

THE CHAMPIONS TRAIL

This figure of eight trail is 13km (8.2 miles) long and links the four Malvern Hills Community Earth Heritage Champions Sites: Gardiners Quarry (SO76604206), Dingle Quarry (SO76534566), Westminster Bank Quarry (SO76494635) and Tank Quarry (SO76874709).

A map showing the route of the trail is given on pages 24 and 25. Detailed route descriptions follow on pages 26-42 in blue type and are numbered to match the way-points on the route map.

In addition to the trail directions, information about each of the Malvern Hills Community Earth Heritage Champions Sites is detailed in this section of the booklet.

The Champions Trail is not signed on the ground. Please note that in the route descriptions where it says 'signposted to' this always refers to the stone signs found around the Malvern Hills. They are typically no higher than knee level, and are usually built into a stone wall (see picture below).



◀
Stone signpost

Starting point:

The interpretation board in Gardiners Quarry, Colwall. Grid reference SO76604206.

Terrain and grade:

The trail includes some steep climbs of, and descends down, the Malvern Hills, all of which are along established footpaths. The majority of the trail length is classed as moderate to easy walking. The terrain is mixed.

Variations:

The Champions Trail can be started at any of the numerous access points (indicated with a yellow way-point on the trail route map and within the route description that follows) and can be walked in either direction. The recommended direction to walk the trail is that written in this booklet. Eight figure grid references for each access point are given in the trail route descriptions.

The Champions Trail can be walked as a linear walk starting at Gardiners Quarry, visiting Dingle Quarry then Westminster Bank Quarry and finishing at Tank Quarry (points 1 to 17 in the trail directions). The length of this walk is 6.5km (4.18 miles).

Refreshments:

The Kettle Sings Tea Rooms (SO76464210)
The Wyche Inn pub (SO76964374)
The Brewers Arms pub (SO76384565)
The Café at Regents Village Shop (SO76354623)
St Ann's Well café (SO77214579)

Public toilets:

Wyche Cutting and St Ann's Well.

Car parking:

Malvern Hills Conservators car parks are all around the Hills. Pay and display £3 a day. Day tickets are valid at all Malvern Hills Conservators car parks on day of purchase.

Map references:

Harvey: Area of Outstanding Natural Beauty
Malvern Hills 1:10,000 scale (recommended map).
Ordnance Survey: Explorer 190 Malvern Hills & Bredon Hill 1:25,000 scale.

GARDINERS QUARRY

You would be forgiven for thinking that there is a sameness about the quarries on the Malvern Hills, except for them differing in shape and size. First impressions can, however, be incorrect! Take a look at any stone wall or building made from Malvern Stone and the variety of rock types that make up the Malvern Hills is clearly evident. In 1848 an eminent geologist proclaimed *'The manner in which all these (he gave a long list of igneous rock types he had observed on the Malvern Hills) are associated, and some of them graduate into others, is so perplexing, and the phenomena are so continually and variously repeated, even in very limited tracts of the mountain (meaning the Malvern Hills), as to demand the utmost care in reasoning on their probable origin'*. Poetic, yet he was making a clear observation; the rocks that make up the Malvern Hills are both complex and widely variable.

Since the early 1800s geologists have made great progress in understanding the nature and origin of the Malverns Complex rocks (refer to page 12). That is not to say that the geological story of the Malvern Hills is a closed book - far from it! With a history stretching back at least 680 million years

there are many aspects of the rocks that are yet to be fully understood. It would be fair to surmise that there is still geology waiting to be discovered here on the Malvern Hills!

1 (S076604206) From the Gardiners Quarry interpretation board walk 30m ahead (east) along the edge of the car park to the small scree slope at the foot of the rock face (shown in the photograph below).

In Gardiners Quarry the story is not so much one of differing rock types, but about what has happened to the main mass of the Malvern Hills rock since it formed all those years ago during Precambrian times.

The main body of rock in the quarry is diorite, a coarse-grained (meaning that you can see the individual mineral crystals within the rock), grey coloured igneous rock. Rather than being one continuous body of rock however, the quarry face is fractured - sections of the rock have broken apart forming joints, or have broken apart and moved - been displaced, relative to the neighbouring section of rock along geological faults. The immense forces that needed to be exerted on these rocks in order for them to break apart like this are hard to imagine, but do conjure



Gardiners Quarry -
the white lines indicate the
edges of the shear zone

up images of the devastation caused by major earthquakes.

The fracturing of the rock in Gardiners Quarry did not take place during one single cataclysmic event, but rather over several phases of earth movements - some much larger than others, and over a period of hundreds of millions of years.

Though fractures occur in several locations in the quarry, the key feature is seen in the rock face above the scree slope. Here, a block of highly fractured rock sits between two geological faults, in what is called a shear zone (refer to the photograph on page 26). The rocks between these two faults, which are lighter and have a pink tinge to them compared to the diorite, have moved against one another under pressure and became crushed and shattered as a result.

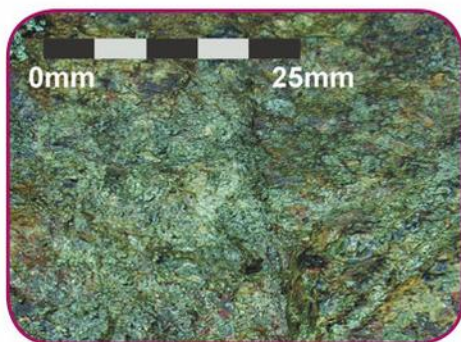
Along with displacing and fracturing masses of rock, movement along these faults has left other telltale signs in the rocks. On the rock face to the right of the shear zone, without having to climb the scree, you will find slickensides on a number of the rock surfaces (see photograph top right). In addition you can see broken up narrow pegmatite dykes (see photograph bottom right) and concentrations of the mineral epidote (see photograph to right).

The faulting in the shear zone in the rock face is not contained solely in the Precambrian-aged rocks of the Malvern Hills, but is thought to continue in a westerly direction through the parish of Colwall into the Silurian rocks that lie adjacent to the Malvern Hills, along the 'Colwall Fault'.

Fault planes also act as gaps through which fluids can flow. In some cases the fluid is magma. When this magma crystallises it forms a body of rock known as a dyke. This photograph illustrates how, during an early phase of fracturing of the rock, a pink granite pegmatite (extremely coarse-grained granite) dyke was intruded into the diorite. Then, during a later phase of faulting and shearing this dyke was broken up and effectively the broken pieces, indicated with arrows, were amalgamated back into the mass of diorite.



- ▲ The surface of a fault plane can become polished forming slickensides, essentially scratch marks. The polished surface can also be grooved; the grooves indicating the orientation of the last phase of movement along the fault plane. Several of the rock surfaces in this small area exhibit slickensides with grooves orientated in differing directions.



- ▲ Epidote is a pistachio-green-coloured mineral. When pressure and heat is applied to the rocks (for example during shearing) water escapes and travels along the fractures in the rock. Epidote crystallises out of this superheated, mineral-rich water, forming thin coverings, concentrations and mineral veins.



THE WILDLIFE AND HISTORY OF GARDINERS QUARRY

Wildlife

The irregular rock face can support vegetation in places, particularly where soil has developed in the joints and along fault planes. This is mainly gorse with its yellow flowers and prickly leaves and bramble. In between there are small areas of acid grassland which mainly consists of pink wavy hair-grass, sheep's fescue and common bent. This short turf also contains wild thyme and sheep's sorrel as well as some mosses. The bare rock faces are home to a variety of lichens colouring the rock surface with interesting patterns. On the lower section, large areas of pink rosebay willowherb bloom in the summer.

The varied habitat is well suited to reptiles such as the common lizard, slow-worms and even adders. It is also suited to a range of invertebrates including butterflies.

History

Historic maps show that a small quarry (15m by 20m) was already in existence by the 1880s and that this was massively expanded (30m x 50m) in the period c.1880-1900 after which the quarry appears to have been disused for a while. The

date of the expansion of the quarry and the single period of expansion suggest that it was used for a significant local building project. Stone from the quarry may have been used in the development of Perrycroft just across the road, which was completed in 1894. Perrycroft was built for the industrialist J W Wilson by the Arts and Crafts architect C F A Voysey. Built on a terrace of the Malvern Hills, the house was designed to take advantage of the excellent views to south and west, and to complement its natural surroundings. If the extracted material was not used for Perrycroft, the nature of the rock suggests it was probably used as railway ballast or road stone.

The quarry was later reopened prior to its final closure in the 1920s. It is thought that the quarry got its name from Charles Gardiner who is believed to have worked the quarry.

2 From the quarry face return to the interpretation board and then head south into the southern part of the car park. Roughly 2/3rds of the way down the car park turn left off the car park towards a bench and on to a clear path which is not immediately in view. Follow the path as it zig-zags its way uphill on to Pinnacle Hill.

Map showing the extent of Gardiner's Quarry at various dates.
By Herefordshire Archaeology



Lichen growing on the quarry face.
Gardiner's Quarry

As you ascend the path Herefordshire Beacon, capped by British Camp with its 2000 year old ramparts still clearly visible, comes into view. Its out-of-line position from the rest of the Malvern Hills makes it prominent, with good visibility in most directions; ideal as an Iron Age defensive settlement.

3 At the top of the path, marked by a set of four steps, turn left onto the adjoining path. Follow the path for 500m to where a path joins from the right. Here views open up to the east across Worcestershire county.

4 Continue heading north. After 40m the path forks. Stay on the main path on the western side of Jubilee Hill. Upon reaching the northern end of Jubilee Hill, views open up again to the east and west of the Malvern Hills.

5 Continue heading north to reach the Wyche cutting. The path along this section of the trail splits on a number of occasions. Always stay on the westernmost path heading north. After 1km follow the path as it begins to descend down to the road at the Wyche cutting.

6 (SO76864370) Cross the road at the junction, then turn immediately right onto Beacon Road. Follow the road uphill to the far end of Upper Beacon car park. Continue north along the main surfaced track for 140m to reach a low cylindrical stone cairn on your right - the Gold Mine.

7 From the Gold Mine turn left onto a narrow path leading gently downhill. Where a path joins from the left continue ahead for a further 50m to where the path splits. Take the path straight on that stays on higher ground. Initially the path rises before levelling out. Continue along the wood-lined path to emerge into a small, grassy, open area.

8 Follow either of the grassy paths out of the

grassy clearing to reach a wide path below. Turn right along the wide path and follow it north for 160m into a car parking area.

9 (SO76694486) Cross the small car park area (part of the much larger West of England car park complex) and take the gravelled track marked with 'authorised vehicles only' signs on either side of it, and a rubbish bin on the left hand side of it. Follow the gravelled track north for around 200m to where the track forks, just before reaching a hidden property on the left. The views across Herefordshire, and on a clear day to the Black Mountains, along this stretch of path are magnificent. Leave the gravelled track and follow the dirt track ahead. Shortly you'll reach a stone wall on the left that surrounds the property. Continue along the track to the far end of the wall and then stay straight ahead for 300m to reach a path T-Junction.

10 Turn left at the junction, then after 5m turn right onto a narrow path. Follow the path downhill, following it as it veers to the right to exit onto the West Malvern Road. Turn right along the road to the bus shelter.

11 (SO76484562) From the bus shelter continue north for 40m, along the road's grass verge, to reach a tarmac bridleway. Turn right and follow the bridleway for 100m uphill to Dingle Quarry on the left hand side of the track (opposite White Cottage driveway).



◀ The Gold Mine Cairn

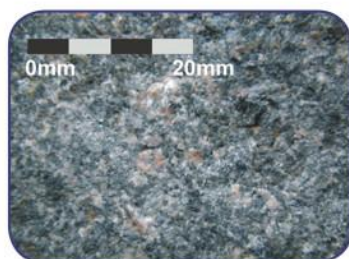
DINGLE QUARRY

Dingle Quarry exhibits a variety of igneous rock types. Igneous rocks are named according to their grain size and the minerals they contain. The table below details the broad classification scheme used to identify igneous rocks.

This small quarry has been worked on three levels. The geology described on the following pages concerns just the middle level of the quarry (where you now stand).

The main mass of rock (referred to as the country rock) in the quarry is a coarse-grained diorite. However, close examination of the rock face reveals that the composition of the rock is not uniform throughout. These igneous rocks started their existence deep within the earth as a rising mass of molten magma (refer to subduction zone diagram on page 12). The various processes in action as the magma rose through the Earth and

those inflicted on the magma as it cooled and turned into rock, resulted in two main rock types being formed - diorite and granite. However, other igneous rocks are present in the quarry including gabbro which can be found in the western wall of the quarry. Gabbro and diorite look very similar - both being coarse-grained and dark in colour. In Dingle Quarry, the way they can be distinguished from each other is that gabbro contains just white and dark crystals (visible to the naked eye); the diorite contains white and dark crystals plus some pink feldspar crystals (orthoclase feldspar).



Diorite

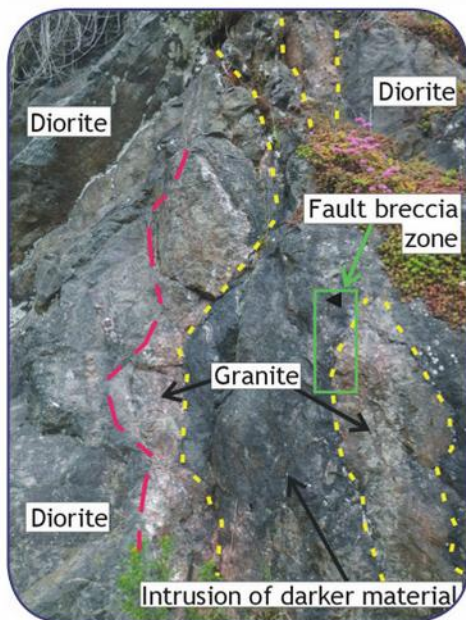
Variation in mineralogy				
<div>Qz - Quartz</div> <div>Fd - Feldspar</div> <div>(P) - Plagioclase</div> <div>(O) - Orthoclase</div> <div>Mi - Mica</div> <div>Ma - Mafic</div>				
Increasing grain size ↑	Coarse grained	Granite	Syenite Diorite	Gabbro
	Medium grained	Micro-granite	Micro-syenite Micro-diorite	Dolerite
	Fine grained	Rhyolite	Andesite	Basalt
	Glassy	Obsidian	—	—

▲ Igneous rock classification table

The remainder of this level of the quarry can be split into three zones (refer to the photograph at the bottom of the page).

The northern wall of the quarry (zone 1) is predominately diorite, yet within this grey rock face are pods of pink and darker grey-coloured rocks (zone 2). The photograph to the right depicts the junctions between these differently coloured rocks. In some cases the junction is sharp, which suggests that the pink and darker grey rocks have been violently injected into the diorite (the yellow dotted lines show the sharp junction between the intruded material and the diorite country rock). In other cases the junction between the pink rock and the diorite is soft, bordering on gradational (red dashed line). This suggests that the pod of pink granite in the centre left of the picture wasn't injected into the diorite but instead was partially amalgamated into the diorite during a much slower mixing process which must have occurred before the violent intrusion of dark-coloured igneous rock on the centre right of the picture.

Another feature present in zone 2 is a fault breccia (shown in a green box, top right photograph). Fault breccias are made up of angular rock fragments, shattered due to movement along a fault plane, and then cemented together into a hard mass.



▲ Fault breccia

Zones in Dingle Quarry. ▼
Picture taken looking
north-east



Zone 1

Zone 2

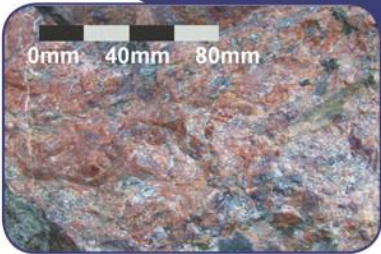
Zone 3

In zone 3 (refer to photograph on page 31 and below) there are near vertical layers of a pinkish rock, crossing the diorite country rock. These are called dykes. They formed as continual movement within the subduction zone (refer to page 12) caused the country rock to crack. Magma was pushed into these cracks and gradually cooled and solidified to form these features. The dykes are extremely coarse-grained consisting of the minerals quartz, feldspar and mica. The rock type is called a granite pegmatite.

These pegmatite dykes abruptly stop at the prominent step that separates the lower and upper parts of this section of the quarry. This step is another dyke made of a darker, much finer-grained, igneous rock called dolerite. As the dolerite dyke truncates the pegmatite dykes it must therefore post-date the emplacement of the pegmatite dykes, and is younger than all the other rocks in the lower section of the quarry.

The junction between the dolerite dyke and the rock below is marked by a narrow zone of highly fractured rock. The junction is a line of weakness in the rock face along which movement would have been concentrated during later phases of tectonic activity. This later movement is what has caused the rocks to become so fractured.

Evidence for these later earth movements is also visible in the narrow mineral veins that fill the fractures in the diorite country rock. These fractures formed due to stresses and strains exerted on the rock during later phases of earth movement.



▲ Granite pegmatite



▲ Highly fractured rocks (middle of photograph) between the dolerite dyke above and granite pegmatite below



▲ Calcite veins filling fractures in the diorite country rock

Zone 3. The dolerite dyke is highlighted between the red lines. Two of the most prominent pegmatite dykes are shown between the white lines and between the blue lines ▼



THE WILDLIFE AND HISTORY OF DINGLE QUARRY

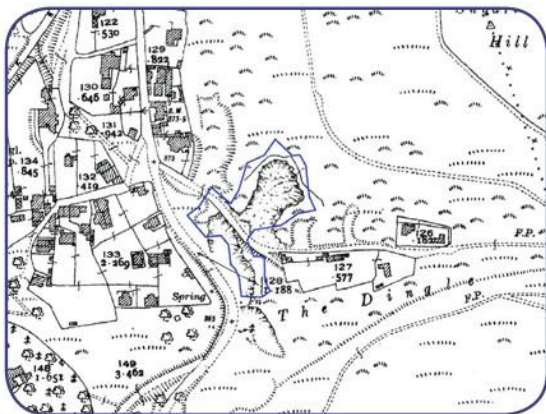
Wildlife

The quarry has small patches of acid grassland, in common with the rest of the Malvern Hills. The rocky face and low-growing acid grassland is an ideal habitat for the common lizard and slow-worm. Green hairstreak butterflies have also been recorded. Other plants to see include herbs such as yellow cat's ear and purple wild thyme. More prominent are invasive species such as red valerian and stonecrop.

History

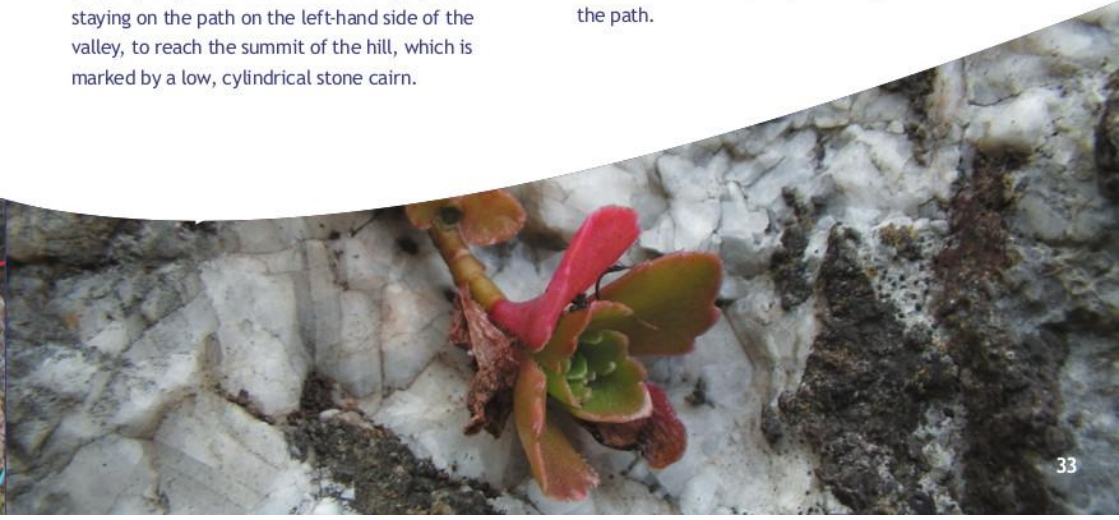
Historic maps show that extraction had commenced by 1885 and that by the opening years of the 20th century Dingle Quarry had been worked on the upper, middle and lower levels. The map of 1927 shows the extent of the quarry to approximately match that of its current day size.

- 12 From Dingle Quarry continue heading uphill along the bridleway. After passing the last property on your left continue heading uphill, staying on the path on the left-hand side of the valley, to reach the summit of the hill, which is marked by a low, cylindrical stone cairn.



▲ 3rd Edition Ordnance Survey map dated 1927 showing Dingle Quarry (not to scale)

- 13 Follow the directional pointer on the cairn to West Malvern (first left). For the first 10m this means retracing your last steps before taking the right hand path which leads around the west side of the hill. Follow this wide path downhill for 650m to reach Westminster Bank Quarry on the right-hand side of the path.



WESTMINSTER BANK QUARRY

Unlike the other three Malvern Hills Community Earth Heritage Champions Sites visited on the trail, the dominant rock type here, in Westminster Bank Quarry, is granite.

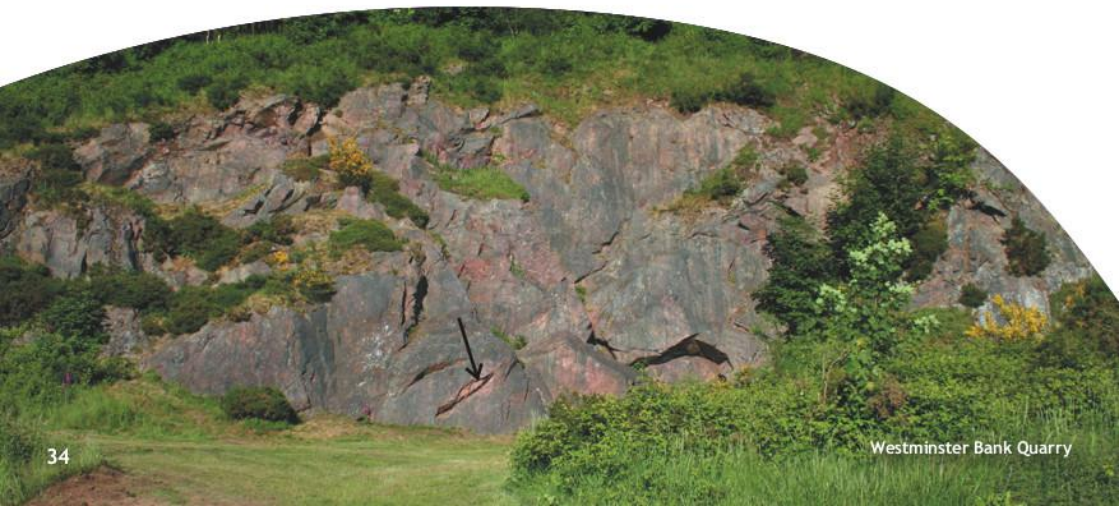
Granite is a coarse-grained igneous rock composed of the minerals quartz, feldspar and mica. It is the feldspar (orthoclase) that gives the rock its pink colour. The size of the crystals in an igneous rock, tells us a lot about its history and origin. A rock containing exactly the same minerals, in the same proportions, as those found in Westminster Bank Quarry, but whose grain size is fine (less than 1mm in diameter) rather than coarse-grained, would not only look very different to granite, but also would have formed under very different conditions.

Grain size in igneous rocks is almost exclusively dictated by the rate at which the molten magma (from which all igneous rocks are formed) cools and solidifies into rock. The granite in Westminster Bank Quarry cooled very slowly, deep underground, allowing the large mineral crystals to form. In contrast, molten lava spewed from a volcano cools rapidly forming fine-grained igneous rocks such as basalt. A microscope is required to see the individual crystals in basalt.

The composition of the granite in Westminster Bank Quarry is pretty much uniform throughout. However, some of the granites in the quarry have been foliated. Foliation results from the deformation and recrystallisation of rocks under stress. The rocks that make up the Malvern Hills have been subjected to several phases of earth movements. This applied pressure has given some of the mass of granite a foliation - the crystals within the granites have been elongated and aligned.

The pressure applied to the rocks during these phases of earth movements not only foliated some of the granites but also caused the rocks to fracture and, in places, tear apart. Evidence for this fracturing can be seen all across the quarry face, particularly in the northern section of the quarry where the rocks have a more shattered appearance.

Granite is not the only rock type present. In the far south of the quarry is a block of sheared diorite, part of which has been heavily altered into schist, a metamorphic rock, due to the heat and pressure applied to it during shearing.

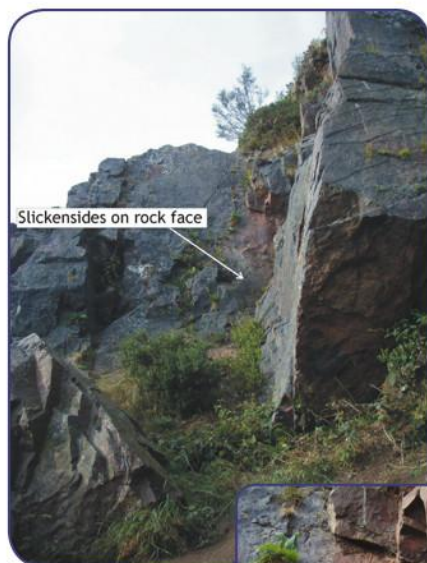




When rocks fracture and move relative to each other along a fault plane, the surface of the fault plane can become polished forming slickensides. These are essentially scratch marks. The polished surface can also be grooved. There is a rock face displaying slickensides on the section of the quarry that protrudes from the main back wall. To reach this spot start at the prominent fracture in the middle of the quarry (marked with an arrow on the photograph on the bottom of page 34). From here follow the path to the right for 10m, and then turn left along the path to reach the high back wall of the quarry. At the rock face turn left again following the back wall of the quarry for 15m up a slope over the rocky outcrops to reach a rock face that faces south. This rock face displays slickensides (refer to photographs on the right).

From Westminster Bank Quarry there are spectacular views across Herefordshire. The hill and vale topography closest to the Malvern Hills is underlain by Silurian-aged rocks. The hills are composed of hard limestones and sandstones whilst the vales between are in softer shales. These Silurian-aged rocks were deposited in a warm shallow sea. The shoreline of the Silurian sea was at one time on the western side of the Malvern Hills, as proved by the discovery in the southern Malverns of fossil shells of creatures that only live in beach environments. Beyond these undulating hills and valleys the landscape flattens out onto the Herefordshire plain, made of sandstones and mudstones known collectively as the Old Red Sandstone. The Woolhope Dome rises out of this plain in the south-west and forms a prominent feature in the landscape.

▲ View to the west from Westminster Bank Quarry



▲ South facing rock face with slickensides



Close up of the slickensides ►

THE WILDLIFE AND HISTORY OF WESTMINSTER BANK QUARRY

Wildlife

The key habitats of the quarry include bare rock face, unimproved acid grassland, neutral grassland, scrub and scattered trees. The acid grassland is largely restricted to the crevices and ledges of the irregular rock face. The rock faces support scattered scrub, mostly in the form of western gorse but also including the occasional immature tree such as sycamore and silver birch. The diverse bryophyte and lichen flora found on the cliff faces are of particular scientific significance. On lower ground on either side of the quarry, scattered trees including silver birch and sycamore become more prevalent. Occasional rowan grow amongst some locally abundant bramble, bracken and tall-herb (rosebay willowherb and common nettle). The grassland on the quarry floor is predominantly species-poor, supporting common grasses such as Yorkshire fog, common bent and herbs including ribwort plantain. The irregular rock face, which supports acid grassland, bracken and scrub as well as open rocky habitat provides optimal habitats for reptiles including common lizard, slow-worm and potentially, adder. Whilst common lizard could occur in a variety of habitats, slow-worm is more likely to inhabit taller and denser grassland swards surrounding the quarry.

The considerable topographical variation, supporting a diversity of habitats and, importantly, bare ground, will undoubtedly provide habitat for a diversity of invertebrates.



▲ Slow-worm. © Nick Button

History

Westminster Bank Quarry may pre-date the Westminster Arms Public House, which used to be nearby and from which this quarry take its name.



▲ Taking root in the fractured granite.
Lichen growing on granite rock

- 14** From Westminster Bank Quarry continue along the path to the Westminster Bank Spring water spout on the right.

Malvern is famous for its water which issues from many natural springs. Rainfall on the Hills seeps into the ground and moves under the influence of gravity through fissures and cracks in the Precambrian rock and along the boundaries where different rock types meet, to emerge as springs throughout the Malvern Hills. There are some eighty-eight springs flowing from outlets all around the Hills.



▲ Westminster Bank Spring

- 15** (S076464617) Just after Westminster Bank Spring the path splits. Follow the path directly ahead. After around 200m the path splits again at Joyner Meadow (on the left). Take the right hand fork signposted to Great Malvern.

- 16** Ignore the first path off to the right. After 100m take the path off to the left. Follow this path to a junction of several paths in an open grassy area, near the ridgeline. At this junction continue straight ahead

for 50m, in the same direction that you have been walking, until you are above the valley below on the eastern side of the Malvern Hills. Follow the path to your right (not immediately visible) which will take you downhill to the dead tree stump in the head of the valley (see photograph below).



- ▲ View from the top of the path that leads down into the head of the valley to the dead tree stump as described in the second half of step 16 in the trail directions

- 17** At the tree stump turn left onto the narrow path, following it downhill for about 400m. After descending the first set of steps, with handrails, go down another set of denuded steps before turning right down a third set of steps to bring you out at the back of North Malvern Clock Tower. Turn left along the North Malvern Road for a short distance before turning left up the drive into Tank Quarry car park.

The base of the recently refurbished North Malvern Clock Tower displays a variety of rocks that are found on the Malvern Hills. An information board detailing a brief history of the Clock Tower is displayed next to the water spout



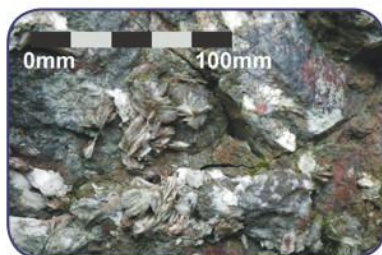
TANK QUARRY

Tank Quarry is one of the most spectacular of the Malvern quarries forming a notch in the north-eastern slope of North Hill. Most of the quarry face consists of the dark-coloured igneous rock - diorite. The rocks within the quarry have been subjected to several phases of earth movements since they formed; the immense forces exerted on the rocks caused them to fracture and in places tear apart along fault lines. This 'shearing' altered the rock. In locations of intense shearing the rocks changed (metamorphosed) into the rock type schist. During these episodes of earth movement bodies of magma (dykes) were injected into the main mass of diorite - many of these bands of rock are composed of pink granite; others are a dark grey dolerite. Though access into the quarry is not permitted, you can pick out some of the dykes cutting across the rock face by viewing the quarry face from the car park.

Within the quarry picnic area is a set of stone cairns displaying a variety of rock types found in Tank Quarry and across the Malvern Hills. Beyond the stone cairns, on the far-side of the grassed picnic area (east) is a 2.5m high rock face. These rocks, like many of those in Tank Quarry, are heavily fractured diorites. Along with the fractures in the rock acting as conduits for magma, fractures also act as gaps through which other fluids can flow. During the emplacement of large bodies of igneous rocks (such as those of the Malvern Hills) and during phases of earth movement, large quantities of superheated water are expelled from

the rock. These hot watery fluids contain minerals in solution. When the conditions are suitable, these minerals crystallise out of solution forming veins, or thin coatings of minerals along faults or joints - hydrothermal deposits.

Hydrothermal deposits in the Malvern Hills include the minerals quartz, calcite, epidote, baryte and iron oxides. Tank Quarry has its fair share of hydrothermal deposits, perhaps in part due to its close proximity, all of a handful of metres, to the East Malvern Fault (refer to page 17). These deposits include baryte which is rare on the Malvern Hills. Baryte can be seen in small patches on the 2.5m high rock exposure to the east of the stone cairns. It has a platy white appearance. It is thought that large enough quantities of baryte were unearthed during quarry operations that it was commercially extracted, though it would have been a very small scale operation. Baryte is the source of barium chemicals as used in paints, dyes and medicines (barium meals). Due to its ability to withstand great pressures, finely crushed baryte is also added to drilling mud to increase its density.



▲ Baryte crystals



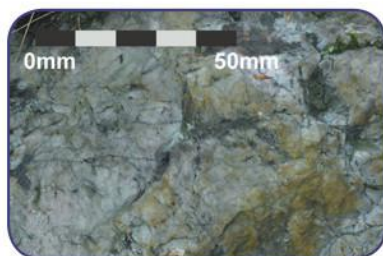
- ▲ Epidote is a pistachio-green-coloured mineral. Epidote is found all around the Malvern Hills as a thin covering on fractured rocks. Many buildings made of Malvern Stone include blocks that have a thin covering of the mineral. Occasionally you can find small veins of epidote.



- ▲ The rusty-red or steel-grey colour of the surface of some of the rock present on the 2.5m high rock exposure is due to the presence of iron oxide, most likely in the form of the minerals haematite or magnetite.

- 18 (S076874709) From the interpretation board in Tank Quarry car park picnic area walk to the bicycle racks. Turn right onto the narrow path behind the bicycle racks which leads up to a second picnic table. Before reaching the picnic table a path leads off at 90 degrees on your left. Don't go down this path, but continue ahead for about 10m to look for a narrower path on your left (If you reach a wide track that leads downhill to the road you have gone too far). Follow this narrow path off to your left for 15m, stopping where the path veers off to the right.

At your feet lies a thick vein of the mineral quartz. You can follow it to the left, where it gets much thicker (over 50cm) and to the right where it gets buried underground. This quartz vein is the thickest recorded on the Malvern Hills. The vein is not one uniform mass of quartz, but it contains fabrics and inclusions of other material - including pieces of the surrounding main mass of diorite rock and small pockets of the mineral epidote.



- ▲ Close up of the quartz vein

Return to the second picnic table where there is a lovely view across Worcestershire.

The relatively flat landscape to the east of the Malvern Hills is underlain by soft Triassic sandstones and mudstones of the Worcester Basin (refer to page 19). From this vantage point, to the north you can see the Silurian limestones and shales of the Abberley Hills. To the north-east are the Lickey Hills formed of Ordovician and Permian sediments. The hard Jurassic limestones of the Cotswold escarpment can easily be seen to the south-east.

View looking east from the picnic table across the Worcester Basin.
Image courtesy of John Stocks

THE BIODIVERSITY & INDUSTRIAL ARCHAEOLOGY OF TANK QUARRY

The present faces of Tank Quarry reach approximately 100m in height and the quarry is around 80m wide at its base. Prior to a partial infill in the 1970s the quarry face reached a further 15m in depth.

From 1870 to 1970 Tank Quarry was worked for its hard, tough rocks providing a source of raw material for use as road aggregate and building stone. Thomas William Morgan is recorded as the quarry owner and stone merchant for 'Tank Quarry works' up until the end of the 19th century. By 1908, ownership had transferred to the Pyx Granite Co. Ltd, with Mr Morgan acting only as a stone merchant. The company continued to own and operate the quarry (existing as a trading name of the Amalgamated Roadstone Corporation Ltd) up until 1970 when extraction ceased. Ownership was then transferred to Worcestershire County Council, who briefly used the quarry as a landfill site. In 1971 the quarry was leased to the Malvern Hills Conservators, who took full ownership of the site in 2007.



▲ Quarry operations at Tank Quarry c.1923.
Image courtesy of the Malvern Hills Conservators

Quarrying has changed the landscape forever but the scar has healed well. Since quarrying ceased the landscape has slowly rejuvenated itself, with the assistance of reclamation work and a tree planting scheme. Silver birch, oak, rowan and the shrub buddleia have thrived in the quarry providing homes, shelter and food for many fauna species. During spring and summer butterflies feed on the buddleia flowers. The quarry also provides excellent foraging opportunities for bats.

Aerial photo showing North Quarry (left) and Tank Quarry (right)





▲ St Ann's Well and cafe sits below St Ann's Knoll

19 From the picnic table follow the path ahead that leads south-east above the level of the quarry car park. The vantage point into Tank Quarry shows the full extent of the quarry. Continue along the path, down the steps, onto the drive and down to the North Malvern Road. Turn right along the road, pass the Clock Tower, before veering right into North Quarry car park. Walk to the far end of the car park.

20 (S077124693) Take the main track on the left hand side of the car parking meter. Stay on the main wide track for around 800m to reach Ivy Scar Rock (a 25m wide, 15m high rock face).



▲ Ivy Scar Rock

Ivy Scar Rock, though also Precambrian in age, is younger than the main body of the Malvern Hills. It is composed of an igneous rock called microdiorite (similar to diorite but the grain size is smaller). Stand back from the cliff face and you can see the flow patterns which formed as the molten rock was intruded into the bulk of the Malverns Complex.



▲ Flow structures in Ivy Scar Rock

21 From Ivy Scar Rock continue heading south along the main path. Where the path splits when you enter woodland, follow the upper path. After around a further 250m the path bends significantly around to the right and Happy Valley Drive comes into view through the trees on the left of the path. Continue along the path to reach a set of three steps on your left. Go down the steps onto the drive.

22 (S077074591) Follow the drive as it bends sharply to the left (signposted to St Ann's Well). Continue along the track uphill to reach a flat grassy area.

- 23 From here follow the wide track behind you signposted to The Beacon. After 10m, turn left onto a wide path and follow it for around 380m (ignore all grassy paths leading off the main path to left and right) to where the main, wide, partly gravelled path switches back on itself to climb the hill. Rushy Valley lies immediately south of you.



▲ View south across Rushy Valley as seen from the end of trail route direction number 23

- 24 Do not follow the switch-back up the hill, but follow the narrow path ahead which clings to the side of the hill as it circumnavigates Rushy Valley. This clear, yet narrow, path passes over easily crossed rocky outcrops in the path floor. After negotiating Rushy Valley the narrow path continues south for around 320m before reaching the edge of Wide Valley. Here the path veers slightly to the right and begins heading downhill. After about 50m you reach the midpoint of Wide Valley where there is a junction of several paths.

Earnslaw Quarry, which is filled with a spring-fed lake

- 25 At the junction of paths, looking down the valley, take the path on the left which heads downhill on the northern side of Wide Valley. When you reach the bottom of the path, turn right along the wide adjoining path.

- 26 Follow the wide path. After 300m, where the path forks to reach the road, stay on the path signposted to the Wyche Cutting. Continue along the gradually ascending path leading to a grassy area after around 350m. Walk to the gravelled path. (For a short detour from the trail turn right along the gravelled track for 30m to reach Earnslaw Quarry).

- 27 Turn left along the gravelled track for 15m to where the path forks, just after a set of steps on your right. Take the right hand path (initially lined on the right hand side with a stone wall) which leads uphill. After 30m the path forks; stay on the upper path. Continue along the main path heading uphill and south for 400m, ignoring any paths joining from the left or right, to reach the Gold Mine cairn on the ridgeline of the Malvern Hills (point 7 on this trail). From the Gold Mine cairn head south along the wide track, down through the Beacon car parks, along Beacon road, turn left and then cross over the road junction to the bus stop shelter and public toilets.

- 28 (SO76864368) From the bus stop shelter follow the road downhill, turning left after 50m onto the road signed for Jubilee Drive. Walk along the road, past the Wyche Free Church and onto the far end of the car parking area. Here, take the path leading onto the Malvern Hills. Follow this path for 1.5km to Gardiners Quarry car park. Along this length of path there are a number of narrow paths leading off to the left. Always stay on the main lower path that runs parallel to Jubilee Drive (not always in sight). The trail finishes in Gardiners Quarry.

EXPLORING THE LOCAL AREA

Local Geology and Landscape trails

The Malvern Hills (1)

Published by Herefordshire and Worcestershire Earth Heritage Trust

Malvern Hills (2)

Published by Herefordshire and Worcestershire Earth Heritage Trust



The Wyche and Purlieu

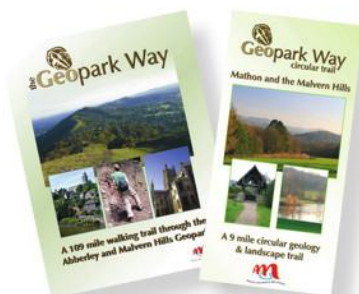
Published by Herefordshire and Worcestershire Earth Heritage Trust

The Geopark Way

Published by Herefordshire and Worcestershire Earth Heritage Trust

The Geopark Way circular trail 'Mathon and the Malvern Hills'

Published by Herefordshire and Worcestershire Earth Heritage Trust (free download from website)

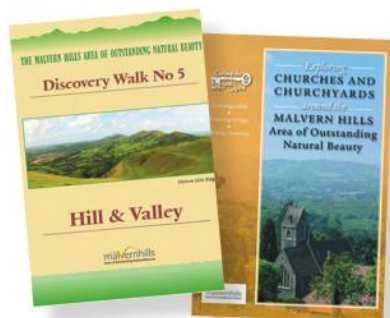


Local Geoconservation Groups and Geological Societies

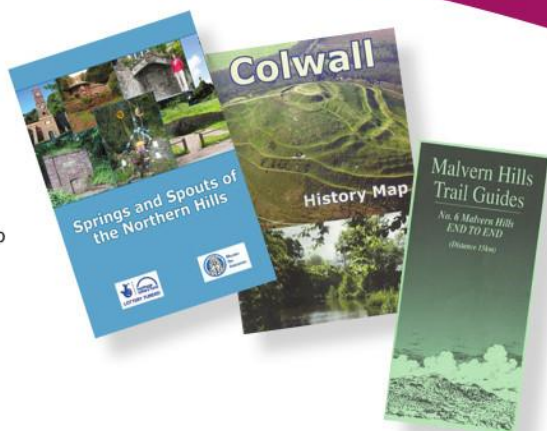
- Herefordshire and Worcestershire Earth Heritage Trust. www.EarthHeritageTrust.org
- Woolhope Naturalists' Field Club Geology Section.
www.woolhopeclub.org.uk/Geology_Section
- Abberley and Malvern Hills Geopark.
www.Geopark.org.uk
- The Teme Valley Geological Society.
www.geo-village.eu

There are numerous walking trails exploring the Malvern Hills and the surrounding area, together with a handful of cycling trails. The Malvern Tourist Information Centre, 21 Church Street, Great Malvern (01684 892289) stocks a wide selection of trail leaflets and guides. Several walks are also available to download from the Malvern Hills Area of Outstanding Natural Beauty (AONB) website.

Below is a small selection of what is available:



- *Discovery Walk No 2: Two Churches and a vineyard*
- *Discovery Walk No 4: Science and Trains in Malvern Wells and Great Malvern*
- *Discovery Walk No 5: Hill and Valley*
- *Exploring Churches and Churchyards around the Malvern Hills AONB*
- *A Literary Trail around the Malverns*
Published by the Malvern Hills Area of Outstanding Natural Beauty



Springs and Spouts of the Northern Malvern Hills
Published by the Malvern Spa Association

Colwall History Map/ Water Map
Published Colwall Village Society

Malvern Hills Trail Guides (set of six walks)
Published by Malvern Hills Trails Group

Useful website addresses for information on the Malvern Hills

- Malvern Hills Conservators
www.malvern hills.org.uk
- Malvern Hills Area of Outstanding Natural Beauty
www.malvern hillsaonb.org.uk
- Malvern Tourism
www.visitthemalverns.org
- General information
www.malverntrail.co.uk
- Malvern Spa Association
www.malvern-hills.co.uk/malvernspa

COMMUNITY EARTH HERITAGE CHAMPIONS PROJECT



▲ Dingle Quarry Champions Site prior to clearance



▲ Dingle Quarry Champions Site after site clearance, initiated through the project, in 2010



▲ Local communities enjoying an event at Gardiners Quarry in 2010 held by the Gardiners Quarry Champions group



▲ The geology of the Malvern Hills is far from being fully understood. At Tank Quarry, members of the Champions group are currently investigating this unusual rock exposure (pound coin for scale)



▲ Tank Quarry Champions Site prior to clearance



▲ Tank Quarry Champions Site after site clearance, initiated through the project, in 2010



what is the

Community Earth Heritage CHAMPIONS project?

The Community Earth Heritage Champions Project, funded by the Heritage Lottery Fund, and Natural England through Defra's Aggregates Levy Sustainability Fund, has involved communities across Herefordshire and Worcestershire.

Each of the nineteen geological sites chosen for the project has a Champions community group carrying out conservation work, promoting the use of the site to other people in their parish and monitoring the site for any changes in condition.

The idea of the project is to take a holistic view of the environment and to understand the relationships between geology, ecology and archaeology.

The Champions have received training in a number of subjects in order to understand the features observed at their site; knowledge which they will now pass on to new volunteers. The conservation work being undertaken will help to ensure the protection of these important features and enable people to enjoy the natural world for years to come.



For more information about the project, or any aspect of the work carried out by the Herefordshire and Worcestershire Earth Heritage Trust, please contact us at:

Geological Records Centre, University of Worcester,
Henwick Grove, Worcester, Worcestershire WR2 6AJ
Tel: 01905 855184 E-mail: eht@worc.ac.uk



www.EarthHeritageTrust.org

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