A Coal Mine in the Sea: Culross and the Moat Pit

DONALD ADAMSON

SUMMARY

The article reconsiders the archaeology of the sixteenth-century Moat Pit mining complex at Culross and offers new interpretations of that archaeology. It places the coal mine in a wider context, suggesting a pivotal role in the development of the burgh.

The study emphasises the innovative nature of Sir George Bruce’s coal mining. The archaeologies of salt and iron working in Culross are considered along with their symbiotic relationships with coal. These industries gave impetus to the development of commerce in Culross, with its much altered, and now sadly neglected, pier at its heart. A comparison between the houses of George Bruce and his brother Edward highlights changing attitudes in Scottish society after the Union of the Crowns in 1603.

The Moat Pit is also used as a case study to consider issues arising between industrial and urban archaeology in Scotland. It explores the impact of this debate upon the site’s current unprotected and arguably undervalued status.

KEYWORDS: coal mining, salt making, iron working

INTRODUCTION

‘About two hundred yards up the Forth, and nearly due west from the extremity of the outer pier, is the celebrated moat of Sir George Bruce, now merely visible at low-water like a heap or rickle of stones.’ (Beveridge 1885, Volume II, 311)

Visitors to the seashore of Culross (Fig 1) will have a rather less than even chance of seeing what is, arguably, one of Britain’s most important pieces of industrial heritage.

The Moat Pit shaft (NS 9801 8541) was sunk about 1590 according to an English visitor who toured the mine in 1618, and subsequently wrote of his experiences (Taylor 1630, 133). It operated until it was inundated by a great storm on 30 March 1625 (Beveridge 1885, Volume I, 162). The importance of the Moat Pit shaft lies in part in the fact that it is a very early example of a mine shaft being sunk within a coffer-dam arrangement in the sea, allowing extensive working under the sea-bed. There does not appear to be any contemporary English or Welsh equivalents, and the first known undersea mining in England was not until the 1730s at Salton Pit near Whitehaven from an onshore shaft (Cranstone, pers comm). The Moat Pit shaft was linked by underground workings to an
inland mine shaft at the Castlehill Mine. The Moat Pit mining complex (Fig 2) employed advanced drainage and ventilation systems, using both water power (which necessitated a reservoir) and a horse-gin to enable bucket and chain systems to drain the mine, via a third shaft. It also provided perhaps the first example in Britain of the direct shipping of coal from the mouth of the shaft.

The geology of the area is such that the coal seams dip south-westwards below the Forth to the west of a fault line, which runs just west of Culross. By constructing the Moat Pit shaft as a second shaft, but connected to the original Castlehill Mine, Bruce was able to exploit the coal reserves which lay under Culross Bay (Figs 3 and 4).

This article will argue that the full importance of the Moat Pit complex will not be perceived unless it is placed in a broader context. The scope of this research is thus intended to be wider than previous studies, and places the mine at the very heart of what may be argued to be Scotland’s first industrial town. The relationships between coal mining, salt making and iron working are seen as pivotal in creating Culross. There is a brief review of Scottish industrial archaeology and urban archaeology, focusing on how it has dealt with early industry and which argues that the historic divide between these two strands of Scottish archaeology may have led to an under-assessment of the importance of industrial Culross. The work also serves to provide archaeological support for the historical research of Professor
Whatley into levels of coal and salt production in seventeenth century Scotland. Archaeological investigation of the decayed pier is related to the trade for which it was once used, and its relationship with the Moat Pit, which was used for the direct shipping of coal from the shaft. In considering the urban built environment of the burgh, attention is drawn to the differences between the houses of George Bruce and his brother Edward, and suggestions made as to what this may represent in relation to changing attitudes in Scottish society immediately after the Union of the Crowns in 1603.

Building on the studies of A.I. Bowman (1970) on the coal mining complex, and Angus Graham (1969) on the pier, this article introduces new evidence, new interpretation, which is facilitated by developments in knowledge in the intervening period of forty years, and a theoretical framework and discussion. New facts have emerged such as the discovery of a line of wooden posts on the south side of the Moat Pit; a circular stone with a central hole on the mud-flats near the Moat Pit; a more detailed survey of the site; the existence of an early Victorian watercolour in the possession of Lord Elgin, which locates the drainage shaft on the foreshore; and the possibly deliberate alteration by Lord Dundonald in 1793 of Taylor’s 1630 account of the mine in order to exaggerate the depth of the Moat Pit shaft. Bowman’s interpretations have been revised on a number of fronts, including
Fig 3 The British Geological Survey Map of 1921 which marks both shafts of the mine. The Moat Pit shaft is marked here with a circle and the Castlehill shaft with a square. Both are on the Calmy or Jenny Pate Limestone outcrop on the surface. The Jenny Pate coal seam is about 40 feet below at each point. Arrows have been added to show the downward direction of the dip of the strata. (copyright National Library of Scotland)

Fig 4 Geological cross-section at the shoreline at Culross. (Fife Pits web-site)

the nature of the two stone patches off the Moat Pit; the method of the mining of the connection between the shafts; and the operation of dual power sources of power in the same period at the drainage shaft. In addition, calculations have been carried out with regard to coal and salt production; suggestions made regarding the construction methods used to build the Moat Pit shaft; attention drawn to the pivotal relationship between the Colville and Bruce families; and a discussion
entered into regarding the symbiotic nature of the three core industries of Culross. The earlier articles were largely empirical in nature, and a theoretical context is now introduced. It is that theory which leads to the belief that it is impossible to consider the development of Culross satisfactorily without placing the coal mine at its very core, and equally, that it is not adequate to consider the Moat Pit in isolation.

**PREVIOUS SCHOLARSHIP ON THE MOAT PIT**

The Moat Pit’s most famous visitor was King James VI (Sinclair 1794, Vol 10 144). However, perhaps a more important visitor was John Taylor, the self-proclaimed ‘Water Poet’, who undertook a tour of Britain in 1618, and left a first-hand description of his visit to the coal mine (Taylor 1630, 132–133). In 1630, he published his collected works in one volume and these include *The Pennilesse Pilgrimage*. In this, he gives a very detailed account of his visit to the Moat Pit and how it operated.

The next detailed account of the coal workings of the Moat Pit was in 1793 by Archibald Cochrane, 9th Earl of Dundonald, a descendant of Sir George Bruce (Dundonald 1793, 1–23). Dundonald writes not only as a working coal-master but also as someone who had access to Taylor’s account and the original 1575 lease from Alexander Colville to George Bruce. He quotes extensively from both. Unfortunately, Dundonald is also responsible for a simple error which has bedevilled the secondary literature until the present. He quotes Taylor as saying that the Moat Pit shaft was 40 fathoms, when in fact the original says 40 feet. This is despite otherwise accurately quoting nearly two pages of Taylor’s 1630 narrative. The depth of the pit is therefore repeated as being 240 feet (i.e. 40 fathoms) in almost every piece of secondary literature, including the current National Trust for Scotland guide to Culross (National Trust for Scotland 2008, 3). The underground roadway certainly sloped downwards from the shaft bottom, but whether the mine reached a depth of 240 feet is impossible to say.

In 1885, David Beveridge, an antiquarian, wrote *Culross and Tulliallan or Perthshire on Forth, Its History and Antiquities*. Two chapters are devoted to the history of Culross from 1588 to 1629, and a third covers the monuments of Culross and Tulliallan, including the Moat Pit (Beveridge 1885, Volume I, 108–164; Volume II, 311–312). The history of Sir George Bruce’s industrial enterprises including the Moat Pit is given extensively, and in part is based on Burgh records (Culross was granted the status of Royal Burgh in 1592). In addition, the chapter on monuments gives measurements for the Moat Pit and also descriptions of the site and the associated Castlehill Mine and the possible location of the drainage shaft on the shore. The book contains early photographs of Culross.

Since the publication of the above primary and antiquarian sources, little has been written in any detail about the Moat Pit. The exception is a 1970 article by A. I. Bowman entitled ‘Culross Colliery: a Sixteenth-Century Mine’ in *Industrial Archaeology*. It is the first written narrative to consider the Moat Pit in modern archaeological terms. Bowman subsequently expanded and updated this article, revising some of his conclusions on the Moat Pit, in the *Forth Naturalist and Historian* (Bowman 1981). In this later article, he also gave more attention to the later coal workings to the east of the village.
There are considerable secondary references to the Moat Pit, especially in books on the history of Scottish and British coal mining. A number of general interest and local history articles also cover the Moat Pit in varying degrees. However, almost all the literature on the Moat Pit itself draws directly or indirectly from the four sources noted above. The most useful secondary works on the mine include *Culross: Past and Present* by A.S. Cunningham (1910); *Mining in the Kingdom of Fife* also by A.S. Cunningham (1913); *The Rise of the British Coal Industry* by J.U. Nef (1932); *A Short History of the Scottish Coal-Mining Industry* by J. McKeechnie and M. Macgregor (eds), (1958); *A History of the Scottish Coal Industry* by B.F. Duckham (1970); *The History of the British Coal Industry, vol 1. Before 1700* by J. Hatcher (1993); and *The Mineworkers* by R. Duncan (2005).

In addition, there are two important unpublished manuscripts concerning the mine in the archives of the Earls of Elgin. These are *The Coal Book of Valleyfield* by J. Cummings (1705) and *Report on the working of the coal at Culross* by J. Gemmell (1907). Lord Elgin also has surviving correspondence between Alexander Bruce, 2nd Earl of Kincardine, grandson of Sir George Bruce, and Sir Robert Moray which refers to the Moat Pit.

**THE ARCHAEOLOGY OF EARLY INDUSTRY IN SCOTLAND**

‘What is the point of an archaeology that simply tells us what we already know? . . . we do indeed know the recent past, but in a very specific way; through a series of myths that limit as much as they enable understanding’ (Dalglish 2005, 148).

The Moat Pit illustrates this point well. It will be argued that there is a need to revisit and revise well-known narratives, using archaeology as a tool to assist our understanding of the development of Culross, as an early industrial village.

The problem, highlighted in the quote above, has been exacerbated in Scotland by the divergence between industrial archaeology and urban archaeology. This has been driven by concerns that are not unique to Scotland, but perhaps have been more pointed in this country. This is due to the need to balance scarce archaeological resources, with the rapid decline of industry, and the need to redevelop urban sites (Dalglish 2005, 157–160).

Industrial archaeology developed in Scotland in the 1960s and 1970s when it was argued that ‘the most vital task of the industrial archaeologist, particularly in urban areas, is to record extant buildings, machinery and structures before the scrap-man, the incendiary and the bull-dozer come’ (Hume 1974, xvii–xviii). This created an anxiety about recording the visible remains of industry, obtaining an understanding of their processes when working, and considering their potential for preservation. In this environment it was natural that something like the Scottish Industrial Archaeological Survey (SIAS) would develop, under John Hume in the 1970s which set out to locate and document the archaeology of Scotland’s industrial past as it rapidly disappeared. In 1982, the Royal Commission on the Ancient and Historical Monuments of Scotland took on the funding of SIAS, with the unit moving to RCAHMS in 1985. In 1991, RCAHMS set up its own Industrial Survey, and survey priorities remain centred on visible sites (Dalglish 2005, 158). However, this has begun to change, and the scope widened beyond the visible
structures of the most recent past. For example, Historic Scotland’s Archaeology Programme notes that ‘some industries… do not survive significantly above ground today and excavation can contribute much…’ (Barclay (ed.) 1997, 35). As the remit for industrial archaeology has recently begun to grow, commentators have argued that it should focus less narrowly on extant structures, technological processes and industrial practice. Instead it should embrace its wider impact on the human experience, consider the implications for the built environment and be integrated with wider archaeological concerns, especially urban archaeology (Atkinson 1997, 111–115).

It has been argued that there is a problem with integrating industrial archaeology with urban archaeology in Scotland because Scottish urban archaeology has shown a general lack of concern for the post-Medieval period (Dalglish 2005, 158). Beginning with a conference in 1971, the Society of Antiquaries of Scotland set up the Medieval Urban Archaeology Committee which was responsible for Scotland’s Medieval burghs: an archaeological heritage in danger (Simpson 1972). The focus of this is very much on the medieval period with the Modern era relegated to the role of either causing destruction of medieval archaeology or permitting its survival (Simpson 1972, 7–10).

Medieval urban archaeology took strong root in Scotland, encouraged by a series of important excavations in the 1970s and 1980s, the creation of the Urban Archaeology Unit in 1978, and the commencement of the Scottish Burgh Survey, founded by the Ancient Monuments Inspectorate. The very influential Burgh Surveys have largely adopted a medieval remit (Dalglish 2005, 159). This continues to the present, with urban archaeology in Historic Scotland’s Archaeology Programme being tied up with the archaeology of The Medieval Burghs (Barclay (ed.) 1997, 33–34). Equally the recent Historic Scotland pamphlet, Archaeology in Towns (Historic Scotland 2003) is largely focused on the medieval.

The very real danger of this silo mentality is that in considering the industrial-era urban environment the role of industrial complexes and inter-related industries in shaping the built landscape is not fully appreciated. Equally, the social history of working people, and the history of everyday life can be relegated to a peripheral concern. Modern urban archaeology therefore has much to contribute. If it is to flourish and be recognised as a worthy area of academic interest in Scotland, we must escape from an overwhelming focus on the medieval in urban locations, and at the same time expand industrial archaeology to consider the wider implications of industry on the environment (frequently an urban environment) and the people who were impacted by it. Dalglish finds some encouragement for that process in both England and internationally (Dalglish 2005, 160).

Taking Culross and the Moat Pit as a case study in relation to this, we can appreciate why it is that neither the Moat Pit nor the Castlehill Mine are Scheduled currently. If a piece of modern industrial archaeology, which is largely invisible, is not valued, then it will not be protected. However, coal was pivotal in the expansion of salt making and iron working in the burgh, and the creation of international trade routes for industrial products from Culross by sea. The houses and commercial properties which the tradesmen, colliers and salt makers built in the early seventeenth century form in large measure the present urban landscape of the village, along with the historic ruined pier. If that landscape is to be fully
appreciated then it must be directly related to the forces which created it, and the Moat Pit is pivotal to that. When so much attention is given to the Palace at Culross, its restored garden, other buildings restored under the Small Houses Scheme of the National Trust for Scotland, and the very pleasant ambience of the village, it is easy to lose sight of the fact that Culross reached its zenith as an integrated industrial complex with its commercial Master living in the very heart of his bustling enterprises.

The guide to Culross (National Trust for Scotland 2008, 4) notes that there is little evidence of Sir George Bruce’s mining activities. Actually, that is not correct. Both shafts of his mine still exist. They are just not presented to the public, interpreted or valued. If the development of Culross could be reconnected to the story of the industries which created it, then those industries would not be considered in isolation, which has tended to happen in previous literature on the Moat Pit. To understand fully the importance of early industry in Culross, this industry needs to be set in context. In considering this context, it should be possible for archaeology to help reinterpret and challenge existing narratives about Culross.

BRUCES, COLVILLES AND THE SCOTTISH REFORMATION AT CULROSS

George Bruce’s grandfather was Sir David Bruce of Clackmannan (see simplified family tree). Sir David, who lived at the time of James IV, had at least five sons and four daughters. His second son, Edward, purchased land at Blairhall from the Cistercian Abbey of Culross in 1540 (Bowman 1981, 85), which is about a mile north of the abbey site. At that time, the Abbot of Culross was John Colville and his brother, William Colville, was the Commendator, whose role was to manage the Abbey property. They seem to have been relatives, possibly brothers, of Sir James Colville of Ochiltree, head of the family, who married Alison Bruce, sister of Edward Bruce. Sir James Colville was Comptroller of the Household to James V, and one of the judges of the Court of Session on its commencement in 1532 (Dewar 2001, 248). Thus even in 1540, when Edward Bruce was acquiring land from the Abbey of Culross, he was doing so from a family into which his sister had married, and with which he seems to have had close ties. It is noted that at that time, other charters from the Abbey were being made out to Colvilles to build salt pans in Culross and also dig the coal which was required for their operation (Bowman 1981, 85).

The Scottish Reformation took place in 1559–60, and at that time the Colvilles expanded their control over the Abbey and its land. Sir James Colville and Alison Bruce had several sons, one of whom was Alexander Colville, who became Commendator of the Abbey. It was Alexander Colville who granted George Bruce, his first cousin, the lease to mine coal in Culross in 1575. Lord Dundonald (Dundonald 1793, 9) quotes the preamble to the lease thus:

To our worthy friend and cousin George Bruce, for the great regard we bear to him. For the especial care he had of our affairs when we were abroad in France, for his great knowledge and skill in machinary, such like as no other man has in these days; and for his being the likeliest person to re-establish again the Colliery of Culross, which has been long in desuetude, insomuch, that we have neither large nor small Coal for our own house fire.
Alexander’s older brother had died young in 1562, leaving a son, James Colville (1551–1629), who ‘earned distinction in the French Wars’ (Dewar 2001, 248), fighting on the Protestant or Huguenot side, and erected Culross into a temporal barony in 1589, becoming Lord Colville of Culross in 1604.

George Bruce was the third son of Edward Bruce of Blairhall. The eldest son, Robert, inherited the Blairhall lands, whilst the second son, Edward Bruce became a successful lawyer and diplomat. It would seem that George, from the 1575 lease, became skilled in engineering and was also a man of business.

George Bruce and Margaret Primrose had three sons and five daughters. There is a magnificent tomb in Culross Abbey with statues of their eight children in prayer besides their effigies. One of the daughters, Christian, was married to Robert Colville (Dewar 2001, 248). He was the heir of James, 1st Lord Colville of Culross. Thus George cemented the business and political alliance between the Colvilles and the Bruces which had allowed his father to obtain the Blairhall lands and then himself to commence his business career in earnest, with the marriage of one of his daughters to the Colville laird. George Bruce was knighted about 1610.

N.B. Robert Colville and his spouse, Christian Bruce, appear on both the Bruce and Colville lines
MINING IN THE PERIOD BEFORE THE REFORMATION

The earliest documentary evidence of mining in Scotland connects it with monastic lands (Duncan 2005, 9). This remained the case up until the Reformation, although increasingly it seems likely that leases or feuks were granted by the Abbeys to local gentry like the Colvilles or Bruces (Bowman 1981, 85). Originally, however, it was the monks who took leases from noblemen. The two earliest charters in Scotland both involve the granting of the right to mine to the Church. These are a Charter of 1219, granting Newbattle Abbey the right to work coal along the River Esk, and a Charter of 1291, giving the monks of Dunfermline Abbey the lease to mine around Dunfermline (Hatcher 1993, 97). The digging of coal for the monks of Culross Abbey had a lengthy history throughout the Middle Ages (Hatcher 1993, 99).

Whilst conducting this researching, the sides of the Dean Burn were examined. There is evidence of what may be a drift working on the side of the defile of the burn, but higher up from the Castlehill Mine site. Outcrops of coal on the surface led to quarrying at first, and it is a natural extension of this to follow the seam of coal as it moves underground at an angle, in a drift mine (Duncan 2005, 11). This is known in Scots as an ‘ingoanee’, or ingoing eye.

A more common practice which lasted until the late eighteenth century was the bell pit. This was a simple means of reaching and working an underground seam. A short vertical shaft was sunk into the ground, and a bell-shaped cavity was worked out when the seam was reached. A wooden platform was frequently constructed in the ‘neck’ of the bell, and the coal carried out by basket, using ladders to the platform and from the platform to the surface. Bell pits are usually only 10 or 15 metres deep.

The depth of the workings was constrained by the technological problems of dealing with roof collapses, flooding, ventilation and problems with gas. However, late medieval and sixteenth-century mining in England has been demonstrated by recent scholarship to have been quite sophisticated, and it is very possible that some of this technology had spread to Scotland, although this is not yet proven (Claughton 1994, 54–59; Hartley 1994, 91–101; Hatcher 1993, 187–238).

MINING INNOVATION BY GEORGE BRUCE

It is important to note the very innovative approach of George Bruce when he took over the then defunct coal workings in Culross, under the terms of the 1575 lease.

There is evidence of a drainage system being used within the mine, which involved a separate drainage shaft. This was operated by water, horse and possibly tidal power. The water-power came from a reservoir created by damming the Dean Burn and then directing the water in wooden troughs over several hundred metres to the drainage shaft, where it powered a bucket and chain system, or ‘Egyptian Wheel’, used to empty a sump. This was later supplemented or replaced by horsepower as the workings got deeper. Later still, there is evidence of Bruce experimenting with tidal-power.
The Moat Pit complex had two entrance shafts, and a third drainage shaft. This would have greatly aided ventilation, though it might have still been necessary to light a brazier at the foot of one of the shafts to induce a flow through the mine.

The Moat Pit shaft, itself an artificial island, was a spectacular feature. There was nothing like it in British mining prior to its construction. It was a water-tight stump of stone, projecting well out of the water, even at high tide. Using it, access to coal which would otherwise have been unreachable was possible. Perhaps more importantly, for the first time it was possible to bring coal directly to the top of the shaft and then immediately load it onto boats for ease of transport.

Many of the innovations are reminiscent of the mining techniques discussed and illustrated in *De Re Metallica* by Georgius Agricola, first published in 1556 (Agricola 1556). It would seem that continental mining techniques were well in advance of those in Britain (Bowman 1981, 88). The Egyptian Wheel, other drainage mechanisms, ventilation apparatus, and techniques of sinking shafts are all discussed in this important work. It would seem probable that Bruce acquired some of his knowledge from the Continent, and this book, which was widely read, would probably have been available to him.

**Mining in Culross after 1625**

The operation of the Moat Pit was brought to a sudden end on 30 March 1625, when a violent storm flooded the mine, devastating the Firth of Forth ports and salt pans (Beveridge 1885 vol I, 162). Sir George Bruce died in May 1625. His eldest son, George, appears to have been in charge of the day-to-day commercial matters of the family, but with the sea having inundated the mine, and there being no available way of draining it, production ceased (Bowman 1981, 112).

Dundonald says that the accident put a stop for several years to the extensive coal and salt trade then carried on at Culross (Dundonald 1793, 11). There is no evidence that mining of the Jenny Pate seam resumed west of the fault line, but a series of at least six mines are known to the east of the fault line. John Gemmell, a mining engineer, employed in 1909 to re-evaluate the Culross coal seams, believed that these shallow pits were also the work of Sir George Bruce, and were connected to the Moat Pit, and were thus subject to flooding from those workings. It seems much more likely that they were independent of the Moat Pit, were the work of George Bruce, the son of Sir George Bruce, in the period after 1625, and used some of the technological ideas of the Moat Pit, albeit to a lesser extent (Bowman 1981, 113–116). Cummings actually gives eye-witness accounts of at least two of the pits to the east of Culross working in the period after 1625, and used horse-mills for drainage (Bowman 1881, 115). These were the Barclay Pit and the St Mungo’s Pit, which was a moat pit, built on the foreshore, and about 40 m from the original shoreline. This pit still exists, although now in the corner of a playing field, built on reclaimed land, and the stone lining of the shaft can be seen. All of these pits are marked on the plan of 1842 by Henry Cadell. This map also shows the depth of three of the pits to the east of Culross being between 17 and 23 fathoms. Some of the technological advances such as the moat pit principle (which was also employed later on the Valleyfield Moat), drainage by horse-mills, and deeper shafts which were lined with stone or wood were retained.
It would seem that the mines were moving eastward towards Valleyfield. Cummings talks (Bowman 1981, 116) of the 2nd Earl of Kincardine (the grandson of Sir George Bruce) having the ‘Dingdong’ mine sunk, to the north-east of the Abbey, which must have been between 1662 and 1680. Dundonald says that the last coal workings of the 2nd Earl of Kincardine were in 1676, and that there were no coal workings until he restarted operations in 1774.

THE ARCHAEOLOGY OF THE MOAT PIT COMPLEX

The mining operations of George Bruce commenced in 1575 with the granting of the lease to mine in Culross, and culminated with the sinking of the off-shore Moat Pit shaft in 1590. The four main areas of archaeology are considered in approximate chronological order, being the Castlehill Mine shaft, the dam and reservoir on the Dean Burn, the drainage shaft on the foreshore and finally the Moat Pit shaft.

Castlehill mine shaft

There is no direct evidence that the ‘sink’ at Castlehill is the landward end of the Moat workings. However, it is the only shaft identified by the 1921 British Geological Survey map in anything like the right area (Woods 2007 (b), 1). It is also sunk through the Jenny Pate Limestone seam to reach the Jenny Pate coal seam, exactly as the Moat Pit was, and John Cummings spoke in 1705 of a ‘sink’ in the Castlehill lands (Bowman 1981, 92).

The Castlehill Mine shaft (NS 9798 8615) lies to the west of Culross, about 15 m east of the Dean Burn. The site is about 15 m across, and forms a circular depression about 3 m deep at most. The centre of the depression has been filled with soil and rubble in the very recent past, and consequently there is now a new mound about 1.5 m high filling the centre of the former shaft.

The dam and reservoir on the Dean Burn

North of the Castlehill Mine shaft, the Dean Burn flows south, from the direction of Culross Moor. There is a defile for about 200 m which is approximately 10 to 20 m deep. Before the burn drops down into it, there is a shallow depression. This may represent the reservoir created by the Dean Burn being dammed. This marshy area extends for about 50 m north and west from an apparently natural bank, with no evidence of masonry, at the top of the defile. This might be the remnants of the original dam. There was water flowing in the Dean Burn in May 2008, but by July it was virtually dry.

The Egyptian Wheel

Documentary evidence would place the site of the Egyptian Wheel on the foreshore to the west of where the Dean Burn enters the Firth of Forth. John Cummings stated in 1705 that there were ‘Two sinks within the sea at Castlehills,
the one a dip, the other an out bearing door, also moted, it not being far within the sea.’ (Cummings 1705)

This can then be compared with John Taylor in 1630. He said:

The sea at certain places doth leake or soak into the mine, which, by the industry of Sir George Bruce, is all conveyed to one well neare the land, where he hath a device like a horse-mill, that with three horses and a great chain of iron, going downeward many fathomes, with thirty-six buckets fastened to the chaine, of which eighteeene go down still to be filled, and eighteeene ascend up to be emptied, which do emptie themselves (without any man’s labour) into a trough that conveys the water into the sea againe . . . (Taylor 1630, 133)

If it can be accepted that the ‘out bearing door’ mentioned by Cummings is the Moat Pit shaft, then the ‘dip’ is likely to be the Egyptian Wheel drainage shaft. This fits with Taylor’s account. Both speak of the shaft being near land, but, by implication, not on it. Cummings says that the drainage or ‘dip’ shaft was moted, along with the shaft out of which the coal was taken – the ‘out bearing door’. Thus, it would seem that the Egyptian Wheel was sited on a moated site, close to the shore (or at least the shore as it was about 1600).

Beveridge confirms that the shaft was just below the high tide mark on the shore:

The projection on the sea-shore, formerly an old ‘bucket-pat’ . . . Remains of masonry which belonged to this pit, and the draining apparatus connected with it described by Taylor, are said to have been in existence in this neighbourhood up to the beginnings of the present century. (Beveridge 1885 Vol II, 312; with emphasis added).

Consequently, maps dating to before the building of the railway in 1906 were examined to identify possible sites for the Egyptian Wheel drainage shaft. Two projections from the land which are rectilinear and thus probably man-made were noted on the First Edition, Ordnance Survey map of 1866. Either of these two sites could represent the old bucket-pat which is mentioned by Beveridge, and thus could be the original site of the Egyptian Wheel.

Both sites were inspected based on the cartographic evidence, for any evidence of surviving archaeology. The railway has not entirely obliterated the site at Blairburn. A substantial curving wall projects through the railway embankment, and is made of large dressed stones (Fig 5). The more westerly site opposite Burnside House is built out in the middle of marshy saltings and appears to be too far west to match documentary accounts. There is no surviving evidence which would conclusively identify either site as being the correct one, but the Blairburn site appears more likely. This is where Bowman places it.

In addition, Lord Elgin has a watercolour of 1855 which shows the site at Blairburn as a walled projection on the foreshore, which looks very similar to what might be expected from a moated construction.
Fig 5  The possible site of the Egyptian Wheel drainage shaft, which was moated, on the foreshore. Railway line and embankment is to rear. (Photo: author)

The Moat Pit shaft

The site lies about 400 m from the shore (Fig 6). Much of the stone from the Moat Pit was removed around 1790 to form part of the Leith breakwater (Beveridge Vol I, 162).

The Moat Pit shaft is situated on the western extremity of a mussel bank which follows the line of the Ailie Rocks as they project west-south-westerly from Culross. It is about 600 m from the end of the old pier. Looking northwards, it is about 400 m to the Fife shore and a further 200 m to the Castlehill Mine shaft. To the south lies deep water.

At the Moat Pit there are three concentric circular walls of stone, which surround what was once the mine shaft. The concentric circles are obscured by tumbled stone, seaweed and mud, but are nevertheless distinct. The Moat pit stands about 1.5 m above the surrounding mud level, rising towards the centre from all sides. The tumbled stone, which is mostly, but not entirely, irregularly shaped, fills the shaft completely. It also extends slightly outside the outer (or third) wall, on all sides; being about 2–3 m beyond on the north and east sides, and about 1–2 m on the west and south sides (Fig 7).

The mine shaft measures 420 cm in diameter. On the inside of the (first) shaft wall, there appears to be an inset for a beam or platform (Fig 8). This inner wall, which forms the wall of the shaft, stands several courses high. The wall would appear to be built in a double skin with at least two courses being laid lengthwise,
Fig 6 The Moat Pit looking north-west towards the Culross shore, showing the concentric stone walls, which are heavily obscured by seaweed and tumbled stone. (Photo: author)

and then with the third course being laid across the underlying stones and acting as a tie. The measurements of the stones vary, although they are all dressed. The wall is 88 cm thick. The tie stones which run across the wall vary between 28 cm and 36 cm in width on the inside edge, and 34 cm and 44 cm on the outside. They are carved to fit a slight curve on the inside and outside edges. They are 30 cm in height. The stones which form the double skin are also 30 cm in height, vary in length between 80 cm and 100 cm, and again appear to have a slight curve. They are about 40 cm in width, and as they were laid in parallel, there is a small gap of about 8 cm between the two courses. No mortar was observed between the stones (Fig 9).

The gap between the first (shaft) wall and the second wall is 110 cm. This gap is filled with puddled clay. The inside of the second wall appears to have a wooden board lining it, with a thickness of about 3 cm. This is associated with wooden posts at intervals of 1 m. These wooden posts are set into the stonework of the second wall and are about 20 cm square (Fig 10). The second wall is a single skin wall of about 88 mm thickness. The stone blocks are similar in size to the tie stones in the first (shaft) wall.

There is a gap of 203 cm between the second wall and the outer (third) wall. This gap is heavily filled with fallen stone. There is no evidence of clay in this gap. Much of the stone is highly irregular, and not dressed. The third wall is also a single skin wall of 76 cm wide. Again the size of the stones, although not uniform,
Fig 7 Measured Sketch Plan of the Moat Pit. Key: A) The shaft of the Moat Pit. This is now choked with stone debris (diameter 4.20 m), B) The first or inner or shaft wall. This is has a double skin with tie stones (width of 88 cms), C) The second or middle wall. This has a single skin (width of 88 cms), D) The third or outer wall. This has a single skin (width of 76 cms), E) The gap between the first and second walls is filled with puddled clay (width of 1.1 m), F) Wooden posts at intervals of 1 m and wooden boards surround the inside of second wall, G) Six exposed wooden posts are built into outside of third wall on the south side. A further two posts are built into the wall under stonework to the west, and two to the east, of the exposed posts. These are at similar distances from one another. Thus there are at least ten posts on the south side of the third wall, I/H) Outliers of stone on south and west sides respectively, J) Two circular stones. The most easterly has a central hole drilled through it.
Fig 8 An inset for a beam or platform in the inside of the first or shaft wall. (Photo: author)

resembles the tie stones of the first (shaft) wall. This third wall has at least ten posts built into its outside edge, on the southern side (i.e. facing the deep water approach). These are about 20–25 cm square. They are built into the wall, but this time on the outside, and were thus exposed to the sea. They are at intervals of 178 cm. The six central posts have their tops fully exposed, but a further four posts were found under stonework, with two on the west side and two on the east side of the group. No posts were found on the outer wall other than on the southern face of the Moat Pit.

The total diameter of the Moat Pit is about 15.5 m (approximately 51 ft). The cross-section therefore comprises an outer wall of 76 cm, a gap of 203 cm filled with fallen stone, a second wall of 88 cm, a further gap filled with puddled clay of 110 cm, an inner wall of 88 cm. This totals 5.65 m. The shaft is 4.2 m. Consequently the cross-section is $5.65 \times 2 = 11.3 + 4.2$, or approximately 15.5 m.

There are two patches of outlying stone. One lies to the south of the Moat Pit and the other to the west. The stone to the south is about 8 m long by 5 m wide, running east-west. There is no physical connection to the Moat Pit evident, and the distance between the Moat Pit’s outside wall and the mound of stone is about 10 m. There is no evidence of regular courses, but some of the stone has been dressed. The stone to the west is about 5 m from the Moat Pit’s outside wall. It is also about 8 m long by 5 m, and runs north-south. Again there is no connection to
the Moat Pit evident, with a mixture of dressed and undressed stone and no regular courses.

Finally there are two circular stones in the mud, about 20 m to the north-east of the Moat Pit. One of these has a hole cut through the centre, although the hole appears to be slightly at an angle. These are approximately the same size, being approximately 125 cm in diameter and 45 cm in depth. These may have no association with the Moat Pit, but could represent some sort of bearing related to the mine.

Discussion of the Archaeology of the Moat Pit

The Castlehill Mine shaft and underground workings

It is not possible to say without excavation whether the Castlehill Mine shaft was lined with stone like the Moat Pit shaft. The shaft could have been as wide as the Moat Pit shaft (4.2 m). From the position, on relatively flat land, below the defile of the Dean Burn, it would seem that a shaft rather than an ‘ingaunee’ is likely, especially as the depression is circular.

The shaft sits on the Jenny Pate limestone stratum, and would descend until it hit the coal seam. The Jenny Pate coal seam is approximately 115 cm thick, and dips at the rate of 1 in 3.5 (Woods 2007(b), 1).
It may be that the Castlehill site was worked pre-Reformation, and merely restarted by Bruce. It is likely that at first the miners would have followed the coal seam as it dipped in a north-westerly direction. However, at some point Bruce must have driven westwards, through the fault line and picked up the Jenny Pate coal seam once more. The seam, west of the fault, dips in a westerly and south-westerly direction.

Bowman suggests that there was a straight tunnel or ‘underground roadway’ linking Castlehill and the Moat Pit (Bowman 1981, 92). This does not make either economic or mining engineering sense (Woods, pers comm), nor does it follow the documentary evidence from Taylor. Such a tunnel driven through rock, and ignoring the coal seam, would have been close to 600 m long. It is said to have been at more than head-height (1.8 m) and must have been at least 1.4 m wide. Woods, a former Mines Surveyor, has carried out calculations, and believes that this would have taken several years of work. All this while, the mine would not have been producing coal (Woods 2007(b), 4).

Taylor says, talking about the Moat Pit shaft:

They did dig forty feet downe right into and through a rocke. At last they found that which they expected, which was sea-cole. They following the veine of the Mine did dig forward still so that in the space of eight and twenty or nine and twenty yeares, they have digged more than an English mile under the sea . . . . (Taylor 1630, 132–133; emphasis added).
This implies that the main underground roadway linking the two shafts followed the strike of the Jenny Pate coal as it swung round from the Moat Pit shaft to the Egyptian Wheel drainage shaft, and on to the Castlehill Mine shaft. In this way it would be possible to mine from both ends, extracting coal as they went, and meet in the middle by calculating the depth of the workings, which were following the same seam (Woods 2007(2), 4). The main roadway would be longer than 600 m as it curved out to the west. This addresses Bowman’s comments regarding the accuracy of the surveying which could lead a tunnel from one small shaft to the other, over hundreds of yards (Bowman 1970, 363), although the surveying skill is still impressive.

Based on the working practices of the time, and supported by the comments of Taylor, it would seem that the mine was worked on the ‘stoop and room’ system. This means that in all likelihood the ‘stoops’, which were the working spaces cut into the coal, were 6–9 ft (1.8–2.8 m) feet square and the roadways would initially have been seam height, and 4–6 ft (1.2–1.8 m) in width. The main underground roadway seems to have been ‘brushed’ (heightened) to head-height, so as to act as the main communication artery (Woods 2007 (b), 3). This main passageway would have had side roads running off it which would have followed the coal seam especially to the south-west, as it sloped deeper. This accounts for Cummings statement of 1705 that ‘these two sinks wasted very far to the SW within the sea’, which so puzzles Bowman (Bowman 1981, 113). Having established the main roadway along the coal seam at perhaps fifty or sixty feet depth, the mine then worked down the dip of the seam.

**Water mills, horse mills and tide mills**

Apart from the archaeological evidence, the existence of a dam on the Dean Burn is known from a legal case of 1607. A complaint was lodged by George Bruce against John Gow.

Johnne Gow came with his servants to the wattir passage that descendis fra the said compleinairis wattir dammis in the common muir of Culrois to the wattir myle of his coilheuch within the sey mark and set the wattir of the said dame by the accustomet course and ganging quhilk it has evir had in all tyme bigane past memorie of man, of purpose to drawe the wattir, althegither fra the compleinairis coilheuch (Bowman 1981, 108).

They apparently tried to draw the water away at first. They then returned and broke the dam, thereby letting all the water escape. Gow’s purpose was as follows: ‘Interny (intending) horse and man for that service of his heuch quilk before was done by wattir . . . ’ (Bowman 1981, 108).

This gives us a lot of clues as to the operation of the dam and the associated water mill, which was evidently used to drain Bruce’s colliery or ‘coilheuch’. It tells us that there was a dam on the Dean Burn, where it drains the Moor of Culross, and this is where the archaeology shows there to have been a dam. It indicates that there was a new channel created to that water mill, away from the accustomed or natural course, to which Gow tried to return the water at first. This is further explained by John Cummings (1705) who says the water to work the
mill ‘was carried in long troughs from Castlehill to the Mote’ (quoted in Bowman 1981, 107).

So it would seem that Bruce ran the water from the dam by way of troughs (presumably wooden) to his water mill which was within the high tide mark. This makes sense if the site is moated, and there is archaeological evidence of this in the form of the great curving stone wall projecting through the railway line at Blairburn. This would not be nearly as difficult as the suggestion that Bruce ran the troughs all the way from the dam to the Moat Pit shaft (about 800 m), including building supports for the troughs across the mud-flats and the foreshore (Bowman 1981, 108). There is no archaeological evidence for this. The simpler interpretation is that the troughs ran along the side of the hill to a water mill on the shore, and that when Cummings said that the water was carried to the Moat Pit, he meant the drainage shaft that drained the Moat Pit.

Sir George Bruce erected machinery consisting of the Egyptian Wheel, commonly called chain and bucket, to drain the coal to the dip of the old workings, which since appear to have been only about five fathoms below the level of the high-water mark… (Dundonald 1793, 10).

It would make sense if the water mill was used to drain the old workings which were about five fathoms or thirty feet deep at the shoreline. The three-horse mill which pulled the Egyptian Mill was then used later to drain the workings as they deepened. It would also have provided more reliable power because the Dean Burn dries up substantially in summer.

It is known that in 1607 there was a water mill and that John Gow wanted to force Bruce to use a man and a horse, and possibly incur extra costs. In 1618 there was a horse mill. There is no evidence to suggest that they operated together, but this is entirely possible, if only to rest the horses.

The Egyptian Wheel as discussed by Taylor was regarded by contemporaries as being a mechanical marvel because of the depth which it could reach (Fig 11). Taylor talks of eighteen buckets going down on a metal chain as eighteen rise. The distance between buckets could be adjusted as the mine deepened. The sump of the Egyptian Wheel must have been at the bottom of the workings to allow water from the workings to reach it by gravity flow long the bottom of the roadways (Woods 2007 (b), 4). It is suggested that water was fed back to the sump of the shaft using a level. The Earl of Wemyss used an adit to drain his mine at Wemyss, and this ran for over two miles in the mid seventeenth century. This device was also used in the lead mine at Wanlockhead and Leadhills at the same period (Duncan 2005, 15). This would have allowed Bruce to continue using the same drainage site whilst the mine was worked ever deeper.

The Egyptian Wheel worked on principles well known in Germany in the sixteenth century. Many of the illustrations of the Egyptian Wheel (e.g. Cunningham 1913, 12 or National Trust for Scotland 2008, 3), show the three horses yoked to one beam. It has been pointed out (Woods 2007 (b), 4) that this is incorrect and that the horses would have been yoked to three separate beams, at 120 degrees to each other, in order to balance the forces on the central pivot.
There is an intriguing reference to the operation of tide mills at the Moat Pit. This is contained in a letter of 1658 from Sir Robert Moray to Alexander Bruce, 2nd Earl of Kincardine which said:

I remember before to have heard of your Grandfather’s Tyde Mills. I do indeed remember to have been in the Moat at Culross when the coal was going there.
some 35 years ago – but I believe that you do not think of recovering that Moat again. One thing you can tell me – whether these Mills that went with the tide drew water from your coals or not . . . (Bowman 1981, 109).

Tide mills of various types had been operated, not terribly effectively, since the Middle Ages. One form was two boats or pontoons moored in a tideway with the water wheel on an axle between them (Bowman 1981, 111). The tidal range here is about 5 m. An alternative form is a tidal pond, filled by a sluice on the rising tide and operating a mill on the ebb-tide (Shaw 1984, 14–16).

The construction of the Moat Pit shaft

Preliminary investigation combined with local knowledge would have identified the existence of the Jenny Pate Limestone at the west end of the mussel bank and due south of Castlehill. Bruce would have known that by going through the rock, the Jenny Pate coal seam would be encountered within a few fathoms. It would therefore be a question of drawing up a plan for the Moat Pit which would protect this shaft from the sea. The construction material was locally-sourced millstone grit sandstone. The most likely source is the quarries west of Culross, which have been used for centuries. There is no evidence of mortar on the site, and it would seem that the structure was dry-stone built like many piers. The puddled clay could be obtained locally (Woods 2007 (b), 2).

Transporting and hoisting of the stone would be an issue. It is suggested that the stone was brought to the site by sea, with perhaps the stone being loaded in nets onto sledges at the quarry, and brought down to below high tide mark. The nets might then have been slung under a boat at high tide, in order to be moved and dumped at a buoyed location near the construction site. The stones were then probably hoisted into position using ‘A Frames’ (Woods 2007 (a) 2).

The first thing to be done on site would be to prepare the foundations for the walls. Initially there would be only one to three hours on site depending on the tides. This would lengthen as the walls rose. It is likely that having determined the centre of the shaft, then a rope stretching from a post would be used to mark the circumference of the walls. A circular footing trench would be cut into the limestone rock so that the masonry could start to be laid. The first (shaft) wall would be built up, and would have a drain or sluice set into it until it exceeded high tide. The first (shaft) wall has a double skin with tie courses. The second wall would follow and then the third (outer) wall. The masonry would be built up using wooden scaffolding on traditional lines (Woods 2007 (a), 3).

When the first (shaft) and second walls were at full height then the space between the two walls was packed with puddled clay, very much as canal builders did, to seal the shaft from the sea and make it water-tight. The inside edge of the second wall was boarded to retain the clay. These wooden boards were pegged to the ring of posts, built into the stone. These were possibly made of elm (Woods 2007 (a), 3).

At the same time the third (outer) wall would be rising. There is archaeological evidence that the south side of this outer wall was piled with at least ten timber posts. Presumably this was because of a concern that because the rock on which the Moat Pit was being built was not flat, then there was a danger of slippage to
the south, although it might also relate to the loading of coal directly onto ships (see below). The excavated material from the shaft would be raised by windlass in buckets or baskets to the top of the Moat Pit, and then tipped over the side of the second wall into the space between that wall and the third wall. This had many advantages, including getting rid of the spoil from the shaft, stabilising the third wall, and limiting contact between any water which penetrated the third (outside) wall and the second wall (Woods 2007 (a), 4). It is likely, based on calculations, that additional rock spoil would have been required to fill the space between the second and third walls.

Once the Moat Pit was operative, it would be possible to work outwards along the coal seam which was found at a depth of forty feet. The coal would be raised, either by bearers using ladders and platforms set into the shaft, or by windlass. The coal was stored on the top, and then directly loaded into ships which tied up alongside. There are six fully-exposed wooden posts at regular intervals on the south, or deep-water, side of the Moat Pit and it is suggested that these might have acted as mooring posts. The height of the masonry is not known, but with a five-metre tidal range in the Forth, and bearing in mind that the mine was inundated by the great storm of 1625, then the masonry might have been between eight and ten metres high (Fig 12). The actual shaft went down at least a further twelve metres. This implies that the total distance from shaft bottom to the top of the masonry was around twenty metres, and it could be climbed using platforms and ladders. There is an inset in the inner shaft wall which might be evidence of this (Woods 2007 (b), 2).

Calculations Relating to the Moat Pit

These calculations were originated by Neil Woods, a former Mines Surveyor, in his paper *The Moat Pit Colliery, Culross* (Woods 2007 (b), 5). These have been expanded and slightly amended by the author.

**Coal Output**

The Jenny Pate coal seam was said to be 3 ft 9 ins (115 cm) thick.

The approximate area of the seam worked was 700 yds on the strike by 300 yds to the dip. This equals 210,000 sq yds.

With an average thickness of 1.25 yds, this implies a cubic capacity of approximately 265,000 cu yds. This is equal to approximately 280,000 tonnes of coal.

If the stoops were 9 ft square with roads 4 ft wide, then approximately 50% of the coal would be won over time. That amounts to 140,000 tonnes.

The Moat Pit was in production from 1590 to 1625, and this implies an average production of 4,000 tonnes per year. This equates to 80 tonnes per week.

These figures are a very rough estimate. The actual production rates would fluctuate due to factors such as water leakage, faulting, haulage distances, ventilation, market demand, labour issues and shipping delays. More coal would be produced if more coal was robbed from the seam but roof problems would
increase. If the Overton Seam at 10–15 m below the Jenny Pate seam was accessed, then again more coal would be available, but there is no evidence of this. Interestingly, Woods produced this estimate completely independently, based on mining knowledge, and without knowledge of Whatley’s work in reducing Nef’s estimates of Scottish coal production in the seventeenth century (Whatley 1994, 2–7). Whatley argues that Nef’s estimates for Scotland should be more than halved.

Nef used a benchmark decade of 1681–90, but was aware of the limitations of the Scottish data (Nef 1932 Vol I, 42–52). Nef assumed that the Tulliallan (15,000 tonnes) and Torry (10,000 tonnes) production totals were the norm in 1680, but Whatley notes that they were very much the exception. If the Moat Pit complex was only producing 4,000 tonnes at the start of the century then this helps to support Whatley’s revisionist views.

**Salt Production**

Dundonald said that when Sir George Bruce died in 1625, he was the master of forty-four salt pans (Dundonald 1793, 16). The ratio of coal to manufactured salt was around 6:1 (Whatley 1987, 9). The mine at Culross would have produced a
mixture of ‘Great Coal’ or charbon d’ecosse which would in all probability have been exported from the Moat Pit direct by ship to England, the Low Countries and Germany. In addition a good proportion of coal produced would have been ‘pan coal’, or small and broken coal which would have been used by Bruce in his salt pans.

If we accept that the production of the colliery was 4,000 tons of coal per annum, then no more than 3,000 tons can have been ‘pan coal’, which is probably a generous estimate. This would have produced 500 tons of salt or 20,000 bushels of salt per annum. This ties up very well with the statistics known for the Scottish saltworks of the eighteenth centuries (Whatley 1984, 68). Whatley gives statistics for salt production in the years 1716–19, and again in 1795–98, based on information from salt tax records. This shows that only the biggest producers of Wemyss and Methil produced just over 20,000 bushels per annum in those periods, with Dysart at this level in 1716–19. This would equate Culross in the period 1590–1625 with those major centres in later centuries. Most Scottish saltworks produced less than 10,000 bushels. The restarted saltworks in Culross (St Mungo’s), owned by the 9th Earl of Dundonald, produced only 1,700 bushels per annum in 1795–98 from five (large) pans.

Consequently, it would seem that the estimate of 90–100 tons of salt per week given by Taylor (Taylor 1630, 133) is grossly over-estimated. This would equate to 200,000 bushels per annum of salt from Culross alone, when the entire Scottish salt industry only produced 132,800 bushels per annum in 1716–19 (Whatley 1984, 68). The more likely explanation is that the mine produced something like 90–100 tons of coal in 1618. Consequently, a reasonable estimate of salt production is 10 tons per week, given that some of the coal would have been ‘great coal’. This assumes that Bruce was not buying in coal from his competitor coal owners, but if he did, he would have been sacrificing much of his profit.

Coal, Salt and Iron

There has traditionally been a close relationship between the production of coal and the manufacture of salt in Scotland (Whatley 1987, 61–76). Coal provided the energy source for salt production. Indeed it has been argued that in the period before the mid-sixteenth century, when little coal was exported or indeed used for domestic heating, that the salt pans may have been the main outlet for Scottish coal (Whatley 1987, 62).

Bruce was exceptionally fortunate with market conditions for salt. From the fourteenth century onwards Bay or ‘great’ salt had been exported in large quantities to northern Europe from the Bay of Biscay. This trade came to be dominated by the Dutch, who not only shipped but refined the salt. In 1566, the Eighty Years War between the Dutch and Spanish began. This disrupted the Dutch salt trade and gave the high-cost, low-quality salt producers of Scotland an unprecedented opportunity to export to England, the Low Countries, Germany and the Baltic. The Spanish trade embargo of 1572 with Holland resulted in the quadrupling of the price of Bay Salt. The result was the development of a Scottish export trade for salt. While still minor in European terms, the Scots were exporting in excess of 1,500 tons of salt per annum by the end of the sixteenth century (Whatley 33–39).
As many as six tons of coal was required to make one ton of ‘marine’ salt (Whatley 1984, 10), during an evaporation process that lasted at least twenty-four hours. The coal that was used was the smaller pieces of coal or ‘pan coal’, which could not be sold for domestic use as ‘Great Coal’. Thus the salt industry not only took the less readily sold coal, but also enabled a value-added activity to be attached to the utilisation of it.

Coal was also one of the energy sources used in post-medieval Scotland for the smithing of iron. There is evidence of a guild of smiths or ‘hammermen’ at Culross from 1549 until 1851 (Beveridge 1885 vol II, 151). In many parts of Britain in the medieval and post-medieval period, coal was used as the energy source for the smithing of blooms or the mending of artefacts. Coal was not used in the bloomery furnace however, and not successfully used in the blast furnace until the eighteenth century. In Culross, coal was certainly used when it came to the smithing of baking girdles, and Culross was famous for this metal product. Culross girdle-makers, who were part of the guild of hammermen, held a monopoly from 1599 until it was overturned in the legal case of Girdlemakers of Culross v. Watson and Masterton in 1725 (Beveridge 1885 vol II, 186). The metal for the girdles may have been produced by bloomeries or charcoal blast furnaces or indeed imported from the Baltic. Evidence for iron production remains lacking in Culross.

Iron working was also related to salt production. At Culross, with forty-four salt pans in operation by 1625, there would be a considerable need for skilled smiths. Pans could be as large as eighteen feet long by nine feet wide and eighteen inches deep, and they were made of iron plates (Whatley 1987, 9). A considerable amount of metalwork was involved, which would have taken much time and skill to make. Equally, it was essential to keep the pans in good maintenance and in full production. One activity was the regular, monthly ‘paddling’ of pans to remove crusting of calcium sulphate, which if not done required the replacement of burnt or holed plates by smiths. Another was ‘beiting’ which was the stripping down and repair of pans every couple of years because of scaling and burning (Whatley 1987, 18). This was a major undertaking, and it is known to have taken six or seven smiths up to eight weeks (Whatley 1987, 20).

It is clear that coal, salt and metal working was intimately connected in Culross. Each relied on the other two. In particular, salt production could be regarded as converting coal to a high value product and reducing transport costs. Metal tools were required for mining and metal pans for salt making. Coal, from the Moat Pit, was the power source behind both salt and secondary iron working.

The Archaeology of Salt Manufacture in Culross

It is widely believed that there are no archaeological remains of the once extensive saltworks left in Culross. For example, there is no mention of anything related to the survival of salt manufacturing archaeology in the current National Trust handbook (National Trust for Scotland 2008), or the Bowman articles (Bowman 1970, 1981). This is not surprising given the destruction wrought by the alterations to the foreshore caused by the railway line of 1906.

The salt industry in Culross had suffered a severe blow in 1625 when the same storm that inundated the Moat Pit also damaged the salt pans (Beveridge 1885...
vol II, 162). Although salt continued to be produced, it is likely to have been at a lower level, and ceased altogether when coal production was halted in 1676. The manufacture of salt in Culross was restarted in 1774 by the 9th Earl of Dundonald, but his saltworks ceased production shortly after 1795, and the next proprietor, Sir Robert Preston, converted the salt-water reservoir at the east end of Culross into a stocked salt-water fish pond, with a dining cottage adjacent, in about 1810 (Martin 2002, 184–185).

So what archaeology is left? The most obvious remaining evidence of the salt-making legacy is the fishpond. This may be much older than first thought. It has been surmised, not unreasonably, that the pond was built between 1774 and 1790 when Dundonald operated his coal and salt enterprises which were not a commercial success (Martin 2002, 184–185). However, the Roy Map of 1747–1755 shows what appears to be a rectangular enclosure on exactly the same spot as the fish pond. This may be evidence of Dundonald enlarging a pre-existing bucket-pat, which would then have dated from the seventeenth century, and before 1676, when coal and salt production ceased.

Several of the revived salt works of the late eighteenth century in Scotland involved both steam pumps for transferring the water to the pan houses and much larger reservoirs (Whatley 1987, 25–26). Dundonald had five salt pans in operation (Martin 2002, 184), and these were associated with this enlarged reservoir which still exists today. It measures approximately 68 m (east-west), and 56.7 m (north-south) internally, and this fits with the measurements given in 1795 when used for industrial purposes (Martin 2002, 185).

The roadside wall of Pond Cottage garden has some discontinuities, and this may suggest that the north wall of one of the eighteenth century salt pan houses, associated has been incorporated into the present boundary wall.

At the west end of the burgh, there are three sites marked on the 1866 Ordnance Survey first edition map which might have represented bucket-pats associated with salt manufacture. Two of these are the sites which may be associated with the Egyptian Wheel, and the third is the very obvious extrusion into the sea to the west of the pier. Unfortunately, due to the railway line of 1906 and subsequent land reclamation, there is limited evidence left of their existence on the ground. However, there still remains the seaward wall of the bucket-pat at Blairburn, which may encompass the site of the moated Egyptian Wheel drainage shaft. As these are west of Culross, and close to the Moat Pit, they could have represented salt manufacturing sites from the period of Sir George Bruce.

The Archaeology of Metal Working in Culross

There is little known archaeology concerned with iron working in Culross. However, a guild of hammermen existed from the sixteenth century, sixteen master smiths were said to be working at the time of Bruce (Cunningham 1910, 64), and the salt pans generated much work (Beveridge 1885, 143–188). Culross produced 4219 girdles between January 1674 and May 1675 from the workshops of six master girdle smiths (Beveridge 1885 vol II, 164). It would seem that much remains to be found.
The abundance and quality of ironstone in the Parish of Culross was pointed out by the 9th Earl of Dundonald (Dundonald 1793, 5–6). That is not to say that the iron was necessarily wholly produced in rural bloomeries and brought into Culross. It may have been produced in Culross, but the evidence does not exist as yet to support or contradict the challenge to the expected norm of rural smelting which has been launched elsewhere (Photos-Jones and Atkinson 1998, 887). In the period of Sir George Bruce, as there is no evidence of furnaces in Culross, the assumption must be that iron was produced from ironstone using traditional bloomery methods, and using charcoal rather than coal as the energy source. More evidence is required however to validate this.

Excavation in Culross Palace (Lewis 1998, 226–227) revealed evidence of secondary iron working. Iron-working residues were found in the excavated east range and also the west and south sides of the Palace courtyard, where they were used to make hard-wearing surfaces. All the debris that was found related to the later stages of iron production, where iron bars or plates were being turned by the smiths into objects. Coal fragments were present in all samples, indicating the importance of the local power source for smith work. The very high proportion of hammerscale in many deposits, together with the absence of heavy bloom-working iron silicate slags, suggested that many deposits were derived from this final phase of the production of iron objects. One of the structures identified in the disappeared east range of the Palace was said to be a workshop for the production of girdles in seventeenth and up to the mid-eighteenth centuries. This was on the basis of metal-working debris found around a truncated hearth. Lewis identifies this site with the girdle-making workshop of the Blaw family, on the basis of sale documents of the workshop in 1722 (Lewis 1998, 227–229).

THE ARCHAEOLOGY OF CULROSS PIER

There has been one previous archaeological study of the pier. This was as part of an article on harbours in the east of Scotland by Angus Graham (1969).

Documentary evidence of Culross acting as a harbour appear in the Register of the Privy Council of Scotland, and also the records of the Royal Burgh of Culross (created in 1592) from the late sixteenth century. References to repairs occur in the Culross burgh records from the seventeenth and eighteenth centuries (Graham 1969, 230). The pier itself is situated so as to protect the anchorage from the west, whilst the Ailie Rocks shelter the anchorage from the south-east. An account of 1689 contrasts the security of the Culross harbour with the open anchorage of Valleyfield (Graham 1969, 230). The Ailie Rocks, but not the pier, which is too far to the west, are shown on the Slezer illustration of 1693 (Fig 13).

The pier as it stands now is in two parts. The outer part is often referred to as the ‘Old Pier’, while the landward part, over which the railway of 1906 runs, is called the ‘New Pier’ (Figs 14 and 15). It is about 190 m from the end of the Old Pier to the high-water mark, as it existed before the building of the railway embankment (Graham 1969, 230). From the end of the Old Pier, the stonework runs back to land for about 45 m with large, squared stone blocks, in precise courses and tailed into a rubble core (apparent from slippages). It stands over 2 m high, and varies in width from 5 m to 8 m. Graham speculates that this
was to allow carts to turn (Graham 1969, 231). The surface is paved with large stone setts, and holds the stumps of several wooden posts. The landward end of the Old Pier has been re-built, as it is made of vertical, unsquared, split stones, which is said to be attributable to the early nineteenth century, which run for about 25 m (Graham 1969, 231). The style of masonry is quite different from the older, horizontal masonry courses of the seaward end of the pier. There is also about 20 m of stonework on the landward end of the Old Pier, which runs north-west, and appears to be angled like a boat ramp. This is also constructed in the manner of the early nineteenth century.

The Old Pier was connected by an elevated wooden walkway, of about 50 m, to the head of the New Pier. This walkway was intact until at least 1938. There appears to have been footings of stone under this walkway which run back to land, with a distinct line of stone running from the Old Pier, although the stone appears to have been moved in order to act as bases for the posts. This may represent the Old Pier running directly back to land (Graham 1969, 232).

The New Pier is overlain by the railway line of 1906. About 20 m are visible on the seaward side of the railway. The club-like head of the pier has been badly eroded in recent years. The pier appears to have been built over two phases with both phases using horizontal courses of stone with large, dry-stone blocks but they are not bonded together. The top surface of the New Pier has been exposed on the landward side of the railway, running back to the former high-tide mark.

It is suggested that the pier at Culross has been subject to rebuilding at a number of different times. Firstly, a pier ran straight back to the land, just to
the west of Sandhaven, dating from at least the time of Sir George Bruce. This was damaged, and broken in two, possibly in the seventeenth century. This was repaired at some time before Roy’s Map was drawn up (1747–55), because the pier on the Roy Map appears to match the shape and length of the New Pier. In this connection, ‘New’ refers to the upper courses of the (truncated) New Pier, which were built on the surviving older base. The Old Pier was subject to repairs in the early nineteenth century, at its landward end, possibly not all at the same time, as indicated by a differing axis of approach to land on the most northerly end. The Old Pier was connected to the New Pier at sometime between 1841 (Graham 1969, 232) and 1859, by the wooden platform based on cartographic evidence. The pier fell out of use after World War II, and is now in a poor state of repair, with the platform long gone, and the seaward end of the New Pier having partially collapsed since Graham’s article of 1969.

THE RELATIONSHIP OF THE MOAT PIT TO CULROSS PIER

Transport economics dictate that an owner would always attempt to have a full load on both outward and return journeys. It has been noted that the bulk of Scotland’s overseas trade was handled by Scottish-owned ships, although ships from Low Countries, England, France and the Baltic were common visitors (Lythe 1960, 132). The main exports from Culross at the time that the Moat Pit was operating would have been coal, salt and metal products. In addition, it is likely that skins,
hides, leather goods, cloth, wool and fish were also exported from the burgh (Lythe 1960, 142–247). The destinations would have been other parts of Scotland, England, Scandinavia and the Baltic, the Low Countries and France (Lythe 1960, 116–141). The major imports were timber from Norway, iron from Sweden, grain
from Danzig and the southern Baltic, manufactured goods and wine from France
and the Low Countries (Lythe 1960, 142–247).

The Moat Pit was directly exporting coal from the mine onto ships which
could tie up alongside the Moat Pit shaft. If the mine was producing 80 to
100 tons of coal per week, then only the ‘Great Coal’ would be exported. The
smaller, broken or pan coal was moved to the salt pans around Culross. Export
figures for coal from Culross between 1590 and 1600 run at between 300 and 400
chalder of coal per annum (Bowman 1981, 122). A chalder was later standardised
at two tons. Exporting 800 tons out of a production of 4,000 tons per annum seems
not unreasonable. Scottish ships were small by contemporary standards and the
cargo carrying capacity varied between 20 and 80 tons (Lythe 1960, 131–133).
Consequently, no more than one ship left the Moat Pit each week with coal for
export, whilst much smaller, inshore craft would have moved the pan coal from
the Moat Pit to the nearby salt pans on a daily basis. It is likely that the sea-going
ships, which exported coal, first discharged their import cargo at the pier, carried
out repairs and refitted, before proceeding the few hundred yards to the Moat Pit
for loading with coal for export. Salt, metal products and any other exports would
have been loaded at the pier. If we assume that 10 tons of salt were produced every
week from Bruce’s salt pans then it is likely that a ship every couple of weeks
would export salt from the pier. This ship may also have carried other products,
such as girdles, hides or textiles, or they may have been shipped as general cargoes
in other ships.

Sir George Bruce, Culross and Access to Markets

Records remain which show that Sir George Bruce owned ships which took part
directly in the export of both coal and salt (Bowman 1981, 84).

Specifically, his ships Falcon and Jesus were plundered in Lowestoft Roads in
1583, where they may have been engaged in the salt trade. The Bruce was captured
by Cornish pirates in 1598 whilst carrying home a cargo of wine from Portugal
(Bowman 1981, 84). There is also evidence in the state papers of Bruce trading
with Scandinavia and the Baltic (Bowman 1981, 84).

The average number of round trips per annum going abroad appears to have
been around three per vessel per annum (Lythe 1960, 135). Taking the Dundee
skipper, Robert Halyburton, as an example, his destinations in the period 1616 to
1618 were Bordeaux, the Baltic, Bordeaux, Norway, La Rochelle, and Norway in
a two year period (Lythe 1960, 135). The busiest time for sea voyages was May to
November. The ship owners of the Forth banded together in order to put beacons
and marks on the crags and reefs of the Forth Estuary in the first quarter of the
seventeenth-century (Lythe 1960, 48). Bruce would have been one of those ship
owners because he was appointed to be a Commissioner for the setting out of
‘marks and lights’ in the Firth of Forth (Bowman 1981, 86).

Roads existed in a primitive condition, and it is known that George Bruce
sent three men to escort John Taylor on his way from Culross to Stirling (Taylor
1630, 133). It is likely that a network of carters and pedlars moved the imported
goods and also some coal and salt around the Forth valley and into Tayside and the
southern highlands.
The bulkier goods, such as coal and salt, were moved around the east of Scotland townships by coastal trading ship. A flourishing coastal trade developed in inshore waters, and the small Fife coastal towns were ideally placed to take advantage of this. An analysis of ships leaving Leith in 1627–8 shows their home ports to be nineteen from Leith, eighteen were foreign, seven were unspecified and thirty-six were from the Firth of Forth area other than Leith, which would most likely have included ships from Culross (Lythe 1960, 130).

The Development of the Built Landscape of Culross

Culross has been called ‘... a unique survival, a town which time has passed by; the most complete example in Scotland today of a burgh of the seventeenth and eighteenth centuries.’ (National Trust for Scotland 2008, 2). Comparisons of the street plan of Culross using the Roy Map of 1747–55, the nineteenth century map of the burgh and the present show that very little has changed in broad outline. This view is reinforced if the 1693 Slezer picture of Culross is studied, where individual buildings, which still remain, can be identified. That is not to say that the burgh is fossilised. There are many new buildings, especially on the fringes of the village, and some which are well camouflaged within the historic core.

The plan of Culross remains centred on the three streets running from the Cross to the Low Causeway, being the Little, Middle and Back Causeways (from east to west). At the west end of the Low Causeway is the Sandhaven, the harbour and the Palace.

The 1933 Inventory of the burgh (RCAHMS 1933, 81) gives no fewer than thirty-three houses and armorial panels in the burgh which were worthy of note, excluding Culross Abbey itself. Almost all of these had seventeenth-century dates attributed to them. The oldest house in Culross is said to be one facing the Mercat Cross, which has a stone dated 1577 in its gable (National Trust for Scotland 2008, 19). Given the existence of the Abbey, and the granting of a Burgh of Barony in 1490 which permitted a weekly fair, some of the houses may have earlier origins. However, Culross would seem to owe its present appearance to the expansion of the burgh in the time of Sir George Bruce. It obtained Royal Burgh status in 1592. It is known that when Bruce died in 1625 that he had 175 'pickmen' working for him, in three collieries, and owned forty four salt pans (Dundonald 1793, 16). Not all of these men would have lived in Culross itself, but an estimate of one hundred and fifty colliers and one hundred salters seems not unreasonable. If girdle-makers, smiths, tradesmen, tanners and sailors are added, with their wives and families, then a population in 1625, in excess of the 1069 reported by the Old Statistical Account in 1791 becomes likely. The street plan was literally set in stone by the building of the causeways on pre-existing roadways, when a 'crowned' construction was ordered by the burgh council in 1661 using cobbles of stone.

Consequently there is circumstantial evidence that many of the existing houses of Culross, albeit in a more humble form, housed the workers of Bruce’s industrial enterprises, or provided habitations for the many trades’ people who would have been attracted by the prosperity of Culross, especially after its elevation to Royal Burgh in 1592.
Culross Palace and Culross Abbey House: Differing Views of Society?

It is not the intention to explore in any detail the complex archaeology of either the Palace or the Abbey House, but rather to note the very different situation, aspect and architecture of two buildings which were built by brothers.

Culross Palace, the extensively restored early seventeenth-century merchant’s house, was built for Sir George Bruce between 1597 and 1611 (RCAHMS 1933, 78). It was the most impressive burgess tenement in Culross when built, and had a stable, courtyard and gardens as well as two domestic ranges to the west and north of the courtyard (Fig 16). It was just a few yards north of the pier. To the west lay the landward entrance to the Moat Pit, whilst the coast was dotted with salt pans and bucket-pats. Immediately to the east of the courtyard entrance was the smithy of the Blaw family, and just five yards to the west of the west range was a working malthouse of Bessie Bar. It was an integral part of the busy street landscape of Culross with domestic and commercial buildings crowding in on it. This would seem to be very much the house and offices of a working merchant. The architectural style is similar to that of the rest of the burgh, with harled walls, pantiled roofs and crow-stepped gables. The house is certainly larger and more prosperous than any other, but it does not set itself apart. It speaks of a mindset where close proximity and association with Bruce’s employees, fellow burgesses and commercial activities was not only accepted but welcomed.

Three years before George Bruce built the north range of the palace in vernacular style, his elder brother Edward Bruce, Lord Kinloss, built Culross Abbey House (Fig 17), which dates from 1608 (RCAHMS 1933, 80). This stands immediately east of the Abbey Church, on the grounds of the former monastery, to the north of the burgh. This is a very different house. Edward Bruce was a lawyer and diplomat who had accompanied the King to England in 1603, there becoming a senior judge, the Master of the Rolls. Although much altered, with major reconstructions in 1670, 1830 and 1955, it is possible to see in the design...
the influence of Palladio and Inigo Jones. This house is built in ample grounds with notable gardens (Beveridge 1885, 287–295). The house and grounds are pictured by Slezer in 1693 (Fig 18), after a third floor was added in 1670, now removed, and it is striking how large, impressive and isolated the house appears relative to the burgh of Culross. It must have appeared both modern and alien to the people of the town.

Thus these two contemporary houses illustrate changing views on society. It would seem that George Bruce, merchant and industrialist, was content to live close by his commercial ventures and employees, in a manner which was similar to other Scottish merchants of the sixteenth century and before. Edward Bruce, unencumbered by commercial relationships and influenced by new thinking encountered in London, wished his house to point up differences in rank, wealth and status.

CONCLUSION – NEW PERSPECTIVES ON THE MOAT PIT

This archaeological study sets the importance of the Moat Pit into context by emphasising its pivotal role in the development of one of Britain’s first industrial villages. The Moat Pit is of national importance in its own right, but it is also central to the story of Culross.
The archaeology of this important coal mine still remains. It awaits protection, recognition, and interpretation. It is to be hoped that these will be addressed in the not too distant future.

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