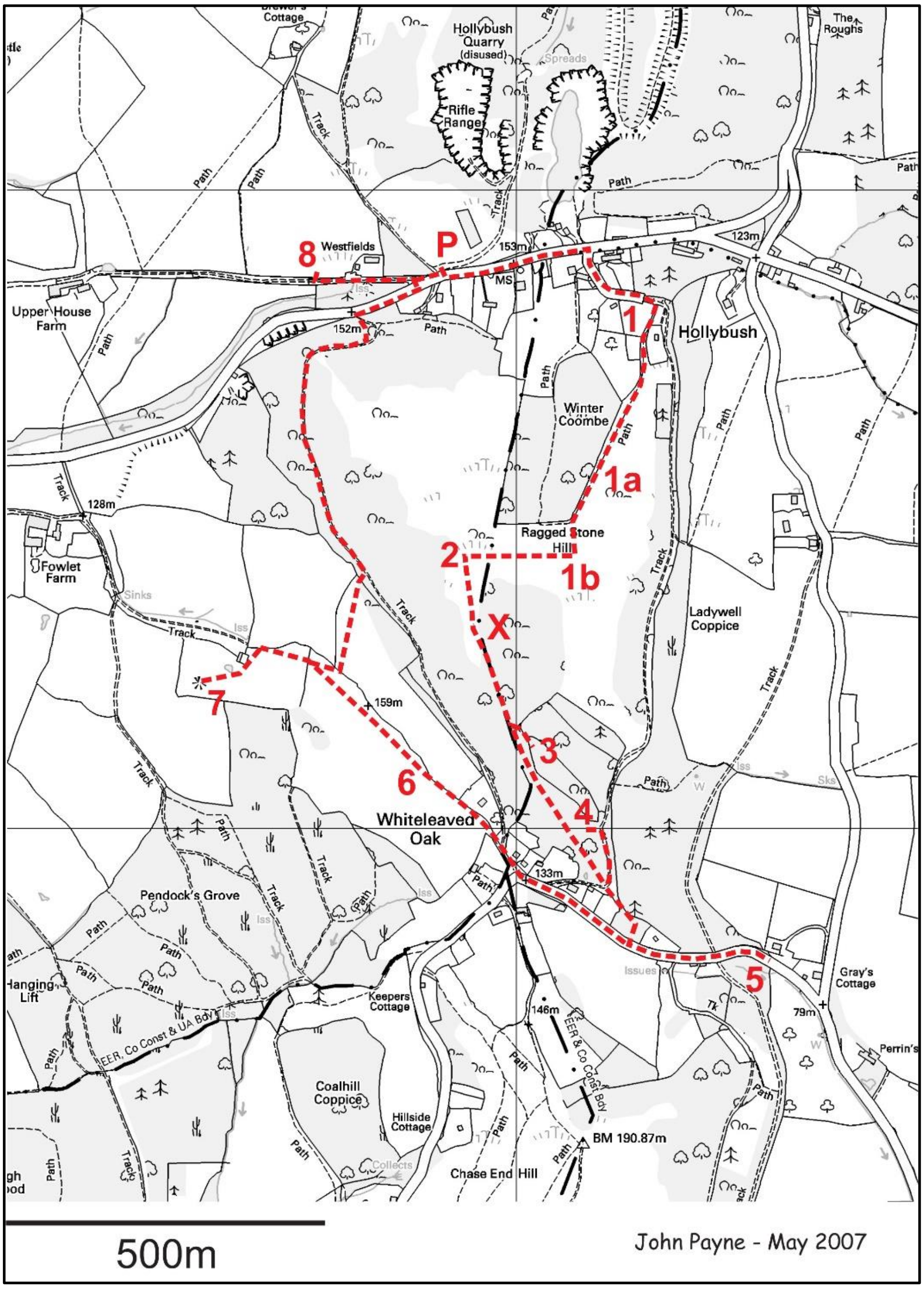
Southern Malvern Hills

Led by John Payne

5 April 2017

Map



P - Hollybush car park (SO 759 369)

We parked at Hollybush car park and John gave us a quick introduction to the walk and the Malvern Hills themselves. The walk is circular, around 7 km. in length, with one sharp climb up Raggedstone Hill. We will mostly see old rocks: the Precambrian, Cambrian and Ordovician. We are unlikely to find any fossils.

John explained how the Malverns were formed. A slab of Precambrian rock was thrust up from the east at an angle of around 30 degrees. The slab is not continuous, but is in units of around 1km long. At each section there is a fault. It is on these faults that the valleys are formed. We are in one now at Hollybush.

We walked east to Hollybush quarry itself. There is no access. The quarry itself closed in the 1960s, having been used to quarry aggregate for the motorways. There are sheer faces, so it is dangerous. The quarrying apparently stopped when they hit the earth works of the hill fort.

1 - Earth House (SO 76147 36799)

The "Earth House" is a house build into the ground. The building of it has been a long term project. What is interesting from a geological perspective is a thrust fault at the back of the house. John had previously mentioned that a thrust fault at around 30 degrees being responsible for uplifting the Precambrian slab of rocks that forms the hills. In reality the thrust fault would be formed by many smaller individual faults, of which this is one. The grinding of the rocks in the fault created a light brown clay called fault gouge. It was noticed that the rock above the fault is more broken up than that below. This is probably due to weathering and the action of frost. The rocks are Precambrian Malverns Complex, those above the fault are very rotten and those below are weathered. As the building work progresses the area is likely to be covered up in the next year or so.

Click below for the Earth House web site:

http://www.underthehollybush.com/

1a - Climbing Raggedstone Hill (SO 76143 36608)

As we climbed Raggedstone Hill John said something about the impact of glaciation on the area. Looking east we could see Longdon Marsh. In Victorian times, due to the presence of marine fossils, geologists thought this area had been inundated by the sea in the past. This turned out to be incorrect and was in fact a consequence of glaciation. In the Anglian stage, half a million years ago, ice came south as far as Gloucester. The Cotswolds were completely covered and sediments were deposited from as far away as Ireland. The Irish limestones have a distinctive pink coloration. The sea inundation theory was then discounted.

There are not many examples locally of the Anglian glaciation, but recently a water flow channel, formed at the edge of an ice sheet, has been uncovered. This was found in the centre of Malvern, during the building of new flats on the side of Warwick House.

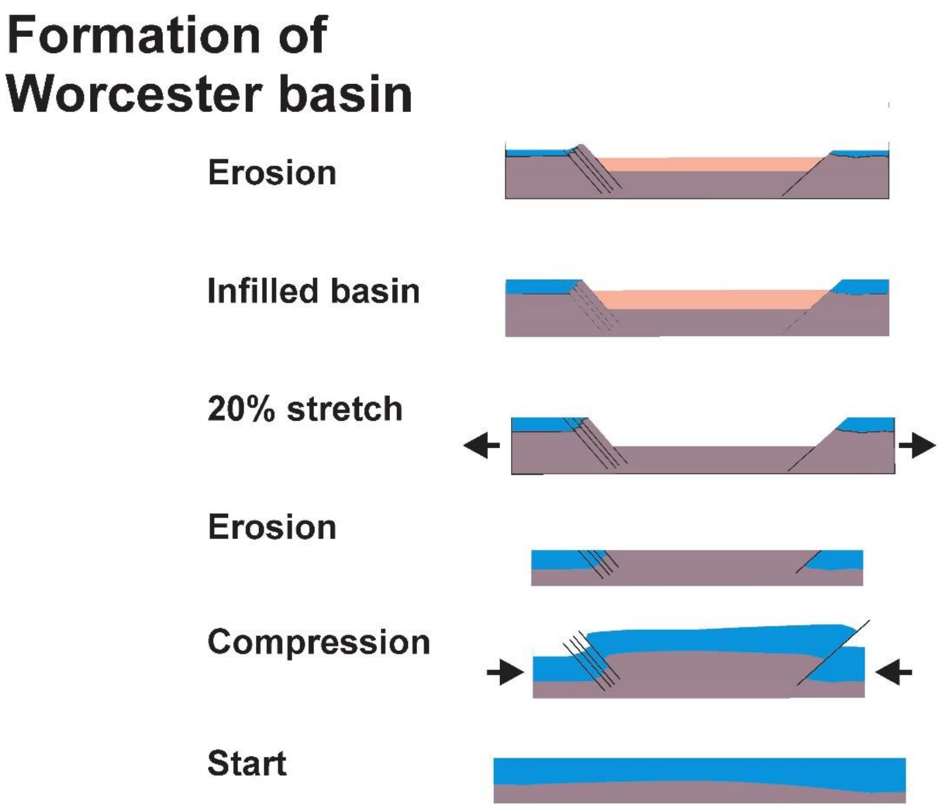
The later Devensian glaciation (20,000 years ago) did not reach the Malverns, stopping around Birmingham in the north and Hereford in the west. But, it brought down many pebbles in the outwash of the melting snow which have been an important source of gravel. Also of interest are the river Severn terraces.

Looking east from Raggedstone Hill

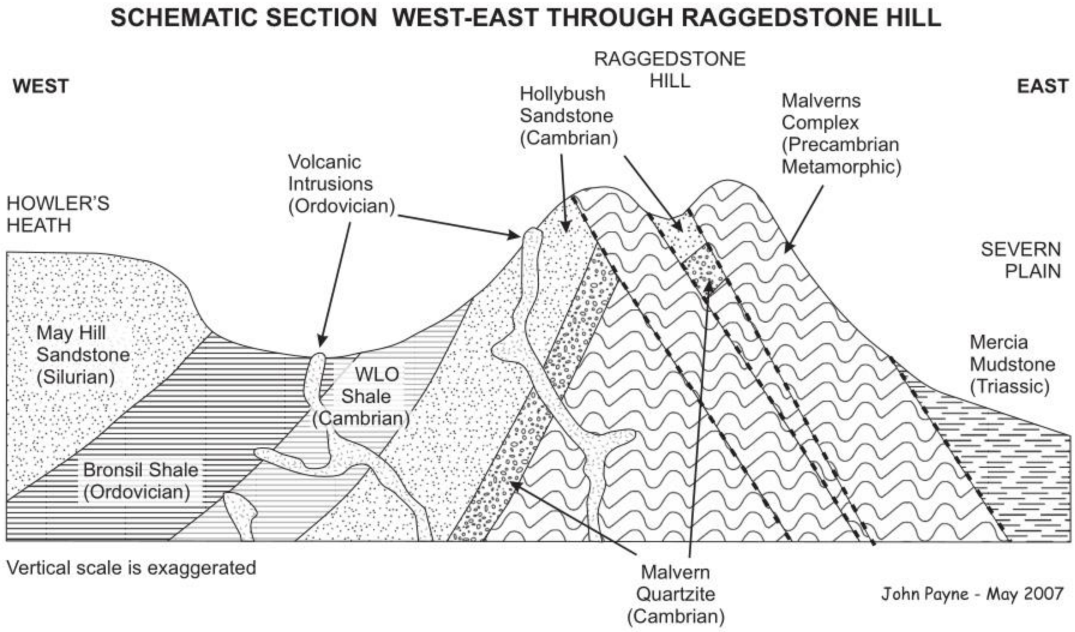
1b and 2 - Summit of Raggedstone Hill (SO 76051 36422)

As we rested at the top of Raggedstone Hill John gave us a bit more detail on the geological history of the hills. After their initial formation of the rock in Precambrian times there was substantial compression from the west. This occurred around 300 million years ago. The compression was along a north/south fault which extends a long way down, 15 to 18 km deep. It dips east from the hills, and stretches (mostly buried) from Cheshire to Dorset. The fault was initially created by two continental plates colliding at an oblique angle. This had the effect of pushing up the rocks in the middle and creating a large mountain range a few kilometres high. After their subsequent erosion there was then crustal expansion pulling the plates apart. A second fault then opened up around Inkberrow to the east creating a basin that sank. The basin was filled with sediment, maintaining its height. The Precambrian Malvern rocks didn't go down and now lay on the surface, continuing down for around 3km. There is also volcanic sediment, around 1km thick, none of which is visible from the surface (from borehole data).

All this happened, of course, very slowly during the Triassic period when the land was a sandy desert near to the equator. At the end of the Triassic the land flooded and there was deposition of marine sediments for around 150 million years. Further earth movements raised the land to above sea level. Then there was much erosion, so that what we now see looking east is approximately the landscape that would have been there at the end of the Triassic, an exhumed landscape.



We then considered the local geology of Raggedstone Hill. The Malvern Hills are around 15km long, but each of the broken sections of Precambrian material are around 1km long. Where the slabs meet there are faults and valleys created. It is interesting that at the top of Raggedstone Hill there appear to be two peaks with one slab on top of another.



In general the Malvern rocks to the north are igneous and mildly metamorphic. In the south there is more metamorphic activity, often of sedimentary material. On the top of Raggedstone there is a lot of quartz in the rocks. Note that quartz is hard, insoluble and has a low melting point.

We finally looked west. Here there are Silurian marine deposits changing into terrestrial Devonian Old Red Sandstone rocks. The rocks have been pushed together by earth movements creating an anticline. The hard Silurian limestone bands, with the softer shales in-between, have created valleys with a north-south trend.

3 - Higher level quarry on Raggedstone Hill (White Leaved Oak Quarry) (76060 36061)

John told us that that this is a historically important site, and it was here where it was proven that the Malvernian rocks were of Precambrian age (Holl 1864). The previous theory, from Murchison, was that the Malvernian rocks had been thrust through the earlier Silurian rocks, and thus were younger than them.

But here we could see a contact between the igneous Malvernian rocks and the Hollybush sandstone, which is Cambrian, and has been dated by the fossils it contains. We could see a beach formation, and a conglomerate with Malvernian pebbles. The pebbles were clearly there before the beach.

In the picture below the sandstone is to the right, the conglomerate is to the left.

4 - Lower level quarry on Raggedstone Hill (White Leaved Oak Quarry) (SO 76113 36007)

We then moved onto the lower-level quarry on the east side of Raggedstone Hill and examined the rocks in the scree. John told us that there were some nice samples of a grey chlorite phyllonite. Phyllonite is caused by the mild metamorphism of coarse rocks such as granites. There was a discussion about the difference between phyllonite and phyllite, the latter is formed by the mild metamorphism of fine grained rocks such as clay.

Examining the scree

Phyllonite

4a - Coal Hill Cottage (SO 75652 35727)

A doleritic igneous intrusion into the country rock of the Coal Hill Cottage garden. There are a number of these intrusions in the area of the hills, thought to be of Ordovician age. The intrusion is to the right of the stick, with the green moss on it.

4b - Gneiss quarry south of Chase End Hill (SO 75852 35021)

This small quarry is a good place in which to observe the effect of squeezing and subsequent recrystallization on the Malvernian rocks, producing gneiss, a metamorphic rock.

We discussed the difference between a meta-gneiss and an ortho-gneiss. An ortho-gneiss is the "traditional" gneiss, formed deep underground with the rocks subjected to very high temperature and pressure over a long period of time. A meta-gneiss is more limited and caused by dynamic metamorphism, the squeezing and squashing of rocks due to earth movements. John told us that all of the gneiss rocks in the Malverns were meta-gneiss, produces by these mechanical forces.

Chase End Quarry

An example of gneiss

6 - Shale pit and dykes (SO 75782 36169)

We walked over the top of Chase End Hill (SO 76091 35509), going North West of Whiteleaved Oak to examine one of the Shale pits. This shale is of Ordovician age and was dug out in about 2002, possibly in an attempt to find fossils. John told us there are minute traces in Uranium and Gold in the shale.

We then walked over the field to the ancient Oak Tree. In the field there were a number of Ordovician dyke intrusions, these stood proud from the surrounding Ordovician country rock as they are less susceptible to erosion. The ancient tree is growing in a spilitic andesite quarry. This rock is an Ordovician submarine intrusion, as were the ones in the field, but had a different composition.

North of 8 - Hollybush Road Cutting (SO 750 366)

We went to examine the road cutting on the A438, half a kilometre west of Hollybush. Here we saw an exposure of Cambrian Hollybush sandstone with Ordovician doleritic intrusions into it. At the boundary of the intrusion John pointed out where the sandstone had been baked and turned into quartzite. Also pointed out was surface spheroidal (onion skin) weathering of the dolerite.

John at the junction between the Hollybush sandstone and the intrusion

Richard Newton