THE GEOLOGY OF BUCK WOOD, THACKLEY

N. A. Alvin, MA, BSc

Buck Wood holds a wealth of historical evidence giving us pointers to what life was like in ages past. We have excavated the Open Air School which came into existence in 1908; we have located charcoal burning platforms from the eighteenth century; and we have excavated a Bronze Age enclosure with evidence dating back 4000 years. But there is even older evidence of what Buck Wood was like in the past – 300 million years ago. This is the very landscape that we see and walk on today.

1 THE CARBONIFEROUS PERIOD AND HOW OUR ROCKS WERE FORMED

The rocks that form our local landscape were created during the late Carboniferous period between 315 and 305 million (Ma) years ago. Thackley was then on a lowland plain with mountains to the north and south. At the time our tectonic plate was located close to the equator, so our climate was hot and had rainy tropical conditions. Large rivers flowed and deposited masses of sand and mud in wide deltas. These deposits were then buried by more sediment and compressed over millions of years to form sedimentary rocks. Mud particles are very fine and only settle when water is not moving. Sandstones are made up of sand grains up to about 2mm and the quartz grains are visible. Siltstones are like sandstone but are made up of much finer quartz. Mudstones are made of fine clay particles.

In the later Carboniferous period the continent was above sea level and luxuriant forest thrived. As these trees eventually died and fell down they were covered and compressed to form the coal seams that covered part of our area. Plant fossils are commonly found in sandstones, formed when vegetation was carried by floods and deposited on sandbanks. Shales or mudstones also occasionally contain fossils of common marine creatures such as brachiopods (bi shelled) and goniatites (spiral shell).

At the end of the Carboniferous period the continent was uplifted and tilted during a major collision between tectonic plates. This mountain building period, which is called the Variscan Orogeny, saw the creation of a large mountain range across Europe. In our area northern England was uplifted to form the Pennine anticline. During the last 20 Ma erosion from wind, water and ice has removed about a

kilometre of overlying sediment and has dug into the Carboniferous rocks below to form the present landscape.

2 THE ROCK STRATA FOUND IN THE THACKLEY AREA

The ground that we walk upon in the Wood is not just one layer of solid rock. It comprises many layers of various types of rock.

The hillside from lower Idle down to the River Aire has the following layers of rock.

ROCK GROUP	ROCKS
	Coal seams of Soft Bed and Hard Bed coal
	Soft Bed Flags
Lower Coal Measures series of rocks.	Shales with flags and Hard Bed coal
	Pot Clay marine band with coal and shales
Millstone Grit rock series	Rough Rock (coarse gritstone)
	Rough Rock Flags (flaggy sandstone with shales)
	Coal seams in shales
	Huddersfield White Rock (sandstone)

Rocks of the Thackley Area

The upper divisions of the rock surface includes Rough Rock Flags and Rough Rock. The Rough Rock Flags layer is a variable succession of generally fine-grained flagstones and sandstone beds with occasional thin shale beds. The thickness ranges from 30 to 70 foot. The Rough Rock is mainly current-bedded (cross-bedded) gritstone, often pebbly. The pebbles are chiefly made of the minerals quartz and less frequently feldspar. This rock ranges in thickness from 50 to 100 foot. Flagstones are exposed in the cutting immediately west of Thackley tunnel, where they are faulted against lower beds.

In the nineteenth century two wells were dug for Garnett and Son's mill in Apperley Bridge. They bored 221 feet down and records show there were 17 layers of rock

including Shales, Galliard (the old miners' name for Ganister), Millstone Grit, and Pebbly Shale as well as various types of Sandstone. The layers varied in thickness from 35 feet down to 6 inch.

The rock layers of the area dip towards the south east forming the steep north west-facing escarpment. This escarpment and the valley floor below is littered with fallen rocks. They may have been dislodged during the last glacial period. Water beneath the ice soaked the joints in the rocks and widened them as it froze. As the ice finally melted the unsupported rocks were left to tumble down the slope.

This escarpment and the valley floor below is littered with fallen rocks.

The flatter areas around Ainsbury Avenue have a covering of Glacial Till or boulder clay, which is a mixture of sand and clay left behind by retreating ice.. This would have covered the whole area but has weathered away, although some erratic cobbles may remain. An erratic is a glacier transported rock that differs from the local bedrock. Erratics may be embedded in Glacial Till or may be deposited on the ground. Their size can vary from small pebbles to large boulders.

Ganister is a hard, fine grained quartz sandstone usually found in a layer below a coal seam. Ganister was crushed and mixed with fireclay to create a material for lining furnaces. Ganister and fireclay are soils in which carboniferous trees grew and which were turned to stone (lithified). They often contain remains of fossilised roots. Many individual rocks of ganister can be seen scattered around Buck Wood.

3 FAULTING AND PLATE MOVEMENTS

As well as creating mountain ranges the movements of tectonic plates also search out weaknesses in the rock formations. Stresses build up in the rocks and eventually a fault occurs. One section of rock moves either up or down in relation to the neighbouring rocks, often by many metres. The upthrown rocks gradually erode and weather away, resulting in different types of rock lying side by side on the surface. There are many faults traversing the Aire valley, mainly running in an east west direction. The beds on the south side are thrown down so Rough Rock and Rough Rock Flags occupy much of the ground eastwards from Shipley to Thackley. The faulting has created flatter shelves of land such as where Thackley cricket field and the Buck Wood archaeological site are situated. The land rises steeply to Idle in the south and steeply down to the river in the north. Some of the faults bring the Rough Rock against Lower Coal measure shales, which is a fall of between 50 and 100 feet. At Thackley Corner the railway cutting is on the Lower Coal Measures. Further north, near the start of Ainsbury Avenue, a fault brings the Rough Rock to the surface and gave rise to a small quarry. A shaft for the railway tunnel on Birk Hill recorded 40 feet of coarse grit. Just above the site of the Open Air School is a mound of shale excavated from the railway tunnel which will have come from Lower Coal Measure shales and flags. Further along Ainsbury Avenue near the Disabled Access gate to Buck Wood and the football field there is another west-east fault and Lower Coal Measures are again brought to the surface. Further north the steep hillside is of Rough Rock and Rough Rock Flags.

Occasional evidence of faulting can be seen in the wood where slickensides were created. In geology, a slickenside is a smoothly polished surface caused by frictional movement between rocks along two sides of a fault. The surface feels smoother when the hand is moved in the same direction that the eroded side of the fault moved.

Slickenside: polished surfaces caused by the movement between rocks along a shifting fault line.

Throughout the wood there are a number of springs which are most likely due to the faulting. Porous Rough Rock is brought against impervious Lower Coal Measure shales and water leaks out into springs. In some areas, in very wet periods, the water flows down the hillside for a distance and then soaks back into the ground only to emerge much further down the slope. Occasionally the faults move slightly, altering the springs. Recently a spring that had flowed for well over twenty years suddenly stopped because the faults shifted. In 2016 major work had to be done to consolidate the 1846 railway tunnel because new faults were making it unstable.

Natural springs: Throughout the wood there are a number of springs which are related to the fault lines and the differing permeability of the layers of rocks. The wetland area in Buck Wood was created to make use of existing springs and boggy patches, opening up a glade and introducing suitable plants to make a unique habitat for wildlife such as native amphibians.

4 THE EFFECTS OF ICE IN THE THACKLEY AREA

Thackley's landscape has been affected by the effects of ice. During the last 2.65 Ma many ice sheets have moved across the area. The last glacial period was the Devensian which was at its maximum around 17,000 years ago, when the ice was so thick that it covered all of the local hill tops. As the ice moved it wore away the land. Rocks were scraped and boulders and clay were swept along in the ice. As the glaciers moved south and east they scraped out valleys creating a distinctive U shaped valley. Glaciers about 300 feet deep flowed down the Aire and Wharfe valleys and met up between Buck Mill Lane and Apperley Bridge. The ice melted about 12,000 years ago and as the ice retreated boulders and mud were deposited across the landscape. The huge flows of meltwater from the ice fields deepened local valleys scouring out the solid rock floor, which was about 20 metres lower than the present surface, before it was filled up by material carried in the water. Much of the original bed rock was planed off by the Aire Glacier. The rocks were then covered by a thick deposit of Glacial Till which was then, in turn, partially washed away by huge volumes of melt water, leaving deposits of silt, sand and gravel. Glacial Till, or boulder clay, is a mixture of sand and clay left behind by retreating ice. The clay often contains a lot of rounded boulders of various sizes. Many medium to large sized rounded stones, which were carried along in a glacier and then deposited, can be seen scattered around the Wood

As the glaciers flowed along they carried large amounts of coarse gravel underneath the ice. These substances provided the abrasion to cut grooves or striations in the underlying rock. Glacial striations can occasionally be seen on rocks in the wood.

Many of the alluvial flood plains of the area may be a consequence of activity by Romano-British people, which resulted in soil erosion following tree clearance and intensified farming. This erosion may have contributed to the thin soil cover throughout the present woodland. The lower sides of the valley have some glacial terraces of gravels and cobbles that were washed out of the ice at the end of the Ice Age. The river has since cut through these deposits leaving them as linear terraces above the river.

5 WHERE YOU CAN SEE THACKLEY'S ROCKS AND GEOLOGY

Stigmaria: a commonly found fossil in Buck Wood

Great care should always be taken when looking for rocks or other features, as the ground is often very uneven and may be slippery in wet weather.

Shales can be seen on the cycle track near the entrance to the wood. These were brought to the surface during the construction of the railway tunnels.
Fossils can be seen in rocks scattered around the wood, and it is worth checking (and replacing) any rock to see if any are present.
The most common fossils are Stigmaria which are the underground roots of tropical forest trees, which later formed coal measures, such as Sigillaria and Lepidodendron. These trees grew up to 50 metres in height and were anchored by extensive roots with rootlets attached to them. The stigmaria roots are covered with a spiral pattern of circular scars where “rootlets” were attached.
Just below the scheduled ancient monument site of the prehistoric enclosure, underneath the holly, there are three mounds of rocks many of which contain fossils. To the right of the main path below the enclosure is a section of dense holly (SE 17450 39200). Once inside the holly the area is quite open and many medium sized rocks bearing fossils can be found.

Horsetail fossil: the fossilised remains of a group of plants, Calamites, with jointed stems related to modern horsetails, but growing to over 18 metres in height.

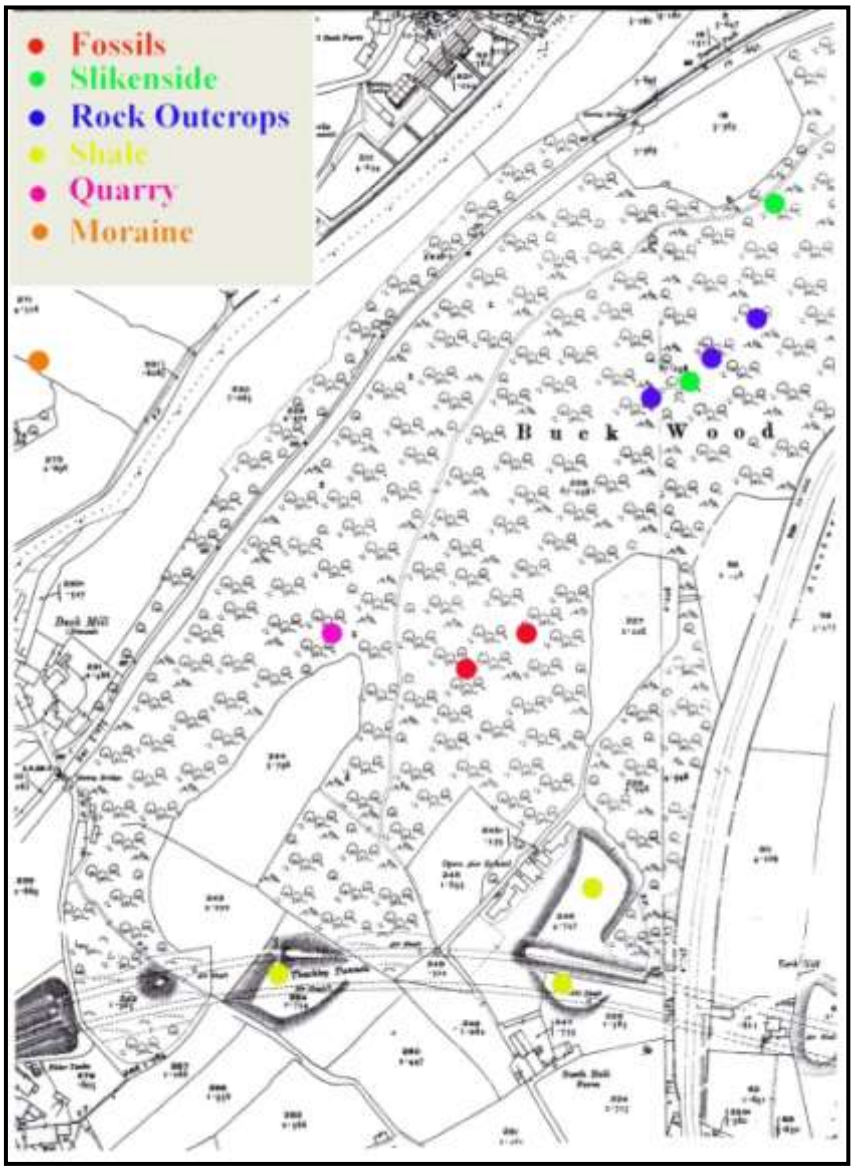
Slickensides. Large boulders can be seen along the lower parts of the bridleway. These have tumbled from higher up the hill owing to glacier action and weathering and erosion. On one, next to the main path not far from the electricity pylon (SE 17754 39752) a slickenside can be seen. Above this area is a steep escarpment at the top of which are many large outcrops of rock. Several of these have large slickenside markings (SE 17466 39395, SE 17559 39734).

Rock formations. On the escarpment to the west of the wood rock formations can be seen. There are examples of cross bedding which show the direction and speed rivers were flowing and laying down layers of sand and grit. At the bottom of the wood underneath a pylon there is a good example of graded bedding. This shows how grits of different sizes were deposited as the flow of the river changed.

Coal. East of the Bradford Beck coal can be traced from near Wrose to Thackley but is nowhere exposed, though old pits and workings are recorded. In Greengates a Soft Bed Coal seam is said to have been 3ft thick. There is a seam in the railway cutting at Thackley Corner, about 100 yards east of the station is believed to be Soft Bed Coal but is only about 7 inches thick.

Terminal Moraine As the last ice age came to an end 12,000 years ago the ice in the Aire valley melted quicker than that in the Wharfe valley, allowing ice to flow down through the Guiseley Gap to Tong Park. As this ice gradually started to melt it left a terminal moraine just across the river from Buck Mill. This can still be seen today as small hills of hummocky gravel.

Erratics. At the top of the wood near the bridleway are around forty circular depressions. These are the remains of quarries where individual boulders were extracted and it is most probable that they were erratic limestone boulders carried down the valley by glaciers. There are also other similar quarries scattered throughout the wood.



Locations of geological features

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