

EARLY GUNPOWDER WORK IN LONGE OR CROMFORD SOUGH, DERBYSHIRE, 1662-1663 AND 1676-1680

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Abstract: Cromford Sough or, to give it its more usual 17th century title, Longe Sough, was begun about 1657/58, some 15 years earlier than previously thought [Rieuwerts, 1983; 1987]. The earlier of the two above mentioned publications considered that gunpowder work visible in a branch level, dated from the second half of the 1670s. However, more recent research suggests that this branch level was not driven for that purpose, but it is a remnant of the original main drivage, abandoned about 1680. The 'branch' was initially driven through shale but when limestone was first encountered the passage was excavated by means of gunpowder blasting. This work possibly dates from 1662-1663, nine years before the earliest proven gunpowder work in a British mine. The remainder of the passage, also driven by means of gunpowder blasting, it is suggested, dates from the period 1676 to 1680.

MODERN EXPLORATION OF THE SOUGH AND BRANCH LEVEL

The original entrance to the sough was situated at the roadside opposite to the present car park of the Greyhound Hotel, in Cromford village [SCL, Bag 180]. The water from the sough issued into Bonsall Brook, but it was re-channelled and culverted during the late 18th century when Richard Arkwright modified most of the water courses around Cromford and the original tail was obliterated in the process. In 1663 the sough tail was described as being situated on Huntley Green.

The sough was examined and partly cleaned out in 1923 by Thomas and William Hodson, during an abortive attempt to reach Godbehere Vein, deeply buried beneath the shale cover on Cromford Moor. Their book of diallings indicates that they were able to penetrate as far as the short branch level leading to Roggelim Coe Shaft, but still a considerable distance short of the intersection with Godbehere Vein [DRO, Rieuwerts, L 379].

The present entrance is situated in the bottom of a sunken, walled enclosure, known locally as the 'Bear Pit'. The reader is referred to Rieuwerts [1983] for a more detailed account of the visible features in the currently accessible portion of Longe Sough.

The first short section is walled and arched and is of hands-and-knees height. Beyond the arched portion the sough is driven through unlined, heavily ironstained, shale. Milking Place Shaft is reached about 550 feet from the tail and close to the shaft a prominent bed of limestone makes an appearance in the roof. The stratum almost certainly equates to what a contemporary miner described as a 'chirt bedd'. It is about 20 inches in thickness and proceeding beyond the shaft it variously occupies the floor, but mainly the midheight and roof of the level, at least as far as a side passage about 860 feet from the tail.

A step-up of about three feet gives access into this conspicuous level which leaves the sough on the west side and is driven towards Greatorex Vein and Dun Rake; it was not surveyed by the Hodsons. More recent examinations, made by the author and colleagues, have revealed that in places it follows a sinuous course and is of small cross sectional dimensions, typically four feet high and two feet in width. Initially it is driven through shale, but after a distance of 92 feet the Cawdor Limestones appear in

the level sole, the beds rising westwardly until at about 120 feet the entire level is cut in limestone. The level continues for 60 feet in the limestone, at which point, after a short dog-leg, it intersects a very thin scrin or leading, along which it continues for some 180 feet until interrupted by another series of short "dog-legs".

It is considered that this is the leading referred to in 1663, because before that date at least part of the sough had been driven "from stoole to stoole" [PRO, DL 1/404]. The mineral laws are quite clear that such a term was used only when cutting through mineralised ground; it was not used when driving through barren ground.

Where the level is driven through the limestone and also in the leading, the walls are adorned with gunpowder shot holes each about 7/8 inch to 1 inch in diameter and about 12 inches in length. Except for the first few yards of drivage in the limestone, where the walls are somewhat rough, the workmanship is of excellent quality and, despite the fact that no pickwork trimming of side walls was undertaken, the precision placing of the shot holes has resulted in a remarkably smooth and uniform cross-section.

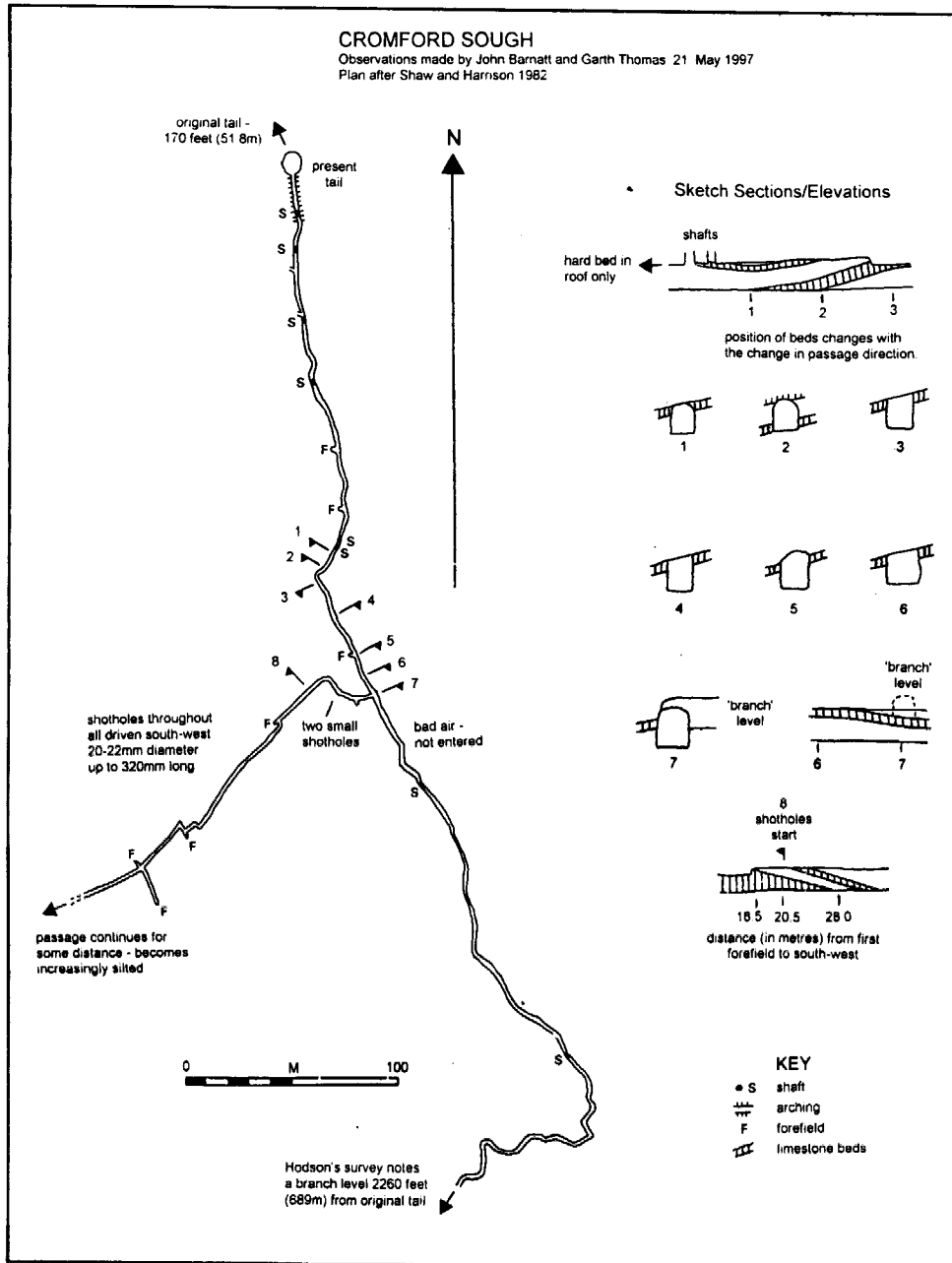
The writer considers that the level, which in effect is now a branch from the main sough, may be a surviving remnant of the original main drivage, before it was abandoned; the total length from the original tail to the forefield is somewhat in excess of 1700 feet. Additionally, the shotholes visible in the limestone and throughout the leading may date from 1662-1663, or at the latest 1676.

THE BEGINNING OF LONGE SOUGH [OR CROMFORD SOUGH]

A good deal of information relating to the early history of Longe Sough between the years 1657/8 and 1680 exists in the records of the Duchy of Lancaster Court and in Chancery cases held in the Public Record Office, Kew.

The original intention of the sough masters was to drive almost due south to intersect the deep, concealed extension to the Great or Godbehere Vein on Cromford Moor, believing no doubt that they would be able to drive through shale for the entire distance. This fact illustrates their ability to forecast the unexplored geological structure buried deep beneath Cromford Moor.

CROMFORD SOUGH
 Observations made by John Barnatt and Garth Thomas 21 May 1997
 Plan after Shaw and Harrison 1982



sunke divers shafts and groves downe into the water.

Up to November 1663, this work had cost the sough masters about £1000.

Robert Sage died in November 1661 and almost coincidentally with his death, the sough, which was then about ¼ mile in length, met considerable difficulty. [PRO, DL 4/121/9a/1680]. Until then it had been carried on

Streight till it come to the Moore and then by reason of hardness the miners could not get streight on forward . . . and were forced to turn aside and cut short crookes.

From this statement, and much subsequent evidence given by other miners to the Duchy Court, it is obvious that maybe slightly before Sage's death, or at about that time, the remaining proprietors had a dramatic change of mind and the whole concept of the sough and its destination was altered.

George Adams, a 55 year old miner from Cromford, had worked at the sough from the beginning and his testimony given in a later law suit dating from 1680 [PRO, DL 4/121/9a/1680] is invaluable:

the workemen did come to a Hardness called a Chirt bedd and did drive under the same for the Length of a hundred yards and by driving under the Chert bedd the levell of the sough was lost . . . soe that water came into the sough and

The sough was begun in either late 1657 or early 1658. The principal proprietor, until his death in November 1661, was Robert Sage who owned 11/24ths of the venture; Sir John Heath, John fferne, John Greatrex and Mr Lowe were the other shareholders.

Sage's death and the contents of his will were the subject of much legal wrangling and lawsuits brought into the Court of the Duchy of Lancaster lasted from 1663 until 1680 [PRO, various].

The first documentary evidence dates from November 1663, when it was stated [PRO, DL 1/404] that Sage and partners

about seven yeares since did - undertake to make a Sough from or neare a place called Huntley Greene in Crumford - - beinge a worke of extraordinary difficulty and vaste Chardge to perfect - -the said Sough being commonly called the Greate Sough or Longe Sough.

The sough was carried forward from Huntley Green and

they have therein for the space of six yeares last past constantly and effectivly wrought and driven on the said Sough and wrought and

prevented them from working therein.

This latter event seems to have taken place in April, 1662, [PRO, DL 1/404] probably near the shale/limestone interface, the water

ysuing forth and running through the sough in such abundance - it changed the colour of water in the greate River of Derwend and the water still continues to Runn in greate abundance.

The unusual step-up leading into the side level may have been decided upon due to water inflows, but it does not seem likely that any inflows encountered in the shale hereabouts would have been of sufficient volume to have been described as "running through the sough in such abundance"

Edmund Swift, another miner who had worked at the sough when the hardness was found, stated that

after yt came to that hardness before mentioned they concluded in Mr Sage's lifetime to catch at Dun Rake and soe to goe towards Rose Rake - it was intended by the Sough masters when they came to ye Hardnesse to turne towards Dun Rake and crosse it towards ye Rose Rake.

During December, 1662, some eight months after the water inflows were encountered [PRO, DL 1/404], the soughers

mett with and found a veine or seate or presumpcon of a veine or Rake going upon or neere the same point or Randum of- one of the said veins - - at greate cost have driven through - hilstones and hardnesse a Long through the said vein or seate or presumpcon - towards the old known veins - about sixty yards in length from where they first found the said Seate or Veyne.

The document also states that the soughers had "wrought underground in and for the said Sough and driven ye same from stoole to stoole in and towards the said Rakes".

It is here suggested that the "seate or presumpcon" of a vein was found in driving the side level, about 180 feet from the intersection. From this point cutting through 60 yards would take the miners along the thin vein or leading before it was lost at a series of "dog-legs" in the passage. The reference to cutting "from stoole to stoole" thus probably equates to this section of the sough.

The sough masters freed a vein in June 1663, taking the precaution of freeing for "new or old", not knowing at that time whether they had discovered a new vein, or the eastern extension of an already proven vein. Hooson [1747] defined the word *seate* as "the first appearance of some Veins - which we discover - in stone or Shale" [Rieuwerts, 1998]. Because of the immense difficulties the sough was then abandoned, until new articles were drawn in 1676.

After the abortive drivage beneath the "chirt bed", George Adams had tried to persuade

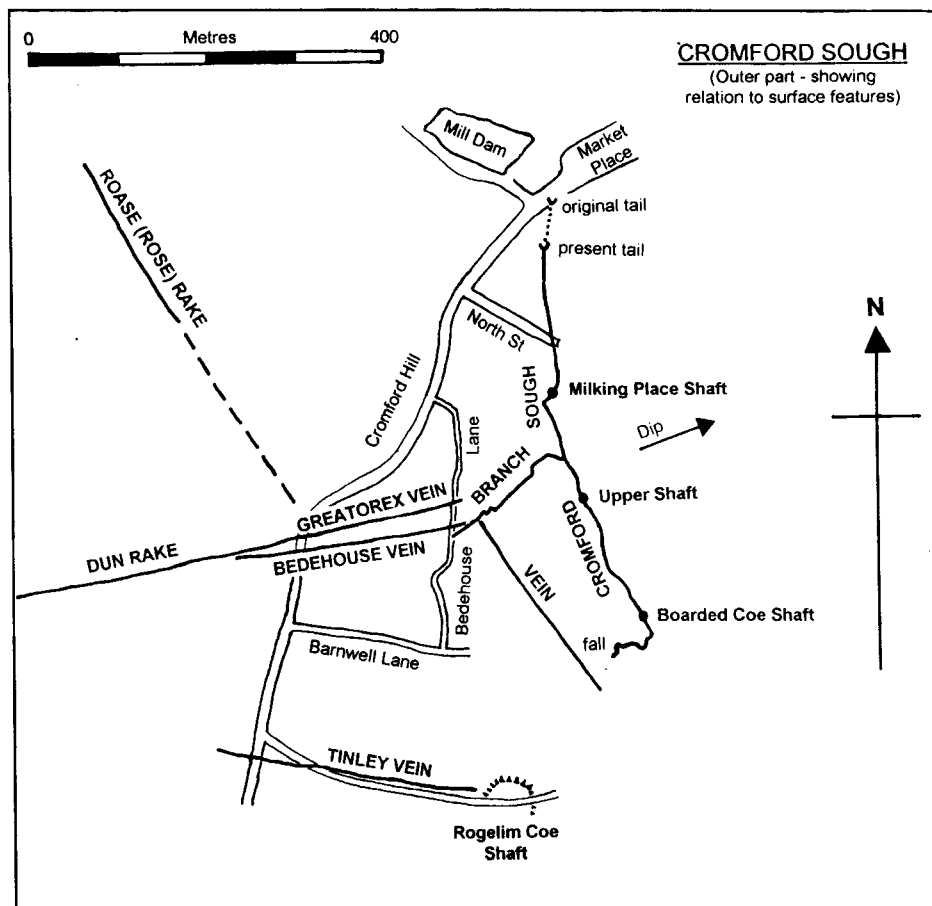
William Glassbrooke who was overseer . . . to goe to the dipp of the shale on the East side - they hoped they could get to the topp of the Chert bedd and soe drive - to the Great Rake - if the sough could have been carried over the Chert bedd . . . it would have been driven through Shale and now it is driving through stone.

Adams' testimony was given in 1680 and Glassbrooke died in 1669, so that Adams must have discussed the problem with Glassbrooke before 1669. Obviously the advice was not taken and in 1680 work was still confined to the side passage.

The so-called "Chert bedd" probably equates to the bed of very hard, dark coloured limestone, interbedded amongst the Cawdor Shales. This bed occurs in the present main sough passage, before and beyond the "branch" level.

If Adams actually used the word "dipp" before 1669, then it is the earliest known example of the word in a geological context [Rieuwerts, 1998].

The sough was abandoned some time after Sage's death, possibly from the winter of 1663 and, although not specifically stated, it



may not have been re-started until 1676. Some support for this hypothesis is provided by Anthony Bowden, miner, of Massonwood, Matlock, who deposed that *after the death of Mr Sage the sough stood unworked then five years ago Adam Hopkinson began it again.*

THE SOUGH [BRANCH LEVEL] RE-STARTED

In 1676 new articles of agreement were drawn up [DRO, Gell 477(b)]. Adam Hopkinson became overseer of the sough and at this time the radical change of plan, begun over a decade earlier, was still in mind. Edmund Swift advised Adam Hopkinson

to seek out for some passage up which they proceded towards Dun Rake thinking to find the Rose Rake and thence to Tinley Veyne and soe up into ye Great Rake.

By 1676 the sough was driving in a vein, presumably the thin leading, beyond, and slightly offset to that already discussed; it was described as very hard. John Alleyn worked at the sough between 1676 and 1680 and deposed that

ever since this deponant has worked thereat (it) hath beene an extreame Hard worke and very expensive

This statement is corroborated by financial accounts for the year May 1677 to May 1678. During the period the sum of £183-8-10 was expended [PRO, C5 479/70]. Other incomplete reckonings demonstrate that the sough was working between 1676 and 1679.

George Adams further testified that in 1680 the sough was driving in stone, not in shale, into the hill towards Dun Rake and Rose Rake, that these veins and Godbehere Vein were situated on separate hills and there was "a very great valley" between them.

The great valley obviously can be identified with Dean (Dene) Hollow. The range of the side level fits this description exactly, whilst any branch situated over 1000 feet further to the south and driven to Dun Rake would certainly not do so.

DATING THE SHOTHOLES

Consideration has been given to the possibility that the side passage was made during the early 18th century or even later and that the documented mid to late 17th century work might relate to another branch level further south.

However, the present main sough, though now blocked by a large fall of shale 2000 feet from the entrance (2170 feet from the original tail) did not encounter mineralised ground within that distance. It is therefore concluded that the latter hypotheses cannot be sustained, as it would have been virtually impossible for even three shifts of miners, working six days each week, to excavate at least in excess of 2200 feet before the "seate or presumpcon of a vein" was found, within the required period of 5 years to December 1662; financial considerations also prove that this length could not have been driven within the limits of expenditure of approximately £1000 made by the sough masters between 1657/58 and November 1663.

The immense difficulties the miners faced with the "hardness" during the early 1660s suggests that gunpowder was not in use at the sough in the immediate aftermath of that event. Such a hypothesis produces a contradiction. If the side level has been correctly identified as the site of this work, then certainly some of the shotholes in the level must have been made during mid to late 1662 and throughout most of 1663. A possible explanation for the anomaly may be that when the hardness was first encountered gunpowder blasting was unknown at Cromford, it being introduced at the sough sometime in 1662 after the decision had been made to turn the sough towards the south west. An alternative explanation may be that gunpowder proved largely ineffectual in a thin bed of hard stone sandwiched within a "cushion" of shale.

Reference to the sough being driven "from stoole to stoole" during 1663, that is in mineralised ground, supports these conclusions. Thus the shotholes within the initial 60 feet of limestone and 180 feet in the leading, may date from 1662-1663, the passage beyond probably dates from the period 1676 to 1680 as previously postulated [Rieuwerts, 1983].

Adams' testimony that the sough was heading toward Rose Rake and Dun Rake, situated on the opposite side of a "great valley" to Godbehere Vein, must surely identify the branch level because it is driven along that alignment towards veins on the north side of Dean (Dene) Hollow.

Before Longe Sough was made two short soughs to drain Dun Rake were begun at "the Nether End of the Deane Wall" [PRO, DL 4/121/9a]. This deposition by Richard Wigley, a Cromford miner, proves that the range of the north eastern end of Dun Rake was directly toward the sough forefield.

There is a peculiar and unexplained anomaly concerning the size of the shotholes in the Longe Sough. Those within the sough are of small dimensions and they contrast sharply with those at the Ecton copper mines where the "Dutchmens" shotholes, dating from about 1670, are 2 inches in diameter and 3 to 4 feet in length (Barnatt, Rieuwerts and Thomas, 1997). However, the quality of workmanship achieved in producing such a regular

cross-sectional shape to the passage, together with the accurate positioning of the shotholes suggests the influence of European miners, but there is no documentary evidence yet available to substantiate this hypothesis.

The shot holes all show signs of clay, stone and spar dust stemming, again a remarkably early example, if indeed the work does date from the suggested period.

The above facts suggest a separate technology was employed at Longe Sough to that used at the Ecton copper mines, though the origin of it is not presently known.

Simon Hughes (pers. comm.) has suggested circumstantial evidence implies that even earlier gunpowder blasting may have been carried out at the Allt y Crib Mine, Talybont. This mine was the site of one of Thomas Bushell's Welsh enterprises. After a visit to Saxony by Bushell and Prince Rupert lasting several months, the drivage rate in the adit at Talybont, which in 1634 and 1635, previous to their visit, had averaged two fathoms per month, dramatically increased to four fathoms a month.

In 1644 the castle at Aberystwyth was blown up with tremendous force, suggesting a large quantity of gunpowder was being stored there; Bushell was using the castle as a mint at this time.

After the signing of the articles of agreement in 1676 the new soughmasters decided to continue to drive south westwards towards Dun Rake. The continuation of the side level, driven in the thin vein or leader in the limestone, fits this description and it therefore dates from 1676-1680. There is no apparent change in the method of gunpowder blasting, the shotholes follow an identical, regular pattern as before.

That the sough was proving very hard, though in a vein, in 1676, together with the miner Alleen's testimony of the extreme hardness and expense between 1676 and 1680, supports this view.

An undated reference states that a sough

begun at a place called Crumford Moor - at the expense of near £20,000, for carrying on the Sough so vast a way thro' Rocks of lime stone, which cud not be worked but by boring holes and blasting with Gunpowder, some times at £20 a fathom.

The document then continues that afterwards a body of rich gentlemen formed themselves into a company to continue the sough for a proportion of the ore laid dry. They had insuperable problems with ventilation until the double drift system was introduced. It could be postulated that the new company might be equated to those responsible for the articles dated 1676, in which case the gunpowder work at £20 per fathom must pre-date these articles.

CONCLUSIONS

Available documentary evidence strongly implies that the side level, hitherto regarded as a branch was, in fact, originally driven as the main sough. It was abandoned perhaps about 1663-1664, then re-worked again from 1676 to 1680, after which the main sough was re-routed through shale, along its present alignment, as George Adams had originally proposed to the overseer, William Glassbrooke.

A reasonable conclusion to be drawn from the detailed

testimonies of the contemporary miners is that the initial portion of the side level was driven about 1661-1663 and notwithstanding the use of gunpowder, due to hard rock and probably considerable water inflows, it was abandoned about 360 feet from its intersection with the present main sough.

If the above supposition is correct, then it seems reasonable to conclude that gunpowder blasting was introduced at Longe Sough in 1662, and at least by 1676. If the former date is correct, subject to further research at Allt y Crib Mine, Talybont the use of gunpowder is the earliest yet recorded from a British mine.

ACKNOWLEDGEMENTS

The author wishes to thank John Barnatt for his constructive criticism of the ideas expressed in this article and also to Garth Thomas for information relating to their joint exploration of the sough. Their careful observations of the occurrence and position of the limestone "chirt bedd" and confirmation of the size and positioning of the shot holes were critical in compiling this account. John Barnatt is also thanked for drawing the two plans.

Thanks are again due to Jon Scaife and Ray Marsh who explored the sough many years ago and first drew my attention to the gunpowder work in the side level. Similarly, to both Richard Shaw and John Harrison who drew the survey that appeared in my first account of gunpowder blasting at the sough. Roger Flindall, as always, has made available valuable historical information in his possession. I am also indebted to David Williams who kindly contacted Simon Hughes on my behalf by internet, and to Simon Hughes who supplied the information about Thomas Bushell and Allt y Crib Mine.

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