# Frost and ice at Hallowe’en Rift.

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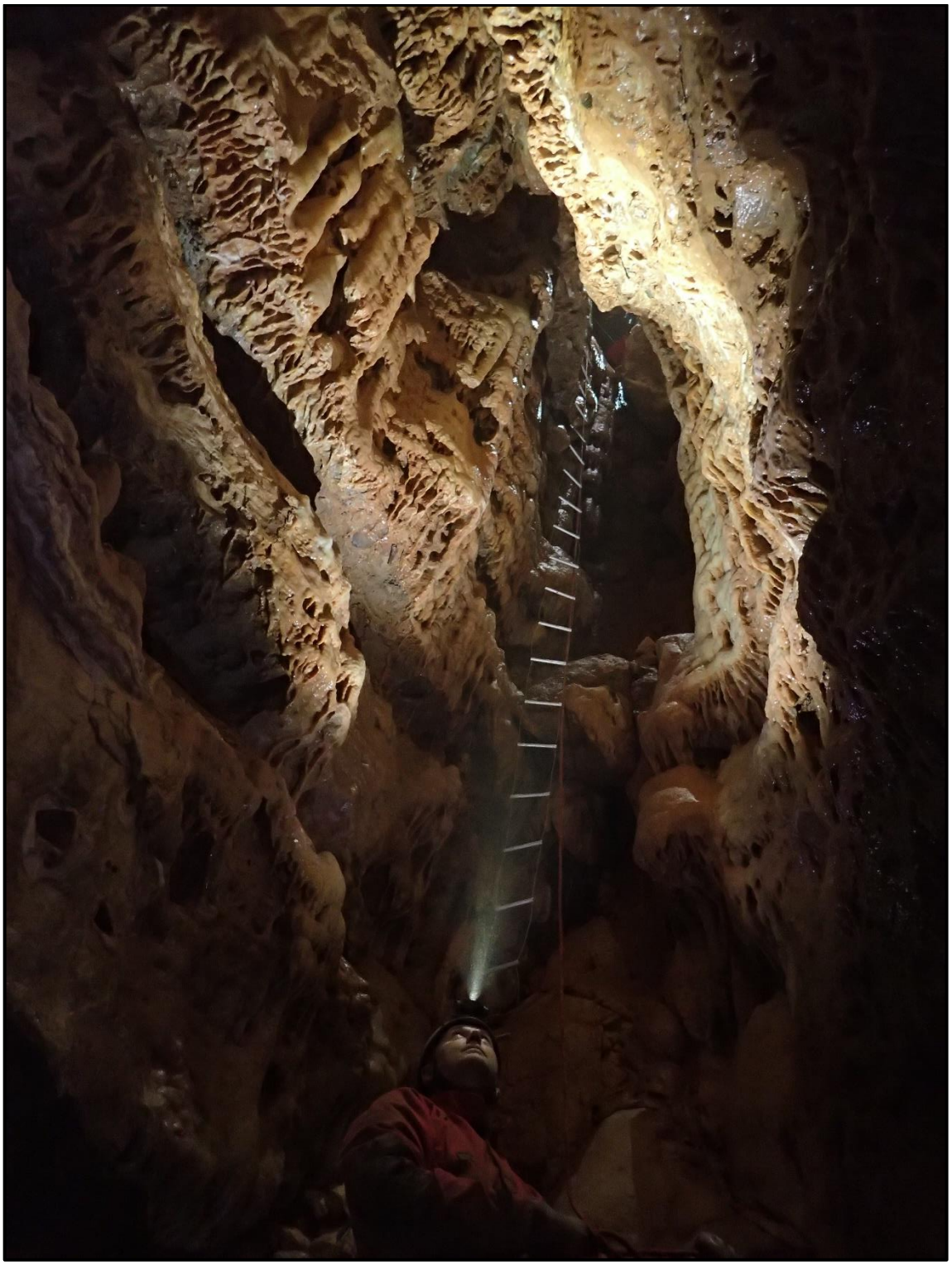

*The rift in An Unexpected Development, first descent 8th August 2018. Photograph by Roz Simmonds*

## Introduction

Hallowe'en Rift, NGR ST 5353 4809, altitude 130m aOD, has a current surveyed length, 304m with a vertical range, c.25m. The cave is located in the wooded hillside to the north-east of Wookey Hole Cave. Excavation of the cave was commenced in 1982, by the end of the 1980s interest at the site had waned. Then, in the early 1990s activity in the cave re-commenced, it was during these excavations that the dig on the north-east side of the entrance was started. Interest, once again, waned as the participants moved onto pastures new. In 2009, the current phase of activity was started, the work concentrated on extending the cave to the north-east side of the entrance.

The cave consists mostly of low bedding, partially filled with sandy silt with cobbles and boulders of dolomitic conglomerate and frequent fragmented calcite speleothems. The low bedding occasionally has intersected several rifts. Most of the low bedding passages have been excavated. In 2018, progress along the bedding accelerated and following several minor breakthroughs, An Unexpected Development was entered in August, it is c.80m long and contains an abundance of shattered speleothems and interesting geo-morphological features.

## Initial observations and notes

There is a change in the sediments that partially fill the low bedding sections on the approach to An Unexpected Development. Initially, the sediments are mostly sandy silt with occasional cobble and boulder-size fragments of fractured calcite speleothems. The fragmented calcite becomes more frequent and after a drop down into a lower bedding it becomes the dominant component of the sediment fill. It had been suggested that the damage was caused by earth movements. However, after a close examination of the sediments and some further research, it is apparent that the cause of the fracturing and damage to the speleothems was caused by the actions of frost and/or ice.

Gilli (2004) suggests that the global evidence for an absence of stalactites or stalagmites collapsing during present earthquakes and the existence of well ornamented caves in seismic zones, testifies the solidity of cave formations, proving the point "caves are very strong" and that speleothems usually do not suffer from earthquakes. The co-seismic origin of massive collapses is doubtful and other mechanisms explain more easily most of the ruptures.

Most of the passages in Hallowe'en Rift are shallow, c5-10m, below the surface and root growth is evident in several areas, there are snail shells in parts of An Unexpected Development and infrequent [old] bat droppings. Present day conditions in the cave are influenced by surface climate, for example, during the summer months the cave is, generally dry, and when it rains, and the ground becomes saturated then the cave becomes wet and usually rather squalid.

During the Pleistocene period, warmer interglacial and interstadial periods produced calcite flowstone deposition in the cave. The following cold glacial and stadial periods caused periglacial activity in the cave, during which the calcite layers became fractured by frost heave and some redistribution of the fragmented calcite occurred by the process of solifluction (Lundberg and McFarlane, 2007). The cave is shallow enough for ice to form within the cave during glacial periods. During the build-up of ice and its subsequent thawing, ice can flow and slide, thereby stalactites and curtains can be sheared off the roof and stalagmites can be tipped over or sheared off their bases and displaced. Lumps of calcite enclosed in ice can be deposited on inclined surfaces or be left in precarious positions, i.e. at positions which would not be stable if deposited by falling (Kempe, 2004).

*Layers of fractured calcite flowstone, the damage caused by frost heave.*

*Shattered speleothems in An Unexpected Development*

*Frost/ice damaged stalagmite at the top of the rift in An Unexpected Development. It is unlikely that the precariously balanced pieces would remain in-situ should they have been the result of earth movements.*

Kempe (2004) describes wide range of phenomena as evidence for ice related damage, including:

- Missing ceiling formations of older generations
- Sheared-off stalactites and curtains, deposited on top of floor speleothems
- Broken and deposited stalagmites
- Sheared-off stalagmites which have shifted from their base but still stand upright
- Cracked conical stalagmites
- Tilted and leaning stalagmites
- Moraine-like piles of floor flowstone
- Precariously placed ceiling deposits

In addition to speleothem damage, Kempe (2004) describes other traces that freezing, and cave ice can leave, including:

- Cryoturbation in cave sediments
- Solifluction deposits
- Transport of gravel without evidence of flowing water
- High collagen content of fossil bones
- Loss of uranium due to ‘leaching’
- Scratch marks on cave walls

**Uranium-series dating**

Uranium-series dating, also called uranium-thorium dating, is a radiometric technique established in the 1960s which has been used since the 1970s to determine the age of calcium carbonate materials such as speleothems and corals. It calculates an age from the degree to which secular equilibrium has been restored between the radioactive isotope thorium-230 and its radioactive parent uranium-234 within a sample. The method has an upper limit circa 500 ka.

Several years ago, speleothems from Hallowe'en Rift were sampled and two uranium-series dates were obtained, 563 +170 -74 ka, unfortunately this date is at the upper limit of the method, but likely relates to Marine Isotope Stage (MIS) 13, Cromerian. A younger date 51.26 +0.31 -0.32 ka, relates to MIS 3, Middle Devensian.

**Comments**

To fully understand the chronology of the events that took place in Hallowe'en Rift more dating of speleothems would be required.

It is likely that frost/ice related speleothem damage has occurred in other Mendip caves, particularly shallow caves and a re-evaluation of these sites should be considered.

Hallowe'en Rift is an ongoing project and work continues.

**References:**

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