Gnosall Heritage Group

On 8th September we were privileged to have a presentation talk from Paul Green on the Geology of Gnosall, dealing with the solid and superficial geology of the area. Solid geology refers to the underlying rocks. At Gnosall these are sandstones and mudstones, up to 250million years old. Superficial geology refers to the unconsolidated surface deposits left behind by ice, glaciers and rivers. At Gnosall they are sands, gravels and silts. They were formed in the last 2.6 million years and mostly in the last 18,000 years. The talk traced the formation of the region from the geological Carboniferous period through the Triassic to the Tertiary period before going on to the Ice Ages.

The Solid Geology of Gnosall

In the Carboniferous period, the area now recognised as Britain lay close to the equator. Rocks formed in the earlier Cambrian period stretched across what is now mid-Wales, the Midlands and East Anglia. Gnosall was close to its northern shore. In the later Carboniferous period, swampy forests covered most of Britain including the Midlands. They were periodically inundated by sea water forming Coal Measures. So, deep beneath Gnosall there are Coal Measures sitting on top of lower Palaeozoic rocks.

In the succeeding Permian period, the area that was to become the Midlands was part of a large continental basin. Its latitude was between 15° and 20° north of the equator, similar to the Sahara Desert today. Few sediments were deposited in this environment and the Permian period is not represented in the sedimentary sequence of Gnosall. During the Permian period, crustal tensions formed a down-faulted rift valley system extending north from Worcestershire and opening out into sedimentary 'troughs' in Staffordshire and Cheshire.

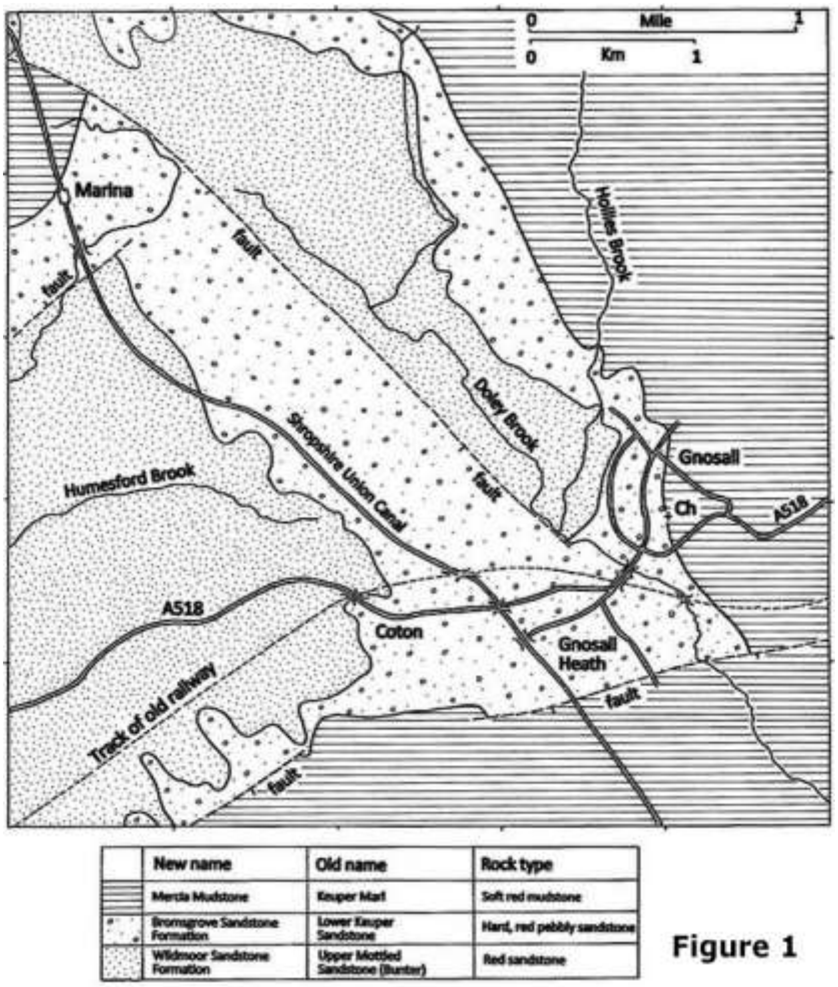

Figure 1

By the beginning of the Triassic period, mountains which had formed to the south were in a climatic zone that attracted seasonal rainfall. Rivers started to flow north through the Worcestershire rift valley and periodic floods washed large quantities of pebbles, sands and silts into the Staffordshire basin. Subsidence in the basin allowed sediments to accumulate to great thicknesses, formerly known as the Bunter Pebble Beds, now the Kidderminster Formation. At Gnosall they are buried beneath later sediments, but outcrop to the east at Stafford and to the west at Newport.

A quieter episode followed of temporary or seasonal lakes and rivers, flowing north into the Staffordshire basin. Fine, well-sorted sandstones were deposited with some bands of mudstone, left behind by overbank floods. There were occasional dry periods when the rivers dried out and were overwhelmed by wind-blown sand. These sediments are the Wildmoor Formation and outcrop on the west side of Gnosall. They are poorly cemented and therefore easily eroded.

The subsequent Bromsgrove sandstones, which were deposited on top of the Wildmoor Sandstones, were formed in a similar environment. Bromsgrove sandstone is well-cemented, making it resistant to erosion. Figure 1 shows the outcrop of the sandstones.

The geological occurrence of a harder resistant rock, sitting on top of a softer weaker rock, can affect the landscape. Where the softer rock outcrops at the foot of a hill slope, with harder rock above it, erosion of the soft rock undercuts the slope, making it steeper. If the layers are of rock are dipping, then the result is a prominent scarp slope. This can be seen between Broadhill and Windmill Bank, the cross section of which is shown in Figure 2.

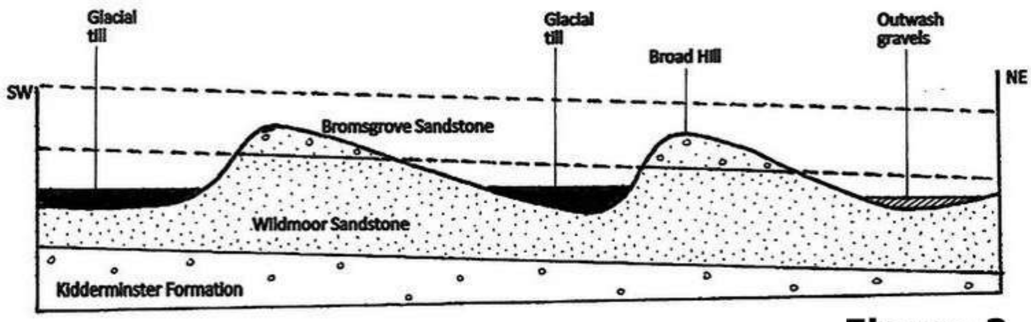

Figure 2

The two hills both have steeper west-facing slopes than east-facing and are separated by a small valley. The two west-facing slopes are the steep scarp faces of the Bromsgrove Sandstone, and the east-facing slopes are dip slopes (i.e. they slope down in the direction of the dip of the sandstone bed).

Erosion of the soft Wildmoor Sandstone at the foot of the slopes has undercut the hard sandstone and steepened them. In the small valley between the scarps is a deposit of glacial till, showing that it was filled by ice during the last glacial episode. It is likely that at an earlier stage in the Ice Age the valley served as an outlet for meltwater and this would have been responsible for some of the erosion of the soft Wildmoor Sandstone.

The hardness of the Bromsgrove Sandstone makes it suitable as a building stone. In the past it was quarried at Broadhill, Cowley and at the Hollies, just off the Knightley Road. It was used to build the church. Older sandstone walls in the village make use of masonry from ancient buildings that have been demolished. Stafford Castle is built of the same stone, quarried at Tixall.

The Mercia Mudstone - By the time of the Mercia Mudstone in the later Triassic, the relief had been reduced to a fairly flat plain. It was a low-energy sedimentary environment of a desert basin which periodically filled with water to form temporary lakes. One such basin was located in mid-Staffordshire. Within this environment sediment was deposited in three ways by the settling out of mud and silt in the temporary lakes; by the rapid deposition of sheets of silt and fine sand in flash floods; and by the accumulation of wind blown dust on the wet mudflat surface.

The rocks themselves are red-brown mudstones, with some of the mudstone layers containing deposits of salt. The water which collected in the desert depressions was often highly saline, and sometimes had its origin in sea water. In the hot arid conditions, the water evaporated to leave salt interbedded with the mud. It is likely that the salt deposits beneath Staffordshire were formed in this way.

Geological Structure – The tertiary period was a time of further folding and faulting, linked to the 'Alpine' earth movements. This had two effects on the rocks in the Gnosall area, which of course now included the Triassic sandstones and mudstones.

The first was to squeeze them into a very gentle anticlinal fold (an arch-shaped fold). The axis of the fold runs NE – SW through Aqualate Mere with an angle of dip of just ~5^{o}. The second effect was to cause faulting. A fault is a shear plane fracture along which two bodies of rock have slid past each other. The sliding is not smooth and continuous but takes place in jumps, causing earthquakes. The Aqualate anticline has been considerably fractured by faulting.

In summary, the solid geology of the Gnosall area began with a basement of Carboniferous Coal Measures on which sediments of Triassic, Jurassic and Cretaceous ages were deposited. Erosion then removed the Jurassic and Cretaceous rocks, exposing the Triassic rocks once again at the surface. Simultaneous with this erosion, earth movements folded and faulted the Triassic rocks, resulting in an outcrop pattern that became the bedrock floor on which the next great geological event occurred.

With acknowledgements to Paul Green.