AN EARLY APPLICATION OF WILLIAM SMITH'S STRATIGRAPHIC SYSTEM IN EXPLORING FOR COAL

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Great Britain in the late 18th and early 19th century was undergoing great change. The industrial revolution was in full flood and there was an insatiable desire for coal to turn the wheels of industry. Traditional mining areas were in the north of England, Scotland and south Wales. To the south, coal was less abundant. However, coal fields were known in the Bristol area since Roman times and their occurrence was to spawn other coal trials in the region. It was one of those trials which, although unsuccessful, saw the first ever application of stratigraphic method in mineral exploration.

At the end of the18th century coal fever was endemic as was the fever for canal building. Amongst other similar ventures there was a grandiose but ill-fated proposal to build a canal, the Dorset and Somerset canal, which was to have connected Bristol to Poole on the English Channel. Some of the canal investors lived in or near the Somerset town of Bruton (some 25 miles south of Bristol). Shortly after the canal was proposed these same investors, together with others, became involved in a scheme to test for coal at Cook's Farm, Brewham near Bruton (Figure 1).

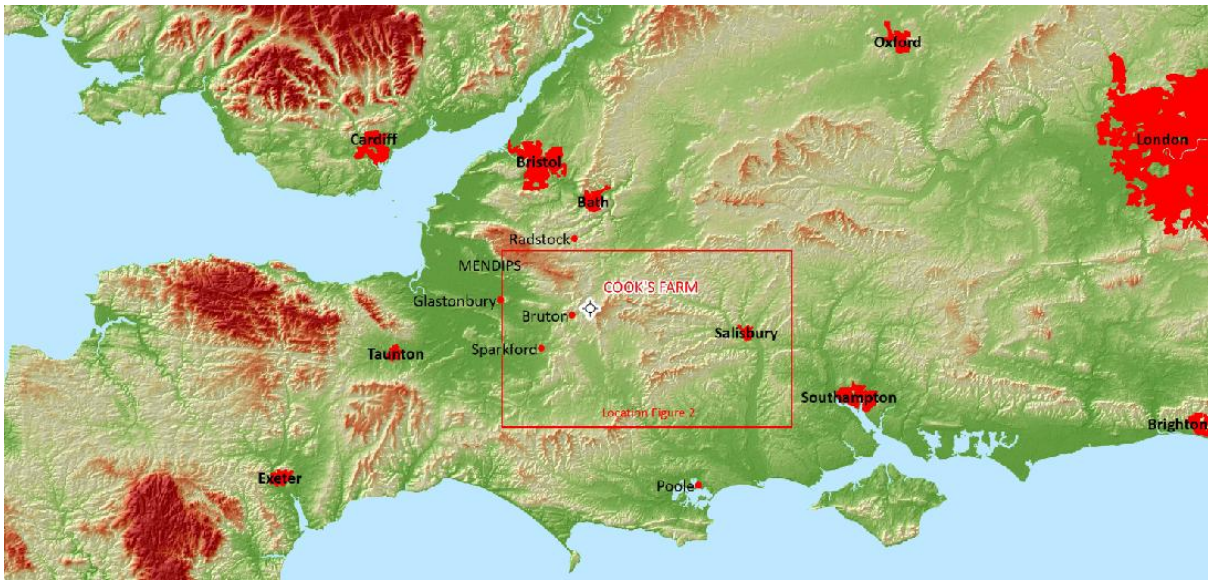

Figure1. Location map of the Cook's Farm Coal Trial

They believed that if coal was discovered, not only would they have had a ready supply for local industry but also a nearby canal to transport the rest to the coast for export. These adventurers raised the sum of £2,000 for the coal trial and took out a lease on land owned by Bruton School. The lease included a production-sharing agreement in which the school would initially receive 5% of all coal produced, increasing to 10% after 5 years. The school also insisted that the site be returned to its original condition in the event that the trial was unsuccessful. The selection of the site for the test was based on the apparent similarity between surface lithology and soils at Cook's Farm with that seen elsewhere in areas where coal had already been found. The proximity of the trial site to the proposed route of the canal may also have been a factor in the selection of its location. Their prospectus declared that the site was "scientifically acknowledged to be the most eligible for such a trial" and a qualified engineer had apparently been consulted. Actually there was no basis for this

claim, the clays and marls found above the Carboniferous Coal Measures in the north of the country were not the same as those seen at Cook's Farm. This fact was later categorically demonstrated by Mr William Smith, the founder of stratigraphy, by the application of his new system, which solved the problem of many similar recurring lithologies, found in England, which had previously bedevilled all earlier attempts to find coal here, outside the known coalfields.

In 1803 diggers at Cook's Farm were employed to sink the shaft and later a waterwheel was installed to assist in pumping operations. Glowing progress reports appeared in the local newspapers and optimism ran high. Before too long the shaft had reached a depth of 120 feet.

It was on the 24th March, 1805, a red letter day in the history of geology, that William Smith visited Cook's Farm. His investigation of spoil from bottom of the pit revealed specimens of a small lobate oyster which is now known *as Gryphea (Bilobissa) dilobotes*. Smith knew this fossil to be characteristic of the Kelloways Stone which was at the base of his Clunch (Oxford) Clay. From his application of what we would now call biostratigraphy, Smith immediately knew that the trial was far too high in the geological succession for coal to be encountered. We know from Smith's nephew, John Phillips that Smith must have shared this information, for Phillips later writes "in spite of remonstrances from Mr Smith and his intelligent friends, the speculators proceeded at a ruinous expense".

Operations continued until Christmas 1807 when, at a depth of 652 feet, water from the Great Oolite aquifer flooded the shaft. This effectively ended mining operation. In 1808 an attempt was made to auction off the lease, waterwheel and other material used in the trial but due to subscriber resistance the sale was postponed. An unsuccessful attempt was made to raise additional funds for the purchase of a steam engine to pump out the shaft but finally in 1810 the company was liquidated. It was a bad day for the adventurers, several of whom subsequently went bankrupt and was also a sad reminder for those who had ignored William Smith's pioneering stratigraphic method.

COOK'S FARM A MODERN PERSPECTIVE

A part of William Smith's 1815 geological map (Figure 2) is shown extending across the Cook's Farm area. With the aid of modern geological mapping it can be demonstrated that Smith had an excellent understanding of the surface geology of the area. In the top left hand (NW) corner of the map the Coal Measures (crosses showing collieries in the southern part of the Radstock basin) are clearly shown overlain by his Red Ground, now known as the Triassic Mercia Mudstone, which also outcrops to the west. Moving east , Smith shows the Jurassic succession from Liassic shale and marl (White and Blue Lias) up the escarpment through middle and upper Jurassic strata consisting of, Fuller's Earth, Inferior and Great Oolite, Forrest Marble, Cornbrash, Kelloways and Clunch Clay (Oxford Clay). In the area around the Fifehead Magdalen-1 well the Coral Rag occurs with Oaktree, (Kimmeridge) Clay, Portland and Purbeck beds outcropping to the east. The wide expanse of the chalk can be seen on Salisbury Plain (shown in green) and to the extreme east Tertiary sands and clays outcrop.

As well as being aware that the trial at Cook's Farm was too high in the succession to find coal, Smith also knew that in the Somerset coalfield, 10 miles north, coal often occurred beneath the Red Ground (Triassic) with an unconformity between it and the Coal Measures beneath, which was certainly not the case at Cook's Farm. Although he knew that this coalfield abruptly terminated

against the limestone of the Mendip hills he seems not to have completely discounted the idea that coals might have occurred south of the Mendips. Indeed, in 1813 he was involved in an attempt to find coal to the south, beneath the Triassic at Compton Dundon, near Glastonbury. However, it is now thought unlikely that Coal Measures ever extended much further south and certainly there is no evidence of Coal Measures being preserved in any of the modern wells shown on the map.

Today, it is known that the Cook's Farm colliery trial was located on an east-west structural feature called the Bruton High. As part of a campaign to search for onshore oil and gas in the 1980s, a long seismic line (CV80-082) was acquired which runs close to the Cook Farm trial site. This line is located on Smith's map and the seismic section projected along the line (Figure 2). The section clearly shows reflectors dipping to the south off the high. Although Smith would have been unaware of the high, he did actually map an outcrop near the base of his Blue Lias, near Sparkford, that coincides with a prominent outcropping Rhaetic reflector located at the western end of the high. To the northeast, younger beds are seen to drape over older Palaeozoic reflectors. The Bruton-1 stratigraphic borehole (4 miles south west of Cook's Farm), encountered a Jurassic sequence beginning in the Fuller's Earth Rock and extending downwards through the Inferior Oolite and Liassic and Triassic, the latter unconformably overlying Carboniferous Limestone at a depth of 962 feet. This compares with Carboniferous Limestone at 3250 feet at Fifehead Magdalen-1 which is situated to the south in the Mere basin. Near Norton Ferris-1 the seismic section shows evidence of possible strike-slip faulting. Towards the end of the seismic section, basal Chalk and Greensand reflectors are seen to unconformably overly upper Jurassic sediments.

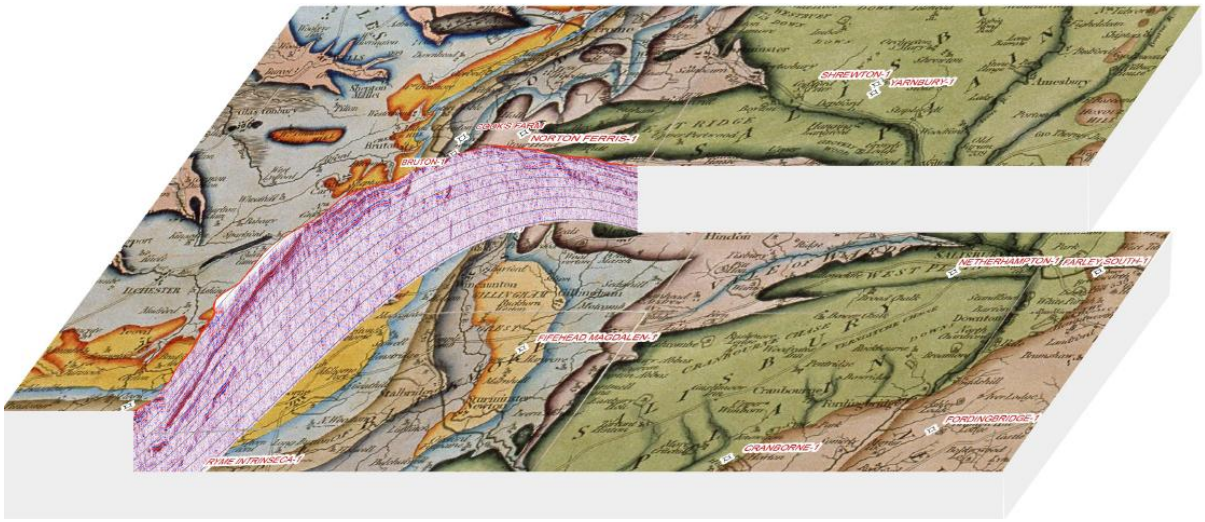

Figure2. A part of William Smith's 1815 geological map (Y map courtesy of the National Museum of Wales) in the southern UK with the seismic section CV80-082 projected along the line of section. Also shown is the location of the Cook's Farm Trial together with more recent wells and boreholes.(Seismic line courtesy of UKOGL)

A representation of the Cook's Farm coal trial is shown in Figure 3, using part of Smith's Geological Table of 1817. The trial was spudded in the Clunch (Oxford) Clay and eventually reached a total depth of 652' in the Great Oolite. It is now known that there was never any possibility of coal being encountered since there is almost certainly an unconformity between Smith's Red Ground (Triassic) and his Mountain (Carboniferous) Limestone. Coincidentally, some 180 years later and only three miles east of Cook's Farm, Norton Ferris-1 (Carless Exploration) was drilled to test for oil. The

primary reservoirs were thought to be the Upper Liassic Midford Sands, and other sandstones within the Rhaetic. Secondary objectives were Carboniferous Walsortian Reef limestone and Devonian sandstone. The Midford Sands were encountered but showed no trace of oil; both the Triassic (Sherwood) sandstone and the Carboniferous Limestone were absent.

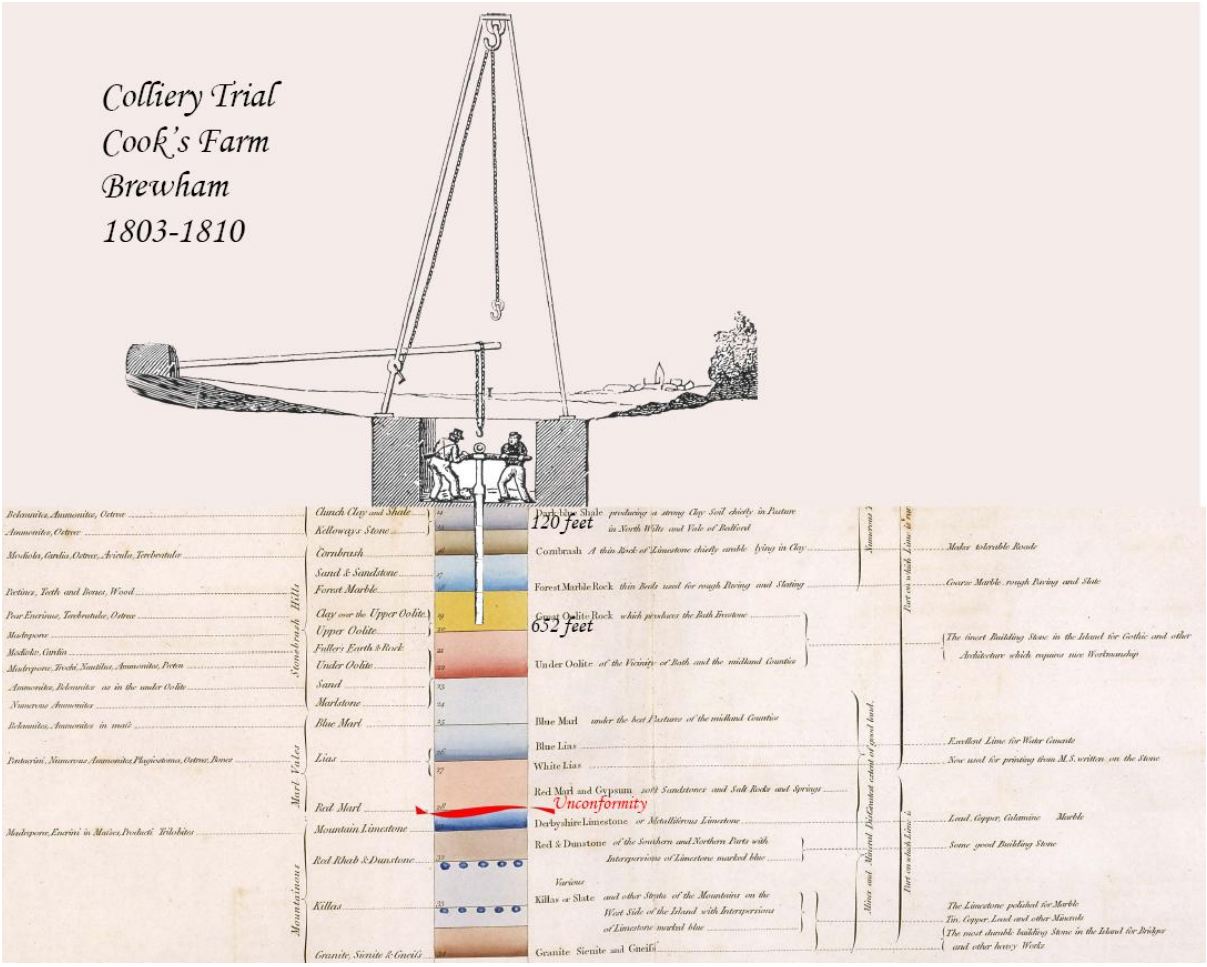

Figure 3. A representation of the subsurface geology at the site of the Colliery Trial at Cook's Farm utilizing part of William Smith's Geological Table of British Organized Fossils (courtesy of the National Museum of Wales).

The full story of the Cook's Farm Trial has been told by Hugh Torrens (in French) in Le 'Nouvel Art de Prospection Minière' de William Smith et le 'Projet de Houillère de Brewham ': Un essai malencontreux de recherche de charbon dans le sud-ouest de l'Angleterre, entre 1803 et 1810. De la Géologie à Son Histoire: Livre Jubilaire pour François Ellenberger, ed. G. Gohau. Paris, 1998.