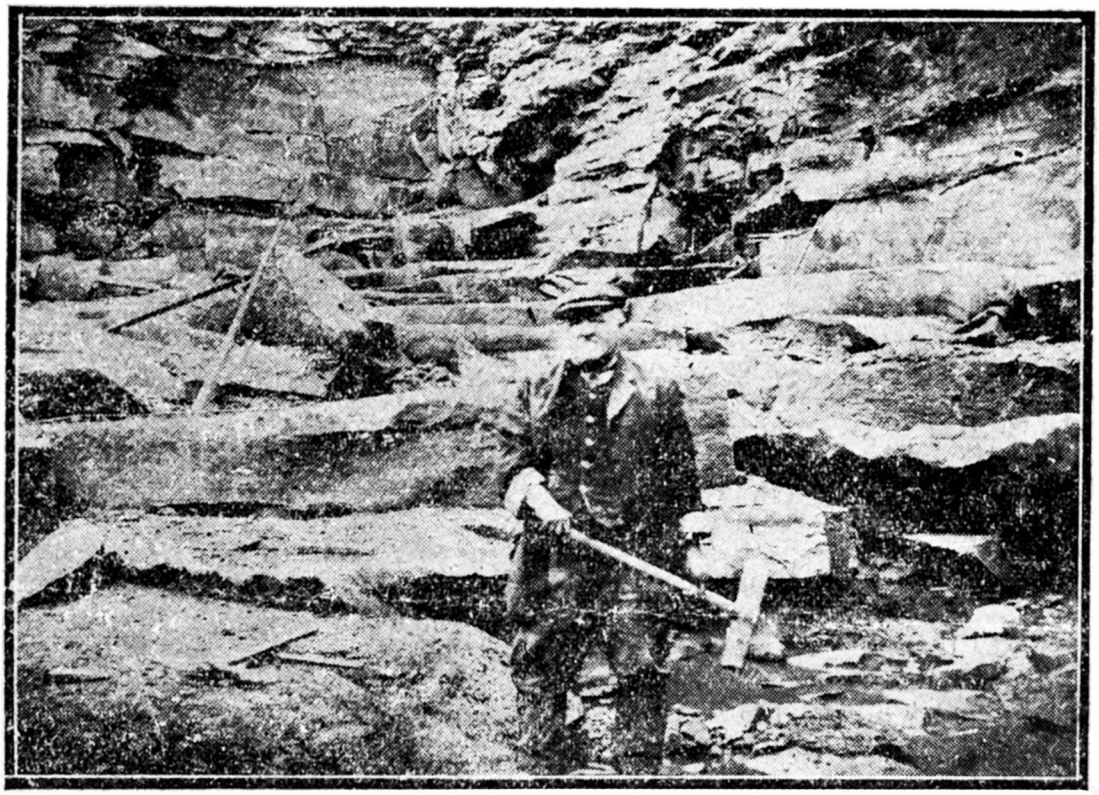
NAB HILL DELPHS
OXENHOPE MOOR
1840-1905



A "GETTER."

Volume 1 - Text

NAB HILL DELPHS
OXENHOPE MOOR
A GEOLOGICAL
and
HISTORICAL
ASSESSMENT

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EXECUTIVE SUMMARY

In November 2011 C.E. Mace was commissioned by Watershed Landscapes, Hebden Bridge, to carry out an historical and geological assessment of the stone delphs at Nab Hill, Cold Edge Road, Oxenhope Moor, Haworth Township, Bradford, West Yorkshire (NGR SE 034 325).

The study is a result of discussions with Gavin Edwards, Community Archaeologist of the Watershed Landscape project, part of the Pennine Prospects initiative. The "Riches of the Earth" programme, an intrinsic part of this, aims to provide an understanding of the way extractive industries helped shape the characteristic upland areas of the South Pennines through documentary research and landscape survey. It was felt that a detailed study of a select group of stone quarries, on Nab Hill above Oxenhope on the boundary of the Bradford and Calderdale Metropolitan areas, would help inform any intended topographical survey of remaining earthworks of the study area that may be carried out. The study therefore provides a geological and historical background to the workings and considers their context in the regional development of the quarrying industry. The area also includes two large reservoirs, Warley Moor and Thornton Moor, and various water catchment systems, built in stone quarried from the immediate vicinity. Therefore a brief consideration of the water industry in the region is provided explaining its impact on the moorland landscape.

The study area comprises a series of delph workings of the mid to late 19th Century associated with early types of extraction of the sandstones of the area. It is a typical example of the Historic Industrial Heritage of this period of the industry with small work faces, dressing sheds and trackways for horse-drawn stone carts. It is set alongside a minor road that was once the main pack horse route between the Haworth area and Halifax. The route of this was lined with farmhouses and small plots of enclosed lands reflecting the impact of marginal farming in an upland area. These small settlements would be much affected by the decision to exploit the area for large-scale water provision schemes for the burgeoning industrial towns of the old West Riding. The isolated nature of the area would mean that the workings remained virtually untouched by the major impact of mechanisation of the stone industry in the second half of the 19th Century preventing them developing into large industrial-scale quarries that so often obliterated the early archaeological evidence of quarrying. Despite the limited use of mechanisation in the 1930s, associated with expansion of one the reservoirs, and larger scale quarrying of two of the workings in the latter part of the 20th Century, which has caused some loss of early evidence, the site remains a significant example of the character of the industry in its early form.

The workings themselves are named separately as Old Fly Delph with Fly Delph, Woodcock Delph, Nab Hill Delphs and Nab Hill which are all located on the extensive moorland escarpment and plateau of Nab Hill. At their height the workings would consist of around twelve separate delphs and it can be estimated around fifty to sixty men would be employed. Today the area is empty with only the ruins of the various farmsteads that made up the hamlet of Fly and its neighbouring settlements near Nab Hill. The disused workings are quarried on an intermittent basis, often only on a small scale.

The delphs exploited the Flags of the Rough Rock series of the Millstone Grit and the identified remains are typical of early forms of extraction. They therefore can be considered to be of considerable significance.

1. BACKGROUND TO THE PROJECT

Introduction

In November 2011 CE Mace was commissioned by the Watershed Landscapes initiative to undertake an assessment of the old quarry workings on Nab Hill, Oxenhope (NGR SE 034 325). The project arose following discussions held with the Community Archaeologist of Watershed Landscapes, Gavin Edwards, about the nature of the workings and their significance.

The aim of the project was to provide an historical and geological background to the site helping explain the nature of the remains through an analysis of ownership, tenancy, organisation and extraction methods relating to their working. It was deemed important to investigate the whole area including the homesteads, the homes of owners and workers alike. In order to help analyse the landscape documentary research would collate the existing information for the context of the workings. A walkover survey would then plot the prominent features of the site with a view to informing a future more detailed landscape survey.

Site Location and Background Information

The study area lies on the watershed of the rivers Aire and Calder in West Yorkshire and on the boundary of the present Metropolitan areas of Bradford and Calderdale at an elevation of 340m AOD (See map 1). The present unclassified road that bisects the area was once the packhorse route between Haworth and Halifax.

Locally the area of formerly enclosed land to the west of the escarpment of Nab Hill is known as the Fly. The area is often simply known as 'on t'Nab' or 'on t'Fly' in the vernacular and the terms are often interchangeable. Although divided by the ancient boundary between the hamlet of Far Oxenhope in Haworth Township and Warley Township, the scattered homesteads seem always to have been considered as one hamlet, particularly by the inhabitants who were often related. The present boundary also follows the old manorial division between the Greaveship of Sowerby, belonging to the Manor of Wakefield, in the south and the Manor of Oxenhope in the north. The area now consists of a series of long-abandoned ruined farmhouses bounded to the east by Nab Hill and its scattered disused quarry workings.

A quarry was present on Warley Moor in 1709 but most of the quarries date from a period of expansion from the 1840s to the decline of quarrying in the area around 1900. Quarrying was carried out on an intermittent basis several times during the 20th century. The quarries exploited the flagrock present in the escarpment edge and on the plateau beyond for building stone. The workings that lie in the Bradford part of the site were featured in a study produced for Bradford Council in the 1990s (Waters et al 1996). The whole area was then assessed in English Heritage's Monument Protection Programme Step 3 for the Stone Quarrying industries (LUAU 1999). A site survey report for the latter informed the Historic Environment Record (HER) for the site held at West Yorkshire Archaeological Services (WYAS) in Wakefield (see Primary Record Number 7020 and 7021). This report gives the site an 'R' rating, of regional rather than national importance, therefore it is not eligible for statutory protection. Although the author of the report felt there was scope for a topographical survey and historical research could enhance understanding of the quarries. This report will provide that background. Several local authors have included some discussion of the

workings in their publications (see Hindley 2004, chapter 5 and Wood 2005, chapter 3). Throughout the report the terms quarry and delph are freely interchanged as titles given to the areas of stone-working, this appears always to have been the case. Although Hindley rightly points out that delf is the correct local spelling and not delph which came into general use in the 19th century (Hindley 2006, 114).

Aims of the Project

- To describe the local geology and to identify the type of stone quarried on the site also to relate this to the surrounding geology and the different types of sandstone in the Pennine regions. Also to consider the relationship between the underlying bedrock and the construction of large drinking water reservoirs.

- To provide a brief descriptive history of sandstone quarrying in Yorkshire.

- To relate the development of quarrying techniques and processes and how they affected the extraction of different rock types and the resulting types of quarries.

- To account for the historical development of the area by considering land ownership, manorial rights, settlement patterns and economic and social issues relating to early stone extraction and the role of "dual economy" in farming and working marginal areas of the moors.

- To investigate the existence of a "village" in the area as considered by archaeological assessments and assess the significance of the numbers of workers often quoted as employed and the scale of exploitation of the workings at their height.

- To use this information alongside documentary evidence for the level of consumption locally and regionally to consider further their significance.

- To describe the development of the water provision schemes, in a brief history of the development of the water industry, to test the theory that the construction of the reservoirs was the major impetus of the workings "boom" and that their completion marked the end of useful life of the quarries.

- To consider the workings' remote geographical position and poor communications and the effect of this on the logistics of the export of bulk materials out of the area.

- To explore other social and economic issues that might explain the end of quarrying in the study area on a relatively large scale and also the decline of the stone industry itself.

Assessment Methodology

In order to understand the complex nature of a quarried landscape it was decided that the bulk of the present report would comprise documentary and cartographic research after an initial consideration of geological factors. Historic maps were felt the best way to record the evidence lost by later working. Oral history was able to relate features once lost to tipping but found at the time of the later working and this information was recorded. Analysis of a walkover survey would then be utilised to enhance further the understanding of the area

Documentary research

The research focused mainly on 19th century material held in local record offices and local libraries. Much use was made of estate records, trade directories, tithe maps and awards and early Ordnance Survey maps. Local government records of the time proved invaluable as did detail from census returns to build up a picture of local land ownership and occupancy of the workings themselves. Material from the National Monuments Record (NMR) was consulted as was information from West Yorkshire's Historic Environment Record (HER).

Earthworks Survey

As a detailed survey of the existing workings would be carried out later, the primary aim was to record the main features of the small delphs, or quarries, it was felt could be identified as remaining from the main phase of extraction. Following analysis of documentary evidence the study area was divided into separate parcels of land determined by ownership and tenancy (see aerial photograph). The main area of survey comprised the northern and eastern parcels of the plateau which both feature building remains, retaining walls, trackways and small working faces. The central and southern quarries have been worked extensively more recently and much of the evidence lost. The earthworks were recorded on an Ordnance Survey 1:2500 scale map base.

Written Accounts

Descriptive records were created for each parcel including location, plan, form, function, possible date and phases of subsequent development. This allowed the initial assessment of the significance of identified features.

Photography

The walkover survey, and hence the photographic survey, were carried out in far from ideal conditions. Snow lay on the ground and light was poor but some attempt was made to photograph the main extant features. It is intended that the photographic record will be substantially revised at a later date.

Project Archive

A written and fully illustrated copy of the report will be archived with Watershed Landscapes consisting of Volume 1, text and Volume 2, illustrations. The Report will also be presented in digital format on a CD.

2. GEOLOGICAL AND HISTORICAL BACKGROUND

Geology

The study area of Nab Hill lies high on the great arc of high ground that forms the watershed of the Aire and Calder valleys in the South Pennines. The area comprises "moors and rough pastures…the characteristic scenery of the Millstone Grit country [with]….bold escarpments, long dip-slopes and tabular hilltops [that] alternate with hollows or 'slacks' eroded along the outcrops of the shale beds" (Stephens et al 1953,1). The escarpments are often where the sandstone of the underlying bedrock outcrops. This bedrock of the South Pennines is formed by the rocks of the Upper Carboniferous era, the Westphalian Pennine Coal Measures and the Namurian Millstone Grit Groups. The Millstone Grit is formed of strata of different grits separated by a series of shales and mudstones (see map 2 reduced from BGS 1st edition 1878, sheet Yorks. 215). The grit series is shown in green and the shales in grey.

Each of these grits, often with an accompanying base of flagrock, has slightly different properties and is suitable for different uses. The youngest of these Millstone Grits are the Rough Rock and the Rough Rock Flags and it these strata that form the Nab Hill escarpment and plateau. The coarse Rough Rock lies further to the east on the plateau leaving the Flags accessible near the escarpment.

The geological structure of the area also lends itself to water-provision schemes, both for industrial use and as a source of clean drinking water. The "soft water yielded by the Millstone Grit areas was of the utmost value in scouring and other washing processes connected with the treatment of wool" (Stephens et al 1953, 2). As the woollen industry expanded demand for water would surge. The rapid expansion of the industrial centres of the West Riding led to a call for improved water supplies by the 1840s. Large surface water catchments schemes were to be built to utilise the many streams flowing both to the north and to the south of the watershed in the study area. These streams rose where the Rough Rock Flags met the underlying shale beds.

Historical Development of Nab Hill and Fly Hamlet.

Fly Hamlet in Warley Township

The study area is an isolated upland area consisting of marginal lands on the edge of moorland that was often referred to as 'wastes' in the past. Some of the waste was enclosed to create new farmsteads. This process began particularly early in Upper Calderdale as suggested by Jennings in his edited work with local history groups in 1992 (Jennings 1992). In the later 15th century, around a hundred years after the plague, recovering population levels began to exert pressure on the existing cultivated land on the valley terraces. There were large tracts of common land, or waste, higher on the moorland edge considered too poor to support mixed farming of pasture and arable. Jennings' group thus concluded "it is not surprising that in the later 15th century the local people should begin to see the advantages of the loom over the plough, of developing textiles from a sideline into an activity which balanced the farming side of the household economy" (Jennings 1992, 46). This adoption of a "dual economy" of domestic textile production and the farming of small holdings allowed the 'small-scale farmer-weaver' to settle the bleak higher ground throughout Upper Calderdale including Warley. Hanson commenting on early textile production in the area noted

there were “no large farms, but most of the clothiers….grew their own corn and kept a few cows” (Hanson 1968, 207). Jennings further noted that “in the years 1500-1503 contractors took in 258 acres in Warley Township….and broke it up into small lots for resale or sub-letting” (Jennings 1992). This included land up to Cold Edge just below the future hamlet of Fly that would develop from the farmstead of Cold Knowle on Warley Moor.

No documentary evidence was found to say conclusively that Knowle was settled as early as this but certainly by a survey of the area for Wakefield Manor in 1624 Henry Walker was renting “a messuage in the Deanhed and a cottage called Knowle (Kendall 1932, 29-68). It has also been suggested that 17th century buildings often replaced earlier ones on the same site (John Patchett *pers. comm.*). The last re- building of Knowle came in 1707 with the construction of a farmstead and associated buildings (WYAS Calderdale, CAC: 23). By 1763 another farm had been built just to the north of Knowle and alongside the Haworth to Halifax road. Fly Brass Laith was already in the occupancy of James Brearley when a draft lease for 21 years was prepared in that year. This homestead was included in a valuation of Warley Township in 1805 along with Knowle when both were occupied by Richard Bates (WYAS Calderdale, HFX: 675). It appears from the accompanying map that another farm at Far New Fly had already been built near the Oxenhope boundary. A conveyance of June 1808 notes that Cold Knowle and Fly had been separate but were now considered one complex when they were purchased by Rawdon Briggs a Halifax banker (WYAS Calderdale, CAC :23/22). They passed to Rawdon Briggs junior in December 1832 (WYAS Calderdale, CAC: 23/23). Further subdivision occurred when another farm was built in the isolated pocket of enclosed land high on Warley Moor, possibly at this date. This was Near New Fly, built to the north of Knowle Farm.

Thus by the rather late Parliamentary Enclosure of Warley Township begun in 1849 the Fly hamlet on the Halifax side consisted of 4 farmsteads strung out along the road and on the spring line formed where the gritstone meets the shales beneath . Map 3 shows the area in 1847. Reduced from the 1st edition OS map of the 6” to the mile series surveyed in 1847-9 but published in 1852.

It should be noted that at this time the wastes still belonged to the Lord of the Manor of Wakefield. The existing quarries at Fly lay on the unenclosed moorland to the east of the road and were being worked by tenants of the Lord. Although the quarries were sold in 1849 the matter would not be finalised until the Enclosure award of 1857. One item includes “compensation for stone quarries – that the valuer shall pay to the said Lord the said sum of £300 in lieu of and in full compensation for his present working stone quarries or delves” (WYAS Calderdale, WYC: 1363)

Nab Hill, Oxenhope Moor

On the Oxenhope side Hindley notes “the combination of farming with the cloth trade was normal by the 1600s” (Hindley 2004, 39). It has been suggested that the production of textiles spread north from the Calderdale area, possibly by the migration of families. The woollen pieces, or kerseys, produced would have been taken to Halifax Market thus indicating early use of the route alongside Nab Hill and along Fly. Hindley also states that “most of Oxenhope’s area was being farmed by 1700, excluding only the accretions added by the 1771-9 enclosure” (Hindley 2004, 43). The already

enclosed land included the 'finger' of improved land extending along the Halifax road to Nab Water. These intakes belonged to Nab Farm.

Detailed work on the history of Oxenhope has been carried out by Hindley and published in two works. See *Oxenhope: The making of a Pennine Community* (2004) and *Exploring Oxenhope: Where to go and what to see* (2006). Chapter 2 of his 2004 publication covers in detail the 'Great Enclosure of 1771-1779'. In this Parliamentary Enclosure much of the waste of Oxenhope Moor was taken in and allotted to existing freeholders. The whole of Nab Hill was divided among several landowners forming the parcels of land that would later dictate ownership and tenancy of the quarries. In listing changes in settlement following the Enclosure Hindley suggests a new farm was established further along the road to Halifax just before the Township boundary (Hindley 2004, 53). Deeds held at Calderdale Archives show that freeholders who had been allotted land on the wastes on and alongside Nab Hill sold some of their land to build the new farmstead, Woodcock Hall, to Thomas Woodcock of Leyland in Lancashire in 1777 (WYAS Calderdale, CAC: 38).

As stated above Hindley has recognised the emergence of a "dual economy" by the 1600s. He also suggests "wool came to be more profitable than farming… and facilitated the subdivision of farms among the children" (Hindley 2004, 39). The owner of Nab, James Ratcliffe, built a new cottage attached to the farmstead in the 1820s, this was occupied by one son and his family in the 1841 census returns. Another building comprising two additional cottages would be built at Nab End alongside the road in the 1840s. Thus the settlement on Nab Hill consisted of Nab Farm and its cottages at Nab End, Nab Water Farm and Woodcock Hall by the 1840s when extensive quarrying began in the area (map 3). The properties, in both Townships, all had attached cottages which would be important to providing accommodation to the workforce that was about to rapidly expand. As already suggested the successful occupation of these isolated farmsteads relied on the practice of a "dual economy". Hindley cites earlier evidence that concluded the "transformation of Oxenhope from a domestic to a factory-based textile community" occurred between 1841 and 1861 (Hindley 2004, 92). With the decline of domestic textile production many young males of local families would find employment in the adjacent quarries as delvers or labourers.

The existence of available accommodation meant that no barrack-type buildings associated with the extractive industries in other isolated upland areas were required. The main period of exploitation would see purpose-built housing, in the form of cottages, this will be covered later, but they are shown on map 4 which shows the full extent of the hamlet in the 1870s. This is taken from a plan showing the properties of Castle Carr Estate and is based on an earlier map that shows the quarries at the time of survey in 1847.

With the passing of the Act of Enclosure in Oxenhope the joint Lords of the Manor had relinquished mineral rights in exchange for other allotments of land. Therefore the right to quarry the stone had passed to the owners of the allotments and their successors.

3. ARCHAEOLOGY OF STONE QUARRYING.

Whilst it is recognised that the extractive industries have been the subject of little detailed archaeological work some studies have been carried out. The granites of the south-west and the slates of North Wales and the Lake District are the subjects of several particularly good works on the stone industry. Sandstone quarrying in Shropshire (Scard 1995) and in Nidderdale (Blacker 1995) has been covered in some detail. Stanier's work of 2000 is a comprehensive, well-informed introduction to the subject of the archaeology of stone quarrying in general. The archaeological section of this report is based on the recommendations of approaches to recording suggested in Chapter 4.

Geology

Sandstone quarrying in West Yorkshire

In order to better understand the remains of Nab Hill a closer look at the geology of sandstones in West Yorkshire is required. Since the British Geological Survey (BGS) introduced its series of geological maps in the 1870s studies have refined our understanding of the make- up of the bedrock in the region (map 2). Much of the following brief consideration of the nature of the rock and its properties is taken from one of the more recent of those studies, that produced by Waters and others for Bradford Metropolitan Council in 1996. Chapter 7 of Volume 2 of the report deals specifically with the exploitation of mineral resources.

As stated previously the Carboniferous sandstones of West Yorkshire consist of the Coal Measures and the Millstone Grit series, which both have been traditionally quarried for building stone. This was to develop into a practice of some importance, "During the eighteenth and nineteenth centuries a very large industry developed exploiting the sandstones….for masonry, flagging and for roofing (Wood 2003).

Early quarries were often worked locally for individual houses, farm buildings and walls. Moorhouse has suggested that the exploitation of the sandstone for roofing, or 'thackstones', may have been quite widespread for a whole range of buildings from the fourteenth to the seventeenth centuries (Moorhouse 1990, 126). By the early 1600s houses themselves were being constructed in stone. These small quarries, or delphs, would take the stone from hillsides with little overburden and often take the gritstones of the upper beds. Individuals were allowed to take stone from wastes to build their own houses. Stone was also available for the repair of roads. With the inclosing of the wastes known deposits of stone would be set aside "for the use of the township and in some cases for the freeholders "(Walton 1938, 58).

As transportation links improved the cost of transporting was no longer as prohibitive and the use of stone began to spread. An English Heritage Research Transaction states that the improvements to transport would allow the expansion to meet regional and even national demands, particularly for flagging (Wood 2003). The composition of the Upper Coal Measures, found to the east and south-east of the study area, made them suitable for paving, in particular the famous 'Elland Flags'. These "comprise fine- to very fine-grained sandstone with the best quality stone having well developed planar bedding, which allows parting by hand", or 'riving' (Waters et al 1996, 38). The durability of

the flags has led to their use in many large cities, particularly London, for paving. Thicker beds, or 'ashlar,' exist in the measures and were used for door and window dressings and copings.

The Millstone Grit series consists of a number of separate grits divided by beds of shale or mudstones. In general the north of the area towards Skipton consists of older, lower grits. The most commonly quarried grits towards the study area begin with the Kinderscoutian Sandstone found above Eastburn, where it was extracted for pulpstones, and some of the Haworth quarries. This stone was also used for general building stone and setts. One of the most widely used Millstone Grits was the Woodhouse. This "comprises a coarse-grained, massive or cross-bedded sandstone underlain by the Woodhouse Grit Flags, which consists of fine to medium-grained, flaggy or cross-bedded sandstone" (Waters et al 1996, 37). This was used for building-stone, ashlar and some flagstone and forms the moors around Haworth and Oxenhope.

Nab Hill

The highest and youngest of the Grit group consists of the Rough Rock, "a massive, current-bedded gritstone, often pebbly…It ranges in thickness from 50 to 100 ft." (Stephens et al. 1953, 62). The top beds of the lower Rough Rock Flags can locally be of gritstone. More generally they consist of "fine- to medium-grained, flaggy or cross-bedded sandstone" (Waters et al 1996, 27). This stone has been quarried extensively for walling and flagstone including large landings. In one of the first reports for the area by the British Geological Survey in 1879 the rock of the study area was specifically mentioned, "first the Rough Rock….secondly…a very variable basement-bed to the last, consisting when well developed of valuable flagstone. These are extensively quarried at Nab, above Oxenhope Moor" (Dakyns et al. 1879, 6). It is of interest to note that the BGS publication of 1953 states that the lower flags were mined through the Rough Rock at Gilstead near Bingley as physical and cartographic evidence suggests this occurred at Nab Hill. This would be unusual in the grits although the technique was widely used in the Elland Flags (see Godwin 1985).

It is possible the thinner beds were used to produce roofing slates. Walton (1938, 39) observes that the Rough Rock Flags were used for roofing in Halifax and Huddersfield. Lower beds, or 'lifts,' of the thicker, cross-bedded ashlar rock were also extracted, "Where [the sandstone] bedding is widely separated and the…bed free from fractures and discontinuities, it may be suitable for the production of block stone" (Waters et al 1995, 26).

Function

As suggested above the quarries were worked for building stone, rubble, particularly for the many miles of stone fences required for parliamentary enclosures and roofing stone. The quarries on Nab Hill were conveniently placed to produce large quantities of all types of masonry needed for the extensive water-provision schemes at Fly Flats (Warley Moor) and Thornton Moor.

Site

The earlier quarries were situated at the edge of the escarpment and were of a hillside type, later they extend further into the plateau.

Form or type

The earlier working of the quarries at the south end of Area 1 and in Areas 3 and 4 would have allowed considerable depths of working to be reached. These could have reached some 10m in depth because little overburden would need to be removed. They could have extracted lower beds of ashlar of some thickness.

The workings at the north end of Area 1, Area 2 and the eastern part of Area 3 were located further back on the plateau. They consist of small, shallow quarries with faces of around 2 to 5m and there also are three shafts and an adit associated with underground working.

Quarry processes

There is much evidence of the removal of overburden, clearing a baring, with the presence of tips over all the study area where the waste was disposed of. Retaining or 'judd' walls would be built and the soil and waste stone stacked behind. More extensive overburden would be loaded onto carts and tipped in dumps fanning out from the moorland edge or filling the worked out earlier quarries. The processes of extraction of the flagstone would have included levering, wedging and boring and drilling for blasting with black powder, all with hand tools. Later dynamite, after drilling with pneumatic drills, was used. Lifting was done with hand cranes in some of the deeper holes. Steam cranes were briefly introduced in the 1930s and mechanised excavators used towards the end of the 20th century.

As an important consideration in understanding the shape and form of the remains on site is the process of quarrying the flagrock, a detailed analysis is required.

Drainage

The flags lie directly above the shales therefore the presence of water would always have been a problem in the delphs. The answer to this was to drive a drift, or sough, falling at a shallow angle under the road following the top of the shale to discharge in the fields. The drain at Fly was probably already in existence by 1849 when the Chaffer Brothers bought the delph. It is specifically mentioned in a lease of 1851. The Award for Enclosure of Warley Township was not prepared for several more years but then the existing tenants were to be paid compensation "for or in respect of any expences (sic) incurred by them in making drifts for draining the said quarries or delfs or in any other matter" (WYAS Calderdale WYC: 1363). The other work could include clearing overburden.

Clearing overburden or a 'baring'

The workable stone often lies below other deposits of peat, soil and 'rag', stone not geologically sound or poorly bedded. The time and expense of clearing a 'baring' could be avoided in early workings in the hillside but as quarrying spread overlying waste could become problematical. An agreement from 1903 for Woodcock Delph gives an idea of the work involved. As the last tenant had just cleared the overburden the new tenant agreed "to pay the landlord 12-0-0 for the bareing done" (WYAS Calderdale JM/591). The sum of £12 is considerable when one realises the tenant is only paying £10 per annum rent.

Extracting the flagrock

Leases from the period and their associated plans show the areas to be worked in blocks that would be staked on the ground (fig 4). Not all the beds of stone in the deposits were workable, any 'lifts' could be found to be poorly formed, or 'half-bred'. Dawson's lease of the 1870s (fig 4) shows the presence of a 'ruttle' a long narrow band of broken up stone that could extend some considerable distance. Whilst the uncertainty of the geology cannot possibly guarantee useful stone throughout the plot the plans are useful in explaining the way the rock would be 'got'. As mentioned below the stone was taken in 'the customary manner'. In the flagrock deposits the natural bedding facilitates the working of the stone in 'posts' these are natural areas of stone, on average 10-15 yards square, formed by seams or vertical joints. As each of these areas is worked the long, shallow features of a typical area of extracted flagstone are formed.

After the overburden had been removed over the leased area and dumped behind 'judd' retaining walls (fig 3a) another wall would then be built in front of and parallel with the proposed face to be worked (fig 3b). The peat having been removed and stacked to dry for fuel the subsoil and useless 'rag stone' would be removed and thrown behind the wall. The wall would then be raised as the waste above the flagrock was removed until the wall was level with the 'post' of flagrock to be worked (fig 3c). The tip behind the wall would then be levelled to form the working area or 'delf hill'. Fig 3d shows a modern flagrock 'post' being worked.

The natural horizontal bedding planes of the stone allowed the lifting of individual sheets with wedges and bars. The bedding would also allow thicker lumps of either flagrock or ashlar to be barred across onto the delf hill to be either split or 'riven' as flags or cut with wedges. When hand cranes were introduced they would be erected on the 'delf hill' where they could lift larger lumps and swing them off the 'post'. (See fig 3e, part of a photo of Meadow Head Quarry, Sheffield (BGS) in Stanier (2000, 35) and also fig 3f). Depending on the variable bedding of the Rough Rock Flags the thinner bedded stone could be split for grey slates. As described above the rock consists of flaggy or cross-bedded stone, the thicker stone would be worked the same and then cut into workable sizes with wedges.

One interesting feature of the extraction of the flagrock in the quarries is the use of mining to reach the better-quality flagstones or grey slates. This process was widespread in the Coal Measures. There shafts could sunk to a depth of around 150 feet from where a series of drifts would fan out following the better seams. (See Godwin 1984 and Walton 1975) Wood states that the shafts on Nab Hill "were almost certainly on a smaller scale - the shafts, when open thirty years ago, were found to be only about 10 or 15 feet in depth (Wood 2005, 35). This would make sense as the shafts

would probably have been sunk to avoid clearing excessive overburden in the Coal Measures. On Nab Hill the shafts seem to have been sunk after the extraction of easier worked flagrocks near the surface. The shafts (fig 3p) could then be used to reach the better quality stone through particularly 'tight' rock. The presence of an adit (3q to 3s) driven under stone known to be almost unworkable to reach better flags in another area of the delphs would seem to add credence to this theory (R. Mace *pers. comm.*). Black powder could have been used to loosen particularly stubborn rock. "Blasting with black powder (gunpowder) in bore holes was known in quarries from at least the eighteenth century, but only when necessary because of its expense and danger" (Stanier 2000, 25). This last statement being particularly poignant at the quarries as Turner relates the death of John Dawson in a blasting accident in 1864 (Turner 1913, 69). Stanier (2000) provides a comprehensive national view of working techniques, See Chapter 3).

Secondary processes within or near the quarry

Whilst some stone would have been used undressed, particularly broken stone for some of the reservoir work, the vast majority of the extracted stone would be processed on site. Wallstones for building would be dressed as would the flags and slates. The local term for the dressing of flagstone is 'fettling'. Larger pieces of worked masonry would be dressed on site but some of the larger blocks of ashlar would be 'scappled' or roughly squared with picks and transported from the site on stone carts to be further processed elsewhere.

Fig 3g shows a lump of flagrock being lifted with chains off the 'post' ready to be swung clear on to the 'delf hill'. In 3h the rock is being split to its natural bedding plane with 'nicker' chisels. Note the other essential tools of square, bar and delving hammer in fig 3j as the stone is lessened. In 3k the flag is being fettled or dressed. This could take place on the 'delf hill' or perhaps the sheets would be taken to a more sheltered area of the quarry and dressed in front of an open-fronted dressing shed. 'Common' flags of all sizes and thicknesses, depending on the bedding, would be produced. Better quality flags with 'tooled' margins and large landings or outhouse tops were also in demand.

No documentary evidence for the production of 'thackstones' or grey slate is available but the thinner beds would be very suitable. One of the Stanworth family, Emmanuel, is specifically referred to as a slater in the 1851 census return, but whether this means he worked on building roofs or produced slates is unclear. Walton's article of 1975 gives good coverage of the production or 'striking' of slates (Walton 1975, 45).

Stanier considers that 'plugs and feathers' were introduced to split the granites of the south-west around 1800 (Stanier 2000, 57). Before the introduction of pneumatic drills the holes required for the process would have to be hand-drilled, this laborious task could be worthwhile for these harder rocks. However it appears that the softer sandstones of Yorkshire continued to be split by wedges much later. Purchase's *Practical Masonry* gives a contemporary view. To use wedges meant "cutting a **V** chase on top and two sides of the block", this would be done with a 'holing' pick, "Sink wedge holes….to as fine a point as possible at the bottom" formed by a 'bottoming' pick. The blunt-pointed wedges "are now gently tapped with a heavy hammer [a maul], till all have got a hold; then harder blows are given in quick succession, and the fracture takes place" (Purchase 1900, 7). See figs 3l to 3n, note the fine-pointed 'bottoming' pick lying on the slab.

The natural bedding of the Rough Rock Flags with its variation of flags and ashlar beds allowed the production of a wide range of sought-after products. The ashlar could be reduced to form dressed walling, used to form kerbs or plinth courses or squared and tooled to make all forms of window and door dressings. This thicker-bedded stone would also be ideal for producing the thousands of yards of coping stones for the conduits of the water-catchment schemes.

Buildings

Dressing sheds would have been the most prolific buildings in the area. With the use of iron tools blacksmiths would have carried out essential work working in smithies. The exposed nature of Nab Hill would have necessitated shelters and on larger sites elsewhere explosives would have been stored in magazines. Whether or not the limited use of black powder needed for smaller scale extraction would have required a purpose-built building here is not known. Whilst many of the buildings in the area are farms with ancillary buildings associated with pastoral farming (see plates Nab End Cottage and Nab Water Farm), purpose built workers' housing was present in the study area. Despite the customary practice of subdivision a house, with possible cottage, built by the Ratcliffes in 1867 can be considered workers' housing (SE 033 323). The quarrying in Area 1 seems to be at its height and a considerable number of the family are involved. Earlier a lease for Fly Delph in Area 4 (WYAS Calderdale, CAC: 33/4) in 1851 stipulated the building of four cottages for the tenants and their workers. A house, occupied by one tenant, and three cottages were built near a spring just to the west of the road at SE 035 319. The house was to become a beerhouse for the quarrymen firstly known as Fly Beerhouse in the census of 1871 and later the Delver's Arms. The building of cottages by the owners, the stone merchants the Chaffer Brothers, could indicate considerable planned expansion of the site.

Transport

Throughout the main period of study horse power was important for all the workings. There appears to be no evidence for the use of sleds for transport to the roads. Whilst within the delphs light carts could be used, along with moving stone and waste with wheelbarrows, most of the stone leaving the delphs would be carried on heavy purpose-built stone carts. Fig 3u shows a contemporary engraving of a cart in a local delph loaded with ashlar kerbstones. Fig 3v is a photo of a cart carrying a large wedge-cut lump of ashlar through the streets of Keighley. There is evidence, both on historical maps and on the ground, of many trackways linking the delphs with the road. A plan of the 1880s shows a row of buildings with a possible loading quay alongside the Oxenhope-Halifax road. Access roads to the complicated series of delphs themselves meant that sometimes owners had to negotiate with other owners to construct new, or use existing roadways, across their property.

Infrastructure

The isolated quarries on Nab Hill could have connected to the transport routes in Calderdale much more efficiently if plans for an early tramway had been brought to fruition. As early as 1809 the owners of the Calder and Hebble Navigation were seeking a Parliamentary Bill "to authorize the making of rail roads from the said navigation to or near to any coal mines, or other mines or stone quarries" (*London Gazette* Issue number 16,293 p. 1387, accessed online 23.1.12). By 1824 the process had slowly evolved to the point where maps and a book of reference of land affected were drawn up (fig 3t). The plans included a branch from Warley village up the north boundary of Brass Fly to access Fly Delph and Old Fly Delph referred to as Cold Edge Quarries. Another branch connected to the wharf at Salterhebble (WYAS Wakefield QE20/1/1824/1).

It appears nothing came of the tramway and transport of the stone would continue down Cold Edge Road and down towards Halifax. Such was the damage caused by the heavy stone carts and such was the danger of fully laden carts sliding off the causeway that tracks of parallel sets of flagstones and an iron trackway with flanges were constructed along the road. From the Fly and Nab Hill stone could be transported to both the canal and railway in Calderdale. The closest station was at Luddenden Foot. The Leeds to Manchester Railway opened the station there on 5th October, 1840. Wharfs for the Calder and Hebble Navigation were located at Sowerby Bridge, linked to Wakefield and the East, and other wharfs were constructed along the Rochdale Canal linking to Manchester and along further connections to Liverpool. Much stone would be used locally in Halifax though regional links have been established and will be discussed below.

The road to Oxenhope allowed access to the railway from 1867. There is cartographic and documentary evidence of the existence of a hand crane at Oxenhope station for the loading of railway wagons. One partnership in particular included stoneworkers in Keighley another growing local market. It is difficult at present to identify the people who were responsible for transporting, or 'leading', the stone from the delphs. One delver, James Stanworth, has two lodgers living in his household a waggoner and a carter in 1851. At this time he is employing 15 men so perhaps a relatively large concern warrants the employment of specialists. It may have been more normal for farmers to lead the stone on a part-time or seasonal basis and one farmer just south of the study area at Upper Withens describes himself as farmer and carter, also in 1851. A brief consideration of the Minutes of Haworth Local Board at Keighley Library Local Studies shows a large proportion of the carters leading stone to the village identified themselves as farmers in census returns.

4. HISTORIC DEVELOPMENT OF LOCAL QUARRYING.

Early organisation

With little research done on quarrying in the district resort is often made to a mid-20th century account to explain the early stone industry. Walton explains " landowners employed labourers to quarry the stone on their land…this ultimately developed into the 'master-taker' system whereby a landowner let out the getting of the stone to a 'master-taker', who undertook to get the stone for a stipulated sum.' (Walton 1938, 43). Locally known as 'getters' these were still important well into the 19th century. Getters, or half-getters seemingly depending on the area of the quarry leased, developed into merchants employing delvers to work the stone. These early entrepreneurs may well have developed trading links with traders in neighbouring regions and leased wharfs on nearby canals. Walton also notes that the masters were often landlords of village pubs (Walton 1938, 44). Many of the enterprises involved were short-term partnerships. This could be a by-product of the short- term leases available, some of which were for just one year. The nature of tenancy may itself reflect the nature of early working, delving was often a seasonal occupation linked with agricultural and textile working or a source of alternative income in trade slumps. Longer term and renewable leases will have been taken out by 'masters', the full-time delvers needing the security of agreements to fulfil longer term trade commitments to larger scale construction in the burgeoning towns.

Leases

Whilst the agreements between some delvers and landowners may have been of a casual nature, those involved with established stone merchants or estates were formalised with the drawing up of leases. One in particular, between the Chaffer Brothers, owners of Fly quarries in the 1850s, and William Stanworth and John Wormald, delvers and merchants, has survived and allows analysis of terms (WYAS Calderdale CAC: 33/4).

The lease deals with the area of moorland "now staked and marked out" and delineated on an accompanying sketch map. The tenants are expected to "follow continue and persue (sic) the present face and to drive in the direction it is now going". As well as working in the customary manner they are also responsible for draining the workings and are instructed "to carry on the present drift or sough for loosing the water". This is an important 5 years lease and they are allowed to "erect cranes or any other apparatus necessary for the working" but as the owners are important merchants in their own right in this instance other terms are included. Stanworth and Wormald "shall and will furnish and supply….as many landings and flags [as the Chaffers] from time to time require". Prices for the set amounts are quoted as is the price for any additional orders and the stone is "to be delivered either at the railway station at Luddenden Foot…or at the canal wharf of the Aire and Calder Navigation". White's Trade Directory of 1853 includes the entry of Stangworth(sic) and Wormald as Stone Merchants at Luddenden Foot.

The Players

As mentioned above the position of stone quarrying in the local and regional economies is a complex one. This section considers the different type of people involved in the exploitation of the stone in the study area, for the size of the area the range seems quite remarkable. Important issues of gender and kinship are introduced along with the role of quarrying in the farming of marginal, upland areas with the decline of the important domestic textile trade.

The Stanworths – The end of Manorial Control in Area 4

The first mention of quarrying in the area is 1709, according to the Wakefield Manor Book of that year there is "a quarie or stone delf on Warley Moor farm'd by John Gawkeroger at the will of the Lord under the yearly rent of 0.13.4" (Charlesworth 1939, 183). Much more work is needed on the records of the Lords of the Manor of Wakefield, the Dukes of Leeds (1700-1838) and Sackville Walter Lane-Fox (1838-1853) to ascertain whether or not this refers to a quarry at Fly. What we can be sure of is the fact the Stanworth family were tenants leasing from Lane-Fox in the late 1830s. The Stanworths are an important family to the whole of the study area. They arrive as delvers by late 1830s from the considerable delving community at Extwistle near Burnley. Just what their relationship to the Manor or to the important stone merchants the Chaffers is requires more detailed work. By the 1841 census the two older brothers, James and William, are working the Fly Delph as tenants of the Lord and living in two households at Old Fly each with a delver as lodger. All three brothers, including the younger John, had been in partnership until 1840. John lived in the cottage at Nab Water and was quarrying as a tenant of the Ratcliffes in Area 1 in 1841. In 1851 another relative, Emmanuel, is living in the cottage at Nab Water. The family are an established professional delving concern.

By 1851 James has moved to the quarries to the north-east of the area at Deep House and William has joined with John Wormald in partnership leasing the quarry at Fly.

The Wormalds – Established local merchants and questions of Gender – Area 1 and 4

John Wormald is named as a stone delver and merchant in 1851 employing 17 men. He is from an important local delving family established in the Mixenden area of Ovenden for several generations. It is not possible with available data to say all these men were all employed at Fly. Wormald moves over to the Cross Roads area near Haworth by the census of 1861, possibly after his lease with Stanworth ends. He begins to lease again in Area 1 in 1865 which may be due to the beginning of the reservoir at Fly. It appears when he dies that his widow Hannah continues his business as she is tenant in 1870. This seems to occur in the trade fairly often, John's mother Mary Wormald had done the same earlier. Again this brief consideration cannot begin to assess the interesting issues raised here.

The Ratcliffes - farmers to delvers- Area 1

In the census of 1841 James Ratcliffe is a farmer and woolcomber. Typically the rest of the household contribute to the concern with sons including combers and a weaver. It can be assumed that everybody would also help with seasonal agricultural work. It is interesting that although the delph higher on the Rough is already being quarried no trades are mentioned in connection with it amongst family members. By 1851 the commencement of larger scale exploitation is reflected within the households of the settlement. As the children marry two more cottages are built and one son-in-law is farming 8 acres there and quarrying. His wife has now begun work as a woolcomber as have her two sisters in the main house. Frederick the eldest son is now quarrying but the role of his next sibling James is vague. The youngest son John is an errand boy. Young boys were often employed carrying tools for sharpening to the smithy. But it is not possible to prove that was amongst his duties. The quarries are now expanding in 1848 four are being worked and bringing in almost £40 per annum in rent alone.

The 1861 census shows some of the daughters have married and left. The main house is now home to James, his wife Grace and three sons now all established delvers. Frederick the eldest son is a quarryman living in one of the cottages at Nab End with the other occupied by an employee. Although the family are only working one of quarries, the 1871 census indicates how important quarrying has become. Some six family members are stone workers and four other workers are living in housing belonging to the farm. Younger female family members are shown to be still working in textiles but now probably in the mills of Oxenhope.

Pubs and Merchants – Areas 1 and 3

Walton has previously been cited referring to the early links between masters employing delvers whilst running the local pubs. There are several examples amongst the quarry tenants to illustrate the late practice of local pub owners having several occupations including operating as stone merchants. Analysis of local trade directories will reveal this to be quite common. John Beverley is the landlord of the Cross Roads in Wainstalls but is also a tenant of the first quarry opened by the Castle Carr Estate at Woodcock in 1847. On his death he is followed by his widow Susannah who continues as stone merchant, grocer and beerseller as her son Daniel works the quarry. She remains in the trade directories till 1881. The quarry was leased until at least 1879. This is another interesting example of a widow carrying on trading in the stone industry.

The Sunderland Brothers illustrate the important ties of kinship with sons following the local traditions of working together. Already young delvers in the census of 1841 they are amongst the first tenants of the Ratcliffes in Area 1 in 1847. They continue as quarrymen employing four men in the census of 1851 despite the fact that there father has died and their mother is farming the smallholding just south of Fly. As the farm is only 8 acres a secondary income would be essential. The brothers continue in the trade leasing various quarries on Nab Hill for around forty years. Sampson is publican and stone merchant at the New Delight down in Wainstalls in 1861 and is probably an important link in the local stone trade.

The Shackletons - Landowners and farmers – Area 2

The Shackletons are an example of a family exploiting minerals on their own isolated holdings. Known as part of the 'Great Enclosure', Area 2 is only intermittently leased for rough pasture in the period up to 1860. The allotment is a considerable distance from their family home at Hainworth Shaw near Ingrow, Keighley. However with the opening of the delphs in Area 1 the opportunity is taken to develop the land, possibly through the initiative of William Stanworth whose partnership with John Wormald seems to have lapsed. When first opened the quarries are leased by Stanworth and Shackleton in partnership with masons in Keighley. Then the Shackleton Brothers themselves develop into a delving concern and also lease other plots sometime after the first partnership is dissolved in 1859. Records are sparse but the brothers and other tenants appear to be working the quarries from 1865 which could indicate increased demand from the reservoir construction recently begun.

William Dawson - Woolcomber to merchant – Area 3

Area 3 is the piece of moorland attached to Woodcock Hall and belonging to the Castle Carr Estate. The farm was leased for life to John Dawson senior in 1785 and passes to his son John. The 1841 census shows the family to be a typical one for the area with their youngest son Willliam, a 10 year old woolcomber. His elder siblings and parents are all listed as stuff weavers. Next door in the attached cottage is a young couple who are also woolcombers, the girl is probably the Dawsons' eldest daughter. William Dawson is not at Woodcock Hall in the 1851 census. After his return from outside the area he opens a delph in 1852 at a time when William Stanworth is living in the attached cottage and perhaps has an influence on Dawson. From this date he is involved on the Hill for some forty years as a merchant until a dispute with the new owner of the estate in 1894. He considerably develops the quarries with at least two identified large workings. He also leases a further quarry from the Ratcliffes on the edge of Area 1. His developments include mining. Earlier leases would suggest the area in which he sank a shaft would be worked around the late 1850s. In 1861 his household includes a stone quarrier, Solomon Gream, from Elland an area of known stone mining. In 1841 Gream was on the census returns serving his apprenticeship in Southowram again an area of mining, could his expertise have been used here? If so perhaps he also showed Stanworth's men working adjacent in Area 2 how to sink their two shafts.

The Chaffers - Owners and Merchants – Area 4

The Chaffers are established merchants at Burnley. At the time of the enclosing of the wastes of Warley Township they buy the existing Fly Delph from the Commissioners and lease it to William Stanworth and John Wormald in 1851. The lease stipulates a minimum amount of stone the owners may wish to take and the prices they will pay. As mentioned above the Chaffers built a house and three cottages here and could have been planning considerable expansion. However they appear to be struggling to raise capital for their quarrying activities. Although Fly Delph and its adjacent land are only bought in 1849 the site is already mortgaged by the time of the lease in 1851. Financial difficulties in the late 1850s could lead to their decision to sell all their concerns at Fly in 1861.

Merchants and trade links - a detailed consideration of infrastructure

With the close proximity of large stone-built water-provision schemes of the 1860s and 1870s it would be tempting to simplify questions of demand and consumption of stone by stating the waterworks created a boom for the quarries. But it must be remembered that the various Acts of the mid-Victorian era related to Public Health also allowed other improvements. An Act for Liverpool in 1842 had allowed for the widening of streets, etc., whilst another of the same year created the city's Health Committee. A further Act of 1846 saw this Committee take over the responsibilities of the Liverpool and Toxteth's Paving and Sewage Board, efficient Local Government control of improvements would see the consumption of paving stone dramatically increase. The huge demand for stone for the provision of worker's housing in the industrial centres of northern England would also encourage landowners to open quarries in areas such as Nab Hill. The geology of the Rough Rock Flags proved ideal for extensive production of large landings, cellar tops and walling as well as paving flags.

Established merchants such as the Chaffers Brothers would have played an important in the regional networks of the stone trade in the early 1850s. The Chaffer Brothers, Thomas and Benjamin, who purchased Fly Delph in 1849, leased large quarries in the Burnley area just over the county boundary in Lancashire. The 1848 publication *A Topographical Dictionary of England* by S. Lewis describes their concerns in two settlements on the western slope of the Pennines. "At Cattover is an extensive quarry of fine grit, producing….flag and other stone….sent by canal, chiefly to Manchester and Liverpool". At Worsthorn "are some valuable flag and slate quarries….leased to Messrs Thomas and Benjamin Chaffer, who have large depots in Manchester and Liverpool: the stone obtained from them has been used in many public buildings both at home and in the colonies."

The lease for Fly Delph to the partnership of Stanworth and Wormald in 1851 clearly states that one option for the transport of the stone is to the Navigation in the Calder Valley. A recent study, *Manchester and the Canal Age Project 1750-1850,* aims to investigate the role of inland waterways in local and regional trade at the time. Between 1794 and 1804 the Rochdale Canal, beginning at Sowerby Bridge, was cut in a westerly direction "through an upland region rich in the raw materials required for Manchester's modernisation, especially stone and coal (Maw et al 2009, 21). By 1820 the Rochdale Canal Company was improving facilities for the handling of bulk materials in Manchester installing cranes "for the loading of flags, stone and timber" (ibid 23). The authors then consider the significance of the transport of stone along the canal.

"By the 1850s the Piccadilly Basin possessed nearly 10,000 yd^2 of wharf space for the stone trade alone…. The making and paving of [Manchester's] roads and streets and the flagging of the floors of its workers' houses generated a demand for considerable volumes of stone that provided employment in the quarries of Lancashire, Yorkshire and Derbyshire" (ibid 31). One carrier on the canal with wharf space in the basin was J and J Veevers, a company specialising in the carriage of stone. They were operating between Sowerby Bridge and Liverpool via the Manchester hubs of Piccadilly and Castlefields.

As the above project shows, much work on regional trade of the late 18th century and the 19th century remains to be done. One major part of this could concentrate on the infrastructure required within the stone trade to meet the exceptional growing demand for all types of stone products at the time.

5. RELATED WATERWORKS

Some initiatives for water supplies had already begun in the growing industrial centres of Victorian Britain before the growth of municipal authorities' provision around the middle of the 19th Century. Private water companies had built some small reservoirs on the edges of towns and some mill owners had cooperated to ensure constant sources of water power. But the later schemes were to alter for ever large tracts of the South Pennines. Some studies of water-provision in select areas of the Pennines have been carried out. See Robinson (1993) *Walls Across the Valley: The Building of the Howden and Derwent Dams.* Quayle (2005) *Manchester's Water: The Reservoirs in the Hills* and Bolt (2007) *A Walk in the Past. A History of Scar House, Angram and Gouthwaite Reservoirs in Nidderdale.*

Warley Moor (Fly Flats)

There were already several water schemes for Halifax including the Cold Edge Dams south of Warley Moor to provide water for the several mills downstream. The larger schemes for Halifax would affect the otherwise isolated and peaceful settlement of Fly as hundreds of migrant workers would descend and turn the area into a scene of industrious activity associated with large-scale labour-intensive Victorian engineering. The Halifax Improvement Act of 1853 indicates that the area to the west of the enclosed land of Fly would be purchased for the construction of Warley Moor reservoir built 1864-9 although Hindley suggests it would not be fully complete till 1878 (Hindley 2004, 166).

The Waterworks schemes intended to supply Halifax with a clean water supply have been dealt with in some detail. See an unpublished report by Harry Armitage entitled '*Dam it: The Building of Halifax Reservoirs 1830-1914'* a copy of which can be found in Halifax Reference Library (at 628.13 ARM). It is therefore intended for the purposes of this report to concentrate on the work at Fly in order to analyse the numbers of workers involved and consider how this relates to historic accounts of the scale of industrial activity in the study area.

Two schemes were planned for the north end of the Luddenden valley in the 1853 Act:-

"A reservoir on Warley Moor, at or near, and on the west side of Fly, in the township of Warley, in the said parish of Halifax."

"An aqueduct or conduit commencing on Midgley Moor, at or near Low Brown Knoll….and terminating at the said reservoir on Warley Moor"

A further Act, the Halifax Parks and Improvement Act 1858, altered the plans by envisaging a larger reservoir. John Frederic Bateman, the engineer chosen for the works, is now considered to be among the leading engineers of the Victorian era. For almost fifty years he was responsible for many important water provision schemes. In 1862 permission was to be granted for trial holes along the line of the proposed embankment and in 1863 tenders for the works were invited. The Salterhebble contractors Parkinson and Mann submitted bids for the two Luddenden Valley works, the Warley Moor Reservoir, Contract no 1, and Contract no 2 for the Midgley Moor conduit. Armitage states the

Contractors were probably very well known to the engineer Bateman as they had already worked together on large projects and they had become very competent at building the conduits required for gravitational systems (Armitage, WM.3). After the acceptance of the Parkinson and Mann bid (WYAS Calderdale, YW: 59), plans for the required land for the conduit on Midgley Moor were pursued and overtures made to the Lord of the Manor Mr Riley. Despite the passing of the Land Clauses Act in 1858 which facilitated the purchase of land required by Local Boards of Health negotiations were lengthy but eventually Riley accepted £733.3.0 for the strip of land in 1865 (WYAS Calderdale, YW: 269/1).

The scheme at Fly itself began in earnest in December 1863 when the Contractors were given permission to commence the access road (Armitage, WM.2). The chapter on Warley Moor in Armitage's account makes very interesting reading in particular when relating the accommodation requirements for the large workforce which included the purchase of a farm and the erection of temporary buildings upon it (ibid. WM.4). This could well be the Fly workers' village mentioned in site records although there is no evidence of a quarry worker's village. A Rates Valuation for Warley Township in 1865 (CMT 27/HXT:576) shows the Contractor John Parkinson as occupier of Old Fly, whether he actually lived there himself is doubtful, more likely the main house was occupied by the resident Engineer Smethirst. In the same section Armitage mentions that many workers were lodged with farms over a wide area. The fact that the way of life could also continue as normal is indicated with the occupation of the cottage at Old Fly by Thomas Butterworth the delver who lived there in 1861. Though perhaps the reservoir works allowed Butterworth to become independent as he appears as a new tenant of the Ratcliffes in Area 1 in 1864 and remains throughout the period of construction. It is noteworthy to mention Butterworth later was closely associated with the Aspinall Brothers, stone merchants and contractors in Mount Tabor just south of the area. The brothers had won the contract to build a tunnel between Castle Carr and Ramsden Wood in Ovenden, an integral part of the overall plans, perhaps Butterworth was specifically supplying stone for its construction.

Writing about the scale of quarrying in the study area Whiteley Turner in his *A Spring-time Saunter* gives an impression of hundreds of men and horses at the delphs. "What a hive of industry Fly was less than forty years ago! Even comparatively young people remember the time when fifteen quarries were in full swing in the neighbourhood, employing more than three hundred men and requiring between fifty and sixty horses" (Turner 1913, 69). The number of delphs probably includes those at Deep House on the eastern part of the plateau. In the four areas the figure twelve is probably correct but numbers of men are more difficult to assess. It is more likely these high figures refer to the workforce at the reservoir. As Armitage states "By September 1864, 220 men were employed on Warley Moor and it was hoped to increase this to 350" and by the time severe storms disrupted work in 1867 "there was poverty and hunger at Fly, there being over 400 men out of work" (Armitage, WM.4).

Apart from the purchase of Old Fly Farm properties on the Halifax side of the area would not be affected by the waterworks until well into the 20th century. Between 1929-32 land, farms and quarries were purchased for extensive re-conditioning to the reservoir and conduit. But farming to the north of the plateau was changed beyond recognition as farms above the new Thornton Moor conduit were purchased by Bradford Corporation. However how the quarries on Nab Hill were affected by the proposed Bradford works is debatable.

Thornton Moor

Again local historian Hindley has produced detailed work for his 2004 publication in considering the waterworks in Oxenhope. See chapter 7. A contemporary view was given by John Brigg in a talk given on the subject of *The Industrial Geology of Bradford* in 1873 to the Geological Section of the British Association. Speaking of the water supply he states "The principal clean-water supply for the manufacturing towns of Bradford, Halifax and Keighley is derived from the hills and moors of the Millstone Grit area….Bradford has fully availed itself of the natural advantages of its position by obtaining a splendid supply of the finest water from the grit hills to the north and west" (Brigg 1874, 6). Bradford's original plans had envisaged one reservoir to the north-west of the study area and a second at the foot of the Nab Hill escarpment in a similar geological position as Fly Reservoir on the shales below the Rough Rock Flags. However the actual works were to see Thornton Moor Reservoir constructed further east on top of the Rough Rock. This appears to be simply a question of height. The gravitational supply planned by the Engineer, again Bateman was employed, needed to be high enough to be above the highest parts of the city in the Thornton and Clayton areas. By building the Reservoir further to the east extensive water catchment schemes were envisaged.

A BGS publication of 1953 describes the works thus,

> "Two conduits along the northern flanks of Wadsworth and Oxenhope moors collect water from numerous streams flowing northwards into the River Aire. The higher conduit at about 1,250 ft. O.D., feeds into Thornton Moor Reservoir, which also possesses a small direct catchment of its own; the lower, at about 1,050ft., O.D, leads by a tunnel beneath Thornton Moor into Stubden Reservoir, Denholme …. Thornton Moor and Stubden Reservoir, with top water-levels of 1,241 and 1,028 ft. O.D. respectively, together form part of the high-level supply for Bradford" (Stephens et al 1953, 146).

The alteration of the plans may well have reduced the work for the Nab Hill quarries. Hindley suggests stone for the Reservoir probably came from Bradford Corporation's own quarry at Delph Hill adjacent to the site (Hindley 2004, 113). The quarries at Deep House on the east of the escarpment would also be more convenient. Considerable amounts of stone would however be needed for the two conduits, both some four miles long, but the western ends of the conduits could be supplied with stone from working quarries near Dike Nook on the turnpike to Hebden Bridge. The construction of good access trackways alongside the conduits would also facilitate movement of stone from the eastern end of Nab Hill. An examination of the central sections of the conduits themselves reveals they are extremely well-constructed and required a considerable amount of worked stone. Therefore it may well be possible to presume the the Nab Delphs were included in the work.

As with the Halifax waterworks schemes further considerable work would be required to identify which quarries fulfilled the demand created. Once the contract was won it appears the Contractors

were themselves responsible for the supply of stone of all types of masonry specified in the tenders (see WYAS Calderdale, YW: 59 for details of tenders for the Warley Moor works). This requires more analysis of their, often sparse, records.

6. IDENTIFIED SITES

This section deals with the archaeology of the individual sites. It includes brief historical notes and also an analysis of the phases of development. These are derived from maps 6-9 which show extracts of the 1st edition 6" series surveyed in 1847, shown in black, overlain by the 1st edition 25" series surveyed in 1892 shown in red. These are not to scale. Extant features are then discussed as identified in the walkover survey.

Area 1

Nab Hill and part of Nab Hill Delphs

History

The location of a quarry of unknown date included in the will of James Ratcliffe in 1830 (WYAS Calderdale SU: 271/1). This delph is worked in 1841-2 when leased to John Stanworth. It is then bought by James Jnr off his sister Rachel and more delphs opened later in the 1840s. One of the brothers builds several cottages further up the road to Halifax which may be attached to earlier quarry buildings, the new building is first assessed for rates in 1867 (SE 033 323). The subject of a legal dispute after Rachel's death they are eventually sold with the rest of the Nab Farm Estate to Bradford Corporation. See above reference.

Assessment

Area 1 is a considerable area of early workings on the north-east corner of the plateau. The early delph at SE 033 323 has long been backfilled. It was excavated straight from the road into the hillside with little overburden. Later the roadside plot was built on with a row of buildings that appear on a plan for the adjacent Woodcock Delph (WYAS Bradford 89D77). This was later the site of the above, previously unknown, house. A brief inspection has revealed extant cellar tops and one cellar of the dwelling. Another delph, one opened around 1846, centred SE 033 324 was considerably enlarged and driven in an easterly direction. This has now been lost to later working in the 1980s and 1990s. Workers at that time hit a bed of particularly tightly bedded stone and found below it an adit entrance (fig3q) where the 19th century delvers had worked the flagstone below. This was photographed by the workers (figs 3r and 3s). The delphs in the north of Area 1 were worked south from an extant access track at SE 034 327. The remains include many judd walls retaining considerable waste forming 'sunken' access tracks. There are good examples of judd walls and shallow working faces, consistent with extensive exploitation of flagstones, and the remains of several rubble built buildings (see survey photos Area 1). This is a considerable area of extraction that includes five separate delphs at its height. There are two peak periods that both coincide with reservoir construction. All five quarries are fully leased between from 1865-1870 when the reservoir at Fly is constructed and again in 1881 when the conduits for Thornton Moor are being built. However except for a period in the mid-1850s the quarries are always busy with several long-term tenants.

Area 2

Part of Nab Hill Delphs

History

Part of the 'Great Enclosure' and allotted to Grace Shackleton. It appears to stay in the family and plots are first leased in 1858. No workings are shown on the OS map of 1847-9. By the time of the first 25" edition, surveyed in 1892, there appear to be two separate areas of small delphs on the north edge of the plot but more major workings to the south against the Midgley township boundary (map 7).

Assessment

At present a small delph hole remains in the north part of the area, centred at SE 036 327, this contains similar features to those in Area 1. The location of the second small delph quite prominent on the historical mapping was unclear at the time the walkover survey carried out in wintry conditions. Further south and lying a considerable way back into the plateau is another complex area of the remains of early flagrock extraction centred at SE 037 324. Just to the south of this point there are the remains of a building and two old shaft heads (fig 3p) identified on OS mapping. In the last few decades these have been capped but they were vertical shafts sunk to exploit the flags underneath (see survey photos, Area 2). The main area of workings in the south of the plot is leased between 1858 and the mid-1870s and again by a new partnership in the 1880s. The smaller plot would appear to be only worked during the mid-1860s when the Warley Moor reservoir is under construction but records are not complete.

Area 3

Woodcock Delph

History

As stated earlier Woodcock Hall was built just after the enclosure by Thomas Woodcock and leased long term by the Dawson family. The delphs are first opened by the estate around 1846. It appears the delph was worked throughout the period from the mid-1840s to the early part of the 20th century. Analysis of a lease to Henry Briggs in 1903 (WYAS Calderdale, JM/591) identifies the plot as Woodcock Delph.

Assessment

Working in the late 20th century destroyed much of the earlier remains of Woodcock Delph, so any consideration of its features must rely on historic cartographic evidence. As the delph that was located at SE 033 323 alongside the road was referred to as the old quarry in the 1850s it can be presumed to be the first one leased in 1846. This was then worked east alongside the boundary with Area 1 to the north possibly under a later lease of the 1870s. The southern portion of the plot opened around 1852 is again worked east throughout the 1850s and 1860s. A shaft was sunk here around 1860 (see map 8). The central delph worked around the 1880s is clear on the map surveyed

in 1892. After the initial period of two tenants in the early 1850s the whole area appears to be leased by one tenant and remains working throughout the period

Area 4

Old Fly and Fly Delph

History

Part of an early enclosure attached to Knoll (1709), Fly Brass Laith appears in a draft lease in 1763 and appears on the Warley township map of 1805 as an isolated enclosed property. The wastes to the east and north-east of the property could be site of the early quarry of 1709. Little documentary evidence survives for the delph at Old Fly. The later Fly Delph, originally called Woodcock seems to be the first area of considerable extraction by the Stanworths as tenants of the Lord of the Manor in the 1830s. Purchased by the Chaffers in 1849 (WYAS Calderdale, CAC: 33/1) and leased to William Stanworth and John Wormald in 1851. The lease seems to indicate a considerable extension of the workings as clauses specify purpose-built cottages will be provided by the Chaffers. These appear to be constructed in 1851-2 for the use of one of the tenants William Stanworth. Later his main residence becomes a beer-house occupied by one of his former workers, Enoch Smith, after Stanworth's death in 1869. The site remains a working quarry throughout the period and it may well be that this quarry and Old Fly Delph are considered as one. After purchase by Halifax in 1929 it is reopened and stone exploited for the improvement of Warley Moor reservoir. Worked again in 1951-2 and 1971-86 the delph was altered beyond recognition. A site visit in late January 2012 showed the delph had once again been opened for small-scale extraction.

Assessment

The later working at Fly Delph was to destroy much of the earlier evidence. Despite this, oral evidence has allowed some recording of worked areas, associated with the extraction of flagrock, lying immediately to the east of the road at the later entrance to the workings at SE 035 319 (see map 9). Workers driving a new access road into the delph through a considerable depth of tipped waste in 1971 found a series of judd walls each separated by around 5m of waste. This indicates early working of flags 'in the customary manner' in what was probably the second phase of the delph after the earlier area just to the north. Documentary evidence exists for the presence of a drift to drain the early workings. Again workers were able to relate the location of a possible outlet to this in the area below the road at SE 034 322. An overgrown stone feature was found and recorded. A road shown on the map surveyed in 1892 in the north-east corner of the plot was the access road to Area 2 and was leased by the Shackletons from the Castle Carr Estate. The site of Old Fly Delph at SE 036 317 could contain good examples of flagrock extraction (see survey photos Area 4) but access is very difficult. The entrance has been filled and the delph lies behind new fencing along the roadside. The fields shown to the west of Old Fly at the bottom of map 9 are the possible site of temporary accommodation for the large reservoir workforce from 1865 to 1869. Further south at the remains of the stone flagged causeway still exist (SE 040 309). The sections seem to be less than were recorded in 1997 at the time of the MPP site visit. Photographical slides taken in the 1960s do record sections of the iron trackway (WYAS Bradford WYB468). Due to technical

difficulties they were unavailable for viewing at the time of the study. The first delph is worked at least from 1840 and probably throughout the period, possibly till 1913. There is then another delph leased during the 1860s and again around 1880, again this coincides with reservoir construction but the records are not complete.

7. CONCLUSION

As shown in Section 2 above the community of Nab Hill and Fly hamlet of the 1830s was a typical area of upland farming in the South Pennines. Successful occupation of the moorland edges was maintained by a mix of farming and domestic textile production. The progressive mechanisation of textile production would gradually make the hand processes, so important to local families, obsolete. For a period between 1840 and the 1880s the easily accessible flagrock of the escarpment of Nab Hill would allow several local families to maintain their isolated independence. The geology of the stone allowed for exploitation by hand processes and little capital was at first required. Therefore the extended Ratcliffe family at Nab Farm in Area 1 and the Shackletons in Area 2 were able to meet some of the demand for flagrock products created by the housing and paving schemes in nearby towns. Whether or not they could have continued to compete with other expanding and mechanising concerns located closer to the markets and the rapidly expanding railway network in the 1860s is doubtful. However the on-going water-provision schemes between 1864 and the early 1880s adjacent to the delphs meant they were kept busy and often fully leased. However, this was not to last. As Hindley summarises "the extinction of the domestic textile industry was fatal for the ancillary incomes which supported farming on the marginal uplands, and stone quarrying around Nab….did not suffice to counter to counter depopulating influences in the later 19th and earlier 20th centuries" (Hindley 2004, 156).

The established quarrying at both Fly Delphs in Area 4 was of a more professional nature and the Stanworths and their associates were an important influence in the area. These concerns were considerable and again they were well placed to meet the increased demands of the 1840s and 1850s despite their isolated position. William Dawson, the long-term occupier of Area 3, was also to take the opportunity of the easily-exploited stone deposits and become an established local merchant. Just how much the success of the Stanworths was due to their connections to the Chaffer Brothers and therefore a much-wider market requires more work. It has been mentioned above the Chaffers faced financial difficulties and this could have caused them to leave their holdings at Fly in 1861. Another explanation could be that Benjamin Chaffer, who was to continue alone in the enterprise and become very successful, had already decided the workings were just too isolated and therefore not suited to expansion. Certainly his other concerns above Burnley were to become fully mechanised and linked to the rail network with large sidings. The Stanworths were fully occupied during the 1860s at the height of the reservoir works at Fly but activity seems just to be maintained after the death of the original brothers, James and William, at the end of the decade. Whilst William junior remained busy right up till at least 1905 the business never became mechanised or expanded. It is out of these early delving families that the large, corporate stone quarrying concerns of the late 19th century emerged. However the introduction of steam power allowed larger-scale exploitation of quarries at lower altitudes, and therefore less affected by climate, and nearer the railways. The quarries nearer Halifax, particularly Northowram and Southowram, and closer to Keighley and Haworth were about to flourish. With the end of the waterworks and the migration of farming families to the mill villages the settlement at Fly and therefore the quarries declined. By the time Turner produced articles for the local paper in 1905 (published as a book in 1913) he commented "At present there are two small quarries, together employing five men" (Turner 1913, 69). One of these is William Stanworth who seemed happy to live out his life "fettling a tooathry slate-st'ns on th' delph-hill" (Turner 1913, 71).

Whilst the remains on Nab Hill identifiable with 19th century workings are now limited to Areas 1 and 2 they are of considerable importance. The extant features can clearly be shown to be associated with hand extraction of flagrock of the period. Many examples of this type of extraction will have been lost to subsequent working but the isolated nature of the delphs meant they remain as they were at the time they were abandoned. It can be also be shown that at certain times the stone from the area could have been supplied to other regions. More work on the history of stone quarrying in the area is required. The delphs were never worked out completely they just became uneconomical and the delvers could not compete with other more accessible quarries.

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