

Lava Cave Investigations, Anjouan, Comoro Islands, April 2009

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Abstract

Investigations were undertaken on the island of Anjouan, Union of Comores, Indian Ocean, with a view to finding and documenting lava caves and any palaeontological material they might contain. Some small sea caves were noted, but only two true lava tube caves were located. Due to the age of the lavas and the development of deep soils, few lava tube caves probably remain. No palaeontological material was located. Some lava tube caves were revisited on the island of Grande Comore but palaeontological prospects were rated low due to unfavourable conditions for preservation of vertebrate material. A brief visit to the island of Mayotte located only one large sea cave.

Background

Greg Middleton commenced speleological investigations in the Comoro Islands - at the suggestion of Dr Bill Halliday - in 1997 (Middleton 1998a, 1998b). Further investigations on Grande Comore were undertaken in 1998) resulting in the documentation of 27 caves with lengths up to 810 metres), together with an unsuccessful visit to the island of Mohéli, but the island of Anjouan could not be visited due to the outbreak of a civil war (Middleton 1999, 2005).

An opportunity to return to investigate caves on Anjouan did not arise until 2009 when hostilities were apparently over and relative normality was restored to the civil administration of the islands. Even a few weeks before we were to go to Anjouan, however, public protests broke out due to fuel shortages. Continuing civil unrest in neighbouring Madagascar made it impossible to transit through that country as was originally planned.

Originally there was to be a team of four, but in the end only the present authors undertook the trip. We were fortunate to have a British contact on Anjouan, Hugh Doulton, who was working with the environmental NGO Action Comores, provided us with reports on conditions on the island and arranged vital contacts for us.

The islands

Geographically, the Comoro Archipelago comprises four main volcanic islands: Grande Comore (Ngazidja, 1025 sq.km.), Anjouan (Ndzuani, 424 sq.km.), Mohéli (Mwali, 211 sq.km.) and Mayotte (Maore, 374 sq.km) (Fig. 1). Politically the first three make up the Union of the Comoros, while Mayotte remains a French overseas territory – but it is about to become the 101st ‘department’ of France.

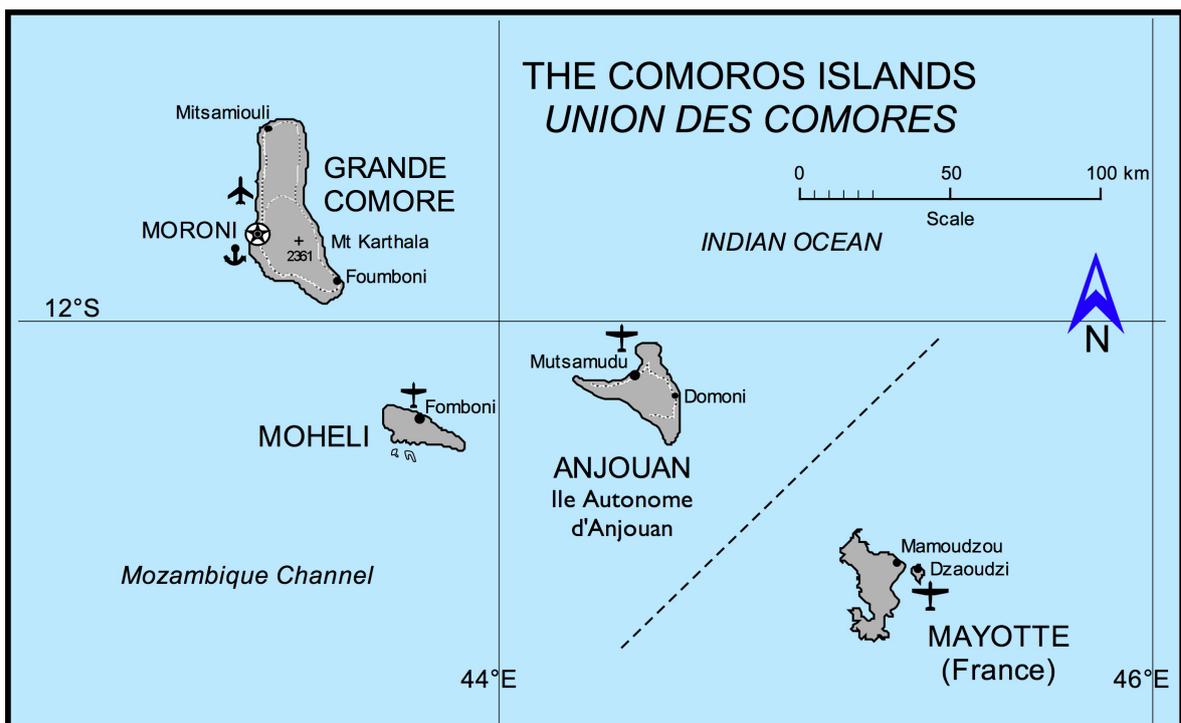


Fig. 1. Map of the Comores Archipelago

Mayotte is the oldest of the islands, followed by Moheli, Anjouan and Grande Comore which still has an active volcano, Mt Kathala (2360 m), said to have one of the largest craters in the world.

Getting there

Getting to the Comoro Islands is never an easy undertaking – and getting around them, even more uncertain. Having decided to avoid politically unstable Madagascar, our alternate route involved transit through the French department of Réunion and the French overseas territory (soon to be a department) of Mayotte. We flew to Moroni, the capital (on Grande Comore) 17 April. Our first price surprise was the new tourist visa issued by Comores – €60 each, payable in Euro on arrival.

We visited the Centre National de Recherche Scientifique (CNDRS) to see if we could get a permit to “look for caves” should that be necessary. Despite our best efforts we were unable to get such a permit and – given the new relative autonomy of Anjouan – it may not have done us much good anyway.

On 18 April we flew with “Aviation Comores International” to Anjouan. At 09:45, with some relief, we touched down at Ouani airport. From there it is a short taxi ride to the capital, Mutsamudu.

Action Comores

At noon we visited the Action Comores office in the hills above the capital and met Hugh Doulton for the first time. He explained that the organisation is involved in comprehensive studies and monitoring of the biodiversity of Anjouan, with particular emphasis on the endangered Livingston’s fruit bat, *Pteropus livingstonii*. Hugh’s function is to organise community aspects of the program which involves education and modification of agricultural practices to minimise impacts on biodiversity.

He introduced us to the staff of Action Comores, including Nassnuri Toilibou and Halidi Ahmed. They set up a meeting so we could discuss our plans with guides who know the island, and had been asked in advance to get together any information they could on caves. Communication was not easy as our French is pathetic and only a couple of them had any English. It transpired that they knew of perhaps only five caves between them. A plan was agreed to visit these over the next three days. Then came the important issue of costs; we were told the guides would cost us €20/day, the driver €10/day and the minivan €60 or a car €50/day, plus petrol! This was going to seriously tax our resources unless we could get more cash.

The *Lonely Planet* guide accurately warns “... Mutsamudu remains smelly and filthy. Shells of burnt-

out cars and piles of rubbish litter the streets, choking the shoreline and the river that runs through the town ... Cattle live on the garbage ...” (Andrew *et al.* 2008). The result is beaches no one would want to walk on, a filthy waterfront grazed by cows and goats, creeks flowing with rubbish and heaps of rotting garbage everywhere. The roads around the town don’t seem to have received any maintenance for many decades so traffic moves slowly, dodging potholes. Perhaps surprisingly, the main roads around the island are tarred and in reasonable condition.

Birds around the town were scarce but fruit bats (*Pteropus seychellensis*) were numerous and evident even during the day – obviously they are not part of people’s diets here.

Sunday 19 April

The minivan with driver and guide turned up just after 07:00 and we drove back towards the airport, then turned south into the spectacular central mountains. We descended to the east coast at the large village of Bambao and continued to Domoni (see map, Fig. 2) where we picked up our second guide, Ishaka Saïd.

We continued to the small village of Chaoueni in the far south. From there we followed paths steeply down towards the coast but, having been told we were within sight of our goal (which, it was becoming more evident, was to be a sea cave) we were overtaken by a gentleman who turned out to be the Mayor of the village. He was concerned that we didn’t have ‘authorisation’ to be there. Our guides tried to convince him that we should be allowed to proceed, but to no avail. From within sight of the cave (even if only a sea cave) it was galling to be forced to climb back up to Chaoueni. Perhaps this setback demonstrated the need for the official ‘permit’ to go cave exploring ...

We then drove down to the coastal village of Moya - with its own, rather run-down tourist hotel! and clean sandy beach!! We walked down to the beach and around a rock platform below the hotel to a filthy pebble beach. At the back of the beach was a small sea cave (Fig. 3). Not particularly impressed, Greg carried out a rough survey and we returned to the road. The cave was 28 m across the mouth, with a maximum depth of 10 m; it was 5.3 m high at the dripline. We tried to explain to our guides that we were looking for deeper caves than this.

On our way back across the island we were shown a waterfall plunging into a pool where the stream made a full right-angle turn. We were told the stream went into a cave but it was impossible to get to a position where one could see where the ‘cave’ might be. We were not convinced but in any case, accessing a cave if there was one would require climbing gear.

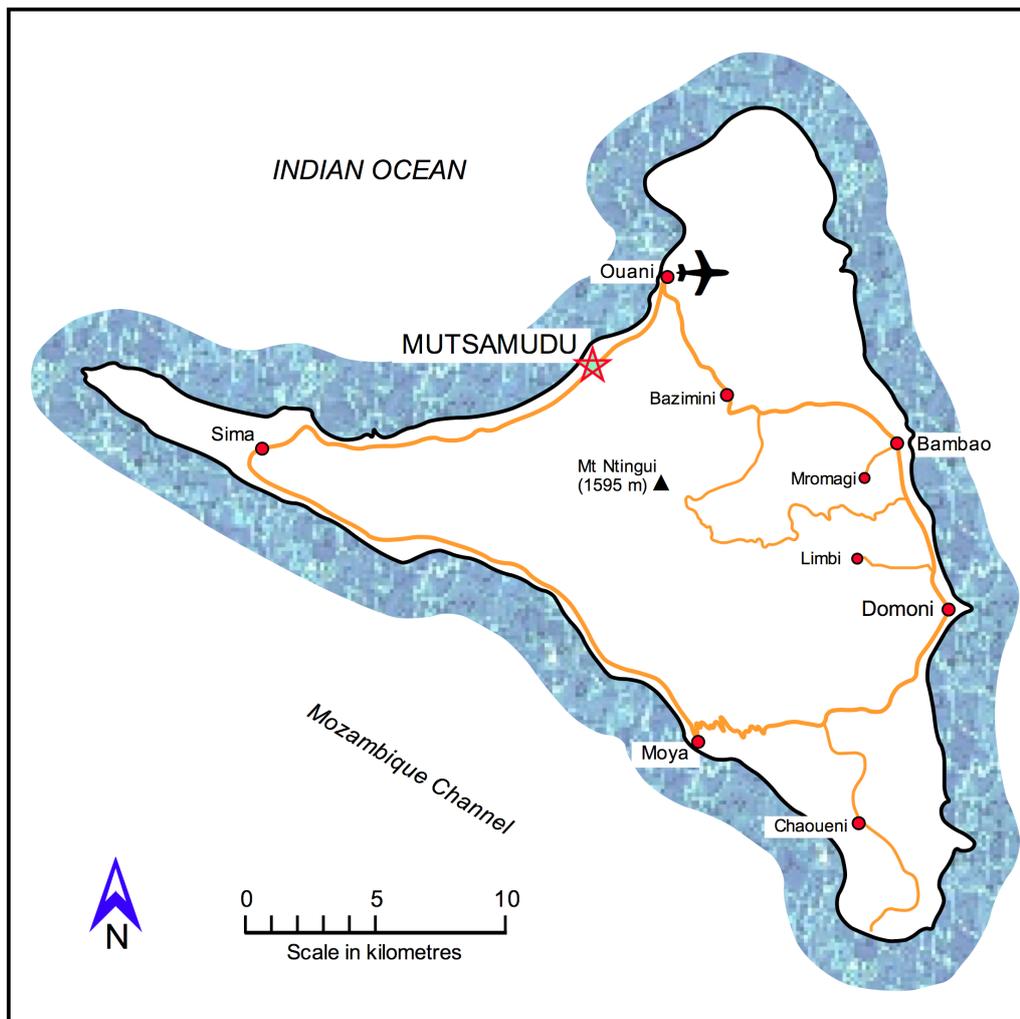


Fig. 2. The island of Anjouan, showing principal roads and places mentioned in the text.

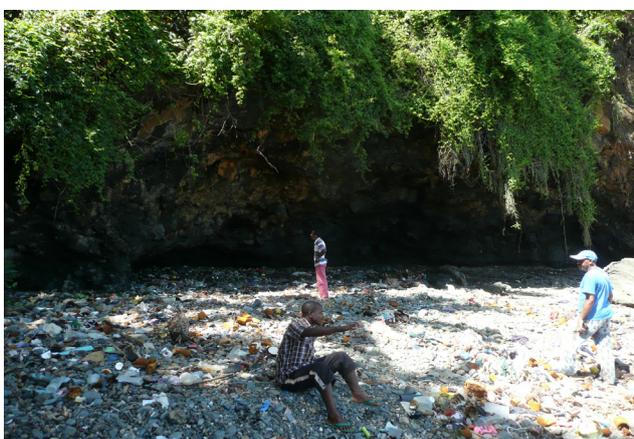


Fig. 3. The rather shallow sea cave at Moya (with garbage).

Apart from giving us some views of the spectacular topography of the island, our first day was rather disappointing.

Monday 20 April

We visited the two main banks on the island but learned that cash advances on credit cards could not be obtained. As we had brought limited cash, we were now in major financial difficulties. Action Comores obtained an “Authorisation de Recherches” for us as “Explorateurs des Grottes Volcaniques” approved by

a Directeur Général of the Ministère de la Production, de la Pêche, de l’Environnement, du Tourisme et de l’Artisanat of the Ile Autonome d’Anjouan. Hopefully this would save us from upsetting any more local officials.

Again we went south but stopped short of the divide, in the village of Bazimini. We were introduced to the Mayor who was happy for us to visit but asked for a report on our findings. Abderemane Maoulid, a local man working with Action Comores, led the way

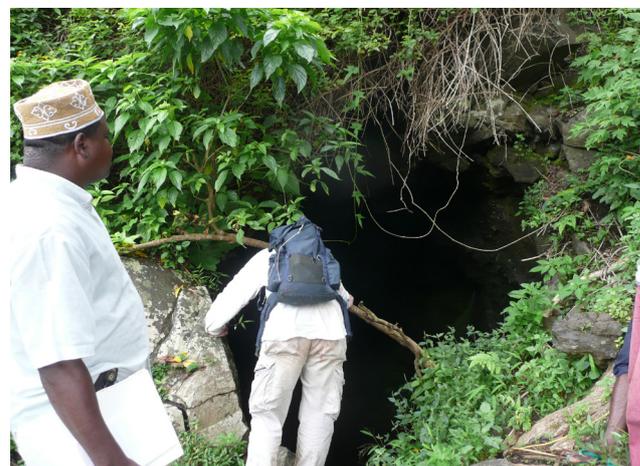


Fig. 4. Abderemane looks on as Julian takes a closer look into Ngama Gombeni.

down narrow paths between small plots and within 15 minutes we were standing in front of what was indisputably a breakdown entrance to a lava tube cave! (Fig. 4) This hole, about 3 x 4 m, opened on the side of a steep gorge. We were told it is called Grotte (or Ngama) Gombeni but our guide could not explain the significance or origin of this name.

An easily climbed drop of a couple of metres brought us to the floor of the tube. The cave was blocked in the direction of the gorge by sediment (and probably a lava seal) but in the opposite direction it descended steeply for about 60 m into the hillside, ranging in height from 0.6 m to 4.5 m (Fig. 5).



Fig. 6. The Anjouan *Miniopterus microbat*.



Fig. 5. Inner part of Ngama Gombeni with highest section of roof; numerous microbats flying about, observed by our guides (who relied on us for light).

There were signs of ceremonies having been performed and offerings left at the downflow end of the entrance chamber. There were lots of grey and grey/tan microbats, which appeared to be the endemic (as yet undescribed) Anjouan *Miniopterus*, *Miniopterus* sp. (Fig. 6) and black and white cave crickets (Fig. 7). The tube ends in a lava seal with a murky black guano pool (Fig. 8). What appears to be a small on-going lead is blocked by apparently back-flowing lava (Fig. 9).

Greg surveyed out with Julian's help (see Fig. 10)



Fig. 7. Ngama Gombeni cave cricket.



Fig. 8. Julian at black pool at end of Ngama Gombeni; poor conditions for bone preservation



Fig. 9. Apparent back-flow of lava, filling potential crawl at end of Ngama Gombeni.

and took a few photographs. Julian could find no bones and was not impressed by the prospects of their preservation in the prevailing very damp conditions. Lots of what was evidently old broken pottery was strewn across the floor among breakdown boulders. We had finished our inspection and recording by 12:30 p.m., delighted at having recorded our first lava tube on Anjouan.

Hopefully Ishaka now understood what we meant by a “grotte” or “caverne”; he assured us he could show us another as we drove down to the coast again at Bambao. We then turned inland and followed the road to the village of Mromagi. We started walking, gently up this time, and soon crossed a small river. Ishaka had to stop and scout around a few times and consult some locals but after about an hour he brought us to an unmistakable lava tube cave entrance (Fig. 11).

Ishaka informed us it was called Ngama Mapoudrou. We explored and surveyed down the fairly smooth tube to a terminal pool about 30 m in (see Fig. 12) (Fig. 13). The walls and roof were remarkably smooth and there was surprisingly little breakdown and little mud. Again, there were sacrificial items just in from

NGAMA GOMBENI BAZIMINI AREA ANJOUAN I., COMORES

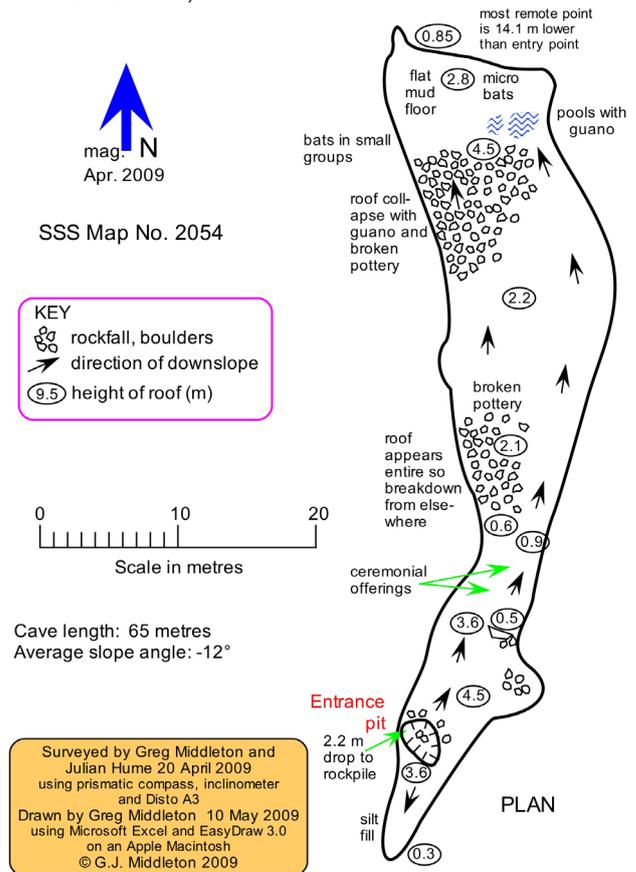


Fig. 10. Plan of Ngama Gombeni, near Bazimini



Fig. 11. Ishaka at entrance to Ngama Mapoudrou.

the entrance (Fig. 14). There were a few hundred bats in the cave. One obliged us by flying into the water. It wasn't a bad swimmer but had little sense of direction. Julian gingerly picked it out and identified it as *Mormopterus acetabulosus* (Fig. 15).

We had finished by 15:40 and were back to Mromagi village about 16:00. We dropped Ishaka in Bambao and returned to our hotel.

Hugh paid us a visit that evening and we told him what we have found, that the prospects (particularly in terms

**NGAMA MAPOUDROU
MROMAGI AREA
ANJOUAN I., COMORES**

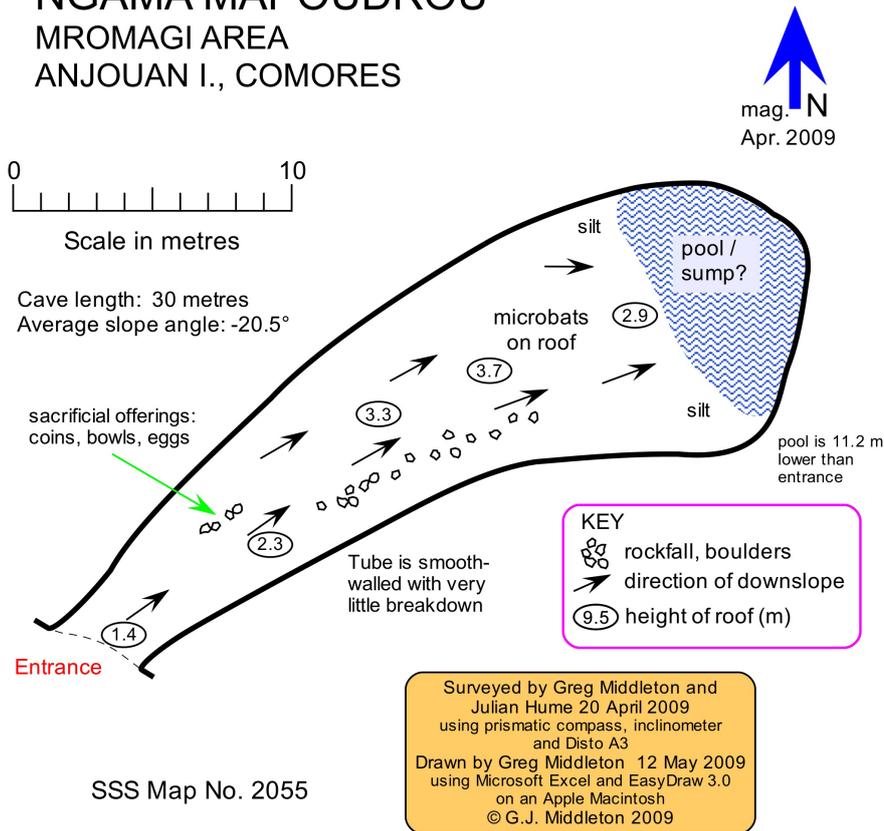


Fig. 12. Plan of Ngama Mapoudrou, near Mromagi.



Fig. 13. Terminal pool (sump?) Mapoudrou.



Fig. 14. Sacrifices just inside Ngama Mapoudrou.



Fig. 15. Rescued *Mormopterus acetabulosus*.

Comore, Anjouan appears to be a lava cave “desert”. Unfortunately, also, the heavy rainfall means that conditions in the caves are virtually continuously damp, providing less than optimal conditions for the preservation of ancient bone material. Thus the lava caves of Anjouan seem unlikely to reveal any major records of the island’s past vertebrate fauna.

Tuesday 21 April

We had asked to be shown the bat roosting site called “Hi Ros” (by Sewall, Granek & Trehwella 2003). We took the usual road east and south and turned inland just north of Domoni to reach the village of Limbi. From there, guided by Ishaka, we walked up into the mountains for about half an hour to a waterfall beside a large overhang which provided a roost site for the

of fossil bone preservation) did not look good and that, as we were fast running out of cash, we would leave on 22nd if we could get seats with Aviation Comores. We discussed our options for paying for the vehicle and guides.

Observations on the caves.

It had become apparent to us from the lush vegetation (sadly most of it introduced, at least at lower levels), the deep soils and the steeply eroded mountainsides, that this is not a “recent” volcanic island. The many thousands of years it takes for such soils to form and erosion to occur on a volcanic island are sufficient for most of the lava caves that were probably there to have collapsed or have been filled with soil and debris. A few small caves survive but, compared to the much more recent and barely eroded Grande



Fig. 16. The large feature we called *Rousettus Overhang* beside a 10 m waterfall. Although clearly the roosting site for many hundreds of *R. obliviosus*, (on left) this may not be the “Hi Ros” site.

endemic fruit bat *Rousettus obliviosus*. The site identified by Sewall *et al.* (2003, p. 348) as “Hi Ros” was described by them as a cave with an entrance 1 m x 0.5 m “behind a waterfall of an intermittent stream”. The distance to the back of the cave could not be determined, nor could the ceiling roost area, presumably because this required passing through the waterfall. This did not fit the site we had been brought to, though there were similarities. In our case the roost was a large overhang 12.4 m high, 15 m deep and about 35 m long with probably a few thousand *Rousettus obliviosus*, beside, not behind, a waterfall (Fig. 16). The overhang was readily accessible and the number of bats could very easily be estimated by a specialist. The “emergence estimate” provided by Sewall *et al.* (2003), was 100 bats, in July 2001. The number we saw was many times this.

Greg did a rough survey (Fig. 17) and had a swim in the plunge pool. The valley was too steep-sided and narrow at the actual site to get a GPS reading, so we had to be content with one a couple of hundred metres downstream where the valley widened a little. The altitude was given as 340 m, though altitudes with that GPS are notoriously inaccurate. Sewall *et al.* gave the altitude of their site as 600 m.

ROUSETTUS OVERHANG LIMBI AREA ANJOUAN I., COMORES

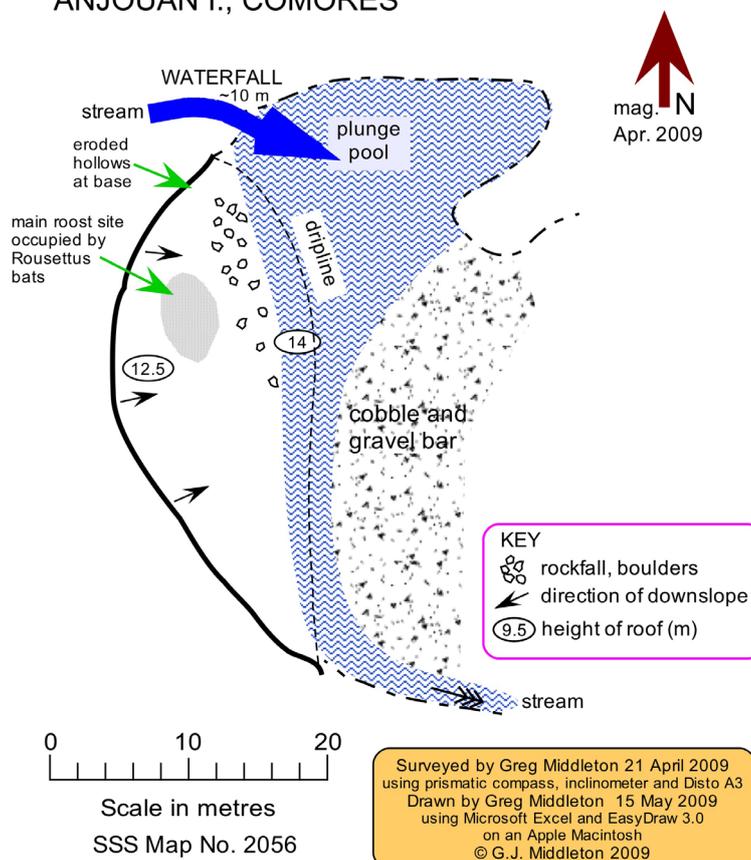


Fig. 17. Plan of *Rousettus Overhang*, waterfall and environs.

We walked back to Limbi, drove back to the main road, north to Bambao and inland to Mromagi. Greg rested while Julian, determined to see a roost site of the rare endemic Livingstone's fruit bat, went with Ishaka and Bacar, UP behind the village. They returned 2½ hours later after a very steep climb; Julian was exhausted. We returned to Mutsamudu.

Anjouan to Grande Comore – 22 April

At 08:30 on 22nd we took a taxi to the airport and caught the 11:00 flight to Moroni. After much frustration and negotiation we managed to bring forward our return flights to Reunion and even obtained a cash advance from the single, occasionally operational, Visa machine in the country.

Grande Comore – 23 April – Panga Betini and coastal cliffs

Despite his finding that the lava caves of Anjouan were unlikely to yield useful palaeontological material, Julian was keen to investigate the much more recent caves of Grande Comore. Accordingly we hired a taxi for the day and drove north to the Hahaya area, near the airport. From his knowledge of the caves Greg selected one with a good “trap”-type entrance, loaded the GPS coordinates into his Garmin and set out for Panga Betini (Middleton 1999). The vegetation on the lava flow was thicker than it had been 11 years earlier but it was not difficult going.

We came upon a fenced hole with bananas, which Greg didn't initially recognise. We checked out the cave – it went for over 100 m to the west and around 50 m to east; we saw no interesting bone material and no silt deposits which might contain palaeontological material. Noting this hole for possible survey, we continued on to the Betini entrance Greg remembered, with little difficulty. At the classic collapse entrance (which Greg had designated HH7 – see Fig. 18) we climbed down the tree (Fig. 19), which was bigger and more leafy than it had been

in '98 – now it almost obscures the hole. We went through the cave (Fig. 20) looking for bones, but found little: very recent rodent, goat and cattle; no birds or bats. Conditions were fairly damp, which is not good for preservation of bones. We did notice, however, some striking bright blue lava stalactites (Fig. 21) and there were masses of hairy black roots hanging from the ceiling – these would be ideal for planthoppers but we could not spot any. We came out the small exit from the north-western passage (HH11), followed the collapsed depression to another small entrance (HH12 - all as shown on SSS Map No. 964, Fig. 18) and went in, looking for the “7 m pit” on the left (HH13).

PANGA BETINI, HH7-10-11 [#16-21- 22] & CAVE HH12-13 [#23-24] HAHAYA CAVE AREA, GRANDE COMORE FEDERAL ISLAMIC REPUBLIC OF THE COMOROS

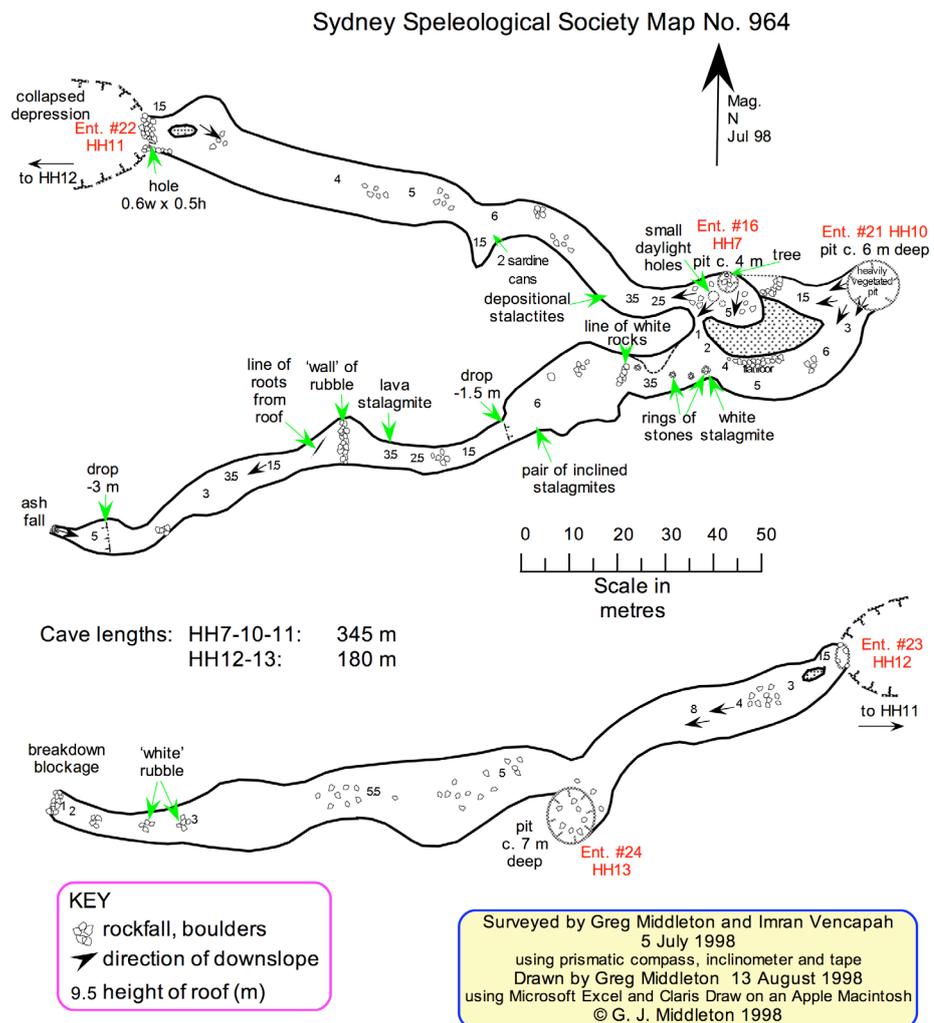


Fig. 18. Plan of Panga Betini HH7-10-11 and Cave HH12-13- prepared in 1998.

When we reached it Greg realised it was the hole we had found earlier in the day. (In 1998 he had only seen this hole from inside the cave as he surveyed; he hadn't bothered to climb out, so he didn't recognise it

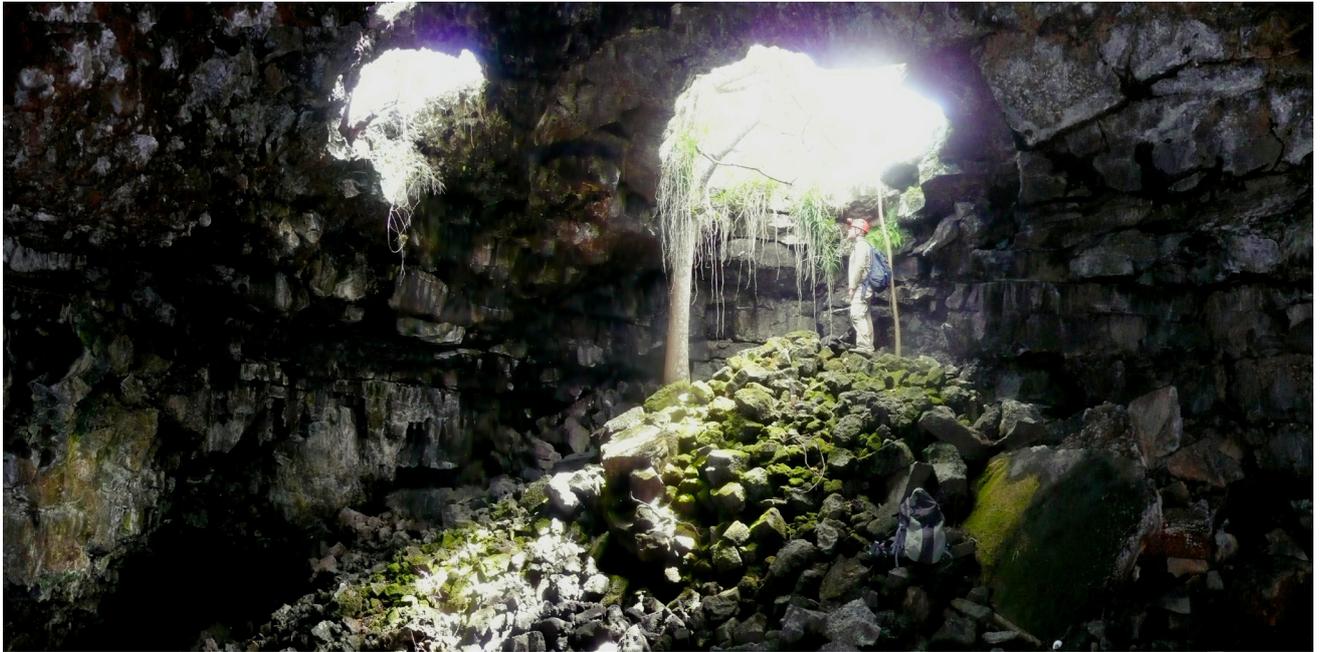


Fig. 19. The HH7 entrance to Panga Betini. Julian stands under the tree which facilitates access.



Fig. 20. Main passage in Panga Betini.



Fig. 21. Unusual blue lava stalactites.

from the surface. We returned to the small entrance (HH12). Julian had seen enough to convince him that the chances of finding anything of palaeontological interest were minimal so we headed back to our waiting taxi.

The taxi was not where we left it so Greg went looking for another cave he knew existed beside the main road. he found it but could not convince Julian it was even worth a look. When our taxi returned; we asked him to take us north to the first track to the coast north of the airport. From his earlier visits and other reports Greg was aware that there were apertures in the cliffs immediately west of the airport – some of which we had seen when coming in to land (Figs 22, 23) – and he was keen to try to check these out.



Figs 22, 23. Sea caves north of Hahaya, Grande Comore, from the air.

At the first road we found a barrier and a security guard but fortunately he was quite happy to let us through. The track ended at a navigation beacon in line with the runway. We left the taxi there and walked a couple of hundred metres to the coast, keen to see if we could find lava tubes opening in the steep sea cliffs. We walked north along the clifftop, observing eroded inlets backed by holes in the cliffs but all appeared to be sea caves. It is possible that lava tubes provided points of weakness which waves have then opened out into the large sea caves now apparent; we could not clearly see to the back of the overhangs to determine whether any vestiges of lava tubes remained. (It is of interest that there is a legend that the first Moslems to settle Grande Comore reached the island from the sea by way of a lava cave. Vérin (1994) locates it “to the north of the run-way at Hahaya” – see postscript to Middleton 1999). We found a way down to a wave-cut platform which exists along a small part of this coast. This gave better views into a couple of the openings (Fig. 24) but still no lava tubes were obvious, apart from some very small openings in the cliff.

with rodent and some snake bones - Julian strongly suspected a barn owl was responsible, but we did not see it. There was obvious white guano below roost sites. Greg made a few measurements and took some photographs. The opening is 17 m wide and 13 m high; it extends about 10 m into the hillside. There are some deeper hollows but no sign of a lava tube or passage. The parent rock appears to be a coarse-grained tuff or volcanic conglomerate.

Back at the ferry terminal we negotiated with a taxi-driver for a 2 hour trip around the island for €30. We drove down south and across to the western side, through the town of Sada and back to Mamoudzou. Apart from a lot of luxuriant vegetation we saw nothing particularly striking except for the volcanic neck of Mt Choungui in extreme south, a different (grey) baobab and very few birds.

We concluded – as we had anticipated – even from such a brief reconnaissance – that, largely due to the age of this island, it is highly unlikely to contain any lava tube caves of any significance.



Fig. 24. Large sea caves in the cliffs adjacent to the airport. Note, for scale, Julian descending on left.

To Mayotte – 24/25 April

On 24 April we flew Air Austral to Dzaoudzi (Mayotte). On 25th we caught the ferry across to the capital, Mamoudzou, on Grande Terre. The rather grand offices of the “Comite du Tourisme” were shut so we found a travel agent where a woman responded a very definite “Non” to my question as to whether there were any caves on Mayotte. We assumed she meant tourist caves but as it is a very old volcanic island, she may be correct in the more general sense. Nevertheless, we had seen a large sea cave from the ferry (Fig. 25) so we walked down to the waterfront and around the cliffs to this obvious marine-eroded cavern. We found the steeply-sloping floor littered

Ile de La Réunion – Mauritius – 25/26 April – Conclusion

In the afternoon of 25 April we flew back to Reunion and, on 26th, back to Mauritius. This concluded our brief and only partly-successful visit to the Comores.

At least we had established that lava tube caves do persist on Anjouan – but our observations of the conditions led to our forming the opinion that they, and those already recorded on Grande Comore, are unlikely to preserve much of the past vertebrate fauna of these islands.

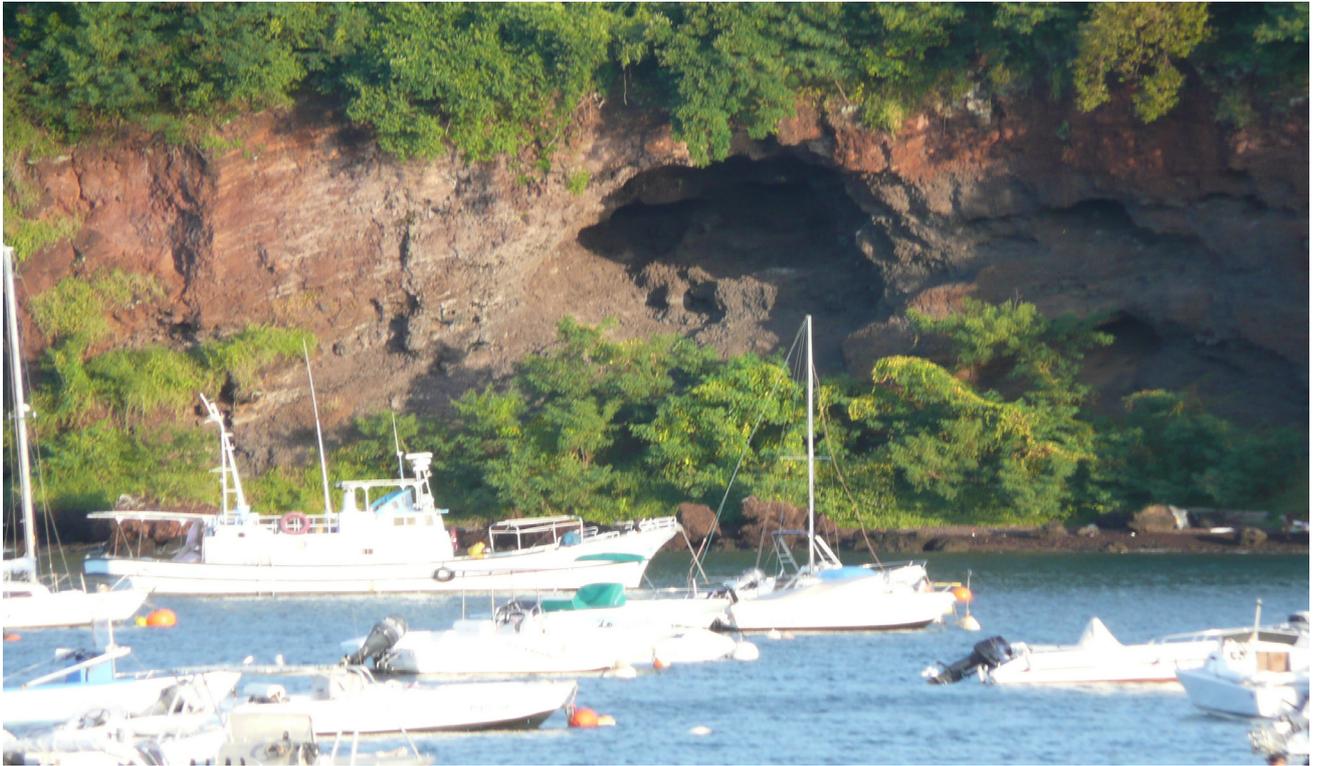


Fig. 25. Sea cave, Pointe Mahabou, Mamoudzou harbour, Grande Terre, Mayotte

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