

The Caves of Loch Ard Gorge

*by
Ken Grimes*

Wide-angle view
from Pearce Cave

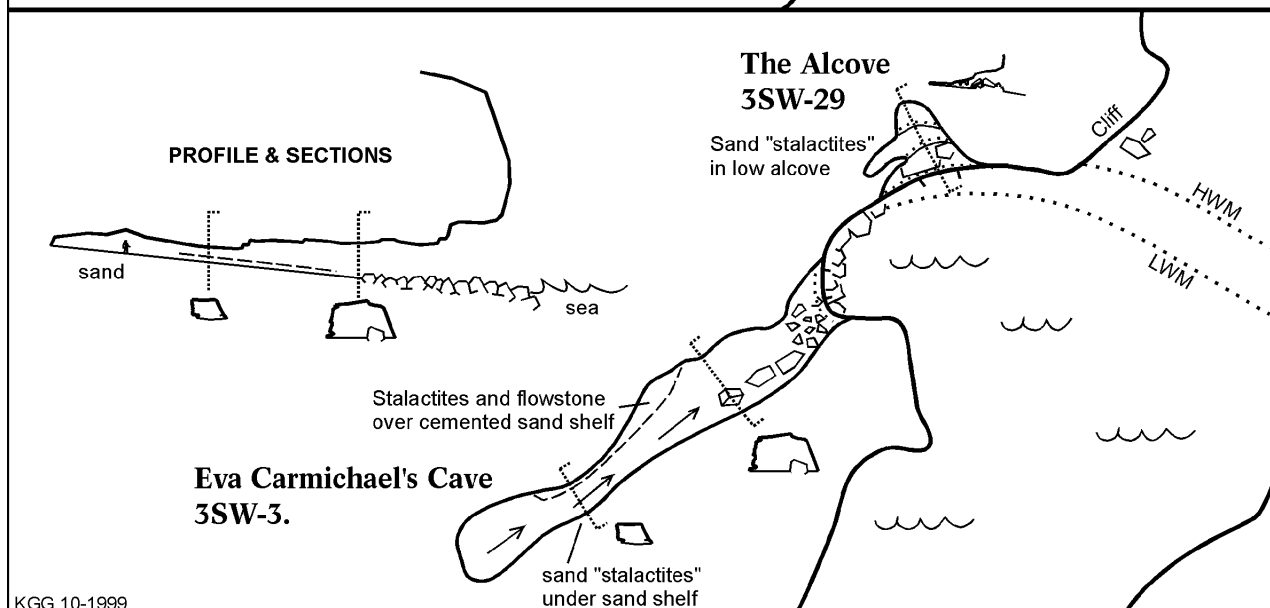
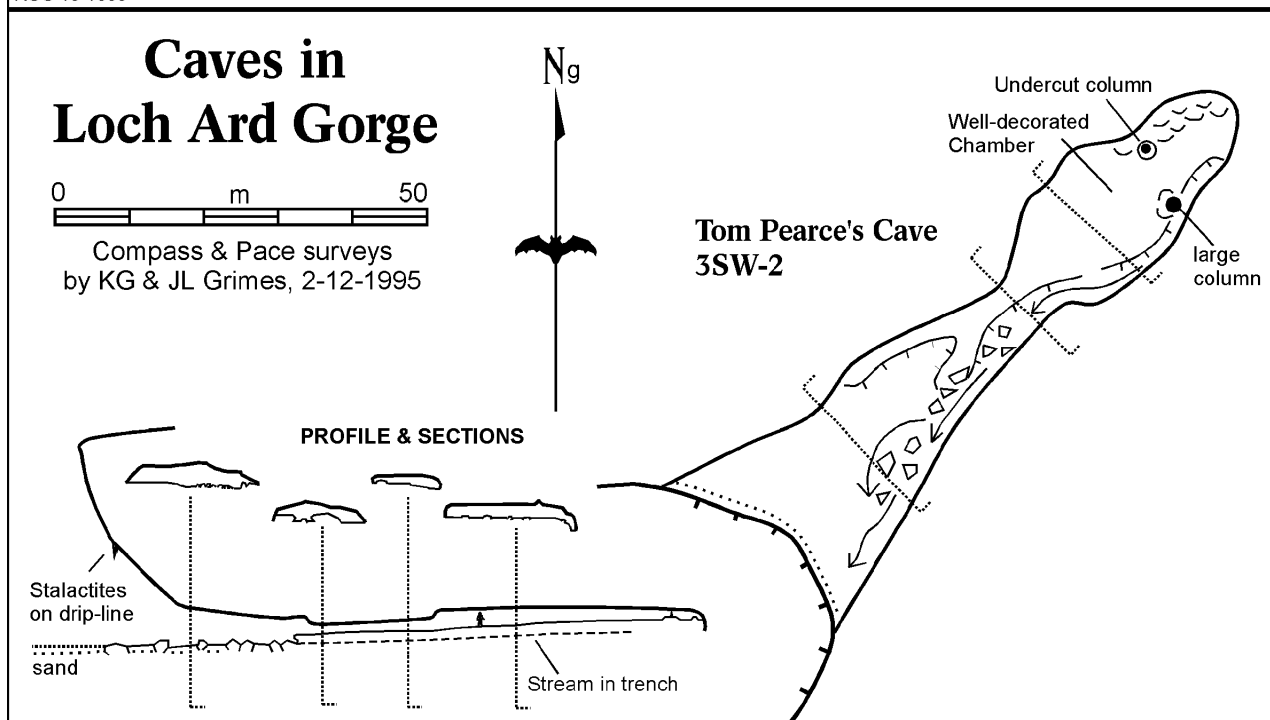
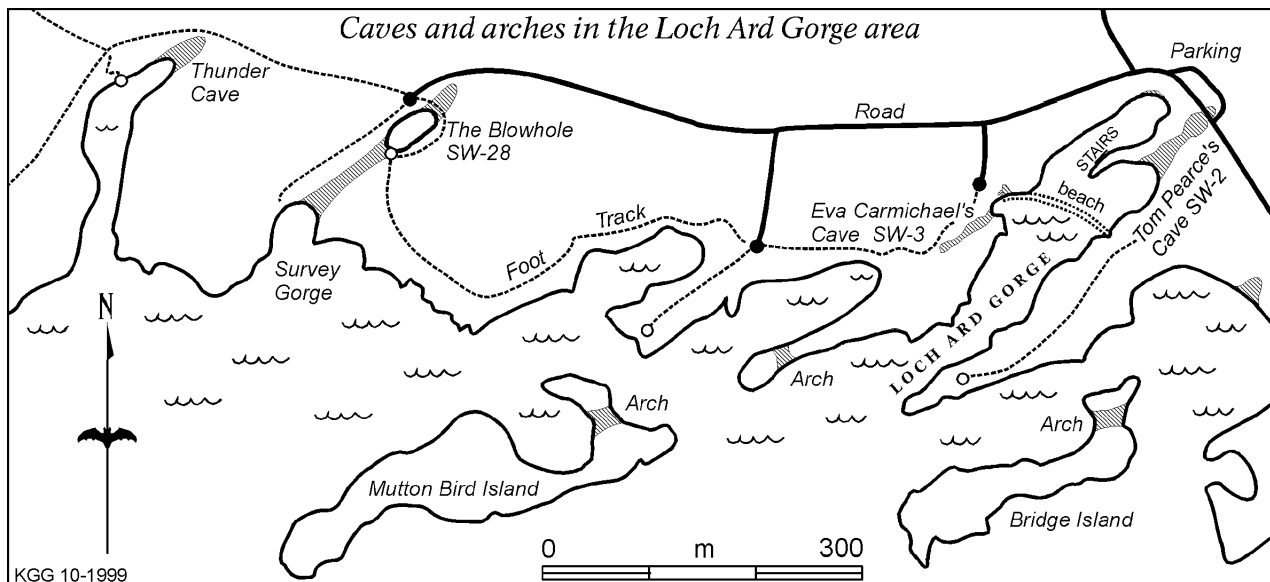
One of the most splendid sights along the Great Ocean Road is Loch Ard Gorge. This deep ravine, with associated caves, is cut into the limestone cliffs of the Port Campbell area, in western Victoria. The gorge is named from the ship wreck of the *Loch Ard* which occurred in 1878 and has two caves that are named after the only survivors of the wreck: Tom Pearce and Eva Carmichael, who sheltered therein.

There are many caves and other karst features along this section of coast (e.g. see Grimes & others, 1999, and Baker, 1943). For example, Baker reported that "forty-five caves occur at the base of the cliffs in the Port Campbell district. In addition, two or three, 20 feet [6m] or so above sea-level, occur at the heads of rocky bays formed in the wave-cut benches, while holes high up in the cliffs represent the outlets of former systems of underground drainage." He also described sinkholes, including some major collapse dolines, arches, solution pipes and other features of interest to speleologists. In addition, the area shows a wide range of other spectacular features including reefs, offshore stacks,

overhanging cliffs, hanging valleys up to 50 m above present sea-level, wave cut benches and notches at various levels.

The host rock is a soft, porous, Tertiary limestone, the Port Campbell Limestone, that forms cliffs about 30m high. The present caves are primarily sea caves formed by wave action, but they also show some karst solutional features. It is probable that marine erosion has intersected prior karst cave passages and enlarged them. Prominent jointing which runs north-east controls the gorge and promontory formation and cave formation. Some deep inlets in this area, such as Loch Ard Gorge, may be the result of roof collapse of previous extensive cave passages. The Blowhole illustrates the beginning of this process; it is a large collapse doline connected to the sea by 100 m of intact cave passage (see map).

Loch Ard Gorge is a well-known site for tourists travelling The Great Ocean Road, and both it and its caves are heavily visited.

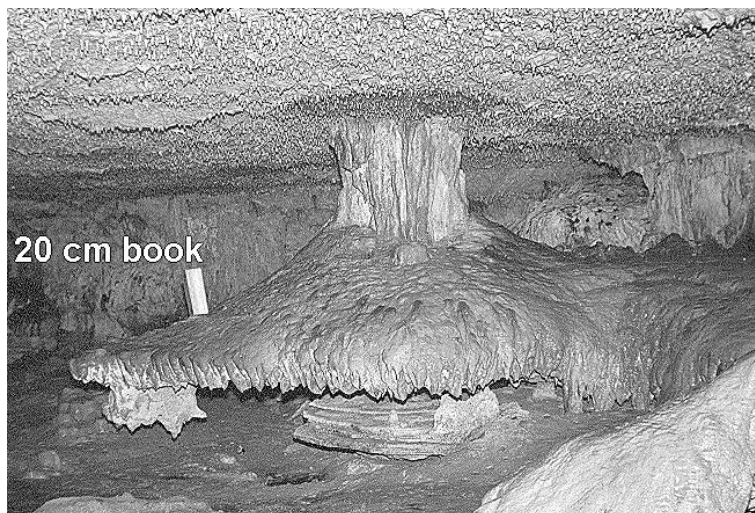


The Caves

I will concentrate on describing the caves within Loch Ard Gorge itself (see maps). In addition to the two main caves, Pearce Cave and Carmichael Cave, there is also a smaller cave which I shall refer to as The Alcove. Access to Carmichael Cave is not possible at high tide, and The Alcove can also be cut off at times, particularly in rough weather. One needs to be careful of the waves at all times when visiting these caves. Pearce Cave is nearly always accessible.

Pearce Cave (SW-2) is 80m long and typically has about 2m of headroom (apart from one duck halfway in). There is some daylight right to the end, but the back chamber is hard to see in without a torch. The front chamber has a lot of green algae and the walls and floor are badly degraded by visitor traffic. A curtain of lumpy stalactites hangs from the overhung cliff above the entrance (see title photo). These lumpy forms are typical of cave entrances where algal (and other vegetation) growth interferes with the development of the more usual shapes. The floor is rubble and sand. There is a shelf of cemented sand along the west wall which extends out into the centre towards the back of this section. The outward flowing stream runs mainly on the east side.

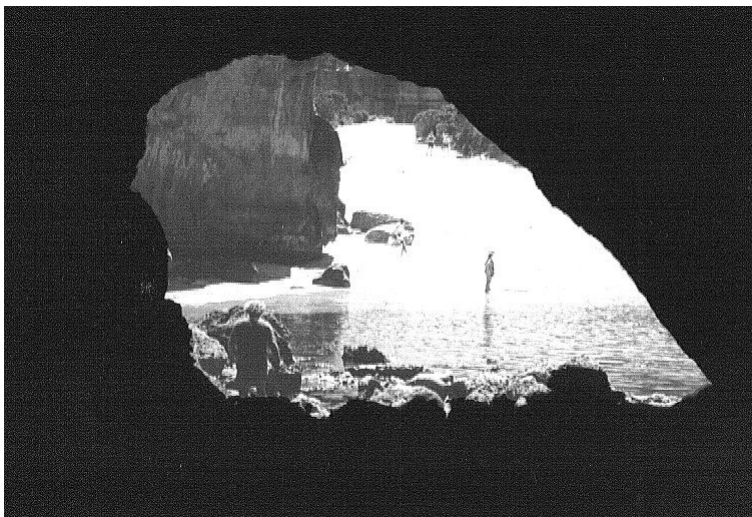
The back chamber gets less visitation because it is darker and less obvious to a casual inspection; but it also has some breakage and graffiti, and the flowstone floor has a coating of sand that has been tracked in on peoples feet - apart from where it has been washed off by the drips. This rear chamber is well decorated. There are lots of short straw type stalactites here, covering most of the flat roof. All are less than 10cm long; I thought this might indicate breakage, but Baker (1942) also refers to them as being short. The floor is flowstone with drip pits, small pools and scattered broad stalagmites and columns. The pools here once contained cave pearls (described as "pisoliths" by Baker & Frostick, 1951, who also provide a detailed description of the caves and the speleothems), but those have all since been collected by visitors. Some localised stalactites, and the flowstones or drip pools below them, show rich red and orange colourations (iron oxide or organic complexes?). There are plenty of active drips, and some continuous trickles falling from the roof. The cave stream rises from beneath a flowstone "false floor" against the east wall at the back. Some columns and flowstone areas now sit about 0.5m above the present floor; the underlying sand has been eroded out but in places cemented patches of this remain (see photo).



Decorations in back chamber of Pearce Cave. A column and flowstone base have been undermined by removal of soft, uncemented, sand. A central area of cemented bedded sand remains beneath the column.

Carmichael Cave (SW-3) is 60m long and typically has about 3-4m of headroom (see map). There is daylight right to the end. The floor is rubble near the entrance, and sand further in which slopes upwards at about 6 degrees to the back. There is a shelf of cemented sand along most of the west wall, about 0.5m above the present floor. The top of this is coated by flowstone, and there are draperies on the wall above, but there are only a few active drips in this cave. A smaller sand shelf on the east wall has some pendant sand "stalactites" beneath it. Access to Carmichael Cave is not possible at high tide.

On one visit we met a Fairy Penguin at the back of the cave - wandering disconsolately and grumbling about all the people who were disturbing its sleep. On another visit we noticed a couple of small piles of fresh guano and found one freshly-dead bat (*Miniopterus sp*) which I took home for identification by the book. The dried carcass was later given to Belinda Cardinal (Museum of Victoria) for use in her study of DNA in bats.



Entrance of Carmichael cave.

The Alcove (SW-29) is a small low-roofed chamber at the base of the cliff (see map). There is semi-daylight throughout. The entrance is concealed behind a large rubble pile and most people do not realise it is there. Normally I would not bother giving a name or number to a small cave such as this, however, it contains the best examples of sand speleothems in the region - possibly the best in Australia as these things appear to be rare at a world-wide scale. These are described later. The Alcove is cut off at high tide and during rough weather. As the entrance is hidden behind rubble, the best protection for this cave is probably to just do nothing that will draw attention of casual visitors to its existence.

The Blowhole (SW-28), 600m to the west of the gorge is a impressive hole (see map). Baker (1943, p375) describes this large (40 m diameter) collapse doline as having an associated tunnel connecting to the sea that is "110 yards [100m] long, and is continued inland from the landward end of the Blowhole opening for 25-30 yards. Tunneling along a major joint plane here amounts to about 200 yards." Access to this is dangerous, requiring ropes or ladders and subject to the hazards of large waves that run all the way in along the tunnel. Miles Pierce (pers. comm.) reports that during a 1970 visit, they "rigged a ladder on landward side to try to get a better look at the end of the cave. In the event, a definite end wall could not be confirmed and there was too much swell to attempt to go right down". With a good swell running, the view into the doline from its southern end is quite awesome.

Thunder Cave is further west again (see map). It is a short sea cave at the end of a long narrow gorge. A set of rock-cut steps leads down to a viewing platform, but there is no safe access to the cave itself.

Baker (1943, p370) reported a *sinkhole* at the "head of the east arm of Loch Ard Gorge" which was about 110 yards [100m] in from the cliff edge and 40 feet deep [12m]. If the location is correctly reported, this must be somewhere near the main parking area but I have not seen it and there is nothing obvious on the air photos. Perhaps it has been filled in? If so, it could become a future subsidence hazard as continuing solution undermines the fill! Alternatively, it could be that Baker is reporting from a third party source, and this is, in fact, a miss-located description of The Blowhole.

The overhang at the back of the west arm of Loch Ard Gorge has more of the lumpy stalactites seen above the entrance to Pearce Cave. In this general area there are a number of large sea arches and other sea caves that can be seen from the various viewing platforms (see location map). One can easily spend a full day exploring this area - or a weekend or longer exploring the whole of this limestone coast (see Grimes & others, 1999).

Sand Speleothems

Carmichael Cave and The Alcove contain sand speleothems: features similar in form to the calcite stalactites, shelves and stalagmites found in normal limestone caves, but which are composed of cemented sand (Grimes, 1998). In addition small cemented "sand pots" have been reported lying loose within the sandy floor of Carmichael Cave. Cemented sand also occurs as shelves and beneath calcite flowstones in Pearce Cave but it does not have such distinctive structures (photo).

Baker (1942) was the first to described the "sand stalagmites" from Carmichael Cave. However, his descriptions are restricted to the small formations ("sand pots") that were sitting loosely in the sand floor. He made no mention of the larger sand formations that are now visible. A later paper (Baker & Frostick, 1951) mentions that in April 1947, high seas apparently just reached the rear of Carmichael Cave and the previously described sand stalagmites had been undermined and tilted. This later paper mentioned the cemented sand shelves, calling them "sand plasters", but still made no reference to the hanging bulbous sand "stalactites" that are seen at present. I suspect that there has been further erosion since 1951. The present floor of Carmichael Cave is about 0.5m below the top of the sand shelves on the wall - which presumably represent the floor level when Baker described the cave in 1942. Baker could well have missed the formations in The Alcove, even if those were not buried at the time, as that small cavity is hidden behind a large fallen block and not obvious. Baker (1943, p380) also described "sand plasters" attached to sea cliffs at the back of partly eroded sandy beaches elsewhere in the region which appear to be similar to the "shelves" seen in the caves.

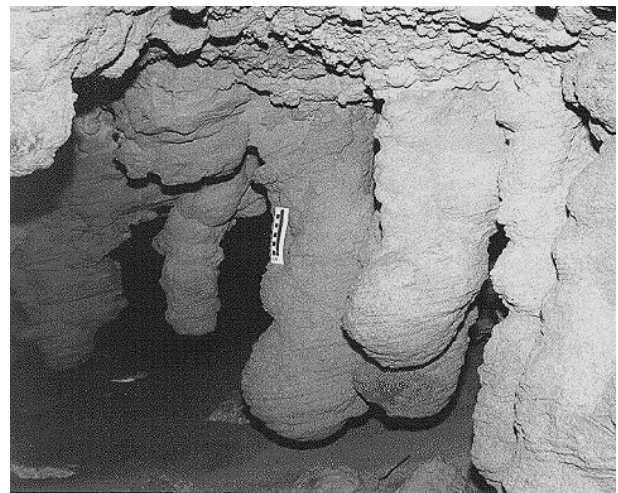
The sand speleothems are formed in calcareous beach sand that has been washed into the caves by the sea. The thin gently-inclined bedding of the original sand bodies is still visible on the surfaces of the sand speleothems and indicates its origin. The sand has buried prior calcite speleothems in places and a broken fragment of a calcite stalactite was found embedded within one of the sand speleothems.

The sand speleothems seem to have formed by calcite-saturated waters that ran or dripped onto, and moved through the loose sand and cemented it in localised areas close to the source (see diagram). In The Alcove the sand fill seems to have reached the roof, and the waters would have entered it directly from cracks or pores in the limestone. Later erosion (storm wave or cave stream) has removed up to a metre of the loose sand to expose the cemented parts (Diagram). The smaller sand pots with drip pits would have formed similarly, but in addition the dripping water kept a small pit open in the top of the cemented formation, and splash and overflow cemented the surrounding sand surface.

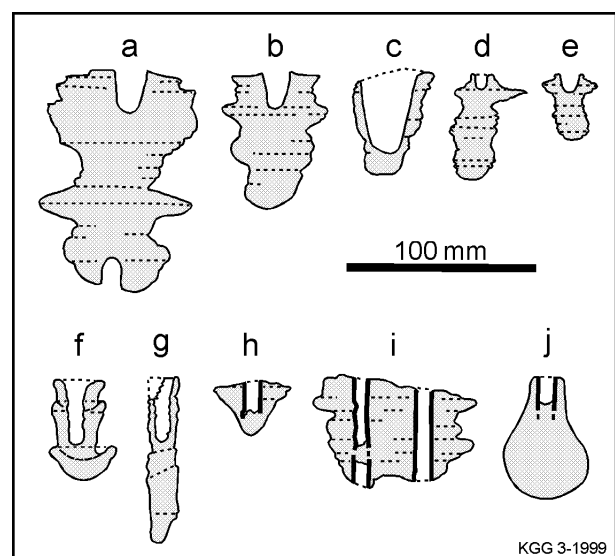
Sand Speleothems

The sand speleothems exposed at Loch Ard Gorge comprise four forms (Grimes, 1998).

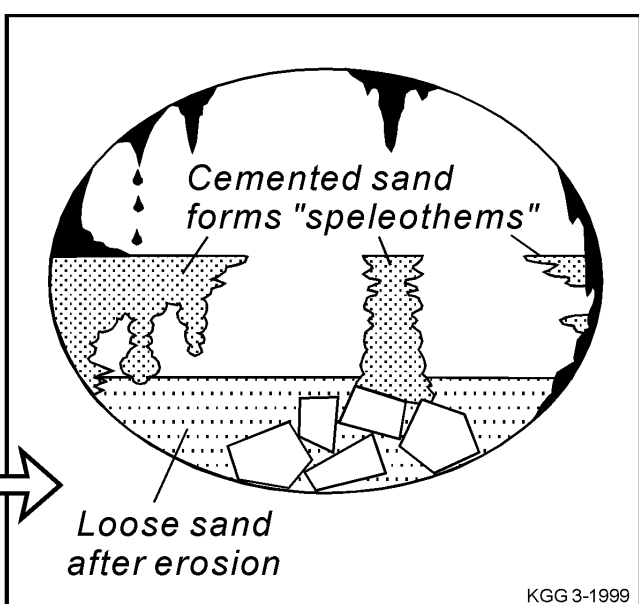
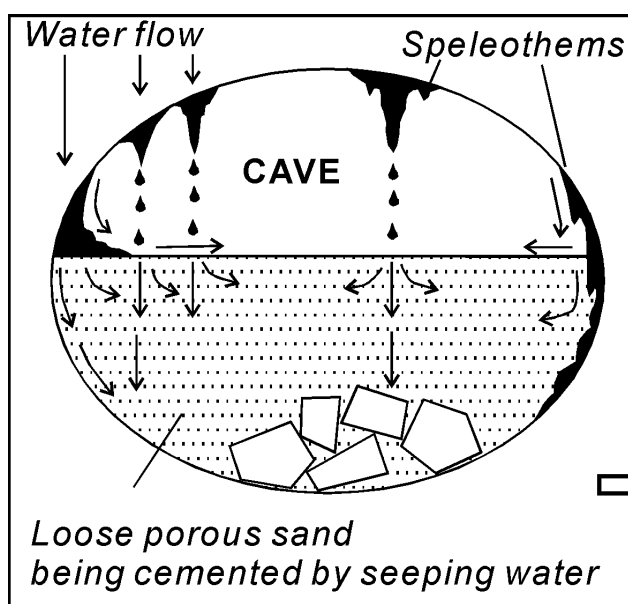
- 1: Horizontally banded **sand "shelves"** occur plastered to the cave walls up to 0.5m above the floors of both Pearce and Carmichael Caves, and are up to 0.5m wide and 0.3m thick. Some shelves now have a hard, smooth, impermeable upper coating of calcite flowstone.
- 2: Bulbous **sand "stalactites"** up to 30cm wide and 80cm long descend from either the roof, or from the shelves, and occasionally reach the floor to make a column (see photo).
- 3: Less common are bulbous to platy, round or flat-topped **sand "stalagmites"** seen rising from rock-slabs at the entrance to The Alcove. These are up to 40cm wide and 80cm high. The plates appear to be cemented bedding planes of the original sand deposit and the flat top may have been the original surface of the sand.
- 4: Smaller unattached **sand pots** occur in Carmichael Cave (see sketches). These small, but distinctive, forms have complex bulbous shapes with a central pit. Baker described them as floating free in the sand, unattached to either the wall or floor of the cave, with only the tip exposed above the sand surface. None of these are currently seen in situ, but in 1998 several loose specimens were found lying in pockets of gravel within the cave.



Bulbous sand "stalactites" in The Alcove.
10cm scale bar.



Sand Pots seen in Carmichael Cave. Top row is from Baker's collection in the Melbourne University. Bottom row sketched by the author. Heavy lines are calcite linings.



How to make sand speleothems (from Grimes, 1998). The sand is cemented in localised areas, and then uncemented sand is removed to leave the "formations".

Management

Potential management problems are mainly to do with the impact of visitors, however there are also some problems which the karst could cause for visitors.

Some natural hazards include the general instability of the soft limestone cliffs, which are continually being attacked by the sea. Parks Victoria are redesigning and relocating many of the roads, tracks and lookouts to allow for this. One possible problem has to do with the sinkhole reported by Baker (1943, p370) as lying 100m in from "the head of the east arm of Loch Ard Gorge". There is no sign of this, and it may be a miss-located description of The Blowhole. But if in fact it has been filled in and lies beneath the parking area, then continuing solution could undermine the fill and cause subsidence problems in the future.

The high visitor numbers to the area are having obvious impacts. People are everywhere, and as there are no toilets provided, they are crapping wherever they can find a quiet place - including Pearce Cave! It seems odd that no toilets are provided at what must be the most popular stopping place on the coast! In fact, there used to be toilets, a mile to the west, but they were closed (and demolished?) after the access road to that area was closed. Parks Victoria has 'proposed' toilets for here in its 1997 draft management plan (Parks Victoria, 1997, figure 5). But they seem to be in no hurry to install them. In the meantime Pearce Cave gets smellier and one must explore it with some care!

Other people problems have to do with erosion of the rock by foot traffic - most obvious on the way to Carmichael Cave, but also on the rubble in the entrance chamber of Pearce Cave. The soft cliff faces also lend themselves to graffiti. Fortunately most people look only at the entrance to Pearce cave and do not reach its far chamber. None-the-less there are problems there with sand tracking over the flowstone floor and minor breakage and graffiti.

The sand speleothems are moderately robust and generally out of the way; and they are probably not the sort of thing that would invite vandalism, though the few sand pots left in Carmichael Cave could tempt light-fingered gemmos (but not cavers, of course!). Most of the cave pearls described by Baker & Frostick (1951) have now been removed. New ones may be forming slowly but those seen in the present pools are poorly formed and not overly tempting.

There are two drill holes in the back chamber of Pearce cave! These have been drilled from the surface through the roof, and continue a short distance into the floor! Their purpose is unknown. The roof openings have been plugged with cloth (and hopefully there is a cement plug

above that) so they are not causing a chimney effect that effects the air flow.

One solution to erosion and sand tracking would be construction of expensive and intrusive walkways. For Carmichael Cave this is unlikely to be done because of the regular wave hazard. Putting a walkway into Pearce cave would probably cause more damage than it prevents as it would invite many people to explore what they would otherwise ignore. Marked trails in Pearce Cave would be less intrusive, but would still invite greater visitation to the back of the cave. The best examples of sand speleothems are in The Alcove. As the entrance is well-hidden behind rubble, the best protection for this cave is probably to just do nothing that will draw it to the attention of visitors to the Gorge.

The best way to protect the more sensitive areas (The Alcove and the back chamber of Pearce Cave) is probably to simply avoiding attracting casual visitors into them. Thus, although there are problems, my suggestion for protection of the karst features in this area is essentially to maintain the present situation - apart from the urgent need to install toilets upstairs.

References

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