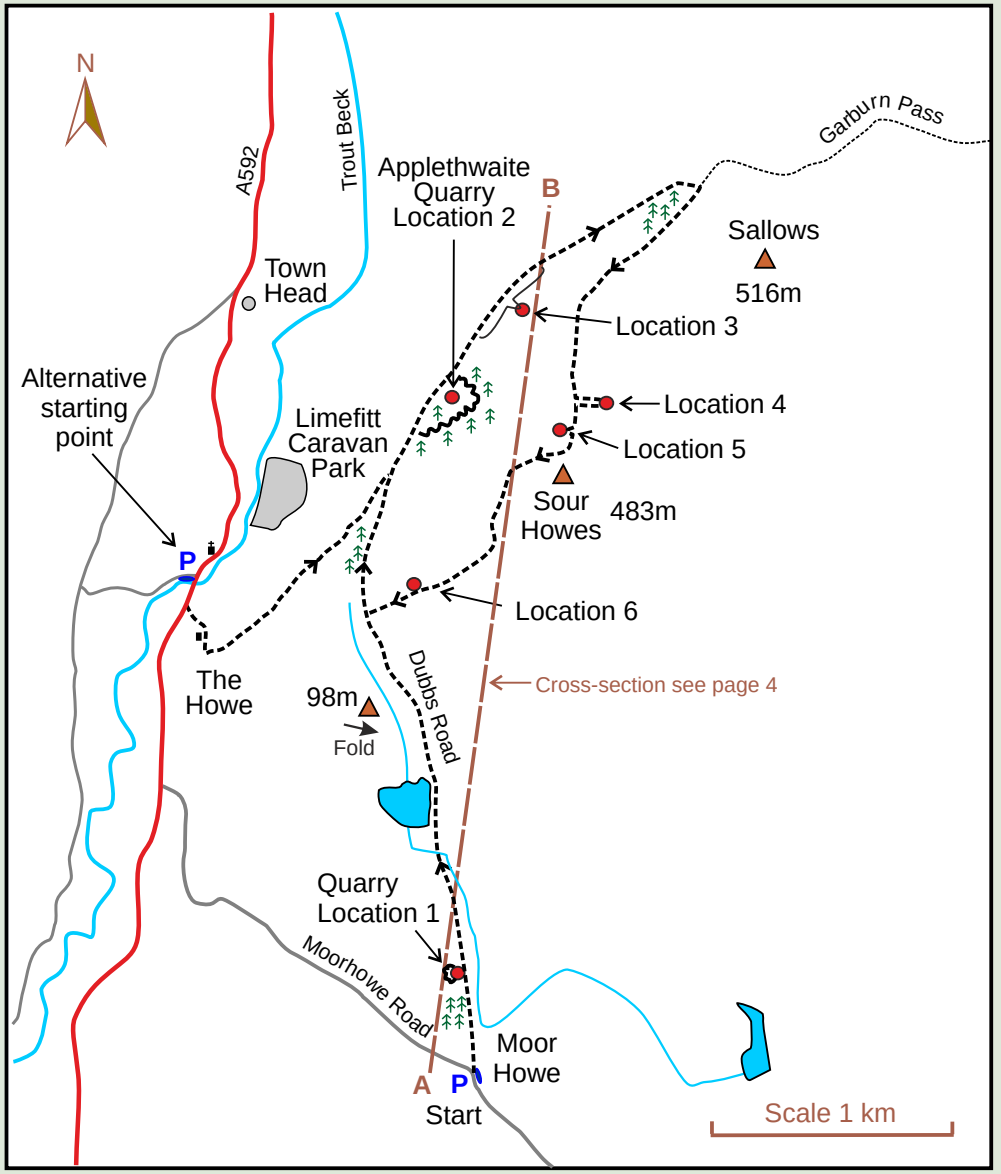
A Geological Trail over the Garburn Pass

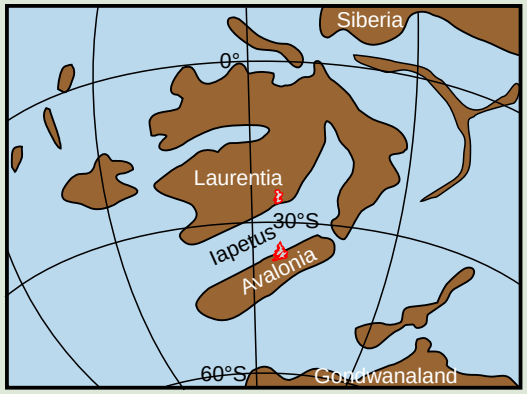
Cumbria RIGS

Regional Important Geological & Geomorphological Sites

The route starts at the Moorhowe Road/Dubbs Road junction at grid reference NY 424006 (Outdoor Leisure Map Number 7). The distance of the walk is 6 miles (9.5 kilometres). Allow 4 to 5 hours to complete the route. The route is entirely on tracks and footpaths on access land. An alternative starting point is a parking area at grid reference NY 412027, an unclassified road off the A592 leading to Troutbeck. Walking boots and suitable clothing are required.



Introduction to the geology: The walk is predominantly on Windermere Supergroup rocks. The rocks were laid down into a subsiding basin 443 to 410 million years ago that was part of an ocean named the Iapetus. The thickness of the strata from points A to B on the route map opposite is approximately 1500 metres. This strata thickness was caused by the Iapetus ocean basin subsiding thus providing an increasing water depth for sediments eroding from land to deposit on the ocean floor. This subsidence was due to loading on the crust of the Iapetus Ocean of the encroaching Laurentian continent to the north. The England area at this time was about 30º south of the equator. Nearby to the south there was a microcontinent named Avalonia and on the far side of the Iapetus Ocean there was a large continent called Laurentia that was slowly moving southwards, causing the ocean to close.



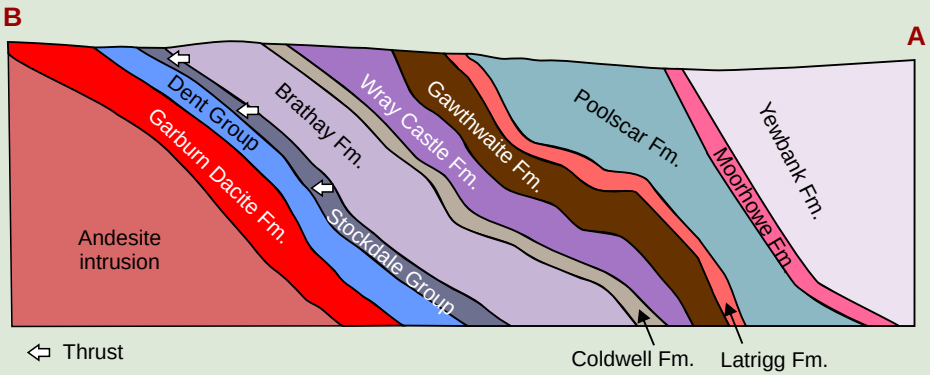
The North Atlantic area 430 million years ago during the Silurian Period

Route Description: The route starts at the junction of the road with the Dubbs Road, it is an track leading north. There is space here for parking cars.

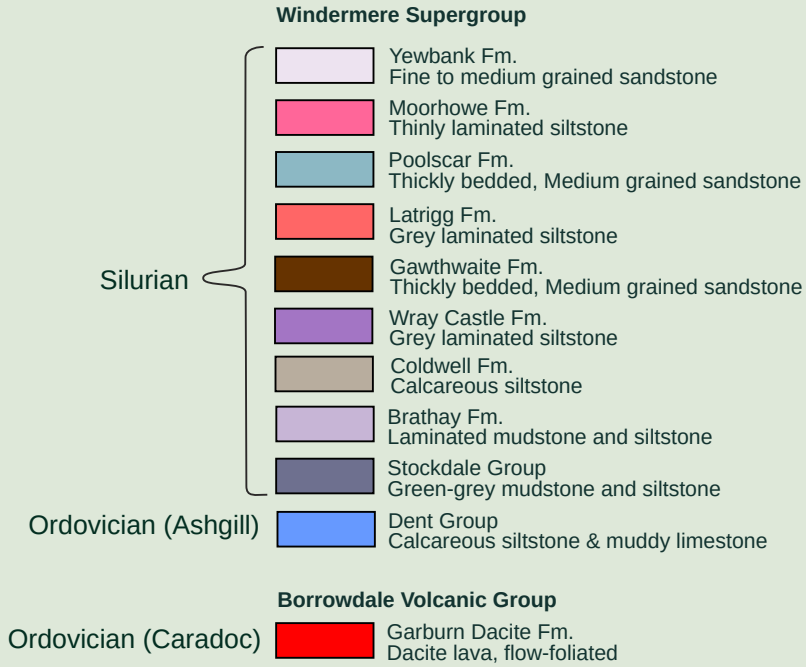
After 100 metres lookover the wall into the field on your right where you will see rocks in the Yewbank Formation. The rock here is a grey coloured finely-grained sandstone, but it does not look like what we normally know as a sandstone. It is a geological term that geologists use for rock that mostly contains silica (SiO_2).

As you walk northwards along the track the rocks are getting older. They are not horizontal, instead they dip downwards. Originally they were laid down horizontally on the sea floor. Due to the continental collision of the Laurentian and Avalonian continents 400 million years ago the strata has been inclined and folded. The figure on page 4 shows how the rocks are exposed today.

Continue along the track to Location 1 - a small quarry on the left-hand side of the track. The route description continues on page 5.



Cross-section showing the formations along the line marked A - B on the route map



Stratigraphic log of the rock deposits along the geological trail

Location 1: The rock exposed is in the Poolscar Formation. It is a grey siltstone with beds of fine-grained sandstones.

The outcrop is dipping at 70 degrees and the direction of the strata is 140 degrees (south-east) as illustrated in the photograph.

Continue along the track to Dubbs Reservoir where there are two different rock formations. The Latrigg Formation where the dam is located and at far end of the reservoir the rocks are in the Gawthwaite Formation. The Latrigg Fm. can be seen on the far side of the reservoir. The Gawthwiate Fm. is not well exposed at the reservoir.

Glacial till near the Dubbs Reservoir

On the right-hand side of the track there is a small feeder stream to the reservoir where glacial till can be seen. This till was laid down about 20,000 years ago when glacial ice was moving southwards down the Troutbeck Valley from the High Street mountains picking up rocks as the glacier advanced.

Pass the reservoir and continue along the track. Ahead and to the left is a small hill. There is a plunging fold immediately to the south of the summit of the hill. See photograph below. These features are not easily seen in the field, but here is a rare example.

All of the Windermere Supergroup formations contain folds, the folding took place when the Iapetus Ocean closed 400 million years ago (see introduction on page 3). The folding episode is known as the Acadian Phase of the Caledonian Orogeny.

Plunging fold north of Dubbs Reservoir

Shortly after the fold you will see ahead of you a small coniferous wood on the left-hand side of the track. About 100 metres before the wood there is a gate on your right. Beyond the gate you will see a prominent ridge with the exposed rocks steeply dipping to the south. Your return route will take you down this ridge.

Where the wood ends there is a track coming uphill on the left to join the Garburn Pass. This is the alternative shorter route mentioned in the introduction.

Further along a spoil tip comes down to the track and after about 50 metres on the right-hand side there is an entrance gate to Applethwaite Quarry. **This is Location 2**. Go through the gate and follow the quarry track uphill to a small mobile phone mast. Applethwaite Quarry is an important geological site and has been designated a Cumbria RIGS site.

The rocks in the quarry are in the Brathay Formation which is a dark laminated mudstone. This quarry has been an important economic resource for the area as it provided roof slates. You can see the quarry face from the mobile phone site. There is no need to approach the quarry face.

The Brathay Formation rocks are easily split due to a feature called cleavage. The cleavage was emplaced when the Iapetus Ocean closed 400 million years ago. The closure caused heat and pressure that chemically altered the rock. It is the cleavage that makes the rock break along planes of weakness and can be easily split and made into slates.

Laminated mudstone in the Brathay Formation

Applethwaite Quarry showing the position of the volcanic bentonite

Brathay Fm. at Applethwaite Quarry: On the quarry face there is a very thin layer of pale coloured bentonite which is a weathered volcanic ash. This ash fell into the ocean sediments from an active volcano.

Return the way you came back to the Garburn Pass track and continue uphill. 50 metres pass the entrance to Applethwaite Quarry there is a white rock band across the track. This is a minor fault that has been mineralised by white coloured silica.

Location 3: 100 metres after quarry entrance look at the rocks on the right-hand side of the track. We have another rock formation. The rocks are in the Dent Group and they outcrop along the track for about 30 metres. You will see a thick bed between dark coloured shale horizons. This bed has weathered to a yellow colour and is a muddy limestone. These rocks were deposited in shallower water compared to the rocks seen earlier in the walk. The Dent Group was laid down about 445 million years ago after the Lake District volcanism had ceased. There was a marine transgression across the area caused by thermal subsidence as underlying granite cooled.

The hammer shows a limestone bed in the Dent Group

About 100 metres beyond the Dent Group the rock changes again. It becomes harder and is it not bedded. This is not a sedimentary rock. We are walking on a volcanic lava flow called the Garburn Dacite Formation. This formation is at the top of the Borrowdale Volcanic Group and the volcanic activity at this time was very intensive with eruptions of exceptional magnitude.

For example, the earlier volcanic Lincomb Tarns Formation has an outcrop of 500 km^2 which buried the entire area.

The Garburn Dacite is a dark-coloured glassy igneous rock. It has a high quartz content and is similar in composition to a granite. The formation is described as being flow-foliated. That means the rock is layered with contrasting colours that formed after the lava flow had cooled. These changes in colour can be seen in the exposures as you ascend the track.

Garburn Dacite exposed on the track

Near the top of the pass you will be leaving the Garburn Pass for grassy and therefore not so well defined paths.

If there is low cloud on the fells it may be better not to continue onwards to Sour Howes but return the way you came.

Garburn Dacite exposed on the track

Continue along the track passing a coniferous wood on your right but before the gate at the top of the pass cross the stile in the wall (right-hand side). Walk uphill following the wall and the wood on your right.

Take this stile at the Garburn Pass summit

Take this stile for Sour Howes

After a short distance cross another stile and turn left. The wall will be on your left-hand side, continue to follow the wall. After 400 metres the wall veers left. Leave the wall at this point and continue uphill following a grassy path to Sour Howes (see photograph above).

Location 4: As you approach Sour Howes you will see a prominent outcrop to the left of the path. Follow the route outlined on the photograph below.

The outcrop exposes the Brathay Formation and displays the relationship between cleavage and bedding. The bedding shows how the deposit was laid down on the ocean floor. The cleavage was produced by the closure of the Iapetus Ocean (see page 3). It is the cleavage that enables the rock to be easily split into roofing slates.

Location 5: Just before you arrive at the summit of Sour Howes, walk 20 metres to your right. You will see a small ridge that exposes the Birk Riggs Formation. This is a sandstone unit (containing a high proportion of silica). This ridge is due to the sandstone unit being more resistant to erosion than the surrounding softer shales.

Near the summit of Sour Howes look down into the Troutbeck valley you and will see a fault controlled feature. This is the Troutbeck Fault which fractured the bedrock along the fault line. The recent ice age glaciers have exploited this weakness and deepened the valley.

At the summit of Sour Howes turn right and follow the path to another stile. After the stile the path continues down a steep ridge.

The rocks in this ridge are in the Wray Castle Formation.

Location 6: The photograph below is a magnificent exposure of the Wray Castle Formation. The rock dips here at 45 degrees to the south.

Continue to walk down the slope, the paths here are a little indistinct but head downhill to the left of the ridge and you will come to the gate shown on page 6. Rejoin the Dubbs Road and return to your starting point.

	GROUP	FORMATION	MEMBER	STAGE	SERIES	SYSTEM
WINDERMERE SUPERGROUP		Kirkby Moor Fm.	Helm Mbr		PRIDOLI	SILURIAN
		Underbarrow Fm.		Ludfordian	LUDLOW	
		Bannisdale Fm.	Rusland Mbr	Gorstian		
	Coniston Group	Yewbank Fm.				
		Moorhowe Fm.				
		Poolscar Fm.				
		Latrigg Fm.				
		Gawthwaite Fm.				
		Wray Castle Fm.				
		Coldwell Fm.	High Cross Mbr	Homerian	WENLOCK	
			Randy Pike Mbr			
		Birk Riggs Fm.				
		Brathay Formation		Sheinwoodian		
			Dixon Ground Mbr			
	Stockdale Group	Browgill Formation	Far House Mbr	Telychian	LLANDOVERY	
		Skelgill Formation		Aeronian		
				Rhuddanian		
			Spengill Mbr	Hirnantian		
	Dent Group	Ashgill Formation	Troutbeck Mbr	Rawtheyan	ASHGILL	ORDOVICIAN
		Appletreeworth Fm.				
		? ? ? Broughton Moor Formation ? ? ?				
		Kirkley Bank Formation	Torver Mbr	Cautleyan		
			App/Hph Mbr			
			Kentmere Mbr			
			basal clastics			
		Stile End Fm. (Y.)	Long Mbr			

After Kneller, Scott, Soper, Johnson and Allen

L = Longsleddale Member; Y. = Yarlside Volcanic Formation; App/Hph = Applethwaite/Pike Haw Members

Formations in the Garburn Pass Geological Trail

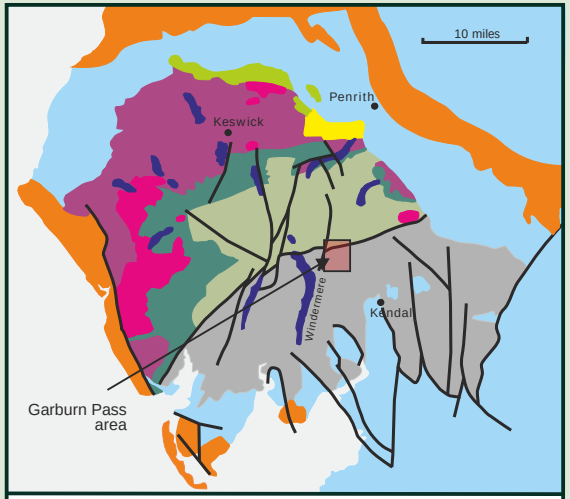
Lithostratigraphic Classification of the Windermere Supergroup

Cumbria RIGS

Conserving Geological Sites

Cumbria RIGS was formed in 1992 to identify and record important places for geology and geomorphology. Cumbria RIGS are supported and funded by Cumbria County Council. The group consists of voluntary professional and amateur geologists. Once RIGS are approved and recorded they need to be conserved, they are visited periodically and if funds are available clearance work is carried out.

Text and photographs by Michael and Gillian Dewey



Generalised geological map of the Lake District and surrounding areas

Eras	Geological Period/Epoch	
Cenozoic	Pleistocene	Ice Ages
	Pliocene	
	Miocene	
	Oligocene	
	Eocene	
Mesozoic	Cretaceous	
	Jurassic	
	Triassic	St Bees Sandstone
Palaeozoic	Permian	Penrith Sandstone
	Upper Carboniferous	Coal Measures
	Lower Carboniferous	Carboniferous Limestone
	Devonian	Mell Fell Conglomerate
	Silurian	Windermere Supergroup
	Dent Group	
	Ordovician	Borrowdale Volcanic Group
		Skiddaw Group
	Cambrian	

Timescale of rocks deposited in Cumbria

This booklet was funded by the Northwest GeoDiversity Partnership.

GeoConservationUK
The Association of UK RIGS Groups