

The Dovey valley

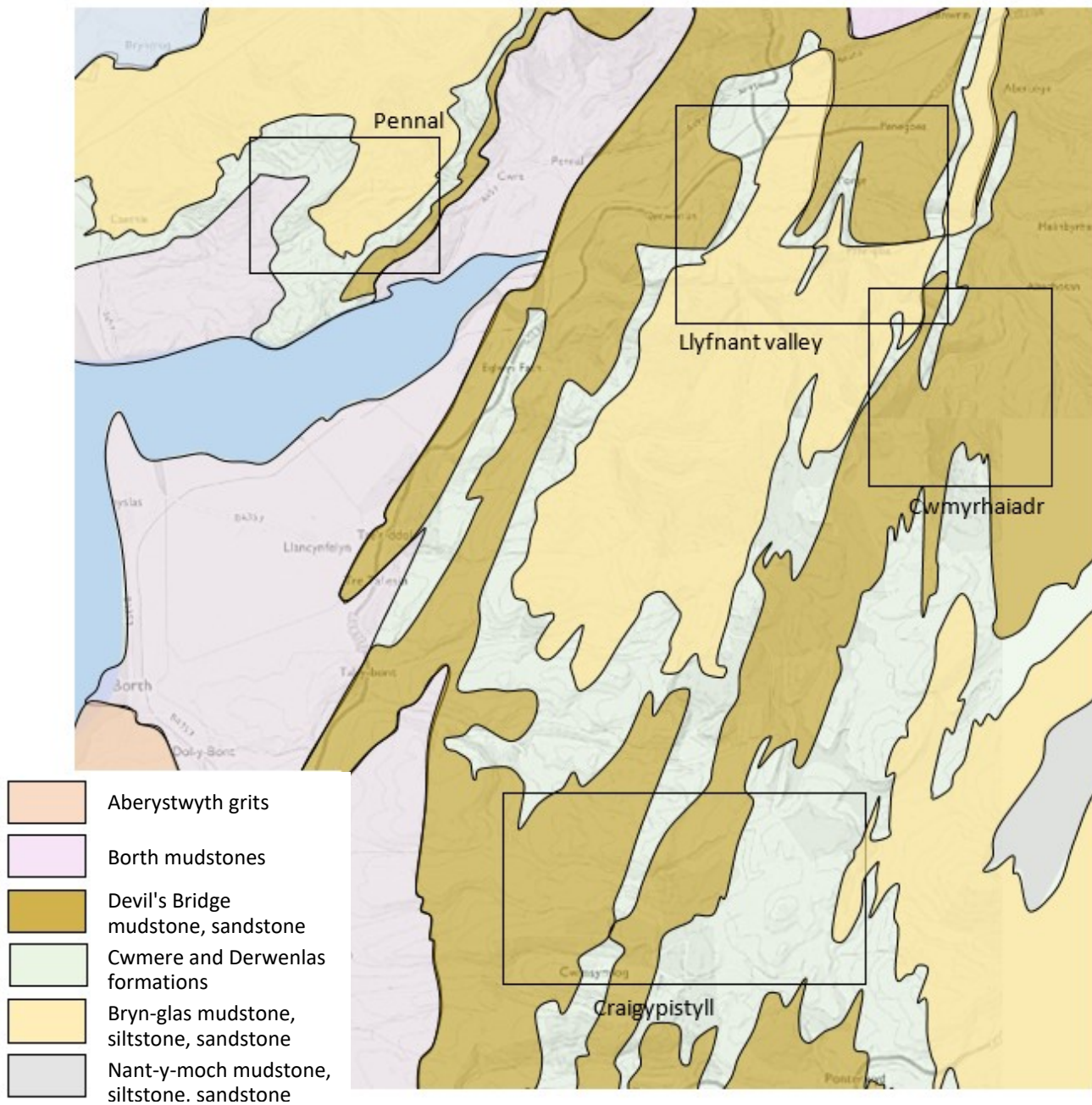


Figure 528: Field excursions.

In this chapter, we move southwards to examine late Ordovician and Silurian sedimentary rocks in the coastal region around the Dovey estuary. The rock formations seen in the Corris slate quarrying area are again present, but some variations in lithology occur. Different names are applied to some strata (fig.529).

The Upper Ordovician slates of Corris merge into the Nant y Moch formation, which contains a mixture of mudstones, siltstones and coarser

sandstones. This indicates a variation in sedimentation within the Welsh basin. Coarser material was supplied from the eastern and southern basin margins, and was deposited on the sea bed slope before reaching the deeper axis of the basin in the Corris area.

The Garnedd-wen formation divides southwards into the Drosgol and Brynglas formations, separated by a prominent band of sandstone known as the Pencerrigewion member.

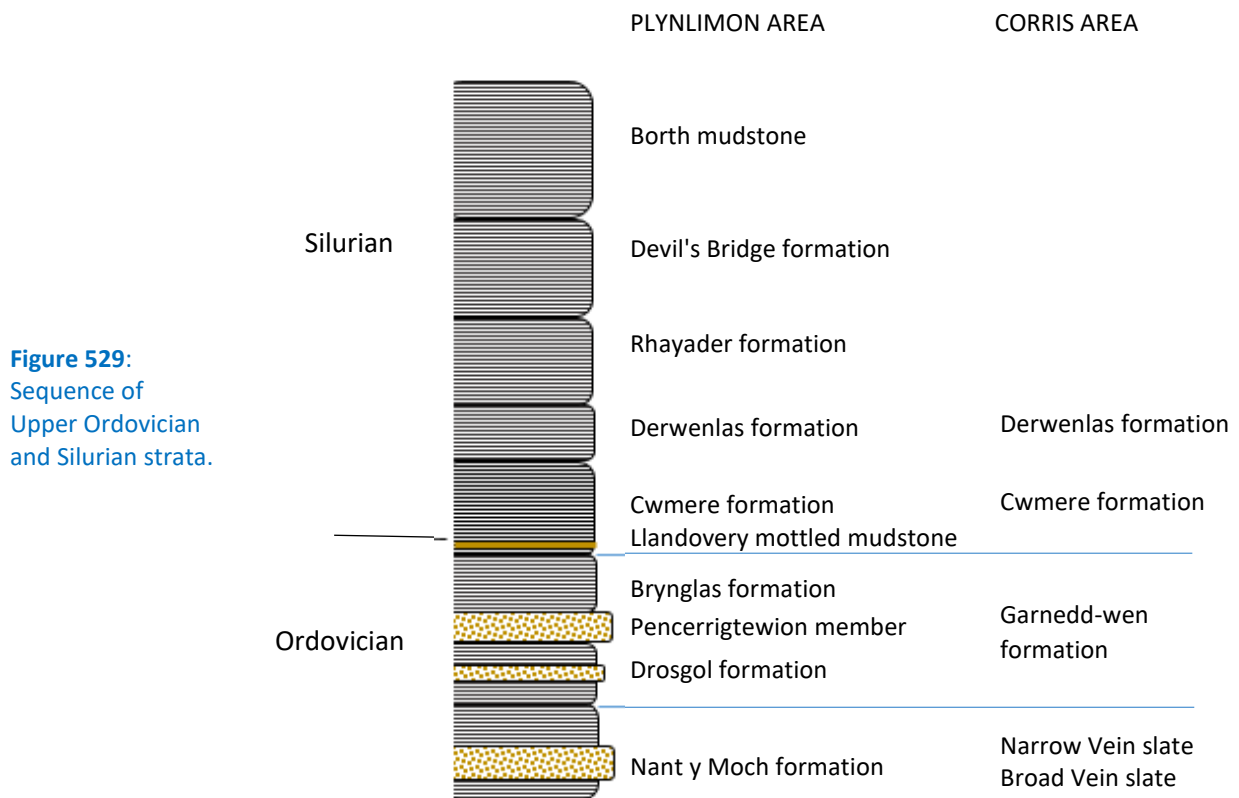


Figure 529: Sequence of Upper Ordovician and Silurian strata.

A major ice age affected the Earth in the late Ordovician, locking vast amounts of water into ice caps and causing a global fall in sea level. This in turn caused emergence of the large land mass of the Midland platform to the east. Rivers carried eroded mud, silt and sand to the coast and discharged this material into the basin. The Pencerrigteuion sandstones are thought to have been formed at the time of lowest sea level and maximum erosion of the neighbouring land masses.



Figure 530: Llandovery mottled mudstone.

The end of the ice age corresponded roughly with the end of the Ordovician period. Sea levels rose again, and the marginal lands around the Welsh basin were flooded. Sedimentation in the basin continued, but mud deposition became dominant. The sea bed was initially well oxygenated, and burrowing organisms flourished. A particularly conspicuous bed which occurs immediately above the Ordovician-Silurian boundary is the Llandovery mottled mudstone (fig.530). This rock consists of numerous burrows infilled with darker mud.

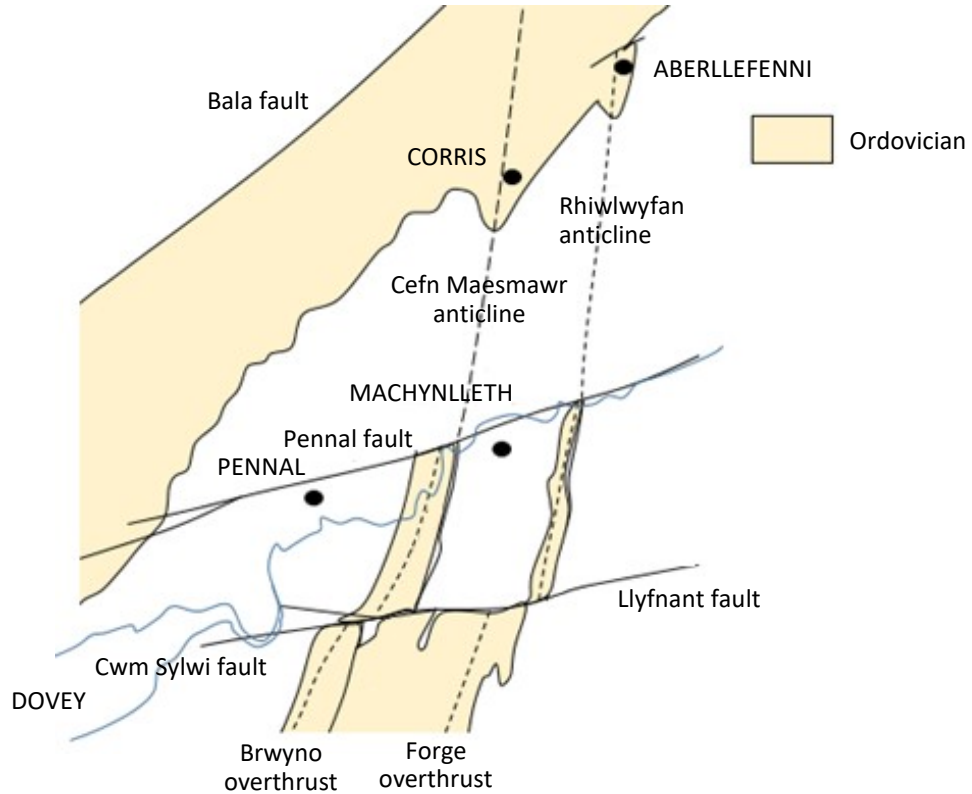
The mottled mudstone forms a useful reference horizon for identifying the Ordovician-Silurian boundary. A series of mudstone formations higher in the Silurian sequence were deposited in deeper water. The low levels of dissolved oxygen were unable to support colonies of burrowing organisms.

Following the closure of the Iapetus ocean at the end of Silurian times, the sedimentary succession of the Welsh basin was subject to extensive earth movements in the Acadian orogeny. In mid-Wales, the most obvious tectonic structures are a series of complex domes in which Ordovician strata, themselves compressed into tight folds, are brought to the surface through the surrounding Silurian cover. Excursions in this chapter visit locations around the Llyfnant dome. The Plynlimon dome will be examined in chapter 20.

The complexity of the Llyfnant dome is illustrated in fig.531. Anticlines at Corris and Aberllefenni can be traced southwards to become components of the Llyfnant dome. The geology of mid- Wales is strongly influenced by fracture zones in the deep

basement which have controlled uplift, folding and faulting. Major fault zones belong to two groups: a northeast-southwest group, of which the Pennal fault is an example; and a north-south group including the Brwyno and Forge overthrusts.

Figure 531: Folding and faulting in the Llyfnant dome.



During the Acadian orogeny, the soft sediments of the Welsh basin were compressed as the crustal mass of the Midland platform converged from the east. Shortening took place by tight folding, with faulting also occurring as the cohesive strength of the rocks was exceeded. Faults probably developed upwards from the deep fracture zones where convergence of basement crustal blocks was taking place. In the Llyfnant dome, pressures produced two shallow thrust faults: the Brwyno and Forge overthrusts. Further west, a block of crust has been forced upwards as a horst structure in the area around Tal y Bont.

Vergence describes the overturning of an asymmetrical fold in which one limb is shorter and steeper than the other. In the Llyfnant dome, vergence is towards the east, perhaps in response to the thrust faulting dragging the bases of folds westwards. Folds become symmetrical in the region of the horst structure around Tal y Bont. Further towards the coast, the vergence direction becomes westerly. It is likely that sediments were pushed upwards in the central area to form an unstable poorly-consolidated stack, which then slid westwards down a slope under the effect of gravity to produce the overturned folds.

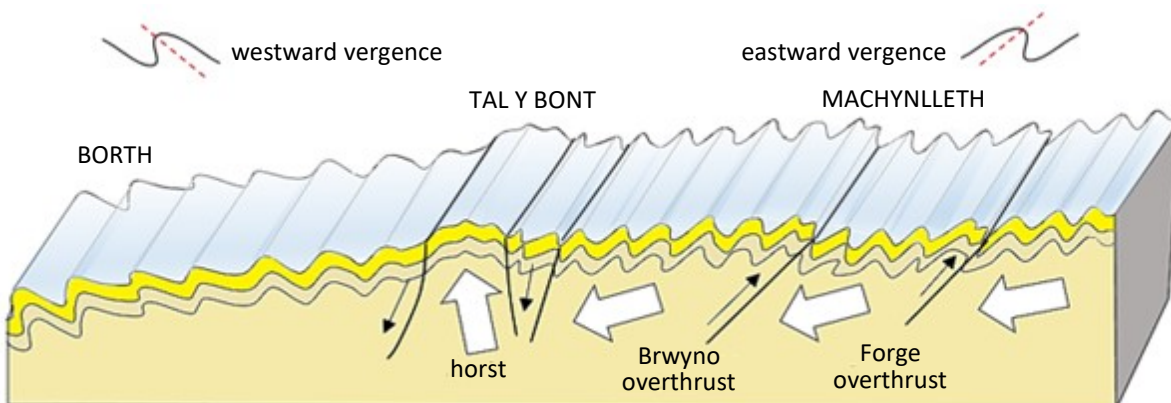


Figure 532: Vergence directions around the Llyfnant dome.

2: Go through the gate at the top of the valley and continue to Llyn Barfog. Examine outcrops of Garnedd-wen sandstone alongside the lake.

3: Take the track at the western end of the lake which ascends to the Panorama Walk overlooking the Dovey estuary. A prominent outcrop of Garnedd-wen sandstone at this point is known as Carn March Arthur, and is linked to an Arthurian legend.

The coarser grain size of the Garnedd-wen sandstone beds at Pennal in comparison to the dominant mudstones of the Garnedd-wen formation around Corris suggests that steep

localised slopes existed on the floor of the Welsh marine basin. We previously saw an example of a localised sandstone within the Garnedd-wen at Bryn Eglwys quarry near Abergynolwyn. The coarser sandstones have the characteristics of proximal turbidites, deposited within slope channels or slope-foot delta fans. Individual sandstone beds may show infilled scour depressions on their bases, where the cloud of fast-moving sand has cut into the underlying mud. Beds may show a characteristic graded bedding, and may be overlain by laminated sand or silt. It is likely that the sea-bed slopes had developed in response to fault movements in the deeper crustal basement.



Figure 535: (left) Llyn Barfog from Carn March Arthur. (right) Garnedd-wen sandstone.

4: Take the path which descends along a small valley towards Tyddyn-y-briddell farm.

5: Examine waste tips and several mine adits alongside the path. These are the remains of Tyddyn Briddell lead mine.

The mine was worked on a small scale for about a century, from 1750 to 1860. Three parallel quartz lodes carrying galena run north-south through mudstones of the Cwmere and Garnedd-wen formations. They have been worked by adit tunnels and shafts, and opencast trenches.

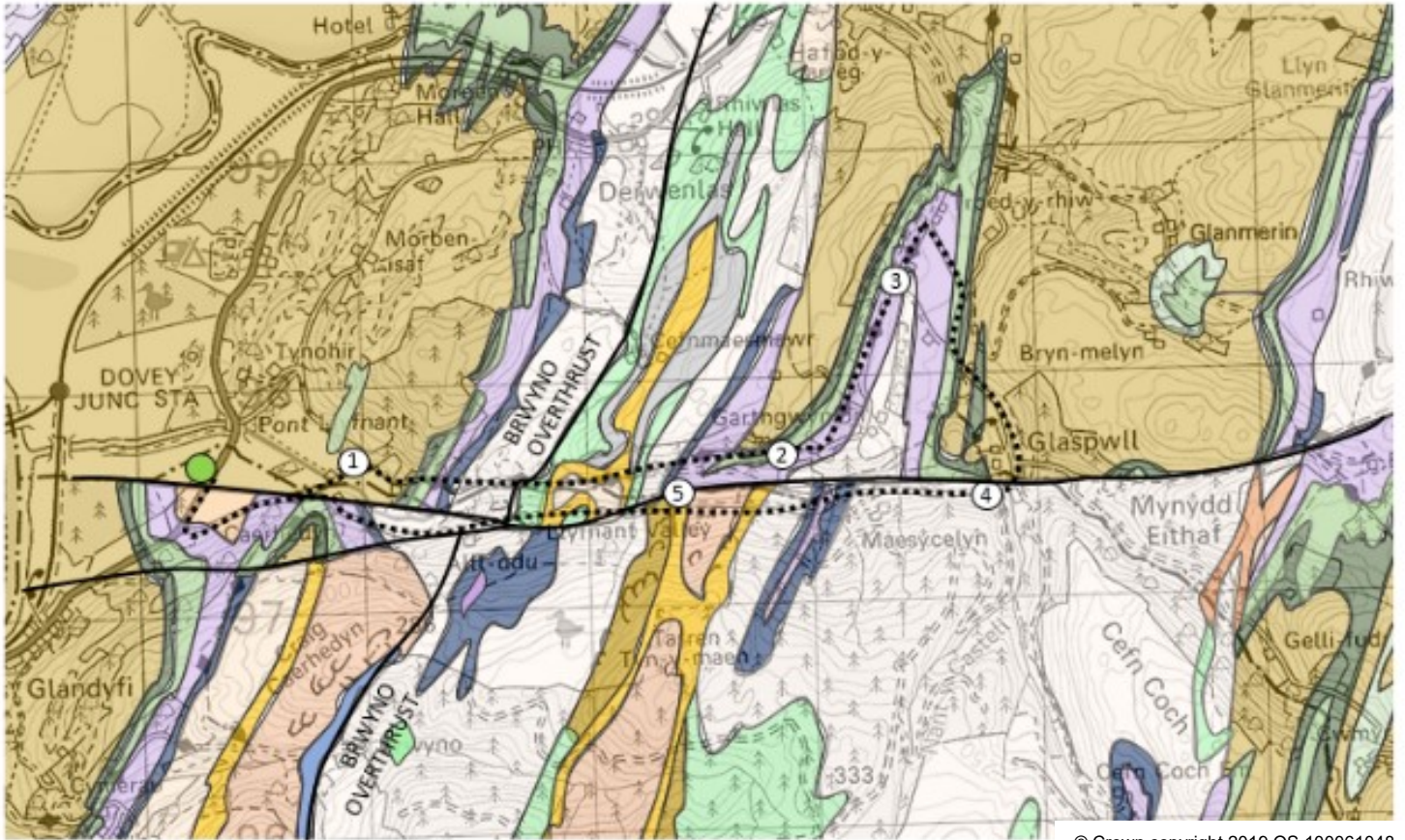


Figure 536:
Adit at Tyddyn
Briddell mine.

Llyfnant valley



5 miles: approximately 2 hours



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ORDOVICIAN

- Bryn-glas slumped mudstone, siltstone, sandstone
- Bryn-glas sandstone
- Pencerrigtwion slumped mudstone, siltstone, sandstone
- Pencerrigtwion mudstone
- Pencerrigtwion mudstone, siltstone, sandstone
- Pencerrigtwion sandstone
- Nant-y-moch mudstone, siltstone, sandstone

SILURIAN

- Borth mudstone
- Devil's Bridge mudstone, sandstone
- Rhayader mudstone
- Derwenlas mudstone
- Cwmere mudstone
- Llandovery Mottled Mudstone

Figure 537: Field excursion

In this excursion we make a traverse across the northern edge of the Llyfnant dome, where Ordovician strata of the Nant y Moch, Drosgol and Brynglas formations reach the surface. At either

end of the valley, younger Silurian strata outcrop. The succession is strongly folded, and affected by faulting including the Brwyno overthrust. We find that fold vergence is towards the east (fig.538).

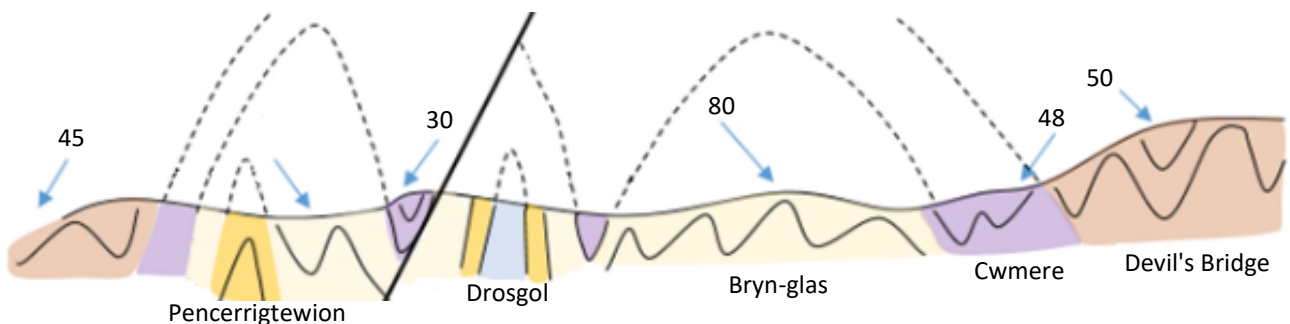


Figure 538: Cross section along the south side of the Llyfnant valley.

Start: Park in the lay-by on the main Machynlleth to Aberystwyth road [SN703976].

1: Follow the minor road up the Llyfnant valley.

On reaching the lower valley, take the minor road which branches to the north at Caerhedyn. A small quarry to the right of the road exposes folded Devil's Bridge sandstones and mudstones.

After crossing the river, a T-junction of tracks is reached. Take the track up the valley through the woodland.

Following the river upstream past Cefn Maesmawr, outcrops of the Derwenlas formation of Silurian age are seen. These sediments and the underlying Cwmere mudstones represent a return to deep water deposition after the end of the Ordovician ice age, with re-flooding of the margins of the Midland platform. The rocks have the



Figure 539: Folded Devil's Bridge sandstones and mudstones.

characteristics of turbidites, discharged from the shelf sea around the Welsh basin to produce sediment fans on the deeper sea floor.



Figure 540: (left) Derwenlas siltstones and mudstones. (right) Cwmere mudstones.



Figure 541: Flooded mine adit in Derwenlas strata.

A small lead mine adit has been cut in the Derwenlas rocks near the river bank. This mine worked a mineral lode which had been emplaced along the Llyfnant fault zone during the Acadian orogeny.

2: Continue to the end of the forestry track at Cyfarthfa, where prominent crags above the valley are formed by Devil's Bridge sandstones and siltstones.

3: Follow the track and minor road to Troed-y-rhiw. Take the turning on the right and cross the valley to join the minor road to Glaspwll.

4: Follow the minor road down the Llyfnant valley along the south side of the river. The road is cut into mudstones, siltstones and sandstones of the

Bryn-glas formation. The rock is splintery with an uneven cleavage, or appears as massive unstratified mudstone (fig.542).



Figure 542: Road cutting through Bryn-glas mudstone in the upper Llyfnant valley.

Continuing down the valley, an outcrop of the Drosgol formation is reached in the core of a small anticline. The rocks are a rhythmic sequence of siltstones and mudstones. These were deposited by bottom currents during a period of falling sea level and emergence of the coastal shelf around the Midland platform in response to the late Ordovician global ice age. The variations in sediment may represent seasonal changes in sediment supply, or storm events affecting the movement of sea bed sediment.



Figure 543: Drosgol alternating siltstone and mudstone sequence.

5: The gradient of the road steepens as a ridge of Pencerrigtewion sandstone is reached (fig.544). This sandstone is thought to have been the product of erosion of the Midland platform at the time of maximum glacial cooling and lowest sea level. The Welsh basin was reduced in width as the marginal shelf emerged. Coarse sediment was carried into the mid-Wales area by large rivers to produce delta fans across the basin floor.

Continue down the valley to rejoin the main road and return to the parking place.

Figure 544:
Pencerrigtewion
sandstone outcrop.
The orientation of the
bedding is indicated.



Cwmyrhaidr



5 miles: approximately 2½ hours

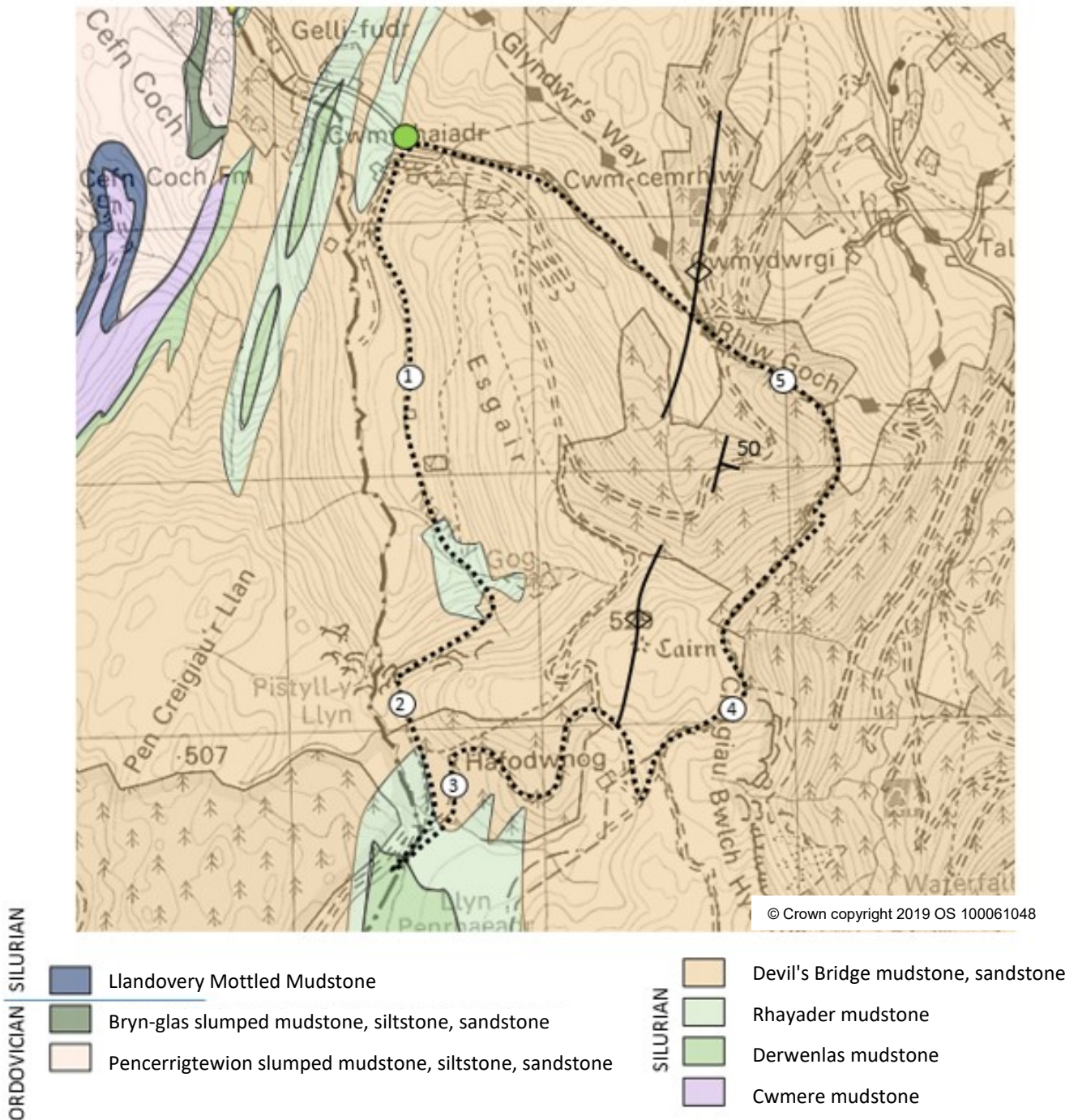


Figure 545: Field excursion

This excursion explores some spectacular areas of scenery around the northern edge of the mid-Wales plateau. The rocks outcropping are primarily mudstones of the Rhayader and Devil's Bridge formations. These sediments represent continued sedimentation in the deepening Welsh basin following the end of the Ordovician ice age. Muds were deposited in part by turbidity currents flowing along the axis of the basin from a distant

source. Also present are hemipelagic muds formed by simple precipitation from sea water over a long period of still water conditions.

Start: Park in the layby at the edge of Cwmyrhaidr village. A sign indicates that vehicles are not permitted beyond this point [SN757963].

Figure 546:
Pistyll y Llyn.
The right branch of the falls lies along the axis of a syncline in the Devil's Bridge sandstone.



1: Take the footpath towards Pistyll y Llyn. The path passes between the farm buildings, then continues up the valley through a series of fields. The waterfall of Pistyll y Llyn comes into view, descending in a ravine cut into a cliff of mudstones of the Devil's Bridge formation.

2: Continue to the base of the scree slope. You will pass the site of a lead mine, where remains of a water wheel and wheel pit are seen. Nearby, surrounded by a group of trees, is a deep open mine shaft (fig.547).



Figure 547: Lead mine at Pistyll y Llyn. (left) Mine shaft. (right) Water wheel pit and remains of the water wheel, installed to pump the mine and lift buckets of ore from the shaft.

Follow the stream up past the mine as it climbs steeply up through the scree towards the head of the side of the valley. Eventually the prominent horizontal path to the head of the waterfall is reached. Take this path along the cliff to the gorge above the falls.

3: Continue across the moorland alongside the stream until a block of forest is reached. Cross a stile and follow the path through the forest to

reach a gravel forestry road. To the right, the road leads to Llyn Penrhaidr.

After viewing the lake, return along the forestry road and continue east towards Bwlch Hyddgen. A small quarry in the Devil's Bridge formation is reached. The rock is a grey, fine grained and poorly cleaved mudstone which shows rusty weathering. The iron oxide film on weathered surfaces is characteristic of the presence of pyrite

crystals in the mud, indicating the activity of iron-fixing bacteria under conditions of low oxygen on the sea bed.

Continue along the forestry track, passing Hafodwnog. Keep to the right at the branch in the track, to reach the edge of the plateau at Creigiau

Bwlch Hyddgen. Forested screes extend down to the deep glaciated valley below (fig.548).

4: Follow the track along the crest of Creigiau Bwlch Hyddgen until an area of clear-felled forestry plantation is reached.

Figure 548:

Creigiau Bwlch Hyddgen.



5: A gate leads to a section of fast downhill mountain bike trail known as 'the chute' which descends around the head of a deep valley

towards Cwmyrhaiadr village. The track is deeply incised in places into the Devil's Bridge mudstone bedrock (fig.549).

Figure 549:

The Chute mountain bike trail, crossing Devil's Bridge mudstones.

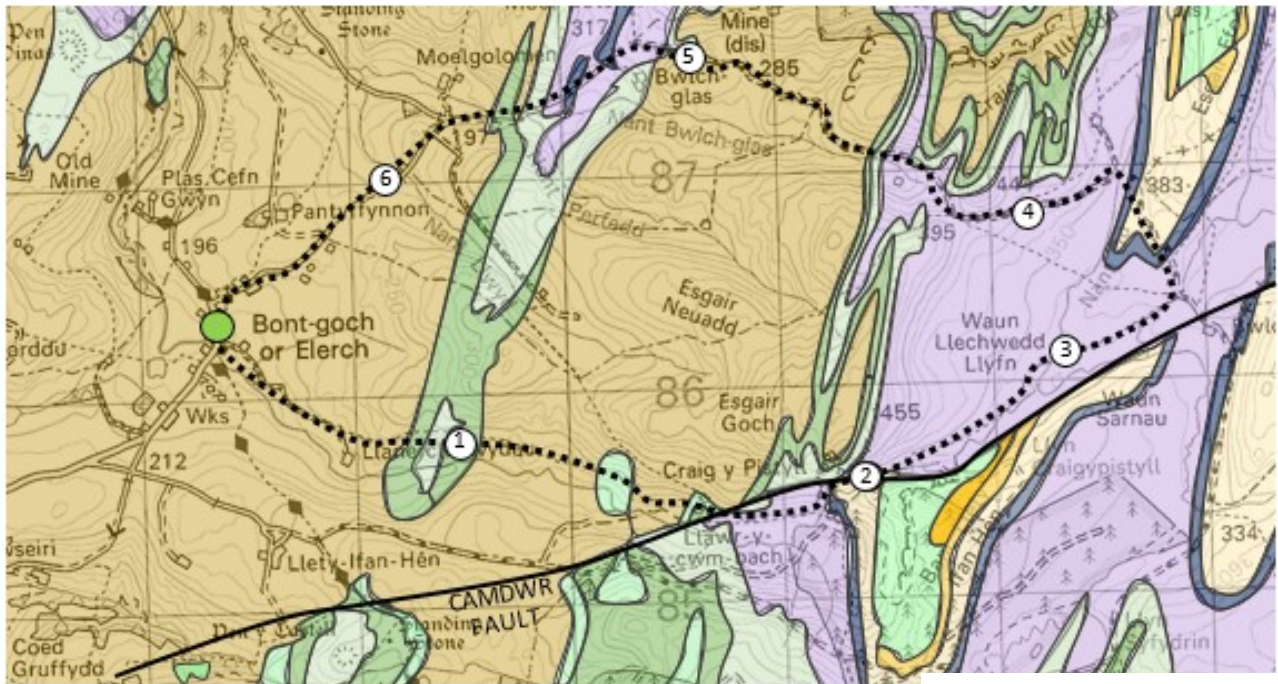


The mountain path descends to join a farm track through fields, then back to the parking point.

Craigypistyll



7 miles: approximately 3 hours



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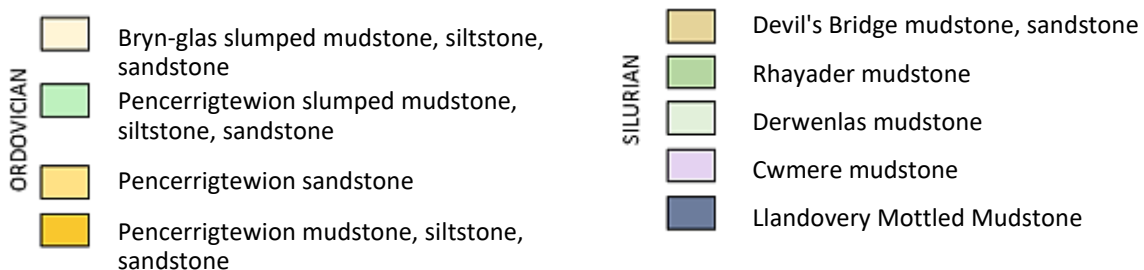


Figure 550: Field excursion.

The principal objective of this excursion is to examine the sequence of upper Ordovician and Silurian sediments exposed in the Craigypistyll gorge along the Camdwr fault. This fault is a major structure which runs eastwards into the centre of the Plynlimon dome.

Start: Park in the village at Elerch Bont-goch [SN684865].

1: From the village, take the farm track which runs through fields on the northern side of the Leri valley.

A small quarry is seen at the side of the track, exposing rocks of the Rhayader formation of Silurian age (fig.551).

In the central area of the quarry, dark grey uniformly fine grained mudstones appear to have been deposited by quiet sedimentation in deep water. The dark colour is characteristic of the incorporation of carbon particles from organic detritus. Above and below are finely laminated mudstone and siltstone sequences characteristic of turbidite deposition in a distal environment far from the sediment source. Turbidite flows may have travelled along the deep axial zone of the deep Welsh basin, depositing their sediment as the flow velocity was reduced.

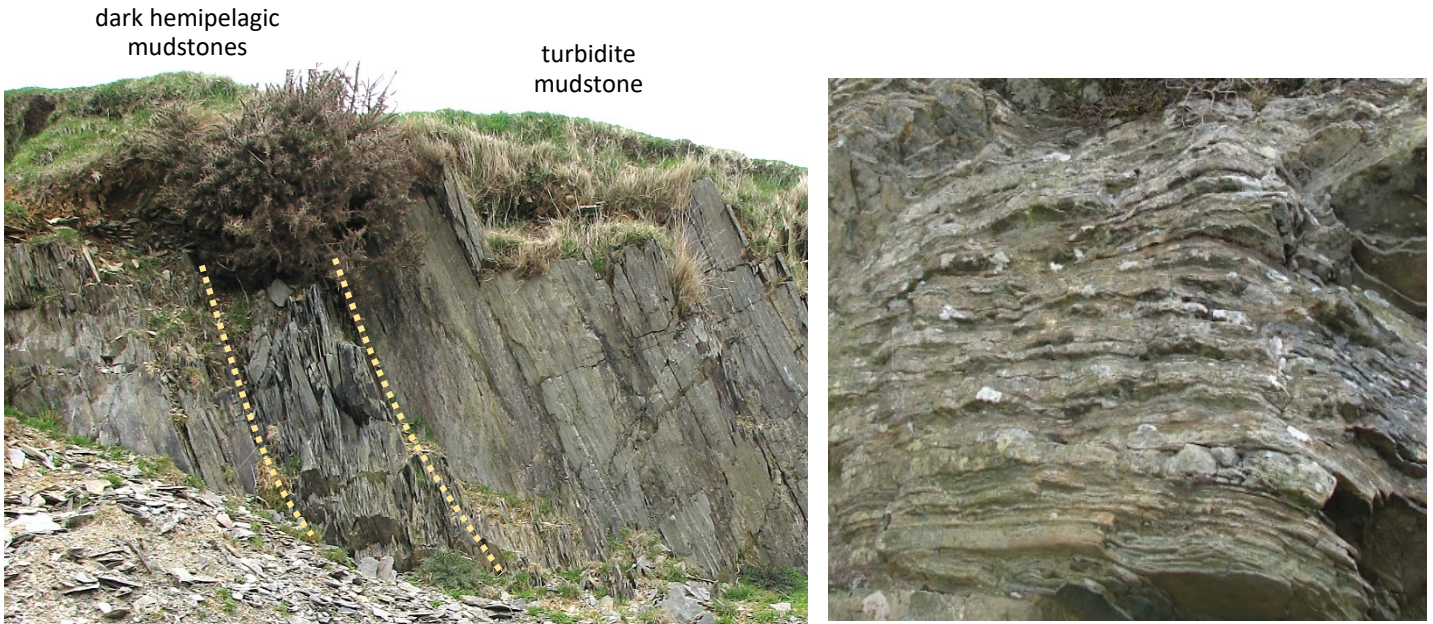


Figure 551: Rhayader formation. (left) Quarry exposing turbidite and hemipelagic mudstones. (right) Laminated mud and silt turbidite deposits.

Continue along the track. After passing Llanerchclwydau farm, the site of a lead mine is reached. There is evidence of the mine shaft, now covered, and a waterwheel pit. The main feature of the site is the remains of a crusher house where ore would be crushed between large metal rollers, ready for the separation of heavy metal concentrates by a water sedimentation method.

2: The track leads us to the Craigypistyll gorge. This large ravine has been cut along the line of the

Camdwr fault, and exposes a sequence of mudstones from the Upper Ordovician Bryn-glas to the Silurian Devil's Bridge formation. The strata dip steeply to the east or west in the limbs of a series of anticlines and synclines which have north-south oriented axes. An example is a large syncline picked out by prominent bands of sandstone of the Cwmsymlog formation which are exposed in the cliff face of Craigypistyll on the north of the gorge (fig.552).

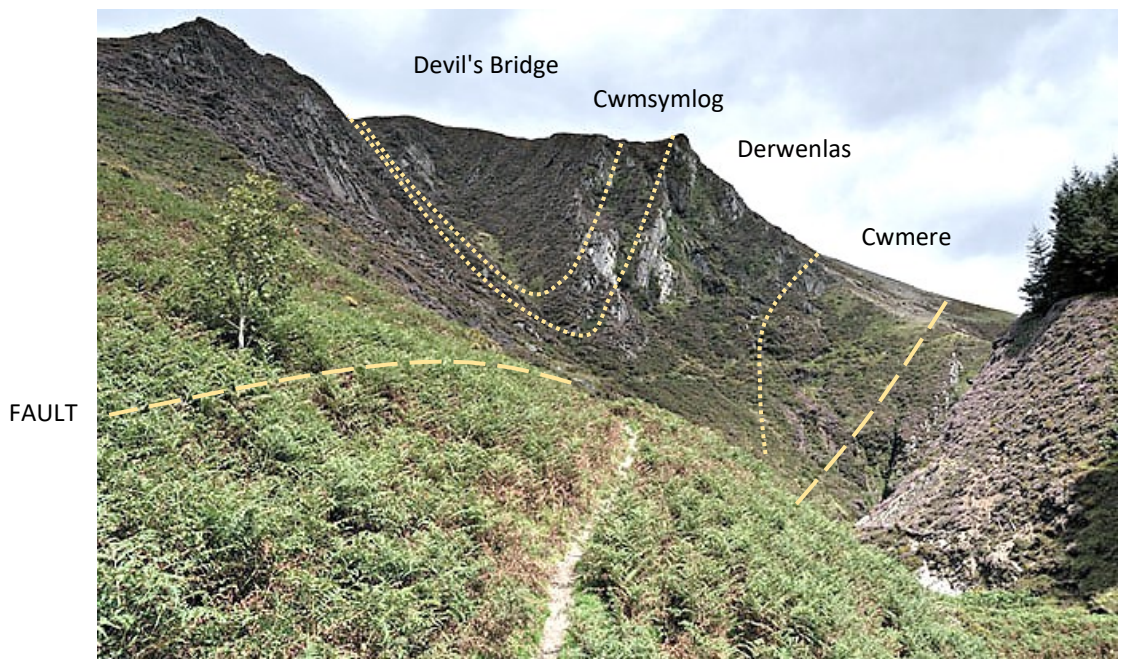


Figure 552: Entrance to Craigypistyll gorge.

Samples of the various formations can be collected and compared as you climb the path through the gorge:

The **Cwmere** rocks are dark grey mudstones with silt laminae which weather to a rusty brown. These sediments were deposited in quiet, oxygen-poor deep waters.

The **Cwmsymlog** formation is composed of fine to coarse grained sandstones which show graded bedding. Mudstone laminae are present. These rocks appear to have a proximal turbidite origin, perhaps as a result of sediment flows being discharged down a sea bed slope related to basement faulting.

The **Derwenlas** rocks are bluish grey mudstones with fine sandstones, and appear to

have been deposited by sedimentation from sea water, combined with movement by bottom currents.

The **Devil's Bridge** formation, similar to the rocks examined in the small quarry lower down the valley, is composed of laminated siltstones and mudstones which appear to have a distal turbidite origin.

We consequently find a mixture of: beds formed by quiet sedimentation in the deep waters of the basin; sediments moved and redeposited by bottom currents; the products of local turbidite flows, possibly down a fault controlled sea floor slope; and the products of turbidite flows originating from a more distant shelf source on the axis of the Welsh basin.

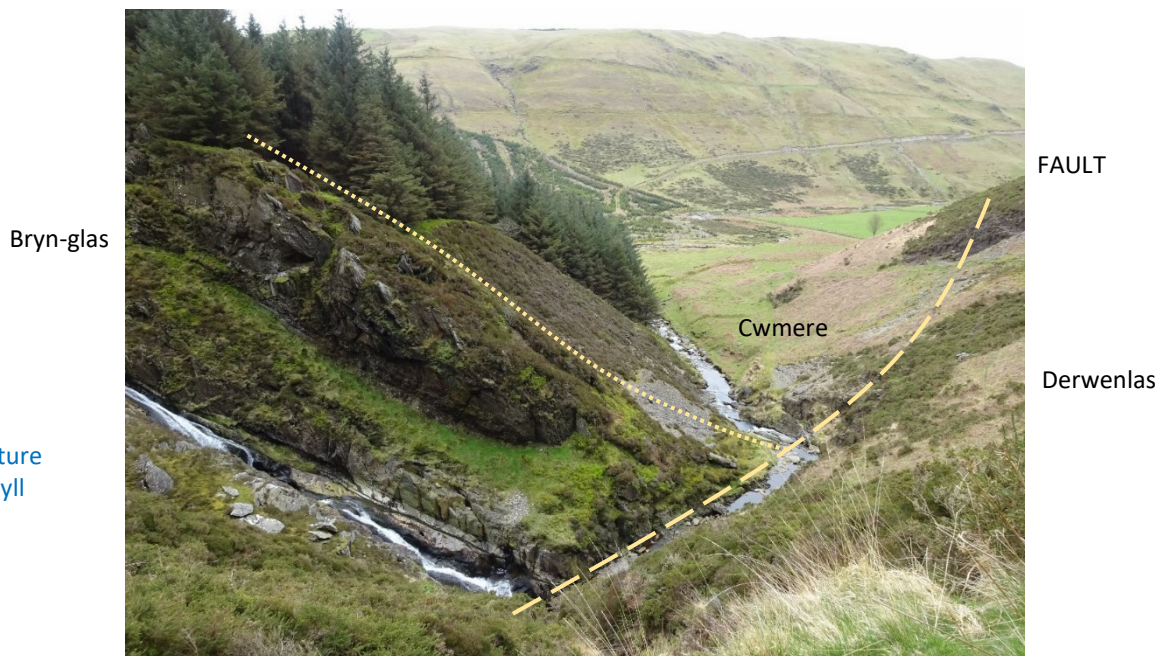


Figure 553:
Geological structure of the Craigypistyll gorge.

3: Ascend the path through the gorge, then continue around the hillside to Llyn Craigypistyll.

4: From the lake, take the gravel track which runs northwards to Banc Sychnant and then through Bwlch yr Adwy.

5: The return route passes close to the Bwlch-glas lead mine which is described in chapter 22. A detour can be made to explore the mine site if time permits.

6: Crossing the hill of Bryn Brith, the track descends along the valley side to re-enter the village of Elerch Bont-goch.