



**The Roman and Mercian lead industry in Britain
with reference to Wirksworth
and the Peak District**

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Anton Shone
Wirksworth Archaeological Society
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www.wirksworthromanproject.co.uk

Introduction

Lead production in Britain in Roman times is, in theory, quite well understood, mainly because of the interest which the finding of inscribed lead ingots (lead pigs) has generated over the years. There were several Roman lead producing areas and many of the ingots, though not all, had inscriptions. Dearne (1990) gives the most accurate and comprehensive list of these. Since 1990 a few more ingots have been found and are identified by the Portable Antiquities Scheme. None of the finds after 1990 have Roman inscriptions relating to the Peak District but two lead pigs of Roman shape were found at Ilam near Ashbourne in 2005 (PAS Database WMID30B156) which brings the total of inscribed and uninscribed lead pigs attributable to the Peak District to 31.

Lead producing areas and civitates

In terms of the lead producing districts of Roman Britain, the inscriptions on the ingots often tell us where they are from.

The Peak District ingots carry the "LVT" inscription which is well understood to be Lutudarum and 31 Roman ingots are associated with the area. Many refer to "SOC LVT", that is the company or society of Lutudarum.



Lead ingot found at Brough on Humber in 1940 now in the Hull Museum, inscribed as:

SOC LVT BRIT EX ARG

"Company (of) Lutudarum British (lead) from the lead-silver works"

There were several other locations where we know lead was produced: "VEB" on ingots appears to refer to Venta Belgarum, that is Winchester, the civitate which covered the Mendip lead field in Somerset, south west of Bath - 26 or more ingots have been found.

"BRIG" for Isurium Brigantum, that is Aldborough, for the Yorkshire Dales and Alston Moor lead mines - 4 ingots are known (see also the note regarding the shipwreck at Ploumanac'h, below)

"DEC" for Deceangli, whose civitas capital appears to have been Canovium Deceangli, which is currently regarded as Caerhun on the west bank of the River Conwy, for the Flintshire ingots - 7 ingots are known.

There are also three ingots known for Shropshire which do not bear a civitate or location inscription, but were they to be inscribed, we might possibly expect them to say "VIR" for Virconium, that is Wroxeter.

Lead was also extracted in Roman times from South Wales at Cefn-pwll-du at Machen, north of Cardiff but no (civitate) inscribed ingots are known for this production area either, but the civitas capital was Venta Silurum (Caerwent) so "VES" might be an inscription for this area were an ingot found showing it.

This system of naming also appears to operate in other Roman provinces, for example, the lead ingots produced in southern Spain were inscribed "SOC VESC" that is Vescorum in the Roman district of Baetica, around modern Malaga.

Naturally these location inscriptions don't occur on all ingots, some are clearly family businesses (such as the earlier Spanish or Sardinian ones) and it is probably the case that very many uninscribed ingots have not found their way into the archaeological record because they would have been less interesting and you could just melt them down and use the lead.

Dating of lead ingots

There is considered to be a sequence of dating of ingots based on their inscriptions which also perhaps sheds some light on how the industry operated in Roman times. The earliest imperial age ingots from Roman Britain are from the Mendips (Dearne, 1990) and their inscriptions imply that the Second Legion on behalf of the Emperor Nero was initially involved in the beginnings of the industry from about AD 49 to AD 60. After this, the industry appears to be handed over from the military and then leased to individuals or companies. It is thought that in the mid AD 60s that some of the individuals from the Mendips had moved north, perhaps both to the Peak District and to Flintshire as the frontier of Roman Britain moved north, this is based on the inscriptions and certainly seems to have occurred by AD 74. At this point greater imperial control appears to be exercised, perhaps from AD 71 onwards (and finally in place by AD 79) because the ingot inscriptions become imperial not private, this coincides with the reign of Emperor Vespasian (from

AD 69-79) who is known for his financial reforms of the empire and for his building programme, these activities together would indeed have implications for the lead industry. The Mendip ingots carry on being imperially inscribed up to about AD 169, when the inscription sequence stops, or more specifically, where no later dated imperial ingots have yet been found in Britain.



Replica of Roman ingot found at Cromford Nether Moor in 1777 in the Wirksworth Heritage Centre:

IMP CAES HADRIANI AUG MET LVT

“Imperial Caesar Hadrian Augustus (from the) Metalworks (at) Lutudarum”

The Peak District ingots, such as those from Yeaveley, also reflect the leasing arrangements through their use of the SOC LVT (Sociorum Lutudarensium) company inscription, and although no Vespasian named ingots have been found for the Peak District, there are ones with Hadrian’s name and the inscriptions change to add “MET LVT”, that is from the metalworks at Lutudarum, rather than “SOC LVT”. The first datable Peak District inscribed ingot is from AD 71, the latest, AD 138, after which there are only uninscribed ingots found. Production carries on because some lead ingots from the Peak District have been identified in archaeologically datable contexts. For example, the two ingots found at Scow Brook at Carsington, a little over two miles from Wirksworth, were in a pit with pottery dated to the late fourth century: AD 375-400 (Branning, 1986). What is not clear, then, is that while closer imperial control may have begun with Vespasian, and was certainly established by Hadrian’s time, we cannot identify whether it ended or continued, simply because the ingots are no longer inscribed: they may still be under imperial control but the ingots simply don’t say so. A number of ingots from the Brigantian lead field were found in a shipwreck at Ploumanac’h (Malban, Côtes-d’Armor) and these appear to date from the fourth century and the lack of standardisation suggests that imperial control was not being exercised over the lead industry of that province by that time.

One of the frequent difficulties expressed by historians of the Peak District Roman lead industry is the inability to find evidence of lead mining activity by way of tools and actual site remains, but this approach, which might be called supply side evidence, overlooks the presence of demand side evidence – we have ingots, boiling pans, tanks and all manner of lead artefacts from the Roman to

the early Saxon period. Although there is a view that there is a complete break in the continuity of lead mining and production after the Romans leave and possibly until the eighth century, this view should be questioned much harder than it has been.

It is clear from the totality of lead ingot finds that the two principal lead producing areas of Roman Britain were the Peak District and the Mendips (Dearne, 1990), the number of discovered ingots from each is not far apart. Although we have to bear in mind that the extent of finds can give us no clue about the numbers of people engaged in lead mining in Roman times, nor even truly represent the magnitude of output, we do know that the lead mining town of Charterhouse in the Mendips, whose Roman name is not known, consisted of a 30 acre town, a 3 acre fort and an amphitheatre: the amount of lead being produced, for the range of uses already known to us, either in the Mendips or in the Peak District, cannot be being mined and smelted by small numbers of people in isolated pockets.

The uses of Roman lead: Lead in the Roman Empire

It is quite odd when we ask "what is the lead being used for?", that we seem to get an extraordinarily badly answered response: one of the challenges in writing this research paper about the uses of Roman lead was that authors and academics talking about lead often hardly go much beyond "it was used for plumbing". To which one might respond "really?" or even "what exactly do you mean by plumbing?" It's only when we start looking at the water supply system of a town such as Pompeii do we get a real idea of what this use of lead means, and the emphasis is certainly on the complexity of the system: its not a bit of pipe knocking around your bathroom.

In many respects lead was the plastic of the Roman age. It had a multitude of uses because it is workable, durable, malleable and comparatively easy to repair. Its main disadvantage is its weight and in certain uses it is poisonous. It is common as an ore (Galena) in the Peak District and not only are the stages of its mining, smelting and use fairly well understood (partly because they carried on through several ages) the range of Roman artefacts made of lead or with lead alloys which have been found by archaeologists and others continue to surprise us. The list here is not intended to be comprehensive, but it does serve as an introduction.

Plumbing and the water supply

Lead was used for things like lead pipes for plumbing and a whole range of water supply related activities. Water supply was important to the Romans and not only have lead pipes been found in towns, villas and settlements all over the empire but also tanks, cisterns and pumps are known as part of the water supply. At Silchester a water (force) pump was found with lead cylinders, used for

pumping water up from a well. In Pompeii the entire town had a public and private water supply system based around lead, wooden and ceramic piping, as well as lead tanks, cisterns, manifolds and junctions to direct and adjust the flow of water. Public fountain locations and pipe junctions had taps and valves, the latter often of bronze, used to control and direct the water supply (Lorenz, 2013) and although this was at a lower pressure than modern systems, it fed not only fountains, but also irrigation systems and public and private baths.

The modern reader may well say "but lead is poisonous", yes, this is so, but if your choice is between having a lead pipe water supply or no water supply then you will have one. In any case water supply based lead poisoning is so slow as to be almost indiscernible, but Romans such as Vitruvius did know of it and ceramic pipes were preferred, but knowledge is poorly spread in ancient days and not everyone would have known. Even in modern times there are still places with lead piping (particularly in America) and older people in Britain will remember being told as children, to "let the water run for a bit" before you filled a kettle or pan, to reduce the risk if you had lead pipes: most old houses in Britain once had lead water pipes. In Roman cities, the water supply would be free-running and mineralisation of pipes (the build up of inside coatings) might also act to reduce the contamination. Quite a lot of internet nonsense was written about lead poisoning bringing down the Roman empire. Water is not the only thing they're drinking, wine and beer are also being drunk and no one has yet managed to claim that the Roman empire was brought down by drinking too much lager or, indeed, eating too much cake. The Roman empire fell because of political incompetence, military weakness and a range of other contributory factors.

Buildings and structures

In addition to the water supply, large quantities of lead was used for buildings in roofs, gutters, down pipes and other drainage and structural features. Lead has been found securing iron tie bars in Roman bridges and in the setting and securing of iron fence posts in coping stones, such as in the fence for the arena wall at the amphitheatre in London (Wilmot, 2008). The demand for lead for buildings (and witness later church building by the Mercians and others) is therefore huge and a source of wealth and income not only to those producing it, but was also an important imperial revenue in Roman times.

Lead acetate in drinks and food

Lead acetate, "sugar of lead" was used to sweeten things such as wine by the richer classes, resulting in an illness known as Saturnine Gout. Originally it was made by boiling down fermented grape juice in lead pans to create a sweet syrup but later the Romans discovered how to make it

in crystalline form, this kind of sweetener was also used in food and occurs in a number of Roman recipes.

In case we believe we are smarter than the Romans in dealing with things which are thought to be poisonous in food and drink, recent academic work is showing the dangers of plastics and microplastics in terms of pollution, poisoning and toxicity in our food chain.

Writing

Thin lead sheet was produced to write on (by scratching with a harder metal or sharpened stone) and is a common find in terms of votive or curse tablets. Equally, lead styluses were used to write onto wax tablets.

Military uses

Lead has a number of military uses, it was used as an alloy in javelin shafts, enabling the javelin to bend on impact so they couldn't be thrown back. The army also used lead for catapult shot and for slingshot (glandes). Consequently the military often had an interest in the supervision of lead production and for its uses in weaponry and the construction of forts, military buildings and military engineering.

As a colour, glaze or powder

Powdered lead was used in (wall) paint making as a base or colour additive with linseed oil and there is known to have been a Roman paint making factory at Kniveton near Wirksworth. White lead oxide was used as well in ceramics to create a (green) glaze for certain types of pottery, and lead was also used in glass making and enamels.

Small tools, small everyday items, weights and wire

Small tools and small artefacts were made e.g. spindle whorls, brooches, pendants, phalluses, personal seals, lead seals for boxes, small pots, lamps, lead tokens, plumb bobs, figurines and statuettes.

Steelyard weights and many other kinds of weights were produced (a steelyard is a balancing weigh scale) such as weights for fishing nets (net sinkers) and lines. In the case of Wirksworth we also know of lead loom weights, which go quite nicely with the spindle whorls for ways of making yarns and clothing. Lead wire was made for the repairing, by riveting or with studs, of objects such

as ceramic pots or leather work. Lead has also been found in some types of quern stones as a bearing for the central spindle. A discussion of lead tokens has been presented by Denise Wilding of the University of Warwick (2017).

Lead sheeting for baths, coffins, sheathing and water tanks

Lead sheet was used not only for bath linings but also for making of coffins, some of which were very decorative (Salway, 1997). Lead coffins are commonly found in Roman contexts, particularly for the wealthy, some 200 coffins of this kind are known from Britain (Wheelan, 2019) and the practice of burying wealthy or important people in lead or lead lined coffins continued into the Saxon Age with lead coffins recorded as being used for both St Cuthbert and St Guthlac (Colgrave, 1956).

Lead sheeting was also used for the sheathing of the hulls of boats (Kahanov, 2011) as well as for anchor stocks.

Roman water tanks: Twenty-eight Roman "Baptismal" lead tanks have been found in Britain (excluding the cistern base recently discovered at Rudston) and a further nine in Anglo-Saxon contexts (Crerar, 2012) although we will look at little more closely at this matter in a moment. In addition, both in the Roman and Anglo-Saxon periods, lead was used to make salt and brine boiling pans (Neville and Fielding, 2005) (Walker, 2000).



Recreation of a Roman salt works in Cheshire showing lead pans
(By Neville and Fielding, 2005)

As an alloy

Lead was mixed with copper as an alloy (bronze) for artefacts such as statues, small and large ornamental objects of all kinds and tools and equipment. Copper was mined in Roman times on Anglesey with smaller mines at the Great Orme, Llandudno and at Alderley Edge near Macclesfield, the latter is only 37 miles via Buxton to Wirksworth.

Lead was also used for the production of pewter, which is an alloy of tin and lead, used in jugs, plates, trays and so on, although this would probably have tended to be made in the Mendips as pewter requires tin and the Mendips are nearest to the Cornish tin producing area. Tin was also used a solder in the making or repairing of lead objects. Lead was also important in certain metallurgical process such as the recovery of silver from copper coinage. Lead was also used as a solder and has been found in the construction of Roman musical instruments such as the Cornu and the Tuba (horns).

Summary of uses

The range of uses is quite astonishing, from ornamental and decorative to deadly, from spinning to shipbuilding. It is sometimes the case that writers on the subjects of Roman metal working or mining will get very excited about copper or silver and downplay lead as being a bit uninspiring, but this is to fail to take in the full extent of the uses of lead and its importance in many respects from the production of domestic and industrial articles to its value to the imperial treasury as a source of income and taxation.

People recorded in the Roman Peak District lead industry

Of the lead ingots which are inscribed and are associated with the Peak District Roman lead field a number make reference to people associated in some way with the industry (Dearne, 1990).

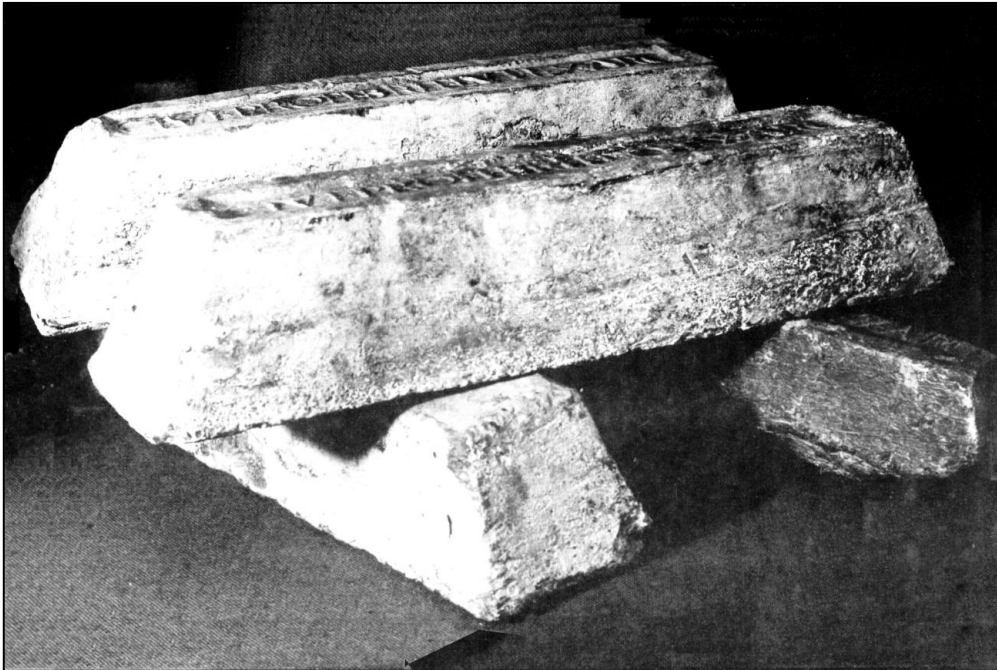
Gaius Julius Protus Role: Brenner

Gaius was a Brenner, that is a lead smelter. This was a key role in the industry and brenners and lead merchants made considerable profits from their activities. There are no known names of lead miners for the Peak District. The ingot inscription reads:

G(aii) | IvI(i) | Proti | Brit(annicvm) | Lvt(vdarvm) | (plvmbvm) Ex Arg(entariis)

(By) Gaius Julius Protus from British Lutudarum (lead) from the lead-silver works

Date unknown. One ingot found at Hexgrave Park nr Farnsfield, Notts and another at South Cave, Brough on Humber and three more at Brough on Humber itself.



Four lead ingots held at Hull Museum, the top two read:

G IVI PROTI BRIT LVT EX ARG

G(aii) | IVI(i) | PROTI | BRIT(annicvm) | LVT(vdarvm) | (plvmbvm) EX ARG(entariis)

Tiberius Claudius Triferna Role: Brenner

The ingot inscription reads: Ti(berii) | Cl(audii) | Tri (ferna) | Lvt(vdarvm) | Br(itannicvm) | (plvmbvm) Ex Arg(entariis)

(By) Tiberius Claudius Triferna from Lutudarum, British (lead) from the lead-silver works

Date between AD 69 and AD 79. One found at Matlock Moor and four more at Broomers Hill, Pulborough, Sussex. Tiberius Claudius Triferna is also known from lead ingots from the Mendips.

Lucius Araconius Verecundus Role: Brenner

The ingot inscription reads: L(ucii) | Arconi(i) | Vericundi | Metal(li) | Lvtvd(arenses)

(By) Lucius Araconius Verecundus from the metal works of the province of Lutudarum

Date unknown. Found at Matlock Bank near a smelting hearth.

P. Rubrius Abscantus Role: Brenner

The ingot inscription reads: P | Rubri | Abscanti | Metalli | Lvtvdare(n)s(es)

(By) P Rubrius Abscantus, from the metal works of the province of Lutudarum

Date unknown. Found at Tansley Moor.

Imperial Caesar Hadrian Augustus Role: Emperor

The ingot inscription reads: Imp(eratoris) | Caes(aris) | Hadriani | Aug(usti) | Met(alli) | Lvt(vdarvm)

Imperial Caesar Hadrian Augustus from the metal works at Lutudarum

Date AD 117-138. Found at Cromford Nether Moor near Wirksworth.

Dearne (1990) gives the most comprehensive list of lead ingots found and their inscriptions to the date of his thesis and a few more recent finds are generally found in the Portable Antiquities Scheme database.

An example: Roman lead tanks: Baptismal Fonts or Builder's Buckets?

The purpose of the lead tanks found in various locations, mainly in southern and eastern England, is not yet clearly settled. Some early work considering them discussed that they might be associated with Baptism, for which a number of suggested reasons were given including that some tanks had the chi-rho symbol (an X with a P through it) on them, regarded in the 1960s as an indicator that they had a religious significance and dating them to after AD 312, when the Emperor Constantine first used that Christian symbol on the shields of his legionaries at the Battle of the Milvian Bridge. This argument has taken hold of the discussion of the tanks in the years since and new finds have typically been referred to as "Baptismal Tanks" or "Lead Fonts".



One of the Roman lead tanks found in Icklingham, Suffolk

That reasoning is not as secure as it may seem and was considered by Belinda Crerar in a review in 2012 to need more careful consideration. There were a number of reasons for the need for re-assessment, amongst them the lack of certainty that being dipped in a tank was actually how people were baptised nearly 1,700 years ago: some tanks were too small for this; also that the tanks were not typically found in places or contexts that had any clear religious significance and finally that the chi-rho symbol was not solely an indicator of Christian beliefs at the time: it was also a symbol of imperial authority. That is to say it occurs a bit like a royal crown on things today, in a few cases the appearance of the crown is genuinely a statement of royal involvement, as sometimes used in weights and measures, but in a lot of cases a crown just appears on things as an affiliation or a souvenir, you might have a mug in your kitchen cupboard with a crown on it. The chi-rho symbol in the fourth century may be the same, it not only occurs on some of the lead tanks

but it also occurs in mosaic floors and sometimes in locations which cannot have a religious significance, therefore its use may be one of imperial affiliation or just possibly of imperial authority or involvement. This latter then, might, tenuously, link the production of large lead items with the continued exercise of imperial authority (or the remembrance of it) in the lead industry, hence the note above when we said the end of imperial involvement in the lead industry could not be determined in relation to the imperial inscriptions on lead ingots.

Therefore, if Crerar is correct and the tanks are not necessarily or directly all religious in nature, what are they? Well, most simply they are water tanks, and archaeologists, lovely as we are, sometimes look for greater meanings in workaday objects than might really apply. For example, some of the tanks were quite damaged in antiquity, leading to their finders suggesting they had been damaged in a ritual of some kind. Secondly, we should ask if the dating of these tanks is as secure as it seems? Clearly, those with Chi-rho symbols must be after AD 312 and the use of the symbol by Constantine: but what of the tanks without this symbol? Here we seem to have an overlooked problem - the lack of security of the archaeological contexts of some of the tanks has given way to an assumption that all tanks must be after AD312, but what if some are before and this has not been properly identified?

In any case the issue of the religious use of tanks doesn't seem to hold up in the Anglo Saxon ones, not only do these not have the Chi-rho symbol, even though the church continues through the Roman and Anglo Saxon periods, but the Anglo Saxon ones appear in quite workaday contexts and three of them contained tools or tool sets for woodworking and construction tasks. It is correct that some tanks are finely decorated, even glorious, but some are just, well, plain old tanks. Then what we may have in some cases is actually tanks from building sites, or simply, they are water tanks and some of them are in quite a state because, well, have you ever seen a builder's bucket?

Continuance of lead mining in the Peak District after the Romans: Dark Age and Anglo-Saxon lead.

Lead contamination in Lindow Peat Bog, Manchester has been analysed to determine when lead production began in England and whether it continued after the end of Roman Britain. The results are most interesting, but have caveats.

First, lead production, as indicated by atmospheric pollution, appears to begin well before the Roman arrival, from 900 BC onwards and by 38 AD is very significant, implying that trade in lead is taking place between the tribes of pre-Roman Britain and Rome prior to Roman Britain and that this might account for why the “start up” of the Roman lead industry here (as evidenced by ingot finds) appears to be surprisingly rapid. Also at this early stage, the atmospheric pollution was somewhat influenced by existing Roman-Spanish production.

Secondly, lead production continues at quite a high level (based on this data) for over a century and then begins to fall. Again this might be reflected in the ingot finds whose last dated imperial inscriptions are AD 169, in addition there will be a certain level of recycling and re-use of lead already made.

Sample code	Estimate Year	Lead concentration in micrograms per gram
LDW 23	1137	15,20
LDW 32	796	4,80
LDW 37	607	0,69
LDW 40	493	1,10
LDW 44	341	0,84
LDW 47	228	2,50
LDW 49	152	4,10
LDW 52	38 AD	4,80
LDW 59	227 BC	0,61
LDW 100	900 BC	0,16
Samples prior to 900 BC		Nil

Where a sample number is not matched exactly to a year in the data tables from the article, the nearest is taken.

The study notes that the isotope data indicates that it is English ores which are the main sources (Le Roux, 2004).

The production of lead appears to increase after the Roman army’s withdrawal from Britain and this uptick in the sample for 493 is curious if accurate. We perhaps should touch on the possible

reasons for there being a pick up in lead production at this date (bearing in mind some variability about the dating range, the listed dates are effectively the mid-point dates in the estimate).

If we were to look for reasons why lead production might increase around this date, the answer still comes from Rome, in the shape of Theoderic the Great. The western Roman Empire fell at the Battle of Ravenna in 476, 66 years after most Roman troops had been withdrawn from Britain. However, the eastern empire at Constantinople didn't fall and it made various attempts to restore the west. In 488 Emperor Zeno sent the Gothic leader Theoderic to recapture Italy, which he did by 493. Theoderic was a Goth (a barbarian, if you like) but he respected the agreement he had made with Zeno and acted in most respects as if he was the western Roman emperor, the fine line being that he apparently never called himself Emperor. He had been educated in Constantinople and his actions kept alive the traditions of the western Roman Empire, even though it would never be restored. Most significantly for the question of lead production, Theoderic began a huge programme of civic restoration and reconstruction, not only in Ravenna and Rome but almost comprehensively throughout the cities and provinces he ruled (Johnson, 1988). Theoderic reigned from 493 to 526, it is therefore in this time frame that we might reasonably look for the need for lead in Theoderic's imperial aspirations and in his programme of "Roman" renewal. Bearing in mind that the political situation in the Peak District in Britain did not change from 410 until the Battle of Chester in 616, there is no reason to suppose that the late Romano-British could not supply lead to Italy during Theoderic's reign, if these assumptions are correct.

After this, by 607, production drops to almost the Iron Age levels of 200 BC as given by the similar levels of contamination: recent work by Wright (2017) suggests this is not only because of a decline in demand, but also because Roman lead was being recycled during the period up to the middle of the 650s, after which "old lead" runs out or is difficult to find and this stimulates demand for fresh lead and results in the big increase in lead production as evidenced by the data for 796 which coincides with developments in church and abbey construction.

Conclusions

The Roman lead industry in the Peak District is evidenced from the earliest ingot as being from AD 71 and there are some indications of lead production in the Peak District before this date. By the Hadrianic age it had come under imperial control as evidenced by the change in the inscriptions on the lead ingots (sometimes called lead pigs or sows), but at some point this direct control ceased and ingots were no longer inscribed after the middle of the second century. However there are finds of fourth century Roman ingots from near Wirksworth at Carsington and given the pollution evidence there is no reason to believe that the lead industry stopped at any point in the historic past. In his Master's thesis, Wright (2017) reviews the evidence for Anglo-Saxon lead mining in

other locations in Britain based again on pollution evidence (for example, in speleotherms from the Mendips) and concludes that there is no evidence for Anglo-Saxon mining in any other orefield except the Peak District.

Interestingly, it should be noted that in the Wirksworth Charter of 835, where Abbess Cynewaru of Wirksworth granted land around the town to Duke Humbert of Tamworth, the amount of the annual lead render to Canterbury Cathedral specified is "300 Shillings". In case we may think this is a couple of ingots, the equivalent value (with inevitable caveats about estimating equivalent values over long periods of time) would perhaps be some £30,000 or 160 tons of lead today, taking a median estimate. Indeed Duke Humbert is hardly likely to be doing this out of the kindness of his heart: he won't be sending the total Wirksworth production to Canterbury, he would be keeping a great deal for himself. If this in any way represents an idea of the Peak District lead output during the Mercian age, it was very large and no doubt very profitable for both Duke Humbert and for Mercia as a kingdom.

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