THE GEOLOGICAL SETTING OF THE MINERAL DEPOSITS AT
BRASSINGTON AND CARSINGTON, DERBYSHIRE

Trevor D. Ford and John A. Jones

Abstract: The first published descriptive catalogue of the lead and baryte mines of the Brassington, Carsington and Hopton area is presented. An analysis is given of the geological setting of fissure-fill and strata-bound mineral deposits in the largely dolomitized Carboniferous Limestone. Dolomitization preceded mineralization and both are regarded as having occurred in late Carboniferous times. Movement of mineralizing fluids was episodic and laterally upwards from over-pressured basins to the east.

Introduction

The Brassington area is mid-way along the southern margin of the White Peak, and lies to the west of the Cromford-Wirksworth area described by one of the authors (Ford, 2006a). Much of the area is a plateau at about 1000 feet O.D. (330 m) bounded by the Via Gellia valley to the north and with a steep south-facing slope around the two villages of Brassington and Carsington. The area is just outside the Peak District National Park, whose boundary is down Hipley Dale, 2 km west of Brassington, and along part of the Via Gellia to the north.

It should be noted that the name Via Gellia dates only from the 18th century and that earlier the valley was known as Bonsall Dale from Cromford to Ryder Point, and as Griffe Dale thence to Grangemill. The southerly branch past Hoptonwood quarries has been known as Hopton Dale, Hopton Dene or, misleadingly, as Via Gellia. Old records sometimes need careful interpretation.

Lead mining around Brassington has a long tradition, dating back to Roman times though the only real evidence of Roman mining is lead ingots with Latin inscriptions (Stokes, 1880). The surviving surface remains of lead mining have been documented by Barnatt and Penny (2004). The Roman lead mining settlement of Lutudarum is thought by some historians to have been near Carsington, at a site now beneath the waters of Carsington Reservoir. The two villages were known as Braston and Carston in the 16th century (Kiernan, 1989) and are sometimes still referred to as Brason and Carson in the vernacular.


Four of the current British Geological Survey 1:50000 sheets map the margins of Carsington Pasture (Sheets 111 - Buxton; 112 - Chesterfield and Matlock; 124 - Ashbourne and 125 - Derby). These maps show many of the mineral veins but the accompanying Memoirs give only brief descriptions of the larger deposits (Frost and Smart, 1979; Aitkenhead et al, 1986; Carruthers et al. 1985; Wilson et al. (1922). Carruthers and Strahan (1923); and Dunham and Dines (1945). Incomplete and unpublished Geological Survey memoirs on the lead mines by Stephens (1942) and Craven (1959) repeated the earlier accounts with some additional comments.

Explanations by the Wirksworth Mines Research Group (WMRG) have provided useful data.

Unpublished notes and a survey of Golconda Mine by its former manager, E. Weightman, have provided useful background information.

Stratigraphy

The following stratigraphic formations are present in the Brassington area. Note that some formal names have been changed in recent years.

Pliocene
Triassic
Namurian
Visean

Brassington Formation
Triassic Shown Sandstone Group
Millstone Grit – Edale Shales
(Keigarian) Woo Dale Limestones
(Eyam Limestones and Longstone Mudstones)
(Moncas Dale Limestones
(Breonian) Bad Low Limestones
(Holkerian) Woo Dale Limestones
(Tournaisian) Rue Hill Dolomites

Footnote: the stratigraphic term Dinantian is now regarded as obsolete by the International Union of Geological Sciences and is replaced by Visean herein (the underlying Tournaisian strata are concealed throughout the area). The limestone beds of the White Peak are now designated the Peak Limestone Group.
The Rue Hill Dolomites and Red House Sandstones (of Tournasian age) in Staffordshire are nowhere exposed but are thought to lie beneath the Woo Dale Limestones throughout the southern part of the White Peak. Dolomitic beds, thought to be part of the Rue Hill Dolomites, were found below limestones in the Ryder Point borehole (Chisholm and Butcher, 1981). No details are known of the pre-Carboniferous basement beneath Brasington though on geophysical arguments it consists of Ordovician slaty mudstones like those found in the Eyam borehole some 25 km to the north (Rogers and Stuart, 1991).

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The Woo Dale Limestones (Holkerian) (formerly the Griffe Grange Limestones) probably underlie the whole area but they are only exposed in the Via Gellia valley from Ryder Point westwards into the lower part of Marks Dale (about SK 255 563).

The Bee Low Limestones (Asbian) are exposed over the greater part of the Brasington area: a large part of this Formation has been dolomitized. Around Grangemill and Longcliffe they show the same system of upward-shallowing cycles as in the Wirksworth area (Oakman and Walkden, 1982), but this is masked by dolomitization elsewhere. The Bee Low Limestones are about 150 m thick and the only mines thought to be deep enough to have gone into the Woo Dale Limestones are Golconda and Snake Mines; they probably reached the Woo Dale Limestones though they were not recognized as a distinct unit.

Contemporary with the Bee Low Limestones, marginal apron-reef complexes consisting of overlapping piles of mud-mounds together with associated fore-reef and back reef limestone facies are present on either side of Hipley Dale, around the Brasington embayment and at intervals around Carsington. The mounds and fore-reef limestones display southerly dips of around 20-30°. Elsewhere the reef facies is concealed beneath the Edale Shales. The shale-covered area south of the limestone massif is underlain by the basal facies of Widmerpool Limestones of Asbian to Brigantian age: these are poorly exposed around the Kniveton inlier to the southwest of Brasington.

The Monsal Dale Limestones (Brigantian age) overlie the Bee Low Limestones northwest of Brasington and around Longcliffe and there is an outlier east of Golconda Mine. The maximum thickness is around 100 m. Lower Monsal Dale Limestones with abundant chert are exposed in Hoe Grange quarry (SK 221 560), west of Longcliffe crossroads. An insoluble residue of chert gravel occurs in some of the Pocket Deposits and indicates that these cherty limestones once covered a much larger area. A small part of the Lower Matlock Lava occurs in faulted outliers around Aldwark and beneath the Monsal Dale Limestones outlier overlooking Ryder Point. Where it occurs west of Longcliffe the slightly lower Winster Moor Lava has been taken as a convenient but different mapping boundary between Bee Low and Monsal Dale Limestones. The Monsal Dale Limestones once covered the whole of the Bee Low Limestone plateau and the marginal reefs but they were eroded off in late Brigantian to early Namurian times, i.e. before the Edale Shales were deposited.

The Eyam Limestones and their shaly equivalent Longstone Mudstones have not been mapped as a separate unit in the Brasington area. If present they are either covered by the Edale Shales or form a narrow outcrop along the foot of the limestone escarpment. The Edale Shales, the lowest unit of the Millstone Grit Series, form the low ground to the south of the limestone massif but they are poorly exposed and partly covered by the Carsington Reservoir. They once onlapped on to the limestone massif, as shown by residuals in the margins of a few silica sand pockets. Projection of girtstones from the escarpment at Barrel Edge above Cromford and further east indicate that the whole Millstone Grit Series once covered the limestone; indeed an escarpment

Fig. 1. Sketch map of the geological setting of the mineral veins around Brasington and Carsington.
of the Ashover Grit occurs south of Carsington Reservoir and, if projected northwards up-dip, would clear the limestone by only 100 m or so. Similar arguments demonstrate that the Coal Measures extended from the Derbyshire coalfield and overlay the Millstone Grit, linking with stratal successions to those of the Staffordshire coalfields. These Upper Carboniferous strata would have had a total thickness of around 1.5 - 2 km over the Brassington area.

The Sherwood Sandstones (Triassic), including their pebble beds, lie unconformably on the Millstone Grit along the Trent Valley and projection of the base of the Sandstones show that they could not have been far above the limestone; indeed Triassic sandstones and limestone are in contact west of Ashbourne. The corollary is that much of the cover of Millstone Grit and Coal Measures had been eroded off during Permian times before the Triassic sediments were laid down. Whether any thin representative of the Permian Magnesian Limestone ever covered the Brassington area is debatable.

Toadstones

The Lower Matlock Lava extends towards but only reaches the Brassington area beneath the Monsal Dale Limestones outlier east of Golconda Mine where it wedges out rapidly (Waters and Ineson, 1981). To the northwest the lava is present in faulted outliers in the Aldwark area but does not appear to have flowed much further south. A basalt lava 9 m thick was recorded in a borehole at SK 222 565 northwest of Longcliffe (Cox and Harrison, 1980) but it is uncertain whether it was the Lower Matlock Lava, the lower Winster Moor Lava or a thick tuff (=clay wayboard). The Winster Moor Lava makes a brief appearance west of Hoe Grange quarry and may be presumed to extend northwards towards Winster: otherwise its underground extent is unknown. Neither this lava nor the Shothouse Spring Tuff north of Grangemill are known to extend into the Brassington area. Wayboards of dust-tuff (Walkden, 1972) occur at intervals within the Bee Low Limestones, but there are few exposures in the Brassington area and only a few records in the limestone resources boreholes (Cox and Harrison, 1980). A wayboard about a metre thick is present in Grange Mill quarry and a possible equivalent occurs within the Bee Low Limestones in the Longcliffe Quarries; this wayboard may extend beneath much of Brassington Moor. Traces of wayboard material were found in the Ryder Point borehole (Chisholm and Butcher, 1981). A wayboard 2 m thick was present in the roof of the approach to the northeast drive in Golconda Mine but this mine level was found by WMRC to have collapsed some years ago. The greenish clay had freely grown scalenohedral crystals of calcite scattered through it. Two thin wayboards occur in the decline from the 60 to the 70 fathom level, with dolomite above and limestone below. The former mine manager, E. Weightman, regarded clay bands as guides to ore but his reports give little idea of where they were or how he reached this conclusion.

A mass of volcanic agglomerate occupies much of Stones Dale, Hopton (c.SK 258 534), but no evidence has been found that it extends beyond the dale so it has usually been regarded as marking the site of a volcanic vent. Another vent is present north of Grange Mill and a thick tuff is in Prospect Quarry nearby: neither is known to extend beneath the Brassington area. The Ible Sill is not known to extend south of the Via Gellia.

Structure

Much of Brassington Moor is composed of very gently northwardly-dipping beds, and the Geological Survey maps note variable dips of round 5 to 8 degrees to the north, northwest or northeast. The southern edge of the limestone massif has marginal reef facies showing generally southerly dips of around 20-30 degrees. The gentle anticline in the Middleton Moor area to the east seems to have died out westwards. Thus folding is insignificant and major mineral veins such as Harborough Rake cannot be related to fold axes. Faulting is minimal: two NW-SE faults west of Brassington village have small downthrows to the southwest affecting the limestone-shale boundary, whilst another fault with a NNW-SSE trend cuts through the village, also affecting the boundary. The WNW-ESE Minninglow Fault lies to the north of Longcliffe crossroads; its easterly end merges with a mineral vein across Marks Dale. In common with mineral veins throughout the White Peak, those around Brassington are probably wrench faults but few displacements of slickensides have been found to confirm this, and no displacements have been deduced. To the east Yokecliffe Rake has a downthrow of 50 m to the south near Wirksworth but it dies out along the southern margin of Carsington Pasture.

Plate 1. Manystones Quarry, showing Dolomite overlying Limestone (Photo - TDF).
The changing stress field deduced by Quirk (1993) and the sequence of events involving ground preparation by end-Visean fracturing followed by mineralization in the late Carboniferous (Westphalian-Stephanian), as described by Plant and Jones (1989), Jones et al. (1994) and Ford (2006a), can be regarded as having occurred at Brassington, as in the adjacent Cromford-Wirksworth area.

The “anticline” regarded by Weightman as a controlling factor in the disposition of the mineral deposits in Golconda Mine is in fact a ridge-like high in the dolomite/limestone boundary: no evidence of a tectonic upfold has been found.

Dolomitization
Much of the Carboniferous Limestone of the Brassington area has been dolomitized by the introduction of magnesium into the calcite molecule resulting in wide areas of secondarily dolomitized limestone (Parsons, 1922; Aitkenhead et al. 1985; Chisholm et al. 1988; Fowles, 1989). Whilst much early opinion related the process of dolomitization to downwards percolation of brines from a hypothetical former cover of Permio-Triassic dolomitic strata (e.g., Parsons, 1922), dolomitization clearly preceded mineralization, which Plant and Jones (1989) and Jones et al. (1994) have argued was in late Carboniferous (Westphalian-Stephanian) times. Thus opinion is now that dolomitization was an early phase of the mineralization process long before any Permian or Triassic beds were laid down (Ford, 2002). Isotopic studies of strontium distribution by Fowles (1989) have indicated a probable radiogenic source of the trace strontium in dolomite having been derived from shale-fluid reactions, a concept which would support dolomitization being a part of the mineralization process.

Alteration of limestone to dolomite (dolostone in American literature) involves the growth of dolomite crystals within the limestone replacing calcite grains. The process destroys most primary sedimentary textures and fossils but larger shells may remain and can sometimes be seen on weathered surfaces. Magnesium-rich fluids are generally thought to have percolated through the limestones via joints and fissures and thence outwards into adjacent limestones. Dolomitization is not always complete and some calcite grains and cement remain. Both mineralizing processes and karstic weathering have at times dissolved the calcite preferentially leaving behind a disaggregated dolo-sand. Periglacial sludging of dolo-sand left the remaining more resistant dolomite as upstanding landforms known as dolomite tors (Ford, 1963a).

Small patches of silicified dolomite adjacent to veins in the Griffe Grange and Carsington areas can be regarded as demonstrating that dolomitization preceded silicification, both being pre-mineralization (Firman and Bagshaw, 1974; Bagshaw, 1978).

The base of the dolomitized limestones controlled the position of the mineral deposits in Golconda Mine at depths of around 300–400 feet (90–120 m) below the surface, i.e. at altitudes of 200–250 m O.D. However the base of the dolomites is over 100 m higher in the face of Manystones Quarry only a kilometre to the west. The dolomite base is also seen at about 300 m O.D. in the eastern cutting of the Hopton tunnel on the High Peak Trail 1.5 km east of the town; the dolomite base is at 275–300 m O.D. in the SE corner of the Pasture. The marginal reef limestones around Brassington and Carsington were less permeable and thus resisted dolomitization. Unaltered limestones are present around Brassington and Carsington were less permeable and thus resisted dolomitization. Unaltered limestones are present in a sag-syncline arrangement. The three Members listed below have been recognized in other sand pits over about a 30 km radius demonstrating the former extent of a sheet of these Miocene strata. They total some 52 m in thickness:-

C: Kenslow Member – about 6 m of grey clays with fossil wood and other plant material.
B: Bees Nest Member – about 6 m of coloured clays and silts.
A: Kirkham Member – about 40 m white sands with occasional pebble layers.

Consolidation tests suggest that more than double the total thickness of 52 m was once present as part of a sedimentary sheet covering the southern half of the White Peak, perhaps giving a cover of as much as 165 m (Walsh et al. 1999). Nothing is known of what sediments lay above the Kenslow Member.

Fossil wood and other plants and pollen in the Kenslow Member indicate an age of late Miocene (Boulter, 1971 a & b; Walsh et al. 1999). The sand and pebbles were mostly derived from the erosion of the Triassic Sherwood Sandstone Formation (formerly Bunter Pebble beds) if the present outcrop is projected northwards plus a minor contribution from the Millstone Grit (Walsh et al. 1980). A hypothesis that the sands were Triassic relics (Kent, 1957) can no longer be sustained. The nearest Triassic outcrops now lie at a lower altitude to the south, demonstrating post-depositional (early Pliocene?) uplift of the limestone massif relative to the Trent Valley, perhaps by as much as 450 m (Walsh et al. 1999). During later Pliocene times, the sediments sagged into the pockets, solution collapse structures forming an interstatal palaeokarst. The sagged sediments show rather uneven inward dips, sometimes nearly vertical. Some pockets are over 200 m in diameter; depths for most are unknown but a borehole near Bees Nest Pit reached bedrock at depths variously recorded as 58 m (Yorke, 1961) or 43 m (Walsh et al. 1999). Other pits may be presumed to be at least 50 m deep. Yorke’s concept of a Triassic river channel through the area is no longer tenable.

As noted in the Geological Survey Memoirs, the Pocket Deposits are often, but not exclusively, confined to the dolomitized limestones, but no genetic relationship has been demonstrated. Several of the pocket margins contain lumps of galena derived from adjacent veins, now much altered to cerussite, which also permeates some nearby sands.

The sagging process has dragged down relics of a former cover of chert gravel at the margins of a few pits. The chert gravel represents an insoluble residue from a former extent of the Monsal Dale Limestones. There are also relics of a former cover of Edale Shales. Both chert and shale relics are present in Bees Nest Pit. Walsh et al. (1999) argued that the total cover reached 165 m above the present limestone/dolomite surface: they also suggested that deposition of the Brassington Formation was near sea level and that uplift took place later.

Apart from the known pocket deposits it is likely that small sand-filled fissures are hidden beneath the soil and turf over much of Carsington Pasture.

Small patches of a white clay mineral (meta-) halloysite (Ford, 1963b) occur on the margins of some pockets where they were known to the quarrymen as “snowballs”. In the late 18th century these attracted the attention of William Duesbury (of Crown Derby porcelain fame) as a possible source of china-clay, but
nothing came of his investigation. Josiah Wedgwood is also thought to have had an interest. Patches of black manganese wad were also found and occasionally exploited as a source of manganese (Ford, 2001; 2006b). Wad was also found, but not exploited, within some cave fills in Golconda Mine, where occasional “snowballs” may also be seen.

The quartz sands have been quarried at least since the late 18th century for the manufacture of furnace-lining bricks, and a fire-brick works has been operated adjacent to Harborough Rocks for many years, by Swan Ratcliffe Ltd. in the 1950s and later by Hobens Quarries Ltd.

The Bragginton Formation is clearly much younger than the mineral veins but a little secondary redistribution of lead has led to cerussite in some sands and to traces of baryte lying on some clay bands within the sands. Yorke (1954-61) noted that timbered shafts had occasionally been sunk through the sands to reach mineral veins in the dolomite beneath. Sand-filled caverns in the Golconda Mine and elsewhere suggest that sands of the Kirkham Member were washed down fissures into caverns long before mining began. Whilst the sands in the Pockets are bleached white, those in the caverns retain red coloration. Pebble gravels in Breck Hollow Mine may represent a basal gravel layer below the Kirkham Member sands. Caverns without sand presumably had no open fissures available for sand to wash down.

Quaternary Deposits
Patches of glacial boulder clay lie horizontally on top of some inclined pocket deposits, indicating that the collapses were pre-glacial. The boulder clay is likely to be of Anglian age. A veneer of boulder clay lies on the limestone plateau east of Golconda Mine. The Geological Survey maps show considerable areas of “head”, i.e. solifluction deposits. Some “head” floors valleys such as north of Longcliffe, but on level ground elsewhere it is far from clear what sources were available for downhill sluudging movement and thus some “head” may in fact be boulder clay.

Minerals, Mines and Veins
The mineral deposits fall into the well-known Derbyshire categories of rakes, scins, pipes and flats, though the use of these terms is less rigid as some fissure veins have been allowed to pass down into “flats” at the dolomite-limestone contact and some veins have been referred to as both scins and flats. Furthermore, the term flat seems to be variously applied to single small bedding plane deposits, or to a group of such ore-bodies or to the whole of a large ore-body at the dolomite/limestone contact. Some fissure veins were said to dip out downwards, but Weightman claimed that other fissure veins in Golconda Mine appeared to taper upwards in the dolomite. Similar upward-tapering fissures have been seen in Masson Hill. Some of the comments in the early Geological Survey Memoir (Green et al. 1887) may be suspect as the surveyors seem to have relied on what they were told by miners.

Galena is scattered through the gangue minerals but is usually most common near the vein walls and is seen intergrown with baryte in most of the flats. Up to 200 tons of lead ore was produced annually from “Bragginton” in the mid 17th century. Almost all baryte is the typical Derbyshire “cawk” variety, poorly crystallized, creamy yellow or occasionally pink, sometimes terminating in cockscobs of small white or cream-coloured tabular crystals in vugs. Larger bladed crystals of baryte, usually white to pink, are less common. Black blades of baryte were found with wad in Red Rake in Marks Dale, where the mineralization was probably a late redistribution of baryte. Baryte was the chief mineral product from the end of the 19th to the mid 20th century but later the Hopton Mining Company’s mill processed baryte from elsewhere in the White Peak, and even used material from the Aberfeldy deposits in Scotland. Only minor amounts were mined around Bragginton during the oil and gas exploration boom in the North Sea in the late 20th century when there was a high demand for baryte mud in drilling operations. Calcite is usually turbid white, columnar crystals (white spar) with occasional pyritic or carbonaceous inclusions; chalcopyrite and other sulphides, such as bravoite, may be present among the inclusions but no studies have been carried out on Bragginton material. Free-grown calcite scalenohedra occur in a few vugs, some crystals up to 20 cm long. Free-grown calcite crystals were also found in a wayboard clay. Other minerals include small quantities of sphalerite and fluorite. Neither in baryte nor in the commercial quantities. Manganese ore is in the form of wad occurred in some baryte vugs and in the sand pits and in the fills in some caves in Golconda Mine.

Secondary oxidation minerals are locally common, including cerussite, smithsonite (= calamine in Derbyshire), malachite, auralitchalcite and hemimorphite. Anglesite pseudomorphs after cerussite have been found in Golconda Mine. The copper carbonates reflect the former presence of cupriferous inclusions in calcite. Hemimorphite (zinc silicate) may indicate reactions between oxidizing sphalerite and siliceous groundwaters derived from the Bragginton Formation. Small amounts of aragonite flowstone have been noted in Golconda Mine: several accumulations of cave pearls were also found there. Manganese dendrites on hydrozincite occur in the same mine. Carbonaceous materials (bitumens) were widespread as inclusions in calcite in Golconda Mine. “Green limnets”, i.e. pyromorphite, has been recorded at several mines, particularly those to the west of Bragginton (Greg and Lettsom, 1858). “Ochre” in the form of limonite nodules with cores of hematite was produced in small quantities from Doglow Mine above Hopton (Bagshaw, 1978).

Mineral deposit textures are more varied than elsewhere in the orefield. The textures recognized in the Golconda Mine (Ford and King, 1965) were probably present throughout the area and include:-
1. Layered ore and gangue minerals encrusting the walls of rakes, scins and equivalent fissures.
2. Cavity linings and stratiform precipitates on cavity floors.
3. Collapse breccias of both fissure and cavity linings.
4. Later linings and fills above collapse breccias.
5. Metasomatic replacements.

In 1985 Ron Slack listed 160 mines but his sketch map shows only a small selection. A year later he noted that there were some 200 named mines on Bragginton Moor and Carsington Pasture: however his map and list of National Grid References only note 65 (Slack 1986). Slack (1999) recorded a further sixteen or so veins and mines in the Griffe Grange area. TheWirksworth Mines Research Group descended some 200 shafts in the 1980s and used a numbering system as it was not always certain which name belonged to which shaft. Many of the mines were very small, producing less than half-a-ton of lead ore per year and the miners supplemented that meagre income with farming. The Barmaster’s Books and other archives record a few other mines at unknown locations. Barmaster’s maps dating from around 1910 show many of the veins and principal mines, but regrettably additional notes in pencil are often illegible. The following list is based on Slack’s lists and maps, the Barmaster’s maps and WMRG records with additions from various sources. Burt et al.’s (1981) summary of mining statistics gave a list of mines, operators, men employed and tonnage produced from 1845 to 1913 but unfortunately many of the mines are without locations, and the nature of the deposit is not described.

Griffe Grange Mines
A group of Griffe Grange mines was shown on Slacks’s (1999) reproduction of a 1725 sketch map but the added Grid Lines seem to be misplaced and the following are difficult to locate: Gate Stoop Mine, Horse Close Vein. Meadow Vein, Mathers Vein, Simpson’s Vein, Longstone Bake, Burnswood, Wood Bottom, Hooson Pipe, Greterex, West and East Eblows (Elbows?), Watchhouse, White Bake, and Old Sough Vein. None of these are shown on the Barmaster’s maps though Eblows and Old Sough were not far from the old quarries. Among unlocated mines were Bone Mill Mine, worked about 1913, Buckley’s Venture up to 1895 and George Mine 1880-1900 (Burt et al. 1981).
1981). Among the adits in Marks Dale, one is Red Rake, close to Griffe Paddock Vein (Flindall, 2006). Elbows (sic) Mine was listed as producing lead in 1896.

Griffe Paddock Vein (SK 263 563) (known as Foulislow Wells according to Flindall, 2006) ranged NW-SE about 100 m or so east of Griffe Grange Farm and crossed Marks Dale. A few yards to the north is the parallel Red Rake, on which adits are still open close to the base of the Bee Low Limestones. The adits were 27 m long to the west and 72 m to the east. Recent exploration found a little crystallized black baryte and wad in a vein only 5 inches (12.5 cm) wide.

Finnisdale (Fynesdale or Wigley’s) Vein extended NW from the west end of Griffe Bage Vein and had a NW-SE trend. It worked for baryte from about 1876 to 1906. Burt et al. (1981) recorded workings were dry, presumably drained by Griffe Sough. Griffe Bage Mines were worked for galena in the late 19th century, and for baryte from about 1876 to 1906. Burt et al. (1981) recorded figures of up to 10 tons of lead ore and up to 20 tons of baryte per annum.

Spinney Level (SK 261 561) is on Haslowfield Vein in Hopton Dene, opposite the quarries and was an adit driven westwards in unaltered Bee Low Limestones. A little water trickles out.

Thus the Golconda ore-body comprises a series of cavities at the dolomite/limestone boundary developed as an early hydrothermal fluid permeated the area. These were then filled with fluids permeated the area. These were then filled

Golconda Mine and adjacent mines

Golconda Mine (Upper Shaft SK 488 5517; Lower (=Nether) Shaft SK 2465 5537). This ancient mine takes its name from the famous diamond centre in India. It was worked principally for lead ore at least from the mid 18th century but production concentrated on baryte in the 1870-1890 period, under the direction of E.M. Wass & Co. who produced up to 500 tons of baryte annually. After a period of stagnation 1900-1914 the mine was re-opened by Hopton Mining Co. in 1915 and worked until 1953 mainly for baryte with galena as a by-product. Water was pumped up to the mill until the 1960s. A geological analysis was given by Ford and King (1965, 1966). They used a plan assembled by the former manager E. Weightman, but a re-survey by WMRG in the 1980s revealed several discrepancies and the later plan is used herein. The Upper Golconda Shaft (main haulage) is 420 feet (126 m) deep, with landings at 300 and 360 feet (90 and 118 m). The Lower Shaft is 270 feet (81 m) deep and was used mainly for access: it was covered with concrete sleepers for safety in the 1980s. The two shafts are 1250 feet (about 400 m) apart. They are connected by “Manchester Gate”, an undulating haulage way, at the 360 ft level and most of the 5 km of workings are between the 360 and 420 feet levels. An incline near the Upper Shaft connects the two levels. The base of the dolomite was recorded at 312 feet in the Upper Shaft but it undulates throughout the mine. The dolomitized limestones have long been said to be crossed by several NW-SE veins, though these were not found during the WMRG survey in the 1980s. Thin mineralized joints are visible in the roof in places, too thin to be worked. It has been said that the main ore body was discovered by following a scrin down from the surface, but no evidence of it was found during the re-survey. The alternative view is that the discovery was via Chariot Mine: there were two levels between the two mines: one was walled up and flooded, but a long connecting level was found by WMRG. The main ore body has usually been termed a “flat” (extending the use of this term from the usually much smaller ore bodies along bedding planes elsewhere in the Peak District). The Golconda ore-body was developed at the dolomite/limestone boundary. It is irregular generally following the dolomite/limestone boundary, rising and falling by as much as 100 feet (30 m) in places. Ore was obtained from flats off the haulage ways which were then backfilled with waste from the next flats; they are thus inaccessible for survey purposes but their location is marked on the WMRG survey. The main haulage way (=Manchester Gate) was 1250 feet (380 m) long, though the two shafts is at a depth of about 360 feet (118 m) with the dolomite base somewhat lower on each side; this arrangement was taken to be an anticline by E. Weightman (unpublished report noted in Stephens, 1942). Weightman argued for potential extensions being in the adjoining synclines and exploration declines were driven to SW and NE. Both were unsuccessful as they went into unaltered limestones below the dolomites with little more than mineralized joints representing the alleged scins in the dolomite. In hindsight, no evidence has been found for an anticline and it would probably have been better if the dolomite/limestone contact had been followed outwards, however much this undulated. Back-filled levels at the northern extremity of the workings hint that workings extended beyond those now accessible.

Thus the Golconda ore-body comprises a series of cavities at the dolomite/limestone boundary developed as an early flush of hydrothermal fluids permeated the area. These were then filled...
or lined with the mineral suite. Partial metasomatic permeations of baryte in porous dolomite border some cavities. The main fill or lining is baryte with dispersed galena. Later solution caused disaggregation of the dolomite and slabs of baryte collapsed into the voids to be cemented into a breccia by late calcite which was often discoloured by an admixture of bitumens and with occasional pyrite or chalcopyrite inclusions. Sedimentary layers of dolo-sand with baryte and galena layers occur on the floors of some cavities sometimes resting on thin clay wayboards. Some vugs contain layers of inwashed sands; lenses of wad and halloysite are occasionally present. Subsequent development of phreatic caverns (known as “shacks”) along intersections of joints and the base of the dolomite yielded several caverns including the 100 ft (30 m) high cavern which forms the lower part of the Upper Golconda Shaft. Cavernization also resulted in the development of younger breccias of baryte lumps intermixed with sands. Some levels were driven through caverns full of laminated sands, occasionally showing minor faulting due to settlement. Sometimes, when the miners followed the baryte deposits they undermined the roof beds and caused collapse of partly disaggregated dolomite blocks, as can be seen forming the floor of the “Big Shack”, a cavern about 100 m long and 20 m high and wide. Secondary oxidation minerals such as aurichalcite and hemimorphite occur in vugs in the baryte linings; cerussite, anglesite and smithsonite are less common. Calcite stalactites are rare but flowstone occurs in several places, particularly the northern end of the Big Shack. Calcite and rare hydrozincite cave pearls are present in a few places.

Newspaper reports in the 1930s of radium deposits in Golconda Mine are too fanciful to be considered further.

Chariot Mine (SK 251 551) lies about 200 m SE of the Upper Golconda shaft. It was linked underground to Golconda Mine and was worked for both galena and baryte at a comparable depth, about 360 feet (118 m). Chariot Mine reached the dolomite/
Plate 2. Golconda Mine - Big Shack, a collapse chamber (Photo TDF)

Plate 3. Golconda Mine - Flowstone formed on bootlace fungus.

Plate 4. Golconda Mine - The Big Shack collapse chamber (Photo - Paul Deakin)

Plate 5. Golconda Mine, about 1980 (Photo - Paul Deakin)

Plate 6. Golconda Mine - Water pump, with Noel Worley (Photo - Paul Deakin)

Plate 7. Golconda Mine - Air winch at the head of incline with Albert Rockarch (Photo - Paul Deakin)
Plate 8. Golconda Mine - Baryte fragments in sand (Photo - TDF)

Plate 9. Golconda Mine - Baryte slab breccia (Photo - TDF)

Plate 10. (Right) Golconda Mine - Hand operated ventilation fan, with Lynn Willies (Photo - Paul Deakin)

Plate 11. (Below) Golconda Mine - Cave Pearls (Photo - TDF)

Plate 12. (Above) Golconda Mine - Aurichalcite encrusting a baryte cavity lining (Photo - John A. Jones)

Plate 13. (Left) Golconda Mine - Galena and baryte on cavern floor with red “Triassic” sand (Photo - John A. Jones)
Plate 14. Golconda Mine - Manganese dendrites on Hydrozincite (Photo - John A. Jones)

Plate 15. Golconda Mine - Spherical aggregates of Hemimorphite encrusting baryte (Photo - John A. Jones)

Plate 16. Golconda Mine - Laminated sands with minor faults, North-east Drive (Photo - John A. Jones)

Plate 17. Golconda Mine - Cave “ice” - Formed by the evaporation of carbonate rich water (Photo - Paul Deakin).

Plate 18. (Right) Golconda Mine - Baryte brecciated vein seen at the bottom of Western Shaft (Photo - John A. Jones)

Plate 19. (Below) Golconda Mine - Pseudomorphs of cerussite after anglesite or galena (Photo - John A. Jones)
limestone contact where there was a NW-SE vein. Weightman reported that “the Chariot deposit was basin-shaped with sides of purple clay with sand in the centre” but he may have been referring to the Pocket Deposit some 200 m SE of Chariot Mine. Another old report referred to the shaft being sunk 210 feet (64 m) partly in “ganister sand” (Rieuwerts, pers. comm.). These reports have been misinterpreted to infer that much of Chariot Mine was within a silica-sand deposit, but recent explorations by WMRG found the shaft to be in more or less solid rock, on a fissure vein with some inwashed sand. In Golconda Mine a sand-filled cavern with a layer of wad lies to one side of the Chariot Road near the Upper Golconda Shaft. Another Chariot Drive off the Southwest Exploration drive was bricked up later precluding access to Chariot workings and the remaining level was used for water storage. Weightman’s MS report referred to clay bands (wayboards?) above and below a mass of solid limestone 45 feet (14 m) thick in Chariot Mine shaft.

**Chance Mine** (SK 253 548) was about 500 m SE of Golconda Mine, close to Harborough Rake. It was 345 feet deep (105 m) and also reached the dolomite/limestone contact. It was re-opened about the same date as Golconda (1915) and much calcite and some galena were found but water precluded development, though details are unknown. A stows was on Chance Mine until the 1960s. Weightman thought Chance Mine was on a fault downthrowing south but no evidence of this has been found. Weightman regarded the veins in Chariot and Chance mines as being branches out of Harborough Rake.

**Harborough Rake**

_Harborough Rake_ (SK 231 549 to 255 543). About 1.5 km long from north of Brassington village eastwards to Eniscloud Barn, this major vein is largely calcite with dispersed galena. It is in unaltered limestone at the western end but the rest is in the dolomite. Most of it lies just south of Manystones Lane, but east of the Harborough brickworks it crosses to the north. It has been worked from at least a dozen shafts, including *Wilcockstones* (2312 5495) and *Longcliffedale Mines* (2307 5485) in limestones on either side of the road junction: *Longcliffedale Vein* trends SW from this junction. *Longcliffedale* shaft was 115 feet (35 m) deep. *Rider Hill* (2330 5491) and *Potosi* (2435 5495) are in dolomite southwest of Manystones Quarry. The limestone/dolomite contact is exposed in the quarry face so the contact must drop considerably to Harborough Rake only 100 m to the south. *Longcliffe Mine* was worked for baryte 1877-1893. The eastern end of Harborough Rake narrowed to 15-20 m near Eniscloud Barn but was worked from a shaft there. Scrins branching off to the north were said to go to Chance and Chariot Mines. The Barmaster’s map shows this end of the rake as Hopton Pipe.

_Roundlow (Roundlowe, Rowlow) Mine* (SK 2382 5493) is in the dolomite in the disturbed ground between Manystones Quarry and the long-disused sand pit SW of the brickworks. Lead and zinc ores and some baryte were produced 1872-1893. Wad was used for water storage. Weightman’s MS report referred to a thick wayboard, perhaps that seen in the nearby Golconda Mine. Farey also recorded “Ochre, China Clay and Gravel” suggesting the proximity of Pocket Deposits. Balldmeer Mine was last worked in 1891. *Upper Balldmeer Mine* (2430 5482) lay about 200 m to the SE. Close by was Pinder Taker Mine (2430 5475). *Nursery Mine* (2444 5482) was on Harborough Rake near the east end of Harborough Rocks. South of Golconda Mine the vein was 4 feet (120 cm) wide, composed of scattered galena in calcite. It haded at 10 degrees to the north. The shaft was 245 feet deep with a winze going to 335 feet. Minor flats at about 150 feet had sand, clay and limestone breccia. There were levels off at 170, 245 and 332 feet but none went very far. Stokes (1879) noted that Nursery Mine yielded copper ores but gave no details.

A second Harborough Rake is lightly pencilled on the Barmaster’s map about 200 m south of the first but there is little sign of it on the surface.

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**Fig. 4. Plan of Roundlow Mine (by the Wirksworth Mines Research Group).**

_Balldeemine* Mine (2419 5490) lay close to where the Rake crosses Manystones Lane: it was noted for its “white ore” (=cerussite). Farey (1811) noted “ore in toadstone” in Balldmeer Mine but this may refer to a thick wayboard, perhaps that seen in the nearby Golconda Mine. Farey also recorded “Ochre, China Clay and Gravel” suggesting the proximity of Pocket Deposits. Balldmeer Mine was last worked in 1891. *Upper Balldmeer Mine* (2430 5482) lay about 200 m to the SE. Close by was Pinder Taker Mine (2430 5475).

**Nursery Mine** (SK 2444 5482) was on Harborough Rake near the east end of Harborough Rocks. South of Golconda Mine the vein was 4 feet (120 cm) wide, composed of scattered galena in calcite. It haded at 10 degrees to the north. The shaft was 245 feet deep with a winze going to 335 feet. Minor flats at about 150 feet had sand, clay and limestone breccia. There were levels off at 170, 245 and 332 feet but none went very far. Stokes (1879) noted that Nursery Mine yielded copper ores but gave no details.
Carsington Pasture
Condway (Conway) Knoll Mine (SK 2485 5453) is in the northeast corner of the Pasture, on a NE-SW vein with many cross-scins all in dolomite. Where the NE end met Harborough Rake it was said to be “full of clay”. It was re-opened briefly around 1919 in conjunction with Golconda Mine and reached 390 feet (121 m; 210 m O.D.). It was worked for baryte and galena in the 1940s, allegedly, and probably mistakenly, at a depth of 140 feet. It was reported to reach “125-130 yards by steps but did not reach the limestone floor” in a Weightman notebook.

Breck (Brett) Vein is an east-west vein across Carsington Pasture into the top of Wester Hollow. It was worked from at least ten mines, including Westerhead (2405 5430), Charles Lum (Leem) (2407 5427), Hewardstone (2426 5430), Speedwell (2422 5426), and Breck (Hollow) Mine (2460 5427). Breck Hollow Mine seems to have been the largest mine on Breck Vein where three veins trending NE, E and SE converged in the middle of the Pasture with coes close by. The main shaft was 245 feet (74 m) deep, and there is a series of climbing shafts nearby; these are thought to have reached the dolomite/limestone contact at
around the depth of 245 feet (74 m). A tramming level trending NE for some 400 feet was found at 158 feet depth in the WMRG exploration in 1984. There were sands and gravels several metres deep in the sides of the level, apparently washed into caverns in the dolomite, representing the lowest part of the Brassington Formation; many of the pebbles were coated with wad. Breck Hollow Mine was first worked for galena but some baryte was produced in 1881-3 and it was still being raised in 1940. Charles Leem Mine was still recorded as a lead mine in 1896.

Several nearby shafts reached only 10 m or so in depth.

Cocker Vein was a NW branch off Breck Vein from near Breck Hollow Mine.

Hewardstone Vein was closely parallel with Cocker Vein with Hewardstone Mine at the junction with Breck Vein.

Westerhead Veins (SK 240 543) were shown on the Barmaster’s map as a group of three short NW-SE veins branching off Breck Vein in “Sidse Pasture”. Charles Lum Vein (SK 240 542) was a continuation SE of Breck Vein.

Flaxpiece Rake (SK 2475 5403 to 246 542) was a vein some 600 m long with a SW-NE trend across the southern part of Carsington Pasture. The Barmaster’s map marks “vein and pipe”. Most worked in the dolomite, the lower SW end is in limestone. The vein was said to be mainly calcite with scattered galena but only a little baryte. Old Horse Vein (SK 2435 5395) was somewhat to the NW of Flaxpiece Rake, Dowstihills Mine (SK 2450 5390) and Stillingtons Mine (SK 2455 9392) were at the lower SW end, not far from the limestone/shale boundary. Young Flaxpiece Vein had a closely parallel course to the SE of Flaxpiece Vein.

Hard Holes Meer Mine (SK 243 537) was on a WSW vein apparently continuing Flaxpiece Vein west of the intersection with White Rake. The shaft is 85 feet (26 m) deep on to a level terminating both to WSW and ENE in a vein only 12 mm wide, but there are levels going both north and south the latter into a cavern 20 feet (6 m) high. Slack (1986) gave a slightly different position for Hard Hole Meer Mine at SK 2425 5396.

Old Wall Vein had a NW-SE trend and crossed Flaxpiece at right angles.

Beardsleys Founder Vein was a SE branch off Flaxpiece parallel to and about 100 m west of Old Wall Vein.

Perseverence Rake, also known as Blackbird or White Rake (SK 244 539 to 239 540) was a vein with a WNW-ESE trend (125 to 3050) across the southwestern sector of Carsington Pasture from Flaxpiece Rake into Wester Hollow. There are traces of several ruined buildings and biddles with settling ponds. Farey (1811) noted Perseverence Mine (SK 2410 5390) on this rake being rich in galena; later it was said to be rich in baryte. The vein was 150 cm wide, mainly calcite with a limestone breccia and baryte on the walls. Horizontal slickensides were seen on the north wall. Horizontal slickensides were seen on the north wall. The shaft is 340 feet (103 m) deep. According to Ron Slack recent explorations revealed a warren of workings but they were not recorded by WMRG. Sand pits on the eastern side of the lane in Wester Hollow were said to be rich in cerussite.

Barisford’s Pipe (Berrisford’s) (SK 2421 5396) is to the north of Perseverence/White Rake.

Old Horse Vein (SK 245 539) and Appletree Vein were parts of an almost N-S vein ranging north from the south end of Perseverence Rake.

There is another Perseverence Rake at SK 232 555. It trends NWW-SSE across the long disused High Peak Quarry near Longcliffe (SK 232 555). It is largely calcite with dispersed galena close to the dolomite/limestone boundary.

Ann Gell (2400 5390) and Victoria (2390 5390) Mines were on an unnamed vein southwest of Perseverence Rake. Prince Albert Mine was presumably near Victoria.

Old Harpur (Harper) (2476 5379) and Upper Harpur (2485 5380) Rakes were two closely parallel ENE-WSW veins on the southeastern part of Carsington Pasture, some 200 m SE of Flaxpiece Rake.
Fig. 8. Plan of Appletree Swang Mine (by the Wirksworth Mines Research Group).

Fig. 9. Plan and Section of Dogskin Mine (Surveyed by Paul Barsby and Peter Allsop, Wirksworth Mines Research Group).
Old Knowle (Old Knoll) Mine (SK 2518 5401). Slack notes this as on a short north-south vein in the SE corner of Carsington Pasture, but the Barmaster’s map shows three closely parallel SW-NE veins merging into one and extending NE through Eniscloud Mine on Harborough Rake and continuing to link up with Clayton’s & Doxey’s Pipe near Hopton crossroads. A short NW-SE cross vein appears to align with the SE vein in Chance Mine.

Dogskin Mine (SK 2450 5420) lay on a SW-NE vein in the dolomite just south of Breck Vein. The shaft was 60 feet (18 m) deep with workings at 35 feet and 60 feet. Another plan shows Dogskin Mine on Flaxpiece Vein at SK 245 538 but this may be in error.

Swang Mine (=Appletree Swang) (SK 2435 5416) was shown on the Barmaster’s map as on a short NW-SE vein branching off Dogskin Vein but Slack (1986) said it was on a flat with no vein. It was worked from 1877 to 1897. Investigations by WMRG in 1984 found a network of drives going in various directions at a depth of 80 to 100 feet (24-34 m) Only one narrow vein was noted but there were several natural caverns in a “flat”. As the mine seems too shallow for it to reach the dolomite/limestone contact the Swang flat may mark a wayboard.

Childrens Fortune Rake (SK 2513 5372) is shown on Slack’s maps as an almost N-S vein near the eastern margin of the Pasture, some 200 m west of the Kings Chair, but the Barmasters map shows both this and two parallel NE-SW veins branching off Yokecliffe Rake, all named Childrens Fortune. The WMRG found the N-S vein to be somewhat sinuous. All three veins are in the dolomite, though WMRG noted that the lowest winze was sunk into limestone following a vein only 3 inches wide. In the dolomite, though WMRG noted that the lowest winze was sunk into limestone following a vein only 3 inches wide. All three veins are

Hughes Scrin (approx. SK 252 539) is a short N-S vein some 70 feet (21 m) NE of Childrens Fortune. Lum Mine (SK 252 538) is on another short N-S vein 30 feet (9 m) further east. Both were marked on the Barmaster’s map but were not listed by Ron Slack.

Innocent Mine (SK 2505 5386) was in the dolomite on a NW-SE branch out of Slack’s Childrens Fortune across the NE ends of the Harpur Veins. William Duesbury (of Crown Derby porcelain fame) had shares in the mine as it yielded small quantities of alleged “china clay”, actually halloysite and kaolinite. Butchers Coe Mine (SK 2505 5369) was nearby.

Waterholes (Watterholes) (SK 2423 5416), Sing-a-bed (SK 2432 5412), Swang and Old Wall Mines lay between Breck and Dogskin Veins in an area of ill-defined veins.

Speedwell Mine (SK 2422 5426) is near the west end of the Pasture on the western end of the E-W Breck Vein, where there is a network of NW-SE and NE-SW veins converging including Hewardstone and Cocker Nab. Galena and later baryte were raised from the network of veins.

New Speedwell Mine was about 150 m south of Speedwell Mine at the NE end of Waterholes Vein.

Nanny’s Hole (SK 247 537) is a short SW-NE adit at the western end of Carsington Village. Two other short adits are nearby.

Hazard Mines (not located) were worked for baryte in the 1880s and for lead in 1896.

Mines near Bees Nest Sandpit

Bees Nest Mine (SK 2403 5452). The shaft was 132 feet (40 m) deep in dolomite. It was worked for baryte 1872-1893 and around 1919. The site has been obliterated by the sand pit workings, but a spar washing plant operated nearby in the 1960s using water from the partly flooded sand pit.

Providence Mine (SK 2398 5457) was about 100 m NW of Bees Nest Mine. It was said to be rich in cerussite. It is almost all obliterated by sand workings but a WMRG exploration found a scrin with brecciated baryte in calcite. A second Providence Mine (also known as Picking Pitts Gate Mine) (SK 2410 5440) was about 200 m to the southeast.

Job Mine (SK 2380 5446) lay on a NW-SE vein in the dolomite some 200 m SW of Bees Nest Mine. Originally worked for lead, baryte was raised in the 1920s.

Sprint Mine (SK 2394 5440) lay about 100 m east of Job Mine. It was worked from 1872 to 1892. There is little visible owing to sand pit waste.

Swallownest and Rushycliffe Mines (SK 2415 5450) were just east of the Bees Nest sand pit close to the Pasture wall; they are largely obliterated by waste sand heaps.

Wester Hollow

Westerhead Mines (SK 2430 5430). Many small mines lie on the higher slopes at the north end of Wester Hollow; they were initially worked for lead ore but later re-opened for baryte and last worked around 1920. The mines are mostly shallow, 18 to 30 m deep, following veins in the dolomite; some were on NW-SE veins. Several reports refer to the mines being in “white
Plate 20. Bees Nest sand quarries (Photo - TDF).


Plate 25. Great Rake Mine about 1950 (Photo - Lynn Willies Coll.).

Plate 26. Great Rake Mine about 1981

Fig. 11. Section of Great Rake Mine (by the Wirksworth Mines Research Group).

Fig. 12. Plan and Section of the Great Carsington Cavern (by the Wirksworth Mines Research Group).
sand" but it is not clear whether they were sunk through the Brassington Formation, or were in fissures with inwashed sand.

Some white lead ore (cerussite) was raised. Sand-filled caverns were also found and “white sand" was raised for firebrick manufacture.

**Nickalum Mine (Nickall’s Lum or Old Brassington Mine)** (SK 2368 5390) is on the brow of the hill west of Wester Hollow. The shaft was capped with concrete long ago and the ruins of an engine house and other buildings were demolished in 2002. There was a crushing circle nearby. The mine was close to the mine workings at the convergence of the NW-SE outcrop of the dolomite/limestone boundary and a WNW-ESE strike of the Larkhall Fault. There was a large adit (SK 2366 5409) and the nearby **Lucks All Mine** (2377 5403). Nickalum shaft is said to have had three “turns" of 70 feet (21 m) each, though other accounts note an engine shaft 210 feet deep (63 m); the “turns" were probably a climbing way close to an engine shaft. Lead ore production reached 880 tons in 1862 and 100 men were employed. After a steady decline, baryte was worked from 1912 to 1919. **Coarsehill Mine** (SK 2195 5416) and the nearby **Nickalum Pipe** (2366 5409) is in a NW-SE vein in dolomitized limestone to the NW of Brassington village. A little galena was produced at **Smeadow Mine** (SK 2280 5458) is in a NW-SE vein in unaltered limestone to the NW of Brassington village. A little galena was produced at **Smeadow Mine** (SK 2280 5458).

**Larks Venture Vein** (SK 2380 5390) was worked SE of Nickalum Mine down to the lane in Wester Hollow. **Great Rake** (SK 242 535 to 237 538) had a NW-ENE trend across the most southerly spur of the dolomitized limestone, SE of Brassington village (Slack, 1986, 1987). **Great Rake Mine** was on two sub-parallel veins about 3-5 m apart with a trend 20 degrees north of due west. The north vein was 3-4 m wide and the south vein 1.8 m wide; both were mostly baryte with scattered galena but the south vein included fragments of limestone. The mine was explored and surveyed by WMRG in the 1980s who found most of the accessible workings to be in the north vein. The mine was worked from two shafts 425 feet (120 m) apart, with a climbing shaft 60 feet NW of the main shaft; this entered the workings at 170 feet (50 m). The Main (West) drawing shaft at SK 2395 5357 was 320 feet deep (96 m) but blocked at 230 feet. An incline went down 400 feet (120 m) with winzes down to 425 feet (128 m). The East Shaft (SK 2405 5354) only went to 250 feet (75 m). Green et al. (1887) referred to “dangerous old workings at the lower levels. A more of workings has been alleged to be in “flats" along the dolomite/limestone boundary but these were not seen during the WMRG survey. The deepest workings were still dry although below the altitude of the springs in Brassington village, confirming the limited local nature of the latter’s catchments. The bottom of the mine is also below the top water level of Carsington Reservoir. Water for processing ore at Great Rake Mine was a problem though some was pumped up. In its later days galena was 1.5% of the output. The mine was re-worked for lead in 1896 and for baryte around 1919-1920 and relics of workings, a winch, engine beds, crushing circle and stone, a concrete base for a jigger hut, a powder house and a haulage ramp down into Wester Hollow were present in the late 1980s (photos in Slack, 1986 and 1987). In its last days the buildings were used for processing iron ore brought from elsewhere in the Peak District.

**Waynes Dream Mine** (SK 2367 5377) was apparently on the western extension of the Great Rake across Wester Hollow.

**Carsington Great Cavern** (SK 242 537) was down an isolated shaft some 50 m ENE of Great Rake Mine. It was a rather featureless natural cavern 100 feet (30 m) deep.

**Yokecliffe Rake**

Yokecliffe Rake (= Oakcliffe) (SK 2485 5362) is the western end of a long rake-cum-fault trending westwards from Wirksworth. It crosses Stones Dale north of Hopton and appears to be faulted against the volcanic agglomerate there for a short stretch. The Barmaster’s map indicates that it splits across Stones Dale and joins up again to the west. To the east of Hopton the fault downthrows south but it is not clear what the displacement is around Carsington. North of that village Yokecliffe Rake is in dolomite but the extreme western limit goes into unaltered reef limestone. Shafts in the Carsington area include **Cow and Calf** (see below), **Have-at-All** (SK 2528 5360), **New Townhead** (SK 2500 5360) and **Old Townhead Mines** (SK 2485 5362): these are just north of the rake. Northwest of Carsington village the vein is around 2-3 m wide and largely calcite. Its termination is seen as calcite stringers in Townhead Quarry. To the east calcite was mined at Old Gell’s Mine near Godreyhole but little attempt has been made to exploit calc-spar near Carsington.

**Cow and Calf Mine** (SK 2530 5363) was at the intersection of Yokecliffe Rake and a NW branch marked as **Cow and Calf Vein** on the Barmaster’s map. The intersection is in unaltered Bee Low Limestones but the vein extends NW into the dolomite. **Doglow Mine** (SK 255 535) is close to Yokecliffe Rake northwest of Stones Dale, Hopton, near the limestone-dolomite boundary. It is marked on some maps as an Ochre Mine and was listed as such in 1896. A collapsed adit (SK 256 537) on the western slopes above Stones Dale was in sands with ochre and wad. Nearby blocks of ochre sometimes have cores of hematite.

**Mines west of Brassington**

**Smeadow Mine** (SK 2280 5458) is in a NW-SE vein in unaltered limestone to the NW of Brassington village. A little galena was produced in 1872 and 1907. **Bunting Camp** (SK 2286 5450) and **Garden End Mines** (SK 2295 5438) appear to be on the same or another closely parallel vein.

**Green Limnets (Linnet Grove)** (SK 2195 5416) and **Upperfield** (SK 2210 5416) Mines were in NW-SE veins in dolomitized Bee Low Limestones well to the west of Brassington and close to Kirkham’s Sand pits. Both yielded green lead ore (pyromorphite) as well as galena and baryte. Both mines were said by Farey (1811) to have yielded “china clay" (halloysite), which was also found in the nearby Kirkham’s sand pits. The WMRG found halloysite “snowballs" in Green Linnets Mine before the shaft ran in during the 1980s. Linnet Grove was worked 1889-1898.

**Stuckstones** (SK 2152 5380) and **Paupers Venture Mines** (SK 2153 5367) were in dolomitized limestones further southwest and also yielded baryte and pyromorphite. Farey (1811) noted “Steatite" and “China Clay", both probably halloysite.

**Cathole Mine** (SK 210 542) (also known as Hipley Mine) is an adit worked for lead ore, baryte and later calcite up to 1913 on the west side of Hipley Dale. It is in unaltered back-reef limestones.

**Throstlenest Mine** (approx. SK 220 550) is on a short NW-ESW vein in dolomite on the north flank of Rainster Rocks. Two shafts were descended in the 1980s but no details are known.

**Bonny Lad**, **White Lion Tor**, **Prince Albert**, **Red Weeds**, **Calves Head**, **Sunnyside** and **Watchhouse** are amongst the mines at unknown locations.

**Hydrogeology**

There are no surface streams on Brassington Moor and no stream caves are known. Epemeral pools of water occur in some sand-pits. Springs in Brassington and Carsington villages are too small to account for percolating rainwater over some...
20 square kilometres of the Moor and probably have very local catchments on wayboards. The trickling flow from Spinney Level (SK 261 562) (c.700 feet O.D.; 210 m O.D.) opposite the Hopewood Quarries is unlikely to be of much significance. Carsington Reservoir lies on the shale country south of the limestone massif: it has no known connection with the karstic drainage pattern.

The earliest reference to underground water in the Brassington area is Defoe’s (1724) account of meeting a lead miner at an unspecified location, generally assumed to be somewhere near Harborough Rocks. The miner gave figures which would place the water-table at 168 m, some 30 m below the present level (c.216 m O.D.) in Golconda Mine, which seems unlikely. However it shows that from an early date water-levels under Brassington Moor were deep, 130-168 m down.

The thermal Middleton Bath spring in the Via Gellia valley (then called Bonsall Dale) was recorded by Short (1734) regrettably without giving a specific locality. He noted that it was on the south side of the Bonsall Brook, “16 yards long, 7 broad and 2 deep...throwing out a prodigious quantity of water”. However, Pilkington (1789, vol. 1, p. 233) noted that the water was “taken away... by a sough some years ago”, almost certainly Cromford Sough as Meesbrook Sough was not effective until much later. The exact site of Middleton Bath may be unknown but it was probably on or close to one of the branches of the Gulf Fault near the sharp bend in the valley. Fairey (1811, vol. 1, p. 505) also noted the former thermal spring. Later, when Meesbrook Sough became effective in the 1840s, the drainage of the whole area was via Meesbrook Sough. Short’s (1734) estimate of the temperature of the Middleton Spring cannot be interpreted in modern terms but was probably similar to the Matlock springs at around 20 °C. The implication is of deep circulation along mineral vein fractures with percolating rainwater on Brassington Moor being heated and returned to the surface via fissures in the Gulf Fault system as warm springs. A good supply of water was obtained from the Rider Point borehole but details of quantity and temperature are not available. Gunn et al. (2006) have presented chemical arguments for the warm springs at Matlock having circulated via fractures deep enough to penetrate evaporites associated with the Rue Hill Dolomites, perhaps 800m below the surface, much deeper than the dolomites found 100-150 m down the Rider Point borehole.

With the depths to the water table such as that recorded in Golconda Mine, local soughs were generally unnecessary, and the only one known is Griffe Sough, driven according to an agreement by John Gell around 1735 (Slack, 1999; Flindall, 2006). The course of the sough is unknown but it was said to have been driven from an underground swallow (Slack estimated this to be beneath Marks Dale about SK 252 562) in a southerly direction beneath Griffe Grange, the surface altitude of the possible site in Marks Dale is 220 m O.D.). How the miners knew about the swallow and how deep it was are unknown, but the sough could not have unwatered veins to any great depth, possibly only by 10 metres. Where the waters engulfed by the swallow in the 18th century ultimately emerged is not known, but it is probable that it resurfaced from the former thermal Middleton Bath springs. Thus it is likely that deep drainage along mineral veins and other fractures would have taken water eastwards from Brassington Moor firstly to Middleton Bath, later to Cromford Sough and finally to Meesbrook Sough.

Studies by Steele (1995) and Shepley (2007) have both indicated that the area around Brassington is mostly in today’s catchment of Meesbrook Sough which also drains mines in the Wirksworth area. This catchment is crossed by numerous mineral veins and other fissures, any of which could transmit both shallow and deep drainage. The pre-sough subterranean drainage pattern still remains something of a mystery, with a probable resurgence at the lost Middleton Bath springs. Perhaps the springs in Brassington and Carsington were larger then.

The southwest exploration drive in Golconda Mine was kept dry by pumping but water was allowed to back up to around 130 m depth in the 1950s and water was pumped up for use in the mill until the mid-1960s. Great Rake and Nickalum Mines are also said to have pumped water for processing purposes but details are unknown.

Few other mines have depths to water recorded so only a very generalized water-table contour map can be constructed (Shepley, 2007).

Caves

Whilst no stream caves are known in the Brassington area, there are several solution caverns in Golconda Mine, some sand-filled. Most of these have been developed at the more or less flat-lying dolomite/limestone boundary. Several other similar caverns have been found in nearby mines but few details have been recorded except for Carsington Great Cavern. Together the caverns demonstrate phreatic speleogenesis at some unknown stage in the past, when the water-table was much higher than at present. Short high level caves in Harborough Rocks, Longcliffe Craggs and on Carsington Pasture, now mainly of archaeological interest, are in dolomite and probably relate to still earlier phreatic speleogenesis. A small amount of drainage enters Golconda and other mines as drip feeds, some depositing stalagmitic encrustations or forming cave pearls. The saged Pocket Deposits are interpreted as karstic inter-stratal solution collapses developed beneath the Brassington Formation cover, implying localized phreatic solution beneath a terrain with an acidic soil cover.

Discussion

The mineral veins of the Brassington-Carsington area are the result of the Mississippi Valley type mineralization that affected the whole of the Peak District. The source of the mineral ions is generally thought to be a result of the overpressuring by deep burial of contemporay shale sequences (i.e. Visean-Namurian) in adjoining basins. This generated hydrothermal fluids containing dissolved ions released during diagenesis of clay minerals. With the load of overlying strata the fluids were squeezed out and migrated into nearby “highs” such as the South Pennines limestone massif. With repeated movements on fissure veins, as suggested by Firman (1977), the seismic pumping envisaged by Sibson et al.(1975) may have assisted fluid movement. Once within the limestone massif precipitation of the hydrothermal mineral suite was effected by reaction with more oxygenated and/or cooler groundwaters (Firman and Bagshaw, 1974; Bagshaw, 1978; Plant and Jones, 1989; Jones et al 1994). Since dolomitization clearly preceded mineralization it is now regarded as an early phase of the latter process (Ford, 2002).

The mineral deposits of the Brassington area were regarded as being mostly within the baryte zone by Dunham (1952) and Mueller (1954), with calcite becoming more common towards the west. However, Firman and Bagshaw (1974) and later Bagshaw (1978) have demonstrated that the distribution of the gangue minerals throughout the ore-field is far more irregular than a simple thermal zoning would imply. Indeed the hypothesis of thermal zones was thought to be so dubious by Bagshaw (1978) that it should be abandoned. Bagshaw observed that fluor spar was largely confined to beds above the Matlock Lower Lava, but, since the Bee Low Limestones of the Brassington area are below this horizon, little fluor spar would be expected there. Butterclif (1976) noted some possibly commercial fluor spar prospects in the Aldwarke area in beds above the Lower Lava horizon. Isotopic dating of alteration of toadstones penetrated by mineral veins suggested an extended episodic mineralization process from late Carboniferous to Jurassic (Ineson and Mitchell, 1973) though the post-Carboniferous dates probably cover only minor secondary redistribution. Repeated re-opening of veins gave paragenetic mineral sequences which varied within a few metres in the same vein (Bagshaw, 1978), though he did not cite any examples from Brassington. However, the sequence of crystallization phases of early calcite with some galena, main baryte, and late calcite again with some galena, proposed by...
Ixer (1986) can be recognized there. Whilst a late Carboniferous
date of the main mineralization agrees with the arguments
presented by Plant and Jones (1989) and Jones et al. (1994), it
does not preclude some later re-distribution, though this would
have to take place at much lower temperatures owing to the
erosional removal of the cover strata and reduction of the depth
of burial. Thus a succession of late Carboniferous migrations
of hydrothermal fluid could result in a patchy distribution of
gangue minerals such as the dominance of baryte in some fissure
veins and of calcite in others, even within a small area such as
Carsington Pasture. Baryte deposition generally preceded
calcite in flats. The Brassington area would mostly fall within
Bagshaw’s Structural Unit 3 which he noted as being mainly
baryte on Middleton Moor. Regrettably, with little fluorite in
the area, no fluid inclusion studies are known to have covered
the Brassington area, though projections from surrounding areas
suggest temperatures of 70-100°C corresponding to a depth of
burial of around 1.5 - 2 km at the time of mineralization. This
cover was composed of Upper Carboniferous clastic sediments,
Millstone Grit and Coal Measures.

The direction of fluid movement has been controversial in the
past, most researchers advocating an upward/lateral flow pattern
rising westwards up the structural dip, guided in separate
compartments by impervious toadstone or wayboards. As the
latter are very limited in the Brassington area the compartment
concept is difficult to apply. In contrast, King (1966) proposed a
downward flow from the former Triassic cover; whilst this may
account for limited secondary redistribution of ore minerals,
the lack of depth of burial to account for the hot hydrothermal fluids
confirms a late Carboniferous date, i.e. pre-Triassic, for the main
episode. Thus, a dominant upward/lateral flow through the
dolomitized limestones seems most likely, rising gently up the
dip and following both fractures and the cavernous limestone/
dolomite boundary. Mineral deposits at the latter effectively
lined the floor of the dolomite basin where the contact between
porous dolomite and compact limestone formed at least a partial
basal barrier to fluid flow.

The mineral vein pattern is dominated by NW and NE trending
veins, with rather fewer E-W veins, similar to the Cromford-
Wirksworth area to the east (Ford, 2006a). Quirk (1993) argued
that the changing stress field caused fissures to open in late
Visean to earliest Namurian times, in effect ground preparation
as described for the Wirksworth area (Ford, 2006). The fissures
were not filled with the hydrothermal mineral suite until much
later in the Carboniferous when the sedimentary cover was at
least 1.5 km thick. Whilst the Brassington area provides little
new evidence for this hypothesis, it is highly likely that it went
through the same stress and mineralization processes. The
corollary is that primary fissure opening preceded dolomitization,
and the fissures survived to receive the main hydrothermal
mineral suite as rakes and seams hosted in dolomite in late
Carboniferous times.

Pyromorphite as a late phase in vugs in some of the Brassington
mineral deposits requires a source of phosphorus. As this is not
a usual component of the South Pennine hydrothermal mineral
suite, another source must be sought. The possibilities are
fossil fish teeth, scales and bones in the basal beds of the Edale
Shales as found elsewhere in Derbyshire, or from fish remains
which could have been present in the off-reef limestones around
Brassington in a situation comparable to Steeplehouse Quarry
above Wirksworth. More research is needed on these possible
relationships.

Conclusions
The mineral deposits of the Brassington area consist mainly of
baryte with galena and some calcite, together with secondary
(oxidation) minerals. The mineral deposits differ from the
adjoining Cromford-Wirksworth area in that they are largely
hosted in flat-lying dolomitized limestones. Fissure veins are
common, but important mineralization took place as cavity
fillings and linings in flats and cavities at the dolomite-limestone
interface, most of them at depths of more than 100 m. Failure
to appreciate the importance of this interface led to abortive
exploratory declines into unaltered limestone in Golconda
Mine. Few other mines reached this depth and explored this
important mineralized horizon, some of which may survive
undiscovered. Phreatic speleogenesis, probably in late Pliocene
times, above the dolomite-limestone boundary resulted in
large caverns, as found in Golconda Mine. Inte-stratal karstic
processes, probably also during the Pliocene, led to the sag-
collapses containing the sands and clays of the Brassington
Formation, which incorporate detached pieces of mineral veins
and secondarily deposited cerussite. Today most of Brassington
Moor’s drainage goes to Meerbrook Sough via deep fissure
circulation and heating. Prior to 1840 the drainage probably fed
Cromford Sough. Both these soughs had thermal water rising on
the Gulf Fault. The pre-sough drainage pattern is unknown but
is thought to have fed springs in Via Gellia which are no longer
operative.

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Trevor D. Ford, John A. Jones, Geology Department, University of Leicester, 31 Bridgefields, Kegworth, Leicester LE1 7RH Derby DE74 2FW

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