# LLANBADOC GEOLOGY TRAIL

**Expanded mobile version**

*This is an extended version of the trail leaflet for those who want to know more.*
The trail can be walked from Maryport carpark in Usk, Cefn Ila Woodland Trust car park or Llanbadoc Island car park.

The trail is on public/permissive footpaths which can be slippery and rough underfoot so **stout footwear** is essential. There are 2 ups and downs of **moderate steepness**. Do not approach high quarry faces as they can be unstable and trees or rock could fall and seriously injure you. Some of the stiles are dog unfriendly, those in Cefn Ila are not. **Please stick to the country code** and follow the waymarkers.

The whole trail is 5.6km or 3.5miles and will take 2-3 hours, but there are a couple of short cuts on other public footpaths.

The trail may be joined at Llanbadoc, Cefn Ila or Usk. Refreshments in Usk. Toilets in Maryport car park in Usk. There are picnic benches in Cefn Ila , The Island Usk and Llanbadoc Island .Take water or better still a picnic with you. Hand lenses useful.

Start: Car park at Llanbadoc Island SO377 000
MapOS Explorer152


*The trail starts at Llanbadoc partly as our tribute to **Alfred Russel Wallace** who was born close-by. Darwin noticed that small differences between species allowed some to survive better than others in different conditions. Wallace added that species varied even if the conditions were identical if they were isolated from each other. So if a new barrier developed then the same species would evolve differently in the now separated areas, giving a clue as to how continents were joined up in the past. His work in Malaysia allowed him to identify an ecological line between species of Australasia and Asia, subsequently known as the Wallace Line, a fair approximation of the tectonic plate boundary between the Australian and Eurasian plates.*

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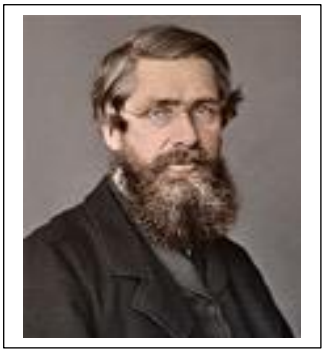


Very few children in Usk had stones in their gardens that were full of fossil shells as Wallace did. We can only guess how it influenced him or how thrilled he might have been that he contributed to the theories explaining why those shells were in those rocks.

***How do these rocks around us form?***

*When land is weathered,older rock is broken down to mostly sand and mud and deposited by wind or water to form new sedimentary rocks. Small changes in conditions can lead to separate flat bands of rocks called **beds** being laid down on top of each other like a pack of cards, the oldest being at the bottom. These sediments*

*and any plant or animal remains( **fossils)** get buried deeply ( at least 1.5km) and any water is squeezed out to form new rock. Sometimes it may be brought back up to the surface by movements of gigantic pieces of the Earth's crust, called plates, which crash into each other swallowing oceans and thrusting mountains up, or rift apart creating new basins and oceans.*

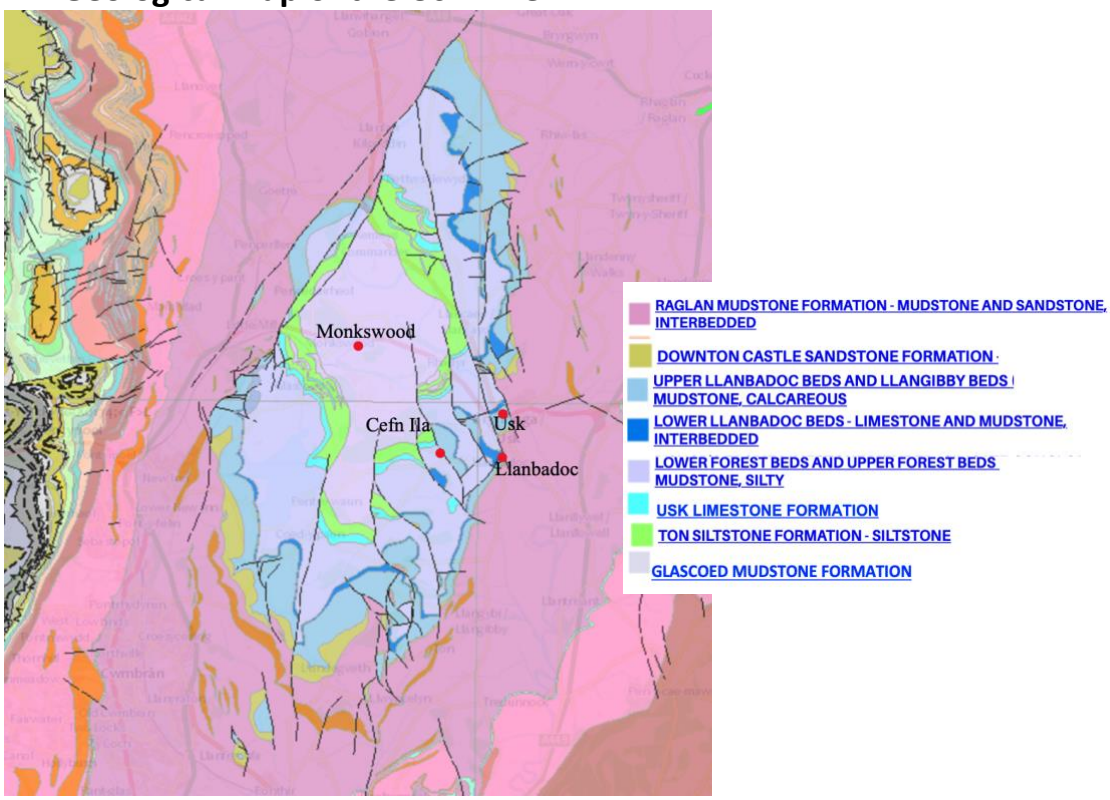
**1 *LOOK across the river*.** These rocks have weathered quickly and form the level ground of the East bank. They are the red rocks of the Old Red Sandstone Formation. Behind you the higher, hilly ground leads to the top of the dramatic 30m high cliff running up to Usk.

Llanbadoc Cliff from the river Usk

If you look at the geological map below you will see an irregular oval, cut off by a fault at the top. This is the ***Usk Inlier***, a dome of older **Silurian** rocks surrounded by younger ***Old Red Sandstone*** ones, with the top worn away to reveal the older rocks in rings, oldest in the centre.

*Geological time is divided into periods, and Silurian is the name used internationally to describe a period lasting from 443.8Ma-419.2Ma (Ma=millions of years ago). It was named after the Silures, the Roman name given to the welsh tribe that lived in South East Wales. There is a Silurian fort above the house on the cliff, Twyn Bell.*

**Geological map of the Usk Inlier**



*The continents move around the globe on floating plates of crust and 430Million years ago( Ma) in the Silurian period our plate (Avalonia)was 30° south of the equator (about the latitude of Brisbane, Australia, today) and was rushing northwards (at 2cm a year) to collide with Scotland which was on another plate (Laurentia).*

*Our continental plate, known internationally as Avalonia was named after Avalon in Newfoundland (also on our plate at the time).Avalon was the name of King Arthur's mystical land which curiously enough was first mentioned by local boy Geoffrey of Monmouth in 1136.*

*Sands and muds from Avalonia were laid down in its surrounding sea for millions of years and when deeply buried became rocks. Sea levels were high at this time but were starting to fall, and as the continents collided around 425Ma, the land rose. This means that the depth of water here varied. Muds were deposited in deeper,quieter water, sands in shallower water. As Avalonia drifted further north, the seawater warmed enough to start depositing limestones, including small reefs on a carbonate platform. When Avalonia and Laurentia slid together, the sea became* ***land*** *with large deltas of sand and mud being brought down from the new mountains to the north. These deposits became reddened due to iron in the sediments drying in the heat and oxidising(rusting), becoming the rocks of the Old Red Sandsone Formation.*

For a map of the Silurian world http://www.scotese.com/images/425.jpg
For a bit more detail of the different types of Silurian rocks, see the last page
https://en.wikipedia.org/wiki/Welsh_Basin for more on plate movements

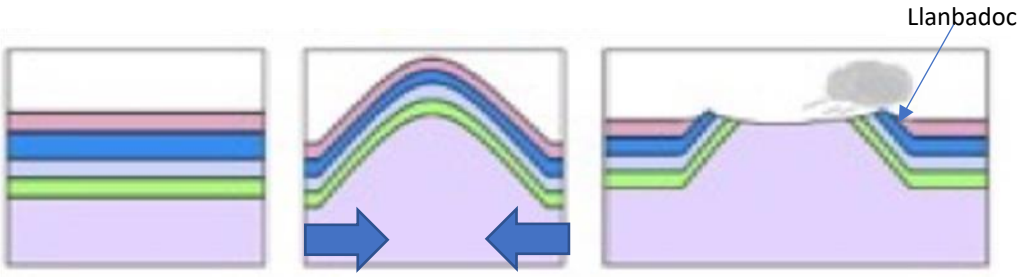
**Turn left out of the car park and walk up to the main road. Turn right to walk by the church and cross by the church tower(2) when safe.**
**Take the path opposite up the bank and stop.**

A Look at the rocks on your right. These bluish rocks have steeply dipping beds and are of the tough Lower Llanbadoc Limestone. It is not a pure limestone as it contains a lot of mud and silt.You can see fossilised little branching bryozoans and corals , and some sparse brachiopod shells. Along the cliff there are several big quarries, some of which were quarried in Roman times for roadstone and mortar. The steep dip of the beds is the clue to the next part of the story.

Steeply dipping
Llanbadoc
Beds

A bryozoan fossil, a small animal that lives in colonies. Each of the tiny compartments contained an individual creature.

The inlier rocks only pop up here because **300 Million years ago** (**Ma**)there was another collision with a continent to our South (Variscan orogeny). These rocks were folded and pushed up into a **dome**.

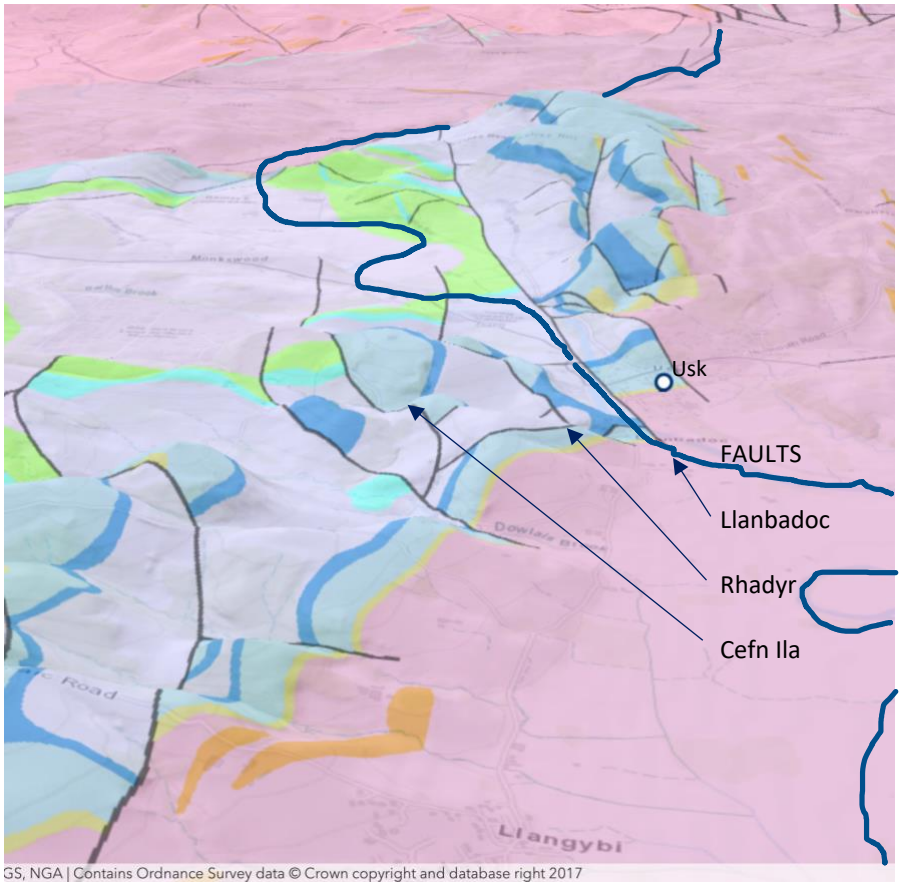



So these rocks are **OLDER** than the ones on the other side of the river even though those younger rocks are now lower. They have been tilted up steeply by huge forces. They formed in a rapidly filling sea, getting less muddy and more sandy towards the top as the continents slid together, closing the sea and raising up the new land.
*The range of f**ossils (a fauna)** found in these beds allowed geologists to work out the rock's **age** compared to other rocks both above and below them but also compared to those in other parts of the world. So Avalonia (here) used to have a different range of fossils than Scotland (on Laurentia) did until they collided then they mixed and evolved to be more and more alike. This helps work out where different continents were, and when they collided.*
The oldest rocks in the dome ( 428 million years old) are soft mudstones and form slightly lower ground in the middle near Monkswood. Tough sandstones tend to form the highest ground of the rim with the limestone below forming the slopes. The limestone here has been quarried since Roman times.

**3 Continue up the footpath onto the top of the cliff, past the gate where the path turns sharply up and cross the next stile. We are now on a level set of long fields. Keep to the right (East)side of the fields .Through the trees you can see Usk on the other river bank far below . Go straight ahead.**

After the formation of the dome which raised the rocks up, the top wore away and 50Ma later it got stretched and sliced up when the new continent (Pangea) rifted apart forming the Atlantic ocean.This led to cracks called faults cutting the dome in a

north-south direction. The damaged rocks tend to be eroded more easily. Looking down through the trees you can see the effect of the Llanbadoc fault, which has been exploited by the river and has helped form the cliff.




BGS 3D http://mapapps.bgs.ac.uk/geologyofbritain3d/ to move this image around

3.As you walk up through the fields at the second stile, the Skirrid pops into view in the distance, then the Sugar Loaf to its left. These are both of Old Red Sandstone. If you look back you will see the long wooded ridge of Wentwood, also of Old Red Sandstone.

View from 3.

4 **For the shorter route**. Carry straight on. You will pass a stile heading down the cliff on your right but this path is very steep, so ignore this and carry straight on until you come to the next stile .
Cross this stile, and you will pass an old limestone quarry on the LEFT. **Do not go near the faces**

The beds here are the Lower Llanbadoc Beds. They seem flat but if you move past the exposure and look back, they are actually quite tilted. You may also notice a lot of holes in the faces as if the rock has been dissolved away. **It Has.** Limestone is slowly dissolved by rainwater which is slightly acidic, even though its tough. Look across at Usk Castle. It is on another slice of the inlier on the Lower Llanbadoc. Take the path now down into Usk. Join the main route after crossing the footbridge, turn right over the second footbridge into the field. Follow the right hedge to the houses and the road, back on the main route.

Quarry in Llanbadoc beds on shorter route

5. **For the main longer walk,stop where the stile appears on your right. Take a left turn up through the middle of the field past the transmission poles and up to the next 2 gates. After the first gate,stop.**

You are now crossing the line of the **Radyr fault**. There are loose pieces in the field which contain fossils of the Forest beds. Have a look. The commonest ones are shells called brachiopods though over 130 different fossil species have been found in the rocks of the inlier.

Brown grey siltstone of Llangibby Beds

Blue grey Lower Llanbadoc limestone

Orangey crinoidal Usk limestone

**6 Cross the next stile now . Walk across straight ahead across the next field. Ignore the farmer's track. Then go through the gate into the next field, walk through the centre of this field (single file)to another gate and walk up by the hedge on your right (North).**

7.There are great views of Wentwod to the east, ridges of the inlier to the south and the coalfield to the west. It doesn't look much like a dome . This is because the centre of the dome has the oldest rocks but they are some of the softest. Some of the outer rocks Llanbadoc and Llangibby beds) form the closest wooded ridges .

*The long ridge of Wentwood to the East is of a tough sandstone from a younger part of the ORS. It was folded up by the same movements that formed the dome. The ridge of the coalfield in the West was also folded, but folded downwards into a basin, so younger rocks called Carboniferous rocks (360- 350Milliion years old) including the coal measures formed there. The lower part of the ridge is ORS again.*

ORS has us surrounded.

8. **At the end of the field walk straight down through the farm yard(beware tractors), then enter through the gate opposite and take path down to the drive of the Woodland Trust's Cefn Ila. Make a short detour up the drive (right) to a face of mudrocks on the right.**

**Stop and take a look.**

*The house is long gone but there are the remains of the walled garden the lake and even the old garden terrace in the trees. There is a fine arboretum. To add to the romance ,the original owner was a friend of Shelley and brought cedar cones from Shelley's grave to grow here in his garden……..*

B There is an exposure of the Llangibby beds on the drive. They are thin beds of mudstones and wider ones of fine sandstone, dipping to the South East as expected. They should be older than the rocks at A but the fossils show they are **younger**.*They have been dropped down by extension on the faults*.
They are very different to the rocks we will see next.

*Cefn Ila house became the local maternity hospital before being abandoned and burning down.*

9. **Go back down the drive and take the first path on the right. It leads steeply towards the pond. Turn next left by the bench and next right at the crossroads of the paths to the information board by the tubular bells.**

C

**The Usk Limestone**.These Wenlock age rocks look orangey and are rough, knobbly and hard. This is the remains of a coral reef full of fossil sea lily pieces (crinoids), corals, bryozoan bits along with some braciopods and trilobites (over 40 species have been found). Take a look at the loose pieces.
It is older than the mudstones and siltstones we have seen so far.

*It was formed in shallower water that was still and clear at a time when there was a generalised drop in sea level.*
*It was quarried here for use as fertiliser or for mortar.*
*It weathers to a brown colour but fresh surfaces are pale grey with tiny pinky crystals. These are calcite crystals mixed with iron which when exposed to the air becomes oxidised to a rusty colour.You can see clumps of crystals weathered out on the surface. The tyre shapes are crinoid stems.*

10.**Having investigated the Usk limestone, go back to the path and head right. Follow this path to the kissing gate and a stile. There is a path on your right but ignore this. Head for the clump of trees ahead to a stile which comes into view on your right. Cross into the woodland to a stile into the next field. This can be slippery when wet.**
**11. Stop when you can see Llancayo windmill and the Sugarloaf.**

D *This is another great view. The Usk valley follows the Llanbadoc fault, but here that's not the edge of the inlier*

We are looking North. The centre of our dome is around Monkswood, just to the left(West) of the prominent line of black poplars. But there is a ridge North of Monkswood which is nothing to do with the dome. It is the gravel and sand material dumped by the Usk Glacier at the end of the last ice age and marks the Southerly edge of the last ice sheet 20,000years ago. It is called a moraine.


Behind Llancaeo mill there is a row of wooded hills running down the right (east) side of the Usk valley towards us. Have a look at the map and you will see they are topped by the tough rim rocks of the inlier, but cut by faults. You may spot Usk castle as the last one appears.

12. Continue along the trees , into the next field, turn right up the lane, then left **before** the gate and go straight down by the hedge until you come to another stile. There is an enormous beech tree on your left. Carefully walk up to the right of it as just beyond it is a quarry in the Lower Llanbadoc Beds.

DO NOT GO NEAR THE FACE, but if you look from a distance you will notice a band of lumpier rock about a metre from the bottom. This is a more concentrated limestone band where the limestone has formed hard nodules.

13.**Continue on the path down left roughly parallel to the stream. Cross the stile ignoring the footbridge on your right. The next stile crosses a footbridge into a field. Walk by the hedge, right, to the path to the road. Cross carefully and turn right up the steps by the brown sign. Walk past the children's playground along the river.**

You can finally see the Old Red Sandstone – in the bridge. Now at the bridge you can stop for refreshment or visit Wallace's statue in Castle Square before returning back over the bridge(be very careful crossing the road) to walk by the river back to Llanbadoc.

As you pass the rugby ground, look for the last house ahead of you under the cliff. This is Kensington House, where Wallace was born. There is a bench opposite the house on the embankment dedicated to his memory, and ahead, a memorial in the churchyard.

Wallace was fascinated by the Natural World and we hope that our journey through continental collisions and coral seas, desert plains and an ice age all in the space of an afternoon is a fitting tribute.

Any queries about fossils, feedback or suggested additions to this leaflet then please email
https://swga.org.uk
Elen Statham , SEWRIGS, 2022.

# Stratigraphic column of the beds of the Usk Inlier

| | Stage | Borders names | Usk names | metres | lithology or type of rock | Approx. date Ma |
|---|---|---|---|---|---|---|
| Part of the SILURIAN PERIOD | Ludlow | Upper Whitcliffe<br>Lower Whitcliffe | Upper Llangibby<br>Middle llangbby | 6-8m<br>36m | Sandy<br>silty | 423 |
| | | Upper Leintwardine<br>Lower Leintwardine | Lower Llangibby<br>Upper Llanbadoc beds | 5-7m<br>21-46m | Fossiliferous-decalcified<br>silty | |
| | | Upper Bringewood<br>Lower Bringewood | **Lower Llanbadoc**<br>Upper Forest-fossiliferous | 58-85m | **Fossiliferous-calcified limestone**<br>**Fossiliferous-** decalcified siltstone | 425.6 |
| | | Elton | Lower Forest beds | 198-214m | silty | |
| | Wenlock | Wenlock limestone formation | **Usk limestone formartion** | 0-12m | **Reef limestone and overlying bedded limestone** | 427.4 |
| | | Coalbrookdale | Glascoed mudstone and overlying Ton siltstone | 244m | Muds and silts | |
| | | | | | | 433.4 |