Copper mining in Richmondshire in the eighteenth and nineteenth centuries

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5

COPPER MINING IN RICHMONDSHIRE

IN THE

EIGHTEENTH AND NINETEENTH

CENTURIES

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CONTENTS

ABSTRACT

Copper mining has been carried on sporadically in Richmondshire since the 15th century, but the period of most intense activity was in the mid-18th century in Middleton Tyas, where there are several richly, but patchily, mineralized veins. The land through which the veins run was owned by five landowners and the inevitable disputes over boundaries and drainage led to litigation and violence. The operation of the mines however was usually carried on by lessees, often working partnerships of miners, rather than directly by the owners.

Three main sources of information survive. The correspondence between Leonard Hartley and William Brown preserved in the latter's letterbook illustrates the technical problems, particularly of drainage, and gives an early account of the working of a steam engine. Details of the commercial problems of another partnership of owners can be gleaned from the accounts kept by their agent Ralph Hutchinson for the period 1742-1767. These give information not only of costs and wages but also of the profitability of the enterprise. A picture of the industry in decline is found in the report written by Gabriel Jars in 1765, the only contemporary descriptive account. By 1780 this phase of activity was virtually dead.

In the mid-19th century mining was revived elsewhere in the parish by a partnership, later transformed into a Public Company, and served later by an associated Railway Company. Though the Mining Company failed to realise its hopes, it was its association with this ailing Railway Company which finally ruined it.

The last attempt to win copper in the area was carried on with minimal capital at Billy Banks between 1906 and 1912. From the period of optimism in the 1750's, when every process was carried out on site the industry had come to this small scale scratching, where the ore was not even washed. Even this proved unprofitable, the mine closed before

the First World War, and to date this concludes the history of copper mining in the area.

PREFACE

The last twenty years have seen a remarkable growth of interest in industrial history, especially in the history of mining. Thanks to the work of Raistrick, Jennings, Clough, Hunt and others the history of lead mining in the Pennine Dales is now quite well known. Large collections of documentary material survive to illustrate the long period of growth and decline in the leadmines. In contrast the copper mining industry which flourished briefly two centuries ago is virtually forgotten and almost entirely unchronicled.

Although this work is concerned mainly with the mines in Middleton Tyas parish in the mid-18th and mid-19th centuries, copper mining was carried on sporadically over a period of four hundred years in Richmondshire.[1] Its fluctuations of fortune must be viewed against the background of the varying prosperity of the British copper mining industry as a whole.

The earliest records[2] consist of entries in the State Papers (Domestic) and Calendars of Patent Rolls in the last quarter of the 15th century referring to a copper mine at Richmond. At that time copper mines were claimed as Mines Royal hence all leases were made by the Crown. There is no direct evidence of actual mining at this period, nor is there of activity by Hochstetter and Thurland, the Elizabethan lessees of the Royal copper mines, though their activities at Keswick and Coniston are well documented.[3]

There is no positive evidence of mining here in the 17th century either, which was a period of decline for the copper industry generally, when the works at Keswick were destroyed in the Civil War and the production from the Fälun Mine in Sweden completely eclipsed British mines.

1. Richmondshire consists of the Wapentakes of Gilling East and West, Hang East and West, and Hallikeld in the North Riding of Yorkshire and is coterminous with the Archdeaconry of Richmond.
2. Dealt with in Chapter 10.
3. See Collingwood W G ; Elizabethan Keswick ; Cumb. & West.Ant.Soc., Tract Series VIII (1912) and Donald M B, London, Elizabethan Copper (1955)

The 18th century saw a revival in the industry associated on the one hand with the Act of William and Mary in 1690, ending the Royal Monopoly, and on the other with the development of more efficient smelting with the reverberatory furnace[4]. This led to such a boom that by the mid-century British production had surpassed all rivals. This period also saw a great increase in demand associated with the beginning of the take-off into an industrial economy, and more specifically with such inventions as the manufacture of brass with metallic zinc (1738), the productions of Sheffield Plate (1742) and the copper-bottoming of ships (1761). Beside the Cornish mines and those on Parys Mountain the volume of production from Richmondshire was indeed insignificant, though sufficient to interest not only a busy industrial spy, but even such giants of industry as John Williams and Matthew Boulton.

At first sight a work devoted, in effect, to the study of a small industry in a limited area over a short period of time might seem to be very parochial. Nevertheless it does have a significance beyond the confines of Middleton Tyas, and introduces facts and considerations of more general interest to the economic historian. Not least is this so because the period of greatest activity was on the threshold of the 'Industrial Revolution'. Whatever view one may take of that unfashionable expression, the material from Middleton Tyas is of great interest for the ways in which it both harks back to the past and anticipates the future.

From most points of view the methods of mining and extraction were no more advanced than those employed two centuries earlier by the gnome-like figures in Agricola's plates in 'De Re Metallica'. Nevertheless these same mines were drained for a time by a 'Fire Engine' of the Newcomen type, which in the 1750's was still a comparative rarity, and outside the coalmines virtually unknown in the North East. Among the documentary material is a series of letters dealing with the construction and operation of this engine, which gives an invaluable insight into the technical and

4. Dealt with in Chapter 7.

organizational difficulties faced by the pioneers of the machine age.

The entrepreneurs who invested in such expensive machinery belong to the new age in mining. From the age of the free-miner working on his own account survived much of organization of ore-getting and remuneration of labour. Thus methods of employment and payment also reflect the fact that it was a period of rapid change as do the techniques of accounting, which seem remarkably casual by modern, or even by 19th century, standards. A complete set of accounts is given in Appendix C, and discussed in Chapter 4.

As well as such interesting technical and commercial detail, the story also traces the growth of a dominant family of landowners and entrepreneurs, the Hartleys. They enter the narrative as mere yeomen, yet within four generations become the friends of the aristocracy and attend at Court. The way in which this family turned every situation to advantage and benefitted alike from the enclosure of common land, from the financial embarrassment of neighbours, from advantageous marriages, from shrewd investment in copper and lead mines and, one regrets to say it, from sheer effrontery and blatant dishonesty is a typical phenomenon of the age.

This work is almost entirely based upon manuscript material, which although incomplete is sufficiently full to recreate a fairly clear picture of the industry and its development. It must be stated that I make no claim that this is the last word on the subject. For instance I have found hardly any papers relating to the involvement of the Milbankes, one of the most important local families, or of their Cornish lessees. Further evidence may well come to light which will invalidate some of my conclusions which are inevitably based upon the chance survival of papers.

In tracking down the material and carrying out this research I have met with kindness and co-operation on all sides, but I must make particular

mention of Mr and Mrs Michael Speir of East Hall, Middleton Tyas, who placed the whole of the Hartley family papers at my disposal, leaving them all available at the County Record Office, Northallerton. Lord Shuttleworth likewise allowed me access to his family papers at the Estate Office at Cowan Bridge, and arranged for a preliminary search to be carried out for me. Sir Henry Havelock-Allan Bt. permitted me to use his family's papers, as did the representatives of the late Lt.-Col. A P Curzon-Howe-Herrick, whose papers are also deposited at the County Record Office. The librarians and archivists of all the collections listed in the biblography gave their unstinted assistance, but my thanks are particularly due to the North Riding County Archivist, Mr M Y Ashcroft and his staff. Of others who have helped me with information I must mention particularly Mr Alfred Hardy of Middleton Tyas, Mr Roland Woodward of Fremington and Mr George Edward Close of Hudswell, who as far as I know is the last surviving copper miner in the neighbourhood and thus the last link with a vanished industry.

CHRONOLOGICAL TABLE

c.1737 Discovery of copper on land of Lady D'Arcy. Partnership formed to exploit it (Lady D'Arcy, John Hutton, John Yorke and Andrew Wilkinson).

1738 Leonard Hartley leased rights to Oliver Kearsley.

1742 Ralph Hutchinson's accounts began for Partners (ran until 1767).
Copper Theft Case, Partners v. Hartley.

1743 First smelting mill built by Partners.

1745 Sir Ralph Milbanke leased rights to William Paul.

1746 Derbyshire connection established with sale of copper and ore.

1748 Shuttleworth v. Hartley over enclosure.

1750 Dr Mawer leased rights in Glebe to Derbyshire Company (Tissington and others).

1751 James Shuttleworth leased rights to Cornish interests (Bethell and Moore). Rivalry between Cornish and Derbyshire firms.

1752-1755 Leonard Hartley correspondence with William Brown. The period of greatest activity.

1753 Derbyshire lease extended to Kneeton. Tissington built smelting mill. Tissington began steam pumping engine.

1754 Partners ended direct working, began to lease mining rights.
Richardson drew only contemporary map still extant for Allan.
Leonard Hartley built a smelting mill.

1755 Steam engine with slide rods solved drainage problem for the time being.

1757 Death of John Yorke.

1758 Death of Lady D'Arcy.

1762 Extant account shows Hartley employing only half a dozen men.

1763 New Vicar, Dr Watson, renewed lease to Derbyshire Company.

1765 Gabriel Jars visited Middleton Tyas and reported activity at low level.

1767 Death of John Hutton. End of Ralph Hutchinson's accounts still extant.

1770 Death of Ralph Hutchinson.

1774 Death of Leonard Hartley.

1775 Shuttleworth leased rights from both the Vicar and the Partners.

1776 Shuttleworth had 33 men at work.

1780 Shuttleworth was employing only three men.
Death of George Hartley.

1783 Matthew Boulton visited Middleton Tyas.

1784 Last extant lease.
Death of Andrew Wilkinson

1790 Abortive attempt to revive mining by Birmingham Company.

1856 First notice of revival of mining in the Merrybent district of the Parish of Middleton Tyas.

1862 Merrybent Mining Company established as a partnership; mines opened.

1865 Mining Company reorganized as a Limited Liability Company.

1866 Merrybent Railway Company formed, and Mining Company re-formed as New Merrybent and Middleton Tyas Mining and Smelting Company Limited.

1869 Lease of limestone from R H Allan.

1870 Opening of Merrybent Railway.

1874 Petitions filed for winding up of Mining and Railway Companies.

1875 Liquidators appointed; mining ceased at Merrybent.

1906-1910 Billy Bank Mine, Richmond, operated by Boulder Flint Company.

1910-1912 Billy Bank Mine taken over and run by Yorkshire Minerals Limited.

PRINCIPAL CHARACTERS

ALLAN, James of Blackwell near Darlington
Landowner in Barton, and after 1753 lessee of mining rights in the same village. Commissioned Richard Richardson to draw only surviving contemporary map of copper mines. Friend of Leonard Hartley. His great-grandson ROBERT HENRY ALLAN (see full biographical note on page 5) collected together the family papers, and was, himself involved in the 19th century copper mining.

BROWN, William of Throckley, Northumberland
The most famous colliery engineer of the day. Built pumps and engines of all types. Called in by Leonard Hartley in 1752 to solve drainage problems. Corresponded with him 1752-1755, and became friend of the family.

D'ARCY, Margaret Lady D (nee Garth) of Sedbury Park d.1758
Widow of James, Lord D'Arcy of Navan and heiress with the Jessop children to his lands in Middleton Tyas. Formed partnership of 'Adventurers' with her relatives John Hutton, John Yorke and Andrew Wilkinson.

GORDON, John of Forcett Park, Yorks (NR)
Agent to Robert Shuttleworth for his properties in the Richmond area in the 1770's and 1780's.

HARTLEY, Leonard of East Hall, Middleton Tyas 1689-1774
Son of Marmaduke Hartley, he built East Hall in 1713. Involved in copper mining from 1738 (Kearsley Lease) and lead mining from 1742 (Beldi Hill). Accused in case of copper theft 1742. Involved in Litigation with Richard Shuttleworth and his tenants, and with the Peacocks over manorial rights, tithes etc. Worked the copper mines on his own land in 1750's (see correspondence with Brown) and prospected further afield. In 1760's his interests taken over by his son.

HARTLEY, George of Middleton Lodge, Middleton Tyas 1726-1780
Son of Leonard. Cambridge graduate, Fellow of Magdalene 1747, Member of Lincoln's Inn. Barrister on Northern Circuit. Friend of the Lowthers. Worked the Middleton Mines 1762-3, but by 1766 had leased them to his cousin Leonard.

HARTLEY, Leonard 1725-1798
Son of Francis, nephew and ward of Leonard (above). Member of Staples Inn. In 1749 qualified as Attorney in Court of Common Pleas, Solicitor in the Court of Chancery and Commissioner for Oaths in the Northern Counties. Interest in copper mines seems to date from 1761 and lease (with Readshaw) of rights in Moulton. In 1766 (with partners) leased Middleton Mines from George Hartley.

HUTCHINSON, Ralph of Richmond, Yorks (NR) d.1770
Variously described as Agent and Steward of John Hutton. Presented accounts for the Partners' mines 1742-1767. Contractor for materials to the Partners. Lessee of mines in Swaledale, Wharfedale and Nidderdale.

HUTTON, John J.P. of Marske Hall, Marske-in-Swaledale, Yorks (NR) d.1768
Son-in-Law of James, Lord D'Arcy of Navan, brother of Matthew Hutton Archbishop of Canterbury. Partner of Lady D'Arcy from 1742.

JARS, Gabriel 1732-1769
French industrial spy who visited Middleton Tyas in a tour of British industry 1764-5. Report published in 'Voyages Metallurgiques' (Vol III published 1781, refers to Middleton Tyas).

MAWER, The Rev. John, D.D. 1703-1763
Vicar of Middleton Tyas 1730-63 (see epitaph quoted on Page 120). Leased mineral rights of Glebe to Tissington in 1750.

MILBANKE, Sir Ralph 4th Bart., J.P. of Halnaby Hall 1689-1748
Married, as his first wife, the sister of the Earl of Holderness (D'Arcy). Succeeded his brother as baronet 1705. 1742 carried out investigation of copper theft case. Enemy of Leonard Hartley. Leased his own mining rights to William Paul in 1745.

PAUL, William of Grinton, Yorks (NR)
1745 Lessee from Milbanke. Having ore smelted in 1750-51. Active in 1754, until reported ill at Richmond.

ROTTON, John of Duffield, Derbyshire
Agent for John Gilbert Cooper of Locke. Came to Middleton Tyas in 1746 to buy copper and ore. Leased smelt mill from Partners 1754 until at least 1767. Settled at Barton, and seems to have been principal dealer in copper.

SHUTTLEWORTH, James of Forcett Park, Yorks (NR) d.1773
Leased mineral rights to Moore and Bethell for 21 years in 1751.

SHUTTLEWORTH, Richard of Forcett Park, Yorks (NR)
Involved in litigation with Leonard Hartley in 1748 over enclosure and lordship of the manor.

SHUTTLEWORTH, Robert of Barton, Lancs
Absentee landlord, but leased and worked the Partners' and the Glebe mines in 1775. His agent still active in smelting until 1780.

TISSINGTON, George of Winster, Derbyshire
Worked for James Shuttleworth before 1746, when he offered his services to the Partners. Lessee of the Glebe (with others) from 1750, and of Kneeton from 1753. Worked the Glebe actively, trying all means to overcome water problem, including steam engine and multiple pumps. On bad terms with Leonard Hartley. Leased Glebe again from new Vicar in 1763. By 1775 lease had lapsed.

WATSON, The Rev. D W
Vicar of Middleton Tyas from 1763. Leased Glebe to Tissington for 14 years in 1763, and to Shuttleworth in 1775. Insisted on landscaping of spoil heaps.

WILKINSON, Andrew, M.P., of Boroughbridge, Yorks (WR) c1698-1784
Husband of James, Lord D'Arcy's granddaughter Barbara, M.P. for Aldborough (WRY) 1735-1765. Member of Lady D'Arcy's Parntership and last survivor of the original Partners.

WYNN (or Winn), William of Middleton Tyas d.1771
First referred to in 1742 as a labourer, Wynn gradually became contractor for most of the work. He undertook building, mining, dressing, smelting and seems to have acted as Ralph Hutchinson's manager. He later bought ore from the Hartleys, and from 1758 rented a farm, which his widow continued to work.

YORKE, John M.P., J.P., of Richmond, Yorks (NR) 1685-1757
Son-in-Law of James, Lord D'Arcy. M.P. for Richmond 1727-1757. Built Yorke Pew in Richmond Parish Church, and Culloden Tower, Richmond. Partner with Lady D'Arcy from 1742 until his death in 1757, when his share was taken over by his widow Anne, who lived until 1768.

CHAPTER 1. AN INTRODUCTION TO MIDDLETON TYAS, THE FAMILIES, THE COPPERMINE AND THE SOURCES OF INFORMATION

THE RECORDS

In 1764, the year after the restoration of the peace of Europe, the French Government sent to Britain a young man whom we would now describe as an industrial spy. Not only was industrialisation proceeding more rapidly in Great Britain than in France, but the increasing use of coal and coke was setting the metal-working industries free from dependence on the dwindling stocks of hardwood. Shortage of charcoal was proving a major problem in France. Gabriel Jars, for such was the young man's name, spent 1764 and 1765 touring Britain visiting mines to see new methods of winning coal and ore. He also paid attention to chemical works, dyeworks, smelting furnaces; in fact all the coal-using industries. In the north-east he visited the Tyne Valley calling at Hexham, Winlaton, Newcastle, Walker and Washington, from where he went to visit the Alum works on the North Yorkshire Coast. His visit to Middleton Tyas must have been made en route from Whitby to Leeds. That an industrial expert should have chosen to visit this small North Riding village on a technological tour from which he omitted Coalbrookdale and Broseley, may today seem remarkable. The reason for his visit was to view the copper mines and smelting works, which by popular report had yielded the purest copper ever found in Britain, having been discovered some thirty years earlier in a limestone quarry. Jars came to Middleton Tyas when the industry was already in decline and the promise of a fabulously rich lode had faded. When his report was finally published in the third volume of 'Voyages Metallurgiques'[1], which did not appear until 1781, it was posthumous in more senses than one. Jars had died in 1769 of sunstroke, and the struggling copper industry at Middleton Tyas was at its last gasp.

1. Jars, G ; Voyages Metallurgiques, Vol III : Paris (1781) pages 72-75. Quoted in translation in Appendix F.

Jars was the only contemporary to publish an account of the copper mining in the area, and that occupying a mere three pages in the three volumes of his report. After his time, apart from minor references in the local historians, the industry passed into oblivion. The only attempt to collate the extant information was made in 1865, when a historical resume was included in the prospectus of the Merrybent and Middleton Tyas Mining and Smelting Company Limited. During the century which had then elapsed practically everything had been forgotten.

The next serious account did not appear until 1936, when Dr Arthur Raistrick, then Reader in Geology at King's College in the University of Durham, published a short account, drawing on Jars and the Brown Letterbook[2]. This brief article is the last record to appear in print.

Hence, printed material has formed only a tiny proportion of the basis of this work, which is largely based on the documents which have survived of the principal landowners of the day. Before examining in detail the evidence for the growth of the copper mining industry it would be as well to consider these papers, the pattern of landownership and the village itself.

THE VILLAGE AND ITS LANDOWNERS

The parish of Middleton Tyas includes the townships of Middleton Tyas and Kneeton, which were separate manors, as well as the adjoining Chapelry of Moulton. Middleton Tyas is a large, scattered village consisting of substantial houses mainly of the 18th and 19th centuries and containing four mansions, Middleton Lodge (1779), The Rookery (1727), East Hall (1713) and West Hall of about the same date. The twenty public-houses which flourished in the mining days have dwindled to three, one of them the modern road-house at Scotch Corner, but the signs of 18th century prosperity are plain to see. On the other hand, Kneeton had even then

2. Raistrick A : 'The Copper Deposits of Middleton Tyas' ; The Naturalist, May 1936

shrunk to no more than the Elizabethan Hall, occupied by the Hobsons, and a few cottages; little more than exists today.

Jars stated that there were five main landowners on whose land copper was mined. He did not name them, but we know them to have been; The Church, the Shuttleworth family, the Hartley family, the Milbanke family, and a partnership consisting of Lady D'Arcy, John Yorke, John Hutton and Andrew Wilkinson (referred to hereafter as The Partners). A sixth, smaller landowner, who at least tried for copper was Mr Steaney. Their comparative standing in the village in 1727 may be deduced from the list of freeholders drawn up in connection with the enclosure[3]. Sir Ralph Milbanke headed the list at £310 followed by William Shuttleworth with £222, Mr Hartley £201, Mrs Hartley (his mother) £5, Mr Gyll £4, Lady D'Arcy £65, Mr Steaney £33, Mr Peacock £29, Mr Sudell £30, Mr Thompson £9, Mr Hobson £100, Richard Cotes (sic) £10, Thomas Burrell £17, thirteen others with £5 or under. The situation of the lands and mines is discussed in Chapter 3 and the activities of the miners in subsequent chapters. Here we will consider the various owners separately.

THE GLEBE

The most stable element in land-ownership was, of course, the Glebe. The papers relating to this are deposited at Leeds and Northallerton. At the former place are the Bishops' Transcripts of the Registers (originally kept by the Bishops of Chester), the Parish Bundle, and the Tithe Map of 1841[4]. The Original Parish Registers have recently been deposited at the County Record Office, Northallerton, and contain additional notes on the copper mines compiled by the Rev. Dr Watson in the 1760's. His predecessor, the Rev. Dr John Mawer was the first incumbent to be involved in mining, having been presented to the living

3. Hutton Papers ZAW ; Northallerton County Record Office

4. Leeds City Record Office ; RD/RR/76 ; CD/PB/6 ; RD/RT/164

in 1730, and remaining there until his death 33 years later[5]. The affluence of the living, even before copper was discovered, is indicated by the size of the mansion known as The Rookery which Mawer's predecessor the Rev. J S Blackwood began in 1727 and which he completed[6].

In the mid-18th century the lessee of the mineral rights of the Glebe was George Tissington of Winster, who had already worked for Shuttleworth (see page 44) and offered his services to The Partners. His activities employing miners brought in from Derbyshire, in the Glebe are described in Chapter 6 with particular reference to the Hartley-Brown correspondence. By the time of Dr Watson's induction to the living in 1763 this lease had ended, as he noted in the Register that no lease then remained.

THE SHUTTLEWORTHS

The activities of the Shuttleworths of Forcett Park are not well documented though they were large landowners in Middleton Tyas and claimants to the title of Lord of the Manor. James Shuttleworth leased his minerals to a partnership who employed Cornish miners (see page 126). In the family papers, which are located in the Estate Office at Cowan Bridge, Lancashire, are some letters which cast light upon the family's dealings with the Hartleys, and a series of letters from their agent John Gordon, written in the late 1770's and early 1780's. The details gleaned from Cowan Bridge and from the Havelock-Allan papers at Northallerton form the basis for the Shuttleworth section of Chapter 8.

James Allan of Blackwell, the ancestor of the Havelock-Allans, was also involved in copper mining at Barton at this time and may have been

5. Milnes L P ; Octocentenary of St Michael's Church ; Middleton Tyas (1958)

6. In a note in the Parish Register, written in Latin, Mawer described the house as not a third part finished and the land as neglected and derelict when he took over. A later clergyman, without profitable royalties, found the house too big and sold it to the Backhouse family, Quaker bankers from Darlington.

instrumental in collecting an assortment of relevant papers. On the other hand it could have been the work of his great-grandson R H Allan who was an antiquarian and also a mid-19th century speculator in the risky business of copper mining[7]. His interests were at Merrybent and his collection of papers, as yet unsorted, is compendious[8]. Among the papers relating to Barton is a very valuable document in the form of a map drawn and annotated in 1754 at the height of the copper-mining activity by Richard Richardson, covering the whole area between Middleton Tyas and Melsonby[9].

THE MILBANKES

Larger landowners even than the Shuttleworths, were the Milbankes of Halnaby whose records, which survive in the Lovelace Papers, in Newstead Abbey and at the County Record Office, unfortunately do not include those of Sir Ralph Milbanke, 4th Bart. Neither Mr Malcolm Elwin, author of the recent book on the Milbankes and Noels,[10] nor the Princess Dmitri of Russia, widow of the last Milbanke Baronet, has any knowledge of such papers. Unless they turn up unexpectedly from some unsuspected hiding place we will have to be content with the few references to Sir Ralph in the 'Copper Theft Case' and the scanty information in Chapter 8.

7. ROBERT HENRY ALLAN born at Sunderland 1802, eldest son of Robert Allan of Newbottle . Practised as a Solicitor before inheriting the Black-well Estate (Darlington) from his uncle. Mayor of Durham in 1844 he presented stained glass windows to the Town Hall as well as St Mary-the-Less. He became High Sheriff of Durham in 1851, a Deputy Lieutenant and Magistrate in that County and the North Riding. His interests were mainly in land and his obituary states that he eschewed investment in joint-stock concerns but on the representation of experienced friends so far departed from his rule as to invest in the Darlington Iron Co., West Hartlepool Iron Co., and the Merrybent Railway & Mining Co. A Fellow of the Society of Antiquaries he helped Surtees and Ord in their work. In his later years he became an eccentric recluse with long hair, curling whiskers and shambling gait. He died on 28 October 1879, leaving £500,000 to his widow and his cousin General Sir Henry Havelock who took the name Havelock-Allan. The Northern Echo of the 29 October 1879 gave an entire double page to his career in addition to the usual obituary notice.

8. The Havelock-Allan Papers are filed under ZDG at Northallerton, and being as yet uncatalogued we can only refer to them as ZDG(B) for the 18th century papers referring to Barton ZDG(M) for the 19th century ones on Merrybent.

9. Map 3, Vol.II, page 11.

10. Elwin M : The Noels and Milbankes ; London (1967)

THE D'ARCY PARTNERSHIP

Reference to the Milbankes brings us to a landowning family of whom we have more information. As Table 2 illustrates,[11] Sir Ralph Milbanke 4th Bt., had first married Elizabeth D'Arcy, sister of the 3rd Earl of Holderness. It was on D'Arcy lands in Middleton Tyas that the first discovery of copper was made, or so it was claimed. At the time the land in question belonged to Lady D'Arcy, fourth wife and widow of James D'Arcy of Sedbury, and the children of her step-daughter, Mrs James Jessop. The Irish title Lord D'Arcy of Navan had been created for James D'Arcy, and after his death in 1731 had passed to his grandson James Jessop, who died only two years later in 1733. The 2nd Lord D'Arcy's sisters were called Barbara, Isabel, Mary and Bethia Jessop. In 1735 the eldest, Barbara, married[12] Andrew Wilkinson, M.P., who became 'Adventurer' with Lady D'Arcy, John Hutton and John Yorke. Both the latter had married daughters of the 1st Lord D'Arcy, Elizabeth was Mrs Hutton and Anne, Mrs Yorke. Their husbands both belonged to substantial local families.

The Huttons had bought Marske-in-Swaledale from the Conyers family in Elizabethan times, and by the early 18th century were considerable landowners with a reputation for breeding racehorses. In 1745 the same John Hutton, commissioned Captain, raised a company of foot, consisting of some fifty local men, to fight the Pretender.[13] His Younger brother, who had entered the Church, became Bishop of Bangor, Archbishop of York and eventually Archbishop of Canterbury (1757-8). The prosperity of the family is borne out by the £50,000 left in his will by Archbishop Matthew and the elegant Georgian mansion completed by Squire John. His papers have been preserved, first at Clifton Castle near Bedale, and now in the

11. Vol.II, page 8.

12. Andrew Wilkinson of Boroughbridge (c1698-1784) was elected as M.P. for Aldborough (WRY) in 1735 in which capacity he served for thirty years : G P Judd, 'Members of Parliament, 1734-1832.'

13. Cave R ; Short History of the Parish of Marske ; Marske (1967)

County Record Office, Northallerton, where they were deposited by the late Lt. Col. A P Curzon-Howe-Herrick. The relevant sections are in files ZAW 117 and ZAW 118, the former contains the balance sheets presented to John Hutton by his agent Ralph Hutchinson and the latter, the supporting vouchers. That the latter had remained undisturbed since the 18th century was evinced by the fact that when examined lately the sand was found still adhering to the ink. These accounts form the basis of Chapter 4 and part of Chapter 8.

The Yorke family of Richmond and Bewerley-in-Nidderdale were deeply involved in mining activities already, mainly concerned with the lead mines of the Pennine Dales. Their house on Bargate Green, Richmond has vanished completely but the Culloden Tower which John Yorke erected to show himself as loyal as his more martial relative, still stands on the site of Hudswell Peel, facing Richmond Castle. Until his death John Yorke represented his town in Parliament.[14]

The Partners, or Adventurers, shared the costs and profits of the enterprise equally. Nor did the Partnership terminate on death, but the share passed to the respective heirs. Chapters 4 and 8 deal with their accounts in detail between 1742 and 1767.

THE RISE OF THE HARTLEYS

Just as the Partners were related, so the other principal family involved, the Hartleys, were related to most of the lesser landowning families in the neighbourhood. This is illustrated in Table 1,[15] compiled from evidence in the Hartley Papers in the County Record Office and from the family memorials in and around the Parish Church. The deposit of the MSS at Northallerton by the family Solicitor and the numbering and cataloguing of the gravestones are both due to Mr Michael Speir of East Hall.

14. Clarkson C ; History of Richmond ; Richmond (1814).

15. Vol.II, page 7.

As well as the family papers[16] and, throwing more light on the day to day working of the mines, is the correspondence between Leonard Hartley (1689-1774) and William Brown of Throckley, perhaps the most famous colliery 'viewer' of his day. Brown's letter books, preserved in the North of England Institute of Mining in Newcastle-upon-Tyne, contain copies of letters between Hartley and Brown written between 1752 and 1755, mainly on the subject of pumping water. (Discussed in Chapter 6).[17] There are frustrating gaps in the letters and incomprehensible paraphrases and lacunae where the clerk omitted a word, presumably having been unable to read the original. Other aspects are difficult to comprehend as the writer took for granted much of the essential detail which would complete our picture of these years' activity. Brown also corresponded at length with Carlisle Spedding of Whitehaven, the Lowthers' manager.[18]

The rise of the Hartleys in little over a century from illiterate yeomen to educated, influential and wealthy landowners forms the background to the history not only of copper mining in Middleton Tyas, but of the gradual consolidation of the bulk of the land there into one estate.[19]

16. The MSS at Northallerton, filed under ZKU, contain a mass of uncatalogued indentures and legal documents of all sorts which are valuable in illustrating the rise of the family. All the Hartley information comes from these papers unless specified. There is also however a smaller set of papers dealing exclusively with mining, both for copper at Middleton Tyas and lead at Beldi Hill.

17. In Chapter 6 and elsewhere they are referred to by the writer's initial, recipient's initial and page number, e.g. HB65, Hartley to Brown, page 65. The full list of dates is given in Appendix E.

18. CARLISLE SPEDDING of Whitehaven, originally a land agent for the Lowthers, became the best known colliery manager of the second quarter of the 18th century. As well as being an efficient manager in the organization of labour, he was a technical innovator. He introduced blasting in coalmines in 1730, and the first undersea workings, introduced gravity-operated tramroads from the pits to the town and harbour, but is perhaps best known for his 'steel mill' introduced to provide a safe light in pits. The pits under his management made extensive use of steam engines which first brought him into touch with Brown. After his death in a colliery accident in 1755 his son James followed him

19. In view of the practice in the Hartley family of using a few Christian names repeatedly it is necessary to number of various Leonards and Georges but where the former name is used without a numeral it should be understood to refer to Leonard (2). The Hartleys principally involved in copper mining are underlined in red in Table 1.

Among the early Hartley papers is a will made by George Hartley (1) yeoman, in 1648. Though the Hartleys were even then not inconsiderable landowners, the details of this will form an interesting comparison with those of George(1)'s great-great-great grandson and namesake, George (4). George (1) left two houses, arable land in the open field, seventeen pasture gates on East Moor and already six closes, but the witnessed cross for signature and bequest of 'one gimmer lamb to my grandchildren' contrast with later affluence and sophistication.[20]

George(1)'s son Leonard (1) of Newton Morrell, a hamlet in the neighbouring Parish of Barton, described himself in his will and other documents as 'gentleman'. This Leonard, his son Marmaduke and grandson Leonard (2) began the process of amassing land and wealth. They benefitted from the early enclosures in the area, Kneeton and the East Moor and Kirkbeck Lands of Middleton Tyas were enclosed by consent, as with so much land in the neighbourhood this took place during the Interregnum; Kneeton in 1655 and Middleton Tyas in 1658.[21]

Later in the 17th century the misfortunes of the Taylor family, who also had ambitions for social advancement but evidently lacked the capacity to realise them, were turned to profit by the Hartleys. Christopher Taylor Senior, yeoman, had acquired land from Sir Francis Boynton, the then Lord of the Manor, during the Interregnum. His grandson, also Christopher, but now a gentleman of Stockton, seems to have been perpetually in debt and

20. Anne, one of the said grandchildren, established by marriage the link between Hartleys and the Peacocks who seem to have lived on bad terms throughout most of the 18th century.

21. The existing references are not detailed about the 300 acres enclosed from the East Moor but as the Kirkbeck Lands are mentioned separately and as George(1)'s will referred in 1648 to Chantry Closes we can assume that the whole Parish east of the beck, excluding those areas, was enclosed at this time.

gradually mortgaged and eventually sold his land, mostly to the Hartleys, by the turn of the century.[22]

The case referred to below in the 1740's[23] quotes a conveyance of the 19/20th November 1697, whereby William Brown and Dorothy his wife, Francis Peacock and Prisca his wife granted and conveyed to Marmaduke Hartley their Manor and Lordship of Middleton Tyas with all appurtenances including mines, quarries, etc. No title deed survived and the validity of this transaction was later questioned. As the family-tree indicates all the family lands passed to Marmaduke, who enjoyed his position as head of the family for only two years, 1707-9.[24]

In the year between his father's death and his own, Marmaduke made his will. His various bequests show the growing wealth of the family, his daughters Mary and Elizabeth received £500 each, and his nephews and nieces £50. His wife was to have £60 per annum for her necessities and his younger son Francis, then 15, £10. The custody of Francis and the balance of the property went to Leonard (2).

Of all the characters in this story none stands out in sharper relief than this Leonard Hartley (1689-1774). In the year in which Leonard inherited the lands, agreement was reached in principle and a start was

22. Following a series of judgements against Taylor in the Court of Common Pleas in 1686-7, Leonard (1) and Marmaduke each paid off some of Taylor's debts, the former £100 to Henry Wilkinson of Stockton and the latter £200 to Ralph Sayer, haberdasher of London. In 1695 they lent him £1500 at 6% and when he failed to redeem the mortgage in five years, bought him out. Of the land they acquired, some was enclosed and some unenclosed. Of the latter were eight acres each in the North and South Fields, and half an acre in the Mains. The enclosed land included West Garth, Park Close, Water Closes, Little Peasey Hill Closes, Cornamire Close, Dale Close, Hall Crofts, East Moor, New Town Lands Close, Old Nine Lands Close, Great Bank Flatt and Little Bank Flatt. The names of the last five of these indicate the persistence of old 'champion' names into the new enclosed pattern.

23. See below page 14.

24. As well as lands and papers, the Hartleys also amassed a collection of family portraits which still adorn the staircase of East Hall. They are all labelled except one, which is described simply as 'Mr Grandfather Hartley'. From his appearance it is likely that this handsome man in flowing peruke is in fact Marmaduke.

made in enclosing Gatherley Moor to the west of the village, along the Roman Road which is now the A1. The procedure seems to have been incredibly leisurely; the Moor enclosure was not completed until 1726. Indeed it was not until 1719 that Commissioners John Marley, Thomas Smithson and John Culley were appointed to redistribute the town lands. Their award was made in 1722 and a fencing agreement in 1726. In the meanwhile land had been changing hands in such a way as to make consolidation of holdings relatively easy. Peacock had bought the plots marked 'C' on map 2 in the South Field area, so it is not surprising that he was allotted the bulk of his land in this area when the South Field finally disappeared.[25] Two maps dated 1720 which survive in the Hartley papers show the division of the North and South Fields. (These fields are delineated by a heavy line on map 2.) We know also of a Church Field and Mill Hill being enclosed at the time. For reasons which will become obvious the maps of these fields do not survive.[26] Such information as does survive indicates a highly complex situation in which the Hartleys played an increasing part, and from the complexities of which Leonard clearly intended to profit.

Leonard had already benefitted by his marriage to Catherine Bowles, who not only bore him a large family but brought with her lands worth £352 per annum in rent ; more than Leonard's, which in 1733 stood at an annual £317/10/10 rental.[27] In the marriage settlement she was guaranteed a

25. As in many 'champion' villages the open fields in question had shrunk to less than 80 acres each.

26. The Church Field was obviously near the Church and the long thin fields running North and South: Kirk Tofts, Church Close, Kirk Bank, Kirk Leazes, show the pattern of a furlong. The division into selions is even more clearly seen in the Rowriggs which run East to West. What system of rotation was employed is not clear. Were the three fields excluding Mill Hill, the basis of the classic three-field system? If so, how did the East Fields fit into the scheme? A reference in 1695 to 'half an acre in the Mains' suggests that that area was also open field at the time. None of these fascinating questions can at present be answered, nor is it within the scope of this work so to do.

27. Catherine's lands were mainly in the Ripon area where the family seems to have originated, though her father was Rector of Bromley, Kent.

jointure of £100 per annum if she survived her husband, considerably more than her mother-in-law, who in fact survived her by a year. Leonard remained a widower for 45 years. Having borne him nine children in as many years, Catherine died in childbirth on June 4 1729.

In the previous year Leonard's brother Francis (2) had also died. His portrait at East Hall (Fig.1) looks older than his 35 years. In his will he described himself as sick but sane and left his brother Leonard as executor of the will. In an age of high infant mortality, many of Leonard's children also died. The Parish Registers record the deaths of Catherine, the eldest, and Stephen, the third, before their first birthday. Of the others, there is no record of the fate of Samuel and Marmaduke. The twin Leonard (4) was apprenticed in 1745 at the age of 18 to Collison, Gibbon and Applebee, brewers of Southwark.[28] In a letter to Brown dated 6 August 1753 Leonard referred to the death of his younger son as a loss for which all the coppermines in the world could not compensate. There is no record of burial in the Registers of either Middleton Tyas or Barton, so this probably refers to Leonard (4). In any case the memorial in the former Church describes George (4) at the time of his death as Leonard's sole surviving son.

THE COPPER THEFT CASE

The beginning of the involvement of the Hartley family in copper mining seems to date from an indenture of lease drawn up between Leonard Hartley and Oliver Kearsley of Sedgefield, and signed on the 18th December 1738.[29] This lease is given in full in Appendix A as typical of most of those referred to in this work. It covers all activities from cutting the turf to refining the metal, making specific mention of precautions against

28. This illustrates the point made by Thorold Rogers (Six Centuries of Work and Wages ; London 1884) that brewing was regarded as a respectable trade suitable for a gentleman's son.

29. Hartley Papers, ZKU ; Northallerton County Record Office.

permanent damage. Payment was to be made as a duty of a specified proportion of production, and the interests of the lessor were to be protected by a clause requiring the lessee to work the lease within a stated period of time.

The question of whether Kearsley actually worked this lease, or indeed whether Hartley's land ever produced copper before 1742 is crucial to the Copper Theft Case prepared by Lady D'Arcy and Partners in 1742 against Leonard Hartley and others. Briefly, they alleged that Hartley had persuaded his gardener, Robert Grainger of Barton, to obtain stolen copper ore from Christopher Dinsdale, a quarryman employed by Lady D'Arcy's tenant, and sell it furtively after hiding it at East Hall. In the summary of evidence given in Appendix B the Partners claimed that the ore in question must have been stolen from them as their mine, discovered in 1737, was the only one which had operated successfully.[30]

The evidence on this question as with so much of this case is conflicting. William Peacock, Thomas Goodburn and Sir Ralph Milbanke all gave evidence[31] to the effect that Kearsley and William Rutherford had spent considerable sums of money and found nothing. On the other hand John White, of North Cowton, who worked for Hartley as a quarryman spoke of finding copper in his quarries since 1733.[32]

Hartley's actions in this case are difficult to explain and his guilt anything but certain. If, as Grainger claimed, Hartley was responsible for the thefts his defence of his actions seems to have been connected with his claim to the Lordship of the Manor. According to Grainger[33] when he expressed anxiety, he was assured by Hartley that he would come to no harm, since he, Hartley, was Lord of the Manor if there was one. If this was true

30. Dr Raistrick in the article mentioned above (published in the Naturalist, May 1936) had not seen this evidence and, disagreeing with Jars, stated incorrectly that mining did not begin until the 1750's.

31. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.

32. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.

33. Hutton Papers ZAW ; see Appendix B.

he seems to have considered that he had at least a valid excuse for his behaviour. Certainly in 1742, through his nephew, he took advice of Counsel over his legal rights. The Barrister, Mr Filmer's reply[34] was dated 1st January 1743. The significance of this date will become obvious. Filmer told Chapman that it would be difficult, in the absence of deeds, to prove the right of the Irwins and Peacocks to sell the manor to Leonard's father 46 years before.[35] The matter was further complicated by the fact that the persons under whom they claimed were Roman Catholics. Filmer also stated that whoever was Lord of the Manor, ore mined on freehold land was the property of the freeholder, though if on waste it belonged to the Lord. This explains why Hartley was so anxious, five year later, to dispute the legality of the enclosure of Church Field.[36] On the basis of one tenant, who still paid or did customary service, Filmer considered that Hartley had not sufficient claim in law to establish a Court Baron.

If Hartley did receive ore from Dinsdale via Grainger, and sincerely believed in his claim, why did he apparently act in such an underhand manner? On the other hand, he may have been quite unaware of the entire proceeding which was a plot to discredit him, as he alleged.[37]

34. Havelock Allan Papers ZDG(B) ; Northallerton County Record Office.

35. See above, page 10.

36. See below, page 23.

37. It can hardly be coincidence that Hartley having become joint lessee in this same year, 1742, of Beldi Hill leadmines near Keld was involved in the endless series of wrangles over the manorial right of the Wharton Estates, culminating in the celebrated case of 1771-2, which became something of a testcase. In this case Lord Pomfret, who inherited the Lordship of Healaugh from the Wharton Trust, claimed that Crackpot Hall Out Pasture upon which Hartley and Parkes were mining was common land. After much stupid and violent behaviour, which formed the basis for Thomas Armstrong's noval 'Adam Brunskill', the case eventually went to the Court of King's Bench, where Lord Pomfret failed to establish his right in 1772. The Draycot Hall Papers in Northallerton County Record Office contain all the material relevant to the case, and rarely refer to Hartley in person who by the time the case was concluded was 83 years old and presumably no longer an active partner.

Such then, were the brief details of the case. There is no record of it ever having gone to Court. Indeed it was Counsel's opinion that the plaintiffs did not have a strong enough case to secure the conviction of any but the small fry. In the statement sent to this Barrister, Richard Floyd[38] there is no hint of any doubt about the facts; that Hartley received the ore from Grainger knowing it to be stolen. All the Partners regarded as necessary was Floyd's advice as to whether the evidence of an accomplice would be adequate to convict Hartley.

A closer scrutiny of the affidavits taken casts a different light on certain aspects of the case.[39] We will attempt, as far as possible, to reconcile conflicting evidence and produce a composite account of the events, indicating the sources of information.

In June 1742 Robert Grainger, the gardener, came to Sir Ralph Milbanke of Halnaby, 4th Baronet and Justice of the Peace, with his allegation against Hartley. It was not until a year later that Milbanke stated that Grainger came in June,[40] previously he had asserted that Grainger visited him first on the 6th July.[41] The inference is that Milbanke knew about the accusation, but waited to act until Hartley was away at Nottingham Races, during the first week of July. Everyone in the village seems to have known of Hartley's absence, and eventually even Milbanke admitted that he did.[42] With the evidence before him, Milbanke invited John Yorke and John Hutton, both Magistrates and both Partners of Lady D'Arcy, to meet him at Halnaby on the 6th.[43] Before the three J.P.'s Grainger made a sworn statement. This was comparatively short, merely relating that he had been frequently sent by

38. See Appendix B

39. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office

40. ibid.

41. Hutton Papers ZAW ; see Appendix B.

42. In the letter which he sent to his uncle, Leonard Hartley, on the 7 July, George Chapman said that Grainger had gone to Milbanke first on the 1 July.

43. Havelock Allan Papers ZDG(B) ; Northallerton County Record Office.

Hartley to buy stolen ore from the quarryman, Dinsdale, for which he had paid him £3/12/-. The ore was then taken to a stable in Stone Horse Park and later removed to Hartley's garden.[44] The statement ends there, but Chapman knew[45] and Milbanke made obvious by his subsequent actions, that Grainger had also said that there were four sacks of ore in East Hall, and that the total quantity was three tons, worth £150.

When Yorke and Hutton asked Milbanke for a search warrant he refused. His motives are not clear, since when asked for a warrant he stated that his presence was better than a warrant. By way of explanation he said that it was more neighbourly and goodnatured to go himself.[46] In view of his relations with Hartley it is difficult to accept this. Whatever his motives were, there is agreement among all witnesses about the next move. The three Magistrates went during the afternoon to the Red Lion, kept by John Ayre. Here they sent for Dinsdale and charged him with theft. Leaving Hutton and Yorke to question him, Milbanke then sent for William Peacock, Chief Constable of the Wapentake of Gilling West, and set off at 5 p.m. for East Hall. En route he enlisted the unwilling assistance of William Wynn and William Musgrave, 'labouring persons', the latter employed by Hartley cutting hedges.[47]

East Hall, Hartley's house, is dated by the rainwater heads which still bear the initials, L.H. and the date 1713. A plain, dignified house of seven bays, it is typical of its period and has changed little since Leonard Hartley's day. One alteration which has been made recently has destroyed the former kitchen entrance and passage (to the right of the

44. Hutton Papers, ZAW ; see Appendix B.

45. Hartley Papers, ZKU ; Northallerton County Record Office; letter from G Chapman to L Hartley dated 7 July 1742.

46. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.

47. ibid.

building in Fig.2). When Milbanke arrived at this entrance he went into the house and demanded to be shown the back kitchen. Opening a door next to it he entered a closet and observed a trapdoor of which he obviously had prior knowledge since he remarked, "Here is the drapdoor I am informed of". Moving a tub of dogmeal William Wynn entered the room by the trapdoor and found one bag of copper ore and some lumps of copper. Milbanke clearly expected there to be four bags. Leaving Musgrave to look after it he proceeded with William and Jeremiah Wynn to the orchard to dig for more concealed ore.[48]

About this time, George Hartley, aged 16, appeared on the scene. There is disagreement about whether he asked to see Milbanke's warrant. George stated that he did and that if was refused ; Milbanke and Peacock that he did not. Certainly he was denied a sight of the information of Grainger. At half past five, while Milbanke and George Hartley were talking, Hutton and Yorke arrived. After looking at the ore found in the house, and leaving the Wynns digging in the orchard, they went to the kitchen garden. A servant stated that Milbanke demanded the key only. At this point accounts differ widely. According to Milbanke the whole proceeding passed off with great civility, George Hartley opening the door for them. On the other hand the latter asserted that he was dragged by force. Having found ore in the kitchen garden, Milbanke returned to the house, told Peacock to pay Musgrave well and instructed Jeremiah Wynn and John Hebden to remove the ore, about a ton in all, to Peacock's house.[49] Once the Magistrates had gone, George Hartley rode to Richmond for his cousin Thomas Chapman. Between eight and nine in the evening they returned and Chapman told the diggers that they had no right in Hartley's garden and were guilty of trespass.[50] In the absence of a warrant he was probably right.

48. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.

49. Affidavits in Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.

50. Hartley Papers, ZKU ; Northallerton County Record Office.

The following day, the 7th, another of Leonard's nephews, Robert Colling from Hurworth, came to Middleton Tyas and advised Chapman to write to their cuple the letter already quoted above in case he wished to take legal advice at York on his way home. The letter was duly sent to Leonard at the 'Feathers', where he was staying at Nottingham. "You may easily imagine the consternation your family was in," Chapman wrote. He also drew Leonard's attention to the unreliability of Grainger's evidence, a fact which became increasingly obvious.[51]

On the same day, Milbanke summoned Dinsdale to Halnaby and further questioned him, using threats and oaths, according to the accused.[52] Since Dinsdale had already been charged, it seems that Leonard Hartley was right when he said that this inquisition was to obtain evidence to incriminate Hartley himself. In the case sent to Floyd it was stated that the owners were not interested in the small fry but were determined to prosecute Hartley if possible.[53] It looks as though Milbanke also had more than a merely professional interest in the affair.

When Leonard Hartley returned is not certain, but on the 12th he sent his nephews Colling and Chapman to Milbanke to ask him for a copy of the information laid by Grainger.[54] To no avail. Nor was George Hartley any more successful on the next day when he went on the same errand to Yorke and Hutton.

On the 13th however, Grainger returned to Milbanke and made a fuller statement, though from what has gone before, it is obvious that its contents were not new to Sir Ralph. According to Grainger, he had been instructed by Hartley, as soon as the mine opened and he had seen samples of the ore, to establish contact with Dinsdale whose job was only concerned with lime-working, with a view to stealing ore. It was to be concealed during the day

51. Hartley Papers, ZKU ; Northallerton County Record Office.
52. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.
53. Hutton Papers, ZAW ; see Appendix B.
54. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.

with limestone and carried off at night. He also gave much more detail of its concealment. In the first place it was carried in two little pokes, made specially for the job, and deposited in an outhouse in Stone Horse Park, there kept under lock and key. To the east of the House (marked A on map 4) is just such an outhouse illustrated in Fig.5. To the right of the door a small hole is visible. It was just such an airhole that Hartley stuffed with thorns when he discovered that someone was removing the horse-loads of ore which had by then lain there for six weeks, so Grainger alleged. It seems very likely that this is in fact the same building to which Grainger referred, and which if his allegation were true proved such an unsatisfactory hiding place, that Hartley ordered the removal of the ore to a partition under the henhouse in the courtyard behind East Hall, where it was securely padlocked.[55]

Grainger also tried to implicate William Coates, the tenant of the field and quarry and Christopher Pattinson, both of whom he accused of having brought ore to East Hall on Hartley's orders. This consignment was hidden in the cellar of the summerhouse in the garden. The building (marked B on map 4) is shown in Figs. 4 and 5 and is clearly identifiable. When the cellar was needed for other purposes, Grainger was ordered to remove the ore to the garden where it lay concealed until Sir Ralph ordered it to be unearthed.[56]

If Grainger is to be believed, Hartley took great pains to conceal his activities. Grainger was not to be seen in Dinsdale's company. Dinsdale was not to be told for whom he was stealing the ore. Coates was not to discover that Dinsdale was doing anything other than working the limestone. According to Grainger however all the servants at East Hall knew of the plot, in spite of the precautions; he implicated Ann Carter the housekeeper, by name. Chapman's letter confirmed that she knew of the copper, having been told of it some two months previously by Grainger; when the summerhouse

55. Hutton Papers, ZAW ; see Appendix B

56. ibid.

was to be used for washing the ore.[57] Presumably this is why the cellar had to be cleared. However Mrs Carter told Chapman that Hartley had said, "A thing of that kind would make a noise, and would be a scandalous affair and I will have no concern in it". Milbanke must have realised that Grainger's credibility as a witness was shaken by the admission in the second statement that he had given incorrect evidence at his earlier questioning.[58] The sums paid to Dinsdale were £5/1/- and £5/12/-. More damning however was the confession that he had paid some of this out of his own pocket and that Hartley had promised him a share of the profits. So far from being a mere accessory, this would make Grainger an accomplice in receiving stolen goods.

There the matter seems to have rested until the turn of the year. Just before Christmas Leonard applied again, through his son, to Milbanke for a copy of the statement indicating that his character was at stake. Milbanke again refused and further replied that there was no way by which Hartley could force him.[59] The advice to the Partners and to Hartley from their respective lawyers must have been sought about this time. As we have seen above the former were advised that since Grainger's was the only evidence, that that evidence was inconsistent, and that the information of an accomplice would be unlikely to convince a jury, they would be wise to drop the case.[60]

Whether it was dropped is not certain since the affidavits sworn by the various parties and quoted already were all taken in 1743.[61] The first batch made on 21 January to William Plummer, Commissioner of H.M. Court of King's Bench, were by George Hartley; Eleanor Stanners a servant at East Hall; John Ayre, publican of the 'Red Lion'; William Musgrave and

57. Hartley Papers, ZKU ; Northallerton County Record Office.
58. Hutton Papers, ZAW ; Northallerton County Record Office.
59. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.
60. Hutton Paper, ZAW ; Northallerton County Record Office.
61. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.

Christopher Dinsdale. The following day Plummer went to Hurworth and took a statement from Robert Colling. At the same time a further statement was taken from Thomas Chapman at Cambridge.

From these emerges a plausible explanation why Grainger may have turned King's Evidence. The publican, Ayre stated that Grainger who owed him £2/16/- for ale and money lent, told him the debt would be settled with money he was to receive from Sir Ralph Milbanke. When the three Magistrates each failed to pay him for his evidence and the debt was still not settled, Ayre went to Grainger's house and told Mrs Grainger he intended to sue her husband. She told Ayre that Milbanke had called and had promised two guineas for the evidence. Grainger, entering suddently, told her to hold her tongue, but the debt was paid shortly after. If Ayre was telling the truth, and there is no obvious reason why he should lie, it sheds a rather different light on the actions of Milbanke at least, if not of Yorke and Hutton.

In April, Plummer took further statements.[62] On the 4th William Rutherford told him of a lease taken out in 1736 from Hartley and its failure. He admitted then having himself bought 15 or 16 stones from Grainger at North Cowton where he then lived, for which he paid 15 or 16 shillings. Grainger had told Rutherford he could get 10 tons if he so desired.[63]

In Middleton Tyas on the 8th, John White, a quarryman, told Plummer that he had frequently found copper ore in Hartley's quarry since 1733. When, in 1736, he was working with Grainger, the latter invited him to join him in an enterprise in which they could make more in three hours than in three weeks of work. White refused and asserted that he heard Grainger approach Dinsdale, who also refused.[64] Thomas Goodburn's evidence corroborated that of White.[65]

62. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office
63. ibid.
64. ibid.
65. ibid.

Francis Coates, another labourer, stated that Grainger had also approached him late one evening to help him, but met with another refusal. Knowing what Grainger was doing, Coates subsequently observed him going home with copper ore in his apron to sell to Rutherford. He also stated that Leonard Hartley's bag of copper ore from his own quarry was lying about at East Hall in open view. Robert Athorp, Leonard Hartley's ward, also said that he knew of copper ore in the house, that the bag was kept in the open in the kitchen, that his guardian told him it came out of his own quarries and that this was common knowledge.[66]

This was borne out by the tailor, Samuel Musgrave, who had also been told by Grainger that there were 20 tons in the garden, and on a later visit that copper ore was hidden over the passage. Musgrave, however, said that Grainger had told him that Leonard Hartley knew nothing of it, having only one small bag of his own. Musgrave alleged that Grainger had also told him that he stole the ore at noon when Dinsdale went hom for dinner not at night as Grainger had asserted, to which he replied that he would be hanged for stealing.[67]

At the beginning of March the Chief Constable, William Peacock, told his version of the story to James Close at Richmond, but asserted that the only ore was in D'Arcy land, a view supported by six old men who swore that in their memory, and the oldest was 77, no copper ore had been found on Hartley's land.[68]

Whether the old men had any reason to wish to injure the Hartleys is not known, but the relations between the Hartleys and Milbankes revealed in the last of the statements, that of Sir Ralph himself, is perhaps the most illuminating of all. In it he was at pains to deny any malice or personal prejudice against Hartley, and to stress the friendly and neighbourly way in which he had acted, making no threat to life or property. He denied either threatening Dinsdale or bribing Grainger to incriminate Hartley but admitted that it was an error of judgement not to have had a search warrant.

66. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.
67. ibid.
68. ibid.

He further admitted that he did know Hartley was at Nottingham Races, but denied that this was why he had delayed making the search. From his statement emerges the cause for the ill-will. Apparently Hartley had farmed one of Milbanke's farms and so ill-managed it that they had ceased corresponding. Having been informed by his other tenants of damage to crops by Hartley, he "Acquainted him in a civil and neighbourly manner of it." He alleged that Hartley ignored this and threatened to shoot Milbanke's dogs if they came onto his land.[69] It may have been at this point that he made the threat, as Hartley stated, to shoot his servants and demolish Leonard Hartley. Whoever was telling the truth, relations were so bad that Sir Ralph, even if he did not 'frame' Hartley, was obviously delighted at having evidence to destroy the character of his enemy.

THE LATER CAREER OF LEONARD HARTLEY

The details of a later case are very relevant to the Copper Theft Case and suggest that an unrepentant Hartley still pursued his claims. In 1748 Richard Shuttleworth, who also considered himself Lord of the Manor, had an abstract of his title drawn up, but when he requested Hartley to produce the Enclosure Award of 1722 he met with evasions. At times Hartley variously pretended not to have it, to have lost it or to have used it as waste paper. We know that the maps of the North and South Fields had not been lost and in fact are still in existence. The dispute however centred around the Church Field and Mill Hill, the arable and pasture land of which Hartley denied had been part of the enclosure. This, of course, was the part of the Manor through which the vein passed and in which the most active mining was carried on. The case went to Chancery and on 10 July 1749 Lord Chancellor Hardwicks (Philip Yorke) ruled that Hartley was guilty of a breach of trust and made, "A particular and severe animadversion," upon his behaviour, commenting critically upon the nuisance and expense he had caused by making all the people concerned travel unnecessarily up to London.

69. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.

In January 1750 James Close, Master-Extraordinary in the Court of Chancery, was instructed to see that the award and deed were in order. Copies of the agreement to which all parties were sworn, were to be kept, triple locked, in a chest at the Vicarage. The keys were to be held by Hartley, Shuttleworth's agent John Jackson and Dr Mawer himself. Hartley's actions in this case can be best explained as a further attempt to establish his right to the minerals in the Manor.[70]

Hartley was obviously not given to living at peace with his neighbours for as well as the 1748-50 case of Shuttleworth v Hartley discussed above, we know of two other lawsuits in which he was involved with other landowners. In one of these he clashed with Richard Horn, tenant of Shuttleworth at Kirkbank Farm, over a right of way.[71] The field road from the village to Lingy Moor passes over Hartley's Kirkbeck Lands into Harley Bridge Close (see Map 2), through a gate and hedge belonging to Shuttleworth's estate. Hartley, wishing to divert the road, acted in his usual cavalier fashion stopping up the gate and having a ditch dug in front of it.

In the other case Hartley was the plaintiff, and petitioned Lord Chancellor Hardwicke against William and Ralph Peacock for failure to pay him the half of the tithe of corn and grain, formerly property of St Mary's Abbey, York, to which he had been entitled for twenty years.[72] Hartley had obviously not forgiven Peacock, the Constable who searched his house, nor Peacock the landowner who had frustrated his plans in 1753 by letting Kirk Bank Pasture to his rival Tissington (see below page 38). This case is not dated but must have been heard before 1756 when Hardwicke

70. See Barnardiston's Chancery Reports Vol.491 Re. Gibson v Smith 1741, in which is was established that the soil of the common land is the Lord's and that Common Rights do not affect his rights.

71. Papers relating to both these cases are among the Shuttleworth Papers; Cowan Bridge.

72. Hartley Papers, ZKU ; Northallerton County Record Office.

resigned the Chancellorship.

Meanwhile Leonard's son George (4) had been to Cambridge and been elected a Fellow of Magdalene on 10 January 1747.[73] His cousin, The Rev. Thomas Chapman D.D., son of Leonard's sister Mary, had been appointed Master of that College in the previous year.[74] His career illustrates the rising social status of the Hartleys and their relations. After Cambridge George (4) and his cousin Leonard (3) both entered the law, no doubt Leonard (2) had suggested it as a suitable career for both. George was a member of Lincoln's Inn and Leonard (3) of Staples Inn. The latter qualified in 1749 at the age of 24 when he was appointed Attorney in the Court of Common Pleas, Solicitor in the Court of Chancery and Commissioner for Oaths in the five Northern Counties.[75] George became a Barrister on the Northern Circuit. In 1752 his father mentioned his attendance on the Judges at Lancaster, Carlisle and Appleby.[76]

In this last town we hear first of George's involvement with politics, when he stayed there for the election of 1754 with old and young Sir James Lowther, the former the creator of Whitehaven and the family fortunes, and

73. Information supplied by the Librarian, the Pepys Library

74. Being at the time only 29, Chapman had to wait six months until the statutory age at which he could take up the appointment. Educated at Richmond Grammar School and Christ's, Chapman had acted as tutor to the Chaytors of Spennithorne and later to the Earl of Buckinghamshire. His appointment at Cambridge was due to the patronage of Lord Howard of Effingham. E K Purnell (College Histories, Magdalene ; Cambridge 1904) expressed a low opinion of Chapman contrasting him unfavourably with his predecessor, Abbot, and regarding him as a merely political appointment. Certainly it was the Duke of Newcastle who obtained him the Vice-Chancellorship in the hope, so it is said, of himself becoming Chancellor. By 1753 Leonard was writing to Brown of his nephew's attendance at Court (William Brown letterbook, HB145/6). Like many of his contemporaries, Dr Chapman seems to have been unduly concerned with position and wealth. A pluralist, he held the living of Kirkby Overblow (WRY), a prebend of Durham and the tithes of Aycliffe (Co. Durham). He had married a wealthy heiress and himself owned extensive investments in coalmines in County Durham about which he frequently sought the advice of William Brown. When he died in 1760 at the early age of 43, of overeating according to Purnell, he left George (4) as executor. Out of his considerable estate of £13,000, he left £56 to the College to finish the chapel, and to his executor, "Two bottles of arrack which proved to be vinegar. Three bottles of wine which proved to be good for nothing", to quote George's own words.

75. Hartley Papers, ZKU ; Northallerton County Record Office.

76. William Brown Letterbook HB71 28 July 1752, Newcastle Mining Institute.

the latter, later Earl of Lonsdale, perhaps the most powerful and unscrupulous political manipulator of the eighteenth century. When Leonard entertained Sir James at East Hall on his way south he too must have been accepted into society.[77] Another noble visitor was Lord Northumberland, Sir Hugh Smithson of Stanwick Park, who stayed there en route for Newmarket. At the junction of the main roads from London to the North-east and North-west, Middleton Tyas was strategically placed. Like the Duke of Northumberland, Leonard was an avid racegoer and as well as his legal and mining activities seems to have led a strenuous social life. He regularly attended the races at York and Richmond, Newcastle and Morpeth, and fairs at Newcastle and Stagshawbank near Corbridge.[78] We have already seen the regrettable consequences of his absence at Nottingham Races.

Of the last twenty years of Leonard's life we are less well informed, even his will has not survived, which is ironical in view of the hoard of papers which he amassed. He had been a difficult neighbour in Middleton Tyas but lest the impression be given that he was no more than a cantankerous, unscrupulous social climber, his letters to William Brown often reveal him as a proud and affectionate father and a genuinely humane man. Unlike Tissington he would not work his men in bad conditions and condemned him for letting miners work midleg deep in water. His indignation knew no bounds when Brown wrote to him of conditions in Bo'ness Colliery (West Lothian) where women carried creels of 13 stones of coal up the shafts. "Pray what can the owners of that colliery been thinking of that before could never continue some means to convey the coales otherwise than by making these poor women so wretched".[79]

77. William Brown Letterbook HB 172 15 September 1754, Newcastle Mining Institute.

78. William Brown Letterbook HB 95 1 October 1752)
151 16 June 1753) Newcastle Mining
153 14 July 1753) Institute
204 No date)

79. William Brown Letterbook HB 186 9 December 1754, Newcastle Mining Institute.

GEORGE AND THE LATER HARTLEYS

Like his father, George (4) married a clergyman's daughter, Mrs Ann Bunting, daughter of the Rev. William Tomlinson rector of Skelton, York, who already had two daughters. George was nearly 50 when his only son Leonard William was born in 1775. In Chapter 8 we refer to the mining activities of George and his cousin Leonard (3) after his father's death. Elsewhere we read of his acting for the Milbankes of Halnaby, indeed Lord Wentworth writing to his sister Judith Noel described him as their factotum. Their father's mutual hostility seems not to have continued. In the Milbanke correspondence there is also a hint of why he retired in 1778 at the early age of 52. Ralph, the former Sir Ralph's grandson, wrote in 1776 to Judith that George Hartley was greatly increased in bulk and slow in acting.[80]

On the 14 April 1777, George signed a contract with John Foss of Richmond to build him a mansion in the Lowfield,[81] to the design of John Carr of York.[82] This hitherto unpublished fact places Middleton Lodge, not one of Carr's most exciting designs, between Constable Burton and Farnley Hall in point of time (Fig. 6). Letters survive to Hartley's agent, another John Ayre, which prove that it was Carr's design that was executed.[83] Not executed in the agreed time however, since it appears that the house was incomplete at the time of George's death. Foss proved troublesome and neither he nor Carr was finally paid until December 1780.

80. Elwin M ; The Noels and the Milbankes ; London (1967) pages 48, 50 & 55

81. This same John Foss, later Alderman of Richmond, gained a considerable local reputation some years later as an architect at Clifton Castle and Thorpe Perrow near Bedale, Swinton Park near Masham, Sedbury Park and Brough Halls near Richmond and at Swinithwaite in Wensleydale. Pevsner N ; Buildings of England, North Riding; London (1966), pages 46, 91, 122, 163, 170, 362, 363.

82. Hartley Papers ZKU ; Northallerton County Record Office

83. ibid.

In June 1779 George had made his will, less than a year before his death.[84] The bulk of his estate was left in trust for his son, who was only five when George died. The land was scattered throughout the three Ridings as well as the Middleton Tyas estate.[85] There were three trustees; George's unmarried Sister Mary, who, following the custom of the time, took the title Mrs Mary Hartley as head of the family, his colleague and friend William Masterman of Red Lion Square, London, and John Bowes.

East Hall and its surroundings were left to Mrs Mary Hartley. All his other relatives benefitted; for instance, his stepdaughters received 100 guineas each, but the position the Hartleys had achieved as benevolent despots of the village is reflected in the bequests to servants and employees. His old and faithful servant John Ayre received an annuity of £10 per annum tax free, which was to be given to his wife if she survived him. From his tombstone we know that John survived his master to enjoy his pension for 21 years. £40 was left to be distributed among the poor at Christmas. A total of 104 adults and 93 children benefitted under the will and the balance of 26/- was used to buy check aprons at 1/- per yard, as an encouragement to young people to go into service. This lavish munificence and benevolent, squirarchical paternalism contrast with the "gimmer lamb to my grandchildren". George died within a year of making his will, on 5 May 1780, and was buried at Middleton Tyas only six years after his father. His epitaph reads, 'Be as a father to the fatherless and instead of a husband unto their mother'. Eccl.10.10.

The rise of the Hartleys had been partly due to the discovery of copper, but, as is related in Chapter 8, by 1780 the industry was all but dead. Mrs Mary Hartley carried on negotiations for its renewal, but henceforth the family fortunes were based upon land. Even the rich leadmines

84. Hartley Papers, ZKU ; Northallerton County Record Office.

85. Harkerside and Grinton in Swaledale, Hope, Barningham, Melsonby, Aldborough, Murton, Osbaldwick, Haxby, Strensall, Brompton, Earby, Barton, at Hurworth (Co. Durham).

at Beldi Hill were proving a troublesome and unreliable investment. Leonard (3) bought up the Shuttleworth lands in 1785, 1800 and 1801 (see map 2). The Rev. William Peacock of Northallerton sold his family lands in Middleton Tyas in 1780, including the field which his uncle had let to Tissington in 1754 to build his engine house (see below page 38). This sale had already been negotiated before George's death and is the land coloured purple on map 2. The same Rev. William borrowed £6,000 from Mrs Mary Hartley who had also lent her brother-in-law, the Rev. John Whaley £2,000. The extent of her loans reached £14,835 before her death in 1797.

The consolidation of the family lands resulted from the inheritance of four bachelors. Francis (2) of West Hall inherited the lands of his father Leonard (3) on his death in 1798. In 1815 he also inherited the Lodge, East Hall and all the lands of the other branch of the family when his second-cousin Leonard William died without issue. On the death of Francis (3) five years later the entire estate passed to his younger brother then living at York. This was George (5) whose portrait in the uniform of the Yeomanry hangs in East Hall. In 1820 George had a survey of his lands made which still survives and shows the vast majority of the land in Middleton Tyas in his hands. The estate was run as eleven farms. Like his brother and cousin, Major George (5) died unmarried in 1841, the last male Hartley, though his nephew and heir Leonard Laurie Campbell took the name of Hartley.[86] When he died in 1883, also unmarried, the land passed to the Eyre family. In 1940 Miss I M Baker-Baker inherited the estate and, as Mrs Michael Speir is the present owner.

Having identified the families and individuals involved in the Middleton Tyas coppermining, we will attempt in Chapter 3 to identify their lands in the mid-18th century and to explain the surviving remains.

86. Hartley Papers, ZKU ; Northallerton County Record Office.

CHAPTER 2 THE OREFIELD

THE GEOLOGY OF THE AREA

"It is a singular fact that as the veins of lead in the Richmondshire mountains decline to the east they become at once more slender and change to copper. The latter has, I believe, never been wrought in this county to advantage". So wrote Whitaker in 1823 in the first volume of his 'History of Richmondshire'. His last statement is open to question, but his geological description, while over-simplified, does describe the mineralization of the area in terms comprehensible to the layman. Thirteen years later Phillips, a much more seriously scientific geologist, invented the term 'Yoredale Series' for the succession of strata in the Carboniferous Limestone which forms the visible structure of the said 'Richmondshire Mountains'.[1] It is in the Main and Undersett limestones of the Yoredale Series that the workable metalliferous veins occur. The village of Middleton Tyas, where the most productive veins have been found is built on the eastern edge of the exposed section of these strata. Indeed it gives its name to the eastern boundary of the Middleton Tyas-Sleightholme Anticline.[2]

East of Middleton Tyas the Yoredale strata are overlain by the dolomite of the Permian to the North-East, and New Red Sandstone to the South-East. The edge of the Permian was recorded by Gunn as running through Chantry Farm. 18th century trials for ore to the east of the beck were unsuccessful, though Fowler[3] found galena (lead sulphide) in the Permian, and Tron reported the discovery of Chalcocite (copper sulphide)

1. Phillips ; 'Illustration of the Geology of Yorkshire', passim.
2. The sources of geological information are listed in the Biblography. The unpublished material in the Institute of Geological Sciences, Leeds, contains much valuable information. The notes of W Gunn, embodied in the 1879 Geological version of the 1857 6" O.S. map are the most complete detailed study of the area. Earp's report and annotated maps prepared during the Second World War, when the mineral resources of the area were again under investigation, amplify this information. The most recent report is that of A R Tron of the Warren Spring Laboratory presented in 1963.
3. Fowler A ; Minerals of the Permian and Tyas ; Geological Association Proceedings 67 (1956).

in dolomitized limestone near Cow Lane. That the limestone is near to the surface is abundantly obvious still. The area around and to the north-west of the village is riddled with quarries, mostly small scale and abandoned, though the largest were worked until recently by Slaters Limited, of Thornton-le-Dale. The Barton Quarry, with its exhausted workings landscaped, is now a familiar feature of the southern end of the Durham Motorway.

Leonard Hartley, writing on the 4 July 1752, to William Brown expressed his satisfaction at having come to the limestone sooner than he expected, in sinking his mine-shaft near Middleton Tyas Church.[4] Writing a century and a half later, Kendall and Wroot recorded that the gap between the Main and Undersett Limestone at Middleton Tyas is no more than fifty feet.[5] Having exhausted the ore in that part of the Main, the miners of Hartley's day went down to what he describes as the 'underbed'. His letters tell of the problems involved in sinking through soft gravel and shale for thirty feet.[6] Saturated with water, perpetually caving in, the shaft was troublesome to sink and timber, and as we will see in Chapter 6, presented special difficulties of drainage before the underbed was reached. Though mineralization is mainly confined to the limestone, Tron did find both covellite and bornite in the shale between the Main and Undersett at Forcett.

THE COPPER VEINS

The nature of the deposits of copper and lead make mining more difficult and infinitely more speculative than the exploitation of minerals such as iron and coal which occur in even, horizontal strata. Copper and lead veins are formed by the filling with the ores of those metals of the faults, or cracks, made in the existing rock strata by a granitic intrusion beneath.

4. William Brown Letterbook, HB 64 ; Newcastle Mining Institute.
5. Kendall P F and Wroot H E ; Geology of Yorkshire ; London (1924).
6. William Brown Letterbook, HB 157, 26 December 1753
HB 160, 26 May 1754
Newcastle Mining Institute.

These fractures though roughly vertical, usually 'hade', or tilt to one side. Fig.7 shows such a vein at Goldscope Mine in the Newlands Valley near Keswick. Here, as the valley cuts across the vein, it has been possible to work the exposed part by open-cast mining, the work of Hochstetter's Germans in the Elizabethan period. Later, deeper working has been done by driving a drift into the vein lower down the slope, on a rising level to cope with drainage problems. At Goldscope both copper and lead were discovered and this was also true of the coppermines in Richmondshire, except for Middleton Tyas itself where there is no mention of lead ores. The mixed production of the mine at Merrybent is illustrated by the table in Appendix G. Drifts into metalliferous veins were not possible either at Middleton Tyas except in quarry faces such as those at Kneeton and Merrybent (Map 6). The great majority of the mines were worked by sinking vertical shafts into the vein, or where the prospector thought the vein lay. The fields around Middleton Tyas are pock-marked with shaft tops, Fig.8 shows such a shaft top (PB2). Some apparently were cut vertically to cut through the vein somewhere between its head and tail. Others, where the line of the vein had been discovered near the surface slanted down, following the course of the fault. These workings have been described as bell-pits, and they look very like them. The name however is a misnomer, as a bell-pit is by definition a single separate working, deriving its bell shape from the horizontal working of a mineral stratum at the foot of the shaft. All the workings in a copper or lead mine were determined by the shape of veins, and those at Middleton Tyas were linked by an apparently complicated series of underground galleries.

Unlike the veins in the west of Richmondshire, such as the Friarfold, those in the east are generally both narrow and of short strike. They do however conform to a general pattern, and lie roughly N.W.-S.E., or more or less at right angles, i.e. N.E.-S.W. The principal veins at Middleton

Tyas as recorded by Gunn are shown on Map 4. The fault west of shaft HD 1 was shown as being unmineralized. He may have missed some of the veins in his survey.

There is an exception at Middleton Tyas to the general rule about copper being discovered only in vertical veins. This is a more unusual geological feature, a flat (or float) of ore. Caused by metasomatism, or the replacement of part of the country rock, this consists of a horizontal layer of the metallic ore. Such a feature was, of course, a rich prize, as its working would be infinitely cheaper and simpler than following along and down veins. In HB 64 Hartley told Brown that the flat was twenty yards wide, and a pickshaft in height. Brown, describing it to Spedding, wrote that it was thirty yards wide and fifteen inches thick.[7] Nowhere is there a precise account of its length but assuming it to stretch from the Church, through the Church Field into Goose Hill (see Map 4) it probably measured some 100 yards in length. In another letter Hartley wrote that it did not lie very deep, being higher than the level of the lower pumping engine.[8] Hence it must have been fairly easy to work, once the ever-present problem of drainage was successfully tackled. Geologically we would expect such a flat to be near the surface, in the zone of oxidization, and to consist of copper carbonates. Not only are the copper veins thinner and more sparse than the lead veins, but there are problems created by the composition of the ore, and the numerous different

7. William Brown Letterbook, BS 69, 11 July 1752 ; Newcastle Mining Institute.

8. William Brown Letterbook, HB 64, 4 July 1752 ; Newcastle Mining Institute.

copper compounds found in one vein.[9]

Gabriel Jars saw and described most of these forms. What he called 'mountain green' ore must be malachite. Chalcocite corresponds with 'vitreous ore', and 'pigeon's throat ore' is a splendid description of the iridescence of bornite. "Yellow' ore he recorded as being seldom seen, as chalcopyrite, the primary sulphide, it would be most abundant at the lowest levels, the most difficult to mine and also the least rewarding. What Jars meant by 'white ore' is difficult to say.[10]

9. Apart from nodules of pure native copper, occasionally found near the top of veins, and recorded at Middleton Tyas, the copper in a vein consists mainly of sulphides. This is true also of lead, of which the commonest ore is galena (PbS), but while this generally retains its characteristics, the primary copper sulphides, chalcopyrite ($CuFeS_2$) and bornite (Cu_5FeS_4) are subject to drastic supergene changes. The action of surface water on the iron in the primary sulphide produces an iron ore, limonite, and sulphuric acid. This acid, percolating into the vein with meteoric water transmutes the ore at the head of the vein into copper carbonates. Pure Malachite ($CuCO_3.Cu(OH)_2$) is 57.3% copper, and pure azurite ($2Cu\ CO_3.\ Cu(OH)_2$) 55.1%, both richer than the primary sulphide, chalcopyrite, which is only 34.5% copper. Leaching down from the surface not only changes the ore in the zone of oxidization where it is subject to the constant passage of surface water, but also enriches the ores lying below the water table. By the carrying down of a solution of copper sulphate these are subjected to a secondary sulphide enrichment. In this zone are found not only the primary sulphides, bornite and chalcopyrite, but also the enriched sulphides, covellite (CuS) at 66.4% copper and chalcocite with no less than 79.8% (Cu_2S). Hence the middle section of a copper vein is likely to yield the richest ore. Richard Richardson, on his map, recorded that the richest ore at Middleton Tyas lay below the water level.

10. The 19th century assay carried out at the School of Mines, London, in March 1862 , describes the ore as vitreous and compased as follows:

Disulphide of Copper	54.08
Protoxide of Copper	28.35
Carbonic Acid	9.23
Water	4.30
Sesquioxide of Iron	1.00
Insoluble Residue	1.63

The veins, of course contain more gangue material than ore at Middleton Tyas as they do anywhere else.[11] Jars described the filling of the faults as consisting largely of 'spar' and 'ferruginous sand', the latter presumably the product of iron leaching. Richardson called it more picturesquely, "lomy soil of the colour of scotch snuff".

The percentages of copper quoted in footnote 9, page 34, as contained in the various copper ores refer, of course, to a pure compound, which is rarely found. It seems that the Middleton Tyas ores were remarkably rich. On the 4 March 1753, Hartley reported to Brown the result of an assay of ore.[12] This letter is not given in full in the letterbook and the surviving version is somewhat ambiguous. The gist is that his ore assayed at $66\frac{2}{3}$% pure, 14 dwt. 11gr. of ore produced 9 dwt. 11 gr. of malleable copper. "The greatest report ever made" may be a justifiable exaggeration, but the purity is very impressive, 18th century Cornish ore averaged 8%. With modern electrolytic methods 0.5% is regarded as economically worthwhile. A contemporary assay done by John Rotton of the Middleton Tyas ore produced 9 dwt. of fine copper from 20 dwt. of ore, 45% pure. A further assay done at the School of Mines, Jermyn Street, London on 27 March 1862, produced a result almost identical with Hartleys, 65.83%. The workmen told Richardson that if a pick axe or any other instrument of iron or steel were left in the water at the bottom of the shaft, it would be turned into copper by the quality of the water. If the occurence of the ore had been less patchy this would have been a phenomenal ore deposit.

11. A gangue material may be cautiously defined as one which appears at the time to be useless, since the miners of the 20th century in the Dales have avidly sought the gangue materials, barytes and fluorspar, thrown away by their Victorian grandfathers.

12. William Brown Letterbook, HB 141, 4 March 1753, Newcastle Mining Institute.

Jars wrote that the ore occured only in scattered nodules. Richardson wrote that apart from one vein it lay in, "flods as they calls it, or rather clods .... from pieces as large as ones head to those as small as the sea sand". Visiting the village in 1783 Matthew Boulton of Birmingham was told by the then Vicar that the ore was found in, "bellys or bunches". He was also warned that sometimes it is very rich and at others quite barren. Seven years later, in a letter to John Vivian, Boulton recalled these facts about Middleton Tyas, and assured him that he could safely ignore the threat to open the mines again to challenge the copper monopoly.[13]

The rewards could be very rich, or alternatively they could fail to materialize altogether. With this knowledge, and with only a rudimentary understanding of Geology, there were entrepreneurs still willing to invest money and take the risk of opening copper mines in the 18th century. The evidence of their activity still survives on the ground, in and around Middleton Tyas to bear out the evidence of the documents. In the next chapter we will consider this archaeological aspect.

13. Correspondence of Matthew Boulton ; Birmingham Assay Office Library.

CHAPTER 3 THE MINES AT MIDDLETON TYAS

THE SITUATION OF THE MINES

In the first chapter the landowners involved in the Middleton Tyas mining were identified. It is less easy to identify with certainty the sites of their various undertakings.

The surface indications consist mainly of blocked shaft tops surrounded by circular heaps of spoil, and, as mentioned above, look very like the remains of bell-pits. Unlike bell-pits they were up to 120 feet deep, though usually not more than 3'6" wide. Evidently they were linked below ground by extensive galleries, following the veins, and also providing drainage levels. Jars referred to galleries to right and left.[1] We have no knowledge at all of the underground layout. If they were planned the plans have not survived. The shafts which have been identified are shown on Map 4, numbered in each field. These will be referred to by initial letters and numbers hereafter, e.g. GH 1 is Goose Hill Field, shaft 1. The fields involved were:-

BS	Black Scar	1
CF	Church Field	1 - 8
FH	Five Hills	1 - 8
GH	Goose Hill	1 - 2
HD	Horndale	1
KB	Kirk Bank	1 - 5
LF	Low Field	1 - 2
LQ	Layberrys Quarry	1
NL	North Layberrys	1 - 16
PB	Parsons Bank	1 - 5
SM	South Manis	1 - 10

which gives a total of at least fifty-nine shafts.

1. Jars G ; Voyages Metallurgiques III.

In the area of maximum activity Richardson (Map 3, Vol.II page 11) was not very careful to detail his map, being mainly concerned to relate it to the proposed work at Barton. He showed Hartley as owning five shafts in the vicinity of the Church and twenty-five shafts in other ownership. Surface indications show many more shafts than that, but Richardson drew his map in 1754, before many had been sunk. The 1857 6" to 1 mile Ordnance Map shows several old mine shafts. The 1879 Geological version gives greater detail, and the 1928 edition of the 25" to 1 mile survey records those then visible. As is often the case with OS Maps this seems to have been rather subjective. Those shown in 1928 are; CF 1, 2, 3 ; GH 1, 2 ; PB 1, 2, 5 ; NL 6, 7, 8, 9, 12. The 1857 map shows in addition several shafts which have since disappeared entirely. HD 1, LQ 1, NL 14 and 15 have all vanished into quarries, as has the shaft shown by Gunn in Black Scar Quarry. NL 16 is quite invisible either on the ground or in an aerial photograph. A number of shafts however can be identified from the RAF vertical survey (1959) which are not visible on the ground.[2] In addition some are quite invisible but can be placed accurately from clear documentary references, as in the cases of CF 8 and SM 4.

In the less heavily worked areas the landowners have obviously made an effort to restore the land to use by blocking the shaft mouths, which would not be difficult with such narrow shafts, levelling the spoil and ploughing them over once the mining had stopped. Two such blocked shafts have recently caved in. When all the shafts which can be identified, by one means and another, are plotted on the map, scattered along the veins and spreading out over the ore-float, it is easy to see why Whitaker wrote in 1823, that the land between the Church and village was still desolate and littered with spoil heaps. He also wrote that the poisonous minerals

2. Aerial Survey Sections 543/RAF/634 (F 21 and 22, 0340 and 0342).

had killed off the vegetation.[3]

In spite of Whitaker's implication that the mines had left a mess, the identification of the spoil heaps is quite difficult. As much of the waste was limestone, it would have a commercial value for lime-burning. In the Hartley-Kearsley Lease of 1738 the limestone spoil was reserved for the landowner.[4] In Goose Hill there is a grass-grown spoilheap marked on Map 4, but in 1763 Dr Watson, presumably disliking unsightly spoil-heaps stipulated that Tissington should use the rubbish from the Glebe to construct a tree-lined terrace, which still leads across the fields to the Church.[5] Mr Speir recently pointed out a cropmark in Beckseys, where the growing corn was stunted and yellow which he attributes to the use of copper refuse in diverting the course of the beck. This line is marked on Map 4, and shows up very clearly on the RAF photographs. In Fig.9 it shows as a light coloured line in the crop. Nevertheless even these suggestions seem hardly adequate to account for all the spoil which must have been produced in nearly half a century of working, and one is forced to the conclusion that much of it must have been tipped into exhausted limestone quarries which were already being worked out around the village.

Positive identification of ownership of particular fields in the mining area is made difficult by changes of ownership, and also changes in field names. For identifying particular fields the earliest comprehensive document is the Tithe Map of 1841 which names both fields and owners at that date, but many of the names in use at that time were different from those a century earlier.[6] The field shown on Map 4 as Parson's Bank is also described elsewhere as Parson's Field, the Doctor's Field, Old Field or the Stripe. The use of a single name to designate

3. Whitaker T D ; History of Richmondshire ; London (1823).
4. See Appendix A.
5. Parish Register in County Record Office, Northallerton.
6. Middleton Tyas Tithe Award RD/RT/164 ; Leeds City Record Office.

groups of separate fields in a particular area; e.g. Rowridge; Thompson's Rowriggs, Peacock's Rowriggs, Hartley's Rowriggs, Moulton Rowriggs, Little Rowridge; tends to make specific identification difficult. Indeed the beck which marks the eastern limit of successful mining is variously called, Acrehowden Beck, Five Hills Beck, Cow Lane Beck and Kirk Beck along a mere two miles of its course.

There were trial workings east of the Beck, made by Tissington in May-June 1753.[7] One shaft 50-60 yards beyond the Beck cannot be certainly identified, but his work to the south-east in Kirkbecks referred to in HB 147 can be confidently connected with the sandstone quarry M (Map 4) which is almost exactly 400 yards from Hartley's Church Field shaft. For geological reasons the search for copper was unsuccessful east of the Beck, and most of the work was concentrated in not more than a dozen fields which we must attempt to identify.

THE GLEBE MINES

The Glebe is the most constant unit of land ownership. Its area in the 18th century is shown on Map 2 and even now has altered little. In 1778 Dr Watson, the then Vicar, drew up a Glebe Terrier,[8] which is useful not only for identifying the Parson's fields, but because each field is described with reference to the neighbouring landowners.

Its details are as follows:-

		A.	R.
1.	The Vicarage house etc.		
	Two gardens an orchard etc.	1	2
2.	Lowfields bounded by Mr Shuttleworth on the south; Mr Shuttleworth and Mr Hartley on the west; Mr Hartley on the north; and the street to Moulton on the east; with a good cowhouse	22	0
3.	Goosehill a triangular field; the street to Moulton on one side; the Church Road (which indeed is part of the field) on another; Mr Hartley, Mr Peacock and Poor Close on the third	5	0

7. William Brown Letterbook, HB 147, 28 May 1753, Newcastle Mining Institute.

8. Parish Register in County Record Office, Northallerton.

4.	Stripe; Goosehill on the west; Mr Hartley on the south; Mr Shuttleworth on the north			
5.	Buddle Bottom; Part of the above Stripe and Mr Hartley on the west; Water Course on the east; a lane on the south and Parson's Bottoms north	2	2	
6.	Parson's Bottoms; The street to Halnaby north; a Watercourse east; Mr Shuttleworth west; the Stripe south	6	0	
7.	Kirk Leazes a lane north; Watercourse east; Mr Peacock south and west	3	3	
8.	Kirkbeck Lands a lane and Mr Hartley west; Mr Hartley south and west; late D'Arcy's ground and East Fields north	18	2	
9.	East Fields the street to Halnaby and Mr Hartley north; Mr Hartley east and south; Mr Shuttleworth and D'Arcy west	22	2	
10.	Roadriggs street to Moulton west; a rivulet east; Mr Shuttleworth north; Mr Peacock south	3	0	
11.	Stripes Mr Crowe and Mr Shuttleworth south; and on the east, north and west by Mr Shuttleworth	8	0	
12.	Chesters and Whinny Moor a lane, Mr Shuttleworth, Ld. Layfield, Mrs Coates and George Spence east; Mr Peacock south; Mr Shuttleworth west; Mr Ld. Hartley and Mr Shuttleworth north	41	0	
13.	Doormire Mr Shuttleworth north and east; Mr Smithson south; Sir Ralph Milbanke and Mr Peacock west	4	0	
14.	Moorclose street south; Mr Hartley east and north; Mr Peacock west	9	0	
15.	Patty Garth street south; Mr Hartley west, north and east	1	1	25
16.	Churchyard Mr Hartley west, north and east; Mr Peacock south	1	3	
		149	3	25

These fields are marked with their numbers of Map 2.

At the centre of the Glebe is the Church and Churchyard where work was already in progress in July 1752 and continued for at least three years. The traces of mining have been obliterated by the use of the whole Churchyard for burials, the southern extension having been in use since 1880.

While it is unlikely that the workings extended under the Church itself, it is possible that the cracking of the tower which necessitated the insertion of tie-bars was caused by mining subsidence. As the Terrier and the map indicate the Churchyard is an island, surrounded almost entirely by Hartley land. This raised difficulties over the drainage of the workings, which will be considered in greater detail in Chapter 6. Suffice it to say that the lease of Kirkbank Pasture by Peacock to Tissington in August 1753, for £200 down and 10/6d per week rent, gave the necessary access from the Churchyard to the Beck, making drainage possible and causing great annoyance to Leonard Hartley.[9] The field in question is steeply sloped down the edge of the scarp and has at some time been ploughed into four lynchets. Into the lowest of these the Engine House was built, with various surrounding buildings. In the immediate area of the Engine House were several shafts and levels associated with drainage, but they have all been filled in, and the luxuriant vegetation makes identification difficult. KB 4 and 5 are quite invisible but marked on the 1857 Ordnance Map. KB 3 is a 12 foot shaft which collapsed in November 1968 and has subsequently been refilled (see Figs. 11 and 12). It is obviously the shaft referred to as, "lying on the left hand near the entrance where they feed the furnace".[10] Until the shaft recently caved in the only indication of its existence was the otherwise inexplicable diversion of the fence around it, shown on the 25 inch Ordnance Map, but now removed.

Connected with the Engine House are the shafts in Parson's Bank. PB 3 must be the Low Horse Engine Shaft (see page 35) which was literally connected in 1775 by sliderods (marked P on Map 4) to the steam engine. Further down the bank are PB 4 and 5, the former presumably being the shaft referred to as "beyond the horse engine".[11] On the 1857 Map PB 5 is identified as a level, not a shaft, though this is not now obvious on

9. William Brown Letterbook, HB 155, 6 August 1753, Newcastle Mining Institute.
10. William Brown Letterbook, HB 166, 1754, Newcastle Mining Institute.
11. William Brown Letterbook, HB 147, 28 May 1753, Newcastle Mining Institute.

the surface. Presumably it intercepted the engine-shaft PB 3, and drained it at that level, which would be at a depth of some 60 feet. At the bottom of Parson's Bank is Buddle Bottom, which declares its use by its name. There are still surface indications of a small building (marked Q on Map 4) and a short watercourse connected with hydraulic separation of ore. The whole question of preparation is dealt with at greater length in Chapter 7.

The most productive part of the Glebe seems to have been the triangular field called Goosehill, which is on the gentle westward slope from the Church. The general relief of the ground, with the Church and PB 1 and 2 on the crest of the ridge is indicated by the 275 foot contour line marked in green on Map 4. Figs. 10 and 11 taken from the north-east and east show the Church's site. The natural drainage of Goosehill is westwards towards Dale Meadow and Ludburn Beck, rather than eastwards to the Kirk Beck. It is reasonable to assume that one of Tissington's horse-engines, for we know that he had two, discharged westwards and the other eastwards. However when he invested in an expensive steam-pump it was clearly desirable to connect all the workings to it, and pump all that water into Kirk Beck.

THE HARTLEY MINES

Hartley also worked on both sides of the ridge. CF 1, 2 and 3 are on the westward slope, but if CF 4 is the engine shaft sunk in July-August 1752 it could easily pump water across the Kirk Beck, being sited almost on the crest of the ridge. The identification of CF 4 as the engine shaft seems likely, since unlike the other three shafts in the field, its top is not surrounded by a collar of spoil. Pumping across the watershed it would clear the water completely away from the other shafts as Hartley wrote in HB 175. On Richardson's map Hartley is shown to be working five shafts. The shaft marked 'B' by Richardson is probably CF 5. We know from his correspondence that Hartley won most of his ore from three shafts, but had ten open by 1755.

CF 1, 2 and 3 are clearly visible in pasture land. CF 4 is less obvious, but shows up well on the aerial photograph. CF 5, 6 and 7 are visible on the edge of the scarp, though, as with much of the site, afforestation is likely in the near future to obliterate the visible remains. In December 1754 Hartley wrote to Brown that they had sunk a shaft at the south end of their ground, a yard from both the Churchyard wall and Peacock's boundary.[12] The only place which fits this description is marked as CF 8, though there is no surface indication whatever. Indeed it seems likely that this shaft was filled in almost at once, as the sliderods from the engine, crossing, "the corner of our bottom, then over the Churchyard", must have passed right over it. The two remaining Hartley shafts unaccounted for are probably those shown by Richardson at the east end of Hartley's ground, and so below the roadway. There is no sign of them there, and his map is not so accurate that we can place them even tentatively on ours.

THE PARTNERS' MINES

In trying to identify the mines of the D'Arcy Partners it is necessary also to refer to the obliteration of traces of mining by subsequent limestone quarrying, which is hardly surprising when the first discovery was made in such a quarry. In the vouchers for RH 1 and 2 there are references to drifts, one being named as Carter's Low Drift. If the vein was laid bare in a quarry face the easiest method of working would be to drive a drift into it, as the levels at Kneeton and Merrybent were worked a century later. The contemporary sketch map (Fig. 13) drawn by George Tissington in June 1746 shows five shafts, two of which labelled G and H, belonged to the Partners.[13] Unfortunately he omitted to include a north-point, and a superficial comparison between his drawing and the modern map suggest that the section of Cow Lane which he drew could be looked at either way round. Certain facts, however, make it almost certain that the

12. William Brown Letterbook, HB 184, 2 December 1754, Newcastle Mining Institute.

13. Hutton Papers, ZAW, Northallerton County Record Office.

top of his map is the east. In the first place, shafts 160 yards to the east of the lane along the line indicated would certainly not qualify for the description of "rich", being off the edge of the carboniferous limestone. Nor is there any feature to the east which could possibly be "Mr Shuttleworth's Dingle". This does fit the eastern half of the shallow valley called Horndale (R on Map 4), and which we know belong to Shuttleworth. If we accept this argument, then Tissington's shafts G and H must have disappeared into Layberrys Quarry, the latter corresponding with LQ 1 which is recorded on the 1857 Ordnance Map, but has vanished since. Comparing Tissington's map with Richardson's much more approximate version it is possible to identify the five shafts from H to C on the former with Richardson's line of six from A to D, a sixth having presumably been sunk between (Tissington's) A and E in the intervening eight years. The shafts C, D and E, which Tissington attributes to Shuttleworth must be SM 6, 5 and 4, the former two of which are still clearly visible. The whole of this southern end of the South Mains is very cut up by mining, and there were probably more shafts than are shown on the map. The triangular portion at the extreme south end of the field is so churned up with workings that it was abandoned as farm land, and is now a densely tangled copse. In this little wood Gunn's map shows three shafts and records the remains of a smelt mill. The site marked N on Map 4 looks more like that of a building than any of the others, though it is impossible to be certain without excavation, the remains being completely overgrown. Hence SM 8 and 10 may well be only spoil heaps and not shafts at all.

To return to the Partners, and the various Layberrys. We have an apparently insoluble problem of identification. We know that the northernmost field, Layberrys, belonged to the Partners who later let it to William Wynn.[14] As Tissington offered in 1746 to explore the land

14. Hutton Papers, ZAW - quoted in Appendix C.

between the points marked 1 and 2 on his map (Fig. 13) it is difficult to believe that mining never took place there. It is significant that in this field not only are there no visible mine shafts, neither is there any rigg-and-furrow. In North Layberrys and Parson's Bank the pattern of rigg-and-furrow is quite clear, with reversed-S riggs, 9 to 10 yards wide. The spoilheap of the numerous shafts in these two fields overlie, and hence are later than, the rigg-and-furrow (see Fig. 14). South Layberrys, between these two last fields, shows no sign of mining at all and has been ploughed in narrow, straight rigg-and-furrow, with 4 to 5 yard riggs. It is hardly likely that this field, lying between two productive ones, and in fact on the junction of the main fault and its stringer, would be left untouched. Clearly Layberrys and South Layberrys have been completely restored to agricultural use, while North Layberrys and Parson's Bank were too badly cut up for restoration and have only been used as pasture ever since.

THE OTHER MINES - MILBANKE AND SHUTTLEWORTH

The identification of the shafts at Five Hills is very difficult, although Richardson showed them on his map. He marked, from north-west to south-west, five shafts together, then after a space a sixth, and after another gap a further two. It seems likely that the five spoil heaps of the first group were the Five Hills, rather than the solitary tumulus recorded nearby, as seems previously to have been assumed. FH 1-3 can be placed with certainty, from Gunn's map. As there are now no visible remains either in the tangled plantation or in Little Sike field, the exact siting of the others is impossible. From the general grouping of the shafts on Richardson's map, and extremely faint traces on the aerial map it is possible to place them tentatively as FH 4-8? The absence of mounds tends to bear out Richardson's note, "None", on each of these shafts, though he qualified it by adding, "Let it not be imagined that there is no copper .... because non was found here. These shafts are sunk a small

way and left with timber in them, as if they intended to sink deeper".[15] One shaft, FH 8, had produced copper, but was flooded. This one belonged to Steaney, the rest seem all to have been the property of Milbanke, though FH 7 was leased by Pearson and Page in the process of being sunk. This is not to say that all Milbanke mines were unproductive. References in Hartley's letters place some of his land next to the Glebe. In HB 147 he mentioned the hedge that separated Tissington and Captain Paull, Milbanke's lessee, and that the latter was, "having good gettings on their side 60 yards further down." It seems reasonable to infer that the field in question was South Layberrys. Both North and South Layberrys belonged to Shuttleworth in 1778, and were together sold to the Hartleys in 1801, but it seems likely, from their different treatment, that they belonged to different owners in the middle of the 18th century.

Tissington also shared a boundary with the Shuttleworth land, as we gather from Hartley's references to the Derbyshire men, Tissington's, and the Cornishmen, Moore's threatening to blow each other up with gunpowder.[16] This may have been on the boundary of the Glebe and North Layberrys, if we are correct in our attribution of ownership to Layberrys and South Layberrys. Certainly, as mentioned above, North Layberrys did belong to Shuttleworth in 1778. There are two facts which militate against this identification. The spoilheaps of shafts NL 12 and 13 spread messily across the line of the boundary hedge into Layberrys, which certainly belonged to the Partners, and which a neighbouring landowner would hardly have tolerated. Also, there are the remains of two small buildings[17] near the gate of this field. They were built of limestone and roofer with pantiles, and seem to fit the description of the buildings erected for the Partners after the Copper Theft Case. Local tradition also supports the view that this was a copper-house. From the available evidence the

15. Havelock-Allan Papers, 2DG(B) ; Northallerton County Record Office.

16. William Brown Letterbook, HB 74, 10 August 1752 ; Newcastle Mining Institute.

17. Marked C and D on Map 4.

ownership of North Layberrys, containing as it does no less than sixteen shafts, must be left as an open question.

It is certain that the fragmentation of ownership of the mineralized area led to endless bickering over boundaries and drainage. The ultimate failure of the mines may be to some degree attributable to the inefficiency of working the deposits by so many competing interests, without any coherent plan of campaign.

CHAPTER 4 RALPH HUTCHINSON'S ACCOUNTS

THE ARRANGEMENT OF THE ACCOUNTS

The accounts preserved in the private papers of John Hutton cover the work done in the Partners' mines between 1742 and 1767. They were submitted to the various Partners by the Agent Ralph Hutchinson of Richmond, in return for a salary of £5 per annum. In the accounts he is described variously as 'Clerk' and 'Accountant'. Elsewhere he is called 'Steward'. Living as he did in Richmond he delegated the responsibility for the actual disbursement of cash to an increasing extent to William Wynn, whom we have already met as one of Sir Ralph's reluctant diggers, and who seems to have approximated to a mine 'Captain'. The vouchers for payments were all submitted to Hutchinson, who made out the balance sheets. These are drawn up in a manner described by Pollard,[1] derived from estate accounting, and often employed in industrial accounts in the 18th century. They are set out in the form of 'Charge and Discharge', an early type of double entry accounting, the reader is referred to Appendix C for their full text. They cover the period from January 1742 to May 1767 in twenty-four separate sheets, which will henceforth be referred to as RH 1 to RH 24.

The periods covered by the individual accounts are as follows:-

RH	From	To	Yrs	Mon	Wks	
1	Jan 1742	Dec 1743 ?	2	0	0	?
2	Jan 1744	Dec 1744 ?	1	0	0	
3	Jan 1745	1 Aug 1745 ?	0	7	0	
4	1 Aug 1745	1 Aug 1746	1	0	0	
5	1 Aug 1746	1 May 1747	0	9	0	
6	1 May 1747	Michaelmas 1748	1	5	0	
7	Michaelmas 1748	Michaelmas 1749	1	0	0	
8	Michaelmas 1749	1 Nov 1750	1	1	0	
9	1 Nov 1750	22 Nov 1751	1	0	3	
10	22 Nov 1751	9 Nov 1752	0	11	0	(NB Calendar Reform)
11	9 Nov 1752	9 Nov 1753	1	0	0	
12	9 Nov 1753	24 Jun 1754	0	8	2	
13	24 Jun 1754	1 Aug 1755	1	1	1	
14	1 Aug 1755	1 May 1757	1	9	0	
15	1 May 1757	1 Aug 1758	1	3	0	
16	1 Aug 1758	1 May 1759	0	9	0	
17	1 May 1759	1 Jan 1761	1	8	0	
18	1 Jan 1761	22 Nov 1761	0	11	3	
19	22 Nov 1761	22 Nov 1762	1	0	0	
20	22 Nov 1762	22 Nov 1763	1	0	0	

1. Pollard S ; The Genesis of Modern Management ; London (1965) pp.209-211.

RH	From	To	Yrs	Mon	Wks
21	22 Nov 1763	22 Nov 1764	1	0	0
22	22 Nov 1764	22 Nov 1765	1	0	0
23	22 Nov 1765	1 Aug 1766	0	9	0
24	1 May 1766	1 May 1767	1	0	0

For one so meticulous it is difficult to understand why Hutchinson used such irregular intervals for the submission of accounts. Indeed it is not always possible to be sure precisely how long his account periods are. In the list above such doubtful cases are marked with a query, though for statistical purposes they have been taken to be accurate. As puzzling as the varying length of the periods is the random pattern of account-days. These include old and new Quarter Days; May Day, Midsummer Day, Lammas, Michaelmas, Martinmas (OS). He also used New Years Day and November 1 and 9 which are neither Quarter Days nor Festivals. The overlap of RH 23 and RH 24 is equally inexplicable.

The series of accounts may be divided into groups, according to the current activity and method of exploitation. As well as the day-to-day running of the mines RH 1 and 2 include a considerable element of non-recurring capital expenditure. RH 3 deals exclusively with smelting, and RH 4 with smelting and mining proceeding together. RH 5, 6, 7, 9 and 11 give details of normal working. In 1750 the account for the sale of copper already produced was summarized and included in RH 8. RH 10 is missing, and evidently has been since the papers were first deposited. Just how regrettable this is in explaining the history of the undertaking will be seen in due course. In RH 12 we have details of the winding-up of direct exploitation of the mines by the Partners. Subsequent accounts merely give details of duty paid by lessees. Hence for information about the working of the mines the earlier half of the accounts is much more valuable and forms the basis of this chapter. Accounts from RH 13 onwards are considered in Chapter 8.

The Copper Theft Case, with its implication of careless management of the Partners' affairs was no doubt the reason for the opening of these

detailed accounts in the same year. Just how effective Hutchinson was in protecting his employers' interests in illustrated at an early stage when he detected a builder, John Gyll, overcharging and amended his bill accordingly. The bill in Gyll's illiterate hand reads :-

January the 5 day 1744
for work done at the coper mill att midleton ties by order of Mr huchinson by John Gyll and his men

myself 6 days	0	7	0
my sun 4 days	0	4	8
my man 4 days and a half	0	5	3
a laber 2 days	0	1	8
myself 2 days at Whiston giting stons and dr/^{e}sing them	0	2	8
my son 1 day	0	1	2
for 4 lode of stons	0	6	0
	1	8	5

Below this, in Hutchinson's precise writing, is added :-

Overcharged in this bill

Myself ½ day	0	0	7			
My man 1 day	0	1	2			
My labourer overcharged	0	0	4			
Myself overcharged at Whashton	0	0	4			
				0	2	5
				1	6	0
Expenses 20th Chris. Hutchinson by myself and son				0	1	0
				1	7	0

The particulars of such payment for different types of labour and the details of purchases of equipment in the itemized bills in ZAW 118 permit one to form a clear picture of the methods employed in the mining, preparation and smelting of the ore.

THE EARLIEST ACCOUNTS

It would be a reasonable assumption that workers and techniques for a completely new extractive industry would be borrowed from the well-established lead mining industry in Swaledale, and that specialized equipment would come from there. Indeed the first account contains a payment of 22/6d for a pump, made to Robert Eliot a carpenter at Fremington near Reeth. It is significant that the specialized tools were made by Edward Whitehouse, the

blacksmith at Marske, the Hutton village, whereas the routine work such as sharpening and nailmaking was done by the local Middleton Tyas smiths William Cape, and later Robert Hedley. Elsewhere we have evidence of Leonard Hartley bringing a smith down from Swaledale to Middleton Tyas in 1754.[2] It is worth noting that a commodity required in bulk, such as nails, was bought by Hartley from as far away as Newcastle, notwithstanding high transport costs.

The mining tools made by Whitehouse included picks, whose points needed frequent sharpening and shafts replacing. We will see later the value of the detailed accounts for sharpening picks and jumpers. The latter were iron mandrills, driven in by a hammer, and remained the standard mining tool until the introduction of an effective rock-drill in the 19th century. The hammers mentioned include groove hammers and boring hammers, as well as mells, or mallets. 'Groove' is dialect word for mine, and appears in the accounts as a description of the timber supplied to the mines, though whether the miners were known as 'groovers', as in Swaledale, is not known. Whitehouse also supplied crowbars, known by the north-country name of 'gavelock', and wedges. These were presumably of the type known as 'plug-and-feathers', used for splitting rocks. The Hutchinson accounts make no mention of blasting powder, though the technique had been perfected by Carlisle Spedding at Whitehaven as early as 1730. The only use the Partners seem to have made of gunpowder was in blasting out the furnace holes. Within ten years Hartley had brought in workmen from Swaledale who were skilled in blasting in water. It seems from the details of the accounts that all the ore won in the Partners' mines was hewn entirely by hand until 1766-7 when no less than £7/3/- was spent on over a hundredweight of gunpowder.

2. William Brown Letterbook, HB 162, 25 June 1754 ; Newcastle Mining Institute.

Whitehouse also supplied clavises, hooks with a spring catch, for raising the kibbles of ore, though these and the washers' piggins were apparently of wood. A cooper at Gayles supplied them, and the blacksmiths frequently charged for 'houpin' them, so they were presumably of the type illustrated by Agricola.[3] We frequently find references to purchases of rope, sold by weight rather than by length, but virtually no evidence of the mechanism used to raise the kibbles. A solitary reference to a 'rouelr' could have a bearing on this, but of windlasses and gins, the erection of which is mentioned in all leases, there is no mention.

The terminology used in describing the tools and equipment corresponds closely with that used in the leadmines. Most of the dialect words are either self-evident or identifiable from published sources. When Wright's Dialect Dictionary[4] fails, Bruff's article in the Transactions of the Yorkshire Dialect Society[5] on leadmining terms is invaluable. Hutchinson himself varied between standard and dialect words. For instance the twigs used in lining the shafts and galleries he described indifferently as 'stoprods' or 'stoprice'. The latter form, using 'rice' to describe gardencanes is still in use in the area.

In view of its value and the recent thefts, it is not surprising that among the first buildings erected was a copperhouse, mentioned at the end of the last chapter, which was built by John Pybus and equipped with two locks, bought at Stockton by William Wynn. In the building of this copperhouse there is a note of 26/- spent on 660 pantiles, but no mention of stone for walling. Presumably the limestone worked on the spot was employed, since the whole mining enterprise began by accident in a limestone quarry. By the same token, one would also assume that the spoil would have a commercial value for burning into lime, as suggested in the previous chapter,

3. Agricola G ; De Re Metallica ; Hoover (ed), New York (1912), page 154.
4. Wright J ; Dialect Dictionary ; Oxford 1900.
5. Bruff H J L ; Glossary of Mining Terms, Yorkshire Dialect Society Transactions XXIV (IV).

though nowhere in the accounts is there any mention of its sale. It will be recalled that in the theft case Dinsdale was employed only to work limestone, and that in the Kearsley lease[6] Hartley reserved the limestone worked for his own use.

THE BUILDING OF THE SMELTING MILLS

By 1744 enough ore had apparently been won to spend £107/14/11½d building a smelt mill, the detail of this account is included in Appendix C. This repays study in illustrating how self-sufficient a village community could be. Building materials, carriage and construction were all provided from the village's own resources. Edward Whitehouse who had supplied smelting and separating tools such as cowlrakes already, now provided all the door-furniture, ladles, rabbles, a tapping-gavelock and a grate-picker for the operation of the furnace. From his forge came the furnace bars and bearers. Only the frames, being of cast, not wrought, iron had to be obtained from further afield. A letter survives covering their dispatch. This is worth quoting in full to illustrate the business methods of the day :-

Mr Ralph Hutchinson

Newcastle
26 Oct 1744

Bought of Cookson, Williams & Co.

	(cwt.	st.	lb.)				
12 frames of cast iron	6	2	19	@ 16/4	£5	8	11
1 plate	0	2	17	@ 14/-		9	1½
Paid for wood pattern for the frames						1	6
Paid cartage to Simon Wright Carrier and ordered him to deliver em to Mr Curry at the sign of the Old Fleece in Darlington							3
					£5	19	9½

Above you have an account of the castings according to your order which hope will please. I told you the price of the frames or moulds would be 18/8 per hundred (i.e. cwt.) but they weighing more than I then expected and being desireous to give encouragement I can have charged them only 16/- and when anything is wanting in our way you may depend of being served on the best terms by,

Your oblig'd h'ble serv't

John Williams & Co.

* Presumably this refers only to the wooden pattern.

6. Appendix A.

The total cost of transporting these iron frames from Newcastle amounted to 16/3d or about 1/3d per ton/mile. Carriage was an expensive item, and increased the cost of bulky commodities such as coal to such an extent that Brown wrote to Spedding in July 1752 that prohibitive carriage rates only militated against the adoption of steam pumping.[7]

PROBLEMS OF TRANSPORT

While farmers such as Thomas Charge, who brought the castings, continued to be employed for occasional cartage, one man, John Peacock, increasingly specialized in providing transport for local haulage. His vehicles were hired to bring sand from Catterick or Easby, stone from Whashton, or to lead bricks, ore or equipment within the village itself. As a considerable land-owner he no doubt had greater reserves of capital to invest in transport. He hired out sledges at 1/6d per day to the Partners, and carts at 3/-. These were presumably farm tumbrils, as the vehicles which brought Hartley 15 cwt. castings from Newcastle were described as waggons, and were presumably four-wheeled. There seems to have been a frequent service of stage waggons up and down the Great North Road at the time. Hartley employed once Pickersgill's waggon to bring him various parts for his machines, but referred also to regular London waggons. In December 1753 Hartley complained of Pickersgill's unreasonable charges.[8] One factor in increasing transport costs may have rising tolls. In RH 3 Hutchinson paid 12/7½d for tolls at Gatherley Bar, since for local work the tolls were paid not by the cart owner, but by the hirer. The detailed voucher for this amount shows that in September 1745 the tolls at this particular bar were doubled, a cart-and-three costing 9d instead of 4½d as before.

Rising costs and dissatisfaction with the service provided caused Hartley, at least, to depend increasingly on sea transport. After April 1753 we read frequently in his correspondence of cargoes sent from Newcastle via Mr James Lamb, wine-merchant, of Stockton. One ship at least, the

7. Willian Brown Letterbook, BS 69, 11 July 1752, Newcastle Mining Institute.
8. William Brown Letterbook, HB 157, 26 December 1753, Newcastle M.I.

'Lark' (Mr J Laverick, Master) was Stockton registered. A reference to Worsel (sic), suggests that the goods were brought even further up the Tees to Low Worsall, presumably by barge. Certainly Hartley found it worthwhile to buy nails, nuts and bolts, anvils and so forth in Gateshead rather than having them made nearer home. Tissington also used sea transport for the carriage of his large engine cylinder from Scotland, though Hartley expressed anxiety for the safety of the vessel.[9] In Chapter 8 we read also of the Shuttleworths using sea transport. Whether the Partners ever did so is not recorded.

To return to 1744/5, Peacock also sold them during that time 221¾ qrs. of coal for smelting. Presumably he bought the coal at the pithead, or at the coal depot at Piercebridge and carried it to Middleton Tyas in his own carts, diversifying his business further. This large quantity of coal was urgently needed, for by the time the mill was complete some 40 tons of ore were awaiting processing. During the first half of 1745 no money was paid for getting or deadwork, the whole labour force being employed in smelting. This activity continued into the next account period, RH 4, though mining had then been resumed. The national crises and Squire John's martial activities seem not to have interfered with working at Middleton Tyas.

THE SALE OF COPPER

In 1746 the copper already mined and smelted was still unsold, and at this point outside interests seem first to have concerned themselves with the Middleton mines. There is a small but significant expenditure in RH 4 of 1/10½d on letters. The voucher shows these to have come from Mr Watkins of Warrington on the 12 February and 7 June, and Mr Rotton of Duffield on the 20 May, 12 and 14 June 1746. Watkins was a nationally

9. William Brown Letterbook, HB 157, 26 December 1753, Newcastle Mining Institute.

important figure in the copper and brass trade[10] but we must assume that his bid for the copper was less satisfactory than that of John Rotton, who was agent for John Gilbert Cooper of Locke near Derby. Like another agent, Hutchinson himself, Rotton was a mineral lessee in his own right. A lease in the Derbyshire County Record Office conntects him with mineral rights in the Peak District village of Winster.[11] It can hardly be a coincidence that George Tissington of Winster wrote in the same week as Rotton to Andrew Wilkinson, sending him the sketchmap and offer mentioned above on page .

In this letter Tissington reminded Wilkinson that he had already offered, while in London, to cut 80-90 yards in Wilkinson's fields looking for the vein which had been found in Shuttleworth's land. Apparently the latter had already called in experienced outsiders to help him. Certainly Tissington claimed that he could do the work both better and more cheaply than Wilkinson's own workmen. Although he considered his expertise superior to that of the locals his offer to undercut them by one fifth was apparently not accepted.

Whereas Tissington was unsuccessful in his wooing of the Partners, the correspondence with Rotton bore fruit and on the 15 October 1746 articles of agreement were drawn up governing the sale of the copper and ore.[12] In the first place Rotton and his partner Joshua Matthewman bought the copper already smelted and refined, at £103 per ton. The total quantity sold under this agreement was 16 tons 7 cwt. 3 qr. 2 lb,

10. Watkins had associated with the Bank Quay Works in Warrington for many years, and more recently with the Cheadle Co. in Staffordshire in partnership with Patten of Warrington, Barker of Argoed, Grosvenor & Hurst of Cheadle. They had virtually taken over the smelting of Staffordshire copper ores and no doubt wished to extend their interests to the North Riding. See Plant R, History of Cheadle, Leek (1881) and V.C.H. Staffordshire Vol.III, London (1967).

11. Derbyshire County Record Office, 195Z/T7.

12. These are given in full in Appendix D.

for which they paid £1,688/10/1d.[13] These transactions were not wholly cleared up until 1750 when, in RH 8, there is recorded the payment of a total of £2,430 to the Partners in fourteen Bills. This included payment for a quantity of unsmelted ore still in hand in 1746. The Partners used Bills of Exchange for an average value of £200 for their transactions. Leonard Hartley also made use of Bills, as in the case of the debt of £101/18/4½d which he would have paid more promptly had the fitter not left for Newcastle before he could obtain a Bank Bill. In HB 99 he enclosed a Bill for £50, which he hoped would be as good as cash, but a fortnight earlier had paid James Ord, the Gateshead smith, with two £20 notes.

It is quite likely that Shuttleworth was already selling his copper to Derbyshire, as the Cornish lease (referred to below on page 126) did not take effect until 1751. Certainly he employed a Derbyshireman to do his cutting, and Rotton's employer, Cooper, stayed at the Shuttleworth home at Forcett when he came to sign the agreement with the Partners in 1746.

Selling ore to Cooper at a fixed price of £28/10/- per ton during the production of 100 tons, gave the Partners a guaranteed price.[14] Fluctuation of price and unreliability of the veins were the great bugbears of the mine owners. By this agreement the Partners eliminated the first, though it would be borne in mind that Hartley mentioned in December 1752 that the best ore was sold in London for £53 per ton.[15] Graph E shows that once the Cooper agreement terminated, and a free market price obtained,

13. Rotton's partner, Matthewman, a member of a well-known Sheffield family is described in his will (1757) as a cutler, but in 1734 in a pedigree in the Jackson Collection (Sheffield City Archives - Jackson 1110) he was styled a button-maker, as was his son Joseph (ACM/SD 75a). This suggests that the first consignment of copper from Middleton Tyas went for the manufacture of brass buttons.

14. In the accounts a ton is always of 21 cwt. This corresponds to the leadmining measure the Fother but that term is only ever used to describe lead (RH 3) never copper or coal.

15. William Brown Letterbook, HB 120, 23 December 1752, Newcastle Mining Institute.

it tended to fall below £28/10/- on average.

Since Cooper bought the copper as ore he required the use of the smelt mill, but as yet paid a millage duty of 1/6d per ton, rather than leasing the mill itself. To do the smelting he did buy the tools, coal, etc., at an agreed price. To supervise the work Rotton took up residence in the area, where he continued to live for some twenty years, buying ore and smelting it, long after the 1746 contract had lapsed. The baptisms and deaths of his family appear in the Register of Barton Parish Church.

Ore was delivered to Rotton on behalf of Cooper when 30 tons had been produced. The preparation of the ore for smelting was still the responsibility of the Partners, and they went on buying piggins, riddles, buckers, etc., The terms of employment of the washers are discussed in the next chapter.

It seems likely that refining, which is attested in RH 4, ceased at this time, since Jars wrote in 1765 that the smelting works only produced matte, which was sent to Derbyshire for refining. The first 30 tons under the new contract were delivered in June 1750. In the detailed vouchers for £3/19/9 expenses (RH 8) Hutchinson gave details of the costs involved in the weighing, which became a regular feature in the accounts. Four labourers weighing ore for four days received a total of 16/- in wages, but on account of their extraordinary labour received ten shillings worth of ale in addition.

THE PROFITABILITY OF THE MINES

As RH 8 contains a full summary of receipts to date, it is possible at this stage to see whether the enterprise was profitable to the Partners. By totalling the expenditure itemised in RH 1-8 and balancing it against receipts from the sale of copper and ore, plus millage, it is possible to calculate that the Partners made an overall profit of almost £2,600 in the first nine years of work. As Rotton settled in two payments, in 1746 and 1750, we can work out an average profitability for 1742-6 (RH 1-4) of some £27 per month, and for 1747-50 (RH 5-8) of some £21 per month. (see Vol.II, page 18). In subsequent accounts it is possible to plot profitability one period at a time since

the ore was sold during each account period. This is illustrated in Graph A. Although a comparison of the first four and the second four accounts reveals no cause for alarm, and although the next period, RH 9, was one of unprecedented profitability, the information summarized in Graphs C1 and C2 must have caused the Partners some anxious speculation.

In RH 7 60% of the cost went on deadwork. Wynn and partners received £176/2/6d for this, compared with a mere £31/12/0½d for getting, and £27/2/7d for washing. Not only was this expensive in labour, but, as Graph D reveals, the cost of sharpening tools rose steeply. Tools to be blunted producing nothing more valuable than broken stone. The Partners must by now have become acutely aware of the fact described later by Jars and others that the mineralization though rich was extremely patchy and irregular.

A further burden on the Partners was Land Tax. On the 9 October 1748 Hutchinson and Wynn attended for two days at Scorton at an appeal to the Commissioners. Neither the appeal nor the dinner to which the Agent treated them had any influence, and from 1750 a £2 Land Tax payment appears in the accounts. A later appeal seems to have been more successful, since in the following year it was increased to £3. With unsure profit margins and unpredictable ore deposits even so small an imposition must have added to the Partners' doubts.

RH 9, which survives only in a copy in John Hutton's untidy writing, must have temporarily reassured them. For a getting cost of £240 and £194 deadwork the mines produced 50 tons of ore worth £1,413. In the details of the account however there are hints of new problems. John Spence not only provided material for the repair of the pumps, which may hint at increased drainage problems, but also nine fathoms of air pipes at 2/- per fathom. As the workings went deeper and became more complex so the problem of supplying fresh air became more acute. Two years later Hartley sank a separate ventilation shaft in his mines. Other problems are also

suggested by the 21 threave of straw and 16,500 stoprods bought, presumably due to the increased friability of the stone.

The stoprods were part of a consignment of wood and wooden tools sold to the Partnership by John Hutton. From 1748 he regularly appeared in this role, and from 1750 Hutchinson did likewise. Half a century later, then the House of Commons Committee investigated the copper industry, they heard evidence from Matthew Boulton on the undesirability of the practice.[16] He alleged that Cornish shareholders were safeguarding their profits in a period of falling prices by virtually monopolizing the supply of essential stores to the firms of which they were a part. One is compelled to wonder whether Hutton at least had anticipated this idea.

RH 10 is missing, and between November 1751 and November 1752 a great change took place. In RH 11, for an expenditure of £272/10/- on deadwork only seven tons of ore were produced. Graphs C1 and C2 again show what an increase this represented both in total and in percentage. For the first time the line in Graph A disappears off the sheet. The Partners were making a dead loss. Perhaps RH 10 told as gloomy a story about 1752. In any case the Partners decided to transfer the risk to other shoulders, and from entrepreneurs became mere rentiers.

The short account RH 12, only 32 weeks in length, is in the nature of a winding-up statement. Outstanding debts were settled and the stores and utensils sold at an independent valuation of £31/10/-. Henceforth Rotton became the tenant of the smelting mill at an annual rent of £10. With the end of the direct working by the Partners the vouchers cease, and so does the information derived from them about working methods. This took place just at the time when the Hartley-Brown correspondence gives us greatest detail about their work. Indeed Hartley referred in a letter dated 26 December 1753, to the Partners having leased the mine at a duty, and obliged the lessees to keep on such a number of hands, for such a term of years and on such a forfeiture as would break the undertakers.

16. House of Commons, Report of the Committee on Copper Mines and Trade, 1799

CHAPTER 5 LABOUR AND MATERIALS

METHODS OF EMPLOYMENT

In the last chapter we referred to the Partners' employment of labour and purchase of materials, in this chapter we are concerned mainly with the costs of both, and again the first twelve of Ralph Hutchinson's accounts provide the bulk of the evidence up to 1754. For the 1760's we have the Hartley accounts prepared by John Ayre, covering 1762-3 and 1766-7[1] and the solitary paybill of the Partners for 1766-7[2] also a similar isolated paybill of Shuttleworth's exists for 1776.[3] Chapter 8 contains a more detailed discussion of the activity after 1754, here we are merely concerned with such data as have a bearing on the cost of materials and labour, and terms of employment.

Any consideration of the methods of employing and paying workers must obviously involve a comparison with other industries, and particularly with contemporary practice in the leadmines of the Dales.[4] The options open to proprietors of mines were basically, either to pay day-rates or some form of piece-rates. By contracting with partnerships of workers to supply ore at a fixed price per ton (the leadmining term 'bing' was never used) the owners transferred some of the risk in a highly speculative venture to the miners themselves. The miners stood to earn a good income if the veins were more productive than expected, but at worst to work for nothing at all. Jars described these partnerships as "entrepreneurs ouvriers".[5] As we have seen in the previous chapter diminishing returns forced the Partners to let the mines at a fixed rate of duty after 1754, but in the previous twelve years most of their ore was won at a fixed

1. Hartley Papers, ZKU ; Northallerton County Record Office.
2. Hutton Papers, ZAW ; Northallerton County Record Office.
3. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.
4. The methods used in the North Pennine Orefield are described fully by C J Hunt (The Leadmines of the North Pennines, Manchester 1970), Chapters 3 and 4.
5. See Appendix F.

rate of duty after 1754, but in the previous twelve years most of their ore was won at a fixed price per ton, usually between £4 and £5, by working partnerships. This approximates to the 'butty' system in the Midland coalmines, the 'tribute' system in the Cornish tin and copper mines, or the 'bingtale' system of Alston Moor. The leading member of the partnership struck the bargain with the owners and shared out the money according to an agreed distribution. A later piece of evidence suggests that at Middleton Tyas this was done in equal shares in ore-winning. In other processes the payment was closely tied to skill and efficiency. The groups seem to have consisted of about half a dozen men, which was enough to practise an effective degree of division of labour. The principal contractor for labour was William Wynn, of whom we have already heard. It is significant that as time went by Wynn tended to refer to his "men" rather than his "partners". Another contractor was George Carter and references to Carter's Low Drift suggest that the partnerships each worked their own particular stints.[6]

The same arrangement may have been in force when, in 1759, nine men; Jos. Cowling, Peter Toser, Robert Jackson, John Rosewarne, Thomas Williams, Robert Watson, William Colling Jr., John Whaits and George Morton, wrote to Mr Leonard Hartley to ask him to act for them in a disputed claim.[7] This was presumably Leonard (3) as the old man would have been 70 years old at the time. This partnership claimed to be 'shareholders' in a quantity of copper in Mains Pasture, to which William Simpson, Peacock's Derbyshire son-in-law, laid claim also. The wording of the letter and its referral to independent arbitrators, Thomas Gyll of Durham, John Hardcastle and Thomas Raper, both of Bedale, suggest that this was a case of an actual lease, but presumably the nine shareholders were a working partnership in the same sense as Wynn and his partners at an earlier date.

6. Hutton Papers, ZAW ; RH 2 in Appendix C.
7. Hartley Papers, ZKU ; Northallerton County Record Office.

Jars wrote that the working partnerships were given permission to dig and prospect freely within their 'arrondissement', which presumably means within a specific area rather than anywhere in the lands of a particular landowner.

To revert to the Hutchinson accounts, the Partners employed deadwork men who sank shafts and drove drifts at a fixed rate, of either 5/- or 20/- per fathom. In this case the variation represents not a greater risk, but the greater difficulty of working in limestone rather than in soil or shale. As the total number of men working in these mines was always very small the same men undertook deadwork as ore-getting. Predictably the principal deadwork contractor was William Wynn, who was paid separately for deadwork and ore-getting. Likewise in 1766 John Ayre, Hartley's agent, paid John Peart and John Bentley a day-rate, 1/4d per day, for getting and in addition a deadwork payment at the rate of 14/- per fathom.

As well as contract labour the Partners employed many men directly, by the shift, the day or the week. The bulk of these tended to be unskilled labour and the specialists were usually self-employed, though occasionally a man who normally worked on his own account, worked instead for a period at a day-rate. Thus Edward Whitehouse, the blacksmith, who supplied the Partners with most of their specialized ironwork, was paid by the day when he worked for them on site at Middleton Tyas, rather than making articles at home in Marske.

An example of the combination of direct and contract labour is to be found in the Copper Mill Account.[8] For instance building workers; the Lumleys, Tarran, Hindman, Simpson, Fryer were paid directly, but John Gyll, also engaged in building, employed his own men. In this case however it was not for a fixed global sum, but at a stated rate per man. The contractor had the responsibility of disbursement and was closely watched, as in the case of the same John Gyll's inaccurate bill mentioned in the

8. RH 2 quoted in full in Appendix C.

preceding chapter.

WILLIAM WYNN

William Wynn appeared as an employer of labour in the Copper Mill Account also, presenting a bill for £6/4/-, representing fifteen days work each by himself and his brother Jeremiah, 41 days by one labourer Will Pownder and 39 by another, Luke Morton. The account included 11 lbs of gunpowder used in sinking the furnace holes. Unlike the leadmining practice it appears that contractors did not pay the Partners for tools and powder. All the bills, including sharpening went to the Partners for payment and there are no records on receipts for repayment. It is just possible that in the mining activity these were all provided for deadwork, and the ore-getters provided their own, but on the evidence available it looks unlikely. On the other hand, while there are regular payments for candles in the accounts from the 1760's and 70's they never appear in the RH series, and so must have been bought by the miners themselves. Jars wrote of the mining companies fixing the salaries of the mining partnerships and providing them with tools, etc.

When the Partners began smelting in 1744 Wynn was active in this field also. Tissington in 1755 employed a professional smelter at a guinea a week.[9] Twenty years later Shuttleworth paid Samuel Champion the same wage, but in addition, paid a further 1/- a week for his lodgings with Ann Weatherall.[10] This Champion was obviously a peripatetic smelter as employed in the meadmines, and indeed may have been a lead smelter most of the time. On the other hand Tissington's man may have been resident, as one Nicholas Orme appears in the list of heads of families in 1755, described as a smelter.[11] The Partners seem to have made do with local talent, notably the Wynns. To produce copper matte is quite a technical

9. William Brown Letterbook, HB 191, 28 January 1755, Newcastle Mining Institute.
10. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.
11. Parish Bundle, Leeds Record Office.

achievement in itself, but in RH 4 reference is made to a refining furnace also. For the reasons stated in Chapter 2 the early ore produced was probably carbonate rather than sulphide, and so easier to smelt. Nevertheless one is struck by the capabilities of Wynn technically as well as organizationally.

The payments for smelting were made directly by the Partners. The Wynns each worked 219 days in the period covered by RH 3, at 1/6d per day. Of the others, Will Sewel worked 128 at 1/4d, Luke Morton 190 at 1/- and Will Liddell for 116 also at 1/-. The differing periods of labour indicate that apart from the Wynns they did not work continuously as a team. The furnaces, once heated up, would have to be kept alight continuously and in RH 4 there are the first specific mentions of payment for night work. In this account period the Wynns worked 304 days smelting, earning £22/16/-, but at the same time, within the space of one year, they also received £143/12/- for getting more than 28 tons of ore. Obviously this could not have been raised in the few days which this would have left them, and since they themselves presumably did the skilled job of smelting, most of the mining must have been done by their partners or employees.

Although the Partners employed fourteen labourers for a total of 284½ days work in 1745-6, the payment to four of these men, to Jeremiah and to Cape the blacksmith was signed for by William Wynn. It was suggested above that Wynn increasingly took on the role of manager. That he spent less time actually working and more in organizing, as time went by, is borne out by the specific reference in RH 7 to work done, "by myself with Clemminson, in the Old Quarry".

In RH 5 we find him extending his activities further, becoming an employer of labour in the peripheral activities of the smelting process, in which he performed the skilled tasks. His charges are detailed as follows:-

An account of work done at Middleton Tyas by William Wynn and Partners in 1746.

Sept 8	Myself and 5 men carrying copper from the copperhouse to the mill	6 6
Oct 14	do. sorting the slaggs	6 6
15	Myself and 4 men do.	5 4
	Myself and 4 men for 2 days weighing and loading 10 tun of copper in Novr	10 8
Jan 16	Myself and 4 at weighing 6 tun of copper	5 4
17	do. removing slaggs	5 4
	Thos. Robinson and his bro. for 2 days each	4 0
24	Will Coates for his cart leading slaggs	3 0
	Scuttles	2 1
		£2 14 1

In RH 7 he took over all the preparation of the ore for smelting, employing five men in 1748 and seven in 1749. With his proliferating activities Wynn's turnover increased as follows :-

	Total			Monthly		
	£	s	d	£	s	d
RH 1	83	4	8	3	9	4
2	129	0	10	10	15	0
3	32	17	0	4	14	0
4 (with Jeremiah)	167	10	3	13	19	2
5	112	5	6	12	10	0
6	198	11	9	11	13	0
7	238	5	$1\frac{1}{2}$	19	10	0
8	333	2	0	25	12	0
9	434	0	$10\frac{1}{2}$	36	2	0
11	309	7	10	25	15	0

The Chief Constable, William Peacock, had described Wynn in 1742 as a "labouring person".[12] In RH 1 he was described simply as a miner. His rise in social standing, which went with his rising income, was confirmed by his appointment in 1766 as Churchwarden. He may be the ex-miner, William -----, who had done so well that he could live without working, and had turned jockey.[13] As his name keeps cropping up in connection with copper to within a year of his death in 1771 however, this seems doubtful. From 1758 he did protect himself against falling earnings from the mines by renting a farm from the Partners at £68 per annum, which his widow continued to work after his death.[14]

12. Affidavit in Havelock-Allan Papers, ZDG(B), Northallerton C.R.O.
13. William Brown Letterbook, HB 203, Newcastle Mining Institute.
14. Hutton Papers, ZAW, Northallerton C.R.O.

One of the functions which Wynn early relinquished was preparation. After two years he handed it over to his former employee Thomas Musgrave. Musgrave detailed the jobs in his pay bills, unlike Wynn who listed his workers by name, it is possible by comparing rates of pay and periods of employment to make an intelligent guess at their identities

MUSGRAVE (RH 9)	WYNN (RH 7)
To the pumper 8 wks @ 4/- per week	Paid G Morton @ 4/- per week
To the buddler do @ 6/-	Paid L Morton & W Guy for 7 and 9 wks @ 6/-
To the picker do @ 3/-	Paid T Hall @ 3/-
Thos Musgrave do @ 8/-	Paid T Musgrave @ 8/-
To the riddler 2 wks @ 6/-	Paid J Clemminson for 3 wks @ 6/-
To the knocker do @ 5/-	Paid E March @ 5/-
To Chris Charge 3 days leading Two fillers 3 days @ 1/- per day	Paid J & G Vates @ 6/-

LITERACY AND EMPLOYMENT

A cause for surprise in studying Musgrave's bill is the fact that he was illiterate, and signed with a cross. Even with the small sample available it appears that there was a definite correlation between literacy and reward, and that illiterates such as Musgrave and Sewel who were paid 1/4d per day were the exception. Although many of the examples are mere signatures on receipts, the degree of literacy is surprisingly high. William Dargue who served the Parish as Clerk for 27 years and Schoolmaster for 48, from 1736 to 1784,[15] seems to have had considerable success. Even in the cases of an isolated signature it is usually possible to classify the writer's literacy in one of four categories, though it must be admitted that this is a very subjective judgement. Those who obviously wrote frequently, could compose fluent English and write with confidence, if not always legibility, comprise Category A. As well as the aristocracy and gentry they include the lessees and agents, such men as Tissington, Hutchinson and Ayre. The engineers Brown and Spedding fall within this group, and so, significantly, does William Wynn. Those who could compose a sentence or a bill adequately, but which was badly written and spelt

15. Middleton Tyas Parish Register.

even by 18th century standards, comprise Category B. Many of these were the local craftsmen, and in the writer's memory the carpenter of a certain Swaledale village sent out bills which were little better spelt than this example from John Smith ;

December 19		
1 dosing of kibils	6	0
Jenuerys		
1 dosing of sinking kibils	12	0
2 dosing of pickshafts	9	0
2 water toubs	3	9
for carish	5	0
	£1	6 9

Category C includes those whose writing is represented only by a signature on a receipt, which is so badly written as to suggest that this was the limit of literacy. Many of the carters and labourers who could write, did so so stumblingly as to suggest that it was a great effort. It is inherent in the nature of a carter's job to be able to sign for loads, and of those who were employed at Middleton Tyas only one signed with a cross.

Many of the labourers in the early period also qualify for Category D, the totally illiterate, though the paybill of 1776 gives the impression of much improved literacy in the intervening thirty years.[16] Of Shuttleworth's thirty-five employees in 1776, only seven were illiterate, and the general standard of signature had improved. Nor was literacy confined to the men, Mary Wynn signed as though she was used to writing, and in Hutchinson's accounts Jane, wife of the ironmonger Charles Alderson, could write legibly.

EMPLOYMENT IN THE LATER YEARS

The passage of time also shows a gradual change in the method of employment. In the 1762-3 account there is an item which might suggest that Hartley either still was, or had lately been paying a contractor to

16. Havelock Allan Papers, ZDG(B) ; Northallerton County Record Office.

win ore for him. Edward Honey was paid £15/3/- for 5 tons 1 cwt of copper for smelting.[17] This looks like a fixed getting rate, but seems rather a poor price compared with the £4-£5 per ton paid twenty years earlier. The fact that Honey appears as a 'dressingmaster' for the Partners four years later, paid at a shift-rate, suggests that the Hartley Payment may represent a fixed rate for dressing ore already won. On the other hand the entry in the Parish Register for his burial describes Honey as a miner. With this possible exception Hartley paid his five men directly in the 1760's and here we have the only valid instance where it is possible to compare the wages paid by two employers to the same man. In 1762-3 John Madgson worked for Hartley for 10d per day. The Partners paid him 1/6d in 1766-7. Peter Toms whom Hartley paid 1/2d per day received 8/- per week from Shuttleworth in 1776. James Vates also was paid 8/- by Shuttleworth, whereas he had been paid only 1/- in 1762-3. Age and experience may have affected their rates of pay, but one gathers the impression that the Partners and Shuttleworth not only paid their workers better but, at this stage, kept them at work for a greater proportion of the time. Poaching of workers was nothing new to the Hartleys. Leonard had expressed his disgust with Ord, the Gateshead blacksmith, who had come to work for him at 8/-per week and deserted to the enemy, Tissington, for 12/-.[18]

The five men mentioned above who were at work in 1766 for Hartley all worked different periods between February and August, and were paid at four different rates. Between August and October they all seem to have worked full time, 53 or 54 days out of a possible 55, but there is no hint of partnership working or sharing of responsibility.

On the other hand in the Partners' accounts for the same period there does seem to be a survival at least of partnership working. Seven men

17. Hartley Papers, ZKU ; Northallerton County Record Office.

18. William Brown Letterbook, HB 178, 17 October 1754, Newcastle Mining Institute.

were each paid 1/4d per shift for 312 shifts. Two of them were stated specifically to have worked respectively William Wynn's share and William Collings share. As they all worked exactly the same length of time they obviously did so as a team. Nevertheless they were paid individually by the Partners and not by a contractor.

This raises the question of whether a shift and a day were the same thing. As 312 corresponds to the number of days in a year excluding Sundays, Christmas Day and Good Friday, it seems likely to be so in this particular case. On the other hand for the one man dressing ore and the four women picking it, each day consisted of one and a half shifts. This may be because their low basic wage made it essential to work more than one shift. Was a shift of, say, eight hours long enough to work underground, whereas surface workers could manage 12 ? Did the miners have an alternative source of income ? Leadmining analogies suggest that this might be so, both as far as the eight hour shift and the smallholding are concerned. In the Hartley-Brown correspondence there is a hint that, like the leadminers of the Dales, they may have knitted to supplement their wages. Hartley told Brown in 1753 that his stockings would not be ready to send up to Newcastle with the blocks.[19]

In 1776 Shuttleworth paid all his men directly except for some of the carpenters and masons, who employed their sons and labourers.[20] Although there is no suggestion of partnerships, all his men but one worked between six and seven weeks, that is full-time. Even without the partnership system the mine could obviously be worked more efficiently with a fairly constant labour force. Shuttleworth's agent detailed all the rates of pay at a weekly rate. Previously the other employers had quoted weekly rates only for washers. Does a weekly rate imply more steady employment than a daily or a shift rate ?

19. William Brown Letterbook, HB 122, 11 February 1753 ; Newcastle Mining Institute.

20. The gradual move in the 19th century from a piecerate to a dayrate system in the leadmines is described by C J Hunt; op.cit., Chap.4.

Just as the account periods are inexplicably irregular, just as the weighings of ore seem to follow no particular pattern, so the length of time between pays seems to vary considerably. Ralph Hutchinson seems to have settled with the contractors and partnerships roughly yearly, which was not unusual at this period in the leadmines.[21] Nor do his account periods exactly correspond with the pay periods, for instance the Wynns were paid for 219 days work each in a period which apparently ran from January to May 1745 and contained a maximum of 126 working days. In the Partners' account for 1766-7 they seem still to have been settling annually, but there is no indication whether they paid 'subs' during the year, or whether the contractors did so, as was often the case in the leadmines.

In 1763 Hartley paid his men at the end of a 29 week period, but in 1766 they received three pays covering 12, 16 and 8 weeks respectively. The Shuttleworth account for 1776 shows the men being paid at the end of a seven week period. It seems that, as in the leadmines, as time went by it became the practice to pay more frequently.

It is also instructive to attempt to compare the rates of pay in the 1740's with those paid later. A direct comparison is impossible, as only one man, George Morton, appears both in the RH 1-12 series and the later accounts. In 1748 he was paid 8d per day for washing. Eighteen years later he was a jack-of-all-trades for Hartley, earning 1/6d per day for filling, sampling, weighing, clearing the stell and repairing the buddles. We do not know when he was born, but as he was married in 1760 and died in 1801, it seems likely that in 1748 he was quite a small boy and so the comparison is invalid. It seems likely also that the other ore pickers who were paid very low wages, 2/- - 3/- per week, were also boys. The later accounts show women employed in this job working one and a half shifts per day at 8d per shift, double the rate Musgrave's picker was paid

21. Hunt C J ; The Leadmines of the Northern Pennines ; Manchester (1970), page 58 et.seq.

in 1750. The wages of skilled ore dressers seem also to have risen. In the 1748-50 accounts no one was paid more than 1/4d, including even Wynn and Musgrave. In the 1766-7 account the Partners paid Edward Honey 1/6d per shift, which means he earned 2/3d.

In the RH accounts there are no specific payments to miners, who would all be paid in partnerships, but labourers received between 8d and 1/- per day (RH 2, John Simpson 8d ; George Fryer 10d ; Thos. Hindman 12d). In Hartley's accounts in the 1760's his workers received between 10d and 1/4d, the lower paid presumably were the less skilled, the wielders of groove hammers and shovellers of spoil. The Partners must also have employed unskilled labour in 1766-7, but in their account no one was paid less than 1/4d per day. This was also the lowest wage paid by Shuttleworth ten years later.

Miss Gilboy[22] found a similar situation in her studies of two sources; the Thornborough Estate papers and the wages paid to labourers for public works on roads and bridges. From a general average of 8d-10d in the 1740's, wages rose to 10d-1/2d in the 1750's and a general level of 1/2d in the 1760's. While Miss Gilboy was at pains to point out that even within the one Riding wages could vary considerably, the situation and economy of Middleton Tyas and Lower Wensleydale are sufficiently similar to make a comparison valid.

The remuneration of craftsmen and the cost of the provision of services seem also to have risen. In the latter category a good example is carting, for which Peacock charged the Partners 3/- per day in the 1740's, cost 5/- per day in 1766. Masons, in the 1740's were paid between 1/2d and 1/5½d; in Shuttleworth's account twenty years later they received 10/- per week, 1/8d per day. A similar increase applies to carpenters, from 1/2d-1/4d up to 1/8d. Both these later rates of pay are higher than

22. Gilboy E W ; Wages in 18th Century England ; Harvard (1943) ; page 155 et seq.).

those quoted by Arthur Young for these trades at Scorton,[23] but again correspond with Miss Gilboy's findings. She detected a rise from 1/6d in 1765 to 2/- on average in 1772. She also pointed out what is obvious in our examples, that the trades of mason and carpenter tended to be paid the same.

An apparent contradiction to the general rule is the blacksmith who was paid 2/- per day in 1776, while Edward Whitehouse had earned as much as 2/6d per day thirty years before. This may of course reflect a greater degree of skill, rather than a general wage movement. This seems to be confirmed when the price for doing a comparable, and not highly skilled job in 1751 is compared with that obtaining in 1776. In RH 9 Whitehouse was paid 4/8d per dozen for hooping piggins. Shuttleworth's agent paid John Walker 1/4d each for the same job. This example is a warning against placing too much reliance on isolated cases, but while the body of material available is small, one gets the impression of an all round increase in labour costs of at least 25% in the 1760's. It may well be that this increase, together with a similar rise in the price of materials, contributed to the final collapse of the industry described in Chapter 8.

In general the wage levels at Middleton Tyas were related to agricultural rather than industrial levels. To the wages, that is of the better paid Lands of the Vale of Mowbray rather than the poorly paid moorland areas. The payments for ale for the men after exceptional labour at the weighing have very much the sound of rural 'wet boons'. The only industry with which there seems to have been any interchange of labour was leadmining, and in 1770 Arthur Young wrote that the pay of leadminers also tended to be comparable with agricultural workers, at a time when, according to his figures Newcastle coal miners were earning on average 15/- per week.

23. Young A ; A Six Months Tour through the North of England, London (1770) (Page 170).

It must be said that although the work was as hard as in a coalmine and generally much wetter, there was not the same element of risk. With no firedamp danger and with shallow, easily ventilated workings the copper miner's life was relatively unhazardous. Just how safe it was is indicated by the fact that there is no mention of a death in the mines in the Parish Register. Every accidental death is clearly specified, whether by falling from a haycart, falling from a limekiln or by stone fall in the limestone quarries.

POPULATION AND THE PARISH REGISTERS

From the Parish Register we can gain some idea of the influence of the rise and fall of the industry upon the population of the village, though at no time is it possible even to estimate the total number of men at work in the mines. The 1801 Census which gives the earliest record of the total population shows a population of some 700, in Middleton Tyas 562 and a further 174 in Moulton,[24] a figure which has not significantly changed in the subsequent century and a half. From 1755 however there survives a valuable document in the Parish Records. This a nominal roll of heads of families compiled in June of that year, showing 140 families in Middleton Tyas and 33 in the Chapelry of Moulton. Of these only 25 names can be positively identified as workers in the copper mines, and with the dual occupation prevalent at the time many of these were probably only part-time copper workers. On the other hand we only have lists of workers for 12 years for the Partners, and for one or two years for the Hartleys and the Shuttleworths. We know none of the names of the men employed by William Paul and hardly any of the immigrants brought from Cornwall or Derbyshire.

In the list of heads of households however there is one name which is totally unfamiliar. The Cornwall County Record Office have confirmed that Michael Genowith was certainly a Cornishman, though his name was

24. Census of Great Britain 1851, Population Tables ; London (1852).

probably spelt Chynoweth originally. In the list also Nicholas Orme is described as a smelter, and so was presumably an outsider. From external evidence we know that two others were from Derbyshire; Samuel Champion and William Simpson, the latter having married into the Peacock family. Apart from this the list does not help us to estimate the scale of immigration.

Based on the surviving Bishops' Transcripts[25] the following figures show the average annual figures for each decade of the 18th century in respect of Baptisms, illegitimate births, marriages and burials.

	Baptisms	Illegitimate	Marriages	Burials
1701-1710	10.6	0	3.3	7.6
1711-1720	10	0	5.0	7.0
1721-1730	10	0.1	2.1	7.6
1731-1740	12.1	0.2	3.7	8.3
1741-1750	14.4	0.2	4.9	12.4
1751-1760	23.5	1	6.1	12
1761-1770	26.2	1	4.8	15.4
1771-1780	21.7	1.9	4.8	13.9
1781-1790	17.5	1.5	4.3	12.2
1791-1800	18.9	1.9	4.9	12.9

The figures show a significant increase in baptisms, marriages and deaths in the 1740's, when the industry was becoming established, and a great increase in the 1750's and 1760's when the outside lessees brought in labour from Cornwall, Derbyshire and the Dales. Equally the figures show a marked falling off once the peak of activity has passed.

We know from Hartley's letters that many of the immigrants were very mobile, moving off when the winter flooding brought the mines to a standstill. This may well account for the absence of many 'foreign' names from the list of heads of families and also have a bearing upon the increase in bastardy. From a negligible percentage in the first half of the century, by the 1770's 8% of children baptised were illegitimate. Nor does the decline of the industry seem to have affected this trend, since by the last decade of the century the figure had risen to 10%.

25. Leeds Record Office, (RD/RR/76).

No doubt the village moralists would lump this together with the twenty public houses as a deplorable legacy of the boom days of the copper mines.

From these figures and the 1801 Census it seems that the population in 1700 cannot have been more than about 400. In this case the formulae given by D E C Eversley[26] are of value for estimating this figure for 1700, but not for calculating the mid-century population, since it was essentially what Eversley terms a 'Klondyke' population. Migration on this scale obviously makes accurate statistical treatment virtually impossible, but it would appear from the figures available that at its peak the population of the parish must have reached 900-1,000. Allowing for natural increase this would suggest an immigration of at least 400, though these would not all be miners. If this is so, then the population must have fallen back by some 30% after the demise of the industry, though never back to the 1700 level. The demands of the quarrying industry must have absorbed much of the available labour. We know that the Leyberrys and Black Scar Quarries were later than the mines, and the quarrying of limestone in the northern part of the parish flourished down to the present decade. On the other hand the Parish Register does speak of pauper ex-miners.

COST OF MATERIALS

Like the cost of labour, the cost of materials seems also to have risen during the lifetime of the copper mines and from the mass of detail in the vouchers we may take a selection of items to illustrate this trend. Blasting powder rose in price from 10d to 1/- per pound between 1744 and 1766, bricks from 10/- to 12/- per 1,000 in the same period. Rope which cost 5d-6d in the earlier period, cost 7¼d per fathom in 1766. Straw, steady at 8d per threave between 1742 and 1751, had risen to 1/2d in 1776. The cost of iron had likewise risen by 50%. Timber alone of the commodities

26. Wrigley E A (Ed) ; An Introduction to English Historical Demography; London (1966) ; (Eversley's Chapter 3 and Appendix A).

used in quantity seems to have remained fairly steady, though the variation in price within the same account suggests a similarly great variation in quality, which makes a direct comparison of prices difficult. In 1749 Thomas Blackburne supplied timber at both 1/6d and 2/- per dozen. These trends which at Middleton Tyas seem to parallel the rise in wages, do not tally with the Schumpeter-Gilboy indices of either producer or consumer goods, which show fairly constant prices throughout this period.[27]

The most difficult problem in discussing prices at Middleton Tyas is that of coal, which was essential both to smelting, and for a time, to drainage. As well as the fact that coal was sometimes measured by volume and at other times by weight, there is the peculiarity of local measures in an age before standardization. Writing from Newcastle, a mere 40 miles away, Brown wrote of, "Twenty bolls which I find will be seven and a half of your quarters."[28] All purchases of coal were made in terms of volume and the prices varied little. In 1744-6 (RH 2, 3 and 4) the Partners bought large quantities of coal while they were still smelting the ore themselves. Subsequently Rotton would presumably go on buying coal, but we have none of his accounts. Within the three years mentioned the Partners bought 456 quarters of coal from five suppliers, almost half of it from John Peacock. The average price was 2/6d per quarter, but seems to have varied seasonally. Thus, Will Coates' bill, "Before May Day 84 Qrs at 2/8d - £11 : 4 : 0. Since May Day 64 Qrs 1 load at 2/4d - £7 : 10 : 1." In 1753 the price was still quoted at 2/6d, as indeed it still was in John Ayre's account for 1762-3.

Brown's calculation that running a 'fire engine' would consume 20 bolls of coal a day, at a cost of 18/9d, suggests that a single boll should cost 11¼d. Elsewhere Brown quoted the price of coal at Middleton Tyas

27. Mitchell B R and Deane P ; Abstract of British Historical Statistics; Cambridge (1962), Chapter XVI.

28. William Brown Letterbook, BH 152, 29 June 1753 ; Newcastle Mining Institute.

as 28/- per Newcastle Chalder.[29] Admittedly this letter was written a year later, and prices varied as we have seen, but 11½d goes into 28/- thirty times and Mott states that there were 21 bolls per Newcastle Chalder.[30] There are other apparent discrepancies in the figures, for instance the 80 Qrs 2 bushels sold at 2/4d per quarter in RH 2 should have cost £9/7/10 but in fact cost only £9/7/-. There may be factors such as discount for quantity involved, but the figures leave several unanswered questions.

In general however we can form a fairly accurate impression of price. Accepting 28/- per Newcastle Chalder, and taking one Newcastle Chalder to equal 53 cwt, and one ton to consist of 21 cwt, this means that in 1752 coal cost 11/10d per ton. In 1765 Jars recorded the price as 15/- - 16/- for 26-30 quintals. Taking a quintal to be a hundredweight this would make the price exactly the same as thirteen years earlier. In 1790 Matthew Boulton, in the letter to John Vivian quoted in Chapter 8, also mentioned the price as 12/- per ton, which suggests that coal prices at least were fairly steady, if extremely high. The nearest colliery at the time was Norwood near Evenwood, some eighteen miles away, all over land. Middleton Tyas may have got its coal direct from the pithead, or from the depot then operating at Piercebridge, but in either case the effect of transport costs was to multiply the pithead price of some 7/- per Newcastle Chalder, by four by the time it reached the village. These figures illustrate the problems faced by the colliery owners in S. W. Durham at this time, which prompted them to commission the canal survey published in 1770, and eventually to sponsor the construction of the Stockton and Darlington Railway.

For smelting there was no practical alternative to coal, and the high cost must always have been a further factor limiting the profitability

29. William Brown Letterbook, BS 69, 11 July 1752 ; Newcastle Mining Institute.

30. Mott R A ; The London & Newcastle Chaldron ; Archaeologia Alliana (4th Series) Vol.XL (1962).

of production at Middleton Tyas. For drainage the 'common fire engine' was an attractive proposition in these exceedingly wet mines, from every point of view but the prohibitive cost of fuel. The possible solutions to the problem of drainage are discussed in the next chapter.

CHAPTER 6 : DRAINAGE PROBLEMS, 1752-5

DRAINAGE TECHNIQUES

The principal problem faced by all the mine owners at Middleton Tyas was the extraordinary wetness of the mines. Just how bad this was is illustrated by Hartley's reference to 10 fathoms of water in a 20 fathom shaft, and that not in the depths of winter but in August.[1] In March of the following year water ran out of the top of the shafts.

As was shown in Chapter 3 the various rival firms were operating in very close proximity to each other, cutting at intervals into the same veins. Hartley and Tissington in particular were treading on one another's heels, and as water pays no heed to legal boundaries, were inevitably interdependent, however unfriendly their relations. Even within his own workings Hartley, in trying to dry out his Number 1 shaft, flooded Number 3. Hostile as Hartley and Tissington may have been, they never reached the stage where work stopped as it did when the Derbyshire and Cornish firms disagreed about what contribution the latter would pay to mutual drainage costs. It was this unfriendliness which led to the threats of blowing each other up with gunpowder.

When Hartley referred his drainage problems to William Brown the latter assured him, in November 1752, that his neighbour's pumps would help to dry out his workings. Six months later the position was reversed, with Hartley's pumps draining water from Tissington's upper level.[2] At this time the lower workings were so wet that Hartley was advised not to try to get down. Richardson noted on his map in 1754,[3] "The copper above the level of the brook lays dry and is drawn out all the year, but is not so rich as that ore which lays in the water." Whenever any extension of working was proposed, either in sinking new shafts, deepening the existing

1. William Brown Letterbook, HB 92, Newcastle Mining Institute.
2. William Brown Letterbook, HB 149, 3 June 1753, Newcastle Mining Institute.
3. Havelock Allan Papers, ZDG(B), Northallerton County Record Office.

ones or working further into the winter this problem of drainage reappeared. This was particularly serious for the 'foreign' operators. Hartley and the Partners could find work elsewhere on their estates for their employees, but the Derbyshire and Cornish miners, when laid off for long periods by wet weather, dispersed, not being entitled to local relief. Even the engineer, Chamption, went off home to Derbyshire in the winter of 1753-4. Tissington paid the smelter to retain his services in 1755, but the less skilled men must have had to fend for themselves. Reassembling a body of experienced men after each period of lay-off must have been a headache. and year-round working a desirable objective. Hence the preoccupation with improved techniques of drainage. In the Hartley-Brown letters there are references to four distinct methods; gravity, handpumps, horsepumps, and steampumps, with three further modifications to improve the efficiency of the last.

As long as the lowest point of a mine is not below that of a convenient watercourse the simplest and cheapest type of drainage is by a drainage level or adit. In the Dales where the valleys are deeply cut, the hills steep and the becks fast-flowing, this was usually a practical solution. At Middleton Tyas in relatively flat country, with a sluggish beck falling very gradually the level of that beck near the village is obviously the lowest point to be drained by gravity. It would not be worth driving long levels like the Derbyshire soughs, to a point further down its course. Coming as he did from Winster, Tissington must have considered and rejected this solution. In January 1755 however he did propose a level of some 300 yards from the engine shaft in Goosehill Field, which he proposed to deepen by three yards, directly out into the beck. This would have passed under the Churchyard and cartroad and needed Hartley's approval to cut through his land. As in most of their exchanges, Tissington appears the more reasonable, proposing that Hartley should make crosscuts to this level and drain all his upper workings by

it. Permission was not granted as Hartley refused to have Tissington's "shabby fellows" on his land, though PB 5 probably represents the eventual realization of the scheme.

In workings below beck level the water will drain to the lowest point, the sump of the deepest shaft, and thence must be pumped out mechanically. Highly complicated pumps, made of wood and driven by animals or water power were illustrated by Agricola in use in Germany two centuries earlier,[4] but the earliest type in use at Middleton Tyas were simple handpumps. No details survive, though the sketch of a two-cylinder pump on Richardson's map gives a clue. In view of the depth of the shafts they were probably operated by two or more men working a double lever like a sailing-ship bilge pump. In 1752, at the beginning of the correspondence, reference is made to handpumps still at work.[5] Indeed it was their inadequacy which necessitated Brown's employment to devise a more efficient machine suited to the problem.

When Brown first visited Middleton Tyas in July 1752 to see the problem at first hand Hartley was very uncommunicative to his rivals about the visit, fobbing them off with the excuse that Brown being at Darlington and never having seen a copper mine before came out of mere curiosity. However he did vouchsafe the information that Brown regarded a 'fire engine' as the last resort. His correspondence with Carlisle Spedding shows in fact that Brown would have preferred to build a 'fire engine' from the first.[6] It is evident that Tissington was already considering this solution himself, since he pressed for more details.

HORSE ENGINES

For the time being Hartley decided on a horse-engine, which Brown built for him, which with Tissington's second horse-engine completed in November 1752 relieved the problem. Most of the structure of Hartley's

4. Agricola G ; De Re Metallica ; (ed Hoover) 1912, pp.173-197.
5. William Brown Letterbook HB 99, 20 October 1972, Newcastle Mining Institute.
6. William Brown Letterbook, BS 69, 11 July 1752, Newcastle M.I.

horse-engine was evidently of wood fastened together with iron bolts. The ironwork was made at Newcastle and sent by Pickersgill's waggon, to which we have already referred, but the woodwork was evidently made in situ. As Hartley's borer, Rawlings, was well ahead with the engine shaft by July 1752 Brown promised to send Wrights to prepare the woodwork within 10 or 12 days. Hartley, impatient to get the job done, "as the season of the year will advance fast," requested that the blacksmith and the "enginear" be sent as soon as possible.[7] Mr Fenwick, the engineer in question, was sent to the site to prepare the materials and supervise their erection, staying in the village during the whole period of construction.[8] On his occasional visits to Newcastle he acted as bearer of correspondence and cash. How many other men were employed on the job is not made clear, but the pieces were large enough to require a "reel and triangle" to lift them into place. Presumably this was the device now known as a shearlegs. No doubt Hartley's men provided the muscle-power.

As a result of delays caused by shortage of wood, fractured castings and poor transport the job took six months. Evidently Fenwick's home-sickness a fortnight before Christmas encouraged him to hurry the job along. With Fenwick, Brown had sent a 1" to 1' scale model at a cost of 17/4d, but unfortunately neither this nor any drawings have survived.[9] Hence we must attempt to reconstruct the appearance of the engine from the information in the letters and contemporary analogies.

In a letter to Spedding, Brown mentioned that Hartley's new engine, driven by four horses, was more efficient that Tissington's two engines

7. The use of this word to denote a mechanical engineer, or fitter as distinct from a millwright, working in wood, is unusual at so early a date, when engineer usually had the connotation of military engineer.

8. William Brown Letterbook, HB 64, 4 July 1752, Newcastle Mining Institute.

9. William Brown Letterbook, BH 97, 15 October 1752, Newcastle Mining Institute.

operated by the same number of horses.[10] Brown listed iron parts ready for despatch.[11] These included bolts to attach the arms to the axletree, a second set of bolts to attach the wheel to the arms and 39 more for the cog wheel itself. From this much detail we may infer that the machine was a cog-and-rung gin like the one which appears in Emerson's book.[12] A vertical axletree turning in a metal gudgeon at top and bottom, and bound with two metal bands to prevent splitting was bolted to the four horizontal arms, each set at 90° to the next. To the outer end of these arms the horses were harnessed to walk round in a circular path. The fact that the cogwheel was attached directly to the arms indicated that the teeth must have pointed downwards. Emerson's gin has a cogwheel attached to the axletree lower down, with upward pointing teeth. Bevel gears were not in use at that time and we may assume that the 39 bolts mentioned above were intended to attach the teeth securely to the wheel rim. Indeed in Emerson's drawing the cogwheel has almost exactly that number of teeth.

Numerous illustrations of horse gins survive from the 18th century, though few show as many as four horses. Most of them show winding or grinding rather than pumping gins. The most valuable illustration is that taken from the Universal Magazine Vol. V (1749) and reproduced by Chaloner and Musson[13] showing the London Bridge pumping engine employing cranks to drive a set of pumps. We know that the Middleton Tyas engine incorporated a very substantial crank weighing 10 cwt which was made at Throckley, and which broke during manufacture. The pump cylinders of which there were three were also cast at Newcastle. In the original

10. William Brown Letterbook, BS 69, 11 July 1752, Newcastle Mining Institute.

11. William Brown Letterbook, BH 94, 15 September 1752, Newcastle Mining Institute.

12. Emerson W ; Principles of Mechanics ; London (1758), more readily accessible in, Atkinson F ; The Great Northern Coalfield 1700-1900; Barnard Castle (1966) page 30.

13. Chaloner W H and Musson A E ; Industry and Technology, , London (1965) plate 7.

specification they were to be of 8" bore and 48" stroke. When installed the stroke had been lengthened by two inches.

Speed and cheapness decided Hartley to have the cylinders made in Newcastle. Brown, who had recently bought a Coalbrookdale cylinder, paid that company the compliment of telling Hartley that the Shropshire firm would make them more neatly.[14] The reputation of Coalbrookdale, casting iron into sand moulds at a high temperature, thereby eliminating blowholes in the castings, was already well established, and they had recently installed Isaac Thompson as their agent in Newcastle.[15] Hartley was right to settle for the cheaper Newcastle product as his cylinders were ready for delivery within a week of ordering. By now he was betraying anxiety, not to say impatience, with the speed of progress.

The last consignment of parts came by Pickersgill's waggon in November 1752, including buckets, joints, clacks and a hide of leather. The buckets were obviously the lifting buckets working in the pump cylinders. The metal joints presumably were iron collars to fasten together and seal lengths of wooden pipe. The clacks, or valves, hinged metal flaps, opened and closed on leather seatings for which the hide was obviously intended.

The position of the pumps is indicated in the letter in which Hartley wrote of the engine at the bottom of the shaft, comparing it with Tissington's which was set too high, causing his men to work mid-leg in water.[16] To obtain a 50" stroke it would have needed a crank with a 25" throw if attached directly to the pump rod. The sideways movement in the pipe would have made this virtually impossible. Assuming that the pumps were in fact at the bottom it seems more likely that the power was transmitted by rocking beams, or tappets, as in the London Bridge engine,

14. William Brown Letterbook, BH 70, 27 July 1752, Newcastle Mining Institute.

15. Rolt L T C ; Thomas Newcomen, A Prehistory of the Steam Engine ; London (1963) page 110.

16. William Brown Letterbook, HB 92, 15 September 1752, Newcastle Mining Institute.

giving an almost perfectly vertical stroke to the pump rod. A conjectural reconstruction is given in Fig.15. Working at a rate of 15 strokes per minute in each cylinder, this gave the engine a theoretical capacity of 24,444 gallons per hour.

Nevertheless the new horse engines were evidently unequal to the problem. Hartley wrote that still only the upper float could be worked, and the few letters dating from the early months of 1753 refer to men being employed on washing and smelting until all the ore was treated, then laid off as before.

Another problem appeared in the form of a shortage of horses, at one time none was available for pumping for three days together. No doubt much of the draught work on the land was still done by oxen. Tissington even sent to Derbyshire for extra horses.[17] With an extension of the work and the sinking of new shafts in 1753 it was quite obvious that horse engines were not the final solution.

In view of these difficulties and the fact that coal was so expensive, it is strange that there never seems to have been a suggestion of using water power to drive the pumps. This was standard practice in the Dales, and Hartley himself discussed the installation of water wheels of up to 27' diameter at Beldi Hill, in his correspondence with Brown. Into the steam age of the 19th century the use of any other power than hydraulic was exceptional in that area, whose technology otherwise seems to have been adopted entirely by the Middleton Tyas copper mines.

THE 'FIRE ENGINE'

Within a few months of the installation of the new horse engines the 'fire engine' proposal was reopened. Richardson noted on his map, "Neither pumps, buckets nor horse engines could keep the water so low as to allow men to work the mine southward, hence comes it that a Fire Engine is now erecting."

17. William Brown Letterbook, HB 103, 21 November 1752, Newcastle Mining Institute.

Whereas Hartley had formerly considered the installation and running costs of such an engine to be too high, the situation was changed when, in May 1753, Tissington offered to build one for him in return for access through his land to drain the Churchyard workings. Brown produced a specification within a month for the construction of this engine.[18] In the event, Peacock's lease of Kirk Bank Pasture in August gave Tissington direct access from the Churchyard to the beck. The offer to Hartley was withdrawn and an engine of his own commenced. From the details available of these two engines, the one only projected and the other actually built, we can piece together a fairly detailed picture of a 'common fire engine' at work.

Such engines of the Newcomen type had been in use in the North East of England practically since their invention. As early as 1715 one is shown on a map at Tanfield Lea, near Stanley.[19] When Brown made a complete list of engines for the information of John Smeaton in 1769 there were 25% more in the North than in the South-West where they first originated. This success was due to the availability of coal. At Middleton Tyas, as in Cornwall, the problem was the cost of coal, as we have seen in the previous chapter. In a colliery the engine burnt the waste coal, which had little commercial value and cost nothing to transport.[20]

18. William Brown Letterbook, HB 147, 28 May 1753, Newcastle Mining Institute.

19. Reproduced in Atkinson F ; The Great Northern Coalfield 1700-1900 ; Barnard Castle (1966), page 25.

20. We have so far used the contemporary term 'fire engine' since, strictly speaking, such a machine was not a steam engine at all, in that the power was not provided by the expansion of steam. The pumprod, attached to the outer end of the pivoted beam, was carried down the shaft by its own weight. On the home stroke the rod was raised, not by steam pressure as in the true steam engines of Watt and Trevithick, but by the creation of a partial vacuum in the cylinder. The piston, pulled up the cylinder by the chain attached to the inner end of the beam, had in turn drawn steam into the cylinder. This steam was now condensed by injecting cold water into the cylinder. Atmospheric pressure operating on the piston, which was crudely sealed by a layer of cold water, forced it back down into the cylinder, thereby rocking the beam and raising the pumprod.

The inefficiency of the atmospheric engine lay in the enormous waste of heat involved in heating and cooling the cylinder at each stroke. Hence such an engine would consume large quantities of coal. Brown calculated the cost of 18/9d per day. In spite of Tissington's claim that the boiler of his engine was a new type, more economical of coal, heating its 4,000 gallon capacity must have strained his resources.

In June 1753 Brown gave the dimensions of his, projected, engine.[21] The cylinder was to be of 42" bore. In view of the estimated cost of coal one can sympathise with Hartley who replied that his Swaledale partner, Parke, had suggested that 40" would be adequate. Tissington's engine when built had a 48" cylinder and a stroke of between 6 and 8 feet depending on the depth of water raised. The latter engine was larger in all its dimensions except in the length of beam. Brown's was to be made of 2'6" x 2' timber 30' long, the extra length being to obtain 2' more stroke. He requested Hartley to find this huge balk of timber plus two others 23' long, and 2' square for the cylinder beams. It is interesting that Fenwick had to travel forty miles to Wetherby to obtain suitable timber, so far had the deforestation of the North Riding proceeded already. When the Tissington engine was built its oak beam measured only 24'3" and consisted of several pieces fastened together with bolts and iron "guirders".

Brown's engine was to have worked three sets of pumps of 12" bore at a depth of 12 fathoms. These, he claimed, would raise 1,200 hogsheads per hour, "which is full Three times as much as your Horse Engine can draw, when your horses go a pritty good pace."[22] In fact it is about $2\frac{3}{4}$ times. Tissington's two sets of pumps were proportionately bigger, with a $20\frac{1}{4}$" bore, which Hartley described as the biggest he had ever seen. Their capacity was claimed to be 2,290 hogsheads per hour, 90% more than Brown's.

21. William Brown Letterbook, BH 152, 29 June 1753, Newcastle Mining Institute.

22. William Brown Letterbook, BH 152, 29 June 1753, Newcastle Mining Institute.

Of the actual construction of the pumps we have no direct information, but various clues in the letters allow us to form a picture of their operation.

As with all atmospheric engines the weight of the pump rod must have provided the power for the lifting stroke. Hence the simple bucket lift was unsuitable as it raised water on the upstroke. The alternative, the plunger lift, raised the water by displacement on the downstroke. The only difficulty in reconciling this explanation with the letters is that they contain references to the clack, in the singular, whereas the operation of a plunger lift depends on two clacks. This is illustrated in the suggested reconstruction of the pumping engine in Fig.16. On the upstroke the lower clack would be drawn open to allow water to enter the pump cylinder, while the upper clack would be sucked shut. On the downstroke the operation reversed, the lower clack was forced shut and the water pushed out of the pump cylinder past the upper clack into the pump shaft. At each stroke the water at the top of the pump shaft would be forced out of the nozzle at ground level. In the diagram only one set of pumps is shown, the other was coupled to it with iron, "so it hangs by the top." This may mean that the pumps were suspended permanently from a capstan and gradually lowered to keep the windbore in the bottom of the shaft. Otherwise it is difficult to identify the 'great rope' which broke so frequently.

The windbore, which is the pointed end of the pump shaft submerged in the water in the sump, is perforated to allow water to enter, but exclude stones. Its failure to do so presented the first problem in the operation of the pumps. In HB 160 there is a reference to thirty feet of gravel which not only created difficulties in timbering the shaft, but also provided an unstable foundation for the engine-house.[23] Evidently this gravel found its way into the pumps and sheared the leather seatings of the valves.

23. Willian Brown Letterbook, HB 160, 26 May 1754, Newcastle Mining Institute.

With a view to durability and eventual resale Brown recommended the pumps should be entirely of iron, at a cost of £5/10/- per fathom, rather than of hooped wood, at 2 guineas. Obviously the speculative nature of the venture made second-hand value an important consideration.[24] The engine likewise, although representing a much greater capital investment than a horse engine, would command a ready second-hand market. Brown did not quote a price for his projected engine, but we know a similar engine he installed shortly before at Walbottle Colliery cost £1,691/5/6d. Tissington's engine which was estimated to cost £1,050 in August 1753 had, a year later, cost £2,000, with its new shaft. At current prices sinking the shaft should not have cost more than about £30 of this. In addition he had the £200 down payment and the 10/6d per week rent to pay to Peacock.

In spite of the heavy investment costs the richness of the ore raised at this time indicates that they were repaid for their risks. Hartley, alone, recorded that he had got £6,000 worth from his No 1 and 3 shafts.[25] Dr Mawer is said to have received £1,400 in royalties. Clearly the sooner the new engine was completed the better.

As with the horse engine, the construction was largely done on site using local materials as far as possible. Brown requested Hartley not only to collect the timber mentioned above, but also to get ready a smith's shop with two hearths for the use of the two blacksmiths who were to be sent to assemble the boiler on the spot.[26] From this we gather the boiler was to be made of iron plates rather than copper which was still widely used. Presumably Tissington's engine was built in the same manner, but was delayed by various mishaps. Having started work at 8 a.m. on the 6 August 1753, the first day of the lease, and completed the building of

24. William Brown Letterbook, BH 154, 5 August 1753 ; Newcastle Mining Institute.

25. Note in the Parish Records, Northallerton County Record Office.

26. William Brown Letterbook, BH 154, 5 August 1753, Newcastle Mining Institute.

the engine-house by mid-November, it must have been very frustrating that the engine did not come into action until June 1754.[27] Richardson on his map drawn in March optimistically showed it with smoke belching from the chimney. One of the major delays was caused by the fact that the ship bringing the cylinder was feared lost, but arrived late at Stockton by Christmas 1753. In the Merrybent prospectus, issued a century later, it was stated that this cylinder came from Carron,[28] though presumably not from the Carron Iron Company as such, since this was not formed until 1759. At least it settles the question of whether the cylinder was of brass or iron. L T C Rolt[29] gives the period 1752-3 as the time when the engine builders of the North of England were just changing over to iron, with the advent of more accurate casting in the cheaper metal.

MODIFICATIONS TO THE STEAM PUMPS

After all his labour and expense Tissington's 'fire engine' apparently was still unequal to the task, in its original form. This was no doubt largely due to the appalling inefficiency of operation described below, but within a few months of completion Champion was devising a new technique.[30] This was a scheme to erect a second beam from the engine working in a new shaft at the east end of the engine-house. "When both beams are in motion it will be something uncommon," wrote Leonard Hartley in September 1754.[31] Three months later, when the scheme came to nothing, he described it as another monument to Champion's folly. Apparently the engine could not cope with the extra burden at this time.

27. William Brown Letterbook, HB 162, 25 June 1754, Newcastle Mining Institute.

28. Havelock Allan Papers, ZDG(M), Northallerton County Record Office.

29. Rolt L T C ; Thomas Newcomen, a prehistory of the steam engine, London (1963), pages 116-119.

30. William Brown Letterbook, HB 166, between June and August 1754, Newcastle Mining Institute.

31. William Brown Letterbook, HB 169, 2 September 1754, Newcastle Mining Institute.

To reconstruct the appearance of the engine house we have the scanty and overgrown ruins (Figs. 17 and 18), the recollections of Mr A Hardy of Middleton Tyas, who remembers the building intact and roofed, and the sketch on Richardson's map. The last may be schematic, but shows a Cornish-looking engine-house, three storeys high, and roughly square in plan. A drawing done from memory by Mr Hardy shows a much lower building with a pyramidical roof, not a pitched roof as on the map. From this evidence and an examination of the plan it seems that Building 1 (Fig.19) must be the engine-house itself. Like most of the walls on the site it is built of random limestone masonry, some 18" thick. On its north side however is an angle shown in Fig.17, and marked 'a' on the plan, built of regular ashlars. To the north of this again is a stub-wall also of ashlar ('b'), separated from the first by about 18" of random walling. How thick these ashlar walls are is not certain, as the whole of the west side of the building is cut into the bank of the lowest lynchet. Richardson showed the chimney on the left (south) and the beam on the right (north) but it would not be wise to depend entirely on this evidence since his orientation of the Church shows it lying north-south also. The wall upon which the beam rested would have been more substantial than 18" thick, so it looks as though 'a' or 'b' was this bob-wall. With the evidence now available, and in view of the overgrown state of the site it is not possible to identify the operation of the engine precisely. The shaft (KB 3) shown at the bottom of Fig.19 must be the one at the east end of the engine house. If 'c' and 'd' are the stokeholes of a smelting furnace (see page 104) this fits Hartley's description, "On the left where they tend the furnace." The shaft in question is not now visible, but in 1968 it fell in, revealing it to be some 12 feet in diameter, and full of water almost to the top. Precisely how the engine operated a pump some 70 feet away must remain a matter for conjecture, though Cornish practice provides numerous examples of remove working by counter-balanced rocking levers.[32]

32. Barton D B ; The Cornish Engine ; Truro (1966), pages 31 and 94.

Whatever the technicalities it was a failure, and in January 1755 Hartley reported a sadly familiar situation.[33] Tissington's men were entirely stopped and most had gone home, taking two couple of Hartley's beagles with them. Paull's men had also deserted en masse, leaving much debt, while the Captain himself lay ill at Richmond. Hartley expressed the opinion that no one was likely to be getting copper before the end of March, but as his own men had sufficient work above ground, this worried him less than his competitors.

After the replacement of the boiler, described below, the engine began to work again on the 28 March 1755, drawing from many new shafts which had been sunk. From BH 196 we learn that Tissington had taken advice from Michael Meinzies, whom Brown described as the patentee of a method of drawing coals without horses.[34] This patent for moving colliery waggons on an endless rope, by counterbalancing the empty waggons with the loaded ones, would not seem suitable for the narrow winding workings at Middleton Tyas.[35] It seems more likely that Meinzies advised on drainage rather than haulage. It may have been on his advice that the second beam was abandoned and the engine coupled by a rope to the pump in the Parson's Field, where Tissington had his first horse-engine. Evidently this was not successful either, but it led to the final solution of the problem.

This last advance in pumping technique on the site cannot be dated exactly. Some time after August 1755 in a letter headed; "Friday Night",[36] Hartley recounted the latest expedient devised by Tissington's engineer. Now the engine had been connected to the lower horse engine again, not with a rope as before, but with sliderods. Their course is marked 'P' on

33. William Brown Letterbook, HB 191, 26 January 1755, Newcastle Mining Institute.
34. William Brown Letterbook, BH 196, 22 March 1755, Newcastle M.I.
35. Patent Office, 653 of 1750.
36. William Brown Letterbook, HB 204, Newcastle Mining Institute.

Map 4. These carried the power a distance of 200 yards, working on twenty-five rollers, eight yards apart. The rods crossed not only the corner of Hartley's bottom field, but after passing over the Churchyard on a rising level, extended over the cartway and field about which Hartley had previously been so sensitive. At this point the cartroad is in a deep cutting and the rods would pass over it at least ten feet about the ground. We can only assume that Hartley had resolved his disagreements with Tissington, and granted the necessary way-leaves.

Angle or vee bobs converting vertical into horizontal motion became quite common in the leadmines of the Dales. It seems likely that this was the method employed here rather than a crank, and must be one of the earliest applications of the method. At the end of the slide rods the second pump worked with the same stroke as the engine, operated by a rope passing over a roller. As stated in Chapter 3, the second shaft was probably PB 3. It is not clear where the engine shaft lies, but there is none visible on the north side of the engine house. It is possible that it was not on that side, and the angle bobs worked at right angles to the main beam. With the weight of two sets of pumps added to the friction of twenty-five rollers, it is remarkable that the engine could produce sufficient power, when the double beam arrangement had failed. Fig.16 suggests the final arrangement.

That the new mechanism was successful is borne out by the fact that copper was being raised in all shafts but one, the drier conditions having permitted them to sink deeper to reach the under-bed. Although there were still twelve feet of water in the sump of the engine shaft, all the shafts to the west were drier than ever before. Hartley's optimism was such that he brought twenty men from Swaledale to help, and talked of a 70" cylinder if the existing one failed to cope with the water in the deepest workings.[37] After the period of trial and error, experimenting with various techniques, one cannot but be struck by the technological

37. William Brown Letterbook, HB 204, Newcastle Mining Institute.

achievement. Clearly Champion, however much Hartley disparaged him, was a resourceful man. As a native of Derbyshire he cannot have gained much experience with 'fire engines' at home, where they were hardly known at this time.

INEFFICIENCY OF OPERATION

By contrast, one is equally struck by the inefficiency with which the engine was managed. It must have been galling for the engineer to see his work ruined by, "boys and ignorant persons". The words are Hartley's. In the mid-18th century, before a body of skilled enginemen had been trained, such men were at a premium even in the coalfields. Their situation was analogous to that of the locomotive drivers in the first decades of the railways, when the scarcity of their skill enabled them to command very high wages. At an isolated industrial site in an otherwise rural area it is small wonder that skilled labour was unobtainable. The result was that in the early months of its operation the engine was frequently out of action. Tissington and Champion quarrelled about its operation and a series of mishaps occurred, necessitating expensive replacements. At that stage Hartley reported their misfortunes with ill-concealed satisfaction.

In HB 173 he told Brown that the men were wet through by water flying out of the shaft, which could easily have been obviated by erecting a wooden circle four or five feet high around the shaft mouth.[38] The great rope had already broken twice, and a pump burst, when work was held up by the displacement of a clack. Normally clacks were fitted with metal loops so that they could be easily replaced. Also there was usually access to the inside of the pump at the level of the clacks to facilitate replacement of the leather seatings. If Tissington's pumps were not so constructed it is hardly surprising that they could not reach the clack, some sixty feet down a narrow pipe in total darkness. After spending

38. William Brown Letterbook, HB 173, 25 September 1754, Newcastle Mining Institute.

three days in fruitless attempts to reach it, and breaking several spears in the process they decided to remove the whole pump. They had started to do so when the rope broke again, and the whole thing fell down the shaft, smashing the windbore. Eventually Champion had to replace this himself with an iron plate, in which he cut holes with a mallet and chisel. On this occasion, and at least ten times in the first six months, the chain broke, presumably the chain from which the pump rod was suspended. These chains remained a weak point in engine design until the invention of the parallel motion.

Hartley attributed these misfortunes to carelessness, both in stoking the boiler and in driving the engine. At times it was stopped for long periods, with the steam pressure building up until it nearly burst the boiler. Although such engines worked at a very low pressure, this was before the days of pressure gauges and safety valves. At other times they worked the engine at such a pace as to threaten to shake it to pieces. On other occasions the mishaps had a touch of comedy, as in the case when by allowing the engine to overheat the sealing water flew about their ears like small shot. It hardly comes as a surprise when we read in January 1755, that Champion had ordered boiler plates from Crowleys, allegedly for a second 'fire engine', needed because of a neighbour, "which puts them about much".[39] Presumably this was Hartley.

Certainly Joseph Cowling, Hartley's agent, found Champion very touchy on the subject. No doubt he was unwilling to admit that a new boiler was needed within six months as a result of incompetent operation. At Middleton Tyas he made it known that it was a new type of boiler for the existing engine. In any case the engine was stopped for two months while the new boiler was installed.

By the end of the correspondence it seems that the skills of the operatives were sufficiently developed to cope with the machinery, and

39. William Brown Letterbook, BH 190, 21 January 1755, Newcastle Mining Institute.

that Hartley's optimism in the last letters to Brown was justified. "We are raising copper fast in all shafts," he wrote, "and by anything that can be forseen will master all the water this summer .... and conquer all difficulties".[40] Obviously he could not forcast whether the veins were going to continue to yield as richly as in 1755. The later history of these two undertakings is continued in Chapter 8.

40. William Brown Letterbook, HB 204, Newcastle Mining Institute.

CHAPTER 7 EXTRACTION

CONCENTRATION

So far we have mainly considered the problems associated with the mining of copper ore, but have referred here and there to the processes involved in separating the metallic copper from the impurities, both the alien minerals among which the ore is found and also the chemicals with which it is compounded. In the Hartley-Kearsley lease,[1] the lessor granted the lessees, inter alia, the right to 'spall', which means the preliminary stages of separation by purely mechanical means without the chemical changes involved in smelting. Obviously it was desirable that the ore should be as rich as possible before ever it came to the furnace, so that expensive coal should not be wasted melting limestone and other useless substances into slag. These processes are collectively termed 'concentration', and are generally based on the simple principle that a body of greater density sinks in water more quickly than a lighter one. Just as the pieces of ore obviously needed to be very small to be smelted efficiently, likewise the smaller the fragments the easier it was to separate the different materials in such a stream of moving water. Hence the first stage of the process was to smash the ore, to pieces about the size of a pea, and among the Partners' first purchases were buckers, mallets with a flat iron head, used for this purpose. We can learn much from Ralph Hutchinson's accounts, not only from the implements bought, but also from the payments to various employees. Those in RH 7 and 9 are detailed in Chapter 5 on page 68.

After the ore was broken up the first job was to pick out by hand the fragments of obvious waste from the metalliferous pieces of ore. This is the process known in the coal industry as screening, and in the copper mines the job was done by women and boys for very poor pay, as indeed

1. See Appendix A.

was the case in the lead mines throughout the 19th century.[2]

The mention of a buddler, a riddler, a knocker and two fillers in RH 9 indicates that two different methods of hydraulic separation were employed, presumably consecutively. Buddling consisted of running water at a constant rate of flow through a wooden launder into a shallow, tilted, rectangular wooden box, across which wooden slats were nailed at intervals. Crushed ore was shovelled into the water at the head of the buddle with a buddle-shovel, and agitated with a cowlrake, an implement consisting of a long iron rod with a semi-circular metal head, very much like the rake used to clear the flues of a fire-back boiler. The lighter refuse containing no metal at all was carried furthest down the buddle and collected on one of the lower slats. The purest ore, being heaviest, sank immediately behind the upper slats. The poorer waste was often re-buddled again immediately, and this may explain the drawing Richardson made of the washing places along the small beck running through the Mains (see Map 3). He showed each of them as a square divided into a series of smaller squares, which could be a schematic representation of a series of buddles side by side. Certainly Agricola showed two buddles side by side, working as a unit.[3] Even if this were so and the waste was buddled several times there was still a considerable wastage of valuable metal in the effluent, as evinced by the receipt in RH 9 of £10/10/- for waste about the buddles.

The riddler and knocker used another method also shown by Agricola[4] employing a tub of water and riddle, and the same principle that the heaviest sinks most quickly. The riddle was held just below the surface of the water, and as the ore was shovelled in, was twisted quickly back

2. Raistrick A and Jennings B ; History of Leadmining in the Pennines ; London (1965), page 285 et.seq.
3. Agricola ; De Re Metallica (Trans. Hoover), pages 305 and 345.
4. ibid. page 292.

and forth by hand, thereby distributing the sinking material evenly throughout the water in the tub. The larger fragments, and the mesh was usually no more than quarter of an inch, could be picked out by hand and the impure ones recrushed and rewashed. As the crushed material which had passed through the riddle settled through the water the side of the tub was vigorously knocked to assist the separation, which resulted in the heavier material settling quickly to the bottom, and the lighter, less valuable above it. The shoveller would have to exercise great care as he removed the layers of material, once the water had been drained out.

The Partners also paid a pumper, a fact which raises further problems of identification. As stated above in Chapter 3 the buddles at Q (Map 5) in the field called Buddle Bottom must have served the Glebe lessee, Tissington. On Richardson's map, of four washeries shown this is the only one with a pump. All the others apparently worked by gravity, and it is not clear why the water of Kirk Beck could not have operated these buddles in the same manner. Indeed, the surviving earthworks (Fig.20) appear to contain just such a channel from the Beck. Nevertheless Richardson clearly indicated a two cylinder pump at this site and nowhere else. The Partners certainly employed a pumper, but the site of their pump and washery cannot be identified, from Richardson or otherwise.

The site of the lowest of the three washeries on the Mains beck is clearly visible at R (Map 5) where the poisoning effect of the copper waste around the buddles is still quite clear both in the aerial photograph and, while the crops are growing, from ground level. The area of yellowing in the crop at this point is quite clearly defined. Further up the beck at S the indications are not so clear, with a much less pronounced and much more widely spread crop mark. It is likely that the actual site of the washery was the same as the present sewage works, and that the tainted soil was scattered during its construction. As the Mains, further up the beck, is pasture, less susceptible than cereal crops to an abnormal amount of

copper in the soil, there is no trace of the third washery. A guess based upon the spacing of the three sites would place it at or about T, though this does not relate correctly to the shafts in Layberrys Quarries which Richardson marked 'A' on his map. As he obviously used rule of thumb rather than triangulation for his survey, it would in any case be unwise to press the evidence of his map too far in an uncertain case. Indeed it would be to misunderstand his purpose in drawing it.

The various methods of hydraulic separation were not really appropriate for treating copper ore, though they continued to be used long after the Middleton Tyas mines closed, for instance at Ecton in Staffordshire. An account of the Duke of Devonshire's mine there, written about 1780 and published sixty years later, described the process in detail.[5] There the ore was broken with hammers at the pit bank before barrowing to sheds in the valley where it was sorted, beaten to fragments and buddled before ticketing and auctioning. Nightingale added that an experienced miner had to superintend the buddling lest the ore be lost by the inexperience of the girls employed.[6] Half a century earlier Gabriel Jars had seen at Middleton Tyas just how inefficient the method was with copper ores, particularly the light carbonates, and wrote that most of the green ore was lost in the water.

Like so many of the techniques employed in the copper mines this one had been adopted from the lead mines. Galena, the commonest ore of lead is very much heavier than the country rock, limestone, and is readily separated by this means. Even then it is still relatively simple to find lumps of galena in the spoilheaps of the defunct lead mines of the Dales and Alston Moor.

THE SMELTING MILLS

Not only was the loss of a great part of the copper carbonates a waste,

5. Anon ; History and Topography of Ashbourne ; Ashbourne (1839).
6. Nightingale ; History of Staffordshire ; (1820).

but their reduction to metallic copper was very much easier than the sulphides, as the removal of all traces of sulphur was one of the greatest problems in smelting copper.

The identification of the sites of the smelting mills is as difficult as that of the washeries. From documentary evidence we know there were at least three. The first was built by the Partners in 1743 for £107, the second built by Tissington ten years later for £500 and the third by Leonard Hartley in 1754 at a cost of some £60. In other words it appears that there were two small mills and one large one. Although two of them at least must have been in operation, Richardson showed none of them on his map. Later maps give the position of two of the mills however. On the older O.S. maps the name Smelt Mill Houses is used for a part of the village in which that name is now forgotten, and which is well away from any mine shafts (marked on Map 5). The exact site of this mill cannot be ascertained but it is likely that this was Hartley's, as in the Parish Bundle there is a record of the later acquisition by the Parson of the area east of the Rookery including Smelt Mill Houses. He exchanged it for another field with George Hartley. The 19th century maps also show the site of a smelt mill in the triangular copse at the southern end of South Mains. As stated above (page 45) this is tentatively placed at N on Map 5, but quite invisible on the ground now. The remains must have been clear a century ago, and indeed are probably those referred to by Dr Raistrick as being still visible in Cow Lane in 1936.[7] As suggested in Chapter 3 this was probably Shuttleworth land at the time, but there seems good evidence to suggest that the Shuttleworths did not in fact build a mill of their own at any stage. Indeed the only evidence we have of them smelting is from the period after the 1775 leases from the Partners and the Vicar, and refers to rent being paid for a smelt mill to

7. Raistrick A ; The Copper Deposits of Middleton Tyas ; The Naturalist May 1936.

a certain Mr Hodgson or Hodson.

We have no positive evidence to identify the oldest mill, that built by the Partners in 1743. It could have been in the Layberrys and swallowed up by the quarry as were some of the Partners' shafts, or it might have been at N. On the other hand if the smelt mill at N had been built by the Partners already, surely Tissington would have shown it on his sketch map of 1746. This is always assuming that we have interpreted the plan correctly in Chapter 3 (page 44). With so many imponderables certainty is at present impossible though archaeological evidence still undiscovered could elucidate the problem.

One piece of apparent archaeological evidence however tends rather to confuse the issue over the Glebe smelt mill. In the Engine House complex the building marked 3 on Fig.19 contains two small openings, at 'c' and 'd', in its north wall. They are surrounded by brick in an otherwise stone wall and considerably eroded as if by fire (Fig.21). They are too narrow and too low to be of any use as windows. If they are stokeholes, as they appear, they conform to Leonard Hartley's description of a shaft as, "by the entrance where they stoke the furnace". Being in the area of the steam engine one would at first think of them as stokeholes for a boiler, but if the identification of building 1 (Fig.19) as the Engine House is correct it is unlikely that the boiler would be some 25 yards away from the engine it served. Nor is there any reason why a boiler furnace should have two adjacent stokeholes. The most logical explanation is that they were respectively the stoke hole and the rabble hole of a reverberatory furnace (see Fig.23). The only snag in this otherwise neat identification is that Tissington built a £500 smelt mill for the Glebe ore in April 1753 and did not lease the Kirk Bank site from Peacock until August.

Another inexplicable point is that Jars referred to a smelt mill in the singular. Nevertheless we know that more than one mill must have

survived and continued in use well after his visit in 1765. John Rotton went on paying rent for the Partners' mill at least until 1767. The Hartley mill was working in 1766, 1781 and 1784, so presumably during the intervening years also. The Shuttleworths, as mentioned above, were actively smelting and refining in 1779 and 1780. Hence it is not clear which mill Jars visited, although he did leave a full account of its operation.

THE FURNACES

Jars' account is given in full in Appendix G, and refers to the furnace shown in Schluter's book[8] the illustration of which was similar to the Middleton Tyas furnace (reproduced in Fig.23). The furnace was of the reverberatory type in which the ore was placed in a shallow fire-proof container described by Jars as a bath. The ore was heated by a coal fire separated from it by a low partition, thus obviating the risk of tainting the metal with carbon or sulphur. The entire structure became white hot and the metal was heated by reverberation or reflection. To conserve heat the furnace was often built over a brick vault, not unlike a modern open-hearth furnace. The furnace described by Jars was built not on a vault, but on a solid mass of masonry, which although it took more fuel to heat, retained that heat much longer. As the ore was not directly in contact with the fire it was necessary to keep moving the contents of the furnace to ensure that it was evenly heated, hence the need for the second opening through which to stir it with a long iron rabble. When the furnace was later adapted to the uses of the iron industry in the 1780's the job of puddling became one of the hardest and unhealthiest in the whole of industry. Since copper has a lower melting point than iron this obviously would not be so difficult.

The reverberatory furnace was not a new invention, a similar type had

8. Schluter ; Grundlicher Unterricht von Hutte-Werken ; Brunswick (1738), Plate 42.

been used for centuries for making glass.[9] In 1678 George, Viscount Grandison patented a similar furnace for smelting lead, and the reverberatory as it was finally adopted was perfected by Dr Wright of Gladlis, Flintshire, who had connections with the North-East through the Ryton Company. It was in use at the Redbrook Copper smelting works in the Wye Valley as early as 1725, but does not seem to have been used in Richmondshire even for smelting lead until the building of the Grinton Lead Smelting Mill in 1733. In the lead industry it never entirely ousted the ore-hearth, which was more suitable for cheaper, smaller scale smelting. Smelting copper however is a much more complicated process than smelting lead, and the reverberatory which could be kept alight for weeks on end was particularly suitable for the long repetitive task. We gather from Jars that the furnace floor, made of soft sandstone would last for two months without repair. This presumably consisted of replacing the clay joints, to which he also referred. Every six months the floor had to be replaced, and Robert Nelson sold the Partners six furnace bottoms for 21/- in 1745, during the period of great smelting activity covered in RH 3. When Mrs Hartley charged Bunting £2 for a furnace bottom which he had ruined, we must assume that in this case the whole mass of masonry underneath needed replacement. From the fact that Gordon bought clay and firebrick in Newcastle in 1779, we may assume also that the furnaces, like those in the iron industry were lined with firebrick. The development of satisfactory refractory materials increased the efficiency greatly.

It seems from Jars' account that the Middleton Tyas ore did not need to be calcined. Highly sulphurous ores were usually roasted before smelting to remove the majority of the sulphur. Indeed the English smelters at Redbrook who could cope effectively with the copper carbonate ores had had to call in Swedes from Falun to show them how to smelt the

9. Jenkins R ; The Reverberatory Furnace ; Proceedings of Newcomen Soc. XIV (1934).

sulphide ores. The low sulphur content probably explains why relatively unskilled labour could be employed at Middleton Tyas in the complex processes of smelting and refining. Certainly there are no references to roasting furnaces in any of the documentary sources.

If Jars wrote a full account of the smelting process, then it was very uncomplicated compared with other copper smelt mills where the ore required as many as nineteen separate forms of treatment to extract metallic copper. He wrote that four to five hundredweights of a mixture of ore, crushed coal, matte (partly smelted copper) and slag were loaded into the heated furnace, the last to act as a flux. After four hours the slag, which had by then floated to the surface, was skimmed off with a large cowlrake and run into rectangular iron moulds on wheels. Such a wheeled mould is illustrated by Clough.[10] Although Jars did not record the size of these moulds we know from observation that they were 1'8" by 1' by 9", as the slag blocks which were turned out of them were used for building, particularly as coping stones. They are still a distinctive feature of the village not only because of their size but also their red colour. As the majority of them are now to be found in the vicinity of East Hall and the Rookery, it may well be that they were produced from the nearby site at Smelt Mill Houses. This is pure speculation, but it is certain that they did not come from the Cow Lane Mill, the slag from which is black, much harder and more brittle than the rectangular blocks. This establishes the site at least as that of a refinery, as this hard black slag contains much less residual copper than the red blocks.

To revert to the process of smelting; the slag was removed and the furnace refilled every four hours for twelve hours together. At the end of this time, the tapping hole was opened and the molten metal teemed into the large ingot-moulds, formed from sand. These worked on the same principle as a water settling-tank. The heaviest part of the melt, pure

10. Clough R T ; Lead Smelting Mills of the Yorkshire Dales ; Leeds (1962), page 97.

copper, settled to the bottom of the first mould, the lighter slag and matte overflowed into the second. Jars used the term 'matte' to describe partially smelted copper, though Gordon, writing in 1779 referred to it as 'regule'. Which was normally used at Middleton Tyas we do not know.

The matte and slag from each tapping were recrushed and went back into the furnace with the next charge. Gradually the matte became more enriched as the impurities separated out into the slag. Even the slag was crushed and washed to recover granules of copper remaining in it. Jars did not record how much copper and matte were produced in 24 hours smelting, but he did note that it consumed some 26-30 hundredweights of coal at a cost of 15-16 shillings. From Leonard Hartley's letters we know that Tissington was at that time smelting 16-18 tons per week.[11] If it was Tissington's mill to which Jars referred then this must be added to the consumption of coal by his 'fire-engine', which would mean that he was paying some 35/- per day for coal alone, when he was both mining and smelting. Even then he was only producing unrefined copper.

When Jars wrote, the mill which he described was likewise only smelting not refining. In other words the product was cuprous sulphide (CuS), not pure copper. This apparently went to Derbyshire to refine, which is a further indication that the mill in question was Tissington's since he and his partners are often referred to as 'the Derbyshire Company', and there is no evidence that John Rotton kept up his Derbyshire connections. As early as December 1753 Hartley wrote to Brown that Tissington's refinery was certainly no good, and that they had sold £8,000 worth of copper 'once through the fire'.[12] In the same letter Hartley stated that he had no intention of refining the smelted copper. On the other hand we do know that the Partners had built and were operating a refinery as early as 1746,

11. William Brown Letterbook, HB 145, 7 April 1753, Newcastle Mining Institute.

12. William Brown Letterbook, HB 157, 25 December 1713, Newcastle Mining Institute.

when it was referred to in RH 4, though whether it went on being used by Rotton and the lessees is not recorded.

It is tempting to explain the decision to refine by a wave of initial optimism in the venture, which with falling production the owners later found to be uneconomical. Jars reference to the fact that, as well as the fire-engine, the moulding-machine had also gone by 1765 tends to bear this out, and it is broadly true that the next chapter describes an industry which contracted rapidly and then continued to operate for many years at a much lower level of activity and capitalization. It must be admitted however that with regard to the refineries the picture is not as simple as this.

In the letters written by John Gordon to Robert Shuttleworth in 1779-80[13] he made several references to the refinery at Middleton Tyas being in operation. On the 2 March 1779 he wrote that 17-18 tons of regule were to be smelted before they could be refined and that it would thus be five or six weeks before it was ready to send to London. This contrasts with the 16-18 tons per week some twenty years before. That the refinery Gordon used was the only one still working is borne out by the fact that it was used to refine copper not only for themselves but also for George Hartley and Dr Watson, the Vicar. That it was a separate building from the smelting mill also emerges from these letters, as does the fact that both were in need of repair, which could ill be afforded. They seem to have charged the Vicar £11/2/8d for carrying and smelting, which produced $8\frac{3}{4}$ cwt of copper. If the ton of coarse copper for refining, referred to in the letter of the 2 March 1779, is the same for which George Hartley was to be charged £3/14/4d in February 1780, there seems to be a remarkable discrepancy in charges.

13. Shuttleworth Papers ; Cowan Bridge.

Jars wrote that in his day the unrefined copper was so good that only about 10% was wasted in the refining process. The normal refining technique at the time, and presumably the one used at Middleton Tyas, was to melt the matte, float charcoal on the surface and blow air over it, as in the ore-hearth. The process of oxidization first burned out the sulphur, in the form of sulphur dioxide, producing cuprous oxide. This was remelted with more matte (cuprous sulphide), the reaction producing pure copper. As most copper ore was so grossly impure this is, of course, an over-simplification of what was a skilled and tedious process.

How long Gordon went on refining, or even smelting, we do not know. In 1781 the Hartley smelting furnace was still in use. In 1784 it was still intact, forming part of a lease. Thus it seems that a reference by Matthew Boulton in a letter dated 1790 in which he described the smelting works as "utterly annihilated" must refer to 1790, rather than 1783 when he had himself visited the mines.[14] By the latter date the mines themselves were flooded and finally closed, as described in the next chapter.

Little remains to bear witness to the smelting and refining activity, but two flowerpots which stand outside East Hall garden, one of which is illustrated in Fig.22. They are obviously sumpter-pots, used to collect molten metal from a furnace, and equipped with four iron lugs for suspension and tilting. Such pots were commonly used in the leadmills, Clough illustrates one from Marrick.[15] It seems reasonable to assume that these originated in the local copper works. As the smelting furnaces mentioned above discharged its molten metal into sand ingot-moulds, it seems likely that the sumpter-pots came from the refinery. If so they are its only recognizable relic.

14. Matthew Boulton Correspondence ; Birmingham Assay Office Library.
15. Clough R T ; Lead Smelting Mills of the Yorkshire Dales ; Leeds (1962), page 115.

CHAPTER 8 THE LATER 18th CENTURY (1754-1800)

We have read in some detail in the foregoing chapters of the problems faced by Hartley, Hutchinson and Tissington up to 1754. Despite the hectic activity with which the Hartley-Brown correspondence ended it must have occurred to all the adventurers by this time that they were unlikely to make a fortune mining copper at Middleton Tyas. In 1752 Hartley had forecast a life of three years for the mines, and in May 1755 wrote to Brown that the ground was holed through and through, so much so that there was little prospect beyond that year. Obviously he was unduly pessimistic, but the following thirty years, so far as they are documented, reveal a declining industry in the village and sporadic efforts to find copper further afield. These other sites are shown on Maps 1 and 5.

KNEETON

Even the Glebe mines which seem to have been the most productive cannot entirely have satisfied Tissington, who signed an indenture in August 1753 with Mrs Alice Hobson and her daughters, heirs of Ralph Hobson lately deceased.[1] (See Genealogical Table 2). By its terms he leased all minerals except coal on Dovecot Hill, Kneeton for seven years at one eighth duty in dressed ore. Richardson's map shows two shafts, "Now trying for copper", between Kneeton Hall and the main road.[2] Certainly Dovecot Hill is a somewhat bumpy pasture still, and much of it has disappeared in a limestone quarry (Fig.24). Richardson also showed shafts to the west of the Hall, which are still visible by the side of the lane (Fig.25). In June 1754 Leonard Hartley wrote to Brown of trials which he had carried out at Kneeton, which may account for these shafts outside the area of the Tissington lease.[3] These trials and others at Melsonby, Forcett, Layton, Feldom and

1. Hartley Papers, ZKU, Northallerton County Record Office.
2. Havelock Allan Papers, ZDG(B), Northallerton County Record Office.
3. William Brown Letterbook, HB 164, 25 June 1754, Newcastle Mining Institute.

Richmond had apparently proved unproductive. His interests even extended to an unidentified copper mine on the Border, worked eighty years earlier by the "Jarmans".

BARTON

A friend of the Hartley family, James Allan of Blackwell Hall also had copper mining interests, which are recorded in a folder of information collected by his great-grandson, R H Allan.[4] Among other things this contains a letter from Hartley to Allan on the subject of duty payments. Clearly he wanted Hartley's advice about what was a reasonable duty to pay. The letter is dated only "Friday night" but can be fairly closely dated.[5] In it he described the Partners still working their own mines, so it must be before June 1754. He also referred to the Hobson lease mentioned above, so it must be after 17 August 1753. As Allan signed a lease of lands in Barton belonging to Robert and John Killinghall of Yarm, on 15 September 1753, the letter presumably falls between the two latter dates.

Allan leased the mineral rights for 21 years at a duty of one seventh, but whether he worked the options is not clear. Certainly he had Richard Richardson draw up the map (Map 3) to which frequent reference had already been made, which is dated 1 March 1754. In this he recommended two areas for exploration. One, H on his map, covers a small field just outside the Middleton Tyas Parish boundary, which appears from the aerial photograph to have been liberally scattered with workings of some sort.[6] Area K on Richardson's map lies within the quarry which R H Allan leased, a century later for quarrying (see Chapter 9), through which the railway, and later the motorway, were constructed. Needless to say there are no surviving traces. Documentary evidence for the working of copper in Barton may yet come to light when all the Havelock-Allan papers have been sorted and catalogued.

4. Biographical Note on page 5.
5. Havelock-Allan Papers, ZDG(B), Northallerton County Record Office.
6. O.S. Reference NZ 225077.

MELSONBY

William Chaytor of Spennithorne had written on the 9 April 1754 to his father advising him against a project to buy the Melsonby Estate jointly with Leonard Hartley in the hopes of winning copper.[7] Significantly William wrote from Lincoln's Inn and had heard of the proposed purchase from the Master of his College, none other than Thomas Chapman, Hartley's nephew.

In the letter to Allan, which antedates this, Hartley spoke of a duty of one seventh paid at Melsonby, "I believe," which suggests that previous owners had tried for copper before him. Richardson's map shows a copper mine working at Melsonby with at least one shaft. This shaft was recorded by Gunn in 1879 at the south side of the quarry (marked 'a' on Map 5) where traces of malachite have recently been recorded.[8] Clearly, although the quarry may have been worked since 1754, no one has considered it worthwhile trying for copper there, and the visible workings can be confidently assigned to Hartley's time.

FORCETT AND LAYTON

Richardson's map extends no further than Melsonby but contains a note, "There is a Town called Laton which lies about Two miles North West of this place where copper is got". On the later map the workings are described as, "old", "Very old" or even "ancient" and consist of an old mine near Sorrowful Hill[9] and an area called Copper Holes south of Forcett Valley[10] which has since been incorporated into the extensive limestone quarries recently operated by Slaters Ltd. It is significant that the prospectus of the Forcett Railway, published in 1865, made no mention of copper, unlike the similar line built at the same time to serve Merrybent.[11] Recently A R Tron

7. Chaytor Papers, D/Ch/C161 ; Durham County Record Office.
8. O.S. Reference NZ 197083.
9. O.S. Reference NZ 152105.
10. O.S. Reference NZ 162115.
11. British Railways Records, York.

(1963) and Dr J H Hull (1967) have reported finding malachite in the limestone, and covellite and bornite in the underlying shales. A lump of ore in the possession of the writer contains traces of both the latter minerals, but with primitive methods of separation and extraction it was obviously not considered worth exploiting after the 18th century.

FELDOM AND ASKE

Hartley's reference to Feldom as unproductive suggests that the evidence of considerable activity in this area dates from somewhat later, when the copper industry as a whole experienced an upturn of fortune. 1761 saw two significant developments. In that year H.M.S. 'Alarm' was copper-bottomed, a technique which was to preserve naval and merchant ships from the teredo and fouling by weed. The problems associated with this are described by Harris but the increase in demand was immediately significant.[12] In the same year the reopening of Parys Mountain Mine in Anglesey, and the realization of the extent of the lode revolutionized the industry.

At this time there was renewed interest in the prospects of copper mining in the Richmond area as well as in Middleton Tyas. In 1763 Alderman Cuthbert Readshaw, who also had mining interests in Moulton after 1761 and Richmond Out Moor after 1764, took a lease of land near Aske from Sir Lawrence Dundas.[13] This was clearly specified and limited to areas named containing 40 meres of land (the customary mere was 30 yards along a vein) from Gilling Road, at Olliver Ducket, through Bend Hagg ('e' on Map 5), where workings are visible, across the Richmond-Ravensworth lane south of Gingerfield Farm.

Several shafts are visible to the west of Gingerfield[14] ('b' on Map 5) and a solitary one on the edge of the Old Racecourse[15]. James Foster, an old man giving evidence to the enquiry into the Richmond Out Moor enclosure

12. Harris J R ; Copper & Shipping ; Econ.Hist.Review XIX, 3 (1966).
13. Zetland Papers, ZNK, Northallerton County Record Office.
14. O.S. Reference NZ 160027.
15. O.S. Reference NZ 160024.

in 1802 recalled that forty years earlier, copper had been found near Gingerfield Hedge and a dispute had arisen between Lord Dundas and Mr Chaytor.[16] The hedge was regarded as the boundary and the copper won was divided. This was the boundary not only of the estates but also of the Borough of Richmond. The Chaytors still had mineral interests when this enclosure took place, the aforementioned William having taken out a 21 year lease in partnership with James Hutchinson in 1792.[17] The late 18th century work at Richmond is described below in Chapter 10.

It seems likely that the ancient workings in the wood on the north side of Rasp Bank ('c' on Map 5)[18] date from the same period in the 1760's, though they lie outside the area of Readshaw's extant lease.

Further west still are the workings at Feldom ('d' on Map 5).[19] From the facts that Leonard Hartley failed to find anything there in 1754 and that the later map refers to the workings as very old, it may reasonably be inferred that they also date from this period. This dating is further corroborated by the fact that in 1766 Sheldon Cradock leased land near his home at Hartforth Hall to John Wastell of Thimbleby for nine years at a duty of one fifth, for the extraction of copper.[20]

The workings now visible on Feldom Ranges consist of a row of bellpits following the vein in the Main Limestone, east and west (Fig.26). Although much torn up by shellfire they are quite clear still and the spoilheaps have produced traces of malachite and chalcopyrite as well as the usual gangue materials, barytes and calcite, and a certain amount of galena. The shallowest pits were to the west where, some 200 yards to the west of Feldom Lane, the surface indications finally peter out. At the eastern end

16. Chaytor Papers, D/Ch/F1038 ; Durham County Record Office.
17. Chaytor Papers, D/Ch/F1024 ; Durham County Record Office.
18. O.S. Reference NZ 152028.
19. These extend from O.S. References NZ 115041 to 125045.
20. Hartley Papers, ZKU, Northallerton County Record Office.

of the vein, on the east side of a small gill, are quite extensive workings, at least one of which seems to consist of shaft, spoilheap and level, rather than merely a bellpit.

In this vicinity also is what appears to be a dressing floor like the one described and illustrated by Agricola where men are at work with buckers smashing the ore prior to washing.[21] In this area of broken stones (fig.27) considerable lumps of malachite can still be found lying on the surface. The nearby farmhouse is still called Buddle House, so presumably the ore was broken up and then taken some quarter of a mile there for hydraulic separation.

To the east of Buddle House, where Sturdy House Lane crosses Copper Mill Bridge[22] there is evidence on the ground to corroborate the impression given by the name of the bridge. Close to the beck is the outline of a small rectangular building some twenty feet by twelve, which could have been a mill. Below it are spoilheaps containing both slag and fragments of malachite. There is also what appears to be a shaft, the purpose of which is not obvious. Indeed this complete small industrial complex would repay closer investigation.

SLEDDALE

At the head of Swaledale are the scanty remains of a solitary copper-mine in Sleddale, on the shoulder of Nan Mea.[23] No information survives, save for a story related by Ella Pontefract and Marie Hartley.[24] This tells of the working of the mine by men employed by an owner at Reeth, who discovered a rich deposit of ore. By the time one of the men had hurried the twenty miles to Reeth and returned with his employer the ore had run out. That this story relates to the 19th century rather than the 18th is suggested by the fact that these shafts are listed by the Ministry of Power

21. Agricola G ; De Re Metallica ; trans. Hoover, page 272.
22. O.S. Reference NZ 144055.
23. O.S. Reference SD 831990.
24. Pontefract E and Hartley M ; Swaledale ; London (1934) page 38.

in the register of abandoned mines. Carruthers who examined the vein in the 1920's found blue ore occurring in it but not in marketable quantities at current prices.[25]

Leonard Hartley had referred in 1753 to a lease from Sir Philip Musgrave, presumably in Swaledale, which yielded as much copper as lead,[26] but as he never mentioned it again in his letters his initial expectations cannot have been realised.

Some chalcopyrite has come from the mines in William Gill, in Arkengarthdale,[27] but again in insignificant quantities.

MIDDLETON TYAS - GABRIEL JARS

To revert to Middleton Tyas, and the mid-18th century, we must consider what Gabriel Jars found in 1765. We have already read what he had to say about mineralization (page 24) and smelting (page 105) at the time of his visit. His descriptions of the level of activity in the mines is not impressive. He reported the familiar fact that when water was reached work was suspended until the shaft was dry. It seems that returns had not justified the retention of the steam engine, since Jars referred to it in the past tense. Tissington had presumably sold it, and reverted to horse pumping. Mr A Hardy of Middleton Tyas, who remembers the engine house still standing, though in truncated form, also recollects that it contained a horse gin. This may have been built for agricultural purposes, such as threshing, after the final demise of the industry but could well have been the original pumping gin.

The mines, Jars described as fox-earths ("Plutot des trous a renard que des ouvertures de mines"), but excusing the poverty of the workings he hit upon one of the persistent bugbears of the industry; undercapitalization.

25. Deway H & Eastwood T ; Special Report on Mineral Resources, Vol.30 ; London (1925) ; Note by Carruthers.

26. William Brown Letterbook, HB 157, 26 December 1753, Newcastle Mining Institute.

27. O.S. Reference NY 915053.

He wrote, "On ne saurait trop blamer les ouvriers qui doivent eviter toute depense inutile a leur entreprise". He admitted however that although production had diminished and hardly covered costs, the mines had formerly been profitable.

Let us now consider the continuing fortunes of the five landowners to whom Jars referred, in so far as records survive for the period.

MIDDLETON TYAS - MILBANKE

Of the Milbanke mines in these years we know next to nothing, beyond the original lease of 21 years made by Sir Ralph Milbanke (4th Bt.) to William Paul in 1745. Five years later Paul paid for the smelting of 29 tons of ore, and 46 tons in 1751. Hartley wrote of him having "good gettings" in May 1753.[28] There are no further details of Sir Ralph, who died in 1748, his son the 5th Baronet or the lessee after 1754 when Hartley told Brown that Captain Paull (sic) was lying sick at Richmond and most of his men had run off.

MIDDLETON TYAS - HARTLEY

Although, as we have seen in Chapter 1, Leonard Hartley lived until 1774, by the 1760's the surviving accounts refer only to his son George and his nephew Leonard (3).[29] In 1761 the latter had proposed joining with Alderman Readshaw of Richmond, mentioned above, in a lease of land in Moulton, occupied by the Shaw family and owned by George Smithson of Moulton Hall, a relative of the Smithson-Percy Dukes of Northumberland. As the indenture survives incomplete it seems this particular lease was not carried out, though a shaft was sunk by someone at Moulton Hall Farm.

There are other accounts relating to activity in Middleton Tyas involving the same Leonard (3), though the earliest one, covering the period 12 July 1762 to 22 January 1763 mentions only George Hartley and

28. William Brown Letterbook, HB 147, 28 May 1753, Newcastle Mining Institute.

29. Hartley Papers, ZKU, Northallerton County Record Office.

his agent John Ayre. Mining costs in this half year amounted to £19/9/6½d and smelting costs £16/10/8d. For a total outlay of £36/-/2½d Hartley received £45 for the sale of 11¼ cwt of coarse copper. There are no other surviving accounts either immediately preceding or following this one.

That a new situation existed four years later is borne out by the title "Copper Account No. 1" in John Ayre's handwriting on the account relating to 1766.[30] It implies that this was the first account of the period when George Hartley leased his interests to "Leonard Hartley & Partners". One of these partners was Miss Parkes, and the fact that the exiguous profits were eventually divided into three indicates that there was one other member of the partnership who cannot now be identified.

They seem never the have employed more than half a dozen men and their total labour cost of £95/15/6d was about a third of that in the detailed contemporary account in John Hutton's papers even though they sank a new shaft, not merely extended existing workings.[31] In bulk they produced 8 tons 5 cwts 3 qrs 20 lbs of ore compared with the Partners' 14 tons 1 cwt 1 qr 19 lbs. The comparison is less favourable when Hartley's total sale price of £126/17/3d is set against the Partners' £463/1/8¼d in RH 24. In other words the average price of the Hartley ore was only £13/6/2d per ton compared with £32/19/4d for the Partners. The rate of duty at one fifth was lower than that paid to the Partners, even after the reduction, and George Hartley received only £25/7/2d in duty payments, less than a quarter of what was paid to Hutton, Wilkinson and Mrs Yorke. Even then Leonard (3) and the other lessees made a profit of £4/13/4d which exceeds William Wynn's loss only in terms of Micawber economics.

Nevertheless, nine years later in March 1779 the mines were apparently still being worked since, as mentioned above, George asked John Gordon, Shuttleworth's agent to refine a ton of coarse copper.[32] A year later, on

30. Hartley Papers, ZKU, Northallerton County Record Office.
31. Hutton Papers, ZAW 117, Northallerton County Record Office.
32. Shuttleworth Papers, Cowan Bridge.

the 14 February 1780, Gordon told Robert Shuttleworth to charge him for £3/14/4d for this work. We cannot be sure whether he paid this, as on the 5th May George Hartley was buried, meriting a Latin eulogy in the Parish Register by the Vicar Dr D W Watson, incumbent since George's old friend Mawer had died in 1763.

MIDDLETON TYAS - GLEBE

Dr Mawer was commemorated by such an extraordinary epitaph that it is worth quoting at length :-

"The Doctor was descended from the Royal Family
of Mawer, & was inferior to none of his illustrious
ancestors in personal merit, being the greatest
Linguist this Nation ever produced.
He was able to speak & write twenty two languages,
and particularly excelled in the eastern Tongues,
in which he proposed to his Royal Highness
Frederick Prince of Wales, to whom he was firmly
attac'd to propagate the Christian Religion
in the Abissinian Empire: a great & Noble
Design; which was frustrated by the
Death of that amiable Prince, to the great mortification
of this excellent Person, whose merit meeting with
no reward in this World, will, it's to be hoped, receive
it in the next, from that Being which justice
only can influence."

In Mawer's time the Old Field had produced £24,000 worth of ore and Goosehill Field £16,000, from which he had received £4,000 in royalties, which might have gone some way towards compensating him for his frustrated missionary ambitions.[33] How much more he received from the mining in the Churchyard is not recorded.

His successor, if less exotic, seems to have been a shrewd businessman and left an account of his transactions in the back of the Parish Register. For a premium of £500 and a duty of one sixth, he leased the Glebe to the same company as before. Leonard Hartley had evidently been wrong in August 1755 when he predicted that Tissington would not return to the village. Apparently Tissington and his partners disagreed about the most profitable method of working the lease. The majority favoured working the

33. Parish Register, Northallerton County Record Office.

known deposits in the fields already worked, by driving a level from Buddle Bottoms to the horse engine in Goosehill, looking for the expected underbed. This is similar to the plan which had been frustrated by Hartley's objections. On the 1879 map PB 5 is described as a level rather than a shaft, and this is obviously the one in question. Evidently the one horse engine was inadequate to cope with the water, and it appears that the lower horse engine at PB 3 was not restored when the slide rods were abandoned.

The minority favoured trials in the Low Field, where about £7 worth of ore had been found in a trial shaft in the middle of the field. This must be either LF 1, which is marked by a tree growing in the spoil, or LF 2 recorded by Gunn and now invisible. In any case there is no sign of more extensive working.

Dr Watson presumably disapproved of the spoil heap left in Goosehill, and stipulated that the spoil from any new workings should be used to make a terrace across the field to the Church, and planted with an avenue of trees as mentioned above in Chapter 3. This was done, but the amount of material seems small, and it is no surprise that he received only £144 in duty, which means only a total of £864 worth of ore was raised. He was probably right when he concluded that the company cannot have made a profit. Certainly the volume of production contrasts with the £40,000 worth of ore in Mawer's time.

Evidently Tissington did not keep the lease up for its full term as on the 20 October 1775 Watson leased Parson's Bottom and the Stripe (i.e. Parson's Bank) to Robert Shuttleworth and Ralph Lodge of St Trinian's, Richmond.[34] The lease was for seven years at a rent of 10 guineas per annum and a quarter duty. He also granted them first option on the mineral rights in Goosehill should he lease it again. The steep increase in the rate of duty suggests a rich strike in the Glebe even at this late stage.

34. Havelock Allan Papers, ZDG(B), Northallerton County Record Office.

MIDDLETON TYAS - THE PARTNERS

Ralph Hutchinson's accounts 13-17 show the quality and quantity of ore produced during the 1750's in detail. Graph E indicates clearly that the average price was steadily falling, though it varied, for instance, between £4 and £42/18/9d per ton during the sale made on the 17 April 1755. This compares unfavourably with Hartley's ore at the time, for which he refused £54 a ton in August 1754. There is no clear pattern of weighings, either at stated intervals or when a certain quantity had been produced, as in the earlier contract. They vary between 3 days and 3 months apart, and between 3 and 10 tons in quantity.

The later accounts in the series do not show such a variety in price at any particular date, nor are they laid out in such detail. Graphs A and B show that production and profitability were both falling rapidly between 1754 and 1758 when, no doubt, the Adventurers were congratulating themselves on having gone over to the duty system.[35]

There was a recovery in 1758-61 (RH 16 and 17) but by now the original Partnership was beginning to break up. John Yorke was found dead in his garden on the 14 July 1757 and is last mentioned in RH 14. Lady D'Arcy died in the following year, and after this only three partners are mentioned; Wilkinson, Hutton and Mrs Yorke, referred to as the Hon. Mrs Yorke & Co. Lady D'Arcy's share was left to her relatives.

The low point of the venture was reached in 1761, with no production at all and an income only from Wynn's farm and the copper mill. Presumably some of the mines were producing ore and Rotton found it worthwhile to lease the mill. Unless, of course, it was leased for a term of years and this represented a dead loss of £10 to him. In 1762 production amounted to only half a ton and to all appearances the enterprise was on the point of collapse.[36]

35. Hutton Papers ; Ralph Hutchinson's Accounts RH 13-15 ; Appendix C.
36. Ralph Hutchinson's Accounts RH 19.

Meanwhile Ralph Hutchinson was busying himself elsewhere on his own account. In 1759 he joined William Sutton of Stockton as lessee of Ellerton (in Grinton Parish) extending a lease made in 1754 for a period of 21 years, to win copper at a duty of one seventh and lead at one sixth. Sutton and Hutchinson were equal partners, the former acting as merchant and the latter as agent till a permanent one be appointed. This partnership agreement refers to a smelt mill which clearly is the one described by Clough as Marrick Old Mill, whose ingots were cast bearing the inscription ELLERTON.[37] This however was a lead mill, and as far as copper is concerned they seem to have had no success.

In the 1760's he extended his interests even further afield, joining George Kearton and Leonard Raw, John Yorke's stewards, and William Bell in a lease of lead mining ground at Appletreewick in Wharfedale and near Greenhow in Nidderdale. The old man, James Foster, mentioned above,[38] recalled that Mr Hutchinson the Steward tried for copper in Richmond Out Moor about this time, but could not get down for the water.

In March 1762 Hutchinson wrote to Hutton to the effect that he gathered that Wynn and Partners had been let the Layberrys for seven years.[39] On the outside of the letter John Hutton made a note that no such lease was made. Certainly a new lease was made with someone at this time. We have seen signs of revival elsewhere in 1763, and RH 20 shows that this also applied to Middleton Tyas. Not only did production increase, but the quality improved. That they had struck a richer part of the vein is also borne out by the new level of duty, one third, which the Partners collected for $3\frac{1}{2}$ years. Indeed until the accounts ended in 1767 the average price never fell significantly below that of the highest averages in previous years, as illustrated in Graph E.

37. Clough R T ; Lead Smelting Mills of the Yorkshire Dales; Leeds (1962) page 115.
38. Chaytor Papers ; Durham County Record Office.
39. Hutton Papers, ZAW, Northallerton County Record Office.

The value of this production can be seen by comparing the duty charged at various times in coppermining leases :

Date	Place	Lessor	Lessee	Term	Duty
1738	M.T.	Hartley	Kearsley	21	one eighth
1745	(M.T.	Milbanke	Paul	21	one sixth
1745	(Kneeton	Milbanke	Paul	21	two elevenths
1750	(M.T.				
	(Church-				
	(yard	Mawer	Tissington		one seventh
	(M.T.	Mawer	Tissington	1	one twelfth
	(M.T.	Mawer	Tissington	subsequently	one tenth
1751	M.T.	Shuttleworth	Moore & Bethell	21	one sixth
?	Melsonby	?	?	?	one seventh
1753	Kneeton	Hobson	Tissington	7	one eighth
1753	Barton	Killinghall	Allan	21	one seventh
1754	Ellerton	Drax	Sutton	21	one seventh
1754	M.T.	The Partners	Wynn ?	?	one quarter
1758	Richmond	Corporation	Chaytor	?	one seventh
1761	Moulton	Smithson	Readshaw	21	one eighth (not executed)
1763	M.T.	Watson	Tissington	14	one sixth
1763	M.T.	The Partners	Wynn & Colling ?	?	one third
1764	Richmond	Corporation	Readshaw	21	one seventh
1766	M.T.	G Hartley	L Hartley	?	one fifth
1766	Hartforth	Cradock	Wastell	9	one fifth
1775	M.T.	The Partners	Shuttleworth	7	one quarter
1775	M.T.	Watson	Shuttleworth	7	one quarter
1784	M.T.	Exors of G.H.	Parkes & Co.	12	one sixth

The Partners charged the highest rate of duty ever, at one third, though Shuttleworth in the 1770's paid the Parson and the Partners a quarter. Most of the areas which had proved profitable were let at a fifth or sixth, while the doubtful ones paid only a seventh or eighth. The duty on the Glebe was very low in view of its profitability, one can only assume that its richness was a windfall for Tissington. From this table it is also reasonable to assume that the quality of ore from the Partners' mines was better than from most of their competitors', at least at this period.

Rotton's name still appears in RH 23 as tenant of the mill, but the Partners began in 1763 to sell the ore to new outside interests. The ore in that year was sold to John Williams, but in subsequent years to Roe of Macclesfield. The latter firm had been established in 1757, but had just taken a lease of the Mona Mine and was the deadly rival of the Williams firm, working the adjacent Parys Mountain Mine.[40] Clearly the Middleton

40. Harris J R ; The Copper King ; London (1964), passim.

Tyas production was significant enough to interest these large firms. Presumably they paid Rotton or others to smelt their ore before sending it, not now to Derbyshire, but to refineries and brassworks in Cheshire. The connection between Rotton and Roe was apparently established as early as 1759, when Rotton wrote to Leonard Hartley from Eaton, the site of the Roe refinery.[41]

By 1767 prospects were deteriorating again and in May of that year the workers applied for more favourable terms. Hutchinson wrote to Hutton to the effect that the work had produced only a cartload, that at a duty of a third they could not afford to dress the ore and that they hoped he would be satisfied with a quarter. In fact RH 24 shows a duty of a quarter charged.

Fortunately we have a solitary piece of detailed evidence from this period. Among Hutton's papers there is a single sheet detailing expenses of production between 29 June 1766 and 1 July 1767, which gives a clear picture of the level of activity as well as a fairly accurate account of the loss suffered by the contractors. Details of wages and prices have already been mentioned in Chapter 5 (pages 70 & 77 et seq) suffice it to say that during the year 4,156 worker/days were worked at a total labour cost of £292/17/-. With materials this brought expenses up to £351/4/6d. RH 24 runs from May Day to May Day so does not exactly cover the same period but, when even the quarter duty had been deducted from the total value of copper ore produced, the sale only brought the contractors £347/6/3¼d. Even at a reduced duty this represents a loss. Wynn was also dealing in the ore produced from the Hartley mines, as well as farming, so he may not have been out-of-pocket overall, but the mines were clearly in a declining state.

Hutchinson's accounts continued until 1767, and during the next year both Anne Yorke and John Hutton died. As all the surviving copies of the

41. Hartley Papers, ZKU, Northallerton County Record Office.

accounts are those submitted to Hutton it is only to be expected that the ZAW series would end there. In November 1770 in the Register of St Mary's Church, Richmond, was recorded the burial of the faithful and diligent Ralph Hutchinson also.[42]

On the 12 June 1775 the Partners leased the mines again. Of the original quartet only Andrew Wilkinson survived, 77 years old but with another nine years of life. The other shares had passed to Hutton's son John; Bethia Jessop, Wilkinson's sister-in-law; Philip Gell of Hopton in Derbyshire and the Rev. Francis Wanley, Dean of Ripon. The new lessees were Robert Shuttleworth and Ralph Lodge whom we have seen above leased the Glebe four months later. They took out a seven year lease at a quarter duty, the same as had been paid eight years earlier.

MIDDLETON TYAS - SHUTTLEWORTH

Although there is considerable evidence of a revival of Shuttleworth activity in the later years, little evidence survives of the work of their Cornishmen during the prosperous years. On the 14 May 1751 James Shuttleworth leased his mineral rights for 21 years to Edmund Moore of Treleigh in Cornwall and Slingsby Bethell, Alderman of London.[43]

In his correspondence with Brown Leonard Hartley made occasional disparaging remarks about the Cornishmen, and mentioned in 1754 that Shuttleworth was, "drowned in the Fore Field".[44] Five years later Rotton referred to Mr Bethell's ore in a letter to Hartley, which proves that the lease ran for eight years at least. Indeed the Cornish lease may have run its full term, but the case in 1759 referred to on page 63 , in which a partnership of miners headed by Joseph Cowling were in dispute with William Simpson, refers to Mains Pasture, which was Shuttleworth land, and makes

42. Leeds Record Office ; Bishop's Transcript of St Mary's Richmond Register.

43. The latter was presumably the grandson of the republican sheriff whose election in July 1680 played an important part in the Exclusion Crisis.

44. William Brown Letterbook, HB 122, 11 February 1753, Newcastle Mining Institute.

no mention of Cornishmen. The only 'foreign' name among the miners is Rosewarne, which is not distinctively Cornish.

The revival of mining by Robert Shuttleworth in partnership with Ralph Lodge just after the end of the 21 years of the Moore lease is borne out by the leases made of the Glebe and Partners' mines in 1775.[45] and also by a few letters, written by John Gordon, Shuttleworth's agent at Forcett, and preserved at the Estate Office at Cowan Bridge. Robert Shuttleworth was already an absentee landlord, and by the end of the century we have records of his letting and selling houses and land in the neighbourhood. The family's property was gradually concentrated in the Burnley area of Lancashire near the family seat at Gawthorpe, and around Kirkby Lonsdale on the borders of that county and Westmorland.

In the Havelock-Allan papers there is a solitary wage sheet to which we have referred in Chapter 5. It covers the period from 3rd March to 21st April 1776 and shows 18 miners, 9 masons, four carpenters and two smelters at work most of that time. This compares favourably with the Hartleys who were employing not more than half a dozen at the time. Shuttleworth must have been optimistic to pay a quarter duty, but Gordon's letters suggest that by 1779 the family's affairs were in a bad state. Even Dr Watson was pleading poverty as an excuse for non-payment of debts. He owed £11/2/8d for working 8 cwt 3 qr of refined copper. Unfortunately we do not know in how long a period the 35 cwt, of which this is presumably the duty, were raised.

In 1780 Gordon referred to three miners still at work repairing the level.[46] Indeed Gordon had paid £1,500 on account of the mines in the previous year. The smelting of 17-18 tons of regule, and its subsequent refining are referred to in Chapter 7 (page 109). The pure copper was

45. Havelock Allan Papers, ZDG(B), Northallerton County Record Office.

46. Shuttleworth Papers, Cowan Bridge.

sent to London, and a reference to a wharfinger's bill from Stockton suggests that it went by sea. It should be noted that as long ago as 1752 Leonard Hartley was selling his best ore in London at £53 per ton, and that in 1754 George Hartley was in London trying to get a better price.[47]

Despite the optimism which must have prompted the new leases and the reopening of a refining furnace, Shuttleworth was thinking in terms of disposing of the mines by 1779, indeed in a letter written in September Gordon expressed the hope that they had already been sold. In February of the next year he informed his employer that he had written an advertisement, which the Vicar had polished up for him, for publication in the newspapers. Dr Watson advised him to put it in the York and Newcastle papers before the London ones, and suggested that if they could not be sold as a going concern, the engine and tools should be sold separately. We must assume that this is what happened, since Gordon made no more reference to copper until the visit of the person from Birmingham in 1789.

MIDDLETON TYAS - THE LAST YEARS

That all the owners had not given up hope entirely is evinced by two things. First, that in 1781 Messrs Hartley and Parkes, represented by Mrs Mary Hartley, executrix of her late brother's will and principal trustee for his six year old son, engaged in a dispute with John Bunting about the burning of the bottom of the furnace built by the late Leonard Hartley for smelting copper ore.[48] A settlement was eventually reached and £7 paid to Bunting on the 3rd March, deducting £2 for the 2 cwt furnace bottom from the £9 owed to him for labour and coal. Secondly, a letter dated 8 June 1781 from William Masterman to Mrs Hartley in which he approved a scheme to try again for copper.[49] He advised her to insist upon free access to the building and smelt mill, and to require the lessees to restore the land

47. William Brown Letterbook, HB 162, 25 June 1754, Newcastle Mining Institute.

48. Hartley Papers, ZKU, Northallerton County Record Office.

49. ibid.

when they had finished. When the lease was finally completed, to commence on 1 January 1784, the duty charged was one sixth of cleaned ore, not a fifth as Masterman has proposed. She did take his advice however in strictly limiting the area of search to the northern part of the estate in the area bounded by Kneeton Lane, Five Hills Lane, Acrehowden Beck and the Parish Boundary, prohibiting any workings within 100 feet of Middleton Lodge, an area which had been worked earlier by Milbanke. Whether the new lessees, Parkes & Co. made any trials after 1784 is unknown. Nor do we know whether Mary's cousin Leonard was one of the partners again. It seems that this was the last of the series of mineral leases in the 18th century, though interest was again revived a few years later.

In a letter written on the 19 April 1790 Matthew Boulton, manufacturer of Soho, Birmingham and partner of James Watt, informed John Vivian in Cornwall of what he had seen at Middleton Tyas in 1783, when he called there on his way back from Scotland.[50] He had spoken to Dr Watson who described the patchy occurrence of the ore, the fact that the last workings were very poor and that the drainage of water with a 'common engine' would cost £4/16/- per day. Boulton saw for himself the poor state the workings were left in, and stated that in his opinion the reopening of the mines was not a practical proposition.

The renewed interest which caused Boulton to write to Vivian arose as a result of the industrial politics of the later 18th century. By 1785 John Williams had established a virtual monopoly in the copper industry, having gained control of the Cornish interests, due to the lower price at which his open-cast mines at Parys Mountain could produce.[51] Some of the users of brass and copper in Birmingham resented this situation and used every means at their disposal to discredit and break the monopoly.[52] By

50. Matthew Boulton Correspondence ; Birminghan Assay Office Library.
51. Harris J R ; The Copper King ; London (1964), passim.
52. Hamilton H ; The English Brass and Copper Industry ; London (1926).

the late 1780's their search for non-monopoly copper brought them to Yorkshire. In 1788 investigating the old copper workings near Malham (WRY) they stumbled upon valuable deposits of calamine. A year later John Gordon wrote to Robert Shuttleworth that they had been visited by another person from Birmingham, who took a plan of all the ground that had produced any quantity of copper.[53] The person in question was probably Captain Mager or Captain Grundy, to whom Boulton referred in his letter. The plan was to be presented at the first meeting of a new company.

In his letter Boulton enclosed a cutting from the morning's newspaper advertising the formation of the Birmingham Mining and Copper Co., with unlimited capital in £100 shares.[54] He advised Vivian not to worry about it. A re-advertisement in the same newspaper on the 17th May, accompanied by a strongly worded plea from, "A Friend to the Manufacturers of Birmingham", to those same manufacturers to subscribe to the scheme and free themselves from the tyranny of monopolists suggests that the shares were not selling well. On the 30th June a "numerous and respectable meeting" held at the Shakespeare Tavern and reported in the Gazette on the 19th July, recommended that the subscription list, due to close that day, should be left open, and the appeal be made further afield to the manufacturers of Wolverhampton, Walsall and neighbouring towns. As Britons they were exhorted not to be silent under oppression, otherwise their oppressors might have reason to think that it implied tacit consent of that tyrannical doctrine which makes power the criterion of right. All to no effect. Boulton had been right to assure his friend that the promoters would soon be sick of mining and he need lose no sleep on their account.

In the following years the Parish Register at Middleton Tyas records the death of the last of the miners. In 1796 an aged pauper, John Thwaites,

53. Shuttleworth Papers ; Cowan Bridge.

54. Aris's Birmingham Gazette for 19 April 1790, page 3, column 4.

formerly a miner, died. George Morton, mentioned in Chapter 5, died in 1801; John Ayre, George Hartley's agent in 1804 and the last familiar figure, Robert Hedley, who had been associated with the mines since 1749, died in 1809.

Fourteen years later Whitaker in his history of Richmondshire wrote that the greater part of the ground between the Church and village was still,

> "tossed in strange confusion, the vegetation destroyed and poisonous minerals substituted to the native mould, by copper works which were wrought here some years ago but now abandoned".[55]

55. Whitaker T D ; History of Richmondshire ; London (1823). Vol.I. page 235.

CHAPTER 9 THE MERRYBENT MINES IN THE 19th CENTURY

THE SOURCES

For some eighty years the copper deposits around Middleton Tyas seem to have lain undisturbed. It is true that about the time that Whitaker was describing the remains of the workings, one Mr Keates was questioning an old miner at Ecton, called Sam Burgoyne, about his childhood in Middleton Tyas. This fact, recorded in Dr Percy's 'Metallurgy', was quoted in the prospectus of the Merrybent Mining Company.[1] Nevertheless the first practical revival of interest seems to have been in April 1856, when the 'Gateshead Observer' reported the fact that a copper mine at Middleton Tyas, "That was drowned and closed a century ago has been reopened at a different point and promises to prove remunerative". Whether the different point was level B (Map 6) behind Kneeton Hall, the earliest workings at Merrybent or somewhere else altogether is not clear. Certainly we have no other record of activity for five years. When this came about there seems to have been no attempt to reopen the old mines in the immediate vicinity of the village. Presumably they were considered either to be worked out or unworkable, though the company did call itself the Merrybent & Middleton Tyas Mining & Smelting Co. Ltd.

The papers of this Company were deposited with the Board of Trade on its liquidation. The general papers are now in the P.R.O.[2] and the mine plan upon which Map 6 is based at the Ministry of Power.[3] The minute books of the associated railway company are preserved in British Railways archives in York.[4] The trials and tribulations of the companies were recorded at length in the local press, notably in the 'Northern Echo' and the 'Darlington & Stockton Times'. Robert Henry Allan kept at least two copies of all

1. Havelock Allan Papers, ZDG(M), Northallerton County Record Office.
2. P.R.O. File BT/31/1107/2154C.
3. Ministry of Power, Abandoned Mine Plan No 536.
4. British Railways Archives, MBD 1-3, York.

such relevant newspapers as well as everything that could possibly have a bearing on his financial interests in the Merrybent companies. Unless otherwise specified the details for this chapter are drawn from this source. These papers, now the property of Sir Henry Havelock-Allan, are deposited at Northallerton and classified under ZDG. The Mineral Statistics[5] and Lists of Mines & Quarries[6] give us detailed information of production, an abstract of which comprises Appendix G, but there is nothing comparable with Ralph Hutchinson's accounts to illustrate the detailed working of the mine.

The fault system in the north-western part of Middleton Tyas Parish and adjacent parts of Melsonby is very complex and the only detailed geological survey is that done by W Gunn nearly a century ago.[7] Some of the details of Gunn's map are obviously not entirely correct, but he gave a good general picture of the structure of the area. The main faults at Merrybent run roughly north-south, more or less at right angles to the main faults at Middleton Tyas. The faults are shown on Map 6 coloured red and marked C.[8] Two converge near the beck and a series of smaller ones run parallel. The main mineral vein is of considerable strike and hades steeply to the east, thinning sixty feet down. The smaller veins Lowes, Smithson's, Robert Raw's and Black Vein are of decreasing strike the further west they lie. The productive North West Vein occurs in a fault at right angles to the others. Gunn's map tallies with the Mine Plan, and the names on Map 6 are those used on the Mine Plan and Earp's annotated map. Positive identification of veins and levels mentioned in 19th century reports is not always possible as they were often known by names of individuals.

5. Hunt R ; Mineral Statistics (Annual) ; London.
6. Geological Survey ; List of Mines and Quarries (Annual) ; London.
7. From letters we know he visited both Samuel Richardson and R H Allan. The latter of course kept his visiting card.
8. See Gunn's Geological Map and Abandoned Mine Plan

Apart from the 1856 newspaper report the earliest documents seen are tacknotes dated 1861, by which J Alderson & F Sanderson leased their mineral rights in Middleton Tyas to Christopher Lonsdale Bradley for a duty of a fifteenth of copper and lead. This rate of duty suggests that the landowners at least were not exceptionally sanguine. With his specialized knowledge Bradley, of Prior House Richmond, must have considered it worthwhile. He was a professional in the field of mining leases having been principal partner in the Blakethwaite Mines near Gunnerside since 1836 and lessee of mines in the Keld area since 1849.[9] Bradley also leased the Hurst mines, near Marske, and his correspondence was carried on on Hurst Mines Company stationery. Bradley's decision to extend his interests to Middleton Tyas may be connected with the abandonment of the Littlemoor Shaft in Birkdale not long before.

THE PARTNERSHIP

Having taken out these leases, and having become the owner of the Merrybent Estate, Bradley must have commissioned the assay of ore samples carried out by the School of Mines.[10] Bradley's knowledge of practical geology must have been considerable, certainly greater than that of Tissington and Leonard Hartley a century earlier. His son, Lonsdale Bradley, published in 1862 a book entitled, 'An Inquiry into the deposition of lead ore in the mineral veins of Swaledale". The younger Bradley in fact became the principal active partner in the Merrybent Mines, forming the Merrybent Mining Company to lease the mining rights from his father. This was a partnership rather than a joint-stock company, in which the other partners were John Tattersall of West Witton and John Cain of Melsonby, both described as mine agents, though the latter seems to have been the resident agent at Merrybent. From his testimonials we know Cain to have been a native of Alston where he worked for Greenwich Hospital before working for

9. Raistrick A and Jennings B ; Lead Mining in the Pennines ; London (1965), page 265.

10. The report dated 27 March 1862, is given on page 34.

five years as foreman in the London de-silvering works of Pontifer and Wood.[11] One would reasonably expect him to have been competent from a technical point of view, and the subsequent misfortunes of the company seem to have been more in the sphere of company politics.

In his diary Francis Newburn recorded the festivites at the official opening in January 1863.[12] On the 22nd, forty to fifty farm carts carried the first consignment of ore to Piercebridge Station en route for the works of Samuel Johnston & Co., at Birkenhead. In honour of the occasion a cold collation was served at Mr Errington's Station Hotel, over which Lonsdale Bradley delivered an optimistic speech.

> The newspaper report of the event stated, "As Cleveland has held an eminent position for the unlimited produce of its ironstone, so will Merrybent and the surrounding district during a course of time be regarded in like manner for the abundant supply of its copper ore."

This first load was only about a tenth of the year's production, 463 tons, which justified the optimism also expressed by Cain in his first Annual Report presented on 9 May 1863. In the following year copper production fell to only about a sixth, but there was a significant production of lead.[13] The mine continued to produce both minerals as the statistics show, and is listed by the Ministry of Power as a lead mine. In 1866 there was recorded the production of 750 oz of silver. Presumably the extraction of this silver as well as the smelting of the raw ore was done elsewhere. Cain's report refers to a drying furnace, but there never seem to have smelting furnaces or refineries.[14] The small reservoirs marked R on Map 6, and illustrated in Fig.29 were probably built to serve washeries though no other visible traces remain.

It appears that the surface adit driven in a generally westwards direction from its mouth at E, coloured green on Map 6 and labelled Upper

11. Havelock Allan Papers ; ZDG(M) ; Northallerton County Record Office.
12. Francis Newburn's Diaries ; Darlington Public Library.
13. Hunt R ; Mineral Statistics (Annual) ; London.
14. Havelock Allan Papers ; ZDG(M) ; Northallerton County Record Office.

Level, must have been the earliest working and can be identified in Cain's reports as the Main Level (not to be confused with the Main Vein). In 1864 it had been driven 70 fathoms west, and a branch level a further 112 fathoms. This measurement would place the point reached exactly at P, where a ventilating shaft was sunk. It seems however that deep workings with an Engine Shaft were contemplated even as early as this. Cain recommended a depth of 40-50 fathoms, though it had only been sunk five by the time the prospectus for the new company was issued in 1865.[15]

THE FORMATION OF THE LIMITED COMPANY

The need for more capital and the security afforded by the recent Limited Liability Acts must have influenced the Bradleys, Cain and Tattersall to transform the partnership into a public company. In the surviving documents the earliest reference to the formation of a joint stock company is dated 11 July 1864, but the process took a year to complete. In April 1865 the partnership agreed with the Merrybent & Middleton Tyas Mining & Smelting Co. Ltd., to sell the plant for £2,751/15/1. In May the leases were sold for £25,000 and in August Christopher Bradley sold the Estate for £20,000.[16] In the new company he held 200 £10 shares. Lonsdale Bradley held 150 ; Tattersall and Cain 80 each ; Henry Briggs of Outwood Hall Wakefield, a colliery owner, held 200 ; Ralph P Ince of London, a former Major, held 200 also and Joseph Boyer of Barton Lodge, 100. Although Lonsdale Bradley retained the Chairmanship, the involvement of local landowning interests in the shape of Boyer was not a happy development for the future of the company.

The new company officially came into being on 22 May 1865 with its Registered Office at Richmond, and Samuel Richardson as its Secretary. Its aims were stated to be :-

15. P.RO. File BT/31/1107/21540.
16. Havelock Allan Papers ; ZDG(M); Northallerton County Record Office.

1. Purchase property a. Merrybent Estate, 344 acres, including the Merrybent Mines.
   b. Plant, machinery, live and dead stock.
2. Purchase and lease of the mines.
3. Search for ore and opening of mines.
4. Getting, purchasing and merchanting of ores.
5. Erecting stamping and crushing mills, smelting and refining workd with necessary engines.
6. Stamping, crushing and refining ores.
7. Carrying on the business of mining, smelting and refining.
8. Leasing lands.

[17]

By now it must have been obvious that farm carts to Piercebridge Station were not an ideal solution to the problem of transporting ore. Clearly it would be advantageous to have a railway nearer, but the quantity of copper and lead ore would never have justified the cost, and if the company began to smelt and refine, the bulk of refined metal even less so. Equally obviously the railway project would have to be a public utility providing carried of bulk commodities such as stone, coal, fertilizer etc. to be viable economically. Thirteen years later, in evidence before the House of Commonns Committee, R S France stated that the railway was promoted in the interests of the landowners, not the Mining Company.[18] Equally obviously the landowners intended to use the resources of the Mining Company to provide themselves with a valuable asset.

The natural resource with the greatest potential eventually proved to be limestone. The edge of the Yoredale Series comes very close to the surface in the area of Merrybent. A railway could carry it to the growing iron industry on Tees-side, whose blast-furnaces had hitherto been supplied with limestone from Weardale, nearly twice as far away as Merrybent. Robert Henry Allan who seems to have been one of the prime movers in the railway scheme owned land between Barton village and Merrybent containing limestone, and through which a railway going to the mines might pass. Before long, Allan discovered the difficulties of being a Director and a creditor at the same time. Conflicting interests bedevilled the company, for instance the Secretary Richardson who was also involved in the

17. P.R.O. File BT/31/1107/21540.

18. Report of House of Commons Committee on winding up Bill of Merrybent Railway, 1878.

initiation of the railway project, was also associated with the firms of Palliser & Richardson, landsurveyors and Richardson & Crathorne, lime-merchants.

Not only the landowners, but the banking interests of the Backhouses and the railway interests of George Leeman of York, Chairman of the North Eastern Railway, became involved. Bringing in this outside capital led to the control of the company passing into other hands, with other motives and interests. Nevertheless it was said of Leeman, at a meeting of the Railway and Mining Companies in 1876, that their misfortunes dated from the time when he left the company. He seems the one professional among rank amateurs.[19]

THE RAILWAY COMPANY AND THE NEW MINING COMPANY

Obviously the Directors regarded the two companies as one from the beginning, whatever the legal niceties. When it came into being on the 11 June 1866,[20] the Merrybent & Darlington Railway Company Limited took up residence at the Mining Company's new offices at 80 Bondgate, Darlington. The Secretary of both, Samuel Richardson, later testified that no share register was kept, no public issue of shares was ever made, no Annual General Meetings were held and the two companies were treated as one and the same. Indeed one batch of stationery was headed, 'The Merrybent Mining & Railway Co. Ltd.'[21]

The stated object of the Railway Company was to build, within three years, a line from the Darlington-Barnard Castle line near Archdeacon Newton to Barton, "6 miles, 2 furlongs, 13 yards to Street Field adjoining Leeming Lane", with a branch line in the Parish of Barton. These lines were to serve the quarries which Boyer and Allan intended opening on their lands. Across the Roman Road the line would serve the Merrybent Estate, limestone quarry, copper mine and freestone quarry on Gatherley Moor. Being built as a tramway on private property, not serving the public, this

19. British Railways Records, MBD ; York.
20. Under the terms of 28 Vic. LXXV.
21. Havelock Allan Papers ; ZDG(M) ; Northallerton County Record Office.

latter section did not need Parliamentary sanction. In the early, optimistic days there was a proposal to join up with the Forcett Railway, whose objectives were generally similar, and whose railhead was only four miles to the west.

The registered capital of the Railway Company was £60,000 in £10 shares, one fifth paid at once.[22] The Directors of the Mining Company were to buy fifty railway shares each, but no shares were ever allotted, the whole capital of the Railway Company being held in trust by the Mining Company. Among the list of Directors are the familiar names, the Bradleys, Briggs, Harris, Boyer, but also newcomers, R Wardell of Aldborough St John, W H W Todd of Hurworth and H K Spark of Darlington.[23]

Within a month of the formation of the Railway Company Leeman formally proposed an association between the two companies. The solicitors' advice that such an action on the part of the Mining Company Directors would be ultra vires led to a hasty reconstruction scheme. Immediately following the Annual General Meeting of the Mining Company on the 7 August 1866 an Extraordinary Meeting was held at which a motion was passed, proposing the liquidation of the Mining Company with the Directors as liquidators.

22. British Railways Records, MBD, York.

23. HENRY KING SPARK : Born at Alston in 1825, the son of a miner, he took up the printing trade in Leeds and Barnard Castle before coming to Darlington in 1848 to work for the Darlington & Stockton Times. He took a job as a coal-merchant's clerk, became a coal-merchant and, by wise speculation, a colliery owner. He built a mansion at Greenbank and achieved respectability as Captain of Volunteers. In 1865 he was dismissed for neglect. He gained control of the Darlington & Stockton Times and used it in the Liberalinterest. He stood three times for Parliament in 1868, 1874 and 1880 against the powerful Quaker Establishment and failed each time. In 1880 the Darlington & Richmond Herald denounced him on the eve-of-poll as an "undischarged bankrupt and vainglorious braggart". He had sold Greenbank in 1875 and moved to Penrith. In 1876 he was declared bankrupt, the Darlington District Bank alone being a creditor for £4,591. He was no more successful in local politics and failed to become Mayor of Darlington. He was a mixture of idealism and dishonesty, having been a pioneer of industrial co-partnerships and advocated old age pensions on the one hand, discussed as the "idol of the working classes". Nevertheless he paid for a portrait of himself for the Town Hall and claimed it had been financed by public subscription. He lived at Barnard Castle until his death in 1899, a lonely, forgotten old bachelor.

Four days later Leeman and Allan were appointed Directors of the Mining Company, and on the 27th its liquidation was announced.[24] Joseph Boyer took over from Lonsdale Bradley as Chairman and the assets were transferred to the New Company via the Secretary. The capital of the New Company was published, along with a list of shareholders, given in full as Appendix H.[25] The holders of 2,500 'A' shares fully paid up, and 3,903 'B' shares with £3 credited, were called upon to surrender their share certificates in exchange for shares in the New Company. As far as we know only one of them protested, the Rev. E Green of Dursley refused to surrender his five shares.[26] Perhaps he realised that the Directors were sacrificing his interests as a shareholder in a Mining Company to those of the Railway Company, but the New Merrybent Mining & Smelting Company Limited had already been registered before he made his protest. The fact that only Green objected was probably due to the fact that in 1866 prospects still seemed hopeful.

Although Hunt's statistics show no copper produced in this year, 205 tons of lead ore were raised. Work on the Engine shaft progressed quickly, in February it had reached 19 fathoms by August, 27 fathoms. The level in the Duchess of Northumberland's land (S-U on Map 6) had been driven 36 fathoms and hopes were still high.[27] Production in 1867, however, showed no improvement. There was still no copper shown in the Mineral Statistics, though the Company records show a sale of Johnstone during the year. This may indicate stockpiling and difficulty in disposing of the ore already raised. Certainly, in the next year they sold ore in Swansea rather than in Birkenhead as before. Lead production in 1867 also fell slightly.

24. London Gazette, 27 August 1866.

25. P.R.O. File, BT/31/1107/21540.

26. Letter in Havelock Allan Papers, ZDG(M), Northallerton County Record Office.

27. Manager's Report, Havelock Allan Papers, ZDG(M), Northallerton County Record Office.

The railway was still only partly built, so the reserves of limestone could not be exploited. The Mining Company was committed to driving a long day-level, which, although a great asset to the lower workings both for transport and drainage, was not directly productive of ore. This level, marked as Lower Level and coloured blue on Map 6, and referred to by Cain as Bussey's Level, intercepted the Engine Shaft at 14 fathoms by the early months of 1869.[28]

The absence of immediate returns from these projects, and the unfavourable balance sheet published on 30 June 1867[29] seem to have precipitated a crisis of confidence, and the beginning of the manoeuvring for control which became such a feature of the subsequent history of the companies. Christopher Bradley was dismissed as a Director under Article 94 of the Articles of Association as he was late in paying calls on his shares. Lonsdale Bradley was busy floating a company to insure coal mines against loss by accident. Perhaps experience warned the Bradleys of impending disaster. Christopher was offered a loan by Briggs to pay the call and regain his seat, but we must assume that he did not accept the offer as the same Briggs wrote to Allan a year later that they were well rid of the Bradleys.[30]

In 1868 Spark seems to have taken effective control, and the Mining Company's affairs to have taken second place to those of the Railway Company. Indeed Hunt recorded no production of metallic ores at all. At the same time the cost of building the railway was steadily rising. As well as £10,000 from the Mining Company, £15,000 from the contractors and £10,000 from the Darlington District Bank the shareholders paid two calls within a year, and Allan was approached on the 11th May for a loan of a further £10,000 for ten years at 5%.[31] The principal was to be repayable within 28

28. Its usefulness as a drainage level is illustrated by the fact that, partly blocked to form a reservoir, it still provides the inhabitant of Tindall House with a water supply.

29. Havelock Allan Papers, ZDG(M), Northallerton County Record Office.

30. ibid.

31. ibid.

days if the interest were not paid punctually. Boyer who was also a creditor protested about this extension of the Company's debts, and retired from the Board. Although Allan still had faith in the venture he had taken precautions to secure his money, and was equally wary four months later, when Briggs suggested that an application by him for some of the new issue of shares would increase public confidence. It suited Allan better to lend a further £5000 in May 1869.[32] Leonard Laurie Hartley wrote to Spark warning him of the danger of converting too much of his floating capital into fixed capital.[33] Although Hartley's rambling, inconsequential letters give a sad hint of his eventual insanity he was certainly correct in criticizing the financial policy of the company. Even Briggs later admitted that they had borrowed far too much in comparison with the share capital, thereby retaining control in relatively few hands.

Despite the money available, through these loans, the work on the railway seems to have been skimped, and the new Resident Engineer, W Bewick Quelch of Bowburn, found a deplorable state of affairs when appointed in February 1869.[34] The track had been laid on cheap sleepers which had already begun to rot, as had the fence-posts. Quelch was instructed to supervise the creosoting of the replacement timbers which were to be Swedish or Norwegian poles. He was also required by the Directors to consult with Nimmo & Macnay the Consulting Engineers with a view to reducing the cost of the bridge over the Tees under construction by Hopkins, Gilkes & Co. of Middlesbrough. His job was not made easier by the fact that the Main Contractors, Lovel & Jones, refused to recognize his authority and withheld the plans. Nimmo & Macnay for reasons best known to themselves acknowledged Quelch's position in a letter to the Railway Company, but refused to do so in a letter to the Contractors. Not surprisingly the Railway Company

32. Havelock Allan Papers, ZDG(M), Northallerton County Record Office.
33. ibid.
34. British Railways Records, MBD, York.

dispensed with their services, leaving Quelch in full charge.[35] How effective he was is doubtful in the light of the report of a North Eastern Railway inspector in 1878 that the sleepers were rotten, that a small tank engine could be used with care but that he had forbidden N.E.R. locomotives or rolling stock to use the line.[36]

There were legal battles developing also. Todd, who had contracted to remove the overburden for cutting into the limestone had involved the Company in a dispute over damage to crops. Captain Wilson of Cliffe sucessfully sued the Company for £1,150 in respect of land and £2,000 for severance (Newcastle Chronicle, 18 June 1870). Local farmers also threatened action over the interference caused by the railway to the supply of water to their livestock.[37]

Despite legal and technical problems the shareholders must have been heartened by the approaching completion of the line. Nearly a year before the opening the Company began to advertise limestone to the ironmasters.[38] In August 1869 Allan had sold the limestone in his land, traversed by the railway, for £1,620 in cash and 2d per ton (of $22\frac{1}{2}$ cwt). The limestone to be won was easily calculable as the agreement stipulated that the quarrying should only be down to the level of the track. The agent, John Marley, whom he appointed to look after his limestone interests was not carried away by the prevailing euphoria.[39] He pointed out that Pease & Partners only sold ironstone with the proviso that the purchaser should also buy their limestone. Furthermore the Forcett Railway was complete and the Forcett Limestone Company, under the Chairmanship of Carl Bolckow, was selling in bulk to Bolckow-Vaughan and others. He might have added that the success of the

35. British Railways Records, MBD, York.
36. Quoted to House of Commons Committee 1878.
37. Havelock Allan Papers, ZDG, Northallerton County Record Office.
38. Newspaper Cuttings in Havelock Allan Papers, DGZ(M), Northallerton C.R.O.
39. Letter to R H Allen in Havelock Allan Papers, ZDG(M), Northallerton CRO.

Forcett undertaking was partly due to the complete separation of the two sides of the business.[40] Whatever the potential production of the Barton area, Marley estimated that there would be an immediate sale for only 120,000 tons per annum. Allan's waning confidence in the whole enterprise may be indicated by the stipulation which he wished to include in the deed, to have the right to stop traffic on the railway to enforce payment. A legal hand had added a marginal note, "As this clause stands it gives Allan the right to stop a public railway which is an offence against the laws of the realm !! "[41]

Whatever misgivings he may have had, Allan generously supported the festivities to mark the opening of the railway to Barton on the 1 June 1870. The ceremony was carried out by Spark, since Allan with his business association with the company as vendor of limestone, as well as being the largest creditor, had resigned his position. The first train arrived, hauled by the locomotive 'Merrybent', bought from Hopper & Radcliffe of Fence Houses for £1,120 and described only eight years later as being like Mr Stephenson's 'Rocket'. The only sour note in the festive atmosphere was struck by the protests of the people of Barton that the regular passenger service at 2d per mile had not materialized, and the protests of Boyer and Hartley that the projected branches to serve their respective estates had, for the time being, been abandoned.

In 1870 the mine gave more cause for optimism. The annual report was presented by Tattersall instead of Cain.[42] He wrote of good production of lead and hopefully of the discovery of lumps of copper ore. He described the Upper Level as having found five veins, before reaching Lady Northumberland's boundary, but made no mention of the level in her lands.

40. British Railway Papers ; British Railways Records, York.
41. Havelock Allan Papers, ZDG(M), Northallerton County Record Office.
42. Manager's Report, Havelock Allan Papers, ZDG(M), Northallerton C.R.O.

Bussey's Level had been continued westwards from the Engine Shaft, and southwards to intersect Fairley's Vein. What he called Hartley's Level was probably the day-level driven from the quarry behind Kneeton Hall at D. This level is still open, some 3'6" high, and entirely surrounded by a jungle of nettles. The identification of this as Hartley's Level is based on the fact that Hartley owned the land at Kneeton, and that his tenant, Sanderson complained in the following year that they were mining too near the surface, and causing subsidence. As this complaint reached the mine manager, Anthony Robinson via Hartley, Allan and Richardson he was understandably annoyed.[43]

Wardell and Cain had taken out leases from the Duchess in Orchard Farm, Melsonby and High Langdale, though whether on behalf of the Company is not clear.[44] A single shaft top remains at High Langdale[45] to show the working of part of the lease. Adit mouth Z may represent the other half. The rate of duty was an eighth of lead and a twelfth of copper, the same rate of duty as was proposed by Richardson to Allan in 1870 for a lease to the Mining Company of the mineral rights in his land at Barton. This was not granted.[46]

Indeed relations between Allan and the Companies began to deteriorate as soon as the railway was in operation and limestone in production. In September 1870 his solicitors, Hutchinson & Lucas, were serving notice on Richardson for payment of £9,000. By October this had been reduced to £5,000 but he did not greet with favour the suggestion that the Company's temporary embarrassment might be solved by another £10,000 issue of debentures. He realised that in the event of a collapse there were going to be far too many creditors to pay. In June 1871 he instructed the solicitors

43. Correspondence in Havelock Allan Papers, ZDG(M), Northallerton C.R.O.
44. British Railways Records, MBD, York.
45. O.S. Reference NZ 193093.
46. Havelock Allan Papers, ZDG(M), Northallerton County Record Office.

to notify the Company that as the 28 days grace had elapsed they were preparing to take action to recover not only the interest but also the principal, under the terms of the original loan. Briggs, newly elected as Chairman, wrote to Allan explaining that Richardson was crippled with sciatica and asking him to be reasonable.[47]

Briggs had been brought in as Chairman as the result of a boardroom coup on the 12 May 1871, when Boyer and Wardell ousted Spark, who left in high dudgeon. Briggs seems to have acted decisively to try to sort out the mess. The Railway Company obtained an extension of two years under the terms of the Railways (Extension of Time) Act 1869, and his report to the Annual General Meeting on the 16th August was once more optimistic. £6,100 had been borrowed at 6% from the Directors to complete the railway, extending it into Boyer's estate and into the company's land, with a further extension to the Gatherley Quarry. Despite his businesslike approach a countercoup in February 1872 led to the reinstatement of Spark. Briggs later sold his shares and dissociated himself from the Companies. Unscrupulous company politicking did no good to a firm whose greatest need was confidence, even more than capital. The ousting of Boyer's candidate augured no good for the Company which could ill afford to annoy one of its biggest creditors. On the 15th April he wrote a letter, the tone of which according to the Minutes Book the Directors regretted. In 1873 he published a printed letter asserting that, whatever Richardson may say, he had ceased to be a Director in 1871. Hence-forth he was to be no friend to the continued existence of the Companies. From this point may be dated their inevitable slide into bankruptcy.[48]

On the other hand the prospects of the Mining Company brightened in the early 1870's. Appendix F shows an improved production in 1872-4, indeed

47. Correspondence in Havelock Allan Papers, ZDG(M), Northallerton County Record Office.

48. Copies of all these proceedings collected by R H Allan in Havelock Allan Papers.

the value of metallic copper produced in the last year of production was a record figure.[49] Not only was aggregate production higher but the quality of ore, 27% pure, was much better than before. The figure of metallic copper production for 1872 must surely be a misprint. Hunt gave 8 tons 4 cwt, but comparing purity and price with other years one is compelled to the conclusion that this was a printing error and the figure should read 18 tons.

Two reports were presented in 1871.[50] The first, by Charles Bawden of Cornwall, summarized the progress made, criticized the methods of ore dressing but was generally optimistic. The other, by the Manager Anthony Robinson, referred to twelve men at work, four in Hartley's vein, two in Bussey's Level driving west from M (Map 6), and six men in a large cross vein, which must be the North West Cross Vein, worked at the lower level, from its intersection with Lowes Vein at O. In neither report is there a mention of deeper workings, at 23 and 50 fathoms. It is not clear when these workings were made. We know that the Shaft had been sunk below the Lower Level as early as 1866. At 23 fathoms drifts had been made to the south-east 33 fathoms, to the west 18 fathoms and to the south 3 fathoms. At the lowest point a single working was carried only some eight fathoms from the Engine Shaft foot. It seems unlikely that after the trouble and expense of sinking the shaft 300 feet it would be abandoned so soon, unless the reason was the total cessation of work in the mine. Working below the day-level would preclude its use for drainage or haulage, and necessitated the installation of a steam winding/pumping engine. The limited use that was made of this for haulage is illustrated by the spoil heaps. Assuming that X and Y contain the waste from the Upper Level, and that the spoil from the Lower Level was brought out at H, once the level was completed, then the small heap W probably represents the spoil raised from the deeper

49. Hunt : Mineral Statistics.
50. Havelock Allan Papers, ZDG(M), Northallerton County Record Office.

levels. Spoilheap Z is probably the overburden from the nearby quarry though Earp considered it to be coppermine spoil, and found copper minerals in it. It could represent the upcast from a shaft sunk during the driving of the Lower Level.

While the mine was not fabulously rich it had obviously overcome its main difficulties, had completed the long Lower Level, permitting easier working of the Main and North-West Veins and seemed to have a reasonably promising future, with limestone as a valuable and more predictable by-product. In 1871 copper sales totalled £4,170/19/1 and limestone only £740/9/-, but by 1874 the letterheads advertised, "Limestone, Lime, Freestone, Crushed Stone, Copper Ore & Lead Ore", in that order.[51]

THE COMPANIES IN DIFFICULTIES

Under Spark's Chairmanship the Companies found themselves still chronically short of money. In October 1872 Spark wrote to Allan reproaching him for supporting him inadequately after requesting him to take the chair. Spark claimed to have put £40,000 into the business, without which it would have failed, and requested the loan of £5,000 or £10,000. Allan, who was once more threatening action for the payment of outstanding debts, not surprisingly refused, suggesting that Spark should approach the Bank. In the following year Spark suggested that Allan should buy the Estate for £30,000 and lease the mineral rights to the Company. This proposal also met with a refusal; Allan would not consider it until the debts were settled. Indeed, he was threatening proceedings to claim against the estate of the deceased Director, Collyer.[52]

At a meeting of the Mining Company Spark repeated the need to raise extra capital and publicly admitted that the railway had crippled the resources of the Company. Nevertheless he still spoke hopefully, and

51. Havelock Allan Papers, ZDG(M), Northallerton County Record Office.
52. ibid.

proposed extending the railway via Richmond and Leyburn to Skipton.[53] When six miles of flat land had nearly defeated them the scheme to construct a line ten times as long as that through the Pennines seems ludicrously optimistic. The basis of this optimism was the contract with Pease & Partners, signed the previous December, which was in fact to prove ruinous. The Chairman's optimism was evidently not shared by all the shareholders and he was troubled by hecklers. They were probably members of the Shareholders' Committee which had been formed in 1873, and had ordered a full investigation of the firm's affairs.

Others were not content merely to protest, and within a month petitions were filed for the winding up of the Mining Company, principally by Boyer, but also by R Spence, ironmonger of Richmond. A week before the Investigating Committee presented its report the two locomotives (the original 'Merrybent', and another built by Henry Hughes of Loughborough) were seized on the order of the Sheriff under a writ of Fi. Fa.. When Spark guaranteed payment of the particular debt the attachment was withdrawn.

The Investigating Committee report was presented by R S France, who described himself as "Colliery Lessee and Quarry Operator". Others described him variously as a liar, a dangerous fellow, a scheming fellow and unearthed the fact that he had earlier been sold up after failing in the construction of the Mold & Denbigh Railway. The evidence in Allan's papers does not prove who brought France in. Spark was generally alleged to have done so, but in a letter to Allan written on 12 December 1874 he made Boyer responsible.[54]

Whoever introduced France he condemned the way the Company had been run at a meeting of the Shareholders' Committee.[55] He referred to it as a company without directors and pointed out that the share capital was

53. Darlington & Stockton Times, 11 April 1874.
54. Havelock Allan Papers, ZDG(M), Northallerton County Record Office.
55. Darlington & Stockton Times, 31 October 1874.

unissued, being held in trust by the Mining Company. The failure of the Directors to raise capital by issuing shares was underlined as the principal cause of failure. The administration of the Company was likewise criticized. The books were chaotic and the balance sheet wrongly headed, in spite of which the adutiors had passed it. Much too ambitious projects had been undertaken, and the expense of the Gatherley freestone quarry, the deep shaft and the winding engine were never justified by returns. Unlike Boyer however the Shareholders' Committee believed that the Company had a future if it could be reorganized. To this end George Close proposed that France should be given shares so he could become a member of the five-man Board of Directors. To show their continued confidence the meeting approved a proposal to complete the railway as originally projected.

Notices appeared in the press of a bill to be presented in Parliament to build extensions from the present railhead at Barton Station.[56] A western branch was to extend as far as the Scotch Corner-Greta Bridge road, and an eastern branch to the vicinity of Morris Grange, south of Scotch Corner. As late as May 1877 Spark was meeting the Directors of the Forcett Railway, presumably still with the idea of joining up the two lines.

The reorganized company moved from Darlington to 76 Finsbury Place, London, where at a meeting on 5 January 1875 Richardson was dismissed from his post of Secretary.[57] A squalid little case was dragged up to prove his incompetence. The Railway Company as a landowner in Archdeacon Newton was summoned by the Waywarden of that Parish for non-payment of £1/3/1½d poor rate. Richardson was held to be at fault in this petty affair, but the evidence produced in 1878 amply illustrates that he was in fact incompetent.[58] Indeed in the absence of adequate minutes the Investigating Committee had had to rely on newspaper reports. When a minute book was

56. Northern Echo, 21 and 30 November 1874.
57. British Railways Records, MBD, York.
58. Report of House of Commons Committee.

produced Richardson was evasive and unconvincing in his explanation to the Committee of a page which had been cut out of it. Richardson blamed France for this, and described him in a latter to Allan as a villain, and Spark as little better.[59] Both Spark and Quelch knew the accusation about the poor rate to be unjust, so he asserted. When replaced as Secretary by John Wade he refused to give up the seal, and became the subject of further proceedings. Whatever France's character, one is compelled to agree with Counsel, who, having heard the evidence before the Parliamentary Committee, expressed the hope that Richardson was not Secretary of any other company and the opinion that if he was it would get into as great a mess as the Merrybent Companies.

BANKRUPTCY

Meanwhile in Chancery the winding-up petitions were heard by Vice-Chancellor Sir C Hall. It was to him that the Extraordinary General Meeting held on the 9 March 1875 left the choice of a Liquidator.[60] His critics believed France had been hoping for the position. Two liquidators were appointed; William Turquand of 16 Tokenhouse Yard, London EC, formerly liquidator of Overend & Guerney, to the Mining Company and John Holmes of 1 Riches Court, Lime Street, London, to the Railway Company.

Turquand assisted Quelch in drawing up a scheme to retrieve the situation even at this late hour. In a report which he presented on the 17 April 1876 Quelch blamed the creditors who were forcing the settlement of their debts for the ruin of the Company, and accused the Reconstruction Committee of selling out its interests. "It is advisable," he wrote, "to say as little as possible as to the means which were adopted to crush, if I may use the expression, all signs of life out of the Company". As an alternative he proposed a scheme to reform the Company under the name of the Tees Valley Mining Co. Ltd., or the Darlington & Richmond District

59. Havelock Allan Papers, ZDG(M), Northallerton County Record Office.
60. ibid.

Mining Co. Ltd.

The Liquidator was to settle the minor debts for goods, amounting to £373/13/3, leaving some £50,000 of claims. The assets to be nominally valued at £150,000, were to form the capital of the new company divided as follows:-

a. The £50,000 claim, divided among the creditors, in proportion to their claims.

b. Shares to be taken up in proportion to share holdings.

c. Paid-up shares and shares credited as paid-up.

Categories a. and c. were to have priority of interests up to 6%. Thereafter b. was to receive 4%. A further share of up to 10% was to be paid to a. and c. Only then were category d. shareholders to share in the income.[61] Talking of returns as great as this shows how impractical was Quelch's scheme.

In July 1876 the Mine Plans were deposited[62] and the Mining Company was effectively dead. The Company had in its demise also contributed to the ruin of Spark who was declared bankrupt in 1876. On 29 April 1878 the Merrybent Estate, complete with fixtures was sold, by auction, at the King's Head, Darlington to Robert Henry Allan. The moveable stock of riddles, kibbles, explosives, jackroll, waggons, wooden buildings etc., was sold on 25 June, and Allan just managed to stop them selling the engine which he had already bought with the estate. The mining equipment was all dispersed, henceforth Allan was only interested in the exploitation of limestone.

Allan had found himself in the position of defendant in the case of Kipling v. Allan, which was the sequel to the case of Darlington District Bank v. Merrybent Railway Company. The Bank, attempting to retrieve a

61. Copy in Havelock Allan Papers, ZDG, Northallerton County Record Office.

62. Deposited with Board of Trade - now Ministry of Power, abandoned Mine Plan 536.

total of £18,508, could not find property enough to meet the debt, and through its officer Kipling successfully sued Allan and Todd as shareholders. According to the Articles of Association they as Directors held 50 shares of £10 and hence were liable for £500 each.[63]

A railway company established by Act of Parliament is more complicated to wind up than a mining company established under the Limited Liability Acts. The winding-up act, was described by Counsel for the Darlington District Bank as, "A very short bill, and a very short story about a very short line, with a very short history, but a very unfortunate one".[64] The evidence of the Parliamentary Committee has already been frequently quoted.

The main opponent of the Bill was France who claimed that it was a plot by the mortgagees and judgement creditors to rob the shareholders of a railway worth £100,000. He accused the Bank of, "A swindling transaction for which they seek legislative sanction". As the debts amounted to £50,000 and the only bid for the railway, inevitably, came from the N.E.R. and amounted only to £20,000 the creditors were acting even against their own interests. The shareholders, every penny of whose money had been spent, had never been consulted about the formation of the New Merrybent Mining Company. If the Company were wound up the creditors would share out all the assets, and the shareholders whose capital had been so wilfully misused would not receive a penny. In his copy of the Report Allan wrote, "False", beside France's statement that the shareholders did not know what had happened until the Investigating Committee told them.

Allan petitioned the Committee for special treatment in settlement of his debts. Not only had he sold land to the Company at a ridiculously low figure, £1,620 for 13 acres at Old Barton Farm, at a time when poorer land

63. Havelock Allan Papers, ZDG(M), Northallerton County Record Office.
64. 41 Vic. XLII.

had been sold for as much as £300 an acre, but had also foregone all severance charges. After the initial payment he had never received a penny, in fact he had returned the cheques regularly until his claim be met in full. His four years forbearance he attributed to his desire not to harm the Company. He contrasted his own position with that of France who had not risked a penny, yet interfered from a safe distance. He also was critical of the Bank which was determined to look after its own interests at the expense not only of the shareholders but also of the other creditors. When the Act was finally passed, Allan's interests under the agreement of 1 August 1869 were specifically safeguarded. Allan died in October of the following year.

The final dissolution of the Mining Company was published in 1883[65] but not before W H Cousins the Registrar of Public Companies had written in some puzzlement to Redpath & Holdsworth, solicitors, requesting them to explain to him the exact difference between the Merrybent & Middleton Tyas Mining & Smelting Co. Ltd., and the New Merrybent & Middleton Tyas Mining & Smelting Co. Ltd.[66] Now it hardly mattered, but for form's sake. Indeed one feels sympathy with the Northern Echo editor who wrote the headline "The Merrybent Company again". France had told the Committee that if the capital of the Mining Company had been confined to the object for which it had been subscribed it would have been a flourishing concern. We are left with an impression of what almost amount to fraudulent conversion, but no company has ever successfully exploited the Merrybent Mine since that day.

In 1911 we read of a firm called the Merrybent Mining Syndicate Ltd., registered at Melsonby, employing three men underground and three on the surface.[67] By 1913 this company had disappeared, to be replaced in 1914

65. London Gazette, 1 May 1883.
66. P.R.O. File BT/31/1107/2154C.
67. List of Mines and Quarries, 1911.

by the Merrybent Mining Company, registered at Bishop Auckland and employing six men underground. The production seems to have been negligible 4 tons worth £20 in 1913, and the project short-lived.

The Railway for all its unsatisfactory construction, was obviously a more valuable asset so long as the limestone quarries continued in production. As a result of the 1878 Act it passed under the control of the Darlington District Bank which disposed of it to the N.E.R. in 1890.[68] In the hands successively of the N.E.R., the L.N.E.R. and British Railways it continued to operate until 6 July 1950, when it was finally closed. Now with the closure of Messrs Slaters's quarry (1971) the limestone production has entirely ceased. Of the railway not a trace remains as its track provided the route for the first six miles of the Durham Motorway (A1M).

68. British Railways Records, MBD, York.

CHAPTER 10 THE RICHMOND COPPER MINE

THE SOURCES

The earliest and, up to the present moment, the latest copper mining in Richmondshire took place not in Middleton Tyas, but in and around Richmond itself. The oldest information still extant dates from the 15th century, and since it refers to a copper mine "near" rather than "in" Richmond this may be the Billy Bank Mine. Although presently administered by the Richmond Corporation for the National Trust, Billy Bank Wood is not part of the Borough, but of the neighbouring Parish of Hudswell. Here a vein of copper is cut and partly exposed by the River Swale.[1] Billy Bank forms the steep side of the concave bank of a meander where the scour of the river has cut into it. The mine lies about three quarters of a mile upstream from Bargate Bridge at a point where the bank is so sheer that access has only been possible at river level by constructing an elevated cartroad from slabs of limestone over the edge of the river itself. Among the spoil from the mine there are still traces of the green and blue carbonates, but the surviving miner who worked at Billy Bank speaks of various other types of copper ore in the vein. The gentleman in question, Mr G E Close of Hudswell, now aged 78 (1970) has been very helpful in relating his recollections of work there sixty years ago. His memories, the official Mineral Statistics[2] and the deposited papers of the Company which worked the mine between 1910 and 1912[3] provide all the information presently available about the early 20th century work. Prior to that we have little but Letters Patent of the Kings of the period of the Wars of the Roses.

1. O.S. Reference NZ 165007.
2. List of Mines and Quarries.
3. P.R.O. File BT 31/13256/109746.

MEDIEVAL ACTIVITY

In 1468 the Yorkist King Edward IV leased for forty years all mines of gold, silver and argentiferous lead north of the Trent to the Earl of Warwick, the Earl of Northumberland and John Howard, Treasurer of the Household, along with one George Willerby, described elsewhere as a goldsmith.[4] This lease contained no mention of copper but indicated a revived interest in the potential of the metalliferous mines in the North of England. Willerby was presumably the working member of the partnership, provided with capital by the noblemen. The Lancastrian King Henry VI issued a Letter Patent during his brief restoration in 1470, pardoning the same Willerby for failing to appear to answer for a debt of £27, incurred under the de facto King Edward IV.[5] In spite of his financial difficulties and the shifting political scene Willerby reported in 1474 on his prospecting in the North East, where there were three mines, one of which produced 27 lb of silver to the fother (21 cwt) of lead. Clearly silver was the principal object of the search.

On the 5 August 1474 King Edward appointed a Commission of Fifteen to enquire into Willerby's report.[6] Among them were the Duke of Gloucester, the Earl of Northumberland, Sir John Pilkington, Sir Robert Constable, Sir William Ivers and various commoners including one William Goderswyke. He was apparently a German merchant, and became a member of the partnership which leased four specific mines from the King in the following year.[7] The mines named were Shildon near Blanchland, Feccheroos (Fletcheras) near Alston, Keswick Mine and the copper mine near Richmond. The last was presumably one of those investigated by Willerby. The rates of duty in this lease of 23 March 1475 (one eighth to the King, one ninth to the

4. Cal. Pat. Rolls, 8 Edward IV, pt III m 14.
5. Cal. Pat. Rolls 49 Henry VI.
6. Cal. Pat. Rolls 14 Edward IV, pt I m 7a.
7. Cal. Pat. Rolls 15 Edward IV, pt I m 22.

landowner and one tenth to the curate of the Parish) compared with those of the earlier, prospecting, lease (one twelfth to the King and one sixteenth to the Lord) indicate that workable deposits had been found. Indeed it stated that the lessees could employ labour and appoint a steward to hold a mine court to settle all but the most serious issues. As well as Goderswyke the lessees were John Marchant, mercer, the Earl of Northumberland and the King's brother Richard, Duke of Gloucester, who had inherited the Neville interests in the North Riding through his wife.

Within three weeks of the lease the working of the mines was placed in the hands of another German. The degree of expertise in all the processes of separating metals already achieved by Germans was then well known throughout Europe and their commercial success is still amply borne out by the 15th century cathedral at Kuttenberg (Kutna Hora) in Bohemia built out of mining profits. The new manager was Walter Barsonhowson (sic) appointed as, "master finer, purger and divider of les ewres and metals", on the understanding that he should take as many apprentices as the lessees saw fit.[8] Clearly the King did not intend English mines to be dependent indefinitely upon German technical skill.

In 1478 the lease was surrendered and a new one made for ten years to a different foreign syndicate. The noblemen dropped out and were replaced by Henry van Orel, Arnold van Anne and Albert Millyng all of Cologne; and a goldsmith Dederic van Riswyk, who was probably Dutch. Significantly the lease was for Northumberland where the Shildon mine is situated; Cumberland covering both Fletcheras and Keswick; and Westmorland. The omission of Yorkshire suggests that the fourth of the mines, the coppermine near Richmond, had not proved profitable enough to continue. In the reign of Elizabeth the German lessees of the Keswick mines, Hochstetter and Thurland, were granted the right to search for copper in Yorkshire.[9]

8. Cal. Pat. Rolls 15 Edward IV, pt I m 12.

9. State Papers Domestic Eliz. Cal. 1547-1580, page 245.

By this time the Northumberland case had established that copper mines were Mines Royal whether argentiferous or not. There is little evidence that the Elizabethan lessees found it worthwhile to mine extensively in Richmondshire, though Clough refers to a furnace established at that time.[10]

THE EIGHTEENTH CENTURY

The series of mineral leases made by Richmond Corporation in the 17th and 18th centuries make reference to copper. There were summarized by Clarkson[11] and recently deposited in the County Record Office, Northallerton. They all refer to land in the Borough, that is to the north of the river, and usually make specific mention of either Richmond Outmoor or Whitcliff Woods. The earliest of the series, running for 21 years from 1668, leased all the mines in Whitcliff to Charles, Lord St John. After the termination of this lease and a further lapse of eight years a partnership took up the lease in 1699 for a further 21 years. Among the partners was Thomas Yorke and this is the first mention of the involvement of this family in the industry. Another name which we have met in the activity at Middleton Tyas is Readshaw, and Caleb Readshaw was a member of the next partnership to take up the lease in 1718. This particular lease was the first to mention copper specifically. When it lapsed in 1739 Francis Lodge proposed to lease the rights at a duty of £8 per ton of refined copper. Ten years later Ralph Close followed, paying £10 for the first ton and £12 for subsequent tons. The mention of the right to cut stoprods in Whitcliff Woods suggests that he actually worked the lease. It was during the next lease by William Chaytor, taken out in 1758, that there took place the activity mentioned in Chapter 8 (page 114) on the boundary of the Race-course which is in the Borough of Richmond and the Zetland Estate which is not, leading to friction between Chaytors and the Dundas family. Ralph Hutchinson was also active on the Outmoor, but with little success. In

10. Clough R T ; Lead Smelting Mills of the Yorkshire Dales ; Leeds (1962), page 97.

11. Clarkson C ; History of Richmond ; Richmond (1814), pages 324-326.

1764 the leases were taken over by Cuthbert Readshaw (see page 118) and in 1792 returned to the Chaytors of Spennithorne in partnership with "James Hutchinson of Richmond, Dr. of Physic", who may have been son of Ralph Hutchinson who certainly had a son called James. On the other hand Hutchinson is a very common name in the area. The seriousness of their intentions is indicated by the terms of their 21 year lease.[12]

As well as listing the mineral leases, Clarkson also stated that the mine at Billy Bank had been worked occasionally prior to his time (1814), and that the Round Howe and the earthwork known as Arthur's Oven on the hill above, were associated with it. Certainly the later miners found evidence of earlier workings. Mr Close described a rabbit-warren of galleries and side passages, all made by 't'owd man', the common term in Swaledale for earlier miners. Unlike the 20th century miners, they seem to have worked the vein from the top with a shaft. The date of some of the earlier miners can be fixed from Mr Close's evidence that they had used blasting powder, producing a different pattern of shattering in the rock from the gelignite used in the first decade of this century. As we saw above (page 52) the use of blasting underground was not introduced until the second decade of the 18th century.

These 18th century workings could have been the work of the Yorkes of Bargate (page 7). Clarkson recorded the fact that in 1798 copper was

12. "of all mines, veins, strings, pipes floats of lead and copper ore now discovered or open to which shall be discovered or opened in or upon those parcels of ground called Whittcliffe Pasture and Out Moor in the manor and parish of Richmond and in all other the commons and waste grounds within the said manor and parish with right to do all acts necessary or usual for finding, getting, dressing, smelting and refining the lead and copper ore and carrying on and working the same mines and works and also to get stoprods in Whittcliffe Pasture for the use of the said mines and to get stone, ling, peats and turves and also to erect and build on the said grounds, bing steads, smiths forges, store houses, furnaces, smelt mills or refining mills .... and to get lime stone and burn the same into lime in the said grounds for building and repairing such edificies and for smelting and refining .... and for the use of the said mines and miners and workmen employed therein .... one seventh part of all lead and one sixth part of all copper smelted, refined and made merchantable ...."

discovered by them in Temple Ground, which lies opposite Billy Bank on the north side of the river. Whellan stated that the ore was of good quality but the workings were discontinued because of expense.[13] Mr Close has been up to a hundred yards into this abandoned working, but does not know how much further it went. Whether the Yorkes followed the vein across the river into their land in Billy Bank at the same time is not known, but there is no record of activity there in the 19th century.

THE BOULDER FLINT COMPANY

The reopening of a copper mine in the early 20th century was a result of the mining of chert, a siliceous stone resembling flint. This was apparently discovered by one J T Ward in Arkengarthdale about 1895. He sent samples to the Potteries where it is used as a raw material in the manufacture of porcelain.[14] Ward's samples interested the firm of Taylor & Co., potters' merchants based on Dieppe in Normandy, who sent W S Taylor and J S Wagstaff from Staffordshire to Swaledale to establish the Boulder Flint Company in about 1904. Mr Ward, who made the discovery, was employed as foreman. Both Taylor and Wagstaff took up residence in Reeth, which is within four miles of the Arkengarthdale chert mine, and not more than ten miles from Billy Bank, where they opened another chert mine. The partly blocked opening of this mine is still visible by the side of the footpath through Billy Bank Wood, much higher up the bank than the copper mine and considerably nearer to the bridge. This appears not to have been successful as it only penetrates a few yards into the hillside.

The lease of the chert must have been followed shortly by the decision to extend their activities to the nearby copper vein since on the 14 May

13. Whellan T ; History of York and the North Riding ; Beverley (1857), p.17.

14. For the information on the chert mines I am indebted to Mr Rowland Woodward of Fremington who was the manager of the Boulder Flint Company until it closed in 1955.

1906 Taylor and Wagstaff leased from the landowner, Richard Henry Prior-Wandesforde, the right to mine copper and lead for twenty-one years, retrospectively from 1 November 1905. Unfortunately the papers of the Boulder Flint Company relating to these transactions between 1906 and 1910 have not come to light, and it is the opinion of Mr R Borrows, of Hudson, Hart & Borrows, Solicitors of Richmond, that they probably went out in the wartime paper salvage drive. The Archivist of the National Library of Ireland, where the Prior-Wandesforde family papers are deposited, does not know of any relating to Richmond either, though the collection is not yet fully catalogued.

For the details of the working of the mine we can draw on Mr Close's memory. As with the earlier copper mining in the area the Billy Bank Mine drew on established local skills. The miners were from further up the Dale, and mostly ex-lead miners, the last of the lead mines having closed just before the turn of the century. Old Gang Mine for instance struggled on against technical difficulties and falling prices until 1898. The Billy Bank miners travelled each week to Richmond, where they lodged, returning home at week ends. Mr Close remembers Hutchinsons, Aldersons, Clemminsons; all typical Swaledale names, and also Frank Parker and his son Tom from Calvert Houses, Gunnerside. The same Tom Parker's daughter now Mrs Scott of Deighton, Northallerton, bears out the fact that the miners received only 18/- per week. Even the manager of the mine, Mr Close's father, kept four cows on a smallholding at Hudswell, for unlike the others he lived near the mine. Prior to the opening of the copper mine he had managed quarries, but had still found the dual occupation necessary, in the same way that miners and weavers had done for centuries.

The methods employed were simple in the extreme. In 1910 the entire plant and tools was valued at no more than £45/7/6d. Apart from blasting with gelignite, the ore was entirely won by hand. Access to the adit

mouth from the point where the riverside track begins to rise towards Round Howe was provided by a cartway of stone slabs supported on stones and raised above the normal river level, running some quarter of a mile at the foot of the bank around the bend in the river. From its mouth the working level penetrates nearly a mile, following the vein in a south westerly direction. This is a sizeable adit, some seven to eight feet high and as wide along most of its length, wide enough to accommodate two waggon tracks. The tubs holding three hundredweights each were pushed by the miners, ponies were never used underground, though horses took the ore from the bank to Richmond Station.

Parallel with the working level, and some fifty to sixty yards away, was a drainage level. Hence the mine was free from the problems associated with deeper mining, but could only be worked down to water level. Mr Close is of the opinion that the vein does not thin out below the rail level and that there is a good deal of ore left which was then unworkable. Although drainage was fairly simply tackled, the length of the workings caused problems of ventilation. The danger of foul air was tested by the simple expedient of candles on clay bobs. When a drift was driven eastwards looking for a vein of lead, air had to be pumped into the workings with bellows. As this drift was also through an unstable stratum of shale, and liable to roof falls, it was unsuccessful and abandoned. The attempted extension of the workings was no doubt due to the disappointing results in the first few years. Appendix G shows a sharp drop in production and profitability in 1908, the third year of production. In 1907, although production had increased as compared with 1906, the quality had deteriorated, only 5% compared with 7%. This was disguised by rising copper prices, from the statistics it is possible to calculate a price of £38/18/- per ton in 1907 and only £28/1/7 in 1906. The unpleasant truth was evident in 1908, when production fell to less than a third in quantity, and purity to only

2.8%. The price received per ton of ore fell from £2/-/5d per ton to £1/1/5d, so the value of production fell to a seventh. In 1908 the labour force had fallen by about half, and in 1909 although the mine continued to be listed no production was recorded.

The reopening in 1910, was probably influenced by rising copper prices. On the basis of the production figures copper brought £44 per ton in 1910,[15] £50 in 1911 and £47 in 1912. The final closure of the mine does not seem to have been due to a slump in general copper prices.

YORKSHIRE MINERALS LIMITED

As with Merrybent in the 19th century (see page 136) the operating company was reorganised from a partnership to a limited liability company, though in this case formed under the Companies Act of 1908. Like Merrybent also the registered office moved from a local address, at Reeth, to a metropolitan one, 20 Copthall Avenue, London EC. Being a Limited Company the papers of Yorkshire Minerals Ltd. were deposited with the Registrar of Joint Stock Companies when it was liquidated after an even shorter history than the Merrybent Companies.

Wagstaff continued as agent, but he and Taylor were bought out under an agreement signed on the 8 September 1910, and retrospective to the 25th May. They were to receive £2,800 for the Prior-Wandesforde lease; £500 in cash and £2,300 in the form of shares in the Company. For some reason not immediately obvious this was altered almost at once to £501/15/- in cash and 9,193 shares instead of 9,200. The registered capital of the Company was only £5,000 in 20,000 shares of 5/- each, of

15. List of Mines and Quarries.

which only 15,407 ever seem to have been allotted.[16]

The earliest of the documents, the Memorandum of Association dated 11 May 1910, named seven shareholders, the partners and clerks of the Solicitors, Allen, Edwards & Oldfield of 16 Eastcheap, each holding one share. They were only men of straw, the actual promoters being Johnson, Dowding, Money, Fison and Churleigh. Apart from Wagstaff and Taylor they continued as the majority shareholders, and the first four named formed the Board of Directors. The organization and capital structure of the Company was set out in full in the Articles of Association, deposited with the Registrar on the 19 May 1910.

The Memorandum stated the objects of the Company which were very wide for a firm with such limited capital. All processes and every conceivable object associated with the extraction of non-ferrous metals was covered, but we know from Mr Close that virtually no processing was ever carried out. The most that was done was washing in tubs, and as this proved wasteful, the ore was thereafter always taken just as it was to the station.

The first call on the shares, as recorded in the Report of the Directors presented on 12 December 1910, was 2/- of the 5/-.

16. The final list of shareholders was published on 14 December 1911 and contained seventeen names, as follows:

*	W Claude Johnson; Civil Engineer; Colemans Hatch, Sx.	5,300
*	F J Dowding; Mining Engineer; Upper Warlingham, Kent.	2,500
	W S Taylor; Potters' Merchant; Reeth, Yorks.	2,000
	J S Wagstaff; ditto ditto	2,000
	C A Allen; S.B.R.; 3 Cushion Street, EC.	2,000
*	S W Money; F.I.D.; 20 Copthall Avenue, EC.	500
*	T E Williams; Gentleman; Enfield, Middx.	500
	E R Johnson; Lieut.-Col.	400
	R Fison; Merchant; Enfield, Middx.	100
	A O Chudleigh; Director; 20 Copthall Avenue, EC.	100
	F Allen; Solicitor; 16 Eastcheap	1
	J Allen; ditto	1
	E Allen; ditto	1
	L Oldfield; ditto	1
	A Berney; Accountant; Beaconsfield	1
	D Melliss; Clerk; Croydon	1
	H Lovell; Clerk; London	1

The Balance on Capital Account at the time stood at:-

Receipts		Payments	
Call on 10800 shares	860	Purchase of Concession	500
Ore returns	145/18/9	Prelim. expenses	39
Loan, advance against return on ore sold	52	Wages & general expend.	495/10/10
		Balance in hand	23/ 7/11
	1057/18/9		1057/18/9

The 1910 production figures show a small production of only 76 tons, but a good quality of ore at 6.54%, and a good ore price of £2/16/10d per ton.[17] As this was probably only half a years production, the promoters were probably optimistic about the reopening. 1911 saw the labour force increased from 13 to 15, and production up to 270 tons, but the price obtained for the ore fell by 5/- per ton to £2/11/10.

In these later years the workings were driven upwards into the vein some thirty feet, where an upper level was cut, the ore being dropped through hoppers into the tubs in the main level. The mine was also suffering from problems of access. The roadway, constantly subject to erosion by the river, was beginning to collapse and the 1911 Statement, published on the 30 June, looked less hopeful. Another shilling had been called on the shares, but the account was in debt by £7, exclusive of loans and bank overdrafts. By the end of 1912 the Company could no longer meet its liabilities even when the shares were fully paid up. An an Extraordinary General Meeting on the 25th October the voluntary winding up of the Company was approved. Production had fallen to a third of the previous year, and quality to only £2/1/2d per ton.[18] Six men only were at work. The final notice of dissolution of Yorkshire Minerals Ltd., appeared in the London Gazette dated 10 October 1916.

In the annual statistics the mine continued to feature for a further two years, once more in the hands of the Boulder Flint Company, and still

17. List of Mines and Quarries.
18. List of Mines and Quarries.

under Wagstaff as Agent. Significant production had ended, but Mr Close remembers that Tom Ward continued to work there as Foreman for the Boulder Flint Company for about two years, but with little success. This presumably explains its continued inclusion in the List of Mines and Quarries. With the closure of the mine Mr Close himself went to work first at Brancepeth Colliery, and later in the ironstone mines at Skinningrove.[19] To date, the closure of Billy Bank Mine in 1912 marks the end of copper-mining in Richmondshire.

In the first days at Middleton Tyas the owners intended to carry out all processes, producing completely refined copper. They later found it more profitable merely to smelt the ore, and to send it away for refining. In the 19th century the Merrybent Company simply mined the ore and carried out a limited amount of inefficient concentration. At Richmond the ore was only mined and sent away unwashed. Unfortunately for the various proprietors the activity did not continue into the age of electrolytic separation, which saved even the ailing Coniston copper mine for a few years later. Nevertheless with rapidly rising copper prices revived interest in the copper deposits of Wales and Cornwall, and modern methods of extraction, using open-cast methods, it is possible that the whole story is not yet written.

19. J S Wagstaff continued to manage the chert mine until he died in 1918, when he was followed by his son. Mr E Cherry took over in 1922, and Mr Rowland Woodward in 1929, continuing until the mine closed in 1955 and the Boulder Flint Company was dissolved.

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INDEX