of geosites that would be elucidative of the region's geological and geomorphlogical evolution and also interesting to illustrate the Earth history and the geological evolution of the São Francisco craton.

The geoconservation plan must also define the boundaries of the potential geoparks and submit them to UNESCO´s Global Geopark Network, considering its basic strategies of conservation, education and geotourism, Facing this situation, the main strategies that are in course of action to reach these goals are described below:

- **Inventory of geosites**: the systematic inventory of geosites adopted the methodology of reconnaissance inventories (Sharples, 2002) and the selection of superlative sites (Wimbledon, 1999). In this first stage, geologists from the Geological Survey of Brazil, who worked on the geological mapping of the region, helped in the selection of the geosites. These geosites include places that are already subjected to touristic visitation and also the ones that gather scientific interest to explain the regional geological evolution.
- **Quantitative geosites assessment**: a specific quantitative methodology for the area is being developed. This will help to prioritize the geoconservation actions for the inventoried geosites, considering the information available and the protection and vulnerability of each place.
- **Propose geotouristic routes**: some geotourist thematic routes will be proposed and interpretative and educational material will be prepared for each one of them.
- **Delimitation of geoparks**: UNESCO´s Geoparks will be proposed, following the project of the Geological Survey of Brazil. Due to the wide area of Chapada Diamantina, the present discussions about the creation of geoparks in this region are related with the number of geoparks to be created and their management structure.

Considering the aesthetic appeal of the area, its geological heritage and the ongoing nature tourism demand, the perspectives for the region is that geotourism can be a very good alternative to foster the sustainable development in Chapada Diamantina. The creation of the Geoparks can also bring to the visitors and local population some knowledge about Earth history and the awareness that the natural resources must be exploited respecting natural limits and facing the social demands.

It must be considered that, in spite of the splendored mining history of the region, nowadays it presents some of the worse social index of the Bahia state, which means that this exploitation did not bring the expected development to the region. Even the ongoing tourism did not bring yet the expected benefits for the local population.

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