KENYA - 1998

8th International Symposium on Vulcanospeleology

Greg Middleton

Although about 20 years in gestation, the IUS Commission on Volcanic Caves' 8th Symposium in Kenya was almost still born. The indications could hardly have been less auspicious: afflicted by more diseases than most people can name[1], just having undergone a turbulent election - the results of which remain in dispute - and suffering flooding from unseasonably heavy rains, Kenya hardly seemed the ideal place for a speleo-convention.

Beating all the odds, however, Jim Simons and his small band of helpers from the Cave Exploration Group of East Africa (CEGEA) got together the first - and perhaps the only - gathering of its kind in East Africa in February 1998. Despite many initial expressions of interest, the eventual international enrolment was six: from Italy (Prof. Paolo Forti), Japan (Takanori Ogawa), Netherlands (Jan-Paul van der Pas), USA (Dr Bill Halliday and Prof. Ron Greeley) and the author from Australia. In addition, former CEGEA members returned from the UK (Gordon & Anne Davies and Dave Womack) and Norway (Bob Davis) to help with guiding and organisation. Present CEGEA members also involved were Dick Fordyce, Clive Ward, Declan Kennedy and Jerry Gibbs.

In the descriptions of the caves visited during the field trips which follow, liberal use is made of the excellent guidebook especially prepared by Jim Simons for the symposium (Simons 1998).

CHYULU HILLS

The first pre-symposium field trip was to the Chyulu Hills, a major volcanic cave area south of Nairobi near the Tanzanian border virtually in the foothills of Mount Kilimanjaro. This chain of recent volcanoes (up to 2,175 m a.s.l.) makes up one of Kenya's most dramatic and unspoilt volcanic wilderness landscapes (Simons 1998, p. 6).

The lava flows cover an area about 80 km north-south and up to 30 km wide, totalling about 2,000 sq. km. The northern and eastern side of the range is within the recently-gazetted Chyulu Hills National Park and the southern tip lies within Tsavo West National Park while the western flanks are Maasai grazing areas. The most recent lava flows in the Chyulu have been dated at 480± 200 years BP but the Shetani flow in the south may be less than 200 years old. The caves in this region have been under study by CEGEA, and especially by Jim, since 1965 (Simons 1974).

A number of springs occur along the eastern edge of the hills where the water falling on the porous lava rises. Our base for the four-day field trip was Umani Springs, near Kibwesi, about 2.5° south of the equator, where Jim Simons' company has established a luxurious tented camp. Due to the recent heavy rains, the normal track to the camp was flooded and we had to use a longer (15 km) track from further north than usual (about 190 km down the Mombassa road).

Mathaioni Lava Cave

This major (1.9 km) cave in the northern Chyulu was visited on 3 February. It was previously mined for bat guano by Jim Simons and in 1972 was opened as the country's first tourist cave following installation of stairs and handrails. Following about a 15 km drive in from the highway at Hunters Lodge, we enjoyed a picnic lunch against the backdrop of the classic lava field landscape near the cave entrance and then descended the usual collapsed rock pile (see Fig. 1).

The entrance passage is about 8-10 m in diameter and floored with roof breakdown. After a couple of hundred metres one comes to "The Pit" where there are wooden stairs to the lower level in which a significant part of the guano mining took place. Jim had left a large sample of the original guano deposit in situ, showing about a 3 m section with banding, mummified bats, etc. The protective fence remains but sadly the guano has since been removed by persons unknown. We then proceeded through a slightly muddy crawl under "The Bridge" which was actually opened as a result of the guano mining (Simons 1998, p. 15) and ascended/descended a couple more short sections of stairs to view the "Chocolate Slab" -

[1] For example, anthrax, cholera, dracunculiasis, dysentery, ebola viris, echinococcosis (hydatid disease), filariasis, giardiasis, helminthic (parasitic worm) infestations, hepatitis, leishmaniasis, malaria (including untreatable strains), Marburg disease (African haemorrhagic fever), meningococcal meningitis, plague, polio, rabies, relapsing fever, Rift Valley fever, schistosomiasis (bilhazia), shigellosis, trypanosomiasis (sleeping sickness), trachoma, typhoid fever, typhus, yellow fever … see web page: http://www.tripprep.com/country/sp97.html.

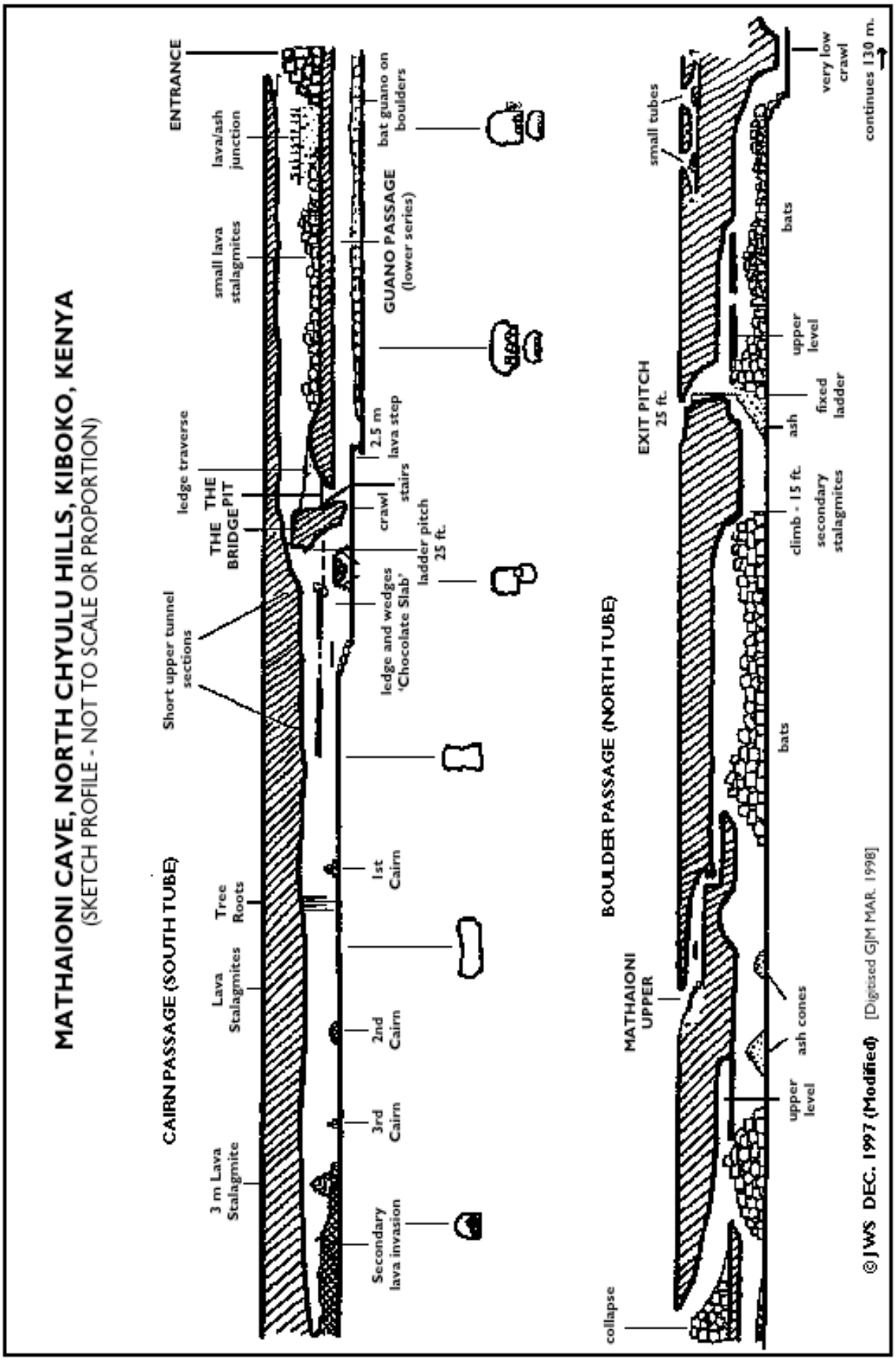

Fig. 1. Sketch profile of part of Mathaioni Cave, North Chyulu Hills (based on Simons 1998, Fig. 10).

the underside of what appears to be a boulder of lava. The surface is a rich chocolate brown with a lustrous glaze and many lava stalactites. The following large section of the tube is known as Cairn Passage from the three piles of rocks which are believed to be burial cairns - though they have not been disturbed to check for the presence of human remains[2]. Between the first and second cairns are a forest of tree roots from fig trees growing above. This passage is also liberally adorned with lava stalactites, benches and various flow marks, indicating levels at which the subsiding lava flowed through the tube. In places the 'skin' of the wall has collapsed, resulting in piles of ash, indicating the original material through which the lava flow passed. Beyond the third cairn is a lava stalagmite built up from a subsequent flow entering a hole in the roof, now filled. The pile of twisted lava blocks reaches a height of about 3 m and is a contender for the world's largest lava stalagmite (Fig. 2). A short distance further on the cave is sealed by subsequent lava which may have blocked the entrance used by the cairn-builders. The acrid smell of ammonia from bat guano becomes stronger as the passage gets smaller.

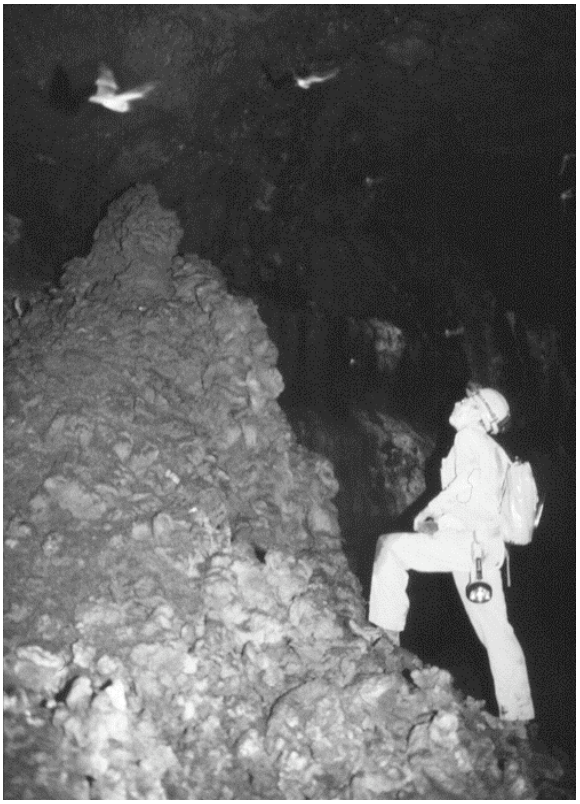

Fig. 2. Giant three-metre lava stalagmite in Mathaioni Cave, Chyulu Hills; formed by the build up of lava spilling into the cave through a hole in the roof, since sealed - Jim Simons.

[2] Jim believes the builders of these cairns entered the cave through an entrance subsequently filled by another lava flow.

Returning through the crawl, some of the party decided to proceed down Guano Passage, rather than returning via The Pit. The floor of this passage is littered with white bat skeletons and the lowest points were filled with pools of an evil-looking foul-smelling black liquid. Paolo found an interesting deposit of white material like moonmilk, which he sampled (Fig. 3).

Fig. 3. Prof. Paolo Forti, world authority on cave minerals, samples a soft white cave mineral deposit, Mathaioni Cave.

A boulder pile provided a route back to the upper level and an entrance in the same surface collapse we had entered by. The cave continues for some hundreds of metres and has at least two more entrances. We emerged from Mathaioni about 3:15; some of the party opted to look at the volcanic landscape while others, led by Jim, went for a short visit to part of

Kimakia Cave (aka Ithundu Mine)

This two-level system has a total length around 1.4 km, first explored by CEGEA in October 1965 (Simons 1974).

We entered where the employees of Jim's company, Kenya Guano Ltd, used to camp while mining the cave's extensive bat guano deposits. We proceeded along the passage to a daylight hole, beyond which it was necessary to walk along a narrow ledge on the right to avoid dropping down a deep slot to a lower level. The miners had installed branches along this ledge, wedged between roof and floor, to clearly demarcate the route and to support lights. After about sixty metres the ledge ran out and it would be necessary to descend over a steep lava fall. Unfortunately the ladder used by the miners was no longer in place and the slippery rock made unaided descent too dangerous. We returned to the entrance and followed the passage in the other direction, descending a two-metre bush ladder into the "New Maxwell House" section. We soon understood the reason for the name as the aroma of bat guano became

progressively stronger. There is still a great deal of guano present although over a metre was dug out.

This section is home to very large colonies of the rare Greater African Free-tailed Bat *(Optomops martiensenni),* a large light-coloured bat with very big ears. Some were hanging low enough for us to clearly see the pink, fleshy tail. Walking in the deep guano, occasionally liquefied in pools, with large numbers of the bats swirling around us in an atmosphere so charged with ammonia as to make breathing difficult, was somewhat unpleasant. Dave made a few attempts to capture the bats on video, using a home-made 12v spot light. We all found it a great relief to return to the relatively fresh air of the entrance. The guys who worked here, extracting the guano (much of which was removed through an artificial hole opened in a thin section of roof) earned their pay!

Back on the surface we met up with the others to return to Umani Springs Camp for a hot shower, a "Tusker" or two and a hearty dinner.

Leviathan Cave

The following day was to be a highlight of the trip - a visit to the legendary Leviathan Cave. This cave was discovered by Jim Simons and his CEGEA associates from aerial photography in 1975. It soon became obvious that it was a major lava cave and was eventually pushed to 12.5 km, with a depth of 470 m (Simons 1998, pp. 16-19). Until about 1995 it was the longest and deepest lava cave known (Hawaii's Kazumura Lava Cave then took over and has since reached 62 km).

To reach Leviathan we had to make a major detour to avoid flooded sections of the normal route. We were away by 7:30 am and travelled down the Mombassa Road, Kenya's major highway, linking the capital (plus Uganda, Rwanda, Burundi and NE Zaire) to the coast, which had been cut by floods in a number of places. There was, in fact, considerable doubt that it would be possible to get through until this day, when the military installed a Bailey bridge to replace a washed-out section of road. Traffic on the highway is normally heavy but the bank-up caused by the wash-aways made things even worse and we had to negotiate two flooded sections of road with numerous large trucks pushing huge bow-waves. A couple of kilo-metres south of the new bridge we turned off to the west (with considerable relief) and by 9:30 reached a ranger station where we took on board two armed Kenya Wildlife Service rangers. We then followed a long and tortuous route through private property and along rarely-used tracks, deep into the Chyulus. At about 11 am we stopped and decided to have an early lunch before heading for the cave.

By diverse paths and a bit of bush-bashing and scouting by Jim, we reached Discovery Collapse about 1:30. We descended into the shady entrance depression, changed and clambered down a rockfall into a large passage - with a steep drop (Fig. 4).

Fig. 4. Large passage with deep cleft below Discovery Collapse, Leviathan Cave.

We edged along a narrow ledge on the left wall and when it ran out, dropped down onto a mid-level floor which dropped off steeply both upflow and down. Fortunately a ladder had been brought; this was rigged at the upflow drop and we descended about 2.5 m to a lower level (see Figs. 5 and 6). Upflow the passage was about 8 m in diameter and easy walking. Paolo found a few minerals, Bill and others took

Fig. 5. 2.5 m ladder pitch into lower level, Leviathan Cave.

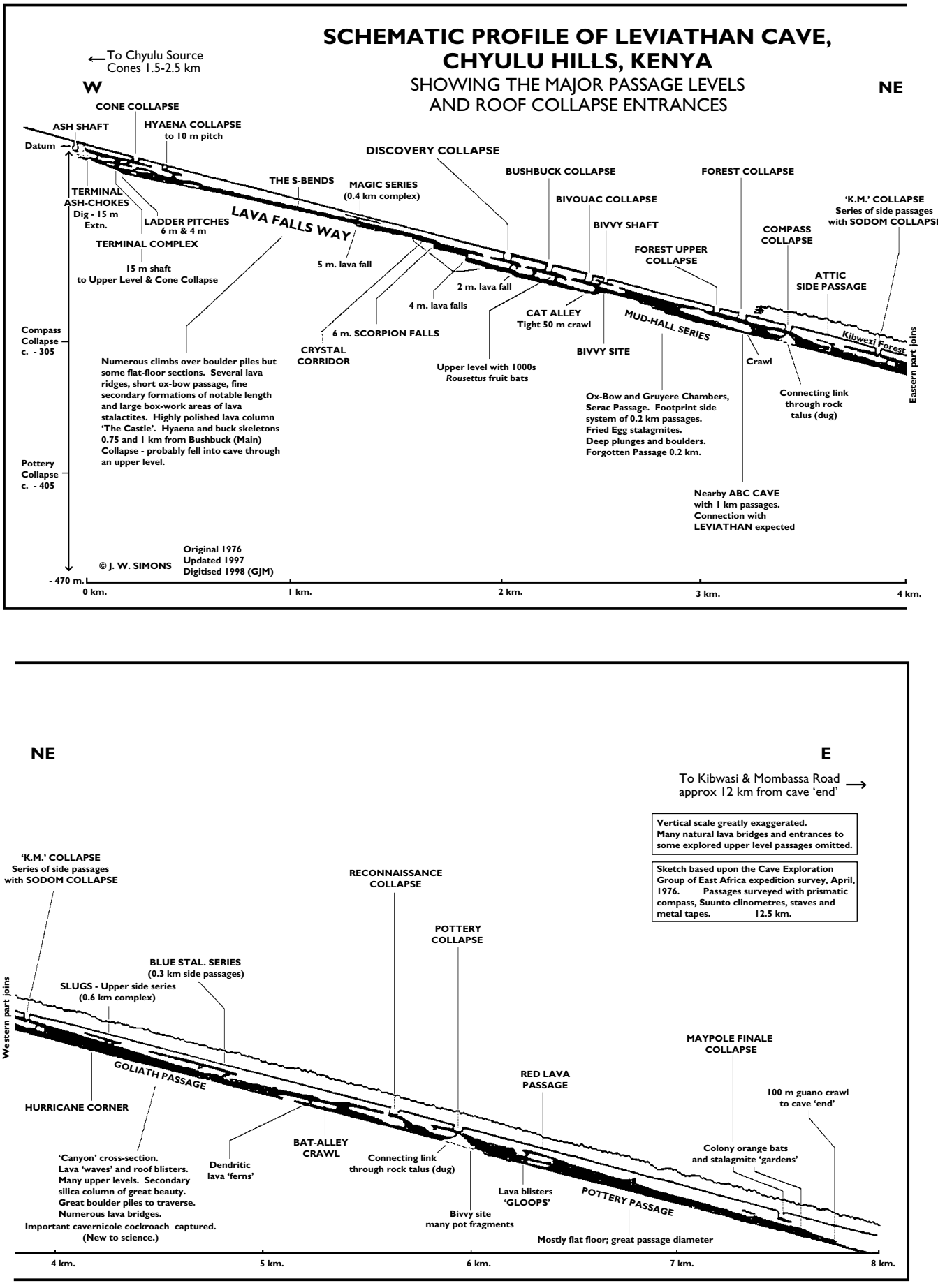

Fig. 6. Schematic profile of Leviathan Cave, Chyulu Hills (based on Simons 1998, Fig. 14).

photos and Ron examined various detailed features. I climbed an easy 4 m lava fall and then the 6 m Scorpion Fall with Bob who had been on the original exploration party and saw the large scorpion which gave its name to the drop. The passage continues to rise gradually, maintaining its large dimensions, with occasional sections of roof-fall. We ascended another 4 m step (Fig. 7) but time precluded a major exploration. Others proceeded down the flow towards Bushbuck Collapse. After about two hours underground, and satisfied that this is indeed a significant lava cave, we returned to the surface (Fig. 8) and made our way back to the vehicles. We were back at camp about 8 pm. On the return trip the rangers arrested two men collecting the leaves of the Miraa tree *(Catha edulis)* within the National Park. This is used as a drug by the locals. We were told they were likely to be fined about 1,000 shillings (c. US $17) - a not insignificant amount by local standards and about three times what their harvests might have yielded.

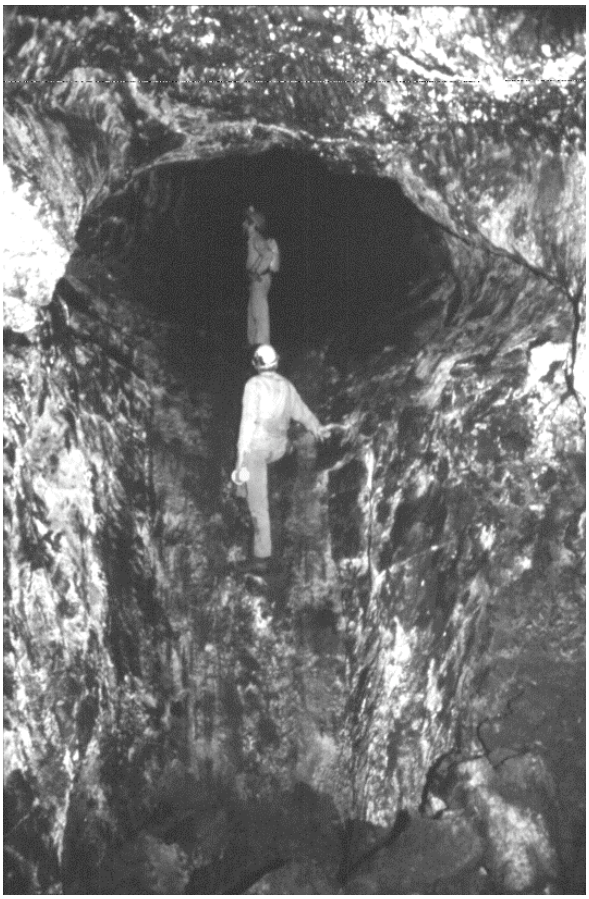

Fig. 7. 4 m lava fall in Leviathan above Discovery Collapse - Bob Davis and above, Dave Womack.

Fig. 8. The IUS symposium party after emerging from Leviathan Cave, north Chyulu Hills, with ranger Calmax Simiyu (right).

Shetani Cave

On 5th we again drove south, this time entering the Mitto Andei Gate of Tsavo West National Park (entry fee US$23 per head + 500/- for the vehicle). Here we indulged in a bit of big game spotting and were able to tick off gazelle, zebra, giraffe and various other ungulates. We lunched near the impressive Mzima Springs, a major discharge from the Chyulus; a significant source of the Tsavo River and water supply for Mombassa. We later watched the resident hippopotamuses happily hippoing away in the large pool below the spring. There is even an underwater observatory but only tilapia are to be seen - apparently the hippos stay well away from it. Getting on with more serious endeavours, we then drove to the Shetani Lava Cone and lava flow - an impressive recent ash cone and large area of aa lava - described contemptuously by Bill as “worthless rock”. Nearby, in an earlier (pahoehoe) flow are a series of 8 m deep shafts and collapse holes leading into lava tubes, most of which are segments of an original single tunnel (Simons 1998, p. 13). Shetani Lava Cave, with about 200 m of passage, is the longest of these and has been opened to the public by the provision of stairs. We visited three segments: to the left of the entry collapse (upflow) there is a 25 m section comprising a high domed passage termed a ‘cupola’ by Bill; to the right is the main section of the cave, comprised of a tunnel about 5 m in diameter with rhino and other animal bones (signposted). After about 100 m there is another collapse with a long steel ladder to the surface. We passed on into a third segment of the tube which, after a few metres, dropped steeply to a lower level. Lacking climbing equipment, we decided to call a halt at this point.

Following this epic caving trip we repaired to the comfort of the Kilaguni Lodge where we downed a few Tuskers and took in the spectacular view of waterhole with wildlife backed by lava cones to the horizon, including Shetani, standing out by its lack of vegetation.

This completed the Chyulu field trip; next day we returned to Nairobi.

NDARUGU RIVER CAVES

A brief visit was made on 6 February to the Ndarugu River Caves in the Thika area, 30 km NE of Nairobi, led by Dick Fordyce. Here a series of caves has formed in relatively soft welded volcanic tuffs of Tertiary age - presumably by a combination of groundwater solution and abrasion. The passageways entered are all quite small (Fig. 9) but form a surprising network with numerous entrances at different levels. One could never assume a narrowing passage would end with what appeared to be a blind passage; the chances were, if you crawled as far as you could see, that the passage just changed direction and continued on. Generally there is not much evidence of the mode of formation but elsewhere there are clear streamways with pebbles, and what appear to be solution-enlarged joints.

Fig. 9. Bill Halliday proves that unlikely holes at Ndarugu can go!

SYMPOSIUM ON VULCANOSPELEOLOGY

The 8th International Symposium on Vulcano-speleology was held at the Panafric Hotel on the weekend of 7-8 February 1998. It was opened by Jim Simons, Chairman of the host organisation, the Cave Exploration Group of East Africa. Jim also presented the first paper, a broad overview of the lava caves of eastern Africa, with particular emphasis on Kenya.

Second was CEGEA Librarian, Declan Kennedy, with a detailed, and at times amusing, history of CEGEA and its efforts to document the lava - and other - caves of East Africa.

The author then presented his report on the first documentation of the lava caves of the island of Grande Comore, west of the northern tip of Madagascar in the Indian Ocean. A total of 15 entrances were recorded, with the longest tube surveyed reaching over 450 metres. Exploration of the three largest caves (all exceeding 300 m) could not be completed (for a report on the trip see Middleton 1998).

Clive Ward spoke about high altitude volcanic caves he had observed over 5,800 m a.s.l. on Mount Kilimanjaro, Tanzania.

The author presented an overview of the lava caves of the island of Mauritius in the Indian Ocean. Over 50 significant caves have been documented, up to 687 m long and recorded since as early as 1769.

Prof. Ron Greeley described the Giant Crater lava tube system of northern California, extending nearly 30 km. It is of particular interest because it is one of few lava tubes to show clear evidence of erosion into pre-existing country rock.

Dr Bill Halliday presented three papers on volcanic features of Hawaii: hollow tumulus caves of Kilauea Crater, sheet flow caves of Kilauea Crater and the need for redefinition of the term “pit crater” with examples from Hawaii.

Prof. Paolo Forti presented the results of his analysis of samples of minerals from two lava caves near Malargue, Argentina.

Gordon Davies reported on a transient chamber heavily decorated with fragile stalactite forms in the carbonatite lava of the crater floor of the active Ol Doinyo Lengai volcano, Tanzania.

Jim Simons outlined the history of his guano mining in Kenyan lava tubes in the ‘70s, most of which was used as a fertiliser for coffee crops.

Bob Davis reported on unusual fissure caves in volcanic tuffs in the Solai region in the Rift Valley of Kenya and speculated on their mode of formation.

A paper on archaeological investigations in a Kenyan lava cave prepared by Bernard Mbae Nubi was read.

Two papers were presented in absentia for Kevin and Carlene Allred (Alaska USA): one speculating on the origin of tubular lava stalactites and related forms; the other on lava tube remelt by radiant heat and burning gasses.

Fig. 10. Bill Halliday, foundation chairman of the IUS Commission on Volcanic Caves (right), hands over the chair to Jean-Paul van de Pas.

The symposium concluded with a meeting of the Commission on Volcanic Caves at which, following formal business, foundation chairman Bill Halliday handed over to Jean-Paul van de Pas (Fig. 10). Jean-Paul paid tribute to Bill's work in setting up the commission which has improved communication among those working on volcanic caves around the world and established a central database on volcanic caves.

MOUNT SUSWA

(or Ol Donyo Onyoke)

On 9 February the post-symposium field trip took most of the participants to an unusual volcano in the Rift Valley 90 km by road NW of Nairobi. The volcano is unusual because voiding of the central magma chamber led to collapse of the central area of the caldera to form a circular graben over 250 m deep. The central island block or 'raft' remained elevated, leaving a circular trough or 'moat' partially infilled by subsequent lava flow (Fig.11). This unique structure (only the lunar crater Poisodonius has a similar appearance) appears to be quite recent and steam still vents from several places (Simons 1998, pp. 20-22).

Exploration and study of the caves of Mt Suswa, principally just east of the main crater, has been pioneered by CEGEA, subsequent to their first being recognised in 1962 (Glover et al. 1964). Indeed, it was the desire to explore and conserve these caves which led to the formation of CEGEA (Simons 1964). There are now 67 documented entrances with an estimated total passage length exceeding 11 km in a remarkably compact area only about 1.4 by 2.6 km (Fig. 12.). Access is by a rough 4x4 track up the NE flanks of the volcano, through Maasai cattle country. The track ends at entrance #14 where the local contingent were to camp for the night.

Cave 13

The first visit was made to the "13 Series" cave. (A major collapse is assigned a number which becomes the identifier for the cave; other collapse entrances in the same system are assigned letters, hence 13A, 13B, etc.). Just inside the entrance is a rough ring of rocks - the remains of a hut such as were constructed in these caves by the independence-fighting Mau-Mau in the 1950s - hence the name of the passage (Fig. 13). Downflow of a further collapsed hole (13C) the tube bifurcates. To the left the 'Ropes Passage' presents some very fine examples of ropy lava folds - some of which have unfortunately been broken by vandals,

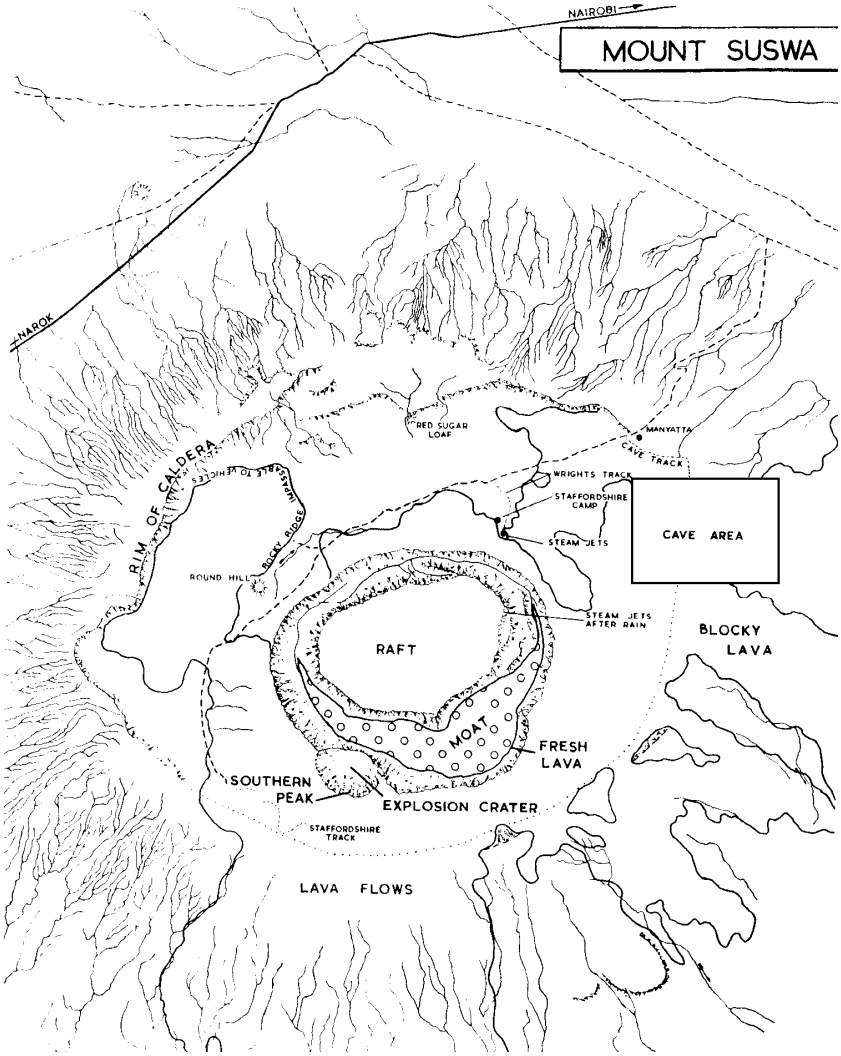

Fig. 11. Plan of Mt Suswa and environs, showing the unique structure of the caldera and the location of the main cave area (from Glover et al., 1964)

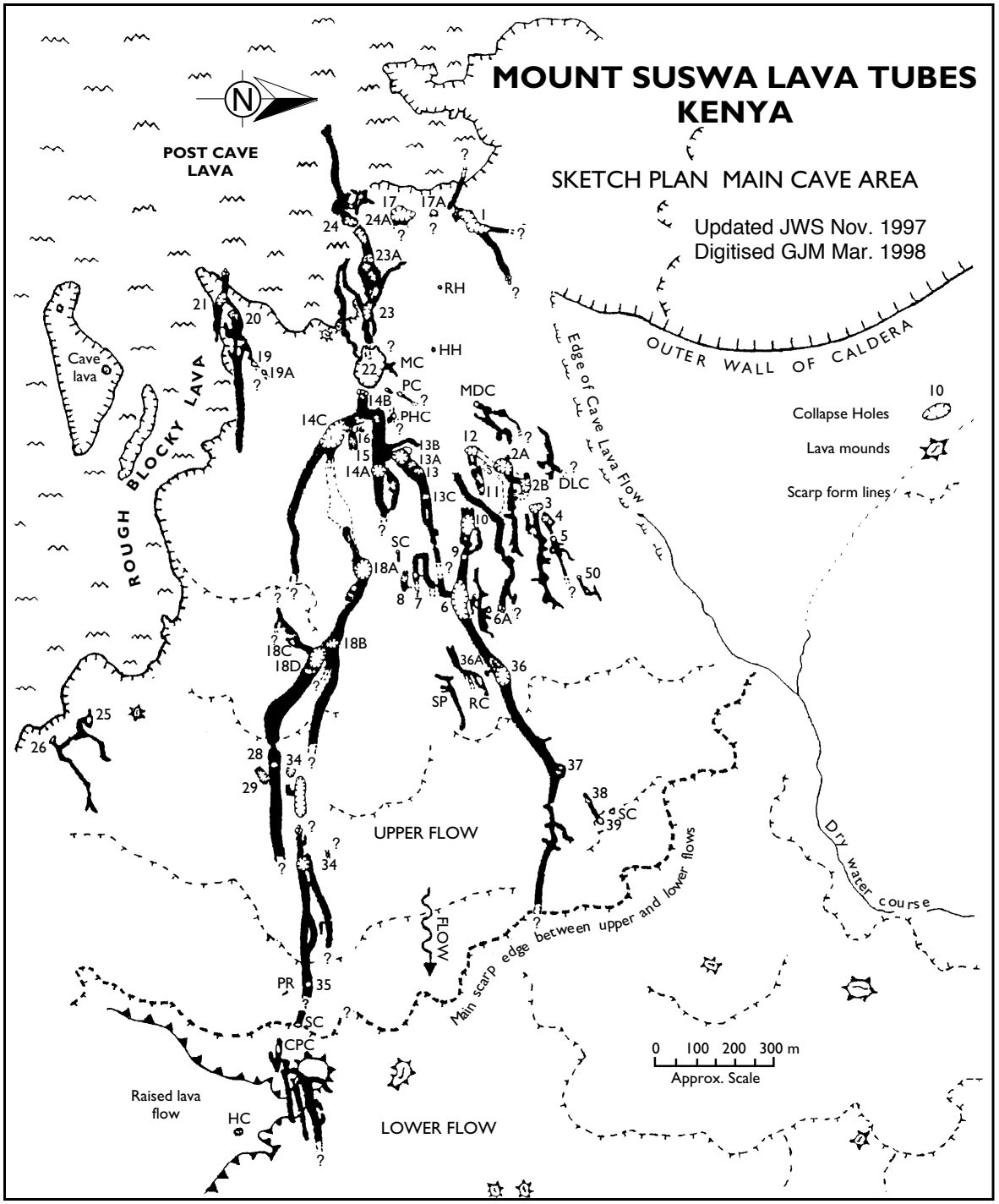

Fig. 12. Sketch plan of Mt Suswa lava tubes (after Simons 1998, Map VI)

revealing that they are hollow. Just prior to the fork is the 'Hand & Thumb' lava lobe, formed when the lava started to flow to the right but then stopped, flowed down the left passage and was subsequently overlain by a further flow. Further on the two tubes reunite and the floor is covered with silt, leading to a crawl, a dig carried out in 1977 and the end in a silt choke.

Cave 14

After lunch, Cave 14, part of the 'Grand Central System', 14-18 Series, was visited. An imposing collapse opens into the large, flat-floored 'Ballroom', from which a couple of passages lead off to the north. This is a traditional camping shelter and the local contingent was to spend the night in this chamber while hyenas wandered around outside.

Cave 12

The first part of this cave is of modest dimensions, perhaps 5 m wide and rarely more than 2.5 m high but it contains many features of interest. There are a number of fine examples of ropy lava on the floor, a high bench feature known as the 'Wedding Cake', masses of small lava stalactites blown sideways, apparently by blasts of hot gasses, and some memorable crawls. Regrettably, the second crawl had silted

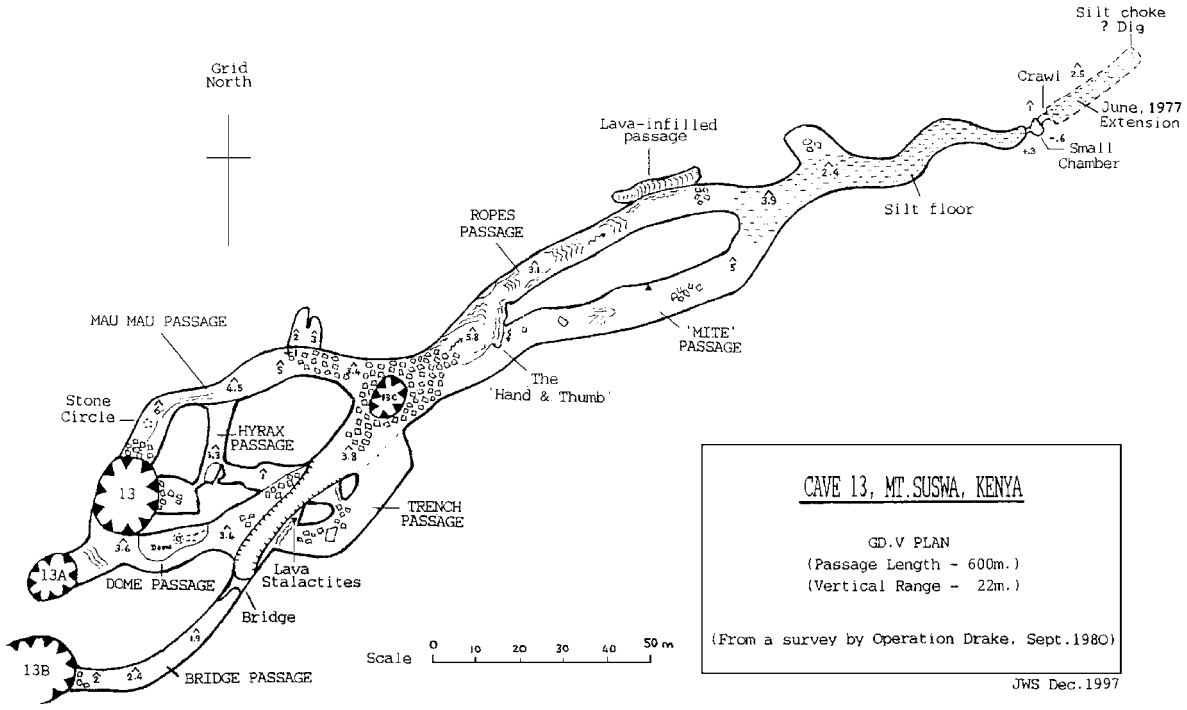

Fig. 13. Plan of Cave 13, Mt Suswa, Kenya (Simons, 1998, Fig. 19)

up, preventing access to the larger part of the system. On our return a number of us stopped to admire and photograph a fine set of lava 'ropes' with a prominent 'toe' of lava emerging from under a subsequent flow (Fig. 14). Our Japanese delegate, Takanori, arrived on the scene at that moment and unhesitatingly declared this the best example of such a feature to be found in any lava cave in the world. (It should be noted that we used the term 'tongue' but this does not conform with Larson's authoritative glossary - Larson 1993 - so I have substituted 'lava toe': *a bulbous mass of lava in tough, elastic skin which emerges from the crusted front of a relatively slow-moving pahoehoe lava flow …* Unfortunately, Larson does not illustrate a 'toe').

Cave 18

Time permitted a visit to only one more cave; Jim suggested 18, a cave which had been used as the backdrop for the film *Sheena - Queen of the Jungle* some years ago. This was another cave from which bat guano was extracted by the energetic Jim Simons and concreted steps down into the 18A collapse remain as a legacy of this time. We passed through the Leopard Lair Passage, noting several mounds of black resinous material, apparently the accumulated excrement of owls (?), passed the upper level Maypole Series, noted the piles of baboon excrement adorning every prominent rock and paused to admire the 18C collapse where some dramatic scenes had been shot for the film (Fig. 15).

Fig. 14. A fine example of a lava toe, Cave 12, Mount Suswa (unfortunately the photo does not do justice to the feature).

Fig. 15. Collapse entrances 18C & D, Mount Suswa - location for a rockfall scene in the local epic "Sheena - Queen of the Jungle".

The story required a rockfall to descend on her ladyship at this point and a large number of pseudo-boulders were fabricated from fibreglass and foam plastic and dropped down through the hole in the roof. Jim collected many of these afterwards but a few still litter the rockpiles. We gazed down into the very large Otomops Passage and savoured the customary guano aroma but time did not permit us to proceed further.

That evening, while the locals camped in the Ballroom chamber of Cave #14, the visitors drove many kilometres to the north to the luxury of the Lake Naivasha Country Club.

The Crater

Back at Mount Suswa on 10 February, the group reformed and drove into and across the caldera to the edge of the inner moat (see Fig. 11). From there we gazed across the moat and central raft to the summit beyond. Steam vents could be seen in the moat and Dave told us of his epic journey to the summit some years ago and exploration of the cave just below it. While we were enjoying lunch three local Maasai youths came to visit. They were mildly interested in us but seem entirely content with their lot and maintain their traditional styles of dress (red cloaks) and adornment (hair dyed red). In the afternoon Jim and Dick returned to Nairobi while the rest drove further north up the Rift Valley past lakes Naivasha, Elemantitis and Nakuru, to stay at the Lake Baringo Country Club.

MOUNT ELGON

Mt Elgon straddles the Kenya-Uganda border. The main summit, Wagagai, is 4,320 m a.s.l., making it Kenya's second highest. The volcano was active during Miocene and Pliocene times and its eruptions were mostly explosive, with little lava. The 3,500 sq.km. comprising the low angle cone is mainly composed of agglomerates, breccias and tuffs. Old lake deposits with an abundance of fossil wood form a marked band in the foothills and are frequently exposed in the caves (Simons 1998, p. 30).

The caves of Mt Elgon have a unique claim to fame: the world's largest cave fauna: elephants (Fig. 16) – but they are also of special interest because they have at least partly been formed by the activities of elephants and other animals, including humans, mining salts from the walls.

As explained by Redmond (1990),

> *Elephants, like all other animals, need salt. If their food does not contain enough, they will search until they find a 'salt-lick'. But unlike other salt-hungry animals, elephants cannot actually lick the salt. Their tongues are simply not long enough to reach around their trunks and tusks. Instead, they dig it up. Using their tusks like a spade to loosen the earth, elephants pick up the clods with the tip of their trunks and put them into their mouths. Even rocks, if they are salty, are ground up by the massive molars and swallowed.*
>
> *Elephant salt-digging behaviour has undercut cliffs in some parts of Africa and Asia but in only one place has it resulted in large caves - on Mount Elgon in Kenya. In the dark recesses of these huge caverns, elephants feel their way to traditional mining bays deep underground. There, working only by touch, they use their tusks as living ivory chisels to prise off lumps of sodium-rich volcanic ash to eat. From their earliest days, baby elephants accompany their mothers right into the caves. The cows, however, keep a careful trunk on their offspring to prevent them wandering off and falling down a crevasse or rock face in the pitch-dark interior.*

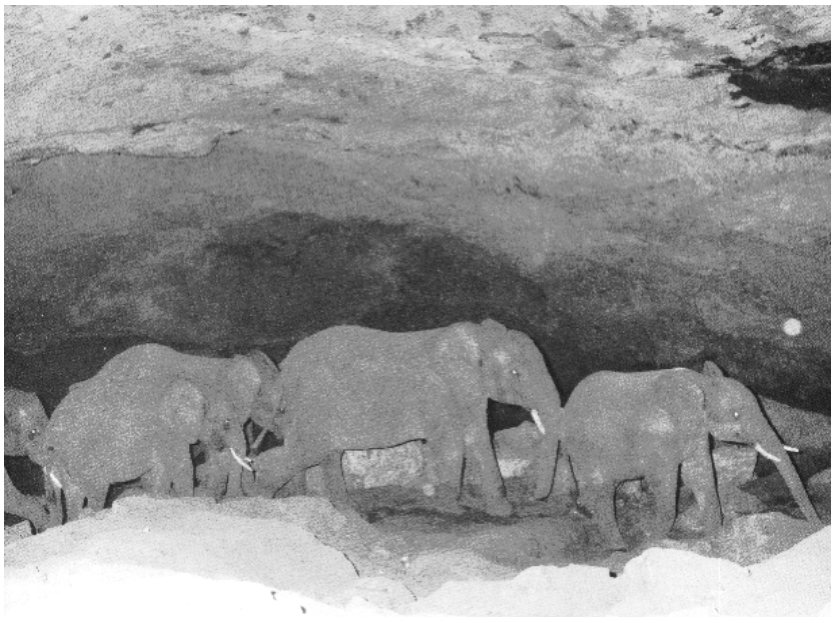

Fig. 16. Elephants still regularly make the hazardous trip into the dark zone of Kitum Cave on Mount Elgon to gouge salt-rich rock from the walls (photo by Ian Redmond from Redmond 1990).

One other claim to fame, of Kitum Cave in particular, is as a source of the untreatable deadly ebola virus. We were assured by Jim (Simons 1998, p. 35) that this was "unproven" - but then, he didn't join us on this part of the trip!

On 11 February we drove the supposedly scenic road via Kabenet (but could see nothing through the thick fog), Iten, Eldoret (where we had lunch) and Kitale, to the Mount Elgon Lodge on the edge of the national park of the same name. The Lodge was evidently a colonial farmhouse, now converted to a tourist lodge but only taking parties of guests by special arrangement. Although we had been led to believe that elephants had probably been wiped out in this region, Gordon and Anne swore that they sighted three while on an excursion around dusk.

Although everyone arose early on 12th and went out looking for elephant, none were spotted. After breakfast we went to the national park headquarters, picked up two (armed) rangers and drove around the lower slopes of the mountain, still hoping to see a 'tusker'.

Kitum Cave (meaning, in Maasai, 'place of the ceremonies')

Caves were what we were really here to see, however, and soon we were parked at the beginning of the track to Kitum Cave, pulling on trog suits and donning bash hats. Kitum is the most accessible of the 'elephant caves' and is reached by a pleasant walk of about 300 m through forest. The entrance is not as impressive as one might expect, having been told it is 45 m across, due to the presence of a wall of fallen rocks which lies in front. A small waterfall tumbles over about the middle of the entrance.

Once inside, the immensity of the chamber becomes obvious, though the roof is only about 4 m high. The chamber widens as you go in and soon, as you ascend the huge central rockpile, the walls are beyond reach of your light (Figs. 17, 18). The evidence of visits by elephants is immediately obvious as there are piles of dung everywhere, clear round footprints in mud and tusk gouge marks on virtually every piece of wall (Fig. 19). Paolo, always on the lookout for cave minerals, soon found crystals protruding from depressions in the ceiling. It appears that these hollows were originally occupied by pieces of wood which were included in the volcanic ash deposited in lakes and swamps. In some cases the wood has become 'petrified' and the rock that replaced it is evident as white inclusions in the tuff or agglomerate. Elsewhere the wood has broken down, leaving a space which was later 'invaded' by mineral crystals. In places these take the form of massive individual crystals, in others there are myriads of tiny radiating crystals, like those formed by aragonite in limestone caves. In one crevice we saw crystals resembling small white gypsum flowers which Paolo thought were most likely the salt the elephants were really after. Whatever care the elephants take, it seems they do occasionally come to grief on their caving excursions: we saw a large skull and many huge bones deep in a crevice. Takanori told of a Japanese film crew which had been filming the elephants in this cave a few years ago when a

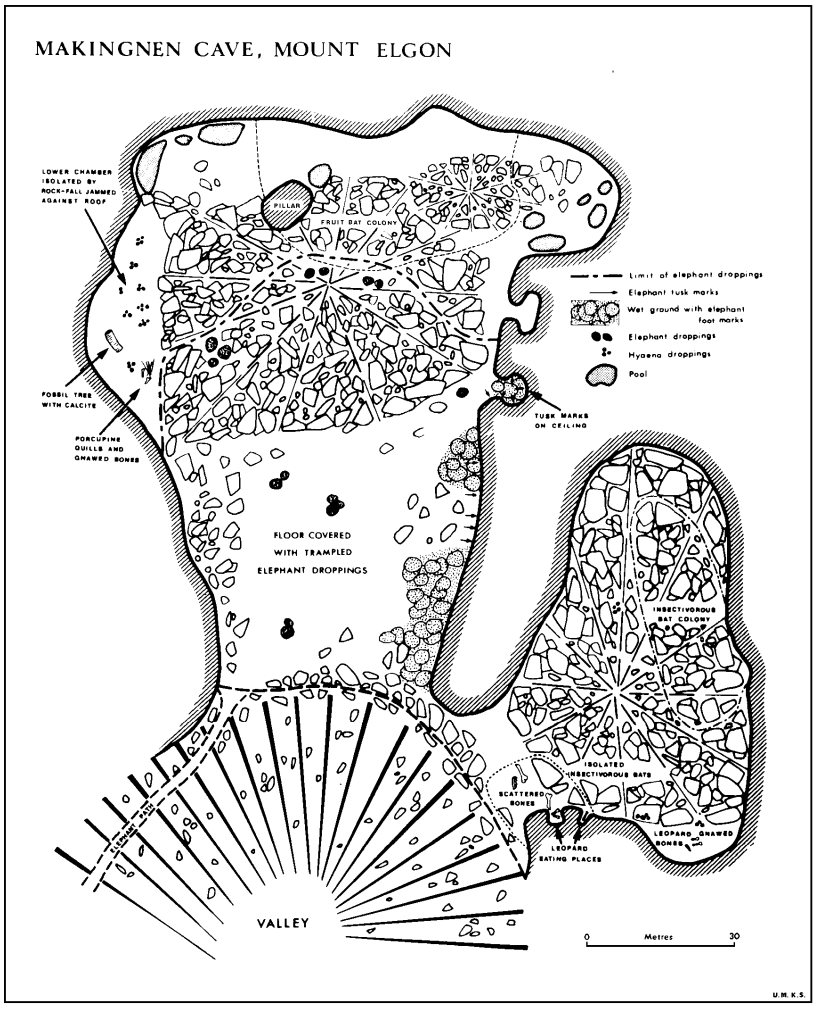

Fig. 17. Plan of Kitum Cave, Mt Elgin, after Sutcliffe 1973. [Despite the title, this diagram represents the cave now known as 'Kitum'.]

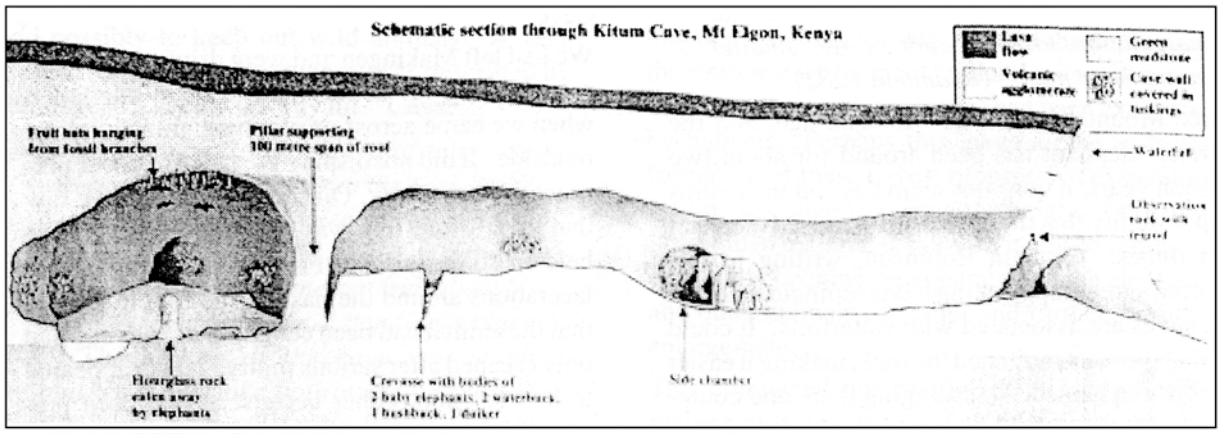

Fig. 18 Schematic section through Kitum Cave, Mount Elgon, after Redmond 1982.

sudden flash of light frightened an elephant and it fell to its death in a floor crevasse. The skeleton of an antelope, perhaps a gazelle, in a small chamber off the right-hand wall, well into the dark zone, indicates that other animals are also enticed into these caves by the salts.

Fig. 19. The walls and lower ceilings of Kitum Cave are covered with gouge marks from the tusks of elephants digging for salts.

Indeed, Redmond, who studied the animals using this and other nearby caves in the early 80s, recorded Cape buffalo, three kinds of antelope, monkeys and baboons all practicing *geophagy* - eating rock - in these caves (Redmond 1982). Redmond observed in the caves on many nights and saw up to 19 elephants at a time in the darkness. He noted that different groups came on different nights and that after spending about half an hour gouging and eating they would generally sleep, often for over four hours. Presumably they appreciated the warmer temperature and/or higher humidity of the cave (Redmond 1982).

While we were investigating the cave, a group of about 20 tourists, came in with their rifle-bearing rangers. They seemed to have only two small torches among the party: they couldn't have seen a lot and the dangers of such a practice are obvious.

The cave is filled with the constant twitter of large numbers of fruit bats *(Pteropus aegyptiacus*) whose eyes glow brightly from the ceiling when a light is shone on them; lots of smaller, solitary, insectivorous bats are also to be seen.

For many years, at least since Thomson suggested, in 1885, that the caves were man-made, people have argued over their origin (see Sutcliffe 1973) and it is not difficult to see why. The fact that all the walls are covered with gouge-marks from tusks or human implements clearly indicates that animals have enlarged these caves, but it is difficult to believe that they are solely responsible. As Simons observes (1998, p. 32):

> *There is some evidence, in the way of small solutional tubes (as at the entrance to Kitum Cave), smooth roofs and domes (as in Makingen Cave), to suggest that groundwater in the soluble pyroclastics may have played an initial part. … Despite all the evidence of man's activity, the writer suggests that the caves are mostly natural and it was the chance discovery of the beneficial rock-salt that led to their being mined and used as convenient dwellings.*

Sutcliffe, in 1973, considered the role of elephants in the formation of these caves. He wrote:

> *It is fascinating to try to calculate how large a cave could be excavated by successive generations of elephants, beginning perhaps underneath a waterfall, over a few tens of thousands of years.*

Redmond believed the role of elephants and other animals, together with humans, has been extremely significant. It's not clear whether he read the Sutcliffe paper, but in 1982 he calculated the volume of Kitum Cave at around five million litres and suggested:

> *If the visiting elephants extracted only one litre per week (a very small amount given the amount of gravel passed in faeces) it would only take about 100,000 years to create a cave of this size. Nor does that calculation take account of the smaller animals or man* (Redmond 1982).

Since Mount Elgon is of Miocene age, and the African elephant has been around for about two million years, it does not seem beyond the realms of possibility that these caves are, indeed elephant salt mines. Graham Robinson, writing in this Journal agreed, suggesting it is no coincidence that the caves are associated with waterfalls. It could be that the water softened the rock, making it easier for the elephants to start digging there and count less generations have just continued the tradition (Robinson 1983). Robinson argues that because elephants are entirely natural we should accept their "mines" as true caves.

Eventually we managed to tear ourselves away from this intriguing cave, as others beckoned. A further kilometre along the road we took another trail into the forest to

Makingen Cave (also spelt 'Makingnen')

The entrance to Makingen Cave is truly spectacular: about 60 m across, at least 15 m high and not obscured by breakdown, and with a much larger waterfall than that at Kitum (Fig. 18). The entrance chamber is dusty towards the front but damp and muddy to the right as one approaches the central rockfall and limit of daylight. It does not appear that elephants go as deeply into this cave, there only being dung and gouge-marks in the outer section. Like Kitum, there is a massive central rockpile and large numbers of bats. The two caves appear to be very similar in plan; in fact we concluded that the plan published by Sutcliffe (1973) as "Makingnen Cave", is actually what is now known as "Kitum Cave".

We had left Makingen and were driving down the road looking for somewhere to have our picnic lunch when we came across an elephant grazing by the roadside. It did not display great alarm at our presence or hurry away. On closer inspection we saw that its left fore-foot was swollen and was being held up off the ground. From what appeared to be lacerations around the base of the foot it seemed that the animal had been caught in a snare and had only escaped after serious injury. It also appeared to be very thin, either because it had been prevented from eating while snared or because it was now having difficulty moving around to browse. We reported the sighting at the park office and were told that a vet had been called to treat the animal.

Chepyanili Caves (or, as I believe the sign said, 'Chepnyalil')

A few kilometres further north, around the base of Endebess Bluff, up quite a steep track from the road, lies a further cave or, as Simons (1998, p. 33) describes it, shelter. It has a much smaller entrance than the two just described and hardly has a dark zone. Again, it has a waterfall cascading over its entrance - a curious feature of most of these caves (one is rather more used to seeing water coming out a cave entrance or discharging at a rising further down the valley side). The ceiling of this overhang was obviously blackened by smoke from fires over a long span of time. We were told that people who had inhabited these caves, the Elkony or Elgon Maasai, had been moved out only about 1968, after the national park was declared. In the deepest recess at the back of the cave was a

Fig. 20. The huge entrance chamber and entrance of Makingen Cave, with its waterfall (note figure at right).

lattice wall of sticks and wood which had been wedged between floor and ceiling, to create a living place and possibly to keep out wild animals. A similar (the same?) structure was described by Sutcliffe (1973) in "Chemyalil" Cave:

> *The most interesting feature of this cave was a small low chamber at the back of the overhang which had been enclosed by a barrier of woven sticks. A low inwardly opening door of the same material about 60 centimetres high, was still standing in place. ... The ceiling of the cave was much blackened by smoke, both inside and outside the barrier, showing that fires had been burned there before the barrier was constructed. Perkins had been informed by the local people that the barrier had been constructed for the protection of children at times of danger.*

The rock appeared to be of similar composition to that at the already-visited caves but here the white, lithified remnants of ancient trees seemed much more obvious. Some of these had the appearance of bone and it was easy to make out shapes looking like skeletons and skulls of animals. There were also signs of elephant dung on the floor, though no obvious tusk gouge-marks in the walls. This cave contained the only rock-art we were to observe in any of the caves, in the form of a series of about ten 'parallel' lines in the shape of an inverted 'U'.

About twenty metres vertically below the first cave we entered, Jean-Paul and the author investigated a wider and deeper cavity, though with a much lower ceiling; less than 180 cm in places. Unlike the higher cave, all the walls of this cave showed clear gouge-marks and near the deepest point we noted a piece of wood with a fire-hardened but worn point which had evidently been used in the not far-distant past to win salts from the walls. My own impression, because of the ubiquity of the mining, the low level of the ceiling and the presence of remnant 'pillars' was that a very large proportion of this 'cave' had been excavated by humans. Perhaps this gives a clue as to the formation of these caves: progressive excavation leading to collapse, raising the height of the roof. If the fallen material is salt-rich it will be removed, eventually opening up a chamber which elephants and other animals can enter and further facilitate enlargement.

CONCLUSION

This completed our caving for this visit. It remained only for us to return to Nairobi, bid our farewells and find our ways home.

Recognition must be made here of the sterling efforts of Jim Simons, aided and abetted by his wife, Françoise, and a small band of CEGEA members, with the active encouragement of Bill Halliday, to get this symposium together and to arrange the excellent field trips. Jim's contribution to the exploration and understanding of the volcanic (and other) caves of Kenya over the past thirty-four years is truly monumental and his continuing enthusiasm is an inspiration to all those who have the good fortune to cave with him. Any cavers visiting Kenya would be well advised to contact CEGEA at P.O. Box 47363 Nairobi to find out about future trips.

The handbook prepared by Jim Simons for the field trips - the best compendium of information yet compiled on Kenya's caves - is likely to continue to be available for a time from the above address. The papers presented at the symposium are expected to be published in due course. The address of the new chair of the IUS Commission on Volcanic Caves is Jean-Paul van de Pas, Vauwerhofweg 3, 6333 CB Schinnert, Netherlands.

REFERENCES

GLOVER, P.E., GLOVER, E.C., TRUMP E.C. & WATERIDGE, L.E.D. 1964 The Lava Caves of Mount Suswa, Kenya. *Stud. Speleol.,* 1(1):51-66.

LARSON, CHARLES V. 1993 *An Illustrated Glossary of Lava Tube Features.* Western Speleological Survey Bulletin No. 87 C. & J. Larson: Vancouver, Washington.

MIDDLETON, Greg 1998 Speleological Survey of the Lava Caves of Grande Comore - September 1997 *J. Syd. Speleol. Soc.,* 42(9): 201-213.

REDMOND, Ian 1990 *The Elephant Book.* Walker Books: London 48pp.

SIMONS, J. W. 1964 The Cave Exploration Group of East Africa. *Stud. Speleol.,* 1(1):73-74.

SIMONS, J. W. E. 1974 The lava caves of the northern Chyulu Hills, Kenya. *Stud. Speleol.,* 2(6):238-256.

SIMONS, Jim W. 1998 *Volcanic Caves of Kenya: a guide for the 8th International Symposium on Vulcanospeleology.* The author: Nairobi, Feb. 1998, 38pp.

SUTCLIFFE, A.J. 1973 Caves of the East African Rift Valley. *Trans. Cave Res. Gp. G.B.,* 15(1):41-65.