

Castleguard Cave, Canada

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Exploration over the last ten years has revealed that the Canadian Rockies contain some impressive caves and karst areas. Three caves in the region have been explored to depths greater than 300 metres, nearly all of the caves are located in wild and beautiful mountain landscapes, and some of the ice caves are almost unbelievably decorated. But still the real gem of the Canadian karst is Castleguard Cave. Not only is it deep, spectacularly located, and in parts well decorated, but also it is long, provides an arduous challenge and has a unique geomorphology.

Caving really got underway in Canada when Derek Ford moved from England to join the staff in the geography department at McMaster University in Hamilton in Eastern Canada. He started a programme of karst research, with fieldwork in the Rockies, with Charlie Brown as one of his first postgraduate students. And in 1967 Charlie was told by a resident of Jasper about an intermittent river cave in the Castleguard Meadows close by the Columbia Icefield. So a two-man party visited the cave and found the way on open and inviting, though they could not pass a short drop not far in from the entrance.

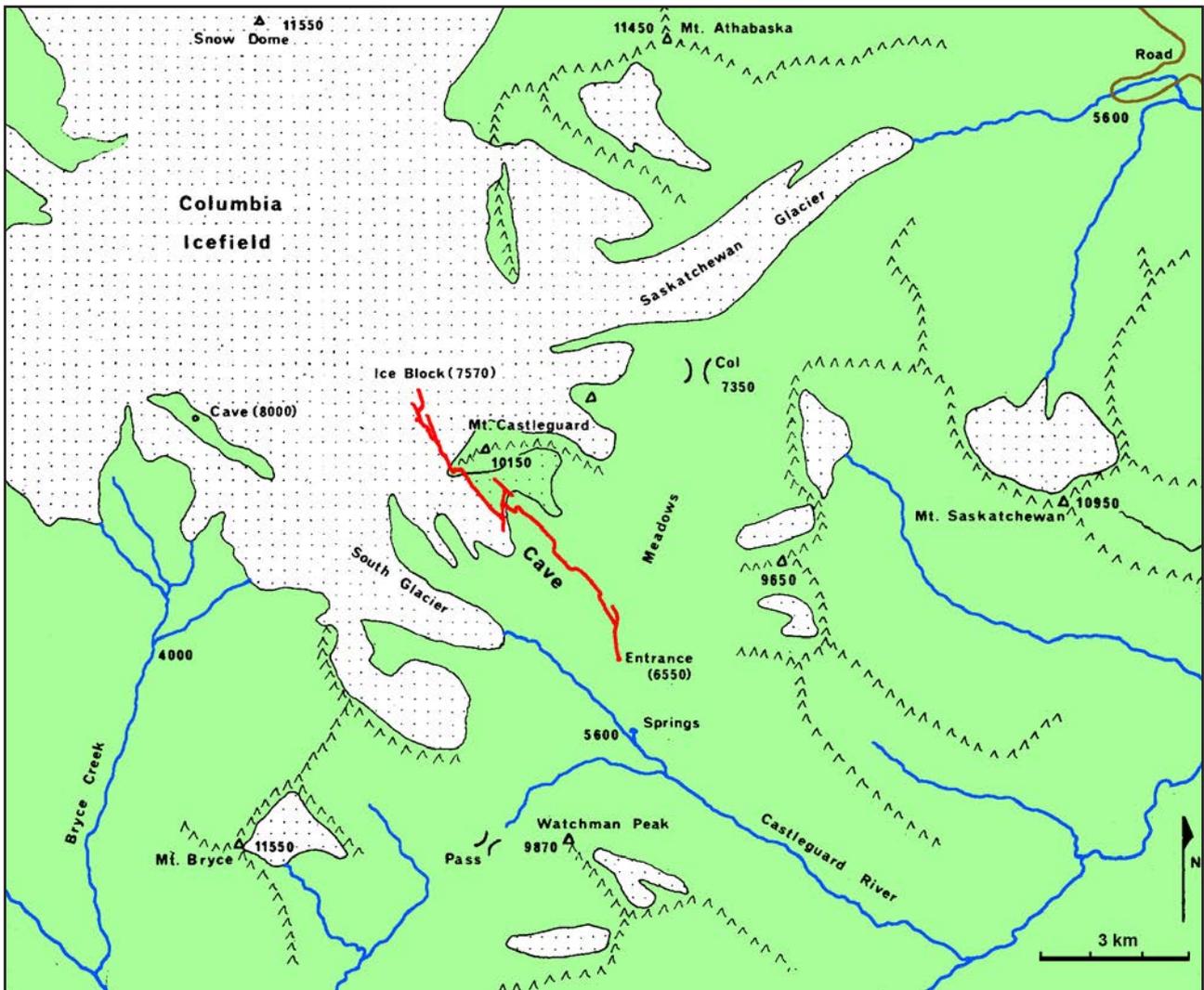
The Columbia Icefield straddles the crest of the Rockies on the Alberta – British Columbia border about midway between Banff and Jasper. The nearest road access to the cave is the Banff-Jasper



First Fissure.



Donny in Second Fissure.



The area around Castleguard Cave; altitudes are in feet.



Looking west across the Castleguard Meadows; the cave entrance is among the dark trees at the far left, and the passage extends to the right beneath the snow-covered benches and way beyond beneath the Icefield that extends between Mount Castleguard on the right and Mount Columbia in the distance.

Highway (see map) which lies just east of the watershed. From this road, the route to the cave lies across 4 km of outwash gravel plains then 5 km up the Saskatchewan Glacier. Up and over a col then leads for another 8 km down the Castleguard Meadows to the entrance. The Meadows are classic Alpine grasslands and the cave lies just below their southern rim, in thick pine forest. Surrounded by rocky peaks and glaciers, the landscape is magnificent. August 1967 then saw the first major explorations in the cave, and these culminated when Mike Boon and Pete Thompson reached the boulder choked rifts of Thompson's Terror about 8000 metres in. Their trip lasted 28 hours and then on the way out they had to wait a few hours for a flood to go down and break a sump near the entrance. The day after they emerged, an even larger flood sumped the first kilometre of cave for more than eighteen days. Because this flooding related to meltwater flow from the glaciers in a rather unpredictable fashion, that was the last summer visit to Castleguard.

The first winter expedition was in May 1968 when a helicopter was used to drop the cavers at the entrance. The advantages of winter exploration were not only safety, but included the freezing solid of the icy canals near the entrance and the complete drying up of the waterfalls. That year the cave was surveyed as far as the 200-foot Aven, and found not to be running up under the Meadows as first thought, but leading out under the centre of the Icefield. The survey was completed by another expedition in April 1970. (The cave map with this article is taken from the McMaster Group surveys.) Pete Thompson and John Fish pushed Thompson's Terror a little further but retreated when the boulder choked rifts developed to suicidal levels of instability, and Julian Coward and Ian Drummond followed the left-hand passage at the Crutch to a wall nearly 10 metres high that they could not climb. The team used a camp in the cave just before Holes-in-the-Floor Passage.

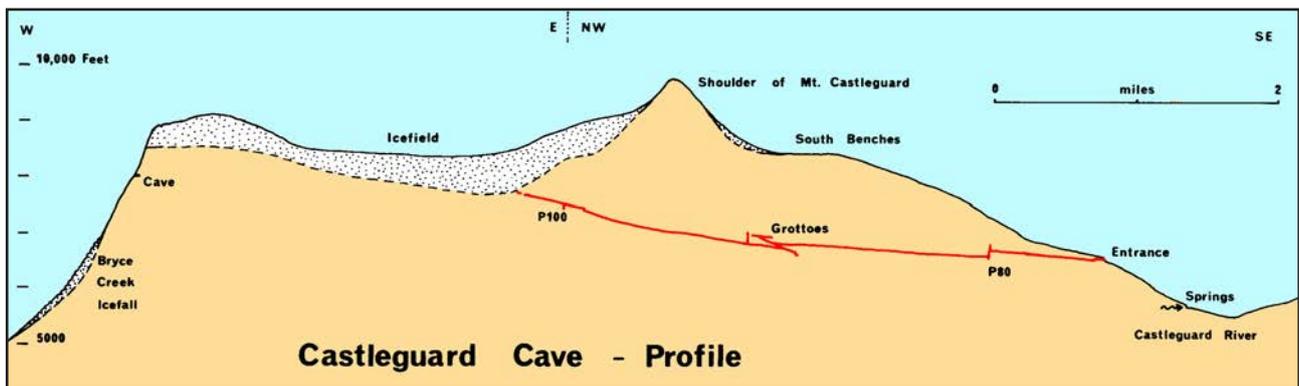
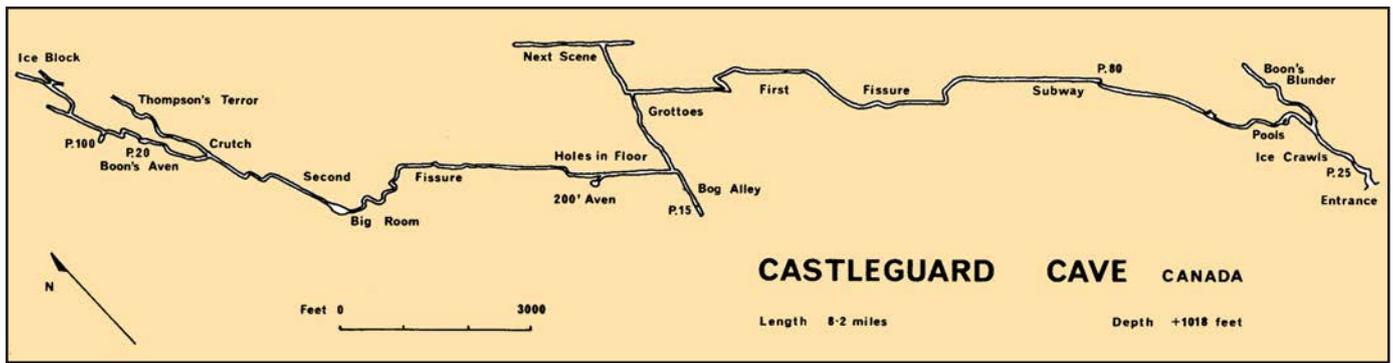
Then in October 1970, Mike Boon returned to the cave – on his own. Politically his trip was nearly a disaster, because he went without permission, and thereby antagonised the National Parks Service (the cave is in the Banff Park) which has always been so helpful towards the McMaster group. But in almost every other way Boon's trip must rank as one of the world's finest caving feats ever. He walked alone through the deep snow up the glacier and down the Meadows and then spent seven days in the cave. For much of the route he had to do double-carries to get all his gear in. But eventually he arrived at his aven, and, using bolts and pitons, climbed it. When he returned to civilisation and told of his exploration of a few hundred metres of passage ending in a sparkling wall of ice, there were many people who would not, or could not, believe him.

Another winter expedition in April 1973 gave Pete Thompson and Julian Coward a chance to follow in Boon's footsteps, and they found his story true to the letter. They also noticed that the strong wind in the cave disappeared at a shaft in the floor of the passage just before the ice blockage. They estimated that this was 30 metres deep, but had no gear to descend it, even though this seemed the only way on. The main purposes of the 1973 expedition were other than exploration; scientific data was collected in volumes and the possibilities of filming the cave were also assessed. Then in 1974 the film was made.

The 1974 Expedition

The Castleguard film was a joint venture. The Canadian National Film Board provided finance and processing facilities; in return they hoped to have a most unusual film to their credit and would also sell it to television in Canada, USA, Britain and elsewhere. The National Parks chipped in too, and provided the surface camp for the expedition, for which they would have a film of one of their more remarkable and inaccessible natural features. All the McMaster group had to do was make the film.

It was decided that the film should show a team of five cavers visiting the cave in winter to collect some water samples and also investigate the end of the cave. The actors were five of the original McMaster cavers. Filming was to be taken half way into the system, and the few sequences beyond



Plan and profile of Castleguard Cave; scale and units are in feet.

there would be based on still photographs. Even so the task was still one of mammoth proportions. The choice of cameraman for the venture was easy: Yorkshire's Sid Perou was invited and accepted, and was greatly assisted by Frank Binney, a Texan with some previous cave film experience. Two general assistants then brought the film team to nine in number, and there was then a second team, of twelve 'sherpas' whose task was to carry food, equipment and batteries in and out of the cave. These included some of the regular Canadian cavers together, with a number from the USA and Britain.

The organisers of the venture, mostly at McMaster, had six months hard work before the expedition, but, for most, everything started on the last day of March when the whole team assembled in a motel at Banff. Next day, a 100-km drive took the team to near the foot of the Saskatchewan Glacier to meet the helicopter. This ran a shuttle service nearly all day, and the 10-minute ride up the glacier and down the meadows was sheer delight. Endless mountains, ice and snow, and bright blue skies. Landing ground was ten metres from the camp, situated right on the edge of the snow-covered Meadows, and a 300-metre walk/slide from the cave entrance. Three metres of snow covered the ground, and the camp sat on top of it. This had been put in specially by the Parks Service and consisted of large wooden-floored ridge tents each fitted with butane heaters. Together with a camp kitchen that provided beer, T-bone steaks and freeze-dried strawberries, it nearly had an air of luxury. But the cold surface condition, and hard work required of the cavers underground made this an investment towards the smooth running of the expedition. The helicopter, while at the camp, was used for a few sequences for the film while everyone else prepared to work in the cave the next day.

Nine days were allotted for the first session of work and filming. The film team started at the entrance working slowly inwards, and returning to the surface each night. The ice provided some spectacular footage but it was cold work – the film team tended to wear duvets for their work while the sherpas rarely wore more than a single sweater when they carried loads in the cave. The sherpas spent nearly all their time carrying gear – food and camp equipment to the campside 5 km in, and an endless chain of snowmobile batteries, each weighing about 12 kg. Nearly 2000 metres of mains cable, and telephone wire, were laid in the cave so that a generator on the surface could be used to

charge batteries at the foot of the 25-metre shaft (see survey). This cut to a minimum the battery hauling through the miserable crawlways of the entrance series. Also during this first phase of the expedition a team went to the end of the cave to obtain the still photographs needed for the film.

Working days in the cave, for the sherpas at least, often exceeded twelve hours, so were alternated with days off as much as possible. And the more energetic used the spare time skiing – the snow-covered Meadows and surrounding mountains provided a terrain to equal any Alpine winter resort. After nine days the filming had reached the Subway, and the helicopter returned so that everyone could depart for Banff for a two-day rest.

The purpose of the helicopter's return was to take the team back to the vehicles parked on the Banff-Jasper highway. However the Saskatchewan Glacier was too much of a temptation for some, and six of the team took a ride just to the top of the glacier from where they had a superb 7-km downhill ski – with the deep snow safely bridging all the crevasses. An avalanche chased the skiers down the last section of the glacier before the helicopter returned to lift them to the road.

Pete Smart and the writer then rode with the helicopter back to its base at Golden 100 km to the south (and took a bus back to Banff). From the camp they flew westwards up the South Glacier to the southern margin of the Icefield, above Bryce Creek. There, two large cave entrances yawn out of a black limestone cliff – could they be a backdoor to Castleguard Cave, after all the wind in the cave proves that a back door does exist somewhere? But the entrances are overhung by a sheer cliff capped by tottering ice seracs, while below them are hundreds of metres of chaotic ice fall and avalanche chutes; checking them out will be quite a challenge. Also on the western side of the Icefield, the helicopter pilot pointed out another huge cave entrance never yet visited, which he had seen on his flights around the region. The Rockies are only just starting to reveal their secrets.

First rushes of some of the cave film sequences were viewed by the team in Banff. They were really excellent, and indeed the whole Castleguard film looks like it will be a classic. The whole team then returned to the camp for Phase Two of the expedition. Filming was continued further inside the



In the Ice Crawls.

cave, and to do this the film team spent a seven-day period underground. They spent four nights at the Grottoes campsite filming from Holes-in-the-Floor back towards First Fissure, and then spent two nights at a campsite set up on a short stretch of (incredibly muddy) false floor in the fissure itself.

The sherpas had to keep the camps equipped, besides endlessly shuttling batteries between the various filming sites and the charging point at the 25-metre shaft. They returned to the surface each night, but as the schedule speeded up they put in successive long days underground. Experience and fitness made the cave easier as time went by for the sherpas, and together with the high level of morale this resulted in a grand clean-up of the cave at the end of the expedition. A single slip in first fissure, resulting in a fractured ankle for one of the film team (who extricated himself from the cave), was the only mishap in an excellent expedition.

Four days underground

The need for a photograph of the ice block at the end of the cave – to be used as a still panned across in the film – gave a perfect excuse for a team to visit the end, and at the same time check out the undescended shaft beyond Boon's Aven. The team was an international one of six: Pete Thompson, once of Bradford and more recently Canadian, as leader, and, as he was also a 'film-star', as dummy for the photographers: John 'Donny' Donovan from Preston; Eoin Finn, a 190-cm tall Irishman who was never actually seen in a Wimpey jacket; George Tracey, a genuine Canadian; and Peter Smart, from Bristol, and the writer as photographers. Needless to say the trip into the cave was done carrying full rucsacs.

As far as the first short drop the passage is an easy walk broken only by some frozen pools with spectacular ice blisters on them. But below that shaft 300 metres of ice passage mostly involve flat-out crawling. The slick ice floor makes tackle carrying a delight – one push and a rucsac disappears almost out of sight. Beyond a chamber decorated with ice columns the passage degenerates into its



The Subway.

Ice columns within a small chamber at the inner end of the ice crawls.



most unpleasant form – 300 metres of stooping and crawling over an uneven floor of boulders and breakdown. Boon's Blunder, on the right, is a second long boulder crawl ending in a flooded pot. In this part of the cave, the temperature rises above freezing, so that the next obstacle is a series of three thigh-deep pools – the only place in the cave where one needs to get wet. Waders were used to pass them, but the hundred or so metres of crawl between them was misery when carrying both rucksac and boots. From the last pool to the 25-metre shaft is easy walking and scrambling along a roomy canyon passage. The pitch itself was laddered, even though a nasty bypass rift was found by Donny on an earlier visit, and beyond it the cave completely changes in character.

A short crawl over mud banks leads to the Subway – 500 metres long, dead straight, an almost perfect phreatic tube three metres in diameter formed on a bedding-joint intersection. It's like walking up a gun barrel, as it beckons the caver into the mountain, but it ends where a little vadose slot in the floor assumes larger proportions. It is these vadose floor slots which make Castleguard so memorable. The next 300 metres is partly easy walking in a tube or along the floor of a slot, and partly traversing on sloping ledges where the slot is wrongly sized. But this is followed by First Fissure – 1500 metres of vadose slot. The roof is the phreatic tube, but the slot is too wide to allow access to it. And the slot tapers down-wards so it is too narrow to walk along the floor. The only way is a mid-height traverse, mostly with a foot on each wall. At some time in the past the Fissure has been almost filled with a very fine silt; most of this has now been washed out, but there are short stretches of false floor left in (the film team camped for two days on the longest), and many of the ledges are just silt stuck onto the walls. Nearly all the rock ledges are covered in the crumbling sediment, so that the traversing is not of the easier variety. The monotony is relieved by awkward climbs and thrutches to change levels, and the odd spread-eagled move across gaping holes in the floor.

Quite suddenly the vadose slot ends, and the Grottoes provide a kilometre of easy walking, half in a phreatic tube and half in a broad vadose canyon. The decorations are beautiful in places – mainly helictites, straws and pearls. A low side passage was first entered when Sid Perou and Frank Binney were searching for a location for a particular film sequence, and they found that it opened out into a spectacularly decorated gallery. Christened the Next Scene, it was later pushed to a conclusion and surveyed by Donny, Pete Smart and Steve Knutson. The same trio used another of their 'rest days' to finish off Bog Alley. Just beyond the campsite it had been utilised and named in earlier years but was only known as a narrow canyon ending in a short pitch. Unfortunately the descent of the pitch only

revealed a few feet of passage ending in a rather unpleasant sump. The campsite in the Grottoes receives the full benefit of the cave's cold wind, but it is the only stretch of flat floor with an adjacent water supply, and with its constant use during the expedition it gradually achieved a fair degree of comfort.

Next morning the team moved onwards with heavy rucsacs – camp was being moved onwards for one night to give time and flexibility at the end of the cave, and in addition there was rope, ladder, survey and photographic gear. The easy walk through the Grottoes ends where the vadose trench that runs off down Bog Alley is still cut into the floor of the main cave. At first there is a false floor containing some magnificent nests of pearls, but these are followed by Holes-in-the-Floor. There the ten-metre-deep canyon contains a number of bridges of remnant sediment fill. The intervening holes – more than a dozen of them – are crossed by straddling, or back-and-foot methods, or just running round one sloping wall (the wall of death technique – always fun with a rucsac on). Some 300 metres of easy walking, in the roof tube where the floor slot is filled with sediments, then leads to Second Fissure. Like the first this involves endless traversing, and it is nearly 3000 metres long. Furthermore, it is much more difficult than First Fissure – there are many more difficult climbs, a number of really difficult moves on very wide traverses, and some sustained stretches of traversing on smooth slippery walls. But as compensation, there are a few easy sections of walking on floors of sediment fill, and one of these not far beyond the Big Room was chosen as an advance campsite. The camping gear was then dumped and the team continued with lighter loads on the more acrobatic section beyond the Crutch.

Second Fissure ends at Boon's Aven, where Mike Boon's original rope still hangs down the steep wall that he climbed. The Aven is really a nick-point, for beyond it the phreatic tube has no slot in its floor – the climb just takes one up out of the end of the vadose trench. Spectacular helictites decorate the easy passage leading to the shaft that was then still undescended at the side of the main passage. At the shaft, the team split into two. The photographers took Pete Thompson to act as model on the various shots needed for the film.

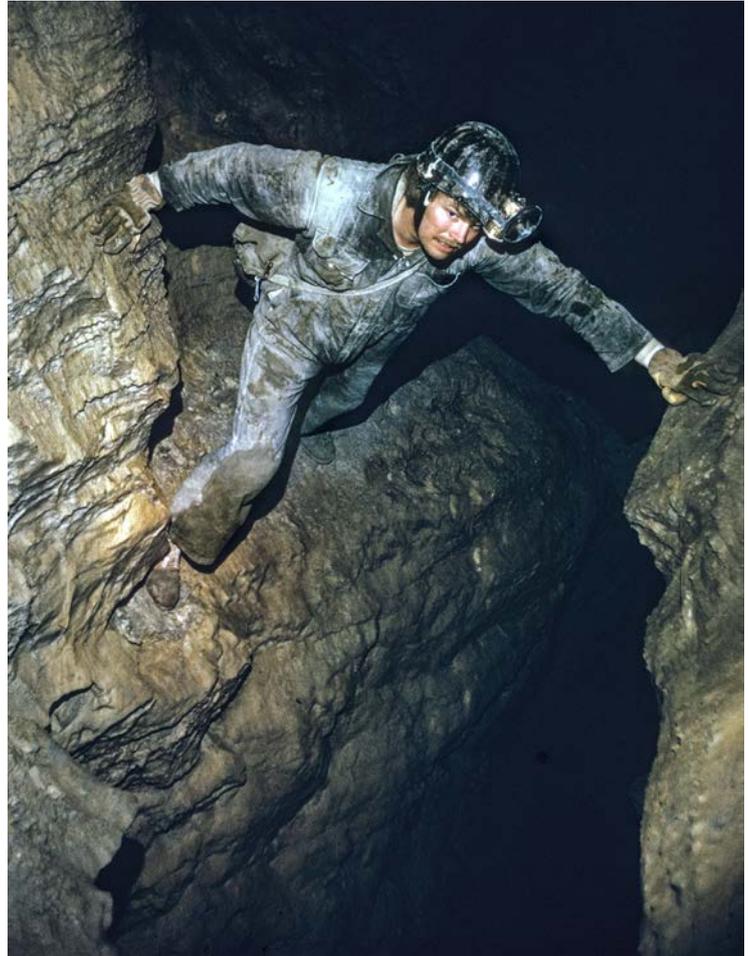
Meanwhile the other three rigged the pitch, and Donny roped down for 30 metres, to find it hopelessly choked at the bottom. The draught appears to go straight across the top of the shaft to what looks like it may be Third Fissure heading to the southwest. But a tedious bolt traverse will be the



The tube section of the Grottoes.



Eoin in Holes-in-the-Floor Passage.



George in Second Fissure.

only way into it, and it looks like a lot of effort to organise another expedition to do just that. Foiled in their attempt to explore onwards from the bottom of the shaft, Donny, Eoin and George systematically checked all the side passages – without making any spectacular finds, or revealing a possible by-pass to the shaft crossing.

From the blind shaft to the end of the cave is easy going, much of it a fine elliptical tube passage. This increases in size and begins to give the impression it will go on for ever, but the caver is brought suddenly to a halt – by a glittering wall of glass-clear ice completely filling the passage. Concentric laminar flow lines show how the ice has been intruded down the passage – from where the cave opens into the bottom of the Columbia Icefield, the surface of which is around 250 metres above this point. It is an unbelievable sight at the end of a remarkable cave. And at a distance of nearly ten kilometres from the nearest entrance it is one of the world's remotest underground locations.

Pete the film star posed patiently while the Very Important Photograph, of him beside the ice blockage, was taken. No chances: two photographers, two cameras, two flashguns, two angles, and each with bracketed exposures. Then a retreat, delayed only when the photographers asked someone to “hold it” on desperate bits of traverse, back down to the Second Fissure camp, which was reached at the end of 15 hours of caving. Another meal appallingly cooked by one who shall remain nameless, and then sleep until 2 p.m. the next afternoon. The following day was easy – just the short but heavy carry back to the Grottoes camp taking pictures at every possible chance. But Pete Smart suffered terribly when he developed a one-day stomach infection that had been doing the rounds of the expedition. It was dangerous for his friends to precede him down the climbs, but he eventually crawled into the Grottoes camp more dead than alive. Next day all were well and it was an easy journey back to the surface. The shaft may not have gone, but the photographs came out well and it had been a fabulous trip.

The Cave and its Setting

It is impossible to speak of Castleguard without mention of its unique geomorphology. The surface around Castleguard Mountain, between the Meadows and the main Icefield must comprise one of the world's finest examples of glacial karst landscape; it has been well described by Derek Ford (1971a). A glacier maximum left conspicuous terminal moraines across the benches, when it started to retreat no more than about 200 years ago. Outside these moraines, and particularly at the higher altitudes, the limestone surfaces are covered in a felsenmeer of frost-shattered debris – a classic periglacial landform. But inside the moraines the limestone benches are spectacularly polished and scraped free of debris; when the climate has ameliorated adequately, solutional etching and trimming will turn them into limestone pavements as fine as any in the Yorkshire Dales, but as yet there is minimal karren development.

More than a hundred sinkholes have been found in the area, both inside and outside the recent moraines. Nearly all are now abandoned, and at depths of as much as 40 metres are choked with frost debris from their walls. A concentration of them around the moraine margin suggests that these at least were developed by meltwater streams sinking almost immediately after flowing from the glaciers. It is debatable whether the sinkholes inside the moraines were formed by sub-glacial melt-streams, or were pre-existing shafts truncated by the glaciers and perhaps invaded by meltwater; the evidence presented by their location, appearance and morphology is rather ambiguous.

Surface drainage today is mainly restricted to the large meltwater rivers from the major glaciers, and some small perennial streams perched on a shale formation that floors part of the lower reaches of the Castleguard Meadows. Rainfall and seasonal snow-melt on the limestone surfaces, together with an unknown proportion of sub-Icefield meltwater, sinks into the karst. Most of it resurges at the Big Springs, south of the cave entrance.



Pete T. beside the wall of ice at the end of the cave.

Unfortunately Castleguard Cave has not yet provided access to the active underground drainage system. The cave is a fossil system of some considerable age. Its dominantly phreatic morphology, truncated at both ends, indicate that it predates the major glacial valleys that surround Mount Castleguard. The extensive vadose trenching, sedimentary fill, and re-excavation of the same, substantiate the hypothesis of a long and complex history. A single sample of stalagmite from First Fissure has given a U-Th date in the order of a third of a million years before present.

This fossil cave system has however been invaded by a significant amount of modern drainage. Percolation water is building a number of modern speleothems; the helictites are particularly noticeable in that nearly all the active ones point towards the entrance – i.e. in the direction of the summer wind within the cave. They are mainly seasonal in their growth, though there is still some seepage water within the cave during the winter. Dripwater and active formations occur throughout the cave, underlying not only the wooded Meadows but also the modern Icefield. The water in the known cave leaves it in at least a dozen places, down impenetrably narrow vadose canyons in the floors of the Fissures and tubes, and down wider shafts (which presumably lead to impenetrable canyons). The largest and only explored such outlet is Bog Alley.

It seems reasonable that all this water re-unites in the great unexplored active system beneath the known cave. Christened Castleguard Two, this active system must exist – it feeds Big Springs. It collects water from the Meadows, and also from an unknown share of the floor of the Columbia Icefield. Typically of a glacial regime its flow maximum is in summer; and it appears that the lower end of the system is restricted, for it overflows up the flooded pot of Boon's Blunder, sumps the next kilometre of passage and emerges as a torrent from the Castleguard Cave entrance. The interesting question about Castleguard Two is – what sort of cave is it? The solute load of the water emerging at Big Springs is remarkably low – maximum recorded total hardness is 28 ppm CaCO₃ (Ford, 1971b). This is typical of glacial water and is indicative of how limited is the extent of erosion by dissolution. Water emerging at adjacent small seepages and springs ranges 84–151 ppm. It just could be that the Icefield meltwater is carving itself a spectacular cave along Castleguard Two. On the other hand the meltwater could have invaded, and little modified, a pre-existing cave passage similar to the known cave.

At present, it is very difficult to estimate the degree of true sub-glacial cave development; the evidence provided so far by Castleguard is inconclusive, but maybe, one day, exploration of Castleguard Two could provide not only another superb cave but also more of the answers.

Acknowledgements

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Postscript

Since 1974, new discoveries have added to Castleguard Cave. Many new side passages have taken its length to more than 21 km, more ice plugs have been found, and a dive of 850 metres in the sump in Boon's Blunder has revealed open passage where exploration continues.