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The story of Barrow Hill is told by its rocks. The evidence to explain the sequence of events that took place over millions of years is found in the rocks. We only have a few small exposures of rock to view at Barrow Hill, but there are plenty of different rock types to see in the churchyard. "**Working with Rocks**" provides the background for work in St Mark's Churchyard.

The Teaching Trail Notes list the Key points to investigate:

We are looking at four aspects of these exposures of rock:
1 – to find out how the rocks were formed.
2 – to find out what happened to the rocks after they were formed.
3 – to find out what is happening to them today or in the recent past.
4 – to find out what they have been used for by Man.

Summary of the Geological History

Barrow Hill consists mainly of 300 million year old dolerite, a hard Carboniferous igneous rock, intruded into sediments which were only slightly older, and which were baked hard. As well as millions of years of erosion, further earth movements and erosion, the present landscape owes much to the work of Man.

- 435 – 395 million years ago, during the Silurian Period, this part of Britain was part of a shallow sea, lying south of the Equator. Lime mud and the remains of sea creatures settled onto the seafloor, eventually forming the limestones we see today at Wren's Nest and Castle Hill, Dudley. Plate collision caused great Earth movements which turned the area into a continental landmass, which later subsided and flooded during the Carboniferous Period.

- 300 million years ago, towards the end of the Carboniferous, when Britain lay near the equator, the sea which once covered much of what is now England, Wales and Ireland had filled with sediment and been covered by sandy river deltas and muddy swamps. Where the swamps dried out the soils became oxidised and the red colour is preserved in the Etruria Marl. The grey and buff-coloured rocks of much of these Coal Measures were formed in anoxic environments. These were ideal conditions for preserving the plant debris, which later became coal.

- Tension in the Earth's crust caused fractures and faults. It was through such routes and into the wet sediments that molten magma forced its way up from depth. At 1000^0C and with plenty of water in the sediments there was extensive explosive volcanic activity. Vast amounts of volcanic ash were spread around, as too were volcanic bombs and lava. This was the Dudley Volcano. The heat metamorphosed the surrounding rocks, like the Etruria Marl, making them quite hard.

- 280 million years ago, further Earth movements at the end of the Carboniferous caused extensive faulting and uplift on a continental scale. Then followed the Permian and Triassic Periods, when Britain lay near the Tropic of Cancer. Red sediments were deposited on the landscape, which owe their colour mainly to the mineral, haematite, an iron oxide. They range from conglomerates to fine sands and mudstones, deposited as sand dunes or in flash river floods. These red rocks are common in the Midlands but are not exposed at Barrow Hill.

- Over millions of years, the Dudley Volcano and surrounding rocks have been steadily eroded. The ash [or tuff] weathers and erodes easily, but some is preserved and covered up in Tansey Green Brick Pit. The hardest, most resistant, parts were the igneous rocks under the volcano and these hills of dolerite stand out from the surrounding area. Barrow Hill, Pouk Hill and the Rowley Hills are three of them.

- Even though quarrying has ceased, the processes of weathering and erosion are still operating today on rocks in walls, buildings and quarries. The rocks are weathered by chemical and physical processes, helping to break them down to form soil, which plants quickly colonise. Rabbits, moles minibeasts and plant roots further help to break up rock material and gravity carries it downhill to form new scree slopes at the base of many quarry faces.

- The wildlife and geological features of Barrow Hill are conserved for the benefit of everyone. We hope that you and your children will enjoy the visit. More detailed information on the geological history can be found in the teacher notes for KS3 and KS4.

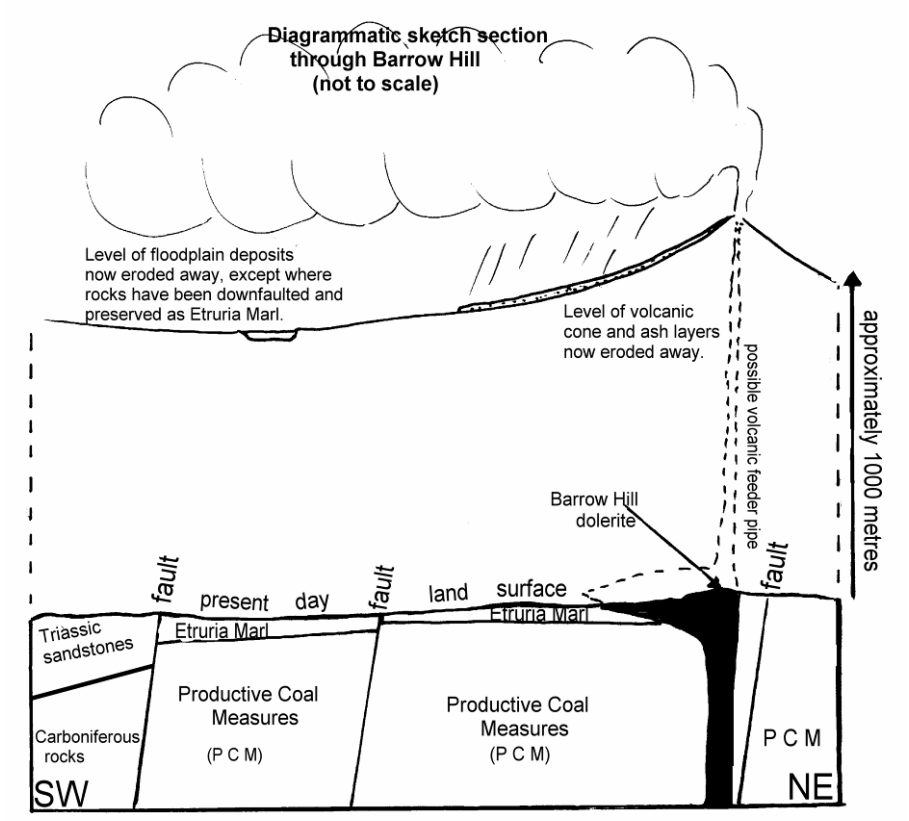

Figure 1. Sketch of the present day outcrops and the eroded Barrow Hill Volcano.

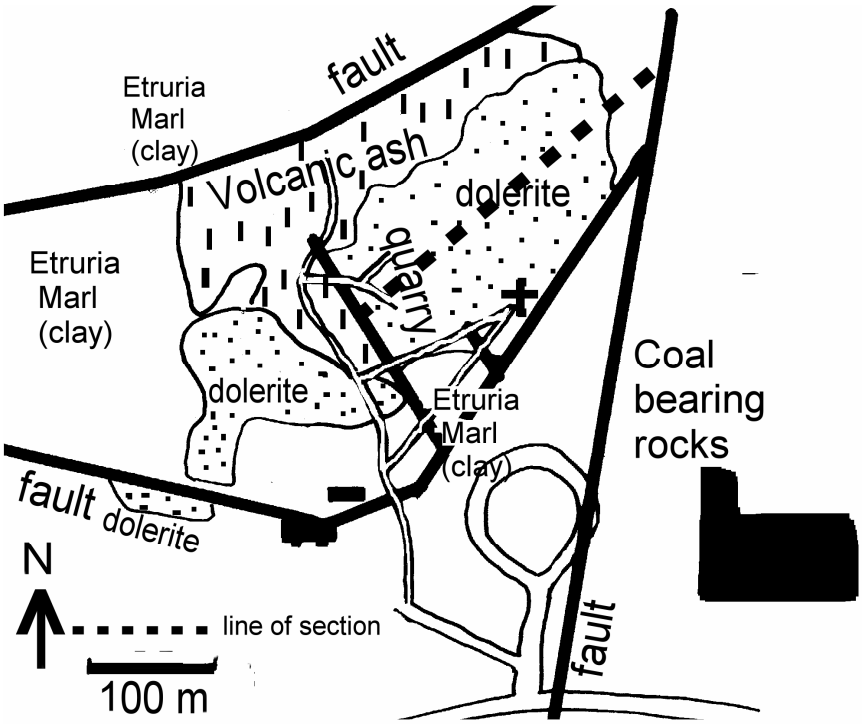

Figure 2. Map of the rock types around Barrow Hill.

The line of the section used in Figure 1 is marked on the map.

Human Use of Stone
The towns in the area around Dudley grew, mainly as a result of the use of coal and other mineral deposits in the area providing jobs. Churches were also built, with St Marks being constructed during the 1840s. Its walls are made of "Gornal Grit" a sandstone of Silurian age formed before our Barrow Hill story began, and outcropping today 2km to the north.

The church has a roof of Welsh slate from Blaenau Ffestiniog and decorative tiles made from local Etruria Marl. (Firing clay in a kiln can be thought of as man-made metamorphism, turning less resistant rocks in to a more resistant man-made artefact). There are also decorative tiles in front of the main church door. Inside the church the main pillars are probably late Carboniferous sandstones. All of these materials were chosen because they are suitable for their purpose: **sandstone** for the walls and pillars because of its physical strength; **slates** for the roof because of their impermeability and being able to split easily into thin sheets; **tiles** from Etruria Marl which are easily moulded into shape and fired to a hard finish in a kiln.

Bricks imprinted with "**J. Collins Pensnett**" have been discovered in an underground drain close to the church door, indicating a local brick making industry, and it is possible that the clay is Etruria Marl from the Tansley brick pit (now not in use) and fired in Pensnett. It is also possible that the black and white ceramic tiles used in the in the graves were local, possibly derived from Doultons Claypit in Brierley Hill. In the past, local iron making furnaces provided many tons of blue-grey slag which became a common wall building material, due to its cheapness and availability. Fragments of this can be seen in the north end of the church wall at Site 3.

The churchyards became full of memorials which likewise reflect the availability, suitability, attractiveness, and cost of different headstones for graves. Early memorials tend to be of local stone (e.g. red Triassic sandstones which have become deeply weathered over time) whilst later ones reflect international trade in suitable, attractive igneous and metamorphic stones, made economic by improved transport systems. Some interesting examples are ceramic, or brick, reflecting a more local industrial material, fired in kilns and suitable for a long lasting memorial. These are a popular feature in Black Country churchyards.

EARTH SCIENCE PRINCIPLES

In this area it is possible to demonstrate the following Earth Science principles.

1) **The Principle of Uniformitarianism:** The biological, physical and chemical processes we see today, operated in much the same way in the past. "The present is the key to the past."

2) **The Principle of Original Horizontality**: bedding planes represent the original horizontal at the time of deposition of sedimentary rocks.

3) **The Principle of Superposition**: in a bedded sequence of strata, the oldest layers were deposited first, and are found below the younger layers, which were deposited later.

4) **The Principle of Cross-Cutting Relationships:** Structures, like faults and joints, which cut through rocks must be later, and therefore, younger than the structures they cross cut. They must also be older than the ones that cut across them.