Carmichael Cave (3H–70): A complex, shallow, "sub–crustal" lava cave at Mount Eccles, Victoria.

Ken Grimes

Carmichael Cave (3H–70) is a shallow lava tube system that starts at the edge of the main southern lava canal at Mt. Eccles and runs north as a series of branching, interconnected low–roofed tunnels and chambers.

Of the known lava caves at Mt. Eccles, this is currently the most interesting. It is a complex system showing a variety of development styles and having a wide range of well–preserved lava features within it. This cave is a critical reference site in the region for the understanding of the development of the shallow "sub–crustal" or "drained lobe" lava tubes. It has had little damage—so far. Its current protection relies on the lack of signposting and location information.

This report compiles observations from many trips by a variety of clubs and individuals (1991 – 1999) and presents the (finally) completed map.

Carmichael's Cave is named after Andy Carmichael, ranger at Mt. Eccles, who died suddenly in early 1993. Several people appear to have discovered and rediscovered its various parts over the last 20 years or so. Peter Matthews tells me that its first VSA record was by a VSA team led by Tom Whitehouse on 12th May 1979, but it wasn't numbered and tagged until 1990. I was first shown the H–71 entrance by Rob Young, a local farmer and field naturalist with a keen interest in the caves, in 1991. He had known of it for some time. On the VSA trip of 25th – 26th June 1994, when mapping commenced in earnest, the H–70 area was connected through to the previously unexplored H–79 entrance, which in turn was found to connect through an impassable squeeze to part of the H–71 section (previously called *Maze Cave*). Most of the cave was surveyed in two weekends in 1994, with teams led by Ken Grimes (H–70, and eastern part of H–79), Tony Watson

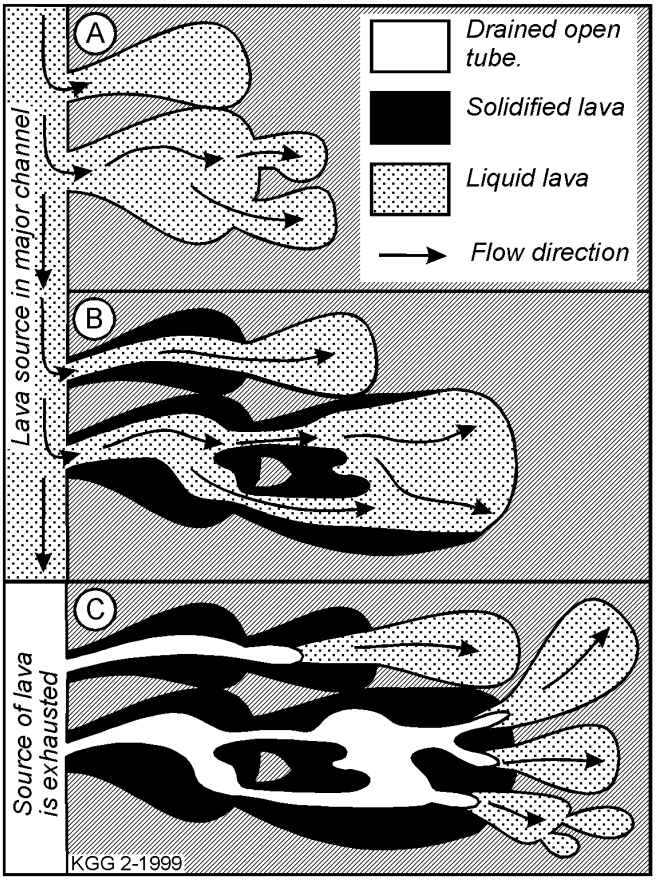


Figure 1: Stages in the formation of sub–crustal lava tubes by draining of thin lava lobes (from Grimes, 1999).

A: Thinly crusted lobes of lava expand by breakouts through ruptures and budding of further lobes.

B: Stagnant areas of the older lobes solidify, but hot flow from the source keeps the feeder conduits liquid.

C: When the source flow ceases some of the conduits may drain to form air–filled cavities.

(H–71, *Maze* and part of the *Big Chamber* area), Peter Ackroyd (surface survey and west from H–79) and Roger Taylor (H–71, part of the *Big Chamber* and the southern passage from the *Maze* area). Ferret (Brett Wakeman) provided a sketch map of the northernmost area beyond the "sharp" aa squeeze—to the best of my knowledge he is the only person to have entered that area! It took a while to get everyone's field notes together, and a few gaps remained, mainly the two passages running south from the H–79 entrance, and for that reason the map in the Vulcon field guidebook has only a preliminary silhouette. The final tidy–up survey was not done until 1999.

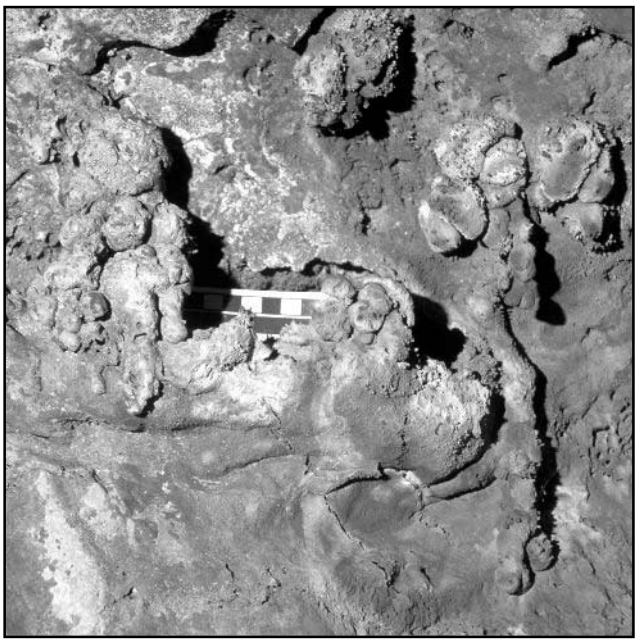


Figure 2: Lava "turds" extruded through small holes in wall lining. Scale is marked in centimetres.

Description

The H–70, 71 and 79 segments are all part of the same system formed in a thin sheet of lava that breached or overflowed the levee banks on the side of the South Canal. The tunnels would have fed a lateral lava flow that ran down the levee slopes to the west and their low but complexly–branching form suggests formation by progressive growth and draining of a series of lava lobes (Figure 1). The *Big Chamber* below the H–71 entrance is a somewhat deeper system, possibly in an older lava sheet, and the H–79 segment has breached into its roof via the *Maze section*.

H–70 Segment

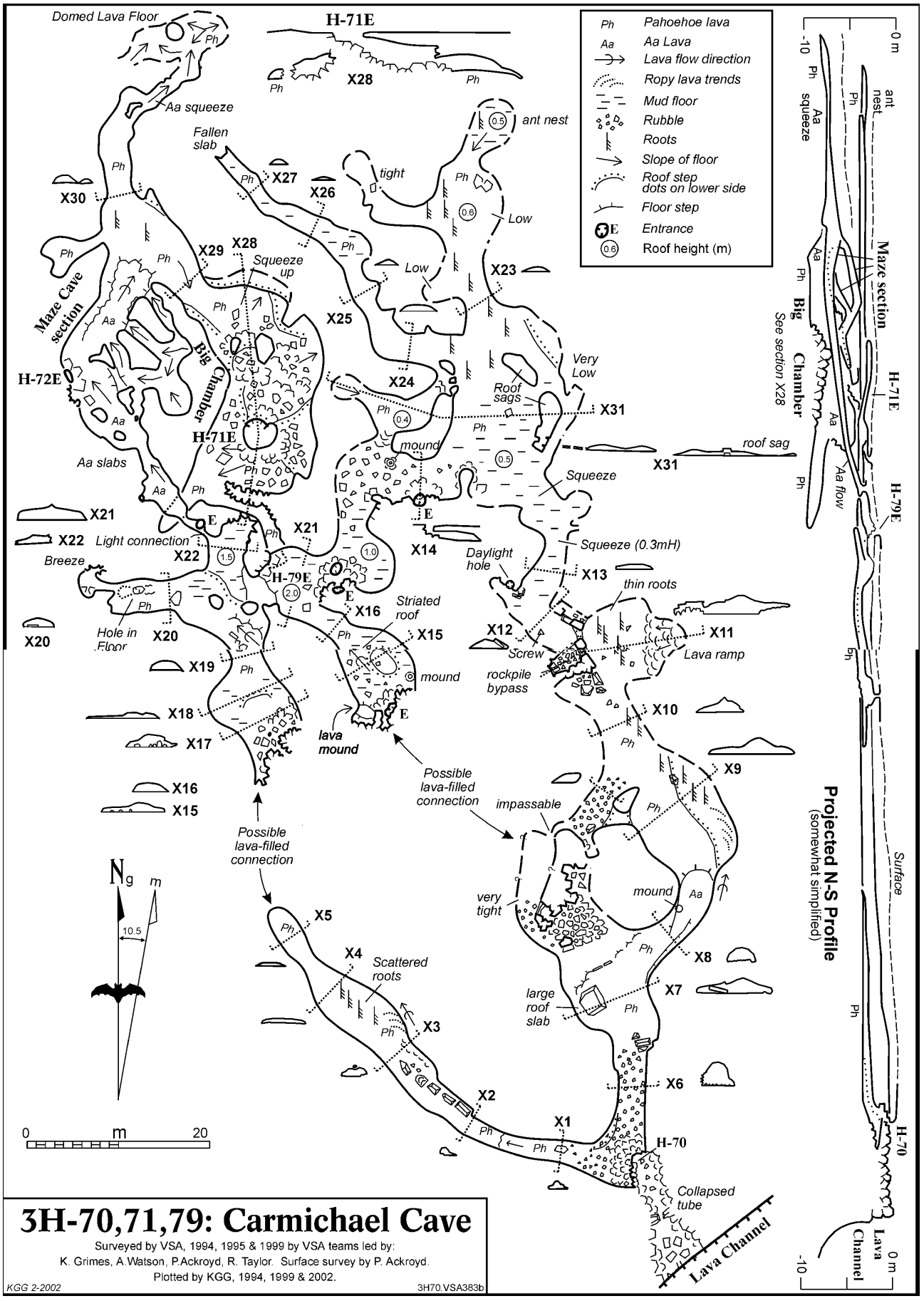
The H–70 entrance is at the southern end of the cave, between the track and the edge of the canal. There is a shallow hollow linking it to the canal that would be due to collapse of that part of the tunnel. Inside the entrance there is a rubble cone and two branches. The northern tunnel leads to the main system (see below). The western branch is a 46m long tunnel, typically 3–4m wide and 1m high initially, but becomes wider and lower towards the end, where the roof finally drops to the level of the lava floor. In one place (see cross section X3) the roof lining has sagged enough to leave a gap above it. There are a few poorly developed lava "benches" and some tree roots, but little else of interest was seen in this passage. Bones of a small dog (or fox?) and a probable brushtail possum were found in this passage.

The northern tunnel starts off as a typical "tunnel" shape about 3m wide and up to 3m high in places. Near the entrance on the right hand (east) side some lava dribbles on the wall slope away from the entrance, suggesting an inward flow of hot gases when they formed. On the left wall and a bit further in look for a small ledge at eye height. This has formed where a thin lining has sagged. Here, lava with a pasty consistency has oozed out through several holes in the remaining lining to form lava "hands" and built up small agglutinated lava–mites on the shelf below. There are also some interesting "dog turd" shaped lava deposits here (see Figure 2). Lower down the lining has fallen off to expose some layered lava. All along this section there are good lava drips and ribs on the ceiling.

The tunnel widens to form a chamber (cross–section X7) then heads off to the NE. On the floor on the left hand side of the chamber one can see the edge of a thin final flow, along with some vertical slabs that would be tilted fragments of lava crust. The largest slab may be a fallen piece of thick roof lining. The rubble pile is collapsed roof material, but you can crawl and squeeze along the southern side to where I could look north into a low chamber, but I was too thick to get into it.

Following the main tunnel the pahoehoe lava floor becomes rougher for a while and approaches an aa style before ending abruptly. The passage then turns to the NW and widens. The floor in this area (X9) is pahoehoe again, with a mosaic pattern that suggests that crustal fragments were cracking and jostling each other on the surface of a stationary flow. The roof has a more hackly surface with secondary cave–coral deposits, in contrast to the smooth linings with drips seen to the south, but there are still some sections with drips in this area.

A side branch to the south–west is blocked at the end by a massive roof sag, but has two very tight 'impossible' continuations on each side: one of which might connect back to the unreachable void I saw from the south.



3H-70,71,79: Carmichael Cave

Surveyed by VSA, 1994, 1995 & 1999 by VSA teams led by:
K. Grimes, A.Watson, P.Ackroyd, R. Taylor. Surface survey by P. Ackroyd.
Plotted by KGG, 1994, 1999 & 2002.

KGG 2-2002 3H70.VSA383b

Panorama of the broad chamber of cross–section X31 would be a drained lava lobe.
Box is 30cm wide—the roof is nowhere more than 1m high.

Incorrect Caption!
the photo this refers to is missing

The main passage continues to what was originally thought to be the 'final' chamber (section X11). This is a moderately sized chamber, up to 1.7m high, with thin tree roots. It has a mound of ropy lava rising up the eastern side. Possibly this was an inward flow from above or from a blocked passage? A couple of very small holes at the base of the west wall give a view into the H–79 section. The way through is by a squeeze up into a rockpile chamber to the west and then back down on the other side.

Western part of the H–79 segment, looking south from cross–section X22. High area to left is a lava mound separating two sub–tubes. Could this be a remnant of a partition separating two lava lobes?

H–79 Segment

This central segment is the largest part of Carmichael Cave and can be divided into a more extensive, but simpler, eastern part, and a more complex western part—with the change in character at section X14 (see map). As well as the numbered entrance there are several others which carry unofficial PJA tags placed during the survey.

The eastern part is essentially a set of low broad rooms and low passages. Roof height is less than a metre throughout and the ceilings are flat to broadly arched, with local sags (photo). The floors are flat pahoehoe lava with mud coatings in places. Breakdown is rare, being confined to a few isolated blocks that have fallen out of slots in the roof. Tree roots are locally common. In the northeastern chamber the floor is slightly higher. There is an ants nest here. A tight (0.3m high) squeeze at section X13 has stopped some thicker–than–normal people. A small chamber at the western end of section X31 is at a slightly higher level. A pahoehoe flow appears to have entered into this chamber from the northwest and exits via shallow ramps down the southern and northeast connections to the rest of the cave.

The western part has some larger passages, up to 2m high, and more breakdown. The floor is mostly pahoehoe plus rubble and some local patches of aa lava. The numbered H–79 entrance is in the centre of this portion and leads to a relatively large, 2m high, domed chamber. The two low, wide, passages south of it both end in rubble blockages. Pahoehoe patterns in these indicate a flow to the north, so these passages may once have been connected to the H–70 area via passages that are now lava–filled or choked by rubble. The arched roofs show striations in several places—possibly formed by gas blasts?

Going west from the entrance chamber of H–79 one climbs over a lava mound into another roomy chamber (1.5m high—see photo). This mound might be a partly remelted partition between two lava lobes; of the type postulated by Hon & others, (1994). A similar, smaller mound occurs south of section X15. From the bigger mound one can continue west to a low–roofed area where an aa flow drops into a floor–hole with a short cavity continuing beneath the thin floor crust. There is a slight breeze at the far end of this area. The map shows that the northern part of the H–79 segment overlies the southern passages of H–71 which are 5m lower, but there is no direct connection. Instead an impenetrable squeeze (light connection) leads to a sloping tube that runs NW into the H–72 maze area.

H–71 Segment (Big Chamber)

The H–71 entrance leads to a large rubble pile that partly blocks and segments what would originally have been a single large chamber with a pahoehoe floor (cross–section X28). This is at a lower level than the rest of the system and may have formed in an earlier lava flow. At the northern end of this chamber there is a good range of lava formations. The floor there is a domed pahoehoe flow and in one place there is a squeeze–up where lava has oozed up and spread out from a crack in the floor. On the north wall there is a lining with lava drips and small "turds" emerging from holes. On the facing wall (to the SW) there are good examples of burst bubbles in the lining. However, one needs a strong light to spot some of these features. At the northwest end of this chamber the floor rises to the junction with the Maze Section.

H–72 Segment (Maze Cave section)

This complex area is the connection between the higher levels of the H–70 and H–79 sections and the Big Chamber of H–71. A small (un–numbered) entrance just beyond the light connection with H–79 leads down a sloping passage with a floor of rugged aa and tilted slabs to the maze area. The mazes are a set of small sloping passages, which seem to have connected the two levels. They all feed out into a single passage to the north with an aa flow on the floor that just reaches the connection with the H–71 chamber (photo). The cave then continues north as a low passage that narrows to a painful aa squeeze then drops to a final chamber with a domed pahoehoe floor.

References

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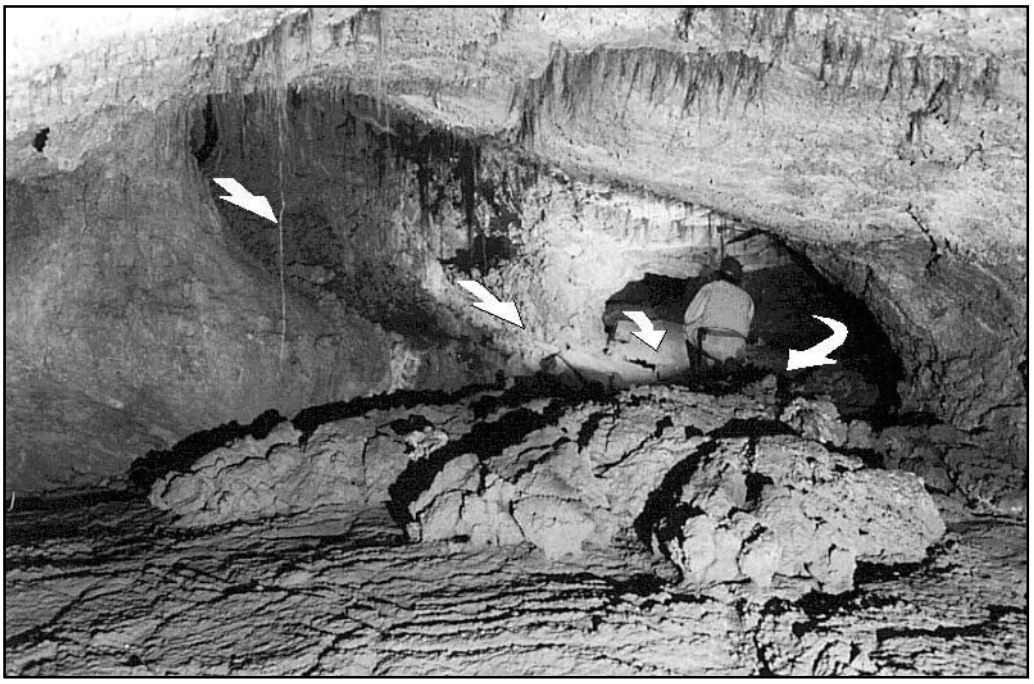

Looking SW into the H–72 maze section. Pahoehoe flow in foreground with a tongue of aa flow invading from higher level. Arrows indicate entry points from maze section.