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MINING AND PROTO-INDUSTRIALISATION

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SYNOPSIS

In a paper presented to the International Mining History Congress, at Bochum, in Germany, Roger Burt questioned the received view that non-ferrous metal mining underwent a revolution in technique, size, structure and organisation in the early modern period.[1] *In particular, he looked at the supposedly pivotal role of German experts in introducing, or diffusing, mining technology and concluded that there was no evidence that the latter "had introduced any new technique, machine or method which had a significant or sustained economic impact on the industry". Instead, Burt proposed a radically different hypothesis, the implications of which are wide ranging, on which to base our understanding of the non-ferrous metal mining and smelting sector. The latter argued, contrary to the received view which saw larger mines, that in the early modern period "By far the largest part of the non-ferrous (metal mining) industry was organised on a basis very similar to that of textiles, with the groove, or small underground working, taking the place of the cottage workshop".*

It is the purpose of this paper to place that hypothesis within the context of the contemporary debate on rural industry and the origins of industrialisation through a process called proto-industrialisation.

Proto-industrialisation is a theoretical model of the kind used by historians to help them understand problems, such as, for example, the ways in which agricultural economies might become industrialised. Franklin Mendels coined the term, in his seminal paper on the subject, as a contribution to the debate on the origin of the Industrial Revolution and, more generally, on the genesis of industrial capitalism.[2] Mendels' original work paid especial attention to textiles and the model since has tended to ignore mining. This paper will, however, establish that, contrary to the accepted view, the model is particularly applicable to England's non-ferrous mining industry.

The debate on the role of rural industries in the process of industrialisation considerably predates Mendels and earlier writers, for example Thirsk and Coleman, made cogent contributions to it. Joan Thirsk noted that, by the seventeenth century, owing to land holdings becoming smaller as a result of partible inheritance, the farmers of Dent dale, in Yorkshire, were supplementing their earnings by stocking knitting, which she described as a local handicraft industry.[3] She also acknowledged that mining and agriculture were ancient bedfellows, especially in the western half of England where much of the farming was pastoral. The latter left the farmer free to mine whilst his family attended to the land and the animals.

Dual employment amongst mediaeval miners was addressed by Blanchard, who gave many examples, but his claim that it was practiced in the stannaries' was questioned by Hatcher.[4,5] The ensuing debate, on the relative importance of other earnings, particularly from agriculture, in family budgets, centred on

the degree of change towards wage dependency [proletarianisation] achieved during the period. Sadly, although this debate was in progress when Mendel's paper appeared, their mutual relevance was not developed and a false hypothesis arose.

It is not intended to discuss the general qualities of Mendel's model here but, because the following section seeks to examine its applicability to metal mining, a brief outline of the concept is necessary. Anyone wanting greater detail of the model and the discussion surrounding it is recommended to read L.A. Clarkson's summary *'Proto-industrialisation: The First Phase of Industrialisation?'*.[6]

The model was debated vigorously by historians and flaws were revealed. In particular, its detractors were quick to attack the grammatical slackness which, for example, led to the use of terms such as deindustrialisation to describe the process whereby proto-industrialised areas failed to become industrialised. The model was also criticised because it covered a large, ill-defined chronology from the sixteenth century to the early nineteenth century. This need not be a problem, however, if one accepts that different industries and regions progressed at their own rate. The debate was mainly about the relationship between agriculture and textiles, however, and the model's applicability to mining has not been considered.

The following criteria are those which, in the right circumstances, led to proto-industrialisation:-

1. Pro to-industrial craftsmen produced goods for markets beyond the regions where lived; often for overseas markets where there was competition from other regions.

2. The products were made by part-time peasant farmers who supplemented their incomes with other work in slack times, for example weaving or stocking knitting. This system was well suited to pastoralism, which demanded less of its labour than cereal farming, and benefited from the low opportunity costs of the workers. German writers have also suggested that harsh, mountainous regions were susceptible to proto-industrialisation.[7]

3. The growth of rural manufacturing created a market for food because proto-industrial workers grew less than was required to subsist. Their need to import food was, therefore, a stimulant to commercial farming.

4. Towns in manufacturing zones were principally centres of trade and commerce where the merchants lived. Moreover, the finishing processes were often done in towns.

Proto-industry may, therefore, be summarised as follows. It changed an area's demography by encouraging the population to grow beyond its food producing capacity. This provided the cheap, expandable supplies of labour on which P.I. thrived. More significantly, however, P.I. intensified labour and made greater use of all members of the family, particularly the cheap labour of women and children.[8] The latter were often waged and many papers have dealt with the process of proletarianisation whereby once independent farmer-manufacturers were turned into wage-earners as a result of their increasing

eliance on merchant-capitalists who supplied them with raw materials and bought their manufactured goods for resale in distant markets. Fluidity of capital was, therefore, an essential feature of proto-industry.

Proto-industry was a rural phenomenon and in most areas textile manufacture was the principal industrial activity practiced alongside agriculture. It is, for example, widely accepted that, in the eighteenth century, extensive areas of Yorkshire's West Riding formed a region of proto-industry based on worsteds and woollens. Rural industry was not, however, confined to the textile districts and, in much of the Pennines, it included coal and lead mining. Whilst it is not intended to look at coal in this paper it is useful to note that many colliery villages on the exposed West Riding coalfield are based on ancient agricultural settlements and may also exhibit features of proto-industrialisation. Moreover, thin seams of coal were worked in most lead mining areas, providing fuel for domestic consumption, limekilns and lead smelting. Mining and smelting are specifically ruled out of the proto-industry model, however, because it has been held, they required a relatively large investment in fixed capital.[9] Burt's compelling argument, for a multitude of small production units, removes the fixed capital obstacle and makes it possible to test the proto-industry model's applicability to the lead mining industry.

Before giving detailed examples, however, we shall first take the model's four requirements and apply them in turn to the industry in general to show that it too can fit the model.

1. Proto-industrial craftsmen produced goods for markets beyond the regions where they lived; often for overseas markets where there was competition from other regions.

From antiquity, Britain's non-ferrous mining fields transported the bulk of their output to distant markets, either for trans-shipment to London or for export. In Yorkshire, Swaledale lead went to Stockton on Tees and Wharfedale-Nidderdale lead went to York and Hull. The latter place also had a large trade in Derbyshire lead by the fifteenth century and shipped large quantities of it to Baltic and Western European Ports.[10]

2. The products were made by part-time peasant farmers who supplemented their incomes with other work in slack times. This system was well suited to pastoralism, which demanded less of its labour than cereal farming, and benefited from the low opportunity costs of the workers.

As remarked above, the sub-division of farms in Dentdale by partible inheritance forced the farmers to supplement their income in some other way.

Thirsk had already understood that a common factor in her rural handicraft industries was a populous community of farmers, often mainly freeholders or customary tenants with a tenure almost as good as freehold, pursuing a pastoral economy. She quoted the phrase 'scratch a weaver and find a parcener (co-heir)' in support of her argument on the effects of partible inheritance.

The decreasing size of holdings meant that underemployed and, therefore, cheap farm labour was commonly available in these communities, which were unfettered by manorial control. This phenomenon was not restricted to

Dentdale, however, and in his study of the Lead Mining Industry of Swaledale, Jennings observed that the economy of Swaledale passed through three main phases:[11]

> The first lasted to the seventeenth century and consisted of agriculture plus mining as one of a number of subsidiary activities.
>
> In the second, from the mid-seventeenth century to the mid-nineteenth century, mining grew to dominate the economy and at the height of this period a large part of the agricultural land was held in small holdings by men who were primarily miners.
>
> During the third, from the later nineteenth century onwards, mining declined and farming reasserted its dominance.

Clearly, Jennings' second phase agrees with Thirsk's comments on Dentdale and, coincidentally, stocking knitting was also important in Swaledale, where many miners who may, or may not, have been involved in agriculture were also stocking knitters.[12] The pastoral farmer's calendar demands breaks for servicing their stock, for example harvesting hay for winter feed and ling from the moors for bedding. Nevertheless, this easily fits the P.I. model's requirement for the need for alternative work in slack times.

3. The growth of rural manufacturing created a market for food because proto-industrial workers grew less than was required to subsist. Their need to import food was, therefore, a stimulant to commercial farming.

Taking Yorkshire's largest mining field, Swaledale and Arkengarthdale, as fairly representative of the mid Pennines, there appears to have been no attempt to grow corn in the upper part of the dale after 1600. A few farmers, however, continued to grow small quantities below Healaugh and most grain was imported. By the eighteenth century, some oats and potatoes were also grown but agriculture was largely pastoral, with sheep rearing being overtaken in importance by cattle fattening during the sixteenth century.[13] In the northern lead districts, part-time farming was also an important side of a miners' way of life.[14]

Although alternative sources of employment must have been important factors in this change, one cannot ignore the climate and elevation of the upper dales, which were unsuitable for intensive cropping. The area from the Scottish border to Craven was, however, well served by drove roads and farmers were able to concentrate on cattle rearing and some dairying, with Scotch Cattle being overwintered and then resold for slaughter. Foodstuffs were imported from the fertile, agrarian farming areas to the east of Richmond.

4. Towns in manufacturing zones were principally centres of trade and commerce where the merchants lived. Moreover, the finishing processes were often done in towns.

As one might expect with a relatively high value commodity like metals, there was no large local demand and, as already noted, the lead trade went to certain ports from an early date. The longevity of tin exports is also well

recorded. Even major market towns, like Richmond, had little or no influence on the lead trade, which was in ingots, and, almost without exception, the finishing processes were remote from the area in which the metal was produced. From the foregoing, we can conclude that non-ferrous metal mining areas did pass through a phase which equates with the basic requirements of P.I. and it is, therefore, appropriate to look at some specific examples.

From the Mediaeval period until the early seventeenth century, many lead mining areas were regulated by Customary Law which encouraged miners to take up small grants, gave them usufruct and resulted in myriad small mines, many only producing a few tons of lead each year. This system, with its potential and necessity for dual employment, provided ideal conditions for P.I. and historians have long accepted the interchangeability of the roles of miner and husbandman in these regions.

Blanchard wrote that "under conditions of acute demographic pressure, such as existed in late thirteenth-century England, one might well find mining communities in which each member, with only a small plot of land and perhaps a cow, was dependent upon his ore sales for a livelihood ...". When the poll tax records of 1379 were examined, however, he failed to find anyone classed as a miner and "that men known to have been engaged in the industry preferred the title ***cultor,*** for that was what they were, farmers to whom mining was an insignificant sideline ...". Blanchard illustrated this by taking the case of one man, John Philips jun., from a study of all but two of the sixty or so miners in the Chewton mining community, at Mendip, in 1540. Philips was "a not a typical miner, whose labours in the meers overlooking Wells normally in the early 1540s seem to have yielded him slightly over a hundredweight of ore annually". The Philips' were one of the three main village families in Chewton, with substantial land holdings. Blanchard felt that Philips was in no way different from his contemporaries in Mendip or Derbyshire and proposed the following as the work pattern of the husbandman-cum-miner.

> "At some time, having acquired a meer either by purchase or prospecting, he entered upon the life of a miner. Thereafter each year, with spring ploughing and lambing past, he would pick up his basket of tools, don his leather 'bradder', and set off each day from about the middle of April to the hills overlooking his farm to grub for ore. There he would toil in the shallow trenches which represented the workings until July or August when the call of the harvest would return him to full time work on his farm. At the end of a season, if he was lucky, he might have accumulated a couple of tons of ore, which after the payment of tithes and lot and cope might yield him a cash income of from 15s to £2, according to the state of the market. Mining, therefore, whilst absorbing little of his working time and dovetailing easily into his agricultural activity, did provide the peasant-cum-miner with a significant cash income"[15,16]

Hatcher rejected the above scenario's relevance to the stannaries, which had their own Customary Law, and observed that, by the later Mediaeval period, "the organisation of the stannaries ... was highly capitalistic with both a marked division of labour and a marked division between capital and labour". He concluded that "the characteristics of the lead miner and of his relationship with the agricultural community, at least as they have been described to us [by Blanchard], may have stronger claims to singularity than to universality".[17]

Nevertheless, there is ample evidence of dual employment amongst tin streamers and miners in south-west England.[18,19] Moreover, Hatcher contradicts his own case by showing that, in the mid-fifteenth century, from 65 to 75 per cent of Cornish tin was produced between late June and Michaelmas, with corresponding figures for Devon of 87 to 95 per cent. This clearly demonstrates the seasonal nature of the work and it was only by the later sixteenth century, that much tinning in Cornwall had become a year round activity. Like the industrial organisation of lead mining, the work force, which worked deposits of alluvial or lode tin, along with ownership, had a diverse composition. Just as there is no evidence of significant proletarianisation amongst lead miners, there is little to suggest that it was a major feature in the stannaries either.

Many mediaeval farmers and their labourers clearly did turn to mining as a sideline but, because Blanchard and Hatcher concentrate on the masculine role, we also need evidence that greater use was made of all members of the family, particularly the cheap labour of women and children. It is difficult to detect them in earlier periods, however. This is because the miners were responsible for presenting their ore ready-dressed for smelting and, as a result, most surviving accounts only cover ore sales and the deduction of duty. The equipment needed for dressing consisted of hammers, shovels, rakes, sieves and tubs and until the early nineteenth century, when it became increasingly mechanised, the process demanded little fixed capital.[20] The detailed accounts of a small lead mine near Burnley, which was worked on behalf of Charles I, from 1629 to 1635, include payments to wives and children for winding ore, rock and water from the shafts and washing the ore.[21]

This mine, often quoted by historians, falls outside the proto-industry model, however, because it was worked on day wages for almost its entire life. The accounts of the extensive Wharton lead mines, in Swaledale, which were worked by bingtale and fathomtale, show women working waste ores but they do not give payments for dressing, winding ete.[22] Nevertheless, there is ample, if fragmentary, evidence from seventeenth and eighteenth century accounts, to show that lead miners were often served by their family but, unlike in coal mining, few, if any, women worked underground.[23]

The system of customary law persisted in Derbyshire but was dropped in other areas, for example the north Pennines and most of Yorkshire by the late sixteenth century. At Grassington, in the latter county, where customary law was used until 1774, fairly small mines predominated until the 1820s, when the Duke of Devonshire's Mineral Agent started to consolidate them.[24] It is useful, therefore, to consider the transition from mines which were owned by individual miners or small partnerships, and which worked one or two meers, to those which covered larger areas and were dominated by capitalists.

By the mid eighteenth century, larger mines needed more fixed capital for whims and pitwork but there were many which required little more than a windlass, ropes, a bucket and a few tools, amounting in value to about the same as a hand loom. This, together with Burt's argument, shows that Mendels' observation that "Fixed investments were not a prerequisite for the success of enterprise [and that] mercantile capital was basically in the form of raw materials,

goods in progress and accounts receivable [because] the basic tools in most industrial processes were simple" is relevant to mining also. The labyrinthine conditions of the mine made supervision of a highly dispersed labour force difficult; a problem which was solved by adopting systems which spread the owners' risks, by putting the onus on the men, and encouraging the latter to be self-motivated. What emerged was broadly analogous to a blend of the factory system of "Room and Power", with the mine owners providing the fixed capital, and the "Putting Out" system, with the miners providing the working capital.

Mendels also noted that "proto-industrialisation had created an accumulation of capital in the hands of merchant entrepreneurs, making possible the adoption of machine industry with its (relatively) higher capital costs". This view is supported by Honeyman's study of the social background of the investors in Derbyshire soughs during the eighteenth century. This concluded that around 75% of the sample were members of social class one, the aristocracy, gentry and major businessmen, such as smelters, lead merchants or rich miners.[25]

Although ownership of a smelting mill was well beyond the means of most farmer/miners, smelting needed fairly low levels of fixed capital. It took large amount of working capital, however, which was absorbed by the stocks of ore, coal, fuel and carriage charges. The period in question saw a revolution in smelting techniques with the demise of the bole, in the late sixteenth century, when the ore-hearth was adopted, and again at the end of the latter century when the cupola or reverberatory furnace was introduced. The organisation of smelting differed from region to region.

The Derbyshire smelters, or brenners, purchased small parcels of dressed ore from the miners, which they mixed and smelted. By the sixteenth century, smelting was dominated by brenners, who developed into a social elite which included a few local gentry families. Because boles had infrequent smelting regimes and consumed prodigious amounts of timber at each firing it was necessary for their owners to be wealthy. They also carried the costs of carrying the pig lead to market at Hull.[26] The ore-hearth and later cupola smelting mills had more regular smelting regimes and a new class of owner, from amongst lead merchants in local towns, came to dominate the smelting industry and the lead trade.

In Yorkshire it was common for each liberty to have its own smelting mill, which was owned by the Mineral Lord, and miners were -required to smelt their ore there under pain of forfeiture for default. This type of system was also used in the north Pennines but there, the early take-up of extensive leases by joint stock companies led to the building of company mills. This system was also widely adopted in Yorkshire from the end of the eighteenth century.

Because of the potential longevity of proto-industrialisation in mining, and the dearth of detailed information on the early workforce, it is, therefore, often easier to look at the transition to the fully industrialised stage. The latter process occurred at varying speeds but, in general, during the eighteenth century, mines were worked by Mineral Lords, land owners, independent venture capitalists and partnerships of working miners, whilst by the nineteenth century the majority of ore came from mines which were worked, under lease, by private

companies. Management was then undertaken by an agent or steward who, in large ventures, was assisted by surface and underground agents. Even by the eighteenth century, when a large area was worked by one company or a mineral lord, for example Arkengarthdale, there were many mines working at once and the smaller ones were often worked seasonally.[27]

One of the main issues of the debate over P.I. is its value in predicting the emergence of industrialisation because it is supposed to carry the seeds of the latter. Regions of pro to-industry frequently regressed, however, and became deindustrialised. This phenomenon is also seen in mining, where, for example, Somerset (the Mendip), large tracts of Derbyshire, part of Yorkshire and much of Devon never progressed to large centralised mines, i.e. industrialisation. In this respect, the success of mining is a special case because it is largely determined by the presence of sufficient mineral which can be won profitably. The examples listed above simply failed that test and, excepting the Mendip, it was left for big mines to emerge in the richer parts of those counties. The high value of tin and its relative scarcity, especially with the shift to lode mining in the seventeenth century, led to industrialisation earlier than in lead mining.

Large, centralised lead mines evolved in the nineteenth century but, in Derbyshire at least, "proto-industry" often remained alongside them.[28] As late as 1856, one important fact that emerges from the evidence of several
witnesses to the commission on the Rating of Mines is that lead mining and agricultural work were complementary and not competitive. The small independent miners, in particular, frequently worked underground in 'winter and took agricultural jobs in the summer, especially at harvest time, when they could earn 25 - 30 shillings a week.[29] The vestiges of the system were alive in Swaledale during the 1860s when the Kinnaird Commission found that "In some districts, small parcels of land are attached to the miners' cottages, enabling them to keep one or two cows, and affording them healthful employment in the open air".[30]

This paper does not purport to show that P.I. was a necessary or an all-embracing phase in every lead mining area but its conclusion is simply that the industry can be considered as part of the proto-industrialisation model. Even such a simple conclusion has significant implications for historians, however, because it re-opens the debate on two of the mediaeval staples (lead & tin) which had hitherto been specifically excluded from the model. The exclusion of smelting, however, was reasonable because it does not fit the model. Further research is needed to answer the question of the model's applicability to the coal and ironstone mining industries but, like the non-ferrous metals, it is likely that P.I. will be recognised in such areas as the Forest of Dean. In other places, where colliers were tied to the colliery owners by bonds, it may be absent.

For mining historians, it is a further reminder that the industry should not be studied in isolation and that research should be broad enough to place mining in the context of neighbouring industry, especially agriculture. The durability of lead mining communities at times of crisis and continual low wages may, in part, be a result of the subsidising effect of combining farming and mining costs.

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   Burt, R. *The International Diffusion of Technology in the Early Modern Period: The Case of the British Non-ferrous Mining Industry.*

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These agree with the low level of output remarked on by Blanchard, who noticed that "Output per man rarely exceeded one or two tons of ore annually" and "At Llanbardarn, Glamorgan, in 1301, the four workmen in the mine raised only about two tons of ore each during a year and this was said to be a 'good' mine".

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> Get up, take thy breakfast, and go to the moor [to work tin];
> The sea-tide of the morning is nothing worth.

Showing clearly enough that from early times this intermixture of employments was to be found, among the ancient alluvial tin-stream workers no less than the latter day miners".

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Number of people employed at waste ore production: ditto.
Number of horse loads (of ore) per mine: ditto.
Amounts of ore got by the waste workers per horse load: ditto.

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Evidence of William Wyatt, Land Surveyor, of Foolow, near Bakewell. The mine is my own and people apply to me [for work], in winter time particularly it is an object to have employment. In the summer-time, miners sometimes go to harvest and other outdoor employment. That is the way in which mines are generally worked in the high Peak. Wyatt paid his men from 15 to 16 shillings per week, which he considered good wages, and there was plenty of labour to be had. Men can go off in harvest time, for a month or six weeks, and get 20 to 25 shillings a week. Many keep a cow and rent small plots of land, and many are small freeholders as well.

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Most of the men (in Swaledale) have small holdings of land, which enables

them to keep a cow and a pig, and which provides them with milk, a cheese for home use, and butter and bacon for market.

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