



CONSERVING THE LAVA CAVES OF MAURITIUS: THE CAVES OF MAURITIUS PROJECT 1998

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Abstract

The Caves of Mauritius Project 1998 was conducted by the author and Jörg Hauchler for the Mauritian Department of Environment. It raised the number of lava caves documented on the Indian Ocean island to 114, with a total 12.8 km of surveyed passage. Information collected was placed into a computer database, including maps of most of the caves. The project highlighted the values of the caves and the threats to them and their fauna. It assessed the particular values of the more significant caves and recommended measures for their protection, particularly a “Plaine des Roches National Park” for the largest assemblage. Management agreements were suggested for privately-owned caves.

The Project

At the 8th Symposium on Vulcanospeleology in Nairobi in February 1998 I presented a summary of the current knowledge of the lava caves of the Indian Ocean island of Mauritius, what was known of their fauna and the threats to them (Middleton 1998). In concluding that paper I expressed the view that “Appreciation of the country’s cave resources is coming only slowly and belatedly to Mauritius” and added, with more hope than confidence, “It now seems likely that a project to fully document, assess and conserve at least a representative sample of Mauritian caves will be undertaken.” That prediction was based on the belief that two years of negotiations with the Mauritian authorities was about to come to fruition. And so it was. On 28 May 1998 I received an offer of a contract to undertake a project entitled “Planning the Conservation and Management of the Caves of Mauritius and Rodrigues” – soon abbreviated to the “Caves of Mauritius Project 1998”.

The project was conceived as comprising three stages:

1. Undertake a comprehensive study of as many as possible of the caves, pipes and lava tunnels of Mauritius and Rodrigues and prepare or obtain surveys of each and compile an inventory of their significant features including location, ownership, current land use and biological content. Make a photographic record of notable features.
2. Prepare an assessment of each cave in terms of its specific values and its potential uses (such as for conservation, recreation, science, education, tourism, water supply, etc.) and determine the optimum use for each cave.
3. Prepare recommendations on the future use and management of each cave, including reservation, as appropriate. Report also on the need for a specific Act for the protection of caves and their contents, and for the conduct of education and publicity campaigns in relation to caves and their conservation.

A period of four months was initially set aside for this work; this was subsequently extended to five (and would have benefited from another). The project report, including the caves database, was presented to the Director of Environment and his staff (and the press) on 22 December 1998.

The author was assisted throughout the project by a German-born resident of Mauritius, Jörg Hauchler, with whom I had been exploring the caves since 1993. We were assisted for the first few weeks by volunteer Imran Vencapah and at other times by Vikash Tatayah and Mario Allet.



For a few days, on Rodrigues, we were joined by Swiss biospeleologist, Pierre Strinati, who added to his collections of Mauritian cave fauna.

Documentation of the resource

The documentation phase went much better than had been expected. While we were initially concerned as to how we might locate more caves, eventually we had to stop looking, although we were still receiving reports of other caves.

Table 1 shows the lava caves documented before and those added during the project.

Table 1 - Documented caves by Region and Area – before and after the 1998 Project

Region	Area	Prior to July 1998			By December 1998		
		No. of entrances	No. of caves	Total length (m)	No. of entrances	No. of caves	Total length (m)
North-West	Goodlands	1	1	225	3	2	355
North-East	Plaine des Roches	28	16	2,500	46	22	3,520
Central West	Moka Range	-	-	-	1	1	4.2
	Plaine St Pierre	8	6	920	11	9	1,115
	Plaine Wilhems	18	9	889	22	12	1,160
Central East	Beau Champ	-	-	-	2	2	14
	Nouvelle Decouverte	11	8	1,406	39	26	3,509
	Quartier Militaire	3	3	129	7	7	749
	Trou d'Eau Douce	3	2	35	3	2	63
South-West	Bassin Blanc	-	-	-	1	1	80
	Chamarel Falls	6	6	109	6	6	109
	Kanaka	-	-	-	13	10	725
South-East	Mont Blanc	8	6	754	9	7	754
	Plaine Magnien	1	1	85	1	1	85
	Rose Belle	-	-	-	2	2	68
	Savannah	3	3	205	4	4	500
	TOTAL	88	61	8,120	170	114	12,810

An additional 3,691 m of passage was documented in karst caves, mainly on the island of Rodrigues.

As this indicates, a further 53 caves were documented during the project; these ranged from a 4.2 m isolated lava tube high in the Moka Range, to an 810 m cave at Roches Noires; in addition, some significant extensions were made to known caves.

These caves and a range of data associated with each are recorded in the Mauritius Cave Database, a copy of which was provided to the Ministry of Local Government & Environment. A total of 93 cave maps accompanied the report, depicting 133 caves (109 of them lava caves).

Values

The caves were shown to possess a range of values, most particularly as essential nesting and roost sites for the Mascarene cave swiftlet, *Collacalia francica*, (see Fig. 1) and the free-tailed bat, *Tadarida acetabulosus*. No less than



Fig. 1 – The Mascarene cave swiftlet is the most obvious of Mauritian cave fauna. For its value to agriculture alone it deserves to have its main breeding caves protected.

35 caves have been reported to house swiftlet populations; two are known to have been destroyed and in three the population sizes are unknown but the remainder have been estimated as indicated in Table 2.

Table 2 – Cave swiftlet population estimates

Estimated population	No. of caves with population within range
>500	1
200–500	2
100–200	3
50–100	3
20–50	7
10–20	10
<10	4

At least 8 caves shelter populations of *Tadarida*, in three cases numbering many thousands. Both the insectivorous bats and swiftlets are insectivorous and consume large quantities of insects, many of which are harmful to agriculture.

The caves also provide habitats for invertebrate fauna which is largely yet to be documented. Pierre Strinati had earlier collected the first endemic Mauritian silverfish (Mendes 1996) and an amphipod which had not previously been recorded in the

Indian Ocean region (Stock 1997). During the project the author collected a scutigrid, eyeless opiloidids, spiders, thysanuras, slaters and isopods, a wingless fly, symphyla, beetles, earwigs, flies and millipedes (Humphreys, pers. Comm.); none of these has yet been identified to species level.

Some of the caves provide reliable access to water (particularly at Roches Noires in the NE - at least 3 caves, Goodlands in the north and Chemin Grenier in the south) which is still used by local people at times.

Many of the caves exhibit interesting geological features indicative of their volcanic origins and are of considerable scientific and educational interest (Fig. 2).

Some of the caves are of historic interest (Middleton 1996, 1997): one was surveyed before 1769, another housed escaped slaves in the 1770s and was visited by Matthew Flinders, in another the owner gave parties and was later entombed, another, containing water, was of such regular shape as to inspire the name “Puits des Hollandais” (“Dutch Well”) by early French settlers.

At least two caves have religious significance: at Palma a Hindu temple has been built in the mouth of a lava tube; at Trois Bras a cave was for many years the site of a Hindu shrine or *kalimye*. Altars in at least two other caves attest to their use as black magic sites.

Very many of the caves have high scenic and recreational values and, in the case of Pont Bondieu, stairways have been installed to facilitate tourist and local community access. Unfortunately this has not been accompanied by information or interpretation so it has done little to raise public appreciation of caves. Promoting the recreational and scenic values of the caves in the absence of a responsible management authority and enforceable statutory protection would pose significant risk of irreparable damage to the caves and threats to public safety.



Fig. 2 – Lava caves contain unusual geological and mineral deposits worthy of protection.



Threats

The lava caves of Mauritius are vulnerable to a wide range of threats. These include:

Entrance closure

The clearest cases of this were the total filling of Providence Cremation Ground Cave (QM2) by FUEL Sugar Eastate and the filling of entrance MB4 (Trou Hironnelle #2) – both of which occurred after we mapped the caves. However, we also had earlier reports of entrances being filled at Petite Rivière, La Louise, Henrietta, Palma, La Martiniere (4), Trou D'Eau Douce, Nouvelle Decouverte, Kanaka, Gros Bois, Savanne and Trois Caverne.

Internal closure

At Palma, Beau Songes and Anna caves have been sealed or cut short; and this has virtually happened at Roches Noires because of dumping of huge quantities of rubbish into a daylight hole.

Rubbish dumping

The dumping of rubbish into caves is extremely widespread. Although, fortunately, in most cases it does not physically seal the cave but it can make entering the cave most unpleasant. The worst cases are industrial rubbish dumped at Pont Bondieu and Plaine des Roches Cremation Ground Cave (Fig. 3) and animal waste at Roches Noires (cows), Bergerie Lava Tube (sheep) and at Mont Blanc (chicken manure etc). We noted significant quantities of garbage in at least 13 other caves.

Vandalism

As occurs elsewhere, the breaking of speleothems is not an uncommon event. This may be accidental but from the fact that the broken pieces are rarely seen, one can assume that “souveniring” is fairly common. Burning of old tyres has had a major impact on some caves, particularly Caverne Trois Bras where every surface in the larger part of the cave is covered in carbon. It is hard to see this activity as other than vandalism, though in some places it seems to occur in conjunction with black magic.



Fig. 3 – Cremation Ground Cave, Plaine des Roches, is almost filled with industrial waste.

Cave Swiftlet nest removal

George Clarke (1859) observed that attempts had been made to commercially exploit the nests of cave swiftlets ‘many years’; before, but apparently without success. Nevertheless, the taking of swiftlet nests is a common occurrence and is presumed to pose a threat to this species which no longer exists in the ‘vast numbers’ noted by Clarke. Despite the erection of a grille to try to protect swiftlets in Petete Rivière Cave and a fence at Palma Lava Cave, no nesting site is currently protected.

Pollution

Unfortunately the island’s largest lava cave, Camp Thorel (Fig. 4) with just over a kilometre of passage, lies entirely under the village of Camp Thorel which is not sewered. The result is that the cave receives large amounts of waste water and only partly-treated sewage from the overlying dwellings. Analysis of samples indicated very high levels of fecal contamination. At least ten other caves receive water of questionable quality.

Siltation

Siltation is a problem wherever sheet flow causes erosion and the products wash into a cave. Mangapoule Lava Cave QM4, Trois Caverne #1 PP2, L'Esperance Lava Cave ND22 and Double Cave ND29 which have all been completely blocked by silt are the worst known examples. All are in sugar cane fields. Many other caves suffer siltation to lesser degrees.

Protective measures already taken

The first official attempt to protect a Mauritian lava cave from the dumping of rubbish was undertaken by the Department of Environment in late 1993 at Pont Bondieu. A wall and chain wire fence were erected beside the road which passes over the cave and provided extremely easy access for trucks dumping rubbish. Stone steps and a handrail were installed to provide safe access into the large pit. As a result all ferns within easy reach have been removed and access for nest bobsbers has been facilitated. Unfortunately no effort has been made to provide interpretation so visitors gain no understanding of the geological structures or processes involved in the formation of the caves and the pit, nor of the fauna which lives there.

Late in 1994 a private effort was made to protect the important swiftlet nesting cave at Petite Rivière, PP1. At the urging of Roger Safford, an English ornithologist who studied the swiftlet (Safford 1993) and the Mauritian Wildlife Foundation, the owners of the land, Medine Sugar Estate, agreed to gate the cave. By January 1995 the hinges had been broken and the gate removed. When questioned, some local people who visited the cave admitted that in the past they had taken swiftlet nests, but said they no longer did so. They thought the gate may have been broken by people thinking it must be protecting something of monetary value. Subsequently the owners repaired the gate but in May 1996 it was blown open using a high explosive (Hauchler, pers. comm.). It has not been repaired since. As the swiftlet population seems to have been growing it does not seem likely that nest removal was the motive for the repeated breaking of the gate. Hauchler has also noted that a second “altar” has recently been constructed closer to the entrance and it may be that practices associated with this are the major motive for keeping free access to the cave.

In May 1994 the owner started actively filling the entrance pit to the Palma Caves with rubble. Because of the importance of this cave for swiftlet nesting this activity was stopped by the Department of Environment and an agreement was subsequently reached with the owner to the

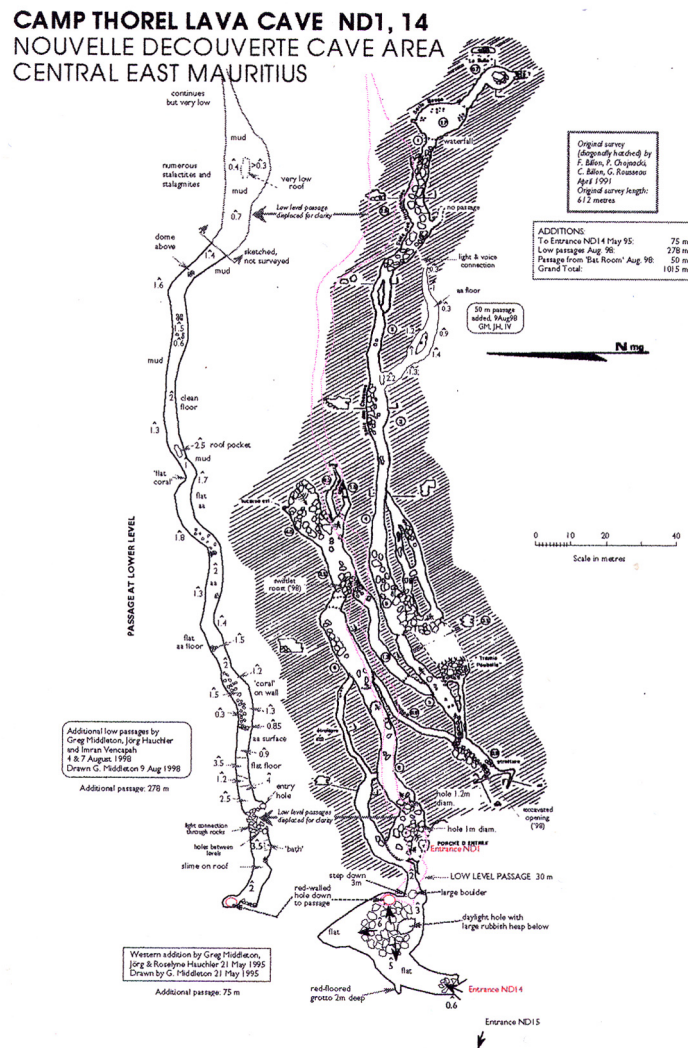


Fig. 4 – The most extensive lava cave in Mauritius, Camp Thorel Lava Cave, is unfortunately also its most polluted.



effect that the Department could carry out protective works and no further filling would occur. A chain-wire fence with a locked gate was subsequently constructed around the pit but this has not been maintained. The lock has been broken and access is unrestricted. Although dumping into the pit has been stopped, rubbish is still being dumped adjacent to the fence, weeds are overgrowing the fence and the area is an eyesore. This demonstrates the need for active maintenance and on-the-ground management in any program to provide long-term protection to the caves.

Recommendations on future use and management

The major recommendations which arose from the study were:

1. The creation of a “Plaine des Roches Lava Caves National Park” encompassing a series of significant caves in the Plaine des Roches area.
4. The other significant caves should either be reserved for conservation and low-key recreation purposes, or made the subject of a management agreement between the appropriate agency of Government and the landowner.

[Recommendations 2 and 3 concerned a karst national park on Rodrigues and priority funding for the cleaning and rehabilitation of Caverne Patate and its eventual lighting with electricity.]

Plaine des Roches Lava Caves National Park

It was proposed that this park be established under the *Wildlife and National Parks Act 1993* and be managed by the National Parks and Conservation Service of the Ministry of Agriculture. Where the land was not State-owned, except where occupied by dwellings, it was proposed for purchase to enable its reservation. Most of the land is extremely poor for agricultural purposes, has very thin soils and supports only exotic weeds and Eucalypts, grown for scaffolding.

Important elements of the project would be:

- The inclusion of as much of the area underlain by caves as possible, extending from the Roches Noires Rising on the coast inland at least as far as the Cremation Ground Caves west of the village of Plaine des Roches, south to the Roches Noires-Plaine des Roches road and north as far as the caves west of Roches Noires football ground. It may be that the park would not be able to be contiguous (at least on the surface) but it should be based on an ecological view of the area, recognising the geological processes that formed the region and the hydrological connections which unify many of the caves at the present time.
- Investigation of the feasibility of opening “Twilight Caverne” (PR18-30-31) (Fig. 5) as a tourist/show cave and offering guided tours through it on a regular basis, eventually with electric lighting. A study should also be undertaken of the feasibility of opening a second entrance to the cave at the terminal rockfall (Fig. 6) and of opening up further lava tunnel presumed to exist beyond that rockfall. This would facilitate trips through the cave and perhaps reveal further pristine lava tube for study and/or opening to visitors.
- Involvement of the local community through a Community Advisory Group to ensure that there was local input to planning decisions, local understanding of the objectives of the park and that opportunities for employment of local people, directly and indirectly, were maximised.



Fig. 5 – Twilight Cavern would be the major focus of a Plaine des Roches Lava Caves National Park.



- Investigation of the feasibility of restoring significant tracts of land with its original native vegetation, particularly around caves where public facilities are to be provided.

TWILIGHT CAVERN PR18-30-31

PLAINE DES ROCHES CAVE AREA
NORTH-EAST MAURITIUS

Based on survey published in Billon et al. 1991

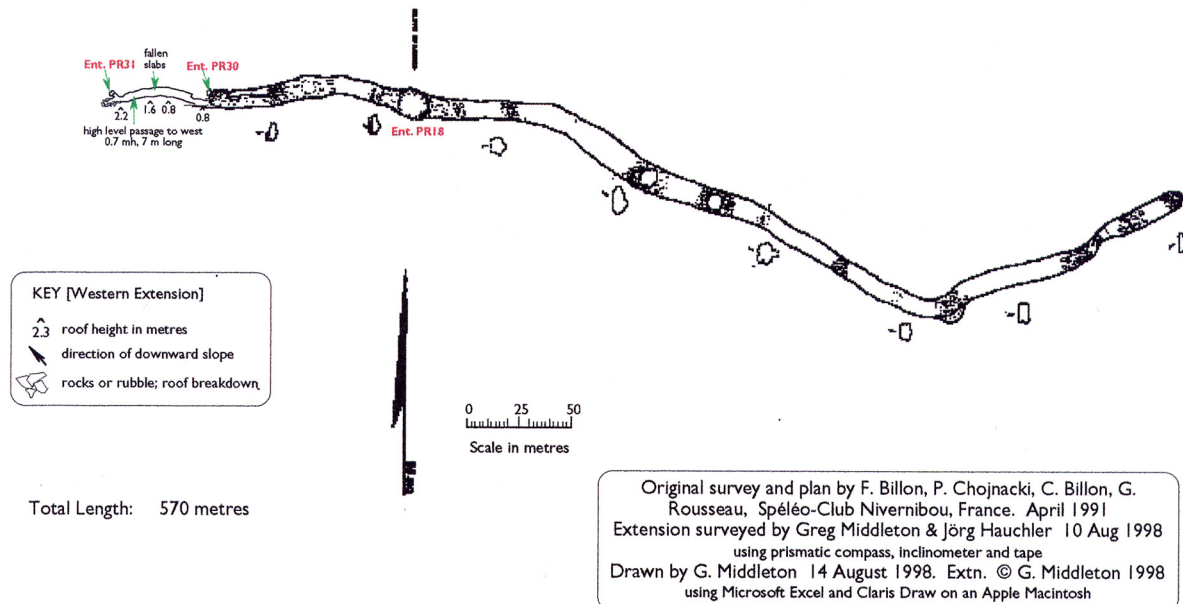


Fig. 6 – Twilight Cavern consists of a simple tube averaging about 12 metres in diameter, with a number of daylight holes. It appears to offer the best prospects for show cave development, especially if the rockfall at the eastern end could be penetrated.

A major cause for concern in relation to this project is the proposal to construct a second international airport in this region. It is not known exactly what site is contemplated but it is hoped that any such proposal would not impact directly on the area proposed as a National Park. This will need to be clarified before the project could proceed.

Management agreements for privately-owned caves

While it is preferable for nationally-important natural and scenic features such as caves to be protected and managed by the official conservation agency wherever possible, it is recognised that this will not be feasible in many cases and the best that can be expected is that the owner will agree to protect any caves on his property - or at the very least agree not to destroy them.

Management agreements can constitute a legally-binding contract between the owner and the Government to ensure that caves are protected or at least not adversely impacted upon, to specify the terms and conditions for access and to give the Government the right to carry out protective works and to maintain the site.

An existing agreement, entered into between the owner of Palma Lava Caves and the Minister in 1995 has not been entirely effective, probably due to lack of action on the part of the Department. It is probably not reasonable to expect a landowner to play a particularly active role under such an agreement (unless there is some way that he can derive some financial benefit). Most of the management action, construction, maintenance works, policing and interpretation is going to have to be carried out by the Government. This needs to be adequately funded and staffed to ensure the most is made of management agreements and that the Government can keep to its side of the bargain.



An improved pro forma management agreement needs to be developed and trial-run in some real situations before the appropriate content and wording can be finalised. Presumably there will always need to be some flexibility and the capacity to insert special clauses to cope with local situations but a pro-forma document should be able to be drafted which covers most situations.

Postscript

The project report and recommendations were submitted to the Department of Environment on 22 December 1998. No advice has been received in the 8 months since as to any action proposed to be taken by the Department or the Government.

References

- BILLON FRANÇOIS, CHOJNACKI PHILIPPE, BILLON CATHERINE & ROUSSEAU GHISLAINE, 1991: *Explorations Souterraines à L'Île Maurice: Compte rendu expédition Avril 1991*. Spéléo-Club Nivernibou: Decize (France) 46pp.
- CLARK G., 1859: *A ramble round Mauritius with some excursions to the interior of that island ...* [in] Palmer & Bradshaw (compilers) *The Mauritius Register: historical, official and commercial* pp. i-cxxxii. L. Channell: Port Louis. Reprinted in *La Revue Agricole*, 24(1):34-51; (2):96-114.
- MENDES L.F., 1996: *Further data on the Nicolettidae (Zygentoma), with description of a new species from Mauritius*. *Revue Suisse de Zoologie*, 103(3):749-756
- MIDDLETON G., 1996: *Early accounts of caves in Mauritius.*, *Proc. Roy. Soc. Arts & Sci. Mauritius*, VI:49-87
- MIDDLETON G., 1997: *Historical accounts of caves in Mauritius.*, *J. Spelean History*, 31(2):27-46.
- MIDDLETON GREGORY J., 1998: *Lava caves of the Republic of Mauritius, Indian Ocean.*, *Int. J. Speleol.*, 27B(1/4):87-93
- SAFFORD ROGER J., 1993: *Conservation of the Mascarene swiftlet Collocalia francica on Mauritius, by protection of a nesting cave*. A report to the Fauna and Flora Preservation Society (project No. 91/17)
- STOCK J.H., 1997: *A new species of Brevitalitrus (Crustacea, Amphipoda, Talitridae) from Mauritius - first record of the genus from the Indian Ocean*. *Revue Suisse de Zoologie* 104(1):3-11