



Trail

## Paving the way

Discover the weird and wonderful limestone pavement of Malham Cove

**Time:** 1½ hours

**Distance:** 3 miles

**Landscape:** rural

Malham Cove, topped with its weird and wonderful limestone pavement, is one of the most impressive natural features in Yorkshire, and a highlight of the Pennine Way.

Its name is virtually synonymous with 'geography fieldtrip'. But put aside thoughts of clipboards, cagoules and soggy sandwiches.

Let's delve a little deeper into this wondrous landscape, which has in its time played host to Britain's Niagara, Peregrine falcons and Harry Potter.

**Location:**

Malham, Yorkshire Dales National Park, North Yorkshire

**Start:**

Water Sinks car park, Malham Tarn Estate, nearest postcode BD23 4DJ

**Finish:**

Malham National Park Centre, BD23 4DA

**Grid reference:**

SD 89436 65817

**Keep an eye out for:**

Peregrine falcons, which have been nesting here since 1993. The RSPB and Yorkshire Dales National Park run a viewpoint you can watch the birds from.

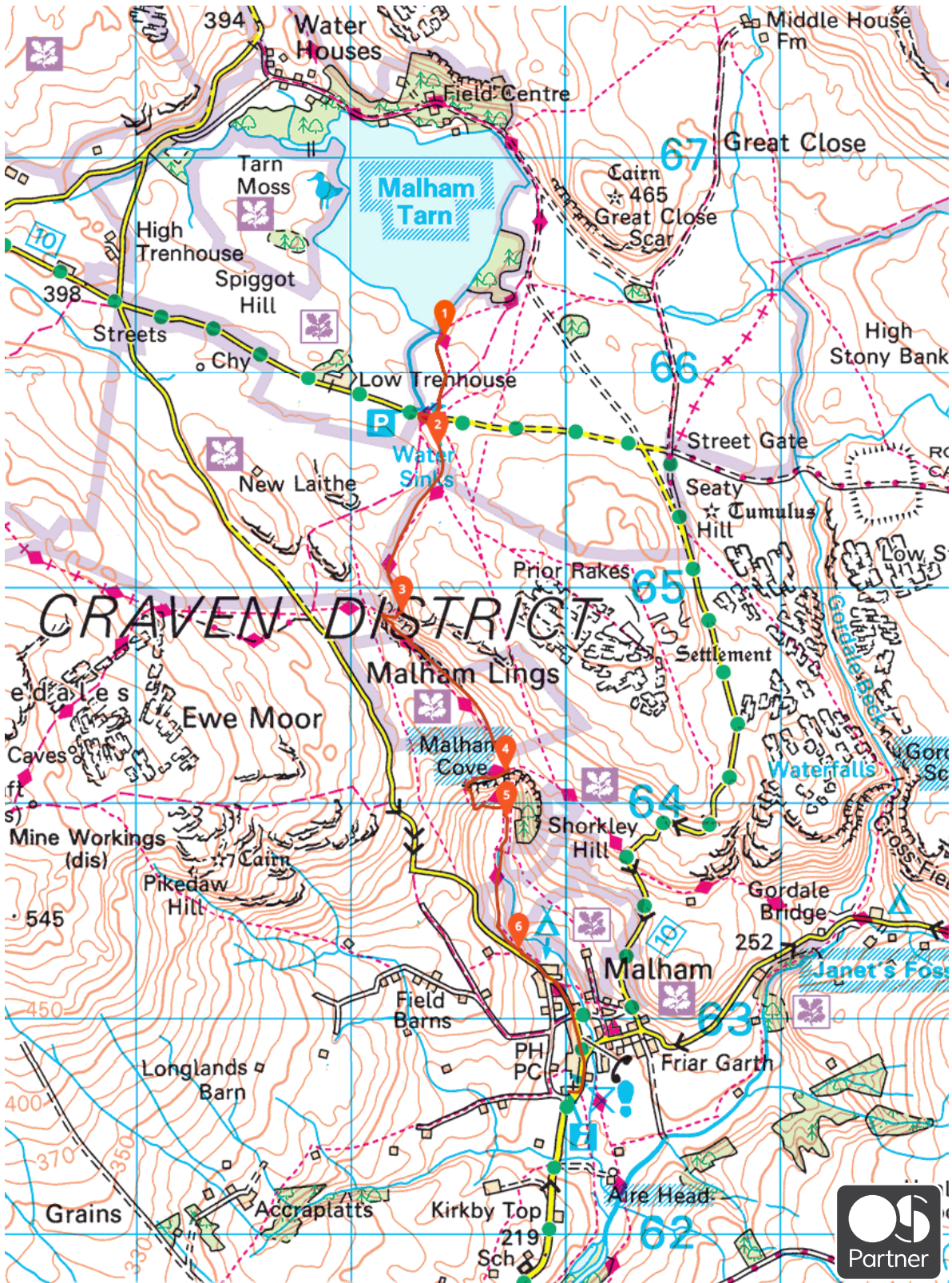
### Directions



From the car park follow the footpath towards Malham Tarn. Stop when you reach the Tarn at Tarn Foot, where an outflow stream leaves the lake and flows back towards the car park. Find a good spot to take in the view.



## Route and stopping points



- 01 Malham Tarn
- 02 Water Sinks
- 03 Watlowes Dry Valley
- 04 Limestone pavement
- 05 Malham Cove
- 06 Cove Road

## 01 Malham Tarn

Malham Tarn is one of those lakes that seem to trap a complete facsimile of the sky beneath its glassy surface. Gaze across the water from where we are standing and you can see Tarn House, leased to the Field Studies Council. The key attraction for visitors is the unusual scenery and this is the result of the limestone rock here.

In fact, this area of the Yorkshire Dales is known as 'limestone country' because this pale-coloured rock dominates the landscape. Over the millennia it has been shaped by ice and water to produce the features we can see today.

Limestone is notorious for being 'porous', which means that water can easily drain through its cracks and fissures. So why is there a tarn here?

Here we are actually standing over a base of different rocks - Silurian slates and boulder clay. These prevent the water from draining away. The Silurian period was approximately 440 - 419 million years ago. The slate was created when clay-based rocks were put under immense pressure due to movements within the earth's crust. This left a hard rock layer, which was later overlain with limestone.

The Pennines are a range of hills often called 'the backbone of England' because they separate North West England from Yorkshire and North East England. They are shot through with a series of faults, or fractures in the Earth's crust. The faults were created during the Carboniferous period (359-299 million years ago) when great movements within the Earth threw up sections of the land and disrupted the layers of rock underground.

One of these, the North Craven Fault, meant that the slate was pushed up closer to the surface. Erosion by ice and water since the last Ice Age (approx 10,000 years ago) scoured away at the limestone on top, leaving a shallow rock basin lined with slate. This then filled with water to form the tarn.

At 337 metres above sea level, Malham Tarn is England's highest lime-rich lake. The limestone provides an alkaline environment creating a special habitat for plants and wildlife, including crayfish, great crested grebe and water voles. The tarn is one of only eight such upland alkaline lakes in England, and has been designated as a National Nature Reserve.

Since 2016 the National Trust has been reintroducing water voles to the tarn to help restore the banks of the tarn. Over 200 voles have been released to date and they have already spread up to a kilometre from their original release site.

This unusual environment, with its distinctive flora and fauna, has inspired many writers and artists. The writer Charles Kingsley, for example, stayed in Tarn House and the tarn itself became the inspiration for his 1863 novel *The Water-Babies: A Fairy Tale for a Land Baby*.

"[He] went on to the bank of the brook, and lay down on the grass, and looked into the clear, clear limestone water, with every pebble at the bottom bright and clean, while the little silver trout dashed about in fright at the sight of his black face..."

### Directions

Retrace your footsteps to the car park and turn right onto the road. Walk down the road and across the outflow stream from the Tarn. Immediately after this go through the gate to your left signposted to Malham Cove. Follow the footpath as it continues alongside the stream and joins the Pennine Way heading for Malham Cove. After a couple of hundred metres the stream you are walking alongside disappears. The precise location will vary depending on how wet it has been, but stop where the water disappears to read Stop 2.



## 02 Water Sinks

The stream disappears into the ground here – not with a dramatic swoosh down a swallow hole, but quietly subsiding into the rocky ground. As a result, this area was given the name ‘Water Sinks’.

Limestone is a porous rock, so water seeps into its holes and cracks and finds its way into underground streams and caves. Over time the limestone has dissolved in the water and the little streams have carved out channels and caverns as they flowed along natural cracks in the rock.

We might expect this water to reappear at the bottom of Malham Cove, following the obvious path of the (now dry) valley above ground. Yet an experiment showed this doesn't happen. . When fluorescent dyes were added to the tarn they didn't show up in the water at the base of Malham Cove.

Instead the dyed water emerged again at Aire Head Springs, a further two miles to the south, where it becomes part of the infant River Aire. The water's precise journey from Malham Tarn and Water Sinks to Aire Head is a mystery, but most likely includes secret twisting tunnels and cave passages through the limestone.

In the late 1940s and early 1950s, an ambitious potholing dig took place here in an attempt to uncover the vast cave system that must be hiding beneath the cove. By 1951, the potholers had reached a depth of 90 feet (the same height as Skipton Church tower!) but they found it increasingly difficult to excavate, so had to stop. Today, Malham's extensive network of caves keeps its secret and await discovery still.

### Directions

Return to the Pennine Way and keep walking downhill towards Malham Cove. The footpath follows a drystone wall for a while and you get deeper and deeper into a dry valley.

The path bends around to the right and you can see the valley opening up ahead and slightly to the left of you. The narrow dry valley you are walking in widens and you get a good view down ahead towards the limestone pavement. (On the OS 1:25,000 map you are by Comb Hill). Stop where the footpath becomes a ledge leading around the side of the hill.

## 03 Watlowes Dry Valley

As we walked to Stop 3 we descended deeper into the valley – its walls rising slowly above us and peppered with the pale grey limestone rocks. The exposed rocks at the side become blockier, like castle ramparts flanking our route.

From our vantage point by Comb Hill we can gaze down into the Watlowes Valley, which widens as it descends. This is a dry valley; there is no stream or river flowing at its base. As we discovered earlier, the water flows underground here. This has not always been the case....

During the last Ice Age, the Pennines had their own ice sheet. Towards the end of the glacial period (around 10,000 years ago) the ice sheet began to melt. Melt water would have flowed under the ice sitting over this area, carving out valleys like the one in which we are standing.

As the ice sheet melted and retreated further it created gushing streams, which rushed down these young valleys, cutting them down deeper into the rock. Water would also have spilled over from Malham Tarn and surged down here. The water couldn't soak into the ground –there was too much of it and the ground was still semi-frozen under the tundra-like conditions of the time.

Once the ice had melted away and the land thawed out, the remaining water could soak into the ground, leaving behind the dry valley we see today.

If you look into the valley you may notice that the slope on the left is slightly smoother, whereas the slope on the right is steeper and jagged. This is because the slope on the left faces south-west and receives more sunshine. Repeated freezing and thawing of water here eroded the valley side, causing rocks and soil to gently slip and slump down the slope.

The slope on the right faces north-west and is much more shaded from the sun. It stayed frozen more continuously and so the slope remained more intact. The jagged sides are the result of a process called frost-shattering. Here the repeated freezing and thawing of water in little cracks in the exposed rock weakened them until chunks broke off leaving a craggy edge to the rock faces.

The other distinctive feature of this valley is the drystone wall running along the bottom. This is the ancient boundary that once separated the medieval estates of Fountains Abbey, to the west, and Bolton Priory, to the east. The land owned by the monks of Fountains Abbey included Malham Tarn and its lucrative fishery. Monks developed commercial interests in mining, quarrying, iron-smelting and milling too, and by the start of the thirteenth century Fountains was one of the wealthiest monasteries in England.

As you descend through the valley take a closer look at the wall. It is relatively straight-sided with a wide and slightly overhanging top. This is different to the more usual type of wall, which has a narrower top. It is possible that it was built this way to prevent sheep jumping over the top and to keep the two estates' assets firmly divided!

#### Directions

Continue along the edge of the hillside until you reach a stile. Climb over the stile and follow the footpath leading fairly steeply downhill into the valley (there are almost steps cut into the rocky ground here). As you descend the path becomes gentler, the valley widens and the ground becomes grassy. The path crosses over a drystone wall and leads you to the limestone pavement.

As you approach the pavement stay on the right hand side of the drystone wall (the footpath over it to the left takes you to Gordale). Head right and up onto the limestone pavement. Find a suitable place to stop (take care walking on the rocks and don't go too close to the edge!)

## 04 Limestone pavement

A lunar landscape, brain tissue, a giant's molars...

...as you pick your way across the pavement take a moment to consider what a curious landscape it really is! Hardly surprising then that it was considered an ideal location for the film *Harry Potter and the Deathly Hallows Part 1*. Malham Cove is where wizards Harry and Hermione camp out whilst trying to evade and defeat the evil Lord Voldemort.

While the landscape certainly looks like it could have been created by magic, the truth to its formation is still pretty incredible.

During the last Ice Age the area we are standing in was covered by ice. The ice scoured away the soil and weaker surface rocks leaving a broad expanse of exposed limestone.

When the glaciers melted and retreated, they dumped the rocks and dirt that had been frozen in the ice and these formed a soil over the limestone. In many places vegetation and even forests grew up. When it rained, water trickling through the vegetation became acidic and it gradually dissolved away the

limestone beneath.

Limestone is a massive rock which has cracks in it, produced as a result of its drying process when it formed, and tensions within the rock. The acidic rainwater trickled into the cracks and gradually widened them. Over time this created fissures and gaps in the rock known as grykes. The blocks of limestone in between the cracks are known as clints.

When the ice finally retreated (from around 10,000 years ago) the soil on top of the limestone pavement was washed away by meltwater. In the last couple of thousand years forest clearance and farming have increased the soil erosion. The resulting exposed limestone has been attacked further by the weather, widening the cracks (grykes). Where rainwater has trickled over the bare blocks (clints) it has created further little gullies across their surface known as karren.

We have been left with a bizarre rocky landscape, scored with lines and riddled with holes and depressions. The rock remains bare as when limestone is eroded it produces very little soil for plants to grow. Incidentally the fell walker Alfred Wainwright warns limestone pavement "has unique propensities for breaking legs" so be careful walking around it!

Peek into the cracks though and you will see some surprisingly lush mini oases. The sheltered and humid atmosphere in the cracks is perfect for growing unusual plants like Hart's Tongue (Britain's only native fern) and Enchanters Nightshade (rather fitting for a wizardly landscape!).

While we are up here, gaze out over Malhamdale below. You will be able to see some of the span of Malham Cove stretching out and get a sense of just how this feature dominates the area. We'll find out how it was formed at the next stop...

#### Directions

Carry along the limestone pavement moving away from the footpath where you joined it until you meet a drystone wall. This is where you will pick up the path that heads down the hillside to your left. Walk down into the Cove with the drystone wall on your right. The footpath is stepped down alongside the drystone wall, with the Cove to your left. When you reach the bottom follow the path to your left to go and have a good look up at the Cove.

## 05 Malham Cove

Gazing up at the sheer sides of the cove, you can almost feel a sense of vertigo at the scale and grandeur of this crescent-shaped sweep of cliff face. Wordsworth wrote a sonnet about Malham Cove that captures something of the awe of seeing it in person:

*"When giants scooped from out the rocky ground  
Tier under tier, this semicirque profound..."*

It might not have been shaped by giants, but this is rather an enigmatic landform; there is still much uncertainty about how it formed.

Part of the explanation for the cove is that it is a dry waterfall. This means a waterfall created it, but there is no water here today.

Between 359 and 299 million years ago earth movements here caused faults to develop. We are now standing over the Mid Craven Fault, and this created the steep slope in front of us. Jump forward to around 10,000 years ago (the end of the last Ice Age) and a river flowed down the Watlowes Valley and over this slope as a large waterfall.

Over time the force of the water in the waterfall gradually wore away the rock face it flowed over, eroding backwards from the fault line and creating the semi-circular shape in the cliff that we see today.

However, a river and waterfall alone would have caused Malham Cove to retreat into a narrow gorge, not this wide crescent. The cove is 70 metres high and its curved walls extend for 300 metres. The precise nature of its formation is still debated but the width of the Cove suggests that ice might have contributed to the cliff erosion during the height of the Ice Age.

The Cove was potentially carved out by ice that slowly descended the cliff, plucking away great blocks of the limestone as it went. This may not have been a single glacier, but an ice stream within a much larger ice sheet.

So the ice carved out the rough wide sweep of cliff, and later it was further shaped by waterfalls, melt-water and the weathering of wind and rain. When the land thawed after the end of the ice age the water flowed underground instead, leaving the valley and waterfall dry.

Major storms occasionally caused water to overflow Malham Tarn, gurgle down the Watlowes Valley and create temporary waterfalls over Malham Cove. Early tourists to this curious landscape, like writer and vicar John Hutton in 1781, were captivated by what they saw:

“A small brook springs out of the bottom of the rocks; but in floods the narrow subterranean passage is not able to give vent to all the water, when there pours down a stupendous cataract, in height almost double that of Niagara”.

Since 1850 such occurrences have been rare. However, when Storm Desmond hit in December 2015, Malham Cove once again briefly became ‘the Yorkshire Niagara’ and England’s highest unbroken waterfall.

#### Directions

Retrace your steps to where you descended the Cove and follow the footpath towards the village of Malham. Stop just before the footpath joins Cove Road.

## 06 Cove Road

Gaze across the valley to the opposite side and you may notice some funny indentations and ridges in some of the fields. These are medieval strip lynchets and are evidence that people once farmed the area.

Lynchets are basically earth terraces. It is thought they were formed as soil collected on the downslopes of fields that were ploughed for long periods of time, or that they were deliberately dug to create deeper soils for growing crops on the slopes.

Here farmers grew barley and oats, and this continued right up until the nineteenth century. There are also the remains of a corn mill further down the valley.

The lynchets are yet another facet of the fascinating landscape we have encountered on this walk. From tarn to cove and beyond, this wondrous world within the Dales has been inspiring visitors for centuries. Artists and writers including painter JMW Turner, poet William Wordsworth and writer Alfred Wainwright have all celebrated it in their work.

It is hardly surprising then that Warner Brothers decided this awesome environment would make an

ideal location for the *Harry Potter* film. The cove and its pavement are intriguing and almost other-worldly. This is all thanks to the limestone rock, which has been shaped over the millennia by earth movements, ice and water, creating a truly wizardly wonder.

#### **Directions**

Leave the footpath and join Cove Road (watching out for cars and bikes). Follow Cove Road through the town. As you begin to leave the town behind turn right into the Yorkshire Dales National Park visitor centre (well worth a visit to learn more).

 **Trail complete – we hope you have enjoyed it!**



