



LAVA CAVES OF GRANDE COMORE, INDIAN OCEAN: FURTHER INVESTIGATIONS, JULY 1998

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Abstract

The author initiated speleological investigations on Grande Comore in September 1997 when some fifteen lava cave entrances were located and, to varying degrees, explored and surveyed (Middleton 1998a, b).

The results of this initial work encouraged a second visit in July 1998. Exploration of most known caves was completed and a number of additional caves were located and surveyed. 28 caves have been documented with a total length of over 4,000 metres. The first known roost of the endemic fruit bat, the cave-dwelling *Rousettus obliviosus*, was located. Efforts to reach the island of Anjouan were unsuccessful, as was a search for caves on the smaller island of Moheli.

Background

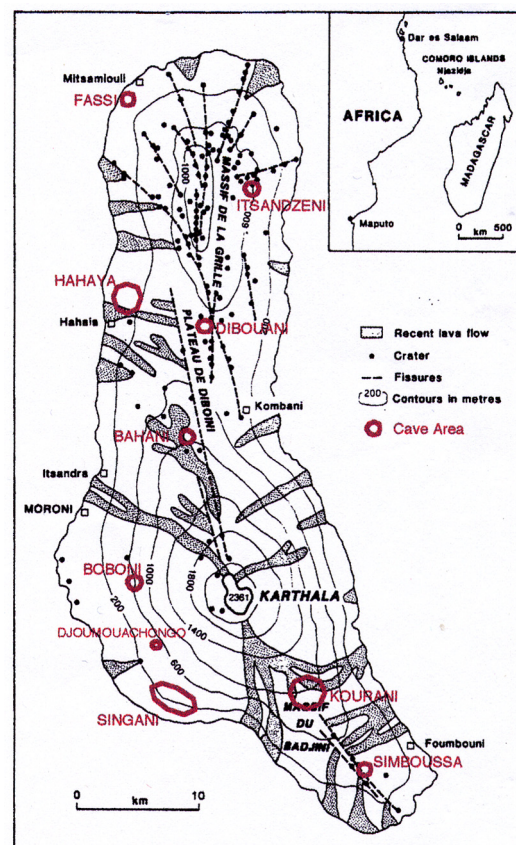
The lava caves of Grande Comore, the largest island of the Comoro Archipelago in the Indian Ocean NW of Madagascar, are the result of lava flows from the active Karthala Volcano or its subsidiary vents (Fig. 1). Significant flows occurred in 1972 and 1977; the most recent (explosive) eruption was in 1991 (Chester 1993, pp. 286-289).

The impetus for investigation of these caves came from Bill Halliday, now Hon. President of the IUS Commission on Volcanic Caves, who had received a verbal report on the occurrence of lava caves on Grande Comore from the late Haroun Tazieff. Some 15 entrances to volcanic caves were investigated by the author on his initial visit in September 1997.

The author returned to the Comores on 29 June 1998 with Imran Vencapah, a cave enthusiast from Mauritius, who acted as interpreter and survey assistant. We were further assisted by Bahassani Djaffar who acted as Comoran-French translator and looked after our car and, when necessary, our ladder and rope.

The plan was first to revisit those caves that had not been fully explored/surveyed the previous year and complete this work; then to try to find others of which we had reports and, finally, to ask the local people about other caves.

Fig. 1 - Grande Comore, showing lava flows, craters and fissures (from Chester 1993) and approximate positions of arbitrary 'cave areas' designated by the author for ease of reference.





Collaboration with CNDRS

In order to establish contact with the Centre National de Documentation et de Recherche Scientifique (CNDRS) we visited its headquarters in Moroni on 30 June. The Director was away but we were introduced to Dr Aïnouddine Sidi, Acting Director, to whom we explained our purpose and intentions. A draft copy of the author's previous report (Middleton 1998b) indicated the work already carried out. Dr Sidi invited our cooperation with CNDRS and indicated his support for our investigations. He subsequently provided us with an official letter and requested that we include a technical officer from the Centre in our team. Yahaya Ibrahim, a botanist by training, subsequently joined us and proved a most valuable member of the team.

Results of investigations

Hahaya Cave Area¹

GPS locations were determined for the three entrances (#10 - now HH1, #11 - HH2, and #12 - HH3) although as all are within a circle of radius less than 20 m, the differences are unlikely to be real, given the c. 100 m accuracy of the instrument.

HH2: The largest of these three caves, the exploration of which could not be completed in September, was completely explored and surveyed. It was expected that this cave, which was heading directly for the main runway of the international airport (Fig 2), would have been detected and collapsed during the airport's construction. This turned out to be the case; about 90 metres beyond the fork where the initial survey had stopped, we came to rubble piles (after a further fork) in all three passages (Fig. 3). From the freshness of the rocks and scratches on them clearly due to earthmoving equipment, it was obvious that the closures were of human origin. Although expected, this was some-thing of a disappointment as this cave had the potential of another 500 m or so before possibly reaching the sea. Indeed, we found marine mollusc shells in this cave which are most unlikely to have got there by any agent other than their own efforts. We continued the survey for a grand total of 475 m (see Fig. 4).



Fig. 2 - The large passage of HH2 held considerable promise, and the potential to reach the sea.



Fig. 3 - Sealed passage in Cave HH2 under Hahaya airport, east coast, Grande Comore.

¹ For ease of reference, I propose some arbitrary cave areas - see Fig. 1. Hahaya (or Hahaïa), code HH, on the west coast in the vicinity of the airport, is the most cave-rich yet identified.

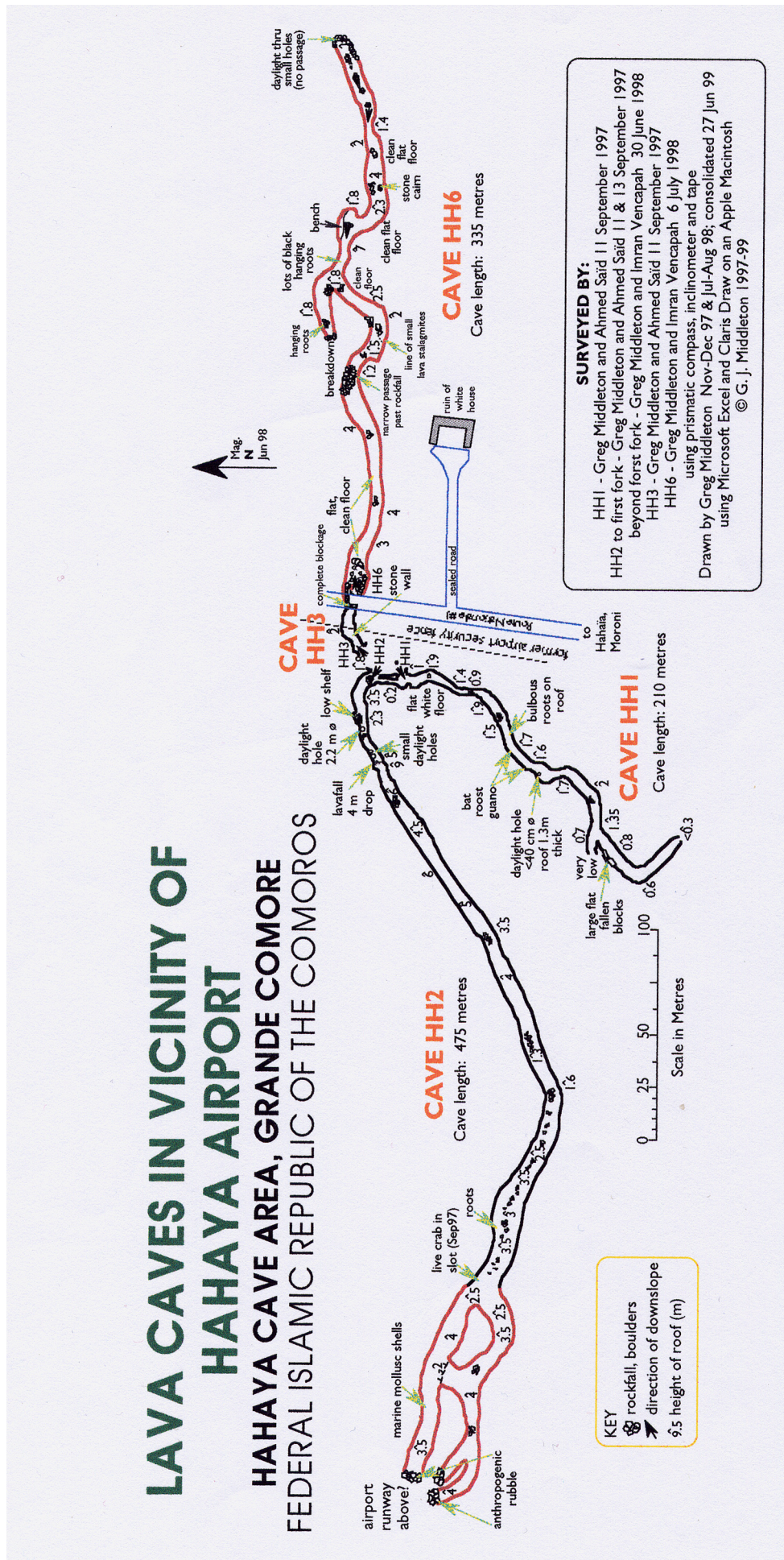


Fig. 4 – Four lava caves in the vicinity of Hahaya international airport. HH1, the major part of HH2 and HH3 were explored and surveyed in September 1997. The western most part of HH2 (beyond the first fork) and HH6 were explored and surveyed in June-July 1998. HH2 may have originally reached the sea, some 500 m to the west, but has been collapsed and filled where it runs under the airport runway.



Ngama Mhimadji-Panga Mnouka (Cave #17-18, HH8-9)

A local man, Ali Mmadi, helped us refind cave #14 [HH4] and showed us others in the vicinity: Panga Betini (#16, HH7), Ngama Mhimadji (#17, HH8: a hole about 20 m deep and 15 m in diameter, named for a type of tree, three of which grow in it) and Panga Mnouka (#18, HH9: meaning odour, though we noticed nothing unusual).

We proceeded to explore and survey from HH9. Fortunately, this connected with HH8 (see Fig. 5), obviating the need to descend that ngama, but we did not find an underground connection with HH7, though it was not far away. While surveying we collected a few snails in this cave and some cave crickets just below HH8. [The snails were subsequently identified as an endemic *Trophidophora* (*Ligatella*) sp. and two natives, *Subulina striatella* and *Gastrocopta microscopica*.] We came across a barn owl in the cave beyond, cowering in the darkness.

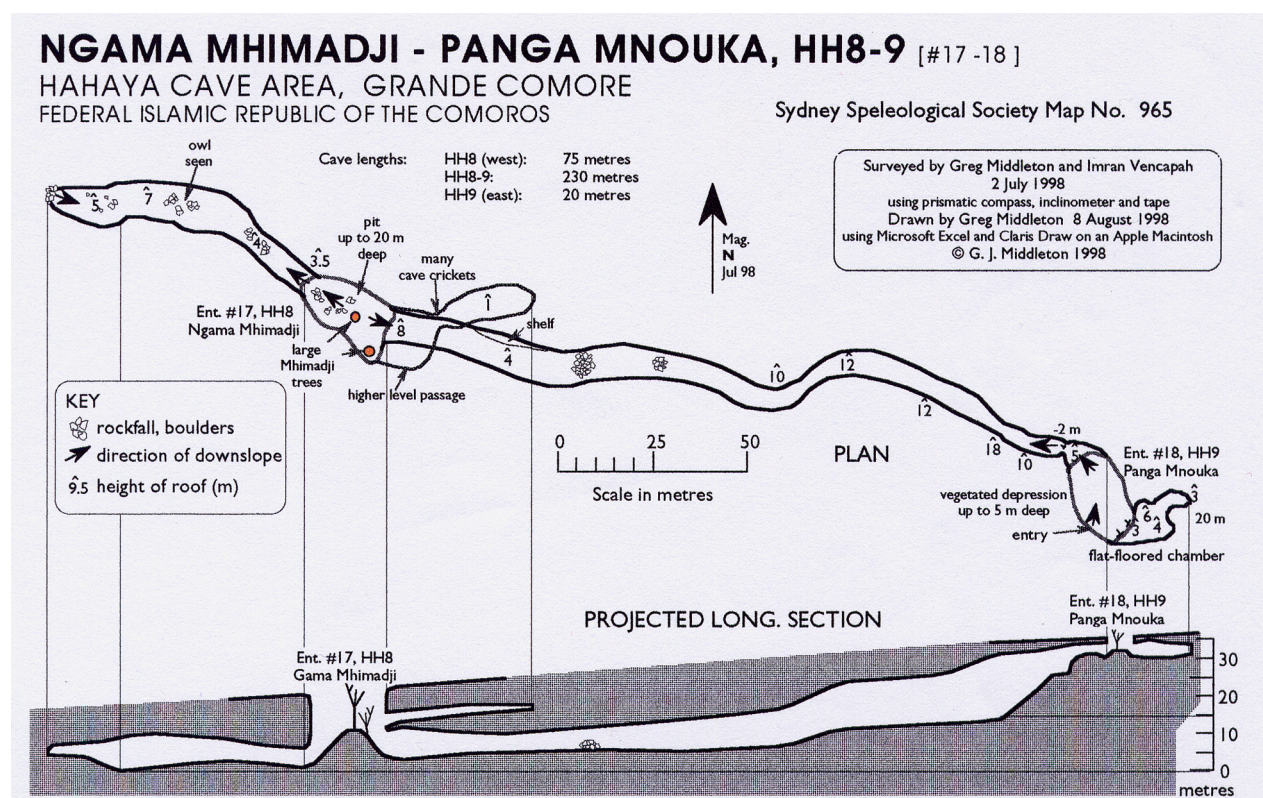


Fig. 5 – Plan and projected longitudinal sections: Ngama Mhimadji – Panga Mnouka, HH8-9, a two entrance lava tube inland of the Hahaya airport.

Panga Mhandou (#14, HH4-5)

On 3 July we returned to Hahaya area to complete the deferred survey of Panga Mhandou. Looking around the entrance chamber, I discovered there was a further section, extending to the east, I had missed last September. We surveyed this (see Fig. 6) and then walked through the cave to the entrance I had referred to as #14a [HH5] where we commenced surveying the rest of the cave. Neither of the two upper levels went very far and the more promising main passage ended in a huge mound of vesicular lava after a further 60 m. A few small insectivorous bats were seen, either solitary or hanging in small groups.

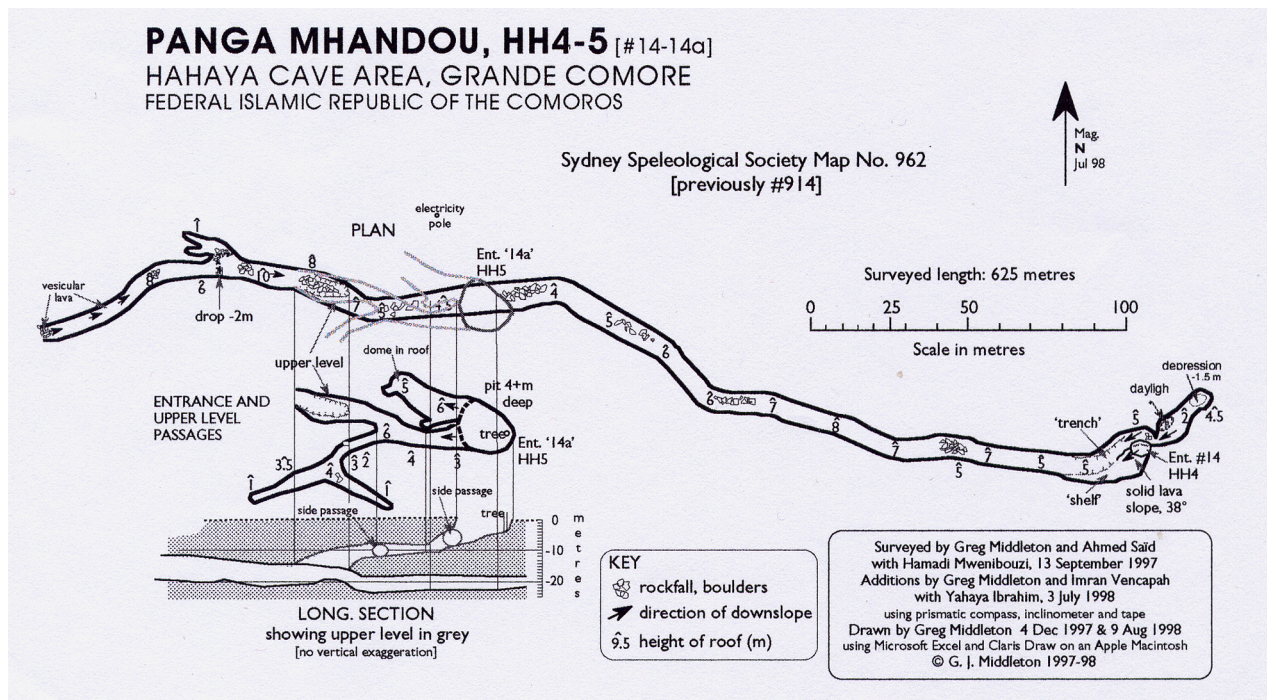


Fig. 6 – Plan of Panga Mhandou, HH4-5, in the Hahaya cave area. The lava tube between entrance HH4 and the passage connecting with HH5 was explored and surveyed in September 1997, the short section east of HH4 and that west of the passage up to HH5 were added in July 1998.

Panga Betini (#16, HH7) and following series (#21-#24, HH10-13)

Panga Betini [HH7] is entered through a hole about 4 m deep (Fig.7). The roof of the chamber at this point is extremely thin, perhaps only 30 cm.

This turned out to lead to quite a complex and interesting system, connecting directly to holes #21 [HH10] and #22 [HH11] which lead, overland along a collapsed depression, to #23-24 [HH12-13]. We surveyed all the accessible passages, which totalled 345 m for Betini and 180 m for HH12-13 (Fig. 8).

In a flat floored chamber just off the HH7 entrance chamber we were surprised to notice a number of stone circles (Fig. 9). These had clearly been placed in position by humans but the reason was not obvious. They did not appear to be fire rings as there was no accumulation of charcoal or ash in them. There were some small fragments of carbon but these seemed much more likely to be the remnants of flaming torches which would have been required for light. Possibly the stones had some religious or spiritual significance, or held water-filled gourds, but we did not notice others in other caves. There was also a low stone wall of a type we did notice in a number of caves. In the same chamber was a very fine white stalagmite. It appeared to be composed of lava and the white material may have been deposited later.



Fig. 7 - Entrance of Panga Betini.

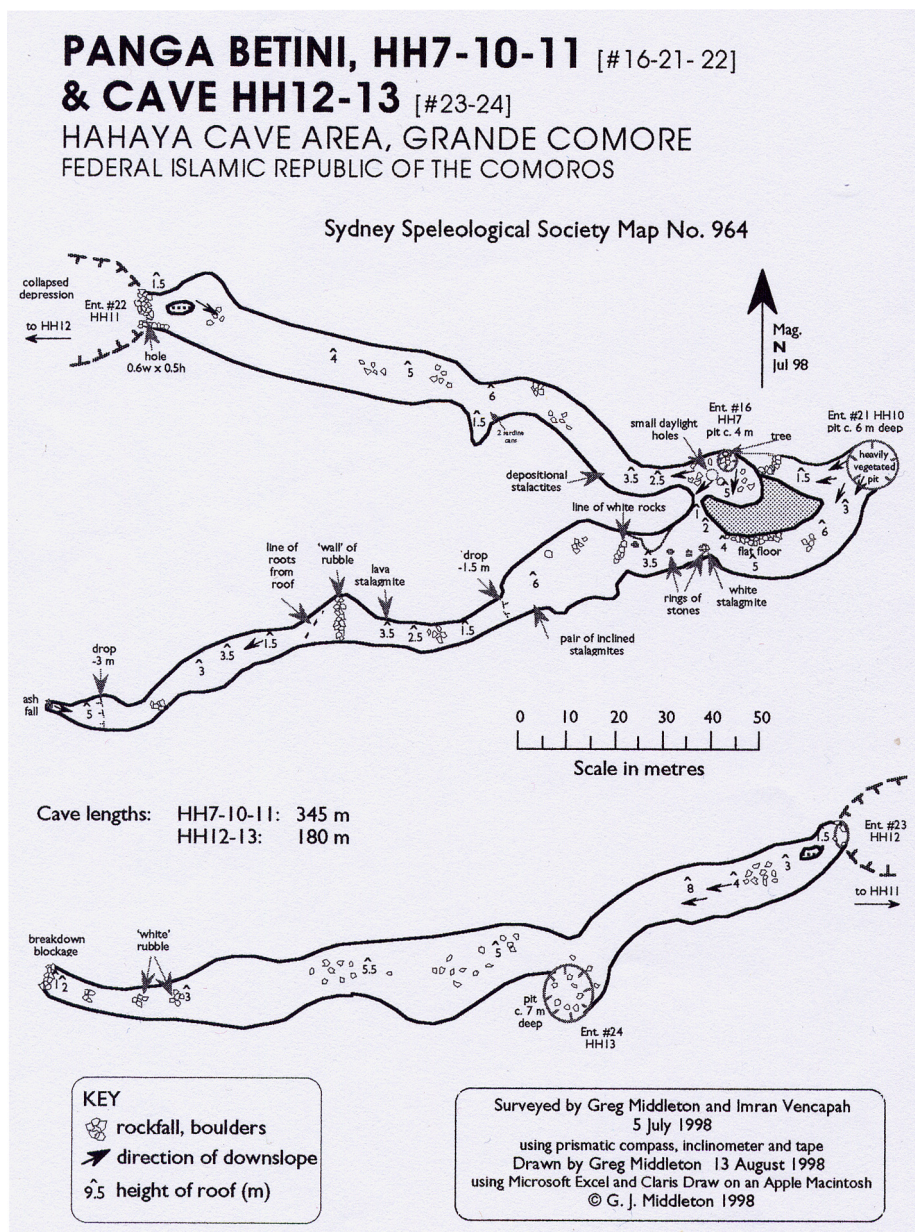


Fig. 8 - Plans of Panga Betini, HH7-10-11, and nearby HH12-13 which probably once connected to HH11 but is now separated by an elongated depression.

Fig. 9 - Unexplained stone circle, Panga Betini.

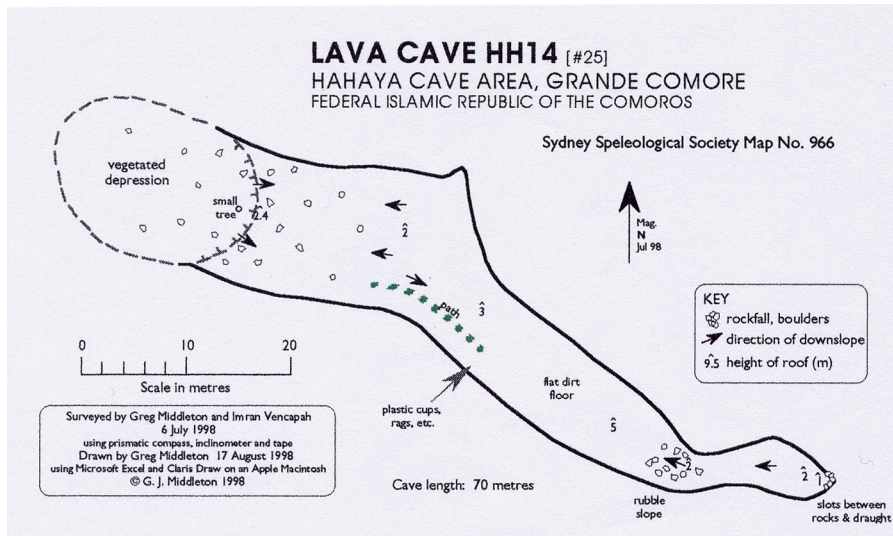


Caves #25 [HH14] and #15 [HH6]

Cave #25 [HH14] was surveyed (see Fig. 10). This held no surprises but we did notice bits of cloth and large numbers of plastic cups of the kind used by some airlines. There was also a well developed path to the back of the cave and someone had been using a car driveshaft to try to excavate at one point.

The last cave I had visited on my first trip, #15 [HH6], on the opposite side of the main road from HH1, 2 and 3 was surveyed. We commenced at the entrance HH3, across the road from HH6, to test my theory that this cave was actually the continuation of HH3 before it was collapsed when the main road was built.

I had noted "... it is possible that there may be a way around it [the rockfall] to the right" (Middleton 1998a, b). Indeed there is and we were able to survey on along some very spacious and clean passage until eventually we reached the inevitable blockage. In this case, however, we were able to see sunlight through small holes. Getting out at this point, however, was not possible. The cave has a length of 335 m. An unexpected find was a stone cairn about 250 m into the cave.



The survey plan is presented in Fig. 4, which also shows HH3 - clearly the former entrance to the system, before roadbuilders collapsed the passage under RN1.

Fig. 10 - Plan of the cave HH14, a small lava tube east of the Hahaya airport. Plastic cups may indicate it has been frequented by personnel from the airport.

Simboussa Cave Area: Ngama Yondzi, SB1

On 1 July we concentrated our efforts on the pits in the Simboussa and Kourani areas. Cave #2 [SB1] was easily relocated as it is beside Route Nationale 5. The pit proved to be 8 m to the top of the rubble pile and a further 6.2 m to the deepest point. We could find only one minor extension, to the south-west (see Fig. 11) in which there were some depositional speleothems, including a very fine, though short, column. There was a species of small insectivorous bat roosting on the walls, often solitary or in small groups. Not a great deal of rubbish has been dumped here, considering how convenient the hole is to the main road – though there was a motorised plough. Unfortunately a lot of medicines, including many hypodermic syringes have been carelessly disposed of in this pit.

We were told the name of the cave is Ngama Yondzi. Subsequently we learned that 'ngama' is equivalent to the French 'trou' (hole or pit).

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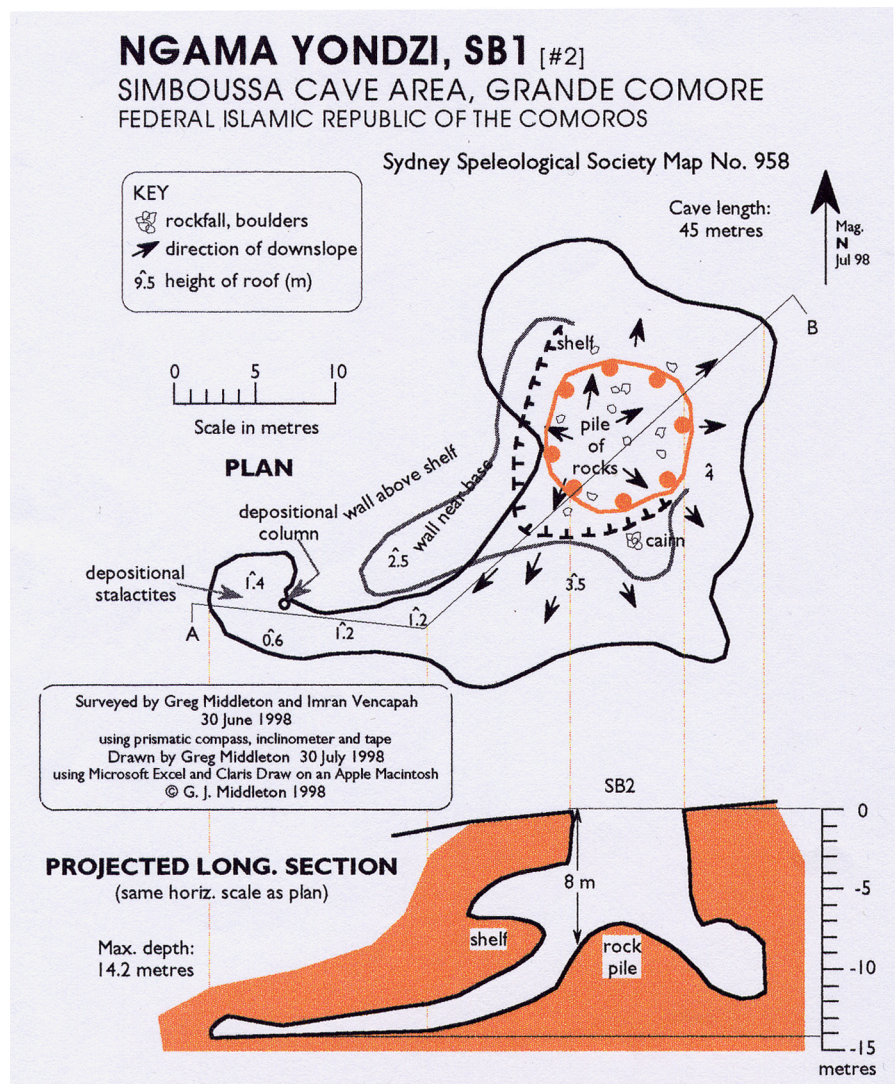


Fig. 11 - Plan and projected longitudinal section of Ngama Yondzi, SB1, "the hole in the field", near Simboussa.



The initial 'n' is hardly sounded. Iain Walker (an Australian anthropologist working in Comoros) has subsequently suggested this is a contraction of "ngama ya hondzi" which, quite appropriately, means "the hole in the field". We also learned that a deep hole or 'abime' (Fr.) is called 'nindi', though we could not ascertain whether this is actually bigger than 'ngama' or just a different dialect.

Panga Evangadjou [SB2], Simboussa Cave Area

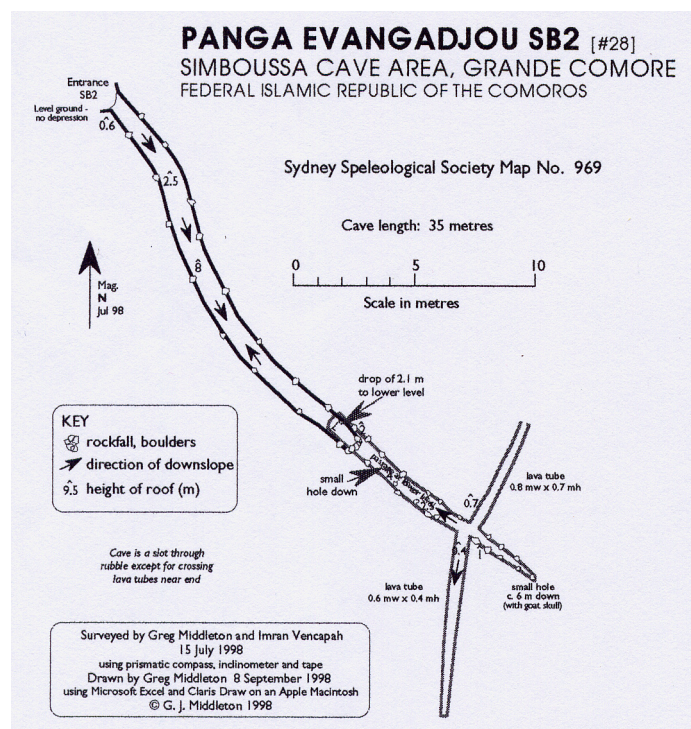


Fig. 12 - Plan of Panga Evangadjou, SB2, near the village of Simboussa. It appears to be more a crack between boulders than a true lava cave.

Whilst on Moheli we were told of a cave at Simboussa in the south of the main island so we went to search for it as soon as we returned to Grande Comore. At first, when we asked about 'pangas' we were directed to Ngama Yondzi, but when we insisted we were looking for a walk-in cave, a youth took us to the north of the village, through a series of what appeared to be small walled gardens, now largely overgrown. In one he showed us a hole, covered by palm leaves to prevent goats falling down it. SB2 turned out to be a narrow slot going steeply downward. After descending for about 10 m it rose slightly before descending again, eventually ending in a jumble of rocks. It was more a cleft than a lava tube, but towards the end a small but perfectly formed lava tube crossed the slot at right angles, tapering off at both ends (see Fig. 12). We were informed its name was Panga Evangadjou.

Kourani Cave Area: KO5 & 6

We later drove up through Nioumamilima on the road to Kourani to the road-side pits I had numbered #7 and #8 [KO5 & 6]. The ladder was attached to the car and lowered into the pit on the southern side (KO5), enabling us to descend.

This is a much smaller pit than SB1, tapering from 5 m to less than 3 m in diameter but it

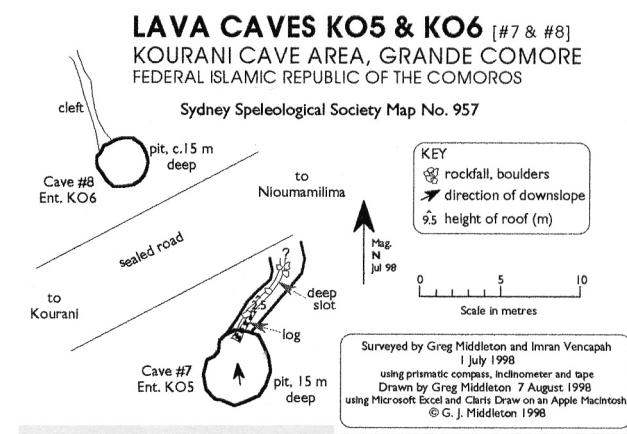


Fig. 13 - Sketch plan of the environs of entrances KO5 and 6, two pits below the village of Kourani.

descends vertically for 14 m to a dirt slope which drops into a deeper narrow slot. Opening from it on the eastern side is a narrow slot with boulders wedged in it. Unfortunately the walls are inclined to flake off and there is no real floor for an undetermined depth below. As we had no way of providing any protection in this section we decided it was too hazardous to proceed. We did note, however, quite a strong, cool draught, which made conditions more comfortable than the heat on the surface. The slot was very reminiscent of Cave #6 [KO4] visited on the previous trip, a few hundred metres to the north (Middleton 1998, 1999).



The northern pit [KO6] was also rigged from the car. It was smaller at the mouth than KO5 and more heavily overgrown. Imran had only descended about 2 m when he dislodged a large mass of rock from just below the lip which fell with a thunderous crash. In view of the danger posed by such unstable conditions and the likelihood that the pit would be similar at the bottom to KO5, we decided not to proceed further with its exploration. I prepared a sketch of the locality (Fig. 13). It was noted that a distinct crevasse-like feature runs away to the north, under dense vegetation, supporting the possibility of these holes being connected with KO4 (Cave #6 – Middleton 1998a) or at least having been formed by the same event.

Singani Cave Area: Panga Pachwa Myembe (#19, SG1-2-3) and Panga La Dzahadjou (#20, SG4)

Yahaya told us of a cave near his village, Mdjoyézi, located above Singani, so we arranged to visit it. We were guided by Abdou Ahamada who cultivates around the cave and presumably owns the land. He showed us one large depression before taking us across the road to another. From the more northerly hole we could see a large depression stretching further north but were told there were no entrances from it. We descended a steep slope into Cave #19, SG1, Panga Pachwa Myembe, which Yahaya told us meant “Local Mango” Cave. We surveyed through a short passage containing many small bats, and a cow skeleton, into a steep-sided canyon (SG2, the large depression we had seen from the road) with vegetable crops. At the southern end of this was another section of cave, (SG2-3) followed by another steep-walled canyon with bananas, etc, growing in it. We climbed up a rough ‘ladder’ for 8 m to reach the surface, to find we had crossed under the road (see Fig. 14).

South of Singani, Yahaya assured us there was another, larger cave. We stopped in the village of Dzahadjou and climbed up through the village, past ancient water cisterns and up to an impressive entrance (SG4), obscured by hanging ferns of great length. Behind was a fair sized chamber up to 10 m high, the floor of which rose steeply as one went in, leading to two small holes. We ignored the lower one as too tight but Imran tackled the upper one. The small passage extended for about 70 m but was eventually blocked (see Fig. 15).

Fassi Cave Area: Panga Nyamaoui (#13, FA1)

Perhaps the most compelling reason for the author to return to Grande Comore was to complete the exploration of Panga Nyamaoui². In September 1997 I had surveyed over 300 m in this cave but knew that it continued both to

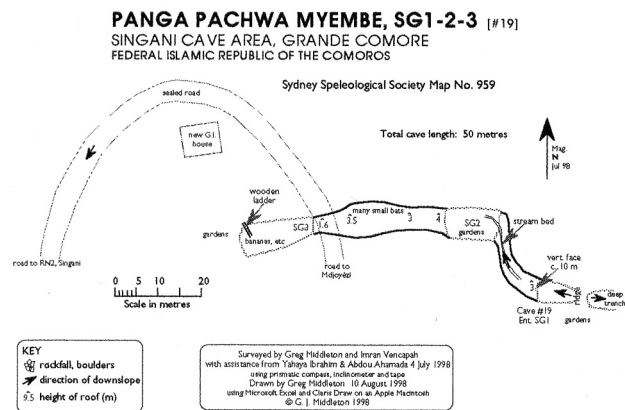


Fig. 14 - Plan of Panga Pachwa Myembe, SG1-2-3, a cave in two sections near the village of Mdjoyézi.

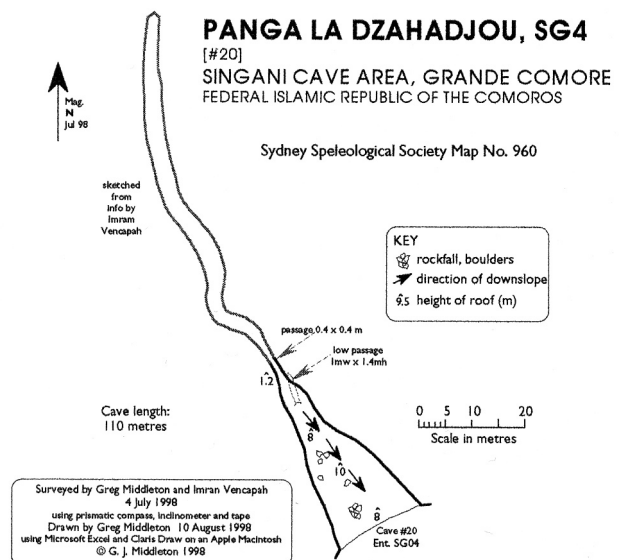


Fig. 15 - Plan of ‘La Grotte Celebré de Dzahadjou’ – “the cave of the village up the lava flow”.



the east and the west. More importantly, I had recorded the presence of bats with bright, highly reflective eyes in the eastern branch - indeed, it was because of their great numbers that I had not been able to get my local guide and assistant to continue.

Further information, provided by Dr Pierre Strinati, well-known Swiss cave biologist, revealed that this bat was probably the little known endemic fruit bat, *Rousettus obliviosus*. Although I had realised it was rather large for an insectivorous species, I had not imagined it was a fruit bat because I thought it lacked the ability to echolocate - which would be essential to reach its roosting site. While this bat had been noted by the German naturalist Günther in 1879, it was not formally described until 1978, by Kock (1978). In one of few papers on this species, Reason, Trehwella, Davies & Wray (1994) have written:

R. obliviosus was only recently formally described and nothing is known about its ecology or population biology. ...

Unlike the Pteropus species which were seen flying several hours before dusk, R. obliviosus was not seen flying before dusk. It is not known whether this species has any echolocation abilities as seen in some other Rousettus species.

There was no indication as to where R. obliviosus was roosting by day [on Anjouan]. Rousettus generally roost in tombs, temples, rock crevices, garden trees, date plantations but most commonly in caves.

... if this species is limited to forest habitat then the deforestation affecting Comoros (especially Anjouan) could have a serious impact on the status of R. obliviosus. Also, if roosting is limited to a few cave sites, these too may be vulnerable.

If the bats in Panga Nyamaoui do turn out to be *R. obliviosus* this would be their first positively identified roosting site and the value of the cave as essential habitat for this species would be greatly enhanced.



Fig. 16 - Panga Nyamaoui entrance pitch. The giant *Dracena* provides access for the nimble.

From Fassi Alismael Yousoof guided us back to the cave in about 20 minutes. We rigged up the ladder and descended the 7.6 m to the rubble pile (Fig. 16). We resurveyed the entrance pit and continued on into the western passage. This part of the cave turned out to comprise a total passage length of 390 m, including a curious parallel passage, accessed only with difficulty via a higher level cross passage (see Fig. 17). In order to descend safely to the parallel passage we had to bring down the wire ladder and anchor it to a large rock in the cross passage.

In the partly explored eastern passage we took up the survey at the beginning of the bat roost and, despite disturbing large numbers and being showered with their urine, we pressed on into the cave. The temperature was markedly higher in this section of the cave, as was the humidity. The very large numbers of cave crickets remarked on in my initial report were still in evidence. There is no doubt that the large numbers of crickets and other insects, as well as a small snail which was present in large numbers (*Allopeas clavulinum*), owe their survival at this remote spot entirely to the excretions of the bats. Shells of the snail *Subulina striatella* were also collected but live specimens were not evident.

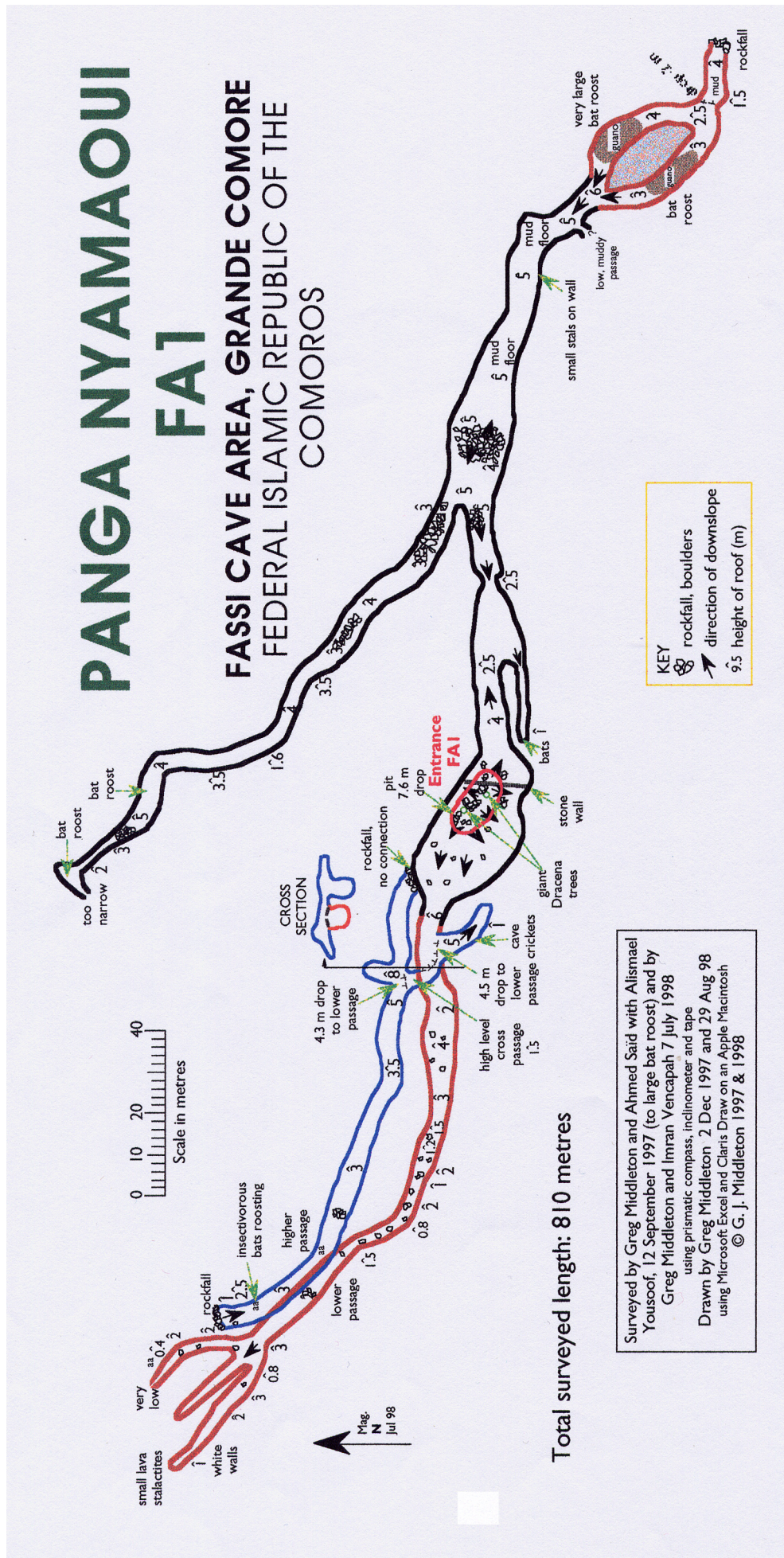


Fig. 17 – Plan of Panga Nyamaoui, inland from the village of Fassi, northern Grande Comore. The passages east of the entrance, FA1, except for the bat roost, were explored and surveyed in September 1997. The bat roost chambers and passages west of the entrance were explored and surveyed in July 1998. The bat roost is the first identified roosting site of the fruit bat *Rousettus obliquus* in the Comoros, and is the bigger of only two known.



The white patches on the floor indicated that the diet of these bats is not that of an insectivorous bat. Another notable feature of these bats was the noise they made. This was a constant high-pitched babble, rather like the sound of the human voice recorded on tape and played back at a much higher speed. These sounds may be related to their echolocation faculties which they must possess in order to safely reach and return from this roosting site.

We searched in vain for a bat skull which might provide positive proof as to the animal's species. In fact we could find only three bones, two of them clearly long bones from the arms. Hopefully these would be of some benefit in identifying the species.³ From this site we also collected a large cricket and some snails. Unlike bat roosts in Mauritius and Madagascar, there appeared to be few cockroaches.

The survey of the eastern part (Fig. 17) shows a final length of 420 metres, giving a grand total of 810 metres for the whole cave and making it the longest thus far recorded in the Comoros.

Itsandzeni Cave Area: Panga Milembeni [#26, IZ1] and Cave #27 [IZ2].

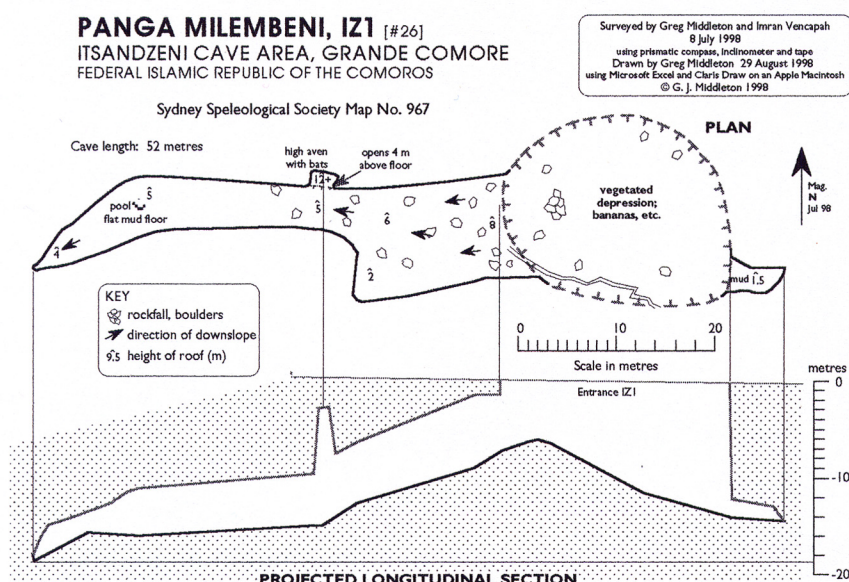


Fig. 18 – Plan and developed longitudinal section of Panga Milembeni, IZ1, north-east Grande Comore.

small high dome (or aven) just inside the cave is the roost of a number of bats which appeared to be the same species as those in Panga Nyamaoui. This group, however, probably only numbered a hundred or so.

On the other side of the entrance pit, which was planted with a type of yam, was only a small overhang. We surveyed the cave - see Fig. 18.

On being questioned, the locals said they knew another cave and directed us further north. This one (identified as #27 or IZ2 as we could not ascertain a name for it) consisted of a particularly deep pit with vertical walls, overhung in places and filled with a mass of vegetation - mainly huge *Dracenas*.

Fig. 19 – A huge *Dracena* provides easy access to Cave #27.



These caves, on the eastern side of the island, were visited with anthropologist Ian Walker and his wife, Anny. Milembeni 'grotte' is marked on the 1:50,000 road map of the island. When we got to the pit the locals assured us was Milembeni we decided the location marked on the map is somewhat too far north (it may, in fact, be the site of another cave). Although the entrance pit was very large and looked promising, the cave turned out to be insignificant - except for the fact that a

³ Dr Bill Trehwella of Nottingham University has since advised that a specialist at the Royal Museum in Scotland is convinced they are *Rousettus*.

We concluded that the *Dracenas* tend to survive in the collapsed pits either because they are susceptible to damage by cyclones and are only protected in the pits or (which I think more likely) they were cleared on the surface to make way for crops and grass, only surviving in those pits which are too deep to be safely cultivated. The biggest *Dracena* provided relatively easy access down the 8 m to

the usual rubble pile (Fig 19). Here we found a true cave (see Fig. 20) which even contained an intriguing, though small, lower level. We noted an old ceramic pot in the main passage and part of a large sea shell of a type which used to be employed as oil lamps.

Boboni Cave Area: Panga Mdrashi [#29 BB1] and Panga Rajab [#30 BB2-3]

A German zoologist, Speiser (1908), described a bat parasite, *Nycteribosca gigantea*, taken from a bat of the genus *Rousettus* 'n. sp' (no doubt *R. obliviosus* described only in 1978) collected in the "Höhle bei Boboni, 640 m über Meer" on 3 August 1903. This information also came to my attention through Pierre Strinati, and I assured him I would make an effort to find what could be a most important cave - especially if it is still a roosting site of *R. obliviosus*.

Boboni, high above Moroni, was the site of a large timber mill, constructed before the turn of the century to exploit the forests high on the side of Mt Karthala. The mill was clearly abandoned many years ago but a village and its hardy inhabitants remain. The fact that this village is at 640 m a.s.l., leaves no doubt that this is the place referred to by Speiser.

Two young men agreed to show us a cave near the village. They led us in a south-westerly direction probably about 500 m to a small field. There, at the base of a stone wall, was our 29th cave entrance, BB1, a gaping hole into which people had been throwing weeds removed from their vegetable gardens. We attached the ladder to a convenient tree and

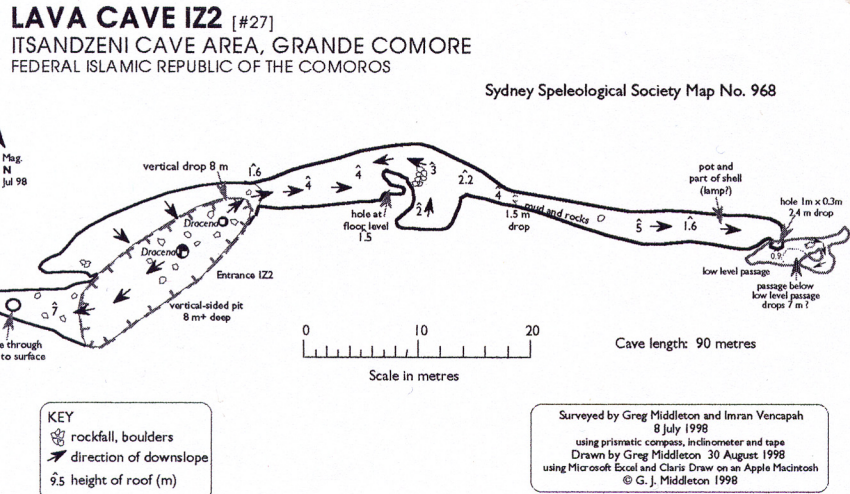


Fig. 20 – Plan of cave #27, Lava Cave IZ2, near Panga Milembeni, north-east Grande Comore.

PANGA MDRASHI BB1

BOBONI CAVE AREA, GRANDE COMORE
FEDERAL ISLAMIC REPUBLIC OF THE COMOROS

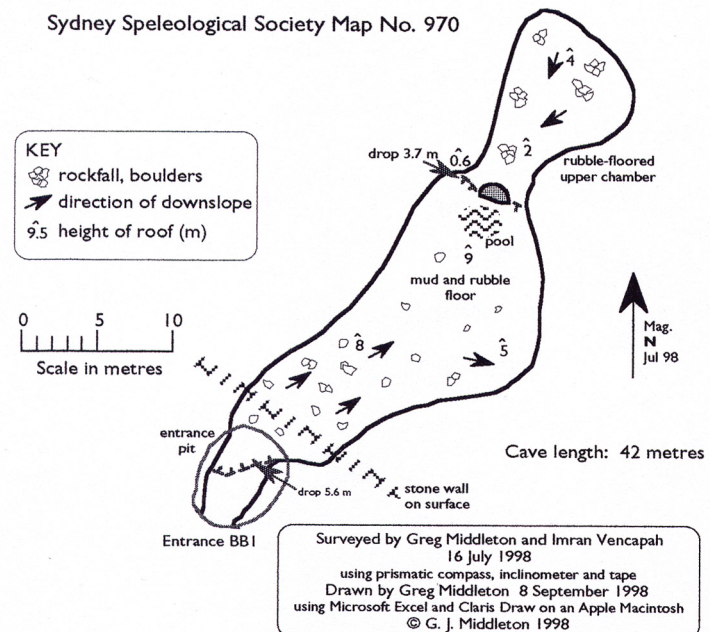


Fig. 21 – Plan of Panga Mdrashi, BB1, "incense burner cave", near Boboni.



climbed down. A steep passage led down to a lofty chamber with a mud floor and pools of water. On the far side of the chamber there was a hole in the wall almost 4 m above the floor. We climbed up and entered another, smaller, chamber with irregular roof breakdown on the floor. It didn't go any further - and there were no signs of bats. Both chambers were very wet and large amounts of water were dripping from the ceiling over virtually the entire area of the cave. These are not conditions favoured by bats and it is most unlikely that this is the 'Höhle bei Boboni'. The cave is known locally as Panga Mdrashi (which can be translated as 'incense burner') - see Fig. 21.

PANGA RAJAB BB2-3 [#30]

BOBONI CAVE AREA, GRANDE COMORE
FEDERAL ISLAMIC REPUBLIC OF THE COMOROS

Sydney Speleological Society Map No. 971

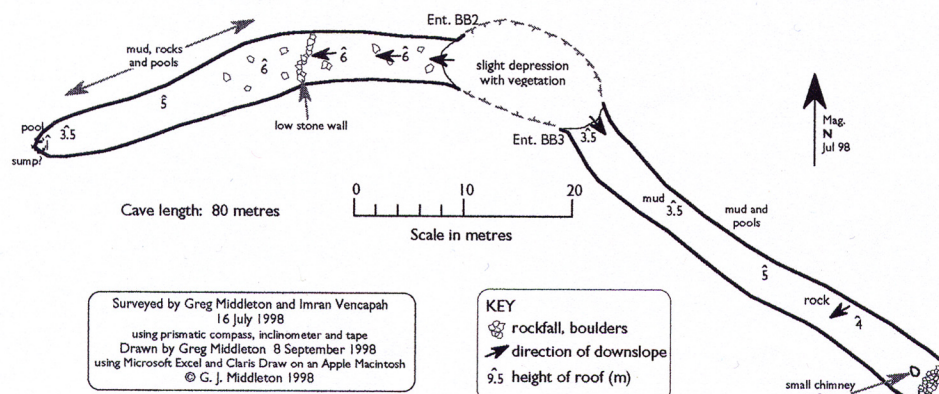


Fig. 22 – Plan of Panga Rajab, BB2-3, near the highland village of Boboni.

We were shown another cave about 740 m further from the village than BB1. Two entrances [BB2 & 3] led away from a central collapsed area and the usual rubble slopes led down

into the depths. In the southern part we found another case of a stone wall having been built across the passage. The cave terminated in a sump - or at least a pool of water (if the tube continues it is too small to admit a human). The northern passage ended after a short distance in a rockfall. In neither part were there any signs of bats, either at the present time or in the recent past. This cave, our 30th, we were told, is called Panga Rajab - see Fig. 22. It seems also not to be the one recorded by Speiser (1908).

Dibouni Cave Area

After I had left Comoros, Iain Walker investigated the cave marked on the map as Pangaleraladjou. It is inland from Hahaya, via Dibouni, and only accessible by four-wheel drive. Iain described the cave as a larger version of Panga Milembeni. There is a large pit, easily entered without climbing, with overhangs north and south. The pit is about 20 m in diameter and perhaps 10 m deep. The passage to the south is 15-20 m long, about 10 m wide and 8-10 m high. It leads to a second pit which appears to have no other exit. There is no spring, as implied by the map, but a small pool which may be larger in the wet season. The passage on the northern side is about 25 m long and 10-12 m high, with a lot of roof breakdown. No bats were sighted.

Djoma la Huwanga (Hahaya Area)

Iain Walker has drawn my attention to the following interesting reference to a cave by Pierre V  rin (1994) (translated from the French):

The marvellous cave bears the name of Djoma la Huwanga, 'the cave of the hatched egg'. It broke, and living beings came out. Their descendants settled Ngazidja, but they had forgotten the extraordinary place. Accompanied by Maurice Kraft, one of the most intrepid vulcanologists on earth, I found myself in the mysterious cave. While he was exploring a tubular gallery under the lava to the north of the runway at Hahaya, Kraft had his attention attracted by a noise that evoked the breathing of a marine monster. He led me there so that I could appreciate the unusual nature of this natural underground phenomenon. The gallery opened out a little above the level of the sea and the to-and-fro of



the waves created a light that was sometimes transparent, sometimes blue. A beach of white sand lay at the entrance of the cave, itself filled with stalactites of cold lava, and I imagined the surprise of the Shirazis who believed themselves in paradise after having suffered what they thought was a shipwreck. But the village of Hadombwe Ilezo, that had welcomed them, was itself covered by a lava flow in 1859.

Thus, this cave is the place where the first Shirazis (Islamic ancestors of the present inhabitants) are supposed to have landed, and would be expected to have some symbolic significance for Comoriens. Whether this cave is the one referred to as HH2 in this report, or another - and whether it still opens to the sea as described, remains to be investigated.

Island of Moheli

Because of the political situation we were unable to visit Anjouan. We did visit Moheli but in five days were unable to discover any significant caves. We were shown some small sea caves but could find no lava tunnels.

Cave regions and areas of Grande Comore

Based on last year's experience and the additional information now obtained, I propose a series of "cave areas" for Grande Comore which group caves in the same locality and provide for a logical, if arbitrary, way of numbering cave entrances.

The larger scale regions are simply Grande Comore North-East, North-West, South-East and South-West. Within these, cave areas are generally named after the closest village, as follows:

<i>Area</i>	<i>Code</i>	<i>No. of entrances recorded</i>	<i>Total length (m)</i>
<i>Grande Comore NE</i>			
Itsandzeni	IZ	2	142
<i>Grande Comore NW</i>			
Bahani	BH	3	30
Dibouani	DB	2	45
Fassi	FA	1	810
Hahaya	HH	14	2,585
<i>Grande Comore SE</i>			
Simboussa	SB	2	80
<i>Grande Comore SW</i>			
Boboni	BB	3	122
Djoumouachongo	DJ	1	4
Kourani	KO	6	66
Singani	SG	4	160

Conclusion

The results of this second trip to the Comoros were most satisfactory, despite the disappointment of not being able to get to Anjouan and the lack of caves on Moheli. Exploration and survey of all of the caves on Grande Comore that had been only partly investigated on the first trip were completed, except for #6, #7 and #8 which were considered too dangerous and #3 and #4 which were too small to enter. In addition, a further fifteen lava caves were located, explored and surveyed, bringing the total to thirty.



The discovery of the first and second known roosting sites of the small endemic fruit bat *Rousettus obliviosus* were confirmed and some invertebrate cave fauna was collected. Many interesting questions remain in relation to the lava caves of Grande Comore and the likelihood of further major discoveries is high.

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