

**An Archaeological Study of Mining in the
Early Modern Period and an 18th Century
Mining Community Within the Vicinity of the
Cistercian Abbey of Strata Florida**

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This work is dedicated to my son Shaun, my mother Ruth and my in-laws Margaret and Brian, all of whom were taken from us too soon.

To the Yorkshire Coal Miners, your like will not be seen again

Declaration

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

SignedDavid Sables..... (candidate)

Date2nd April 2025.....

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used the extent and nature of the correction is clearly marked in a footnote(s). Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

SignedDavid Sables..... (candidate)

Date 2nd April 2025.....

STATEMENT 2

I hereby give consent for my thesis, if accepted, to be available for deposit in the University's digital repository.

SignedDavid Sables..... (candidate)

Date 2nd April 2025.....

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Abstract

A mixed methodological approach was applied to investigate whether mining had taken place prior to the 19th century within a six-kilometre area centred on the Cistercian Abbey of Strata Florida, Wales. The outcome of the research concluded there were more mine workings than had been previously thought, with a total of 19 mines and 22 trials recorded. Archaeological excavations revealed evidence that mining had taken place in the Early Modern Period, also much earlier than had previously been recorded. Surveys of the mines showed that some of them had been worked for hundreds of years, with the earliest archaeologically dated mine, Bronberllan Mine, working as far back as the 1680s.

An exploration of the social economic aspects of mining during the 1750s was also undertaken, based on documents and records relating to the mine of Esgair Mwyn. The study demonstrated that mines had been of significant importance for both the local and regional economy and had created well-developed trading links with other industries both within Wales and Great Britain. The study was also able to reveal that the lives of the workers were more varied than previous studies have indicated and that many had taken advantage of the numerous opportunities to enhance their position and financial income either through promotion, undertaking extra work or by providing goods and services required by the mine and other workers. A study of female mine workers during the 18th century was also made possible, revealing the wide variety of roles undertaken by women at that time.

The results of this work have provided a unique insight into the working lives of the 18th century miner workers at Esgair Mwyn which now forms a base for future studies into both social and economic studies of Cardiganshire mining.

Table of Contents

<i>Acknowledgements</i>	<i>iv</i>
<i>Abstract</i>	<i>v</i>
<i>List of Figures</i>	<i>ix</i>
<i>Chapter 1 Introduction</i>	<i>1</i>
1.1 Introduction	1
1.2 Geology of the Research Area.....	4
1.3 History of Mining in Cardiganshire up to 1750	7
1.4 Previous Research in the Research Area.	9
1.5 Defining the Research	10
1.6 Research Resources	11
1.7 Conclusion	13
<i>Chapter 2 Literature Review</i>	<i>15</i>
2.1 Introduction	15
2.2 Economic History and Mining	15
2.3 Landscape Archaeology Theory	19
2.4 General History Texts	20
2.5 Understanding the History of Metal Mining.	26
2.6 Literature on Welsh Metal Mining	28
2.7 Women in Mining.....	31
2.8 Conclusion	32
<i>Chapter 3 Methodology this</i>	<i>34</i>
3.1 Introduction	34
3.2 The Aim of the Research	34
3.3 Theoretical Concepts Underpinning the Research.....	35
3.4 Data Collection Methods	37
3.5 Limitations of Surveys	45
3.6 Extenuating Circumstances.....	45
3.7 Conclusion	46
<i>Chapter 4 - The Survey on the Mines and Trials</i>	<i>47</i>
4.1 Introduction	47
4.2 Discussion on the 19 Mine Sites within the Research Area	56
M1 Bronberllan Mine SN74552/66364	56
M2 Bron Caradoc SN6905/6960	58
M3 Bron Mwyn SN7140/6440	59
M4 Bryn y Gors SN73114/65882	63
M5 Cilfach y Rhew SN742/692	64
M6 Creigaen Ddu SN7760/6510	64
M7 Cwm Caddwr SN68120/67512	66

M8 Cwm Mawr SN73569/67259	67
M9 Dyffryn Cottage SN75261/68486	67
M10 Esgair Ddu SN76774/69674	67
M11 Esgair Mwyn SN 75438/69333	68
M12 Hendrefelin SN7150/7010	70
M13 Llwyn y Gwyddyl and Llwyn Llwyd SN746/685	73
M14 Llwyn Malus SN690/6780	73
M15 Llwyn y Gog SN72650/67550	76
M16 Logaulas Mine SN740/716	76
M17 Maen Arthur SN734/728	76
M18 Pen Llan Fach SN73760/70027	77
M19 Tyny Graig SN69763/69544	78
4.3 Discussion on the 22 Trial Sites	79
T1 Abbey Consols Gargoed SN76803/67208	79
T2 Berthgoed SN76360/645964	79
T3a Berthlwyd SN700/719	80
T3b Gwaith Goch SN700/719	80
T4 Bryeneithino SN76102/69622	80
T5 Bryn Coryn Trial SN7610/6950	81
T6 Bwlch y Dwyallt SN760/637	82
T7 Castle Dinas SN80618/64326	82
T8 Cefngoer SN71957/66461	83
T9 Chwarel Mawr SN76364/70622	84
T10 Claer Ddu SN79210/68783	85
T11 Cloddiau SN72238/69007	87
T12 Crilfach yr Heol SN74754/69275	88
T13 Crofftau Bridge SN7522/6484	89
T14 Crud y Awal SN75057/68192	92
T15 Drysgol / Glansychant SN70845/69188	93
T16 Gwaith Douglas Trial for Gold SN78839/268189	94
T17 Pantyfedwen SN75200/64900	95
T18 Peny Bwlch SN79037/63402	95
T19 Talfryn Farm SN70713/70000	96
T20 Troed y Rhiw SN76735/66307	97
T21 Ty Mawr SN73175/66428	98
T22 Tyndol SN76823/68070	99
4.4 Mines and Trials Conclusion	100
4.5 Summary of Survey Results	100
<i>Chapter 5 – Sites with Possible Medieval and Early Modern Mining</i>	<i>101</i>
5.1 Introduction	101
5.2 Discussion on the Eight Mine Sites	102
M1 Bronberllan Mine SN74552/66364	102
M8 Cwm Mawr Mine SN73569/67259	125
M9 Dyffryn Cottage Mine SN75261/68486	136
M10 Esgair Ddu SN76774/69674	140
M11 Esgair Mwyn Mine SN75438/69333	143
M13a Llwyn y Gwyddyl SN746/685 / M13b Llwyn Llwyd SN7465/6864	162
M16 Logaulas Mine SN740/716	172
M17 Maen Arthur Mines and Possible Smelt Mill SN734/728	178
5.3 Discussion on the Five Trial Sites	195
T1 Abbey Consols Gargoed SN76803/67208	195
T2 Berthgoed Trial SN76429/64506	197
T3a Berthlwyd Trial SN723/734 / T3b Gwaith Goch Trial SN719/724	203
T17 Pantyfedwen Trial SN75200/64900	206

T19 Talfryn Farm Trials SN70713/70000	215
5.4 Discussion on Results of the Landscape Surveys	220
5.5 The Silver Question	222
5.6 Chapter Conclusion	236
<i>Chapter 6 – An Examination of the Social and Economic Aspects of Mining in the mid-18th Century at the Mine of Esgair Mwyn</i>	<i>239</i>
6.1 Introduction	239
6.2 Management of the Mine	239
6.3 Maintenance of an Industrial Workforce in a Rural Landscape	245
6.4 Esgair Mwyn Management Team	256
6.5 The Underground Workers	266
6.6 The Surface Workers	274
6.7 The Role of Women	291
6.8 Health and Underground Working Conditions at Esgair Mwyn	299
6.9 Economic Links	302
6.10 Conclusion	306
<i>Chapter 7 Results and Conclusion</i>	<i>309</i>
7.1 Introduction	309
7.2 Limitations of the Study	310
7.3 Results of the Archaeological Surveys	312
7.4 Conclusion of Archaeological Investigation	315
7.5 The Socio-Economic Aspects of Mining	316
7.6 Results of the Documentation Research	317
7.7 In Summary	321
7.8 Moving Forward - Further Research	322
<i>Primary Sources</i>	<i>324</i>
<i>Secondary Sources</i>	<i>330</i>
<i>APPENDIX A - Glossary of Mining Terms</i>	<i>342</i>

List of Figures

	Page
1.1 Map of Great Britain Showing location of Research Area	3
1.2 Map of Wales	3
1.3 General Section of Strata of Central Wales Orefield	5
4.1 List of the 19 mines located within the research area	50
4.2 Map of 17 of the mines identified within the research area	51
4.3 List of the 22 trials located within the research area	52
4.4 Map of the 22 trials identified within the research area	53
4.5 Map of the 17 mines and 22 trials identified within the research area	54
4.6 Map Showing the Mineral Deposits within the Research Area	55
4.7 Map of M1 Bronberllan Mine 1880	57
4.8 Features recorded at M2 Bron Caradoc	58
4.9 Map of M3 Bron Mwyn Mine 1905	60
4.10 Features recorded at M3 Bron Mwyn	62
4.11 Features recorded at M4 Bryn y Gors	63
4.12 Features recorded at M6 Creigaen Ddu	65
4.13 Features recorded at M7 Cwm Caddwr	66
4.14 Map of M11 Esgair Mwyn 1880	69
4.15 Features recorded at M12 Hendrefelin	71
4.16 Map of M12 Hendrefelin 1905	72
4.17 Features recorded at M14 Llwyn Malus	75
4.18 Features recorded at M18 Pen Llan Fach	77
4.19 Features recorded at M19 Tyny Graig Mine	78
4.20 Features recorded at T4 Bryneithino Mine	80
4.21 Features recorded at T5 Bryn Coryn	81
4.22 Features recorded at T6 Bwlch y Dwyallt	82
4.23 Features recorded at T7 Castle Dinas	82
4.24 Features recorded at T8 Cefngoer	83
4.25 Features recorded at T9 Chwarel Mawr	84

4.26	Features recorded at T10 Clear Ddu Trial	86
4.27	Features recorded at T11 Cloddiau Trial	87
4.28	Feature recorded at T12 Crilfach yr Heol	88
4.29	Features recorded at T13 Crofftau Bridge	90
4.30	Map of T13 Crofftau Bridge 1905	91
4.31	Features recorded at T14 Crud y Awal	92
4.32	Features recorded at T15 Drysgol / Glansychant Trials	93
4.33	Features recorded at T16 Gwaith Douglas	94
4.34	Features recorded at T18 Peny Bwlch	95
4.35	Features recorded at T20 Troed y Rhiw	97
4.36	Features recorded at T21 Ty Mawr	98
4.37	Features recorded at T22 Tyndol	99
5.1	List of the 13 sites discussed in detail in Chapter 5	101
5.2	Map of M1 Bronberllan Mine 18 th /Early 19 th century mining remains	114
5.3	Map of M1 Bronberllan Mine 1880	115
5.4	Map of excavations carried out at M1 Bronberllan 2013	116
5.5	Detailed record of features identified at M1 Bronberllan	124
5.6	Map of M8 Cwm Mawr Mine 1905	126
5.7	Detailed record of features identified at M8 Cwm Mawr	135
5.8	Map of M9 Dyffryn Cottage 1905	137
5.9	Detailed record of features identified at M9 Dyffryn Cottage	139
5.10	Map of M10 Esgair Ddu 1905	141
5.11	Detailed record of features identified at M10 Esgair Ddu	142
5.12	Original plan of the Esgair Mwyn mine surface drawn by Lewis Morris dated 1754, with surviving features identified during the 2013-2018 surveys	153
5.13	Plan of M12 Esgair Mwyn (1754) with surviving features of the pre 1746 mine, as identified during the research survey.	154
5.14	Plan of M12 Esgair Mwyn drawn by Lewis Morris 1754	155
5.15	Map of M12 Esgair Mwyn 1880	156
5.16	Detailed record of features identified at M12 Esgair Mwyn	161
5.17	Map of M13 Llwyn Llwyd dated to 1880	164

5.18	Map of M13 Llwyn Llwyd dated to 1880 showing possible 18 th century remains	165
5.19	Detailed record of features identified at M13 Llwyn Llwyd	171
5.20	Map of M16 Logaulas Mine dated 1905	173
5.21	Map detailing location of the excavations undertaken at M17 Maen Arthur Mine during the research	190
5.22	Map of M17 Maen Arthur showing the only known mining feature, prior to the research. An adit which had formally been attributed to Grogwynion mine	191
5.23	Detailed record of features identified at M17 Maen Arthur	194
5.24	Map of T1 Abbey Consols Gargoed	196
5.25	Detailed record of features identified at T1 Abbey Consols Gargoed	197
5.26	Lisburne Estate Map of T2 Berthgoed Trial Site	199
5.27	Detailed record of features identified at T2 Berthgoed Trial Site	202
5.28	Map showing mining features identified at T17 Pantyfedwen dated 1905	208
5.29	Detailed record of features identified at T17 Pantyfedwen	214
5.30	Map of T19 Talfryn Farm Trials 1905	217
5.31	Detailed record of features identified at T19 Talfryn Farm Trials	218
5.32	Chart showing the Abbey Consols lead production figures 1848 - 1909	226
5.33	Chart showing the Abbey Consols silver production in troy ounces based on figures and statistics from Burt, Waite and Burnley (1985)	227
5.34	Maps showing results of soil sampling and geophysical mapping at Strata Florida	234
5.35	Maps showing results of soil sampling and geophysical mapping at Strata Florida	234
6.1	Plan of the Esgair Mwyn mine surface layout 1754	277

Chapter 1 Introduction

1.1 Introduction

Interest in the history of British mining stemmed from these industries being used in the formation of a British national identity. This identity was based upon the portrayal of Great Britain as the catalyst of the Industrial Revolution and as a world leader in technological development from the 18th century onwards (Allen, 2009, p. 135). The study of metal mining, became an integral part of the formation of this cultural memory, with the history and archaeology of mining being examined, using an array of different approaches. A number of studies have been undertaken examining the economics of the industry, while others have looked at the subject through the lens of technologies. A large body of studies has also examined the social aspects of the mining industry. Such studies have looked at matters including the politics of mining and how mining communities developed a sense of identity and self-worth through the comradery of shared danger. Following the rapid decline of British heavy industry, mining has become an increasingly popular area of study, often with a focus on community and politics (Turner, 2000, p. 3). In Ceredigion, this was expressed through the introduction of the European Union-funded 2007 Metal Links Project, which sought to reconnect former metal mining communities with their mining heritage and promote links between the members of the European Community (Jones and Jenkins, 1998, p. 160; Metal-Links, 2007). This research seeks to further these efforts by recording and interpreting mining remains found within an area which has not been examined in depth by any previous researchers.

This research was aimed at answering three questions these were as follows

1. Was there evidence to show mining had taken place in the Medieval and Early Modern Period within the research area?
2. If mining had taken place, could the people involved be identified?
3. Was it possible to find information on the socio-economic aspects of mining within the research area relating to the Medieval and Early Modern Periods?

For this work, the end of the Medieval Period and the beginning of the Early Modern Period has been placed at 1536, as this was the date which has been general accepted as the start of the English Reformation, and was also the first time Strata Florida was threatened with dissolution (Williams, 2001, p. 80).

This thesis is the result of an archaeological investigation into mines and mining activities within a six-kilometre area centred on the former Cistercian Abbey of Strata Florida in Ceredigion, Wales (see figures 1.1 and 1.2) (GeoIndex, 2024; Ordnance Survey Ltd, 2024). The research area was chosen because the Abbey of Strata Florida once owned much of the land that the Cardiganshire Orefield was set within. It seems likely that if the monks at Strata Florida had worked the mines, they would have utilised deposits that were closest to the Abbey when building it, to minimise the distance ore had to be transported. Therefore, while only three of the mines within the research area had a known history before the 19th century, there was a possibility that all the mine sites may have been exploited much earlier and possibly in the Medieval Period.

Cardiganshire mines have been studied by historians and archaeologists since at least the late 18th century. However, the majority of these studies have focused on the larger mines in the north of the Cardiganshire Orefield, and on mining in the Bronze Age and the 19th century. This has resulted in the mines south of the orefield and those from other time periods under-studied and under-represented in the historical record. To add to this complexity of mining studies, it has always been assumed that mining had taken place on the Strata Florida granges in the Medieval Period, however there has been no documentary or archaeological evidence to support this assumption.



Figure 1.1 – Map of Great Britain. Research Area shown with red circle (*Great Britain Overview Ordnance Survey Map, 2024*)



Figure 1.2 Map of Wales showing location of Research Area, Strata Florida, Wales (*GeoIndex, 2024*)

This lack of interest is puzzling as the Cistercian Abbey of Strata Florida has been at the centre of Welsh identity since its founding in 1164, and due to this historic and social importance has been used as a geographical reference in documentation through to the present (Austin, 2022, p. 17). The very existence of the abbey would have stimulated mineral production locally starting from its construction, the re-roofing of the abbey following a fire in 1284 and the ongoing maintenance, all of which would have led to periods when large amounts of lead were required (Williams, 2001, p. 104). It seems reasonable to assume that some of this lead would have been sourced from mines close to the abbey. However, little research has been carried out on these mines resulting in their histories being largely unknown. As many of these mines were small, they had not been subjected to the sustained reworking that many of the larger mines in the north of the Cardiganshire Orefield had undergone. These mines therefore offered the possibility that remains of pre 19th century mining may have survived in them. These two factors meant that the area close to Strata Florida Abbey was an ideal area to search for information on mining in the understudied Medieval and Early Modern Periods.

1.2 Geology of the Research Area

The Cardiganshire Orefield is one of the largest lead-zinc ore fields, in terms of area, in the British Isles (Thomas, 1961, p. 191). The geology of the orefield was first officially classified in 1833 by the British Geological Society, with geological mapping being undertaken between 1848 and 1850. This was further updated by Oliver T. Jones in a report on the mineral wealth of Cardiganshire for the British Government in 1922 (Jones, 1922). The information provided in this report formed the basis of the current understanding of the geology of the Cardiganshire Orefield.

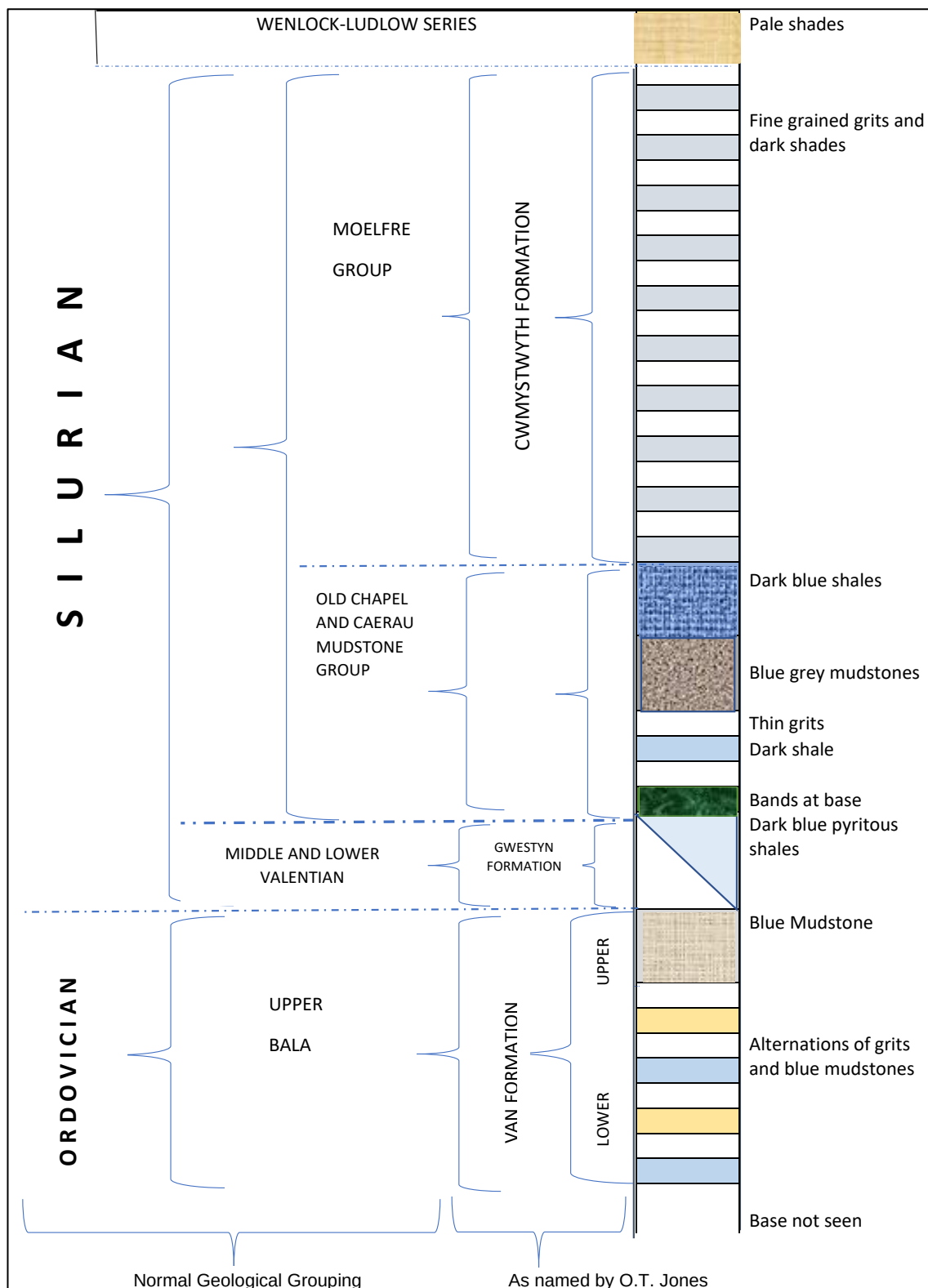


Figure 1.3 General Section of Strata in Central Wales Orefield Showing Ore-Bearing Horizons (Not to Scale)

Courtesy of Alison Sables based on Jones (1922) and Foster-Smith (1979)

The lead ore deposits found within the research area were members of a class of ores known as hydrothermal deposits (Pirajno, 2013, p. 23). These ores were formed through a process where heat and pressure forced saline aqueous fluids out of rock formations. These heated fluids leached metals out of the surrounding strata which then usually mixed with other dissolved elements such as sulphides. The fluids, which included the metals, were then forced by pressure along fissures in the strata towards the land surface. During this process the fluids cooled leaving a mixed deposit of minerals and sulphides on the land surface and fissure walls (Pirajno, 2013, p. 23). As lead is not the only mineral within the fluids lead, it is often found in conjunction with zinc ore, and on less frequent occasions, with copper and iron. In many deposits the lead within the ores also contained silver (Thomas, 1961, p. 191).

The mineral deposits in Cardiganshire had been laid down in two main episodes, the first being 390 million years ago and the second 360-330 million years ago (Bird, 2012, p. 53). There may also have been a third phase around 240 million years ago, but this has not been positively confirmed (James, 2017, p. 77). The lodes generally followed two main orientations, north-south and east-west. They varied in length, in some cases continuing for several kilometres. The faults also varied in width from a few centimetres to over a hundred metres. An important aspect of these events was the silver content of the deposits. The initial deposit contained minerals with a higher silver content due to the fluid containing inclusions of argentiferous tetrahedrite which were rich in silver. The second event contained significantly less tetrahedrite but was much larger and in many areas, overlaid or mixed with earlier deposits, as was the case at Cwmystwyth (Bird, 2012, p. 53). Due to this second event, some mines had sections within their lodes that contained a mixture of minerals from both events and deposits with a significantly higher silver content than the ores in other parts of the mine. Another aspect that affected the silver content of the mineral deposits was the process of weathering action which caused the breakdown of exposed rocks. This action freed minerals from the surrounding host rock and caused secondary enrichment of the surface deposits. In these cases, this had resulted in the upper ore deposits becoming silver-enriched (Bird, 2012, p. 53). This again led to some sections of the mines having higher silver levels than others.

The primary mineral formation in the research area was the Frongoch lode (Foster-Smith, 1979, p. 76). This lode consisted of mineralised strata that contained lead, zinc and copper ores, often in conjunction with less valuable material, such as stone or quartz. This lode had been worked at most of the mines within the research area (Foster-Smith, 1979, p. 76). The most extensively mined minerals within the research area were galena (lead sulphide) and cerussite (lead carbonate). Cerussite ores were mainly found in the weathered secondary enrichment zone close to the mine surfaces and were prized for their lead and silver content. A third mineral which was also mined extensively was sphalerite (zinc sulphide). Sphalerite was a common ore found in the mines of mid-Wales, however, it had little economic value until 1837. At that time the development of a zinc coating for iron as a rust inhibitor led to the development of a market for zinc ore (Cocks and Walters, 1968, p. 19). The expansion of the sphalerite market coincided with the fall in price of lead, enabling many mines to remain open by mining zinc ore and reworking their old waste heaps. The strata of the Cardiganshire Orefield can be seen in Figure 1.3.

1.3 History of Mining in Cardiganshire up to 1750

The earliest evidence of metal mining on the mainland of England and Wales was located in mid-Wales (Timberlake, 2003, p. 115). Perhaps the most important site found to date is the Cwmystwyth mine, which has been the site of excavations for many decades by the Early Mines Research Group (EMRG) (Timberlake, 2003, p. 1). These excavations confirmed that it was an important, multi-period mine that had been worked for its copper from at least 2500 BC until it was abandoned in 1600 BC (Timberlake, 2003, p. 115).

The Iron Age saw a marked increase in the use of lead in casting bronze, plus an increase in the production of gold and silver for coins (Cunliffe, 1978, p. 70). However, there is only minimal evidence that any gold was mined in Cardiganshire. While it was likely that some of the other metals used in this period came from Cardiganshire due to the deposits of lead, silver and gold in this area. There is, however, little evidence of lead production from this time, as only two sites have been found. The first is the remains from a smelting site at Llancynfelyn Borth Bog, part of which had been dated to between 60 BC and AD 90 (Page et

al., 2013, p. 294). The second piece of evidence that implied mining had been undertaken in this period was a wooden spade that was dated to between 4 BC and AD 71. The spade was discovered in an open cut at Penpompren, near the Erglodd mine on the outskirts of Talybont, Wales in 2018. This was a strong indication that the Erglodd workings had been in use at the end of the Iron Age and the beginning of the early Roman Period (Lord, Timberlake and Craddock, 2019, p. 65).

Evidence of mining dating to the Roman Period within Wales was, and still is, limited. Although no evidence of Roman mining has been found in Cardiganshire, there was evidence of smelting at Llancynfelyn Borth Bog, part of which dated to between AD 210 and AD 240 (Page *et al.*, 2013, p. 294). The most reliable evidence of Roman mining in Wales to date was found 65 kilometres away from Strata Florida at the Dolaucothi mines in the neighbouring county of Carmarthenshire. These mines have provided the only positive proof of Roman mining in Wales (Burnham and Burnham, 2004, p. 2).

Evidence of smelting activity in Wales during the Medieval Period is more plentiful. At Banc Tyndol, Cwmystwyth, the remains of wind-blown hearths were found and excavated. Radiocarbon dating of material from the site returned dates of AD 670 – AD 840 and AD 880 – AD 1020, suggesting that the same location had been used for lead smelting over a 300-year period (Timberlake, 2002, p. 46). Analysis of the remains showed that the source of copper ore and lead being smelted had originated from Cwmystwyth, showing that these deposits had been exploited during the Bronze Age and the Medieval Periods.

The founding of the Strata Florida Abbey in AD 1164 led to the Cwmystwyth mineral deposits coming under the control of the Cistercian Order (Austin, 2022, p. 17). However, documentation concerning mining or any other aspects of the economy relating to the Strata Florida Abbey in the Medieval Period was notable by its absence. All that was known about mining on the Strata Florida granges, at the beginning of the research, was that lead mining had taken place at the

Comote of Genau'r-glyn mine, in the parish of Llanabadarn Fawr near Aberystwyth in 1282 (Lewis, 1967, p. 28). It was also known that in 1451 lead from the Strata Florida Mines had been used to repair Cardigan Castle (Lewis, 1967, p. 28). In 1505, a lease was granted by the last abbot of Strata Florida to a tenement at Briwnant (Bond, 2004, p. 348). A copy of the list of leases issued by the abbot, which included this agreement, contained a note against it saying, '*mines here*', which implied that this may have been the site of some of the lead mines worked by the abbey (NLW, Cwrt Mawr, MS 873D). In 1539, John Leland (King Henry VIII's Antiquary) visited Cwmystwyth and saw evidence of mining which he said had ceased due to a lack of wood (this description indicated that the mines had only recently finished working) (Toulmin Smith, 1906, p. 118). All of the above information refers to sites in the north of Cardiganshire, highlighting that very little investigation had been carried out on metal mining within the research area.

At the start of this research there was no information on mining of minerals in the southern part of Cardiganshire before the 1750s. William Lewis (1967), the leading academic researcher on metal mining in Wales, concluded that if mining had been carried out in the first half of the Early Modern Period in the southern part of the orefield, then it had been very localised and limited in scale. His description of mining in the research area during the 1750s indicated that the reopening and success of Esgair Mwyn had led to the development of Logaulas, Cwm Mawr and Esgair Ddu. He also suggested that other mines within the research area had not been worked before the 19th century (Lewis, 1967, pp. 28, 101).

1.4 Previous Research in the Research Area.

Very limited archaeological investigation into mines within the research area had been undertaken. The results of these were stored in the archives of Cadw, Dyfed Archaeological Trust and the Royal Commission on the Ancient and Historical Monuments for Wales (RCAHMW). The data was based mainly on the work by Bick (1978), Foster-Smith (1979) and Jones (1922). The Historic Environment Record (HER) held at the Dyfed Archaeology Trusts (DAT) contained a copy of

Robert Prothero Jones' unpublished survey notes from his Ceredigion Metal Mines Survey (1993) and the RCAHMW Upland Survey 2012 (Hall and Sambrook, 2008). While some of the mines recorded in these databases were the results of site visits made by the above researchers, many others were based on cartographic evidence, with the references consisting of a place name and a grid reference. The HER contained details on 18 mines and seven trials within the research area. However, while the position of all of the mines, with the exception of Maen Arthur, had been recorded, only Esgair Mwyn had been surveyed in depth, leaving the vast majority of mining features unrecorded.

1.5 Defining the Research

The research on the mines developed out of the multi- agency Strata Florida Project and was one of several studies initiated in order to understand the workings and heritage of the abbey and the surrounding landscape. The Strata Florida Project was keen to understand the relationship between the abbey and the mining features that were within close vicinity to it and to investigate the industrial aspects of heritage in the area. The research aimed to ascertain whether there was archaeological or documentary evidence showing that lead mining had taken place in southern Cardiganshire during the Medieval and Early Modern periods. Due to my 25 years of coal mining experience and the work I had carried out at Strata Florida as part of my undergraduate archaeology degree, (during which the research area had been identified as having the potential to contain pre-19th century mining remains), it was thought that I could bring a deeper understanding of how mining was undertaken. I was therefore, approached by Professor David Austin to formally undertake this research.

The decision to limit the research area to within approximately six kilometres centred on the Abbey of Strata Florida was based on the logistics of focusing resources to their full potential. The research had been limited by time, finances available and feasibility, and as such, a research area that was large enough to contain a good sample of mines, but not so large to be unworkable, was essential.

The initial proposal had been to explore mining on all the southern Cardiganshire granges of the abbey. However, due to the overwhelming number of mining remains, on these granges it was reduced. The revised area was a radius of six kilometres centred on the abbey. This area contained 33 square kilometres. The northern boundary was marked by Yspytty Ystwyth and the southern boundary was marked by Allt Ddu farm. At the east boundary was Castle Dinas and at the west, Cwm Caddwr. All of the mines included in this research fell within this boundary with the exception of the Logaulas and Maen Arthur mines which were just outside. Both of these mines were included after important information was discovered regarding these sites.

The aim of the research, therefore, was to answer the following three research questions:

1. Was there evidence to show mining had taken place in the Medieval and Early Modern Periods within the research area?
2. If mining had taken place, could the people involved be identified?
3. Was it possible to find information on the socio-economic aspects of mining within the research area relating to the Medieval and Early Modern Periods?

1.6 Research Resources

Archives

As well as the information from the archaeological investigations stored by Cadw, Dyfed Archaeological Trust and the Royal Commission on the Ancient and Historical Monuments for Wales (RCAHMW), a number of other facilities which held documentary evidence relating to mining in their archives were available.

The main archival facility used was the National Library of Wales in Aberystwyth (NLW). Here, a number of the family archives from the Cardiganshire landowners were stored, including those of Lord Lisburne and the Earl of Powis, both of whom had owned much of the land and minerals within the research area. These sources, along with other collections in the library, contained a wealth of information on mining in Cardiganshire. The library's internet web pages and cataloguing system made searching for documents in the archives easier than it

had been for earlier researchers, although the collections were still catalogued under broad headings.

Many of the files contained dozens of documents concerning mining mixed in with papers relating to other subjects. Each file had to be sifted through, read, documented and then used to search for information which might be useful. A number of the documents were written in Welsh or, in the case of older documents, Latin. Each had to be translated before going through the recording and search process. Documents within the archives were also searched for place names which may have related to mining in the past. Names on maps which contained the Welsh word Mwyn (Mine) were a strong indication that they been the site of older mining such as Bron Mwyn and Esgair Mwyn. To confirm this, the earliest use of the name was traced back to documents such as leases, letters and land registers. There was also the problem that many names had changed or mutated through time, often being anglicised or spelt several different ways within the same document. Names relating to mines were frequently interchanged, such as the word Mwyn meaning mine and Maen, which means stone. These issues were complicated and difficult to work through, especially when examining original documents from the 17th century.

This examination of archives at other facilities across the United Kingdom was also undertaken. Cadw, HER, National Monuments Record (NMR) and RCAHMW were all important resources for documentary research. Their online search facilities were used to identify sites, and as importantly, enable the identification of sites that were not on the databases. The Royal Commission's aerial photography section proved to be an essential tool when combined with satellite imagery in the identification of sites and features for surveying.

Cartographic Evidence of Mining

Maps were another useful resource in the study of mining and, as mentioned earlier in this chapter, had formed the basis for what was known about mines within the Historic Environment Record. As part of the research, Estate maps, Tithe maps and Ordnance Survey maps (including the drawings made by the cartographer on which the first edition was based) that were stored in the national

libraries of Wales and Scotland were examined. The maps were a crucial part of the archaeological investigation and were used in conjunction with satellite imagery, Google Earth, historic photographs and site surveys.

Oral Histories

It had been hoped that oral histories from people who lived in the area and had known miners, either as family members or as friends, would form part of the thesis. It was known that it would be most unlikely to find information predating the 19th century, however, family memories passed down through generations would have been useful, providing an insight into how people had lived and how mines were worked. My own families' recollections of mining and certain events were vividly recounted, including how friends and relatives had been maimed or killed underground and the hardships of strikes. Unfortunately, the collection of oral histories concerning mining families in the research area proved to be difficult due to the closure of the mines when metal mining finished in Cardiganshire in the early 20th century. An appeal was made to local residents in the Strata Florida area by means of a leaflet drop, posters in shops and on Facebook. Two people responded. It was decided that based on the small sample size that this approach would not be suitable for use within the research.

1.7 Conclusion

The research area was shown in the Geological Survey (Jones, 1922, p.184) to have contained deposits of lead, copper, zinc and silver. These deposits were some of the earliest worked in the British Isles. Despite this, very little research had been undertaken on mining in Cardiganshire. Researchers in the past have, instead, chosen to look at the silver-rich mines of the north of the county and technical aspects of mining, rather than the smaller mines of the south. In addition, the majority of research that had been undertaken had focused on mining in the Bronze Age and 19th century, leaving the Medieval and Early Modern Periods largely unexplored. This left a gap in the knowledge of mining in the research area that needed to be addressed.

This research aimed to fill the gap by finding archaeological and documentary information on mining in the Medieval and Early Modern Periods.

A number of resources were available, including the support of the Strata Florida Project on excavations. Information within Cadw, HER, DAT, NMR and RCAHMW on known mining in the area were also accessed. A large number of original documents were available in national archives concerning some of the mines, including family archives of the landowners as well as correspondence by the mine managers and historic photographs. These documents were used in conjunction with the research into place names, which enabled the land surveys to be targeted. They also enabled unrecorded mining features to be located as well as supporting the archaeological investigation into mineral extraction during the Medieval and Early Modern Periods.

Chapter 2 Literature Review

2.1 Introduction

There has been a vast array of literature published within the genres of history, archaeology, mining and anthropology. Due to this, it was deemed appropriate for this review to focus on the literature and debates which surround metal mining in United Kingdom and in particular Cardiganshire. The review included an examination of the differing approaches taken by industrial, historical and landscape archaeologists and the theories they had used to understand mining remains. The review identified a number of areas that were under represented in the literature including a lack of information on mines in the southern part of the Cardiganshire Orefield, a lack of examination of the social aspects of metal mining in Cardiganshire, and a preponderance of information on 19th century mining.

2.2 Economic History and Mining

The majority of the research on the history of mining has been undertaken by economic historians who studied the effects that mining had on the economy of Great Britain and other countries. Economic historians such as Blanchard (2001), Claughton (2009), Lewis (1967) and Rees (1968) have used historical documentation in an attempt to understand how economics influenced where, when and what was mined and the effect mining had on the local and wider economy over time.

Blanchard (2001), who was one of the most influential economic historians on mining, undertook extensive research on mining in the Medieval Period and the part it played in the world economy at that time. Blanchard's style of writing was engaging and accessible as he blended information on economic history, archaeology and technological innovation (Blanchard, 1972, p. 93). Blanchard led the development of the miner/farmer theory, making a strong case for the proposal that one of the main groups working mineral resources in the Medieval Period were farmers, who made a living from a mixture of small-scale farming and seasonal mining (Blanchard, 1972, p. 93). His research also put forward the

argument that wealthy farmers and the gentry had a greater involvement in mining in the Early Modern Period than was previously thought. Blanchard's miner/farmer theory proved useful when examining the Medieval rent books of Strata Florida and the cost books relating to the working of the mines from the Early Modern Period within the research area. It helped explain how people who were leaseholders of farms also worked as miners or labourers at the mines. Blanchard's theory (1972, p. 93) also helped explain why the survey for this research found so many mining trials close to deserted settlements and why some of the small landowners had chosen to develop the ore deposits on their own land in the first half of the 18th century.

Industrial Archaeology

Industrial archaeology is possibly the most important area of academic research associated with mining. It has been critical for the development of theories and for how to understand the archaeology of mining sites. A premise, generally accepted, is that industrial archaeology is largely concerned with the period from the end of the Early Modern to the present. Industrial Archaeology, a term first used by Michael Rix in 1955 (Raistrick, 1972, p. 19), diverged away from mainstream archaeological studies in the 1960s in an attempt to record the large amount of industrial heritage that was being destroyed during the slum clearance and urban regeneration at that time (Raistrick, 1972, p. 19). Empirical theory was often applied in this type of archaeological work, as it was thought by many in this field to be the most appropriate methodology due to the nature of the material and the way it was studied (Palmer and Neaverson, 2000, p. 73). The limited type of investigations and publications carried out by industrial archaeologists reflects the lack of finances that have been allocated to this area of archaeology. This has resulted in reports that are largely limited to recording standing buildings or engineering features (Johnson, 1996, p. 43). This is reflected in many of the reports produced by mining interest groups, which have focused on buildings and processes rather than the wider theoretical aspects of a site or its place within the broader historical debates on the cause and effects of industrialisation.

One of the first writers on industrial archaeology and its application to the study of the mining sector was Raistrick (1968, p. 10). Raistrick produced works based on his knowledge as a geologist and on history as seen from a Marxist

perspective. Although some of Raistrick's ideas have since been superseded, his thoughts on mining in the Pennines demonstrated a depth of knowledge few have since matched (Raistrick, 1972, p. 2). One of the most influential books produced by Raistrick was *Industrial Archaeology; A Survey* (Raistrick, 1972), a book still used today as a reference work for those seeking to understand some of the most common features found on industrial and mining sites. Raistrick's work gave a detailed overview of what was known of the metal extraction industries at the time of writing. Another influential writer was Tylecote (1962). His books, *Metallurgy in Archaeology* (1962), *A History of Metallurgy* (Tylecote, 1976) and *A Prehistory of Metallurgy in the British Isles* (Tylecote, 1986) became some of the standard reference works for the study of mining and metalworking in Great Britain during the 1970s and 1980s. The main emphasis of these works, as with many books from that period, was a focus on technologies, processes and descriptions of the buildings where the activities took place. These books proved useful when identifying remains found during the research, especially when used in conjunction with Raistrick's work.

Due to the nature of industrial archaeology, with its focus on technological development and the recording and understanding of industrial remains, books and papers written on the subject did not include an in-depth exploration of the social aspects associated with mining. This is an aspect which has become increasingly more important to understanding industrial processes, as has been included in more recent works, such as *Copperopolis; Landscapes of the Early Industrial Period in Swansea* (Hughes, 2005). *Copperopolis* was an important reference text as it helped identify where some of the ores from mines within the research area were taken to be smelted, as well as discussing influential people involved in the process. Hughes explored the Swansea metal industry from the 17th century into the 21st century and included a social context by exploring the development of the complicated relationships between owners, workers and the processes used. Hughes divided this study between the industrial processing (copper smelting) and transportation as well as the masters and employees, and social hierarchies within the workforce, including how both groups used the institutions of the developing town for their own ends (Hughes, 2005, p. 267). The study expanded out of Swansea by discussing how developments in this town had impacted on the surrounding areas and the industry as a whole. By using

these themes, Hughes (2005) brought writing on the subject into line with studies of mainstream archaeological theorists and anthropologists who had also examined the sector through the lens of archaeology, ideology and economics. Another study on this subject was the *Archaeology of Places and Landscapes* (Thomas, 2001, p. 20). Thomas believed that to understand the archaeology of a site, all possible social interactions should be taken into account, as these processes often change and undermine the original intentions of the site constructors (Thomas, 2001, p. 168). All these ideas influenced the way that the chapters on social aspects of mining were applied to this research. For descriptions on aspects, such as housing, of the lives of those who worked within the Cardiganshire mining industry, it was necessary to search county histories such as those covering Cardiganshire (Jones and Jenkins, 1998, p. 160), or books on local vernacular housing such as *The Welsh House* (Peate, 2004, p. 1) plus wider-ranging works on miners' housing carried out by Gauldie (1974, p. 10), although these publications looked at the later period of mining history, they were used to understand the deserted mining settlements found during the surveys.

Industrial Archaeology and How Theory can be Used to Understand Aspects of Mining Sites

Marilyn Palmer

Palmer (1983) has had a long association with mining archaeology and has written reports on many sites, including works on the Potosi Mine in Wales (Palmer, 1983, p. 5) and the Bassett Mines in England (Palmer and Neaverson, 1987, p. 5). The works by Palmer and Neaverson (1987) argued that industrial archaeology was not isolated from its surroundings but should be viewed as part of a wider network of influences and interactions. This idea has been explored in detail by Markus (1993) in *Buildings and Power* (Markus, 1993, p. 8), which suggests that buildings and machinery, as well as being instruments of production, could also be interpreted as agents of symbolism. A prime example of such an industrial site was the Crossness Sewage Pumping Station in the London Borough of Bexley which, when it was built in 1865, was lavishly decorated in a gothic revival style and was as much a statement of power as it was a pumping station (Palmer and Neaverson, 2000, p. 73). Metal mining sites can also be used to test the application of Markus' (1993, p. 8) ideas. Lewis Morris (Mine Superintendent at Esgair Mwyn in 1754) ordered the building of a mansion

on the mine site and then purchased a large and expensive three-faced clock from Liverpool to be set on top of the bookkeeper's house for all to see (NLW, Powis Castle Deeds, MS 21935, p. 1). It can be argued that this mansion and clock were not necessary and that the expenses were unjustifiable, and therefore more of a reflexion of Morris's self-worth and personality, which he put above the needs of the mine. Markus's and Gwyn and Palmer's (2005, p. 9) ideas also went some way to explain why a large and impressive coach house was built at the small, impoverished mine of Bronberllan. Using Markus's (1993, p. 8) theory, it could be argued that buildings such as the coach house, and the installation of expensive machinery at loss making mines, were being used as a symbol of (perceived) wealth to encourage investors rather than instruments of production.

2.3 Landscape Archaeology Theory

Landscape Archaeology looks at past interactions by humans with their environment and landscape, and the impact they had upon it. Landscape archaeology also covers the complex ideas of interaction, which embody politics, emotion, aesthetics, and symbolism, all of which leave no physical record, but are an integral part of the human experience. As such, it was a fundamental part of this research. Since the late 1970s, University of Wales, Trinity Saint Davids (previously University of Wales, Lampeter) has been central to the development of archaeological theory and home to some of the leading theorists in landscape archaeology. Academic research in this area included Austin (2006), Fleming (2007), Shanks (1992), Thomas (2001) and Tilley (2010). These academics developed many of the current theories, including phenomenology, which was based on the ideas of philosopher Edmund Husserl (2001, p. 11) in order to better understand past land use. Many of the theories and research developed by those in this sector included aspects such as sense of place, identity and memory, that had not previously been explored in studies of mining heritage. These theories had been central to debates between archaeological theorists such as Fleming (2007), Tilley (2010), and Johnson (2006), who, amongst others, suggested that Landscape Archaeology is a study area in its own right. In these debates, Fleming (2007, p. 2) asserted that the act of surveying and interpreting landscapes was not a mundane empirical descriptive exercise, as Johnson (2006) had implied, but was, rather, reading the archaeology of the landscape using field craft. Fleming also suggested that landscape archaeology had developed into a branch

of theoretical interpretation in its own right. Another landscape archaeologist who has been active in this area was Austin (2006, p. 193), who is the leading researcher on Strata Florida and the Cistercians in Wales. The work on the granges of the Cistercian Abbey at Strata Florida by Austin (2006, p. 193) and Fleming (2007, p. 2) has been fundamental to this research in understanding landscape use, including mining activities.

2.4 General History Texts

The scarcity of books covering metal mining in Wales meant that to better understand its social and economic impact in pre-18th century Wales, it was necessary to look at works on metal mining within a broader, more generalised history. For example, information on the economic and social aspects of industries were found embedded within works such as *Roman and Early Medieval Wales* (Arnold and Davies, 2000, p. 40). This publication on the history of Wales had a section on industry which included a short piece on metal mining in the Roman period. To find writing on Medieval Period mining it was necessary to explore a little deeper and use more specific works such as *The Welsh Cistercians* (Williams, 2001). Williams is one of the most authoritative writers on the Welsh Cistercians and their activities in Wales. His books (Williams, 1998, 2001, 2014) are an in-depth history based on his interpretation of the surviving historical documents. Aspects of mining were found within his description of the economy and holdings of the various Cistercian Abbeys of Wales.

Writers from Earlier HPeriods

The books written on mining in earlier time periods (pre-20th century) were viewed as a reflection of the ideas and state of knowledge of the time period. As such the information they contained was treated with caution. They did, however, offer information on approaches to mining and technologies that had been used at the time the books were written.

Georgios Agricola

One of the most influential writers used by those researching mining heritage was the German Scholar Georgios Agricola. Agricola published his book *De Re*

Metallica in 1556, which was later translated into English by Herbert and Lou Hoover (Hoover and Hoover, 1950). The practices discussed were of German origin and illustrated the techniques used in mining during that period through the eyes of Agricola, and as such, this book was a personal interpretation of the practises he observed. The strength of this book lay in its detailed description of processes and its outstanding illustrations. However, the book described mining as a well-funded, organised, capital-intensive localised industry, whereas in practice, many of the processes would have been implemented in a piecemeal manner at different mines across Germany, depending on how profitable a particular mine was.

The piecemeal application of new ideas could almost certainly be applied to mining in Wales. It seems likely that some miners would have been aware of these evolving technologies, mainly because many were adaptations of machines that were used in other industries, such as building construction (Gimpel, 1976, p. 59). Many of the technologies in *De Re Metallica* (Hoover and Hoover, 1950) had already been described in books on mining technology produced by British writers Richard Rufus and Rodger Bacon in the 13th century showing that they were already in use in England at that time (Rapp, 2002, p. 10). The strength of *De Re Metallica* was the illustrations and description of processes, so much so that it could be used as a template of the varying technologies archaeologists could find on a mine site dating to the Early Modern Period and how the such a mine might be laid out.

Seventeenth Writings

By the 17th century there was an increase in the interest in Welsh mining, with Thomas Bushell promoting his Welsh mines through the production of pamphlets and petitions to parliament (Bushell, 1642). Bushell's pamphlets were useful because they also contained the names of some miners who were connected to mining and smelting in Cardiganshire. This information was invaluable as it was then used to identify how a pool of miners had become established in Cardiganshire. It was possible to trace some of the miners back to where they had lived and worked before coming to Wales. In some cases, it was also possible to identify the ancestors of Bushells workers who went on to work at the mines within this research. Although mining was disrupted by the English Civil

War (Boon, 1981, p. 136), within a few years other writers such as John Pettus (1670), John Ray (1674), Shiers (1709) and William Waller (1704) were also writing about the Cardiganshire mines. The texts produced by these writers were both political and descriptive, centred on debates of removing the monopoly of the *Society of Mines Royal*, and on curtailing Crown mineral rights. Ray's (1674) work was important because it gave details of the smelting processes that had been carried out in Cardiganshire. Unfortunately, this work did not explore the mining of the ore.

Another writer who had a great influence on subsequent writers was John Pettus (1670), who wrote *Fodinae Regales*. This was one of the most influential books from this period in terms of formatting and layout as it started the iconic format which has become the standard for books on metal mining. The format begins with a brief description of Bronze Age mining going on to the Roman Period. Often this part of the book carries an emphasis on how important British minerals were in the Roman economy. The history then moves to the Elizabethan Period and the formation of the *Society of Mines Royal*. This structural format has been followed by writers through time and into the early 20th century. Despite the advances in mining knowledge, *Fodinae Regales* is still relied upon and referenced by those studying 17th century mining in Cardiganshire.

Eighteenth Century Writings

William Waller

Waller's (1704) work was interesting because it provided details, descriptions and plans of the mines plus maps of where the mines were located. Also included were accounts detailing the number of workers employed and the processes carried out. These accounts again proved useful in helping to understand the scale of mining in Cardiganshire. However, it must be remembered that his work concentrated on the northern part of the Cardiganshire Orefield and was aimed at promoting Waller's business interests. Much of Waller's (1704) writings were concerned with the arguments and politics surrounding the *Company of Mine Adventurers* and prompted a flurry of books and pamphlets by Shiers (1709), Mackworth (1707) and Stringer (1713). These publications were aimed at

reassuring the public and promoting British mining and, as such, they were treated with caution.

A book that proved central to showing how mines had been worked was *The Miners Dictionary* (Hooson, 1747). This book was important because it not only explained mining vocabulary but also described the ways mining had been undertaken, and the specialist tools that had been used. The book was, in effect, designed to be a reference work for mine owners and those who wished to understand mining in England and Wales.

Another 18th century book which is still relevant was *Mineralogia Cornubiensis* (Pryce, 1778). This book contained descriptions from a Cardiganshire mine owner about his understanding of geology, metallic lodes of copper and lead mines in the mid-18th century, plus the machinery and techniques used to extract the ore. The influence of both *De Re Metallica* (Hoover and Hoover, 1950) and *The Miners Dictionary* (Hooson, 1747) was evident within this book. *Mineralogia Cornubiensis* differed from the older books on the subject, as it also contained sections on the management of mines, the accounting and the setting of bargains with miners. This book indicated that by the second half of the 18th century mining was becoming professionalised with a system of mine management being developed. By the time *Mineralogia Cornubiensis* (Pryce, 1778) was written, mining was moving away from a system where the miners were in control of deciding who did what work and how the ore was to be removed to a system where mine owners employed mine managers and supervisors, and where defined roles for workers both on the mine surface and underground, were put in place. The large input of capital needed to work and develop mines, which often came from joint stock companies and investors from outside the area, necessitated the development of a management and accounting structure within the mining industry.

Nineteenth Century Writings

The 19th century brought about a renewed interest in mining within Britain. During the early years of the century this was evidenced by Britain producing much of the world's output of lead. This developing interest was matched by a host of publications on the subject, including the first collection and publication of mineral

statistics in the United Kingdom. These were published in the *Memoir of the Geological Survey of Great Britain and the Museum of Practical Geology* (Geological Survey of Great Britain, 1846). These statistics have formed the basis of much of the research on metal mining in the 19th century as well as the majority of what was known about the history of mines within the research area before this research. Hunt (1887) went on to write a history of British mining based on the information he had gathered while in his editorial post, titled *A Historical Sketch of British Mining* (Hunt, 1887, p. 895) which was republished in 1978. In this book Hunt (1887) collated information from the experts of his time and combined their information with that gained from the mineral statistics. This allowed him to give an overview of the history of mining as understood in that period, with added information and his insights on the origins of some of the better-known British mines. The book also contained a dictionary of mining terms, some of which, it appears, were drawn from the glossary's produced by Pryce (1778), with the addition of more recent terms from other mining areas.

The 19th century also saw an explosion of printed newspapers and trade magazines. One publication that was particularly pertinent to this research was *The Mining Journal and Commercial Gazette*, first published in 1835, which was a trade paper for those involved in mining, selling mining equipment and those wishing to invest in mining. This journal, which was later changed to *The Mining Journal* (The Mining Journal, 2023) was useful as it contained articles relating to companies that had been formed to work mines and lodes in the research area. As part of the drive to gain new investors and to keep current shareholders informed of the state of mines, mine agents published regular updates in the paper. These helped identify what work had been undertaken, the dates and by whom, in a number of the mines within the research area. For instance, there were no official returns for the Maen Arthur Wood mines in the 19th century, which would indicate that they were not being worked. However, there were articles in *The Mining Journal* which wrote that development work had been carried out there in 1856 (Francis, 1856, p. 733). While the articles within the journals were useful, the articles had to be treated with caution as some of the claims made by these agents had been exaggerated in order to gain funding from investors. Therefore, in order to ensure that the information used for this research was as accurate were possible, the reports from the journals were verified by cross-

referencing the information with other original documents such as letters, journal articles and other contemporary publications.

Another book which was consulted from this period was *The History of the Cardiganshire Mines from the Earliest Ages and Authenticated History to AD 1874, With Their Present Position and Prospects* written by Absalom Francis (1874), an influential promoter of Cardiganshire mines. This book contained information on the condition of many of the mines and was particularly useful in interpreting the remains of some of the smaller mines to the west of Strata Florida. It also proved to be relevant when used in conjunction with the Francis family mining papers (NLW, Francis Family Papers, File GB 0210 Franmine) and articles in the Mining Journals, which contained reports and details on the mines within the book. For many of the mines, the descriptions by Francis were the most detailed of any found, although, once again, this book was written to promote financial interests and was read with this in mind.

A key book written at the end of the 19th century that helped understand the history of the Strata Florida Abbey was *The Cistercian Abbey of Strata Florida* (Williams, 1889, p. 196), which covered the history of the abbey and a detailed report of his excavations undertaken in the 1870s. Even though this book was not directly related to mining, it was helpful in understanding the history of the abbey, its past economy and the archaeological remains on the site. It was useful as it helped to identify the area where the remains of smelting hearths had been found in the 1840s and during the excavations undertaken by Williams (1889).

Twentieth Century Publications

Two older series of books that were important to this work were the interpretations of the letters written by the Morris brothers, which were published by Davies (1907) and Owen (1947). These books were important as they contained details of some of the correspondence concerning Lewis Morris's work as Deputy Steward of the Crown Manors in Cardiganshire and other duties during the 18th century. These books provided details of not only mining and the people involved at the crucial time period relating to this research, but also an insight into the everyday life and the economy of Wales in the mid-18th century. These books led

to the identification of other correspondence from the period stored in the archives of the National Library of Wales and other archives.

2.5 Understanding the History of Metal Mining.

Given the major role metal mining has played in the history of the British Isles, it was surprising that no single comprehensive history of the sector had been produced. The most complete studies on mining were within the economic histories which only covered partial sectors of the industry, as in the case of the *Early British Tin Industry* (Gerrard, 2000) and *The British Lead Mining Industry* (Burt, 1984). These books were a mixture of economic history and detailed descriptions of the technological processes involved in the mining and smelting of lead ores. The owners or those who provided the finances were described in detail, while the workers tended to be referred to by the role they had undertaken on a particular site, if at all. Occasionally the authors made mention of the wider economic aspects which supported the mining and the surrounding communities. These works were useful when seeking to understand the technologies employed in mining and the interaction between different mining sectors.

Archaeological Research into Metal Mining in Cardiganshire

The archaeological study of metal mining in Wales is known to have begun in the 1920s as part of an evaluation of the mineral resources of the United Kingdom (Jones, 1922). The study was initiated following reports of the discovery of querns and hammer stones at a number of metal mines. Although Jones (1922), the geologist who undertook the review of Cardiganshire mines (including some within the research area), was unable to date these remains, he speculated that many metal mines in Wales had their origins in the Bronze Age. Since many of the mines in his comprehensive survey have since become inaccessible his work was used as a reference to the lodes within them.

The *Memoir of the Geological Survey Special Report* (Jones, 1922) led to a renewed interest in the history of Welsh metal mining. As part of this Jones ordered an archaeological study on mines which contained indications of being ancient, with the aim of better understanding the history of these remains (Davies, 1938, p. 59). In 1935, a study of the mines for the British Association for the

Advancement of Science was undertaken by Oliver Davies (1938). This survey has since formed the basis of all later archaeological investigations and surveys of Cardiganshire mining, including this research and is still extensively referenced by researchers today.

Davies (1938) went on to undertake several excavations at mine sites, including Cwmystwyth (Davies, 1946, p. 60). The Cwmystwyth excavations revealed an area at Copa Hill which he thought had been undertaken by Celtic people working for the Romans. However, due to a lack of datable evidence, Davies (1946, p. 60) could only speculate about the origins of these features. It was not possible to determine why he believed that the remains were from the Roman Period, other than he was part of the long tradition of assigning finds of ancient mining to the Roman Period. His findings were subsequently used as the basis for the work of the Early Mines Research Group, which carried out extensive excavations at Copa Hill and other mines, leading to the identification of a further fourteen mines conclusively dated to the Bronze Age (Timberlake, 2018, p. 25).

Early Mines Research Group

The Early Mines Research Group was formed in 1988, and as the name implies, is interested in identifying the early metal mining sites in Britain which contained remains of Bronze Age mining (Timberlake, 2003, p. 3). This group is made up of some of the leading British mining archaeology academics, including Mighall (2000, p. 1161), Timberlake (2003, p. 3). This group have published many articles and books on Bronze Age sites and have worked at a number of mines in Cardiganshire including Cwmystwyth (Timberlake and Prag, 2005, p. 124). The excavations undertaken at Copa Hill by the Early Mines Research Group concentrated on the excavation of the Bronze Age workings and its wider historic landscape and were published as a BAR Monograph (Timberlake, 2003).

As well as these focused investigations of individual sites, a comprehensive survey of mines in mid and north Wales has been undertaken by Cadw, the results of which were published in the Council for British Archaeology Research report *Mountains and Orefield's Metal Mining Landscapes of Mid and Northeast Wales* (Jones, Frost and Walters, 2004). This survey focused on mining remains

in the landscape and contained a general history of lead mining as a background for the study. This report was used as an example of how to carry out an archaeological survey of metal mining sites. In addition, it contained clear photographs of machinery, dressing floors and buildings, so was a valuable aid to the interpretation of features that could be found on these sites. This survey was also a political statement by Cadw affirming that mining remains are a part of Wales's archaeological heritage and, as such, worthy of preservation. This was important as a debate was taking place at that time between the heritage lobby, who wished to protect the mining archaeological record, and environmentalists, who sought to limit the damage being caused by mining pollution. This debate was keenly felt in mid-Wales, where much of the Cardiganshire water catchment area was being polluted by lead and zinc from disused mines (Environment Agency Wales, 2002, p. 3).

2.6 Literature on Welsh Metal Mining

The literature on mining sites within Wales is dominated by two influential works on mining. These are *Lead Mining in Wales* (Lewis, 1967) and *Industry Before the Industrial Revolution* (Rees, 1968). Both books were referred to extensively within the research when examining the late Medieval and Early Modern Periods sites.

William Lewis (1967)

Lewis wrote *Lead Mining in Wales* (1967) at a time when Britain was still a country with a vibrant mineral extraction industry and, as such, the book gave a sense of reflection about an industry that was not dead but undergoing yet another period of inactivity. The book contained some elements of social history within it. However, many of the documents he had relied on had come from various archives of companies and large landowners. His work was slanted towards a history from the owners' perspective. Lewis (1967, p. 259). Lewis (1967) sought to add further breadth to his work by including demographics, transportation and a wealth of statistical information which could be used to explore and expand research into other related areas of Welsh mining history. This book was used as a basis for further exploration of documents and resources identifying important archives.

William Rees (1968)

Another important writer who was active in the mid-20th century was Rees (1968), whose book *Industry Before the Industrial Revolution* was part of the reassessment of the economic history of the Industrial Revolution that was taking place in the 1950s and 1960s. Using primary documents, Rees (1968) examined heavy industries, including mining, in the periods before the development of the steam engine which prompted the expansion of these industries. Because the book covered several industries and countries, the writing on metal mining was not as detailed on Wales as that written by Lewis (1967). Nevertheless, it was useful because it covered England, Wales and Ireland and it described the links between the three countries that had influenced the Welsh industry, setting its history in its wider context.

Roger Burt

Burt (1984) recognised that while the history of the tin and coal industries had been examined in detail, including their social, economic, political and technical history, no similar study had been undertaken on the British lead industry. His publication, *The British Lead Mining Industry* (Burt, 1984), helped to fill this void by focusing on the economics of the industry by examining ownership and history of the large companies becoming involved in mining from the late 17th century. The strength of this book was its blend of economics and the exploration of social aspects of history, including the health of the miners and their standard of living. The information regarding aspects of Welsh lead mining had been influenced by the work of Lewis (1967), with some of the assumptions made by Lewis accepted as correct and repeated by Burt. This work, which when used alongside *Lead Mining in Wales* (Lewis, 1967) and *Industry Before the Industrial Revolution* (Rees, 1968), has provided the foundation for other economic histories of the industry.

As well as the works by Burt (1984), Rees (1968) and Lewis (1967) there were many other writers who had studied specific areas and aspects of mining within mid-Wales. Much of the information these writers had gathered was taken from the official mineral statistics which began to be collected in the 19th century. Due to this, many of these other works had scant information on the mines' early history, as their purpose was to describe the technology and the types of

machinery and processes used on the site. These books, again tended to follow a standard format by including photographs of the buildings on the site during its production period, and another one contrasting it with whatever remained at the time of the publication along with a brief description of the owners and management of the mine. This group of books could be further subdivided into two types; those which were specific to a particular mine, and those which covered several mines, either by area or by company. Some of the books that covered several sites were often little more than gazetteers, giving a grid reference and a brief outline of the mine on the sites. For example, *The Cardiganshire Mines* (Foster-Smith, 1979) which listed the names of the mines, their location by a grid reference and the names of the owners at the time of the mines' demise and the occasional photograph. These books were helpful, as, despite their limited information and bibliographies, they provided a starting point for further academic study.

David Bick

The most influential author who wrote specifically on the Cardiganshire mines was David Bick (Vernon, 2009, p. 2). Bick's series of books, *Old Metal Mines of Mid-Wales* (Bick 1978), have become the starting point for all those interested in metal mining in mid-Wales. These books were of great value to this research, not only because of Bick's expert knowledge of the sites and machinery, but because he had visited the mine sites regularly between the 1940s until his death in 2004. These books gave a unique snapshot of the condition of the mines within the research area when he visited them in the 1970s. This was important because sites such as Esgair Mwyn have been subject to considerable change due to visits by scrap merchants, movement of materials by landowners and remediation work by the Environment Agency Wales (Environment Agency Wales, 2002, p. 3).

George Hall

A close colleague of Bick's was the mine owner and author George Hall (1993). Hall had a keen interest in mining in Wales, and in particular the mines of Cardiganshire, having a family history of working at the Esgair Mwyn mine. Hall wrote several books and numerous articles on mining, including *Metal Mines of Southern Wales* (Hall, 1993) which was very similar to the *Old Metal Mines* series

(Bick 1978), and was important as it included some mines within this research area. Hall (1993) also carried out important work cataloguing and cross-referencing articles on Welsh and Shropshire mines, which had been published in *The Mining Journal*. Following his death, Hall's work was digitised and made available online by the Welsh Mines Preservation Trust. This made searching for information on individual mines within *The Mining Journal* considerably easier, having said that searching the journal is still time consuming.

Dr Peter Claughton

Claughton (1994) has also been closely associated with many of the aforementioned writers and has contributed to many books and conferences. He is also one of the supervisors for this thesis. His article, *Silver Lead Technological Choice in the Devon Mines* (Claughton, 1994, p. 87), explained why technology was introduced and how it helps to make the working of certain sites economically viable. Claughton's later works explored mining as part of a network of social interactions and exchanges (Rippon, Claughton and Smart, 2009, p. 121). Claughton raised concerns regarding the constricted time periods of mining investigation and in his paper *Quantity or Quality* (Claughton, 2009, p. 101) he warned that the overemphasis on specific time periods had led to a distorted view of mining in the past. He argued for a united investigation on all aspects of the industry, taking into account topics such as market forces, transportation and social issues (Claughton, 2009, p. 101).

2.7 Women in Mining

The role of women in mining is a subject which has only been touched upon in the most general way both in academia and within this research. The miners' strike of 1984/85 publicised the role of women in mining communities (Holden, 2005, p. 4), and there has been a growing interest in the role of women in mining and its communities ever since. As with other areas of female employment, few articles or books have been published on women working in the metal mining industry. For this reason, research on women in mining and other mining-related industries was consulted and works such as *Women in the Industrial Revolution 1750-1850* (Pinchbeck, 1969) provided a general grounding on the subject as it covered the timeframe of this research. This book helped to understand the

variety of roles women undertook within society. John's (2013) work '*By the Sweat of Their Brow; Women Workers at Victorian Coal Mines*' (John, 2013) was also useful. This book discussed the tasks undertaken by women at mines and how they were perceived by other members of society at that time. It was interesting, as the perception of the women working in metal mines was that they were hard-working and honest. By comparison, women working at coal mines were thought of as being somewhat feckless and immoral (John, 2013, p. 31). John's work was also helpful as it outlined the political debate surrounding the Coal Mine Acts of the 19th century, which forced women out of the mines and away from the higher wages that came with these roles and into lower paid surface work.

A more detailed investigation on the role of women at metal mines has come from Mayers (2023). Mayers wrote several books and papers on the women who worked at the Cornish metal mines. In the book *Female Employment at the Metal Mines of the UK and Ireland* (Mayers, 2023, p. 6) details of the work carried out by the women are explained regarding all the main metal mining industries. It goes on to talk about some aspects of their working lives, including tasks undertaken, the working conditions and the effects on their health. The works by John (2013) and Mayers (2023) relate to the 19th century by which time technologies and the industries had changed significantly, which in turn had altered the roles of women at the mines. Mayers (2023) book draws together information from a large number of sources and covers all periods where information was available. Although the study did not cover mines within the research area, it still provided a base for this research to set the work of women in mines into a wider context.

2.8 Conclusion

Metal mining, due to its important role in the history of Great Britain and the prominence of its archaeological remains, is of interest to many areas of academic study. The literature on research into the specific area of metal mining has focused on the economic and technical elements of the industry. This has resulted in a concentration of knowledge within specific time periods, mainly the Bronze Age and the period between the late 18th to the early 20th centuries, plus

the technical aspects of the industry. Due to this, the Medieval and crucially proto-capitalist time period between the 15th and early 18th century were perceived as a technically stagnant period and remains a neglected area of study. Part of this stemmed from the appeal of mining to a wide range of interest groups and the significant amount of readily available information on later periods. This has led to a concentration of research on the 19th century and the economic and technical aspects of the industry and a continued imbalance of mining history.

The review confirmed that this imbalance was evident in Cardiganshire as very little research had been undertaken on mining in the Medieval and Early Modern Periods in the county. The review also showed that the only research carried out on mines within the research area had been a small number of surveys of known mine sites and their post-19th century history. The exception to this was the mine of Esgair Mwyn which, because of its political and 18th century management history, had been studied in some detail. Another significant area of research identified as being under-represented, was the social aspects of mining. There had been very little examination of the lives of Cardiganshire miners or of the role of women in this industry. It is acknowledged that these areas of study would be difficult to remedy as there was little information available on Medieval and Early Modern mining. This research sought to fill this gap by using information found in archaeological surveys and excavations to explore the extent of mining in the Early Modern Period within the research area. Social aspects of mining and the lives of the people who worked at the mines within the research area is discussed in Chapter Six. Using original documents from the 18th century workings of Esgair Mwyn mine, the types of work undertaken, payments for work and the role of certain individuals are examined. The original documents enabled a unique view of the effect the opening of Esgair Mwyn had on society and the local economy.

Chapter 3 Methodology this

3.1 Introduction

This chapter discusses the aims of the research, what was required to achieve the aims and the theories that underpinned the approaches that were taken when looking at documentation, conducting surveys and interpreting the information found. It discusses the resources that were available and the limitation of these resources and the impact these had on the research.

3.2 The Aim of the Research

The aim of the research was to establish whether mining had taken place in the Medieval and Early Modern Periods within the research area by looking for evidence that would answer the following questions.

1. Was there evidence to show mining had taken place in the Medieval and Early Modern Periods within the research area?
2. If mining had taken place, could the people involved be identified?
3. Was it possible to find information on the socio-economic aspects of mining within the research area relating to the Medieval and Early Modern Periods?

All the mines and mining features within the research area were to be located, identified and examined. The purpose of this was to see if any of the mines and trials fulfilled the criteria set by this research in order to answer the research questions.

To fulfil the criteria the mine needed:

- to have evidence of remains dating to either the Medieval or Early Modern Periods.
- to be suitable for an archaeological excavation.
- to have permission obtainable from the landowner in order for the excavation to take place.
- to have suitable access to the site which was essential in order to undertake an excavation.

From the onset of the research the safety and well-being of those involved in, or affected by, the research was considered. Every effort was made to take into consideration the feelings and wishes of all those contacted during the research, including the families and local residents who may have been involved in mining in the area. The full nature of the project was explained to the landowners before the study began in order to ensure that access to the land was permitted and that the research would be viable. Permission was gained from the landowner before any land was entered on for the purpose of the research, including the field survey and the excavation. In some cases, caveats were put on by the landowners, such as the owner of Maen Arthur who, while allowing the excavation to proceed, asked for the number of people excavating the site to be kept to a minimum, and for the exact position of the site to be restricted to academic publications only. Because of this, the grid references have been limited to the general area of the mine in papers given to the public and the excavation was conducted almost solely by the researcher.

3.3 Theoretical Concepts Underpinning the Research

A range of theoretical concepts were applied to help interpret and understand past behaviour.

Empirical theory was deemed appropriate as the research included technological, archaeology, geology, mineralogy and survey, all of which were based on empirical principles (Siapkas and Hillerdal, 2015, p. 10). The results of the surveys undertaken of the research area were examined using theoretical aspects taken from Landscape Archaeology and Industrial Archaeology enabling diverse approaches to the interpretation of the sites. The theories supporting Landscape Archaeology were used to understand the medieval life and economy and land use which differed from those held by later populations in the Early Modern Period. Industrial Archaeology was used to explore the evolution of the technical aspects of mine sites over the time periods studied. This Marxist theory was used in the interpretation of historical documents supported the understanding of the context in which the surviving texts had been written.

Marxist theory (McGuire, 2008, p. 14; Spriggs, 2009, p. 1) was also used to help understand social change and some of the influences which may have had an impact on the historical and economic events being studied within the research area (Weber, 2009, p. 56). It was also used to understand why the documents examined had been written by, or for, the power-holding elites within societies. In the case of the Cardiganshire mines, these were the Crown, the aristocrats and the gentry, rather than by the general population. It was also used to understand why the majority of the workers did not possess the literacy skills and means to produce documents and preserve such documentation. Interpretation of Marxist theories helped to recognise the inequality of power, the evolution of the gentry class and the different ways the mines examined had been managed in the past (McGuire, 2008, p. 14). This theory was useful for explaining how and why owners and managers were able to exploit miners who were seen not only as workers, but as a captive market of consumers, who were coerced to buy produce and goods at greatly inflated prices as part of their working contract (Weber, 2009, p. 56). Feminist Theory (Mayers, 2023, p.6), was applied when trying to understand the lack of visibility of women and girls within the historical documentation relating to the metal mining industry in Cardiganshire (Mayers, 2023, p. 6). This theory also proved useful when examining the roles undertaken by women and the division of female labour at Esgair Mwyn in the 1750s.

The more ephemeral aspects of life in the past were considered by applying phenomenology theory (Tilley, 2010, p. 25). Phenomenology has been largely ignored in studies on mining, but the elements of this theory provided a platform that enabled consideration of the deep bonds and a sense of place and belonging that permeate through many mining communities, even today. Phenomenology was also applied when looking at how people such as Esgair Mwyns mine manager Lewis Morris viewed folklore including the belief in underground spirits, such as the 'Knockers' (Hoover and Hoover, 1950, p. 217).

3.4 Data Collection Methods

Identifying Evidence of pre-19th Century Mining Extraction

The land within the research area was surveyed several times over the course of a number of years in order to locate, identify and record all archaeological evidence of mining and, if possible, show when this mining had been undertaken. A recording sheet was designed for this purpose and used to record the accurate GPS position, description of the site, and interpretation of all features and mining activities that could be identified. This ensured that all sites were recorded equally and appropriately. All evidence of pre-18th century mining and artefacts plus evidence of datable mining material were recorded. Where possible, during the site survey, taking into account health and safety protocols, accessible underground workings were examined.

During this process, features that showed evidence of mining technologies and the methods that had been used in driving tunnels and working the ore deposits were recorded. This was possible as different technologies left specific markers on the stone. The advantage of identifying the method of extraction was that the technologies used could give an indication of the date the mine had been in use. This, however, would not be an exact date, as the introduction of technologies varied over time and it was not possible to say exactly when they had been in use at a particular mine. Evidence of the use of mining technology would be able to provide a useful timeframe of mining at that feature but secure documentary or datable evidence was also needed to positively date any mining found.

Evidence of Ore Extraction Technologies

All spoil heaps that were located in the research area were examined. It is likely that the majority of these features had been reworked several times over the years as new smelting technologies developed. New technologies made it economically viable to smelt ore that had been discarded in the spoil because it was too small to dress. Because of this undisturbed spoil heaps were given particular attention on the premise that they may contain a sealed context, buried surfaces or discarded material that could be used to date the spoil (Timberlake,

2003, p. 1). The composition of the spoil deposit can also give an indication of the age of the working. As an example, if a spoil heap contained large amounts of discarded zinc mineral it could be possible that the spoil had been discarded before the 1830s, as this was the time when large-scale mining of zinc first developed in Cardiganshire (Cocks and Walters, 1968, p. 13). The discarded rock was examined for signs of burning and tool markings which could further indicate when the spoil had been produced. Discarded tools, such as hammer stones and anvils, could also indicate early mining sites. Many of the spoil heaps were positioned on land surfaces that potentially contained organic remains that could be carbon dated, giving the age of their construction. For the same reason, old trial trenches were sought out and identified for the potential to section, looking for buried landscapes that could be dated. The disadvantage of dating a mine by any tool remains found within the spoil is that the tools themselves could not be dated other than by typography which is not reliable. Finding indications of the use of excavation tools such as hammerstones or gunpowder can however give an indication of the period when the mine was worked.

Hammerstones often leave a bruised and dented surface on the working face and are tools sometimes found discarded in mining waste. This technology was often used in conjunction with fire setting however, the 18th century it had fallen out of use in Cardiganshire. The technique of fire setting was used to break hard rock, whereby fires were lit against working faces. The heat expands the moisture within the rock, causing it to soften and/or delineate, making it easier to excavate. The signs of this technology were smoke-stained rocks plus the remains of the material used for burning located either within the workings or in the spoil. Another pre-gunpowder technology used were chisels, in order to cut a groove into the rock at the working face. Small iron chisels were then inserted into it and hammered until a small section of the rock split away. This technology is marked by a series of regular steps cut into the rock with chisel-shaped markings showing where the rock split off. The markers made through the use of wedges are distinctive. A line of holes was made in the rock being worked. Two iron wedges, called feathers, were placed into the holes on top of each other and iron chisels were placed in between them. The chisels were then hammered into the space between the feathers. This would split the rock along the lines of holes leaving a

ragged edge not dissimilar in look to the edge of a bird's wing. This method of working mainly fell out of use after the introduction of gunpowder.

Soft rock was often worked using picks, which varied in length dependent on the space available. Normally the pick would be made of iron around 60 cm long with a hardened or steeled point at each end. The ends of the pick were ground to a sharp, square-sided point. The impressions where the pick had bitten into the rock are often left in the tunnel side and roof. This method of working carried on after the introduction of gunpowder with picks being used when it was more economic to do so or when poor roof conditions prevented the use of shot firing.

The use of gunpowder for breaking rock underground was introduced in Cardiganshire in the late 17th century and was being used at most mines by the 1750s (Pierre and Weber, 2011, p. 33). Breaking rock in this way was called bore and fire or shot firing. The indicators of the use of bore and fire are the remains of shot holes in the walls of the working face and a much more irregular surface of tunnels. It is difficult to date mining using this technology, however, older bore holes tended to have a rougher bore surface due to the poor quality of steel cutting edges that were produced pre-19th century (Pierre and Weber, 2011, p. 33). These can, in some cases, be identified by those skilled in this area.

As well as mine sites, trial sites were also examined looking for indicators of how and when they were made. For this work the definition of a trial is an excavation looking for ore. This covers many features such from trenches, pits and shafts which were sunk on a lode but did not proceed to production.

The Surveys and Data Collection Methods

Data was collected from a range of sources, including identification of archaeological features and from documentation. In order to gain an understanding of the history of metal mining, including the methods and machinery used, mining museums in England and Wales were visited (some on several occasions). These included The Great Orme Copper Mines Llandudno, North of England Lead Mining Museum Killhope, Peak District Mining Museum Matlock, Llywernog Silver Lead Mining Museum, Dolaucothi Gold Mine Pumpsaint, Beamish Museum, Iron Bridge and the Clearwell Caves and

associated sites in the Forest of Dean. These museums contained documents, archives and items of machinery relating to metal mining. They also contained underground remains, including examples of fire-setting worked faces. A visit to the underground iron workings at Puzzle Wood in the Forest of Dean was particularly informative as it contains the remains of a small unlit fire to be used for fire setting. These remains, and other similar remains seen at the Great Orme, showed that as well as large fires, as seen in *De Re Metallica* (Hoover and Hoover, 1950, p. 120), fire setting could be used on a small scale to work discrete areas of mineral.

Desktop Survey

An initial desktop survey was undertaken in order to assess how much information on mining features within the research area existed in the archives. Information was found in a variety of sources and included the unpublished surveys undertaken by Jones (1922, p. 20) and Prothero-Jones (2006). The results of these surveys were stored at the Royal Commission on the Ancient and Historical Records of Wales, Cardiganshire Archives and Heritage Environment Records at Dyfed Archaeology. The archives stored in these places were important as between them they contained details on the position of all known mining sites as well as documentary sources that had been used in collating this information. It was found however that the majority of the information on mines within the research area was based on the book *Mines of Cardiganshire* (Burt, Waite and Burnley, 1985, p. ix) published in the 1980s by the University of Exeter. Despite this, the information within these archives provided a starting point for the identification of mining sites within in the area.

As part of the desktop survey maps covering the area were also examined. Maps had often been taken as being authoritative and unbiased in the past. Tithe maps, while being important because they identified land use, only showed a limited amount of information, which land owners required. There was also the problem that maps only became reliable with the development of Ordnance Survey mapping in the 1840s. It became apparent during the desktop survey that maps would be of limited use when looking at land use prior to the 19th century. Later Ordnance Survey maps of the 1840s and 1890s also had omissions. For instance, in the 1803 surveyor's sketches that were used to produce the 1840

Ordnance Survey map of the area, the Bronberllan mines were not shown and the Cwm Mawr Mine was over-emphasised. Additionally, many of the sites had mining remains, such as trials in close proximity, that were not marked on the maps. There were also discrepancies in field names, some of which were obvious and easy to identify, while other sites were simply marked by the word 'shaft', which were later omitted from subsequent editions of maps. For these reasons it was necessary to examine, several editions and sizes of Ordnance Survey maps covering each part of the research area to be examined.

It was decided that one of the most effective ways to understand the historic land use of such a large area within a reasonable time frame was with the use of remote sensing imagery such as satellite and aerial photography data. These images were used to help identify potential areas of historic mining. Once these areas had been identified, the field surveys could take place. The photographic surveys carried out by the RAF in the late 1940s, 1950s and 1960s, which were preserved in the RCAHMW (Parry, 2008), proved to be useful as they provided a snapshot through time of the mines as they underwent remediation by farmers. The aerial photographs, while useful, did not produce a completely accurate map of the mines. Unfortunately, large-scale aerial photography of the British Isles was not undertaken until the late 1940s, by which time mining in Cardiganshire had ended. Many of the mines in the area had been subjected to demolition and salvage processes by the time the aerial photographs were taken. The RAF photographs were compared with later satellite imagery and helped to form the basis for the ground surveys. Satellite imagery proved useful and provided information that had not been documented elsewhere. For example, the Hendrefelin mine, located on the edge of Graig y Bwlch quarry, was believed to have been largely destroyed. However, when aerial photographs and historic mapping of the mine were compared with satellite imagery, it was clear that mining remains still existed and that the site was more complicated than previously thought. Satellite imagery also aided the identification of features such as trenches, whose position could be noted and visited to ascertain if they were mining-related. The remote sensing data was most useful when combined with documentary evidence from the archives, the Ordnance Survey maps and the aerial photographs. At the time of starting the research on the mines, the area close to the abbey had recently been subjected to a LIDAR survey for the

purposes of the Strata Florida Project. Unfortunately, the LIDAR data had been set at a two-metre resolution, which meant that it was an insufficient resolution to identify small mining features. The ideal resolution would have been a minimum of 0.25 metres for this research, and as such, this method was not appropriate and could not be used.

Documentary Sources

Targeted searches were undertaken of the extensive archives held in UK national libraries with the hope of locating information on mining in the research area. The examination commenced with current literature on metal mining, mining in Wales and mining within the research area, followed by an examination of historical documents on mining, which included books, trade papers and journals dating from the 16th through to the 19th century. Works outside of mining which included references to mining in the area or contained descriptions given by people travelling through Cardiganshire from the 15th until the mid-19th centuries were also identified and examined. In order to gain detailed information relating to the workings of known and newly discovered mining sites, original mining publications were examined.

The archives of the main landowners in Cardiganshire, the Earl of Lisburne and Earl of Powis, were also examined. The majority of the historic records relating to these two families are held in two main collections, the Crosswood Deeds and the Powis Castle Collections. In these documents were correspondence, leases and other legal documents to and from these powerful families. Few documents relating to mining in the Medieval and first decades of the Earlier Modern Periods were found, so in an attempt to see if and where mining had occurred in these periods, legal documents such as lawsuits, leases and rental rolls from the 17th and 18th centuries were also examined. It was hoped that these documents would contain information relating to where mining had taken place and identify potential mining sites of earlier periods. These archives were useful in not only identifying mines, but also the people involved and the social and economic aspects of mining. The information, within these archives although often informative, had to be treated with caution because, not unexpectedly, there was a bias towards documentation written for, and by, the wealthy and literate. In an effort to redress this bias, resources were employed to search for the names of people from the

working classes and explore their involvement in mining. This proved difficult and time-consuming as very few of the workers were included in documents and any information was often very brief.

This bias had a significant impact into the research of the social aspects of mining and meant that the discussion in this chapter was reliant on documents, such as letters and ledgers, that came from Esgair Mwyn in the 1750s. Although they were able to provide an exceptional look at the workers, providing information which would be appropriate and accurate, there was an inevitable bias towards areas where the documentation was strongest. This bias was recognised and taken into account.

Another aspect that had to be taken into account was the lack of completeness and language used in the documents, as many were fragments of larger original ones, often containing names which were incorrectly spelt. In some documents there could be several versions of a person's name on the same page or place names that had evolved and changed over time. Grammatical errors often occurred during the translation of the older Welsh documents into English, causing considerable difficulties when it came to locating the sites that were being discussed in the documents. The study of these texts highlighted not only the changing methods in mining but the changes to the specialised mining vocabulary.

The Surveys

A number of landscape surveys were undertaken in order to collect the wide range of data needed to evaluate the variety of processes which had taken place on the land. This was not a linear process, with one mine researched, surveyed and documented after another. Instead, over the course of several years, all the sites were visited and revisited on a number of occasions, often due to fresh information discovered in documents or revealed through the archaeological surveys. These visits were extremely helpful as they revealed further information about the working processes of these sites and enabled a fuller understanding of how they had functioned in different time periods. All the known mines within the area were surveyed first, with the main features on the mine sites identified and recorded. The surveys were influenced by both the archaeological findings and

documentary research, which resulted in a to-and-fro process between archive and mining sites.

As part of this research a survey of the chemical contents of soil was undertaken within the precincts of the abbey in order to ascertain if there were any raised levels of metals, as this could be used to help identify possible metal processing sites. In conjunction with the Strata Florida Project, four hundred soil samples were collected over a period of two years from the abbey precinct and fields around the Bronberllan mine. Each sample was tested at the University of Wales, Lampeter laboratory to ascertain the background levels of lead, tin, copper and zinc. Once this had been established the metallic concentration within each sample was established using their Pye Unicam PU9100 atomic absorption spectrophotometer. The samples were then tested for magnetic susceptibility (which indicated possible burning) and phosphates (an indication of human and animal occupation) (Crowther, 2008). The use of modern portable X-ray fluorescence equipment would have made this survey more cost-effective in time and money, however at the time of the survey this was not available due to cost constraints.

Samples cores were taken from the trees in woodlands and mining features near to the abbey in the hope that dendrochronology could be used to determine the age of some of the remaining mining features. A range of core samples were taken from trees found growing within leats and shafts in order to ascertain the ages of the trees. The premise was that once a tree had started to grow within a shaft or feature it was a good indication that it had fallen out of use by this time. Of course, the feature could have been out of use before the tree started to grow, but this method gave a definitive timeline by which the feature was no longer being used. This method was used in woodlands around the Strata Florida Abbey complex. Unfortunately, these samples showed that the woodlands had been cleared in the early 20th century, meaning the data was not appropriate for the research.

3.5 Limitations of Surveys

Despite using all the above survey techniques, the identification of some of the smaller features, such as trial pits and trenches was reliant on the surveyors' interpretation. This was mainly due to the similarity between stone quarrying and other landscape features. Small trial pits and trenches excavated for either stone or metal can often look identical when a site is overgrown. The identification of these features is made more problematic as, in many cases, both stone and metals were mined on the same site. An example of this was found at Bronberllan mine where, what had previously been described as a hillside shaft, was actually a small stone quarry with an associated adit which had been driven to prove the quality of the stone rather than been used to explore for metal. This being the case, as in all research of this kind, some features may have been incorrectly identified.

It had been hoped that evidence of mining in the Medieval Period would be discovered however no archaeological or documentary evidence of mining was found from that period. The failure to find documentary evidence from this period may have been due to letters and deeds being lost or destroyed over time due to the turbulent history of the abbey and its dissolution. Alternatively, some documents may still exist but have not yet been uncovered or identified. The failure to discover medieval archaeological evidence was likely to be due to this research being limited by financial constraints. The archaeological remains recovered that dated to later periods strongly indicated that further investigations would recover Medieval or older mining remains, particularly at the Bronberllan mine.

3.6 Extenuating Circumstances

During the data collection period, the world came to a standstill due to the outbreak of the Covid-19 pandemic. This had an immediate and direct impact on this study due to the resulting country-wide lockdowns between March 2020-June 2020 and January 2021- July 2021 and continued restrictions. All public facilities that were closed during this time took several months to reopen, and then only with limited accessibility. This meant access to the archives and libraries was not possible and there was a requirement to leave the excavation of Maen Arthur due to the travel restrictions imposed during the pandemic (and the vulnerability of the

landowner). As a result, it has not yet been possible to complete the excavation at Maen Arthur.

3.7 Conclusion

It was decided that a mixed methodological approach would be applied to the research as this would enable a broad data collection. The aim of the archaeological surveys was to look for sites with evidence of mining which dated to the Medieval or Early Modern Periods. The remains found on each site were examined for signs of the technologies used and any features that were indicative of working the ore in certain time periods.

All spoil deposits were examined looking for indications of when they had been made. The combination of the documentary and archaeological research was aimed to build a comprehensive picture of mining in the area which included an account of the social aspects of mining before the 19th century in the vicinity of Strata Florida.

Chapter 4 - The Survey on the Mines and Trials

4.1 Introduction

The research area centred on the former Cistercian Abbey of Strata Florida. This site had been chosen because the Cistercians were well known for their extensive industrial and mining activities. It has always been assumed that the Cistercians had worked the mineral deposits of their Cardiganshire lands however, at the start of the research there was no archaeological evidence of mining on the former Strata Florida lands and the documentary evidence of mining was limited to three documents. The first document was a report that showed lead had been supplied from the Strata Florida mines to repair the roof of Cardigan Castle. The second referred to the lease of a mine near to Aberystwyth and the third was a report dated to 1539, written by John Leland (King Henry VIII Antiquary) claiming that he had seen evidence of former mining at Cwmystwyth (Toulmin Smith, 1906, p. 118) (Williams, 1967, p.36). The lack of evidence proving that mining had taken place in the Medieval Period was most likely due the limited archaeological research in this area. The building and maintenance of Strata Florida Abbey would have required a great deal of lead. As there were a number of lead mines close to the abbey site it seems most likely that lead from these mine sites had been used in building the abbey Therefore there was a significant probability that evidence of mining dating to the Medieval and Modern periods could be found in this area. This was also an area where very little detailed surveying of the mines and trials had taken place, meaning that the information gathered on the historic mining activities would add considerably to the history of the area and mining in Cardiganshire.

A number of small metal mines had been identified prior to this research close to the site of the monastery with names suggesting that the monks had exploited the mineral deposits beneath their lands in order to build and maintain the abbey at Strata Florida. Unfortunately, as already mentioned archaeological and documentary information covering mining in the Medieval and Early Modern Periods was almost non-existent. Therefore, in order to understand mining during these periods it was necessary to examine documents from later periods with the

hope of finding information that referenced back to sites of earlier mining within the research area.

The desk-based research, which also included an examination of the geology of the area to be surveyed, was used to identify all mining sites that had already been recorded on maps and published materials. The databases of the Dyfed Archaeological Trust, Royal Commission of Ancient and Historical Monuments for Wales and Cadw had information on the sites to be surveyed. This included known history and if any non-intrusive or intrusive investigations that had been carried out previously on any of the sites or within the vicinity of the research area. This was followed between 2012 and 2018, inclusive, by a number of archaeological landscape surveys. These extensive surveys were then followed by further targeted surveys on any of the sites where new information, either documentary or archaeological, was discovered. The information gathered from all the surveys and historical documents in relation to the mines and trials was collated and is discussed in detail below. The research surveys are referenced with their date to distinguish them from other surveys that were undertaken by others in the past. When finished, the data recovered will be disseminated and deposited with the local and national archives. Where feasible, the surveys included the consideration of the wider landscape around the mines and trials. All leats and tracks which served the sites were surveyed, followed to their source and recorded. When an unrecorded site was identified, any documents concerning it were sought out with the aim of tracing its history back, including, if possible, who made the feature and when. Any information that was found on the mining features, such as notations on maps, in journals and in mine records was used in conjunction with the landscape surveys to locate sites of mining within the research area. Archaeological excavations were carried out on the sites that showed a reasonable potential of containing Medieval and Early Modern mining remains.

The research initially focused on the four mines that had been recorded by Bick (1978) within a one and half kilometre radius of the Strata Florida Abbey. Following the examination of historical documents, including diaries, private letters, official account books, as well as journals published histories, records, aerial photographs and Ordnance Surveys, the number of mine sites increased

significantly. As a result of these findings, the research was expanded to include all the additional mining features that had not been previously identified or recorded. In total, the landscape surveys identified 19 mines plus an additional 22 trial sites where mining trials had been carried out within the research area.

Consequently, as a result of this research, the number of mining sites identified within the research area increased to a total of 41 (see figures 4.1 and 4.3). All of these sites were surveyed and recorded. Put together, this information has redefined the history of the industrial landscape of Strata Florida and provided evidence of previously unrecorded mining features and trials within this area. The map of the mining sites identified during the research can be found in figures 4.2 and 4.4.

List of the 19 mines located within the research area			
Mines			
ID	Name of Site	Grid Reference	Comments
M1	Bronberllan	SN74552/66364	Discussed in Chapter 5
M2	Bron Caradoc	SN6905/6960	
M3	Bron Mwyn	SN714/644	
M4	Bryn y Gors	SN73114/65882	
M5	Cilfach y Rhew	SN742/692	Record of mining on this grid reference. But no mining was found, possibly incorrect entry on the database
M6	Creigaen Ddu	SN776/6510	
M7	Cwm Caddwr	SN68120/67512	
M8	Cwm Mawr	SN73569/67259	Discussed in Chapter 5
M9	Dyffryn Cottage	SN75261/68486	Discussed in Chapter 5
M10	Esgair Ddu	SN76774/69674	Discussed in Chapter 5
M11	Esgair Mwyn	SN75438/69333	Discussed in Chapter 5
M12	Hendrefelin	SN715/701	
M13	Llwyn y Gwyddyl / Llwyn Llwyd	SN746/685	Discussed in Chapter 5
M14	Llwyn Malus	SN690/6780	
M15	Llwyn y Gog	SN72650/67550	Not found possibly wrong position in William Edward's book <i>Ar Llethrau Ffair Rhos</i> or has been built over
M16	Logaulas Mine	SN740/716	Discussed in Chapter 5
M17	Maen Arthur	SN734/728	Discussed in Chapter 5
M18	Pen llan Fach	SN73760/70027	
M19	Tyny Graig	SN69763/69544	

Figure 4.1 List of the 19 mines within the research area

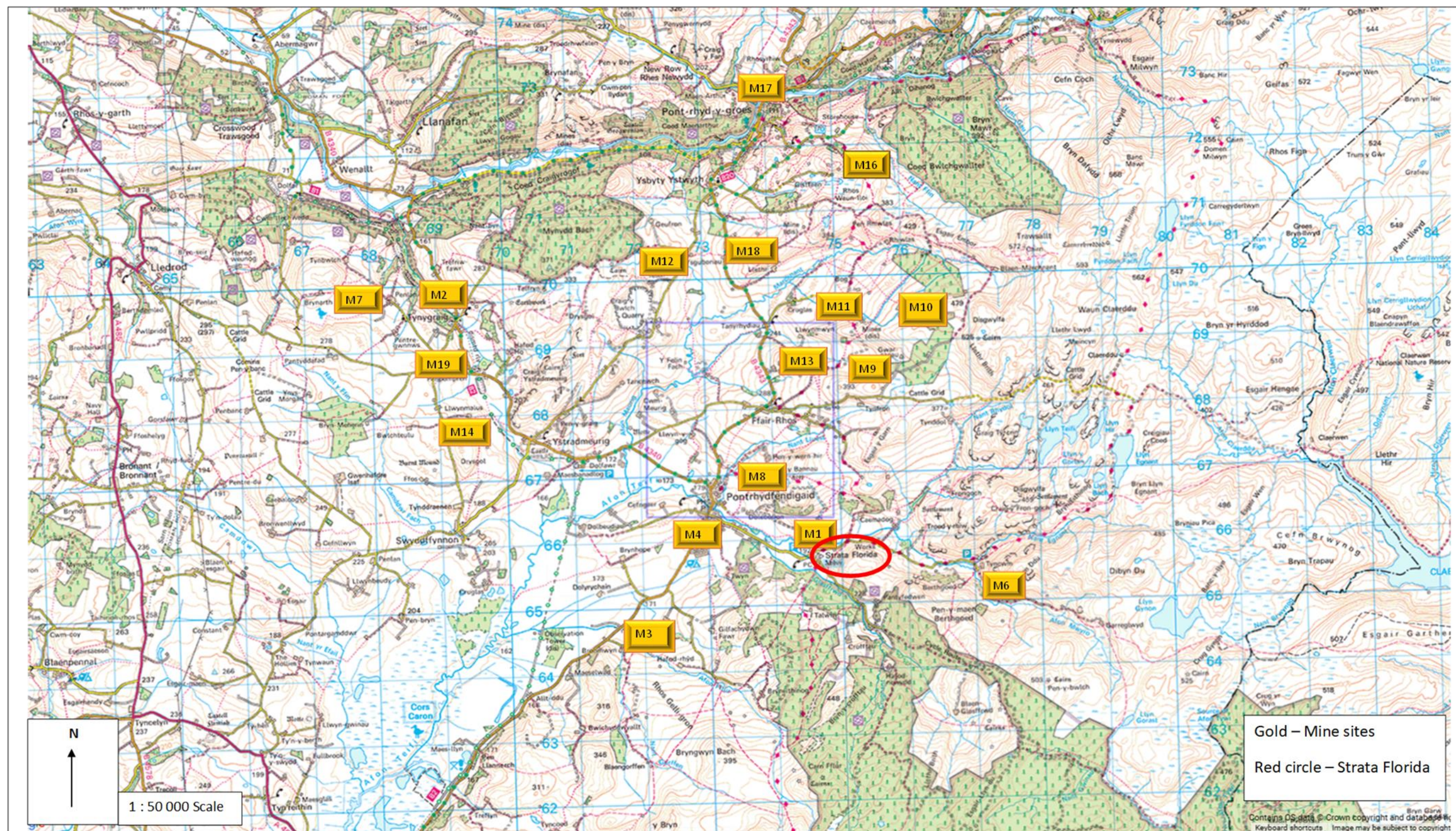


Figure 4.2 Map of 17 mines identified within the research area (Ordnance Survey, 2002).

List of the 22 trials located within the research area.			
T1	Abbey Consols, Gargoed	SN76803/67208	Discussed in Chapter 5
T2	Berthgoed	SN76360/64594	
T3	Berthlwyd / Gwaith Goch	SN724/727 SN700/719	Discussed in Chapter 5
T4	Bryneithino	SN76102/69622	
T5	Bryn Coryn	SN7610/6950	
T6	Bwlch y Dwyallt	SN760/637	
T7	Castle Dinas	SN80618/64326	
T8	Cefngoer	SN71957/66461	
T9	Chwarel Mawr	SN76364/70622	
T10	Claer Ddu	SN79210/68783	
T11	Cloddiau	SN72238/69007	
T12	Crilfach yr Heol	SN74754/69275	Recorded as an adit on mapping
T13	Crofftau Bridge	SN7522/6484	Discussed in Chapter 5
T14	Crud y Awal	SN75057/68192	Discussed in Chapter 5
T15	Drysgol / Glansychant	SN70845/69188	
T16	Gwaith Douglas	SN78839/68189	Gold trial
T17	Pantfyedwen	SN7520/6490	Discussed in Chapter 5
T18	Peny Bwlch	SN79037/63402	
T19	Talfryn Farm	SN70713/70000	Discussed in Chapter 5
T20	Troed y Rhiw	SN76735/66307	
T21	Ty Mawr	SN73175/66428	
T22	Tyndol	SN76823/68070	

Figure 4.3 List of the 22 trials within the research area

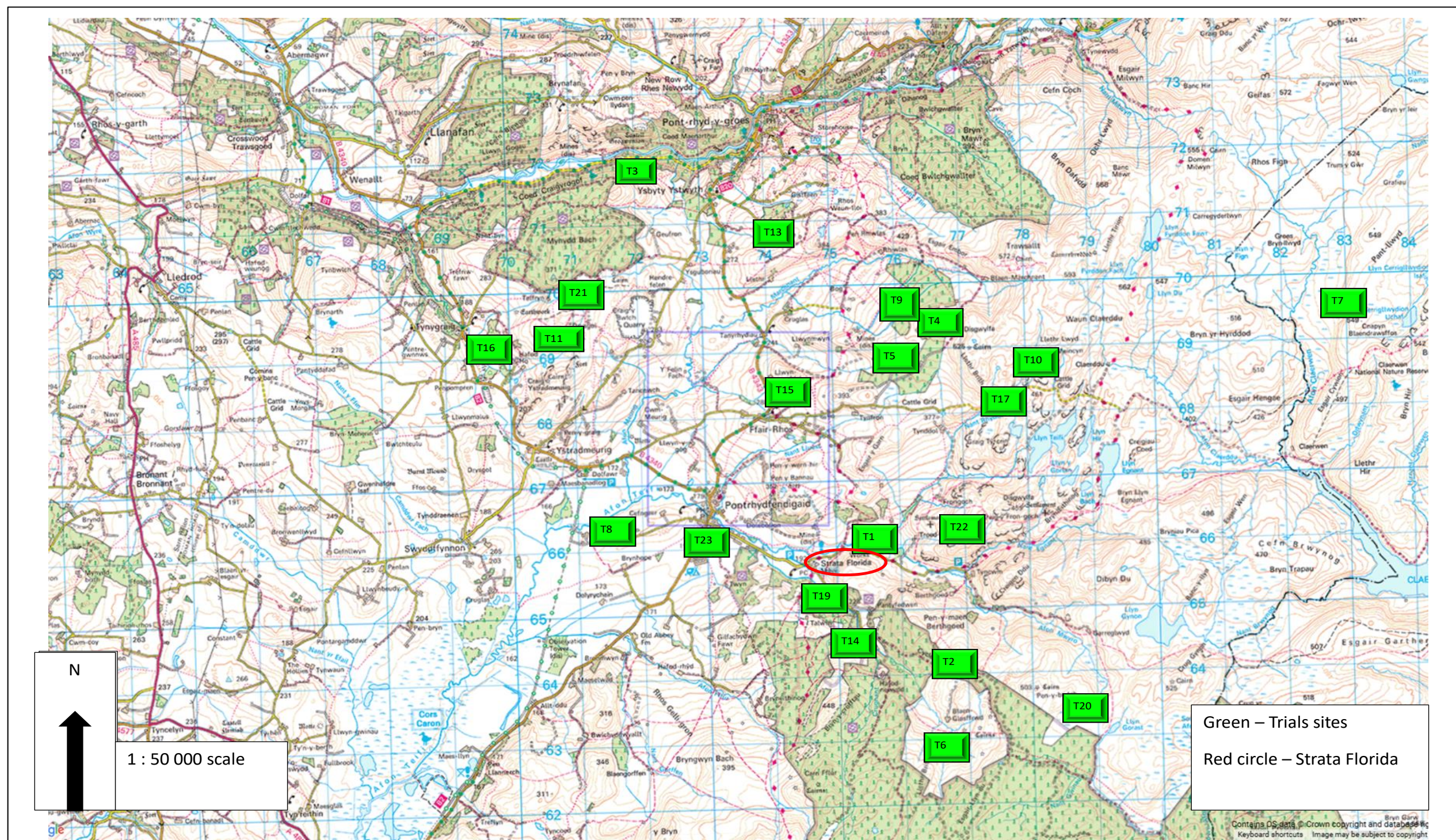


Figure 4.4 Map of the 22 trials located within the research area (Ordnance Survey, 2002)

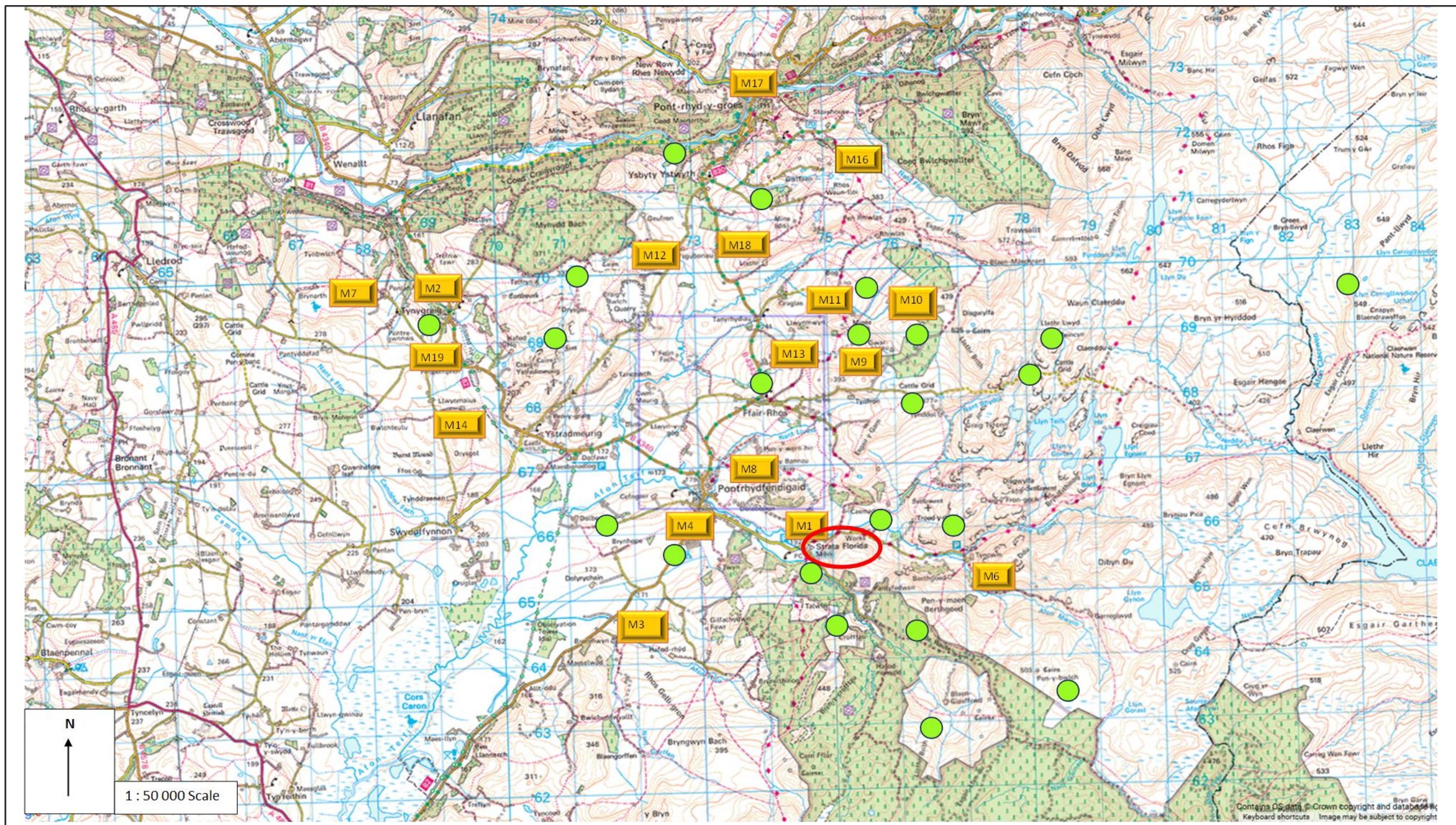


Figure 4.5 Map of the 17 mines and 22 trials identified within the research area (Ordnance Survey, 2002)

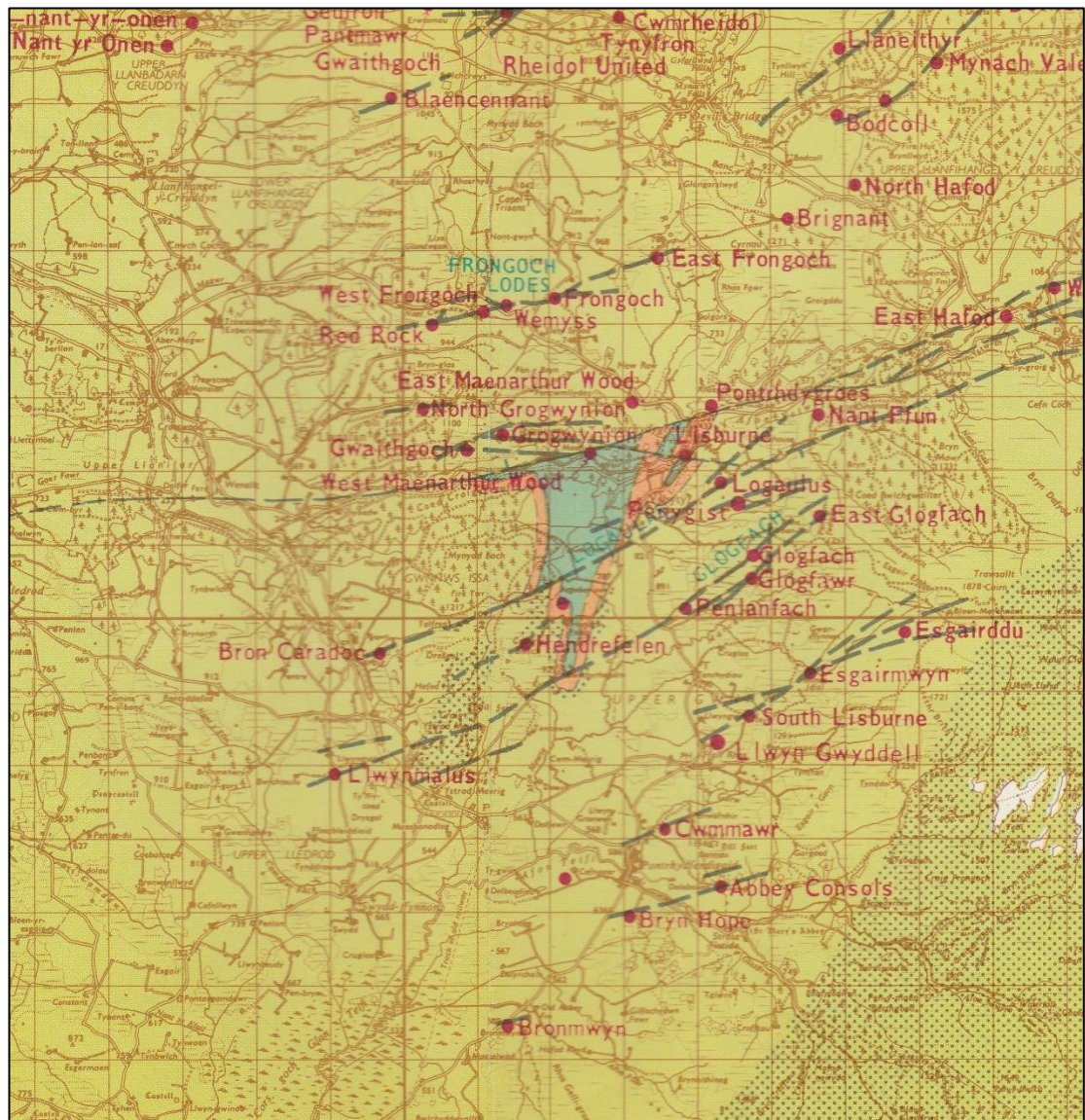


Figure 4.6 Map Showing the Mineral Deposits within the Research Area.(Ball and Nutt, 1976)

4.2 Discussion on the 19 Mine Sites within the Research Area

M1 Bronberllan Mine SN74552/66364

- This mine was mentioned in the RCAHMW Coflein Database.
- The RCAHMW file did not contain any documentation before 1840. It is marked on Ordnance Survey maps from this time onwards.

This mine had a documented history dating back to the early 16th century. The mine had been worked almost continually from the 16th century until the early 20th century and still contained surface remains that dated to the last quarter of the 17th century. It was identified that this site was suitable for further investigation as it contained archaeological remains that dated to the time frame required. As such, one of the two large excavations undertaken during this research was carried out on this site. This site is discussed in detail in Chapter Five.

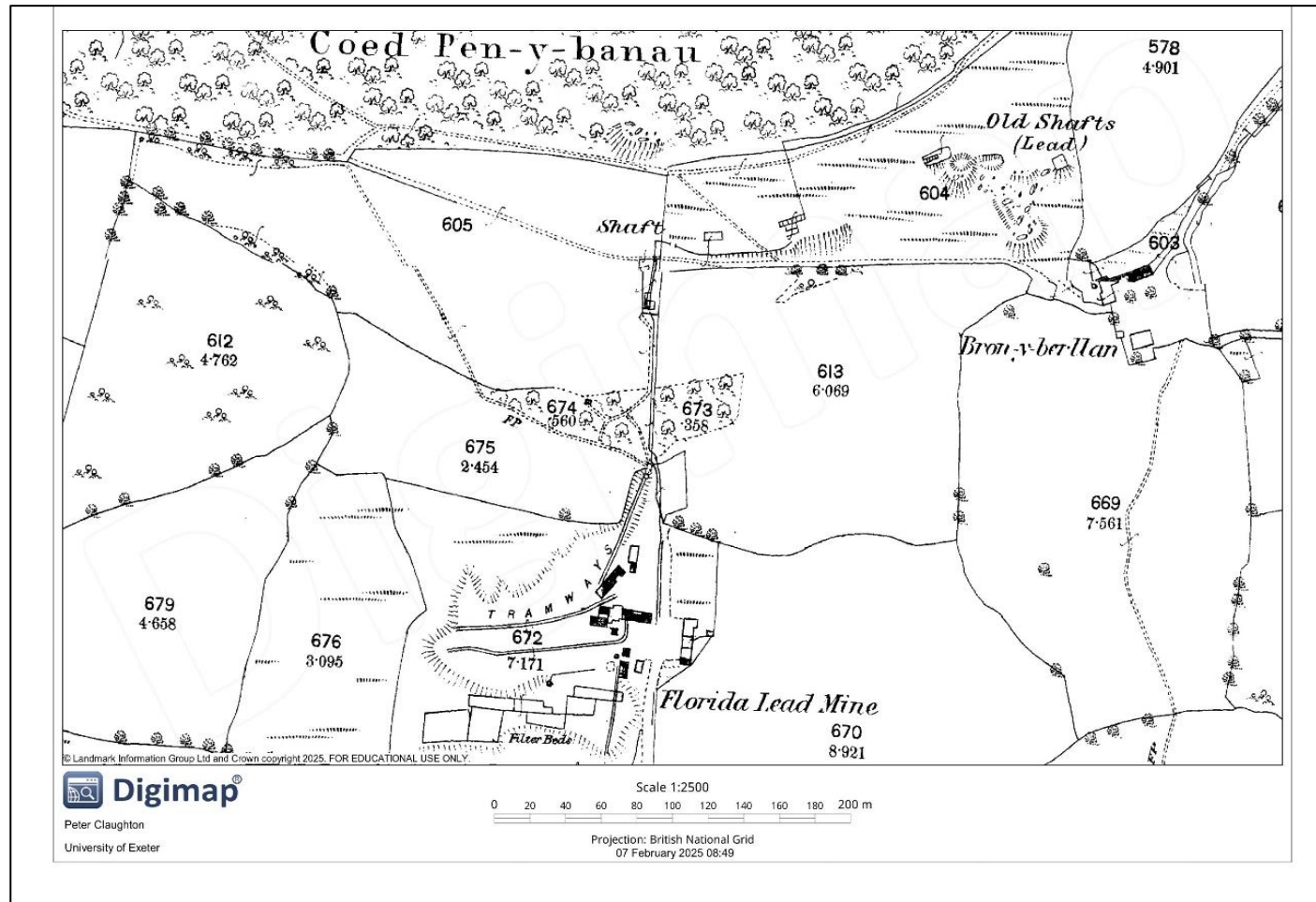


Figure 4.7 Map of M1 Bronberllan Mine 1880 (Digimap, 2025)

M2 Bron Caradoc SN6905/6960

- This mine is also known as Caradock Mine and Hafod y Gofiant, and was recorded on the Royal Commission on Ancient and Historical Monuments Database.
- It has also been recorded on the 6 inch to 1 mile 1880 Ordinance Survey Map and in the Mineral Statistics (Burt, Waite and Burnley, 1985).

Documentary Evidence.

The earliest evidence and history of this mine came from Absalom Francis, who wrote that in 1874 the manager was J. M. Davies, while the land was owned by Mr Atwood, a solicitor of Aberystwyth. Francis further reported that there were some minor trials on what appeared to be the Bron Caradoc lode, at Hafod y Gofiant, some 500 metres east of Bron Caradoc, although these workings did not progress beyond a trial (Francis, 1874, p. 113). The main Bron Caradoc site did progress to being a mine and appears to have been worked on a small scale from 1861 to 1871. Francis indicated in his report that no machinery was in situ on the site at the time of his report (Francis, 1874, p. 116). A survey of the site in 2013 found a number of features, including open adits, trenches and other mining features. These remains appeared to date to the 19th century, although having said that, the surface deposits may also have been worked in earlier periods.

M2 Bron Caradoc		
Feature	Quantity	Grid reference
Adits	3	SN69077/69638 SN69077/69686 SN69015/69743
Destroyed Adit	1	SN69274/69519
Trial Adit	1	SN68913/69838
Costeaning Trenches	1	SN69133/68961
Platform cut by stone quarrying	1	SN 27000/69515
Open works	2	SN69356/69528 SN69254/69520

Figure 4.8 Features recorded M2 Bron Caradoc

M3 Bron Mwyn SN7140/6440

- Also known as Caron Mine, this mine is recorded on the RCAHMW Coflein Database. Also recorded on the 6 inch to 1 mile 1880 Ordnance Survey map and in the Mineral Statistics (Burt, Waite and Burnley, 1985).
- The RCAHMW file contained limited documentation on this mine.

The known history of this mine was limited to the work that had been undertaken on the site in the 19th century. The Welsh name of the site Bron Mwyn translates to 'Mine on the Breast of the Hill'. This is a name that was used during the Medieval Period indicating that this was most likely the site of mining at that time. Surveys of the site in 2012 and 2014 found no mining remains dating to before the 19th century.

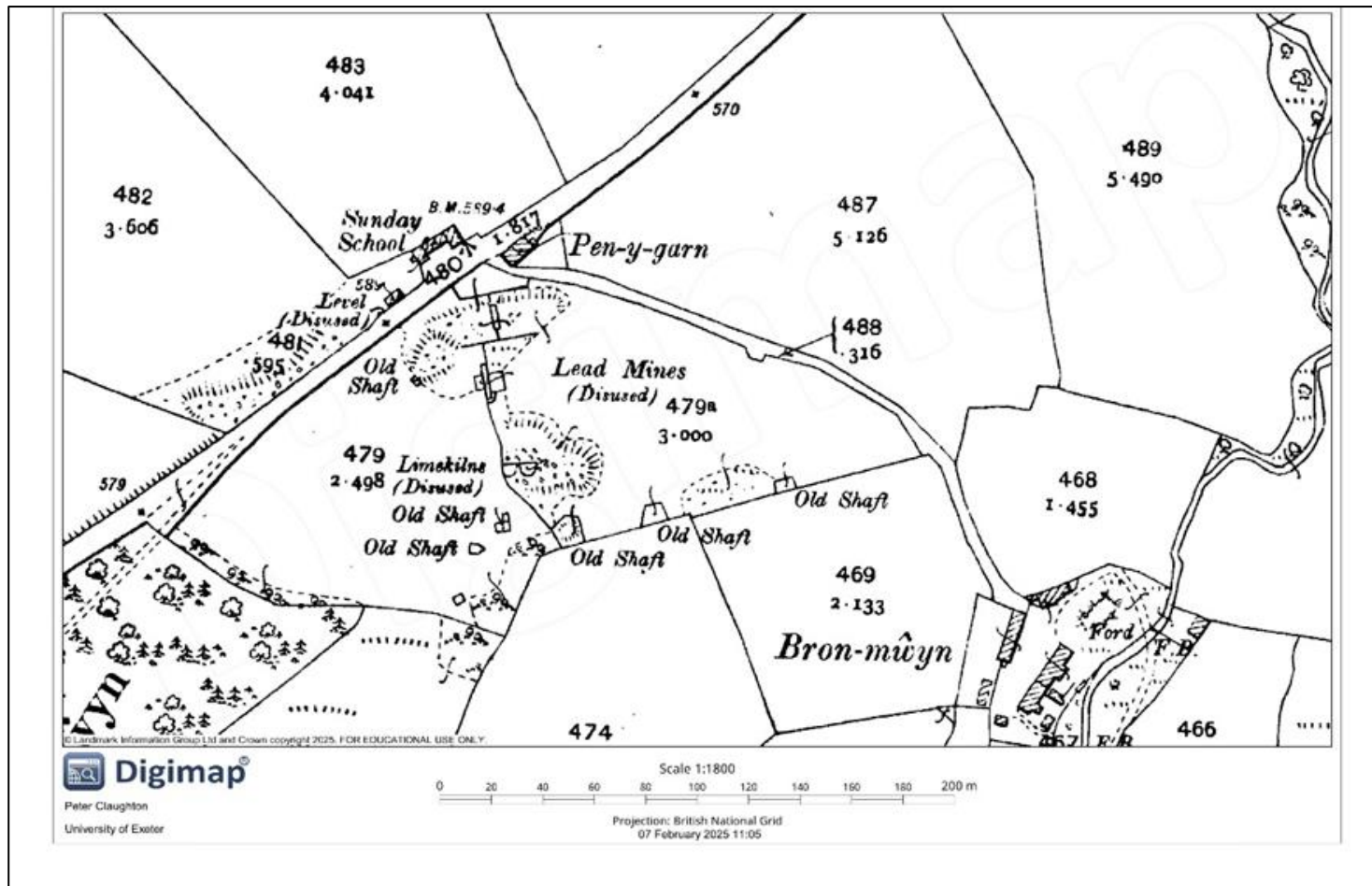


Figure 4.9 Map of M3 Bron Mwyn Mine 1905 (Digimap, 2025)

M3 Bron Mwyn			
Feature	Quantity	Grid reference	
Adit	1	SN71367/64510	
Crushing House	1	SN71405/64466	
Leat	1	SN71420/64430	
Open work	1	SN71437/64414	
		SN71421/64411	Back filled shaft
		SN71410/64409	Shaft and open work in very close proximity to each other. Shaft has been sunk through open work.
		SN71426/64421	Open work driven into side of shaft. Spoil from open work used to backfill shaft.
Ore bins (lime kilns)	2	SN71395/64448 SN71533/64436	
Round buddles	1	SN71400/64493	
Reservoir	1	SN71551/63229	
Shafts	7	SN71460/64418 SN71431/64413 SN71415/64409 SN71526/64446 SN71396/64402	

		SN71409/64420 SN71377/64475	
Spoil heaps	4	SN71436/64439 SN71338/64499 SN71418/64437 SN71444/64413	
Waterwheels		SN71404/64495 SN71400/64493	

Figure 4.10 Features recorded at M3 Bron Mwyn

M4 Bryn y Gors SN73114/65882

- This mine was also known as Bendigaid, Bryn Crach, Bryn Hope, Cardigan South Bog, Cnwch, and West Florida.
- This mine was recorded on the RCAHMW Database and maps dating from 1880.
- The first recording of this mine was under the name Bryn Hope in the mineral statistics (Burt, Waite and Burnley, 1985, p. 9).

This mine had been worked in conjunction with other mines, including Bryn Hope and Caron, and had appeared under several names in The Mining Journal and other publications during the 19th century. Documentation indicated that this mine had been worked sporadically throughout the 19th century without any great success, possibly due to water problems as the mine shafts had been sunk into an area of bog land. The leat system that served Bryn y Gors also served the Pantyfedwen mining site. The 2013 survey of this mine found a number of mining features which all appeared to date to the 19th century. As no evidence of 18th century mining was identified, this mine was not included in any further investigation.

M4 Bryn y Gors		
Feature	Quantity	Grid reference
Bog land	1	SN72346/62560
Crushing house	1	SN73282/65553
Leat	1	SN76373 /64428
Open works		SN72830/65936 SN73152/66009
Shafts		SN72782/65948 SN72780/65949 SN73055/65919 SN73122/66012 SN73152/66009
Waterwheels	2	SN73325/65544 SN73295/65574

Figure 4.11 Features recorded at M4 Bryn y Gors

M5 Cilfach y Rhew SN742/692

Recorded as a mining site on the DAT database, however when the area was surveyed no signs of mining were found. Possibly due incorrect grid reference entry on the database.

M6 Creigaen Ddu SN7760/6510

- This mine was recorded on all databases and with Coflein.
- The mine was recorded on OS maps of the area.

This mine had been recorded by Foster-Smith (1979) who showed that it consisted of a level driven into the hillside at SN77625/65060, however, the amount of work that had been carried out plus the spoil observed during the 2014 survey indicated that this was more than a small trial.

Foster-Smith (1979) also wrote that old mines had been recorded on the site in 1856 and that large amounts of Cerussite had been found within them (Foster-Smith, 1979, p. 84). During the 2014 survey, it was noted that the mine was close to several small slate quarries that were on the same hillside and so it may be that the mine had worked slate as well as metal. The premise that this mine had worked slate has been given weight following a survey of the waste on site as it did not contain any metallic mineral. Three small back-filled shafts were also identified, along with a large square cut adit. This adit could not only drain a substantial amount of water from the mine, but was also large enough to handle the passage of a standard-sized mine-tub.

There was no evidence of pre-19th century workings seen on the site and therefore it was not included in this study.

M6 Creigaen Ddu			
Feature	Quantity	Grid reference	Comments
Adit	1	SN77625/65060	
Open working	1	SN78457/65346	Grassed over open working possibly for stone or a trial for ore.
Shafts	3	SN77625/65060 SN77622/65067 SN77620/65079	
Spoil heaps	4	SN77625/65060 SN77622/65067 SN77620/65079 SN77628/65060	Three are very small, made up of slatey stone
Slate quarry workings	2	SN77374/65312 SN77562/65967	
Trial trenches	4	SN77977/65129 SN77991/65155 SN78051/65258 SN78150/65090	

Figure 4.12 Features recorded at M6 Creigaen Ddu

M7 Cwm Caddwr SN68120/67512

- This mine was recorded on the RCAMW Database but not with Coflein.
- It was marked on the 1880 Ordnance Survey map.

It was probable that this mine had been named after the former small holding which lay 40 metres to the east of it. The mine had been put into the database because it had been recorded on the 1880 map. The survey of the site in 2013 identified a small adit which had been backfilled. A small spoil deposit which contained some minerals was found close to the mouth of the adit. A stone quarry and trial were found 24 metres north of the site. This small mine appeared to have been little more than a trial on the same lode as the Llwyn Malus Mine. Other than the 1880 Ordnance Survey maps, no documentary evidence was found for this mine. It had previously been suggested that rather than a mine, it was an adit draining the Llwyn Malus mine (Hall, 2010; Hughes, 2010). However, after visiting both sites in 2015 and examining geological maps, it was apparent that this was a separate mine. This had also been the conclusion of the RCAHMW surveyor who recorded it as such on their database

M7 Cwm Caddwr		
Feature	Quantity	Grid reference
Adit	1	SN68120/67512
Stone quarry	1	SN68111/67563
Small trench	1	SN69386/67209

Figure 4.13 Features recorded at M7 Cwm Caddwr

M8 Cwm Mawr SN73569/67259

- A mine recorded on the RCAHMW and DAT Databases.
- This mine appeared on maps from 1880 and on the surveyors' drawings for the 1840 one-inch maps.
- This mine was also worked under the names of Pen y Wern Hir, Cambrian and Fair Chance.

The results of the survey of this site are discussed in detail in chapter 5.

M9 Dyffryn Cottage SN75261/68486

- This mine was recorded on the RCAHMW Database but not with Coflein.

The results of the survey of this site are discussed in detail in chapter 5.

M10 Esgair Ddu SN76774/69674

- This mine was recorded on the RCAHMW and DAT Database and with Coflein.
- This mine had also been worked under the name Ddu and as part of Esgair Mwyn.

This mine was situated on a hillside east of Esgair Mwyn mine, and was first discovered by the surveyor employed by Lewis Morris in the 1750s (National Library of Wales, MS 15101). It has a working history that began in 1768 and had been tried several times in the 18th century. The mine was worked again in the 1850s, with the production returns being combined with the returns for Esgair Mwyn until 1889 (Burt, Waite and Burnley, 1985, p. 36). The results of the survey of this site are discussed in detail in chapter 5.

M11 Esgair Mwyn SN 75438/69333

- This mine was recorded on all Databases and with Coflein.

Esgair Mwyn mine was, at one time, one of the most important mines in Wales, not because of the quantity of ore produced but because of the part it played in the disputes between the Crown and landowners over mineral rights, during the 18th century. This mine had an almost complete documented history that dated from the 18th century until the 1970s. This mine was last worked by the mining author George Hall (2010). The results of the survey of this site are discussed in detail in chapter 5.

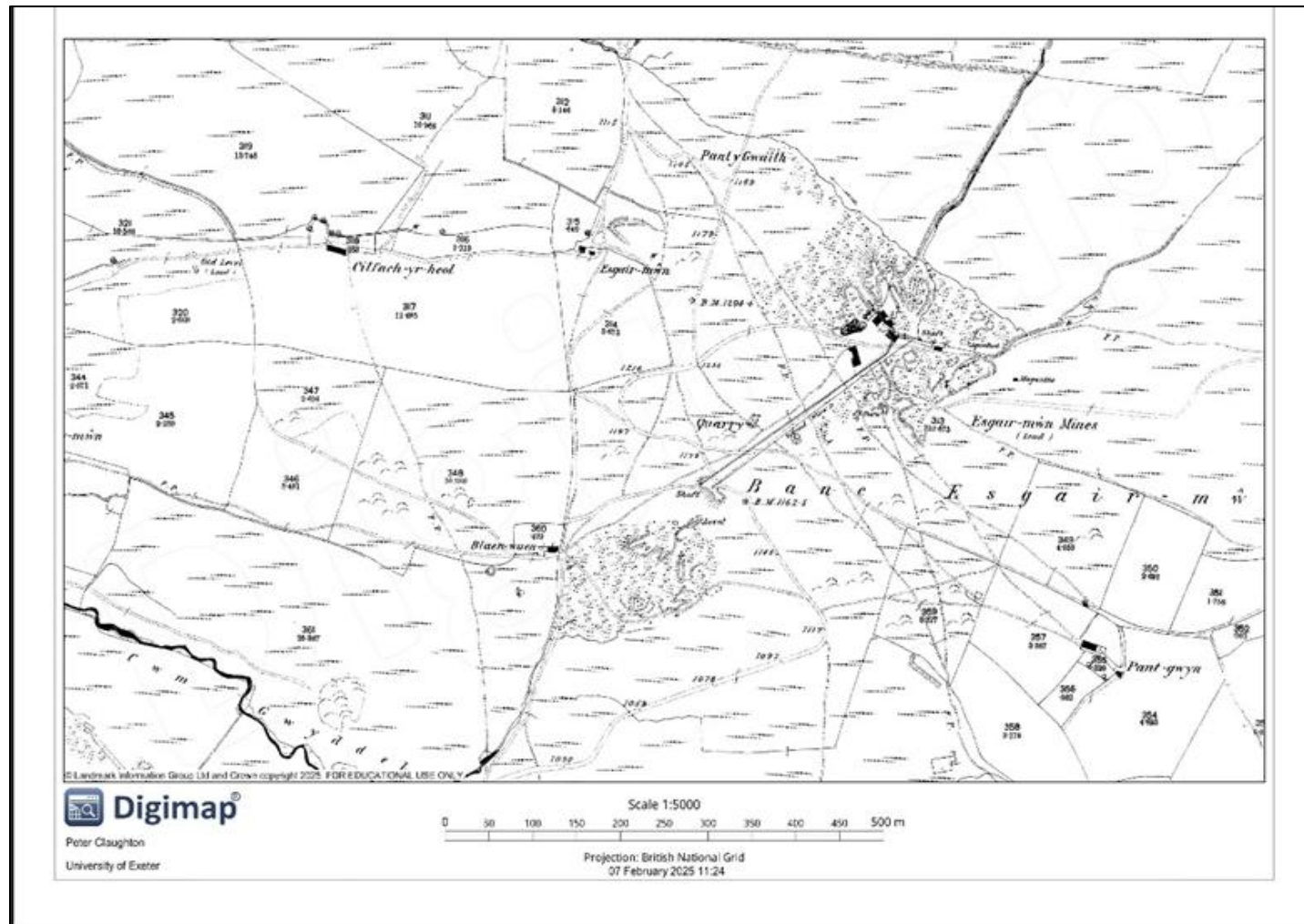


Figure 4.14 Map of M11 Esgair Mwyn 1880 (*Digimap, 2025*)

M12 Hendrefelin SN7150/7010

- This mine had also been worked under the names of West Lisburne and Ella.
- This mine was recorded on the RCAHMW and DAT Databases
- It was noted on the 1880 Ordnance Survey map.

Historical documents showed that this mine had made returns in 1870 which amounted to 20 tons of ore, producing 15 tons of lead, under the name Hendrefelin (Burt, Waite and Burnley, 1985, p. 57). It had also made returns under the name of West Lisburne from 1880 through to 1884, but these returns reported that the mine had not produced lead ore during this period. (Burt, Waite and Burnley, 1985, p. 62). Jones (1922, p. 141) proposed that this mine had been a series of trials rather than a fully productive mine.

It had been thought that much of the mining remains had been destroyed by the Graig y Bwlch stone quarry which encroaches on to the mine site. While part of the mine workings may have been destroyed, mining features have survived on the eastern, western and northern edges of the quarry. This mine had a well-developed infrastructure which included a leat, a waterwheel and a rod run, but lacked dressing floors or crushers. There were three areas of mining on the site; one around the original farm of the same name, a second to the southeast of the first area and a third directly south of the farm. All three had levels associated with them and appeared to have been worked separately from each other. The main focus of the workings was along the west ridge just below the quarry. It could be that there were three mines in operation here rather than one. There were indications that this had been a multi-period site which had been trialled on a number of occasions. This site would benefit from further archaeological surveys which unfortunately fall outside the remit of this study.

M12 Hendrefelin		
Feature	Quantity	Grid reference
Adit	2	SN71876/69909 SN72185/70124
Trials	5	SN71757/69778 SN71762/69785 SN71895/69913 SN71505/69578 SN71828/69811
Shafts	6	SN71557/69648 SN71499/69557 SN71665/69736 SN71779/69811 SN71886/69901 SN71874/69898
Spoil heaps	2	SN71858/69930 SN71773/69807
Rod run cut	1	SN71739/69768
Waterwheel	1	SN71706/69762

Figure 4.15 Features recorded at M12 Hendrefelin

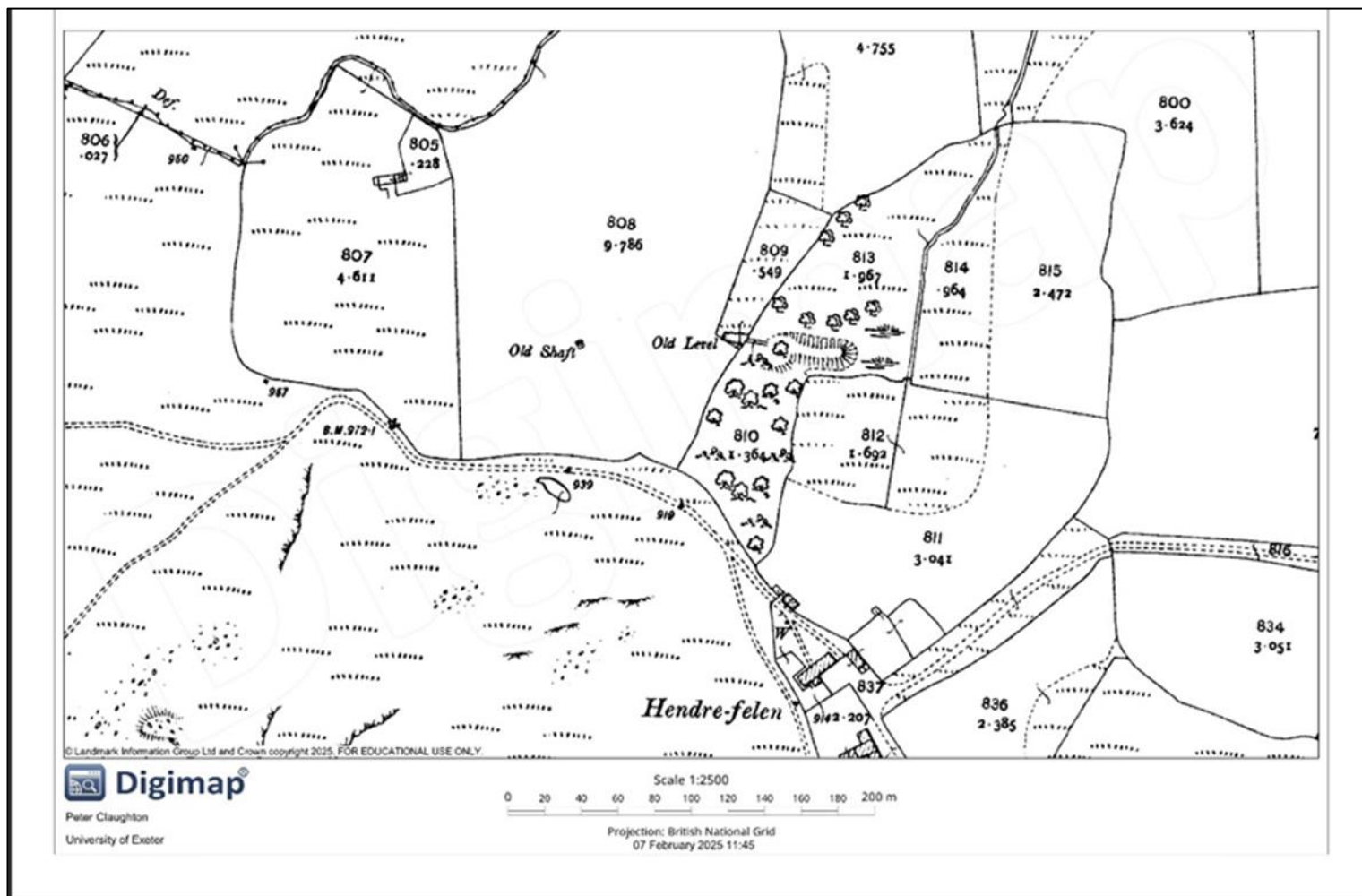


Figure 4.16 Map of M12 Hendrefelin 1905 (Digimap, 2025)

M13 Llwyn y Gwyddyl and Llwyn Llwyd SN746/685

- These mines were also worked under the name of Lisburne South.
- Both mines were mentioned on maps, DAT and with Coflein and worked the same deposits for the most of their history as a single mine.

As their history and the archaeology of these mines are so intertwined, this research has treated them as a single mine. The results of the survey on this site are discussed in detail in chapter 5.

M14 Llwyn Malus SN690/6780

- This mine had also been worked as West Lisburne mine, (although there was no connection with Hendrefelin mine which had also been worked under the name West Lisburne) (Bick, 1978, p. 37).
- This mine was recorded on the historical maps and on the RCAHMW and DAT Databases.

The first records for this mine began in the 1840s (Burt, Waite and Burnley, 1985). The lode where this mine worked was documented to have contained a remarkable amount of silver (Smyth, 1848, p. 655). Bick referenced this mine it at SN690/3780 and recorded two shafts (Bick, 1978, p. 37). Three shafts were identified during the surveys.

The great drawback of this mine, like many of the mines in the area, was that it suffered from too much water underground and not enough water above ground to power the pumps to drain the mine. The archaeology suggested that water had been gathered from several sources, including streams, field wash and water gathered under the rod run to power the waterwheels on the site. The owners had attempted to overcome this problem by purchasing a Cornish engine from the Greens of Aberystwyth (Foster-Smith, 1979). However, this proved to be too expensive to run and was later replaced by a 50-foot waterwheel (Bick, 1978, p. 37).

The boiler for the engine remains on site and was interesting as it is the oldest Cornish engine boiler still in-situ in Ceredigion, as well as being the first Cornish engine produced at the Greens Engine Works at Aberystwyth. The remains at the site consisted of the foundations of the Cornish engine house, the boiler and three shafts. The mine also had an adit which has been backfilled on the eastern side of the hill. The area around the former adit was quite disturbed and could not be located with confidence. On the western hillside were the remains of a rod run system, a waterwheel casement, a small cobbled dressing floor and a reservoir. When constructing the reservoir, the builders had taken advantage of the contours of the hillside which resulted in a long and narrow triangular-shaped feature.

The engine house had been demolished to ground level, forming an excellent plan of the building, which is presently covered in several tons of redeposited spoil. This site would be perfect for a community project involving the local residents, archaeologists, historians and mining groups with the purpose of excavating and understanding the history of the site. The site did not contain evidence of pre-19th century workings, making it unsuitable for this research.

M14 Llwyn Malus			
Feature	Quantity	Grid reference	Comments
Shafts	3	SN69019/67910 SN69899/67921 SN68844/67867	
Adits	2	SN 69700/68000 SN68122/60475	
Rod runs	1	SN68373/67875	
Waterwheel	1	SN68216/67857	
Leat	2	SN68197/67858 SN68195/67460	
Reservoir	1	SN68255/67803	
Spoil heaps	3	SN68209/67846 SN68208/67841	A large spread of waste, some of which has been redeposits from other parts of the site
		SN68192/68192	
Laid cobbled dressing floor	1	SN68227/67848	
River	1	SN68115/67990	
Prospecting trench	1	SN69620/67929	
Trial pits	3	SN69568/67934 SN69235/67627 SN69177/67459	
Cornish engine house foundations Cornish Boiler	2	SN68973/67889 SN68978/67908	

Figure 4.17 Features identified at M14 Llwyn Malus

M15 Llwyn y Gog SN72650/67550

- This was an unrecorded mine.
- This mine was mentioned in *Ar Llethrau Ffair Rhos* (Jones-Edwards, 1963).
- The mine was known to Simon Hughes (2010).

A mine named Llwyn y Gog was noted in William Edward's book *Ar Llethrau Ffair Rhos*. This book is based on Edwards's memories of mining in the area (Jones-Edwards, 1963, p, 5). The mine was later identified and visited by Hughes around 1987, at which time the mine was still open but flooded (Hughes, 2010). During the 2014 survey, no sign of disturbed ground or spoil was visible at the grid reference given or the immediate surrounding area. However, it may be that it was destroyed during the construction of modern farm buildings on the site or that the given location was incorrect.

M16 Logaulas Mine SN740/716

- This mine was recorded on the DAT Database and with Coflein.
- It was marked on the 1880 map.

This mine was located slightly outside the original defined research area but was included after important documentary evidence showed that it had been worked much earlier than had been thought. The results of the survey on this site are discussed in detail in chapter 5.

M17 Maen Arthur SN734/728

- Unrecorded Mines.

This site consisted of a series of adits, buildings and other features that were discovered following a number of targeted searches over a number of years. During the 2014 survey, the mines were found in the woodlands at Maen Arthur Woods. The results of the survey on this site are discussed in detail in Chapter Five.

M18 Pen Llan Fach SN73760/70027

- A mine recorded on the RCAHMW and DAT Databases.
- This mine was recorded on all the maps.

Documentary evidence of the mine was found in Foster-Smith (1979, p. 79) and Bick (1978, p. 30).

The remains of two waterwheel casements and a much-degraded leat were identified as well as a shaft, an open working and associated small spoil heaps. One of the open workings may have contained a possible adit.

This mine lay on the eastern side of the B4343 road and may have been worked from at least the 18th century when it was discovered by Oliver Lewis the surveyor for Lewis Morris (NLW, Crosswood Deeds, MS I.1035, p. 18). The remains at this mine were in good condition. It appears that for much of its working life this mine had been an extension of Glogfach Mine. The mining remains, though interesting, appeared to relate to more recent mining

M18 Pen Llan Fach mine		
Feature	Quantity	Grid reference
waterwheel casements	2	SN73739/70038 SN73757/70007
leat	1	SN73200/68200
Shaft	1	SN73759/70041
Open working	1	SN73754/69975
Spoil heap	2	SN73642/69967 SN73664/69939

Figure 4.18 Features recorded at M18 Pen Llan Fach

M19 Tyny Graig SN69763/69544

- Recorded on the DAT database.
- Marked on the 1880 map.
- Absalom Francis (1874) recorded two mines at this site.

Historic mapping indicated that there were several levels on the site. No official name was recorded for this mine and so for the purposes of the 2014 survey and, this research, the site was named after the nearest village, Tyny Graig.

Although Absalom Francis (1874) recorded that two mines were being worked in this area, after examination of the mining remains it proved impossible to distinguish any features that would separate one part of the works from the other and so to all intents and purposes this was a single mine. The survey of the site identified two spoil heaps, two adits, one building, an associated stone-built platform and a cart track leading to the building. It appeared that the adits had begun as trenches and later developed into full adits. It seems likely that the miners had been exploiting an area of mudstone and shale which contained small stringers of mineral at a point where two rock formations interfaced. It was probable that the veins were richer below ground.

M19 Tyny Graig Mine		
Feature	Quantity	Grid reference
Adits	2	SN69763/69544 SN69763/69560
Spoil heaps	2	SN69726/69526 SN69740/69503
Storage building and loading platform	1	SN69727/69554

Figure 4.19 Features recorded at M19 Tyny Graig Mine

4.3 Discussion on the 22 Trial Sites

As, well as fully developed mines, evidence of mining had also been left by those searching deposits in the form of trials. Trials can be difficult to date without excavation and are sometimes difficult to distinguish from other features found in the landscape. Trials can vary in size and depth from small isolated trenches of one metre to over a hundred metres. Trials can also take the form of pits and adits and may have associated spoil deposits. This can make them difficult to separate from very small mines. The majority of trials also proved to be barren and so they were abandoned as soon as they had been made, with the workers moving on to another search area. This meant it was unlikely to have been recorded in any documentation. Trials are however an important part of the mining process and can provide a fuller picture of mining in an area and because of this deserve recording in their own right

T1 Abbey Consols Gargoed SN76803/67208

- This trial was marked on the 25-inch Ordnance Survey maps of 1888 and 1891.

Documentary evidence found during the research suggested that this site had first been trialled in the 18th century by Mine Manager John Ball in 1771 (NLW, Roberts and Evans Solicitors Records, MS L2). The site was tried again in the 1870s but was not fully developed into a full mine. The results of the survey of this site are discussed in detail in chapter 5.

T2 Berthgoed SN76360/645964

A series of trenches, trials and small quarries was found after the examination of the historic mapping of Berthgoed and Troed y Rhiw made by Thomas Lewis for Wilmot Lord Lisburne around 1781. The results of the survey on this site are discussed in detail in chapter 5.

T3a Berthlwyd SN700/719

T3b Gwaith Goch SN700/719

These trials were previously unrecorded and did not appear on any maps.

- Evidence of these trials was discovered during the documentary research and landscape survey in 2018.

In 1742, a lease of minerals on this land was awarded to the *Company of Mine Adventurers* (NLW, Crosswood Deeds, MS II.275). This site is discussed in detail in chapter five

T4 Bryeneithino SN76102/69622

- This trial was previously unrecorded and did not appear on any map.
- The trial was discovered during the landscape survey of 2012 and revisited several times.

A number of mining related features were found during the 2012 and 2014 surveys around a squatter's village called Rhos Gelli Gron. This village had been recorded as the home of many miners during the 19th century censuses. Features found included an open cut and a number of pits. It could be that these features related to activities carried out by the inhabitants of the 19th century squatter's settlement at Rhos Gelli Gron and may have been speculative trials by miners who identified the outcrops of the quartz-filled fault which were found in the area. While these features are useful in building a picture of land use in the area, the events were too small and short-lasting to produce information on pre-18th century mining.

T4 Bryeneithino		
Feature	Quantity	Grid reference
Costeaning trenches	4	SN76102/69622 SN76285/69593 SN76289/69581 SN76310/69632

Figure 4.20 Features recorded at T4 Bryeneithino Mine

T5 Bryn Coryn Trial SN7610/6950

- This trial was mentioned in the RCAHMW archives.
- It was also marked on the 25 inches to 1 mile Ordnance Survey map of 1890.
- The RCAHMW file did not contain any documentation on this mine other than that it was marked on the Ordnance Survey maps.

This trial was mentioned by Foster-Smith (1979), however, a survey of the site in 2018 found no mining features located at the quoted grid reference. There was, however, an area of disturbed land and a small trench found nearby at SN76102/69622, which was the same location as an old sheepfold noted on the 1890 map. A costeaning trench was found at SN76285/69593 and a further two trenches were found at SN76289/69581 and SN76310/69632. These last two features may be related to water management. As no evidence of 18th century mining was identified, this mine was not included in any further investigation.

T5 Bryn Coryn Trial SN7610/6950		
Feature	Quantity	Grid reference
Costeaning trenches	4	SN76102/69502
		SN76285/69593
		SN76289/69581
		SN76310/69632

Figure 4.21 Features recorded at T5 Bryn Coryn

T6 Bwlch y Dwyallt SN760/637

Foster-Smith mentions that a trial had been carried out at SN706/637 but did not give any more details (Foster-Smith, 1979, p.198). In their uplands survey, Hall and Sambrook (2008, p. 12) identified what they thought were mining remains. When the sight was visited in 2015 for the purposes of this research, three areas of disturbed land were found but could not positively be identified as mining. As no evidence of 18th century mining was identified, this mine was not included in any further investigation.

T6 Bwlch y Dwyallt		
Feature	Quantity	Grid reference
Possible trenches	3	SN706/637

Figure 4.22 Features recorded at T6 Bwlch y Dwyallt

T7 Castle Dinas SN80618/64326

- This was an unrecorded trial found through a combination of information given by mining author George Hall (2010) and the 2012 landscape survey.

This trial was located east of Strata Florida Abbey and situated to the north of a footpath, which itself was possibly the remains of a leat. The trial was a long trench in shallow ground with very little spoil deposit. George Hall suggested that this feature had been the Castle Dinas mine mentioned in The Mining Journal from 1847 until 1854 (Hall, 2010) although this seems unlikely as the remains appeared too small for such an undertaking

T7 Castle Dinas		
Feature	Quantity	Grid reference
Trench and spoil	1	SN80618/64326

Figure 4.23 Features recorded at T7 Castle Dinas

T8 Cefngoer SN71957/66461

- This was an unrecorded trial discovered during the 2012 landscape survey.

The trial comprised of a small open work on an outcrop with an associated development spoil which had no visible mineralisation. This open work may be a 19th century trial trying to pick up an extension of the Bryn Hope lode and, therefore, did not meet the criteria for inclusion in this study.

T8 Cefngoer SN71957/66461		
Feature	Quantity	Grid reference
Open work	1	SN71957/66461

Figure 4.24 Features recorded at T8 Cefngoer

T9 Chwarel Mawr SN76364/70622

- This was an unrecorded trial discovered during the 2014 landscape survey.
- A quarry was recorded nearby on the 1880 map. However, there was no evidence of any other mining features.

The historic photography and satellite survey identified a number of unrecorded pits and trenches that were further to the east of the nearby Glog Fach mine to which they did not appear related. These were identified during the 2014 survey as the remains of the footings of a building, trial trenches, open-cut workings and the remains of stone quarries. One open cut was small and trench-like, while the other was a large square in construction. These trials seemed unusual both in their construction and position, being in boggy areas and between hills. The second cut was around four metres by five metres and had raised banks around it. The foundations of a substantial wooden or clom building (10 metres long x 8 metres wide) were found near to the workings and could possibly be the remains of a shelter or barracks for the people who had worked these four features. It seems likely that all these features are related to stone quarrying. As no evidence of 18th century mining was identified, this mine was not included in any further investigation.

T9 Chwarel Mawr Trial		
Features	Quantity	Grid reference
Stone Quarry	1	SN76281/ 70602
Possible trial	2	SN76364/70622 SN76068/70702
building foundations	1	SN76148/70878

Figure 4.25 Features recorded at T9 Chwarel Mawr Trial

- This was a previously unrecorded trial.

There were a number of sterile quartz outcrops in the area, some of which were striking in their size. However, the majority of the deposits at SN79210/68783 did not contain metallic ores. A trial was identified at SN79210/68783, where miners had worked ore and which also contained a 30cm wide quartz vein. This vein had been exposed through erosion by the Afon Claer Ddu stream. The workings appeared to be slight, as the waste dumps were small, however, the waste could also have been deposited into the fast-flowing stream that cut across the site. Close to the area of mining were the remains of five ruined huts at SN79203/68937, SN79183/68929, SN79133/68974, SN72204/60055 and SN79171/68847, located on the ridge in which the vein lay. The buildings appeared to have been built in the 18th century based on their similarity in style and construction, and they could be the remains of a small mining community. There were also the remains of a substantial stone-built sheep dip at SN79214/6878, and it could be that this site was, at one time, the centre of a miner farmer community. This site and the buildings clustered around the mineral outcrop were deemed worthy of further post-doctoral investigation to ascertain the full extent of the mining and settlement in order to better understand if this was a multi-period site.

T10 Claer Ddu Trial			
Feature	Quantity	Grid reference	Comments
Quartz vein	1	SN79210/68783	
Very small spoil dumps	2	SN79214/68766 SN79221/68756	Partially covered in grass
Ruined rubble buildings	5	SN79203/68937 SN79183/68929 SN79133/68974 SN79204/60055 SN79171/68847	Built in the side of the hillside. This could be associated with mining or sheep farming activity.
Costeaning trench	1	SN7980/6859	
Sheep dip	1	SN79214/68781	
Bothie / farm	1	SN79285/68603	

Figure 4.26 Features recorded at T10 Clear Ddu Trial

T11 Cloddiau SN72238/69007

- This trial was not documented or recorded on Coflein.

This was a small trial that was recorded by Foster-Smith as having been made to test the continuation of the Glogfach vein (Foster-Smith, 1979, p. 80). Although the general area of the trial was provided in the book *Mines of Cardiganshire* by Foster-Smith (1979), the actual site was eventually located using satellite imagery. Unfortunately, the landowner would not allow access to the site, and so it had to be viewed from a public path close by instead. The area around the adit is discussed in more detail in the section on the Talfryn Farm trials.

T11 Cloddiau			
Feature	Quantity	Grid reference	Comment
Adit	1	SN72238/69007	A small trial adit here, some mineral appears to have been produced.

Figure 4.27 Features recorded at T11 Cloddiau Trial

T12 Crilfach yr Heol SN74754/69275

- Trials are marked as an old level on the 1880 and 1900 historic mapping.

Two parallel trenches were located at SN74754/69275 in the vicinity of the ruined farmstead Crilfach yr Heol. As the trials are approximately 700 metres west of the mine of Esgair Mwyn it is likely that the trials are associated with that mine. The two trials lie abreast of each other and appear to have been made seeking to cut a lode in a north-south orientation. There is little spoil in the area and the remains are well grassed over, indicating that the features are quite old and that there is little metal pollution in the immediate area. The lower reservoir at Esgair Mwyn was said to serve a mine in this general area (Browne and Hughes, 2003, p. 44). However, these trials seem too slight to have justified the amount of money it would have cost to build a leat; that being said, they are on the leats line so it is possible. It is most likely that these are 19th century trials and, as such, are not covered within this research. The trials are marked as an old level on the 1880 and 1900 historic mapping.

T12 Crilfach yr Heol SN74754/69275		
Feature	Quantity	Grid reference
Trials	2	SN74754/69275
		SN74734/69266

Figure 4.28 Feature recorded at T12 Crilfach yr Heol

T13 Crofftau Bridge SN7522/6484

Crofftau Bridge is an example of a mining site on which no information could be found in the written records. The remains were isolated and set away from other mining features, positioned 60 metres upstream from the modern bridge which leads to Crofftau Farm, which is around one and half kilometres to the northeast of the Strata Florida Abbey. The remains are set on a narrow strip of woodland adjacent to the riverbank, which had been walled off from both the road and surrounding fields, effectively isolating the area from walkers.

Archaeological Findings

Two small stub adit-like excavations have been made into the north and south banks of the river Teifi, having been driven into rock that was exposed by river action. The adit on the northern bank, located at SN75229/64848, was 0.3 metres below the bank surface and was 0.6 metres high x 0.4 metres wide. This adit had been driven 0.4m into the bank and was at least one metre deep, thus being high enough to prevent water from entering the workings. The adit appeared to have been dug in order to follow a vein of ore into the bankside. Opposite this adit, on the southern bank, was a slightly smaller adit at SN75229/64848, which also appeared to have been following a vein.

There were no signs of any ore remains in either of the adits or in the river bed. Neither adit had tool marks to show whether they had been created using stone or iron tools. Further, there were no remains of shot firing holes, which would have been indicative of 18th and 19th century mining. That said, it was quite feasible that these marks had been removed by water action.

On the southern river bank a few yards east of the adits, at SN75266/6484, the remains of a small back-filled shaft were discovered. The shaft measured 1.2 metres across, although it had been backfilled and grass had grown over its entrance. There was no raised collar and the shaft was only visible as a shallow depression in the landscape. There was no spoil associated with the shaft or the adits located close to the site, which indicated that the material excavated had either been used to backfill the shaft or may have been deposited into the river.

Despite undertaking a thorough search of the area, no buildings or building remains were found on the site.

Discussion on Crofftau Bridge

It had not been possible to find any documentary evidence that related to the Crofftau mining remains. The shallowness of the riverside adits indicated that the mineral deposits had been slight; possibly a splinter vein where the majority of the ore had been in the section that had been cut away by the river. Considering the location, there must have been enough ore to warrant the effort of investing in its removal, along with the sinking of a trial shaft. It could be assumed that the lack of spoil and the slightness of the work indicated that the excavations had not progressed beyond the trial phase.

It had not been possible to establish a timeline of when the work had been conducted, however, it was likely that the deposits were highly visible and so would have been attractive to miners dating as far back as the prehistoric times. Documentary records for the local area have provided a date which showed that miners from Esgair Mwyn were working around the vicinity of this trial in the 1750s (NLW, Powis Castle Deeds, MS 21900, chapter 19) and again in the mid-19th (NLW, Crosswood Deeds, MS I.1035, p. 42). It was quite possible that the trial could have been excavated during these periods. However, without documentary or archaeological evidence for mining at this site neither of these assumptions can be proved. While interesting, excavation of these mining remains would add little to the research due to their small size.

T13 Crofftau Bridge			
Feature	Quantity	Grid reference	
Short Adits	2	SN75229/64848 SN75266/64847	
Trial shaft	1	SN75266/64847	

Figure 4.29 Features recorded at T13 Crofftau Bridge

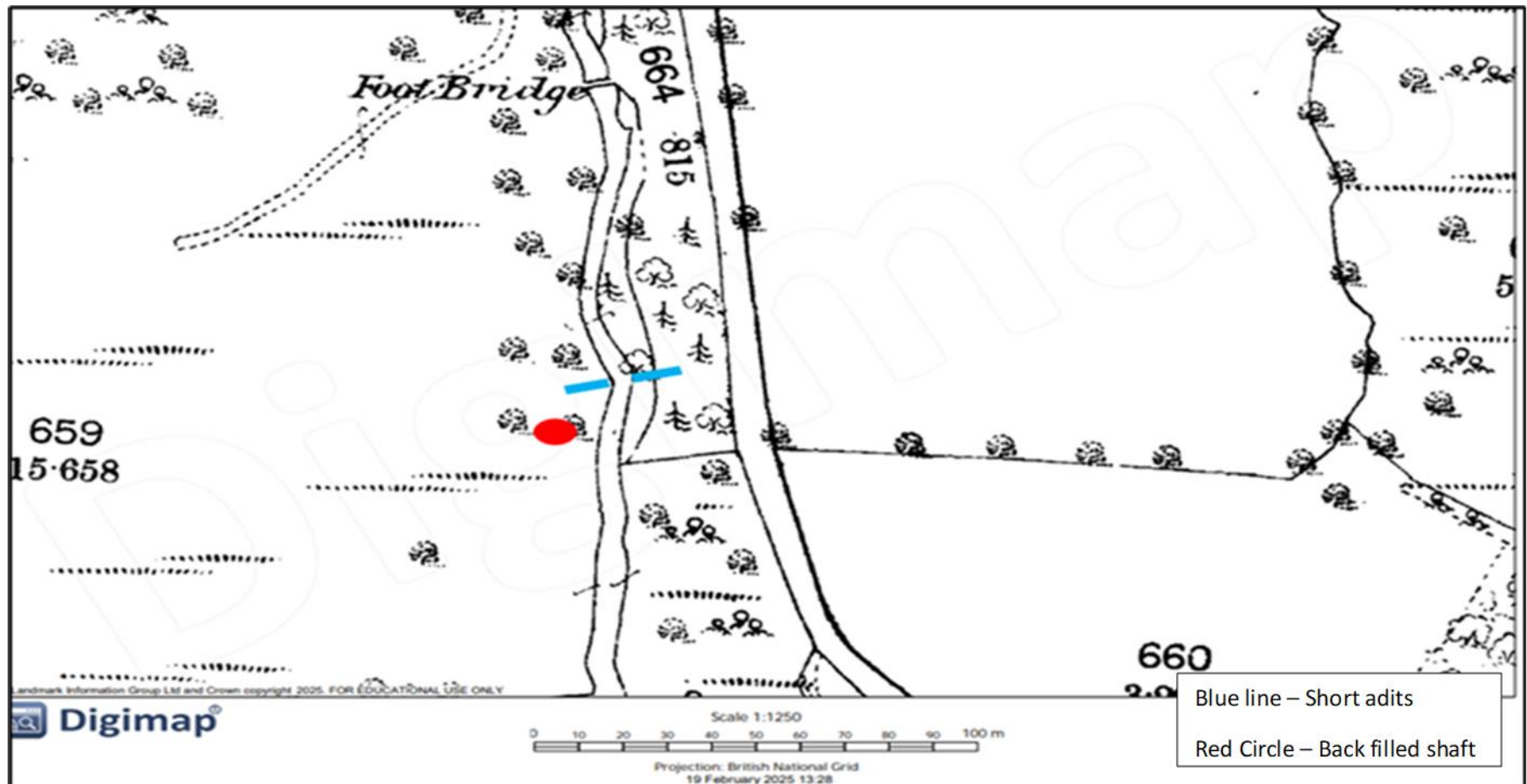


Figure 4.30 Map of T13 Croftau Bridge 1905 (*Digimap, 2025*)

T14 Crud y Awal SN75057/68192

- This was an unrecorded trial that was discovered during the 2015 survey.
- There was no documentary evidence on the trial.

This was an area that contained several trials, which had been discovered while following a leat which had served the Llwyn y Gwyddyl mines near to a house named Crud-y-Awal, 1.5 km east of the Llwyn Llwyd and Llwyn y Gwyddyl mines. All of the trenches appeared to pre-date and be unrelated to the house, although spoil from the trenches had been used to construct one of the boundary walls. All of the trenches were overgrown, and the grass was lush and green indicating that the soil contained little mineral content. Near to the trials was an area covered with gorse which usually indicates an outcrop of rock, and it may have been this that initiated the interest in this area. Alternatively, a leat which supplied water to the Llwyn y Gwyddyl workings passed within a few metres of these features and they could have been related to mineral deposits found during the leat's construction. As no evidence of 18th century mining was identified, this mine was not included in any further investigation.

T14 Crud y Awal			
Feature	Quantity	Grid reference	
Costeaning trenches	6	SN75057/68192 SN75104/68157 SN75069/68192 SN75087/68207 SN75101/68207 SN75133/68288	Trench SN75133/68288 is larger and far less defined than the other features and appears to relate to a different event.
leat	1	SN76200/68200	From Teifi pools to Llwyn Llwyd mine

Figure 4.31 Features recorded at T14 Crud y Awal

T15 Drysgol / Glansychant SN70845/69188

- These trials were marked on historic mapping from 1880.
- The trials were recorded on the DAT Historic Environment Record.

The 2016 survey of the area located three trials and one adit in the same positions mentioned on the database. The trials lay in a NW/SE orientation while the adit had been driven directly north into the hillside. Two of the trials and the adit were within a 40-metre square area, indicating that the lode outcropped at this position. There was a single small conical spoil heap on the site, which had been cut into, and around 25% of the spoil removed. There was no sign of any buildings or infrastructure on the site.

T15 Drysgol / Glansychant Trials			
Feature	Quantity	Grid reference	Comments
Adit	1	SN70845/69188	
Spoil	1	SN70845/69188	
Trials	3	SN70789/69255 SN70809/69252 SN70665/69505	This last trial was situated away from the main site in disturbed ground.

Figure 4.32 Features recorded at T15 Drysgol / Glansychant Trials

T16 Gwaith Douglas Trial for Gold SN78839/268189

- This was a previously unrecorded trial.
- There was no documentary evidence.

This site was initially identified by Simon Hughes (2010), after he had interviewed a miner who had worked in the mine just before the First World War. The miner recalled a shaft being sunk near Teifi pools to prospect for gold. Hughes felt that the location was sufficiently close to the Rhiwnant Dome, which was known to contain gold, to confirm the miner's recollection and that it should be taken as credible (Hughes, 2010).

Following the directions by Hughes, a five-metre long, backfilled trench on a vein at SN78839/68189 was identified during the 2014 survey. Some mineralised quartz was found within the trench-fill material. This trial was interesting as it is one of the very few examples of gold mining in Cardiganshire but confirmed that independent mining was being undertaken well into the 20th century. However, for the purposes of this research, the dating of the work falls outside of the research criteria (being too late a date).

T16 Gwaith Douglas		
Feature	Quantity	Grid reference
Trial trench	1	SN 78839/268189

Figure 4.33 Features recorded at T16 Gwaith Douglas

T17 Pantyfedwen SN75200/64900

- This site was recorded on the RCAHMW and DAT Databases.

This trial was noted on the RCAHMW database under the name of Pantyfedwen at SN752.649 which noted that the shaft had been used as a rubbish dump. A full survey of the site made during 2012 located a second mine shaft, two adits, a leat system, and several other mining features. This site is discussed in detail in chapter 5.

T18 Peny Bwlch SN79037/63402

- Unrecorded trial.

This site was visited as part of the 2014 survey. A trench 8 metres long x 1.5 metres wide x 0.6 metres deep was identified. No other features were found in the area. The weather was stormy when the site was visited, resulting in a GPS reference that may be out by some metres. This site was not relevant to this study.

T18 Peny Bwlch		
Feature	Quantity	Grid reference
Costeaning Trench	1	SN79037/63402

Figure 4.34 Features recorded at T18 Peny Bwlch

- This site contained unrecorded trials, cairns and a possible settlement site.

It was probable that this was the Geufron site that Lewis Morris mentioned in 1756 in his book *A history of the Crown Manor of Mevenyth in the County of Cardigan South Wales* (NLW, Powis Castle Deeds, MS 21900, chapter 17) as it is located on the edge of the Geufron House lands. A number of archaeological features were found at this site relating to mining, stone quarrying and settlement remains.

The site has been occupied since the Bronze Age and was therefore suitable for this research. This site is discussed in detail in chapter 5.

T20 Troed y Rhiw SN76735/66307

- Unrecorded trials.
- Identified from historic RAF aerial photography.

The examination of RAF photographs from 1946 identified a number of trench-like features in the area of Troed y Rhiw. A physical survey of the site identified three costeaning trenches and two open works. This site was known to hold the remains of a Medieval Period great barn and its associated buildings that had belonged to the Abbey of Strata Florida. It was also the site of a 19th century miner/farmer settlement at SN76735/66307 (Fleming and Barker, 2008, p. 262). The trials found on this part of the site may have been related to the work of miners who had lived in the area seeking stone for building or ore to sell. A survey of the area around Troed y Rhiw found a series of trials which seemed to refer to a search for larger ore deposits and there was a possibility that it could have been the work of Philip Pugh who was granted a lease to work minerals on this tenement by Lord Lisburne on 2 July 1759 (NLW, Crosswood Deeds, MS II.283). While this was interesting, the site did not warrant further investigation at this time.

T20 Troed y Rhiw			
Feature	Quantity	Grid reference	
Costeaning trench	4	SN76514/66444 SN76486/66428 SN76684/66676 SN77613/67249	
Open works	2	SN76677/65640 SN76646/65640	
Open cut	1	SN76670/76670	
Modern quarry	1	SN76501/66464	

Figure 4.35 Features recorded at T20 Troed y Rhiw

T21 Ty Mawr SN73175/66428

- This mine was mentioned in the RCAHMW Database as a single shaft.
- It was marked on the Ordnance Survey maps of 1891 and 1909.
- The RCAHMW file did not contain any documentation on this mine other than that of a shaft marked on the Ordnance Survey maps.

A survey of the area in 2012 identified a number of features, including an area of scrubland and trees between the modern housing which appeared to be a back-filled shaft. An unusual ditch surrounded a former farm site, indicating that the area had been prone to flooding. The river Afon Teifi flows through the site as well as between the farm and the shaft, which was marked on the maps. In the centre of the river at this point, a rectangular excavation had been made into the bedrock. This indicated that a water wheel had once been positioned there. Other features identified on the site included the remains of a raised track which had been laid out eastwards towards a bend in the river where a small ford may once have been. Slightly to the south of this track and the farm was a depression that abuts the river bank. This depression appeared to be the remains of a second small shaft. The absence of mining at this part of the site on 1880 maps and its appearance on the 1891 map suggested that mining work on the site must have been undertaken between the surveying dates for the 1880 and the 1891 maps. Its absence from the maps after 1909 indicate that the shaft had been abandoned and possibly backed-filled by that time.

T21 Ty Mawr			
Feature	Quantity	Grid reference	Comments
Water Wheel pit	1		
backfilled shaft	2	SN73167/66439 SN73222/66353	
ditch	1	SN73175/66428	The ditch surrounding the farm building
raised track	1	SN73243/66343	
Farmhouse	1	SN73240/66374	
Cottages	1	SN73248/66477	
Track	1	SN73250/66347	

Figure 4.36 Features recorded at T21 Ty Mawr

T22 Tyndol SN76823/68070

- Unrecorded Trial

Hughes (2013) reported that he had interviewed a former miner who had worked the mines at Fair Rhos, including a trial on a rock outcrop at Tyndol, shortly before the First World War (Hughes, 2013). During the 2014 survey, three distinct working phases were identified. The last period of exploitation appears to have been to extract stone, as a quarry had been driven into an outcrop. This outcrop had also previously been cut by road construction. However, it was apparent that a mining trial had been undertaken previous to these events. The mining trial area was on the eastern end of the stone working, where there were three small open workings, all of which were well grassed over suggesting little ore had been removed. This was an interesting feature that showed that a great deal of small-scale speculative mining had been undertaken well into the modern era without being recorded. However, overall, the site held little promise of being a multi-period site and was therefore not suitable for this research.

T22 Tyndol Unrecorded Mining Trial		
Feature	Quantity	Grid reference
Trial	1	SN76823/68070

Figure 4.37 Feature recorded at T22 Tyndol Trial

4.4 Mines and Trials Conclusion

This research was aimed at finding evidence of mining that had taken place during the Medieval and Early Modern periods within a defined area centred on the Cistercian Abbey of Strata Florida. The research was undertaken over a number of years using a combination of documentary research, a series of landscape surveys and selective archaeological excavations. Following several surveys of the area, a total of 19 mines and 22 trials were identified. Prior to this study only eighteen mines and seven of these trial sites had been known about. Following the surveys, a total of 41 mining sites were included in the research.

4.5 Summary of Survey Results

With the exception of Esgair Mwyn mine, no other mine within the research area had been surveyed in any detail. No identifiable mining remains were found at two of the 19 mine sites. This could be due to either the remains having been destroyed through weathering or human action, or an incorrect Ordnance Survey grid reference had been recorded on the databases for the site. The survey highlighted that at the majority of the sites the mining machinery had been taken away, with the exception of Bronberllan where several sets of rails remained in position, the spoil had been removed or disturbed and the shafts had been backfilled. Generally, the only buildings relating to mining works that had survived were the larger stone ones which, in most instances, had been levelled to their foundations. Despite this destruction one of the best features to have survived was the cobbled dressing floors, with good examples being found at Llwyn Malus, Esgair Mwyn and Bronberllan. The other features that survived well were the leats and trial trenches. During the surveys a concentration of previously unknown trial trenches between the mining sites of Esgair Mwyn, Bronberllan and Talfryn Farm were identified and recorded. The large number of trials in such a small area indicated that the area had been of great interest to miners at some time. A number of the 41 mining sites recorded in this chapter contained pre-19th century mining remains and documentation which supported the hypothesis that mining had taken place within the research area in the late Medieval and Early Modern Periods. The findings on 13 of these sites are examined in detail in Chapter Five.

Chapter 5 – Sites with Possible Medieval and Early Modern Mining

5.1 Introduction

This chapter continues the discussion in Chapter Four on the mines and trials identified within the research area by providing an in-depth discussion on the eight mines and five trials that contained evidence of Medieval or Early Modern mining. The discussion is based on the documentary and archaeological evidence discovered that supported the premise that mining in Medieval or Early Modern Periods had been undertaken in the research area. As such this study has been able to provide an updated and more complete history of mining in this area. The names of the 13 mines and trials included in this chapter can be seen below. This chapter provides a discussion on each mine and trial:

ID	Mines	Grid Reference
M1	Bronberllan Mine	SN74552/66364
M8	Cwm Mawr Mine	SN73569/67259
M9	Dyffryn Cottage Mine	SN75261/68486
M10	Esgair Ddu Mine	SN76774/69674
M11	Esgair Mwyn Mine	SN75438/69333
M13	Llwyn y Gwyddyl and Llwyn Llwyd Mine	SN746/685
M16	Logaulas Mine	SN740/716
M17	Maen Arthur Mine	SN734/728
ID	Trials	
T1	Abbey Consols Gargoed Trial	SN76803/67208
T2	Berthgoed Trial	SN76360/645964
T3	Berthlwyd / Gwaith Goch Trials	SN724/727 / SN700/719
T17	Pantfedwen Trial	SN7520/6490
T19	Talfryn Farm Trial	SN70713/70000

Figure 5.1 List of the 13 sites discussed in detail in Chapter Five

5.2 Discussion on the Eight Mine Sites

M1 Bronberllan Mine SN74552/66364

- Located on the Frongoch Formation
- Has also been known as Bronberllan, Abbey Consols, The Florida Lead Mine and Cwm Mawr Number Two
- This mine was recorded on all known metal mining databases

At the start of this research, the history of Bronberllan was confined to information collected after 1848. This data consisted of the number of people who had been employed, in a given year, the quantity of ore produced and the company who had leased the mine. The result of the land survey, archaeological excavations and investigation of documentary sources carried out as part of this research indicated that mining activity on this site had been carried out almost continually, albeit on a limited scale, from at least the 1520s until the mine made its last official returns in 1913.

The Survey of Bronberllan and its Landscape

Bronberllan mine is situated in an area where lead and zinc deposits outcrop on the southern flank of a hill called Bannau, two kilometres east of the village of Pontrhydfendigaid, Cardiganshire. The mine is overlooked by the Iron Age hillfort of Pen y Bannau 0.6 kilometres north of the mine and the Cistercian Abbey of Strata Florida, which is 0.8 kilometres to the south. This position with the topography of the site, and the position of the abbey, made it highly likely that the lode would have been worked centuries before it first appeared in documents written by Lewis Morris (NLW, Powis Castle Deeds, MS 21900, chapter 19).

An initial survey of Bronberllan and the area around the mine identified a number of features including two quarries, a large open cut, eight shafts, five completed adits, three trial adits and a stope. Twenty-five costeaning trenches, a reservoir, a small bridge, leat systems and slime pits were also located. Full details of these and other features found can be found in the table at the end of this section. Following a study of these remains, it was confirmed that this was a historical and archaeologically interesting site that contained mining remains from several time

periods. Further surveys of the area revealed that the majority of the 19th century mining infrastructure which had been recorded in documentation and on mapping has been destroyed in the early 21st century during to the construction of a quarry and a motor racing track. The construction of these features had destroyed one of the three water wheels on the site and a turbine room which provided electricity to the mine via a Pelton Wheel (Webb, 2012, p. 73). Quarrying has also destroyed the powder magazine and most of the inclined railway which once transferred ore from the shafts downhill to the main processing areas. The bottom adit (Adit two) which once drained the mine has also been partially destroyed and is now collapsed and sealed. The 19th century mining buildings including the manager's house, offices, blacksmiths shop and other buildings on the site were levelled at some point in the early 21st century and the stone removed from the site. The remnants of the round buddles and jigs had also been levelled and much of the spoil had been removed and used as hard core for the construction of the race track. The only pieces of the mine that survived from this part of the site were the slime pits which remained in relatively good condition. The survey also showed that much of the layout from the pre and early 19th century mine had survived due to redevelopment of the mine at a new site in the 1850s. These remains, like others on the site, continue to be damaged by farming activities.

The Old Mine Surface

As discussed above, a substantial amount of the pre-19th century mine surface had survived including a reservoir and complicated leat system. The leat system had initially used water collected from sources near to the mine including rainwater and water drained from boggy ground which was collected in a small turf walled reservoir on the hill above the mine at SN74650/66568. Water from this reservoir was transported down a leat (Leat One) before being released in the area of the open cut. There was a noticeable difference in height and incline of the land surface on the eastern side of the site compared to that on the western side and the hillsides around it. This would indicate that part of the hillside had been removed by hushing using water from the reservoir. Following its use for hushing the reservoir and leat one had subsequently been used to provide water for three buddles. Leat One was augmented by a second leat (Leat Two) which served a waterwheel which was later destroyed during the redevelopment of the

mine. The upper portion of leat two had been damaged by falling trees with parts being destroyed by the building of a farm track.

In the mid-19th century, the reservoir and leat one and two were superseded by a third leat system (Leat Three) which took water from Teifi Pools water from this system was used to run two water wheels and turbine plant in the later 19th century. This leat is now being used as a mountain cycle track and has become seriously degraded. A fourth and separate leat (Leat Four) took water directly from a small stream to the east of the mine in order to run the small water wheel on the side of Bronberllan coach house, farming activity has almost totally destroyed leat four with only a few metres remaining intact. As well as the leat system, a number of other archaeological features were identified in the survey which warranted further investigation. These features included a large open-cut which had been excavated along the mineral lode at SN74603/66370. A number of shafts had been sunk into the bottom of the open-cut including one which, the research showed, had been worked in the 17th century. This showed that the openwork had been excavated some time before this before the 1680s. A number of adits were also found on the site. The oldest of these adits appears to be the upper adit (Adit One) which documentary evidence indicates was in use in the late 18th century. This adit had been cut through by a shaft sunk in the 1850s (Williams, 1856, p. 806). Adit Two also called the lower adit had been started around 1771, but had not reached the lode until the 1870s (NLW, Roberts and Evans Solicitors Records, MS L2). Other adits found on the site were subsequently dated by documentary evidence to the 19th century.

The area immediately to the south of the open work was covered in a scree of broken stone and ore that is consistent with hand dressing. The remains of a partially obscured cobbled ore crushing surface were located two metres south of Shaft One at SN74596/66350. To the south of the cobbled surface were three oblong depressions. These were the remains of the buddles, with a much-degraded leat joining them to each other. There was no machine dressing waste on this part of the site.

A physical survey of the wider area was undertaken using landmarks identified on the satellite and historic photographs led to the identification of 25 costeaning trenches on the hillside above Bronberllan. Research into the documents noted only one trial/trench had been made and that was in 1855 (NLW, Francis Family

Papers, File 20/61). This trial had been destroyed by the sinking of Shaft Four almost immediately after its construction. The construction of 25 trenches would have been a significant investment and would undoubtedly have appeared in correspondence about the mine during that period and therefore, it seems likely that the other trenches were made sometime before the 19th century. This raises the question of when were the trials made and who ordered them to be constructed.

From 1850 the history of the mine was well documented, which indicates that the 24 undocumented trenches were made before 1850. Documents found so far have shown that little work had been undertaken at the site between 1771 and 1850 and implied that mining had been limited and constrained to the area where the lode outcropped on the mine site. There is a possibility that the 24 trenches had been constructed under the direction of Hector Phillips who was searching for silver deposits in the area in the 1670s (Rees, 1968, p. 485). Phillips' search for silver ore however appeared to have also been limited and were unlikely to have included such expansive trialling. The trenches show a continuity in size and orientation that suggests they were constructed by the same people and around the same time. Interestingly, they are almost identical to trials on the hillsides near to the Esgair Mwyn and Llwyn Llwyd mines which the research indicates had been constructed by Oliver Lewis and Evan Williams who undertook a campaign trialling the Crown Wastes for Lewis Morris in the 1750s (National Library of Wales, MS 15101, p. 55). Furthermore, it is recognised that Lewis Morris leased Bronberllan in 1746 and is known to have ordered many trials to be undertaken on neighbouring landholdings. The similarity in construction between those trials at Bronberllan and those found at Esgair Mwyn, leads to the most probable assumption is that Lewis Morris constructed the 24 costeaning trenches. This however cannot be proved without archaeological investigation.

Other features identified during the surveys included a stone quarry (Quarry One SN74743/63942) the bottom of which an adit (Adit Five) had been driven (SN74743/63948). This quarry had initially thought to have been pre-19th century. However, this feature contained the same stone that was used in the construction of the mine buildings in 1858 (Trewin, 1858, p. 6) and therefore probably dated to the late 1850s. Consequently, it was decided that an area of spoil from the east

slope of quarry one should be sectioned but unfortunately no dating information was recovered from it. Directly above this quarry, two small trials (SN74357/66452 and SN74360/66462) were found ascending the hill which possibly related to the search for building stone deposits. Again, it has not been possible to date these features.

History of Bronberllan from Research Documentation

The earliest reference to Bronberllan in relation to mining dated to 1520s. This reference was found in a 19th century copy of rental documents from the last decades of the Monastic Period at Strata Florida (1480 to 1539) (NLW, Cwrt Mawr, MS 873D). The original document (which had not survived) was part of an inquisition that had taken place in 1577. The document included details of rentals (land and housing) dating back to the last decades of the 15th century, with one particular lease concerning the area where Bronberllan mine was situated. This ninety-nine-year lease for the mine had been issued by Richard Tally, the last Abbot of Strata Florida Abbey, for land holdings called Maes Banathlog on the grange of Penarth, to Ivan Morgan ap David Lloid (NLW, Cwrt Mawr, MS 873D, p. 44). Although this lease record was undated, it was signed by Tally, which meant it would have been issued before the abbey was surrendered in 1539. As all the other leases on the same page had been made between 1520 and 1528, it can be reasonably assumed that this agreement also dated to the 1520s (NLW, Cwrt Mawr, MS 873D, p. 44).

The name Banathlog, when translated into English, means 'The Peak of Interest'. This is unusual as most Welsh place names relate to geographical features, for example 'Brynawelon' or 'Windy Hill'. The use of the name 'Banathlog' indicates that the tenement had been marked out as different, and of special interest, when compared to the other tenements in that area. Although Maes Banathlog could not be located on any maps, based on its position within the rental document, (tenements are laid out in a geographical order within granges rather than alphabetically), it was possible to identify it as being on the hill of Banna near to a farm presently called Bronberllan. As well as giving the names of the lease holders, the lease also named the head of the households of those living on the land holdings; Ivan Price David Goz, his son William ap Ivan Price Goz, Thomas

ap Levan Moyne, and his son Levan ap Levan Moyne (NLW, Cwrt Mawr, MS 873D, p. 44). The names of these occupants were interesting, as the surname Moyne translates to miner. Therefore, the names were Thomas - son of Levan the miner and Levan son of Levan the miner.

Other supporting evidence of mining came from the names of the tenants called Goz. Documents dating to 1525 showed that Thomas Philip ap Moredith and Ivan Gwillam Goz were the occupiers of the tenement Tiddin y Rhos, next to Pant y Grave, a mining site at Cwmystwyth. This linked members of the Goz family to both the Banathlog and Tiddin y Rhos tenements, and as part of their rental duty, they were required to undertake what appeared to be mining related tasks, as the lease for Tiddin y Rhos stated that they were to provide the carriage of timber and flints (NLW, Cwrt Mawr, MS 873D, p. 22). As flint is not present in Cardiganshire, and other tenements mention the carriage of 'stone', the word 'flint' most likely refers to another type of material rather than stone. As 'flint' was only mentioned in leases of tenements next to known mines this suggests that the term flint referred to unprocessed ore. There were only two other leases that stipulated the carriage of timber and flint, and these were for Lloyn Tavy Icha (also called Keven Case) and Lloyn Fleur (NLW, Cwrt Mawr, MS 873D, p. 10) both of which were located near to Banathlog. This reinforces the premise that the Moyne and the Goz families were mining at that time on site now called Bronberllan.

Finding the names of miners in documentation from the Medieval Period was extremely unusual but, in itself, was not enough to indicate that they had been carrying out mining on the Bronberllan site. There was, however, documentary evidence from other sources showing that a David ap Levan Howell had worked as a miner in 1535 and that Levan Howell had leased a tenement called Brywnant y Dolmen on the Cwmystwyth grange (NLW, Cwrt Mawr, MS 873D, p. 17) which was the site of Craig y Mwyn, the only mine known to have belonged to the Cistercian Abbey of Strata Florida in the Monastic Period (Williams, 2001, p. 268). This rental tenement, plus Thomas ap Levan Moyne whose name translated to 'miner', strongly suggests that his employment was that of a miner. As people were known by the work they undertook, his children would have been known as David ap Leven Moyne ap instead of Howell. This strengthens the proposal that Thomas ap Leven Moyne and his son Leven ap Leven Moyne were the son and grandson of David ap Leven Howell, and reinforces the idea that the Howells /

Moyne's were a family of miners and that they were working mines, not only at Cwmystwyth, but also the mine at Maes Banathlog, now known as Bronberllan.

Documentary evidence of mining at Bannau also showed that a Sir Hector Philips had been looking for silver in last quarter of the 17th century. Phillips had gained the home grange of Strata Florida Abbey in 1674 through his marriage to the widow of Richard Steadman. Shortly after gaining these lands Phillips applied to the *Society of Mines Royal* for permission to work the silver deposits on lands at Pen-y-Bannau (the hill on which Bronberllan stands) (Rees, 1968, p. 485). Phillips' application was interesting for two reasons; he requested only a very limited area for the exploration implying that not only was he aware that there were mineral deposits on the land but where they were, and the fact that Philips was looking for silver was also interesting as the lode at Bronberllan may have had silver in viable quantities in the Medieval Period (this is discussed in the Silver Question section 5.5). Phillips applied for permission when the mines in Cardiganshire were working below their potential and the *Society of Mines Royal* was seeking to reassert its monopoly in the area through litigation (Lewis, 1967, p. 55). It is likely that politics was involved in forcing Philips to apply for a licence as he had been a parliamentarian sequester and as such would not have been popular with the powerful Royalists in the area, who may have been willing to report him had he not received appropriate permission to mine. In the end Phillips abandoned his search for silver after only three years (Rees, 1968, p. 458), indicating that the deposits of argentiferous ore had already been worked out by 1674. Archaeological evidence from the excavation for this research showed that Shaft One (the eastern most shaft situated within the open cut), had ceased being worked around that time inferring that the mine had ceased production or mining had moved to another part of the site.

Documents relating to mining at Bronberllan next appeared in 1718 and included a fragmented page from the personal diary of Richard Morris who had been the manager and later the owner of Llangyfelach lead smelter in Swansea, which opened in 1717 (Hughes, 2005, p. 16). The page showed that he had met with the Steadmans' who had inherited Bronberllan mine in 1693. In this document, Morris remarked that '*Mr & Mrs Steadman were charming people*' (Swansea University, Richard Burton Archives, MS Lac/R81/1). The subsequent pages of the diary likely described the reason why he had met the Steadmans, had not

survived, although it was part of Morris' duties as manager of the smelter to visit the Cardiganshire metal mine owners and lease holders in order to secure supplies of ore for the new smelting works. Whether Morris succeeded at that time is not known, however the Steadmans did supply ore to the works 14 years later. A further notebook written by Richard Morris between 1729 and 1742 contained notes on some of the mines from which he had received ore. The notebook showed that Richard Steadman had sent two loads of lead ore to the Llangyfelach smelting works, the first in April 1731 and the second in 1733 (National Library of Wales, MS 15101). The quantity of ore sent in 1731 was 7 tons (5cwt) which produced 4 tons (12cwt) of lead. The second load was 6 tons (3cwt) and 3lbs which yielded 4 tons (12cwt) 3lbs of lead. It was noted that none of the ore contained silver. The information within the notebook, showed three things: a) that ore was being produced at Bronberllan, b) that the ore being produced had a high lead content but was low in silver and c) that the Steadmans were managing the mine.

In 1746 the Steadman's passed the management of the mine to Lewis Morris by awarding him a 21-year lease at a royalty of 21 shillings per ton of ore produced (NLW, Powis Castle Deeds, MS 21900, chapter 13). It is tempting to assume that because Bronberllan only appeared twice in the records in relation to ore being sent to the Llangyfelach smelting works, that this was the only ore produced at this mine between 1717 and 1746. However, it seems more likely that ore was produced and sold to rival smelting firms in Flintshire such as the Richardson's and Smedley's who were active in Cardiganshire at that time (Lewis, 1967, p. 96). An alternative theory is that the produce could have been sold as potter's ore to ceramic producers who would have used the ore in its raw form.

In 1746, Richard Steadman died and passed his land holdings to William Powell who continued with the lease for Morris (Meyrick, 1907, p. 249). The documentation did not specify how Morris worked the mine or how much ore was produced at that time however Morris was impressed by the quality of the deposits within this mine. In 1747, Morris wrote that Bronberllan mine contained potters' ore (used for making ceramics) of the best kind, even keeping a sample in his mineral collection (Webb, 2012, p. 51). Bronberllan next appears in the documentation in 1756 Morris, who still owned the lease, wrote in his *History of the Crown Manor of Mevenyth*, that it was an old mine. However, the mine was

not working at that time, as he recorded that a fine of six guineas had been imposed for leaving the mine unworked (NLW, Powis Castle Deeds, MS 21900, chapter 19). It appears likely that the mine became idle due to flooding of the workings, as a lease dated to 1771 indicated that the mine had been left unworked due to drainage problems. In that year William Powell granted a lease of the mine to John Ball, Mine Manager, on condition that he drove a deep adit from the bottom of Bannau Hill to drain the old workings at Bronberllan (NLW, Roberts and Evans Solicitors Records, MS L2). The royalties to be paid by Ball was £1 per ton of ore made merchantable on the premises (NLW Roberts and Evans Solicitors Records, MS L2). This clause showed two things: a) that ore was being cleaned and prepared on the site in the 18th century, and b) the fact that ore could be sold without smelting may indicate that the main market for the ore was for the ceramics trade. Documentation showed that Ball had commenced driving the bottom adit (Adit Two) in 1771 but work appears to have stopped when he died in 1776. Consequently, Adit Two was not completed until 1870, one hundred years later (Williams, 1870, p. 732).

The last decades of the 18th century saw a depression in the metals market and it is likely that Bronberllan was not worked in this period. It is known that in the early 19th century the mine was being worked by a Mr Thomas Kemp and Mr Samuel Hewood until the 1840s. It appears that their undertakings had been very limited as they had only been able to work parts of the upper workings by draining them using hand pumps (NLW, Francis Family Papers, File 20/61). It is no longer possible to examine the underground workings at Bronberllan however by reading the mining reports made in the 19th century on the mine it is possible to understand several things about the mineral deposits at Bronberllan and how they had been worked by miners in the Medieval and Early Modern Periods. First, it was clear the amount of spoil on the old mine site, identified during the research surveys, did not correspond to the amount of mining that had been undertaken before the 19th century, as much of the waste produced had been disposed of underground. Edward Williams described, writing:

‘the eastern level is full of stuff we have cleared about six foot of same, but we have found a shaft going down which is full of stuff’ (Williams, 1856, p. 806).

Williams also noted that clearing the old workings was a slow and dangerous undertaking and that it was decided to enter the old workings by sinking a new

shaft in an area that Williams described as containing the remains of “the old Roman workings” (Williams, 1857, p. 241). The report showed the richness of the ore deposits that had been worked by the miners who came before him. The sinking the shaft went well at first with Williams writing:

“The shaft is in the most splendid course of lead ore ever saw” (Williams, 1857, p. 241).

This course however ran out and the mine had to rely on the ore that had been discarded in the old workings before the 19th century. Despite this the returns made on the ore production to the British Government showed that the most productive period of lead mining at Bronberllan had been between 1856 and 1860, with the average production of 121.9 tons of lead ore per year being reported. This was only exceeded once, in 1872, when 272 tons was produced (Burt, Waite and Burnley, 1985, p. 45). This indicated that large quantities of lead had been discarded in the waste, which in turn suggested that the old upper deposits that had been worked in earlier periods including the Early Modern Period and had been extremely rich in metallic ore.

The 19th century reports also indicate that the mine had been worked extensively and that the majority of the ore had been removed before it had become flooded in the mid-18th century. When the bottom adit (Adit Two) finally broke through to the old (Early Modern) workings, they proved disappointing containing only a little lead and large amounts of zinc ore unworked (Williams, 1870, p. 732). This was confirmed during the landscape survey of the mine surface, when what are now known to be 17th century or earlier workings spoil deposits, were found to contain large amounts of discard zinc. The 19th century reports also showed that there were two different lodes at Bronberllan the eastern lode and the western lode. The eastern lode had been worked before the 19th century with mining operations moving to the western lode from the mid-19th century. The 19th century reports also raise the possibility that the some of the ore removed had been cerussite. In 1871 an old shaft, known as Percy’s Shaft, was reopened and J. Williams Mine Agent realised that this was a totally different lode from that on the western part of the mine which his 19th century miners had first worked (Lendow, 1871, p. 348). In 1884 Edward Halse who had been the Chief Mine Agent at Bronberllan published a description of the mines geology (Halse, 1884, p. 5). He described the old workings as having been rich in ore but heavily worked in the past

(meaning before the 19th century) (Halse, 1884, p. 10). He went on to say that the upper levels had contained the best ore deposits and that much of this lode had been removed long before the area was re-entered in the 19th century with only pockets of ore left. Halse agreed with Williams that there were two lodes at Bronberllan and went on to state that the eastern lode worked prior to the 19th century as well as zinc and galena also contained valuable cerussite deposits (Halse, 1884, p. 10).

In summary, the 19th century reports were important as they showed that Bronberllan had two separate and distinct lodes and that the mine had a long working history, with the eastern lead deposits containing galena and cerussite had largely been worked out prior to the 19th century. Interestingly the zinc left by former miners in the eastern lode and the ore within the western lode enabled the mine to continue working until 1913 under manager Thomas Edwards who, by that time only had one man working at the site (Burt, Waite and Burnley, 1985, p. 1).

Excavations at Bronberllan Mine

Based on evidence discovered during the survey, Bronberllan was identified as a multi-period site that was also suitable under the research criteria as a site for archaeological excavation looking for pre 19th century remains. In 2012 the first excavation for this research was undertaken on several features at this site including two small spoil heaps, a buddle, a leat and small stone slab bridge. However, the main focus was on a spoil heap associated with Shaft One at SN74603/66370. This had been chosen due to its undisturbed condition and its position on the eastern-most end of the open cut (see figure 5.4). This was a place where both the topography and documents indicated pre-19th century mining had taken place. Analysis of the material on the surface spoil heap at Shaft One supported this interpretation, as it contained larger quantities of discarded zinc in comparison to the other spoil deposits on the site. The discarded zinc indicated that the spoil had most likely been laid down before the 1830s when the market for zinc was very small (Cocks and Walters, 1968, p. 13).

A number of stratigraphic layers from the spoil heap were removed down to 0.8 metres to the first layer (Layer One), where a layer of underground development waste was encountered. This stratigraphic Layer One contained substantial

amounts of heat-fractured, fire-reddened, shattered and splayed rock. Layer One also contained charcoal and partially burnt wood remains in a good state of preservation. The size and fracture patterns of the fire-reddened rocks plus the burnt wood and charcoal were interpreted as the remains of underground fire setting that had been used to break hard rock. This interpretation was reinforced when several larger pieces of rock with carbon deposits from smoke were discovered within the same Layer One. These rocks were unburnt and only had soot like carbon deposits on one face indicating that the other faces had not come into contact with the smoke. Combined with the shape of the rocks, this suggested that these stones were the remains of dressing waste from the roof of the workings. Dressing a tunnel involves prising away loose pieces of rock from the roof and sides, thus preventing them from falling and hurting the miners in the area.

The width of the wood remains indicated that faggots of small wood, possibly made from brush or coppiced wood, had been used in the fire-setting process. This was interesting as most illustrations of fire setting show the use of more substantial pieces of wood, as illustrated in Agricola's *De Re Metallica* (Hoover and Hoover, 1950). The use of small brushwood would make sense however as wood had been a valuable commodity in mid Cardiganshire, having been in short supply in the Strata Florida area from as early as 1536 (Toulmin Smith, 1906, p. 123). Random samples of these remains from Layer One were subsequently tested and returned a radiocarbon date of AD 1685 $\pm$ 30 BP. (Beta Analytic Limited, 2016)

Shaft One at SN74603/66370, however, was older than Layer One, as the carbon dating samples had been taken from the upper layers of the associated spoil heap associated with Shaft One. These upper layers were the last in a series of deposits, made sequentially, one on top of another. As the spoil heap lay in the eastern end of shallow open cut it meant that the mine itself had been worked considerably earlier than 1685. The spoil heap that had been examined had itself laid on top of the remains of an even earlier, levelled, spoil heap which therefore dated to an earlier phase of mining. This in turn indicated that Shaft One had been worked before the fire setting had occurred. It was not possible to determine how much earlier without further excavation of the feature. The upper part of spoil heap associated with Shaft One had been constructed in a conical shape with a

lower section that had been bolstered by a revetment constructed using glacial erratic boulders. The deposition pattern indicated that the spoil heap had been laid down in small loads and that initially the valuable ore had been separated from the waste underground

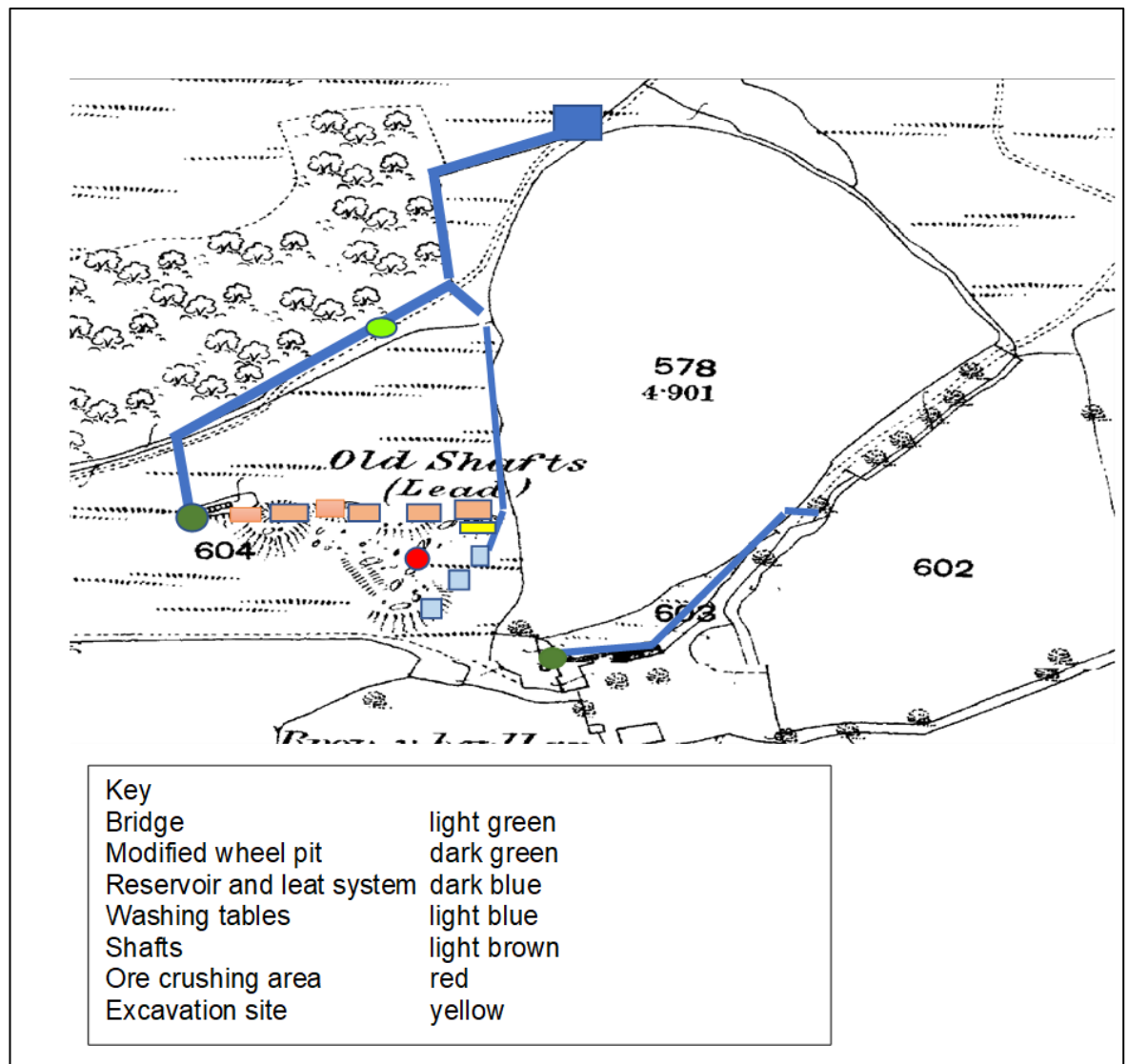


Figure 5.2 Map of M1 Bronberllan Mine 18th /Early 19th century mining remains

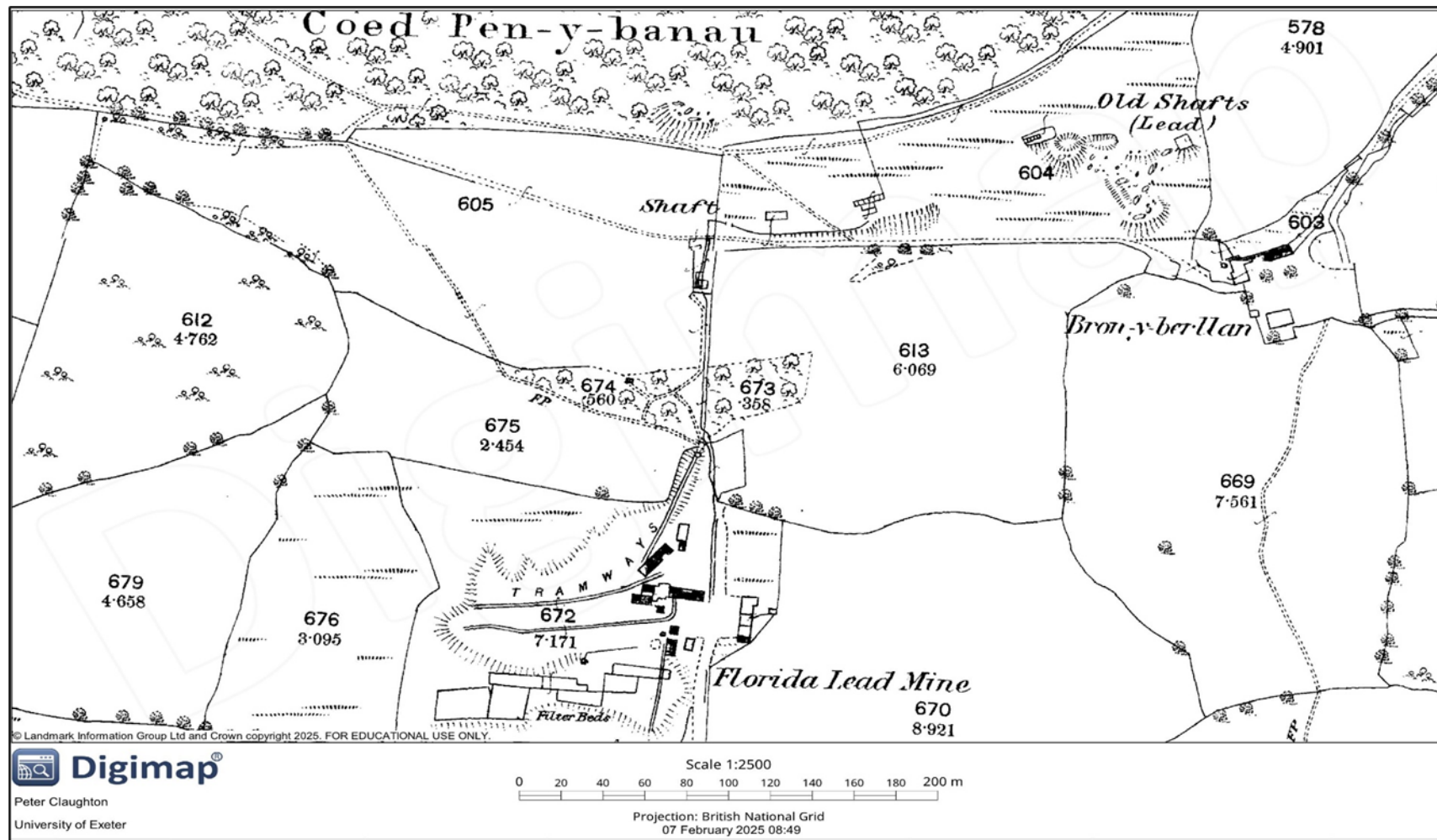


Figure 5.3 Map of M1 Bronberllan Mine 1880 (Digimap, 2025)

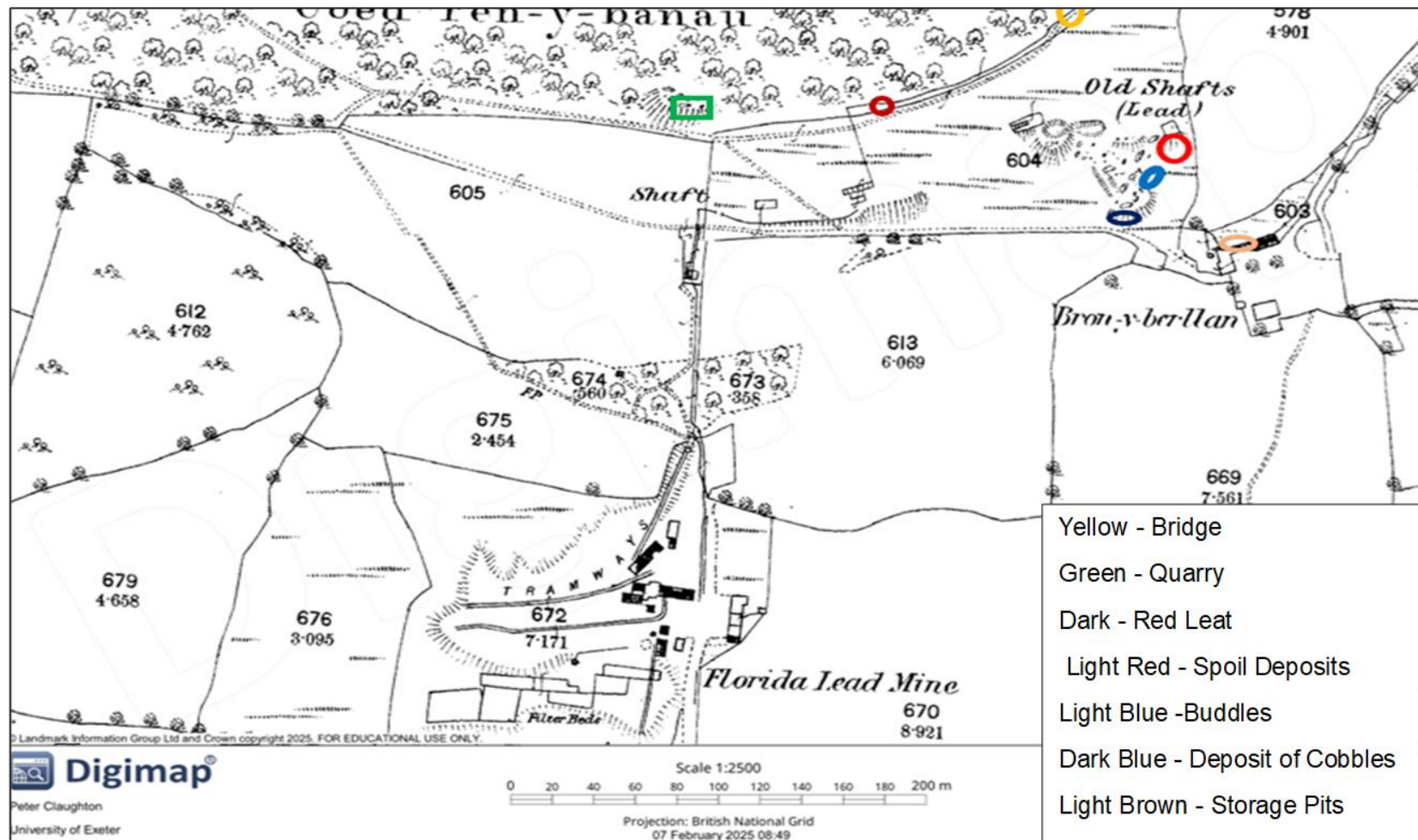


Figure 5.4 Map of Excavations carried out at M1 Bronberllan 2013 (Digimap, 2025)

Discussion

At the start of this research the records showed Bronberllan had a very limited known partial history which included a note showing Lewis Morris had kept a piece of ore from the mine in 1746 and that he had held a lease for the site in 1756. Nothing else was known until the mine managers made returns to the UK government in 1848 although the history of the mine from that date was still only limited to what was contained in the Government Mineral Records. Research carried out by John Webb (2012) expanded somewhat on its history covering the second half of the 19th century.

Summary of Bronberllan History

The examination of documentary sources plus evidence from the archaeological survey and excavation undertaken for this research has revealed a long history dating back to early 16th century. It has shown that miners had been living on the site from around 1520, and that the mine had been in operation, albeit intermittently, from at least the late Medieval Period until it ceased production in 1913. Detailed examination of mining reports from the second half of the 19th century showed that there were two distinct lodes at Bronberllan and that the mine had first been worked on the eastern lode. The upper deposits on the eastern part of the sett had contained lead ore in considerable quantities with indications that these deposits had been worked out before the 18th century. The position of the shafts within a large open cut (SN74603/66370), with Shaft One dating to around 1685, plus the lay of the topography showed that the mine had initially been worked as an outcrop until the surface deposits had been exhausted. After this the deposits were worked as an open cut followed in turn by a series of shafts sunk along the lode. Reports made at that time indicated that this part of the lode had been worked from west to east. Documentation also showed that between 1731 until the 1860s potters ore was the main product before it was overtaken by zinc. The underground deposits had initially been worked by stopeing with a series of shafts that were dug out in order to gain access to deeper deposits. As these areas became emptied of ore and abandoned, they (and the tunnels leading to them) were backfilled in order to redirect air flow to the newer working areas. This was a similar situation to that

encountered by Lewis Morris in 1751 when he worked the neighbouring mine of Esgair Mwyn which was a mine that had rich upper deposits that had been largely worked out by the time he reopened the mine and where large amounts of ore that had been left in the waste were reworked which helped maintain the profits of the mine in the 19th century. The eastern lode at Bronberllan became cut off due to flooding in the mid-18th century and it was at that time that the landowners became aware of the rich ore lodes in the old mine, causing them to try to drain and re-enter the old working (which was eventually achieved in the 1870s). There are also strong indications that the eastern lode was rich in silver however this presently remains unproven (this is discussed below in the section The Silver Question section 5.5). The mine was worked on a small scale until 1913 when it was closed.

M1 Bronberllan Mine SN74603/66370			
Summary of features identified at the site	Quantity	Grid reference	Description of feature
Open cut	1	SN74603/66370	Open cut into which a line of shafts has been sunk
Parch marks in outline of oblong building 6 x 4 metre	1	SN74565635	Parch mark of building through which rail lines have been laid. Possible ore loading station
Ore Crushing Area	1	SN7459666350	Immediately to the south of Shaft two is a cobbled ore crushing area of around 4metres x 3.7metres
Shafts These shafts relate to at least two time periods	8	SN74603/66370 SN74591/66371 SN74578/66370 SN74567/66372 SN74548/66373 SN74534/66376	Shaft One site of excavation Shaft Two (possibly a collapse) - immediately to the south of this is a cobbled ore crushing area Shaft Three Shaft Four driven through an earlier adit at SN74574/66342 Shaft Five

			Shaft Six has the remains of foundation cuts for the head gear adjacent to it at SN74538/66383 and SN74530/66381 plus an associated bob pit at SN74531/66368
		SN74445/66356	Shaft Seven this could have been an air shaft that has collapsed making it appear much larger than when it was originally made
		SN74372/66314	Shaft Eight has the remains of a bob pit cut into one side and has an interesting slip face at approximately 3m depth
		SN74572/66612	Shaft Nine is to the north east of the site (this shaft has an associate small trial SN74574/66610. Water drains from this area into the mine leat system).
Bob pit	1	SN74531/66368	Former wheel pit reworked into bob pit
Stope	1	SN74407/66330	Stope breaking surface and its associated well grassed over spoil heap
Collapsed Shaft or adit	1	SN74374/66294	This is a back filled shaft or adit which appears to predate Shaft Eight.
Adits	5	SN74439/66334	Adit One
		SN74354/66395	Adit Two This is the deep adit now partially collapsed at its portal, but still draining water. According to O.T Jones this adit is 128.016 metres long
		SN74574/66342	Adit Three top adit. This adit has been driven to access eastern workings. Sometime in the 18 th century Shaft Four has been driven through it

		SN74370/66290	Adit Four This adit appears to be linked to shaft number seven at SN74445/66356. It is a dry and very shallow feature to the north east		
		SN74743/63948	Adit Five An interesting feature that could be categorised as a trial but is large enough to warrant inclusion in this section. This adit has been driven into the wall of the quarry at SN74743/63942;		
Costeaning trenches	25	SN74254/66773 SN74290/67138 SN74736/66862 SN74407/66342 SN74289/67141 SN74849/66857	SN74397/66504 SN74402/66524 SN74439/66488 SN74539/66401 SN74532/66422 SN75984/66707 and associated Adit	SN74487/66653 SN74320/66705 SN74344/66668 SN74475/66565 SN74470/66623 SN74470/66623	SN74424/66665 SN74474/66689 SN74480/66717 SN74656/66748 SN74520/66781 SN74452/66641
Quarries	2	SN74743/63942 SN74366/66243			
		SN74858/66956	This trench is now part of a drainage system but a visit to the site revealed that it is deeper and has higher banks than any other part of the ditch. This indicates that it is a real trial rather than an exploration trench.		
Trial adits	2	SN74357/66452 SN74360/66462	Both these trials are slight, and based on the remains have not penetrated very deeply into the strata.		
Reservoir	1	SN74657/66573			

Leat starts	1	SN74614/66536	Start of leat to eastern mine waterwheel
Bridge over leat	1	SN74583/66459	Small stone slab bridge over eastern waterwheel leat
Eastern waterwheel leat	1	SN74573/66441	Eastern waterwheel leat destroyed by track building
Leat turning point	1	SN74445/66378	The top leat once turned here to the waterwheel. The flow of water to the pit has left a small hollow.
Eastern waterwheel pit	1	SN74456/66344	Eastern waterwheel pit powering east to west direction workings, partially destroyed. This wheel pit was excavated by Jones in 2006. Waterwheel gear house the foundations can be identified in this much disturbed area.
Waterwheel drainage adit and leat	1	SN74438/66328	This adit is four metres long and is of stone cut and shut construction. The adit drains into a leat that feeds a second waterwheel lower down the hillside.
Waterwheel rod run	1	SN74472/66352	Waterwheel rod run stone cut for 30 metres. This feature runs for 15 metres, allowing for the raise and backwards and forwards operation of the rods. The feature is in direct line to the winding pit.
Bob pit for Shaft Six	1	SN74528/66373	This feature has been identified in the records as a bob pit; however, it may have a water wheel pit
Lower waterwheel pit	1	SN74366/66243	This feature has been partially destroyed by recent quarrying activities. This wheel appears to be used in conjunction with the Pelton wheel used to power crushers and jigs
Gear pit for waterwheel	1	SN74372/66240	Gear pit for above waterwheel, now partially destroyed by quarrying activities

Start of leat to turbine	1	SN74629/66597	
Sluice	1	SN74440/66412	This sluice allowed water to either continue to the turbine run or be turned and redirected downhill to the eastern waterwheel at SN74437/66409
Eastern waterwheel	1	SN74437/66409	
Start of turbine run	1	SN74391/66429	
Erosion of leat	1	SN74449/66377	
Former turbine house	1	SN74366/66217	Site of former turbine house, now destroyed by the quarry, as indicated on maps and photographs.
Remains of water braiding	1	SN74607/66370	
reservoir	2	SN74650/66568 SN7665/68000	On mine site Teifi Pools
Start of hushing leat system	1	SN74601/66463	
Possible hushing release point	1	SN74609/66378	
Terraces/buddles	3	SN74506/66337	
Small platform on site of a building on map now destroyed	1	SN74335/66230	Site of a building now destroyed by quarrying. Given its position and size, it is likely that this was the powder magazine (identified through mapping and aerial photography).

Storage pits	4	SN74437/66409	No longer visible after being backfilled.
Mine Captains house	1	SN74391/66116	The site of mine captain's house was identifiable in 2006/8 but has now been completely removed
Slime pits	2	SN6900/6595 SN74006595	Earth walled slime pits associated with 19 th century ore processing

Figure 5.5 Detailed recorded of features identified at M1 Bronberllan

M8 Cwm Mawr Mine SN73569/67259

- Also known as Pen y Wern Hir and Fair Chance
- A mine recorded on the RCAHMW, Cadw and DAT databases
- Recorded maps from 1880.
- Written about by Bick (1978), Bird (2012), Foster Smith (1979), Lewis (1967) and Webb (2012)
- The mine worked the Frongoch formation.
- The Mineral Statistics recorded returns from 1911 to 1918 in which time it produced 836 tons of lead ore and 131 tons of zinc ore.

Introduction

Although there is no complete documented history of Cwm Mawr Mine, David Bick (1978, p. 36) and Foster Smith (1979, p. 84) have both written a limited overview of the mine's history. The early history has also been described equally briefly by Lewis (1967, p. 108), while Webb (2012, p. 76) has discussed the later history and its geology. Bird (2012, p. 89) has discussed the installation of a water pressure pump at Cwm Mawr and its operation in detail. This research sought to provide a more comprehensive history of when the site had been worked, using the information sourced from documentation, archaeological surveys and the informative research carried out by the authors mentioned above.

History of Cwm Mawr Mine

Cwm Mawr mine lies 500 metres north of the village of Pontrhydfendigaid on the lower western flank of Bannau Hill below a hillfort of the same name. The mine is largely contained within the length of a small but steep sided dingle through which a stream called Nant Lluest flows. Although there are indications that there may have been mining on the site earlier (discussed later in this section), the earliest recorded documentary evidence of mining at Cwm Mawr was a lease drawn up on the 8th February 1753 (NLW, Crosswood Deeds, MS I.877). This document was an agreement to work the mineral on the site that was drawn up between Wilmot Vaughan Lord Lisburne and a syndicate of investors from outside Cardiganshire. The members of the syndicate were David Hopkins, Edward Parry, Joseph Vipond, Joseph Vipond junior and William Frost (NLW, Crosswood Deeds, MS I.877). The lease was for 23 years and permitted the mining of minerals under a tenement called Pen y Wern Hir in the parish of Gwnnws (this is the name of the farm immediately north-east of Cwm Mawr mine). Pen y Wern Hir mine was one of a group of new mines that had been opened in the area at that time following the discovery of the rich ore deposits at Esgair Mwyn in 1751. The other mines were Esgair Ddu, Llwyn y Gwyddyl and Llwyn Llwyd (NLW, Powis Castle Deeds, MS 21900, chapter 16). The investors who had taken out the lease appear to have come from outside of Cardiganshire and were probably drawn to the area after hearing about the large profits that had been made by Esgair Mwyn when it first opened (Lewis, 1967, p. 100). The lease of Pen y Wern Hir was for 23 years with a duty of 13 shillings per ton of ore produced until 13th of October 1754 and 20 shillings per ton after that date to be paid to Lord Lisburne (NLW, Crosswood Deeds, MS I.877). The terms of the lease show that while it was known there were minerals on the site, and that as the mine was new, an allowance had been made for a development period which was for the first 20 months.

Documentation on the mine next appears in 1765 when Lewis Morris wrote that Chauncey Townsend, a Swansea lead smelter owner (Hughes, 2005, p. 4) was working it under the name Cwm Mawr with John Ball as his manager, although no lease documents were found that confirmed this (NLW, Powis Castle Deeds, MS 21900, chapter 18). Cwm Mawr was not included in any of the various leases of mines given to Townsend by Lisburne, however a portion of a lease from 1762

has survived which showed that Townsend had been given some property by Lord Lisburne but did not show what the property was. As all other leases granted to Townsend were mines, it is possible that this was the missing lease for the Cwm Mawr mine (NLW, Crosswood Deeds, MS II.307).

In early 1770 two documents were drawn up by Lisburne's lawyers that concerned the mine at Pen y Wern Hir. The first was a new 21-year lease which was issued to John Vaughan, John Probert and Edward Hughes for tenements at Pen y Wern Hir and Nant y Frynaches plus all minerals under them (Nant y Frynaches is a house south of Pen y Wern Hir now called Nant y Naches). The annual rent was a heriot of eggs and poultry plus 30 shillings per ton of ore produced (NLW, Crosswood Deeds, MS I.1035). The inclusion of the heriot indicates that one of the tenements was to be lived in by one of the leaseholder's which, given that Probert was the person most involved in the running of the mine, was probably the tenant. The second document concerned the articles of partnership for Fair Chance Mine (only the draft of this document has survived) (NLW, Crosswood Deeds, MS I.1037). These articles set out who was to be involved in the exploitation of minerals under the tenements of Pen y Wern Hir and Nant y Frynaches confirming that Fair Chance was on the same site as Pen y Wern Hir mine. The mine was not named Fair Chance, due to the mine being seen as having a fair chance of success but rather it was, as in the case of many Welsh mines, named after the parcel of land in which the mine was sunk. In this case the Cwm Mawr mine was situated on a field which was called Llidiart Chance which translates as Gate into Fair, as this field was original site of a fair (market) from the Monastic Period through to the Elizabethan Period (Williams, 2001, p. 262).

The document repealed the earlier lease that had been issued to Vaughan, Probert and Hughes and was replaced with articles of agreement to work the mine by a new partnership. The partners included the original three investors John Vaughan, Edward Hughes and John Probert plus Wilmot Vaughan Lord Lisburne, William Powell, Stephan Saunders. The new investors were members of the local aristocracy and gentry; however, it was notable that John Probert, Lisburne's former steward, who was a prominent and experienced mine manager, had also remained. The decision of Lisburne and the other landowners to run the mine was a reflection of society at that time where local landowners were forming

groups in order to work a number of the mines together in the area. Shares in the venture were to be split into 16 parts with Lisburne holding four of the 16 shares. The last 12 shares were to be split equally between all the partners (including Lisburne), giving each partner a holding of two shares (NLW, Crosswood Deeds, MS I.1037). That Lisburne retained the majority of the shares was a reflection of his loss of royalties from the land as the landowner.

Working the new Fair Chance mine was, however, to prove problematic and the mine soon ran into problems with water coming in from the old workings (Lewis, 1967, p. 108). Letters concerning the working of Fair Chance at that time show that the mine was having problems returning any profits and that it had not achieved the output hoped for. The records show that the expenditure on the mine between June and July 1775 was £480/7/10d, without the production of ore of any type (NLW, Powis Castle Deeds, MS 3608). The mine then appears to have fallen idle around 1776 probably due to drainage problems.

Lewis (1967, p. 108) suggests that the partners were later convinced by the miners to try and the work the mine again in 1777 (Lewis, 1967, p. 108). However, a letter written by Edward Hughes and H Jones on 8th July 1778 claims that the miners had misled the company and that the workings were not as rich as they said and were far wetter than had been indicted. He added that '*miners in general were a pack of lying rascals*' (NLW, Powis Castle Deeds, MS 3914). In the same letter Hughes suggests that the way forward would be to employ more men on the pumps in the whimsy which would be costly for little return. He also advised Jones that they extend the workings in the mine bottom, then drive a deep adit to meet the new bottoms and drain the mine (NLW, Powis Castle Deeds, MS 3914). Hughes had already been in discussions over the bargain for the adit and drain but had not concluded it. The adit was to be supervised by Mine Captain James Lowe, who later managed a number of mines for Probert including Esgair Mwyn and Fair Chance (NLW, Powis Castle Deeds, MS 3653) (Bird, 2012, p. 89). Lowe said that he could drive an adit from the garden of the tenement of Nant y Naches to the mine bottoms 110 metres to the north and that the cost of the work would be £3/18 per fathom (1.8 metres), to be paid with every 20 fathoms driven. The adit would be a wagon way 1.8 metres high x 1.2 metres wide. Lowe said that he could set seven men to start work on the adit by the 20th of October 1778 but that the company would have to provide wheelbarrows, trucks and rails plus the

bellows and pipes, and that a number of air shafts would have to be made at intervals along the tunnel length. The miners driving the adit were to have use of a store house and the smithy and in addition, houses with gardens were to be provided as accommodation for the men. However, Hughes had not agreed with this estimate and had suggested to Jones that the company should drive a harder bargain by asking Lowe to employ more men and drive the adit further for the same money (NLW, Powis Castle Deeds, MS 3914).

This letter tells us several things about how Cwm Mawr was being worked at that time. Driving the adit required miners with specialist skills who did not appear to be living in the local area, indicating that Lowe had a team of miners in mind. In addition, there was no mention of the use or provision of gunpowder in the proposal which indicated the Lowe believed that the strata would be soft enough to be worked by pick. The use of explosives can cause fractures resulting in the tunnels becoming unstable and prone to collapses, with the additional risk of flooding. There was also no mention of timber to be used, particularly for supporting the tunnel roof, suggesting that the strata were a stable rock. The adit was eventually driven as a narrow tunnel (1.2 metres wide) which meant that only one person was able to work the face with a pick. The narrow tunnel meant that trucks could not be used and so the waste would have been removed by wheelbarrow. The description in the letter gave an indication of how many miners would have been employed in the excavation of the adit. In addition to the miner at the face, at least one miner would be working the bellows which supplied air to the working face via a series of pipes. That meant that at the very least three people would be working on the tunnel during the shift; two pick/clean-up men and a trammer (using the wheelbarrow), and a man on the bellows at the adit entrance. The employment of seven men, as recommended by Lowe, would suggest that the project was being worked on a two-shift basis. Unfortunately, all the work was wasted as the tunnel the miners they produced was too shallow to drain the mine workings as they had been unable to drive a deep adit due to the position of the mine on the lower slope of Banna Hill.

These problems seem to have disheartened Wilmot Vaughan Lord Lisburne who, in March 1784, transferred his shares in Fair Chance to John Probert and reverted to collecting landowner's royalties of 25 shillings a ton and a rental of £25 for the land (NLW, Crosswood Deeds, MS I.1142). By 1781 Probert owned

75% of the shares in Cwm Mawr (Bird, 2012, p. 89). Convinced that if the mine could be drained it would make a profit, Probert and the remaining partners sought other ways to drain the mine. Their options however were limited as draining the mine by adit had failed and draining the mine by horse or human powered pumps had proved ineffective and expensive. The use of steam engines to work the pumps was not an option due to the expense of importing coal which would have made the mine insolvent. Attention therefore turned to the use of a water pressure engine. Investigations into the use of a water engine seem to begin about 1781 with a letter written by Edward Davies and sent to the manager of Fair Chance, Mr J. Pierce. The letter discussed building a water pressure engine with Davies saying it would cost £154/10 shillings (Bird, 2012, p. 89). The engine would have been capable of drawing 24 gallons of water per minute to a height of 50 feet (15.24 metres). This project does not appear to have proceeded as by August 1785 a London firm, Cole and Smeaton, had installed a water pressure engine at Fair Chance (Bird, 2012, p. 89). This engine, however, was unreliable and required constant repair and adaption, and in fact, never achieved its aim as the mine continued to be unworkable in all but the driest times. Probert, was faced with a falling market for lead due to the wars with France, and subsequently closed Fair Chance in 1791 having said to have lost £4000 in the venture (Webb, 2012, p. 78).

This was not, however, to be the last fortune lost at this mine as another failed attempt was made to work the mine between 1836 and 1840, by John Taylor (Burt, Waite and Burnley, 1985, p. 27) again using a water engine. This was probably the more reliable engine designed by Trevithick, and similar to the one of which had been installed at Alport in Derbyshire in 1803, a mine which Taylor had also managed (Willies, 1999, p. 39). Despite the new engine Taylor was not able to work the mine at a profit due to the amount of water within the workings and abandoned the mine in 1840 (Burt, Waite and Burnley, 1985, p. 27).

The final two attempts to work the mine were by the *St James Syndicate* in 1911 and the *Cambrian Lead & Zinc Mining Co* in 1912-1913 (Burt, Waite and Burnley, 1985, p. 1). During this time the mine was subject to modernisation and a large capital investment (it is from this period that the majority of the remains on the site date to). This time they were able to drain the mine by means of electric pumps, which were said to have removed 4000 gallons of water per hour (Webb,

2012, p. 79). This investment however came too late as this was the very time that the price of lead reached its lowest point (Lewis, 1967, p.116) and the mine officially ceased production in 1913 (Burt, Waite and Burnley, 1985, p. 27).

Was Cwm Mawr Mine Worked Before 1753?

Although the first documentary evidence shows mining had been carried out on the Cwm Mawr site in 1753, there were indications that these deposits may have been worked much earlier. The dingle on which the mine straddles had been eroded by the stream, scouring out the line of the lode which would have made the mineral deposits visible in the Nanty Cwm stream bed. The position of the lode outcrop would have made the ore vein easy to identify and so it was unlikely that a prominent deposit would not have been tried. The dingle has very vertical sides which appear, in part, to be due to mining and are suggestive of some very low-grade ore being taken from the area of SN73720/67327. Circumstantial evidence of mining on the site was also identified in documentation. A lease dated 26th March 1733 mentioned a tenement on the land at Ffair Rhos called Tuy yr Grave (House of the Grave), (NLW, Crosswood Deeds, MS II.170). The word 'grave' is one of a group of words that were commonly associated with former mining sites in Cardiganshire, including grove, greave and groove. As such, the name Tuy yr Grave may be an indication that mining had been carried out in the vicinity of Pen y Wern Hir prior to 1733. There was also a statement by Lewis in his book that Fair Chance had been difficult to drain due to the enormous amount of water entering it from old workings nearby (Lewis, 1967, p. 108). This statement raises the question 'was Fair Chance, which was opened in 1769, the same mine as Pen y Wern Hir mine that was opened in 1753, or were they two separate mines adjacent to each other?' (NLW, Crosswood Deeds, MS I.1037) (NLW, Crosswood Deeds, MS I.877). It seems, based on the names, documentary evidence and statement made by Lewis (1967, p. 108) that the mines dating to 1753 and 1771 were separate mines near to each other working on the same lode or that the lode had been tried much earlier under the name Tuy yr Grave. It is unlikely that this can be proved one way or another as subsequent workings and the radical redevelopment of the mine in 1913 have cleared the site of the majority of the older surface remains.

Survey of Cwm Mawr Mine

The site had three visible adits:

Adit One - SN73351/67063

Adit Two - SN73579/67237

Adit Three - SN73681/67296 (Small stub adit sunk into the riverbank)

Adit One SN73351/67063

This long adit, whose entrance is at SN73351/67063, was built to drain the mine. While water still flows from the adit it has collapsed near to the entrance.

Adit Two SN73579/67237

This is a small adit along a fault in the rock which has been cut through by quarrying activity. One of the walls has the initials JP and RT and the date 1771 inscribed into it. These initials have been interpreted as those of John Probert and an unknown person (Webb, 2012, p. 80). While this would be a neat explanation, from an archaeological it is problematic, as it assumes that the initials were made at the same time. The initials however have a different morphology. The letters 'R' and 'T' were pecked out with a pick while the letters JP and date have been chiselled out and then worked and deepened in a wearing action. The letter that has been interpreted as a 'J' in the standard style for the 18th century and could relate to John Probert or at least someone with the initials 'JP'. I would suggest however that the two sets of initials are not from the 18th century but are probably the result of someone leaving their mark when either working at or visiting the area in more recent times.

Adit Three SN73681/67296

The riverbank Adit Three at SN73681/67296 can only be reached when the stream is low and has been partially covered by debris from the bank above it. It appears to be coffin shaped but little else can be said about this feature without it being excavated. The dingle bank sides at SN73720/67327 are very vertical sides which is suggestive that some very low-grade ore has been taken from the

riverbank at this point. The remains of surface buildings and infrastructure of the mine date mainly to the 20th century when the surface workings were electrified with the power being provided by gas engines at SN73564/67273

One interesting feature of the site is a reservoir at SN73608/67301, which appears to not serve any visible waterwheel or have any outlet to the gas engine site. It had been thought prior to the survey that there was no feed to the reservoir as no leat had been located from the Nant Lluest stream. However, during the survey the remains of a leat fed from the Glasfryn stream was located at SN63658/67407. It could be that the reservoir was never used, and that the decision was made to use gas engines or it could be that it was constructed for the water engines which were then superseded by gas engines and that water had been transferred by pipe or wooden launders rendering it obsolete. The latter seems likely given the method of construction and the fact that it seems to have an infill of silts and soil, and it could be that this feature is one of the few remains of earlier 19th century mining.

Discussion

Cwm Mawr is a mine that has been worked under several names from the 18th century. However, there are indications that the mine may have been worked for longer than presently thought. The site has been changed considerably from the 1970s as can be seen in the aerial photographs with large amounts of spoil having been removed from the site and several areas of the dingle have been quarried away. While it is quite feasible that this could be an early mining site it is unlikely that evidence has survived above ground due to farming operations which continue into the present day, having destroyed the majority of the evidence of pre-20th century mining. One area in which this mine could prove interesting is in the underground archaeology where the remains of the 18th and 19th century water engines could be found.

List of features identified at M8 Cwm Mawr Mine SN73569/67259			
Summary of features identified at the site	Quantity	Grid reference	Description of feature
Adit One (Long Adit)	1	SN73351/67063	
Adit Two (Stub Adit)	1	SN73579/67237	
Adit Three (Stream Side Adit)	1	SN73681/67296	
Reservoir	1	SN73608/67301	
Settling ponds	1	SN72447/67183 down to SN73413/67147	
Shafts	5	SN73569/67259, SN73599/67246 SN73502/67175 SN73345/67090 SN73665/67296	New engine shaft which is reported to have had an associated shallow adit now probably destroyed Old engine shaft unnamed shaft unnamed shaft stream bank shaft
Gas Engine house and crushers	4	SN73564/67273 SN73558/67242 SN73541/67224 SN73511/67197	Remains of crushing plant buildings
Spoil mostly now removed	1	SN73567/267259	
leat		SN63658/67407	
Dingle stream side workings?	1	SN73720/67327	

Figure 5.7 Detailed list of features identified at M8 Cwm Mawr Mine

M9 Dyffryn Cottage Mine SN75261/68486

- Located on the Frongoch Formation
- This mine was recorded on the RCAHMW Coflein database
- The mine was noted as a shaft on the 1880 Ordinance Survey map.

A disused shaft located on craggy ground close to a small holding called Dyffryn Cottage, which first appears on the 1880s Ordinance Survey map. The site is far enough away from the Llwyn Llwyd and Esgair Mwyn mines and concentrated enough to be classified as an independent mine. Due to this it was included on the RCAHMW database,

Documentary Evidence Discovered During this Research

At the start of this research all that was known about this site was its inclusion on the ordinance survey map of 1880 which showed a shaft at SN74968/68612. As it was noted on the map the shaft was included in the RCAHMW database as a mine. While there is no documentary evidence about who sank the shaft, its position coincides with that given by Lewis Morris in 1756 of a mine called Llwyn y Gwyddyl (NLW, Powis Castle Deeds, MS 21900, chapter 13), found by his surveyor Evan Williams who was searching the area for new mineral deposits (NLW, Powis Castle Deeds, MS 21935, p. 57). It can therefore be assumed that this was part of the Llwyn y Gwyddyl mine which was on the Esgair Mwyn lode, a mine, according to Lewis Morris, that was being worked by the land owner Mr Jones of Llanfair (NLW, Powis Castle Deeds, MS 21900, chapter 13).

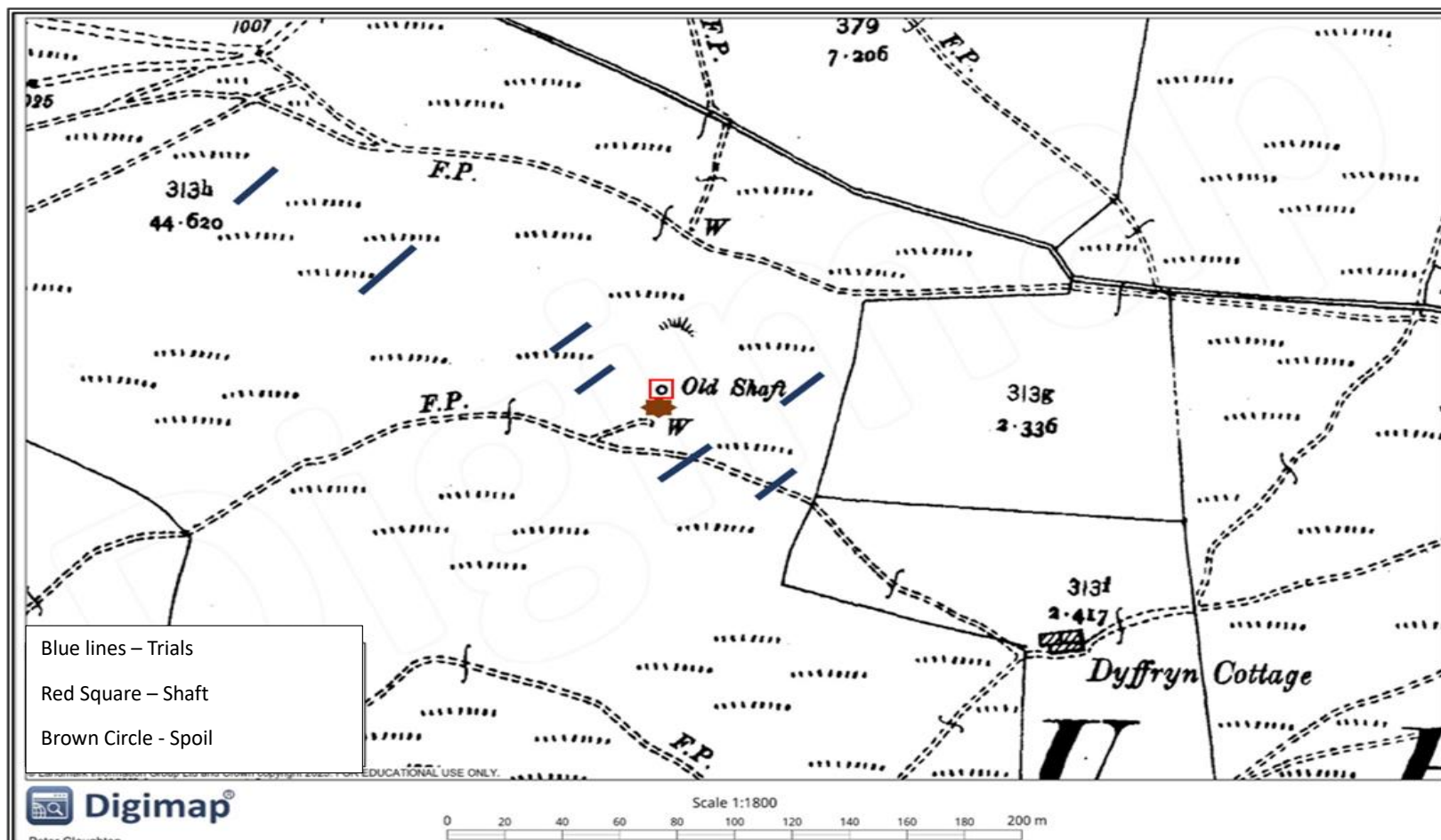


Figure 5.8 Map of M9 Dyffryn Cottage 1905 showing survey findings (Digimap, 2025)

Archaeology of the Site

Once the site was located from the Ordinance Survey map, an examination of historic photographs and satellite imagery of the area led to the identification of a number of mining like features around the site. A walking survey of the site identified a distinct group of mining features near to the ruined farmstead of Dyffryn Cottage (See figure 5.8). These consisted of seven costeaning trenches, the longest being 10 metres long x 1.3 metres wide and the shortest being 3 metres long x 1 metre wide. The average being 8 metres long x 1 metre wide. All the trenches were around 0.3 metres deep. These features were situated on an area of rocky ground and were aligned in an east-westerly orientation. A small grassed over mound of material was found at the site but it was not possible to ascertain if this was spoil or some other feature. A leat was identified running close to the site however, the leat served the Llwyn Llwyd mine and not the Dyffryn Cottage mine indicating that these workings had been abandoned by the time the leat had been constructed.

Discussion

Little can be said about the remains at Dyffryn Cottage other than they are most likely to be the remnants of an off-shoot of the Llwyn y Gwyddyl mine that was opened around 1756 and worked by the landowner Jones of Llanfair. The small amount of waste on the site and the lack of infrastructure indicated that the mine had not proceeded beyond a trial, for which there could be several reasons. The mine had been sunk at a time when mining had become more capital intensive and so the owner may not have been able to afford to pay the cost of running this part of Llwyn y Gwyddyl Mine or it could be that the lode, while initially appearing rich, had quickly petered out. While the current landowner was not averse to my initial survey of the site, he was not in favour of the public using footpaths that crossed his land and as such he is unlikely to grant permission for a more prolonged survey or excavation.

M9 Dyffryn Cottage mine SN275261/268486			
Summary of features identified at the site	Quantity	Grid reference	Description of feature
Costeaning trenches	7	SN75000/68399 SN75004/68425 SN75069/68453 SN75023/68453 SN75082/68461 SN75099/68477 SN75141/68492	All of similar depth and width
Possible spoil heap	1	SN68550/68490	
Cottage	1	SN75261/68486	Stone built
Leat	1	SN71109/69853	
Pits	2	SN75120/68484 SN75126/68488	backfilled
Shaft	1	SN74968/68612	

Figure 5.9 Detailed record of features identified at M9 Dyffryn Cottage Mine

- This mine was recorded on the RCAHWW, DAT and Coflein database
- This mine had also been worked under the name Ddu and as part of Esgair Mwyn.

This mine was situated on a hillside east of Esgair Mwyn mine, and was first discovered by the surveyor employed by Lewis Morris in the 1750s (National Library of Wales, MS 15101, p. 55). It has a working history that began in 1768 when it was initially worked by Mine Manager John Ball and then by John Paynter in 1775 (Lewis, 1967, p.108). The mine was tried again in the 1850s, with the production returns being combined with the returns for Esgair Mwyn until 1889 (Burt, Waite and Burnley, 1985, p. 36). Bick (1978) and Foster-Smith (1979) both suggested that this was a small mine, not more than a trial. However, the infrastructure and amount of spoil on the site noted during the 2014 survey indicated that Esgair Ddu had been a fairly large mine compared to the majority of the other mines within the research area as shown in figure 5.10. Lewis (1967) suggested that Esgair Ddu had been worked as an open cast mine by Probert in the 1768 (Lewis 1967, p. 276). However, this appears to be incorrect as the archaeological remains found during this research indicated the majority of the work had been undertaken via an adit and two shafts.

This was an interesting mine which still retained some of its 18th century infrastructure features, making it appropriate for this study, however the land owner would only permit one visit to the site. Because of this it was not possible to include it as part of this research.

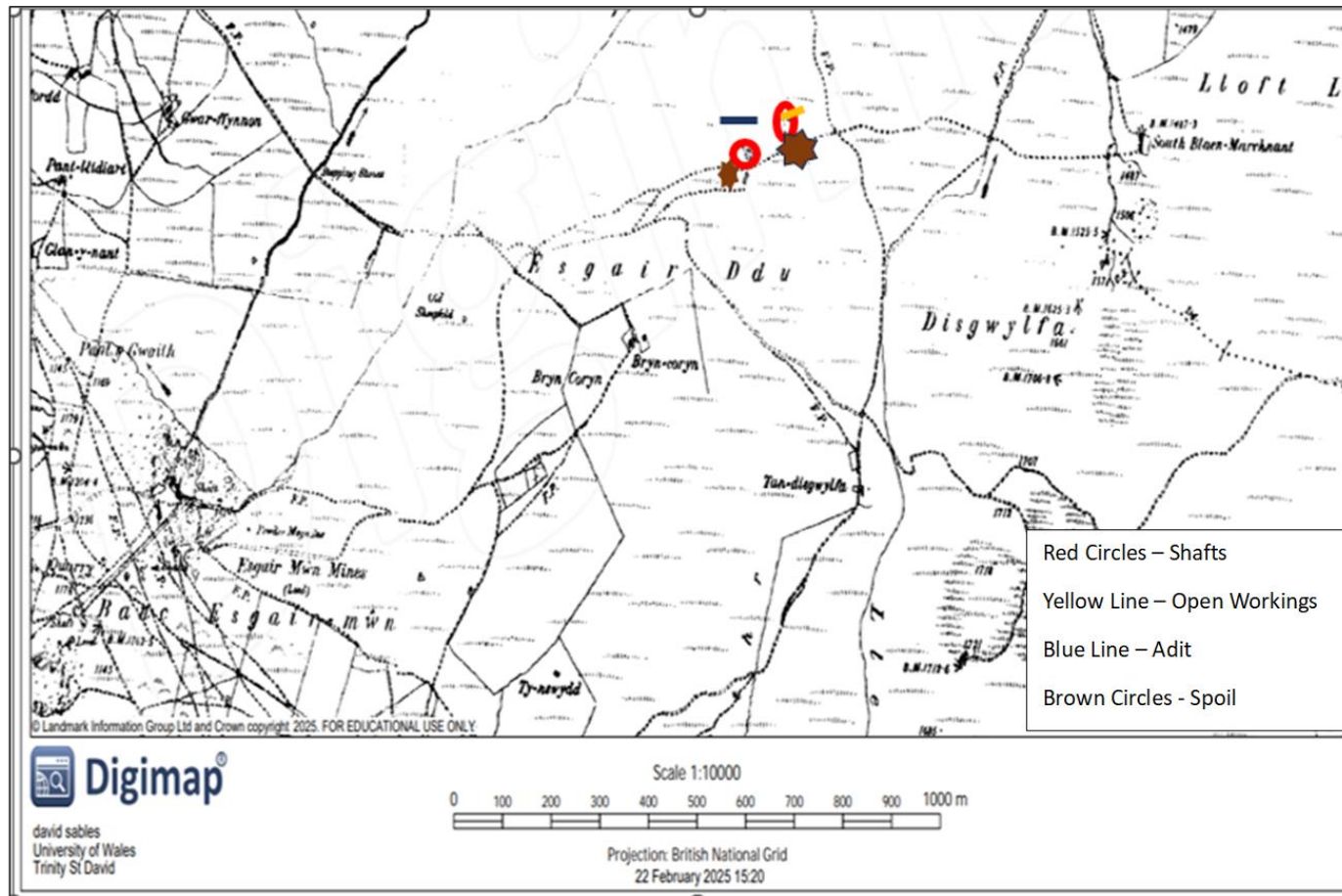


Figure 5.10 Map of M10 Esgair Ddu 1905 showing 18th century features (Digimap, 2025)

M10 Esgair Ddu SN76774/69674			
Feature	Quantity	Grid reference	Comment
Adit	1	SN76774/69674	
Open cut / shaft	2	SN76762/69629 SN76694/69664	18 th century open working with shaft sunk through the floor
Crusher house	1	SN76703/69660	
Dressing floor	1	SN76711/69668	
Waterwheel pit	1	SN76693/69650	
Leat	1	SN76773/69607	
Trial trenches	7	SN76285/69598 SN76311/69640 SN76102/69623 SN76663/69614 SN77077/69568 SN77098/69636 SN77195/69639	
Spoil heap	3	SN76328/69631 SN76694/69664 SN76703/69660	

Figure 5.11 Detailed record of features identified at M10 Esgair Ddu

M11 Esgair Mwyn Mine SN75438/69333

- Located on the Frongoch Formation
- This mine was recorded on all known Welsh mining databases

Esgair Mwyn mine is situated on the summit of the small hill of Esgair Mwyn, three kilometres north of Pontrhydrygroes and worked the Esgair Mwyn silver-lead vein, which is part of the Frongoch formation (Foster-Smith, 1979, p. 83). The recorded history of the mine dates from its reopening in 1746 until it was last worked in 1970s. It is recorded in all the mining heritage databases that cover Cardiganshire. Although a relatively small mine, it could be argued that Esgair Mwyn was one of the most important mines in Wales, as disputes surrounding its ownership in the 1750s shaped the Crown's policy on the exploitation of metallic minerals on its lands for the next 150 years. Because of this legacy, the history of the mine has been written about in detail by authors such as David Bick (1978), George Hall (2012), William Lewis (1967), and William Rees (1968). However, in order to provide a more detailed understanding of how the mine was worked and by who, an in-depth analysis of documents relating to the mine that were written in the 1750s was undertaken as part of this research. The results of this analysis formed the discussion on the social aspects of mining in Chapter Six, and as such this section will provide a brief overview of the history and the historical documentation concerning the mine.

History of Esgair Mwyn

Esgair Mwyn is situated on the Cardiganshire Crown Wastes and as such was owned by the Crown. In 1746 Lewis Morris, as the Deputy Steward of the Crown Manors of Cardiganshire, gave a lease to miner Evan Williams and three brothers with the surname Morgan, to drain and reopen the old mine at Esgair Mwyn (NLW, Powis Castle Deeds, MS 21900, chapter 13). The miners however were unable to drain the mine and gave up. A second lease was issued to the same men but again they failed, this time due to bad weather and the large amount of water entering the old workings. A third lease was issued to these men in June 1751 but this time they were directed by Lewis Morris to abandon their attempts to drain

the mine and to instead dig a trial on the south side of the original workings. In doing so the miners discovered a vein of lead ore which after a few feet increased in size and richness to seven inches of solid ore (Lewis, 1967, p. 100). Realising the potential of the mine Morris joined with the four miners to work Esgair Mwyn under a bargain, extracting an estimated 1000 tons of ore in the final eight months of the lease (Lewis, 1967, p. 100). Morris gave the justification that he had been advised to do this for the Crown to ensure the work was protected from intrusion as well as being properly supervised and funded (NLW, Powis Castle Deeds, MS 21900, chapter 13).

When the lease expired in 1752 the Crown, seeing the substantial profits made from the mine by Morris and his partners, took the decision to work the mine for itself and appointed Lewis Morris as Agent and Superintendent of His Majesties Mines in Cardiganshire (Lewis, 1967, p. 100). The profitability of the mine inflamed a dispute between the Crown and local landowners over the ownership of the mine which escalated and on the 23rd of February 1753 an armed mob, led by members of local gentry, the sheriff, his assistant and two magistrates seized control of the mine. At the same time, they illegally imprisoned Morris at Cardigan jail (NLW, Powis Castle Deeds, MS 21935, p. 33). On receiving this news, the Crown representatives in London sent a detachment of the Scotch Greys Cavalry to reclaim and secure the mine, and reinstall Lewis Morris as Steward (Lewis, 1967, p. 102). Following this a court case was started in Parliament which initially supported Lewis Morris but which ended in a settlement between the local landowners and the Crown, and with Morris being removed from his official positions in 1756 (Hall, 2012, p. 3). The lease for the mine passed to Lord Powis with a royalty of 50% although this was later reduced. Lord Powis continued the redevelopment of the mine, eventually draining the old workings in 1766 (Bick, 1978, p. 32). Following the death of Lord Powis in 1776 the lease was eventually given to Thomas Jones, Robert Shore and John Lewis (Lewis, 1967, p. 107). By 1788 control of the mine had passed to a consortium led by John Probert (Lewis, 1967, p. 108), although by this time the original lode that had been discovered by Lewis Morris was largely worked out. The lack of ore plus the depression in the lead industry during the late 18th and early 19th century caused by the wars with France meant that little work was undertaken at Esgair Mwyn during that time period (Lewis, 1967, p. 115). The 19th century saw a revival of interest in Cardiganshire mining however it appears that like Bronberllan, the

most productive parts of the lode had been removed by that time. Despite this Esgair Mwyn continued to be worked by a number of companies and was in continuous production until 1927. Further attempts were made to reopen the mine in 1947 (Bick, 1978, p. 33) and again in 1973, both of which failed (Hall, 2012, p. 12). However, these last attempts made Esgair Mwyn the last working mine in southern Cardiganshire.

History of Working the Mine Before 1746

Although it is not known when this mine was first opened, in 1756 Morris wrote that the mine had not been worked in living memory and that the local people thought the mine was of ancient British or Roman origin. However, based on his own observations of items found in the old workings Morris thought that there had been an attempt to reopen Esgair Mwyn during the reign of Queen Elizabeth I (1558-1603) (NLW, Powis Castle Deeds, MS 21900, chapter 13). Morris was a capable and experienced surveyor and mine manager, so by using his detailed description of the site and artifacts, it was possible to gain a significant amount of information about when the mine had been extracting ore and how the mine had been worked.

Morris's attention was initially drawn to Esgair Mwyn by the old spoil heaps which appeared to have lain untouched for many decades, covered in a thick layer of black peat, and which contained a large quantity of ore pieces (NLW, Powis Castle Deeds, MS 21900, chapter 13). Discarding ore in this way could be an indication that the mine had last been worked at a time when only larger pieces of ore could be processed due to the use of bole furnaces (Rippon, Claughton and Smart, 2009, p. 90). Another indication of the mine's age was found on a map drawn by Lewis Morris in 1754, shown in figure 5.13. The map showed four, what were described as, Old Trenches, which were spread across the full length of the lode. One of these trenches had a small open work at its centre. A second, larger open work was also on the map but not named. Morris had claimed that it was his knowledge of mining that led to his decision to trial the south side of the open work, however looking at the map and the survey of the archaeology, it seems now that he had based his decision on where miners had previously trialled, as he ordered a trial to be made at the end of the longest old prospecting trench (Trench One) marked on the 1754 map (NLW, Powis Castle Deeds, MS 1646-7)

This trial trench was in the same area as the main focus of the old mine, which appeared to be the location of the open working. Lewis described, second, larger open working as being 100 yards (91 metres) long x 20 yards (18 metres) wide x 10 yards (9 metres) deep (NLW, Powis Castle Deeds, MS 21900, chapter 13). This was, however, an exaggeration as the open cut was only around 60 yards (53 metres) long. All the pre-1746 features labelled on the map were identified and located on the site during the surveys undertaken for this research. The old trenches marked on Morris's map showed that the miners in the past had identified the main lodes on the site and that by putting the newer trenches close to the old trenches, Morris had been able to find the position of the rich veins.

As well as the map Morris also provided detailed descriptions of the old underground workings at Esgair Mwyn. An idea of how and when the mine had been worked before 1746 was gained through Morris's description of what he observed when he and his workmen first entered the old workings, via the new workings on the southern vein, originally the old mine had been entered via an inclined shaft which was not visible from the surface due to it having been back filled. This shaft had ladders of solid wood still in-situ, having been built into the floor, with the wooden steps purposely filled with debris including pieces of ore to form a series of steps by the former miners. The incline of the shaft was shallow enough to allow people to walk up the incline even when carrying ore, rather than climb up the steps (NLW, Powis Castle Deeds, MS 21900, chapter 13). Morris wrote that the vein had been cut by working up towards the surface using stopes and that the miners had cut an adit 1.8 metres high x 0.9 metres wide x 12 metres long in order to reach the southern ore vein (NLW, Powis Castle Deeds, MS 21900, chapter 13). This last statement was important as it indicated that the new deposits Morris discovered in 1751 had already been worked, and confirmed this by saying he had found objects within an old backfilled shaft on the southern vein. Morris made no mention of seeing water within the old part of the mine which implies that these workings were separate from the flooded part of the mine. Water had been a problem at some time as Morris had said he had found a broad, shallow wooden shovel similar to those used to throw corn. Morris thought it had been used to move water, presumably to a sump where it would be decanted into a bucket which would then be hauled to the surface. Although no rope had been found by Morris, there were wear lines in the rock at the centre of the stope in the position where he thought the buckets had been drawn to the surface, through a

hole in the roof (NLW, Powis Castle Deeds, MS 21900, chapter 13). This meant that water had been present at some time before 1746 but had been in manageable amounts and had not required the use of pumps to remove it. The description also showed that the working was a stope that had at one time breached the surface but had been sealed or become covered over time.

Morris devoted a large part of Chapter 13 in his book '*A History of the Crown Manor of Mevenyth*', describing how the ore had been worked. Morris wrote that unlike his miners who had worked the stopes standing on platforms, the pre-1746 miners had worked the stopes standing on stemple's (round ended pieces of wood wedged into sockets cut in the rock walls of the mine (Hooson, 1747, p. ST)). These were made from large split beams of wood up to 20 centimetres in diameter which were set close together so the miners could stand on them. Most of the stemple's were made from birch, alder, oak and service trees (that Morris mentioned the service tree was interesting as it is an extremely rare type of apple tree and this may be one of the first documented mention of the species in Wales) (Hampton and Kay, 1995, p. 380). He noted that only the oak had been debarked which implied that there had been a market for oak bark at the time the stope was being worked. The oak trunks had been split and had mortices cut into them in order to make lock pieces (a way of securing a piece of wood in position to support the roof of workings) which indicated that the managers/miner's thought oak was the most suitable timber for this job. Morris looked for, but could not find signs that saws had been used to cut any of the timber, suggesting that they had been cut using axe (NLW, Powis Castle Deeds, MS 21900, chapter 13). Morris took the lack of saw marks as an indication that the wooden supports had been set in the monastic period. However, an alternative theory could be that the timber had been dressed by miners on the site instead, as traditionally axes were part of the miner's tools (Hoover and Hoover, 1950 p. 150). However, no iron tools of any kind were found within the stopes so this cannot be proved.

Morris also looked for signs of how the rock had been broken, particularly for signs of gunpowder which are usually identified by the remains of shot firing holes. When Morris was unable to find this evidence, he turned his attention to looking for the remains of fire setting in the form of burnt material such as ash and charred fuel remains, which he called coals. Once again, he was unable to find any evidence of this technology within the old mine workings, so went on to

look at how the rock and ore had been removed. Morris was not able to identify any pick marks, either in the crosscut or in the other parts of the workings and concluded that the rock and ore had been removed using small wedges of chisels in the ancient manner which he associated with the Romans (NLW, Powis Castle Deeds, MS 21900, chapter 13). Confirming his thoughts that the workings he had examined were very old. Morris was partially correct as this was a method that had been used to cut rock before the introduction of gunpowder however this technology continued to be use in some circumstances so is not a positive dating tool (Hoover and Hoover, 1950, p. 150; Pierre and Weber, 2011).

Although this part of the mine had previously been extensively worked, Morris described large quantities of valuable ore as having been left unworked or discarded in the floor and other parts of the mine workings (NLW, Powis Castle Deeds, MS 21900, chapter 13). This description appears to confirm the reports in the Mining Journal, describing the upper deposits, like the nearby mine of Bronberllan, to be very rich in ore. Reports in the Mining Journal state that a rib of solid galena three metres wide had been found in the old workings and second one, one metre wide, in the new part of the mine (Unknown, 1847, p. 114). The discarded galena in the stairs and floors plus the large amount left in the spoil heaps are suggestive that the initial dressing had taken place underground. This adds weight to the proposal by this research that these workings most likely date to the pre-17th century, when small pieces of ore were uneconomic to smelt (Rippon, Claughton and Smart, 2009, p. 90). During his visits Morris found evidence of both wicker baskets and gad sticks. He wrote that he had found the remains of a basket that had been constructed from woven rods. He surmised that the miners had carried the ore out of the mine in wicker baskets carried on their backs via the stairs (NLW, Powis Castle Deeds, MS 21900, chapter 13). Interestingly this basket was very similar to the remains of a woven hazel basket found in a Bronze Age mine at Cwmystwyth (Timberlake, 2003, p. 45).

Alongside the basket remains Morris discovered gad sticks. These would not only indicate that the quantity of ore being removed from the mine had been recorded but also, possibly, that the miners were being paid by the number of baskets they had filled. Morris also recovered a piece of coarse cloth laying on the floor within the stope, which looked like the type used on the British military uniform from the mid-18th century (NLW, Powis Castle Deeds, MS 21900, chapter 13). Morris

assumed that the cloth was associated with other artifacts that had been found by his miners which included a small iron knife and a tobacco pipe bowl. By putting it altogether Morris thought that the cloth, knife and pipe bowl proved that there had been an attempt to reopen the mine in the Elizabethan Period and that this attempt had been defeated by water flooding into the mine. This last part was interesting as Morris's description of the old workings indicated that the mine had been dry when he reopened it and that the miners had not been troubled by water in this part of the workings. Instead, Morris may have been thinking about the flooded upper workings which his miners had failed to drain (NLW, Powis Castle Deeds, MS 21900, chapter 13). There was no description of these upper workings and as such it would not be possible to try and date them, however it may be possible to gain an idea of when the old workings were in operation through the descriptions of the workings and the finds he made.

Dating the old workings using Morris's Descriptions and Finds

Although the small iron knife cannot be used to support Morris's argument without scientifically dating of this part of the mine, the pipe bowl, however, was significant as it could have dated this part of the workings to 16th century or later. It is more probable however that the pipe bowl dated much later as smoking was unusual and very expensive in the Elizabethan Period and therefore it was more likely that the pipe had been discarded by a miner in the 17th century. This idea is supported by documents that noted miners in Cardiganshire had also smoked in underground workings in the 1600s (Bushell, 1642). Morris's description that the cloth he found was similar to that worn by soldiers is also problematic as it is now known that soldiers did not wear uniforms of the type Morris described during the Elizabethan Period, indeed British military uniforms were not developed until the 17th century (Lyndon, 1976, p. 108).

Morris wrote that the mine had not been worked in his living memory and that the local people thought the mine was of ancient British or Roman origin, in fact Morris himself had thought that the old works had been first sunk by the Romans. He based this assumption on the idea that the mine had initially been worked by open work, and that the stope had been worked using chisels and wedges (NLW, Powis Castle Deeds, MS 21900, chapter 13). He may have been correct but this would be very difficult to prove as these tools had been used in mining from the

Bronze Age up until the introduction of gunpowder in the 17th century (Pierre and Weber, 2011, p. 30). The discovery of the pipe bowl however indicates that the mine that had been entered was not Elizabethan. After carrying out this re-evaluation of the artifacts found by Morris it was concluded that the artifacts were from a later date, most probably the mid-17th century although this does not mean that the mine was not being worked earlier.

Conclusion

Together the artifacts discovered by Morris, and the documentary evidence uncovered during in this study, show that Esgair Mwyn was indeed a multi period site that had been worked in, and contained features from the Early Modern Period (circa. 17th century). It would seem that Esgair Mwyn had initially been opened possibly in the Medieval Period, then closed and then reopened sometime in the 17th century, which would date the mine to later than the dates suggested by Morris and later writers. This estimate was based on the descriptions given by Morris, as discussed above, with the most likely date for the reopening of the works being the mid-17th century.

It was not possible to say who had been working the mine prior to Morris reopening it in 1746, however, it was possible to deduce certain facts. Pre-1746 the mine had been worked by opencast workings and the use of shafts. The underground works had been carried out by stope, one of which had breached the surface. Although some of the mine had been flooded, the works on the southern vein had not. This part was probably abandoned because the rich upper deposits had been worked out. The fact that unworked ore had been left on the floor and stairs was a significant indication that the deposit had been rich at one time. The remains of smaller pieces of ore both underground and in the spoil heaps, indicate that the ore remains had little value, and so were probably smelted locally by Bole furnace rather than spending the profits sending it away to be smelted.

The amount of timber that had been used for the internal supports indicated that at one time this had been a well-funded mine. This could also be seen with the use of stemples set close together (using expensive timber) rather than platforms made up of sawn boards which use less timber. The gad sticks imply that the

work was managed and the quantity of ore extracted was being recorded, possibly in order to pay a bargain or pay dues to the landowner. Moving the water out of the mine, which according to Morris' description had been undertaken by rope and bucket, indicated that Esgair Mwyn was not suffering unduly from a large amount of flooding at that time. Finally, neither Morris nor this research were able to identify signs of fire setting. Instead, the rock had been worked with chisels and wedges, indicating that the rock had been relatively soft.

The Survey

Esgair Mwyn was visited and surveyed for this research on numerous occasions over a number of years. During these surveys the maps produced by Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW, 2023) and Lewis Morris in 1754 were compared with what could be seen on the ground. Particular attention was paid to testing the accuracy and locating of features shown on the 1754 map (NLW, Powis Castle Deeds, MS 1646-7). While some of the shafts and the two open cuts were located, features in the centre of the mine had been either destroyed or buried under the large 19th century spoil dumps that define the site. There were only two other features illustrated on the 1754 map that survived: a possible cobbled dressing floor at SN7556/69252 and Bradshaw's house, which was a low outline of the external walls set in the grass at SN75900/69100 (see figure 5.13). The area on and around this mine has been intensively trialled with some areas having undergone several campaigns of hushing.

The main features of interest to this research were those that could be dated including the pre-1746 prospecting trenches, of which there were 17 found on the main mine site and another 27 discovered in the area around the site, making a total of 44 trenches. Attention was paid to finding the remains of the 18 trenches recorded on Morris's 1754 map, with all being found (NLW, Powis Castle Deeds, MS 1646-7). Many of the other 28 trials (not recorded on Morris's map) may date to the time he ordered trials to be conducted on the Crown Wastes which led to the discovery of several mines including the neighbouring mine of Llwyn Llwyd which Morris went on to manage (NLW, Powis Castle Deeds, MS 21900, chapter 19).

As well as the 44 prospecting trenches, six hushing trenches were found, two of which were recorded on the 1754 map. This was interesting as hushing is not mentioned in any of the documents that Morris wrote. Instead, when writing about trials he always referred to trenching, indicating that the hushing trenches on his map were made before Morris took control of the mine in 1746 (NLW, Powis Castle Deeds, MS 21900, chapter 13). By using Morris's map to identify what he called the 'old trenches', it would be possible to excavate and section these features, possibly dating and identifying an earlier phase of mining exploration on the site.

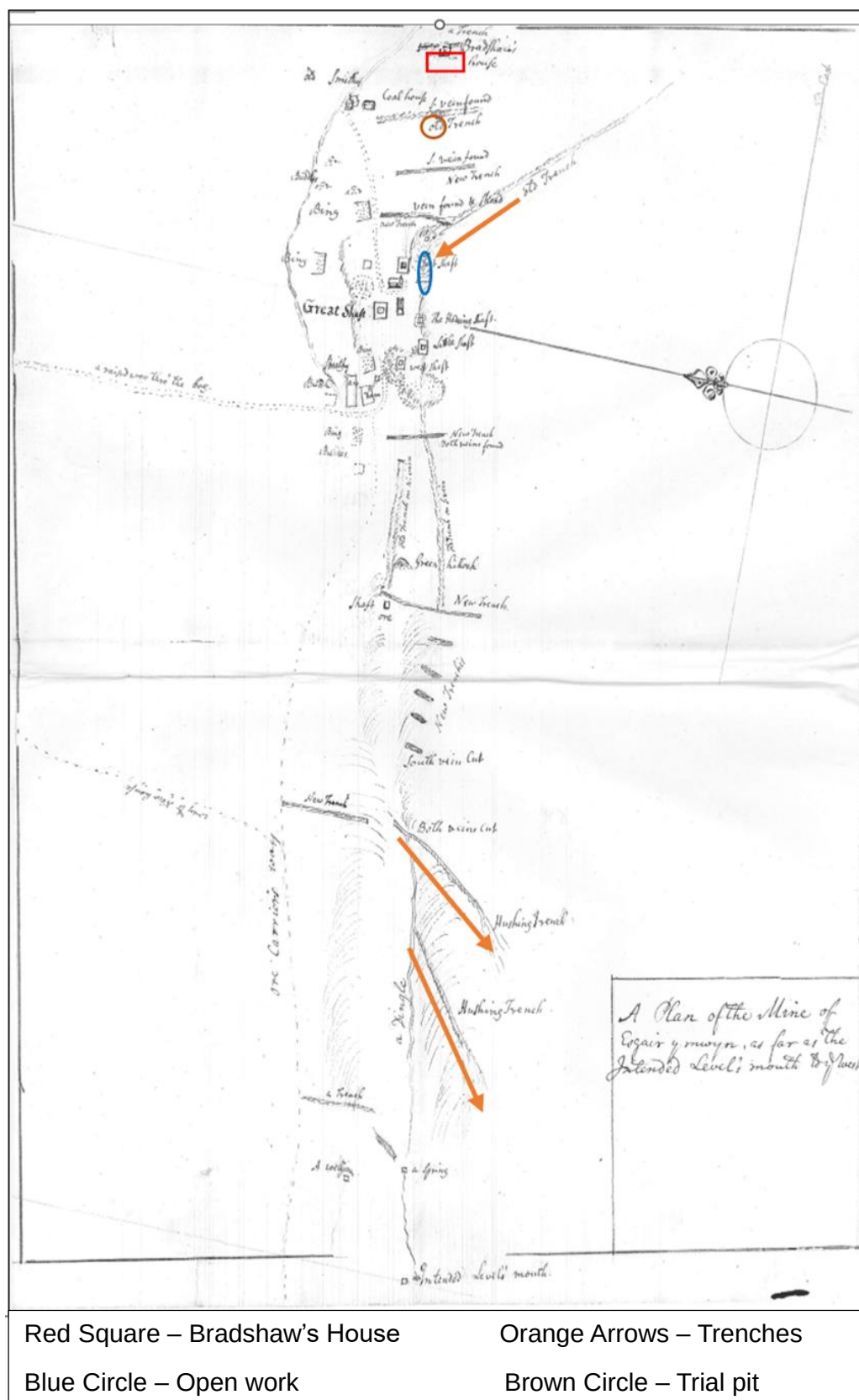


Figure 5.13 Plan of Esgair Mwyn (1754) with surviving features of the pre 1746 mine, as identified during the research survey.

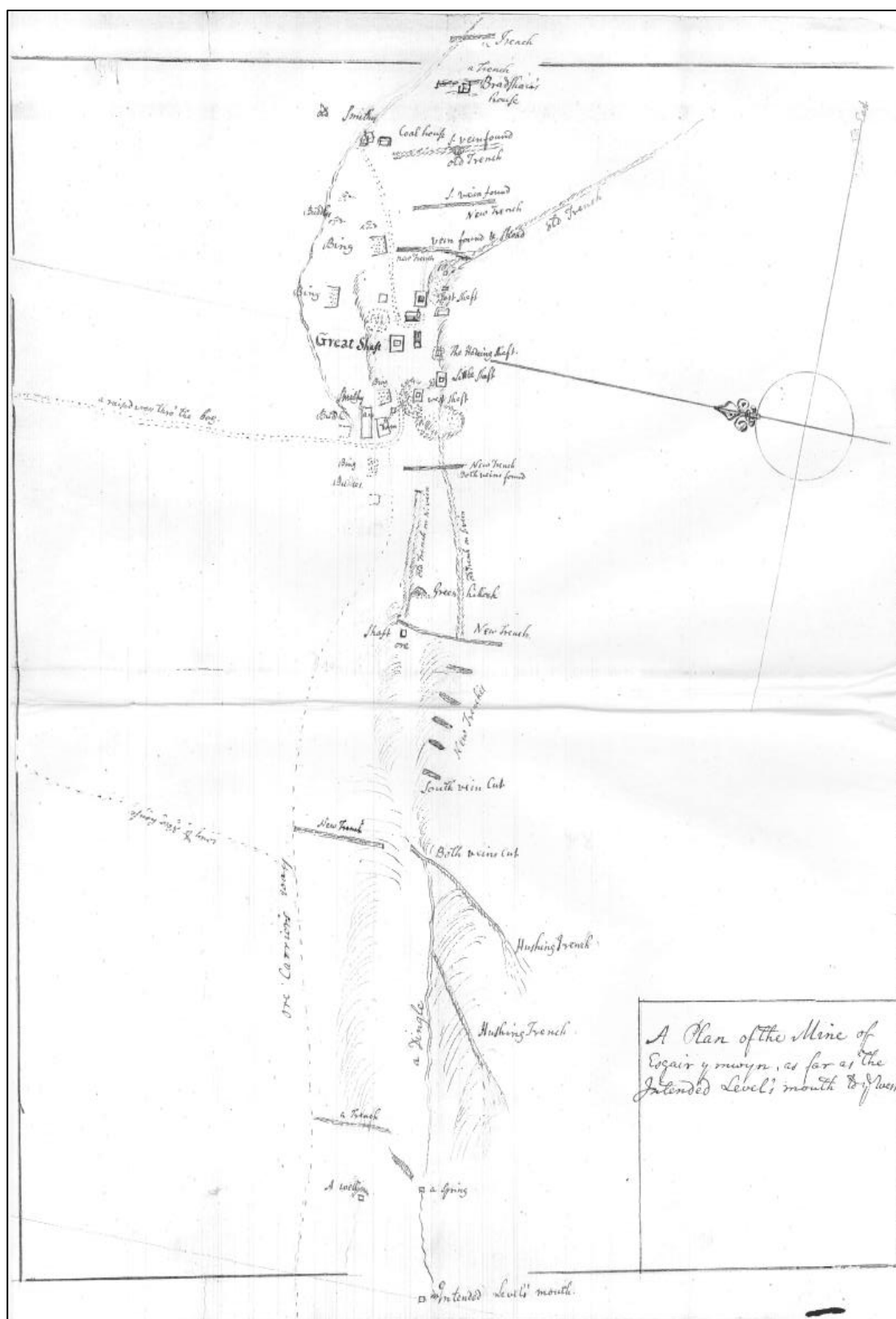


Figure 5.14 Plan of Esgair Mwyn drawn by Lewis Morris 1754

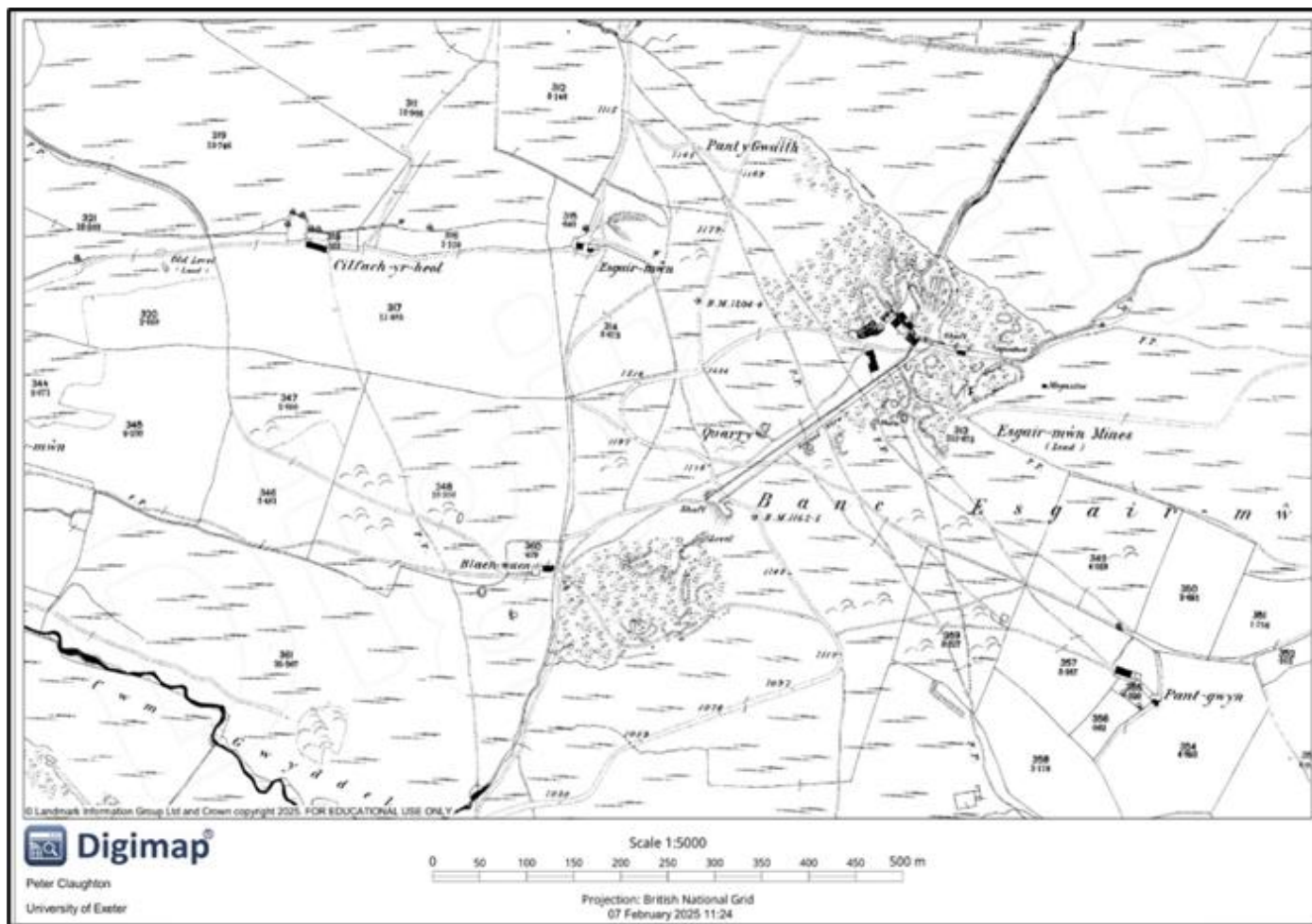


Figure 5.15 Map of Esgair Mwyn 1880 (Digimap, 2025)

Discussion

During this research, documentary evidence that had not been seen before was uncovered that showed Esgair Mwyn had been worked as far back in the Early Modern Period. Documents show that the property was known by this name in 1530 when it was recorded in the Strata Florida rentals (NLW, Cwrt Mawr, MS 873D). Its history, however, based on topography was shown to be much older. Lewis Morris wrote that he and the local population thought that the mine had been worked by either the Ancient Britons or the Romans, although it would require an archaeological excavation of the works to establish when it was first worked, which fell outside the remit of this study.

Lewis Morris's description of how the mine was worked and the artefacts his men found underground led him to surmise that there had been an attempt to reopen the mine in the Elizabethan Period. However, a detailed analysis of these finds through this research led to a reinterpretation of the finds, indicating that the reworking was later, possibly in the 1640s, (100 years before Lewis Morris ordered its reopening). After 1746 this Esgair Mwyn was continually worked until its closure in 1927. The reworking of the mine over time has resulted in much of the Early Modern infrastructure illustrated on the 1754 map being buried or destroyed. The identification of the trial trenches which pre-date the map offers the opportunity of finding evidence which may date the older trench. Any results would however not date other parts of the mine and although interesting, for this reason Esgair Mwyn was not suitable for further excavation work during this research.

M12 Esgair Mwyn			
Summary of features identified at the site	Quantity	Grid reference	Description of feature
Building outline,	1	SN75900/69100	remains of a building whose walls are covered by grass. This on same site as a building described as being Bradshaw's house on 1754 map
Possible Hushing channels	6	SN75609/69195 SN75639/69220 SN75476/69125 SN75243/68922 SN75499/ 68962 SN75281/68990	
Remains of destroyed brick building, 19/20 th century and boiler waste	1	SN75455/69100	Possible boiler house

Leats Several leats were found but these are the main ones	3	275600 269250 275310 269280 275380 269250	SN75456/69065 SN75441/69061 SN75458/69066 SN75261/69015 SN75673/69197 SN75683/69185 SN75642/69181 SN75642/69181
Costeaning trenches On main site	17	SN75681/68999 SN75756/69269 SN75757/69184 SN75745/69211 SN75758/69184	SN75715/69182 SN75692/69191 SN75678/69213 SN75660/69203
Costeaning trenches Away from main site	27	SN75664/69171 SN75781/69212 SN75683/69181 SN75781/69266 SN75667/69193 SN75709/69073 SN75630/69237 SN75441/69062	SN75678/69212 SN75445/69103 SN75693/69181 SN75474/69068 SN75694/69189 SN75484/69074 SN75711/69188 SN75498/69084 SN75719/69183 SN75498/69090 SN75714/69196 SN75718/69196 SN75744/69210 SN75759/69183 SN75884/69035

		SN75672/69196 SN75456/69066	SN75899/69032 SN75914/69032
Dressing Floor	1	SN7556/69252	Cobbled Dressing floor In a position noted on 1754 mine map
Shafts	8	SN75503/69127 SN75527/69119 SN75510/69120 SN75411/69084	SN75451/69091 SN75317/69031 SN75292/69045 SN75288/68964
Reservoirs	5	SN75376/69405 SN75447/69365 SN75729/69210 SN75735/69146 SN75277/69008	The last feature is a well grassed over open working and small spoil heap. It has a leat / track leading to it, this could have been an aborted hushing reservoir?

Reservoir serving workings lower down the valley	2	SN75218/69305	
1970's mill	1	SN75402/69329	
19 /20 th century mill	1	SN75513/69197	
19 th century spoil heaps	4	SN75493/69273 SN75550/69273 SN75554/69078 SN75554/69078	The last two are well grassed over spoil heaps and are associated with slight open workings
Inclined railway	1	SN75436/69125	

Figure 5.16 Detailed record of features identified at M12 Esgair Mwyn

- These mines were also worked under the name of Lisburne South.
- Both mines were mentioned on maps, DAT and Coflein.
- Both worked the same deposits, for the most of their history as a single mine.

As their history and the archaeology of these mines are so intertwined, this research has treated them as a single mine. This research has shown that this site was first discovered by Oliver Lewis the surveyor who undertook trials on the Crown Wastes for Lewis Morris in 1751 (National Library of Wales, MS 15101). Both mines worked a continuation of the Esgair Mwyn vein. The Llwyn Llwyd part of the lode, which was located on the lands owned by a Roderick Richards, was leased by Lewis Morris and Co., on an 11-year lease from 1753 (NLW, Powis Castle Deeds, MS 21900, chapter 18). Llwyn y Gwyddyl, although described as adjoining Llwyn Llwyd, had been worked as a separate mine by its land owner Thomas Jones of Llanviar, as part of the Dyffryn Cottage workings in 1756 (see M9) (NLW, Powis Castle Deeds, MS 21900, chapter 18).

It was the Llwyn Llwyd mine that Lewis Morris wrote to his brother stating that he was having trouble retaining workers due to actions of spirits within the mine. In the letter, dated 14 October 1754, Morris described that he had problems keeping young miners at the mine when he opened it due to the 'knockers' (spirit creatures who lived in mines) scaring off the inexperienced miners (Lewis, 1967, p. 324).

In the 1770's, Llwyn y Gwyddyl mine was recorded as being worked by a group of Derbyshire miners who drove a 45-metre level before they became discouraged due to the lack of lead ore. The mine was then taken over by John Probert and a consortium of local landowners (see M8 Cwm Mawr mine for further details) who were said to have found rich deposits (Lewis, 1967, p.108). Little is known of the workings of the mine at that time but the period generally was marked by a decline in the market for ore which led to the abandonment of many mines by the end of the century, most likely including Llwyn Llwyd and Llwyn y Gwyddyl. By the mid-19th century both mines were being worked as one unit

under the name of Lisburne South (Burt, Waite and Burnley, 1985, p. 61). It was in this period that most of surviving buildings on the site were constructed.

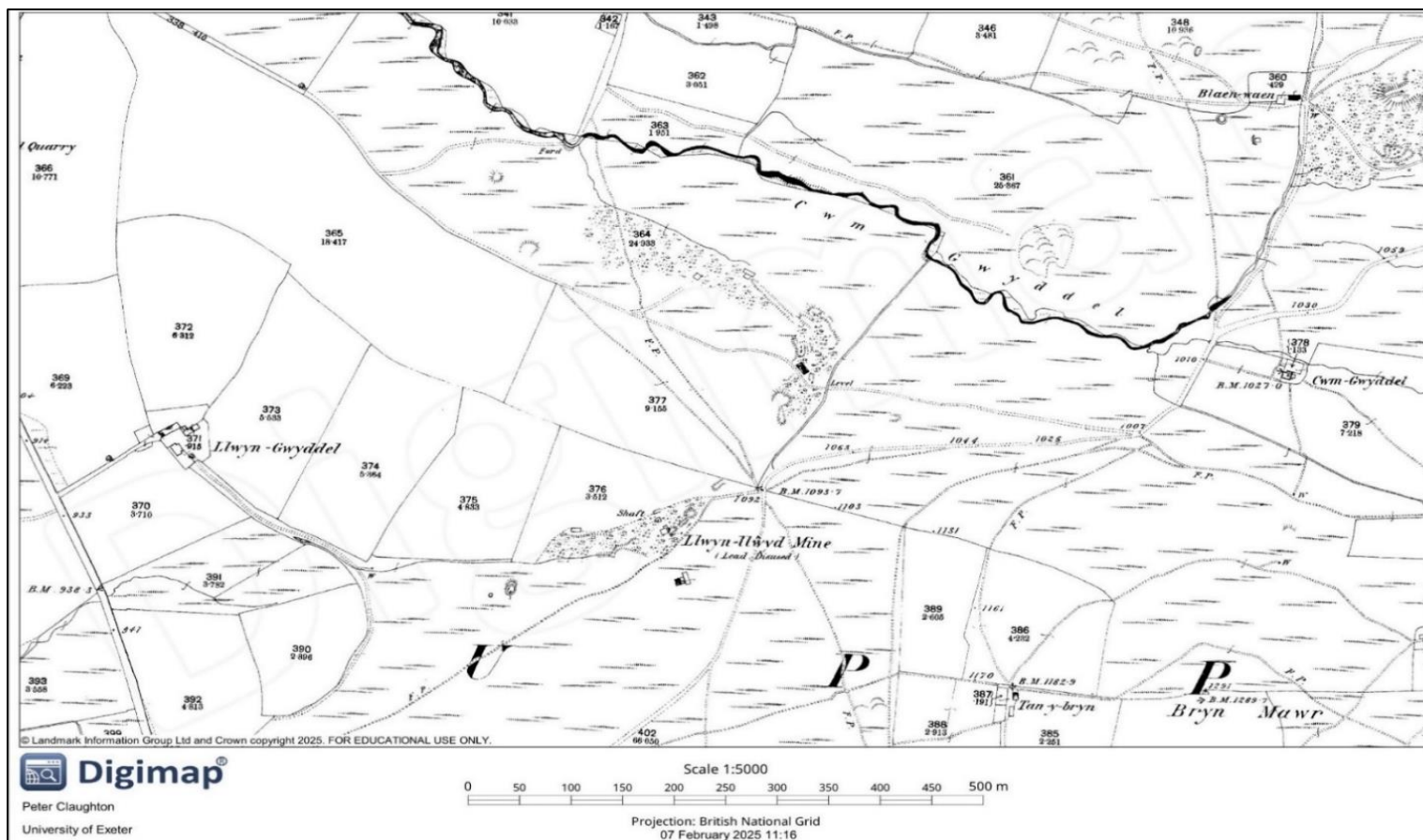


Figure 5.17 Map of Llwyn Llwyd dated to 1880 (Digimap, 2025)

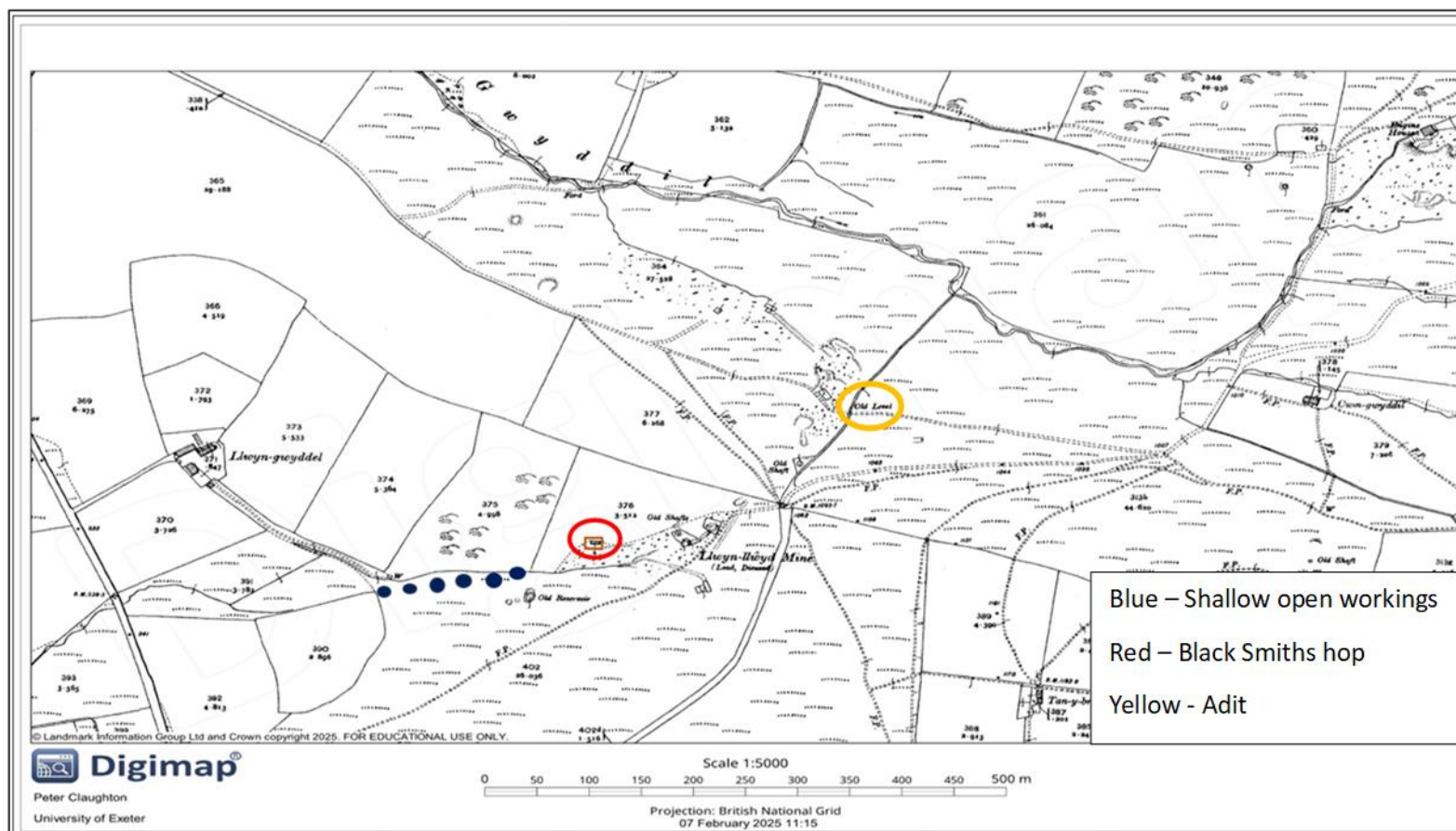


Figure 5.18 Map of Llwyn Llwyd dated to 1880 showing possible 18th century remains (Digimap, 2025).

Survey Results

The 2014 survey identified a number of features on the site including adits, shafts pits, water management features and buildings. The site also included a number of standing buildings including a blacksmith's workshop, a crushing house with integral waterwheel, and a housing covering an inclined shaft. A second waterwheel and leat were located at SN74546/68446. A number of spoil deposits were found on this part of the site which were free from vegetation, indicating that they were younger than other spoil deposits which had become overgrown with grass. The mineral deposits had been worked via inclined shafts of a square construction, which at the time of the visit, were open. The adits were found at SN74637/68617 and SN74385/68808 and both of these had their own associated spoil heap which had later been used as a source for farm track material. An unfinished adit was found in a boggy area at SN74503/68814 with its associated spoil heaps at SN74542/68807. These spoil heaps had been flattened off at some time in the past. Several bell-like pits were also recorded working ore deposits.

Discussion

The deposits on the Llwyn Llwyd part of the lode had been worked by a series of shallow bell-pit like excavations that were laid out in an east to west orientation. From a topographic point of view, these features appeared to relate to the earliest phases of mining on the site, possibly as part of Llwyn Gwyddyl. The preservation of the pits on the Llwyn Llwyd part of the lode was remarkable. The line of shafts had been sunk along vein to work the ore. The collars and associated waste from the sinking of these shafts remain and because of the boggy nature of the ground have not been damaged by farming activity or later mining. At least one of the buildings (the blacksmith's shop) appeared to date to the early phases of mining on the site. This makes the site important as a relatively undisturbed example of a small 18th century site. Unfortunately, the landowner did not want people using the public right of way footpaths which crossed his land and has, in the past, refused permission for surveyors to enter his land on a number of occasions. Therefore, it would be unlikely that permission to undertake further research at Llwyn Llwyd would be granted so consequently, no further research on this mine is possible at this time.

M13 Llwyn Llwyd and Llwyn y Gwyddyl			
Feature	Quantity	Grid reference	Comments
Spoil heaps	6	SN74364/68884	Conical Spoil heap
		SN74542/68807	Small spoil heaps possibly levelled in past (associated with abandoned adit).
		SN74621/68760	Strip like spoil heap with track on top
		SN74677/68720	Large spoils heap signs that it is being removed for track making.
		SN74646/68642	Grassed over spoil heap
		SN74496/68486	Grassed over spoil heap
Shafts	10	SN74254/68421 SN74215/68426 SN74188/68417 SN74299/68432 SN74376/68439 SN74362/68438	

		SN74362/68432 SN74502/68443 SN74496/68519 SN74633/68593	
Smaller trials		SN74625/68587	
Adits	4	SN74637/68617	Associated spoil SN74646/68642
		SN74385/68808	Associated spoil SN74364/68884
		SN74646/68664	Deep adit associated spoil heap SN74364/68884
Unfinished Adit		SN74503/68814	Adit abandoned unfinished associated spoil heap SN74542/68807
Buildings	5	SN74440/68502	Blacksmith's shop

		SN74525/68500	Crushing mill / hopper
		SN74545/68761	Building foundations
		SN74655/68712	Building foundations
		SN74602/68510	Building platform
Water management features	4	SN74594/68787	Small waterwheel pit
		SN74525/68500	Crusher waterwheel
		SN74546/68446	Main waterwheel
		SN74365/68438	Reservoir for Llwyn y Gwyddyl workings

		SN74450/68481	Slime pits /Reservoir
Leat's		SN74700/68300	Water wheel leat from Teifi pools
Costeaning trenches	9	SN74625/68581 SN74580/68542 SN74571/68521 SN74602/68531 SN74466/68601 SN74483/68607 SN74526/68617 SN74668/68588 SN74719/68639	
Pits	6	SN74625/68581 SN74624/68573 SN74616/68580 SN74615/68579 SN74601/68570 SN74598/68564	

Disturbed land	1	SN74040,68432	Disturbed ground possibly due to mining
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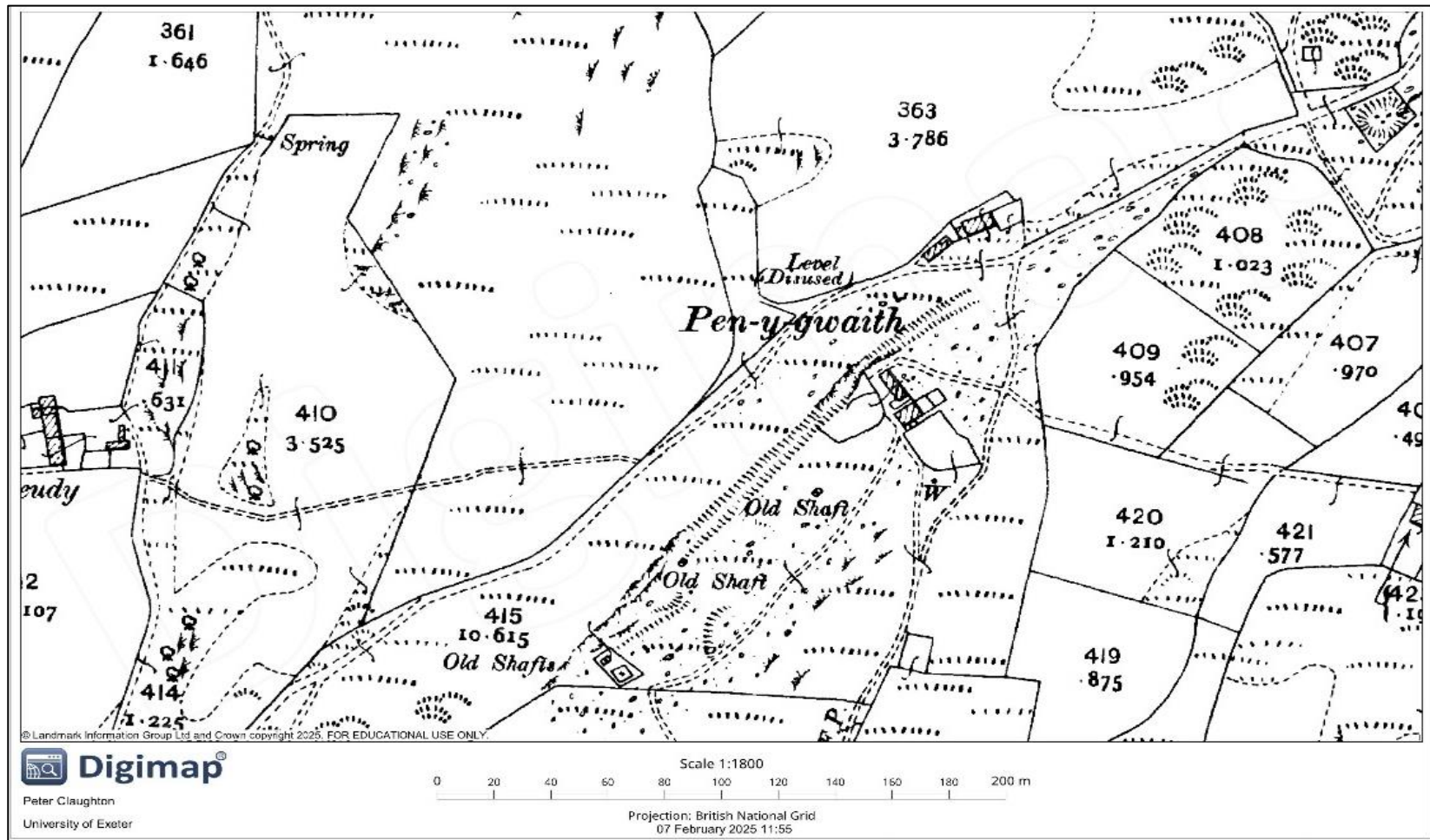
Figure 5.19 Detailed record of features identified at M13 Llwyn Llwyd and Llwyn y Gwyddyl

M16 Logaulas Mine SN740/716

- Has also been known as East Logaulas, Logylas, Lisburne, Gawrth y Moyne ar war Clawdd y Spitty Istwith
- This mine was recorded on all known metal mining databases
- Located on the Frongoch Formation

The Logaulas mine is located north of the Strata Florida Abbey and was initially just outside the original research area and as such was not included in the data set. However, the documentation on mining in the area revealed new and important information regarding the history of Logaulas which warranted further investigation and it was therefore decided to include it in this study.

Prior to this research it was had been assumed that Logaulas mine had been abandoned, and then reopened around 1768 by Chauncey Townsend and John Probert (Bick, 1978, p. 22). Information uncovered during this research showed however, that this assumption was incorrect, with the documents relating to the mine showing that mining had been carried out continuously on the Logaulas site from at least 1631, 137 years before, and possibly much earlier. The site of Logaulas was consequently visited and surveyed for this research. Mining remains in the form of adits, shafts and open works were identified however the site has been extensively cleared by previous landowners and no archaeological evidence of pre-19th century remains were identified.



History of Logaulas Mine as Known Prior to the Start of this Research

Prior to the information uncovered during this research, the known history of Logaulas, on the lands owned by Lord Lisburne, did not go back further than 1768, when it was reopened by Chauncey Townsend. In 1786 the lease of the mine was taken over by John Probert (Lewis, 1967, p. 108). Probert's production on the mine was hampered by water coming in to the workings. His attempts to drain the workings eventually led to the development of the Level Fawr tunnel (the Great Level, which was, in its time, the longest drainage tunnel in central Wales) which drained Logaulas and three other mines (Bick, 1978, p. 22). The 19th century saw renewed interest in Logaulas and the mine was worked by a number of companies with varying degrees of success. The last recorded production was in 1913 (Burt, Waite and Burnley, 1985, p. 60).

Revised History Dating Back to 1631

During this research documentary evidence was found which showed that the extraction of minerals at the Logaulas site had taken place in 1631. This was 137 years earlier than it had originally been thought (Bick, 1978, p. 24). There were also indications that mining had taken place decades earlier than 1631 but there was no documentary evidence to support this. The evidence of this is outlined below. The earliest documents found relating to mining on the site now known as Logaulas mine were Letters of Patent that dated to 10th of December 1631. These letters concerned minerals that were on lands that had been sold by the Crown to two London investors; William Collins and Edward Fenn, giving them ownership of the lands and the right to extract minerals from a mine called Spittie Riwiscoith (NLW, Crosswood Deeds, MS I.248). The name Spittie Riwiscoith is an archaic corruption of the name Ysbyty Ystwyth, which is the present-day village where the Logaulas mine is located (Austin, 2018).

Rather than being mine owners, Collins and Fenn investors who were actively buying a range of assets, established businesses and enterprises located on the former granges of Strata Florida, from the Crown. Collins and Fenn had also purchased the rights to the profits received from the fairs (markets) at Talsarn and Fair Rhos and the fishing at Stymlyn, as well as a number of other lands and

mines (NLW, Crosswood Deeds, MS I.248). A significant part of Collins and Fenn strategy appears to have been to acquire mines in Cardiganshire. Collins and Fenn's interest in these mines may have come about by the profits made by Sir Hugh Myddelton's Cardiganshire mines (Lewis 1967, p. 42) or by the mining reports by Francis Bacon, who had also purchased several leases of mines in the area in 1616. It was interesting to note that all the mines that Collins and Fenn had purchased, including Craig Mwyn at Cwmystwyth and their other enterprises, were working at the time of being purchased (NLW, Crosswood Deeds, MS I.248), and from this, it may be assumed that the mines they bought at Yspytty Ystwyth were also working when the documents were drawn up. The evidence from these Letters of Patent clearly show that mining was already established at the Logaulas mine in the early 17th century.

The Gawrth y Moyne ar war Clawdd y Spitty Istwith mine

Sometime after 1631, Orlando Gee of Petworth Sussex, who was also a London investor, bought the leases for minerals at Craig Mwyn at Cwmystwyth and those at Yspytty Ystwyth that had formally been owned by Collins and Fenn. On the 4th February 1668, Gee sold a one fourth share of lease of minerals on lands at Yspytty Ystwyth to a miner, called Thomas Desbry, giving him permission to extract minerals from a mine named Gawrth y Moyne ar war Clawdd y Spitty Istwith (NLW, Crosswood Deeds, MS I.388). Y Spitty Istwith, like Spittie Riwiscoith, is an archaic Welsh version of the name Yspytty Ystwyth (the name of the village). Ar war Clawdd translates to 'on the wall or dyke' and Gwarth y Moyne translates to 'mine work'. The document also states that the mine was near the chapel, therefore, the name *Gawrth y Moyne ar war Clawdd y Spitty Istwith* can be translated to mean *Mine work on the trench or wall near the chapel of Spitty Istwith*, (*Yspytty Ystwyth* was the previous name for the site of the Logaulas mine and which ties the 1631 documentation to the mine). By cross referencing historic maps that showed the location of the Spitty Ystwyth Chapel with the 1631 lease documents that referenced the chapel and the wall or trench near to the chapel, it was possible to identify the location of Gee's mine. As this mine was the only one on the site it can be surmised that this was the same mine Collins and Fenn leased of 1631, which was later worked by Townsend in 1768 at SN740716, as Logaulas mine.

The terms of Desbry's lease stated that he was to give every ninth ton of Potter's ore to the landowner Orlando Gee (NLW, Crosswood Deeds, MS I.388). This was interesting and showed three things: first, it was expected that the mine would be productive, secondly, the mineral was known to be producing potters' ore and finally that the mine had been worked before the 1668 lease had been issued, probably under Collins and Fenn's ownership. A second agreement issued on the same day by Gee awarded the other three parts of the mine lease to a local landowner, Morgan Herbert of Hafod (NLW, Crosswood Deeds, MS I.394). Seven years later in 1675, Orlando Gee sold the chapel and lands at Spittie Riwiscoith to Edward Vaughan of Crosswood for £115 (the Vaughan's went on to become the first Viscount of Lisburne in 1685, then Earls of Lisburne in 1776) (NLW, Crosswood Deeds, MS II.147). The sum of £115 was among the largest payments made by the Vaughan family in the last quarter of the 17th century and indicates that Edward Vaughan believed the land and minerals at Spitty Ystwyth would be very valuable.

In 1742 John Vaughan Lord Lisburne gave a 21-year lease of minerals at Spitty Ystwyth and Gawrth y Moyne mine to the *Company of Mine Adventurers*. This document covered a number of mines and areas on Lisburne lands and a standard charge for the lease of one ninth of all merchantable ore was charged for all properties (NLW, Crosswood Deeds, MS I.820). By 1756 the company changed the name of the mine from Gawrth y Moyne to Logaulas and according to Lewis Morris the company were paying a duty of 20 shillings a ton of ore produced to Lord Lisburne (NLW, Powis Castle Deeds, MS 21900, chapter 19). Morris did not mention that the mine was not working or that the *Company of Mine Adventurers* had been fined for not working the mine. This implies that the mine was in production at the time he wrote the document. However, the *Company of Mine Adventurers* fortunes were in decline and on 11th April 1758 Wilmot Vaughan Lord Lisburne promised to lease the Logaulas mine to Chauncey Townsend and at the same time nullified all unexpired leases that had been issued to the *Company of Mine Adventurers* by John Vaughan Lord Lisburne (NLW, Crosswood Deeds, MS I.939). However, due to a family dispute, Lisburne could not transfer the lease until four months later on the 15th August 1758. Unusually for leases of this period the documents showed that duty was paid on the ore produced as well as on the waste (NLW, Crosswood Deeds, MS II.276). This, and the document written by Morris confirmed that the mine had been in

production in 1758 when Chauncey Townsend's lease was drawn up. From this period onwards the history of the mine has been well documented (Bick, 1978, p. 22).

Conclusion

The documentation, when combined with maps and an archaeological survey of the site confirmed that the 18th century mine of Logaulas was on the same site as the mine, Gawrth y Moyne ar war Clawdd y Spitty Istwith mine, leased by Collin and Fenn in 1631. The documents also confirmed that the Logaulas mine had been known by a number of different names in the past and that it was a multi period site which had been worked almost continually since 1631 until it officially closed in 1913. This date takes the documented working of the mine back 137 years from the current acknowledged date. Although no documents have currently been found to support the theory, the site name recorded in the 1668 lease for Orlando Gee indicates that the site had been mined not only as far back as Collins and Edward Fenn 1631 lease, but much earlier and possibly as far back as the Medieval Period. Unfortunately, the site has been cleared of much of its surface features and while some archaeological evidence of Early Modern mining may have survived underground, the majority of the surface archaeological evidence has been destroyed.

M17 Maen Arthur Mines and Possible Smelt Mill SN734/728

- This mine was not recorded on any of the known databases and its history was unknown prior to this research.

The interest in Maen Arthur for this research was initiated by the mention of a smelt house in the Crosswood Deeds land transfer of 1608 (NLW, Crosswood Deeds, MS I.159). The position of the Maen Arthur smelt house has become lost over time, although a suggestion to its position was made in a report written by Oliver Davies in 1936 (Davis was one of the founders of mining studies in Cardiganshire), for the British Association for the Advancement of Science. The report stated he had been told of the discovery of a small amount of lead-rich slag in the area of Maen Arthur (Davies, 1936, p. 305). Unfortunately, while Davies reported this discovery, his letters showed no indication that he had followed up on the information. The second was an assertion that mining had taken place at Maen Arthur by Foster-Smith (1979) who wrote that a trial level had been driven at SN733728 in order to ascertain if the Grogwynion vein continued in an eastward direction towards Maen Arthur (Foster-Smith, 1979, p. 76). Due to these two documents, it was decided that this site was worthy of further archaeological investigation and that locating the Maen Arthur smelting site would provide important information on mining and smelting in the southern part of the Cardiganshire Orefield as well as enhancing the knowledge of local and regional mining in west Wales.

Documentary Evidence of Mining and Smelting at Maen Arthur

The earliest indications that mining had been undertaken at Maen Arthur related to the *Society of Mines Royal* and a farmer of mines (leaseholder) in Cardiganshire, George Evans (Rees, 1968, p. 442). Evans had been involved in a number of legal actions over the mining rights in the Cwmystwyth area in 1587 and a dispute for mineral rights in the Maen Arthur area. In 1589 Evans won a court case against Morgan ap Rees, Levan Lloyd ap Morris, Thomas Birde and Humphrey Wainwright banning these men from working in the lead mines of Llanvihangell Akrythyn Parish for up to 21 years (National Archives London, Court case 59/14). As the parish of Llanvihangell Akrythyn centred on the church at

Maen Arthur, this indicated that the mines these men had worked illegally were in the vicinity of the Maen Arthur Wood and Grogwynion mines. Grogwynion was a well-known mine at that time and therefore, if it had been the disputed mine, it would have been named in the documents. This leads to the strong possibility that the disputed site was in the area of the mines found at Maen Arthur. The hypothesis that mines were being worked in the area during the 16th century would go some way to explaining why a smelt mill had been constructed at Maen Arthur sometime before 1608 (NLW, Crosswood Deeds, MS I.159).

The next piece of documentary evidence of industrial activity was the first and only mention of a smelt house on the Maen Arthur site, found in a property transfer deed dated 1608 (NLW, Crosswood Deeds, MS I.159). The description in the deed was unfortunately brief, but it identified the building as a smelt mill and gave its general location as Maen Arthur. Although the position of the mill would have been known at that time, as it fell out of use, knowledge of its location faded, eventually being totally forgotten. Despite this, it can be deduced that by its inclusion in the 1608 transfer document, the mill had been operational at that time and that there were mines working in the area which produced the ore for the smelter. In December 1601 details of the buildings at Maen Arthur and their names were uncovered in an indenture document. Only one mill was recorded as being on the site, which was a water corn mill called Melyn Maen Arthur (NLW, Crosswood Deeds, MS II.147). In 1608 a document concerning the transfer of properties stated that as well as the Melyn Maen Arthur water corn mill there also a smelt mill at Maen Arthur (NLW, Crosswood Deeds, MS I.159). Because the smelt mill was not mentioned in the transfer of 1601 but was mentioned in the 1608 document it can be surmised that the smelt mill had been built during the seven years between December 1601 and May 1608, although no documentation on when it fell out of use was found. As no large amounts smelting waste (slag) was discovered or recorded at Maen Arthur, the mill was unlikely to have been in operation for more than a few decades. This premise was supported by a clause in a 1693 lease between John Lewis and Richard Betts stating that any ore or metal produced at Grogwynion, (the mine that abutted Maen Arthur) should be taken to the port at Aberdovey and transported by boat to a smelter outside Cardiganshire (NLW, Coleman Deeds, MS D.D.132). This in turn indicates that the smelter would have been out of use by 1693, and possibly earlier.

That the building was recorded as a smelting mill in the documentation implies that it was more likely to be an ore hearth smelter rather than a bole furnace, which had been built between 1601 and 1608 (NLW, Crosswood Deeds, MS I.159). The construction and operation of this smelt mill would have been a capital-intensive process and it would have required a significant discovery (or discoveries), probably of argentiferous ores to initiate it being built. As the smelter was said to have been constructed at Maen Arthur and close to Grogwynion it can be surmised that it had been built primarily to process ores from these and other mines in the area in an attempt to replace local smaller, ad hoc smelters eliminating the expense of sending ore to the large smelters in Bristol and Chester (Hughes, 2005, p. 16).

The first positive identification of miners or mining at Maen Arthur appears in a lease of the Maen Arthur mill dated 1740 which was awarded by John Vaughan Lord Lisburne to a miner called John Meredith and a carpenter Rees Meredith. It was not specified what kind of mill it was, but as the smelt mill was out of use by that time it must have been the water mill. The lease was for only three years, which was much shorter than the average at that time (normally 21 years), in addition, the rent was very low compared to other leases and, unlike other rents, did not appear to involve cash payments (NLW, Crosswood Deeds, MS I.804). As one of the tenants had been listed as a miner, and since the terms of the lease were very unusual (short term and no cash involved), it may be that Lisburne had issued the lease to encourage mining on the site. In the end, neither John nor Rees Meredith took the lease up. In 1742 the mineral rights at Maen Arthur were leased by the *Company of Mine Adventurers* under the name of Grogwynion as part of a lease that covered various other mines across Lisburne's lands (NLW, Crosswood Deeds, MS I.819). By 1758 the mines and minerals at Maen Arthur were no longer being referred to as part of the Grogwynion deposits and from this date onwards were referred to by the name Maen Arthur (NLW, Crosswood Deeds, MS I.939). In the same document Wilmot Vaughan Lord Lisburne promised to give the lease of Maen Arthur to Chauncey Townsend with some interesting terms (NLW, Crosswood Deeds, MS I.939), which stipulated that Townsend was to wait six months from the date he took control of the mine, to when he was permitted to sell any ore that his miner extracted. This, said the document, was to ensure that any mineral already raised at the mine before this lease came into effect, had been sold and removed from the site (NLW,

Crosswood Deeds, MS I.939). While the *Company of Mine of Adventurers* ended up losing control on most of the leases issued, John Vaughan Lord Lisburne, John Ball and Lewis Pryse still retained the lease of Maen Arthur for the *Company of Mine Adventurers* in April 1758 (NLW, Crosswood Deeds, MS I.939).

These above documents showed several things; first, that in 1742 the minerals at Maen Arthur were referred to as part of the Grogwynion deposits but by 1758 they were treated as separate and were leased under the name Maen Arthur. Second, that Pryse and Ball were working the Maen Arthur mines for the *Company of Mine Adventurers* (Lewis, 1967, p. 105). Third; the clause in the promised lease to Townsend indicates that the mine was in production in 1758 and finally the clause in the promised lease postponing the sale of ore suggests that there may have been some difficulty selling the ore that the mine had already produced. Despite Lord Lisburne's promise, Townsend was not given the lease of Maen Arthur, and instead, on 17th July 1762, it was given to a miller called Edward Owen. Owen was given a three-year lease of the Maen Arthur mine and its minerals and was to be paid for at 21 shillings per ton of ore produced (NLW, Crosswood Deeds, MS I.965). The question is why was the lease given to Owen rather than Townsend? The answer was most likely due to a series of serious disputes between Lisburne and the Crown's representative, Lewis Morris at that time. Lisburne became embroiled in a disagreement over the ownership of Esgair Mwyn which led to a confrontation with Lewis Morris. Part of the dispute was that Townsend had bought a fraudulent lease concerning Esgair Mwyn from Lisburne for £1,000 and promptly sold it to the Crown for £3,500 plus an additional £4000 worth of ore (Lewis, 1967, p. 102). Unsurprisingly, this caused the relationship between Townsend and Lisburne to become far less cordial than it had been. As Edward Owen was already living at Maen Arthur, he would probably have been involved in running the mine along with John Ball and so the transition of ownership from Lord Lisburne to Owen would have been less complicated. This would have been a good outcome for Lisburne as the revenue would have stayed the same and Townsend would be excluded from more leases. That the lease payments were based on the production of the ore and did not mention seeking ore implies that the mines were operational and expected to be productive.

In 1768 the Maen Arthur mines were taken over and worked by a consortium of Cardiganshire gentry including a Colonel Vaughan, Thomas Johnes Esquire, Mr.

Edward Hughes and Mr. John Probert (NLW, Powis Castle Deeds, MS 3608). This was the same group of mine adventures who had been involved in the opening of Cwm Mawr and working other mines within the research area (see page 131).

A series of letters concerning Maen Arthur, (written by the lease holders), showed that in 1771 the mine was in a development stage with the owners spending £120 on expanding the mine between 16th October 1768 and 3rd June 1771 (NLW, Powis Castle Deeds, MS 3608). In 1787 the tenement of Maen Arthur was leased by a miner James Lowes of Dolygows Cardiganshire (NLW, Powis Castle Deeds, MS 12794). Lowes was not a common miner but rather Probert's mine manager, and a man who went on to manage the majority of the mines in southern Cardiganshire (Lewis, 1967, p. 111). As many of the mine agents at Maen Arthur had lived on the site it seems likely that Lowes had also lived and worked at Maen Arthur for the consortium which was now led by John Probert. This theory was reinforced when an unusual clause was found in the Powis Castle Deeds documents. The clause stated that the tenant should pay royalties for mines, minerals and launders, and that the Earl retained the mineral rights and right to enter the land for mining (NLW, Powis Castle Deeds, MS 12794). This would appear to imply that Lord Lisburne was keen to retain an interest in the Maen Arthur mines on his lands. However, by the 1790s the price of lead had collapsed due to the effects of the wars with France which led Lowe to comment that it was not worth developing promising discoveries while the war continued (Lewis, 1967, p. 116). This was perhaps the reason why there seemed to be a lack of interest in the minerals at Maen Arthur until the 1850s.

In the 1850s the mines and mineral deposits at Maen Arthur came under the control of the Francis family who were mining managers and promoters and who, during the second half of the 19th century, managed many of Ernest Vaughan Lord Lisburne's Cardiganshire mines (Bick, 1978, p. 48). At the same time, the development works at these mines was carried out by their cousins the Williams. During the 1850s the Williams family developed a number of the mines that are part of this research, for Francis family including Maen Arthur (NLW, Francis Family Papers, File 20/61). Letters written by John Williams, to Matthew Francis between January 1857 and May 1857 discussed a series of adits being worked at Pont Ystwyth and Maen Arthur, and showed that the Williams family were

working two sites (NLW, Francis Family Papers, File 49). The first site was called the Old Mine. The description of the Old Mine matched the remains found during the survey of Maen Arthur, leading to the hypothesis by this research that Pont Ystwyth Old Mine and Maen Arthur were one and the same mine.

The work at Maen Arthur mine was also mentioned in a series of articles published in *The Mining Journal* between 1856 and 1857, written by Matthew Francis, under the name of the Pont Ystwyth Mine (Francis, 1856, p. 733) description of the reported position of Pont Ystwyth and the ore deposits, when taken in conjunction with the letters mentioned above, showed with some certainty that the Pont Ystwyth mine and the Maen Arthur mines discovered during the research survey were the same.

The second work was a new adit that had been driven from the river Ystwyth towards the Old Mine (Maen Arthur). Further correspondence concerning the mines written between 1856 and 1857 described how the workings in the Old Mine (Maen Arthur) had been cleaned out and the tunnels extended further into untouched deposits. They also described how the Ystwyth adit was being driven into the same ore lode from the opposite side of the hill towards the 'Old Work' (NLW, Francis Family Papers, File 49). The 1857 letters described the lode as unusually wide and very rich. This led the Williams family to ask Matthew Francis if he would make a bargain with the miners to work the deposits on their behalf. In the end the bargain was not made as the last letter, written by Williams in May 1857, expressed the frustration of the miners at the lack of money being invested in the development of what they saw as a very rich mineral deposit (NLW, Francis Family Papers, File 49). Francis described the lode as being made up of lead carbonate of lime and blend (Francis, 1856, p. 733). This is consistent with the lead carbonate that had a covering layer of limestone ore that had been recovered during the excavation of the building at Maen Arthur during this research. This indicated that the ore within the building was from the Maen Arthur Mine.

Documentation concerning mining at Maen Arthur next appeared in 1878 when the Maen Arthur Wood mines were taken over by the *Lisburne Mines Company Limited* (NLW, Crosswood Deeds, MS II/1.408), who had worked Frongoch mine from 1868 until 1877 (Burt, Waite and Burnley, 1985). The company then sold the Frongoch to Ernest Vaughan, Earl of Lisburne for £5,000 and received as part of

the deal the lease of the mines and minerals in the parish of Ysbyty Ystwyth and Maen Arthur Woods site. In the lease, the Maen Arthur site was described as consisting of a strip of land in the parish of Llanafan, running parallel with the river Ystwyth, westward from the Grogwynion mine to Pont Llanafaw and Llanafan church. The land extended inwards from the river to the crest of the hill above the Gwaith Goch mine. The *Lisburne Mines Company Limited* also had the use of the road from Pont Llanafaw to Level Fawr mine and the payment for the 25-year lease was a royalty of 1/14 of ore produced (NLW, Crosswood Deeds, MS II/1.408). The area outlined in this lease are the same lands and mineral deposits that had been described in the letters written to Mathew Francis in 1857 under the names of Pont Ystwyth adit and the Old Mines (NLW, Francis Family Papers, File 49).

The final documentary evidence found concerning the Maen Arthur mines was a plan of the workings and mineral deposits as outlined in the lease above (NLW, Crosswood Deeds, MS II/1.408). The plan, dated 1880, showed the Maen Arthur Woods mines and the extent to which they had been worked (NLW, Crosswood Deeds, MS 443). This plan matches exactly with the features found during the 2016 research survey of Maen Arthur (see figure 5.2). As well as showing the Maen Arthur adits, the plan also showed the Maen Arthur hill with adits driven on both sides of it, as described in the Pont Ystwyth letters in 1857 (NLW, Francis Family Papers, File 49). The plan also showed the extent of the previous mine workings on the site, which documentation uncovered by this research, indicated had been undertaken in the 18th century. Interestingly, the plans also showed that the majority of the lode was unworked at that time.

Survey of the Maen Arthur Mine Area

A survey of the parish of Maen Arthur area was carried out as part of this research beginning in 2013 and ending in 2016. The aim of the survey was to find and identify unrecorded mining features and to locate the site of the smelt mill mentioned in the Crosswood Deeds (NLW, Crosswood Deeds, MS I.159).

The Maen Arthur area is extensive and includes part of the workings of the former Grogwynion and Gwaith Goch mines (see T3), along with woodlands which contain many known mining features and open pastures, and so the survey

began with an examination of historic photography and satellite imagery of the pasture lands which was then followed up by a thorough and detailed ground survey on foot.

The ground survey started with an examination of the area around SN733728 where a trial was said to have been undertaken (Foster-Smith, 1979, p. 76). However, as no evidence of mining was found on the site or in the general vicinity, the survey moved on to the rest of the Maen Arthur area which was searched systematically and repeatedly over four years. Particular attention was paid to areas of flat ground where grass cover was inhibited due to pollution of the soil from smelting waste and that had enough space for a smelt house plus a water supply to power bellows, (although the water supply was optional as bellows could have been human powered). First and foremost, the pasture lands were examined and while a number of archaeological features were found none of them related to pre-19th century mining or smelting and so the survey moved on to examine the extensive wooded areas.

Existing mapping of the woodland areas gave little useful information other than to show that the wood coverage had remained relatively stable over the last 150 years. The historic aerial photographs and satellite imagery could not be used either as they did not show the ground below the tree cover. This part of the survey therefore had to be carried out on foot, which was extremely difficult due to the heavily wooded and sloped terrain and dense undergrowth. Again, no features relating to smelting or mining were identified in the main body of the Maen Arthur woodland. After examining the main wooded area, the survey moved on to examine a small spur of woodland near to where the former Maen Arthur water mill had been situated and that had, on previous visits been identified as having the potential to being the site for a smelter. This area consisted of a small triangular terrace of land which had formed on the southern side of a deep gorge created by the stream Nant Cell. Abutting, and above the eastern end of the terrace was a waterfall, and 20 metres upstream to this were stepping-stones across the Nant Cell indicating that this had most likely been the main way to access the site in the past. This would make sense as the site was difficult to access from any other direction, being surrounded by a steep incline with no roads or tracks leading to it.

Historic maps showed there had been an adit entrance several hundred yards away on the southern edge of the strip of woodland, however this adit had always thought to have been related to the Grogwynion mine. A detailed survey of the land was undertaken in 2016 which showed that the Nant Cell stream had cut a deep gorge through the densely wooded hillside and that the stream had dropped three metres, forming a waterfall. The stream then continued to descend more gradually over the next two and half kilometres before it combined with the river Ystwyth. A narrow terrace of land had formed next to the waterfall which had been cleared and enlarged by quarrying and then levelled. Trees had since grown back but more sparsely than in the woodland around it.

A number of archaeological features including a reservoir and associated leat system, a short area of revetment walling on the southern riverbank, a building which had been levelled and infilled, three adits (including the one identified on the map), two trials, and a possible shaft. The northern bank of the Nant Cell was also surveyed, but no signs of historic mining activity or archaeology were identified.

Survey and Excavation at Maen Arthur 2016 / 2017

In 2016 a full archaeological survey of the mine site was undertaken which revealed that it had been built on two levels of the hillside, with the upper level (above the main terrace) concerned with the water management for the site. A small reservoir had been built immediately upstream of the waterfall which was filled by water taken from the stream. Water from the reservoir was taken via a leat 90 metres to the site where it turned 90 degrees to feed a waterwheel. At a later date, the leat had been extended by several hundred metres in order to feed a Pelton wheel further down the gorge.

The remains of a levelled building and the waterwheel pit were identified on the terrace which was two and half metres below the level of the leat. This terrace had been levelled to enable the construction of the building which, when found, was completely covered with thick grass and had three trees that had previously rooted, grown within what was subsequently found to be building. The only signs that any buildings had stood here was a revetment wall on the riverbank and a barely visible raised area of turf which marked a section of the line of the

waterwheel pit. Clearing the turf revealed a building that had been built in a south to north orientation. The southern, land side, wall had been built close to a quarried rock face, while the northern wall of the building formed part of the stream bank revetment. The remains of a waterwheel casement were uncovered adjacent to the eastern wall. The casement was one metre long and stood 0.5 metres high. A stone lined drainage channel took water down the outsides of the building to the stream. There was a drop of two metres down from the leat to the level of the waterwheel casement. This indicated that the waterwheel had been of the overshot type.

Two trials, a possible shaft (Shaft One) and three adits (labelled One, Two and Three) were also found on the site. Both trials were shallow and close to Adit Two and appear to have been related to finding shallow surface deposits. Shaft One was located in the same area and may have been related to the same objective. These adits were later found to have been marked on a site plan dating to 1880 found in documentation relating to mining in this area (NLW, Crosswood Deeds, MS II/1.408).

Adit One was located on the eastern side of the site, at riverbed level just in front of the waterfall. This adit was 45 metres long x 1.6 metres high x 0.46 metres wide, and so just wide enough for one person to walk in slightly crouched over. The adit was not wide enough for two people to work in side by side. Pick marks were found along the length of the tunnel along with evidence of shot firing in the form of the remains of a shot firing hole located in the adit wall near to the inbye end of the adit. Two shallow depressions about two-inches wide were positioned opposite each other in the wall sides near to the shot hole, and identified as possible niches for a drill or drill rod support while the shot-firing hole was being drilled. It would appear that the work in the adit had stopped when the ore vein had petered out. Sand deposits at the inbye end of the adit indicated that it had been flooded up to at least 0.5 metres along the whole length at some time.

Adit Two was located 50 metres further east of Adit One. The entrance to this adit was also at riverbed level with a small amount of mineral in the adit floor by the stream. This adit was more substantial than Adit One. The mineral deposits had initially been worked by open work for the first 15 metres. The open cut was 15 metres long x three metres high x two metres wide. The open cut ended at the adit entrance and had then become sealed by material that had washed down

from the hillside. A set of holes similar to putlog holes were located opposite each other in the open cut walls sides indicating that the miners had worked on platforms at least at that part of the open cut. That the miners had worked on platforms meant that the open cut had been worked from the stream inwards and upwards rather from the surface down and that perhaps miners had later enlarged an earlier and smaller tunnel. No shot firing holes were found within the open cut. The open cut ended at an adit portal which had become blocked by material washed down from the hillside.

No spoil was found near either Adit One or Two, but given their proximity to the stream, it seems logical that the spoil from these adits had been deposited directly into the fast-flowing Nant Cell.

Adit Three was located a further 40 metres east and higher up the hillside from Adit Two. The uphill southern end of the adit had been visited previously as part of this research when looking for the location of Foster-Smith's (1979, p. 76) reported Maen Arthur trial, but this had been discounted as it was marked on Ordnance Survey maps as part of the Grogwynion mine workings. Adit Three had collapsed back from the adit portal for 100 metres and had then been reused as a field boundary. The hedging that had grown along the collapsed length was diverse and well established indicating that the adit had been out of use for many years. Two small spoil heaps were found by the adit opening. These were also well grassed over again indicating that the adit had been out of use for many years.

Excavation of Building One

The excavations carried out 2016 and 2017 on this building showed that it had been constructed from dressed coursed stone which had been bonded using lime cement. The building consisted of two rooms of equal size with a waterwheel pit on its eastern wall. Water from the wheel had discharged directly into the river. The lower courses of stonework at the northern end of the building formed a revetment in the riverbank providing both protection against river erosion and a substantial base upon which to build.

There appeared to have been a second, less substantial, building adjacent to the main building but this has not yet been positively proven. At some point the

buildings and wheel-pit casement had been purposely, partial demolished to ground level and then infilled. Much of the building stone from these buildings appears to have been taken and reused for a nearby bridge, as it contained the same type and size of stone identified in the building being excavated. During the excavation of the upper stratigraphic level of the building, which consisted of a mixture of demolition material and soil washed into the building from the hillside above, three broken stone roof shingles and a single piece of red ridge tile were recovered. No other tiles, shingles or slates were recovered, indicating that either the roofing material had been removed from the site or that much of the roof had been thatched. The second stratigraphic layer which lay directly underneath the demolition layer consisted of a thin deposit of black soot like material. Beneath this soot-like deposit was a third layer consisting of a mixture of soil and stone which contained the occasional pieces of coal, charcoal, burnt limestone and a substantial amount of limestone coated cerussite ore. Several splashes of lead were found within the stone courses and on the stone of the interior walls of the building.

Artifacts Recovered from Building One

A number of artifacts were during excavations of the site including several pieces of ceramics and a small tobacco pipe bowl which have been dated to the 17th and mid-18th centuries (Williams, 2017). A ball of lead and two small pieces of slag-like material were also recovered. No material dating to later than the 1750s was found.

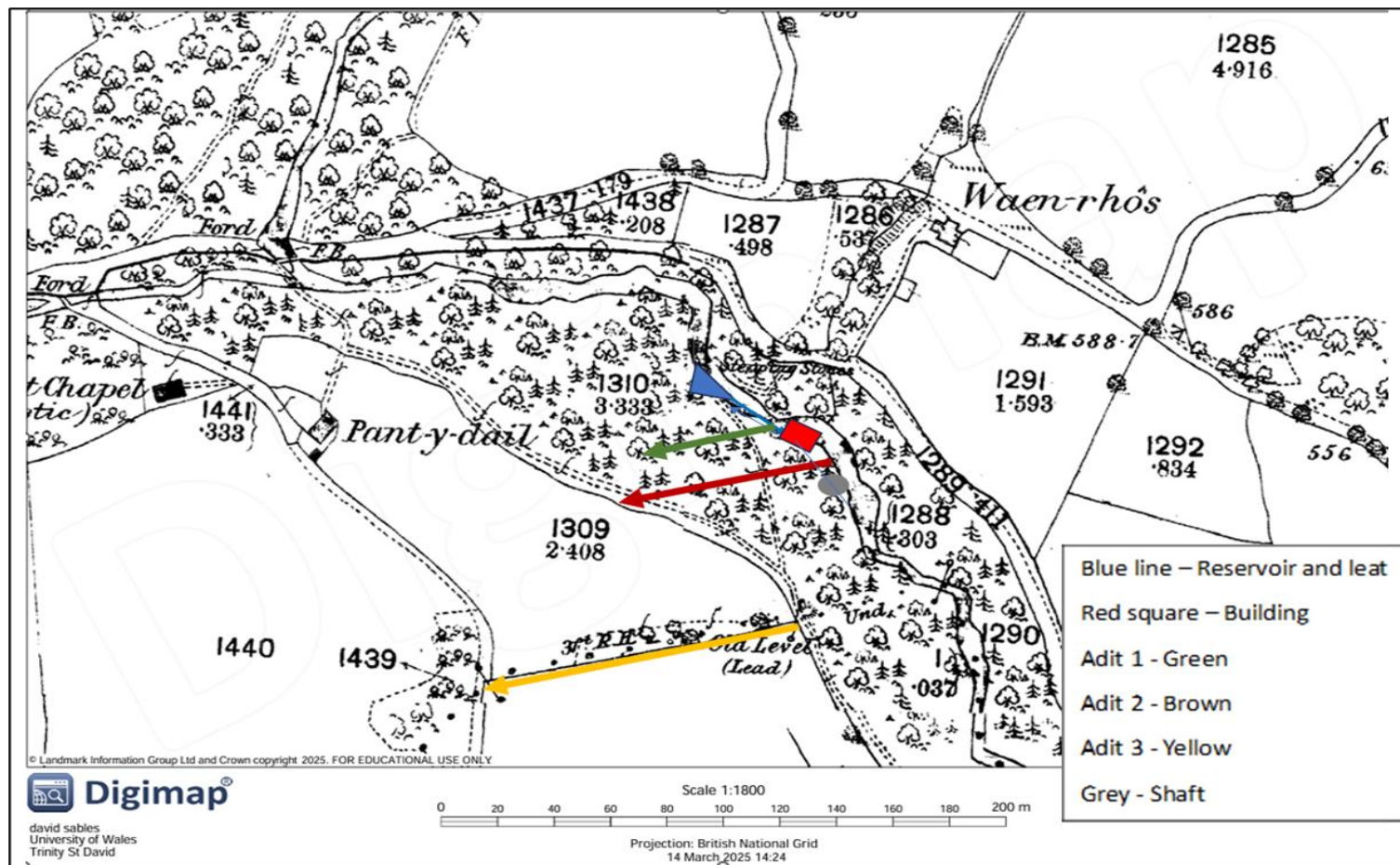


Figure 5.21. Map detailing location of the Excavations undertaken at M17 Maen Arthur Mine during the Research (Digimap, 2025)

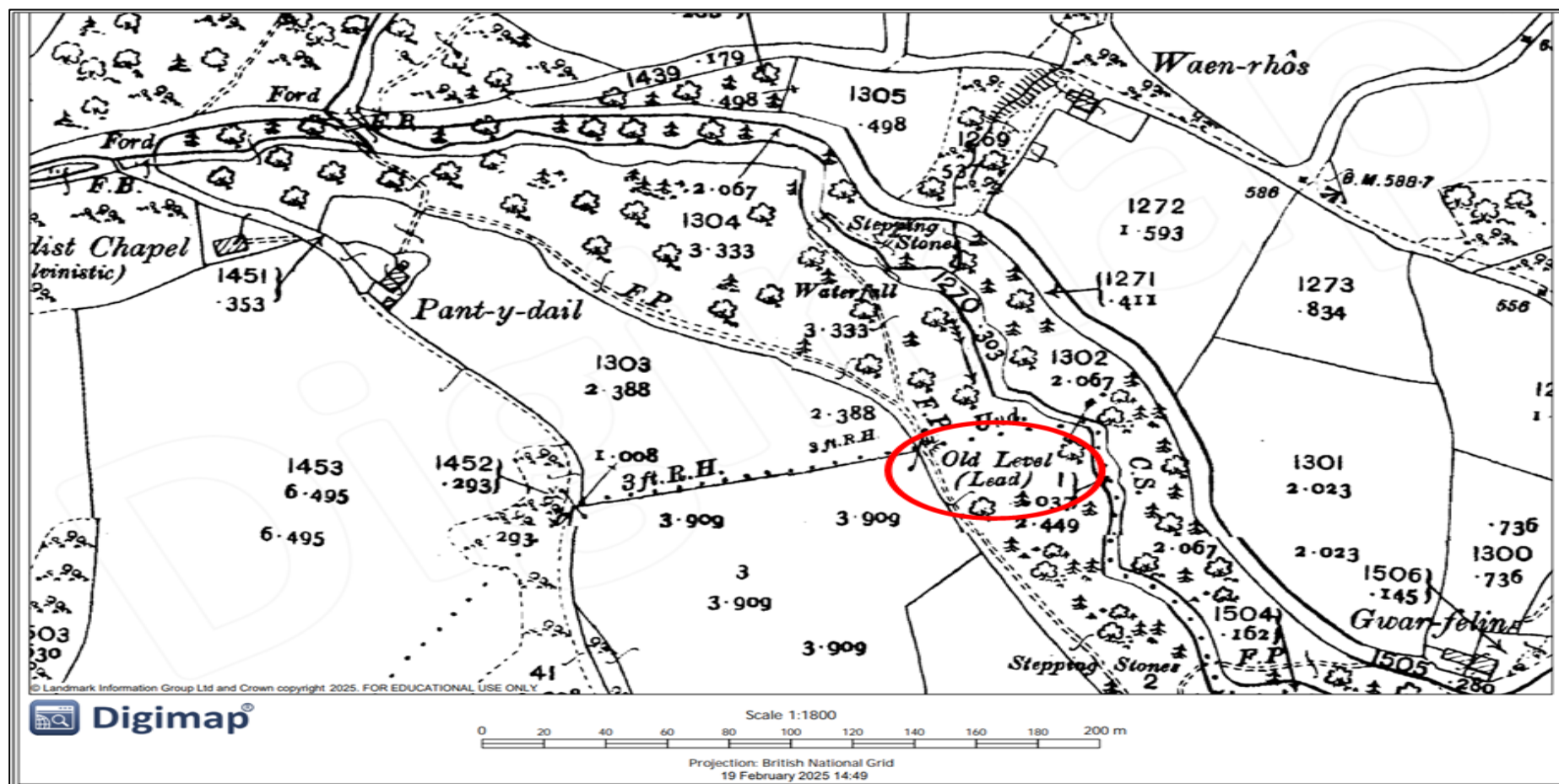


Figure 5.22 Map of M17 Maen Arthur 1900 showing the only known mining feature, prior to the research. An adit which had formally been attributed to Grogwynion mine (Digimap, 2025)

Discussion of the Survey and Excavation Results

During the survey, at least one ruined building was identified at Maen Arthur. A second building, (Building Two) called Henfelen is currently used as a domestic residence for the landowner. Both buildings are set in a suitable position for a watermill. A potential, less substantial building could not be proven at this stage.

The manner in which the excavated building (Building One) had been constructed and the quality of the materials used demonstrated that a good deal of thought, money, time and effort had been invested in its construction. The inclusion of a waterwheel pit plus the reservoir and leat, supports the hypothesis that this building had, at some time, been a mill. The documentation within the Crosswood Deeds archives mentioned three types of mills at Maen Arthur. The first was a water corn mill which was called Melyn Athuwr. The second was a smelt mill which only appears in the 1608 document (NLW, Crosswood Deeds, MS I.159). The third was a grist mill which is also only mentioned once, this time in 1744 (NLW, Crosswood Deeds, MS I.843). As neither of these mills appear in the later archives, it indicates that they were only in use as a mill for a short time although it does not necessarily mean that the building had been destroyed, rather it may have had a change of use. The position of Building One, in between the adits, would also have been a good site for other types of buildings relating to mining such as a store house or blacksmiths, however, these would not have required a waterwheel, which strengthens the idea that this building had been used as a mill of some type. The excavation revealed that Building One had been constructed on a platform positioned below the surrounding landscape within a steep sided gorge, making it quite difficult to access. This makes it unlikely, although not impossible, to have been a corn mill, as this would have required access for horse and carts. For the same reason the building was unlikely to have been the grist mill. Conversely the site would have been easily accessible for pack horses, which was how most ore was moved in the 17th century (Lewis, 1967, p. 295) supporting the hypothesis of it being a smelt mill. This idea is further strengthened by the fact that the site bore a remarkable similarity to the Lumb Clough smelt mill in West Yorkshire, which, like the Maen Arthur smelt mill, had been built in the early 17th century (Dickenson, Gill and Martell, 1975). The finds within the building indicated that it had been in use from the 17th century through to the mid-18th century which coincides with the dates mining had taken place on the site.

The soot and splashes of lead indicate burning, however if this had been related to the destruction of the building or accidental then more burnt material and charred timber would have been expected, so it is unlikely the building had been destroyed by fire. The burning may also have been related to some form of industrial activity, although which form is unclear. Although the position of Building One plus the ore and lead within the building and the waterwheel pit all point to it being related to smelting, no smelting slag was recovered, even if the waste had been thrown into the fast-flowing stream. However, if the building had only been used as a smelter for a short time and had then undergone a change in use the slag could be within the lower stratigraphic layers of the building. Taking all this into account, the results of the survey and excavation indicated that this had been a mill of some kind and that some activity which included burning had taken place within it. The building had been used to store silver rich lead carbonate ore shortly before it had fallen out of use in the mid-18th century. As the only other mill type building, Henfelen, was found on the site the building being excavated was most likely to have been either the corn, grist or smelt mill mentioned in the Crosswood Deeds.

Conclusion

A range of documentary evidence has shown that there was a prolonged interest in the area of Maen Arthur for over four hundred years and included driving a number of adits on the deposits and building a smelt mill on the mine site. This interest was perhaps due to the largely undeveloped deposits of silver rich cerussite ore which so excited Williams and his miners in 1856. Each exploration at the Maen however, appears to have been short term, with the 18th and 19th century mining efforts in particular, being curtailed by a depression in the market. This left the Maen Arthur deposits tested but, according to the 1880 plans, largely unworked. The demolished building (Building One) close to the river, which was partially excavated for this research, was undoubtedly a well-constructed mill of some type, but whether it was the smelt mill mentioned in the Crosswood Deeds is still open to speculation as the excavation was not able to definitively prove its use. Therefore, further excavations will be required to fully understand its function. The dates returned on the tobacco pipe bowl and the ceramics indicated that the building had fallen out of use by the mid-18th century. If it can be proved

that Building One is the Maen Arthur smelt house mentioned in the Crosswood Deeds, it will be of national importance and due to this, further research and archaeological work will need be undertaken to establish when the mines and Building One were constructed, how long the building had been in use and to confirm its function.

M17 Maen Arthur		
Summary of features identified at the site	Quantity	Grid reference
Adits	3	SN73672/ 72875 SN73685/72682 SN73682/72802
Reservoir	1	SN7566/7286
Buildings	1	SN73673/72874
Quarry	1	SN73671/72878
Trials	3	SN73685/72682 SN73687/72680 SN73688/72678 (trial Shaft)
Leats	1	SN7566/7286 to SN73673/72874

Figure 5.23 Detailed record of features identified at M17 Maen Arthur

5.3 Discussion on the Five Trial Sites

T1 Abbey Consols Gargoed SN76803/67208

- This trial was marked on the 25-inch Ordnance Survey maps of 1888 and 1891.

History of the Site

Documentary evidence found during the research suggested that this site had first been trialled in the 18th century by Mine Manager John Ball. In 1771, Ball was given a lease of mines and minerals for an area of land called Caymadog which included Gargoed. This was referenced in an agreement between Reverend Doctor William Powell, the landowner and John Ball Esquire, a miner (NLW, Roberts and Evans Solicitors Records, MS L2). It is unclear how much work Ball undertook, but the site does not appear to have developed beyond a trial as there was no further written information on mining there before 1879. It was at that time that mineral deposits on the site were tried by the *East Florida Silver Lead Mining Company* (Kitto, 1879, p. 924). In 1888, a level was marked on the 25-inch Ordnance Survey map at SN765/671 which showed that the deposits had been explored in some detail. At the same time a number of articles appeared in *The Mining Journal* that may have related to this site, but as they cannot be positively attributed, they have not been used for this study.

In 2013 landscape survey identified an area of disturbed ground which was possibly a trench (now part of a field drainage system) at SN74858/66956. Its position within the drainage ditch was noticeable by being deeper and higher, when compared with the rest of the ditch. There was a smaller trench nearby at SN74849/66857. The remains of an open work were found at SN76644/65645 and an associated trial trench was found at SN75672/65172. All of these features were grassed over and appeared to be quite old however it was impossible to say whether they related to either mining trials or stone quarrying without excavation which was deemed to be outside the scope of this research.

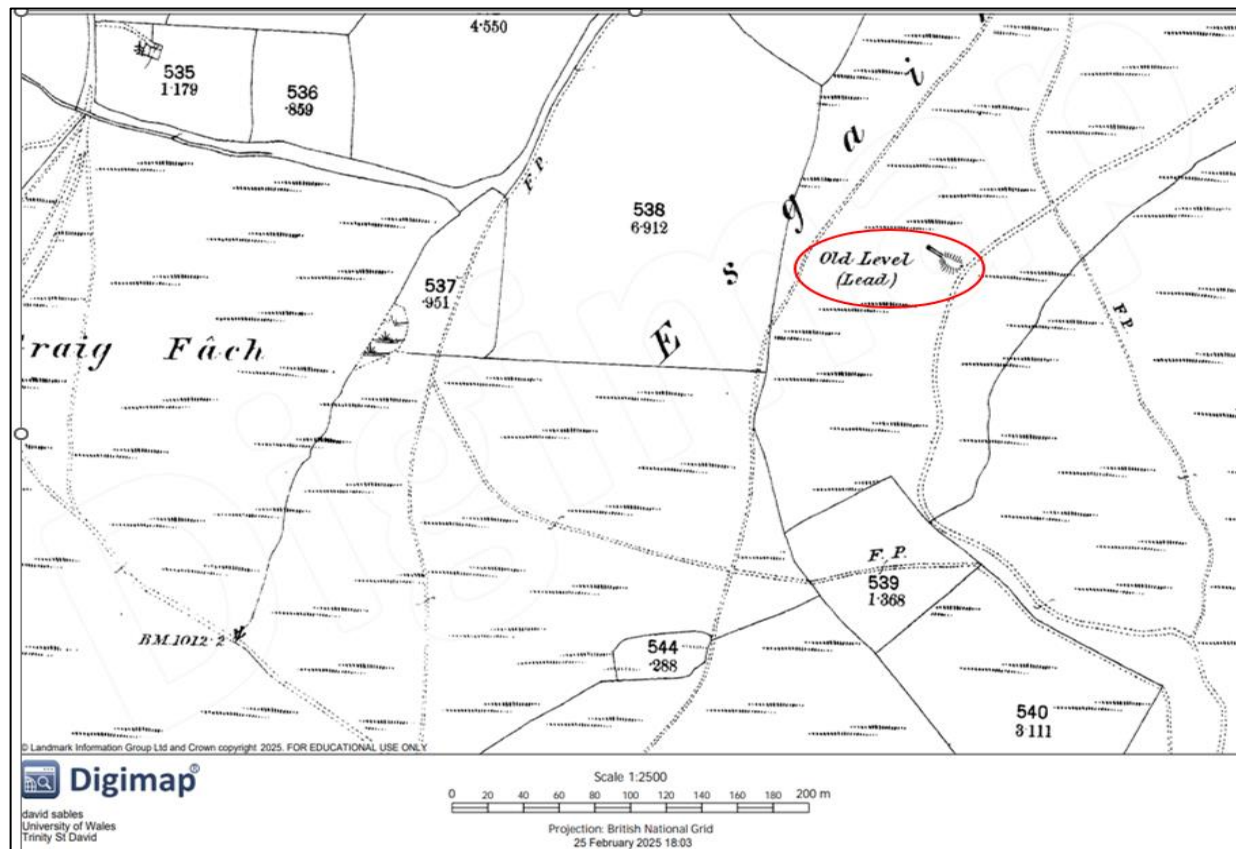


Figure 5.24 1880 map of T1 Abbey Consols Gargoed showing trial level

T1 Abbey Consols Gargoed		
Feature	Quantity	Grid reference
Adit	1	SN76803/67208
Costeaning Trenches	3	SN74858/66956 SN74849/66857 SN75672/65172
Open work	1	SN76644/65645

Figure 5.25 Detailed record of features identified at T1 Abbey Consols Gargoed

T2 Berthgoed Trial SN76429/64506

- Unrecorded trials
- None of the features were recorded on any of the historical databases.

Summary of Survey of Berthgoed Trial

During the examination of historic mapping of Lord Lisburne's estate maps, which covered the research area, documentary evidence reference to an old trench was marked on the map of Berthgoed and Troed y Rhiw made by Thomas Lewis for Wilmot Lord Lisburne around 1781, as part of a collection of maps of his estates in Cardiganshire. The boundaries of the tenements on the map were marked by prominent features in the landscape such as streams, large rocks and on the southern boundary by what was described as an old trench. There was no known mining at Berthgoed but as the title 'Old Trench' had sometimes been used to describe an open work related to mining, it was decided to investigate and identify if the trench had been mining related.

Locating the trench

Although the Berthgoed map had a scale to which it had been drawn and a north arrow on it, as to be expected there was no grid reference to help identify the

exact location. However, the names on the map made it possible to identify the general area it covered. Land use and field shapes at Berthgoed had changed considerably since the map had been produced, but it was still possible to identify parts of the eastern boundary narrowing the search area to several hundred square metres. At the time the map was made, this area had been open upland pasture but which had now developed into a mature forest with a thick bramble undergrowth making the search an arduous and a difficult undertaking. The site of the trench was eventually identified on a steeply inclined piece of recently cleared woodland (by the Forestry Commission). The area around the trench was then searched for other archaeological features before moving on to survey the remaining areas marked on the map.



Figure 5.26 Lisburne Estate Map of Berthgoed Trial Site and Troed y Rhiw (Lewis, 1781)

Archaeology

The trench that was marked on the 1781 map was found at SN76429/64506. This trench measured 4 metres long x 0.75 metres wide x 0.5 metres deep. As the map was dated circa 1781 (NLW, Crossswood Deeds, MS 094/9/2) and the trench described as an old trench at that time, this implied that the initial workings would have been older. The survey of the trench showed that it had been worked in two sections. No pick marks were found indicating that wedges had been used to free the stone. This indicates that the trench had originally been made to remove blocks of good quality building stone which had outcropped at this spot. The method of removing stone at this site was similar to the technics used at an unrecorded quarry site on the neighbouring tenement found during the survey on the hillside at SN7495/6535. The way these two quarries near to Strata Florida Abbey were worked suggested that the landowners were testing the stone deposits in the area for its suitability for use in the construction of high-status buildings.

At some time after its original construction, the trench at Berthgoed had been extended. The stone in the extension had been extracted with much less care as this part of the working face was marked by irregular vertical fractures. This indicated that the excavators at this point were taking smaller pieces of irregular shaped stone and were not interested in quarrying large pieces of undamaged stone. The irregular stone was probably used for the construction of a boundary wall located 40 metres north of the trench on the crest of the hill. This idea was strengthened by the discovery of a number of small trenches and pits in the immediate area around the trench. A series of small quarries were also found spaced at fairly uniform distances along the length of the wall, showing that locally gained stone had been used. Only the trench was shown on the map indicating that the quarries and the wall were all post 1781. The steepness of the hill where the Berthgoed trench was situated would have prevented the use of wheeled carts, indicating that the stone would have been removed from the site using sledges.

After the initial survey of the trench, the survey area was expanded to include the whole of the former tenement of Berthgoed. This led to the identification of a number of other small excavations. These were set away from the wall and were

degraded, lacking distinct edges, indicating that they had been subject to prolonged weathering over time. These appeared to be older than the wall related quarries and it is probable that these were trials for stone or metal working and not for the wall. As well as these stone quarries, a number of larger mining related costeaning trenches were located on the eastern hillsides at Berthgoed. These trenches lay in a line at roughly equally spaced distances across the hill between Berthgoed and Troed y Rhiw and had likely been constructed in order to cut across, and locate, mineral lodes. This prospecting may have related to explorations undertaken by 18th century mine manger Phillip Pugh who had been given a lease of minerals in the area in 1759 by Wilmot Vaughan Lord Lisburne (NLW, Crosswood Deeds, MS II.281).

As well as stone and mineral deposits the survey also identified three small and very, degraded building platforms and associated enclosures at SN76546/64691. These may have related to a deserted transhumance farmstead/settlement. They are, however, unlike the 18th and 19th century abandoned farmsteads in the area. This was because no stone walling was visible and the building platforms were below the surrounding ground surface, indicating that these remains may predate the 18th century.

Conclusion

While the trench that was noted on the 18th century map did not relate to mining, the survey it initiated, led to the finding of several costeaning trenches that were. The interpretation of all these features show that Berthgoed had been the site of sustained industrial activity over many years, including stone quarrying, metal mining, forestry and farming. The identification and examination of the numerous stone quarrying activities, plus the identification of a possible habitation site, has contributed to the history of Berthgoed and Cardiganshire. However, while all of the features found were interesting none of the mining features identified were substantial enough to warrant further investigation within this research

T2 Berthgoed Trial Site			
Trench noted on the 18 th century map	1	SN76429/64506	Much degraded trench 4 x 0.75 metres
Possible trials	3	SN76373/64428 SN76384/64857 SN76360/64594	These features appear to be older than Other excavations and not related to the wall construction. So are possibly small trials for stone or metals
Costeaning trenches	5	SN76360/64594 SN76358/64603 SN76417/64564 SN76373/64428 SN77420/63860	Aimed at cutting and locating the lode
Disserted settlement	1	SN76546/64691 SN76511/64637	At least three building platforms cut into the hillside and associated enclosures
Stone quarries relating to wall building	5	SN76413/64485 SN76490/64419 SN76501/64433 SN75910/64980 SN76064/64899	A series of small quarries accessing stone for the building of a boundary wall

Figure 5.27 Detailed record of features identified at Berthgoed Trial site

History of the Sites

These two trials were constructed by the *Company of Mine Adventurers* who were one of the most well-known mining companies in Cardiganshire during the 18th century. At their height, the company was thought to have held the lease for 28 mines (Lewis, 1967, p. 85). However, despite an auspicious start the company failed to deliver the promised rewards to its shareholders and soon became embroiled in lawsuits and very public disputes with its shareholders. Prior to this research it was thought that the company had stopped seeking new mines around 1710 (Lewis, 1967, pp. 88, 89), however documents uncovered during this study showed that the company were still seeking to develop new mines into the 1740s and continued to work a few of their mines into the 1750s.

Outlined below are two trials, Berthlwyd and Gwaith Goch, which the company acquired the leases for in December 1742 and maintained control of until September 1756 (NLW, Powis Castle Deeds, MS 21900, chapter 19). This area must have been of some considerable interest as the minerals were leased to other people on several occasions during the 18th and 19th centuries. The mines in the lease included the mines Grogwynion, Logaulas, and trials at Berthlwyd and Gwaith Goch (NLW, Crosswood Deeds, MS II.275). The position of the Grogwynion and Logaulas sites had already been recorded on old maps however, the location of Gwaith Goch was questionable as there are two mines of the same name on the Coflein database. Berthlwyd was not recorded as its position was unknown. During the surveys for this research both the Berthlwyd and Gwaith Goch trials were located.

T3a Berthlwyd Trial

A lease given to the *Company of Mine Adventurers* dated 7th December 1742 stated that Wilmot Viscount Lord Lisburne had awarded a lease for 21 years for ores at the tenement named Berthlwyd, in the parish of Llanvihangell y Croddin. The rent for these tenements was one ninth of all merchantable ore raised (NLW, Crosswood Deeds, MS I.819). A search of the documentary history and maps

identified the location of the tenement of Berthlwyd to being between the Grogwynion and Maen Arthur mines. No evidence that the site had been worked under the *Company of Mine Adventurers* under their 1742 lease was found. The site must have shown promise as in 1756 John Ball leased the tenement of Berthlwyd (NLW, Crosswood Deeds, MS I.897). Ball lost the lease to Chauncey Townsend in June 1758, who renewed it again in September 1762 (NLW, Crosswood Deeds, MS II.275). After 1762 no further references to mining on this site was found. However, as the site was on the edge of the research area and being explored in order to locate the site of Maen Arthur, the information relating to this site warranted further examination of mapping and satellite photographs.

Survey of Berthlwyd Trial

Although no evidence of mining was shown on the maps of the area, the 2015 landscape survey identified several trial-like features near to the former tenement of Berthlwyd. A visit to the site in 2018 confirmed the existence of three degraded costeaning trenches at SN 723/734. These were located in an isolated position and did not seem to be connected to any farming or drainage activities. It was concluded that these were mining trials that had been constructed to look for mineral deposits and probably related to the endeavours of either the *Company of Mine Adventurers* or Chauncey Townsend in the first half of the 18th century.

T3b Gwaith Goch Trial

There were two mines recorded under this name in the database. One on the Vaughan family lands at SN719/724 and one on the Nanteos lands at SN711/784. The documents showed that the mine leased by the *Company of Mine Adventurers* was located on lands owned by the Vaughan family. Therefore, the trial was in the same area as the later 19th century Gwaith Goch Mine at SN719/724, and was not the mine at SN711/784 which was on Nanteos lands. Foster-Smith (1979, p. 75) described Gwaith Goch as a mine that had been worked on four levels from around 1857 to 1861, with the site being used in 1916 for the dressing of ore from Frongoch mine (Bick 1978, p. 18).

Documented History of Gwaith Goch Trial

Although it was known that Gwaith Goch mine had been sunk on the site in the 19th century, it had been thought that this was the first mine on the site (Bick, 1978, p. 18), Research into documents concerning the leases of the *Company of Mine Adventures* trial have now shown that mining in the area of the 19th century mine had started at least a hundred years before. The site was first leased to the *Company of Mine Adventurers* in 1742 by John Vaughan Lord Lisburne (NLW, Crosswood Deeds, MS I.819). The company seemed to have opened a mine on the site, as Lewis Morris described Gwaith Goch as a mine on the Common of Creuthyn, being worked by the *Company of Mine Adventurers* who were paying a duty of 21 shillings a ton (NLW, Powis Castle Deeds, MS 21900, chapter 19). Morris's description showed that Gwaith Goch mine was established and working at that time. It may be the case that Gwaith Goch continued to be worked beyond 1756, as its lease was transferred to Chauncey Townsend two years after Morris wrote his description in 1756 (NLW, Crosswood Deeds, MS II.275), (NLW, Crosswood Deeds, MS II.276). There was then a gap in the records of 109 years until a mine of the same name was recorded on the same site.

The mineral statistics showed that the Gwaith Goch mine made its first mineral returns in 1860 and ceased making returns in 1863 (Burt, Waite and Burnley, 1985, p. 56). In 1919 the site was reused to work the spoil from nearby Frongoch mine and was abandoned shortly afterwards (Bick, 1978, p. 18).

The Survey of Gwaith Goch Trial

When the site was visited in 2017 it was not possible to identify any pre-19th century mining features.

Conclusion of the Berthlwyd and Gwaith Goch Trials

The newly discovered documents and the information from the archaeological surveys showed several things. First, that our understanding of mining in this part of the southern area of the Cardiganshire Orefield was, at best, partial. Previously unknown documentation in the form of letters and leases have shown that the area in which the 19th century Gwaith Goch mine had been sunk and had been the site of mining from at least 100 years earlier than thought. The letters and

lease documents discovered during this research have made it clear that even with the well-researched areas of mining, such as the *Company of Mine Adventurers*, there is much more information to be discovered within the archives. The documents showed that the *Company of Mine Adventurers* were still investigating and developing new mines into the 1750s, forty years after they were thought to have stopped looking. The documents concerning Gwaith Goch Mine showed, once again, that many mines that were thought to have been started in the 19th century have a much longer history than recorded.

These trials and leases are important as they show that minerals in the southern part of the orefield were being worked in the Early Modern Period. This also indicated that the *Company of Mine Adventurers* were still actively seeking new ore deposits into the 1750s. This was contrary to the thoughts of many researchers who believed that after the lawsuits of 1710 the company had lost interest in mining (Lewis, 1967, p. 93).

T17 Pantyfedwen Trial SN75200/64900

For the purposes of this research, Pantyfedwen mines were named after the woodlands with which they are located, as it was not possible to find their historic name in any of the literature. The mines lay a kilometre east of the Strata Florida Abbey. This site was very interesting as it appears to have been a multi-period site, where mining had been carried out on a fairly large scale in the 19th century. A significant effort had been put into developing the infrastructure which included sinking two shafts, cutting one adit and starting to cut a second. A leat had been constructed which stretched nearly the whole length of the valley to supplement water from the river in times of drought. The only sign of spoil was identified was just to east of Shaft One SN75097/65057. This was less than would have been removed in excavating the shaft. The lack of spoil suggests that very little production had been undertaken at the site, and that most of the waste that was associated with the sinking of the shafts and building of infrastructure may have had been deposited in the river.

Mining remains had already been identified at Pantyfedwen and were recorded on the RCAHMS and DAT mining databases. These records noted that there was a shaft which was then being used as a rubbish dump. The landscape survey of the area (discussed in Chapter Three) revealed a mining site which included tracks, adits, shafts and an unusual leat system that ran for over three kilometres.

The survey also located a number of quarries which may have related to metallic ore and others which appeared to be related to deposits of high-quality building stone and aggregate for road building. There were no indications that there had been buildings on the site.

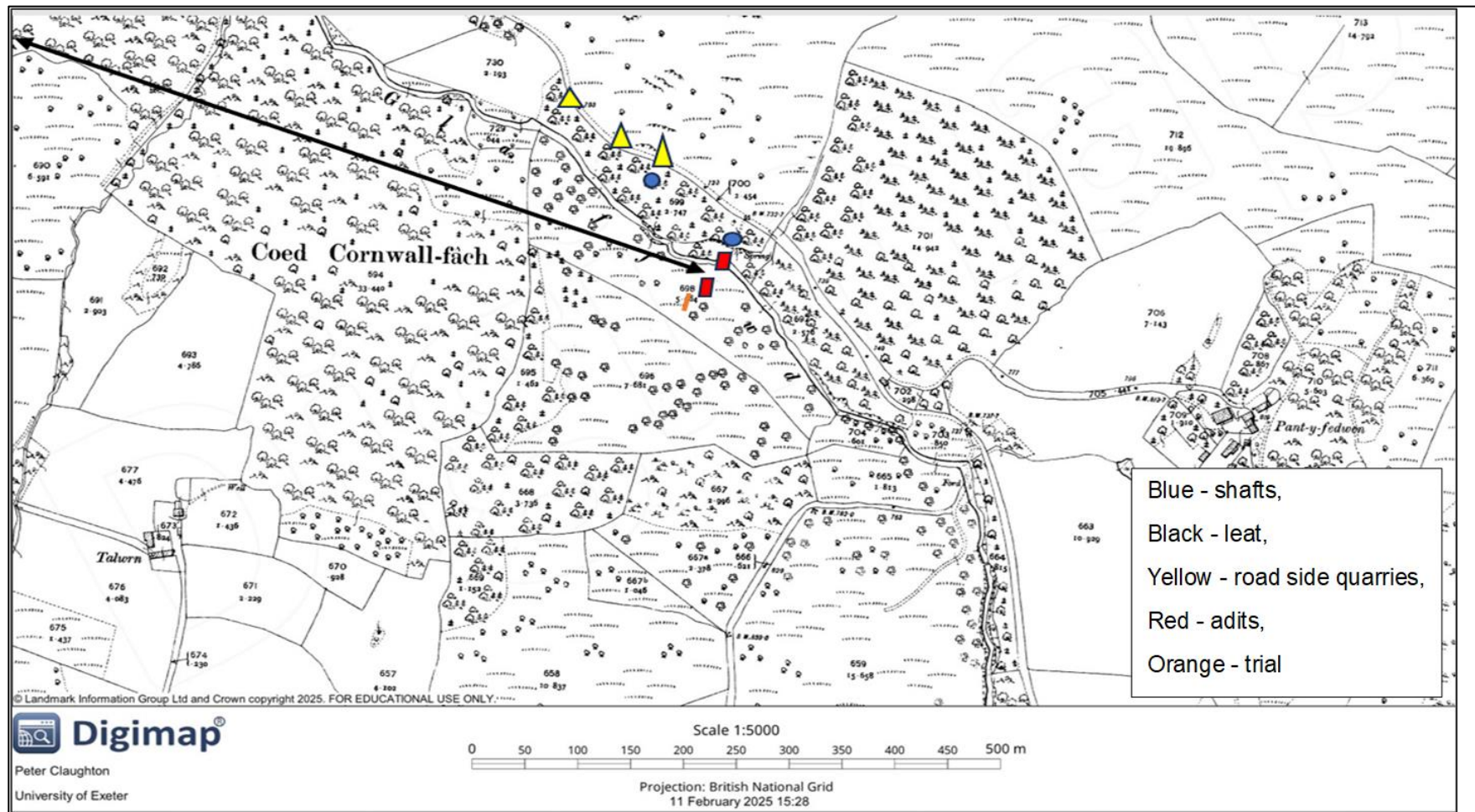


Figure 5.28 Map showing mining features identified at T17 Pantyfedwen dated 1905 (Digimap, 2025)

Mining Features found at Pantyfedwen

Shafts

The two shafts were located in the woods immediately south of Pantyfedwen farm. Both of the shafts were approximately 2.5 metres wide x 3.5 metres long and had been back filled with rubbish. There was no spoil associated with the Shaft One closest to the abbey. There was a short track that appeared to be associated with Shaft Two which led to a small deposit of spoil covering the slope down to the river.

Shaft One SN75035/65225

This shaft stood in isolation to the other mining features on the site, which could indicate that it had not been the main focus of mining activity. It was difficult to assess when the shaft had originally been sunk or if it was connected underground to the other shaft on the site. The entrance of the shaft had become enlarged following the collapse of the area around it, this was confirmed after examining RAF photographs taken in 1947. The photographs also showed that the shaft was open in 1947 and that the area immediately south of it had subsided leaving a large open pit. Sometime after the photograph had been taken local people began to back fill the shaft with rubbish, which has continued over time without the shaft overflowing. The subsidence around the shaft appeared to have increased over the 12 years it was being monitored, which was accompanied by continued deposition of material into the shaft. The depth and increasing area of collapse around this shaft is a strong indication that this was a substantial working.

Shaft Two SN75097/65057

To the west of Shaft One was a second shaft (Shaft Two) SN75097/65057 which was of similar proportions and which had also been backfilled with rubbish. One metre below the Shaft One top was a 0.5-metre-wide opening in the side of Shaft Two. The function of this aperture is unknown but looking at the way the rock was bruised on the roof and sides of the opening, rather than cut, indicates that metal tools had not been used in its construction. Due the shape and position of the aperture this feature has been interpreted by this research as the remains of an earlier mining feature that has been cut through during the construction of the

later shaft. No stone tools were found in the area nor were any other remains or features indicative of earlier mining.

Adits and Leat

Two adits were found at Pantyfedwen both of which were close to Shaft Two. The ground below the aperture on this shaft had been removed to create a large rectangular adit entrance (Adit One), the portal of which was 3.5 metres below the shaft collar. Adit One had become blocked by soil although water still flows out from the entrance. Directly opposite, on the other side of the river Teifi, was a second adit (Adit Two) SN75097/65098 of the same shape and similar size for which construction had been started but not completed.

A revetment had been built on the southern river bank located below Adit Two at point SN75097/65098 where the leat joins the river. It is most likely that the revetment had been constructed to protect the leat from erosion by the river. This leat was interesting as it traversed the hillside from Abbey Woods to the waterwheels at the Bryn y Gors mine. This made the leat unusual, not only because it served two mines at opposite ends of the valley but also because it brought water to the Pantyfedwen mine, which is in the opposite direction to the river's natural flow.

Trial

Only one trial trench was found on the site. This trial, found at SN5098/65101, measured four metres long x one-metre-wide x 0.2 metres deep.

Roadside Quarries

The six small quarries with an average size of four metres x two and a half metres, had been cut into the roadside bank and are likely to date to the 1840s. The initial interpretation for their use was that they related to road building activities, however upon further reflection it seemed unusual that all of the quarries had cut through quartz lodes. While perhaps one stone quarry might cut a quartz lode by accident, it is improbable that six would. This led to the question 'had these quarries been originally dug to locate quartz deposits and therefore predated the

road building of the 1840s or had they been dug to provide road building materials and stumbled on the quartz veins by accident?’

This question cannot be answered for sure without further investigation, however it was not unusual for the building of roads to lead to the finding and exploitation of minerals, especially when a road cut through a valuable stone or metal deposit. Often, when these valuable deposits were found they would often be taken advantage of by estate owners who naturally would want to maximise the returns of their lands.

Discussion on the Archaeology and History of the Mine

While no documents have been found confirming when the mining features were constructed there was circumstantial evidence that the mines dated to two different periods. The old workings looked like they were made using stone tools suggesting they were prehistoric, but unfortunately the remains were so slight that dating evidence is unlikely to be found by excavation. The second period the mine was in use, based on the topography, was in the 19th century.

When Stephen Williams (1889) wrote about the excavations he had undertaken on Strata Florida Abbey in 1887 and 1888, he said that he was convinced that the monks had worked the nearby lead deposits close to the abbey. He did not mention which mines he thought they had worked nor did he talk of any other mining being undertaken near to the area of the of abbey. He did, however, mention a lime kiln above the small spring called Dyffryn (Williams, 1889, p. 224). This was puzzling as the location given by Williams matched that of Shaft One at Pantyfedwen. Further, the nearest possible candidate for a lime kiln was a stone structure built into the side of a leat, over 200 metres away at SN74791/65438. It was possible that the shaft could have been sunk on the site of a lime kiln however a more likely explanation is that Williams had mistaken the disused shaft for a lime kiln. As a consequence of the shaft collar collapsing into the workings, the shaft is now over two and a half metres wide. This means that, at one time it would have been much smaller, and nearer the size of the mouth of a lime kiln. Williams described the kiln as being a deep conical depression containing limestone and charcoal (Williams, 1889, p. 222). As is the practice today, it would have been normal to back fill shafts to prevent sheep (and people) falling into

them. The report of a conical depression indicates that it was a shaft that had been back filled for some time and that the limestone and burnt material in the shaft was more likely from buildings and field clearance rather than limestone being burnt for agricultural reasons. As Williams published his findings in 1889, Shaft One had to have been made sometime before then. It would appear that the supporting structure of Shaft One had collapsed sometime after 1889 and was again back filled.

As discussed earlier, no documentation directly relating to these mines was found. However, circumstantial evidence indicated that Pantyfedwen was quite likely to have been part of a group of mines that had been worked under the name Bendigaid. Other mines in this group were Bryn y Gors and Bryn Hope. This idea was supported by two articles published in The Mining Journal in June 1880. The first article was on a mine called Bendigaid that may have related to the Pantyfedwen mine:

"It is nearly 40 years since this mine was first worked, when a small shaft was sunk, from which a large quantity of lead was obtained, in large lumps, some of which weighed nearly half a ton. A fresh shaft was commenced sometime after to cut the lode at 35 fathoms depth; this was never completed, and the mine has been idle many years. A small company is now being formed, whose chief object is to continue the sinking of the new shaft to cut the lode. The mine is in a good district, having the celebrated Lisburne, Grogwinion, and Esgair Mwyn mines at no great distance" (C.E, 1880, p. 653)

A follow up report was published five days later:

"I have known the property for many years (over 20), and have always looked forward to its being worked as is now projected. The former workings were mere scratchings, and the yield of lead from them" (M.E, 1880, p. 685)

It is not known who CE was but these reports are puzzling as they bear little relationship to the archaeology or descriptions of the Bendigaid mine written at the same time.

In 1870 Thomas Spargo (1870, p. 30) wrote that Bendigaid, also known as Bryn y Gors had shafts that had been sunk through a bog producing lumps of ore up to half a ton in weight. Later, Absalom Francis (1874) wrote that it was a mine at which five shafts had been sunk in the 1850s (Francis, 1874, p. 134). Neither of the descriptions written by Spargo (1870) or Francis (1874), both of which predated the article by CE (1880), matched his description of Bendigaid mine. The only part of the description that did correspond was the reference that trials on the site had found lumps of ore, some of which weighed up to half a ton (Spargo, 1870, p. 30). Taking all this into account, it would appear that the Bendigaid mine workings written about in *The Mining Journal* by CE were not the Bendigaid mine described by Francis and Spargo in their books. CE's descriptions however matched with the archaeology of Pantyfedwen found during the field survey of the Pantyfedwen site for this research. During the field survey two shafts, one of which had aspects that were unfinished and another which appears to have been abandoned at some time and back filled were identified. This raises the possibility that the Pantyfedwen workings were an outlying part of Bendigaid. This idea is strengthened by the fact that both Bryn y Gors and Pantyfedwen are joined by a common leat that feeds both mines.

When were the mines at Pantyfedwen worked?

As already stated, there was no documentary or archaeological evidence relating to this mine. However, in the Early Modern Period and later periods a number of people who were miners were recorded as living and working at Pantyfedwen. In 1752 the account books noted that Richard Evans, a resident of Pantyfedwen had worked at Esgair Mwyn mine as a miner (NLW, Powis Castle Deeds, MS 21935, p. 10). The same accounts showed that Lewis Morris bought an oak woodland at Pantyfedwen in 1754 and had his miners cut down and debark the trees (NLW, Powis Castle Deeds, MS 21935, p. 42), demonstrating that between 1752 and 1754 skilled miners were living and working at Pantyfedwen. Given that Morris was working at the Bronberllan mine and was urging people to look for mineral deposits in the area (NLW, Powis Castle Deeds, MS 21900, chapter 19), it would be unusual if this site had not been known and trialled at that time. The size of the shafts and the infrastructure found on the site showed that

Pantymfedwen had been on the cusp of developing beyond a trial and was on the verge of becoming a mine.

T17 Pantymfedwen Trial			
Summary of features identified at the site	Quantity	Grid reference	Description of feature
Quarries	6	SN74950/65304 SN74922/64600 SN75595/64659 SN75604/64631 SN75488/64631 SN75600/64635	
Adits	1	SN75097/65057	Driven into bottom of shaft
Trial	1	SN5098/65101	
Unfinished adit	1	SN75097/65098	Entrance cut then backfilled
Shafts	2	SN75035/65225 SN75097/65057	Adit driven into the shaft
Stone Structure	1	SN74791/65438	
Leat end Pantymfedwen	1	SN75097/65098	

Figure 5.29 Detailed record of features identified at T17 Pantymfedwen

Another set of mine workings, for which there is no documentary evidence, were found close to a farm house called Talfryn. For the purposes of this work these have therefore been called the Talfryn mining trials. This site was identified following the survey of the lands around Hendrefelin mine. The survey identified a number of mining features close to Talfryn Farm which did not appear to relate to Hendrefelin.

Location of the site

Talfryn is situated five kilometres north-east of Strata Florida Abbey. The area around the Talfryn Farm site was archaeologically important as it contained a number of features including a large Bronze Age burial and an Iron Age hillfort. The north-east part of Talfryn Farm abuts the 19th century mining site of Hendrefelin (Bick, 1978, p. 38) and immediately south of the site lies the small mine of Cloddiau. The mining remains found at Talfryn Farm were geographically separate and did not appear to be related to either of these other mines. The survey carried out for this research found a number of features which related to settlement, stone quarrying and mining. These included thirteen cottages appearing to date to the 18th and 19th centuries, ten of which were ruined and three which were still occupied in 2024. To the eastern area, and close to Talfryn Farm, there were three sub-circular building platforms (similar in style to remains from round houses). There were also four small stone pits (quarries) and a series of boundary walls running through an area of bog land. Three small cairns and seventeen mining related features including costeaning trenches, pits and one backfilled open working were found see figure 5.30. The area on the eastern edge of the building platforms had been flooded by a spring and there were indications that the submerged area had contained more of these features. The trials fell into three types; pits, short costeaning trenches and long costeaning trenches. The two short trenches were typical of the trial trenches found in this part of Cardiganshire but there were three unusually long costeaning trenches, one of which was over 100 metres in length. This type of trial was very unusual in mid-Wales but common in west Somerset and Exmoor, where it was often used to search for iron deposits (Claughton, 2012). These differing styles may indicate

that the trials had been created at different times, which suggests that this was a mining site that had been worked in several different time periods. The large number of trials and the lack of shafts and spoil indicated that no large deposits had been found on the site. Geological maps of the area showed unusually heavily faulted strata with a series of small mineral veins rather than a single large mineral deposit. The small size of the mineral deposits would have dictated the method of mining in the area. This would have taken the form of small excavations on scattered mineral deposits. The size of these and the lack of spoil means such sites could easily be mistaken for trials.

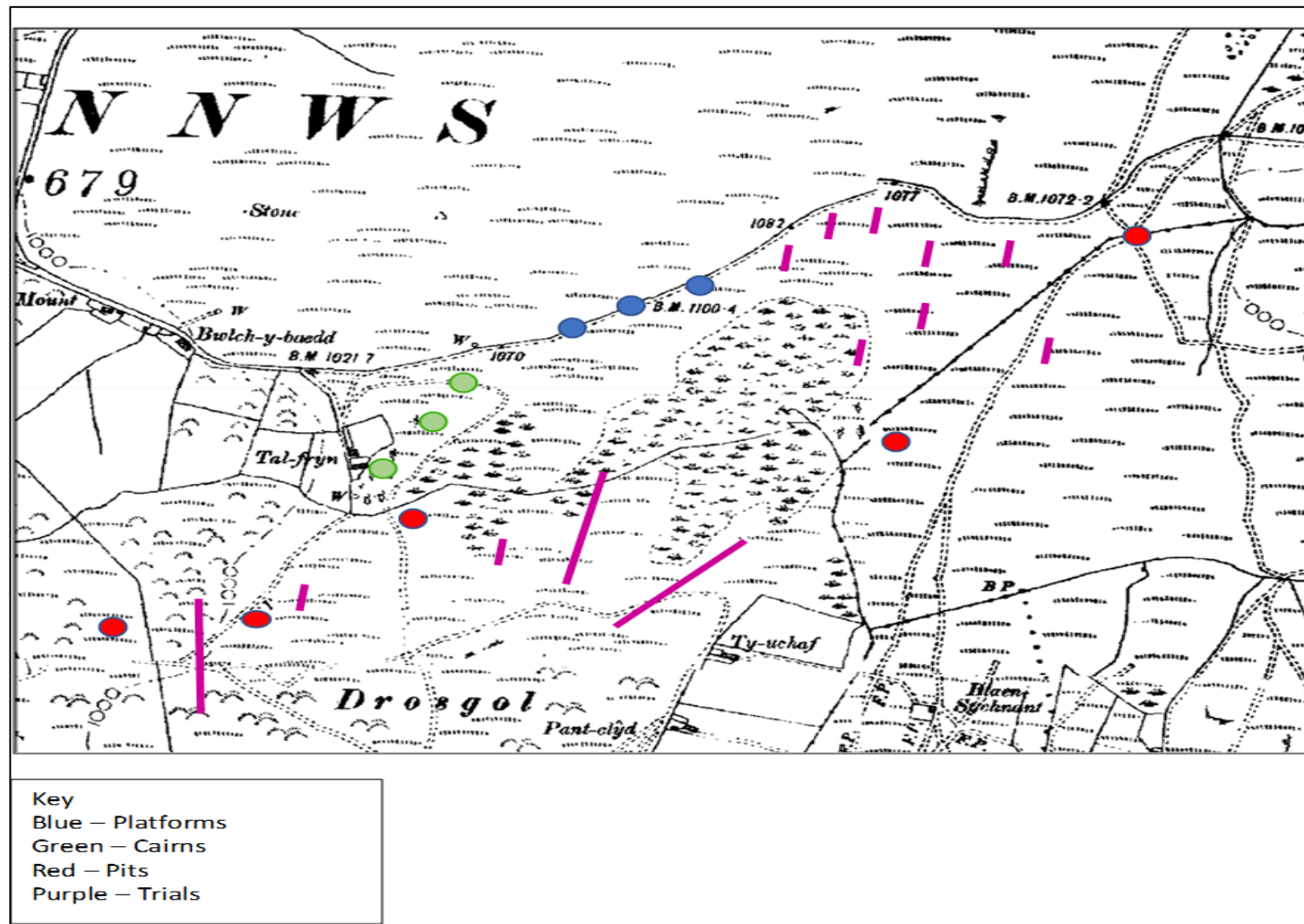


Figure 5.30 Map of T19 Talfryn Farm Trials 1905 (Digimap, 2025)

T19 Talfryn Farm Trials			
Feature	Quantity	Grid reference	
Open pits	4	SN70597/69650 SN70637/69701 SN70652/69717 SN70659/69734	
4		SN70584/69653 SN70570/69650 SN70907/70076 SN71632/70341	
Costeaning Long trench		SN70595/69626 SN71488/70071 SN71442/70190	
Costeaning trench	12	SN70971/70102 SN70784/70058 SN70699/69465 SN70681/69969 SN70611/69765 SN70492/69877 SN71335/70298	SN71335/70242 SN71392/70138 SN71351/70202 SN70360/69880 SN70050/70050 SN70080/70070 SN70090/70070
Stone quarry pits	3	SN70713/70000 SN70707/69960 SN70709/69981	
Quarry face	1	SN70652/69739	
Spring	1	SN 74104/70104	
platforms	3	SN70928/70112 SN70882/70081 SN 70855/69978	

Figure 5.31 Detailed record of features identified at T19 Talfryn Farm Trials

Documentation on Mining in the Area

Following on from the survey, documents relating to possible mining in the Talfryn Farm mine were studied. These showed that mining had been undertaken for longer than previously thought by many researchers. The earliest references to mining came from a document written by Lewis Morris, in which he reported spots of ore being found at Bwlch y Badd near Hendrefelin, known here as Talfryn Farm mine by a miner. In the same document Morris went on to describe seeing

“.... a vein on the common above Geufron, between it and Pont Llanevan on which there is an old trench in a fisabby rock but no trials in this age made upon it” (NLW, Powis Castle Deeds, MS 21900, chapter 17)

This reference, while not dating the features, implied that at least some of the trenches that had been surveyed were already old by the mid-18th century. When these trials had been made is not known, however it appears that at least some of the trials were made before the 18th century.

Discussion

It is not known who or when the trials were made. However, the number of platforms and cottages indicated that there was once a substantial mining community on this site. Lewis Morris, in his description of the area, indicated that there were no buildings other than Geufron House on the site which suggests that the buildings postdate his description of 1756 (NLW, Powis Castle Deeds, MS 21900, chapter 17). The presence of an ancient burial cairn and hillfort plus the building platforms suggest that people had been living, and possibly mining, on this site for thousands of years. This site has the potential of containing the remains of a Bronze Age metal mining settlement which would make the site of national importance. At the very least it is a large formally unrecorded settlement site which contains pre-18th century mining trials. An in-depth survey of the site could lead to a better understanding of the building and mining remains.

5.4 Discussion on Results of the Landscape Surveys

At the start of the research, only three mines within the survey area had a known history going back to the Early Modern Period. The recorded history of the other 15 mines in the research area began in the 19th century. One mine, Maen Arthur, was unrecorded prior to this research and its history was unknown. The history of the other 15 mines was based on the detail returns made to the British Government. These returns were first collected and published in *The Mineral Statistics of the United Kingdom* in 1845 (Burt, Waite and Burnley, 1985, p. v). Basing the history of mines on these returns alone, made it seem that these mines had been sunk in the 19th century. Almost no attention had been given to mining trials and, very few had been a recorded, therefore it had been assumed that these had also been made in the 19th century. The results of the landscape surveys undertaken as part of this research showed that it was most likely that many mineral deposits within the research area had been trialled several times possibly from the Bronze Age onwards. The sites of Bronberllan, Esgair Mwyn and Maen Arthur were particularly interesting as these mines had contained areas of topography that was indicative of very early mining. While no datable evidence of mining from the Prehistoric, Roman or Early Medieval Periods was found, evidence of Medieval and Early Modern mining was found at several sites, with a number being shown to have been worked continuously from then until the beginning of the 20th century.

Evidence of Mining in the Medieval Period

The examination of place names within the Monastic Leases revealed that two of the mines, Esgair Mwyn and Bron Mwyn, had names recorded in the last monastic leases, indicating that they had been worked as far back at least to the late Medieval Period. In a similar way, an examination of surnames that related to people employed as miners within the lease and rental documents, showed that miners were living at Bronberllan and almost certainly working a mine on that site in 1520.

The premise that mining had been carried out in the Early Modern Period was confirmed following the excavation and dating of material from spoil heaps at Bronberllan which proved that the mine had been in production from the 1670s. As the material had been recovered from spoil deposits had been placed on top

of several earlier deposits which had been laid down within a large open cut, production at the mine would have therefore begun far earlier than the 1670s. This evidence, when combined with the documentary evidence on Bronberllan outlined in this chapter, indicated that mining had taken place at Bronberllan from at least the late Medieval Period and that this mine had been worked almost continually from 1520 until 1913. This research was able to show that Bronberllan was the oldest positively dated mine in the southern part of the Cardiganshire Orefield.

Pre-Early Modern Mining

Documents written in the 18th century by Crown Agent and Mine Manager Lewis Morris were used to understand the historic mining not only in his own time period but also identify sites of earlier mining. Morris's letters, diaries and accounts described locations of several places which containing what he described as ancient mining. These places were visited and surveyed and when appropriate included in this research. Pre-Early Modern mining features were identified at Talfryn Farm, an area visited during the landscape surveys. The area had been described by Lewis Morris in 1765 as an area where ancient mining trials had been undertaken (NLW, Powis Castle Deeds, MS 21900, chapter 17). This area was found to contain a series of trials and pits which were not connected to other mining in the vicinity. The observations made by Morris together with the results of the landscape survey of the site indicated that at least some of the mining trials at Talfryn Farm had been made during the pre-Early Modern Period. Morris also reported attempting to drain a large open work and then entering old working at Esgair Mwyn. Morris described these works as ancient. While this cannot be confirmed it does show that Esgair Mwyn had been worked much earlier than 1748 when Morris first visited the site (NLW, Powis Castle Deeds, MS 21900, chapter 17).

Evidence of Mining in the Early Modern Period

The discovery of previously unseen and unpublished documents within the archives provided evidence that the majority of mines within the research area had been worked in the 18th century. Historic documentation outlined in this

chapter showed that four mines Esgair Mwyn, Bronberllan, Logaulas and Maen Arthur had all been worked from at least the start of the Early Modern Period, with Cwm Mawr, Esgair Ddu, Llwyn y Gwyddyl and Llwyn Llwyd all being worked from the mid-18th century. The documentation also showed that trials had been made in the 1740s at Berthlwyd, while trials at Abbey Consols Gargoed, Cloddiau and Dyffryn Cottage were made as part of the boom in mining initiated by Lewis Morris in the 1750s and the resulting large profits that were made at Esgair Mwyn at that time. These results confirmed that mining had taken place within the research area from at least the start of the Early Modern Period on at least three sites Bronberllan, Esgair Mwyn and Logaulas.

5.5 The Silver Question

This section outlines the argument that some of the mines within the research area, that were thought to have been low in silver ore, had originally contained mineral deposits including silver ore in workable quantities. It may have been that the silver, due to its scarcity and high value, was the main product being mined and that the lead was a by-product of this process (Rippon, Claughton and Smart, 2009, p. 20). The presence of these ores, in a large, easily worked lode, as seems to have been the case at Esgair Mwyn and Bronberllan, in the pre-Early Modern Period (Halse, 1884, p. 10), would have been extremely attractive to miners and made it profitable to work the lode even when the price of lead was very low

While several of the mines in the north of the Mid-Wales Orefield were renowned for the amount of silver they contained, by contrast the mines in the southern part were generally thought to have been low in silver (with the exception of the mines south of Tregaron). This, however, may not always have been the case, as documents have shown that Strata Florida Abbey received some of the annual rent for grazing rights in the form once known as 'Mountain Silver' (Jones, 1937, p. 278). Because native, or pure silver, was almost unheard of in the United Kingdom (Rees, 1968, p. 369), the silver mentioned in the documents, must almost certainly have been produced from the mining of either copper or lead. If this was the case, then it was possible that the 'Mountain Silver' mentioned may also have been sourced from southern mines as there were indications that mines within the research area had also contained silver ores in sufficient quantities to warrant cupellation.

Roger Bird and the Cwmystwyth Mines

Roger Bird (2012) made the argument that Cwmystwyth, which today has been assayed as a mine with an average of four ounces of silver per ton of metal produced, once contained ores with significantly higher silver contents (Bird, 2012, p. 53). As proof of this, Bird produced evidence that in 1707 the *Company of Mine Adventurers* worked deposits at Cwmystwyth that made returns of twenty ounces of silver per ton of lead produced. He went on to argue that while the Cwmystwyth lode, which had generally been associated with one, single, low silver mineral deposition 360-330 million years ago (Bird, 2012, p. 53), had instead been subject to two phases of mineralisation. Bird's proposition was that the first phase was the argentiferous depositions of 390 million years ago. This was overlaid by a later, non-silver mineralisation event 360 - 330 million years ago (Bird, 2012, p. 54). Bird's theory was supported by documentation and material found during this research. These included the report written by Lewis Morris on the mineral deposits he had discovered in 1753 at Craig Goch mine. This mine was situated on the Cwmystwyth lode, around 500 metres south of the site later examined by Bird. Morris wrote that he had found veins a foot wide which contained both potters' ore and the silver-rich, steel-grained ore (NLW, Powis Castle Deeds, MS 21900, chapter 16). Further indications that Cwmystwyth may have contained silver deposits were also supported by the interest shown by Cornelius le Brun Gut, a German mining engineer. Brun Gut had come to Wales with the specific aim of working the silver rich lead mines (Morgan, 2001, p. 74). In 1664 the landowner of the Cwmystwyth mines, John Jones of Nanteos, transferred the lease of the mine to Brun Gut in exchange for a loan of £1,000. This mine lease was interesting as it stipulated that the repayment had to be between 8 shillings and 20 shillings per ton depending on the richness of the vein (NLW, Coleman Deeds, MS D.D.128). If Bird (2012) was correct, then other mines, in addition to Cwmystwyth, would have been subjected to the multi phased mineralisation events. This would inevitably include those located south of the orefield and situated within the boundaries of this research.

M1 Bronberllan Mine

A mine close to Esgair Mwyn, which may also have once contained silver rich lead ore, was Bronberllan. Like the other mines in the research area, Bronberllan

ore had originally been thought to be low in silver. The first descriptions of the ores at Bronberllan were made in the early 18th century when the smelters at Llangyfelach were asked to assay the ores for the mine owner, Richard Steadman. The 1731 report stated that the ores did not contain silver (National Library of Wales, MS 15101), and this assertion was reinforced by Lewis Morris, who later leased the mine from the Steadmans. In 1756, Morris wrote that Bronberllan mine instead produced potters' ore of the finest kind (NLW, Powis Castle Deeds, MS 21900, chapter 19). In 1846 Bronberllan was leased by James Raw and James Wall who submitted returns to Hunt at the British Geological Survey in 1848 (Burt, Waite and Burnley, 1985, p. vii) showing they had only produced lead ore. (NLW, Nanteos Records, MS Box 6), Following this, the mine moved into the control of a Mr Maitland who worked the mine under a take note for three years. No silver was reported to have been produced by Maitland, with the first mention of silver coming from Bronberllan in 1856. The mineral statistics returns for Bronberllan that were made to the Mining Records Office show that from 1856 silver was being produced in significant amounts, indicating that the miners were exploiting a substantial deposit of argentiferous ore (Burt, Waite and Burnley, 1985, p. 1). Yet in 1884 Edward Halse, the Mine Captain, had said the lode at Bronberllan was non-argentiferous which was contrary to his own production figures (Halse, 1884, p. 10). The question therefore became, why had this mine been recorded as producing significant quantities of silver in the second half of the 19th century? (Burt, Waite and Burnley, 1985, p. 1). One answer to this question could be that the silver had come from the remains of another silver rich lode close to the surface, the majority of which had already been removed prior to the 19th century.

Bronberllan Silver from Old Workings

The first documented evidence of silver production appeared in the records of the Nevill smelter at Llanelli in 1856. Two notes produced in that year stated that argentiferous lead had been received from Abbey Consols (Bronberllan) and had been sent for cupellation (NLW, Nevill Industrial Records, MS File 1.358), (NLW, Nevill Industrial Records, MS File 1.359). This indicated that samples from the mine, presumed to be low in silver today, had previously had areas that were rich enough to be considered as argentiferous. The first record of silver production in

the Government Mineral Statistics coincided with *W.M. Batty and Co.*, taking over the lease of Abbey Consols (Bronberllan) in 1857 (Burt, Waite and Burnley, 1985, p. 1). The 1857 Mineral Statistics stated that 426 ounces of silver had been produced from 76 tons of lead (Burt, Waite and Burnley, 1985, p. 1). This marked a period of sustained investment including the development of the mine's infrastructure. The last record of silver production was in 1909, when 304 ounces of silver was removed from 51 tons of lead at a time when the ore was being cleared from the site (Burt, Waite and Burnley, 1985, p. 45).

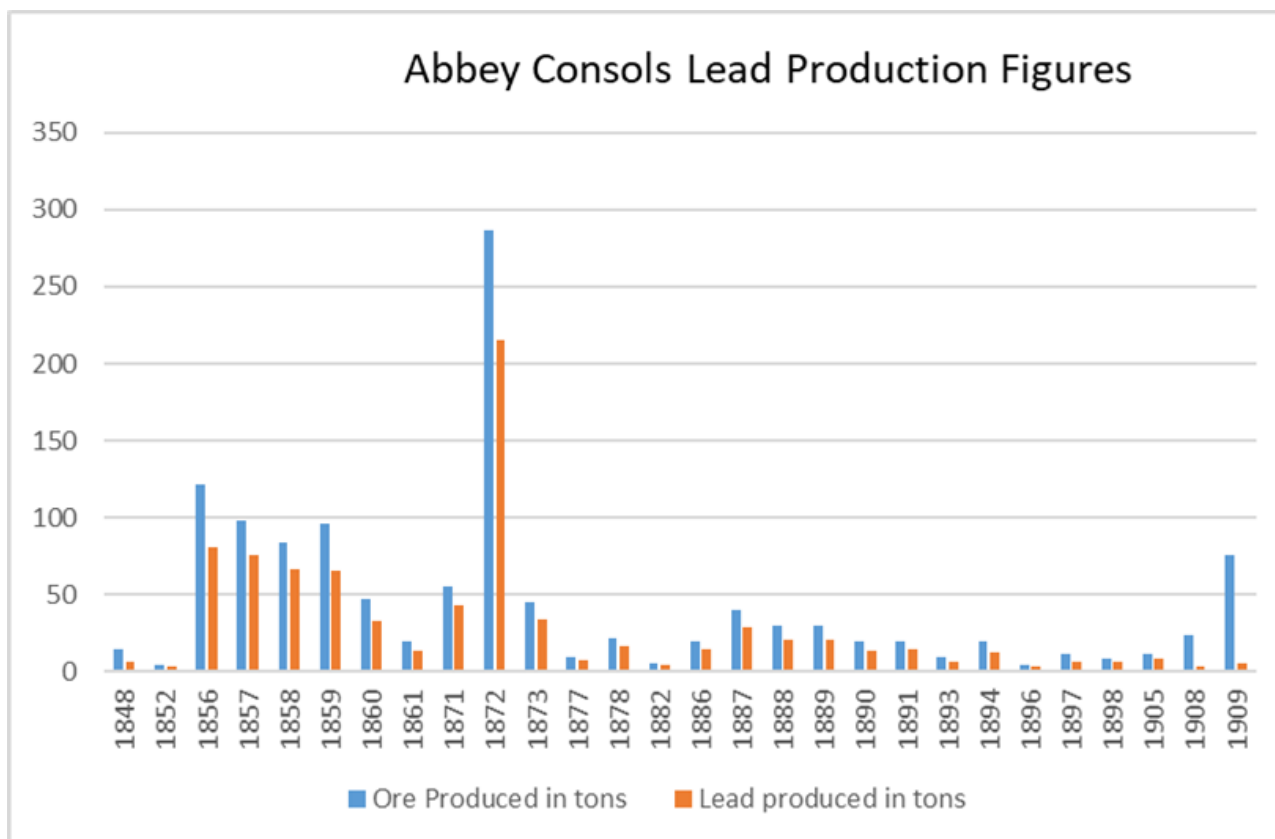


Figure 5.32 Chart showing the Abbey Consols lead production figures 1848 – 1909 based on figures and statistics taken from Burt, Waite and Burnley (1985)

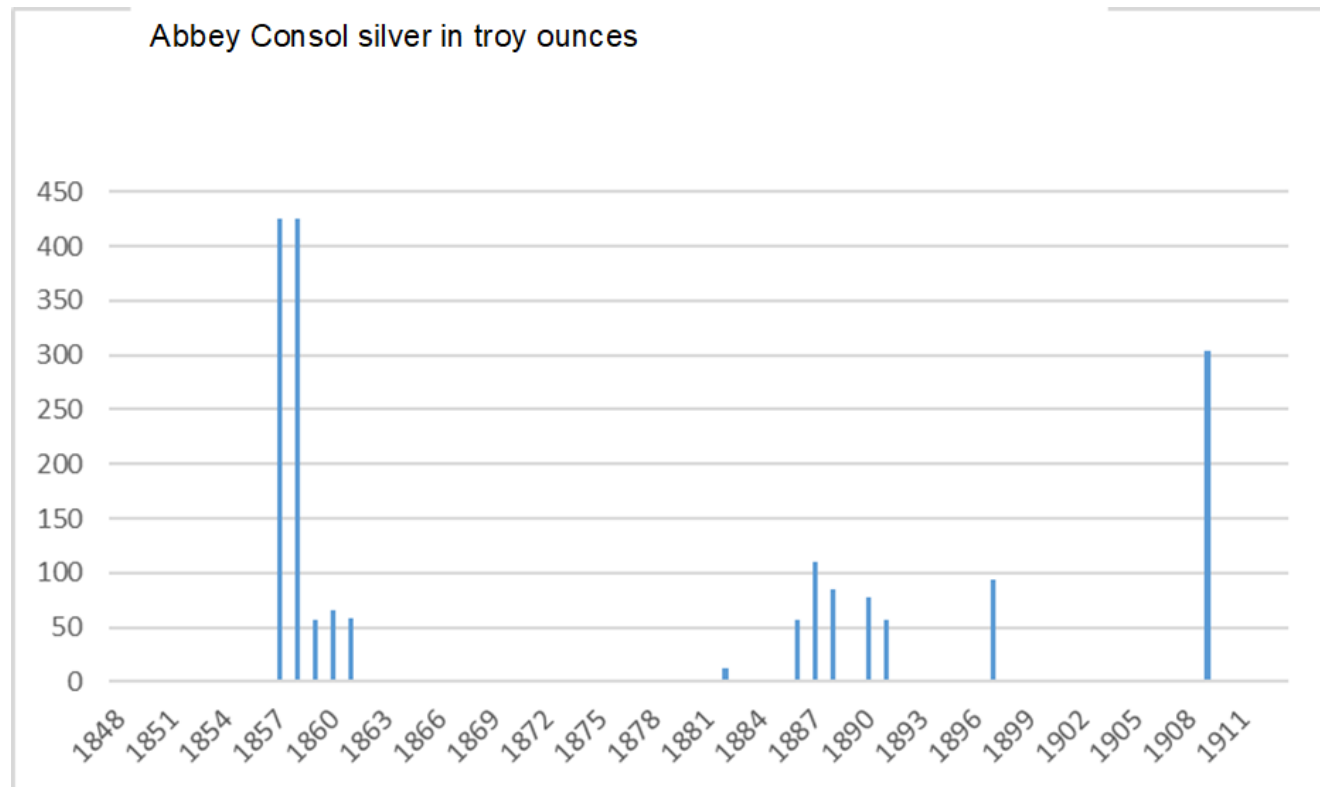


Figure 5.33 Chart showing the Abbey Consols silver production in troy ounces based on figures and statistics from Burt, Waite and Burnley (1985)

Location of Silver Ores at Bronberllan

Although it is not explicitly stated where the silver was found, there are clues within correspondence relating to the working of Bronberllan, written by members of the Williams family who had managed the mine. The correspondence revealed that the first silver had been extracted when workers were clearing the disused workings on the eastern side of the mine and reworking the deads found within them.

The descriptions within these letters also indicated that miners had been working in the older, higher deposits on the eastern side of the mine. Edward William's letters described how they had hit a second shaft, indicating that they were clearing workings along the line of shafts that had been sunk along the lode at the bottom of the open work (NLW, Francis Family Papers, File 20/61). This is thought to be the oldest part of the mine and is located closest to the eastern most shaft and spoil heap (this area was included in the 2012 excavation. The correspondence also indicated that the majority of the ore produced (including the argentiferous ore) had come from this part of the mine.

In March 1857, Williams wrote that the lode, whose entrance was via the farmyard adit, was quite distinct from other lodes that they had seen on the site. He went on to say he also had a pair of men clearing the old shafts sunk on the eastern lode. Williams noted that this old shaft, named 'Percy's shaft', had contained 10 fathoms of ground that had been left unworked and that this lode was totally different to that being worked on the western side of the mine (NLW, Francis Family Papers, File 20/61).

This was the same area that Edward Halse, who had been the chief agent of the mine between 1877 and 1882 (Burt, Waite and Burnley, 1985, p. 45), described as being rich in ore. However, he also said that this part of the mine had been heavily worked in the past (meaning before the 19th century) (Halse, 1884, p. 10). Halse further mentioned that he had seen a large vugh (cavities in the mineral) which had been filled with cerussite. Within the cerussite infill were remobilised fragments of another vein plus country stone and more recent deposits of mineral material which had been mixed and overlaid by a final deposit of lead carbonate (silver rich lead ore). Halse went on to describe the deposit as containing solid balls of material made up of fragments of old vein material within a matrix of

hardened clay material with small pieces of galena and zinc ores cemented together with cerussite. This mixture was then coated with pyromorphite and cerussite (Halse, 1884, p. 10). Due to their curved shape, Halse thought these balls had developed in-situ as the crystals within them had grown. He suggested that the lead carbonate had been the last to form as it appeared to have gradually overlaid the iron pyrites in the vein material (Halse, 1884, p. 10). During the 2012 excavation for this research, iron pyrites were found in abundance in the waste associated with the dressing floor and the spoil heap excavated in the original mine surface on the Eastern section of the mine. This indicated that it was this same area of lode which Halse described, and in fact it was the eastern lode that was being mined in the late 17th century.

What Halse had described was a remineralisation event during which part of the Bronberllan ore lode had been reanimated and mixed with new material. This demonstrated that this part of Bronberllan mine had undergone more than one mineralisation events, which supported the argentiferous deposition event 390 million years ago and the non-argentiferous deposition event 330 million years ago described by (Fletcher, Swainbank and Colman, 1993, p. 77) and Bird (2012, p. 53). Both Williams and Halse's description of re-entering the eastern lode, together with the dates for the high silver returns from the 19th century, closely mirrored the times when miners were reworking areas in the eastern side of the mine. It was therefore likely that the silver produced at Bronberllan in the 19th century was from the eastern part of the lode and came from ore which had been discarded in the waste left in the abandoned workings dating to the late 17th century. So, if this eastern lode was so rich, why had the mine consistently been reported as poor in silver? It would be fair to suggest that one of the reasons that this lode went unnoticed was that Lewis Morris instructed his men to work the higher deposits on the western lode, which happened to be low in argentiferous ore. Morris had been aware of the older workings but had been unaware of the pockets of silver-rich ore within them (NLW, Powis Castle Deeds, MS 21900, chapter 18). Another reason was the work of Jones (1922), who had described the mine as containing low amounts of silver. However, he had based his findings on the Mineral Statistics and a plan of the later workings, which only covered part of the mine (Jones, 1922, p. 128). Questions have since been raised during this research as to how accurate that plan was in any event, and whether Jones had even visited the underground workings at Bronberllan at (Webb, 2012, p. 71).

Jones did not say how he had estimated the silver content of the ore at Bronberllan, but his estimates appeared to have been a simple ratio of the total amount of silver to lead produced based on the official mineral returns. This simplistic calculation was problematic as it seemed to include the years when silver had not been produced at all. If the ratio calculation had instead related solely to the years when the silver was known to have been produced, then the resulting figures would have been substantially higher, and arguably a more accurate guide.

In Summary

A scenario for the development and working of the mines silver deposits could now be constructed.

- Bronberllan mine contained argentiferous minerals which were initially laid down during the mineralisation 390 million years ago.
- This deposit was later remobilised and mixed during the second and final mineralisation event 360-330 million years ago.
- It was likely that the argentiferous deposit had then been subjected to a secondary enrichment due to weathering of the upper deposits.
- The rich silver deposits, which had been laid down in the second non-argentiferous event, had been mostly worked out by the end of the 17th century at which point the mining had moved to the western part of the site.
- The eastern part of the mine had been drained and reopened in the 19th century, at which time the mine started to produce the silver recorded in the Mineral Statistics from the old workings on the eastern lode.

M11 Esgair Mwyn Mine

One of the mines within the research area which could have contained richer silver deposits than has been more recently suggested was Esgair Mwyn. Esgair Mwyn is described today as having very little silver in its upper workings with the most valuable silver bearing deposits lying at its lower depths these showing a return of around 24 ounces of silver per ton of lead (Ratzner, 2016). These lower deposits were not reached until the early 19th century (Burt, Waite and Burnley, 1985, p. 44). The upper deposits on the site had largely been removed by the time Morris reopened the mine, so the silver content of these ores is unknown (NLW, Powis Castle Deeds, MS 21900, chapter 13). Consequently, there was a possibility that Esgair Mwyn may have once contained silver rich upper deposits that had been subject to the secondary enrichment and remineralisation as Bird (2012) proposed at Cwmystwyth. This idea was also borne out in the 18th century mine's accounts. The evidence of silver rich lead deposits from Esgair Mwyn was found in documents relating to *The Anchor Smelting Company* at Penyrancor Trefchan near Aberystwyth (Lewis, 1961, p. 130). Between 1786 and 1792, this smelting works removed silver from lead that was extracted from 13 mines in Cardiganshire (NLW, Powis Castle Deeds, MS 18871) However, the majority of the ore had come from Esgair Mwyn (NLW, Powis Castle Deeds, MS 21942). This ore was reported to have been very hard to smelt and had required mixing with ores from other mines in order to process it (NLW, Powis Castle Deeds, MS 21942). Hard ores which were difficult to smelt were a problem long associated with silver rich lead ores (Bird, 2012, p. 53). As such, there was a distinct possibility that Esgair Mwyn had produced lead which contained enough silver to make it worthwhile cupellating.

M17 Maen Arthur Mine and Silver Production

The Maen Arthur mines had been unworked and largely forgotten, until they were rediscovered during the 2016 survey undertaken for this research. They did not appear in the Mineral Statistics and were unknown to Jones when he undertook his survey of the Cardiganshire Orefield (Jones, 1922, p. 184). While he may have been aware of the reference to the Maen Arthur Smelter in the Crosswood Deeds (NLW, Crosswood Deeds, MS I.159), Jones would probably not have been

aware of the documents now held at the National Library of Wales showing that the Maen Arthur mines had a history possibly dating back to the 17th century. These documents indicated that these mines, and the surrounding area, had been trialled on an intermittent basis from the 17th century until the late 19th century (Sables, 2018, p. 40). Three adits were found on the site, two of which contained the remains of lead carbonate deposits. During the excavation of a levelled building in the centre of the complex, a large amount of lead carbonate ore was found within its two rooms. The ore deposits found in the adits and the building indicated that lead carbonate was the primary product of the Maen Arthur Mines. The lead carbonate would have been produced in the weathered zone close to surface where the silver was dissolved from ore by freshwater and redeposited, forming lead carbonate, with any silver in the galena below this level remaining as discrete silver minerals alongside the lead carbonate in a process known as remineralisation (Misra, 2000, p. 681). As lead carbonate is known to be rich in silver, the discovery of this ore would have made these mines extremely attractive and encourage investment in them. It may have been the silver content of the lead carbonate that stimulated the interest in this mine which, according to documentary evidence, had been trialled intensively during the 18th century (NLW, Powis Castle Deeds, MS 12794). Documentary evidence found in the archives suggest some unspecified quantity of silver rich lead ore had been produced from Maen Arthur. Letters relating to the mine showed that the people leasing Maen Arthur in the 1780s had also been involved in the consortium that managed the setting up and running of *The Anchor Smelting Company*. As such it was very likely that at least some of the argentiferous ore produced by Maen Arthur was processed at that smelting works, along with the ore from Esgair Mwyn and Cwm Mawr (NLW, Powis Castle Deeds, MS 3608). *The Anchor Smelting Company* was open from 1786 until 1792, which also corresponds to the time period when the Maen Arthur mines were working. Furthermore, this was the period when the smelter was reported to be producing silver too (NLW, Powis Castle Deeds, MS 18871).

Strata Florida Abbey and Silver Production

As already mentioned, information gathered from a range of sources during this research suggested that the mining of argentiferous depositions had taken place

on the granges of the Cistercian Abbey of Strata Florida. As well as mining, documentary evidence that silver smelting had taken place at the abbey was found. This activity was known to have occurred at other Cistercian abbeys. An example being excavations at Tintern Abbey which uncovered the remains of several bowl hearths and a cupellating hearth dating to the late 15th century known to be used for smelting (Courtney *et al.*, 1989, p. 129).

At Strata Florida Abbey, Stephen Williams (1889) further wrote in his excavation report that in the 1840s a Medieval smelter had been uncovered by workmen who were constructing a road close to the abbey (Williams, 1889, p. 224). Williams also noted that he had also found a number of smelting sites on other parts of the abbey precinct and said he was sure that the monks had been cupellating there. Williams supported his assertion by having the lead he found during his excavations assayed (Williams, 1889, p. 224). Although Williams did not provide details of who assayed the samples or list the results, he confirmed that his lead samples had not contained silver and in saying this, proved that the monks of Strata Florida had removed the silver from the lead they had used in the building of the abbey.

Soil Samples at Strata Florida

As part of this research, a targeted soil sampling survey of places thought likely to contain mining remains had been undertaken early on. The inner precinct of the abbey had already been surveyed, looking for high levels of organic phosphate (indication of animal or human activity) and magnetic susceptibility (an indication of areas of burning) within the soil. A combination of positive results from these tests would be indicative of human occupation or buildings (Crowther, 2008). The 400 samples tested were collected from a grid of four by three metre areas of soil. A number of additional samples, produced as part of this research, from the excavation areas were also tested for their zinc, lead, and copper levels. Silver was not included in the testing as due to its solubility it would not remain within the soil (Hughes, 2013). One sample from within the precinct boundary produced results of lead and zinc metal contamination, and magnetic susceptibility that far exceeded the norm for the survey area (see figures 5.2 and 5.3). A topographical survey was undertaken at the location, and it was noted that

the ground was higher than the other areas, suggesting that it was possibly the site of a demolished structure.



Map showing the location of high returns in the Strata Florida soil sample results (Crother, 2008)



Geophysics map showing the site of location 'A' at Strata Florida Abbey

Figures 5.34 and 5.35 Maps showing results of soil sampling and geophysical mapping at Strata Florida (Crowther, 2008)

(Bezant, 2010), also suggested that a structure had been there at one time. Due to the high readings from the soil surveys, it was postulated that this may have been a cupellation site. To test this theory, the magnetometer survey readings taken by Bezant were compared with the magnetometer survey of other known cupellation smelting sites and the two scans proved to be almost identical (Bezant, 2012). Following these exercises an examination of the finds from the 2012 excavations was carried out looking for smelting waste, however none was identified. This was followed by an intensive ground survey of the abbey precinct, with particular attention being paid to all the walls on the site as these were made up of the stone re-used from the original abbey buildings. These walls had been used as a place to deposit unwanted material found on the land during farming activities. In September 2012 a single piece of litharge measuring 2.54cm x 7.6cm x 13cm (a by-product of cupellation) was found in the central packing of a loose stone wall 15 metres north of the possible cupellation site. A sample from this litharge was submitted to Simon Hughes in 2013 to identify the origin of the lead within it. No other mineral was recovered from any of the walls surrounding the abbey precinct. Unfortunately, Mr Hughes passed away before he could complete his analysis and the submitted sample has not yet been returned. The wall within which the litharge was found, was separated by the road which ran through the abbey precinct, which reinforced Williams's assertion that road builders had cut through a cupellation furnace in the 1840s (Williams, 1889, p. 224). The combination of the litharge sample, the position of the high soil readings plus the data from the magnetometer mapping results indicated that this could be the remains of a cupellation site. It was not possible to conduct further investigations of this feature as part of this research, however it is hoped that it will be feasible to undertake further excavations of the site as part of postdoctoral research.

The Silver Question Conclusion

This has shown that while mines within the research area are now thought to be low in silver, at least three of them (Bronberllan, Esgair Mwyn and Maen Arthur) had most likely contained argentiferous ores at one time. This would have made the deposits from these mines very attractive to Medieval miners and would go some way to understanding why Bronberllan and Esgair Mwyn had been worked so intensively before the 18th century. It also explains why a smelt mill

was built at Maen Arthur and why that mine had been tried, often unsuccessfully, over several centuries. In the case of Bronberllan, it appears that these deposits had been largely worked out by the late 17th century, with only remnants being found when the old workings were cleared.

Given these findings there was also a strong possibility that other mines within the research area had also contained argentiferous ores. Documentation suggests that the silver deposits from some mines may have been processed at small cupellation smelters that had been built close to the Strata Florida Abbey site during the Medieval Period. In the 18th century a consortium of local landowners who, in an effort to avoid the cost of sending their ore to the smelters outside of Cardiganshire, built *The Anchor Smelting Company* (Lewis, 1961, p. 130). Their records show that silver was being produced from ores within the research area. This however was the final attempt to smelt in the area and, once this smelter closed in 1792, the ore was sent outside Cardiganshire for processing. Finally, as no records were kept, it was not until the 19th century that it was possible to know how much silver was being produced by the mines within the research area.

5.6 Chapter Conclusion

The extensive landscape surveys undertaken between 2012 and 2018 plus the research into the wide range of previously unexamined documentation has significantly enhanced the understanding of mining in southern Cardiganshire. A significant number of previously unidentified mines and trials were identified, establishing that mining had been more widespread than had previously been thought, supporting the hypothesis of this research. The research also proved that mining within the study area had begun earlier than had been previously thought, and that it had been carried out in the late Medieval, and Early Modern Periods. This research has shown that several mines had been worked almost continually from the early 16th until the 20th century. Based on the documentary and archaeological evidence uncovered during this research, it has been possible, for the first time, to build a comprehensive history of mining from the start of the Early Modern Period until the 20th century. The information discovered during this research highlighted that landowners within the area had sought to take advantage of the stone and minerals deposits that lay on the land they

owned throughout the Early Modern Period. This indicated that the economy of the research area had been more diverse than had been previously thought and had contained an industrial aspect. The research demonstrated that by the 1700s there were well developed social and economic links with other parts of the Wales and England. The intensity of mining and number of mines being worked within the research area increased after the discovery of the rich deposits at Esgair Mwyn, leading to mining becoming an important industry within the area. Due to this expanding industry, the research revealed, far more people were involved in mining than had been previously thought. How many people were involved is not known, for while it was possible to identify the landowners and lease holders, the vast majority of those involved remained invisible.

Although the surveys provided a great deal of information in relation to what was previously known and recorded, the details related to the technical aspects of mining as well as information regarding the mine managers, land owners and financial investors.

The surveys could not answer the second and third research questions, these being;

1. Was it possible to find information on the social-economic aspects of mining within the research area relating to the Medieval and Early Modern Periods
2. Was it possible to identify those involved in mining.

Even if there had been an archaeological investigation of the mine workers housing undertaken, what could it have told us about the workers personal lives? It would not have revealed the more ephemeral aspects of everyday life such interactions between workers, the hardships they suffered or the conflicts/relationships that developed between them. It is only in the mid-18th century when very limited information on mine workers within the research area began to appear in documentation. To explore these aspects of the mineworkers lives the correspondence between major landowners in the area, and owners of smelting firms and managers of mines was examined. Also examined were port books and accounts relating to mines within the research area was examined. Were available diaries and personal papers of those involved in mining in the area were also examined. The results of these investigations the kinds of

information found and the conclusions reached are outlined in detail in Chapter Six

Chapter 6 – An Examination of the Social and Economic Aspects of Mining in the mid-18th Century at the Mine of Esgair Mwyn

6.1 Introduction

To date, no definitive work exploring the social aspects of metal mining outside the 19th century has been produced. One of the aims of this research was to go some way to rectifying this by looking at the social and economic aspects of mining during the 18th century. This exploration was based on 18th century documents, which included the Esgair Mwyn mine account books and contemporary personal correspondence of Lewis Morris, Wilmot Lord Lisburne, and the Earl of Powis. These documents made it possible to explore the way ore was mined and processed at Esgair Mwyn mine during the 1750s, with the main focus being on the people who carried out the work. This exploration includes an important discussion the role of women within metal mining in Cardiganshire during the period, a neglected area of study. The chapter also discusses how during Lewis Morris's tenure as Deputy Surveyor of the Crown mines, the area saw the importance of mining increase with a corresponding effect on the local economy, including an influx of workers into the area to staff the expanding sector. This change was sustained as the importance of mining continued throughout the 18th century, eventually reaching its peak in the 1850s before declining in the later part of that century.

6.2 Management of the Mine

This part of the thesis relied to a great deal on information sourced from the 680 letters, surveys and accounts produced by Lewis Morris during his tenure at Esgair Mwyn. For this reason, it felt appropriate to understand who Lewis Morris was and explain his involvement in Cardiganshire mining.

Mine Agent -Lewis Morris 1701-1765

As much of this part of the research has been based on his accounts and letters it seems fitting to explore the kind of person Lewis Morris was. Lewis Morris was born in Anglesey in February 1701, and was the oldest of five children, (four brothers and one sister). His father Morris ap Richard was a carpenter, cooper, and corn dealer who owned a small farm near Treath Dulas Anglesey. His mother was Margret Morris Owen, a descendent of minor Welsh nobility, something her son Richard later wrote, that she had been very aware of (Jenkins and Ramage, 1951, p. 21). It is not known who educated Morris, but he was literate in English and Welsh and also had a good understanding of mathematics (Owen, 1949, p. 467). He was a man to whom family was important and he had a close relationship with his family, which can be seen in the frequent letters which the brothers continued to exchange until his death. Morris was married twice; his first wife was Elizabeth Griffiths, whom he wed in 1729 (Jenkins and Ramage, 1951, p. 27). After Elizabeth died around 1741, Morris married his second wife Anne Lloyd, in 1749 (Davies, 1907, p. xiv). As said, Morris was interested in seeing his family prosper. He ensured this by using his influence and links to the aristocracy to gain members of his family lucrative positions, as in the case of his sister's son John Owen, who he made Mine Agent at Esgair Mwyn (NLW, Powis Castle Deeds, MS 21935, p. 64). Morris was aware, however, that this patronage had to be negotiated carefully so as not to upset his patrons. He often reinforced this point in his correspondence to his family and at one point rebuked his brother William who had approached Lord Powis directly regarding a post without consulting Morris first (Davies, 1907, p. 256). Morris's letters also showed his awareness that his own position within society was reliant on the patronage of others. In 1755 he wrote to his brother saying that his life and welfare were as dependent on Lord Powis as the Morris family were dependent on his own patronage (Davies, 1907, p. 373).

Morris, like any person, had a character made up of a mixture of strengths and weaknesses. One of his strengths was his honesty, which can be seen in his account books. He went to great lengths to make sure the families of miners received money due to them if something happened to their relatives while working for him. One such case was that of Richard John James, who had died before he had been paid. Morris made a special effort and dispatched one of his

miners to ensure that James' widow received her late husband's wages (NLW, Powis Castle Deeds, MS 21935). Another example of this side of Lewis's personality was in a letter written by his brother Richard. In this letter Richard complained that Lewis was over-generous, citing a time when some money was being given to a miner's widow, Morris had refused to take out the money owed to himself. When questioned by his brother, Lewis Morris replied that there was too much misery for the widows to take advantage and that the sight of the widows unclad children was shocking to behold (Jenkins and Ramage, 1951, p. 32). Secondly, Morris ensured that detailed accounts were kept and that all outlays were accounted for with the profits forwarded to the Crown (NLW, Powis Castle Deeds, MS 21935). These personal traits and his even handedness appeared to have inspired loyalty amongst his friends and workers, even in the face of extreme intimidation. An example of this was the surveyor Evan Williams and the Assistant Agent William Jones who, on Morris's orders, refused to hand over keys to buildings at the mine when threatened by a mob led by Chauncey Townsend (NLW, Powis Castle Deeds, MS 1169).

One of Morris' weaknesses was an inability to face criticism from those he thought were wrong or incompetent. This was a fault that he admitted he had, writing to his brother that, while he was honest and hardworking, he was too proud to face criticism by other state officials and the gentry (Thomas, 1901, p. 34). It was also said that in later years, due to his worry about the disputes over the mining leases, he had become embittered, and easily irritated (Jenkins and Ramage, 1951, p. 25).

As said Morris's was hardworking but he also had a strong entrepreneurial side to his personality. Morris began working in 1724 when his mathematical skills gained him the position of Estate Surveyor for the Meyrick family of Bodorgan. In 1729 he was appointed Customs Master of Beaumaris, Holyhead (Bick and Davies, 1994, p. 1). In 1735 his love of literature and history led him to set up a publishing business producing the magazine *Gems of Antiquity*, the first periodical produced in Wales (Bick and Davis, 1994, p. 1). In 1737 Morris accepted the post of Admiralty Surveyor of St George's Channel (Davies, 1907, p. xiii). While Morris was said to be reluctant to take this position, it brought him to the attention of the influential Corbett family. By 1742, after completing the St George's Channel survey, Morris made his first venture into the mining industry through taking a

lease of mineral on lands close to Cwm Darren mine (NLW, Cwrt Mawr, MS 37/122 CR II.490). In 1744 Morris was appointed by the Crown to survey the Crown Manor of Cwmmwd y Perveth with a remit to establish where the boundaries of the Crown holdings lay plus noting the position of the mines in the manor (NLW, Lewis Morris Manuscripts, File 603E).

The survey became necessary as William Corbett, the Crown Steward for Cardiganshire, had lost legal disputes over mine ownership due to the uncertainty of where the boundaries of Crown and Common Lands lay. In 1742 William Corbett and Charles Richards of Pen Glais were granted leases of all the Crown mines in the Manor of Cwmmwd y Prerfedd (Lewis, 1967, p. 98). Local landowner Thomas Pryse of Grogwynion, sued Corbett and Richards, claiming that Darren Fawr and Bwch Gwyn mines near Ystumtuen belonged to him and not to the Crown (Lewis, 1967, pp. 98, 99).

It was during this survey that Morris first came into conflict with the gentry families of Powell and Pryse, when he identified that a number of the mines claimed to be owned by them were actually located on Crown and Common Land and therefore being worked illegally. Thomas Powell of the Nanteos Estate tried to intimidate Morris, threatening him with legal action, telling him that if he went onto the land and surveyed it, he would be prosecuted for damages. Morris was also threatened by Thomas Pryse, of the Gogerddan Estate, another powerful member of the Cardiganshire gentry, who told him that he would also prosecute Morris should he undertake the survey (NLW, Cwrt Mawr, MS 852E/2). These were not threats to be taken lightly, because as Morris had written, these men had control of the local courts and justices, and would not hesitate to drive him out of the county (NLW, Cwrt Mawr, MS 852E/2). Morris, showing either his strength of character or obstinacy, decided to continue with the survey. Morris explained the difficult situation to his brothers, writing that during the survey many of the local officials and landowning gentry had been either obstructive or incompetent or both (NLW, Cwrt Mawr, MS 852E/3). Following this, the influential Powell and Pryse families became his adversaries for the rest of his life, resenting any intrusion by outsiders, including the Crown, regarding how they governed their lands.

The survey was particularly problematic to the Powell family as it threatened their profits made from the mines located on the newly defined Crown land which they

had been exploiting since at least the 1720s (National Library of Wales, MS 15101). Morris, although worried, went on to complete his survey in 1745 and on the basis of his findings the Crown was able to resist the Powell family's attempts to retain several disputed mines (Lewis, 1967, p. 97).

It was on the strength of his survey of Cwmmwd y Perveth, that Morris was appointed Assistant Crown Steward for Cardiganshire by William Corbett in 1746 (Lewis, 1967, p. 99). Carrying out the survey of the mines had, in many ways, prepared Morris for the difficulties he was to face as William Corbett's assistant. Morris's ambition, plus his knowledge of the Welsh language, made him the ideal person to look after the Crown's mining interests in mid Wales. Morris took his role seriously and was forceful in his defence of the Crown rights, being prepared to prosecute landowners who infringed these areas (NLW, Powis Castle Deeds, MS 9113). As a result, he very quickly became involved in disputes with several members of the local gentry. However, as Morris was able to speak to the local residents in Welsh, he was able to establish who had claims to the land and when the mines had last been worked. This was crucial as it enabled Morris to establish that the Crown had owned Esgair Mwyn and several other disputed mines (NLW, Powis Castle Deeds, MS 21900, chapter 18). Following his appointment as Corbett's assistant, Morris's focus turned to exploring the mineral deposits on the Crown Wastes located south of the river Ystwyth. These surveys led to the opening of a number of old and new mines with the results being collated in his pamphlet, *'A History of the Crown Manor of Mevenyth'*, written in 1756 (NLW, Powis Castle Deeds, MS 21900, chapter 1). Documents showed that Morris, having a keen eye for a profit, used his official position to gain leases to work a number of these mines. Within ten years of being appointed as Deputy Steward, he held the leases on 10 of the 37 mines that he reported operational in Cardiganshire in 1756 (NLW, Powis Castle Deeds, MS 21900, chapter 19). As part of his duties Morris ordered three long abandoned mines to be investigated; Nanty Creiau, Nanty Goch and Esgair Mwyn. Although his miners at Nanty Creiau sank new shafts producing a very small amounts of ore, it was the reopening of Esgair Mwyn in 1751 that was the most important (NLW, Powis Castle Deeds, MS 21935, p. 29). It was following the reopening of Esgair Mwyn and the large profits it then produced, that resistance to Crown mineral rights and the local gentry's dislike of Lewis Morris reached a crisis point.

In 1746 Morris agreed a bargain with four miners to drain the old workings at Esgair Mwyn, however, all their attempts failed. The miners were then instructed to trial along the south side of the old mine workings where they discovered a nine-inch-wide vein of pure galena only two feet below the surface. When it became apparent that large profits were to be made from this vein, Morris used his influence to become a partner with the bargain takers. In the eight months remaining on the bargain, just over 1,000 tons of ore was raised. While much of this ore came from the new workings, a substantial amount was from the ore left in the old spoil heaps, which Morris described as being rich in lead ore (NLW, Powis Castle Deeds, MS 21900, chapter 18). After being informed of the profits that had been made at Esgair Mwyn, the Crown decided to run the mine on its own account after the bargain had expired (NLW, Powis Castle Deeds, MS 18968).

As a reward for finding and reopening the mine, Morris was appointed Superintendent of His Majesties Mines in Cardiganshire and Merioneth, as well as agent of Esgair Mwyn. In addition to the new title, Morris was allowed to set his own salary. For working the period between July 1752 and December 1754, Morris paid himself £1,250 in wages (plus expenses) (NLW, Powis Castle Deeds MS 21935, p. 64). This was a substantial amount when compared to one of his miners who would have earned £47/6/- over the same time period and it led his brother Richard to say that Morris was rolling in money (Jenkins and Ramage, 1951, p. 27). This appointment marked the zenith of Morris's career. He was now a man who keenly felt a sense of self-importance. Morris's sense of self grandeur can be seen in his letters describing in detail how he had designed his own seal of office. It can also be seen when he purchased a very large and expensive multi-faced clock for the mine as well as ordering a mansion to be built for his use when on the site (NLW, Powis Castle Deeds MS 21935, p. 29).

The profits made at Esgair Mwyn plus his staunch defence of the Crown's mining rights continued to incense the local gentry and on 23rd of February 1753 an armed mob of Powell's tenants and Grogwynion miners attacked the mine. They were led by John Ball, Mine Manager for Grogwynion mine, two magistrates and a sheriff (NLW, Powis Castle Deeds, MS 21900, chapter 18). During the incident the infamous Magistrate Herbert Lloyd of Peterwell put a cocked pistol to Morris's head and threatened to shoot him unless he handed over the mine. Morris

sensibly agreed and was taken to Cardigan Jail where he remained for 15 minutes before being released on bail, which restricted him to the town of Cardigan (Davis, 1907, p.223). In his accounts of the event, Morris portrayed himself as an innocent victim in this process, a view which has been accepted by many historians. Lewis (1967, p. 101), who argued in *Lead Mining in Wales* that Morris was the victim of scheming landowners led by Lord Lisburne. While this may have had an element of truth to it, when viewed from the local landowners' perspective, they obviously felt that they had a legitimate grievance. They may have, with some justification, seen Morris as an arrogant and tactless outsider seeking to use his official position in conjunction with Thomas Corbett to gain control of as many Cardiganshire mines as they could. Within days of the seizure of the mine the Crown had sent a contingent of the Royal Scots Greys, under the command of Thomas Jones to regain the mine and guard it from any further intrusions (NLW, Powis Castle Deeds MS 21935, p. inner flyleaf).

Although Morris was given back control of the mine, shortly afterwards he was called to London to testify in the court case that had arisen from the event (NLW, Powis Castle Deeds MS 21935, p. 57). Morris did not help his case by being aloof and abrasive to the officials he met and by refusing to provide details regarding how much ore had been produced during the bargain. The whole affair became an embarrassment to the Crown, so aided by Powell Pryce's powerful allies in London, the case was allowed to quietly die. Shortly afterwards, Morris was accused of stealing Crown funds, resulting in his dismissal in 1756 from all his official positions (Lewis, 1967, p. 103). By this time Morris had become an embarrassment to the establishment and to his main supporters, including the Earl of Powis, who consequently switched his support away from Morris to those opposing him. Morris attempted to carry on in public life and in 1760 was appointed a Justice of the Peace for Cardiganshire (Jenkins and Ramage, 1951, p. 25). He was, though, a spent force, and the remainder of his life while still leasing some mines his interests turned to the study of history until his death on the 11th April 1765.

6.3 Maintenance of an Industrial Workforce in a Rural Landscape

The Subsistence Scheme

One of the problems that faced by Lewis Morris and those wishing to open and work mines in Cardiganshire was how to feed and maintain a large industrial

workforce within the rural area. Therefore, the introduction and provision of subsistence was an important element of mining life. Subsistence was a scheme that was started by the mine owners, aimed at resolving the problem of sustaining and keeping a mining workforce in an isolated area and was crucial to the success of mining enterprises. This largely unexplored area of mining life underpinned the social economy of 18th century Cardiganshire mines.

The subsistence system

Traditionally, at that time, Cardiganshire mine workers were paid three months in arrears, on the set Quarter Days, these being Lady Day (March 25th), Midsummer Day (June 24th), Michaelmas Day (September 29th), and Christmas Day (December 25th). The miners had to support themselves for these three months or until the next Quarter Day, when they were finally paid. If mining was undertaken as secondary to other employment or as a miner/farmer, this may have been difficult, but it was possible. If the main source of income was from mining, this was virtually impossible. This made the development of a professional mining workforce who relied completely on mine wages to live, unviable, leaving it impossible to recruit workers to mines in isolated areas such as Cardiganshire. Rather than change the payment system to pay miners on a weekly basis, it had been decided at some time in the past, to introduce a system of credit through which miners would receive enough money or food to live on until they were next paid. This system was called 'Subsistence' and it became an essential part of the mining industry in order to maintain a workforce at that time. The advantage to the workers was that it enabled them to gain, what could be, well paid employment by receiving advances on wages not yet earned or to buy goods, food and services from the mine owners which were not always affordable locally.

The subsistence system also had several benefits for the mine owners. The main one being that it was able to keep a steady workforce in a rural community without having to subsidise their food and accommodation. Not only that, but many mine agents inevitably used the scheme to make a profit by selling goods at inflated prices to its captive market because the miners often lived away from their original homes and support networks. The abuse of the system often left the receivers of subsistence in perpetual debt and unable to seek alternative employment.

Abuse of the Subsistence System

While Morris made a profit from subsistence the mine accounts showed that he treated his workers fairly, especially compared to other managers of mines in the area. The accounts showed that, unlike at least two other managers of Esgair Mwyn, he had not given subsistence in lieu of wages (Lewis 1967, p. 103). Although Morris was not against the giving of alcohol to his men, it seems that he wanted a sober workforce as he did not supply strong alcohol as part of subsistence and only sold ale to five workers in the same quarter (NLW, Powis Castle Deeds, MS 91930). The accounts did show that he gave his men strong spirits when he thought trouble was imminent (NLW, Powis Castle Deeds MS, 21935, p. 34).

One Mine Agent who positively encouraged the drinking of alcohol and used it and the subsistence system to enrich himself was John Ball. Ball had also been Mine Agent at Esgair Mwyn, Grogwynion mine and, as this research has shown, Maen Arthur, during the 1750s for the *Company of Mine Adventurers*. While managing their Grogwynion mine he refused to supply subsistence, instead paying his workers in strong ale that his wife brewed, food and goods from his shop at inflated prices (Lewis, 1967, p. 272). Although not illegal at that time, this action tied his indebted workers to the mine and financially enriched Ball. In a similar case Mine Agent John Paynter used the subsistence scheme as a full wage rather than making a bargain. In 1757 Paynter was involved in an argument with a team of miners led by John Charlton over the non-payment of wages. Charlton had written to Lewis Morris asking for his help stating that Paynter had set a bargain for work, but gave them subsistence payments and not their pay on the agreed day. He had promised several times to pay the sum owed but, in the end, had failed to pay their full enumeration. When Charlton went to Paynter's home asking for their full wages in cash, he had been beaten with a stick by Paynter and driven out of the county by Paynter's servants (NLW, Cwrt Mawr, MS 852E/3). Paynter was later reported as having stated that there was a profit of 50% to be made by supplying miners needs and under his direction James Low, who was a manager at Esgair Mwyn and other mines including Maen Arthur in the 1770s, sold corn and rye to mine workers at almost double the price he had paid the farmers for it (NLW, Powis Castle Deeds, MSS 3646). By the 1780s there were complaints that people were taking over mines not for the minerals but for

the profits that could be made out of the subsistence provision provided to the miners (Lewis 1967, p273). The downturn in mining and employment appears to have brought an end to the use of subsistence. These are just two examples of the many managers that abused the subsistence system. The impact on the life of mineworkers that these practices caused cannot be underestimated. The enrichment of mine agents was achieved at the cost of a cycle of abuse of the payment system, debt for the worker and to all intent slavery of a mining workforce.

Subsistence Scheme and the Esgair Mwyn Account Books

The Esgair Mwyn account books of 1749 to 1755 outlined details of the subsistence provided to the mine's employees. Although these details were limited, when used in conjunction with other documentation, an insight into a relatively well-run version of a subsistence system was possible, enabling an understanding of what the mineworkers bought, ate and where they lived. Research into the account books covering Esgair Mwyn between 1749 and 1755 showed two specific phases of the mine giving subsistence. The initial phase covered the period when the running of the mine was first being taken over by the Crown. During this phase the majority of subsistence was in the form of food with a minority of people received subsistence in cash and goods. The second phase began in early 1753 when, with the exception of a few cases, subsistence was given as cash. That the first phase, in the form of food, is most likely a reflection of the upscaling of the workforce new into the area, needing food rather than payment. The second phase, when cash was given, can be seen as a reflection of the workers now being integrated into the local population with the knowledge and links to buy food and goods locally, presumably at a cheaper price and without contract to the mine.

The Esgair Mwyn accounts indicated that the majority of the workers were forced to take up subsistence at some point during their employment. In the 1752/53 accounts only twenty workers did not make use of subsistence, although it is not known why. Interestingly, all but one of the stem captains and none of the ore weighers or management took up subsistence either (NLW, Powis Castle Deeds, MS 9110). As these were the highest paid workers at the mine it suggests that they had accumulated enough income or resources to survive without it. Between

23rd September 1752 to 22nd November 1752), of the 183 workers listed in the audit books, 125 asked for an advance of either money or food. Of these, 500 received one advance of cash, while 31 received two cash payments (NLW, Lewis Morris Manuscripts, File 602D). While a William Clocker received a single payment of £1/19- (the equivalent of thirty-two days wages at 12d a stem) the largest subsistence payment made in the accounts (NLW, Lewis Morris Manuscripts, File 602D).

Items Purchased by the Miners

The account books showed that a large proportion of workers who claimed subsistence asked for food (NLW, Lewis Morris Manuscripts, File 602D). The most common food bought was cheese, which 33 workers purchased (NLW, Lewis Morris Manuscripts, File 602D). Cheese was sold by the pound, with the average weight purchased being 11lbs at an average cost of 4d a pound. The second most common food purchased were cereals, of which rye was the most popular, bought by 11 workers. Corn was requested by three workers, while wheat and pil corn (a type of naked oat called pillas) was taken by one person (NLW, Lewis Morris Manuscripts, File 602D). The cereals would most likely have been used to make bread, broths and porridges. The popularity of these items suggests that the staple diet of the workers at Esgair Mwyn had been mainly bread and cheese. Cereals and bread are versatile foods and would have been used to bulk out other foods such as broths and stews. As well as the staple items, four shillings worth of jam was bought by a cooper named Hugh Williams from the merchant Valentine Owen, under subsistence (NLW, Lewis Morris Manuscripts, File 602D). This was the only mention of jam and the price paid seems to have been high compared to other foods sold. Although the amount of jam supplied was not mentioned, the price suggests that it was a large amount. This one-off supply of a large quantity of jam was especially unusual as there was no mention of honey or sugar, for which jam may be used as a replacement. As the Jam was supplied by a merchant it could be that the jam was bought in bulk, to be divided between other miners. If so, why was the jam not being made by the local wives? Was it possible that there had been a poor spring and so fruit had been scarce that year? It may have been used to make traditional medicine such as Rosehip Syrup, which is still used as a remedy for arthritis and

inflammation, common complaints amongst miners (Roberts and Cox, 2003, p. 31). It is hard to imagine that the miners would not have sought out foods to augment their diet, including seasonal wild foods such as berries, mushrooms, dandelions, nettles and fennel found in hedgerows (Black, 2020). It was also highly likely that they gathered eggs from nests, trapped and eaten small birds such as sparrows, thrushes and blackbirds, adding much needed protein to their diets. Poaching rabbits and fish off local or Crown land was an option to those who were willing to risk the penalties (NLW, Powis Castle Deeds, MS 21935). Only five workers were recorded as receiving alcohol on subsistence; Richard Gho bought 6d worth, William Evan of Rhos 3d worth, Jamie Macdonald 3d worth, William Cavnach 6d worth and William Evan 6d worth of ale. Interestingly these were all dated to 28th of February 1754 (NLW, Powis Castle Deeds, MS 91930). This raised the suggestion that these men were friends possibly celebrating a wedding or birthday or even commemorating the death of someone.

One feature the subsistence accounts did not show was the food taken underground or the social aspects that food played in the lives of these people. Food taken underground by miners needed to be easy to carry and eaten without the need for bowls, which would have unnecessarily increased their load. Foods would likely to have been similar to a pasty, highly seasoned so as to cut through the dust that often blocked a miner's palette. By the 20th century British coal miners were taking flasks of hot Oxo, Bovril or other peppery drinks for this purpose. The 18th century miners would have no doubt had a drink which achieved the same ends. Naturally the accounts did not discuss when and where the miners ate. However, there has always been a strong social aspect to meal breaks underground and it is unlikely that it would have been different at Esgair Mwyn. Men would have gathered in convenient meeting places such as tunnel junctions, eating while discussing important work matters away from managerial interference. Meal times were also places when people learnt about each other, their lives and backgrounds. This would have been particularly advantageous at Esgair Mwyn where the workforce had come from a wide range of geographical locations and backgrounds. As such, time spent finding commonalty between people while eating would have helped form bonds between workers who relied on each other for their safety. The information in the subsistence accounts books was an important aspect to understanding the nutritional and social value of food

consumed by miners in Cardiganshire in the 18th century, and is an area that deserves further research.

Credit for Goods

Credit for goods was also provided as part of subsistence. The items purchased were necessities such as lanterns which merchant Valentine Owen, sold to five of the workers at a cost of 2/2d. Other more unusual items supplied included a hat for Jenkin William for 4/- (NLW, Lewis Morris Manuscripts, File 602D). The price of four shillings was equivalent to four days wages for a miner and even taking in to account the additional expense of it being a rural area, this hat seemed expensive. One of the most likely explanations was that the hat was related to working in wet conditions such as shaft sinking. Sinking shafts was a notoriously dangerous occupation for miners as they were working in conditions where water poured down into the shaft after the breaching of the water table. This water eroded the shaft sides bringing with it loose material. In later periods, to protect them from the water and potentially dangerous missiles, the shaft sinkers often wore thick coats and wide-brimmed hats that covered and protected their head, neck and face. These hats would have also been worn when working in a stope (driving upwards) in wet and unstable strata. The investigation into historical work clothes is an interesting subject and is also something that again deserves further research. In addition, to purchasing from merchants, miners at Esgair Mwyn could use subsistence to buy from local farmers as in the case of John Adams, who bought hay worth 10/- from a farmer named Rowe (NLW, Lewis Morris Manuscripts, File 602D). Although the weight of the hay was not given, the amount paid was equivalent to eight and a half days of Adams pay. It seems that this amount would have been far more than was needed for domestic use such as bedding suggesting it was probably feed for animals. If this was the case, it implies that while Adams' had worked as a miner, he had also owned animals and probably lived on a smallholding which he had, in part, supported using subsistence.

Accommodation Charges

Another important element of subsistence was the payment for accommodation. Many of the local workers would have had their own homes as was the case of

Edward Bradshaw who lived in a cottage on the edge of the mine site. This house which was marked on Lewis Morris' 1754 map of the mine and was identified during the survey of Esgair Mwyn. However, the influx of workers into the area, as happened in the 1750s, would have put considerable strain on the local housing stock. This can be seen in correspondence between John Paynter and the Earl of Powis where Paynter complained that Chauncey Townsend, Manager of Lon Glas, had bought up all the available housing in the area for his miners (NLW, Powis Castle Deeds, MS 2999). In order to address this problem barracks were often built at mines to house the miners (Lewis, 1967, p.41). There however no record of any such buildings be constructed at mines in the research area.

The only accommodation provided for workers at Esgair Mwyn was a house that had been leased for accommodating soldiers and was later reused to provide housing for William Jones, Assistant Agent and Evan Williams the surveyor of the Crown Wastes. (NLW, Powis Castle Deeds MS 21935, inner front cover). This would have been a reflection of their status and their need to be at the mine to carry out their duties. There could be a number of reasons for the lack of barracks, first to save the cost of building and maintaining it and secondly that mining at Esgair Mwyn was so attractive the workers had been drawn from other mines close by or thirdly that people were willing to live in temporary camps until they found accommodation within walking distance. The reality is probably a mixture of these strategies. A number of the mine workers had the cost of their accommodation paid directly to landlords as part of their subsistence. In some cases, it was possible to identify the location of where the miners had lived. David John Evan used £1/-/4d of subsistence to pay William Jones. It would appear that Jones had lent Evan money to pay his landlord Evan Edwards for lodgings at Ysbyty Ystwyth. In another case John Jones, originally from Llang y Mog, received subsistence in cash to pay David Williams of Ffair Rhos for lodgings. John Hope, who had also lodged in Ffair Rhos, used 2/- subsistence to pay someone described simply as the "Old Woman" for his lodgings (NLW, Lewis Morris Manuscripts, File 602D). The locations of the rooms being rented were all within walking distance of the mine. Many of the payments made for lodgings were through third parties, who were possibly acting as intermediaries, and that the payment was a repayment of a loan already made for the rent. The credit given for lodgings worked as an advantage to the mine lease holders who, if the scheme had not existed, would have had to construct barracks for the workers to

live in, as had been necessary at Cwmystwyth in the 16th century (Lewis, 1967, p. 41). The money received would have given extra income to those renting out the rooms, however, housing so many workers would have led to overcrowding.

Despite the advantages created by the new mines, the flood of new workers in to the area and the problems with housing would undoubtedly have caused friction within the local communities. This influx of men would have altered the ratio of men to women which was likely to also have caused tensions. While the emotions of the workers were not recorded, the ease at which the Powells were able to gather together hundreds of men to seize control of Esgair Mwyn, may have been evidence of the resentment of the local residents against the incomers, including Lewis Morris.

Medical Care

Within the accounts, four workers received medical treatment paid through subsistence. Jenkin David Clerk, a labourer paid 10d, while miners Morgan David Jenkin and Robert Jones Drummer paid doctors' fees of 6/- and 23/- respectively (NLW, Lewis Morris Manuscripts, File 602D). The last reference of a payment to a doctor appeared in February 1754 with Blacksmith Griffeth Owen paying 1 shilling (NLW, Powis Castle Deeds, MS 29130, p. 6). Robert Jones the Army Drummer was an interesting case as he was a soldier who had been sent to guard Esgair Mwyn but also worked as a Labourer. The cost of his medical treatment at 23/- was significant and raises the question of why he paid for the treatment and did not go to the army surgeon. Was this an emergency treatment or it may have taken too long to reach the army surgeon. Conversely, he may have chosen a local doctor because he thought he would get better treatment.

These payments were evidence that at least some workers had access to medical treatments that were often unavailable to most of the working population at that time. While the accounts did not say what the miners were treated for, mining was a dangerous profession and often resulted in injury or illness (Donoghue, 2004, p. 283). While only four payments for a doctor were shown in these documents, the health of the workers would have been a consideration of the owners, especially when there was a shortage of skilled mine workers. This may have been one of the reasons that Chauncey Townsend wrote to John Paynter in November 1765 suggesting a form of insurance scheme whereby each miner

paid either a penny or halfpence a week to the mine agent in return for medical treatment by a doctor for themselves and their wives (NLW, Powis Castle Deeds, MS 2994). Although nothing came of this suggestion, it was interesting that it was being discussed at a time when Laissez-faire ruled supreme. That Townsend put forward this scheme was perhaps an example of his paternalistic attitude or alternatively it could be suggested that he was touting for work for his friend Doctor Lloyd who had recently established himself at Aberystwyth.

As said, prior to 1752 the majority of subsistence at Esgair Mwyn had been given in food and goods. However, by 1752 subsistence was being paid in cash, with the exception of the washers who still received the majority of their subsistence in the form of food. The change from food to cash was a natural progression following the taking over and expansion of the mine by the Crown which had led to an influx of workers into the area. These new workers had no accommodation or support to see them through until they received their wages which were paid quarterly in most areas and so the subsistence in food would have been essential. As the newcomers integrated into the local community however, they would have learnt where to obtain food and goods. Some may possibly have joined a squatter's settlement such as that at Rhos Gelli Gron and Troed y Rhiw as this would have given them land to grow food as well as access to cheaper food and goods, with the cash becoming more advantageous. The Washers however continued to be paid subsistence mainly in food. As the washing would have been undertaken by some of the poorest workers and females, it is likely that the food was used to feed the family.

The documents concerning Esgair Mwyn also provided an insight into the lives of some of the workers when away from the mine. It seems that food and alcohol played a large part of their leisure time. The Quarter Days were a day of celebration when Lewis Morris provided food and drink to the workers, wages were paid and new bargains agreed (NLW, Powis Castle Deeds MS, 21935, p.35).

The accounts indicated that there was no shortage of inns in the area and revealed that Lewis Morris had bought strong drink from nine of them (NLW, Powis Castle Deeds MS, 21935, p.34). As well as these social activities some of the miners would have taken part in religious activities, including attending the

large Methodist meetings that were starting to take place in that period. Methodism went on to form the basis of education and training for many of the future mining activist and proved to be crucial in the development of mining unions in the 19th century (Thompson, 1976, p. 47; Phillips, 1983, p. 430). The workers would almost definitely have enjoyed singing, dancing, gambling and playing games. Although the days off were limited to Sundays, other days that were celebrated included days where fairs were held, such as those at Ffair Rhos, a kilometre away. These travelling fairs had been held on July 15th, August 15th and September 14th and were the largest in Cardiganshire. Documents suggested that thousands of people had attended them in the 17th century (Jones, 1939, p. 95).

As well as these past times a few of the workers may have enjoyed reading as the research showed that some of the workers could read and write. One example of these workers is William Clocker. William was known to own a copy of the book *Llyfr Carolau a Dyriau Duwiol Y Trydydd Argraphiad* (Book of Carols and Godly Towers) by the Welsh poet Owen Foulk. A rare partial copy of this book is held in the National Library of Wales. This book contains an inscription dating to 1747 showing that it had belonged to the miner William Clocker who had worked at Esgair Mwyn (National Library of Wales, Printed Books/32). William Clocker would have been aware of the intrinsic value of the book, and possibly as a family heirloom, as it was later passed on to a John Clocker. It is possible that he bought the book and enjoyed reading the poetry within it. If this was the case then we can say that William Clocker was literate in Welsh and English.

Summary

The subsistence system was developed to attract and support the mining workforce. The system relied on an agreement that the employees would work enough days required to repay the advance and that the management would honour the bargains. The advantage to the worker was that they could gain employment at a mine and have access to food and lodgings until they received their wages. The advantage to the employer was that it attracted and maintained a dedicated workforce throughout the year at little or no cost to themselves. The disadvantage of the system was that it was often abused by mine agents who either paid workers with subsistence or placed excessive prices on goods in order to make larger profits.

The importance of all these documents concerning subsistence, which included the Esgair Mwyn accounts and correspondence, cannot be underestimated. They enabled an exploration into the lives of the people involved in mining and the society they lived within. Characteristics of people could be interpreted between the lines such as Lewis Morris's arrogance, Chauncey Townsend's paternalism towards his workers and Balls uncaring manipulation of both owner and worker. The documents confirmed that members of the aristocracy held the real power within society and that they used their patronage to achieve their own goals. Yet despite this imbalance of power, workers were not mere units of production. Indeed, the workers lives were not monochrome but were more varied and colourful with many enjoying a richer life than has been presented in past research.

6.4 Esgair Mwyn Management Team

Between 1751 and 1756, Lewis Morris was employed both as Superintendent of the Crown Mines in Cardiganshire (until 1756) and as Mine Agent at Esgair Mwyn. As Mine Agent, Morris oversaw four other members of the management team: Oliver Lewis - Grove Steward, Evan Williams - Surveyor of the Commons, John Owen - Mine Agent and William Jones - Assistant Agent. Oliver Lewis and Evan Williams were employed to look after a team of miners working on the Crown Wastes while John Owen and William Jones oversaw the running of the mine. Their duties included overseeing the daily expenditure on wages, goods and services. This section discussed the roles of the mine agent and the management team.

In 1751 Morris was appointed Superintendent of the Crown Mines in Cardiganshire, which included the role of mine agent at the Crown Mine Esgair Mwyn. He held this post until his dismissal in January 1756 (Thomas, 1901, p. 50). In this role, Morris was responsible for the Crown Mines and the mineral deposits on the Crown Wastes (Thomas, 1901, p. 50) and received a generous salary of £500 a year plus expenses (NLW, Powis Castle Deeds, MS 21935, p. 64). Morris also received incomes from his role as Customs Officer at Aberdovey, personal profits of £270 per annum from his mine leases plus profits accrued as a bargain taker at Esgair Mwyn in 1751 (Davies, 1907 p. 268). Morris became a very wealthy man.

As Mine Agent, Morris's main duty was to oversee its expansion from a small mine worked by four miners to one employing over 200 workers. Morris (undoubtedly with advice from his most trusted miners) decided where the shafts were to be sunk on the lode and how the mine was to be worked and drained. In order to achieve this task Morris was permitted a substantial budget by the Crown for purchasing equipment notably from former bargain holders (including himself) as well as extra tools, timber and gunpowder that were required to equip and run the larger mine (NLW, Powis Castle Deeds, MS 21935, p. 25). Morris also oversaw William Jones the bookkeeper who recorded payments, as well as the stems worked and subsistence issued in the Day Book and Quarterly Account Books (NLW, Cwrt Mawr, MS 852E/3), (NLW, Powis Castle Deeds, MS 21935).

Part of Morris' responsibilities included communicating with the Crown representatives, reporting to them what was happening at the Crown Mines and on the Crown Wastes. Morris's letters to the representatives confirmed that he had an excellent understanding of Cardiganshire mining and the politics of patronage. Unlike many of his contemporaries, Morris had clearly observed the miners working the ore underground as the way he described visiting the old workings at Esgair Mwyn in his 1765 booklet *The History of the Crown Manor of Mevenyth* (NLW, Powis Castle Deeds, MS 21900), highlighted his mining knowledge. Morris described the different techniques of removing mineral that had been used by previous, early miners at Esgair Mwyn and, as importantly, how their techniques differed from those used by his current miners (NLW, Powis Castle Deeds, MS 21900, chapter 18). In an effort to find potentially valuable mines for the Crown, Morris ordered a detailed survey of the Wastes to be undertaken (NLW, Powis Castle Deeds MS 21935, p. 63) and using his knowledge of the Welsh language he personally questioned miners and shepherds as to whether they had found any new deposits. He also advised landowners to ask their employees to report any mineral deposits they had seen. His efforts led directly to the discovery of several new mineral deposits and the opening of at least three new mines which were Llwyn y Llwyd, Llyn y Gwyddyl and Dyffryn Cottage (NLW, Powis Castle Deeds, MS 21900, chapter 18).

Morris' management style was paternalistic, treating the miners with respect while acknowledging that they were of lower status, and paid them accordingly. This was in marked contrast to other mine managers who saw miners as outsiders, a

source of labour and as a captive market to whom they could sell goods at inflated prices. Morris even made an effort to pay wages that were due to his workers even when he felt that they had betrayed him, as in the case of those accused of rioting against him in 1753 (NLW, Powis Castle Deeds MS 21935, p. 57). Like many men of wealth at that time, Morris practiced nepotism, using his position to appoint members of his family into lucrative positions including his nephew John Owen who he appointed as Mine Agent at Esgair Mwyn. Morris' style of management was in stark contrast to his contemporary, John Ball who was accused of using his position as Manager of Grogwynion mine to rob the lease holder Chauncey Townsend and the miners he employed (Lewis, 1967, p. 106). Despite being accused of being a less than competent miner by Townsend, Morris and John Paynter, Ball went on to manage a number of mines for the Earls of Powis and Lisburne (Lewis, 1967, p. 106).

Oliver Lewis – Grove Steward

Oliver Lewis was a Grove Steward employed by Lewis Morris in 1749 to supervise the miners who had taken a bargain to work on Crown lands, including those who were to reopen Esgair Mwyn (NLW, Powis Castle Deeds MS 21935, p. 57). The work undertaken by Lewis at Esgair Mwyn was in two parts. The first part was during the twelve weeks from July to October 1750, when his duty was to report to Lewis Morris the progress being made at Esgair Mwyn. This implied that Lewis was literate, setting him aside from some of the stem captains. In addition, he was to ensure that the Crown received the correct duty owed for ore produced. For this, Lewis was paid nine shillings a week. For the following 40 weeks he was paid by the bargain takers themselves earning £18 (NLW, Powis Castle Deeds, MS 21935, p. 57). This last part may have been in recognition of his experience as a miner and which would have been an asset after finding the rich ore deposits (NLW, Powis Castle Deeds, MS 21900, chapter 13). In the story of Esgair Mwyn being reopened, Lewis was barely mentioned. There were, however, indications that he may have been written out of the mine's history on purpose due to the role he played at a pivotal time in the mine's history. Lewis was working at Esgair Mwyn when the new rich deposits were discovered. The bargain to reopen Esgair Mwyn had been set in June 1751 with new ore deposits being found in July 1751 (NLW, Powis Castle Deeds, MS 21935, p. 57). This

would put the successful trial at the time when Lewis had been working at the site.

Interestingly, in his booklet, *The History of the Crown Manor of Mevenyth* (NLW, Powis Castle Deeds, MS 21900) Morris wrote that after the early attempts to reopen the mine had failed, he had ordered further trials to be made on the south side of the old workings which successfully found the rich ore deposit (NLW, Powis Castle Deeds, MS 21900, chapter 13: NLW, Powis Castle Deeds MS 21935, p. 1). While the miners were included in this article, Oliver Lewis was not. His role has been erased. Morris writes as if he himself was at the site when the new deposits were found. This is unusual as Morris's letters, which are comprehensive, also contained no mention of his being at the site when the important find was made. There was also no claim for expenses for visiting the sites on the Common at that time has been found.

The removal of Oliver Lewis from this document raises the possibility that it was Lewis not Morris who ordered the miners to excavate on the southern side of the old workings which led to the discovery of the rich deposits that had brought Morris so much esteem and financial gain. It would have been within the remit of Lewis as a supervisor at a seemingly insignificant site to make a decision to look for mineral veins. This idea is given weight by a map dated to 1754 which showed that a number of trials had been made on the mine site looking for mineral veins (NLW, Powis Castle Deeds, MS 1646-7). That Morris claimed the discovery as his own would have been in accordance with common practice at that time, as shown by Shapin (1989, p. 554) in his article, '*The Invisible Technician*'. This would also have fitted with Morris's trait of self-promotion which is so evident in his writing. The reason for this would have perhaps been to impress Lord Powis on whom patronage Morris was so dependent and to who the booklet was dedicated. The true story, however, will not be known unless new documentary evidence is found. When Esgair Mwyn was transferred to the Crown, Lewis continued as grove steward being paid 18d a stem until at least 1754 (NLW, Powis Castle Deeds, MS 21935, p. 14). He did not, it seems, continue to work on the Commons, as in December 1752 that post was taken up by a former stem captain called Evan Williams

Evan Williams - Surveyor of the Commons

Evan Williams was the second Surveyor of the Commons. He had been employed as a stem captain in 1752 before taking over the position in December of that year (NLW, Powis Castle Deeds, MS 21935, p. 2). His duties included overseeing and a team of miners searching for new deposits on the Crown Wastes at distances of up to 19 kilometres from Esgair Mwyn. The team of workers varied over the term covered by the accounts but its core members consisted of miners Edward Lewis, David Williams, Morgan Evans, John Jenkins and John Rodrick (NLW, Powis Castle Deeds, MS 21935), (NLW, Powis Castle Deeds, MS 21929). Evans had good communication and literacy skills which he used to report his findings to Lewis Morris. Williams's wages were 18d a day plus expenses, which included the upkeep of a horse. That he had a horse indicates that Eavans would be supervising several sites at the same time. Unusually, William's wages were not included with the pay of other miners. Instead, he was paid directly by Lewis Morris. Morris estimated that Williams had worked 150 days during the years 1752-1754 for which Morris paid him £10, two years in arrears (NLW, Powis Castle Deeds, MS 21935, p. 63). It is not clear why the salary was paid so late but after 1753 Williams's work as surveyor was reduced and he combined surveying with other roles. At this Evans lived in a house that had formally been rented for the soldiers at Llwyn y Mwyn called Cilfach y Rhew (NLW, Powis Castle Deeds MS 21935 p 37). Williams also acted on behalf of Morris, purchasing woodlands in his name from Mary Richard of Havod y Goven in November 1753 (NLW, Powis Castle Deeds, MS 21935, p. 40). Perhaps to tide him over until he received his wages, Williams sold various goods and services to the mine. In November 1753 he sold £6 worth of bedclothes to Morris for the soldiers who had been sent to guard the mine. In 1754 he sold £3 worth of dried turf (peat) to heat the mine houses and for the smithy fire (NLW, Powis Castle Deeds, MS 21935, pp. 39, 63). This was a large amount of turf and indicated that Williams either owned a farm or smallholding which included an area of peat or he had rights to peat from nearby land. The fact that Williams had to make reports and that he acted for Morris buying woodlands indicated that he was both literate and numerate. While his ability to wait two years for his wages and still buy products to sell to Morris implied that he had a considerable amount of disposable income. As mentioned in the section on women, Williams' wife Jane, also earned

money from the mine by carrying out a number of duties, which included washing bedding and feeding important visitors to the mine (NLW, Powis Castle Deeds, MS 21935, p. 65). One assumption could be that the extra duties awarded plus the opportunity to sell to the mine afforded to Williams and his wife had been due to their good relationship with, and the patronage of, Lewis Morris. Morris in return must have seen attributes in the couple that he found useful or admired.

Both Evan and Jane Williams appear to have been intelligent, hard-working and, as important, loyal supporters of Morris. This can be seen in a terrifying event that took place in April 1755. Williams had been instructed to move into the mansion house at Esgair Mwyn with his family and take care of it while Morris was in London defending a lawsuit over the ownership of the mine. On April the 4th 1755 Chauncey Townsend (a lease holder of other mines in the area) arrived at the mansion house along with 150 men. Townsend demanded that Williams and his family vacate the property and hand the keys over to him (presumably so he could install his own man to control the mine). This must have been very frightening for Williams and his family, but despite this, he refused to leave and eventually Townsend backed down and his men left leaving Williams still in control of the house (NLW, Powis Castle Deeds, MS 1169). This last event showed that Williams was not only loyal to Lewis Morris but also a man of courage and resolve.

John Owen - Mine Agent

Following his promotion to Superintendent of the Crown Mines in Mevenyth in July 1752, Lewis Morris appointed his nephew, John Owen, as Mine Agent (Thomas, 1901, p. 45). This position carried the combined duties of both Agent and Bookkeeper of Esgair Mwyn for which Owen received a salary of £50 per annum (NLW, Powis Castle Deeds, MS 21935, p. 32). As Mine Agent, Owen was responsible for the day to day running of the mine and was given allowances to make and pay bargains. He was also authorised to buy items locally and pay for the cost of transporting the goods needed to the mine (NLW, Powis Castle Deeds, MS 21935, p. 64). Owens, on the face of it, was a good choice for the position being both numerate and literate and with the ability to communicate in Welsh and English with his workforce (NLW, Cwrt Mawr, MS 742). However, the account books show that after Lady Day 1753, the majority of the transactions had been

made by either Lewis Morris or the Assistant Agent William Jones, who had taken over as Bookkeeper from Owen. This indicates Owen may have been losing interest in the position, and was instead dedicating his time to other things. It would also appear that Owen and Morris's relationship was declining. In January 1755 Owen was called to London to help Morris defend a legal dispute concerning the ownership of Esgair Mwyn. After his arrival Owen became increasingly critical of Morris in his letters to other family members. He criticised Morris's attitude towards him, describing Morris as the fat man who was interested in nothing but money. Morris, despite showing his affection for Owen in his correspondence, also had misgivings writing to his brother that Owen was too quick to complain and had no outstanding qualities as a person (Jenkins and Ramage, 1951, p. 27). Given this statement it would seem that Owen, like other members of Morris's family, had received his position simply because he was a close relative of Lewis Morris and not because he merited it.

William Jones - Stem Captain, Assistant Agent and Bookkeeper

Jones was appointed by Lewis Morris following the transfer of the mine to the Crown to the position of Stem Captain and subsequently Book Keeper. He was then promoted to Assistant Mine Agent. In the Michaelmas Quarter of 1752 Jones was paid 18d a stem (NLW, Powis Castle Deeds MS 21935, p. 10). Interestingly, this amount did not increase despite being given more responsibilities during his employment. At the same time, Morris was receiving £500 per year and John Owen (Morris' nephew) was earning £50 per year for essentially undertaking the same duties. The differences in wages between these men was not related to ability but a reflection of the class and patronage system society operated within, with Jones regarded as a lower class than Morris. While we can say little about Jones' personality, letters written by Jones plus the account book's he completed showed that Jones had excellent literate and mathematical skills, and indicated that he had received more than a rudimentary education. This education had enabled him to rise above other miners to a position of power and respect. Unsurprisingly, Jones was in a minority, being one of 41 of the 170 mine workers who could sign their name for subsistence. Of these only 23 had a confident and flowing signature that indicated they were used to writing (NLW, Lewis Morris

Manuscripts, File 602D). The inability to write well would have prevented workers no matter how skilled a miner they were from progressing beyond Stem Captain.

As part of his duties Jones was required to live on site and work in the mine offices which Morris rather grandly described as a mansion (NLW, Powis Castle Deeds MS 21935, inner front cover). Because of this he would have been intimate with workers but aware of his position and the power he had to affect the lives of others. This can be seen in his letters to Lewis Morris but perhaps the best example was found in his jottings on the back cover of the Day Book of Subsistence 1753/54, where Jones had practiced writing his signature. This was evidence that Jones saw that the way he wrote was a reflection of his abilities and how he would be judged, believing the better the hand writing the more educated he would be thought to be. The most striking part of these jottings was a statement that had been written over and over again, on different days (as can be seen by their position on the page). The statement was *Be courteous to all but familiar with few* (NLW, Lewis Morris Manuscripts, File 602D). This was undoubtedly a phrase he had chosen to practice his handwriting, it however the choice of phrase showed how he saw his precarious position between the workers and management, with his need to be seen as neither too close to the workers nor as classing himself as being equal to his superiors with the danger that people would try to use him for their own benefit.

While it can be speculated that Jones would have felt frustration at the inequality of his role, and the rewards he received this was not evident in the surviving documentation, and it is unlikely he would have openly questioned it. As indicated by the above phrase, it maybe that Jones would have grumbled to himself and very trusted friends about the short coming of individuals but accepted his status as part of the working-class system. Jones, as far as can be seen, had a good relationship with Morris and had been loyal to him even in trying circumstances, by defending his employer's interests when Chauncey Townsend and a mob took control of the Esgair Mwyn in 1755 (NLW, Powis Castle Deeds, MS 1169).

Interestingly, Jones was the only member of the management team who had experience of working underground as a stem captain (NLW, Powis Castle Deeds, MS 21935, p. 4). Initially, Jones was recorded in the accounts along with the miners and labourers, indicating that his work was concerned mainly with the production process. This changed on Lady Day 1753 when Jones was appointed

Bookkeeper as well as Assistant Mine Agent and his name was no longer included with the manual worked (NLW, Powis Castle Deeds MS 21935, p. 14). This was not simply because Jones was overseeing the recording of payments, it was a mark of his change in status. After his appointment as Bookkeeper Jones took over the day to day running of the mine from John Owen, Mine Agent and from Midsummer Quarter 1753 it was Jones and not Owen who was responsible for the orders and payments for the mine (NLW, Powis Castle Deeds MS 21935, p. 35). Jones also became responsible for providing provisions and housing of the soldiers guarding the mine, and for the payment of rent for a house at Llwyn y Mwyn (NLW, Powis Castle Deeds MS 21935, p. 37). This was unusual as previously properties leased by the mine had been the responsibility of Lewis Morris. This new duty may have been an acknowledgment of Jones's abilities and the growing trust between them. In January 1755 Morris and John Owen were called to London and Jones took over full management of Esgair Mwyn (Thomas, 1901, p. 45). Jones' responsibilities included overseeing the winding down of the mine when it was put on what would today be called Care and Maintenance (where a mine is kept open but not worked) while its ownership was being established in London. His duties included overseeing the dismissal of all the Esgair Mwyn workforce, with the exception of the pumpers who were needed to prevent the mine from flooding again. The court case went against Morris leading to his dismissal from Esgair Mwyn. Jones continued working at the mine for the new Mine Agent John Paynter, as in 1776 he was recorded carrying out dialling (surveying the underground workings) and looking for new mineral deposits (NLW, Powis Castle Deeds, MS 3113). Jones's mining skills were again recognised in 1760 when John Ball came under criticism by his employers John Paynter and the Earl of Powis for the time taken, and his inability, to complete the driving of the drainage adit at Esgair Mwyn. When Paynter brought in outside experts to look at the work Ball responded by deploying Jones (who was still working at the mine as miner) to survey and oversee the finishing of the drive (NLW, Powis Castle Deeds, MS 3113).

The Mine Workers Working Week and Wages

The normal working week for Esgair Mwyn workers appears to have been six days, with extra pay for work undertaken on Sundays and Saint Days (equivalent

to bank holidays). This was the same as the standard working week in mining across England and Wales, which was noted in *The Miners Dictionary* (Hooson, 1747), and in the accounts of the Keswick mines owned by the Hechstetter family (Hammersley, 1988, p. 21). The normal length of a working day underground (called a Stem), was eight hours, which did not begin until the miner reached his starting workplace, sometimes several metres from the entrance (NLW, Powis Castle Deeds, MS 29130). Each stem was measured using a Watch-Candle which was placed in a well-ventilated area so that it burned at a steady rate for the eight hours (Lewis, 1967, p. 269).

The workers at Esgair Mwyn were paid on a day wage rate as opposed to a mutually agreed bargain which was more usual at that time in Cardiganshire mines (Lewis, 1967, p. 267), (NLW, Powis Castle Deeds, MS 21935, p. 1). This raises the question as to why Morris had chosen to pay his workers this way. The decision to pay a day wage could have been the result of a recently negotiated bargain Morris had made with miners to reopen Esgair Mwyn. Morris made the bargain based on the reopening of the old workings, but as discussed in Chapter Five, a new lode was then discovered resulting in the mine proving to be much richer than thought. Because of this unexpected turn of events, those who had made a bargain made a great deal of money with little return to the Crown who owned the mine (NLW, Powis Castle Deeds, MS 21900, chapter 13). Unsurprisingly, it was expected that Esgair Mwyn would continue to be very profitable and produce large amounts of easily extractable ore and as such it was in the owners' favour to employ workers on a day wage, thereby maximising the Crown's profits from the mine. This would also have been an advantage for the workers who accepted employment on a day wage as they received a guaranteed payment per stem worked, as opposed to the riskier bargains which rarely made the returns they hoped for. At that time, as well as the advantages of a set wage and regular work, miners also had their tools, candles and gun powder provided. This was unusual at that time and would have been seen as a monetary advantage as other Cardiganshire mines workers were required to buy these from the mine agent, often at inflated prices (NLW, Powis Castle Deeds, MS 9110). (NLW, Powis Castle Deeds, MS 21935, p. 29) (Lewis, 1967, p. 267).

6.5 The Underground Workers

The Stem Captain

There were 19 stem captains recorded in the Esgair Mwyn accounts earning the highest day wage of 16d a stem which was only equalled by the timbermen. The Stem Captain was an employee whose duties was to ensure that the instructions of the Mine Agent were carried out. He was, in effect, a Charge Hand who worked with and supervised a group of workers undertaking a defined task. This was a well-established role that had been in use for many years throughout England and Wales (Hammersley, 1988, p. 106). At Esgair Mwyn the stem captains received their orders from the mine agent before meeting their team at the start of the stem on the porch of the bookkeeper's house. The stem captain outlined the Agent's instructions, issued the materials and tools required and deployed the team to their work areas (NLW, Powis Castle Deeds MS 21935, p. inner flyleaf). stem captains would have been chosen from their specialist areas, for example, miners supervised miners, timbermen supervised timbermen and pumpers supervised pumpers. Unlike agents, the stem captains only received their higher rate of pay when working as a supervisor. When not supervising they received the normal pay rate for that job. This can be seen in the case of William Richard who worked 63 stems as a stem captain at a rate of 16d per stem, and 18 stems as a miner at the lower rate of 14d per stem in the Christmas Quarter 1752 (NLW, Powis Castle Deeds MS 21935, p. 4).

Timbermen

Timbermen, alongside the stem captains, were the highest paid day wage workmen, receiving 16d a stem. According to the Esgair Mwyn accounts, one stem captain and three men were employed as timbermen, with a further five men working in the role as a secondary occupation. It is not clear what the role of a timbermen was, as the records did not describe it. Interestingly, there has not been any explanation of this kind of employment found in any mining literature either. It can however be said with certainty that timbermen were not coopers, carpenters or persons employed in cutting and sawing timber, as these were mentioned separately in the accounts as trades in their own rights. The accounts

showed that timbermen and miners were the only people who undertook the task of timbermen so it can be taken that it was related to underground work. While their title implies that they were using or working with timber, they were not installing or repairing wooden pump pipes, as this was noted in the accounts concerning watermen. The timbermen appear to have worked an average of 60 stems a quarter, implying that they were undertaking tasks that needed to be carried out on a regular basis (NLW, Powis Castle Deeds MS 21935). Therefore, it was most likely that the work these men undertook was installing wooden roof supports and making booming's (platforms) for the miners to work on. Timbermen may also have maintained the wooden shaft linings, as these would have needed to be repaired on a regular basis. These types of work would have been heavy and dangerous, which may have been reflected in their high wages of 16d per stem (NLW, Powis Castle Deeds, MS 21935, p.1). Just how dangerous the work was can be seen in the death of two miners in 1768 who were killed when the wooden lining of one of the shafts at Esgair Mwyn gave way, crushing the men working there (NLW, Powis Castle Deeds, MS 3861).

Miners

There were on average 80 miners recorded working each quarter at Esgair Mwyn in accounts between the years 1752-1754. In addition to these 80 men another ten miners were being paid a day wage to work at Nant y Craig before transferring to work under a bargain (NLW, Powis Castle Deeds, MS 21935, p. 55). The highest paid miners received 14d a stem while the lowest were paid 8d, with the average wage being 12d a stem (NLW, Powis Castle Deeds, MS 21935). No explanation was given as to why the rates of pay varied. However, it seems reasonable to assume that the miners were paid according to their skill set and that those who undertook the highly skilled or dangerous jobs were paid the higher rates. This can be seen in the accounts under John Paynter's management in 1788 when Esgair Mwyn shot firers were paid 12d and other miners were paid 10d a stem (Rees, 1968, p. 571). It is also likely that the variation in pay rates related to the difficulties of the work going up in scale for those who worked in places with hard strata or in very wet conditions. One of the lowest paid miners was John Hope junior who received 8d per stem. While little is known about him, it appears that he had previously laboured for his father John

Hope Senior (who had been paid 14d per stem) (NLW, Powis Castle Deeds, MS 21935, p. 8) and it may be that his low pay reflected the fact that he was being trained by his father.

Many of the miners also worked in secondary roles as and when required by the mine agent. John Ellis was recorded in the accounts working as both a miner and a labourer in the Michaelmas Quarter of 1752. In these cases, the men were paid at the higher rate position. John Ellis was also listed as a miner / timberman in the Christmas Quarter accounts of 1752 earning 16d a stem. These dual roles seem, in some cases, to represent trial stages before being moved to the higher paid role. In the case of Ellis, he moved through the stages of labourer to miner to timbermen by Lady Day Quarter 1753 (NLW, Powis Castle Deeds, MS 21935, pp. 2, 4, 8). In other circumstances these secondary roles related to work undertaken away from the mine. This was the case of miner Hugh Williams who had been made a temporary stem captain to oversee men felling wood for use at the mine. Another entry showed that miner John William David had been paid £2/6d for charking wood (drying wood or burning the surface of wood to make it waterproof) in the Michaelmas Quarter of 1754 (NLW, Powis Castle Deeds, MS 21935, pp. 10, 20). These observations show several things; first, that there was a formal demarcation between job roles within the mine. Second, that people who had the skills and opportunity, could move from one job up to another. Third, that workers appear to have undergone trial periods before being accepted for the higher paid and more skilled roles.

The role of miners was varied and the men were paid to carry out a number of different jobs during the stem. Some would have cut ore from the soft rock or excavated sumps to collect water. Others would have shovelled the ore using normal and socket shovels (shovels designed to scoop material from narrow veins and openings) (NLW, Powis Castle Deeds, MS 21935, p. 31). In the accounts, references were made for large amounts of gunpowder and associated items that were bought and used at the mine.

These items, along with the gunpowder, tell us several things about the conditions in the mine. The purchase of several sets of blasting tools indicates that there was more than one team of shot firers employed (NLW, Powis Castle Deeds, MS 21935, p. 31). That large quantities of gunpowder were regularly purchased indicates that the strata were extremely hard. The listings of greaseproof paper

and clay show that the mine workings were wet as waterproof cartridges had to be produced and the shot holes made watertight. The special straw fuses rather than the use of feathers confirm that the shots were fired in wet conditions. This is confirmed by the accounts which show that by 1752 miners at Esgair Mwyn were having problems with water gathering within the mine (NLW, Powis Castle Deeds, MS 21935, p. 26). This would have made the work of the shot firing team difficult, as it was imperative that the gunpowder be kept dry at all times. At least two men would have had to work together to drill the shot holes. They would have made up the waterproof cartridges and placed them in the shot holes, which were then sealed with stemming made of clay. A hole would have been made through the clay down the bore as far as the charge. This had to be done with great care as the steel rod could catch against the rock causing a premature explosion. Finally, a fuse straw would have been placed into this cavity, at which point the miners would have been evacuated to a safe distance. They would then fire the charge. After firing, the miners would dress the rock in the area of the explosion using augers (removing loose rock from roofs and walls), and the timbermen would assemble and position any timber required to support unstable strata (NLW, Powis Castle Deeds, MS 21935, p. 31). All the valuable ore would then have been removed.

The Pumpers / Watermen

Pumpers (also known as Watermen) was the name used in the accounts to describe the men who worked the pumps that removed water from the mine. Forty-one men were employed in this position between 1752 and 1755 and were paid between 10d and 12d a stem. The normal working week was six days; however, it was often necessary for the water to be pumped out on Sundays and Saints' Days. For working these extra days, the men involved were given enhanced payments (NLW, Lewis Morris Manuscripts, File 602D, p. 32).

In the 1750s there were four drafts of pumps were being worked, which indicated that the water had been lifted out in short stages. This showed that hand pumps worked by men rather than by water or animal power had been used (NLW, Powis Castle Deeds, MS 21935, p. inner flyleaf). Morris had written to the Earl of Powis in 1763 explaining that his decision to use men instead of other methods was

based on economic factors (NLW, Powis Castle Deeds, MS P.1326). Morris reasoned that to pump out all the water that needed to be removed, it would be necessary to have four horses, each working six hours on a whimsy, lifting barrels of water out of the mine. This would have been more costly than using men as the horses had to be purchased, fed and housed. Drawing the water would also have been problematic as lifting water barrels could not be done at the same time as lifting ore kibbles, resulting in having to choose between either moving ore or removing water from the mine (NLW, Powis Castle Deeds, MS P.1326). Men did not need to be housed or fed by the mine owner and their wages were lower than the cost of purchasing and looking after horses. The manned pumps were also more compact, being pinned to the shaft wall, which meant that the water could be pumped out at the same time as ore was being wound up. This was important, as by that time, water pumping was being carried out around the clock. The records showed that between 3rd January 1755 and 13th April 1755, miners worked the pumps for 1,519 stems at a cost of £78/3/- (NLW, Powis Castle Deeds, MS 21935, p. 60). The pumps at Esgair Mwyn were of a suction type and were set within the shafts, enabling the water to be extracted in stages. At the first stage, water was collected and directed via drains into a sump made in the lowest part of the mine. From there, the water was pumped up around three metres to a pump on the second level. This process was repeated all the way up until the unwanted water reached the mine surface level where it was drained away from the site. The pump pipes were made from timber that had been especially chosen for its straightness, grain and length. It seems likely that this timber had been especially grown for this purpose by a Mrs Lloyd of Cwmnewidion (a small gentry estate around three kilometres to the north of Esgair Mwyn) at a cost of £1/12- as no suitable trees were found in any of the three woodlands Morris had bought for the mine. The timber was turned into pipes at the mine by John Rodrick, who bore out the tree trunks using specialist equipment bought from John Pugh at a cost of 10/6-. The metallic parts were the only pieces of the pumps made off site, having been constructed by William Richard at Pen y Wern (NLW, Powis Castle Deeds, MS 21935, pp. 40, 41, 42). All the initial costs for the parts and construction labour, including leather and nails, came to £8/7/8- excluding the pumpers wages. This demonstrates not only the expense of the construction of the pumps but also the complicated logistics that were involved in removing water from the mine using even the most basic technologies.

The pumpers, unlike other underground workers at Esgair Mwyn were not supervised by a stem captain but by the chief pumper, Evan David Edward and after 1755 directly by William Jones, Assistant Agent (NLW, Powis Castle Deeds, MS 21935, p. 21). The pumpers appeared to have worked in teams of two. This was presumably so that while one man pumped the other could be resting. In that way a constant rate of pumping could be maintained. In the wetter months when there was an increase in the amount of water entering the mine, the number of men working on each level was doubled from two to four to cope with the higher water levels. The accounts seemed to suggest that the pumpers worked with the same partner for up to twenty weeks. For example, teammates Rees Lloyd and Thomas Evan David worked a total of 120 stems together on the pumps between 3 January 1755 and 30 April 1755 (NLW, Powis Castle Deeds, MS 21935, pp. 60, 61).

As well as working the pumps the pumpers also helped with installing, maintaining and extending the system as the mine deepened. A team, consisting of a pumper, timbermen and cooper, was formed to maintain the pump barrels and renew the leather pipe unions and valves. The amount of leather, nails and wood bought by the mine suggested that this was a task that was undertaken on a regular basis (NLW, Powis Castle Deeds, MS 21935, p. 40).

The entries concerning payments for water control in the accounts were helpful in understanding when the mine had experienced water problems. In July 1752 when the mine was taken over by the Crown it was stated that only a small amount of water had gathered in the lowest part of the mine and that this had been removed at a cost of £6/6- (NLW, Powis Castle Deeds, MS 21935, p. 27). This indicated that at that time water ingress had not been a problem and that the workings had probably not breached the water table. This was supported by the list of workers, which in 1752, contained only one entry under pumper, David Edward, Chief Pumper. This suggests the pumpers were not required full time and that in their place miners or labourers had worked the pumps when needed (NLW, Powis Castle Deeds MS 21935, p. 21). The number of entries regarding the cost of removing water steadily increased from 1752 until the mine ceased production in January 1755. The end of production led to the majority of the underground workers including the head pumper David Edwards being dismissed (Thomas, 1901, p. 45). However, it was necessary to keep 24 men to work the

pumps at an average cost of just over £80 a quarter until the mine recommenced production under John Paynter in 1756 (Lewis, 1967, p. 103; NLW, Powis Castle Deeds, MS 21935, p. 90)

Underground Labourers

There were ninety-two men identified as labourers at Esgair Mwyn between the years 1752 and 1755. Although the accounts did not specify where these people worked, they did indicate that labourers were employed to work both underground and on the surface.

Labourers were the lowest-paid of the day wage workers, earning between 7d and 12d a stem, with the average wage being 10d (NLW, Powis Castle Deeds, MS 21935). No explanation was given for the difference in wages paid, but it was likely that the higher rates of pay were related to carrying out heavier work. William Lloyd was an example of this when he worked 91 stems at 10d a stem as a labourer and then two days at 12d a stem for undertaking heavy labouring at the Smithy (NLW, Powis Castle Deeds, MS 21935, p. 21). A number of men were recorded as labourer / timbermen and consequently paid a higher rate of 11d per stem but not the full timbermen's rate of 18d, implying that they specialised in labouring for the timbermen. Evan Lloyd of Caron was employed as a labourer at 11d and later as a mason, building a house at the mine at a rate of 12d per stem. Evan Lloyd was later employed as a mason to build a wall underground, which may explain why he received the higher labouring wage rates (NLW, Powis Castle Deeds, MS 21935, p. 20). The lowest paid labourers were John Ellis and John Hale who earned 7d, a stem, which if this premise is correct, would suggest that they were employed on easier underground or surface work (NLW, Powis Castle Deeds, MS 21935, p. 2). Despite being the lowest paid workers, the labourers were some of the most important and versatile members of the mines' workforce carrying out a wide variety of functions. As such the role of labourer would have been attractive to those who needed employment but did not have any previous mining experience. The majority of the unskilled men who worked as labourers at Esgair Mwyn would, in most cases, have been agricultural labourers as they had made up the majority of the 18th century workforce. Only

four labourers were written in the accounts with occupations not related to mining against their names.

The first was Evan Lloyd, noted above as a labourer and mason, while Morgan Lewis (who was also paid 8d a stem for labouring) and another worker, had the title Shoe Maker against their names, so possibly they had previously worked as cobblers. David Thomas, who worked 39 stems as a labourer at 9d a stem had the prefix *Skoelmaster* (Schoolmaster), indicating that he had been a tutor at some time (NLW, Powis Castle Deeds, MS 21292). The fourth person identified was Thomas Rees, a former tailor who worked 20 stems as a labourer in the Lady Day Quarter of 1753 (NLW, Powis Castle Deeds, MS 21935, pp. 7, 21). There could be many reasons why these men chose to work as labourers. However regardless of the reasons, employment as a labourer would have given people moving into the rural area the potential for regular employment, despite any language or mining skill barriers. It seems likely that people with trades such as tailors and cobblers carried on their trade by repairing clothing and making shoes for their fellow workers. This could explain why there is no mention of clothing and only one instance of shoes being paid for under subsistence.

The underground labourers would have worked the same eight-hour stem system that the miners worked, as opposed to the surface labourers who were required to work 12 hours. The work undertaken by the labourers required little training and could be carried out by men with little or no mining skills (although any work underground would require at least some instruction due to the dangers of working in such a hazardous environment). Labourers would have been required to transport all the materials needed within the mine, including the task of winding it up and down the shaft (NLW, Powis Castle Deeds, MS 21935, p. 46). The deads (waste rock) need to be moved to a designated storage area and the valuable ore had to be collected, usually in wicker kibbles and carried by an underground labourer to a shaft where it was then wound up to the surface (NLW, Powis Castle Deeds, MS 21900, chapter 13). As there was no mention of mine cars or rails being purchased in the accounts, the labourers must have moved materials either by carrying them in their arms, in baskets or in the wheelbarrows which had been purchased from a local merchant called David Williams (NLW, Powis Castle Deeds, MS 21935, p. 27). The decision not to use mine cars would have been made in order to save time and money. A letter in the files of the National Library

of Wales describes the construction of a 6' high by 4' wide wagon-way at the neighbouring mine of Cwm Mawr around the same time (NLW, Powis Castle Deeds, MS 3575). This tunnel was projected to have cost £3/18 a fathom plus the price of rails and wagons, whereas driving a wheelbarrow way, which would have been 6' high by approximately 2' or the width of a man's shoulders would have cut the costs considerably. It would have sped up the construction of the tunnel with the saving in expenditure on wages, gunpowder and purchase costs of mine cars and rails.

6.6 The Surface Workers

The layout of the Crown mine at Esgair Mwyn had been thoughtfully planned out to minimise the distance travelled between work areas. New buildings and water systems had been constructed and part of the site levelled for the building of crushing floors, buddles and bing steads. This work had been undertaken by Thomas Watkins, who had been paid 5/- to clear hillocks around the shafts (NLW, Powis Castle Deeds, MS 21935, p. 26). There were eight shafts at Esgair Mwyn in the 1750s. Seven were in use, with the eighth having been backfilled and reused as a store. All of the shafts had been lined with wood planks to prevent their sides collapsing. The lining of the shafts may be an indication that the strata through which they had been cut had been made unstable by earlier mining. There was also a shallow adit which had been used to drain the upper workings to a depth of seven metres (NLW, Powis Castle Deeds, MS 21935, inner flyleaf).

An office had been built close to the shafts where the bookkeeper lived and where the money, valuable items and explosives were stored (NLW, Powis Castle Deeds, MS 21935, p. inner flyleaf). There were two blacksmith shops at the mine. The original smithy had been built on the east side of the site. By 1754 this had been superseded by a second one built between the shafts. The second smithy had a building attached to it that stored coal, charcoal and charred peat ready for use in the forge (NLW, Powis Castle Deeds MS 21935, p. inner front cover). A crushing floor, eight buddles and six bing steads had been constructed near to the shafts as places where ore could be crushed, washed and safely stored (NLW, Powis Castle Deeds MS 21935, p. 26). The bing steads had wooden floors, making it easier to shovel the ore and prevent valuable mineral from being trodden down and lost (NLW, Powis Castle Deeds, MS 21935, p. 32: Hooson,

1747, p. BI). Morris also had two new roads constructed through the bogs that lay to the north and south of the mine. These superseded the ridgeway which was formally used and eased the transportation of goods to and ore from the mine (NLW, Powis Castle Deeds, MS 1646-7: NLW, Powis Castle Deeds, MS 21935, p. 32).

Ore processing

The separating and washing of minerals were an integral and expensive part of the ore preparation process carried out at Esgair Mwyn. Yet, despite the importance of this aspect of the mine, no description of the process was included in any of the documentation relating to Esgair Mwyn. This was perhaps a reflection of 18th century thinking on mining compared to the 19th century, where reports were dominated with descriptions of processes and machinery. In order to better understand this process, for the purposes of this study, the descriptions of ore processing given by Agricola (Hoover and Hoover, 1950) in the 17th century and Hooson (1747) in the 18th century, were combined with information and descriptions from the accounts of Esgair Mwyn plus Lewis Morris's map and his description of the site (see figure 6.1). These were then compared with the information gathered from surveys of the site and used to build a model of how the ore had been processed at Esgair Mwyn.

The ore was initially transported from the working face to the shaft bottom by labourers in kibbles. The kibbles which had a wooden bottom and wicker sides, were produced on site with only the wooden bottoms being bought (NLW, Powis Castle Deeds MS 21935, p. 32). These were of a traditional style which had been in use for hundreds of years and were similar to the remains of one Morris found in the old workings (NLW, Powis Castle Deeds, MS 21900, chapter 13). When the ore reached the shaft bottom, the kibble would have been wound up and out of the mine by the Lander using wooden winches called turn-trees. The winches had been made on site by John David at a cost of 1/- (NLW, Powis Castle Deeds MS 21935, p. 38). The rope for the winches had been bought by the pound; initially from a merchant named John James and thereafter from a number of local suppliers (NLW, Powis Castle Deeds MS 21935, p. 29). The accounts showed that large quantities of rope had been bought for the mine. This was

possibly not only a reflection of the number of shafts at Esgair Mwyn but also that men were using safety ropes while working at height within the stopes. Once on the surface, the kibbles were taken by the labourers to the dressing floors.

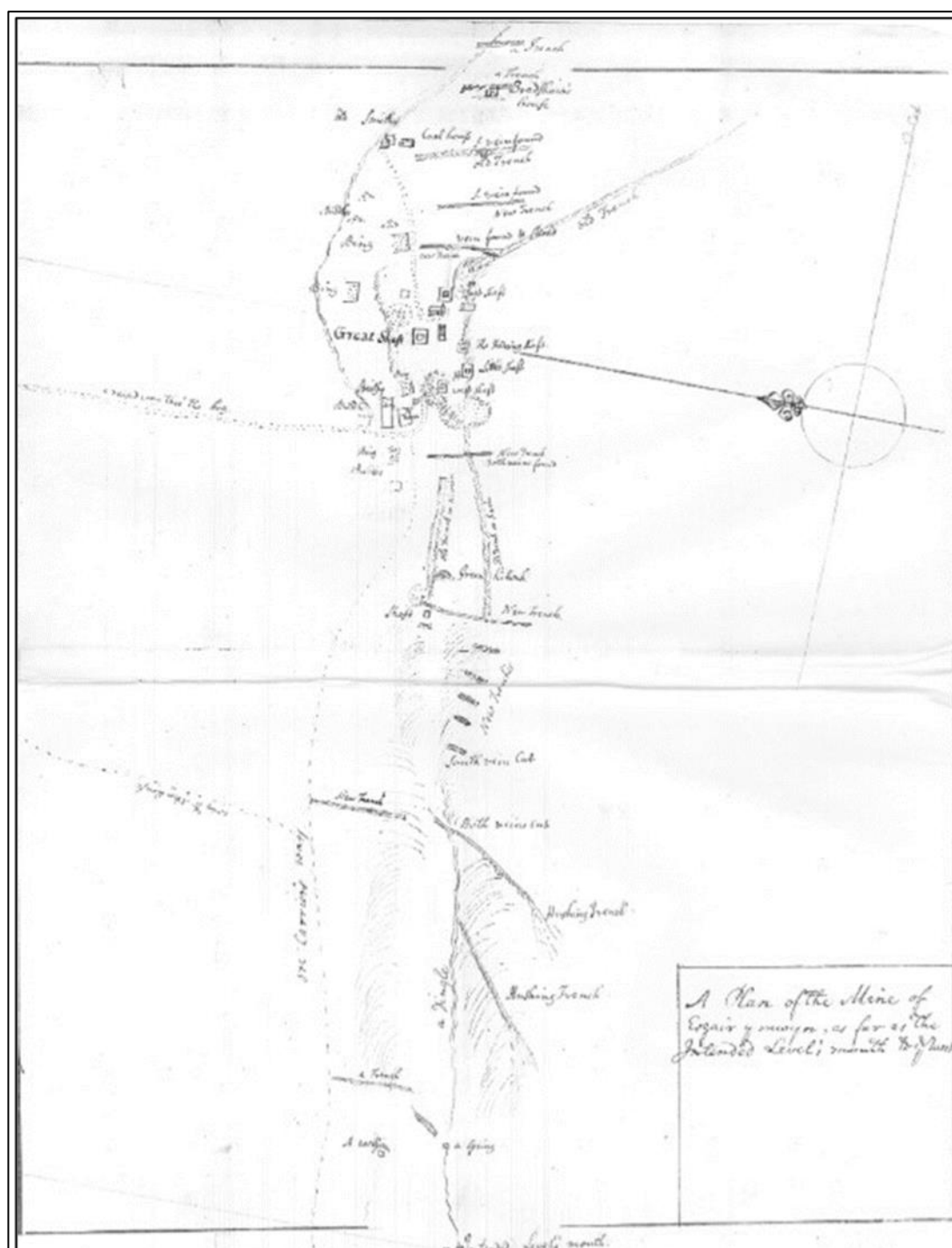


Figure 6.1 Plan of the Esgair Mwyn mine showing surface layout 1754 (NLW, Powis Castle Deeds, MS 1646-7)

Dressing Floors

The dressing floors had been constructed close to the shafts, buddles and bing steads in order to minimise the distance that the ore was moved and to save time and labour (NLW, Powis Castle Deeds MS 21935, p. 32). The dressing floor consisted of a hard cobbled surface, which enabled the ore to be easily crushed. No archaeological remains were recovered nor was any mention made in the documentation of machinery being used to crush ore at Esgair Mwyn in the 18th century. This indicates that the ore had been crushed by labourers using specially designed hand tools such as the bucking hammer (Hooson, 1747, p. BU). A crushing floor in a similar position to the one noted on Lewis Morris's 1754 Map of Esgair Mwyn, was identified during the 2016 site survey as seen in figure 6.1 (NLW, Powis Castle Deeds, MS 1646-7). The dressing floor had a shallow downhill slope and had been constructed using homogenous pebbles, which appear to have been imported to the site as they were of a very different type to those found on the site. The dressing floor was similar to one found at the nearby 18th century Bronberllan mine site. This floor, although slightly smaller, had also been constructed with the imported pebbles and also had a shallow downhill slope. There could be several reasons for the slope, but the most likely was to make it easier to sweep up pieces of small ore. The similarity between the two dressing floors was interesting as Lewis Morris had been the Manager of both sites in the 1750s. This raises the possibility that the floors had been designed and even constructed by the same person. However, more research is required before any positive conclusions can be made, as neither of the floors have been dated. After crushing, the ore was transferred to the buddles.

The Buddles

Buddles were shown on the map by Lewis Morris and in the accounts of Esgair Mwyn. In this context, buddles were a defined area enclosed by a wall where the washing of ore took place. Later, in the 19th century, the term 'inclined buddles' were also used to describe washing tables or tubs. In 1755 there were eight buddles at Esgair Mwyn. The account of their construction plus the map of the mine suggested that the buddles had been contained within three stone walls with an opening at the fourth end (NLW, Powis Castle Deeds, MS 1646-7). These

walls had been built by the masons using stone quarried close to the mine at a cost of £7/17/2 (NLW, Powis Castle Deeds MS 21935, p. 30). Two of the eight buddles had been built in line with a stream that ran along the side of the mine enabling water to be taken directly from it for the washing process. Other buddles at the mine relied on water being channelled from a small reservoir which had been constructed a few yards north of the main concentration of buddles. The accounts showed that a Jim Morgan had been paid 5/-6d to level part of the hill so that the reservoir could be completed (NLW, Powis Castle Deeds MS 21935, p. 32). The levelling of the site shows that the ore processing system had been designed by Morris rather than developing organically. The water that fed the reservoir naturally picked up organic material from the surrounding area. Due to this, the reservoir needed to be cleaned and made watertight in preparation for ore washing on several occasions (NLW, Powis Castle Deeds MS 21935, p. 37). Clearing the reservoir in preparation for ore washing suggests that the ore was only washed when an optimum amount had been accumulated, rather than daily, thereby making the most efficient use of labour.

Washing the Ore

The washing began once the crushed ore and gangue material had been deposited onto the buddles. The buddles were approximately six to seven feet long and between two and two and a half feet wide (Hooson, 1747, p. BU). The buddles had sides and a shallow incline to allow a stream of water from the reservoir (or stream) to wash all the light, unwanted material down the buddle into a tub. Washers would have used wooden rakes to agitate the material. The washing process used the flow of water to wash the waste down the buddle, leaving the heavy lead ore to be collected. While no buddles have survived at Esgair Mwyn, descriptions of buddles can be seen in Georgius Agricola's *De Re Metallica* (Hoover and Hoover, 1950, p. 347). Interestingly, the excavations at the Bronberllan mine indicated that the tables there were of a similar size and design, being set on a slight incline that had been achieved using a natural slope and setting two of the table legs on a pad stone. While many of the buddles illustrated by Agricola were lined with cloth, this was unlikely to be the case at Esgair Mwyn as the only cloth listed in the accounts was used for making sacks to store charcoal (NLW, Powis Castle Deeds MS 21935, p. 40). Although Hooson (1747,

p. 51) had written that washing ore by tub and sieving had largely fallen out of use by the 1740s, this method continued at Esgair Mwyn into the 1750s. Evidence that tubs were used could be seen in payments to David Morgan who provided tubs to the mine in 1752 (NLW, Powis Castle Deeds MS 21935, p. 26).

Morris believed that washing ore using inclined buddles and tubs was efficient. A letter written by the Assistant Agent William Jones in 1755 shows him complaining that Morris's successor was using a type of buddles which led to large amounts of ore being put into the waste, something he said Morris would have not allowed (NLW, Powis Castle Deeds, MS 1169). Despite Morris's thoughts about washing ore, buddles and in tubs, this method was inefficient. Inevitably, large amounts of mineral would have been missed and deposited on the waste dump. Owners were well aware of this and either rewashed the dumps themselves or sold the dumps to people willing to rewash the ore waste. During Morris's tenure the rewashing was undertaken by a team of washers who were paid £18/19/6. This was a significant amount of money and indicates just how inefficient the washing process was. The clean ore from the washing process was then bagged ready to be picked up by the carriers to be taken either to the warehouse in Aberystwyth or the customer (NLW, Powis Castle Deeds, MS 21935, p. Inner flyleaf).

The Warehouses

During his time as Mine Agent, Lewis Morris leased three warehouses in Aberystwyth in order to store goods and ore before it was shipped to the smelters. The main warehouse was a large building situated near to where the dock stands today. The building was leased from Rodrick Richards Esq at a cost of three guineas a year. The second warehouse was on the bridge by the dock and was leased from Jemimah Parry, a widow, for two guineas a year. The third and smallest of the warehouses also included a small room above the main part of the building. This property was leased from another widow called Mrs Taylor, which she rented to Morris at two guineas a year (NLW, Powis Castle Deeds, MS 21935, p. Inner flyleaf).

The Surface Trades

This section examines the trades undertaken by the surface workers at Esgair Mwyn in the mid-18th century. This is an area that has been somewhat neglected by researchers in favour of exploring technologies and processes rather than looking at the people who undertook this work. Between 1752 and 1755, the majority of the surface workers were paid on a day rate, although on occasions by bargains. The length of a normal stem (shift) for those working above ground was twelve hours which was measured by the mine clock (a multi faced clock on top of the bookkeeper's house) (NLW, Powis Castle Deeds, MS 21935, p. 29).

The Blacksmiths

An important surface worker was the blacksmith as he was responsible for maintaining the iron equipment, sharpening and steeling tools and occasionally fabricating any iron work when needed. Griffith Owen was the blacksmith at that time and was paid 18d per stem (NLW, Powis Castle Deeds MS 21935, p. 17). Although Owen was the only blacksmith, he did not always work alone, occasionally being assisted by a number of different men. All of the men chosen were recorded as having been labourers, as was Willian Lloyd, who was paid 12d a stem in the Mid-Summer Quarter of 1754 to help the blacksmith (NLW, Powis Castle Deeds MS 21935, p. 21).

The iron which Owen worked came from a number of merchants, with the initial supply purchased from a Mr Rigby of Liverpool by Lewis Morris (NLW, Powis Castle Deeds MS 21935, p. 29). Rigby was quickly replaced by local suppliers, Valentine Owen of Newtown and John Pugh of Aberystwyth. This change was most likely due to the speed at which orders could be made, transportation issues or costs. After March 1753, iron was also bought directly from a forge owned by a Mr Buncell (NLW, Powis Castle Deeds MS 21935, p. 31, 43). As well as working with iron, Owen also worked with steel which was bought under the names of German Steel and Blister Steel and on one occasion simply just Steel. These were generic names given to steel in the 18th century and did not refer to different types. German Steel referred to where the steel production was thought to have originated and Blister Steel referred to the process of making steel (Derry and Williams, 1979, p. 480), (NLW, Powis Castle Deeds MS 21935, p. 43). That Owen,

a smith in a remote part of Wales, could turn steel into complex and precision artefacts such as a drill-bits indicates that these technologies were embedded within society. That Lewis Morris could call upon so many suppliers indicates that iron working was an integral part of the industrial economy of Cardiganshire by the 1750s.

The Carpenters

The accounts noted that ten men had the title 'Carpenter'. These men were paid between 11d and 13d per stem with the average pay being 12d (NLW, Powis Castle Deeds MS 21935).

William Hopkin was the first person to appear in the accounts as a carpenter. He also had the shortest tenure, being paid 12d for one stem in the Michaelmas Quarter of 1752. The highest paid carpenter was Rowland Rees, who was paid 13d per stem for working 74 stems in 1753. Jacob Evans was the longest serving Carpenter, having worked 324 stems between the Michaelmas 1752 and Christmas 1754 at a rate of 12d per stem (NLW, Powis Castle Deeds MS 21935, pp. 2, 6, 10).

As well as being employed as carpenters several of the men were employed in dual roles: carpenter/miner or carpenter/labourer. The carpenter/miners received a higher wage of 12d per stem (equivalent to the average miners' day wage). This indicated that the men had been paid the wage of the highest paid job. The lowest paid carpenter was Hugh Morris, who first appeared in the accounts as a labourer then moved on to become a carpenter/labourer earning 11d per stem in the Lady Day Quarter of 1754. Carpenters also worked under bargains. Evan Edward had a bargain to make buddles for the mine in February 1753. He not only constructed the buddles but also sold the boarding that was used for the floor of the buddles under a separate transaction (NLW, Powis Castle Deeds MS 21935, pp. 10, 15). The mixed roles undertaken by carpenters demonstrated that it was not a specialist trade like the cooper or blacksmith. While cases such as Edward selling boards to the mine was a reflection of the opportunity for workers to make money from the mine in ways other than labour.

The Coopers

Two men were recorded as coopers in the accounts, with a further two noted as coopers plus another trade. A coopers day wage was 13d a stem. The name Cooper is traditionally associated with the making and repairing of barrels, casks and tubs. However, from the descriptions in the accounts, it appeared as if there had been an overlap in the work carried out by carpenters and coopers. Coopers were recorded as undertaking work which today would be classified as a carpenters work, making pick Holmes (tools used to break hard ore (Hooson, 1747, p. PI)) and repairing wheelbarrows (NLW, Powis Castle Deeds MS 21935, inner leaf).

The first person employed at Esgair Mwyn as a cooper was John Morris, who worked at the start of the Michaelmas Quarters 1752. His employment, however, was short-lived and after working only four and a half stems, he left Morris's employment. John Morris was replaced in the same quarter by Hennery Hugh (NLW, Powis Castle Deeds MS 21935, pp. 1, 3). Hugh appears to have worked alone with the exception of one stem in the Lady Day Quarter of 1753 when a Thomas Edward was paid 12d for working as the coopers' labourer (NLW, Powis Castle Deeds MS 21935, p. 7). The coopers appear to have been valuable tradesmen as Morris's description of the mine specifically mentions the blacksmith and the coopers, suggesting that their work was essential to the mine. Their importance to the mine was also shown in their higher wages and unlike carpenters who had dual occupations, coopers only appeared in the accounts as woodworkers. A covered workshop was built at the mine for the coopers to work in, perhaps a further demonstration of their importance at the mine.

The Masons

The accounts showed three men were employed under the title of mason. They were usually paid by a day wage of 12d a stem, although on occasions they worked under a bargain. These men were David John Oliver (Mason), William Harris (Mason/Slater) and Evan Lloyd (Labourer/Mason). That Oliver was called Mason implied that he was the senior person who constructed and oversaw all the stonework at the mine. The accounts show that Harris was the specialist house builder, having worked solely on constructing the mine agent's house. The

third person, Evan Lloyd of Caron, was a Labourer but was also paid for 16.5 days working as a mason (NLW, Powis Castle Deeds MS 21935, p. 20). Lloyd appeared in the accounts with the miners and labourers, which indicated that he undertook a variety of general duties, possibly also including underground work.

The Weighers

Four people were included in the accounts with the title weigher. The wage was initially 12d a stem but increased to 14d in Michaelmas 1753 (NLW, Powis Castle Deeds MS 21935, p. 11). The weighers were neither part of the labouring work force or the management. They were required to be literate and numerate in order to calculate how much ore had been produced and record the amounts in the account books. It was a position of trust and power, as the role also involved inspecting it to ensure that it was not contaminated with unwanted material. If the Weigher disagreed with the labourer about the weight or thought the ore was not clean, it would be rejected or sent back to be washed again. This would have affected the worker's pay, and possibly their employment prospects. More often than not, the Weigher, being employed by the leaseholder, would have been open to pressure to under weigh or reject ore in order to increase the owner's profits. Over the decades this caused many disputes in the mining industries leading to workers being given the right to appoint their own Check Weight Man, under the Mines Regulation Act 1860 (Baylies, 1993, p. 50)

The ore was weighed several times during the process using beam scales purchased by Lewis Morris in November 1752 from Mr Edward Trafford of Liverpool (NLW, Powis Castle Deeds MS 21935, p. 29). The weighing was undertaken for several reasons; first, so the men who were on bargains and paid by the weight of produce, were paid correctly. Secondly, to ensure that none of the valuable ore was stolen or lost. This was a reflection of how valuable the material was and perhaps also the amount of pilfering and corruption that would have taken place.

The ore weighing processing

- The initial weighing was undertaken at the shaft side before the ore was crushed.
- The ore was crushed and washed and reweighed with the amount of pure lead ore recorded.
- The ore was stored ready for onward transportation.
- Waste ore that was recovered from the rewashing was weighed and recorded.
- Ore was weighed prior to being passed to the carriers and transported to either the customer or the warehouse.

Once the ore had arrived at its destination, it was weighed a final time to ensure that the quantity delivered corresponded with the amount that had left the mine. Any ore that was stored at the Aberystwyth warehouse also underwent a final weigh-in before it was passed to the ship or picked up by the buyer.

The first person to appear in the accounts as a weigher was Richard Davies. Davies, who was noted as the Principal Weigher at the mine, was employed on Lady Day 1752. Although he was on the books, Davies was not recorded as having worked any stems or received any wages. This implies that at that time the mine had not produced enough ore to justify the cost of his wages for weighing it (NLW, Powis Castle Deeds MS 21935, p. 1). By Christmas Quarter of 1752 Davies had worked 66 stems and been paid 12d a stem amounting to £3/6s (NLW, Powis Castle Deeds MS 21935, p. 5). By the Midsummer Quarter of 1753 Davies' pay had increased to 14d per stem and had been provided with an assistant weigher James Johnes who was also paid 14d a stem. From the Midsummer Quarter 1753 Morris also employed a weigher at Aberystwyth, named Hugh Evan. Like Davies and Johnes, Evan was paid 14d a stem (NLW, Powis Castle Deeds MS 21935, p. 11). Evan was joined in the last two quarters of 1753 by a Richard Williams who was a weigher of ore at Aberystwyth. Williams, however was not paid his wages of £5 until the 3rd of January 1754 (NLW, Powis Castle Deeds MS 21935, p. 51).

Both Evans and Williams were replaced by James Johnes in the Christmas Quarter of 1754 (NLW, Powis Castle Deeds MS 21935, p. 51). Evans and Williams were dismissed as they were both involved in the attempt to take over

the mine in 1753. Richard Williams was the brother of John Williams of Llwyn y Mwyn, who claimed ownership of Esgair Mwyn. Williams also stole the weighing record books which listed the amount of washing that had been carried out at Aberystwyth, refusing to hand them over to Lewis Morris (NLW, Powis Castle Deeds MS 21935, p. 24). The loss of Aberystwyth weigher's books caused Morris problems at a later date (Lewis, 1967, p. 103).

Ore was not the only product weighed. In the Mid-Summer and Michaelmas Quarters of 1753, a miner called Hugh Williams was employed on a bargain to weigh the tree bark ready to be sold to Mr Buncell, (the owner of an iron smelter that supplied much of the iron used at the mine). Williams had been paid 6d a ton and received 6/- 4 $\frac{1}{2}$ d for weighing slightly under a total of 13 tons of bark (NLW, Powis Castle Deeds MS 21935, p.36). It was likely that the bark was weighed again at the warehouse at Aberystwyth

The Manual Workers

The Surface Labourers

As mentioned earlier, the way was ore processed was not outlined in the documentation. The same was true for the workers who carried it out. The only surface workers mentioned in the accounts with reference to their daily work were the craftsmen and some of the washers. There was, however, a large group of workers who were paid a day wage but whose duties were not defined in the accounts, these were the labourers. Of which only the duties of Marry Morris and the soldiers who undertook work for Lewis Morris while stationed at the mine were recorded. Marry Morris was described as working as a Lander for 10d a stem (NLW, Powis Castle Deeds, MS 21929, p. 47). The landers job was to unhook the kibbles and empty them when they reached the surface. He would also have been responsible for clearing the area around the shaft of spills of ore and waste (NLW, Powis Castle Deeds, MS 21929, p. 47). The labourer work undertaken by soldiers was to work the shaft winches from which Merry had removed the kibbles. While little could be said about the lives of the majority of workers more could be said about the soldiers, who were troopers of General Campbells Royal North British Dragoons and had arrived to guard the mine in March 17th 1753 (NLW, Powis

Castle Deeds, MS 21935 p. 33). The troopers were initially under the command of Thomas Jones the Elder, however there was no mention of him in the accounts and it was unlikely that he visited the mine (Lewis, 1967, p. 102). Instead, it appears that Sargent Robert Mackenzye was in command of the troopers while at the mine. The accounts show that while at the mine the troops received good treatment and were billeted in a house at Llwyn y Mwyn called Cilfach y Rhew which belonged to John Williams (NLW, Powis Castle Deeds, MS 21935 p. 37). The soldiers were provided with new bedclothes, straw beds, cooking utensils, turf for heating and candles for light (NLW, Powis Castle Deeds, MS 21935 pp. 39, 41). Twenty-six of the troopers were allowed to supplement their military pay by labouring at the mine. The wages were recorded in the account books as being paid by the then Mine Agent John Qwen as Morris was away from the mine at that time (NLW, Powis Castle Deeds, MS 21929, p. 24). The troopers' wages were collected by Sargent Robert Makenzye who was not recorded as working for Morris, instead appearing to maintain his station and management of his men. That Makenzye signed for the men's wages and this could have been for several reasons. Not only would they would have needed his permission to undertake the work so he would have rostered the troops to enable them to work, but as his position as a sergeant meant he was literate and numerate, he would have overseen the agreements and probably taken a payment from his men for his troubles. This would explain why the troopers had been paid by shifts rather than by stem. The advantage to Morris was that the soldiers replaced the workers who had been driven away from the mine and were afraid of returning due to the continued intimidation of Powell (NLW, Powis Castle Deeds, MS 21935 p. 64). It seems likely that some of these troopers would have seen military action as the regiment had recently taken part in the War of Austrian Succession which had ended in 1747, it was also probable that some of these soldiers went on to fight in the Seven-Years War as in 1756 their regiment was off fighting in Germany (Almack, 1908, p. 41). No other tasks carried out by labourers were mentioned so it seems likely, that the unskilled jobs required to run the mine had been undertaken by the labourers. On average 83 labourers were employed each quarter at Esgair Mwyn (NLW, Powis Castle Deeds, MS 21935). They would have undertaken all the essential, low-level activities not mentioned within the accounts that enabled a mine to function. They would have cleaned, swept, unloaded carts and moved materials around the site. They would have moved

the mineral ready to be processed, carried out the crushing of the ore and taken the crushed materials to the washers. They would, as has already been seen, assisted other workers such as the blacksmith. This demonstrates that the labourers despite being the lowest paid of the workers, were also the most versatile of the workforce.

The Washers

Despite being traditionally undertaken by women, children, the elderly and the infirm, the washers were an integral and important part of the system, as can be seen in the hundreds of pounds expended to wash ore in the accounts.

Only seven people were listed in the Esgair Mwyn accounts as washers or washing waste ore, contrary to the subsistence accounts and letters which indicated that at least 25 men and women had worked as washers (NLW, Powis Castle Deeds, MS 1169). This could be because the washers worked under a collective bargain meaning that only the lead worker signed the accounts. The payments received for these bargains varied in value according to the season, presumably because more money was offered when there was a shortage of labour, for instance, during the harvest months or in the winter when the weather was wet and cold (NLW, Powis Castle Deeds MS 21935, p. 50).

The bargain takers worked under a piecework system whereby the more ore they washed the more money they earned. This left them not only needing to wash as much as possible as quickly as possible, but also having to be reliant on the honesty and fairness of the weighers and management for their wages. As the accounts and letters showed, this was not always the case and workers were often taken advantage of. In one case, washers Jane Evan Jenkin and Morgan Thomas cleaned 100 tons of waste ore. However, this ore was stolen in February 1752. Morris wrote that he agreed that the ore had been washed, but said it had neither been properly weighed nor accounted for correctly before it had been stolen. Because of this he refused to pay the washers, causing them to lose their wages of £25 (NLW, Powis Castle Deeds, MS 21935, pp. 59, 63).

In September 1752 David Morgan, the first washer to appear in the accounts, was earned £2/11/4d for providing tubs and associated equipment for washing ore (NLW, Powis Castle Deeds MS 21935, p. 26). It was probable that he was

one of the former bargain holders who had reopened Esgair Mwyn and that the washing equipment he sold to the mine was the same that had previously been used by them. This would explain how it was possible for a washer, one of the lowest paid workers, to have been able to supply such costly equipment (NLW, Powis Castle Deeds, MS 21935, p. 37). The second person mentioned as a washer was Jane Thomas who received payments for washing the waste ore on five separate occasions (NLW, Powis Castle Deeds, MS 21935, pp. 39, 42, 45). As Jane Thomas was mentioned the most times in the accounts, it was most likely that she was the principal washer at Esgair Mwyn, who represented a team of both men and women. Jane was the wife of Morgan Thomas who was also mentioned several times in the accounts as a washer. In 27 December 1754 Jane agreed a bargain to washing and to washing what was described as the eastern hillock. Jane received £7/7s in subsistence goods; this was a large amount and therefore presumably the goods for her team. She also received £1/1s in cash. There seems to have been a gap between the taking of the bargain and the washing which took place on the 17th January 1755. The washing which was completed in the quarter ending on 12th April produced 8 ton 17 hundred weight of washed ore. After the removal of subsistence, Jane took £18/1/6/6d (Powis Castle Deeds, MS 21930, Esgair Mwyn account book Lady Day quarter 1754). It seems likely that Jane, as head washer, employed her husband Thomas and other members of her family including Evan Thomas as washers. This was another example of the nepotism that could be seen throughout the mine accounts and Morris' letters.

The next two most mentioned female washers were Jane Evan Jenkin and Morgan Thomas who, as mentioned above, made bargains to wash ore. Other washers were identified via the subsistence records included Owen Lewis, Marry Evan Lewis, Lewis Griffith, Janett Prichard, Thomas Owen, Catherin, Jane and Janett Richard. There is a strong possibility that there were other workers involved however it was not possible to identify them. It can be assumed with some confidence that Jane Evan Jenkin, and Thomas Morgan alongside Jane Thomas collected and distributed the wages and subsistence for the unnamed workers (NLW, Lewis Morris Manuscripts, File 602D; NLW, Powis Castle Deeds, MS 18577; NLW, Powis Castle Deeds MS 21935, p. 59). The type of subsistence these workers received was different from other workers, as the vast majority of Washers received cereals. Why would this have been? It seems to indicate that

many of the Washers were making bread, which in turn indicated that they had access to a bread oven. As Washers were recruited when needed plus they had access to a bread oven, indicated that most washers were people from the local area.

The Carriers

A significant part of the Esgair Mwyn expenditure was spent on the transportation of lead ore from the mine by workers called Carriers. Between September 1753 and June 1754, carriers transported a total of 1,767 tons of ore from the mine to Aberystwyth at a cost of £1,060/6d (NLW, Powis Castle Deeds, MS 21935, p. 59). Morris employed twenty-seven people for this job and owned sixty-three pack horses (Lewis, 1967, p. 296). Twenty-six of the carriers were male and one was female, all of whom lived in the villages around Aberystwyth (NLW, Powis Castle Deeds, MS 18577).

The work of the carriers involved leading pack horses loaded with ore across the 19 kilometres of difficult hills and marshy terrain that separated Esgair Mwyn from the warehouses at Aberystwyth. Until 1752 the carriers would have used a ridgeway route which avoided much of the boggy lowlands. However, after Christmas 1752 they were able to use a much shorter route through to Ffair Rhos and Aberystwyth after Lewis Morris paid Denise Burn and Richard Lewis £1/8- to cut two roads through the bog lands (NLW, Powis Castle Deeds MS 21935, p. 32). The carriers made the journey throughout the year regardless of the weather conditions and for this they received a payment of 1/- per mile or 8d per bag of ore carried from the mine to Aberystwyth (NLW, Powis Castle Deeds MS 21935, p. 59). This was considered to be relatively well-paid work and carriers such as James Morgan of Lann Lwyd, earnt 10/- for carrying eight bags of ore (NLW, Powis Castle Deeds, MS 18577). This wage compared favourably with the miners who were paid 14d per stem. The sole female carrier, Mary Johnekin, would have also undergone the same privations and was paid the same wages as all the other carriers ore, which was unusual for women at that time (see section 6.7) (NLW, Powis Castle Deeds, MS 18577).

6.7 The Role of Women

Exploring the role of women in metal mining was an important part of understanding the social aspects of mining within the research area. However, researching women's roles was complex due to the sparseness of information available and the historic lack of interest in the roles of women. The invisibility of women in the documentation was partially due to the effects of coverture which had stemmed from those who controlled the writings and points of view around matters like education, finance, politics and industry. Men of influence, power and money created the expectation that respectable married women did not work (Lyon Blease, 1910, p. 8). This gave rise to the pervasive insinuation that most women had not worked in the past. Not only did this denigrate working women as lacking respectability (Pinchbeck, 1969, p. 240), but also created a stigma around the work undertaken by women, playing down their contribution to industry and to the economy of the United Kingdom. This was particularly true in mining where it was more about the issue of morality, rather than danger that brought about the Coal Mines Act 1842, preventing women from working underground in British mines (John, 2013, p. 12). Despite the masculinity of history, documents and records show that women were not uniformly immoral, powerless or inarticulate. History and life have shown us that many women are proactive and resistant to subordination. These past attitudes towards women have, however, left the role of women and their contribution to the workplace and to home life difficult to explore. The exception to this has been the research into the roles of women in coal mining, which has been quite extensively explored with several books written on the subject (John, 2013, p. 238). Even this, however, was slight compared to the studies on men and machinery. Fortunately, research on women in mining industries has recently started to gather pace and it is anticipated that the information uncovered for this study will contribute to other studies in this area.

Evidence of Women Working at the Mines within the Research Area

The exploration of men working at Esgair Mwyn naturally led on to exploring the roles of women and how these might have looked at that time. The limited research that has been published on the lives of women in mining has suggested that in less well-funded mines, the whole family worked together to make the best

of a bargain (Pinchbeck, 1969, p. 241). This research argued against the notion that women were merely homemakers who provided domestic support whilst bearing children, rather, they were an integrated part of the 18th century family wage economy (Tilly and Wallach Scott, 1987, p. 104). Kiernan's model of the metal mining family portrayed the men to be working the ore underground while the women drew it to the surface, dressed, sorted and then washed it alongside the older men and children (Kiernan, 1989, p. 12). There is evidence of this model in Cardiganshire where miners, wives and children were employed in a variety of roles above ground in the late 17th century, including washing and breaking ores (Stringer, 1699, p. 16). Although this may be a fair representation of some mining families, evidence gathered during this research from sources that have not previously been explored, including mines ledgers and the National Census records, suggests that this broad theory needs reconsideration as this evidence now shows that some women did work underground.

In the 1841 National Census an entry showed Elizabeth Arthur, aged 19 years old from Llancynfell, Cardiganshire, had registered herself as a miner at Llancynfell lead mine (UK Census Online, 1841). At Ysphyty Ystwyth, Simon Hughes identified a tombstone showing an unnamed female who was described as a miner dating to the third quarter of the 19th century (Hughes, 2013). This is unusual as most females were classed as 'the wife of' or 'the daughter of' and so this could be a reflection of her family's pride, at her being a member, of what would have been classed as, an elite group of mine workers. Although sparse, these records confirm that, contrary to current thinking, women had worked as underground miners in the Mid-Wales Orefield, including mining the ore. The records from Esgair Mwyn support the proposal that women were not hidden homemakers (Laslett, 1965, p. 2). Rather, many worked at the mines, undertaking activities that were physically demanding (often in adverse weather conditions) out of necessity to contribute financially to the household. Documents and mine ledgers from Esgair Mwyn confirmed that women had worked alongside the men, sometimes doing the same work for the same wages.

In 1753 four women were employed by Morris to work in the woodlands at Rhos y Rhiw that he had purchased in order to provide timber for Esgair Mwyn. Cutting down woodland was a major undertaking for the mine managers, who had to redeploy a number of miners to cut down the trees, strip the valuable bark, then

cut the wood to size. The women, named Margret Thomas, Mary Oliver, Margret Williams-Edward and Margret Williams, were paid to ready the timber for transport and prepare the wood ready to be turned into boards, roof supports and charcoal (NLW, Powis Castle Deeds, MS 21935, p. 36). On another occasion, Jane Thomas from Ysbyty Ystwyth was paid to strip bark from the trees at Pantyfedwen, wash the ore waste at the mine as well as provided lodgings to a miner from Esgair Mwyn (NLW, Powis Castle Deeds MS 21935, p. 39). It was also interesting that although Jane was in charge of collecting large sums of money and several bargains, she could not sign her name. This implied that she was numerate but not literate. One reason that she had not learnt to write could be because she had no need for it in her day-to-day life, while people would use mathematics regularly. Neither Jane or her fellow workers were likely to have had either the disposable income to purchase ink and paper or the need to write to someone. Jane must have had some skills and a personality that was recognised and required by Lewis Morris (who the accounts show knew her). For not only was she paid for undertaking a number of jobs, she was also able, in a male dominated industry and a patriarchal society, to attain a position where she represented several men and collected their wages.

It was not unusual for the women to work several jobs at the same time in order to increase their income. In April 1754 Mary Jonekin, who was from Llanliar had been employed to move ore by pack horse from Esgair Mwyn to the warehouses in Aberystwyth. Mary was the only woman amongst the twenty-six carriers and unusually, there was no gender pay inequality with each carrier receiving 8d per bag (NLW, Powis Castle Deeds, MS 18577).

Another woman whose name appeared several times in the ledgers was Jane Evan Jenkin, who also lived in Ysbyty Ystwyth. Jane was noted in the ledgers to have undertaken a wide variety of jobs, more so than her female co-workers. Her roles included working as a maid and washing ore as well as being in charge of collecting the wages for all the other ore washers. Jane was also paid to clear the mine house after the soldiers had left, which included hiring five labourers to clean the house and wash the bedclothes at a cost of 3/6d- (NLW, Powis Castle Deeds MS 21935, p. 46). In 1753 Jane was also responsible for cooking duties, presumably when Morris or visitors were present, with the records noting that on Wednesday 17th October 1753 Lewis Morris paid Lewis Oliver for food ingredients

which Jane had ordered (NLW, Powis Castle Deeds, MS 21935, p. 57). Finally, she was responsible for overseeing the payment of the washer's subsistence charges.

In a subsistence society with little economic surplus, people had to take advantage of all opportunities available and having several jobs was not usual. Even so, this number and variety of jobs did appear exceptional. It was interesting to note that some of the work had financial responsibility and required a good understanding of arithmetic, even though Jane had signed her name with a cross, which implied she could not write. This would suggest that either Jane or whoever had taught her, had decided that while basic numeracy was worthwhile, literacy was not. Many of the women had to be resourceful and produce an income from a variety of different sources, some relating to mining but others from more traditional roles (Laslett, 1965, p. 2). Unmarried women often worked as servants or took in washing, worked as housemaids or supplied lodgings. Jane Williams was paid £4/16 for victualling and hosting the Crown Surveyors Rees Thomas and Thomas Pryse for 32 days while they surveyed the Esgair Mwyn mine (NLW, Powis Castle Deeds MS 21935, p. 63). One record showed a payment of 2/- was given to John Hope junior, to give to the 'old woman' at Ffair Rhos as payment for lodgings for Rees Thomas of Llwyn y Gog (NLW, Powis Castle Deeds, MS 21935).

Seasonal work would have impacted on the type and availability of work for women who lived on the miner/farmer squatter settlements such as Troed y Rhiw (Coflein, 2020). According to Pinchbeck's research, many of the women and children were left to cultivate the land and tend the stock while the men worked at the mines (Pinchbeck, 1969, p. 20). However, it is reasonable to assume that, as in later periods, some women would have sold food or beer, which they had brewed themselves, to travellers (Borrow, 1955, p. 489), while those from local farms would have carried out the majority of the farming tasks (Pinchbeck, 1969, p. 17). The mining documents confirm the hypothesis that women working in the mines were able to optimise the well-paid opportunities a mine offered in terms of work and wages. This was particularly the case where wives, husbands and sons interchanged between the mine and the farm depending on the season and work available.

Family Life

It was not possible to determine from the Esgair Mwyn documents how many miners were married. Wives were rarely mentioned. Three miners were noted as married, while a further two were recorded that they had worked alongside their sons (NLW, Lewis Morris Manuscripts, MS 602D). In these cases, the fathers appeared to be much older than most of the other miners. Women, although not necessarily wives of the miners, were mentioned in the accounts. The fact that wives (and children) were rarely mentioned in the documents from Esgair Mwyn, this did not mean they were not there. Given that over 230 men were recorded as working at Esgair Mwyn, it was highly probable that significantly more than five men were married. Even Lewis Morris, (the Mine Manager), appeared many times in the accounts without mention of the women in his life or indeed his family, yet he had been married twice (his first wife died) and he had several children (Jenkins and Ramage, 1951, p. 27).

So, where were their wives and why were the majority of them not mentioned in the mine records? As discussed above, some women were in the mine ledgers, however, not enough to account for all the wives that would have been expected. A percentage of the miners would have come from the local population, living in the area with their wives. Others, such as Robert Rees from Cribyn, a village 32 kilometres south of the mine, were more likely to have stayed at the mine working a number of shifts, then returned home before going back after a few days. Other workers had names that implied they were from further afield, including Europe. The German families Clocker and Hechstetter, miners who had moved to the area from Cumbria, appeared several times in the documents. This strongly implies that men had moved to Wales for the work, possibly leaving their wives and families until they either returned home or their families moved to Cardiganshire to be together.

Women Merchants and Businesses

Between 1752 and 1754, eleven women were noted as merchants providing goods to Esgair Mwyn. Although the information on these women was limited, the ledgers did provide their name, the goods they had sold and occasionally where they had been based. No other information was available to indicate how they had gained their businesses or indeed whether these women were married or widowed. The majority of these women, as was the case with most of the mine suppliers in the accounts book, made only a single transaction in that period. However, three women stand out as exceptions to this. In fact, two were responsible for the second and third largest number of sales transactions overall. The Esgair Mwyn audit book (NLW, Powis Castle Deeds, MS 21935) showed that a Mrs Catteral made 19 transactions with the mine, selling goods such as brown paper, barrels of coal and candles. Further research into this entrepreneurial woman revealed that not only had Mrs Catteral been a successful merchant, but was also part owner of a ship, along with John Morgan, the mine's stem captain who she later married, and his brother David Morgan (Davies, 1907, p. 262). Having such inside trading links proved to be very useful, as she became one of Lewis Morris' main suppliers of goods. The ship, although not named, appeared to have undertaken a triangular trade route moving goods between Portsmouth, Dublin and Aberystwyth (Davies, 1907, p. 262). This would indicate that Mrs Catteral had either visited or met merchants from each of these locations.

Mrs Catteral was clearly purchasing goods in centres outside Cardiganshire and transporting them by sea to Aberystwyth and then by horse and cart to Esgair Mwyn. It was also highly likely that she was selling goods to other working mines as well. Using the triangular shipping routes to import the wide range of goods required by local businesses, including mining, demonstrated that shipping had been a vibrant industry at that time. Many entrepreneurs from a wide cross section of society, including women, appeared to have invested in shipping in order to set up business. Another major supplier to the mine was Mrs Humphreys, who made twelve sales, which was the third highest number of transactions. Her sales included diverse consumable items such as candles, gunpowder and paper (NLW, Powis Castle Deeds MS 21935, p. 40). No other information was available regarding this woman; however, it showed that Mrs Catteral was not the only female merchant.

The transactions between the mine and merchant businesses owned by Mrs Catteral and Mrs Humphreys were significant when compared to the other single exchanges recorded in the accounts. It could be suggested that the large number of transactions negotiated, and the amount of goods supplied by these two women, would have made it difficult for the mine to function without them, or at least their supply chain or contacts (NLW, Powis Castle Deeds MS 21935, p. 41). Jane de la Loyde, who first appeared in the mine accounts as a buyer of ore for a company, purchased 30 tons from Morris and his partners in 1751 (NLW, Powis Castle Deeds, MS 18968). Jane went on to be another of the main merchants who supplied items such as greased paper for making blasting cartridges (NLW, Powis Castle Deeds MS 21935, p. 39).

Ownership of Property Relating to Mining

The eleven women noted in the ledgers had, between them, been able to lease property, buy and sell ore and supply goods and services to the mine owners. This demonstrated that these women not only had access to money and influence but also had the ability to make transactions with Lewis Morris on terms that may have been the same or similar to the men. Of the four woodlands that Lewis Morris purchased to supply wood for Esgair Mwyn mine, two had been owned by women. Mary Pugh, who may have been related to the John Pugh (who supplied goods and specialist mining equipment) sold a woodland at Rhos y Rhiw for £60 to Lewis Morris in 1752 and Mary Richards, in the Christmas Quarter of 1753, sold Morris a small coppice of wood located at Hafod y Goven for £6/1- (NLW, Powis Castle Deeds MS 21935, pp. 25, 40). There was no information on how these two women came to own the woodlands, however, it was customary, on the death of a farmer who had no son to succeed him, for his wife or daughter to take over the holding and running of the farm (Pinchbeck, 1969, p. 10).

The documents showed that two of the three warehouses rented by Morris in Aberystwyth had been owned by women. A widow, Jemimah Parry, owned a warehouse situated on the bridge at Aberystwyth, for the price of two guineas a year. While a second woman, Widow Taylor, rented a warehouse to Morris for 13/- a year (NLW, Powis Castle Deeds MS 21935, flyleaf). Once again, it is probable that these women inherited these properties. These merchant women

were likely to have been key economic elements in Aberystwyth, especially within the backdrop of an expanding capitalist society, and may even have given these women a voice in local affairs. This voice, however, would have had to be exercised behind the scenes, as women were not able to openly wield political power (Clark, 1919, p. 39). That two of the women were addressed as widows may also have been important. In the majority of cases, the death of the husband, who was the head of the household and master of the business, would have been a blow financially. For example, when Richard John James died in service at Esgair Mwyn his widow Jane received his wages only after his subsistence had been repaid, which only amounted to £2/15s, as it only covered the 57 days Richard had worked underground (NLW, Powis Castle Deeds, MS 21935). However, a woman married to a more affluent merchant could fare better in widowhood, since it freed her from coverture, allowing her to regain any financial freedom she had before her marriage. If it was permitted within her late husband's will, she could also opt to take on the role as head of the business and so gain further financial security (Pinchbeck, 1969, p. 284).

The Lady Dowager Dorothy Lisburne

One section of society where women could wield great power was the rich and titled. After the death of the male head of the family, women from these sections of society often inherited large estates and the great power that went with them. One such person was the Lady Dowager Dorothy Lisburne (nee Hill), the second wife of John Vaughan. Dorothy Hill married John Vaughan in January 1725 following the death of his first wife. She was settled with a jointure of £400 in 1726 by Lord Lisburne, charged to the Trawsgoed Estate, and in 1727 she gave birth to a daughter, Malet (NLW, Crosswood Deeds, MS I.714). Shortly after, although there was no formal separation or divorce, John Vaughan moved to London and they did not see each other again. Lady Lisburne had been involved in mining at the highest level and retained control of the leases for several mines even after her husband's death in 1741 (NLW, Crosswood Deeds, MS I.504). Through this control she prevented Lord Wilmot Lisburne (John's brother) from leasing any of the mines to Chauncey Townsend in 1752 (NLW, Crosswood Deeds, MS I.938). This showed that, although Wilmot had inherited the title from his brother, Dorothy had retained a great deal of control over part of her husband's properties. It also

indicated that, as the law stood, following the death of a husband, his widow was able to take over ownership of land and possessions and so also became more visible in the record (Laslett, 1965, p. 100).

6.8 Health and Underground Working Conditions at Esgair Mwyn

The underground workers worked in difficult and dangerous working conditions with an ever-present fear of being maimed or killed by falling rocks, as was the case of the two miners mentioned earlier who were killed at Esgair Mwyn (NLW, Powis Castle Deeds, MS 3861). Their stem began once they had reached the area of the mine they were working. This meant that even before they had begun work, many would have had to walk, using a lantern or candle, while carrying their food, water and equipment some distance underground. Many would have climbed up and down several sets of slippery ladders and walked, bent almost doubled over through the often wet and narrow tunnels. In some cases, the tunnels would have been so small the men would have had to crawl through them. There was no provision of helmets, knee and shin pads, gloves or safety boots, although it is probable that the miners improvised for their own comfort and safety. These conditions would have taken their toll on the workers' energy and stress levels before they had started their stem. Many of the miners would have suffered from slips and falls which in some cases, no doubt caused broken bones. As damaging to the health problems that accumulation of injuries from working in these conditions. These would have included repetitive strain injuries plus the physical impact of carrying out heavy labour over many years. These conditions would have become evident in those that were fortunate to survive into later life, developing osteoarthritis in the elbows, knee joints and in the back (Roberts and Cox, 2003, p.355). Some underground workers would have also developed high impact vibration injuries caused by holding the drill piece while making of the shot holes (Roberts and Cox, 2003, p. 145). These painful disabling disorders would have eventually forced them to seek other employment at the mine.

Lung Diseases and Lead Poisoning Caused by Poor Air Ventilation

A common but very serious problem found in many lead mines before the 20th century was the lack of ventilation. Poor ventilation meant that those working in

the areas the furthest from the mine entrances were deprived of air. The workers in that area would have experienced an increase in fatigue. In addition, they would have had heightened exposure to dust particles caused by the breaking and moving of rock around the workings (Roberts and Cox, 2003, p. 299). Over time, the inhalation of silica and lead particles would have caused serious lung problems such as silicosis and other health deterioration due to long-term exposure to lead (Roberts and Manchester, 2007, p. 135). The lack of ventilation would also have inhibited the removal of toxic fumes caused by the use of gunpowder to break rock, again resulting in poisoning and in some instances asphyxiation. This would have been a particular problem at Esgair Mwyn, as the accounts showed that shot firing had been regularly undertaken (NLW, Powis Castle Deeds, MS 21935). In addition, many of these workers were likely to have suffered from hearing loss caused by the explosions reverberating in the confined area of the tunnels (Donoghue, 2004, p. 284).

The lack of ventilation within mines often led to the development of other noxious gases, such as Black Damp. Black Damp was, and still is, a well-known hazard within mines (Hooson, 1747, p. DA). The gas is a mixture of nitrogen, carbon dioxide and water vapour and is a common problem in poorly ventilated areas of mines. Breathing in this gas would have resulted in drowsiness, unconsciousness and eventually, death. As the gas gathers in low areas where there is poor air movement, it would have been particularly dangerous to those working in cramped conditions which necessitated that they worked lying down or low sitting positions. Morris had been aware of Black Damp and the problems it caused within the mines, as he had written about it in a draft letter to the Earl of Powis (British Museum London, MS 14929/45). In an attempt to alleviate the poor ventilation problems at Esgair Mwyn, an adit had been driven and shafts had been sunk at regular intervals along the lodes in order to bring air to poorly ventilated areas. There also appears to have been attempts to direct air to where it was needed as there was mention of filling redundant shafts and tunnels which were no longer in use with waste rock (NLW, Powis Castle Deeds, MS 21935, p. Inner Leaf). The attempts to direct air could also be the reason why stone masons had built a wall within the mine (NLW, Powis Castle Deeds, MS 21935 p. 20). The construction of walls to direct air as well as the backfilling of disused areas to reduce the volume of air space was a common solution to poor ventilation, which is still used today.

Working in Wet Conditions

As shown in the section on the pumpers, Esgair Mwyn had become increasingly inundated with water. Although preventing Esgair Mwyn from flooding was the primary reason for the water to be pumped out of the mine, a secondary advantage was that it reduced the risks presented by standing water and to the miners working in it.

Working in a wet mine would have brought difficulty to the miners' day-to-day activities. At Esgair Mwyn during Lewis Morris and John Ball's time as Mangers there was a real fear amongst the miners that they may be drowned if water in the flooded old working would break into the new workings as the adit neared the old workings (NLW, Powis Castle Deeds, MS 3113). This was a real danger as one of the miners William Clocker could testify to as his grandfather had narrowly escaped death by drowning while driving an adit at Talybont in 1641 (Boon, 1981, p. 230). As well as the danger from drowning miners at Esgair Mwyn and other wet mines faced the ever-present problems caused by water. Water would have caused the rungs of the ladders used to enter the mine and reach the working platforms to become slippery and dangerous. This was likely to have led to a number of slip and fall injuries amongst the workers (Mills, 2010, p. 1). Working in water is also cold, tiring and disorientating. Mine water, depending on the minerals dissolved within it, can also be acidic and cause sores. Water dripping onto a miner can affect their sight, sap their concentration and may cause them to lose their grip on tools. Moreover, standing water quickly becomes contaminated with waste including human urine and faeces of all kinds, which can lead to stomach problems and the infection of open wounds. Working in these conditions also increased the chance of a miner being infected with ring worm a parasite which was common among miners (Roberts and Cox, 2003, p. 7). Therefore, working underground dusty or wet conditions would have had induced a number of health problems on a person they were likely to have accumulated a number of health problems many of which would not have been immediately apparent to the worker but would have been evident in older workers. It is likely that many of the Esgair Mwyn underground workers would have suffered from respiratory problem and joint pain and shortened lives.

An interesting question that arose from looking at the mining conditions was why employers allowed people to work in these environments; and why people undertook employment which they were aware would cause them harm and shorten their lives. The answer for the employer was not that they were always uncaring or driven by finances, as could be seen from Lewis Morris' management style and Chauncy Townsend attempt to start a health scheme for mine workers in the area. Instead, the way society was set up meant that the owners saw the workers not only from a lower status but also as being the other.

While an employer could be kind to some, when he came into contact with the mass of the workers they would be seen as the other, untrustworthy and a commodity from which to make a profit. The miners working environment could not be seen let alone experienced by owners or other workers in other industries and could be only imagined marking out the miner as different a thought that was reinforced by seeing the soaked filthy grim covered men returning home from work. The dictates of capital and profit determined what was safe with any injuries or illness were seen as part of the contract when a worker took on employment and was implicit in what has now been named as *laissez faire*. An example of this indifference could be seen with the reporting of the death of the two Esgair Mwyn miners in 1768. The deaths were reported to the Earl of Powis' Mine Manager, John Ball. While the deaths were seen as unfortunate, they were not a matter of importance and instead used as an excuse for the lack of progress driving an adit (NLW, Powis Castle Deeds, MS 3861).

From a worker's point of view there was probably an acceptance that injuries were just a risk that came with of the job. For those coming from a mining background it would have been taken as a fact of life and seen as natural that some people died or that some miners would suffer breathing problems. The advantage of being able to finish work after eight hours for a decent wage or to have food and goods provided would have been a great draw to those who owned no land or had been victims of enclosures in other areas. However, the greatest enticement to take employment in mines would have been not having any work in a society where people who did not work generally starved.

6.9 Economic Links

Lewis Morris was convinced that in order to succeed, a mine had to have good links to the sea. Writing to the Earl of Powis, he stated that if this was not the case

the cost of transport would consume the profits (Owen, 1949, p. 250). By 1750, Morris had established good transportation links and was able to import merchandise and export ore to within England and Wales with relative ease. Initially, the equipment required to work Esgair Mwyn (on behalf of the Crown) was imported from Liverpool, which at that time was taking over Chester as the key port on the river Dee (NLW, Powis Castle Deeds, MS 21935, p. 29). (Longman, 2019, p. 40). Once, the mine was in production, as there were no smelters in Cardiganshire in the 1750s, the majority of ore from Esgair Mwyns was sent to either Flintshire or Swansea for smelting by ship.

As mentioned in the section on the Carriers it had cost twelve shillings to transport one ton of ore, the 19 kilometres from Esgair Mwyn to the warehouses in Aberystwyth. The cost of sending ore by ship the 252 kilometres from Aberystwyth to Swansea cost exactly the same (Lewis, 1967, p. 100). This highlights the stark difference in the cost of moving bulk material by road and ship. It also shows that if the ore had not been exported by sea, none of the Cardiganshire lead mines in the research area would have been economically viable.

When Morris reopened Esgair Mwyn, his main customers were the smelting companies in Flintshire and Swansea. The first being a Mr Smedley & Co, which bought 600 tons of ore (NLW, Powis Castle Deeds, MS 18968). This was almost certainly the *Smedley Smelting Company* of Bagillt Flintshire (Lewis, 1967, p. 133). The second largest customer was Thomas Cainnes, who bought 225 tons of ore on behalf of *Mr Richardson & Co* (NLW, Powis Castle Deeds, MS 18968). This was most likely the *Richardson Smelting Company*, who owned the Llanerch y Mor and Pentrobin lead smelters in Flintshire (Jones, 2009, p. 5). Morris also sold ore to the Swansea smelting companies, with David Morgan of Talybont purchasing 100 tons of lead ore in February 1752 on behalf of a Mr Morris of Swansea (NLW, Powis Castle Deeds, MS 18968). This was almost certainly Richard Morris, the owner of the Llangyfelach Copperworks (Hughes, 2005, p. 20). Lewis Morris's final large customer was Chauncey Townsend who in 1754 negotiated the arrangement directly with the Crown shortly before Morris was removed as Mine Agent (Lewis, 1967, p. 102). Townsend, in 1754 took all the unwashed ore that remained at the mine, after it had been put onto care and maintenance, to supply his lead silver smelter works at Llangyfelach (Hughes,

2005, p. 60). The accounts showed that Morris also sold ore to intermediary merchants, who then sold it on to smaller businesses. One such merchant was Jane de la Loyde who, in partnership with Richard Parry, bought seven separate loads totalling 63 tons of lead ore (NLW, Powis Castle Deeds, MS 18968). Ore was also sold to individuals such as a potter by the name of Evan Griffith of Talybont, who purchased a ton of ore directly off the bank (mine surface) (NLW, Powis Castle Deeds, MS 18968). As a potter, Griffith would have used the ore in the glazing process without the need to smelt it (Derry and Williams, 1979, p. 93).

Suppliers of Goods within Wales

Although the initial equipment to reopen the mine had come from Liverpool. Morris quickly turned to Welsh suppliers located in in Aberystwyth, Newtown, Carmarthen, Llandeilo and Brecon (NLW, Powis Castle Deeds, MS 21935, p. 31). Between 1751 and 1754 seventy-three individuals were recorded in the accounts as supplying goods to the mine. Unsurprisingly, the merchants who made the most sales were the ones that provided items that needed to be replaced on a regular basis, such as candles, gunpowder, fuses, greased paper, sieve bottoms and iron for making mining tools. Valentine Owen was the principal supplier of goods to the mine, and the main supplier of goods for subsistence, with the records showing he had sold goods to the mine thirty-five times between 1752 and 1753. The suppliers with the least number of entries appeared to have provided specialised equipment to the mine, such as the grind stone sold by William Jenkin to the mine in the Michaelmas Quarter of 1754 (NLW, Powis Castle Deeds, MS 21935, p. 49). The main supplier of specialist mining equipment, though, was John Pugh, a blacksmith. Pugh was the main provider of shovels and rakes and tools such as shot firing and pump boring equipment (NLW, Powis Castle Deeds, MS 21935, p. 31). Pugh's ability to supply large orders of iron tools indicated that he was most likely the owner of a foundry rather than actually being a blacksmith.

As well as buying from merchants, the records indicated that items and equipment had also been purchased from nearby mines. John Ball, Mine Manager for the *Company of Mine Adventurers* at Grogwynion, sold goods to Morris on three occasions in the Michaelmas Quarter 1752 (Lewis, 1967, p. 272,

NLW, Powis Castle Deeds, MS 21935, p. 27), These transactions indicated that there was an agreement between the mine agents in the area which allowed the sale of materials between mines when supplies ran short.

Morris also purchased natural resources such as clay, turf and timber directly from the landowners. Rather than buying dressed timber, Lewis Morris chose to purchase four whole woodlands. Two of the woodlands were owned by David Hopkins and located to the south of Esgair Mwyn near to the former Abbey of Strata Florida. The first one Hopkins sold cost £16 which was located at Pantyfedwen while the second was at Bron Mwyn and had been bought for £70. The cost of Bron Mwyn indicates that this was a large woodland (NLW, Powis Castle Deeds, MS 21935, p. 42). Interestingly, both these woodlands were at sites of 19th century mines (see Chapter Four). The last two woodlands were to the north of Esgair Mwyn at Rhos y Rhiw and Hafod y Goven and were both on lands owned by women. The woodland at Rhos y Rhiw was sold by Mrs Pugh for £60, while a Mary Richards sold a small coppice of wood at Hafod y Goven to Morris for £6/1- (NLW, Powis Castle Deeds, MS 21935, pp. 40, 42). The felling of the woods at Pantyfedwen, Rhos y Rhiw and Bron Mwyn was carried out by workers from Esgair Mwyn between 1752 and 1753 (NLW, Powis Castle Deeds MS 21935, p. 26). The small coppice of wood at Hafod y Goven was left standing and unused perhaps due to Lewis Morris's fall from grace.

Hugh Williams, a miner, oversaw the felling process being paid 18d a stem (NLW, Powis Castle Deeds, MS 21935, p. 10). Processing the timber was a costly and arduous undertaking with both men and women being employed on the task. Once felled the timber was sorted and cut into either props or boards. The smaller wood was used to produce cordwood, white coal and charcoal which was made by John William David, who was paid 18d a stem (NLW, Powis Castle Deeds, MS 21935, p.19). David's high wages were perhaps a reflection of his skill and long hours he would have had to have spent tending the charcoal kilns. While the majority of the wood was destined for underground use, there were some types and parts of wood which were too valuable to be used in this way. The bark on the oak trees was of particular value to the tanning industry, so was stripped and sold (Clarkson, 1974, p. 142). Four women were paid £1/2- for stripping twelve tons of bark at Pantyfedwen (NLW, Powis Castle Deeds, MS 21935, p. 37). The woods also contained deal trees. These trees were valued for their long straight

trunks and were used to make floor boards for the houses being built at Esgair Mwyn. These board and all the other timbers were sawn by carpenters Richard and Jacob Evans who were paid £3/4/9d for working at a saw pit that had been constructed near the woodlands processing the timber and other material was transported in carts to Esgair Mwyn by local landowners (NLW, Powis Castle Deeds, MS 21935, pp. 39, 44). Because landowners were providing the transport, most timber was moved when carts were not required for farming activities, such as harvesting. This can be seen in the records of transportation of timber from Rhos y Rhiw and Pantyfedwen during the Christmas Quarter 1752, a time when the weather was poor but carts were available (NLW, Powis Castle Deeds, MS 21935, p. 30). The employment of farmers to move timber in what was traditionally an economically quiet part of the farming year would have provided extra income to the farmers and creating employment for workers and stimulated the local economy. It also showed that Morris bought so much timber, showing that he felt secure in both his position at Esgair Mwyn and that the mine was going to be worked on a considerable scale.

6.10 Conclusion

Access to these documents, consisting of the account ledgers and private letters regarding Esgair Mwyn, made it possible to explore how the mine was worked over nine years between 1746 and 1755, along with an understanding of how Mine Agent Lewis Morris played a pivotal role in mining in the research area in the mid-18th century. Morris brought an energy and enthusiasm that revitalised mining in the research area. Morris' style of management was professional and, in some ways, paternal and stood out in stark contrast to other managers in this period. Aside from Morris only Townsend showed any interest in his workers welfare, he however, lacked Morris's knowledge of metal mining. Whether Morris would have been as successful had Esgair Mwyn not proved so rich is debatable. However, Morris's disdain for the local gentry and their generations of long opposition to the Crown's claims to lands and minerals and his reliance on the support of the Earl of Lisburne would have surely, eventually, led to his downfall. That so many of Morris' letters and accounts survived provided an opportunity to understand the responsibilities of the management team and how they contributed to the running of Esgair Mwyn. The documents examined provided

details, not seen before, making it possible to see the way mine owners used the subsistence system to support an industrial workforce in a rural area. Importantly they provided the opportunity to get a sense of the people who are usually invisible within the historic record. The accounts noted aspects of their lives that were not known about or understood, such as where they came from, what they ate, the working conditions and the health problems that may have arisen from them. It became possible to see the flexibility and skills of the workforce and demonstrated how some workers had maximised their earning potential by providing, not only labour to the mine, but also supplying goods and services. There were however limits to the types of jobs that workers could aspire to. The need to produce accounts and other documents meant that being literate and having good numerate skills, were by the mid-18th century, a necessity for members of a mines management. Those in management or the roles of Weigher or Warehouse Keeper were required to keep detailed records and write to those above them when requested. This prevented the majority of the mines workforce from progressing beyond the role of Stem Captain.

The opening of Esgair Mwyn had a substantial and positive impact on the economy of the villages around it and Cardiganshire as a whole. Although, looking at the workings in other mining areas, that despite claims by Lewis Morris that his actions alone caused an increase in the mines being worked within the research area, they did not. Instead, luck was on his side as Morris happened to discover the lode just as the market for lead ore was expanding while lead production was declining in other areas resulting in a number of new smelting firms such as the Chauncy Townsends Swansea Works actively seeking new supplies for their smelters. This was an extension of what had already happened in the northern part of Cardiganshire. Morris's reopening of abandoned mines with the discovery of new ore deposits was also aided by the influx of miners into the area who were able and eager to identify ore deposits.

The increase in the number of mines being worked within the research area resulted in new workers being employed to staff the mines. The accounts often listed both the names of the workers and the places they had come from showing that there was even an many of the incoming workers came north Wales and England. These incomers included Morris himself was from Anglesey while John

Ball and John Paynter were from England (Lewis, 1967, p.102). Although some of the workers already lived in the area and had come from nearby mines, the accounts suggest that the majority of the new incoming workers were men without families. The opening of the mines and so many of men coming to work them would have affected the local social and economic aspects of society in the area. Unsurprisingly, the accounts indicated that the financial opportunities offered due to the opening of these mines were, of course, taken advantage off by people in the local area. The working of the mines created a new revenue source to not only the landowners but also merchants, farmers and people who provided numerous services, including accommodation, food and drink, laundry to name a few. The accounts also provided the opportunity to look at the under-researched role of women in the mining industry. The male dominated patriarchal society actively discriminated against women and this could be seen in the mine accounts with women being restricted in the types of work they were allowed to undertake. The accounts showed that there had been a few enterprising women who had successfully negotiated obstacles, taking advantage of the opportunities brought by the opening of Esgair Mwyn, and in some cases had achieved positions of economic influence. The documents also showed that people could, in the right circumstances, advance within the mining workforce and create their own business opportunities. To some extent, they were able to control their own destinies within what would be seen today as a restrictive and controlling society. Finally, the examination of the documents showed that the workers lives had not been limited to simply enduring work to survive. Instead, many had ambitions to rise above their place in society.

Chapter 7 Results and Conclusion

7.1 Introduction

It has long been recognised that the Cardiganshire Orefield was one of the most important in the British Isles. However, due to the higher silver percentages in some mines in the north of Cardiganshire, the majority of mining studies have focused on these larger mines. The studies have also focused on two main time periods, the Bronze Age and the 19th century. This has resulted in the mines in the south of the orefield being under-represented in the historical records. Alongside this, the few studies that have been undertaken on the social aspects of 18th century mining in Cardiganshire were often brief or incorporated within other specialised studies. As a result, this has left a gap in the research concerning metal mining in the Medieval and Early Modern Periods in the south of the Cardiganshire Orefield. As such, the purpose of the research was to go some way to redressing this imbalance by investigating mining within a defined area centred on the Strata Florida Abbey to ascertain whether mining had been taking place at that time. This research area had been chosen with great care, as although it was an area that had been neglected by researchers, it contained a large number of mines that may have been of pre-19th century origin.

It was decided that, in order to explore this further, a mixed methodological approach should be used to answer the following questions;

- Was there evidence to show mining had taken place in the Medieval and Early Modern Periods within the research area?
- If mining had taken place, could the people involved be identified?
- Was it possible to find information on the socio-economic aspects of mining within the research area relating to the Medieval and Early Modern Periods?

A broad range of data collection methods were considered in order to gain as much information on the mines as possible. Over a number of years, a significant

amount of data was collected from publications, archaeological field surveys, excavations and primary sources in the archives.

Between 2012 and 2018 a substantial number of field surveys were undertaken in an area of around six kilometres centred on the Strata Florida Abbey. The national grid reference of each site was recorded, along with a full description of features seen, including any evidence of historical mining. This was the first time such a wide-ranging and detailed survey of the mining sites in this area has been undertaken and it has provided an important map of mining in the area. The field surveys were supported, and sometimes led, by information gathered from primary documentation stored in archives throughout the United Kingdom. These documents provided rich, detailed information relating to mining activities, including land and mine leases, court papers and letters, many of which had not been used in mining studies previously, and provided an insight into the land ownership, mine working and mining processes.

7.2 Limitations of the Study

The mixed methodological approach provided the opportunity for broad data collection however, problems were encountered which limited some aspects of the study.

Access to the land on which the mines were located required permission from the farmer or landowner. For a number of reasons, this was not always forthcoming. Many of the farmers were Welsh first language speakers, which created complications with communication and many were suspicious of an Englishman on their land wanting to undertake a survey. In some cases, caveats were put in place, limiting the access to the site or the dissemination of any findings.

A major aspect of the survey was the identification and classification of the mining features. This was not always easy as the similarity between stone quarrying and other landscape features were open to interpretation and on many of the sites both stone and metals had been mined. The classification of some of the smaller sites was also open to interpretation. In some cases, previous Ordnance Survey cartographers had misinterpreted features, such as a shaft at Strata Florida that was reinterpreted during this research as a small stone quarry with an associated adit. This adit had been driven to prove the quality of the stone rather than to mine

metals. This being the case, as in all research of this kind, the identification of some of the features may be open to debate.

The primary sources were deemed to be an essential element of this study. One of the main issues was the lack of surviving Medieval documentation. In order to overcome this, documents from later periods, such as land leases and legal cases that related to past mining events, were studied. Unfortunately, this process was further complicated when the National Library of Wales began a comprehensive process of revising the referencing and filing systems, which included the allocation of new reference numbers to documents. This continued throughout the data collection period and had a significant impact on accessing the documents, especially through the online system.

As the study progressed, a number of data collection methods were considered which turned out to be inappropriate, too expensive or not suitable. These included:

LIDAR

The existing LIDAR data covering the research area was of two-metre resolution, which meant that the resolution was insufficient to identify smaller mining features. The ideal resolution would have been a minimum of 0.25m and so this method was deemed inappropriate.

Soil Sampling

In conjunction with the Strata Florida Project, over a period of two years, four hundred soil samples were collected from within the abbey precinct and fields around Bronberllan mines. Several weeks were spent in the laboratory testing the soil for high metallic content with the aim of identifying areas of mining or smelting activity. Although this process was successful in identifying metal processing sites, it proved too expensive and time-consuming for use in the wider survey of the mines.

Oral Histories

During the research period, members of the local community were invited to share oral histories regarding the local mining activities. Unfortunately, only two

people responded. It was decided that based on the small sample size, this approach would not be suitable for the study.

Dendrochronology

It had been hoped that dendrochronology could be used to determine the age of some of the mining features or archaeological remains from the sites. It was unfortunate that none of the wooden materials recovered from the excavations or mines were suitable for dating. Core samples were also taken from woodlands around the Strata Florida Abbey complex, which showed that the woodlands had been cleared in the early 20th century possibly in connection with the 1st World War. As this date fell outside the remit of this research, this method was discontinued.

7.3 Results of the Archaeological Surveys

Between 2012 and 2018, a total of 41 mining sites were identified within the research area. Of these, 19 were mines and 22 were classified as mining trials.

Mines

At the beginning of this research, 18 of the mine sites were already known within the research area. As a result of the surveys, the previously unknown mine, Maen Arthur was discovered, taking the total number of mines to 19. One of the mines, Cwm Mawr, already had a known history from its sinking until its closure and five mines; Esgair Mwyn, Logaulas, Esgair Ddu, Llwyn y Gwyddyl and Llwyn Llwyd, had a known partial history which dated back to the 1750s. Of these, only Esgair Mwyn had previously been subjected to a full detailed archaeological survey. The history of the remaining 13 mines was limited to the 19th century.

Trials

Only seven of the 22 trial sites had been previously known. During the surveys an additional 15, previously unrecorded, trial sites were identified. Although no records were available to say who constructed these sites, by crosschecking information within the original legal documents it was possible to date a small number of trials to the mid-18th century. The surveys identified an area between the Esgair Mwyn and Bronberllan mines as being the most heavily trialled in the

research area. As these trials were uniform in size but random in their bearing, it would appear they were most likely to have been made by Hector Phillips while searching for silver in the 1690s and Lewis Morris, who leased several mines in the 1750s.

At the start of this research there had been no archaeological evidence to show that any of the mines in the research area had been worked before the second half of the Early Modern Period. The archaeological evidence has shown that mining was more widespread than had been previously thought and took place in the first half of the Early Modern Period. Topographical features at Esgair Mwyn indicated that mining had been undertaken there prior to the Early Modern Period, supporting the premise that mining had probably taken place in the last decades of the Medieval Period.

Documentation showed that at least four older mines, Bronberllan, Esgair Mwyn, Logaulas and Maen Arthur had been worked from the start of the Early Modern Period. These were joined later by the mines at Cwm Mawr, Esgair Ddu, Llwyn y Gwyddyl and Llwyn Llwyd, which were sunk in the 1750s. The documents showed that mining had continued in many mines from the mid-18th century until the collapse of the Cardiganshire mining industry in the early 20th century. The results of the four oldest known mines, and the oldest found trial, are discussed below.

M1 Bronberllan

The excavations carried out on a spoil heap at Bronberllan recovered the remains of material used in fire setting, which returned a radiocarbon date of AD 1685 80+/-30 BP. (Beta Analytic Limited, 2016). Although this proved that the Bronberllan mine had been worked in the last quarter of the 17th century, the remains recovered suggested earlier mining had taken place. The dated spoil was on top of two earlier spoil heaps and all three spoil deposits came from the final shaft sunk into the floor of a large open work. Therefore, 1685 was the latest in a sequence of mining events on that part of the site. A synopsis of mining on this part of the site concluded that the open working had been constructed in the Medieval Period, if not earlier. Documentation confirmed the premise that mining had been undertaken in the Medieval Period. A lease issued in 1525 showed the

Moyne family (which translates to miner) were living and working at Bronberllan and the name of the tenement was Banathlog (The Peak of Interest). Put together; “Miners living at the peak of interest” suggests that the Moyne’s were mining at Bronberllan in the last decade of the Medieval Period. Interest was likely due to the rich upper deposits of argentiferous ores at Bronberllan and two other mines (Esgair Mwyn and Maen Arthur) and could explain why Bronberllan and Esgair Mwyn appeared to have been worked so intensively in the pre-Early Modern Period. It could also explain why a smelt mill had been built at Maen Arthur and why there were remains of cupellation sites reported at the Strata Florida Abbey. Documents showed that Bronberllan continued to be worked throughout the Early Modern Period, with ore being sent by Richard Stedman to Swansea for smelting in 1731. The results confirmed that this mine had been in production from at least the last decade of the Medieval Period and for most of the Early Modern Period.

M11 Esgair Mwyn

It was known prior to this research that Esgair Mwyn was an old mine that had been worked as a large openwork and by shafts. It was believed to have been first worked in the Roman era and abandoned in the Elizabethan Period based on how the mine had been worked and the artefacts found in the old workings in 1750. A re-evaluation of this history was carried out and showed that the mine had last been worked in the mid-17th century rather than the late 16th century. The topographic information indicates that Esgair Mwyn had been worked from at least the Medieval Period while documentation showed it had been worked from 1746.

M16 Logaulas

Logaulas was an important mine worked in the Early Modern Period. It was believed to have been opened by Chauncey Townsend and John Probert in 1768. It was already known that this was an ancient site. However, it was not possible to find archaeological remains from the pre-19th century periods to confirm any dates, as the site has been extensively cleared. Documentation uncovered during

this research confirmed that Logaulas had been worked under several different names from 1631, from at least 137 years earlier than had been thought.

M17 Maen Arthur

This site was completely unknown at the start of the research. It was discovered in 2016 during the surveys and documents showed that minerals had been worked intermittently from 1589 until the early 20th century. The earliest documentary evidence showed that Morgan ap Rees, Levan Lloyd ap Morris, Thomas Birde and Humphrey Wainwright were banned from working a lead mine in 1589. In 1608 a smelt house at Maen Arthur was included in a property transfer deed. In 1740 the first positive identification of miners at Maen Arthur appear. After this date a number of letters, agreements and leases show that mining was carried out intermittently until the site was abandoned in the early years of the 20th century.

The Company of Mine Adventures

Evidence was discovered that proved companies were also seeking new ore deposits in the area. The earliest of these concerned the *Company of Mine Adventurers* who took leases on a number of mines and new mineral deposit sites in 1742. By crosschecking historic mapping and the archaeological survey with the leases, it proved possible to find the locations of several trial sites. One site, Berthlwyd, was found to have not progressed beyond the trial trench stage. The lease documents and this site were important because they confirmed that people were working in established mines. They were also important as they showed that people were actively seeking new ore deposits in the Early Modern Period when mining was thought not to have been taking place.

7.4 Conclusion of Archaeological Investigation

This research found documentary indications that mining had been undertaken at the very end of the Medieval Period at Bronberllan, however it had not been possible to find any datable archaeological evidence to support this assertion. It is more than likely that Bronberllan, Esgair Mwyn and Logaulas plus other sites

were being worked in the Medieval Period and even before. It is also very likely that a larger, more extensive excavation at Bronberllan could lead to the identification of older mining. The research was, however, able to prove that mining had been undertaken at several sites much earlier than had been previously thought.

This research has established that metal mining was being undertaken in the research area during the Early Modern Period. It has also shown that several mines once contained silver in workable amounts which may have given impetus to mineral production at Esgair Mwyn and Bronberllan in the Medieval Period. As such, it could be suggested that silver production at Bronberllan in the Medieval Period, may have been the reason for the cupellation sites at Strata Florida Abbey and that the silver-rich deposits at Maen Arthur and other mines, were the reason that a smelt mill was recorded in 1608. Mining in the area continued into the Early Modern Period on a small scale until the 1750s, when the research identified that there had been a localised mining boom. This was, in part, caused by Lewis Morris reopening Esgair Mwyn and the significant profits that were made by that mine. Due to the surveys order by Morris, at least three new mines, Esgair Ddu, Llwyn y Gwyddyl and Llwyn Llwyd were opened. This increased interest continued until the late 18th century when the lead industry entered into a period of depression caused by the Napoleonic Wars.

7.5 The Socio-Economic Aspects of Mining

The second part of the thesis focused on the social aspects of mining and was undertaken in order to answer the second two questions:

1. If mining had taken place, could the people involved be identified?
2. Was it possible to find information on the socio-economic aspects of mining within the research area relating to the Medieval and Early Modern Periods?

The socio-economic aspects of metal mining in the Medieval and Early Modern Periods are an under-researched area, due in part to the lack of available information, but also owing to research historically focusing on machinery and processes rather than social interaction. The research on the mining activities

near to Strata Florida provided an opportunity to explore some aspects of the social economic lives of people in this industry in the Early Modern Period.

The discovery of documentation and letters concerning people who lived and worked at Esgair Mwyn over 9 years (1746 and 1755) presented a rare insight into the aspect of a local industry and population. Although what has been learned may not be the same at all mines in Cardiganshire in the period, there will be aspects of commonality, such as working and living conditions. Unexpectedly, the accounts also provided an insight into the role of women in the mining economy. This, like all aspects of heritage concerning women, is a much-neglected area of study.

7.6 Results of the Documentation Research

The lack of documentation covering the activities of the monks at Strata Florida hampered any investigations of mining during the Medieval Period. However, the later copies of Medieval leases indicated that Bronberllan had been worked at the very end of that period. At least two sites; Bron Mwyn and Esgair Mwyn, had names that indicated mining had taken place there before the Early Modern period. It seems likely from the topography and archaeological investigation that pre-Early Modern mining had taken place at other sites however it was not possible to confirm this without further investigations.

While the mine owners, mine agents and leaseholders were regularly recorded in the documentation, there were incredibly few references to the mine workers. The rental records for the Cistercian Abbey of Strata Florida identified the Moyne family living at Bronberllan from the 1520s. The Moyne's seemed to have a dual income model of keeping sheep and working the mine. The documents showed there had been a professionalisation of mining resulting in the development of mining labour in Cardiganshire. Many people came from outside of Wales, some even settling permanently.

The information from the Esgair Mwyn account and day books plus private letters dating to the 1740s and 1750s explored how the Esgair Mwyn mine had worked and the employees. The documents showed that the infrastructure in Cardiganshire was able to supply goods required by the large mines and support a significant mining workforce, indicating that the mining economy in the south of

Cardiganshire had been well developed and of interest to investors by the 18th century. These documents were also used to gain an insight into previously hidden or misunderstood aspects of mine working and covered aspects, including subsistence, wages, bargains and food eaten.

The documents found within the archives were an excellent source of data, particularly those relating to Esgair Mwyn which gave a detailed account of the mine, workers and land use. Although all the job roles were mentioned including those undertaken by women, it was noticeable that children were absent from the records. The omission may have been a decision by Lewis Morris not to employ children at Esgair Mwyn. However, it is more likely due to the definition of a child at that time, which is known to differ from our present definition. It was also possible that some of the washers whose names were not included in the accounts were children. The employment of children within the mining workforce is a subject worthy of further investigation.

The research was able to show that not only did the reopening of Esgair Mwyn provide employment for over 200 workers, but also provided information on who these people were, how much they earned, the work they undertook and descriptions of goods and food they purchased. Many of the workers were skilled tradesmen, including woodsmen and masons, while two workers were described as shoemakers and one as a Schoolmaster. The accounts also demonstrated that some people who were directly employed by the mine were able to enhance their wages by providing additional essential services to the mine. These services were many and varied and included selling bread to fellow workers, washing linen or transporting turf to the mine. This shows that as well as the mining economy that there was a small but vibrant economy within the working population with links to the local community. The accounts also provided an insight into a much-deprived area of study, the exploitation of female workers. Unsurprisingly, the Esgair Mwyn accounts revealed an ingrained inequality against females. While women appeared to have been paid the same as their male co-workers, they also appeared to have been prevented from undertaking the majority of jobs. The work opportunities for women in the 1750s were limited and traditional. However, within the backdrop of an emerging capitalist society, a very small group of women rose to positions of responsibility and some to positions of importance. A minority even

became business merchants, ship owners and property landlords, contributing to the local economy and mining industry in Cardiganshire in the mid-18th century.

The original documents related to the mines showed that mining had been an integral part of the economy during the Early Modern Period in the research area. It has been proven that mining provided a source of employment and opportunity for both the local population and incoming people for many centuries. Importantly, this research has shown that even the mines located in rural west Wales were an important source of employment and revenue and attracted both the rich to invest and run the mines and the skilled (and unskilled) to work them. There had been a shortage of mineworkers throughout the British Isles and especially in Wales, and this would have hindered mining and restricted the size of the Cardiganshire mining industry including within the research area. This was reflected in the lack of mention of mines and miners within documentation with only one family being mentioned in the leases of the Abbey granges.

The results of the investigation highlighted that lease holders and owners of mines had been forced to import miners from outside of the research area. While it was likely that there had been an exchange of miners between the Flintshire and Cardiganshire mining area's during earlier periods, these exchanges did not become visible in the documentation until the Early Modern Period. At this time documents record a series of influx of mine workers into the north of Cardiganshire and most likely the research area, with some of these workers moving on mass from other mining areas, for example the English miners came to work at Llwyn Llwyd after the Derbyshire mines closed, with other mine workers moving from north Wales or north Cardiganshire. Another example found were the Clocker who were decedents of German miners and who had been brought to Cardiganshire by William Waller in 1640. This indicates that miners were part of a group of transient workers that was developing in British society in this period. Others may have been the descendants of miners brought in by other Society of Mines Royal leaseholders, as they were known to have imported labour in order to overcome the difficulties of obtaining local labour due to the opposition of local landowning families such as the Powells and Herberts.

It should be asked why these workers would have wanted to work in these new mines, in mid Wales. As already stated, it could be because that the miner workers did not have the same ties to employment as farm workers, who were

tied to the land and the landowners by leases of tenements. In some areas miners lived in barracks or in houses owned by the mine owner meaning that when the mine closed or suffered a down turn they would not only have been made unemployed but also homeless at the same time. The lack of alternative work and housing forced them to move to find work in order to survive in a society which offered no social support to the unemployed. Lewis Morris's management style, and the fact that workers worked 8-hour stems rather than the 12 hours worked by those in alternative employment while earning the same wages, would have been a powerful attraction. The sense of independence which miners enjoyed would also have made mine work attractive. The mid-18th century was a period of transformation for the British economy particularly in agriculture, with the changes to enclosures leading to an increased efficiency in food production but a drop in the number of people being employed in rural industries. As a result, while the Industrial Revolution was in its gestation, the mobile workforce which Hobsbawm (1962, p. 47) saw as crucial to its development, was expanding. This could be seen in the Esgair Mwyn accounts which showed a large number of workers moving into the area, many of whom were coming from other occupations. It would appear that the period Lewis Morris was the management saw the high point of the miner's working conditions. Following Morris, Ball took control of Esgair Mwyn and introduced his management style of not honouring bargains and selling goods on credit to his workers at inflated prices, which became the norm until the mid- 19th century. This, and a downturn in lead sales, resulted in many who could, leave the mining industry and the area, resulting in a residual workforce left to seek subsistence in any way they could.

The rapid entry of a large number of mine workers into the area undoubtedly would have put a strain onto the local infrastructure, causing a shortage of accommodation, evident in Paynter's complaint that Townsend was buying up all the available cottages in the area for his men to live (NLW, Powis Castle Deeds, MS 2999). The higher price of food charged to the miners as subsistence by the mine managers (even the modest amount of inflated prices charged by the more moderate employers) would have driven up prices in the area. This would have worsened the plight of the poor and even caused friction between mine workers and the local population. However, working underground would have forced these local and incomers to cooperate and would have broken down some of the barriers for their safety and to complete the work required. Eventually many of

the miners would have married into the local population and become part of the local community. There was no record of any animosity between the local people and miners but this may be because the troubles between the local land owners and the Crown representatives became an outlet for the anger and resentment that nearly always accompanies an influx of outsiders.

7.7 In Summary

The archaeological study set out to investigate the history of mining on six kilometres of lands centred on the Cistercian Abbey of Strata Florida, Wales and to establish whether mining had taken place during the Medieval and Early Modern Periods. Evidence was collated from a number of sources, including field surveys, archaeological excavations, historical documents and mapping. Surveys identified 41 sites (19 mines and 22 trials), one possible smelting site, one possible cupellation site and an unrecorded habitation site. Part of one mine positively dated to the 1680s, while one mine appears to have been continually worked from 1530 to 1913. The research showed that mining for silver and lead had been undertaken over hundreds of years, in an area that had a professional and well managed mining industry.

Original documents including land leases, Mining Journal publications, private letters and the account books of Esgair Mwyn showed beyond doubt that mining had contributed to the local and national economy, providing employment for several hundred people within the local area. The accounts books also provided a rare insight into the lives of the workers and enabled a look at the role women played in mining in the mid-18th century. This research has shown that metal mines had been an important part of a well-established economy with links that connected them to all parts of Wales and beyond.

The documentary and archaeological investigations have shown that mining had been undertaken in the study area on a small scale from at least the end of the Medieval Period and there was a strong possibility that it had been carried out earlier at the majority of the known mining sites. Mining in the area flourished in two time periods, these being the mid-18th century, when the rich deposits at Esgair Mwyn prompted but marked increase in mining activities. The second period of intense mining activity was in the mid-19th century. In these periods large amounts of money were spent on working and developing the mines and mineral deposits. While some of this money was sourced from the local land owners,

money was also drawn in from outside investors including smelting firms in Chester and Swansea. During these periods there was an influx of people into the area which put a strain on, and brought changes to, aspects of the social and economic the infrastructure of the area.

7.8 Moving Forward - Further Research

The results from this research have contributed to the current understanding of Cardiganshire mining in a number of ways. The archaeological aspects such as the mapping of the mining activity centred on the Strata Florida Abbey has, for the first time, established the location of the mines and trials in the research area. A number of unexpected but significant discoveries were also made, including the important but previously unrecorded mine of Maen Arthur, the remains of a possible cupellating site at Strata Florida Abbey and a possible lead smelter mill at Maen Arthur. As a result of these findings, discussions on future possible excavations at Strata Florida are ongoing while the excavations at Maen Arthur continue. Both of these sites are of potentially national importance. In addition, a possible deserted mining settlement was identified at Talfryn Farm plus a number of unrecorded non-mining features were also identified, including hut platforms, buildings and stone quarries.

The study of the economic aspects of mining at Esgair Mwyn in the 1750s discussed in this work has provided new knowledge, showing the deeply interwoven interrelationship between commerce, farming, forestry, transport and shipping. It has also delved in the politics of Cardiganshire in the 18th century and how this influenced the Crown's attitude to exploration of its minerals.

The investigation of social aspects and the exploration of documents relating to the people involved in the running of Esgair Mwyn has revealed that the lives of workers were more varied than had been previously thought. It showed that they, like us, also had hopes and ambitions. It has also shown community which had been previously portrayed as a stable farming community was subject to the same pressures of communities today including immigration and lack of housing that many of our communities are experiencing today

Information in this work forms a firm base for further research on these and other aspect of life in southern Cardiganshire in the early Medieval Period. The results have and is being deaminated in several ways. A conference for mining interest

groups was organised as part of this research in order to share initial outcomes with professional and research organisations. Organisations with a vested interest in the area have shown an interest in the results, which have also been used in consultation with Natural Resources Wales to protect archaeological sites during mine remediation work. It is intended to publish papers in the relevant heritage journals on the outcomes, which will also be presented at conferences involving mining heritage groups. Discussions to publish the findings from this research in a book funded by the Strata Florida Heritage Project are ongoing. This will form one of a series of books covering the heritage of the area. A number of walks and talks are also being organised to disseminate information to local communities.

It is hoped that this research will form part of ongoing studies into mining in the area. Several recommendations for future investigations (a number of these have already begun) have come out of this research, including:

- A follow up in-depth survey of the mines which have been superficially surveyed during this research. This would record important aspects of the fast-disappearing industrial remains.
- A series of follow up excavations on spoil heaps at Bronberllan and detailed survey of the 18th century dressing floors identified in the present research. The purpose would be to discover the earliest date of mining on that part of the site and may reveal evidence of mining from the Medieval Period.
- An excavation of trial features at Esgair Mwyn that were identified by Lewis Morris in 1756 as being ancient. This could go towards establishing the age of the mine and the trenches.
- An excavation of the possible smelting site at Strata Florida Abbey which was identified during the survey, with the aim of positively identifying the remains in an area containing high metallic residue readings.
- That the excavations of the building on the Maen Arthur mine site be continued.
- Research into the 18th century Esgair Mwyn accounts be expanded to locate similar documentation on other mines in the area in that time period.

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APPENDIX A - Glossary of Mining Terms

This glossary was drawn from several mining sources including The Old Metal Mines of Mid-Wales (David Bick, 1978), Historical Sketch of British Mining (Robert Hunt, 1887), Mineralogia Cornubiensis, (William Pryce, 1778), The Miners Dictionary (Hooson, 1747), Fodinae Regales (John Pettus, 1670). Some of the words were found in 18th century account books and documents concerning lead mining held in the archives of the National Library of Wales

A

- Adit, Inclined tunnel constructed in order to drain or to enter a mine
- Adventure, Working mine
- Adventurers, Group of individuals or company who invest in, or work mines
- Air Shafts, Shaft sunk at intervals along a tunnel so that men could have air
- Argentiferous ore, Ore with a high silver content
- Assay, Test of ore for silver or gold content
- Assistant Mine Agent, Person who assists the Mine Agent in the running of a mine
- Atmospheric Engine, Early type of steam engine
- Attle, Waste from ore dressing
- Articles, Terms, a legal agreement

B

- Back, The roof of a level
- Back Fill, to refill a hole, excavation or shaft
- Bangerts, A course of earth used to support a tunnel roof
- Bank, The shaft side
- Barracks, Accommodation for miners on the mine site
- Bargain, An agreement to undertake work for a negotiated price.
- Barmaster, Head of a traditional miner's court of law and an arbitrator between miner and landowner.
- Barmote Court, Miner's customary laws court
- Bail, Bale Hill, Windblown smelting site
- Belland, Type of lead poisoning that effects the lungs
- Belly, Place where a mass of ore protrudes from the strata

- Bing, Eight hundredweight of lead ore
- Bing Ore, Large pieces of pure ore that has been dressed ready for sale
- Bing Stead, A walled area where lead ore dressed and stored
- Bit, Interchangeable end of a boring rod usually made of steel secured to the rod with wire.
- Black Jack, Zinc ore
- Black Work, Oxidised lead the mineral left after a smelt in a bole furnace. It was often recovered after a second firing
- Blasting, The use of explosives placed in bored holes to break and fracture rock.
- Blende, Ore containing zinc sulphur and iron
- Bole, A type of windblown smelter
- Boomings, Platforms set on top of Stemple's within underground workings which miners stood on to work at height
- Bouse, Boose, A place in the mine where round ore was found
- Bouse Ore, Ore which could be sold directly from the mine undressed
- Borer Piece, A boring rod of iron with a steeled or sharpened iron end which is used to make holes in rock for shot firing,
- Boring, Making of a hole in rock to be filled explosive to break rock
- Bottoms, The lowest part of a working area in a mine
- Bout, A measurement of ore; a long bout being 24 dishes; a short bout being 12 dishes
- Bucker, A flat-headed hammer to break ore and separate waste from valuable ore on the knock stone
- Buddle, A wooden water filled trough in which mineral is separated from unwanted material. The system was later mechanised with the introduction of the round buddle
- Buddle Work, Partly dressed ore taken from a buddle
- Bunding, A type of scaffolding used to make a windbreak on surface, also the name of work platforms within mines
- Bunning, A platform on which miners stood to work, also a form of roofing in an area of loose strata
- Brace, A platform for miners to work on
-

C

- Captain, Experienced miner who oversees other mine workers
- Carreta, Cartload (1680lbs) of merchantable lead
- Cartridge, Paper cone into which gunpowder was poured, then wrapped and sealed before being inserted into a bored hole in the rock. In wet areas these was made of water proof grease paper. Cartridges were later evolved to contain other types of explosives
- Cast, Throw material using a shovel
- Cavers, Poor people in customary liberties who go to abandoned mines and take small pieces of ore and after dressing it sell to smelters
- Cerussite, Lead carbonate
- Chalcopyrite, Copper sulphide
- Charking, Drying of wood or turf ready for burning. Also, the name for the process of scorching wood surfaces to make them water resistant
- Chippers, People who dressed round or bing ore
- Chisels, Two-foot-long iron tool with a pick point end, the point is hardened or steeled
- Churn, Type of pump, small hand pump
- Clift, Short hole 5 to 6 inches deep which was drilled into soft rock. Iron wedge and spreading bits were then driven into the hole to break the rock.
- Clives, Hook on which the Corfes were hung to raise them up the shaft
- Coating, Filling old workings with waste rock
- Coe, Cove, Small building built above a shaft to prevent water entering the shaft
- Concentrate, Lead ore dressed ready for smelting
- Corfe, Wicker basket
- Corfe, also called Corves, A box used to carry of drag ore out of the mine
- Coffin Level, Hand driven level shaped like a human, wider at the shoulder and narrow at the head and feet
- Copperas, Iron sulphate in the form of green coloured crystals
- Count House, Place or room at a mine where miners are paid and accounts of the mine are kept
- Costening Pit or Trench, Trench or pit made in search of ore
- Coves, Wooden or thatched buildings erected over shafts to prevent rain water entering the mine
- Crosscut, Level between two veins driven through dead ground

- Cross Grained, Lead ore, Galena where the grain is not distinct
- Crown Wastes, Open moorland owned by the Crown
- Crushing Machine, Type of machine used to crush or ready for separation. These could be animal or water powered
- Cupola, Name for smelting furnace
- Custom, Articles and agreement under which an independent miner worked

D

- Damp, also called Fire Damp or Black Damp, Chock Damp, carbon monoxide
- Dailing, Surveying underground. Named after the compass used for surveying
- Day, Surface of a mine
- Day Book, Mining account book
- Day Hole, A shallow mine working mineral near the surface
- Day Ore, Ore worked near to the surface
- Day Worker, A worker who is paid a day wage rate
- Day Wage, Payment to a worker for a day's work at a set rate rather than by a bargain
- Deads, Excavated material of no monetary value
- Dead Work, Tunnelling through ground where there is no ore
- Deer, A cross cut, tunnel from one vein to another vein
- Dip, also called a Swilly, A place where the vein turns downwards before returning to its original level
- Dish, A weight or measure of lead
- Dog and Bitch, Two pieces of boring rods that screw together
- Doorsteds, Wooden roof support in the shape of a box
- Drawing Machine, Winding engine
- Drawers, Persons in charge of a windless winding men or material up the shaft
- Dress, to remove waste materials from ore making it ready for smelting. Also to remove loose rock from a tunnel roof or walls to prevent it falling and injuring people
- Dressing Floor, Cobbled area where ore is dressed

- Dresser, Person who dresses the ore – removing unwanted material from the ore
- Dressing a Tunnel, this involves the prizing away loose pieces of rock from the roof and sides of a working, thus making the area safe by preventing material falling and hurting those working in the area.
- Drift, An inclined tunnel either into a mine or from one part of the workings to another
- Drive, Work a tunnel forward
- Duty, A payment per ton produced in the form of ore or money to the land owner or mine owner

E

- Engine Shaft, Shaft fitted with pumping equipment or an engine for lifting
- Ewers, Wide veins
- Eye, Entrance shaft into a mine

F

- Fange, A gap left in the back filled tunnels allowing air to be directed into and ventilate the working areas
- Farm, Lease out land or a mine
- Farmer, Owner or lease holder of the land where miners mined or searched for ore
- Fathom, Unit of length - six feet
- Fausteds, Waste left in the sieve after washing ore in it
- Feathers, Iron tools used in breaking rock
- Feeder. A band or layer
- Fleaks, Shelters for surface workers
- Fire Engine, Name for an early type of steam engine
- Fire Setting, Use of fires to soften and break rock
- Fiery Drake, Meteor landing place that was said to indicate that ore was there
- Flint, Local (to Ceredigion) word used to describe ore used in the Cwrt Mawr 308D Strata Florida Rental records
- Foot, Ped, Formel, A weight of ore amounting to 70lbs
- Footway, Series of ladders which miners use to enter or leave a mine

- Fother, Measure of lead usually used to measure non-argentiferous metal. This amount varied over time but was normal 70lbs
- Forcer, Small hand powered pump for forcing air into mine for ventilation
- Force Pump, Type of pump used to remove water from a mine
- Fore Field, end or limit of a level or workings
- Fore Stop, a temporary roof support used when driving through unstable ground
- Fother, Fodder, Fudder, Weight by which smelted lead was sold. This measure varied from area to area.
- Founder, First shaft driven on a lode
- Found Head, A small slender pick often weighing less than ½ a pound
- Frame, A square or rectangular framework of planks around 30 cm across which was used to support the sides of a shaft when sinking through loose and unstable ground
- Fuse, A means of lighting the gunpowder in the borehole. In the 18th century these were made of a rolled-up piece of paper with gun powder in it or a feathers and straws with gun powder within them

G

- Gad, Chopped and dried wood used in a slag hearth also known as white coal
- Gads, A wedge tool with either a tempered iron or steeled edge used for cutting into hard rock. The blunt end of the wedge had a hole into which a pole was put to hold the wedge in place while it was hammered into the rock
- Gad Stick, Wooden stick used in accounting by cutting notches in it.
- Galena, Lead sulphide
- Gangue, Waste materials attached to lead ore
- Gate, An underground roadway
- Gavelock, Iron crowbar used for stirring the contents of an ore hearth
- Get, Obtain by digging
- Gossan, Weathered upper part of a lode
- Gin, Horse driven machinery for lifting material out of mine
- Gin Driver, Person in charge of the gin engine
- Groove, Open work that leads into a mine

- Grove Steward, A person appointed by Mine Agent to oversee the workers at the mine (usually when the mine was in the development stage)

H

- Hack, A tool used when working soft strata. One end is sharpened and steeled as in a pick, the other end is a sharp flat blade which is also tempered or steeled
- Hadeing, Vertical mineralised wall, in effect a slip side which is mineralised
- Hammer Stone, Stone used as a hammer to break free ore
- Hand Gin, Small type of windless to wind men and material in and out of a mine
- Head Tree, Type of support similar to a Door Stead but set up to prevent the wall of the tunnel collapsing rather than the roof
- Hillock, Discarded heap of mine waste
- Hinget, Top of a hanging wall
- Hole, When an new adit breaks into workings
- Horse, A seat made of a piece of wood through which a rope was threaded on which miners would be hauled up and down a shaft
- Horse Head, A hollow tree trunk placed at shaft top. Wind was directed down it into the shaft and through hollowed-out tree trunks into the workings
- Hush, Method of removing surface materials using a rush of water to reveal a lead vein
- Hushing Channels, Gutters, Channels down which water is directed to the area to be cleared by hushing

J

- Jaggers, Pack horse drivers
- Jigger, A type of sieve used to separate small ore from waste

K

- Kibble Bucket, Metal or wooden container used to raise ore out of the mine. These were often barrel shaped
- Kicker, A piece of stone left to support a large rock and prevent it from falling

- Kind, Kindly, Soft easy work
- Knock Stone, Large flat round stone upon which ore was broken using a hammer
- Knocker, Spirt or Being who lives within the hollows within the earth

L

- Lander, A man or boy employed to hook on and remove kibble and to clean spilled ore and
- Laths, Boards placed between upright timber props to stop loose earth flushing into the tunnel
- Launder, Wooden trough to transport water
- Lease, Agreement of more than a year between the mineral Lord and adventures or miners to work
- Leat, A man made water course cut into the landscape to carry water to a mine
- Level, A tunnel driven from mine shafts to form galleries for working
- Liberty, Area where the miner was permitted to search for ore
- Ligat, Foot of the hanging wall
- Lime Blasting, Using the chemical reaction caused by adding water to lime that is then placed in a bore hole to break rock
- Limp, Thin wooden tool used to skim ore out of a sieve
- Lobbs, Underground stairs made of wood ore cut into the rock
- Load, Measure of lead consisting of nine dishes of ore
- Lock Pieces, A type of wooden roof supports. Timber roof supports with mortices cut into so that they can be secured together in position
- Lode, An ore deposit within a mineralised fault
- Lord of the Soil, Land owner on which the mine is situated

M

- Maul, A large iron hammer
- Malachite, Copper carbonate ore
- Mandrerl, A double headed pick which has been steeled to cut into hard rock
- Marchasite, Crystallized iron pyrites (Iron Sulphide)

- Match, A piece of paper about 3 inches long filled with gun powder used to light the fuse in a shot hole
- Mear of Ground, A defined area of ground on which a miner was allowed to excavate
- Mear Stake, A wooden stake driven into the ground to mark out a miner's mear
- Metalliferous, Containing metal
- Mine Agent, Person in charge of managing a mine, but answerable to the mine owners
- Mineral Time, Eight-hour shift between 8pm and 4am. Outside this time the miners left the mine so that fire-setting could be carried out
- Mineral Way, Regular route used by miners and those moving ore to get to and from a mine
- Mines Royal, A mine claimed by the Crown because it contained silver in workable quantity or a gold mine
- Mundick, Iron Pyrites (iron sulphide)

N

- Needle, Blasting tool used to make a hole in a stemmed blasting hole
- Noger, Drill rod of various lengths up to three feet x one inch wide with a steeled cutting end. Holes were started with the shorter rod and other sizes used subsequently as needed
- Portal, Entrance to a mine

O

- Oker, (ochre) Soil rich in iron oxide
- Old Man, Workings which were made and worked in times outside of living memory
- Open cast, Open cut, Quarry type working along a mineral lode, often limited in width to minimise the amount of worthless material that had to be removed from the workings.
- Open Rake, Open cast working
- Ore, Valuable mineral

- Ore Hearth Furnace, Type of furnace for smelting lead where peat (or coal) was used as fuel. Air was blown into the fire to raise the temperature by human or water-powered bellows,
- Ore slide, Semi-circular open top building in which ore was stored

P

- Panel, Area of the mine left unworked in order to support the roof or area of the mine
- Pick, Iron tool used to excavate rock. Miner's pick heads were usually double ended around 2 ft in length with sharpened square points
- Pick Holme, Specialised pick for working hard rock
- Pick Men, Miners whose job was to work hard rock using picks
- Pig, A lead ingot
- Pipe, A vertical vein of ore
- Placer Lode, Mineralised ore that has been moved usually by water action away from its original place of deposition
- Plug, A blasting tool, and also an iron wedge placed in a hole or crevices to split rock
- Potters Ore, Ore that can be used unrefined by potters to make lead glaze
- Pricker, A blasting tool, used to make a hole in the powder for the fuse to fit in
- Prop, roof support
- Proping, Searching for ore
- Pump, Machine for removing water from workings
- Punchions, A type of roof support
- Purcassers, Poor people who search the waste for small pieces of ore
- Put-log, Piece of timber wedged into sockets cut into both sides of a working to support the wall or form the cross pieces of a platform to work from.

Q

- Quartz, Silicon dioxide mineral clear when pure, white or red tinged when contaminated
- Quarry, Open working where mineral is excavated near to the surface

R

- Race, small thread-like vein of ore
- Rag and Chain Pump, Pump for removing water from mine
- Rails, Wooden planks, and later iron rails, for a wagon or tram to run on
- Rake, A series of shafts driven along an ore lode
- Ramer, A blasting tool used to compact the powder
- Ribb, Area of ore that is separated from and protrudes from the surrounding strata
- Rider, Rocky strata separating or dividing an ore vein
- Riddle, A type of sieve used for separating ore from loose unwanted material holes were around an inch in diameter
- Riggot, Blasting tool, a type of blasting tool. A plug with a notch for a feather fuse to be inserted down to the powder charge
- Rise, Underground shaft driven upwards
- Roofing, Working ore upwards towards the surface
- Round Ore, Ore which is pure and free from contaminants that can be taken out of the mine without the need to dress it
- Rute, Small thread of ore

S

- Saller, A single flight of ladders
- Serving the Sieve, Person who carried ore to the washers
- Set, A defined area which can be worked by a miner
- Shaft, Vertical passage excavated into a mineral deposit
- Shaft Collar, Top of a shaft
- Shaft foot, Bottom of the shaft
- Shift, A set time period of work
- Shodes, Small individual pieces of ore found in the landscape or streams
- Shot Firing, Process of using explosive placed in a bored hole to fracture rock
- Sink, Shaft driven under a level also to excavate downwards
- Sills, Layers of strata
- Sill Stone, Stone in strata

- Slag, Material produced in both bole and ore hearth smelting which could often be re-worked to make slag lead
- Slag Hearth, Furnace which attained a higher temperature in order to re-work slag and make slag lead, which was less pure than ore hearth lead
- Slickenside, A smoothly polished surface caused by frictional geological movement between rocks along a fault
- Slider, Square cut piece of timber used to make a frame to support the shaft sides
- Smelt, Remove metal from ore by application of heat
- Smelt House or Smelter, Area where smelting is undertaken usually using water or steam power
- Smelting Site, Site where smelting is undertaken
- Smytham, Ore which is small enough to fall through the sieve
- Sole, Bottom area of a shaft as it is being sunk, also floor of deepest part of the workings
- Sough, Gate driven within a mine often to drain water
- Spar, Quartz /calcite, crystallised calcium carbonate
- Sphalerite, Zinc blende
- Spurfork, Forked piece of timber used to hold another in position
- Standing Ground, strata that will stand without support
- Stamps, Mechanical machine for breaking and crushing ore
- Steel Grained Ore, Close grained lead ore (usually has a high in silver content)
- Stem, A set period of time worked, a shift (usually 8 hours). A double stem is working an extra six hours
- Stem Captain, Supervisor of men on a shift or job
- Stemple, Piece of wood used to support the sides of a stope, they were often used as steps to climb and as support for bunds
- Steward, Master or overseer of mine workings
- Stoke Hole, Short hole five to six inches deep. Holes drilled into soft rock. Into which wedge and feathers were driven to break the rock.
- Stool Ends, Areas left to support the roof of workings when the ore has been removed
- Stope, Remove ore by working upwards
- Stope for Stemple's, Holes cut into sides of workings to locate a stemple

- Stowe, Wooden windlass positioned over shaft for raising ore
- String, Stringer, A small narrow vein of ore
- Subsistence, Food, money or goods given to a mine worker by the mine management as credit to sustain them until they received their wages. On payment of wages the cost of the subsistence was required to be repaid back.
- Sump, Hole made in floor either directly below the shaft or in the lowest area of the workings where water can be collected
- Sun Vein, Sun Side, Veins or deposits found on the south side

T

- Tack Note, License to explore a mine usually for lead
- Take Note, Document outlining the agreement that allowed miners to work a mine ore area of the workings
- Taker, Miner who took a lease or bargain of a mine
- Tamping, Seal a charged shot firing hole with clay ore and small stones in order to direct the force of the explosion
- Ticketing, A note which showed an agreed price to be paid for ore not yet produced
- Timbering, Timber, The setting of wooden roof supports.
- Timberman, Person who set roof supports
- Tithe, Custom or duty payable to mine or land owner
- Tontale, Contract with miners for payment by weight of lead smelted
- Tram, Small wheeled wagon for use within the mine
- Tramer, Person who moved trams around the mine
- Trial, To make a trench of pit looking for ore deposits
- Trunks, Hollow tree trunks through which air was directed into the mine
- Tumbler, Large detached lumps of ore
- Turbary, A turfed field
- Tut, Make a bargain or to undertake a task at a given price
- Turnbole A variation on the bole, developed in Durham, whereby the furnace could be revolved to face the prevailing wind
- Turn Trees, Type of winch for drawing material and men in and out of the mine
- Twitches, Walls of veins which are close together

V

- Vein, Mineralised area within a rock formation
- Vein Stone, Quartz or stone found within lode or vein
- Vein Stuff, Ore associated with gangue
- Virgula Divinatoria, divining for ore usually using a hazel rod

W

- Wagon way, Road big enough for trams to be moved along, at least four feet wide
- War Gear, goods such as tool, ropes etc required to work a mine
- Waste, Stone and other mineral remains left after washing the ore, collected in a specific area called the waste ready for rewashing
- Watermen, Men employed to work underground removing water from the mine
- Water Icicles, Stalagmites and Stalactites'
- Wedges, Iron tools of several sizes and types called Stook or Cleaving wedge. Stook or Cleaving wedges were driven between two pieces of iron called leaves, thereby splitting pieces of rock off. A similar wedge seven to eight inches long was hammered into natural joints and split rock in that way. Nut Wedge, a third type was much shorter at around three inches in length. This was used to split quartzes and stone.
- Wharr, rope and pulley system used to drag corves or kibbles
- Wholes, Area of a mine that had never worked
- Wind Engines, Windmill used to drain mine workings
- Wind Pipes, Hollow tree trunks through which air was transported into the mine
- Winze, Underground shaft driven downwards
- Whim, or Windless, A rotary machine powered by horse, used to draw material out of the mine

Y

- Yorkings, Wide square timbers used as roof supports