VOLCANIC CAVES IN VICTORIA

- Ken Grimes

During the Study Tour following the 1999 13th ACKMA conference at Mount Gambier delegates will be visiting some volcanoes and lava tubes in western Victoria, as well as limestone caves. The following is an overview of those volcanic cave areas.

The extent of the Newer Volcanics Province, as it is called, is shown on the accompanying map. The eruptions have been going on for at least 5 million years, and as the most recent was probably less than 10,000 years ago there will doubtless be more in the future. However, in spite of lobbying by the local Tourism Organisations, these will probably not occur in our lifetimes.

The two main areas of lava caves are at the Byaduk caves, near Mount Napier, and at Mount Eccles, both in the western part of the province (see map). We will visit each of these areas as part of the Study Tour.

Mount Napier and Byaduk

At Mount Napier a few small caves occur in the scoria of the summit crater, and several small lava tubes and an arch are known on the slopes of the mountain. A long lava flow runs down the Harman Valley to the west of Mount Napier, and contains the extensive Byaduk Caves. There is a good view of this flow from the main road. In the **Byaduk Caves** area collapse of parts of the main feeder tunnel has exposed the largest and most spectacular tunnels, arches and collapse dolines in the region. The largest tunnels are up to 18m wide, 10 m high and extend to depths of 20m below the surface. There are also some smaller but more complicated caves, and a multilevel system which has a shallow surface maze, and two lower levels connected by lava cascades and chutes where the lava drained downward to the lowest level.

Mount Eccles

At Mount Eccles the main volcano has a deep steep-walled elongate crater which contains Lake Surprise. The crater wall has been breached at its north-western end by a large lava channel (or "canal" as they are called locally). A line of smaller spatter and cinder cones and craters extends to the southeast from the main crater.

Another small but well-defined lava canal runs southwards from one of these smaller cones and ends at the **Natural Bridge**, which is a roofed over section of the canal. The pointed, 'gothic' roof of this cave suggests that it was roofed by levee overgrowth - and the contorted layers visible in its walls would be linings that were built up and then slumped while still hot.

Tunnel Cave is found where the big lava canal leaves the main crater. This is an easily accessible cave, right next to the walking track. It is a typical lava tube, with "railway tunnel" dimensions and shape. The flat floor is the top of a solidified lava pool. As you walk into the cave the roof becomes lower and eventually reaches the floor. The tube would originally have continued but is now blocked by solid lava (see map).

Beyond the immediate area of Mount Eccles, basalt lava flows form a field about 16 km long and 8 km across. From the western end of this lava field a long flow, the Tyrendarra Flow, runs 30 km southwards to the present coast and continues offshore for a further 15 km - indicating that it formed at a time of lower sea level. This must also have had a major feeder tube, but no drained sections have been discovered to date.

Most of the longer caves at Mount Eccles are in or adjacent to the lava canals, but there are a number of small caves scattered throughout the area, and the known distribution may simply reflect the more intensive exploration along the main canals. The caves associated with the canals are generally formed in the levee banks on each side and would have fed small lateral lava lobes or sheets when the canal overflowed. Some are simple linear feeder tubes, but many have branching forms and complexes of low broad chambers which suggest draining from beneath the solidified roof of a series of flow lobes. They show a good range of lava 'decorations'.

Formation of Volcanic Caves

Lava tubes form in basaltic lava flows by two main processes: first by the roofing over of surface lava channels in several ways; and second by the draining of still molten material from beneath the solidified crust of a flow (details will be given in the Study Tour Guidebook). Other types of volcanic caves (non-tubes) also occur.

Tubes formed by draining of crusted lava lobes and flows are generally smaller than those formed by the roofing of a channel, but tend to have more complex forms. Lava lobes can be stacked vertically as well as advance forwards so that a complex three-dimensional pattern of branching tubes forms. The long lava flows in the region would all have been fed by large cylindrical lava tubes that continued to carry hot lava for tens of kilometres through the insulated core of a partly solidified flow.

The above discussion refers to the formation of lava-filled tubes. In any area only a small percentage of the tubes will be drained and accessible to cavers - most remain filled with solidified lava at the end of the eruption or are

interrupted by lava sumps in the lower parts (not recommended for cave divers!). See the map of Tunnel Cave at Mount Eccles for an example of a tube that is filled by solid lava at its present "end". Older open tubes may be buried by younger flows and become inaccessible.

Lava tubes are not the only type of cave that can form in volcanic rocks. **The Shaft** at Mount Eccles is an explosive cavity and throat within a spatter cone that remained open after the volcanism ceased. The still open throat, 3m across, bells out below into a volcanic chamber that is 23m deep and 24m across.

Features found in Volcanic Caves

The lava caves contain a distinctive suite of lava structures or "decorations", some of which are illustrated in the figure. The level of lava within the tubes tended to fluctuate during the course of the eruption, and so we find thin linings plastered onto the walls and roofs, and 'tide-marks' are indicated by solidified benches or shelves on the sides of the tubes. Some shelves can reach right across a passage to form a false floor.

The thin wall linings can rupture, peel back and curve over to form draperies and scrolls. Where a lining has pulled away from the wall we may find tacky forms resembling toffee or sharks teeth. Some linings are smooth, but others have a sharp hackly surface which may be due to the bursting of many small gas bubbles. Rafted slabs floating on a flow surface may leave grooves and striations on the semi-solid wall linings. Lava "hands" of semi-solid lava can be squeezed out through cracks or holes in the lining. Some forms that have been extruded or dribbled through small orifices evoke scatological terms. Analogies to sheep, dog, cow etc can be seen.

Small round-tipped lava stalactites, (lavacicles, lava drips) form where molten lava has dripped from the roof. Lava ribs form where lava dribbled down the walls of the cave, or where the whole lining has sagged and wrinkled. If the floor was already solid (unusual) drips of lava from the ceiling can build up lava stalagmites. Stalagmites often have a form in which the original drips can still be seen welded together as a lumpy mass.

The floor of the tube is often flat or slightly arched - being the surface of the last flow of lava through it. If a lava flow within a tube forms a solid crust, then drains away from beneath it, we get a tube-in-tube effect with a thin false-floor bridging the tunnel. The floor can be smooth or have a 'ropy' surface of pahoehoe lava with wrinkles and other patterns that indicate the flow direction. As lava cools and loses gas it becomes stiffer and breaks up into a knobby or hackly rubble (aa lava), which eats both overalls and their contents. Transitional types which are still solid, but have jagged surfaces, are sometimes called "cauliflower aa". Small lava mounds, or tumuli, may be heaved up by pressure from below - these are analogous to the much larger versions we see on the surface. Lava 'puddings' or 'boils' can form from pasty lava that oozes up through holes and cracks. In some caves the crusted floor has buckled and broken into a jumble of heaved up plates, or cracked into a mosaic of jostling plates with rounded or upturned edges. Material falling from the roof may be rafted some distance downstream and may end up welded into the floor, or piled up in 'log jams'.

Management matters

Formations in lava tubes are even less renewable than those in limestone caves. At least a broken calcite stalactite ***might*** regrow in a few thousand years, but a broken lava formation will ***never*** do so - unless someone builds one hell-of-a hot campfire in the cave! The stony rise country of the recent lava flows is similar to karst in that surface water goes underground quickly and, if moving in lava tubes, it is unlikely to be filtered of any contaminants. A major conflict comes from the volcanic cones being also a source of scoria, and many have been or are still being quarried away. There are several active and abandoned quarries at both Mt Eccles and Mt Napier, and some interesting volcanic features have been destroyed.

FURTHER READING

BADDELEY, G. [Ed], 1995: *Vulcon Guidebook*, (20th Biennial conference, Australian Speleological Federation). Victorian Speleological Association, Melbourne. (see chapters 5 & 6).

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