REPORT

Blue-collar Geologists

Back in the 19th century, men who were appointed "Borough Engineer" were expected to perform in the roles of architect and property surveyor and the new profession of "civil engineer" - and last but not least to act as someone who was geologically aware. This was a range of skills that few had on appointment, but many acquired eventually by practical, and sometimes painful, experience. To some extent, Brunel might stand as the example, but he was exceptional in his confidence if not in his real background knowledge.

There were, however, several men who deserve to be recognised for their achievements. In London, two names stand out. One was Joseph Bazalgette, chief engineer to the Metropolitan Board of Works, the supreme authority then overseeing planning and construction in the capital. It fell to him to engineer both the supply of clean and safe drinking water and also the disposal of the dangerous wastes of the growing city and its suburbs; this was in the years following the notorious 1858, known widely as the Year of the Great Stink, when the normally polluted Thames became excessively stinking, Bazalgette solved the problem by embarking on the greatest exercise in tunnelling and pipe-laying ever seen in London. His collecting sewers took waste to the processing plants at Crossness and Becton, while his water mains traversed all the newly expanded suburbs.

In the process, he gained an awareness of the Paleogene rocks of the London Basin, to an extent unrivalled in earlier surveys. His engineering was set up in fullest awareness of the problems posed by fat clays, pyritic clays and, above all, the challenge of water-logged sand lenses that were virtually quicksands. The massive granite walls of the London Thames Embankment were his most visible legacy. A contemporary Surveyor to the City, William Haywood, acquired his geological experience when he bridged the notorious Fleet River with the massive Holborn Viaduct supported on its deep-founded piers of granite from Ross of Mull.

All of these men were following approaches to work set down by William Mylne, the last of a long line of Scots mason-engineers extending back to the time of James I as royal appointments. In London, Mylne specialized in water supply, channelling the streams and springs of Middlesex and Hertfordshire to the needs of the expanding city, preparing the way for Bazalgette. In sinking deeper wells, surveying the lines of acqueducts and pipelines, Mylne gained a knowledge of subsurface outcrops and their facies variations within a short distance. His data was collaged to create one of the best maps of London geology, published in 1856 as *Geological Map of London and its Environs* (with revised editions in 1858 and 1871). On a scale of 1.43 inches to the mile, and using a combination of hachures and shading, his first edition map is still the best to use when trying to explain to non-geologists the relationship between geology and topography in the core area of London. In 1856, much of north and southeast London was yet to be covered by new housing and factories. With the benefit of his access to trenches and tunnels, a modern geologist, armed with state-of-the-art geophysical equipment, would be hard pressed to achieve Mylne's detail. Mylne was invited to join the Committee of the Geological Society set to revise and update the Society's Geology Map of England and Wales, initiated by Greenhough and then in its third edition. Elected a Fellow of the Royal Society in 1860, he remained a Fellow of the Geological Society until his death in Amwell, Hertfordshire, in 1890.

Geological map of Nottingham

All the above is preamble to drawing attention to similar geological awakenings in Nottingham at about the same time. With a great similarity to the work just mentioned by "engineers" in London, Arthur Brown, Borough Engineer, and Frederick Jackson, Civil Engineer, produced a very clear map, which they entitled *Plan of the Borough of Nottingham showing surface levels by contour lines and geological formation* (see back cover of this journal). The map is at the unusual scale of $3^{1}/_{3}$ inches to the mile, with the scale divided into chains and yards. We are told that "the geological features are from the ordnance plan, re-surveyed and amended in detail by J. Shipman of Nottingham and approved by W. Talbot Aveline FGS &c". The map was published as an appendix to the *Report of the Health Committee of the Corporation of Nottingham, 1882*. It was referred to in a description of the sanitary conditions of Nottingham, where another map showed the distribution of deaths by diarrhoea and dysentry (257 out of a total of 4588 deaths in 1882, with two more deaths from cholera).

The map is undated, but is much earlier than 1882. The base map of the streets of Nottingham dates to around 1850, and is one of various maps prepared at the behest of Jackson around that time. The geology is straight from the Geological Survey, and almost matches that on the One-inch Sheet 126 until the new 1:50,000 appeared in 1996 after the resurvey by Messrs Howard, Ambrose, Charlesley and Brandon. Aveline was the field mapping officer of the Survey at the time, while Shipman was assistant editor of the Nottingham Daily Press, "an exhaustive worker on Nottingham geology, and was always on hand at any temporary exposure" (Morrell & Sarjeant, 1964). Much of his data would have gone into publications of the Nottingham Naturalists' Society, but much may have found reached this map of the Borough Engineer.

Like the Mylne map of London, the Nottingham map is contoured at an interval of 30 feet, giving a good impression of the topography that is trenched by

the River Leen and by the Daybrook Stream. Bold print records clearly the district names and the plots that would be important to a Borough Engineer. These include the Union Workhouse, the Lunatic Asylum, cemeteries and burial grounds, the gasworks, Sanitary Wharf(s), reservoirs at Belle Vue and Bagthorpe, the prison and the original University.

The geology offers coverage mainly within the Permian and Triassic succession. The name Triassic does not appear in the legend of the map's key, but its Bunter and Keuper are bracketed as New Red Sandstone (though this excludes the Permian red beds). Lithological comments on superficial deposits are scattered across the map, so that there are "drift clay, sand and pebbles" and "drift clay and quartzite and magnesian limestone pebbles" at Radford Woodhouse. Several quarries are marked in Bulwell, along with two brick yards and a large brick works. It would have been the business of the Borough Engineer to have the fullest awareness of what was where as the city expanded. Strangely, however, there is no note of the sand mines and sandstone caves for which central Nottingham has become well known. Cave cellars beneath individual houses were probably never recorded. Rouse's sand mine on Mansfield Road was probably sealed off, lost and forgotten in the 1850s, but it is surprising that there is no mention of the mines and quarries between Mansfield Road and the Forest. The Park Tunnel must have offered a wonderful new exposure when it was being excavated at about this time, but it was opened in 1855, so could just post-date this map. But details of the sandstone do seem to be a remarkable omission from this record of geology in the East Midlands.

A Nottingham geologist abroad

The other local government officer-geologist of whom Nottingham can be justly proud is Felix Oswald (1855-1958), who in his life did several adventurous things, mainly climbing and mapping in the Caucasus Mountains of Armenia in the last years of Queen Victoria's reign. He entered the Civil Service with a BA degree of the University of London when that was possible as an external degree, possibly taken in Nottingham. On his own initiative and inclination he studied botany, geology and zoology, and he achieved a BSc to add to his first degree. His geology was serious, as we find him providing coloured illustrations of rocks in thin section for Teall's *British Petrography*, the standard for petrological descriptions until Hatch and Wells' textbook came along (with the pen-and-ink drawings that we all copied for style).

It was his interest in rocks which took Oswald to Armenia in 1898 with the traveller H.F.B. Lynch. Later, he went in company with Douglas Freshfield to make mountaineering first ascents, including parts of the formidable volcano Nimrud. Those climbs saw them making their own geological maps, having previously completed the topgraphical surveys. Their map was presented at a meeting of the Geological Society in London in 1906 and was part of the reason for his gaining a DSc of London University.

His privately printed book, *The Geology of Armenia*, summarising his several expeditions in the company of Freshfield, won him the Murchison Fund of the Geological Society for 1907, their Centenary Year. A copy of the map of Armenia was deposited with the Geologists' Association Library before the First World War, was seen in the 1950s, but sadly was lost in flooding of the store at a later date. It would be interesting to learn whether other copies survive in collections in Nottingham.

Oswald's work overseas, which extended to East Africa before the outbreak of the 1914-1918 war, was all undertaken while he held the post of Probate Officer for the East Midlands, which saw him living in Nottingham up to his retirement in 1926. He collected fossils from the Tertiary clays of the Kavirondo Gulf in Kenya, combining with specialists from the British Museum in their description in the Quarterly Journal of the Geological Society in 1914 (Volume 70, pp 128-162). Domestic duties were suspended in 1914 to allow him to return to the Caucasus on behalf of the pre-Revolution Government of Russia to lead the search for oil inland from the producing fields along the Caspian shore. At this time, Professor Serge Tomkeieff, later of Armstrong College in Newcastle (later King's College), was also engaged by the British Government as a liaison between this country and the interim administration.

To Tomkeieff, Oswald was a first rate geologist, with a good grasp of that part of the mountains. Oswald clearly fits the image of the polymath, living up fully to that role with the detachment which characterises scientists of that era. Having achieved completion of work in one field, he turned to meet the challenge of something quite different. His early fascination with petrology became an attention to palaeontology. In his later years in the East Midlands, a continuing interest in geology was eventually part displaced by serious studies of the archeology of the Roman Fosse Way; and this took his name into recognition in the files of the Society of Antiquaries, probably allowing him to fulfil his Probate duties more assiduously. Local Government and the Civil Service must have been more lenient at those times, but in the process, allowed a talent just a little less than that of Sorby to blossom. Add the contribution of Douglas Freshfield, and Nottingham was making a significant contribution to British science at the beginning of the last century.

References

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Eric Robinson