Malvern U3A Geology Group

A Field Trip to the Huntley area – 3 July 2019

Fourteen members of Malvern U3A Geology Group travelled by car-sharing to the Leaf Creative Garden Centre, Ross Road, Huntley, GL19 3EX to meet our Guide John Moseley from Gloucestershire Geology Trust (GGT).

After coffee we set off, past Huntley Church (Grade I listed) and Huntley Primary school to the Huntley Quarry Geology Reserve. This was officially opened in 2007, and was the first geology reserve in Gloucestershire. The reserve and its surrounding woodland cover an area of 0.87 hectares. It is owned and managed by Gloucestershire Geology Trust.

Much of the following has been extracted from an article, by John Moseley, (published in the Newsletter (No. 246) of the Black Country Geological Society in December 2017) and John's field notes produced for our visit.

Location and Geography

Huntley Quarry is situated just north of the A40, approximately 400m west of the Leaf Country Garden Centre on the southern slopes of Bright's Hill. Hobbs Quarry is approximately 2km further west, south of the A40 and north of the village of Longhope.

Huntley and Hobbs Quarries are surrounded to the north, south and west by low undulating hills covered in a mix of woodland and fields, and they sit at the southern end of a roughly southeast - northwest trending belt of high ground. This includes May Hill to the northwest of Huntley Quarry and Bright's Hill. The high ground continues in this direction to the Woolhope Dome approximately 20km (12.5 miles) away near Hereford.

To the east the ground falls gently into the Vale of Gloucester and the Severn Valley, through which the River Severn flows on its southward journey to the Bristol Channel. On the far side of the Severn Valley lies the western escarpment of the Cotswolds.

The Huntley Quarry Reserve contains three quarries:

Acker's Quarry is a small, newly conserved, site, which exposes Triassic Bromsgrove Sandstone sediments, some 237 – 228 million years old. These sediments were probably deposited in a river or estuary that flowed across the deserts of the supercontinent Pangaea.

Bright's Hill Quarry (not visited) was re-exposed in March 2007 and can be found to the back of Huntley Quarry. Exposed here are Early Silurian (Huntley Hill Formation) siltstones and sandstones, dating from 436 – 428 million years ago. These sediments were probably deposited in a shallow marine environment bordering a landmass called the Midlands Platform.

Huntley Quarry is the main quarry within the reserve and is described as a 'geological gem' – see below.

Geology – Structure and Setting

The rocks and landscape around the Huntley and Hobbs Quarries hint at much structural deformation having occurred in the past. Huntley sits at the junction of two major structural features:

- the southern extension of the approximately north-south trending Malvern-Abberley Axis characterised by the East Malvern Fault, known locally at Huntley as the Blaisdon Fault. It is downthrown to the east and has been subject to several stages of movement over time.
- the south-easterly-trending Woolhope-May Hill periclinal-anticlinal Axis which trends towards the northwest from Huntley, through May Hill and northwards to the Woolhope Dome inlier. A valley separates this feature from the Malvern-Abberley Axis to the east. Hobbs Quarry is situated on the western limb of this structure.

The most significant movements on the East Malvern/Blaisdon Faults during the Triassic were trans-extensional, resulting in normal movements and forming the Worcester Basin, or Worcester Graben, to the east. Today this feature is seen as the Vale of Gloucester and the Severn Valley.

However, not all movements along the Blaisdon Fault were normal. The landscape north of Bright's Hill and the geological map, show a clear area of low-lying ground comprising Triassic rocks offset to the west of the Blaisdon Fault and the Malvern-Abberley Axis. This off-set has been interpreted as listric faulting, which is characteristic of strike-slip duplexes. However, limited exposure in the area makes determining the nature of faulting difficult and open to debate.

The May Hill Anticline generally comprises Silurian strata with a core of Llandovery Series rocks that progress upwards through the Wenlock and Ludlow Series. The limestone strata seen in Hobbs Quarry are Gloucestershire's equivalent of the Wenlock Limestone and form the western limb of the anticline, dipping away to the southwest at approximately 25°.

Geology - Stratigraphy

The rocks of the Huntley area range from the Palaeozoic to the early Mesozoic and include examples of Ordovician, Silurian and Triassic strata. No superficial Quaternary or more recent deposits are present in the Huntley and Hobbs Quarry area. However, glacial and river terrace deposits are present covering the bedrock geology of the Vale of Gloucester and the Severn Valley.

The Cotswold escarpment, forming the horizon east of the Vale of Gloucester and the Severn Valley represents Lower and Middle Jurassic strata that once covered this area prior to erosion. The escarpment strata comprise mudstone and oolitic limestone and include the famous Bath Stone as a capping rock.

At the local scale, Huntley Quarry is the only known exposure of the Huntley Quarry Beds, recently dated by the BGS using acritarch and chitinozoa microfossils to be Late Ordovician to Early Silurian (445 – 439 million years old).

The Malvern U3A Geology Group Visit

The first exposure visited showed sub-horizontal sandstones and siltstones typical of the Huntley Quarry Beds. They are predominantly immature fluvial sandstones with an arkosic to sub-greywacke character. They are termed arkosic because they contain fresh felspar, in other words erosion and deposition were rapid as the felspars have not weathered and are still fresh.

They are also termed volcaniclastic sediments as they contain clasts of volcanic-derived material, lava and ash-fall deposits. They can contain some shale clasts indicating that earlier finer-grained sediments, deposited during tranquil conditions, were ripped up and mixed with later coarser-grained sandstone when flood conditions prevailed.

Figure 1 Exposure (1) - horizontally-bedded Huntley Quarry beds

Figure 2 Exposure (2) - vertically-dipping Huntley Quarry Beds

At exposure 2, a matter of 10 to 20 metres away the same sediments were seen but this time similar coarse sandstones showed a sub-vertical dip. Vegetation obscured

the intervening geology and the structural relationship between the two sites could not be determined.

At exposure 3, the Blaisdon Fault, part of the East Malvern Fault Complex, is clearly displayed. Horizontally-dipping Ordovician Huntley Quarry Beds (HQ Beds), on the western (LHS) side of the exposure are separated from flat-lying Triassic Mercia mudstone rocks by the steep, easterly-dipping Blaisdon Fault.

A number of observations were made:

- A fault breccia has been formed along the fault plane. Note the angular fragments just above the hammer in the photo below.

Figure 3 Exposure (3) – Fault Breccia developed on the Blaisdon Fault in Mercia Mudstone Beds

- Water has always flowed/seeped from the fault vein, but when the fault plane was cleared and exposed some years ago, using a backhoe, water squirted out at a high pressure. This water flow has reduced the weathered and fractured

Mercia Mudstone to mud which has since flowed and obscured much of the contact.

- Malachite (green copper carbonate) was observed to the east of the fault plane within the Mercia Mudstone. This is known as red bed mineralisation. It is not uncommon in continental sandstones such as the Mercia Mudstone and it results from the transport of base and precious metals in solution by saline sub-surface waters. The metals are precipitated when the waters encounter zones with different geochemical conditions and the metals can no longer remain in solution. A minor occurrence of gold, presumably of similar provenance is also known to exist along strike to the north.
- At Exposure 3, if you follow a particular HQB horizon from west to east it steepens in dip until it is near-vertical. Folding has been induced in the HQ Beds adjacent to the Blaisdon Fault by movement on the fault dragging the HQ Beds in the direction of the fault movement – a drag fold. In this instance the HQ Beds on the west would have moved downwards and the fault would be a reverse fault.

Figure 4 Exposure (3) – Drag-folded Huntley Quarry Beds

However, the situation is not so simple. The Blaisdon fault separates the older Ordovician Huntley Quarry beds on the west from younger, Triassic Mercia Mudstone Beds to the east. Although the structural observations of drag-folding at Exposure 3 clearly indicate downthrow to the west, later movements along the reactivated fault

indicates downthrow to the east - the overall structural setting of the Blaisdon/East Malvern Fault system

This reactivation is often seen on large faults with translational movement and probably reflects continued movement over a long period of time with different senses of movement being created as a response to different tectonic regimes.

The Blaisdon Fault has moved in different directions over the course of its long history, displaying several phases of global tectonic plate movements from the closure of the Iapetus Ocean, the formation of the supercontinent 'Pangaea', and the subsequent pulling-apart of that landmass. These movements can be seen to affect the bedding and sediments, as well as the overall structure of the rocks. There are a number of associated smaller thrust faults seen within the main face, and on the newly exposed ramp section (not visited) where the core of a tight fold is also evident.

Phase of Movement	**Sense of Movement**
Mid-Devonian (Acadian?)	?
Variscan	Reverse-shift with the development of a drag-fold array
Permo-Triassic Movement	Normal displacement, generating progressive subsidence and creating the Worcester Graben
Post-Triassic movement	Trans-tensional shift on the BF?

The youngest strata seen at Huntley are Middle to Upper Triassic (c230Ma) in age. The Upper Triassic is represented by red-brown mudstones and brecciated mudstones belonging to the Mercia Mudstone Group - as exposed in the eastern wall of Huntley Quarry and described above.

Figure 5 – Exposure (5) Ackers Quarry

Very weak, red-brown Middle Triassic sandstone belonging to the Bromsgrove Sandstone dips very gently eastwards and is exposed in Ackers Quarry (Exposure 5) to the east of Huntley Quarry.

These rocks form the western flanks of Bright's Hill and together with the Mercia Mudstone dip eastwards to underlie the Severn Valley were quarried as a building stone and can be seen in several local buildings.

After lunch we took a short walk to Huntley Hill Quarry to Exposure 5 – a small quarry in the Huntley Hill Sandstone.

On the way we saw extensive views of the Severn Valley.

Figure 6 – A view across the Severn Valley from Huntley Hill

In Fig 6, looking east across the Severn Valley from the lower slopes of Huntley Hill, areas of higher ground generally represent older river terraces and the wooded areas are often underlain by more gravelly sediments.

We then walked on to a small quarry with an outcrop of the Huntley Hill Formation.

In the BGS Memoir accompanying the Tewksbury Sheet Worssam (1989) describes the Huntley Hill Formation as consisting mainly of grey and brown, feldspathic sandstones and conglomerates with subordinate mudstones.

The conglomerates consist mainly of poorly sorted, rounded clasts of quartzite and pink felsite. In addition, angular fragments of Malvernian rocks and andesite porphyry have been recorded. The sandstones are locally gritty and are composed of moderately well-rounded quartz grains with sub-rounded to sub-angular fragments of pink felsite.

At the top of the formation, these sandstones are interbedded with flaggy, laminated, fine-grained sandstones to form a transition into the overlying Yartleton Beds. Mudstones probably less than 5 m thick occur locally in the upper part of the formation.

The uppermost 150 m or so of the formation crop out in this district, out of an estimated total thickness of between 180 m (Lawson, 1954) and 280 m (Ziegler and others, 1968).

The Huntley Hill Formation is poorly fossiliferous, the most commonly recorded fossils being species of ***Eocoelia*** and ***Lingula.***

The Huntley Hill Quarry was the final stop of the day before returning to the cars for the drive back to Malvern.

Our thanks go to John for a most interesting day in beautiful surroundings.