The Llanbadoc geology trail **Elen Statham, Spring 2020**

This report is an account of the efforts to date to establish a geololgy trail on public footpaths around Llanbadoc, Monmouthshire.

The idea for the trail came from a series of events over a few years. Firstly, as a keen amateur geologist I was always a bit sniffy about our local offerings as not being dramatic enough for my attention. I was interested in every aspect of geology- apart from palaeontology. Over 20 years ago I was told by a colleague at work that he used to take his son to Llandegfedd dam to look for ammonites. It was another 10 years before I realised that he probably meant *trilobites* as the strata are Silurian in age. It was about 5 years ago after a need to convalesce that I thought I would take a look at these fossils to stop me watching endless daytime TV. My main discovery was that these fossils are pretty to look at and pretty plentiful in certain places - not to mention being important in the elucidation of the theory of evolution and paleogeography. I was also struck by the fact that despite my children going to school locally there was no mention in the curriculum of any of our local geology. In fact there was no mention of it anywhere, except for a small display case in a corner of Newport Museum.

When I retired, I became a member of the local RIGS group and became aware that part of the remit was public education. I started to walk a lot more which led to my next discovery - beautiful Cefn Ila- which had recently been acquired by the Woodland Trust and fitted with a carpark and a circuit of footpaths. And there was an odd looking exposure in the middle of it. By this time I knew a bit more about the mysteries of the Usk Inlier and aware of the geological story it told. The enthusiasm of the South East Wales RIGS group in clearing the exposures and for developing the project meant that a trail became a possibility. Though there is no spectacular geological treasure on the trail, it is a beautiful walk with a good story that will hopefully inspire a new audience.

Photo : 1 Panorama North from Coed Duon.

It starts as all good adventures do, with a map.

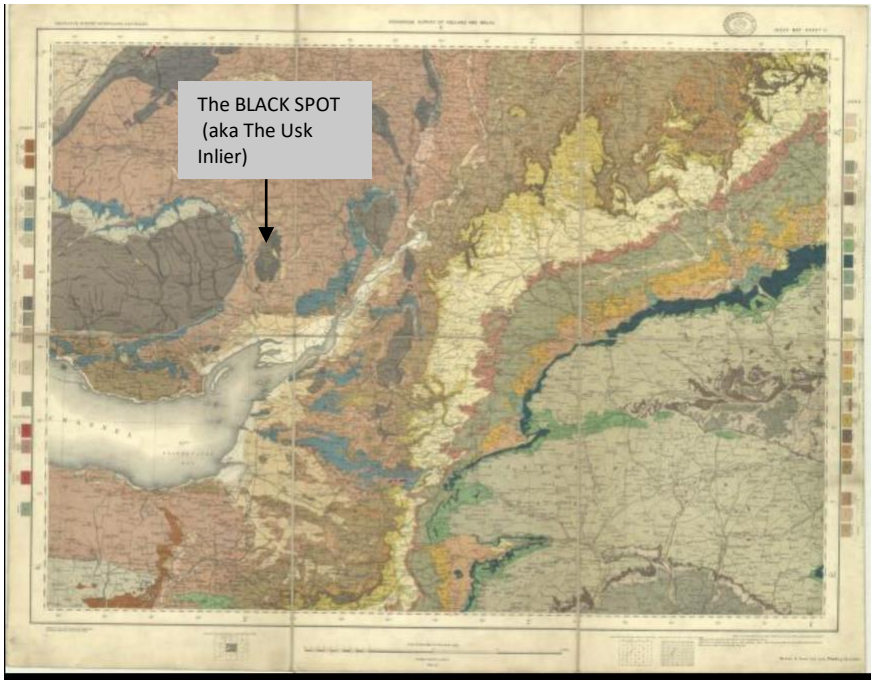


Photo 2: Photo of the 1901 map Gloucester (copyright BGS The Usk Inlier is the Black Spot. I know. Collective groan expected.)

The walk is on part of the Silurian Usk Inlier, one of a series of borderland inliers of Wenlock to Ludlow age (433.4-423Ma).

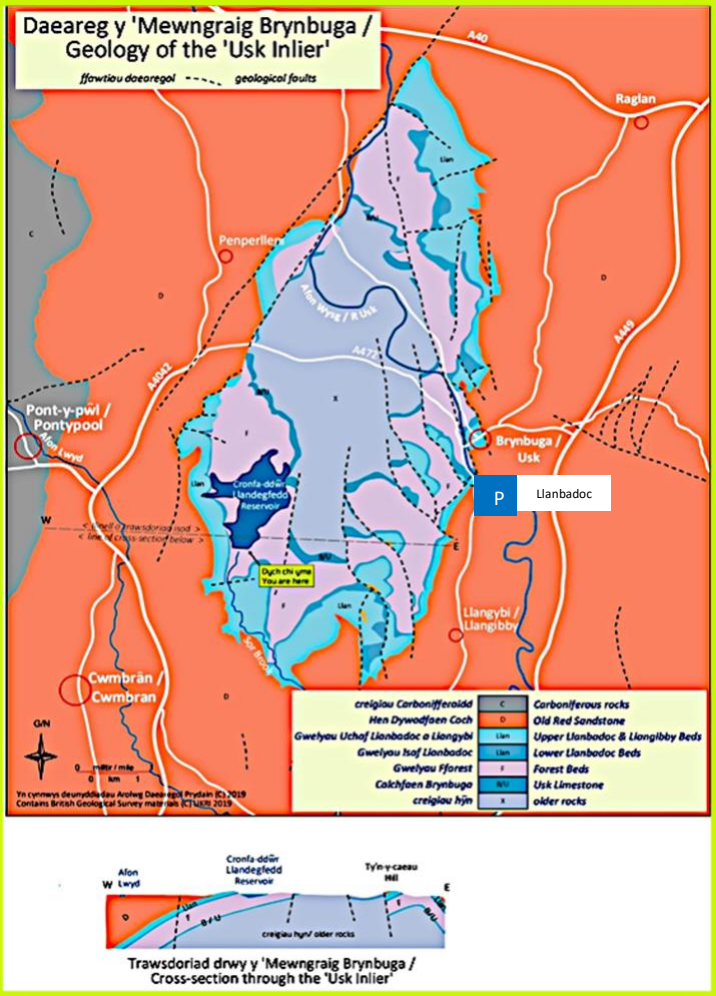
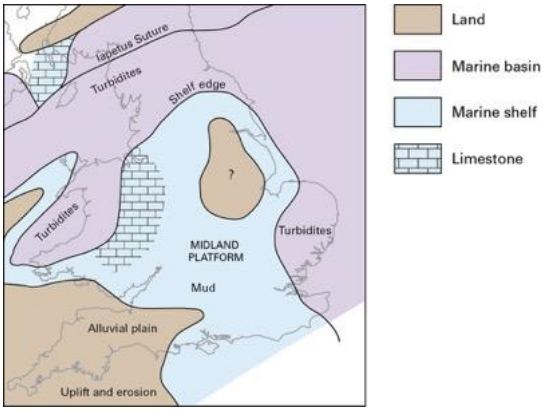


Photo 4: Strat column

Series	Formation	Local Names (Walmsley 1958)	metres	Interest
Ludlow	Upper Whitcliffe Lower Whitcliffe	Upper Llangibby Middle llangbby	6-8m 36m	
	Upper Leintwardine Lower Leintwardine	Lower Llangibby Upper Llanbadoc beds	5-7m 21-46m	Fossiliferous-decalcified Steep dip
	Upper Bringewood Lower Bringewood	**Lower Llanbadoc** Upper Forest-fossiliferous	58-85m	**Fossiliferous-calcified limestone** **Fossiliferous-** decalcified siltstone
	Elton	Lower Forest beds	198-214m	
Wenlock	Much Wenlock limestone formation	**Usk limestone formartion**	0-12m	**Reef limestone and overlying bedded limestone**
	Coalbrookdale	Glascoed mudstone and overlying Ton siltstone	244m	

To be specific, the inlier is a pericline of older marine Silurian rocks surrounded by younger Old Red Sandstone rocks (still Silurian -Pridoli- but now continental). The oldest exposed inlier sediments were deposited on a relatively stable crustal block called the Midland Platform in early Wenlock times. Sea levels at this time were peaking and the area was a shallow shelf sea slowly accumulating muds from land situated to the south. This part of northern Avalonia was bordered by the Welsh basin in the northwest and the central North Sea to the east ,but its southern margin is obscured by Variscan cover.

Photo 5 Mid Silurian Paleogeography



Palaeogeographical sketch map of deposition during the mid Silurian. BGS P785837.

Avalonia had rifted off Godwana during Ordivician time and was chasing Laurentia to the north, closing the Iapetus Ocean in the process and opening the Rheic in its wake.

Avalonia collided obliquely with Laurentia by late Llandovrey time with intraplatform rifting and increased subsidence of the Welsh basin. Iapetus closed diachronously from south-west to north-east through to Wenlock time at a latitude of 25^0 south of the equator. By late Ludlow time Laurentian crust was overthrusting the British segment of Avalonia.

High global sea levels during early Wenlock time started falling, with two hiccups of greater shallowing coinciding with the deposition of the Wenlock aged Much Wenlock (Usk) limestone formation and the Ludlow aged Aymestry (Lower Llanbadoc) limestone, interrupting the now coarsening upwards sequence. The thickest reef limestones of Wenlock age formed near the Church Stretton-Pontesford Lineament at the edge of the Welsh Basin but behind this in shallow water, smaller reef limestones grew. Age and depth of deposition led to the division of the series by its facies and fauna into different formations.

There is little impact on the Midland platform from the excitement of Iapetus closure to the north in terms of deformation but the subsequent compression resulted in uplift.

The Welsh basin was rapidly filling up and the shore line was moving rapidly south eastward, coinciding with the eustatic sea level fall. Rapid erosion from newly uplifted land resulted in rivers bringing sediments down from the North to fill the shallow sea where progressively sandier, less calcareous sediments were deposited, evolving into an alluvial plain by the end of the Silurian (419 Ma). Further compression during the Acadian orogeny again had little effect on the Midland platform sediments. 130 Million years later, closure of the Rheic Ocean and collision with Gondwana caused the Variscan Orogeny, which welded together the supercontinent of Pangea. This caused far reaching deformation and the Usk pericline was formed at around this time. Subsequent rifting during the Permo Triassic as Pangea broke apart resulted in the inlier being cut by N/S normal faults.

This complex story undepins the trail, but it is not its heart. The aim here is to encourage a different, more careful view of any landscape, by asking questions such as "Why is there a huge cliff in Usk?". On first aquaintance, it is a bit of a surprise.

Photos 6 and 7 of the 30 foot high Usk cliff.

The trail starts at Llanbadoc, a small hamlet on the west bank of the Usk river at the base of the cliff, opposite the town of Usk. The cliff is actually the eastern margin of the inlier. The rocks on the opposite bank are low and the soil is red. But at the start of the trail there is an exposure of steeply dipping grey blue beds of the Upper Llanbadoc beds with fossil remains, and the soil is grey. The cliff of Lower Llanbadoc limestone has been quarried for its limestone since Roman times. It also lies parallel to the Llanbadoc fault which has facilitated erosion by the Usk river.

Photo 7 of the steeply SE dipping beds and a close up of a bryozoan.

The highest beds of Ludlow time are generally sandier and tougher than the older central mudstones so they tend to form topographic highs around the inlier e.g.Ty'n y Caeau hill. From the top of the cliff there are beautiful views of Wentwood to the South and the Black mountains to the North, both of Old Red sandstone.

Photo 8 From left:Wentwood to the South East of the ilier, Brownstones formation.Ty'n y Caeau Hill ,centre middle distance, late Ludlow beds.

The path runs across the next N/S fault to a view of the Western slopes of the coalfield whose lower slopes are Old Red sandstone again. It then leads to Cefn Ila. It was a Tudor manor, then a gentleman's mansion with an arboretum, and then a maternity hospital. It then closed, burnt down and was eventually acquired by the Woodland Trust who have restored the walled garden, the pond, and built a bat house as well as caring for the arboretum and planting hundreds of trees.

It also has an exposure of a siltstone with a different dip and decalcified fossils, and an exposure of the Usk limestone formation

Photo 9 Fragments found on the path.

Photo 10 Exposure of Usk limestone cleared by SEWRIGS group

Usk limestone –crystalline crinoidal limestone with bryozoan and coral fragments, brachiopods and occasional trilobites.

The solitary coral measures 2 cm.

Photo11 Crinoidal fragments are easy to spot.

The trail then returns to Usk by way of a path with a glorious view of the Eastern edge of the inlier, cut up by faults and dipping South Eastwards and the Black mountains (ORS). To the west there is another ridge that is nothing to do with the inlier. It is the terminal moraine of the usk glacier, and marks the Southerly edge of the last ice sheet.

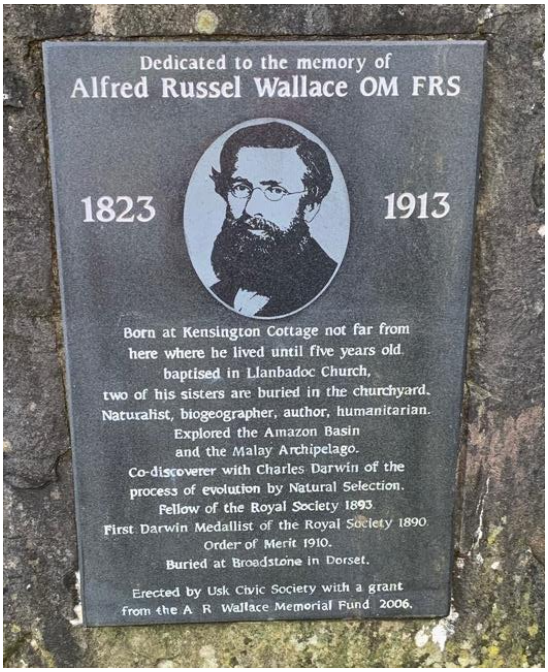
Photo 12 Inlier looking North from Coed Duon.The moraine ridge is marked.

The path passes another small quarry and returns to Llanbadoc passing Usk bridge, the only close up of the Old Red sandstone on the trail.

Photo 13 Usk Bridge

Returning to Llanbadoc on the path on the flood defences, there is a memorial bench on the path as we get closer to the church of Llanbadoc. It is dedicated to Alfred Russel Wallace

whose contribution to evolution and paleogeography we hope will not be forgotten. He was born in the house opposite the bench. There is a bigger memorial plaque near the church.



Prior to the Covid pandemic we hoped the stiles would be repaired and paths would be ready by this summer. Ramblers, The Woodland Trust, Llanbadoc Community Council and Welsh Water have all taken on to do some of the work for the project but there will now be an inevitable delay. However, I hope it will be a walk to look forward to when this latest evolutionary leap can be taken in our stride.

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