Bull. Peak District Mines Historical Soc., Vol. 7, No. 1, pp. 31-39, May 1978.

THE GEOLOGY AND EXPLORATION OF THE HUBBADALE MINES, TADDINGTON

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Summary: A series of explorations carried out in the Hubbadale Mines have enabled a study of the geology and mineralization to be made for the first time of this important series of mines. This has shown that the mines worked a northwest-southeast trending pipe vein developed in the D_2 (Brigantian) Monsal Dale Limestones. The deposit consists of a series of premineralization solution cavities which have been partially infilled with calcite, marcasite, baryte, galena and fluorite. Later karst processes have eroded these producing a more extensive series of caverns partly filled with sediments derived in part from erosion of the primary minerals.

The oxidation of the marcasite so common in the pipe vein cavities has led to the formation of locally acidic ground waters which caused corrosion of the limestone walls producing a limestone sand analogous to 'rottenstone', believed to be that previously referred to as 'white sand'.

A combination of underground exploration and geological observation has shown that Whale Sough acts as an outlet for water percolating into the limestone south of Taddington which formerly flowed southwards to Lathkilldale. The existence of a sough from the Waterloo Hotel Taddington is shown to be unlikely on geological grounds.

The Hubbadale mines (spelt Hubba - not Hubber - according to Kirkham, 1964) are situated between the villages of Taddington and Monyash. They have often been cited as examples of the fabulous richness of pipe vein orebodies yielding enormous profits. Early descriptions of the stratigraphical position of the deposit were provided by White Watson (1811) who noted that the pipe lay above a toadstone bed. A stratigraphical section of the mine in Carruthers and Strahan (1923) showed that the pipe lay in limestone with two wayboards beneath the 'great white clay'. They stated that the pipe ran N.15°W. to 25°W. and was intersected by a large number of parallel cross veins. There was said to be much 'white sand' associated with the pipe and iron ore was found with the galena which was picked out in lumps requiring little washing. A lump weighing 10 tons was said to be encountered in 1768 when the mines worked at a profit of £17,000.

The history of mining activity has been thoroughly documented by Kirkham (1964) and historical notes on later mining activity have been added by Willies (1976). The geology of the Hubbadale pipes has never been thoroughly documented and a series of explorations have been carried out in an attempt to rectify this position.

EXPLORATION OF THE HUBBADALE MINE WORKINGS

During the period 1974-1975, after the re-opening of Magpie Sough, explorations were carried out on the Hubbadale Mines. It was considered at that time that the Magpie Sough drained both the Magpie and Hubbadale Mines and the re-opening of the Sough increased the possibility of entering the workings previously considered to lie below water.

Work began by detailed surface mapping on scales of 1:2500 and 1:10560 of the shafts and veins with a view to descend those that were open. The distribution of these is shown in fig. 1. At the same time studies of available historical records was begun. It rapidly became obvious that Kirkham's (1964) account had more than thoroughly covered this ground, but N. Butcher drew the author's attention to a plan at the Institute of Geological Sciences, Leeds, dated 1842, showing the veins and shafts of the Hubbadale Mines and this added substantially to knowledge of the later 19th century workings (Willies, 1976). This data forms the basis of figs. 1 and 2 showing the distribution of veins and shafts. The following is an account of the results of the descents of the shafts and presents a geological interpretation of the Hubbadale Pipe for the first time.

The most northerly shaft on the pipe is referred to as "Top Shaft Pipe" on the 1842 plan. This shaft is isolated from the main Hubbadale site lying on the upper range of Hubbadale Pipe. The shaft is oval in cross-section and is in good condition being covered by an old boiler plate and securely fenced. A descent was made but after about 150 feet it

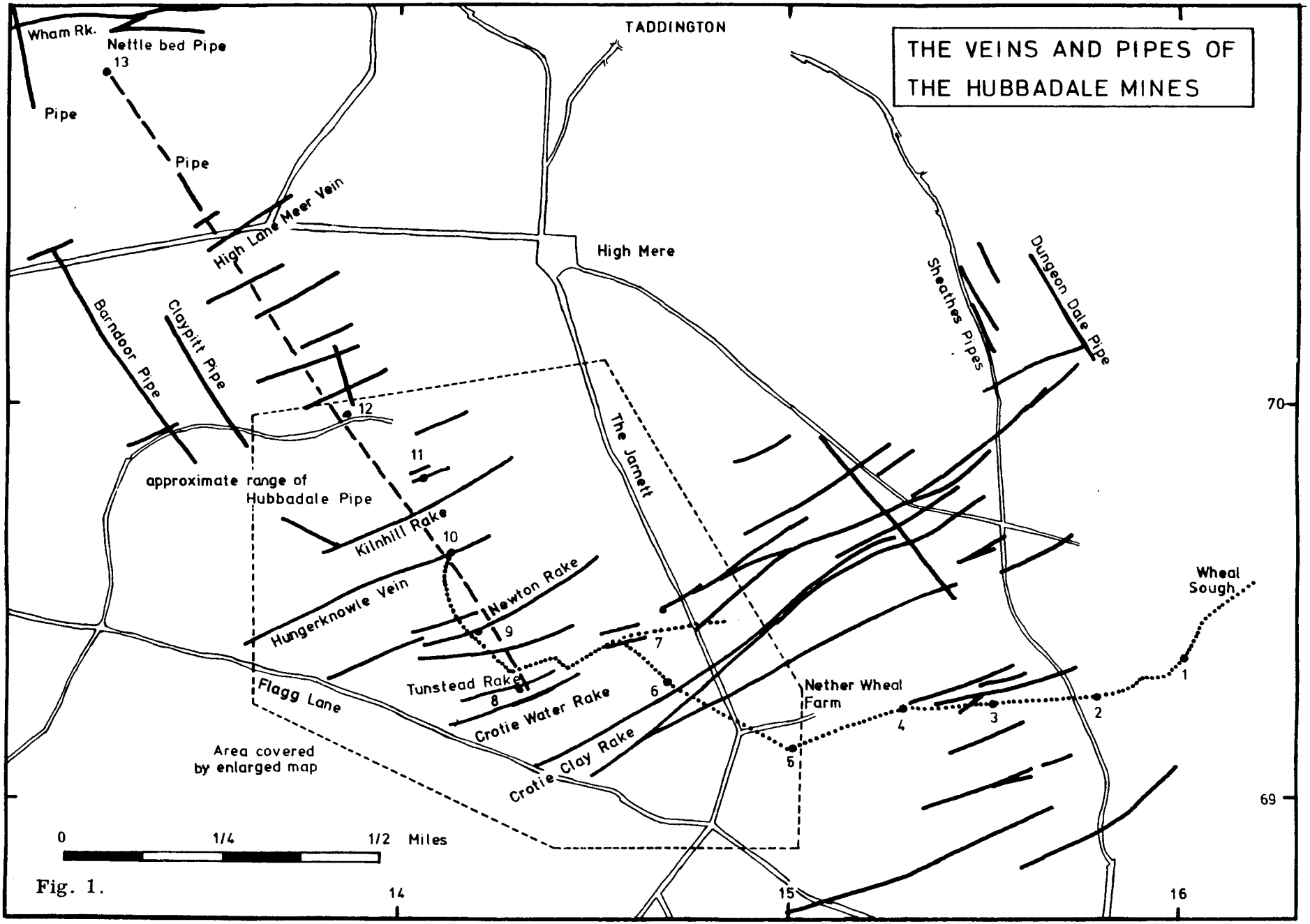
THE VEINS AND PIPES OF THE HUBBADALE MINES
TADDINGTON
Wham Rk.
Nettle bed Pipe
13
Pipe
Pipe
High Lane Meer Vein
High Mere
Barndoor Pipe
Claypitt Pipe
Sheathes Pipes
Dungeon Dale Pipe
12
11
approximate range of Hubbadale Pipe
The Jarnett
Kilnhill Rake
10
Hungerknowle Vein
Newton Rake
9
7
Wheal Sough
Tunstead Rake
8
6
Flagg Lane
Crotie Water Rake
Nether Wheal Farm
1
2
3
4
5
Crotie Clay Rake
Area covered by enlarged map
0
1/4
1/2 Miles
70
69
14
15
16

Fig. 1.

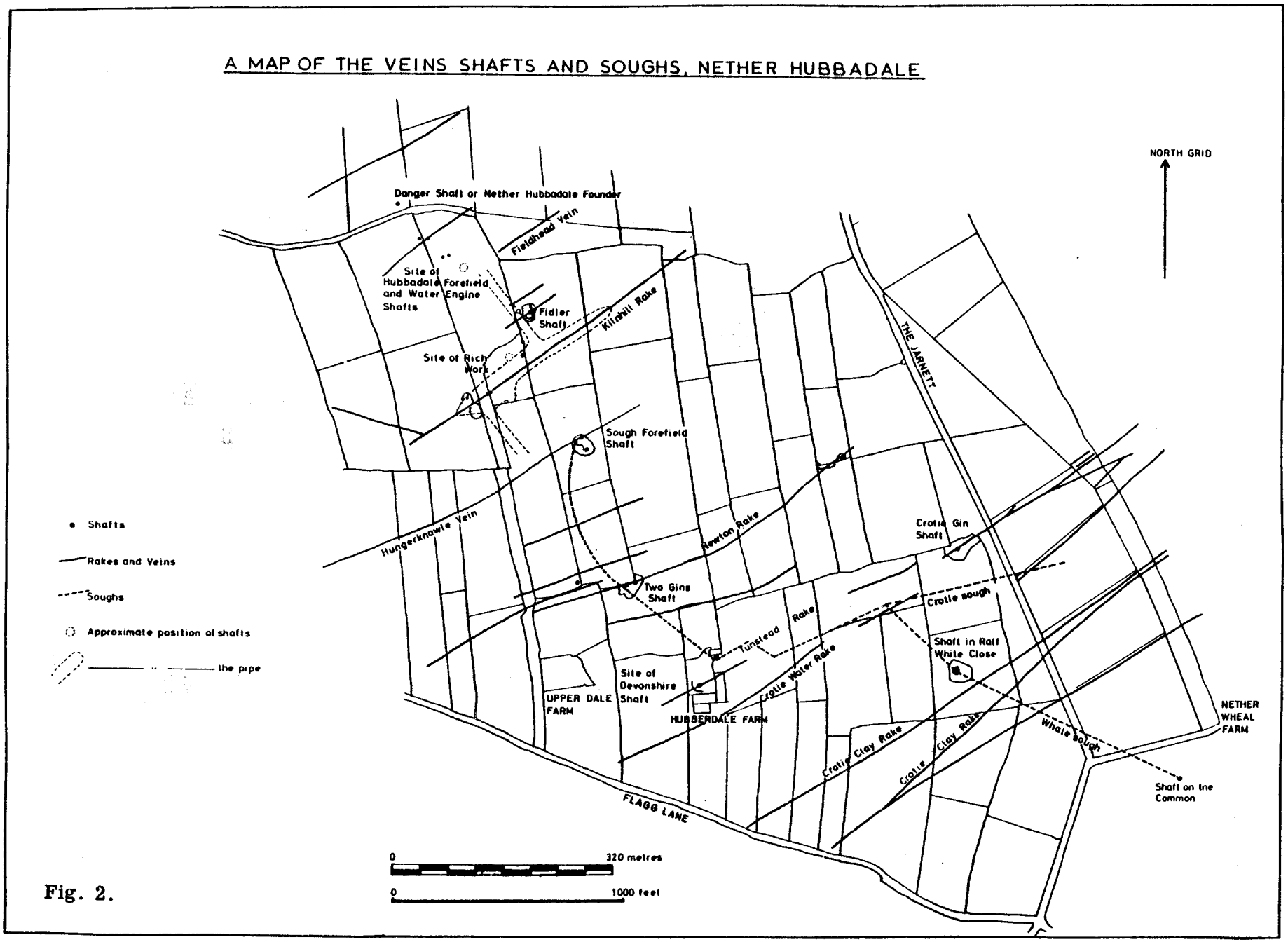
A MAP OF THE VEINS SHAFTS AND SOUGHS, NETHER HUBBADALE
NORTH GRID
Danger Shaft or Nether Hubbadale Founder
Fieldhead Vein
Site of Hubbadale Forefield and Water Engine Shafts
Fidler Shaft
Kiln Hill Rake
Site of Rich Work
THE JARNETT
Sough Forefield Shaft
Hungerknowle Vein
Newton Rake
Crotie Gin Shaft
Two Gins Shaft
Crotie sough
Tungstead Rake
Shaft in Ralf White Close
Site of Devonshire Shaft
Crotie Water Rake
UPPER DALE FARM
HUBBERDALE FARM
Crotie Clay Rake
Crotie Clay Rake
Whale sough
NETHER WHEAL FARM
Shaft on the Common
FLAGG LANE
Shafts
Rakes and Veins
Soughs
Approximate position of shafts
the pipe
0
320 metres
0
1000 feet

Fig. 2.

appears to have been either filled or has collapsed. Some sand-filled pockets were found at 150 feet. (Shaft 13 on fig. 1).

There is little evidence of workings between this shaft and High Lane Meer Vein (fig. 1). South of High Lane Meer there is substantial evidence of vein workings with numerous shallow trenches and many small collapsed and filled-in shafts. Fragments of nodular goethite, sometimes pseudomorphing marcasite, and baryte are conspicuous on the hillocks.

Investigations on the Barndoor and Claypitt Pipes (fig. 1) failed to reveal any evidence of old shafts and surface evidence here is scant.

Shaft 12,variously known as Danger Shaft or Nether Hubbadale Founder, at first sight appeared to be a strong candidate for providing access to the pipe vein. It is covered by a well-constructed limestone "beehive" which generally indicates that little in the way of debris has been tipped down the shaft. A winch descent of this shaft was carried out reaching the bottom of the shaft at 129 feet. A small chamber is developed at the base of the shaft about 6 feet in diameter, some 15 feet high with natural phreatic solution pockets in the walls. The floor of the chamber is covered by brown clay, silts, and limestone blocks and it appears that the shaft was once substantially deeper and has been filled at some unknown date. Geological notes were made during the explorations these revealing that the base of the shaft was developed within dark grey rather thinly bedded limestones which pass gradationally upwards into pale grey thickly bedded cherty limestones. Three clay wayboards at 17 feet, 99 feet, and 113 feet from the surface are developed within the pale limestones. By comparison with recent Institute of Geological Sciences maps the limestones belong to the Monsal Dale Limestones (D_2) with the dark limestones representing a basinal facies of this formation.

A number of old collapsed shafts and hillocks south of Whitefield Lane have been variously identified by N. Kirkham using historical data as Hubbadale Forefield Shaft, the Water Engine Shaft. South of Fidler Shaft is a small uneven field which appears to have been hillocked at some period. A series of mounds testify to the position of a number of shafts sunk onto the rich part of the Hubbadale Pipe (Kirkham, 1964) where Kilnhill Rake intersected the pipe (fig. 2). All these have collapsed or have been filled in and this denies access to the site of the rich lead ore finds of the 18th century.

To the southeast of the old Forefield and Water Engine Shafts is a large shaft mound with a large square-topped 5 x 4 ft shaft partially covered by old railway sleepers. A small round climbing shaft lies a few feet to the east of this shaft and this leads after 50 feet into the main shaft.

It is not completely clear from Miss Kirkham's descriptions what the name of this shaft is but the 1842 plan names it Fidler Shaft. It has also been called Naylor's Shaft from a later attempt to re-open the mine by Naylor. (Shaft 11 on fig. 1).

Early examinations during the winter months proved that the shaft was partly flooded. Descents were made during the early spring of 1975 and it was possible to see a level just beneath the water to the west. A descent during the early summer when the water had apparently disappeared permitted a survey of the workings from the base of the shaft to be made.

The shaft is some 228 ft deep, flooding to 218 ft in the winter months. A level 5 to 6 feet high and 4 feet wide driven to the west was entered and it soon trended round to the south. After about 60 feet this level has been backfilled with limestone pack and this has allowed silt to accumulate. It is possible to crawl for a further 20 feet in a southerly direction before it becomes too low for further progress. A number of small cavities about 3 feet in diameter were observed in the roof of this level. There are lined with columnar calcite with some small specks of galena. A second branch level may be followed to the southwest which follows a small baryte vein. This has been partly worked in the roof. After some 40 feet the level turns sharply to the northwest intersecting strongly mineralized and unstable ground. Following this mineralized ground for 20 feet a short unstable winze has been supported in the past by square-set timbers. The winze was descended for 15 feet where a small low-level, silt- and clay-covered passage was entered. This was followed for 13 feet to the west in pale grey limestone. A

number of phreatic solutional features in this passage indicate that this passage was driven by enlarging a network of phreatic solution pockets. The details of the mineralization seen are described later, however it is apparent that this shaft and workings have intersected pipe vein-type mineralization.

Approximately 220 yards to the southwest of Fidler Shaft is another large shaft mound referred to be Kirkham as the Sough Forefield sunk on Hungerknowle Vein (shaft 10, figs. 1 and 2). Although open at the top this shaft has been filled with farm debris.

Continuing southeast along the range of the Hubbadale Pipe Two Gins Shaft lies 160 yards northwest of Hubberdale Farm in a small wooded enclosure (shaft 9, fig. 1). The Two Gins Shaft in fact consists of two shafts set about 10 feet apart. The eastern one of these has collapsed and is marked by a rubbish filled depression. However, the western one is still open and covered by wooden railway sleepers. In cross-section the shaft is rounded whilst the other is more square in section. We were not permitted to descend this shaft which lies on ground belonging to Hubberdale Farm and it is believed that illicit explorations by others have prejudiced the landowner against any future activity.

Explorations were also carried out on the Hubbadale or Wheal Sough. The Wheal Sough was driven in the first part of the 18th century from Deep Dale to Hubbadale Pipe a distance of over 2600 yards. Miss Kirkham noted how little evidence is available concerning the location of the sough tail apart from the relics of a cut and cover level. Access to the sough may be gained by descending a shaft located adjacent to a dew pond in the floor of Deep Dale (fig. 1, shaft 1). This shaft is about 40 feet deep and leads into the sough after a tight newt-infested squeeze. The initial parts of the sough are low, rarely exceeding 3 feet in cross-section, and the floor is covered by silt. After about 130 feet a swallow hole is intersected by the sough and takes a substantial flow of water. Beyond the swallow the sough becomes amphibious with a height of 3 feet being maintained, the air space varying from 18 inches to less than 6 inches. The floor of the sough is heavily calcited with flowstone, apparently still accumulating. In places the flowstone reduces the height of the sough to below 3 feet. After 792 feet the level intersects a shaft to surface (shaft 2, fig. 1) where the level opens up to between 6 and 8 feet in height. The level may be followed for a further 200 feet where a small partially collapsed chamber is encountered. Exploration ended here where the sough has been choked by a fall of limestone blocks mixed with gravelly sediment. A strong flow of water issues from the base of this choke and flows along the sough. It is estimated that this chamber lies between shafts 3 and 2 on fig. 1. The observations in the sough agree in detail with the old surveys.

Geological observations made in the sough indicate that throughout its length the level is driven through very dark grey thinly-bedded chert limestone with shale partings. A thin clay wayboard occurs interbedded with these and forms the roof to the outer sections of the sough. These limestones belong to the dark facies of the Monsal Dale Limestones also seen in Danger Shaft and Fidler Shaft (fig. 3).

It may be possible to by-pass this fall by descending some of the shafts to the east of Nether Wheal Farm shown to be sunk onto the sough on many of the old mine plans (fig. 1). Crotie Gin Shaft (7), the shaft in Ralf White Close (6) and the Shaft-on-the-Common (5) (Kirkham, 1964) have all collapsed. This only left shafts 4 (Pagoda Shaft) and shaft 3 (fig. 1) as possible routes onto the sough. Shaft 4 was descended to a depth of 191 feet where is ended in a collapse. A small baryte vein was observed in the shaft which had been partly worked but otherwise there was little evidence of mining.

Faced with such disheartening results it seemed unlikely that shaft 3 (fig. 1) would lead into the sough and at this point explorations terminated.

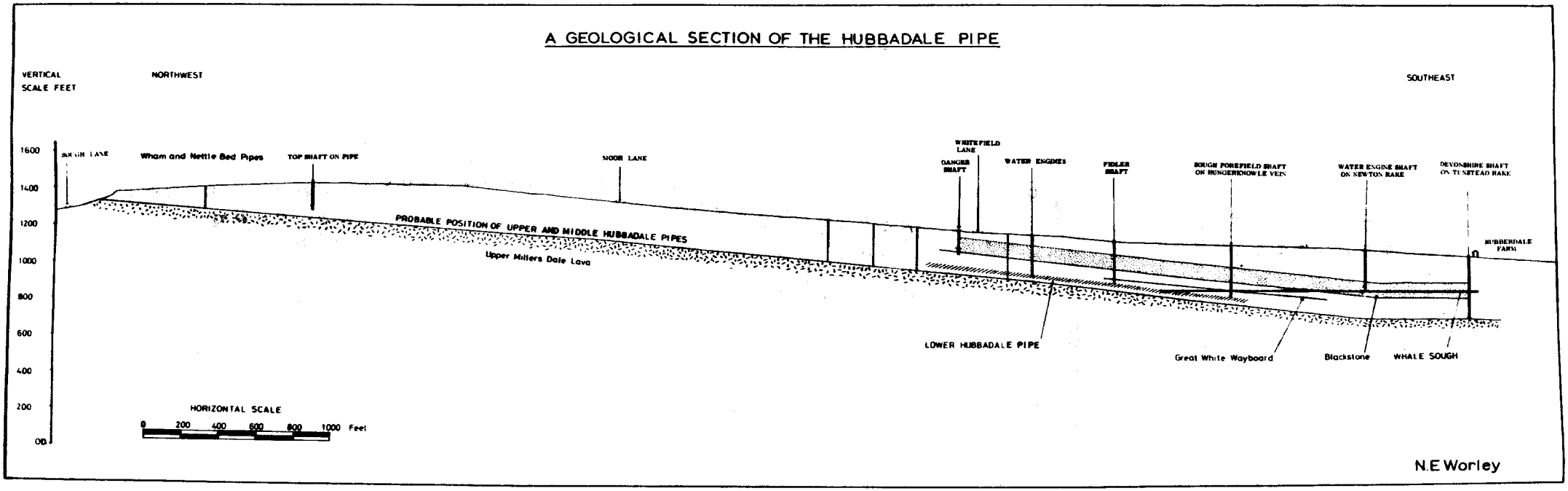
A GEOLOGICAL SECTION OF THE HUBBADALE PIPE
VERTICAL SCALE FEET
NORTHWEST
SOUTHEAST
1600
1400
1200
1000
800
600
400
200
00
Wham and Nettle Bed Pipes
TOP SHAFT ON PIPE
NOOR LANE
WHITEFIELD LANE
DANGER SHAFT
WATER ENGINES
FIDLER SHAFT
BORGH FORESIELD SHAFT ON HUNGERKNOWLE VEIN
WATER ENGINE SHAFT ON NEWTON RAKE
DEVONSHIRE SHAFT ON TUNSTEAD RAKE
HUBBERDALE FARM
PROBABLE POSITION OF UPPER AND MIDDLE HUBBADALE PIPES
Upper Millers Dale Lava
LOWER HUBBADALE PIPE
Great White Wayboard
Blackstone
WHALE SOUGH
HORIZONTAL SCALE
0 200 400 600 800 1000 Feet
N.E Worley

Fig. 3.

Stratigraphy

A total of 280 feet of limestone is exposed in the workings which belong largely to the Monsal Dale Limestones pale facies (Aitkenhead, 1977). Dark facies limestones are seen in the shafts about 135 feet from the surface (fig. 3) and are also seen at outcrop in the sides of Deep Dale half a mile to the east of the pipe. These limestones are also exposed in the Wheal Sough where they consist of very dark grey thinly-bedded limestones with numerous cherty horizons.

The overlying Eyam Limestones have been mapped by Chisholm et al. (1976) and outcrop adjacent to Wheal Farm. It can be argued that the succession exposed in the Hubbadale Mines probably represents an almost complete succession of Monsal Dale Limestone as it appears that, though the Eyam Limestones have been eroded off, little of the Monsal Dale Limestones have been removed.

Compared with other sections of Monsal Dale Limestones the succession exposed in the Hubbadale mines appears to be substantially thinner than seen in Monsal Dale where over 550 feet are exposed. This implies that thinning of the succession has taken place which may be related to the development of an anticlinal structure through Taddington.

A number of clay wayboards are exposed in the old workings. The thickest is about 1 ft thick and has a greyish-white colour resting on top of an eroded limestone surface. This clay wayboard is probably the Great White Wayboard referred to in contemporary accounts and plans (Kirkham, 1964). It seems likely that this clay wayboard is known to occur in the sides of Deep Dale and between Sough Top and Taddington. It is difficult to correlate this thick wayboard precisely with any of the major lava flows in the district but it appears that it lies either at the horizon of the Shacklow Wood lava (exposed in Magpie Sough) or the Litton Tuff. A thinner clay wayboard is also constantly referred to in the historical documents as forming the roof to the pipe vein. The mapping carried out in Fidler Shaft confirmed this documentary evidence.

The pipe itself is developed within the pale grey limestones which have been studied at the foot of Fidler or Naylor's Shaft (fig. 2). Here the limestones are pale grey, thickly-bedded biomicrites with numerous crinoid ossicles. They are generally chert free. A lava horizon was penetrated below the sole of the pipe and this is recorded in the old documents being referred to as the 'channel first cut'. (Channel is an old term for toadstone). The same lava was also intersected in the Devonshire shaft (fig. 1, no. 8) sunk by Taylor to dewater the mines to a depth of 45 metres below adit level (Willies, 1976). It is likely that the lava is the Millers Dale Upper Lava which outcrops at Taddington and Sough Top (fig. 3). These observations comply with a general southerly dip of the lava.

From the old documents and arrangement of the shafts it is clear that the Hubbadale Pipe trends southeast from Sough Top to Hubbadale Farm. It is crossed by a number of southwest-trending veins and rakes whose general distribution is shown in fig. 1. Besides the Hubbadale Pipe a number of other pipes are known and these include Barndoor Pipe, Claypitt Pipe, Nettlebed Pipe, Sheathes Pipe, and Dungeon Dale Pipe, all of which trend southeast parallel with the main pipe. In its lower parts referred to as Nether Hubbadale the pipe is shown at its widest which also coincides with the intersection of Kilnhill Rake (fig. 2) where the general trend of the pipe appears to be offset.

The pipe vein exposed in the level from Fidler (shaft 11) can only be entered during periods of drought. A passage driven along a barytes vein intersects a series of elliptical cavities up to 0.5 metres in diameter. These are usually filled by fibrous white calcite, marcasite, and baryte. Smaller amounts of galena and fluorite were also seen in some of the cavities. Most of the marcasite had a radiate structure with cuniform terminations and it is often pseudomorphed by goethite. Extensive weathering of the limestone walls of the pipe has taken place resulting in instability of the wallrocks. This weathering

has caused disaggregation of the limestone walls surrounding the pipe vein cavities and in places the wallrock is reduced to a fine greyish-brown sand similar in texture to a "rottenstone". It is likely that this is the 'white sand' referred to be Carruthers and Strahan (1923) and which Ford suggested (in Kirkham, 1964) might be cerussite. The disaggregation was probably caused by weathering of the marcasite in the cavities to form pseudomorphs in goethite, which produces an acidic aqueous by-product. With probably only a slightly lower than normal pH even this was sufficiently acidic to attack the limestone causing weathering to take place along the grain boundaries. Solution along the boundaries tended to disaggregate the limestone and produced a fine-grained calcite sand. Examination of the disaggregated limestone has shown that it consists largely of fine calcite particles with small amounts of euhedral quartz and a little fluorite. These acidic solutions have also etched the fibrous calcite which lines many of the cavities. Solution on a larger scale has also removed substantial quantities of calcite gangue levaing the less soluble galena in the form of detached fragments. Later karst solutional effects evident in the pipe vein have removed disaggregated calcite and thereby further concentrated the galena. Collectively these processes have resulted in the production of lumps of detached galena within disaggregated limestone, mixed with sands and gravels washed in by surface drainage. Thus the rich deposits worked in the 18th century must have consisted largely of the alluvial galena referred to as "lumps of lead ore" by Carruthers and Strahan (1923).

In Taylor's 1842 report flats were recorded below the base of the "blackstone" (dark facies Monsal Dale Limestones) on Tunstead Rake in the vicinity of Ralf White Close (shaft 7 in fig. 1). These probably lie in the pale grey shelf facies Monsal Dale, higher stratigraphically than the main Hubbadale pipe.

The total recorded production of lead ore from the pipe was calculated by Wm. Wyatt (1829) who found that 13,201 loads 1 dish (3300.25 tons) were produced at a profit of £21,558 during the period September 1767 to October 1770!

It appears from a study of the available evidence that the Hubbadale pipe is developed within the shelf facies of the Monsal Dale Limestones and that the dark limestones are poorly mineralized. A number of clay wayboards appear to influence the distribution of the deposits but the effect of these is not clear.

The mineral deposit is typical of many of the pipes of the Southern Pennines but is unusual as it contains large quantities of marcasite. Oxidation of this probably led to extensive disaggregation of the wallrocks producing "white sand", and causing corrosion of the calcite gangue. This process apparently released galena from the pipe vein cavities and it accumulated as placer deposits in karst cavities.

SOUGHS AND HYDROGEOLOGY

Magpie Sough has been regarded recently as the main resurgence for the north side of the Monyash basin, and the question has arisen as to what extent it affects the Hubbadale area (Christopher and Beck, 1977, p. 216). When the blockage in the Magpie Sough was removed in 1975 about 2½ million gallons were released but it is not known to have had any effect at Hubbadale.

The exploration of the Whale Sough showed that a substantial flow was emerging from below the blockage reached, but that this was disappearing down a swallow nearer the tail. So it seems that the high ground around Slipper Low (SK 142707) and Sough Top (SK 130707) still drains via Whale Sough towards Deepdale, but is lost in the swallow. This water probably reappears at the springs around Lees Bottom, possibly including some rising through the bed of the River Wye, though this would imply that the water passes through two toadstones. Alternatively some slow flow may go to the "boil-up" in Magpie Sough, via fractures associated with Townhead Vein. However, Magpie Sough was driven long after Whale Sough, and there remains a problem as to what were the hydrological conditions before Magpie Sough was driven. It seems likely that the water-table in the Hubbadale area was much

higher and that the driving of the Whale Sough lowered it to something approaching its present altitude. It seems possible that percolation of rainfall to the Hubbadale pipes was slow owing to the impedence provided by the thin dark shaly beds of the Monsal Dale Limestones. Some rainfall may simply have percolated a few feet then flowed down the dip of the highest bed towards the Monyash basin.

The early 18th century (?) sough driven from south of the Waterloo Hotel (Rieuwerts, 1966) and variously known as Wham or Waterloo Sough (SK 132714) has its tail at 1180 ft OD, much higher than Whale Sough. In spite of legends that is was driven to connect with Hubbadale Mines, no evidence for such an assertion has been found, and it is more likely that it did no more than drain the Wham mines, ¼ mile to the south. Even so the soughers would have had to drive through the Upper Millersdale lava, here dipping gently south, for some hundreds of feet. The tail is obstructed by two stone walls enclosing a tank installed for water supply, no longer used. The inner wall would have to be removed to permit exploration unless a shaft on to the sough can be found.

ACKNOWLEDGMENTS

The authors wish to acknowledge the help of John Peel and Andy Gillings during descents of the shafts. Lynn Willies helped greatly with many parts of the historical background with his usual enthusiasm. Drs. T.D. Ford and N.J.D. Butcher are thanked for discussions on various aspects of the geology. Dr. Aitkenhead is thanked for access to the Institute of Geological Sciences documents. The cooperation of the landowners in the district is acknowledged and Harry Parker helped with some of the aspects of this work.

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