Firstly, several schools could offer scholarships to the ancient universities. Threshfield (Linton) Grammar School was founded in 1674 under the will of a clergyman who also provided scholarships for pupils to go on to his old college, St. John's at Cambridge. Over 20 local boys thereby went to Cambridge prior to 1732. Bradford, Leeds, and Giggleswick grammar schools also had scholarships to offer. Promising boys would be encouraged to move from schools that lacked such endowments to those that had them, so that they could go on to university. For this reason, William Whewell moved from Lancaster Grammar School to Heversham in Westmorland, to take advantage of the latter school's Cambridge scholarships.

The other redeeming feature of the northern scene is that there was significant interest in science outside the school syllabus. Occasional masters would encourage an interest in mathematics, astronomy or natural history, or would help boys with aptitude for mathematics get to a school with a scholarship (as Whewell was helped by a supportive master).

There were also enthusiasts for science who had no connection with the schools. A remarkable example was John Dawson of Sedbergh (1734-1820), a shepherd in Garsdale in his early years who taught himself maths, was helped by contact with a surgeon (Dr. Bracken), and eventually got to Edinburgh to study medicine. On returning to Sedbergh he practised medicine in the neighbourhood, but soon established such a reputation as a private tutor in mathematics that he could make a living that way. He would accommodate students in his own house, and go from room to room teaching individuals in rotation. Such was his reputation that students came from Cambridge during the summer to study with him, and he is said to have tutored twelve Cambridge senior wranglers in Sedbergh between 1781 and 1808. Among local boys who benefited from Dawson's teaching was Adam Sedgwick.

All this helps explain why students from the north did well at Cambridge especially in mathematics and natural philosophy. Despite their limitations, local grammar schools were effective stepping stones to university and enabled several men to follow scientific vocations.

But by the end of the eighteenth century, attendances at the schools were falling. When the reforms that were urgently needed were put in place during the next century, education was much improved but more rigidly organised. The conditions which had produced so distinctive a group of "hard progeny of the north" in the sciences then began to fade.

GEOLOGY IN JUDY WOODS;
a draft report following a brief field visit.

Alison C Armstrong, Museum Officer, Natural Sciences,
Bradford Museums
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The woods lie within the south boundary of Bradford Metropolitan District. The woods are on the generally east facing dip slope of the Pennines. The land is round about 500 feet OD and the woods are cut by streams draining southward.
The Clifton Rock forms a plateau around Royds Hall and is exposed in Royds Hall beck. This sandstone is massive between Wyke and Royds Hall and has been quarried. It is also seen raggy and with shaly beds exposed in the beck.

GEOLOGICAL HISTORY

The area is underlain by Upper Carboniferous sedimentary rocks. These are composed of shales with coal seams and sandstone rocks. These rocks were all deposited in the tropical swamps which once fringed the southern end of a great continental land mass about 320 million years ago.
The shales were muddy deposits and are composed of fine grained muddy minerals. The flaggy and blocky sandstones were various kinds of sands and are made up of quartz grains with variable amounts of silt. The coals are compressed plant remains formed from the peaty debris which accumulated in the swamps. Nodular ironstones , a mixture of iron oxide and clay, sometimes with white iron carbonate bands, formed from the muddy swamp environment. Fossils are mostly impressions of plant stems preserved in the sandstones.

Over millions of years these sedimentary deposits hardened into rock, mostly during the great Hercynian crustal disturbances at the end of Carboniferous times. The Pennines formed from the thrusting up as a long north-south arched, or anticlinal, ridge of rock about 180 million years ago .The rocks faulted and fractures under the strain, many faults aligned in a NW-SE direction, and tilted to the east . The east flowing river systems , such as the river Aire and Calder, began to form in Permo-Triassic times and the new Pennine hills were massively eroded away. There were further periods of uplift and tilting and erosion. Probably Jurassic and Cretaceous seas covered the worn Pennines but all rocks of those ages have been removed. The "valley within a valley" profile seen in upper Calderdale was caused by Tertiary uplift of the eroded hills and the renewed deep down cutting of the Calder through its old valley, helped by Ice Age meltwater. This lowering of the Calder valley floor would have affected Royds Hall Beck which has also cut down deeply through sandstones and shales.

In the last 2 million years the Ice Age occurred. The area underwent two periods of ice cover which moulded the contours. The very last period of ice cover, the Devensian ice age, further shaped Airedale and Wharfedale to the north forming deep wide valleys, but ice failed to cross the water shed into Calderdale. Airedale ice terminated by the moraine at Apperley Bridge and a lobe of ice pushed up the Bradford Beck reaching up to Odsal at its maximum about 17,000 years ago. Land south of Odsal around Judy Woods was exposed and would have undergone tundra weathering and erosion by glacial meltwaters. These formed the deep cloughs typical of upper Calderdale. They also moulded the landscape of Judy Woods with its V-shaped stream valleys.
Natural soils formed in the last 10,000 years after the ice had melted away and native wildlife, plants, animals and woodland adapted and returned. By 7000 years ago the North Sea formed which hindered the spread of continental species back to Britain. Plant pollen analysis from places like Ilkley Moor indicate that Mesolithic people were already clearing the land, perhaps to encourage deer. By 7000 years ago pollen from weed species indicates that farming activity was taking place and native wildwood being cleared.

The area around Judy Woods has prehistoric finds indicating the presence of the first farmers in Neolithic and Bronze Age times. There were extensive Bronze Age populations eg Rombalds Moor where farming methods and a wetter climate led to irreversible soil changes and the growth of heath. Continuing Iron Age and Romano-British land clearance caused soil erosion which produced the alluvial floodplains and alluvial deltas in areas like Airedale but may also have affected the Judy Woods area.
Farming, a human activity which affects the land more than any other, has continued for centuries, changing the landscape to the one we see today.

GEOLOGY and ROCKS

The rocks beneath Judy woods are from the upper part of the Lower Coal Measures (LCM) ; a series of Upper Carboniferous age shales with coals and sandstones. The general geological sequence shows the following;

Section;	Rocks;
UCM	
Shale	
LCM	Lousey coal Shale Trub coal (shaly stone coal worked in Royds Hall Beck possibly for engine coals) Shale

Shertcliffe coal (exposed in Royds Hall Beck in valley bottom above Clifton Rock. 2 feet but a dirty not stone coal. Borehole recorded Shertcliffe coal in Great Wood)
Shale
Beeston coal
Shertcliffe Seatstone (flaggy sandstone and rag and quarried for moulding sand for cast iron)
Clifton or Oakenshaw Rock (Variable but here jointed, false bedded , medium grained sandstone)
Shale
32 Yd and fireclays (exposed in Royds Hall Beck)
Shale with ironstones
Crow coal (worked at Syke Pit Wibsey)
Shales
Ironstones
Black Bed (2 feet thick good household coal with important ironstone above but often absent due to "wash outs")
Sandstone
Better Bed (2 feet thick low sulphur coal used for smelting at Low Moor Ironworks)
Elland Flags (sandstone)

The solid geology, however, is not much in evidence in the Wood. Shale and coals easily weather away to clay and the sandstone is concealed by a covering of brown earth soil. The sandstone however makes the plateau-like feature above the beck and on which Royds Hall and Wooodside stand. It is exposed as beds of sandstone where the becks have cut through it forming steep sided valleys eg on Royds Beck near Station Road south entrance and it forms a diagonal waterfall halfway down Low Wood and where a small stream has cut down towards Horse Close Bridge. The sandstone has soft partings of silty sandstone seen where outcrops have been used for walling stone. A small quarry of ragstone remains on the east boundary, north of the mineral line. Apparently there are plant fossils to be found in sandstone near the road.

Where some of the top of the Clifton Rock is exposed in a stream in Royds Hall wood, there is evidence of weathered top rock as if it was exposed to tundra weathering.

Sandy shale is exposed in the beck below Horse Close Bridge.

Small reddened ironstones can be seen amongst the black shale debris from the coal spoil heaps, showing that ironstones occurred in the shales here.

SOILS

Soils form from a combination of weathering of the parent material, water re-arranging the ingredients and the actions of the biological world and minibeasts . Natural soils can be easily and irreversible changed by draining and by adding humus/compost or chemicals to change the texture or chemistry . The soil will then support other plants and can be selectively re-seeded. Farming activity therefore has huge impact on natural soils.
Soil types are named and recognised by studying a soil section and noting the changes in colour and texture of the top soil layer, the subsoil and the parent material. The parent material here is flaggy and raggy sandstone or impervious shale rock.
Two kinds of soil were observed. Firstly, there are brown earths on sandstones which are found in the still wooded areas and in the surrounding fields on sandstone. These have loamy topsoil of 6 – 12 inches of a dark brown colour and full of decayed leaf litter humus. The subsoil is sandy yellow and stony. The soil is not deep and best suited to pasture. Even where there are now fields, brown earth soil is a woodland soil and evidence of the once general spread of native woodland over the area. Once trees have gone, soil loses its annual leaf fall and if this is not replaced artificially eg by manuring, the soil will be impoverished; this is what happened in the uplands in the Bronze Age, resulting in heather moor formation.

Secondly, gleys or stagnogleys (waterlogged, yellow, blotchy clays) have developed from the weathering and biological activity on the impervious shales. These are poorly drained soils giving wetter areasand mostly associated with the bell pits where the spoil heaps have impeded the drainage. A thin greyish loam is seen on yellow clay.

There is also a lot of made-up ground in the wood as a result of coal mining spoil heaps and road and path making. Amongst road material near the entrance is limestone whilst near Royds Hall Lane was found some iron slag, perhaps road hardcore used from the Ironworks waste. Blast furnace slag was sold for road-making from the late 18th C just to get rid of it. Much of it is glassy green but this was more like dark, bubbly, foundry run-off slag.

ECONOMIC GEOLOGY

There is evidence of extensive coal mining activity throughout the woods, although none of this is shown on the First Edition OS map of c 1850. Perhaps it was buried under vegetation at the time of the Survey, The Royds Hall estate was purchased for £34,000 about 1785 for its mineral wealth but it is possible the coal seams outcropping in the Royds Hall valley were worked from day holes or drift mining earlier on. Low Moor coal and iron ore began to run out by

1845 but was imported from Yorkshire. Coal was widely used as household fuel from the late 1500s and certainly in the 1600s , so it may have been exploited by the land owner from that time. The Lousey, Trub and Shertcliffe coal seams that were mined in the woods were only poor coals suitable for engines (in much demand eg for textile mills from about 1800) and were never used in smelting. Interconnecting hollow-ways do seem to be visible running through the wood, just as they do on Baildon Moor where they link each bell pit.

Many workings are bell pits with the spoil tipped mostly on the downhill side. Their shafts were left to fall in, forming a depression. Two or three larger bell pits on flat wet ground are seen at the wood boundary just north of the mineral line, near a beck are marked on a map of 1783. These would have been shallow, perhaps 40 feet deep, and maybe pre 1850; the smaller and flatter ones are probably older. The very large pit in Old Hanna Wood and pits in nearby surrounding fields to the NE with large spoil heaps are probably some of the later pits and have sunk shafts through the Clifton Rock to reach the Crow Coal below. The Old Hanna pit has a curious mound with numerous hollows in its sides as if there has been some later working of the debris, perhaps during 20th c coal shortages. The First Edition OS map C1850 shows that the long stretch of Station Road did not exist but was a wide "coal stand" area, probably for collecting coal and possibly from the coal mined nearby. It may have been used by the steam trains. At the north end of the coal stand however was an engine house and the start of a mineral line (marked "paling") heading north to join the network to the Ironworks. Between 1850 and 1890 the curving mineral line running uphill through Low Wood was built, possibly as a replacement. This cuts across old coal pits and coal spoil was used in making its embankments. heavy rain and eroded soil, has caused gullying damaging the cutting of the track .

The field boundaries in 1850 are predominantly hedged since they were taken out of the woodland. Remains of hawthorn hedges, now thin and full of gaps, remain above the cottage site. The farm of Woodside has irregular fields which suggests assarting of the woods to make pastures. Fields around Horse close include irregular and thin fields which may have been used for arable crops. The map of c 1890 shows a reduced number or hedgerow trees, perhaps because sheep were replacing tradition cow-keeping.

The fields around the wood have thin, low, stone walls typical of the area. These are not old walls and they may well replace hedges. The walls are not very thick but have faced sides and infilled centres. Some retain their top stones of semicircular shaped sandstones. This style was much used in the area. There are some rabbit bolt-holes built in, suggesting some game sport went on. Stone used for walling includes boulder-like sandstone, probably field clearance stone, blocky medium gained sandstone probably the Clifton Rock. Some walls are made of fieldstone and weathered lumps and boulder-like stones from the top of the Clifton Rock. Other walls are of poor flaggy and soft sandstone known as rag.

Other walls are of squared, dense more massive sandstone with evidence of cross bedding. Eg in High Fernley Lane.
A roughly hewn gatepost is also of this stone.
Horse Close Bridge has some architectural aspirations with piers and string courses and there are also a number of masons marks. The stones have Georgian tooling, though of rather basic quality, with chisel drafted margins and pecked interiors. The original top stones on the parapet are similarly tooled and are canted. The parapet has been much repaired using other stones including a long door head stone. On the N side of the bridge one stone has a rusticated design. The bridge may have been built by local walling masons .

A woodbank, a bank and ditch runs along the boundary with Royds Hall Lane . This might be part of the older arrangement of the woodland.
Some of the becks on the flatter slopes above the wood are stone riveted ; but possibly where the becks form land boundaries eg near the small ragstone quarry in Low Wood and in the field above Royds Hall wood

WATER
Wells and troughs are marked on the map. With the fault lines and alternating porous sandstones and impervious shales, there are many areas where water flows from the ground. All houses and stock require water and a spring flows in to a trough behind the cottage remains. Troughs would have watered animals on the road too.

LANDSCAPE HISTORY

The woods should be looked at in the context of its township and surroundings. There has been a long history of land use with evidence of prehistoric finds in the area.
The boundaries of the townships are probably centuries old and the beck forms that between Bierley and Lightcliffe townships.

The woods today lie within the south boundary of Bradford Metropolitan District. In 1086 the area was part of Wibsey. In medieval times, the townships of North Bierley (in which Royds is situated) and Wyke were part of an area of scattered small settlements of low density. It must have been a marginal area with very low density population to the west, such as at Queensbury, and Ovenden.

Landlords in medieval times included the de Lacy family in the 11th and 12th century and in the 14th C the Honour of Pontefract had the manors of North Bierley and Wyke . Royds is mentioned in 1276 as having a park. The de Swillington family lived there. Royds seems to be a third settlement in the

township, along with Wibsey and North Bierley . There were small settlements in Wyke too but these were part of the Manor of Bradford in 1314.
There are references in the 1300s to coal working in Hipperholme showing that coal mining was taking place then. 14th century records show assarting of woods in Wibsey, Hipperholme, Cleckheaton. This probably led to the fragmentation of the woods by the 19th century. Springs or coppices are referred to. (See West Yorkshire ;an archaeology survey to 1535. WYAS. Moorhouse and Faull)
The present Royds Hall incorporates a substantial timber framed house of c 1538 with a stone wing of c 1600. Timber building was common on the Coal Measures even into the early 17th century with buildings surviving in Leeds and Halifax.
By the 16th C the area had became much wealthier. The 14th-17th centuries were a period of population growth with a number of enclosures in the 16th century for farming.). Royd itself is often a 14th century word indicating an area given to a tenant for clearing and farming, so its name mention in 1276 is not surprising. Published accounts in West Yorkshire Deeds (Local Record Series. Vol 2 1936. Bradford Historical and Antiquarian Society) refer to leases from the Rookes family of Royds Hall from the late 16th C. There are references to new enclosures such as in 1609 to land "late enclosed out of a great close of land, wood and pasture called Royds Hall park". Hedges and oak trees are also mentioned. A lease of 1567 lists many of the fields around the hall such as Broad Royd, so these fields existed then.
N Bierley and Wyke commons and moors were eventually enclosed for farming (c 1800??)
In 1789 the Manor of Royds was bought by Low Moor Iron Company (founded i1788) for its mineral wealth and by 1801 the Company owned a third of all properties in North Bierley as well as Royds Hall. Blast furnaces were working by 1791 and by 1806 it became the largest ironworks in Yorkshire helped by Government demands for cannon for the Napoleonic wars. By 1900, although no longer using local coal and iron, the ironworks had the largest plate mill in the country. Boilers etc were made from the iron sheets produced.

<u>JOSEPH DAWSON 1740-1813</u>
Royds Hall was the home of Rev. Joseph Dawson, one of the founders of the Low Moor Ironworks who had considerable geological and chemistry interests. He must have known the woods. He probably knew from his geological knowledge which were the good coal seams required for smelting. He had been tutored by Joseph Priestley, the scientist, whilst training as a Non-conformist minister. He built up a collection of minerals with a catalogue listing several thousand minerals kept at Royds Hall, some listed as being in the parlour. His collection and catalogue was given by his son to the Bradford Philosophical Society in 1868 and is now part of the geology collections of Bradford Museums. Joseph Dawson had tried to found a philosophical society about 1808 (ref ; Pacey,A, Emerging from the Museum;Joseph Dawson, mineralogist,1740-1813. The British Journal for the History of Science Vol 36 p455-496) Dawson also founded the Yorkshire and Derbyshire Iron-Masters'Association and encouraged

scientific papers to be read. He included a lecture on blast furnaces and amounts of sulphur affecting iron quality.

end
