

# The Hidden Legacies of Mineral Extraction at Silver Glen

by

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# Abstract

This study examines the environmental and cultural legacies left by eighteenth-century mining activity at Silver Glen, near Alva. In 1714 Sir John Erskine employed men from Leadhills to prospect his land for precious minerals. They would find veins of silver running into the Ochil Hills at the back of his estate. Erskine would keep the mine a secret and then travel to Europe at the beginning of the Jacobite Rebellion to procure money and arms for the rebel cause. He would leave his wife, the Lady Catherine to look after the secretive mining venture. This study will show that this venture began a cycle of defining the glen by exploitation and abandonment. It will assess the mining activity at the site by examining documentary evidence. These documents will be shown to lack any great amount of detail regarding the physical work and processing at the site and will not help towards an understanding of the environmental impact that the mining activity had. There will also be a reassessment both Sir John Erskine and James Hamilton. A re-evaluation of Hamilton will question his role in the creation of the legendary 'forty tons' of ore that were buried in barrels, it will be concluded that his dubious character would lend itself to bring this figure into question. Sir John's role has also never been questioned and it will be shown that due to his owning a serf, a fact hitherto not mentioned within the literature, a reassessment is required. These findings will lead to the conclusion that this will have an impact on the glens cultural legacy as it brings into question facts that have been hitherto taken for granted. An assessment of the industrial archaeology in conjunction with an elemental analysis will be made. The analysis will show that there are high levels of harmful elements at the spoil heap on the site. The industrial archaeology will show two potential processing sites that have not been known until now – the dressing floor and the smelter. The finding of two potential sites and the presence of contaminates may have a significant effect on mans use of the glen. It will be shown that the use of the glen throughout the twentieth-century has never been considered and this study will show that it has gone through cycles of exploitation, for both minerals and leisure, but that it has always retained an element of abandonment throughout.

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## **Abbreviated Titles**

NAS – National Archives of Scotland

NLS – National Library of Scotland

## Introduction

In the eighteenth-century, Silver Glen, which sits on the Ochil Hills, just east of Alva in Clackmannanshire, Scotland, was the location for intense, yet short lived silver and cobalt mining ventures. This industrial activity has indelibly left its mark on the landscape, in the form of mine shafts and adits. Sir John Erskine, a landowner of modest earnings<sup>1</sup>, was well aware of the wealth that could be gotten from finding precious minerals on his estate. He enlisted the help of miners from Leadhills to prospect his estate, and they found two veins of silver. This find would become infamous and Sir John's estate would fleetingly become the focus for Isaac Newton, Master of the Mint, in 1716. The story would become part of local legend, and ultimately lead to giving the glen the title of 'Silver Glen'. It can be argued that this legend needs to be reassessed. In all the scholarly work that considers the glen it can be asserted that the focus has mainly been on the mine workings themselves, with some attention given to their history. The most thorough work is by Stephen Moreton who recounts the story of the Erskine family throughout the mining ventures, and gives details of the minerals at the site.<sup>2</sup> What has yet to be considered is the impact that these mining activities had on the surrounding environment. Not only that, there is a paucity of literature which considers the cultural impact of the mine and how the local

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<sup>1</sup> R. Paul, 'Alva House Two Hundred Years Ago' in *The Hillfoots Record*" Alva 27<sup>th</sup> March – 16<sup>th</sup> April (1901)

<sup>2</sup> Stephen Moreton, *Bonanzas and Jacobites: The Story of Silver Glen* (Edinburgh, 2007)

community has related to the glen as being part of their history. It will be established that due to the shortcomings of these other studies there is a need for a far more rigorous evaluation of the environmental impact that the mining had on the glen. From this assessment it will be possible to understand how man has come to use the glen as part of a post industrial landscape. Such an examination will create a valuable component to the history of Silver Glen; a component that has hitherto been unknown.

To begin, it would be prudent to consider scholarly work that has dealt with the history of Silver Glen. Wilson highlights that there was a slump in mining activity towards the latter half of the seventeenth century but that Erskine's discovery revived this feeling.<sup>3</sup> Smout adds to this and asserts that the dramatic circumstances which surrounded the discovery as being somewhat of a starting point for prospecting in Scotland.<sup>4</sup> Shaw echoes this but goes further and states how much of a catalyst the Union of 1707 was in promoting a new wave of mineral prospecting.<sup>5</sup> There are articles that are concerned with the broad topic of metal mining throughout the Ochils, such as John G Harrison's *Heavy Metal Mines in the Ochil Hills*, that deals with a lot of the eighteenth-century documentation.<sup>6</sup> As detailed as Harrison is, there is scarce mention of what activity took place at the Silver Glen mines. The wealth

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<sup>3</sup> G. V. Wilson, G. V. Wilson, 'The Lead, Zinc, Copper and Nickel Ores of Scotland' in *Memoirs of the Geological Survey Vol. XVII.* (Edinburgh, 1921), p.3

<sup>4</sup> T.C. Smout, 'Lead-mining in Scotland, 1650-1850' in Peter L. Payne, *Studies in Scottish Business History*, (London, 1967), pp.103-135, p.105

<sup>5</sup> John Shaw, *Water Power in Scotland 1550-1870* (Edinburgh, 1984), p.80

<sup>6</sup> John G Harrison, *Heavy Metal Mines in the Ochil Hills: Chronology and Context*

of documents that Harrison highlights is extremely useful and there are a number of hints that these documents may contain more detailed accounts of activity. *The Forth Naturalist and Historian* journal has provided articles that consider the glen, and they are useful in that they plot out the mining plans, but because they do not engage entirely with the documentary evidence they are lacking in any great amount of depth regarding the history. There are smaller publications that make brief mention of the mines such as Swan's *Clackmannan and the Ochils* and Corbett et al's *The Ochil Hills* but there is only fleeting mention of the activities.<sup>7</sup> As previously stated Stephen Moreton's *Bonanzas and Jacobites* is without doubt the most useful publication as it recounts a portion of both the silver and cobalt mining activity by utilising a wealth of contemporary documentary evidence. Moreton also analyses some of the remaining industrial archaeology, as well as this he gives a detailed analysis of the spoil heap at the site, to which he recounts the minerals therein, but there is again little detail about the environmental or cultural impact of the mining and its processes.

The mine workings themselves have been given a great deal of attention in most scholarly work, having been mapped out by Dickie and Forester, as well as Moreton who assesses an 1889 survey of the mines as

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<sup>7</sup> Adam Swan, *Clackmannan and the Ochils* (Edinburgh, 1987), p.68; L. Corbett & E. K. Roy & R. C. Sneddon., *The Ochil Hills* (Stirling, 1994), p.36

well as the original survey conducted in 1716.<sup>8</sup> Due to the parameters of this study there will not be an extensive assessment of the workings, as it can be argued that the focus placed on the mines themselves has taken away from the site as a whole and eschews other landmarks of industrial activity that are dotted around the site. An example of this being a dam that has been constructed on Silver Burn, presumably for creating a water supply as a pipe runs a few meters from this dam to a cylindrical iron water tank. The age of this tank is unknown but it has ceased to be used and is in a state of abandonment. There is no mention of this construction in any scholarly work besides a cursory mention given in the Grampian Speleological Group (GSG) report of their visit in 2005.<sup>9</sup> There are also a number of iron rails, around two meters in length, that do not look dissimilar to railway lines, and there are two of these lying sporadically around the site, one in Silver Burn in close proximity to the main 'Silver Chamber' entrance, and the other on the west side of the burn next to another, much larger adit. It is curious to note that although two can clearly be seen inside the workings themselves in a photograph in the GSG report, they are not mentioned.<sup>10</sup> These examples show that there is more to the industrial archaeology than the mine workings. Although the water tank and the rails are perhaps not vitally important to the mining activity, they are useful as they help to shed light upon how the glen has come to be used after the mining had ceased.

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<sup>8</sup> D.M. Dickie & C.W. Forster, *Mines and Minerals of the Ochils* (Clackmannan, 1974), p10; Stephen Moreton, *Bonanzas and Jacobites: The Story of Silver Glen* (Edinburgh, 2007), p.73

<sup>9</sup> Grampian Speleological Group Bulletin, March 2007, p.22-23

<sup>10</sup> Grampian Speleological Group Bulletin, March 2007, p.22



From a cursory look around the glen it can be asserted that there is very little visual evidence that the mining has made any significant



thriving and diverse array of plant life does not mean that there are zero records of an environmental impact at Silver Glen, resulting in the amount of pollution that may have befallen the

glen due to the operations at the mine. Such an analysis was carried out by the British Geological Survey.<sup>11</sup> Within this report there is detail of the rock type and a description of the mine shafts and tunnels, yet there is no mention of any pollutants. The most notable issue with the mines and one that is indicated on a notice next to the 'silver chamber' as highlighted by the Central Scotland Bat Group, is the presence of radon gas.<sup>12</sup> Moreton states that this is due to traces of uranium found within the mines that generate this gas, and cites an Inspector of Mines report that suggested fencing off the mine entrances.<sup>13</sup> There is an undated video from the Woodland Trust that shows park rangers giving guided tours around the mine workings in which there are gated entrances.

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<sup>11</sup> British Geological Survey, *No.53 Investigation of polymetallic mineralisation in the Alva, central Scotland*

<sup>12</sup> Central Scotland Bat Group Newsletter, Issue 46 April 2006

<sup>13</sup> R.J. Cole, Inspector of Mines April 1990, cited in Moreton, S. (Edinburgh, 2007), p.82



Source: Woodland Trust Video

The issue with the radon gas shows that there are already known contaminants on the site which are a direct result of the mining activity, and action was taken in the form of the gates. Such measures will have had an effect on the way the way the public use the glen and therefore have influenced the cultural legacy of the mines; if they are seen as being dangerous it can be argued that this would deter people from visiting the area as a whole and result in abandonment. With that said it can be asserted that abandonment has come to be part of what defines the glen. It will be shown throughout this study that although man has used the glen in some way it still retains an element of having been abandoned.

In order to establish a better understanding of the industrial activity that took place within the glen a thorough assessment of the documentary evidence is required. The principal documents used will be letters sent to Sir John Erskine from his wife, the Lady Catherine, the Erskine family papers and the Erskine-Murray Manuscripts. As well as this there will be a journal written by Lauderdale at the time of the first silver mine inspection and the Royal Mint Papers which also recount this

inspection. The Erskine papers contain written accounts by Sir John Erskine, and all related documents concerning work at the silver mine. The Erskine-Murray manuscripts are correspondence to the Erskine estate regarding work at the cobalt mine, with a great many from John Williamson overseer, and Nicholas Crisp a cobalt specialist in London. The other main source for this study will be local newspapers: the Alloa Journal, Alloa Advertiser & Journal and Alloa Hillfoots & Advertiser. Each of these will provide vital insight into how the glen has been viewed within the local community.

These sources will be compared with the industrial archaeology to create a broader understanding of what is on the ground and how this can be related to what is conveyed in the contemporary accounts. A useful source for this will be surveys made of the mine workings by the Grampian Speleological Group, as they provide first-hand accounts of the site from 1964 and 2005. An elemental analysis of the soil will then be carried out to uncover any contamination created by the mining activities and to assess whether this has had any detrimental effects on the site. In conjunction with all of these sources, photographs and maps will be utilised for illustrative purposes.

The history of Silver Glen needs to be reevaluated. It has been shown that scholarly work has touched upon the documentary evidence and engaged with the industrial archaeology but none have combined

them successfully. By engaging more with what is on the ground it will help to gain an understanding of how man has used the landscape post-industry. This will be done in order to discover the environmental and cultural legacies that have hitherto not been given attention. It will be shown that the glen has been exploited for its minerals and more recently for leisure pursuits and heritage value, yet between these phases it has been abandoned. It will be shown then that the Silver Glen has gone through two distinct cyclical phases – exploitation and abandonment.

## **1. A History of Exploitation**

The story of Sir John Erskine's discovery of silver rich ore on his estate in 1714, took place against the dramatic backdrop of the Jacobite Rebellion. By the end of 1716, Sir John could consider himself as being a fortunate man. As a staunch Jacobite he had gone to Europe in September 1715 in an attempt to procure financial support and arms for the rebels cause. The failure of this rebellion would leave him exiled in France, and wanted by the British crown. His saviour would be a silver mine that he

and his wife, the Lady Catherine, had kept secret since 1714. Sir John's mining operation would only be small, but the amount of silver found would be significant. This discovery would ultimately give the glen its name, and not only that but it would considerably alter its environment. This chapter will map out the activities that have taken place within the glen, activities that have changed how the glen has come to be used. This will be done by assessing the documentary evidence pertaining to the eighteenth-century mining ventures. Examining these documents will help to build a detailed picture of activity on the site, and thus contribute to uncovering parts of the environmental legacy that have hitherto been given no attention or unknown. Although it may sound fanciful the mystery and intrigue that surround a great deal of the history will become an important factor in building the glen's cultural identity.

Between 1711 and 1714 Sir John Erskine brought in miners from Leadhills to prospect his estate for minerals. Erskine was a reasonably wealthy man, however if he was able to extract precious metals from his estate then this would assist him immeasurably in making improvements to his land, which he was extremely eager to do.<sup>14</sup> The miners found a string of silver ore, which when followed led to a much larger mass.<sup>15</sup> Once Erskine had established that there was potentially a great deal of silver ore on his land there is evidence to suggest that he kept the operations low-key. The most compelling argument for this comes from a

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<sup>14</sup> R. Paul, 'Alva House Two Hundred Years Ago' in *The Hillfoots Record*" Alva 27<sup>th</sup> March – 16<sup>th</sup> April (1901)

<sup>15</sup> Statistical Accounts of Scotland, 1791-99, p.141

former servant John James, he claimed that he was one of the first to be involved with the mining stating that “we continued the work with so great success and secrecy that servants belonging to the same family never knew what we were about ... severall hundreds pounds value was Refined in a very short time.”<sup>16</sup> James was originally employed in 1711 to help train the servants on Erskine’s estate, and he had volunteered to help Erskine out when told about the mine.<sup>17</sup> He then goes on further to state that Erskine had employed some of his own tenants to dig the ore, and that they did not know what it was they were doing.<sup>18</sup> These statements are useful, however they should be treated with caution, and they are given by a man who was in partnership with James Hamilton. Hamilton had been given the position of overseer after John Erskine had to leave on account of the rebellion; in hindsight this move would prove to be initially disadvantageous for Erskine. Hamilton would travel to London to inform the crown of the mine. For what reason this was done is not abundantly clear, although his departure is documented by Lady Erskine, in a letter to her husband, she states “James [Hamilton] went away three months agoe for he turnd wrong in the head & wold not stay.”<sup>19</sup> It would transpire that Hamilton had given a deposition to the crown, within which he details the secret affairs relating to the mining. The Crown would be very interested to know of a rebel hiding what could potentially be a lucrative silver mine from them. Within the deposition he states:

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<sup>16</sup> John James, quoted in Stephen Moreton *Jacobites and Bonanzas* (Edinburgh, 2007), p.17

<sup>17</sup> *Ibid*, p.17

<sup>18</sup> *Ibid*, p.17

<sup>19</sup> NAS, GD1/44/7/14

*“John Erskine’s Lady then employed this despondent as overseer of four men that digg’d the ore out of the mine for about three months in which time they dug out of the mine ... about forty tons of ore to which was brought to Sir John Erskine’s house and there packed in pipes, hogs head and other casks which they buried in the bank to the north west end of the house.”<sup>20</sup>*

This evidence is extremely revealing. It shows that there were four men working the mine in Sir John’s absence, it states how much ore was taken from the mine and then asserts this ore was then hidden in barrels near to the house. These facts are important to emphasize as they helped to contribute towards the legends that would become synonymous with the story of Silver Glen – the forty tonnes of ore and the hidden barrels containing that ore. As with the John James letter, this deposition should be treated with some caution. Although the fact that Hamilton informed the crown of the activity displays that he thought it was worth jeopardising his employment and relationship with the Erskine’s over, and perhaps is less likely inclined to lie. Upon finding out of Hamilton’s betrayal Lady Erskine writes:

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<sup>20</sup> NLS, MS.5160 (Paul), f.5

*“the discovery of James H has made of Mr Nabit’s<sup>21</sup> affair it has grieved me very much & it is no small satisfaction that it has not failed by any neglect of mine but he certainly designed to comitt the villainy & went away with that vein for nothing I could do could make him stay.”<sup>22</sup>*

This shows that Lady Erskine believed Hamilton to be untrustworthy and that he had alerted the crown for his own gain, this then raises questions about the figure of forty tonnes which has become the most quoted sum within the literature, this will be discussed later.

During John Erskine’s absence the most illustrative account of activity at the mine was documented through Lady Erskine’s letters, unfortunately they are most notable for their lack of detail. Lady Erskine wrote many times to Sir John who was for the most part staying in St Germain, in Paris, expressing on numerous occasions her hope for her husband’s safe return. Little is given away by Catherine about the mines themselves, she opts for code words such as “Mr William” which can be postulated to mean a miner, and at points could be the mine itself.<sup>23</sup> She also uses the word “Mr Nabit”; Nabit being the name given to the hill.

Any names given are initialled, such as “P.C”<sup>24</sup>; one can assume that this

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<sup>21</sup> “Mr Nabit” is a reference to the mines themselves

<sup>22</sup> NAS, GD1/44/7/18

<sup>23</sup> NAS, GD1/44/7/10, in this letter she states “...as for Old W work I am obliged to give it up yesterday.”

<sup>24</sup> NAS, GD1/44/7/1



stands for Patrick Campbell of Monzie, John's brother-in-law<sup>25</sup>, and "D.P"<sup>26</sup> standing for Daniel Peck. Such secrecy does not help in documenting the activity but it does add to the mystique of the operation and the dedication by Lady Erskine to keep it a private affair.

Unfortunately the cryptic nature of Lady Erskine's letters makes a lot of things unclear. What is unfortunate is there is language used that could elude to work at the mines, but could also be attributed to work on the estate, one such example reads "...it convenient to have seven carts goeing & eighteen men & will continue that number if possible till its ended there is such a deepness of earth that it is no easy work."<sup>27</sup> It is not complicated to assume that 'deepness of earth' could refer to the mining activity, and if that is the case then seven carts being used to take the excess waste from the site would be a large amount indeed. This cannot of course be used as definitive evidence of the mining activity, as the earth could refer to ploughing, or another farming practice, but given the quantity of ore purportedly taken from the ground, there could be a strong case for the 'deepness' referring to the mine. It is also evident from her letters that the secrecy of the mine had not lasted, as by June 1716 she writes "as to Mr Nabit his fame was too much spread abroad to continue employing old Wm & all of a sudden there was no more valuable thing to be got in that place."<sup>28</sup> The 'fame' mentioned could be argued as the first time the silver mine had started to be talked about amongst the local community, this

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<sup>25</sup> *Publications of the Scottish History Society, XLIV, Miscellany (1904) vol.2, pp.371-430, p.414*

<sup>26</sup> NAS, GD1/44/7/5

<sup>27</sup> NAS, GD1/44/7/11

<sup>28</sup> NAS, GD1/44/7/10

shows the beginnings of the glen's cultural legacy. This also shows that working at the mine had stopped due to lack of minerals being found.

It would transpire that due to an old law of 1592 that stipulated one tenth of silver or gold found should be paid to the crown, Sir John Erskine would soon be able to return to his estate. Lord Townsend presented this idea to King George I, and on receipt of the sample of ores from Hamilton, and the promising description he gave of the mine, he enlisted Isaac Newton, who at the time was Master of Mint, to oversee an inspection of the mine. Erskine would receive his pardon and returned to his estate by the end of 1716.<sup>29</sup>

The inspection was carried out in January and February of 1717 by Dr Justus Brandshagen, who had been chosen by Newton to visit Erskine's mine. These inspections were conducted in order to authenticate James Hamilton's account. Brandshagen was accompanied by the Earl of Lauderdale along with James and Thomas Hamilton. Their accounts, specifically those of Brandshagen and Lauderdale are the best contemporary sources for detailing what was taking place, although it will be shown that they are somewhat lacking. It should be mentioned that there is evidence to suggest that there was an attempt made by Lady Erskine to fill up the mine; Lauderdale's journal states that "the only place that to his knowledge any ore had been dug out of, And the shaft or sink

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<sup>29</sup> *Publications of the Scottish History Society, XLIV, Miscellany (1904) vol.2, pp.371-430, p.417*

of the Mine and Level which entered to the same from below being entirely filled up with earth and stone.”<sup>30</sup> It can be postulated then that the ‘deepness of earth’ alluded to previously was regarding the mines. The instructions from the Royal Mint concerning what was to be done at the site were seemingly all followed, as all three men sign a riposte to these instructions which states “so far as the season of the year would permit being thus finished.”<sup>31</sup> If this is the case then the instructions can be regarded as descriptive of the work that took place; however there is no great amount of detail given about physical work to be carried out, merely instructions to break “pieces of Ore from each of the said veins and make Assays thereof upon or near the place where the same shall be taken.”<sup>32</sup> The instructions regarding the assaying of the ore will be seen to be vital in discovering potential processing sites.

It has been shown that although Brandshagen and Lauderdale provide some insight into work that took place at the mine there is very little account of the physical work that went on. What *is* known about the physical labour is that gunpowder had been used to help with digging. Henry Kalmeter, a Swedish industrial spy<sup>33</sup> who visited Alva in June 1719 states that “...the work continued and they had entered 10 or 12 fathoms with their tunnels, blasting with gunpowder where the rock was hard.”<sup>34</sup>

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<sup>30</sup> NAS, RH69/26/3

<sup>31</sup> NAS, RH4/165/3

<sup>32</sup> NAS, RH4/69/26/1

<sup>33</sup> Henry Kalmeter, in T.C. Smout (ed.), ‘Journal of Henry Kalmeter’s Travels in Scotland 1719-1720’ in *Scottish Industrial History; a Miscellany* (Edinburgh, 1978), pp.1-52, p.1

<sup>34</sup> *Ibid*, p.38

This fact is mentioned very little, if at all in the literature. What is also lacking are descriptions of how the ore was processed prior to smelting. This would be invaluable information as it would help in creating a better idea of the environmental impact. Unfortunately there is a paucity of information on documented processing at the site. Brandshagen's report provides a great amount of detail about the different assaying techniques used whilst smelting, what is not mentioned is the location of the smelter. If a smelter had been constructed the location would help to establish where the most amount of pollutants had been created and again would help towards assessing the environmental impact. Brandshagen laments at the "considerable time, pains & expense in clearing this mine and in building furnaces for assaying"<sup>35</sup> There is evidence however, to suggest that this smelting did not take place in a purpose built structure, but within Erskine's house itself. Kalmeter states that he had been told by an eye witness that "they smelted the best of the ore as well as they could at home in the house, in great pots or crucibles with lead, also refining it"<sup>36</sup> This is corroborated by Isaac Newton who writes, with what seems like an eagerness for the inspection to end owing to "diminishing expenses"<sup>37</sup>, he states that he has given instructions for Brandshagen and the Hamiltons to find a "convenient place for setting up one or more furnaces." With haste being the theme it would seem unlikely that they would have taken the time to construct a purpose built structure. Further

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<sup>35</sup> NLS, MS 5099, f.38, also in RH4/165/3

<sup>36</sup> Henry Kalmeter, in T.C. Smout (ed.), 'Journal of Henry Kalmeter's Travels in Scotland 1719-1720' in *Scottish Industrial History; a Miscellany* (Edinburgh, 1978), pp.1-52, p.38

<sup>37</sup> NAS, RH4/165/3

to this, Brandshagen said of Erskine that he had been “particularly civil & kind to me, by procuring me & my family and the Hamilton’s good lodging & accommodation near the mine in the Minister of Alva’s house but likewise in accommodating us with necessary tools, with work people, and with a house where we built the furnaces and made the assays.”<sup>38</sup>

It can be put then that Kalmeter’s eyewitness was telling the truth; with Erskine being so accommodating there is a strong argument to state that the furnaces were indeed built inside his house. Kalmeter goes further with a most revealing fact stating that “the aforementioned owner has begun to build a smelting and refining house where a stream comes below the mountain.”<sup>39</sup> This could very well be the case as around that time Erskine had drawn up a lease with the London Lead Company which asserted that “possessed in his own right and of his workhouse, furnaces & stamping mills”<sup>40</sup> If Kalmeter is to be believed then there is a such a building that fits this description on the earliest detailed map of Alva House estate.

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<sup>38</sup> NLS, MS 1560, f.39

<sup>39</sup> Henry Kalmeter, in T.C. Smout (ed.), ‘Journal of Henry Kalmeter’s Travels in Scotland 1719-1720’ in *Scottish Industrial History; a Miscellany* (Edinburgh, 1978), pp.1-52, p.39

<sup>40</sup> NLS, Erskine-Murray Manuscript, MS 5098, f.6



Source: National Library of Scotland Maps

There is yet further evidence that places the smelter in this location.

Assessing another lease in 1728 to the Duke of Atholl provides the power to “build houses for the workmen, hovels and stables & to build & erect smelting and refining houses or mills with all opportunaces [sic] necessary water engines or other engines to make & set up.”<sup>41</sup> This shows that there was every intention to build a smelter. A more detailed analysis of this hypothesis will be carried out within the next chapter.

Sir John Erskine’s venture would only last until the late 1720s, the correspondence comes to a close within the Erskine family papers. The next mining venture would be taken up by Charles Erskine, Lord Tinwald, who was Sir John’s brother and he would open the mine again in a bid to find more silver. What Tinwald would find instead was “true cobalt of the kind which affords the zaffer or blue for porcelain.”<sup>42</sup> John Williamson who was employed at Leadhills had been given the job of

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<sup>41</sup> NLS, Erskine-Murray Manuscript, 5098, f. 45

<sup>42</sup> NLS, Erskine-Murray Manuscript, 5098, f.49

overseeing the reworking of the mines and provides a great deal of correspondence with Tinwald, giving updates about work at the mine. Although much detail is provided about the amount of fathoms that had been dug there is very little detail about the physical work or any processes taking place on the site. It is evident that since the silver mining had come to a halt the mines were in a state of disrepair, and Williamson states his concern “this method of clearing out the rubbish from the old workings and draining the water from the general level and the two drifts above may perhaps occasion more expenses than was at first adverted to.”<sup>43</sup> With mention of clearing out the mines and the expenses this is very similar to what was said during the first mining venture. With regards to testing the Cobalt’s quality, Nicholas Crisp was Erskine’s specialist, who was located in London, and his correspondence offers a great amount of detail on the matter. Crisp had volunteered to test the cobalt for Erskine in March 1763 stating that “as I have a place ready and a Furnace immediately to work a considerable quantity I so not see why half a tonn or more may be worked every week.”<sup>44</sup> In a great number of correspondences he displays that he is being extremely meticulous in testing the Cobalt. Erskine was clearly eager to discover if the samples he had been sending Crisp contained silver, he writes back to him “There is a good deal of arsnick in it. Iron, copper and other metals but wither silver, I have no yet tryed.”<sup>45</sup> Crisp clearly has invested interest in the cobalt,

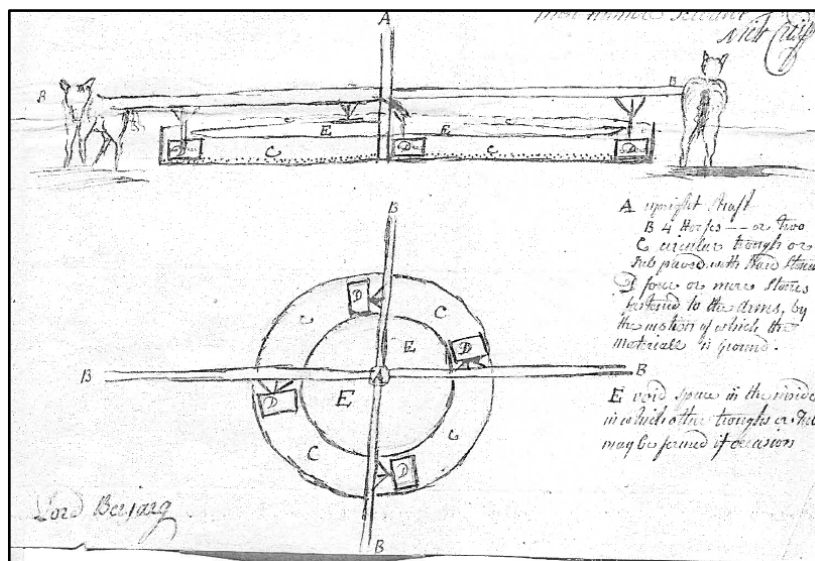
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<sup>43</sup> NLS, Erskine-Murray Manuscript, 5098, f.31

<sup>44</sup> NLS, Erskine-Murray Manuscript, 5099, f. 7

<sup>45</sup> NLS, Erskine-Murray Manuscript, 5098, f.130

without doubt on a scientific level, in one letter his excitement is visual on the page, and he writes with hurried excitement “I have produced to an imminent colourman with some of the best I could import from Saxony of the FFF.<sup>46</sup> He tried them all without being informed of the FFF being foreign and he was fixed upon that as the worst of the five and that the other four were greatly preferable to it.”<sup>47</sup> His enthusiasm can be seen from his signature which is almost unrecognisable. The greatest insight into possible processes at the mine comes from Crisp who sends a letter to Tinwald of an unknown date but postulated to be 1762 in which he recalls a conversation he had with Harry Erskine. Crisp explains that he knew of two men involved with a cobalt mine in Sweden and claims their knowledge to be invaluable to Tinwald. What is most illuminating is that he provides a sketch of a crushing mill which he suggests could be used to process the cobalt ore.



<sup>46</sup> 'FFF' is not explained within the letter, however it is explained in the Cobalt book with the Erskine collection and stands for 'Fine Fine Fine Cobalt', in NLS 5135, f.32.

<sup>47</sup> NLS, Erskine-Murray Manuscript, 5099, f.39



It has been shown that Crisp was an influential figure to Erskine and it is worthy of note that within the Erskine's family papers there is a book entitled "An Essay on Cobalt".<sup>48</sup> Within this book there is great detail about how to build a smelter and the processes involved in smelting itself. At the back of this book there are corrections made in Nicholas Crisp's handwriting. This gives more credence to the possibility that a smelter was built. This can be further shown in a lease taken out in 1759 by Lord Tinwald which provides useful detail for parts of the estate: "the Grounds of Alva upon the Dove-coat burn, from the old Smelt house on the south to a place to be marked out one hundred fathoms to the north of the shielburn".<sup>49</sup> This is illuminating for a number of reasons. It gives the name 'dove-coat burn' this is most likely the name of the "Silver Burn" before the infamy of the silver mine grew. What is most useful about this is the mention of the 'old smelt house'. Given that it is being described as an 'old' smelt house; this strongly suggests that it has been a structure for a sustained period of time and so could have been built by Sir John Erskine.

As it was with the silver mine, there was great excitement about the new cobalt mining activity but it would soon come to a halt, but this time it can be seen to be for different reasons; from correspondence it can be

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<sup>48</sup> NLS, MS 5135

<sup>49</sup> NLS, Erskine-Murray Manuscript, 5098, folio 84

postulated that Charles had ran out of money. A letter from John Stephenson mentions that he had received word from John Williamson that “the works were stopped although a few fathoms more would have given us a thorough trial.”<sup>50</sup> The loss of the activity would be lamented two years later in a letter from John Stephenson who states “it has been great concern to me to find our Cobalt Company decline to nothing.”<sup>51</sup> Offers would continue to trickle in to Tinwald regarding the quality of his cobalt, however this was all too late as by 1766 work had ceased.<sup>52</sup> There was even an offer from a Rob Wilson at the Carron Company in Falkirk regarding good quality iron being found in his ore.<sup>53</sup> With news of work drawing to a halt, Tinwald received letters proposing he reopen the mines once again, with John Seyfert explaining how his plan would create “1700L clear produce”, and that he would provide Erskine with a sixth of his takings which would give him “300L a year, and more than likely 10 times this amount!”<sup>54</sup> This demonstrably shows that there was a strong desire to continue exploiting the glen. Seyfert’s plea would go unanswered and the mines are left abandoned. It can be argued that the examples shown above reflect a theme of exploitation and abandonment. The land is used, then immediately left, this will be shown to be a key-theme throughout the glen’s history.

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<sup>50</sup> NLS, Erskine-Murray Manuscript, 5099, f.56

<sup>51</sup> NLS, Erskine-Murray Manuscript, 5099, f.71

<sup>52</sup> NLS, Erskine-Murray Manuscript, 5099, folio 56

<sup>53</sup> NLS, Erskine-Murray Manuscript, 5099, f.116

<sup>54</sup> NLS, Erskine-Murray Manuscript, 5099, folio 64

What cultural implications can be gleaned from this documentation? The statistical account of the 1790s contains one of the first instances that alludes to the ore having been stolen “it has been conjectured, that Sir John drew from L.40,000 to L.50,000, besides much ore, which was suppose to have been purloined by the workmen.”<sup>55</sup> This is important as this story has become synonymous with the history of the silver mining, and along with the hidden barrels has been a main component of the cultural legacy, yet the aforementioned amount of ore has never been questioned. There obviously were barrels buried on site, as shown within Branshagen’s journal, but it can be argued that James Hamilton along with his accomplice John James were involved with the buried barrels. There is an eyewitness account of the ore being stolen as recounted by Lauderdale who had asked servants of John Erskine if any more of the ore had been buried elsewhere on the estate he was told that “the rest of the ore had been from time to time carried away but they knew not where”<sup>56</sup> The fact that Lauderdale had evidently spoken to more than one servant alludes to only a very small number of people knowing of the ore being taken away. Lauderdale then questions the location where the casks were shown to be – “having considered this piece of ground in which the casks were said to be hid it appeared to us that it could not have contained the quantity of forty tons”<sup>57</sup> This brings into question the quantity of forty tons that is so regularly cited. John

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<sup>55</sup> Sir John Sinclair, *The Statistical Account of Scotland 1791-1799 Volume IX Dunbartonshire, Stirlingshire & Clackmannanshire* (Wakefield, 1978), p.157

<sup>56</sup> NAS, RH4/69/26/9

<sup>57</sup> NAS, RH4/69/26/6

Erskine then showed them to another spot where most casks had been buried “discovered six small casks or barrels filled to the tops ... with nothing but stones that probably had been brought out of the shaft or sink when they were digging for the ore.”<sup>58</sup> It can be argued that even Sir John Erskine may have been surprised when they found there was no ore in the barrels. There is evidence to suggest that both James Hamilton and John James were involved in a venture to ship out barrels of ore. The Erskine papers contain questions by an unknown author to be asked of Hamilton with one being “Did you cause three casks of ore to be shipt from Alloa in John James’s name?”<sup>59</sup> This is by no means concrete evidence, but it certainly raises new questions about the site. It questions the legendary forty tons of ore and it also questions the role of James Hamilton as it can be postulated that his part in the whole affair was much larger than has been considered. Hamilton’s character is questioned by Newton who writes “James Hamilton had pretended to know the mines yet they loitered at Edinburgh some weeks till Sir John Erskine came down to show them the Mine.”<sup>60</sup> The Hamilton’s also complain about their being underpaid, with one issue being that the “business of walking the mine” had not been “among the instructions.”<sup>61</sup> It is also curious to mention that there are two occasions where Erskine recounts with consternation that he had been “represented at court as if [he] had offered & designed violence against those sent down here for viewing his

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<sup>58</sup> NAS, RH4/69/26/8

<sup>59</sup> NLS MS.5160, f.7

<sup>60</sup> NAS, RH4/69/26/33

<sup>61</sup> NAS, RH4/69/26/33

mines”<sup>62</sup> and on a previous occasion had concern over “lying stories sent up by James Hamilton of John Erskine having threatened, insulted & maltreated him” and that there had been occasion to bring soldiers along for their protection.<sup>63</sup> As has been mentioned previously this would be in stark contrast to how accommodating Brandshagen found John Erskine to be. What this shows is that there are narratives hidden amongst the most well known stories about Silver Glen. The forty tons has been brought into question as the derivation of this number was given by James Hamilton who has been shown to be a rather questionable source.

What has been created here is a picture of exploitation. The glen had been exploited for its minerals and evidence to suggest that James Hamilton had exploited his position at the silver mine for financial gain. This theme of exploitation can be taken further and it is by no means confined to the eighteenth-century. There has been recent interest in the mineral wealth that the glen offers; this interest has been based on the ore that has already been pulled from the ground. In 1994 the spoil heap, created during both the mining activities, was thoroughly investigated by Stephen Moreton and Brian Jackson, with the help of researchers and local mineralogical activists.<sup>64</sup> This group were interested in finding silver and cobalt mineral specimens, and to aid them in their endeavours they used a mechanical digger. Although such equipment is an extremely useful tool

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<sup>62</sup> NLS, MS 1560, f.12

<sup>63</sup> NLS, MS 1560, f.10

<sup>64</sup> Brian Jackson, ‘Mineral Rescue Collecting at the Alva Silver Mines’ in *Forth Naturalist and Historian*, Vol.17, pp.3-4, p.3

in excavating such a difficult site, disturbing a large pile of mining waste would most definitely have disturbed a great deal of detritus and pollutants. This would only have been exacerbated by the use of a sluice box constructed from diagrams drawn in 1910.<sup>65</sup> The amount of water used in this process would have spread any pollutants present within the spoil heap down the hillside and into the burn. If this was indeed the case then this amount of disturbance could not only be detrimental to the surrounding environment but it could potentially spread any historical pollution. Such an amount of disturbance would also be unfortunate for this study. Moreton's activity shows that he has added to the history of mineral extraction. It can be seen that these activities fit into the environmental legacy of the site, fitting the mould of exploitation. The cultural legacy of this activity will be assessed within the next chapter.

The draw of the glen for those seeking potential mineral wealth has been made evident here. With the eighteenth-century estate owner looking to gain more wealth, and the twentieth-century enthusiasts, hoping to uncover rare minerals – both exploiting the land without too much thought given to the environmental effects of their actions. It has been shown that the actions of James Hamilton have had significantly more consequence than has previously been thought. It was his deposition that created the legend of the 'forty tons' in the barrels, and having been seen to be a man of questionable nature this deposition can

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<sup>65</sup> Ibid, p.3

be placed in doubt. If this is the case then that would alter the history of the silver mining and the mystery surrounding the hidden barrels that have made the story of Silver Glen popular. In order to assess this it would be prudent to analyse the landscape in great depth. By doing this it will be possible to get a general idea of how the mining and its potential historical pollution has affected the environment. In conjunction with this analysis it would be beneficial to address the remaining industrial archaeology, through this it will be shown what physical impact these activities have made.

## 2. Industrial Archaeology Reassessed

Without a thorough analysis of the soil it can be asserted that there is a distinct lack of any visible pollution at Silver Glen. A walk up Silver Burn is not the easiest of tasks, but in doing so one encounters a number of mine workings on either side, principally the east side. The documentary evidence has shown that they are products of eighteenth-century industry, these shafts and adits are the most obvious components in telling the story of the environmental impact that mining had on the glen. What is known of the mining activity has been recounted, and it has shown to be somewhat lacking in detail with regards to the site as a whole. It would be prudent then in this chapter to analyse the remaining visible industrial archaeology. Such an analysis will help to provide a broader understanding of how this mining has impacted the landscape in the glen. A useful technique to achieve this would be to utilise a six point plan as created by industrial archaeologists Marilyn Palmer and Peter Neaverson.<sup>66</sup> The six points of this archaeological method are: 'source of raw materials', 'processing plant', 'power sources', 'secondary industry',

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<sup>66</sup> Palmer & Neaverson, *Industry in the Landscape* (1996)



‘accommodation’ and ‘transport’.<sup>67</sup> Assessing this environment using these points will be a useful place at which to start a physical analysis of the site as it will construct a picture of the areas of interest with regards to sites of potential contamination. What this chapter will establish is that this plan functions well, but only up to a point and that it assumes prior knowledge of the site. With this knowledge already in place as provided by the eighteenth-century documentary evidence, the plan will be utilised to help create a picture of activity within the glen and in doing so help towards an understanding of the environmental impact.

It would be useful to briefly explain the six-points as a method for analysis. This first, that of ‘source of raw materials’, are the minerals which created the industry to begin with, the second point ‘processing plant’, is the location of where these minerals were prepared and sorted. Thirdly ‘power sources’ is one of the most vital components to an industrial site to keep it functional and water is the most common of sources as it can be utilised for powering mills, alongside a number of other fundamental processes. The fourth point is concerned with a ‘secondary industry’ that is created as a direct result of the initial first industrial endeavours. Point five is the evidence of any accommodation within the landscape, such a discovery is important as it can help towards illustrating how many people were at a site, and human influence upon a site no matter how large or small is impactful and will have altered the

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<sup>67</sup> Ibid, pp.14 - 16

environment in some way. The sixth and final point deals with transportation and the relationship it can have with the industrial site, this can be important, especially when searching for pollution as clearways and paths would have been a catalyst for spreading contaminants. All these points demonstrably ask a number of simple questions about an industrial landscape, from these questions however it will be possible to extrapolate new information from the site.

How conducive is this plan in creating a detailed picture of industrial activity? There is a lack of any direct criticism of this six-point plan, however there does exist many debates centred on the study of industrial archaeology, with some detractors opposing the subject completely. One such criticism comes from Cranstone who is very direct in stating that industrial archaeology as a discipline is obsolete.<sup>68</sup> His argument predicated on his assertion that it should be incorporated into the broader field of archaeology. Symonds disagrees with this assertion strongly and highlights that it is valuable scholarly work as it concentrates on narratives; assessing the human aspect of industrial sites.<sup>69</sup> Clark is constructive in her analysis of the discipline asserting that field evidence provides a critical perspective on narratives, and furthermore can provide evidence for largely undocumented sites.<sup>70</sup> Clark does however highlight

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<sup>68</sup> David Cranstone, 'After Industrial Archaeology?' in Eleanor Conlin Casell and James Symonds (ed.), *Industrial Archaeology: Future Directions* (New York, 2005), pp.77-95, p.77

<sup>69</sup> Symonds, in Eleanor Conlin Casell and James Symonds (ed.), *Industrial Archaeology: Future Directions* (New York, 2005), p.37

<sup>70</sup> Kate Clark, 'From Valves to Values: Industrial Archaeology and Heritage Practice' in Eleanor Conlin Casell and James Symonds (ed.), *Industrial Archaeology: Future Directions* (New York, 2005), p.95-119, p.106

the opinion of Buchanan who states that industrial archaeology has made 'little impact on social and economic history' but that it has managed to gain some recognition for its illustrative purposes.<sup>71</sup> Clark goes further and believes that without documentary evidence it is very difficult to fully understand an industry as the economical issues or issues of land ownership are missing.<sup>72</sup> This is not to say she is reductive of the archaeological assessment and asserts that without such documents one is forced to scrutinise more extensively and ask why certain decisions were made, and to a certain extent connect with the creator of the industry. Perhaps the latter is fanciful, but such a method of analysing the site is conducive to exploring different possibilities for locations of structures. It has been shown that an assessment of an industrial archaeological site with a paucity of documentary evidence is scarce in its detail; however reading the landscape without a great deal of background knowledge helps to accumulate a number of searching questions. Given that there is already prior knowledge of the site, examining the industrial archaeology will only enhance an understanding of the mining activity and its environmental impact.

Turning attention to the six-point plan itself and taking the first point 'source of raw materials' it is quite straight forward enough to state that the silver ore was the initial reason why work began at the glen in 1714.

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<sup>71</sup> Buchanan, cited in Clark, in Eleanor Conlin Casell and James Symonds (ed.), *Industrial Archaeology: Future Directions* (New York, 2005), p.95-119, p.106

<sup>72</sup> *Ibid*, p.107

With the discovery of silver and cobalt minerals found in the spoil heap it can be left in no doubt about the type of mining that was taking place.<sup>73</sup>

As mentioned previously what is left of the mining activity is illustrated by several mine entrances, now all gated off, and filled in shafts.



Source: Author

The second point is 'processing plant' and this is interesting within this location as this would usually ask the user to consider buildings where processing has taken place, and a cursory glance around the main adits and surrounding environs would suggest that there are none. With that being stated there are two structures on the site, although these perhaps may not be related to any mining processes. The first is a ruinous dry-stone dyke which runs north to south just east of what is regarded as the 'silver chamber', and there is another wall in a state of great disrepair that runs perpendicular and comes close to meeting it on the west side of the

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<sup>73</sup> Brian Jackson, 'Mineral Rescue Collecting at the Alva Silver Mines' in *Forth Naturalist and Historian*, Vol.17 (1994), pp.3-4, p.3

burn. It is at this intersection where a water tank stands. This tank is made of cast iron, but is now obviously not in use as it is filled with large stones.



Source: Author

The dam that has been built on the burn was certainly constructed for this water tank as there is an iron pipe leading from the dam to the tank, further to this there are a number of other damaged pipes in the vicinity. The documentary evidence does not mention this tank or dam. It can be suggested then that this dam was built in the twentieth-century and given its size perhaps it was used to provide water for a house or houses below the glen. Dickie and Forester postulate the building of the dam obliterated one of the levels that Tinwald had driven.<sup>74</sup>

The dry-stone wall has clearly outlived its use, as much of it is now scattered down the east side of the glen, and the dam and tank are now very much redundant and abandoned objects. If Dickie and Forester are

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<sup>74</sup> Dickie, D.M. & Forster, C.W., *Mines and Minerals of the Ochils* (Clackmannan, 1974), p.13

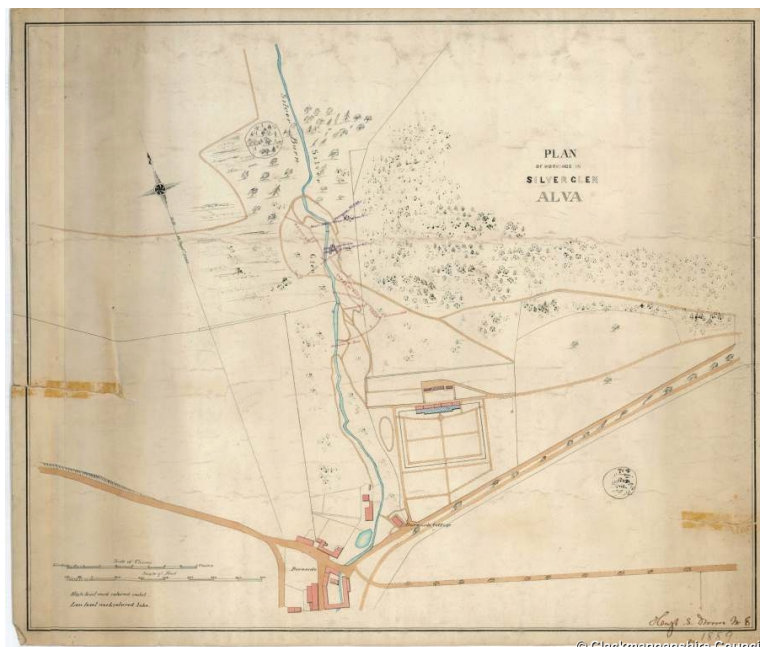
correct and the dam was indeed built upon the cobalt mine then such disregard for the previous work adds to the theme of exploitation and abandonment that has come to define Silver Glen.

To achieve a better understanding of how the glen has been exploited, finding the location of a processing site is of the utmost importance. This is due to certain processes such as smelting; a technique used to separate the silver from the raw ore, requiring a vast amount of heat, and in order to create this heat a furnace would need to be built. From the previous chapter it was shown that furnaces *were* built, but their locations were never disclosed. Before the smelting process however the ore would need to be prepared, and this was done on a dressing floor where the silver ore would be separated from other minerals that were attached to it. Both these locations would be hotspots for various contaminants and therefore locating them would be useful in highlighting how these could have spread throughout the site. For the furnaces there would need to be a source to burn and during the eighteenth-century this would most likely have been peat but traces of this are extremely difficult to judge. However it would be metals and chemicals used in the smelting process that would leave the most recognisable chemical footprint, indeed Seulki et al have shown that arsenic can be found in residual form at smelter sites.<sup>75</sup> Processes such as smelting ask the question of power

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<sup>75</sup> Seulki Jeong, Hee sun Moon, Kyoungphile Nam, 'Differential in vitro bioaccessibility of residual As in a field-aged former smelter site and its implication for potential risk' in *Science of the Total Environment* 463-464 (2013), pp.348-354

sources, and this leads on to point three of the six-point plan. The power source at this site is demonstrably the Silver Burn, as water is required for a great many mining processes, not least of all smelting, and with it being so near the mine workings this makes it the biggest power source. With this being the case, what is the argument for the potential location of a smelter? The same map that shows the paths from 1889 also displays a building at the foot of the glen that curiously has water running through it.

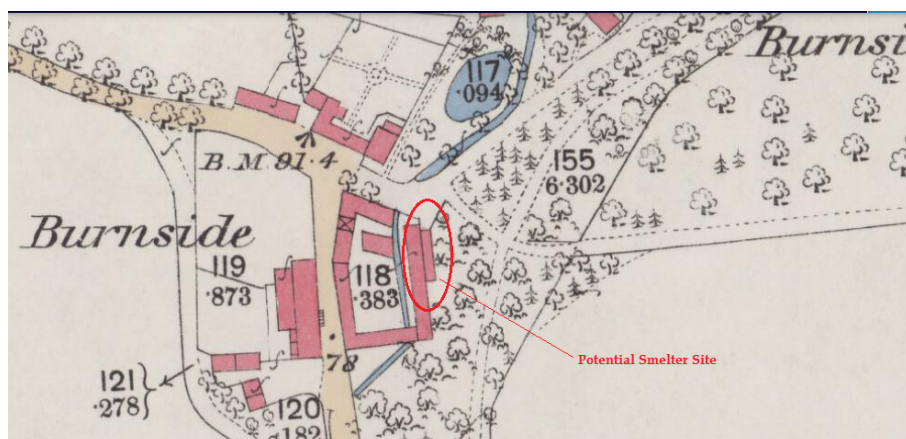


Source: Alloa Archives, PD239/204/3

It can be suggested that with its proximity to the mine (around 200m) this building is a candidate for being the smelter. Further to this, Palmer and Neaverson argue that industrial structures were built in a functional tradition, meaning that their style was determined by the function that

they carried out.<sup>76</sup> This would account for the burn seemingly flowing through the building.

There is evidence to suggest that this water course has been changed to account for the smelter. As stated in the previous chapter the lease documents between Sir John Erskine and the London Lead Company contain permission for “the courses of water, burns & rivulets to change, turn & alter as shall be most convenient.”<sup>77</sup> Such a proposition can be seen to have been taken up. The first Ordnance Survey (OS) map of Alva shows in detail the site of the potential smelter, it also shows the water course going through the bottom of the building as shown in the 1889 map. This alteration can also be seen on Roy’s military map as drawn between 1747-55, within this it depicts Alva House Gardens and it can be postulated that the change in the water course is pictured here also.



Source: National Library of Scotland Maps

The alteration of the water course remains to the present day. As the newest map shows there was building development taking place at the

<sup>76</sup> Palmer & Neaverson, *Industry in the Landscape* (1996), p.14

<sup>77</sup> NLS, MS 5160, f.45



time the photograph was taken and it shows that the watercourse is being preserved.



Source: <http://www.google.co.uk>

This evidence can be combined with the reference to the “old smelt house” that stood upon the “Dove-coat burn” which is mentioned as part of a lease that Tinwald had drawn up.<sup>78</sup> Also depicted on the 1862 OS map are other buildings adjacent to, as well as to the west of this building, and this leads to point five ‘accommodation’. If this building was indeed the smelter it can be postulated that these other structures, given the short distance from the workings, can be considered as potential residences for the miners. It can be stated then, that due to its possible previous uses this location can be considered as an area containing potentially high levels of metals and harmful contaminants. For this argument to be made stronger this location requires an elemental analysis; such an analysis would help to uncover the mining’s hitherto unknown effects on the environment. In addition to this if the soil analysis alludes to this structure being the

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<sup>78</sup> NLS, MS 5098, f.84

smelter then it will add a new area of investigation within the study of Silver Glen's industrial archaeology.

With regards to point four in the plan 'secondary industry', this commenced with Tinwald's cobalt mining. The existence of this industry is only known if you look at the documentary evidence, without this knowledge the mines themselves would only appear to have involved one industry and that it was this one era of activity that had created several shafts and adits. The last point in the six-point plan is the presence of transport. There are a number of paths that lead off from the site itself, and an 1889 map shows this in detail. Within the documentary evidence there is barely any mention of transportation. Lady Erskine mentions carts in her letters, but these can only be speculated to be referring to working at the mines. If carts were involved there are a number of paths that could potentially have been used that are shown on the 1889 map, but these could be more recent than those which were used in the eighteenth-century. With this being stated, as was highlighted in the previous chapter there are a number of iron rails around the site that may allude to a transportation system of some kind in operation. A reporter for the Alloa Advertiser guessed that these could have been used for previous explorers of the mines to access the silver chamber easily.<sup>79</sup> The most intriguing aspect of the mine workings is the absence of an obvious 'day level', an entrance like this would be conducive to transporting the

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<sup>79</sup> Alloa Advertiser, Friday 5<sup>th</sup> April 1963

minerals out of the mine. There is one such entrance on the east bank that is commonly acknowledged to be the opening to the 'silver chamber', this is a fact strongly contested by Moreton.<sup>80</sup> He contests that this myth has derived from Wilson's description of the mines given in 1921 where he describes the workings on the west side of the burn as being "shallow."<sup>81</sup> Wilson then goes on to describe the three winzes that have been sunk on the east side of the burn and highlights that the top one is said to be where the native silver was obtained.<sup>82</sup>

Such a prolonged 'myth', as Moreton believes it to be, would be an interesting one to investigate, as it raises a lot of questions regarding the placement of certain processes with relation to the mine, further to this it would be key in pinpointing areas where pollutants would be most prevalent. Moreton's argument that it must be the west side of the burn is substantiated by asserting that due to the proximity of the spoil heap even a casual observer would state that it is too large to have come from the one chamber.<sup>83</sup> Moreton's argument is quite compelling and given the descriptions of the silver mine running north to south within the documentary evidence it can be seen that Moreton is correct. The location of the silver chamber is not the only area of contention within the glen. The various descriptions of the mines are testament to this. Moreton highlights the umbrage taken by John Erskine over Justus Brandshagen's

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<sup>80</sup> Stephen Moreton, *Bonanzas and Jacobites: The Story of the Silver Glen* (Edinburgh, 2007), p.80

<sup>81</sup> G.V. Wilson, 'The Lead, Zinc, Copper and Nickel Ores of Scotland' (Edinburgh, 1921), p.144

<sup>82</sup> G.V. Wilson, 'The Lead, Zinc, Copper and Nickel Ores of Scotland' (Edinburgh, 1921), p.144

<sup>83</sup> Stephen Moreton, *Bonanzas and Jacobites: The Story of the Silver Glen* (Edinburgh, 2007), p.81

description of the mine, when it was first surveyed in 1716. Such differing views of what the mines looked like are useful as they show the complexity of the mines themselves. There are two reports which are of particular interest in this area as they are the only modern comprehensive first-hand accounts of not only what the inside of the mines look like but also of the surrounding environs and these were carried out by the Grampian Speleological Group. The first of which was conducted in 1964, and it is useful as it was carried out without a great deal of prior knowledge of the site, demonstrated by their surprise at blindly discovering a "20 foot shaft with a grid over it."<sup>84</sup> It illustrates the difficulties in traversing some of the workings by stating that: "these were situated in the most ludicrous positions in that the entrances to two of the passages were half way up a 45 foot crevice in the hillside, and the entrance to a third lay about ten feet from the bottom"<sup>85</sup> Such an overtly frustrated description not only highlights how difficult the terrain is in the glen, but also goes some way to understanding the conditions the miners were facing in the eighteenth-century.

This assessment has shown that the Palmer and Neaverson six-point plan is an effective tool for a basic understanding of the industrial archaeology at this site. The plan has however not led to anything that could be considered conclusive but has highlighted several areas of

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<sup>84</sup> Holliday, J. (1964) 'The Alva Silver Mines', *Grampian Speleological Group Bulletin 1st Series Vol.2 No.1* pp.6-9, p.8

<sup>85</sup> Holliday, J. (1964) 'The Alva Silver Mines', *Grampian Speleological Group Bulletin 1st Series Vol.2 No.1* pp.6-9, p.8

interest and raised a number of questions. The location of the smelter is of particular interest, if the elemental soil analysis provides sufficient evidence of contaminants then a strong case could be made to show that the structure in question was indeed the “old smelt house”.<sup>86</sup> Another site of interest that would contribute towards an understanding of environmental impact would be the spoil heap. An elemental analysis of this site would help to show if there was a large quantity of contaminants therein and if these have been spread over the rest of the site. Such a finding could arguably affect the future use of the site, as its existence would add another tangible facet to its history and this could have implications for the glens cultural legacy.

### **3. Poisoned Earths?**

The historical background when combined with an outline of the existing industrial archaeology has provided an insight into the

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<sup>86</sup> NLS, MS 5098, f.84

alterations that Silver Glen has undergone. It has seen short periods of intense industry where it has been extensively exploited for its minerals, and then it has been left for long periods of time; abandoned. A superficial assessment of the documentary evidence could potentially lead to the conclusion that the site has been contaminated. A visit to Silver Glen would not reflect this. Visually there are no obvious contaminants to be seen, there is little barren ground and good vegetation. This is in stark contrast to other similar metal mining sites, such as Leadhills, where historic mining has left floodplain sediments grossly polluted with metals.<sup>87</sup> At these sites there are obvious landmarks that denote heavy industry; Silver Glen's evidence for this activity is far more concealed. In order to discover if there are indeed any contaminants on the site it would be useful to analyse the soil. An elemental analysis of the soil would provide key insight into what pollutants, if any, have been left. Such an analysis would give a general reading as to the state of the soil and if it has been contaminated by the mining activities, showing if it is rich in metal or harmful elements. The data from this analysis would then be added to what has been learned through the industrial archaeology. Doing so could prove invaluable in establishing locations of the smelter and the dressing floor, and these locations would be constructive in examining how contaminants from the activity could have been spread.

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<sup>87</sup> J.S. Rowan, S.J.A. Barnes, S.L. Hetherington, B. Lambers, F. Persons, 'Geomorphology and pollution: the environmental impacts of lead mining, Leadhills, Scotland' in *Journal of Geochemical Exploration* 52 (1995), pp.57-65

## Methodology

Scholarly work from Griffith has shown how elemental analysis of soil across an archaeological site can contribute towards understanding its historic human uses, especially when there are no “stains...but chemical residues.”<sup>88</sup> Further to this study there have been other investigations into how valuable an elemental analysis can be, such as Middleton & Price<sup>89</sup> and Terry et al.<sup>90</sup> These both draw a link between soil chemical data and human activity, and although both studies are conducted within the footprint of buildings they both advocate how this elemental data can be combined with remaining archaeology to create a deeper understanding of a site. A notable study is carried out by Wilson et al who have highlighted some of the potential problems and issues with this type of analysis – their findings reveal an uncertainty in how accurate such a soil analysis can be when looking for abnormalities or differences between similar farm sites.<sup>91</sup> It can be argued that the metalliferous nature of the Silver Glen site will potentially uncover irregularly high amounts of metal elements which would overcome such an issue. A study conducted in 2013 utilised an elemental analysis to examine a fifteenth-century silver

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<sup>88</sup> M.A. Griffith, ‘A pedological investigation of an archaeological site in Ontario, Canada, II. Use of chemical data to discriminate features of the Benson site’ in *Geoderma*, Vol.25, Issues 1-2, February 1981, pp.27-34, p.33

<sup>89</sup> William D. Middleton and T. Douglas Price, ‘Identification of Activity Areas by Multi-element Characterization of Sediments from Modern and Archaeological House Floors Using Inductively Coupled Plasma-atomic Emission Spectroscopy’ in *Journal of Archaeological Science* 23 (1996), pp.673-687

<sup>90</sup> Richard E. Terry, Fabian G. Fernández, J. Jacob Parnella, Takeshi Inomata, ‘The story in the floors: chemical signatures of ancient and modern Maya activities at Aguateca, Guatemala’ in *The Journal of Archaeological Science* 31 (2004), pp.1237-1250

<sup>91</sup> Clare A. Wilson, Donald A. Davidson, Malcolm S. Cresser, ‘Multi-element soil analysis: an assessment of its potential as an aid to archaeological interpretation’ in *Journal of Archaeological Science* 35 (2008), pp.412-424

mine, and found there to be very high concentrations of As, Cd, Pb and Zn within the spoil heap.<sup>92</sup> The landscape in question shows quite drastic signs of pollutants within the soil with large portions of the site showing an absence of visible vegetation<sup>93</sup>, this differs from Silver Glen which shows very little visible signs of pollution.

To understand if a lack of visible pollution shows the full extent of any environmental impact an analysis of Silver Glen was conducted by taking twenty six soil samples across a grid square marked A-Z<sup>94</sup> 50m apart.

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<sup>92</sup> C. Ash, L. Borůvka, V. Tejnecký, A. Nikodem, O. Šebek, O. Drábek, 'Potentially toxic element distribution in soils from the Ag-smelting slag of Kutna Hora (Czech Republic): Descriptive and prediction analyses, *Journal of Geochemical Exploration* 144, (2014), pp.328-336, p.328

<sup>93</sup> C. Ash, L. Borůvka, V. Tejnecký, A. Nikodem, O. Šebek, O. Drábek, 'Potentially toxic element distribution in soils from the Ag-smelting slag of Kutna Hora (Czech Republic): Descriptive and prediction analyses, *Journal of Geochemical Exploration* 144, (2014), pp.328-336, p.328

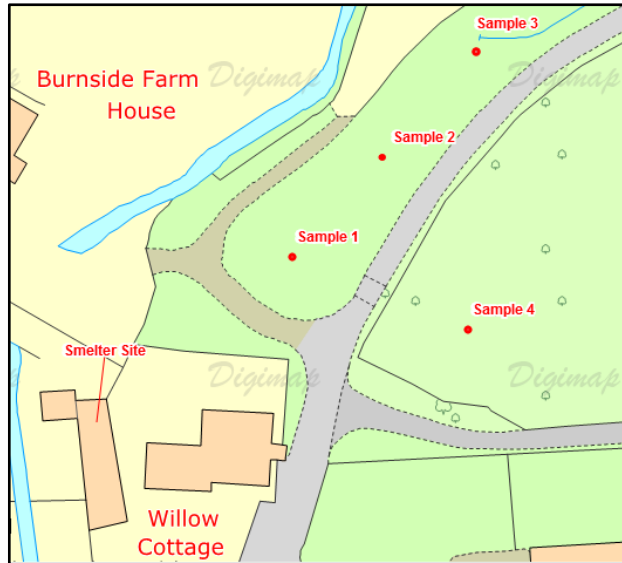
<sup>94</sup> Although all were taken equidistant from the other point B had to be moved as the terrain was too difficult to traverse





Sample	Grid reference
A	8915 9775
B	8920 9775
C	8925 9775
D	8930 9775
E	8915 9770
F	8920 9770
G	8925 9770
H	8930 9770
I	8920 9765
J	8925 9765
K	8930 9765
L	8935 9765
M	8920 9760
N	8925 9760
O	8930 9760
P	8935 9760
Q	8920 9755
R	8925 9755
S	8930 9755
T	8935 9755
U	8920 9750
V	8925 9750
W	8930 9750
X	8935 9750
Y	8920 9745
Z	8925 9745
AA	8930 9745
BB	8935 9745

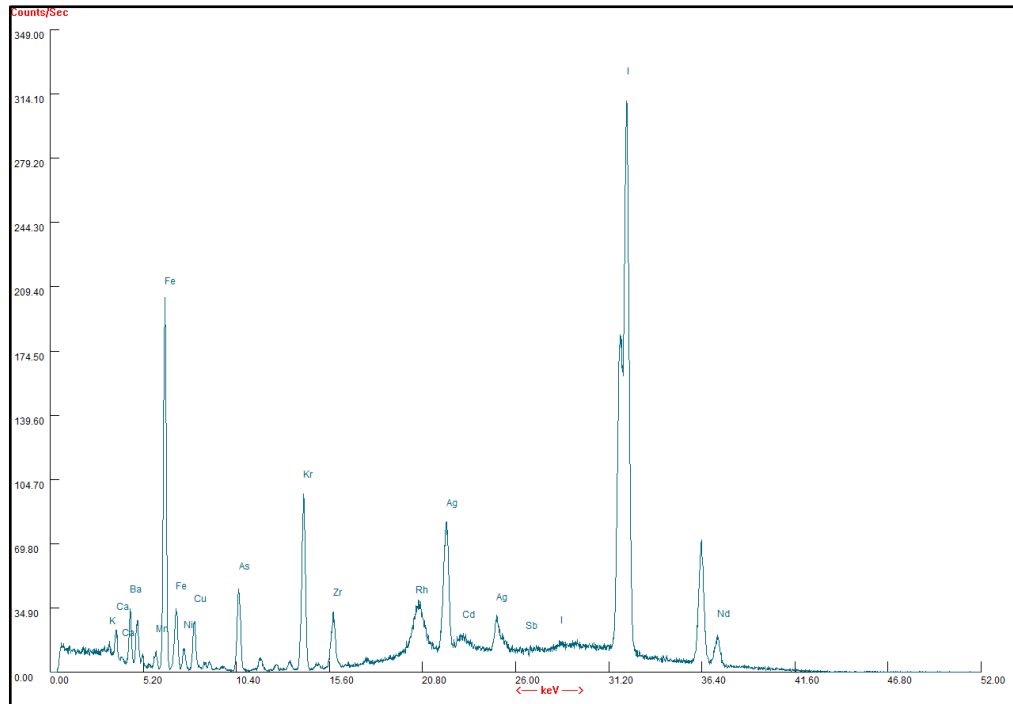
The samples were taken at 20cm depth using an auger in order to establish topsoil pollution. In the main the wind blows from the south west to the north east and this was accounted for by aligning the samples predominantly to the north east of the site. In addition to these samples there were another 4 taken at close proximity to what is believed to be the smelter in order to pick up any pollutant footprint it may have left. They were taken at three points, each moving in a north easterly direction from the 'smelter' site to account for the wind.



Source: Digimap

Sample	Grid Reference
Sample 1	89281 97243
Sample 2	89273 97234
Sample 3	89279 97210
Sample 4	89293 97212

The last sample was taken in the adjacent field, with the knowledge that if this was the smelter site historic airborne pollution would land at some distance further away from the point of activity rather than closer to it. All the samples were dried and then analysed using XRF. This process fires a high energy x-ray at the sample and each separate element therein reacts and produces a unique energy signal specific to that element, and this is read by the XRF machine. This data is collated and a table is produced that displays how much of each element is present within each sample, as is shown below.



This analysis was by no means exhaustive. Each sample was only scanned once, meaning that the results provided here are not precise readings of the site. With that said however they will function well as being illustrative of any contamination caused by the mining activity.

## Results

A mineralogical note written by Moreton states that although Silver Glen was worked for primarily native silver and argentite, as well as cobalt, copper, lead and zinc, there were bismuth, mercury and selenium minerals found which had not previously been recorded. All these

elements are said to have derived from the Lower Devonian lavas.<sup>95</sup> This is useful as it indicates that Silver Glen lies on what is named the 'Ochil fault' and along this fault there are pockets and veins of precious metal, and in Sir John Erskine's case it was silver. As Moreton also correctly states, where there are large deposits of native silver there are also other metals such as cobalt, nickel and arsenic.<sup>96</sup> It will be shown that these three elements will be valuable in ascertaining the level of contamination at the site.

A cursory glance at the data from the site would reveal that sample point 'I' has produced the highest readings. From maps of the site it is evident that this sample point was located on what is commonly understood to be the 'waste heap' or spoil heap.<sup>97</sup> The results would demonstrably reflect this. Compared to the background data the spoil heap shows a high percentage of Sr, As, Zn, Cu, Ni, Co, Mg, Ca, K and S.

SAMPLE	As	As Error	Pb	Pb Error	Zn	Zn Error	Cu	Cu Error	Ni	Ni Error	Co	Co Error	Fe	Fe Error	S	S Error
Sample A	52.59	16.55	114	11.94	74.26	13.29	< LOD	25.39	< LOD	47.32	< LOD	184.19	44253.82	508.89	2191.63	122.51
Sample B	18.9	10.57	20.76	7.75	40.18	11.04	< LOD	27.22	< LOD	43.47	< LOD	166.88	36016.7	441.89	771.95	85.85
Sample C	25.32	14.37	57.83	10.64	60.95	13.81	< LOD	35.31	< LOD	52.45	< LOD	194.04	39843.28	520.45	1235.05	94.12
Sample D	23.41	12.74	47.29	9.37	65.87	12.92	< LOD	22.41	< LOD	45.7	< LOD	174.2	34493.7	451.14	1286.77	96.91
Sample E	29.04	15.51	69.67	11.5	68.29	14.22	< LOD	38.22	< LOD	55.95	< LOD	204.86	44723.8	567.39	1110.48	95.36
Sample F	21.23	11.4	31.89	8.38	57.99	12.08	< LOD	28.76	< LOD	47.92	< LOD	170.15	36447.72	449.16	1245.08	101.71
Sample G	< LOD	21.23	72.04	10.69	84.1	14.04	< LOD	24.24	< LOD	49.29	< LOD	185.25	39467.9	494.54	1145.34	98.55
Sample H	21.46	12.23	22.28	9	68.84	14.12	< LOD	33.45	< LOD	53.48	< LOD	199.44	42012.54	543.81	1218	96.74
Sample I (Spoil Heap)	1800.66	68.09	156.56	20.33	243.85	30.87	1957.34	89.4	881.91	85.81	852.04	188.52	38705.89	718.69	7293.87	199.14
Sample J	29.99	12.82	39	9.25	68.27	13.28	< LOD	29.98	< LOD	48.22	< LOD	181.29	38168.76	486.48	977.96	87.97
Sample K	43.25	12.36	20.08	8.37	88.32	14.43	< LOD	38.16	< LOD	51.14	< LOD	193.94	42602.84	523.62	1099.96	98.37
Sample L	23.28	13.65	57.52	10.16	67.15	13.34	< LOD	33.33	< LOD	50.48	< LOD	185.72	39807.33	500.03	1161.22	89.59
Sample M	25.93	14.86	74.29	11.11	58.11	13.2	< LOD	39.94	< LOD	53.28	< LOD	198.78	45834.7	551.42	968.02	96.19
Sample N	35.85	13.61	48.59	9.73	78.5	13.86	< LOD	42.44	< LOD	50.96	< LOD	181.81	37088.23	481.52	1049.85	100.21
Sample O	22.96	12.99	40	9.55	75.93	14.08	< LOD	26.38	< LOD	52.33	< LOD	187.09	37264.57	495.37	1353.51	97.83
Sample P	26.92	12.74	30.4	9.24	68.8	14	< LOD	43.94	< LOD	52.64	< LOD	199.07	42588.84	541.22	1116.29	97.78
Sample Q	< LOD	27.9	48.05	10.6	108.61	16.27	41.57	20.39	< LOD	77.67	< LOD	246.42	73513.24	767.69	1334.04	114.96
Sample R	30.7	13.39	27.4	9.67	86.66	15.53	< LOD	39.54	< LOD	55.86	< LOD	237.69	62004.25	710.79	1012.22	94.88
Sample S	< LOD	18.04	29.97	8.93	81.33	14.16	< LOD	24.22	< LOD	50.02	< LOD	178.57	34393.83	469.49	879.26	86.17
Sample T	< LOD	28.94	42.01	9.58	43.05	12.54	< LOD	25.39	< LOD	50.06	< LOD	178.08	34134	470.57	900.66	96.09
Sample U	< LOD	21.16	67.51	10.79	107.25	15.5	< LOD	30.84	< LOD	49.57	< LOD	219.82	59324.46	639.32	1558.23	109.87
Sample V	19.99	12.02	31.69	8.94	89.08	14.41	< LOD	26.67	< LOD	49.71	< LOD	201.95	49840.03	568.38	1218.9	105.94
Sample W	21.61	13.64	54.07	10.18	89.36	14.56	< LOD	26.99	< LOD	51.9	< LOD	193.58	43027.14	530.39	904.78	98.58
Sample X	< LOD	17.04	29.03	8.62	68.68	13.01	< LOD	25.86	< LOD	48.88	< LOD	173.08	34731.79	456.92	966.42	97.5
Sample Y	37.8	19.75	168.85	14.84	88.73	14.82	< LOD	27.08	< LOD	51.95	< LOD	201.05	45989.81	561.87	914.82	99.12
Sample Z	< LOD	19.36	48.49	9.67	56.98	12.75	< LOD	31.77	< LOD	48.21	< LOD	171.07	32165.24	443.72	921.41	90.97
Sample AA																
Sample BB																

<sup>95</sup> Stephen Moreton, Mineralogical Note, *Mineralogical Magazine*, December 1988, Vol.52, pp.719-20

<sup>96</sup> Stephen Moreton, *Bonanzas and Jacobites: The Story of Silver Glen* (Edinburgh, 2007), p.70

<sup>97</sup> *Ibid*, p.70

Navarro et al highlight that spoil or slag heaps are considered to be unreactive given that the potential contaminates are bound within low-soluble compounds such as silicates, oxides and glassy forms.<sup>98</sup> The results of this analysis can be shown to conform to this. One of the first analyses of the site was given in 1921 as part of the *Memoirs of the Geological Survey* and was carried out by Wilson whose analysis of the minerals within the 'old dumps'<sup>99</sup> stated that they contained "barytes, calcite and quartz, which carry argentite, chalcopyrite and mispickel, together with malachite, erythrite and native silver."<sup>100</sup> Wilson also gives a breakdown of what is contained within a cobalt ore.

<b>Wilson's Cobalt Analysis</b>	
Cobalt .....	31.85%
Iron.....	10.24%
Copper.....	9.77%
Arsenic.....	33.3%
Galena.....	7.53%

Source: G. V. Wilson, 'The Lead, Zinc, Copper and Nickel Ores of Scotland' in *Memoirs of the Geological Survey Vol. XVII.* (Edinburgh, 1921), p.144

The Grampian Speleological Group utilise Wilson's survey as part of their examination of the mine.<sup>101</sup> Moreton asserts that there are 35 mineral

<sup>98</sup> Andres Navarro, Esteve Cardellach, Jose L. Mendoza, Merce Corbella, Luis M. Domenech, 'Metal mobilization from base-metal smelting slag dumps in Sierra Almagrera (Almeria, Spain)' in *Applied Geochemistry* 23 (2008), pp.895-913, p.896

<sup>99</sup> Spoil heaps

<sup>101</sup> Holliday, J. (1964) 'The Alva Silver Mines', *Grampian Speleological Group Bulletin 1st Series Vol.2 No.1*, pp.6-9, p.6

species identified at the site, both common and rare.<sup>102</sup> He also gives a thorough breakdown of all the minerals which he had discovered at the site, and these are consistent with Wilson's, but he also highlights the vast number of arsenates, arsenides and sulphides present.<sup>103</sup>

Within these minerals it can be argued that the sulphides offer some insight into potential movement from the spoil heap. The sulphides present within the spoil include bornite, chalcocite, digenite, marcasite and pyrite, and all these contain Fe and Cu to varying degrees. Both of these elements are present in high levels at points I and Q. Indeed, point Q has given the highest concentration of Fe at 73513.24ppm. It can be postulated that minerals such as Marcasite and pyrite which are both iron disulfides and insoluble in water.<sup>104</sup> This insolubility would mean that they would not weather but merely be displaced meaning that they have potential to be washed downhill either due to rain or perhaps as part of a mineralogical excavation such as Moreton's.<sup>105</sup> Given that Point Q is situated 100m downhill from Point I this could very well have been the case. What is especially acute within the spoil heap results is the amount of As that is present. The analysis yielded a result of 1800.66ppm, when this is compared to the average range in a rural setting of between 4 -

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<sup>102</sup> Stephen Moreton, *Bonanzas and Jacobites: The Story of Silver Glen* (Edinburgh, 2007), p.84

<sup>103</sup> *Ibid*, p.84

<sup>104</sup> CRC Handbook of Chemistry and Physics, p.4-55

<sup>105</sup> Brian Jackson, 'Mineral Rescue Collecting at the Alva Silver Mines' in *Forth Naturalist and Historian*, Volume 17 (1994), pp.3-4

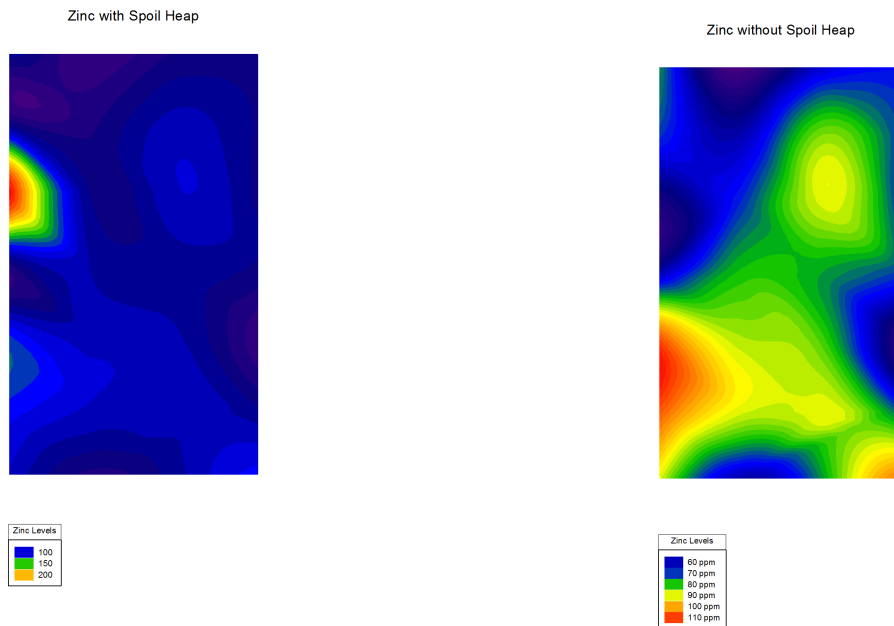
55ppm, and where the median across Scotland is 9.1ppm<sup>106</sup>, these results are quite stark. Excluding the spoil heap results the mean As level across the site is 28.34ppm, this is still quite high, yet it sits between the average range for Scottish soil. This high As reveals a great deal about the mining activity. Such a hotspot conveys that not only was this the spoil heap but the evidence is compelling enough to suggest that this is where the ore was processed. This can be evidenced in the amount of cobalt that is present also. As previously stated the spoil heap is approximately 100 metres uphill from where a lot of the Cobalt was found<sup>107</sup>, when relating this to the mining activity this can be seen as unusual. Intuitively when metal is being mined heavy minerals are taken downhill to be processed, yet the amount of cobalt at the spoil heap suggests that that might not have been the case. Further to the elemental data, on a practical level this area could physically have been the flattest and most convenient location to process the ore.

The graphs below, which are a representation of the site itself, help to contextualise the stark concentration of contaminants at the spoil heap when compared to the rest of the site. The concentration of Zn can be seen at the left hand side of the site at what is point I where the spoil heap is located. When the spoil heap results are taken out of the data, as shown in the right contour graph, it can be seen that there has potentially been a

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<sup>106</sup> Dobbie, K.E., Bruneau, P.M.C and Towers, W. (eds) 2011. The State of Scotland's Soil. Natural Scotland, [www.sepa.org.uk/land/land\\_publications.aspx](http://www.sepa.org.uk/land/land_publications.aspx), p.66

spread of Zn downhill from the spoil. Given the amount of Zn at point K this can be postulated to have been spread from airborne pollution from the spoil, or given its location next to a path it could have been spread through movement on the site.



The spoil heap has yielded the most immediately obvious results, and has shown that there is a high concentration of contaminants therein. This then poses the question as to how the rest of the site compares, and what can be gleaned from their results. By comparing the most common metals found within the SEPA background levels it will be possible to establish if there has been any significant contamination. For the purpose of ascertaining a background level the mean of the readings have been calculated eschewing the inordinately high levels given from the spoil heap. The mean of Cd in Scottish soil is stated to be 0.16ppm<sup>108</sup> and any

<sup>108</sup> Dobbie, K.E., Bruneau, P.M.C and Towers, W. (eds) 2011. The State of Scotland's Soil. Natural Scotland, [www.sepa.org.uk/land/land\\_publications.aspx](http://www.sepa.org.uk/land/land_publications.aspx), p.64



that has been found on site has been lower than a level of detection, this is in contrast to the similar mining site in the Czech Republic.<sup>109</sup> As has been shown in the graphs above Zn at the site has provided an average reading of 73.812ppm. With the mean average in Scottish soil in a rural setting being 55.5ppm<sup>110</sup>, this demonstrably shows that there is a higher content of Zn than is normal. There is no concrete evidence to suggest that this particular metal has been spread through airborne pollution; however as has been mentioned, the higher Zn contents at points Q and U suggest that Zinc could have travelled downhill from the spoil heap, again this has been illustrated in the graphs above. When looking at other metals on the site the results for Co and Cu are intriguing as there is very little found on the site. Given that the documentary evidence has shown that both copper and more acutely cobalt was found in abundance at the site, the lack of high levels in the data is interesting. Cobalt is however found in high levels at the site of the spoil heap, but nowhere else. Copper yields very little quantities, again except for at the spoil heap where it is well above the Scottish average. The only other sample to find a significant level of copper was at sample point Q where the reading was 41.57ppm again this is significantly higher than the normal background level of 13.55.<sup>111</sup> Another possible reason for the higher levels of metals at points Q and U is their proximity to a smaller spoil heap that now only appears

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<sup>109</sup> C. Ash, L. Borůvka, V. Tejnecký, A. Nikodem, O. Šebek, O. Drábek, 'Potentially toxic element distribution in soils from the Ag-smelting slag of Kutna Hora (Czech Republic): Descriptive and prediction analyses, *Journal of Geochemical Exploration* 144, (2014), pp.328-336, p.328

<sup>110</sup> Dobbie, K.E., Bruneau, P.M.C and Towers, W. (eds) 2011. The State of Scotland's Soil. Natural Scotland, [www.sepa.org.uk/land/land\\_publications.aspx](http://www.sepa.org.uk/land/land_publications.aspx), p.64

<sup>111</sup> Dobbie, K.E., Bruneau, P.M.C and Towers, W. (eds) 2011. The State of Scotland's Soil. Natural Scotland, [www.sepa.org.uk/land/land\\_publications.aspx](http://www.sepa.org.uk/land/land_publications.aspx), p.64

to be mere barren rock.<sup>112</sup> This spoil heap is close to what is purported to be one of the cobalt mine workings, this would also account for point Y being higher in metals such as lead. Points Q, R and V also show higher readings for heavy metals. From the graphs it can be seen that there are heightened levels of heavy metal around where there was greatest mining activity, and it also displays that this metal has possibly moved down the hill.

The results from the four samples taken in close proximity to what is potentially the site of the smelter have not been conclusive. They have however shown higher than expected levels of some metals.

SAMPLE	Sr	Sr Error	As	As Error	Pb	Pb Error	Zn	Zn Error	Cu	Cu Error	Ni	Ni Error	Co	Co Error	Fe	Fe Error	Mn	Mn Error	Cr	Cr Error	S	S Error	Mg	Mg Error
Smelter Sample 1	171.5	5.89	28.6	13.85	41.7	10.08	82.26	14.96	34.68	19.81	<LOD	56.29	<LOD	197.82	39115.5	528.43	668.06	124.06	107.2	55.69	1475.9	107.8	<LOD	7752.09
Smelter Sample 2	108.4	4.49	<LOD	28.4	36.39	9.3	58.02	13.14	<LOD	41.25	<LOD	51.24	<LOD	177.08	32897.8	461.44	427.15	111.27	<LOD	64.22	945.13	96.83	<LOD	4483.46
Smelter Sample 3	202.2	5.9	21.8	13.64	64.31	10.21	141.7	16.37	29.94	17.81	<LOD	49.98	<LOD	179.37	39112.2	487.58	501.87	107.37	103.5	45.78	2592.3	128.1	<LOD	5755.28
Smelter Sample 4	153	5.19	30.28	14.93	79.69	11.01	136.1	16.48	51.91	19.12	<LOD	50.13	<LOD	178.44	36308.2	473.75	370.94	105.02	71.69	44.07	1188.2	97.77	<LOD	6377.93

When compared to the readings from the rest of the site the finding of high levels of copper is particularly interesting given that the only copper found within the glen itself was close to the spoil heap and to where processing was taking place. The levels of sulphur are also worthy of note here as they again are particularly high with the highest being 2592ppm compared to the mean average across the site at 1141ppm. Given the vital role that sulphur played in the smelting process, as mentioned on a number of occasions in the documentary evidence, and the high levels of metals present within the samples this could be a strong indication that it

<sup>112</sup> Stephen Moreton, *Bonanzas and Jacobites: The Story of Silver Glen* (Edinburgh, 2007), p.80

is close to a source of contamination. These results combined with the evidence from the previous chapter of Kalmeter's observation of a smelting house being built "where the stream comes below the mountain"<sup>113</sup>, and the references given to the "old smelt house" there is an argument to be made that this building was indeed the location of the smelter. Further to this the industrial archaeology has shown that the burn curiously runs through the building, and this combined with the altered watercourse adds a great deal more weight to the argument. Of course a far more rigorous analysis would be required to bolster this claim, and there could be another source responsible for these heightened metal levels, with that said however the evidence is compelling.

The parameters of this study have meant that the analysis was by no means exhaustive. The sampling and analysis methods that were used were quite basic, however it is still possible to make a number of observations about historic use of the site and the environmental impact that it has made. The spoil heap has given the most cause for concern with regards to the site being contaminated. The contour graphs have shown that some metals may have spread downhill, but that any airborne pollution from the spoil heap can only be suggested. It can then be asserted that any significant contamination on the site as a whole has not taken place. With regards to any elements that are potentially damaging to the site, these are bound up within insoluble minerals meaning that

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<sup>113</sup> Henry Kalmeter, in T.C. Smout (ed.), 'Journal of Henry Kalmeter's Travels in Scotland 1719-1720' in *Scottish Industrial History; a Miscellany* (Edinburgh, 1978), pp.1-52, p.38

they are not prone to weathering and cannot spread easily over a large area. The one level that is most concerning is the level of arsenic present within the spoil heap. Although this too could be bound up within a mineral the significantly high level should be considered for further investigation. It has been shown that the cause of such high levels is due to this location having been used as a spoil heap. However, the variation of elements and minerals combined with the inordinately high level of arsenic has indicated that this area could also have been used for the dressing of the ore, amongst other processes. With potential locations for the dressing floor and the smelter this helps to add new dimensions and asks more questions about the glen and how it has been used. The locations of such processes could be challenged, and indeed perhaps these are not the locations of these mining processes, however by questioning these findings one has to analyse further and in doing so this would be a valuable contribution to the story of Silver Glen.

#### **4. Legacies in the Landscape**

The glen's existence in the public conscious began with Erskine, and although he would become aware of its infamy he would not have been aware of the legacies for which he would become responsible for. These are legacies that have not been considered in any literature related to the glen, or if they have they have only been alluded to; they are Silver Glen's hidden legacies. Although they are not all tangible they can be seen as being environmental and cultural legacies. As has been considered previously there is partial visible proof within the glen of the impact that the mining had on the environment in the form of shafts and adits. The lasting effect of mining and the pollution that it produced has not been addressed until now, and the results have shown that the spoil heap holds within it a large quantity of harmful elements. Although a lot of these

elements such as arsenic are bound up in minerals, it was shown that other metals have spread throughout the site. This has highlighted that although the glen may look unaffected, the soil has told a different story. The result of this discovery could potentially have an effect on mans use of the site. Mining demonstrably shows exploitation of the landscape, but the exploitation is not exclusive to searching for minerals. Man has utilised the site of Silver Glen up to the present day, and this use can be argued to be exploitative, in both senses of the word.<sup>114</sup> It has been used for leisure pursuits, such as walking and picnicking, as well as for educational opportunities, but after these periods of use it has promptly been abandoned. This chapter will address the transition that the site has gone through; from what was a site of heavy industry to one of leisure. It will utilise a number of sources, but in the main it will assess newspaper articles from the local area. Through this, a portrait of how the glen has come to be seen by the local community will be formed, and in turn show the cultural legacies which have been missed from the literature. It will be shown that although the glen has been consistently used by man it has always retained an element of abandonment. It is this abandonment that has come to define the glen in the present day.

Once work had come to a halt at Tinwald's cobalt mine, there is very little evidence to suggest that any work began there again until 1889. In the Alloa Journal there is mention of mining being resumed, where it also

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states that work had commenced for a week but that they were yet to discover any “precious ore.”<sup>115</sup> This illustrates that after more than a hundred years the compulsion to exploit the glen had not lessened. This venture was not successful. In 1904 there is once again excitement surrounding a mineralogist by the name of Mr Wesley who had visited the glen and taken a “hundredweight of the rock [and] had it assayed.”<sup>116</sup> It is then reported that he convinced two mining engineers from London to make arrangements to have the mine workings cleared out and for operations to commence in a bid to see if reworking the mines would be advantageous. There is no more evidence to suggest that this venture was any more successful than the first in 1889. These reports demonstrably show that there is a theme of exploitation, arguably with disregard for any environmental impact as there is only ever an emphasis on the rich ore that could be gotten. This is highlighted at the end of the article which states that “When the first ore is struck, the flags will fly in Alva.”<sup>117</sup>

There is a great deal of evidence to show that Silver Glen has been romanticised within local culture. An article in the Alloa Advertiser in the 1970s bemoans the loss of the glen as a ‘stirring place’<sup>118</sup>, commenting that it now merely contained “sheep nosing around among last year’s bracken.”<sup>119</sup> The statement helps to highlight man’s cyclical relationship with the glen in that it has gone through periods of use, followed by

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<sup>115</sup> Alloa Journal, 10 August 1889

<sup>116</sup> Alloa Journal, 13 August 1904

<sup>117</sup> Alloa Journal, 13 August 1904

<sup>118</sup> Alloa Advertiser & Journal, 11 April 1973

<sup>119</sup> Alloa Advertiser & Journal, 11 April 1973

periods of abandonment. There is evidence to suggest that in the 1930s the glen was having a resurgence of popularity for within the minutes of a council meeting relating to pollution at Silver Glen it was asserted that “the Glen was now in a pretty good condition, and the many visitors during the summer months had found comfort and pleasure in walking through it.”<sup>120</sup> The article goes on to state that “the water in the Silver Glen supply was in danger of being polluted, chiefly through visitors to the town.”<sup>121</sup> Not only does this show that the glen was very popular with tourists but it also uncovers one the biggest curiosities within the glen; the water tank, as discussed in chapter two. The article goes on further “the visitors did not realise that it was part of the town’s water supply.”<sup>122</sup> Considering Silver Glen as a location for a water supply is not uncommon in its history. A newspaper article from 1954 highlighted a proposal that had been put forward by the council to build a water tank that was to hold “1,500,000 gallons” and it was expected to cost £10,000.<sup>123</sup> A tank of this size within the glen would create a substantial amount of damage, and would potentially have effected how the glen was used by man.

It can be seen that mans use of the glen has not been homogenous. It can be suggested that it had fallen into disuse after an incident in 1925 when a woman fell down one of the shafts; she would later succumb to

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<sup>120</sup> Alloa Journal 10<sup>th</sup> September 1938

<sup>121</sup> Alloa Journal 10<sup>th</sup> September 1938

<sup>122</sup> Alloa Journal 10<sup>th</sup> September 1938

<sup>123</sup> Alloa Advertiser, 31 July 1954



her injuries and died some months after.<sup>124</sup> The group that the lady was with had come from Cowie “to Alva, for the purpose of having a picnic on the hills.”<sup>125</sup> Illustrating that although this landscape has been defined by its mining heritage it is still seen as a place to enjoy for its scenery. Indeed, the same article which documents the unfortunate incident begins by describing the glen as “a picturesque gully”<sup>126</sup>; perhaps this is akin to the ‘stirring place’ as mentioned above. The accident however resulted in calls for the mine to be “immediately fenced to prevent further accidents of the kind”<sup>127</sup> and this could have been the reason there was a waning in the glens popularity. An article in 1963 exploring the mine warned of the dangers within the workings stating: “If anyone goes poaching around the mines as a result of this article, and plunges headlong, their last thought can be ‘I can’t say I wasn’t warned!’”<sup>128</sup> The cycle of use can most starkly be seen when the two visits of the Grampian Speleological Society (GSS) are considered. The first took place in 1964 and the second was in November 2005. Upon the second visit the same author, who had been there both times highlights that in 1964 all the entrances lay in open grassland with only a few isolated trees that were used for belaying ladders for access down shafts, however the second visit was entirely different. The glen was now densely overgrown by mature ash, sycamore and hawthorn. This observation shows that human use of the glen had fallen quite dramatically.

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<sup>124</sup> Alloa Journal 10<sup>th</sup> October 1925

<sup>125</sup> Alloa Advertiser, 6 June 1925

<sup>126</sup> Alloa Advertiser, 6 June 1925

<sup>127</sup> Alloa Advertiser, 10 October 1925

<sup>128</sup> Alloa Advertiser, 5<sup>th</sup> April, 1963

It can then be seen that there exists within the local conscious a definition of Silver Glen that marries the industrial landscape and picturesque rural location together. From this unusual definition it is possible to assert that Silver Glen can be defined as an 'edgeland'; it is neither industrial nor rural. This term was created by Marion Shoard to describe a site that lies between an urban and a rural space.<sup>129</sup> Edensor et al consider the pleasure that can be found from playing in sites on the urban fringe, where fun is derived from drawing parallels with childhood adventure, a "transgressive, playful delight."<sup>130</sup> Edensor expanded on this emotion with regards to ruins and spaces that were deemed as 'dangerous' and 'unsightly', highlighting how these sites provoke alternative forms of public life, a casting off of self-consciousness and the "pursuit of illicit and frowned-upon practices."<sup>131</sup> The glen can be defined in these terms. Counter to the aforementioned picnicking past, the glen can also be seen to have been used for illicit behaviours; the evidence for this has been documented by many who have visited the site. The GSG describe the first workings they came across on the west side of the burn, and how they had to crawl "over sharp scree, broken bottles and other debris"<sup>132</sup> and the next workings they came to as they went up the hill were "choked with miscellaneous rubble including bed-ends and beer

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<sup>129</sup> Paul Farley & Michael Symmons Roberts, *Edgelands Journeys into England's True Wilderness* (London, 2012), p.5

<sup>130</sup> Tim Edensor, Bethan Evans, Julian Holloway, Steve Millington & Jon Binnie, 'Playing in industrial ruins' in Anna Jorgensen & Richard Keenan (ed.), *Urban Wildscapes* (New York, 2012), pp.65-79, p.68

<sup>131</sup> Tim Edensor, *Industrial Ruins: Space Aesthetics and Materiality* (Oxford, 2005)

<sup>132</sup> Holliday, J. (1964) 'The Alva Silver Mines', *Grampian Speleological Group Bulletin 1st Series Vol.2 No.1*, pp.6-9, p.7

cans.”<sup>133</sup> Moreton also comments on the amount of debris present on the site which included “rubble, sheep bones, bottles and other rubbish.”<sup>134</sup> The Central Scotland Bat Group adds to this list of detritus by asserting that they had discovered “used candles and even camp fires.”<sup>135</sup> The terrain of the glen is not particularly conducive to a traditional camping experience, given the steep incline and how overgrown it has become; with that being said camping is not completely unheard of in the glen as in 1926 there is an incident of a tent catching fire.<sup>136</sup> With the presence of unusual, almost alien objects such as candles combined with the evidence of alcohol use it fits the description of Shoard and Edensor’s edgeland.<sup>137</sup> The glen, neither in the town, nor fully in a rural setting is used by those who seek seclusion either for illicit behaviours, or merely as a place for social gathering. This demonstrably adds another component to the glen’s uses. Recent improvements at the glen which include the erecting of an information panel and viewing platform across the burn, illustrate that it is being promoted as part of local heritage and a point of interest for tourists. This would perhaps fit the definition of the glen in the first half of the twentieth-century but it is now somewhat at odds with how the glen has come to be used in the last fifty years.

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<sup>133</sup> Holliday, J. (1964) 'The Alva Silver Mines', *Grampian Speleological Group Bulletin 1st Series Vol.2 No.1* pp.6-9, p.7

<sup>134</sup> Stephen Moreton, *Bonanzas and Jacobites: The Story of Silver Glen* (Edinburgh, 2007), p.80

<sup>135</sup> Central Scotland Bat Group Newsletter, p.3

<sup>136</sup> *Alloa Journal*, 14 August 1926

<sup>137</sup> Tim Edensor, *Industrial Ruins: Space Aesthetics and Materiality* (Oxford, 2005), p.27

The heritage aspect involving the mythologizing of the initial silver mining activity has added longevity to the story of Silver Glen; the mystery surrounding the hidden barrels and the clandestine mining has created intrigue. There are other stories attached to the glen that have either been missed or eschewed from the current literature, and although not all can be verified they are important as they show that there are hitherto unknown components to its history that can be investigated further. The most interesting of these involves a brass serf collar that belonged to a worker at the silver mine. The story is found within an article from the Alloa Advertiser from 1880, found in amongst the Erskine family papers. A highlander who had been found guilty of theft was condemned to death, but instead was given to John Erskine as a servant. He was then given a brass collar which had an inscription stating "Alexr. Steuart found guilty of death for theft at Perth the 5th of December 1701, & gifted by the Justiciars as a perpetual servant to Sir Jo. Areskin of Alva."<sup>138</sup> The story ends tragically with the man drowning himself in the River Forth. The brass collar was found by fishermen years after and presented to the National Museum of Antiquities in Edinburgh in 1784. This story sounds apocryphal, yet the brass collar is in the collection of what is now the National Museum of Scotland.

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<sup>138</sup> NLS, Alloa Advertiser 20 March 1880 in MS 5160, f.16-18



Source: <http://nms.scran.ac.uk/database/record.php?usi=000-100-001-337-C>

This not only adds another dimension to Sir John Erskine's character but asks more questions and indeed more depth to the history of the glen. More information about the men who worked the mine is given in an article written in 1973 in which it states that the miners that Sir John Erskine had brought in were from Wales and it exclaims "Welsh-speaking Wales at that. Complete foreigners in Alva!"<sup>139</sup> These workers are not mentioned in the documentary evidence; however the use of workers from elsewhere in Britain was not uncommon in the mining industry, especially in the eighteenth and nineteenth-century. At Tomnadashen on the Breadalbane estate, sixteen men and two boys from Wales were employed.<sup>140</sup> The article reveals more about the Welsh miners stating that they "camped out in huts on the hill face."<sup>141</sup> Again, there is no miner accommodation mentioned in the documentary sources, but there is

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<sup>139</sup> Alloa Advertiser & Journal, 11 April 1973

<sup>140</sup> Jack Bainbridge, 'Lord Breadalbane's Mines' in *The Scots Magazine New Series*, Vol. 114, No.1 October 1980, pp.38-46, pp.41-42

<sup>141</sup> Alloa Advertiser & Journal, 11 April 1973

evidence of barrack accommodation on metalliferous mining sites, used when their homes were some distance from the mine.<sup>142</sup> The most detailed evidence of the men working the mine is given by the Earl of Lauderdale who names six workers present when Brandshagen had arrived to inspect the mines.<sup>143</sup> The mention of the Welshmen and the huts could be argued to have derived from oral history, and since there is no other record of it, this could be apocryphal. This does not diminish its value as part of the glen's cultural legacy – it adds to it. These examples, like the soil samples in the previous chapter, help to build and create narratives that have gone undiscovered, and are therefore useful in giving a complete picture of the mine's history. The stories that may seem untrue are valid as they contribute towards an understanding of how the glen is seen within the local community.

Man's use of the glen has changed quite dramatically, from industrial hub to picturesque picnic site. This change has not been a quick one. There has always existed a constant need to search for minerals, from the mining activity itself to the mineralogist enthusiasts. In addition to this it has also been shown that man has exploited the land for a number of other leisure pursuits, including educational. In a 1995 article in the *Alloa Advertiser* it highlights a children's club called 'Cygnets' who

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<sup>142</sup> Catherine Mills, *Regulating Health and Safety in the British Mining Industries, 1800-1914* (Farnham, 2010), p.162

<sup>143</sup> Lauderdale Papers, RH4/69/26/4

embarked on a silver treasure hunt around the glen.<sup>144</sup> Other educational endeavours have been undergone such as a Clackmannanshire Field Studies Society Research Group, along with pupils from Alva Academy and the Army Youth Team excavated the top shaft above what they believed to be the Silver Chamber.<sup>145</sup> From these examples and the ones given above it can be seen that the glen has come to be exploited by a number of groups and by the public in general for leisure. Given its industrial past it is intriguing that it has come to be used as much as it has, but considering Edensor's analysis of industrial ruins it is perhaps not surprising. Between the period of initial abandonment in the late eighteenth-century and the beginning of the twentieth, the glen underwent a social change and was viewed as a tourist attraction and picnic spot. Since the last half of the twentieth-century this use has fallen dramatically and the glen, now filled with evidence of anti-social behaviours, can be said to be in a state of abandonment. This chapter has reiterated that man's use of the glen has gone through two distinct phases – exploitation and then abandonment.

## Conclusion

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<sup>144</sup> Alloa Advertiser, 10<sup>th</sup> November 1995

<sup>145</sup> D.M. Dickie & C.W. Forster, *Mines and Minerals of the Ochils* (Clackmannan, 1974), p.9

Sir John Erskine's decision to look for precious metals on his estate would come to define the glen – giving it the title 'Silver Glen'. Both the silver and cobalt mining activities would be defined by their large amount of production in a very short period of time; the mines would promptly be discarded when minerals or money ran out. These actions began a cycle of exploitation and abandonment. This trend would continue into the twentieth-century. Man has never stopped using and exploiting the site, it has been used for leisure and education, amongst other activities, yet throughout has retained an element of abandonment. This sense of abandonment has also become a defining factor, and as was seen from Edensor et al, this air of dereliction has become partially the reason why it appeals to some people. This raises the question: what does the future hold for Silver Glen? It would be useful to evaluate the findings of this study and postulate how these will affect how the glen is used.

In order to address the hidden environmental and cultural legacies that the mining has left, the history of the glen has been reassessed. It has highlighted that a more thorough assessment of some of the actors has been missed, namely that of James Hamilton and Sir John Erskine himself, and this proves to be vital when considering the history. The evidence brought to light about the 'forty tons' of ore hidden in barrels, a fact that has never been in dispute, can be seen as questionable. James Hamilton's character is much maligned by both Lady Erskine and Isaac Newton, and this highlights his initial claim of 'forty tons' as being very dubious.



Through the documentary evidence it can be seen that Sir John Erskine, whose character is never questioned in any of the literature, is perhaps more complex than has been initially thought. Hamilton's deposition accuses him of maltreatment, and although Hamilton is perhaps not the best source for such an accusation the evidence of the serf's collar adds another dimension to both the story and Erskine's character. This has shown that both their roles have been undoubtedly undervalued. This means that a far more rigorous assessment of Hamilton and Erskine is needed. Such a reassessment could potentially alter how the history of the glen is viewed.

Furthermore this study has questioned where the mining processes have taken place. Although the documentary evidence did not provide precise locations for these processes, knowledge has been gleaned from Newton and Brandshagen that furnaces were built, but their impact on the environment would have been very little as the assaying took place in the house. Kalmeter's eyewitness account proved to be the most valuable as it has now been established that a smelter was in the process of being built on the Erskine estate in 1719. This knowledge was combined with the industrial archaeology to show that a structure located on the south side of the burn was the potential location of the smelter. The elemental analysis added more credence to this hypothesis showing high levels of some metals and sulphur. This has shown that combining science with the history has discovered the location of a hitherto unknown site and as such

also indicated where there could potentially have been a source of contaminates. The discovery of a smelter this size could mean that it was being used by other mines along the Ochil Hills such as in Menstrie glen, at Loss Hill<sup>146</sup> or Erskine's Copper mine to the west of Silver Glen. More research into this proposed smelter would be invaluable in adding more depth to the history of not only Silver Glen, but the Ochil Hills too.

It can be asserted that the soil sampling was by no means thorough enough, and each sample could have been analysed more than once in order to achieve a more accurate reading. However, given the parameters of this study it gave some intriguing insight into the spread of elements on the site. It was not conclusive but it can be asserted that there has been a partial spread of heavy metals travelling downhill from the spoil heap. Further to this the analysis showed that the area regarded as only being the spoil heap could have been the dressing floor. This hypothesis requires further investigation. The documentary evidence has also provided a drawing of a crushing mill, by Nicholas Crisp that could have potentially been used at the site. This has contributed towards a better understanding of how the mining has impacted the environment. It highlighted the arsenic hotspot within the spoil heap. Although there was already knowledge of arsenic being present in the spoil heap<sup>147</sup>, the inordinately high level has meant that this particular spot should be

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<sup>146</sup> Royal Commission on the Ancient and Historical Monuments of Scotland, *'Well Sheltered & Watered'* (Clackmannan, 2001), p.60

<sup>147</sup> Stephen Moreton, *Bonanzas and Jacobites: The Story of Silver Glen* (Edinburgh, 2007)

reassessed in order to establish if these levels are a threat to human health. If the levels are found to be unsafe, how would this come to affect human usage of the site? It can be argued that it would be viewed as contaminated and therefore unsafe. At its most extreme it could usher in a new phase and lead to almost complete abandonment and alter mans relationship with the glen irrevocably.

When the industrial archaeology has been considered in other scholarly work the focus has solely been on the mine workings and this has meant that there is a paucity of detail regarding the state which the rest of the site is in. This study has attempted to provide more detail about the glen's condition. From this it has been gleaned that it has gone through phases – mineral extraction, leisure and abandonment. With that being said the derelict quality of a disused mine, a place once thriving with industry then left to decay will naturally have an air of abandonment. They have an element of the unknown about them, as described by the GSG “...just inside the entrance lay a shaft (we really could not estimate the depth) filled with clear, chlorine-green water, icy-cold, a most beautiful and yet terrifying sight.”<sup>148</sup> This element of abandonment was clearly no issue for those who visited the site as somewhat of a tourist destination at the beginning of the twentieth-century. This usage would diminish by the end of this century, and the

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<sup>148</sup> Holliday, J. (1964) 'The Alva Silver Mines', *Grampian Speleological Group Bulletin 1st Series Vol.2 No.1* pp.6-9, p.8

glen would come to be defined by its derelict state with evidence of anti-social debris.

The mine and its associated activities have left undiscovered and hitherto unknown legacies, this study has gone some way to establishing just what these legacies are. By combining the historical documents with scientific analysis it has provided a far more detailed account of the glen than has been given before. The environment of the glen, which visibly seemed unaffected by the historic mining, has been shown to contain contaminated by-products of the mining activity. The glen which was claimed to be once a “stirring place” has fallen into abandonment, and this cycle of use and neglect has come to define the use of the glen.

With steps being taken to make the glen more accessible, by clearing paths and making safe the entrances to some of the mines, there is potential for the future usage of the glen to change.<sup>149</sup> With that said the discovery of potentially harmful levels of chemicals on the site such as arsenic it may prove difficult to promote the site as part of local heritage. The mine workings sit on the Ochil Hills as a monument to mans exploitation of the landscape, and as they get filled with more bottles and cans it will continue to tell a similar story.

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<sup>149</sup> Ochils Landscape Partnership, <http://ochils.org.uk/hills-time>

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