# There’s copper in them thar hills (or not!)

The adit mine, in Bulkeley Woods towards the southern end of the Sandstone Ridge, has long been known. We have numerous anecdotes from adults, who as children, played in this tunnel, we have documentary evidence that indicates that this was a speculative, exploratory tunnel hoping to discover further deposits of copper. But a recent mine survey, carried out by the Sandstone Ridge Trust has added so much more information, interpretation and colour to our understanding of local copper ore exploration.

To step into the adit, unique to the Ridge, is to step back in time to around 1830. The day the miners abandoned tunnelling is very much how we find it now. The following article describes the physical features of the adit, evidence of how the miners worked and what they were hoping to find (and what they didn’t find!), along with a description of some of the creatures that now call it home.

From the outside the adit gives little away, it is a low arch about 30cm high where the opening to the tunnel has been largely filled in by years of accumulated leaf litter. And this was where we headed. After uncomfortable squeeze, half submerged in leaf litter and its accompanying bug life, this narrow gap began to widen out, and after about 10 metres the leaf litter gave way to a sandy floor and the height allowed for stooped walking. Upon looking up, the adit tunnel could be seen in all its glory!

*Picture 1. Near the entrance looking out. Note regular pattern of pick-marking on the roof and walls*

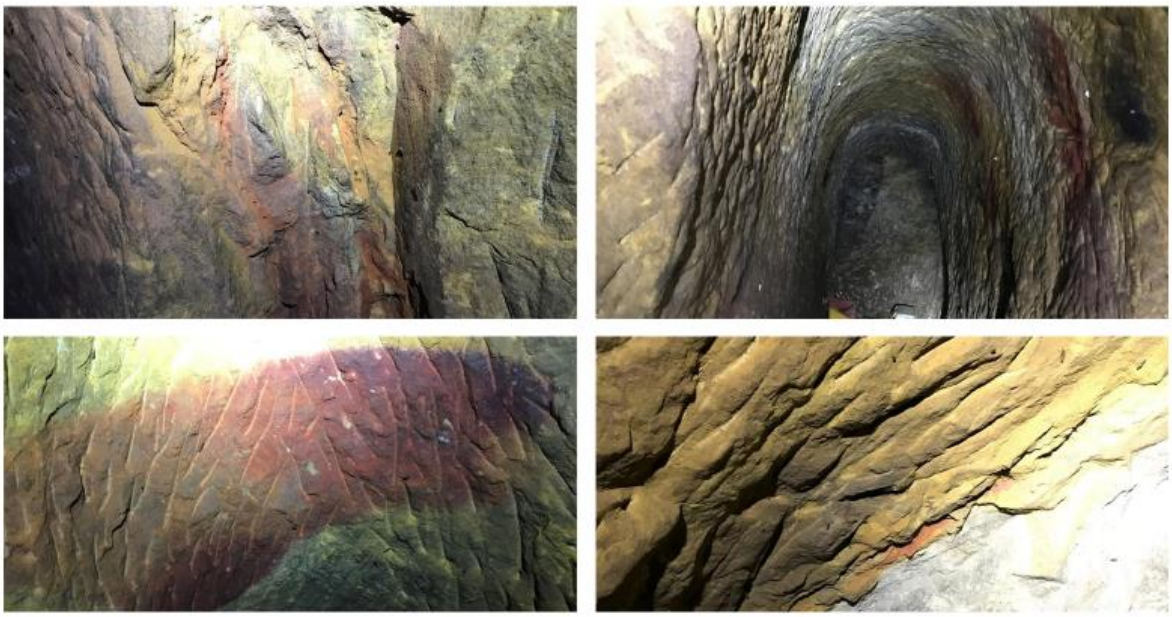
*Picture 2. Looking towards the end of the mine. Note niches on left wall.*

The passage runs for approximately 33m in a north westerly direction from the entrance. At the end of this passage, the miners left a low bench (about 30cm high) cut into the end wall indicating the moment work was stopped along the main tunnel.

The tunnel has been hand-picked with no clear evidence of the use of explosives. All the tunnel surfaces show excellently preserved pick strike-marks. A 25mm borehole was found near to end of the tunnel, and with no powder marks, it suggests that the plug and feather method was used to split the rock.

*Picture 3. The view towards the tunnel terminus, showing the bench of sandstone left when working finished*

The adit has been dug through relatively soft Wilmslow Sandstone. For much of the tunnel length, this is represented by white sand, the colour resulting from the red iron oxide having been removed over time (bleached). This white sand has been extensively mined as a cleaning/abrasive agent from several locations along the sandstone ridge (see article, ref. *#1*). However, iron rich fluids moving through this porous sandstone has subsequently redeposited iron minerals, resulting in one of the highlights of this survey: stunning colours of dark and bright reds, to orange and yellow, variably patterned through the tunnel.



*Picture 4. Images showing the varied iron staining*

At intervals of approximately 2m (probably 1 fathom or 6 feet), there are niches in the left hand wall of the adit which clearly were used to hold candles but may have had another

purpose as candles were also mounted in smaller niches throughout. The larger niches may also have served as a measure of distance worked as two fathoms may represent about one week's work (based on experience at Alderley Edge). If this were the case at Bulkeley Adit, the mine would have taken about 10 weeks to excavate.

*Picture 5. Smaller niches for candles along the left hand wall. Note the black carbon staining from the flame over each recess from candles which were burning nearly 200 years ago.*

But why dig a tunnel here?

This adit, being separate from the mine workings at Gallantry Bank, probably represents the attempts of one of several speculators hoping to open up a new copper ore-body in the early nineteenth century. The most likely of these was George Walmsley of Bolesworth Castle (1799-1867). Bolesworth historian, Wendy Bawn writes:

> *George's mining ambitions became clear in 1828 when he saw an opportunity to exploit the old copper mine at nearby Gallantry Bank, Bickerton – he was also convinced that these veins of copper might extend under part of his Bolesworth Estate. The land and copper mine at Gallantry Bank was still part of the Egerton estate at that time and George Walmsley was one of seven men (including a Welsh miner) who took out a six-month lease from November 1828 to investigate the mining possibilities. The others were –*
>
> *N Bather of Chester* *William Okill of Liverpool*

*S Cartwright of Chester* *John Leicester of Liverpool*

*Thomas Cartwright of Chester* *Benjamin Profitt of Llanassa, a miner*

*However, they do not appear to have been very successful and the mine was later abandoned. Interest was revived again in 1835 but this time George Walmsley was not involved because in 1832 he had been forced to sell the Bolesworth Castle estate due to his precarious financial situation. Part of the sales particulars stated optimistically that "In an adjoining Estate in the Township of Bickerton, Veins of Copper Ore have been discovered which are now about to be worked, and it is considered that these Veins extend under part of the Bolesworth Estate."* (ref. #2).

This adit, therefore, may date from Walmsley's 1828/29 investigations although a date in the early 1830s is also possible. Nigel Dibben has observed a morphological resemblance between the passage type at Bulkeley and passages dating from 1810 at the Alderley Edge copper mines, (ref. #3).

So, as well as an understandable desire to have economically viable copper deposits on the Estate, what was the geological evidence for copper here?

Well the quick answer is none, other than a general proximity to the Bickerton copper ore deposit. Copper at Bickerton is deposited along and adjacent to a major fault plane (the Bickerton-Bulkeley Fault) that runs SW – NE along the eastern margin of the Bickerton and Peckforton hills. Copper ore occurs against this fault plane in a zone of sandstone up to about 1 metre thick, often less, though it may extend a long way down. In fact this fault (a fault is where earth stresses have fractured the rock and movement has taken place relative to the two sides) is very deep seated, and is thought to have a vertical displacement of about 300m.

Above the site of the Bulkeley adit, fractures and small faults can be seen in the sandstone cliffs, and the British Geological Survey does record a fault here, running approximately north – south. Maybe, it was thought at the time that this minor zone of faulting 'plumbed' into the main ore-bearing Bickerton – Bulkeley Fault, and that copper deposition had extended to the adit location.

Significantly, 5 metres before the end of the adit, the tunnel intersects a fault running almost due north – south and dipping westwards about 70 degrees from the horizontal. The faulted section is marked by two side excavations. On the north side of the tunnel, little development has taken place although a very narrow joint filled with soft sand seems to have been scraped out.

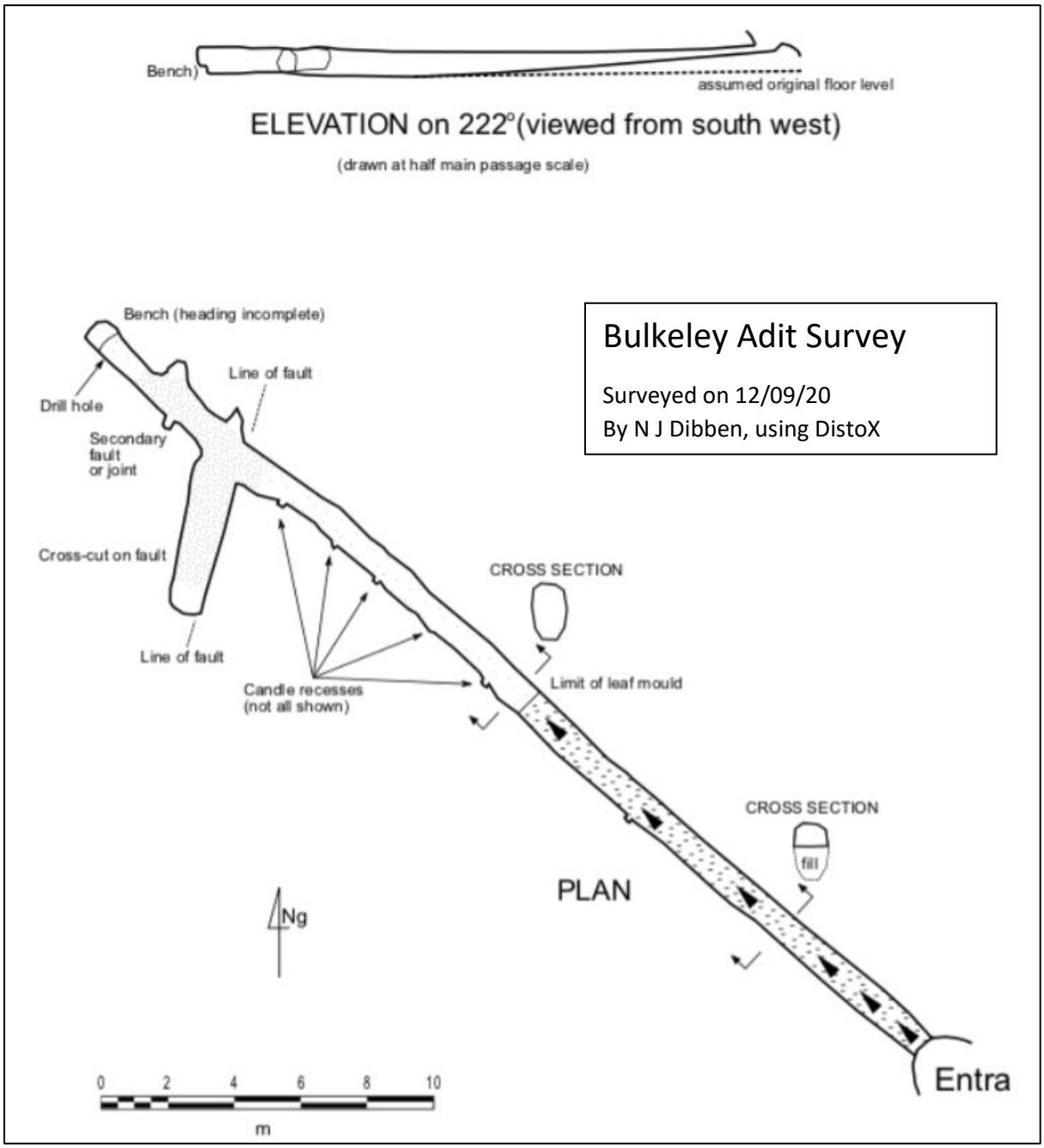
*Picture 6. Fault on north side of adit. Little of interest to the miners here, with the removal of a small narrow band of white sand*

On the south side, the fault has been mined out for 4.5m with clear evidence of the fault on the south east wall. This appears to be mineralised with barite, but no trace of copper is visible.

*Picture 7. Tunnel cut on west side of the adit, along and adjacent to the fault. The inclined fault plane is smooth with fine striations, indicating where movement has occurred*

So, it appears as though the tunnel had intentionally been driven to strike the north-south fault which looks to be visible in outcrop in the cliffs almost directly above the tunnel-fault intersection. It may be that the miners in the early 19$^{th}$ century looked at the very same rocks to help decide on the position and aspect of their proposed adit.

The attached plan illustrates the dimensions of the tunnel and orientation.




The tunnel has now been claimed as a home to a wide range of invertebrate life, (plus the occasional hard-hatted mammal). A selection of the bugs present on the walls is shown, most of these species are taking shelter, with some being more permanent residents. Knowing a crawl through the leaf litter to exit the adit was still required, it was felt better to remain ignorant of what abundant life lay in there! No plant life (other than at the entrance) was present. No moths were identified, but this may have been due to the time of year (they are usually found overwintering).

Using a cave for shelter offers animals many advantages;  no need for camouflage, avoiding potential predators, constant temperature and humidity and absence of frost.

The most common species here include parasitic wasps and true flies. The wasps, each marked by a vivid yellow spot, were found congregated in the depressions of candle niches along the walls. These adults are safe enough, however, in the spring, they lay eggs that as larvae parasitise the larvae of, in particular, the Yellow Underwing moth. A little known but interesting fact to celebrate; this species won Cave Animal of the Year, in Germany in 2017!

Among the flies here some are characterised by a striking sky blue-coloured thorax, these are spread more evenly across the walls. Another fly, a crane fly, is probably a summer visitor, and is characterised by the way its speckled brown wings cover its abdomen. This species is the present incumbent of Cave Animal of the Year (2019).

Also commonly occurring are adult caddis flies, they may be present here as part of their resting stage during the summer.  They may also provide a valuable food source for other creatures, given the large accumulations of wings on parts of the cave floor. More typical cave residents were present, particularly the cave spider (our third winner, in 2012).

Although no plant life was noted, a particularly unpleasant fungus was. *Cordyceps* is a group of parasitic fungi which entombs the bodies of insects, fungal strands then invade and feed off the contents of the victim.

Occasionally, the floor of the cave would break away under the weight of a knee, revealing what may be an unidentified mammal burrow.


*Picture 8. Faunal and fungal observations*

1. Crane fly (*Numonia nubeculosa*)
2. Cave Spider (*Meta menardi*)
3. Fly (probably *Gymnomus amplicornis*)
4. Evidence of a mammal burrow

5 & 6. Parasitic fungus (*Cordyceps*), entombing a wasp, (#5 shows the wasps' wings still visible)

7. Parasitic wasp (*Diphyus quadripunctorius)*
8. Common Pill Bug

9. Caddis fly (?*Stenophylax permistus)* 10. Accumulations of Caddis fly wings

This article is intended to provide an insight into the thoughts and skills of these early miners, how they might have read and interpreted the landscape and the difficult conditions in which they quickly worked this adit. And perhaps of their disappointment as they kept tunnelling along the barren southern fault extension, to eventually admit failure and abandon this search for copper ore.

Nick Holmes

*Due to conservation risks and the inherent dangers of underground exploration (roofs susceptible to cracking and to rock falls), the Sandstone Ridge Trust does not support visits to any caves without the permission of the landowners and due attention to safety. We cannot accept responsibility for personal injury should anyone choose to explore caves on the Ridge.*

References


Ref. #1, https://www.sandstoneridge.org.uk/beneath-ridge/from-pickaxe-to-kitchen-floor-sand-mining-on-ridge.html

Ref. #2, *Bawn, W. Sources: Cheshire Archives and Local Studies (CALS: DEO 63, DEO 64 and DEO 204/6. CALS: CP/BIK/C, C J Carlon, Gallantry Bank Copper Mine Bolesworth Castle archive*
*'Bolesworth and the Barbours', W Bawn and D C Barbour, 2017*
*Denbighshire Record Office, DD/WY/7318*

Ref. #3, https://www.derbyscc.org.uk/alderley/history_passage_types.php.