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THE NENTHEAD & TYNEDALE LEAD & ZINC COMPANY LTD. 1882-1896

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(The substance of this article was presented as a short talk at a meeting of the Northern Mine Research Society held in Billingham, Cleveland, in September, 1975.)

Introduction

Most writers on the lead industry of the British Northern Pennines during the last half century mention the Nenthead & Tynedale Lead & Zinc Company Ltd. The company has three commonly stated claims to fame: firstly, in 1882, it took over the leases of mines in the Nenthead area previously held by the London Lead Company; secondly, it initiated the transition from mining for lead to mining for zinc. Thirdly, in 1896, the Nenthead & Tynedale Company handed over its unexpired mining leases to the great Belgian Mining organisation, the Vieille Montagne Company of Liege, which, in the ensuing years, carried out extensive working of the mines round Nenthead for zinc. During the period from 1896 to 1921, the VM Co produced 92,000 tonnes of zinc concentrates from the locality;[1] by the time the Belgian company withdrew from the field of Alston Moor in 1947, more than 250,000 tonnes of blende (i.e. zinc-sulphide mineral) had been extracted from the old lead workings, as well as from large developments at Nentsberry and Rotherhope Fell .

In the early years of this century upwards of 300 were employed in the Vieille Montagne mines in the Northern Pennines, while the money disbursed at that period amounted to some £40,000 a year.[2]

This article is based upon documents relating to the Nenthead & Tynedale Company, coupled with a survey of established sources. Contributions and [22] comments from others would be welcomed, in order to augment the amount of knowledge concerning the company that is readily available.

The Early Use of Zinc from Alston Moor

The first use of zinc minerals from Alston Moor is said to have occurred in 1794, in which year Richard Grey

"…. obtained a grant of the calamine found in Nenthead fields and Haggs North vein mines. He was engaged with washing the old refuse heaps of the former of these mines to about 1831.[3]

It seems likely the dressed carbonate mineral was sent to industrial centres such as Sheffield or Newcastle for incorporation, with copper, into brass.

For a few years around 1820, the Commissioners of Greenwich Hospital maintained a section for zinc-making at their Langley smelting mill in Northumberland, but the fall in the price of spelter, or zinc metal, during the 1820s, led to its abandonment. It was probably in connection with this attempt at smelting that, in 1817, "considerable

quantities of black jack or sulphide of zinc were raised by Thomas Shaw and Company from the Guddamgill and Brownley Hill mines."[3]

The first-edition O.S. map[4] marks a 'spelter works' situated near to Nenthead at Wellgill, close to the workings on the Gudhamgill and Brownley Hill veins – the grid reference of the building would be NY 777444. An aqueduct there presumably served a water-wheel providing power for breaking down the zinc ores, but it was not a smelting works. A tramway connected the building with the Bloomsberry level at the mouth of Gudham Gill. The site has since been covered by the railings dumps from later dressing operations. Most likely referring to this building, Wallace in 1890 observed:[5]

"At Nenthead the Methodist Society's meetings were at first, I believe, held in the school-room at Foulard, about one-half a mile from the village; generally known as the Calummy House, now in ruins .... it was used as a store-house of ores of zinc, by Thomas Shaw & Co. in 1817."

Demand for zinc increased considerably as the 19th century progressed, and in 1845 the site for a new smelting works was leased midway between Alston and Brampton, on the estate of the Earl of Carlisle: this became known as the Tindale Fell works.[6] The proprietor of the venture was James Henry Attwood, one of a family having wide interests in minerals and metals. The site selected was conveniently placed for receiving raw materials from Alston Moor, and it was close to collieries at Hallbank Gate and Midgeholme.[7] In addition, the Earl of Carlisle's private railway system skirted it.[8] It was the spelter works at Tindale Fell which, from 1882, formed the 'zinc' part of the Nenthead & Tynedale Company's assets.

The Origins of the Nenthead & Tynedale Company

The Nenthead & Tynedale Company was closely associated with the Swan family of Newcastle upon Tyne. Shortly before 1830, two brothers Swan were born in Sunderland, where they grew up and attended school. After an abortive apprenticeship to a tailor in Sunderland, the elder brother, John Cameron Swan (1827-1916), moved to Newcastle where he trained as a chemist and druggist, and was then employed as dispenser at the Homeopathic Hospital in the city. He was soon followed to Newcastle by his younger brother, Joseph Wilson Swan (October 1828-May 1914) who entered the business of Mr. John Mawson; in due course he gained a distinguished reputation for his part in improving photographic materials and in developing the filament electric lamp. In later years he was Sir Joseph Swan, FRS. [23] Meanwhile, in 1855, John Cameron Swan opened a general merchant's business on his own account. Before long the merchandise handled included ores and chemicals.

In 1868, following the death of Mr. Attwood, the Swans created a company, the Tindale Spelter Company, to acquire the zinc-smelting works at Tindale Fell. At that time the works was producing some 800 tonnes of metal a year, partly from zinc-bearing materials transported from Alston Moor, and partly from imported zinc ores. During the next fourteen years, under the active direction of J.C. Swan, the yearly

output increased to about 1400 tonnes, but imported ores rather than the local mines supplied much of the raw material.[9]

The London Lead Company, at its mines in the neighbourhood of Alston Moor, had been interested solely in lead. Large quantities of good zinc minerals were left standing in the mines, or were packed into old workings as 'deads' to help support the roof. The Swans no doubt soon came to regard control of the mines as advantageous. In 1879 the Tindale Spelter Company obtained, presumably from the LLCo. the leases of two mines lying 1½ to 2½ km east of Alston - Bayle Hill and Farnberry, and in the following year the dressing floor at Wellgill was leased. In face of increasing competition from foreign lead, coupled with simultaneous rise in mining costs resulting from exhaustion of readily-accessible mineralised veins, the London Lead Company was attempting to contract its holdings and rationalise its business in the northern Pennines.

The Swans entered into negotiations, with the result that agreement was reached for the transfer of mine leases in the Nenthead area, and for the sale of the lead-smelting mill at Nenthead together with the freehold of the large estate known as 'Priorsdale". This extended outwards from Garrigill, south-eastwards to the county boundary between Cumberland and County Durham, and northwards as far as the boundary between Cumberland and Northumberland.[10]

(J.C. Swan was chairman of the Green Hurth Mining Company which, in neighbouring County Durham, held the lease of land extending to meet part of Priorsdale at the county boundary.)

According to Dr. Arthur Raistrick, the total sum agreed to be paid to the LLCo. was £30,562. 7s. 6d.[11] although a document prepared for the buyers in October 1882 referred to £50,000 as the estimated cost of the Nenthead deal.[12] Whatever sum was actually entailed, it required to be raised, and so it came about that in 1882 the Prospectus for a new company was published - that of the Nenthead & Tynedale Lead & Zinc Company Limited. As its title implied, the aim was to treat both lead and zinc, and it was hoped thereby to achieve lower unit costs for mining and also for marketing the metallic products. It was realised that the price for lead was poor but, besides affording the opportunity to obtain the assets of the LLCo. it was hoped this weakness would quickly pass. As things turned out, although the price of lead improved during the first few years of the new company's activity, after 1889 it fell again to even lower levels (i.e. less than £10 a tonne), and this was one factor contributing to closure in 1896.

At much the same time that the Nenthead & Tynedale Company was formed, the London Lead Company surrendered its leases in Weardale and sold its property in Stanhope. When these transactions were completed the long-established company retained as its sole holding in the northern Pennines its interests in Teesdale; by 1905 these interests too had been [24] closed and the company wound up. At much the same time that the Nenthead & Tynedale Company was formed in 1882 partly to acquire lead assets around Nenthead, in June 1883 – less than one year later – another

company was established to procure certain mining leases and smelting works situated in County Durham: this was the Weardale Lead Company Ltd. Although not connected with the original Weardale company, John Cameron Swan became deputy chairman of the concern some years later and following reorganisation. The Nenthead & Tynedale Lead & Zinc Company, then, was formed "for the purpose of acquiring all the Freehold and Leasehold property, Mines of Lead Ore, and Zinc Ore, Crushing, Dressing, and other Machinery and Smelting Mills, situated in the valleys of the Tyne and Nent, and hitherto owned and worked by the London Lead Company and by the Tindale Spelter Company."[13]

Interesting details concerning the operations of the London Lead Company at Nenthead, and the Tindale Spelter Company, are contained in a manuscript document which is fortunately preserved: Memorandum as to purchase of property ... (ibid). The Memorandum was prepared in October, 1882, during the first month of the new company's responsibilities, and while 'the plates of lead with the new mark are just commencing to be made'. The document, which runs to 12 sides of handwritten foolscap, takes the form of a critical assessment of the likely profitability of the new enterprise, and a commentary upon an estimate prepared by J.C. Swan. The report's author is not known. He stated that, while separate audited figures for Nenthead were not available, the overall printed accounts of the LLCo. for the year to 30 October, 1881, showed a working loss of more than £11,000. Some 9600 tonnes of lead were held in stock throughout the year. The author commented:

"through the length of time during which the London Lead Co. has existed, its affairs have fallen too much into unprofitable grooves, and its products have not been well sold ..."

For information relating specifically to Nenthead, the evidence of LLCo. officials had to be accepted. The full capacity of the smelting house was reckoned to be 8000 bings* or 3,250 tonnes of concentrates a year, although in recent times it had not worked at this level. Because lead ore "is habitually dressed to a nearly fixed percentage of lead .... it is calculated with confidence that 3 bings 1½ cwt, equal to 25½ cwt will make a ton of lead, and allowing for 3% loss in the crystallizing process 26¼ cwt (1.33 tonne) of ore should be the right proportion ...."

It was hoped that the new company would treat 5000 bings, or 2030 tonnes, a year from its own mines, to yield 1550 tonnes of lead; an additional 2000 bings of dressed ore could be purchased to augment revenue, the profit from such custom-smelting being estimated at £0.50 a bing. According to the experience of Mr. Bainbridge ('manager') processing costs of the LLCo. including depreciation, amounted to £2.80 a ton of lead, although at Nenthead the cost was actually somewhat lower, at £2.68 (2. 13s. 7d). exclusive of litharge-making.

A second metal product taken into account was silver, calculated to amount to 12,000 ounces (373.2 kg) from the 5000 bings. "Mr. Bolton the head of the Smelthouse estimates 3400 ozs silver to be a fair 'three months' work ...." In 1882 the selling

price of silver stood at £0.23 an ounce (i.e. £7.40 a kg), but by 1894 had fallen to £0.13. * one bing = 8 cwt = 0.40 long ton = 407 kg

The Potential Assets of the Company at Formation: (1) Nenthead Mines

The mine leases of the LLCo., in 1882, apparently had between 50 and 60 years to run.[14] They were held from the Lords of the Admiralty, as Lords of the Manor of Alston Moor. Royalty payments on production had been fixed at one-twelfth, but "during the recent depression in lead they have been reduced to one-eighteenth."[13]

Particulars of the mines, as given in the Prospectus of the new company published in 1882, are reproduced in Appendix 1. At that time, 163 men were employed in winning ore, with a further 26 on exploration or other unproductive tasks; work was proceeding on 27 veins in 11 localities. Altogether, there were said to be 51 "important veins and branches" lying within the mining properties. Weight was lent to the statements made in the Prospectus by the inclusion of a report by the civil and mining engineer T.J. Bewick.[15] Ore was cheaply extractable "for there are 43 miles of levels (of which 35 miles are laid with iron rails) and these effectively drain the mines…." Moreover, future prospects were attractive, for "The Admiralty deep level driven from Alston up the Nent Valley unwaters a section of strata 40 fathoms (73 metres) deeper than the present working levels."

As far as zinc was concerned, during the 14 years of the Nenthead & Tynedale Company's activities, mine production expanded considerably – from some 1500 tonnes of concentrate in 1881, to 5,500 tonnes in 1895 (for detailed figures see Appendix 3). For lead, however, there was no resurgence of interest in the years after 1881, and output dropped from 1600 tonnes of concentrate in 1881 to only 820 tonnes in 1894. The expense of processing the zinc concentrates to metal was substantially higher than the equivalent cost for lead-smelting – £8.15 a ton of metal compared with £2.80. The silver that was separated from lead after smelting formed a useful by product that contributed an extra 10 per cent or more of the value of the lead.

Mining costs during 1880 and 1881 had been running at £17,000 a year: the 1881 production of 1600 tones of lead concentrate and 1500 tonnes of zinc concentrate was the highest since 1875. For the future years, higher mine outputs were planned, at levels of more than 2000 tonnes of lead (which was not realised, as stated above), and 2500 tonnes of zinc concentrate (which was considerably surpassed). A figure of £19,000 was suggested as likely to represent the mining cost for these larger quantities.

In the light of these various comments concerning costs and tonnages, it is possible to draw up a rough financial balance for the Nenthead & Tynedale Company's workings, as envisaged at its inception in 1882 (Table 1). From the sums involved, it appears that, after taking overheads and unforeseen expenses into account, a working profit of around £6000 a year could have been expected. The basis of this estimate was a market price for lead of more than £14 a tonne, so that the lead product would

contribute nearly 60 per cent to the total revenue, with zinc accounting for less than 35 per cent. But in fact, by the end of the company's period of operations, the price for lead had fallen to less than £10, and it was zinc which had become much the more important product, accounting for nearly 80 per cent of metal sales revenue.

[26]

TABLE 1 - Estimated yearly revenue and expenses of the Nenthead & Tynedale Lead & Zinc Company Ltd. at time of formation, 1882.

		£
Expenses:		
Costs of mining drawing, and dressing	(5000 bings (2035 tonnes) lead ore (2500 tons (2540 tonnes) zinc ore	19,000
Lead-smelting and other treatment costs, including certain general charges and depreciation.		
2000 tons lead concs. to make 1542 tons (1548 tonnes) lead, @ £2.80 a ton		4,270
Carriage of zinc concs. from Nenthead mines to Tindale works, 2500 tons @ £0.30	750	
Smelting costs at Tindale, 2500 tons zinc concs. to make 750 tons (762 tonnes) zinc @ £8.15	6,110	
		6,860
Overheads and unforeseen expenses		3,000
		33,130
Revenue:		
Metal sales:		
1524 tons (1548 tonnes) lead @ £ 14.37		21,900
12000 oz (373.2 kg) silver @ £0.23		2,760
750 tons (762 tonnes) zinc (or spelter) @ £17.12		12,840
Profit from custom-smelting a further 2000 bings (814 tonnes) lead ore obtained from other mines @ £0.50		1,000
Profit from smelting 2000 tons (2032 tonnes) dressed zinc ore, purchased elsewhere @ £0.37		750
Rents from houses and farms		677
		39,927

Hence, working profit expected amounts to more than £6,000 a year.

The Potential Assets of the Company at Formation:
(2) Nenthead Dressing and Smelting Plant

Around 1840, a published account described Nenthead, "with its smelting-mills and its washing floors, on which may usually be seen a multitude of children engaged at work"[16] During the ensuing 40 years, however, the dressing equipment of the London Lead Company was modified, and was said to have been substantially improved shortly before transfer to the Nenthead and Tynedale Company. The Memorandum of 1882 observed:[12] "There are two excellent mills for crushing and dressing ore, one

of which needs some change to ensure greater regularity of stroke, both of which are handed over nearly new …. and there are other less modern appliances in other localities ... apparently in good working condition."

Of these concentrating mills, one served Smallcleugh level and other high levels, while the other was fed from Rampgill and Caplecleugh levels. There is a suggestion that the new company largely restricted its activities to the latter mill, situated in Nenthead village.[1]

Evidently the Nenthead dressing floors saw innovations around the middle of the 19th century, when several fresh kinds of separating machine were installed to deal with fractions of ore finer than about 1 mm in size. The new devices included a percussion table introduced to Nenthead by J.D. Stagg, a continuous moving canvas-belt separator developed at Allenheads by Brunton, and a pattern of slime trunk devised by a "Nenthead employee", Attwood.[17]

[27]

Nenthead smelting mill, built c.1740 by Colonel Liddell and partners, was sold to the LLCo. a few years later, and brought into use before 1750[18] During the 19th century it was one of the company's two chief metallurgical plants, the other being at Eggleston, 2 km east of Middleton in Teesdale. It was said to be capable of treating 3250 tonnes of lead concentrate a year, to yield 2540 tonnes of market lead. Other products were litharge, or lead oxide, "of a quality much appreciated",[13] and silver. It was claimed that all of the machinery, with the exception of that in the silver works, was worked by water power. The main storage reservoir, situated within the company's freehold of Priorsdale, possessed an area of nearly 3 hectares (over 6 acres) and a capacity of 80,000 cu. metres (17½ million gallons).

According to Raistrick and Jennings[19] soon after 1835 the first large-scale trials of Hugh Lee Pattinson's new desilverising technique were carried out in the "old smelt mill" at Nenthead. Pattinson's process exploited the change with temperature of the solubility of silver in liquid lead in order to separate the precious metal from the base bullion. Soon, J.D.Stagg[20] had devised a modification to the desilverising process in which some of the heavy manual work was eased by use of a crane. By the time of the sale of the works to the Nenthead & Tynedale Company, however, a substantial modification to Pattinson's original process had been introduced. In this development, attributed, to Luce and Rozan in Marseilles, steam was blown into the lead: this served both to stir the bath of liquid metal, and to hasten its cooling. The large number of pots required for "hand pattinsonisation" was reduced, although the Rozan steam process needed a specially shaped crystallising vessel.[21] In Northern England, besides Nenthead, "steam pattinsonisation" was in use at the LLCo's remaining smelting mill at Eggleston in Teesdale, and at Cookson's plant on the Tyne. For use of the patent, a royalty of 3s .6d was levied on each ton treated (i.e. £0.178 a tonne), but it was confidently expected this patent would expire in 1883. The Rozan treatment was reckoned to cut desilverising costs by about 12s. a ton (£0.61 a tonne).[12]

Another aspect of the Nenthead plant that merits comment was the equipment for condensing and collecting lead fume that arose in the furnaces. The stumpy iron-banded brick chimney at Nenthead remains a feature today, situated high on the open moorland to the east of the smelting house, and formerly connected with it by a system of flues. In 1842, the statement was made that "when the wind carries the smoke upon the road, as …. must be the case about three parts of the year out of four, it is most offensive to travellers, and in a populous district it would not be endured for half an hour. Even at the distance of half a mile it is disagreeable, and would be destructive to the health if a person remained long in it. When the wind blows in such a direction as to carry the smoke to the washing floors upon the children, or upon the village, it must be disagreeable."[22]

J.D. Stagg installed fume-condensing equipment (patented in 1843) in which the furnace gases were cleaned by passage through water held in a multiple-compartment chamber. This fume condenser was erected on ground near the plant on its northern side. From the smelter building the furnace gases were led to the condenser by means of a stone flue, carried on an arch across the roadway. In order to draw the gases through the tanks of water, some kind of pump was necessary, and at Nenthead there were "three large pumps working in alternation and moved by a water-wheel."[23] On behalf of the designer, it was claimed that[24] "The rushing of [28] air, smoke, fumes, &c, to supply what the air-pumps or other exhausting machines draw off, causes a very considerable motion in the water, and the dashing and spray consequent thereon, very materially aid the washing, condensation, and purifying of the fume, &c."

In fact, the oscillatory motion of the water was found to be a nuisance.[25] Moreover, the condensing chambers, together with the valves and other parts of the pumps, initially suffered seriously from the corrosive effect of the sulphur laden gases. In due course these difficulties were largely overcome, but, writing in 1870 Dr. John Percy doubted whether
anybody would erect a condenser of the Stagg pattern in the light of the experience gained over many years: it had proved to be expensive. Twenty five years later again, in 1895, Sir Isaac Lowthian Bell, the Middlesborough
ironmaster and doyen industrial metallurgist, writing a personal letter, went further in condemnation of the device:[26] "I remember at Nenthead …. there was an exhausting apparatus at work …. the wash produced there was lead fume of considerable value. The whole thing proved a failure." Of the fume collected (whether by the Stagg condenser and/or by the common hill-side flues), at the time of the sale in 1882, the Memorandum commented "The condensation of fumes from the Lead-Smelting house .... is so effectual that the Mill-Master thinks 2000 pieces or 100 tons of lead will be made from the chimney sweepings next time it is swept."

The Potential Assets of the Company at Formation:[3] Zinc

As far as the zinc side was concerned, the new Nenthead & Tynedale Lead & Zinc Company was to acquire the assets of the Tindale Spelter Company for the sum of £ 18,500.[27] Besides the equipment for smelting at Tindale Fell, the resources included the leases to the crushing mill and dressing floor at Wellgill (1 km west of Nenthead, along the Nent Valley) for which a yearly rent of £10 was paid and which were said

to be “quite new”, and to Bayle Hill and Farnberry Mines, held under lease from the Lords of the Admiralty - i.e. The Greenwich Hospital Commissioners. There was also the lease to Gudhamgill Mine which at the time was said to be worthless but which subsequently, under the well organised and adequately financed direction of the Vieille Montagne Company, yielded several thousands of tonnes of zinc minerals. In addition, the lease of a calamine (zinc carbonate) mine in Spain, at Almunecar, was included; for this, the Spanish Government was paid a yearly rent of £5.

The zinc works at Tindale Fell was said to have cost initially £7230, while a further £7000 was claimed as spent in improvements during the good years for zinc in the early 1870s.[12] Certainly its yearly output of spelter doubled from 700 tonnes in 1870 to more than 1400 tonnes in 1882. Site rent (including water) was £20 a year; neighbouring tenants were paid £65 a year in compensation for damages and, at the time of transfer to the new company, the site lease had 13 years to run.

The process involved in reducing calcined zinc concentrate to liquid zinc metal was non-continuous, laborious, and demanding in fuel and refractory clays. Its cost, for each tonne of metal produced, was considerably higher than the corresponding figure for lead – £8.15 compared with £2.80. At that time, to yield 100 tonnes of spelter, 330 tonnes of dressed ore were required, and the expenses of mining, dressing, and transport to the works might amount to £6.50 for each tonne of zinc.[28] During the years immediately prior to 1882, Tindale processing profit was said to average £1.25 a ton of metal (£1.23 a tonne). Under the proposed [29] reorganisation, the spelter works was expected to produce one half its yearly output, or some 760 tonnes of zinc, from Nenthead mine concentrates, while the remainder came from smelting imported materials. But as things turned out, by the 1890s the Nenthead mines were produci.ng sufficient quantities of zinc ore to keep the Tindale works fully occupied.

It is possible the assets of the Tindale Spelter Company, at £18,500 were somewhat over-priced but, in the event, £3000 of the total sum was still owing in 1895. What is certain is that zinc-making proved to be the mainstay of the new company. The market price for the metal increased substantially during the first few years, rising from around £13 a tonne in 1885 to £24 in 1891. By 1895, however, in similar fashion to lead, the zinc price had slumped again to a new low level of £12½.

Progress of the Nenthead & Tynedale Company, from 1882 to 1896
When the new company was launched its directors were:

T. Bell Barker, South Shields (Director, North Green Hurth Mining Co. Ltd.) Henry Nelson, Newcastle on Tyne and South Shields (Dale, Young, Nelson & Co. Bankers), John Pattinson, Gateshead, Major-General Henry Y.D. Scott, CB, FRS, Sydenham, (Chairman) J. Cameron Swan, Newcastle on Tyne (Chairman, Green Hurth Mining Co. Ltd.) and the Secretary was William M. Henzell, Junior, with office at 1 Dean Street, Newcastle.[29]

John Pattinson (1828-1912), director of the Nenthead & Tyndale Company through its 14 years of active existence, was public analyst in Newcastle, a prominent public

figure, son of H.L. Pattinson (of 'desilverisation") and brother-in-law of J.C. Swan.[30] Major-General H.Y.D. Scott died in 1883: how he came to be connected with the new company is not known. From 1886, he held a leading position in the development of South Kensington under the commission of the Great Exhibition of 1851, and was made responsible for building the Albert Hall.[31]

The Company began business on 1 October, 1882. Its authorised capital was £120,000 in £1 shares, but the amount of money available never reached anything like this sum. At the time the Prospectus was published, 40,000 shares had been 'privately applied for'; later, a further 8085 shares were issued to other subscribers. The company was evidently not a spectacular attraction to the investing public, although by 1883 its list of shareholders included 72 names. The directors at the time of formation (except for Major-General Scott) held 5000 shares apiece, and a similar number was held by J.W. Swan.

By March, 1884, 10 shillings (£0.50) had been called on each of the 48,000 odd shares issued, thus providing a capital sum of £24,000. In 1888, the company's capital stood at £43,000 paid up - equivalent to £0.90 a share – while mortgages of £36,000 had been incurred. For the year to 30 Sept. 1889, the accounts showed a nett profit of £2,230, making a total credit to profit of £4,100: out of this sum a dividend of 7½ per cent was paid. (It is not known what dividends were paid in earlier years). In 1890-1 a further dividend of 2½ per cent was paid, but this proved to be the company's last.

Although the quantities of zinc ore raised from the various mines increased steadily under the company's management (Appendix 3) and (following an initial drop to 1884) the prices obtainable for lead and zinc rose appreciably, after 1888 the market price of lead declined once more, and after 1891 that for zinc showed a similar trend (Figure 1). Thus, although the directors may, for a few years, have felt justified in their decision to float the undertaking, after 1891 they can only have been filled [30] with increasing gloom as the prices fell relentlessly to the disastrously-low levels of 1894-5.

According to the report presented to shareholders at the Annual General Meeting held in the company's offices, 4 St. Nicholas' Buildings, Newcastle upon Tyne, on 25 April, 1895, the Nenthead smelting works had produced 762 tonnes of lead and 0.234 tonnes (7533 ounces) of silver during the year to 30 September, 1894. In the same period, the Tindale Fell works had made 1900 tonnes of zinc.[32] But because of the falling prices, sales income must have been about £5000 less than that obtained in the previous year (Table 2).

At the beginning of 1895 the. company still had mortgages of £25,000 outstanding. In addition, there was a banker's overdraft of some £7000 secured by mortgage debentures, and the sum of £3,900 remained owing as part of the purchase money of the Tindale Spelter Company. These financial commitments were a crippling burden for, although the balance sheet could show "a profit" on mining and smelting operations of £531 .12s .10d ft interest charges demanded no less than £ 1891 .7s. 2d. so leaving a debit balance on the year's working of £ 1359. 14s. 4d. (1359.717).

Table 2 - Metals produced, and prices obtained 1893 and 1894.[32]

Metal Product	Quantity year to 30 Septr. 1893	Produced year to 30 Septr. 1894	Price obtained (nett at works) 1893 £	1894 £	Sales Income (deduced) 1893 £	1894 £
Lead	906 tong tons (920 tonnes)	750 tons (762 tonnes)	9.60	9.145	8700	6860
Silver	7533 ounces (234 kg)	7533 ounces (234 kg)	0.158	0.129	1200	980
Zinc	1854 tons (1884 tonnes)	1870 tonnes. (1900 tonnes)	17.89	16.133	33200	30200
Total					43100	38040

However, added to the difficulties that resulted from the low prices obtainable for its products, a further complication arose for the company: this was the expiry, in May, 1895, of the site lease of the Tindale spelterworks. Preparations aimed at a renewal of the lease had been started two years beforehand, and certainly one draft for a fresh lease had been drawn up. But there were difficulties. The Landowner, the Earl of Carlisle, had early discovered that a zinc smelter was not the nicest of tenants: it generated sulphurous fumes that killed the surrounding vegetation and upset farm animals; and it attracted men of a kind who (doubtless for want of other amusement) were interested in alcohol and poaching – and Lord Carlisle was a staunch total abstainer. Moreover, the workmen and their families were housed in badly-overcrowded cottages. Besides these complaints, it was claimed that, by raising the level of Tindale Tarn in order to obtain greater water power for the crushing machinery, the spelterworks' company had water-logged some pastures. Thus the terms proposed for renewal of the lease were such that J.C. Swan could not accept without argument, especially in view of the poor state of the metal markets. The result was deadlock. The spelterworks' lease expired. The following year it was reported that the works was being dismantled by the company.[33]

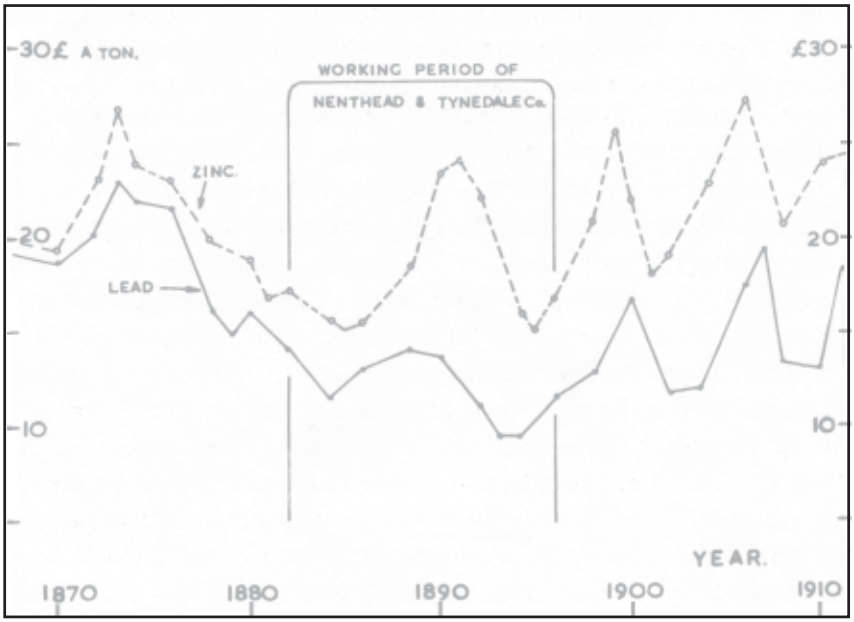
When the Nenthead & Tynedale Company's directors first came into contact with the Vieille Montagne Company is not known - or how that [31] contact came about, although it seems likely to have been a result of J.C. Swan's wide trading activities. However it was at the end of 1895 the Belgian concern took over the unexpired leases to the Nenthead Mines for a period of 42 years.[34] Probably a sum of around £35,000 was paid by the Vieille Montagne Company to the Nenthead & Tynedale Company in 1896 while the 'latter was still actively trading: a further sum amounting to £10,000 was paid by instalments over the next three years to July 1899.

FIGURE I. MARKET PRICES FOR LEAD AND ZINC. 1870-1910.

The Winding up of the Nenthead & Tynedale Company, 1896-1928

Luckily, as a result of the Company's (Winding-Up) Act of 1890, detailed evidence remains available concerning the transactions made during the period of liquidation.[35]

At a meeting of the Company held on 17 July, 1896, two special resolutions were passed. These were: (1) "That the Nenthead & Tynedale …. Company be wound-up voluntarily"; and (2) "That Mr. W.M. Henzell (Secretary to the Company) be appointed Liquidator …" In fact Mr. W.M. Henzell died in the following year after serving as secretary since the company's inception in 1882. His place as liquidator was taken by James Ions Clark who, in turn, was succeeded in 1916 by Edmund Percy Deas.[36] Despite the expectation, in 1896, that the winding-up proceedings would occupy "about four years", altogether the task took more than 30 years, for the last transactions were completed only in November, 1928.



On the occasion of the first repayment to shareholders, in August, 1896, there was a total of 65 names on the register, although three-quarters of the shares were held by 6 of the original leading proprietors. In the first few years, besides instalments from the Vieille Montagne Company (it was remarked that payments for the mines were conditional on the quantity of mineral to be raised), income came to the Nenthead & Tynedale Company from several other sources.

Rents of land and property brought in £600-£700 a year (from the VMCo and from others), shooting rights produced £50-£70, and sales of stores and other items - mainly timber - to the Belgian company provided amounts totalling £ 1200 during the six years up to 1903. By 1900, share-

Rents of land and property brought in £600-£700 a year (from the VM Co and from others), shooting rights produced £50-£70, and sales of stores and other items - mainly timber - to the Belgian company provided amounts totalling £ 1200 during the six years up to 1903. By 1900 shareholders had been repaid £0.337 (6s .9d) on each share held.

After disposing of the mining leases, the chief asset remaining to the company was the freehold of the 'Agricultural, mineral and sporting" Priorsdale estate of 880 hectares (2165 acres), valued by the company at £28,000, but carrying a mortgage of £14,000. Mortgage interest amounted to about £600 a year. In 1902, a field was sold for a parsonage, for £30. Shortly afterwards, an unsuccessful attempt was made to sell Priorsdale in its entirety: the London Estate Agents, Walton & Lee, were engaged, and the particulars of the property advertised by printed catalogue.[37] Amongst items of houses, plantations of timber, and stretches of open moorland, in Nenthead the catalogue described as for sale the fully licensed public house The Miners' Arms, together with other leasehold properties "comprising a considerable portion of the thriving village of Nenthead, and including ... School House, now used for purposes of Entertainment, the Reading Room, the Post and Telegraph Office, some Five Superior Residences .... 36 ... Cottages with Gardens, and some 32 acres (13 hectares) of valuable Accommodation Land ...."

An auction was billed to take place at the Central Station Hotel, Newcastle upon Tyne, on 16 June, 1903, but alas, the property remained unsold. The costs of the auction were put at £308; in the previous year Walton & Lee had been paid £51 .10 for "advertising property". At the same time, appreciable sums were expended on fences and other. Repairs to the estate.

The following year, the Lords of Admiralty purchased parts of the freehold area for £9750, to leave a residue of freehold property valued at £15,000 (with mortgages of £7,500). Again, in 1905, the Lords of Admiralty bought freehold property in Garrigill for £7,000, to leave unsold properties at Nenthead valued at £7,500 (but carrying a mortgage of £4,000). In 1909 a portion of leased land was sold to the Vieille Montagne Company for £400, and the concern continued to retain the use of other cottages and land at Nenthead, under lease, until 1922. Up to this time, rents of nearly £300 a year were paid. After the lease had been surrendered, steps were taken to sell the remaining property "in lots by direction of the solicitors acting for the mortgagee, as opportunity offers."[39]

It took unti1 July, 1928, to dispose of the last cottages, the total sum realised during this time being £4,400. In a final statement to shareholders at the conclusion of winding-up, in November, 1928, the liquidator summarised the transactions effected during the period from August 1896 (Table 3).

Table 3 - Main features of financial transactions during liquidation, 1896 to 1928.[4]

Property realised	£31,781	mortgage repaid	£14,000
		Interest	7,977
Rents received	10,935	arbitration award &	
Timber, scrap metal		expenses re	
and stores sold	1,521	spelter works	592
		estate upkeep	1,261
(some cash was available at the		returns of capital to	
beginning of the liquidation period,		shareholders	24,766
presumably as the result of sale		expenses	1,422
to the VM Co.			

Taken over all, shareholders got back £0.51½ (10s., 3.61) on their £0.90 paid, a total of £24,766 being redeemed during the period of liquidation. This relatively-satisfactory result reflects creditably on the liquidators, who sedulously did what they could in the interests of shareholders during a period extending for more than a generation.

Conclusion

The Nenthead & Tynedale Lead & Zinc Company Ltd tried to bring renewed commercial success to a group of well-established Pennine lead mines by integrating the use of zinc minerals with those of lead. The company entered the field at a time of low prices for both lead and zinc, and during the latter part of its 14 years of operations it had to contend with a climate of falling prices which, under any circumstances, would have made successful trading difficult (Table 4).

Table 4 - Approximate average prices for lead and zinc, taken over seven year periods.[41]

Years	Lead Price, £ average	Zinc Price, £ average	
1869-1875	20.3	22.3	
1876-1882	16.6	19.6	
1883-1889	12.9	16.9	) Period of operation of
1890-1896	11.1	19.7	) Nenthead & Tynedale Co.
1897-1903	13.4	20.7	
1904-1910	14.7	23.7	

It is interesting to speculate what might have been the outcome had the company enjoyed better market prices for its products, together with an extension to the use of its zinc-smelting site at Tindale Fell. There would then have been no incursion of the Vieille Montagne Company into the northern-Pennine field. But in that case, almost certainly, throughout the first quarter of the present century the mining of zinc and the search for fresh oreshoots would have been pursued with less vigour than was shown by the Belgian company.

Acknowledgements
I am pleased to record the help of Mr. Edward J. Deas of Gosforth, whose father, Mr. Edmund P. Deas, played an important part of liquidator of the Nenthead & Tyndale Company. Mr. E.J. Deas kindly showed me papers relating to the company, and has entered into useful and enjoyable discussion. I am also grateful to Mr. P. Jackson of Sheffield for generously making me a copy of a plan of Priorsdale Estate dating from the time of the events described" and to Mr. J.E .Richardson of Nenthead for providing the plan and agreeing to its reproduction here.

Appendix 1 - Details of mining work said to be in progress in 1882[13]

No. of Men Raising Ore	No. of Men On Dead Work	WHERE	Whether employed in raising ore, or in exploration
14		Rampgill Mine	Raising ore in Rampgill Vein and in Sun Vein.
	2		Crosscutting south, for proof of Sun Vein.
	4		Continuing Admiralty Level, east from Carr's Vein, for proof of Rampgill Vein.
5		Scaleburn Mine	Raising ore in Scaleburn Vein.
11		Carr's & Hang-	Raising ore in Smallcleugh Vein.
4		ingshaw Mine	Raising ore in Hangingshaw Vein.
8		Longcleugh Mine	Raising ore in Longcleugh Vein.
2			Raising ore in Carr's Vein.
8			Raising ore in West String.
14		Smallcleugh Mine	Raising ore in flat between Great Cross Vein and Smallcleugh Cross Vein.
4			Continuing opening drift for proof of Milburn's High Flat in Great Limestone and raising ore therein.
6		Middlecleugh Mine	Raising ore in 2nd. Sun Vein.
5			Raising ore in North Vein.
2			Raising ore in Middle Vein.
4			Raising ore in 1st Sun Vein.
16			Caplecleugh Mine Raising ore in Sun Vein.
6			Raising ore in North Vein.
8			Raising ore in North Lead.
6			Raising ore in Archer's Vein.
	4		Crosscutting south, from Coal Sills Level.
20		Guddamgill Mine	Raising ore in Guddamgill Vein.
4		Browngill Mine	Raising ore in North Side Vein.
4			Raising ore in Sun Vein.
12			Raising ore in North Lead.
	4	Slaggyburn Mine	Driving level south in west portion of Sir John's Vein.

	8	Priorsdale	Rising from crosscut for proof of string intersecting Black Ashgill Cross Vein and drifting to open ore working therein.
	4		Crosscutting east from drift for proof of vein in Great Limestone.
163	26		21 veins in which ore is being raised; 6 veins under exploration and development.

From: Prospectus. Nenthead & Tynedale Lead & Zinc Company Ltd. (Newcastle upon Tyne, 1882)

[35]

Appendix 2 – Details of mining operations during the year ended 30 September 1894 (compiled at 25 January 1895)[42]

No. of Men	Name of Mine	Production ld ore (bings)	zc ore (1 .tons)	Remarks
26	Rampgill	514	715	Ore won from 8 places. (At present January 1895, there are 15 men employed in 6 places. "The Deep Level working has been carried forward 9¾ fathoms (19m) in very hard ground – the 3 yards Limestone. A rise has been commenced and taken up 4.1/8 fathoms (8m) in the Plate."
7	Longcleugh	134	144	"At present there are four places being worked by 8 men …. On 'tribute', and the future will largely depend on the value of the ground …. opened out."
7	Smallcleugh	292	-	"At present there are ten men employed at three different Fore-breasts in the High Flats. Two of these places are improving and advancing into whole ground, which will give the opportunity of increased output."
56	Middlecleugh	661	1580	Ore "principally obtained from the Middle and second Sun Veins. A working in the west end, in whole ground," has been worked a length of 40 fathoms (79m) at the top of the Great Limestone and is fairly rich. A trial has been lately commenced to prove the strata above the Great Limestone, viz: the Coal Sills and Little Limestone …. If this trial is

Appendix: 2 cont'd/

				successful it will materially strengthen our facilities for cheapening production of lead ore …. There are at present 15 places being worked."
15	Capleclough	104	520	Four different workings. "The Forebreast has been advanced 24 fathoms (47 m) north-west during the year. This gives us a length of vein opened out of 38 fathoms (75 m) .. we think the opening drift should be pushed forward ... to open out yet another length of ground. "

[36]

40	Guddamgill	108	1306	"This is less than last year's output, chiefly on account of our having to stop the Forebreast in the North Vein ... to put through a crosscut for ventilation, and also to improve our method of working. At present we are lifting the Stopes from the crosscut northward ... We have 14 men employed in 'Flat' workings, and 26 in the 'Vein' workings."
?	Brownley Hill	48	121	".... a very satisfactory increase in yield of mineral as compared with previous years."
	Total:	2015	5479	
	1893 production for comparison:	1744	5378	
	Welgill Wastes	154	1093	"rather greater than last year's output ... having been able to put more Wastes through the dressing machinery."

One bing = 8 cwt = 0.4 long ton = 407 kg.

From Mine Agents' Report – Joseph Thompson and Walton Holmes, Mine Agents – Nenthead & Tynedale Lead & Zinc Co. Ltd. 12th annual balance sheet and report, to 30 September 1894. W.M. Henzell, Secretary. (Newcastle upon Tyne, 10 Apri1 1895).

Appendix 3 - Quantities of zinc ore raised by the Nenthead & Tynedale Company, and zinc metal produced

Year	Dressed zinc ore produced (tonnes) (rounded)	Zinc metal (or spelter) from Tindale Fell works (tonnes)
1882	c.1500	1430 (rounded)
1883	2300	1580
1884	2700	1400
1885	3100	1400
1886	3200	1210
1887	3250	1340
1888	3900	1540
1889	4050	1530
1890	3900	1550
1891	4000	1460
1892	5300	?
1893	5450	1880
1894	5550	1900
1895	5650	?
(1902	c.8000)	

Figures for dressed zinc ore are taken from Swan, J.C. in discussion of [37] The Alston mines, by the Revd. W. Nall. Trans. Instn. Min. Engrs. Vol.24 (1902-3), 410.

Similar, but not identical, production figures are given by Wallace, W: Alston Moor: its pastoral people …. (Newcastle upon Tyne, 1890), 159-60.

Figures for zinc metal are taken from The mineral industry, vol.1 (1892), 469. (New York, 1893), and from 12th annual balance sheet and report to 30 September 1894, Nenthead & Tynedale Lead & Zinc Company Ltd. (Newcastle upon Tyne, April 1895).

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(1) Dunham, K.C.: Geology of the northern Pennine orefield, vol.1 (HMSO, 1949), 167. (Mems. Geol. Survey Gt. Britain).

(2) Swan, J.C.: in discussion of The Alston mines, by the Revd. W. Nall. Trans. Instn. Min. Engrs. vol.24 (1902-3), 410.
At Nenthead, on the occasion of the VM Co's centenary in 1937, the local manager, Mr. Amos Treloar, stated that, since 1896, 14½ km (9 miles) of development work had been done, at a cost of £90,000, while £40,000 had been spent on plant replacements and the total sum expended "was not less than £700,000" (Vieille Montagne: a hundred years of zinc smelting, "A.R." Trans. Newcomen Soc. vol. 18 (1937-8), 266-7.

(3) Wallace, William: Alston Moor: its pastoral people. (Newcastle upon Tyne, 1890), 160.
These historical developments were summarised by Smith, S.: Lead and zinc ores of Northumberland and Alston Moor. (HMSO, 1923), 10. (Mems. Geol. Survey, spec. rpts. mineral resources Gt. Britain, vol.25)

(4) O.S. 1st edn 6 inch map, Cumberland XXXIV, surveyed 1859, published 1867.
(5) Wallace, note 3, p.74.
(6) Almond, J.K. Production of zinc metal and oxide fume at Tindale Fell, Northern England. Jrnl. Hist. Metall. Society, vo1.11, No.1 (1977). 30-38
(7) The last significant colliery, the King Pit at Halton Lea Gate, closed in 1954.
(8) Robert Stephenson's locomotive Rocket hauled coal on this line for a few years c.1840.
(9) Production of zinc ore in Cumberland, according to the official annual volumes of Mineral statistics (for HMSO) was as follows:-
1861-1870 5900 tonnes in 10 years, valued at £2.50 a tonne;
1875 1080 tonnes, valued at £3.20 a tonne on average;
1890 3900 tonnes, containing 42 per cent zinc, and having an average value of £2 .95 a tonne.
(10) The Priorsdale estate had been purchased by the LLCo for £7,300. In the first half of the 19th century 200 hectares (500 acres) were planted with timber for mine purposes.
Raistrick, A: Two Centuries of Industrial Welfare.
(London: Society of Friends, 1938, 29: 17.
(11) Raistrick, A: The London Lead Company, 1692-1905.
Trans. Newcomen Socy. vol.14 (1934), 119-62 (p.144).
(12) Anon.: Memorandum as to purchase of property etc. 27 October 1882. (Manuscript) in possession of Mr. E.J. Deas of Gosforth, Newcastle upon Tyne.
The Prospectus of the new company suggested £47,500 .

[38]

(13) Prospectus. Nenthead & Tynedale Lead & Zinc Company Ltd. (Newcastle upon Tyne, 1882).
(14) Swan, J.C. in letter to R.W. Cooper 28 January 1896.
Howard of Naworth Papers, C607/3, University of Durham.
(15) Thomas John Bewick of Haydon Bridge had been a pupil of Thomas Sopwith in the Allendale Mines and was concerned with mining and dressing ore at Langley Barony, on the north side of the Tyne corridor, north west of Hexham.
(16) Mitchell, Dr. James: Children's employment commission: appendix to first report (mines), part 2 (1842), 722.
At that time, little shelter was generally provided for those engaged in washing. The London Lead Company, however, did have 'fleaks':- large boards nailed together forming a wall of timber, which may be moved about from one spot to another, and so placed that the boys working at washing may be protected from the direct violence of the wind and tempest of rain but this is no protection when the rain falls directly downwards ...." (page 732).
Mr. H.L. Beadle, of Richmond, North Yorkshire, informs me that such 'fleaks' were in regular use in Teesdale in the early part of this century; they 'did not take much erecting and gave a lot of shelter on a windy hillside. It was not often the rain came straight down.'

(17) Raistrick, A and Jennings, B: A history of lead mining in the Pennines. (Longmans, 1965), 236-7, quoting Cat. Science Museum, mining and ore dressing. (HMSO, 1920), 84; 86-7.

(18) Raistrick and Jennings, note 17, p.145-6. Around 1820, the equipment installed was stated to be: 4 roasting furnaces, 2 refining furnaces, 1 reducing furnace, 4 ore hearths and 1 slag hearth. (Forster, W: A treatise on a section of the strata from Newcastle on Tyne to .... Cross Fell ... (Alston: 1821, 2nd edn.) p.418)

(19) Raistrick and Jennings, note 17, p.245.

(20) Joseph Dickinson Stagg (1815-1851) had a promising start as assistant to his father, Joseph Stagg, Superintendent for the LL Co. and in 1842 he was appointed 'manager of the mills, washing floors and counting houses.' Illness, however, forced him to retire in 1844, and he died young. (Raistrick, A: Two centuries of industrial welfare. (London: Society of Friends, 1938), 146)

(21) Collins, H.F: The metallurgy of lead and silver, part 1 - lead. (London: Charles Griffin, 1899), 300-4.

(22) Mitchell, James, note 16, p.736.

(23) Percy, J: Metallurgy of lead. (London: John Murray, 1870), 441.

(24) Armstrong, Sir Wand others (eds): Industrial resources of Tyne, Wear and Tees. (Longmans, Green, 1864), 154.

(25) This was one reason why most fume condensers came to contain brushwood or pebbles in the chambers to help to damp down the pulsations.

(26) "Extracts from letter from Sir Lowthian Bell to Lord Carlisle, 22 January 1895". Howard of Naworth Papers, C607/3, (University of Durham).

(27) The proprietors of the Tindale Spelter Company, in 1882, were: J.C. Swan, J.W. Swan, Elizabeth Mawson, John Pattinson, and Mary Allison Swan. (Prospectus, note 13).

(28) The cost of transporting zinc concentrate from Alston Moor to Tindale works was taken as about £0.30 a tonne. This sum was made up of two main elements: (1) cartage from Nenthead to Alston, @ £0.15 - a matter of 8 km (5 miles), and on a downhill gradient; and (2) railway freight from Alston station to Tindale @ £0.12½, a distance of 21 km (13 miles).

(29) Public Record Office: file BT31 /14717, contains details of the company, regd. no. 17356.

(30) John Cameron Swan, his family and friends, 1827-1916, by his daughters Emily and Mary. (n.d. but 1919-20), 73-5.

(31) Dict. Nat. Biography, vo1.17 (Oxford Univ. Press).

(32) Twelfth annual balance sheet and report, to 30 September, 1894. Nenthead & Tynedale Lead & Zinc Company Ltd. (Newcastle upon Tyne, 10 Apri1, 1895. The balance sheet showed over £1900 in wages was owing.

(33) For a fuller account of the circumstances surrounding closure, see Almond, J.K. Tindale Fell spelter works in east Cumbria, and its closure in 1896. Trans. Cumberland Westmorland Antiq. Arch Socy. (in the press).

(34) Particulars, plans and conditions of sale, of ... “Priorsdale” (Walton & Lee, Mount Street, London, c.1903); also note 14.

(35) Public record Office: file BT34/2501.

(36) Mr. E.P. Deas was, from the 1890s, associated with J.C. Swans commercial enterprises in Newcastle upon Tyne, and was also later a director of the Weardale Lead Company Ltd.

(37) Note 34. The catalogue contained a wealth of detail concerning buildings, tenants, etc. and included large-scale coloured plans of the area.

(38) This had been purchased by the London Lead Company in 1823.
(Raistrick, A: Two centuries of industrial welfare.
(London: Society of Friends, 1938, 24.
Besides dwelling houses in the freehold estate, Beldy House, Beldy Mill and five nearby cottages close to Carrigill were advertised as leasehold. These properties, and those in Nenthead village, were held under lease of 1000 years from 1621.
To Mr. H.L. Beadle I am grateful for the information that at one time a shaft, Beldy Gin Shaft, was sunk close to Beldy Mill in connection with the construction of an underground waterlevel which it was hoped would de-water Garrigill valley. Little headway was made, however, once in the Whin Sill, and the attempt was abandoned.

(39) Letter to shareholders from liquidator, 31 January, 1924.

(40) Statement of liquidator’s receipts and payments ... Edmund P. Deas (Newcastle upon Tyne, November, 1928).

(41) The figures are based upon values shown graphically by Smith, S:
Lead and zinc ores of Northumberland and Alston Moor. (HMSO, 1923), Plate 3, facing p. 12. (Mems. Geol. Survey, spec. rpts. mineral resources Gt. Britain, vol.25).