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ROOFS OF NENTHEAD SMELT MILL

by Raymond A. Fairbairn

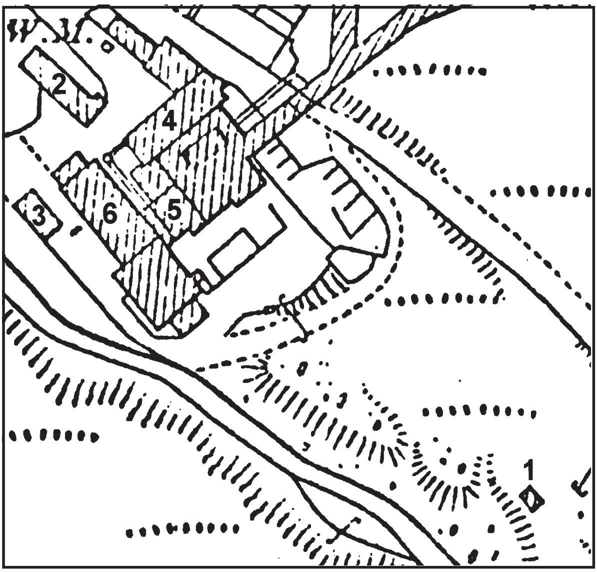
SUMMARY

When Nenthead smelt mill was being demolished in 1974, the author realised that, while many of the structures could be recorded as photographs or could be traced from the foundations, the details of the roofs would be lost forever. Measurements were made of the accessible roofs together with those of some of the buildings. The purpose of this article is to present the result of the work done at that time.

INTRODUCTION

The mill was first built in 1737 by George Liddell. Though it is by no means certain how much of his original buildings survive, it seems very likely that some of them are incorporated into the fabric of the later structures. In 1745 the London Lead Company purchased the mill and it seems that considerable rebuilding would have to take place to accommodate the processing changes introduced by this company. Most, if not all, of the roofs on the site were probably the work of the London Lead Company. The Company employed a considerable number of artisans, including joiners, and it is to the latter that the timberwork of the roofs must be attributed. All the early buildings were roofed with grey slates which were quarried locally. Welsh slate was only used on the later buildings. Figure 1 identifies the buildings that were standing when the measurements were made.

Fig. 1
Nenthead smelt mill with the location of the buildings shown.



Throughout the site, the standard of joinery is exceptionally high. King post roof trusses were used in most of the buildings. Clear roof spans from 3.56 to 9.1 metres were covered with grey slates. A clear span of 9.9 metres was covered with Welsh slate. The design of the king post trusses was modified as the span increased, the most extreme modification being that used for the 9.9 metre span Welsh slate roof. Sadly, the largest building on the site was lost before the measurements were made. It must have had a span in excess of 11 metres, but, as far as is known, no record of the roof structure has survived.

LIDDELL'S MILL

The following account of the cost of building the mill includes the source of the grey slates used for the roofs.

Alston May 26th 1737
Bargains made for building a Smelt Mill Viz
Let Joseph Archer & Thomas Yeates the
winning of Slates for Covering one side of the
House at 20s per Room Each Room to be
3½ Yds 7 Romes .... £7 - - -
Mr Emerson will furnish Slates
for the other Half at 7 £14
Let Thomas Forster the Wheel to make
& Bellos frames and hanging for 4 harths
& all other things belonging to ye Ironworke 15
Let John & Thomas Watson all the Slates to Lead from
Flintey fell and Killup for 14
Let Peter Muncaster & Nicho's Lee
the winning Leading and walling all the Hous
& Wheel hole and plastering the Chimneys
Casting the foundations of House and Wheele hole etc for ... 56 10
Richard Fetherston offered to take all the
Carpenter work Sawing and hewing and the
Chimneys 10 doors & Cases & 4 Windows
Sawing the Wall plate & as by Mr Walton
Letter to Mr Emerson Wherein he says the
Sd Rich'd Fetherston Impowerd him offer for
Him. The Laths is to be Included of oake 12
£111 10s

Where the quarry on Killhope was is not known, but Flinty Quarry is still being worked and provides some fine building stone.

THE BUILDINGS

Building No.1 - (Described by P. Jackson, 1969, as Carr's Level Mine Shop, though there is no proof that this was its function.)

This was the smallest building measured, with a clear span of only 3.56 metres. The roof used was a single collar with a single purlin per side. Similar trusses were used in the construction of local houses and barns. The roofing material was grey slate.

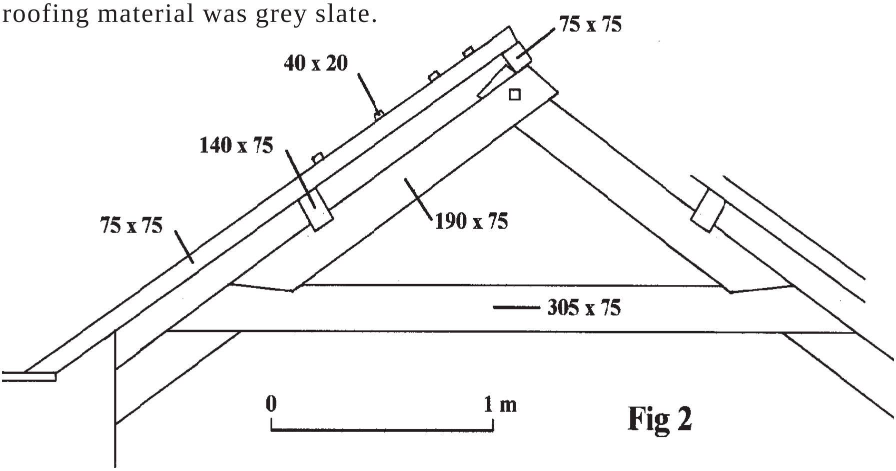
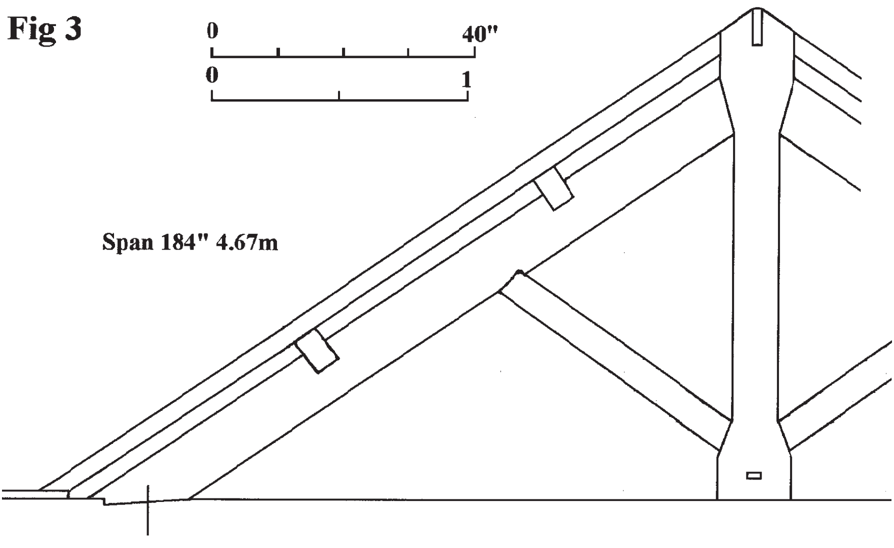


Fig 2

Building No.2 - The building was known as the Barracks because it was used to house Italian miners early in the 20th century. The presence of blocked doorways and ventilation slots indicates that the building had at some time undergone considerable modifications, including the replacement of the original roof. The building was one of the narrowest on the site, having a clear span of only 4.67 metres. The roof trusses were standard king post trusses without modification. The angle between the tie beam and the principal rafter was 35°, and the struts were set at 38° to the horizontal. The roof was of grey slates.

Fig 3



Building No.3 - Known as the Petroleum Store, this is obviously a recent name and the original use of the building is not known. A clear span of 5.54 metres was bridged by standard king post truss and two purlins were used. The principal rafter angle was 34°. The roof material was grey slates.

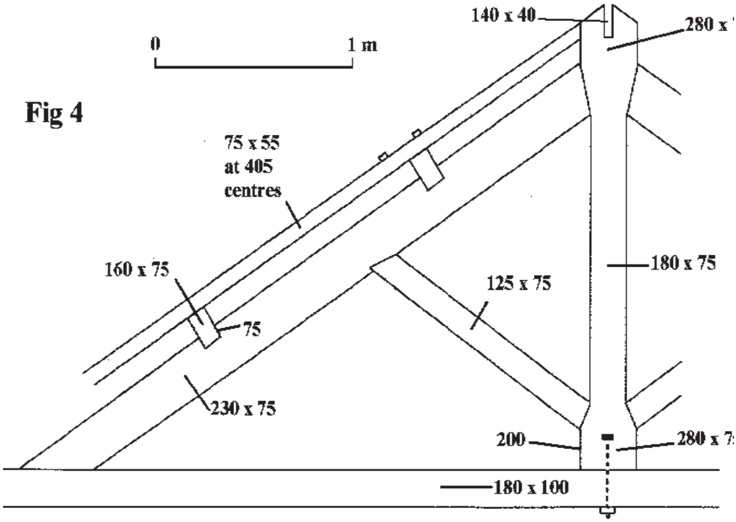


Fig 4

Building No.4 - (Designated A in the Northern Pennine Heritage Trust records.) The clear span was 7.11 metres and the trusses were king post with additional metal ties. The roof material was grey slate.

PLATE I Building No.4 (buildings No.2 to the left and No.3 to the right).

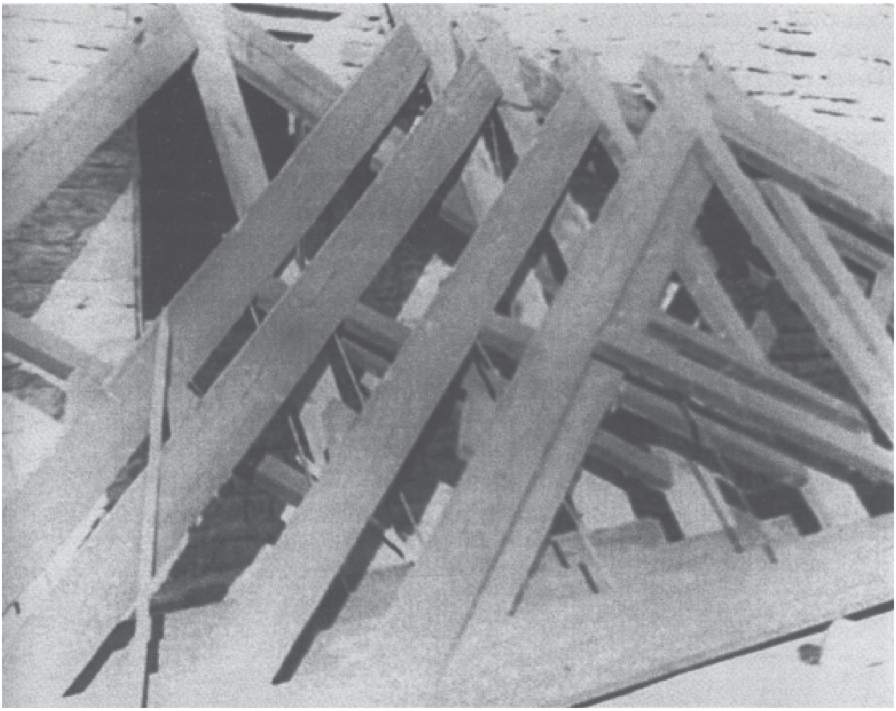
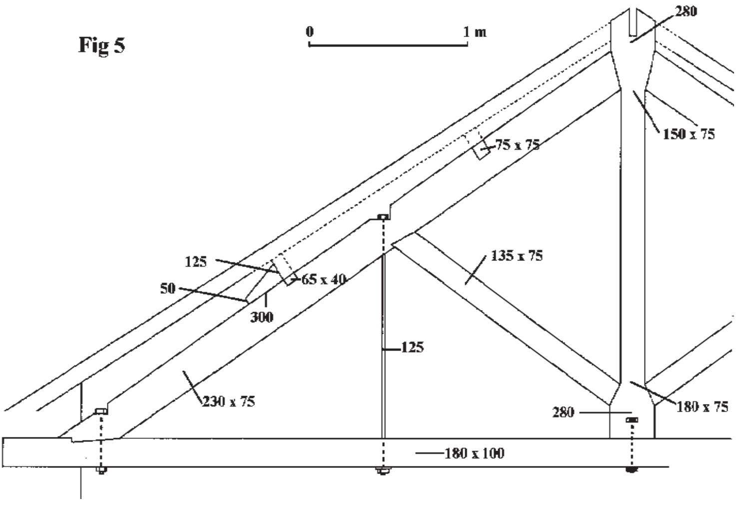


PLATE II   Trusses from building No.4.

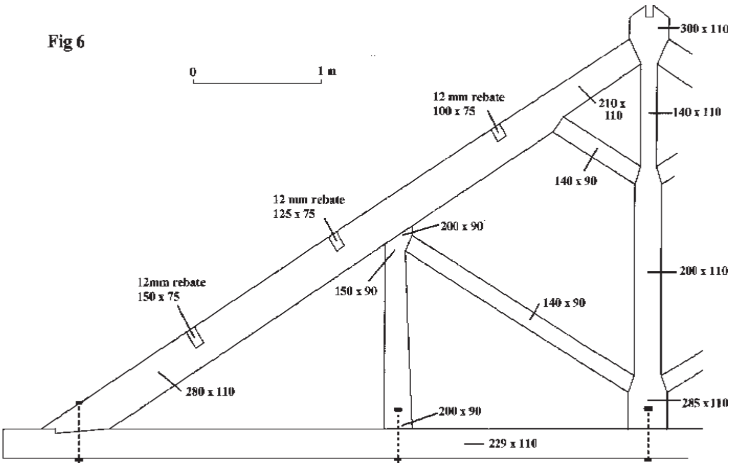
Fig 5



Building No.5 - (Designated F in the Northern Pennine Heritage Trust records.) The roof trusses were lying on the east side of the chimney. Measurements of the building, combined with a photograph taken before demolition, show that they belonged to the building situated at the end of the flue. The clear span was 9.14 metres and the trusses were king post with additional posts. Three purlins were used. The roof material was grey slate.

PLATE III Building No.5.

Fig 6



Building No.6 - (Designated C in the Northern Pennines Heritage Trust records.) This is the only building known to use Welsh slate. This was not available to the area until the late 1830s when several factors combined to make it available. Slate duty on sea borne slate was removed in 1831, the Newcastle and Carlisle Railway opened in 1835-8, and the turnpike through Allendale to Nenthead was built in 1826 making transportation easier. It is possible that the building was constructed to house the Pattinson process, as the

Fig 7

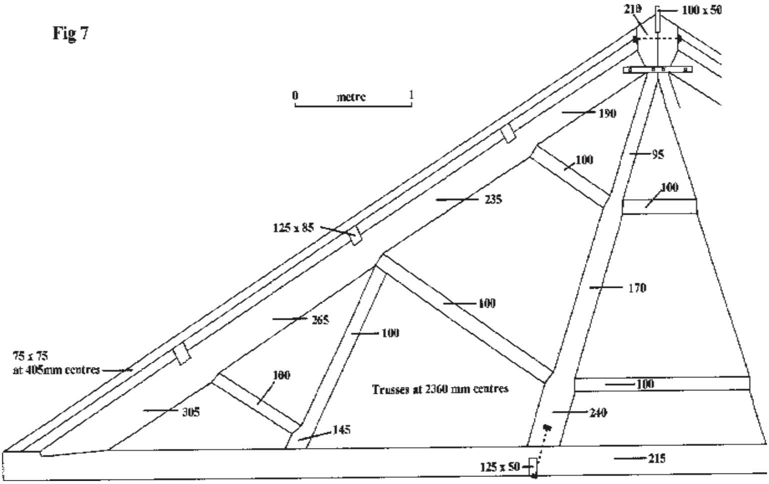


PLATE IV View inside building No.6.

London Lead Company purchased the right to use this process in 1836. The trusses used to span the 9.9 metres were highly-modified king post trusses.

GREY SLATES

Before the introduction of Cumbrian and Welsh Slates into the region in the 19th century, the local strata known as the Slate Sills provided a good quality roofing material. Locally cut slate was, in fact, thinly bedded sandstone. It was commonly called ‘grey slate’, possibly a corruption of ‘great slate’.

Usually the slate is oblong with a single peg hole situated centrally about 100 millimetres from the top. The upper edge of the bottom of the slate is feathered (or chamfered), and the two side edges feathered in opposite directions, so that each slate slightly overlaps the slate to its right.

LENGTH OF THE SLATE

The slates were produced in a wide range of sizes, the size being defined as the distance from the hole by which the slate was suspended down to the lower edge of the slate. In 1987 Smith recorded the name used in Weardale for the various size of slates. The author has measured the divisions marked on a slate-measuring stick used in Alston in the early 1970s.

WEARDALE	**LENGTH**		**ALSTON**	**LENGTH**		
NAME	**Ft**	**ins**	**No**	**Ft**	**ins**	**cm**
			XV	3	8¼	113
Wantingom	3	6	XIV	3	5½	106
Longmerkles	3	4				
Shortmerkles	3	2	XIII	3	2½	98½
Longsegrum	3	0	XII	2	11½	91
Shortsegrum	2	9	XI	2	9½	85
Longonwell	2	6¼	X	2	6¾	79
Shortonwell	2	4¼	IX	2	4½	73
Ember	2	2	VIII	2	2	67
Eighteen	2	0	VII	1	11¾	61
Sixteen	1	10	VI	1	9½	55½
Fourteen	1	8	V	1	7½	50½
Twelve	1	6½	IV	1	5½	46
Wobart	1	4½	III	1	4	40½
Nine	1	2¾	II	1	2	36½
Baisler	1	1¾	I	1	0	31½
Scutcheon		11¼				
Longbeck		10½				
Shortbeck		8¼				
Fare thee well		7¼				

The first conclusion has to be that there is a marked similarity between the Alston and Weardale measurements.

Examination of the list of Weardale names and lengths lead to the conclusion that it is a combination of two, or possibly three, separate lists and that some distortion has taken place during the process of combination to produce a smooth gradation.

The numerical Weardale names form a logical sequence whereby the length equals the name plus six inches. The long/short series was apparently at two inch intervals, starting at zero, with the shorts and longs falling onto sequential numbers. There remains Scutcheon, Baisler, Wobart and Ember which fall out of either sequence. It may be a coincidence, but, if long and short were applied to these names, there would be sufficient to fill the gap between Longbeck and Shortonwell. At first sight there should be no difficulty in combining two simple numerical sequences, but the slope of the relationship between name/number and length is different and to overcome this it has been necessary to introduce fractions of an inch which in real terms are not significant.

The Alston stick units may be a copy of the Weardale units, with errors creeping in due to repetitive copying. The alternative is a combination of two sequences.

How accurate are a grey slate's dimensions? The difficulty is in making the hole exactly where it is required, which also implies a constant diameter of hole, as the length is measured from the bottom of the hole. Examination of rows of slates from a roof shows that variation of up to plus or minus half an inch does occur, the even line of the edge of the slates being achieved by selection so that the maximum length errors never coincide.

Measurement of slates from ten different roofs in the Nenthead area showed that the correlation between actual slate lengths and the Alston measuring stick was not very good, with a number of rows of slates falling between the Alston stick numbers, but with most of the rows falling within two centimetres of a stick unit. The arithmetic mean was 0.4 centimetre less than the unit and the standard deviation was 1.7 centimetres. Without wishing to throw doubts on the accuracy of the roofers, it may be that the holes were made prior to using the slates and it would then have been possible to select the over or undersize slates and use them in rows of the between dimension.

SLATES ON THE ROOF OF BUILDING A

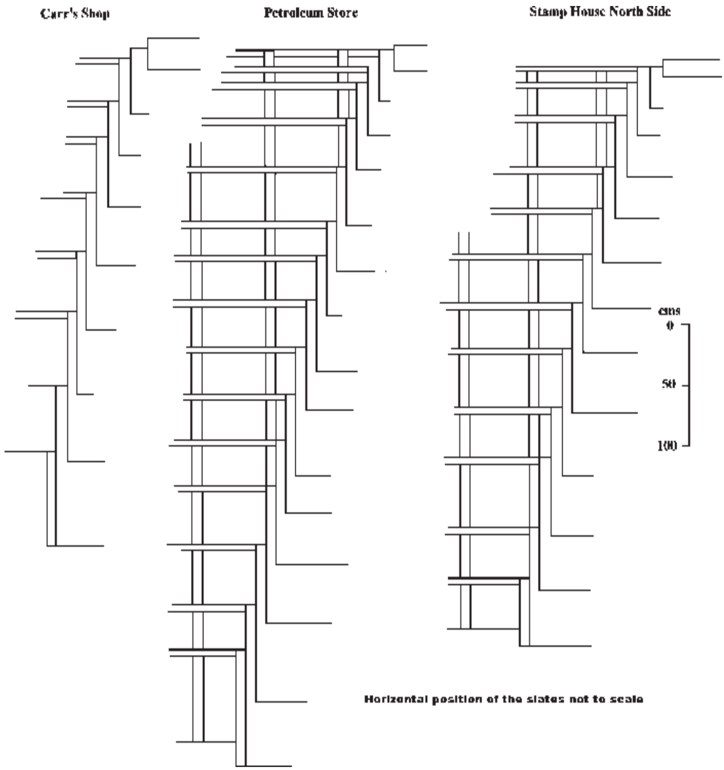
Position	Exposed length	Length hole to edge	Nearest Alston measuring stick length	
Ridge tile	cm	cm	No	cm
17	15	n.d.		
16	18	40	III	40
15	22	n.d.		
14	22	57	VI	55.5
13	20	56	VI	55.5
12	27	62	VII	61
11	28	67	VIII	67
10	28	66	VIII	67
9	28	67	VIII	67
8	30	73	IX	73
7	30	74	IX	73
6	33	n.d.		
5	36	78	X	79
4	37	84	XI	85
3	43	94	XII	91
2	36	96	XIII	98.5
1	0	65	VIII	67

SLATE OVERLAP
For a slate roof to be watertight, it is essential that each slate overlaps the second slate below it. Within reason, the larger the overlap the better the quality, particularly in the resistance to blown snow penetration. The local farming tradition was to place 'fogging' (dried moss collected off the fell) between the slates to prevent snow blowing up them. No evidence was found for the use of fogging at the Nenthead mill, though it should be noted that the moss oxidises fairly rapidly and has to be replaced.

The three roofs included in Fig 8 show that the overlap varied considerably,

Measurement of the overlap was difficult as many of the nails holding the laths were no longer in place and the pegs holding the slates were in poor condition. The average overlap was 25 mm, i.e. one inch, and was marginally greater in the bottom half of the roof than in the top half. One inch overlap may seem small, but account must also be taken of the head of the slate above the holes, which means that only where a hole falls directly below the joint between two slates is the overlap 25 mm from the point of view of rain penetration. The top edge of the slate is usually from 75 to 100 mm above the peg hole.

THICKNESS
The thickness of the slate was between 15 and 40 mm, averaging 25 mm, with the thickest slates being used to close the wall top. There was only a



very weak correlation between slate length and thickness, the average for slates over 70 mm being 30 mm and for slates below 70 mm being 25 mm. At first sight, this may be unexpected, but presumably quarries producing slate had a range of bed thicknesses and they would probably try to produce the largest slates practical. As the slate broke, smaller sizes could be produced, but the bed thickness remained the same. The thicker beds would be stronger, and this may account for the longer slates being slightly thicker.

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