Cave Conservation and Restoration Couse in Brazil

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Introduction

Several Brazilian show caves are in areas protected for environmental, historical, and cultural significance. In some cases, evidence of anthropogenic impact in popular tourist caves spans more than 100 years of public use. Cumulative consequences of infrastructure installation, maintenance, and visitor-flow operations include graffiti, trash, construction rubble, broken speleothems, stained formations, and disturbed sediments. Cave management plans describe the resulting detrimental impacts to fauna, habitat, and microclimate (Alt, Moura NCKMS 2013). The urgent need to implement conservation activities with on-going monitoring, mitigation, and restoration in these fragile, Brazilian cave environments stimulated coordination of the first International Cave Conservation and Restoration Course in Brazil.

Held during April 2014 in Brazil's southeastern state of Minas Gerais (Figure 1), we designed the Course to introduce current best techniques, philosophy, and ethics with daily hands-on cave projects. Students used theoretical and practical activities to produce tangible restoration progress on two heavily visited show caves, Gruta do Maquiné and Gruta do Rei do Mato. Augusto Auler of the Instituto do Carste (Brazilian Karst Research Institute) in cooperation with corporate sponsor Anglo American Mining Company invited Jim Werker and Val Hildreth-Werker to collaborate with Luciana Alt and Vitor Moura in conducting the seven-day training. The Course, an important step toward initiating conservation actions set forth in management plans for both caves, was enabled through environmental compensation laws and cave protection legislation established after 1988, and is one of Brazil's pioneering initiatives in karst outreach and restoration.

History, Impacts, Motivation

Gruta do Maquiné, located in the highlands of Minas Gerais, is a popular national

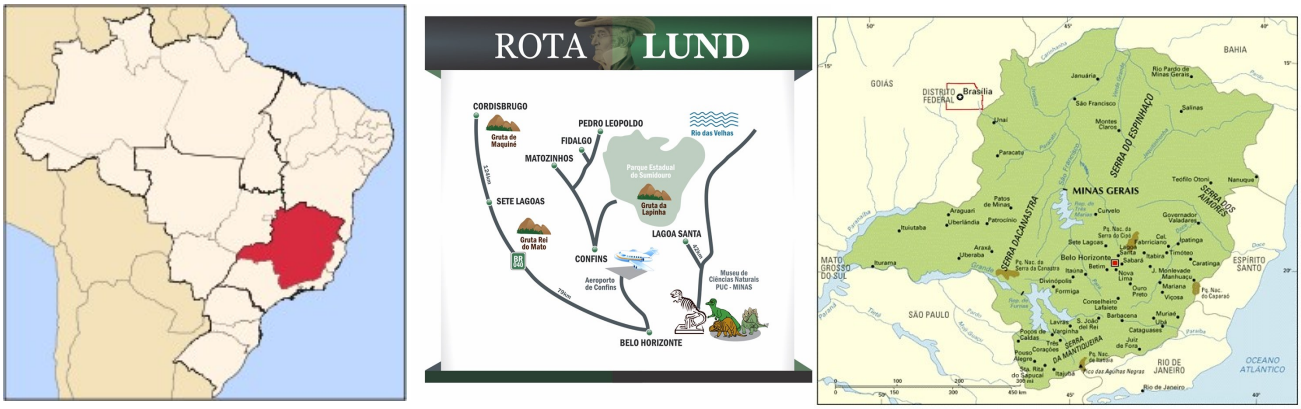

Figure 1 Location maps

destination renowned for paleontological discoveries made during the 1830s by accomplished Danish scientist, Peter Wilhelm Lund. Famed twentieth-century Brazilian novelist, João Guimarães Rosa, who was born in the nearby small town of Cordisburgo in 1908, described the magical chambers and beautiful speleothems of Maquiné. About a century ago, Maquiné became an important tourist site and the first Brazilian cave developed for organized visitation; and in the late 1960s, also the first to install an electric lighting system. This show cave is one of the most visited commercial caves in Brazil and receives about 50,000 visitors per year.

A second show cave named Rei do Mato lies about 50 kilometers from Maquiné, near the city of Sete Lagoas. State and municipal agencies organized commercial tourist visitation in the 1980s and installed walkways and stairs. The walls of Rei do Mato protect a splendid mutli-level chamber filled with speleothems of rare beauty.

Administered under the supervision of the State Forestry Institute, both caves are in protected areas and operate through public-private management partnerships. The State Tourist Board of Minas Gerais implemented a national advertising campaign promoting the Peter Lund Museum and three show caves including Maquiné, Rei do Mato, and another touristic cave, Gruta do Laphina, as destinations on a regional tourist route known as Rota Lund (Lund Route) along highways north of the major city of Belo Horizonte.

Both cave operation units began implementing resource management plans written by Alt and Moura in 2009/2010. These plans include detailed studies and diagnoses of environmental impacts, provide recommendations for visitor activities, document concerns regarding installed infrastructure, and propose measures to reduce harmful consequences by improving infrastructure and mitigating negative-impact activities (EIF 2010). In addition to historic and contemporary signatures, graffiti, trash, broken speleothems, and debris from development, Alt and Moura describe a variety of specific problems such as iron stains on speleothems, metal flaking from walkway degradation, accumulations of iron plates under the catwalk, and deteriorated wood left from old walkways in Rei do Mato, as well as compacted soils, disturbed sediments, undelineated visitor pathways, questionable handholds, and other concerns in Maquiné.

Between 2009 and 2013, cave managers began to implement a few of the proposed conservation advances, but progress was slow and sporadic. For example, installations of LED-based lighting systems began to replace old high-voltage lamps. With many issues described in the management plans, and little remediation initiated at the cave sites, the Instituto do Carste partnered with Anglo American Mining in applying federally mandated environmental compensation fees to support the first International Course on Cave Conservation and Restoration. The main objective of the Course was to provide hands-on training in identification, mitigation, and control of environmental impacts linked to tourism and public visitation.

Brazil's First Cave Conservation and Restoration Course

To reinforce the conservation-management processes of these two show caves, Course directors defined three objectives: 1) train and engage conservation stewardship; 2) initiate mitigation and monitoring projects; 3) and motivate ongoing restoration progress.

A pioneering initiative in Brazil, the first International Course on Cave Conservation and Restoration is a milestone for future cave conservation and restoration activities in the country. The intent was to train, motivate, and

Students worked in small groups, identifying anthropogenic impacts in Gruta do Maquiné and creating impact maps for their assigned areas

Course participants spent a day collecting trash in Maquiné, completing the tasks by sorting the garbage to determine what activities generated the waste—thereby discovering the need to improve communication of protocols regarding infrastructure maintenance and visiting tourists. Trash sorting in the parking lot blossomed into spontaneous art statements using objects found in the cave passages. Lata lixo is Portuguese for trash can!

Discussion and testing of the best techniques for removing the thick lint layer covering speleothems in Rei do Mato included mindful protocols for wildlife and minimum impact techniques. Participants gained valuable hands on experience in a variety of restoration tasks. Photos Luciana Alt, Val Hildreth-Werker

establish practical experience to enhance ongoing advances. Delivered by Val Hildreth-Werker and Jim Werker who authored the NSS manual titled Cave Conservation and Restoration (2006), coordination and logistics of the Course counted on the expertise of Luciana Alt and Vitor Moura, who coordinated and authored the 2009/2010 Management Plans for both caves, Maquiné and Rei do Mato (EIF 2010).

During the seven-day Course, all theoretical and practical activities were carried

out in the facilities and caves of Maquiné and Rei do Mato. Lectures, discussions, demonstrations, and group assignments filled the week with conservation management activities. Following classroom presentation and discussion of theoretical concepts, we assigned small teams with daily hands-on cave projects involving resource assessment, impact analysis, decision-making, planning, group dynamics, consensus building, and execution of cave management tasks. The seven-day schedule enabled participants to spend many hours each day in small groups, literally planning and executing a variety of in-cave conservation-management projects. Student teams took our classroom theories and restoration methods directly into the caves, used the information we presented to identify problems, plan strategies, make decisions, and then performed actual hands-on application of the tasks. As projects became more complex, participants adapted plans and techniques to better fit the specific situations they encountered. The Course provided opportunity for in-depth analysis, application of decisions, and fine-tuning of skills.

Through an application process, 27 students were selected to attend this first Course. Skills and backgrounds of those selected were very diverse. Some represented federal, state, and private environmental protection agencies; others were long-time interpretive guides from the two caves. We had archaeologists who worked in federal as well as academic venues; lawyers representing environmental agencies; a few members of the caving community; and some mining company officials. Other applicants fill a waiting list for the second course, which is planned for this coming year.

Classroom information and practical in-cave activities gave students technical training for performing current best practices in caves based on the foundation of *primum non nocere*—first do no harm. Drawing from current best practice concepts published in *Cave Conservation and Restoration* (Hildreth-Werker and Werker 2006), the Course curriculum covered techniques, philosophy, and ethics of cave management. We include the word *current* in front of best practices, as a reminder to stay abreast of new studies and use science-based information to continually improve and redefine standards and practices in cave conservation (Spate, et al.1998; Hildreth-Werker 2006).

Tangible Outcomes

Participants accomplished much impressive conservation work in the two protected tourist caves during the Course week. Teams identified, documented, and initiated restoration projects addressing some of the conservation concerns described in the cave management plans. All students gained tangible field experience in resource assessment, identification of conservation issues, impact mapping, low-impact caving ethics, cave cleaning, special attention for historic materials, lint debris removal, speleothem restoration, lampenflora control, trail delineation, historical and cultural marking analysis, contemporary graffiti removal, and visitor routing to enhance safety and mitigate impact. The week of instruction, discussion, and practical training inspired participants to propose follow-up programs for continuing the work initiated through the Course.

Following the Course, participants employed in various federal, state, and private cave-resource management positions created new minimum-impact protocols for work in their respective scientific disciplines. Results include new protocols for cave archeologists and biologists. These documents represent tangible positive outcomes of the philosophical discussions, technical methods, and impact-reducing ethics presented during the Course. On the other hand, proposed plans for continuing conservation and restoration projects in the caves have not been implemented. Much still needs to be done; we will design our next course to stimulate continued training and especially motivate ongoing annual restoration events.

Brazil's first International Course in Cave Conservation and Restoration is an important initiative for karst outreach and instigates new pathways forward in the protection and conservation of caves.

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References

Alt L, Moura V. Use of impact mapping for planning the infrastructure in tourist caves – case study: Maquiné Cave, Brazil. In: 20th National Cave and Karst Management Symposium Proceedings, 2013. Carlsbad NM: National Cave and Karst Research Institute. p 77-88.

Hildreth-Werker V, Werker JC, editors. 2006. Cave Conservation and Restoration. Huntsville, Alabama: National Speleological Society. xiv+ 600 p. [Contains a wealth of detail from 46 contributors describing current best tools and methods for identification of cave resources, perpetuation of speleological processes, cave conservation, restoration, and speleothem repair.] ISBN 1-879961-15-6
Available through Amazon, NSS http://bookstore.caves.org and http://www.karstportal.org/node/20158/.

Hildreth-Werker, V. 2006. Current Best Practices. In: Hildreth-Werker V, Werker JC, editors. 2006. Cave Conservation and Restoration. Huntsville, Alabama: National Speleological Society. p 17-18. ISBN 1-879961-15-6

IEF. 2010. State Forestry Institute Management, Plan for the Natural State Monument Peter Lund / Maquiné Cave / Booklet I, Belo Horizonte, Brasil. (In Portuguese)

Spate A, Hamilton-Smith E, Little L, Holland E. 1998. Best practice and tourist cave engineering. In: Smith DW, editor. *Cave and Karst Management in Australasia XII.* Carlton South, Victoria, Australia: Australasian Cave and Karst Management Association. p 97-109.