ODIN MINE, CASTLETON, DERBYSHIRE
by
J.H. Rieuwerts and T.D. Ford

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"Come fellows drink drink drink your fill, 
Full soon we must gang up the hill; 
Where Odin rich in shining ore, 
Shall give us glasses - hundreds more. 
Then luck to Odin - golden mine, 
With metal bright like th' sun doth shine".

William Wood, 1862.

The dress of these women ... seems contrived to secure them from the cold and wet attendant on their employment. The head is much enwrapped and the features nearly hidden in a muffling of handkerchiefs over which is put a man's hat ... the fair miners of Derbyshire whom I saw were complete harridans. A man's coat of coarse grey or dark blue cloth defends the arms, back, throat and bosom of each lady from the cold; beneath it, but tucked up to form a kind of bag appears a gown of red stuff, set off by a bright green petticoat; then some shoes at least three inches thick, bound on to the feet with handkerchiefs, thongs and cords. Some of the women were very old, and one in particular, who had worked in the mine from her youth was nearly a hundred years of age, yet she was upright and active and wrinkles alone betrayed the fact.

(From a newspaper cutting dated 1829 in Derby Library, Local Studies Accession No. 3213, p. 90).
INTRODUCTION

Odin Vein outcrops, or, to use a mining phrase, is "cut out to Day" by the side of the Castleton to Chapel-en-le-Frith Road. Here, near the "Hairpin Bend" the narrow, slightly inclined, rock-walled gorge is a well known feature.

The vein forms the boundary between Treak Cliff Hill and Mam Tor, the former with its famous show caves, the Blue John Caverns and Treak Cliff Cavern, the latter standing much higher, the great scarred face like a gigantic quarry. Distinctively hummocky ground marks the landslip at the foot of Mam Tor, extending northwardly and eastwardly in a fan-shaped mass.

The present entrance to the mine is via a small slit at the south western extremity of the gorge, as all former means of access, i.e. those used during its working life, are either blocked or covered.

The mine is well documented, there being in existence five reckoning books, upwards of a dozen plans, a wealth of information in Barmasters' books and in the voluminous correspondence of the Bagshawe family.

At least five soughs were associated with the mine and at least two major drawing levels. There is evidence that another two or even three soughs were driven and one other drawing level. These are problems not yet resolved.

The workings were shown to the public in the late 18th and early 19th centuries and the minerals it produced earned it a place in most guide books of the period, but these give little detail. Most of these books took the name to indicate that the Danes had formerly worked the place, but there is no evidence for this. In this context it is also worthy of comment that virtually all pre 19th century references call it Oden mine, or in one case Owden. Only at the beginning of the 19th century does the spelling Odin become common, but the older spelling was still retained in many instances.

Although there are gaps in our knowledge, this book sets out to record what is known of the mine's long history, spanning as it does six centuries and terminating with an up to date assessment of the geology and mineralogy, and an account of recent explorations in the old workings.

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ODIN MINE — A WALK OVER THE SURFACE
by T.D. Ford

Before attempting to understand the history of Odin Mine it is essential to walk over the surface and to study the relative positions and heights of the surviving relics (Figs. 1 & 3). If these are clear in the mind it will be so much easier to place oneself in the mind of the Old Man, to look at the problems from his point of view and to comprehend his solutions to these difficulties.

A good starting point is the parking bay by the roadside outside Odin Gorge. From here the disposition of the limestone surface inclining rapidly from Treak Cliff across the mouth of Odin Gorge towards the road can be seen. The shaft of the worked-out vein or Gorge is obvious, and above and beyond it the steep shale slopes rise towards the landlip scar of Mam Tor. Close to the shaft is a cave mouth, commonly called Odin Cave today but once apparently known as Gank or Toume Hole. The flat area between this and the road is the grassed over waste tailing of a spar-washing plant which operated here in the 1940s and 1950s. The waste filled a hollow some 20 feet deep with the Cattlegate entrance to the mine therein. A tunnel ran under the road roughly under the lay-bys to the crusher and processing floors close to the Knowlegates Engine shaft and the now-unknown site of the much earlier Sough Engine Shaft (Plate 2).

From the lay-by walk a few yards down the road and turn sharply back down a track to the cruster wheel (Plate 2) erected in 1823 for £40. Beyond this the hollow now occupied by the stream was once the site of vast waste hillocks depicted in a watercolour by J. Webster in 1789 (Plate 1). These carried a row of small buildings, presumably used as office, store, blacksmith's shop, stable etc. but these and much of the grooves or slickensides can be seen now. In a number of places high up, mainly on the south wall, the "egg-holes" were in place the vein was worked underground, and the natural hill slope across the vein was still continuous. The waste was removed during road-building operations last century.

At the road is the grassed over waste tailing of a spar-washing plant which operated here in the 1940s and 1950s. A circular hollow may be noticed on the grassy lower slopes of Treak Cliff some 200 yards south of Odin Mine — this resulted from a different type of mine — a flat landmine in the Second World War. Close to the Gorge a track climbing the bank to the left (south) is the site of an inclined railway to the pipe-workings of the 1940s and 1950s. Crossing the road and climbing the stile the mineral waste banks are relics of the spar-washing of the 1940s and most came from Bradwell Moor unlike the waste below the road which is mainly from Odin Mine. Odin Sitch was dammed in the 1940s and put through a spar-washing plant of which nothing now remains. Crossing to the lower part of the Gorge what is believed to be the "Auger Hole" of the 1767 small-plan, may be found on the south (left) wall — the only obvious drill mark (Plate 5). Beyond, the slickensided wall of the vein can be followed past old pick marks for some 30 yards to some blocks at the entrance to the Gorge proper, just below the foot of the shallow limestone valley of Odin Gully, which rises southwards to the Blue John Cavern. This was once the course of Odin Sitch but the water had to be diverted or the vein would have been very difficult to work.

The narrow part of Odin Gorge is the worked-out vein, and the southerly slope or head can be seen by virtue of the left wall overhanging. A major rockfall blocks entry to the mine though it can be reached by climbing down from the lip with the aid of ropes. Some mineral adheres to the left wall, and horizontal grooves or slickensides can be seen. In a number of places high up, mainly on the south wall, the "eggholes" where stumps were once bored across the vein can be seen. The implication of these is that when the stumps were in place the vein was worked underground, and the natural hill slope across the vein was still continuous. It has been uncleared either by open-cut working or by collapse at a subsequent date. A series of deep notches occur in the south wall close to floor level and they must have held the supports for a substantial platform once (Plate 3).

A small branch working at the entrance to the Gorge is believed to be Widowers Vein. It contains a white clay mineral deposit of allophane. Climbing up the steep bank above this brings one to the northlip of the Gorge (Cara — the shale is very slippery in wet weather), where one can see the shale cover resting on a few feet of limestone above the mine entrance. A few yards further and the course of Odin Sitch is rejoined. From here almost to the Blue John Cavern it is an artificial course or least diverting the stream out of Odin Gully; the point of diversion is obvious some 150 yards higher up. There is no record of when this was done though payments to divers and soughers in the first few years of the 18th century suggest that either it was cut then or was being maintained. The mine would have been in constant danger of flooding with the stream in its original course, though placing laundering across the vein would have reduced the risk.

As one climbs the path alongside Odin Sitch, at a point in line with the vein and Gorge, a shallow depression in the opposite bank, beneath Mam Tor, with some mineral waste in the shelly soil outside, may have been the entrance of the 18th century "levy".

Climbing to the road opposite the Blue John Cavern, one crosses over the probable site of Tinkers Shaft. Some 300 yards up the road a gate on the right leads to the remaining waste hillocks of Engine Shaft (still open but covered and concealed for safety). The line of a tramway of 1908 vintage can still be made out leading down to the gate. Between the Engine Shaft hillocks and Mam Tor are two small grassed-over shale mounds, believed to be the "Blue Hillocks" of the 1757 plan. An early Engine Sough is believed to
have its tail in the gully near the gate but nothing can be seen.

Returning to the road, take the right fork (A625 to Chapel-en-le-Frith) and climb to the brow. On the left a stile leads to a footpath to Windy Knoll with its bitumen deposits and bone cave. Immediately over the stile and about 10 yards to the right (west) a shaft hollow and mound may be on an unrecorded working in the South Vein of the Forest Liberty section of Odin Mine. Following the main road on the right the Peak Park's picnic site is on the landscaped relics of the waste heaps of the Castleton and Forest shafts. The fence down the east end of the picnic site marks the mining Liberty boundary between Castleton and Peak Forest Liberties, and the two shafts were sunk either side of this, largely for legal reasons. They appear to have run in long ago.

In the wood between the Chapel and Edale roads a solitary shaft mound and hollow mark the site of West Shaft, almost at the western limit of the known workings and range of the vein.

Looking southwest down the fields towards Peakshill Farm a row of low mounds marks the course of Peakshill Sough driven in 1726-9 with unknown results.

This walk is approximately one mile in a straight line, and the ascent is about 500 feet. Having fixed the positions of the shafts and other features, it is worth turning to the Table of Critical Heights to see how deep it is to the top of the limestone, the Cartgate, the Old Sough and the Tricket Sough at various positions along the walk.

In the account of which follows it is worth keeping all these facts in mind. Many of the old records are incomplete or ambiguous, or what the miners were referring to is uncertain. Puzzling it out as far as we have has proved a fascinating study, but many problems remain unsolved and we sincerely hope that one of the results of this book will be the discovery of further documents which may help to fill the gaps in our knowledge.
Fig 1 The plan of workings in Odin Mine in 1757 in relation to present-day surface features.
Plate 1  Water-colour of Odin Mine in 1789 by John Webber (1750-1793) reproduced by permission of Whitworth Art Gallery, Manchester.
Plate 2

Odin Mine and Mam Tor from the waste hillocks; note crusher in left foreground with entrance to culvert leading to the Cartgate behind it (photographed about 1949 by T. D. Ford)

The tail of Odin Sough emptying into Hollowford Brook near Trickett Bridge. The course of the sough goes under the barn. (photo: H. M. Parker)
THE HISTORY OF ODIN MINE

by J.H. Rieuwerds

1. Early Bannote Court Disputes

Despite widespread claims in early Derbyshire topographical guides, and elsewhere, that Odin Mine was worked by the Danes, hence its name, the Saxons and even the Romans, there is no documentary evidence to support any of this. Most pre 19th century mining records refer to it as Oden Mine, and it was still being called by this name in the mid 19th century.

The first reference to the mine is very exciting because thereby it becomes the earliest named mine in Derbyshire, predating the reference to Mondale Mine in the Quo Warranto of 1288 (Brookebank 1918) *. The exact date is not known, but is not later than 1280. Amongst offenders brought to justice in the Royal Forest of the Peak was one John of Ballyhag. He was frequently in trouble with the Forest authorities for hunting and poaching and he had been found hunting in Eaxter Wood, Castleton, and in the wood at the entrance of Odin. This “entrance of Odin” cannot be anything but a reference to the mine entrance.

Thus we have positive evidence of mining at Odin in the late 13th century, which is also interesting in another direction because Mondale Mine and Odin Mine, along with Nestus Mine, Matlock Bath are traditionally referred to above all others as being ‘very old mines’. This is notwithstanding references during the mid 12th century to mines at Tideslow.

There than follows a gap of nearly 350 years before further references can be traced. Amongst the Bagshawe papers in Sheffield City Library are some of the earliest details of the history of Oden or Odin Mine, these being contained in several mid 17th century documents of Bannote Court proceedings. The mine at this time was described as being situated at:

“a certayne piece of comen there near unto a place called Mam Torre opposite lead myns, vevnes, Raikes, groves meares of ground and possessions for groves and meares of ground called Odin Groves or Odin Works”.

The story opens with an Agreement dated 8th July, 1663* made between Richard Torre of Castleton of the one part, and Rowland Eyre of Bradway, Nicholas Stones of Hemsworth, Roger Lee of Little Sheffield, John Lee of Hazelbarrow, and Robert Dakin, a miner of Castleton of the other part. Richard Torre lived at Gooseshill Hall, Castleton. He had interests in many mines in the Castleton area and was a considerable landowner. His daughter Alice married Adam Bagshawe (Shawcross 1993); their son Richard later became a major shareholder in the mine. The Bagshawe family retained this interest in Oden Mine until the 1850s. Torre also leased 1/3rd of the Tithe ore in Castleton for 11 years from January, 1669 at a rent of £10 per year. There is a story, so far not substantiated by documentary evidence, that he was Barmaster of Castleton Liberty. He was born about 1634 and died in 1696. His daughter was Anne Tatton who inherited all her father’s estate. Her first husband was William Tatton of Wythenshawe, Manchester; her second husband was Robert Radcliffe. Rowland Eyre’s will is dated 28th June, 1688.

Dakin owned the following shares in the mine; 5/24ths above the Gank Mouth and 3/24ths below the Gank Mouth, but he subsequently sold these shares to Henry Knyveton for £1000 in December, 1668. This enormous sum of money clearly reflects the richness of the mine and the shareholders’ faith in its potential.

A summary of the possessions at Odin in which Dakin had his shares and which he sold to Mr. Knyveton make it clear that a considerable amount of ground was set with stows although much of it was certainly not being worked, and indeed some parts have never been worked to this day.

The document proves that stows were set for 18 meers of ground below the Gank Mouth along the range of the vein and terminating in a small stream 150 yards north east of Knowlegates Farm. This range was entirely in the shale, and just how familiar the miners of the period were with the geology of the area cannot be assessed, but either they hoped for the vein to continue up into the shale, or alternatively did not appreciate the steep dip of the limestone beneath the shale cover.

* The printed copy of Brookebank’s article has “at the entrance to Odin”, but this is a printers error. Brookebank’s original manuscript (Brookebank Collection, No 12, S.C.L.), clearly says “at the entrance to Odin”.

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A sough driven by Rowland Eyre and partners, and Richard Torre at joint expense will be discussed in detail later, but it was almost certainly driven along the above line of possessions,

"firstly they began at Heins barne and sowe up the hill at that Randoine 18 possessions betwixt yt and ganck mouth".

Twelve meers were set on the north side of the above range, down the hill from the Gank Mouth and eleven meers on the south side.

"And from the ganck mouth up the hill in the Randoine of ye Rake 29 possessions".

Twelve meers were set on the north side of the above range, down the hill from the Gank Mouth and eleven meers on the south side.

There were six meers on the north side above the Gank Mouth and an additional four meers, "on ye north at Stonehole".

Mr. Knyveton purchased in all a share in 80 meers or 2560 yards of ground for his £1000.

Briefly, the details of the agreement of 1663 (2) may be summarised as follows:—

That as Eyre and his partners owned Oden Groves and Richard Torre held meers and possessions adjoining, they should cast them all together for their more effectual working and draining. Torre was to have a half share of the part downhill from a place called the Gank Mouth, and 1/6th of the part up the hill. Eyre and partners were to have the other half share below the Gank Mouth, and 5/6ths above it. The cost of carrying on the works and also the driving of a sough to the Gank Mouth were to be equally shared, but if the sough had not been—

"wrought and brought upp to the Veyne and laid dry soe that lead oare may be gotten with in seaven years next after the date of these articles ...".

Torre was to pay back half of the clear profits he had received out of his sixth part and only to retain a half of the sixth, i.e. 1/12th of the part above the Gank. Within the seven years, the sough had also to be "perfected from meare to meare for the laying dry of all the said groves and meares of ground by degrees one after another and for gettlinge of the leade oare therein, if the same bee likewise not hindered or impeded by them the sayd Rowland Eyre ... (and partners) ...".

Again failure would result in Torre having the same penalties as above. If the sough was carried above the Gank Mouth each partner was to pay his own apportionable share of the cost of driving it.

Behind this seemingly straightforward arrangement the background was very involved and led subsequently to a dispute in the Barmoot Court in June, 1669. In the first action Torre was the plaintiff against Anne Tatton and partners, objecting to certain wording in the original Agreement of 1663. Before the Agreement was drawn up the Defendants had been in possession of the Oden vein for many years previously. A document, undated but about 1670 stated

"they — (Eyre and partners) — have been in possession for 60 years last past".

This is interesting as it positively dates mining at Oden to the beginning of the 17th century, not withstanding the very early 13th century reference. Rowland Eyre, Nicholas Stones, Roger Lee, John Lee and Robert Dake "were for a long tyme partners at this worke and spent much moneys there and the water prevalled soe ff are upon them that without soughing it was not likely to make then any profit. Thereupon they were often considering a way to dryne and sough it, having the whole failde there to themselves and noe possessions near them".

They made borings along the proposed line of the sough and apparently Torre heard of this. He did not have any shares at Oden and he

"Sett some possessions near where they began to sough where was noe Veyne nor Rake nor ever likely to be and farr from the old works they soughed for".

Furthermore he threatened to sue them for coming through his ground if they continued.

Torre then attempted to bargain with the miners for a share in the workings promising to do all he could to be a good partner and to further the work to the best of his ability. But he must have been a troublemaker because it was only with the greatest reluctance that Eyre and his partners finally agreed to have the Articles drawn up and sealed

"they being soe fearful of dealing with him".

The dispute which subsequently arose centred around the location of two points, Gank (Ganck) Mouth and Gank Doore and 24 yards of ground which separated the two. Torre claimed that although in the Agreement of 1663, the division point from which the various shares were to be divided was named as the Gank Mouth, in reality it was a miswording and the Gank Doore was meant; furthermore that all present at the signing of the Agreement knew full well the true location of this division point. Trouble about this place had certainly arisen at the signing because
"the great dispute that was betwixt them was whether hee should come to Ganck Doore or Gank Mouth which kept them up all night and att last agreed Ganck Moutth".

Torre claimed that Gank Mouth had not always been known by that name, but had formerly been known as Torre Cheeks and therefore confusion had arisen in naming the two points.

"He hath run at great hazard in bringing up the rough and beare the chief man in perfecting that worke and that if it had not beene for him it had never beene bought - - - ."

On the other hand Eyre and partners had several witnesses, amongst them Robert Dakin Junior, Robert Ashton, Robert Dakin the Elder and Robert Nall, who had all worked at Odin previously and who contradicted the evidence of Torre. For example Robert Dakin, Junior

"was a workman there long before and since the sealing of the Articles knows the place to be called Gank Mouth and see commonly all the tym that the ground in question as Gank Mouth that the shaft of the grove is aboute it and stands betwixt it and the Doore; knows the setting up of the Doore and who made it, that neither the Doore nor the place where the Doore is was ever called Gank Mouth, that the Gank Mouth was sometimes called Nase of the Torre and gives his reason why sometimes called the Gank Mouth and sometimes nase of the Torre".

Robert Nall was formerly a partner at the mine and he too always knew the place to be called Gank Mouth. He had also been a workman at the mine.

"John Nall proves the bargaine from Dakin by which Torre hath a 3rd pt of Dakins part and see takes it for Ganke Mouth".

Robert Dakin the Elder gave evidence that up to that time, i.e. June, 1669, Torre had contented himself with taking his sixth part according to the Articles and also paid wages accordingly. Another witness could prove that Torre had accounted with Mr. Kniveton, (who appears to have acted as a kind of mediator), for the ground in question along with the other ground (presumably that below the Gank Mouth).

When the case was presented in the Barmoot Court the Grand Jury gave their verdict against Torre.

There then followed a second Trial in the Court in which William Tatton and Nicholas Stones were plaintiffs against Richard Torre. The case was substantially the same with one or two new facts emerging which are interesting in throwing light on the mine at that time. The plaintiffs claimed that "Ye place was called Ganck Mouth and hath beene open for 40 years last past and see called ye other to wit Ganck Doore medice long before ye Articles and ever since called Ganck Doore".

Torre refused to employ an Overseer at the mine, and did not pay his share in the general expenses: "sets on workemen to oppose the plaintiffts workemen, --- and bring his friends and relations to purchase (Lead ore)"

Summarising the dispute over 300 years after it happened is somewhat difficult, but the evidence seems to be that sometime previous to June, 1669, Torre had brought the sough to, or very near to the Gank Mouth. The driving of this point was done at an equal cost to both parties. He had until July, 1670 to complete the level, and, only having a sixth part of the vein above the Gank Mouth, that is the richer part of the vein, as the limestone rose south-westward from beneath the shal covering, realised that if he could push the point of division between his half share and his sixth share further south-westward along the vein by 24 yards he would of course have more ore.

The Gank Door, made shortly before the Agreement of 1663 was at a point 24 yards further south-westward along the vein. As the Gank Mouth had been open at least 40 years before the dispute, and also the ground between the two places was described as being "batwixt two Torres", obviously the checks of the vein, it appears as though this part of the vein had already been stopped out to daylight.

At the toe of the Mam Tor landslip, about 80 yards north of Knowlegates Farm is a spring of water. Evidence for an old sough tail is not absolutely convincing but viewed from certain angles a small bank of shale spoil appears to be possible at the tail of the level, and immediately on the west side of the fence as a rather more convincing shaft mound.

Further westward in the rough hummocky ground of the Knowles enclos are two other possible shaft mounds, unfortunately now much overgrown and denuded so that one cannot be certain.

However, the spring and first shaft mound are in direct line with the eastern end of Odin gorge and the field on the opposite side of the ditch is the "Fans". The eighteen meers of ground ranging from Gank Mouth, if produced along the line of the gorge pass directly through the shaft and spring and terminate at the stich at the fence of the Fans Field. There is some evidence to suggest that a level referred to as the "Old Mans Level" on Robert How's section of 14th March 1765 may in fact be this sough and further details are discussed.

The verdict of the Barmoot Court to the second trial is not recorded, but in October 1673 they were
still in dispute, this time Anne Tatton, wife of William being the principal defendant. It was agreed that all disputes should stand in abeyance until May Day, 1674 and meanwhile the managing of Oden Mine to be carried on by Richard Charlesworth as Overseer for Mrs. Tatton and partners, and Christopher Oldfield as Overseer for Richard Torre. They also agreed that all disputes still pending be referred to Francis Berkley, Henry Balguy, Richard Colton and Edmund Hore.

Parallel with this long drawn out battle, were minor affairs, again dealt with by the Barmoot Court. At the Small Barmoot Court held at Castleton on the 20th August, 1669.

"John Shallcross Esq., complaines himself to this Court against Nicholas Stones, gent, Robert Hallom, Overseer, for entering into and unlawfully detaining and withholding from the complainent, one fourth part of ye next Taker meare of ground up ye hill westward from ye deep shaft meares in over Oden formerly in possession of ye said Robert Hallam, lying and being in ye Liberty of Castleton".

Less than one month later a counter Bill was presented before the Court by Nicholas Stones against Shallcross.

"Nicholas Stones complains against John Shallcross for unlawfully entering and unjustly withholding one fourth part, all but one fourteenths part of one grove or meare of ground commonly called Hallams Shaft in nether Oden within ye Liberty of Castleton, -- to the damage of £40".

Thomas Hall and Thomas Charlesworth were the Deputy Barmasters of Castleton Liberty at this time.

Careful examination of the walls of the gorge, particularly west from Widowers Venture Vein reveals several distinct levels of temple holes, a few shot holes and sporadic evidence of pick work. There is no direct evidence of the date of any of this work, but the pattern of the temple holes suggests that the vein was worked initially underground and not open cast as previously imagined. The work must have taken place at an early date, perhaps either in the mid-seventeenth century or early eighteenth century. The short length of vein between Gank Mouth and Gank Door appears to have been stopped out to daylight prior to 1669.

The diversion of the Odin Sitch, mentioned in the Walk section of this book, must have taken place before this part of the vein was worked, otherwise the stopes would have been flooded. No proven documentary evidence has yet come to light, although an isolated reference to "cutting ye sought of Mem Side" in 1709 may refer to this work as a sough in Derbyshire means not only a drainage level, but also a surface ditch. A further entry in June 1711 of a payment of £2 2s 4d to "ditchers on Mem Side" may be significant.

2. Early Expansion

Richard Bagshawe and the beginning of the Knowlegatet Sough

From the date of the arbitration in 1673, there is then silence in the mine's history until the year 1704, at which time several trials were made with ore from Odin to determine smelting and related costs and also the quantity of smelted lead obtained from a specific quantity of lead ore.

During the early years of the 18th century Richard Bagshawe of Castleton had a considerable interest in the mine. He was born in 1674, son of Adam Bagshawe and Alice Torre, and resided at Goosehill Hall. He was a major shareholder in the mine and had extensive shares in mines in Castleton, Bradwell and Hucklow, and coal mines in Sheffield Park. His Agent at the Odin Mine was Robert How. Bagshawe was a large landowner and was High Sheriff of Derbyshire in 1721. He died in 1760 (Shawcross 1903).

Two account books covering the years 1704 to 1707 and 1708 to 1716 give an insight into the conditions at the mine and the people employed there. The vein was proving extremely rich and by late 1706 the workings had reached over 500 yards west from Gank Mouth, deep beneath the shales of Mam Tor.

A note in the reckoning book states that from October 1704, to the beginning of March, 1705, "the forefield hath gott 3984 dish the nine meers has gott 729 dish", so even in these early years a high rate of production is in evidence.

There is mention in January, 1705, of a 'Levy' (which usually means a level) and ore was later mined from it. One year later, in January, 1706, the sum of £6 1-0 was paid for ale when "ye Levy was stricken through".

In June, 1706 the first ore was recorded as being mined from "Nine Mears at Levy".

Ore continued to be mined from 'the Levy', 'the Levy in Nine Mears' and later from 'Levy beyond Nine Mears', the last recorded measure being in August, 1707.

In these Reckoning Books a distinction was made between ore raised at 'Oden forefield', 'the Levy', 'Nine Mears', and 'Oden Hillock'.

The position of the Nine Mears is known and in fact contained the 8th to the 15th meers west from the Gank Mouth in Oden South Vein, including Tinker Shaft meares, one meer eastward and seven meers westward. Richard Bagshawe owned shares in the whole of Oden Mine, but for some reason now unknown,
The crushing wheel and circle erected in 1823
(photo M. E. Smith)

The waste hillocks and crusher looking towards Castleton, along the line of Knowlegates Sough. Trickett Sough trends towards the left-hand side of the village.

The diversion leat taking Odin Sitch round the top of the Gorge.

Slickensides (top left) and a row of notches (lower centre) for a former platform in the narrow part of Odin Gorge.
Dressed stone stemples in Little Shaft vein.

Dressed stone stemples in Little Shaft Vein.

Stone arching in the roof of the Cartgate Chamber (M. E. Smith)

Stone pillar and stemples near the Cartgate Chamber (photo M. E. Smith)
he had a different proportion in the Nine Meers from the rest of the mine. Perhaps this part of the vein was discovered by driving in the shale at a high contour behind the Oden Gorge. It may have even been fired for a 'new or old' vein before a connection was established with the lower workings from Gank Mouth.

By June, 1706 the Levy had been driven beyond the Nine Meers, and payments were made to copers for mining lead in it.

Old plans make it perfectly obvious that the Oden Vein is in reality a vein complex or a series of parallel or near parallel veins connected by small sills. One could wonder whether the Levy was an exploratory/drainage level driven in the shale at a fairly high contour, seeking the westward continuation of the vein. Due to the extensive Mam Tor landslip much has been obliterated, but there are pieces of veinstuff in very denuded shale hillocks at the side of the Odin stream diversion, with another shaft mound immediately on the east side of the middle lay-by on the Mam Tor road. This is very probably Tinkers Shaft.

James Hall's plan, undated but probably drawn in 1752 entitled, 'A Plan of Oden from the Gank Mouth to the forefield of the Levy', contains a table indicating depths to which the meers along the vein had been worked below this Levy. As no figures are recorded east of the 15th meer, excepting one meer in Crooked Knot Vein, coupled with the above evidence one could speculate whether a level was driven in the shale from the west side of the Odin gully diversion, intersecting the line of the vein near Tinkers Shaft. Whether in fact the Levy of the early 1700s and the Levy on the 1752 plan are the same, and can be linked to the surface signs in Odin Gully, is not at all certain but the evidence is suggestive.

Considerable quantities of ore were mined and in April, 1706 no fewer than 41 men and 8 women were employed at the mine. The reckonings took place every three weeks and some miners were earning up to £22/- for a three week stint. The women were paid 5/- for three weeks. One of them, Dorothy Neeham, an ore dresser on the hillocks, died in November, 1705 and 7/6 was paid for her coffin. Of the various items purchased, a sieve from Wingate grove cost 4/6, and two ropes from the same source cost 7/2. Powder was 3/9 for an unspecified quantity.

A shaft was sunk on Mam Side, and was probably commenced in September, 1707. Two turn trees and a drawing hook were obtained, and there are references to 'leading stone to Mam side', and walling. One cannot be certain which shaft this could be, but there seem to be two possibilities, either the one shown on a later plan as Blue Hillocks, or perhaps even the Mam Engine. On April 28th, 1710 there is a reference, "for drawing water at Mam Side, 7 days, 9/-".

and at about the same time, "for bargain on Mam Side sinking, £3-0-0".

The labour force at the mine had dwindled to 16 men and 2 women in 1708.

Bagshawe's account books covering the years 1709 to 1715 shows that during this time consistently large amounts of ore were raised, 8173 loads on which a profit of over £2,400 was made.

The book opens with "1709. An account of all my shares and parts of Groves in Castleton Liberty, Oden, above the Gank Mouth, North Vein, 31 meers, South Vein, 34 meers, Swine Hole Pipe, Takers at Knot, or for the symptom in the Sough, 35 meers, Pipe below Tinkers Shaft, In Peak forest takers at South Vein, North Vein, At these my part is of the nine meers in the Sun Vein, viz Tinker Shaft meer and 7 meers west and 1 meer eastward, and 2 meers in the North Vein, viz Hallom shaft and another, Below Gank Mouth, North Vein, 17 pairs set January 18th, 1711, South Vein, 19 pairs set January 21st, 1711, There is an isolated reference in October, 1709 to a sough at Mam Side, but the context, and lack of further entries suggest that it was possibly a surface watercourse made to drain excess surface water away from the new shaft.

"for cutting ye sough of Mam Side, 15/-", "Old shafts at sough, Mam Side".

The soft, thinly bedded shales and sandstones of Mam Tor were rather aptly described by the miners "Driving 3 fathoms in slivver, £1-0-0".

The book also gives an interesting insight into the costs of mining materials at this time. Two sieves cost 8/6, a pump cost 10/6, and a kibble 1/4, stamplc were 6d. each, Candles were 5d/lb, and by 1714 gunpowder, an interesting item, was 1/2 per lb. The mine by this time had its own smithy and £2-2-4 was paid for slate for it.

Reckonings commence on the 13th July, 1711 for 'ye Sough below Gank Mouth'. Exactly five months later this sough had been driven 150 yards at a cost of £21-14-6, or 8/- per fathom.

"The Sough at 6/- per fathom as agreed is 79 fathoms at £21-14-6, Shafts at 5/- per fathom is 20 fathoms at £5-10-0, 8 fathom above set at 2/6 per fathom is £1-0-0, set the Sough to the lime door at 3/- per fathom".
A further total payment of £18-16-2 indicates that another 107½ fathoms were driven in this sough making a total length of 186½ fathoms or 373 yards. The sough therefore had cost £40-10-8, and as no further entries occur for bargains, one assumes that at this point the sough level finished, by the end of May 1712.

Reference to later plans, coupled with levels recently taken, makes it almost certain that this sough is the first section of the Knowlegate Sough.

Payment for sinking 8 fathoms of shaft at 2/6 per fathom appears to relate to a small, now completely covered climbing shaft, by which the miners entered the sough, and the shaft just over the fence, 6 fathoms deep, marked by a conspicuous mound of shale sinking dirt.

Mr. W. Fletcher of Knowlegate Farm remembers the low bolt entrance of the sough on the north bank of the Sitch a few yards west of his outbuilding. The entrance is not now visible due to Mr. Fletcher cleaning and widening the Sitch at this point.

The 20 fathoms of shafts at 5/6 per fathom would be for shafts three and four situated in the south ground between the Farm and the main mine hillocks. The third shaft, 9 fathoms deep, is again marked by a fairly obvious mound of shale sinking dirt. There was formerly a coe at this shaft. The fourth shaft is difficult to find in the trees and scrub. It is named on one mid 18th century plan as 'Rail Shaft, not open'. The site is now a deep depression with shale spoil on three sides, the shaft was originally about 11½ fathoms deep.

The reckoning suggests that at least two more shafts were sunk, but unfortunately one cannot be certain to which shafts the entries refer.

One shaft was being sunk in January, 1712, 'set ten to sink 10 fathoms in the shaft on the North side the Sitch at 4½ per fathom'.

This may well be a shaft between the Rail shaft and the Sough Engine in the Knowles. In July, 1712 a further 4 fathoms were sunk at 11½ per fathom. There do not appear to be any surface indications of such a shaft.

Between May and July, 1713, a shaft at least 15 fathoms deep was sunk costing nearly 11½ per fathom, the actual total cost being £8-3-6d. Earlier 23 feet had cost 19/2d., or 6/- per fathom. This clearly represents sinking a larger shaft, but it cannot refer to sinking in limestone.

The Sough Engine in the Knowles was 19 fathoms deep to the sough so there is a possibility that the above sinking referred to this shaft. The Sough Engine shaft was sunk 101 feet between 1750 and 1752 and another 9 feet were added in 1756, no doubt this 110 feet being below the Knowleges Sough, as the shaft was 39 fathoms deep by 1769. The other possibility seems to be that the 1713 sinking was the 'Sough foremost Shaft', and the 'shaft on the north side of the shaft' was the Sough Engine in the Knowles. The exact position of the former shaft cannot be traced from surface evidence, but from mine plans the depth to the level must have been about the same as the Sough Engine Shaft.

Ore was mined from the sough, the first measure being recorded on September 25th, 1713; 'Ore at Sough in Nether Oden, 11 dishes'.

This ore would be obtained from the Taker Meers set out below Goat Mouth in Odin North and South Veins in January, 1711. The likeliest place would be at the shale/limestone contact in the vicinity of the Sough 'foremost shaft' and the west end of what was to become in the 1750s the first Taker Meer west from the Sough Title west Founder Meer. Six loads and four dishes were obtained in 1713 and 92 loads and 3 dishes in 1714. Ore was still being mined in the Sough Title in 1717.

James Hall's plan of 1752 shows the Sough Vein as a distinct Vein from the main Odin Vein.

Later plans do not make this distinction, and in fact show the main Odin Vein extending approximately along the line of the Sough Vein and eastwardly beyond the Sough Engine Shaft.

A document dated August, 1769, summarising the meers in each vein belonging to Oden Title, lists 10 meers in Odin Old Vein in Odin Sough Title. At the contour of the sough any vein in the immediate vicinity of the Sough Engine Shaft would be in shale.

As the first Taker Moor west from the west Founder Moor (i.e. from the Founder shaft or Sough Engine Shaft) was only freed in 1753, one can only assume that mining at this early period was from another vein or from within the two founder meers of the Sough Title.

The sough terminated at the 'Sough foremost Shaft' the site of which is now obliterated by the extensive alteration of the hillocks. When the sough was continued past this point in the 1760s, the limestone rose up into the sole at the west end of the 1st Taker Moor.

The level had been driven at a rapid rate, 3½ feet per day, clear reflection of the ease of driving in the soft shales above the limestone. According to measurements taken from the reckoning book, it was 373 yards long, the figure is confirmed exactly by Robert How's plan of the sough and mine in 1757. If the length of the short gates to the offset shafts are also taken into consideration.

Seven miners were employed at the sough in 1713 amongst whom were Ellis Hall, Sampson Wilson, Thomas Spencer and three members of the Nall family, Henry, John and Jude.

During January, 1712, three workmen spent three weeks and three days laying troughs in the sough below the Goat Mouth at a cost of £2-12-6d.

This was followed in August of the same year by, 'workmen laying troughs in nine meers', so obviously drainage was effected from the forefield of the workings through to the sough tail, the water being conveyed through the levels and sough by means of the wooden troughs.
3. The Lord's Meer and the workings in Peak Forest Liberty

Oden Over Grove proved to be a very profitable mine and from 1722 until 1728, just over 9000 loads of ore were measured on which a net profit of £6000 was made. Although it is not absolutely certain, probably all this lead was mined in Castleton Liberty, exclusive of large quantities being mined at the Lords Meer in Peak Forest Liberty from 1726 onwards.

The vein was followed westwardly beneath the flank on Mam Tor and was cut out of Castleton Liberty and into Peak Forest Liberty, according to one reference in 1722. Again this became a period of disputes over alleged trespass, between Richard Bagshawe and partners at Old Oden Vein, and the Duke of Devonshire, as owner of the new Lord's Meer, and lessee of the mineral dues.

When a vein was worked out of one liberty into another it was regarded as a New Vein and had to be freed. Two Founder Meers were given to the miners, whilst the third meer was the Lord's Meer, which could be purchased from the owner of the mineral dues, in this case the Duke of Devonshire.

Also the miners had a right to cut through it in order to get to their Taker Meers lying beyond. The Oden Old Vein partners were to keep clear all gates and levels, but could not sell any ore that they found in doing so. If they decided to purchase the Lords Meer a valuation was set upon it by the Barmoor, after they had been down into the mine to ascertain its value.

The owners of Oden Old Vein did not free a founder meer when the vein was first cut into Peak Forest Liberty, and furthermore they trespassed into the Lord's Meer. The Duke of Devonshire had a right to claim the vein, but he did not insist on forfeiture. Instead, on October 29th, 1726 an agreement was reached between the Duke and Bagshawe and partners. The essentials are as follows: the Duke was to peacefully and quietly enjoy and have the said Lords Meer. For the better working of not only the Lords Meer but also the rest of the mine the Duke was to have use of the ropes, chains, gates and leveals in the founder meers, but could only use them from 12 noon to 12 midnight. Bagshawe and partners were to have use of them the remaining 12 hours.

The Duke agreed to work his part of the Lords Meer through as quickly as possible so that they could get to the Taker Meers lying beyond. The Oden Old Vein partners were to keep clear all gates and shafts, and to have liberty to carry on at their own cost a Drift or Levell through the shale in the Lords Meer to their first Taker Meer. The cost of chains and ropes used was to be equally divided between the Duke and Bagshawe and partners when the Lord's Meer had been worked out.

The amount of the trespass committed by Bagshawe and partners into the Lord's Meer was to be assessed by John Johnson, a very experienced mining Agent from Winster, and by Roger Shower.

One document states that the Duke actually took a half share in the two Founder Meers in the Old Vein in Peak Forest Liberty.

The reference to the shale Drift or Levell is interesting because at this contour any drift or level would be important either as an exploratory/haulage gate or for drainage. One could postulate therefore whether this Drift or Levell was a continuation westwardly along the line of the vein of the "Levy" mentioned in the early part of the 18th century. Robert Haw's plan of 1757 recorded that in the 3rd Taker Meer in Peak Forest Liberty, "the Vein overlapped the Levy" and the forefield was at the end of the 6th Taker Meer, in the shale.

The evidence seems to be that a major Level or "Levy" was driven through the greater portion of the mine during the first half of the 18th century. The position of the entrance to this level still remains a mystery. The logical place for such an entrance would be at the Gark Mouths, but in this case it seems odd that the Cartgate driven in the second half of the 18th century should be driven from the same place.

Perhaps by this time the old "Levy" was either too small to use as a Cartgate or was in bad repair, or the entrance may have been at a much higher contour, as discussed earlier.

Alternatively, a sough driven initially to the Mam Engine Shaft, may well have been continued in the shale westwardly toward Peak Forest Liberty.

The hilllocks at the Mam Engine Shaft have been very much disturbed by fluor spar hillrockers, and a shaft lined with gritstone and plumbed some 20 years ago at 180 feet deep has been covered over. Between here and Tinker Shaft is a place underground called Swine Hole, "not cut but selfy open from whence at times of flood cometh a great quantity of water which sinks at the Day at a place called the Round Hill near to the Engine Sough Tail".

Round Hill has not been located so this remains a mystery for the moment. The water obviously entered the mine through natural caverns, but the relative positions of the Engine Sough Tail and these cave systems are at the present time not known. There have long been stories and traditions about links between Oden Vein and the Blue John Caverns.

There seems to be one or two possibilities regarding the position and range of the Engine Sough.

The most obvious is a Shale Gate driven from the stream flowing into the top end of Oden gully. There are

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* However, there is a possibility that this Engine Sough was originally driven as an exploratory gate seeking signs of minerals in the shale along the range of the vein. This would probably be around 1700 before Mam Engine Shaft was sunk.
one or two issues of water into this stream but no sign of a sough and perhaps the likeliest place would be just below the Marn Tor Swallet. This swallow could be where the water sank underground, but it is difficult to reconcile the “Round Hill” with anything to be seen today. The two mounds of shale sinking drift in the enclosure below the Marn Engine could be on the line of the sough. This sough is probably a fairly early one and could date from the time of sinking the main shaft, that is early in the 18th century.

In the working of his Lord's Meer, the Duke of Devonshire discovered two new veins, one called the North Vein, ranging northwardly in Peak Forest, the other called South Vein ranging southwardly toward Castleton Liberty, and claimed them according to mineral custom.

The Odin partners then began a cross cut or drift towards the South vein with the intention to find and first free this vein in Castleton Liberty. The overseer of the Lord's Meer put a door across the mouth of this drift, claiming that it was within Peak Forest Liberty, and would not allow Bagshawe's miners into it. The Grand Jury had been down Bradshaw shaft in Castleton Liberty and disliked to the mouth of the drift, later giving their opinion after the dialling had been laid out on the surface, that the mouth of the drift was 8 feet 6 inches within Peak Forest Liberty. Bagshawe was very doubtful about this, saying it was within Castleton Liberty and he asked the Duke if he would agree to two experienced miners, one to be nominated by the Duke and the other by himself, to re-dial the mine18.

Bradshaw shaft does not appear to be recorded under that name in any other document, but from its position close to the Liberty Boundary on the Castleton side it must have been what later became known simply as Castleton shaft.

There were other disputes pending between the Duke and Bagshawe and partners but, on May 22nd 1729, the Duke freed his first Founder Meer in Castleton Liberty. To end the disputes the Duke and Bagshawe and partners finally agreed to the following:

“The Duke to have liberty to use a shaft in Castleton Liberty adjoining to Peak Forest, called Bradshaw shaft, to work the Lord's Meer North and South Veins and make any new drifts or cross cuts, as may be necessary, at his own expense.

To use a cross cut or Drift already made.

The Odin Partners to have liberty to cut new drifts through the Lord's Meer at their own expense, to their first Taker Meer lying westwardly and carry the water from their Taker Maers through the Lord's Meer, by laying launders, doing as little damage as possible and making merchantable to the Duke, any ore found”19.

The Lord's Meer at Odin Mine was a particularly rich area, probably due to the traditional zone of enrichment near to the base of the Edale Shales. From the available reckonings it would appear that along with its associated South Vein, the Lord's Meer was worked from November, 1726 until June, 1738, during which time 4462 loads of ore were measured20. Some of the ore was taken to the Shacklow Mill on the River Wye near Ashford, for smelting.

The Duke of Devonshire worked the part of the vein on his own account, leasing one third to Mr. Samuel Rotherham, and one third to Mr. Sherrat.

The Rotherham family were Lords of the Manor of Dronfield. They were interested in lead smelting as well as mining. John Rotherham had interests in a lead smelting mill in 162321, and this is probably the same as “John Rotherham owning a Myle called Cliff's Milne” in 1687 (as noted in Sheffield City Libraries Local History pamphlet No. 1, on the Water Mills of Abbeydale). This mill was at Dore. John Rotherham leased one third of the ore one of the parishes of Bakewell, Hope and Tideswell from Sir Philip Gell of Hopton for £75 per annum from at least March 1704 to 171722. Samuel Rotherham leased Halls House smelting mill, Totley, in the 1730s. He leased the duties of Lot and Cope from the Duke of Devonshire for Castleton, Bakewell, Hadeley and Peak Forest Liberties until 1737. At that date the duties were taken on lease from the Duke by Richard Bagshawe23.

This latter fact probably explains why there is no mention of wrongful freeings for Odin Sough Vein and Odin Old Vein during the 1750s.

In 1726, twelve men were employed mining ore on cope, and doing some day wage work in addition. Fifteen men were employed as drawers and pumpers and seventeen women on the surface dressing the ore24. Gunpowder at this time was 1/d per pound and 1½d per ounce. A pair of “Baliss” (bellowsl cost £2-5-0d., and by 1729 as much as £3-6-0d. per month was paid for “charge of blowing ballis”, so obviously ventilation was a major problem, perhaps with so much driving being done in the shales, this is not surprising. An entry for October, 1727 records that Thomas How, Henry How, George Mortin and Thomas Joyel were each paid 10d. for cutting the water gate. There are extensive entries all through the reckonings for pumping; in September, 1733 15/- was spent “cutting room for three pumps”. Just over three months later, in January, 1734, 36 feet of pumps cost £2-2-7, and four Ragg wheels 10/-.

The men on day wage were paid 1/- per shift and 10d. per shift for drawing. In contrast the driving of levels was done on bargain.

“June, 21st, 1730. Godfrey Mortin and his partners for driving of the slate drift at 10/- per fathom, is £7-4-0d.”

Godfrey Mortin was “killed in ye mine” in 1747. This was at a mine on Hentley north of Dirtlow Rake.
The letting of the cope bargains for the actual mining of the ore was quite different.

"June 24th, 1732. Memorandum of Barging made between Robert Hallom, overseer at the Lords meer at Oden and the copers at followeth. The Masters are to find all materials (materias), thatt belongeth to the mines only the copers are to find women Lads and cendals and pouder the term that copers are to have it is Betweext June ye 24th untilt. Mickle mast Day 1732 att nineteen shillings and sixpence per load as witnes our hands.

Tho How his mark.
George How his mark.
Jos Bancroft his mark.
Jos Barbor his mark.
Godfrey person, are to choose their partners to make them ten in number.

William Hambleston
George How
Thomas Hall his mark.
Thomas Marshall his mark.
Robt paramount his mark.

As the vein was worked into Peak Forest Liberty so the ground was set out and meers progressivelry treed. During June, 1727 Mr. Robert Charlesworth, a partner in the mine, called Robert Burrows, the Peak Forest Barmaster, to view 61 pairs of possessions set as Taker Meers "for a new vein - if the custom of the mine found it to be so".

Robert Burrows was still the Barmaster of Peak Forest in 1737.

As sought, the course of which is marked by a line of shale mounds and run-in shafts, empties itself at the shale-limestone boundary, approximately 230 yards east of Peakshall Farm. The level was no doubt intended as a dual purpose trial, to locate if possible the western extension of Oden Vein in Peak Forest Liberty, and to serve as a pumpway if necessary. It was being driven during the period 1726-1729, but the Duke of Devonshire brought an injunction against the Oden partners to prevent them from driving the level, as they were depositing great spoil heaps on the surface (Kircham 1962). Obviously the Duke was experiencing trouble with the Oden people in more than one direction during these years. Whether the level was at all successful is not known, but it is unlikely. The most northerly of the Sough shafts is on the approximate line of the presumed continuation of Oden Vein although the most westerly known point of working is over 480 yards away from the shaft.

During October 1728 the Lord's Meer partners committed a trespass into the Founder Meer of Oden Vein and a letter from Samuel Rotherham, who it will be remembered had a third share in the Lord's Meer, to Richard Bagshawe explains briefly what happened:

"I was at Bradwell this week ... and was informed that our workmen at Oden had made a trespass upon your ground by carelessness or willfulness or both and our Overseer nor better. I ordered Isaac Morton to acquaint you yesterday ... We propose to send John Johnson next Thursday or Friday to inquire into it."

The Duke of Devonshire acknowledged the extent of the trespass committed by his miners and in May 1737 he paid Bagshawe and partners £168-9-8, plus a further £18-3-8 as "one half of the Pumps, tools and pumping belonging to the partners at the late Lord's Meer laid out for Oden Vein in the Peak forest", a total of £186-13-4.

"As ordered by his Grace to be paid in full for a trespass committed by the said partners or Agents into the Founder Meer."

From November, 1728 when the Duke of Devonshire commenced working his Lord's Meer until the end of the accounts in June, 1736, a total of 4462 loads of lead ore were mined. At an average weight of 65 lbs. per dish of dressed lead ore, this figure represents about 1165 tons of ore. The capital expended in carrying out this mining was slightly in excess of £4800, but unfortunately no profits are recorded. However, lead was selling during the period at about 22/- to 25/- per load, which would give an overall profit of perhaps £500-£800. The Lord's Meer was give up in June 1736.

Notwithstanding the richness of the Lord's Meer, large quantities of ore were raised from the part of Oden Vein owned by Richard Bagshawe and partners. Between 1727 and 1736 over 21,000 loads were raised from "ould Oden Veine" in Castleton and Peak Forest Liberties.

In April 1732 Richard Bagshawe junior wrote,

"at Oden they are driving north but all in Shale, ... they are throng sinking ye Engine; ... Where they are sinking in the first Taker proves hard and they don't get half wages."

One cannot be certain but the Engine may possibly be West Shaft at the Forefield.

They had freed their Third Taker meer back in 1728.
Robert How became Castleton Barmaster in 1741 and remained until his death in 1756. He was succeeded by his son, also Robert (born 1727) until the last years of the century, he died in 1810. A third Robert, born 1778, was then Castleton Barmaster until 1822 being succeeded by Jonathan. Jonathan was sworn Barmaster in October, 1822 and became Bradwell Barmaster in 1825. He was still in the position in 1857. At the Census of 1851 he was 63 years old and was assisted by his son John. They lived in Cross Street, Castleton, where he died on 25th May, 1864.

John How was Bradwell Barmaster in 1867 and he is in the group photographed at Rake Head Mine in that year. Jonathan was succeeded by yet another Robert, presumably the brother of the above John, and who was listed as a farmer in the 1851 Census. He was sworn Barmaster at a Great Barmote Court at Monyash on 11th October, 1864, and died in 1908 aged 81, after an accidental fall.

Most of the mid 18th century plans and sections of Oden were drawn by Robert How (son) whose father had been Agent at Oden mine for Richard Bagshawe from at least 1728. A brother, Edmund, was the Peak Forest Barmaster by the late 1740s. The whole family, as may be imagined, were prominent in local affairs.

One was mined in Peak Forest Liberty from 1747 to 1750, but amounts are not specified. Edmund How was the Barmaster, receiving a salary of £6.00 per annum. He died in January 1789.

There is a curious gap in the records of the mine from 1740 until 1747, but there then follows a continuous and well documented period until the second half of the 19th century when the mine finally closed as a producer of lead.

Note: The brief information on the How family, Isaac Mortin and Robert Burrows, Barmasters of the Castleton and Peak Forest Liberties, has been compiled from a number of sources. Various documents in the Devonshire Collection, Brooke-Taylor documents, Bagshawe collection, Oakes Deeds and Barmasters collection have all been useful, as well as some printed sources such as Shawcross (1903), Evans (1913) and the Census Returns.

4. The Driving of the Cartgate and the continuation of Knowlegates Sough

The famous Cartgate level, a well known feature of the mine, was commenced either late in 1751 or early in 1752. The first entry is dated 15th November, 1751 and shows "workmen holding the hill for a Cartgate, 3/6", and a second reference at the same time "Clayton and Co removing their tool".

A Cartgate was driven up Crooked Knob Vein and this was in the process of being excavated in September, 1752, when Robert Andrew, Thomas Middleton and John Hall were cutting it for 5 weeks each. Robert How's 1765 section shows that this was at the same contour as the main Cartgate.

After this initial outburst of enthusiasm little appears to have been done until 1755. Between August of that year and the summer of 1758, 146½ fathoms were driven at a cost of £123-3-4d. The actual cost to the proprietors of the mine would be somewhat less than this as the miners supplied their own candles and powder. Candles were 3/6 per pound, powder cost 9/6 per 35 lbs.

Robert Marshall and partners drove the Cartgate until the mid part of 1756 at which time George Needham and partners took over. No driving took place between 1758 and June, 1765, this being substantiated not only by the reckoning book but also from the fact that whereas 293 yards were driven between 1755 and 1758, the forefield was still only approximately 300 yards west of the Gank Mouth in February, 1755.

During the following 4½ years over 560 yards were driven, the forefield standing 864 yards west of the Gank Mouth in September 1759. There are several references to clearing the level and the carters were paid 2½d. per cartful. The ore was dragged out in four-wheeled "carriges" along a plankway in the Cartgate (MacRitchie 1765). This confirms references in the Reckoning Books to "planking the Cartgate".

Richard Bagshawe's account book for the years 1754 to 1774 shows that 12,331 loads of ore to the value of £18,330 was obtained from Oden mine at a net profit of a little over £5,076. This book includes accounts for several mines and was kept by his steward, William Hodgkinson. Richard Bagshawe junior resided at both Wormhill Hall and the Oakes in Norton. He was born in 1703 and died in 1778. He had two brothers, both of whom held shares in the mine. His mining interests covered a wide area of Derbyshire and also extended into the Grassington area of Yorkshire. He was also very interested in smelting and along with, but independently of, the London Lead Company introduced the Cupola smelting process into Derbyshire (Willes 1971).

The barmaster's book covering the same years indicates that in fact 22,482 loads were measured at the mine. Bagshawe from 1765 owned a half share at Oden, but the account book, particularly after 1764
Shaft. This latter is associated with driving of the low level Oden Sough from Trickett Bridge in the early Sough and this shaft have already been discussed.

The Hoole, or Robert How, or both, were swindling Bagnall to the tune of several thousand pounds from Oden mine-skins. Twenty three miners names appear in the reckoning book in 1757 and amongst surnames familiar in the Castleton area for generations are Eyre, Dakin, Neschem, Nall, Royse, Marshall, Hall and Ashton.

Some of the ore was taken to Bagnall's Tolley Cupola to be smelted, and wood, no doubt a convenient return load, was obtained from Smackley Wood at the head of Cordwell Valley. Some timber was also fetched from Wadley Park.

In May, 1766 it is recorded that £1-10-0d. was paid

"filling Rushup Engines", (meaning "filling") and in August of the same year a further £1-8-0d. was paid for the same task. One George Lowe was for four days taking down the engine, and four men assisted with the demolition being paid 10d. per day. George Lowe was paid £2-10-0d. for erecting an engine at the Cumber Mine, Montacute, in 1765 (Robey 1963), and in July 1776 he was paid £3-5-1/2d. for supervising the dismantling of a gin at the Cop Mine in Bradwell Liberty and re-erecting it at Hills Rocks Mine, Hazledean. Thus he was obviously in demand as a wheelwright and engineer by the lead miners over a wide area of Derbyshire. The number of days and the expenses involved give the impression that the engine at Rushup was something larger than the usual gin. Unfortunately no details are given so this must remain a rather intriguing question for the moment.

A further reference, again without any associated detail occurs in September, 1760, "Thomas Southern for his trouble coming to view the engine, 10/6d."

Thomas Southern came from Wensley near Matlock and was an engineer of some consequence. For example he re-erected the old atmospheric engine from the Mill Close Mine, at the Gregory Mine, Ashover, in 1768 (Nixon 1960). It is difficult to imagine that he would have journeyed to Oden Mine merely to examine a relatively simple piece of equipment such as a horse-gin. There are no documentary indications that a pumping or winding engine was ever used at the mine, so this problem must also remain for the moment.

We are often reminded that injury and death were an ever present threat in the mine, and in May, 1760 two miners were hurt. Dr. Harrison was paid a guinea for, "setting Robert Nall legg and Jos Rowbotham arm, both broke in the mine."

By 1750 references begin to appear again for Oden Sough: on one section at least it was named as Knowledges Sough. The Sough Title consisted of two Founder Meers, the Lord's Meer, three Taker Meers and twenty-four yards of ground to the Gank Mowthar, the beginning of Oden Old Grove Title. According to a plan made in early 1750s they had a separate vein called the Sough Engine Vein, and the main Oden Vein, shown only as a dotted line east of the Sough foremost shaft, had not been proved.

The plans drawn in 1757 and 1760 show the Sough Vein as being the eastern continuation of the Oden Old Vein. This continuity would be established after 1753 when the Knowedgates Sough was re-started from the Sough foremost shaft, where it had been left in May 1712, and then stopes worked below the sough from this point westwards towards the Gank Mouth. (see Fig. 3)

By November 1750 they were sinking in the Sough Engine Shaft, and by 1752 it had sunk at least 101 feet, another 9 feet being added in 1766. Nicholas Bradshaw and partners and later Nicholas Daykin and partners were responsible for the sinking. The cost, inclusive of candles and powder was £74-17-4d. The depth to the sough was 114 feet, and 117 feet further to the shaft foot. Earlier details of the Knowledges Sough and this shaft have already been discussed. An accurate survey recently made of the portion of the mine from Knowledges Sough tail to Oden gorge indicated that the Sough Engine in the Knowles, or Sough Founder Shaft is not the shaft which is open at the present day and generally referred to as the Knowles Shaft. This latter is associated with driving of the low level Oden Sough from Trickett Bridge in the early years of the 19th century.

Between the end of June 1761 and March 1753 the sum of £30 was paid to George Lowe for an engine; this would be the usual type of horse-gin. Yelling the engine race cost £1-2-8d. and the delivery of stones, or as the reckoning book puts it, "leading stone to the Engine race", cost an additional £1-1-5d.

The sum of £5 was paid in November 1761 to "workmen when discovered the vein". This discovery was made during the deepening of the Sough Engine Shaft beneath the Knowledges Sough. This vein was named the Sough Engine Vein, and as already explained was thought to be a separate vein to Oden Vein, it being discovered beneath a considerable cover of shale. Only after stoping had taken place and the workings pushed westwardly, along with the sough, was the continuation between the two veins established.

As no stopes are shown on the 1769 section between the west end of the Sough Title third, the old Oden Title at Gank Mouth, it is interesting to speculate whether, even after the sough had been driven through, the Sough Engine Vein and Oden Old Vein were regarded as separate veins for mineral legal purposes. There is no mention of wrongful freeings in the Barmasters Books, but perhaps this is not too surprising in view of the fact that the Bagnahes in addition to being major shareholders were also the lessors of the Lot and Cope.

The first measurement of ore after the discovery of November 1751 was in the next reckoning and to the end of that year they measured 135 loads. This was followed by 248 loads in 1752 and 277 loads in 1753. All this ore was obtained from stopes in the limestone, initially within the two founder meers, before the first take mill was tried in May 1753.

The men driving the sough were paid about 6/6d per fathom, candles were 1/- per pound.
The Sough Title continued to measure ore until 1765. In 1754, 502 loads were measured at a gross value of £917. The following year 1146 loads were raised which realised £2170, but this decreased to 227 loads in 1756 at a value of £384. No further ore was mined in the Sough Title after this date.

The plans and sections of the mine provide measurements at various dates enabling the further progress of the driving of the sough, and later the driving of the Cartgate to be followed.

The earlier part of the history of the sough has already been discussed. A plan dated March 14th, 1765 shows that it had then reached the west end of the 3rd meer west from the Gank Mouth in Odin Vein (see also fig. 3). This is 193 yards beyond the 'Sough fivemore shaft', the presumed forefield of the earlier part of the sough in June 1712, and still so in 1753. The Odin Mine reckoning book recorded 182 yards being driven between 1753 and 1754. Previously, in 1751, eighteen fathoms had been driven as a "going gate", thus providing direct access from the sough level to the Knowles Shaft, avoiding the peculiar dogleg in the older part of the sough, so these figures correlate very satisfactorily, the additional eleven yards presumably being driven sometime between June 1754 and March 1766.

Bargains made with the miners to drive the level varied tremendously, ranging from 5/- per fathom paid to Robert Hall in October 1757 to £3-10-0d per fathom paid to Jacob Royse early the following year.

The total cost of driving the level from 1753 to 1754 was £85-11-7d exclusive of timber, powder, etc.

The sough forefield was 512 yards west of the Gank Mouth in September, 1769; early in the 19th century it extended into Peak Forest Liberty.

There is a curious and inexplicable loss of level in the sough of 11 yards, in the 26th meer west from the Gank Mouth at the eastern extremity of what is described as "the Brass Castle, a very hard and barren part of the vein".

The sough then continued at this higher altitude and so into Peak Forest Liberty.

Most early 19th century Derbyshire guide books describe Odin Mine, and mention both the Cartgate and the Knowlegates Sough. The descriptions are mostly identical.

"It consists of two levels running horizontally into the mountain, the upper a Cartgate by which the ore is brought from the mine; the lower one a water level to drain the works which have been carried a mile from the entrance". (Britton & Brayley 1802).

These references show that both the Cartgate and the Knowlegates Sough levels extended into Peak Forest Liberty at the latest by 1795 as MacRitchie commented that "this mine goes nearly in a plain about a mile under the hill; the whole is laid with boards along which the miners drag out the ore in four-wheeled carriages to the houses at the entrance".

The mine was famed for its crystallisations and mineral products, including obviously the abundance of lead ore, and also fluorite, calcite, sphalerite, and rarer minerals such as elaterite, sulphur and selenite and reputedly wulfenite. (Mawe 1802).

The mine was shown to visitors and one writer observed that "it can be explored with comparatively little inconvenience", the working miners were described as being honest and intelligent men. Hedinger, writing in 1795, recommended that all intending visitors should enquire for Samuel Needham, a miner there and "a most civil and intelligent man".

The plan and section drawn by Robert How in 1769 throws further light into the extent and condition of the workings. Parts of the vein were worked as much as 25 fathoms below the Knowlegates Sough, the water being laboriously lifted up to it by teams of hand pumpers. Good ore was obtained from some of the stopes, for example in the 10th meer, immediately east of Crooked Knott Vein rither point, twenty-two men got 100 loads of ore in six or seven weeks. Unfortunately a large spring was cut on 4th August, 1769 and was noted on the 1769 section - "double to what we had before and obliged us to give it up. The vein was best when the last spring was cut and seemed to be growing better".

A particularly interesting point is that from the end of the 19th meer to the 22nd meer the Cartgate and part of the Sough level were driven through shale. The depth to which the shale extended was not known, but one old miner living in 1769 stated that it reached 20 fathoms below the Cartgate. This confirms an old report that "the adit is driven in limestone and after passing through shale enters again into the limestone".

The vein was lost where the shale came down and as one account puts it, "The vein lost, occasioned by a fall of shiek falling into the vein".

whilst an earlier account terms it, "in Shiek Torrs and not in the vein":

Before the main Cartgate was driven there was a shorter level which in 1757 extended from the foot of the Mem Engine shaft to the end of the 31st meer, a distance of 224 yards; and termed the "Engine Cart Drift". It is unfortunate not clear whether this drift was higher than or at the same altitude as the Cartgate; it may or may not have been incorporated. The indications are therefore that before the forefield of the main Cartgate was driven into this part of the ground sometime about 1768, the ore and deads were hauled to the surface up the Mem Engine Shaft. The enormous hillocks formerly heaped up around the shaft support this
Fig 2 Redrawn versions of the two surviving profiles of the Trickett Bridge Sough to Odin Mine: above - the proposed sough of 1772; below - the proposals of about 1816 carried out between 1816 and 1822.
Fig. 3 A compilation of all the available data from plans, sections and account books concerning Odin Mine brought on to one section.
deduction. They have been used for road repairs in recent years.

One section of the mine drawn originally in March, 1765 with additions up to March, 1767, supplies yet further details of the workings. The vein above the Cartgate was largely cut out; this is not surprising as a study of the plans drawn between 1750 and 1768 indicates that by the latter date a tremendous amount of work had taken place already in the higher levels of the mine right through into Peak Forest Liberty.

Twenty men were raising ore 20 fathoms below the Cartgate in March 1769 at a point in the 10th meer.

One detail shown on the 1765 section and not on any other section or plan, but briefly noted in one reckoning book, is what is termed 'Old Mans Level'. Just exactly what was the original function and extent of this level is not now altogether clear. The section shows it commencing at the foot of a sump at the beginning of the 4th meer, and 14 fathoms below the level of the Cartgate, extending a distance a little over 90 yards westwardly to the 'Old Mans Level full of rubbish'. There is a gap until the 9th meer, from which it then extended 114 yards to the west forefield. The latter portion was undoubtedly re-driven between January, 1761 and November, 1762, at a cost of only £27-2-4d.23

The immediate question which arises is of course could this level be the original sough dating from the 1660s. The section shows that the Old Man's Level was driven at a fairly steep gradient, and when these points are drawn out to scale there is every likelihood that this level could be the old sough, the contour of the projected line conforming to the postulated sough fall.

Contemporary with the above period is the tale of the murder in the Winnats Pass of the runaway lovers, Alan and Clara in 1766. It is well known and need not be repeated. Among the many versions of the story is one that the five murderers were miners at the Odin Mine.

There are in fact many different printed versions of the story of Allan and Clara, and there is a manuscript version in the Woolley Manuscripts in the British Museum with details said to have been obtained from the death bed confession of one of the miners and written by Mr. Marshall of Edale. It names the other miners involved.

Of the names quoted, two, those of James (or John) Bradshaw and Francis Butler cannot be traced in the mine reckoning books but three others or men with identical surnames do appear to have worked at the mine in the 1750s and 1760s. Thomas Hall and Nicholas Cook were miners, whilst James Ashton, recorded in legend as a carter to a smelt mill on the Sheffield road, was actually a carter at the mine, working in the Cartgate level. One account of the murders states that the miner blacksmith was met by the other four on his way back to Castleton from the mine, and was more or less forcibly made to accompany them.

The blacksmith during these years was one George Berley, so again this part of the tale does not fit with the evidence from the mine reckoning books.

5. The Deeper Exploitation of the Mine

The richness of the vein coupled with the fact that they were obliged to hand pump as much as 150 feet to the Knowlegates Sough prompted the proprietors to consider deeper drainage and a deeper Cartgate level.

A section dated the 8th May, 1772 shows that a new deep level sough was proposed to be driven from Trickett Bridge on Hollowford Lane just north of Castleton village, to the east forefield of Oden Vein, a distance of 1552 yards in a direct line. The distance the sough was to be driven beneath each field was tabulated, together with each respective landowners name. There were to be four air shafts sunk to the level, a cumulative depth of 44 fathoms and 4 feet.

Concurrently an estimate was prepared for "Driving a level from Hollowford Sitch to the east forefield of Oden Vein... without timber" driving 776 fathoms at 25/- per fathom would cost £970, and three air shafts 31 fathoms deep overall a further £31. Indicated in the estimate were "Unforeseen expenses, perhaps meeting with Blackstone... £132-12-7."

The overall cost including air fans and planking the Cartgate would be £1300; if timber was required for the sough then the sum would be £1416. For some reason not now known the sough was not proceeded with at this time and another forty four years went to stope before it was commenced.

Great quantities of ore were measured in Peak Forest Liberty, particularly from 1794 to 1802 when the vein in this Liberty raised over 11,000 loads, the total yield in Peak Forest between 1776 and 1822 being 12,492 loads of grove ore, and significant quantities of belland, 1957 loads.26 No doubt the Knowlegates Sough enabled the majority of this lead to be mined, but it is easy to understand why deeper drainage and access was such an attractive proposition and really very necessary.

Robert How's section of 1765 has extensions to the Knowlegates Sough and Cartgate levels drawn in pencil. These extensions are undated but are in the hand of Robert How III (born 1778), and therefore date from the early years of the nineteenth century. In Peak Forest Liberty extensive stopes are shown below Knowlegates Sough from the Lord's Meer westwardly. They are 20 fathoms below level in the 2nd Taker Meer and no doubt the bulk of the ore was obtained from these stopes.

There is no evidence, either documentary or otherwise, that the vein was at any time worked further westward than the 4th Taker Meer in Peak Forest Liberty. The plan of 1757 shows a shaft in this meer called West Shaft.
The Peakhill Sough, driven in the 1720s was probably an attempt to prove the western continuation of Odin Vein, but, as discussed previously it is extremely doubtful if this Sough ever connected with the mine workings. Certainly the level did not figure significantly in the history of the mine, in 1726 and in 1729 water was taken from the Peak Forestaker mains eastwardly through the Lord's Meier. The quantity of ore raised in Castleton Liberty decreased from the high output years of the 1750s and 1770s so that between 1801 and 1816 only 3360 loads were mined. The need for a new low level sough became greater than previously, but the consistently high output of the previous century was never again reached. (Appendix 3).

The reason for the long delay in driving the Trickett Bridge Sough is not clear. A later, but undated section of the proposed sough is at first glance apparently very similar to the 1772 version. Closer scrutiny reveals several significant differences. From the style of handwriting (Robert How III born 1778), and the fact that by this time Sir William Chambers Bagshawe was a landowner beneath some of whose fields the intended sough would pass, the section can be dated to after 1800. Probably it immediately predates the commencement of the sough, i.e. about 1815-1816. The fall is a few yards north of Trickett Bridge on Mill Lane in Castleton village (Plate 2).

Again, individual distances beneath each field were tabulated, the revised total length being 1582 yards or 30 yards longer than the original proposal of May 1772. The original range was perfectly straight and aimed directly at the east forefield of the vein. The later sough diverted to the north by some 5° for a distance of 3500 feet, before turning slightly at two points to reach the forefield of the vein at the same position that the 1772 level would have done. Why the line was altered is not certain but perhaps the new owner of Knowlegates Farm would not permit the sough to be driven under his fields. The fields belonging to this farm are the only ones not affected by the later sough.

The later line is, so far as one can gather, the actual course taken by the sough. At this part, that is from the fall to 11 yards west of the Lord's Meier, or 53 yards east of the Sough Engine in the Knowles, was driven through Edale Shales, although there is some evidence to suggest that the sough may pass through the top of a buried knob of limestone beneath Dunsarc Meadow.

On both sections the Knowles shaft is 'suposed 39 fathoms', and there is the 'suposed rising of the vein', both of which suggest that the lower workings beneath Knowlegates Sough were flooded or otherwise inaccessible by May 1772, although still open in 1769. Four air shafts, 264 yards apart, were to be sunk, but the shafts visible to-day are not in these positions (Fig. 2).

Apparently there was insufficient capital for the undertaking and in 1816 there was put forward, 'A Scheme for Unwatering Odin Mine'. (Fig. 2). The shareholders were named in this document, 12/24ths and 1/48th being owned by Sir William Chambers Bagshawe of the Oakes in Norton. The Rev. William Bagshawe owned 3/24ths and Robert How the Barmaster, 2/24ths.

A letter dated 8th May 1816 states:
"The money for unwatering Odin Mine to be advanced by the Estate of Sir WC. Bagshawe, to the interest (which was 5%) of the money accumulate until the mine shall be able to pay the interest of the money to Sir William —."

According to a document at Chatsworth on June 12th, 1816, "Joseph Eyre, John Clayton and Co began Odin Level in foxhill".

This document gives a detailed account of the distance driven, cost and other information from that date until May 1820.

After spending the first three days on wage work at 2½ a day, the four men began to take bargains of 10 fathoms at a time, at prices ranging from 10/- to 25/- per fathom. By the end of the year 110 fathoms had been driven at a cost of £107-14-0. This included £1-10-0 given for 'fixing the bellows and boring'. The following year saw 143 fathoms driven at a total cost of £238-17-0, which sum included boring 13 yards in Robert Eyre Field, probably for ventilation, and 'scouring' the sough on nine occasions at 6½-time.

A letter from Robert How to the Rev. William Bagshawe, dated 5th Feb 1817 states:
"we are going on at the sough as well as we could expect unless it would always stand and not need walling. We are now sinking our first shaft when done we shall begin to wall the level, we are got about 297 yards. The whole is 1582 yards you know it depends on being hard or soft or other inconveniences in regard to the length it will take to drive it."

In January 1818 boring began in Mamsitch Field and was finished 22½ yards deep in April. This shaft is the first for which Eyre, Clayton and partners were paid for the actual sinking. The reference to boring before the shaft was sunk is very interesting. One could speculate whether the reason for this was perhaps they expected meeting limestone in the sough. They were probably well aware of the undulations of the shale/limestone contact. In this instance and also in the later shaft in Dunsarc Meadow it cannot have been for ventilation purposes as each shaft was completed well before the arrival of the sough forefield.

The Mamsitch field shaft was sunk during May and June 1818 and cost £23-12-0. The sough reached the shaft in September 1819. The sough was advancing satisfactorily and in reply to a query from Sir Archibald Grant, one of the shareholders, Wyatt wrote in March 1818—
During 1818 the sough was driven 129 fathoms on which £213-14-0 was spent. The bargains now started
to rise steeply and by November, a fathom was costing 42/-.

In December they bored 26 yards 1 foot in 'dunscore meadow' and then took the shaft sinking
initially at 15/- per fathom, but after sinking 14 fathoms 1 foot the price was increased to £1-10-0 a fathom
so that the shaft eventually cost £21-15-0. The shaft was completed by mid-January 1819, the south
reaching this point in August.

The reckonings suggest that harder rock was met in the sough forefield under Dunscore Meadow
because bargains rose quickly from 52/- a fathom to 60/- and 64/- in September and November 1819.
The level was driven 108 fathoms in that year and a further 43½ fathoms by May 1820 at which
date the reckonings cease. The total cost of driving the sough, the boring and sinking two shafts was
£1021-17-4, and the level was by this time 538½ fathoms in length. This means that the forefield in May
1820 was under a field called Bull Meadow some 250 fathoms approximately from the eastern forefield of
Oden Vein.30

In March 1820 it was stated
"...the Oden level goes on about as expected, and toward next Xmas it will
be coming near or at the old mine to relieve it from water.* 29

Between June 1816 and May 1820 the sough had been driven an average of 270 yards a year so the remaining
500 yards to the vein by that reckonning would take about 21 months. One can only assume therefore that by
'next Xmas' it is December 1821 that is meant.

This estimate was not too far wide of the mark because a letter from William Bagshaw at Barner
Cross to Benjamin Wyatt, dated 29th October, 1821 commented,
"Joseph Cock informs me that they had met with lime-
stone at Oden, 11 yards west of ye Lord's Meer. Have
they found any ore yet?" 31

The sough would thus have encountered the rising limestone in the east Founder meer of the Sough Title,
and thus correlates very well with mine sections showing the shale/limestone contact. The Lord's Meer was
at the eastern end of the east Founder meer at Sough Engine in the Knowle.

An undated sheet records that £3237-11-9d. was advanced and lead ore sold to the value of
£3032-1-3½d. Unfortunately the reckonings are incomplete during these years but it would appear that
the sum was advanced between the years 1816 and 1821/1822, when the sough reached Oden Vein.

A considerable amount of buying and selling of shares took place in these years. During October
and November of 1821, Mr. W.J. Bagshaw sold a 1/24th share to Robert How, the Barmaster, for £100,
a 1/24th share to John Read of Norton House for £100, and 1/24th to the famous sculptor Sir Francis
Chantrey also for £100. A similar share was bought by John Brown, a Sheffield Solicitor for the same
amount. By contrast Thomas and Hannah Elliott of Castleton sold a 1/72nd share to Robert How Ashton
for £5 in October, 1822. On the same day he bought a further 1/72nd share from Isaac Ashton for a similar
sum. Robert How Ashton continued to buy shares in the mine in subsequent years including a 1/24th
share from the Rev. J. Dixon in September, 1826 for £1, and the 1/24th belonging to John Read for £20
in 1842. 32

A detailed map of the parish of Castleton drawn in 1819 33 shows a number of buildings on the
hillslooks on the east side of the road, but none are named or their function indicated. Presumably they were
the usual coes, ore houses, smithy, etc. A water colour by Webber in 1769 shows the hillslooks considerably
larger than they are today, with numerous small buildings. These presumably included the houses at the
mouth of the mine referred to by MacRitchie (1795), who commented "About one hundred and twenty
huts constantly employed here; have houses at the mouth of the mine where they reside every day except
the Sundays. Here they wash the lead ore and render it fit for the smelting houses!". The meaning of the
word "huts" here is uncertain; at face value it seems the miners may have lived in the ones during the week
and only returned home at weekends, but this is unlikely with Castleton so near, and it may simply mean
that the miners were at work there every day. A photograph taken early this century enables the ruined
coes to be picked out close to the Cartgate entrance beneath the road. Much of the hilllook material has
been carted away over the years, and from time to time stone was sold for road making; one reference states
that £3-2-6d. was received for, "stone to Turnpike at sundry times". 29

The 'holling through' of the Trickett Bridge sough with the vein meant a period of renewed activity
both on the surface and underground.34 The horse-driven crusher, a well known feature of the mine even
today, was erected in 1823. The grill stone for the wheel cost £1-10-0d., but the iron rim which fitted around
the perimeter of the wheel and the iron crusher plate cost £33-9-6d. which was paid for these two items, to
Messrs. Benjamin Smith and Co. of the Duckmantle ironworks near Chesterfield. The men were treated
at 4/6 worth of ale when the crusher was set up. 29

* This is the earliest dated crusher known in the Peak District, though the lack of iron tyre and track on some may mean
they are older.
A new gin shaft was sunk to the Trickett Bridge sough, and it seems almost certain that the open
shaft on the hillocks is this latter shaft and is not the 'Sough Engine Shaft in the Knowles', as previously
believed. They were three days letting down stone to wall the Engine Shaft in July, 1826, and Green's
North Derbyshire Geological Memoir of 1837 commented that

"More recently (i.e. after 1802) a shaft was sunk on the
east side of the high road to a depth of 60 fathoms and a
water level driven into it from 'Trickett Bridge in Castleton'.

This shaft was obviously a major haulage way for the deep sough, and in February 1828 the mine Agent
and Joseph Ashton claimed expenses for going

"to Ashton Park Bridge to look at drawing engines
which he said he could improve".  
Several miners were hurt or killed in the mine. Dr. Cheetham was paid 19/4d in March 1823
"for attending John Barber, Robert Eyre, Thomas Eyre
and Micah Eyre who were hurt in the mine".

In January 1827 Jasper Hall was hurt, followed by a more tragic event at the end of January, as
reported in the Derby and Chesterfield Reporter, 2nd February 1832.

"On Monday a poor industrious miner named George Hall lost
his life in the Odin Mine, by a fall of rock which slighted
upon him. He has left a wife and five children to lament
his loss".

The reckoning book adds that £10-10-0 was collected by

"Subscribers to George Hall family who was killed in the mine".

A second miner was killed in May 1834. The Jury of the Small Barmote Court found at their 'Great Inquest'
that Samuel Eyre of Castleton was killed, "by a fall down a hole 6 or 7 yards deep at the said mine". They
further decided that his death was accidental.  
His widow was given £5-0-0.

"Cash given Mary Eyre whose husband was killed in the mine".

Notwithstanding the opening up of the vein at a depth hitherto untried, the mine was overall losing
money and the immediate prospects not very encouraging. A letter written by Robert How Ashton to the
Rev. William Bagshawe in July 1827 is a very clear indication of the condition of the mine during those
years,

"...we came to a pipe in the forefield of Odin Mine where
we got a little ore, but it is now so barren that we have
been under the necessity of giving it up for the present, and
I have returned to pursuing the vein where I am sorry to say
we have not any ore at present. The vein is so much confused
at this time that I am almost at a loss in what direction to
pursue it, it being very much attended with water courses and
cavities and broken and thrown about in every direction,
but I hope in a little time we shall be past them".  

The accounts show that from 1816 to 1839 the mine lost £1,045, although the reckonings for individual
years reveal that profits were made from 1822 to 1832, with the exception of one year, 1826. Profits were
also realised in 1833, 1839 and 1840. However, from 1820 to 1840 only 12,449 loads of ore were measured,
or an average of 590 loads per year, contrasting sharply with the boom years of the 1760s, 1860s and 1770s, when
27,583 loads were raised between 1754 and 1779, an average of 1060 loads per year, or even greater contrast
between 1727 and 1736, when 2,200 loads per year were averaged.

During the early months of 1828, twelve to fifteen companies of miners were raising ore on cope.

An interesting note in the reckoning book is entered in September, 1827 when Robert How Ashton went
to Sheffield, intend to try if I could sell Jack Ore.  

"Jack Ore is of course Sphalerite or zinc sulphide. Ashton was no doubt wondering if the Sheffield
brass founders were interested.

The interchange in the workforce is particularly noticeable. Few of the miners remained at one
mine for any length of time and reference to the ore measurement books reveals that the copers moved between
Odin Mine and Hazard Mine with regular frequency and also appeared from time to time at other mines in
the neighbourhood. Some of them had very good spells and mined very considerable quantities of ore. For
example, John Broadbent obtained 455 loads of ore at Odin Mine between April and May 1831, and although
prices are not quoted this ore must have been worth £900 to £1000. It would be interesting to know how
many other miners were in his gang.

The progress of the sough was very slow. By the end of November, 1831, it had reached 'Rither
Point Hole' and had been driven to the men when the water was let out from it. 34 This point seems to
be Aymie Gutter rither about 230 yards west of the Gank Mouth. Thus in ten years they had driven some
400 yards. Between the end of December, 1830, and September, 1831, John and Thomas Barber and Co.
drove 14 fathoms in the sough at a cost of £42. This conforms with a letter of 1836 in which it was said
that the level was driving at about one yard per week. This letter, written in May of that year from John
Bagshawe to Archibald Grant also stated that the level was then 64 yards from the 'old man' or bearing part of the vein. A pencil note on the back of a letter dated 2nd April, 1836, indicated that since 1833 the level had been driven 236 yards through the barren part of the vein. Five men were working, the dimensions of the level being 7 feet high and 4 feet wide.35

The foresfield of the sough is shown by a pencilled cross some 12 yards west of the beginning of the 18th meir, together with the date, also in pencil, April 12th, 1836, added to How's plan and section of 1769.36

The foresfield therefore in 1833 was approximately at the western end of the tenth meir. There is no indication why the intervening 236 yards was barren, or indeed why a further two meirs or 64 yards would bring them to the bearing part of the vein.

A document headed "A Statement of the Facts relating to Tithe Ore at Odin Mine",37 gives further evidence of the dwindling nature of the mine's resources, and points to the impending exhaustion of the workable ore.

Although the mine only paid 1/30th as Lot, identical with all other mines in Castleton Liberty, the Tithe was still taken as every 1/13th dish. The lot had been reduced in 1830, and remaining mines in the Liberty only paid 1/20th as Tithe. The proprietors had paid

"...a very considerable sum in driving up a Level to relieve it from the water ... and was expected to have been sufficiently rich to have repayed the proprietors for their outlay, which hitherto has not been the case, for after working it for nearly seventeen years since the Level got up to the vein it has repayed but a small proportion of the outlay, although it has got a considerable quantity of ore and given employment to the greatest part of the Lead Miners in the Village".

The document then goes on to describe the nature of the remaining ore,

"...there is now a large portion of the vein left uncut in consequence of its being too poor to pay the workmen's wages, and the dues as they now stand ..."

The case is then pleaded for a reduction in the Tithe ore from every thirteenth dish to every twentieth dish.

"...it is of greater moment to the mine that the Tithes should be reduced, ... in consequence of the Hazard Mine being to all appearance nearly exhausted and Odin Mine likely to be the greatest source of employment for the Miners in the Village. ... The reduction would enable to owners of the mine to cut a large portion of the vein now left as too poor to be wrought."

The above document is undated but as the low level Odin Sough reached the vein about 1822, it must have been written about 1839.

A series of isolated reckonings in 184038 indicate that around a dozen men were mining ore on cope, and some were certainly earning good money. For example in seven weeks ending 30th May, William Jackson mined 36 loads and 6 dishes for which he received £99 17s 6d. He would provide his own candles and powder. Similarly in October in a seven week period, Robert Eyre mined ore worth £25 11s 1d. John Barber and Son mined only £6 6s 7d. of ore on cope, and earned £7 14s 2d. on wage work for six weeks and one day. The junior miners, when on wage work earned 2/6d. a day, or 15/ for a six day week, younger miners earned 1/6d. a day. From the above it would seem that their £6 6s 7d. worth of ore was raised in five days. Samuel Ashton mined £14 18s 10d. worth of ore on cope, and he and his son had only three days each on wage work at 2/6d. per day.

Many of the Odin miners can be traced from sources other than mine account books and the like.

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Amongst the Odin miners are the following:—

Sam Ashton senior born 1775, lived at the Siggate in 1819.
Sam Ashton junior born 1821.
James Ashton born 1806.
John Broadbent, born 1795, lived near Goosehill Bridge. His wife Barbara was an ore washer at Odin.
John Barber born 1790, lived at Siggate in 1819.
John Barber born 1806.
Thomas Barber born 1790; lived at Mam House. The Barbers of Mam were mining at Maskhill Mine & Oxlow in 1763.
John Clayton born 1775, lived at the bottom of the Siggate at the entrance to Cave Dale.
Joseph Cock lived at the Siggate in 1819, but he is not mentioned in the Census of 1841.
Jacob Eyre, born 1803, lived at Mill Bridge. His son Jacob, born 1831 was a miner.
John Eyre born 1800, had a son 13 years old in 1851, was also listed as a lead miner.
Micheal Eyre, born 1801.
Robert Eyre, born 1801.
Elia Hall born 1811, lived at Goosehill, not to be confused with the celebrated Castleton geologist of the same name.

George Hall, lived at the village green. Killed at Odin in 1832.

Joseph Hall living also at the Siggate in 1819.

Jasper Hall, living at the Siggate in 1819.

William Jackson born 1801.

Joseph Kirk.

James Hall born 1793, lived in How Lane.

Joseph Needham.

Samuel Needham, born 1795, lived at Loosehill, Woodseats.

Isaac Rose born 1800, died 1858, lived at Brads haws Fold in 1851.

Thomas Sidebottom, born 1811.

Thomas Walker.

Ann Watts, born 1778, pauper and ore washer.

Joseph Wright.

Finally, at least two miners appear to have been working at the mine well into old age, a practice not uncommon in the lead mining industry, Joseph Hall and Joseph Whittingham were both working at Oden Mine in 1840, and if they are the same men, and no one else of those names could be found in the 1841 census, then Hall was 76 and Whittingham 72. Whittingham lived in How Lane in 1851 and was described as "Pauper - lead miner". He was definitely working at the mine in 1847.

The mine agent, Robert How Ashton, earned 16/- a week and Isaac Rose, whose position is not specified, 17/- a week. It would seem likely that Rose was the actual Mine Manager.\(^{35}\)

The grinding of the ore was done by one William Slack, who lived at Dunscar Farm. Apparently this only seems to have been necessary for about three days in a seven week period of reckoning.\(^{35}\) Robert How Ashton again wrote to Mr. W.J. Bagshawe in August, 1841, repeating the by now familiar story,

"I am sorry to say Oden is very poor at present!".

The cough level continued and in 1843 was costing £8 per yard to drive.\(^{35}\) The mine was by now regularly losing money. The last available reckoning book ends in November, 1845, so that after this date evidence is somewhat scanty.

Robert How Ashton had built the smelting mill at Marsh Farm in about 1840 and Sir Archibald Grant, writing from Aberdeenshire, suspected unfair dealings to certain shareholders. He did not receive his accounts regularly, and several of his letters reflect his uneasy feelings over the general management and accounting at the mine.

For example he wrote to W.J. Bagshawe in August 1841 as follows:—

"... the Agent at the mine has built a Cupola of his own and is taking the ore and smelting it and selling the lead".\(^{35}\)

During September, 1843 he again wrote to W.J. Bagshawe,

"Mr. R.H. Ashton still appears to be extremely dilatory in making up his accounts, as it was not until the 8th of last month that he forwarded to me copies of the accounts for the years ending 8th January, 1842 and 7th January, 1843, although I made repeated applications for him to do so.

I should be glad to know how far the partners are connected with Mr. Ashton in his smelting concerns, and if you are satisfied that proper steps are taken to ensure justice being done to the interests of the shareholders in all these transactions".\(^{35}\)

Bagshawe noted on this letter,

"profits in these years come from smelting connections and from holding the lead until he could sell to advantage".

Lord Pomfret had experienced similar troubles at the time of the famous Beldi Hill disputes in North Yorkshire. He probably had the right idea when he wrote in 1773:

"... the only way to have a just account and to make a full profit of the mines in Swaledale is not to employ anyone at Steward who is a Yorkshireman and particularly of that neighbourhood". (Raistrick 1955).

His comments apparently applied to Derbyshire mines and Derbyshire agents just as much.

The fortunes of the mine continued to decline, so that by October 1847 only five Companies of miners were raising ore on cope bargain, but three of them, Robert Eyre, Joseph Needham and Joseph Whittingham then 79 years old, had worked at the mine many years. There was a considerable interchange of the workforce between Hazard Mine and Oden Mine and several miners worked intermittently at both.

Hazard Mine continued to produce ore on a fairly large scale until 1865. After 1871 lead was only measured for a total of four years, and production ceased completely at Hazard Mine in 1884.

Ore was measured in Peak Forest Liberty in 1849 and 1850 and in 1857, 1858 and 1862, but only trifling amounts.\(^{35}\) The five years combined yielded only 91 loads. The North Derbyshire Geological Survey
Memoir (Green, 1887) stated that the sough continued westwards along the vein from the new shaft in the Knowles for a distance of 1250 yards, which if this statement is correct, means that it extended just into Peak Forest Liberty. In February, 1850, three members of the Grand Jury of the Barmote Court, two for Castleton Liberty and one for Peak Forest were put into Oden Mine by the Barmaster.

"to see where the partition mark between Castleton and Peak Forest Liberties ought to be made, but they found it to be four feet short of being out of Castleton Liberty". 28

A month later they went back into the mine, "to make the partition mark and they made it on the north side of the Level".

This entry appears to relate to the low level Odin (Trickett) Sough.

The mine continued until 1869, in which year the last ore measurement was recorded. 38 There was a gap in production from 1849 to 1852 and the Bagshawe family, who had retained a principal interest in the mine for over a century and a half, finally withdrew in September 1856. 29 For the last years of its long life the mine was owned by Robert How Ashton. During Ashton's time just under 4000 loads of ore were raised, 37 but no charges or profits are available. The ore was selling at 35/- a load in 1869. 38

The absence of any plans, reckoning books or correspondence after 1845 means that it is not possible to know of developments underground, or from what part of the workings the ore was raised. Some underground working apparently took place in 1908 and 1909 from the Mam Engine Shaft and it is said considerable quantities of fluorspar and barytes were raised, but unfortunately no details remain. The hillocks were worked later, but again few details are available (Carruthers 1922). Most hillocks were finally removed as ballast for re-building the Mam Tor road.

There is a very persistent local legend that 70 miners were drowned in the mine when it was flooded after an explosion of Silex bedsides. The men supposedly still lie there and the mine was blown up to prevent a re-occurrence of the tragedy. No documentary evidence has come to light to verify the story, and the Parish Registers do not record any mass mortality, so for the moment it must remain a legend.

Another legend which must remain is that of the ghost in the Cartgate beneath the road, said to be James Ashton, the carter mentioned in the story of the murder of Allan and Clara in the Winnats.

John Royse in 1943 more or less confirmed the date of closure without mentioning the fluorspar working at Mam Engine in 1908-9. He also hinted that the mine was intentionally destroyed by the indiscriminate removal of mineral which had been left to support walls and stope roofs.

The final thoughts are perhaps best conveyed by Royse's words when he investigated the mine in the 1920s:

"I dreamt of lighting it brilliantly with electricity for the public to see its drama, depicting a story in human life and character". (Royse, 1943).
Plate 5

Aymie Gutter vein (?) in a working near the head of the 35 ft pitch (photo M. E. Smith)

The worked-out Little Shaft vein with stemples (photo M. E. Smith)

Odin Gorge and Gank Mouth cave; grassed-over tailings in foreground

The Auger Hole in the southern Gank Tor
Wooden spade with iron edge.

One-piece wooden spade

Miners' Picks

Old miners' tools found in Odin Mine (photos by M.E. Smith)
ODIN MINE — THE ACCESSIBLE WORKINGS TODAY
from notes contributed by P.J. Lord

The only entrance is in the back of the narrow Odin Gorge. (Fig. 4) Descending from the north side with the aid of a rope or ladder takes one onto a pile of large blocks, from which two narrow slits lead underground. That on the right has a 10 ft. ladder into the mine, situated on Little Shaft Vein (Plate 5). Some 60 feet in a cross cut leads back into the other opening, which is in the divergent Odin Old Vein. After another 60 feet a second cross-cut links the veins but progress is blocked by a fall. A little further on a short climb is necessary to continue along Little Shaft Vein. Crossing a hole in the floor a second hole is found by a cross-cut to the right into what is thought to be Amy Gutter Vein (Plate 5) though the headings therein are blocked in both directions. Bad air has occasionally been encountered here. Overhead are stopes with wedged remnants of shale false floors.

A hole in the floor by the cross-cut is a ladder pitch of 35 feet in Little Shaft Vein, which leads or slopes southwards at about 1 in 6 through most of the mine, as do the other veins. This means that all the ladder pitches are really very steep slopes of 1 in 6 or 1 in 8, with the base offset from the top, as shown by "tie-lines" on the plan of the accessible workings. At the foot of the 35 ft. pitch there are two ways: to the west is a 125 ft. pitch into a series of levels and stopes still in the Little Shaft vein more or less beneath the point of descent; two further ladder pitches of 15 feet and 50 feet are near the bottom. A cross-cut at the bottom of the 50 ft. pitch leads southwards into the stopes of the more or less parallel Slicken Drift and Gin Swale veins. Near the foot of the 125 ft. pitch another cross-cut eventually leads to the Odin Old Vein. Alternatively, turning east from the foot of the 125 ft. pitch a stope in the Little Shaft Vein leads to a blind 90 ft. pitch; a cross-cut 30 feet down this pitch, however, joins the Odin Old Vein, close to the foot of a loose 60 ft. pitch from near the Cartgate Chamber.

The alternative and most used route from the foot of the 35 ft. pitch is eastwards 300 feet along a level in Little Shaft Vein, partly with a stone-stempled roof (Plate 4). A short climb down leads into Cartgate Chamber, in Odin Old Vein, where it has merged with Little Shaft Vein as in the Gorge. The Chamber lies under the south wall of the Gorge and this still has the fine stone arching of the original Cartgate roof high above, but the original floor has subsided by 40-50 feet to give a chamber of this height some 140 feet long. At the eastern end is a major collapse under the wider part of the mouth of the Gorge. It is presumably between this and yet another collapse of the Cartgate portal where John Royse sank his shaft in the 1920s. There are two openings in the Cartgate Chamber wall; in the left-hand (north) wall near the end a window leads to a short cross-cut into another westward trending working apparently in Widow's vein, doubling back under the collapse of the Cartgate two ladder pitches of 45 and 50 feet lead into stopes in Odin Old Vein. High in the right-hand (south) wall of Cartgate Chamber is an opening leading upwards into a short natural passage with water trickling down. This is believed to be Jose Hole on the old plans and it is very nearly under the lower end of Odin Gully, close to where a small stream sinks in wet weather. The Jose Hole entrance is difficult to reach without using either the old man's stemplers or maypoiling techniques.

Westwards from where one enters the Cartgate Chamber a climb down leads into a confused area near the head of loose 60 ft. pitch into lower stopes on Odin Old Vein. But crossing the head of this, a fork is reached, where workings in Little Shaft Vein trend NNEW and a short heading in Odin Old Vein can be followed WSW. Near the foot of the 60 ft. loose pitch is a further pitch of 125 ft. into an isolated stope with standing water at the bottom. There is evidence that this backs up for some 20 to 30 feet in wet weather, but in drought it falls to sough level. In the east wall a level 20 feet up, difficult of access leads into stopes trending eastwards, but in which a 20 ft. pitch stopped progress owing to lack of ladder on the single occasion it was visited.

The lower levels are in a dangerously unstable state and have only been visited a few times. Two routes are possible: one via the 125 ft. pitch and the cross-cut into Odin Old Vein, the other via the 15 and 50 ft. pitches below the 125 ft. pitch. Taking the first of these, after the cross-cut one can traverse along Odin Old Vein to the head of an 85 ft. pitch. This leads through the roof of a continuation of the Cartgate, and leaving the ladder 30 feet down, a traverse using pitons allowed access to the westward continuation of the Cartgate, potentially the base way on into the inner regions of the mine, but the floor was composed of deads which collapsed under the explorers, who only extricated themselves with difficulty and the further Cartgate remains unexplored. Continuing to the foot of the 85 ft. pitch a level, also reached via the pitch below the 125 ft. leads westwards. It soon forks into what appear to match with Slicken Drift vein and Gin Swale vein on the old plans. A pitch of 35 feet leads to a 20 ft. pitch or, by-passing this and doubling back, another 20 ft. pitch leads to the same place in water in Gin Swale vein. A level could be seen leading west under water and some hammering of the roof allowed access via a tight duck to some 250 feet of level and stopes above, with a flooded shaft in the floor and a natural above. So far as is known this section has only been explored once and the "duck" had filled up to form a sump on the return journey.

The furthest point reached is less than 500 feet west of the entrance in the Gorge, and is at a depth of about 285 feet below the entrance. The question arises as to whether any part of what is accessible can be linked with any of the soughs. The Knowlegate Sough should be about 114 feet below the Cartgate and there is a short roofed-over length of level at about the position in Little Shaft Vein below the loose 60 ft. pitch, but it is far from clear that it was part of a sough. The Trickett Sough could be expected to lie about
220 to 240 feet below the Cartgate, according to the gradient up from Knowles Engine shaft. Water can be reached via a pitch of 125 feet beneath the loose 60 ft. pitch, at the duck in Gin Swale vein, and in the flooded shaft therein. These three points are approximately at the same depth below the Cartgate, about 220 feet. They suggest that the Trickett Sough is submerged but by only a few feet and thus that drainage still leaves the mine via the sough.

If the complexity of this small section of the mine is representative of the rest, it is clear that the mid 18th century plans are only of the Cartgate's main line, and that Odin Mine is really much more complex than hitherto suspected. The veins mentioned above have only been identified tentatively with the small 18th century plans and the assignments may not be correct. The somewhat variable hade and the divergences at the variousither points make interpretation very difficult. Perhaps future exploration will reveal more clues.

Fig. 4 Plan and section of the accessible parts of Odin Mine today, surveyed by Peter Lord with the assistance of Sheffield University Speleological Society and South Yorkshire Caving Club.
THE GEOLOGY OF ODIN MINE
T.D. Ford

Remarkably little is known of the geology of Odin Mine in spite of its long history. Mawe's account (1802, pp.46-48) is probably the most complete and has the merit of being first-hand, whereas most subsequent authors e.g. Farse (1811), Glover (1833), have done little more than quote Mawe, with or without generalizations. Even Green's Geological Survey Memoir (1867, p.123) and Carruthers & Strahan's Lead ore Memoir (1923, pp.48-49) do little more than quote Mawe. The recently published Geological Survey 1 inch map (Sheet 99 - Chapel-en-le-Frith) and 1:25000 Sheet (Castleton and Edale (SK 17/18)) show only the same straight line vein as is mentioned in Mawe's early account. The Geological Survey's memoir on the Chapel-en-le-Frith district (Stevenson & Gaint, 1971, p.312) summarized earlier work but added little comment. Ford & Ineson (1971) also summarized the state of knowledge.

All these early accounts agree in that the vein is exposed only in the short limestone outcrop and that it continues in the limestone under the shales with a trend some 10° south of west, and that it shows a pronounced hade to the south. This latter feature is visible in the slope of the walls of the Odin Gorge as seen today, but the trend of the vein seen in the gorge is misleading, for if projected in the same direction westwards, the vein would pass well to the south of the Empire and Castleton shafts on the southern slopes of Mam Tor. The 1757 plan explains this discrepancy by showing that the trend of the workings is quite clearly not that of a simple rake. It is unfortunate that so little of the old workings is now accessible, but some reassessment of the geology is possible from a close examination of available surface exposures, plus the limited section accessible underground, in conjunction with the 1757 and 1769 plans.

The layout of the veins on the plans is that of an "en echelon" series of strong NNW-ENE fractures linked by oblique weaker and more irregular NW-ENE fractures. This is similar to features seen elsewhere in the Derbyshire ore field where the lateral stress of faulting was taken up in a series of shears rather than on one fault plane. One is tempted to wonder whether some direct continuations of the strong fractures were mineralized beyond the known limits of the mine, or whether the old miners missed this concept - and the possible ore!

The exposed section of the vein cuts across the most northerly tip of the Carboniferous Limestone of Derbyshire, at the northern foot of the complex of reef limestones of Treak Cliff. Recent studies by Simpson and Broadhurst (1969) have shown that much of the 'limestone' exposed around Odin Gorge is in fact a Boulder Bed, or conglomerate, at the base of the Edale Shales of Mam Tor. The Boulder Bed may be up to 40 feet thick and individual boulders may be up to 20 feet long. It is well exposed between the road and the entrance to Odin Gorge, in the topmost parts of the walls of the Gorge, in Odin Stech close to the top of Odin Gully and at Windy Knoll quarry (see map). Voids between the boulders are often filled with Blue Fluorspar (further south on Treak Cliff the main part of the Blue John deposits are in such a situation; see Ford, 1899) together with limited amounts of galena, baryte, calcite, hydrocarbons and the recently discovered glucorite (Young et al., 1968). It may be presumed that wherever the workings further into the mine extended up to the base of the shale cover, the Boulder Bed was encountered and similar mineralization was found. It is in such a situation that minerals produced by oxidation, such as siderite and gypsum, would be found where percolating waters had attacked pyrite in the shales. A larger amount than usual of the pyrite may be the reason for the name of Brass Castle in one part of the mine. Impure iron and manganese oxides would also result from chemical effects at the shale-limestone boundary.

The Boulder Bed effectively masks the amount of vertical fault displacement in Odin Gorge. At the uppermost extremity of the Gorge the shales appear to be thrown down to the north against limestones and Boulder Bed on the south, but only 8 feet or so of displacement is evident. With the slacks in the Gorge walls providing evidence of horizontal movement, it may well be that the vertical component there is little more than 8 feet, but the lateral displacement of undulations in the unconformity may mean that the vertical component is very variable.

Beneath the Boulder Bed the main part of the mine is quite clearly within solid limestones. In and around Odin Gorge the lower reef-limestone with numerous fossils, showing rather weak bedding developments. Further into the mine, and at greater depths, other limestone facies were encountered but the details are unknown except in so far as fragments of fine-grained dark limestone and black shaly limestone are common on the waste hillsides. These are suggestive of a basin facies, lying in the north of the limestone "masii". Occasional blocks with Gigantoproductus spp. suggest that some part of the basin facies is of Docynia age, representing beds which were eroded from the higher parts of Treak Cliff before the Edale Shales were deposited.

No evidence has been found that the workings ever reached Todstone and there is little short to be seen on the dumps. Slae fragments within blocks of gangue mineral, however, indicate that much of the vein had been contaminated by material falling in from the shale cover. The 1757 plan provides somewhat vague indications confirmed in other references that the vein had been worked westwards from the limestone into shale and back into limestone. This suggests that the main drive or Cartgate had passed through the undulations of an irregular shale-limestone contact. Such a contact is only to be expected in such a situation of shales resting unconformably on an eroded limestone surface. Doubtless it is the timbered parts of the main drive through the shales which have collapsed. In parts of the drive it is probable that they had one wall of limestone and one of shale.
The thickness of the cover of shale was doubtless an important feature of interest to the miners, but few figures survive. At the inner end of Odin Gorge the roof above the open workings is little more than 7 or 8 feet (as noted by Mawe) of limestone mostly boulder bed, beneath some 20 feet of shale. Projecting this level, Tinkers Shaft may have been sunk through as much as 180 feet of shale though there may have been a buried limestone knoll (see notes on small plans). The Engine Shaft was plumbed some years ago at 180 feet and it was dry at this depth. Since the collar of the Engine Shaft is over 300 feet above the top of Odin Gorge, one is tempted to think that this plumbed depth was to the shale-limestone boundary and that either there was a ledge or offset at this depth, or that collapse at the shale-limestone boundary has taken place. Projection of the shale-limestone boundary northwards from the entrance to the Blue John Caverns suggests that this depth of 180 feet is about right in the Engine Shaft. Nothing is known of the nature of the Engine, though the date of one-1757 would suggest no more than a horse gin. The depth of the workings below the shaft collar here to the Cartgate must have been about 550 feet, so one is left with a problem of how haulage of the substantial waste which once lay round the Engine Shaft, was accomplished.

The Castleton, Forest and West Shafts are all close together not far north of where the limestone disappears beneath the shale cover at Windy Knoll, where again there is a substantial Boulder Bed. There was probably about 300 feet or so of shale cover above the limestone in these three shafts, with the West Shaft having the thickest cover.

A quarter mile further west is the problematic line of shafts with shale hillocks only, running down to near Peakshill Farm, apparently on a scarp driven in 1726-9. There is no evidence that the limestone was reached here; it is possible though unlikely that workings after the 1757 and 1769 plans were drawn as far as beneath the Peakshill shafts without connection being made. It is recorded that the depth to the furthest workings was 450 feet, but the reference points concerned are not known. If the Trickett Bridge sough, at little over 600 feet O.D. was taken as far as the West Shaft it would be over 700 feet deep. Any attempt to reconstruct the geology of the mine by projecting the shale-limestone boundary from visible outcrops must also take into account the fact that this boundary was encountered in the Edale borehole at a depth of 325 feet beneath the Barbot Booth viaduct, i.e. at 500 feet O.D. This was on the anticlinal crest with the Mam Tor-Losehill syncline to the south. Since the boundary outcrops at around 1300 feet O.D. at Windy Knoll the slope of the boundary northwards is considerable, and any workings further west or north would soon run out of the limestone. The synclinal nature of the Losehill-Mam Tor-Rushup Edge ridge makes this possibility of running out of the limestone even more likely, and with faulting being present this appears to have terminated the workings.

A study of the 1757 and 1769 plans shows quite clearly that there is more than one vein in Odin Mine. Proceeding west from Knowles Shaft the main vein lies to the south of Odin Gorge but this displacement can be explained by the southerly hade (slope) of the vein from the Gorge at least to Knowlsgates Sough level, though it is not clear on which level the plan was drawn; it could be either Sough level or Cartgate. Between Tinkers and Engine Shafts there is a somewhat irregular vein with a WNW trend. Near the Engine Shaft it appears to join a vein parallel to that beneath the Gorge, i.e. bearing some 10° south of west. This lies in the approximate line of a fault, the Mam Tor fault seen in the west side of the landslip scar of Mam Tor (some displacement must also be allowed for by virtue of the hade of both fault and vein). Workings have followed this vein back under Mam Tor in an ENE direction, probably until they ran out of the limestone at the unconformity. This fault is also in line with a very minor fracture seen at the north-east foot of the scar of Mam Tor, though it is uncertain whether the displacement is only some 10 feet. A large fault may lie concealed beneath the shaft having the thickest cover.

A quarter mile further west is the problematical line of shafts with shale hillocks only, running down to near Peakshill Farm, apparently on a scarp driven in 1726-9. There is no evidence that the limestone was reached here; it is possible though unlikely that workings after the 1757 and 1769 plans were drawn as far as beneath the Peakshill shafts without connection being made. It is recorded that the depth to the furthest workings was 450 feet, but the reference points concerned are not known. If the Trickett Bridge sough, at little over 600 feet O.D. was taken as far as the West Shaft it would be over 700 feet deep. Any attempt to reconstruct the geology of the mine by projecting the shale-limestone boundary from visible outcrops must also take into account the fact that this boundary was encountered in the Edale borehole at a depth of 325 feet beneath the Barbot Booth viaduct, i.e. at 500 feet O.D. This was on the anticlinal crest with the Mam Tor-Losehill syncline to the south. Since the boundary outcrops at around 1300 feet O.D. at Windy Knoll the slope of the boundary northwards is considerable, and any workings further west or north would soon run out of the limestone. The synclinal nature of the Losehill-Mam Tor-Rushup Edge ridge makes this possibility of running out of the limestone even more likely, and with faulting being present this appears to have terminated the workings.

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Oddly two scins visible today, lying south of the mouth of Odin Gorge, are not shown on the plan, but Widowers Vein appears to be the scin branching northwest at the mouth of Odin Gorge, now containing white allophane deposits. The extent and nature of the scins within Odin therefore remains unknown. No "horses" of limestone within the vein are clearly shown on the 1757 and 1769 plans, though "rither" points occur where scins branch. A "horse" or "rider" was noted by Mawe in 1802, who commented about the miners "Working either side of a rither unthil the veins rejoined." The only accessible underground section of Odin at the back of the Gorge includes a "rither" or rider point, where Little Shaft Vein splits off to the north of Odin Old Vein. Each is little more than two feet thick, and the block of limestone between them in the Gorge is about 10 feet thick, increasing westwards. Most of the accessible parts of the mine are in these two veins, though a scin, probably Amy Gutter, branches back to the north-east, going under Odin Sitch. In the lowest levels still accessible another vein, probably Gin Swale, branches off Odin Old Vein. This part of the mine corresponds to that shown in two of the small old plans, and the vein names are suggested by comparison of those with Peter Lord's survey of accessible
...workings. Further into the mine the veins either rejoin or only one vein takes the whole mineralisation, and Mawe noted in 1802 that the vein varied up to 8 feet.

As the latest available plan of Odin Mine dates from 1789 and the mine was worked for another 100 years, it is tempting to speculate where this could have been. Apart from the obvious deepening of the workings as the Tricklett Sough was driven westwards from 1818 onwards it is possible that all or any of the veins branching on the north side of the Cartgate could have been worked progressively further beneath the shale cover as the limestone sloped down into the Mam Tor syncline. Unfortunately little evidence is available though feelings of miners should give some clues if the books were available.

Slickensides is a term applied to the grooving on opposite walls of a fault fracture by the pressure of the two rocks faces against each other. Horizontal grooving of this nature is clearly evident in the opposing walls of the Gorge, but this cannot have been produced by the walls pressing on each other when they are now up to 8 feet apart and once had a mineral fill between them. Instead they are probably evidence of the last phase of movement of the opposing walls when they ground against the sides of the mineral fill. Indeed there are still patches of mineral fill an inch or so thick adhering to the south wall, but the patches themselves have another slickensided surface on them, inclined gently westwards. Since what little of the mineral fill which can be seen is thoroughly brecciated, it is evident that there have been several phases of more or less horizontal grinding movement. But the initial opening of the fissure was almost certainly the result of tension pulling the walls apart. Thus it can be argued that the replacement of the minerals in Odin Rake was a lengthy procedure initiated by tension and continued through several phases of lateral stress, with limited net displacement of the walls as a result. If the walls of the inaccessible parts of the mine, and of the branch s, could be examined a stress pattern could probably be unravelled.

Odin Mine is one of the localities in Derbyshire where explosive slickensides has been noted. Better known in the Eyam mines, this can be explained as a length of vein in which both the minerals and the wall-rock are still in a state of physical stress, perhaps by virtue of convexities of the two walls having been faulted until they are opposed and under pressure. Driving a mine level into such an area increases the strain at the forefield until only a tickle with a drill may be needed to release the stress explosively. The miners knew about this and prodded the face with a long bar on arrival at work each day to test the possibility of a critical stage having been reached. Even so, there were occasional accidents and men were injured by flying rock fragments as described by Whitehurst (1778), and by Mawe (1802, p.48) (see also Strahan 1887).

One feature of the surroundings of Odin Mine as seen today, but which is not portrayed on the old plans, is the number of small pipe caverns. The most obvious of these is the cave now known as Odin Cave, but which appears to have been called Gank Hole (or Toume or Joume Hole) by the miners. The former name was still in use 30 years ago. Its roof is in the Boulder Bed and the cave appears to have owed its origin to solution by ground water opening out one or more voids between limestone boulders. This seems to have occurred after the deposition of blue fluor spar which was found as an insoluble residue in blocks dispersed through the ochreous clay fill, much of which still remains in the cave. Other pipe caves open either side of Odin Gully in solid limestone, with a foot-wide slot running through them parallel to Odin Rake. Fluor spar was worked here during the 1939-45 War, most of the few tons obtained being found as loose blocks in the clay fill. A shaft about 40 feet deep was sunk into another pipe cave lying between Odin Cave and Gully. This cave was so full of clay that little mining took place. At the back of Odin Gorge there are small solution cavities lined with crystals of calcite, baryte and fluor spar. Doubtless others similar to these occurred further into the mine but no record of them survives.

Mueller (1964) has attempted to make a case for a genetic relationship of the Blue John veins of Treak Cliff to Odin Rake on the basis of the distribution of hydrocarbons, which was not described in detail. Ford (1954) has shown that the relationship is far from simple. The lack of Blue John in the fill of Odin Rake, its very minor development in the voids of the boulder bed there, and the deficiency of galena and baryte in the Blue John deposits themselves make a direct feeder relationship unlikely but it is still possible to regard the fracture as having been a leader for the Blue John at an early stage in mineralization, before it was opened sufficiently for the main mineral fill to be deposited.
THE MINERALOGY OF ODIN MINE

T.D. Ford

The common lead ore of Odin Mine, as throughout Derbyshire, is galena. It is commonly seen on the waste hillocks coated with the oxidation product cerussite (PbCO₃). Blende (sphalerite, ZnS, also known as Black Jack) is less common but pieces may easily be found on dumps. Occasional specimens of its oxidation product smithsonite (ZnCO₃ — commonly called calamine) are also to be found on the hillocks.

The yield of lead ore is discussed elsewhere in this report, but no records of commercial production of blende have yet come to light. An attempt was made to sell it, but prices were too low. Glover (1833, p.202) noted that the best lead ore yielded 3 ounces of silver to the ton weight of lead, but this is almost certainly a quote from someone else as most of his account repeats Mawe's. Molybdate of lead (wulfenite) was recorded by Mawe without specific locality but it has generally been thought that he obtained his specimens from Odin Mine. No confirmation of this has been obtained in recent times, though geological surveys have noted higher than usual occurrences of Molybdenum in this area.

The gangue minerals fluor spar, baryte and calcite make up the bulk of the vein. The hillocks have been reworked several times for fluor spar, so that the remaining material is hardly a guide to the original contents of the vein. Dunham (1962, p.52) summarized the available information. The hillocks around Knowles Shaft were last partly re-worked in 1944, with the aid of a log-washer situated close to Odin Sitch just above the road. Much material was also brought here from Bradwell Moor and from the pipe veins in Odin Gully, so that the remaining hillocks are contaminated and not purely representative of Odin Mine itself.

The Upper Odin dumps (around Engine Shaft) were also re-worked in 1909, and "a considerable quantity of fluor spar and barytes was raised." (Carruthers & Pocock, 1917, p.63) and Dunham and Dines (1945) quoted an assay of the hillocks in 1942 as showing fluor spar 23.3%, silica 1.2%, calcite 21.5%, barytes 41.6%, galena 2.7%, which may well be a reasonable assessment of the gangue minerals in the middle portion of the mine though low for lead. The fluor spar content would not have been economic at that time though adequate today. It is possible that over-crushing allowed much of the fluoride to be lost in the fine tailings where it can still be found today. John Royse made a vain attempt to reopen Odin Mine outside the gorge between the Wars but he only sank into the Cargate between two falls. The hillocks at Engine Shaft were largely removed for ballast during road-maintenance operations in the 1940s and 1950s. The hillocks around the Cartleton and Forest Shafts have similarly been removed and only a limited amount of mainly baryte and calcite survives, and this has recently been "landscaped" as a picnic site.

Such evidence as there is thus suggests that the proportion of gangue minerals changes along the vein, with fluor spar dominant at the east end, calcite as baryte increases in the middle range and calcite important in the west. Apart from the little known and short-lived attempt in 1909-9, no underground mining for fluor spar or barytes has taken place and there is little doubt that large quantities of pack of fluor spar and baryte still remains in the mine, plus unknown quantities in riders, replacements and pipe veins (see Ford & Ineson 1971).

At present there is no evidence that Blue John fluor spar was ever mined in Odin Mine, though it is common in the pipe veins of Troop Cliff to the south (Ford 1886 & 1899). Dark blue fluor spar occurs at the entrance to Odin Gorge, and was found in the workings in Odin Gully, but none show the typical bending of Blue John. Some of the 'pipes' noted on the 1757 plan may have contained Blue John, but the date of the plan makes it more likely that Blue John came into general use in the 1760s and 1770s. One rock is known as Blue Cap vein and may have contained blue fluor spar close to the shale cover.

A number of other less common minerals have been found at Odin. They include sulphur and gypsum (Mawe, 1802, 6.6-7) as oxidation products from pyrite in the shale. Selenium, CaSO₄·2H₂O needles are common on shale in the roof in the entrance series of the accessible workings. Pyrite and marcasite nodules occur in the shale and presumably also occurred in shale-filled voids in the Boulder Bed. Pyritic inclusions also occur in calcite and fluor spar.

There are frequent references to bitumen in old literature and with the Windy Knoll hydrocarbon deposits to close, this is not surprising. Hydrocarbons or bitumens, subsequently known as Elaterite, were first recorded at "an old mine about two miles west of Castleton" believed to be Odin Mine as early as 1773 by Martin Lister, one of the founders of the Royal Society. Hatchett described it as elastic bitumen in 1787, but in the mid 19th century the much larger deposits at Windy Knoll were uncovered by quarrying and subsequent studies have mostly been on those though doubtless they are applicable to Odin Mine as well. Mueller (1954) noted the varied character of some 30 different hydrocarbons around Windy Knoll and Odin, and gave mineral names of uncertain validity to some. Perring (1968) distinguished certain groups of both branched and unbranched long-chain members of the paraffins. Heidberg and Krafft-Graf (1969) studied a sample from Odin Mine (without giving details of its provenance) and claimed to have recognized fossil poly~cene in its constitution (though one cannot help wondering about contamination from their packing material!). Hydrocarbons are widespread in Derbyshire particularly at the shale-limestone contact, and it is a pity that the Odin occurrences are no longer accessible for scientific study. Samples are present on the hillocks but they are not common.

Iron oxides such as goethite are not uncommon on the dumps, and presumably result from infiltration of iron-rich waters from Mam Tor like those now draining from a culvert Odin Sitch above the Gorge. Hall (1868, p.55) recorded vivianite [Fe₅(PO₄)₂·6H₂O] at Odin Mine. Manganese dioxide dendrites are not uncommon on joints.

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Quartz rock similar to that at Pindale has been found on the hillocks at Odin and authigenic quartz crystals have been found in the small quarry adjacent to the R.A.C. Box at the Chapel and Buxton road junction, close to Windy Knoll. But quartz crystals have not been seen in any undoubted Odin vein material.

A few traces of copper carbonate stains are to be seen on the dump material (though these may easily be confused with the cently discovered glauconite) but there is no evidence of copper ores as both Pilkington (1789, pp.142 & 189) and Farey (1811, p.353) noted.

Other minerals found at Odin Mine include glauconite found in stylolites and voids between boulders in the Boulder Bed by Young et al. (1968) and uraniferous collophane apparently in the same environment (Peacock & Taylor, 1968). The white clay mineral allophane forms stalactitic deposits in the scree branching northwest from Odin Gorge (Wilkinson, 1950).

Some varieties of the more common minerals deserve a mention. Fluorspar is commonly dark blue in the pipe-veins adjacent to Odin Gorge, but most of the fluorspar found in the accessible workings is white or very pale blue with a sugary texture. Transparent clear or amber fluorspar is not uncommon the dumps, and it sometimes shows zones of gaseous or pyritic inclusions. Baryte occurs only in the common cawd variety, but calcite may vary in its nature. Much of the calcite on the dump is turbid white, but occasional specimens may be found which are clear but which contain zones of pyritic inclusions. Crystals of this variety have been found in the solution cavities at the back of the Gorge where broad scalenohedra are outlined by inclusion zones. The interiors of such zoned crystals are commonly quite clear and can be broken down to yield small rhombs of "Iceland Spar".

Since so little of the original vein is accessible, it is not possible to work out any paragenetic sequence of deposition. Limited faces of vein are visible in the accessible workings but they show little more than alternating crusts of fluorite, and baryte with lines of galena blebs generally close to the walls. Blocks on the dumps are commonly brecciated and a great variety of associations can be made out - fluorspar cementing brecciated baryte; baryte encrusting fluorspar; calcite cemented by and encrusting fluorspar, etc.
GEOCHEMICAL PROSPECTING

by T.D. Ford

A number of trials of techniques of geochemical prospecting have been carried out around Odin Mine in recent years by Leicestershire University graduate students. As these throw a little light on possible extensions of the mine they are summarized here.

The principle on which the techniques work is that the soil if undisturbed and uncontaminated, reflects the chemistry of underlying rocks. Webb (1959, pp.422-3) showed that a continuation of Gregory vein at Ashover could be detected though the limestone was covered by 700 feet of shale. This was thought to be possible at Odin Mine though the more varied geology, the presence of landslip material and contamination from old hillocks limited the sites where undisturbed soil samples could be collected.

Traverses across the known line of the mine or of projected extensions have been made by augging the soil to a depth of 18 inches at intervals of 5, 10 or 20 feet. Stream sediment samples have also been collected in traverses along the brooks north of Dunscar Farm.

Generally the soil samples have shown an increase of five to ten times the background value of lead, zinc, and copper over the expected positions of veins. Tests for fluorine in the soils using the specific ion electrode method have usually confirmed the results shown by chemical analysis for the metals. The methods were tested by traverses across the line of Nether End vein, east of the Engine Shaft, down the southern flank of Mam Tor, where the ground was disturbed only by the two Blue Hillocks of shale. These were avoided in the traverses, which all showed marked increases in the values for lead, zinc, copper and fluorine. (Fig. 5).

Two traverses were taken down the south slope of Rushup Edge, west of the Edale road turning and thus west of the known limits of the mine. Both showed marked increases just below the road. Close to the road junction there were two peaks about 50 yards apart, and some 200 yards further west these peaks were nearly 100 yards apart, suggesting that the vein splits westwards. Unfortunately it was not possible to sample near the line of the Peakshill “sough” or further west.

Sediment samples taken in the streams below the toe of the landslip, north of Dunscar Farm, also showed marked increases in lead values at the projected position of Odin vein but some subsidiary peaks to the south may suggest branch veins there; these were less obvious in the soil samples though the main vein was confirmed. Further east, near Hollowford Centre, a second peak appeared to the north of the first and suggests a vein branching to the northeast out of Odin Vein. From Dunscar Farm eastwards the top of the limestone is probably around 500 feet below the surface, and these anomalies have thus been detected through some 500 feet of shale. One other traverse is of interest in showing the presence of a probable vein some 60 yards north of Odin Gorge, apparently on the projected line of Amy Gutter vein; the ground here was very disturbed and possibly contaminated.

The traverses on the south flank of Mam Tor were sampled again at a later date and analysed for all the possible trace metals which might occur, e.g. Ba, Be, Bi, Cu, Cd, Co, Ti, Ni, Mn, Mo, Cr, Ga, Zr, Ge, Sr, V, Li, etc. to see whether any of these could be used as “pathfinders” to the major metallic elements lead and zinc. Only Mn, Mo and Co showed much sign of value in this way, though as they were not always found to be useful over other veins in similar geological circumstances elsewhere in Derbyshire, they cannot be regarded as reliable pathfinders. The conclusion is that it is far more significant to analyse the soil for lead and zinc when looking for lead veins! Excess Cu and Zn serve to distinguish contaminated ground from natural geochemical anomalies.

A by-product of this last study and others like it is that it is now known that the presence of appreciable traces of molybdenum in the soil affects the proper uptake of copper by vegetation, even when enough copper is available. The copper shortage in the vegetation causes a deficiency disease in animals grazing on the affected areas, which can be countered by the provision of trace elements such as copper in the affected pastures. Some areas around Castleton and Edale are known to be affected, though parts of Staffordshire suffer rather more.

Further soil sampling recently has added to the detailed knowledge of the distribution of elements in soils overlying limestone and sandstone as well as shale. Attempts to analyse for fluorine have shown broad peaks over vein areas, but they are less definitive than the lead peaks on the traverses.

These geochemical techniques have shown that the approximate position of the vein can be detected even when covered with several hundred feet of shale and have thus extended the known length of the Odin vein(s) by more than half a mile.

Geophysical methods have been little tried around Odin but a series of traverses using the Self-Potential method in the area north of Castleton village showed a pronounced anomaly along the expected line of the vein, thereby supporting the geochemical methods.
Fig. 5. Outline geological map of the area around Odin Mine with geochemical sampling traverses indicated. The thick bars signify high values for lead, zinc and copper.
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(24) B.S.A. Odin Sough, Castleton. Section of proposed sough, 15th May, 1772.
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Abbreviations—
  B.S.A. Maps, plans and manuscripts formerly housed in the British Speleological Association headquarters at Settle, Yorkshire, and now in the Derbyshire Record Office, Matlock.
  O.D. Old Deeds, Local History Dept., Sheffield City Libraries.
APPENDIX 1

CRITICAL HEIGHTS AND DEPTHS IN ODIN MINE

(from east to west)

<table>
<thead>
<tr>
<th>Location</th>
<th>Height/Depth (Explanation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odin Sough tail (Trickett Bridge)</td>
<td>600 ft O.D. (on contour)</td>
</tr>
<tr>
<td>Knowlegates Sough tail</td>
<td>about 750 ft O.D.</td>
</tr>
<tr>
<td>Road by gate down to crusher</td>
<td>883 ft (bench mark)</td>
</tr>
<tr>
<td>Cartgate (by crusher)</td>
<td>approx. 870 ft</td>
</tr>
<tr>
<td>Knowles Engine shaft</td>
<td>870 ft</td>
</tr>
<tr>
<td>Old Sough in Knowles Engine Shaft</td>
<td>114 ft down, i.e. about 756 ft O.D.</td>
</tr>
<tr>
<td>Tricket Sough</td>
<td>240 ft down, i.e. 630 ft O.D. (allowing 30 ft rise from tail)</td>
</tr>
<tr>
<td>Tinkers Shaft top</td>
<td>approx. 1160 ft (close to 1184 ft bench mark)</td>
</tr>
<tr>
<td>Top of limestone in gorge</td>
<td>approx 1000 ft</td>
</tr>
<tr>
<td>Engine shaft top</td>
<td>approx 1420 ft</td>
</tr>
<tr>
<td>depth to Cartgate 1420 - 870 = 550 ft</td>
<td></td>
</tr>
<tr>
<td>depth to Knowlegates sough 1420 - 756 = 664 ft (no allowance for rise from tail)</td>
<td></td>
</tr>
<tr>
<td>depth to Tricket Sough 1420 - 630 = 790 ft (no allowance for rise)</td>
<td></td>
</tr>
<tr>
<td>Top of limestone at road junction by RAC box</td>
<td>1272 ft O.D. (bench mark)</td>
</tr>
<tr>
<td>estimated depth of shale in Engine shaft is 1420 - 1272 = 148 ft plus allowance for northerly slope of shale/limestone surface, say 52 ft, so depth to limestone probably about 200 ft.</td>
<td></td>
</tr>
<tr>
<td>Probable tail of Engine Sough in gully 100 yards NE of RAC box about 1250 ft</td>
<td></td>
</tr>
<tr>
<td>Mam Tor Swallet entrance 1236 ft; bottom 1200 ft</td>
<td></td>
</tr>
<tr>
<td>Gate to Windy Knoll on Chapel road</td>
<td>1353 ft (bench mark)</td>
</tr>
<tr>
<td>Forest and Castleton shafts</td>
<td>approx. 1400 ft O.D.</td>
</tr>
<tr>
<td>Edale road corner</td>
<td>1373 ft O.D. (bench mark)</td>
</tr>
<tr>
<td>West shaft top</td>
<td>1380 ft</td>
</tr>
<tr>
<td>depth to Knowlegates Sough 1380 - 756 + 33 = 657 ft (33 feet added for step-up in How's profile)</td>
<td></td>
</tr>
<tr>
<td>depth to Tricket Sough 1380 - 630 = 750 ft (no allowance for rise)</td>
<td></td>
</tr>
<tr>
<td>Limestone surface at Windy Knoll</td>
<td>1350 ft</td>
</tr>
<tr>
<td>estimated depth of shale in Forest and Castleton shafts is 1400 - 1350 = 50 ft plus allowance for dip of limestone surface northwards from Windy Knoll, say 300 ft, so depth of shale will be about 350 ft.</td>
<td></td>
</tr>
<tr>
<td>Lowest Shaft hillock of Peakhill Group</td>
<td>1220 ft</td>
</tr>
<tr>
<td>Lower hillock by Upper Holt Farm</td>
<td>1020 ft</td>
</tr>
<tr>
<td>Limestone surface on north flank of Peakhill</td>
<td>1250 ft</td>
</tr>
<tr>
<td>estimated slope of shale-limestone surface from Peakhill to projected line of vein west of West Shaft could give thickness of say 400 ft, and this would place top of limestone at 850 ft.</td>
<td></td>
</tr>
</tbody>
</table>

Top of limestone in Edale borehole (just north of Barber Booth Viaduct) 500 ft O.D. These are "shales and thin limestones", massive limestone appear 160 ft lower at 332 ft O.D. This borehole was on the highest known point of limestone under Edale.
APPENDIX 2

CHECK LIST OF SOUGHS AND LEVELS AT ODIN MINE

Odin Grooves Sough. (Torre's Sough, Eyre's Sough.)
(see also Old Man's Level).
Commenced by Eyre and partners before July 1663, and afterwards continued in joint partnership with Torre as far as the Gank Mouth. Perhaps its tail was at the toe of the Mam Tor landslip north of Knowlegates Farm. It reached the Gank Mouth before June 1669. The Old Man's Level shown on a section dated 1785 is possibly this old sough.

Knowlegates Sough. (= Present Level of 1772)
Commenced in 1711 and reached the Sough foremost shaft May 1712 having cost just over £40, and a little under another £20 for air shafts and haulage shafts. It was then left until 1753 at which time it was continued along Odin Vein. It had reached Peak Forest Liberty by about 1800. The tail was in Odin Sitch close to Knowlegates Farm. From here it was driven through shale to a little beyond, (west of), the Knowles or Sough Engine Shaft. It was referred to as the 'Present Level' on the 1772 section and also on one of about 1815-16 Odin Sough. (Trickett Bridge Sough).

Originally proposed to be driven in 1772, though it was not started until 1816. The actual course of the sough is different from the original line as envisaged in 1772. It reached Odin Vein late in 1821 after a drive of 1582 yards, all in shale. Continuing in the vein, it reached Peak Forest Liberty in 1850.

Peakshill Sough.
Driven during 1726-29, partially as a sough, but no doubt there was a more important intention of locating the western continuation of Odin Vein beneath the shales of Rushup Edge. Little is known of its history or extent.

Black Sough. (Edale Sough).
This title was freed as a new vein in 1824 in Edale Liberty. The shale sinking dirt mounds, seen from the Mam Nick-Edale road are probably associated with this level, but not proved. Again perhaps it was in search of the western extension of Odin Vein, but few details are known.

Engine Sough.
Mentioned only briefly on a mine plan drawn in 1757, it was almost certainly a shale gate level from the Odin gully driven to the Mam Engine workings. No dates are known, but it perhaps dates from the early years of the eighteenth century. A SHALE DRIFT or LEVEL mentioned in connection with the Founder Miers and Lord's mer in Peak Forest Liberty could be an extension of this sough along the vein. It is possible that the so-called Engine Sough was originally driven as an exploratory gate seeking signs of mineral in the shale along the range of the vein. This would be west of the Forefield of the Levy in 1708 and prior to the Mam Engine Shaft being sunk, indeed it may have been sunk on such a mineral showing.

The Levy.
The evidence is ambiguous and there may have been one or two 'levys' at the mine. One was driving during the period 1704 to 1706, and by the latter date it was over 500 yards west of the Gank Mouth. One was mined in it.

James Hall's plan, drawn in the early 1750s, notes the 'Levy' in the western part of the mine in Peak Forest Liberty. A part of it at least was in limestone, but the shale dipped down as it was driven westwards, so that it was abandoned with its forefront in shale.

If there were two 'levys' the first must have been either the Cartgate driven in the early 18th century from the vicinity of Gank Mouth, the most logical site for one, or it was a higher exploratory and haulage level driven mostly in shale from the Odin diversion channel. This latter seems unlikely, and it may be that the mid to late 18th century Cartgate (see below) was simply a rehabilitation of the earlier Levy. In this latter case the Levy and the Cartgate are effectively the same.

Cartgate.
One of the most famous features of the mine, it was the main haulage gate in the mine and a part of it is still accessible for a short distance. The original entrance at Gank Mouth was depicted in an early print. Several Derbyshire topographical guides mention the level. It seems likely that the main line of all three plans (1752, 1757 and 1769) was drawn along where the Cartgate lay, though driving it did not start until 1755 and continued up to 1800. The only explanation which can be offered for this apparent anomaly is that the Cartgate was a linking-up and reconditioning of earlier haulage ways and the Levy noted above.

Engine Cart Drift
Shown on Robert How's plan of 1757, it was a short haulage way only a little over 200 yards long at that time. It was driven from the Mam Engine Shaft westwardly along the vein prior to the driving of the main Cartgate, though its depth beneath the surface is not known.

Old Man's Level.
Shown on one mine section in 1765. There is some evidence to suggest that this level may in fact be the same as the sough Eyre and Torre drove in the 1660s. It cannot be the same as the 'Levy', because this was over 500 yards west of the Gank Mouth in 1706, whilst the 1765 section shows that at that time the forefront of the Old Man's Level some 400 yards west of the Gank Mouth.
Peakshill and Black Soughs.

As recorded elsewhere in this book, there is a line of mounds of sinking dirt, very largely shale, about a quarter of a mile west of the known limits of Odin Mine, trending down the slope below Rushup Edge towards Peakshill Farm. There are records of a sough having been driven hereabouts in 1726-1729. It was almost certainly a shale-gate, that is a sough driven through relatively soft shales to reach the line of a vein, though the top of the limestone with the vein itself may have been considerably lower. It would then serve as a pump way, reducing the height to which water had to be lifted, and it could also serve as an exploration level to search for other veins. It may be that there was geological reasoning for the miners could have argued that, as there were two buried knolls of limestone north of the Gorge and north of Windy Knoll, so there might be another buried knoll north of the next northward projection of the limestone-shale boundary. Their reasoning may well have been correct but we have no evidence that it was ever tested to a conclusion. The logical tail to any shale-gates or sough is on the west side of Peakshill knoll, at about 1200 feet O.D., though no tail can be located in the rough ground there. The height of 1200 feet O.D. raises a problem, for the main workings of the mine are much lower (the Cartgate is at 870 feet O.D.) so that one would have thought that drainage would have gone eastwards along the workings anyway.

On the Edale side of Rushup Edge, roughly in line with the Peakshill mounds, there are three mounds of sinking dirt, all shale and sandstone, near Upper Holt Farm; one mound is just above the road and the others below, and Nellie Kirkham has noted what may be a possible tail to the Holt Level "a few hundred feet below Lower Holt Farm". The alignment with Peakshill has suggested to some investigators that there may have been a plan to drive a level right through Rushup Edge to link Peakshill and Holt levels, but there is no evidence of any such plan. The mounds at Upper Holt Farm are at about 1000 feet O.D., some 200 feet below the probable Peakshill Sough tail, and Nellie Kirkham's possible tail is below 900 feet O.D. It is possible to speculate that if the two levels were connected by an internal shaft one could divert the Giants Hole stream through and operate a water-pressure engine, but again there is no evidence whatever of such an intention.

Historical evidence, in fact, indicates that the Holt sinkings were a century later than those at Peakshill, for the Castleton Barmaster's Book for 1814-1838 (in the Barmaster Collection) recorded:

"26th. August, 1824, Robert How Ashton, Jeremy Royse and partners gave one dish of ore to free a Founder Meer in a new vein lying and being in the Liberty of Edale and Parish of Castleton and called Black Sough."

While this does not prove that the Holt level was the Black Sough, there is no doubt that Robert How Ashton, being deeply concerned with Odin, would realize the implications of continuing the level in a southerly direction to intersect Odin Vein or any branch from it. There is no evidence of any vein at Holt Farm.
### APPENDIX 3

ORE MEASURED AT ODIN MINE (to nearest load)

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
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<tr>
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</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1136</td>
</tr>
</tbody>
</table>

Castleton Liberty

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1710</td>
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<tr>
<td>1</td>
<td>1170</td>
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<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td>1225</td>
</tr>
<tr>
<td>4</td>
<td></td>
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<tr>
<td>5</td>
<td>1217</td>
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<tr>
<td>6</td>
<td>1225</td>
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<tr>
<td>7</td>
<td>1193</td>
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<td>8</td>
<td>998</td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
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</table>

No records of production.

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1720</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>736</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>912</td>
</tr>
<tr>
<td>4</td>
<td>1469</td>
</tr>
<tr>
<td>5</td>
<td>1253</td>
</tr>
<tr>
<td>6</td>
<td>965</td>
</tr>
<tr>
<td>7</td>
<td>3843</td>
</tr>
<tr>
<td>8</td>
<td>4711</td>
</tr>
<tr>
<td>9</td>
<td>3417</td>
</tr>
</tbody>
</table>

Peak Forest Lord's Meer began to be worked.

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>1730</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2004</td>
</tr>
<tr>
<td>2</td>
<td>1022</td>
</tr>
<tr>
<td>3</td>
<td>1872</td>
</tr>
<tr>
<td>4</td>
<td>1602</td>
</tr>
<tr>
<td>5</td>
<td>2065</td>
</tr>
<tr>
<td>6</td>
<td>2798</td>
</tr>
<tr>
<td>7</td>
<td>1920</td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>712</td>
</tr>
</tbody>
</table>

Lord's Meer ceased work.

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1750</td>
<td>114</td>
</tr>
<tr>
<td>1</td>
<td>473</td>
</tr>
<tr>
<td>2</td>
<td>421</td>
</tr>
<tr>
<td>3</td>
<td>495</td>
</tr>
<tr>
<td>4</td>
<td>501</td>
</tr>
<tr>
<td>5</td>
<td>660</td>
</tr>
<tr>
<td>6</td>
<td>714</td>
</tr>
<tr>
<td>7</td>
<td>1429</td>
</tr>
<tr>
<td>8</td>
<td>1349</td>
</tr>
<tr>
<td>9</td>
<td>1147</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1760</td>
<td>843</td>
</tr>
<tr>
<td>1</td>
<td>975</td>
</tr>
<tr>
<td>2</td>
<td>1069</td>
</tr>
<tr>
<td>3</td>
<td>1210</td>
</tr>
<tr>
<td>4</td>
<td>1078</td>
</tr>
<tr>
<td>5</td>
<td>997</td>
</tr>
<tr>
<td>6</td>
<td>812</td>
</tr>
<tr>
<td>7</td>
<td>651</td>
</tr>
<tr>
<td>8</td>
<td>652</td>
</tr>
<tr>
<td>9</td>
<td>785</td>
</tr>
</tbody>
</table>

No records of ore production from 1737 to 1749 except 1739.

Castleton Liberty only.
1770  1122  Castleton Liberty
       1  1312  
       2  1687  
       3  1496  
       4  1996  
       5  1294  
       6  1210  Includes 2 loads mined in Peak Forest Liberty.
       7  1131  Castleton Liberty
       8  648  
       9  816  

1780  1  2  3  57  Peak Forest Liberty only.  No other accounts available
       4  
       5  
       6  
       7  
       8  
       9  

1790  49  Peak Forest Liberty only
       1  362  Peak Forest Liberty only
       2  340  Peak Forest Liberty only
       3  1190  Peak Forest Liberty only
       4  1792  Peak Forest Liberty only
       5  1097  Peak Forest Liberty only
       6  1977  Castleton and Peak Forest Liberties
       7  1868  Castleton and Peak Forest Liberties
       8  2473  
       9  

1800  1292  
       1  974  
       2  910  
       3  448  
       4  381  
       5  28  Peak Forest only
       6  426  Peak Forest and Castleton Liberties
       7  322  Castleton Liberty only. No ore mined in Peak Forest
       8  276  
       9  248  Castleton Liberty only. No ore mined in Peak Forest

1810  276  
       1  147  
       2  116  
       3  118  
       4  216  
       5  147  
       6  106  Castleton Liberty only. No ore mined in Peak Forest
       7  25  Peak Forest only. No account for Castleton
       8  60  Peak Forest only. No account for Castleton
       9  16  Peak Forest only. No account for Castleton

1820  460  Castleton and Peak Forest
       1  410  Castleton and Peak Forest. (Only 5 loads in Peak Forest)
       2  670  Castleton and Peak Forest. (Only 7 loads in Peak Forest)
       3  904  Castleton Liberty. No ore mined in Peak Forest Liberty between 1822 and 1849
       4  691  
       5  296  
       6  581  
       7  620  
       8  654  
       9  844  

1830  766  Castleton Liberty only
       1  1864  
       2  1166  
       3  436  
       4  96  
       5  26  
       6  7  Castleton Liberty only.
<table>
<thead>
<tr>
<th>Year</th>
<th>Ore Recorded</th>
</tr>
</thead>
<tbody>
<tr>
<td>1837</td>
<td>70 Castleton Liberty only.</td>
</tr>
<tr>
<td>8</td>
<td>437</td>
</tr>
<tr>
<td>9</td>
<td>742</td>
</tr>
<tr>
<td>1840</td>
<td>616 (4 loads 2 dishes in Knowlegates or Odin Sitch)</td>
</tr>
<tr>
<td>1</td>
<td>447</td>
</tr>
<tr>
<td>2</td>
<td>466</td>
</tr>
<tr>
<td>3</td>
<td>626 Castleton Liberty only</td>
</tr>
<tr>
<td>4</td>
<td>317</td>
</tr>
<tr>
<td>5</td>
<td>314</td>
</tr>
<tr>
<td>6</td>
<td>277 Castleton Liberty only</td>
</tr>
<tr>
<td>7</td>
<td>319</td>
</tr>
<tr>
<td>8</td>
<td>319 Castleton Liberty only</td>
</tr>
<tr>
<td>9</td>
<td>4 Peak Forest. No ore recorded in Castleton</td>
</tr>
<tr>
<td>1850</td>
<td>26 Peak Forest. No ore recorded in Castleton</td>
</tr>
<tr>
<td>1</td>
<td>— No ore recorded</td>
</tr>
<tr>
<td>2</td>
<td>517 Castleton Liberty</td>
</tr>
<tr>
<td>3</td>
<td>313 Castleton Liberty</td>
</tr>
<tr>
<td>4</td>
<td>281</td>
</tr>
<tr>
<td>5</td>
<td>262 Castleton Liberty</td>
</tr>
<tr>
<td>6</td>
<td>265</td>
</tr>
<tr>
<td>7</td>
<td>512 Includes 30 loads in Peak Forest</td>
</tr>
<tr>
<td>8</td>
<td>568 Includes 27 loads in Peak Forest</td>
</tr>
<tr>
<td>9</td>
<td>616 Castleton only</td>
</tr>
</tbody>
</table>

The above ore records have been compiled from various accounts in the Barmasters Collection, the Devonshire Collection, the Rylands library, the Brooke-Taylor manuscripts, the Bagshawe and Oakes papers. They vary somewhat in detail and it is not known which is the correct set of figures but they are a reasonable general guide. In addition to the above small amounts of ore are recorded as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Ore Recorded</th>
</tr>
</thead>
<tbody>
<tr>
<td>1842</td>
<td>Trickett Brook: 1 load 3 dishes</td>
</tr>
<tr>
<td>3</td>
<td>2 3</td>
</tr>
<tr>
<td>4</td>
<td>6 6</td>
</tr>
<tr>
<td>5</td>
<td>2 7</td>
</tr>
<tr>
<td>7</td>
<td>2 3</td>
</tr>
</tbody>
</table>

It is not known for certain where the ore recorded from Knowlegates or Odin Sitch, from Trickett Brook and from Mam Sitch Pool was actually obtained, but it can be speculated that these were from reworking of washings in the respective stream. That from Knowlegates could have washed down from the hillocks; that in Trickett Brook could have washed right through the sough, but Mam Sitch Pool remains a mystery.

The ore at Odin recorded from 1855 to 1865 is as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Ore Recorded</th>
</tr>
</thead>
<tbody>
<tr>
<td>1855</td>
<td>ORE: 2 loads 3 dishes</td>
</tr>
<tr>
<td>6</td>
<td>5 0</td>
</tr>
<tr>
<td>723</td>
<td>12 1</td>
</tr>
<tr>
<td>9</td>
<td>10 1</td>
</tr>
<tr>
<td>1860</td>
<td>8 8</td>
</tr>
<tr>
<td>1</td>
<td>2 3</td>
</tr>
<tr>
<td>2</td>
<td>0 3</td>
</tr>
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<td>3</td>
<td>0 0</td>
</tr>
<tr>
<td>4</td>
<td>0 0</td>
</tr>
<tr>
<td>5</td>
<td>0 1</td>
</tr>
</tbody>
</table>

1 dish = approximately 55 lbs 1 load = approximately 585 lbs 3% loads = approximately 1 ton.
NOTES ON THE OLD PLANS

APPENDIX 4

a) Introduction

A number of old plans have been traced and all are now in the Derbyshire Record Office, some having been transferred there from the British Speleological Association collections. Three plans and three vertical profiles of the whole range of the mine are known, and there are four small plans of parts of the mine only: these are all mid 18th century in date, mostly drawn by Robert How the son. Regrettably no plans of the 19th century workings are known. Two sections of Odin Sough (Trickett Sough) are known and they differ considerably. That dated 1772 was a proposal for the sough along a different route from that actually taken and shown on the 1815-16 version.

Several modern transcriptions and copies of these plans were seen long before the originals became available for inspection. It soon became evident that there were discrepancies between the copies and this led to problems of interpretation which were only solved when the originals came to light. The moral of this is that in any investigation of an old mining story, don't trust other people's copies or notes on the evidence, but go to the originals yourself.

The main plans and sections are reproduced on the folding sheet in the pocket inside the back cover.

b) James Hall’s plan of about 1752

Drawn on two sheets of parchment sewn together, this plan (now in the Derbyshire Record Office, B.S.A. collection) carries no date and the reference to James Hall has been added on the back at a later date. Two factors point to a date of 1752: firstly, the Crooked Kniel vein is shown only as far as the First Taker meer and an entry in the Barmaster’s book notes a Second Taker being taken in April 1752, presumably not long after the First, and the Sough Engine Vein was discovered in November 1751. Also the North Point on the plan is clearly neither true north nor magnetic north of today. North is shown about 18° west of present true north and reference to John Robey’s chart of secular variation (Bull. PDMHS vol. 2, part 6, 1965) shows that at that date, magnetic north was at about that position. The plan is drawn, as stated thereon, on a scale of 16 yards to one inch, but bears a bar scale in units which appear to be 12 yards long: the reason for this is not known. To make allowance for photographic reduction in this publication a correct bar scale has been transferred there from the British Speleological Association collections. There are also a note that those parts of the vein coloured blue were rich.

The plan as a whole is not greatly different from Robert How’s plan of 1757. It shows the whole range from the Sough Engine shaft to the Foremost Shaft in the Forest Liberty (= the West Shaft). The Engine, Castleton and Forest Shafts are shown, but not Tinkers Shaft. Unlike the two later plans a South Foremost Shaft is shown, 40 yards west of the Sough Engine shaft. The supposed range eastwardly of the Sough vein and of Odin Old Vein are shown, with some 20 yards of workings in the former only. Knowledge of Sough is shown, with three shafts and ‘well shaft not open’. There is a peculiar ‘dog-leg’ bend in the sough near the shafts. Meers are shown both in the Sough Title and in the main mine numbered west from Gank Mouth.

Figures which appear at first glance to be bearings are given beside each straight stretch, but the angles between them do not tally with the change in alignment of the vein: the meaning of these figures is not known. A tabular explanation is given, and it does not differ much from that on Robert How’s plan. The main line is clearly that of the Cartgate on later plans but on this the word Cartgate is not used and it is referred as ‘The Levy’ (= level). The explanation notes that they lost the vein and then found it again on driving through to the Nether End Vein. They lost it again west of the West Shaft. This confirms the opinion expressed in the geological notes that the line of workings penetrates two north-trending ridges of limestone with a shale hollow between. One ridge trends north from the Gorge, while the other seems to trend north from approximately the road junction east of Windy Knoll. The “Shiver Drift” north of Windy Knoll suggests the presence of shale there as well.

The explanation refers a number of times to “North slicking” or to a “sun slicking”. The writing is not clear and it may be “sticking” instead of “slicking”. A sticking is a term for a strong joint or fracture in the limestone used elsewhere in Derbyshire but one cannot help wondering if “slicking” is an old term for what we now think of as a slickensided fault plane, which could well be more or less the same thing as a strong joint. So whichever of slicking or sticking is correct, the meaning may be of fractures leaving the vein, with little or no mineralization, to either the north or the south side, not necessarily due north or due south. In general miners would follow these for a time in the hope that they would “bally out” and contain ore. Also in cutting the existence of such fractures would ease the labour of driving. On the other hand some might be tight and under stress so that they would “explode” and such explosive slickensides are recorded from Odin Mine by Whitehurst (1778) and Mawe (1802).

In addition to the explanation the plan carries a table of the “depths of each meer worked under the levy”, i.e. the depths to which workings had been taken below the level. The first 14 meers have no figure given, many of the others have zero entered, but the 21st and 22nd have 14 fathoms by them. These are in Nether End vein, three meers east of the Engine Shaft, which was apparently a rich part of the vein. There is also a note that those parts of the vein coloured blue were rich. The blue section is from the Nether End vein all the way to the West Shaft except for one meer at the Castleton Shaft. In the five taker meers in the Forest Liberty, at the extreme western and of the mine, the depth chart shows that it was worked 10 to 14 fathoms below the Levy.
The branch vein which appears on all the plans called Crooked Knerl, seems to have various spellings and on James Hall's plan is "Crooked Knerl" twice over. This is probably a slip of the draftsman's pen at the time. Knerl is still an unusual name and it is interesting to speculate what it or its crookedness meant. Similarly one can speculate on the meaning of "Amy Gutter", "Slatter Buttock" and of "Swine Hole", but we have no evidence.

c) Robert How's plan of 1757

The original of the plan reproduced herein is over 6 feet long, on a scale of 2 inches to 1 yard or 32 yards. The notes and lettering given here are exactly as on the original, except that the dialling figures along each meer have been omitted for clarity. The north is obliquely towards the bottom of the original plan, and it appears to be the contemporary magnetic north some 19½° west of true north, when the shafts are related to the surface. The block-lettering appears twice, once in each of Castleton and Forest Liberties.

Although the workings shown on Robert How's plan are over a mile long, the only points which can be related to the surface features seen today are the Mam Engine Shaft, Castleton, Forest and West Shafts. This plan has a peculiar cone symbol at the founder in the Sough Title and at the Mam Engine Shaft: it presumably signifies some sort of winding-engine and there is a note somewhat to the east "the Engine in the Knowles". Working eastwards from the Sough Engine Shaft, the sough tail comes out at a former built in the stream bank by Knowlesgate Farmyard, and two cobbled air-shafts (shown by an "off-set" symbol) can be found in the rough ground between the farm and the remaining tips. A third is less certainly located. Taking levels into account Knowlesgate sough intersected the shaft 144 feet down. (The later Trickett's Sough reached Knowles Shaft at 240 feet). The "day-leg" of Hall's 1752 plan has been cut through.

It is on turning westwards from the Sough Engine Shaft that some difficulties arise in referring features from the plan to the surface. The 6 inches : 1 mile and 25 inches : 1 mile Ordnance maps show Odin Gorge by means of a rock-drawing symbol, but it is shown extending much nearer the road than at present, as far as the mouth of Odin Cave. Taking this into account, and checking it by measuring on the ground, it seems that the feature named Gank Mouth (A on the plan) must be close to the mouth of Odin Cave, and this has been confirmed by an old Castleton miner who said he used to know the cave as "Gank Hole". Immediately outside this was the original entrance to the Cartgate as portrayed in a print dated 1810 (the culvert under the road (now buried) was only added when the road was built). This point would also be the lowest place where the vein itself would outcrop in natural conditions, so it seems to have been the logical starting point for measuring meers, numbered on the plan "1st meer", "2nd meer" etc. No founder meer is marked which is somewhat surprising, but, being an old vein, no Lord's meer was necessary. Founder's Meers are noted in the Sough Title only in the position of the 4th meer to the east, near Knowles Shaft.

As A is identified as Gank Mouth, a former extension of Odin Cave, the small vein branching north-west at the mouth of Odin Gorge which contains the allophane deposit is point B, named Widower's Vein on other plans. C then seems to be the present day entrance section of Odin Mine, where the two veins diverge evidently what is referred to on the plan as a Hanging Rither. Points D, E and F lie in the range of the accessible workings, and they are discussed in the notes on small plans.

Transferring the 1757 plan to the Ordnance map, Tinkers Shaft is found to lie under or very close to the main road up Mam Tor. All evidence on the surface has been destroyed by subsequent road building (and rebuilding at increasingly frequent intervals). It is notable, however, that the position of Tinkers Shaft is just clear of the margin of the Mam Tor landscape, where the miners had the double advantage of not having to sink through loose ground, and having the least depth to sink to the vein and Cartgate. A hollow in the ground immediately below (east) the lay-by formed by the bend of the road does not look like a shaft hollow, but may be a collapsed stop. Crooked Knerl Vein branches WNW a little way west of Tinkers Shaft, more or less under the south flank of Mam Tor. "Founders Meers" are marked here though only one meer is noted. The termination of the workings shown is almost on a line with the vein subsequently met east of Engine Shaft, and presumably further workings subsequent to 1757 may have linked these two points at greater depth.

Beyond Crooked Knerl two "doors" at N and P appear to lead to branch veins not depicted (see notes on small plans). One of these is called Blue Cap, and it is interesting to speculate that this may have been a fluor spar vein which became more blue towards the shale cover, or which may have contained Blue John. At Q is the "Swine Hole" - a self-open or cavern, "from whence at a flood cometh a great quantity of water from a place at the day's surface called Round Hill very near the Engine Sough Tail." It is uncertain what this refers to - could it be that one or other of the streams draining the side of Mam Tor once went underground via or near the Blue John Caverns, and entered the workings? The location of the Engine Sough Tail is not known; presumably it was a sough gate from the head of Odin Gully to the Engine Shaft. Two shale hillocks west of the old tramway may have been shafts to this sough. Points S, T, U and W refer to features now unknown, but point X denoting "Blue Hillocks at the Day" is almost directly beneath two shale hillocks on the southern slopes of Mam Tor. The small size of these hillocks and lack of limestone waste suggests that they were never sunk deep enough to reach the vein.

Some three meers east of the Engine Shaft, at Windy Door, they "found the vein". From the geological analysis it is clear that this was not the same vein as in Odin proper, but a parallel rake. It does not seem to have a separate name on the 1757 but on both 1752 and 1769 plans it is called Nether End vein. From here to Castleton Shaft several points are marked but there is no available evidence as to what these features were.
Castleton Shaft and Forest Shaft are only some 20 yards apart on either side of the boundary of Castleton and Peak Forest Liberties, and the "Forest Wall" is still the Parish Boundary today. Two founder meers and a Lord's Meer are marked here, and four taker meers beyond. The West Shaft, now a hollow in the wood close to the Edale rock fork, was sunk to the fourth meer, but beyond this it seems "the levey was driven in shale" and the vein was lost. It is possible that mining at deeper levels subsequent to 1757 penetrated further west, but at present there is no evidence as to whether the line of the possible sough between Peakshill and the Holt farms was ever reached. But not far west of Forest Shaft, a South Vein was found trending east to the north of Windy Knoll. It is not known whether this was worked further subsequent to 1757 but the geology suggests that the limestone should have been rising from beneath the shale cover, and so a greater workable height of vein should have been available. A shaft hollow and mound lie roughly on the continuation of the South Vein in the field some 10 yards southwest of the stile leading to Windy Knoll.

As mining carried on nearly another century, during which the Odin (Trickett) Sough itself was driven, there is little doubt that much further work took place and that the main veins were followed deeper and their branches were explored. But we have no evidence — and no surviving mine plan of 19th century date.

\[ \text{d) Robert How's plan and Section of 1769} \]

Robert How produced a further plan in 1769, 12 years after his first and this time with North at the top! It shows a number of features which differ from the 1752 and 1757 plans, and, much more interesting, it added a vertical profile with both Cartgate and Knowlegates Sough levels on it. Two other versions of the profile add further detail. Several modern copies of this 1769 plan misleadingly give the impression that all was drawn in 1769, but in fact substantial additions were made in pencil in a different hand: some of these are dated up to 1836 and were probably added by Robert How's son (also Robert How). The parts drawn in pencil are indicated by notes added on the reproduction in this book. The eastern half of the plan also has the sole of the works represented by a red line which cannot be reproduced here. Proceeding from east to west, the differences between the two plans are: a) The Knowlegates Sough is not shown on the 1769 plan. nor are the peculiar levels and branches at Knowles Engine; b) veins between Gank Mouth and Tinkers Shaft are shown in more detail than in 1757, but Tinkers Shaft itself is not shown at all; c) details of the veins between Tinkers Shaft and Engine Shaft differ only slightly; d) from a point some 2 meers west of the Engine Shaft, the Sough is some 5 fathoms higher and was added in pencil after 1769; e) the Castleton, Forest and West shafts are not shown on the 1769 plan, though the position of the Forest boundary is marked, and there is no south branch seen near the Forest boundary.

The three vertical profiles were apparently all drawn by Robert How (the son) around 1765-1769. Profiles A and B are separate documents but profile C is on the same sheet as his plan of 1769. Profile A carries his signature and is dated March 14th 1765, but it carries additions, one of which is dated March 15th 1769. It has a number of features which differ from the other two profiles. It should be noted that the original is drawn with West to the right, and at a larger scale than the others. It has been re-oriented for easier comparison herein, but the scale is still different.

Profile B is undated but it is so similar to profile C that it was probably a rough draft drawn a little earlier. Most of the details are the same on profiles B and C but B adds a few explanatory notes, while C adds some stops between the Cartgate and Knowlegates Sough in the 14th to 17th meers. At the extreme western end the wiggly line on C is probably meant to represent the shale/limestone contact, while the curved line on B may symbolize a stop of. The western part of profile C on the original of the 1769 was added in pencil, from the 27th meer on the Cartgate and from the 17th meer on Knowlegates level. As discussed below, it is some mason to believe that there were added after 1800, in which case profile B may also be later than 1769, but there is no evidence to settle this point.

A note on profile B suggests that Toume Hole may not be the Gank Hole cave, but may instead be the shafts and chambers now known to Explorers as Bell Shaft, off the Cartgate Chamber. The Sough Engine shaft is shown on profiles B and C to a depth of 39 fathoms below the Cartgate. A number of irregular lines drawn on profile C in red ink appear to mark stops in work or recently cut out.

"The additions in pencil to both plan and profile, probably dating from the period 1800 to 1836 when the last is dated. are in two forms: scattered notes on the plan (ranged on the reproduction herein) and pencilled lines or continuation of lines on the profile:— (a) westwards from a point marked 'O', three meers west of the Main Engine Shaft, at the Cartgate level, the point 'O' was the forefield of the Cartgate in 1769 when the original plan was drawn, and (b) about half the total length of the Knowlegates Sough. The end of the ink portion of the Sough represents its asrend as it stood in 1769.

A pencilled note added to the plan in the 18th meers forefield April 12th 1836 presumably refers to the Trickett Bridge Sough. It cannot be the forefield of the Knowlegates Sough as this had reached Peak Forest Liberty by the early years of the 19th century.

The Trickett Bridge Sough does not appear on either the plan or profile. A further pencil note on the plan "142 yards to R.D. point" has no obvious meaning. Two further comments of interest are that by the wiggly line descending westwards at the extreme west end appears a note "20 fathoms below the level:" this suggests they sank this distance during stopping out the vein. Nearby is a short pencil line and note "East end of the last pump hole" suggesting they raised water to the sough by pumps, probably of the rag and chain type. Isolated from anything else on the plan is a pencil sum "1824/1769 - 53 years". The significance of this is not known, and the subtraction should, if full years are intended, come to 55 years.
Heywood’s 19th century guidebook refers to Odin Mine as having the main level, “a gently declining shaft nearly one mile in length”, so being “comfortable” for tourists, but Robert How’s section shows both Cartgate and Sough as horizontal; unless there was some subsequent and unlikely regrading the declining was probably imaginary!

e) Various small plans

Five such small plans are known; two cover the area near the entrance and Odin Gorge and are dated 1765 and 1777; while the other two cover the area around Crooked Knoll vein and are dated 1753 and 1755. The fifth is undated and covers the entrance area only and is not reproduced herein.

The plans of the entrance area should be capable of being matched with what can be seen on the surface and in the accessible workings near the Gorge, but considerable difficulties are present (Fig. 8). The two dated plans differ somewhat but some features are common. The key point in interpretation is the position of Gank Mouth; this is not the site commonly known as Odin Gorge as we know it today, then apparently known as Gank Hole and which may be the Old Pipe known as Teume Hole on the large 1760 plan (Jose Hole on the 1757 plan is further west). The undated plan is puzzling in one feature only — it shows an enclosure on the south side of the narrow gorge labelled Teume Hole in a position which does not match Gank Hole. Gank Mouth seems to have been the original entrance and must have lain a few yards east of the present most easily point visible on the vein, i.e., it lay under the present flat area of grassed-over talings between the road and the beginning of the Gorge. An old postcard photo shows the rock face sloping outwards (eastwards) from the lowest point now visible between two rocks apparently known as the Gank Tors. The title and measures of the main Odin Mine were measured westwards from this concealed point, to the east lay the Sough Title. Even if Gank Mouth cannot be seen, the small plan of 1755 notes an Auger Mark on the south side of Gank Mouth and a large drill hole is still visible there. Measuring westwards from this it confirms that Widow’s vein must be the small branch working on the north side where one climbs into the narrow part of the Gorge today and which has white allogene deposits on it. The trend of the vein does not quite match with that in the visible working and there is no cross door evident, though it seems that it was at Cartgate level.

Further west there is a cross door marked on both 1765 and 1767 plans, linking the Cartgate on Odin Old Vein to Little Shaft vein. Again allowing for the fact that these two plans were probably drawn at Cartgate level, and access to the mine is some 50 feet higher at the back of the Gorge, it seems that the present entrance is in Little Shaft vein and the narrow parallel feature to the south in Odin Old Vein. They are linked by a cross door some 60 feet inside. One can then climb a short rise in Little Shaft vein, and after a further 55 feet a cross-cut in the north leads into a sub-parallel vein with workings going ENE and WSW. This could well be Amy Gutter vein.

Immediately below the cross-cut into Amy Gutter Vein, a ladder pitch of 35 feet drops into a heading trending back towards the entrance. This is in fact in the same Little Shaft vein, but it appears to be off-set on the plan of the accessible workings owing to the southerly hoods of slope of the vein at about 1 in 6. Some 200 feet to the ESE it opens into a large chamber with the stone-arching of the Cartgate in the roof. The floor has subsided here. A branch vein going westwards is the Odin Old Vein and an alternative route allows access to a continuation of this and to two more or less parallel (and sloping) veins probably Bicken Drift and Gin Swale veins. It is unfortunate that so little of the workings are still accessible as it is far from easy to relate what one can see today to the old plan.

One can now follow part of the Cartgate back towards the original entrance but it is blocked roughly under the mouth of narrow section of the Gorge. A hole in the north wall leads to a short cross-cut into a heading on what is probably Widow’s Vein; beneath it two ladder climbs lead into steps at about the junction of Widow’s and Odin Old Vein. In the south wall below the Cartgate an opening reached only by a tricky climb leads into a natural cavern with a trickle of water entering. This is roughly below Odin Gully and the water is probably the small stream therein.

Returning to Widow’s Vein, another problem is that the 1767 plan shows this to have a strong hade or slope, falling 9 inches per yard southwesterly; this is not evident in the accessible workings but hade can easily change with depth. A further problem is that the plan notes the Vein Head of Widow’s Vein was 15 fathoms above the Cartgate. However, shale is visible only about half this height above the position of the Cartgate. The discrepancy could be explained if the limestone-shale surface undulates sufficiently to rise into a knoll-like form beneath Odin Sitch. This is quite feasible on geological grounds and there is, in fact, a hint of it in the dips of the shales along Odin Sitch.

Turning to the two small plans of Crooked Knoll, (Fig. 7) nothing is visible on the surface and none of the workings is accessible so only limited discussion is possible. Both add detail to the main 1757 and 1769 plans and serve to show that these are no more than the main line of the Cartgate and little else. The 1753 plan of Crooked Knoll is the simpler one and draws attention to the position of Blue Cap vein and to ore in the roof. One is tempted to deduce from this that Blue John fluor that may have been present but there is no record of this otherwise. The later (1765) plan shows that there is a rift splitting Crooked Knoll vein into north and south veins, and a note says that the South Vein rises 14 fathoms above the Cartgate. Again there is a hint here of a buried limestone knoll under the shales below the flat area beneath the face of Mam Tor. Blue Cap vein crosses above both Crooked Knoll and South Vein at an oblique angle at this point possibly in the Boulder Bed — just the geological conditions under which one could expect blue fluor that.

These two plans demonstrate the strong possibility that other branch vein complexes are present in Odin Mine and are not recorded.
Fig. 6. Two small plans of the entrance area of Odin Mine: above by Robert How dated Feb. 14th. 1765; below unsigned but dated March 17th. 1767.
A Plan of Crooked Knerl Vein and Blue Cap Self Cross Door.
August the 2nd 1753.

Fig. 7. Two small plans of the Crooked Knerl area of Odin Mine: above dated August 2nd. 1753, below dated May 29th 1755.