CHERT QUARRYING IN SWALEDALE AND ARKENGARTHDALE

by

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abridged by Alan Mills

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For over fifty years from the late Victorian period until the 1950s, chert quarrying provided much-needed employment in these two North Yorkshire dales following the decline and extinction of in the area. This paper describes what chert is, where it is found locally, what it was used for, when, how and by whom it was worked and what caused the demise of the industry in the early 1950s. The term "chert quarrying" is used because the workings in this area were described by their owners as chert quarries, e.g. Fremington Chert Quarries and Hungry Chert Quarries, and the workers called themselves "chert quarrymen" in spite of the fact that that most of the chert was quarried underground in levels, adits or tunnels, often in areas formerly worked by lead miners!

Chert is a crystalline rock consisting of very fine grains of quartz. Almost pure silica (SiO_2), it occurs as nodules or layers in sedimentary rocks, and in the Dales it is associated with limestones which are about 340 - 300 million years old. It is a hard rock; on the Moh's Hardness Scale from 1(talc) to 10 (diamond) it is classified at 7. Shiny or glossy in appearance, it varies in colour; underground in this area it can appear as blue, pink or creamy-brown but when exposed tends to weather to shades of grey.

PLATE I. *Chert block measuring 12" by 8" by 9" from Fremington Edge (possibly a rejected paver), now in the Swaledale Museum. (Author's photo).*

Flint is another variety of chert occurring in chalk rocks of the Late Cretaceous Period (ca. 91-65 million years ago). This much younger rock occurs, mainly as nodules, in chalk in other areas of the country. Flint also consists of almost pure silica, the relevance of which will be clear later.

The northern part of the Yorkshire Dales, including Swaledale and Arkengarthdale, is underlain by rocks of the Yoredale Series, originally deposited in Carboniferous times about 330 million years ago. The Yoredale sequence consists of repeating layers of sedimentary rocks, mainly limestone, sandstone (or grit) and shale (or plate) with some thin bands of coal. These rocks derived from sediments laid down in an area of warm sea close to the Equator, into which a large delta flowed. Sea level fluctuated over time so that when sea levels were higher the hard skeletons and shells of marine creatures were deposited and eventually compressed into limestone. When sea level was low, the sandy or muddy deltaic deposits laid down eventually formed sandstone (grits) or shale (plate), and when the sea retreated temporarily so that vegetation was able to grow, coal was the end result.

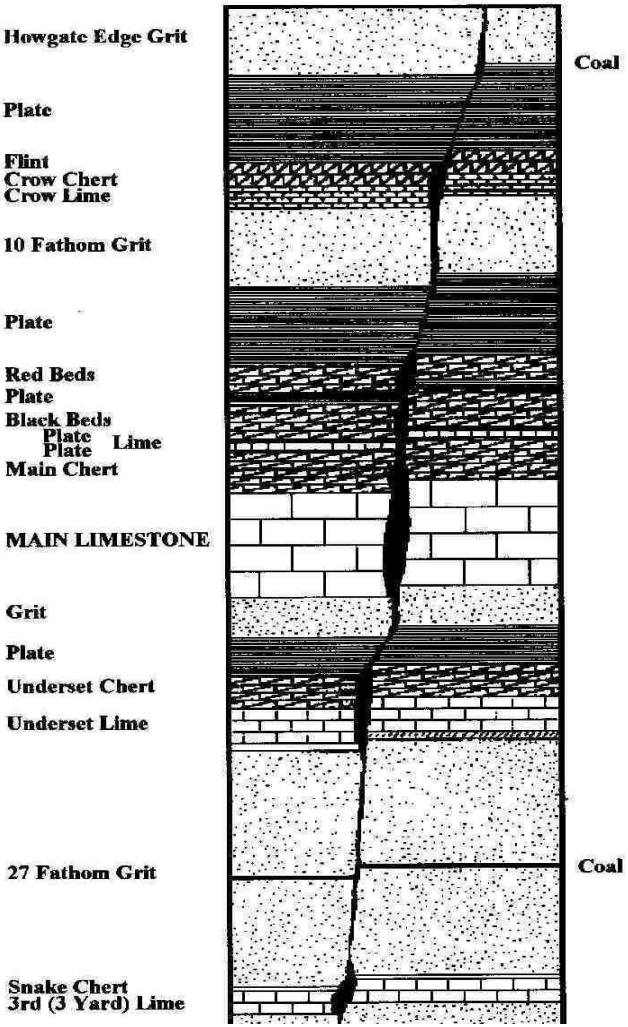

Fig.1. *Section through rocks of the Yoredale series of Carboniferous rocks in Swaledale and Arkengarthdale.*
*(*Mike Gill, 2004, *Swaledale, its Mines and Smelt Mills,* Landmark Publishing Ltd, p.9).

The above section shows how the chert layers are associated with the various layers of limestone. The oldest limestone in the section, the 3 Yard limestone, lies beneath the thin seam of the Snake Chert, the Underset limestone below the Underset Chert, the Main Limestone under the Main Chert and the Crow Limestone under the Crow Chert. It will be noticed that the strata are almost

horizontal, and thus convenient for quarrying, although there is general faulting, indicated by the jagged line at an angle through the strata with some displacement on either side of the faults; these fault lines were usually where metallic ores, including those of lead, were found.

Chert was probably the earliest mineral resource to be used in the Dales as its hardness made it useful for weapons and tools. Chert scraping tools and an arrowhead found on Reeth Low Moor by archaeologist Tim Laurie are displayed in the Swaledale Museum, Reeth. Flint was more highly prized for tool production by early man but the closest source for Swaledale and Arkengarthdale would have been the Yorkshire Wolds so chert was a local alternative. .

Fremont (Fremie) Hutchinson, the famous "last lead miner" of Swaledale and Arkengarthdale, maintained that some of the streets of Paris were paved in chert and it is believed that some London streets also used it. Chert paving was used for some railway platforms for durability.

The use of chert in the pottery industry was, however, what lead to the opening of chert quarries in the Swaledale area in the late nineteenth century. By 1772 Josiah Wedgwood of Stoke on Trent, trying to emulate fine oriental porcelain, had discovered that flint ground between chert stones produced a superior white base for china manufacture. Wedgwood's resultant china, called "Creamware", became very popular, and demand rocketed for both flint and chert. Wedgwood and later potters were initally supplied with chert from the Derbyshire Pennines or Flintshire, both relatively close, but demand was outstripping supply by the end of the nineteenth century.

To find out how chert was used in the Potteries it helps to visit Cheddleton Flint Mill, near Leek, Staffordshire. This mill, in operation until 1968, is preserved by a trust to show the processes used in many such mills in the past. The following photograph shows the two mill buildings at Cheddleton.

PLATE II. *Flint grinding mills, Cheddleton (photo by permission of the Trust).*

The two flint mills were water-powered until 1928 and the Trust's literature illustrates operations (see Fig. 2). Barges (2) on the Caldon canal (1) alongside the site brought in materials such as coal from the Staffordshire coalfield and flint pebbles, known as boulder flint, from the beaches of south and eastern England and northern France, or animal bones (for bone china). The coal and flint or bones was layered in flint kilns (6) and fired for several days at about 1000 degrees C, which made them more friable and thus easier to grind. This process, known as calcining, also had the desired effect of turning bone and flint white.

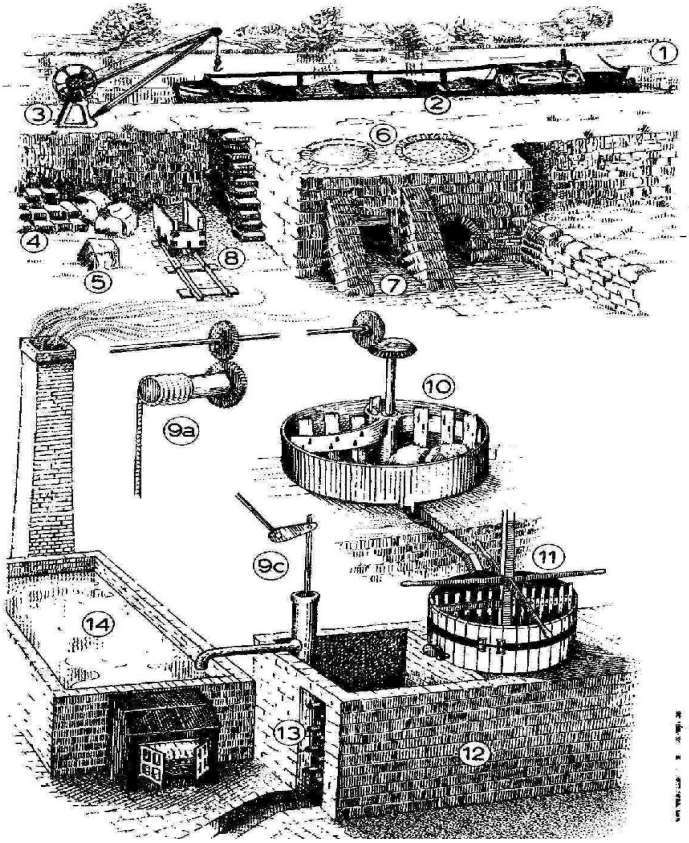

Fig. 2.. *Operations at Cheddleton Flint Mill taken from literature produced by the Cheddleton Flint Mill Industrial Heritage Trust, with permission.*

Chert blocks (3 & 4), brought in by canal or rail, were of two kinds, known as pavers and runners. The smaller ones, of the hardest chert, were pavers, cut to specific sizes, with the larger ones, runners, more crudely shaped. The calcined flint or bones taken from the kilns at (7) were taken to the grinding pan in the flint mill for the grinding process.

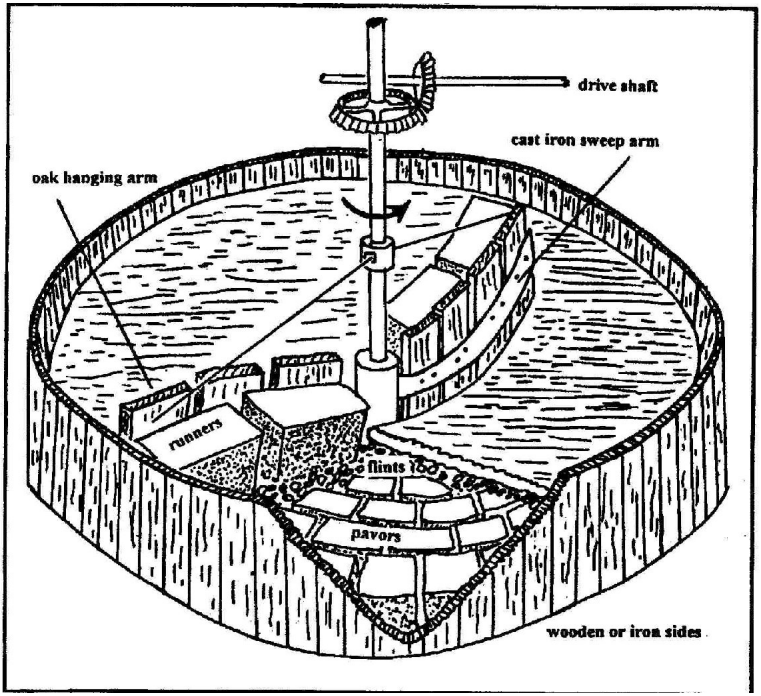

Fig. 3. *Chert grinding pan.*

This pan, shown in Fig. 3[i], had an iron base plate and outer edge and a paved floor consisting of blocks of chert known as pavers (or paviors). These had to be cut to critical thicknesses and rested on top of clay which formed a bed and watertight seal. The calcined flint or bone to be ground was loaded into the pan and water was added to reduce dust and thus the risk of silicosis. The sweep arms, usually four in number, were turned by the drive shaft powered by the water wheels and they pushed round the larger blocks of chert, known as runners, by means of the oak hanging arms attached to the sweep arms. The flint was crushed between the runners and the pavers and eventually ground down to powder, taking up to 24 hours. The resultant mix of flint powder and water was known as slop flint. This was then taken through various processes of checking and drying (11-13) before it was sent as powder to the pottery makers. Some flint mills had up to twenty pans operating but Cheddleton had only two.

This information seemed to provide a satisfactory explanation as to the function of the chert produced in Swaledale and Arkengarthdale and sent to the Potteries. The chert quarrymen all stated that they produced pavers to specific sizes as well as runners but they had different ideas as to what these blocks were used for. Walter Appleton was convinced that the chert ground itself instead of

grinding flint, Freddie Dodds said that it was ground for glazes and several local people claim to have pottery "made from" the chert produced in this area. Some confusion might have arisen from the fact that flint and chert were often referred to interchangeably in the Potteries. In order to clarify this, various organisations in the Potteries were approached and the following statement from the Stoke Potteries Museum seemed the clearest:

"Chert was used in the Potteries to grind ceramic materials such as calcined flint and bone. During the grinding process the chert wore away and the material was mixed with that being ground. As chert is chemically similar to flint there was no problem of contamination. So chert was ground and used in pottery making but only as a result of grinding other materials needed for pottery. Silica, which is mostly what chert is, is a major part of pottery bodies and the glass former of pottery glazes".

The three main sources of chert for the Potteries were Derbyshire, Flintshire and the Richmond area. Chert for flint mills needed high silica content, sufficient hardness not to erode too quickly, to remain rough while in use and be free of cracks and other defects. A comparison[ii] of percentage of silica content of the chert of the three main areas shows Derbyshire chert to be 82.53% silica, Flintshire 93.56% and Swaledale 95.69%. It would seem that Swaledale chert was serious competition in terms of silica content but distance from the Potteries was a limiting factor.

Coming back now to Swaledale and Arkengarthdale, the decline of lead mining in the latter half of the nineteenth century led to a dramatic decline in the population as the miners sought work elsewhere. Chert quarrying provided some alternative employment.

The precise date when chert production began is uncertain. The 1895 O.S. map shows no chert quarries in the area but by the time of the 1901 census there were three chert workers shown in Reeth and four in Booze in Arkengarthdale. Two characters were certainly involved from the start. The first was James William Close, born in Swaledale, a chartered accountant in Leeds and freehold owner of land and mineral rights in the Fremington/Marrick area[iii]. Fieldhouse and Jenning's "History of Richmond and Swaledale" states that in 1895 "his company was mining chert on Fremington Edge" although the source of this statement has not been found. However, by 1896, Close was proposing the construction of a Swaledale Light Railway to transport lead and chert to the Richmond railhead[iv].

The second person involved was John Thomas (Tom) Ward (see ***PLATE III***). He was the son of a lead miner who was listed as the Reeth postmaster , registrar of births, marriages and deaths and watchmaker(!) in the 1890 Reeth directory. John Hardy [v] called him "the last of the old prospectors" and claimed

that it was he who found the ample supplies of chert on Fremington Edge and presumably realised its value to the pottery industry.

PLATE III. *John Thomas (Tom) Ward, far right, and Edward Cherry, fourth from left, outside the Buck Hotel, Reeth, in 1925.* (*Swaledale Museum).*

In 1896 Tom Ward is credited with having sent samples of chert from Fremington Edge to Taylor and Company of Dieppe, potters merchants who seem to have supplied French boulder flint, and one of many companies he may have approached. In 1904 he was employed in some capacity, possibly foreman, at the Fremington Edge chert quarries as he was signing the chits for chert transport to Richmond Station (see Table 1). By 1905 he had results: two gentlemen arrived, W.S. Taylor from the potters' merchants in Dieppe, and John Shatwell Wagstaff, a potters' merchant from Stoke on Trent, who was described in the 1911 census as a "dealer in chert and flint"[vi]. The Boulder Flint Company, with whom Wagstaff must have been involved, was based in Glebe Street, Stoke-upon-Trent in an 1896 directory and it now took over the running of the chert quarry on Fremington Edge. The stages of the takeover, the signatories and details of the weight of chert produced is given in the table below covering 1904 - 1906.

Table 1. Chert Haulage from Fremington Yard to Richmond Station 1904-6

Date	Signatory	Weight of chert

Sept 1904	John Thomas Ward	52 tons
Feb 1905	John Thomas Ward	100 tons
Mar 1905	Mr Wagstaff	75 tons
June 1905	Mr Wagstaff	108 tons
Aug 1905	Boulder Flint Company	35 tons
Nov 1905	Boulder Flint Company	99 tons
May 1906	Boulder Flint Company	119 tons

Source: North Yorkshire County Record Office, Ref. ZLB/2/272.

John Shatwell Wagstaff set up home in Reeth, probably first at South View, and certainly later at Bridge House on Bridge Terrace. He had been a very active prospector for chert. Letters dating back to 1888 show that he had geological reports regarding possible sources in many parts of Europe and even beyond.[vii] John Rhodes, a geologist employed at the Geological Survey in London advised him that he thought "Yorkshire would hold its own against all comers in the chert business"[viii] and thus he was to run the Fremington Edge Quarries for the Boulder Flint Company until his death in 1916[ix]. He also opened a copper mine at Richmond riverside - see later.

***PLATE IV**. J.S. Wagstaff Senior (1846-1916), his son Jack (J.S. Wagstaff Jnr) and daughter Lucy. (Source: Suzan Fowkes, Lucy's daughter).*

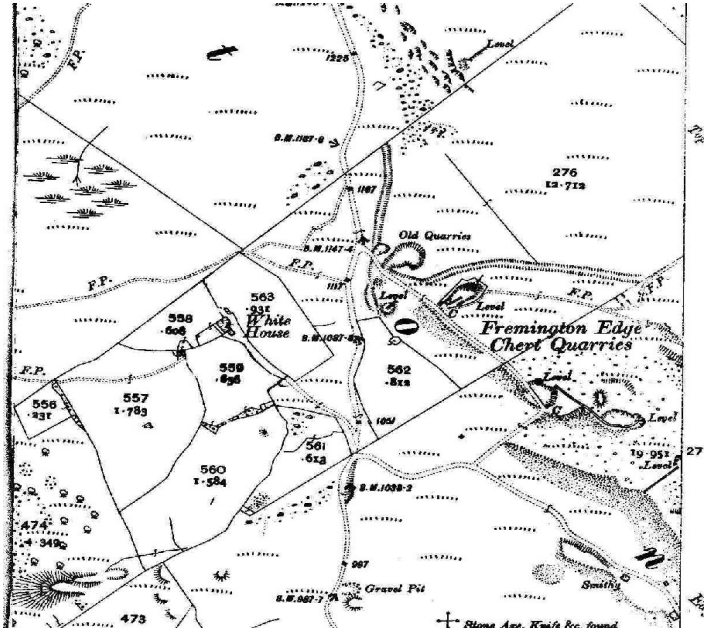

Fig. 4. *1910 O.S. Map showing Fremington Edge Chert Quarries and the White House above High Fremington. (Swaledale Museum).*

On the map section showing Fremington Edge chert quarries (Fig. 4) in about 1910, five levels (tunnels or adits) can be identified; it is said that seven was the maximum, but they are unlikely to have all been worked at once. Underground quarrying produced pristine rock, unaffected by weathering and a geological sketch section prepared for J.S. Wagstaff Sr[x], now in the Swaledale Museum shows that the stratum worked was the Underset Chert. Downslope there was a smithy for the sharpening and replacement of tools, and close by was the White House, the site being reached by a steep narrow road from Fremington.

PLATE V. *Present day photo of Fremington Edge showing the whitish waste tips to the upper right of the White House (centre left). (Author's photo).*

A visitor to the site today sees little except the access track and the waste tips. Small stone buildings and platforms can be recognised and there is a concrete base which supported the compressor for the water-cooled power drills used by about 1945, backed by a blocked up entrance to a level.

The loading of chert for transport to the rail station at Richmond was done at Low Fremington, close to the junction with the minor road up to the chert quarries. Chert was brought down from the quarries by horse and cart with brakes fitted to cope with the dangerously steep incline[xi]. Adjoining the main dale road (B. 6270) there was a wooden shed, a second stone-built smithy, various cranes and a weighbridge, as the quarrymen were paid and transport costs were determined by weight of chert shipped. A chert loading stand was constructed here later and is now the only obvious relic to be seen.

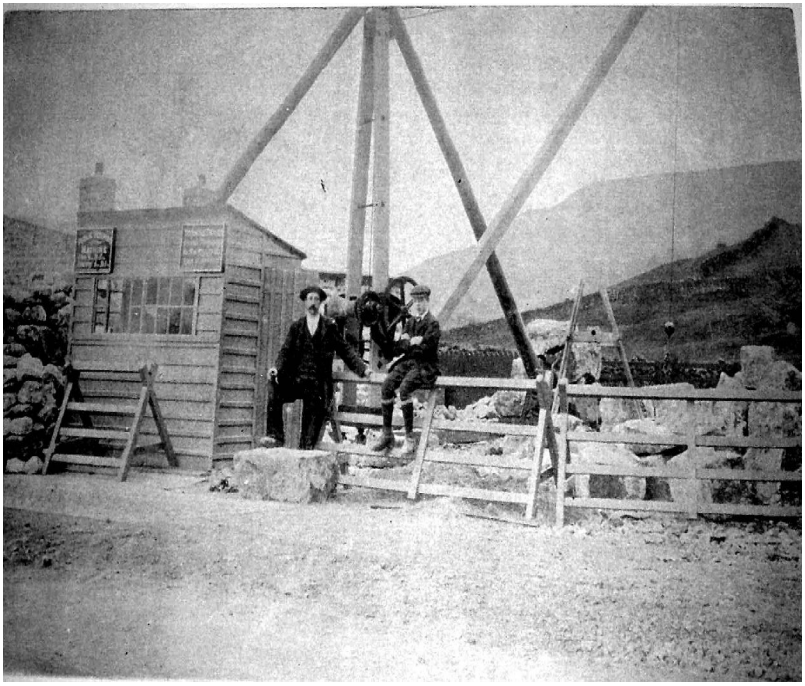

PLATE VI. *The Boulder Flint Company's chert loading area at Low Fremington ca 1910 with John Shatwell Wagstaff Jr.(Jack), aged about 14, sitting on the fence. The name of the older man is not certain. (Swaledale Museum Archive 118).*

The method of working the chert seemed to remain similar for almost all the sixty or so years of operations. A geological section shows that the Underset Chert layer lay above the Underset Limestone, the underlying rock being known as the "bearing bed". The chert would have natural vertical joints between which the quarrymen worked. The bearing bed was drilled and holed using a drill rod, or 'jumper', held by one man and a 7lb. hammer held by his partner. After each blow of the hammer the jumper would be turned and so on until the hole was of an adequate length to take a charge, probably of gelignite.[xii]. Howard Rule worked there between 1934 and 1940 following his father Archie Rule, a former gold miner, who was one of the earliest employees. Howard claimed that it was "extremely hard work".as it could take half a day to bore two holes not more than two feet deep each. The only lighting underground was by candles bought by the workers and propped up in a blob of clay at a convenient place. Blasting was done before lunch or at the end of the day to allow the dust to settle as the risk of silicosis was a real threat to the men's health. As they undercut the chert block between the natural joints, the workers would support it with wooden props. Finally the props were blown out with a stick of dynamite

and the huge block, perhaps weighing 15-25 tons, would fall under its own weight, often breaking up in the process[xiii]. The rubble was then cleared out of the level and thrown down the slope outside: this was Walter Appleton's job as a fifteen year old in the early 1930s. As it was cold and dirty work, involving crawling on hands and knees in the dark, he soon left to go into farming in the fresh air![xiv]

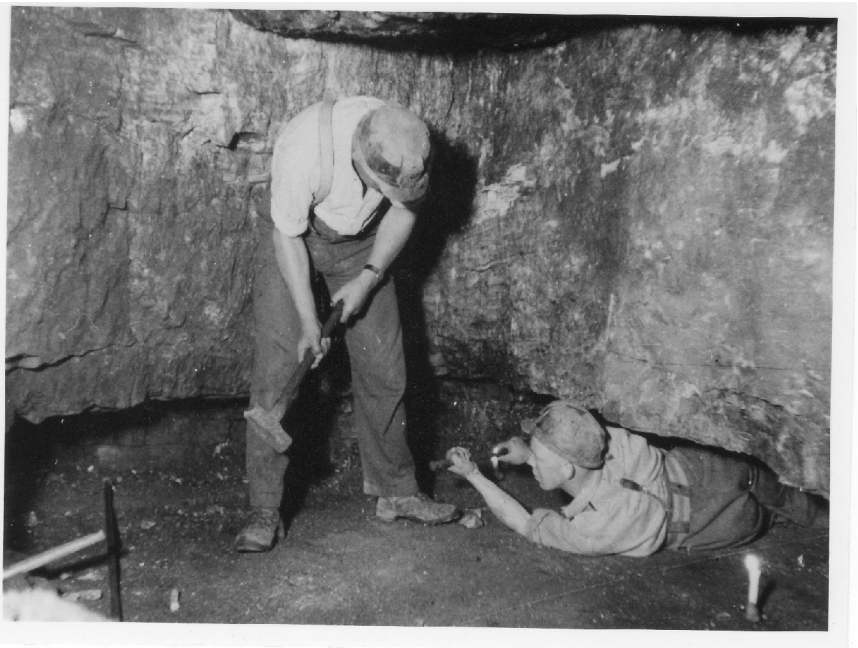

PLATE VII. *Raymond Longstaff and John Stubbs undercutting a chert block using a drill rod ("jumper") and hammer. (Swaledale Museum Archive 118).*

The blocks would be split underground into the approximate sizes required, probably using the old plug and feather technique, and were then manhandled on to low four wheeled trolleys (bogies) to take them out of the level. The highly skilled trimming to specific sizes for pavers, usually 12,14 or 16 inches, was done outside the levels for the light, using metal gauges for sizing. The working face of a paver and the running face of a runner, which could weigh up to 15 cwt., were dressed smooth[xv]. This was a very cold job in winter. It also gave rise to cut hands due to sharp, flying chips of chert and in at least one dresser's home a cow-dung poultice was used at night to ease the pain![xvi]

The chert quarrymen at Fremington Edge worked from 8.30 to 5 and Saturday mornings and in later years, at least, got a basic wage and a bonus depending on the weight of chert. Wages in the early days were about £1 a week rising to £6

after the Second World War. Fremont (Fremie) Hutchinson said it was "hard, harder than lead mining". Freddie Dodds worked there for several years after the war and conditions were somewhat eased by then by the introduction of water-cooled power drills powered by a compressor outside the level which replaced hand drills[xvii].

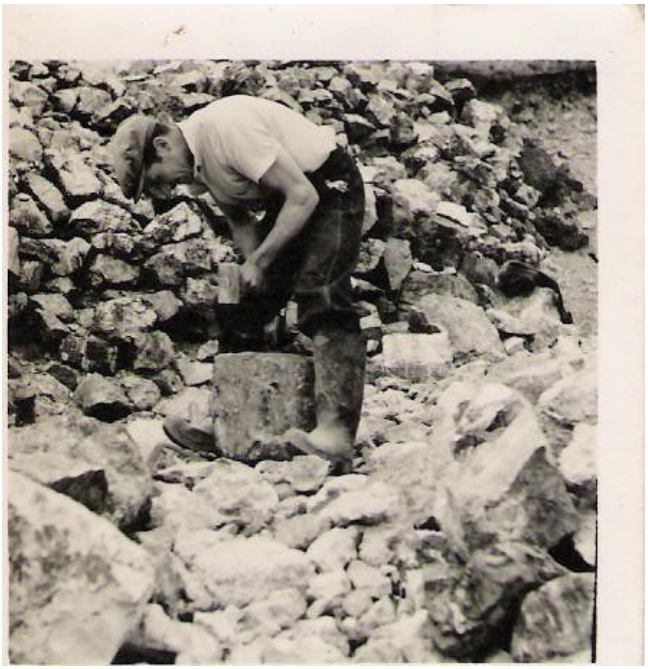

PLATE VIII. *Dressing a block outside at Fremington Edge. (M. Woodward).*

This work was obviously dangerous and there were two fatalities reported by the Mine Inspectors in the earlier days of operations. Michael Hillary, aged 30, was killed in 1907 "by a fall of roof which broke down the timber" and Albert Harker, aged 28, was killed in 1912 "by a fall of side at the face"[xviii]. There were also many non-fatal and unreported accidents, Walter Appleton remembering one worker whose damaged leg was amputated by the local doctor on the kitchen table at the White House. Silicosis due to dust inhalation, probably carried off several quarrymen before their time.

PLATE IX. *Steam traction engine at Low Fremington towing chert-filled trucks ca. 1905. (Swaledale Museum Archive 118).*

Throughout the sixty or so years of quarrying at Fremington, distance from the main market in the Potteries and thus the cost of transport was a major consideration. A 1905 postcard shows that an early form of chert transport was a steam traction engine and this was followed by various types of rather ancient lorry. In 1904 the haulage cost was four shillings a ton[xix] although it is not clear whether this was to get the chert to Richmond Station or the Potteries. At the time the chert sold for between 25 to 42 shillings per ton delivered at the Potteries[xx].

So very soon after establishing themselves at Fremington, John Shatwell Wagstaff and Tom Ward were looking for sources of chert closer to Richmond. In 1906 they reopened an old chert quarry in Billy Banks Wood, close to the River Swale at Richmond.. This proved unproductive, with too much shale in the chert, but led to six years of them working a copper mine near river level. Another attempt was made with a chert quarry at Whitcliffe (Wycliffe) Scar, Richmond, exact date unknown but possibly about 1919[xxi], and again at Underbank, in the scar below Hudswell Church[xxii]. The owner of the Underbank quarry was shown as Tom Ward from 1910 - 1922 but this only seems to have been worked by three men in 1913 and 1914. As these attempts proved unproductive, it seems the Boulder Flint Company resigned themselves to concentrating on Fremington Edge.

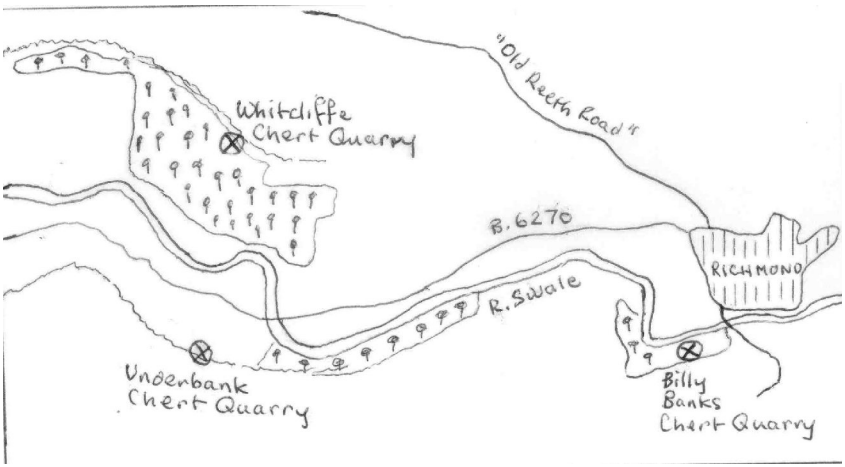

Fig. 5. *Sketch map showing the sites of three chert quarries near Richmond.*

The cost of transport from Fremington led James William Close and Tom Ward to look again at the idea of a Light Railway from Fremington to Richmond, first proposed by them for the transport of lead and chert in 1896, and this time their plans got as far as a Commissioners' Enquiry in 1912 at the King's Head in Richmond[xxiii]. James William Close's statement at the enquiry was that "chert had to be taken to Richmond in a motor wagon, carrying five tons, or a (horse and) cart with fifteen cwt...for use in the Potteries". Interestingly he also mentioned that they "recently sent forty tons to San Francisco for use in gold mines"! Tom Ward stated, on behalf of the Boulder Flint Company, that they produced about 1200 tons per year but with a railway from Reeth they could double output and also double employment from the current 26 workers. Detailed plans and costings were prepared and the railway may have happened if it had not been for the outbreak of the First World War, which scuppered the idea for good.

Fremington Edge Chert Quarries

Date	Company	Agent/Manager	Employment
1905	Boulder Flint Co.	J.S. Wagstaff Sr.	10 below, 8 above
1914	Boulder Flint Co.	J.S. Wagstaff Sr.	16 below, 2 above
1918	Boulder Flint Co.	Edward Cherry	12 below, 4 above
1921	Boulder Flint Co.	J.S. Wagstaff Jr.	16 below, 5 above
1930	Boulder Flint Co.	Edward Cherry	4 below, 4 above

1938	Boulder Flint Co.	Edward Cherry	8 below, 5 above
1945	Boulder Flint Co.	R. Woodward	4 below, 2 above
1950	Boulder Flint Co.	Not given	5 below, 5 above
1953/4?	Shevels, Shevels & Woodward (C.)		3 in total?

Table 2. *Fremington Edge Chert Quarries 1908 - 1954. (Prepared from information from the List of Mines).*

The chart above shows that Jack Wagstaff, son of John Shatwell Wagstaff Senior, was manager of the Fremington Chert Quarries from 1919 until 1922 before Edward Cherry took back control in the 1930s. After the Second World War Roland Woodward managed the business for the Boulder Flint Company, still apparently based in Stoke on Trent. The Boulder Flint Company abandoned the site in about 1952 as demand for chert was collapsing for reasons to be discussed later. There was a "last ditch operation" by Roland Woodward's son, Charles, and Ernest and Cecil Shevels[xxiv], but they were unable to make it pay and everything at Fremington Edge had closed down by about 1954.

PLATE X. *Charles Woodward with a water-cooled power drill in Fremington Edge Chert Quarries ca. 1953 (M. Woodward's photo).*

John Shatwell Wagstaff Senior, who had established the Boulder Flint Company at Fremington, died in 1916. Some time earlier he had shown his son Jack

possible future sources of chert in Arkengarthdale with a view to providing Jack with a business after the 1914 - 18 war. Jack returned to Reeth in 1919 and became the manager for the Boulder Flint Company until 1922. In that year a major dispute was serious enough to encourage Jack and several of the most experienced chert workers, including Ben Hall, Tom Peacock, Joe Siddle, George, Jack and Ralph Hird and Tommy and possibly Fremie Hutchinson, to break with the Boulder Flint Company [xxv] and establish a new operation in Arkengarthdale. Jack took out a lease on Moulds Low Level from the C.B. Estates[xxvi] and began to work chert in that former lead level.

Moulds Low Level was close to the Langthwaite to Low Row road so convenient for transport, presumably by lorry by that date. Until 1932 Jack worked chert in this level, using what seems to have been a different technique from that used at Fremington. According to Les Tyson[xxvii], the workers first removed the overlying rock above the chert and then, using natural joints in the chert, cut out blocks beneath to the approximate sizes required. This may have involved less blasting and could have been safer.

PLATE XI. *Jack Wagstaff (front row left) as captain in Reeth Home Guard. (Swaledale Museum Archive 118).*

PLATE XII. *Underground in Moulds Low Level with chert blocks showing a blue colour due to ferrous oxide in the rock. (photo :A. Mills).*

In 1932 Jack turned his attention to the Crow Chert beds high up on the west side of Arkengarthdale above Whaw in a former leadmining area known as the Hungry Hushes, the main one being Stoddart Hush where he had formerly done some opencasting for chert. Jack called this new operation the Hungry Chert Quarries and, because of their location, access and transport required a new approach. Jack came up with one. Leading diagonally and then directly upslope from near the cattle grid on the Tan Hill road beyond the ruined CB Mill, he built an incline railway on wooden sleepers, probably using old lead mine rails. Plate XIII taken in 1946 shows the view of it from above the main chert working area with the Tan Hill road down in the far distance. The rails brought empty bogies up to a stone shed with corrugated iron roof held down by stones; this housed the double wheels with attached cables which controlled the rise and descent of the bogies, the loaded ones going down balancing the empty ones coming up. There was a shed halfway down where the loaded bogies would be attached to a motor-driven winch which lowered them down to the Bottom Chert Stand[xxviii]. As at Fremington, this was built for ease of loading on to lorries and can still be seen close to the cattle grid on the Tan Hill road. Here there was a three-legged crane and an adjoining stone shed, now demolished, and some of the buildings at the old CB or New Mill nearby were used as a smithy and offices.

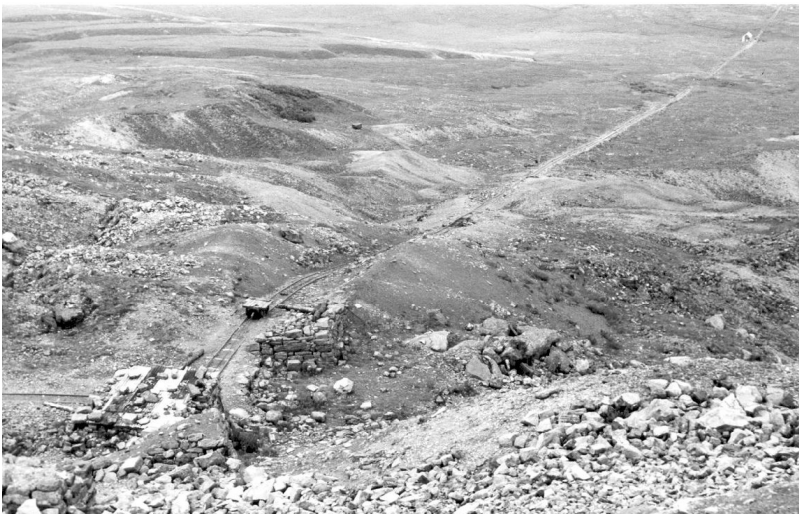

PLATE XIII. *Looking down the incline railway in 1946. Taken by J.O. Myers (Swaledale Museum Archive 118). .*

Near the top of the incline was a dressing floor with another three-legged crane and railways for the bogies going off towards the levels, which were probably three in number. The small old lead miners' smithy higher up the slope was used for day-to-day sharpening of tools and also provided shelter and warmth for lunch breaks. Ramsay Hutchinson, the blacksmith in the 1950s, told Les Tyson that most workers were on piecework so that if the chert blocks proved to be the wrong sizes or split the men wouldn't be paid, although Jack Wagstaff is said to have provided paid holidays and insurance[xxix]. No fatalities are recorded, but Jake Stubbs and Sidney Hird were trapped for a day by a rock fall when props failed[xxx]. More details are given in Les Tyson's paper in NMRS 53, using information from Ramsay Hutchinson and other ex-workers and including lists of some of the men who worked there (see References). His paper is illustrated by some of the photographs shown below which were taken by J.O. Myers in 1946 and are now held in Swaledale Museum Archive 118. Other photographs are from the collection of Jean Henderson, Jack Wagstaff's daughter, now also in Swaledale Museum.

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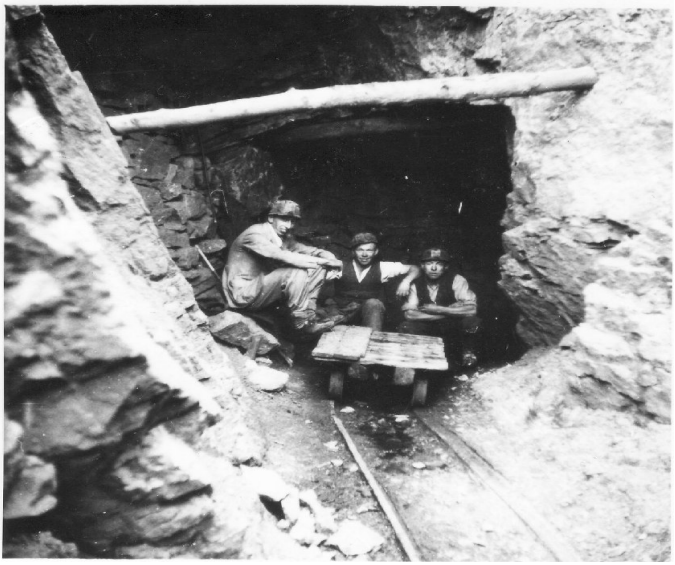

PLATE XIV. *Frank Woodall, J.R.(Jake) Stubbs and Vincent Coates with bogie emerging from a level at Hungry Hushes.*

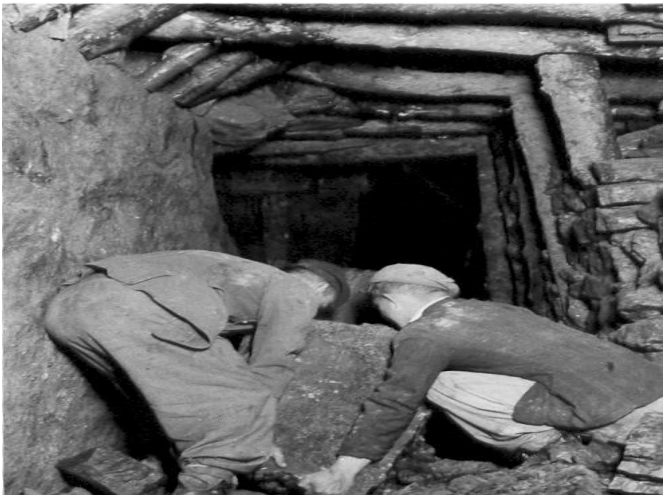

PLATE XV. *Willie Stubbs and Ramsay Hutchinson manhandling a block.*

PLATE XVI. *Loaded bogie on the turnplate before descending the incline.*

PLATE XVII. *Loading chert at the Bottom Chert Stand, Arkengarthdale. Date unknown. (Swaledale Museum Archive 118).*

During the Second World War several workers were called up, reducing the work force to five men by 1945. After the war business and employment picked

up again[xxxi], although photos suggest that the harsh snowy winter of 1947 held up work for a long period[xxxii]. A surviving invoice form for the business from the 1940s advertised the only wares as blue chert pavers and runners[xxxiii] . Jake Stubbs used to drive Jack Wagstaff to the Potteries quite regularly to drum up business, leaving home before dawn[xxxiv]. The main customer was Johnson Brothers, with whom Jack felt he had a good relationship; it was therefore a severe shock when, in August 1950, he was suddenly informed that they would not need any more chert. Jack desperately chased other customers and other uses for chert but, failing in that, he had to close down his company and cash in any assets, mainly as scrap. Leo and Ramsay Hutchinson, George Wilson, Sidney Hird and Willie Stubbs were involved in the demolition of the railway and sheds.

PLATE XVIII.. *Leo Hutchinson and George Wilson demolishing the incline railway. The hut had housed the winch engine. (Swaledale Museum Archive 118).*

So why did both the Fremington Edge and Hungry Chert Quarries close in the 1950s? All sorts of reasons were given locally. Walter Appleton said local chert was replaced with "silex" from France, which was cheaper ("silex" is French for chert and flint) and John Hardy and Ella Stubbs talked about "French pebbles", also said to be cheaper. But the most likely explanation, confirmed by the Cheddleton Flint Mill, is that cylinder, or ball, grinding mills replaced the grinding pans in the Potteries. The first ones were batch mills, developed in

Germany as early as 1867, and later replaced by continuous mills. Flint pebbles and other pottery raw materials could grind themselves in these mills by a process of attrition and grinding pans and therefore chert blocks were needed no more. Interestingly, a letter[xxxv] shows that John Shatwell Wagstaff Senior had been aware of the threat of the ball mills as early as 1908 - did he pass this worry on to his son?

So ended the last major phase of mineral extraction in the two dales. Chert quarrying had lasted for just less than 60 years and seems almost forgotten but it had given employment to former lead miners, their sons and others who, without it, might have had to leave the two dales. Tourism, shooting and farming were left as the mainstays of the economy of the two dales but there are still reminders of the chert quarrying on the slopes of Fremington Edge, in the Hungry Hushes and in the woods on the valley sides of the Swale near Richmond.

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Jean Henderson and her cousin Suzan Fowkes have supplied much of the personal and technical infomation contained in this paper, for which the author is very grateful. Les Tyson and Mike Gill have also been very helpful and encouraging.

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