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PAPERS, ETC.

On the Mining Operations of the Romans in Britain.

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Among the various ways adopted by the Romans for augmenting the commerce of their settlements, there are two, of which the traces still remain: the improvement in communication by the laying out of good roads, and the development of the mineral wealth of a country by mining; and since authenticated remains of the latter are very rare in this country, it becomes important to examine with care whatever is attributed to the agency of that great people, and to compare it with their known works in other parts of the world.—Warrington W. Smyth, M.A., in *Memoirs of the Geological Survey of Great Britain*, vol. I. p. 480.

THE design of the following essay is to give an account of the mining operations of the Romans in Britain. For the elucidation of this subject it appears necessary first to consider what were their practices and their methods of working in other parts of the empire, and more particularly in Spain, their principal mining district. In 1808 the philosophical faculty of the University of

Göttingen, aided by the munificence of the King of Westphalia, offered a prize for the best essay on this very topic. The result was that the prize was divided between two students of that faculty, Bethe and Roloff, whose dissertations—"De Antiquæ Hispaniæ Re Metallicâ"—were published, and now afford the most valuable information. At this moment Dr. Thurnam, of Devizes, has in the press a portion of his great work on British Ethnology, in which this matter is treated with learning and diligence not to be surpassed. He has generously communicated to me what he has written. I therefore proceed to offer a few remarks on Roman mining in general, and shall then endeavour to trace it through this country.

All mines were the property of the state. Like the salines, or salt-works, these were either kept by the government in its own hands, or were let to individuals for a rent or royalty. Many thousand persons were employed in them, being principally slaves or condemned malefactors.*

Criminals were condemned to the mines, either for life, or for a term of years, according to the nature of the crime. Females, as well as males, were liable to this punishment; but, probably, they were required to do the lighter work, such as breaking the ore after it had been brought to the surface of the ground.†

The retention of mines by Government may account for the inscription found on pigs of lead, such as

IMP. HADRIANI AUG.

in the genitive case, showing that they belonged to the

* Bulenger, *De Vectigalibus Pop. Romani*, cap. 22; in Grævii Thes., vol. VIII., p. 871. Smith's *Dict. of Gr. and Roman Antiquities*, VECTIGALIA, § 5.

† Titus Pompa, *De Operis Servorum*, in Polenus, Supplem. in Thes. vol. III., p. 1369.

Emperor. In other instances the name of an individual, occurring in the genitive, shows that he rented his mine from the government, *e.g.*

L. ARVCONI. VERECVNDI.

This implies that the lead was the property of Lucius Aruconius Verecundus.

The operations of the miner appear to have been in general similar to those which are still in use. The ore was first obtained near the surface, and the workings were abandoned as soon as their depth, taken in conjunction with the increasing influx of water, rendered them unprofitable. Various kinds of machinery were employed to drain them, among which Diodorus (v. 37, 38) and Strabo (L. III. p. 147) mention Egyptian screws (*ταῖς αἰγυπτίαις κοχλέαις*), meaning the instrument known as the Screw of Archimedes (see Casaubon ad loc.). The 33rd Book of Pliny's Natural History, which treats of metals, shows clearly that the ancient Romans made the same efforts to penetrate the bowels of the earth which we now employ, although they were obliged to desist at a far greater distance from its centre, because the steam-engine was unknown. The use of gunpowder and that of the mariner's compass in mines are also modern improvements.

With these exceptions it appears to me that we may take in hand the work of George Agricola, *De Re Metallicâ*, first published in 1546, and regard its descriptions, with its expressive wood-cuts as sufficiently accurate representations of the mining processes of ancient times.

That Britain was amongst the most important of all the Provinces of the Roman Empire in regard to mineral products, appears both from the testimonies of ancient authors, and from remains found on the spot.

Pliny calls lead "Nigrum plumbum," *i.e.* "Black lead," to distinguish it from tin, which he calls "Candidum," *i.e.* "white." He says, "We use black lead for pipes and sheets. It is extracted from the ground with considerable labour in Spain, and throughout Gaul, but in Britain it occurs near the surface so abundantly, that a law has been spontaneously enacted to prevent its production beyond a certain quantity." *Hist. Nat.* XXXIV. 17, s. 49.

In the *Life of Agricola* by Tacitus (c. 32) a speech is attributed to the British leader Galgacus, in which servitude in the mines is especially mentioned as the consequence of defeat: "Ibi tributa, et *metalla*, et cæteræ servientium pœnæ." This servitude, as we learn from Diodorus (l. c.), was dreadfully severe.

Britain had supplied tin as an article of traffic long before the Roman invasion. It must have come from Cornwall, since it is found in no other county. Although it does not appear that the Roman roads ever extended into Cornwall, nor that they had cities or large encampments there, yet many coins of the Emperors Antoninus, Domitian, Valentinian, and others, have been found, and it is mentioned more particularly that Roman coins have been discovered in the stream-works of Bodmin parish, among which was one of Vespasian.* The chief use of the tin brought from Cornwall probably was to serve as a flux for copper. The copper by itself would have been nearly infusible; the tin by itself would have been weak, soft, and comparatively useless; but when a small quantity of tin was added to the copper, this refractory metal was subdued, and the bronze or bell-metal, which resulted from

* Borlase, *Observations on the Antiquities of Cornwall*, 1754, p. 278. Carew, *Survey*, p. 8. Charles Sandhoe Gilbert, *History of Cornwall*, 1820, vol. I., p. 253.

the mixture, was hard enough to be converted into weapons and tools of all kinds, and in short to make the implements for which iron was afterwards used. The ore first obtained would, almost of necessity, be that which is called "stream-tin;" and the following account of it by Pliny is remarkably accurate: "It is a sand of a black colour found on the surface of the earth, and is only to be detected by its weight. Small pebbles occur along with it, especially in the dry courses of torrents. The miners wash these sands and smelt what subsides in furnaces."*

There is sufficient reason to believe that the Emperors had Roman soldiers stationed at the mines of Cornwall, to superintend the working and to transport the tin to the seat of the Empire.

It has been disputed whether the trade in British tin was conducted by St. Michael's Mount, or by the Isle of Wight. Strabo and Diodorus are the authorities cited to determine the question; but as they only quote an earlier author, Posidonius, who knew nothing of Britain as a Roman Province, it appears to me that we cannot absolutely depend on their testimony. It, however, seems highly probable that both tin and other metals, having been formed into pigs or ingots,† were conveyed by land

* Summa tellure arenosa et caloris nigri; pondere tantum ea deprehenditur. Interveniunt et minuti calculi, maximè torrentibus siccatis. Lavant eas arenas metallici, et quod subsidit coquunt in fornacibus.—*Hist. Nat.* XXXIV., 16. s. 47.

† The section of a Roman pig, found with many others at Carthagena, in Spain, has the form of the *astragal* at the base of Ionic columns. Probably, therefore, Diodorus (v. 22) means this form by ἀστράγαλος. The pig here referred to may be seen in the Museum of Economic Geology, Jermyn St., London. Another from the same group was presented to the British Museum by Vicount Palmerston. Each of them has the following inscription:

M. P. ROSCIEIS. M. F. MAIG.

to some Roman settlement on the southern coast of Britain, and, having been transported to Gaul, were conveyed overland to Marseilles, Narbonne, or some other considerable port on the Mediterranean.* I incline strongly to the opinion of the Rev. Edmund Kell, of Southampton, that the Ictis of Diodorus (v. 22) is the Isle of Wight, having been one of the principal places for the shipping and conveyance of British products to the mouths of the Seine and the Somme. There is ample reason to believe that St. Michael's Mount was at that time remote from the sea and surrounded by a forest.

Having offered the preceding general observations, derived chiefly from the testimonies of ancient authors, and also traced the production of the Cornish tin, which was the first effort of Roman mining and metallurgy in Britain, I shall now endeavour to collect the evidence which is furnished by remains of all kinds found upon the spot. Beginning in the North of England, we shall proceed southwards.

NORTHUMBERLAND & CUMBERLAND.

It might be expected that among the numerous and varied displays of Roman power and cultivation, which present themselves along the course of Hadrian's Wall through Northumberland and Cumberland, counties which are among the richest in the production both of coal and of metals, not a few traces of ancient mining and metallurgy would occur. As an excellent summary of the facts I quote the following passage from Dr. Bruce:

"In nearly all the stations of the line the ashes of

* De Poilly's *Recherches sur une colonie Massilienne*, in the *Mem. de la Société d' Emulation d' Abbeville*," A.D. 1849, is an interesting treatise shewing the nature of the overland commerce in ancient Gaul.

mineral fuel have been found; in some a store of unconsumed coal has been met with, which, though intended to give warmth to the primeval occupants of the isthmus, has been burnt in the grates of the modern English. In several places the source whence the mineral was procured can be pointed out; but the most extensive workings that I have heard of are in the neighbourhood of Grindon Lake, near Sewingshields. Not long ago a shaft was sunk, with a view of procuring the coal, which was supposed to be below the surface; the projector soon found, that, although coal had been there, it was all removed. The ancient workings stretched beneath the bed of the lake.

"In Allendale and Alston Moor numerous masses of ancient scoriæ have been found, which must have resulted from the reduction of lead from its ore. In the station of Corchester portions of lead pipe have been found; it is an inch and a half in diameter, and has been formed by bending round a flat strip of the metal and soldering the joint.

"Iron has been produced in large quantities. In the neighbourhood of Habitancum masses of iron slag have been found. It is heavier than what proceeds from modern furnaces, in consequence, probably of the imperfect reduction of the ore. In the neighbourhood of Lanchester the process seems to have been carried on very extensively. On the division of the common, two large heaps were removed, the one containing about four hundred cartloads of dross, the other six hundred. It was used in the construction of some new roads, which were then formed, a purpose for which it was admirably adapted. In the neighbourhood of one of these heaps of scoriæ, the iron tongs represented in plate I, fig. 1, so much resembling those at present used by blacksmiths, was

ploughed up. During the operation of bringing this common into cultivation, the method adopted by the Romans of producing the blast necessary to smelt the metal was made apparent. Two tunnels had been formed in the side of the hill; they were wide at one extremity, but tapered off to a narrow bore at the other, where they met in a point. The mouths of the channels opened towards the west, from which quarter a prevalent wind blows in this valley, and sometimes with great violence. The blast received by them would, when the wind was high, be poured with considerable force and effect upon the smelting furnaces at the extremity of the tunnels."*

It will be observed that we have here satisfactory evidence of the production of coal, iron, and lead. The method of obtaining a blast is very remarkable; and, as it appears, that the Roman colliers extended their workings to so great a depth as to penetrate even under a lake, it is evident that they must have had contrivances for raising the water out of the mine to the surface, either by buckets, by pumps, or by the screw of Archimedes. I think we may also infer that the mines were ventilated on the same principle which was applied in smelting the ore, viz., by the force of the wind. Pliny in his account of well-sinking (xxxi. 28) says, that besides the principal shaft, "it was the practise to sink vent-holes on each side of the well, both right and left, in order to receive and carry off the noxious exhalations. Independently of these evils," he continues, "the air becomes heavier from the greater depth merely of the excavation, an inconvenience which is remedied by keeping up a continual circulation with

* *The Roman Wall;* an historical and topographical description of the barrier of the lower isthmus, extending from the Tyne to the Solway, 2nd edition, London 1853, p. 432-434.

ventilators of linen cloth." *(Riley's Translation)*. We may infer that air was driven into the mines in the same manner. In modern times it is customary to use a tube of sail-cloth through which air is forced by the mere impulse of the wind from the deck of a vessel to the bottom of the hold. The iron tongs mentioned by Dr. Bruce exactly resembles the instrument placed in the hands of Vulcan in ancient works of art. It may be observed that Hadrian evidently planned this "*Limes*," or boundary, so as to include the lead mines within his territory.

YORKSHIRE.

The lead mines of Greenhow Hill are near Pateley Bridge, in the parish of Ripon, and in the township of Dacre. Greenhow Hill is a ridge of limestone. "At Hayshaw Bank near Dacre Pasture were found, in 1734, two pigs of lead, of the same shape and dimensions." "One of them was bequeathed to the British Museum by Sir William Ingilby, bart., and presented by his executors in 1772." The inscription, which it bears, may be read as follows :

IMP. CÆS. DOMITIANO AVG. COS. VII.

It gives the date of A.D. 81 for the production of this specimen, since in that year Domitian was elected consul the 7th time. I conceive also, that it should be read in the ablative case, *Imperatore Cæsare Domitiano Augusto consule septimum.* On this supposition the mine may have been worked by private hands.

The other pig, found at the same time and place, is preserved at Ripley Castle, the family mansion of the Ingilbys, and bears the same inscription, augmented by

the terminal BRIG., which must have alluded to the Brigantes, as the inhabitants of the district.*

DERBYSHIRE.

In April, 1777, a pig of lead was found on Cromford Nether Moor, near Matlock. It was the property of Peter Nightingale, Esq., the ancestor of Florence Nightingale, and was by him presented to the British Museum in 1797. It is inscribed thus:

IMP. CÆS. HADRIANI AVG. MEI. LVI.

The letter I repeated near the end is supposed to stand for T, and MET. LVT. for *Metallum Lutudarense*, the name of the mine. The ground of this supposition will appear hereafter. The weight of the pig is 126 lb, which is supposed to be a sufficient load for a small horse to carry day after day on bad roads.†

Another pig, the property of Adam Wollay, Esq., of Matlock, was found on Matlock Moor in 1783, and given to the British Museum together with the last. It is much smaller than those already mentioned. The inscription upon it is read as follows:

L. ARVCONI VERECVNDI METAL. LVTVD.

Here we have the name, as I formerly explained, of a private miner, or lead merchant; and the abbreviations, METAL. LVTVD., are explained as referring to Lutudarum, a Roman station, mentioned by Ravennas, which was at

* Sir Henry Ellis, *Townley Gallery*, II. pp. 287, 288. Phillips, *Rivers and Mountains of Yorkshire*, p. 37, 72. Ward, *Considerations on a draught of two large pieces of lead with Roman inscriptions upon them found in Yorkshire*, Phil. Trans., vol. XLIX. part 2., p. 694. Pennant, *Tour in Wales*, p. 51–53.

† Dr. Pegge, in the *Archæologia*, vol. v., p. 369–375. Sir Henry Ellis, *Townley Gallery*, II., p. 290. Bateman, *Ant. of Derbyshire*, p. 134.

or near Chesterfield.* Aruconius appears to be a name of British origin. Perhaps this Lucius had removed to Lutudar from Ariconium, the modern Weston in Herefordshire, and an important mining station of the Romans.

A third pig, also found on Matlock Moor, A.D. 1787, and formerly the property of Mr. Molesworth, bore the following inscription:

T. CL. TR. LVT. BR. EX. ARG.

This has supplied matter for many conjectures. More especially the last letters EX. ARG., being interpreted EX. ARGENTO, have been supposed to prove that the lead was obtained from argentiferous galena. The initial contraction CL. is supposed to stand for the Emperor Claudius, and, if correctly interpreted, would prove this metal to have been smelted as early as A.D. 49. The letters TR. may have meant *Tributum*, and LVT. *Lutudarense;* lastly BR. might mean *Brigantum*, so that the whole inscription would imply, that this piece of lead, extracted from silver in the territory of the Brigantes at Lutudarum, was tribute paid to Claudius.†

NOTTINGHAMSHIRE.

In the year 1848 a pig, weighing 184 lb, was ploughed up on the site of an old encampment at Hexgrave Park, near Southwell, in the occupation of Mr. John Parkinson. It bore the following inscription:

C. IVL. PROTI. BRIT. LVT. EX. ARG.

It is in the possession of Richard Milward, Esq., of Thurgarton Priory. A cast from it is in the Museum of

* *Monumenta Historica Britannica*, Lon. 1848, folio p. xxv. b. Sir Henry Ellis, p. 288–290. *Archæologia*, VII., p. 170.

† *Archæologia*, vol. IX., p. 45–48.

Economic Geology, Jermyn St., London, and another in the Library of the Lincoln Diocesan Architectural Society. The inscription is within a raised border, which is externally 20 in. long, $3\frac{3}{4}$ in. wide.

STAFFORDSHIRE.

A pig of lead was found on Hints Common, three quarters of a mile from the Watling Street, in digging for gravel, four feet below the surface. It appears from the following inscription to have been cast A.D. 76.

IMP. VESP. VII. T. IMP. V. COS.

It bears the letters DECEA G on one side, with an interval between A and G. These letters are supposed to indicate that it came from the Ceangi, a British tribe.* Compare this with the inscription on the Marquis of Westminster's pig, mentioned below.

This pig, having belonged formerly to Mr. Green, an apothecary at Lichfield, who died in 1793, is known by his name. From his possession it passed into that of the Rev. Dr. Webb, Master of Clare Hall, Cambridge, and on his decease it was purchased by the trustees of the British Museum. Its length is 22 inches; its weight 152 lb. A cast from it is in the Museum in Jermyn Street.

CHESHIRE.

No mines of any importance have been opened in Cheshire, except the salt-mines. Although, therefore, we have satisfactory evidence that Roman pigs of lead have been found in this county, we must suppose them to have been brought from the neighbouring counties, probably

* *Gent. Mag.* 1772, p. 558, with a wood-cut, and Feb. 1773, p. 61. *Archæologia*, vol. v., p. 375. Shaw's *Hist. of Staffordshire*, vol. i., p. 331.

from Staffordshire or Derbyshire, perhaps from Flintshire. Camden, in his *Britannia*,* says he had been assured on good authority that 20 such pigs were found at Halton, near Runcorn, and that they bore the following inscriptions:

IMP. DOMIT. AVG. GER. DE CEANG. (A.D. 96)

and

IMP. VESP. VII. T. IMP. V. COSS. (A.D. 76)

The truth of the testimony, thus recorded by Camden, is fully confirmed by the almost entire agreement of these inscriptions with those on four other pigs which were subsequently discovered, two in Yorkshire, a third in Staffordshire, as already mentioned, and a fourth found Sept. 29th, 1838, in the township of Great Boughton, within the parliamentary borough of Chester. This last is preserved at Eaton Hall, the seat of the Marquis of Westminster, and bears the following inscription, with the addition of DE CEANGI. at the side:†

IMP. VESP. V. T. IMP. III. COS.

A similar block of lead was found imbedded in a wall about four feet under ground, in Common Hall Street, Chester: weight 1½ cwt. It is considerably thicker at one end than at the other. The middle part of the inscription is entirely defaced, but the letters CAESARI are legible at the beginning, and VADOM at the end. It is consequently

* Gough's edition, Lon. 1806, vol. III., folio, p. 45.

† *Monumenta Historica Britannica*, inscriptions, p. 134. On the site of the Cangi, who are mentioned by Tacitus, Ann. XII. 32, Brotier says: "De Cangorum situ diu disputatum. Tandem innotuit eos septemtrionalis Walliæ partem, *North Wales*, et provincian Cestriensem, *Cheshire*, habitâsse. Ibi repertæ massæ plumbeæ cum inscriptione,

IMP. DOMIT. AVG. GER. DE CEANG.

Id est, *Imperator Domitianus Augustus Germanicus de Ceangis.* Vide eruditos Camden, *Britannia*, p. 546; et Stukeley, *The Medallic History of Carausius*, vol. I., p. 176.

referred to the reign of Domitian. This remarkable object belongs to the Archæological Society of Chester, and is preserved in their museum.*

SHROPSHIRE.

A pig was found at Snailbeach Farm, in the parish of Westbury, where lead is still obtained, part of the mine being known as the Roman Mine. It is preserved in the British Museum, having been presented in 1798, by John Lloyd, Esq., and is inscribed as follows :

IMP. HADRIANI AVG.

Sir Henry Ellis has given a transverse section and a draw- of it, and observes : "Its greatest length is 22 inches by 7 ; the upper surface 19 by 3½ ; its weight 191 lb."†

A highly interesting account of a visit to the Roman lead mines in the parish of Shelve, in Shropshire, by Thos. Wright, Esq., M.A., F.S.A., is published in the *Illustrated London News*, of October 4th, 1856, p. 351.

According to Mr. Wright's description, "two or three veins had cropt out almost parallel to each other, and the Roman miners actually cut the mountain from top to bottom into great ridges or grooves. We might suppose from the appearance, that they began at the bottom, and then, after they had followed the metal in one spot as far as they could, they commenced immediately above, and filled up the previous excavation with the waste from the new one. As we approach the top of the hill, the remains of these excavations take the form of vast caverns, which have evidently gone to a great depth ; but the entrance has been clogged up with fallen rock." Mr. Wright

* C. Roach Smith, in *Journal of the Archæological Association*, vol. IV., A.D. 1849, p. 51.

† *Townley Gallery*, vol. II., p. 291.

informs us that a pig of lead, in perfect preservation, with the stamp of the imperial works, as above given, and of the time of Hadrian, is exhibited in the dining-room of Linley Hall, the residence of Mr. More, near which are the remains of a Roman villa. The weight of this pig is 190 lb. It was found about 60 years since in the parish of Shelve; and one exactly like it has been found much more recently in the parish of Snead, and is now in the Museum of Joseph Mayer, Esq., at Liverpool. The description of the pig from Snailbeach, now in the British Museum, agrees with this account. Mr. Wright's description of the great open trenches, excavated above one another in the declivity of the mountain, coincides with Mr. Strange's account of the "very deep and large caverns in the limestone," which he saw at the Roman lead mines of Kevenpwll-du, near Machen, in Monmouthshire.* Mr. Wright, moreover, gives a wood-cut of two remarkable wooden implements, of the size and shape of a common spade, with handles only just long enough to hold by, and with other peculiarities. They were found in the mine.

NORFOLK.

Mr. Samuel Woodward, in his *Descriptive Outline of the Roman Remains in Norfolk*, traces a Roman road to the west of Venta Icenorum, leading to Peterborough; and, coming to the parish of Saham, he says, "In removing Saham wood, some years ago, three pigs of Roman lead were discovered, and sold to the village plumber.†

SOMERSETSHIRE.

A pig was found some years ago at Bath, near the

* *Archæologia*, vol. v., p. 75. This account of the open workings of the Romans is confirmed by other writers; see *Bethe*, p. 27.

† *Archæologia*, vol. xxiii., p. 369, London, 1831.

Sydney Gardens, by the workmen of Mr. Goodridge, architect, of that city, whose property it now is. This pig is deposited in the Museum of the Royal Literary and Scientific Institution, in Bath. It bears exactly the same inscription as those from Snailbeach, Shelve, and Snead, so that it may reasonably be presumed to have come from the Shropshire mines. In its size and form it also agrees remarkably with these specimens.

Other pigs have been found at the mines on the Mendip Hills. Camden and Leland describe one found at Wookey Hole, in the time of Henry VIII, with the following inscription :*

TI. CLAVDIVS CÆSAR AVG. P.M. TRIB. P. VIIII.
IMP. XVI. DE BRITAN.

Dr. Thurnam makes the following remarks on this specimen :† "Another object of lead, often described as a pig, but really an oblong plate, 'oblonga plumbi tabula,' and part probably of a trophy, was also found on the Mendips in the 16th century. The inscription clearly identifies it with the year 49 of our æra, and precisely accords with that on well-known coins of Claudius, on the obverse of which is a triumphal arch bearing an equestrian statue between two trophies, and inscribed like the lead plate."

In August, 1853, a pig of lead was found near Blagdon, on the northern flank of the Mendip Hills. It has the inscription :

BRITANNIC AVG. FIL.

referring to Britannicus, the son of Claudius, and proving its date to be a little prior to the last. The history of the discovery of this pig, and of its preservation, deserves to be

* Camden's *Brit.*, I., 83. Horseley, 328. Ward in *Phil. Trans.*, vol. 49., part 2, p. 694, &c.

† *Crania Britannica*, p. 100. See also *Archæol. Journal*, vol. XI., p. 279.

FIG. 1. Roman Tongs, page 7.

FIG. 2. Pig of Lead found near Blagdon, page 17.

FIG. 3. Bronze Celt, found in a Roman coal-mine, page 26.

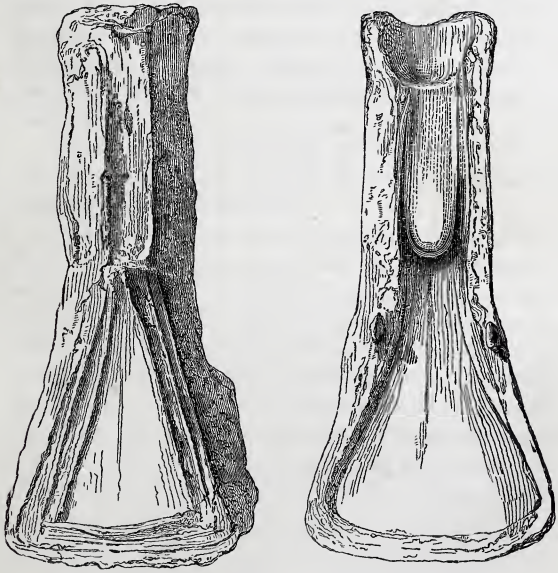


FIG. 4. Bronze Celt-mould, found at Danesfield, page 27.

mentioned. It was found by a countryman in ploughing, and taken to the shot-works of Messrs. Williams, at Bristol. Through the exertions of Mr. Albert Way, and the kind co-operation and generosity of Mr. Williams, it was fortunately rescued from the furnace, and is now preserved in the British Museum. Its form is clearly shown in the wood-cut, Plate I, fig. 2, which also shows the form of all the above-mentioned pigs, and for the use of which I am indebted to the Archæological Institute of Great Britain and Ireland. There is a space between BRITANNIC and AVG., where the letters have been effaced. They may have expressed the name of the Emperor Claudius. On examining the object itself, I was satisfied that the last letters are FIL, which is the reading adopted by Mr. Roach Smith, and not II, or IMP., as other antiquaries have supposed. Hence, I conclude, that the inscription, which is of unusual historical interest, may be thus restored :

BRITANNICI CLAVDII AVGVSTI FILII.

The letters V. EIP., or V. ETP., twice impressed on the sloping side, are not explained.*

At Charter-house, on the same range of hills, abundant traces of Roman mining have been observed. Together with a copper coin of Antoninus Pius, large heaps of slag have been found, still rich in lead, so as to prove that the Romans were not very successful in the extraction of the metal from its ore; also a quantity of the ore finely pounded, so as to be ready for smelting, and in the state now known by the name of *slimes*. The appearance of the hills around the Charter-house mines corresponds in an extraordinary degree with that which Mr. Thomas Wright

* *Archæological Journal*, vol. XI., p. 278–280. Roach Smith's *Collectanea Antiqua*, vol. III., p. 258.

describes in the above extract. There are several grooves cut in the mountain, from which the ore was doubtless extracted. Some remarkable implements of wood, and a very powerful iron pick-axe, were found at Luxborough, not far from Dunster, where it appears that the Romans had iron-mines, and made use of the Brown Hematite. These are preserved, with the above-named specimens, in the Museum of this Society, at Taunton, and are given in Plate II. of the illustrations of this paper.

Another pig of lead is referred to in Stukeley's *Itinerarium Curiosum*, A.D. 1723, p. 143, in the following terms: "At Longleat, in my Lord Weymouth's library, is a piece of lead weighing 50 pounds, one foot 9 inches long, two inches thick, three and a half broad, found in the Lord Fitzharding's grounds near Bruton in Somersetshire, and was discovered by digging a hole to set a gate-post in; upon it this memorable inscription, which I suppose was some trophy; communicated by Lord Winchelsea.

IMP DVOR AVG ANTONINI ET VERI ARMENIACORVM

,,

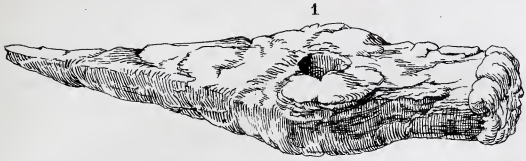
This would give A.D. 163 as its date.

HAMPSHIRE.

A pig was found in 1783, near the Broughton Brook, Stockbridge, and belonged to the late Mr. J. M. Elwes, of Bossington. It bears the following inscription, with the date of Nero's fourth consulate, A.D. 60–68, and evidently referring to the Ceangi:

NERONIS. AVG. EX. KIAN. IIII. COS. BRIT.

It has letters on the sides, among which the following are important, viz., EX ARGENT., because we have already



MINING IMPLEMENTS,

Supposed to be Roman, found at Luxborough, Somerset.

T.G. Crump del. *Ford, lith. Taunton*

found on other pigs EX ARG.* The letters are supposed to stand for EX ARGENTO, and to intimate that the lead was extracted from silver. This seems to be the true explanation, although, I think, we might read EX ARGENTIFODINIS. Even in the present day we find that where the galena contains a large proportion of silver, as is frequently the case in the British Isles, the mines are not called lead mines, but silver mines. Also the litharge, which is an impure oxide of lead, formed on the surface of the melted mass during the process of refining, is called *argenti spuma*, "froth of silver," not froth of lead.† It would seem consistent with these ideas to regard the lead as extracted from silver, rather than the silver as extracted from lead, although the ore really contains a far greater proportion of lead than of silver.

SUSSEX.

In January, 1824, four pigs were found at Broomer's Hill, near Pulborough. They were the property of Lord Egremont, as Lord of the manor, and he presented one of them in July following to the British Museum. It bears the same inscription with that found in Derbyshire, A.D. 1787.‡ Another is preserved at Parham House, near Steyning, the residence of the Hon. Robert Curzon, to whose son, the distinguished traveller and antiquary, I am indebted for this information. The latter part of the in-

* *Gent. Mag.*, 1783, p. 936. *Archæologia*, IX. p. 47. *Archæol. Journal*, vol. XI., p. 279. *Journal of Archæological Association*, vol. I., p. 326., A.D. 1849, vol. V., p. 227. T. Wright, *The Celt, the Roman, and the Saxon*, p. 237.

† *Agricola de Re Metallica*, L. X., p. 376-378, Ed. Basil, 1657. Pliny, XXXIII., 35.

‡ *Mon. Histor. Britannica*, vol. I., p. 120. *Sussex Archæological Collections*, vol. II., p. 176.

scription on it is almost erased; the beginning is legible, and appears to agree with that in the British Museum. The two other pigs, found at Broomer's Hill, were melted down, the inscriptions being illegible.

On a review of the preceding account it appears that forty-four pigs of Roman lead have been discovered in different parts of England, proving the activity and industry with which this business was conducted. The pigs are remarkably regular in their form, though differing considerably in size and weight. The letters upon them are well-formed. These circumstances indicate the care and skill employed in producing them, although metallurgy is proved to have been far below the perfection to which it has now attained, inasmuch as it is found profitable to collect the slag of the Roman furnaces in order to extract from it the metal which it still contains.

The Romans, who became domiciled in Britain, appear to have indulged to an uncommon degree in the use of lead for interments. In the Museum of the Yorkshire Philosophical Society there are four leaden coffins, found in one of the burial-places of Eburacum.* Mr. Bateman, of Youlgrave, in Derbyshire, has two, one found at York, the other at Colchester. Similar discoveries have been made in London, Kent, Wilts, and Gloucestershire, and some of these coffins are ornamented in a singular and rather elegant style, with circles, escallop shells, and beaded astragals.† In November, 1854, a perfect Roman tomb, of very remarkable construction, was discovered at Caerwent, anciently Venta Silurum, in Monmouthshire. It was situated beside the Via Julia, which led from Bath to Caer-

* Wellbeloved's *Descriptive Account of the Antiquities*, p. 59.

† C. Roach Smith, in *Journal of Archæological Association*, II., 296-301. *Archæological Journal*, X., 255.; XII., 283.

went. According to the exact description of this tomb, given by Mr. Octavius Morgan,* it consisted of an outer rectangular chamber, constructed with large slabs of stone, and containing a ponderous stone coffin. The space, surrounding this coffin and intervening between it and the inner sides of the chamber, was filled with small coal, unburnt, and rammed down so as to be tight and hard. The inside of the stone coffin was lined with lead, fitting closely all round, soldered at the corners, and covered with a plain oblong sheet of lead. Mr. Morgan concludes, from the locality and the mode of interment, that the man, whose bones were found in this leaden coffin, was a person of distinction in Venta Silurum. Mr. Roach Smith (l. c.) shows that Roman leaden coffins have been not unfrequently discovered in Normandy. It seems that the facility of procuring lead at that time induced the wealthy and powerful to use leaden coffins more frequently in England and the opposite part of Gaul than in other parts of the world.

The connection appears so obvious between articles of the same class found in the opposite provinces of Britain and Gaul, that no apology appears necessary for introdncing here some account of three pigs of Roman lead discovered in France.

The Abbé Cochet, of Dieppe, to whose kindness I am indebted for this information, states, that a part, probably about half of one, was found in 1840 among the ruins of the theatre at Lillebonne, the ancient Julia Bona, near the mouth of the Seine. This specimen is now preserved in the Museum at Rouen. It weighs 43 kilogrammes, and 5 hectogrammes. It is at the widest part, which M. Cochet properly calls the top, 12 centimetres broad by 28 long, so

* *Archæological Journal*, XII., 76-78. *Archæologia*, vol. XXXVI.

that, if it was divided about the middle of its original length, it must have agreed both in size and form with most of those found in England. It bore an inscription in two lines, agreeing in this respect with two of those found in Somersetshire. The following letters, which alone remain, are the commencement of the lower line :

. . . . . .

NACIS VGPA. . . . . .

These letters are 2 centimetres long, and their elevation or projection above the surface of the lead is 2 or 3 millimetres.

Another pig was found in the ruins of Vieil-Evreux, the ancient Mediolanum, also in Normandy.*

The third forms part of the collection of the Historical and Archæological Society of Chalons-sur-Saone. It was found in 1855 at Sassenay, near that city, not far from the Roman road, which led from Chalons to Langres, and thence to the coast opposite Britain. In its angular form it corresponds with the English specimens, and differs from the Spanish. It is represented in an engraving, and described in a very interesting memoir by M. Marcel Canat, President of the above-named Society, in a dissertation, which is inserted in the third volume of their *Memoirs*(pp. 28-30,57). On one of the long sloping sides it has the following inscription :

. . . . . AVGPARTHICIADIABENICI

and at the bottom LVICVC and DL'P. The former of these two inscriptions occurs twice.

M. Canat observes, that the long inscription could only refer to the Emperor Septimius Severus, since he alone ob-

* *Bulletin Monumental*, Paris, vol. XXII., p. 409. *Révue Archæologique*, Paris, 1856, p. 548-550. Cochet, *Normandie Souterraine*, 2nde edition, p. 120.

tained the surnames PARTHICUS and ADIABENICUS : also, that this pig of lead was cast between the time of his assumption of the title ADIABENICUS and the time of his death, *i. e.*, between 195 and 211.

M. Canat does not attempt to interpret the letters LVICVC ; but with respect to the last inscription he remarks, that the accent, by which the two first letters are separated from the third, indicates, that they denote numbers, and that P stands for PONDO. He consequently reads it 550 pound. In support of this explanation he farther states, that, whereas the name of the Emperor is in relief, having been impressed upon the mould, which was probably of clay, the two shorter inscriptions have been impressed upon the lead, after it was taken out of the mould. It was then weighed, and its weight was stamped upon it. Nevertheless we do not know what unit was meant in this instance by the letter P. It commonly denoted so many *libræ;* but this does not at all suit the present circumstances. M. Canat conjectures that it here denoted the *semis* or *half-libra.*

The actual weight of the pig is 86 kilogrammes and 3 hectogrammes, agreeing with the larger specimens found in England, and agreeing also with the mark upon the lead, if M. Canat's interpretation of the letter P be admitted, and the Roman *libra* be supposed equal to 324 grammes; for 550 half-libræ, so estimated, amount to 89 kilogrammes and 1 hectogramme. The loss of 2 kilogrammes and 8 hectogrammes may very well be ascribed to accident, waste, or abrasion.

It is concluded, from all these circumstances, that the entire inscription on the first specimen was,

IMP. L. SEPTIMI. SEVERI. PERTI
NACIS. AVG. PARTHICI . . . . ,

probably followed by the year of his Consulship, either A.D. 194 or 202, or by the epithet ADIABENICI. The same title, with some additions, was found by Maundrell on two granite pillars near Sidon,* and has been observed, with various abridgments, or additions, in other cases.

It is the opinion of the French antiquaries, that these three pigs of lead were imported into Gaul from Britain, although the mines of Pont Gibaud in Auvergne appear to have been worked by the Romans, lamps, tools, and utensils of Roman fashion having been found in them, in addition to which Pliny states† that lead was obtained in Gaul, though with difficulty, and in comparatively small quantity.

This appears to me a proper occasion to mention the ingot of Roman silver, preserved in the British Museum. It was discovered in 1777, within the Tower of London, at a great depth under the present surface of the ground, with three gold coins of the Emperors Arcadius and Honorius. It is fully described in the 5th volume of the *Archæologia*. It weighs 320 grammes. The inscription in a cavity on its surface is :

EX OFFE
HONORINI

This must, I think, have referred to the silversmith to whom it belonged, just as Roman pottery is marked with the potter's name preceded by some abridged form of EX OFFICINA. Portions of similar ingots, also preserved in the British Museum, were lately found near Coleraine, in Ireland, one bearing the impress CVRMISSI, the other

* *Journey from Aleppo to Jerusalem*, ed. London, 1810, p. 62.
† See above, p. 4.

EXOFFA TRICII. It appears probable that they were of British origin, though found in Ireland.*

Besides showing the extent of the mining operations of the Romans throughout England, the above-mentioned discoveries also give us their date. The oldest pigs are those bearing the names of Claudius and his son Britannicus; they cannot be later than A.D. 49. On the other hand the ingot of silver may be referred to a period not long antecedent to the termination of the Roman power in this country.

By taking in succession the English counties, we have been led to the evidences of the production of silver and lead by the Romans. We shall now take Wales, and there find proofs that they also obtained copper.

I am indebted to Mr. Thomas Wright for the information, that the copper veins at Llan-y-menach, near Oswestry, were worked by the Romans. Roman coins of Antoninus, Faustina, and others, have been found in the recesses of the mine. But further north the evidences are much more ample and distinct.

Mr. Pennant describes a mass of copper, weighing 42 lb; it is in the shape of a cake of bees-wax, the diameter of the upper part being 11 in., and its thickness in the middle $2\frac{3}{4}$ in.; on the upper surface is a deep impression with the words SOCIO ROMÆ. It is conjectured that the merchant or owner of the cake intended this inscription to signify that he consigned it to his partner at Rome. Across this inscription is impressed obliquely NAT SOL, meaning, perhaps, *Natalz Solum*, and intended to show that the Roman adventurer still remembered his native country. It was found at Caer Hen, the ancient Conovium, four

* Rev. John Scott Porter, in *Ulster Journal of Archæology*, May, 1854, p. 184. See also, *Arch. Journal*, vol. XII., p. 97.

miles above Conway, and, as Pennant observes, "was probably smelted from the ore of the Snowdon Hills, where of late years much has been raised." This cake is still preserved at Mostyn Hall, Flintshire, being in the possession of the Rt. Hon. Lord Mostyn. An engraving of it may be seen in Gough's edition of Camden, vol. III., p. 190, pl. ix., fig. 13.

The same author (Pennant) describes some of the implements found in ancient mines, and refers them to the Roman times. He also says that "miners often discover the marks of fire in ancient mines."* This seems to agree with the statement of Pliny, that fire was used in breaking the rocks in order to extract the metallic veins.

These remarks of Mr. Pennant are confirmed and illustrated by the recent observations of the Hon. William Owen Stanley. The old workings had been broken into at Llandudno, near the Great Ormes Head. Part of a stag's horn, which had probably served as a handle, and portions of two bronze picks were found. In another ancient working of considerable extent were found a number of stone mauls of various sizes, described as weighing from about 2 lb to 40 lb, and rudely fashioned, having been all, as their appearance suggested, used for breaking, pounding, or detaching the copper ore from the rock. "These primitive implements," says Mr. Stanley, "are similar to the water-worn stones or boulders found on the sea-beach at Penmaen Mawr, from which, very probably, those most suitable for the purpose might have been selected." He describes one in particular, found at Amlwch Parys mine, in Anglesea: "It is of hard basalt, about a foot long, and evidently chipped at the extremity in the operation of breaking other stony or mineral

* Pennant's *Tours in Wales*, ed. London, 1810, 8vo., vol. I., p. 73.

substances. The miners at Llandudno observed, however, that their predecessors had been unable to work the hardest parts of the rock, in which the richest ore is found; for they have recently obtained many tons of ore of the best quality from these ancient workings."* Mr. W. O. Stanley presented some of the above-mentioned implements of stone to the British Museum, where they may now be seen in the department of British Antiquities.

Among the implements described by Pennant was an iron wedge, $5\frac{1}{4}$ inches long, found in working the deep fissures of the Dalar Goch strata, in the parish of Disert, Flintshire. Its remote age was shown by its being much incrusted with lead ore.

If this iron wedge had been of bronze, our antiquaries would have called it *a celt*. I therefore embrace this as a fit opportunity for introducing a few remarks on the use of celts in mining. Some years since I produced an essay *On the use of Bronze Celts in Military Operations*.† Many of the facts and circumstances, which I then mentioned, are equally applicable to the present case; more especially, the bronze celts, 18 or 20 in number, which were found in Andalusia, in a Roman coal mine, and which had been attached to a straight wooden handle, and used as we use a chisel, a spud, or a crow-bar, are examples in point.‡ See the wood-cut (Plate I, fig. 3) of one of them, half the length of the object itself. Also some of the bronze palstaves, which I described on that occasion, and which are in the collections at Paris, are large enough for almost any mining operations without exception. ||

I beg to refer to the same memoir for the account of

* *Archæol. Journal*, vol. VII., A.D. 1850, p. 68, 69.

† Published in the *Archæological Journal*, VI., 363–392.

‡ See *Arch. Journal*, VI., 69, 369. || Ibid., p. 374.

celt moulds (p. 385-388), since these moulds prove, that the celts of all kinds, whether chisels, wedges, or palstaves, cast in them, must have been used in large quantities, and for many different purposes.

Two of these bronze celt-moulds were found in 1800, at Danesfield, near Bangor, consequently in the very heart of the mining district, in which copper was obtained. Dr. Wm. Cleaver, then bishop of the see, presented them to his friend and patron, the Marquis of Buckingham, so that they were among the objects dispersed at the sale at Stow, in 1848. On this occasion the wrong halves of the two moulds were placed together, in consequence of which one half of each set is now in the British Museum, and the other belongs to Lord Braybrooke.* The wood-cut (Plate I, fig. 4) exhibits the outside and inside of one half of a mould, reduced to half the real length.

The following passage in *Carew's Survey of Cornwall* (B. 1, p. 8), relates to the ancient tin mines of that country, and affords an additional proof of the use of bronze celts in ancient mines: "There are taken up in such works certain little tool's heads of brass, which some term *Thunder-axes*, but they make small show of any profitable use."

It is well known that the bronze chisels, of which I am speaking, as well as the stone implements of the same class, were called *thunder-stones*, or *thunder-axes*, until the old Latin term *Celtes* was properly applied to them by German antiquaries. The more common Latin term for this instrument in ancient times was *dolabra*. Mr. John Taylor, jun., of London, who is extensively concerned in mining, both in South Britain, and on the Continent, in-

* Mr. Albert Way on *Bronze Celts found in Wales, Archæologia Cambrensis*, third series, 1856.

forms me, that those adits, which are reputed to be Roman, are distinguished by being chiselled.

The ancient gold mine of Gogofau, near Llan-Pumpsant, in Carmarthenshire, was probably worked by the Romans, who appear to have had a station in the vicinity. "The majority of the workings, extending to a considerable depth for some acres over the side of the hill, are open to the day, or worked, as usual in the early days of mining, like a quarry. . . . Here and there a sort of cave has been opened on some of the quartz veins, and in some cases has been pushed on as a gallery, of the dimensions of the larger levels of the present day, viz., 6 to 7 feet high, and 5 or 6 feet wide. . . . If we examine Pliny for the state of knowledge on this subject among the Romans, we find that gold was obtained by three processes: first, washing the sands of certain rivers; secondly, following the lode by shafts and levels (puteis et cuniculis), whilst the earth is supported where necessary by props or pillars of wood; thirdly, by excavating hollows of larger magnitude, supported for a time by arches of rock, which are afterwards gradually removed to allow the whole superincumbent mass to break in. The ore is broken, washed, burnt, ground to powder, and pounded with pestles (quod effossum est, tunditur, lavatur, uritur, molitur in farinam, et pilis cuditur)."*

It only remains that I should give an account of the production of iron in England under the Romans. This appears to be the department in which the widest difference is perceptible between ancient and modern operations. In the extraction of gold, silver, tin, lead, and copper, the

* Warrington W. Smyth, M.A., on the Gogofau mine, in *Memoirs of the Geological Survey of Great Britain*, p. 481, 483. See also, Murchison's *Silurian System*, p. 367; and *Archæological Jornal*, VII., 173.

Romans employed methods which were substantially the same as those now in use. But our iron furnaces may be regarded as the growth of modern times: so entirely do they surpass the exploits of antiquity both in extent, and in metallurgic science. The vast and almost inexhaustible strata of clay iron-stone, belonging to our carboniferous series, which keep our immense furnaces incessantly at work, were scarcely touched by the Romans. The kinds of ore which they smelted, were principally those which engage the attention of rude nations, and which occur in comparatively small quantities near the surface of the ground, such as bog iron-ore, hematite, and nodules, disseminated through rocks of a comparatively recent geological epoch. Under these restrictions we find clear and abundant traces of Roman iron-works in England.

"In Strabo's days," says Mr. Pennant (l. c.), "iron was in great plenty, as he mentions it among articles of exportation (L. IV. p. 279)." Mr. Pennant also gives the following account: "Immense beds of iron cinders are to this day found in the Forest of Dean, the reliques of the Romans; others in Monmouthshire; another was discovered near Miskin, the seat of Wm. Basset, Esq., beneath which were found a coin of Antoninus Pius, and a piece of earthen-ware (*Archæologia*, II., 14); and finally others in Yorkshire, also accompanied with coins;* all which evince the frequency of iron foundries during the period of the Roman reign in Britain. These cinders are not half exhausted of their metal; for the Romans knew only the weak powers of the foot-blast. They are now worked over again, and yield a more kindly metal than

* "A notable example is mentioned by Whitaker of Roman coins being found in cinders turned up at Brierly, in the West Riding of Yorkshire." —Taylor's *Archæology of the Coal Trade*, p. 151, in the *Newcastle Memoirs of Arch. Institute*, vol I.

what is produced from the ore." (Leland, Itin., I. 144, VI. 102. Camden, II. 722.)

One of the most important sites of Roman iron-works appears to have been Ariconium, the modern Weston in Herefordshire, adjoining the Forest of Dean. I have already alluded to this station as the probable residence of L. Aruconius, who afterwards, as it appears, settled at Lutudar, in the mining district of Derbyshire. "At a place called Cinder Hill," observes Mr. Thomas Wright, "we have only to turn up the surface to discover that it consists of an immense mass of iron scoriæ. It is evident that the Roman town of Ariconium possessed very extensive forges and smelting furnaces, and that these cinders were thrown out on this side of the town close to the walls."* The discovery of mineral coal in the Roman sepulchre described by Mr. Octavius Morgan, and the proofs of its abundant production in Northumberland,† may suggest the inquiry, whether it was not employed in smelting the iron-stone at Ariconium.

Roman coins were found under the refuse of mines at Luxborough, on the Brendon Hills, near Minehead. The ore at this spot, as has been already observed, (p. 18,) is Brown Hematite.

I am informed on the authority of Dr. Thurnam, and of Mr. Charles Moore, of Bath, that Mr. Cunnington has found Roman pottery with scoriæ of supposed ancient iron-works at various places about Devizes. The ore is that which occurs in the ferruginous portion of the green-sand formation. The same kind of ore has been wrought abundantly in modern times in the counties of Kent and Sussex, and the iron produced from it by the ancient Britons may be presumed to be that to which Julius

* *Wanderings of an Antiquary*, p. 23, &c. † See above, p. 6-8-21.

Cæsar refers in the following terms: "In maritimis ferrum nascitur, sed ejus exigua est copia," *i.e.* "Iron is produced in the maritime districts, but only in small quantity." (B.G. Lib. v. c. 12.)

The following summary of facts is given by Mr. Thomas Wright:

"In various places in Sussex, as in the parishes of Maresfield, Sedlescombe, and Westfield, immense masses of ancient iron scoriæ, or slag, are found. At Oaklands, in Sedlescombe, there is a mass of very considerable extent, which, on being cut into for materials for road-making, was ascertained to be not less than 20 feet deep. The period to which they belong is proved by the frequent discovery of Roman coins and pottery, intermixed with the cinders. At Maresfield, especially, the fragments of Roman pottery and other articles are so abundant, that, as we are informed by Mr. M. A. Lower, of Lewes, who first laid these facts before the public, when one of these cinder-beds was removed, scarcely a barrow-full of cinders could be examined without exhibiting several fragments. The material for the Roman furnaces was the clay iron-stone from the beds between the chalk and oolite of this district, which is found in nodular concretions consisting often of an outer shell of iron ore with a nucleus of sand. These are found near the surface of the ground, and the Romans dug small pits, from which they extracted these nodules, and carried them to the furnaces, which stood in the immediate vicinity. These pits are still found in considerable groups, covered almost always with a thick wood, and the discovery of pottery, etc., leaves us no room to doubt that they are Roman works." *

* *The Celt, the Roman, and the Saxon*, p. 234. The reader may also consult Conybeare and Phillips's *Geology of England and Wales*, p. 136-140; and Mantell's *Geology of Sussex*, p. 24-30.

Lastly, it appears that the Romans worked the iron-ore, which is found under similar circumstances in Oxfordshire. *

The conclusion to be drawn from the facts now collected together appears to me to be that the mining operations of the Romans were characterised by the grandeur, the wisdom, and the methodical regularity, which were the general features of their government. The Britons, whom they subdued, had already attained to considerable proficiency in mining, and still more in the working of metals; but under the Romans mining and metallurgy made a progress equal, probably, in amount to that which has been effected from the cessation of their sway in Britain up to our own time.

The question has been raised, what motive urged the Romans to invade and conquer Britain, and to hold it so long under their dominion? Undoubtedly ambition, the love of power, and the desire of annexation, were motives of great force. The love of gold has also been assigned, with considerable reason.† But ought not a still higher place to be assigned in this instance to the love of tin, lead, copper, and silver? Next to Spain, this island appears to have been the most productive territory held by the Romans for the working of mines, and to the prosecution of this object they seem to have applied their energy in Britain more than to any other branch of industry.

Note.—In compiling the above memoir, I have received

* Mark Anthony Lower, in *Sussex Archæological Collections*, II. p. 169-176, III. p. 248; and in the *Journal of the British Archæological Association*, IV. p. 265; Thurnam's *Crania Britannica*, p. 102.

† *Bruce's Roman Wall*, p. 29-31.

the most kind and valuable assistance from various correspondents. Several of them are already mentioned by name, or their publications are quoted. But I wish to record my obligations more especially to Mr. Albert Way, who was my predecessor in this field of research, and has generously assisted me to the utmost of his ability.