



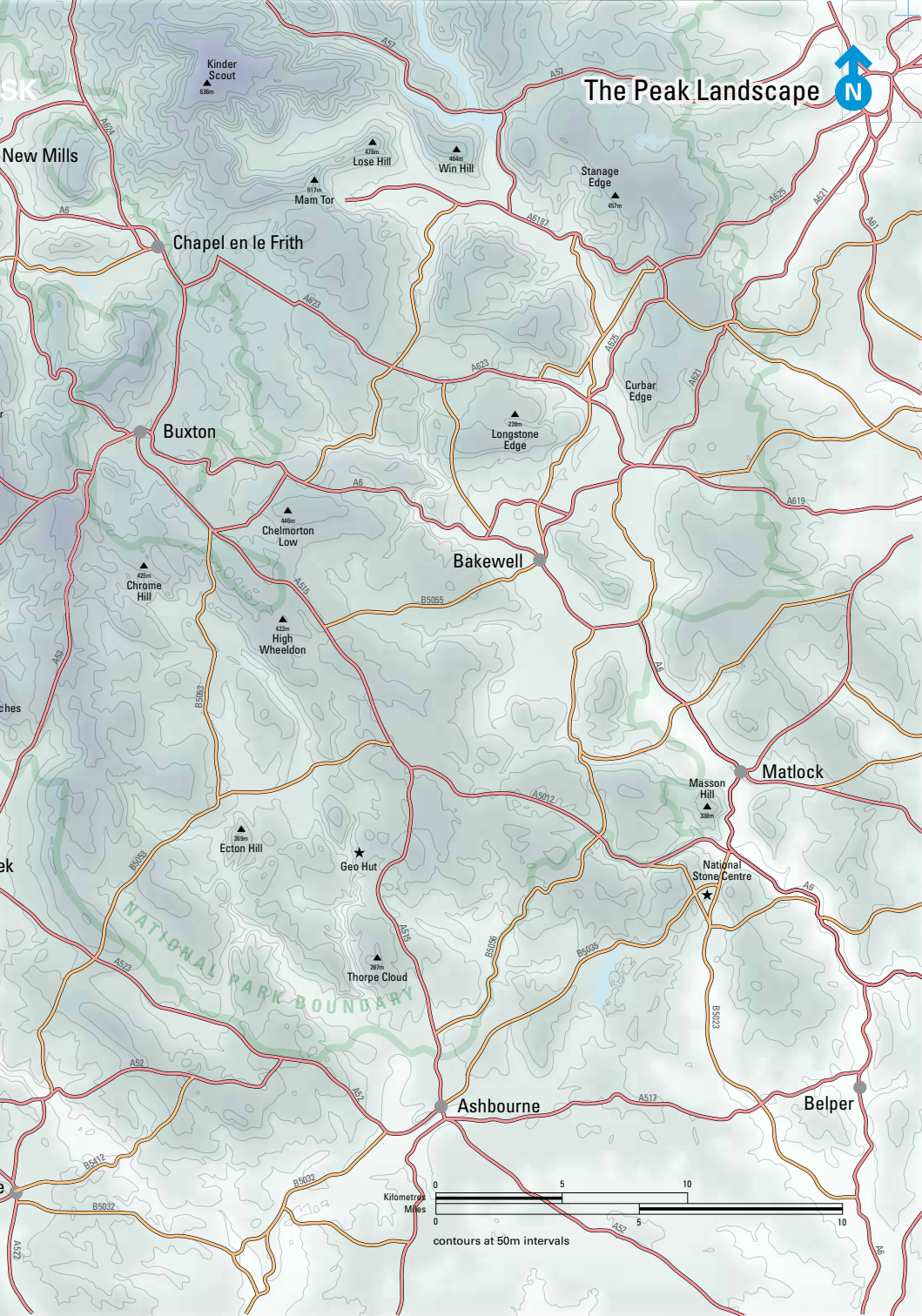
*RockTrails*

# Peak District

Paul Gannon

A HILLWALKER'S GUIDE TO THE GEOLOGY & SCENERY





# The Peak Landscape



contours at 50m intervals

*Rock*Trails

# Peak District

Paul Gannon



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Grit and peat on Kinder Scout.

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# Introduction

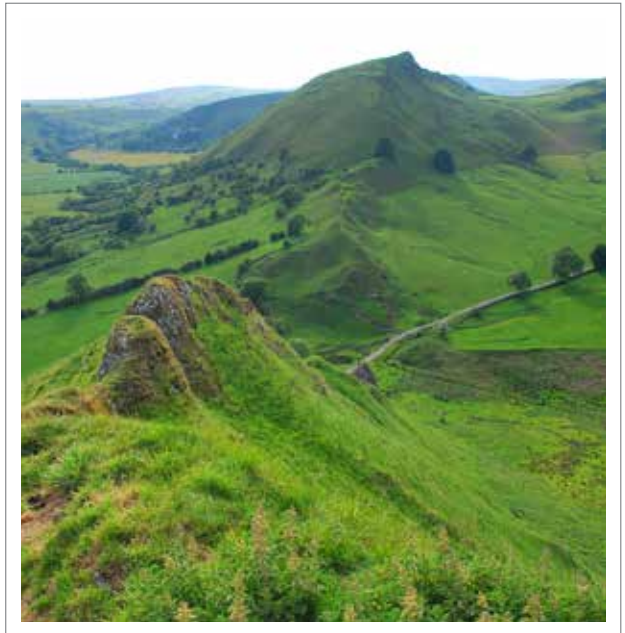
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The Peak District is England's most popular hill-walking area. Its varied scenery has attracted praise from writers and naturalists as well as those who seek out the pleasures of natural beauty and outdoor exercise. For more than three centuries its mix of intriguing dale and invigorating hills, easy walking on grassy fields and tough going on moorlands of bog and its unusual limestone scenery with dry valleys, deep gorges and underground drainage systems have captured the imagination and aroused the desire to get out in the fresh air.

Many of those who walk through this marvellous landscape, teasingly placed between major conurbations, wonder why it looks like it does. What created the immense variety of landscape in the Peak District? What is the role of the underlying geology and what is the contribution of human beings? Why is the White Peak so grassy, scattered with dry valleys, gorges, sink holes, fossil sites and the remains of mine workings as well as modern

Photo 0.1 |

White Peak scenery  
– Chrome Hill seen  
from Parkhouse  
Hill, Dove valley.



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day quarries and cement works? Why is the Dark Peak so different, with its rolling moorland, endless acres of bog, heather and rocky 'edges'?

This book attempts to help walkers and other visitors to answer such questions. This book is in two parts. The first seven chapters record the fascinating story of how colliding continents, violent volcanoes, irresistible mountain-building forces combined with millions and millions of years of slow accumulation of 'sedimentary' rocks such as 'limestone', 'grit', 'sandstone' and 'shale', as well as fierce erosion by glaciation have shaped the landscape we see nowadays. I attempt to explain what sort of rocks were created and how to recognise signs of immensely violent 'tectonic' forces, to spot evidence of tropical seas full of life, and to look for indications of glaciation on the hills and in the dales today. The second part of the book contains 15 recommended walks, with a wide variety of geological features and consistently excellent views of the best of the Peak District's wonderful scenery.

I hope the reader will derive more pleasure from walking the fells through appreciating something of the combined influence of volcanoes, glaciation, erosion and the like on the present-day landscape. The book concentrates on what you can see as you walk about, without recourse to a hand lens or other specialist geologists' tools. The aim is to enable the reader to identify major and minor landscape features in the Peak District and maybe elsewhere too. The landscape we see before us is the product of many different forces and



Photo 0.2 | Dark Peak scenery – viewing the landscape from Kinder Scout's southern edge.

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factors. Identifying and unravelling these different forces and factors on the ground is an endlessly fascinating pastime for the landscape lover.

This book is written specifically with the walker in mind. While geology is a fascinating

Photo 0.3

Kinder Low.



subject it is also a science; it relies on a complex scientific terminology. My aim has been to minimise the use of jargon and to make the processes that have determined the shape of the landscape comprehensible to the average reader.

This has meant some simplification of the jargon and a pruning of the detail to a minimum. All the same we will, I'm afraid, have to deal with a minimal set of terms such as 'plate tectonics', 'reef limestone', 'landslides', 'scarp slope' and so on.

When I first use a piece of jargon I have put it in quote marks (for example, 'sandstone'). Many of these terms are defined in the Glossary, but I have also sometimes assumed that the meaning of a term is obvious from the context in which it appears.

While reading this book you may well find it useful to have open a large-scale map of the Lake District such as the OS 1:50,000 map (though the 1:25,000 map is essential for navigating on the ground). The 1:50,000 maps convey more easily an impression of the topography than the 1:25,000 maps, which are often crammed with vital navigational detail which can make it difficult to get an overview of the topography at a glance. Using a map while reading the book would also assist the reader to locate the places mentioned as examples (the index

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of place names at the back of the book includes grid references of places named in the text).



Photo 0.4

Narrowdale, a dry limestone valley in the foreground, with tilted sandstone and shale forming 'edges' in the central distance.

## CHAPTER 3

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# Grains of Grit

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The name says it all: 'Millstone Grit'. The very words carry an image of the rough vertebrae of England's mountainous spine, and remind us also of the gritty spirit of the hardy people who determinedly eked out a fragile living in the hostile highland conditions. No other geological name in Britain is more evocative of its present-day environment. For geologists, however, the Millstone Grit is simply the name given to rocks deposited on top of the Carboniferous Limestone.

Much of the scenery of the Millstone Grit areas of the South Pennines and the northern stretches of the Peak District (known as the Dark Peak) is harsh. Here is some of the toughest walking in England, across such rain-sodden, wind-blasted, mud-blanketed moorland as Kinder Scout (photos 1.2, 3.1, 3.3 and photos for walk 1), Bleaklow (bleak indeed in all but the best of weather) and Black Hill (named after its muddy black soil). These are areas with few rock outcrops, but plenty of peat bog and soggy wet ground. It is a landscape of stark beauty, though it is a beauty that is not always immediately apparent to the weather-battered walker. It takes grit to walk, work or live among these wild hills.



Photo 3.1 | View over Kinder Scout plateau from Kinder Low.



However, not all Millstone Grit scenery fits this gritty description and we will see some tamed areas also, where green fields jostle for dominance with moorland and where prosperous-looking stone farmhouses pepper the slopes (photo w2.5). The Millstone Grit scenery is not all gritty. In fact, the Millstone Grit rocks are not all grits. They are a mix of different types of sedimentary rocks known as 'sandstone', 'siltstone' and 'shale', with only some outcrops of 'grit' (which is simply another name for coarse sandstone). The differentiating factor between these types of sedimentary rock is the size of the eroded mineral grains that form the sediments that make up the rock. Very small particles form shale (or 'mudstone'), medium-sized ones form siltstone and larger ones sandstone.

As the name implies, at least some of the rocks of this group were used for making millstones. Fortunately or unfortunately, the name expanded to cover not just the beds used for millstones, but all the grits, sandstones and shales laid down on top of the Carboniferous Limestone until the time of the next group of rocks, the Coal Measures. This is a shame as grit and shale are, shall we say, like chalk and cheese. Their very different characteristics are what lie behind the scenery of the Dark Peak.

Certainly the sandstone and grit are the most conspicuous of the Millstone Grit rocks, forming the rocky 'edges' that characterise much of the Dark Peak scenery (photo 3.2 and photos for walks 1, 9, 10 and 11). This is because of the resistant nature of sandstone and grit which are not easily eroded. The sandstones and grits of the Millstone Grit are divided by geologists into a number of 'formations' the Mam Tor Beds, Shale Grit, Kinderscout Grit, Five Clouds Sandstones, Roaches Grit and Chatsworth Grit (to name the main formations; there are several subsidiary formations).



Photo 3.2 |

Shining Edge, Shining Tor;  
Shutlingsloe in distance.

However, shale is the antithesis of grit. It is easily eroded away and belies the tough grit-ty image of the Millstone Grit label. It is made up of very tiny fragments of eroded material. This small size of fragment would normally result in a mudstone, but shale also includes some organic matter. This is usually only between three and five percent of the total mass of the rock, but it means that shale and mudstone have very different characteristics. Shale is usually 'laminated' into very thin layers (effectively a form of bedding). It is usually 'friable' and can often be crumbled by hand, while mudstone shows no such lamination and is harder.



Photo 3.3 | Crumbling shale beds,  
stream side exposure, Goldsitch area.



Photo 3.4 | Shale being eroded away  
between two beds of sandstone, Back Tor.

While the sandstone and grit are exposed to view in the rocky edges, out on the hills there are generally few exposures of shale. It seldom peers through the covering vegetation and, when it does, it is usually just a small, dark muddy-looking mess on the banks of a stream and easily missed. Nonetheless, in several of the walks (numbers 1, 2, 3, 7, 9 and 11) shale outcrops can be seen. In all these places the shale is seen crumbling away and, in several instances, it has patches that are slumped and broken. At some locations it is clear that the shale is being eroded away underneath overhanging sandstone – foretelling of a rock fall or river-side collapse to come.

It is precisely this mix of tough, resistant grit and sandstone and weak, friable shale that determines so much of the scenery and geomorphology of the Dark Peak as we will see in the remainder of this chapter and also in chapter 6 (where we look at landslides caused by the interlayering of sandstone and shale).

# Making deltas

Geologists estimate that the modern-day Mississippi gives a good idea of the size of the river transporting material down from the north of our area. The river system, on reaching the sea, built out a delta on top of the Carboniferous Limestone, smothering all of it with mineral sediments. The delta of this great river covered much of what is present-day northern and western Europe. On reaching the delta, the big river split into 'distributary' channels. Each distributary pushed out into the sea, often building natural levees, then dumped material along and at the end of the channel.

The channel would thus slowly build upwards and outwards as a 'lobe' of low-lying land; a landscape of flood plains, marshes, tidal flats and lakes. At some point, probably during a flood flow, the distributary breached its levees some way back, finding a new, steeper, shorter route to the sea. The new channel would eventually extend out progressively to form a new lobe. This is a process known as 'channel diversion'. Over time a series of overlapping lobes were built up and out (diagram 3.3).

One feature often seen in the rocky edges is called 'cross bedding'. This type of bedding is not the standard horizontal or gently tilted bedding seen in limestone

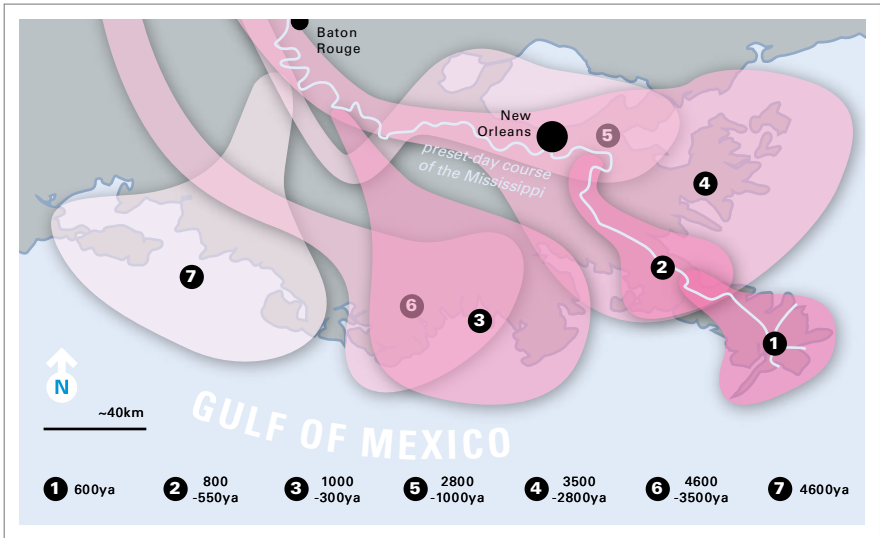


Diagram 3.3 | Delta lobe build out on the Mississippi.

valleys and quarries. On individual boulders and tors on the rocky edges the bedding runs in a series of curved lines, often cut off at the top by another series of curved lines at a different angle. This curved bedding is produced by fast currents typical of those found in powerful river channels. The cutting across one set of curved beds by a later set is the result of the river channel shifting place. Cross bedding is very obvious on some edges such as Kinder Scout (walk 1), Millstone Edge and Stanage Edge (both on walk 9, photo w9.4) and the Roaches (walk 11, photos w11.1 and w11.4).

Another important facet of the Millstone Grit rocks is their 'cyclic' nature with layers of sandstone followed by shale, followed by sandstone, shale and so on. Within our area the different layers of shale and sandstone are repeatedly found on top of one another in cycles, with each cycle representing a new lobe of the delta being built out. At first only the very finest mud particles were carried far out, but as the distributary channel moved forwards medium-fine particles of silt were carried out and dumped. As the lobe was built out, it was sand that was being dumped. Across the Pennines there are a dozen or more separate sandstone layers, with intervening shales (and also siltstones).

Some rock formations within the Millstone Grit are more varied with rapid changes between sandstone and shale, such as the Mam Tor Beds (photos w3.4 and w3.5).

The deposits of material that formed the Millstone Grit Group rocks originally covered the entire area, including the areas where limestone forms the surface rock today. The rock covering of Millstone Grit has been eroded away above the White Peak and also the South Yorkshire Dales, exposing the underlying limestone.

The Chatsworth Grit, for example, forms the long line of impressive rocky edges on the eastern side of the Peaks known as Derwent Edge, Stanage Edge, Millstone Edge and Curbar Edge. It also forms a less prominent edge in the south-western corner of the Peaks, known as Gradbach Hill (walk 11). This particular edge is over-shadowed by its neighbouring edge, the Roaches, which is particularly impressive. The fact that the same Chatsworth Grit appears at the surface on both sides of the area strongly suggests that it was once a horizontal layer that covered the whole of the area between the eastern and western edges and that, after being slightly folded up, most of it eroded away. The remaining edges remind us that the delta once covered hundreds of square kilometres of the entire region and beyond.

Perhaps the best known of the Dark Peak hills is Kinder Scout. It was mass trespass actions on Kinder Scout in the 1930s that sparked off the political movement for gaining access to these previously forbidden areas. This also resulted in the creation in the late 1940s of Britain's National Parks (of which the Peak District was the first) and, more recently, of the 'right to roam' access legislation which has opened up even more stretches of the Dark Peak (and indeed some parts of the White Peak) to access by walkers. It is all too easy when we stride out across access land to forget the effort it took to open it up for us.

Kinder Scout's gently tilting summit plateau is the highest point in the Dark Peak. The wide open boggy moorland is more than 600 metres high over an area of some 5 kilometres east to west and 3 kilometres north to south – even though the summit itself reaches only 636 metres in height. The summit plateau is capped by a highly resistant layer of grit, known as the Kinderscout Grit. It forms the marvellous edges on the southern, eastern and northern rims of the summit plateau (walk 1). The great size of the fairly flattish summit plateau means that once you get away from the edges views are extremely limited, even from the 'summit', which can be a challenge to locate. Indeed, even in good clear weather navigation away from the edges is challenging. In misty weather it is downright demanding of navigational ability (photo 3.1).

The flattish summit plateau results in a 'stepped' scenery on the flanks, with 'shelves' and 'steps' visible in the flanks of the mountain (photo 3.5 and diagram 3.1). The easily eroded shale underlies the shelves and sandstone/grit forms the steps.


Bleaklow and Black Hill, north of Kinder Scout, are even more bleak. There are no rocky edges to offer a slightly less traumatic walking experience in bad weather, and there are very few rock outcrops to draw the interest of walkers who want to learn a bit about the geology of the scenery they are walking through. The bogs are bigger and tougher and the navigation much more challenging (even in clear weather) than Kinder Scout. All the same, walking these hills is supremely rewarding offering the opportunity to appreciate what remains, despite some human intervention, of a wilderness in the close environs of major urban areas.

This is a landscape of rolling hills with a multitude of small streamlets flowing outwards in all directions from the highest points, coalescing into a few larger valleys which cut into the mountain massif. The soil is thin and impoverished, supporting heather, bilberry and grasses. The views on all these hills are limited to the great expanses of moorland and wide open skies.

To the east and south of Kinder Scout the Millstone Grit landscape is subtly different. There is a long zone running from north to south of long rocky edges, some stretching for several kilometres from north to south, broken and indented only by faults and folds. The





 View west from Grindslow Knoll, showing underlying geology

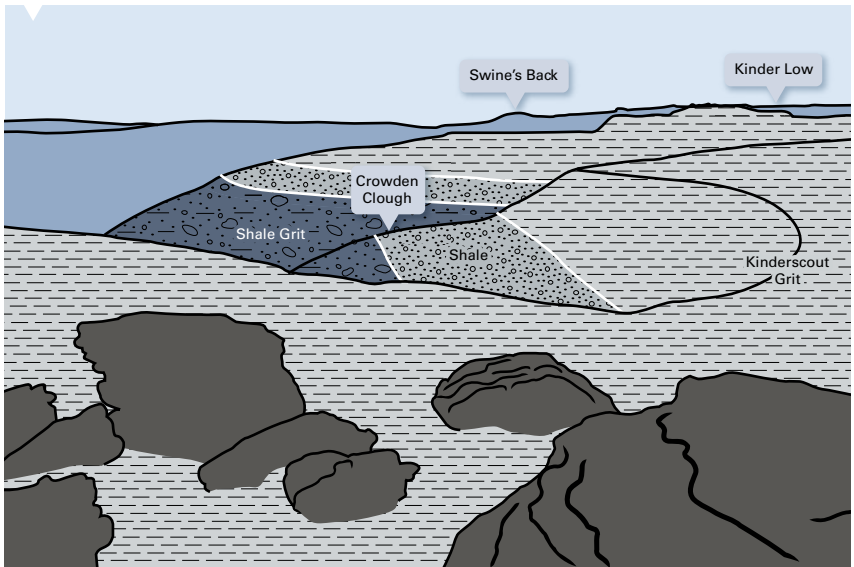


Diagram 3.1 + Photo 3.5 | Shelf and step topography on Kinder Scout.

View west from Grindslow Knoll, showing underlying geology.

edges are usually tilted with a gentle slope dipping down from the top of the edge, often to another edge. Indeed in places it is clear that there are several edges, one after the other. The steep rocky edges are known as 'scarp slopes' or 'scarps' and the gentle slopes as 'dip slopes', producing scarp and dip topography. This tilting is the result of later tectonic activity which has slightly arched the beds of the Millstone Grit (chapter 5); where the beds remain horizontal the effect is to produce 'step and shelf' topography.

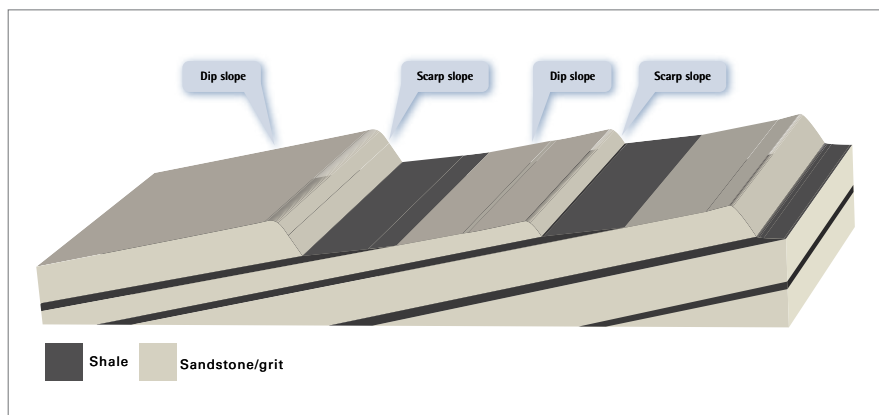


Diagram 3.2 | Scarp and dip slopes.

To name just a few of the more outstanding examples we can note Derwent Edge, Stanage Edge, Millstone Edge (photos for walk 9) and Curbar Edge (photos for walk 10). These are all in fact part of the same edge running on and off over 15 kilometres in a line of rocky crags, often smattered with climbers and topped with walkers. The rock forming the edge is known as the 'Chatsworth Grit'. This rather reverses the usual situation where walkers look up to see climbers – along the rocky edges you can frequently peer down at climbers getting up to your level the hard way.

The rough grits of the edges are notorious for ripping into frail skin and flesh as climbers place their entire weight on two or three fingers jammed into tiny cracks. Some of Britain's great rock climbers such as Joe Brown and (the decidedly gritty) Don Whillans first learnt their skills on the grit edges. They also offer hillwalkers many of the Dark Peak's scenic gems and, while they can provide some of the toughest walking conditions possible in stormy weather, they can also introduce the discerning hillwalker to some spectacularly impressive scenery.

From Curbar Edge, the view west is to the grassy limestone plateau with its verdant dry

valleys (and glimpses of quarry). To the north and south, the view is of the rocky edge running off into the distance. To the east it is of flattish moorland, interrupted by the odd up-turned edge rolling off into the distance and with hints of 'urbania' beyond. The skies are wide open, but the views are of contrasts east and west and underline the significant role played by the underlying geology in the present-day scenery.

On the western side there are fewer rocky edges, instead the scenery is marked by less steep, vegetated edges which punctuate the skyline. Axe Edge, standing imperiously over the upper reaches of the River Dove (walk 4), exemplifies the western edge scenery with its absence of exposed rock. A few kilometres to the north Shining Edge (photo 3.2) is also vegetated, but there is a tiny rocky edge which offers fine views of the area to the south-west around the shapely form of Shutlingsloe (also a magnificent viewpoint in itself as well as being highly attractive to look at). South of Shining Tor there are several small, isolated rock outcrops that break the surface as remnants of a rocky edge. Further south there are two superb rocky edges – the Roaches and Ramshaw Rocks (photos 3.6 and 3.7 and photos for walk 11).



Photo 3.6 | Ramshaw Rocks, dip and scarp slope almost indistinguishable except for clear tilt of bedding from upper right to lower left.



Photo 3.7 | Ramshaw Rocks, improbable rock sculpture.

Smaller and less intimidating moors than those of Bleaklow and Black Hill are found in the Millstone Grit areas to the west and east of the White Peak. Abney Moor is a good place to get a feel for moorland walking without the same physical and navigational effort demanded by the more massive moors to the north (walk 2).

This is a more subdued landscape of mixed moor and field (if only for pasture) and of isolated stone farmhouses. The moorlands that remain are remnant patches of what was once a much more extensive area. Enclosure and attempts at farming started in earnest in the 18th and 19th centuries though some areas, for example around Bretton, are of medieval origin.

The 'stepped' nature of the landscape is still easily visible in this more restrained scenery. There are even a few small rocky edges to be seen producing in places a rather compacted Dark Peak landscape experience, for example at the western end of Bretton Clough (walk 2).

The low leonine hill called Abney Low is a classic example of this more moderate scenery, considerably modified by human influence. The layered nature of the hill is easily discerned with flat areas separated by short sharp rises (photo w2.5). The whole of Abney Low is agricultural land, grass pasture divided into fields by a grid of dead straight stonewalls with a substantial old farm sitting at its centre.

The Millstone Grit rocks were laid down in an expanding river delta, draining from the north into the subsiding sea. The sediments that formed the rock were dumped in freshwater lakes, but there were a few occasions when relative sea levels rose and the delta area was inundated by the sea. This short-lived incursions are recorded in thin 'marine bands' containing marine fossils which enable geologists to work out the time relationship between the different rocks of the Millstone Grit in our area and elsewhere.

On the other hand, as well as incursions of the sea, there were times when the area temporarily built up far enough above the sea level to form swamps in which a very special type of rock (coal) was formed. Only a few very thin coal seams were laid down in the upper parts of the Millstone Grit, but their appearance tells us that the environment was changing once again and foretold of bigger changes to come.



## Walk #1 Kinder Scout

START	▶	EDALE STATION (1230 8535)
FINISH	●	CIRCULAR ROUTE
TIME	🕒	5 HOURS+
GRADE	⬆	NAVIGATION ● ● ● ● ● (IN CLEAR WEATHER)
	⬆	TERRAIN ● ● ● ● ●
	⬆	SEVERITY ● ● ● ● ●

Kinder Scout is a real Millstone Grit mountain moor. Its flattish summit plateau covers a substantial area, virtually all of it smothered in heather and peat. The plateau offers tough walking with numerous boggy 'cloughs' that need to be crossed. Navigation is difficult enough in good weather and becomes all but impossible in bad conditions. However, along its sharp edges on the southern, western and northern limits of the plateau, the situation is quite different. There are still plenty of muddy tracks in wet



weather, but the paths are generally pretty clear (though still need to be treated with care in misty weather) and the views are much more varied than from within the great moor itself.

From the geological point of view, this walk reveals a variety of features visible in the rocks around and under foot. The route is along the southern edge of Kinder Scout, offering panoramic views over Edale to the Lose Hill, Mam Tor and Rushup Edge ridge as well as close encounters with amazing rock sculptures. The descent brings you down through Grindsbrook Clough, a real mountain valley (initially on a steep rocky track) with more fascinating geological features.

320 million years ago a distributary channel of a large river draining from mountains to the north carried down eroded material and dumped it into the sea, slowly building a delta. As the river channel met the sea, the heavier fragments of eroded material (sand) fell rapidly to the sea floor in the immediate area. However, lighter material (mud) was carried a bit further. Over time, as the end of the river was extended further out, the sand was dumped on top of the mud. Eventually the river stream overflowed its existing channel and a new channel developed. Over several million years, the whole area underwent prolonged but gradual subsidence. Layer after layer of mud and sand were laid down on top of one another which hardened to form shale and sandstone (sometimes known as 'grits').

Today, many millions of years later, one layer of sandstone is exposed on the edges of the summit plateau. The rough, gritty sandstone is known as the Kinder-scout Grit (though it is also found elsewhere such as on the summit knoll of Win Hill, Offerton Moor and Eyam Moor). While there is plenty of sandstone to be seen, the softer shale is usually covered with vegetation and is rather shy. Nonetheless this route also takes you past an impressive outcrop of shale underlying the Kinderscout Grit. The exposed rocks are crumbling, cracking and slumping as they are undermined by a stream.

It is the relative strength of the two rock types which has produced the flat, sandstone-capped summit plateau with its sharp edges and makes it one of the most popular walking areas in the Peak District.

From east to west the plateau is about 6 kilometres long and from north to south is about 3 kilometres (though in its north-western corner it is less than 1 kilometre

north to south and similarly it thins out to the east). The 'summit' itself is 636 metres high, though in fact the highest section runs south-west to north-east from Kinder Low at 633 metres in the south-western corner, via the highest point, to Crowden Head at 632 metres near the northern edge. This represents a slight bowing or folding of the rocks into a gentle anticline running north-south. On either side of this fold the plateau dips very gently away to the north-west and the east, only dropping to 590

metres around the Druid's Stone visited at the start of this walk.

From Edale station or the car park head north up the tarmac road towards Kinder Scout until a footpath sign is reached on the right at [124 586](#). Follow the footpath towards Ollerbrook Booth joining an east-west track among the complex of buildings at [1275 8590](#). Follow the track east towards Nether Booth. Just after crossing a fence at [134 856](#) bear left and follow the footpath towards the Youth Hostel at Rowland Cote. There are several access points onto the moor behind the complex of Youth Hostel buildings, but the best route is to go through the grounds round into the clough to find the stile leading to a path rising on the western side of Lady Booth Brook.

Follow this path up to the first side valley, noting occasional outcrops of sandstone, then break off left following the side stream up to about [1375 8685](#). From here it is worth taking a little time to view the surrounding scenery and to decide between a harder or an easier way to the edge. The first attraction of the scenery will undoubtedly be south towards Lose Hill and Back Tor where the landslip area (walk 2) is easily seen, but take time to study the slopes around you. The edge is visible on the skyline but below it the scenery is subdued, vegetation covering everything. Yet there is a pattern to the landscape here with flattish areas separated by short and somewhat steeper slopes. This is best seen looking across the clough to Upper Moor and the slope/shelf below it. These slopes and shelves are etched into the layers of sandstone and shale. The shale is easily eroded away, but the sandstone is harder and forms the top of each little rise. This is clear at the skyline, where the sandstone is exposed, but less obvious lower down where sandstone and shale alike are clothed in peat and vegetation.

From here decide on a route. The direct line involves heading a little west of north straight for the edge on the horizon. The going is rough and involves a small scramble to get onto the edge, but it takes you up close to the fascinating shapes of the weathered faces of some of the rocks of the edge which are not easily seen from above once on the edge (photo



Photo w1.1

Weathering pattern on  
slab of Kinderscout Grit.  
Height of boulder 1.8m.



Photo w1.2

The Druid's Stone.

w1.1). The strange shapes of the weathered rocks are a key feature of this walk.

If you find the terrain too rough or bracken makes this direct route too difficult, an easier route can be found near the stone wall/fence marked on the map from [1375 8685](#) which meets the edge at [132 872](#) (though this takes you some way to the west of the Druid's Stone).

The Druid's Stone (photo w1.2) is slightly laid back from the edge and is best approached from the west, so some tramping over rough ground may be necessary. Certainly from the west one can appreciate the name, but not from the north-east where it appears more like two creatures engaged in some activity or other. It looks different again from other angles.

Close up, it can be seen to consist of very gritty sandstone with small quartz pebbles clearly visible. The Druid's Stone is the first of many weird formations which will be seen on this walk, making them a key aesthetic as well as geological point of interest throughout. Naturally the shapes, with innumerable atmospheric variations, have attracted many painters and photographers as well as walkers and geomorphologists.

Return to the track along the edge and turn right onto it, following the edge as it swings between south-west and north-west for the next 3 kilometres or so towards the head of Grindsbrook Clough. The first feature on the way is Ringing Roger, a headland sticking out between Ollerbrook Clough and Grindsbrook Clough. The far end of the headland is a superb viewpoint along the edge to the east and the west, as well as across Edale to Mam Tor and Rushup Edge and the landslips on their northern flanks.

Ringing Roger's array of exposed tors forms a mass of wind-carved rock which mock the minimalist form of the Druid's Stone. These tors betray more clearly their geological structure in their shape (photo w1.3). The secret lies underfoot and in the wind that is almost always a feature of the weather here. The track is almost entirely made up of sand which has been eroded from the rocks. This happens because some of the sandstone is cemented with calcareous cement which was deposited in small amounts as lime mud. This breaks down chemically with the acid water of the peat bogs, releasing the grains of sand. If you pick up some of the lumps of sandstone on the track you will find that you can easily crumble them in your hand

Photo w1.3

Dramatic natural  
sculpture, Ringing Roger.



## Kinder Scout

(but elsewhere, where the rocks are cemented with silica, they are very resistant).

The loose sand provides material for the wind to whip up and blast at the exposed tors. The tors here show that they are made up of harder and softer layers, with the later being more easily eroded. So we end up with the shapes that characterise this cluster of natural sculptures.

As you walk along the edges you may also notice that the sandstones are often different colours, some almost white, others brown or grey. These colours are determined by the way in which the rocks weather owing to their chemistry. When a rock is freshly broken it is immediately subject to chemical weathering from contact with the atmosphere and the acidic peat. However, the rock tors show that most rocks will eventually become grey, often covered in micro-lichen and visible lichen.

Continue along the track with superb views over Grindsbrook Clough to the hills beyond it which show once again the pattern of shelves and slopes, easily seen in profile on and below Grindslow Knoll on the other side of the clough (photo 3.2 and diagram 3.1).

At the head of Grindsbrook, at [1065 8745](#), the stream has eroded down into the rocks and exposed their slabby structure (photo w1.4). You can also detect the 'dip' or tilt of the beds, originally laid down horizontally but gently bowed by the distant collision of tectonic plates many millions of years ago. Kinder Scout is part of an anticline or upward fold that runs



Photo w1.4

Tilted bedding exposed  
in dried-up stream bed.



Photo w1.5 | Rock sculpture, Woolpacks.

all the way up the Pennine range.

From here a number of extensions are possible. For more amazing stone sculptures a trip to the Woolpacks is essential (photo w1.5). For a much longer extension, the best route is to head via Grindslow Knoll and the Woolpacks to Kinder Low (photo 3.1). Kinder Low is only 3 metres lower than the actual summit, but the views are much better with the north-western edge and the eastern flanking hills easily visible. Kinder Scout's rock strata are only gently tilted in any direction.

Return to the top of the western feeder stream into Grindsbrook Clough (at [1055 8722](#)) and descend into the valley. The way is steep and rocky for the first 100 metres or so, but the angle soon relents. Take your time and stop every now and then to enjoy the rock scenery.

After a few minutes keep an eye out for the appearance of an outcrop of shale on the left of the stream. There are sections of the shale which have broken and slumped as the stream cuts into the base of the outcrop (photo w1.6). This contrasts with the solid rocky edges seen earlier in the descent. The boulders at the top of the clough are all sandstone which has collapsed after being undermined by the eroding of the lower shales. The process





Photo w1.6 |

Slumped and crumbled  
shale outcrop stream,  
Grindsbrook Clough.

is clearly seen along this extended outcrop of collapsing shale.

After a few metres the shale outcrop is replaced by another group of sandstone strata. The rock strata are usually hidden under vegetation but can be seen peeking through in places in the slopes under Ringing Roger above you on the left as you descend into the village.