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# Helictite

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A Nadal

Caverne Patate

# HELICTITE

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*Cover: "Ile Rodrigues, Stalactites et Stalagmites de Caverne Patate" Reproduction from a postcard by Alain Nadal*

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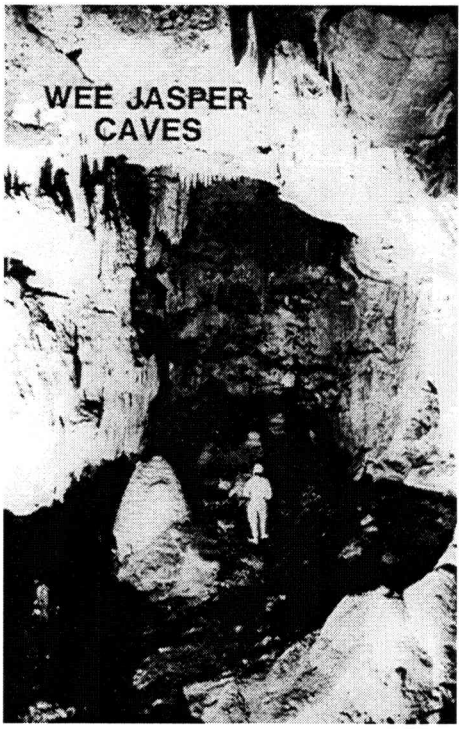


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# Early Accounts of Caves in Mauritius

. . . . . .Greg Middleton[1]


## Abstract

A survey is attempted of published accounts of lava caves on the Indian Ocean island of Mauritius up to the early 20th century. A number of writers mentioned caves as part of the natural curiosities of the island, though there was a high level of information recycling. The earliest written cave account dates from 1769; the cave it relates to is also most written-about and, on current knowledge, is the oldest on the island. On neighbouring Rodrigues the earliest record is thought to date from 1789.


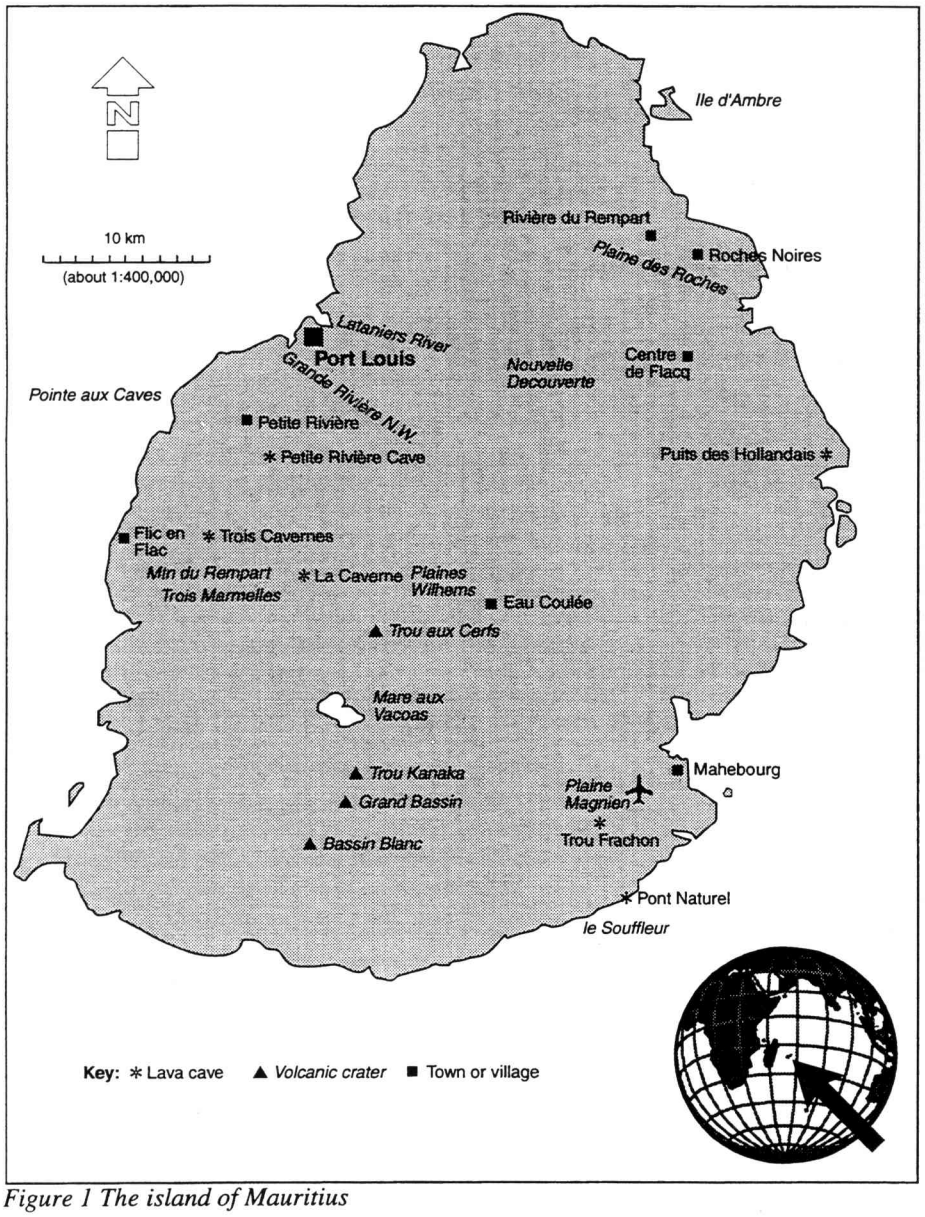


*Figure 1 The island of Mauritius*

Mauritius is a tiny island of 1,825 km$^2$ in the southern Indian Ocean. It lies about 850 km east of Madagascar and some 5,500 km west of Port Headland, Western Australia. Mauritius, with its 'dependency' of Rodrigues, 560 km to the east, and the French island of Réunion, 160 km to the SW, comprise the Mascerene Islands.

The main island of Mauritius is almost entirely volcanic, having originated about 13 million years ago in seabed eruptions which took until about 8 million years ago to reach the ocean's surface. The island's spectacular mountain peaks are remnants of two large volcanic craters and there are a number of smaller and more recent craters, including Trou aux Cerfs, Grand Bassin, Bassin Blanc and Trou Kanaka. The volcanoes have been extinct for at least 200,000 years, though odd lava flows may have occurred as recently as 26,000 years ago, particularly in the Plaine des Roches area in the NE. There are some limited exposures of calcareous aeolianite on the south and north coasts, and it comprises some small islets in the south.

Mauritius was first visited by Arab traders before 1000 AD, but they generally remained closer to the coast of Africa and established no settlements east of Madagascar. The Portuguese were the first Europeans to enter the Indian Ocean, in 1498, and in 1507, they sighted Mauritius. It was left to the Dutch, however, to claim sovereignty, which they did in 1598, naming the island after Prince Maurice of Nassau. To protect its trading activities in the region, the Dutch East India Company made the first settlement in Mauritius in 1638. The Dutch are remembered for ruthlessly exploiting the then extensive ebony forests and, by 1660, for the extinction of the flightless dodo. They also introduced deer, pigs, monkeys

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and rats, which subsequently wrought havoc among the remaining native animals.

The Dutch abandoned Mauritius in 1710, but in 1715 it was seized by the French and renamed Ile de France. They settled in 1721 and remained in possession until defeated by the British in 1810. The island then became the British colony of Mauritius, but was allowed to retain its French language and culture. It became independent in 1968, and a republic within the Commonwealth in 1992.

As Mauritius was a key island in the Indian Ocean because of its location and reasonable port, it was visited by many European travellers, especially prior to the opening of the Suez Canal (1869). Many visitors made observations on the geology, including the lava caves. Their published journals contain interesting insights on contemporary views of vulcanology, and observations on particular caves but are widely scattered and often rare. The present paper, though not claiming to be exhaustive, attempts to bring these fragments together.

Figure 1 indicates the location of places in Mauritius mentioned in the text.

## Saint-Pierre (1769)

The earliest published account of a Mauritian cave appears to be in a letter written by Bernardin de Saint-Pierre on 15 August 1769. This was published in 1773 as part of the author's anonymous account of his voyage to "l'isle de France" (Saint-Pierre 1773). The cave described is at a locality known as Chebel, near the small village of Petite Rivière, and is now generally known by the latter name. The account, in translation, is as follows:

*A Journey on the Island*

*Two inquisitive natural historians, M. de Chazal, Conseiller and M. le Marquis d'Albergaty, Captain of the Legion, proposed to me, some time ago, that we go and see, a league[1] and a half from here, a large cave, to which I agreed. First we made our way to the Great River[2]. This Great River, like all such of this island, is only a large brook which a launch could not go up beyond shotgun range of its mouth. There is there a small establishment comprising a hospital and a few stores, and it is also here that the aqueduct starts which conducts water to the town. One sees on a little hilltop looking like a sugar-loaf, a kind of fort which defends the bay.*

*Trip to a cave*

*Having passed the Grand River, we took as a guide the local miller. We walked for about three quarters of an hour to the west in the middle of woods. As we were on a plain I thought we were very far away from the cave, the entrance of which I supposed would be on the side of some mountain, when we found it without thinking at our feet. It resembles a hole in a cavern of which the roof has collapsed. A few Mapou roots hang perpendicularly and close up part of the entrance. Nailed in the centre is the head of an ox.*

*Before descending into the abyss, we had lunch. After which candles and flaming torches were lit and we provided ourselves with lighters to make fire.*

*We descended a dozen or so steps on rocks which block the entrance and I found myself in the most vast subterranean place which I have seen in my life. The roof is formed of black rock, in an arc of minimum height.*

*Its width is about 30 feet, and its height twenty. The ground is very flat, it is covered in fine soil, which rainwater has deposited there. On each side of the cavern, at the height of a balustrade, there is a large cord[3] with mouldings. I believe it is the product of water which flows there at different levels in the rainy season. I confirmed this observation by the sight of several fragments of land and aquatic shells. However the local people believe that this is the former opening of a volcano. It has to me more the appearance of the former bed of a subterranean river. The ceiling is coated with a shiny, dry glaze, a kind of stony concretion which spreads over the walls and in a few places even on the ground. There are ferruginous stalactites which break under your feet as if you are walking on a crust of ice.*

*We travelled quite a long time, finding the ground utterly dry, except at three hundred paces from the entrance where part of the roof has collapsed. The water from above percolates through the soil and forms a few puddles on the floor.*

*From there on the ceiling progressively lowers. Imperceptibly, we were obliged to move on our hands and knees: the heat suffocated me[4]; I could no go further. My more agile and lightly dressed companions continued on their way.*

*Retracing my steps, I found a root as large as a finger, attached to the ceiling by very small filaments. It was more than ten feet long, without branches or leaves and appearing never to have had any; it was entire at its two ends. I think it is a plant of a peculiar species. It was filled with a milky juice.*

*I returned therefore to the cave entrance where I sat down to breathe freely. After some time I heard a muffled buzzing, and I saw, by the gleam of the torches carried by the Negroes, our travellers appear in cap, shirt and underpants so dirty and so red that one could take them for characters in an English Tragedy. They were bathed in sweat and smeared with this red earth, on which they had dragged themselves on their stomachs until they could go no further.*

*This cave gets more and more blocked up. It seems to me that it could be made into superb store rooms, by building walls to prevent water from entering it. The Marquis d'Albergati gave me the dimensions that are here, with my notes.[5]*

1. Four kilometres.
2. Grande Rivière Nord-Ouest or Grand River North West.
3. What he refers to as "un gros cordon" later writers have called, more descriptively, a "parapet". It is a low ridge of lava, evidently a remnant of a late, low stage of the flow. Such features are common in Mauritian lava caves.
4. The "suffocation" he experienced was more likely due to an elevated level of carbon dioxide at the end of the tube than an actual increase in temperature.
5. The table which follows here is a modified form, taken from Grant's translation (1801, p.494).

**Table 1.** Grant's translation (1801) of St Pierre's version (1773) of the Marquis d'Albergati's data on the dimensions of the lava cave at Petite Rivière.

| | | | Fathom | Feet |
|---|---|---|---|---|
| The ground is very dry in all this part of it: there are also several chinks which run along the whole breadth; the entrance is east-north-east. | The first vault from the entrance | Height | 3 | 2 |
| | | Breadth | 5 | 0 |
| | | Length | 22 | 0 |
| The subterraneous passage turns to the north-east one quarter east; the ground is dry, and throughout this part is a kind of causeway or parapet about two and a half [feet] high, &c. | The second vault from the first turning | Height | 2 | 5 |
| | | Breadth | 4 | 0 |
| | | Length | 68 | 2 |
| The vault turns to the east-north-east, and two degrees thirty minutes north: at its extremity it has but four feet in height, but it rises again within a few fathoms: it is stony and damp, and some small petrefactions are observable in this part of it. | Third vault from the second bend | Height | 1 | 5 |
| | | Breadth | 2 | 24 |
| | | Length | 8 | 2 |
| The parapets and mouldings continue on the sides; there is also a space of about fifty feet, filled with stones, detached from the vault; the passage continues in a straight line. | Fourth vault | Height | 3 | 0 |
| | | Breadth | 4 | 3 |
| | | Length | 58 | 2 |
| It runs on to the north-west quarter north five degrees west. | Fifth vault, third bend | Height | 1 | 2 |
| | | Breadth | 3 | 0 |
| | | Length | 38 | 2 |
| To the north-west quarter north two degrees thirty minutes. | Sixth vault, fourth bend | Height | 1 | 4 |
| | | Breadth | 3 | 3 |
| | | Length | 15 | 0 |
| To the west quarter north two degrees thirty minutes. | Seventh vault, fifth bend | Height | 1 | 4 |
| | | Breadth | 2 | 4 |
| | | Length | 26 | 4 |
| To the west quarter south-west two degrees thirty minutes | Eighth vault, sixth bend | Height | 1 | 5 |
| | | Breadth | 3 | 0 |
| | | Length | 15 | 0 |
| To the north-west quarter north two degrees thirty minutes north. | Ninth vault, seventh bend | Height | 1 | 1 |
| | | Breadth | 5 | 0 |
| | | Length | 28 | 2 |
| M. de St. Pierre penetrated no father. | | | | |
| To the north-west three degrees thirty minutes west, you are obliged, for one-third of this vault, to crawl upon the belly; it was formerly of easier access. | Tenth vault, eighth bend | Height | 2 | 0 |
| | | Breadth | 3 | 0 |
| | | Length | 16 | 4 |
| At the end there are some moist places: and the vault threatens ruin in two or three parts. | Eleventh vault | Height | 0 | 2 |
| | | Breadth | 1 | 4 |
| | | Length | 6 | 0 |
| | The whole length | | *342* | *2*[a] |

a. While Grant translates 'pieds' as 'feet' and 'toif' (toise) as 'fathom', in fact a French foot is about 33 cm whereas an English foot is 30.48 cm and a fathom (6 English feet) is 1.82 m, while a toise is 1.949 m. Therefore the total length according to Albergati is 667.2 m. A survey in 1991 (Billon *et al.* 1991) indicated a length of 665 metres, born out by my own survey (Middleton 1994), showing Albergati was remarkably accurate and making this the longest cave known in Mauritius.

These data are sufficiently detailed to give a good idea of the cave and could have allowed a map of sorts to have been prepared. I have been unable to find any evidence that one was. Fortunately St Pierre's suggestion that the cave could be converted to a store by building walls to stop the seepage water was not taken up.

## Grant (1801)

In 1801 Charles Grant published a "History of Mauritius" comprised largely of papers and memoirs prepared or collected by his father, Baron Grant. In chapter III Grant strings together a series of observations which, in his view, "seem to contradict the opinion of volcanoes in the island" (Grant 1801, p. 82). Among these detailed observations is the statement

> *In fact, at the mouth of this same river* [Rivière du Rempart], *at the distance of two or three leagues, there are several caverns of great depth. A great part of the road which leads from the river of the rampart to Flacq, is formed on beds of rocks: in some places it appears to be hollow, and resounds upon the horses' feet.*

The "caverns of great depth" are most probably those beneath the Plaine des Roches, just south of Rivière du

Rempart. In fact it appears that this area of relatively recent lava flows (as recent as 26,000 years ago (Antoine 1983)) may well contain the most extensive series of lava tubes in Mauritius.

Continuing his case against a volcanic origin for the island, Grant states (p. 82):

> *Volcanoes never fail to leave traces of their ravaging power; such as calcined and melted stones, pumice stones, lavas, cinders, &c.; but none of them are to be seen in the Isle of France. The mountains are in general indented with points like the comb of a cock. Those which are flat on the summits, present the appearance of a pavement, and no signs of a funnel are to be seen in any part.*

Despite his many detailed and carefully recorded observations, Grant was entirely incorrect in his interpretations and such statements as "no signs of a funnel [presumably he is referring to a volcanic vent] are to be seen in any part" are simply wrong. Evidently the lava caves were cited by others as proof of volcanic activity; he didn't see it that way (p. 83):

> *As a last resource, the partizans of volcanoes throw themselves into the caverns[1], which they insist have been the mouths of the volcanoes that have produced the present appearance of the island; but, on visiting them, they seem to be nothing more than quarries of stone, originally resting upon earth, which has abandoned them. They now sustain themselves like vaults formed by human labour; and the proof is, that all these quarries are situated on gentle declivities. Some of them are to be seen on the plains of Willems, &c.*

Taken literally, this appears to be suggesting that the lava caves were quarries and thus cut by human hands, yet Grant does not suggest whose labour was involved, nor does he seem concerned at the awful difficulties such an enterprise would have entailed. He admits of only one tiny problem with his theory: the 'parapets' or mouldings which run along the walls of many of the caves (remnants of the last stages of molten lava to flow through them) but he does not make clear why these pose a difficulty for him (pp. 83-4):

> *The most difficult circumstance to explain in these quarries are the parapets that crown them, which are of equal breadth and height; particularly on the cavern of Piton de la Decouverte[2], in the plantation of the late M. Le Juge, first in rank in the supreme council. Immediately before the entrance of it, there is a kind of cylindrical opening, about twenty paces diameter, and worked in the rock like the coating of a well. The hole may be twelve feet in depth, and its stones are whole and entire, a proof that they have not suffered the operation of fire: the descent into this hole is by an easy declivity, which consists of a rude mass of rocks and earth, and immediately faces the entrance of the cavern, from whence the same declivity passes under a kind of arcade, and descends eight or ten feet. A large cavern succeeds, from seventy to eighty paces wide, and from twelve to fifteen feet in height. It presents a fine vault formed with free stones of an enormous size, through which the water filters in every part: the ground, that is of black hue, is consequently soft: and the drops of water, which mark the place where they fall by a small hole, lose themselves in the earth. Though the ground possesses sufficient consistency to bear a man, a stick of five feet long may every where be plunged into it with the greatest facility. There is a small hole at the extremity, through which it would be impossible to pass without the assistance of the creeping plants and shrub-wood which grow about it: by clinging to them, a person may draw himself through it. Through the greater part of this cavern there is, on both sides of it, a parapet wall, that rather inclines from its perpendicular, and is from three to four feet in height. This cavern must have been formed by a sinking of the ground, and probably has been deeper than it is at present, as the rains which enter it, always bring something with them.*
>
> *These parapets are the more remarkable in the caverns, as the mountains themselves appear also to possess them. On examining the bottom of the river Lataniers, near the plantation of the priests, which is among the mountains, it is perceptible that these steps, or parapets, rise from the bottom of the river up the mountains, and extend along the chain of them.*

The transfer of the 'parapets' from the caves to the mountains seems to be another example of Grant's distorted view of things.

In the latter part of the book (chapter 28) he includes a translation of Bernardin de St. Pierre's description of the Petite Rivière lava cave and the table reproduced above. The translation is not always literal, omits some sentences and contains errors (I hope mine is an improvement).

## Bailly (1802)

Pitot (1914) notes that a French geologist, Bailly, visited two lava caves at Flacq and one at Petite Rivière in 1802. While Pitot included an English translation of Bailly, Milbert (1812) quoted Bailly's original "notes on the geology of Ile-de-France" (in French) with, he says, Bailly's permission. I have not been able to locate any publication by Bailly himself but offer this translation of Milbert's quotes:

> *In different parts of Ile-de-France caverns or subterranean cavities are to be seen which extend under the ground, of little depth, but which are sometimes of great length. I have visited two of these, one in the region of Flacq and the other in the part of the island which is beyond the Grande Rivière. Here are my observations[3]: the entrance is situated in land with a gentle slope, in the middle of a wood; this opening appears to have been produced by a sinking of the roof, which seemed to me to not be more than four or five feet thick in this place. This rock fall must have blocked up the continuation of the cave which I believe ought to continue on the opposite side from where one can see it,[4] and to head towards the crown of a small hillock which is a little further off. Entering this cave one notices that it has the shape of a semi-circle, of which the diameter is the base. Its walls are composed of a compact lava, blackish, and with small irregular cavities; here one also sees crystals of peridot. All*

1. Presumably he means figuratively!

2. Unfortunately I do not know the whereabouts of this cave, though caves are known in the region of Nouvelle Decouverte.

3. On the Petite Rivière cave.

4. An original and correct suggestion, taken up later by Pike, below.

*those who have visited this cave have spoken of a sort of cornice which one observes at a height of three or four feet on the walls on both sides of the cave; this cornice, which corresponds exactly on both sides, appeared to me to be of a different nature from the rock to which it adheres. Its colour is grey, its texture is crumbly and granular, and it resembles dried mud; it appears to me to have been part of a [lava] flow from an eruption which made its way through this cave, where it ran out. This mark is due to a part of the flow which, adhering to the walls, dried and solidified at the points where it was in contact with the rock which formed the sides of the cave.*

*The cave soil, which is very muddy, and which always slopes down to the sea, is comprised only of the earth that the rains have carried along, and that the water which percolates from the roof continually thins out.*

*The other cave which I have visited, in the region of Flacq, is rather similar to the first, except that the bottom is full of water which has filtered through the rocks. This water supplies all the neighbouring houses, which have no other. Travelling through the neighbourhood, one sees a large number of places where the land has subsided, and where one sees hollows which extend under the soil. I do not doubt that they relate to other caves, and that there are also a large number of them in the country that I have not had occasion to see.*

*While I was in the Flacq region I noticed a flow of black, dense lava which has had to advance through a forest. Indeed, everywhere one sees holes of cylindrical shape, on the surface of which one notices the form of bark moulded in relief, which makes it very recognisable. I have seen some in which one still finds encrusted fragments of carbon which are undoubtedly the remains of trees which have been destroyed in this fashion. It is probable that the lava flow had already for the most part cooled at the time when it crossed this forest, and that its passage was quiet, otherwise it would have burnt and spoilt everything in its way, without leaving any trace of the forest which existed there previously.*

The caves here referred to are most probably some of those on Plaine des Roches, immediately south of Rivière du Rempart. Some of the caves do have water in them and there are no surface streams. One of the caves is still used for washing clothes but the water is unlikely, today, to be fit for drinking.

## Milbert (1812)

J. Milbert, in his *Voyage pittoresque à l'Isle de France* (1812) appears to have added little original, mainly quoting Saint-Pierre and Bailly. However, in introducing the subject of caves (p.358), he says:

*In various parts of the island one comes across caverns or natural caves, some of which are remarkable for their more or less picturesque appearance, and others for their size. We are going to give the dimensions of the biggest of all; it is located near the Pointe aux Caves, and is surrounded by various other smaller ones*[1]*. It is because of this situation that the point of which we just spoke takes its name*[2]*.*

*M. Bernardin de Saint-Pierre has given in this respect very accurate information. As a consequence we are going to extract the following from his "Voyage à l'Ile-de-France".*

Here follows a simplified version of the table set out above, not acknowledging the original source as the Marquis d'Albergati.

Milbert's chapter IV, entitled Geological Details, begins on p. 92 with an acknowledgment that it entirely derives from Bailly's notes on the geology of the island.

## Flinders (1814)

Following his circumnavigation of Australia (1801-03), Matthew Flinders sailed for England, intending to call at the Cape of Good Hope, but his ship started leaking and he stopped at Mauritius to repair it on 15th December 1803 (Ly-Tio-Fane Pineo 1988:67). Unfortunately France was then at war with England, so Flinders was detained by the French Governor of Mauritius, Decaen. He was held at various locations and was later allowed freedom to travel within specified limits. While staying at "The Refuge", a couple of miles south-east of Trois Mamelles, he made a number of journeys on which he carefully observed the countryside. Of the crater lake, Grand Bassin, he wrote (Flinders 1814: 428-429):

*The elevated bank round the Grand Bassin consists partly of stones thrown loosely together; though porous, the stone is heavy and hard, of a dark grey colour and contains numerous specks of what seemed to be feldt spath, with sometimes particles of mica and olivine; it is more or less ferruginous, gives a bell-like sound when struck, and in some parts appeared to have run in the manner of lava. From this description and the circular form and elevated position of this basin, the geologist will probably be induced to think it the crater of an ancient volcano; and since there are other large holes nearly similar to it, and many caverns and streams underground in other parts, it may perhaps be concluded that if the island does not owe its origin to subterraneous fire, it has yet been subject to volcanic eruption and that the Grand Bassin was one of the vents.*

He seems to be reluctant to categorically state that the feature is volcanic. Perhaps Grant's views still had some influence and Flinders was reluctant to oppose them directly. Subsequently he visited some caves (now known as Trois Cavernes) on the coastal plain below his residence and recounts an interesting story (1814: 450-452):

*Upon a plantation in the Plains of St. Pierre, about one mile from the foot of the Montagne du Rempart, are some caverns which M. Curtat procured me the means of examining. In the entrance of one is a perpetual spring*[3]*, from which a stream takes its course under ground, in a vaulted passage; M. Ducas, the proprietor of the plantation, said he had traced it upon a raft, by the light of flambeaux, more than half a mile without finding its issue*[4]*; but he supposed it to be in a small lake near the sea side. The other caverns had evidently been connected with the first, until the roof gave way in two places and*

1. This is probably supposition by Milbert, as these "various others" are not known today.

2. This appears to be further supposition; the cave to which he refers is about 4 km from Point aux Caves.

3. There is no longer a spring, even after heavy rain, but the cave clearly takes water, and an old stone water tank has been constructed above it, evidently to hold water once pumped from the cave.

*separated them. The middle portion has a lofty arch, and might be formed into two spaceous apartments; its length is not many fathoms, but the third portion, though less spaceous, runs in a winding course of several hundred yards. From being unprovided with torches we did not pass the whole length of this third cavern; but at the two extremities, and as far within as could be distinguished, the roof admitted of standing upright, and the breadth was eight or ten yards from side to side.*

*About thirty years before, this part of the Plains de St Piérre had been covered with wood, and the caves inhabited by a set of maroon negroes[1], whose depredations and murders spread consternation in the neighbourhood. Their main retreat in the third cavern was discovered by a man whom they had left for dead; but having watched them in their haunt, he gave information to the officers of justice, and troops were sent to take them. After securing the further outlet, the soldiers crept to the principal entrance, near which the maroons kept a sentinel with loaded musket in the top of a tree; he was found nodding on his post, and having shot him they rushed in a body to the mouth of the cavern. The poor wretches within started from their beds, for they slept in the day time, and flew to arms; a skirmish ensued, in which another of them was killed and two soldiers wounded; but at length, finding their retreat cut off, the sentinel, who happened to be their captain and chief instigator, killed, and the force opposed to them too great to overcome, they yielded themselves prisoners to the number of fifty-one; and were marched off, with their hands tied, to head quarters, to the great joy of the district. Besides arms and a small quantity of ammunition there was little else found in the cavern than a bag of dollars, a case of wine, some pieces of cloth, a slaughtered goat, and a small provision of maize, not more than enough for one day. The skull of their captain, who was said to be possessed of much cunning and audacity, was at this time lying upon a stone at the entrance to the cavern; and for narrowness of front and large extent at the back part of the head, was the most singularly formed cranium I ever saw. Little oblong enclosures, formed with small stones by the sides of the cavern, once the sleeping places of the wretches, also existed, nearly in the state they had been left[2]; owing apparently to the superstition of the black and the policy and disgust of the white visitants to these excavations.*

*The stone here is mostly of an iron-grey colour, heavy, and porous; and there were marks upon the sides of the middle cavern which might have arisen either from a sulphureous substance yielded by the stone when in a state of ignition, or from an impregnated water draining through the roof during a succession of time; upon the whole, though it seemed probable that these caverns owe their origin to the same cause as the subterraneous canal at Ménil, the marks of fire in them were neither distinct nor unequivocal. The position of these long, winding excavations, in a country nearly level and of small elevation, appeared to be the most extraordinary circumstance attending them; but in this island they are commonly so situate, particularly that remarkable one, of which a detailed account is given in Grant's* History of Mauritius *from M. de St. Pierre.*

Flinders was eventually released by Decaen in 1810. He immediately returned to England but was in ill-health from his confinement and died in 1814, the year his journal was published.

## Clark (1859)

George Clark was a schoolteacher in Mahebourg. His "Ramble Round Mauritius", being his observations on the industry and natural history of the island in 1858 was published in the *Mauritius Almanach* of 1859. Because of its rarity, Clark's paper was reprinted in two parts in the *Revue Agricole* in 1945. The following extracts are from the reprint.

*On the Eastern side of "Plaine des Roches" is the estate called "Roche Noire", from a remarkable black rock, which gives its name to a point at its extremity. ... Under this estate are several extensive caverns, through which flow rivers of fresh water, always cool and limpid. Before reaching the sea, this passes through a large hollow in the rocks, on the shore, where its remarkable clearness must strike everyone who sees it[3]. These caverns are the resort of vast numbers of the Esculent Swallow[4]; and an attempt was made many years ago to turn their nests to profit; but it was found that it would not pay to employ hired labour for collecting them, and I believe from that time the birds have been left unmolested.* [p. 38]

Sadly, Clark's optimism regarding the cave swiftlet was unwarranted; its nests continue to be destroyed to this day, some say for making birds-nest soup but probably much of the destruction is pure vandalism.

*This part of the district is called "Petite Rivière" and extends from the third to the seventh mile along both sides of the road.*

*There are some caverns well worth visiting in this district, but they were so accurately described in Bolton's last Almanach that they only require a passing mention here.* [p. 97]

*To the west of the road lies the celebrated "Trou au Cerf", and about two miles beyond Curepipe, opposite a police station, is a spot called "L'Eau Coulée". On both sides of the road are flat masses of rock and on the right runs a brawling brook beyond which is a long low cavern through which a subterranean river, the water of which I believe is always cool and clear, and forms a delightful spot for a bath. The cavern itself offers nothing remarkable. The sound given in passing over*

4. There is no evidence that there was ever a stream of such size in this cave and it is only accessible for about 20 metres. It has taken a lot of slit in recent years but is never likely to have attained the reported length.

1. i.e. escaped slaves.

2. Examination of the cave on 10.4.94 revealed that four or five lines of stones fitting this description still run out from the walls at the back of the main chamber of the "third cave", some 214 years after the events described by Flinders.

3. This submarine rising still exists, though overgrown and difficult to find; the water is *still* remarkably clear, especially considering the large number of people now inhabiting its catchment.

4. He is, of course, referring to the Mascarene cave swiftlet, *Collocalia francica.*

*several spots in the immediate neighbourhood of this, indicates the existence of other cavities, which have not been laid open.* [pp. 109-110]

## Pike (1873)

Nicholas Pike (Fig. 2) was the United States' Consul in Mauritius between 1867 and at least 1873. He was an inveterate traveller and recorded his observations and impressions on many subjects in great detail. His book is regarded as "one of the most informative and comprehensive books ever written about Mauritius"—Hollingworth. He took a particular interest in flora, fauna and geology, though some of his ideas on the latter are highly original. He seems to have taken advantage of any opportunity to enter a cave. Of Pointe aux Caves and Petite Rivière caves he says (pp. 287-291):

*As the name of this place [Point aux Caves] imports, there is a large cavern, which can be entered on foot at low water; but it being then high tide, we were obliged to take a small boat. We found a number of the edible swallows'-nests and their eggs (the* Collocalia francica*). I was soon satisfied this was only an entrance to the caverns running up to Petite Rivière*[1]*. I had visited them once before and knew their locality, so proposed to my friends to proceed thither after breakfast. We put some lunch in our vasculums, and set off through a wild uncultivated tract, with here and there a few scraggy Bois noir-trees. We reached a Chinaman's shop, and provided ourselves with candles, and went on to the entrance to the cave, which is close to the railway station. The position is marked by clumps of aloes which grow directly over it.*

*Large loose rocks and stones lie all round the entrance to this cavern, which is of very remarkable formation.*

*Pretty little lizards (*Platydactylus cepedianus*) flit about in all directions, and soon after we entered the first cave we saw innumerable eggs of this lively animal in groups of threes; but it was difficult to detach them from the rocks on account of their fragility.*

*Cave No. 1 is about thirty feet wide and twenty feet high, and visitors' names are carved all over it. Rude walking-sticks were lying on the ground, left by former explorers, of which we availed ourselves. We each lit a candle and proceeded to examine this cave.*

*The bottom is of fine earth, but hard, smooth and dry as a macadamised road, and there is no perceptible dampness on the sides. It is of an elliptical form, and has at first sight the appearance of being the work of man*[2]*. Numerous cracks and fissures are visible. Small incrustations in the form of icicles cover the vault, and fall and crumble at the touch. They are composed of degraded rock and oxyde of iron, and formed by the water percolating through the porous formation overhead.*

*Figure 2 Nicholas Pike, US Consul and amateur naturalist [from frontispiece, Pike 1873].*

*On each side of this cavern, more perceptibly at the entrance, there is a series of mouldings about two feet from the bottom, which extends its entire length*[3]*. The roundings and polish of surface of these beadings were probably formed by the water being charged with carbonic acid gas, which is frequently disengaged through fissures in the earth, particularly after earthquakes or great volcanic eruptions.*

*We explored cave after cave*[4] *till we came to an aperture so narrow that we had to pass on our hands and knees, and there we stopped; but I had seen enough to convince me that, though now blocked up, they once extended to the one that has its outlet at the Point aux Caves*[5]*.*

*There is a perceptible slope downwards nearly the whole length of the caverns. We did not find any inconvenience from the heat mentioned by former explorers*[6]*, though we remained in one of the inner chambers nearly two hours.*

*For the Dimensions of the different divisions I will*

1. Yet he gives no details of the 'large cavern'. While there are a few small sea caves at this point, searches in 1991 by Billon *et al.*, and in 1993/94 by the author and members of the Spéléo-Club de l'Océan Indien have failed to find any cave at this location with even a vague possibility of a connection to an inland lava cave.

2. Is this rather silly comment included out of respect for Baron Grant who had seriously promoted so ridiculous a suggestion?

3. As noted by most earlier observers, however Pike goes on to give an imaginative but totally incorrect explanation for the 'mouldings'.

4. Modern terminology might render this less ambiguously "chamber after chamber", although being a lava tube of fairly uniform cross section the passage is only divided by occasional bends.

5. Pike seems to have been easily convinced; the passage does contain mud (no doubt a lot more now than in the 1870s) but the dimensions of the passage itself are shrinking to such a stage (less than 1m x 1m) that the idea of the cave ever having continued another 4 km is quite ludicrous. A group of French speleologists visiting the island in 1991 went to some lengths to debunk this unlikely tale by exploring the cave and examining the sea cliffs. They satisfied themselves that no such connection has ever existed (Billon *et al.* 1991; Marimootoo 1994).

6. This is clearly a reference to St. Pierre, as translated by Grant.

*give an extract from Baron Grant's work[1], which on this point I find more accurate than some others I have seen[2]:— 'The second vault turns NE quarter E, is 17 feet high and 21 feet broad, 110 long, ground dry, with a kind of causeway 2 1/2 feet high. The third vault turns ENE at one end, is only 4 feet high, but rises to 12 feet; it is 24 feet broad by 250 long; ground moist and damp, and contains small petrifactions. The fourth, 18 feet high, 27 broad, and 350 long; parapets on the sides. The fifth is 8 feet high, 18 broad, and 230 long; runs NW. The sixth, 10 feet high, 20 broad, and 90 long. The seventh runs W, 10 feet high, 16 broad, and 220 long. The eighth runs WSW, 16 feet high, 18 broad, and 90 long. The ninth runs SW, 7 feet high, 30 broad and 170 long. The tenth, 12 feet high, 18 broad, and 96 long, runs NW: part of this vault has to be crawled through. The eleventh, 2 feet high, 10 broad, 36 long: ground moist and vault in ruins.'*

*We found the curious plant that Baron Grant mentions 'as a singular plant full of milky juice, root thick as a finger, and ten feet long, without branches.' There is no appearance of leaf or bud on it, the extremities are entire, and it is not uncommonly found in such places.[3]*

*As we returned to the mouth of the cavern, my impression was that this entrance had been formed by the falling in of part of the vaulted roof, as the large detached rocks proved. In all probability an opening could be found to a much larger cavern directly opposite,[4] this one lying in a SE direction, and would be found to ramify with others extending over the whole island. I examined about 1,000 feet beyond the caves by removing the soil and tapping the rock with an iron crow-bar, and could follow what I conceive to be the continuation of them by the hollow sound produced. It appears to me there is reason to believe that this was, ages ago, the course of a subterranean river[5]. We know for a fact that during earthquakes rivers as well as lakes disappear underground, some times continuously, the water flowing through internal cracks, similar to those produced on the surface, which form canals for its passage.*

*This phenomenon is sometimes coincident with the appearance of some abundant spring in a more or less distant place; but it often happens also that the water nowhere re-appears, and we must conclude it runs directly to the sea. This is not at all impossible in this case, when we remember the convulsions the whole island has undergone. Some river may have been swallowed up by the earth, after a superficial course of more or less extent, which forced its way through a subterranean canal, til some fresh upheaval turned aside its course, leaving the now empty caverns.*

*We have proofs of one subterranean river which makes its appearance on the south-west coast, where a considerable body of fresh water is forced up through the salt water that washes the shore at Savane. There is also one on the property of M. Ducasse, where there are two remarkable caves, not far from these mentioned above[6]. I have not seen them, but will give a slight description of them, as I have heard it. One of them is still traversed by a subterranean stream.*

*The other has two large dry chambers, one nearly fifty feet square, where it was said the festive board was often spread by its former hospitable proprietor. Such scenes have long passed away, and it now contains the tomb of the once generous Amphitryon[7]. This tomb is of massive masonry, similar to an alter, on which, on the anniversary of his death, the friends and relatives place flowers and lighted candles, and pray for the repose of his soul. After passing this large cave, it is not possible to penetrate for more than thirty or forty feet. I do not doubt that all these caverns were formerly part of a continuous chain, extending at least through this whole district.[8]*

*The railway crosses one part of these caverns[9], and as we left them we stopped at the station of Petite Rivière for a rest. Master and men expressed their surprise that we should have ventured so far into the 'womb of the earth,' as they termed it. Nothing would have induced them to face its dangers. Strange noises were heard there at night and they were sure it was the abode of evil spirits. One of the Malabars[10] at the depôt had beheld dread things only a week before. A tall pale woman, dressed in white, was seen, with two villainous-looking men following her with axes in their hands, and calling out 'La Mort, la mort, la mort aux blancs' Oftentimes music was heard, to which they listened for hours; and this was supposed to be the echo of the military band at Bourbon* [Réunion], *as it was well known the cavern passed all the way under the sea to that*

1. As indicated above (see Grant), these data derive from the Marquis d'Albergati, via Saint Pierre, and are not "Grant's work".
2. It's a shame he didn't cite these. The others *I* have seen all derive from the same source (d'Albergati).
3. These plants are quite common in the interior of caverns in Virginia, and one of a different species I found, some years ago, whilst on an exploring expedition through the great Croton Aqueduct, New York - NP.
4. This may be Pike's idea, or he may be parroting Bailly who appears first to have drawn attention to this possibility. Roger Safford was actually told by a local in 1991 that there had been another section of this cave but that its entrance had been deliberately filled in. The more recent story may be derived from the earlier; it seems unlikely, if there had been another cave, that it would have been filled in deliberately by Pike's day.
5. It doesn't appear to have occurred to him that it was a 'river' of lava, although the true origin was understood by Bailly at least as early as 1802.
6. These caves are at Trois Cavernes, near the turnoff to Flic en Flac; the same caves as were described by Flinders (1814).
7. No such tomb is evident in 1994.
8. While chains of lava tubes certainly exist, Pike is drawing a very long bow in suggesting that all the caves in the district were once joined.
9. The cave referred to is at Petite Rivière; the railway was removed in the 1960s.
10. A term for an indentured Indian labourer, many of whom came from the Malabar coast; today it is not considered a polite term but a form of it persists in the local patois, Creole.

*Figure 3 Pont Naturel, a double-arched natural bridge [from Pike 1873]*

*island![1] I did not hear, however, of any one who had explored so far. All sorts of stories were told us, to which of course we listened with becoming gravity.*

Later (p. 322) Pike described the double-arched natural bridge on the south coast (Fig. 3):

*At a little distance along the coast [from Le Souffleur, the Rock Spout] is another curious monument to the work of the ocean, the 'Pont Naturel,' as it is called. It resembles a real bridge, with a pile and two arches, through which the sea swirls and rushes with the greatest impetuosity. The formidable chasm is daily widening, the foaming billows breaking against the rocks, and the arches are being gradually undermined, so that some future cyclone will cause their total disappearance.*[2]

Pike also visited Ile d'Ambre where he described an interesting feature (pp. 341-342):

*Amber Island is composed of volcanic rock and lava, and was formed by an immense flow in this direction from the interior of Mauritius, as well as a flow from a large volcano now submerged, lying in a NE direction ... ... The whole place swarms with rabbits, and some of the party started off shooting, and some, with myself, went to examine a curious hole in the centre of the island*[3]*. I had previously made up my mind to enter it, so had provided myself with a good stout rope, and one of our party and two of the servants accompanied me on the descent.*

*This opening is circular, about one hundred feet in diameter, and about twenty-five feet deep, containing water.*

*On the south side there is a dry place, and on this we intended to land. The side of this hole is rough and perpendicular, not a spot on which to rest a foot, and looks as if cut by hand. We fixed a rope to some bushes, and down we went hand over hand to the bottom.*

*A species of fern, the* Acrostichum aureum, *was growing just where we landed, and on its fronds I captured a singular spider* (Tetragnatha pretensa), *then quite new to me. We disturbed a number of rats and crabs: and in the deepest water were mullets, many of them I should think over two pounds' weight.*

*The water was brackish, and rose and fell with the tides though at least half a mile from the sea. This opening has probably been formed by the falling in if the walls of a cavern, which traverses the whole of Amber Island. The masses of rock heaped up have choked any communication with either side, although not sufficient to arrest the flow of water. At some distance are several caverns opening into the sea, but I had not time to visit any of them. Near the landing-place Mr de Chazal showed me a fissure in the rocks, a few inches wide, extending some hundreds of yards, and which he said was the top of a cavern containing water. We could hear its splash as we flung stones down the opening.*

Pike, though certainly a fine naturalist, either wouldn't accept the geologists' explanations for the formation of lava caves or hadn't read them. The latter is highly unlikely, yet he didn't try to refute them. He seems to have been the last of the part-informed amateurs. After him the descriptions and explanations, when they are given, are strictly orthodox – more or less in accordance with the modern geological view.

## Haig (1895, 1898)

Major H. de Haga Haig was a British officer stationed for a time on Mauritius. In April 1895 he presented a comprehensive paper *The physical features and geology of Mauritius* to the Geological Society in London and in

1. Réunion and Mauritius are about 220 km apart; even Pike doesn't seem to believe this one.
2. Fortunately, not yet (1994).
3. Now known as Trou Anglais ('English Hole').

1898 had an account published of his near-drowning in a Mauritian lava cave.

Haig (1898, pp. 464-465) mentions the craters noted by others: Grand Bassin, Bassin Blanc, Trou aux Cerfs and Trou Kanaka, but adds others including 'Ravenala Crater' (his own name for an unnamed crater containing many travellers palms), Grand Trou North and Caves Crater[1]. Haig (1898, p.466) makes numerous references to caves, particularly:

> *At Vacoas there are a number of caves of no great extent, but many of them contain water, often affording the only supply of that necessary of life ... Not far away is one of the most striking examples of a river flowing some distance underground, at a spot called l'Eau Coulée. It is about 2 miles from Curepipe, on the Port Louis road. Within a stone's-throw of the highway on the right, runs a main tributary of the Grand river N.W., at this point the size of a fair trout stream, in a shallow wooded gully. It enters a cavern through the centre of a lava-flow, high enough to walk into. The roof is broken through in four more places lower down, at one of which another stream comes in from another cave; and, finally, a hundred yards or so away there is a deep pool in which the water can be seen welling up, carrying sticks and leaves with it, and thence it flows off over a rocky course into a ravine. It appears strange that another stream should rise close to the mouth of the cavern, run within 10 feet of the river in the cavern, and then diverge and disappear amongst the rocks, probably feeding the tributary stream in the cavern. It is a fact worth noting that one of the openings in the roof of the cavern was 'burst up' by the water, during the hurricane in February 1876, and this probably furnishes a clue for the explanation of the fact that so many of the caves amongst the lava-flows are broken through[2].*
>
> *At a place called Petite Rivière, there is a beautifully perfect cave, like a railway-tunnel in solid lava, with ledges of the same a few feet above the ground, running along the sides. The cave is about 30 feet high and the same wide, with an arched roof. The writer followed this cavern for 1¡ mile[3], until he found it nearly filled up by detritus brought in by a stream, whose bed was well-marked. A current of air passed through downwards, and, as on the coast 3 miles away there are lava-cliffs full of caves, it seems probable that this cavern communicates with some of them[4].*
>
> *It is difficult to account for the origin of caves of this description; probably they are formed somewhat in this manner:— A slowly flowing lava-stream descends a gentle slope; it reaches a steeper descent and its flow is accelerated; the centre, the most liquid part, is drawn out, leaving the cooled and hardened roof and sides, its place being taken by steam and other gases given off by molten lava. The bubbly lava-drops from the roof and on the walls would thus be explained, and the ledges would represent levels at which the lava stood longer than usual. Or these caves might be caused by the molten centres of lava-streams flowing on after the supply from the craters had ceased, and thus leaving hollows behind them. In the Petite Rivière cavern there are seven ledges distinguishable, all very scoriaceous. The upper one is covered with layers of lava which appear to have trickled down the walls. This theory explains why the roof, sides, and floor are all in one mass of solid rock, which it would be difficult otherwise to account for.*

He also describes the Souffleur blow hole and the double-arched Pont Naturel on the south coast, which he says (1898, p. 467) has:

> *... two spans of about 25 feet each, and supported in the middle by a natural pillar 30 feet high. This has been caused by the roofs of two contiguous caverns being broken through, leaving a narrow piece of their roofs standing, supported on part of the original division between them. The sea roars through the bridge and into the cavern beyond, sending up clouds of spray, and slowly but surely eating away the supports.*

Referring to the Flacq region, he suggests 'this extensive tract of lava-flows' has 'issued from the craters of Macchabée, Baisse, Grand Trou North, and the Caves' (Haig, 1895, p. 467). He continues:

> *The lower part of these lava-flows, called the Plaine des Roches, is nearly flat ... These lava-flows are full of caves and steam-holes; one of the latter, called the 'Puits des Hollandais' is worthy of notice. The hole is nearly circular, with a bell-mouth, and about 35 feet across. It is filled with water to within 15 feet of the ground-level. The sides are perfectly vertical and the author found the depth with a sounding-line to be from 82 to 86 feet in different parts[5]. ...*
>
> *In the Plaine des Roches, near Roche Noire, are two caverns containing running water, which formerly was pumped up for irrigation. The upper cavern is in a solid mass of rock; its height is about 40 feet, and width 60 or 70; it divides into two smaller ones, which can be followed for some distance. The roof appears to have been broken into by a later lava-flow, which flowed in an partially filled up one side; in its steep, treacly-looking slope are cracks out of which water wells up into the cavern and runs away down the two small ones it divides into. The other cavern containing a stream of water passes under the road, but cannot be followed far because the fragments broken down from the roof fill up the opening. On the sea-coast close by are a number of inlets, at the end of one of which can be seen the opening of a cave[6]. The water at this end is quite fresh and issues below the surface, from the cave, in a strong stream; the inlet itself appears to have*

1. I have not identified any of these latter three craters.
2. A much simpler explanation, especially considering that few of the caves have streams, is that the roofs collapsed under their own weight.
3. Had he really never seen Albergati's figures of over a hundred years before, showing a length of less than 0.4 mile?
4. The same old Pointe-aux-Caves-connection! and, earlier, reference to the same old 'parapets' or 'mouldings'.
5. This 'pit' or sinkhole is indeed an interesting feature, though it seems now to be unknown to the locals. When visited on 28.5.94, it was heavily overgrown and difficult to find. It was filled to the surface with clear water and contained many large fish. It has been used as a source for water, probably for irrighation, but the pumping station has been abandoned for some years. Diving would be required to determine whether any horizontal passages lead from it.
6. This is the same opening as that noted by Clark (1859).

*been formed by the roof falling in, for it is deep and narrow, with vertical sides.*

*In the upper part of Flacq there is a very strange dry ravine which extends for about 1¡ mile; it is caused by the roof of a cavern falling in, leaving broken vertical walls, in some places as high as 80 feet. Every 200 or 300 yards are pieces of the roof remaining in their original position, and forming natural bridges across the gully. ... This is really one of the strangest natural curiosities in Mauritius ... In the 'Caves' crater (a cluster of seven), from which many of these lava-flows have come, there are five dome-shaped caves, all in solid rock. From their position and structure there can be little doubt that they have been formed by the columns of molten lava, in the craters, sinking and leaving their cooled crusts as roofs ... In one of the small craters there is a little conical hill, down the centre of which is a funnel-shaped hole, 54 feet deep. Probably this was one of the last cones thrown up by the dying volcano...*

*... Ile d'Ambre is composed of lava-beds and has a number of strange circular holes, some of them 100 feet across, 20 or 30 feet deep, with rocky, vertical sides, and partly filled with sea water. They look as if caused by the falling in of roofs of circular caverns, but probably they are only unusually large steam-holes.*

In describing the geology of the island, Haig (1895, p. 469) mentions that the later lavas 'contain more lime than the older lavas, and in their caves stalactites several inches in length are to be found.'

In contrast to the serious scientific tone of his 1895 paper, Haig's 1898 report of his near-drowning is flowery and melodramatic, to the point where its veracity has to be questioned. (It also contains racist and stereotypical comments which today would be unacceptable.) The cave is not named or located and there are few clues to its identity. Haig recounts (1898, p. 389):

*The cavern we were to explore has an evil reputation; it is, of course, haunted, as is every other strange place, to the superstitious negro. In this case the ghost is that of a murdered Chinaman, whose skeleton was long ago found in its depths. It is said to extend beneath the sea to the island of Bourbon, 120 miles distant; also to be the mouth of a volcano, and no one who has ever been far into it has ever come out alive. We had not much faith, however, in these Creole tales, and were determined to see for ourselves.*

*A short drive, and a walk of a mile ... brought us to a cup-like depression, nearly filled with masses of black, cindery lava, piled in confusion. On one side was an opening,* [Fig. 4] *almost the shape and size of a railway tunnel.*

*Figure 4 "On one side was an opening" from Haig 1898*

A guard was left at the entrance to ensure that no one lit a fire there, as he says was a practice of 'the negroes', 'to appease the evil spirits who lived therein'.

*We lighted our candles and put match-boxes into our pockets; then, taking with us a Creole mulatto, François, who was reputed to be very plucky, we clambered into the opening.*

*The roof, floor and sides were all one block of rock, as porous and full of holes as a sponge. The sides were everywhere covered with black, glassy lava drops, which once had trickled down and formed a heap on a curious ledge, running along both sides, a few feet from the floor*[1]*. ...*

*After we had gone about half a mile, a muffled roar became audible, which gradually increased as we approached. ...*[François panicked and ran back towards the entrance, hitting his head and extinguishing his candle.] *Nothing came out of the black opening, and as the rumble died harmlessly away, it occurred to me that it was only the train to Port Louis going over our heads, for the cavern passed under the railway. ...*

*About half a mile in there was a sudden drop in the floor of about four feet; and shortly after that it began to be covered up with gravelly earth. ... and we now saw, from its traces, that a stream evidently flowed through after heavy rains. The earth brought in by this gradually filled up the bottom of the cavern, and the farther we went the more the floor rose to meet the roof.*

*We had gone about two miles when the roof came down so low that we despaired of getting through. ... After this we came to another low piece, which we traversed on hands and knees; and we thought we must be nearing the coast, which here is a high cliff full of caves, for a noise like the beating of waves made itself heard*[2]*. However we came upon another low piece, even worse than the last, and, as it was my turn, I went in with a candle and the*

1. That ledge again!

2. The Pointe-aux-Caves-connection again?

*[geological] hammer and dug away, in the close, stifling air, for some twenty yards, getting through at last by keeping my arms stretched out in front, wriggling on my face like a snake, and forcing myself along by my feet. ...*

After much effort, Haig's companion comes through, but the hapless François gets stuck. Amid much mirth at the man's distress, Haig notices the candle burning dimly, and then it goes out. François, of course, is blamed and in his subtle way the calmly panicking Officer threatens to stab the Negro with a knife if he doesn't get through the hole. Our hero saves the day by dragging the man out. Thoroughly done in by all this activity, they start back, only — shock, horror — to note:

*"What is this? It's wet!" And there, sure enough, was a small trickle of water showing itself on the floor of the cave. He struggled through the opening and shouted to me to be quick, for the rivulet was rapidly increasing in size.*

Things get progressively worse until, having abandoned the long-suffering François at a low point (well, the water *was* edging up their shins), the Officer and his companion find themselves huddled on a ledge as the water continues to rise:

*We clung together, pressed against the wall, and awaited our fate in positive terror in the pitchy blackness. ... It was evident that one of those heavy tropical downpours, like a waterspout, ... had come on and was finding its way into the cave a great deal faster than it could get out. ... Poor François, we thought, must be drowned by now; we were much higher up the cave, and already the water was five feet deep, and if it rose three more we should be done for. Where the unfortunate François was the roof was nowhere four feet above the floor ...*

It gets far too dramatic to reprint in a serious paper but, in brief, just as the water gets so deep it is about to run down their throats, although they are standing on tip-toes, the flood subsides and they are saved! After going back to the entrance they return in a vain effort to find François' body but can find no trace of it and assume it has been washed through a space too small for them to crawl through (!) They return to their starting point, dreading having to tell François' family of his death, only to be greeted by the 'plucky mulatto'. The highly unlikely explanation for this amazing turn of events is that François found 'a dark fissure in the roof into which he was able to squeeze' and which eventually lead to daylight.

Although presented as a narrative, and although a real cave appears to be described, it is difficult to accept this story as factual. The cave in question seems certain to be the well-known Petite Riviére cave (which had a railway crossing it; though there is no known cave two miles long) but it seems inconceivable that it could fill so quickly with water and it certainly doesn't have a concealed access point part way along. On present knowledge there must be serious doubts that this account is entirely accurate, though it may have been based on fact.

## A Postcard (early 1900s)

Early illustrations of Mauritian caves seem to be very rare. In fact the earliest I have been able to locate is on a postcard, bearing the caption 'The Caves in Vacoas' (Fig. 5). The postcard is featured in a recent Mauritian book on the early postcards of the island (Kervern & Martial 1991). It is captioned:

*Near the Church of the Visitation in Vacoas, these caves give the district its name "The Caves". The postcard is circa. 1906.*

The caves that I know of 'in Vacoas' are, in fact, in the adjoining village of La Caverne. Neither of them resemble the cave entrance shown on the postcard which appears much higher than the entrances to the La Caverne caves and, indeed, higher than most lava caves in Mauritius. In fact, the rock shown has a decidedly limestone look about it and there are large stalactites hanging from the roof. The cave featured is possibly one of the limestone caves on Rodrigues, if it is in Mauritius at all!. This post card was printed overseas, probably in France, and it may be that the printer got the caption wrong.

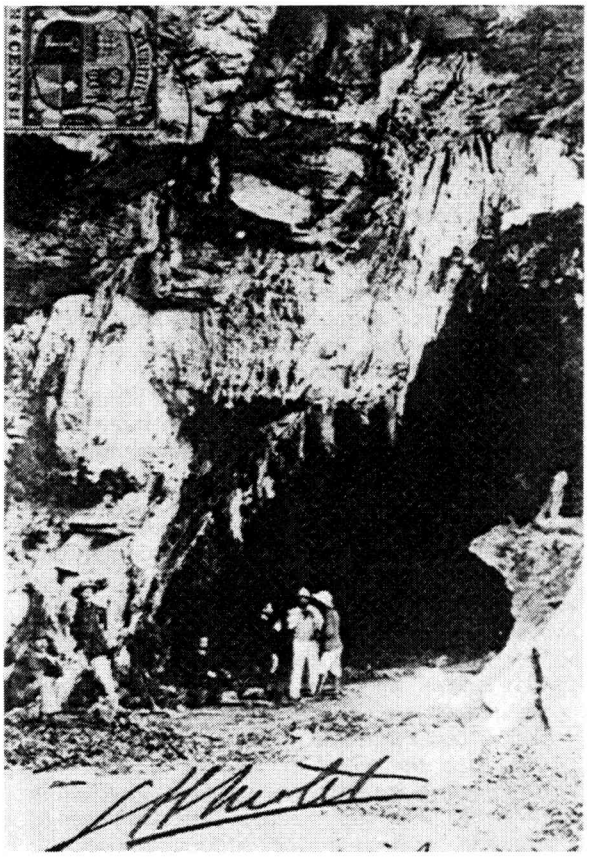

*Figure 5 An early 20th century postcard "The Caves in Vacoas" rephotographed by C.J. Howes FRPS, from the collection of Dr Trevor Shaw*

## Pitot (1914)

Pitot (1914), in describing the geology and topography of Mauritius gives a simple and straightforward description of a lava cave (p. 75):

*In various parts of Mauritius there are caves or subterraneous cavities, at a moderate depth below the ground, which sometimes extend a long way*[1]*. One called* ***Trou Fanchon*** *may be seen at Plaine Magnan* [Magnien], *Grand Port, on the right of the high road from Port Louis to Mahébourg. The entrance to it measurers 20 feet by 40 feet wide. At 100 feet in the interior, among fallen stones, which occasionally drop from the vault, some water filters through its sides.*[2]

Pitot then goes on to quote (in abbreviated translation and with acknowledgment) from Bailly (though he does not acknowledge the apparent intermediary, Milbert

1. These words are strikingly similar to the opening lines of Bailly, as quoted by Milbert (1812, p. 102).

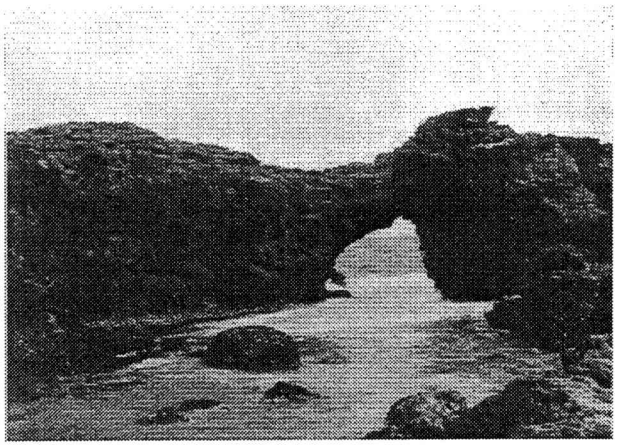

*Figure 6 Pont Naturel—the natural bridge in basalt on the south coast, from MacMillan 1914*

(1812)). He thus correctly interprets the formation of lava caves but he adds, without making it clear that he is no longer quoting Bailly:

> *It is said that this cave has its exit on the sea-shore several miles distant, at Pointe aux Caves; but it is too narrow, in some parts, to allow a man to accomplish the journey through it, even if he crept along on his knees.*

Thus further perpetuating the myth of the Petite Rivière–Pointe aux Caves connection.

Pitot also mentions the double-arched natural bridge, Pont Naturel, on the south coast (p. 81) which is illustrated in the book (Figure 6):

> *... it is a long narrow rocky causeway*[1] *protruding into the sea, and has been hollowed out by the waves in two different places, so as to form two very regular arches separated by a pile.*

Nearby, the blowhole known as the Souffleur must then have been a much more spectacular water spout ("to a height of fully sixty feet") than it is now.

## Cave-dwelling bats

The Abbé de La Caille seems to have been the first traveller to mention small (insectivorous) bats on Mauritius, in 1763, though they were noted on Réunion at least as early as 1703 (Cheke 1987). The present cave-dwelling bats of Mauritius are the free-tailed bat, *Tadarida acetabulosus* and the tomb bat, *Taphozous mauritianus,* the latter being the first insectivorous bat to be described from Mauritius which was later found to be widespread in Africa and other Indian Ocean Islands (Cheke & Dahl 1981).

The extinct fruit bat, *Pteropus subniger* (smaller than the surviving *P. niger),* was interesting in that it had the strange habit (for a fruit bat) of roosting in hollow trees, rock clefts and caves (Cheke 1987). It was last recorded in 1864. With a wingspan of about 600 mm in would surely have been among the biggest of the world's cave-dwelling bats.

It is of interest that the earliest reference in the literature to any *Pteropus* (a genus widespread in Indo-Malaya and Australia but not found in Africa) is an illustration and description of *P. niger* by Clusius in 1603 (Andersen 1912, quoted by Cheke & Dahl 1981, p. 207).

2. This cave lies in a large depression in the middle of the village of Plaine Magnien; at the time of my visit on 15.5.94, however, after a lot of rain in the area, it was filled with water and would have required swimming to enter.

1. Pont Naturel is not, in fact, on a 'long narrow rocky causeway'; it lies along the general line of the coast. The existence of a 'causeway' may be the impression given by Fig. 6 which appears to be a photograph taken from the sea. Perhaps the author had no more knowledge of the site than was derived from the photograph.

*Figure 7 Flaming torches in use in Caverne Patate, Rodrigues, about 1972 from a photo by Alain Nadal*

## The Island of Rodrigues

Discovered by the Portuguese in 1528, Rodrigues was first settled by a group of French Protestants under François Leguat in 1691. Two years later Leguat was arrested by the Dutch and the island was abandoned until the French settled it in 1725. The British took possession in 1809 and used the island as a base for their invasions of Réunion and Mauritius the following year (Ellis 1988).

The limestone caves of Rodrigues achieved a period of fame as the source of bones of the extinct solitaire *(Pezophaps solitarius)*. Bones of the solitaire (which was extinct by 1760) were collected from a cave by a Mr de Forvalle in 1786 and a Mr Labistour in 1789 (North-Coombes 1971). The earliest record is thought to date from the second collection. These found their way to the French naturalist Cuvier in 1831 and interest in them led to further excavations in 1831, 1845, 1864, 1865, 1866, 1874 and 1875. Being mainly scientific expeditions, there are written accounts of most of these as noted by North-Coombes (1971). The largest cave, Caverne Patate, has remained a tourist attraction, though the use of flaming torches fuelled by kerosene (Fig. 7) and the (until recently) uncontrolled removal of speleothems has robbed the cave of most of its natural beauty.

## The Island of Réunion

Mauritius' neighbouring island of Réunion, then known as Ile Bourbon, was settled by the French in 1665. The initial settlement site was in St Paul's Bay in the island's north-west. It seems a cave provided the settlers' first shelter; it has been termed "Grotte des Exiles" (North-Coombes 1983) but is generally known today as Grotte des Premiers Français (Willox 1989), located in a park at the foot of a basalt cliff to the south of the town of St Paul. The cave is barely 20 metres deep and, though about three metres high, it is extremely damp and could not have provided very salubrious living conditions. The settlement was moved to St Denis, the present capital, in 1669 (Addison & Hazareesingh 1984). The cave remains a minor tourist attraction. Lamenting the relative absence of fossil remains on Réunion, North-Coombes (1983) remarks: "such caves or grottoes as exist have long ago been dug up, not by naturalists but by treasure seekers".

## Acknowledgments

I wish to acknowledge the invaluable assistance of Dr Trevor Shaw in tracking down most of the early references to the caves of Mauritius, in providing copies of many of them and in commenting on an early draft of the paper; to Carl Jones and Wendy Strahm for providing access to some of the papers and for encouragement; and to Clement Moutou, President of the Spéléo-Club de l'Océan Indien, for information and assistance in visiting numerous caves on Mauritius. I was greatly assisted in translating the French passages by Mme. Paul-Marie Bolton, to whom my thanks.

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# Cocklebiddy Shells

. . . . Rosemary Brown

Research Associate, The Australian Museum

## Abstract

Five genera of shells were collected from the sediment around Cocklebiddy Cave lake in the Nullarbor Plain. All shells belong to small. modern gastropod terrestrial snails.

Small motile invertebrates live in underground waterways but few have been described from Australia. The primitive syncarid crustacean *Anaspides tasmaniae* has been recorded in Marakoopa Cave (Williams, 1965). A new genus of swimming isopod crustaceans has been collected in a limestone cave pool in the Kimberley region of Western Australia (Wilson and Ponder, 1992). An unusual hydrobiid gastropod mollusc, *Pseudotricula eberhardi* was collected in the caves of Precipitous Bluff, southwestern Tasmania (Ponder, 1992). In Malaya, the archaeogastropod mollusc *Hydrocena monterosatiana* has been collected in the limestone Batu Caves (Berry, 1965).

Most records of cavernicolous infauna have come from central Europe. These include an archiannelid from Swiss grottes, copepod crustaceans from Yugoslavian karstic rivers, amphipod crustaceans from French caves and molluscs associated with underground springs (Delachaux, 1921; Petkovsky, 1935; Baluzuc, 1957; Karaman, 1954, all cited in Delamare Deboutteville, 1960).

In the hope of finding material of similar significance, two litres of soft sediment were scraped from the banks of the lake in Cocklebiddy Cave, at water level, in January 1995. The Cocklebiddy Cave of Western Australia, situated nearly 50 km from the Great Australian Bight, contains the world's longest divable underground waterway (Allum, 1985). The collection site was estimated to be approximately 200 metres from the collapse doline entrance.

A litre of lakewater was taken from the surface of the lake. One litre of the red-brown sediment was preserved in 18% alcohol, and then was flushed through one millimetre nylon mesh, to collect hard taxa. The second litre was diluted with fresh water and a stream of fine air bubbles was passed through it to collect hydrophobic taxa. Then this sample was also preserved in alcohol and sieved.

The bubbling technique produced a small number of diatoms. Small mammal bones formed a minor component of the filtered residue. A femur 13 mm long, a humerus 15 mm long, and mandibles bearing small pointed teeth were consistent with the skeletal structures of the insectivorous bats known to frequent these caves. Small leathery fruits comprised another minor component. These were identified as species of *Halosarcia halocnemoides* (grey samphire) and *Sclerolaena patenticuspis* (spear-fruit copperburr), both members of the family Chenopodiaceae, which includes salt bushes, and *Tetragonia eremaea* (native spinach, warrigal cabbage) of Family Aizoaceae. The major components of the residue were the empty shells of small modern gastropods.

One sample contained a much greater number of shells than the other. Ten mL of mud from the first contained 23 complete shells, and another ten ml of mud from the second contained only four. The pH of the water was neutral (7.05).

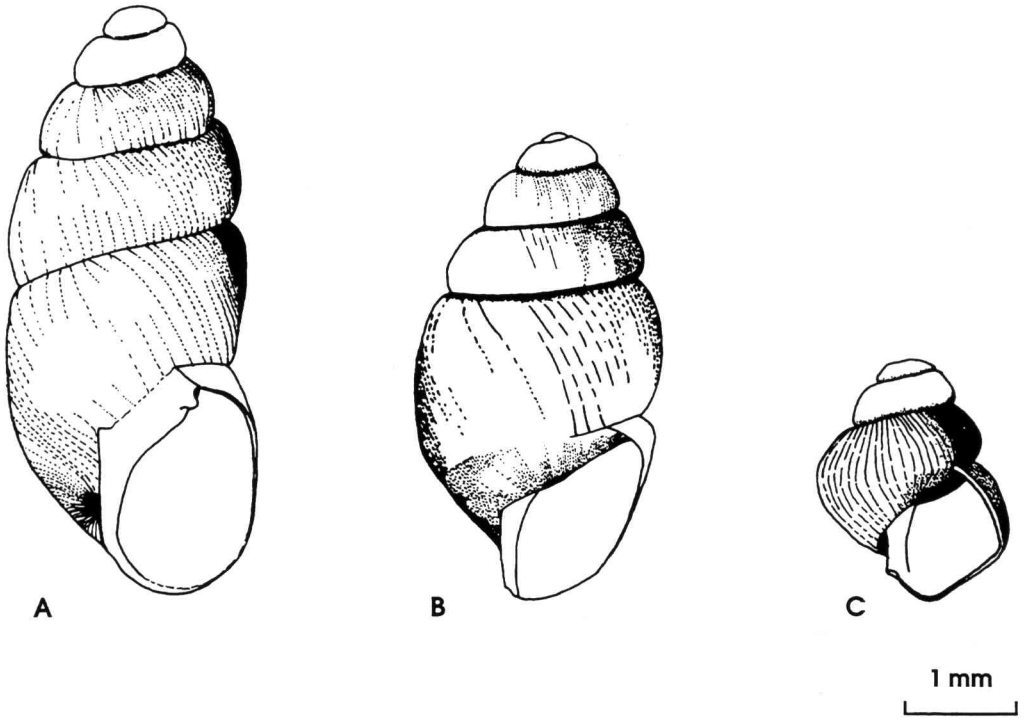
Five genera of shells were identified. Of a total of 569 whole shells extracted from the samples, 56% comprised a species of the planorbid *Gyraulus* and 21% a pupilloid species of *Pupilla*. *Pupoides adelaidae* comprised nearly 8% of the collection. In addition, J1 (3%) and J2 (4%) are possible juveniles of *P. adelaidae*. A member of Family Punctiidae constituted 7% of the whole shells. Less than 1% (four shells) resembled *P. adelaidae* which curves from the right, but these shells were sinistral and were slightly smaller and narrower than *P. adelaidae* shells - they are possibly shells of *Pupoides myoporinae*.

Why were so many of these empty shells aggregated in the stygian lake of Cocklebiddy Cave? They are all terrestrial genera that can be collected in sheltered microhabitats that are not closely associated with groundwater. Pupilla is found cemented to the underside of branches, punctiids are found in leaf litter and under logs. Gyraulus is the only representative of the ten gastropod families that are associated with Australian inland waters (Williams, 1968), but Gyraulus is a cosmopolitan pulmonate snail found in a variety of habitats.

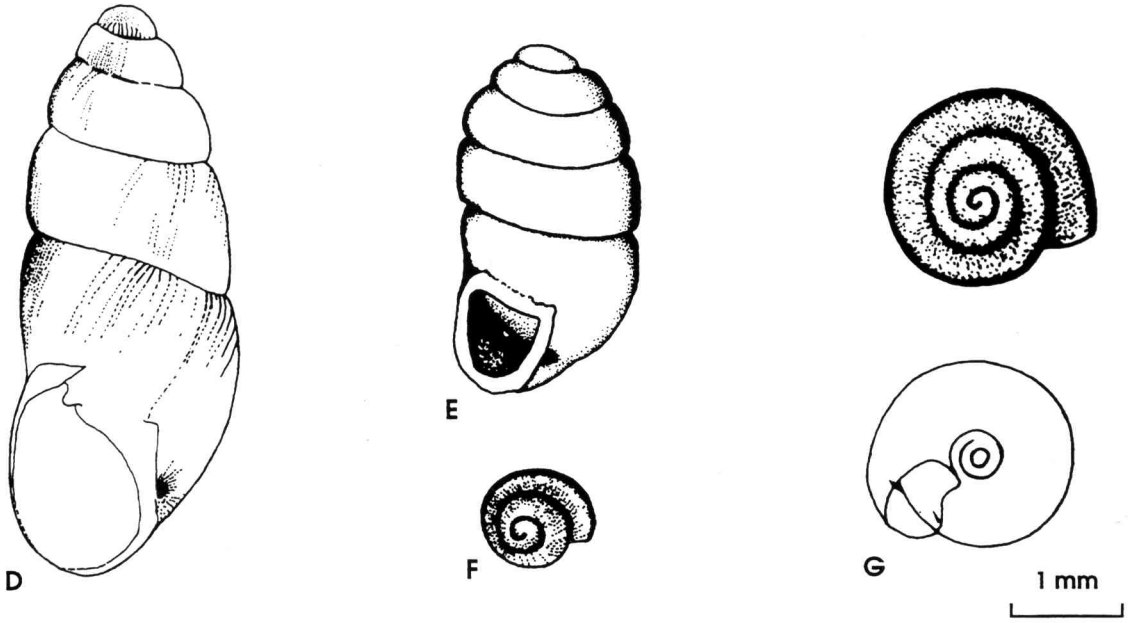
Among Australian land snails, "the need to find a place to shelter and retain moisture means that many species of the arid zone are found associated with deeply fissured limestone or sandstone rock" (Bishop, in Keast, 1981). After noting that the Nullarbor Plain is a low plateau of tertiary limestone, Richards (1972) wrote, "Below the massive surface crust of the limestone is a widespread zone of Miocene Nullarbor Limestone honeycombed with small interconnecting cavities a few cm in diameter. This is laterally extensive across the Plain, and beneath it is white chalky limestone - the Upper Eocene Wilson Bluff Limestone. Throughout the whole area, numerous cracks and solution tubes lead down through the surface crust to the Nullarbor Limestone."

So it seems possible that the living molluscs sheltered in these vadose passages, seeps and crevices, possibly grazing on diatoms and crustose algae. Together with the tough, leathery fruit from surface shrubs, they may have been washed into the deep, phreatic lake by severe flooding, such as recorded in Pannikin Plain Cave, 30 km away (Wright, 1990). Flooded solution tube networks could be expected to contain reservoirs of anoxic water. Anoxic conditions following flooding have been postulated as a cause of mollusc mass mortality (McIntyre, cited in Roy, 1981). As one sample contained many more shells than the other, it seems that they occur in scattered aggregations, as they would if transported by scouring floods.

Any living snails collected in caves should be preserved in 5% formalin, neutralised by adding carb soda to excess, or in 70% alcohol, or even in fortified spirits.




*A* Pupoides adelaidae—*adult shell* *B* *J1—shell of juvenile* P.adelaidae *C* *J2—shell of juvenile* P.adelaidae




*D* Pupoides myoporinae—*adult shell* *E* Pupilla sp.—*adult shell*

*F* *Shell attributed to Family Punctiidae* *G* Gyraulus sp.—*adult shell*

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# Errata

Cavernicolous leeches in Papua New Guinea
Virginia M. van der Lande, page 35 Helictite 32(2).
The references to Richardson and Ruhberg were combined. Printed below are the correct references.

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Contributors from all fields of study related to speleology will be considered for publication. Suitable field include Earth Sciences, Speleochemistry, Hydrology, Meteorology, Conservation, Biospeleology, History, Major Exploration (Expedition) Reports, Equipment and Techniques, Surveying and Cartography, Photography and Documentation. Comprehensive descriptive accounts of the exploration and morphology of individual caves will be welcomed, but simple trip reports and brief cave descriptions are not adequate. Papers overall should not exceed 20 printed pages in length. Contributors intending to write at greater length or requiring any advice on details of preparation are invited to correspond with the Editors. All manuscripts will be read by referees. Short "Letters to the Editor", expressing a personal view or giving a preliminary report of interesting findings, are welcomed, and will be given preference for speedy publication.

## Manuscripts

Submitted manuscripts should be in final form ready for publication. As proofs are not normally sent to authors particular care should be taken to check for typing errors. Manuscripts should be typed, double spaced, on one side of the paper. The title should be upper case bold and the author's names should follow. A brief and explicit summary of the notable aspects of the paper, headed abstract, should precede the main text.

Throughout the main text headings should be in upper case, centred and bold, while subheadings should use lower case bold aligned with the left margin. Acknowledgements should be placed at the end of the text before the references, and the author's addresses for correspondence should follow the references.

Authors are requested to submit a copy of their manuscript on floppy disk as well as hard copy in the first instance. Disks may be 3 1/2" or 5 1/4" in either MSDOS or Macintosh format. If sending text as a word processing document (Microsoft Word etc.), please send a copy as text on the same disk.

## References

References should be listed alphabetically at the end of the manuscript and cited in the text by the author's name and the year of publication (e.g. "(Grey, 1988)"). Where there is more than one reference to the same author in one year the letters a, b, c, etc. should be added. If there are more than two authors, they should all be named at the first citation and in the reference list, but the first name followed by *et al.* should be used in subsequent citations. References should be checked particularly carefully for accuracy. Journal titles should be abbreviated following the "World List of Scientific Periodicals", which is available in most large libraries.

The following examples illustrate the style:

GREY, M.R., 1973 Cavernicolous spiders from the Nullarbor Plain and south-west Australia. *J. Aust. ent. Soc.* 12: 207-221.

VANDEL, A., 1965 Biospeleology. *The Biology of the Cavernicolous Animals.* Pergamon, London. Pp. xxiv, 524.

WIGLEY, T.M.L. and WOOD, I.D., 1967 Meteorology of the Nullarbor Plain Caves. In: J.R. DUNKLEY and T.M.L. WIGLEY (eds), *Caves of the Nullarbor. A Review of Speleological Investigations in the Nullarbor Plain. Southern Austalia*: 32-34. Speleological Research Council, Sydney.

## Illustrations

Figures and photographs should not duplicate information in tables or other material. Photographs should be clear black and white prints with sharp focus. The number of pages with photographs will be kept to a minimum. Where several photographs are to form one plate they should be mounted together on white card. Any lettering required on photographs should be applied with "Letraset". Figures should be drawn in Indian ink on white card, heavy paper or tracing material and lettered using stencils or "Letraset" or supplied as Laser prints. Most computer drawn documents can also be handled if they are in Macintosh format. Please avoid using unusual fonts unless they are included with the diagram.

All illustrations should be drawn to fit a full page print area of 170 x 215 mm or 80 x 215 mm to fit single columns. They may be larger provided that these proportions are maintained, but allowance for reduction must be made when choosing letter sizes and line thickness. Diagrams for inclusion in the text must be drawn to a width of 80 mm.

Figures and plates should each be numbered consecutively and specifically referred to in the text. The numbers should be marked lightly in pencil on the margin or back of each illustration. Captions should be typed on a separate sheet.

## Units

The S.I. system (Australian Standard AS 1000) should be used unless citing historical data, in which case the original units should be quoted and appropriately rounded metric equivalents added; "100 feet (30 m)".

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