

A Septuagenarian Visits Sites of Teenage Dreams

Part 1: Ireland and Northern Ireland

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Photographs by Kirsty Dixon

I became involved in cave and karst science at around the age of 15 under the mentorship of the ebullient, world-renowned karst expert, Yorkshireman Joe Jennings (1916-1984). Dip and Punchbowl caves at Wee Jasper were not my first cave visits, but working over several years with Joe to map these caves to enable him to explain their genesis started my career.

Good Yorkshireman that he was, he talked often about the caves and karst of Yorkshire – Malham Cove and Gaping Gill as examples. He also talked often about the Burren in Ireland – the wonderful limestone pavements – dramatic clints and grikes – mind-blowing karst scenery! Told me I should visit those places – well after 60 years I did so!

I wanted to visit my daughter Jess and lovely six-year-old granddaughter, Hafren, so Kirsty and I set off to visit the British Isles – we got to England, Wales, Ireland, Northern Ireland and Scotland. Five countries! And the weather was good for us throughout. Kirsty drove some 5,820 miles (9,366 km)

I won't bore you with all of our excursion but will talk about some of the Association of British and Irish Showcaves (ABIS – which I think is a nice wordplay on 'abyss'). See more at <https://www.visitunderground.com/>

I contacted most of the sites listed below – giving them the last ACKMA Journal. I got little feedback but as our journey progressed, we developed more direct contacts.

We visited three caves in Ireland, one in Northern Ireland, three in Yorkshire (England) and one site in Wales with three caves. So here goes with Ireland's caves – we will visit Yorkshire and Wales – and the Burren again in the December Journal.

Crag Cave (County Kerry, Ireland): (Ireland's Most Exciting Showcave) <https://cragcave.com/>

Crag Cave was one of our most interesting sites – not only the cave itself but other offerings which included a wonderful 22 page booklet with a great discussion of how caves have contributed to the understanding of climate and vegetation change over the past 10,000 years. The booklet also describes the cave formation, development process and the local history amongst other facets. Their excellent website has many great pictures showing off the excellent cave lighting created with “a special atmosphere for the viewers to make the caves themselves the star attraction and not the mechanics”. Would that recent experiences in Australia had the same philosophy.

Unlike most of our Australian show caves, Crag Cave, and others we visited, was opened to the public recently – in 1989. Over two million visitors have enjoyed the cave since its opening. The tour is self-guided with audio interpretation.



We arrived here a day early, introduced ourselves to Michael who provided us with morning coffee and who rang the owner, Donie Geaney, who turned up within a few minutes. After some chat with Donie we set off down a longish set of stairs to the cave itself.

Figure 1: The stairs descending into Crag Cave (left)

The show cave itself is about 350 m long (the whole cave system is about four kilometres long). It is relatively sparsely decorated but what can be seen is very beautiful – the lighting is very well done, indeed.

Many of the chambers are named for places created by J.R.R. Tolkien in *The Lord of the Rings*. The cave also has beautiful displays of small solution scallops, indicating fast-flowing waters, and fossils within the limestone walls. In some cases, the speleothems are protected by Perspex sheets with the usual problems of condensation and dust – but a vast improvement over chicken wire or even heavier mesh barriers that we saw elsewhere on our trip.



Figure 2: Some of the decorations in Crag Cave, note the protective Perspex shield (end-on) on the right (above)

Crag Cave– has a remarkable children’s playground (Crazy Cave), a coffee shop heavily used by local mothers and their children and the usual gift shop. In the visitor centre there are a number of great posters outlining various aspects of the cave and its surroundings. These include a variety of scientific papers based on research at the cave. All-in-all a great start to our caving excursion.

Figure 3: One of the excellent information panels in the Crag Cave Visitors Centre (right)

Cave Formation

Do you know the difference between a cave and a pothole?

A cave is a cavity in the ground, large enough for human entry, that forms along the horizontal bedding plane in the rock. Occasionally, a cave may open up to form a cavern.

A pothole is a vertical cave that usually forms along a vertical fracture in the rock.

A series of caves and potholes makes up a cave system.

There are different types of caves. Primary caves form at the same time as the surrounding rock, for example, lava tubes. Secondary caves form in the rock after it has been deposited. Crag Cave is an example of a secondary cave.

Secondary caves form by different processes. Erosional caves are formed by water carrying rocks or sediment and eroding the rock, for example a sea cave. Solutional caves are formed by mildly acidic rainwater dissolving the soluble limestone along cracks and fractures in the rock. These cracks get bigger over thousands of years to eventually form caves.

Stalactite
Stalactites form from water droplets depositing calcite as they fall.

Stalagmite
Stalagmites form when drops of water from the roof splash onto the floor of the cave. Stalactites and stalagmites may eventually merge to form a column/pillar.

Flowstone
Flowstone results from water flowing over the rock surface depositing calcite as it goes. Draperies are wavy sheets of calcite that form when the flowstone meets an overhang, similar to icicles.

Gour Pools
Gour pools (or rimstone pools) form when calcite deposits create a dam in the flowstone.

Fun fact!
The largest stalagmite in the world is 32m tall.

Fun fact!
Speleogenesis is the birth and development of a cave from the beginning to its collapse and renewal.

Figure 4: Scientific paper on cave research on display in the entrance to Crag Cave (below)

RECONSTRUCTION OF PAST CLIMATES

6. How old are the cave formations at Crag?

In this project we have used the uranium-thorium dates revealed by their small ratio deficit from the homology of several stalagmites. This work has been carried out by Dr Yanning Zhang using a mass spectrometer at the Open University, U.K. He has found that most of the cave formations are younger than 10,000 years old – in other words, most of the stalagmites and stalactites began to grow when the last ice age ended. This makes sense because during the last ice age the ground above the cave would have been permanently frozen and little or no water would have been able to percolate through the soil. The cave system itself must be much older of course.

7. How was climate reconstructed for the past 10,000 years?

One stalagmite was removed for detailed study. It was cut in half to reveal the pattern of growth (see Figure 1). The small samples drilled at regular intervals along its length have been dated. These ages range from 10,250 ± 245 years at the base of the stalagmite to 46 years at its top. It appears that this stalagmite grew continuously during this time. Having established that this was the case, we then took several hundred small samples along the length of the stalagmite using a small diamond drill. These small samples were subjected to a range of chemical analyses. Measurements carried out included the ratio of the isotopes of oxygen and carbon, and trace element contents (magnesium and strontium).

8. What were the main results of the project?

(i) Using the simplest interpretation of the oxygen isotope data we have calculated that mean annual temperatures in the early part of the Holocene period (the past 10,000 years) were probably 1-2°C warmer than the average value for this time. Temperatures reached their maximum value between about 11,000 and 8,000 years ago, and that this was followed by a decline until about 3,500 years ago (see Figure 1 above).

(ii) Carbon isotope results are also shown in Figure 1. The most important result is that the changes in carbon isotopes in the carbon from the stalagmite correspond to lines in the past when there were large changes in the vegetation that covered Britain.

(iii) Studies of these elements are continuing but initial results suggest that high Mg/Ca and high Sr/Ca ratios in the period around 7,000 years ago, and from 4,000 to 2,000 years ago indicate that there were times of drier climate. Further work is required to confirm this result.

5. How are cave formations formed?

When you enter Crag cave you will notice that the roof, walls and floor of the cave are covered by deposits of calcium carbonate or calcite (CaCO₃). Some of these were deposited by dripping water (stalactites) and soda-droplets on the roof, stalagmites on the floor, others by flowing water (flowstone, on the floor and walls). These deposits form because the soil above the cave has a very high partial pressure of carbon dioxide (CO₂) due to plant respiration, and when rain falls on the ground it percolates through the soil and picks up some of this carbon dioxide in solution to form weak carbonic acid. This carbonic acid then dissolves away some of the underlying limestone to form a solution which is saturated in calcium carbonate. When this solution reaches the cave where there is a smaller amount of CO₂ in the air, it loses its extra CO₂ to the air, like what happens when you open a bottle of fizzy drink. The water has lost this gas so it can no longer hold calcium carbonate in solution, but it falls out (precipitates) to form stalactites, stalagmites and flowstones. There is no need for the water to evaporate or warm up for this to happen!

Figure 1. The graph shows the concentration of CO₂ in the soil above the cave. The concentration starts high (around 10,000 ppm) and generally decreases over time, with some fluctuations.

Doolin Cave (County Clare, Ireland): (Experience Europe's Largest Stalactite – 125 steps down, 350 million years back in time) www.doolincave.ie

Our next stop was Doolin Cave. It was only opened in 2006 and again there is a very good little booklet and website. We did not meet the Browne family who own this cave. This is a guided cave whose main feature is the complex stalactite some 7.5 m in length. The spectacular stalactite is in an otherwise sparsely decorated large chamber which enhances the impressive view. It is said to be the largest stalactite in the Northern Hemisphere – eclipsed by caves in the tropics – although having seen images of enormous stalagmites in China I am sure that there will be longer stalactites there.



Figure 5: The large stalactite in Doolin Cave (left)

Interestingly in the entrance shaft there are excellent examples of *calthemites* – speleothems derived from concrete and similar materials as described by Garry K Smith in ACKMA Journal No.104, 2016 – use Rauleigh's excellent search engine to find the article on our website. Garry also presented a paper on these at the recent Tākaka Conference. These calthemites have grown in less than 20 years.

Figure 6a and b: Calthemites growing in the entrance passage to Doolin Cave (below)



The cave has received several awards and is conservatively managed with visitor numbers set at 55,000 a year – the only show cave that I know of that has such a limit. It is part of The Burren UNESCO Global Geopark. There is a café, a nature trail and a pottery associated with the cave. They also have resident goats on the roof of the entrance building!



Figure 7: Resident goats on the roof of the Visitor's centre at Doolin Cave (left)

Aillwee Cave (County Clare, Ireland): (*Inspiring Awareness of The Burren Underground Landscape*)
<https://aillweeburrenexperience.ie/>



And on to Aillwee Cave – a fine phreatic tube, a raptor centre and a farmshop specializing in cheeses and fudge! Unfortunately, we were unable to meet the director, Nuala Mulqueeney, but enjoyed our guided tour and subsequent chat with guide Abigail Coyne and her colleagues, who were very excited to have someone so knowledgeable of caves and karst visiting.

Figure 8: The main phreatic tube passage in Aillwee Cave - eroded upwards (left), photograph by Aillwee Caves

The cave is a phreatic tube displaying excavation upwards in a process known as paragensis. This is where a phreatic tube is partially filled with sediment forcing the flowing water to erode the roof of the passage ultimately forming a canyon. The tour is a round trip of some 900 m and includes spectacular waterfalls.

Figure 9: One of the waterfalls in Aillwee cave (right)

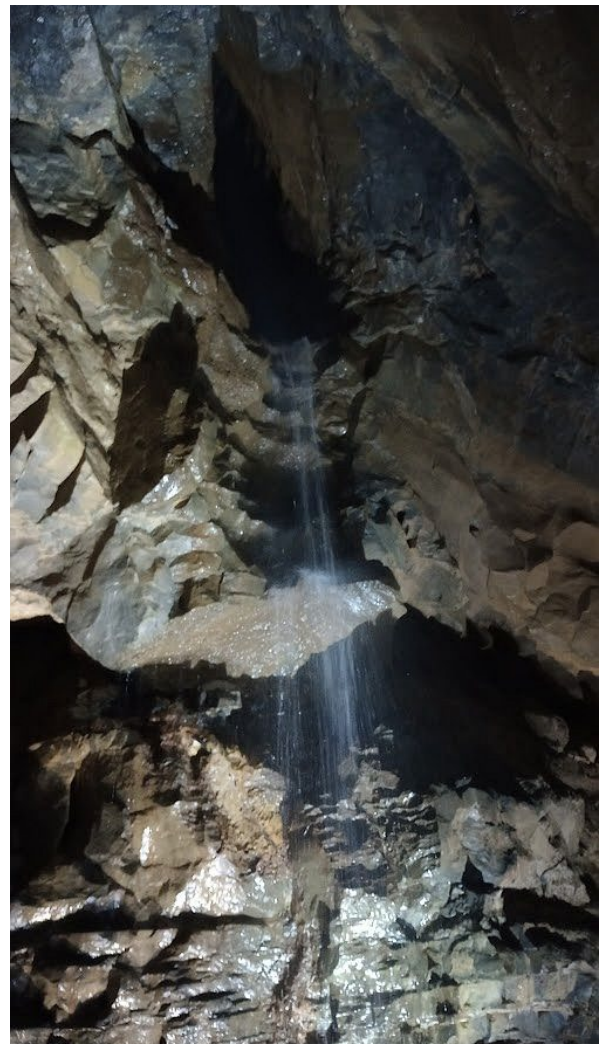
Research in the cave has led to an understanding of climate change and vegetation change over the past millennia. At one time the land over the cave was overlain by forest – nothing like the scene today! The cave was opened to the public in 1976. It contains a variety of sub-fossil bones including those of the extinct Brown Bear (*Ursus arctos* - 10,400 years old) and the tooth of a horse dated at 2,100 years old. The bear bones showed evidence that the animal had been eaten by humans.

There was no booklet here and the website is reasonable but doesn't tell us much about the cave itself. The website does include a remarkably comprehensive environmental policy for the operation of the cave as a public facility.

We attended a 45 minute show in the raptor centre where a small falcon and a delightful little white owl caught meat thrown in the air and from the falconer's hands. Some children had the awesome (a word that I hate!) experience of having a bird on their gloved hand. The centre also is a hospital for injured raptors.

We did a little fudge and cheese tasting - excellent.

The Doolin and Aillwee Caves above are within the Burren and Cliffs of Moher UNESCO Global Geopark and are on the *Wild Atlantic Way* with its stunning coastal cliff lines <https://www.thewildatlanticway.com/>



Marble Arch Caves (County Fermanagh, Northern Ireland): (*Delve into the Deep*) www.marblearchcaves.co.uk



We then hopped over the border into another country and found the Marble Arch Caves in the Cuilcagh Lakelands UNESCO Global Geopark.

Figure 10: Geopark recognition at Marble Arch Caves (left)

Unfortunately, Sean Corrigan was away for medical reasons, but we did meet fellow manager Sharron (Sean's sister). This guided cave was opened in 1985 and formerly commenced with an underground boat trip (only runs when water levels and staffing permit).

E.A. Martel, the renowned French cave explorer (*The Father of Modern Speleology* - Google him!) first suggested that Marble Arch be developed for tourism in 1895! The tour follows the Yorkshire Ramblers exploratory route of 1935, takes about an hour and traverses about 1.5 km – there are 154 steps to enter and leave the cave! Parties are restricted to 21 persons. There is no booklet available here, but the website is adequate with a good Q&A section. A separate visitor centre has good displays.

Figure 11: Scalloping in Marble Arch Cave (right)

There are three rivers in the cave – management reviews weather and river levels each day and decides what tours can be held safely. The cave is not overly-decorated – but some are very spectacular and nicely lit. The overwhelming beauty of the cave is its scalloping and other water-worn bedrock features.



Figure 12: Some of the decoration in Marble Arch Cave, with well-designed lighting (left)

To be continued in the December Journal when we move to English and Welsh caves. I will also talk more about The Burren then.