THE FIRST DETAILED GEOLOGICAL SECTIONS ACROSS ENGLAND, by JOHN FAREY, 1806-8

by

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Summary

Several years before his monumental work on the Agriculture and Minerals of Derbyshire (1811), John Farey drew what are believed to be the earliest extended geological sections of British regions. These were never published and have been overlooked in works on the history of geology. Redrawn versions are presented, with short discussions of their content and significance.

Introduction

During the course of investigation of a collection of Derbyshire lead-mining documents in Sheffield Central Reference Library, two rolled-up hand-drawn and hand-coloured geological sections were found (catalogued as Oakes Deeds 1221 and 1224). Subsequently it was discovered that "fair copy" versions of the longer of these two sections had been donated (a) to the library of the Geological Survey by the widow of W. Topley, author of the Weald Memoir (MS 404-B); and (b) to the library of the Palaeontology Department of the British Museum (Natural History) by C. D. Sherborn. Another copy is said to have been given to the Geological Society by Greenough in 1811. Topley's section is bound with another detailed section across the Weald by Farey, and with a small section across the Derbyshire Coalfield. None of these sections was apparently ever published, in spite of their obvious important place in the foundations of British stratigraphical knowledge. Redrawn versions are presented here, with interpretations of Farey's state of knowledge compared with the facts known today. Their relationship to the rest of Farey's work is also briefly discussed.

The Sections

1) The Ashover-Trusthorpe section (Text-fig. 1) is 9 feet long by $7\frac{1}{2}$ inches wide and carries the following dedication:-

"To the Right Honourable Sir Joseph Banks President of the Royal Society this section of the principal Strata of England as the same crops out and appears between Trusthorpe near Sutton on the eastern coast of Lincolnshire passing his seat at Revesby the towns of Tattersall Sleaford and Ancaster in that County; Newark Hockerton and Mansfield in Nottinghamshire; Pleasley Temple Normanton and Ashover in

Derbyshire and extending to Sir Joseph Banks seat at Overton in the last-mentioned parish; compiled from materials collected during an extensive tour undertaken at the instance of the worthy President in the Autumn of 1807 in prosecuting the discoveries made and taught by Mr. William Smith on the arrangement of the British Strata, is most respectfully inscribed by his Obedient and very humble servant

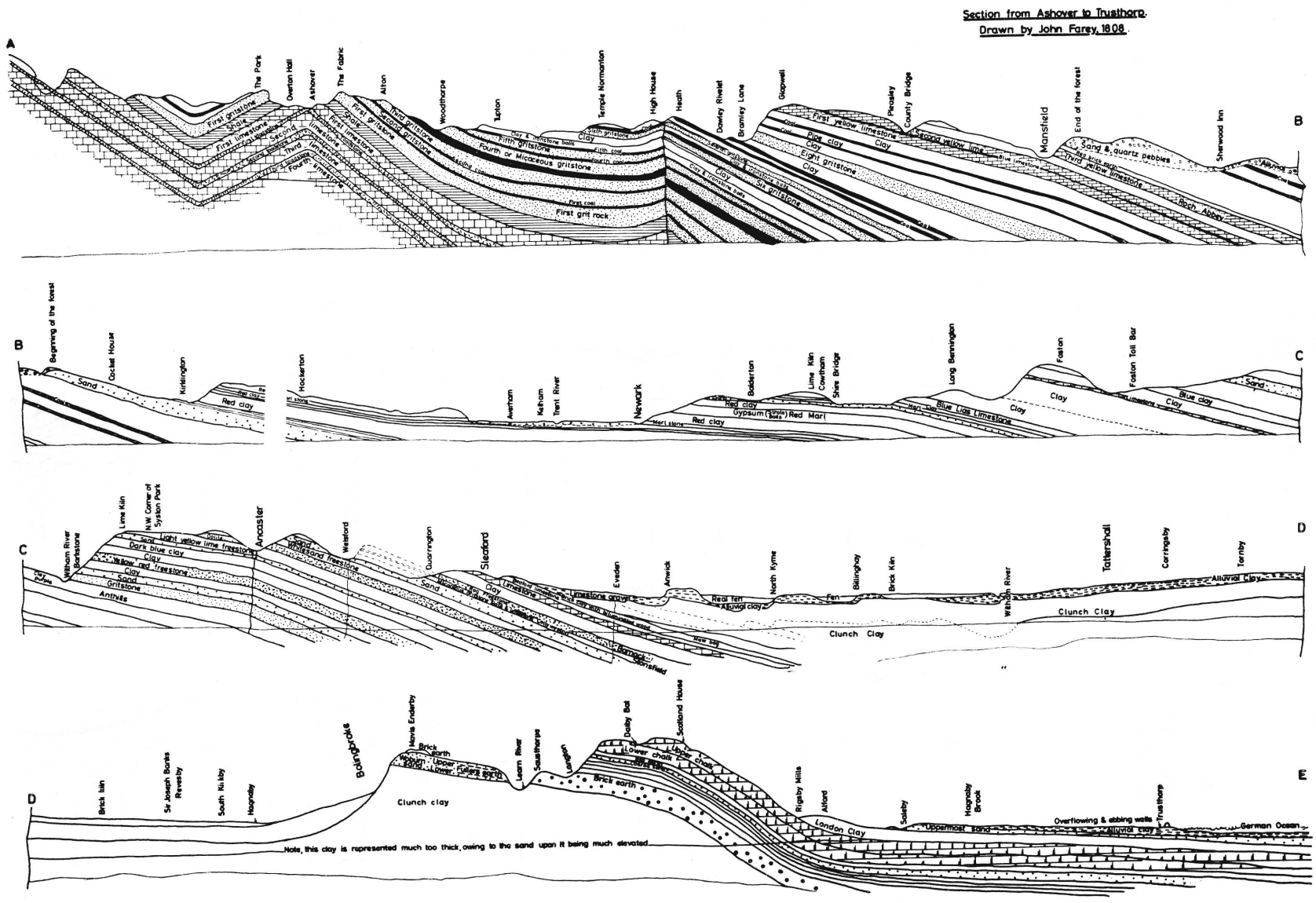
John Farey senior
Land and Mineralogical Surveyor,
12 Upper Crown St., Westminster."

The section is not dated but, as Farey is known to have made other tours in Derbyshire in 1808 and later, and as these are not mentioned in the dedication, it seems likely that the section was drawn before his 1808 tour; the Geological Survey and the British Museum (Natural History) copies are both dated 17th February 1808. This appears to be the first extended section of British strata ever drawn. Previous sections were of limited areas only, e.g. Strachey's Somerset Coalfield 1719, Whitehurst's Matlock gorge 1778 and 1786, and White Watson's Derbyshire Mountain, Ecton Mines etc. in the 1790's (see Ford 1960). Sherborn (1929) published a brief description of the section now in the British Museum (Natural History), but no published version of the section has been traced.

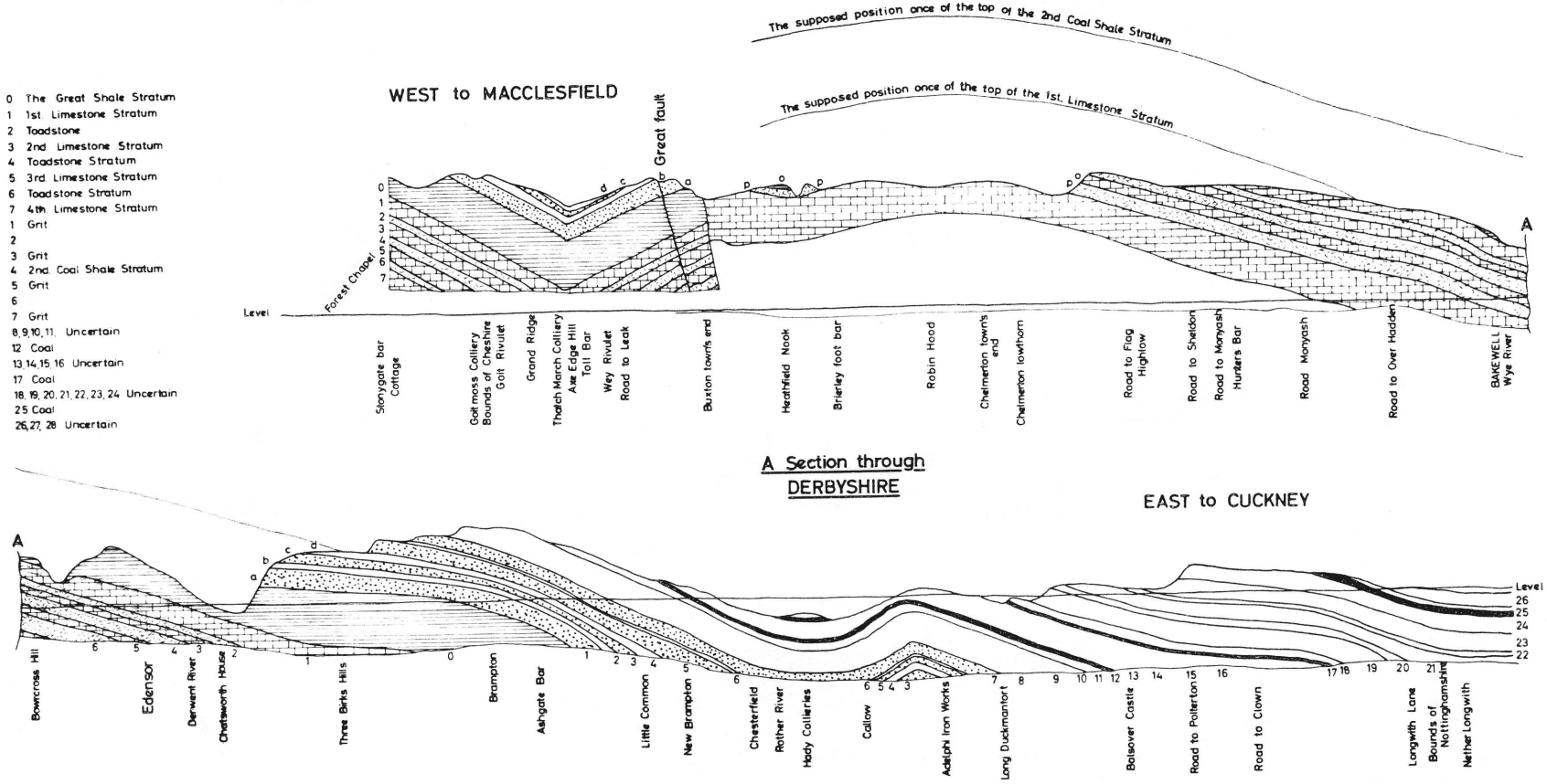
The western end of the section appears to start in the Matlock gorge and shows the correlation of limestones and toadstones (basaltic lavas etc.) beneath the Tansley syncline into the Ashover anticline, where recent boreholes appear to have penetrated a vent rather than an orderly succession (Ramsbottom et al., 1962). The limestones and toadstone are numbered downwards but the succeeding Millstone Grits and coals are numbered upwards, contrary to the practice later adopted for the Staffordshire Millstone Grit. On the British Museum (Natural History) copy the Fourth Grit is marked "Ealand Edge", which probably suggests a correlation with the Elland Flags of the West Riding. In the Derbyshire coalfield the synclinal development around Temple Normanton is clearly recognised and the faulted Brimington-Callow anticline to the east is shown by a dislocation of the strata - the only apparent fault shown on the section. The approximate position of the thicker coals is shown correctly, e.g. the High Hazles Seam which outcrops near Bramley Lane.

The Permian Magnesian Limestone escarpment at Glapwell is shown, but his subdivisions of the Magnesian Limestone are not so easily recognizable. The First and Second Yellow Limestones appear to be equivalent to the Lower and Middle Magnesian Limestone; the Third Yellow Limestone seems to be the equivalent of the Upper Magnesian Limestone, which outcrops well to the north of Mansfield but not at Mansfield itself (F.M. Taylor, personal communication). The Bunter Pebble Beds outcrop is correctly shown, but his interpretation of these as alluvial is the major error of the section. (It is perhaps excusable, in view of the wide areas of derived Bunter gravels along the Trent Valley.) His placing of coal directly beneath the Pebble Beds is less easy to understand, unless he was aware of the fact that the Permian beds are overlapped around Nottingham so that the Trias does in fact rest directly on Coal Measures. To the east, to beyond Newark, the Keuper Marl with its red clay, "marlstone", and gypsum "strata balls" is represented without major deviation from the outcrops known at present.

The Lower and Middle Lias on the section seem to be clear from Long Bennington, where the Blue Lias (hydraulic) limestones are depicted, to the River Witham at the foot of the Lincoln edge, but Farey seems to have found some difficulty in representing the alternation of clays and sands of the Upper Lias and Lower Estuarines in the escarpment. The Yellow-Red freestone is marked on the British Museum (Natural History) copy "Northampton - Uppingham" but the other Oolite Limestones are a little confused. The Collyweston and Stonesfield "Micaceous Gritstone Slate and Limestones" are wrongly correlated and are overlain by Barnack Rag Freestone; they are also wrongly placed above the Ancaster Freestone. The Oolite near Ancaster is marked in the British Museum (Natural History) copy "Ketton-Bath", again showing mistaken correlation. The Great Oolite Clay and Limestone (with its subdivision the Bedford Stone) are, however, clearly shown around Sleaford.



Text-fig. 1. Farey's section from Ashover, Derbyshire to Trusthorp, Lincolnshire, 1808



Text-fig. 2. Farey's section across the Peak District

The thickness of the Oxford and Kimmeridge Clays has been exaggerated by the scarp of the Cretaceous being made too high, but it is interesting to note that the two great clays have been separated by a broken line. The intervening Ampthill Clay has not been recognized.

The Lower Cretaceous is shown on the section as Woburn Sands with a Fullers Earth subdivision in the middle, but this also is a mistaken correlation by Farey and should be the Spilsby Sandstone Series. The overlying clays are left unnamed. The coarse sand and Red Cawk above are clearly the Carstone and Red Chalk. Two divisions of the Chalk proper are recognized. Finally, to the east, the fen clays are mistakenly labelled "London Clay" at Alford. The superficial deposits of the fens need no comment.

In this section Farey is considerably more detailed than William Smith's map, published several years later in 1815. Farey had the advantage of a larger scale, approximately 1 inch to 1 mile, whilst Smith's map was 5 miles to 1 inch. The only major error in Farey's portrayal is the position of the Bunter Pebble Beds; less important errors are in the Oolite Limestone, the Woburn Sands and the London Clays - all understandable in the state of knowledge in the early 19th century. The confusion in the Jurassic rocks at first seems surprising in view of William Smith's work in the Bath area, but the correlation of some of the equivalent beds in the Midlands is still uncertain in places.

2) The Derbyshire section (Text-fig. 2) in Sheffield library is catalogued as Farey's (Oakes Deeds 1224) and is nearly 4 feet long by 7½ inches high. Although again on a scale of about 1 inch: 1 mile, it has been taken across the Derbyshire "Dome" further to the north-west; the wider outcrops there afford more room to depict the Millstone Grits and Coal Measures in fuller detail. It has the appearance of having been drawn by a different hand (perhaps a draughtsman under Farey's instruction), with a key added in another hand. There is no inscription and it does not bear Farey's name, so there is a possibility that it is not Farey's work.

The section starts near Macclesfield and crosses the Goyt syncline, showing a thick basal Millstone Grit Shales overlain by two grits. Two faults are shown at the boundary of the Limestone at Buxton but the words "Great Fault" appear in the wrong place; the boundary here is in fact an unconformity. To the east across the Limestone "Dome", three toadstones are shown alternating with limestones in the Sheldon-Bakewell Area, though it would be difficult to place these toadstones today. The words above the "Dome" note the former extent of the top of the Limestone and the Second Coal Stratum, and clearly indicate that Farey understood that these superincumbent strata had been eroded away.

East of Chatsworth, the thick "Edale" Shales are followed by four thick grits, presumably the Kinderscout, Ashover, Chatsworth and Crawshaw horizons. In the Coalfield, a large number of horizons are shown but are labelled "uncertain" in the key, only a few important coals being specified. These show the influence of the Brimington-Callow anticline. Coal No. 12 is about the Silkstone horizon; No. 17 is either Parkgate or Deep Hard; but coal No. 25 is unidentifiable. Langwith is well within the Magnesian Limestone outcrop and this latter stratum is not indicated on the section.

Topley's Geological Survey version of this section is across the coalfield and Millstone Grit only, but has considerably better stratigraphic detail. The gritstone beds 1, 3, 5 & 7 are labelled "First, Second, Third and Sixth Grits" respectively. Bed No. 13 is labelled "Tenth Grit", No. 18 "Thirteenth Grit", and No. 22 "Twentieth Grit". Beds No. 24 upwards are labelled "First, Second, Third and Fourth Yellow Limestones" and the Coal (no. 25) is marked "Blue Limestone".

This section is drawn partly along the same line as the well-known section in White Watson's Delineation (1811).· Comparison of the two shows that the latter had a finer comprehension of the structure of the Carboniferous Limestone area, whilst Farey understood the coalfield better. It is a pity that this Derbyshire section of Farey's is undated, for it could have provided a clue as to who had more influence on the other's ideas - White Watson or Farey (see Ford 1960). It is known, however, that they disagreed over the nature of faulting, and that Watson's account of the Matlock area (1813) was written to "correct Farey's

section". The limited number of faults on this section may indicate that it was drawn before Farey had fully formulated his own ideas on the subject, for his Great Peak Fault and Bakewell Fault are not shown on this section.

3) The London - Brighton section (Text-fig. 3) in the Geological Survey collection (MS 404 -B) is again on a scale of 1 inch: 1 mile and is 5 feet 3 inches long. It bears the inscription "To the Right Honourable Sir Joseph Banks, President of the Royal Society, in testimony of his zeal and liberality in promoting every inquiry connected with Natural History, this Section of the Strata of the Earth which crop out and appear on the surface in the road between London and Brighton, (made from notes taken in passing this road three times in July and August 1806 and February 1807, and applying the Principles taught by Mr. William Smith, relating to the Stratification of England), together with a Description to accompany it, is most respectfully inscribed by his most obedient and very humble servant

John Farey Senr.,
Land Surveyor and agent,
12 Upper Crown Street,
Westminster."

This section is of particular interest in showing numerous faults, in contrast to the other sections described above. They are shown as "gulfs" widening downwards, and are thus a preview of his block diagrams of faults in his book on Derbyshire(1811). A wide, but otherwise undistinguished, "gulf" is shown beneath the Thames in London; this may represent what is now known to be the buried channel.

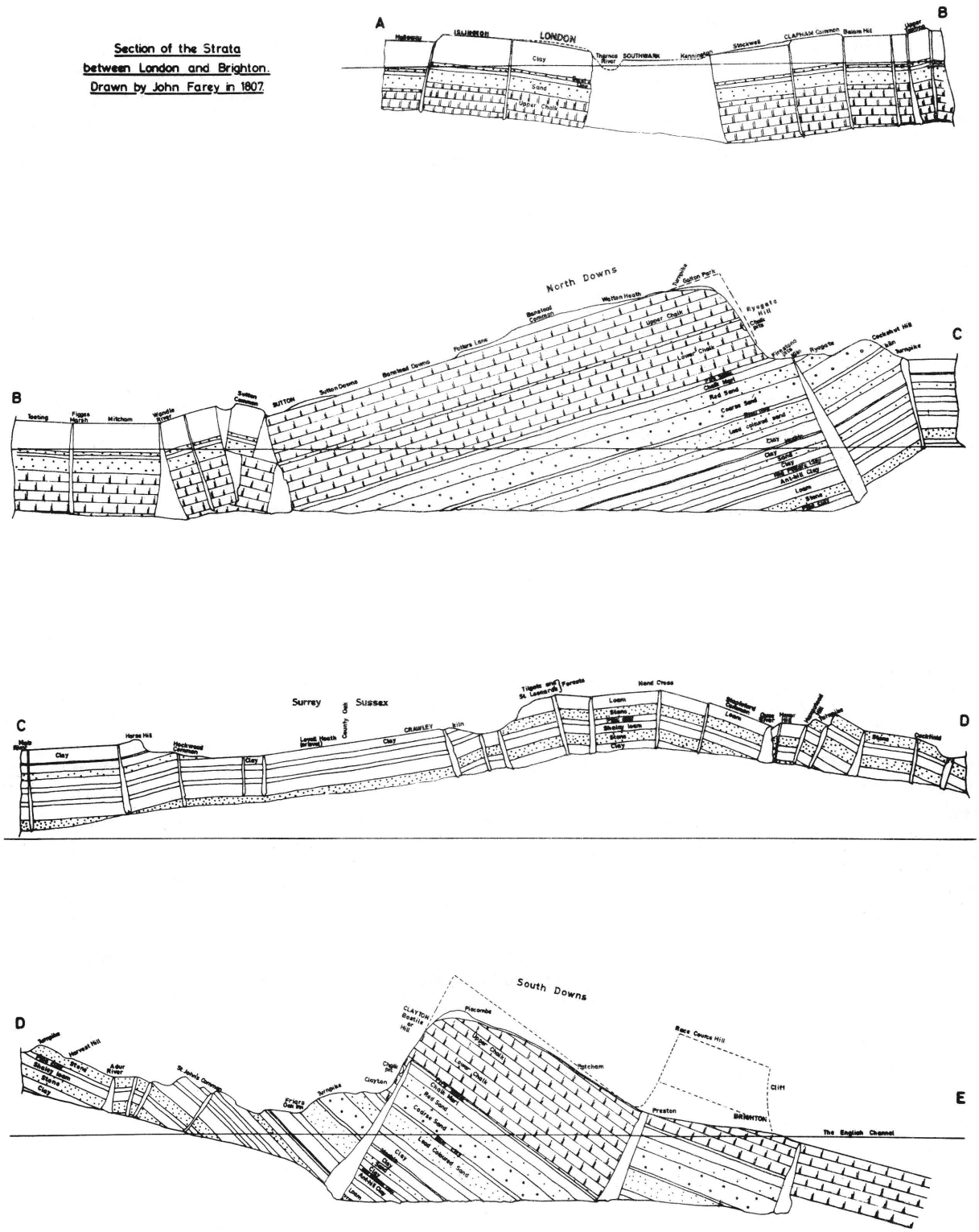
In the London area, the London Clay is shown overlying the Woolwich Beds "Sand and Clay", the Thanet Sands and the Chalk, but the veneer of Tertiaries on the North Downs around is not subdivided, probably owing to the "piping" down into the Chalk of both Lower Tertiaries and Lenham Beds. Beneath both North and South Downs the "Chalk Marl" is evidently the Gault, and the "Firestone" is the Upper Greensand, once mined as a Hearthstone in Surrey. The Folkestone and Hythe Beds follow beneath Ryegate and Cockshut Hill, being shown as "Red Sand, Coarse Sand and Lead-coloured Sand". The "Blue Clay" placed by Farey between the two latter strata is not now recognized. Horse Hill is depicted as a feature, though shown as made of clay; the feature is now known to be due to the presence of the Charlwood Sandstone,which Farey has misplaced to beneath Hockwood Common, where only Weald Clay occurs. The thin band which Farey shows beneath Horse Hill appears to represent the Sussex Marble.

In the centre of the Weald the two Tunbridge Wells Sands are clearly shown, with the "Pipe Clay" apparently the Cuckfield Clay. But to the south, around the Adur River, there seems to be some confusion with the Wivelsfield Sand in the Weald Clay. The lowest stratum shown in the central Weald appears to be the Grinstead Clay, which outcrops well to the east of the line of section and has been correctly projected in the sub-surface.

Taken as a whole this section is a remarkable achievement for only three journeys across the Weald, so that it seems likely that these were protracted journeys with plenty of time to talk to quarrymen etc.. No doubt other pioneer geologists were also consulted, but no mention is made of them.

The Relationship of the Sections to Farey's other work

John Farey was born at Woburn, Bedfordshire,in 1766. After a common school education he went to a school in Halifax at the age of 16,to study mathematics, philosophy, drawing and surveying. At the age of 26 he was appointed steward to the Duke of Bedford at Woburn. It was there in 1802 that he met William Smith, when the latter was engaged to survey the strata of the Duke's estates. Farey became a convert and disciple of Smith; he indeed gave us the first published account of Smith's discoveries on stratification in 1806, in the first of a series of contributions to Tilloch's "Philosophical Magazine" over a period of some 10 years. From 1807 to 1810 Farey was engaged to survey the Agriculture and Minerals of



Text-fig. 3. Farey's section across the Weald from London to Brighton, 1807

Derbyshire for the Board of Agriculture. It is in the first of the three volumes of this work (published 1811) that Farey published in detail the fruits of his geological knowledge and discoveries. In the introduction to the chapter on "Soils", Farey outlined Smith's succession of strata down to the Red Marl (Keuper, as we now know it), adding his own details regarding the Carboniferous later. He discussed the significance of tracing outcrops and included a simple geological map of Derbyshire.

In this book Farey established a number of "Firsts"; these have been overlooked through being concealed under the title of what appears to be a local report of limited significance. The only recognition hitherto has been the short accounts by Mitchell (1873) and Challinor (1947). The Firsts are:-

The First published regional geological map of a part of Britain.

The First published regional descriptive memoir.

The First geometrical exposition of the nature of faulting.

The First demonstration of the significance of tracing outcrops.

The First recognition of the effects of denudation on outcrops.

The First description of a British Pre-Cambrian area (Charnwood Forest).

It is surprising, in view of the above, that the sections described herein have not previously been recognized and published. The only section in his book on Derbyshire is a very simple one across the Matlock gorge, apparently drawn to show that the "Gulf" postulated by Whitehurst (1786) was not present beneath the Derwent.

Farey's name fades from the geological scene about 1815 and it may be presumed that he was occupied as a mineral and land surveyor from then until his death in 1826 in London.

Conclusion

No comprehensive study of Farey's works has ever been published, the longest to date being that of Challinor (1947). According to Mitchell (1873), most of his manuscripts were lost during a fire at John Farey Junior's house in 1850 (Sherborn 1929). It is thus hoped that the presentation of these sections of Farey's will help towards an understanding of one of our great pioneer geologists.

Acknowledgements

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