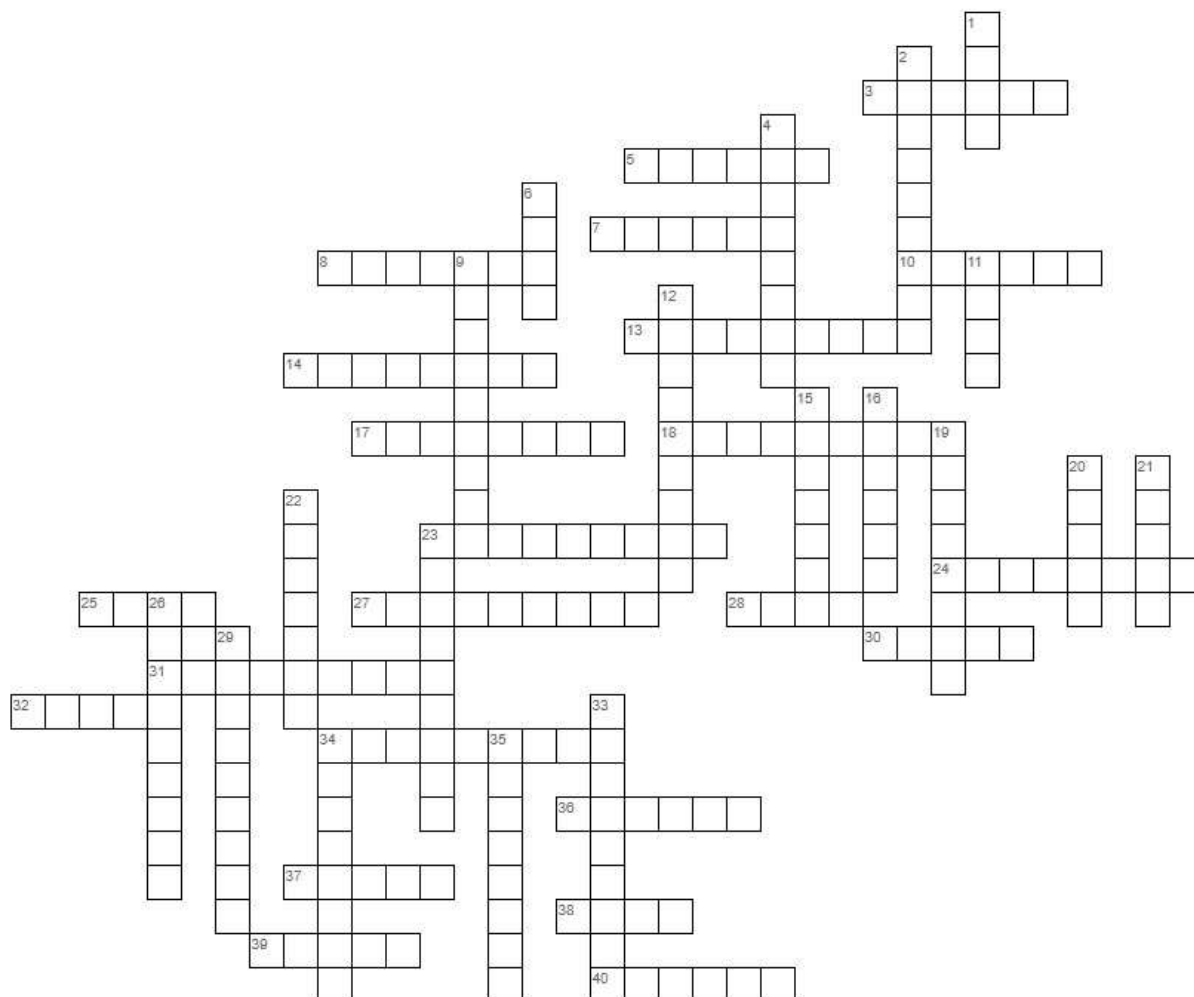


Ecton Hill Geocross V84

No contact geocaching and crossword

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To solve this crossword puzzle you need to visit the 14 locations of the main feature in the following photographs.

You will need the what3words app (W3W) on your GPS device. Using your GPS device held over the main feature you then get the what3words address. You will probably have to move around to find the W3W square containing the 'word' provided.

Save all the words and eventually fit the words to the crossword grid.

There are just three crossword clues. Find these words first, then fit all the other words to the grid. There may be more than one solution. One word may appear twice, you only need it once for the crossword.

Clues

10 ACROSS people playing

32 ACROSS bright beam

35 DOWN walking

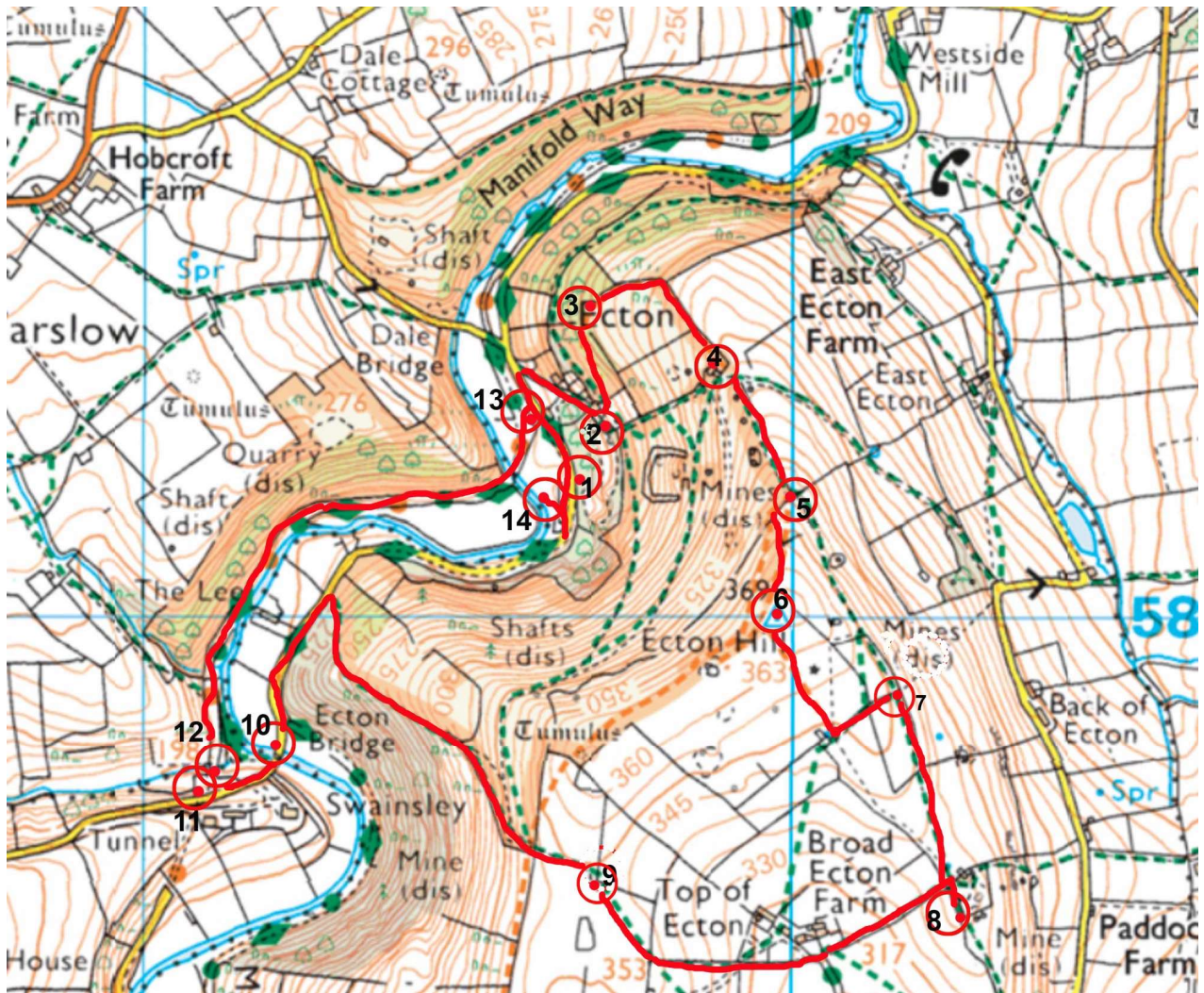
The GPS on mobile phones can be imprecise. This can mean that multiple devices very close to each other might show different 3 word addresses, not because the 3 word addresses of your actual location is different but because the devices each think they are in slightly different places. Each location is a grid square 3x3 metres.

In order to help you ensure that you obtain the correct three word (W3W) address, the first word in the W3W is provided as a clue. You may need to walk around the main feature into different 3 x 3 metre grid squares to find the correct W3W address.

E.g. Let's assume that you are at a location given by the W3W address thick.verge.commented and you are told the first word of the W3W address is the word "thick". You now know you have found the right one.

Location	OS grid reference	W3W		
		First word	Second word	Third word
1 Clayton Deep Mine adit	SK 09597 58084	gifted		
2 Ratcliffes Folly	SK 09720 58279	carbonate		
3 Powder House	SK 09684 58448	openly		
4 Deep Ecton Engine House	SK 09874 58373	piglet		
5 Stile & gate	SK 10000 58186	took		
6 Ecton Hill trig point	SK 09979 57999	nicknames		
7 Fossil coral stile pillar	SK10207 57964	really		
8 Standing stone	SK 10257 575343	loudness		
9 Path and wall junction	SK 09701 57589	microfilm		
10 Road bridge end	SK 09209 57793	acting		
11 Swainsley tunnel	SK 09088 57715	resurgent		
12 Cycle Route 549 sign	SK 09104 57746	wimp		
13 Wooden bench	SK 09602 58283	takers		
14 Deep Ecton adit	SK 09629 58138	attending		

Each of the locations can be found on the route below. The locations are listed in order and sufficient background is included to help you triangulate your position to identify the location



The Hollow Hill of Ecton

Ecton Mine was once the deepest mine in Britain, 1350 feet below the ground.

Mining of copper ore at Ecton Hill began in the Bronze Age, 4000 years ago. The hillside is scattered by various shafts and surface workings, but the boom in copper mining came when the 4th and 5th Dukes of Devonshire began working the richest veins in Deep Ecton Mine and Clayton Deep Mine in the 1750s.

The copper ore is within vertical veins called 'pipes', and the mining engineers employed by the Devonshires, followed these veins down, well below the depth of the River Manifold.

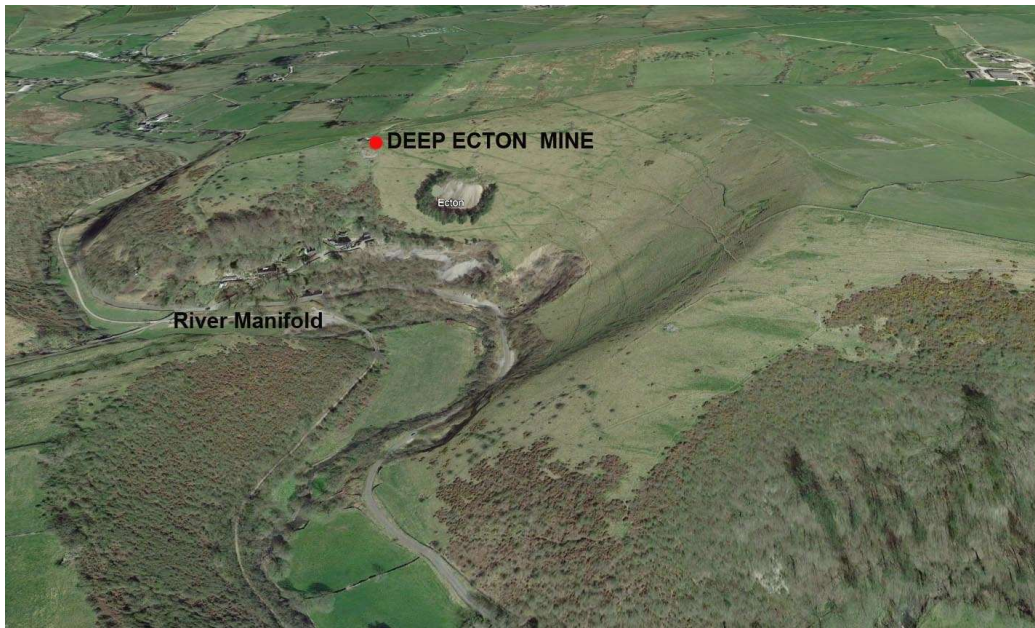
The mine's workings included large chambers excavated to allow mining below river level. These chambers housed a water powered balance engine and a capstan for raising and lowering equipment. Major pumping systems were developed.

Deep Ecton Mine was the first mine in Britain to use gunpowder.

The mine's winding shaft brought the ore to the surface to be 'dressed', after which it was sent by horse and cart for smelting. The winding shaft was originally powered by horse gins, but in 1788 it was replaced by one of the first steam winding engines.

The mine's workings are now flooded but have been partially explored using submersibles.

The underground caverns were so huge it was said they could accommodate St Pauls Cathedral, the largest building in London at that time.



Minerals of Significance at Ecton Hill

The mineralisation happened as a result of the excessive folding of the limestone beds running on a north – south axis along Ecton Hill. This phenomenon can be seen very clearly on the steep hillside going towards Ecton hamlet from Apes Tor Sough. The effect of this folding was to create vertical fissures orientated from east to west, of considerable depth from the surface, into which superheated water from deep below ground could flow. Superheated water, at temperatures up to at least 400°C, remains as a liquid because it is highly pressurised. In this condition minerals that are very insoluble, even in normal boiling water, can dissolve fairly easily. Thus, minerals in the magma, deep below the surface, can be transported upwards into the cracks in the folded limestone. These hydrothermal, mineral-bearing fluids cool and become less pressurised as they rise and so the minerals in them become less and less soluble. Different minerals, having differing solubility characteristics, crystallised out at different levels to form the mineral deposits that were mined at Ecton.

One peculiarity of the Ecton hydrothermal fluids was that the predominant minerals were copper compounds, which deposited in high concentrations within the vertical cracks to become pipe veins that could be mined. Everywhere else in the Peak District, the mineral is lead-containing galena. The copper ore extracted at the height of Ecton's working life usually contained around 15% copper. Modern day extraction manages on a maximum of 1% copper and must be done using opencast methods. In its heyday, the Ecton Deep

Mine alone was producing around 4000 tons of copper metal per year, at a profit of 40% and employing up to 300 people. The combined mines on Ecton Hill are thought to have produced 100,000 tons of copper over the whole of their operational life from 1750 to 1799.

The principal minerals found at Ecton include:

- Chalcopyrite – copper iron sulphide: dull gold colour, often associated with white calcite
- Malachite – copper carbonate: greenish blue
- Azurite – copper carbonate hydroxide (sometimes referred to as basic copper carbonate): azure blue
- Galena – lead sulphide: shiny silver
- Haematite – iron oxide: rusty coloured
- Sphalerite – zinc sulphide: bronzy-black/honey yellow
- Cassiterite – tin oxide: reddish brown to black and very hard
- Calcite – calcium carbonate: brilliant white crystals

Location 1 OS ref SK 09597 58084

Clayton Deep Mine adit

W3W gifted.brambles.burst



There are two adits (tunnels) about 100 metres apart in Ecton Hamlet, where water from the very deep mines was pumped out into the River Manifold.

The two mines are Clayton Deep Mine and Deep Ecton Mine, both owned by the Dukes of Devonshire.

This is the outflow of the adit driven straight into the Clayton mineral pipe. Not far in, the adit goes through a section of 'calcrete' that can be seen by the fence, on the right, a few metres towards the Ecton hamlet houses. To mountaineers and geologists, calcrete is also known as 'breccia' and is a coarse-grained sedimentary rock that is loosely bound together by a finer grained matrix. Calcrete is not stable, so the adit roof and walls had to be extensively supported through the calcrete section. Roof falls were far from uncommon.

The adit tunnels were also the miners entrance to the mines. Below the water level of the River Manifold, the miners could continue to descend a further 310 metres (1035 feet) to the lowest workings.

Location 2 OS ref SK 09720 58279

Ratcliffe's Folly – Steam compression vessel

W3W carbonate.handrail.stepping



The 'folly' which stands below Deep Ecton Mine dates from 1922, and is therefore nothing to do with the mines which closed in the late 1790s.

It does however have a fine copper clad steeple and most people think it is one of the mine buildings

Arthur Ratcliffe was a surveyor, MP for Leek, and director of a building society. In 1922 his doctor ordered him to take some time off work for the benefit of his health.. On a visit to the Manifold Valley in Staffordshire, he found a small bungalow to renovate as a weekend retreat, and bought it for £11.

In 1922 he was granted permission to extend the existing bungalow as a cottage with two rooms below and one above.

Ratcliffe became completely obsessed with the project, and the cottage grew to become his palatial country seat.

As a surveyor he travelled around the country and accumulated all sorts of masonry fragments, many of which he incorporated into what was quickly becoming 'Ecton Castle'.

In 1937 Ratcliffe had a new idea and asked his builder to add a copper clad spire to the turret over the main entrance.

The house is now called The Hillocks, but is better known as 'Ratcliffe's Folly'.

In a yard to the side of The Hillocks is the preserved Deep Ecton Mine steam engine compression tank. Designed by James Watt, the steam engine was used to pump water out of the 400 metre deep mine.

Once the Deep Ecton mine reached the River Manifold level 90 metres below the Engine House, pumping was required to access the huge man-made caverns of copper ores below that. An ingenious pumping system was devised to use water flowing **into** the mine via a gutter installed into Apes Tor Sough. A simple balance beam was built inside a chamber, constructed over the ever-deepening shaft, consisting of pump rods going down the shaft at one end and a large bucket on the other. When the bucket was almost full with water coming in through the sough it weighed the beam down, lifting water up the shaft through the pipes. The bucket hit the chamber floor, emptied and both that water and the pumped water flowed out along the floor of the sough and into the river at Apes Tor and/or Deep Ecton adit.

That pumping system was more efficient than modern electric pumps. At its deepest, Ecton Deep mine's vertical extraction reached over 300m below river level so, as the mine deepened beyond the capabilities of the water pump, a steam engine was built inside the chamber. The smoke and spent steam were directed up the shaft. In all, two steam engines were constructed underground; a novel approach to removing water from what was then the deepest mine in Europe. The steam compression vessel standing in the grounds was one of the two originally constructed inside the mine.

Location 3 OS ref SK 09684 58448

Powder House

W3W openly.rods.apricot



Deep Ecton was the first mine to use gunpower for mining purposes, in 1665.

Powder houses, as the name suggests, were built away from the main workings of a mine so that, in the event of an explosion (which was more common than the owners would have preferred), only the powder house was damaged. They often had circular walls, so that there were no corners where the force of an explosion would be concentrated. In this case the building, re-constructed in 1884 to replace a previous version, was given a rectangular footprint but the roof is not tied to the walls and is held down solely by the weight of the tiles. In this way, a blast was supposed to take off the roof but leave the walls intact. Perhaps it actually worked, as there are no records of this building being destroyed by the dynamite inside blowing up.

Location 4 OS ref SK 09874 58373

Deep Ecton Engine House main door

W3W piglet.toasters.lies



Deep Ecton Engine House is one of the best preserved examples of 18th century Peak District mining infrastructure. It is a Scheduled Ancient Monument and is thought to be the oldest mine winding engine house in the world.

The Engine House is the 'Main Event' on a visit to Ecton Hill.

Yet very few people are aware of it. In the Peak District National Park it is second only to the better known and more accessible lead mine at Sheldon, Magpie Mine, which was still being worked in the 1950s.

The building is the 1788 engine house, which replaced the two pumping engines that were inside the mine. It housed the steam engine designed by James Watt. The Dukes of Devonshire always hired the best expertise that money could buy.

The main shaft is now covered with concrete slabs and the 'balance shaft' is a little way below the building, surrounded by stone supporting wall and covered with a steel mesh.



It is very hard to envisage what lies below the concrete slab, so here are the main points:-.

Deep Ecton Mine was once the deepest mine in the UK.

Copper mines were worked on Ecton Hill from the Bronze Age 4000 years ago.

Ecton Deep Mine boomed from 1750 to the late 1790s.

The Dukes of Devonshire owned the mine and made a £300,000 fortune from it, worth £68 million pounds today, which paid the creation of The Spa and The Crescent at Buxton. After the mines closed and some canny investments had been very lucrative, this fortune also contributed massively to the improvements at Chatsworth House.

The mine's features include:

Deep workings: The mine's total depth is 390 metres, and its lower flooded workings extend over 300 meters below the River Manifold.

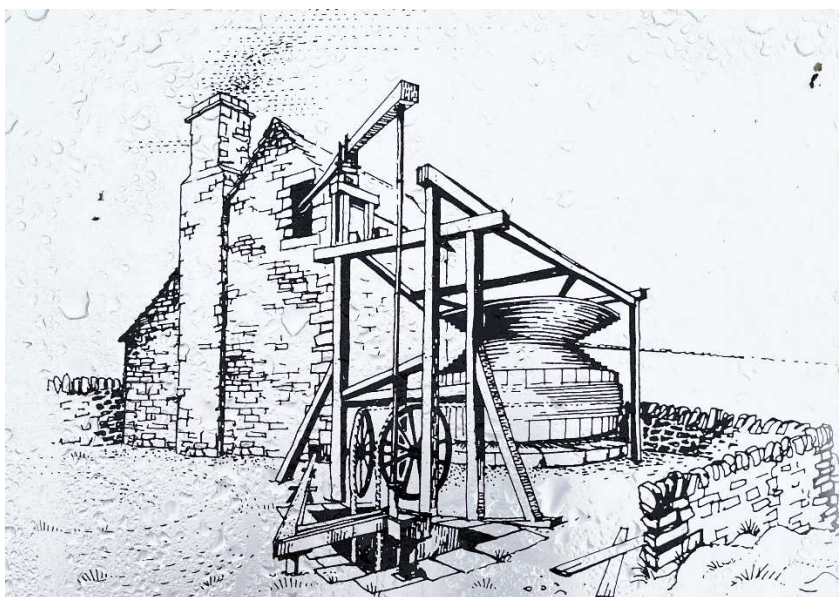
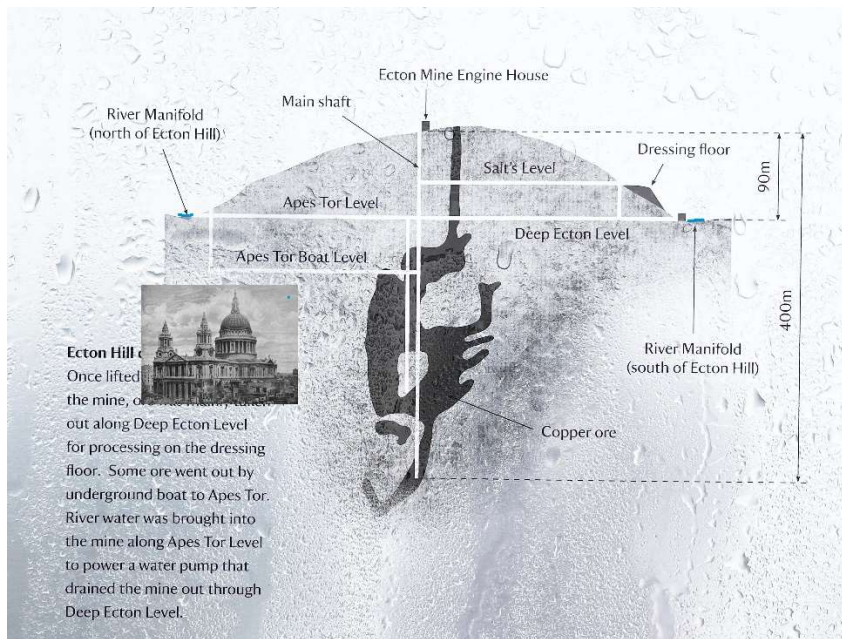
Underground chambers: The mine's underground chambers begin about 120 meters below the hilltop. They contain a water balance engine, a water wheel, and a capstan.

Balance cone: The mine's balance cone and shaft counterbalanced the weight of the winding rope and the ore bucket, thus reducing the energy required to raise the copper ore.

Winding engine: The mine's winding engine by James Watt was steam-powered and commissioned in 1788.

The Hollow Hill of Ecton is aptly named. The entrance shaft is 90 metres deep before the excavations open out into the main copper ore workings. Below are vast caverns going down another 310 metres. These hollowed-out workings are large enough to hold St Pauls Cathedral (111 metres), the tallest building in London in 1720.

They were kept dry by continuously pumping water up 310 metres to Deep Ecton Level, where adits (tunnels) drained into the River Manifold. When the mine closed in the late 1790s, pumping stopped and the spaces became flooded to the water level of the River Manifold.



In 1788 the mine was at the height of its prosperity. The new steam engine by James Watt was installed, which raised 40 tons of ore per day, and also about 8000 gallons of water. By this time, the Ecton Mine was producing 4000 tons of copper per year at 40% profit, and employed 300 people.

By 1795, the Deep Ecton engine shaft had been sunk to 1350 feet.

Mining ventures famously 'Boom and Bust'. Taking out this amount of ore can only lead to one end, and in the early 1790s, ore output suddenly dropped by half as the copper ore body was almost worked out.

A cryptic note pencilled in the account book summed this up- "Mine Failed".

The Duke of Devonshire, who had never exploited his workers but provided hospital, housing and a school, continued mining until 1825.

Many of the workers at the mine also farmed and the Duke paid a pension to those workers who were unable to find fresh employment due to their age.

Location 5 OS ref SK 10000 58186

Stile & gate

W3W took.divorcing.flashing



This unusual stile, followed by an 'ungated' gateway, has pillars made from different rocks. The 'downhill' one is gritstone and the 'uphill' one is limestone. This arrangement can be seen in several places around Ecton Hill and reflects the hill's position close to the western boundary between the reef limestones of Ecton and the gritstone beds to the west.

Location 6 OS ref SK 09979 57999

Ecton Hill Trig Point

W3W nicknames.tube.stint



The copper mine beneath Eldon Hill was developed by the 4th and 5th Dukes of Devonshire between the 1750s and 1790s, and was the deepest mine in Britain.

Mining on this scale was a very expensive business, but the Devonshires had very deep pockets, and the profits from mining were 40%.

The 4th and 5th Dukes of Devonshire had a commercial interest in the success of Buxton as a spa town to rival Bath and Harrogate. They made a fortune mining copper in nearby Ecton, and used some of the money in creating the centrepiece of Buxton Spa, The Crescent, above an underground spring which delivered 1 million litres per day.

Meanwhile, on the east side of the Peak District, in the glorious splendour of the Derwent Valley, they were able to pay for major extensions to Chatsworth House, and to commission Capability Brown to landscape Chatsworth Park.

On the slopes around the Ecton Deep Mine are many minor workings which date back 4000 years to the Bronze Age.

Ecton Hill trig point is beautifully maintained by the National Trust, who manage most of the surface features of the site which are now a protected monument. The underground parts of Ecton Deep mine belong to the Ecton Mine Educational Trust. This is a charitable organisation that maintains the mine and runs geology and mineral process chemistry courses, via its sister organisation the Ecton Hill Field Studies Association.

Location 7 OS ref SK 10207 57964

Fossil coral stile right hand pillar facing south

W3W really.moves.tungsten



The uphill limestone stile post contains a small patch of fossilised coral of the *Coralina* species. Most of the obvious fossils in the walls hereabouts, are crinoids.

Coral colonies are found on reefs in warm shallow seas. The Manifold Valley has several large outcrops of Reef Limestone. Those at Eldon Hill date back approximately three hundred and fifty million years.

Fossilized coral forms when the calcium carbonate in coral skeletons is replaced by minerals like calcite or silica. This process occurs when acidic groundwater slowly dissolves the calcium carbonate.

Location 8 OS ref SK 10257 575343

Standing stone

W3W loudness.crash.laser



Limestone is frequently found associated with deposits of chert. Chert is a microcrystalline or cryptocrystalline (crystals can only be seen under magnification) that is found in limestone. It has the same chemical composition as flint, which is associated with chalk, but a slightly different crystal structure. Whereas flint can be cleaved to provide clean and sharp edges, chert just fractures into random pieces. The sharpness is there but you don't get useful flakes. On this small standing stone can be clearly seen the main limestone body with a layer of chert covering its northern face.

Location 9 OS ref SK 09701 57589

Path and wall junction

W3W microfilm.workloads.shed



Above the steep slope down to the river, where path and wall both change direction.

This path would have been very well used during the mines operation.

Location 10 OS ref SK 09209 57793

Righthand road bridge end

W3W acting.verifying.these



This bridge was built to cross the River Manifold which, at this point, is usually flowing. Across the bridge is the gateway into Swainsley Hall.

Swainsley Hall was built for Leek businessman Sir Thomas Wardle. He was a silk textile manufacturer and dyer and his home was visited by many eminent people, including Mark Twain and Baden-Powell of scouting fame. William Morris was also invited but unfortunately died just before his planned visit.

Location 11 OS ref SK 09088 57715

Swainsley Tunnel north entrance

W3W resurgent.aimlessly.prevented



Sir Thomas Wardle was a shareholder of the Manifold light railway, and had the tunnel constructed so that his enjoyment of the valley was not affected by the noise or smell of the trains.

The Leek and Manifold Valley Light Railway (L&MVLR) was a narrow gauge railway that operated between 1904 and 1934, a long time after Ecton Mine closed. The line mainly carried milk from dairies in the region and passenger services to the small villages and beauty spots along its route.

Since the tunnel is now also used by motor traffic, walkers and cyclists going along the Manifold Valley Trail take their life in their hands at this point!

The line had a large number of stations in a relatively short distance, and there were refreshment rooms at Thor's Cave and Beeston Tor. In all the line crossed the River Manifold dozens of times.

The line was a single track which began from Hulme End, and only involved the use of one steam engine. The original intention was to continue the railway line to Hartington but both the finance and the need dwindled, so it was terminated at Hulme End instead.

The most important traffic on the line was outbound freight from the creamery at Ecton, famous for its Stilton cheese. Most of the product was sent on by dedicated milk trains for London.

In 1932 United Dairies closed its Ecton creamery. The loss of this milk trade removed most of the goods traffic from the line, and the railway closed finally to all traffic in 1934.

The Manifold Valley footpath and cycle way opened in July 1937, now called 'The Manifold Way'

Location 12 OS ref SK 09104 57746

Cycle Route 549 signpost

W3W wimp.combos.competent



Where the road from Wetton Mill exits the tunnel it becomes a footpath and cycle route, The Manifold Way. Cycle Route 549 is 19.4 miles long and connects Hurdlow with Waterhouses.

Location 13 OS ref SK 09602 58283

Wooden memorial bench

W3W takers.creamed.horseshoe



One of a number of memorial wooden benches, provided by family and friends of people who loved this valley.

Location 14 OS ref SK 09628 58138

Deep Ecton Adit

W3W attending.suppose.outermost



Deep Ecton Adit was dug in 1774 and gave access from just above river level to the main chamber (ore pipe) under the engine house (Location 4). This saved miners a long climb down the mine.

It was also the principal route through which the mine was drained so that the lower levels could be worked.

Until quite recently it used to be possible to enter Ecton Mine through Salt's Level, behind the folly building, and exit down a series of ladder ways via Deep Ecton Adit. Sadly, due to significant safety concerns about the ladder way security, this is currently not possible.

The structures above and to the left of the Deep Ecton Adit entrance are much more recent, being mainly remnants of the Ecton Creamery, a dairy and cheese-making factory that predate the one now at Hartington. This business was the main reason why the Leek and Manifold Light Railway was built.

Before that, this was the site of the only smelting works to be used at Ecton. The railway was never used to transport minerals as the mines were largely worked out in the late 1790s, long before the railway arrived in 1904. It was originally intended to extend up to Hartington, to service the cheese factory there, but this never happened.

Hartington Stilton Cheese is now made in the new premises at Pikehall Farm, Hartington.