

CAVE TOURISM in BRAZIL: GENERAL ASPECTS and TRENDS from the BEGINNING of the 21st CENTURY

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Introduction

In its territorial enormity, comparable to a continent, Brazil¹ has extensive and significant karst areas in carbonates and quartzites, and more than 10,000 caves formally registered. Among these caves, we can highlight some notable features such as the Toca da Boa Vista (the longest cave in Brazil with 107 km already mapped), the abyss Guy Collet (probably the deepest in the world in quartzite with 670m), lake do Cruzeiro, inside the cave Buraco do Inferno da Lagoa do Cemitério (its ~13 hectare lake is the largest underground in the country) and the porch of the cave Casa de Pedra, with its impressive 215 metre high entrance is probably one of the tallest in the world.

Such figures partially illustrate the panorama of caves in Brazil, but do not synthesize its diversity and variety. These features are best observed through the various tourist caves that can be found in the country, approximately 175 according to the latest compilation made by Lobo et al. (2008), but without having fully analysed the whole country as yet. In this general overview, there are caves suited for different types or profiles of visitors: contemplators, adventurers, students, researchers, pilgrims, religious people, and even those with some kinds of disabilities, among others.

In this context of natural and market landscape, it is the main objective of this paper to present a brief discussion regarding the general scenario of tourist use of caves in Brazil, considering the environmental, spatial, and legal aspects.

Types of Brazilian show caves and their main characteristics

To present the characteristics of 175 Brazilian show caves would be a descriptive endeavour that would not fit well in an article of just a few pages. Thus, in order to allow a better analysis, the caves were grouped by similarities, allowing a general overview of the range of use and activities possible in terms of their main characteristics.

The first group consists of show caves with physical structures and artificial lighting. Some Brazilian caves have fixed lighting systems installed as well as walkways and other infrastructure for visitation. Most are caves that were developed in the mid-1960s, a time when these types of infrastructure were understood as exemplary, both in Brazil and in other countries. This group is herein represented by the following caves: Botuverá, do Diabo, São Miguel, Maquiné, Rei do Mato,

Lapinha, Mangabeira and Ubajara. Besides these, other caves received fixed lighting systems and infrastructure, but in more recent times, already under newer concepts, ideas of developing caves, the initiatives were more focused on trying to reconcile use and conservation. As an example, one can mention the gruta de São Miguel, in the city of Bonito. This cave was developed for tourism in mid-1990 with compact fluorescent lights and lighting systems for individual sectors of the cave.

In this group, it is noteworthy to mention that some attempts were made to upgrade the lighting systems (previously with incandescent lights) with those less harmful to the environment. Since 2010 to the present, attempts have been made with the use of LED lighting systems at the caverna do Diabo, gruta do Maquiné, gruta da Lapinha and gruta Rei do Mato (Fig. 1). However, the final result does not apply to all caves in the same group. In the caverna do Diabo an option towards a type of lighting system that would increase the value of the cave. In the other three caves, questionable initiatives were made: coloured light systems were installed diverging from the usual ideals of Brazilian show caves and also with cultural aspects of our country. These examples resemble the Chinese caves, where cultural patterns understand that this initiative of super-structuring caves is more common (e.g. Shi & Zhang, 2013). On the use of equipment with coloured lights, it is important to highlight that part of the system used had problems with high humidity of the cave environment and has not been working correctly.

On the other hand, one must mention the story of some of the guides from the “colourful caves” mention that children have become enchanted with the visual effects possible in a range of thousands of shades and colours, used randomly and without aesthetic, or conservation criteria. In Brazil, especially in the current scenario of increasing sustainability discourses by politicians and in the society itself after the United Nations Conference on Environment and Development (The Earth Summit, Rio-92), the expectation of people is for sightseeing in natural areas with a broader contact with the environment, and not so many man-made elements have increased considerably.

The second group is composed of show caves with infrastructure but with no lighting systems (Fig. 2). In this case, we highlight some caves whose visits are motivated primarily by ideas more closely linked to the prospect of adventure and closer to ecotourism, even when performed activities are not characterized as ecological. Some of them also receive large flows of visitors annually, being among the most famous of the



Fig. 1. Examples of show caves with structure and light systems in Brazil. **A-B:** gruta Rei do Mato at the Natural State Monument of Gruta Rei do Mato (Photo: L.E.P. Travassos). **C:** Entrance to the lapa Nova do Maquiné at the Peter Lund Natural State Monument (Photo: M.B. Timo). **D:** Touristic structure inside the gruta da Lapinha at the Sumidouro State Park (Photo: L.E.P. Travassos). **E-F:** The Visitor's centre at the caverna do Diabo and its LED light system inside, at the Caverna do Diabo State Park (Photo: H.A.S. Lobo)

country. Classic examples are the caves of Lago Azul, Santana, Morro Preto, Colorida, Fendão, Torrinha, Pratinha, Poço Azul, Poço Encantado, Terra Ronca, Angélica, Janelão, Rezar, Desenhos, Bonita, Lapa Doce, abismo Anhumas, buraco das Araras, among many others. These caves are among the most popular of this second group and usually are associated with important and consolidated nature tourist centres such as the region of Bonito, Chapada Diamantina, Cavernas do Peruaçu National Park (PNCP), and the State Parks of Terra Ronca (PETAR) and the Turístico do Alto Ribeira (PETAR).

In these caves, the common fact observed is the use of more rustic structures, but mostly wood. Many of them do not have suitable environmental management plans, which should include strategies for the use of appropriate materials in the structures, management systems and efficient control of visitation. Exceptions are seen in the caves of Lago Azul, in Bonito, or in the Santana cave, PETAR. There is no doubt that these two caves are the most studied caves in Brazil in terms of carrying capacity and limits of use of the environment (e.g. Boggiani et al. 2007 for the Lago Azul and Lobo 2008 for the Santana). In some other caves there are

ongoing initiatives (e.g. Rezar, Janelão, Desenhos, and Bonita, all in the Cavernas do Peruaçu National Park) and the prospect of future organization (e.g. caves Santana and Morro Preto, both in the PETAR) of structures with more appropriate visitation system based on inert materials (plastic, stainless steel, cement) which are less harmful to the environment, as advocated by Cigna (2010), among others.

Another aspect identified in some caves from this group is the impact consequent on the use of acetylene as a source of illumination. Some caves, such as Santana, received over the years up to 1,000 visitors per day using carbide lamps. Considering that the groups were composed on average of one carbide lamp between 20 individuals and usually the guide was the only one usually carrying a carbide lamp, one can estimate roughly 50 carbide lamps per day in high season periods, particularly between the years from 1998 to 2003. In case of a confined and poorly ventilated environment such as this cave, the result was the massive deposition of residues from burning acetylene on speleothems and cave walls. Although the use of carbide lamps was prohibited in Santana Cave and others in the PETAR in 2003, the impact of this type of visitation is still visible



Fig. 2. Examples of show caves with structures and without light systems in Brazil. **A-B:** The lake at gruta do Lago Azul (Bonito) and the new stairs under construction without previous studies, at the Gruta Lago Azul Natural State Monument (Photo: H.A.S. Lobo). **C-D:** Interior of the gruta do Janelão and general overview of an old farm which is under process of being adapted into a visitor centre, at the Cavernas do Peruaçu National Park (Photo: H.A.S. Lobo). **E-F:** Entrance of the Lapa Nova de Vazante, and some kind of tourist structure (Photo: L.E.P. Travassos).

today, more than 10 years after changing this practice. However, in many other Brazilian caves the use of carbide lamps is still allowed for tourism and may generate in the future new situations of great aesthetic and environmental impact as mentioned above.

It is useful to mention that this second group is the least homogeneous of all discussed in this paper. Some caves like gruta do Lago Azul have a formal structure for visitation and access, and is considered to be one of the most important tourist destinations in Brazil. At the other extreme, one can mention relatively little visited

caves like the gruta do Fendão, with more difficult access (adventure), low levels of the attractiveness (Intervales State Park) and the relative proximity of other caves of greater interest in the PETAR.

The third group is composed of undeveloped show caves. In this case, are included caves that receive frequent visits, but do not have structures to support visitation. Often, the lack of structures is intentional to maintain the character of adventure and intimate contact with the environment such as the caves Brejões, Lapão, Penhasco, Tememina, Desmoronada, Ouro Grosso and Água Suja. The latter, located in PETAR, was the focus of great controversy during the development of its management plan from 2009 to 2011. While tourist operators and managers in the region wanted to keep the visitation the same way it always had been done, with tourists walking by the underground river bed (Fig. 3), researchers pointed out the need to establish a protective limit in the river due to troglobites. The problem was solved using the method of provisional carrying capacity (Lobo et al. 2013) that pointed to the traditional type of visitation, but at a smaller scale. The idea was supported after a better understanding of the river dynamics which, with its constant seasonal floods, presents energy flows of magnitude many times greater than the visitor impacts.

Other caves of this group do not have visitation structures by the apparent lack of necessity. It can happen due to the relatively low complexity of the environment, the low risks to the visitors and also by visitor management strategies. Examples are the caves of Salitre, Macumba, Mãozinha and Fogo.

Finally, the authors also considered the cave-churches or sacred caves. These caves are the ones that have been adapted entirely or in parts to serve as churches or shrines, especially by Catholic practitioners. It is within this group that we can identify the largest sacred cave visited in Brazil: the lapa da Igreja (Fig. 4), in Bom Jesus da Lapa. Its visitation dates from the mid-18th Century, and currently the number of pilgrims and tourists who visit the religious complex each year has reached close to one million.

Studies such as the one by Steil (2003), have demonstrated that visitors go to such caves for both religious and curiosity reasons, and it is generally impossible to distinguish Catholics from conventional tourists, as also mentioned by Travassos (2012). In environmental terms, the original cave was completely changed, being transformed into a religious temple, but generating an unusual and unique cultural landscape comparable, for example, to cliff castles and cave dwellings of Europe. (e.g. Predjama and Landar, Slovenia and Slovenian ethnic territory in Italy, respectively) or the Buddhist temples in eastern countries (e.g. Longmen and Mogao caves, China).

Other caves with such characteristics are observed all over Brazil. We can mention the lapa Velha and lapa Nova from Vazante, the cave of Terra Ronca, the lapa da Mangabeira, and the lapa of Our Lady in Antônio Pereira. In common, all cave-churches had their visitation initiated by religious traditions associated with a hierophant or manifestation of the sacred, whether by miracles attributed to the place or to a character, and also by tradition started centuries ago by local parish priests.

It is noteworthy that there is a spatial concentration of these caves in the midwest and southeast regions, as the result of natural and socio-political aspects. It is observed in these regions, extensive carbonate karst areas that naturally have a higher number of existing caves. Adding to this it is also important to note the fact that the greatest amount of speleological research historically occurred in these regions. In relation to social and political factors, one can say that the midwest and southeast regions have higher tourism development in the country, for reasons ranging from the location and conservation, as well as the development of policies that include incentives to tourism, for example.

The demand for cave tourism in Brazil

According to current data from the Brazilian Ministry of Tourism, it is estimated that the total domestic travel in Brazil is around 190 million per year (FIPE, 2012), but accurate accounting in this case is complicated by the continental dimensions of the country and due to the various options used for transportation (buses, airplanes, boats, owned or rented vehicles, etc.). As an example, data from the Ministry of Tourism indicate that domestic airborne flows in Brazilian airports reach almost 86 million arrival and departures.

To be added to the quota of the total international inbound in Brazil, the most current records of the Brazilian Ministry of Tourism (Ministério do Turismo, 2013) indicates that there were approximately 5.6 million of arrivals in 2012 (close to 297,000 from Asia and 53,000 from Oceania). Of the arrivals, 21.3% claimed to be visiting Brazil for motives or reasons related to nature, adventure and ecotourism; motivational segments in which, in theory, caves and karst areas would have a greater probability of being visited.

The scenario is vast, giving the impression that the Brazilian touristic potential linked to caves and karst areas is enormous. However, the data do not show an aspect that is latent and cultural in Brazil: the largest influx of tourism in the country, whether domestic or international, is linked to the tourism of sun and beach. However, one must consider the seasonality, because these flows are largely concentrated on weekends and holidays, and also during the summer school holidays in the country which stretch roughly from December to February. Out of this period several factors discourage Brazilians from visiting caves, one of which is the temperature of the underground. Brazil's climate is very favourable to outdoor practices almost throughout the year. In winter, in many karst regions, the average temperatures are rarely lower than 10°C, and precipitation tends to be zero or near it. In theory, this mild climate should be favorable for cave visitation. However, on average, Brazilian perceives temperatures between 10°C and 20°C as being a very cold climate and not very stimulating for visiting caves; many with water inside and average temperatures slightly lower than the external environment.

Another aspect to be considered is the remarkable flow of visitation for educational purposes, made by schools of all educational levels. As an example, in the region of PETAR, activities with schools account for over 60% of its nearly 30,000 tourists per year. Currently this park has 13 caves open for tourism and there is a plan for six more in the years to come. Thus, its visitation flow is



Fig. 3. Examples of Brazilian undeveloped show caves. **A-B:** Students from the Universidade Federal de São Carlos at the caverna Água Suja, PETAR. The access to the cave's interior is made by entering the underground river, an activity perceived as being adventurous (Photo: H.A.S. Lobo). **C-D:** Gruna do Penhasco. In C one can see the general view of the main chamber and in D, a common troglophile in the caves of the region (Photo: H.A.S. Lobo). **E:** Main chamber of the Lapa do Caboclo, Cavernas do Peruaçu National Park (Photo: L.E.P. Travassos). **F:** Collapse chamber in the gruta do Morro Oco, also at the Cavernas do Peruaçu National Park. The circle in the image shows a person as scale (Photo: L.E.P. Travassos).

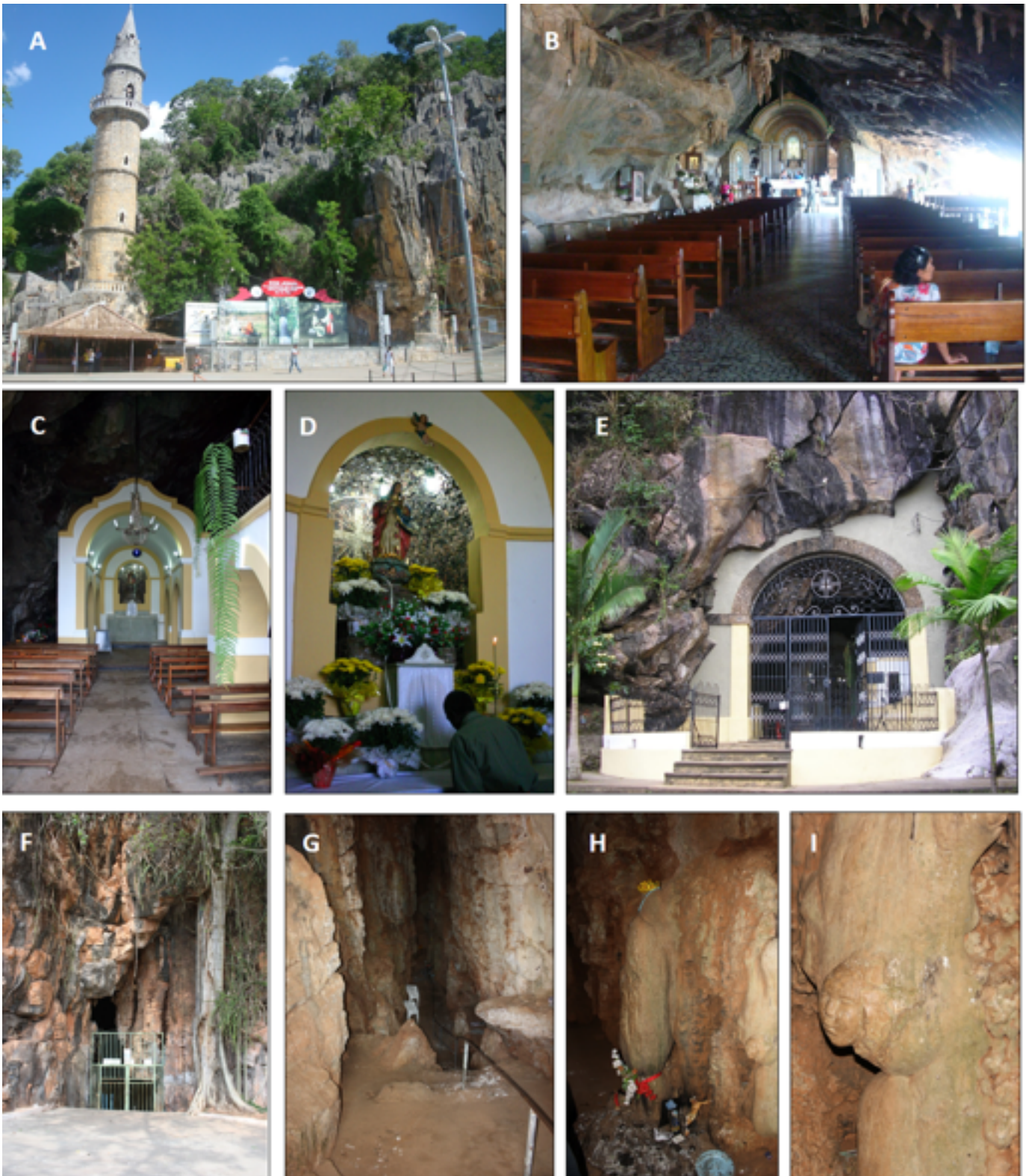


Fig. 4. Cave churches in Brazil. **A-B:** Sacred cave of Bom Jesus da Lapa. (Photo: H.A.S. Lobo). **C-E:** General aspects of the sacred Lapa de Antônio Pereira. (Photo: L.E.P. Travassos). **F-I:** General aspects of the sacred Lapa Velha, Vazante. In H one can see the stalagmite of approximately 1.80m which is perceived by the pilgrims as Our Lady. In I, it is possible to see an “angel face” carved in the cave wall near the “Our Lady” (Photo: L.E.P. Travassos)

considered low given the abundance of attractions. In addition to the show caves, the region also has rivers, waterfalls and trails through the Atlantic Rain Forest, for example.

Besides the schools, other motivations have been identified in tourists willing to visit Brazilian caves. They were grouped and described in the works of El-Dash & Scaleante (2005) and Lobo et al. (2010), and the most characteristic profiles identified correspond to the following travel motivations: a) contemplation b) adventure (with activities including rappelling, diving or even caves with greater difficulty, similar to the practice of technical or sportive speleology), and c) religion and spirituality. There are no studies on specific profiles of visitors according to age or income, except for occasional works in some show caves. There appears to be little or no homogeneity among visitors to these variables, so that, apparently, Brazilian caves are visited by tourists with varied profiles as well.

In this context, one must clarify that few Brazilian destinations in karst areas survive solely or mostly of tourist activity in caves or outside them. Bonito, Chapada Diamantina, and the region of the PETAR, are among the greatest examples of success in this direction. Most of its attractions correspond to elements of the karst landscapes (Fig. 5).

Recently, notably in the state of Minas Gerais, academic dissertations had been done in an attempt to encourage geotourism in karst areas, especially in the federal and state protected ones in the north portion of the metropolitan area of Belo Horizonte, capital city of Minas Gerais. The research was intended to help people to better understand the scientific value of this landscape, but one can't forget that visitors also do not stop contemplating the landscape (e.g. Evangelista Pinto & Travassos 2013; Borges et al. 2013).

The amounts charged in Brazilian caves and other tourist attractions in karst areas are equally varied. As extreme examples, and focusing only on tourist attractions formally established, the authors identified values between US\$10 (basic tour with local guide in the Diabo Cave) and US\$230 (tour with rappelling and boat ride on the lake of the Anhumas abyss in Bonito). Obviously, these extremes need to be considered in terms of the variety of activities offered and even the limit of daily visitors. In the Diabo Cave nearly 1000 visitors per day are allowed whilst the Anhumas abyss has a maximum allowable number of 16 persons per day.

Between these extremes, one can point an average cost of approximately US\$20 most Brazilian show caves, including the entrance fee and a local guide. By comparison, it is noteworthy that the Postojna Cave (Slovenia), receives hundreds of thousands of visitors each year at a cost of ~US\$30. If the visitor wishes, it is possible to buy combined tickets to the Predjama Castle, as well as to the biospeleological station of the Postojna Cave.

Environmental conservation in Brazilian show caves

It is the author's belief, in general, that the Brazilian law which should allow the protection of the

speleological heritage is quite weak. There are no specific laws for the protection of caves and karst areas, although the Constitution of 1988 describes the caves as "property of the Union", being a heritage of the Brazilian people. In other words, there is no private right regarding caves in Brazil. Therefore, the owner of the land where a cave is located is not the owner of the cave and needs permits from the government to use it for tourism.

One can think that this condition could be favourable to cave conservation. However, several disparities are observed. In many cases current Brazilian legislation is designed in a way that it is simpler to get permission for the destruction of a cave for mining purposes than to obtain authorization for its sustainable use for tourism. The major obstacle in this direction is the complex and extensive study required in order to obtain the authorization for opening a cave for tourism: the so-called "Plano de Manejo Espeleológico" (Speleological Management Plan). This document proposes a series of studies with high costs making it impossible to formalise show cave development for most small entrepreneurs. The result is a lot of caves running marginalised and subject to closure at any time by enforcement actions of regulatory officials or by formal complaints of public prosecutors.

But why do these discrepancies occur? Although attempts to answer such questions always come up against the usual complexity of relations between environmental conservation policies, it is necessary to consider two classic problems in Brazil: excessive number of taxes (which increases the cost of all works undertaken for planning, as well as the final price of the touristic attractions), and lack of basic research, which must be carried out by the entrepreneur at the time of preparation of the speleological management plan. Thus, the private entity end up paying too much and feels discouraged in attempting to formalise its tourist enterprise.

Attempts in order to search for resolution to this problem are the proposal of more simplified ways of managing caves intended to a small scale use, as well as through what is known as the "Termos de Ajustamento de Conduta" (Terms of Conduct Adjustment). These documents allow entrepreneurs to use caves for tourism in "a precarious situation", in order to generate funds to meet the costs of a Speleological Management Plan.

Another discrepancy observed in this same scenario is that most of the Brazilian show caves are located in natural protected areas which belong to the government. On one hand these caves are more "shielded" or protected because they are in areas in which use is more restricted and on the other hand its use for tourism suffers from the same problem that the private show caves. A considerable number of show caves managed by the government have no Speleological Management Plans, creating a paradoxical situation in which the government demands from individuals a prerequisite that it does not comply with on its own lands.

Two recent cases in Brazil can be highlighted: the tourist caves at the PETAR only had its Management



Fig. 5. Examples of Brazilian karst landscapes with exceptional scenic, scientific and tourist values. **A:** PETAR State Park, a karst area covered by dense Atlantic Rain Forest (Photo: H.A.S. Lobo) **B:** Collapse doline used to enter the lapa Doce, Chapada Diamantina, Bahia (Photo: H.A.S. Lobo) **C:** Serra da Bodoquena, with its dissected karst and clean water rivers (Photo: D.D. Granville). **D:** Massif of Baú, in the border of the Sumidouro State Park (Photo: L.E.P. Travassos). **E:** Karst massif at the Sumidouro State Park, Lagoa Santa, Minas Gerais (Photo: L.E.P. Travassos)

Plan prepared in 2010, after a temporary closure in 2008 due to years of neglect by the public sector and lawsuits against the government. The project cost more than US\$800,000. In another bad example, three show caves from the same region (Maquiné, Lapinha and Rei do Mato) had all their lighting system changed in 2011, which cost close to US\$1 million dollars, without the development of a previous project. As a result, a new

lighting system, although based on LED technology, presents several problems such as low moisture resistance, spotlights located direct into the eyes of tourists, excessive colours and areas of darkness on the visitor circuit, making it more dangerous to tourists.

This inappropriate use increases the impacts of visitation, and the consequences as already known and

widely studied in Brazil (Lobo 2008) and worldwide (Gillieson 1996; Cigna & Burri 2000) are sometimes disastrous. Inadequate management actions in the past have been responsible for the loss of significant portions of the Brazilian speleological heritage, both due to the inappropriate use as well as the actions without planning.

On the other hand, managers of some show caves have been working based on appropriate management plans that emphasize both the use of low impact as well as the conservation of the cave environment. Good examples can be seen in the country in several regions, such as in Bonito (gruta de São Miguel and Anhumas abyss, both privately operated) and the Cavernas do Peruaçu National Park, managed by government. In the case of Peruaçu, executive projects for all visitor infrastructure elements were drafted between 2010 and 2011, and has been designed with inert materials (plastic and stainless steel, for example). The development has been underway since the beginning of 2013, before the formal opening of the park for tourists. However, one must consider that the caves have no specific Speleological Management Plan, and the use will be oriented by the Parks' General Management Plan which is not fully focused on the use of its caves that could be opened for tourists.

Conclusions

We have tried to demonstrate that the use of caves for tourism in Brazil is still in involvement and exploration phases (cf. Butler, 1980), but it is developed in a very controversial basis. If on one hand, extreme environmentalists insist in believing the "myth of untouched nature" and support equally extreme initiatives of minimum impact on caves that are often not attractive to tourists and pose a risk to visitors. On the other hand, supporters of development at any cost do not meet the necessary studies so one could rationally use the resource.

Noteworthy is the fact that the touristic use of karst and caves has become object of interest of the Brazilian scientific community, although there are still only a few studies that address the issue in this country. Equally recent are the studies focused on carrying capacity or cave microclimate in the caves outside the midwest and southeast regions of the country, for example.

If on one hand these conditions can be seen as negative for the Brazilian show caves, for the other side they must also be seen as a broad and productive setting for future research opportunities, and also for socioeconomic development and environmental conservation through tourism in caves.

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