EXCURSION

Ticknall Quarries

Leader: Keith Ambrose, British Geological Survey

The village of Ticknall in South Derbyshire is sited in an area of varied geology. The former lime quarries in the village worked the uppermost beds of the Early Carboniferous Peak Limestone Group, formerly known as the Carboniferous Limestone. These are now referred to as of Mississippian age rather than of Dinantian age. The rocks are all of the youngest Brigantian age and, although we do not see the junction with the overlying Namurian beds, the latter crop out very close by. The limited evidence suggests this is an unconformity, with strata of Arnsbergian age overlying the Peak Limestone with the Pendleian absent. Locally, the Carboniferous is overlain unconformably by the Permo-Triassic Moira Formation (formerly Moira Breccia) and Triassic Chester Formation (formerly Kidderminster Formation, Polesworth Formation and Bunter Pebble Beds). The former is a predominantly mudstone sequence with some sandstone, and was worked for bricks in Ticknall. The Chester Formation consists of sandstones, pebbly sandstones and conglomerates and forms the basal unit of the Sherwood Sandstone Group. The Thringstone Fault runs NW-SE through the village and forms the known eastern edge of the Leicestershire Coalfield and western edge of the Precambrian Charnian rocks. There are four other inliers of Peak Limestone in the area aligned parallel to the Thringstone Fault; all dip gently to the northeast unlike the steep westerly dips seen in the Breedon and Cloud Hill inliers 4 km to the east.

Hull (1860) and Fox-Strangways (1905) both gave only brief mention of the limestones at Ticknall and in adjacent inliers. Parsons (1918) gave the first detailed sections from this locality, dividing the exposed sequence, then about 15 m thick, into five units. Mitchell and Stubblefield (1941) agreed with Parsons' findings. The only recent work has been by Monteleone (1973) in an unpublished PhD thesis. He examined all of the Carboniferous limestone outcrops in Leicestershire and South Derbyshire, including the Ticknall sections, in detail and proposed a two-fold subdivision, combining Parsons' units (see Table).

A two-fold subdivision similar to that of Monteleone (1973) has been recognised during the recent survey (Ambrose and Carney, 1997; Carney *et al*., 2001, 2002), although the member names are not retained. There is repetition of the interbedded limestones and mudstones lower down in the sequence in the Ticknall borehole. The lower part of the sequence originally exposed in

Well-bedded limestones and dolostones at Locality 2.

the caverns are now no longer visible (Parsons' Sandy Stratum and below), but can be broadly recognised in the Ticknall borehole.

Past workers have published faunal lists from the Ticknall quarries (Hull, 1860; Harrison, 1877; Fox-Strangways, 1905, 1907; Parsons, 1918). Wilson (1880) found 30 species of fish, mainly teeth, in the mudstone beds of these quarries, and he lists several other species found by other workers at the same locality. In addition, Parsons (1918) published specimen lists from the Calke Park inlier, and Mitchell and Stubblefield (1941) listed specimens collected from the old quarry [SK370226] near to Calke Abbey. More recently, Monteleone (1973) gave further faunal lists for Ticknall and Calke Park. All workers concluded the fauna indicated a D_2 (Brigantian) age for these beds. The brachiopod *Gigantoproductus* is one of the key fossils found that indicates this age. No additional faunal collection was made during the recent survey by the British Geological Survey, but sampling for foraminifera in the Ticknall Borehole confirmed the Brigantian age for the upper part of the sequence. Elsewhere, a Brigantian age is indicated for the Ticknall Limestone at Grace Dieu (Kent, 1968), about 10 km to the south east, and in Cloud Hill quarry, where *Gigantoproductus* has also been found and the sequence includes the typical palaeosols seen in the Ticknall borehole.

The Ticknall Limestone has been mineralised and was worked for lead nearby to the southeast, at Dimminsdale. Some minerals have been noted from

Parsons (1918)		*Monteleone (1973)*	
Grey and yellow dolomite Thinly bedded limestones	3.4m 3.4m	Thinly bedded limestone and dolomite member	7m
Sandy stratum Foraminiferal limestones and shales Crinoidal limestones	0.7m 4.1m 3.4m	Limestone and shale member	8m

Comparison of part of the stratigraphical successions recognised by Parsons and Monteleone at Ticknall.

Interbedded nodular limestones and mudstones at Locality 3.

the Ticknall inlier, namely galena, chalcopyrite, baryte and aurichalcite (King 1968).

BGS drilled a borehole at Ticknall [359236] as part of the Loughborough sheet mapping programme. It proved a very interesting sequence, comprising around 55 m of Ticknall Limestone, overlying 33 m of Cloud Hill Dolostone Formation. The nature of this junction is uncertain. It may be a fault or a karstic surface; the age of the Cloud Hill Dolostone in the borehole is Early Asbian. This, in turn, overlies about 82 m of the Calke Abbey Sandstone Formation, comprising dominantly sandstones and conglomerates with minor mudstones and palaeosols, and a few thin limestones at the top. At present the age of these beds is not know but they are likely to be Early Chadian. They contain pebbles derived from Charnwood Forest, indicating a source from the south east for a dominantly fluvial-alluvial fan-debris flow association. Cambrian age Stockingford Shale Group was encountered at the base of the borehole. In the borehole, the Ticknall Limestone and Cloud Hill Dolostone are variably limestones or dolostones. They vary from shallow water, proximal carbonates (grainstones) to more distal interbedded carbonate-mudstone sequences. The shallow water carbonates suggest high energy conditions. Lower in the sequence but not seen in the quarries, are common calcretes, indicating periods of falling water levels and subaerial exposure, and fine grained sabkha-peritidal carbonates. The whole sequence is one of predominantly shallow water deposition. This differs from the deeper water storm deposits and mud mound reefs seen at Breedon and Cloud Hill quarries.

The area presents an interesting history for lime production, brick making, coal mining used to fire the lime kilns and a nearby iron furnace. Going farther back in time, there was once a very productive pottery industry at Ticknall. Domestic and decorative pottery was made here from the late 15th century, although claypits are mentioned as far back as the 13th century. By the 17th century, Ticknall was famous for the production of earthenware goods, mainly dairy ware and kitchen pots, and was a major producer of 'Midland Purple' and finely decorated Cistercian ware. However, during the 18th century, ceramics from Stoke on Trent started to flood the market and Ticknall's cottage industry diminished, until the last pottery closed in 1891. The fields around the village still yield many fragments of pottery. The precise clays used by the potters are not known, with a number of potential sources locally. Mudstones occur in the Ticknall limestone but are not abundant. They also occur in the nearby Millstone Grit and Coal Measures, with the Swadlincote area being famous for its fireclay deposits. Mudstones also occur in the Moira Formation.

Mines and quarries

Records show that quarrying for lime at Ticknall or in the nearby Dimminsdale quarry began as early as 1393 and continued to 1950. The first known date for Ticknall is the 14th October 1462. Limestone in the Ticknall area was also worked for building stone, mortar and fertiliser for soil. To produce mortar, an early cement for building, the limestone was stacked in kilns in layers with coal and set alight to produce quicklime, which was then mixed with sand and water. This may well extend back into Roman times; indeed, it is thought that the Romans developed this process. Marling the land, or the spreading of lime, dates back to medieval times when fields were only used once every three years due to lack of fertility. This was only a very localised industry, close to outcrops of limestone, as transport costs prohibited movement of materials any distance. Any unburned limestone was used to build houses and walls. The limeyards expanded in the 17th century and again in the 18th century, when mines were excavated into the rock faces. However, the working areas were limited by overburden of Millstone Grit to the east, and by the Harpur-Crewe estate at Calke Abbey. During this period, there were five allotments, or quarries, on the south side of the road and two to the north. Boundaries between the allotments were left unquarried. They tended to be worked only on a part-time basis and generally by farmers. The quarries at the eastern end were prone to flooding and the water was pumped out; today they are filled with water.

The lime was mainly used locally, but transport networks developed to export it farther afield. Originally it was proposed to build an extension of the Ashby Canal to the limeyards but this proved too expensive. A tramway was built to the quarries linking the pits to the Ashby Canal. New markets were found and the lime-burning expanded. The required coal was brought from local pits at Pistern Hills and Ashby Woulds. The kilns burned the finer coal with larger lumps used for the domestic market. The bases of the kilns were charged with brushwood or other inflammable material, which was ignited to burn overlying layers of coal. Kilns built around 1804, coinciding with the opening of the tramway, provided lime for mortar in the construction of Moira Furnace. Soon after, six additional kilns were built and a separate limeworks established. By the middle of the 19th century, the Harpur-Crewe family had a complete monopoly of the limeyards and they were leased to a single tenant. In these later years, the

The western portal of the Ticknall Tramway tunnel.

limestone was mined in order to extract the best quality stone. When abandoned, the mines formed popular picnic spots with the local inhabitants, but this practice ceased in 1952 with the collapse of one mine. Mine entrances can be seen in the extreme southeastern part of the former workings and evidence of mine collapse is apparent within the main part of the limeyards.

The decline of the Ticknall limeyards was caused by the failure to use new technology and by the coming of the railways. This made limestone in the Peak District much more accessible. By the latter part of the 19th century, Ticknall was in decline and only supplied local markets. The last firing of the kilns was in 1940.

The Ticknall Tramway was built and opened in 1802, 20 km long at a gauge of 4 ft 2 ins (1.27 m), linking the lime yards and brick works at Ticknall with the Ashby canal and Moira Furnace. A tunnel was built to reach the quarries by taking the tramway under the access road into the Harpur-Crewe estate at Calke Abbey. This tunnel is one of the oldest railway tunnels in the world. Within the Ticknall complex, the fine arch you can see crossing the main road near the entrance to Calke Abbey, took a branch of the tramway over to the limeyards and brick yards on the north side of the road. In 1830, a branch of the tramway was opened to the limeworks at Dimminsdale. As well as taking lime away from the yards, the tramway was also used to bring in coal to fire the kilns. This came from local pits. The tramway was last used in May 1913 and finally closed in September 1915. Although the tramway has now been removed, its course is visible as embankments and cuttings to the south of Ticknall. The tunnel in the grounds of Calke Abbey still remains and is a scheduled monument.

The nearby Moira collieries operated an iron furnace (the Moira Furnace, built in 1804 close to the Ashby Canal) for smelting iron ores brought in from the local mines by canal. Limestone needed for the smelting process was brought in by tramway and canal from Ticknall.

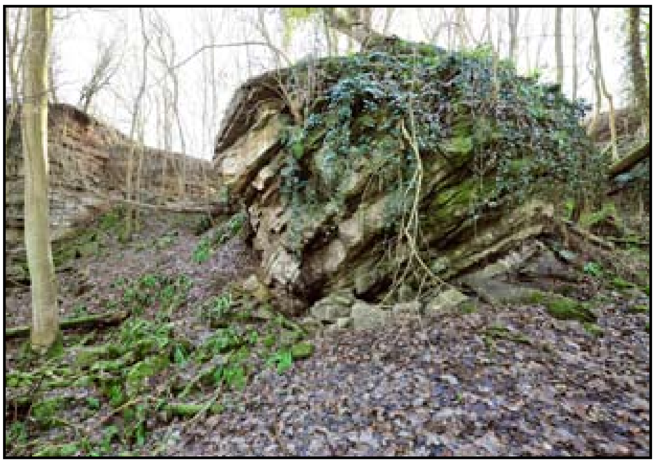
Excursion route

A walk through the quarries starts at the east end of the lime yards [SK363237] and proceeds westwards through the main site. The first locality is on the left, with a view of the quarries on the right hand side of the track and shows all that can now be seen of the former mines in the quarries, with the arched roof of one of the mines clearly visible. All the exposed rocks are dolostone; access is possible but difficult.

Locality 2 [360237] has several exposures in the quarries. A massive, yellowish-stained dolostone can be seen in the upper part of all sections, forming the uppermost bed in the quarries. It is locally sandy, varying to a dolomitic sandstone. This upper bed is the most heavily dolomitised part of the sequence, and, because of the intense alteration, it is poorly fossiliferous.

Locality 3 [359236] has the upper, more massive dolostone together with the underlying beds. These consist of grey, muddy, finely crystalline limestones with common interbeds of fissile mudstone up to 0.2 m thick. The limestones are undulating and nodular where thin, due to secondary, diagenetic migration of lime. These rocks resemble the Jurassic Blue Lias Formation. Fossils are locally common, with some shell beds of *Gigantoproductus* together with crinoids and colonial corals. There are two prominent limestone beds that can be seen in many of the exposures. These beds are locally dolomitised. Only about 6 m of these beds are now visible, compared to over 9 m noted by Parsons (1918). These beds of interbedded limestone and mudstone were the main beds targeted for the lime production. Interestingly, some modern cement manufacturing also uses interbedded limestones and mudstones, such as the Blue Lias of Warwickshire. The

Opening into one of the old mines at Locality 1.



The collapsed block of limestone at Locality 3.

bedding is close to horizontal; however, on the left, a large block of limestone shows a steep dip to the north where it has collapsed over one of the former mines.

At the west end of the quarries irregular mounds of spoil cover the floors of the pits, and exposures are limited. The tunnel [356237] once took the Ticknall Tramway under the road into the Harpur Crewe estate. It is still easily walkable, with a torch. At the far end, a path to the left returns to ground level.

References

Ambrose, K. & Carney, J.N., 1997. Geology of the Calke Abbey area. *Brit. Geol. Surv. Tech. Rept.,* WA/96/17.

Carney, J.N. and 8 others, 2001. Geology of the country between Loughborough, Burton and Derby. *Sheet Descripton, Brit. Geol. Surv.*, Sheet 141.

Carney, J.N., Ambrose, K. & Brandon, A., 2002. Geology of the Loughborough district – a brief explanation of the geological map. *Brit. Geol. Surv.,* Sheet 141.

Fox-Strangeways, C., 1905. The geology of the country between Derby, Burton-on-Trent, Ashby-de-la-Zouch and Loughborough. *Mem. Geol. Surv. G.B.,* Sheet 141.

Fox-Strangeways, C., 1905. The geology of the Leicestershire and South Derbyshire Coalfields. *Mem. Geol. Surv. G.B.*.

Harrison, W.J., 1877. *A sketch of the geology of Leicestershire and Rutland*. W White: Sheffield.

Hull. E., 1860. The geology of the Leicestershire Coalfield and the country around Ashby de la Zouch. *Mem. Geol. Surv. G.B.*.

Kent, P.E., 1968. The Lower Carboniferous at Grace Dieu. 80-81 in Sylvester-Bradley, P.C. & Ford, T.D. (eds.), *The Geology of the East Midlands.* Leicester University Press.

Mitchell, G.H. & Stubblefield, C.J., 1941. Carboniferous Limestone of Breedon Cloud, Leicestershire, and the associated inliers. *Geol. Mag.,* **78**, 201-219

Monteleone, P.H., 1973. *The Carboniferous Limestone of Leicestershire and South Derbyshire.* Unpublished PhD Thesis, University of Leicester.

Parsons, L.M., 1918. Carboniferous Limestone bordering the Leicestershire Coalfield. *Q. J. Geol. Soc.,* **73**, 84-110

Wilson, E., 1880. Fossil fish remains from the Carboniferous Limestone of South Derbyshire. *Midland Naturalist,* **111**, 172-174.

VALE

Richard Aldridge, 1945-2014

Richard Aldridge was Emeritus Professor of Geology at the University of Leicester. He joined the University in 1989 from the University of Nottingham, where he was Reader in Palaeontology. He became a Professor at Leicester in 1996, served as head of the Department of Geology from 1998 to 2004, and held the F.W. Bennett Professorship from 2002 until he retired in 2011.

His passing is a great loss to the academic community as well as to his family and friends. A Londoner by birth, he gained his BSc in Geology and a PhD from the University of Southampton. Dick, as he was always known, was a palaeontologist specializing in the investigation of Lower Palaeozoic fossils. He was a world authority on conodonts that he used in ground-breaking discoveries that helped elucidate the early evolution of vertebrates. Such research was highlighted in Simon Knell's book on *The Great Fossil Enigma*. He investigated ancient, exceptionally well-preserved fossil deposits, especially in South Africa and China, in order to reveal the palaeobiology and evolution of extinct animals and thereby gain insight into key episodes in the history of life. Using a range of microfossils he also established schemes to date, correlate and environmentally signature early rock sequences both locally and internationally.

His leadership and wisdom was widely sought after, and he served many learned societies and organisations with distinction. He served as president of the International Palaeontological Association (2002-6), the Palaeontological Association (2008-10), the Micropalaeontological Society (1995-8), and the Geology Section of the British Association for the Advancement of Science (2001-2). He was also on a range of NERC, Royal Society and other professional committees. His academic merit and contributions were widely recognized; he was the recipient of the Lapworth Medal of the Palaeontological Association, the Coke medal of the Geological Society and the Brady Medal of the Micropalaeontological Society.

Dick enjoyed teaching and he excelled at it. In addition to his distinguished scientific research and publications his enduring legacy will undoubtedly be his enthusiasm for learning and for the philosophy and curiosity-driven nature of science that was warmly appreciated by all the undergraduate students he taught over the years and by nearly 30 doctoral research students who benefited from his training. Many of those he supervised now occupy senior positions in academia and other professional bodies. He was a much-loved and generous colleague, always willing to help and offer advice. Especially when he was in Nottingham, he was an active member of the Society, and edited the *Mercian Geologist* from 1992 to 1995.

David Siveter and Mark Purnell